Rous Regional Water Management Strategy

(Adopted Council November 2009)

Foreword

This Regional Water Management Strategy has been prepared for Rous County Council (Rous Water) by Water Services, NSW Department of Commerce. It presents Rous Water's Regional Water Management Strategy and includes an Emergency Drought Management Plan that meets the requirements of the Drought Management Check List (August 2007) of the Department of Water and Energy.

Version	Reviewed by	Issued Date	Comments received
Advanced Draft	Kamal Fernando	December 2008	From Rous Water
Final Draft	Kamal Fernando	January 2009	
Revised Draft	Wayne Franklin	June 2009	
Final Document	Wayne Franklin	December 2009	

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Executive Summary

This report describes the Regional Water Management Strategy for Rous Water and indicates how water is managed in the Rous Water area both during normal times and also during periods of drought.

Included in this report are sections with information on:

- Baseline information about Rous Water's:
  - Customers;
  - Supply network;
  - Climate;
  - Major assets (e.g. dams, water treatment plants).
- Current and future population numbers and water demand;
- Demand restriction policy:
  - When to introduce and lift restrictions;
  - How Rous Water alters its operations during drought;
  - Ongoing demand management options.
- Historical droughts;
- Emergency options for additional water supply during droughts;
- Community consultation and communication strategy;
- Monitoring during droughts.

The following table summarises the trigger points for timely implementation of appropriate restrictions, and when restrictions can be eased.

Restriction Level	Rocky Creek Dam Capacity (%)	
	Introduction of Restrictions	Lifting of Restrictions
1	60	70
2	50	60
3	40	50
4	30	40
5	20	30
6	15	20
7	10	15

1 Introduction

1.1 Objectives of this Report

This report describes the water management strategy of Rous Water, during normal times and also during periods of drought. Adherence to this strategy should ensure that high quality water supplies can be maintained to the customers of Rous Water under almost any conceivable circumstances of drought.

1.2 Objectives of the Regional Water Management Strategy

The objectives of the Regional Water Management Strategy are to:

- review the current and future water demands of the supply area;
- assess the capability of the Rous Water system to meet current and future demands under normal and drought conditions;
- develop strategies that will allow future water demands to be met;
- identify the issues which need to be addressed in adopting the restrictions;
- show the triggers for the introduction of water restrictions;
- list the actual restrictions that apply at each level of water restrictions, Levels 1 to 7;
- indicate how Rous Water will access the various water sources available for supply to the Region, under different levels of water restrictions;
- predict the reduction in customer water use for each level of water restrictions;
- show the triggers for removing water restrictions;
- indicate what internal and external resources are required to manage a drought;
- develop a drought management plan;
- show how restrictions are to be enforced; and
- outline the awareness and education program to communicate the Water Management Strategy to the public.

1.3 Location

Rous Water is a bulk drinking water supplier that provides water to four major customers; the local government areas (Councils) of Lismore, Byron, Ballina

and Richmond Valley. These Councils then distribute water to individual retail customers in the major towns of Lismore, Ballina, Evans Head, Coraki, Alstonville, Lennox Head, Bangalow, Byron Bay and Brunswick Heads (plus some smaller towns). Rous Water also supplies water directly to about 2,000 rural customers. A total population of around 95,000 is serviced by Rous Water, over an area of about 3,000 sq. km.

Figure 1: Location map with main towns and pipelines

Rous Water's head office is located in Lismore NSW. A locality map of the Rous Water's supply area is provided in Figure 1 **(**above**).**

The permanent population served by Rous Water was approximately 95,000 in 2008, with seasonal increases of approximately 30,000 people during the peak tourist season (Christmas/New Year period). However a peak day demand variation of this magnitude has not been recorded in the treated water production records.

1.4 Overview of Rous Water Operations

Rous Water draws raw water mainly from the Rocky Creek Dam (RCD) and treats it at the adjacent 70ML/d Nightcap Water Treatment Plant (WTP). RCD is located in the Nightcap Range approximately 27km north of Lismore. Another raw water source, the Wilson's River Source, also supplies raw water to Nightcap WTP via a 20km rising main.

The Nightcap WTP supply is supplemented by water supplied from the 7.5ML/d Emigrant Creek WTP. Raw water for the Emigrant Creek WTP is drawn from the nearby Emigrant Creek Dam (ECD) which is located approximately 15km north west of Ballina.

Finally, several borefields are available, which are capable of supplying up to 3ML/d of groundwater if required. In general, these borefields are only operated during droughts.

The treated water from these sources is distributed, mostly by gravity to Rous Water's four Local Government customers using its distribution network and the reservoirs as shown in Figure 2.

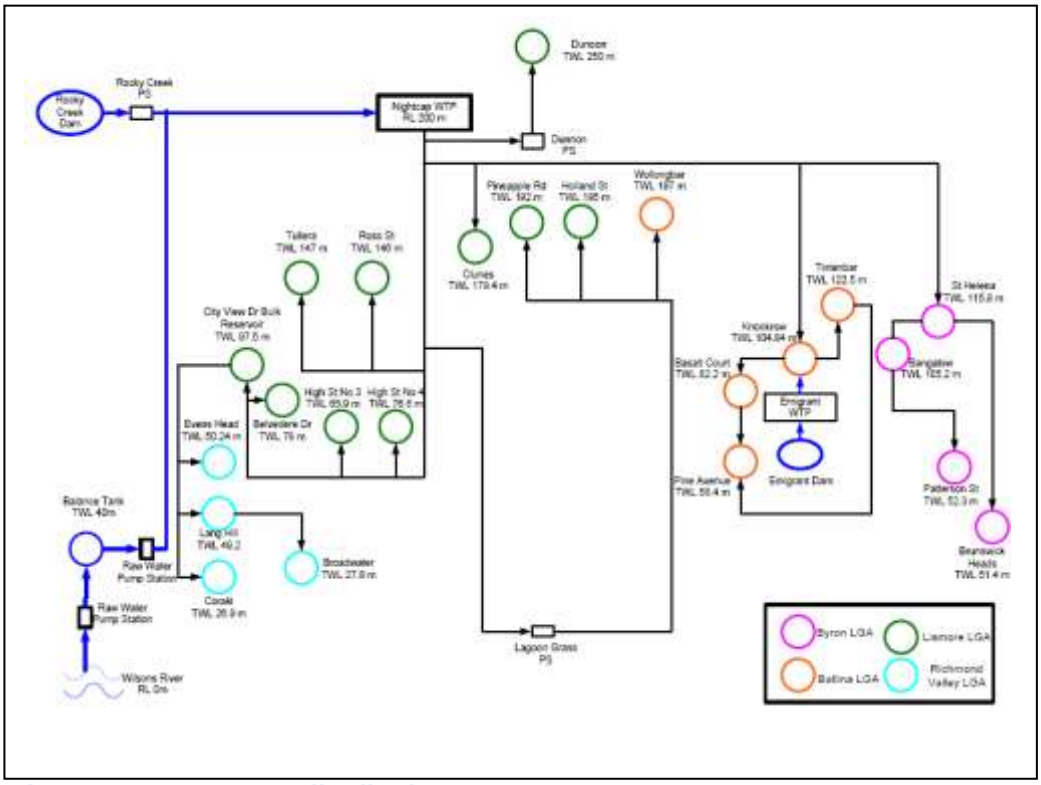


Figure 2: Rous Water - distribution system

1.4.1 Raw Water Sources

1.4.2 Rocky Creek Dam

Rocky Creek Dam is Rous Water's major water storage, and was commissioned in November 1953. Water is pumped from the dam to the Nightcap WTP located to the south east of the dam and treated prior to distribution.

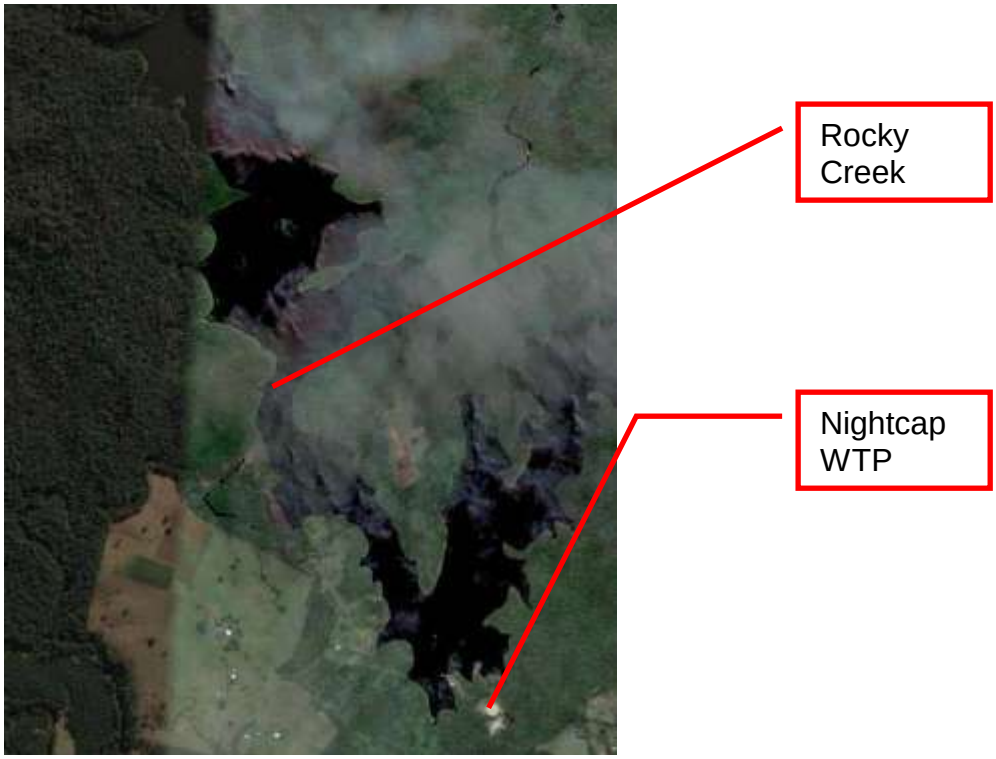


Figure 3: Satellite image of Rocky Creek Dam

The secure yield of RCD is 9,600 ML/annum with a maximum effective storage capacity of 14,000 ML. The Storage level variation of RCD from 2000 to 2008 is provided in Figure 4.

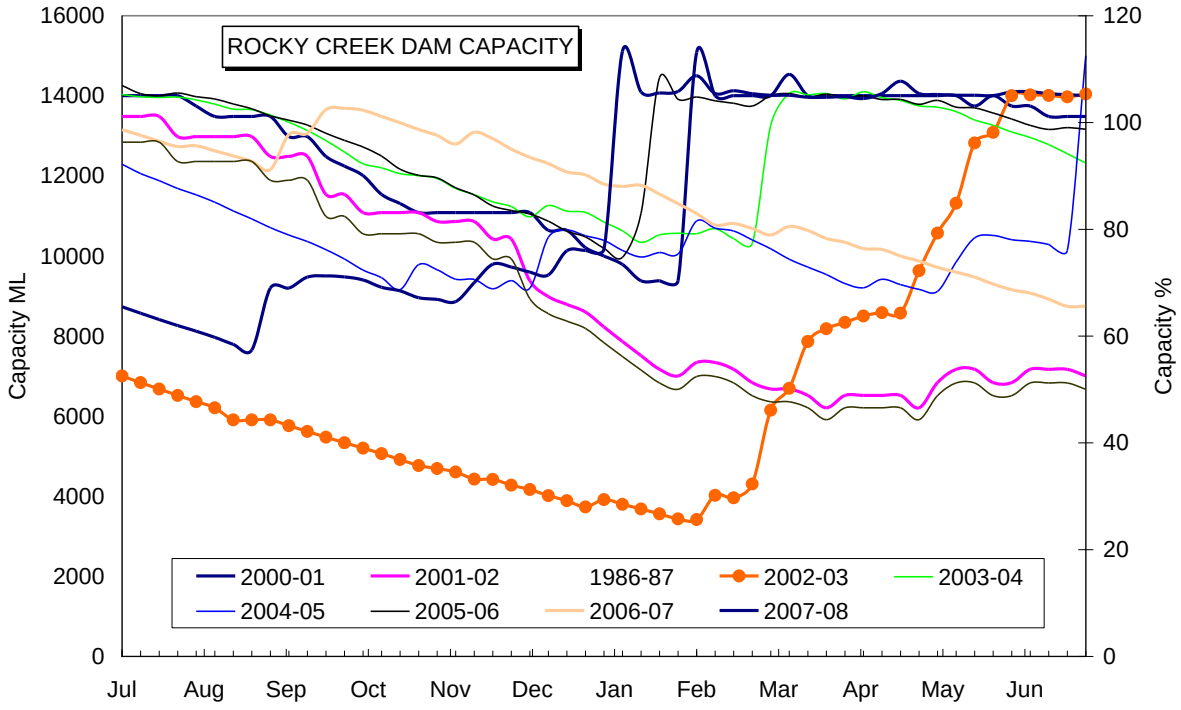


Figure 4: Rocky Creek Dam level variation from 2000 to 2008

During the first four decades of its operation, Rocky Creek Dam did not experience severe drought and was observed to spill regularly. The dam is considered to be a very reliable water source. Demand Management

indicators were implemented by some Constituent Councils and Rous Water, from approximately 1990 onward. This resulted in a significant reduction in per capita water consumption which, despite the growth in population, tempered the demand on Rocky Creek Dam.

The impact of the severe drought in 2002/03 surprised most people and resulted in Rocky Creek Dam falling to approximately 23%. In anticipation of the dam levels falling further, Rous Water constructed an emergency supply abstracting water upstream of Lismore. Analysis of the performance of Rocky Creek Dam after the drought showed that it would not have failed had the emergency source not been built.

The following two figures show height / volume / surface area graphs for Rocky Creek Dam.

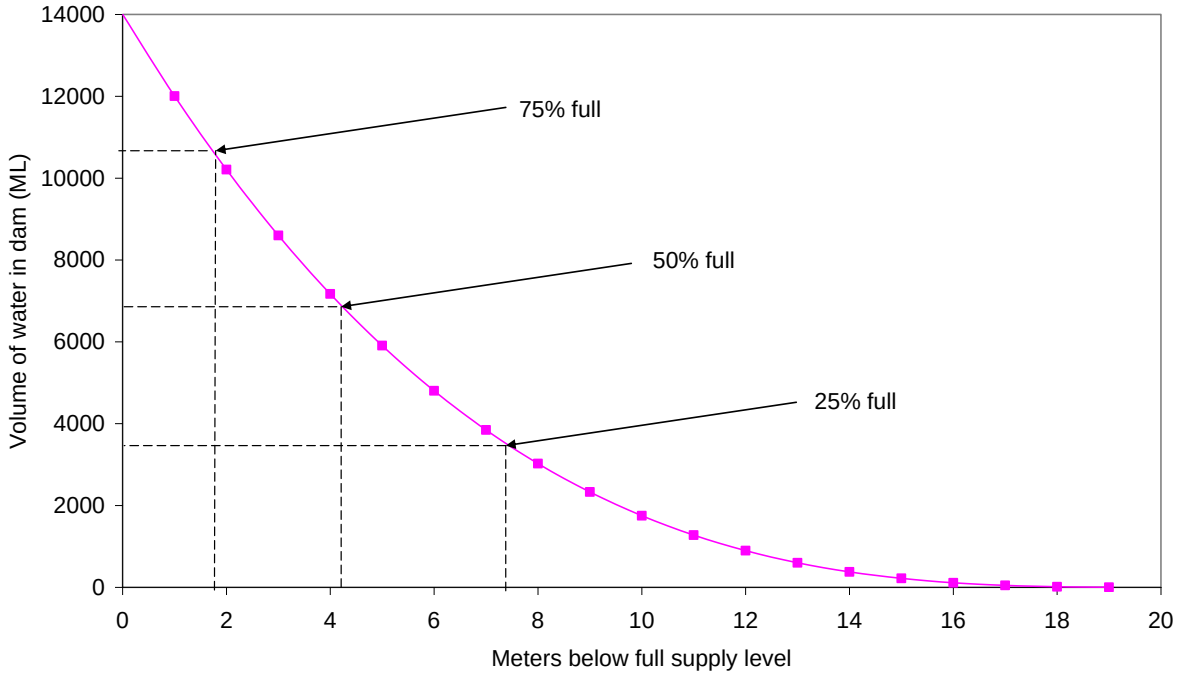


Figure 5: Rocky Creek Dam storage volume vs. height data

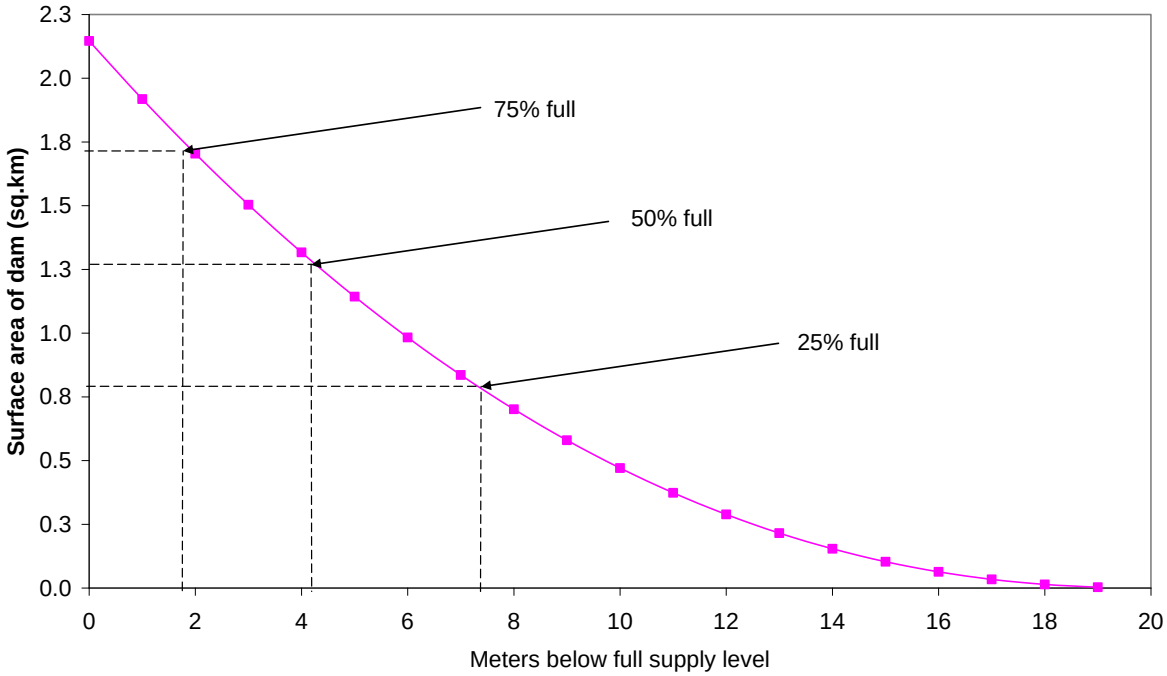


Figure 6: Rocky Creek Dam storage volume vs. surface area data

Finally, there is no requirement to release water from the Dam into the Creek for downstream users or environmental flows, although if the Dam is full water will spill via the spillway into Rocky Creek.

1.4.3 Emigrant Creek Dam

Emigrant Creek Dam (ECD) is located approximately 15km North West of Ballina and was built in 1968. The secure yield of the dam is 1,600 ML/ annum with a maximum effective storage volume of around 800 ML.

Figure 7: Satellite image of Emigrant Creek dam

Ownership of Emigrant Creek Dam was transferred from Ballina Shire Council to Rous Water when Ballina Shire became a member of Rous Water in the mid 1980s. The dam is used as a supplementary supply to Rocky Creek Dam, with a small amount of water being treated at Knockrow Water Treatment plant. Extraction from the dam ceased in 1999 pending the construction of a new water treatment plant and upgrading of the dam for safety reasons. The dam was drawn down by release of water to Emigrant Creek. This occurred in 2001/02 (See Figure 8).

The 2002/03 drought saw the dam recommissioned for the duration of the drought. During 2004/05 the dam was again drawn down by release to Emigrant Creek to allow the construction of the inlet works for the new water treatment plant. Since 2005 the water has been treated at an advanced 7.5ML/d membrane filtration plant, which has only been used sporadically as Rocky Creek Dam has supplied sufficient water to the Rous Water network.

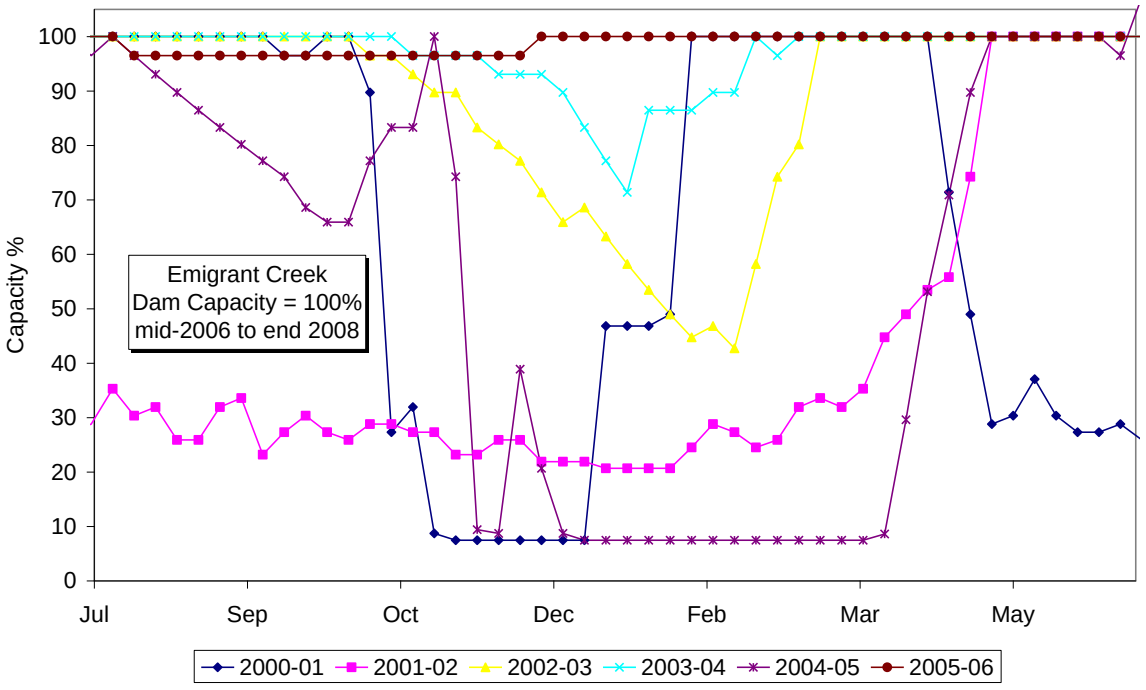


Figure 8: Emigrant Creek Dam level variation from 2000 – 2006

The following two figures show height / volume / surface area graphs for Rocky Creek Dam.

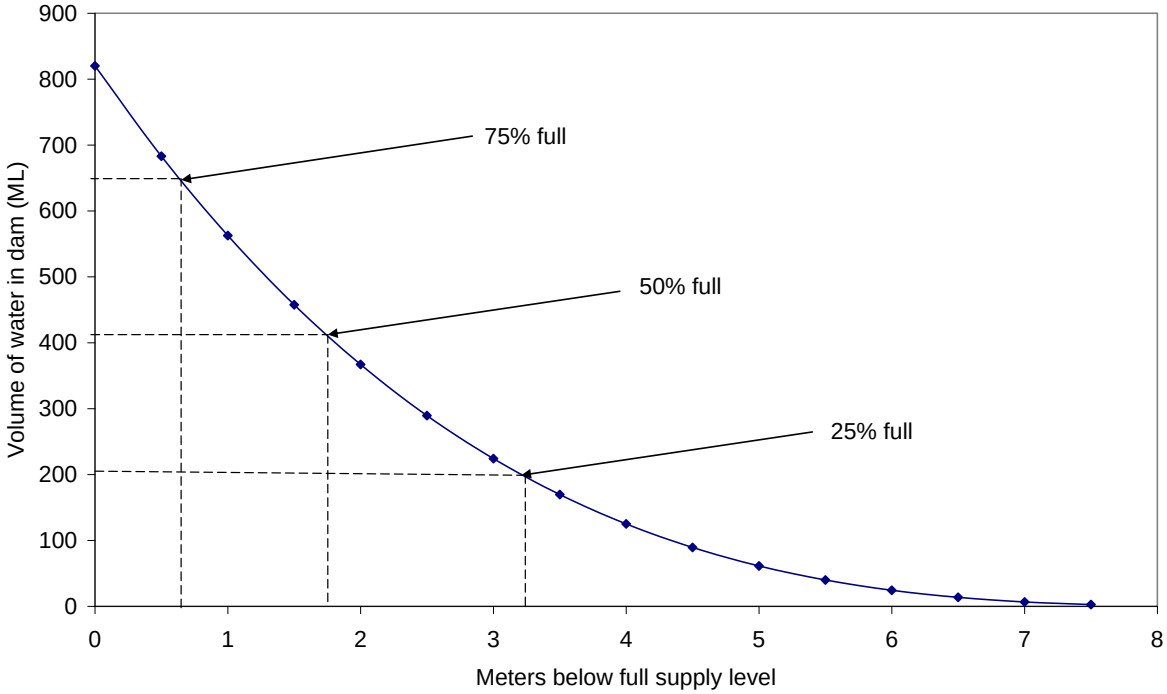


Figure 9: Emigrant Creek Dam storage volume vs. height data

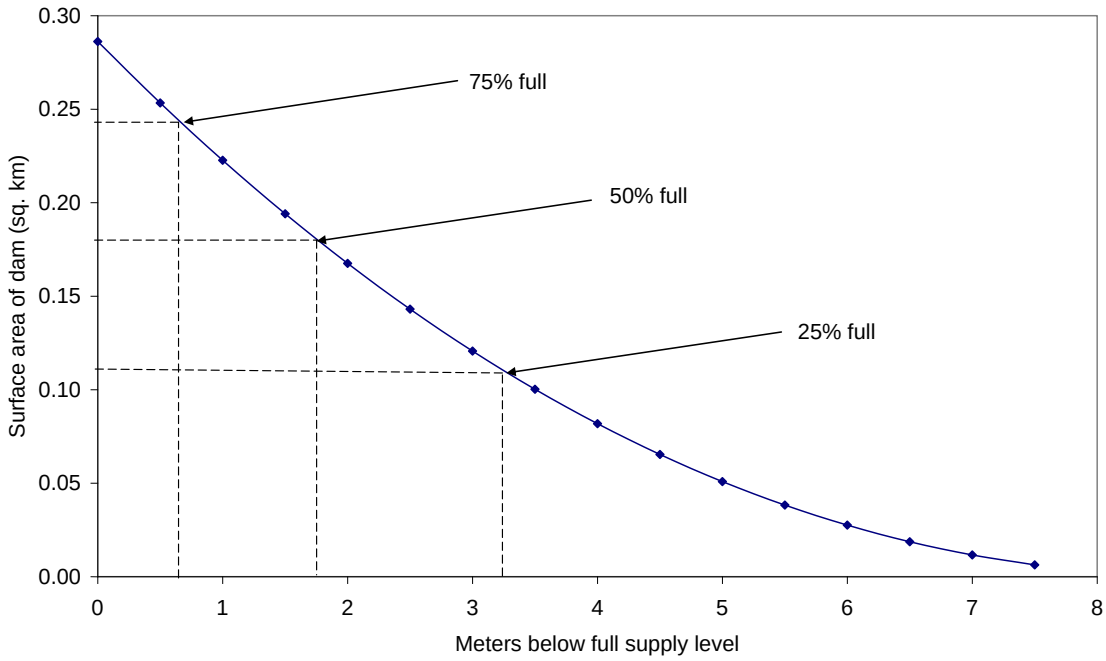


Figure 10: Emigrant Creek Dam storage volume vs. surface area data

There is a requirement to release water from the Dam into the Creek for environmental flows, according to the "Bishop Rules", as developed by consultant Keith Bishop and agreed to by DWE. The required releases under these rules are summarised below in Table 1.

Month	Minimum daily release (ML)	Additional releases required?
January	7.5	No
February	7.5 first half of month, 10 second half of month	No
March	10	No
April	10 first half of month, 7.5 second half of month	No
May	7.5	No
June	30 for half of month, 5 for other half of month	Yes, if sufficient flow in this month
July	5	Yes, if sufficient flow in this month
August	5 first half of month, 7.5 for second half of month	No
September	30	No
October	10	No
November	10 first half of month, 7.5 for second half of month	No
December	7.5	No

Table 1: Environmental flow rules for Emigrant Creek Dam

1.4.4 Plateau Bores

Rous Water operates 2 bores on the Alstonville Plateau. These bores are located at Lumley Park, Alstonville, and Convery's Lane at Wollongbar. The combined production of these bores is approximately 1 ML/day.

Lumley Park bores perform reliably while the Convery's Lane bore is observed to have a declining yield. During 2002/03 drought, Lumley Park experienced some drawdown but did not have a decline in yield. The Convery's Lane bore experienced a significant decline in yield.

1.4.5 Woodburn Bores

Rous Water owns three licensed bores at Woodburn. An investigation completed early in 2002 confirmed that Bores No 1 and 2 were no longer serviceable and that Bore No 3 was suitable for rehabilitation. During 2002/03 drought, bore 3 was rehabilitated and bores 1 and 2 were re-drilled.

Based on production tests carried out by DWE at the time, it is estimated that up to about 2ML/d of water can be extracted from these bores.

1.4.6 Wilson's River

In 2002/03 a major drought required development of an emergency source of water for Rous Water. This was done by converting an existing gravity pipeline delivering water from Nightcap WTP to Lismore into a rising main transferring raw water from the Wilson's River up to Nightcap WTP. This emergency system was decommissioned shortly after its completion, after heavy rainfall refilled Rocky Creek Dam.

1.4.7 Wilson's River Source

Rous Water had previously (1995) identified the Wilson's River as the next source of water for the regional supply. Following the drought in 2002/03, Rous Water proceeded to construct permanent infrastructure. The permanent system was named the "Wilson's River Source", and was completed in 2008.

The Wilson's River Source system consists of two pump stations ("low lift" and "high lift") and a 20km long 660mm OD Sintercote steel rising main to pump water from the Wilson's River to the Nightcap WTP. This system is capable of supplying between 5 to 30 ML/d of water to the Rous Water system via the Nightcap WTP. This source adds approximately 4000 ML/annum of secure yield to the Rous Water system.

The current DWE Licence:

- allows Rous Water to pump up to 5400ML/annum as a 3 year rolling average;
- allows Rous Water to pump 25% of the available flow above the nominated cease to pump flow rates:
    - In summer pumping at 5ML/d may start at a river flow of 105ML/d, and once river flow reaches 205ML/day (or above) pumping can carried out at 30ML/d (the maximum pumping capacity);
    - In winter pumping a 5ML/d may start at a river flow of 61ML/d, and once river flow reaches 161ML/d pumping can be carried out at 30ML/d.

1.5 Water treatment

1.5.1 Nightcap WTP

Nightcap WTP employs Dissolved Air Flotation and Filtration (DAFF), ozone/ Biologically Activated Carbon (BAC) process and chlorination for disinfection and has a rated maximum capacity of 70 ML/day. The ozone / BAC treatment was added in 2008 to treat water supplied from the Wilson's River Source as a drinking water quality risk assessment identified potential contaminants in the river water that could not be removed by the original treatment process.

Figure 11: Satellite image of Nightcap WTP

1.5.2 Emigrant Creek WTP

Emigrant Creek WTP employs membrane filtration, ozone/BAC and chlorination for disinfection, and has a rated maximum capacity of 7.5ML/day.

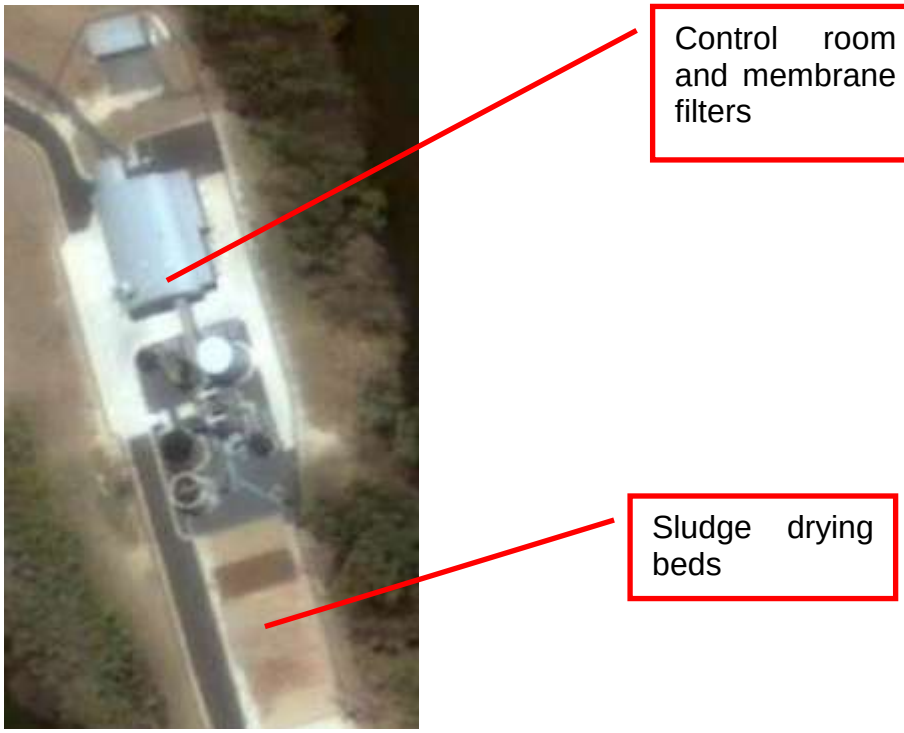


Figure 12: Satellite image of Emigrant Creek WTP

1.5.3 Plateau Bores

Lumley Park Bore is chlorinated; Convery's Lane bore is untreated being pumped straight into Wollongbar reservoir where it is mixed with chlorinated water for residual disinfection.

1.5.4 Woodburn Bores

In 2002 Rous Water examined the existing WTP at the borefield and several rehabilitation works were carried out. This work included replacement of filter media, maintenance of aeration equipment, rehabilitation of electrical switchgear and servicing of disinfection and lime/CO_2 dosing equipment.

The lime/CO_2 dosing equipment is necessary to ensure the quality of water produced is of an equivalent standard to that produced by the Nightcap WTP.

The current water treatment facility however, needs upgrading. Rous Water expects to upgrade this facility to meet basic needs in the future.

1.6 Climate

The area supplied by Rous Water has a sub-tropical climate, with mild to warm temperatures all year round. The following graph shows temperature data from Alstonville, which is approximately halfway between Lismore and Ballina.

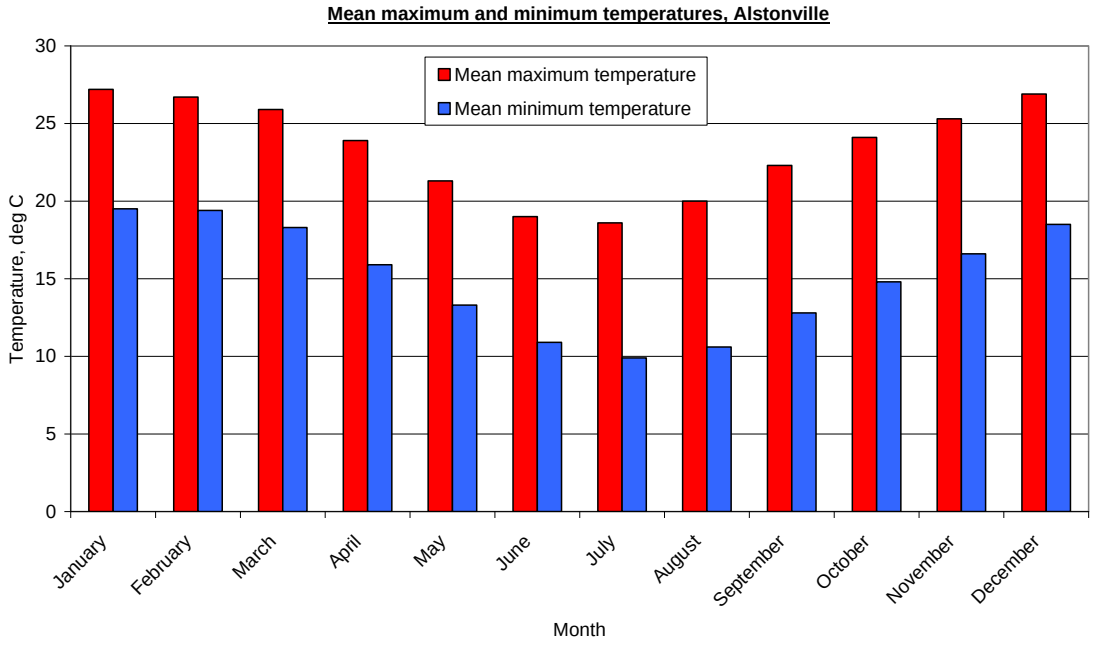


Figure 13: Maximum and minimum temperatures at Alstonville

Rainfall is relatively high. The mean annual rainfall at Alstonville is 1800mm per year.

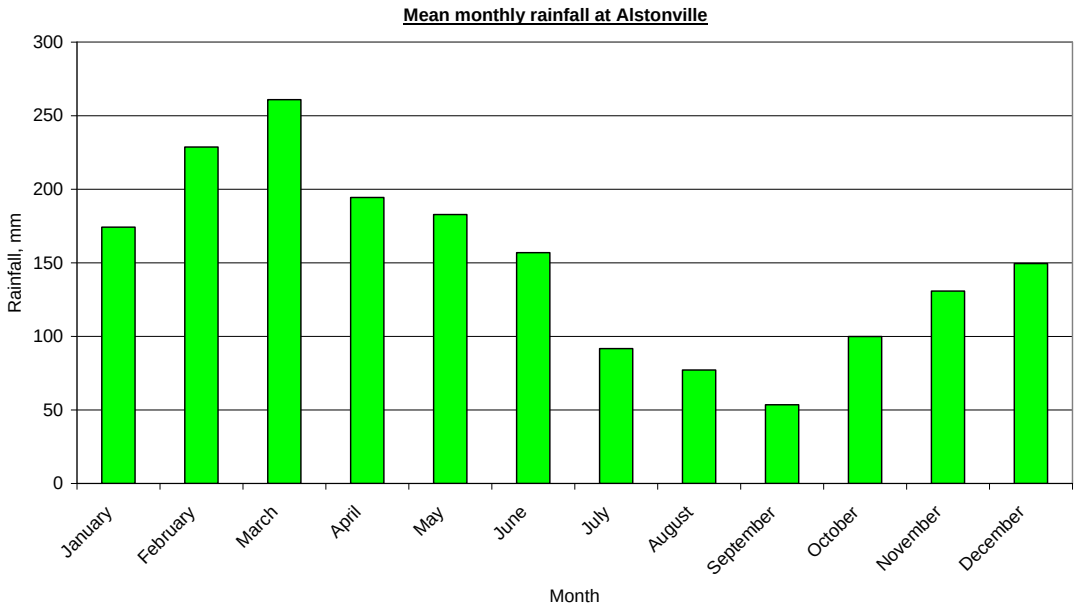


Figure 14: Mean monthly rainfall at Alstonville

Evaporation is also relatively high, with mean annual daily evaporation reaching 4.2mm per day, or 1.5m per year.

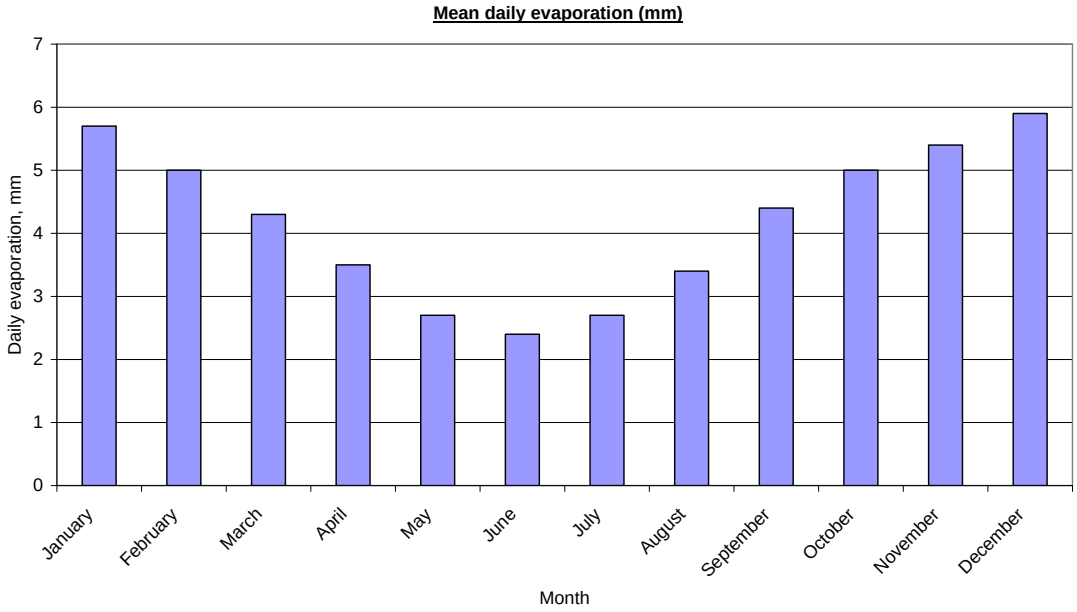


Figure 15: Daily evaporation at Alstonville

2 Population and Water Demands

2.1 Population projections

In November 2005, Rous Water engaged GeoLINK to undertake population and water demand projections up to 2050. The following population projections have been sourced from the GeoLINK report (see Chapter 8 - References).

The population breakdown for Rous Water's supply area in 2001, as adapted from the GeoLINK report is provided below:

LGA	Number of people supplied by Rous Water in each area	% of total LGA population supplied by Rous Water
Byron Bay	18,864	62
Ballina	30,346	82
Lismore	28,711	69
Richmond Valley	5,190	25
Rural	4,471	N/A
Total	87,582	~60

Table 2: Breakdown of population in Rous Water's supply area in 2001

The report provided population projections up to the year 2050 in Rous Water's supply area based on three scenarios:

- High Growth - 180,000
- Medium Growth - 148,000
- Low Growth - 121,000

These population growth scenarios are show in Figure 16 (below).

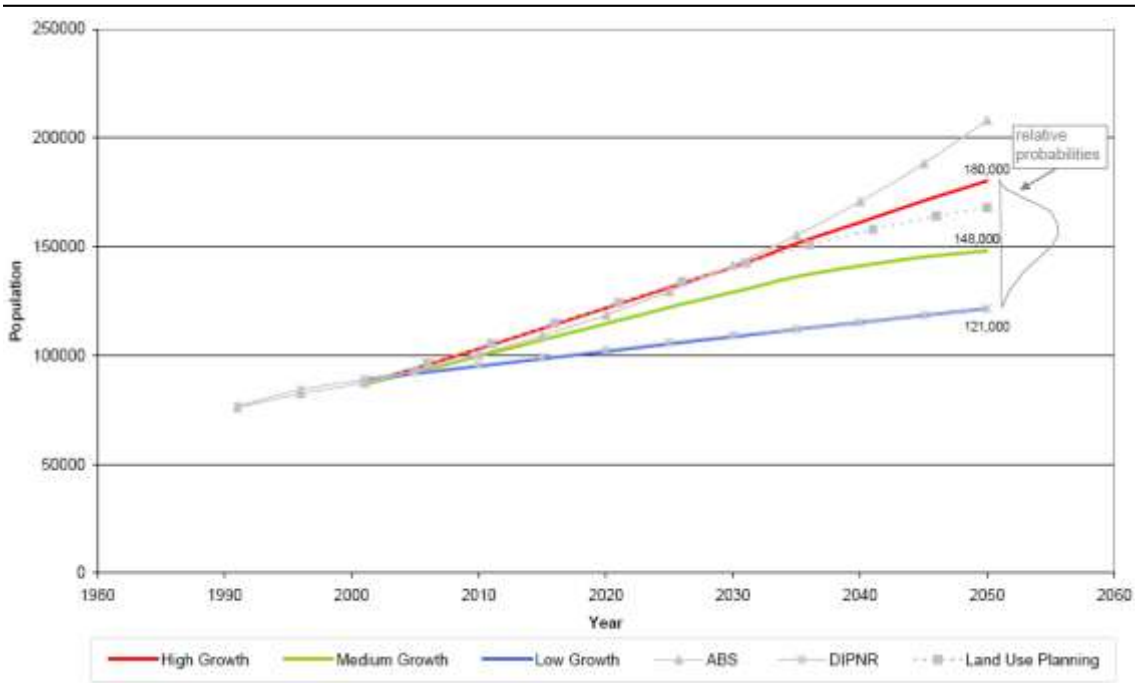


Figure 16: Population trends for the Rous Water area

The report also concluded that the probability of the growth scenarios is skewed towards the high and medium scenarios. This probability distribution is based on combining the probability distributions estimated for each local government area (LGA) with a higher weighting given to the LGAs with higher populations.

In addition to the population indicated above, a total peak tourist population of about 43,600 has also been predicted for 2050.

2.2 Types of water consumers

GeoLINK investigated the types of consumers supplied with water in each of the LGA. A summary of the breakdown of the usage in each LGA is provided below.

LGA	Residential	Commercial and industrial
Byron Bay	75%	25%
Ballina	77%	23%
Lismore	74%	26%
Richmond Valley	75%	25%

Table 3: Residential vs. commercial water usage in each LGA

In addition, a 2002 report “Rous Water Drought Management Strategy” (see Chapter 8 References), states that Rous Water Rural customers are 23% residential and 77% commercial and industrial, a much higher percentage of non-residential users than in the Council areas, presumably reflecting the farming related activities in this customer group.

The 2002 report also gave the following table with the largest non-residential users operational at that time.

	Business	Industry	Demand (ML/yr)	Council Area
1.	Norco	Food Processing	89	Lismore[1]
2.	Sunny Brand Chickens	Food Processing	69	Byron[1]
3.	Southern Cross Uni	Tertiary Education	49	Lismore[1]
4.	Lismore Base	Hospital	47	Lismore[1]
5.	Caroona	Nursing Home	39	Lismore[1]
6.	Linclean	Commercial Laundry	32	Lismore[1]
7.	St Vincent's	Hospital	31	Lismore[1]
8.	Crowley Village	Aged Accommodation	30	Ballina[2]
9.	Ballina Fair	Shopping Centre	23	Ballina[2]
10.	Lismore Square	Shopping Centre	23	Lismore[1]

Table 4: Large non-residential users, 2002

1 – These are actual consumption figures. Council provided figures for the last 12 months of meter readings

2 – These are average consumption figures based on the last 2 years of meter readings provided by Council

In 2002 the average demand for the top ten non-residential customers was approximately 1.2ML/d which equated to less than 5% of total average demand, indicating that any restrictions should be targeted mainly at residential customers.

The equivalent data for 2007 is shown below.

	Business	Industry	Demand (ML/yr)	Council Area
1	Norco	Food Processing	125	Lismore
2	Sunnybrand Chickens	Poultry Processing	63	Byron
3	Linclean	Commercial Laundry	50	Lismore
4	Southern Cross Uni	Tertiary Education	41	Lismore
5	Lismore Base	Hospital	39	Lismore
6	Caroona	Nursing Home	29	Lismore
7	St Vincent's	Hospital	28	Lismore
8	Crowley Village	Nursing Home	26	Ballina
9	Arts Factory	Hostel	26	Byron
10	Ballina RSL	Club	24	Ballina

Table 5: Large non-residential users, 2007

The average daily demand for the top ten non-residential customers was approximately 1.2ML/d in 2007, confirming previous results.

2.3 Historical / Current Water Consumption

2.3.1 Annual Demand

The following water consumption data have been obtained from treated water production records maintained by Rous Water.

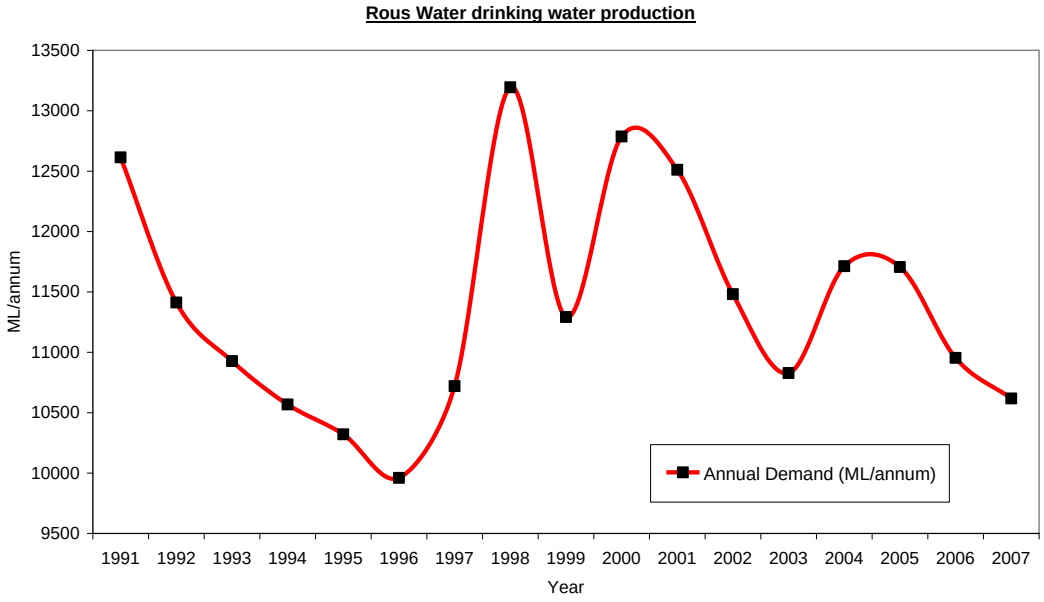


Figure 17: Annual Rous Water drinking water production

It is reasonable to assume that, in the absence of any other factors, the demand for water would increase with the increase in population in the Rous Water supply area since 1991 (Figure 16). However, as shown in Figure 17, annual demands have fluctuated significantly in Rous Water's supply area, and no long term trend is readily visible. Significant drops in water demand have been experienced in times of drought (1996, 2002, 2003 and 2007). These reductions in demand can be directly attributed to the implementation of water conservation measures and other demand management measures.

2.3.2 Seasonal Demand Variation

Demand has a high seasonal component and fluctuates throughout the year. Factors influencing seasonal demand within the Rous service area include increased domestic outdoor usage during the hot summer months, and increased rural demand during hotter times.

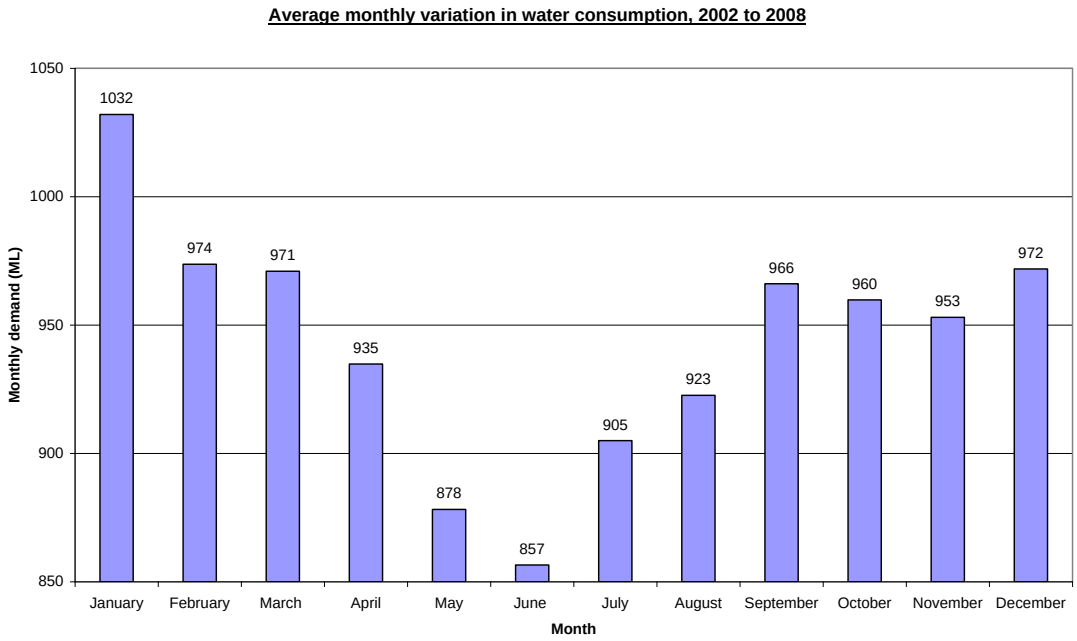


Figure 18: Monthly variation in water consumption 2002 to 2008

NB. Monthly consumption figures were normalised to a standard 31 day month for comparison purposes

2.3.3 Daily Demand Variation

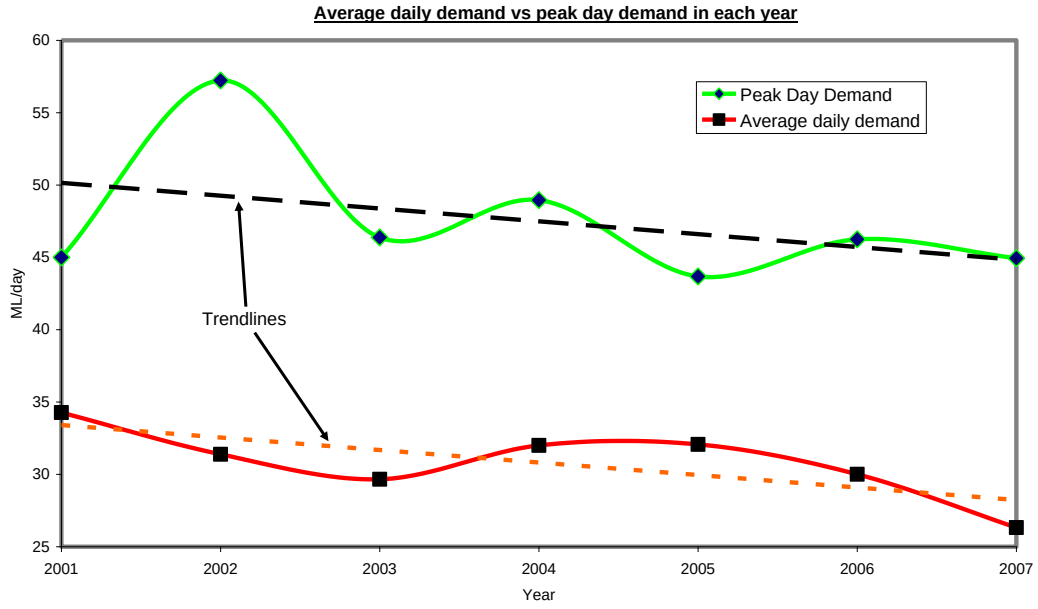
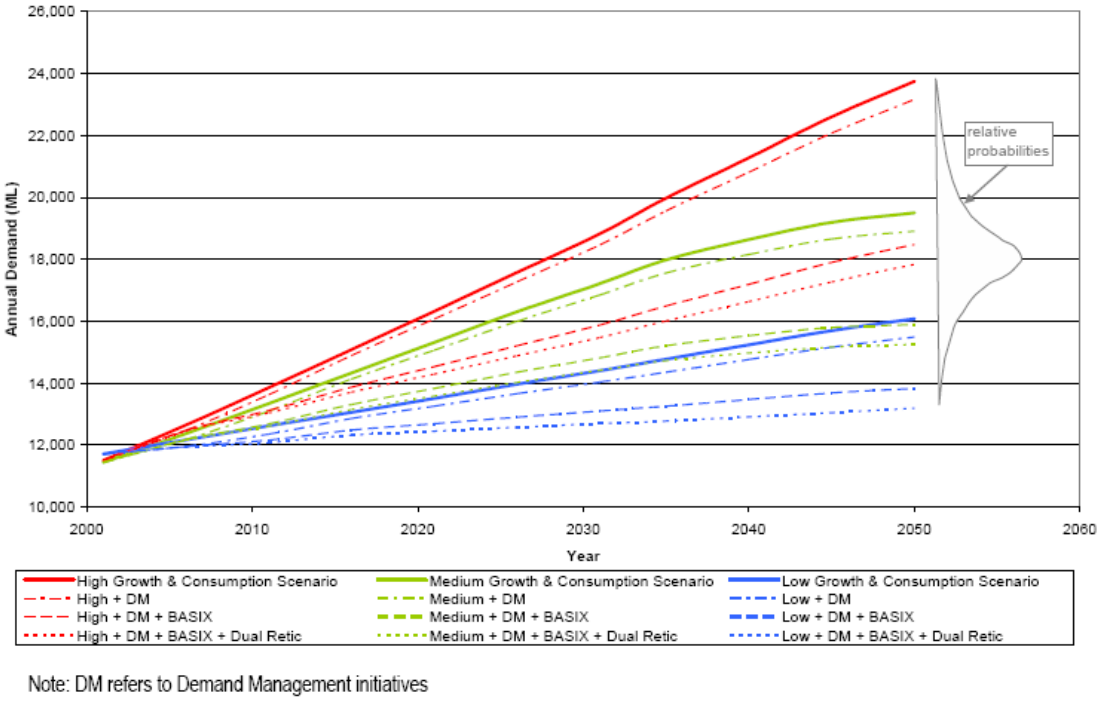


Figure 19: Average daily demand vs. peak day demand 2001 to 2007

As seen in annual demands during drought periods, peak daily demands have also been reduced reflecting consumers' response to demand management and drought management measures. Although the peak (maximum) daily demand in 2002 was 57 ML/d, since then it has reduced to 45ML/d in 2007. The average daily demand is approximately 30ML/day.

2.4 Future Water Consumption

In response to the predicted population increases (Figure 16), GeoLINK has provided water demand projections for three possible different growth scenarios as shown in Figure 20. GeoLINK has predicted an annual demand of 18,000ML by 2050 is the most likely outcome. However, it should be noted that according to GeoLINK's calculations annual demand could be as low as 13,200ML or as high as 23,800ML.



Note: DM refers to Demand Management initiatives

Figure 20: Future water demand projections

2.5 Demand Hardening

Demand hardening in a community occurs as long term improvements in water use efficiency such as the NSW State Government BASIX (Building Sustainability Index) rules reduce the amount of water that can be saved by applying short term restrictions on water use. For example, applying Level 1 restrictions might have reduced consumption by 10% in the 1980's, but might only reduce consumption by 5% in the 2000's. This demand hardening needs to be considered when estimating the water savings that could be made at different levels of restrictions in the Rous area.

2.6 Demand Multipliers

Demand Handling may result in the earlier imposition of a higher level of restriction to meet the target consumption set out in Table 9. Based on detailed analysis of past consumption records, the following monthly demand multipliers were adopted to help develop the restriction policy for drought management. The monthly demand multipliers are multiplied by the annual demand expressed as a monthly average demand to obtain the target demand for the particular month.

Month	Target demand multiplier	Month	Target demand multiplier
January	1.27	July	0.98
February	0.95	August	0.97
March	1.03	September	1.02
April	0.97	October	1.03
May	0.91	November	0.97
June	0.88	December	1.03

Table 6: Target demand multipliers for each month

3 Regional Water Management Strategy

3.1 Introduction

The main tool underpinning the objectives of a Water Management Strategy is a supply/demand hydrological model developed by NSW Water Solutions which:

- estimates the amount of secure supply based on records of streamflow in the Rous Water area from 1892 and estimates how much water could be supplied from each of Rous Water's raw water sources; and
- calculates how variable levels of demand will affect the availability of water in Rous Water's main source of raw water, Rocky Creek Dam.

The hydrological model estimates the amount of secure supply by using the 5/10/20 rule, which states:

1. Restrictions should not be in place for more than 5% of the time (**5% rule**);
2. Restrictions should not be introduced more often than (on average) once in 10 years during the period of analysis, which has to be at least 100 years (**10% rule**);
3. The system should be able to supply 80% of normal demand (i.e. 20% reduction in consumption) through a repeat of the worst drought on record starting with the storage drawn down to the level at which restrictions would be applied to satisfy the 5% and 10% rules (**20% rule**).

The 5:10:20 rule is the industry standard in NSW for the introduction of water restrictions. Rous Water has adopted this rule as its performance target in its Management Plan.

In addition to adherence to the 5/10/20 rule the hydrological model uses the following parameters / rules in calculating secure yield and the effects of restrictions:

- Calculate which mix of raw water sources would allow secure supplies of 11,000 ML/annum, 12,000ML/annum, 13,000ML/annum, and 14,000ML/annum;
- Emigrant Creek WTP starts when Rocky Creek Dam falls below 95% full;
- Emigrant Creek WTP stops when Emigrant Creek Dam is empty or Rocky Creek Dam is more than 95% full;
- Wilson River pumps start when Rocky Creek Dam falls below 95% full to maximise secure yield, however this can be relaxed when the target secure yield is less than the maximum secure yield;

- Wilson River pumps work at a variable rate depending on DWE Licensing rules and energy considerations up to a maximum of 30ML/day.

It is noted that designing the system to 5/10/20 rules in effect provides drought security to a much worse drought than has occurred in the last 100 years. From the interaction of the 5/10/20 rules it can be argued that the drought conditions that demand can be satisfied (with 20% restrictions) is akin to a “1 in 1000 year drought”.

3.2 Water Restrictions

In adopting the restrictions to be applied at each level, there are a number of issues to be considered, which are:

- It is desirable that the restrictions adopted should comply with the consistent Water Restrictions for the North Coast;
- The restrictions should be consistent with the ongoing demand management strategy and any permanent water conservation measures adopted for the Rous Region;
- In designing restrictions, it is important to recognise that the imposition of a particular level of restrictions is dictated by the need to achieve a predetermined daily consumption at a particular dam water level rather than by the actual level;
- The need to remain flexible in formulating restrictions so that developments and issues arising during an actual drought event can be reflected in the restrictions imposed. The restrictions described in Appendix 2: Rous Water Restriction Levels would be modified on an "as needs" basis with the decision to modify any particular restriction or introduce a new restriction being made by consensus decision of the Rous Regional Demand Management Steering Committee.

3.3 Introducing Restrictions – the first trigger point

Rocky Creek Dam is Rous Water’s primary water source so the choice of when to introduce restrictions is based on the amount of water in this Dam. The hydrological model was used to determine the trigger for introducing Level 1 Restrictions to enable compliance with the 5/10/20 rule. The trigger point was found to be when Rocky Creek Dam falls to 60% of capacity.

If restrictions were to be introduced before the RCD level falls to 60% capacity, then restrictions would be experienced more often than the recommendations of the 5/10/20 rules, i.e. restrictions would be experienced by the community more often than 1 in 10 years on average.

If restrictions were not introduced until after the RCD level falls to below 60% of the capacity, there would be an increase in the risk of needing to introduce even more severe restrictions if a drought continued. In the 2002/03 drought this occurred and the late introduction of restrictions brought considerable criticism from the community.

3.4 Triggers for higher levels of restrictions

Having adopted 60% in Rocky Creek Dam as the primary trigger it is necessary to quantify the subsequent trigger levels.

When Rocky Creek Dam reaches	Supply Status	Source Status	Restriction Level
100%	Normal Operation	Rocky Creek Dam only	Ongoing water saving measures
95%		Start Wilson's River Source and Emigrant Creek Dam	
60%	Dry Period Operation	Start Woodburn Bores, Convery's Lane Bore	1
50%			2
40%			3
30%		Start Ballina Council's Plateau Bores	4
20%	Emergency Operation	Start Wilson's River Emergency Extraction	5
15%			6
10%			7

Table 7: Trigger levels for operational changes under drought scenarios

Under normal operation i.e. in the range 100% to 60% full, Rous Water need only operate Rocky Creek Dam, the Wilson's River Source and Emigrant Creek Dam. Once RCD level drops to 60% of its capacity, mandatory demand restrictions are introduced and all available Rous Water bores are made operational.

If the drought continues and the Rocky Creek Dam is less than 30% full, any supply available from Ballina Council's Alstonville Plateau sources would be brought on line.

Finally, if an emergency operation regime needs to be started when Rocky Creek Dam is 20% full, permission would be requested to operate the Wilson's River Source out of its normal licensing conditions. Note that the secure yield and drought safety of the Rous Water system have been estimated without taking into account this emergency action at the Wilson's River Source. The inclusion of this action in the strategy would allow the Region to survive a more severe level of drought than any that could realistically be expected.

3.5 Triggers for Lifting Restrictions

There are no generally recognised rules in NSW about how water restrictions should be eased. However, after discussions with stakeholders the basic principles for removing water restrictions should be as follows:

- Restrictions should be removed as quickly as possible so that the community does not endure unnecessary inconvenience and hardship;

- Restrictions should not be lifted too quickly, as a subsequent fall in water level in Rocky Creek Dam would trigger the reintroduction of a more severe level of restriction causing nuisance value to the community.

As the two objectives in opposition to each other, a restriction lifting strategy was developed that balances the probability of needing to reintroduce restriction against the level they were lifted. The hydrological model was used to examine the need to reintroduce harsher restrictions in the same drought event as a result of a particular restriction lifting strategy.

Restriction Level	Rocky Creek Dam Capacity (%)	
	Introduction of Restrictions	Lifting of Restrictions
1	60	70
2	50	60
3	40	50
4	30	40
5	20	30
6	15	20
7	10	15

Table 8: Introduction and lifting of restrictions

3.6 Target Consumption Levels

Table 9 (below) provides the daily target demands for the different levels of restrictions for base annual demands of 11000, 12000, 13000, 14000 and 14200 ML/annum. These target daily demands are determined by dividing the annual demand by 365 days and multiplying the answer by the monthly multiplier given in Table 6.

RCD %	Restriction level	Demand reduction (without seasonal adjustment)	Base annual demand 11,000 ML/a	Base annual demand 12,000 ML/a	Base annual demand 13,000 ML/a	Base annual demand 14,000 ML/a	Base annual demand 14,200 ML/a
>60	0	1.0	30.14	32.88	35.62	38.36	38.90
60	1	0.95	28.63	31.23	33.84	36.44	36.96
50	2	0.85	25.62	27.95	30.28	32.61	33.07
40	3	0.75	22.61	24.66	26.72	28.77	29.18
30	4	0.70	21.10	23.02	24.93	26.85	27.23
20	5	0.67	20.19	22.03	23.87	25.70	26.06
15	6	0.64	19.27	21.02	22.78	24.53	24.87
10	7	0.44	13.20	14.40	15.60	16.80	17.04

Table 9: Target daily demands at different levels of restrictions

Appendix 1: Hydrology Study provides the results of using the hydrological model with the adopted restrictions policy for different cases:

1. Meeting different annual target demands;
2. Pumping up to 30ML/day from the Wilson's River Source;
3. Pumping based on optimising the Wilson's River Source electricity tariff (average 16.79 ML/day).

The results in the Appendix show the frequency and duration of restrictions that would be expected for the repeat of the 1892 to 2003 climatic conditions. It shows the 5/10/20 rules would be satisfied.

3.7 Ongoing Demand Management Options

Whilst the level of RCD varies between 100% and 60% Rous Water operates various demand management strategies to reduce the overall demand for water in its area of operations.

The current Demand Management Plan has been reviewed in 2009 and will include, as a minimum:

- Retrofit Program for residential homes, including replacement of shower heads and installation of tap flow regulators;
- Rainwater Tank Rebate Program;
- Dual Flush Toilet/Cistern Rebate Program;
- Outdoor Water Efficiency Program (including Mulch Rebate Program);

- Non-Residential Assistance Program (including funding of water saving projects by businesses);
- Reclaimed Water Reuse Assistance Program;
- Every Drop Counts primary school education program;
- Water Action Grants and resources for secondary schools;
- Catchment to Tap bus tours and resources for tertiary students and the community.

As well as these programs, the NSW Government currently offers additional rebates on rainwater tanks and water efficient washing machines. Rous Water provides information to customers and promotes these programs as well.

4 Emergency Drought Management

4.1 Droughts in the Rous Water's supply area since 1892

Rainfall records for the Rous Water area are available from 1892 onwards. This dataset was used to estimate streamflow in the area from 1892 to 2003. This data in turn was used to model how the current infrastructure (Rocky Creek Dam, Emigrant Creek Dam, Wilson's River Source, bores) would have behaved if they had existed during this time period, under various system demands and conditions (see Appendix 1 for more details).

This work showed that, if a "drought" is defined as any time when Rocky Creek Dam storage volume drops below 60% full, then under a system demand of 11,000 ML/yr there would have been two years in which the system would have been in drought, in 1903 and 1916.

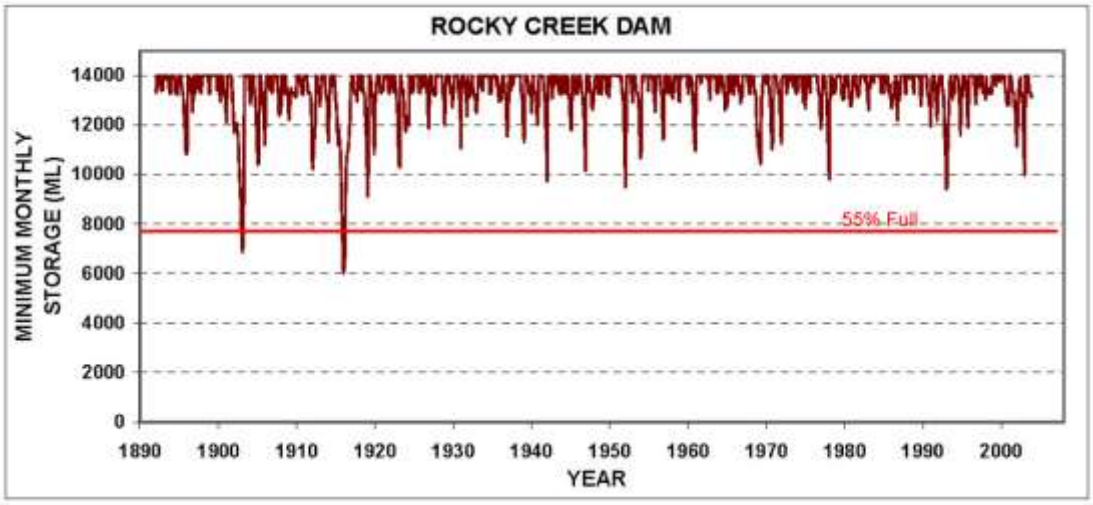


Figure 21: Rocky Creek Dam behaviour, 1892 to 2003, 11,000 ML/yr demand, up to 30ML day pumping from Wilson's River Source

Under a system demand of 14,200 ML/yr there would have been one additional year in which the system would have been in drought, in 1919.

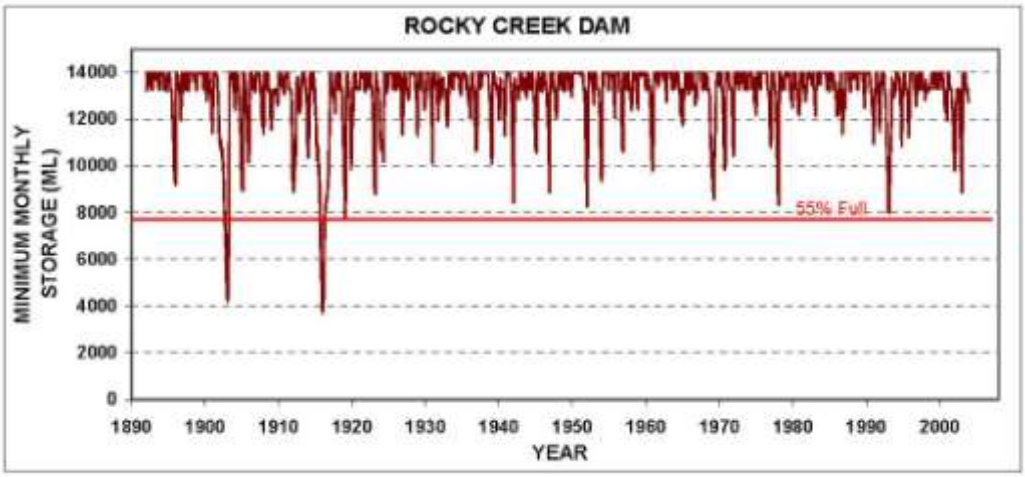


Figure 22: Rocky Creek Dam behaviour, 1892 to 2003, 14,200 ML/yr demand, up to 30ML day pumping from Wilson's River Source

4.2 Emergency Supply Options

If storage volumes in Rocky Creek Dam fall below 20% (see Table 7) then Rous Water moves into Emergency Drought operational mode. In this mode demand would be restricted as much as possible and emergency sources of water would be sought. It is emphasised that it is highly unlikely that these emergency sources of water would ever need to be considered / constructed, as hydrological modelling suggests that there is sufficient security of supply using existing infrastructure for the region to survive extreme droughts.

In 2002 the "Rous Water Emergency Management Strategy" (see Chapter 8 - References) was developed. This report discussed a range of emergency supply options in the case of extreme drought, and a brief summary of these options is provided below. For all options various Local and State Government permissions, plus agreement from local landowners would need to be obtained before any construction activity could commence.

4.2.1 Marom Creek Weir

The Marom Creek weir source is owned by Ballina Shire Council and is a water source for the village of Wardell (along with Ellis Road and Lindendale Bores). Subject to the permission of the Council it is possible to extract and deliver 3 ML/d of water to Rous Water via the Wollongbar Reservoir. This source is regularly replenished by coastal rainfall which does not reach inland to Rocky Creek Dam. It is therefore considered to be a useful source of water when Rocky Creek Dam is depleted.

Figure 23: Location of Wardell and Marom Creek

4.2.2 Duck Creek Weir, Alstonville

Water from this source has not been used for water supply purposes for some considerable time. This source is expected to behave in a similar manner to Emigrant Creek and Marom Creek.

Due to the expected comparatively high cost of a transfer system and a water treatment facility and the expected low yield, this source was not considered as a viable solution for drought management strategy.

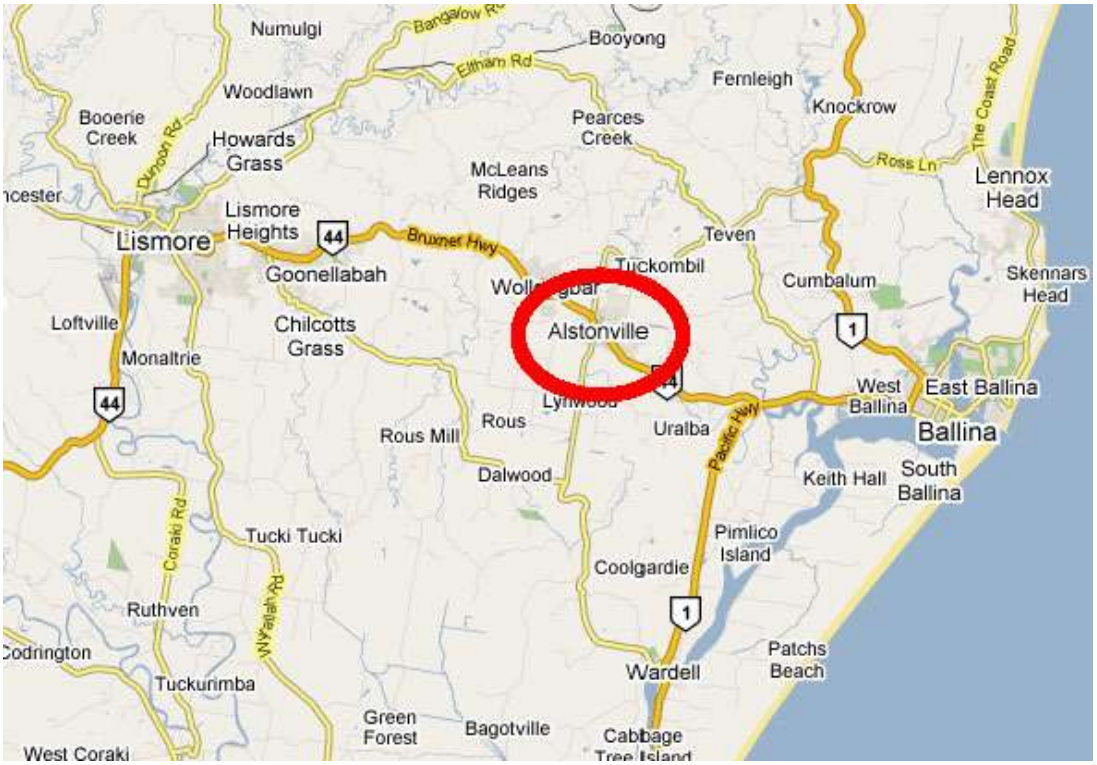


Figure 24: Location of Alstonville

4.2.3 Wilson's River at Lavertys Gap

Byron Shire Council (BSC) currently draws water from the Laverty's Gap Weir on the Wilson's River to supply the township of Mullumbimby. However, during droughts the water level in the weir has been observed to drop rapidly. In 2007 an emergency pipeline was built to supply 0.5ML/d of water to Mullumbimby from Rous Water. This pipeline could be adapted to return water from Laverty's Gap back to Rous Water's system, if there were sufficient water at the Weir, and Byron Shire Council were willing to give permission for this to occur. However, generally when RCD catchment is subject to drought, the level in the Laverty's Gap Weir is also low.

Hence this option is not considered as a viable solution for the drought management strategy.

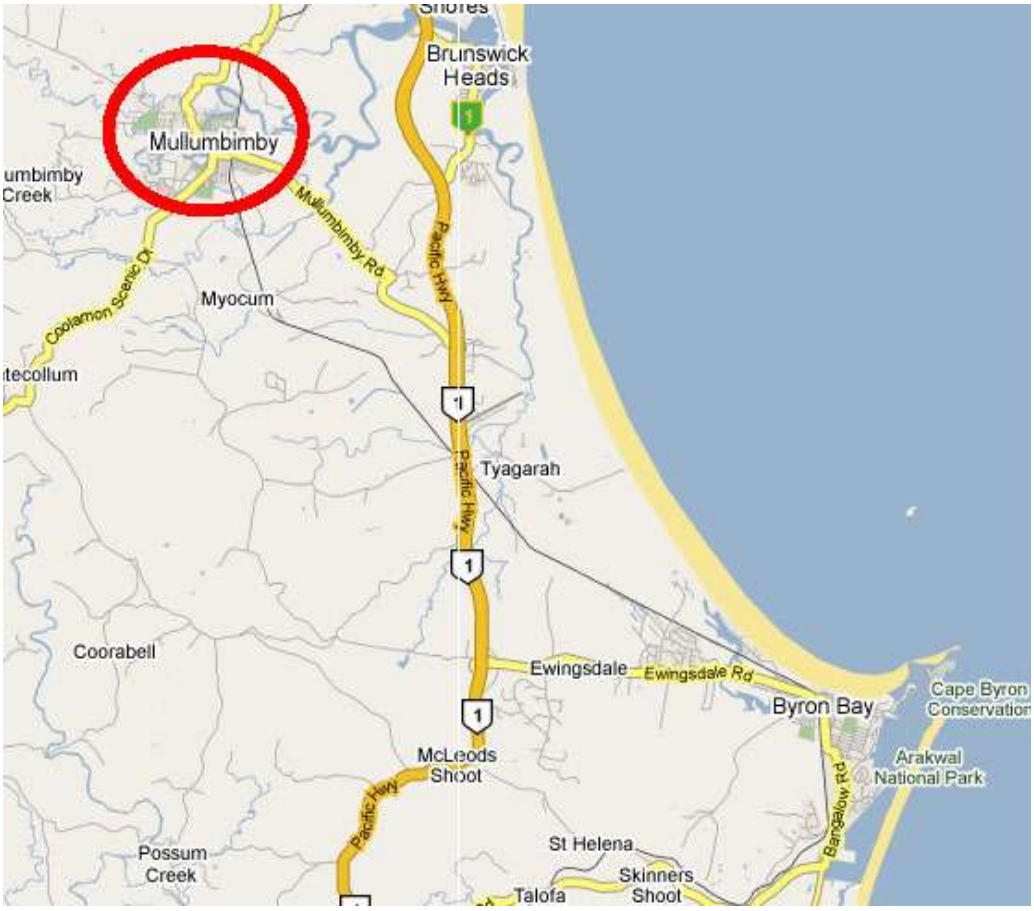


Figure 25: Location of Mullumbimby

4.2.4 Pipeline Connection to Tweed Shire Council's System

A pipeline could be constructed to connect the northern part of Rous Water's system to Tweed Shire Council's (TSC) system. This pipeline would run between Ocean Shores (in Byron Shire) to Pottsville in Tweed Shire (a distance of approximately 15km). Given the configuration of both existing systems, the maximum supply rate would be of the order of 3 ML/d. However, during drought periods Tweed Shire Council may not have sufficient spare water to supply this amount of water (or any amount) to Rous Water. The Council has a policy of not supplying water to other authorities whilst their main dam, Clarrie Hall Dam is less than 95% full.

Hence this option is not considered as a viable solution for the drought management strategy.

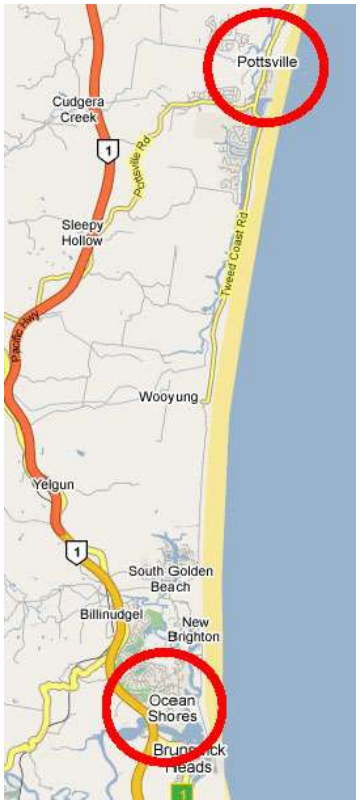


Figure 26: Locations of Ocean Shores and Pottsville

4.2.5 Pipeline from Casino

A pipeline could be constructed from the weir pool at Casino to Lismore (a distance of approximately 30km), with the permission of the local Council, Richmond Valley, and also DWE, which releases water upstream of Casino at the Toonumbar Dam. However, it is highly likely that Casino will be under emergency restrictions when Rous Water's supply area is under drought situations, thus reducing or eliminating the potential benefit of this source. Hence this option is not considered as a viable solution for the drought management strategy.

Figure 27: Locations of Casino and Lismore

4.2.6 Wilson's River Catchment upstream of the Tidal Limit

Water could possibly be extracted in the Wilson's River at Nashua (Byron LGA), Coopers Creek at Repentance (Lismore LGA), and Terania Creek at The Channon (Lismore LGA). However, DWE has suggested that the low flows at these sources were likely to allow only short term extraction of relatively low volumes of water. In addition, there would be difficulties in transferring water from the extraction points into Rous Water's system, plus issues with existing extraction licences / riparian rights.

Hence this option is not considered as a viable solution for the drought management strategy.

Figure 28: Locations of The Channon, Repentance Creek, Nashua

4.2.7 Coastal Groundwater

In the 2002 study DWE advised that bores in coastal areas could supply significant quantities of water, with the permission of the local Councils, Byron and Ballina.

However considerable work would be needed to identify suitable areas, drill test bores, carry out production testing and water quality testing. In addition, costs of carrying out this work, provision of suitable water treatment facilities and construction of pipelines to link these sources to Rous Water's infrastructure (or alternatively to the infrastructure of Byron and/or Ballina) were likely to be significant.

It is also likely that bores would be required in a number of distant locations within the coastal plain. This in turn would result in power supply difficulties and high operational costs. Finally, this option is further limited in that water from coastal groundwater sources cannot be easily or economically transferred to inland areas served by Rous Water.

Hence this option is not considered as a viable solution for the drought management strategy.

4.2.8 Desalination

Desalination of seawater has also been considered. Although it is technically feasible to use reverse osmosis membrane technology to provide sufficient potable water to augment Rous Water's supplies, the associated capital and operating costs are extremely high, as is shown in Table 11.

	Costs (Note 1)			Annual Costs		
WTP Capacity (ML/day)	Membrane Desalination Equipment	Ancillary WTP Infrastructure (Note 2)	TOTAL COST (Note 3)	Membrane Desalination Equipment	Other WTP costs incl Power	TOTAL
10	$15 m	$6 m	$21 m	$0.5 m	$0.7m	$1.2m
15	$23 m	$8 m	$31 m	$0.7 m	$1.0m	$1.7m
20	$33 m	$10m	$43 m	$1.0 m	$0.1m	$1.1 m

Table 10: Estimated costs of various sizes of desalination plant (2002 prices inflated to 2007 dollars)

NOTE 1: Approximate costs only; Includes pre-construction cost.

NOTE 2: Includes saltwater pool, pumps, pipework, controls, buildings, disinfection system, civil works, etc.

NOTE 3: No allowance included to pump water produced by the plant into the distribution system, also WTP construction costs have increased faster than the general rate of inflation in recent years so actual costs may be higher.

Portable reverse osmosis units have been considered for several other water supplies as an emergency measure, however they have been found too expensive to purchase and problematic in operation.

Finally, this option is further limited in that water from coastal desalination plants cannot be easily or economically transferred to inland areas served by Rous Water.

To carry out investigations, design and install the necessary equipment to access these water sources would take approximately 12 months under emergency conditions.

4.2.9 Water Carting

To supply 15ML/day to Rous Water's customers would require 750 movements of 20,000 litre tankers per day. Assuming each tanker could fill up and empty its contents into the bulk water reservoirs of Rous Water twice a day then 375 tankers would be needed every day. There would be problems obtaining this number of tankers and another problem would be whether there was a source of water with 15ML/day spare anywhere near Rous Water's area of operations (particularly if there were a regional drought). Finally the cost of

hiring the tankers / drivers would be prohibitive, at $500 per day per tanker the cost would be $187,500 per day.

4.2.10 Wilson River below tidal limit

As described before Rous Water has recently constructed a permanent system to transfer Wilson's River water to the Nightcap WTP. The extraction of this water is subject to extraction rules defined by Department of Natural Resources (DNR) license 30SL066818. These rules allow Rous Water to pump 25% of the available flow (Max of 30 ML/d) when the river flow is above cease to pump limits. However it is understood that there is about 17,000ML of water stored in the tidal pool, which could be pumped to Nightcap WTP using the existing infrastructure, if DWE temporarily suspended the Licence conditions. Rous Water has all the infrastructure in place to enable this source to be used immediately DWE issued an Emergency License.

During drought conditions the salt water/fresh water interface moves upstream. Experience in the 2002/03 drought showed that this movement occurred slowly and did not compromise this emergency source. Prolonged drought and use of the source may result in the interface moving to the intake point.

4.3 Summary of the options

A summary of the above options is provided below:

Supply option	Benefits	Issues
Marom Creek Weir	May be able to supply 3ML/d	Viable for supply to part of Region
Duck Creek Weir	May be able to supply some water	Poor water quality Low yield Not viable
Laverty's Gap Weir	May be able to supply some water Some infrastructure already in place	Low or zero yield Not viable
Connect to Tweed Shire Council	Could supply up to 3ML/day.	High cost Issues with transferring water Not viable
Pipeline to Casino	Could supply some water	Low or zero yield Not viable
Coastal bores	Could supply substantial amounts of water	The high complexity of a system to deliver water from multiple bores at the coast to inland areas Not viable
Desalination	Could supply substantial amounts of water	Very high capital cost Would take 12 months to investigate, design, construct The difficulties of delivering water from the coast to inland areas Not viable
Water carting	May be able to supply some water	Would have a very high operating cost Not clear if any neighbouring water authorities would have any spare water Not viable
Temporarily relax extraction licence for Wilson's River Source	Could provide all the water required for the Rous Water system Would not require any additional capital costs Could be implemented very rapidly	Viable option Need to monitor salt water intrusion and provide contingency plan at an early stage

Table 11: Summary of emergency water supply options

4.4 Future Emergency Drought Management Strategy

Based on the above information it is believed that the only viable source as an emergency drought management strategy is temporary suspension of licensing rules to allow additional pumping from the Wilson's River, supplemented by up to 3ML/d from Ballina Shire's Marom Creek Weir.

5 Rous Water Communication Strategy

The communication strategy for drought management comprises four key areas, being:

- Inter Council communication between the five (5) regional Council's, this being achieved through the Regional Demand Management Steering Committee;
- Community Education. The Community Education and Communication Program has a number of phases to match the level of restriction and severity of drought;
- Discussions with the major non-domestic water users (see Table 5) in the Rous Water area to find out if there are any additional steps they can take to reduce water demand; and
- Communication with relevant State Government Agencies, e.g. DWE, Department of Environment and Climate Change (DECC), Department of Local Government (DLG), Department of Health (DH).

The Regional Demand Management Steering Committee monitors and oversees the implementation of the ongoing demand management strategy and water restrictions, in the event that restrictions are imposed. The Committee includes a DWE representative.

The Committee generally meets quarterly but in the event of water restrictions, would meet more regularly as required. As the need arises, or as the level of water restrictions increases, representatives of DECC, DLG and DH would be invited to take part in Committee meetings to participate in any decision-making processes.

As part of the formal consultation process with the community, this Water Management Strategy will be publicly exhibited and promoted.

Rocky Creek Dam %	Water Restriction (WR) Level	Water Consumption Targets (ML/d), e.g. for 11000 ML/a demand		Actions to be taken	Resources
		Max (Jan)	Min (Jun)		
100-65	N/A	N/A	N/A	• Ongoing community education of water conservation and future water supply strategy and linkages – Ongoing Water Conservation Measures. • No enforcement; voluntary compliance. • Demand management programs on a rolling basis. • Advertising for all water restrictions (WR's) ready to be printed and used at short notice. • Town signs ready to be installed at short notice.	• Rous Water to design and produce advertisements, leaflets and notices in consultation with all Councils. • Rous Water to design and produce road signs in consultation with all Councils. • Councils to secure RTA approval and development approval for road signs.
5.1 Escalating Water Restriction Levels					
70	N/A	N/A	N/A	• Media release #1, Advertisement #1 in nominated newspapers and on radio - Rocky Ck Dam is at 70%; Level 1 WR's will be necessary at 60%. • List Level 1 WR's in newspapers. • Print Level 1 leaflets within 2 weeks. • Install town signs (folded) in approved locations.	• Convene Regional Steering Committee • Councils to install town signs at approved locations. • Rous Water to issue media release, book and place advertisements. • Rous Water to supervise printing of leaflets/notices. • Commence training of Council compliance staff.
65	N/A	N/A	N/A	• Media release #2, Advertisement #2 in nominated newspapers and on radio - Rocky Ck Dam is at 65%; Level 1 WR's will be necessary at 60%. • List Level 1 WR's in newspapers. • Level 1 leaflets ready for distribution.	• Councils to complete installation of town signs. • Rous Water to issue media release, book and place advertisements. • Rous Water to supervise printing of leaflets/notices. • Continue training of Council compliance staff.

Rocky Creek Dam %	Water Restriction (WR) Level	Water Consumption Targets (ML/d), e.g. for 11000 ML/a demand		Actions to be taken	Resources
60	1	36.36	25.19	• Media release #3, Advertisement #3 in nominated newspapers and on radio - Rocky Ck Dam is at 60%; Level 1 WR's are now in place; Daily consumption target; Fines apply - first violation warning, second violation fine. • List Level 1 WR's in newspapers. • Distribute Level 1 leaflets. • Print Level 2 leaflets within 1 week. • Town signs show Level 1.	• Rous Water to distribute leaflets to households and businesses via Australia Post. • Rous Water to issue media release, book and place advertisements. • Rous Water to supervise printing of Level 2 WR's leaflets/notices. • Complete training of Council compliance staff. • Councils to maintain town signs. • Councils to issue warnings and record repeat non-compliance.
55	1	36.36	25.19	• Media release #4, Advertisement #4 in nominated newspapers and on radio - Rocky Ck Dam is at 55%; Level 2 WR's will be necessary at 50%; Daily consumption targets; Impact of Level 2 WR's. • List Level 2 WR's in newspapers.	• Rous Water to issue media release, book and place advertisements. • Councils to maintain town signs. • Councils to issue warnings and fines.
50	2	32.53	22.54	• Media release #5, Advertisement #5 in nominated newspapers and on radio - Rocky Ck dam is at 50%; Level 2 WR's are now in place; Fines apply – first violation warning, second violation fine. • List Level 2 WR's in newspapers. • Distribute Level 2 WR's leaflets. • Print Level 3 leaflets within 1 week. • Town signs show Level 2.	• Rous Water to distribute leaflets to households and businesses via Australia Post. • Rous Water to issue media release, book and place advertisements. • Rous Water to supervise printing of Level 3 WR's leaflets/notices. • Councils to maintain town signs. • Councils to enforce Level 2 WR's and issue warnings.
45	2	32.53	22.54	• Media release #6, Advertisement #6 in nominated newspapers and on radio - Rocky Ck Dam is at 45%; Level 3 WR's will be necessary at 40%; Target consumption; Impact of Level 3 WR's. • List Level 3 WR's in newspapers.	• Rous Water to issue media release, book and place advertisements. • Councils to maintain town signs. • Councils to enforce Level 2 WR's and issue warnings.

Rocky Creek Dam %	Water Restriction (WR) Level	Water Consumption Targets (ML/d), e.g. for 11000 ML/a demand		Actions to be taken	Resources
40	3	28.71	19.89	• Media release #7, Advertisement #7 in nominated newspapers and on radio - Rocky Ck dam is at 40%; Level 3 WR's are now in place; Fines apply – no warnings; Focus on residential outdoor use. • List Level 3 WR's. • Distribute Level 3 WR's leaflets. • Print Level 4 leaflets within 1 week. • Town signs show Level 3.	• Rous Water to distribute leaflets to households and businesses via Australia Post. • Rous Water to issue media release, book and place advertisements. • Rous Water to supervise printing of Level 4 WR's leaflets/notices. • Councils to maintain town signs. • Councils to enforce Level 3 WR's.
35	3	28.71	19.89	• Media release #8, Advertisement #8 in nominated newspapers and on radio - Rocky Ck Dam is at 35%; Level 4 WR's will be necessary at 25%; Impact of Level 4 WR's. • List Level 4 WR's in newspapers.	• Rous Water to issue media release, book and place advertisements. • Councils to maintain town signs. • Councils to enforce Level 3 WR's.
30	4	26.79	18.56	• Media release #9, Advertisement #9 in nominated newspapers and on radio - Rocky Ck dam is at 30%; Level 4 WR's are now in place; Fines apply – no warnings; Focus on all outdoor water use; Highlight innovative ideas. • List Level 4 WR's. • Distribute Level 4 leaflets. • Print Level 5 leaflets within 1 week. • Town signs show Level 4 WR's.	• Rous Water to distribute leaflets to households and businesses via Australia Post. • Rous Water to issue media release, book and place advertisements. • Rous Water to supervise printing of Level 5 WR's leaflets/notices. • Councils to maintain town signs. • Councils to enforce Level 4 WR's.
25	4	26.79	18.56	• Media release #10, Advertisement #10 in nominated newspapers and on radio - Rocky Ck Dam is at 25%; Level 5 WR's will be necessary at 20%; Impacts of Level 5 WR's; Focus on innovative ideas. • List Level 5 WR's in newspapers.	• Rous Water to issue media release, book and place advertisements. • Councils to maintain town signs. • Councils to enforce Level 4 WR's.

Rocky Creek Dam %	Water Restriction (WR) Level	Water Consumption Targets (ML/d), e.g. for 11000 ML/a demand		Actions to be taken	Resources
20	5	25.64	17.76	• Media release #11, Advertisement #11in nominated newspapers and on radio - Rocky Ck dam is at 20%; Level 5 WR's are now in place; Fines apply; Focus on commercial and industrial customers. • List Level 5 WR's. • Distribute Level 5 WR's leaflets. • Print Level 6 leaflets within 1 week. • Town signs show Level 5 WR's.	• Rous Water to distribute leaflets to households and businesses via Australia Post. • Rous Water to issue media release, book and place advertisements. • Rous Water to supervise printing of Level 6 WR's leaflets/notices. • Councils to maintain town signs. • Councils to enforce Level 5 WR's.
17.5	5	25.64	17.76	• Media release #12, Advertisement #12 in nominated newspapers and on radio - Rocky Ck Dam is at 17.5%; Level 6 WR's will be necessary at 15%; Impacts of Level 6 WR's; Focus on innovative ideas; Focus on commercial and industrial customers. • List Level 6 WR's in newspapers.	• Rous Water to issue media release, book and place advertisements. • Councils to maintain town signs. • Councils to enforce Level 5 WR's.
15	6	24.47	16.95	• Media release #13, Advertisement #13 in nominated newspapers and on radio - Rocky Ck dam is at 15%; Level 6 WR's are now in place; Fines apply; Focus on commercial and industrial customers. • List Level 6 WR's in newspapers. • Distribute Level 6 WR's leaflets. • Print Level 7 leaflets within 1 week. • Town signs show Level 6 WR's.	• Rous Water to distribute leaflets to households and businesses via Australia Post. • Rous Water to issue media release, book and place advertisements. • Rous Water to supervise printing of Level 7 WR's leaflets/notices. • Councils to maintain town signs. • Councils to enforce Level 6 WR's.
12.5	6	24.47	16.95	• Media release #14, Advertisement #14 in nominated newspapers and on radio - Rocky Ck Dam is at 12.5%; Level 7 WR's will be necessary at 10%; Emergency situation; Impacts of Level 7 WR's; Focus on innovative ideas; Focus on commercial and industrial customers. • List Level 7 WR's in newspapers.	• Rous Water to issue media release, book and place advertisements. • Councils to maintain town signs. • Councils to enforce Level 6 WR's.

Rocky Creek Dam %	Water Restriction (WR) Level	Water Consumption Targets (ML/d), e.g. for 11000 ML/a demand		Actions to be taken	Resources
10	7	16.76	11.61	• Media release #15, Advertisement #15 in nominated newspapers and on radio - Rocky Ck dam is at 10%; Level 7 WR's are now in place; Fines apply; Focus on commercial and industrial customers. • List Level 7 WR's. • Distribute Level 7 WR's leaflets. • Town signs show Level 7 WR's.	• Rous Water to distribute leaflets to households and businesses via Australia Post. • Rous Water to issue media release, book and place advertisements. • Councils to maintain town signs. • Councils to enforce Level 7 WR's.
5.2 Decreasing Water Restriction Levels					
15	6	24.47	16.95	• Media release #16, Advertisement #16 in nominated newspapers and on radio - Rocky Ck dam is at 15%; WR's have been relaxed to Level 6; Acknowledge improvement; Fines still apply. • List Level 6 WR's in newspapers. • Provide Level 6 leaflets on request. • Town signs show Level 6.	• Rous Water to issue media release, book and place advertisements. • Councils to maintain town signs. • Councils to enforce Level 6 WR's.
20	5	25.64	17.76	• Media release #17, Advertisement #17 in nominated newspapers and on radio - Rocky Ck dam is at 20%; WR's have been relaxed to Level 5; Acknowledge improvement; Fines still apply. • List Level 5 WR's. • Provide Level 5 leaflets on request. • Town signs show Level 5.	• Rous Water to issue media release, book and place advertisements. • Councils to maintain town signs. • Councils to enforce Level 5 WR's.
30	4	26.79	18.56	• Media release #18, Advertisement #18 in nominated newspapers and on radio - Rocky Ck dam is at 30%; WR's have been relaxed to Level 4; Acknowledge improvement; Fines still apply. • List Level 4 WR's in newspapers. • Provide Level 4 leaflets on request. • Town signs show Level 4.	• Rous Water to issue media release, book and place advertisements. • Councils to maintain town signs. • Councils to enforce Level 4 WR's.

Rocky Creek Dam %	Water Restriction (WR) Level	Water Consumption Targets (ML/d), e.g. for 11000 ML/a demand		Actions to be taken	Resources
40	3	28.71	19.89	• Media release #19, Advertisement #19 in nominated newspapers and on radio - Rocky Ck dam is at 40%; WR's have been relaxed to Level 3; Acknowledge improvement; Fines still apply. • List Level 3 WR's in newspapers. • Provide Level 3 leaflets on request. • Town signs show Level 3.	• Rous Water to issue media release, book and place advertisements. • Councils to maintain town signs. • Councils to enforce Level 3 WR's.
50	2	32.53	22.54	• Media release #20, Advertisement #20 in nominated newspapers and on radio - Rocky Ck dam is at 50%; WR's have been relaxed to Level 2; Acknowledge improvement; Fines still apply. • List Level 2 WR's in newspapers. • Provide Level 2 leaflets on request. • Town signs show Level 2.	• Rous Water to issue media release, book and place advertisements. • Councils to maintain town signs. • Councils to enforce Level 2 WR's.
60	1	36.36	25.19	• Media release #21, Advertisement #21in nominated newspapers and on radio - Rocky Ck dam is at 60%; WR's have been relaxed to Level 1; Acknowledge improvement; Fines still apply. • List Level 1 WR's in newspapers. • Provide Level 1 leaflets on request. • Town signs show Level 1.	• Rous Water to issue media release, book and place advertisements. • Councils to maintain town signs. • Councils to enforce Level 1 WR's.
70	N/A	N/A	N/A	• Media release #22, Advertisement #22 in nominated newspapers and on radio - Rocky Ck dam is at 70%; WR's have been lifted; Ongoing Water Conservation Measures apply; Acknowledge efforts. • Remove town signs.	• Rous Water to issue media release, book and place advertisements. • Councils to remove town signs.

5.3 Advertisements in Nominated Newspapers

In this plan, “nominated newspapers” means the following newspapers published in the Rous Water region:

Newspaper	Day of Issue	Deadline for Display Advertising	Deadline for Classifieds	Contact	Phone Number
Northern Star	Saturday	Thursday	Friday	Debby Milgate	02 6622 7808
North Coast Advocate	Thursday	Tuesday	Tuesday 5:30pm	Debby Milgate	02 6622 7808
Byron Shire News	Thursday	Tuesday	Wednesday midday	Debby Milgate	02 6622 7808
Byron Shire Echo	Tuesday	Friday midday	Monday midday	Peter Couldwell	02 6685 5222
Richmond River Express Examiner	Wednesday	Friday	Monday midday	Debby Milgate	02 6622 7808
Northern Rivers Echo	Thursday	Monday 5pm (bookings) Tuesday (artwork)	Monday 5pm	Mark Robinson	02 6622 2888

5.2 Radio Advertising

Radio advertising means:

a. 2LM/2ZZZFM;
b. Other, free radio advertising, as nominated by Rous Water or constituent Councils.

5.3 Town Signs

The town signs referred to in this communication plan are RTA and Council approved road signs, informing visitors to the region that Water Restrictions are in place. They indicate the level of Water Restrictions that applies and are to be installed at pre-approved locations on main roads in the region. Individual Councils will be responsible for approving, installing, maintaining and adjusting signs in their Council geographical areas.

5.4 Funding

The implementation of the communication plan is to be funded from a restricted asset, built from contributions by the constituent Councils.

5.5 General Comments

The cost of printing and wastage are significantly reduced, by designing undated Water Restriction leaflets/notices. These are to be pre-printed as required and issued at short notice. The Water Restriction notices alert the public to consult local newspapers and radio for the dates that Water Restrictions are in place.

The placement of advertisements in newspapers and on radio is co-ordinated by Rous Water, as outlined in this plan. The design, printing and distribution of Water Restriction leaflets/notices is also co-ordinated by Rous Water.

6 Monitoring during droughts

During droughts Rous Water continues with its normal routine of monitoring and recording the level of each of its main water sources which are:

- Rocky Creek Dam
- Emigrant Creek Dam
- Wilson's River (monitoring of daily stream flow)

In addition, any groundwater bores being used are monitored for draw-down, this being observed as a threat to their viability during the 2002/03 drought.

Daily water production from each source is mentioned and recorded. In addition the daily supply of water to each of the Constituent Councils' reservoirs is monitored and recorded. This information is then forwarded to each of the Constituent Councils for their advice and action as appropriate.

The daily water production for all sources is compared to the respective target water production of the current restriction level.

Water quality is routinely monitored both in real time continuously at the water treatment plants and by collection and analysis of samples from the sources, at the treatment plant and throughout the water distribution network.

Additional sampling and testing is carried out depending on the source of water and the identified risks. Examples of this are the increase in frequency of algae identification and counting carried out at each dam during extended warm periods.

7 DWE Drought Management Check List

DWE produces guidelines for efficient and effective management of water utilities, entitled “Best Practice Management of Water Supply and Sewerage - Guidelines”. Included in these Guidelines is a “Drought Management Checklist, which suggests drought related components that Local Water Utilities should include in their water strategy planning documents (for further details please see Appendix 3: DWE Best Practice Drought Management Plan Guidelines).

As Rous Water is predominantly a bulk water supplier (rather than the more typical local government operated water and sewerage utility) many of the components of the DWE drought management checklist are not relevant to the activities of Rous Water. However, those parts of the checklist which are relevant to Rous Water are described in the following Chapters of this report.

7.1 Executive Summary

This part of the checklist is described in the Executive Summary of this Report.

7.2 Background

This part of the checklist is described in Chapters 1 and 4 of this Report.

7.3 Objectives

This part of the checklist is described in Chapter 3 of this Report.

7.4 Data

This part of the checklist is described in Chapters 1 and 2 of this Report.

7.5 Plan

This part of the checklist is described in Chapters 3, 4 and 5 of this Report.

7.6 Monitoring during drought

This part of the checklist is described in Chapter 6 of this Report.

7.7 Consultation

This part of the checklist is described in Chapter 5 of this Report.

7.8 Operation of Drought Management Plan

This part of the checklist is described in various chapters of this Report, including “Appendix 2: Rous Water Restriction Levels”.

8 References

1. Dunoon Dam - Population and Demand Projections
   GeoLINK, November 2005

2. Rous Water Drought Management Strategy
   NSW Department of Public Works and Services, November 2002

3. Regional Water Management Strategy
   Rous Water, July 2004

4. Best Practice Management of Water Supply and Sewerage – Guidelines
   NSW Department of Water and Energy, August 2007, ISBN 0 9752232 0 8

Appendix 1: Hydrology Study

Tables A1 and A2 in this Appendix summarise the results from running the hydrological model for the adopted restriction policy for the specified conditions for a repeat of estimated climatological conditions for 1892 to 2003. Figures A1 to A10 show the storage behaviours resulting from the different annual demands and pumping from the Wilson's River at Lismore.

The results and storage behaviour show the system more than satisfying the restriction conditions implied by the 5/10/20 rules and that these rules provide significant reserve storage to allow restricted demand to be met through much worse droughts than experienced during the period 1892 to 2003.

ROUS REGIONAL WATER SUPPLY

TABLE A1 Operational Run with Restriction Applied at Total Storage < 55% Full, up to 30ML/d Lismore Pumping

Run No.	Emigrant Creek Dam Transfer (ML/d)	Pumping from Wilsons River Limitation			Annual Demand (ML/a)	Transfer from Wilsons River		Restriction			Critical Drought	
		5 ML/d Limit *1	25% above EFR *2	D/s Irrigation		When RCD is less than % full	Transfer Capacity (ML/d)	Applied at Storage (%)	Duration (%)	1 in x year	From	To
YR11	7.5	Yes	Yes	Yes	11000	95	30	55	0.57	56.00	12/11/1914	31/01/1916
YR12	7.5	Yes	Yes	Yes	12000	95	30	55	0.74	56.00	04/11/1914	31/01/1916
YR13	7.5	Yes	Yes	Yes	13000	95	30	55	0.97	56.00	04/11/1914	31/01/1916
YR14	7.5	Yes	Yes	Yes	14000	95	30	55	1.38	37.33	01/11/1914	31/01/1916
YR42	7.5	Yes	Yes	Yes	14200	95	30	55	1.59	22.40	01/11/1914	31/01/1916

Run No.	Annual Demand (ML/a)	Duration % and Frequency 1 in x Years	RESTRICTION LEVELS AND DEMAND REDUCTION RATIO							
			0	1	2	3	4	5	6	7
			1	0.95	0.85	0.75	0.70	0.67	0.63942	0.43796
YR11	11000	Duration	99.43	0.37	0.20	-	-	-	-	-
		Frequency		56.00	112.00	-	-	-	-	-
YR12	12000	Duration	99.26	0.33	0.41	-	-	-	-	-
		Frequency		56.00	56.00	-	-	-	-	-
YR13	13000	Duration	99.03	0.35	0.41	0.21	-	-	-	-
		Frequency		56.00	56.00	112.00	-	-	-	-
YR14	14000	Duration	98.62	0.63	0.30	0.45	-	-	-	-
		Frequency		37.33	56.00	56.00	-	-	-	-
YR42	14200	Duration	98.41	0.78	0.31	0.49	-	-	-	-
		Frequency		22.40	56.00	56.00	-	-	-	-

Program : ROUS6A18.BAS

NOTES

(1) Streamflows

Daily inflows to Rocky Creek Dam, Emigrant Creek Dam, Wilsons River and Leycester River are supplied by DNR
Total inflow to Wilsons Source = (Inflows of Wilsons River + Lycester River + residual catchment + Commerce's simulation previous day RCD spill) – (DNR's RCD spill + d/s irrigation)
STP inflow is NOT included in the inflow for Wilsons Source
Period of simulation from 01/01/1892 to 31/12/2003

(2) Transfer from Wilsons Source and Emigrant Creek Dam:

If Rocky Creek Dam >= 95% full No Emigrant Creek Dam transfer and No transfer from Wilsons Source

No transfer from Wilsons River if the flow available or water required is less than 5 ML/d.
Transfer is limited to 25% of flow above the Environmental Flow releases which is:
41 ML/d for March to August and 85 ML/d from September to February

Transfer capacity from Wilsons Source

Summer (October – June)		Winter (July – September)	
River Flow (ML/d)	Maximum Pump Capacity (ML/d)	River Flow (ML/d)	Maximum Pump Capacity (ML/d)
<107	0	<61	0
107	5	61	5
132	11.25	82	10.25
181	23.5	>=161	30
196	27.25		
>=207	30		

Transfer capacity from Emigrant Creek Dam = 7.5 ML/d

(3) DEMAND

(i) Annual and Daily Demand

Run No.	YR11	YR12	YR13	YR14	YR42	
Annual	11000	12000	13000	14000	14200	ML/a
Daily	30.14	32.88	35.62	38.36	38.90	ML/d

(ii) Monthly Demand Multiplier

Month	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Multiplier	1.27	0.95	1.03	0.97	0.91	0.88	0.98	0.97	1.02	1.03	0.97	1.03

(iii) % of Demand for each Centre

(A) Lismore	
Lismore (Holland St)	4.1
Lismore Urban	25.4
(B) Byron Bay	
Byron Bay	15.8
Ocean Shores	6.3
(C) Richmond River	
Coraki	3.1
Lower River	4.3
(D) Ballina	
Ballina	26.7
(E) Rural & Losses	
Clunes Rural	1.2
Bangalow	6.7
Dunoon	1.6
Alstonville	5.0
Total	100.2

(iv) Level of Restriction

Restriction Level	Nil	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Rocky Creek Dam Storage %	>55	<=55	45	35	25	20	15	10
Demand Multiply By	1.0	0.95	0.85	0.75	0.70	0.67	0.63942	0.43796

(4) No Environmental Flow Releases from any of the storages

No releases other than Bishop's modified Low flow protection release for Emigrant Creek Dam
No releases from Rocky Creek Dam
Environmental flows for the Lismore Source incorporated in Lismore Source Pumping Rules

(5) Dam Storage and leakage

Storage in dam:	**Full storage ML**	**Dead storage ML**	**Leakage ML/d**
Rocky Creek Dam	14000	150	1.15
Emigrant Creek Dam	820	50	0.23

ROUS REGIONAL WATER SUPPLY

TABLE A2 Operational Run with Restriction Applied at Total Storage < 55% Full, Reduced Lismore Pumping for electricity tariffs (average 16.79 ML/d)

Run No.	Emigrant Creek Dam Transfer (ML/d)	Pumping from Wilsons River Limitation			Annual Demand (ML/a)	Transfer from Wilsons River		Restriction			Critical Drought	
		5 ML/d Limit *1	25% above EFR *2	D/s Irrigation		When RCD is less than % full	Transfer Capacity (ML/d)	Applied at Storage (%)	Duration (%)	1 in x year	From	To
YQ11	7.5	Yes	Yes	Yes	11000	95	16.79	55	0.70	56.00	12/11/1914	30/01/1916
YQ12	7.5	Yes	Yes	Yes	12000	95	16.79	55	1.37	56.00	04/11/1914	30/01/1916
YQ13	7.5	Yes	Yes	Yes	13000	95	16.79	55	1.61	37.33	04/11/1914	30/01/1916
YQ14	7.5	Yes	Yes	Yes	14000	95	16.79	55	2.28	16.00	01/11/1914	25/02/1916
YQ42	7.5	Yes	Yes	Yes	14200	95	16.79	55	2.44	14.00	01/11/1914	25/02/1916

Run No.	Annual Demand (ML/a)	Duration % and Frequency 1 in x Years	RESTRICTION LEVELS AND DEMAND REDUCTION RATIO							
			0	1	2	3	4	5	6	7
			1	0.95	0.85	0.75	0.70	0.67	0.63942	0.43796
YQ11	11000	Duration	99.30	0.35	0.35	-	-	-	-	-
		Frequency		56.00	56.00	-	-	-	-	-
YQ12	12000	Duration	98.63	0.76	0.42	0.19	-	-	-	-
		Frequency		56.00	56.00	112.00	-	-	-	-
YQ13	13000	Duration	98.39	0.75	0.37	0.49	-	-	-	-
		Frequency		37.33	56.00	56.00	-	-	-	-
YQ14	14000	Duration	97.72	0.80	0.79	0.34	0.34	-	-	-
		Frequency		16.00	56.00	56.00	56.00	-	-	-
YQ42	14200	Duration	97.56	0.94	0.78	0.33	0.39	-	-	-
		Frequency		14.00	56.00	56.00	56.00	-	-	-

Program : ROUS6A20.BAS

NOTES

(1) Streamflows

Daily inflows to Rocky Creek Dam, Emigrant Creek Dam, Wilsons River and Leycester River are supplied by DNR
Total inflow to Wilsons Source = (Inflows of Wilsons River + Lycester River + residual catchment + Commerce's simulation previous day RCD spill) – (DNR's RCD spill + d/s irrigation)
STP inflow is NOT included in the inflow for Wilsons Source
Period of simulation from 01/01/1892 to 31/12/2003

(2) Transfer from Wilsons Source and Emigrant Creek Dam:

If Rocky Creek Dam >= 95% full No Emigrant Creek Dam transfer and No transfer from Wilsons Source

No transfer from Wilsons River if the flow available or water required is less than 5 ML/d.
Transfer is limited to 25% of flow above the Environmental Flow releases which is:
41 ML/d for March to August and 85 ML/d from September to February

Transfer capacity from Wilsons Source

Summer (October – June)		Winter (July – September)	
River Flow (ML/d)	Maximum Pump Capacity (ML/d)	River Flow (ML/d)	Maximum Pump Capacity (ML/d)
<107	0	<61	0
107	5	61	5
132	11.25	82	10.25
181	16.79	>=161	16.79
196	16.79		
>=207	16.79		

Transfer capacity from Emigrant Creek Dam = 7.5 ML/d

(3) DEMAND

(i) Annual and Daily Demand

Run No.	YQ11	YQ12	YQ13	YQ14	YQ42	
Annual	11000	12000	13000	14000	14200	ML/a
Daily	30.14	32.88	35.62	38.36	38.90	ML/d

(ii) Monthly Demand Multiplier

Month	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Multiplier	1.27	0.95	1.03	0.97	0.91	0.88	0.98	0.97	1.02	1.03	0.97	1.03

(iii) % of Demand for each Centre

(A) Lismore	
Lismore (Holland St)	4.1
Lismore Urban	25.4
(B) BYQon Bay	
BYQon Bay	15.8
Ocean Shores	6.3
(C) Richmond River	
Coraki	3.1
Lower River	4.3
(D) Ballina	
Ballina	26.7
(E) Rural & Losses	
Clunes Rural	1.2
Bangalow	6.7
Dunoon	1.6
Alstonville	5.0
Total	100.2

(iv) Level of Restriction

Restriction Level	Nil	**1**	**2**	**3**	**4**	**5**	**6**
Rocky Creek Dam Storage %	>55	<=55	45	35	25	15	10
Demand Multiply By	1.0	0.95	0.85	0.75	0.70	0.63942	0.43796

(4) No Environmental Flow Releases from any of the storages

No releases other than Bishop's modified Low flow protection release for Emigrant Creek Dam
No releases from Rocky Creek Dam
Environmental flows for the Lismore Source incorporated in Lismore Source Pumping Rules

(5) Dam Storage and leakage

Storage in dam:	**Full storage ML**	**Dead storage ML**	**Leakage ML/d**
Rocky Creek Dam	14000	150	1.15
Emigrant Creek Dam	820	50	0.23

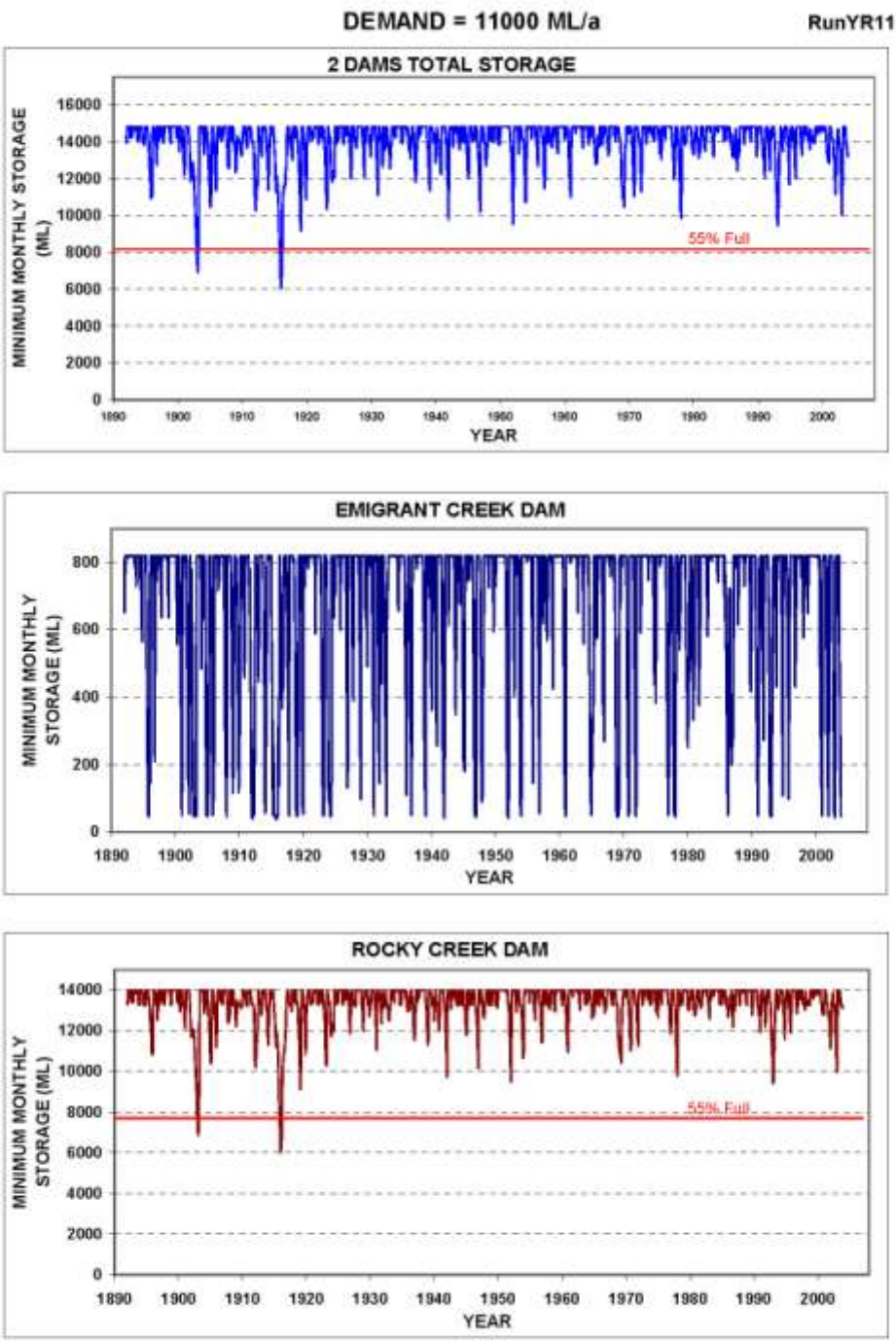


FIGURE A1 STORAGE BEHAVIOUR, 11,000 ML/a DEMAND, up to 30ML/d PUMPING

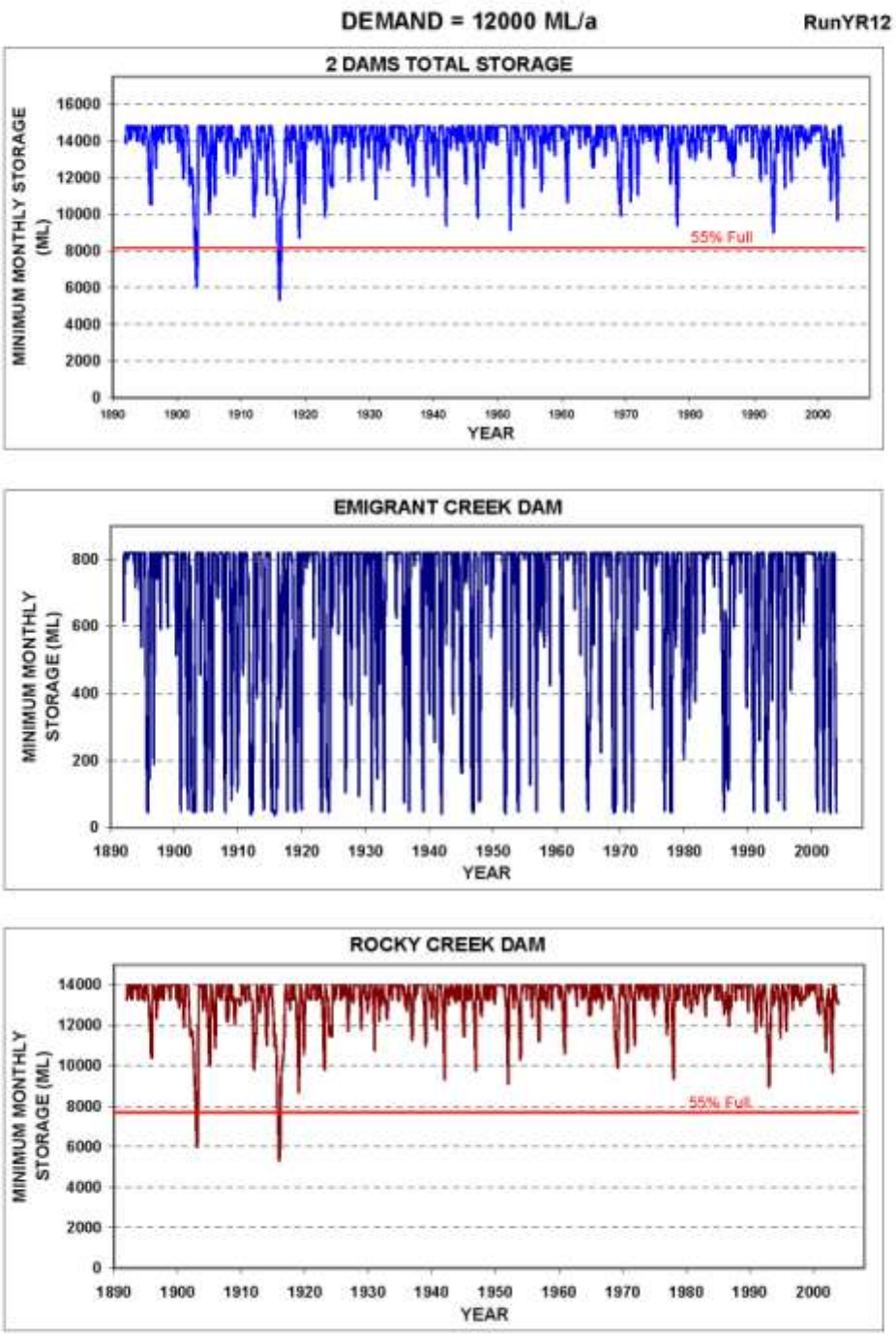


FIGURE A2 STORAGE BEHAVIOUR, 11,000 ML/a DEMAND, up to 30ML/d PUMPING

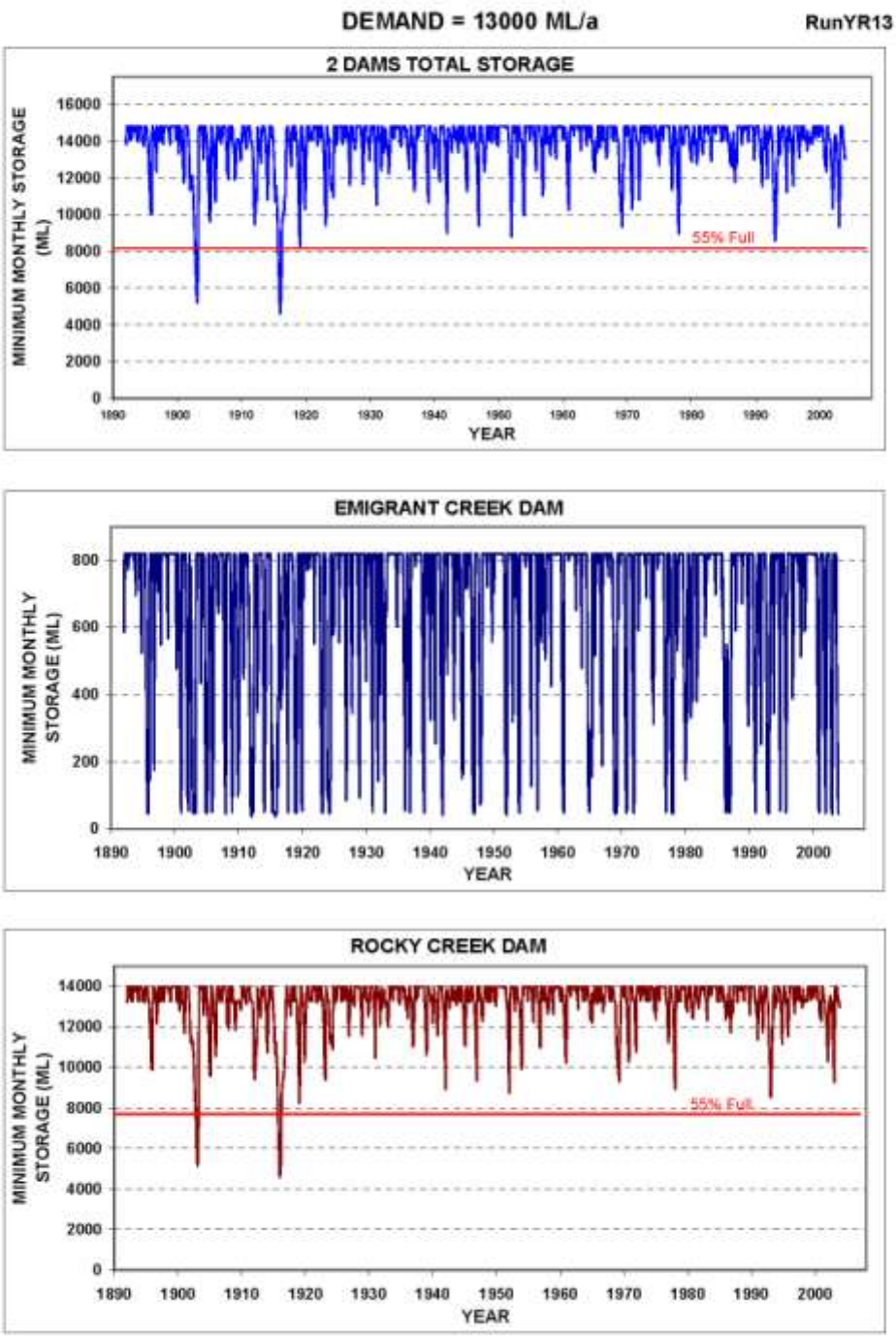


FIGURE A3 STORAGE BEHAVIOUR, 13,000 ML/a DEMAND, up to 30ML/d PUMPING

28/01/2009

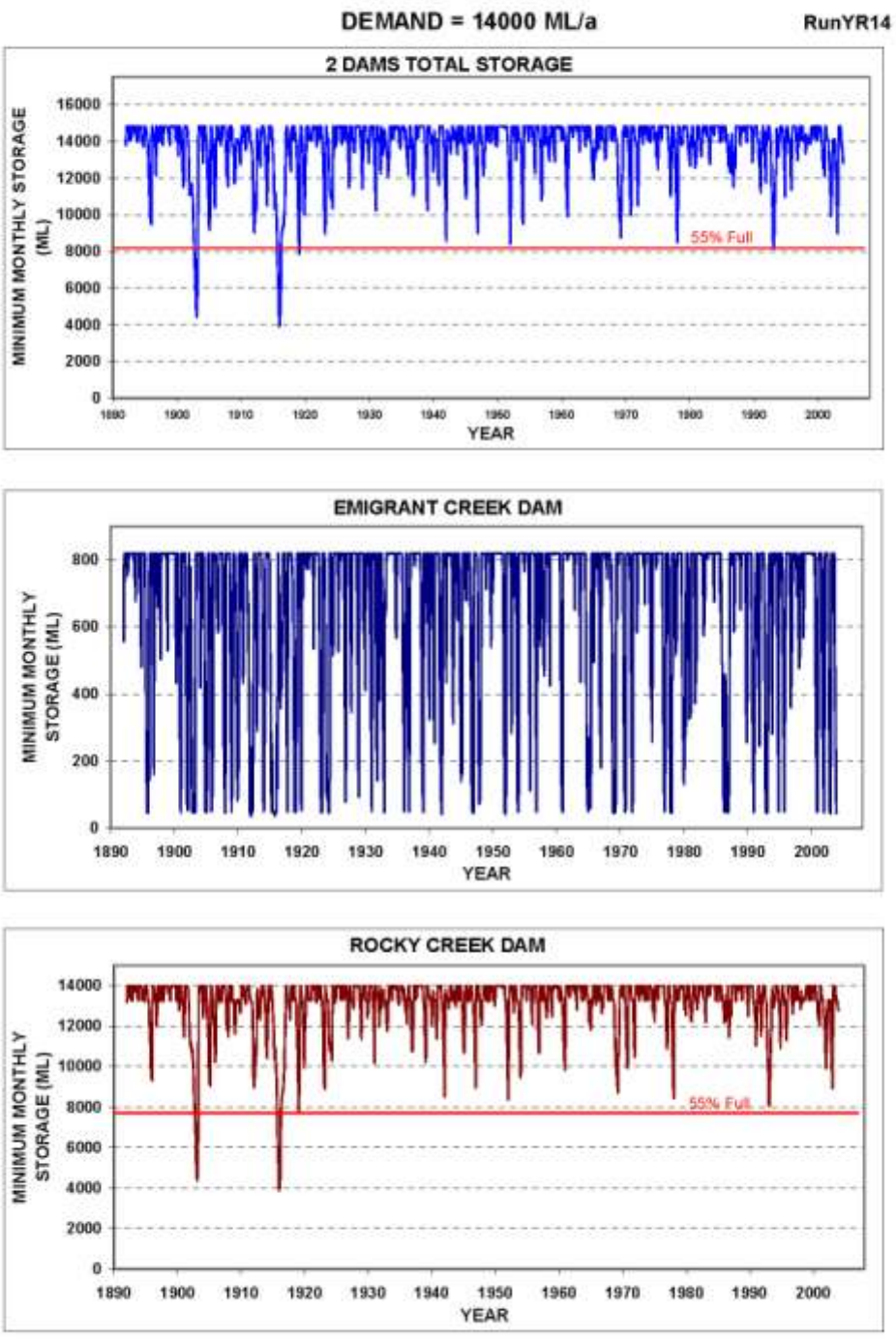


FIGURE A4 STORAGE BEHAVIOUR, 14,000 ML/a DEMAND, up to 30ML/d PUMPING

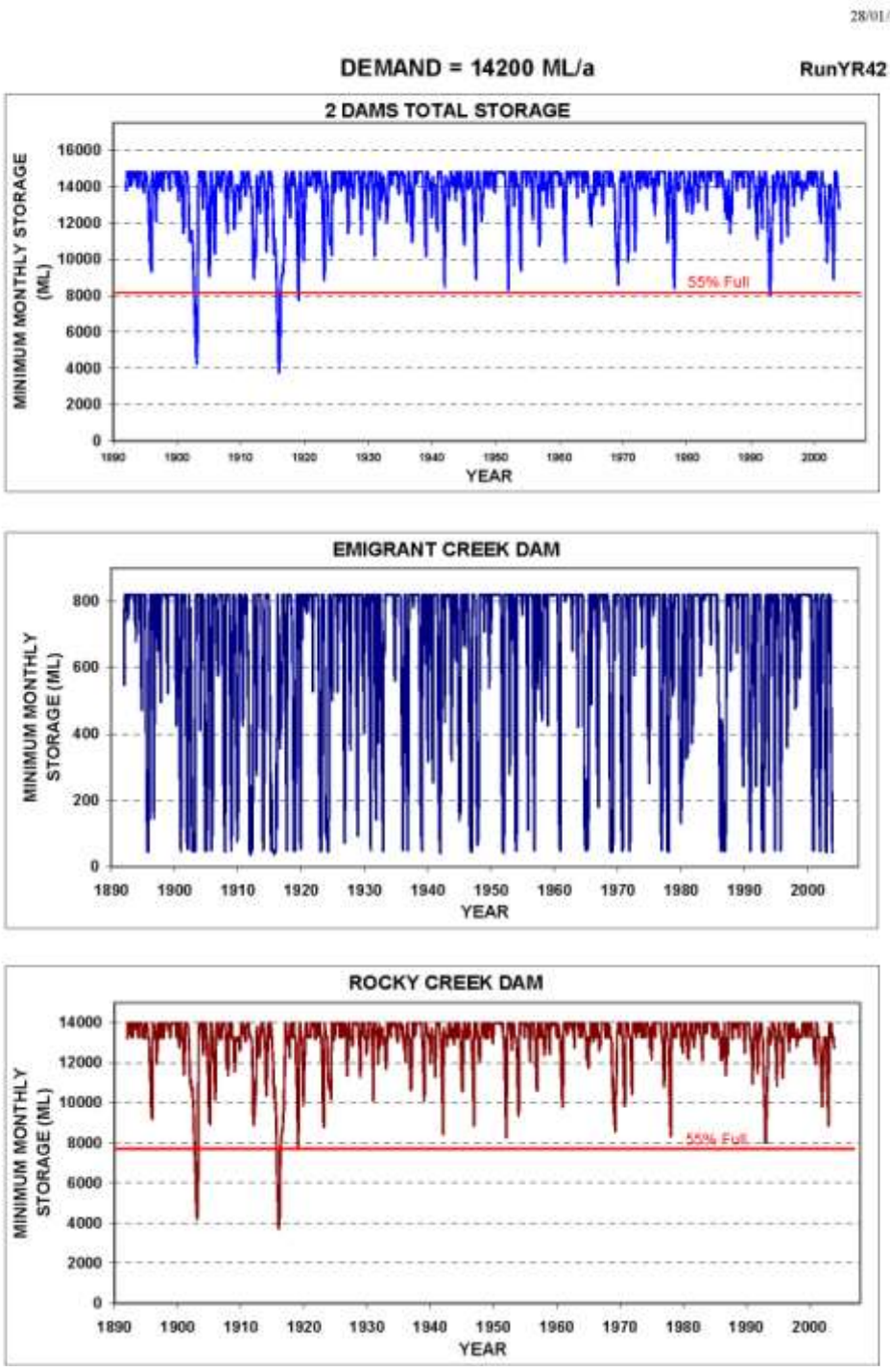


FIGURE A5 STORAGE BEHAVIOUR, 14,200 ML/a DEMAND, up to 30ML/d PUMPING

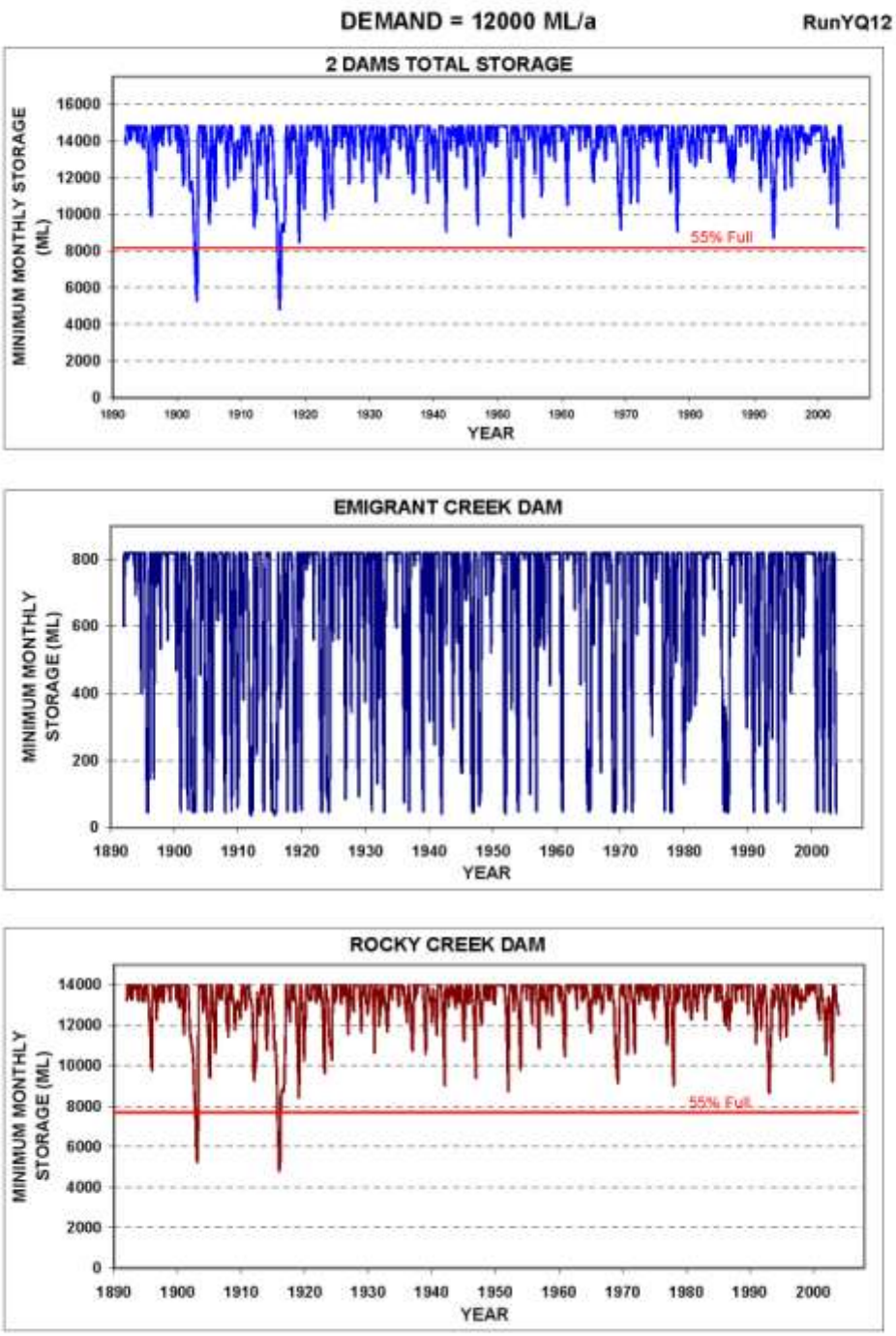


FIGURE A7 STORAGE BEHAVIOUR, 13,000 ML/a DEMAND, TARIFF PUMPING

28/01/2009

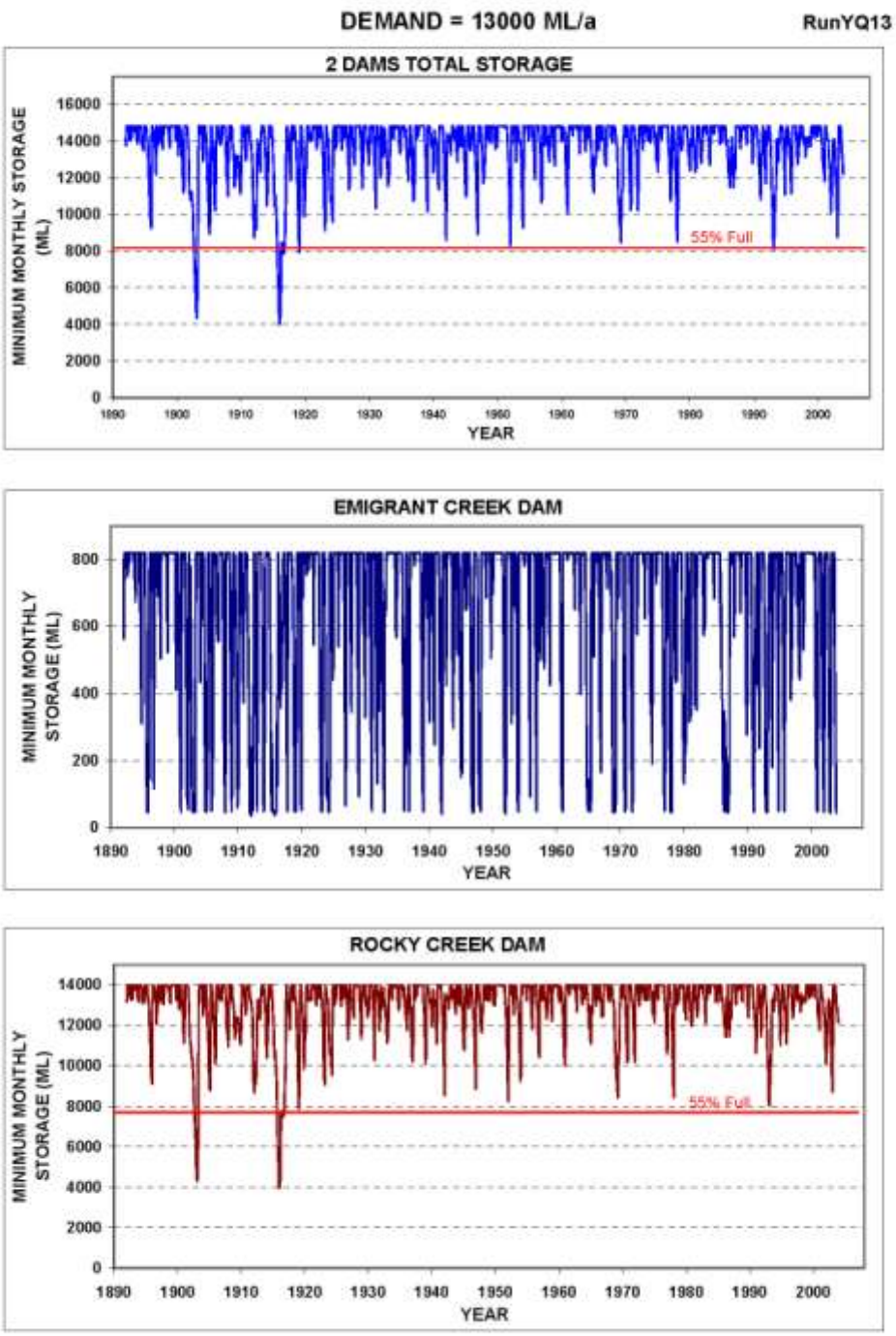


FIGURE A8 STORAGE BEHAVIOUR, 13,000 ML/a DEMAND, TARIFF PUMPING

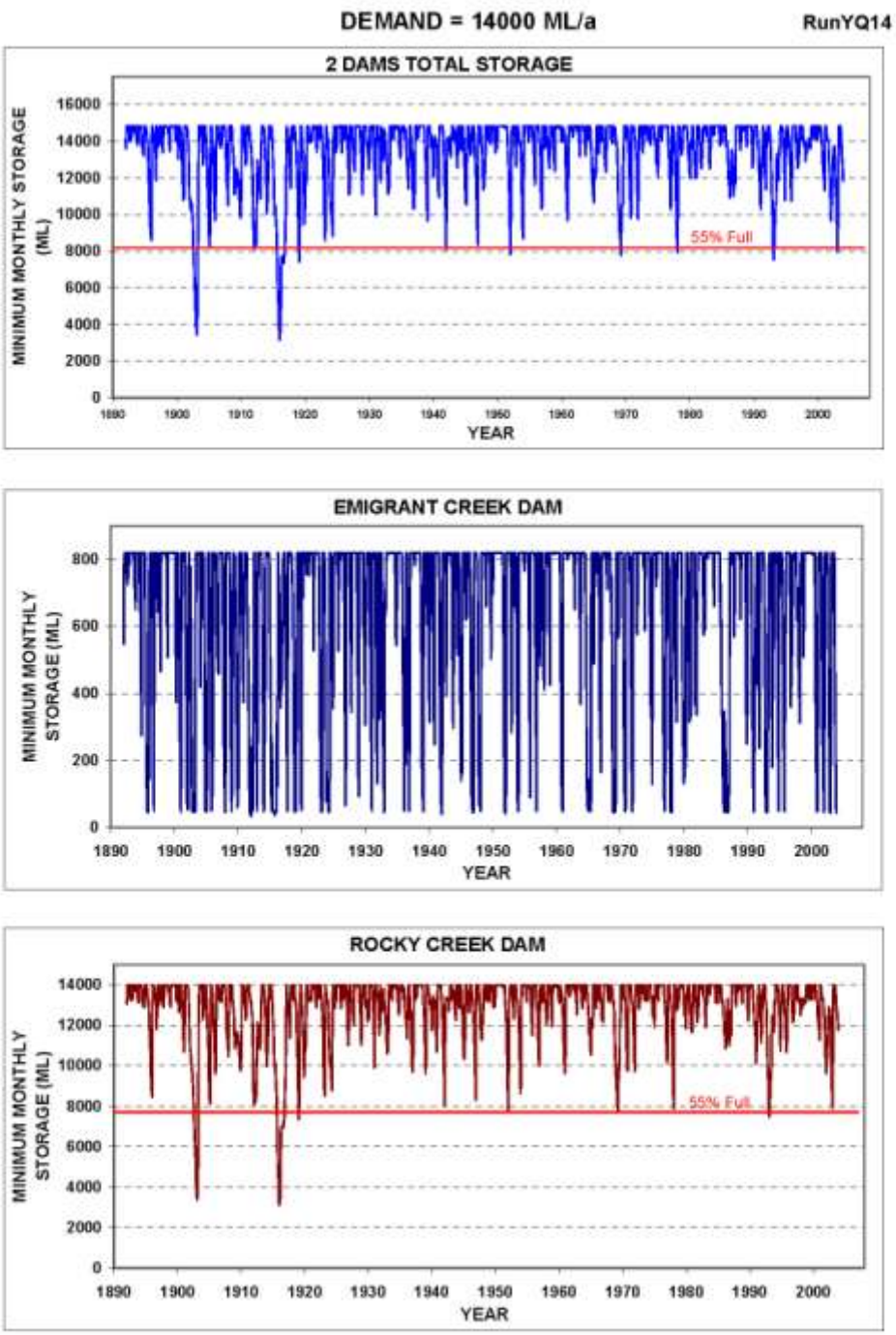


FIGURE A9 STORAGE BEHAVIOUR, 14,000 ML/a DEMAND, TARIFF PUMPING

28/01/2009

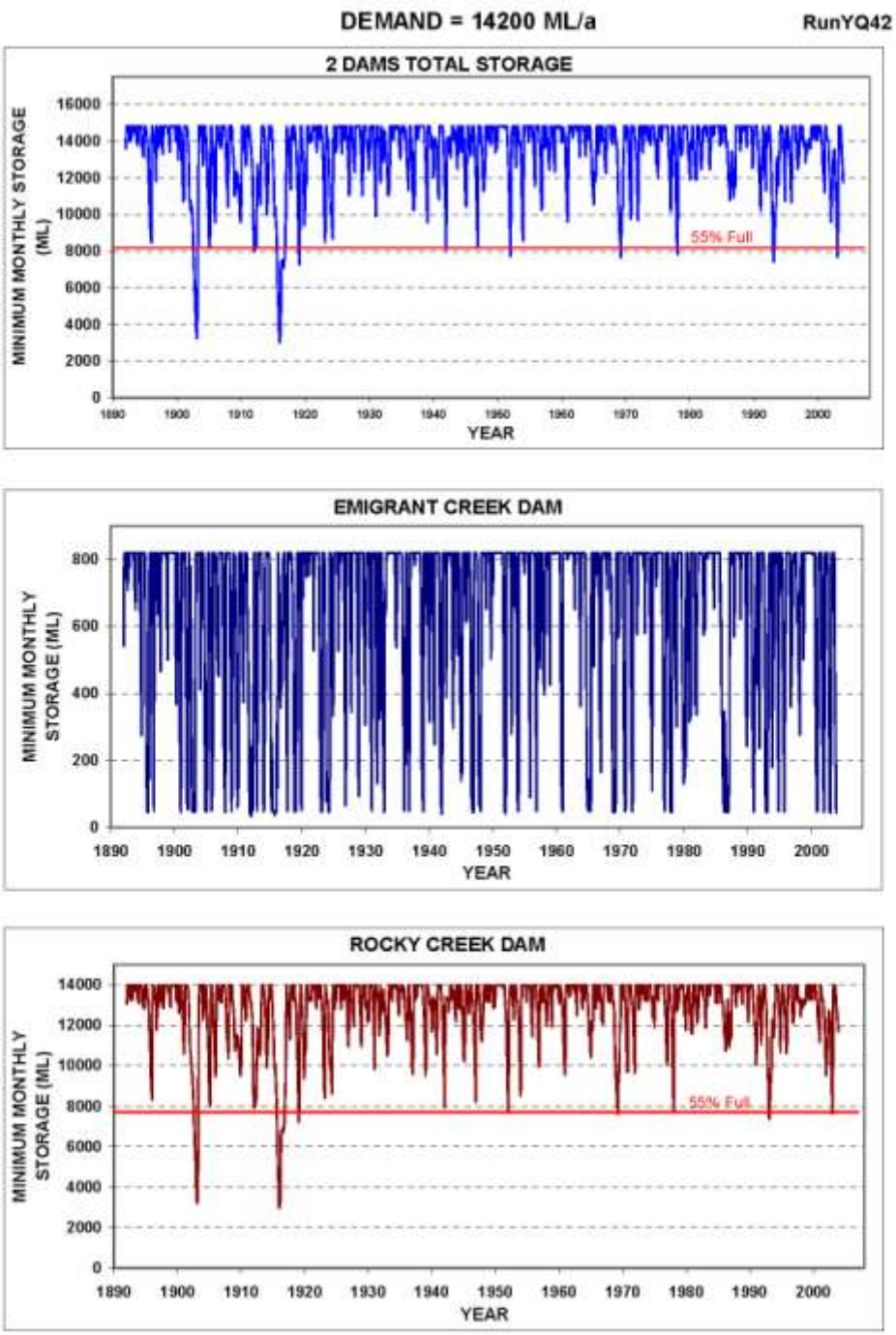


FIGURE A10 STORAGE BEHAVIOUR, 14,200 ML/a DEMAND, TARIFF PUMPING

Appendix 2: Rous Water Restriction Levels

The following information describes the actions that are taken at the different levels of restrictions.

Water Restrictions Level 1

Water customers of the following Councils:

Ballina Shire
Byron Shire
Lismore City (excluding Nimbin)
Richmond Valley Lower River Customers
Rous Water

are advised that the following water restrictions apply

DOMESTIC

Gardens, Car Washing, Window Cleaning	Sprinklers and fixed hoses may be used between the hours of 6am to 10 am and 3 pm to 7pm.
Use of Hoses	All hoses must be fitted with an on/off nozzle.
Boats, Boat motors and trailers used in saltwater environments	No restriction
Swimming Pool – Private	• Filling of new pools allowed. • Topping up of pools allowed. • Emptying and refilling of existing pools banned.
Washing of driveways, paved areas and roofs	Buckets or watering cans only for health and safety reasons.

BUSINESS/COMMERCIAL PREMISES

Public Gardens	Sprinklers 1hr/day 5am-6am – or application for times.
Sports Grounds	Sprinklers 1hr/day 6am-7am – or application for times.
Beach Showers	No restriction.
Market Gardens, Orchards, Nurseries & Commercial Flower Gardens	Sprinklers 2hr/day - application for times.
Washing Motor Vehicles	No restriction.
Washing of Buses, Taxis, Food Transport, Ambulances & Garbage Vehicles	No restriction.
Brick Cleaning, Carpet Cleaning, Car Detailing and Under boring	No restriction.
Building	No restriction.
New Turf	Watering in – then sprinklers 1hr/day for first 7 days – application for times.
Paved public areas, where food is prepared or consumed, or for health reasons	No restriction.
Water Cartage – Potable Supply	Recipients of water to comply with restrictions set out in this Table.
Auto Flush Urinals	• On timers – banned • On demand – OK

INDUSTRIAL

Ready Mix Concrete & Others	No restriction

RURAL

Stock	No restriction
Irrigation	Sprinklers 2hr/day - application for times.

Water Restrictions Level 2

Water customers of the following Councils:

Ballina Shire
Byron Shire
Lismore City (excluding Nimbin)
Richmond Valley Lower River Customers
Rous Water

are advised that the following water restrictions apply

DOMESTIC

Gardens, Car Washing, Window Cleaning	• Sprinklers and fixed hoses banned. • Micro-sprays for 15 minutes. • Hand held hoses can be used for 2 hours per day every second day between the hours of 3pm and 10pm on odd or even days matching house numbering.
Use of Hoses	All hoses must be fitted with an on/off nozzle.
Boats, Boat motors and trailers used in saltwater environments	No restriction
Swimming Pool – Private	• Filling of new pools allowed. • Topping up of pools allowed. • Emptying and refilling of existing pools banned.
Washing of driveways, paved areas and roofs	Buckets or watering cans only for health and safety reasons.

BUSINESS/COMMERCIAL PREMISES

Public Gardens	Sprinklers 1 hour per day 5am-6am – or application for times.
Sports Grounds	Sprinklers 1 hour per day 6am-7am – or application for times.
Beach Showers	No restriction.
Market Gardens, Orchards, Nurseries and Commercial Flower Gardens	Sprinklers 2 hours per day - application for times.
Washing Motor Vehicles	No restriction.
Washing of Buses, Taxis, Food Transport, Ambulances & Garbage Vehicles	No restriction.
Brick Cleaning, Carpet Cleaning, Car Detailing and Under boring	No restriction.
Building	No restriction.
New Turf	Watering in – then sprinklers 1 hour per day for first 7 days – application for times.
Paved public areas, where food is prepared or consumed, or for health reasons	No restriction.
Water Cartage – Potable Supply	Recipients of water to comply with restrictions set out in this Table.
Auto Flush Urinals	On timers – banned On demand – OK

INDUSTRIAL

Ready Mix Concrete & Others	No restriction

RURAL

Stock	No restriction
Irrigation	Sprinklers 2 hours per day - application for times.

Water Restrictions Level 3

Water customers of the following Councils:

Ballina Shire
Byron Shire
Lismore City (excluding Nimbin)
Richmond Valley Lower River Customers
Rous Water

are advised that the following water restrictions apply

DOMESTIC

Gardens, Car Washing, Window Cleaning	• Sprinklers and fixed hoses banned. • Micro-sprays for 15 minutes. • Hand held hoses can be used for ½ hour per day every second day between the hours of 3pm to 10 pm on odd or even days matching house numbering.
Use of Hoses	All hoses must be fitted with on/off nozzle.
Boats, Boat motors and trailers used in saltwater environments	Use of hand held hoses or "muffs" for 10 minutes only for cleaning after each use.
Swimming Pool – Private	• Filling of new pools allowed. • Topping up of pools allowed. • Emptying and refilling of existing pools banned.
Washing of driveways, paved areas and roofs	Buckets or watering cans only for health and safety reasons.

BUSINESS/COMMERCIAL PREMISES

Public Gardens	Sprinklers 1 hour per day 5am-6am – or application for times.
Sports Grounds	Sprinklers 1 hour per day 6am-7am – or application for times.
Landscaping to Buildings and Properties	One hour per day on alternate days, hand held hoses – application for times.
Beach Showers	No restriction.
Market Gardens, Orchards, Nurseries & Commercial Flower Gardens	Sprinklers 2 hours per day - application for times.
Motor Vehicle Washing Businesses	No restriction.
Washing of Buses, Taxis, Food Transport, Ambulances, Garbage Vehicles & Commercial Vehicles	No restriction.
Brick Cleaning, Carpet Cleaning, Car Detailing & Under boring	No restriction.
Building/Construction	No restriction.
New Turf	Watering in – then sprinklers 1hour per day for first 7 days – application for times.
Paved public areas, where food is prepared or consumed, or for health reasons	Hand held hoses 1 hour per day – application for times.
Water cartage for refilling rainwater tanks	Water carriers must be registered with respective Council.
Auto Flush Urinals	On timers – banned On demand – OK

INDUSTRIAL

Ready Mix Concrete & Others	No restriction

RURAL

Stock	No restriction

Water Restrictions Level 4

Water customers of the following Councils:

Ballina Shire
Byron Shire
Lismore City (excluding Nimbin)
Richmond Valley Lower River Customers
Rous Water

are advised that the following water restrictions apply

DOMESTIC

Gardens, Car Washing, Window Cleaning	• Sprinklers and fixed hoses banned. • Micro sprays for 15 minutes. • Hand held hoses can be used for ½ hour per day every second day between the hours of 3pm and 10pm on odd or even days matching house numbering.
Boats, Boat motors and trailers used in saltwater environments	5 minutes hose use for cleaning motor only. Buckets can be used for cleaning boat and trailer.
Swimming Pool – Private	• Topping up of pools to 300mm below skimmer box allowed by hand held hose only to prevent structural damage ½ hour per week on Mondays 5.30pm to 6pm. • Emptying and refilling of existing pools banned. • New pools to be filled only to 300mm below skimmer box to prevent structural damage.
Washing of driveways, paved areas and roofs	Buckets or watering cans only.

BUSINESS/COMMERCIAL PREMISES

Public Gardens and general paved areas	Buckets or watering cans only.
Sports Grounds (General)	Buckets or watering cans only.
Sports Grounds (Turf cricket pitches only)	Hand held hoses 1 hour per day, 7.00am-8.00am.
Fountains	Banned.
Landscaping to Buildings and Properties	Buckets or watering cans only.
Beach Showers	Banned
Market Gardens, Orchards, Nurseries & Commercial Flower Gardens	Sprinklers/hand watering 1hourper day - application for times. Watering cans or buckets allowable at all times.
Motor Vehicle Washing & Car Detailing Businesses	Buckets or Machine Recirculation only.
Washing of Buses, Taxis, Food Transport, Ambulances, Garbage Vehicles & Commercial Vehicles	Buckets or Machine Recirculation only.
Brick Cleaning, Carpet Cleaning, and Under boring	Limited to essential business use only.
Building/Construction	Limited to essential business use only.
Bowling Greens & Golf Greens only	Hand held hoses 1 hour per day 6pm-7pm.
New Turf	Once only 1 hour water in by hand held hose and then bucket or watering can only.
Paved public areas, where food is prepared or consumed, or for health reasons	Bucket and mop or watering can only.
Water cartage for refilling rainwater tanks	No restriction – private carriers must be registered. No new permits issued.
Auto Flush Urinals	On timers – banned. On demand – OK.

INDUSTRIAL

Ready Mix Concrete and others	Limited to essential business use only.

RURAL

Stock watering	No restriction

Water Restrictions Level 5

Water customers of the following Councils:

Ballina Shire
Byron Shire
Lismore City (excluding Nimbin)
Richmond Valley Lower River Customers
Rous Water

are advised that the following water restrictions apply

DOMESTIC (URBAN and RURAL)

Gardens	Use of sprinklers, micro-sprays, fixed and hand held hoses banned. Gardens can be watered by buckets only.
Car Washing	Town water banned.
Window and General Cleaning	Town water banned.
Boats, Boat motors and trailers used in saltwater environments	Town water banned.
Swimming Pool – Private	Town water topping up and filling banned.
Washing of driveways, paved areas and roofs	Town water banned.

BUSINESS/COMMERCIAL – USE OF TOWN WATER SEVERELY RESTRICTED

Pools and Spas - Ancillary to Business e.g. Motels/resorts	Town water topping up/filling banned.
- Public (including privately operated)	Limited to 8 hours operation per day only except under an approved WMP***.
Public Gardens and general paved areas	Town water banned.
Sports Grounds (General)	Town water banned.
Sports Grounds (Turf cricket pitches only)	Town water banned.
Fountains	Town water banned.
Landscaping to Buildings and Properties	Town water banned.
Beach Showers	Banned.
Market Gardens, Orchards, Nurseries & Commercial Flower Gardens	Sprinklers/hand watering 1 hour per day – evenings only. (Under approved WMP***). Watering cans or buckets allowable.
Car Washing & Detailing Businesses	Buckets only except under an approved WMP***
All vehicles	Washing for health and safety reasons only – by buckets.
Brick Cleaning, Carpet Cleaning, Under boring, Painting Pest Control and House Washing	Use of town water with pressure cleaner's hoses and similar equipment - banned. Buckets only.
Building/Construction/Maintenance	Use of town water with pressure cleaner's hoses and similar equipment - banned. Buckets only.
Bowling Greens and Golf Greens	Town water banned.
New Turf	Town water banned.
Paved public areas	Washing for health and safety reasons only – by bucket.
Water cartage for refilling rainwater tanks	To be used only for activities permitted by these restrictions – no new permits issued.
Auto Flush Urinals	On timers banned – on demand OK.
Stock Watering	Essential use – maximum 1 beast per ha. equivalent.

INDUSTRIAL / PROCESSING PLANTS	Limited to 8 hours operation per day only except under an approved WMP***.

RURAL

Stock Watering	No restriction.

*****WMP = Water Management Plan**

Water Restrictions Level 6

Water customers of the following Councils:

Ballina Shire
Byron Shire
Lismore City (excluding Nimbin)
Richmond Valley Lower River Customers
Rous Water

are advised that the following water restrictions apply

DOMESTIC (URBAN and RURAL)

Gardens	Town water banned.
Car Washing	Town water banned.
Window and General Cleaning	Town water banned.
Boats, Boat motors and trailers used in saltwater environments	Town water banned.
Swimming Pool – Private	Town water topping up and filling banned.
Washing of driveways, paved areas and roofs	Town water banned.

BUSINESS/COMMERCIAL – USE OF TOWN WATER SEVERELY RESTRICTED

Pools & Spas - Ancillary to Business e.g. Motels/resorts	Town Water topping up/filling banned.
Public (including privately operated)	Limited to 8 hours operation per day only except under an approved WMP***.
Public Gardens and general paved areas	Town water banned
Sports Grounds (General)	Town water banned
Sports Grounds (Turf cricket pitches only)	Town water banned
Fountains	Town water banned
Landscaping to Buildings and Properties	Town water banned
Beach Showers	Banned
Market Gardens, Orchards, Nurseries and Commercial Flower Gardens	Watering cans or buckets allowable.
Car Washing & Detailing Businesses	Buckets only except under an approved WMP***
All vehicles	Washing for health and safety reasons only – by buckets.
Brick Cleaning, Carpet Cleaning, Under boring, Painting Pest Control and House Washing	Use of town water with pressure cleaner's hoses and similar equipment - banned. Buckets only.
Building/Construction/Maintenance	Use of town water with pressure cleaner's hoses and similar equipment - banned. Buckets only.
Bowling Greens & Golf Greens	Town water banned
New Turf	Town water banned
Paved public areas	Washing for health and safety reasons only – by bucket.
Water cartage for refilling rainwater tanks	To be used only for activities permitted by these restrictions – no new permits issued.
Auto Flush Urinals	On timers banned – on demand OK.
Stock Watering	Essential use – maximum 1 beast per ha. equivalent

INDUSTRIAL/PROCESSING PLANTS	Limited to 8 hours operation per day only except under an approved water management plan.

RURAL

Stock Watering	Banned.

*****WMP = Water Management Plan**

Water Restrictions Level 7

Water customers of the following Councils:

Ballina Shire
Byron Shire
Lismore City (excluding Nimbin)
Richmond Valley Lower River Customers
Rous Water

are advised that the following water restrictions apply

DOMESTIC (URBAN and RURAL)

Gardens	All external use of town water banned. Internal use limited to 100 litres per person per day.
Car Washing	
Window & General Cleaning	
Boats, Boat motors and trailers used in saltwater environmer	
Swimming Pool -- Private	
Washing of driveways, paved areas and roofs	

BUSINESS/COMMERCIAL – USE OF TOWN WATER SEVERELY RESTRICTED

Pools & Spas - Ancillary to Business e.g. Motels/resorts	Town Water topping up/filling banned.
Public (including privately operated)	Town water banned.
Public Gardens and general paved areas	Town water banned.
Sports Grounds (General)	Town water banned.
Sports Grounds (Turf cricket pitches only)	Town water banned.
Fountains	Town water banned.
Landscaping to Buildings and Properties	Town water banned.
Beach Showers	Banned.
Market Gardens, Orchards, Nurseries and Commercial Flow Gardens	Town water banned.
Car Washing & Detailing Businesses	Town water banned.
All Vehicles	Washing for health and safety reasons only – by buc
Brick Cleaning, Carpet Cleaning, Under boring, Painting Pes Control and House Washing	Town water banned.
Building/Construction/Maintenance	Town water banned.
Bowling Greens & Golf Greens	Town water banned.
New Turf	
Paved public areas	Washing for health and safety reasons only – by buc
Water cartage for refilling rainwater tanks	To be used only for activities permitted by these restr – no new permits issued.
Auto Flush Urinals	On timers banned – on demand OK.
Stock Watering	Town water banned.

INDUSTRIAL/PROCESSING PLANTS	Town water banned.

RURAL	Stock watering banned.

Appendix 3: DWE Best Practice Drought Management Plan Guidelines

Appendix D - Drought Management

Check List – August 2007

A comprehensive drought management plan details the demand and supply issues to be addressed during drought conditions and includes adoption of a schedule of trigger points for the timely implementation of appropriate water restrictions. Appropriate drought management planning will ensure that town water supplies with significant storage do not fail in times of drought.

Drought management planning includes documenting basic data on water demands, rainfall, evaporation, records of past droughts, the existing water supply system, and its water resources, and strategies to achieve the objective of having sufficient water to satisfy the basic needs of the community.

This check list is essentially a road map to assist LWUs to quickly implement sound drought management planning. LWUs should have a sound drought management plan in place and be ready to implement their plan when drought conditions arise.

Drought Management – Check List

Topic		Outcome Achieved
1. Executive Summary		☐ Covers all major issues, objectives, planning, strategies and monitoring for existing essential supplies of water to the service area(s).
		☐ Includes a summary of the drought management plan and an adopted schedule of trigger points for timely implementation of appropriate water restrictions.
2. Background	A.	☐ Includes the existing water supply system(s) in the service area(s) and a locality map.
	B.	☐ Includes history of past droughts.
	C.	☐ Includes information on the impact of past droughts on water services, eg. restrictions, effect of restrictions on demands, any emergency sources identified, etc.
3. Objectives	A.	☐ Identifies key objectives required to maintain a basic/restricted supply to all users. There is a need to consider social and environmental impacts.
	B.	☐ Tailor strategies relevant to the service areas.
	C.	☐ Endorse and implement a plan that minimises the risk of the community running out of water.

Drought Management – Check List

Topic	Outcome Achieved
4. Data	A. ☐ Identification of all communities served by the LWU's reticulated water supply, those with private reticulated water services and those with no reticulated water services within the service area(s).
	B. ☐ Identification of any properties, businesses, other LWUs etc. that may seek water in times of drought.
	C. ☐ Identification of all water requirements. Identify the normal and minimum potable and non-potable water requirements.
	D. ☐ Identify water dependent industry/businesses, any fire fighting requirements and opportunities for recycled water use.
	E. ☐ Includes a description and plan of all water supply schemes in the service area(s).
	F. ☐ Includes height/storage volume and height/surface area graphs for all water supply dams and weirs.
	G. ☐ Historical performance of rivers, dams, weirs and bores in previous droughts.
	H. ☐ Includes the average rainfall figures and evaporation rates.
Note: All data to be specified on a daily basis.	
5. Plan	A. ☐ Demand management options.
	B. ☐ Restriction strategies including means and methods for the enforcement of restrictions and the expected results of imposing restrictions.
	C. ☐ Adopted schedule of trigger points for the timely implementation of appropriate water restrictions in order to minimise the risk of failure in times of drought.
	D. ☐ Availability of alternative water sources (including estimated costs and times to implement).
	E. ☐ Water cartage options.
	F. ☐ Identify legislation, local laws and council policies affecting the contingency arrangements.
	G. ☐ Links to water sharing plans/committees, water management plans/committees, irrigators, etc.

Drought Management – Check List

Topic		Outcome Achieved
	H.	☐ Impact of extraction on downstream stakeholders.
	I.	☐ Impact of reduced flows in watercourses.
	J.	☐ Level of prediction and intervention.
	K.	☐ Identify human resource requirements.
6. Monitoring During Drought	A.	☐ Daily monitoring of demands.
	B.	☐ Daily monitoring of water supply sources (dams, bores and streams).
	C.	☐ Monitoring impact of restrictions on consumption
	D.	☐ Monitoring the electrical conductivity, alkalinity and algae levels in the water sources.
7. Consultation		☐ Comprehensive media strategy and public consultation.
		☐ Regular consultation with appropriate government agencies (DWE, DECC, NSW Health etc).
8. Operation of Drought Management Plan (DMP)	A.	☐ DMP should discuss, analyse and identify any impact on other regions and localities ie. upstream, downstream or conjunctive water users.
	B.	☐ DMP should demonstrate a sustainable strategy that considers all other stakeholders.
	C.	☐ DMP documents an agreed procedure for progressive implementation of water restrictions.

REFERENCE

Drought Management Guidelines, NSW Local Government Water Directorate, December 2003.

For further information and assistance, please contact Stephen Palmer, Manager Planning on 8281 7331 or Stephen.Palmer@dwe.nsw.gov.au