

Ballina Shire Council

Water and Sewerage

Infrastructure Planning

Planning Report

May 2004

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Executive Summary

Background

GHD was commissioned by Ballina Shire Council to prepare a planning report for Council's water supply and sewerage infrastructure.

The objective of the project was to undertake an appropriate level of strategic planning for Council's water supply and sewerage infrastructure to assist in the development of Development Servicing Plans. Specifically, the work required:

- ▶ Phase A – Investigation, Assessment and Concept Design Phase;
- ▶ Phase B – Development Servicing Plans;
- ▶ Phase C – Consultation;

This planning report documents the outcomes of Phase A of the project.

Population and Demand

The table below summarises the existing and future equivalent tenements for Ballina Shire for water and sewerage.

Water and Sewerage Equivalent Tenements

Year	Water	Sewerage
2003	13,970	12,651
2008	16,090	14,741
2013	18,140	16,771
2018	19,850	18,471
2023	21,360	19,981
2028	22,520	21,141
2033	23,430	22,061

The table below summarises the existing and future Peak Instantaneous Water Demand and Peak Wet Weather Sewerage Flow.

Peak Water and Sewerage Flows

Year	Water (L/s)	Sewerage (L/s)
2003	838	507
2008	965	593
2013	1,089	678

Year	Water (L/s)	Sewerage (L/s)
2018	1,191	746
2023	1,281	807
2028	1,351	856
2033	1,406	898

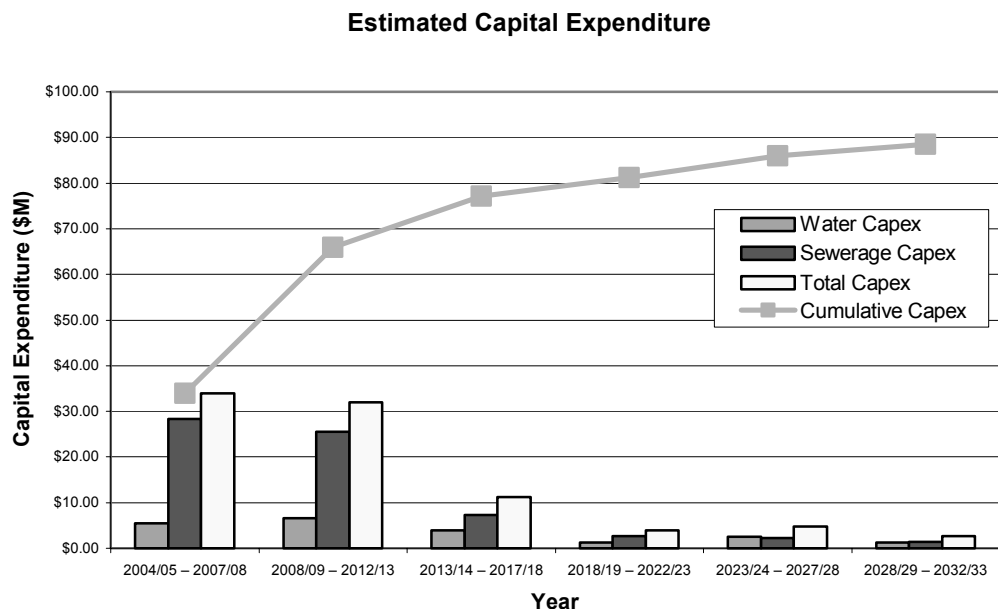
Capital Works Programme

The water supply system and sewerage system were modelled using the modelling software, WaterCAD and SewerCAD respectively. The results from these models were used to determine the capital works required. For the sewerage system, capital works relating to Option 2A of the Ballina Shire Urban Water Management Strategy were also included.

The water capital works programme amounts to some \$21m over 30 years.

The sewerage capital works programme amounts to some \$67.5m over 30 years.

The table below summarises the estimated capital expenditure requirements for each 5 yearly interval for the next 30 years.



Recommendations

Given the findings of this study it is recommended that Ballina Shire Council adopt the capital works programmes presented in this Planning Report as a basis for the preparation of Development Servicing Plans documentation.

It is further recommended that Ballina Shire Council:

- ▶ Interface and plan with Rous Water to ensure the projected Peak Daily Demands can be adequately supplied;
- ▶ Create ten (10) new water supply pressure zone boundaries, for reasons and triggers stated in Section 8.2;
- ▶ Modify the existing water supply pressure zone boundaries, for reasons stated in Section 8.2;
- ▶ For the proposed Wollongbar HLZ and East Ballina HLZ water supply zones, during the reticulation detail design phase, optimise the boundaries from what is shown in this report; and
- ▶ Select a trigger for construction of the second North Creek Canal water trunk main crossing along the Pacific Highway. These works may be triggered either by year, or by construction of the proposed second bridge crossing.

1. Introduction

1.1 Background

GHD was commissioned by Ballina Shire Council to prepare a planning report for Council's water supply and sewerage infrastructure. This planning report will form the basis for preparation of Development Servicing Plans (DSPs).

1.2 Objectives

The objective of the project was to undertake an appropriate level of strategic planning for Council's water supply and sewerage infrastructure to assist in the development of Development Servicing Plans. Specifically, the work required:

- ▶ Phase A – Investigation, Assessment and Concept Design Phase;
 - Preparation of capital works development strategies to meet the water supply and sewerage services needs of the Shire, including preparation of population / development projections, and completion of any necessary modelling and analysis of the systems.
- ▶ Phase B – Development Servicing Plans;
 - Preparation of DSP documentation in accordance with relevant NSW legislation and guidelines, defining developer charges for water supply and sewerage services.
- ▶ Phase C – Consultation;
 - Assisting Council to gain acceptance and adoption of the DSPs through active participation in consultation with key stakeholders.

This planning report documents the outcomes of Phase A of the project.

1.3 Previous Documentation

The following planning reports provided a foundation to this study:

- ▶ Final Draft Ballina Shire Urban Water Management Strategy (DPWS, August 2002);
- ▶ WATSYS model files for Council's existing water supply network;
- ▶ Water and Sewerage Asset Register. The registers were available in MS Excel format;
- ▶ Draft Water and Sewerage Strategic Business Plan (DPWS, 2003);
- ▶ Ballina Council Urban Land Release Strategy – 2000;
- ▶ AutoCAD files of existing water supply and sewerage infrastructure; and,
- ▶ Water Supply Trunkmain Analysis (DPWS 2003).

The information from the available documentation was used as inputs into the infrastructure planning and DSPs phases of the project where required.

1.4 Project Drivers

The key project drivers were:

- ▶ Ballina Shire Council has prepared Draft Water Supply and Sewerage Strategic Business Plans (SBP). These plans have been reviewed by the DLWC and comments have been provided to Council on the changes required. Although Council is not heavily dependent on State Government funding from the Country Towns Water Supply and Sewerage Program, the completion of the SBP process is dependent on the completion (as a minimum) of Phase 1 of the DSP project.
- ▶ The NSW State Government requires that all non-metropolitan water utilities implement Development Servicing Plans (DSPs) for applying water supply and sewerage infrastructure charges to land developers. Councils are required to implement these plans no later than June 2004.
- ▶ Council has a number of challenges with the information that will be required as inputs into the DSP process. Examples of the challenges that existed at the commencement of the project include:
 - The spatial information for water supply and sewerage assets was not held in an electronic environment eg. GIS;
 - The existing water supply and sewerage asset registers were not up to date;
 - Council had minimal resources that have both the skills and time to undertake the required DSP process;
 - Council had a number of disparate information sources that needed to be compiled in order to prepare up-to-date DSPs. Examples included the DPWS Trunk Water Model and the existing WATSYS water model.
- ▶ To overcome these challenges, existing data, mainly in the form of as-constructed drawings, was used to develop spatial water and sewer models. The development of these spatial models in effect provided Ballina Council with a GIS layer of their water and sewerage infrastructure and a complete asset register.

2. Population and Hydraulic Load

2.1 Study Area

Ballina Shire covers an area of 49,300 hectares, of which approximately 2,300 hectares is serviced by water and sewerage. The respective service areas are illustrated in Figure 2.1 and Figure 2.2.

2.2 Land Use Planning

Information on town planning for future land use was sourced from Council's Local Environment Plan and GIS data. Existing land use is illustrated in Figure 2.3 - Figure 2.5.

2.3 Resident Population

Population estimates for the major urban areas in Ballina Shire are shown in Table 2.1.

Table 2.1 Current Population Estimates¹

Area	Population (2001)
Ballina-Lennox Heads	23,689
Alstonville - Plateau	8,233
Wardell	612
Rural	5,854
Total	38,388

2.4 Equivalent Tenements

The number of existing Equivalent Tenements (ET) was sourced from previous analyses carried out by Council, including:

- ▶ The existing WATSYS water supply model demands; and
- ▶ Sewer demand calculations by Council.

Where required, the existing analyses were factored by growth rate estimates to estimate the 2003 ET (base year). The following tables summarise the existing ETs.

¹ From DPWS Estimates, 2002

Table 2.2 Equivalent Tenements – Water

Service Area	Equivalent Tenements (2000)	Equivalent Tenements (2003)
Ballina	7,459	7,795
Lennox Heads	2,338	2,741
Alstonville/Wollongbar	2,908	2,997
Wardell	437	437
Total	13,142	13,970

Table 2.3 Equivalent Tenements – Sewerage

Sewerage Treatment Works (STW)	Equivalent Tenements (2003)
Ballina STW	3,913
Lennox Heads STW	5,766
Alstonville STW	2,682
Wardell STW	290
Total	12,565

2.5 Projected Equivalent Tenements

The Equivalent Tenement growth over the next thirty years was determined using population projections determined by Ballina Shire Council using data from the 2001 Census. It is understood that these projections were to be used to update the 'Ballina Urban Land Release Strategy – 2000'. The projected ET growth is summarised in Table 2.4. Future residential and industrial areas are illustrated in Figure 2.6 - Figure 2.13.

Table 2.4 Projected Equivalent Tenement Growth

Time Period	Projected Shire ET Growth	Total ET	
		Water	Sewerage
2003		13,970	12,651
2003 - 2008	2,090	16,090	14,741
2008 - 2013	2,030	18,140	16,771
2013 - 2018	1,700	19,850	18,471
2018 - 2023	1,510	21,360	19,981
2023 - 2028	1,160	22,520	21,141
2028 - 2033	920	23,430	22,061

Projected ET growth in this document is for the purpose of capital works planning only. Actual population growth will be subject to the rezoning process and Council Development Approval.

2.6 Planning Unit Loads

The unit loads adopted for water supply planning purposes are shown in Table 2.5.

Table 2.5 Water Supply Unit Loads

Consumption Parameter	Value
Peak Daily Demand (PDD)	1,700 L/ET/day
Peak Instantaneous Demand (PID)	0.06 L/ET/s

The unit loads adopted for sewerage planning purposes are shown in Table 2.6.

Table 2.6 Sewerage Unit Loads

Area	Value
Ballina / Lennox Head /Wardell	0.042 L/s/ET Peak Wet Weather Flow (1,550 L/EP/day at 2.35 EP/ET)
Alstonville / Wollongbar	0.033 L/s/ET Peak Wet Weather Flow (1,200 L/EP/day at 2.35 EP/ET)

2.7 Water Supply Load

Projected water demands are represented in Figure 2.14 and summarised in Table 2.7.

Table 2.7 Projected water demands

Year	Peak Daily Demand (ML/day)	Peak Instantaneous Demand (PID) (L/s)
2003	23.7	838
2008	27.3	965
2013	30.8	1,089
2018	33.7	1,191
2023	36.3	1,281
2028	38.3	1,351
2033	39.8	1,406

A detailed assessment of projected population and water demands is given in Appendix B.

2.8 Sewerage Load

Projected sewer loads are represented in Figure 2.15 and summarised in Table 2.8.

Table 2.8 Projected sewage loads

Year	Peak Wet Weather Flow – Ballina STW (L/s)	Peak Wet Weather Flow – Lennox STW (L/s)	Peak Wet Weather Flow – Alstonville STW (L/s)	Peak Wet Weather Flow – Wardell STW (L/s)
2003	165	243	87	12
2008	169	313	98	13
2013	247	316	101	14
2018	265	358	108	15
2023	282	395	114	16
2028	301	420	117	18
2033	316	442	118	19

An assessment of the projected sewage loads by treatment plant is given in Appendix B.

3. Existing Infrastructure – Water Supply

3.1 Background

Ballina Shire sources the majority of its water from the Rous Water Authority, however it also has limited access to internal water sources. The following sections describe the respective service areas.

The existing water supply infrastructure is illustrated in Figure 3.1 - Figure 3.10.

3.2 Scheme Descriptions

3.2.1 Ballina and Lennox Head

Ballina and Lennox Head are serviced from trunk supply mains extending from Knockrow reservoir, which is owned by Rous Water. Current service agreements with Rous are to maintain water in Knockrow reservoir subject to exceptional circumstances.

Flow from Knockrow is regulated at the Waterwheels and North Creek Road motorised valves, and by manual operation of adjacent line valves to restrict flow to the service reservoirs. This ensures that peak flows in the supply mains are reduced and undue strain on Knockrow is avoided. Operation of the valves is adjusted according to the season and demands experienced.

The existing supply capacity is nominally 26.4 ML/day, however Rous has scheduled future augmentations to the Knockrow reservoir. The supply mains from Knockrow are owned and maintained by Rous up to the Waterwheels and North Creek Motorised Valves, however it is envisaged that Council will take ownership of these mains in the near future.

The existing service reservoirs are:

- ▶ Pine Avenue and East Ballina. These service the local areas of East Ballina, Ballina Island, North Ballina and West Ballina; and
- ▶ Basalt Court and Lennox Head. These service the Lennox Head area.

All residences are serviced from the Council service reservoirs to minimise the peak flows in the Knockrow supply mains and to minimise the amount of storage required at Knockrow. The following exceptions exist, however, which are fed directly from the Knockrow supply mains:

- ▶ Fig Tree Hill Drive. This local area, to the north of Lennox Head, has elevations unable to be serviced by the Lennox Head reservoir;
- ▶ Greenfield Road. Initial development of the Pacific Pines subdivision, west of Lennox Head, is serviced by a temporary DN200 mm connection to the Knockrow supply main, as service from the existing Basalt Court reservoir is not readily available. Ultimate supply will be from the planned new Pacific Pines service reservoir; and

- ▶ Deadmans Creek Road. This development area to the northwest of the main Ballina settlement is serviced from a temporary reservoir. Projected further development will trigger a change to supply from the planned Ballina service reservoir.

The existing booster pump stations in the Ballina/Lennox Head system include:

- ▶ Basalt Court. This is located at, and supplied by, the Basalt Court reservoir and services elevated areas surrounding the reservoir.
- ▶ East Ballina Private Boosters. There are a number of private boosters installed by residences at the property connection to supply adequate household pressures in the elevated areas of East Ballina.

3.2.2 Wollongbar and Alstonville

Wollongbar and Alstonville are supplied from the Wollongbar service reservoir, which is supplied under agreement by Rous from a connection in James Road. Council owns the Wollongbar reservoir. The existing supply capacity is nominally 9.7 ML/day.

450/500/525 mm mains along the Bruxner Highway supply flows by gravity from the reservoir to Alstonville and to the lower areas of Wollongbar. The Wollongbar booster pump station, located at the reservoir, supplies the elevated areas of Wollongbar via a 200 mm main along the Bruxner Highway.

3.2.3 Wardell

The settlements of Wardell, Cabbage Tree Island and Meerschaum Village are supplied from three separate water sources:

- ▶ Marom Creek Water Treatment Plant, with a supply capacity of 1.9 ML/day;
- ▶ Ellis Road Bore, with a supply capacity of 0.95 ML/day; and
- ▶ Lindendale Bore, with a supply capacity of 0.35 ML/day.

Preferred supply is from the Marom Creek Water Treatment Plant (WTP), which is owned and operated by BSC, however the bores are able to supplement supply. The combined capacity of the supply sources is approximately 2.2 ML/day, which is lower than the sum of the individual supply capacities due to utilisation of common rising mains when operating concurrently.

All three sources lift water to the Whites Lane Reservoir, which in turn gravitates flow to the Meerschaum Balance Tank. A Pressure Sustaining Valve immediately before the inlet to the tank ensures the upstream Hydraulic Grade Line remains above 176.5 m AHD to maintain adequate residual pressures in Meerschaum Village.

Meerschaum Balance Tank gravitates flow to the Wardell service reservoir, which in turn supplies pressure to Wardell and Cabbage Tree Island.

3.3 Supply Mains

BSC's Asset Register provided the approximate make-up of the existing water supply mains:

Table 3.1 Existing Supply Mains

Diameter	Cumulative Length (km)
100	94.4
150	102.8
200	50.7
225	3.1
250	0.2
300	20.7
375	3.7
450	1.9
500	11.5

3.4 Service Reservoirs

Details of the existing service reservoirs are shown below. Minimum operating levels are for the reservoirs one third full, and are representative of Council's Desired Standards of Service (DSS).

Table 3.2 Existing Service Reservoirs

Service Reservoir	Owned By	Total Volume (ML)	TWL (m AHD)	BWL (m AHD)	Minimum Operating Level²
Knockrow	Rous	1.1	104.20	97.30	99.6
Pine Avenue	BSC	20.3	58.24	44.24	48.9
East Ballina	BSC	4.5	58.24	44.24	48.9
Basalt Court	BSC	4.0	82.20	73.30	76.3
Lennox Head	BSC	2.4	57.14	50.30	52.6
Wollongbar	BSC	10.4	197.30	185.60	189.5
Whites Lane	BSC	0.45	184.56	174.56	177.9
Meerschaum Balance Tank	BSC	0.24	165.00	162.50	163.3
Wardell	BSC	1.6	73.80	64.55	67.6

There are two additional storages located on the boundary of Wollongbar and Alstonville, which are unused and effectively decommissioned due to inadequate elevation. These are:

- ▶ Grey's Reservoir. 1.2 ML and a TWL of 172.68 m AHD; and
- ▶ Russellton Reservoir. 4.0 ML and a TWL of 182.03 m AHD.

3.5 Pump Stations

Table 3.3 provides details of the existing pump stations for all water supply systems.

² Derived from the BSC Draft Water Reticulation Specification (2002)

Table 3.3 Existing Pump Stations

Pump Station	Make	Model	Motor Power	Nominal Duty	Controls / Settings	Comments
Basalt Court Boosters					Nil	
Wollongbar Boosters	Mono	Instream 100/16: 165 mm impellor.	Pump 1: 15 kW Pump 2: 22 kW	46 L/s @ 25 m	Nil	Duty quoted for Pump 2
Marom Creek WTP Lift Pumps				22 L/s	On – Whites Lane 183.2 m Off – Whites Lane 184.2 m	
Lindendale Bore Lift Pump	Grundfos	SP45-18	22 kW	6-16 L/s	On – Whites Lane 182.6 m Off – Whites Lane 184.2 m	18 stage bore pump
Ellis Road Bore Lift Pump	Grundfos	SP45-18	22 kW	6-16 L/s	On – Whites Lane 182.9 m Off - Whites Lane 184.2 m	18 stage bore pump
Ellis Road Booster Pump	Grundfos	CR60-60	15 kW	11 L/s @ 88 m	On – Whites Lane 182.9 m Off - Whites Lane 184.2 m	6 stage vertical pump

4. Existing Infrastructure - Sewerage

The Ballina Shire sewerage infrastructure comprises the following:

- ▶ Four (4) sewerage treatment plants located at and servicing the following centres:
 - Ballina (12 000 EP);
 - Lennox Head (18 000 EP);
 - Alstonville (8 000 EP); and
 - Wardell (1 750 EP).
- ▶ Approximately 115 sewage pump stations and associated rising mains and reticulation.

Table 4.1 summarises the cumulative lengths of the Ballina Shire trunk gravity sewer mains.

Table 4.1 Cumulative Gravity Main Lengths

Diameter	Cumulative Length (km)
225	7.3
300	8.2
375	4.2
450	2.4
500	0.3
600	0.4
750	1.7

The existing sewerage infrastructure is illustrated in Figure 4.1 - Figure 4.3.

Details of existing pump stations are summarised in Appendix C.

5. Standards of Service and Design Parameters

5.1 Water Supply

5.1.1 Desired Standards of Service

The water supply network is planned to meet the following desired standards of service³:

Minimum pressures:

- ▶ For domestic customers, a minimum residual pressure of 20m at the property boundary at Peak Instantaneous Demand (PID);
- ▶ For industrial customers, a minimum residual pressure of 25m at the property boundary under Peak Instantaneous Demand (PID);
- ▶ A maximum residual pressure of 80 m head at the property boundary;
- ▶ A positive head must be sustained at 2/3 PID with a fire flow of 10 L/s from each successive hydrant; and,
- ▶ For Ballina, minimum pressures are to be maintained with no supply available from Knockrow reservoir, for the possible situations where a trunk main break occurs, or pipe maintenance is required.

Water Quality:

- ▶ Water quality to meet the 1996 NHMRC/ARMCANZ *Australian Drinking Water Guidelines* 98% of the time; and
- ▶ Water quality complaints less than 10 per 1,000 connected properties per annum.

Interruption of Service:

- ▶ Nil unplanned interruptions greater than 6 hours; and
- ▶ Nil programmed interruptions greater than 12 hours.

Water restrictions:

- ▶ Water restrictions applying for not greater than 10% of the time on average.

5.1.2 Planning and Design Parameters

The major components of the water supply network are planned according to the following Department of Public Works Standards:

Rising and Gravitation Mains: Are sized to deliver Peak Daily Demand (PDD) over 22 hours and 24 hours respectively, with the diameter of a rising main sized to give the least present worth of capital and pumping costs. Gravity mains are sized by consideration of available head and grade.

³ Based on the requirements of the BSC Draft Water Reticulation Specification (2002)

Reticulation: Reticulation is to give minimum pressures, as outlined above, with the active storage of the service reservoir(s) 2/3 depleted during periods of maximum demand.

Table 5.1 provides the Hazen-Williams 'C' friction factor values that were adopted, in accordance with best practice.

Table 5.1 Adopted friction factors

Nominal Diameter	Hazen-Williams 'C' Value
150 mm or less	100
200 mm – 250 mm inclusive	110
300 mm or greater	120

5.2 Sewerage

5.2.1 Desired Standards of Service

The sewerage network is required to meet the following standards of service.

Effluent Quality

- ▶ Sewage effluent meeting Environment Protection Authority 90 Percentile License Limits (BOD, SS, total N, NH₃N, Oil and Grease, Total P, Faecal coliforms);

Chokages

- ▶ All sewer chokes removed and service restored within 8 hours;

Overflows and Odour

- ▶ Sewer overflows to the environment less than one per 100 km of mains per year;
- ▶ Odour complaints less than 1 per 1000 properties per year

5.2.2 Design Parameters

Gravity Mains

- ▶ Mannings "n" friction value = 0.014;
- ▶ Minimum velocity at Peak Wet Weather Flow (PWWF) = 0.6m/s;

Trunk sewerage pump stations

- ▶ Emergency storage = 8 hours @ Average Dry Weather Flow (ADWF), where the ADWF is the average dry weather flow of the pump stations gravity catchment only;
- ▶ Duty pump to be capable of matching PWWF inflow;

Rising Mains

- ▶ Minimum velocity = 0.75m/s;
- ▶ Maximum velocity = 2.0m/s.

6. System Performance – Water Supply

6.1 General

The trunk water supply network was modelled using Haestad Method's WaterCAD software, to determine the performance of the existing system under projected hydraulic loads.

6.2 Scenarios

The following scenarios were analysed, at increments of five (5) years from 2003 – 2033:

1. Three consecutive Peak Daily Demands (PDD). This determined the capability of supply mains, supply sources and pump stations to maintain an average supply to the service reservoirs equivalent to PDD;
2. Peak Instantaneous Demand (PID). This determined the minimum pressures experienced in the individual service areas; and
3. Fire Flow (FF) with 2/3 PID Background demand. This was carried out to check the validity of recommended capital works under fire flow conditions and that the available fire flows could meet the minimum desired.

6.3 Existing Network Performance

6.3.1 Peak Daily Demand

The performance of the existing Service Reservoirs is presented in detail in Appendix D, with the key outcomes discussed below.

Pine Avenue and Basalt Court Reservoirs

Gravity mains from Knockrow Reservoir supply Pine Avenue and Basalt Court Reservoirs. Model results indicated that, under existing conditions, these reservoirs have adequate supply to meet PDD. By 2008, however, the results indicated that the supply rate was not able to match the overall PDD demand, which fails the Desired Standards of Service Criteria.

By 2028, the model results predict that Pine Avenue reservoir would fail under PDD after 3 days continuous PDD. Similarly, by 2033, the model results predict that Basalt Court would also fail under similar conditions.

That the reservoirs would, in the short term, not be able to be supplied with PDD by the existing mains, and yet not run dry until 2028-2033, is indicative of their relatively large storage volumes compared to demand.

In order to meet the Desired Standards of Service, augmentations to the supply system from Knockrow reservoir are required in the short-term.

East Ballina Reservoir

This reservoir is balanced by the water level in Pine Avenue, and the model results demonstrated that the hydraulic grade here closely matched the hydraulic grade of Pine Avenue. At most, the hydraulic grade lagged Pine Avenue by a maximum of 0.5 m under 2033 PDD conditions. This indicates that the existing transfer mains between the two reservoirs are adequate to meet projected demands.

Lennox Head Reservoir

For all scenario years, results showed that adequate volumes of water could be gravitated from Basalt Court Reservoir to the Lennox Head reservoir, and the existing gravity supply main to the reservoir is sufficient to meet the 2033 PDD.

Whites Lane and Wardell Reservoirs

For all scenario years, Whites Lane Reservoir could be adequately supplied from the existing water sources and infrastructure. In turn, there are sufficient mains, and adequate hydraulic grade from Whites Lane Reservoir to Meerschaum Balance Tank, and from Meerschaum Balance Tank to Wardell Reservoir, to adequately supply Wardell reservoir with 2033 PDD.

6.3.2 Peak Instantaneous Demand

Modelled pressures and hydraulic grades are shown in Appendix D.

Ballina

There are considerable areas that cannot meet the Desired Standards of Service under existing planning demands due to:

- ▶ Elevated areas could not be supplied with the minimum pressure with Pine Avenue and East Ballina Reservoirs 2/3 depleted due to insufficient static head. Many of the areas in East Ballina are currently serviced by private boosters already because of this, however other properties without boosters are also affected, also in East Ballina;
- ▶ The adopted PID unit load of 0.06 L/s/ET is considered conservative planning unit load; and
- ▶ With the adopted boundary condition of no supply from Knockrow reservoir, the mains from Pine Avenue to Ballina Island, especially across the Missingham Bridge, have insufficient capacity.

With growth local trunk main deficiencies are modelled in the North Ballina industrial area and for existing mains supplying West Ballina.

Lennox Head

The majority of Lennox Head is adequately serviced under existing demand conditions, except for the very north of Lennox Head, which is serviced by a 200 mm gravity main from Lennox Head reservoir. This main is restrictive under planning demands and low pressures were modelled in this area. Further growth in this area shows pressures reduce even further with time.

Growth to the south of Basalt Court Reservoir will place a strain on the existing 200 mm gravity supply main from Basalt Court Reservoir and the results showed that downstream pressures reduced as a result, with some elevated areas achieving less than desired minimum pressures.

Wollongbar and Alstonville

Under existing conditions, all of Wollongbar and Alstonville is adequately serviced by the existing infrastructure, apart from new development in the northeast of Wollongbar, which, because of elevation cannot meet the minimum desired 20 m residual head.

With growth, particularly in the north of Wollongbar, which will need to be fed from the Wollongbar booster pump station due to high elevations, the existing 200 mm boosted main supplying the area along the Bruxner Highway has insufficient capacity to meet the projected demand, and modelling showed significant pressure drop downstream of this main.

The Wollongbar booster was judged to have adequate capacity to meet the projected growth in PID with expected new developments in north Wollongbar.

Wardell

Under existing and future conditions, for which limited growth is projected, the existing infrastructure has adequate capacity to meet the projected PID.

7. System Performance - Sewerage

7.1 General

The sewerage system was modelled using Haestad Method's SewerCAD software.

The model indicates that the current performance of the Ballina Shire trunk sewerage system is generally adequate. Figure 7.1 - Figure 7.3 illustrate the performance of the trunk gravity system under PWWF.

All areas of the trunk gravity system are performing adequately with the exception of the 150mm main immediately upstream of SP2201. This main is generally adequate except when several of the upstream pump stations are pumping simultaneously. If all the upstream pump stations were to be running simultaneously there is a high probability of the gravity main overflowing.

The gravity main from Wollongbar to Alstonville STW appears to be under-capacity but it operates as an inverted siphon and therefore flows under pressure in some sections with no adverse effects.

The performance of each pump station is detailed in Appendix E. The existing pump station capacities have been obtained from the results of draw down testing provided by Ballina Shire Council. Table 7.1 summarises the pump stations that are currently under-capacity. Note that this assumes the current upgrading of SP2201 is complete.

Table 7.1 Under-Capacity Pump Stations

Pump Station	PWWF (L/s)	Capacity (L/s)	Deficiency (L/s)
SP2013	11.9	11.5	0.4
SP4106	1.7	0.8	0.9

The emergency storage requirements for each pump station are detailed in Appendix F. Total storage has been calculated as the in-system storage within the wet well, gravity mains and manholes below the overflow level of the pump station and above the duty pump start level. In the majority of cases, the overflow level was estimated, meaning the calculated in-system storage may not be exact. Table 7.2 summarises the pump stations that currently do not have adequate emergency storage capacity.

Table 7.2 Emergency Storage Deficient Pump Stations

Pump Station	Storage Required (m ³)	Total In-system Storage (m ³)	Storage Deficiency (m ³)
SP2306	37	18	19
SP2309	53	46	7
SP3101	11	9	2
SP3105	37	36	1

8. Capital Works – Water Supply

8.1 Bulk Water Supply

Wollongbar has a projected 2033 PDD of 6.8 ML/day, which does not exceed the nominal capacity of the James Road supply to Wollongbar Reservoir. Similarly, the 2033 PDD of 1.0 ML/day from Wardell does not exceed the nominal capacity of the Marom Creek WTP. However, demand projections predict that the 26.4 ML/day nominal capacity of supply from Knockrow Reservoir will be exceeded by 2018.

The projected demands calculated as part of the system planning should be forwarded and discussed with Rous Water to ensure that adequate capacity is maintained in the supply sources.

8.2 Water Supply Zones

The projected ultimate water supply zone boundaries are shown in Figure 8.1 - Figure 8.2.

It is recommended that ten (10) new water supply zones be formed, and the description and triggers for these are discussed below:

- ▶ **Ballina Heights:** To service new development. To be supplied from a new service reservoir (Ballina Heights) with a feed from the Knockrow reservoir gravity mains.
- ▶ **Ballina Heights High Level Zone (HLZ):** To service new development surrounding the planned Ballina Heights reservoir site.
- ▶ **Ross Lane:** To service new development. To be supplied from a new service reservoir (Ross Lane) with a feed from the Knockrow reservoir gravity mains.
- ▶ **Ross Lane HLZ:** To service new development in the elevated areas of the Ross Lane reservoir service area.
- ▶ **Pacific Pines:** To service new development in the western portions of Lennox Head. To be supplied by a gravity feed from Basalt Court Reservoir.
- ▶ **Pacific Pines HLZ:** To service new development in the elevated areas in the north of the Pacific Pines reservoir service area.
- ▶ **Lennox HLZ:** To meet increasing demands from further development surrounding Fig Tree Hill Drive, which is currently serviced by direct feed from Knockrow reservoir, it is planned to remove the supply from Knockrow and to feed Lennox Head reservoir, via a booster pump station.
- ▶ **Angels Beach:** To service new development. To be supplied from a booster pump fed by Pine Avenue Reservoir. Analysis showed that the mains from Basalt Court Reservoir, which is higher than Pine Avenue Reservoir, had insufficient capacity to service the area from this direction.
- ▶ **East Ballina HLZ:** This would constitute roughly 30% – 40% of existing properties in East Ballina currently serviced by gravity from Pine Avenue and East Ballina Reservoirs. These areas cannot maintain minimum desired pressures under gravity

conditions due to elevation. It is planned to form a new pressure zone fed by a booster pump station with new reticulation where required.

- ▶ **Russellton HLZ:** Planned developments in the areas surrounding the decommissioned Russellton Reservoir have elevations too high to be able to be serviced from Wollongbar reservoir. It is planned to form a new pressure zone fed by a booster pump station with stop valves closed in the existing reticulation at appropriate points.
- ▶ **Wardell HLZ and Medium Level Zone (MLZ):** No development in the elevated areas of Wardell was anticipated to occur within the study horizon. However, should development occur, new pressure zones are required for these areas, with probable supply from a booster pump station.

It is also recommended that the following existing pressure zone boundaries be altered and/or extended:

- ▶ **Ballina:** To transfer existing properties to the new East Ballina HLZ, as previously discussed.
- ▶ **Basalt Court HLZ:** Additional existing properties that cannot be supplied with adequate pressure with Basalt Court Reservoir 2/3 depleted, and some infill in the area, will require extension of the existing pressure zone boundary.
- ▶ **Basalt Court:** The extent of the existing boundary to be reduced in places to accommodate the new Pacific Pines pressure zones and the extension of the Basalt Court HLZ boundary. The boundary to be extended in areas south of the reservoir, to accommodate projected developments in this vicinity.
- ▶ **Wollongbar HLZ:** To be extended to accommodate existing properties elevated above the supply HGL of Wollongbar Reservoir at Minimum Operating Level, and to service new developments in north Wollongbar. Analysis indicated that spare capacity is available from the Wollongbar booster pumps for the proposed boundary. The proposed boundary does, however, encompass many lower-lying development areas that may be serviced by gravity flow from Wollongbar Reservoir, but were judged difficult to service from the existing infrastructure in this fashion. It is recommended that optimisation of the boundary occur at the reticulation detail design phase.
- ▶ **Wardell:** Extension of the boundaries to accommodate projected new development.

8.3 Reservoirs

Figure 8.3 - Figure 8.12 show the planned capital works for augmentation and extension of the water supply network.

Table 8.1 summarises the details of three (3) new service reservoirs that are planned for construction to supply new development areas:

Table 8.1 Reservoir Works

Reservoir	Nominal Operational Volume (ML)	TWL (m AHD)	Works Commencement
Ballina Heights	4 ML	90	2004-08
Pacific Pines	6 ML	70	2004-08
Ross Lane	2 ML	90	2023-28

8.4 Pump Stations

The existing supply from Knockrow Reservoir is biased towards Pine Avenue due to this reservoir being considerably lower than Basalt Court Reservoir. Currently, this hydraulic bias is controlled by the North Creek Road motorised control valve, which regulates flow to Pine Avenue Reservoir. This valve opens and closes based on the levels in both reservoirs.

The capacity of the existing gravity mains from Knockrow, where found to be insufficient to maintain PDD supply to Pine Avenue and Basalt Court reservoirs in all future scenarios, and hence fails the performance criteria.

Further analysis showed that velocities in the gravity mains were relatively low, which indicates that, with in-line boosting, the capacity of the mains could be significantly increased. This option would prove more cost-effective than large duplicate gravity mains.

Similar conclusions were reached by a previous report by DPWS (2003), which considered the capacity of the supply system from Knockrow Reservoir, and recommended that an in-line booster be constructed in North Creek Road, on the dedicated rising main to Basalt Court Reservoir, to serve a dual purpose:

- ▶ To augment the flows through the existing gravity supply mains; and
- ▶ When operating, to bias flow towards the Basalt Court Reservoir, to counter the bias towards Pine Avenue Reservoir under gravity conditions.

The works recommended by DPWS were reviewed and found to be cost-effective and adequate to service demands for the planning horizon.

Table 8.2 summarises the pump station works that are required.

Table 8.2 Pump Station Works

Pump Station	New or Upgrade	Duty	Required Power (kW)	Works Commencement
North Creek Road In-line Booster	New	185 L/s @ 24 m	44	2004-08
Ballina Heights HLZ Booster	New	17 L/s @ 25 m	4	2004-08
East Ballina HLZ Booster	New	56 L/s @ 30 m	16	2004-08
Russellton HLZ Booster	New	20 L/s @ 15 m	3	2004-08
Angels Beach HLZ Booster	New	26 L/s @ 20 m	5	2004-08
North Lennox HLZ Booster	New	30 L/s @ 20 m	6	2008-13
Pacific Pines HLZ Booster	New	54 L/s @ 25 m	13	2008-13
Ross Lane HLZ Booster	New	15 L/s @ 15 m	2	2023-28
Basalt Court Booster	Upgrade	45 L/s @ 30 m	13	2008-13

8.5 Distribution Mains

As discussed previously, DPWS compiled a planning report considering the augmentation options for supply from Knockrow Reservoir to the Ballina/Lennox Head service reservoirs. The preferred strategy adopted was:

- ▶ Installation of the North Creek Road Booster Pump Station (discussed previously);
- ▶ Augmentation of the existing DN375 mm main from Knockrow Reservoir to Ross Lane with a parallel DN450 mm main;
- ▶ Construction of a DN300 mm main from Ross Lane to the proposed Ballina Heights Reservoir. This will maintain capacity in the existing DN375 mm main along the Pacific Highway to service Ballina;
- ▶ Replacement of the aging DN200 mm along Ross Lane with an DN450 mm main;
- ▶ Duplication of the transfer main from Pine Avenue Reservoir to East Ballina Reservoir.

Analysis determined that the existing transfer mains from Pine Avenue to East Ballina Reservoir were adequate and duplication was not required. Aside from this, the proposed works by DPWS were found to be cost-effective and hydraulically adequate for the planning horizon. No other works were deemed to be necessary.

8.6 Trunk Mains

Ballina

As noted previously, the mains from Pine Avenue reservoir have insufficient capacity to service Ballina Island, North Ballina and West Ballina under existing and future PID with the assumed boundary condition of no supply from Knockrow Reservoir. The existing mains across the Missingham Bridge provide the largest restriction, with a head loss of 12 m over the bridge under 2033 PID conditions. Other existing mains feeding flows westward and northwards in Ballina Island were similarly under capacity.

It is recommended that these mains be augmented. Council has advised that there is insufficient room to place an additional 500 mm diameter main on the Missingham Bridge, and hence the planned works include thrust boring under North Creek.

Similarly, the planned works for augmentation of supply to North Ballina allow for thrust boring of a new main across the North Creek Canal, as this is scheduled to occur prior to construction of the second Pacific Highway bridge crossing. As this short crossing would primarily increase security of supply, rather than augment the hydraulic capacity of the existing main, there is an option to defer construction of the main until commencement of bridge construction.

A 300 mm diameter main is proposed as part of the West Ballina Arterial Road project, which will ensure security of supply to West Ballina and augment the hydraulic capacity of the existing mains. The timing and alignment of these works will therefore be dependent on the construction period for the roadway.

Additional local main deficiencies were found, and works to augment their capacities scoped. Details are provided in the planned capital works programme and supporting figures.

Lennox Head

The existing trunk mains in Lennox Head generally had sufficient hydraulic capacity for demands over the planning horizon, with the following exceptions:

- ▶ The existing DN200 mm main from Lennox Head reservoir along Ballina Street is already at capacity and is not sufficient to accommodate further infill development in Lennox Head as well as supply additional flows to the proposed North Lennox HLZ. A parallel DN300 mm main is recommended.
- ▶ The existing reticulation has insufficient capacity to service the projected Lennox Meadows development. A DN200 mm augmentation to service this area is recommended.
- ▶ The single DN200 mm trunk main from Basalt Court reservoir along North Creek Road cannot supply growing demands in development areas south of Basalt Court reservoir. A parallel DN200 mm augmentation is recommended.

Wollongbar and Alstonville

The existing trunk mains in Wollongbar and Alstonville generally had sufficient hydraulic capacity, with the exception of the sole DN200 mm supply main from the

Wollongbar booster along the Bruxner Highway, which cannot supply increasing future demands. Under 2033 PID conditions, the head loss along this main was found to be approximately 32 m. It is recommended that a parallel DN200 mm main be constructed as an augmentation.

Wardell

The existing mains were found to be of adequate capacity and no further augmentations are recommended.

8.7 Basis of Unit Rates for Cost Estimates

For new reservoirs and mains, unit rates were adopted from the Department of Land and Water Conservation (DLWC) 2001 Reference Rates. Pump station cost estimates were determined through reference to previous contract rates for the larger pump stations and adjustment of the DLWC reference rates for the smaller pump stations.

8.8 Capital Works Programme

The proposed capital works programme is shown in Table 8.4. A summary of capital expenditure is shown in Table 8.3.

Table 8.3 Water Supply Capital Works Expenditure

Year	Capital Expenditure \$M
2004/05 – 2007/08	\$5.52
2008/09 – 2012/13	\$6.53
2013/14 – 2017/18	\$3.92
2018/19 – 2022/23	\$1.25
2023/24 – 2027/28	\$2.53
2028/29 – 2032/33	\$1.25
Total	\$21.0

Ballina Shire Council
Water Supply Capital Works
Overall
Table 8.4

Construction Period	Area	Item	Capacity/Size	Quantity	Units	Unit cost (\$)	Total Cost (\$)	Works Code
Water Treatment Plant								
	Nil							
Service Reservoirs								
2004/05-2007/08	Ballina Heights	Reservoir	4 ML	1	\$	920,000	\$ 920,000	WR-01
2005/06-2009/10	Pacific Pines	Reservoir	3 ML	2	\$	770,000	\$ 1,540,000	WR-02
2023/24-2027/28	Ross Lane	Reservoir	2 ML	1	\$	630,000	\$ 630,000	WR-03
							\$ 3,090,000	
Water Pumping Stations								
2004/05	Ballina Heights	HLZ Booster	17 L/s 25 m 4 kW	1	\$	70,000	\$ 70,000	WP-05
2005/06	East Ballina	HLZ Booster	56 L/s 30 m 16 kW	1	\$	120,000	\$ 120,000	WP-10
2011/12-2012/13	North Creek Road	Booster	185 L/s 24 m 44 kW	1	\$	350,000	\$ 350,000	WP-01
2007/08	Russellton	HLZ Booster	20 L/s 15 m 3 kW	1	\$	60,000	\$ 60,000	WP-06
2007/08	Angels Beach	HLZ Booster	26 L/s 20 m 5 kW	1	\$	65,000	\$ 65,000	WP-07
2008/09	North Lennox	HLZ Booster	30 L/s 20 m 6 kW	1	\$	70,000	\$ 70,000	WP-08
2009/10	Basalt Court	Booster Upgrade	45 L/s 30 m 13 kW	1	\$	110,000	\$ 110,000	WP-02
2010/11	Pacific Pines	HLZ Booster	54 L/s 25 m 13 kW	1	\$	110,000	\$ 110,000	WP-03
2025/26	Ross Lane	HLZ Booster	15 L/s 15 m 2 kW	1	\$	60,000	\$ 60,000	WP-09
							\$ 1,015,000	
Water Mains								
2012/13-2014/15	Ballina System - Duplication of DN375 Knockrow Reservoir to Ross Lane		DN450 mm	1,500	m	\$ 314	\$ 470,000	WM-02
2004/05-2007/08	Ballina System - Laneway Mains DN100		DN100 mm	4,600	m	\$ 76	\$ 350,000	WZ-01
2004/05-2007/08	Ballina System - Laneway Mains DN150		DN150 mm	1,800	m	\$ 110	\$ 200,000	WZ-02
2014/15-2017/18	Ballina System - Replacement of DN200 Ross Lane		DN450 mm	3,700	m	\$ 314	\$ 1,160,000	WM-03
2004/05-2007/08	Lennox Head System - Laneway Mains DN100		DN100 mm	1,700	m	\$ 76	\$ 130,000	WZ-03
2004/05-2007/08	Lennox Head System - Laneway Mains DN150		DN150 mm	500	m	\$ 110	\$ 60,000	WZ-04
2007/08	Angels Beach	Angels Beach - Pressure Zone Distribution - Stage 1	DN200 mm	600	m	\$ 140	\$ 80,000	WD-05
2010/11	Angels Beach	Angels Beach - Pressure Zone Distribution - Stage 2	DN200 mm	500	m	\$ 140	\$ 70,000	WD-19
2008/09-2010/11	Ballina Heights	Ballina Heights - Reservoir Supply Main	DN300 mm	5,000	m	\$ 198	\$ 990,000	WM-01
2007/08	Ballina Heights	Ballina Heights - Pressure Zone Trunk	DN300 mm	1,100	m	\$ 198	\$ 220,000	WD-01
2007/08	Ballina Heights	Ballina Heights - Pressure Zone Distribution	DN200 mm	600	m	\$ 140	\$ 80,000	WD-02
2010/11	Ballina Island	Ballina Island - Main parallel to Missingham Bridge	DN500 mm	380	m	\$ 349	\$ 130,000	WD-23
2011/12	Ballina Island	Ballina Island - Thrust boring parallel to Missingham Bridge	DN500 mm	380	m	\$ 1,000	\$ 380,000	WD-23
2008/09	Ballina Island	Ballina Island - Pressure Zone Distribution - Augmentation for Coastal Growth	DN375 mm	600	m	\$ 250	\$ 150,000	WD-22
2009/10	Ballina Island	Ballina Island - Pressure Zone Distribution - Augmentation for Coastal Growth	DN450 mm	500	m	\$ 314	\$ 160,000	WD-33
2010/11	Ballina Island	Ballina Island - Pressure Zone Distribution - Augmentation for Coastal Growth	DN300 mm	1,400	m	\$ 198	\$ 280,000	WD-35
2010/11	Ballina Island	Ballina Island - Pressure Zone Distribution - Augmentation to North Ballina	DN250 mm	1,300	m	\$ 163	\$ 210,000	WD-34
2012/13	Ballina Island	Ballina Island - Pressure Zone Distribution - Augmentation to North Ballina	DN300 mm	600	m	\$ 198	\$ 120,000	WD-44
2005/06	Basalt Court	Basalt Court - Distribution Main Upgrade	DN200 mm	300	m	\$ 140	\$ 40,000	WD-43
2006/07	Basalt Court	Basalt Court - Pressure Zone Distribution - Area 1	DN200 mm	300	m	\$ 140	\$ 40,000	WD-10
2013/14	East Ballina	East Ballina - HLZ Distribution	DN250 mm	400	m	\$ 163	\$ 70,000	WD-31
2014/15	East Ballina	East Ballina - HLZ Distribution	DN200 mm	400	m	\$ 140	\$ 60,000	WD-41
2015/16	East Ballina	East Ballina - Reticulation Duplication for Rezoning to HLZ					\$ 150,000	WD-42
212/13	East Ballina	East Ballina - Distribution Main Upgrade	DN450 mm	600	m	\$ 314	\$ 190,000	WD-32
2008/09-2012/13	Lennox Head	Lennox Head - Distribution Main Upgrade	DN300 mm	1,200	m	\$ 198	\$ 240,000	WD-26
2011/12	Lennox Head	Lennox Head - Distribution Main Upgrade	DN200 mm	400	m	\$ 140	\$ 60,000	WD-27
2004/05-2007/08	North Ballina	North Ballina - Pressure Zone Distribution - Area 1	DN200 mm	1,000	m	\$ 140	\$ 140,000	WD-13
2004/05-2007/08	North Ballina	North Ballina - Pressure Zone Distribution - Area 2	DN200 mm	600	m	\$ 140	\$ 80,000	WD-30
2008/09-2011/12	North Ballina	North Ballina - Pressure Zone Distribution - Area 1	DN200 mm	800	m	\$ 140	\$ 110,000	WD-37
2008/09-2012/13	North Ballina	North Ballina - Pressure Zone Distribution - Area 1 - Supply Augmentation	DN250 mm	300	m	\$ 163	\$ 50,000	WD-21
2008/09-2012/13	North Ballina	North Ballina - Distribution Main Upgrade	DN300 mm	700	m	\$ 198	\$ 140,000	WD-36
2008/09-2012/13	North Ballina	North Ballina - Distribution Main Fishery Ck Canal Crossing	DN300 mm	160	m	\$ 800	\$ 130,000	WD-36
2013/14-2015/16	North Ballina	North Ballina - New Highway main	DN300 mm	2,900	m	\$ 198	\$ 570,000	WM-07
2005/06-2007/08	Pacific Pines	Pacific Pines - Pressure Zone Trunk - Stage 1 (DN300)	DN300 mm	1,500	m	\$ 198	\$ 300,000	WD-08
2005/06-2007/08	Pacific Pines	Pacific Pines - Pressure Zone Trunk - Stage 1 (DN375)	DN375 mm	400	m	\$ 250	\$ 100,000	WD-07
2005/06-2007/08	Pacific Pines	Pacific Pines - Reservoir Supply Main	DN250 mm	400	m	\$ 163	\$ 70,000	WD-06
2008/09-2012/13	Pacific Pines	Pacific Pines - Pressure Zone Distribution - Stage 1	DN200 mm	1,700	m	\$ 140	\$ 240,000	WD-09
2008/09-2012/13	Pacific Pines	Pacific Pines - Pressure Zone Distribution - Stage 2	DN200 mm	1,100	m	\$ 140	\$ 150,000	WD-28
2023/24-2027/28	Ross Lane	Ross Lane - Pressure Zone Distribution - Stage 1	DN200 mm	2,900	m	\$ 140	\$ 410,000	WD-04
2023/24-2027/28	Ross Lane	Ross Lane - Pressure Zone Trunk	DN250 mm	1,100	m	\$ 163	\$ 180,000	WD-03
2011/12	West Ballina	West Ballina - Pressure Zone Distribution - Area 1	DN300 mm	200	m	\$ 198	\$ 40,000	WM-06
2016/17	West Ballina	West Ballina - Pressure Zone Distribution - Area 2	DN200 mm	500	m	\$ 140	\$ 70,000	WD-15
2005/06	Wollongbar	Wollongbar Boosted - Pressure Zone Distribution - Area 1	DN250 mm	800	m	\$ 163	\$ 130,000	WD-17
2006/07	Wollongbar	Wollongbar Boosted - Pressure Zone Distribution - Area 2	DN250 mm	1,300	m	\$ 163	\$ 210,000	WD-18
2016/17	Wollongbar	Wollongbar Boosted - Pressure Zone Distribution - Area 1	DN200 mm	100	m	\$ 140	\$ 10,000	WD-45
2013/14	Wollongbar	Wollongbar Boosted - Distribution Main Upgrade	DN200 mm	1,200	m	\$ 140	\$ 170,000	WD-40
							\$ 9,390,000	
Miscellaneous								
2003/04-2032/33	Miscel Plant Replacement			1	Item	\$ 1,500,000	\$ 1,500,000	M-01
2003/04	Water Main Replacement			1	Item	\$ 300,000	\$ 300,000	M-02
2003/04	Install Miscel Mag Flow Meters			1	Item	\$ 20,000	\$ 20,000	M-03
2003/04	Security Fence Pine Ave Reservoir			1	Item	\$ 25,000	\$ 25,000	M-04
2003/04	East Ballina Reservoir Internal Painting			1	Item	\$ 160,000	\$ 160,000	M-05
2003/04	GIS Water Supply Layer			1	Item	\$ 50,000	\$ 50,000	M-06
2003/04	Bulk Water Station Renewals			1	Item	\$ 50,000	\$ 50,000	M-07
2003/04	Marom Crk WTP Catchment Plan			1	Item	\$ 40,000	\$ 40,000	M-08
2003/04	Miscellaneous Telemetry Installation			1	Item	\$ 50,000	\$ 50,000	M-09
2003/04	Pine Ave Reservoir Mixer			1	Item	\$ 20,000	\$ 20,000	M-10
2003/04	East Ballina Reservoir Mixer			1	Item	\$ 10,000	\$ 10,000	M-11
2003/04	Lennox Meadows Trunk Main			1	Item	\$ 120,000	\$ 120,000	M-12
2003/04	Marom Crk Switchboard			1	Item	\$ 60,000	\$ 60,000	M-13
2009/10-2032/33	Water Main Renewals			1	Item	\$ 4,800,000	\$ 4,800,000	M-14
2003/04-2008/09	Meter Replacement Programme			1	Item	\$ 300,000	\$ 300,000	M-15
							\$ 7,505,000	
TOTAL							\$21,000,000	

9. Capital Works - Sewerage

9.1 General

A Capital Works Programme has been prepared that will enable the Ballina Shire sewerage system to cope with the projected increase in population. The capital works programme has been determined from the following two sources:

- ▶ Results of SewerCAD modelling of the trunk sewerage system performed by GHD; and,
- ▶ Works associated with Option 2A of the Ballina Shire Urban Water Management Strategy (UWMS) (DPWS – 2002).

Capital Works relating to Sewerage Treatment Works and Reclaimed Water Reuse have been extracted from the UWMS. Capital Works relating to sewage pump station, rising mains, and gravity mains have been determined from the SewerCAD modelling.

9.2 Operational Strategies

This increase in population has also required some changes to be made in the operational strategies of the Ballina Shire sewerage system. These changes are as follows:

- ▶ A new pump station will be constructed at North Ballina that will pump to the Ballina STW. The existing Cumbalum pump station that currently discharges into the West Ballina pump station rising main will discharge into the new North Ballina pump station;
- ▶ Flows from West Ballina via SP2101 will be diverted from Lennox STW to Ballina STW;
- ▶ SP2201 and SP2208 will also be diverted into the new North Ballina pump station. The diversion of SP2208 will reduce the load on the gravity sewer immediately upstream of SP2201 (refer Section 7.1) and eliminate the need for this main to be augmented;
- ▶ Development at Lennox Head will allow SP3108 and SP3106 to be decommissioned and diverted to SP3107; and,
- ▶ Development within the Wollongbar expansion area will allow SP4101 and SP4103 to be decommissioned and diverted to the new Wollongbar pump station within the expansion area.

9.3 Capital Works Programme

The proposed sewerage capital works program for Ballina Shire is detailed in Table 9.2 - Table 9.7, and illustrated in Figure 9.1 - Figure 9.6. The adopted unit rates are based on the Department of Land and Water Conservation's NSW Reference Rates together with rate information from other appropriate sources.

The total estimated cost of sewerage capital works over the next 30 years is \$67.5m. Of this amount, \$7.3m relates to capital works determined from SewerCAD modelling and \$60.2m relates to work set out under Option 2A of the Ballina Shire Urban Water Management Strategy. Table 9.1 summaries the estimated capital expenditure required over the next 30 years.

Table 9.1 Sewerage Capital Works Expenditure

Year	Capital Expenditure \$M		
	SewerCAD Modelling	Option 2A - UWMS	Total
2004/05 – 2007/08	2.58	25.81	\$28.39
2008/09 – 2012/13	1.39	24.10	\$25.49
2013/14 – 2017/18	1.36	5.99	\$7.35
2018/19 – 2022/23	0.91	1.80	\$2.71
2023/24 – 2027/28	0.98	1.25	\$2.23
2028/29 – 2032/33	0.12	1.25	\$1.37
Total	\$7.3	\$60.2	\$67.5

Ballina Shire Council
Sewerage Capital Works
Table 9.2
2004/05 - 2007/08

Item	Capacity/Size	Quantity	Unit cost (\$)	Total Cost (\$)
SP2013				
Upgrade Pumps	14 L/s @ 21 m	1	63,800	63,800
SP2306				
Construct emergency storage	19 m ³	1	43,900	43,900
SP2309				
Construct emergency storage	31 m ³	1	64,300	64,300
SP3002				
Construct emergency storage	38 m ³	1	73,400	73,400
SP3101				
Construct emergency storage	56 m ³	1	88,000	88,000
SP3105				
Construct emergency storage	25 m ³	1	54,500	54,500
SP3106				
Decommission		1	10,000	10,000
SP3107				
Upgrade Pumps	37 L/s @ 35 m	1	124,000	124,000
New rising main to replace existing 100mm	230 m of 200 mm	230	128	29,424
Construct emergency storage	53 m ³	1	86,500	86,500
SP3108				
Decommission		1	10,000	10,000
SP4106				
Upgrade pumps	3 L/s @ 14 m	1	23,100	23,100
New rising main to replace existing 100mm	350 m of 63 mm	350	53	18,550
Proposed Aged Care Facility				
New pump station	21 L/s @ 17 m	1	161,000	161,000
New gravity main	170 m of 225 mm	170	262	44,485
New rising main	1050 m of 150 mm	1050	110	116,009
Proposed River Oaks Development				
New pump station	20 L/s @ 21 m	1	161,000	161,000
New gravity main	290 m of 225 mm	290	262	75,886
New rising main	1420 m of 150 mm	1420	110	156,889
Proposed Pacific Pines Development				
New gravity main	520 m of 225 mm	520	262	136,071
Proposed North Ballina Pump Station				
New Pump Station	150 L/s @ 19 m	1	456,500	456,500
New rising main connecting to SP2101 rising main	100 m of 375 mm	100	250	25,000
New rising main diverting SP2201 to North Ballina PS	610 m of 150 mm	610	110	67,396
Wollongabar Expansion Area				
New pump station	19 L/s @ 45 m	1	182,600	182,600
New gravity main	350 m of 225 mm	350	262	91,586
New gravity main - Ramses Street	440 m of 225 mm	440	262	115,137
New rising main	820 m of 150 mm	820	110	90,598
SP4103				
Decommission		1	10,000	10,000
Ballina STW				
Interim Works Upgrade of Ballina STW		1	1,800,000	1,800,000
Ultimate Upgrade of Ballina STW		0.41	23,300,000	9,450,000

125 Hectare Reclaimed Water Reuse Site	0.06	3,900,000	250,000
Reclaimed Water Distribution Trunk Mains	0.03	720,000	20,000
Ballina Catchment Infiltration and Inflow Works	0.70	1,590,000	1,113,000
Open Space Reclaimed Water Irrigation Works	0.20	250,000	50,000
Lennox Head STW			
Lennox Head RWF Step Screen	1	100,000	100,000
Optimisation Upgrade of Lennox Head STW	1	950,000	950,000
Quality Upgrade of Lennox Head STW	0.95	4,300,000	4,100,000
50 Hectare Reclaimed Water Reuse Site	0.79	1,560,000	1,230,000
125 Hectare Reclaimed Water Reuse Site	0.10	3,900,000	400,000
Lennox Catchment Reclaimed Water Storage	0.16	310,000	50,000
Reclaimed Water Distribution Trunk Mains	0.33	1,650,000	550,000
Lennox Catchment Infiltration and Inflow Works	0.70	1,590,000	1,113,000
Ballina Heights Dual Water Supply Reticulation	1	500,000	500,000
Ballina Heights Dual Water Supply Reservoir	1	700,000	700,000
Open Space Reclaimed Water Irrigation Works	0.67	300,000	200,000
Wardell STW			
Wardell Catchment Infiltration and Inflow Works	1	300,000	300,000
Alstonville			
Alstonville STW - UV	1	230,000	230,000
Reclaimed Water Reuse Scheme	1	1,600,000	1,600,000
Alstonville STW - Optimisation	1	200,000	200,000
Miscellaneous			
Plant Replacement Sewer	0.17	1,500,000	250,000
Infiltration and Inflow Rectification (Scoping)	1	50,000	50,000
North Creek Rd Reticulation	1	200,000	200,000
Pump Station Upgrades	1	150,000	150,000
Pump Station Telemetry	1	250,000	250,000
Total			\$28,385,630

Ballina Shire Council
Sewerage Capital Works
Table 9.3
2008/09 - 2012/13

Item	Capacity/Size	Quantity	Unit cost (\$)	Total Cost (\$)
SP2001				
Upgrade pump motors	45 kW	1	15,000	15,000
SP2309				
Upgrade pumps	14 L/s @ 19 m	1	63,800	63,800
SP3101				
Upgrade pumps	15 L/s @ 35 m	1	98,000	98,000
SP3110				
Parallel gravity main - Hutley Dr	1290 m of 300 mm	1290	349	450,081
Proposed Barrett Land Development				
New pump station	17 L/s @ 6 m	1	149,900	149,900
New gravity main	320 m of 225 mm	320	262	83,736
New rising main	710 m of 150 mm	710	110	78,444
Proposed Henderson Land Development				
New gravity main	300 m of 225 mm	300	262	78,503
North Ballina Pump Station				
Diversion of SP2101 to Ballina STW	600 m of 450 mm	600	372	223,200
Diversion of North Ballina PS to Ballina STW	600 m of 375 mm	600	250	150,000
Ballina STW				
Ultimate Upgrade of Ballina STW		0.59	23,300,000	13,850,000
50 Hectare Reclaimed Water Reuse Site		0	1,560,000	330,000
125 Hectare Reclaimed Water Reuse Site		0.52	3,900,000	2,030,000
Ballina Catchment Reclaimed Water Storage		0.30	500,000	150,000
Reclaimed Water Distribution Trunk Mains		0.97	720,000	700,000
Ballina Catchment Infiltration and Inflow Works		0.30	1,590,000	477,000
Open Space Reclaimed Water Irrigation Works		0.80	250,000	200,000
Lennox STW				
Quality Upgrade of Lennox Head STW		0.05	4,300,000	200,000
125 Hectare Reclaimed Water Reuse Site		0.53	3,900,000	2,080,000
Lennox Catchment Reclaimed Water Storage		0.84	310,000	260,000
Reclaimed Water Distribution Trunk Mains		0.67	1,650,000	1,100,000
Dual Water Supply Trunk Mains		1.00	950,000	950,000
Lennox Catchment Infiltration and Inflow Works		0.30	1,590,000	477,000
Open Space Reclaimed Water Irrigation Works		0.33	300,000	100,000
Wardell STW				
Reclaimed Water Works		1	300,000	300,000
Reclaimed Water Storage		1	300,000	300,000
Alstonville STW				
Alstonville Constructed Wetland		0.05	1,000,000	50,000
Alstonville Catchment Infiltration and Inflow Works		0.20	500,000	100,000
Alstonville STW - Biosolids Management Works		1	200,000	200,000
Miscellaneous				
Plant Replacement Sewer		0.17	1,500,000	250,000
			Total	\$25,494,664

Ballina Shire Council
Sewerage Capital Works
Table 9.4
2013/14 - 2017/18

Item	Capacity/Size	Quantity	Unit cost (\$)	Total Cost (\$)
SP2306				
Upgrade pumps	7 L/s @ 10 m	1	37,900	37,900
SP2308				
Upgrade pumps	10 L/s @ 14 m	1	49,000	49,000
SP3001				
Upgrade pumps	90 L/s @ 25 m	1	197,500	197,500
New parallel rising main	1340 m of 250 mm	1340	172	230,646
SP3110				
Construct emergency storage	53 m ³	1	86,500	86,500
SP4101				
Decommission		1	10,000	10,000
Proposed Angels Beach Development				
New pump station	17 L/s @ 23 m	1	149,900	149,900
New gravity main	320 m of 225 mm	320	262	83,736
New rising main	1250 m of 150 mm	1250	110	138,106
Existing Cumbalum Pump Station				
Upgrade pumps	105 L/s @ 15 m	1	149,750	149,750
New gravity main	640 m of 225 mm	640	262	167,472
Wollongbar Expansion Area				
New gravity main	240 m of 225 mm	240	262	62,802
Ballina STW				
125 Hectare Reclaimed Water Reuse Site		0.42	3,900,000	1,620,000
Ballina Catchment Reclaimed Water Storage		0.7	500,000	350,000
Lennox STW				
125 Hectare Recalimed Water Reuse Site		0.36	3,900,000	1,420,000
Alstonville STW				
Alstonville Constructed Wetland		0.95	1,000,000	950,000
Alstonville Catchment Infiltration and Inflow Works		0.80	500,000	400,000
Miscellaneous				
Plant Replacement Sewer		0.17	1,500,000	250,000
SewerMain Renewals		0.25	4,000,000	1,000,000
Total				\$7,353,312

Ballina Shire Council
Sewerage Capital Works
Table 9.5
2018/19 - 2022/23

Item	Capacity/Size	Quantity	Unit cost (\$)	Total Cost (\$)
SP2006				
Upgrade pumps	12 L/s @ 21 m	1	56,400	56,400
SP3110				
Upgrade pumps	165 L/s @ 35 m	1	276,625	276,625
Proposed Cumbalum SP1				
New pump station	50 L/s @ 10 m	1	202,000	202,000
New gravity main	450 m of 300 mm	450	349	157,005
New rising main	950 m of 250 mm	950	172	163,518
Wollongbar Expansion Area				
New gravity main	200 m of 225 mm	200	262	52,335
Wardell STW				
Additional 1750EP IDEA Tank		1	500,000	500,000
UV Disinfection System upgrade		1	50,000	50,000
Miscellaneous				
Plant Replacement Sewer		0.17	1,500,000	250,000
SewerMain Renewals		0.25	4,000,000	1,000,000
			Total	\$2,707,883

Ballina Shire Council
Sewerage Capital Works
Table 9.6
2023/24 - 2027/2028

Item	Capacity/Size	Quantity	Unit cost (\$)	Total Cost (\$)
Proposed Cumbalum SP2				
New pump station	35 L/s @ 55 m	1	195,000	195,000
New gravity main	350 m of 300 mm	350	349	122,115
New rising main	480 m of 200 mm	480	128	61,406
Proposed Cumbalum SP3				
New pump station	30 L/s @ 10 m	1	161,000	161,000
New gravity main	50 m of 300 mm	50	349	17,445
New rising main	480 m of 200 mm	480	250	120,000
Proposed Cumbalum SP4				
New pump station	13 L/s @ 7 m	1	135,100	135,100
New gravity main	270 m of 225 mm	270	262	70,652
New rising main	860 m of 150 mm	860	110	95,017
Miscellaneous				
Plant Replacement Sewer		0.17	1,500,000	250,000
SewerMain Renewals		0.25	4,000,000	1,000,000
			Total	\$2,227,736

Ballina Shire Council
Sewerage Capital Works
Table 9.7
2028/29 - 2032/2033

Item	Capacity/Size	Quantity	Unit cost (\$)	Total Cost (\$)
Cumbalum SP3				
New gravity main	450 m of 225 mm	450	262	117,754
Miscellaneous				
Plant Replacement Sewer		0.17	1,500,000	250,000
SewerMain Renewals		0.25	4,000,000	1,000,000
			Total	\$1,367,754

10. Conclusions and Recommendations

This section summarises the important conclusions identified in the course of this investigation. In addition, key recommendations are provided for Council's consideration.

10.1 Conclusions

The important findings of this study include:

► Population

- Ballina Shire had approximately 32,500 residents in the year 2001 serviced by water and 38,400 in total;
- The water supply system serviced approximately 10,950 ET and the sewerage system serviced approximately 12,600 ET in 2003.
- ET growth of approximately 9,400 is anticipated over the next 30 years.

► Demands

- Water

The following unit demands were adopted for the water supply modelling:

- Peak Day Demand 1,700L/ET/day
- Peak Hour Demand 0.06L/ET/s

- Sewerage

The following unit loads were adopted for the sewerage modelling:

- Ballina / Lennox Head / Wardell 1,550L/EP/day
- Alstonville / Wollongbar 1,200L/EP/day

► Capital Works Programmes

Capital works programmes have been prepared for the water supply system and sewerage system to service the anticipated population growth over the next 30 years. These capital works programmes will form the basis of the Development Servicing Plans.

The water capital works programme amounts to some \$21m over 30 years.

The sewerage capital works programme amounts to some \$67.5m over of 30 years. Table 10.1 summarises the estimated water and sewerage capital expenditure for the next 30 years. Figure 10.1 illustrates the estimated capital expenditure over the next 30 years.

Table 10.1 Estimated Water and Sewerage Capital Expenditure

Year	Water	Sewerage	Total
2004/05 – 2007/08	\$5.52	\$28.39	\$33.9m
2008/09 – 2012/13	\$6.53	\$25.49	\$32.0m
2013/14 – 2017/18	\$3.92	\$7.35	\$11.3m
2018/19 – 2022/23	\$1.25	\$2.71	\$4.0m
2023/24 – 2027/28	\$2.53	\$2.23	\$4.8m
2028/29 – 2032/33	\$1.25	\$1.37	\$2.6m
Total	\$21.0m	\$67.5m	\$88.5m

10.2 Recommendations

Given the findings of this study it is recommended that Ballina Shire Council:

- ▶ Adopt the Capital Works programmes presented in this Planning Report as a basis for the preparation of Development Servicing Plans documentation.

It is further recommended that Ballina Shire Council:

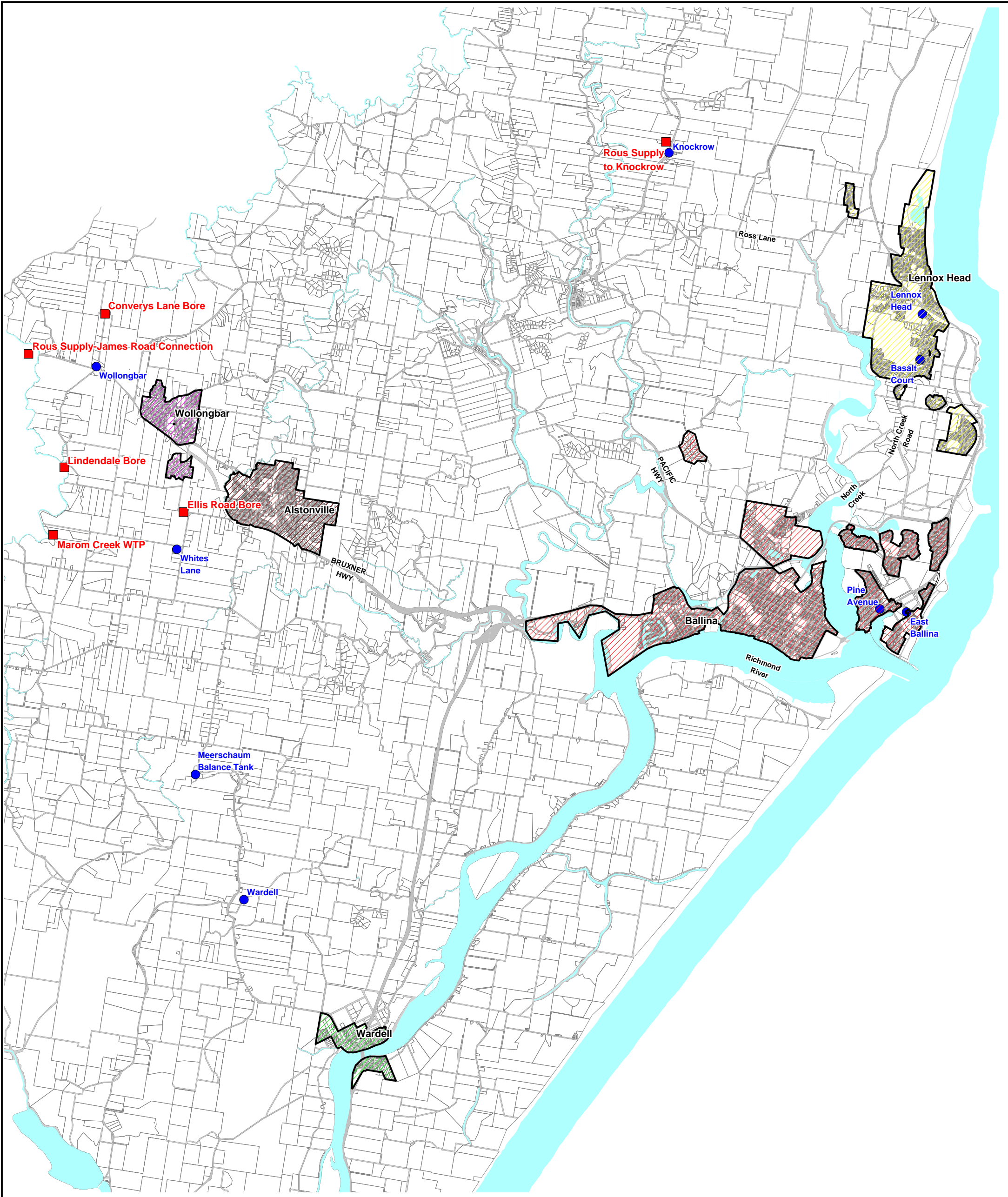
- ▶ Interface and plan with Rous Water to ensure the projected Peak Daily Demands can be adequately supplied;
- ▶ Create ten (10) new water supply pressure zone boundaries, for reasons and triggers stated in Section 8.2;
- ▶ Modify the existing water supply pressure zone boundaries, for reasons stated in Section 8.2;
- ▶ For the proposed Wollongbar HLZ and East Ballina HLZ water supply zones, during the reticulation detail design phase, optimise the boundaries from what is shown in this report; and
- ▶ Select a trigger for construction of the second North Creek Canal water trunk main crossing along the Pacific Highway. These works may be triggered either by year, or by construction of the proposed second bridge crossing.

11. References

- ▶ DPWS (2002), Ballina Shire Urban Water Management Strategy – Final Draft Options Study Summary Report, DPWS Report No. DC 02158, prepared for Ballina Shire Council, August 2002.
- ▶ DPWS, Draft Water and Sewerage Strategic Business Plan, prepared for Ballina Shire Council, June 2003.
- ▶ Ballina Shire Council (2000), Urban Land Release Strategy – 2000, prepared for Ballina Shire Council, May 2000.
- ▶ DPWS (2003), Water Supply Trunk Main Analysis, prepared for Ballina Shire Council, 2003.
- ▶ DPWS (2003), Water Supply Developer Charges Calculation, prepared for Rous Water, February 2003.
- ▶ Sydney Water (2000), Developer Charges Handbook, May 2000.

Appendix A

Figures



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LEGEND

- Water Supply Source
- Reservoir

North

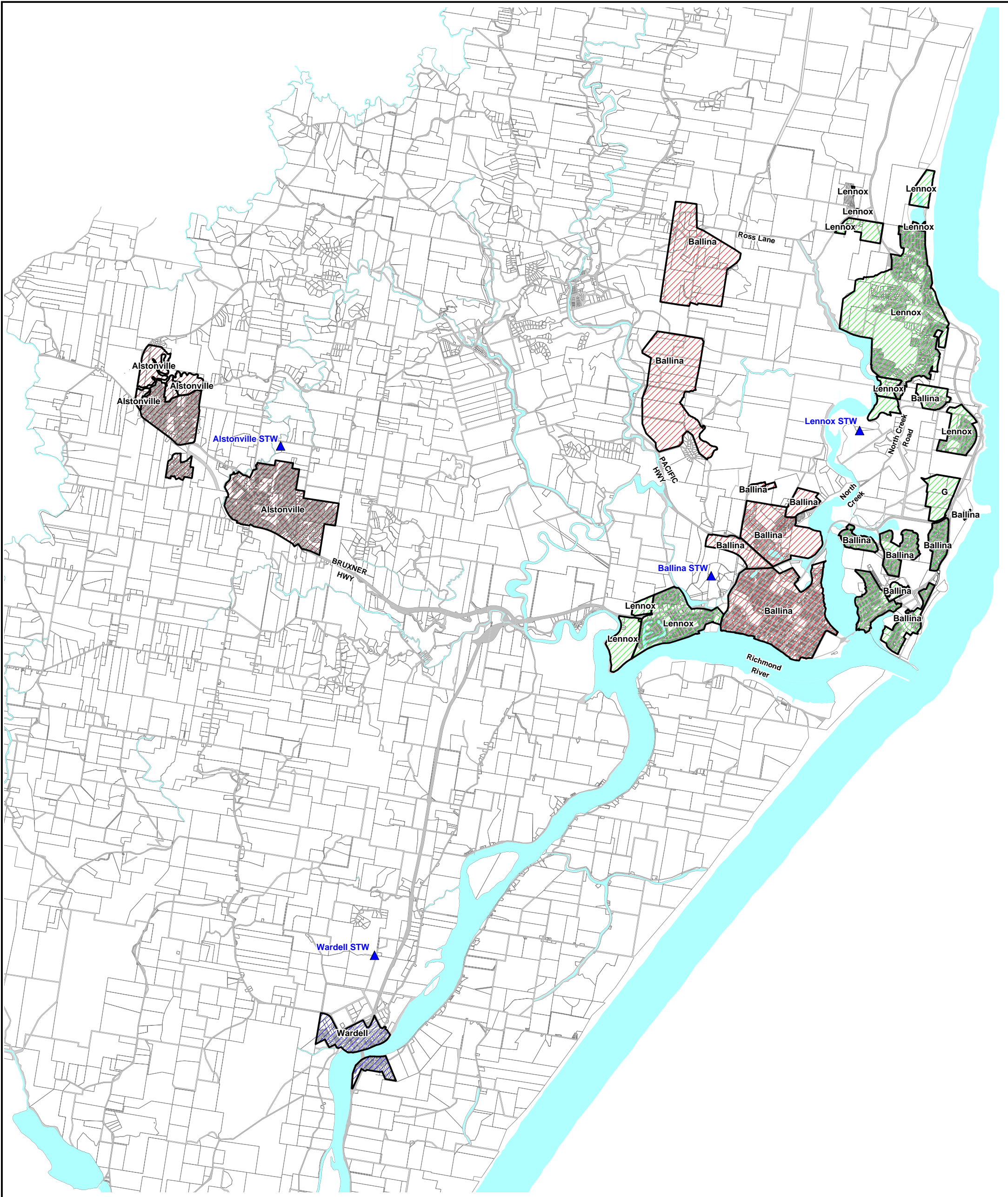


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Figure 2.1
Existing Water Supply Service Areas



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LEGEND

▲ Sewerage Treatment Works

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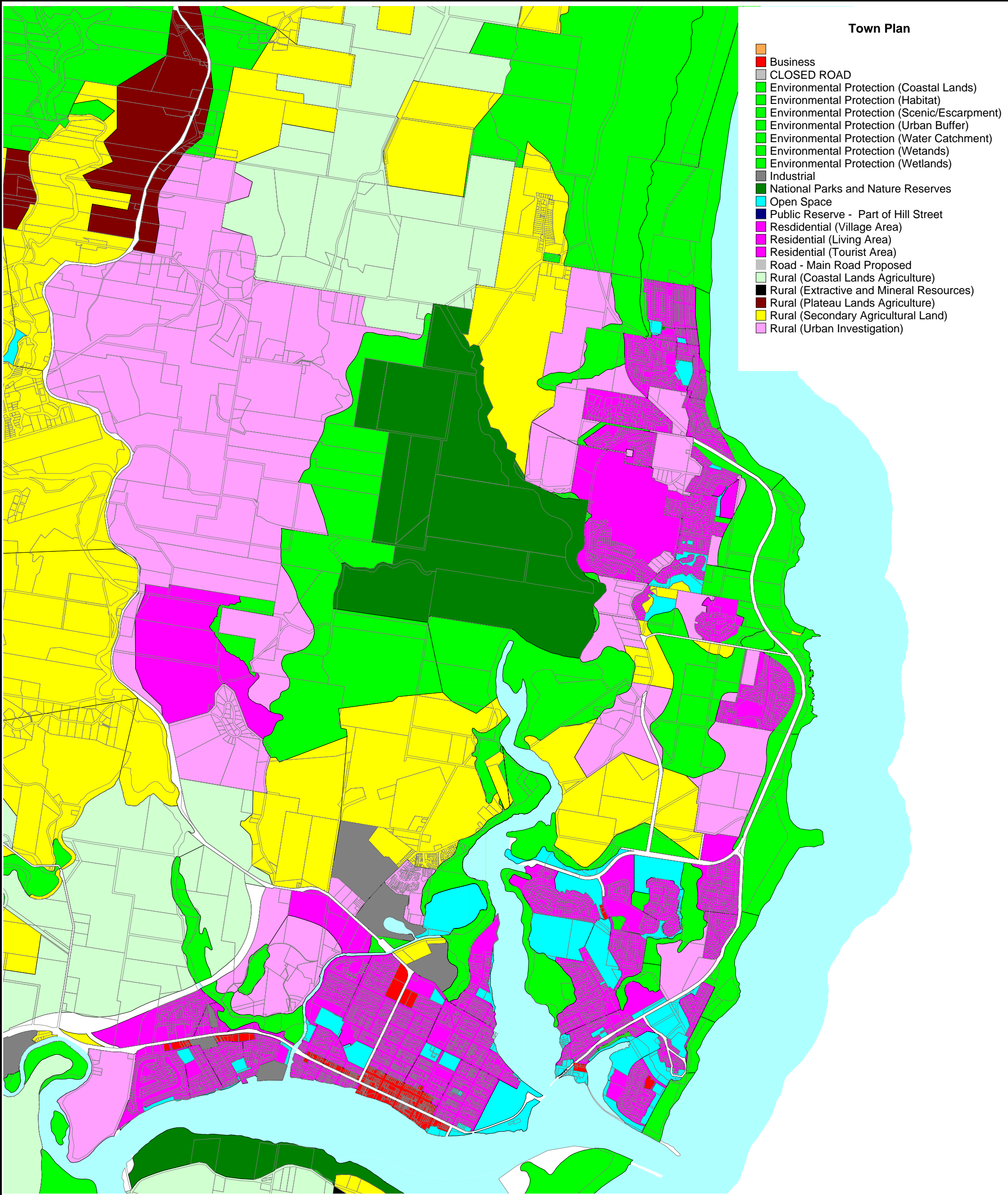


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Figure 2.2
Existing Sewerage Service Areas



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Ballina Shire Council

Figure 2.3
Town Plan -
Ballina and Lennox Head

FIGURE 2-4
Town Plan -
Alstonville and Wollongbar

Town Plan

- Business
- CLOSED ROAD
- Environmental Protection (Coastal Lands)
- Environmental Protection (Habitat)
- Environmental Protection (Scenic/Escarpment)
- Environmental Protection (Urban Buffer)
- Environmental Protection (Water Catchment)
- Environmental Protection (Wetlands)
- Environmental Protection (Wetlands)
- Industrial
- National Parks and Nature Reserves
- Open Space
- Public Reserve - Part of Hill Street
- Residential (Village Area)
- Residential (Living Area)
- Residential (Tourist Area)
- Road - Main Road Proposed
- Rural (Coastal Lands Agriculture)
- Rural (Extractive and Mineral Resources)
- Rural (Plateau Lands Agriculture)
- Rural (Secondary Agricultural Land)
- Rural (Urban Investigation)



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FIGURE 2-5
Town Plan -
Wardell

Town Plan

- Business
- CLOSED ROAD
- Environmental Protection (Coastal Lands)
- Environmental Protection (Habitat)
- Environmental Protection (Scenic/Escarpment)
- Environmental Protection (Urban Buffer)
- Environmental Protection (Water Catchment)
- Environmental Protection (Wetlands)
- Environmental Protection (Wetlands)
- Industrial
- National Parks and Nature Reserves
- Open Space
- Public Reserve - Part of Hill Street
- Residential (Village Area)
- Residential (Living Area)
- Residential (Tourist Area)
- Road - Main Road Proposed
- Rural (Coastal Lands Agriculture)
- Rural (Extractive and Mineral Resources)
- Rural (Plateau Lands Agriculture)
- Rural (Secondary Agricultural Land)
- Rural (Urban Investigation)

North



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 Future Development Areas

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**Figure 2-6
Projected Dwelling Growth -
West Ballina, North Ballina
and Ballina Island**



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 Future Development Areas

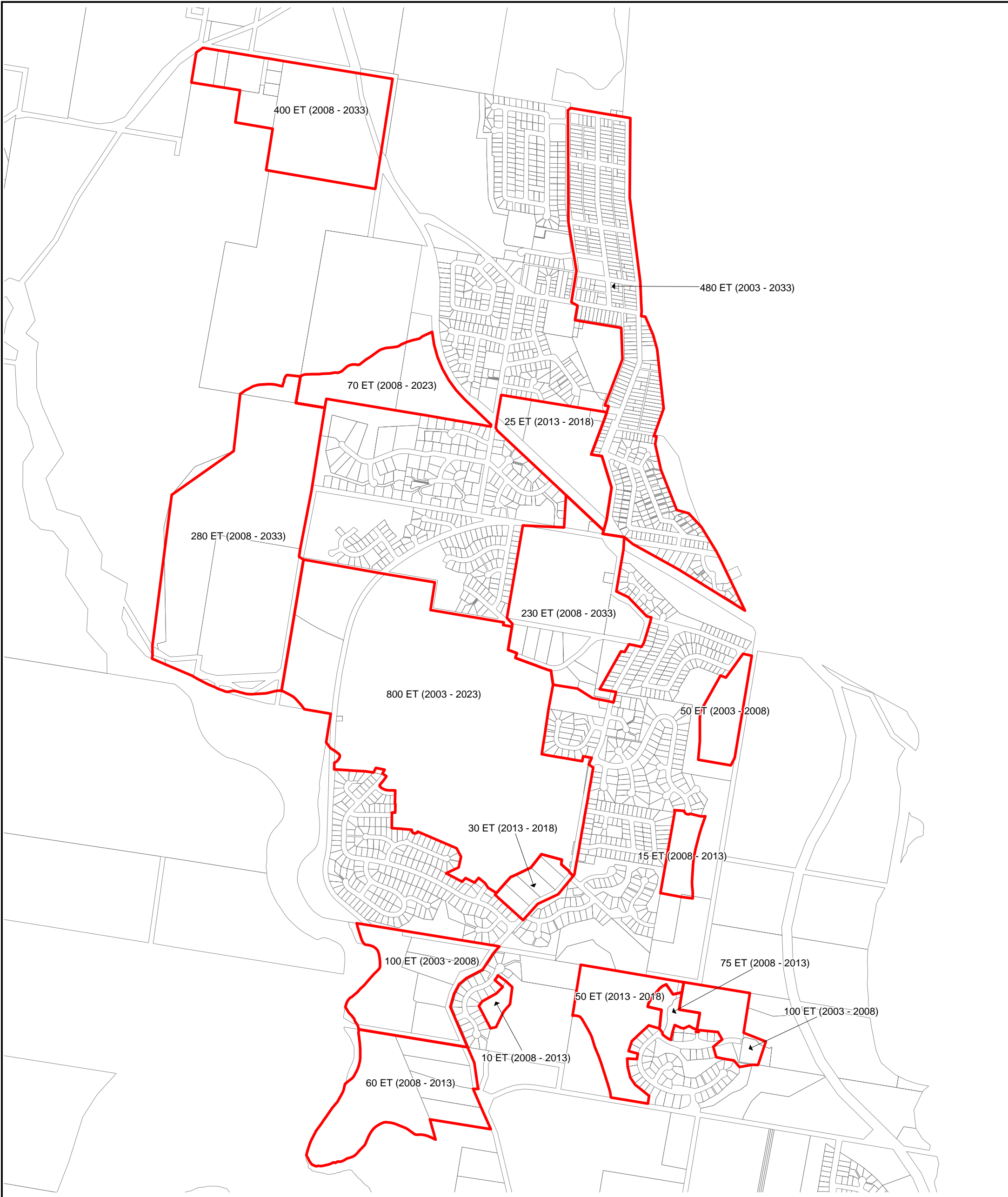
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**Figure 2-7
Projected Dwelling Growth -
East Ballina**



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**Figure 2.8
Projected Dwelling Growth -
Lennox Head**

FIGURE 2-9
Projected Dwelling Growth -
Alstonville

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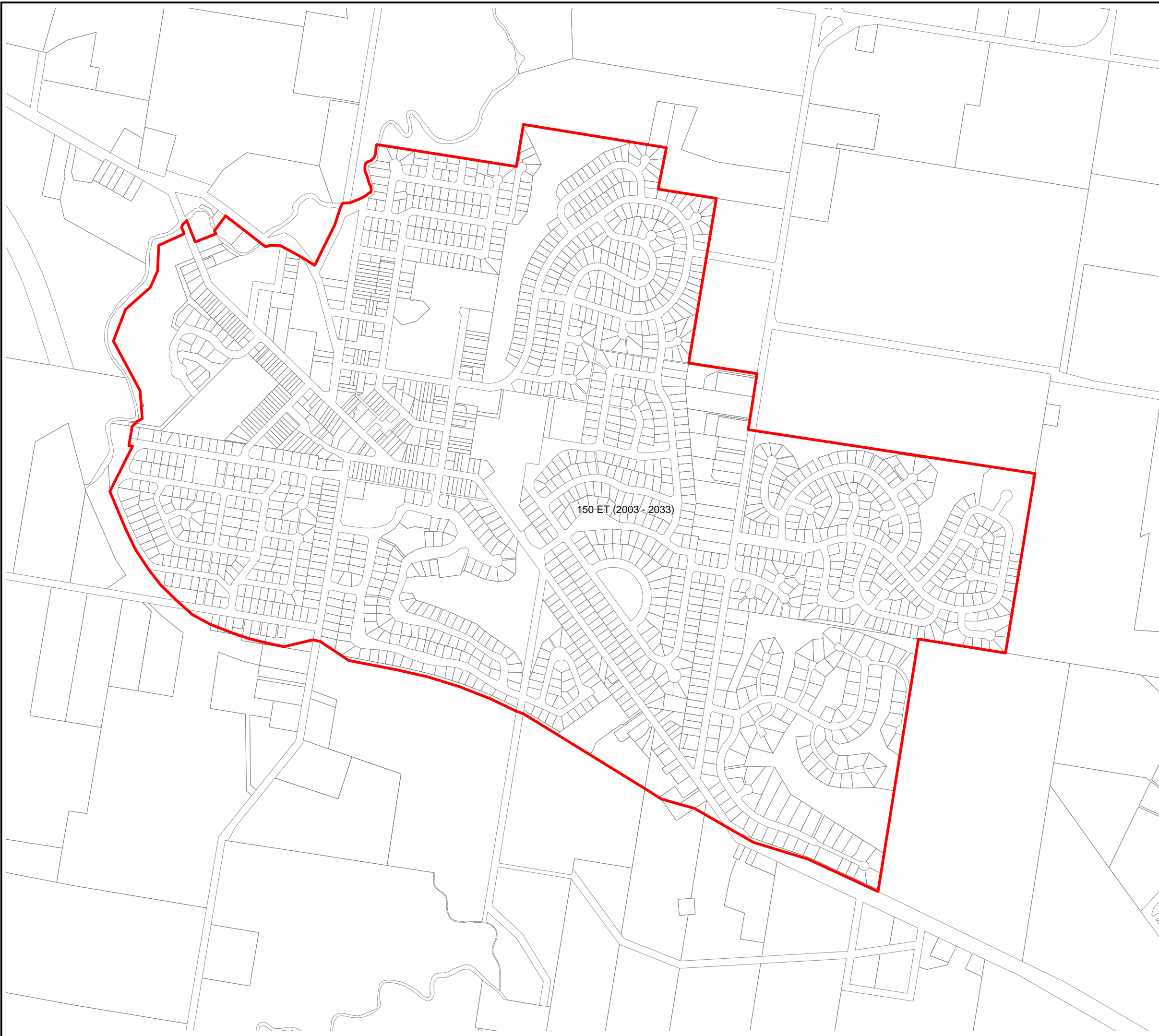
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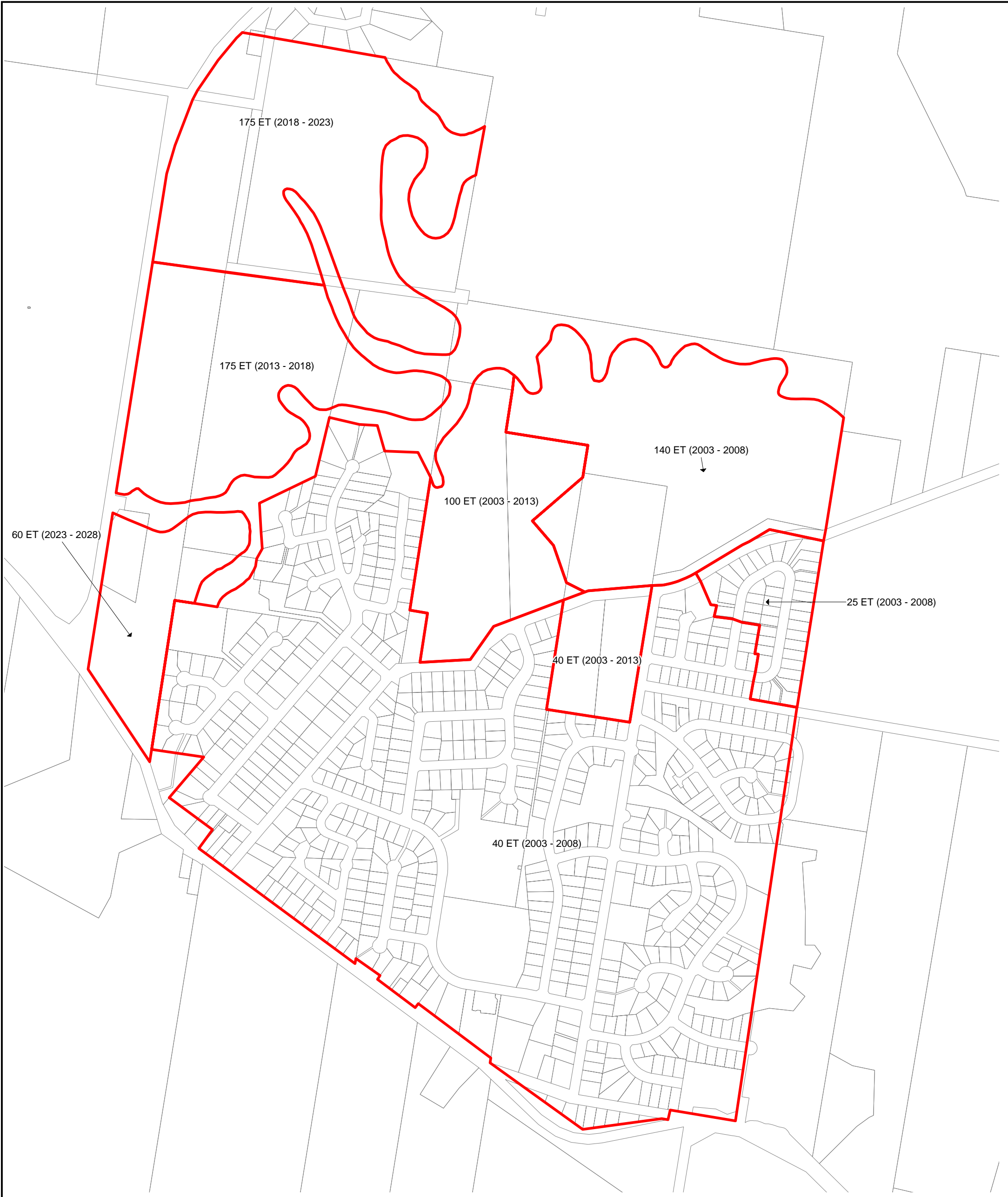
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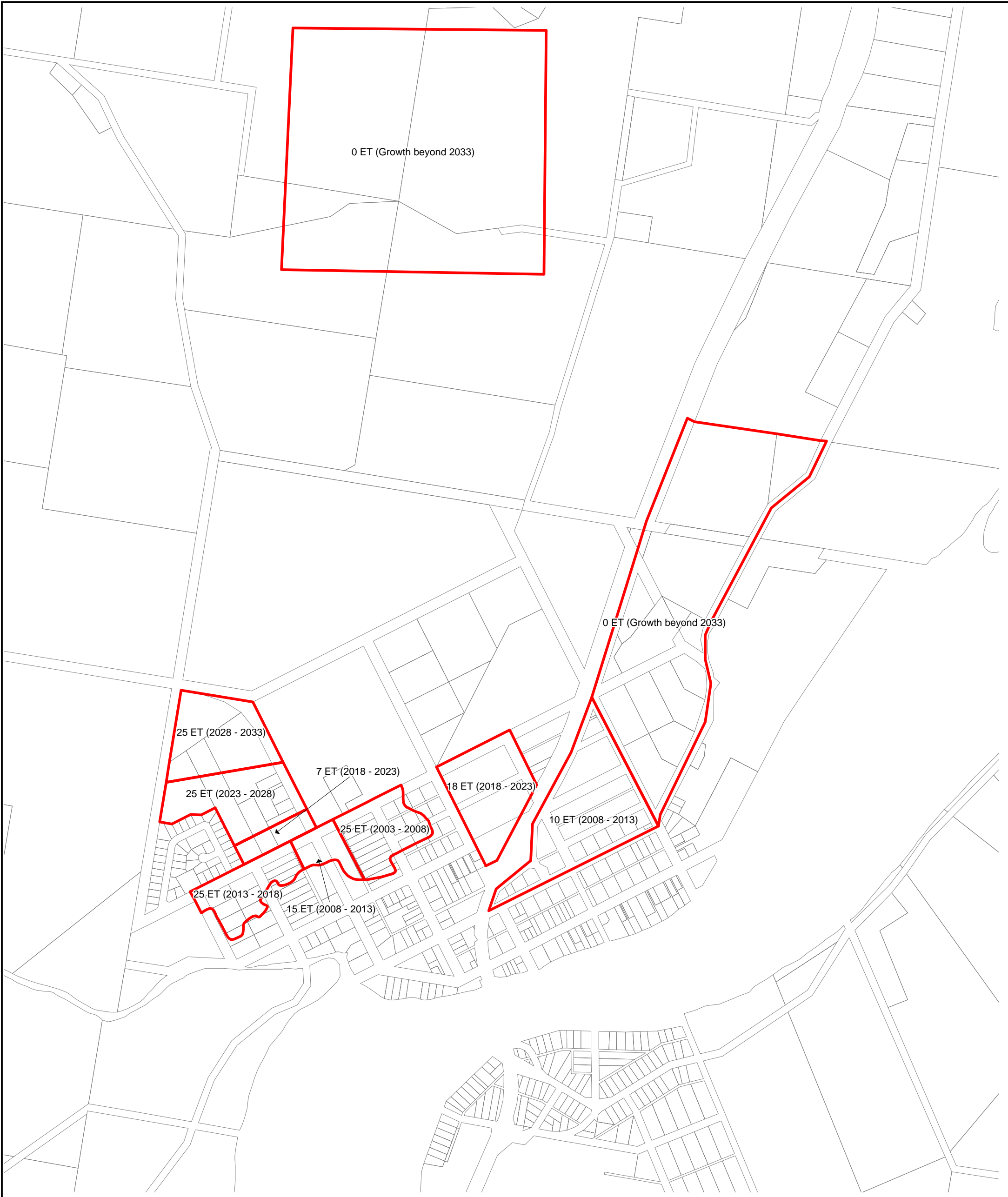
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**Figure 2-10
Projected Dwelling Growth -
Wollongbar**



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 Future Development Areas

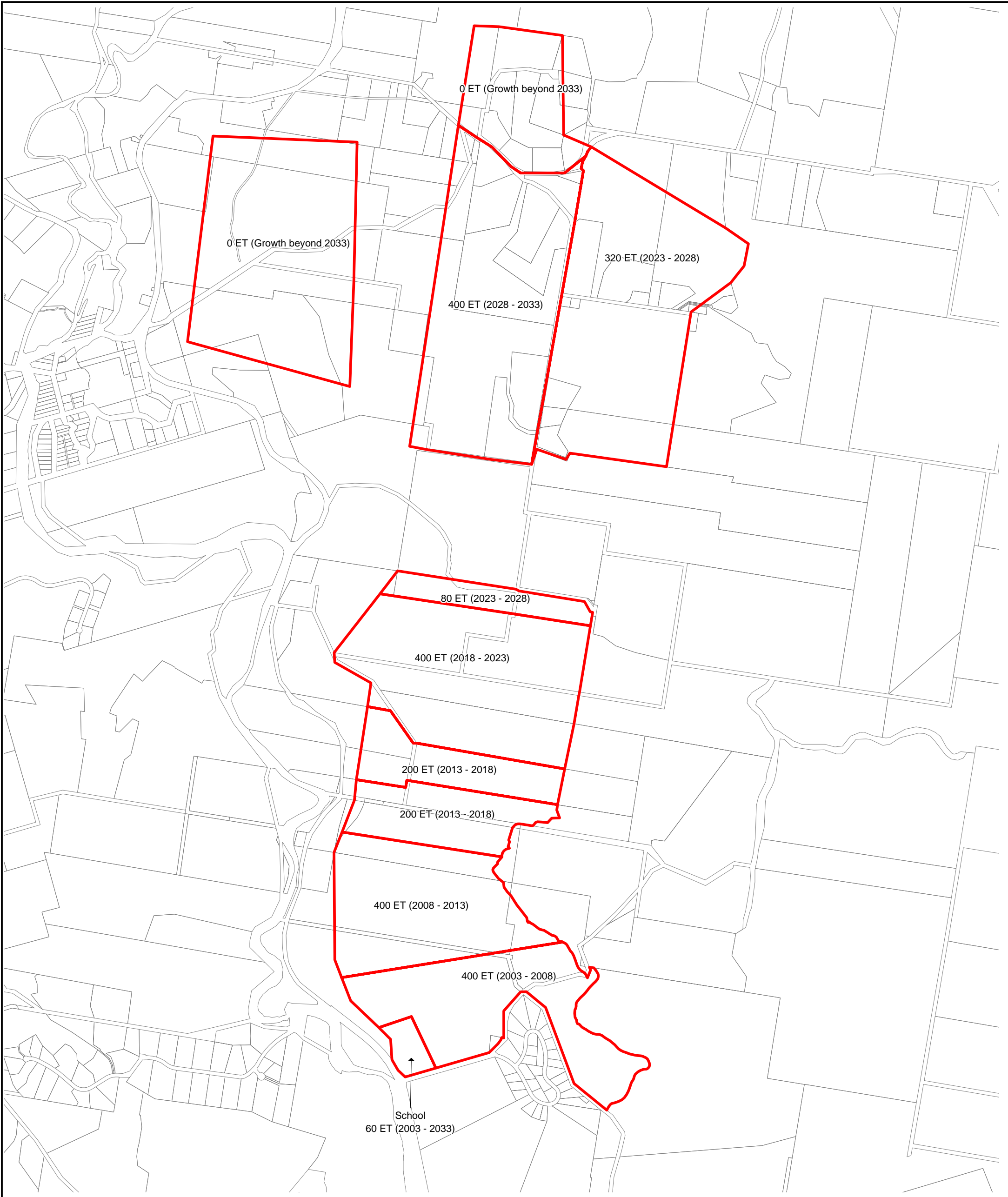
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**Figure 2-11
Projected Dwelling Growth -
Wardell**



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Future Development Areas

North



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**Figure 2-12
Projected Dwelling Growth -
Cumbalum**

FIGURE 2-13
Projected Industrial Growth

Legend

Projected Industrial Growth



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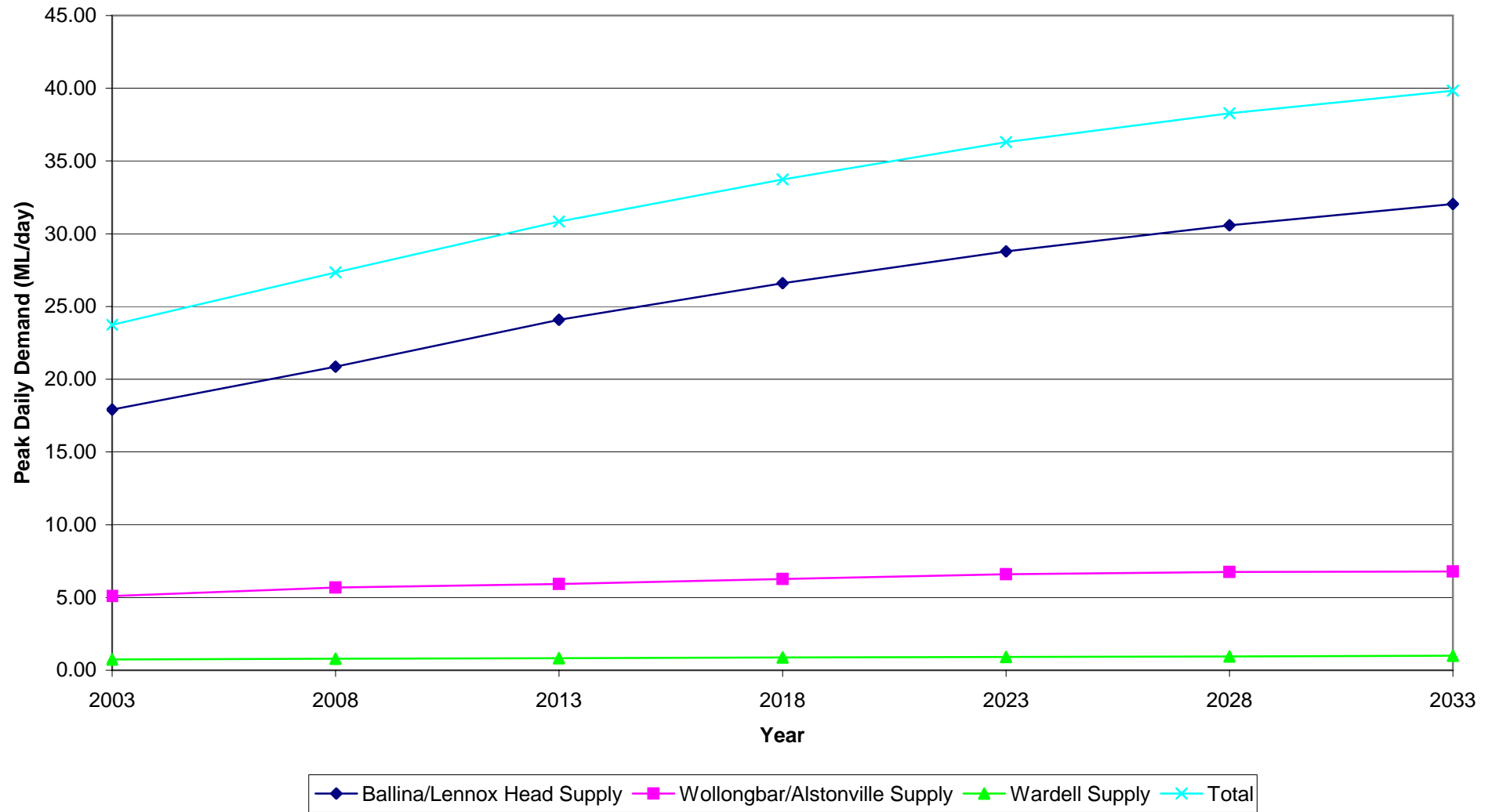
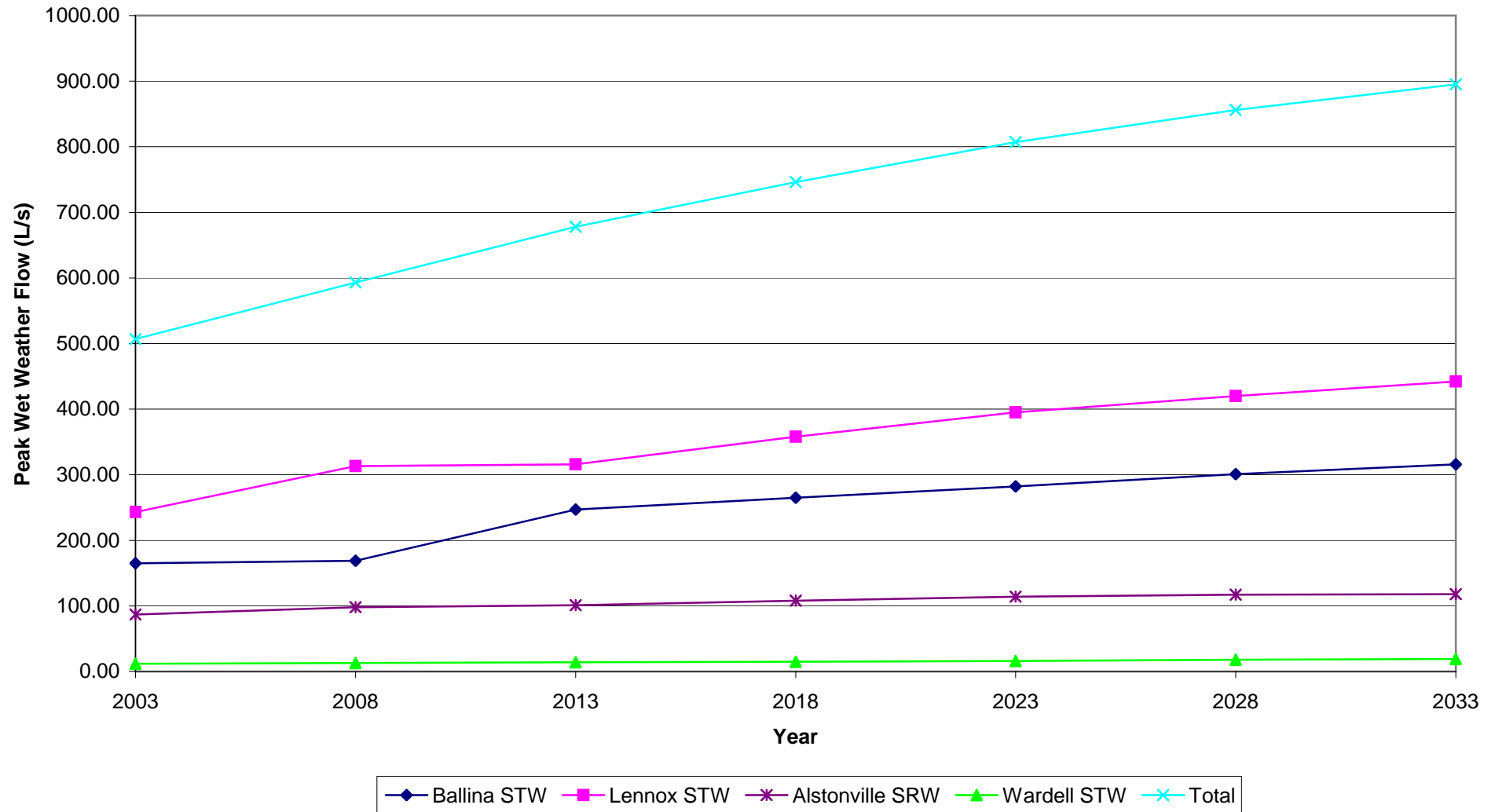
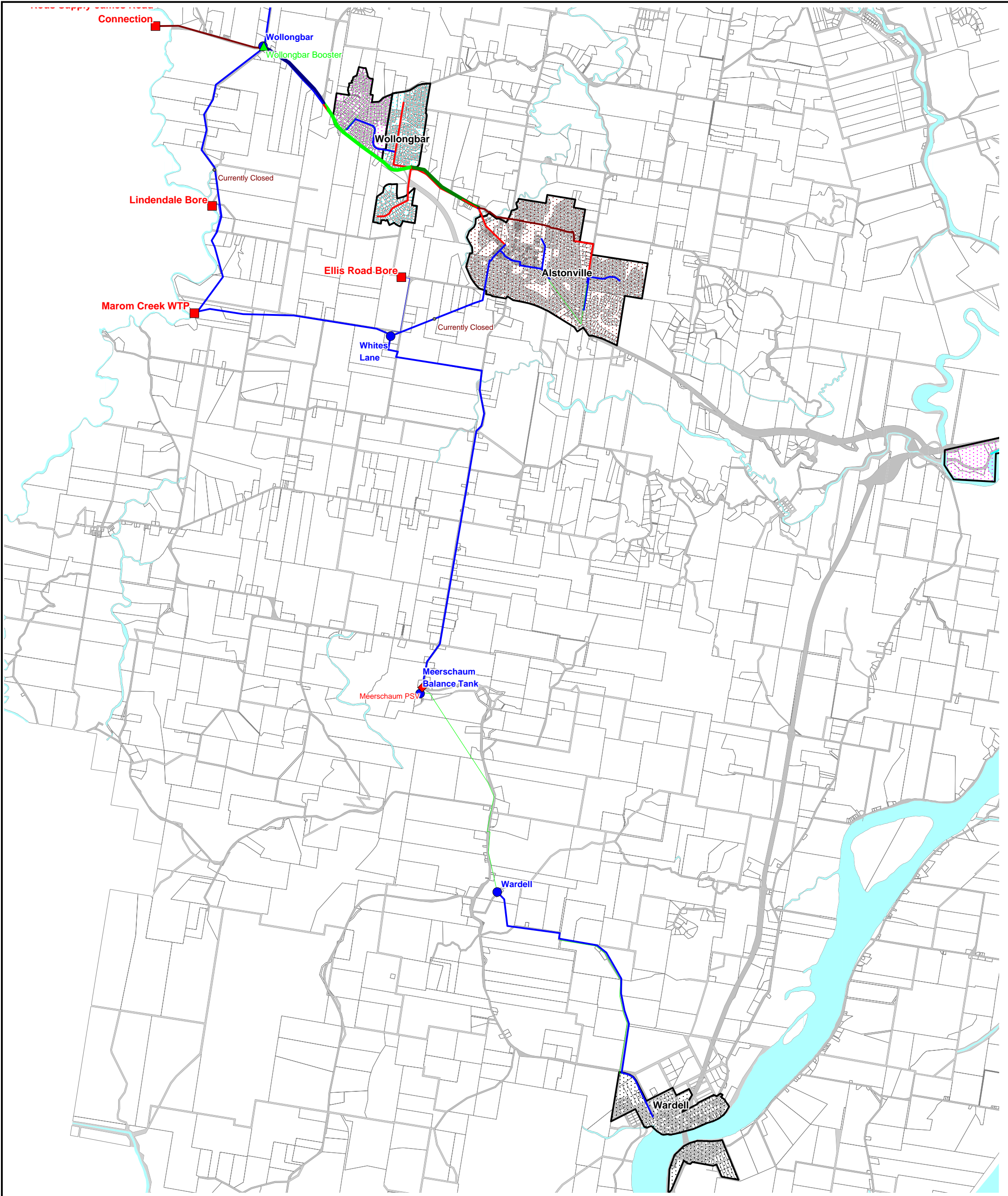
Figure 2.14 - Projected Water Demand

Figure 2.15 - Projected Sewage Loads



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G:\41\12595\Mapinfo\12595-39.WOR

LEGEND

Diameter (mm)

- 100
- 150
- 200
- 225
- 250
- 300
- 375
- 450
- 500
- 525
- 600

- Water Supply Source
- Reservoir
- Pump Station
- Control Valve

North



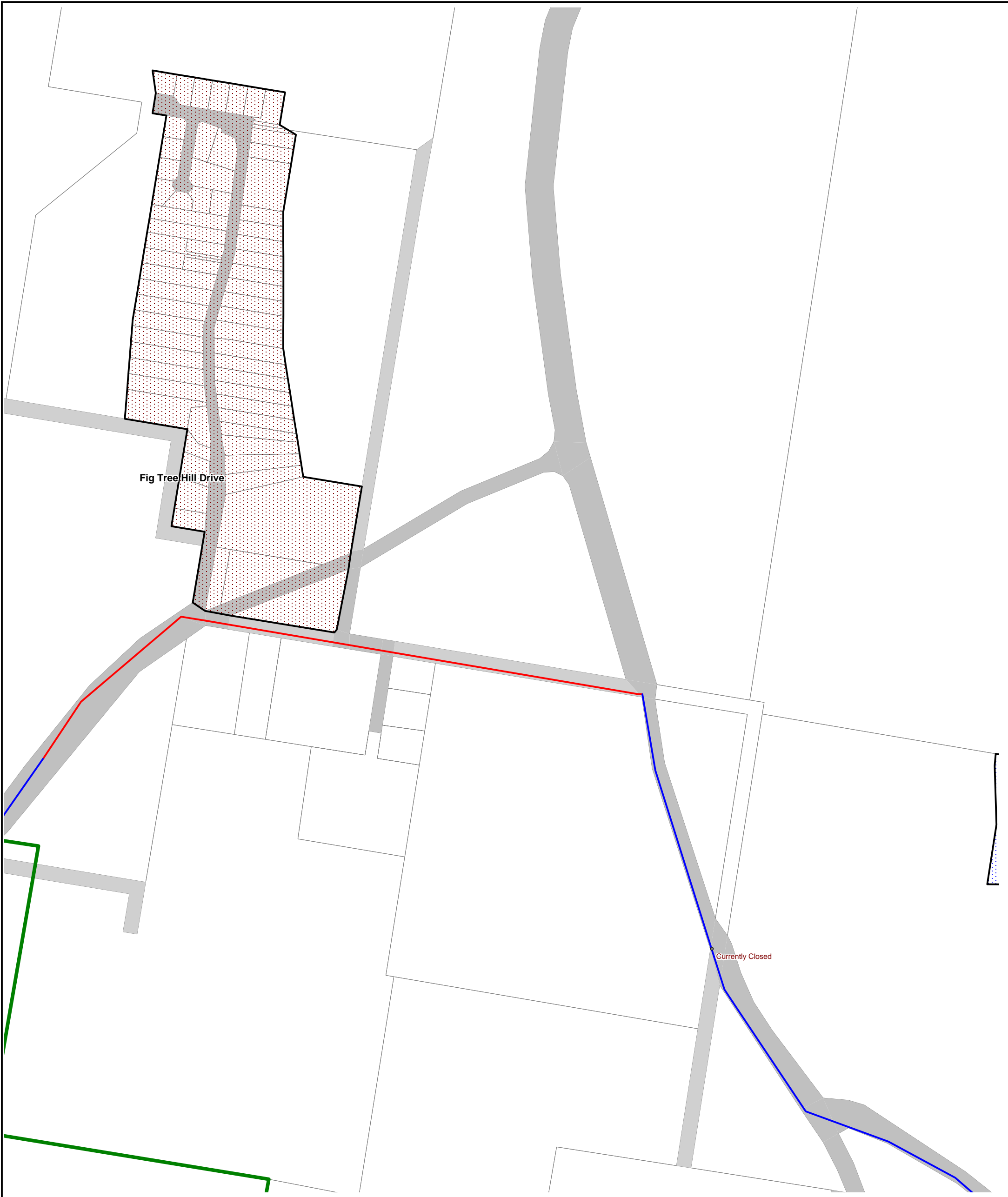
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kilometres

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Ballina Shire Council

Figure 3.2
Existing Water Supply System

Inland Areas



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LEGEND

Diameter (mm)

- 100
- 150
- 200
- 225
- 250
- 300
- 375
- 450
- 500
- 525
- 600

- Water Supply Source
- Reservoir
- Pump Station
- Control Valve

North



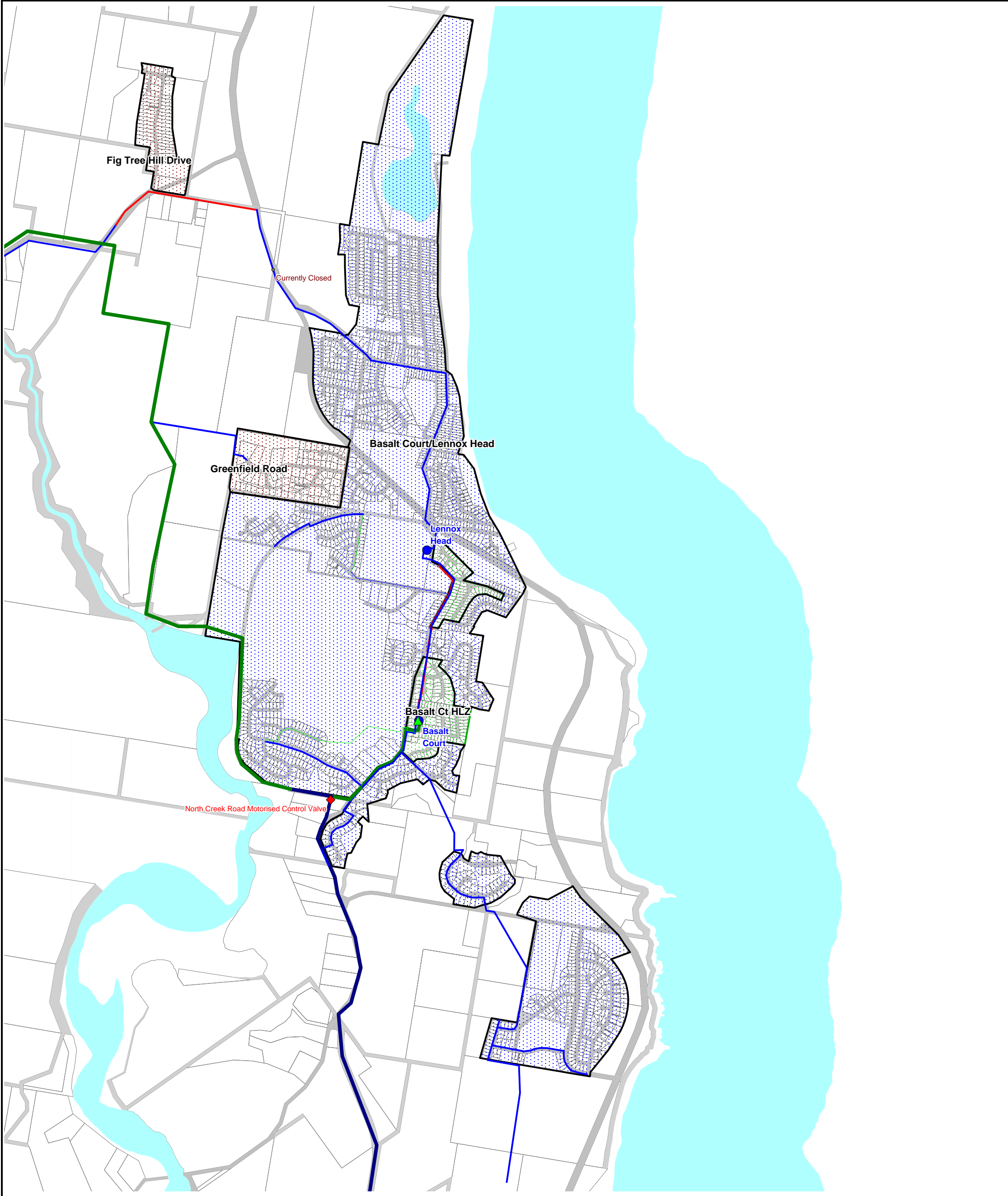
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kilometres

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Figure 3.3
Existing Water Supply System

North Lennox/Fig Tree Hill Drive



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LEGEND

Diameter (mm)

- 100
- 150
- 200
- 225
- 250
- 300
- 375
- 450
- 500
- 525
- 600

- Water Supply Source
- Reservoir
- Pump Station
- Control Valve

North



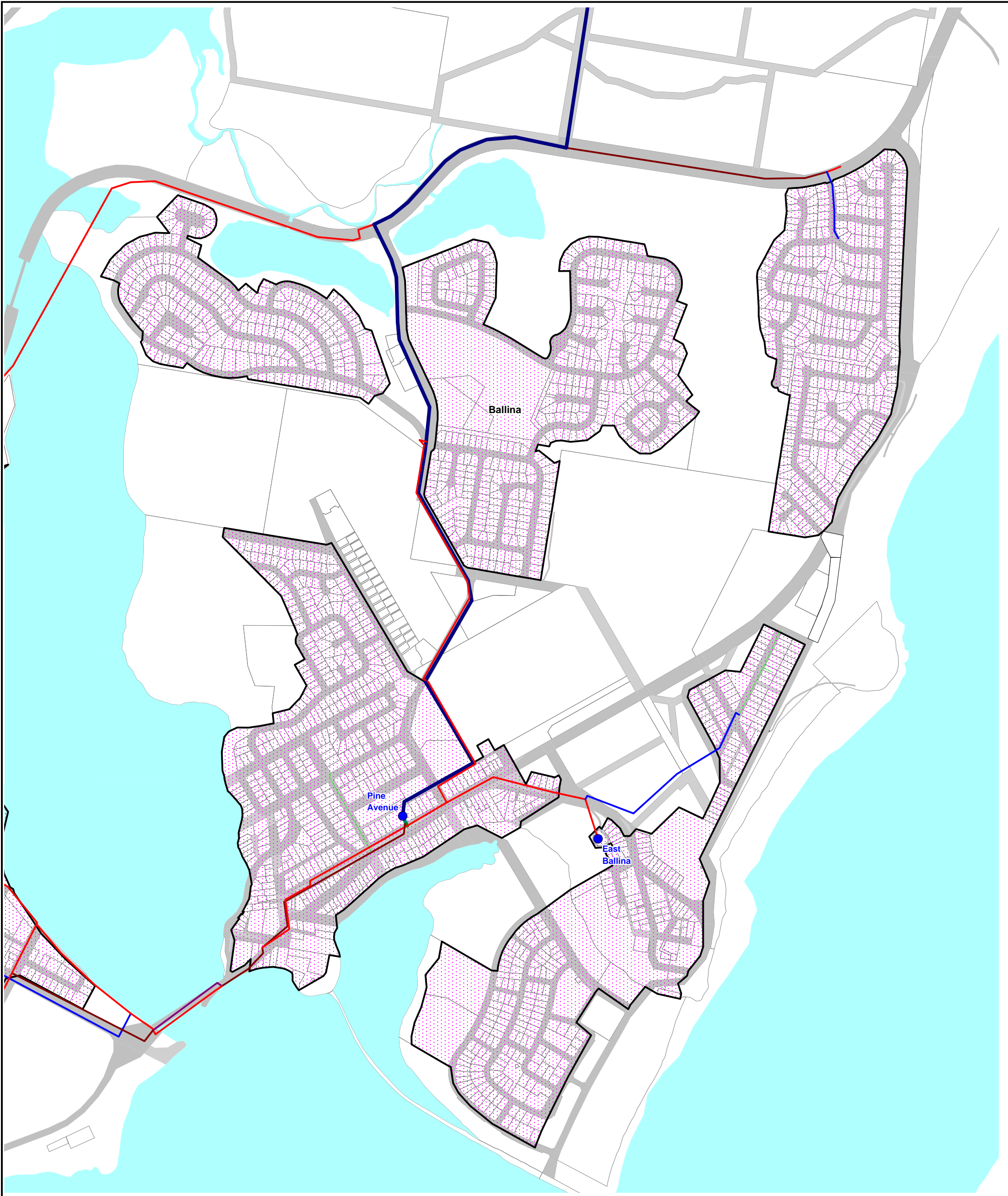
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kilometres

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Figure 3.4
Existing Water Supply System

Lennox Head



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LEGEND

Diameter (mm)

- 100
- 150
- 200
- 225
- 250
- 300
- 375
- 450
- 500
- 525
- 600

- Water Supply Source
- Reservoir
- Pump Station
- Control Valve

North



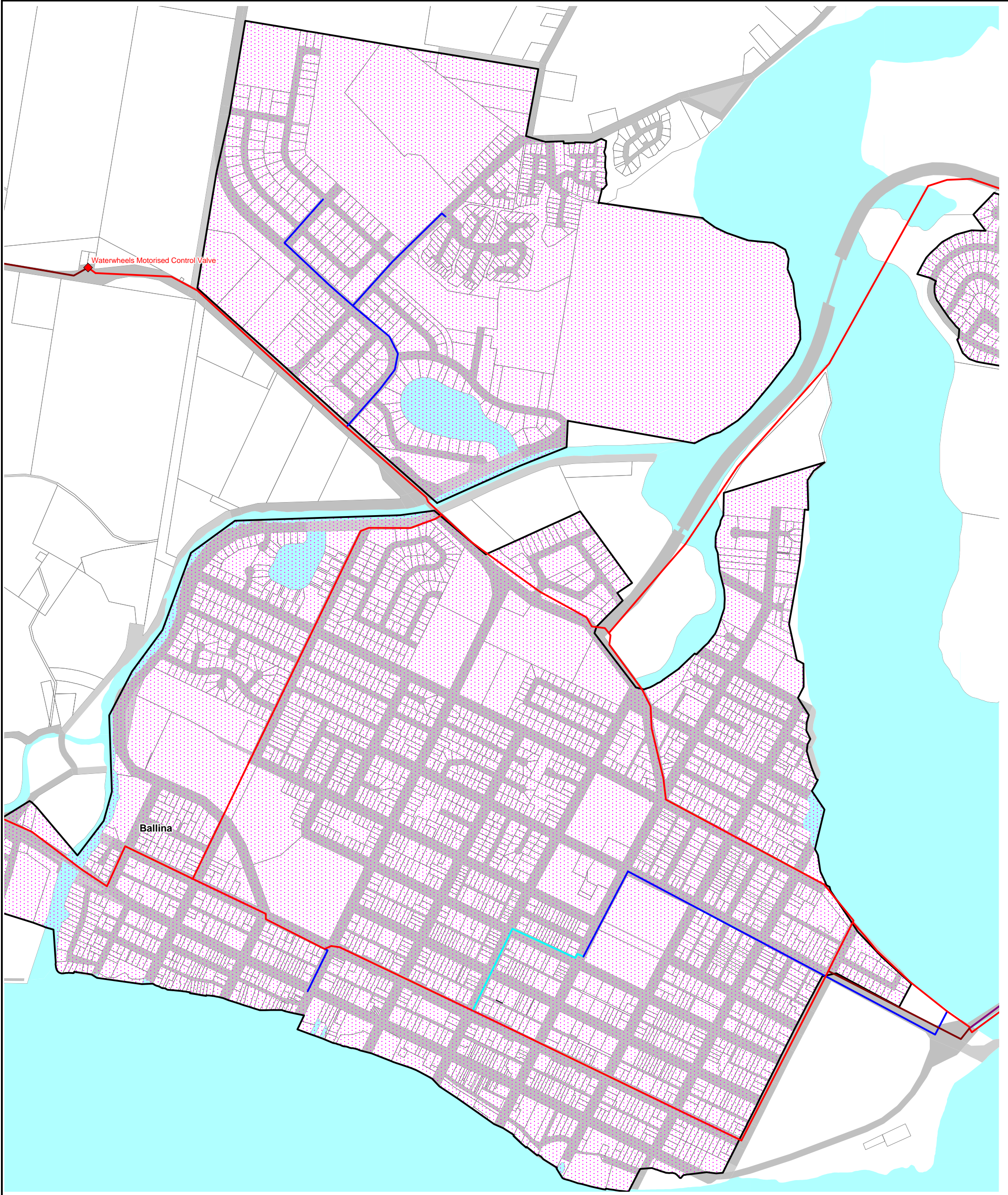
0 0.25 0.5
kilometres

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Ballina Shire Council

Figure 3.5
Existing Water Supply System

East Ballina



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LEGEND

Diameter (mm)

- 100
- 150
- 200
- 225
- 250
- 300
- 375
- 450
- 500
- 525
- 600

- Water Supply Source
- Reservoir
- Pump Station
- Control Valve

North



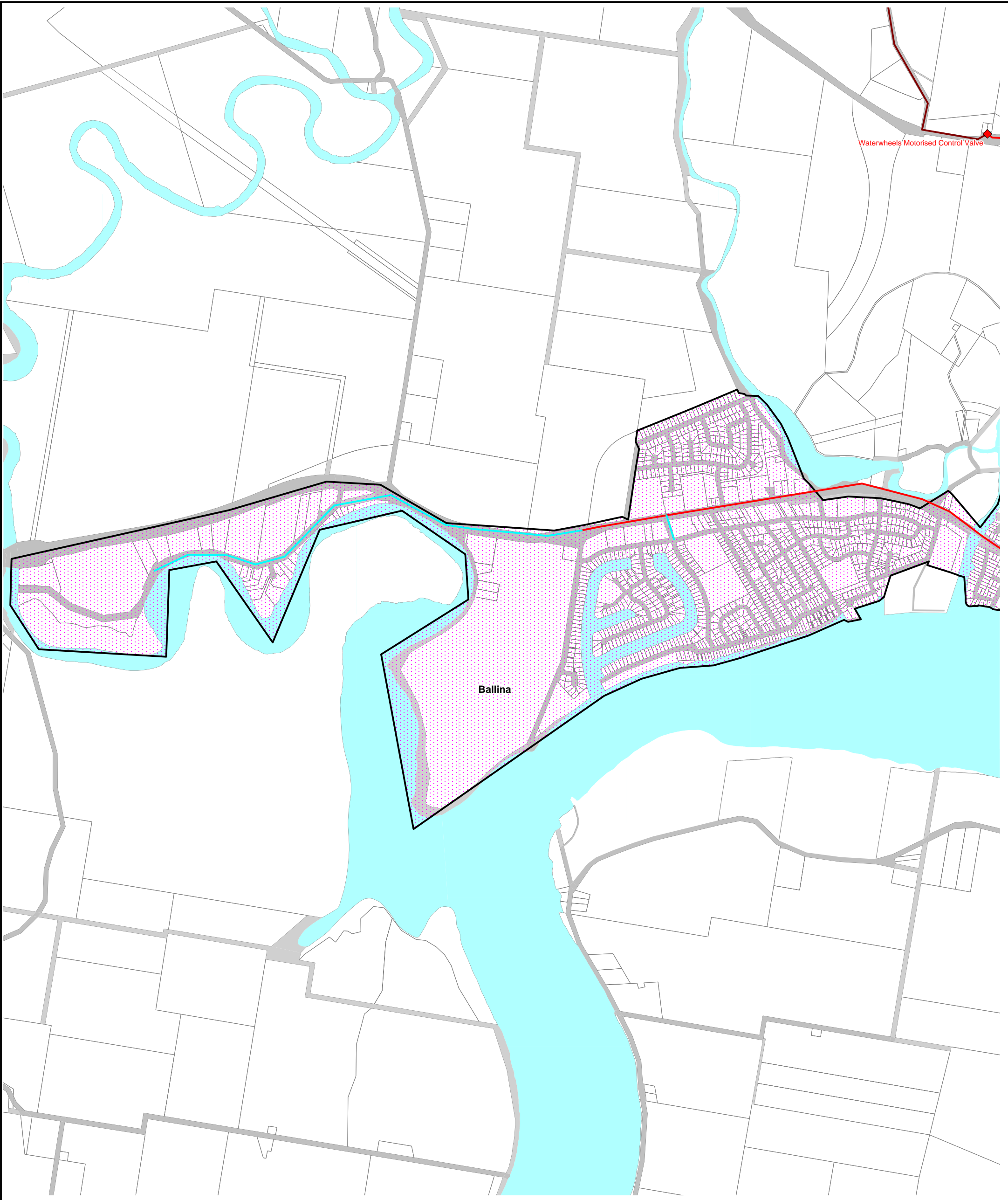
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kilometres

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Figure 3.6
Existing Water Supply System

Ballina Island



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LEGEND

Diameter (mm)

- 100
- 150
- 200
- 225
- 250
- 300
- 375
- 450
- 500
- 525
- 600

- Water Supply Source
- Reservoir
- Pump Station
- Control Valve

North



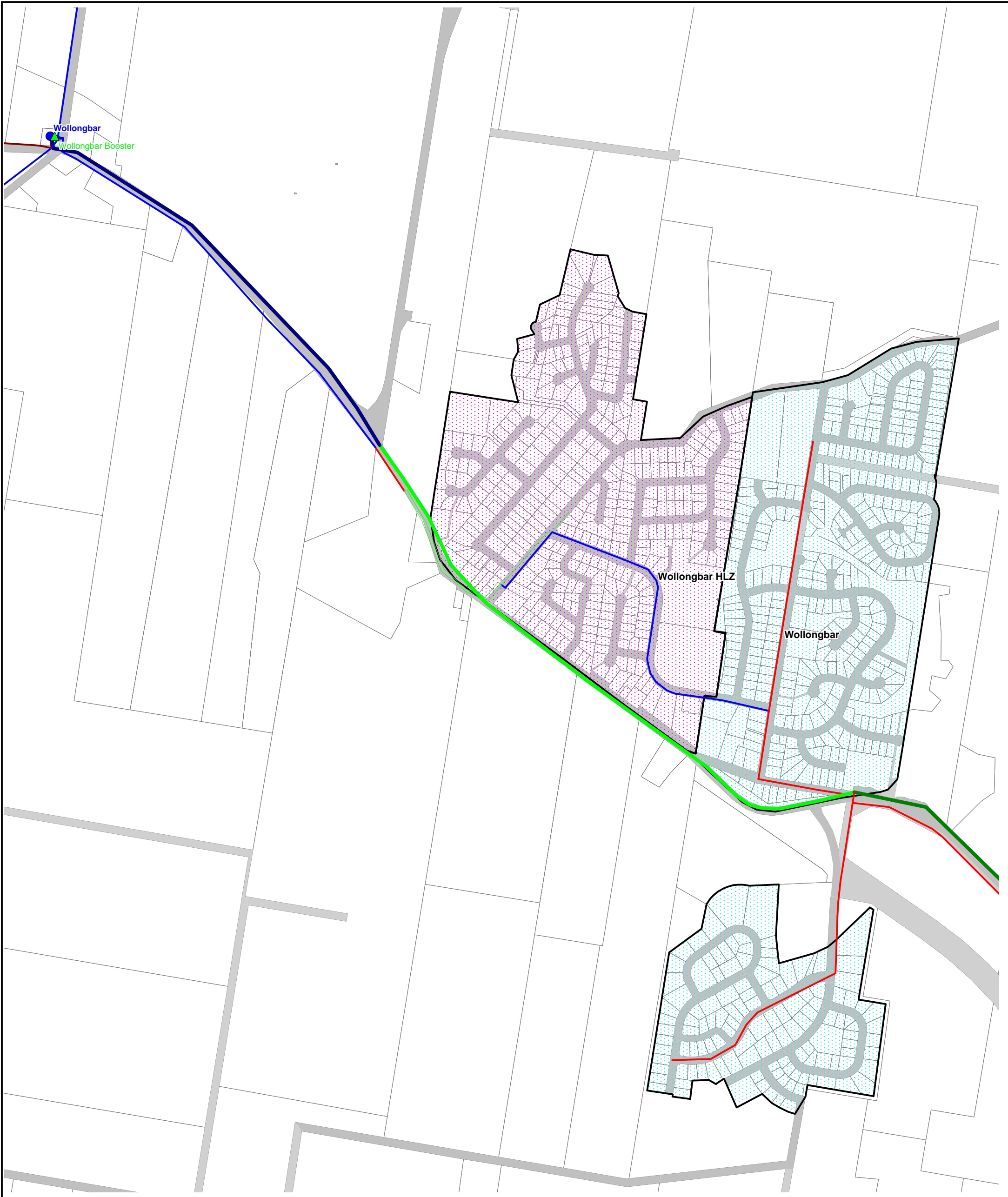
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kilometres

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Figure 3.7
Existing Water Supply System

West Ballina



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LEGEND

Diameter (mm)

- 100
- 150
- 200
- 225
- 250
- 300
- 375
- 450
- 500
- 525
- 600

- Water Supply Source
- Reservoir
- Pump Station
- Control Valve

North



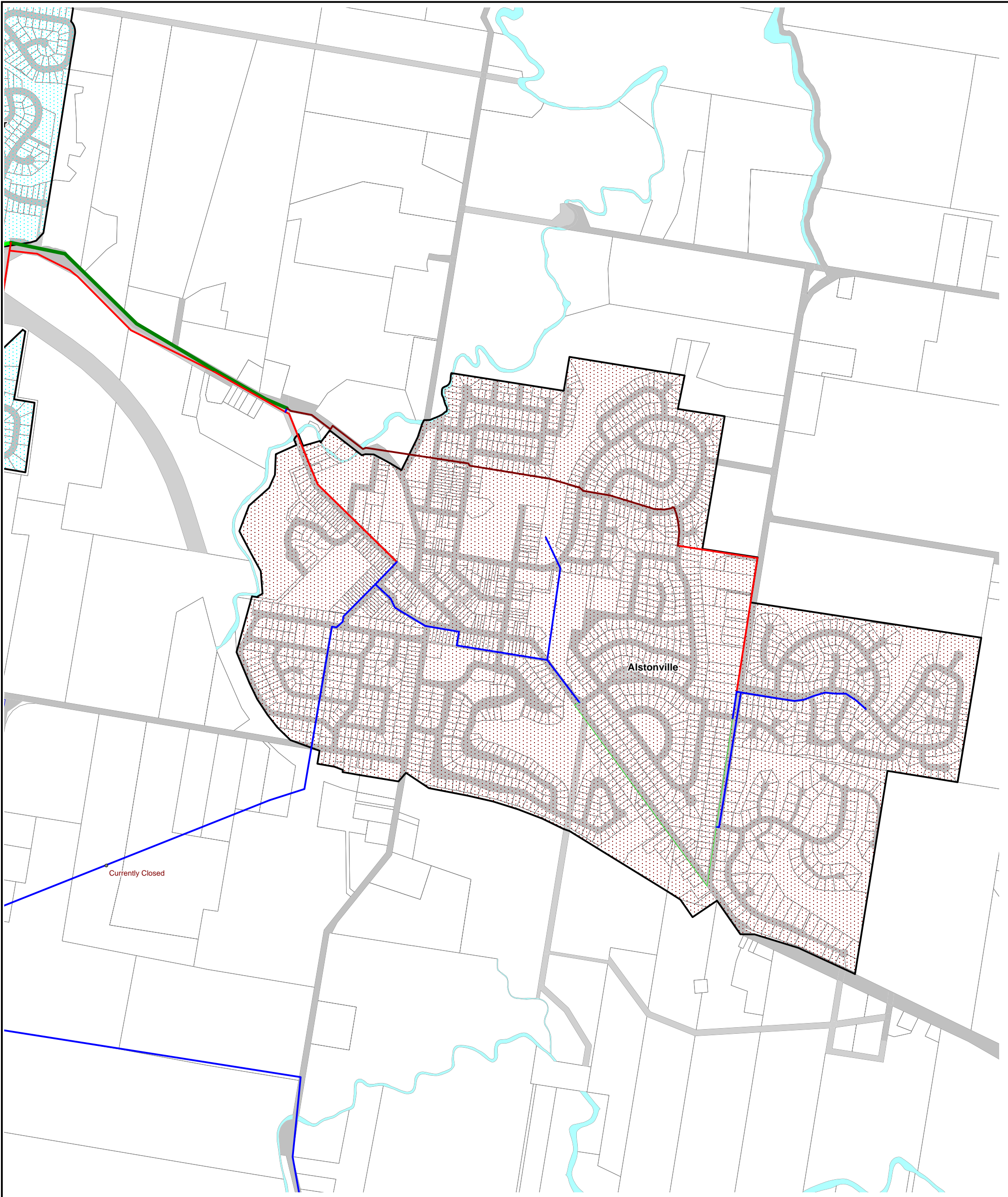
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kilometres

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Figure 3.8
Existing Water Supply System

Wollongbar



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LEGEND

Diameter (mm)

- 100
- 150
- 200
- 225
- 250
- 300
- 375
- 450
- 500
- 525
- 600

- Water Supply Source
- Reservoir
- Pump Station
- Control Valve

North



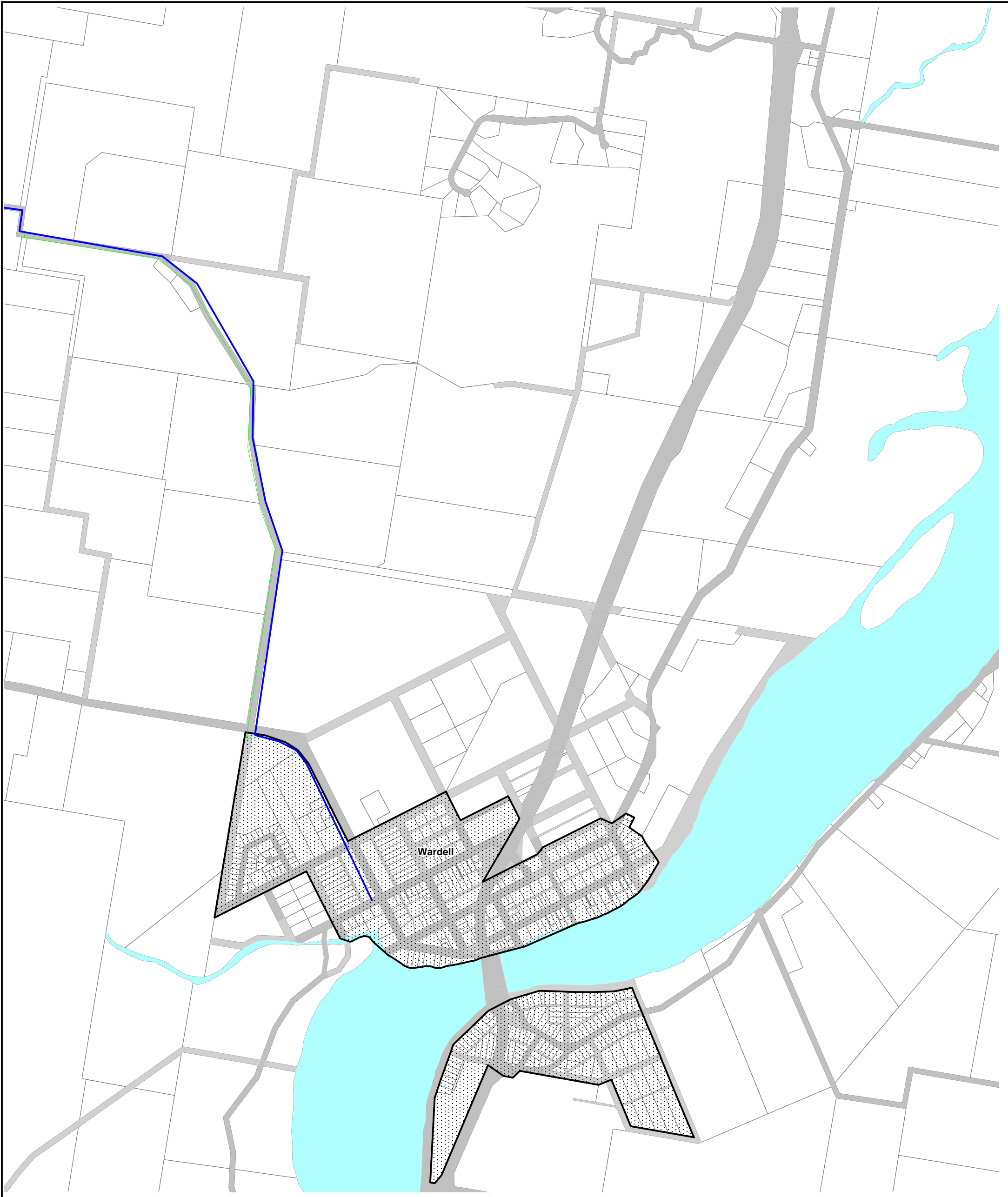
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kilometres

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Figure 3.9
Existing Water Supply System

Alstonville



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LEGEND

Diameter (mm)

- 100
- 150
- 200
- 225
- 250
- 300
- 375
- 450
- 500
- 525
- 600

- Water Supply Source
- Reservoir
- Pump Station
- Control Valve

North



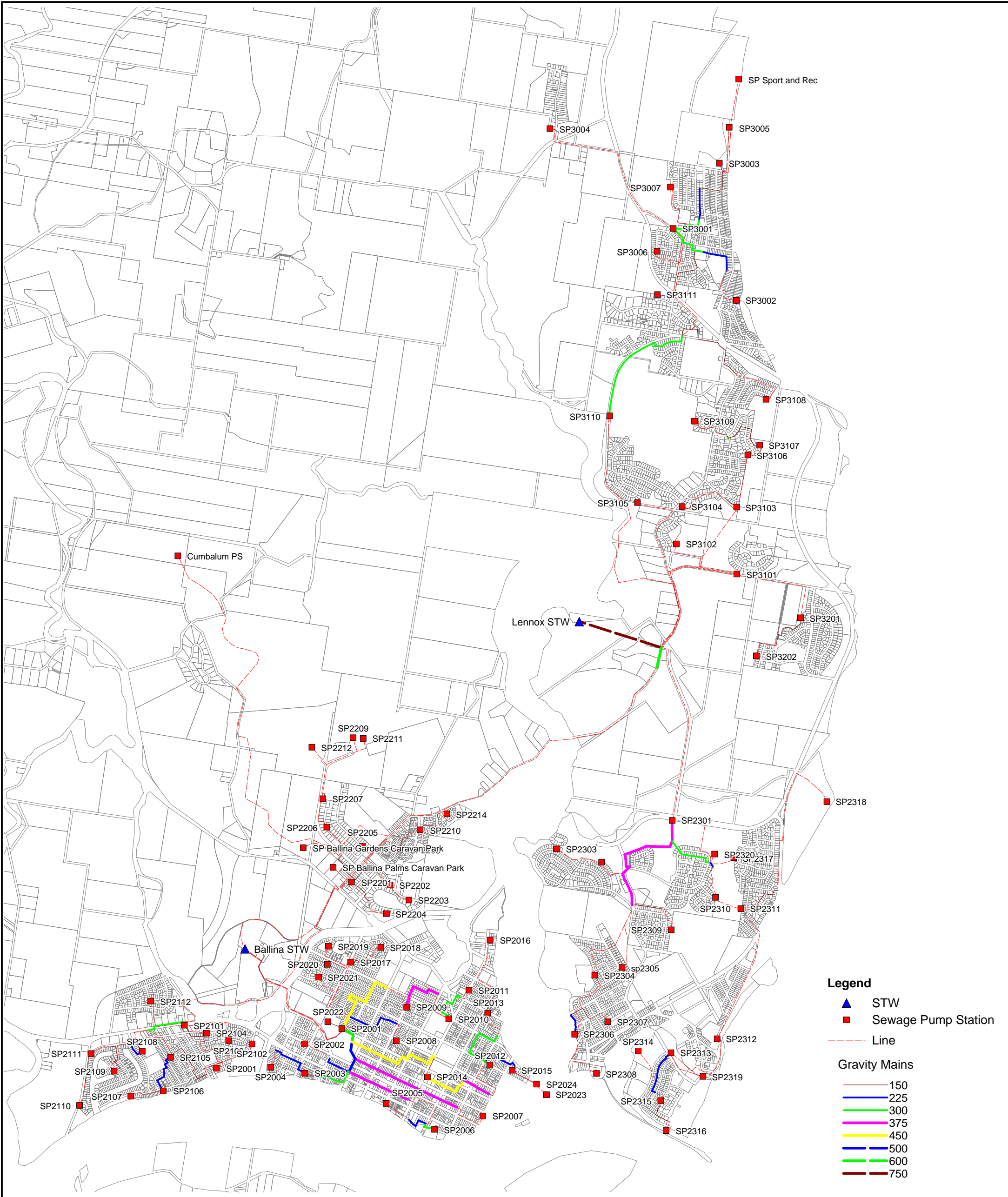
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kilometres

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Figure 3.10
Existing Water Supply System

Wardell



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Source Information: Base Data supplied by Ballina Shire Council.

Ballina Shire Council

Figure 4.1
Existing Sewerage
Trunk Infrastructure -
Ballina and Lennox Head

FIGURE 4.2
Existing Sewerage
Trunk Infrastructure -
Alstonville and Wollongbar

- Legend
- STW
 - Pump Station
 - Rising Main
- Gravity Mains
- 152.4
 - 225
 - 304.8
 - 381



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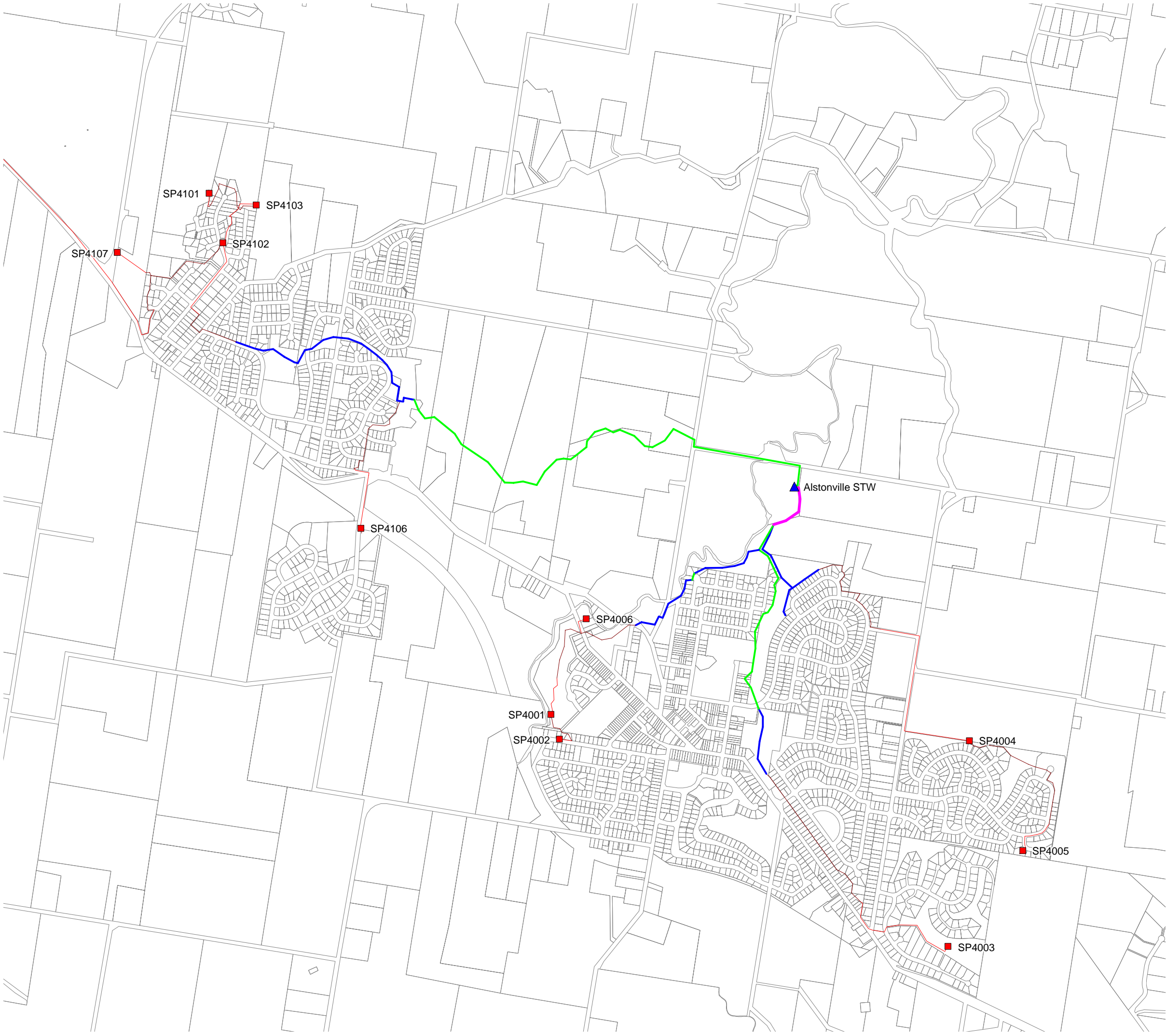


FIGURE 4.3
Existing Sewerage
Trunk Infrastructure -
Wardell

- Legend
- STW
 - Pump Station
 - 150 Gravity Main
 - Rising Main



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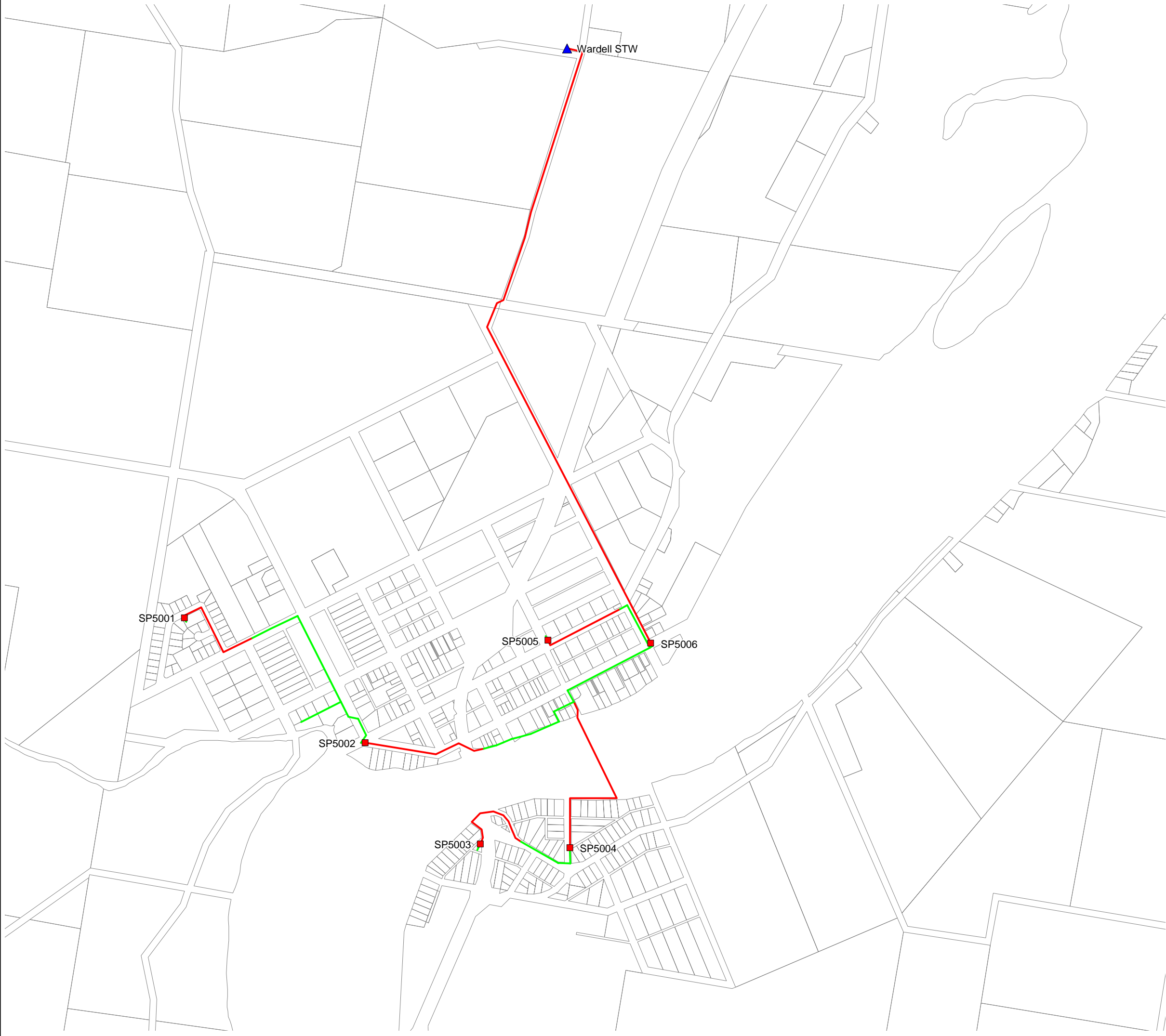


Figure 7.2
Existing PWWF Performance
Alstonville / Wollongbar

Gravity Mains by % Capacity

	>150	(18)
	100 to 150	(0)
	50 to 100	(37)
	0 to 50	(166)

North



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Figure 7.3
Existing PWWF Performance
Wardell

Gravity Mains by % Capacity

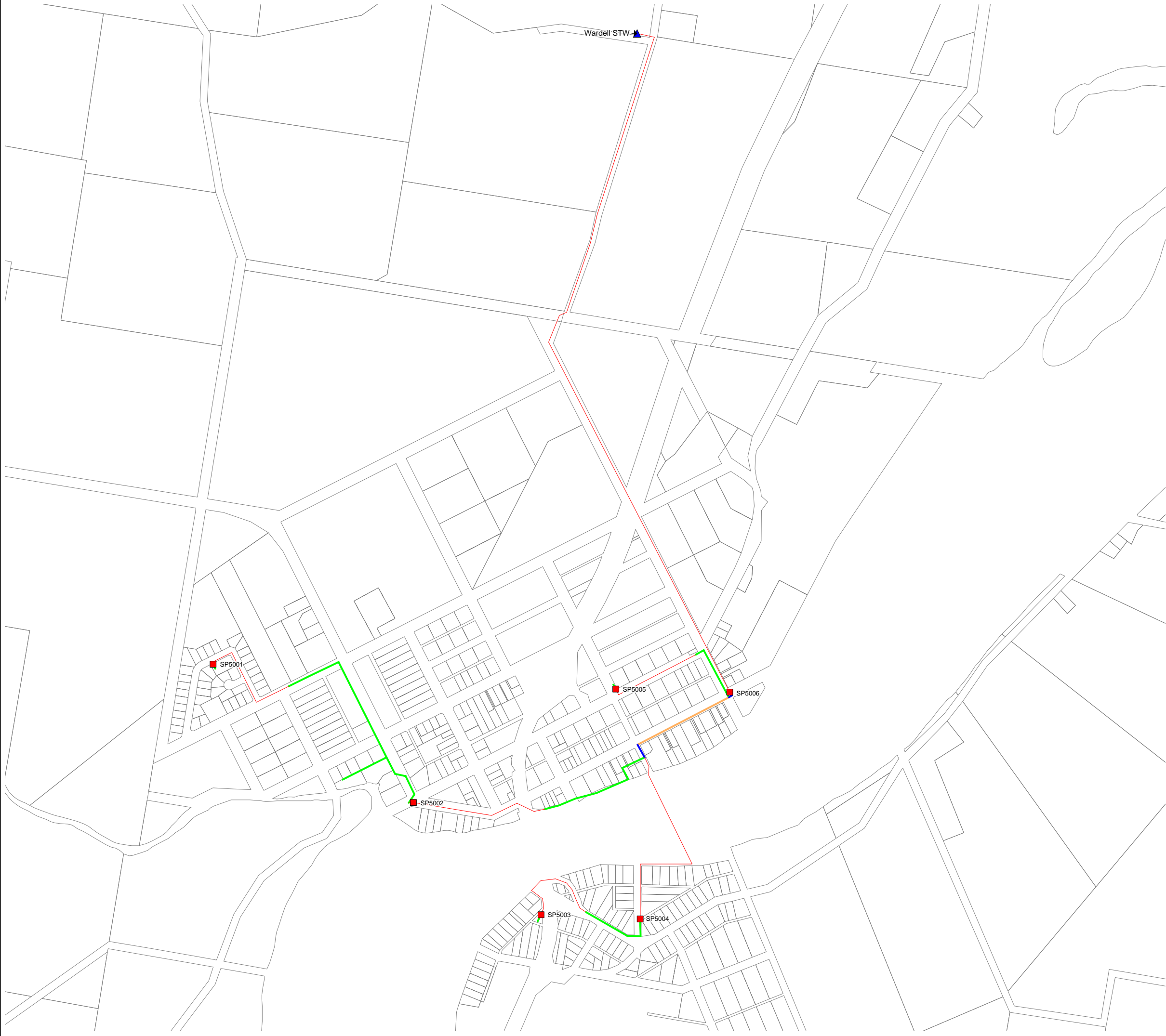
- 100 to 150 (1)
- 50 to 100 (2)
- 0 to 50 (23)

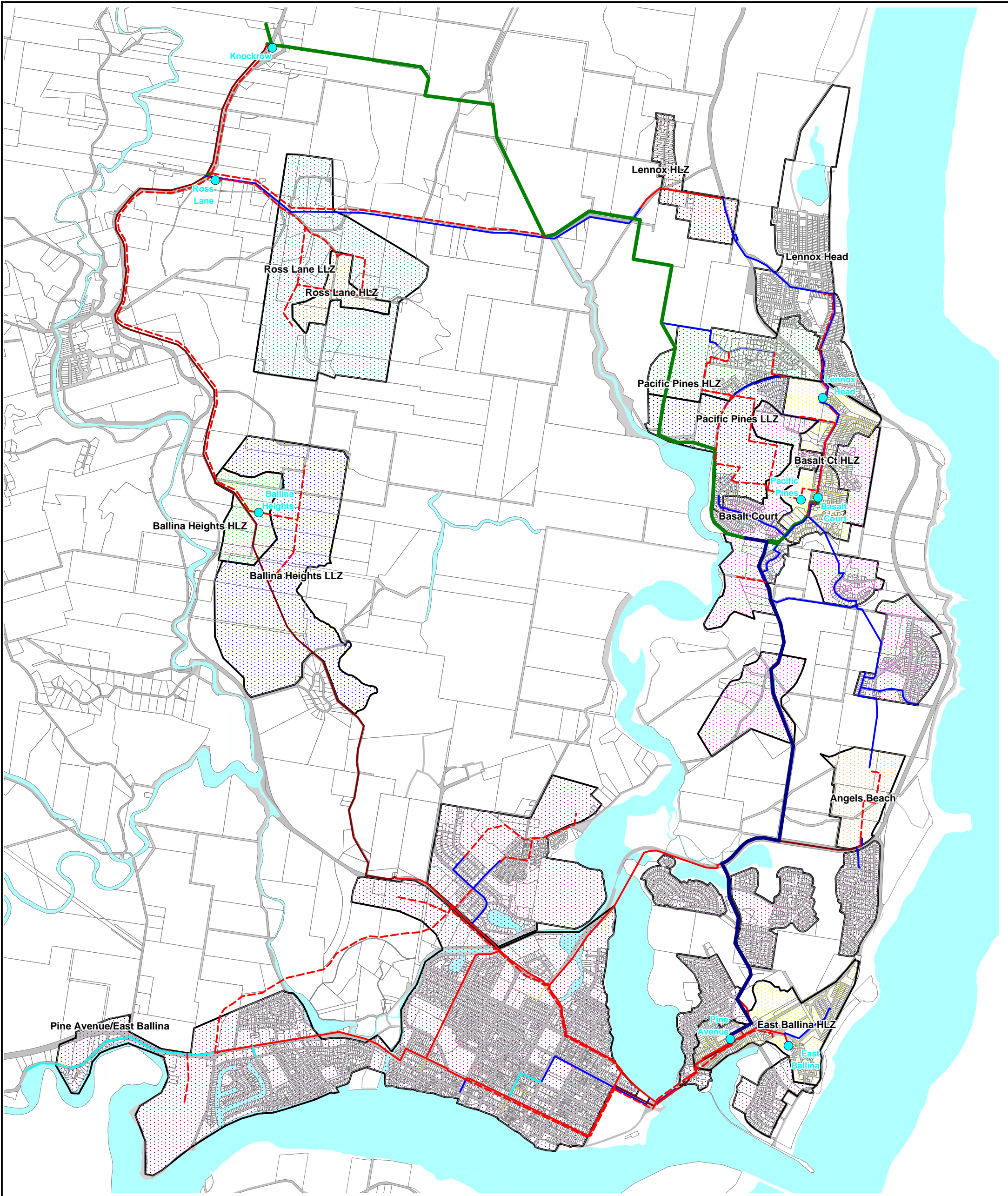
North



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LEGEND

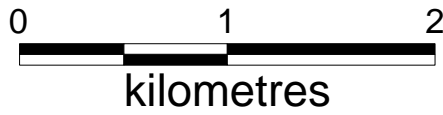
Existing Mains Diameter (mm)



Reservoir (Existing & Future)

Proposed Trunk Main

North

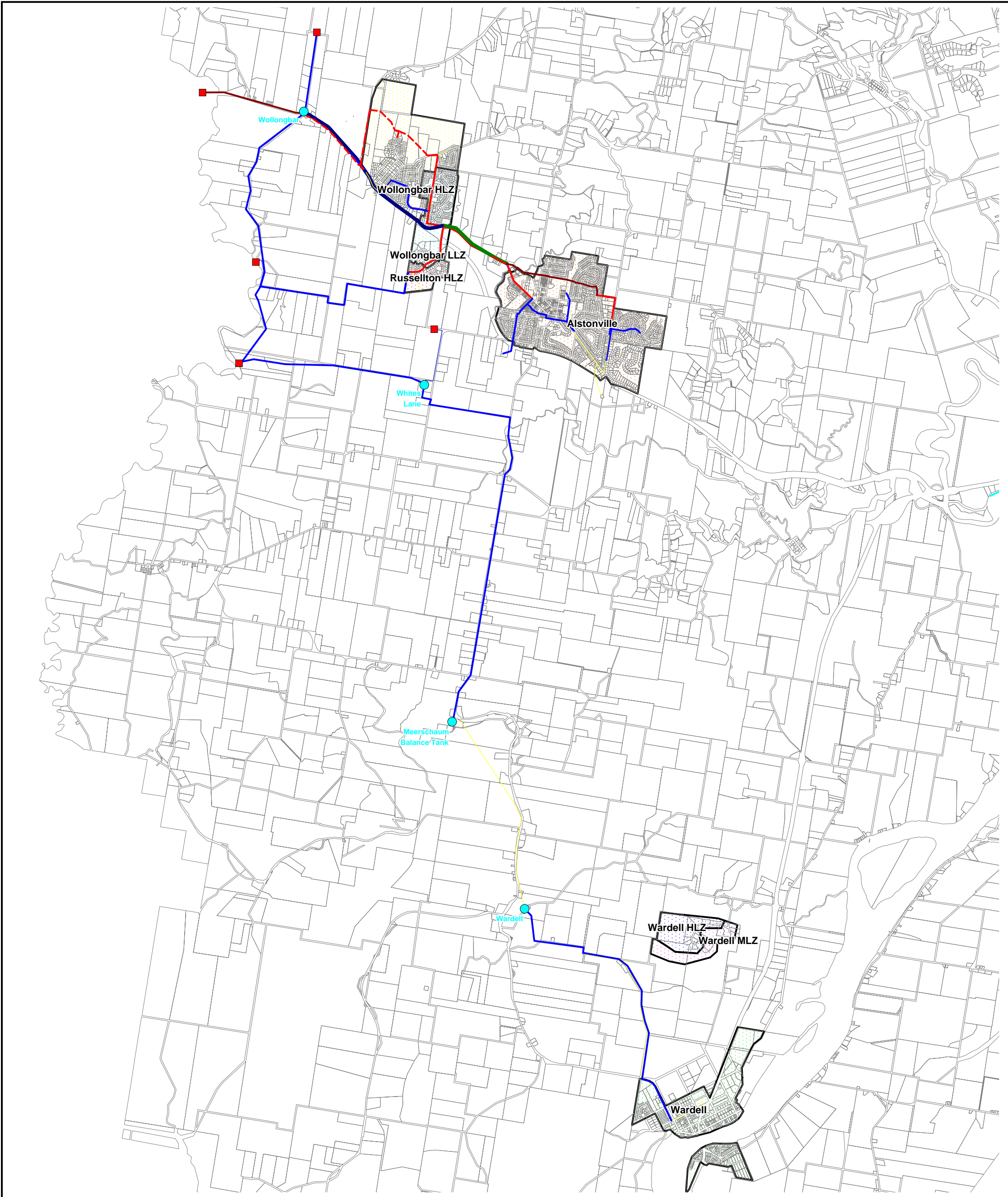


Source Information: GIS Data supplied by Ballina Shire Council

Ballina Shire Council

Figure 8.1
Proposed Water Supply
Pressure Zones

Coastal



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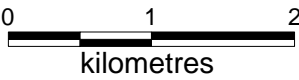
LEGEND

Existing Mains Diameter (mm)



Reservoir (Existing & Future)
Proposed Trunk Main

North

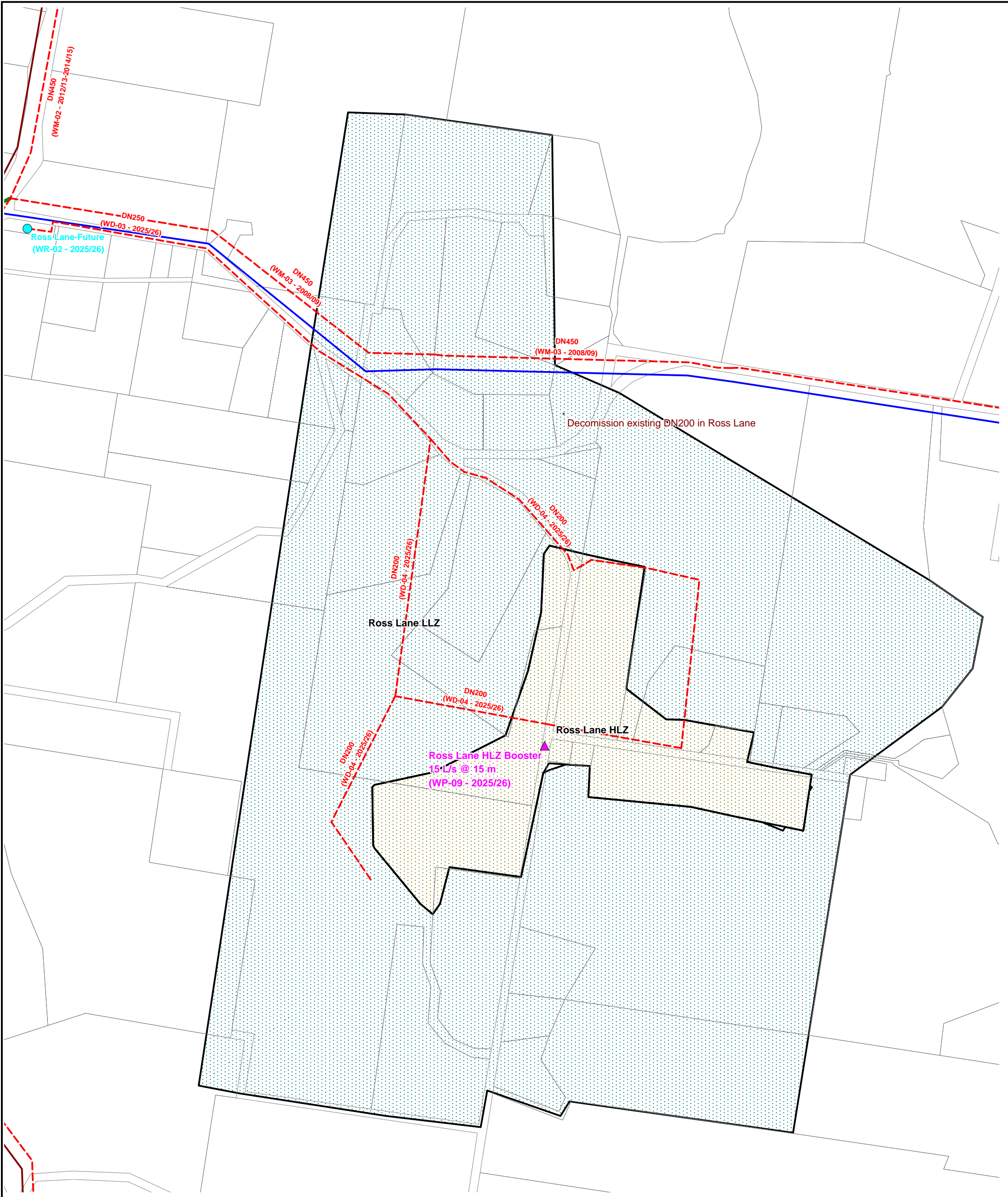


Source Information: GIS Data
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Ballina Shire Council

Figure 8.2
Proposed Water Supply
Pressure Zones

Inland



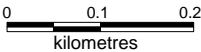
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LEGEND

Existing Mains Diameter (mm)



North

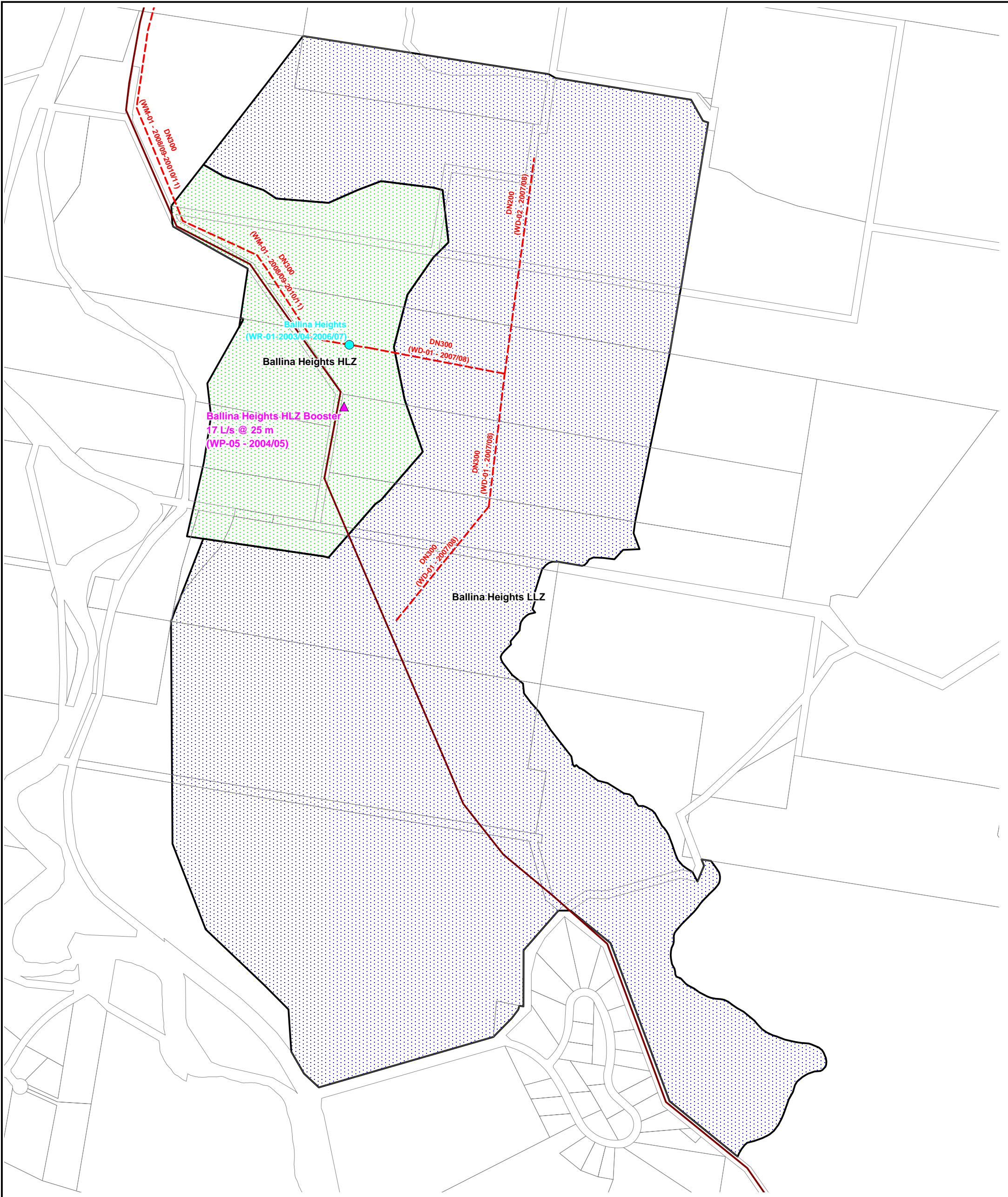


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Figure 8.3
Proposed Water Supply
Augmentations/Extensions

Ross Lane



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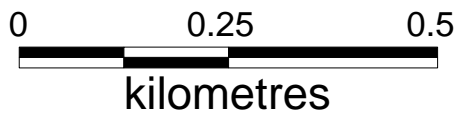
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LEGEND

Existing Mains Diameter (mm)



North

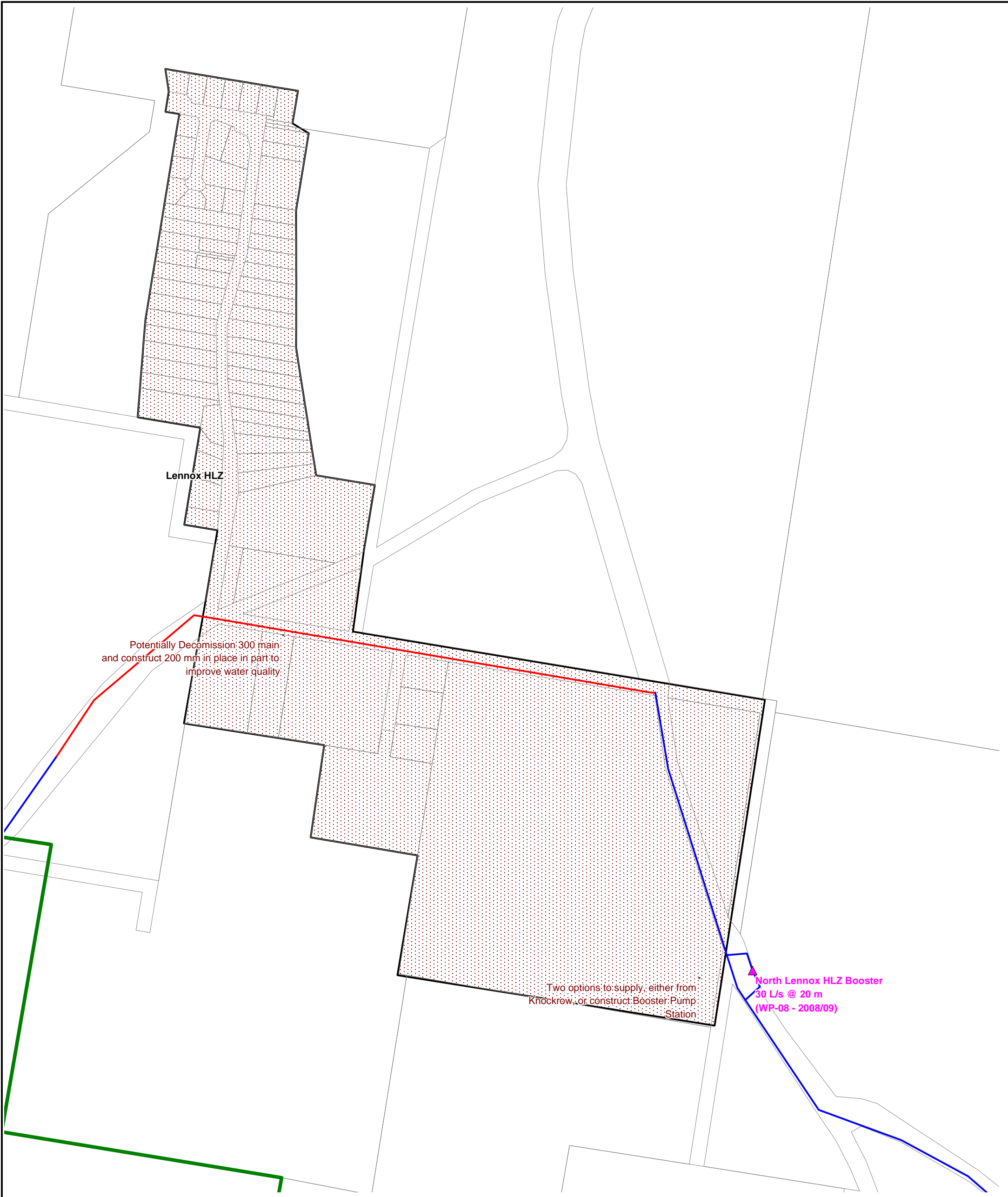


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Ballina Shire Council

Figure 8.4
Proposed Water Supply
Augmentations/Extensions

Ballina Heights



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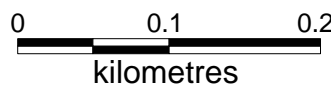
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LEGEND

Existing Mains Diameter (mm)



North

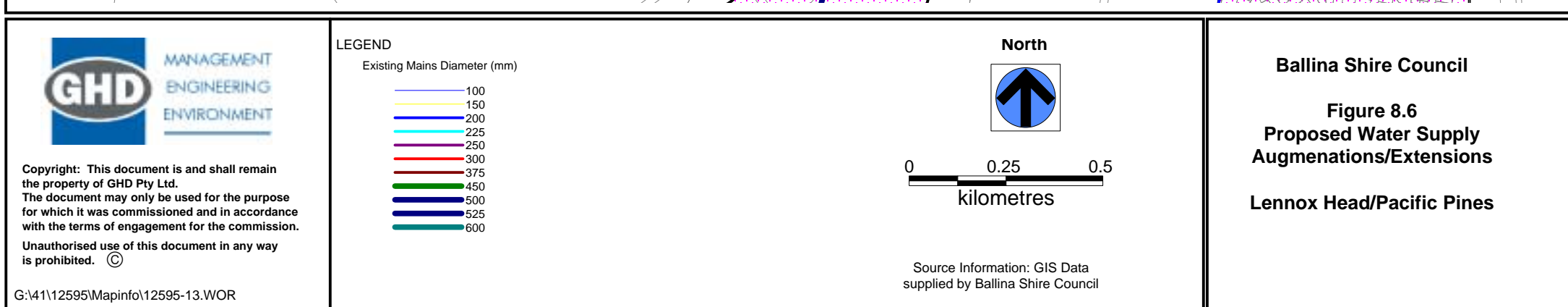


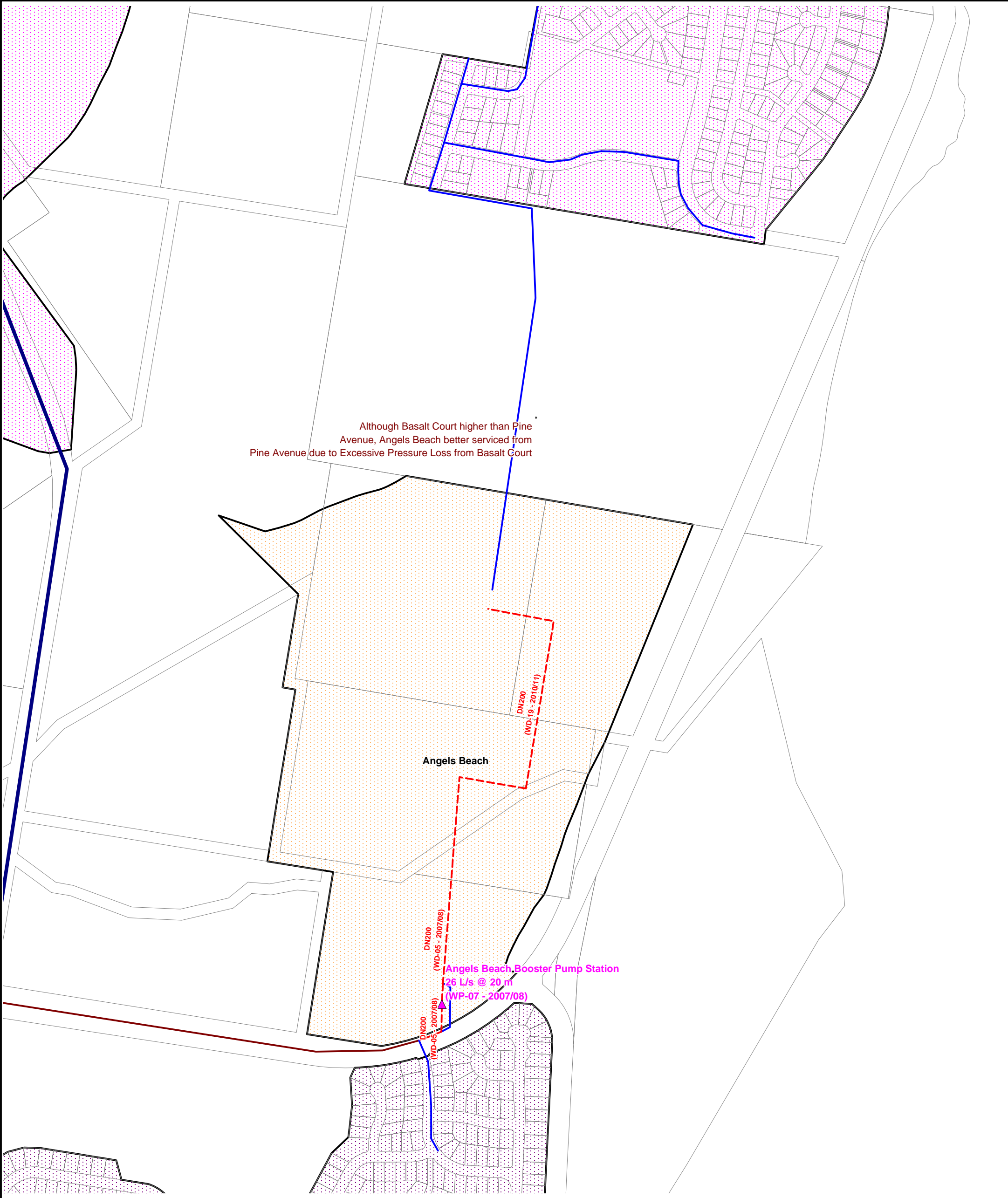
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Figure 8.5
Proposed Water Supply
Augmentations/Extensions

Lennox Head HLZ





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LEGEND

Existing Mains Diameter (mm)

100
150
200
225
250
300
375
450
500
525
600

North



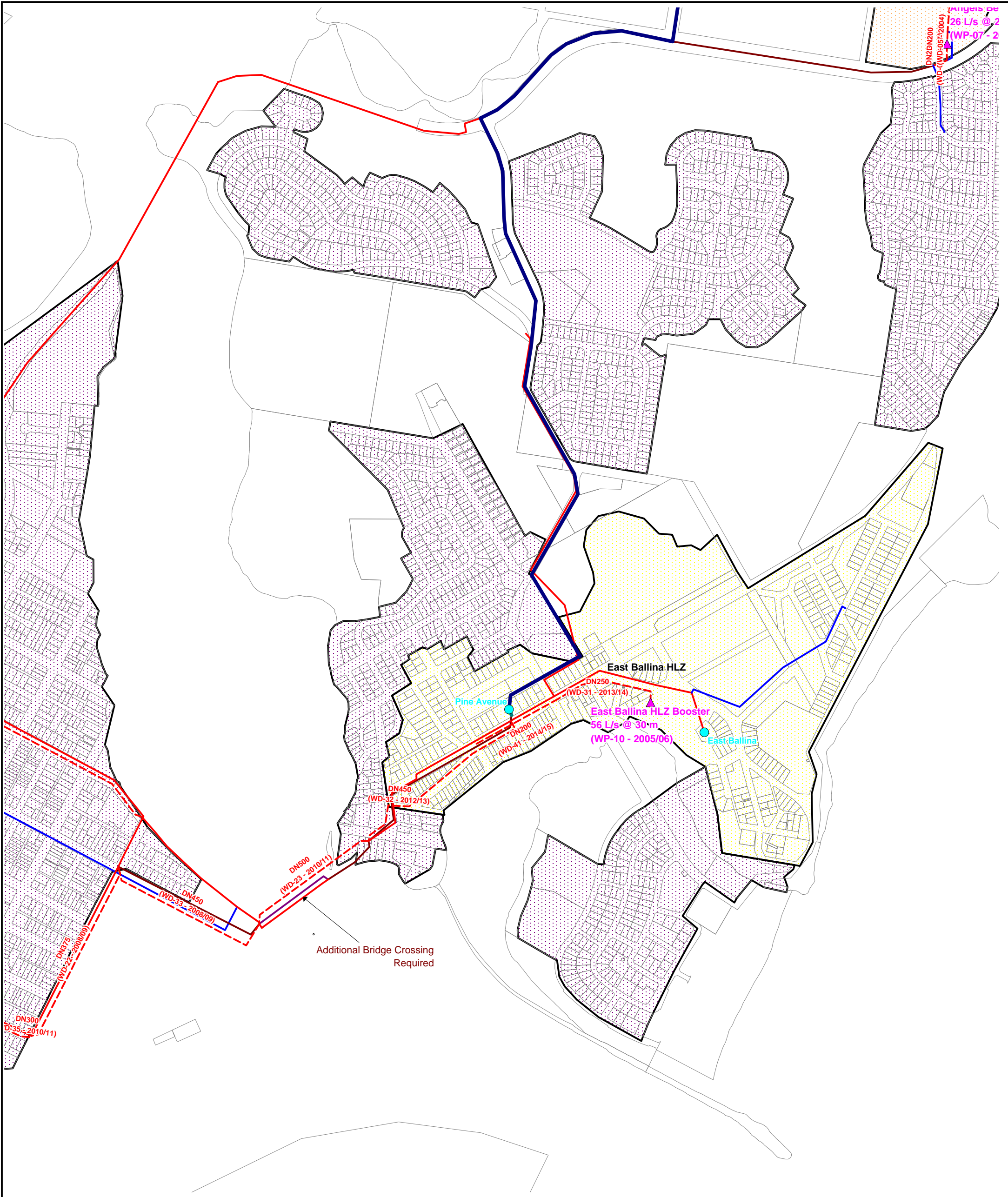
0 0.1 0.2
kilometres

Source Information: GIS Data
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Figure 8.7
Proposed Water Supply
Augmentations/Extensions

Angels Beach



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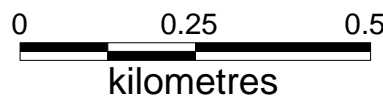
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LEGEND

Existing Mains Diameter (mm)



North

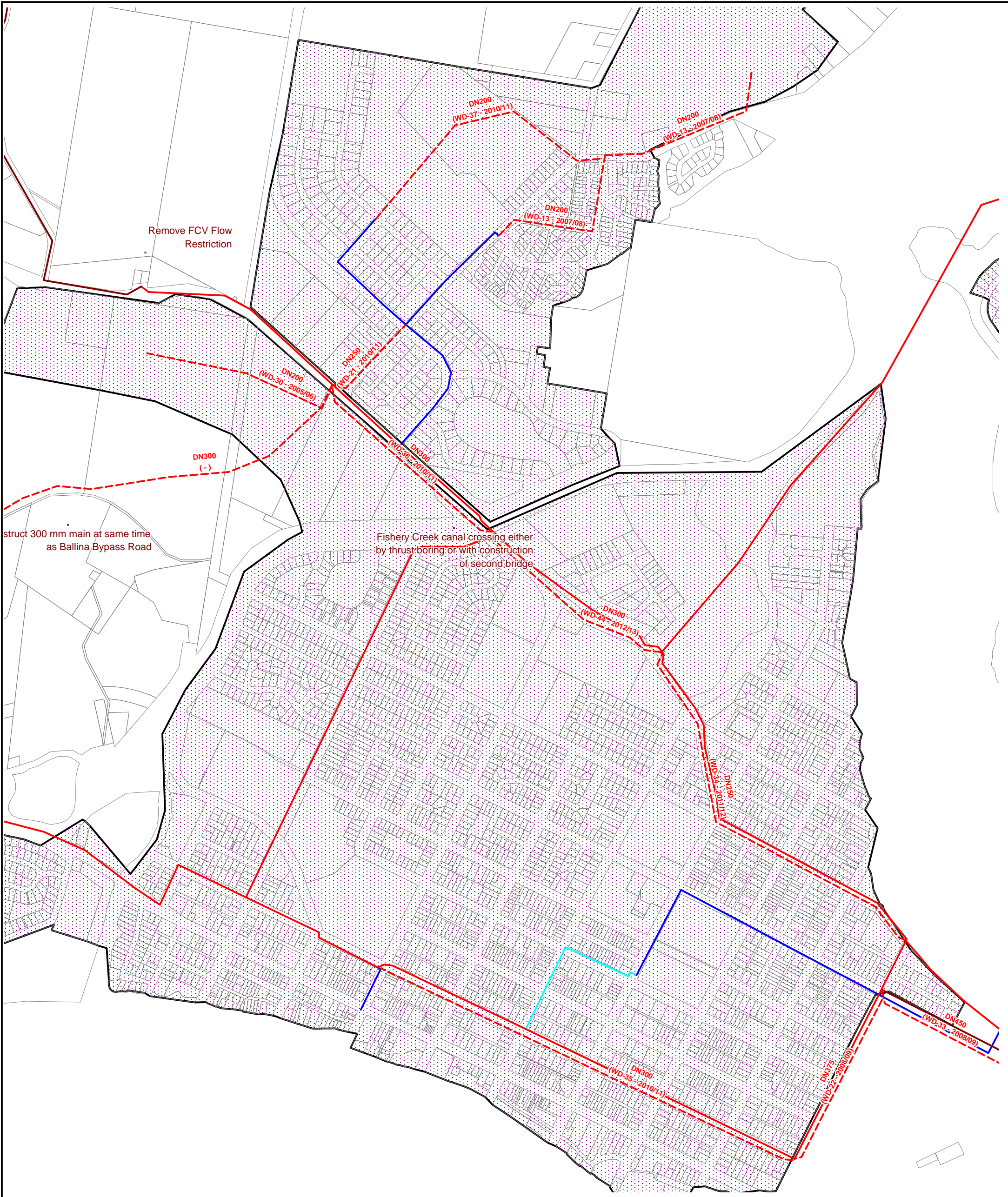


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Figure 8.8
Proposed Water Supply
Augmentations/Extensions

East Ballina



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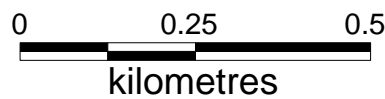
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LEGEND

Existing Mains Diameter (mm)



North

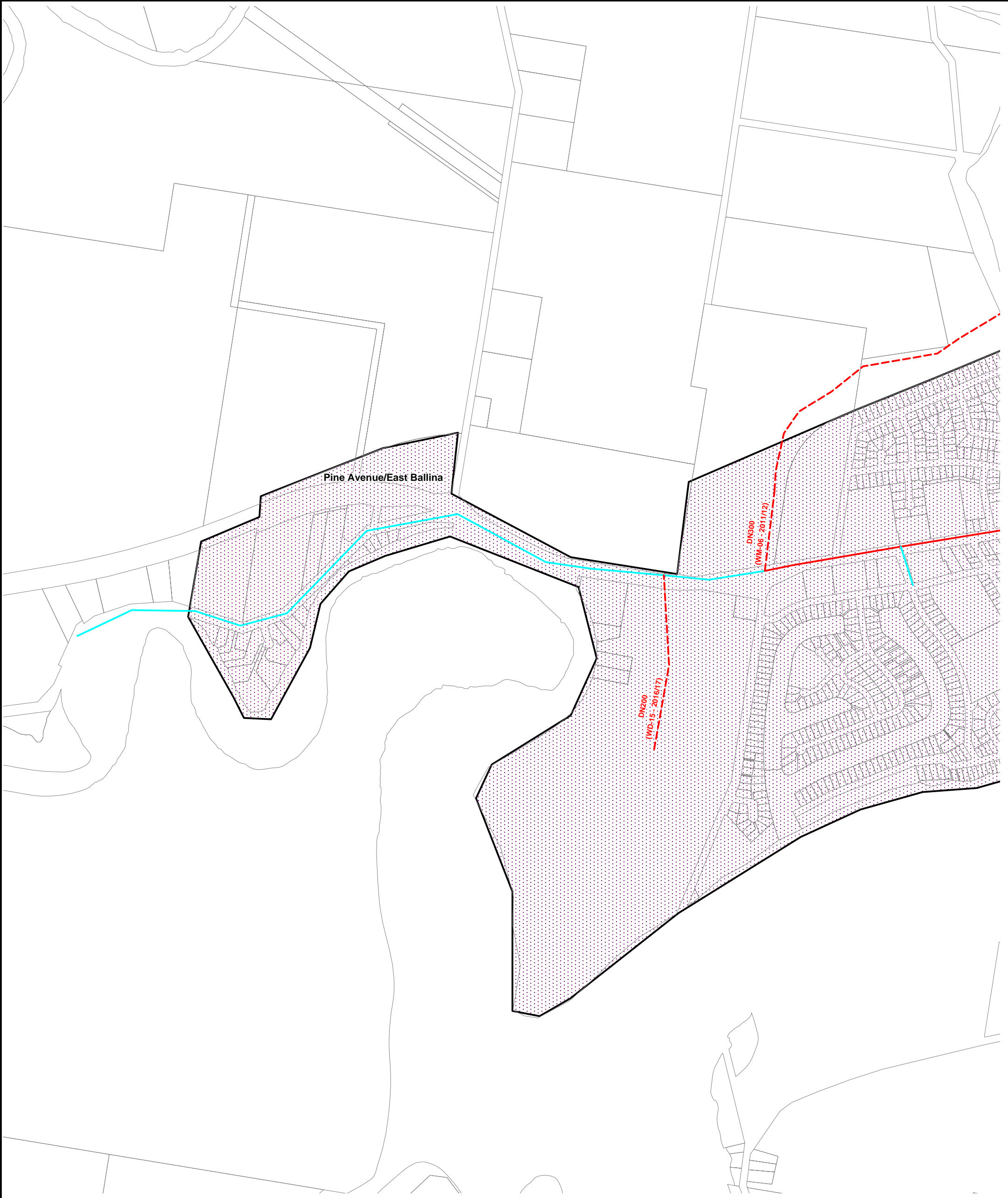


Source Information: GIS Data supplied by Ballina Shire Council

Ballina Shire Council

Figure 8.9
Proposed Water Supply
Augmentations/Extensions

Ballina Island/North Ballina

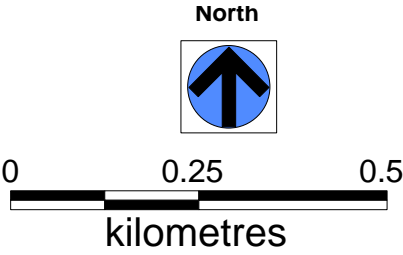


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LEGEND

Existing Mains Diameter (mm)

100
150
200
225
250
300
375
450
500
525
600

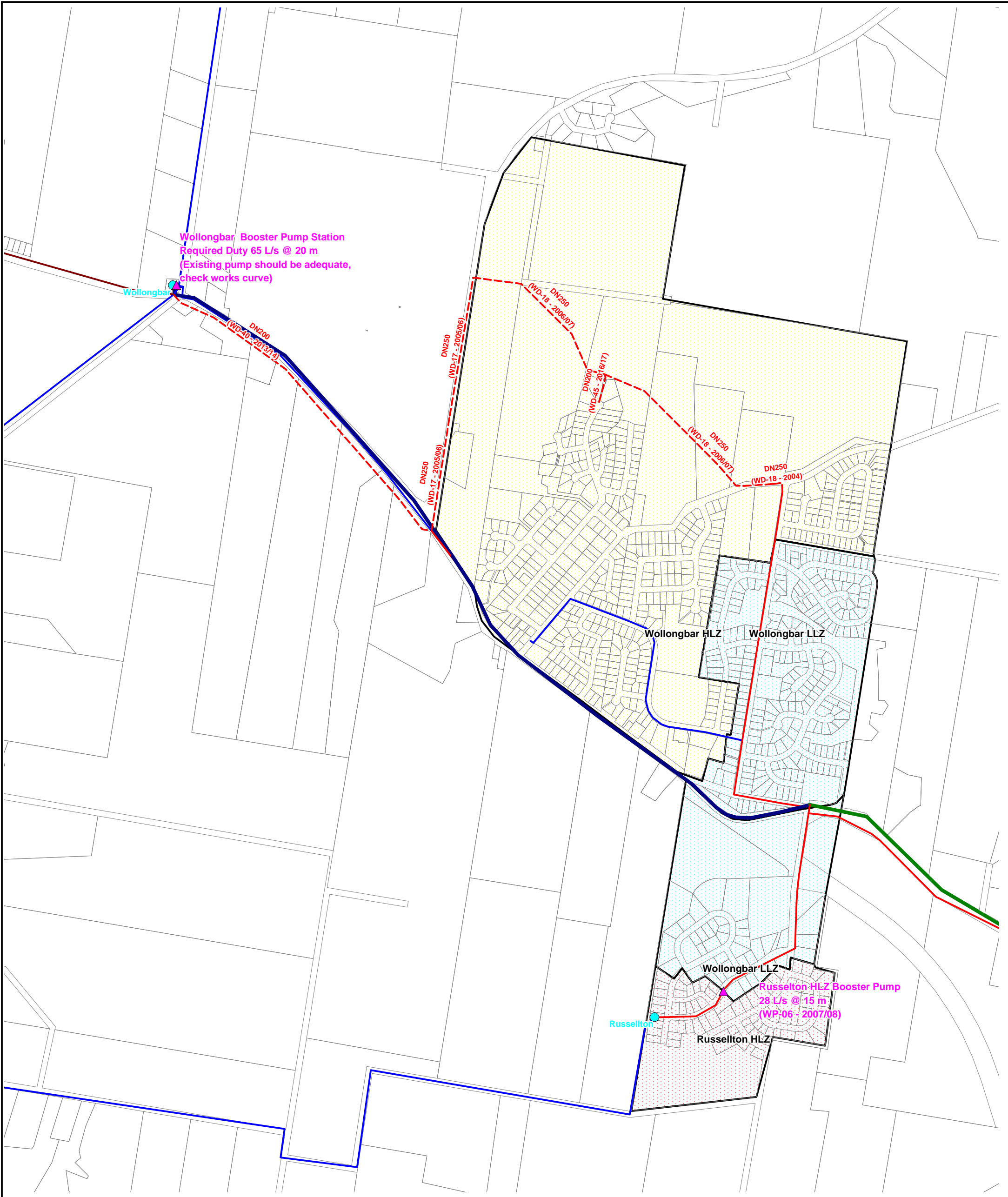


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Figure 8.10
Proposed Water Supply
Augmentations/Extensions

West Ballina



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LEGEND

Existing Mains Diameter (mm)

- 100
- 150
- 200
- 225
- 250
- 300
- 375
- 450
- 500
- 525
- 600

North



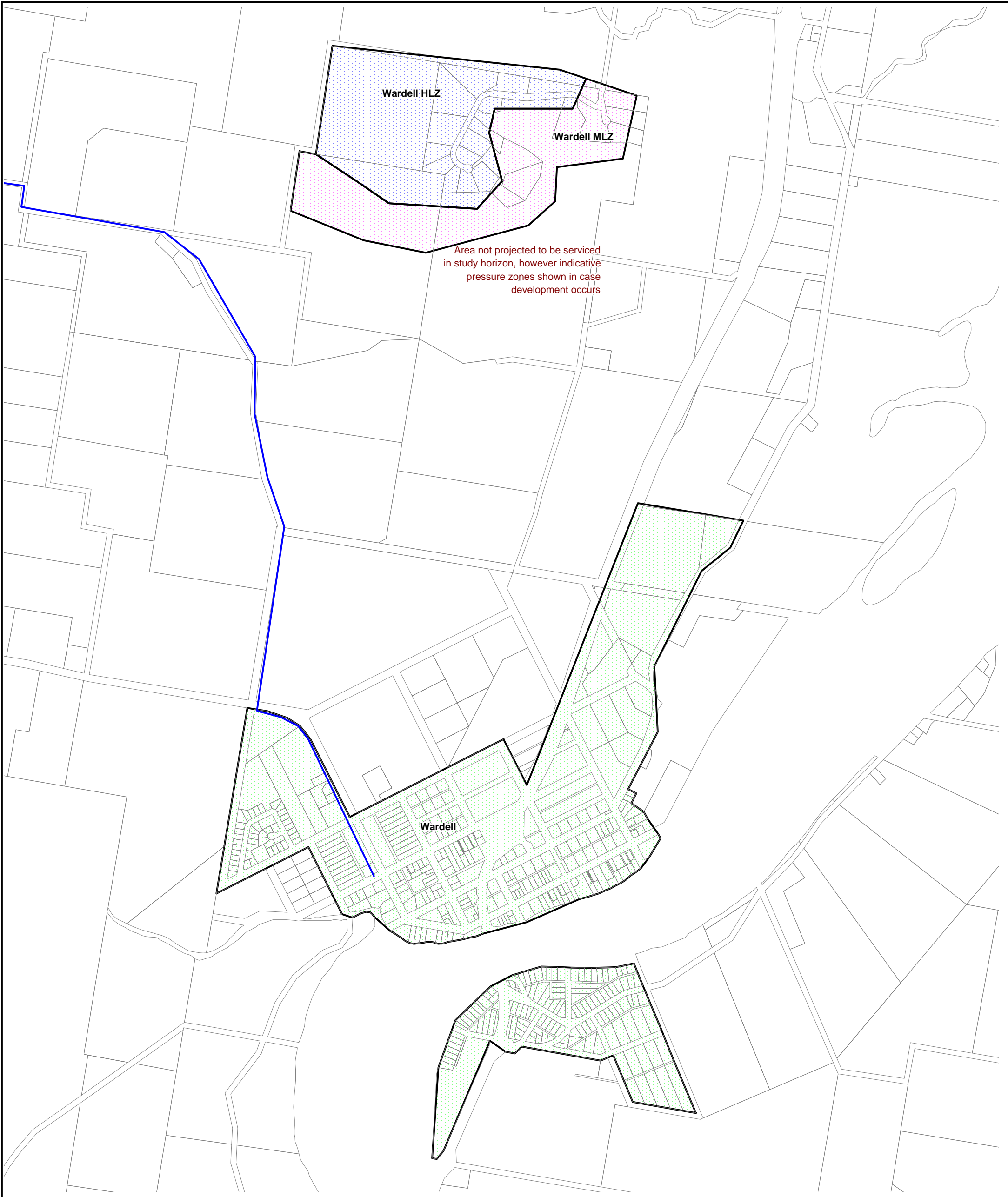
0 0.25 0.5
kilometres

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Ballina Shire Council

Figure 8.11
Proposed Water Supply
Augmentations/Extensions

Wollongbar



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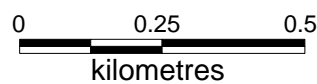
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LEGEND

Existing Mains Diameter (mm)



North



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Ballina Shire Council

Figure 8.12
Proposed Water Supply
Augmentations/Extensions

Wardell

Figure 9.1
Sewerage Capital Works -
Ballina Island

- Legend
- Existing Pump Station
 - Existing Rising Main
 - Existing Gravity Main
 - Future Pump Station / Upgrade
 - Future Gravity Main / Upgrade
 - Future Rising Main / Upgrade
 - New Release Areas



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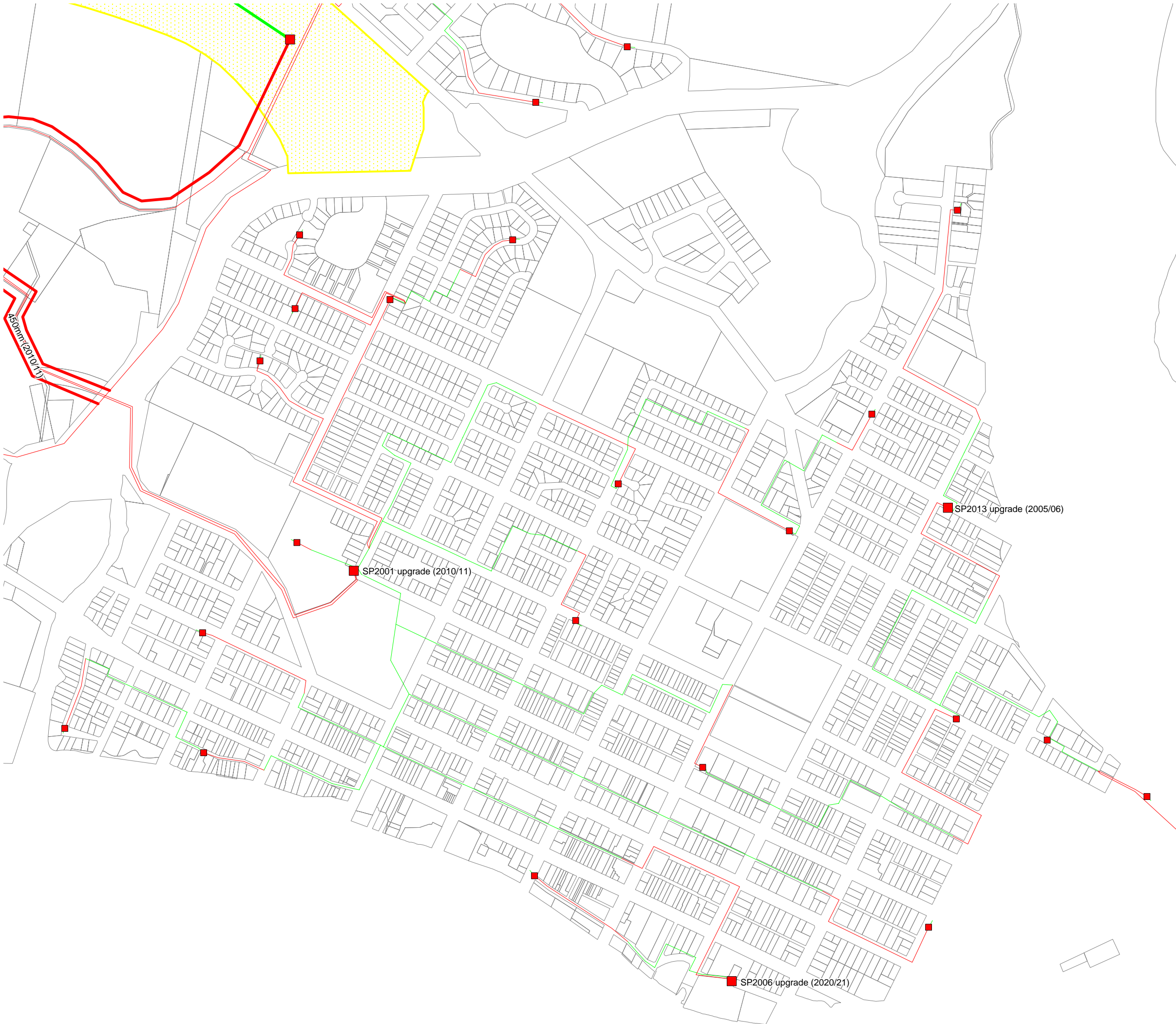


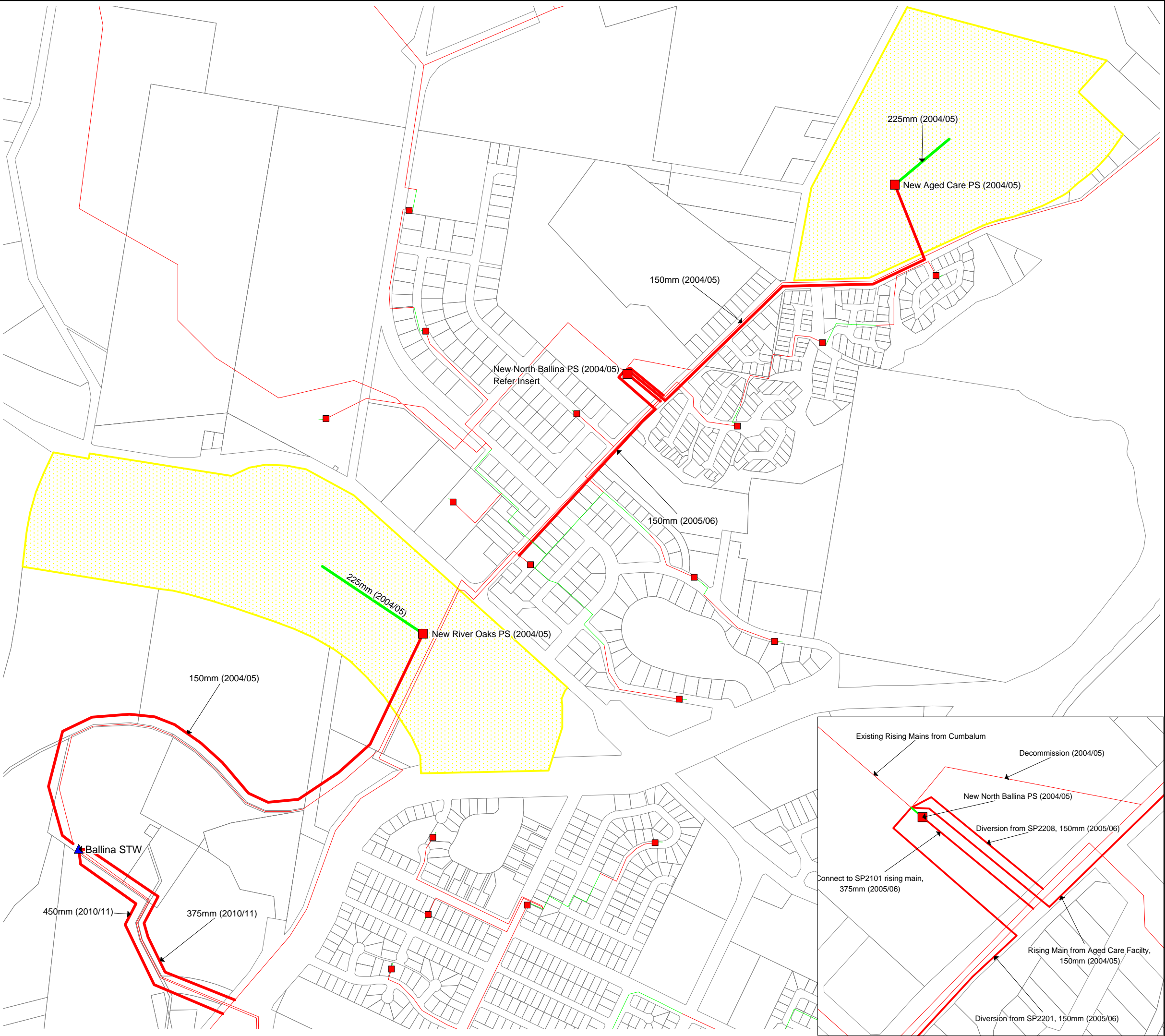
Figure 9.2
Capital Works -
North Ballina

- Legend**
- Existing Pump Station
 - Existing Rising Main
 - Existing Gravity Main
 - Future Pump Station / Upgrade
 - Future Rising Main / Upgrade
 - Future Gravity Main / Upgrade
 - New Release Areas



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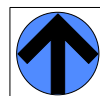
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Legend

- Existing Pump Station
- Existing Rising Main
- Existing Gravity Main
- Future Pump Station / Upgrade
- Future Rising Main / Upgrade
- Future Rising Main / Upgrade
- New Release Areas

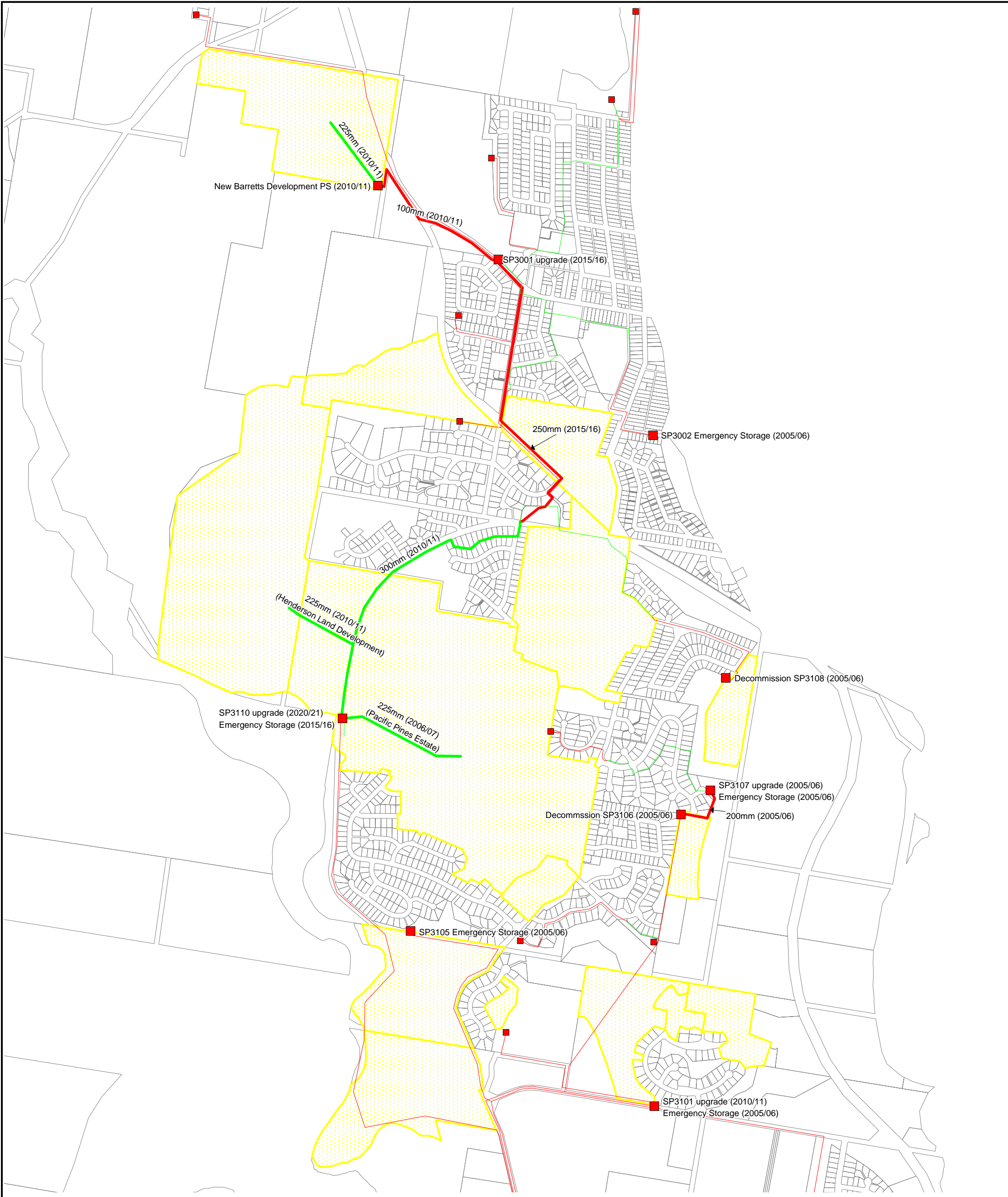
North



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Ballina Shire Council

**Figure 9.3
Capital Works -
East Ballina**

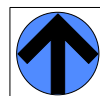


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Legend

- Existing Pump Station
- Existing Rising Main
- Existing Gravity Main
- Future Pump Station / Upgrade
- Future Gravity Main / Upgrade
- Future Rising Main / Upgrade
- New Release Areas

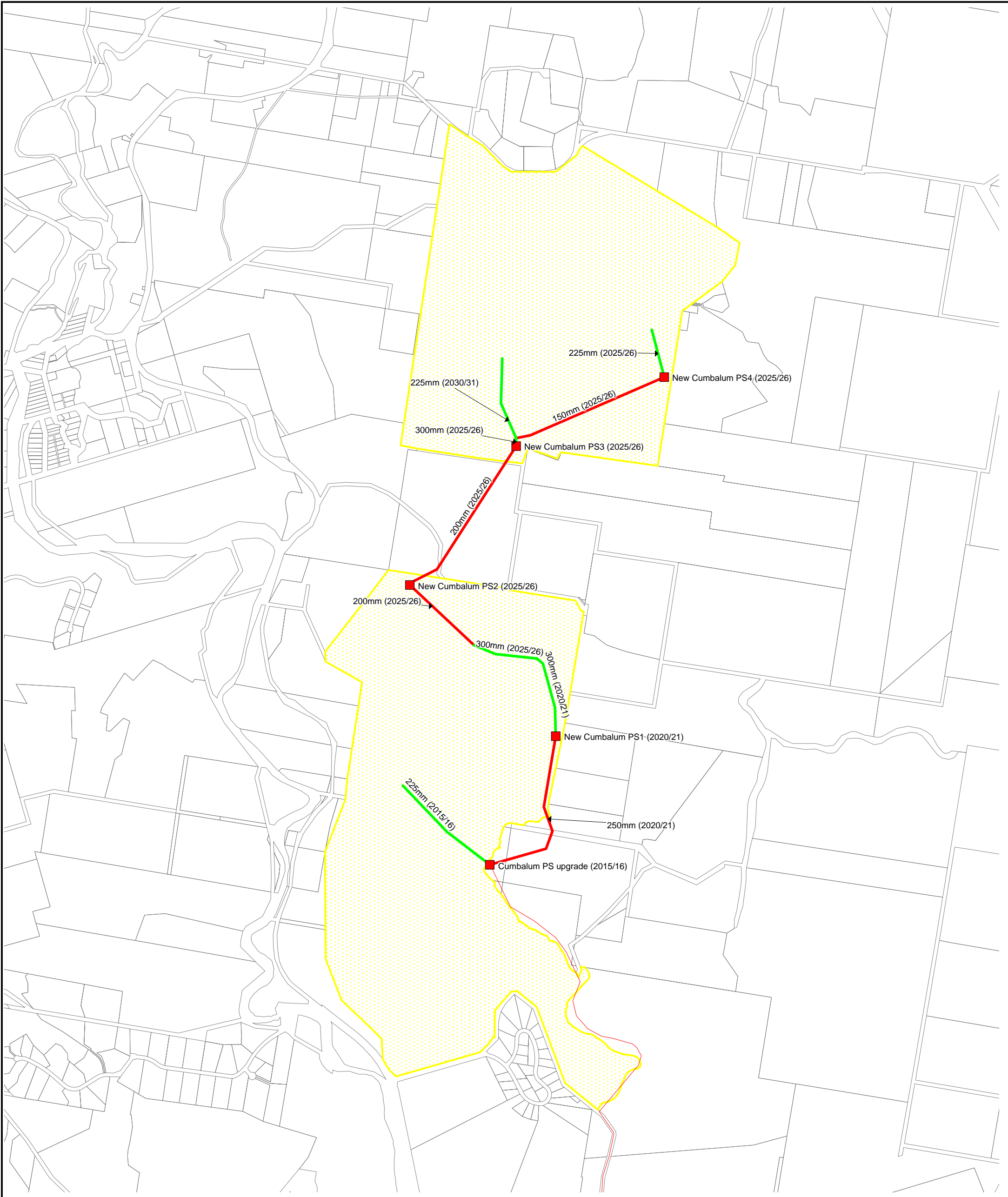
North



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Ballina Shire Council

**Figure 9.4
Capital Works -
Lennox Head**



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Legend

- Existing Pump Station
- Existing Gravity Main
- Existing Rising Main
- Future Pump Station / Upgrade
- Future Gravity Main / Upgrade
- Future Rising Main / Upgrade
- New Release Areas

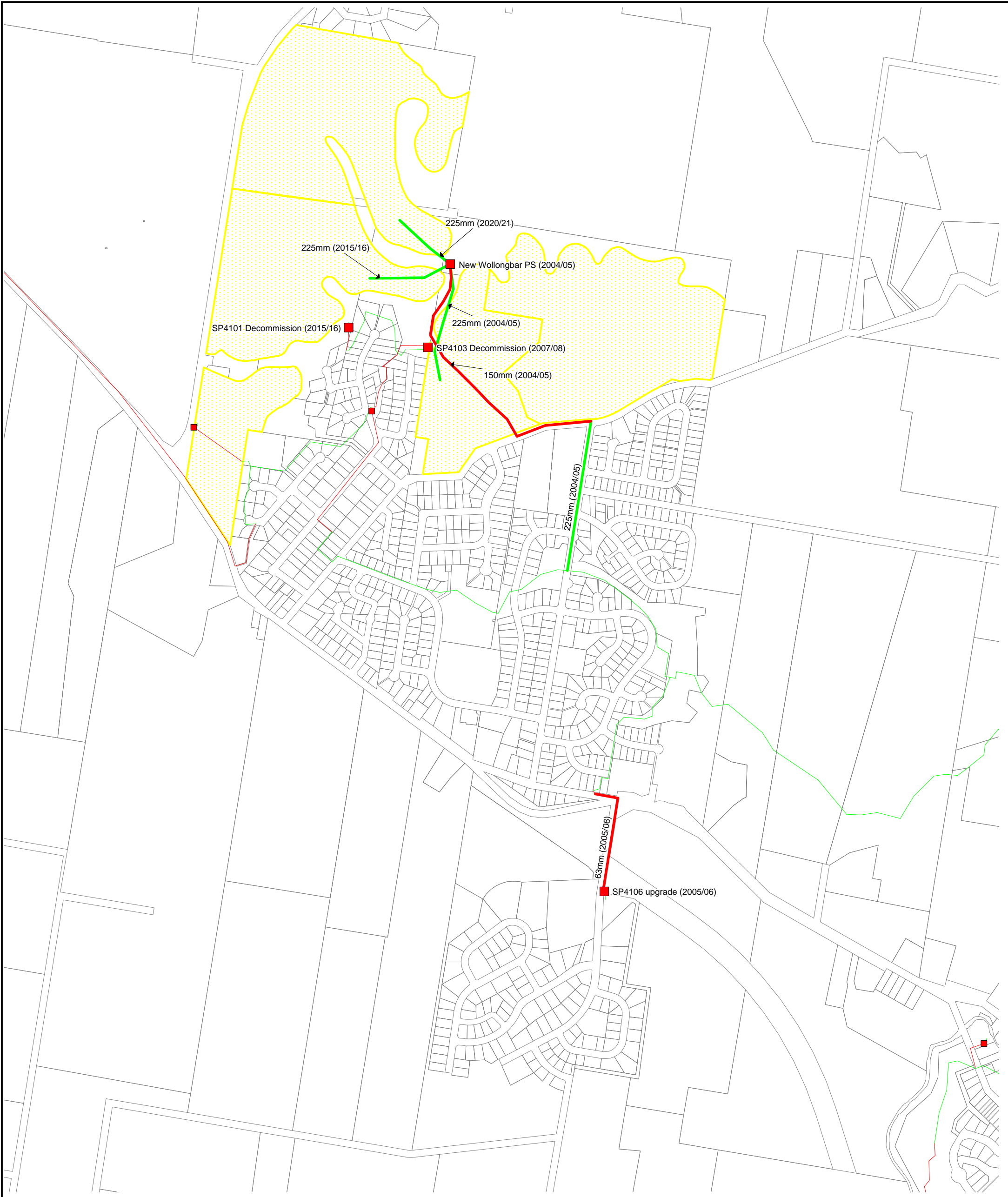
North



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Ballina Shire Council

Figure 9.5
Capital Works -
Cumbalum



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Legend

- Existing Pump Station
- Existing Rising Main
- Existing Gravity Main
- Future Pump Station / Upgrade
- Future Gravity Main / Upgrade
- Future Rising Main / Upgrade
- New Release Areas

North

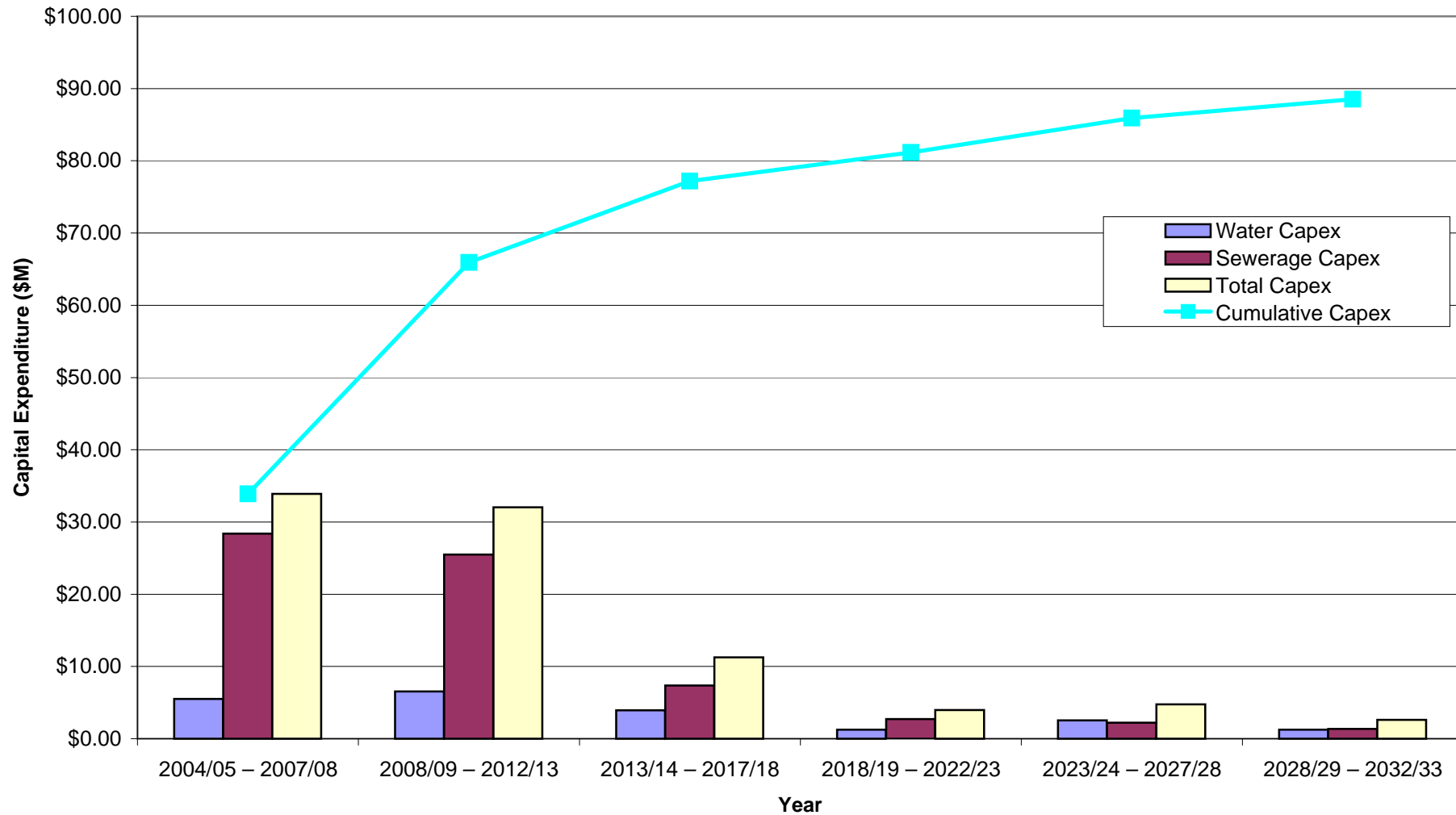


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**Figure 9.6
Capital Works -
Wollongbar**

Figure 10.1 - Estimated Capital Expenditure



Appendix B

Population and Flow Projections

Water Supply - ET Projections

Water Supply - ET Projections								PDD Projections (ML/day)				PDD Unit Load		1700 L/ET/day		PID Projections (L/s)				PID Unit Load		0.06 L/s/ET	
Water Supply Zone	2003 ET	2008 ET	2013 ET	2018 ET	2023 ET	2028 ET	2031 ET	2003 PDD	2008 PDD	2013 PDD	2018 PDD	2023 PDD	2028 PDD	2031 PDD	2003 PID	2008 PID	2013 PID	2018 PID	2023 PID	2028 PID	2031 PID		
Supplied by Knockrow																							
Zone - Pine Ave/East Ballina	7,795	7,886	8,561	8,838	9,065	9,286	9,387	13.3	13.4	14.6	15.0	15.4	15.8	16.0	468	473	514	530	544	557	563		
Zone - East Ballina HLZ	0	669	804	929	929	929	929	0.0	1.1	1.4	1.6	1.6	1.6	1.6	0	40	48	56	56	56	56		
Zone - Knockrow	295	0	0	0	0	0	0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	18	0	0	0	0	0	0		
Zone - Basalt Ct Boosted	824	498	543	608	658	708	758	1.4	0.8	0.9	1.0	1.1	1.2	1.3	49	30	33	36	39	42	45		
Zone - Basalt Ct Gravity	612	862	1,022	1,072	1,072	1,072	1,162	1.0	1.5	1.7	1.8	1.8	1.8	2.0	37	52	61	64	64	64	70		
Zone - Lennox Head	1,010	1,090	1,170	1,250	1,330	1,410	1,490	1.7	1.9	2.0	2.1	2.3	2.4	2.5	61	65	70	75	80	85	89		
Zone - North Lennox HLZ	0	103	203	283	378	448	503	0.0	0.2	0.3	0.5	0.6	0.8	0.9	0	6	12	17	23	27	30		
Ballina/Lennox Head Sub-Total	10,536	11,108	12,303	12,980	13,432	13,853	14,229	17.9	18.9	20.9	22.1	22.8	23.6	24.2	632	666	738	779	806	831	854		
Zone - Ballina Heights	0	410	820	1,156	1,459	1,549	1,559	0.0	0.7	1.4	2.0	2.5	2.6	2.7	0	25	49	69	88	93	94		
Zone - Ballina Heights HLZ	0	0	0	74	181	181	181	0.0	0.0	0.0	0.1	0.3	0.3	0.3	0	0	0	4	11	11	11		
Zone - Ross Lane	0	0	0	0	0	296	657	0.0	0.0	0.0	0.0	0.0	0.5	1.1	0	0	0	0	0	18	39		
Zone - Ross Lane HLZ	0	0	0	0	0	24	63	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0	0	0	0	0	1	4		
Cumalum Sub-Total	0	410	820	1,230	1,640	2,050	2,460	0.0	0.7	1.4	2.1	2.8	3.5	4.2	0	25	49	74	98	123	148		
Zone - Angels Beach	0	70	85	110	260	410	470	0.0	0.1	0.1	0.2	0.4	0.7	0.8	0	4	5	7	16	25	28		
Angels Beach Sub-Total	0	70	85	110	260	410	470	0.0	0.1	0.1	0.2	0.4	0.7	0.8	0	4	5	7	16	25	28		
Zone - Pacific Pines	0	170	345	595	800	800	800	0.0	0.3	0.6	1.0	1.4	1.4	1.4	0	10	21	36	48	48	48		
Zone - Pacific Pines HLZ	0	518	618	733	803	873	893	0.0	0.9	1.1	1.2	1.4	1.5	1.5	0	31	37	44	48	52	54		
Pacific Pines Sub-Total	0	688	963	1,328	1,603	1,673	1,693	0.0	1.2	1.6	2.3	2.7	2.8	2.9	0	41	58	80	96	100	102		
Knockrow Sub-Total	10,536	12,276	14,171	15,648	16,935	17,986	18,852	17.9	20.9	24.1	26.6	28.8	30.6	32.0	632	737	850	939	1,016	1,079	1,131		
Supplied by James Rd																							
Zone - Wollongbar Boosted	322	581	651	826	1,001	1,061	1,061	0.5	1.0	1.1	1.4	1.7	1.8	1.8	19	35	39	50	60	64	64		
Zone - Wollongbar Gravity	2,674	2,554	2,579	2,604	2,629	2,654	2,679	4.5	4.3	4.4	4.4	4.5	4.5	4.6	160	153	155	156	158	159	161		
Zone - Russelton HLZ	0	208	255	255	255	255	255	0.0	0.4	0.4	0.4	0.4	0.4	0.4	0	12	15	15	15	15	15		
James Rd Sub-Total	2,996	3,343	3,485	3,685	3,885	3,970	3,995	5.1	5.7	5.9	6.3	6.6	6.7	6.8	180	201	209	221	233	238	240		
Supplied by Marom Ck/ERB/LB																							
Zone - Wardell	437	467	487	512	537	562	587	0.7	0.8	0.8	0.9	0.9	1.0	1.0	26	28	29	31	32	34	35		
Marom Ck/ERB/LB Sub-Total	437	467	487	512	537	562	587	0.7	0.8	0.8	0.9	0.9	1.0	1.0	26	28	29	31	32	34	35		
Grand Total	13,969	16,086	18,143	19,845	21,357	22,518	23,434	23.7	27.3	30.8	33.7	36.3	38.3	39.8	838	965	1,089	1,191	1,281	1,351	1,406		

Notes

Sewerage - ET Projections

STW	ET							PWWF (L/s)						
	2003	2008	2013	2018	2023	2028	2033	2003	2008	2013	2018	2023	2028	2033
Ballina	3,913	4,005	5,853	6,293	6,703	7,153	7,505	165	169	247	265	283	302	316
Lennox	5,766	7,421	7,490	8,498	9,382	9,975	10,492	243	313	316	358	396	421	442
Alstonville	2,682	3,000	3,088	3,315	3,506	3,598	3,624	113	126	130	140	148	152	153
Wardell	290	315	340	365	390	415	440	12	13	14	15	16	17	19
Total	12,651	14,741	16,771	18,471	19,981	21,141	22,061	533	621	707	779	842	891	930

Appendix C

Existing Sewerage Infrastructure Details

PUMP No.	Address	Well Dia.	Year	Pump Details
BALLINA ISLAND				
SP2001	Swift St	-	1975	220 KW TKL VERT SPINDLE 74-SS-225
SP2002	Tamar St	1.8	1975	2.6 KW FORRERS 4S250/3
SP2003	Richmond Ave	1.8	1975	1.7 KW KRUGER UKA 100 17.2.3
SP2004	Norlyn Ave	1.8	1975	1.5 KW KRUGER UKA 080 58.2.0
SP2005	Fawcett St	1.8	1975	2.6 KW FORRERS 4S250/3
SP2006	Regatta Ave	2.7	1975	2.6 KW FORRERS 4S250/3
SP2007	Owen St	1.8	1975	1.7 KW KRUGER UKA 100 17.2.3
SP2008	Burnett St	1.8	1975	1.5 KW KRUGER UKA 080 17.2.0
SP2009	Grant St	2.7	1975	1.7 KW KRUGER UKA 100 17.2.3
SP2010	Fox St	1.8	1975	5.5 KW KRUGER UKA 100 17.7.5
SP2011	Cherry St	1.8	1975	1.7 KW KRUGER UKA 100 17.2.3
SP2012	Bentinck St	2.7	1975	2.9 KW KRUGER UKA 100 17.4.0
SP2013	Skinner St	1.8	1975	3.3 KW FORRERS 4S250/3
SP2014	Webster Ln (Church)	2.7	1975	5.5 KW KRUGER UKA100 17.7.5
SP2015	Namatjira Pl	1.8	1977	1.5 KW KRUGER UKA080 58.2.0
SP2016	Cherry St (Crowley Village)	1.8	1981	6.0 KW FORRERS 4S250/3
SP2017	Temple St	1.8	1978	9.0 KW MONO AFP0010HD 100/200/1
SP2018	Catherine Crs	1.8	1981	1.5 KW FORRERS 3SX7/2 TLC
SP2019	Christine Pl	1.8	1978	1.5 KW MONO AFP-002 100/160/1
SP2020	Clavan St	1.8	1980	5.5 KW MONO AFP-7 100/200/1
SP2021	Vera St	1.8	1991	6.0 KW FORRERS 4S250/3
SP 2022	Tafe College	1.2	-	-
SP 2023	Missingham Bridge - ampitheatre	1.8	-	-
SP 2024	Commemoration Park	1.8	-	-
WEST BALLINA				
SP2101	Pacific Hwy(Coastline)	4.8	1976	12.5 KW KRUGER UKA 125 27.17
SP2102	Boatharbour Rd (RTA)	1.8	1979	1.5 KW KRUGER UKA 080 17.2.0
SP2103	Apsley St	1.8	1979	7.5 KW MONO AFP0010 100/230/1
SP2104	Kalinga St	1.8	1976	1.5 KW FORRERS 4S250/3
SP2105	Oakland Ave(Weerama Park)	1.8	1979	5.5 KW KRUGER UKA100 17.7.5
SP2106	Riverside Dve(Riverside Park)	1.8	1979	1.5 KW KRUGER UKA080 17.2.0
SP2107	Riverside Dve(Faulks Res.)	1.8	1979	1.5 KW MONO AF15-4 CB34
SP2108	Quays Dve (Rugby Union)	1.8	1979	1.5 KW MONO AF15-4 CB34
SP2109	Spinnaker Crs	2.7	1982	6.0 KW MONO AF60-4
SP2110	Burns Pt Ferry Rd (Marina)	1.8	1985	1.5 KW MONO AF15-4 CB22
SP2111	Burns Pt Ferry Rd	1.8	1985	1.5 KW MONO AF15-4 CB22
SP2112	Westlands Dve	1.8	1993	6.0 KW MONO AF60-4 CB61
SP2113	Waterview Crt	1.8	1995	KW MONO AF60-4 CB61
NORTH BALLINA				
SP2201	North Creek Rd (Canal) No:1	2.4	1980	18.5 KW MONO AFP-25 100/230/1
SP2202	Racecourse Rd (No.1)	1.4	1980	3.0 KW FORRERS SGV135 TLC
SP2203	Racecourse Rd (No.2)	1.5	1980	1.5 KW MONO PIRANHA 17-2
SP2204	Endeavour Close	1.4	1980	3.0 KW FORRERS SGV135 TLC
SP2205	Piper Drive	1.8	1980	2.6 KW FORRERS 4S250/3 165
SP2206	De Havilland Crs	1.8	1980	2.5 KW FORRERS 4S250/3
SP2207	Sth Cross Dve (BSC Depot)	1.4	1990	1.0 KW MONO MUTRATOR CD60R4
SP2208	Yellowfin Way	1.8	1993	6.0 KW FORRERS 4S250/3
SP2209	Ballina Airport No. 1	1.6	1993	3.0 KW FORRERS SGV150
SP2210	Whiting Way	1.8	-	-
SP2211	Ballina Airport No. 2	1.2	-	-
SP2212	MRF	1.2	-	-
-	Ballina Palms Caravan Park	1.8	-	-
-	Ballina Gardens Caravan Park	2.0	-	-
EAST BALLINA				
SP2301	Angels Beach Dve (Chickiba No.1)	3.8	1985	54 KW FLYGT W3300.180
SP2302	John Sharpe St	3.0	1981	7.5 KW MONO AFP-00100 ---/240/1
SP2303	George Pearce Pl	1.8	1981	7.5 KW MONO AFP-00100 ---/240/1
SP2304	Northumberland Dve	3.2	1984	15 KW MONO AFP-20 100/300/1
SP2305	Jameson Ave	1.6	1984	3 KW MONO PIRANHA 25-2
SP2306	The Serpentine	1.8	1976	2.9 KW KRUGER UKA100 17.4.0
SP2307	Coogee St	1.8	1976	6.0 KW FORRERS 4S250/3
SP2308	Shaws Bay C/van Park	2.7	1976	2.9 KW KRUGER UKA100 17.4.0

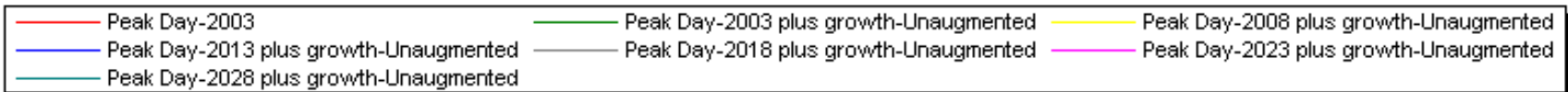
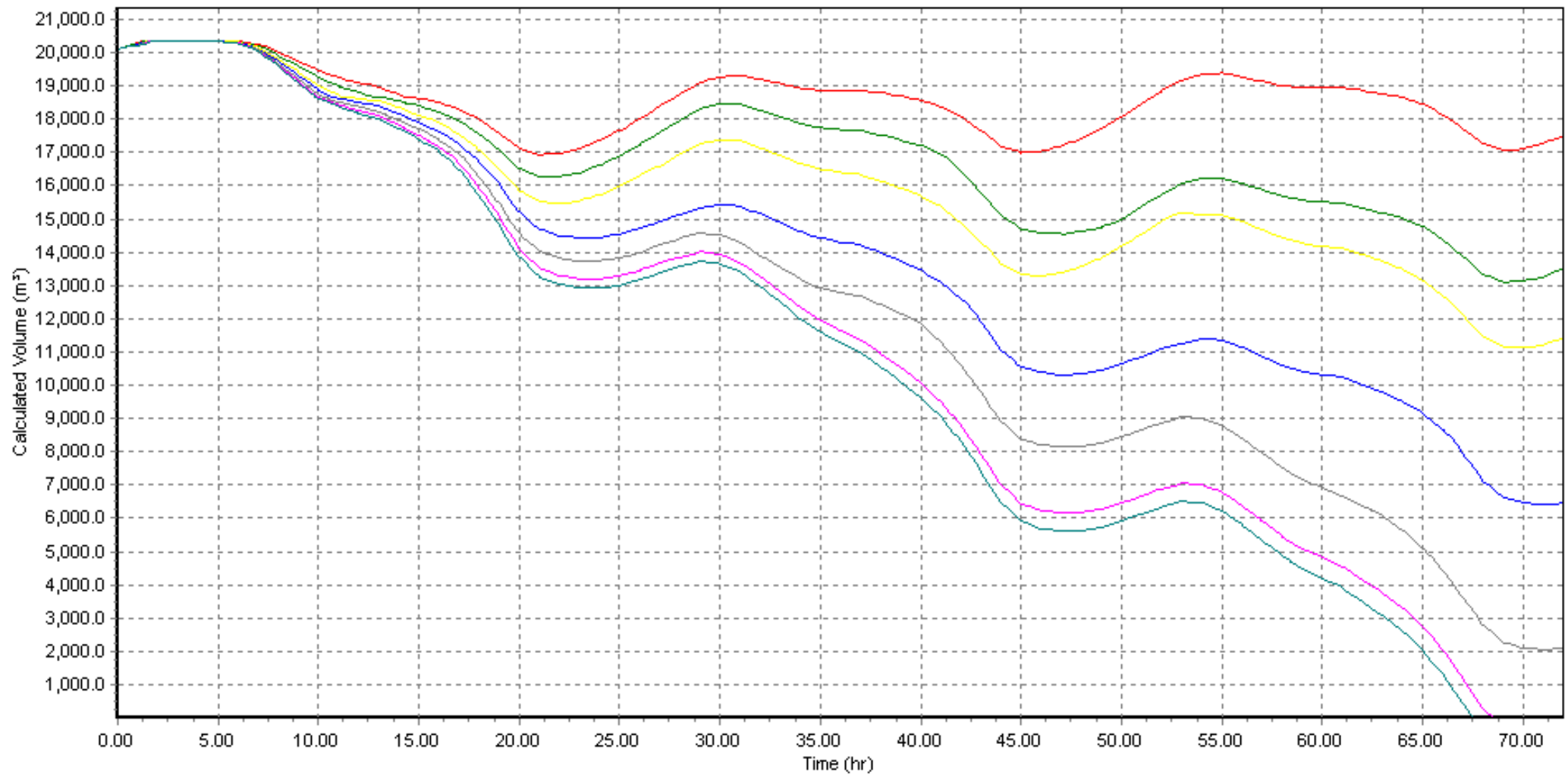
PUMP No.	Address	Well Dia.	Year	Pump Details
SP2309	Anderson St	1.8	1978	3 KW MONO AFP-4 100/200/1
SP2310	Tuckeroo Dve	1.8	1986	2.9 KW KRUGER UKA100 17.4.0
SP2311	Bayview Dve	1.8	1986	5.5 KW MONO AFP-7 100/200/1
SP2312	Shelly Beach Rd	3.2	1993	15 KW FORRERS 4S250/3
SP2313	Compton Dve	1.8	1976	15 KW MONO AFP-20 100/300/1
SP2314	Pop Denison Park	1.0	1986	3 KW FORRERS SGV FDR
SP2315	McKinnon St	1.8	1976	1.7 KW KRUGER UKA100 17.2.3
SP2316	Lighthouse Pde (Coastguard)	0.7	1984	1.5 KW MONO PIRANHA 16-2
SP2317	Silver Gull Dve (Angels Beach)	3.0	1992	6 KW FORRERS 4S250/3
SP2318	Flat Rock Rd (Camping Ground)	1.2	1983	2.2 KW MONO MUTRATOR CD60R4(GR2)
SP2319	Lighthouse Pde (SLSC)	-	1990	1.5 KW MONO PIRANHA 17-2
SP2320	Chickiba Dve Playing Fields	1.8	1994	1.2 KW MONO PIRANHA 12-2
LENNOX HEAD				
SP3001	Byron St (Lennox No.1)	4.2	1981	30 KW FLYGT CP3201 HT
SP3002	Rutherford St	1.8	1981	7.5 KW MONO AFP-0010 100/240/1
SP3003	Lake Ainsworth C/van Park	1.5	1988	3.0 KW MONO PIRANHA 30-2
SP3004	Fig Tree Hill Dve	1.8	1993	6.0 KW MONO AF60-4 CB62
SP3005	Toilet Block (Lake A. beach)	1.5	1993	3.0 KW FORRERS SGV115
SP3006	Lakefield Ave	1.8	1995	ASSUME 6 KW
SP3007	Emily Place	1.8	-	-
LENNOX HEAD HEIGHTS				
SP3101	Skennars Head Rd	1.8	1983	11.0 KW MONO MUTRATOR CLN213R4
SP3102	Tara Downs	1.5	1985	2.9 KW MONO PIRANHA 30-2
SP3103	Castle Dve (Castle Hill)	1.8	1981	1.5 KW MONO AFP-002 100/184/1
SP3104	Page Crt (Stone Hut)	1.1	1981	4.0 KW MONO MUTRATOR CD70R4(GR2)
SP3105	Rainforest Way (Pacific Pines)	3.0	1990	11 KW MONO MUTRATOR GEO7/MSR3
SP3106	Amber Dve (Boulder Beach)	1.8	1981	18.5 KW MONO AFP-25 HD 100/190/1
SP3107	Seamist Pl	1.8	1988	6.7 KW FORRERS SGV265
SP3108	Survey St (Blue Seas)	1.5	1981	18.5 KW MONO AFP-25 HD 100/190/1
SP3109	Karaluen Crt (Warrawee)	1.8	1981	18.5 KW MONO MUTRATOR CD60R4
SP3110	Montwood Dr (Pump Station B)	4.8	1987	7.5 KW FORRERS 4S250/3
SP3111	The Grove	1.8	1987	6.7 KW FORRERS SGV265
SP3113	Skennars Heads Sporting Fields	-	-	-
SKENNARS HEAD				
SP3201	Headlands Drive	3.2	1990	22 KW FORRERS 4S330/3
SP3202	Carrol Avenue	1.8	1993	ASSUME 6 KW
ALSTONVILLE				
SP4001	Cawley Cls (Alst.High School)	1.8	1984	1.5 KW MONO AF15-4 CB21
SP4002	Coral St	1.8	1974	1.5 KW FLYGT CG3065 201
SP4003	Cedar Crt (Oceanview)	1.8	1976	18.5 KW KEBCO 25HP
SP4004	Granada Pde (Panorama)	1.8	1985	18.5 KW MONO AFP-25
SP4005	Pinehurst Crt	1.8	1993	2.5 KW MONO PIRANHA 25-2
SP4006	Bulwinkel Park	1.4	1994	1.2 KW MONO PIRANHA 12-2
WOLLONGBAR				
SP 4101	Queens Park Court	1.8	1975	12.5 KW KRUGER UKA125 26.17
SP4102	Central Park Dve (Sharwood)	1.8	1975	12.5 KW KRUGER UKA125 26.17
SP4103	Stanley Park Dve	1.8	1992	7.5 KW FORRERS 4S250/3
SP4104	-	-	1991	9.0 KW FORRERS 4S250/3
SP4105	-	-	1989	7.4 KW FLYGT 3127.180
SP4106	Kays Lane (Russellton)	2.4	1989	2.2 MONO MUTRATOR CD60R4
SP4107	Sneaths Rd	1.8	1993	9.0 KW FORRERS E100/280
WARDELL				
SP5001	Lindsay Cres	1.8	-	-
SP5002	Bath St	2.4	-	-
SP5003	River Dr	1.5	-	-
SP5004	Mary St	1.8	-	-
SP5005	Swamp St	1.8	-	-
SP5006	Richmond St	3.2	-	-
SP5007	Cabbage Tree Is Pump B	1.8	-	-
SP5008	Cabbage Tree Is Pump A	1.8	-	-

Appendix D

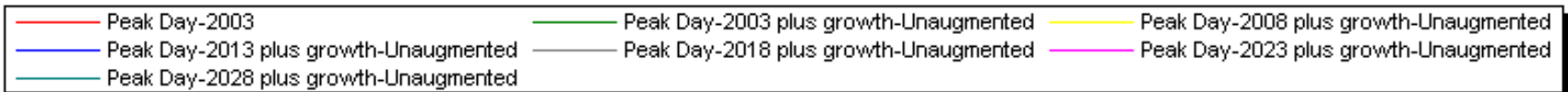
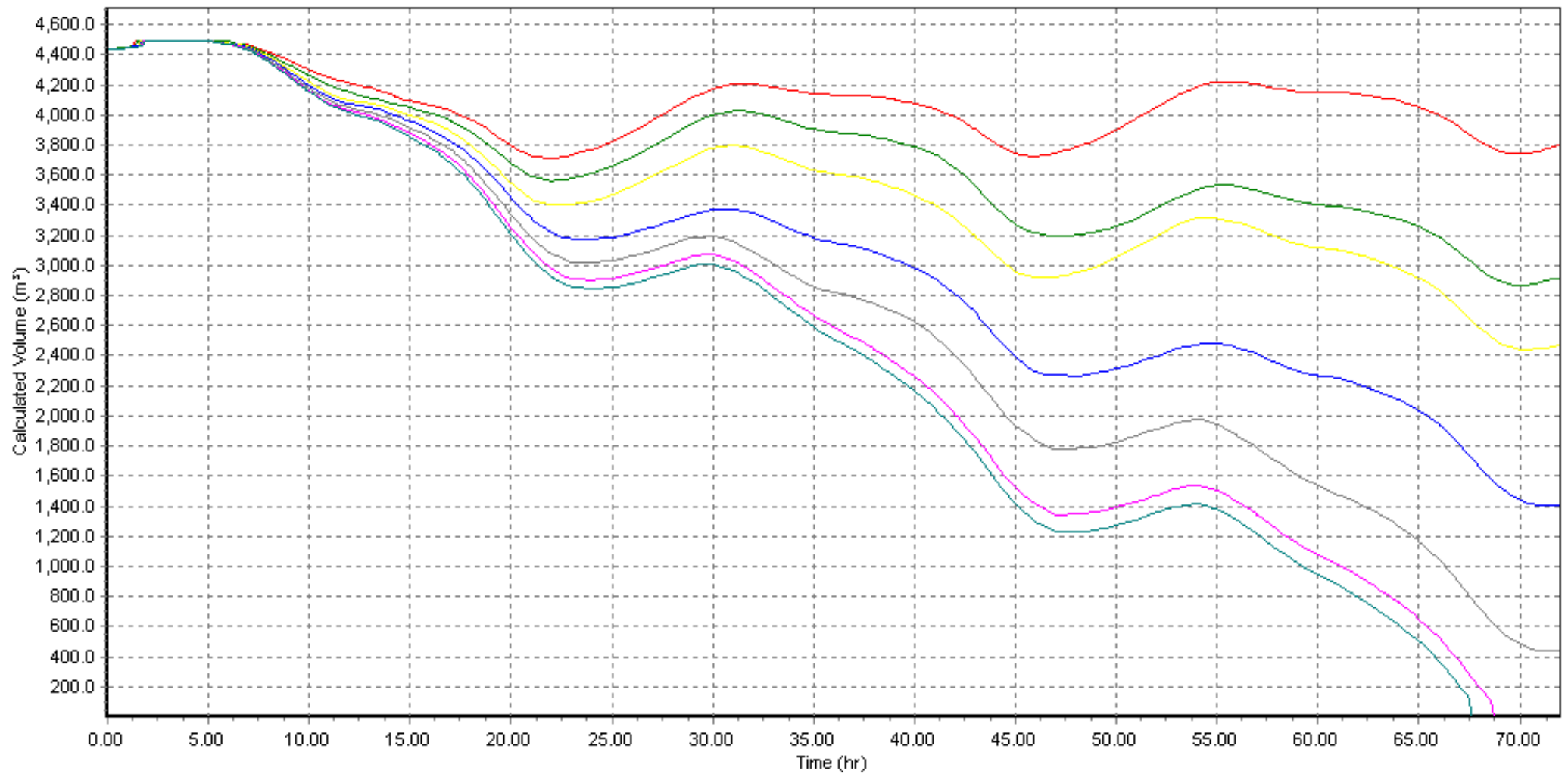
Existing Water Supply Network Performance

WaterCAD Results

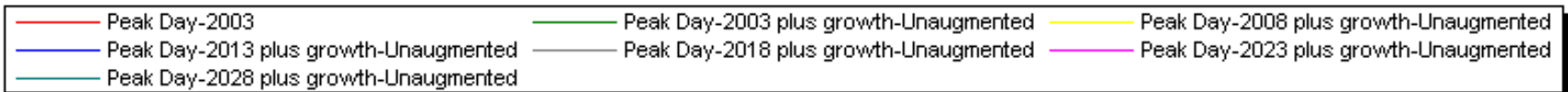
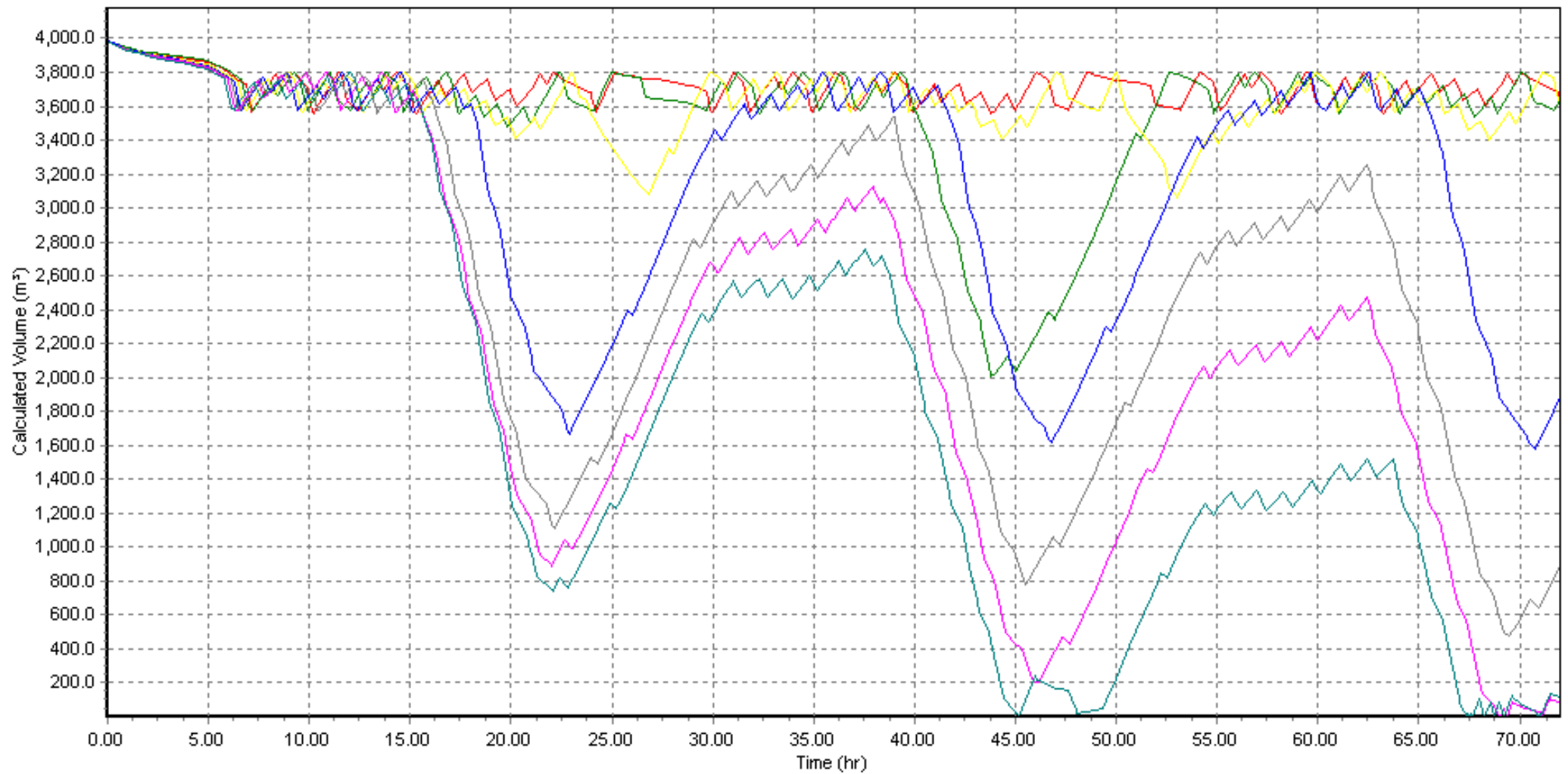
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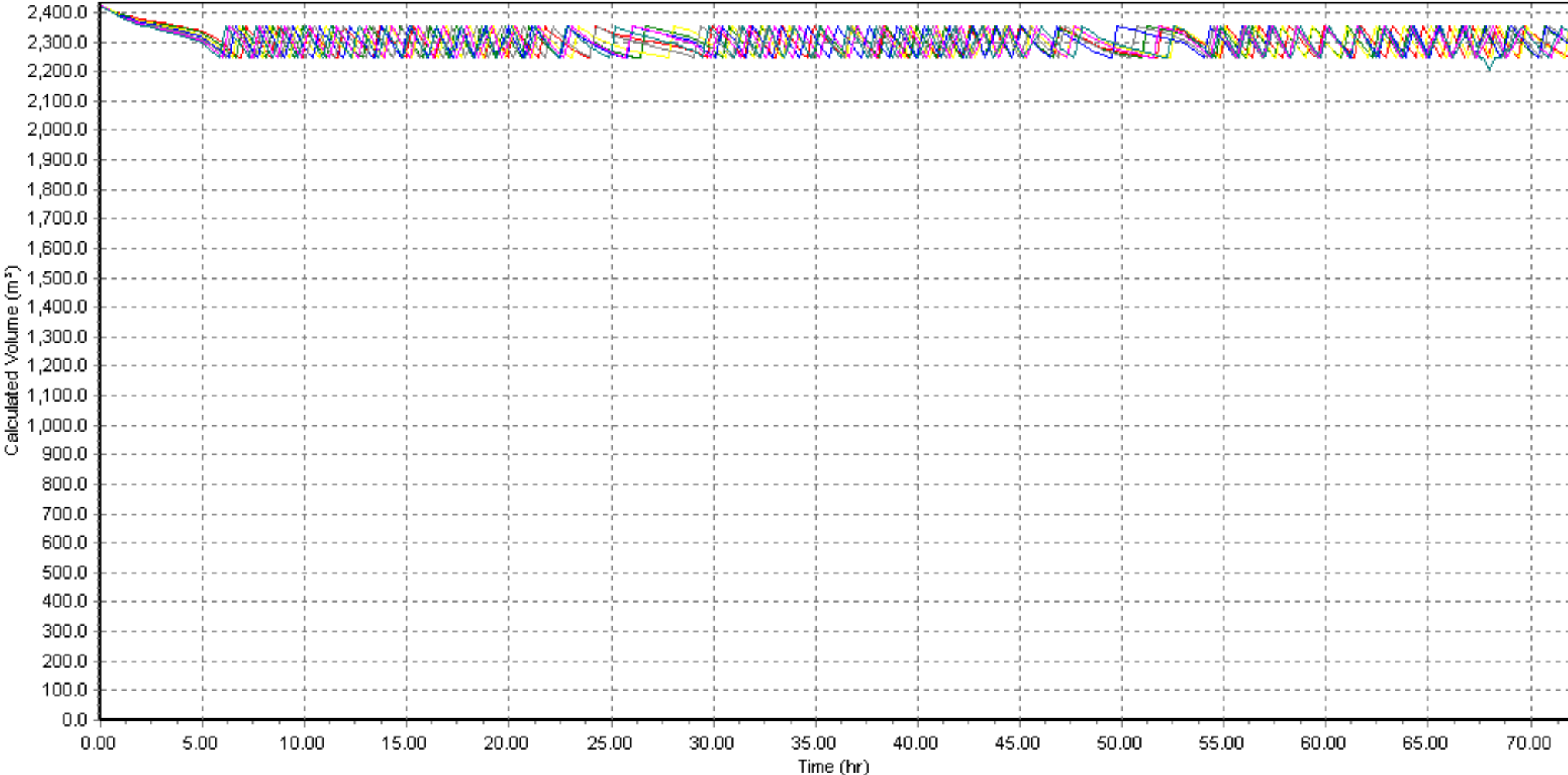
Element: T-East Ballina



Element: T-Basalt Court

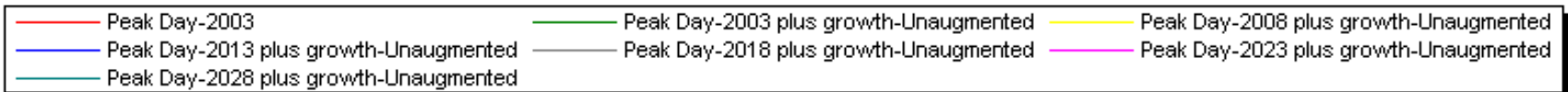
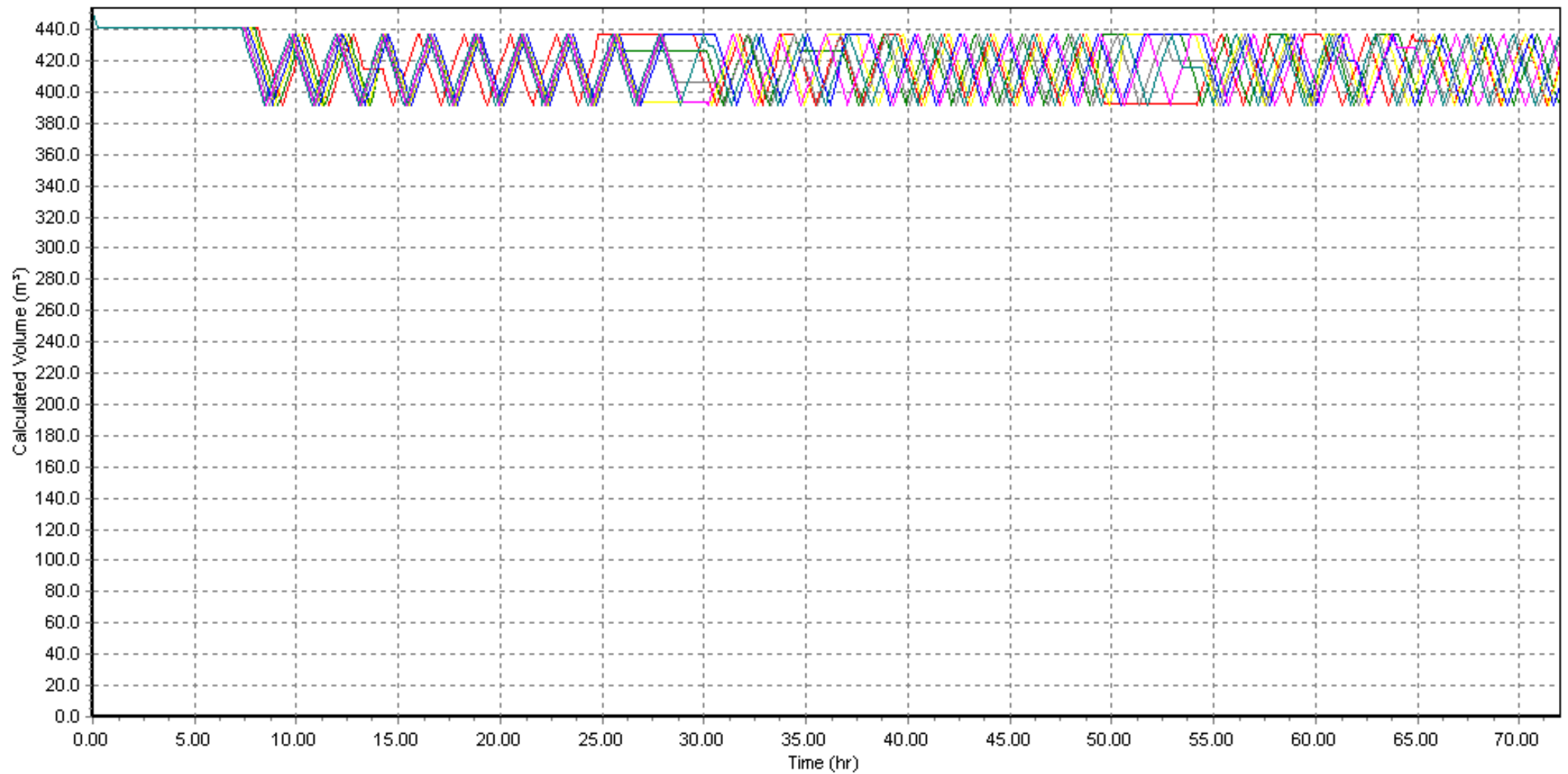


Element: T-Lennox Head

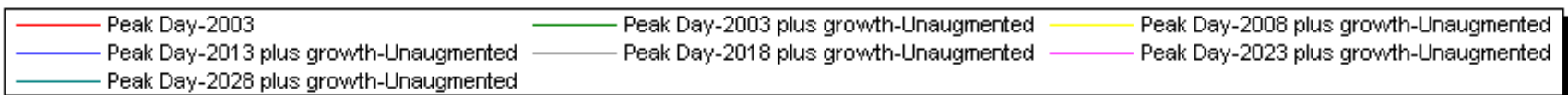
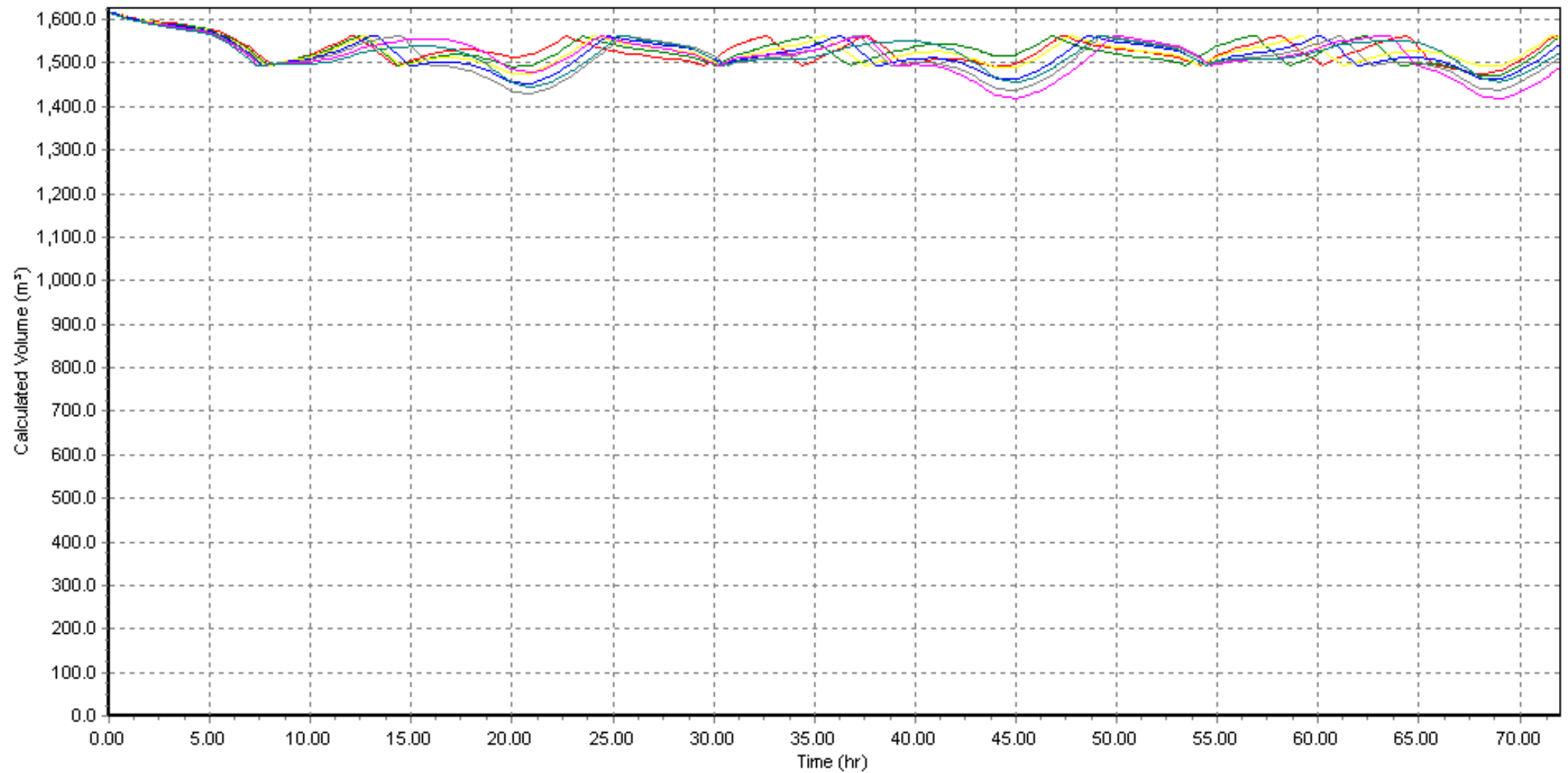


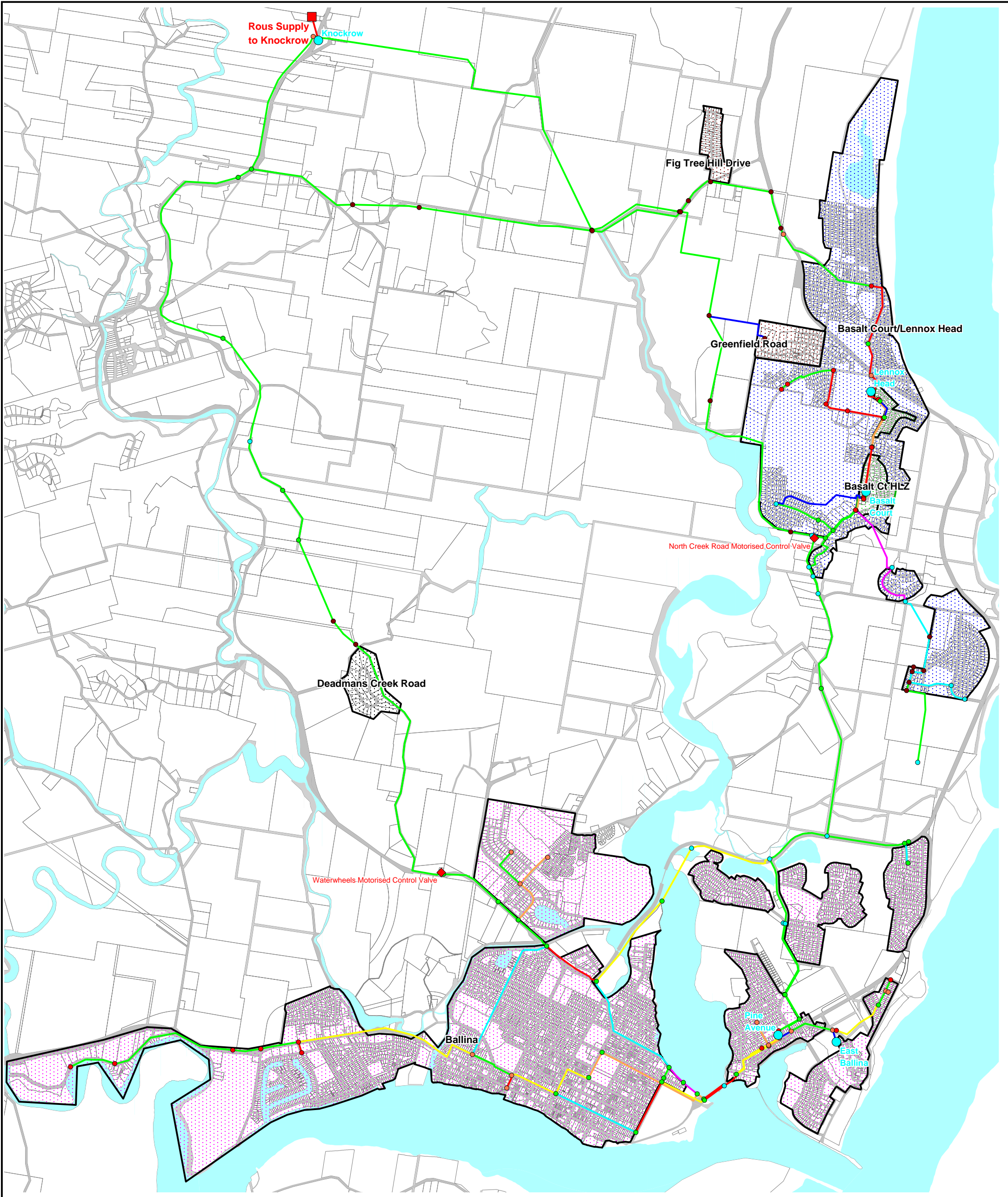
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|---------------------------------------|---------------------------------------|---------------------------------------|
| Peak Day-2003 | Peak Day-2003 plus growth-Unaugmented | Peak Day-2008 plus growth-Unaugmented |
| Peak Day-2013 plus growth-Unaugmented | Peak Day-2018 plus growth-Unaugmented | Peak Day-2023 plus growth-Unaugmented |
| Peak Day-2028 plus growth-Unaugmented | | |

Element: T-Whites Lane



Element: T-Wardell





MANAGEMENT
ENGINEERING
ENVIRONMENT

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LEGEND

HL Gradient (m/km)

- Greater than 10
- 6 to 10
- 4 to 6
- 3 to 4
- 2 to 3
- 1 to 2
- 0 to 1

Residual Pressure Head (m)

- Greater than 60
- 40 to 60
- 20 to 40
- 15 to 20
- Less than 15

- Water Supply Source
- Reservoir
- Control Valve

North

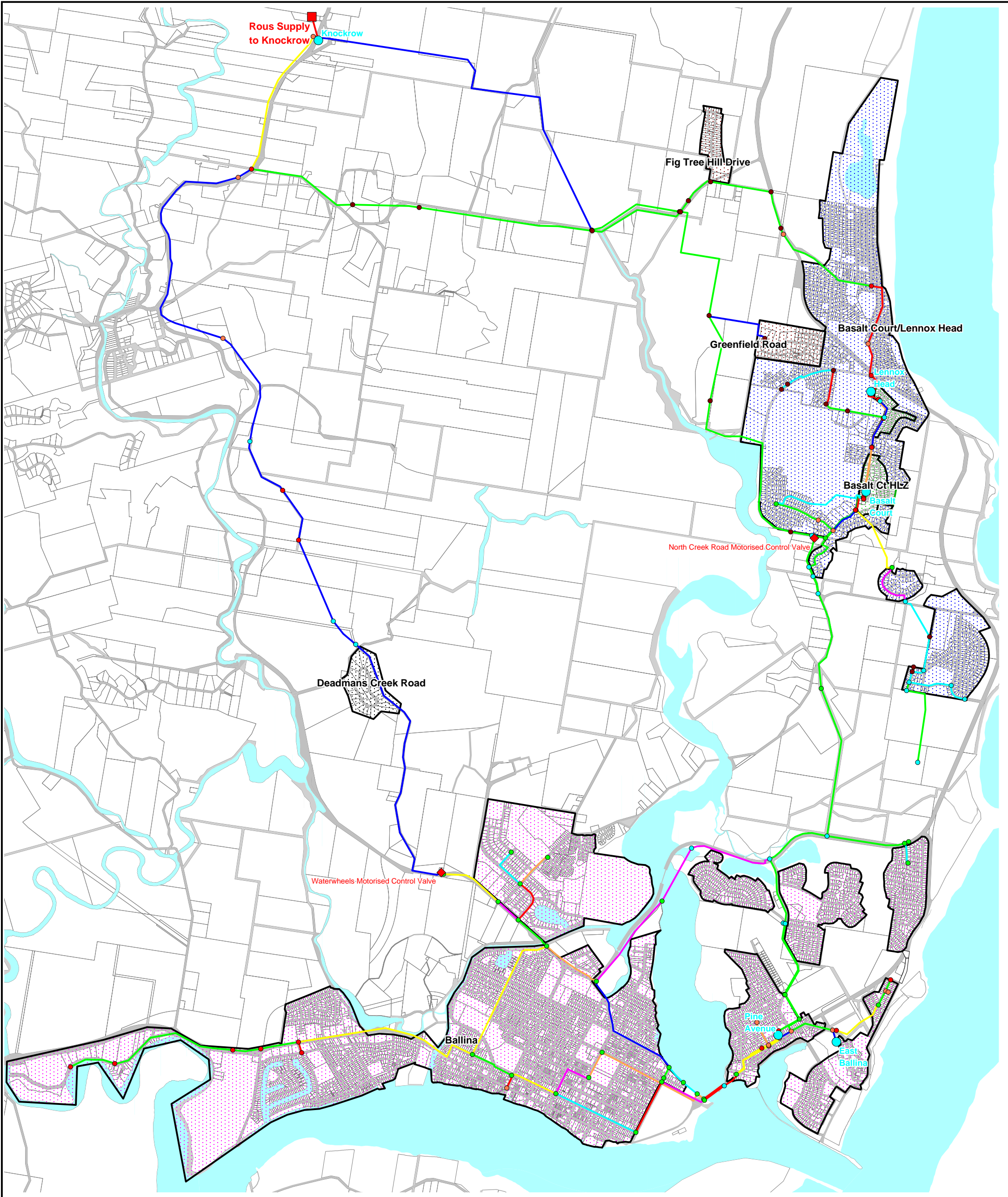


0 0.25 0.5
kilometres

Source Information: GIS Data
supplied by Ballina Shire Council

**Ballina Shire Council
Existing Water Supply
System Performance**

**Coastal Areas
2003**



MANAGEMENT
ENGINEERING
ENVIRONMENT

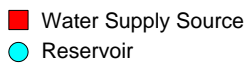
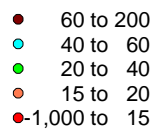
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PPResults by Gradient2008



PJResults by P2008



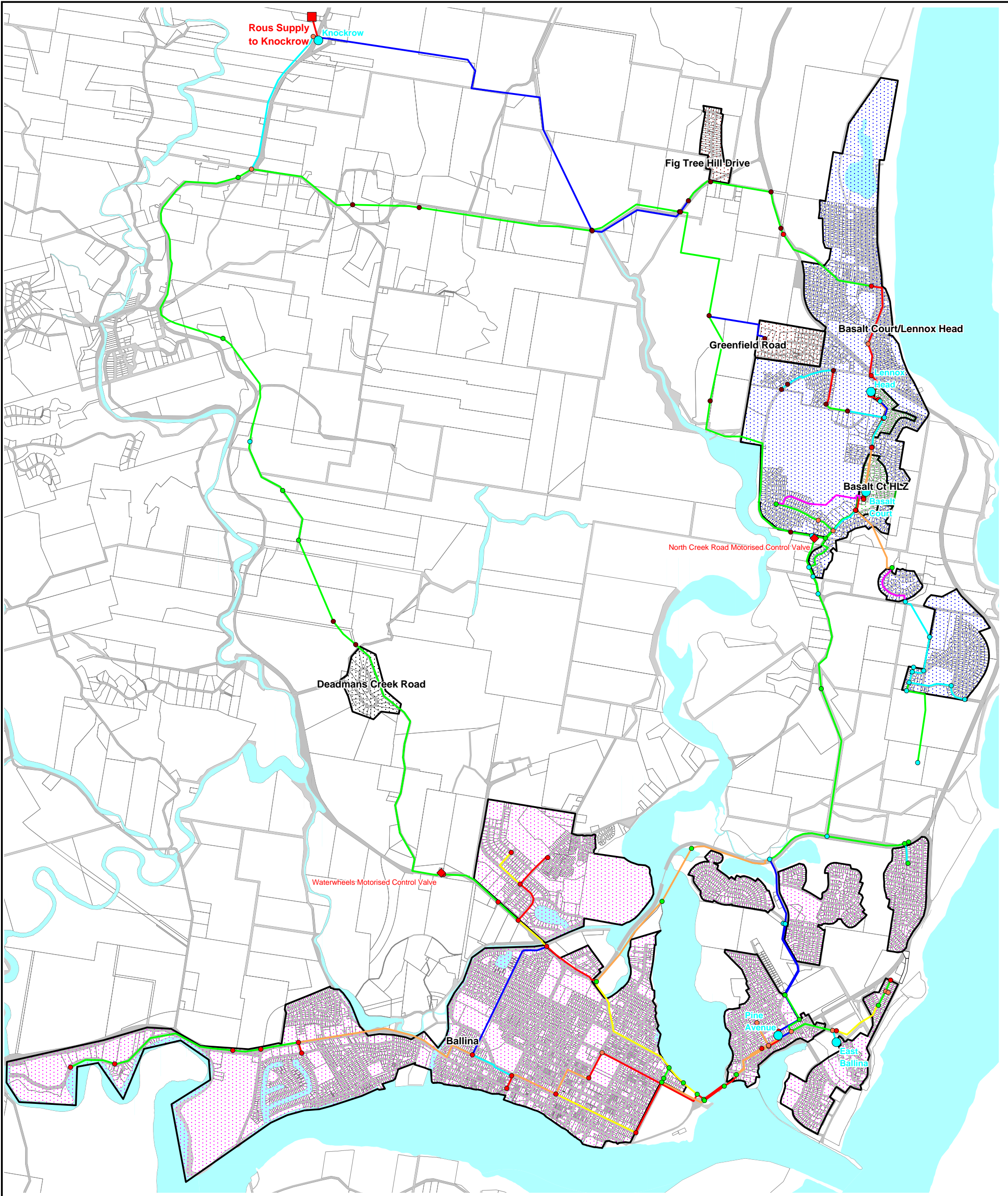
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Source Information: GIS Data
supplied by Ballina Shire Council

**Ballina Shire Council
Existing Water Supply
System Performance**

**Coastal Areas
2008**

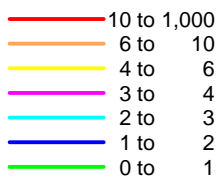


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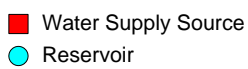
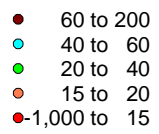
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PPResults by Gradient2013



PJResults by P2013



North



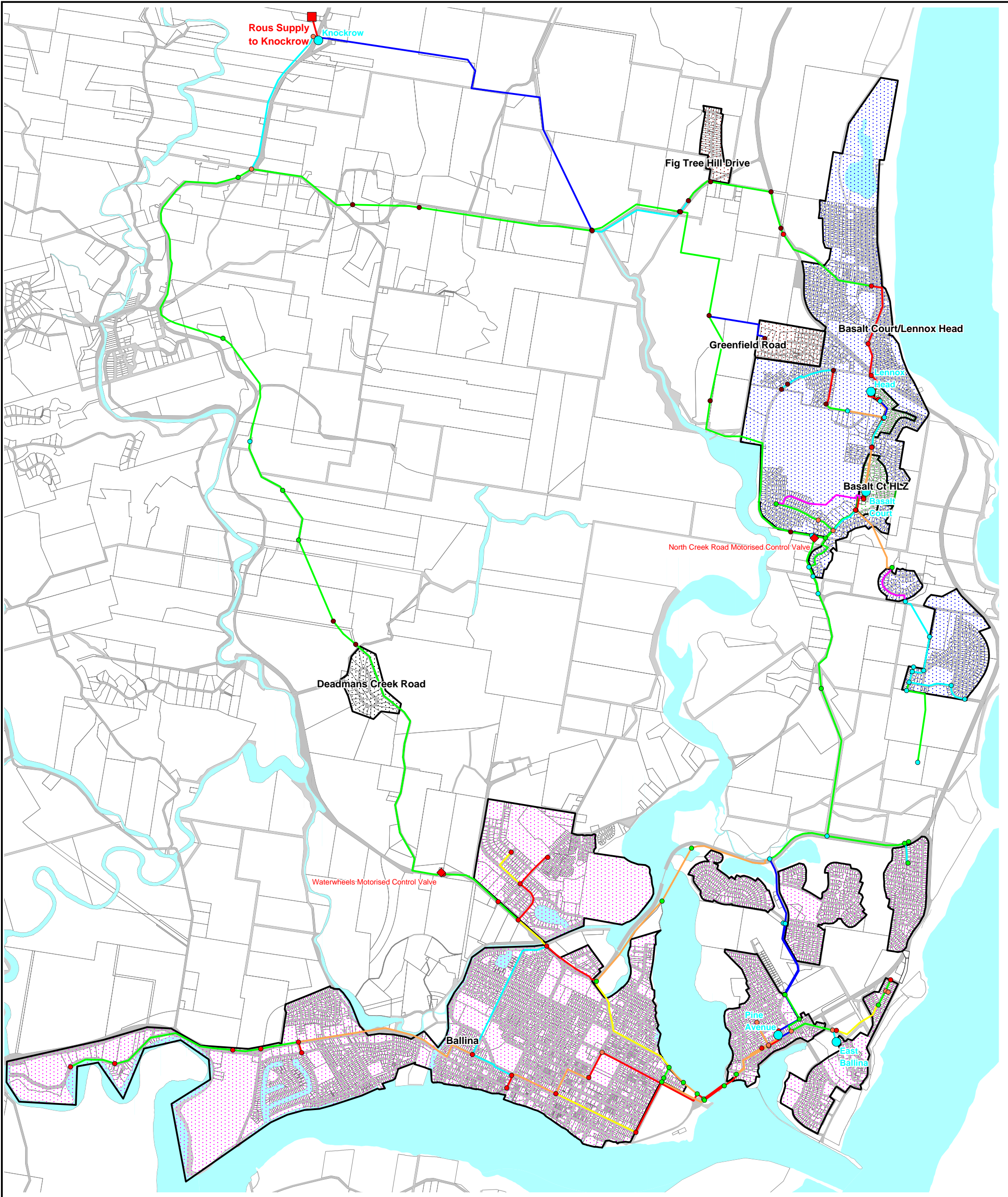
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kilometres

Source Information: GIS Data supplied by Ballina Shire Council

**Ballina Shire Council
Existing Water Supply
System Performance**

**Coastal Areas
2013**



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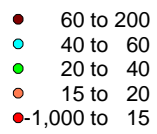
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PPResults by Gradient2018



PJResults by P2018



Water Supply Source
Reservoir

North

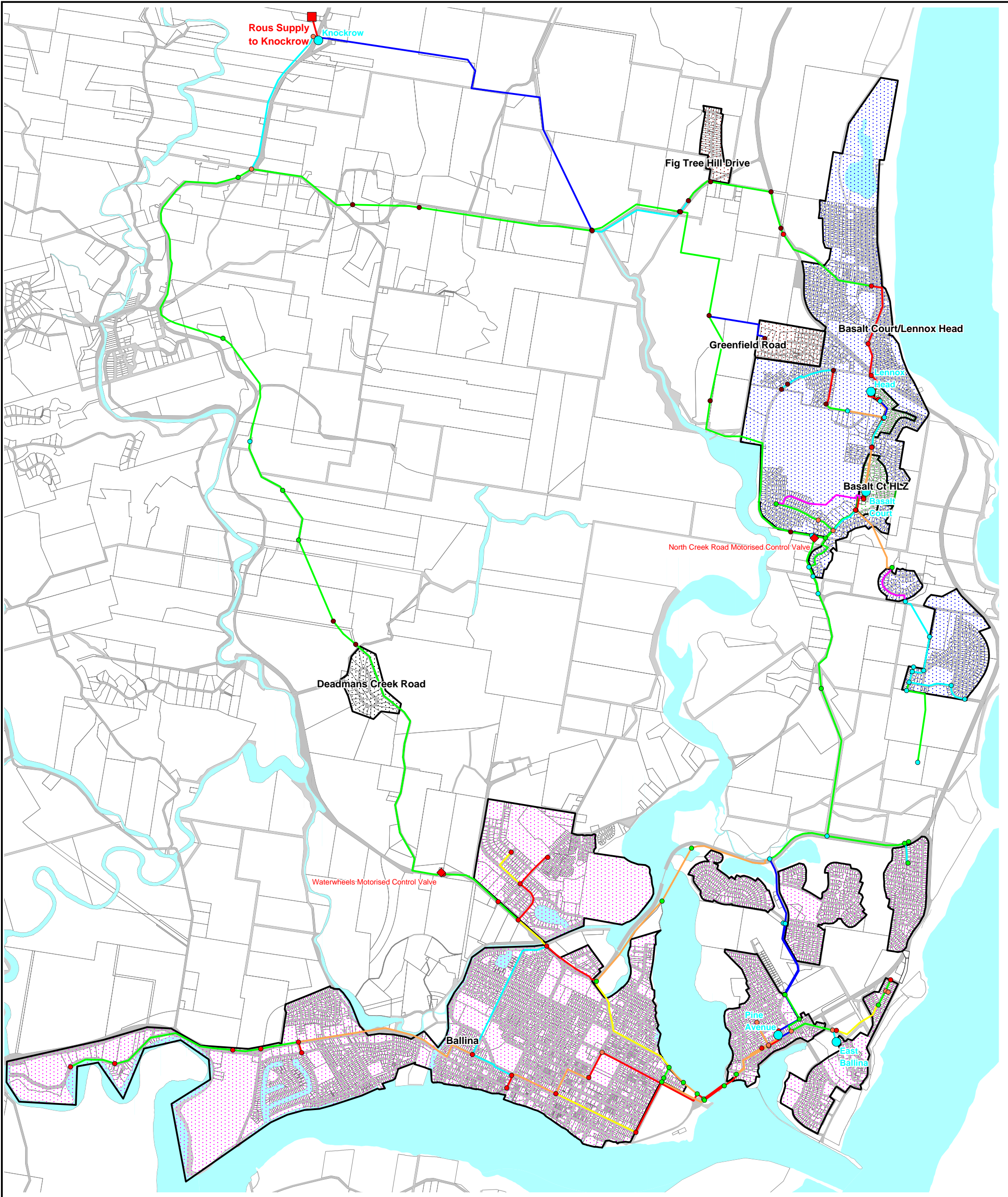


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Source Information: GIS Data
supplied by Ballina Shire Council

Ballina Shire Council
Existing Water Supply
System Performance

Coastal Areas
2018



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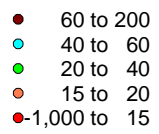
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PPResults by Gradient2018



PJResults by P2018



Water Supply Source
Reservoir

North

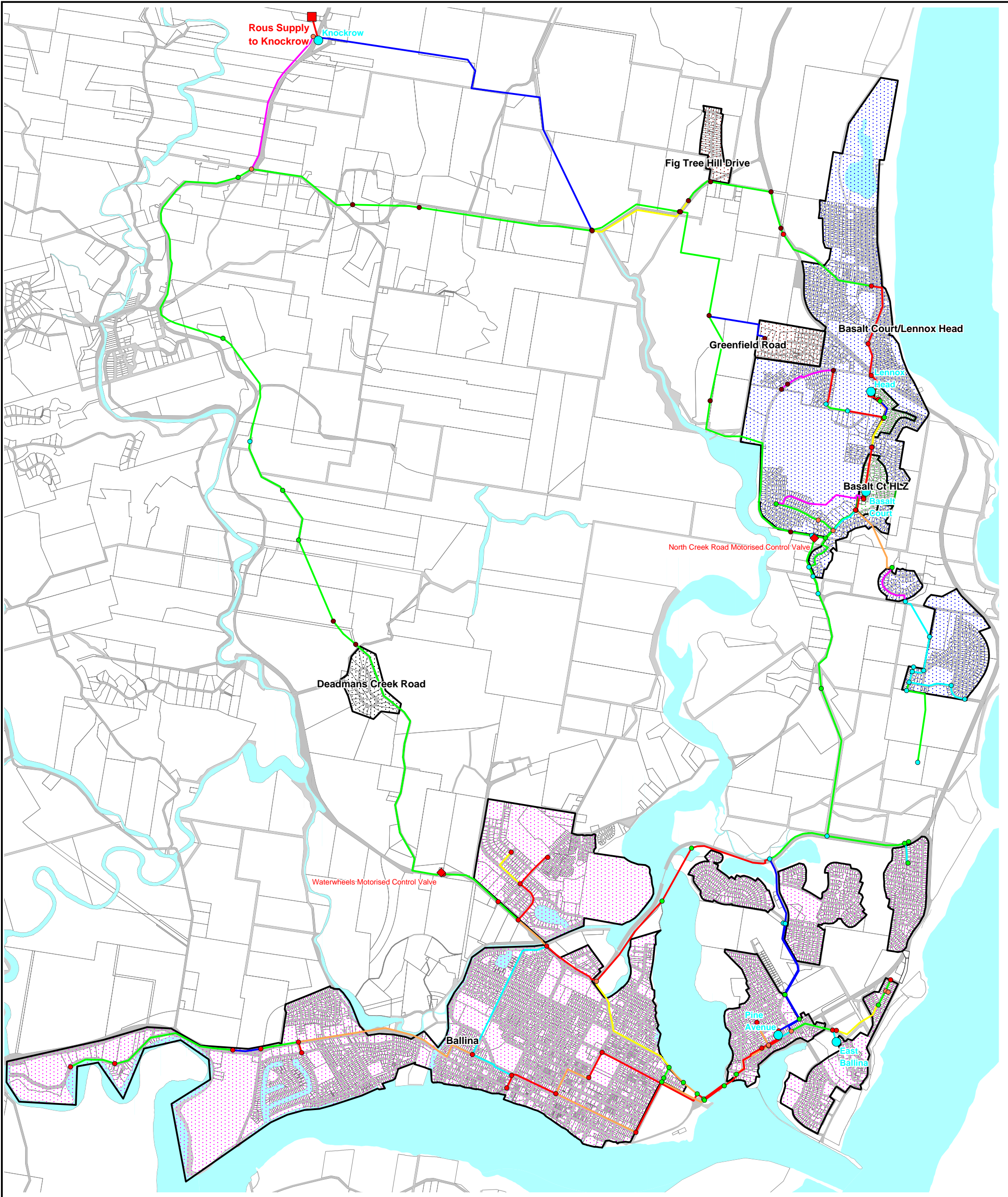


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Source Information: GIS Data
supplied by Ballina Shire Council

Ballina Shire Council
Existing Water Supply
System Performance

Coastal Areas
2018

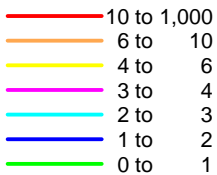


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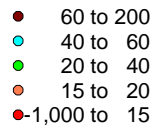
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PPResults by Gradient2028



PJResults by P2028



Water Supply Source
Reservoir

North

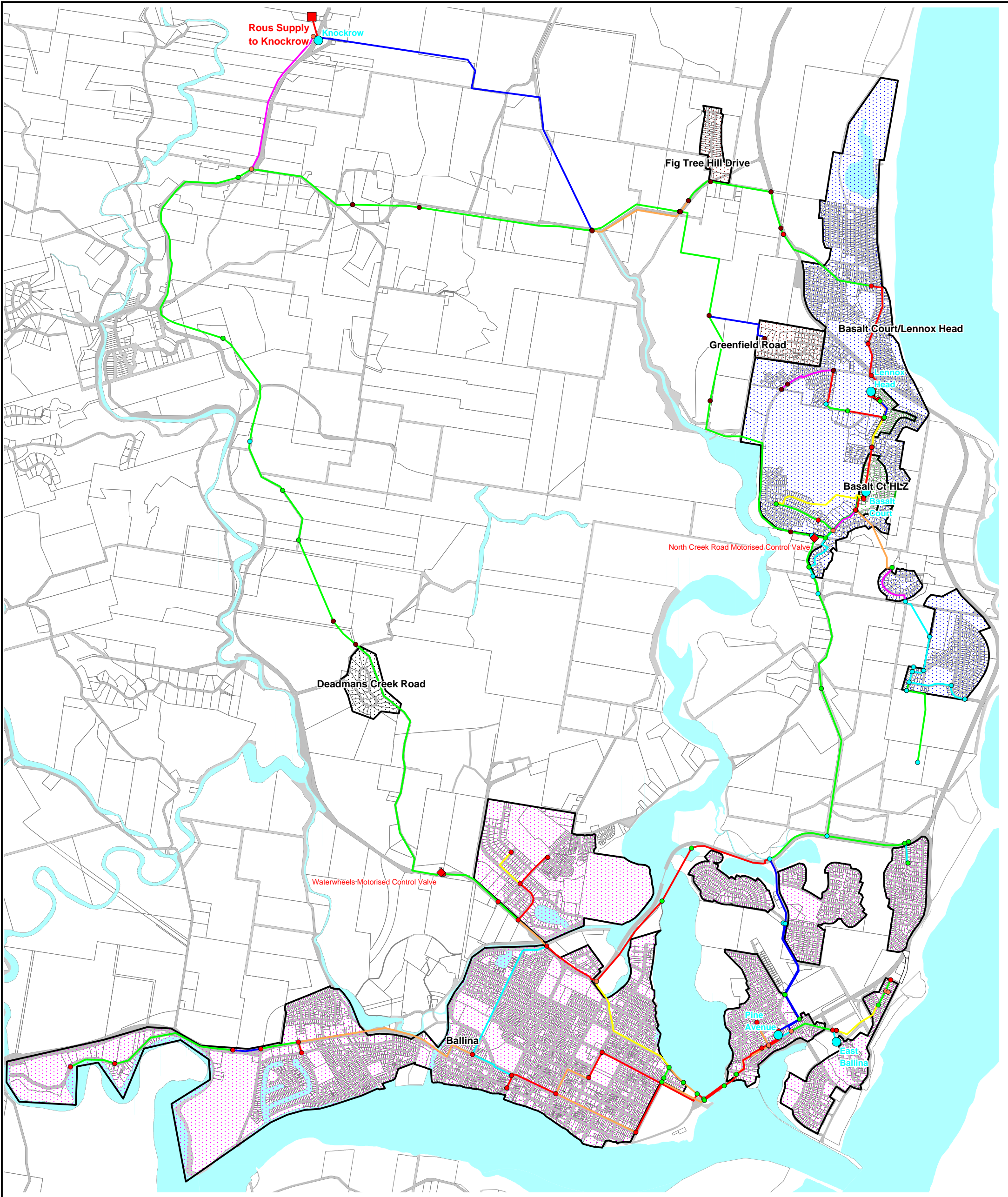


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Source Information: GIS Data
supplied by Ballina Shire Council

Ballina Shire Council
Existing Water Supply
System Performance

Coastal Areas
2028



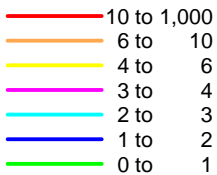
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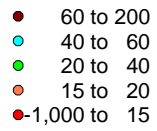
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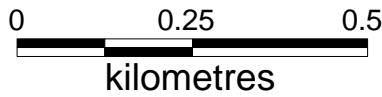
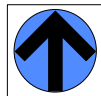


PJResults by P2033



Water Supply Source
Reservoir

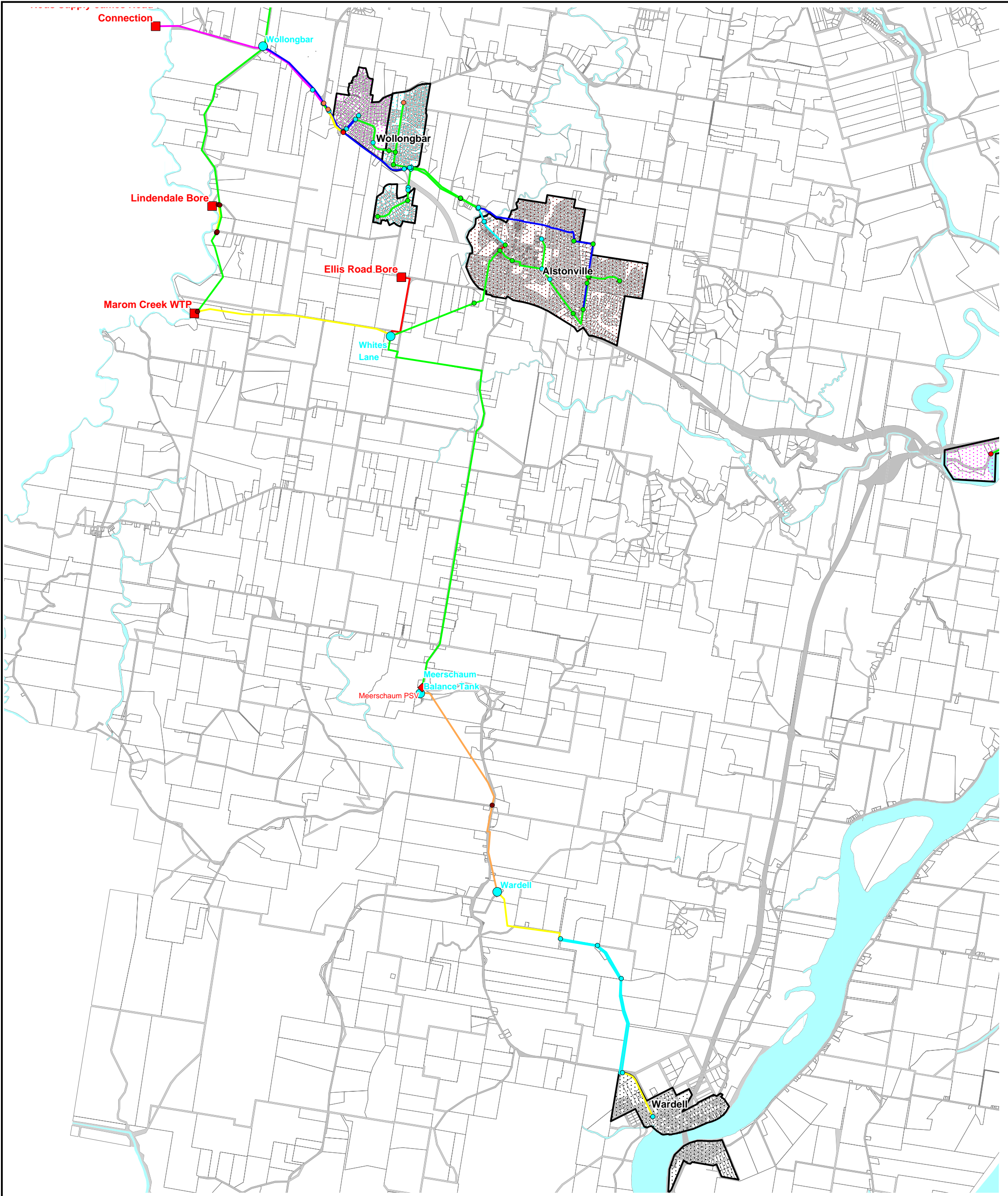
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Source Information: GIS Data supplied by Ballina Shire Council

Ballina Shire Council
Existing Water Supply
System Performance

Coastal Areas
2033



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HL Gradient (m/km)

- Greater than 10
- 6 to 10
- 4 to 6
- 3 to 4
- 2 to 3
- 1 to 2
- 0 to 1

Residual Pressure Head (m)

- Greater than 60
- 40 to 60
- 20 to 40
- 15 to 20
- Less than 15

- Water Supply Source
- Reservoir

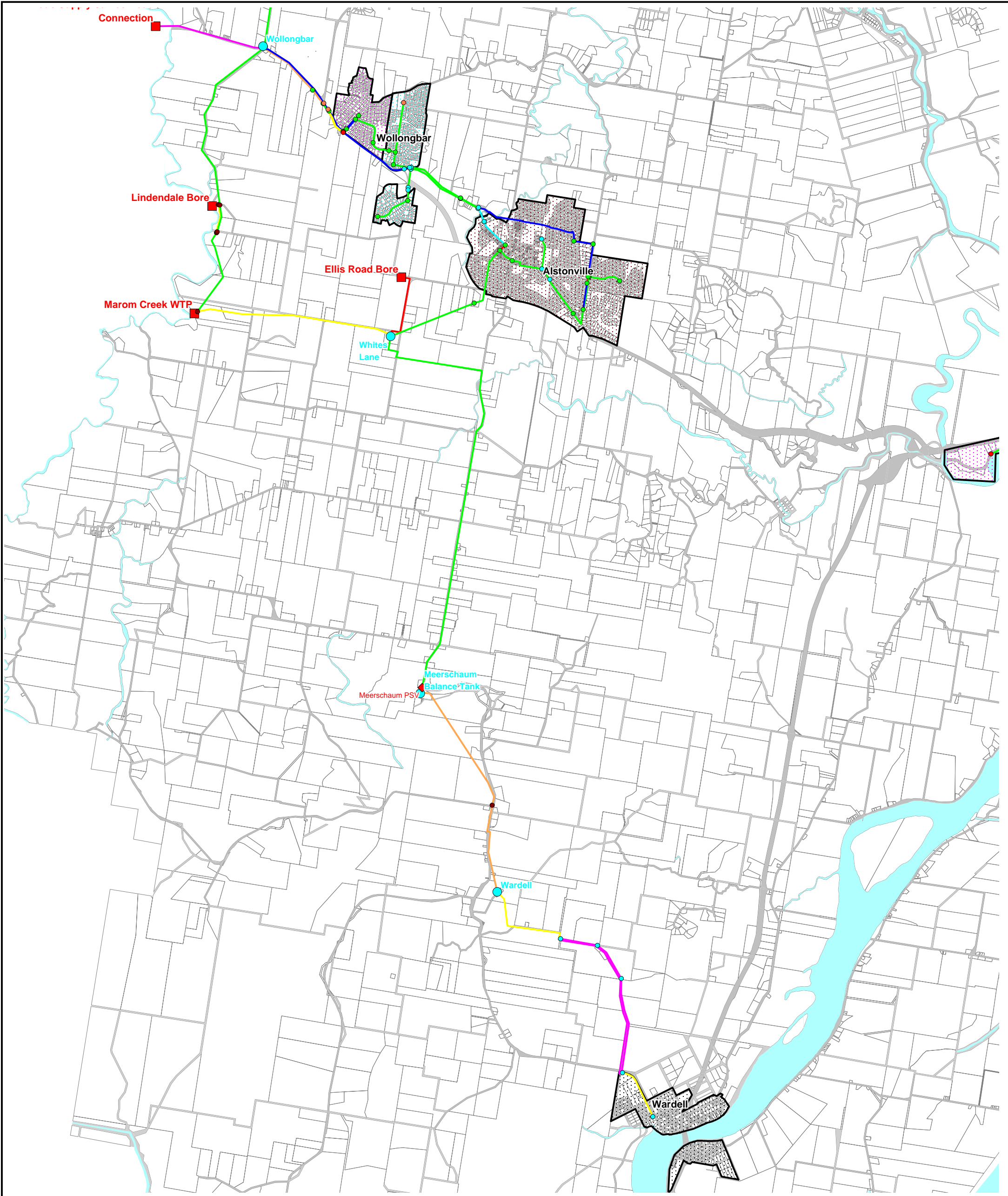
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0 1 2
kilometres

Source Information: GIS Data
supplied by Ballina Shire Council

Ballina Shire Council
Existing Water Supply
System Performance
Inland Areas
2003

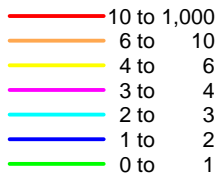


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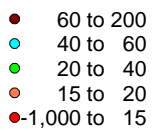
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PPResults by Gradient2008



PJResults by P2008



Water Supply Source
Reservoir

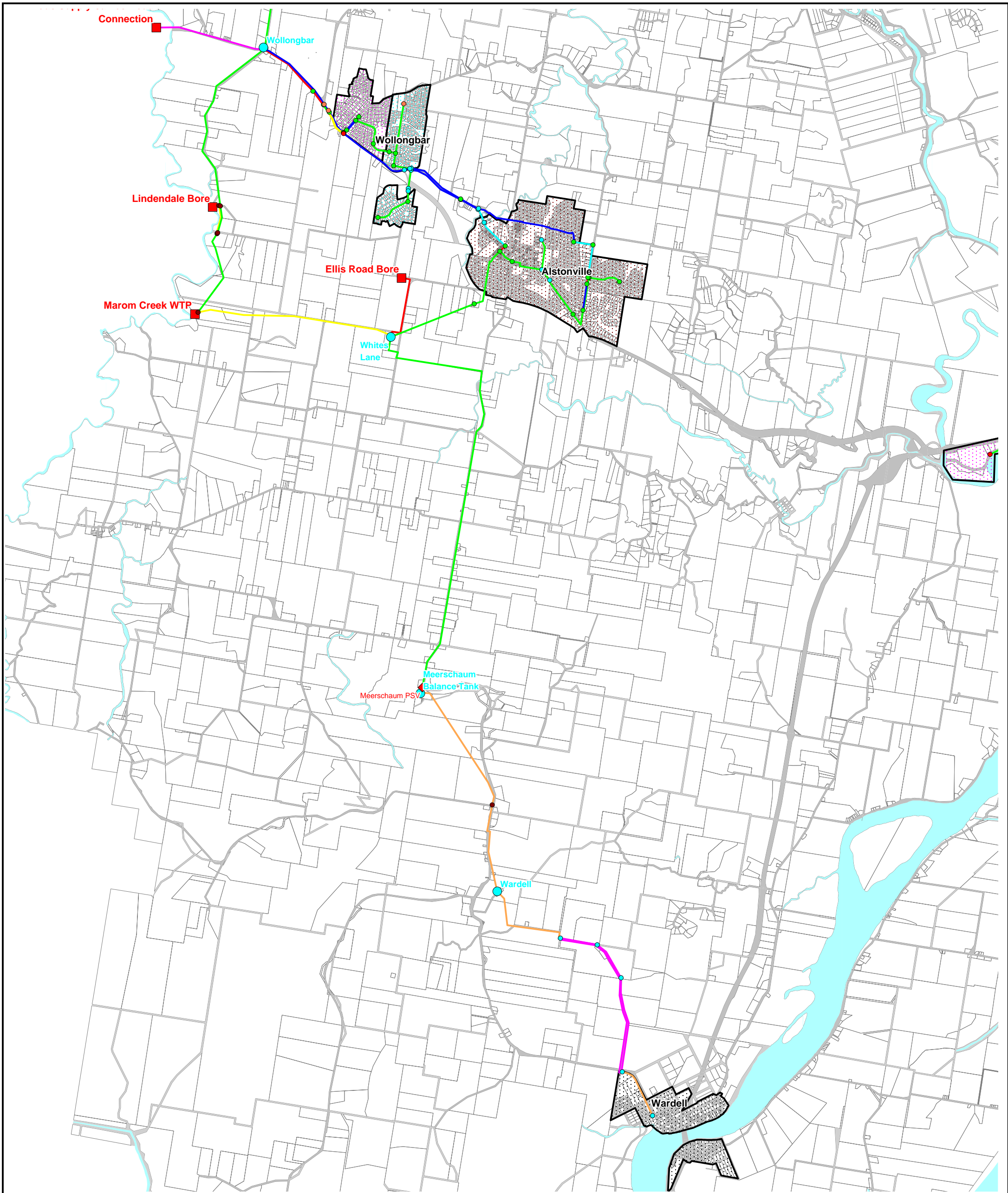
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0 1 2
kilometres

Source Information: GIS Data
supplied by Ballina Shire Council

**Ballina Shire Council
Existing Water Supply
System Performance
Inland Areas
2008**



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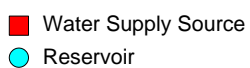
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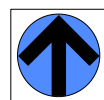
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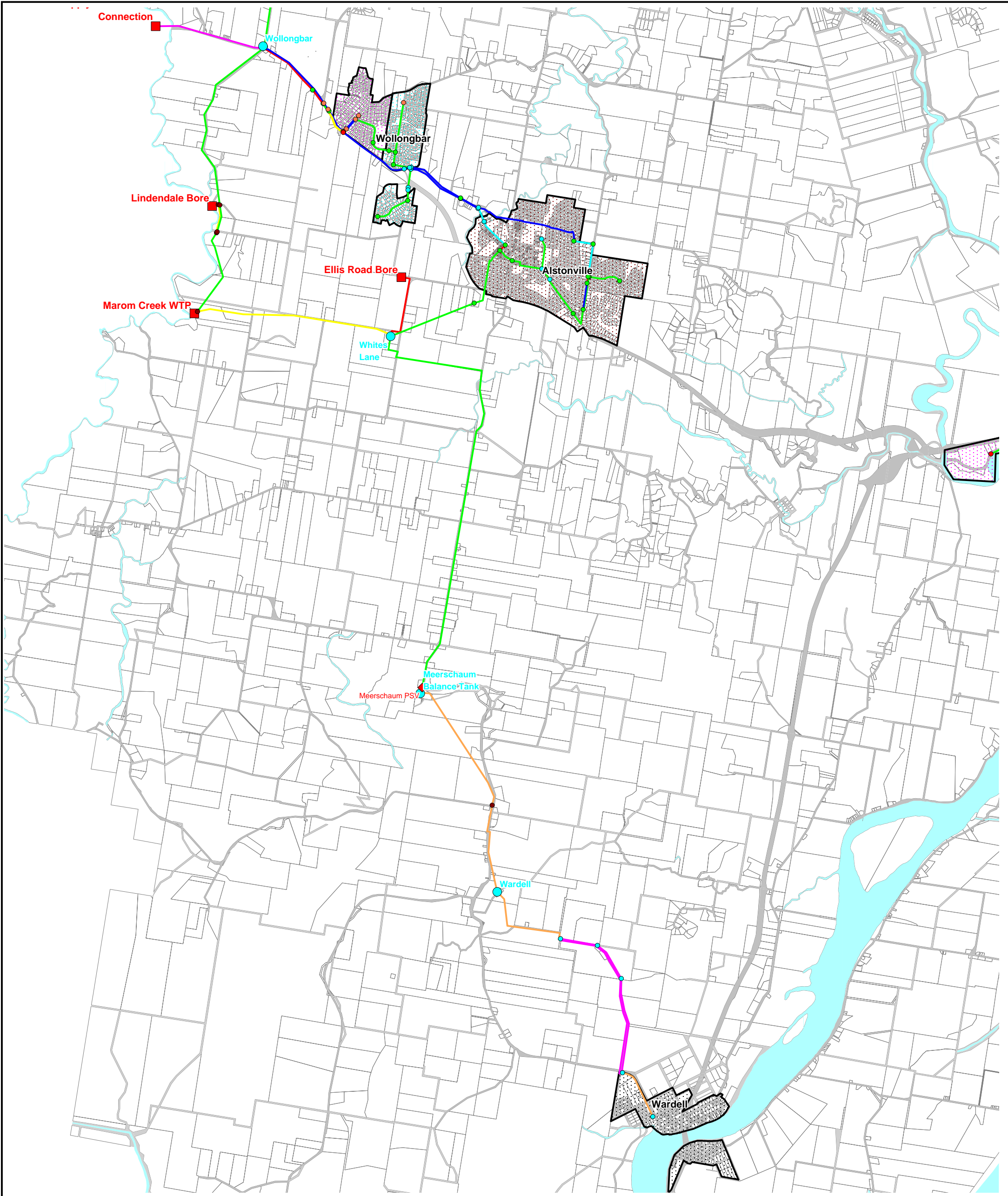


North



Source Information: GIS Data supplied by Ballina Shire Council

**Ballina Shire Council
Existing Water Supply
System Performance
Inland Areas
2013**



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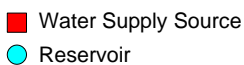
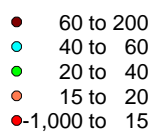
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PPResults by Gradient2018



PJResults by P2018

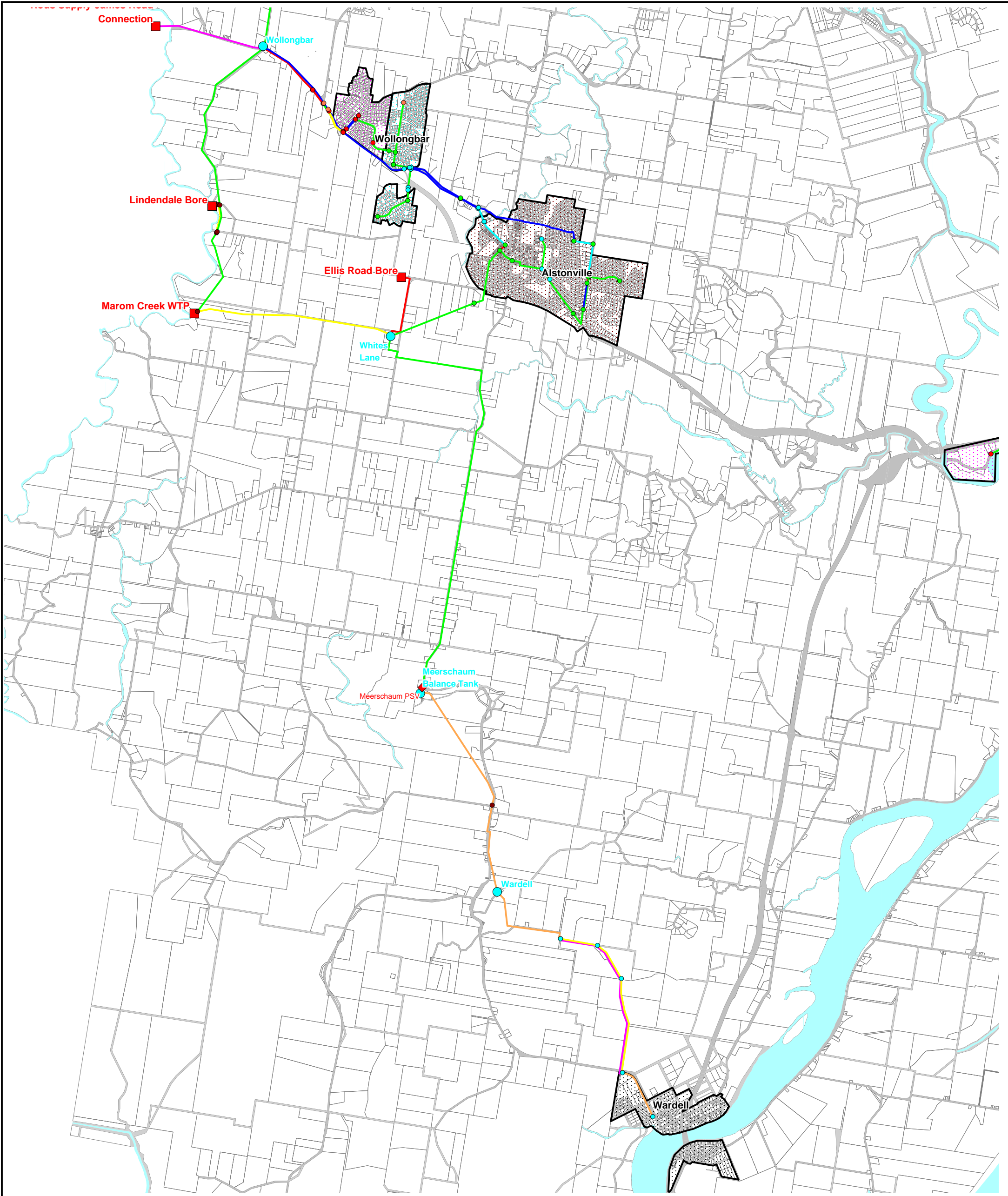


North



Source Information: GIS Data
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**Ballina Shire Council
Existing Water Supply
System Performance
Inland Areas
2018**

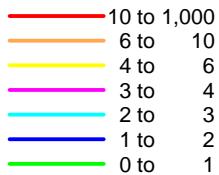


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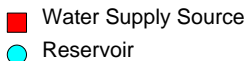
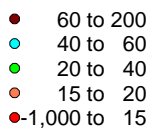
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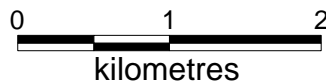
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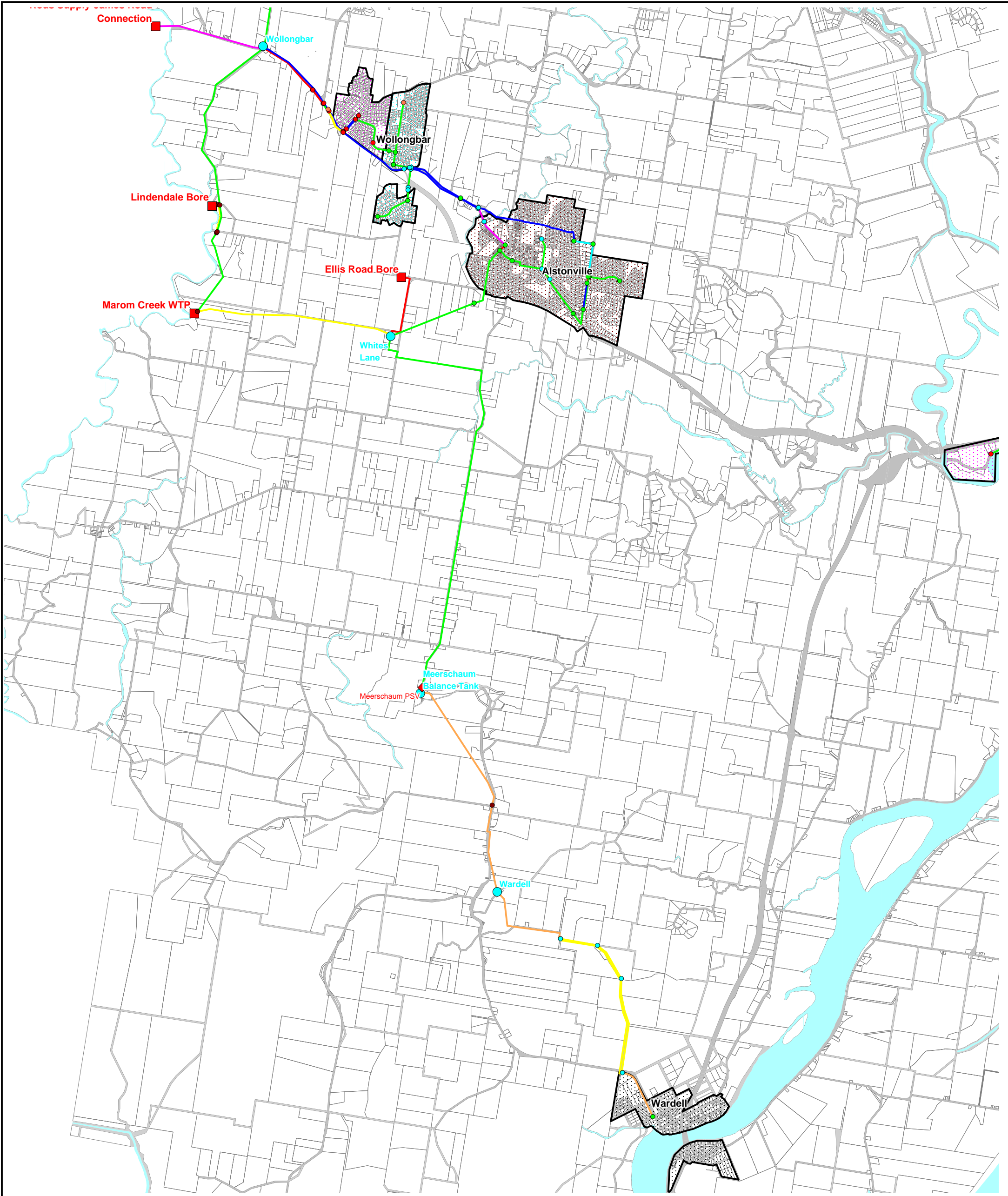


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Source Information: GIS Data supplied by Ballina Shire Council

**Ballina Shire Council
Existing Water Supply
System Performance
Inland Areas
2023**

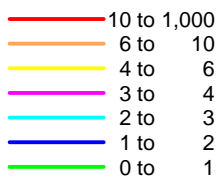


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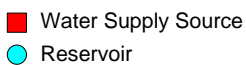
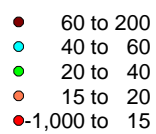
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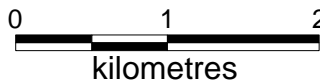
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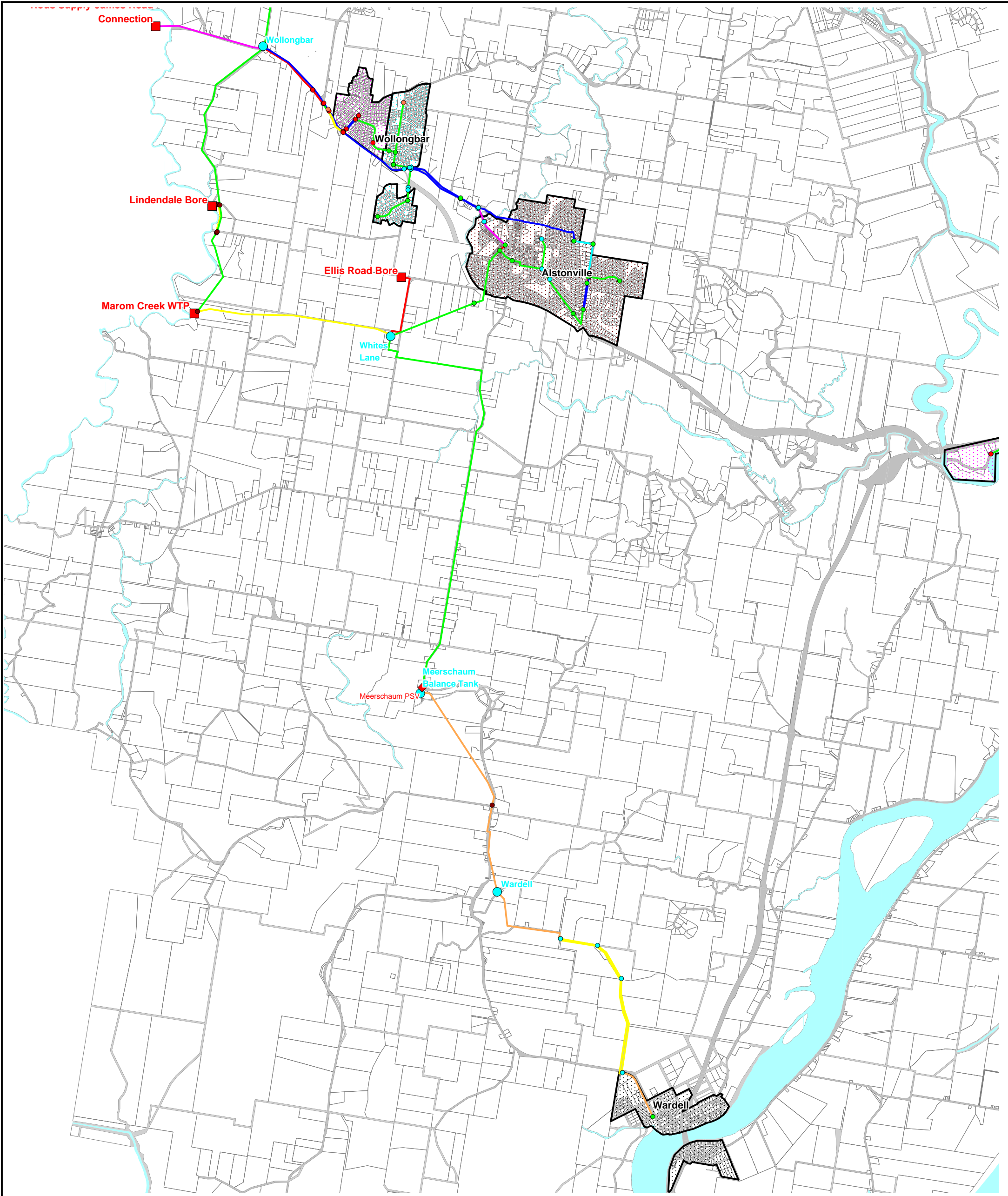


North



Source Information: GIS Data
supplied by Ballina Shire Council

**Ballina Shire Council
Existing Water Supply
System Performance
Inland Areas
2028**

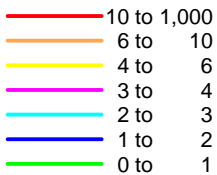


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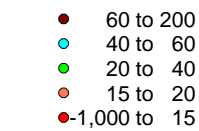
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PP Results by Gradient 2033



PJ Results by P2033



- Water Supply Source
- Reservoir

North



0 1 2
kilometres

Source Information: GIS Data
supplied by Ballina Shire Council

**Ballina Shire Council
Existing Water Supply
System Performance
Inland Areas
2033**

Appendix E

Existing Sewerage Pump Station Performance

Pump Station	Existing Capacity	Projected Inflows (L/s)						
		2003	2008	2013	2018	2023	2028	2033
SP-2001	152.2	146.1	150.3	154.6	158.9	163.1	167.4	171.6
SP-2002	6.6	7.5	7.5	7.5	7.5	7.5	7.5	7.5
SP-2003	10.4	6.8	6.8	6.8	6.8	6.8	6.8	6.8
SP-2004	15.6	2.2	2.2	2.2	2.2	2.2	2.2	2.2
SP-2005	5.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
SP-2006	9.6	7.5	8.1	8.8	9.4	10.0	10.7	11.3
SP-2007	8.5	5.4	5.4	5.4	5.4	5.4	5.4	5.4
SP-2008	13.2	6.0	6.0	6.0	6.0	6.0	6.0	6.0
SP-2009	29.7	27.1	27.1	27.1	27.1	27.1	27.1	27.1
SP-2010	24.6	12.1	12.1	12.1	12.1	12.1	12.1	12.1
SP-2011	8.1	4.0	4.0	4.0	4.0	4.0	4.0	4.0
SP-2012	23.2	26.6	27.9	29.1	30.4	31.7	32.9	34.2
SP-2013	11.4	11.9	12.3	12.6	12.9	13.3	13.6	14.0
SP-2014	27.8	33.2	35.4	37.6	39.8	41.9	44.1	46.3
SP-2015	14.0	1.9	1.9	1.9	1.9	1.9	1.9	1.9
SP-2016	8.9	6.7	7.0	7.4	7.7	8.1	8.4	8.7
SP-2017	13.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0
SP-2018	6.6	2.7	2.7	2.7	2.7	2.7	2.7	2.7
SP-2019	5.4	2.2	2.2	2.2	2.2	2.2	2.2	2.2
SP-2020	3.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
SP-2021	6.9	3.6	3.6	3.6	3.6	3.6	3.6	3.6
SP-2022	1.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SP-2023	1.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SP-2024	1.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SP-2101	118.5	47.3	52.5	57.5	63.8	68.0	68.0	68.0
SP-2102	7.4	1.3	1.3	1.3	1.3	1.3	1.3	1.3
SP-2103	9.5	5.0	5.0	5.0	5.0	5.0	5.0	5.0
SP-2104	4.5	0.6	0.6	0.6	0.6	0.6	0.6	0.6
SP-2105	24.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0
SP-2106	6.9	1.0	1.0	1.0	1.0	1.0	1.0	1.0
SP-2107	13.4	1.3	1.3	1.3	1.3	1.3	1.3	1.3
SP-2108	6.0	2.7	2.7	2.7	2.7	2.7	2.7	2.7
SP-2109	10.7	7.5	9.8	9.8	9.8	9.8	9.8	9.8
SP-2110	7.2	0.8	1.9	1.9	1.9	1.9	1.9	1.9
SP-2111	6.6	3.1	4.1	4.1	4.1	4.1	4.1	4.1
SP-2112	16.7	7.3	7.3	7.3	7.3	7.3	7.3	7.3
SP-2113	4.0	0.8	0.8	0.8	0.8	0.8	0.8	0.8
SP-2201	21.5	19.1	11.5	11.5	11.5	11.5	11.5	9.8
SP-2202	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
SP-2203	1.6	0.5	0.5	0.5	0.5	0.5	0.5	0.5
SP-2204	2.1	0.3	0.3	0.3	0.3	0.3	0.3	0.3
SP-2205	1.9	1.1	1.1	1.1	1.1	1.1	1.1	1.1
SP-2206	5.3	2.4	2.4	2.4	2.4	2.4	2.4	2.4
SP-2207	2.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
SP-2208	14.9	8.2	8.2	8.2	8.2	8.2	8.2	8.2
SP-2209	0.8	0.1	0.1	0.1	0.1	0.1	0.1	0.1
SP-2210	6.1	4.7	4.7	4.7	4.7	4.7	4.7	4.7
SP-2211	3.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SP-2212	1.4	0.2	0.2	0.2	0.2	0.2	0.2	0.2
SP-2214	1.0	0.9	0.9	0.9	0.9	0.9	0.9	0.9
SP-2301	116.9	99.3	105.6	111.3	116.6	116.6	116.6	116.6
SP-2302	13.1	8.6	8.6	8.6	8.6	8.6	8.6	8.6
SP-2303	14.4	2.2	2.2	2.2	2.2	2.2	2.2	2.2
SP-2304	45.3	26.0	27.7	29.3	31.0	31.0	31.0	31.0

SP-2305	1.8	2.6	2.6	2.6	2.6	2.6	2.6	2.6
SP-2306	6.2	6.4	8.1	9.8	11.5	11.5	11.5	11.5
SP-2307	5.0	1.3	3.0	4.6	6.3	6.3	6.3	6.3
SP-2308	5.9	6.0	6.0	6.0	6.0	6.0	6.0	6.0
SP-2309	9.4	9.2	9.2	11.5	13.4	13.4	13.4	13.4
SP-2310	3.8	1.1	1.1	1.1	1.1	1.1	1.1	1.1
SP-2311	11.3	8.7	8.7	8.7	8.7	8.7	8.7	8.7
SP-2312	19.5	24.3	26.0	27.7	29.4	29.4	29.4	29.4
SP-2313	18.1	17.7	17.7	17.7	17.7	17.7	17.7	17.7
SP-2314	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SP-2315	8.9	6.7	6.7	6.7	6.7	6.7	6.7	6.7
SP-2316	1.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SP-2317	17.4	9.2	9.2	9.2	9.2	9.2	9.2	9.2
SP-2318	1.4	0.5	0.5	0.5	0.5	0.5	0.5	0.5
SP-2319	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SP-2320	3.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SP-3001	56.6	48.6	52.0	55.4	66.4	73.9	80.2	86.0
SP-3002	20.6	13.4	14.5	15.7	16.8	18.0	19.1	20.2
SP-3003	1.8	4.3	4.3	4.3	4.3	4.3	4.3	4.3
SP-3004	5.6	3.2	3.2	3.2	3.2	3.2	3.2	3.2
SP-3005	0.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8
SP-3006	12.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6
SP-3007	3.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SP-3101	6.9	3.1	7.3	10.9	13.0	13.0	13.0	13.0
SP-3102	1.9	1.2	1.2	1.6	1.6	1.6	1.6	1.6
SP-3103	16.9	2.6	2.6	2.6	3.9	3.9	3.9	3.9
SP-3104	2.7	1.2	1.2	1.2	2.4	2.4	2.4	2.4
SP-3105	6.8	6.3	10.5	10.5	10.5	10.5	10.5	10.5
SP-3106	37.7	Decommission						
SP-3107	6.4	4.3	0.0	0.0	0.0	0.0	0.0	0.0
SP-3108	5.9	Decommission						
SP-3109	9.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
SP-3110	122.1	66.3	73.5	90.4	116.3	137.0	148.4	157.1
SP-3111	2.2	1.4	1.4	1.4	1.4	1.4	1.4	1.4
SP-3201	25.3	10.4	10.4	10.4	10.4	10.4	10.4	10.4
SP-3202	5.9	1.0	1.0	1.0	1.0	1.0	1.0	1.0
SP-4001	11.2	9.2	9.4	9.6	9.8	10.0	10.2	10.4
SP-4002	2.8	0.4	0.4	0.4	0.4	0.4	0.4	0.4
SP-4003	10.9	4.0	4.0	4.0	4.0	4.0	4.0	4.0
SP-4004	12.5	7.9	7.9	7.9	7.9	7.9	7.9	7.9
SP-4005	1.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7
SP-4006	1.8	0.1	0.1	0.1	0.1	0.1	0.1	0.1
SP-4101	5.0	2.0	2.0 Decommission					
SP-4102	16.6	4.1	2.8	2.8	2.8	2.8	2.8	2.8
SP-4103	4.3	Decommission						
SP-4106	1.1	1.7	2.4	3.0	3.0	3.0	3.0	3.0
SP-4107	10.8	1.0	1.0	1.0	1.0	1.0	1.0	1.0
SP-5001	6	1.9	2.0	2.0	2.0	2.0	2.1	2.1
SP-5002	30.3	4.5	5.5	6.0	7.1	7.3	8.3	9.2
SP-5003	3.9	1.0	1.0	1.0	1.0	1.0	1.0	1.0
SP-5004	31.9	3.0	3.1	3.1	3.1	3.1	3.2	3.2
SP-5005	8.8	1.5	1.5	1.5	1.5	2.2	2.2	2.2
SP-5006	41.3	12.2	13.3	14.3	15.4	16.4	17.5	18.5
SP-Ag Dept	2.8	1.0	1.0	1.0	1.0	1.0	1.0	1.0
SP-Cumbalum	40.0	0.0	17.3	34.6	51.9	69.1	86.4	103.7
SP-Gardens Caravan Park	3.6	1.0	1.0	1.0	1.0	1.0	1.0	1.0

SP-Palms Caravan Park	2.1	1.0	1.0	1.0	1.0	1.0	1.0	1.0
SP-Sport and Rec	2.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0

Appendix F

Existing Sewerage Pump Station Storage Calculations

Trunk Sewage Pump Station Storage Volumes											
PUMP No.	Location	Existing PWWF (L/s) Gravity Catch. only	2033 PWWF (L/s) Gravity Catch. only	Existing Storage Req. @ 8 Hours ADWF (m ³)	2033 Storage Req. @ 8 Hours ADWF (m ³)	PS Storage (m ³)	Pipe Storage (m ³)	MH Storage (m ³)	Total Storage (m ³)	Existing Storage less Existing Storage Req.	Existing Storage less 2033 Storage Req.
SP2001	Swift St	38	47	219	268	0	785	402	1187	968	919
SP2003	Richmond Ave	5	5	26	26	9	15	9	32	6	6
SP2006	Regatta Ave	7	10	37	59	26	54	68	148	110	88
SP2009	Grant St	15	15	87	87	25	101	118	244	157	157
SP2010	Fox St	8	8	46	46	13	58	81	153	107	107
SP2012	Bentinck St	13	18	74	106	24	100	130	254	180	148
SP2013	Skinner St	5	5	30	30	8	27	69	105	75	75
SP2014	Webster Ln (Church)	7	12	38	70	31	120	83	234	196	164
SP2017	Temple St	4	4	25	25	12	5	10	27	2	2
SP2101	Pacific Hwy (Coastline)	10	28	55	160	111	53	66	230	175	70
SP2105	Oakland Ave (Weerama Park)	10	10	60	60	12	26	33	71	11	11
SP2109	Spinnaker Crs	4	6	25	33	30	35	76	141	116	108
SP2301	Angels Beach Dve (Chickiba No.1)	7	10	43	60	86	179	46	311	268	251
SP2304	Northumberland Dve	14	14	78	78	38	10	32	80	2	2
SP2306	The Serpentine	7	7	37	37	8	3	7	18	-19	-19
SP2309	Anderson St	9	13	53	77	9	10	27	46	-7	-31
SP2312	Shelly Beach Rd	7	12	38	67	66	5	10	81	43	14
SP2313	Compton Dve	11	11	63	63	13	46	90	149	86	86
SP3001	Byron St (Lennox No.1)	22	36	126	204	71	86	68	225	100	21
SP3002	Rutherford St	13	20	77	116	12	20	46	78	1	-38
SP3101	Skennars Head Rd	2	11	11	66	5	1	3	9	-2	-56
SP3105	Rainforest Way (Pacific Pines)	6	11	36	60	25	2	9	36	-1	-25
SP3107	Seamist P1	4	14	25	79	10	3	14	26	1	-53
SP3110	Montwood Dr	13	71	75	410	183	72	24	279	204	-58

Appendix G

Data Collation

Sources of Ballina Shire Council Data

Data Summary

Phase	Data	Status	Use
Population and Development Projections	Ballina Urban Land Release Strategy – 2000, prepared by Ballina Shire Council Town Planning Department, May 2000.	Received	This report is based on 1996 census data. The growth rates obtained from the 2001 census revealed growth has slowed. The projected populations used in this report are out of date. This report will still be used to broadly determine the areas where growth is likely to occur.
	Ballina Population Projections based on 2001 Census data.	To be provided	The population projections in this report will be adopted for the purpose of determining future populations.
	Other mapping data showing future development areas and estimated population of development areas (loose drawings).	To be provided	<p>This data, together with the abovementioned population projections, will be used to determine the spatial distribution and magnitude of future growth.</p> <p>GHD will illustrate the growth in a layer (every 5 years) in Mapinfo (see below).</p>

Phase	Data	Status	Use
	<p>GIS information in Mapinfo format. Specific layers requested were:</p> <ul style="list-style-type: none"> ▶ Cadastre ▶ All available contours ▶ Road Names Text ▶ Sewage Pump Station Catchments ▶ Sewage Pump Stations ▶ Shire Boundaries ▶ All available Town Planning Zones / Data 	Received 27/6/03	The requested GIS information will be used to assist in developing population projections, analysing the water and sewerage systems and presenting results.
	Aerial Photography.	To be provided	We understand that a new photography run is to be undertaken in September 2003 (approximately). If this data is available (any format) this will assist in the presentation of our findings.
Water and Sewerage Assessment, Planning and Analysis	Ballina Shire Urban Water Management Strategy – Issues and Opportunities Paper, prepared by DPWS, Oct 2002.	Received	We will use these two reports to “feed into” the capital works program for sewerage/effluent management. In order to do so an option must be selected. We understand that the following options have been adopted at this stage:
	Ballina Shire Urban Water Management Strategy – Final Draft Options Study, prepared by DPWS, Aug 2002.	Received	<ul style="list-style-type: none"> ▶ Ballina – Lennox Head: Option 2d (Please confirm our selection of this option. ▶ Alstonville Sewerage: Please advise the preferred option. ▶ Wardell Sewerage: Please advise the preferred option.

Phase	Data	Status	Use
	Ballina Water Supply – Trunk Main Analysis, prepared by DPWS 2003	Received	<p>We will use this report to “feed into” the capital works program for trunk water supply system. In order to do so an option must be selected. We understand that Strategy 2 has been adopted at this stage.</p> <p>Please confirm this is correct.</p>
	Water and Sewerage Strategic Business Plan	To be provided	<p>We are unclear, at this stage, what information in the SBP will be used in the DSP process. We will provide further comment on this once the document has been received and reviewed.</p>
	Rous Water – Water Supply Developer Charges, prepared by DPWS, Feb 2003.	Received	<p>We have briefly reviewed this report and spoken with Wayne Franklin at Rous Water. The key issue is to avoid charging for infrastructure that has already been provided for in the Rous DSP charge ie. double dipping.</p> <p>From our discussions with Wayne, we understand that Rous have only allowed for the construction of a new reservoir at Knockrow ie. no augmentations downstream from Knockrow.</p> <p>Therefore, from a technical perspective, we have concluded the Rous DSP document/calculations can be ignored.</p> <p>Please confirm this is correct.</p>
	WATSYS model files for Alstonville, Wollongbar, Ballina, Lennox and Wardell.	Received	<p>The WATSYS model files contain information relating to elements of the water supply system, including demands, elevations, diameters etc. We will extend these existing models to analyse the trunk water system under the 30-year projected demands. We have assumed the existing demands in the models are correct for year 2000 demands.</p> <p>Please confirm this approach is appropriate.</p>

Phase	Data	Status	Use
	Schematic of Sewer System in Excel format.	To be provided	Council does not have an existing model of the sewerage system. Until receipt of the sewer system schematic and loads in excel format, we cannot comment this information. It is likely that, with this information, we will be able to estimate rising main and pump station augmentations. However, in order to analyse the existing gravity network/augmentations, consideration may need to be given to constructing a trunk SewerCAD model. We will discuss this with Council upon receipt of the schematics/excel calculations.
	Sewer Loads in Excel format.	To be provided	
	Sewerage reticulation drawings in TIF format. These drawings do not contain asset identifiers that link to the sewerage asset register.	Received	All available drawings of the water and sewerage systems will be used to assist in the assessment, planning and analysis of the systems.
	Sewerage reticulation drawings in AutoCAD format. The areas of North Ballina, Ballina Island and Wollongbar were not available in AutoCAD format. These drawings do not contain asset identifiers that link to the sewerage asset register.	Received	<p>Drawings of the sewerage system that illustrate asset ID's that correspond to the sewerage asset register are not yet available. These will be made available after the Council's existing hardcopies have been digitised.</p> <p>Drawings of the water system that illustrate asset ID's have been made available.</p> <p>The asset ID's will be important in the development of the DSP's as they provide a way of linking an asset in the asset register and its corresponding valuation with the actual location of that asset.</p>
	Water reticulation drawings in TIF format.	Received	

Phase	Data	Status	Use
	Water reticulation drawings in AutoCAD format. The areas of Alstonville and Wollongbar were not available in AutoCAD format. The AutoCAD drawings graphically contain asset identifiers that correspond to the water asset register.	Received	
	Hardcopies of other relevant water and sewerage plans.	Received	
30 Year Capital Works Program	Water and Sewerage Capital Works plan for 2003/04, 2004/05, 2005/06.	Received	These capital works will be used as a basis for the development of the 30-year capital works plan. Once we piece together the various capital works required, we will compile a 30-year capitals works plan for Council comment.
Preparation of Developer Service Plans	Existing balances of Water and Sewerage funds.	Received	Existing funds are to be used on future capital works. These funds need to be taken into account when preparing DSP's with the effect of reducing the Developer Charge per lot. We understand these funds are not committed to specific projects/areas. The existing S64 funds are as follows: Water - \$2.8m Sewerage - \$6.5m
	Water and Sewerage Asset Registers from Finance Section in Excel format.	Received	It appears that asset registers obtained from the Finance section and the Engineering sections are identical, which prevents any confusion.

Phase	Data	Status	Use
	Water and Sewerage Asset Registers in Excel format from Engineering Section.	Received	<p>The valuations within the asset registers will be updated based on NSW Dept of Land and Water Conservation Reference Rates. Updated valuations will be required when calculating the value of spare capacity in the systems.</p> <p>As discussed earlier, the asset ID's in the asset registers are required to match the asset valuation with the physical location of that asset.</p>
	Water Asset Register files in WATAR format and Sewerage Asset Register Files in SEWAR format.	Received	The asset registers in WATAR and SEWAR format will not be utilised as they appear incomplete and the available registers in Excel format appear to contain better information. We will use the registers provided in excel format.
	Digitised Sewer Plans that show asset numbers that corresponding to Sewer asset register.	To be provided	As discussed earlier, these plans are required in order to match the asset ID with the physical location of the asset.

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Document Status

Rev No.	Author	Reviewer		Approved for Issue		
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