

Rous Water

Open Space Water Efficiency Review

June 2016

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PROJECT 16-042- OPEN SPACE WATER EFFICIENCY REVIEW

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CONTENTS

1.	INTRODUCTION	3
2.	METHODOLOGY	3
2.1	Mapping Open Space Sites	3
2.2	Consultation with Local Councils	3
2.3	Consultation with Private Customers	4
3.	KEY FINDINGS	5
3.1	Irrigation of Sporting Fields by Local Councils.....	5
3.2	Open Space Irrigation by Private Customers	6
4.	SUMMARY OF POTABLE WATER USE FOR OPEN SPACE IRRIGATION	8
5.	CONCLUSIONS AND RECOMMENDATIONS	10
	REFERENCES	11
	APPENDIX 1: OPEN SPACE WATER EFFICIENCY SITE DATABASE	13
	APPENDIX 2: BOWLING GREEN WATER CONSUMPTION ESTIMATES	21

TABLES

Table 1:	Council – managed open space sites irrigated with potable water	5
Table 2:	Estimate of typical sporting field water requirements.....	6
Table 3:	Privately managed open space sites contacted as part of this review.....	7
Table 4:	Estimate of potable water consumption for open space irrigation	9
Table 5:	Typical bowling green water requirements either through rainfall or irrigation	23
Table 6:	Mean Monthly Rainfall for main urban centres in the Rous Region (BOM, 2016). Highlighted cells show months when rainfall is typically below 100mm	23
Table 7:	Mean Rainfall deficit to be made up each month by irrigation	23
Table 8:	Bowling clubs - Estimate of water required to supplement local rainfall to maintain bowling greens	25

FIGURES

Figure 1:	Consumption data for Council-managed fields with potable water irrigation.....	6
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1. INTRODUCTION

The Rous Water Future Water Strategy (MWH, 2014) recommended an Open Space Water Efficiency Program be implemented as part of enhanced demand management actions. The program is described as “implementing water savings through more efficient irrigation controls in public open spaces, such as parks and sporting grounds”. This report provides a review of the Open Space Water Efficiency Program including:

- The current level of open space potable water irrigation in the Rous Water region (public and private areas) – customers, purpose, locations, area, volume, frequency, operation, infrastructure, etc.;
- The potential for water savings and any strategies to achieve water savings through modified irrigation practices/infrastructure, training, rebates, metering, new technology, etc.; and
- Recommendations for a Rous Water open space irrigation efficiency program.

The key aim is to determine whether there are significant water savings to be made in the open space customer sector and whether there is any opportunity for Rous Water to promote water efficiency measures.

2. METHODOLOGY

2.1 Mapping Open Space Sites

Mapping of the region was undertaken to identify any public and private open space areas with potential for irrigation using:

- Aerial photography and available GIS data on LEP zoning;
- Open space sites:
 - Sporting fields (football ovals, soccer fields, cricket ovals, AFL grounds, rugby grounds, etc.);
 - Golf courses;
 - Bowling clubs;
 - Schools; and
 - Other (e.g. racecourses, showgrounds, etc.); and
- Water supply assets within Rous Water supply area.

The mapping exercise was undertaken to provide a list of sites that may be irrigated with potable water and would require further investigation (refer Appendix 1).

2.2 Consultation with Local Councils

Local councils within the Rous Water region were contacted to identify open space areas currently irrigated with potable water. Where potable water was used, the available information on the current irrigation systems/methods were also documented including:

- Triggers for irrigation;
- Irrigation methods and infrastructure;
- Irrigation frequency and duration; and
- Metered consumption records.

2.3 Consultation with Private Customers

Privately owned sporting clubs were contacted to determine the level and pattern of potable water usage for open space irrigation. The study focussed on bowling clubs and golf courses as the main type of private open space in the region. One golf club and one bowling club from each LGA was contacted to provide a sample of private potable water use in the region.

3. KEY FINDINGS

3.1 Irrigation of Sporting Fields by Local Councils

Sporting fields are the only open space areas in the region regularly irrigated by the councils although the majority of sporting fields are either irrigated with recycled water or not irrigated at all. Sporting fields managed by the clubs are discussed in Section 3.2.

Ballina Shire Council irrigates sporting fields in Ballina and Lennox Head with recycled water (where available). Byron Shire Council irrigates the sporting fields in Byron Bay and Ewingsdale with recycled water. Richmond Valley Council does not irrigate any open space areas. The only open space sites that are currently irrigated in Lismore LGA with potable water are Oakes Oval and Crozier Oval (the main sporting fields in Lismore City which host major sporting events) and Williams Reserve in Lennox Head (Ballina LGA), as it is not close to recycled water supplies. Table 1 and Figure 1 present annual water consumption volumes for the venues using potable water for irrigation for the last 5 years (note that meter data for Lismore LGA does not differentiate between irrigation supply and other uses). Water used at Oakes Oval in Lismore has increased over the last 5 years from just over 1 ML in 2010/11 to 5.8 ML in the 2014/15 financial year. It is unclear whether this is due to increased irrigation or increased use of the facility for functions as Council has promoted the use of this facility in recent years. Consumption at Crozier Oval has remained relatively constant at approximately 0.2 ML per year. Consumption at Williams Reserve in Lennox Head has fluctuated significantly with the highest consumption of 2.7 ML recorded in 2013/14.

Table 1: Council – managed open space sites irrigated with potable water

Name	Location	LGA	Annual potable water usage (kL/a)					
			2010/11	2011/12	2012/13	2013/14	2014/15	Average
Oakes Oval ¹	Lismore CBD	Lismore	1,133	1,296	3,396	4,957	5,814	3,319
Crozier Oval ¹	Lismore CBD	Lismore	nd*	203	160	184	188	184
Williams Reserve	Lennox Head	Ballina	nd*	58	20	2,782	1,271	1,033

1. Irrigation and amenities consumption are not separately metered.

*nd - no data available

LCC has recently installed an automated irrigation system at Crozier Oval to enable Council to set times for watering based on expected rainfall. Due to the low usage of potable water, LCC staff do not foresee any need for additional investment in new irrigation infrastructure.

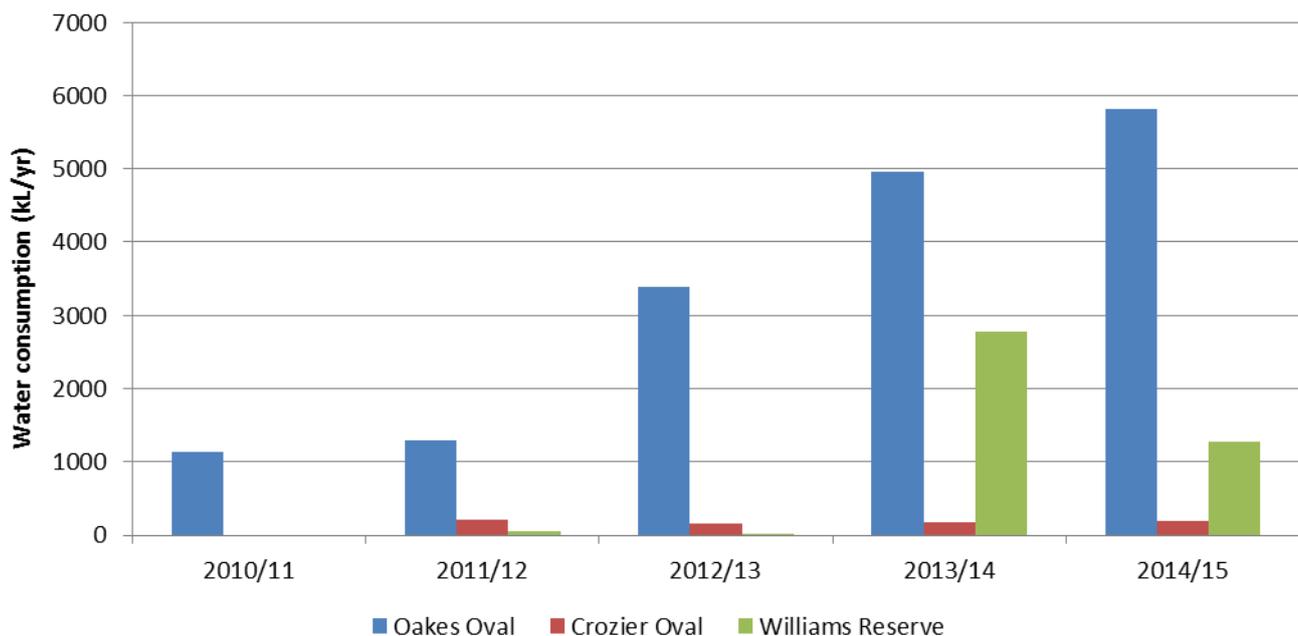


Figure 1: Consumption data for Council-managed fields with potable water irrigation

3.2 Open Space Irrigation by Private Customers

Periodic irrigation of public sporting fields by some sporting clubs is undertaken as required to maintain suitable playing surfaces. Examples include a small amount of watering of natural turf cricket wickets prior to games in summer and pre-game watering to soften the playing surface on rugby grounds and soccer pitches during dry times. Generally, potable water is used and the connection is not sub-metered to allow separate identification of irrigation water use and consumption from on-site amenities and club facilities. Artificial hockey fields in Ballina and Goonellabah are watered but it is assumed that the on-site rainwater tanks supply the majority of irrigation needs.

In order to quantify water consumption by sporting clubs, an estimate of typical irrigation requirements was calculated for each category of open space based on best-practice requirements developed by Sydney Water (2011) and Bowls Australia (2011) using an assessment of rainfall deficit. As Sydney has lower average annual rainfall than the Rous Water region, the identified irrigation requirements would be a worst case scenario when applied to this region. Details are provided in Table 2. For the sites where irrigation with potable water was identified, an estimate of total annual water consumption was made using this data (refer Table 4, Section 4).

Table 2: Estimate of typical sporting field water requirements

Type	Irrigation requirements (ML/ha/a)	Source
Elite fields (state/national competition generally associated with stadiums)	4 to 9	Sydney Water (2011)
State/regional/first grade playing surface	2.5 to 5	Sydney Water (2011)
Local sports fields	1.5 to 3.5	Sydney Water (2011)
Cricket wickets	2.8	Estimated based on consultation as part of this review
Bowling Clubs	13	Bowls Australia (2011)

Only three local sporting fields were identified as having some periodic watering by sporting clubs to maintain playing surface condition. Quays Reserve uses tankered water on occasions and Bangalow soccer fields and Tom Kendall Oval in New Brighton are occasionally irrigated by travelling irrigators. Six natural turf cricket pitches (Kingsford Smith in Ballina and Blair Oval, Heaps Oval, Neilson Park, Nesbitt Oval and Mortimer Oval in Lismore) were also identified as being watered with a small amount of potable water on a weekly basis during the cricket season. The remaining cricket pitches in the region have access to recycled water, were synthetic turf or were not watered.

Where town water is used for irrigating open space, users contacted were asked about triggers, methods and frequency and duration of watering. Metered consumption records were obtained from Council where available and metered separately from other uses on site (Table 3). Key findings are:

- The majority of clubs contacted did not use potable water for irrigation of open space area;
- Where alternative water sources such as recycled water, stormwater or bore water are available, the clubs used this for irrigation, with many of them citing the cost of potable water as a main driver for using alternative sources;
- Where alternative supplies are not available, the clubs indicated they only watered in the drier months when necessary and potable water use for outdoor irrigation was minimal as the cost of potable water is a disincentive for its use;
- Out of the clubs contacted, the only golf course using potable water for irrigation was the Lismore Golf Course;
- Bowling Clubs use recycled water where available in Ballina and Byron Bay; and
- The Lismore Heights Bowling Club does not have access to recycled water but utilises on-site rainwater tanks supplemented with potable water when required. The greens are assessed by grounds staff before watering takes place to minimise over-watering. It is expected that other bowling clubs in the region without access to recycled water would have a similar system in place.

RVC has advised that Evans River K-12 School has the ability to irrigate fields with potable water although the use is expected to be minimal due to high rainfall.

Table 3: Privately managed open space sites contacted as part of this review

Type	Name	Location	LGA	Potable water used in irrigation?	Water supply sources
Golf Club	Ocean Shores Country Club	Ocean Shores	Byron	No	The course is irrigated with water from on-site dams and weirs
Bowling Club	Byron Bay Bowling Club	Byron Bay	Byron	No	Club uses recycled water from Byron Bay sewage treatment plant
Golf Club	Ballina Golf Club	East Ballina	Ballina	No	The course is irrigated with recycled water from Ballina Lennox recycled water plant
Bowling Club	Cherry Street Bowling Club	Ballina	Ballina	No	Club uses recycled water from Ballina Lennox recycled water plant
Golf Club	Lismore Golf Club	Lismore	Lismore	Yes	Some potable water used to supplement water taken from on-site dams/lakes. Consumption data provided by LCC.

Type	Name	Location	LGA	Potable water used in irrigation?	Water supply sources
Bowling Club	Lismore Heights Bowling Club	Lismore	Lismore	Yes	Some potable water used to supplement water from underground rainwater tanks on-site. Watering undertaken when physical assessment of the playing surface indicates watering is necessary.
Golf Club	Evans Head Woodburn Golf Club	Doonbah	Richmond Valley	No	The course is irrigated with bore water and some rainwater tanks
Bowling Club	Evans Head Bowling Club	Evans Head	Richmond Valley	No response received. Council has advised that this club has a dedicated bore for water supply.	
Bowling Club	Broadwater Bowling Club	Broadwater	Richmond Valley	RVC believes some potable water may be used.	

Bowling club consumption was estimated using typical irrigation requirements for bowling greens and a local rainfall deficit model to determine the amount of potable water required to supplement rainfall (Table 4). It has been assumed that all bowling clubs that are not connected to alternative water supplies use potable water for irrigation of greens, unless Council has advised that potable water is not used. Details are provided in Appendix 2.

4. SUMMARY OF POTABLE WATER USE FOR OPEN SPACE IRRIGATION

Information gathered as part of the above tasks was entered into a database documenting the information gathered for each site (Appendix 1). Table 4 summarises the total estimated potable water consumption for open space irrigation in the Rous Water region. In general, there is a low level of potable water use for open space irrigation with most sites either:

- Not irrigated (due to generally high rainfall in the region);
- Irrigated with recycled water where available (most of Ballina and Byron Bay sites); or
- Irrigated with on-site water, either bore water, dams, weirs or rainwater tanks (common for golf courses and some bowling clubs).

Opportunities for water savings were identified (Table 4) based on the amount of potable water currently used for open space irrigation and the existing level of water efficient infrastructure already in place in the region. Opportunities for increased efficiency are limited.

The amount of open space irrigation in the region is predicted to be 16 ML/a although this would vary based on climatic conditions. This represents 0.13% of Rous Water's average annual demand (12,000 ML/a) and 0.55% of the annual non-residential consumption in the region (2,900 ML/a).

In drought times (or periods of low rainfall), the use of potable water for irrigation is expected to increase above the levels indicated here. The (draft) regional drought management plan restricts the use of potable water for irrigation from Level 1 restrictions with time allowed for watering decreasing with each restriction level and all irrigation ceasing at Level 4 restrictions.

Table 4: Estimate of potable water consumption for open space irrigation

Type	No. of sites with potential town water irrigation	Potable Irrigation Methods	Annual consumption estimate (kL/a)	Estimation Method	Potential Opportunities
Bowling club	9	Most have sprinkler systems installed, or use portable sprinklers or hoses – based on soil moisture and physical testing	3,275	Appendix 2 – rainfall deficit method	It appears that water is conserved as far as possible as cost of water is a key consideration. Potential for increased use of alternative supplies such as rainwater tanks or groundwater bores, although it is assumed that some already have tanks and that space limitations may be a constraint.
Golf course	1	Permanent irrigation system	2,119	Metered consumption data	Only 1 golf course identified in the region using potable water (Lismore Golf Club) mainly for tees and greens. Potential for alternative supplies.
Cricket pitch	6	Typically hand held hose with spray nozzle used for 30 minutes on morning of home game (approx. once a week)	101	Estimated (Table 2)	Very low water use, no real opportunities to change practices.
Public sports field – local club management	3	Various methods including: travelling irrigator, sprinklers, water tanker etc.	6,635	Estimated (Table 2)	Small number of sites undertaking watering on an as needed basis. Potential for alternative supplies.
Public sports field – council management	4	Permanent Irrigation systems	2,269	Metered consumption data. Oakes Oval consumption is assumed to be the same as Williams Reserve as no separate metering.	Oakes, Crozier and Williams Reserve. LCC has recently installed new irrigation system at Crozier and not likely to invest in additional infrastructure.
School	1	Unknown but town water connection is available.	1,500	Estimated (Table 2)	RVC has advised that Evans River K-12 uses potable water for irrigation. Potential for alternative supplies.
TOTAL	24		15,900		

5. CONCLUSIONS AND RECOMMENDATIONS

The Rous Water Future Water Strategy (MWH, 2014) made the following assumptions in the development of the open space water demand management program:

- 10% of Rous Water non-residential customers are targeted in the program with 50% participation rate (based on current customer numbers, 235 customers would participate in the program out of 4,700 non-residential customers);
- Ten sites per year targeted over 11 years (110 total);
- Assumed water savings of 30% of outdoor end uses, scaled up to 1 ML/a;
- Rous Water implementation costs of \$4,000 per account, training for a landscape manager of \$980 for a two-day course and program set-up costs of \$20,000;
- Rebate provided by Rous Water of \$10,000 per account (50% of total cost); and
- Annual administration cost of \$8,000 p.a.

The Open Space Water Efficiency Program in the Future Water Strategy has a present value of \$1,010,000 and a benefit cost ratio for Rous Water of 3.6. The present value of community costs is \$1,610,000 with a benefit cost ratio for the community of 2.2. Total annualised costs are \$1.40 per kL for the predicted average water saving of 80 ML/a.

It appears the opportunities for participation in the program are significantly lower than assumed by MWH (2014). The data collected for this study (Table 4) suggests that alternative supplies may be the only opportunity for potable water savings.

Alternative supplies (such as rainwater tanks) may be considered at the following sites. It has been assumed that 80% of potable water use can be substituted although this would be site specific:

- Up to nine bowling clubs with average water savings up to 290 kL/a each (total water savings of 2.6 ML/a);
- One golf course with water savings of 1.7 ML/a;
- Up to three sports fields with average water savings of 1.8 ML/a each (total water savings of 5.3 ML/a); and
- One school with water savings of 1.2 ML/a,

If these 14 customers were targeted and all potential water savings were realised, the total water savings would be 11 ML/a (0.09% of Rous Water's average annual demand).

For many sites, the addition of alternative supplies such as rainwater tanks may be attractive to provide an alternative source of irrigation water, but as there is currently limited potable water irrigation, the benefit to Rous Water in reducing demand is minimal.

Rous Water's existing residential rainwater tank rebate program provides a rebate of up to \$1,000 for tanks 9,000 L or greater with additional rebates for internal plumbing. This program has had a low take-up over recent years. Rous Water also offers a business and community rebate program which also has a low take-up rate. Where significant water saving opportunities are identified, Rous Water may contact customers directly, audit the water usage and identify potential water savings projects (such as rainwater tanks).

A separate open space rebate program (or direct approaches to these customers) is not considered to be warranted due to the low level of usage and low number of customers using potable water. However Rous Water should promote the opportunity as appropriate in parallel with other public information campaigns.

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APPENDIX 1: OPEN SPACE WATER EFFICIENCY SITE DATABASE

LGA	Type	Council/Private	Open Space Property/Business Name	Suburb	Irrigated?	Water Supply	Notes
Ballina	Bowling Club	Private	Lennox Bowling Club	Lennox		Potable	estimate usage
Ballina	Bowling Club	Private	Alstonville Plateau Bowls and Sports Club	Alstonville	Yes	Potable	
Ballina	Cricket Pitch	Public Land managed by Club	Kingsford Smith - cricket pitch	Ballina	Yes	Potable	A tap located near cricket pitch used for watering with hose by club in summer
Ballina	Sportsfield - Council	Public	Fripp Oval AFL ground	Ballina	Yes	Recycled	Club waters for approx. 10mins early morning on day of game to soften up the ground
Ballina	Sportsfield - Local Club watering	Public managed by Club	Quays Reserve Ballina Rugby Union Club	West Ballina	No but tanker used	Potable	Not irrigated, but get tanker in and water from time to time
Ballina	Sportsfield - Council	Public	Williams Reserve	Lennox Head	Yes	Potable	confirmed to be watered with potable water
Ballina	Bowling Club	Private	Cherry Street Bowling Club	Ballina	Yes	Recycled	recycled water for some use and reticulated for some use
Ballina	Bowling Club	Private	RSL Bowling Club	Ballina	Yes	Recycled	
Ballina	Golf Course	Private	Ballina Golf Course	East Ballina	Yes	Recycled	
Ballina	School	Private	Alstonville High School	Alstonville	No	Not irrigated	Not irrigated
Ballina	School	Private	Ballina High School	Ballina	No	Not irrigated	Not irrigated
Ballina	School	Private	North Coast TAFE Wollongbar	Wollongbar	No	Not irrigated	Sports fields - rugby ground
Ballina	Sportsfield - Council	Public Land managed by committee	Alstonville Showground	Alstonville	No	Not irrigated	Council mows but does not water. They don't think it gets irrigated
Ballina	Sportsfield - Council	Public	Crawford Park Alstonville	Alstonville	No	Not irrigated	Not irrigated
Ballina	Sportsfield - Council	Public Land managed by club	Kingsford Smith - hockey club	Ballina	No	Not irrigated	Synthetic turf
Ballina	Sportsfield - Council	Public	Megan Cres	Lennox Head	No	Not irrigated	Not irrigated
Ballina	Sportsfield - Council	Public	Porter Park	West Ballina	No	Not irrigated	Not irrigated
Ballina	Sportsfield - Council	Public	Skennars Head Soccer field	Skennars Head	No	Not irrigated	Not irrigated
Ballina	Sportsfield - Council	Public	Wardell Sports Ground	Wardell	No	Not irrigated	Not irrigated

LGA	Type	Council/Private	Open Space Property/Business Name	Suburb	Irrigated?	Water Supply	Notes
Ballina	Sportsfield - Council	Public	Cawara Park	Ballina	Yes	Recycled	
Ballina	Sportsfield - Council	Public	Chickiba Oval	East Ballina	Yes	Recycled	
Ballina	Sportsfield - Council	Public	Fripp Oval	Ballina	Yes	Recycled	
Ballina	Sportsfield - Council	Public	Kingsford Smith	Ballina	Yes	Recycled	
Ballina	Sportsfield - Council	Public	Saunders Oval	Ballina	Yes	Recycled	
Ballina	School	Private	Southern Cross K-12	Ballina	No	Not irrigated	Not irrigated
Byron	Bowling Club	Private	Brunswick Heads Bowling Club	Brunswick Heads		Potable	
Byron	Bowling Club	Private	Bangalow Bowling Club	Bangalow		Potable	Assume no access to recycled water but some rainwater usage as for Lismore Heights
Byron	Sportsfield - Local Club watering	Public	Tom Kendall Oval	New Brighton	Yes	Potable	Occasional use of travelling irrigator in drought conditions
Byron	Bowling Club	Private	Byron Bay Bowling Club	Byron Bay	Yes	Recycled	
Byron	Golf Course	Private	Ocean Shores Country Club	Ocean Shores	Yes	on-site dams	No town water used for open space areas. The course is irrigated with water from on-site dams and weirs
Byron	Golf Course	Private	Byron Bay Golf Course	Byron Bay	Yes	Recycled	Treated effluent
Byron	School	Private	Byron Bay High School	Byron Bay	Yes	Recycled	Treated effluent used on sports field
Byron	Sportsfield - Council	Public	Brunswick Heads Playing Fields - (Alby Lofts Oval, Hockey Field, Top Field)	Brunswick Heads	No	Not irrigated	
Byron	Sportsfield - Council	Public	Eureka Playing Field	Eureka	No	Not irrigated	
Byron	Sportsfield - Council	Public	Suffolk Park Playing fields	Suffolk Park	No	Not irrigated	
Byron	Sportsfield - Council	Public	Byron Recreation Ground - (Soccer, Multiuse, Rugby Field)	Byron Bay	Yes	Recycled	Soccer field only, treated effluent
Byron	Sportsfield - Council	Public	Cavanbah Centre - (Cornell Family Fields, Field 2, General Purpose, Herb Elliott Athletics/Hockey)	Ewingsdale	Yes	Recycled	yes irrigated with treated effluent

LGA	Type	Council/Private	Open Space Property/Business Name	Suburb	Irrigated?	Water Supply	Notes
Byron	Sportsfield - Council	Public?	Red Devil Park	Byron Bay	Yes	Recycled	Travelling irrigator used as necessary, treated effluent
Byron	Sportsfield - Local Club watering	Public	Bangalow Recreation Ground (soccer fields and Shultz oval)	Bangalow	Yes	Potable	Occasional use of travelling irrigator.
Lismore	Bowling Club	Private	East Lismore Bowling Club	Lismore	No		Advice from Council
Lismore	Bowling Club	Private	South Lismore Bowling Club	South Lismore	No		Advice from Council
Lismore	Bowling Club	Private	Lismore City Bowls Club	Lismore	No		Advice from Council
Lismore	Bowling Club	Private	Lismore Heights Bowling Club	Lismore	Yes	Potable/Rainwater	They have an underground rainwater tank for storage. They only water when it needs it (checks ground conditions). Some water use in drier months.
Lismore	Cricket Pitch	Public Land managed by committee	Blair Oval (Rec 3)- cricket pitch	Lismore	Yes	Potable	Small amount used by club to maintain cricket pitch in summer
Lismore	Cricket Pitch	Public Land managed by committee	Heaps Oval (Rec 5)- cricket pitch	Lismore	Yes	Potable	Small amount used by club to maintain cricket pitch in summer
Lismore	Cricket Pitch	Public Land managed by committee	Neilson Park Turf Wicket - cricket pitch	East Lismore	Yes	Potable	Small amount used by club to maintain cricket pitch in summer
Lismore	Cricket Pitch	Public Land managed by committee	Nesbitt Park Oval- cricket pitch	South Lismore	Yes	Potable	Small amount used by club to maintain cricket pitch in summer
Lismore	Cricket Pitch	Public Land managed by committee	Mortimer Oval (Rec 8),	Lismore	Yes	Potable	Small amount used by club to maintain cricket pitch in summer
Lismore	Sportsfield - Council	Public	Crozier Oval (Rec 2), Lismore Park	Lismore		Potable	metered consumption provided by LCC
Lismore	Greyhound Track	Private	Coleman Point Gbota Greyhound Breeders Owners Trainers Asso	Lismore	No		Advice from Council
Lismore	Private recreation	Private	Go Kart Track	Lismore	No		Advice from Council
Lismore	Racetrack	Private	Lismore Turf Club	North Lismore	No		Advice from Council

LGA	Type	Council/Private	Open Space Property/Business Name	Suburb	Irrigated?	Water Supply	Notes
Lismore	School	Private	Kadina High School	Goonellabah	No		Advice from Council
Lismore	School	Private	Lismore High School	Lismore	No	Yes	Advice from Council. High potable consumption
Lismore	School	Private	Richmond River High School	Lismore	No		Advice from Council
Lismore	School	Private	Trinity Catholic College	Lismore	No	Yes	Advice from Council. High potable consumption
Lismore	School	Private	Woodlawn College	Woodlawn	No		Advice from Council
Lismore	School	Private	Southern Cross University Rugby Ground	Lismore	No		Advice from Council
Lismore	Showground	Private	Lismore Showground	North Lismore	No		Advice from Council
Lismore	Sportsfield	Private	Spinks Park Croquet Club	Lismore	No		Advice from Council
Lismore	Sportsfield - Local Club watering	Private	Thistles Soccer Club	Lismore	No		Advice from Council
Lismore	Sportsfield - Council	Public	Adam Gilchrist Oval,	Perradenya	No		Advice from Council
Lismore	Sportsfield - Council	Public	Albert Park	East Lismore	Yes	bore water/town water	Albert Park is mostly irrigated using bore water from the river but they are also able to irrigate via town water connection too
Lismore	Sportsfield - Council	Public	Arthur Park	North Lismore	No		Advice from Council
Lismore	Sportsfield - Council	Public	Blair Oval (Rec 3), Lismore Park	Lismore	No		Advice from Council
Lismore	Sportsfield - Council	Public	Clifford Park	Goonellabah	No		Advice from Council
Lismore	Sportsfield - Council	Public	Davidson Oval (Rec 10), Lismore Park	Lismore	No		Advice from Council
Lismore	Sportsfield - Council	Private	Dunoon and District Sports and Recreation Club	Dunoon	No		Advice from Council
Lismore	Sportsfield - Council	Public	Heaps Oval (Rec 5), Lismore Park	Lismore	No		Advice from Council
Lismore	Sportsfield - Council	Public	Hepburn Park - Hockey Fields, Goonellabah	Goonellabah	No		Advice from Council
Lismore	Sportsfield - Council	Public	Hepburn Park - Touch, Oztag, Cricket,	Goonellabah	No		Advice from Council

LGA	Type	Council/Private	Open Space Property/Business Name	Suburb	Irrigated?	Water Supply	Notes
Lismore	Sportsfield - Council	Public	Humbley Oval (Rec 4), Lismore Park	Lismore	No		Advice from Council
Lismore	Sportsfield - Council	Private	Italo Club	Lismore	No		Advice from Council
Lismore	Sportsfield - Council	Public	Jim Roder Oval	Lismore	No		Advice from Council
Lismore	Sportsfield - Council	Public	Jolley Field (Rec 6), Lismore Park	Lismore	No		Advice from Council
Lismore	Sportsfield - Council	Public	Lee Oval	Lismore	No		Advice from Council
Lismore	Sportsfield - Council	Public	Lyn Larson Oval,	South Lismore	No		Advice from Council
Lismore	Sportsfield - Council	Public	Mackney Courts - Netball Grass	Lismore	No		Advice from Council
Lismore	Sportsfield - Council	Public	Marie Lee Oval,	South Lismore	No		Advice from Council
Lismore	Sportsfield - Council	Public	McKenzie Park,	North Lismore	No		Advice from Council
Lismore	Sportsfield - Council	Public	Mortimer Oval (Rec 8), Lismore Park	Lismore	No		Advice from Council
Lismore	Sportsfield - Council	Public	Neilson Park Turf Wicket	East Lismore	No		Advice from Council
Lismore	Sportsfield - Council	Public	Nesbitt Park Jogging Track	South Lismore	No		Advice from Council
Lismore	Sportsfield - Council	Public	Nesbitt Park Oval,	South Lismore	No		Advice from Council
Lismore	Sportsfield - Council	Public	Recreation Grounds	Lismore	No		Advice from Council
Lismore	Sportsfield - Council	Public	Richards Oval (Rec12)	Lismore	No		Advice from Council
Lismore	Sportsfield - Council	Public	Riverview Park	South Lismore	No		Advice from Council
Lismore	Sportsfield - Council	Public	Rugby Union Field	Lismore	No		Advice from Council
Lismore	Sportsfield - Council	Public	Weston Park	Goonellabah	No		Advice from Council
Lismore	Golf Course	Private	Lismore Golf Club	Lismore	Yes	Potable	Water meter consumption provided by LCC from 2011-2016
Lismore	Sportsfield - Council	Public	Oakes Oval	Lismore	Yes	Potable	as irrigation is not separately metered, consumption assumed to be same as Williams
Richmond Valley	Bowling Club	Private	Evans Head Bowling Club	Evans Head		Potable	
Richmond Valley	Bowling Club	Private	Coraki Memorial bowling Club	Coraki		Potable	

LGA	Type	Council/Private	Open Space Property/Business Name	Suburb	Irrigated?	Water Supply	Notes
Richmond Valley	Golf Course	Private	Coraki Golf Club	Coraki	Yes	Recycled	Advice from Council
Richmond Valley	Sportsfield - Council	Public	Stan Payne Memorial Oval	Evans Head	No	None	Recycled water pipework installed but not connected
Richmond Valley	Sportsfield - Council	Public	Windsor Park	Coraki	No	Not irrigated	Advice from Council
Richmond Valley	Bowling Club	Private	Woodburn Bowling Club	Woodburn	No	Potable	No longer operating
Richmond Valley	Bowling Club	Private	Broadwater Bowling Club	Broadwater	Yes	Potable	Advice from Council
Richmond Valley	Golf Course	Private	Woodburn-Evans Head Golf Club	Doonbah	Yes	Bore water/rainwater	No potable water used
Richmond Valley	School	Private	Evans River K-12 School	Evans Head	Yes	Potable	Advice from Council

APPENDIX 2: BOWLING GREEN WATER CONSUMPTION ESTIMATES

Table 5: Typical bowling green water requirements either through rainfall or irrigation

Average area per bowling green (m ²)	Water required (L/week)	Depth of water required (mm/week)	Depth of water required (mm/month)
1600	40,000*	25	100

*The Bowling Green Construction Guidelines state that *"In the hotter months, a green will typically require in the range of 40m³ of water per week (from rain or irrigation) to maintain turf cover"* (Bowls Australia, 2011)

Table 6: Mean Monthly Rainfall for main urban centres in the Rous Region (BOM, 2016). Highlighted cells show months when rainfall is typically below 100mm

Urban Centre	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	Total no. months<100mm
Lismore	151.7	131.1	131.1	119.5	75.6	98.4	37.6	60.1	41	77.7	112.1	123.1	1179.6	6
Byron	164.4	166.6	142.1	177	99.4	164.9	96.3	75.4	47	95.8	93.4	139.3	1509.2	6
Ballina	181.1	198.1	213.1	188.7	168.4	195.3	117.4	83.9	62.4	97	125.1	141.9	1879.1	3
Evans Head	157.1	151.8	172.4	168	105.8	172.9	74.2	84.3	55	86.3	130.3	93.8	1481.5	5

Table 7: Mean Rainfall deficit to be made up each month by irrigation

Urban Centre	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lismore					24.4	1.6	62.4	39.9	59	22.3		
Byron					0.6		3.7	24.6	53	4.2	6.6	
Ballina								16.1	37.6	3		
Evans Head							25.8	15.7	45	13.7		6.2

No allowance for supply from rainwater tanks.

Table 8: Bowling clubs - Estimate of water required to supplement local rainfall to maintain bowling greens

Open Space Property/ Business Name	Suburb	LGA	Irrigated ?	Water Supply	Area of green (m ²)	No. of greens	total irrigation area (m ²)	Irrigation water volume required to supplement rainfall (kL/month)												Total cons (kL/a)
								Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Alstonville Plateau Bowls and Sports Club	Alstonville	Ballina	Yes	Assume Potable	1600	2	3200	0	0	0	0	0	0	0	52	120	10	0	0	181
Cherry Street Bowling Club	Ballina	Ballina	Yes	Recycled			0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lennox Bowling Club	Lennox	Ballina	Yes	Assume Potable	1600	2	3200	0	0	0	0	0	0	52	120	10	0	0	181	
RSL Bowling Club	Ballina	Ballina	Yes	Recycled			0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bangalow Bowling Club	Bangalow	Byron	Yes	Assume Potable	1600	2	3200	0	0	0	2	0	12	79	170	13	21	0	297	
Brunswick Heads Bowling Club	Brunswick Heads	Byron	Yes	Assume Potable	1600	3	4800	0	0	0	3	0	18	118	254	20	32	0	445	
Byron Bay Bowling Club	Byron Bay	Byron	Yes	Recycled			0	0	0	0	0	0	0	0	0	0	0	0	0	
East Lismore Bowling Club	Lismore	Lismore	Yes	Council advises non-potable	1600	3	4800	0	0	0	117	8	300	192	283	107	0	0	1006	
Lismore City Bowls Club	Lismore	Lismore	Yes	Council advises non-potable	1600	2	3200	0	0	0	0	0	0	0	0	0	0	0	0	
Lismore Heights Bowling Club	Lismore	Lismore	Yes	Potable/Rainwater	1600	3	4800	0	0	0	117	8	300	192	283	107	0	0	1006	
South Lismore Bowling Club	South Lismore	Lismore	Yes	Council advises non-potable	1600	3	4800	0	0	0	0	0	0	0	0	0	0	0	0	
Broadwater Bowling Club	Broadwater	Richmond Valley	Yes	Assume Potable	1600	2	3200	0	0	0	0	0	83	50	144	44	0	20	340	
Coraki Memorial Bowling Club	Coraki	Richmond Valley	Yes	Assume Potable	1600	2	3200	0	0	0	0	0	83	50	144	44	0	20	340	
Evans Head Bowling Club	Evans Head	Richmond Valley	Yes	Assume Potable	1600	3	4800	0	0	0	0	0	124	75	216	66	0	30	511	
Woodburn Bowling Club	Woodburn	Richmond Valley	Yes	Assume Potable	1600	2	3200	0	0	0	0	0	83	50	144	44	0	20	340	
Total (kL/a):																	3,275			