APPENDIX 2: INTERIM REPORT 2 – LONG-TERM WATER RESOURCES AND DEMAND

Hydrosphere Consulting

noroc

Northern Rivers Regional Organisation of Councils inc

Northern Rivers Regional Bulk Water Supply Strategy

Interim Report 2 – Long-Term Water Resources and Demand

March 2013

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PROJECT 12-025– NOROC REGIONAL BWSS – INTERIM REPORT 2

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EXECUTIVE SUMMARY

The Northern Rivers Regional Organisation of Councils (NOROC) has resolved to develop a long-term (50-year) regional water supply strategy incorporating integrated water cycle management approaches.

The first stage of the project was to identify the status of the existing water resources and current demand for water. This is the subject of Interim Report 1 – Existing Bulk Water Sources and Demand. The second stage of the Regional BWSS (this report) documents the development of a long-term (50 year) demand forecast for the region. By 2060, the Northern Rivers water supplies are predicted to serve approximately 146,000 residential properties and 14,000 non-residential connections with a regional demand of approximately 40,000 ML/a.

The current secure yield of the region's water resources (approximately 32,000 ML/a) is expected to decrease with the impacts of future climate change by approximately 6,000 ML/a or 26% by 2060.These predictions are inexact as there is significant uncertainty with the current secure yield and the impacts of demand hardening, environmental flow requirements and climate change into the future. Despite this, there is little doubt that augmentation of the majority of the water supplies in the region will be required due to population growth and the reduction in available water resources.

The expected demand, secure yield and supply deficit at 2060 is summarised in Table 1. Major augmentations will be required in the Rous Water bulk supply area and Tweed Shire Council Bray Park system. Mullumbimby and Kyogle will also require significant augmentation compared to the current supply. Smaller augmentations (compared to current supply) will also be required in Casino, Bonalbo and Nimbin.

Table 1: Future Demand, Secure Yield and Supply Deficit (ML/a)

Supply Area	2060 Forecast Demand	2060 Predicted Secure Yield [1]	Year that augmentation may be required	2060 Predicted Supply Deficit	2060 Supply Deficit (% of current supply)
Rous Water bulk supply	15,790	10,695 – 9,160	2022	5,100 – 6,600	37% - 48%
Wardell	201	unknown	unknown	unknown	unknown
Mullumbimby	691	380	2025	310	71%
Kyogle	441	250	2015	190	59%
Bonalbo	47	52	2048	5	10%
Woodenbong and Muli Muli	59	66	Not required within next 50 years		
Nimbin	88	unknown	unknown	unknown	unknown
Casino	2,410	2,020	2025	390	15%
Bray Park (Tweed District and Uki)	19,983	13,750	2030	6,230	45%
Tyalgum	61	96	Not required within next 50 years		
Region	*40,000*	*26,000*		*14,000*	*43%*

1. Secure yield of Rous Water supplies has been determined using the 5/10/10 rule. Secure yield of all other supplies has been determined using the 5/10/20 rule.

The next stage of the Regional BWSS will involve the identification of options to ensure long-term water supply security for the region.

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1. INTRODUCTION

NOROC has resolved to prepare a Bulk Water Supply Strategy (BWSS) for the Northern Rivers Region. The Regional BWSS will consider the long term demand and water supply security of the existing serviced areas as well as the water supplies for the decentralised systems in rural areas. The major stages of the strategy development are shown in Figure 1.

Interim Report 1 (Existing Water Resources and Demand) identified the status of the existing water resources and current demand for water within the region. The current stage of the Regional BWSS (this report) involves the development of a long-term (50 year) water demand forecast for the region. The forecast demand will also be compared to the expected future secure yield of the region's water resources.

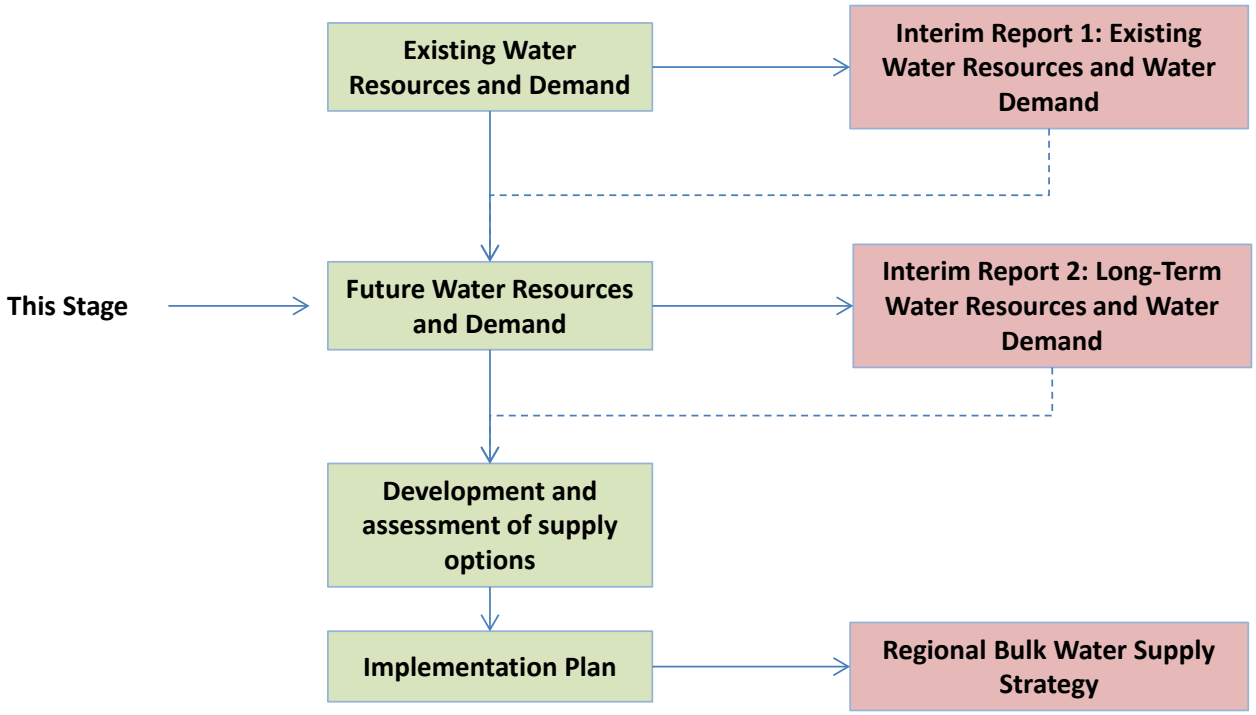


Figure 1: Regional BWSS Development Process

To enable estimation of total future demand it is necessary to predict the number and types of connections within each supply area as well as trends in water demand by connection type and location. Broad-scale information on regional growth, previous studies and connection types is provided in Sections 2 and 3 with a detailed analysis on a council by council basis provided in the subsequent parts of this report. Where sufficient data are not available, the assumptions and rationale for estimates are provided as part of this report.

2. AVAILABLE DATA

Some background data are available to enable prediction of future connection growth and water demand as discussed below.

2.1 NSW Planning Far North Coast Regional Strategy

The Far North Coast Regional Strategy (FNCRS, NSW Planning, 2006-2031) was prepared to manage the Region's expected high growth rate in a sustainable manner. The Regional Strategy is based on a projected regional population increase of 60,400 from 2006 to 2031 as derived by the Department of Planning's Transport and Population Data Centre. To accommodate the additional 60,400 people anticipated to be living in the Region by 2031 the Regional Strategy has set individual dwelling targets for each local government area (Table 2). These targets include dwellings in areas not connected to a reticulated water supply. The Council growth management strategies considered in this report (Section 2.4) have generally been based on the FNCRS dwelling targets.

Table 2: Local Government Area Dwelling Targets (FNCRS, 2006-2031)

LGA	Existing Dwellings (2006)	Additional New Dwellings to 2031
Ballina	16,720	8,400
Byron	13,090	2,600
Kyogle	4,110	3,000
Lismore	17,640	8,000
Richmond Valley	8,710	9,900
Tweed	34,650	19,100

2.2 Rous Water Future Water Strategy Demand Forecast

The Rous Water Future Water Strategy Demand Forecast (Hydrosphere Consulting, 2012b) documents the existing number of connections, existing per connection demand and predicted future connections and demand for the Rous Water service area between 2010 and 2060. The future demand forecast been generated from an estimate of the baseline (2010) demand and the growth in demand generated by the new connections.

In this report, these data have been used to present future water supply connections and demand forecasts for each Constituent Council and the Rous Water retail customers. Data on per connection demand for the Rous Water service area have also been applied to other water supplies in the region where appropriate.

2.3 ABS Census Data

Data from the 2006 and 2011 census of population and housing (single and multi-dwelling numbers and population) for the urban centres/localities that correlate with the water supply systems have been used to estimate the recent growth and predict future growth in water supply connections in each area.

2.4 Council Data

The Councils have provided the available data on future dwelling projections and water supply system augmentation requirements. These are discussed for each Council in the Sections 4 to 12.

Overall the regional predictions for NOROC follow the FNCRS trends. Most Councils have generally followed the FNCRS in their growth management strategies and therefore the NOROC BWSS reflects this. The

exception is RVC which has not prepared a growth management strategy. Growth in Casino predicted in this BWSS (based on recent growth) is lower than the FNCRS predictions.

The data used in this strategy is for water supply areas only. Rural development (predicted in the FNCRS) is not included in the growth predictions used here.

3. CONNECTION TYPES

Interim Report 1 presented the available data on single residential, multi-residential, dual reticulated (single and multi-residential) and non-residential connections for each water supply system for the five years from 2007/08 to 2011/12. For Interim Report 2, the future water supply connections have been estimated as follows:

- Prediction of the future growth in each water supply area;
- Prediction of the type of future housing (dual reticulated, multi- or single-residential etc.); and
- Prediction of the future non-residential development in each supply area.

The Rous Water Demand Forecast (Hydrosphere Consulting, 2012b) presents the current and future connections (2010-2060) as either:

- BASIX dual reticulated residential (single and multi-residential);
- BASIX residential (single and multi-residential);
- Non-BASIX residential (single and multi-residential);
- Non-residential; or
- Rous retail connections.

For the other Council water supply systems in the region, the number of connections for each connection type has been estimated as follows:

- Census data has been used to estimate the number of new connections since 2006 (assumed to be all BASIX compliant/water efficient connections);
- The ratio of multi-residential to single residential dwellings in 2011 has been used to estimate the current and future split of multi-residential properties;
- Connections that are currently not BASIX compliant are assumed to be progressively converted to BASIX properties through installation of water efficient appliances and water saving measures; and
- The number of non-residential connections is expected to increase at the same rate as the future population growth.

The only dual-reticulated connections are within the Ballina Shire bulk supply area. However, extension of the recycled water system to other water supply areas will be considered as part of the development of the regional bulk water supply strategy.

4. BALLINA SHIRE COUNCIL

4.1 Predicted Connection Growth

The following data have been considered in the estimation of future water supply connections for Ballina Shire water supply systems:

- Rous Water Future Water Strategy Demand Forecast;
- ABS Census data (2006 and 2011) for Wardell Urban Centre/Locality;
- Ballina Shire Council Growth Management Strategy, 2012; and
- Ballina Shire Housing Demand and Supply Forecast Methodology Statement, 2010.

The approach used for each water supply system is discussed in the relevant sections below.

4.1.1 Rous Water Bulk Supply Area

The number of connections in each 10 year period is given in Table 3 and Figure 2. These figures are taken directly from the Rous Water Future Water Strategy Demand Forecast (Hydrosphere Consulting, 2012b). The major source of data was the Ballina Shire Housing Demand and Supply Forecast Methodology Statement (2010) prepared as part of the development of the 2012 Growth Management Strategy. The information available included projections of dwelling units between 2006 and 2031 (including infill and new release areas) for each urban area. The remaining dwelling capacity (beyond 2031) for the Cumbalum new release area has been identified and this is assumed to have been developed by 2060. Between 2031 and 2060, the rate of infill has been determined from extrapolation of the average rate of infill to 2031.

Figure 2 shows a decrease in growth at 2031 which corresponds to Council's development projection period. In reality, the reduction in growth rate is expected to occur more gradually although the total number of connections at 2060 is not expected to be significantly different.

Table 3: Future Connections – Ballina LGA Bulk Supply Area

Connection Type	2010	2020	2030	2040	2050	2060
BASIX dual reticulated single residential [1]	264	1,368	2,585	3,138	3,883	4,907
BASIX dual reticulated multi-residential	126	993	1,949	2,383	2,968	3,774
BASIX single residential	333	1,308	2,167	2,653	3,112	3,711
BASIX multi-residential	87	1,495	2,886	4,054	5,252	6,575
Non-BASIX single residential	7,902	6,733	5,668	5,223	4,968	4,725
Non-BASIX multi-residential	3,749	3,391	3,067	2,844	2,705	2,573
Total Residential Connections	*12,461*	*15,289*	*18,321*	19,986	22,250	25,313
Non-Residential connections	1,365	1,987	2,609	3,231	3,853	4,475
Total Connections	13,826	17,276	20,930	23,217	26,103	29,788
Rous Water supply area growth (total connections) % p.a.	0.47%	2.2%	1.8%	1.0%	1.3%	1.4%

1. To be connected to recycled water supply in 2013/14.

Source: Hydrosphere Consulting (2012b)

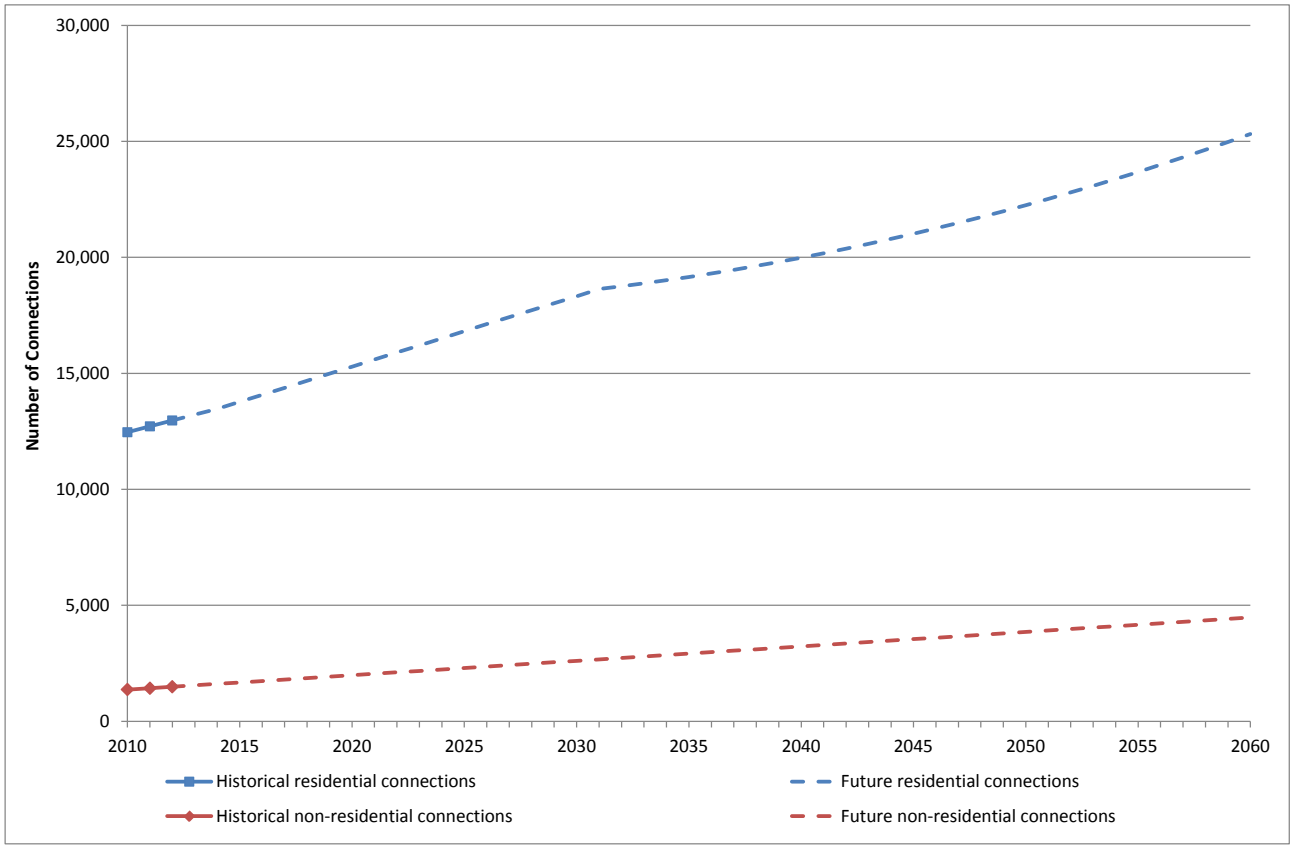


Figure 2: Future Residential and Non-residential Connections – Ballina LGA bulk supply area

4.1.2 Wardell

Analysis of the 2011 and 2006 Census data for Wardell suggests an increase in occupied dwellings of 1.8% p.a. over the five year period with an average of 3 new single residential dwellings and 1 new multi-residential dwelling each year and an average population growth rate of 0.61% p.a. Based on the Ballina Shire Housing Demand and Forecast Methodology Statement, the average future growth rate to 2031 is expected to be 4 new dwellings per year. Although the extent of available land beyond 2031 is not known, this growth rate is assumed to continue for the 50 year period.

The growth in non-residential connections is expected to be 0.61% p.a.

The rate of conversion to efficient households is assumed to be 1.0% p.a. between year 1 and year 25 and 0.5% p.a. between year 26 and year 50. This results in conversion of 29% of the existing non-BASIX houses to “efficient” houses over the 50 year period.

The resulting number of connections in each 10 year period is given in Table 4 and Figure 3.

Table 4: Future Connections – Wardell

Connection Type	2010	2020	2030	2040	2050	2060
BASIX single residential	4	57	114	164	208	251
BASIX multi-residential	2	8	14	20	27	33
Non-BASIX single residential	276	248	219	203	190	178
Non-BASIX multi-residential	2	0	0	0	0	0
Total Residential Connections	*284*	*314*	*351*	*388*	*425*	*462*
Non-Residential connections	28	29	31	33	35	38

Connection Type	2010	2020	2030	2040	2050	2060
Total Connections	312	343	382	421	460	499
Water supply area growth (total connections) % p.a.	-	1.1%	1.0%	0.94%	0.86%	0.79%

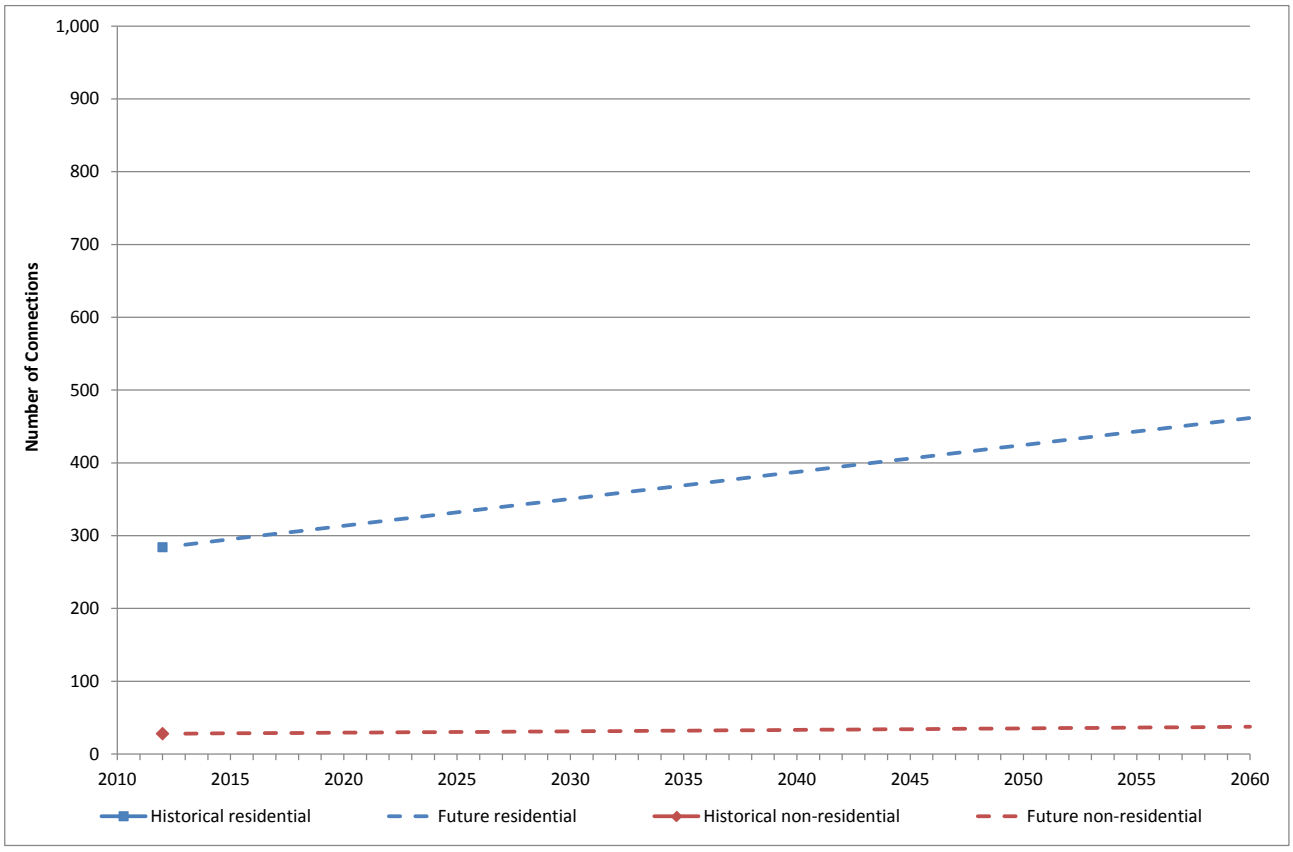


Figure 3: Future Residential and Non-residential Connections – Wardell

4.2 Predicted Future Demand

4.2.1 Rous Water Bulk Supply Area

The predicted demand for each 10 year period is given in Table 5 and Figure 4. These figures are taken directly from the Rous Water Future Water Strategy Demand Forecast (Hydrosphere Consulting, 2012b). The major source of data was the 2012 Section 94 Contributions Plan which provided projections of the number of future standard dwelling units for the major development areas from 2011 to 2036. Figure 4 shows a marked decrease in growth at 2036 which corresponds to Council's development projection period. In reality, the reduction in growth rate is expected to occur more gradually although the total number of connections at 2060 is not expected to be significantly different.

Figure 4 shows the reduction in consumption predicted to result from the implementation of pressure management trials which resulted in leakage reduction of approximately 240 ML/a (Hydrosphere Consulting, 2012b) as well as the connection of the recycled water supply in 2013/14. In Hydrosphere Consulting (2012b), the connection of the recycled water supply was assumed to result in a reduction of approximately 42 kL/a (dual reticulated connections). Further data on actual potable water consumption will be available once the recycled water supply is connected.

Table 5: Future Demand – Ballina LGA Bulk Supply Area (kL/a)

Connection Type	2010	2020	2030	2040	2050	2060
BASIX dual reticulated single residential [1]	47,439	188,176	355,449	431,459	533,890	674,823
BASIX dual reticulated multi-residential	22,510	98,064	192,462	235,357	293,162	372,695
BASIX single residential	45,818	179,851	298,004	364,789	427,939	510,259
BASIX multi-residential	8,573	147,684	285,026	400,376	518,751	649,389
Non-BASIX single residential	1,579,171	1,345,699	1,132,737	982,158	865,252	754,143
Non-BASIX multi-residential	494,683	447,383	404,605	375,252	356,906	339,456
Total Residential Connections	*2,198,193*	*2,406,857*	*2,668,283*	*2,739,385*	*2,797,777*	*2,857,172*
Non-Residential connections	451,805	657,671	863,537	2,789,391	2,995,899	3,300,766
Total customer consumption	2,649,998	3,064,528	3,531,819	1,069,403	1,275,268	1,481,134
Unmetered Water	851,145	641,539	739,363	807,813	894,141	1,001,060
Unmetered Water (%)	24%	17%	17%	17%	17%	17%
Total bulk water supplied	3,501,143	3,706,067	4,271,183	4,666,606	5,165,309	5,782,960

1. To be connected to recycled water supply in 2013/14.

Source: Hydrosphere Consulting (2012b)

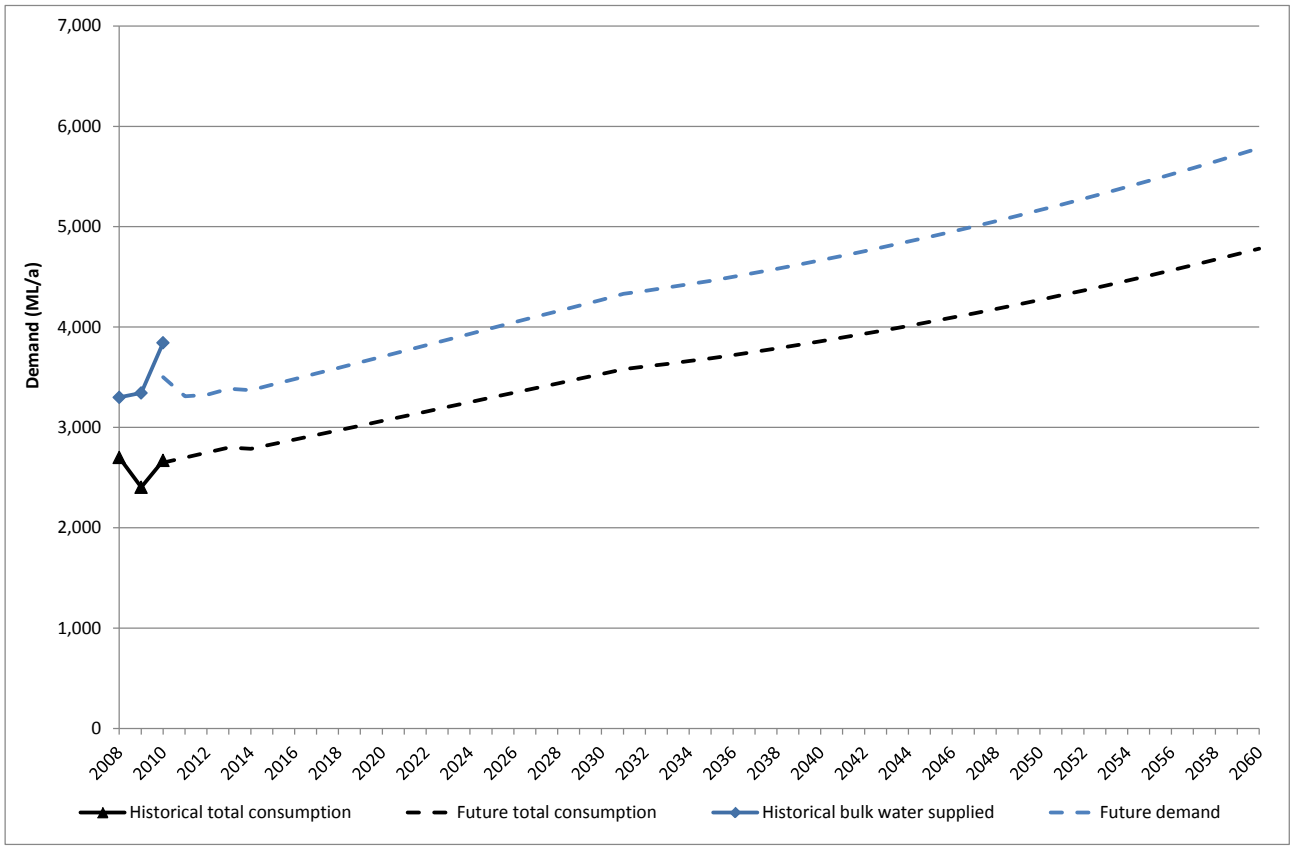


Figure 4: Future Demand - Ballina LGA bulk supply area

The unmetered water is for the distribution system only (i.e. not including bulk supply losses from Rous Water.

4.2.2 Wardell

Ballina Shire Council is not able to supply consumption (customer sales) data for Wardell customers due to limitations of its customer database. In the absence of specific data, it is assumed the unmetered water in the system will be 10% of raw water extraction and the customer demand will increase at the same rate as the connection growth.

The predicted demand for each 10 year period is given in Table 6 and Figure 5.

Table 6: Future Demand – Wardell (kL/a)

Connection Type	2010	2020	2030	2040	2050	2060
Total customer consumption	116,723	122,959	137,466	151,973	166,480	180,987
Unmetered Water	12,969	13,662	15,274	16,886	18,498	20,110
Unmetered Water (%)	10%	10%	10%	10%	10%	10%
Total bulk water supplied	129,692	136,621	152,740	168,859	184,978	201,097

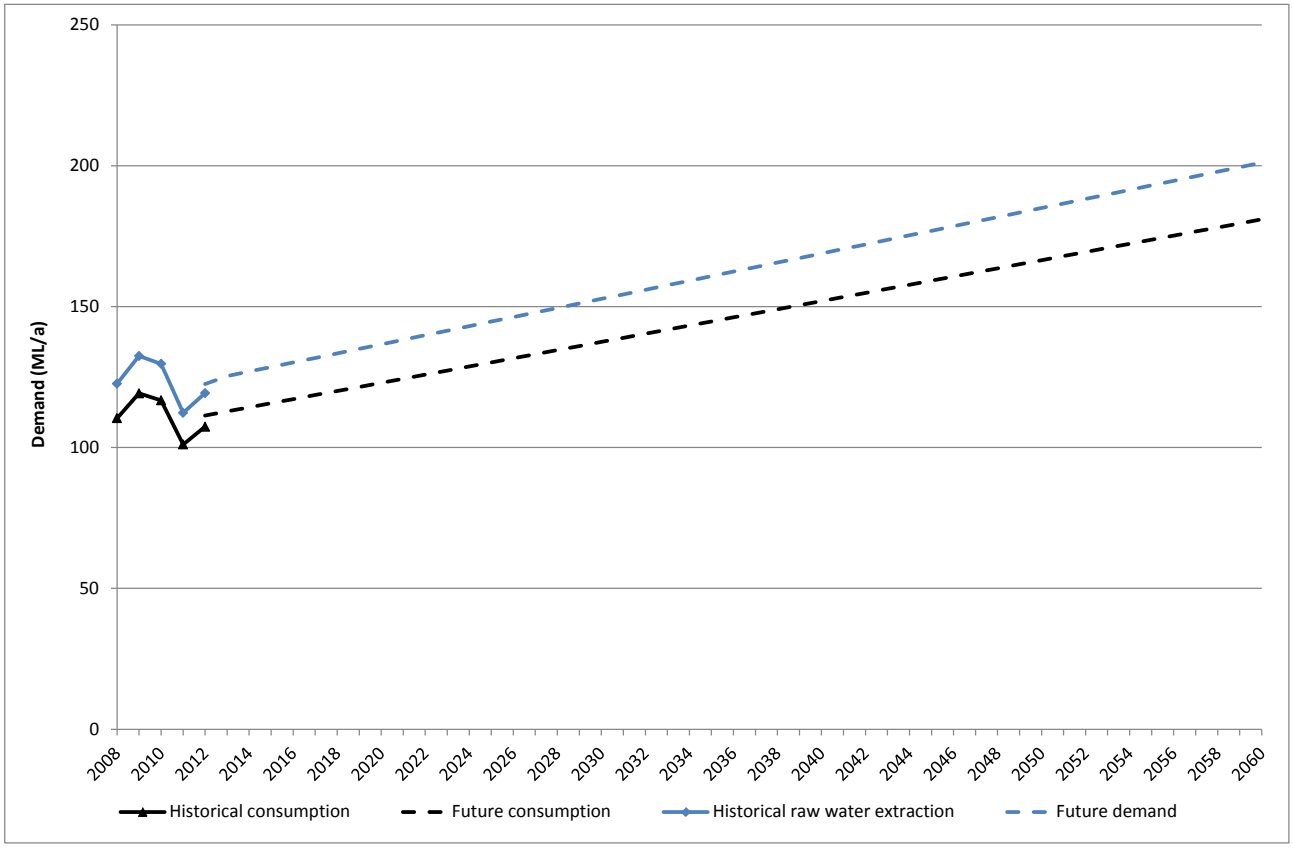


Figure 5: Future Demand - Wardell

5. BYRON SHIRE COUNCIL

5.1 Predicted Connection Growth

The following data have been considered in the estimation of future water supply connections for Byron Shire water supply systems:

- Rous Water Future Water Strategy Demand Forecast;
- Water Supply Development Servicing Plan (DSP) 2012; and
- ABS Census data (2006 and 2011) for Mullumbimby Urban Centre/Locality.

The approach used for each water supply system is discussed in the relevant sections below.

5.1.1 Rous Water Bulk Supply Area

The number of connections in each 10 year period is given in Table 7 and Figure 6. These figures are taken directly from the Rous Water Future Water Strategy Demand Forecast (Hydrosphere Consulting, 2012b). The major source of data was the 2012 Section 94 Contributions Plan which provided projections of the number of future standard dwelling units for the major development areas between 2011 and 2036. After 2036 no new release areas have been identified. Figure 6 shows a marked decrease in growth at 2036 which corresponds to Council's development projection period. In reality, the reduction in growth rate is expected to occur more gradually although the total number of connections at 2060 is not expected to be significantly different.

Council has also provided data on the number of residential water supply assessments in 2011 and 2012 which are lower than number of connections predicted by the Rous Water Future Water Strategy Demand Forecast as indicated on Figure 6.

Table 7: Future Connections – Byron LGA Bulk Supply Area

Connection Type	2010	2020	2030	2040	2050	2060
BASIX single residential	452	1,725	2,845	3,495	3,701	3,888
BASIX multi-residential	118	1,275	2,314	3,052	3,552	4,050
Non-BASIX single residential	6,478	5,587	4,811	4,289	3,906	3,541
Non-BASIX multi-residential	1,526	1,380	1,248	1,157	1,101	1,047
Total Residential Connections	12,461	15,289	18,321	19,224	19,879	20,535
Non-Residential connections	1,088	1,317	1,546	1,661	1,661	1,661
Total Connections	9,662	11,284	12,764	13,654	13,921	14,187
Rous Water supply area growth (total connections) % p.a.	1.3%	1.5%	1.0%	0.20%	0.19%	0.19%

Source: Hydrosphere Consulting (2012b)

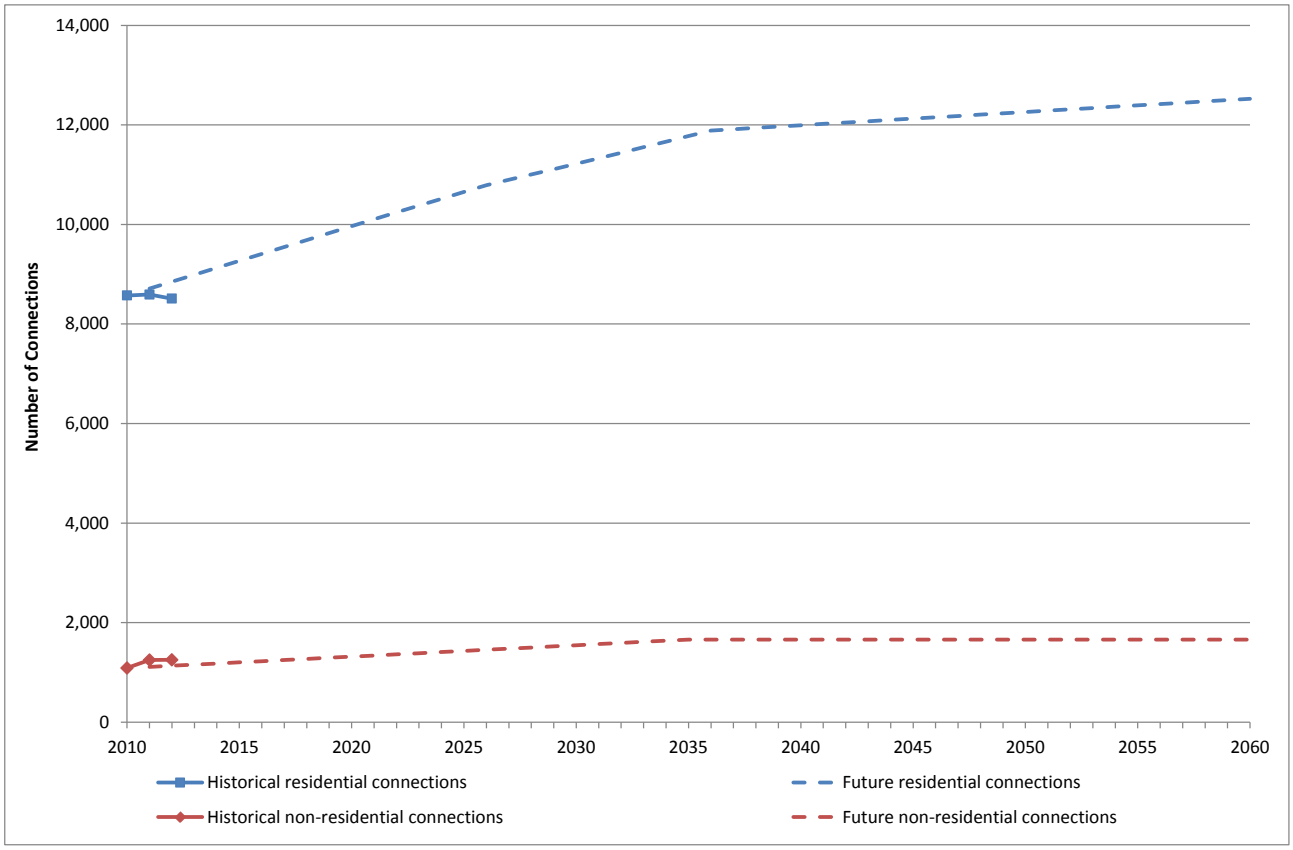


Figure 6: Future Residential and Non-residential Connections – Byron LGA bulk supply area

5.1.2 Mullumbimby

Analysis of the 2011 and 2006 Census data for Mullumbimby suggests an increase in occupied dwellings of 0.77% p.a. over the five year period with an average of 7 new single residential dwellings and 2 new multi-residential dwelling each year and an average population growth rate of -1.0% p.a. The connections data provided by Byron Shire Council suggests the connection growth between 2011 and 2012 was 7.1% p.a. and averaged 0.5% p.a. in previous years.

The Byron Shire DSP predicted future growth in Mullumbimby to average 1.3% p.a. for the next 30 years as the rate of development in Mullumbimby was expected to increase with the removal of the development moratorium in 2010. This growth rate of 1.3% p.a. has been adopted for this report and is assumed to continue for the 50 year period.

The growth in non-residential connections is also expected to be 1.3% p.a. for the 50 year period.

The rate of conversion to efficient households is assumed to be 1.0% p.a. between year 1 and year 25 and 0.5% p.a. between year 26 and year 50. This results in conversion of 31% of the existing non-BASIX houses to “efficient” houses over the 50 year period.

The resulting number of connections in each 10 year period is given in Table 8 and Figure 7.

Table 8: Future Connections – Mullumbimby

Connection Type	2010	2020	2030	2040	2050	2060
BASIX single residential	33	306	626	939	1,255	1,604
BASIX multi-residential	3	29	59	89	119	152
Non-BASIX single residential	1,232	1,189	1,066	978	918	859

Connection Type	2010	2020	2030	2040	2050	2060
Non-BASIX multi-residential	116	113	102	94	90	85
Total Residential Connections	1,384	1,636	1,853	2,100	2,381	2,700
Non-Residential connections	176	218	249	283	322	366
Total Connections	1,560	1,855	2,102	2,383	2,702	3,066
Water supply area growth (total connections) % p.a.	0.4%	1.3%	1.3%	1.3%	1.3%	1.3%

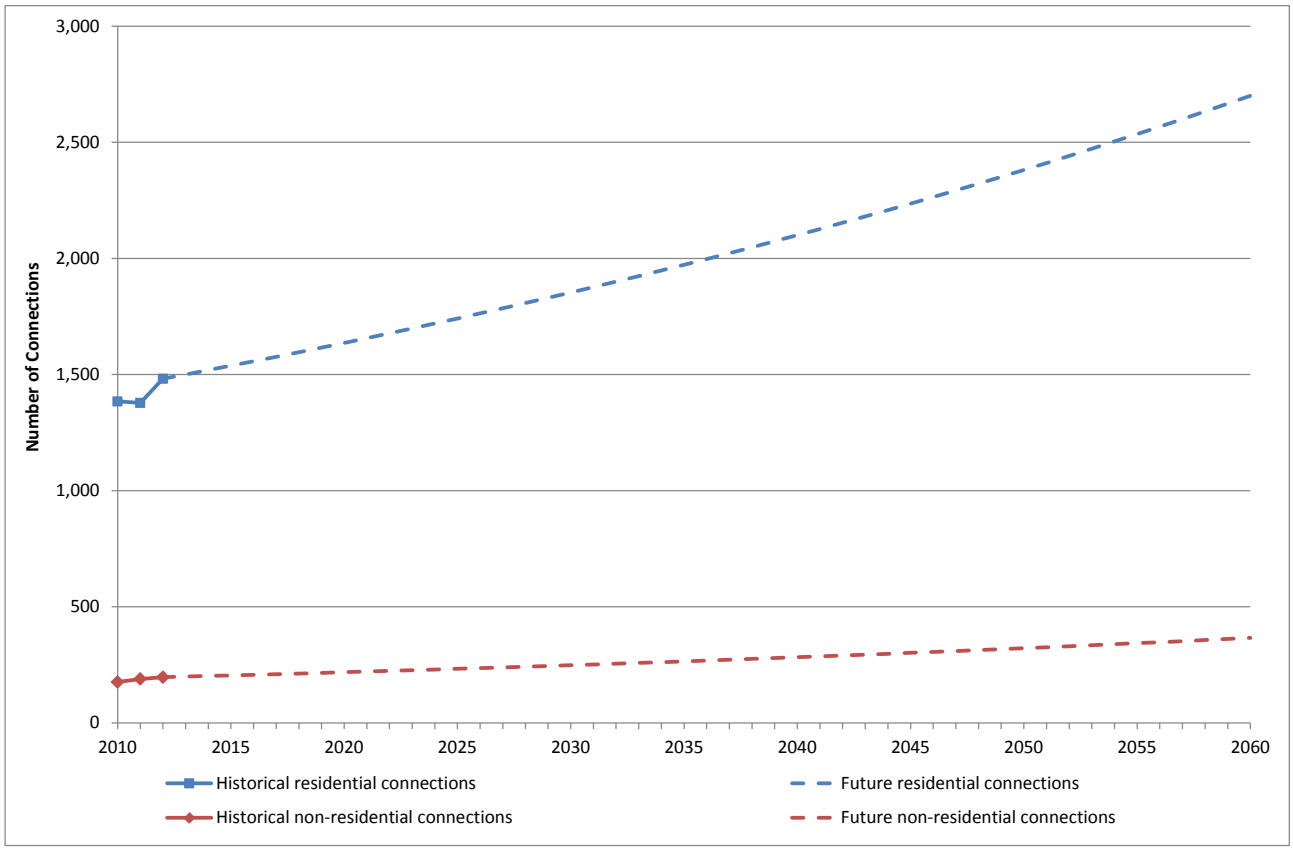


Figure 7: Future Residential and Non-residential Connections – Mullumbimby

5.2 Predicted Future Demand

5.2.1 Rous Water Bulk Supply Area

The predicted demand for each 10 year period is given in Table 9 and Figure 8. These figures are taken directly from the Rous Water Future Water Strategy Demand Forecast (Hydrosphere Consulting, 2012b).

Council has also provided data on the customer consumption in 2011 and 2012 which is lower than the consumption predicted by the Rous Water Future Water Strategy Demand Forecast as indicated on Figure 8.

Table 9: Future Demand – Byron LGA Bulk Supply Area (kL/a)

Connection Type	2010	2020	2030	2040	2050	2060
BASIX single residential	62,182	237,207	391,269	480,646	508,939	534,655
BASIX multi-residential	11,634	125,914	228,527	301,423	350,834	399,972
Non-BASIX single residential	1,241,831	1,071,098	922,211	822,203	748,738	678,866

Connection Type	2010	2020	2030	2040	2050	2060
Non-BASIX multi-residential	204,360	184,819	167,147	155,021	147,442	140,233
Non-Residential connections	747,237	904,550	1,061,863	1,140,519	1,140,519	1,140,519
Total customer consumption	2,267,244	2,523,587	2,771,016	2,899,811	2,896,473	2,894,246
Unmetered Water	106,460	121,014	132,879	139,055	138,895	138,788
Unmetered Water (%)	4.5%	4.6%	4.6%	4.6%	4.6%	4.6%
Total bulk water supplied	2,373,703	2,644,601	2,903,895	3,038,866	3,035,367	3,033,034

Source: Hydrosphere Consulting (2012b)

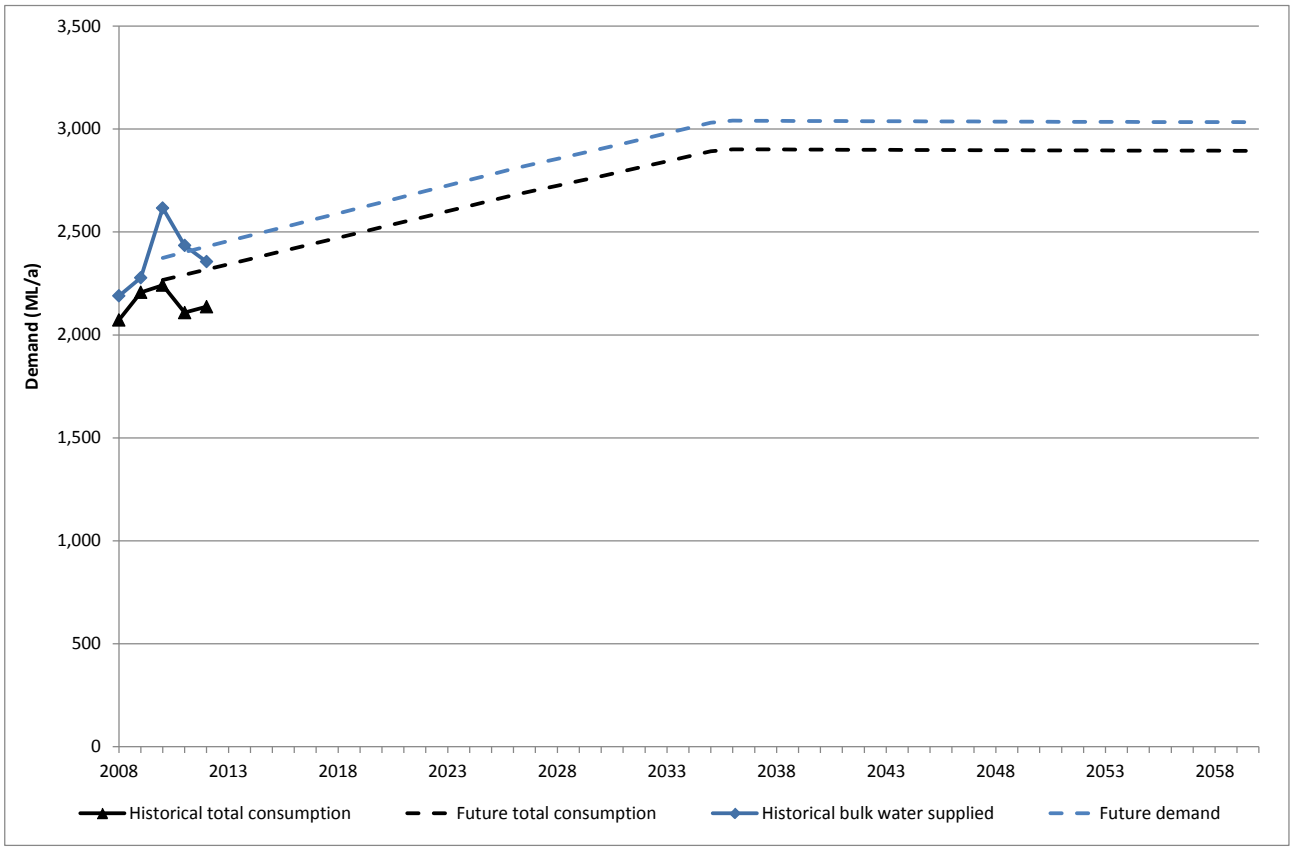


Figure 8: Future Demand - Byron LGA bulk supply area

The unmetered water is for the distribution system only (i.e. not including bulk supply losses from Rous Water).

5.2.2 Mullumbimby

All BASIX connections in the Mullumbimby service area are assumed to have the same per connection consumption as those for the Rous Water bulk supply area as follows (Hydrosphere Consulting, 2012b):

- BASIX single residential connections: 138 kL/connection/a; and
- BASIX multi-residential connections: 99 kL/connection/a.

Using the historical consumption data and average consumption per residential connection from Interim Report 1, the consumption per connection for non-BASIX connections has been calculated as follows:

- Non-BASIX single residential connections: 165 kL/connection/a; and

- Non-BASIX multi-residential connections: 132 kL/connection/a.

The average consumption for non-residential connections from Interim Report 1 is 385 kL/connection/a.

The predicted demand for each 10 year period is given in Table 10 and Figure 9.

Table 10: Future Demand – Mullumbimby (kL/a)

Connection Type	2010	2020	2030	2040	2050	2060
BASIX single residential	4,524	42,084	86,133	129,127	172,531	220,608
BASIX multi-residential	306	2,849	5,838	8,759	11,709	14,980
Non-BASIX single residential	247,832	199,958	179,268	164,446	154,329	144,420
Non-BASIX multi-residential	15,258	14,807	13,391	12,420	11,813	11,235
Non-Residential	68,613	84,030	95,615	108,798	123,799	140,867
Total customer consumption	336,533	351,871	398,917	452,451	513,365	582,678
Unmetered Water	53,714	65,581	74,350	84,327	95,680	108,599
Unmetered Water (%)	13.8%	15.7%	15.7%	15.7%	15.7%	15.7%
Total raw water extraction	390,247	417,452	473,267	536,778	609,046	691,277

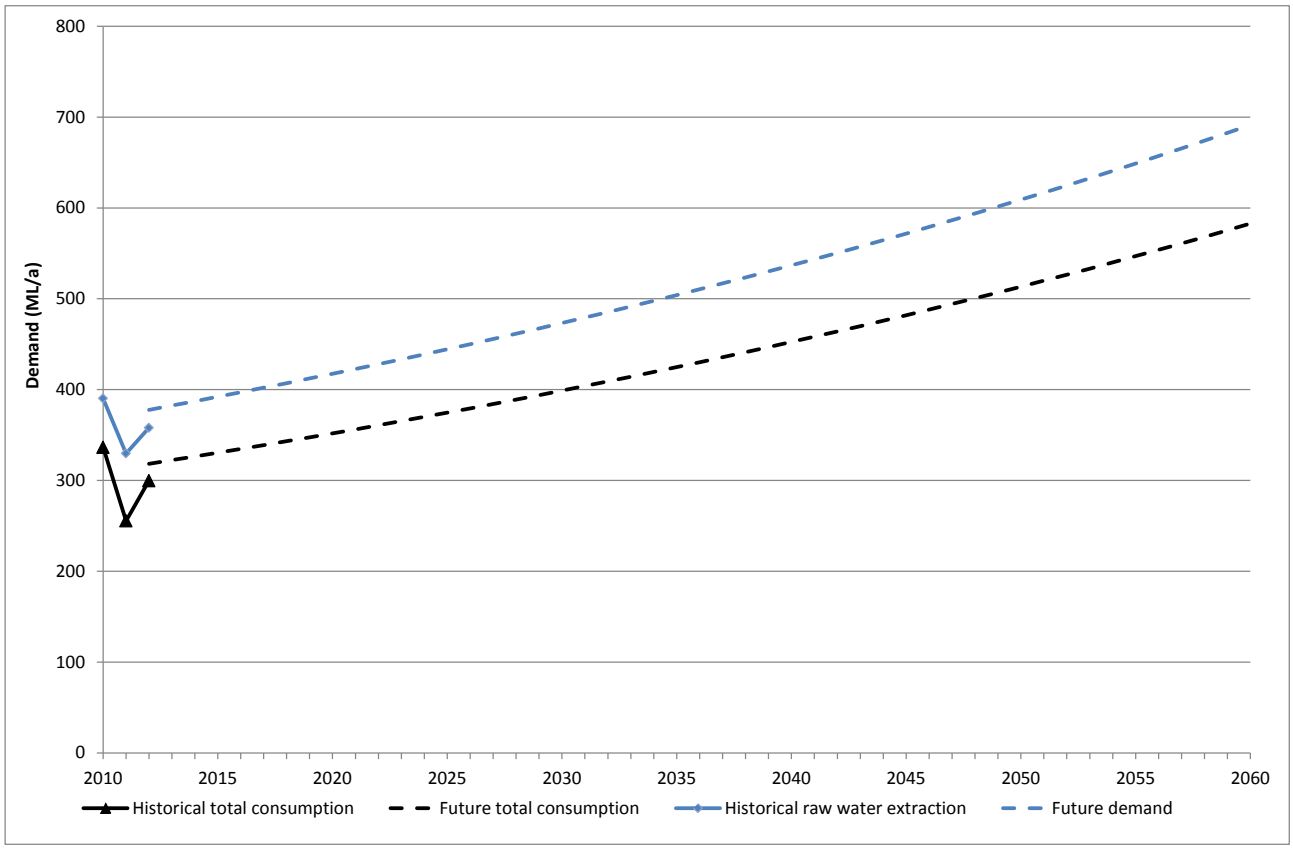


Figure 9: Future Demand - Mullumbimby

Data on the contribution of treatment losses and distribution system losses to the total unmetered water is not available for Mullumbimby water supply.

6. KYOGLE COUNCIL

6.1 Predicted Connection Growth

The following data have been considered in the estimation of future water supply connections for Kyogle Council water supply systems:

- Kyogle Integrated Water Cycle Management (IWCM) Strategy Study (MWH, 2006);
- Kyogle Council Local Growth Management Strategy (2010);
- Bonalbo Long Term Water Supply and Drought Strategy (NSW Department of Commerce, 2005);
- Urbenville-Woodenbong Water Supply Augmentation Strategy Report (DPWS, 1998b); and
- ABS Census data (2006 and 2011) for Kyogle and Bonalbo Urban Centres/Localities.

The approach used for each water supply system is discussed in the relevant sections below.

6.1.1 Kyogle

Analysis of the 2011 and 2006 Census data for Kyogle suggests that growth over the last 5 years has been negligible. However, the IWCM Strategy and Local Growth Management Strategy predict average growth of 0.5% p.a. to 2034. This growth rate has been adopted for this report and is assumed to continue for the 50 year period.

The growth in non-residential connections is also expected to be 0.5% p.a.

The rate of conversion to efficient households is assumed to be 1.0% p.a. between year 1 and year 25 and 0.5% p.a. between year 26 and year 50. This results in conversion of 30% of the existing non-BASIX houses to “efficient” houses over the 50 year period.

The resulting number of connections in each 10 year period is given in Table 11 and Figure 10.

Table 11: Future Connections – Kyogle

Connection Type	2010	2020	2030	2040	2050	2060
BASIX single residential	27	244	493	723	936	1,157
BASIX multi-residential	2	20	41	60	78	97
Non-BASIX single residential	1,064	965	866	797	751	706
Non-BASIX multi-residential	89	81	73	68	65	61
Total Residential Connections	1,182	1,310	1,473	1,648	1,830	2,022
Non-Residential connections	203	211	222	233	245	257
Total Connections	1,385	1,521	1,695	1,881	2,075	2,279
Water supply area growth (total connections) % p.a.	-	1.2%	1.0%	1.0%	1.0%	0.92%

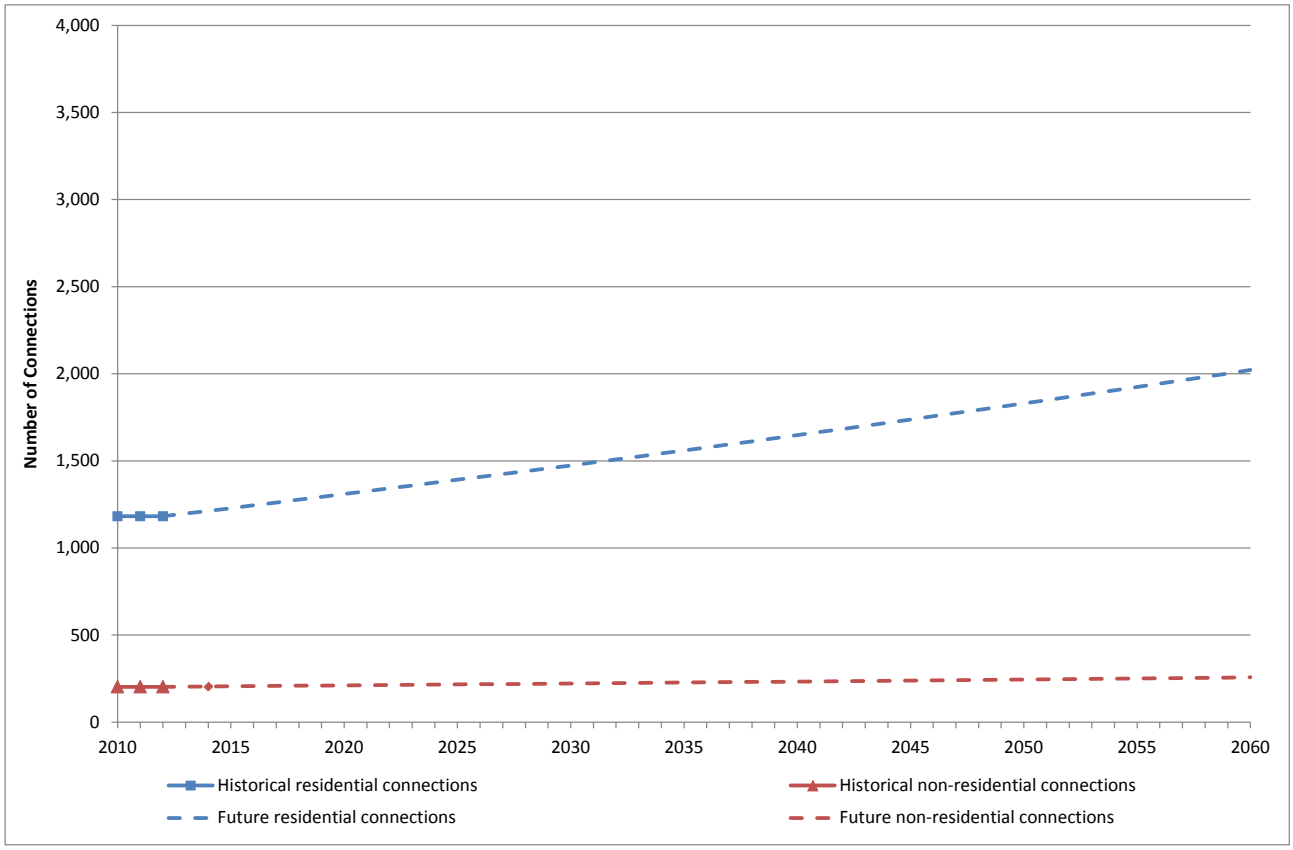


Figure 10: Future Residential and Non-residential Connections – Kyogle

6.1.2 Bonalbo

Analysis of the 2011 and 2006 Census data for Bonalbo suggests an increase in occupied dwellings of 0.31% p.a. with 2 new single residential dwellings over the 5 year period with a reduction in population at a rate of -1.8% p.a. However, the Bonalbo Long-Term Water Supply Strategy and Local Growth Management Strategy predict average growth of 0.7% p.a. to 2034. This growth rate has been adopted for this report and is assumed to continue for the 50 year period. The Census data suggests all dwellings in Bonalbo are single residential.

The growth in non-residential connections is expected to be 0.7% p.a.

The rate of conversion to efficient households is assumed to be 1.0% p.a. between year 1 and year 25 and 0.5% p.a. between year 26 and year 50. This results in conversion of 30% of the existing non-BASIX houses to “efficient” houses over the 50 year period.

The resulting number of connections in each 10 year period is given in Table 12 and Figure 11.

Table 12: Future Connections – Bonalbo

Connection Type	2010	2020	2030	2040	2050	2060
BASIX single residential	0	21	46	67	84	101
BASIX multi-residential	0	0	0	0	0	0
Non-BASIX single residential	148	137	124	115	109	104
Non-BASIX multi-residential	0	0	0	0	0	0
Total Residential Connections	148	157	169	181	193	205
Non-Residential connections	44	47	50	54	57	61

Connection Type	2010	2020	2030	2040	2050	2060
Total Connections	192	204	220	235	250	266
Water supply area growth (total connections) % p.a.	-	0.76%	0.70%	0.66%	0.62%	0.58%

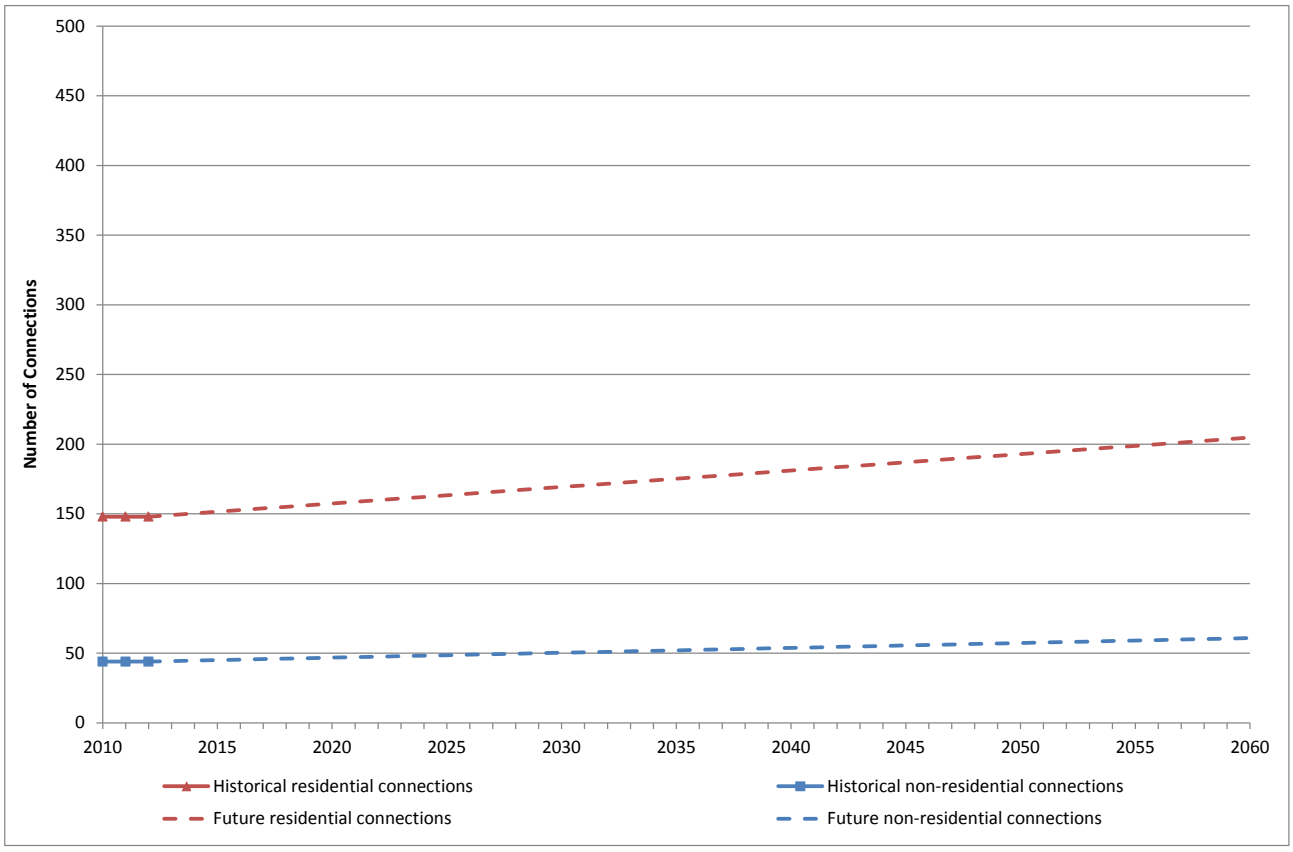


Figure 11: Future Residential and Non-residential Connections – Bonalbo

6.1.3 Woodenbong and Muli Muli

The Urbenville-Woodenbong Water Supply Augmentation Strategy Report and Local Growth Management Strategy predict growth of one new connection per year to 2022. This growth rate has been assumed to continue to 2060. The number of non-residential connections is expected to remain constant.

The rate of conversion to efficient households is assumed to be 1.0% p.a. between year 1 and year 25 and 0.5% p.a. between year 26 and year 50. This results in conversion of 30% of the existing non-BASIX houses to “efficient” houses over the 50 year period.

The resulting number of connections in each 10 year period is given in Table 13 and Figure 12.

Table 13: Future Connections – Woodenbong and Muli Muli

Connection Type	2010	2020	2030	2040	2050	2060
BASIX single residential	0	23	49	71	88	105
BASIX multi-residential	0	0	0	0	0	0
Non-BASIX single residential	189	174	158	146	139	132
Non-BASIX multi-residential	0	0	0	0	0	0
Total Residential Connections	189	197	207	217	227	237

Connection Type	2010	2020	2030	2040	2050	2060
Non-Residential connections	47	47	47	47	47	47
Total Connections	236	244	254	264	274	284
Water supply area growth (total connections) % p.a.	-	0.41%	0.40%	0.38%	0.37%	0.35%

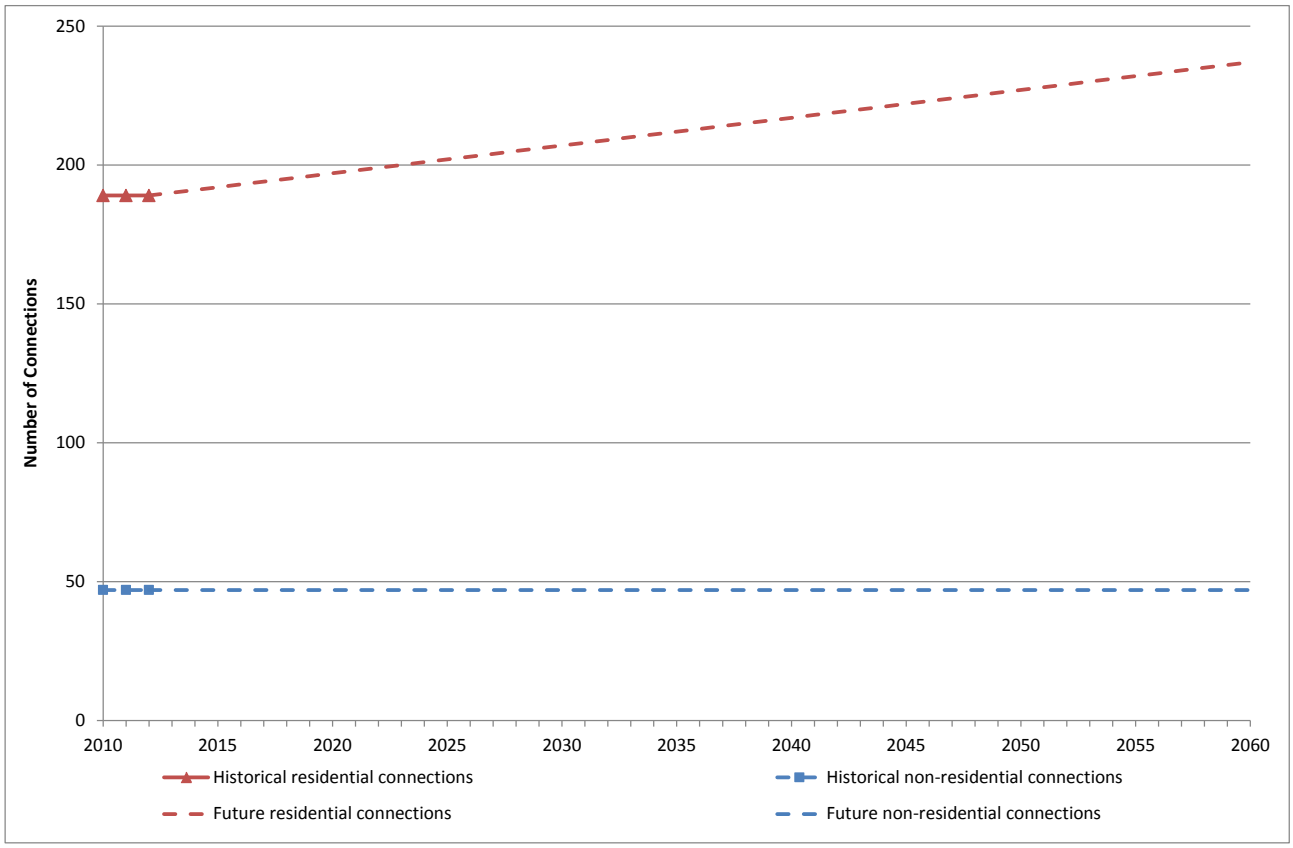


Figure 12: Future Residential and Non-residential Connections – Woodenbong and Muli Muli

6.2 Predicted Future Demand

6.2.1 Kyogle

All BASIX connections in the Kyogle service area are assumed to have the same per connection consumption as those for the Rous Water bulk supply area as follows:

- BASIX single residential connections: 138 kL/connection/a; and
- BASIX multi-residential connections: 99 kL/connection/a.

Using the historical consumption data and average consumption per residential connection from Interim Report 1, the consumption per connection for non-BASIX connections have been calculated as follows:

- Non-BASIX single residential connections: 166 kL/connection/a; and
- Non-BASIX multi-residential connections: 127 kL/connection/a.

The average consumption for non-residential connections from Interim Report 1 is 450 kL/connection/a.

The predicted demand for each 10 year period is given in Table 14 and Figure 13.

Table 14: Future Demand – Kyogle (kL/a)

Connection Type	2010	2020	2030	2040	2050	2060
BASIX single residential	3,655	33,504	67,726	99,359	128,757	159,064
BASIX multi-residential	219	2,011	4,069	5,974	7,745	9,573
Non-BASIX single residential	183,701	159,982	143,647	132,098	124,455	117,126
Non-BASIX multi-residential	11,719	10,259	9,278	8,605	8,184	7,784
Non-Residential	112,154	95,108	99,878	104,966	110,285	115,874
Total customer consumption	311,449	300,864	324,598	351,001	379,427	409,421
Unmetered Water	23,301	23,263	25,098	27,139	29,337	31,656
Unmetered Water (%)	7.0%	7.2%	7.2%	7.2%	7.2%	7.2%
Total raw water extraction	334,750	324,127	349,696	378,141	408,764	441,077

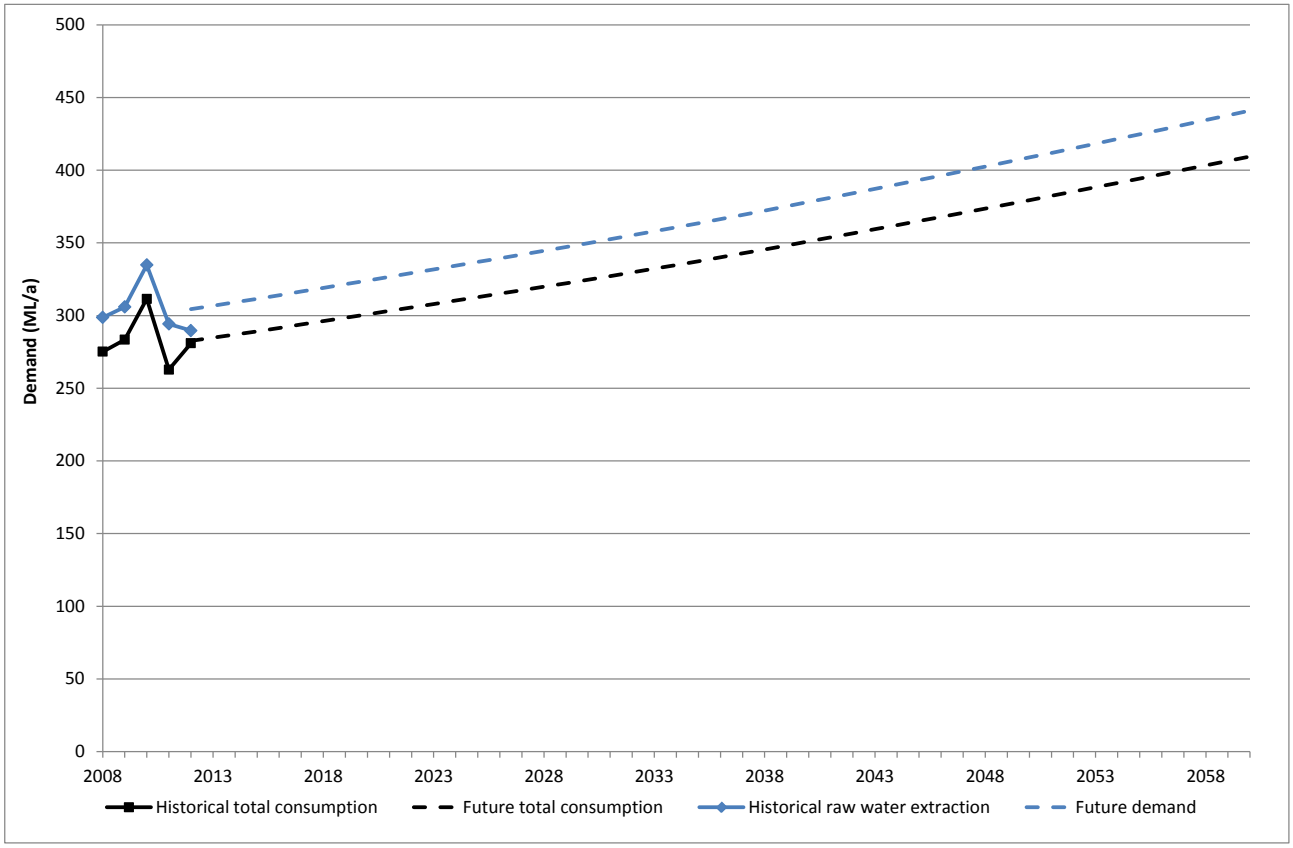


Figure 13: Future Demand - Kyogle

The unmetered water for Kyogle is made up of approximately 4% distribution system losses and 3% treatment losses.

6.2.2 Bonalbo

Using the historical consumption data and average consumption per residential connection from Interim Report 1, the consumption per connection for residential connections in Bonalbo has been calculated as 116 kL/connection/a. The average consumption for non-residential connections from Interim Report 1 is 197 kL/connection/a.

The predicted demand for each 10 year period is given in Table 15 and Figure 14.

Table 15: Future Demand – Bonalbo (kL/a)

Connection Type	2010 [1]	2020	2030	2040	2050	2060
BASIX single residential	0	2,424	5,311	7,723	9,744	11,734
BASIX multi-residential	0	0	0	0	0	0
Non-BASIX single residential	17,882	15,849	14,334	13,294	12,644	12,026
Non-BASIX multi-residential	0	0	0	0	0	0
Non-Residential	10,063	9,234	9,927	10,620	11,313	12,006
Total customer consumption	27,945	27,507	29,571	31,636	33,701	35,765
Unmetered Water	N/A	8,488	9,125	9,762	10,399	11,036
Unmetered Water (%)	N/A	23.6%	23.6%	23.6%	23.6%	23.6%
Total raw water extraction	14,000	35,995	38,696	41,398	44,100	46,801

1. In 2010 the catchment for the off-stream storage provided a significant component of the raw water supply and river extraction was reduced.

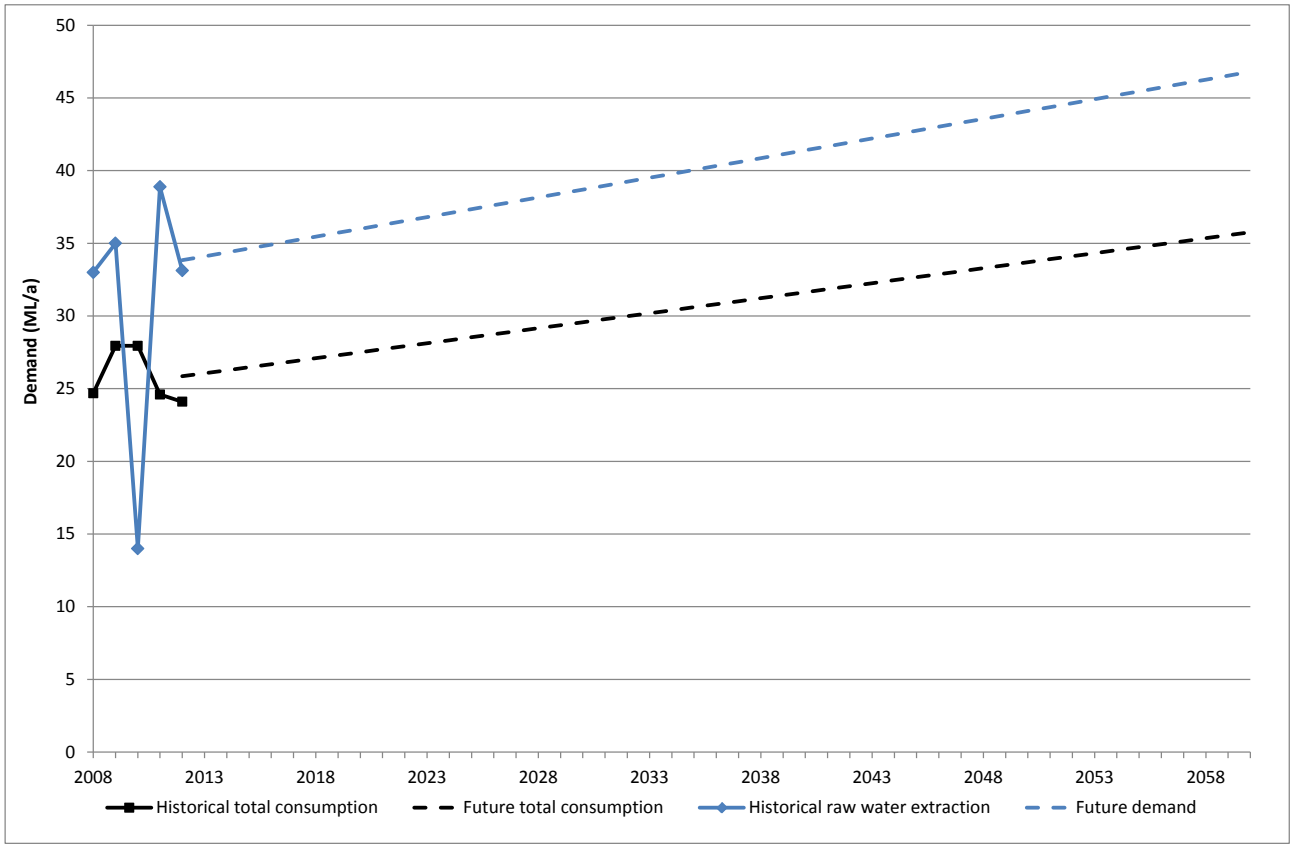


Figure 14: Future Demand – Bonalbo

The unmetered water for Bonalbo is made up of approximately 13% distribution system losses and 10% treatment losses. Raw water from the river and the bores is pumped into the off-stream storage which also has its own catchment. Hence the total raw water demand may be higher than presented in Table 15.

6.2.3 Woodenbong and Muli Muli

Using the historical consumption data and average consumption per residential connection from Interim Report 1, the consumption per connection for residential connections in Woodenbong and Muli Muli has

been calculated as 160 kL/connection/a. The average consumption for non-residential connections from Interim Report 1 is 275 kL/connection/a. The unmetered water is for the distribution system only (i.e. not including bulk supply losses from Tenterfield Shire Council).

The predicted demand for each 10 year period is given in Table 16 and Figure 15.

Table 16: Future Demand – Woodenbong and Muli Muli (kL/a)

Connection Type	2010 [1]	2020	2030	2040	2050	2060
BASIX single residential	0	3,108	6,776	9,725	12,083	14,394
BASIX multi-residential	0	0	0	0	0	0
Non-BASIX single residential	29,823	27,939	25,268	23,435	22,289	21,199
Non-BASIX multi-residential	0	0	0	0	0	0
Non-Residential	12,919	12,919	12,919	12,919	12,919	12,919
Total customer consumption	46,606	43,966	44,963	46,078	47,291	48,512
Unmetered Water	24,394	9,367	9,579	9,817	10,075	10,335
Unmetered Water (%)	N/A	18%	18%	18%	18%	18%
Total bulk supply from Tenterfield Shire	71,000	53,332	54,541	55,894	57,366	58,846

1. A landslip during 2010 caused a break in the main supply from Tenterfield Shire Council, resulting in significant leakage. This data has not been used in the calculation of average historical unmetered water or raw water extraction.

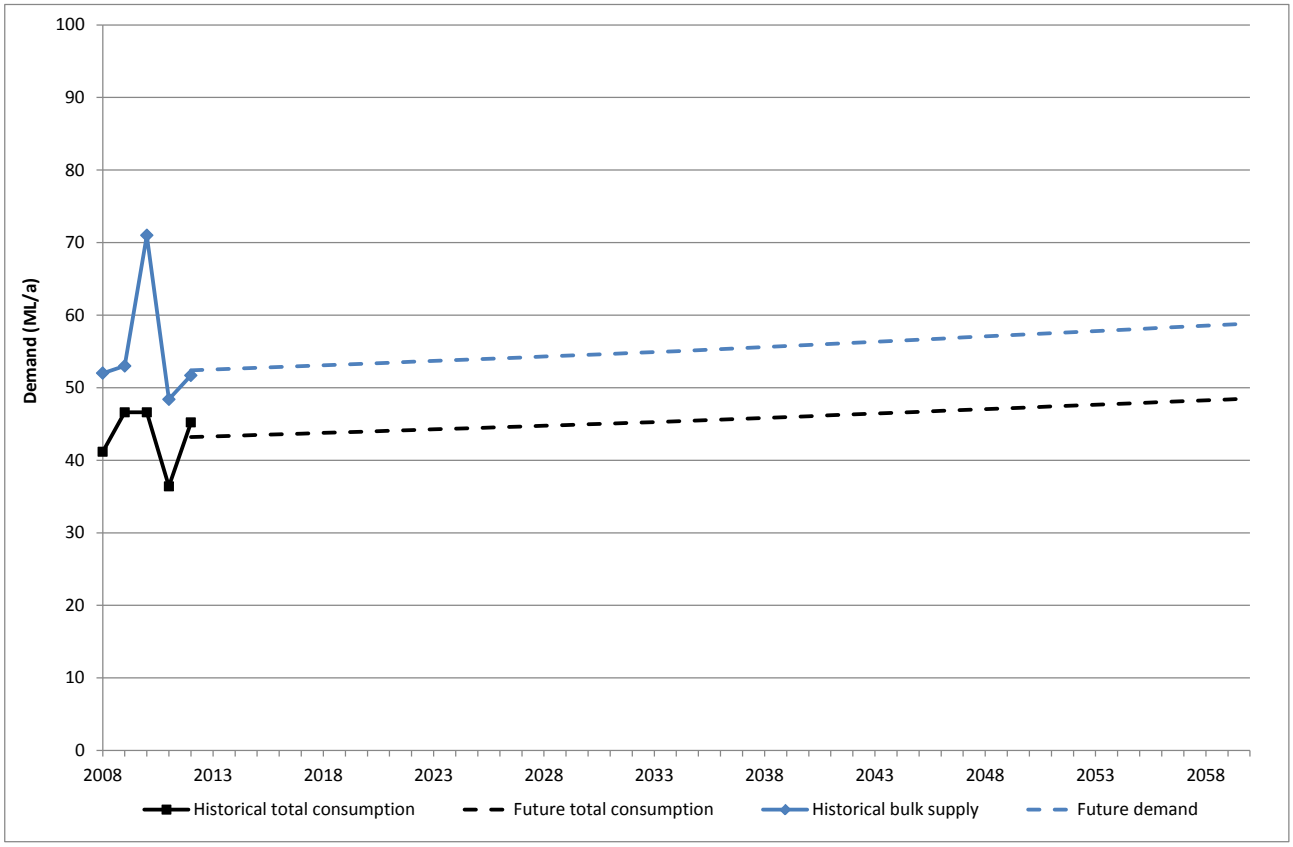


Figure 15: Future Demand – Woodenbong and Muli Muli

7. LISMORE CITY COUNCIL

7.1 Predicted Connection Growth

The following data have been considered in the estimation of future water supply connections for Lismore City Council water supply systems:

- Rous Water Future Water Strategy Demand Forecast; and
- Lismore Housing Strategy and Housing Analysis Part B, 2012.

The approach used for each water supply system is discussed in the relevant sections below.

7.1.1 Rous Water Bulk Supply Area

The number of connections in each 10 year period is given in Table 17 and Figure 16. These figures are taken directly from the Rous Water Future Water Strategy Demand Forecast (Hydrosphere Consulting, 2012b). The major source of data was the Lismore Housing Analysis which provided estimates of dwelling yield for potential urban release areas to 2018 and 2031. Between 2031 and 2060, the rate of development in new release areas was assumed to continue at the same rate as 2018 - 2031.

Figure 16 shows a marked decrease in growth at 2018 which corresponds to Council's initial projected growth period. In reality, the reduction in growth rate is expected to occur more gradually although the total number of connections at 2060 is not expected to be significantly different.

Table 17: Future Connections – Lismore LGA Bulk Supply Area

Connection Type	2010	2020	2030	2040	2050	2060
BASIX single residential	354	3,586	5,100	6,322	7,312	8,278
BASIX multi-residential	92	1,227	1,881	2,504	3,102	3,697
Non-BASIX single residential	446	4,813	6,981	8,826	10,414	11,976
Non-BASIX multi-residential	10,650	9,392	8,281	7,527	7,017	6,541
Total Residential Connections	12,245	15,243	16,202	17,225	18,260	19,305
Non-Residential connections	1,190	1,581	1,972	2,168	2,168	2,168
Total Connections	13,435	16,824	18,174	19,393	20,428	21,472
Rous Water supply area growth (total connections) % p.a.	0.81%	0.80%	0.76%	0.53%	0.51%	0.49%

Source: Hydrosphere Consulting (2012b)

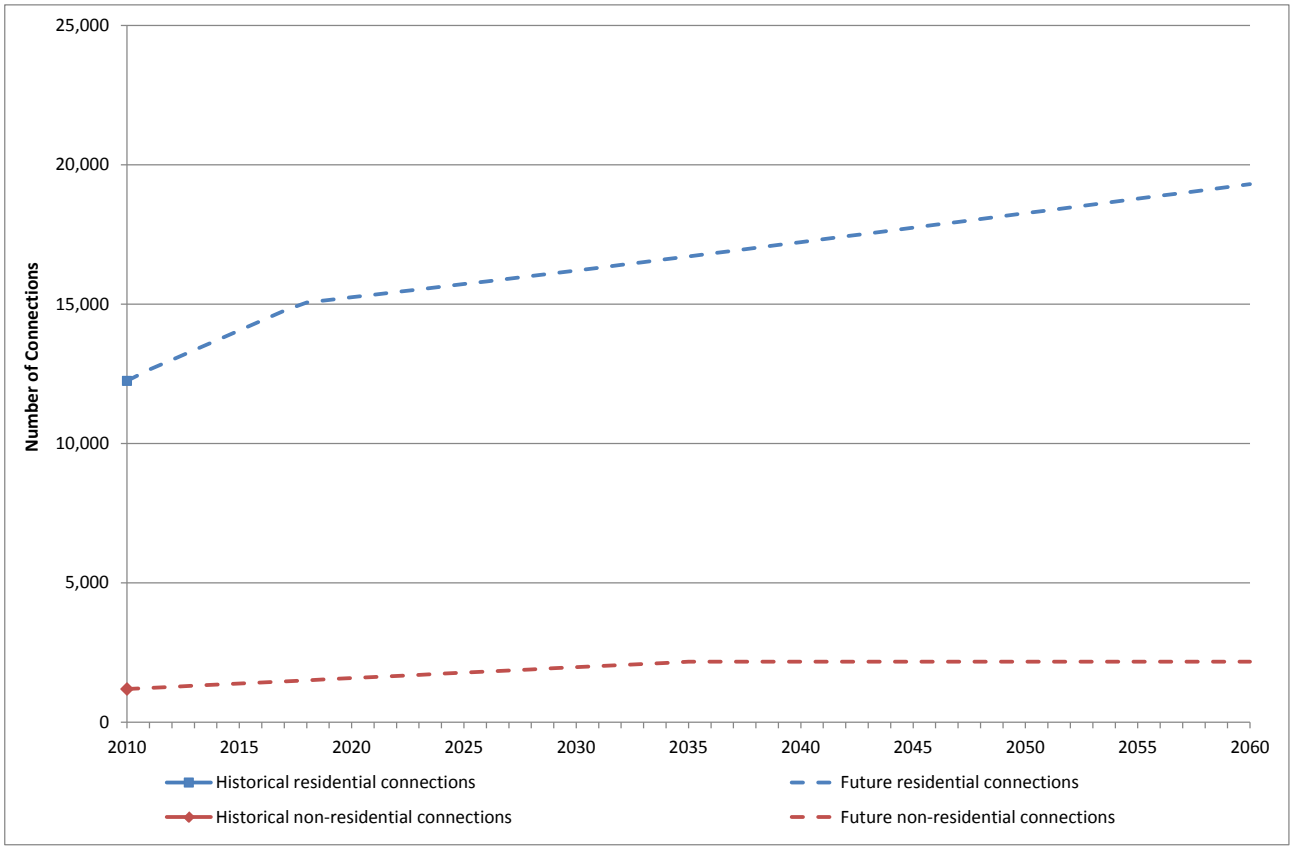


Figure 16: Future Residential and Non-residential Connections – Lismore LGA bulk supply area

7.1.2 Nimbin

Analysis of the 2011 and 2006 Census data for Nimbin suggests an increase in occupied dwellings of 8.8% p.a. over the five year period with an average of 8 new single residential dwellings and 2 new multi-residential dwelling each year and an average population growth rate of 6.6% p.a. The Lismore Housing Analysis allows for potential village expansion of 360 lots. However, Council has advised that future development will be constrained by the available water resources and this development will not all be within the Nimbin water supply service area. The maximum expected service capacity is predicted to be approximately 450 equivalent tenements to be reached at 2060. This equates to a growth rate of approximately 0.7% p.a. The growth in non-residential connections is also expected to be 0.7% p.a. for the 50 year period. All growth is expected to occur in the Nimbin urban area. The number of rural water supply connections in Nimbin is expected to remain the same.

The rate of conversion to efficient households is assumed to be 1.0% p.a. between year 1 and year 25 and 0.5% p.a. between year 26 and year 50. This results in conversion of 30% of the existing non-BASIX houses to “efficient” houses over the 50 year period.

The resulting number of connections in each 10 year period is given in Table 18 and Figure 17.

Table 18: Future Connections – Nimbin

Connection Type	2010	2020	2030	2040	2050	2060
BASIX single residential	41	85	113	138	160	183
BASIX multi-residential	3	7	9	11	13	15
Non-BASIX single residential	118	89	80	73	69	65
Non-BASIX multi-residential	10	7	7	6	6	6

Connection Type	2010	2020	2030	2040	2050	2060
Rural residential	75	75	75	75	75	75
Total Residential Connections	247	263	283	303	323	343
Non-Residential connections	68	72	77	82	87	94
Total Connections	315	335	360	385	410	437
Water supply area growth (total connections) % p.a.	-	0.74%	0.70%	0.66%	0.63%	0.60%

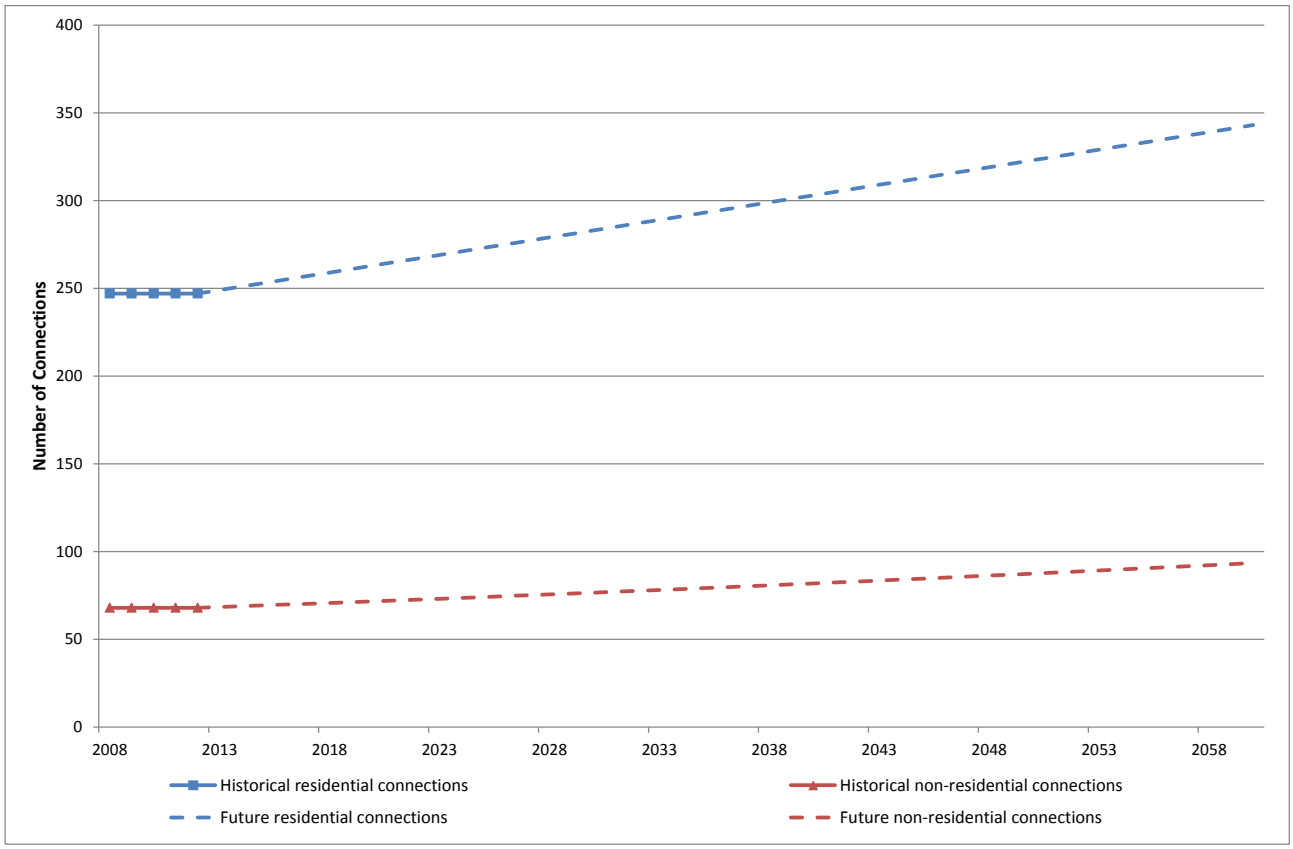


Figure 17: Future Residential and Non-residential Connections – Nimbin

7.2 Predicted Future Demand

7.2.1 Rous Water Bulk Supply Area

The predicted demand for each 10 year period is given in Table 19 and Figure 18. These figures are taken directly from the Rous Water Future Water Strategy Demand Forecast (Hydrosphere Consulting, 2012b).

The bulk water supplied by Rous Water in 2010/11 and 2011/12 was lower than forecast.

Table 19: Future Demand – Lismore LGA Bulk Supply Area (kL/a)

Connection Type	2010	2020	2030	2040	2050	2060
BASIX single residential	48,655	493,118	701,276	869,336	1,005,532	1,138,325
BASIX multi-residential	9,103	121,162	185,788	247,335	306,357	365,174
Non-BASIX single residential	1,971,663	1,738,616	1,533,115	1,393,496	1,298,967	1,210,851

Connection Type	2010	2020	2030	2040	2050	2060
Non-BASIX multi-residential	175,438	158,663	143,492	133,082	126,576	120,387
Non-Residential connections	799,914	1,062,831	1,325,748	1,457,207	1,457,207	1,457,207
Total customer consumption	3,004,773	3,574,390	3,889,419	4,100,455	4,194,638	4,291,944
Unmetered Water	392,122	463,514	504,366	531,733	543,946	556,564
Unmetered Water (%)	16%	11%	11%	11%	11%	11%
Total bulk water supplied	3,396,894	4,037,904	4,393,785	4,632,188	4,738,584	4,848,508

Source: Hydrosphere Consulting (2012b)

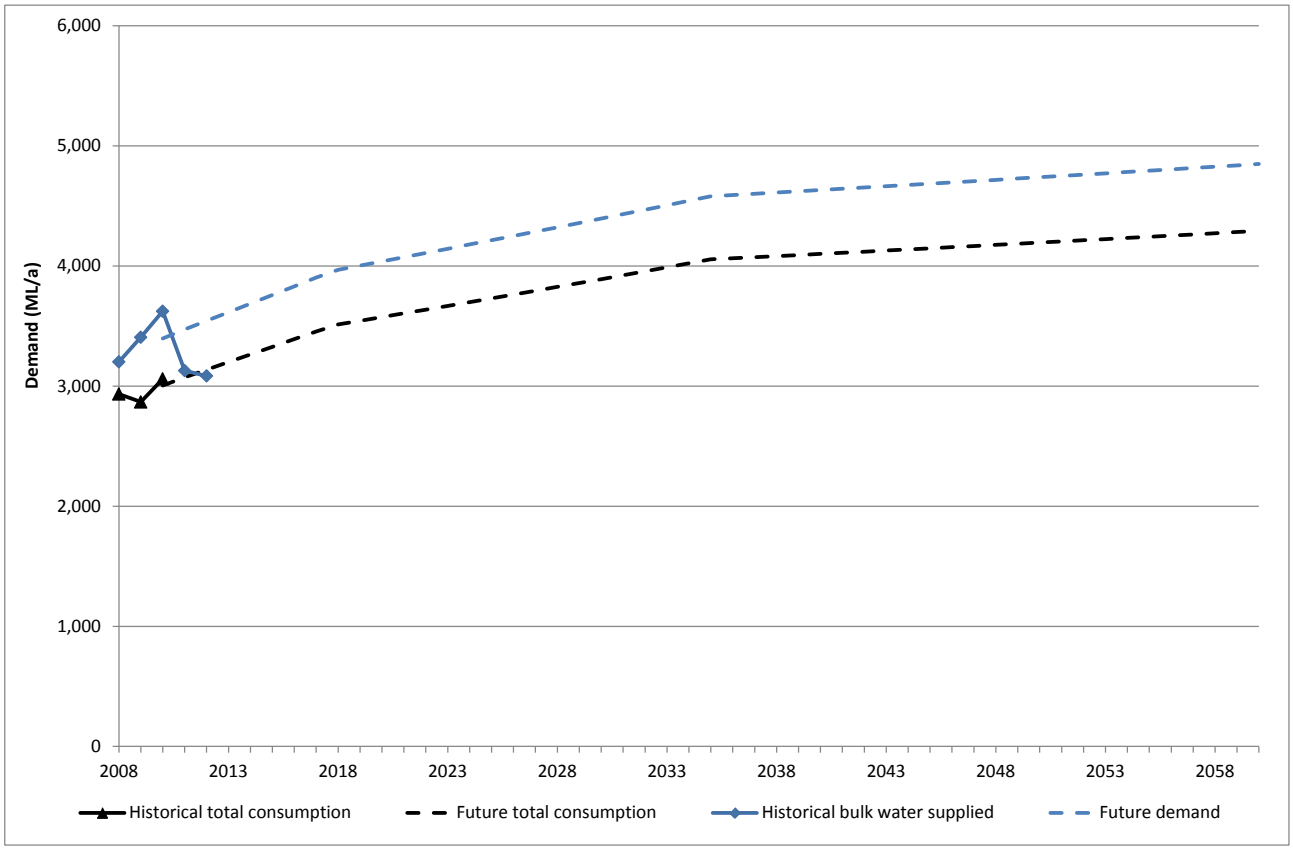


Figure 18: Future Demand - Lismore LGA bulk supply area

The unmetered water is for the distribution system only (i.e. not including bulk supply losses from Rous Water.

7.2.2 Nimbin

All BASIX connections in the Nimbin urban area are assumed to have the same per connection consumption as those for the Rous Water bulk supply area as follows (Hydrosphere Consulting, 2012b):

- BASIX single residential connections: 138 kL/connection/a; and
- BASIX multi-residential connections: 99 kL/connection/a.

Using the historical consumption data and average consumption per residential connection from Interim Report 1, the consumption per connection for non-BASIX connections has been calculated as follows:

- Non-BASIX single residential connections: 157 kL/connection/a; and
- Non-BASIX multi-residential connections: 120 kL/connection/a.

The average consumption for rural residential connections is 166 kL/connection/a and the average consumption for non-residential connections from Interim Report 1 is 314 kL/connection/a.

The predicted demand for each 10 year period is given in Table 20 and Figure 19. As discussed in Interim Report 1, raw water flows from the river to DE Williams dam and is recycled through the dam to improve dam turnover and water quality. Raw water extraction is therefore significantly higher than customer demand. It is expected that the planned modifications to the Nimbin water supply to improve water quality will resolve these operational issues and significant volumes of water will not be required in future for dam turnover. The future demand is presented as the customer demand plus 10% unmetered water.

The predicted demand for each 10 year period is given in Table 20 and Figure 19.

Table 20: Future Demand – Nimbin (kL/a)

Connection Type	2010	2020	2030	2040	2050	2060
BASIX single residential	5,691	11,679	15,487	18,923	22,057	25,162
BASIX multi-residential	337	687	907	1,105	1,285	1,464
Non-BASIX single residential	20,156	13,938	12,491	11,468	10,791	10,146
Non-BASIX multi-residential	1,268	883	798	740	704	670
Rural residential	14,717	12,466	12,466	12,466	12,466	12,466
Non-Residential	20,993	22,648	24,224	25,910	27,715	29,647
Total customer consumption	63,162	62,301	66,372	70,612	75,018	79,555
Unmetered Water	7,018	6,922	7,375	7,846	8,335	8,839
Unmetered Water (%)	10%	10%	10%	10%	10%	10%
Total raw water extraction	70,180	69,223	73,747	78,458	83,353	88,395

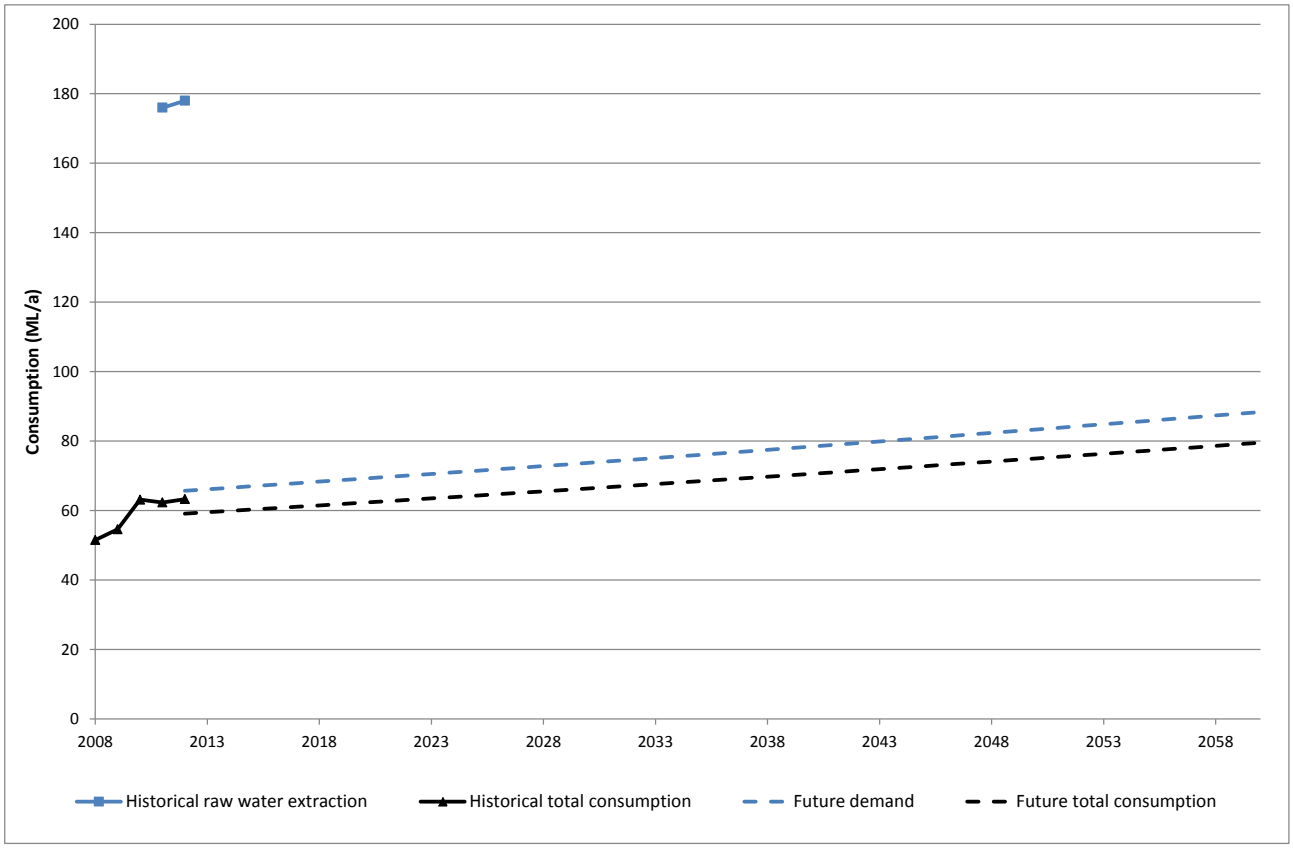


Figure 19: Future Demand - Nimbin

8. RICHMOND VALLEY COUNCIL

8.1 Predicted Connection Growth

The following data have been considered in the estimation of future water supply connections for Richmond Valley Council water supply systems:

- Rous Water Future Water Strategy Demand Forecast; and
- ABS Census data (2006 and 2011) for Casino Urban Centre/Locality.

The approach used for each water supply system is discussed in the relevant sections below.

8.1.1 Rous Water Bulk Supply Area

The number of connections in each 10 year period is given in Table 21 and Figure 20. These figures are taken directly from the Rous Water Future Water Strategy Demand Forecast (Hydrosphere Consulting, 2012b). The major data sources were the sewerage strategies for Woodburn and Evans Head which provided the projected number of equivalent tenements in each area to 2050 and Broadwater development projection scenarios prepared for a 2011 review of the sewerage scheme design. The major effect on growth is the development of the major future land releases (assumed to occur between 2015 and 2050) but the timing of these is dependent on development applications and market forces.

Table 21: Future Connections – RVC LGA Bulk Supply Area

Connection Type	2010	2020	2030	2040	2050	2060
BASIX single residential	92	283	450	566	651	696
BASIX multi-residential	24	487	928	1,194	1,449	1,683
Non-BASIX single residential	116	771	1,379	1,760	2,100	2,379
Non-BASIX multi-residential	1,574	1,243	959	794	657	526
Total Residential Connections	2,300	2,565	2,837	3,016	3,197	3,324
Non-Residential connections	267	300	334	334	334	334
Total Connections	2,567	2,865	3,170	3,350	3,530	3,658
Rous Water supply area growth (total connections) % p.a.	0.43%	1.4%	0.67%	0.54%	0.52%	0.35%

Source: Hydrosphere Consulting (2012b)

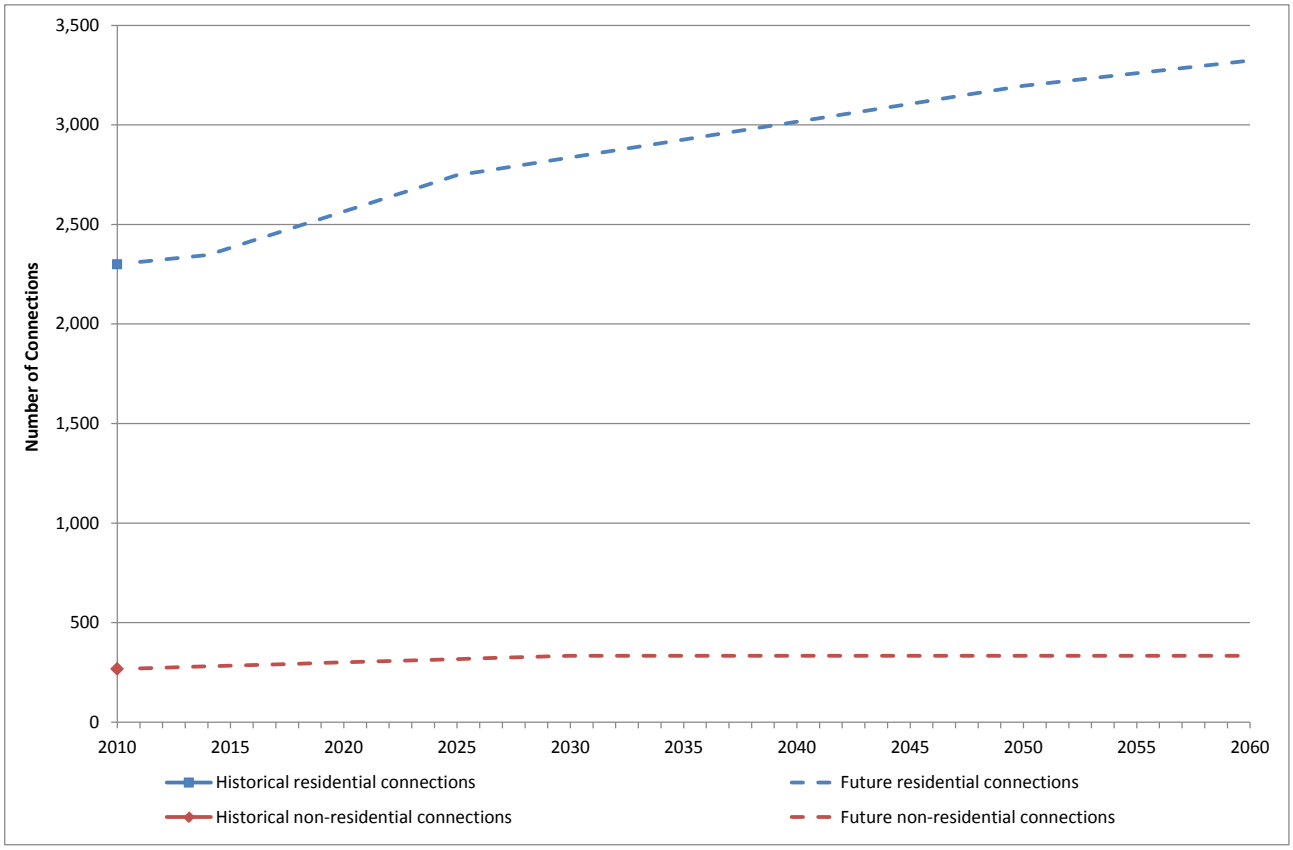


Figure 20: Future Residential and Non-residential Connections – RVC LGA bulk supply area

8.1.2 Casino

Analysis of the 2011 and 2006 Census data for Casino suggests an increase in occupied dwellings of 0.42% p.a. over the five year period with a reduction in single residential dwellings of 5 per year and 24 new multi-residential dwellings each year and an average population growth rate of 0.48% p.a. The connections data provided by Richmond Valley Council suggests the residential connection growth between 2008 and 2012 was 1.3% p.a. with an average of 21 new single residential dwellings and 29 new multi-residential dwellings per year. This rate of new dwellings has been adopted for this report and is assumed to continue for the 50 year period.

The growth in non-residential connections is expected to be 0.48% p.a. for the 50 year period. The number of Food Producer connections is expected to remain constant.

The rate of conversion to efficient households is assumed to be 1.0% p.a. between year 1 and year 50. This results in conversion of 39% of the existing non-BASIX houses to “efficient” houses over the 50 year period.

The resulting number of connections in each 10 year period is given in Table 22 and Figure 21.

Table 22: Future Connections – Casino

Connection Type	2010	2020	2030	2040	2050	2060
BASIX single residential	34	262	470	677	885	1,092
BASIX multi-residential	6	271	556	841	1,126	1,411
Non-BASIX single residential	3,543	3,079	2,785	2,519	2,278	2,060
Non-BASIX multi-residential	383	585	529	478	432	391
Total Residential Connections	3,966	4,197	4,339	4,515	4,721	4,954

Connection Type	2010	2020	2030	2040	2050	2060
Non-Residential connections	459	471	494	518	543	570
Total Connections	4,425	4,557	4,597	4,752	4,997	5,257
Water supply area growth (total connections) % p.a.	0.29%	0.3%	0.38%	0.43%	0.47%	0.49%

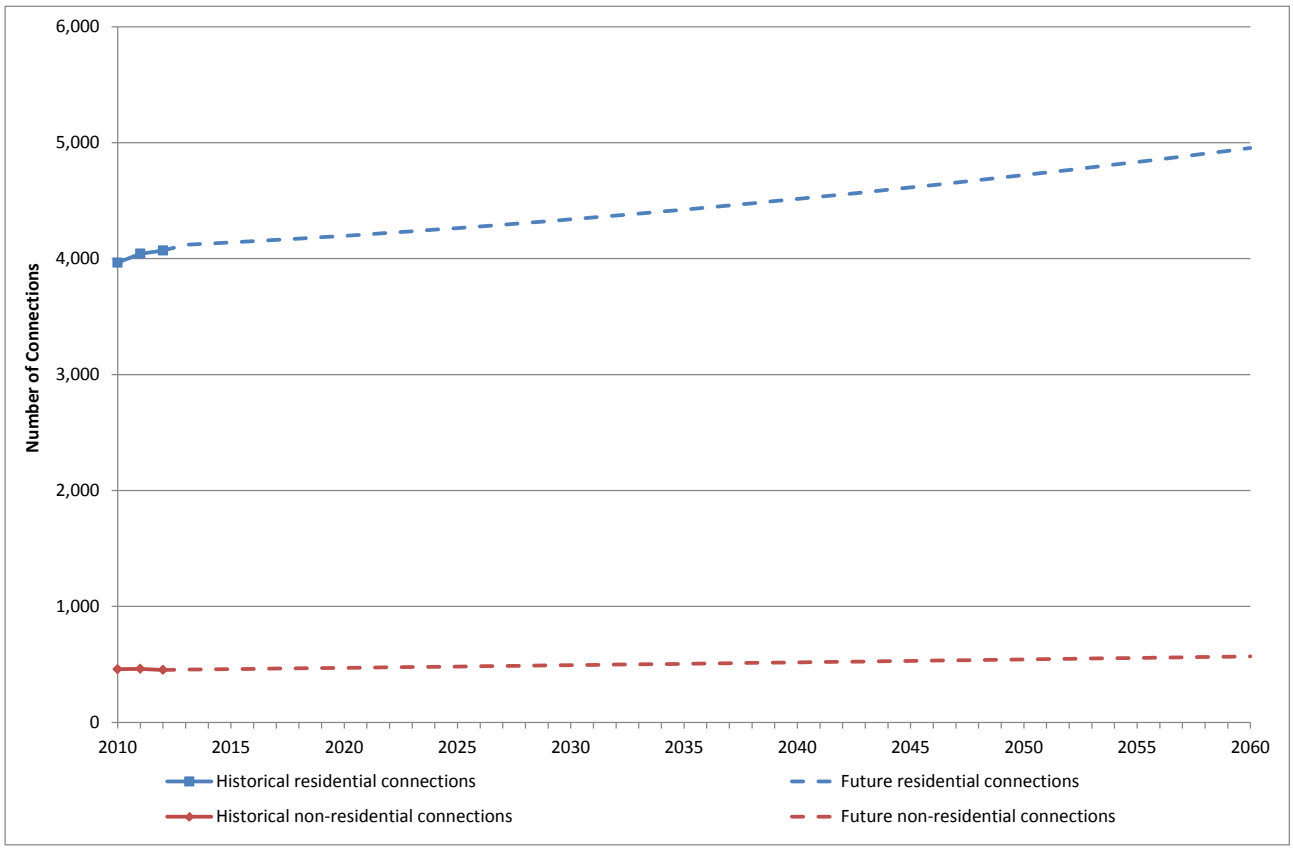


Figure 21: Future Residential and Non-residential Connections – Casino

8.2 Predicted Future Demand

8.2.1 Rous Water Bulk Supply Area

The predicted demand for each 10 year period is given in Table 23 and Figure 22. These figures are taken directly from the Rous Water Future Water Strategy Demand Forecast (Hydrosphere Consulting, 2012b).

Table 23: Future Demand – RVC LGA Bulk Supply Area (kL/a)

Connection Type	2010	2020	2030	2040	2050	2060
BASIX single residential	12,655	38,921	61,945	77,815	89,513	95,759
BASIX multi-residential	2,368	48,144	91,701	117,939	143,093	166,224
Non-BASIX single residential	282,533	223,100	172,108	142,407	117,918	94,399
Non-BASIX multi-residential	74,626	67,490	61,037	56,609	53,841	51,209
Non-Residential connections	174,288	196,074	217,860	217,860	217,860	217,860
Total customer consumption	546,470	573,729	604,651	612,629	622,225	625,451

Connection Type	2010	2020	2030	2040	2050	2060
Unmetered Water	104,834	111,442	117,448	118,998	120,862	121,489
Unmetered Water (%)	16%	16%	16%	16%	16%	16%
Total bulk water supplied	651,303	685,171	722,099	731,627	743,086	746,940

Source: Hydrosphere Consulting (2012b)

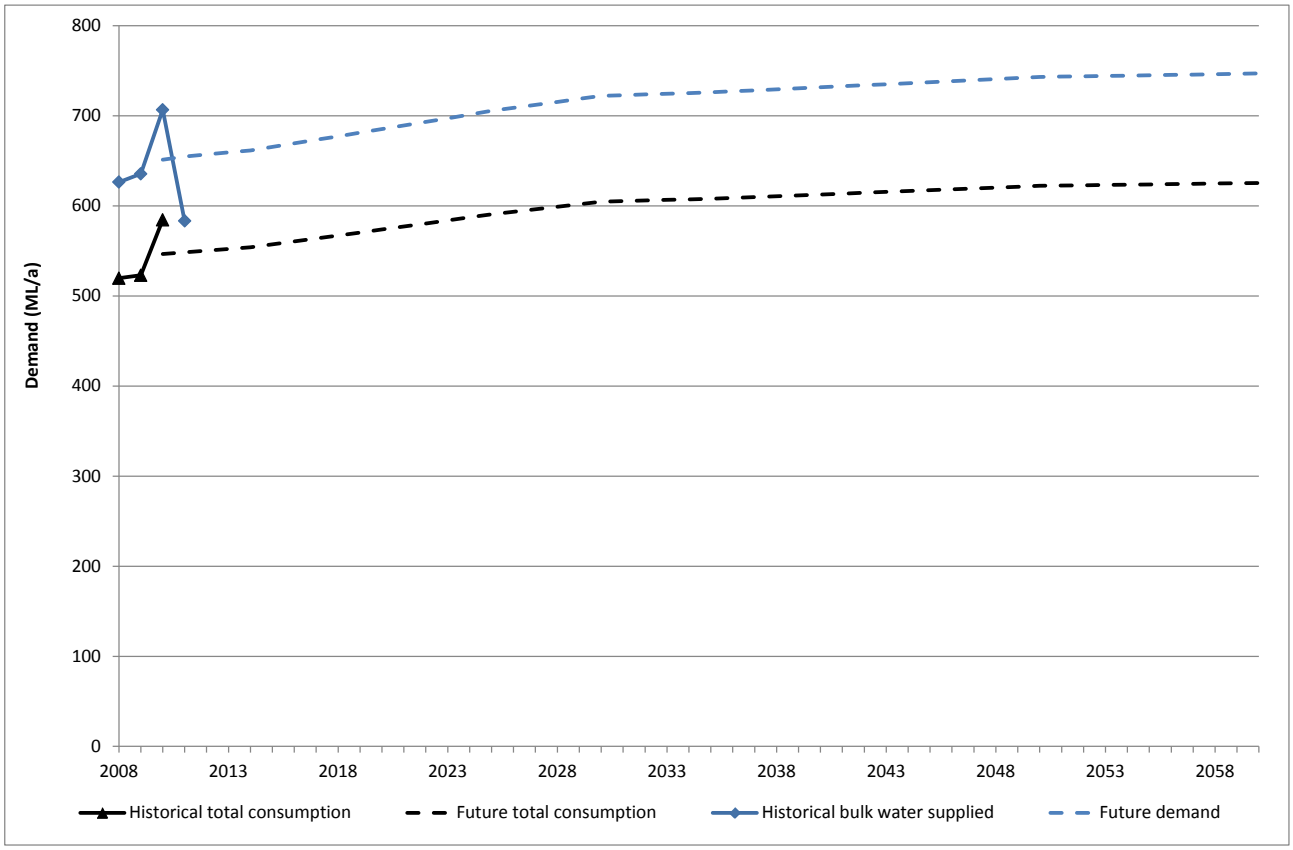


Figure 22: Future Demand - RVC LGA bulk supply area

The unmetered water is for the distribution system only (i.e. not including bulk supply losses from Rous Water.

8.2.2 Casino

All BASIX connections in the Casino service area are assumed to have the same per connection consumption as those for the Rous Water bulk supply area as follows (Hydrosphere Consulting, 2012b):

- BASIX single residential connections: 138 kL/connection/a; and
- BASIX multi-residential connections: 99 kL/connection/a.

Using the historical consumption data and average consumption per residential connection from Interim Report 1, the consumption per connection for non-BASIX connections has been calculated as follows:

- Non-BASIX single residential connections: 202 kL/connection/a; and
- Non-BASIX multi-residential connections: 137 kL/connection/a.

The average consumption for non-residential connections (excluding Food Producers) is 666 kL/connection/a. Food Producer consumption is approximately 207,000 kL/a.

The predicted demand for each 10 year period is given in Table 24 and Figure 23.

Table 24: Future Demand – Casino (kL/a)

Connection Type	2010	2020	2030	2040	2050	2060
BASIX single residential	4,623	36,047	64,581	93,114	121,647	150,181
BASIX multi-residential	630	26,747	54,895	83,043	111,191	139,339
Non-BASIX single residential	745,300	621,169	561,774	508,058	459,479	415,544
Non-BASIX multi-residential	87,949	79,904	72,264	65,354	59,105	53,454
Non-Residential	1,368,440	1,344,266	1,359,560	1,375,608	1,392,449	1,410,121
Total customer consumption	2,206,942	2,108,133	2,113,073	2,125,178	2,143,872	2,168,639
Unmetered Water	253,125	234,332	234,881	236,226	238,304	241,057
Unmetered Water (%)	10.3%	10.0%	10.0%	10.0%	10.0%	10.0%
Total raw water extraction	2,460,067	2,342,465	2,347,954	2,361,404	2,382,176	2,409,696

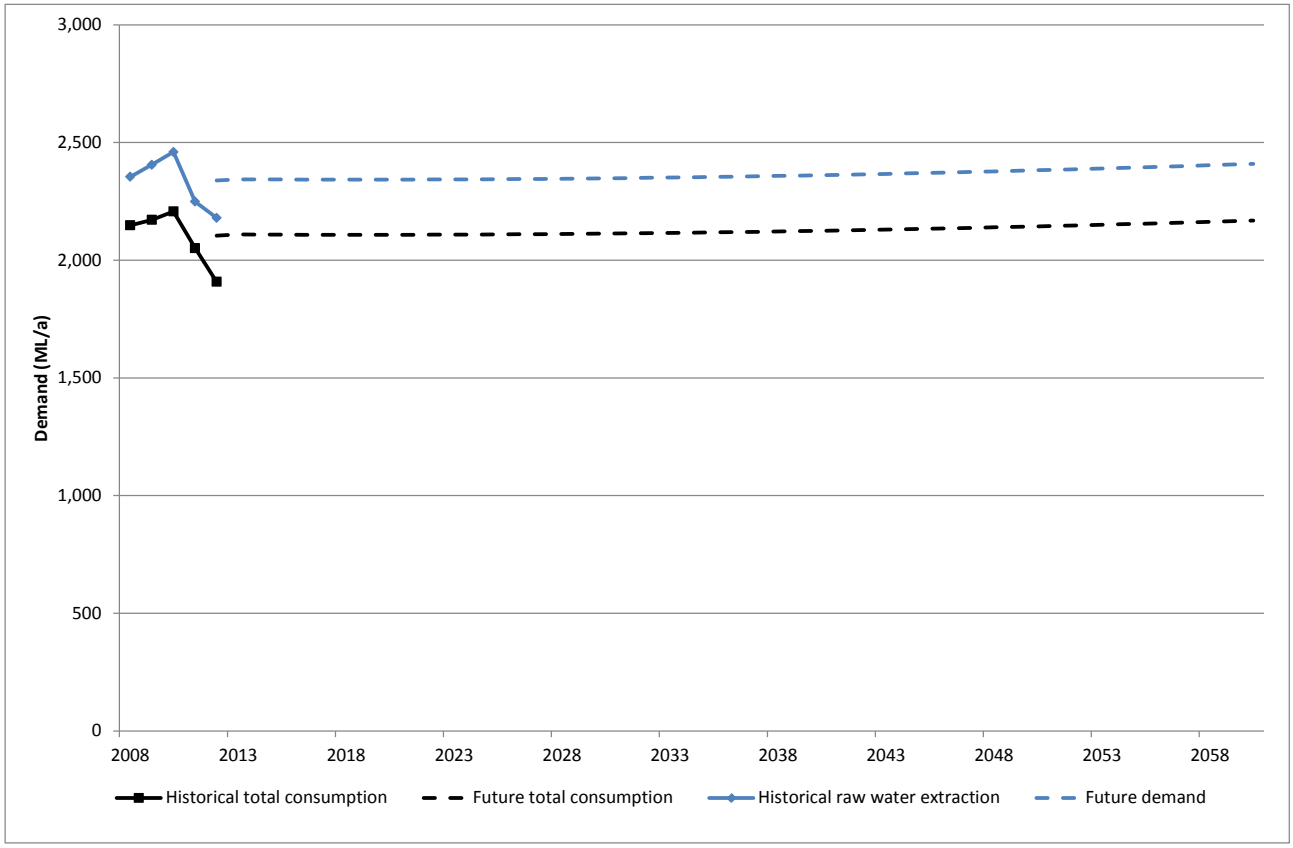


Figure 23: Future Demand – Casino

Data on the contribution of treatment losses and distribution system losses to the total unmetered water is not available for Casino water supply.

9. TWEED SHIRE COUNCIL

9.1 Predicted Connection Growth

The following data have been considered in the estimation of future water supply connections for Tweed Shire Council water supply systems:

- Tweed Integrated Water Cycle Management (IWCM) Strategy Six Year Review Background Paper (Hydrosphere Consulting, 2012a);
- Tweed Urban and Employment Land Release Strategy (2009); and
- ABS Census data (2006 and 2011) for Tyalgum and Uki Urban Centres/Localities.

The approach used for each water supply system is discussed in the relevant sections below.

9.1.1 Uki

Analysis of the 2011 and 2006 Census data for Uki suggests that growth over the last 5 years has been negligible. In addition, the Tweed Urban and Employment Land Release Strategy does not identify any future land development for Uki. Therefore it has been assumed that the number of water supply connections in Uki will remain constant at 173 residential connections and 7 non-residential connections (refer Interim Report 1).

9.1.2 Tweed District

The Tweed IWCM Strategy Six Year Review Background Paper provides data on predicted future population served with water supply in the shire. Tweed Shire Council is currently updating the long-term population forecasts for the Tweed although these will not be available for this project. Potential future growth scenarios to 2041 from the IWCM Background Paper are presented in Figure 24. This figure shows:

- The historical population served with water supply (the blue line);
- A 30 year forecast based on the actual rate of growth (1.3% p.a.) experienced between 2006 and 2011 (the red line);
- The population forecasts assumed in the Demand Management Strategy (the purple line); and
- An increased growth rate (average 2.2% p.a. of 30 years) which assumes the 2031 population previously predicted by Council will still be realised (the green line).

For the IWCM Strategy review, Tweed Shire Council has adopted the population forecast represented by the green line (representing a growth rate higher than currently experienced). Council's current estimate for the ultimate shire population is 180,000 people (or approximately 172,000 people served by the Bray Park water supply). For the purposes of this report, the ultimate population is assumed to be reached at 2060 and growth between the 2041 population and the ultimate population is assumed to be linear. The number of future residential water supply connections has been calculated from the average historical occupancy ratio for 2008 to 2012. The number of non-residential water supply connections is assumed to grow at the same rate as the population growth.

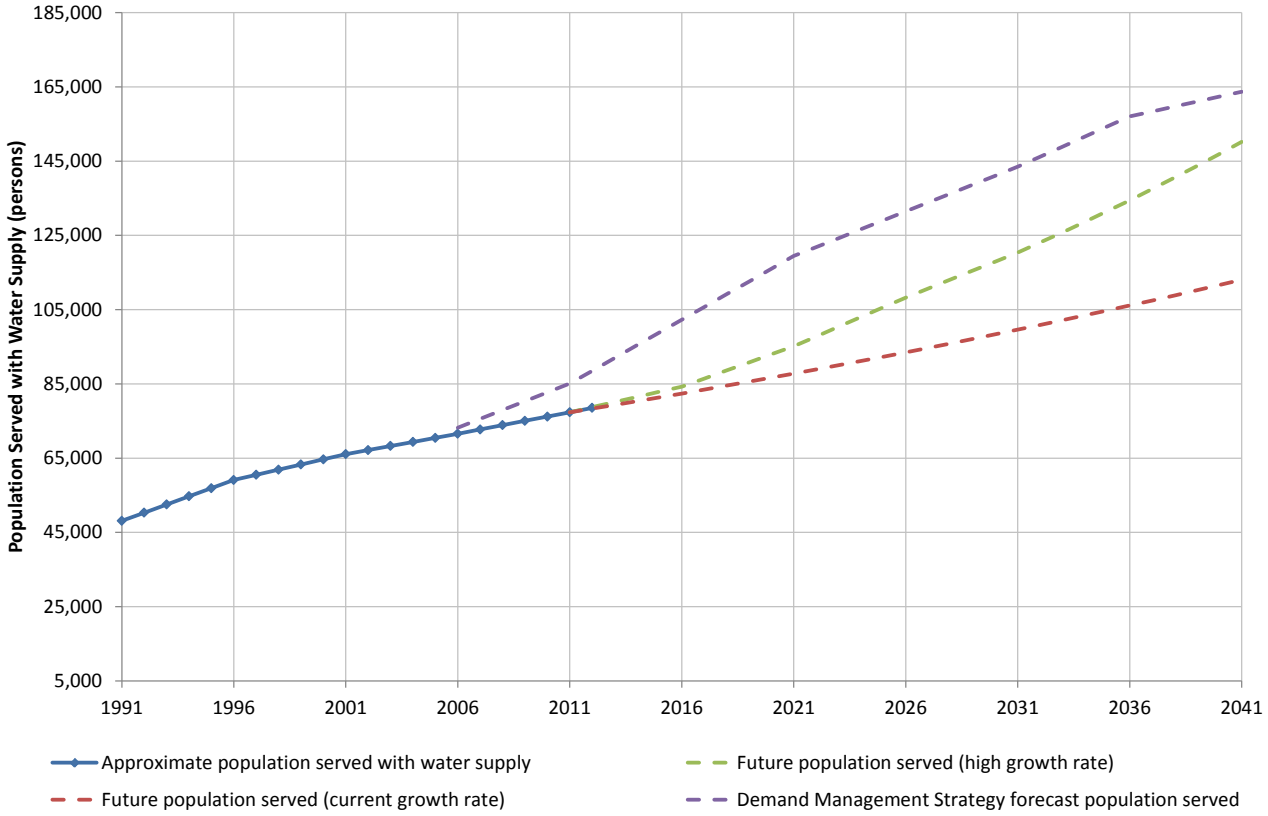


Figure 24: Comparison of Population Forecasts – Population Served by Bray Park Water Supply

Source: Hydrosphere Consulting (2012a)

The resulting number of residential and non- connections in each 10 year period is given in Table 25 and Figure 25.

Table 25: Future Connections – Tweed District

Connection Type	2010	2020	2030	2040	2050	2060
Residential connections	31,007	38,312	48,662	60,661	66,345	71,147
Non-Residential connections	1,941	2,016	2,560	3,191	3,489	3,734
Total Connections	32,948	40,327	51,222	63,852	69,831	74,881
Water supply area growth (total connections) % p.a.	0.6%	2.4%	2.1%	2.2%	0.7%	0.7%

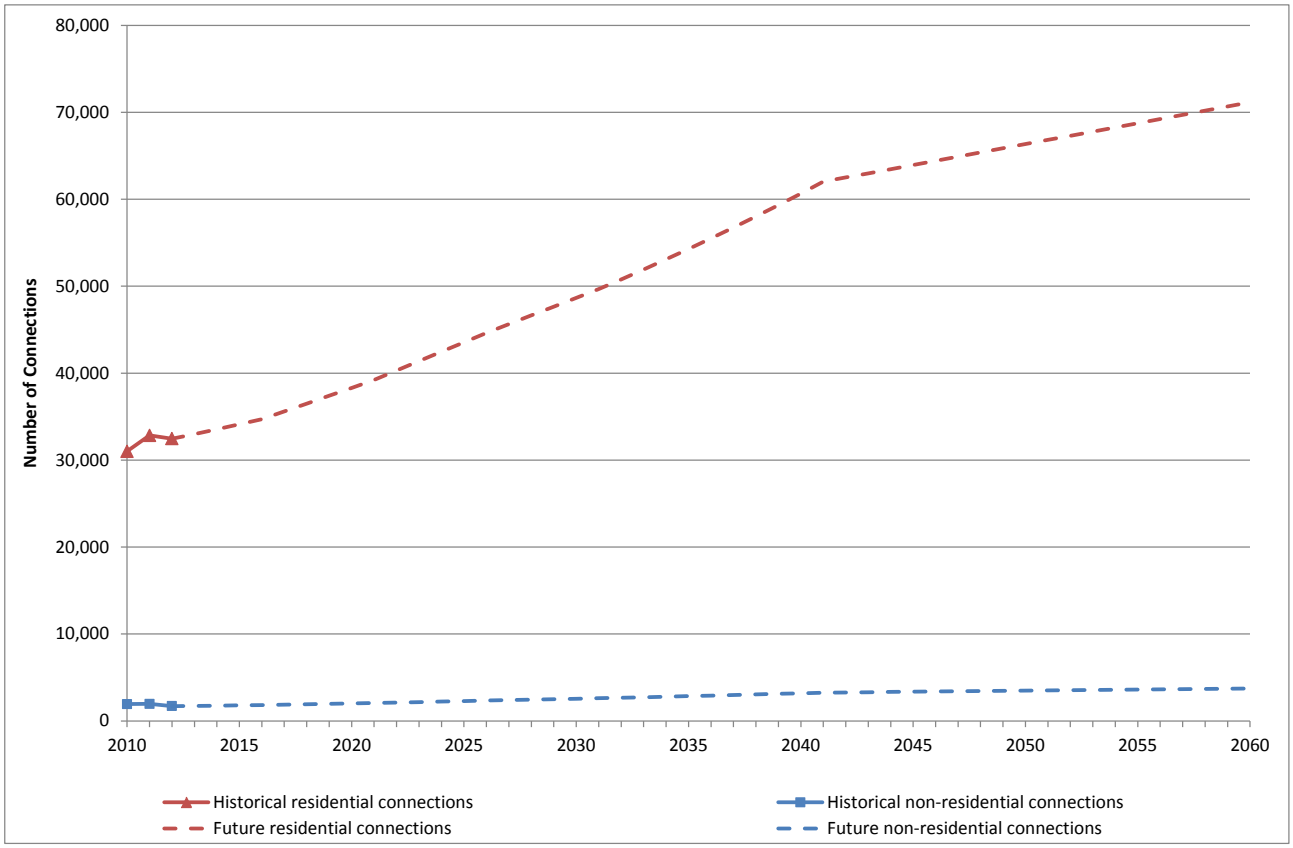


Figure 25: Future Residential and Non-residential Connections – Tweed District

9.1.3 Tyalgum

Analysis of the 2011 and 2006 Census data for Tyalgum suggests an increase in occupied dwellings of 2.3% p.a. with 2 new single residential dwellings over the 5 year period and population growth of 2.0% p.a. This growth rate has been adopted for this report and is assumed to continue for the 50 year period. The Census data suggests all dwellings in Tyalgum are single residential.

The growth in non-residential connections is expected to be 2.0% p.a.

The rate of conversion to efficient households is assumed to be 1.0% p.a. between year 1 and year 25 and 0.5% p.a. between year 26 and year 50. This results in conversion of 30% of the non-BASIX houses to "efficient" houses over the 50 year period.

The resulting number of connections in each 10 year period is given in Table 26 and Figure 26.

Table 26: Future Connections – Tyalgum

Connection Type	2010	2020	2030	2040	2050	2060
BASIX single residential	5	30	56	80	101	122
BASIX multi-residential	0	0	0	0	0	0
Non-BASIX single residential	90	83	75	70	66	63
Non-BASIX multi-residential	0	0	0	0	0	0
Total Residential Connections	96	113	131	149	167	185
Non-Residential connections	14	18	21	26	32	39
Total Connections	110	131	153	176	199	224

Connection Type	2010	2020	2030	2040	2050	2060
Water supply area growth (total connections) % p.a.	-	1.7%	1.5%	1.3%	1.2%	1.2%

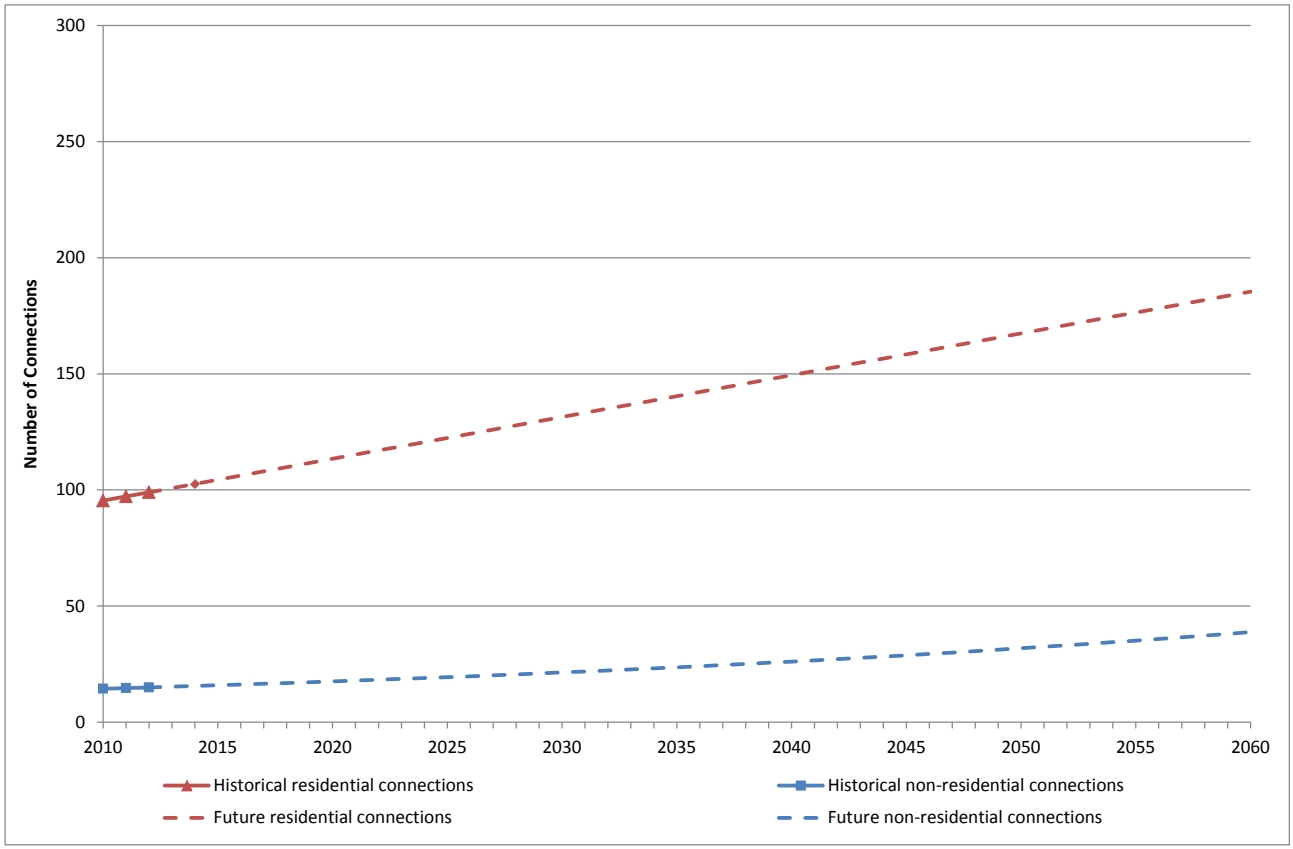


Figure 26: Future Residential and Non-residential Connections – Tyalgum

9.2 Predicted Future Demand

9.2.1 Uki

As the number of water supply connections in Uki is expected to remain constant, there is not expected to be any significant change in the water demand. A slight decrease may be experienced with conversion of non-efficient connections to efficient connections. The customer consumption is expected to be 43 ML/a with unmetered water at 17% of raw water extraction (refer Interim Report 1). Raw water extraction is expected to be 52 ML/a.

9.2.2 Tweed District

Tweed Shire Council has adopted a target water demand of 300 L/person/day based on total WTP production with the current demand at approximately 316 L/person/day. For the purposes of estimating long-term demand, it has been assumed that this target will be achieved in the short-term and maintained over the 50 year period.

The predicted demand for each 10 year period is given in Table 27 and Figure 27.

Table 27: Future Demand – Tweed District (kL/a)

Connection Type	2010	2020	2030	2040	2050	2060
Total customer consumption	8,378,715	8,589,235	10,907,815	13,594,900	14,870,060	15,947,846

Connection Type	2010	2020	2030	2040	2050	2060
Unmetered Water	2,092,845	2,145,429	2,724,566	3,395,750	3,714,260	3,983,471
Unmetered Water (%)	20%	20%	20%	20%	20%	20%
Total raw water extraction	10,471,560	10,734,663	13,632,381	16,990,650	18,584,320	19,931,317

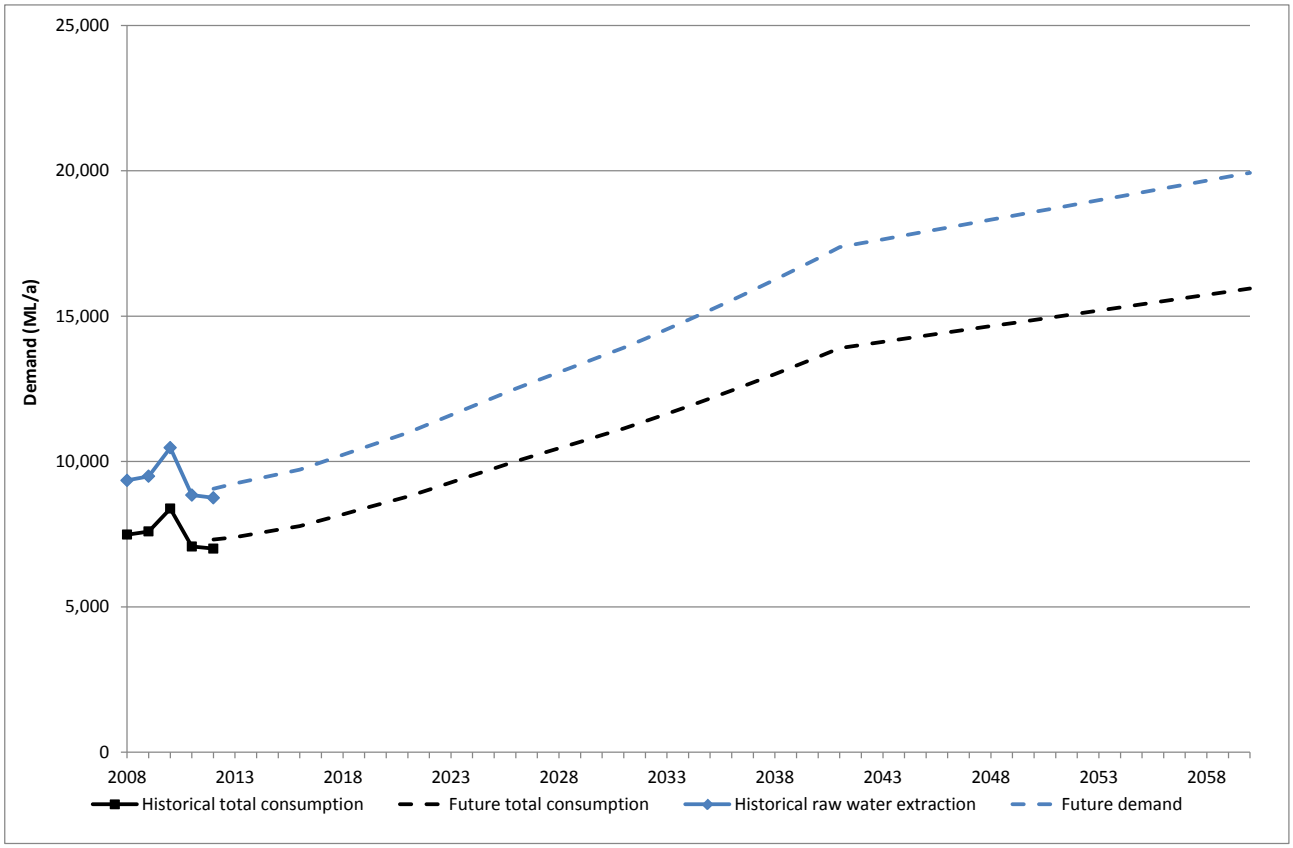


Figure 27: Future Demand – Tweed District

The unmetered water for the Tweed district is made up of approximately 14% distribution system losses (non-revenue water) and 6% treatment losses.

9.2.3 Tyalgum

Tweed Shire Council has provided Tyalgum consumption data for 2012 (Interim Report 1) and this suggests that unmetered water in 2012 was 1% p.a. This level of unmetered is not considered appropriate for the long-term demand forecast and 10% unmetered water has been adopted for the 50 year period.

All BASIX connections in the Tyalgum service area are assumed to have the same per connection consumption as those for the Rous Water bulk supply area (BASIX single residential connections: 138 kL/connection/a). Using the historical consumption data and average consumption per residential connection from Interim Report 1, the consumption per connection for non-BASIX single residential connections has been calculated as 186 kL/connection/a. The average consumption for non-residential connections from Interim Report 1 is 678 kL/connection/a.

The predicted demand for each 10 year period is given in Table 28 and Figure 28.

Table 28: Future Demand – Tyalgum (kL/a)

Connection Type	2010	2020	2030	2040	2050	2060
BASIX single residential	743	4,174	7,741	10,965	13,909	16,829

Connection Type	2010	2020	2030	2040	2050	2060
BASIX multi-residential	0	0	0	0	0	0
Non-BASIX single residential	17,278	15,486	14,005	12,989	12,354	11,750
Non-BASIX multi-residential	0	0	0	0	0	0
Non-Residential	9,812	11,918	14,527	17,709	21,587	26,314
Total customer consumption	27,732	31,620	36,326	41,727	47,927	54,988
Unmetered Water	N/A	3,513	4,036	4,636	5,325	6,110
Unmetered Water (%)	N/A	10%	10%	10%	10%	10%
Total raw water extraction	33,772	35,020	40,244	46,237	53,114	60,943

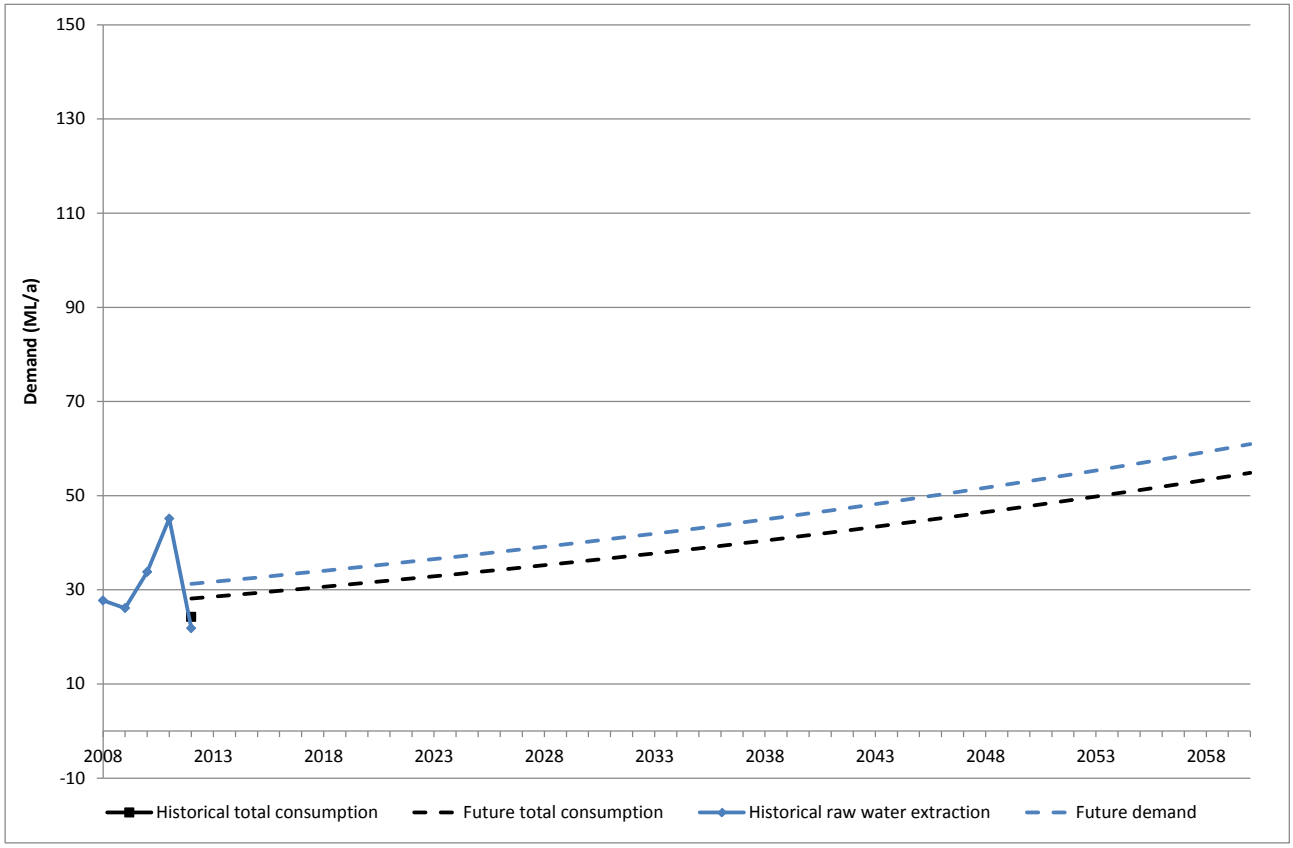


Figure 28: Future Demand – Tyalgum

10. ROUS WATER RETAIL

10.1 Predicted Connection Growth

The Rous Water Future Water Strategy Demand Forecast provides data on future water supply connections for the retail supply. The number of connections in each 10 year period is given in Table 29 and Figure 29.

Table 29: Future Connections – Retail Supply Area

Connection Type	2010	2020	2030	2040	2050	2060
Retail connections	2,180	2,425	2,653	2,850	3,044	3,238
Retail supply area growth % p.a.	1.1%	1.0%	0.85%	0.69%	0.64%	0.60%

Source: Hydrosphere Consulting (2012b)

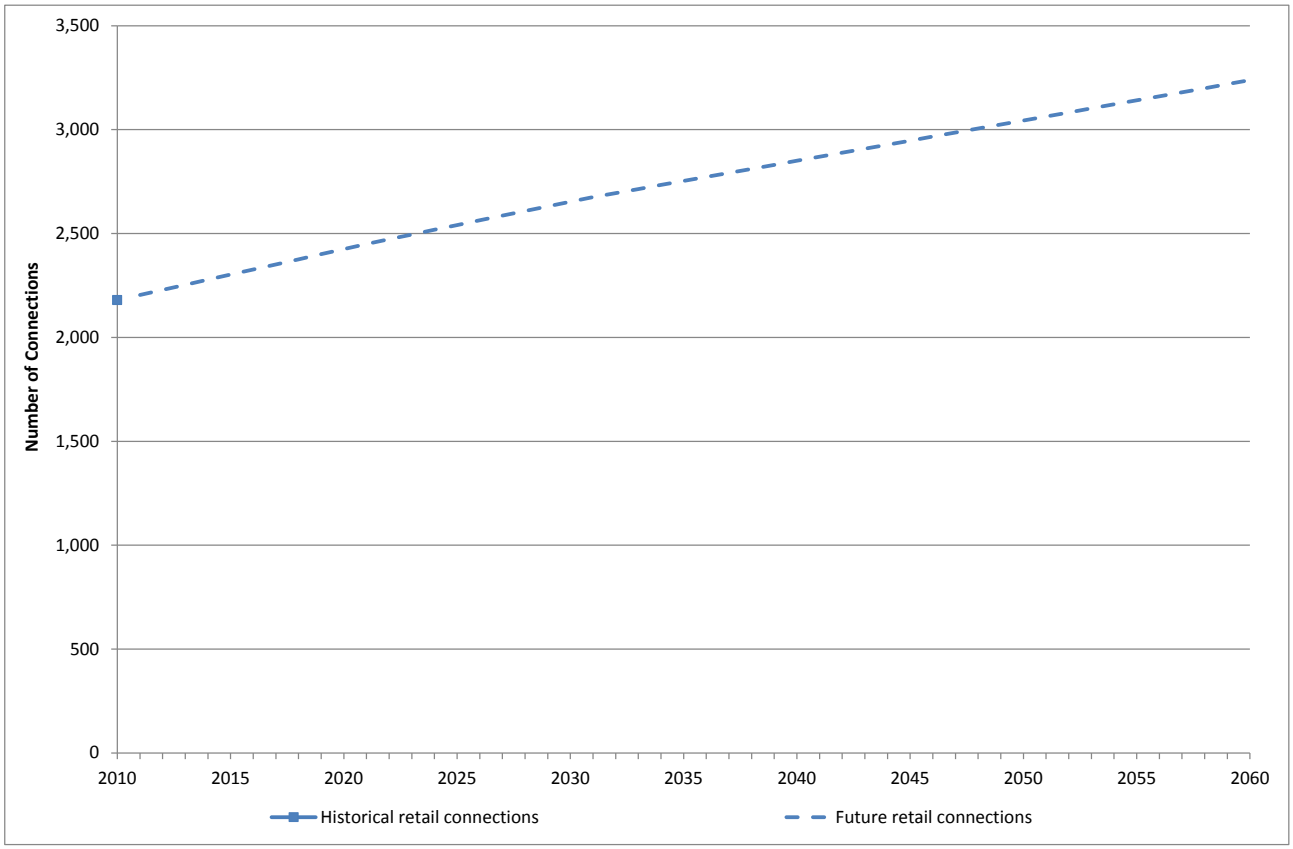


Figure 29: Future Retail Connections

10.2 Predicted Future Demand

The predicted demand for each 10 year period is given in Table 30 and Figure 30.

Table 30: Future Demand – Retail Supply Area (kL/a)

Connection Type	2010	2020	2030	2040	2050	2060
Retail Connections	739,165	822,236	899,577	966,373	1,032,152	1,097,931

Source: Hydrosphere Consulting (2012b)

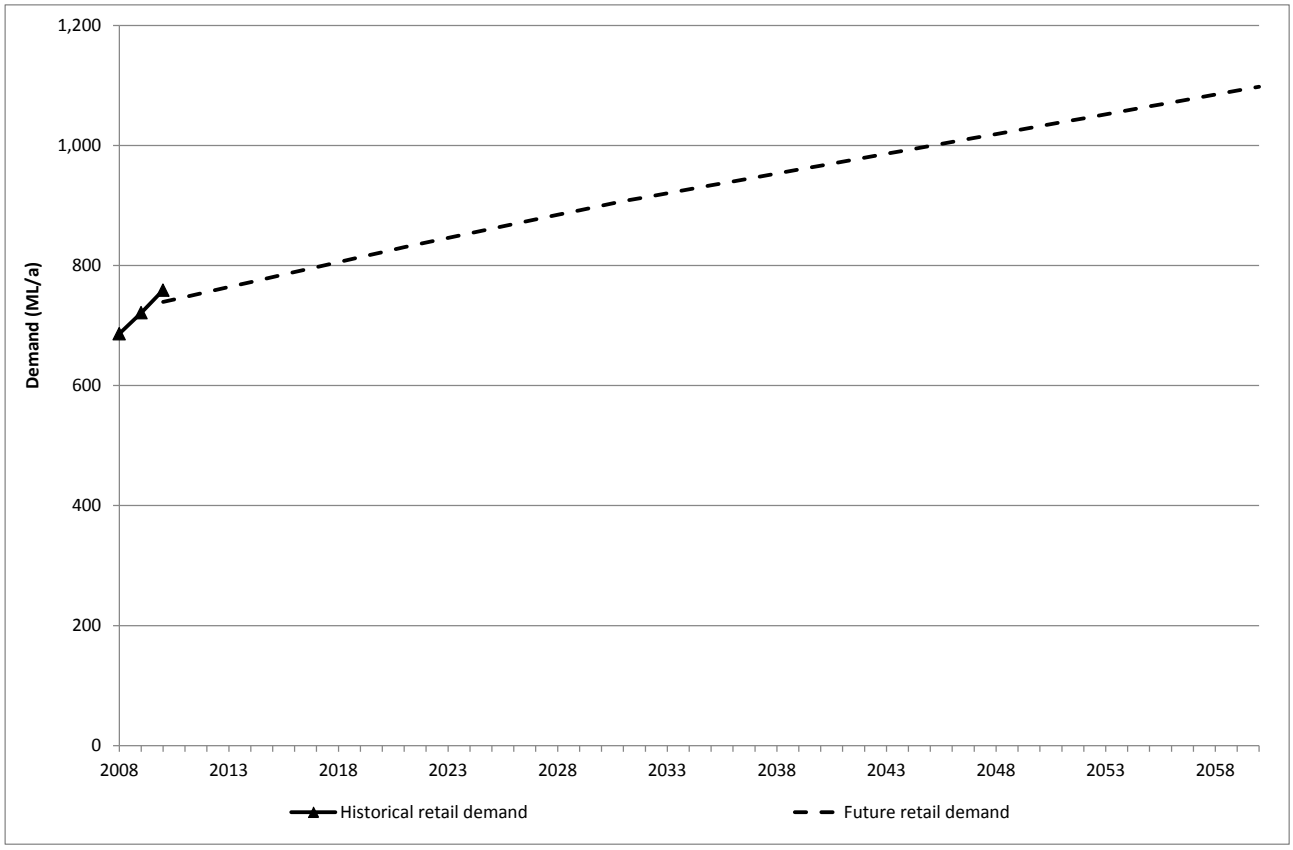


Figure 30: Future Demand – Retail supply area

11. REGION

11.1 Predicted Future Connections

The total number of future water supply connections for the region in each 10 year period is given in Table 31 and Figure 31.

Table 31: Future Connections – Region

Connection Type	2010	2020	2030	2040	2050	2060
Total Residential Connections	74,160	89,737	106,220	122,555	132,751	142,895
Retail connections	2,180	2,425	2,653	2,850	3,044	3,238
Non-Residential connections	6,883	8,321	10,218	11,866	12,877	13,848
Total Connections	83,223	100,482	119,091	137,271	148,671	159,981
Regional growth (total connections) % p.a.	-	1.8%	1.5%	1.4%	0.7%	0.7%

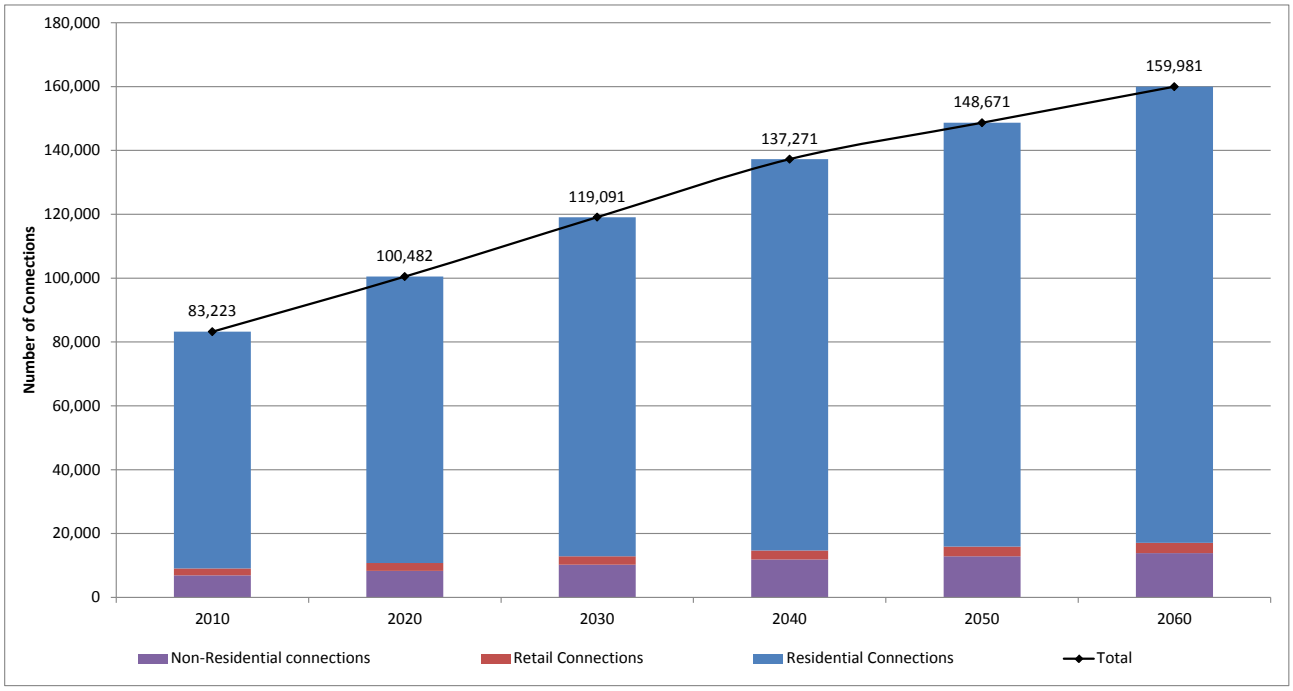


Figure 31: Future Water Supply Connections – Region

11.2 Predicted Future Demand

The predicted demand for each 10 year period is given in Table 32 and Figure 32. The demand is expected to decrease in the short term (between 2010 and 2015) due to:

- The predicted leakage savings achieved by Ballina Shire Council;
- Connection of the recycled water supply in Ballina Shire; and
- The high level of unmetered water in 2010 in the Rous Water supply area which is not expected to continue.

Table 32: Future Demand – Region (ML/a)

Connection Type	2010	2020	2030	2040	2050	2060
Total Customer Consumption	20,765	22,240	25,799	29,347	31,337	33,243
Unmetered water	4,109	4,067	4,837	5,646	6,101	6,529
Unmetered water (%)	17%	15%	16%	16%	16%	16%
Total raw water demand	24,874	26,307	30,636	34,993	37,438	39,772

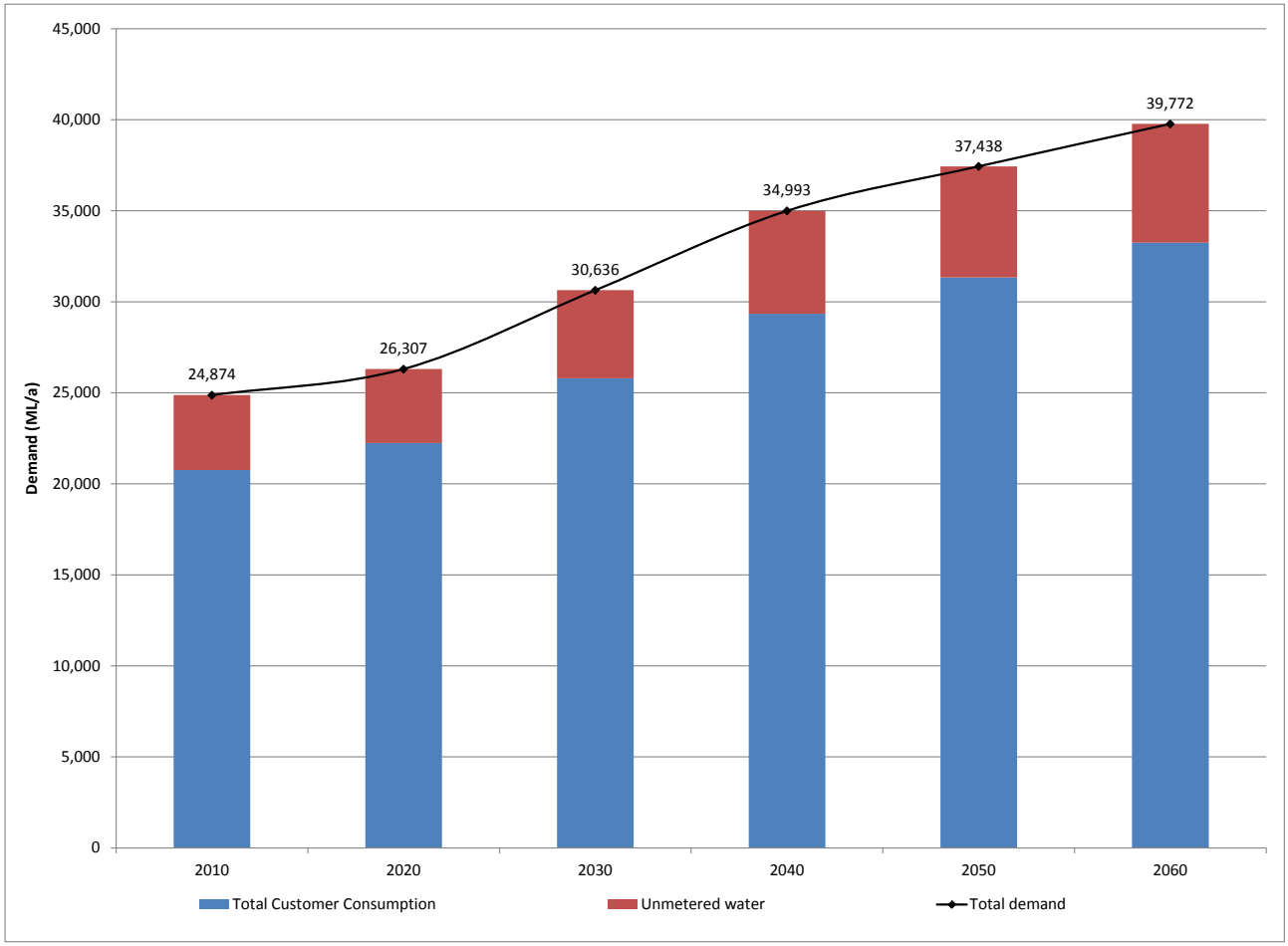


Figure 32: Future Demand – Region

12. PRIVATE WATER SUPPLIES

Interim Report 1 summarised the available data on external bulk sales (to water carters) in the region. The average external bulk sales in the study area was estimated to be less than 100 ML/a. From the available data, the maximum demand (experienced in 2009/10) was estimated to be less than 150 ML/a or <1% of current regional demand.

The potential for increased demand from private water supplies during prolonged droughts is not known. However, it would be appropriate to consider an increase in demand that may result from external sales of potable town water to fill private rainwater tanks during a drought.

The current number of residential properties and population not connected to a town water supply within the region has been estimated from the number of dwellings reported in the 2011 Census.

Table 33: Population not connected to a town water supply

Area	Dwellings (2011) [1]	Occupancy Ratio [1]	Connected Properties (2011)	Unconnected Properties (2011)	Unconnected persons (2011)
Ballina	18,024	2.4	12,999	26,143	62,743
Byron	14,455	2.4	10,091		
Kyogle	4,397	2.4	2,015		
Lismore	18,467	2.4	12,896		
Richmond Valley	10,019	2.4	6,355		
Tweed	40,084	2.4	32,743		
Rous Retail	included above	2.4	2,205		
Region	105,446		79,303		

1. ABS Census (2011)

The emergency water demand is assumed to be the minimum requirements required to satisfy basic sanitation and sustenance as follows (WHO, 2005):

- Drinking – 4 L/person/day;
- Cooking – 3 L/person/day;
- Laundry - 7 L/person/day;
- Personal hygiene - 21 L/person/day;
- Toilet - 18 L/person/day;
- Total – 53 L/person/day.

The estimated emergency demand is 3.3 ML/d assuming all unconnected properties required town water. This equates to 6% of the current average demand.

It is not expected that all of this demand would be supplied by the town water supplies in the region as:

- Some water carters will operate from neighbouring local government areas (e.g. South-east Queensland, Clarence Valley and Tenterfield Shires);
- Town water restrictions during drought may prohibit external sales of town water;

- There are limitations on the ability of the water carters to service this demand; and
- Some properties utilise bore water which may continue to be available during a drought.

When drought restrictions are in force, it is expected that town water demand would be reduced below the forecast average demand. Therefore, any short-term increased demand resulting from external sales is not expected to be significant when compared to the annual average demand. However, as the demand approaches the secure yield of the water supply systems, the increased risk of increased demand during hot, dry weather must be considered when planning for water supply augmentation.

13. FUTURE SECURE YIELD

Secure yield of a water supply system is expected to be impacted by the effects of climate change which is considered likely to reduce water supply through changes in local rainfall, evaporation, rainfall-runoff and stream-flows. Water demand reduction measures which have been effective in the past, are unlikely to lead to similar gains in the future due to demand hardening, where previous demand management measures have eliminated many of the non-essential uses of water and it is now a lot harder for water restrictions to achieve significant reductions in demand. When forecasting future supply availability, it is necessary to modify existing yields based on the expected impact of these factors.

13.1 Rous Water

13.1.1 Prediction of Future Secure Yield

The Rous Water bulk supply system was one of the 11 non-metropolitan water supplies included in a pilot study currently undertaken by NSW Office of Water to provide insights on the impacts of climate changed hydrometeorological data on water security and to develop a suitable methodology and guidelines for application by other NSW water utilities. The pilot study involved hydrological and system modelling to determine the impact of climate change on secure yield. The pilot study incorporated the scientific logic of the CSIRO's Murray Darling Basin Sustainable Yields Project which used daily historical data from 1895 to 2006 and applied the relevant global climate models (GCMs) to provide projected (~2030) climate changed data for each GCM for this period.

Climate changed daily stream flows were modelled utilising existing calibrated rainfall-runoff models with predicted daily rainfall and evapotranspiration data assuming an increase in average maximum daily temperature of 0.9°C above 1990 conditions by 2030 and an increase of 2°C by 2060. Climate changed secure yields were determined from water supply system simulation models using the daily climate changed stream flows, rainfall and evapotranspiration data.

The study forecasted the percentage change in year 2030 secure yield due to climate change for each of the 11 water supplies in the pilot study. The pilot study determined that the secure yield after climate change should be considered to be the lesser of:

- Secure yield for the median of the 15 GCMs on the basis of the 5/10/10 rule; and
- Secure yield for the GCM with the lowest secure yield on the basis of a 5/10/25 rule (the 25% severity of restrictions under this rule amounts to being able to 'survive' the least favourable GCM, albeit with relatively harsh water restrictions to cope with the reduced availability of water).

The secure yield of Rous Water's supplies was predicted to be reduced by 9% by 2030 (Samra and Cloke, 2010).

Subsequent to the NSW Office of Water pilot study in 2010, Rous Water has undertaken further analysis of its system headworks model to determine secure yield currently and allowing for future climate change. The current secure yield (14,600 ML/a) reported in Interim Report 1 was based on application of the 5/10/20 rule. Rous Water has also assessed the current secure yield based on the 5/10/10 rule (allowing for demand hardening) as 13,800 ML/a (NSW Public Works, 2012). The recent work has also provided estimates of future secure yield adjusted for climate change on the basis of warming of 1°C (predicted to occur by about 2032) and 2°C (predicted to occur by about 2060). The results are shown in Table 34. These estimates were based on the methodology from the pilot study for 0.9°C warming.

Table 34: Rous Water – secure yield adjusted for climate change

Case	Secure Yield Estimate (ML/a)	Estimated Change in Secure Yield
2010 - Current (5/10/20) – reported in Interim Report 1	14,600	+ 5.8 %
2010 - Current (5/10/10)	13,800	-
1°C warming (~2033)1 adjustment factor = 0.825 applied to Current (5/10/10)	11,400	- 17.5%
2°C warming (~2060) adjustment factor = 0.664 applied to Current (5/10/10)	9,150	- 33.7%

1. Based on non-linear extrapolation of the global warming scenario (0.9°C above 1990 conditions by 2030 and an increase of 2°C by 2060)

The reduction in secure yield (17.5 %) for the 1°C warming is significantly greater than obtained for the Office of Water pilot study for 0.9°C warming (9% reduction). This is apparently due to the different rainfall and runoff assumptions used to generate the input data.

Rous Water is planning to consider a range of scenarios based on the data in Table 34 in the development of its Future Water Strategy. The potential supply scenarios and the forecast future demand for Rous Water bulk supply and retail supply are shown on Figure 33. The secure yield time series has been derived from linear extrapolation of the current, 2030 and 2060 estimates. It is expected that Rous Water will further refine these estimates as part of the development of its Future Water Strategy.

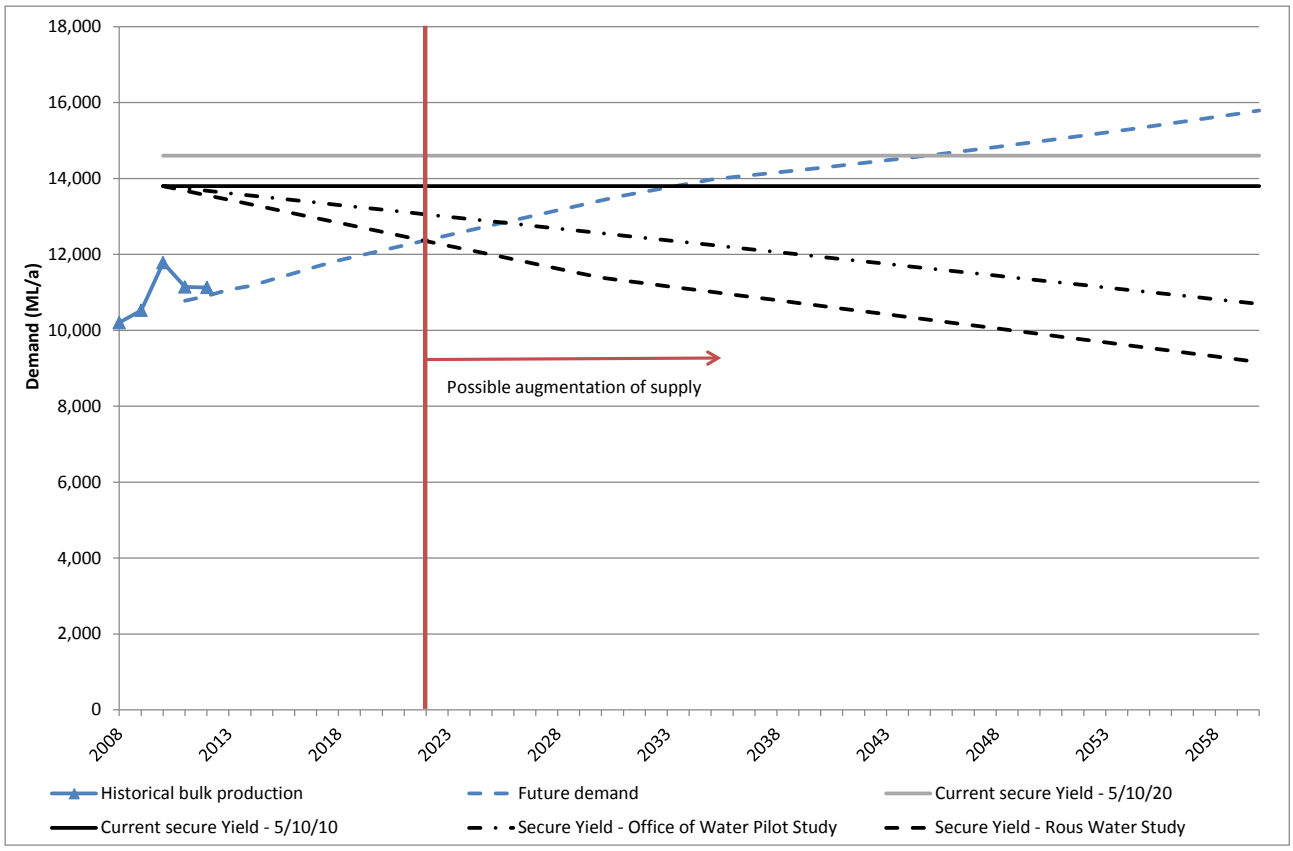


Figure 33: Rous Water Future Demand and Supply Forecasts

The above forecasts predict that augmentation of the Rous Water supply may be required from 2022. The potential supply deficit at 2060 is predicted to be between 4,500 ML/a and 6,000 ML/a.

13.2 Impact of Climate Change on other Water Supply Systems

There are no data available on the impact of climate change on the secure yield of the other regional water sources. While the Office of Water pilot study suggests that the impact of climate change is system dependent, the main impacts on year 2030 secure yield were found to be no greater than a reduction of 9% for the coastal utilities included in the pilot study and the impact of climate change on the other system located on the northern NSW coast included in the study (Coffs Harbour) is also predicted to be -9%. This suggests that the findings for Rous Water may be similar for the other water supplies within the region.

A study undertaken by Seqwater (QWC, 2010) has adopted a 10% reduction in surface water availability (by 2030) across south-east Queensland for long-term water supply planning. No other studies have predicted the impact of climate change for the longer term (2060).

In the absence of local data for the other water supply systems in the Northern Rivers region, it is considered appropriate that water supply planning considers the impact of a 10% reduction in secure yield of surface water sources due to climate change by 2030. Beyond 2030, it is considered that the loss in secure yield will be at least 20%, however, Table 34 indicates that this may be as high as a 33.7% reduction. Given the preliminary nature of this long-term forecasting, combined with the limited assessment of current secure yield for the other water supply systems, it may be premature to apply these higher reductions to the remainder of the region and therefore an interim forecast of 20% reduction by 2060 has been assumed. Despite this, the Regional BWSS will need to consider the risk of future increased reductions in secure yield and the ability of any adopted options to be able to cater for greater climate change impacts should they occur.

13.3 Impact of Demand Hardening on other Water Supply Systems

The secure yield data reported in Interim Report 1 is based on the 5/10/20 rule. Apart from Rous Water, the local water utilities have not yet assessed the impact of demand hardening on their water supplies. As discussed in Section 13.1, the impact of demand hardening is predicted to be a reduction in the secure yield of Rous Water supplies of 800 ML/a (or 5.8%). Any potential reduction in secure yield due to demand hardening will be considered during the development of the Regional BWSS.

13.4 Wardell

The current secure yield of the Wardell water supply system in not known.

13.5 Mullumbimby

The current secure yield of Laverty's Gap Weir is reported as 480 ML/a based on the 5/10/20 rule.

The potential future supply (based on a 10% reduction in secure yield due to climate change by 2030 and a 20% reduction by 2060) and the forecast future demand for the Mullumbimby water supply are shown on Figure 34.

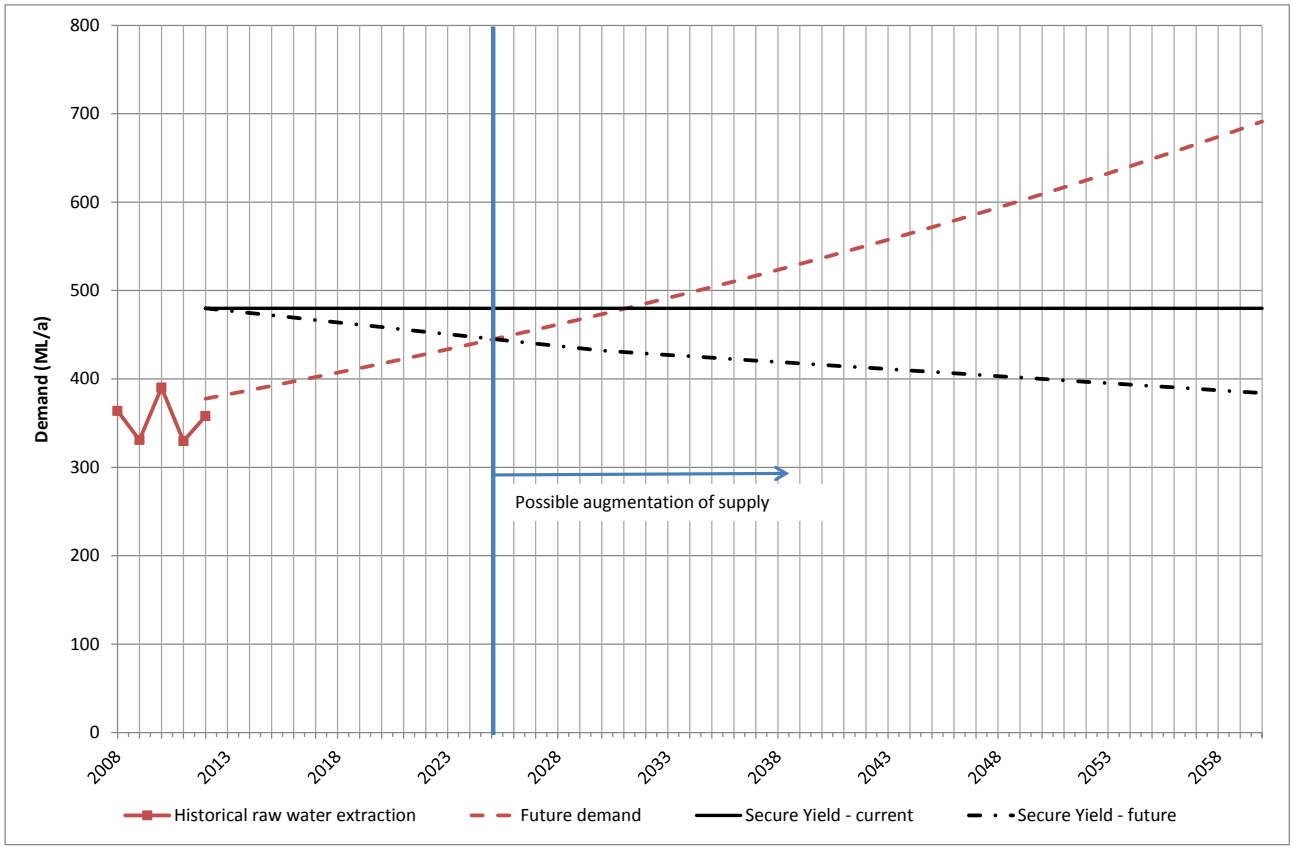


Figure 34: Mullumbimby Future Demand and Supply Forecasts

The above forecasts predict that augmentation of the Mullumbimby supply may be required from 2025. The potential supply deficit at 2060 is predicted to be approximately 310 ML/a.

13.6 Kyogle Council

13.6.1 Kyogle

The current secure yield of the Kyogle water supply is reported as 320 ML/a based on the 5/10/20 rule.

The potential future supply (based on a 10% reduction in secure yield due to climate change by 2030 and a 20% reduction by 2060) and the forecast future demand for the Kyogle water supply are shown on Figure 35.

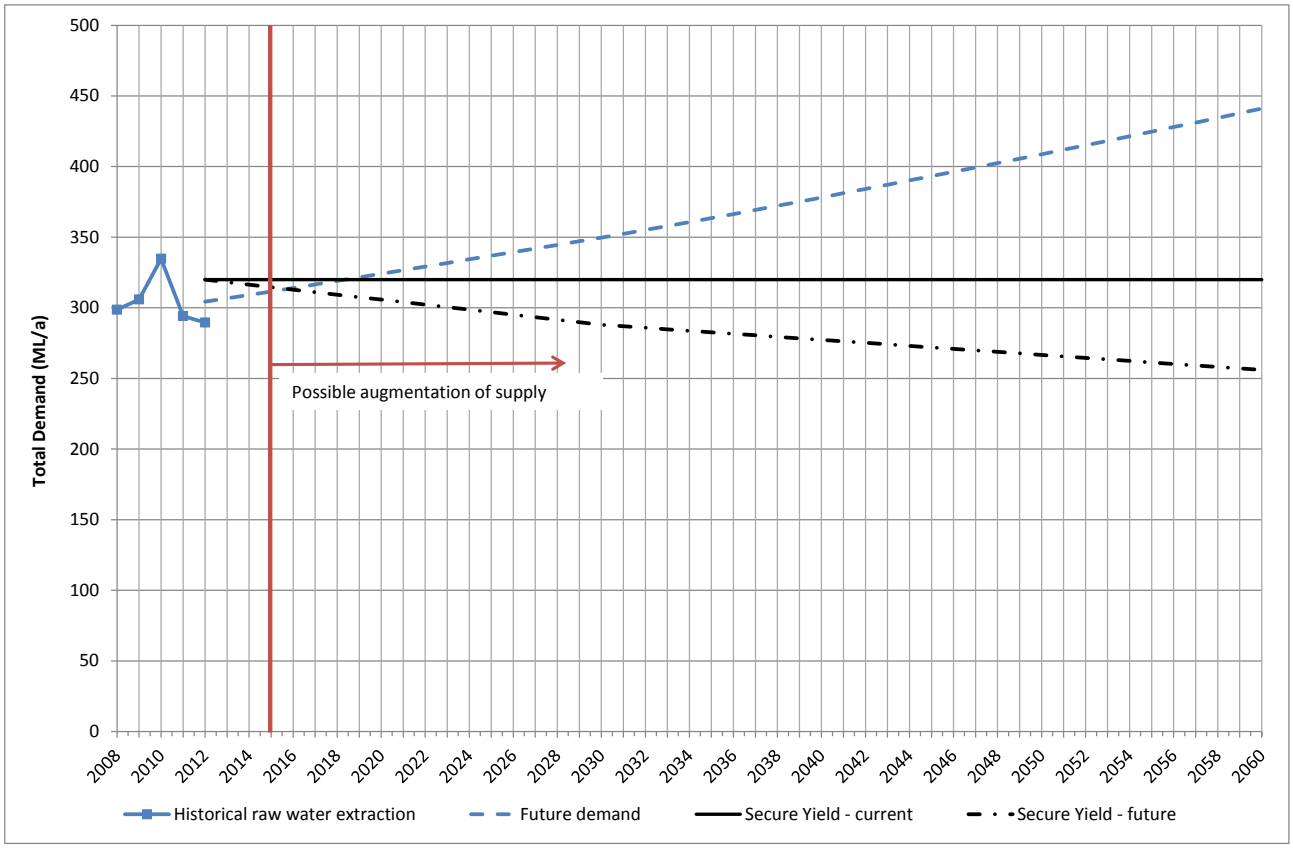


Figure 35: Kyogle Future Demand and Supply Forecasts

The above forecasts predict that augmentation of the Kyogle water supply may be required from 2015. The potential supply deficit at 2060 is predicted to be approximately 190 ML/a.

13.6.2 Bonalbo

The current secure yield of the Bonalbo water supply is reported as 52 ML/a based on the 5/10/20 rule.

The potential future supply (based on a 10% reduction in secure yield due to climate change by 2030 and a 20% reduction by 2060) and the forecast future demand for the Bonalbo water supply are shown on Figure 36. As discussed in Section 6.2.2, the catchment for the off-stream storage provided a significant component of the raw water supply in 2010 and river extraction was reduced. This data has not been used in the calculation of future demand.

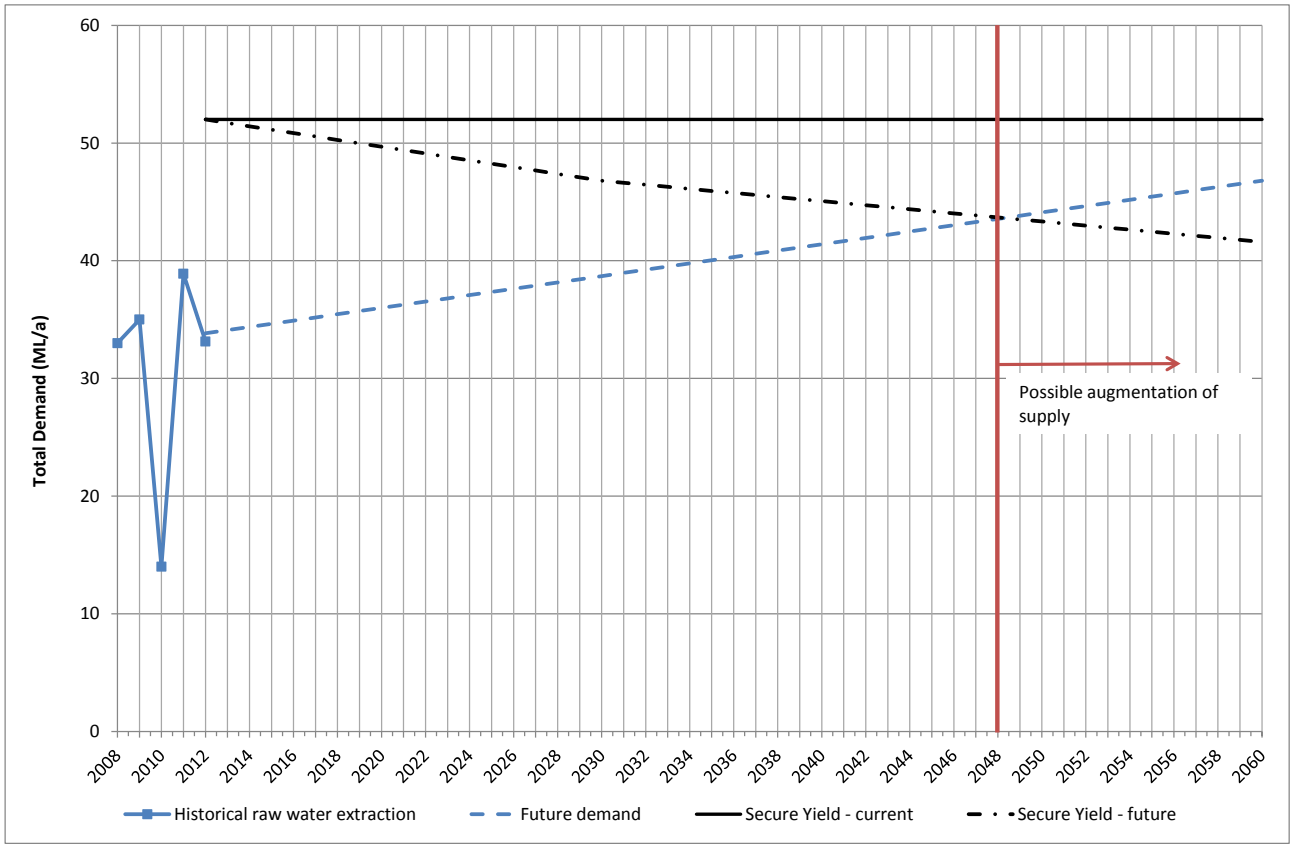


Figure 36: Bonalbo Future Demand and Supply Forecasts

The above forecasts predict that augmentation of the Bonalbo water supply may be required from 2048. The potential supply deficit at 2060 is predicted to be approximately 5 ML/a.

13.6.3 Woodenbong and Muli Muli

The current secure yield of the Woodenbong and Muli Muli water supply is reported as 83 ML/a based on the 5/10/20 rule.

The potential future supply (based on a 10% reduction in secure yield due to climate change by 2030 and a 20% reduction by 2060) and the forecast future demand for the Woodenbong and Muli Muli water supply are shown on Figure 37. Note the data for 2010 have not been included in the calculation of future demand as a land slip caused major leakage.

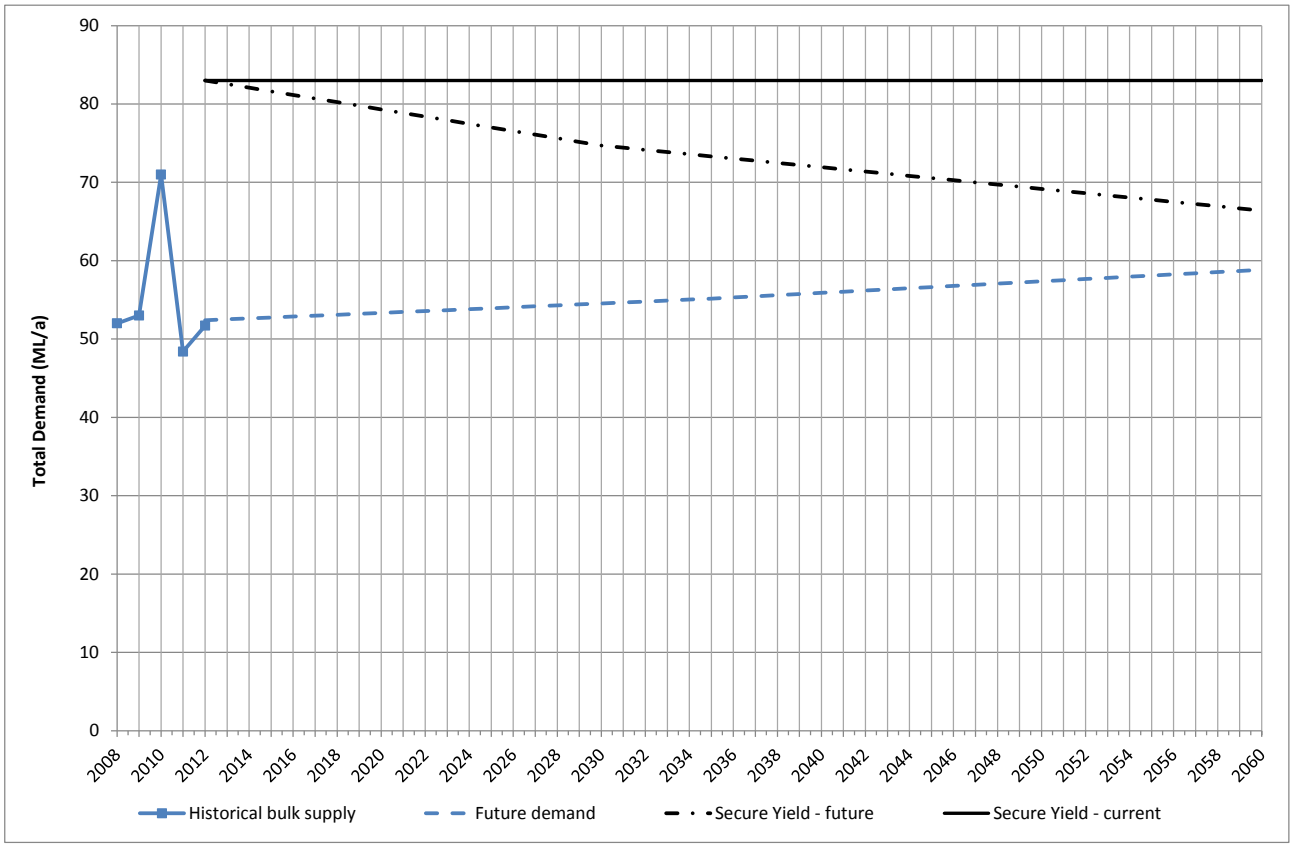


Figure 37: Woodenbong and Muli Muli Future Demand and Supply Forecasts

The above forecasts predict that augmentation of the Woodenbong and Muli Muli water supply will not be required within the next 50 years.

13.7 Nimbin

The current secure yield of the Nimbin water supply is reported to be between 63 ML/a and 157 ML/a based on the 5/10/20 rule and depending on the future environmental flow requirements and various stream flow data sets. However, it is noted that the predicted secure yield is significantly lower than the current volume of water extracted (approximately 177 ML/a) and there is significant uncertainty in the secure yield for Nimbin.

Due to the uncertainties with the available secure yield estimates, further work will be required to predict the current and future secure yield.

LCC is currently implementing a staged process for water quality improvement with Stage 1 including pumping from DE Williams Dam to rural consumers to improve supply quality. Water will still be required to be extracted from the weir for dam turnover and hence extraction will continue to exceed demand. Supply in the near future is expected to be at current levels but no supply issue (deficit) is envisaged for the near future (based on recent experience).

The predicted future demand is based on the predicted future consumption and 10% unmetered water as discussed in Section 7.2.2.

13.8 Casino

The current secure yield of the Casino water supply is reported as 2,525 ML/a based on the 5/10/20 rule.

The potential future supply (based on a 10% reduction in secure yield due to climate change by 2030 and a 20% reduction by 2060) and the forecast future demand for the Casino water supply are shown on Figure 39.

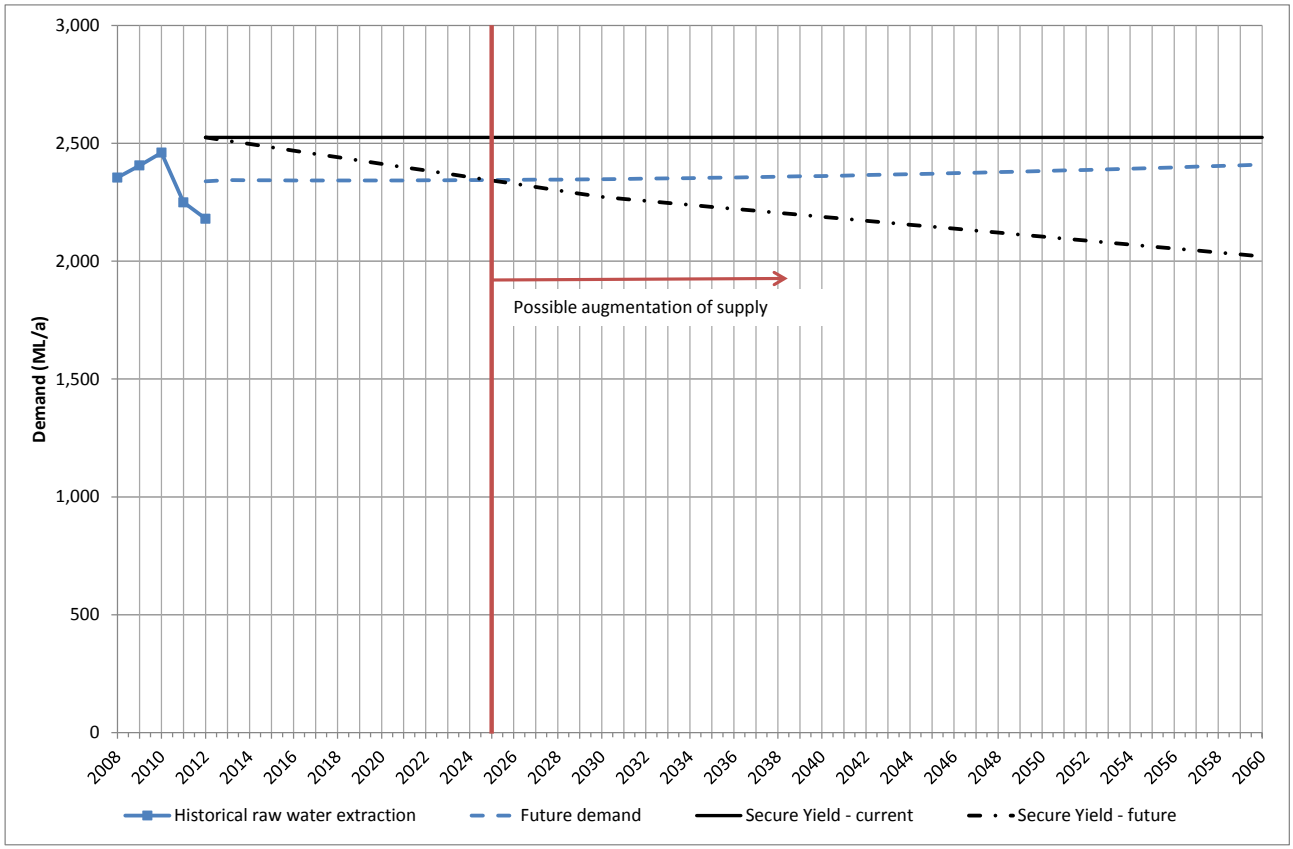


Figure 38: Casino Future Demand and Supply Forecasts

The above forecasts predict that augmentation of the Casino water supply may be required from 2025. The potential supply deficit at 2060 is predicted to be approximately 390 ML/a.

13.9 Tweed Shire Council

13.9.1 Bray Park

The system yield of 13,750 ML/a has been adopted by Tweed Shire Council in the consideration of options for augmentation of the Clarrie Hall Dam/Bray Park water supply (serving the Tweed District and Uki) based on modelling undertaken by SunWater in 2006.

The effect of the environmental flow requirements in the water sharing plan was assessed by NSW Public Works in 2010 using its in-house system behaviour yield model. This study found that the WSP environmental flow requirements are not as constraining as the conditions previously modelled to predict secure yield. However, there were limitations with the model and Council's approach has been to continue to adopt the secure yield of 13,750 ML/a for planning purposes as it allows for some buffer to account for modelling assumptions and future climate change and demand hardening. Council will review the secure yield pending the results of the IWCM review currently underway.

Given the conservative nature of the current secure yield estimate for the Bray Park system, it is not considered appropriate to apply the reduction in secure yield due to climate change to the current estimate of 13,750 ML/a.

The current secure yield and the forecast future demand for the Bray Park water supply are shown on Figure 40.

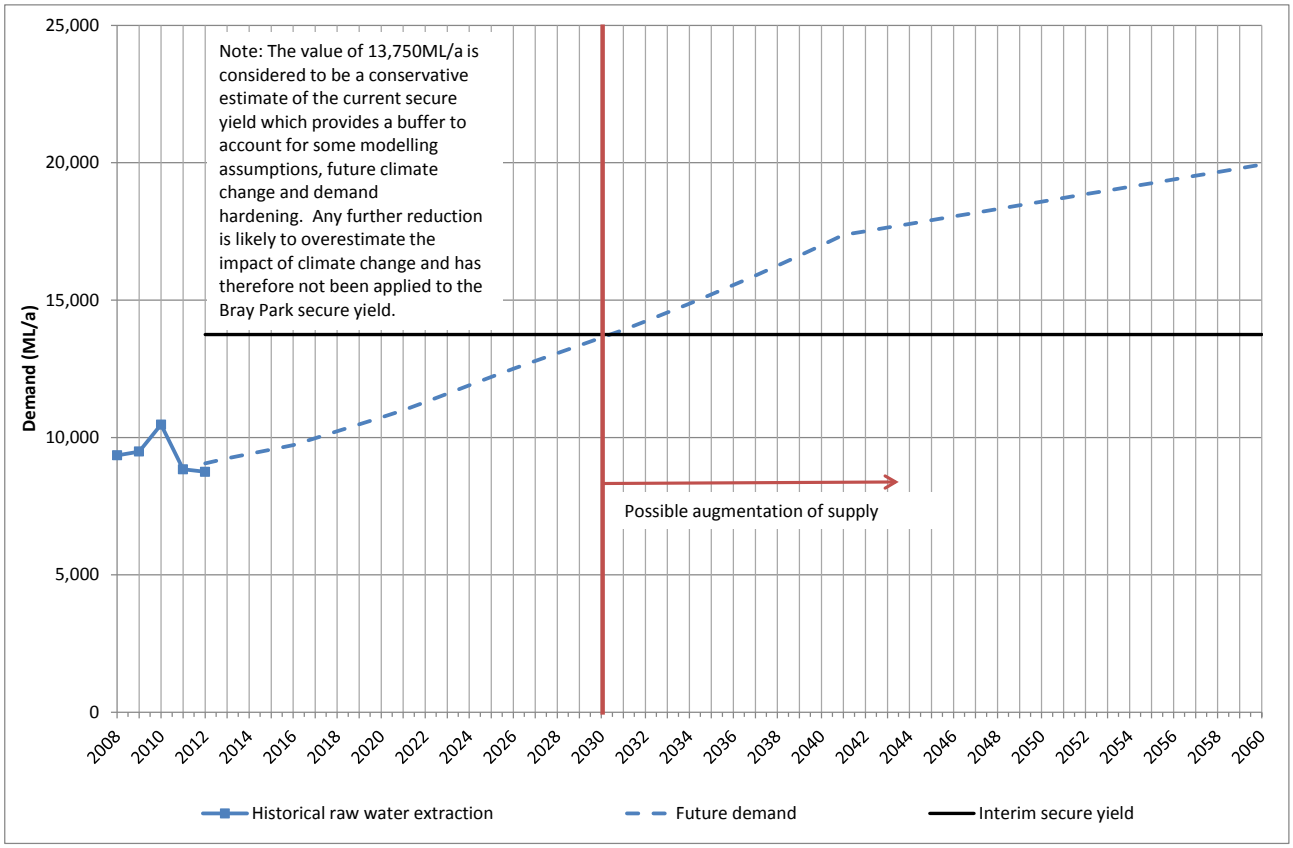


Figure 39: Bray Park System (Tweed District and Uki) Future Demand and Supply Forecasts

The above forecasts predict that augmentation of the Bray Park water supply may be required from 2030. The potential supply deficit at 2060 is predicted to be approximately 6,180 ML/a. However, long-term water supply planning will need to consider a potentially larger supply deficit that may result from climate change impacts.

13.9.2 Tyalgum

The current secure yield of the Tyalgum water supply is reported as 120 ML/a based on the 5/10/20 rule.

The potential future supply (based on a 10% reduction in secure yield due to climate change by 2030 and a 20% reduction by 2060) and the forecast future demand for the Tyalgum water supply are shown on Figure 41.

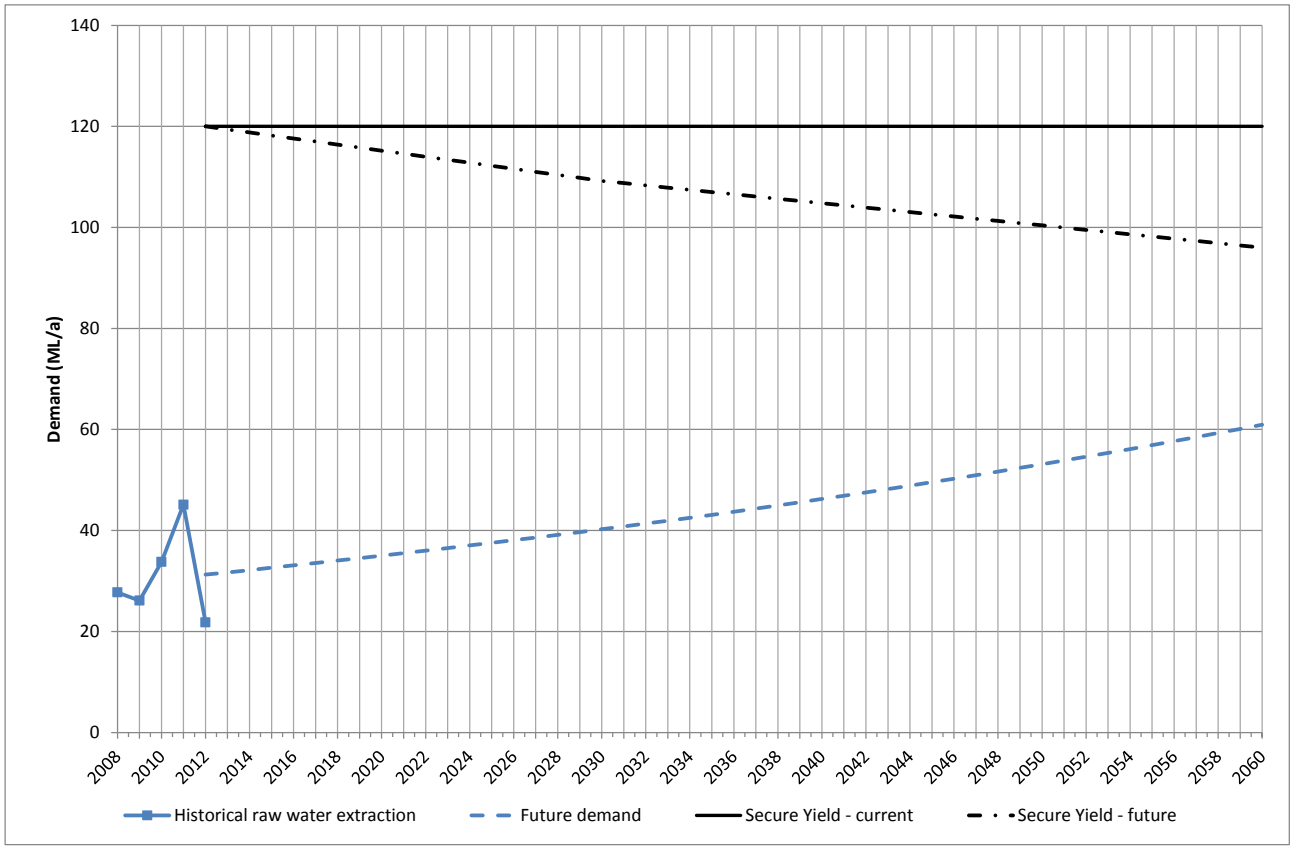


Figure 40: Tyalgum Future Demand and Supply Forecasts

The above forecasts predict that augmentation of the Tyalgum water supply will not be required within the next 50 years.

14. SUMMARY AND CONCLUSIONS

14.1 Summary of Long-Term Connections, Demand and Secure Yield

Table 35 provides a summary of the current and predicted future residential and non-residential connections, demand and secure yield for each water supply system.

The predicted increase in demand at 2030 and 2060 is illustrated in Figure 42 and Figure 43 for each system.

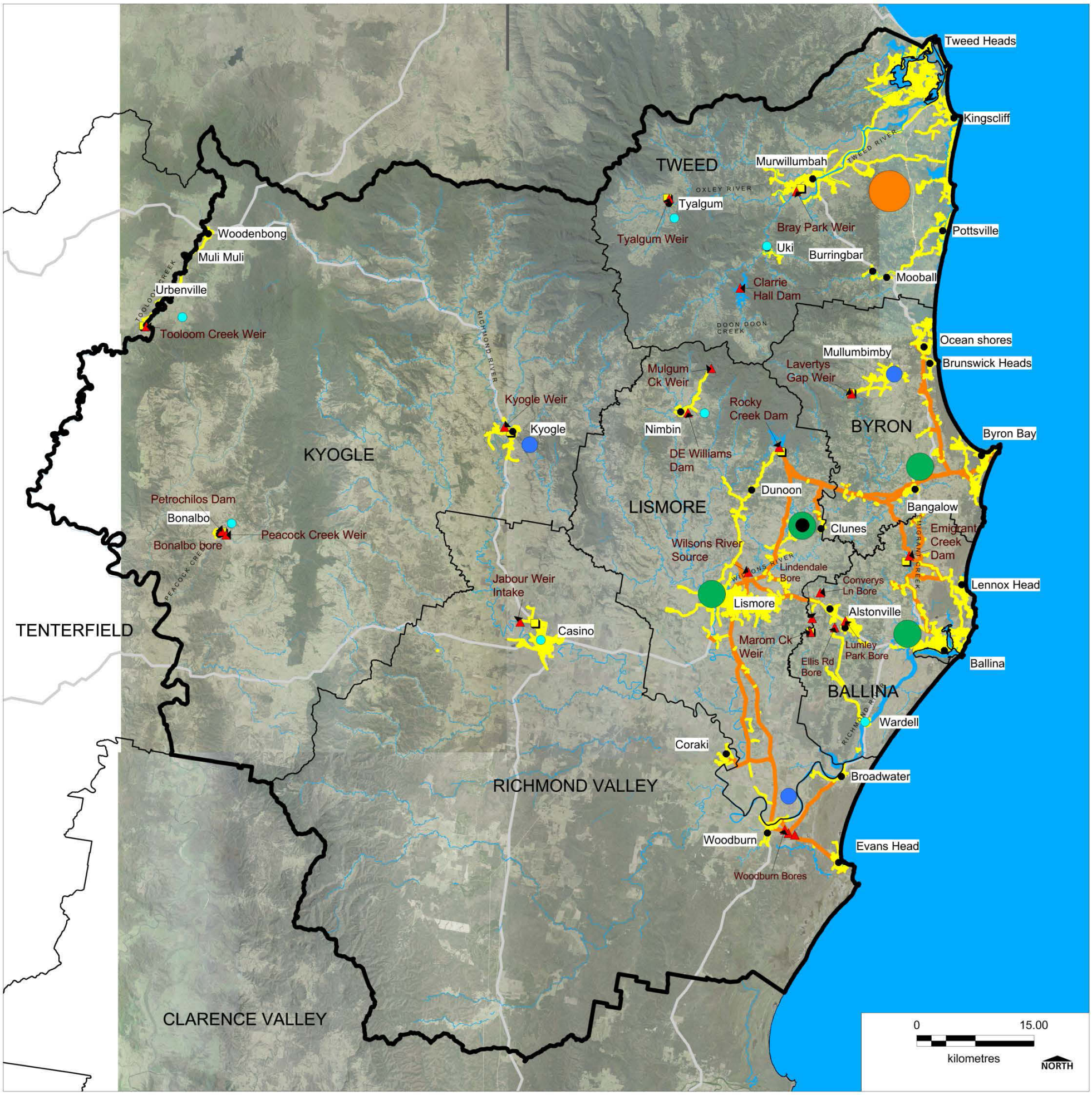
Table 35: Summary of Long-Term Connections, Demand and Secure Yield

System	Current (2012)				2030				2060			
	Residential connections	Non-residential connections	Total Demand (ML/a)	Secure Yield (ML/a) [1]	Residential connections	Non-residential connections	Total Demand (ML/a)	Secure Yield (ML/a)	Residential connections	Non-residential connections	Total Demand (ML/a)	Secure Yield (ML/a)
Rous Water Bulk Supply												
Ballina	12,967	1,489	3,325	13,800	18,321	2,609	4,271	11,385	25,313	4,475	5,783	9,163
Byron	8,853	1,134	2,429		11,218	1,546	2,904		12,526	1,661	3,033	
Lismore	13,000	1,268	3,543		16,202	1,972	4,394		19,305	2,168	4,849	
RVC	2,323	274	657		2,837	334	722		3,324	334	747	
Retail	2,229	-	756		2,653	-	900		3,238	-	1,098	
Bulk unmetered water	-	-	193		-	-	230		-	-	281	
Kyogle Council												
Kyogle	1,182	203	304	320	1,473	222	350	288	2,022	257	441	256
Bonalbo	148	44	34	52	169	50	39	47	205	61	47	42
WMM	189	47	52	83	207	47	55	74	237	47	59	66
Tweed Shire Council												
Tweed District	32,471	1,701	9,062	13,750	48,662	2,560	13,633	13,750	71,147	3,734	19,931	13,750
Uki	173	7	52		173	7	52		173	7	52	
Tyalgum	99	15	31	120	131	21	40	109	185	39	61	96

System	Current (2012)				2030				2060			
	Residential connections	Non-residential connections	Total Demand (ML/a)	Secure Yield (ML/a) [1]	Residential connections	Non-residential connections	Total Demand (ML/a)	Secure Yield (ML/a)	Residential connections	Non-residential connections	Total Demand (ML/a)	Secure Yield (ML/a)
Other systems												
Mullumbimby	1,482	197	378	435	1,853	249	473	432	2,700	366	691	384
Wardell	284	28	123	Unknown	351	31	153	Unknown	462	38	201	Unknown
Nimbin	247	68	66	101	283	77	74	91	343	94	88	81
Casino	4,070	453	2,338	2,525	4,339	494	2,348	2,273	4,954	570	2,410	2,020
Total Region	79,717	6,928	23,344	31,986	108,873	10,219	30,636	28,449	146,133	13,849	39,772	25,858

1. Secure yield of Rous Water supplies has been determined using the 5/10/10 rule. Secure yield of all other supplies has been determined using the 5/10/20 rule.

2. Secure yield of Tweed District/Uki supplies from Bray Park weir for 2012 is possibly and underestimate and for 2060 is possibly an overestimate.

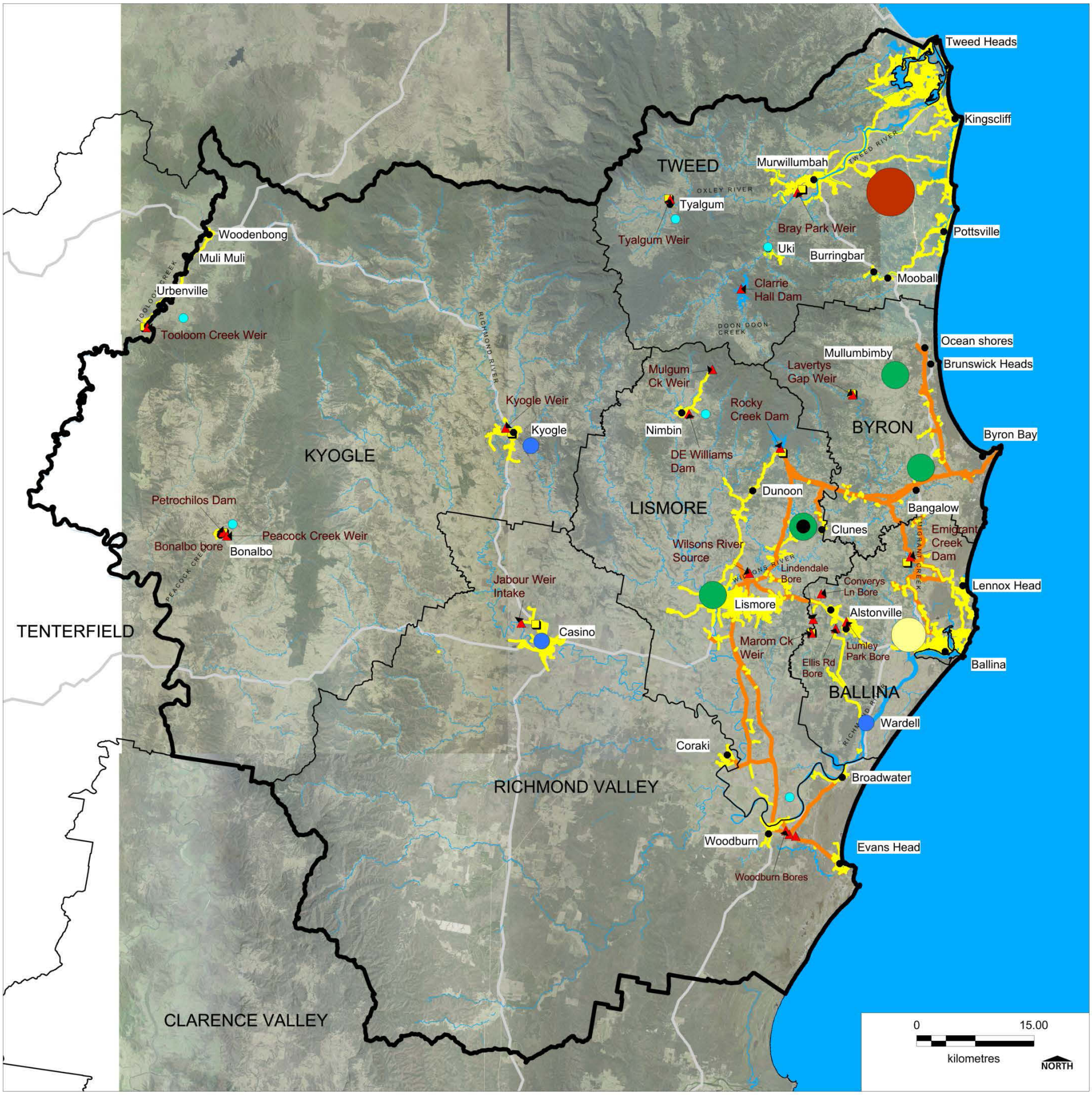


LEGEND:

Water Supply Pipelines:
- Rous Water Network
- Distribution Network
- Water Source
- Water Treatment Plant
- Localities
- Major Roads
- Waterways
- LGA Boundary
- Study Area

Forecast increase in demand from current to 2030 (ML/a)
- 2,000 to 5,000
- 1,000 to 2,000
- 100 to 1,000
- 30 to 100
- 0 to 30
- Rous Water Retail

Figure 41: Predicted Future Increase in Demand (between current and 2030)



LEGEND:

Water Supply Pipelines:
- Rous Water Network
- Distribution Network
- Water Source
- Water Treatment Plant
- Localities
- Major Roads
- Waterways
- LGA Boundary
- Study Area

Forecast increase in demand from 2030 to 2060 (ML/a)
- 5,000 to 10,000
- 2,000 to 5,000
- 1,000 to 2,000
- 100 to 1,000
- 30 to 100
- 0 to 30
- Rous Water Retail

Figure 42: Predicted Future Increase in Demand (between 2030 and 2060)

14.2 Key Findings

The Northern Rivers Region is predicted to serve approximately 146,000 residential connections and 14,000 non-residential connections by 2060, an increase of 66,000 residential connections and 7,000 non-residential connections from current values. Regional demand is expected to increase by 16,500 ML/a to 40,000 ML/a by 2060.

The current secure yield of the region's water resources (approximately 32,000 ML/a) is expected to decrease with the impacts of future climate change by approximately 6,000 ML/a or 26% by 2060. These predictions are inexact as there is significant uncertainty with the current secure yield and the impacts of demand hardening, environmental flow requirements and climate change into the future. Despite this, there is little doubt that augmentation of the majority of the water supplies in the region will be required due to population growth and the reduction in available water resources.

The expected demand, secure yield and supply deficit at 2060 is summarised in Table 36. Major augmentations will be required in the Rous Water bulk supply area and Tweed Shire Council Bray Park system. Mullumbimby and Kyogle will also require significant augmentation compared to the current supply. Smaller augmentations (compared to current supply) are also required in Casino, Bonalbo and Nimbin.

Table 36: Future Demand, Secure Yield and Supply Deficit (ML/a)

Supply Area	2060 Forecast Demand	2060 Predicted Secure Yield [1]	Year that augmentation may be required	2060 Predicted Supply Deficit	2060 Supply Deficit (% of current supply)
Rous Water bulk supply	15,790	10,695 – 9,160	2022	5,100 – 6,600	37% - 48%
Wardell	201	unknown	unknown	unknown	unknown
Mullumbimby	691	380	2025	310	71%
Kyogle	441	250	2015	190	59%
Bonalbo	47	52	2048	5	10%
Woodenbong and Muli Muli	59	66	Not required within next 50 years		
Nimbin	88	unknown	unknown	unknown	unknown
Casino	2,410	2,020	2025	390	15%
Bray Park (Tweed District and Uki)	19,983	13,750	2030	6,230	45%
Tyalgum	61	96	Not required within next 50 years		
Region	*40,000*	*26,000*		*14,000*	*43%*

1. Secure yield of Rous Water supplies has been determined using the 5/10/10 rule. Secure yield of all other supplies has been determined using the 5/10/20 rule.

14.3 Next Steps

The next stage of the Regional BWSS will identify options to ensure long-term water security for the region. Existing and future management issues will be identified based on the predicted supply deficit documented in this report, as well as any water resource challenges and pressures. Management opportunities will be considered from a range of measures to improve data collection and knowledge as well as local and regional options for improving water supply security.

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