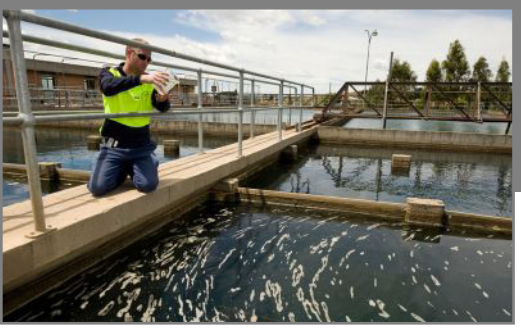
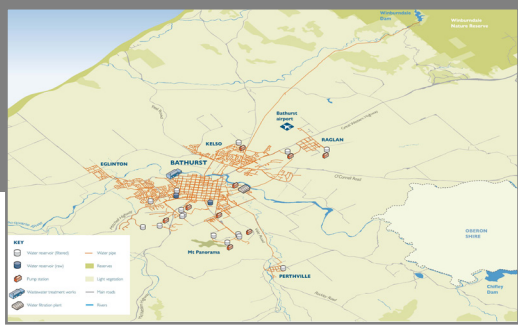
Bathurst Regional Council

Drought Management Plan





OCTOBER 2014

BATHURST REGIONAL COUNCIL

HydroScience
Strategic Water Solutions

Bathurst Regional Council

Drought Management Plan

HydroScience Consulting

A.B.N. 79 120 716 887

Email: hsc@hydroscience.com.au

Sydney Office

Level 1, 189 Kent Street

Sydney, NSW, 2000

Telephone: 02 9249 5100

Facsimile: 02 9251 4011

Byron Bay Office

6/64 Centennial Circuit

Byron Bay, NSW, 2481

Telephone: 02 6639 5600

Facsimile: 02 6680 9319

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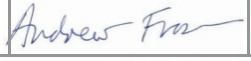
3	HHA	AFR	Andrew Fraser		October 14

Executive Summary

Bathurst Regional Council's (BRC) Drought Management Plan has been developed to ensure the community recognises the issues associated with drought management and their role in supporting Council's actions during drought.

The aim of this plan was to review and update Council's 2007 Drought Contingency and Water Supply Emergency Management Plan. It also provides a strategic approach for managing water supply in the Bathurst Local Government Area (LGA) during the periods of drought or when emergency conditions arise.

The NSW Office of Water's Best-Practice Management of Water Supply and Sewerage Guidelines (2007) require Local Water Utilities to have a sound Drought Management Plan in place and be ready to implement their plan when drought or emergency conditions arise. This plan also satisfies the guidelines requirements.

This drought management plan has the following uses:

- As an operational support document for water supply management
- As an authorised approach to drought management enabling staff to act without fear or favour knowing that necessary actions have been endorsed beforehand
- As the basis for further Government grant applications to address the needs identified in this plan
- As the basis of a public awareness and community communication tool for use by Council to demonstrate transparent and responsible drought management

Bathurst Regional Council (BRC) sources water from surface and groundwater resources and delivers potable and raw water supplies to the Bathurst LGA.

The BRC water filtration plant has a current capacity of 60 ML/d. The plant provides potable water to the urban supply areas of:

- City of Bathurst
- Kelso
- Raglan
- Perthville
- Eglinton

Council also maintains the raw water pipeline which extracts water from Winburndale Dam and delivers raw water to the two reservoirs. The main uses of this raw water supply include irrigation of Council Parks, industrial uses and the provision of domestic use in stock watering and irrigation.

Council operates two bores to provide a non-potable supply to the Hillview Estate.

All other villages are supplied by rainwater tanks and/or privately owned groundwater bores.

To align drought management with other emergency planning approaches this drought management plan has been divided into four main sections:

- Prevention (see section 2 to section 3)
- Preparedness (see section 4)
- Response (see section 5 to section 9)
- Recovery (see section 10)

Each of the above section addresses Council's actions from a pre-drought or to post drought or situation.

The water restrictions will be activated in an event when the water supply capacity falls below a capacity equivalent to Chifley Dam capacity at 40%. Beyond this trigger criteria Council could decide to commence drought actions as Council sees fit, for example when other nearby Councils are in drought.

BRC has adopted the Bathurst, Orange and Dubbo (BOD) water restriction definitions (as shown in Appendix B). The BOD water restrictions are comprised of 6 levels of water consumption targets and their respective residential, non-residential, internal and external water usage constraints.

The BRC drought triggers for implementing drought restrictions are summarised in the table below. The table also shows the targeted residential water consumption per person at each water restriction level for the Bathurst Local Government Area (LGA).

Triggers	Water Restrictions Levels	Demand
Chifley Dam Storage Volume		Estimated Residential Consumption (L/person/day)
> 40%	No restriction	304
≤ 40%	Level 1	278
≤ 35%	Level 2	250
≤ 30%	Level 3	219
≤ 25%	Level 4	183
≤ 22%	Level 5	159
≤ 15%	Level 6	129

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1 Introduction

This Bathurst Regional Council (BRC) Drought Management Plan (DMP) has been developed to ensure that relevant authorities and the community recognise the issues associated with drought management and their role in supporting Council's actions in the event of a drought scenario.

The purpose of this plan is to provide a strategic direction and plan for managing water supply to the BRC Local Government Area (LGA) during periods of drought or during emergency interruptions to water supply.

The NSW Office of Water's Best-Practice Management of Water Supply and Sewerage Guidelines (2007) requires Local Water Utilities to have a sound Drought Management Plan (DMP) in place and be ready to implement their plan when drought or emergency conditions arise. This plan satisfies this Best-Practice requirement. A copy of NSW Office of Water's Best Practice Guidelines Drought Management checklist is included in Appendix A.

1.1 Objective

This DMP aims to describe how BRC will regulate the water supply during drought periods. The purposes of this plan include the following applications:

- As an operational support document for water supply management
- As an authorised approach to drought management enabling staff to act without knowing that necessary actions have been endorsed beforehand
- As the basis for further Government grant applications to address needs identified in the drought management plan
- As the basis of a public awareness and community communication tool for use by Council to demonstrate transparent and responsible drought management

This plan provides a combination of long-term and short-term management actions to respond to drought situations. These responses are in the form of water conservation measures, restrictions and options for addressing both demand and supply.

The main scenarios that would trigger a drought management response and introduction of supply restrictions include:

- Failure of supply from water source(s)
- Contamination of supply, either at the source or within the supply system
- Concentrations of algae or suspended material in the source water
- Power failure affecting transmission of raw and/or filtered water
- Major system failure, including failure of major distribution mains, service reservoir(s) or distribution pumping stations
- In very specific circumstances trigger to implement empathetic water conservation measures due to lack of water supply in the neighbouring Local Government Areas

Council's response would largely depend on the magnitude and/or duration of any of the above scenarios and the ability of the system to supply water to consumers.

1.2 Drought Management Strategy

The objective of a drought strategy is to ensure a systematic, effective and efficient response to manage the water shortages which results from drought.

By applying incident management principles, the drought management process would be divided into four phases to manage and reduce the impact. This DMP has been developed to incorporate drought management strategic actions categorised into these four drought management phases. A summary of these actions is provided below:

Prevention

Low levels of water availability due to climate during drought are outside Council's control. It is therefore important to review the climate patterns, past drought events, past drought impacts to the water supply system, water sharing plans rules and develop responses, undertake education and reinforce positive choices to eliminate or reduce the impact of future events.

Preparedness

To lessen the effect of drought and reduce the vulnerability of the water supply, the following drought strategy measures have been developed in order to be prepared for drought:

- Defined water restrictions levels
- Staged supply side actions e.g.:
  - At Level 1 - Closely monitor weir water level and the overflow rates
  - At Level 2 - Investigate and design infrastructure required to extract water from dead zone of Chifley Dam
  - At Level 3 – Review water carting plan
- Further investigation of alternative water supply options to reduce the vulnerability of a single source water supply
- Investigation of alternative water resources and measures to extend water supply capacity by reducing demand and develop demand side actions e.g. :
  - Limited usage of sprinklers and fixed horses for all customers
  - Limited usage of washing cars at home, when water restriction levels 5 and 6 implemented completely banned

Response

In the event of a drought, the implementations of the following actions have been detailed in the Drought Management Plan:

- Monitoring
- Implementing water restrictions
- Water carting
- Providing public notification

Recovery

When the conditions return to normal, the following actions are to be considered:

- Restoring water supply demand and lifting water restrictions
- Reviewing drought management actions and plan in the light of experience

This plan is structured on the basis of these drought management four phases.

Drought Prevention

The following sections detail the prevention phase of the drought management strategy

2 Water Supply Background

Bathurst Regional Council (BRC) sources water from both surface and groundwater resources and delivers potable and raw water supplies to the Local Government Areas (LGA) as shown in Figure 1.

Figure 1: Bathurst Regional Council LGA

2.1 Potable Water Supply

The BRC Water Filtration Plant (WFP) provides potable supply to the urban area and villages, those are:

- Cities of :
  - Bathurst
  - Kelso
- Villages of :
  - Raglan
  - Perthville
  - Eglinton

2.1.1 Bathurst Water Supply Scheme

The BRC WFP current treatment capacity is 60 ML per day. The water supply scheme's reticulated supply network (Figure 2) includes four inlet pumps from the Macquarie River weir to the WFP. Water sourced from the weir pool is treated and pumped to 22 reservoirs located around the City of Bathurst and Perthville. The combined capacity of the filtered water reservoirs is 91 ML. The water supply scheme also includes 10 pump stations and over 382 km of pipeline (source: BRC IWCM Concept Study, May 2008).

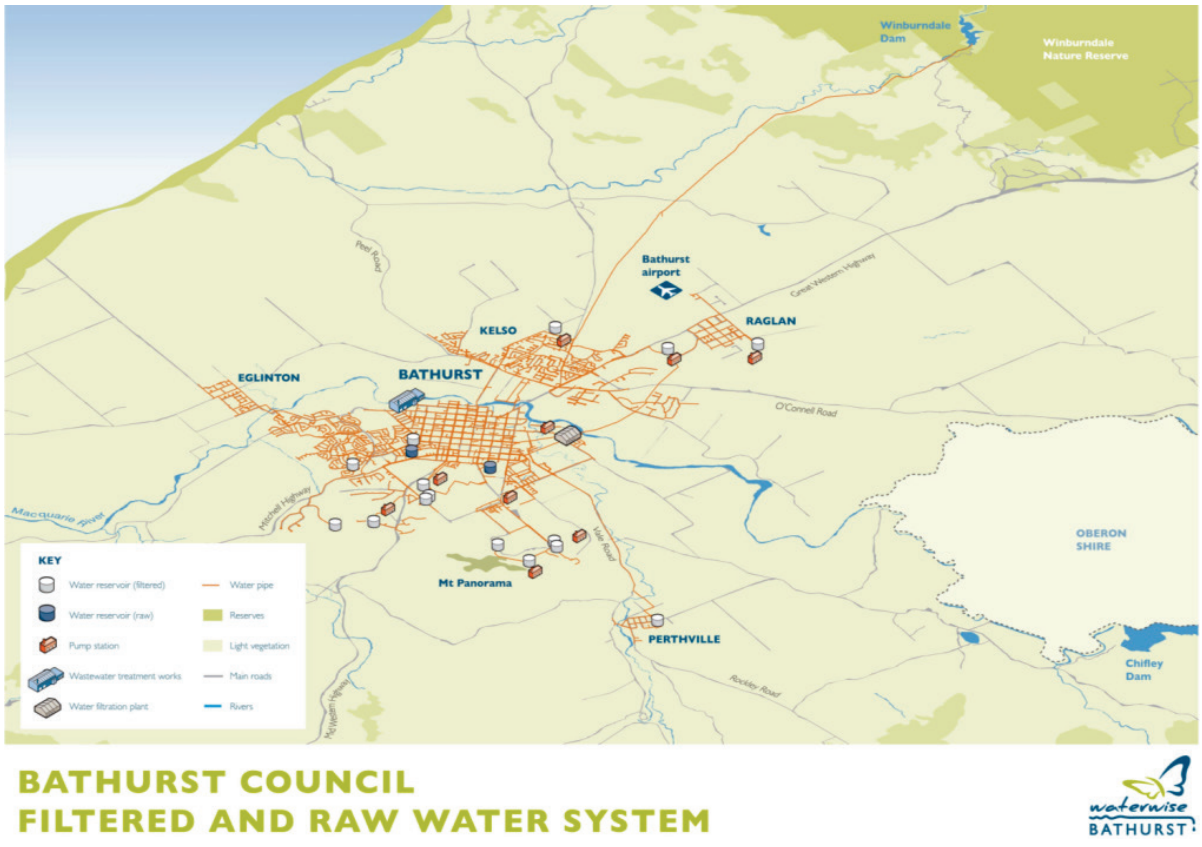


Figure 2: Bathurst Water Supply Network

2.2 Raw Water Supplies

2.2.1 Winburndale Dam Raw Water Supply

Winburndale Dam delivers surface water to two raw water reservoirs located in Bathurst via a pipeline that was originally wood stave which is prone to leaks and has been replaced as required over significant lengths The primary uses of raw water supply include irrigation of Council Parks, industrial use and the provision of domestic use in stock watering and irrigation.

2.2.2 Hillview Estate Groundwater Supply

Groundwater is extracted from two bores to provide non-potable supply to the Hillview Estate located at Walang. The water supply infrastructure comprises a groundwater bore, a rising main and two storage tanks with total capacity of 270 kL (source: BRC IWCM Concept Study, May 2008).

2.3 Alternative Water Supplies

Rockley, Sofala and the other rural villages are not serviced by the reticulated water supply. These localities are supplied by rainwater tanks and privately owned groundwater bores.

Further investigations were recommended to consider an alluvial aquifer fed by the Turon River for a Sofala Water Supply and an alluvial aquifer fed by Peppers Creek for a Rockley Water Supply with the outcome being very significant costs, and the service to be utilised by very few residents. Therefore these projects have not been continued any further.

2.4 Water Resources

2.4.1 Chifley Dam

Chifley Dam is located 17 km upstream on the Campbells River. It is the principal water source for the city of Bathurst. Release from the Chifley Dam flows directly into Campbells River which becomes the Macquarie River at the confluence with Fish River.

BRC is licenced to extract surface water from the Chifley Dam (WAL: 80SL095434) subject to the condition that a flow of not less than 4.53 ML per day is allowed to pass out of the dam into Campbells River downstream. When the inflow into the dam is less than 4.53 ML per day, the flow allow to be passed out of the dam shall match the inflow for the duration.

2.4.2 Winburndale Dam

Winburndale Dam was constructed in 1931. Water from the dam is directed to two designated raw water reservoirs in Bathurst. It has been identified that Winburndale Dam concrete structure will require an upgrade in order to be compliant with NSW Dam Safety standards. Investigations are well advanced and a Dam Safety Emergency Plan is in place (sources: BRC IWCM Concept Study, May 2008; BRC IWCM Strategy, Feb 2009)

2.4.3 Groundwater

BRC is also licenced to extract 17 ML of groundwater per annum (WAL: 80BL144789) to provide non-potable supply to the Hillview Estate.

Investigation studies were carried out to examine the potential groundwater source available within the Lachlan Fold Belt under of the NSW Water Sharing Plan for the Murray-Darling Basin (MDB) Fractured Rock Groundwater Sources area. This option was not deemed viable at this time.

2.5 Water Demand

2.5.1 Distribution of Water Usage

Based on the recent studies, the breakdown of Bathurst potable supply demand by customer type and the demand trend are shown in the following figure. The outcomes indicate that the major users of revenue water in the Bathurst region from 2006 to 2012 were residential customers approximately 60% while commercial and industrial customers were the next biggest users approximately 20% and 18% respectively. The changes in customer demand in Figure 4 showed that the overall demand has fallen over the period from 2007 to 2012. The primary driver for reduction was identified by Council as Best-Practice Management Guidelines, pricing structure.

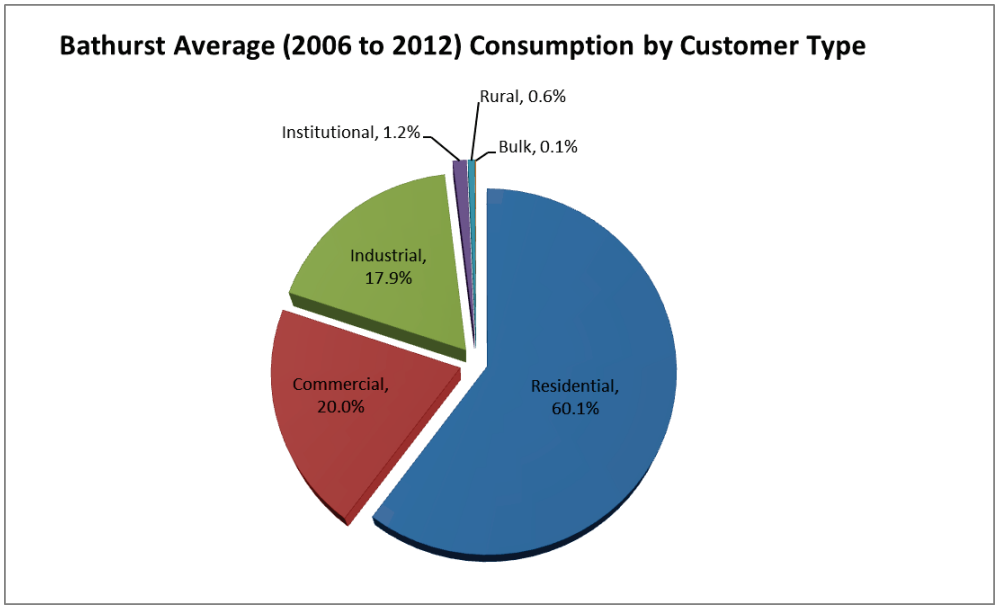


Figure 3: Bathurst Average Water Consumption by Customer Type

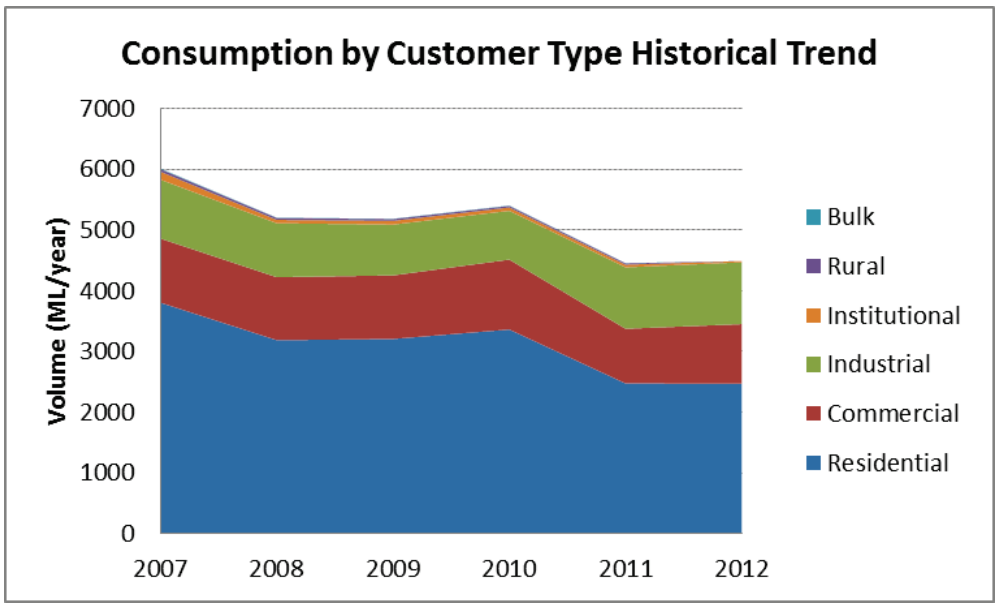


Figure 4: Bathurst Historical Water Consumption Trend

In addition to the residential population, commercial and industrial consumers, BRC also supplies water for firefighting needs and for general parks and gardens irrigation in the urban areas. Details of water demand for firefighting requirements are included in Section 7.1.2.

2.5.2 Top Water Consumers

The top water users in Bathurst are listed in the following table. Two of these top water users use raw water supply while the rest only consume potable supply from the Bathurst WFP.

Table 1: Bathurst Top Water Users

Customers	Customer Type	Industry	Supply Type	Average Consumption (ML/year)
Simplot Australia Pty Ltd	Industrial	Food Manufacture	Filtered	377
Devro Pty Ltd	Industrial	Food Manufacture	Filtered	361
Charles Sturt University	Industrial	Education	Filtered	112
Vincentian Fathers Trustees	Non-Ratable	Education	Raw	78
The Crown	Commercial	Government	Filtered	77
Devro Pty Ltd	Industrial	Food Manufacture	Filtered	72
Corrective Services NSW	Gov. Non-Ratable	Government	Filtered	63
Simplot Australia Pty Ltd	Industrial	Food Manufacture	Filtered	59
Effem Foods Pty Ltd	Industrial	Food Manufacture	Filtered	58
Bathurst City Council	Non-Ratable	Local Government	Filtered	37

Customers	Customer Type	Industry	Supply Type	Average Consumption (ML/year)
Western NSW Local Health District	Hospital	Health	Filtered	30
Western NSW Local Health District	Hospital	Health	Filtered	30
The Crown	Gov Non-Ratable	Government	Filtered	28
Bathurst City Council	Commercial	Local Government	Filtered	28
The Crown	Non-Ratable	Government	Filtered	23
All Saints College	Non-Ratable	Education	Filtered	23
The Trust Company Limited	Commercial	Shopping Centre	Filtered	18
Bathurst Showground Trustees	Non-Ratable	Showground	Filtered	17
Bathurst City Council	Non-Ratable	Local Government	Filtered	15
Bathurst City Council	Commercial	Local Government	Filtered	15
Bathurst City Council	Commercial	Local Government	Filtered	14
Presbyterian Church NSW Prop	Non-Ratable	Education	Filtered	14
Bathurst Golf Club	Golf Club	Recreation	Raw	14
Glenray Industries Ltd	Commercial	Laundry Services	Filtered	14
Bathurst City Council	Non-Ratable	Local Government	Filtered	13
Frank Whiddon Masonic Homes	Commercial	Retirement Village	Filtered	12

(Source: BRC staff email correspondence, July 2013)

Some of the large water users in Bathurst LGA are industrial and commercial users. It is recommended that BRC approaches these major business users in advance of drought to make special arrangements for water restrictions during droughts.

Whilst it may be the case that significant savings can be made during droughts, many of the large potable water users may not be able to cut back their consumption without affecting their production and/or staffing levels.

2.5.3 Population Projections

Bathurst Regional Council has adopted Profile ID population analysis as a reference for population analysis for the region. The population forecast projections (based on the 2011 Census population estimates) indicated that BRC LGA will have an average growth rate of 1.2% per annum between 2013 and 2031.

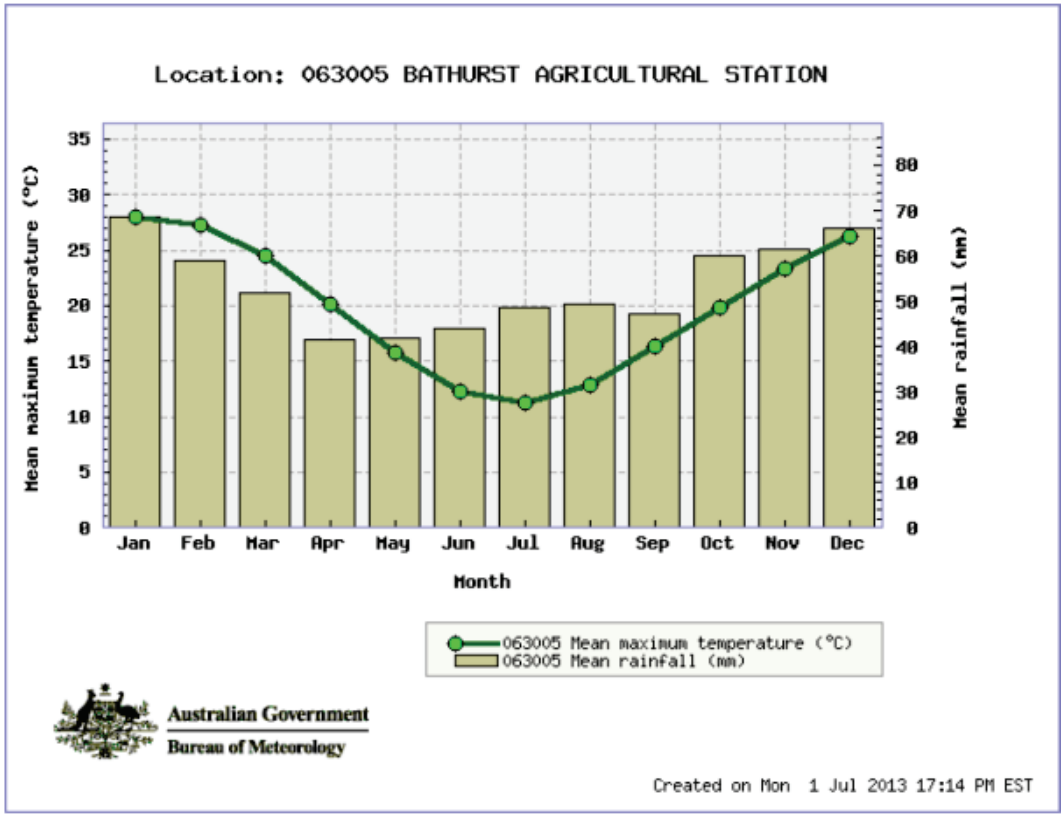
Assuming a steady growth on the basis of this growth projection, the population will have increase by 41% over 30 years. As a result, the water supply demand will likely to increase in a similar extend.

3 Climate

3.1 Climate Impact

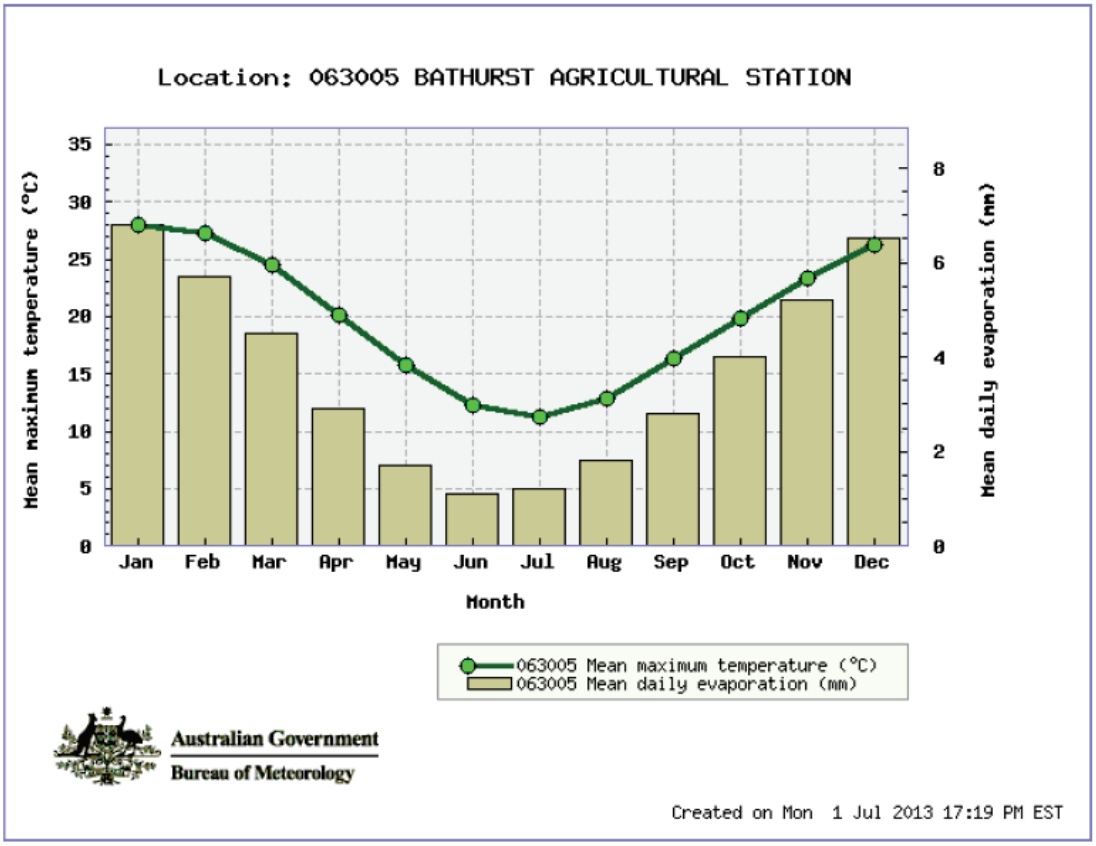
The Bathurst Region has a highly variable climate with a large temperature range. Generally, the area experiences cool to cold winters with irregular snow falls at higher elevations and warm to hot summers (source: IWCM Concept Study, MWH May 2008).

Climate statistics records over an extended period from the Bureau of Meteorology are summarised in the figures below.



Statistics	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	Years
Mean maximum temperature (°C) for years 1909 to 2013	28.0	27.2	24.5	20.1	15.7	12.2	11.3	12.9	16.4	19.9	23.3	26.3	19.8	89
Statistics	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Annual**	**Years**
Mean rainfall (mm) for years 1908 to 2013	68.6	58.9	51.9	41.3	41.8	44.0	48.7	49.4	47.0	59.9	61.3	66.2	639.1	105

Figure 5: Bathurst Maximum Temperature & Mean Rainfall



Statistics	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	Years
Mean maximum temperature (°C) for years 1909 to 2013	28.0	27.2	24.5	20.1	15.7	12.2	11.3	12.9	16.4	19.9	23.3	26.3	19.8	89
Statistics	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Annual**	**Years**
Mean daily evaporation (mm) for years 1966 to 2013	6.8	5.7	4.5	2.9	1.7	1.1	1.2	1.8	2.8	4.0	5.2	6.5	3.7	41

Figure 6: Bathurst Maximum Temperature & Mean Daily Evaporation

3.1.1 Global Climate Change

The Global climate has changed throughout history. The current warming trend is of particular significance and it proceeds at a rate that is unprecedented in the past. Climate data collected over many years reveal the signals of a changing climate. The rapid climate change evidence that has significantly impacted on the hydrology in the supply catchments includes extreme events of intense temperature and rainfall coupled with changes in runoff.

The Intergovernmental Panel on Climate Change Report (IPCC, 2007) found that in the absence of strong greenhouse gas abatement measures, the global climate will continue to warm through the 21st century, most likely by at least several additional degrees Celsius compared with the 20th century (source: Bathurst Climate Change and Water Security Plan, SKM Jun 2011).

3.1.2 Future Climate Trends

The Australian annual average daily mean temperatures have increased by 0.9 °C while the Sea surface temperatures have increased by about 0.8 °C since 1910. The average temperatures are projected to rise by 1.0 to 5.0 °C by 2070 when compared with the climate of recent decades (source: State of the Climate, CSIRO 2012).

Temperature increases include an increase in the number of hot days and nights, and a decrease in cold days and nights. Trends in inland NSW appear to be similar to the national average trend.

The observed changes in Australian precipitation particularly in the eastern third of the Australian continent show a consistent decline in precipitation. In the vicinity of Bathurst, the changes equate to a rate of decline of approximately 15-30mm/decade from 1950 to 2006.

Significant uncertainty remains regarding changes in evaporation. However, projections have identified that open body evaporation which is most relevant for reservoir yield studies will likely to increase in the future (source: Climate Change in Australia, CSIRO 200; Bathurst Climate Change and Water Security Plan, SKM Jun 2011).

3.1.3 Climate Change Impacts in Bathurst

Global warming introduces a great deal of uncertainty with respect to future water supply security. Many forecasts suggest that the future climate will be hotter and drier in the Bathurst Region. The recent drought across large areas of the Australian continent is an example of the kind of climate conditions that might be expected to be seen more frequently. A hotter and drier climate could have a significant impact on both water security and many water-dependent water assets in the Bathurst region.

3.2 Past Drought Experience

The Australian Bureau of Meteorology (BOM) defines drought as "a prolonged, abnormally dry period when there is not enough water for users' normal needs". BOM monitors rainfall deficiencies across Australia. However, the declaration of drought and the provision of drought assistance is the responsibility of the relevant State and Federal Government departments, which consider many factors apart from rainfall.

Based on BRC's records, the last dramatic drought to have an impact on the Bathurst Region was in 1982–83. The short-term rainfall deficiencies lasted up to one year. Water restrictions were developed in 1983 to minimise the water demand during the severe drought period.

In December 1997, BRC imposed water restrictions as a result of a massive increase in water usage due to searing heat over the summer period. The highest water restrictions level imposed was Phase 2 – no fixed sprinklers at any time. The water restrictions were lifted in mid-1998 when rainfall and run-off into Chifley Dam improved.

In 2001 work was completed on Chifley Dam storage to significantly upgrade capacity from 16,000 ML to 30,800 ML. This was a $30 M investment by Council which significantly boosted water security.

Although the majority of NSW was in drought in 2004, Bathurst has not experienced water supply shortage since the upgrade of Chifley Dam. No water restrictions imposed during this period.

3.2.1 Water Security in Bathurst during Drought

Historically, Bathurst's water supply has met the demand through past drought periods and the Bathurst LGA has been well serviced with a reliable water supply following the augmentation of Chifley Dam in 2001. A number of studies have also been developed to examine the impacts of climate change on Bathurst's water security.

During the millennium droughts which resulted in severe water shortages in many areas in Australia, the storage levels in Chifley Dam fell below 50% a number of times as indicated in Figure 7. While the Chifley Dam supply remained above critical levels, the significant fluctuations in storage levels suggested that the security of Bathurst water supply may not be as reliable as had been assumed.

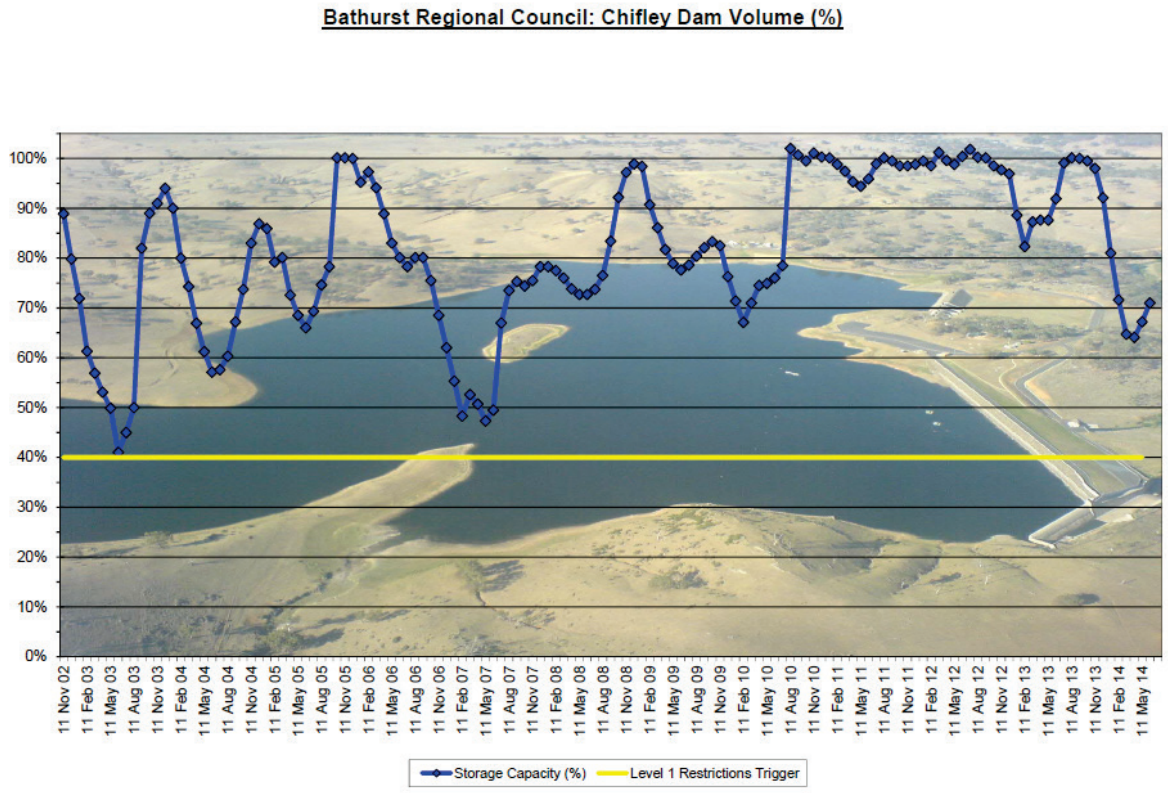


Figure 7: Chifley Dam Levels November 2002 to May 2014

(source: BRC website [accessed July 2014])

3.2.2 Effect of Water Security on Demand

Reductions in rainfall and increasing temperatures and evapotranspiration rates associated with climate change mean reduced rain falling on hotter, drier catchments. This in turn will impact water security and increase the demand for water for urban irrigation and potable supply. Increases in water use due to climate change will be likely to impose pressure on per capita water demands and will in turn reduce the reliability of supply.

Future increases in water demands will result in increased volumes of water required to be treated and transferred resulting in an increase in energy cost and greenhouse gas emissions. An increase in the severity of peak demand conditions will also increase the magnitude of peak daily demands placing increased pressure on water treatment and transfer infrastructure.

3.2.3 Drought Issues

Review and analysis have identified that the following drought issues are likely to affect the Bathurst Regional Council water supply system. These drought issues are shown in the following table.

Table 2: BRC Drought Issues

No.	Issue	Analysis	Conclusion
1	Reliance on surface water supply	With the sole source of water supply being surface water, Bathurst is more vulnerable to drought conditions than communities with a more diverse source of supply.	Reliance on surface water from closely located catchments increases drought vulnerability.
2	Climate change	Future climate change is shown to potentially reduce the reliability of supply.	Given the severity of the consequences of supply failure it would be duly diligent to start investigating and implementing supply amplification options.
3	The consequences of supply failure	With a serviced population of approximately 40,000 people, the consequences of water supply failure are severe, with significant impact on local business, the economy and environment.	Given the severity of the consequences of supply failure it would be duly diligent to start investigating and implementing supply amplification options.
4	Cost and logistics of water carting	With a serviced population of over 40,000 people, costs of water carting to meet even basic needs is likely to be prohibitive.	As above
5	Uncertainties in flow volumes and transmission losses.	There are some major data gaps in the monitoring of stream flows in the region. This information is essential for the ongoing monitoring of Bathurst's water supply security.	Implementation of the re-commissioning of the three level monitoring stations as flow gauges is essential.
6	Uncertainty in the volume of Chifley Dam seepage	Given design and site constraints, the Chifley Dam seepage weir, the weir can be submerged during periods of high flow. Outside of these periods, monitoring has indicated very low levels of dam seepage.	Council may Commission a study to assess the seepage impact. This would be expected to cost in the order of approximately $20,000.
7	Groundwater availability	Although the current drought management plan suggests that there is potential to utilise groundwater to contribute to an emergency supply, there are insufficient resources in the region to make a contribution to the regular water supply.	Groundwater an option for emergency supply only.
8	Demand hardening	Demand management programs such as BASIX and WELS and other programs implemented by Council will continue to put downward pressure on water demands. Many of the targeted demands are those discretionary water uses that are traditionally targeted by water restrictions.	With increased levels of demand management, reductions in water use during drought periods using water restrictions will be harder to achieve in the future. Council must be diligent to continue Waterwise information and education.

(Source: R. Beatty, SKM)

Drought Preparedness

The following sections detail the preparedness phases of the drought management strategy

4 Drought Strategies for Water Supply

The aim of a drought strategy is to ensure a systematic, effective and efficient response to manage water shortages which result from drought.

Prior to the development of the drought response and water restrictions definitions, it is crucial to understand the conditions of the water supply system under normal operations, the findings of investigative studies on the water sources and the major water user and their demands. These details are summarised in the following sections.

4.1 Urban Water Supply Overview

BRC's potable supply is connected to the Bathurst Water Filtration Plant (WFP) and its water supply network. The Bathurst urban area receives its surface water from two catchments: the Fish River catchment to the East of Bathurst; and the Campbells River Catchment to the South East of Bathurst which receives releases from the Chifley Dam.

Water is released from the Chifley Dam into the Campbells and then the Macquarie Rivers before it reaches the weir constructed across the Macquarie River downstream. There are a number of licences between the dam and the weir. Water is extracted by a significant number of irrigators before it reaches the weir (see Figure 8). This area is considered to be a high value agricultural area producing vegetables, lucerne and other crops, many of which are processed in Bathurst generating employment.

BRC's WFP intake is located adjacent to the weir on Macquarie River. Water is extracted from the weir to provide potable supply to urban areas via the Bathurst WFP.

As flows between the dam and the weir at Bathurst are directly influenced by Chifley Dam town water releases, the access conditions for licensed water users in the Campbells River Downstream and Macquarie River above Bathurst management zones have been designed to protect town water supply by suspending access when dam levels drop significantly, and Level 5 restrictions are in place.

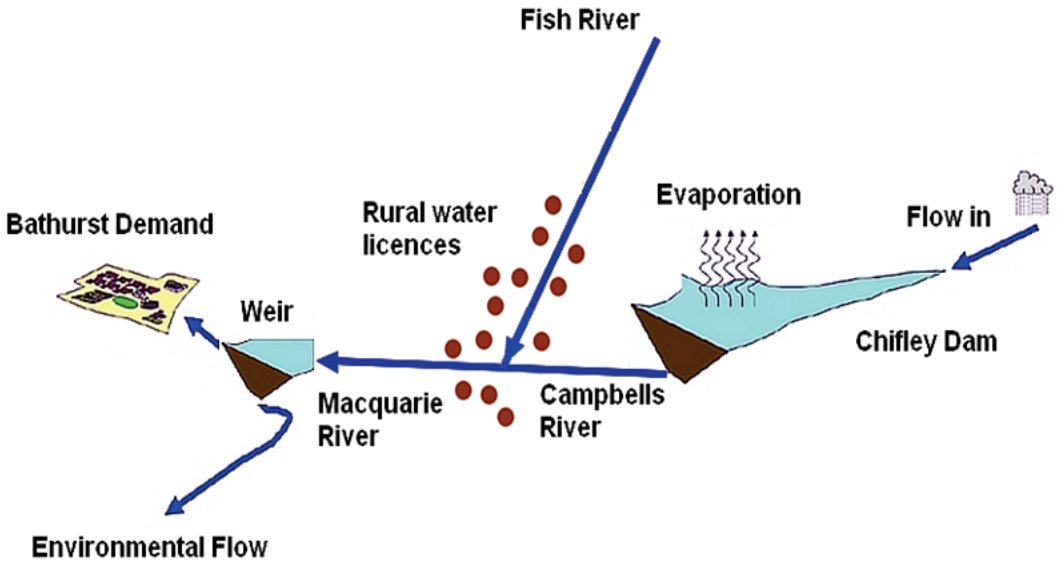


Figure 8: Fish River & Campbells River Catchments

4.1.1 From Source to WFP Intake under Normal Operations

Under normal operations, BRC operates the dam based on the following factors:

- inflow rate into Chifley Dam
- existing volume percentage of Chifley Dam
- water demand of the irrigators downstream of Chifley Dam
- water supply demand in Bathurst urban areas
- Flow rates at the Campbell and Macquarie Rivers

BRC also monitors the weir water level and the overflow rates on a daily basis.

The flows between the dam and the weir (located at Macquarie River above the Bathurst management zone) are directly influenced by dam releases and the access conditions for licensed water users in this area.

Based on BRC's water extraction licence (80SL095434) when there is an inflow of greater than 4.53 ML/day into Chifley Dam, an outflow of no less than 4.53 ML/day is maintained from Chifley Dam into Campbell's River for environmental flows.

Under standard operations, releases from Chifley Dam together with the flow from the Fish River supply are usually sufficient to cover the irrigators' rural water demand and produces a constant overflow at the weir. BRC is therefore able to extract water supply from the weir without the need of additional releases from Chifley Dam. However, when there is less than 100 mm of water going over the weir at the WFP, BRC releases water from Chifley Dam.

During the summer periods (November to March), irrigators tend to have higher water demand. As a result, BRC releases water from Chifley Dam to ensure sufficient water is available at the weir for town supply.

Based on the Water Sharing Plan, when Chifley Dam capacity is less than or equal to 22% (Level 5 Water Restrictions), "which equates to the water level being approximately 700 m at the storage gauge (563008)", the "cease to pump" access rules apply (source: NSW Office of Water, September 2012 Water Sharing Plan for the Macquarie Bogan Unregulated and Alluvial Water Sources).

4.2 Relevant Water Security and Yield Studies

4.2.1 Bathurst Climate Change and Water Security Study

The climate change and water security study undertook integrated modelling of the combined Fish River and Chifley Dam water sources to determine current levels of supply security. The modelling involved the simulation of demand and supply over the 50 year planning horizon using a multiple replicate stochastic hydrologic simulation. Over this period the water demand is anticipated to grow from 6,500 ML/annum to almost 7,800 ML/annum.

For a stable climate regime based on historical data, the results suggested that security of supply would begin to erode towards the end of the period of forecasts due to the risk of supply failure (defined as when the Chifley Dam storage fell below the 10% mark).

Three climate changes scenarios were examined that represented changes in rainfall, temperature and evaporation associated with low, medium and high emissions. Under the climate change scenarios examined, the security of water supply would be at significant risk at the 2010 level of demands of 6,500 ML/annum, even under the low emissions scenario.

The study identified a range of options for working towards improved water and drought security. These were:

- The construction of a pipeline to convey water from Chifley Dam to Bathurst; and
- The rehabilitation of the Winburndale pipeline

Both of these options remain current and valid as approaches that will improve water security.

In addition, the study recommended the re-instatement of existing water level monitoring stations on the Campbells River (above Chifley Dam), Fish River (at Tarana) and in the Macquarie River (below the Bathurst water supply intake weir) as full flow gauging stations. This remains a priority for Bathurst in monitoring:

- Potential changes in the hydrology of the Fish and Campbells River catchments
- Better understanding the volume and nature of water losses in the Campbells and Upper Macquarie Rivers between Chifley Dam and Bathurst

(source: R. Beatty, SKM)

4.2.2 Recent Yield Study

The recent Bathurst Water Supply yield study (Public Works, Nov 2012) involved an assessment of the impact of potential climate change on the safe yield of the Chifley Dam. The safe yield is defined as the volume of water that can be extracted on an annual basis whilst still maintaining urban water supply reliability as defined by the 5-10-10 rule. This rule is defined as:

- Being under restrictions on water use no more than 5% of the total time
- Being under restrictions no more than 10% of years; and
- Water restrictions are assumed to result in a 10% reduction in normal demand

The study did suggest that the yield of Chifley Dam would be reduced under some climate change scenarios, and significantly so. The study thus confirmed the findings of the water security study. The study has some limitations in use for drought planning purposes. This is because:

1. The yield study did not calibrate the Chifley Dam inflow streamflows against the observed water levels in the Chifley Dam. This work was undertaken in the water security study and suggested that catchment runoff was lower (reduced by 45%) than that derived using calibration on streamflow records alone
2. Bathurst (and indeed no other urban community) does not operate under the 5-10-10 rule. Communities employ a variety of levels of water restrictions which are progressively introduced as storage levels fall

In the study, the safe yield of the water supply based on a historical stable climate regime was estimated to be 11,100 ML/annum. This was reduced by 24% (8,400 ML/annum) and 37% (5,900 ML/annum) in the two scenarios adopted.

It is difficult to make comparisons between the two studies because:

1. There is no summary of the climate change impacts on seasonal rainfall, temperature and evaporation levels in the report with which to compare with those estimates used in the water security study
2. It is not clear from the secure yield study what restrictions (if any) were placed on irrigation users during drought periods. In the climate change and water security study, restrictions on irrigation users were assumed to be closely aligned with outdoor urban users
3. The study did not make the same reductions in Chifley Dam inflows that were made in the Climate Change and Water Security Study (as mentioned above)

Examining the results of both studies, the safe yield study appears to provide a more optimistic view on supply security under stable climate scenarios (most likely because of higher assumed inflows to Chifley Dam) and a more pessimistic view of the impact of climate change. Nonetheless, the study does confirm that the prospect of climate change does place additional uncertainty on water security and that the historical climate record may not provide reliable estimates of future water security (source: R. Beatty, SKM).

4.2.3 Centroc Water Security Study

The Centroc Water Security Study identified a range of regional options that could be used to enhance supply security. For Bathurst, there was the recommendation that a 600 mm diameter pipeline be constructed to convey water from Chifley Dam to Bathurst. This pipeline would reduce the volume of water lost to groundwater and evaporation during the 19 km of transit along the Campbells and Upper Macquarie Rivers. It would also assist in controlling access to the water by irrigators, who at the moment have the equivalent of town security water by virtue of their access to this water in transit. The project has been estimated to have a capital cost of $20 million and annual operation and maintenance cost of $1.5 million to serve approximately 32,749 customers in 2059.

A feasibility study for the pipeline from Chifley Dam to Bathurst was completed in 2008. Two potential pipeline routes, a road and a Campbell and Macquarie river bank options were developed as shown in Figure 9. Details of the study outcomes are included in the Chifley Dam to Bathurst Water Treatment Plant Pipeline Prefeasibility Assessment Report (Oct 2008).

The pipeline remains an important option for improving water security to urban Bathurst.

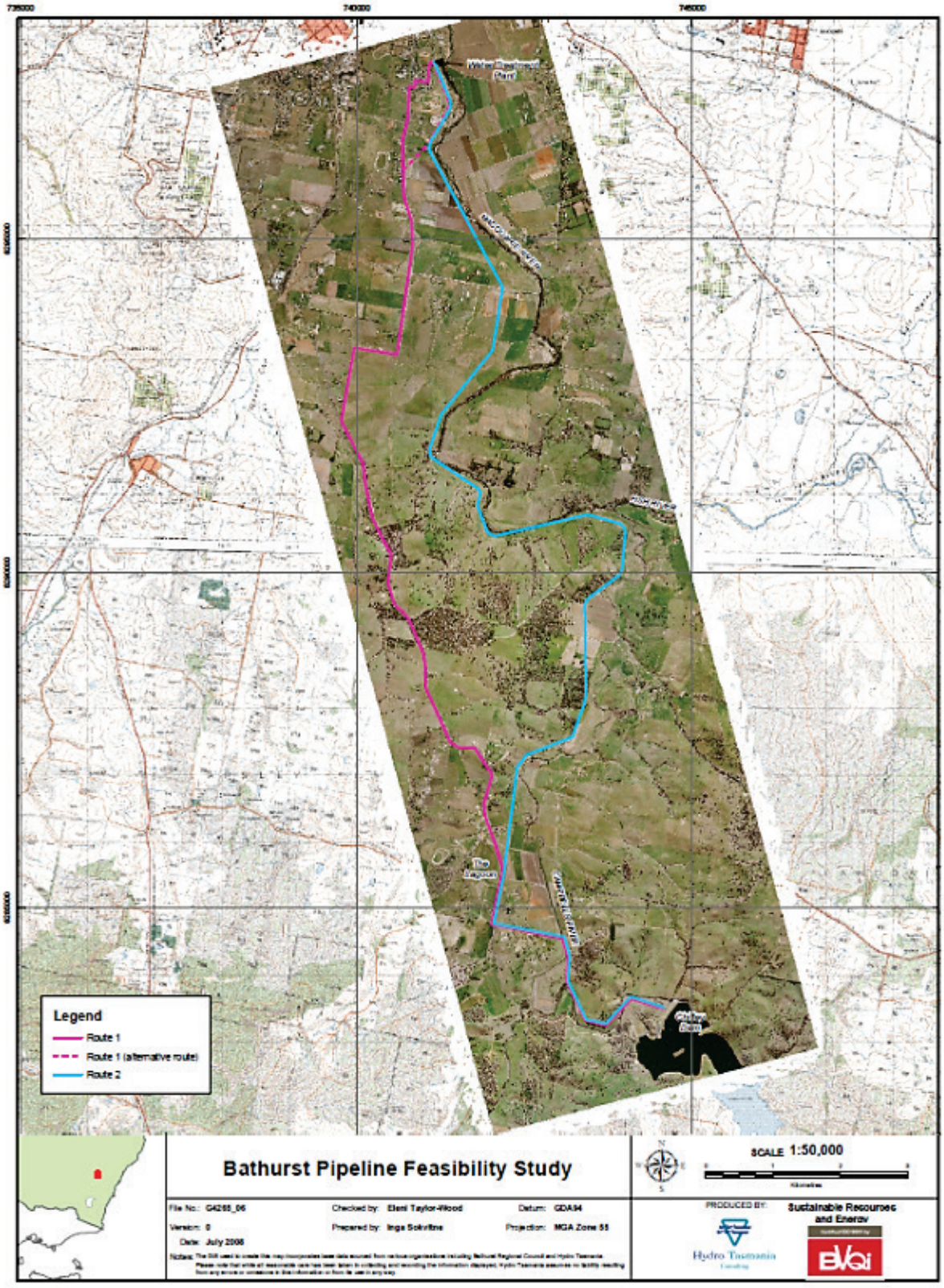


Figure 9: Bathurst Pipeline Route Options

(Source: Chifley Dam to Bathurst Water Treatment Plant Pipeline Prefeasibility Assessment, Hydro Tasmania Consulting, Oct 2008)

4.2.4 Centroc Regional Drought Management Strategy

BRC is a member of Centroc. The regional plan has been prepared to examine how the Centroc member councils can work together in voluntary arrangements to better manage the region during drought.

The Regional Drought Management Plan aims to provide a voluntary consistent regional approach to managing water supply during drought periods, to enable implementation of consistent water restrictions definitions across Centroc which can be applied locally using individual Council's triggers and to specify a regional drought management framework.

This regional plan is an umbrella document that examines ways that Centroc Councils can voluntarily integrate drought management strategies for the Centroc region.

The Regional Drought Management Plan recommends the development of a Centroc regional water carting plan. This carting plan is intended to manage water availability, technical resources and general logistic issues during an extreme drought situation when the water carting requirements for multiple Centroc member Councils.

As part of the Centroc Regional Drought Management Strategy, a Drought End Use Model was developed to estimate the theoretical water demand in each major town in the Centroc Region during drought. The model estimates the changes in demand in each water end use under each level of water restrictions. The Drought End Use Model is also applied to estimate the water demand in Bathurst at each water restrictions levels.

The Centroc Regional Plan provided recommendations to member councils as shown below: This BRC DMP addresses these recommendations for BRC Local Water Utility (LWU).

Drought Demand Side

- Recommendation R1: All Centroc Councils:
  - Adopt BOD water restriction definitions
  - Calibrate their Individual Council triggers to utilize BOD water restrictions definitions

This would facilitate regional use of the drought demand end use model.

- Recommendation R2:
  - Water restrictions both local and regional should include measures that reduce water consumption in the non-residential sector as outlined in the BOD definitions, with careful consideration of the potential social and economic impacts
- Recommendation R3:
  - Centroc develop a policy on an individual Council and catchment basis for member consideration for water conservation in urban areas during periods when irrigators are affected by severe drought

Drought Supply Side

- Recommendation R4:
  - Water Utilities intending to rely on groundwater for urban communities, for emergency supply should ensure that the appropriate investigations / modelling have been undertaken to increase confidence in the availability of groundwater supplies during drought events
  - These groundwater studies could be performed on a regional basis by Centroc
- Recommendation R5:
  - A Centroc regional water carting plan to be developed.
- Recommendation R6:
  - Centroc investigate the need for short and long term urban water allocation transfers and trading between members of the Centroc council group

Drought Management Framework

- Recommendation R7:
  - Centroc Board consider establishing a regional drought committee through the Centroc Water Utilities Alliance
  - This Committee provides advice to the Centro Board where heads of consideration include regional drought administrator and a strategic and emergency budget

4.2.5 Fish River Water Supply Scheme

The Fish River Water Supply (FRWS) sources raw water from the Oberon Dam and Duckmaloi Weir to provide water supply to four major customers. The FRWS serves as source water supplies for Lithgow City Council, Oberon Council, the Sydney Catchment Authority (SCA) and power generation for Delta Electricity.

Although the Fish River Water Supply Scheme (FRWSS) does not provide supplies directly to the Bathurst Town Water Supply, the FRWSS is upstream of the Macquarie River and has direct impact to the river flow. In addition, the NSW Office of Water has included an amendment provision in the FRWSS water sharing plan to allow State Water to apply to trade additional entitlement provided that State Water can demonstrate there will be minimal impacts on BRC's water supplies.

4.3 Bathurst, Orange, Dubbo (BOD) Drought Water Restrictions

The Bathurst, Orange & Dubbo (BOD) Alliance collaboratively developed and adopted a set of Regional Water Restriction system in Nov 2009. This common water restrictions system provides standardised drought water restrictions definitions for residents across the region. At present, Orange City Council has adopted the BOD water restriction definitions. Most other Centroc Councils are considering adopting BOD water restriction levels and definitions. Such standard definitions offer an opportunity to educate the regional community as to the standard definitions and therefore utilise regional media (TV, radio, newspaper) to communicate the current water restrictions levels in each Council.

BRC has adopted the Bathurst, Orange and Dubbo (BOD) water restriction definitions. The BOD water restrictions definitions are also adopted by the Centroc Regional Drought Strategy.

Drought Response

The following sections detail the response phases of the drought management strategy

5 Drought Strategy

5.1 Overview

The aims of the Drought Strategy are to:

- Ensure timely warning can be provided to the appropriate authorities in a drought event
- Provide relevant information for use in response to a situation when water availability becomes a concern
- Identify emergency conditions which could endanger the health of consumers or the environment or impact on the continual supply of water to consumers
- Outline procedures to Council staff so as to respond to and mitigate emergency conditions
- Enable timely warning to appropriate personnel to implement appropriate actions

In response to a diminishing water supply during drought, actions required to be undertaken to initiate drought response strategies include the following steps:

- Activation
- Implementation
- Review

It is important to establish a drought management team prior to implementing the drought strategies. This team defines who will perform the key roles and identifies each team member responsibilities during the drought event. The drought management team will contain specific Council's personnel for these key roles.

This Drought Management Plan will be administered by BRC. During drought, this plan will be overseen by the Council's Drought Management Team which will be appointed by Council General Manager. Outside drought events, this plan will remain the responsibility of the Manager Water and Waste.

The details of the drought strategy activation process are presented in the following section. The implementation and review processes are detailed in Section 6 - Drought Demand & Supply Actions.

5.1.1 Drought Strategy Activation

The implementation of the Drought Management Plan including identifying and reviewing situations, overseeing the implementation of supply and demand actions, approving media releases and reviewing operations will be the responsibility of the Drought Incident Manager (e.g. Manager (Water and Wastewater)) and the Drought Management Team. These actions are categorised under the following groups:

- Operations
- Logistics
- Communication
- Administration
- Recovery

The drought strategy activation process is summarised in Figure 10. The responsible personnel and their respective responsible actions are included in Table 3.

Water Restrictions will be activated in an event when the water supply is affected due to natural climate conditions or a hazardous event which leads to the water supply capacity to fall below a capacity equivalent to Chifley Dam capacity at 40%. Beyond this at a lower level Council may enact drought actions as per Table 3 levels.

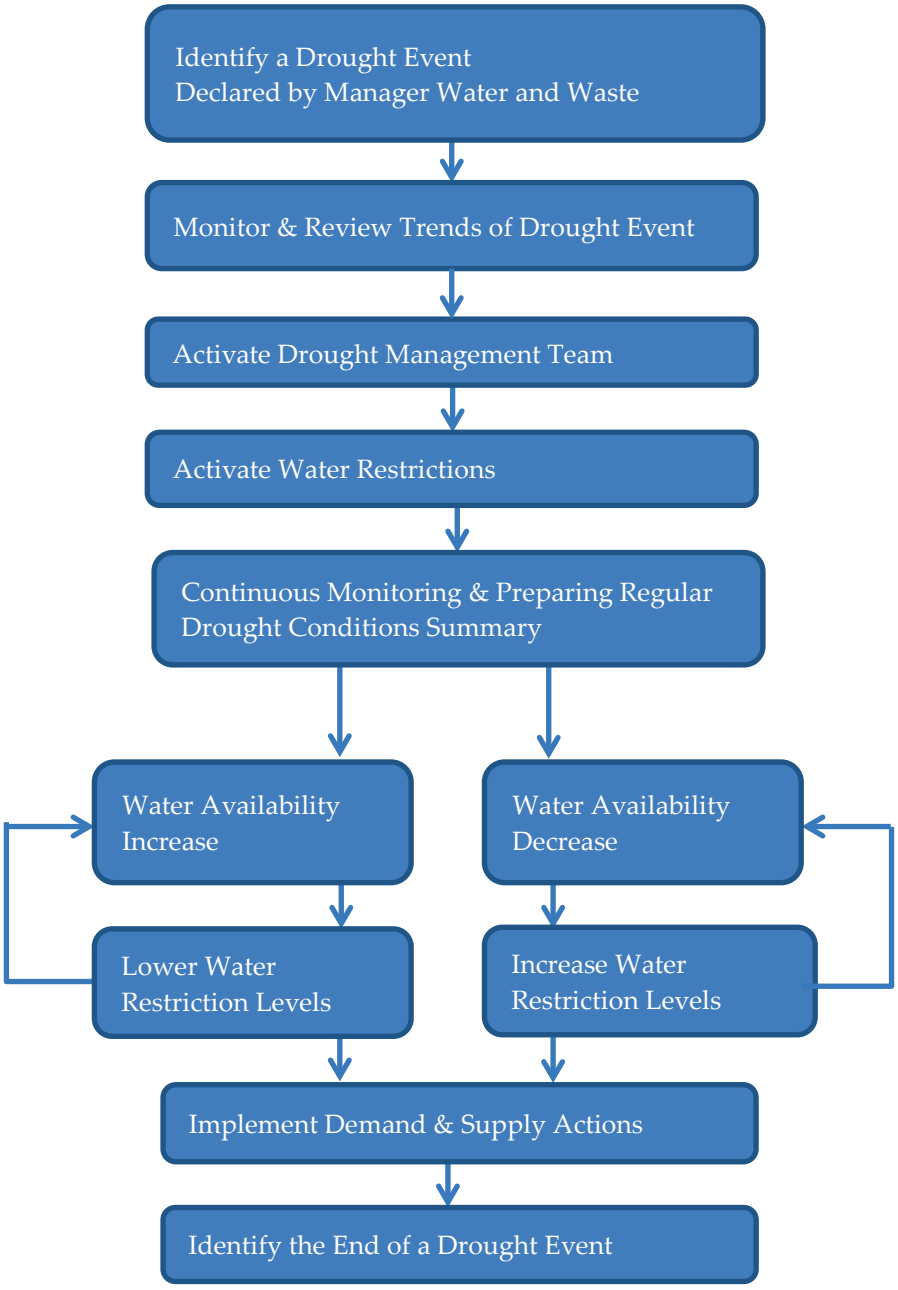


Figure 10: Drought Strategy Activation Flow Diagram

Table 3: Drought Strategy Responsible Personnel & Actions

Water Restriction Levels	Appointed Drought Incident Manager	Alternative Personnel (When the 1st personnel option is not available)	Actions
	Responsible Personnel (in order of ascending incident escalation)		
Level 1	Manager Water and Waste	Senior Water and Sewer Engineer	▪ Appoint Drought Management Team Activate drought strategy and impose water restrictions ▪ Prepare regular drought progress summary for Council use
Level 2	Manager Water and Waste	Senior Water and Sewer Engineer	▪ Activate drought strategy and impose water restrictions ▪ Prepare regular drought progress summary for Council use
Level 3	Manager Water and Waste	Senior Water and Sewer Engineer	▪ Activate drought strategy and impose water restrictions ▪ Prepare regular drought progress summary for Council use
Level 4	Director Engineering Services	Manager Water and Waste	▪ Activate drought strategy and impose water restrictions ▪ Prepare regular drought progress summary for Council use Advise General Manager and Councillors
Level 5	Director Engineering Services	Manager Water and Waste	▪ Activate drought strategy and impose water restrictions ▪ Prepare regular drought progress summary for Council use Advise General Manager and Councillors ▪ Assign personnel to manage specific tasks of operations, logistics, communication, administration and recovery
Level 6	Director Engineering Services	Manager Water and Waste	▪ Activate drought strategy and impose water restrictions ▪ Prepare regular drought progress summary for Council use Advise General Manager and Councillors ▪ Assign personnel to manage specific tasks of operations, logistics, communication, administration and recovery

Note: The procedures detailed in the table above are general guidance that are considered to best fit the likely situations. In actual situations, Manager water and waste and/or Director Engineering Services may appoint staff to undertake tasks as appropriate.

The relevant documentation for Drought Management Plan Activation will include the following:

Table 4: Drought Activation Hazard Events

Hazard	Relevant Plan/Activation Document
Failure of supply from water source (e.g. Blue Green Algae event or other source water contamination)	▪ Blue Green Algae Action Plan ▪ DWMS ▪ Considered on a case by case basis
Contamination of supply, within the supply system	▪ BRC Water Quality Emergency Response Management Plan ▪ DWMS
Power failure affecting transmission of raw and/or filtered water	Considered on an individual case basis
Major system failure, including failure of major distribution mains, service reservoir(s) or distribution pumping stations	Considered on an individual case basis
In very specific circumstances trigger to implement empathetic water conservation measures due to lack of water supply in the neighboring Local Government Areas	By Council resolution

5.2 Drought Management Team Roles and Responsibilities

The 'Drought Management Team' (DMT) consists of the Incident Manager, Operations Coordinator and Communications Coordinator and the respective teams they control. The table below describes the main responsibilities of each specified role. It is a Council responsibility to provide an appropriate training to make sure nominated personals in a drought event are aware of their responsibilities.

Council's Media Spokesperson, normally the Mayor, should also have relevant critical incident media training.

The General Manager remains separate from the detailed incident management process. The general manager's main roles are to ensure effective communication and liaison with all key stakeholders and authorities.

Table 5: DMT Roles and Preliminary Responsibilities

Role	Incident Responsibility
Drought Incident Manager: Responsible for coordinating the overall incident response	▪ Officially declare a Drought Incident ▪ Activate and deactivate the Drought Management Team (DMT) ▪ Lead the DMT ▪ Provide an assessment of the details of situation to General Manager ▪ Brief the General Management team/Councillors initially ▪ Allocate roles and prioritise tasks, particularly for Coordinators ▪ Ensure adequate facilities and resources – both specialist and support ▪ Ensure key stakeholders notified and personally handle liaison with authorities and major customers ▪ Arrange provision of any essential support requirements ▪ Assess key issues, priorities and potential implications, and develop overall response strategy and tactics ▪ Direct and co-ordinate the inputs of the operations and communications groups ▪ Reconvene the whole team as required for updates and reviews ▪ Monitor new developments, information flows, and response effectiveness ▪ Monitor the use of procedures and guidelines and effectiveness of actions taken ▪ Keep General Manager informed, and ensure all stakeholders are given regular updates ▪ Monitor team member performance and establish relief system during an extended incident, including relief for the Incident Controller role ▪ Issue stand down instructions as appropriate and ensure arrangement of debrief /counselling / investigation/recovery plan ▪ Commence consideration of potential contingency or recovery plans which may need to be initiated ▪ Identify needs for additional internal / external resources; organize, activate, and brief the personnel required ▪ Approve all situation reports prior to circulation ▪ Post incident, coordinate review of incident and update of the Drought Incident Management Plan
Operations Coordinator: Responsible for the link between the Drought Management Team and Bathurst Regional Council's operational activities and technical resources	▪ Implement the Operational Response Procedure during drought ▪ Receive briefing and role allocation, and co-ordinate own group ▪ Brief the General Management team/Councillors as required ▪ Identify additional resources required ▪ Establish communications channels and protocols with Operations Team at site, then obtain detailed situation updates and assessments ▪ Assess incident details and collate appropriate reference material (system maps, directories, operating procedures etc.) ▪ Advise on technical / operational implications and solution / mitigation options, then provide instructions and advice accordingly to incident site team ▪ Ensure master incident log started, noting timed situation developments, responses, actions planned, and responsibilities ▪ Assess impact on operability of Council facilities, and consider contingency options to maintain services ▪ Provide advice, information updates, and resource support to the Operations Team ▪ Co-ordinate inputs from technical advisors ▪ Handle communication with other external groups as required by the Communications Team leader (e.g. emergency services and the regulator) ▪ Stand down as instructed and contribute to debrief / investigation

Role	Incident Responsibility
Communications Coordinator: Responsible for a positive public face of Bathurst Regional Council is maintained through the release of appropriate, timely and consistent messages to staff, customers, regulators, the media and other stakeholders.	▪ Liaise with Incident Manager to implement the Customer Notification Procedure ▪ Receive briefing and role allocation, and co-ordinate own group members; identify additional resources required ▪ Ensure the media database and customer notification listing are current ▪ Allocate specific responsibilities within the DMT for communications with each stakeholder category (authorities, customers, media, and staff) ▪ Obtain latest incident details and arrange priority notifications ▪ Establish ongoing stakeholder update processes ▪ Consider media management strategy and media monitoring ▪ Liaise with other response agencies regarding communications responsibilities and actions ▪ Approve and issue agreed initial media release / holding statement ▪ Provide "messages" guidelines to the Communications Team and other affected staff, and ensure all external messages and statements are centrally co-ordinated and approved ▪ Arrange media interviews etc. as appropriate and brief spokesperson ▪ Organise enquiry response resources ▪ Develop staff information bulletins as required ▪ Monitor communications effectiveness and external perceptions ▪ Stand down as instructed, and contribute to debrief/investigation ▪ Coordinate IT representative to be on standby and issue alerts to customer alert database ▪ Coordinate and monitor communication via social networking (Facebook, Twitter, other)
Support Officer: Responsible to provide general support to the DMT	▪ Provide record keeping support to DMT ▪ Write up regular situation/progress reports as required for distribution to DMT members ▪ Assist in maintenance of filing system and records ▪ Provide telephone answering support for the DMT ▪ Organise all stationery requirements ▪ Organise catering and refreshments for DMT ▪ Carry out errands as required by the DMT ▪ Ensure the periodic collection of logs and other documentation for collation and archiving ▪ Participate in SITREP meetings and update DMT on any critical issues
Operations Team: The Operations Team includes all staff within Council mobilised to perform actions in the field and the office in response to an incident	▪ Promptly report relevant issues and information to the Operations Coordinator or nominee ▪ Carry out tasks as required by the Operations Coordinator or nominee ▪ Participate in SITREP meetings and update DMT on any critical issues as required ▪ Keep a log of activities including monitoring Chifley Dam water levels, flows in the Macquarie River and Fish River, daily water demand, daily temperature and rainfall, impact of restrictions on water consumptions, etc.

Role	Incident Responsibility
Communications Team: The Communications Team includes all staff within council mobilised to communicate with any of the relevant stakeholders during an event	▪ Provide record keeping support to DMT ▪ Assist in maintenance of filing system and records ▪ Provide telephone answering support for the DMT ▪ Assist in preparation of communication materials, media releases, Q&A's, etc.

Source: BRC Water Quality Emergency Response Plan – Version 2.0, June 2014

5.3 Emergency Contact Details

In a drought/emergency event contact details are summarised in the table below.

Table 6: Emergency Event Contact Details

Name	Organisation	Role/Position	Phone Number (Business Hours)	Phone Number (After Hours)
David Sherley	Bathurst Regional Council	General Manager	02 6333 6203	0408 637 527
Gary Rush	Bathurst Regional Council	Mayor	02 6333 6205	0419 181 629
Doug Patterson	Bathurst Regional Council	Director Engineering Services	02 6333 62326	0418 861 678
Brian Dwyer	Bathurst Regional Council	Local Emergency Management Officer (LEMO)	02 6333 6524	0418 965 580
Stuart Davies	Bathurst Regional Council	Regional Emergency Management Officer (REMO)		
Russell Deans	Bathurst Regional Council	Manager Water and Waste	02 6333 6225	0418 453 602
Nicholas Lavoipierre	Bathurst Regional Council	Senior Water and Sewer Engineer	02 6333 6238	0408 267 833
Victoria Erskine	Bathurst Regional Council	Media Officer	02 6333 6179	0409 454 084
David Cashen	Bathurst Regional Council	Water Filtration Plant Supervisor	02 6333 6244	0407 212 388
Operator on Call	Bathurst Regional Council	Operator On Call	02 6333 6244	0418 458 258
Damien Tom	Bathurst Regional Council	Reticulation Engineering Officer	02 6333 6296	0418 453 315
Paul Walther	Bathurst Regional Council	Systems Coordinator	02 6333 6516	0409 321 175
	NSW Office of Water			
	Rural Fire Service			
Local Public Health Unit	NSW Department of Health		1300 066 055	
Andrew Helms	EPA		0409 343 454	

6 Drought Demand & Supply Actions

6.1 Introduction

Actions are required to be undertaken in response to the diminishing water supplies during drought. To balance drought impacts, the actions required have been categorised in two groups:

- Demand-side actions – actions that the water users (e.g. domestic, commercial, industrial) are required to undertake in order to achieve the expected demand targets (i.e. estimated water consumption reduction at each water restriction level). These actions also aim to prepare for foreseeable worsening situations. Penalties can be applied for non-compliance with declared water restrictions levels. Public information is set out to form part of these actions, even when not specifically listed
- Supply-side actions - actions that Local Water Utilities are required to undertake in order to ensure the water supply will meet the expected drought demand. These actions also aim to prepare for foreseeable worsening conditions

6.2 Demand Actions

Demand-side actions are expected to be undertaken by water users in response to the reduction of water supply. The following sections include details of the water restriction levels applied during drought due to progressive reductions in water availability.

Each water restriction level incorporates:

- Triggers – the circumstances that will cause the water restriction level to be declared
- Water restrictions – aimed at reducing the customer water demand regulating the type and duration of water-using activities. If not specifically mentioned, the restrictions regime of each successive level includes at least the step of the previous levels
- Targets – the demand levels that the water restriction levels aim to achieve

6.2.1 Triggers

The expected triggers for BRC to implement drought restrictions in the Bathurst Region are included in Table 7. The proposed water restriction triggers were developed on the basis of Chifley Dam storage volume percentage and the estimated water availability to the Bathurst water supply system.

These triggers were developed on the basis of estimated water availability and water demand. If the derived demand reduction is not achieved by introduction of the expected restriction level, the next level should be applied.

Due to the nature of Bathurst's water supply system and that the triggers are used for implementing restrictions in the Bathurst LGA, the water restrictions triggers are to be applied exclusive of any additional flow being available from the Fish River supply.

6.2.2 Water Restrictions

BRC has adopted the Bathurst, Orange and Dubbo (BOD) 6 levels water restriction definitions (as shown in Appendix B).

The BOD water restrictions are comprised of 6 levels of water consumption targets and their respective residential, non-residential, internal and external water usage constraints.

The water restriction levels are aimed at reducing the water demand through regulating the type and duration of water-using activities. The restrictions regime of each successive water restriction level is to be declared based on a set of water restriction triggers (see Table 7) specifically designed to suit the water supply to the Bathurst LGA.

6.2.3 Targets

A Drought End Use Model was applied to estimate the average daily and per capita demand targets expected at each water restriction level in Bathurst water supply area. Details of the Drought End Use Model estimated demand is provided in Appendix C. The target residential consumption per person at each water restriction level for the Bathurst LGA is shown in Table 7.

Table 7: Bathurst Regional Council Water Restrictions Triggers

Triggers[1]	Water Restrictions Levels	Demand[2]
Chifley Dam Storage Volume		Estimated Residential Consumption (L/person/day)
> 40%	No restriction[3]	304
≤ 40%	Level 1	278
≤ 35%	Level 2	250
≤ 30%	Level 3	219
≤ 25%	Level 4	183
≤ 22%	Level 5	159
≤ 15%	Level 6	129

1. Supply triggers provided by Council
2. Estimated using 7 years average annual consumption and BRC population of 32,050 in 2013 (estimation based on 2011ABS Census data for Urban centre locality population 31,294 and assuming a 1.2%/year growth)
3. BRC has an existing water wise program whereby Council is committed to conserving water and working with the community to preserve water resource.

6.2.4 Sustainable Duration of Bathurst Water Supply Source

As BRC had not been placed on water restrictions during the millennium drought, only limited information is available to accurately assess the likely impact of various stages of restrictions on demand patterns. The Drought End Use model developed for the Centroc Regional Drought Strategy project has been applied to estimate the water demand at the Bathurst LGA at different water restrictions levels (see Table 8). Table 8 shows:

- The water restriction triggers (column A) that were developed based on Chifley Dam storage volume percentage which drive Council to implement the restrictions levels

- The volume available from the Chifley Dam (column B) and the equivalent in number of days or months of supply remaining from the Dam were estimated on the basis of the expected daily demand at each level of restriction (column C & D)
- The BOD water restrictions levels (column E)
- Estimated average daily demand of potable supply in Bathurst (column G) - including both residential and non-residential usage
- Irrigation Extraction (column H) – in the Bathurst Climate Change and Water Security Plan (SKM 2011), a comparison of the sum of rural water entitlements and average town water usage from 2005-06 to 2008-09 indicated that the total rural surface water entitlements were equal in magnitude to town water use in the vicinity of Bathurst with both representing 49% of total usage. It was therefore assumed in this analysis that the irrigator extraction demands would be the same as Bathurst average daily demand in column G. However, the irrigation extraction will cease at Level 5
- Pan evaporation at Chifley Dam (column I) was estimated based on the evaporation loss being a function of the dam storage surface area at each water restriction levels, the evaporation coefficient (0.7) and the rate of evaporation in Bathurst at (13 ML/d)
- Dam seepage at Chifley Dam (column J) is assumed to be constant at all water restrictions levels
- Evapotranspiration loss and loss due to surface water and groundwater exchange (column K). A number of studies of the major river systems in NSW indicated that the volumes of water losses of Unaccounted for Differences (UAD) are difficult to undertake due to the need to estimate the inflows from ungauged tributaries and travel lags between flow gauging points. In addition, the translation of information from one catchment to another is very problematic due to differences in topography, hydrogeology and vegetation. Given those constraints, it was assumed that the evapotranspiration loss and loss due to surface water and groundwater exchange would be approximately 3.6% of the average daily demand (column G) (source: Water Balance And Unaccounted Difference In The Murrumbidgee Regulated River, NSW Office of Water, 2012)
- The total potable supply daily demand (column F) were estimated as the sum of demands in column G to column K

Table 8: Drought End Use Model Demand Analysis

Supply Triggers	Dam Usable Volume	Sustainable Duration (Cumulative no. of days until supply depletes)		Water Restrictions Levels	Demand Estimations (ML/d)					
Chifley Dam Storage Volume		(Days)	(Months)		Total Demand	Estimated Average Daily Demand (Res & Non. Res)	Irrigators Extraction	Pan Evaporation at Chifley Dam	Seepage at Chifley Dam	Evapotranspiration & Groundwater loss
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)
≤ 40%	9,240	273	9.1	Level 1	57.25	18.93	18.93	16.33	1.00	2.06
≤ 35%	7,700	246	8.2	Level 2	53.62	17.66	17.66	15.37	1.00	1.93
≤ 30%	6,160	217	7.2	Level 3	47.93	15.95	15.95	13.29	1.00	1.73
≤25%	4,620	185	6.2	Level 4	41.37	13.92	13.92	11.03	1.00	1.49
≤ 22%	3,696	163	5.4	Level 5	24.09	12.47	0	9.75	1.00	0.87
≤ 15%	1,540	73	2.4	Level 6	21.03	10.81	0	8.47	1.00	0.76
10%	3,080	Dead volume								

The outcomes of the table above are graphically presented in Figure 11.

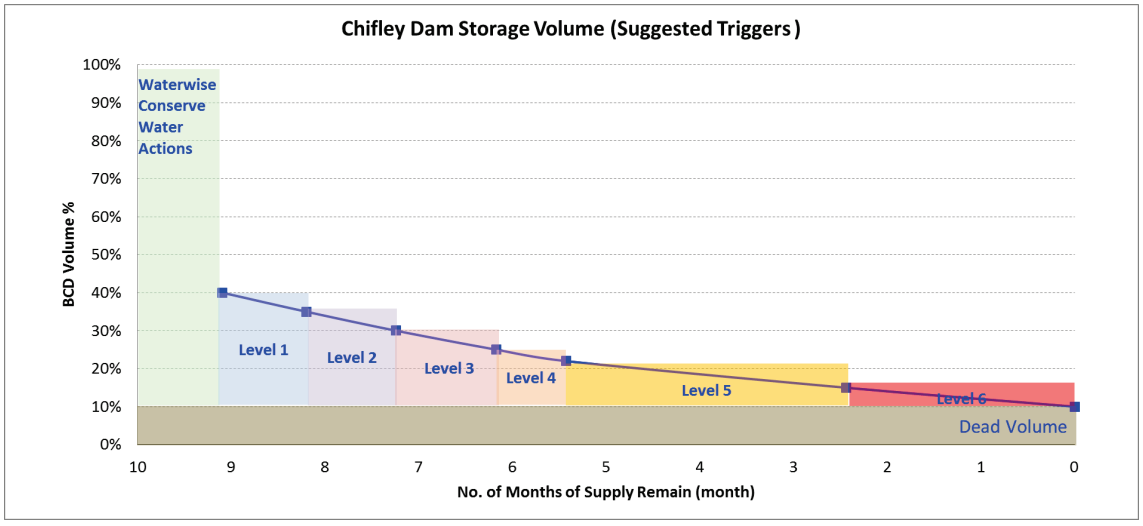


Figure 11: Water Restrictions Sustainable Duration

6.2.5 Water Restrictions Escalation

Based on Bathurst's surface water access licence (80SL095434) requirements, a flow of 4.53 ML/day or more from Chifley Dam is permitted when there is an inflow of no less than 4.53 ML/day into Chifley Dam.

During a drought event when the inflow to the dam decreases to less than 4.53 ML/day, Council will need to apply for NSW Office of Water's permission to release water from Chifley Dam into Campbells River.

Under normal operations when the weir inflow decreases due to reduction of Fish River flow, increase in irrigators demand or various other reasons, BRC may release water from Chifley Dam.

In order to estimate the sustainable duration of Bathurst water supply during drought, the following assumptions were made in order to project the water availability under a worse possible scenario:

- There is no inflow into Chifley Dam
- The remaining storage in Chifley Dam is subjected to seepage and evaporation
- Water releases from Chifley Dam are subjected to transfer loss including seepage, and surface water and groundwater exchange evapotranspiration along the rivers
- Neither the flow from Fish River into the Macquarie River nor the water available in Chifley Dam, dead storage was considered in the analysis. In the event when additional flows are available from the Fish River, the Bathurst water security will be enhanced

Water Restrictions Level 1

As the Chifley Dam storage volume decreases to 40% or less (up to 35%) during drought, level 1 water restrictions are activated.

Water Restrictions Levels 2 to 3

As the Chifley Dam storage volume decreases further, Level 2 and Level 3 water restrictions are triggered at 35% and 30% respectively. Based on the water restrictions definitions (Appendix B), the Bathurst water demands are expected to reduce.

At level 3 water restrictions, BRC will need to initiate discussions with irrigators (upstream of the weir) on the potential of Water Sharing Plan of "cease to pump" access rules at Level 5 water restrictions.

Water Restrictions Level 4

BRC continues with Chifley Dam releases while monitoring the weir water level and the overflow rates.

Water Restrictions Levels 5 to 6

As the water restriction approaches level 5, irrigators are required to stop all extractions based on the Water Sharing Plan "cease to pump" access rules.

In the event of water carting being required, BRC has a register to detail water carters in the local areas.

At level 6, Chifley Dam storage volume is expected to sustain only 3 months of supply if the assumed drought conditions do not improve. Council will need to activate significant measures to secure water supply to Bathurst. Such measures would include seeking State Government support, access dead storage at Chifley Dam, commence water carting, apply cease pumping rules to irrigators, closely monitor daily demand, etc. (see section 6.4 and Appendix B).

6.3 Alternate Supply Options

During drought, existing water resources are expected to decrease at a rate dependent on the respective water demand rate at a particular water restriction level. While current water resources are diminishing, other supply options may be considered as potential alternatives for supplementary or emergency water source. The alternate water resources available within the Bathurst LGA water supply areas are summarised below.

6.3.1 Alternative Water Source

Small Community Water Supply

In 2007, the Department of Commerce in collaboration with BRC, conducted an assessment of the performance of the water supply systems in Sofala and Rockley. The assessment outcome recommended further investigation for single reticulated potable schemes which are extracting water from a local alluvial aquifer (fed by Turon River) and alluvial aquifer (fed by Peppers Creek) for Sofala and Rockley water supply systems respectively.

Potential for Emergency Groundwater Supply

The potential of groundwater for emergency water supply during drought was preliminary assessed (SKM, Sep 2013). The analysis included 3 stages to investigate:

- Assessing current groundwater capability
- Assessing groundwater potential
- Implementation of a preliminary predictive modelling for operational and system assessment

The finding indicated that during extreme drought where minimal recharge would be anticipated, the total volume of groundwater available in the close proximity of Macquarie River Alluvium may range from 2,500 to 9,000 ML. The pumping analysis results suggested that the alluvium can support pumping rates sufficient to extract a significant proportion of the required water supply demand under level 6 water restrictions.

The preliminary analysis provided some confidence to the ability of the alluvial aquifers in Bathurst to make a significant contribution to an emergency drought water supply. The following recommendations were specified in the report:

- Council should commence a program of medium-term monitoring of alluvium levels and water chemistry over time in the Macquarie River Alluvium in the vicinity of Bathurst. It is suggested that three locations evenly spaced from the confluence of the Campbells and Fish Rivers to the downstream extent of the Macquarie alluvium near Bathurst would provide the information needed
- Council should conduct pumping tests in bores adjacent and at a distance from the river to determine appropriate specific yield estimates at these some locations over a period of up to two weeks to establish drawdown curves upon which to base estimates of specific yield and transmissivity
- An integrated numerical surface and groundwater model should be created to provide better estimates of sustainable extractions under both normal and drought conditions
- A geophysical survey could also be conducted of the alluvium to help delineate zones of preferential yield

Groundwater Study Findings

The Preliminary Assessment of the Potential for Emergency Groundwater Supply Study (August 2014) has the following findings. The executive summary of the report is provided in Appendix F.

- It indicated that the fracture rock is not useful as an alternative water resource
- It identified the riparian groundwater resource within 20 km of Bathurst is anticipated to have a total volume of 2,500 to 9,000 ML in the close proximity Macquarie River Alluvium. This is an estimate of the sustainable harvestable volume and would not recharge
- If BRC was to develop an emergency bore field for emergency water supply during drought, assuming 2,500 ML is available from the potential groundwater resource, this would extend BRC's supply for Level 6 water restrictions demand (at 8.8 ML/d) from less than 3 months to one year
- The key issue in this supply option is irrigators prospective use of groundwater after the cease to pump rules are applied
- BRC's negotiation of town water supply access licence for emergency groundwater supply may not be successful
- Capital cost of bore field and water treatment may be prohibitive
- SKM groundwater study recommendations on groundwater investigations, REF, concept design and other initial work still to be completed
- BRC needs to determine feasibility of groundwater option with compare to dam raising and/or beneficial reuse options

6.3.2 Recycled Water

Effluent from Bathurst Waste Water Treatment Plant (WWTP) is reused for irrigation purposes (approximately 25%). Further opportunities exist for treated effluent reuse to reduce potable water demand could be considered. It might be necessary for Council to increase the tertiary treatment capacity (filtration and disinfection) at Bathurst WWTP to accommodate any further major uses of effluent reuse such as dual reticulation in existing/new development areas.

6.3.3 Stormwater

In general, during drought stormwater is unlikely to be available in safe quantities.

6.3.4 Demand Management

Council has prepared Demand Management Plan (July 2014) in parallel to this project. The BRC's demand management plan recommended new demand management actions such as:

- Dual reticulation for all new residential developments
- Permanent low level of restrictions on water use
- Residential Washing Machine Rebate
- System water loss management
- Rainwater use for Hector Park amenities block
- Stormwater Harvesting for Bathurst Golf Course

It is anticipated that BRC will continue the implementation of existing water conservation measures and where practical implement the recommended water conservation measures identified in the demand management plan. If BRC decides to implement demand management strategies, it is recommended that a process to monitor and evaluate implementation be developed to measure effectiveness.

If council may implement the demand actions recommended in the Demand Management Plan, it could expect 10% per capita demand reduction in 30 years (see Figure 12).

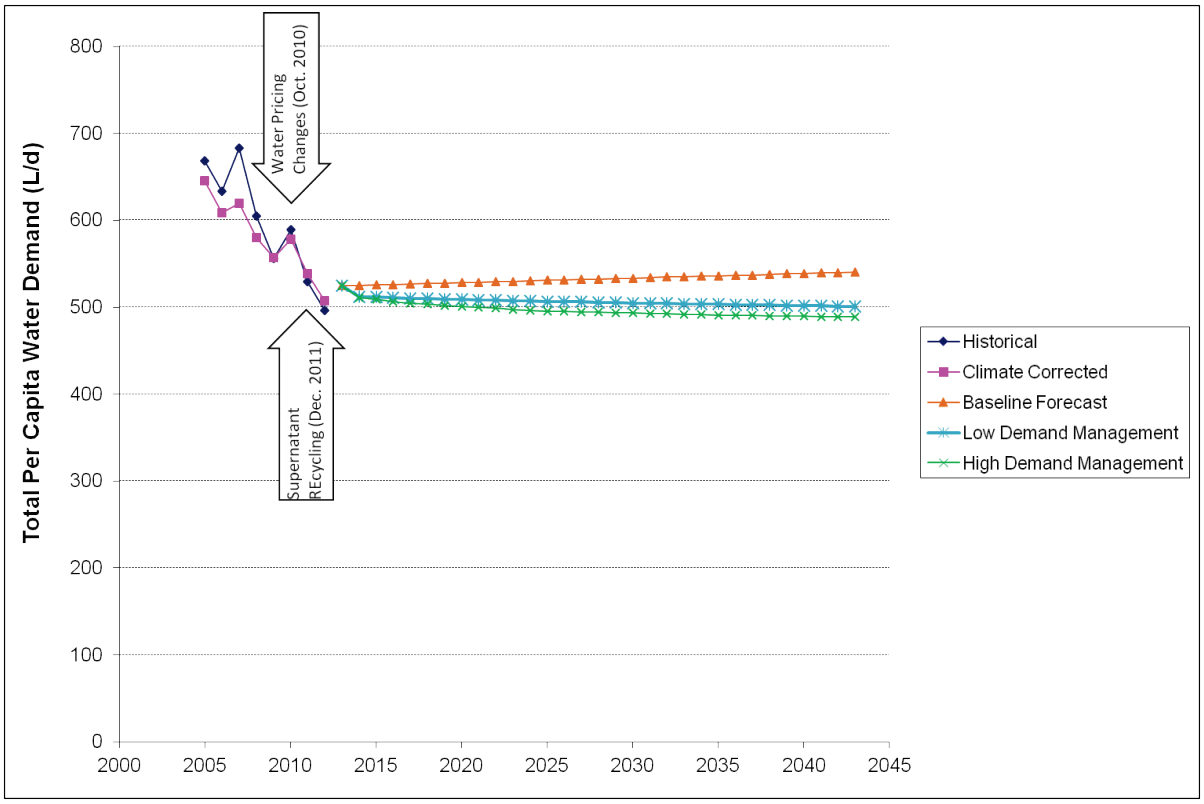


Figure 12: Bathurst per Capita Demand Projection

(Source: BRC Demand Management Plan, July 2014)

6.3.5 Water Carting & Evacuation

Under extreme circumstances, evacuation may be a possible option for small populations. However for large populations evacuation is not likely to be applicable. The social disruption in relocating large populations would be very difficult to manage. Water carting may therefore be a less averse option for large populations.

Table 9 shows the appropriateness of water carting for different community sizes.

Table 9: Water Carting Feasibility

Number of people	Water Carting Option Feasibility	Advantages/ Disadvantages
10	Yes	Low cost, quick to implement
100	Possible	Low cost, quick to implement
1000	Possible	
5000	Unlikely	
20000	No	Very Expensive
50000	No	Very Expensive, logistically almost impossible to organise and coordinate, long lead times required to prepare.

During drought, Government assistance towards the cost of water cartage may be available. This drought relief assistance funding is subjected to quantities and cartage arrangements approved by the NSW Office of Water.

Water Carting Cost Calculation

The water carting cost is estimated to evaluate the water carting option as an alternative supply. The cost estimation is calculated based on the following formula:

Estimated Cost = **Carting Volume** (i.e. water demand for internal usage) x (**Water Carting Cost** (i.e. transport & servicing charge) + **Cost of water** (i.e. water usage charge))

Table 10 included a list of estimated water carting costs for different periods.

Table 10: Cost Estimation for Water Carting

Water Carting from Lithgow Fish River Scheme to Bathurst town reservoir							
Carting Duration	1day	2 days	3 days	1 week	2 weeks	3 weeks	1 month
Estimated Cost ($M)	$1.63	$3.26	$4.89	$11.40	$22.80	$34.20	$48.85
Water Carting from Orange Icely Road Water Filtration Plant to Bathurst town reservoir							
Carting Duration	1day	2 days	3 days	1 week	2 weeks	3 weeks	1 month
Estimated Cost ($ M)	$1.54	$3.09	$4.63	$10.81	$21.63	$32.44	$46.35

Water cartage is generally only cost effective for small towns. Emergency capital works may be recommended as the best solution to the LWU's water supply problem. These might include emergency bore supplies, temporary or permanent connection to another source or water supply scheme, or the development of new water sources. Based on the 2011 census data, the Bathurst LGA has a population of 38,519; water carting is therefore not likely to be applicable to the Bathurst LGA during drought. It does however provide a context for State Government decisions on providing Bathurst with drought preparedness assistance.

6.4 Supply Actions

When drought occurs, actions must be taken to mitigate the effects of water shortage and assure a reliable water supply is available to meet the health and safety needs of the community.

Drought management Supply-side Actions should be implemented while the community takes action to reduce water demand using water restrictions. The supply actions are proposed to be implemented within a time frame of which the available water supply is sufficient to sustain the estimated water demand at the particular water restriction level. The supply-side actions are actions that Council will undertake to ensure there are alternate water supply options to continually supply water to its customers during drought.

Drought supply-side actions to be undertaken by Council in a drought event are included in Table 11.

Table 11: Bathurst Water Restriction Supply Side Actions

Water Restrictions Levels & Triggers (Chifley Dam Storage Volume %)		Supply-Side Actions
No Restriction	> 40%	▪ Continue water wise program and educate the community to conserve water ▪ Implement demand management actions as identified with DMP
Level 1 Low	≤ 40%	▪ Continue with Chifley Dam releases if required while monitoring the weir water level and the overflow rates ▪ Monitor Chifley Dam volume, flow rates at Fish River, Macquarie River and the weir water level.
Level 2 Moderate	≤ 35%	▪ Continue with Chifley Dam releases while monitoring the weir water level and the overflow rates ▪ Review alternate water source availabilities such as groundwater ▪ Review emergency water supply procedures ▪ Investigate water carting source and establish supply arrangements ▪ Investigate and design infrastructure required to extract water from dead zone of Chifley Dam ▪ Monitor, Chifley Dam volume, flow rates at Fish River, Macquarie River and the weir water level.
Level 3 High	≤ 30%	▪ Continue with Chifley Dam releases while monitoring the weir water level and the overflow rates ▪ Initiate discussions with irrigators (upstream of the weir) on the potential of the impending cease to pump access rules when Chifley Dam capacity is equal to or less than 22% at Level 5 water restrictions. ▪ Review alternate water source access and water acquisition ▪ Review water carting plan ▪ Establish infrastructure required to access water from dead zone of Chifley Dam depending on timeframe and on investigations ▪ Monitor Chifley Dam volume, flow rates at Fish River, Macquarie River and the weir water level

Water Restrictions Levels & Triggers (Chifley Dam Storage Volume %)		Supply-Side Actions
Level 4 Very High	≤ 25%	▪ Continue with Chifley Dam releases while monitoring the weir water level and the overflow rates ▪ Alert irrigators on the impending cease to pump access rules when Chifley Dam capacity is equal to or less than 22% at Level 5 water restrictions ▪ Implement alternate water source access and water acquisition ▪ Notify fire brigade on water supply for firefighting purposes ▪ Review water carting options and establish supply arrangements ▪ Continuous monitoring Chifley Dam volume, flow rates at Fish River, Macquarie River and the weir water level
Level 5 Extreme	≤ 22%	▪ Advise and ensure irrigators are compliance to the cease to pump access rules when Chifley Dam capacity is equal to or less than 22% ▪ Prepare infrastructure for water carting ▪ Prepare infrastructure to access water from dead zone of Chifley Dam ▪ Continuous Chifley Dam volume, flow rates at Fish River, Macquarie River and the weir water level
Level 6 Critical	≤ 15%	▪ Implement communication strategies and provide notification to the community with addition of letter box drop under emergency situations ▪ Emphasise irrigators on the cease to pump access rules when Chifley Dam capacity is less than 22% ▪ Commence water carting for internal domestic usage only ▪ Access water from dead zone of Chifley Dam ▪ Continuous monitoring Chifley Dam volume, flow rates at Fish River, Macquarie River and the weir water level

7 Regulatory Framework

The NSW Office of Water works in partnership with local water utilities (LWUs) in regional NSW to manage town water supplies during drought. In NSW, LWUs are responsible for water supply to country towns and villages.

During times of drought, the NSW Office of Water may provide technical or financial assistance to LWUs in the preparation or revision of drought management plans, manage depleted supplies, implement emergency capital works or for carting water. Emergency capital works may be recommended as the best solution to the LWU's water supply problem. These might include emergency bore supplies, temporary or permanent connection to another source or water supply scheme, or the development of new water sources.

7.1 Bathurst Regional Council

Under the Local Government (General) Regulation (2005), Council is empowered to restrict water supply (by public notice published in a newspaper circulating within Council's area.

Under the Local Government Act (1993) Section 637, the offence of "wilfully or negligently wastes or misuses water from a public water supply, or causes any such water to be wasted", will incur a penalty of up to $2,200.

BRC delivers water under the provisions of the NSW Local Government Act (1993). Some aspects of the water business are carried out under the provision of the NSW Water Management Act (2000). Water restrictions will be enforced by BRC's Ordinance Officers who are empowered under the Local Government Act (1993) to issue infringement notices. Council would need to allocate resources accordingly.

Customers who fail to comply with Council's water restrictions can have their water supply restricted; face on-the-spot fines of $220 and/or prosecution in the local district court. The maximum penalty which can apply as follows:

- Maximum penalty: 20 penalty units
- Current penalty unit: $110

Consumers who are identified breaching water restrictions in place will incur the following:

- For the first observed breach, a warning letter will be issued from the BRC General Manger
- For the second observed breach, a penalty infringement notice will be issued under the Local Government Act
- For breaches in excess of two occasions, both the appropriate fines as in (1) and (2) and that the council may cut off or restrict the supply of water to premises in accordance with Clause 144 of the Local Government (General) Regulation (2005)

This Drought Management Plan is administered by the Council. During drought, this plan will be overseen by the Council's Drought management team. The implementation of this Drought Management Plan will be the responsibility of BRC staff.

7.1.1 Exemptions

Exemptions from some water restrictions (Level 1 to 4) may be available for specific water use. Applications for exemption can be lodged with BRC using the Application for Exemption from Water Restrictions form in Appendix D.

All exemptions are subject to change, following regular reviews as the drought progresses.

Exemptions are only valid for the specific water restriction level applied. Lodging a new exemption form is required when the restriction level changes.

An exemption may be granted if:

- The activities require water for health and hygiene
- The activities require water for safety
- There is no feasible water less alternative
- Business will experience significant financial impact when water restrictions in placed

All successful applicants will receive a permit stating the exemption granted by BRC and the conditions they must comply with. The BRC Water User permit (see Appendix D) must be prominently displayed at all times.

Business permit issued are for the purpose of business use only. Business owner or employee personal use is not permitted.

BRC may revoke the permit and/or issue an infringement notice(s) if:

- The information provided in the application is found to be false
- Water is being used for purposes other than that stated in the application
- Activity is found to be non-compliant to the permit conditions

7.1.2 Fire Fighting Requirements

Under all demand reduction options, preference will be provided to accommodating firefighting requirements.

The last 20% of all water stored in service reservoirs are reserved for firefighting purposes.

In the event when the emergency conditions last for more than 3 days, fire services will be directed to arrange alternate water source (e.g. water tankers) if appropriate.

7.1.3 Public Health

In the time of drought public health is a most considering factor. Council needs to manage water supply and distribution systems that are fundamental to the protection and preservation of the health of the community.

Under emergency conditions, approximately 18 ML of water is to be stored in the service reservoir and reserved for firefighting or public health purposes.

7.1.4 Conflict Resolution

In an event when conflict arises from water use, Council will provide conflict resolution to resolve the matter at the lowest possible level to achieve an agreement within the relevant legislation, regulation, code or Council Policy. The agreement will be achieved between the complainant(s) and, in the ascending order of level, the Council's authorised officer, Council's General Manager or his delegated senior management officer empowered.

7.1.5 Drought Relief Funding

The Local Land Services (LLS) is a critical link between the rural community and government during drought, both at a State Council level and at the district level. The LLS play a key role in drought declarations. BRC will rebate 50% of water costs for water sourced from the filling stations only when drought is declared by the LLS. Details of the LLS agreed drought agricultural conditions identified is included in the NSW Department of Primary Industries website.

7.2 NSW Office of Water

The NSW Office of Water works with partner agencies and with the community to provide a reliable, sustainable supply of water for households, irrigators, farmers, industry and the environment.

For non-metropolitan areas the Office of Water provides managerial, technical and financial support under the Country Towns Water Supply and Sewerage Program.

Available water determinations are made for each water source generally at the start of a water year (on 1 July). The licensed volume or the percentage of the share component is defined by NSW Office of Water. (Source: NSW Office of Water website)

7.2.1 Water Sharing Plans

The Bathurst LGA is located within the area covered by the water sharing plan for the Macquarie Bogan Unregulated and Alluvial Water Sources (Figure 13). The water sharing plan commenced on 4 October 2012.

Figure 13: Macquarie Bogan Unregulated and Alluvial Water Sources Water Sharing Plan Area

Bathurst Regional Council operates the dam in accordance with the drought management plan which includes specified triggers for water restrictions based on the capacity of dam.

The Water Sharing Plan - Macquarie River above Burrendong water source access rules are applicable to BRC (see Appendix E). It has a reference point located at the Chifley Dam storage gauge (563008).

The sharing plan cease to pump (CtP) rules are triggered when Chifley Dam reaches 22% storage, which coincides with Level 5 Water Restrictions (source: Water Sharing Plan for the Macquarie Bogan Unregulated and Alluvial Water Sources, NSW Office of Water, Sep 2012)

The CtP rules do not apply to town water supply access licences. There are also other exemptions which include activities that are considered critical human needs or animal health requirements. These licences with access to very low flows include:

- Town water supply access licences
- Domestic supply
- Stock supply for first 5 years of the plan, after which the CtP rule will apply
- fruit washing
- cleaning of dairy plant and processing equipment for the purpose of hygiene
- poultry washing and misting
- cleaning of enclosures used for intensive animal production for the purposes of hygiene

Users of basic land holder's rights are also exempt from the CtP.

(Source: Water Sharing Plan for the Macquarie Bogan Unregulated and Alluvial Water Sources, NSW Office of Water, Sep 2012).

8 Monitoring During Drought

It is important to monitor the water demand patterns when water restrictions are enforced particularly during an ongoing drought event. The water demand patterns provide information to plan out the drought supply actions required to be implemented in the foreseeable future.

BRC monitors city-wide consumption of filtered and raw water on a daily basis. During water restriction periods, monitoring can be increased.

The following monitoring is required during drought.

- Potable water daily demand
- Raw water daily demand
- Daily monitoring of water supply sources (surface water & groundwater) including:
  - Water level at Chifley Dam
  - Flows in the Macquarie River
  - Flows in the Fish River
- Daily temperature and rainfall
- Impact of restrictions on water consumptions
- Potential availability of alternative water supply sources
  - alternative groundwater source
- Water source quality
  - Electrical conductivity(monthly)
  - Total Dissolved Solids (monthly)
  - pH (daily)
  - Alkalinity (monthly)
  - Algae levels (Visual inspection – daily; Lab testing – 7 to 10 days)
  - Taste and odour (on complaint)
  - Chemical analysis (monthly)
  - Microbial analysis(weekly)

9 Consultation

9.1 Community Engagement

Engagement with the community is a critical element of an effective drought management program, as it ensures customer acceptance of the requirements or behavioural changes in order to meet the water demand reduction.

BRC's media/community strategy is as follow:

General Water Conservation Campaign

Council actively promotes information on ways to effectively conserve water. This includes the ongoing Waterwise Programme accompanying numerous information mediums.

Water Restrictions Public Notification

Notice of water restrictions or change in level of restrictions are provided to the community via the following approaches

- Public notices in the Western Advocate
- Notices on Bathurst Regional Council's website
- Radio announcements
- Television announcements
- General media releases – Western Advocate

General water restrictions to be imposed will be communicated officially via public notices and a range of media announcements. Under emergency situations Council will use technology as available, a letter box drop, mailout, SMS, E-mails, etc to notice to the every affected customer. In addition, media releases and interview format with Council's staff would assist in conveying the message about the need to reduce water usage.

Special engagement with industry and institutions will be required to develop specific industry plans relating to drought management.

9.2 Government Consultation

Drought management consultation assistance can also be accessed from the following Government Departments:

- NSW Office of Water
- NSW Health (issues related to water quality)
- NSW Department of Primary Industry
- Australian Government Department of Agriculture, Fisheries and Forestry

Drought Recovery

The following sections detail the recovery phase of the drought management strategy

10 Recovery

In reference to the Australian Emergency Manual (Disaster Recovery, EMA 2004), the recovery process is set out to be a coordinated process to support "affected communities in the reconstruction of the physical infrastructure and the restoration of emotional, social, economic and physical wellbeing". The recovery process may also "provide an opportunity to improve these aspects beyond previous conditions, by enhancing social and natural environments, infrastructure and economies, and contributing to a more resilient community".

Generally, the recovery process will commence at the end of the response operations.

A Recovery Co-ordinator will be appointed by the drought management team to oversee the recovery process. The recovery co-ordinator will be responsible for managing the assessment of drought impacts and determining the appropriate personnel to co-ordinate the recovery activities.

A post drought event reporting process will be commenced within 5 working days of the completion of a critical drought event which will include a de-briefing exercise convened by the recovery Co-ordinator. A post drought event report must then be submitted to the General Manager within 5 working days.

A drought recovery survey will be developed to evaluate the process required to restore the physical infrastructure and the restoration of emotional, social, economic and physical wellbeing. The drought recovery survey will assess the following criteria in order to determine the priority of recovery actions required:

- Ownership
  – to determine the ownership of private or public asset to determine the source of assistance that may be available
- Severity of impact
  – Council to develop a scale to determine the severity of social, economic and financial impact to be based upon
- Time to recover
  - Council to evaluate a timeframe required to recover from the drought impact
- Cost of impacts
  – the financial loss due to the drought impact

With the details provided in the drought recovery survey, Council will then be able to seek the appropriate resources to address the recovery needs. The recovery process will involve restoring the community to the point where normal social and economic activities may resume.

The BRC Recovery Coordinator should also work with Council to assist the community to return to pre-drought water consumption over an appropriate period of time. This is appropriate because the water supply provides social amenity and the LWUs financial sustainability is based on this.

11 Review

To ensure the ongoing effectiveness of this plan a periodic program for exercising drought management will be developed and implemented in conjunction with Council's other emergency management training programs. This drought management plan should also include a periodic (annual) review of:

- Council positions
- State Agency information
- Council templates
- Technology use/updates
- Other relevant changes/updates

Appendix A

NSW Office of Water Best-Practice Management Guidelines
Drought Management Plan Checklist

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

Appendix B

Bathurst, Orange, Dubbo Water Restrictions Definitions

REGIONAL SYSTEM OF WATER RESTRICTIONS for BATHURST, ORANGE, DUBBO - November 2009 Review

ACTIVITY	WATER RESTRICTIONS					
	LEVEL 1 LOW	LEVEL 2 MODERATE	LEVEL 3 HIGH	LEVEL 4 VERY HIGH	LEVEL 5 EXTREME	LEVEL 6 CRITICAL
TARGET WATER CONSUMPTION	260 litres/person/day	240 litres/person/day	220litres/person/day	200 litres/person/day	160 litres/person/day	120 litres/person/day
RESIDENTIAL WATER USE						
Watering of Lawns ***Note: Subject to varying Summer and Winter Times*** Watering systems, microsprays, drip systems, soaker hoses, non fixed sprinklers, hand held hoses only.	**Summer Time** between 1800-0900 hrs only daily. **Winter Time** 0600-1000 hrs and 1600-2200 hrs daily.	Watering systems, non fixed sprinklers, hand held hoses, microsprays, drip systems, soaker hoses, only. **Summer Time** between 0600-0900 hrs and between 1800-2100 hrs every second day as per odds and evens system. **Winter Time** between 0700-1000 hrs and between 1600-1900 hrs every second day as per odds and evens system.	Watering systems, non fixed sprinklers, hand held hoses not permitted at any time. Microsprays, drip systems, soaker hoses, only. **Summer Time** between 0600-0900 hrs and between 1800-2100 hrs every second day as per odds and evens system. **Winter Time** between 0700-1000 hrs and between 1600-1900 hrs every second day as per odds and evens system.	✗ Not permitted	✗ Not permitted	✗ Not permitted
Watering of Residential Gardens ***Note: Subject to varying Summer and Winter times***	Watering systems, microsprays, drip systems, soaker hoses, non fixed sprinklers, hand held hoses only. **Summer Time** between 1800-0900 hrs only daily. **Winter Time** 0600-1000 hrs and 1600-2200 hrs daily.	Watering systems, non fixed sprinklers, hand held hoses, microsprays, drip systems, soaker hoses, only. **Summer Time** between 0600-0900 hrs and between 1800-2100 hrs every second day as per odds and evens system. **Winter Time** between 0700-1000 hrs and between 1600-1900 hrs every second day as per odds and evens system.	Watering systems, non fixed sprinklers, hand held hoses not permitted at any time. Microsprays, drip systems, soaker hoses, only. **Summer Time** between 0600-0900 hrs and between 1800-2100 hrs every second day as per odds and evens system. **Winter Time** between 0700-1000 hrs and between 1600-1900 hrs every second day as per odds and evens system.	Watering systems, non fixed sprinklers, hand held hoses not permitted at any time. Microsprays, drip systems, soaker hoses, only. **Summer Time** between 1800-2000 hrs only on each Wednesday and Sunday. **Winter Time** 1600-1800 hrs on each Wednesday and Sunday.	Watering systems, non fixed sprinklers, hand held hoses, microsprays, drip systems, soaker hoses, not permitted at any time. Bucket / watering can watering only. **Summer Time** between 1800-2000 hrs on Sunday only. **Winter Time** between 1300-1500 hrs on Sunday only.	✗ Not permitted
Topping up, filling garden water features	✓ Permitted	✓ Permitted	✓ Permitted	✓ Permitted	Not to be topped up or filled.	Not to be topped up or filled.
Irrigation of new turf	Permitted for one week after laying after which level 1 restriction on watering lawns applies	Permitted for one week after laying after which level 2 restriction on watering lawns applies	Permitted for one week after laying after which level 3 restriction on watering lawns applies	✗ Not permitted	✗ Not permitted	✗ Not permitted
Washing down walls or paved surfaces	✗ Not permitted	✗ Not permitted	✗ Not permitted	✗ Not permitted	✗ Not permitted	✗ Not permitted
Topping up private swimming pools/spas	✓ Permitted	Only between hours of 0700-0900 and between 1800-2000 hrs, every day.	Only between hours of 0700-0900 and between 1800-2000 hrs, every day provided pool covers are used	Only between hours of 0700-0900 and between 1800-2000 hrs, every day. Pool covers must be used.	✗ Not permitted	✗ Not permitted
First fill of private swimming pools	✓ Permitted	Only between hours of 0700-0900 and between 1800-2000 hrs, every day	Only with Council permission and provided pool covers are used.	Only with Council permission and after water savings elsewhere within property. Covers must be used.	✗ Not permitted	✗ Not permitted
Washing cars at home	Permitted with bucket and rinse with trigger hose on lawn at any time.	Permitted with bucket and rinse with trigger hose on lawn between 0900-1200 hrs any day.	Permitted with bucket only on lawn between 0900-1200 hrs any day.	Permitted with bucket only on lawn between 0900-1200 hrs any day.	✗ Not permitted	✗ Not permitted
Baths, showers	✓ Permitted	✓ Permitted	✓ Permitted	Five (5) minute showers, one bath per person per day	Three (3) minute showers, one bath (100 mm depth) per person per day	Three (3) minute showers, one bath (100 mm depth) per person per day
Washing of clothes	✓ Permitted	✓ Permitted	Full loads only encouraged.	Full loads only permitted.	Full loads only permitted.	Two full loads of clothes per week
Use of evaporative air conditioners	✓ Permitted	✓ Permitted	✓ Permitted	Permitted only 0700-2400 hrs daily	Permitted only 0700-2400 hrs daily, exemptions may be granted to aged accommodation or nursing homes.	Permitted only 1800-2200 hrs daily, exemptions may be granted to aged accommodation or nursing homes.
Inflatable or temporary childrens pools	✓ Permitted	✓ Permitted	✓ Permitted	✓ Permitted	✗ Not permitted	✗ Not permitted

REGIONAL SYSTEM OF WATER RESTRICTIONS for BATHURST, ORANGE, DUBBO - November 2009 Review

ACTIVITY	WATER RESTRICTIONS					
	LEVEL 1 LOW	LEVEL 2 MODERATE	LEVEL 3 HIGH	LEVEL 4 VERY HIGH	LEVEL 5 EXTREME	LEVEL 6 CRITICAL
NON - RESIDENTIAL WATER USE						
Watering of Lawns ***Note: Subject to varying Summer and Winter times***	Watering systems, microsprays, drip systems, soaker hoses, non fixed sprinklers, hand held hoses only. **Summer Time** between 1800-0900 hrs only daily. **Winter Time** 0600-1000 hrs and 1600-2200 hrs daily.	Watering systems, non fixed sprinklers, hand held hoses, microsprays, drip systems, soaker hoses, only. **Summer Time** between 0600-0900 hrs and between 1800-2100 hrs every second day as per odds and evens system. **Winter Time** between 0700-1000 hrs and between 1600-1900 hrs every second day as per odds and evens system.	Watering systems, non fixed sprinklers, hand held hoses not permitted at any time. Microsprays, drip systems, soaker hoses, only. **Summer Time** between 0600-0900 hrs and between 1800-2100 hrs every second day as per odds and evens system. **Winter Time** between 0700-1000 hrs and between 1600-1900 hrs every second day as per odds and evens system.	✗ Not permitted	✗ Not permitted	✗ Not permitted
Watering of Gardens ***Note: Subject to varying Summer and Winter times***	Watering systems, microsprays, drip systems, soaker hoses, non fixed sprinklers, hand held hoses only. **Summer Time** between 1800-0900 hrs only daily. **Winter Time** 0600-1000 hrs and 1600-2200 hrs daily.	Watering systems, non fixed sprinklers, hand held hoses, microsprays, drip systems, soaker hoses, only. **Summer Time** between 0600-0900 hrs and between 1800-2100 hrs every second day as per odds and evens system. **Winter Time** between 0700-1000 hrs and between 1600-1900 hrs every second day as per odds and evens system.	Watering systems, non fixed sprinklers, hand held hoses not permitted at any time. Microsprays, drip systems, soaker hoses, only. **Summer Time** between 0600-0900 hrs and between 1800-2100 hrs every second day as per odds and evens system. **Winter Time** between 0700-1000 hrs and between 1600-1900 hrs every second day as per odds and evens system.	Watering systems, non fixed sprinklers, hand held hoses not permitted at any time. Microsprays, drip systems, soaker hoses, only. **Summer Time** between 1800-2000 hrs only on each Wednesday and Sunday. **Winter Time** 1600-1800 hrs on each Wednesday and Sunday.	Watering systems, non fixed sprinklers, hand held hoses, microsprays, drip systems, soaker hoses, not permitted at any time. Bucket / watering can watering only. **Summer Time** between 1800-2000 hrs on Sunday only. **Winter Time** between 1300-1500 hrs on Sunday only.	✗ Not permitted
Topping up public swimming pools/spas, including those in motels etc.	✓ Permitted	Only between hours of 0700-0900 and between 1800-2000 hrs, every day.	Only between hours of 0700-0900 and between 1800-2000 hrs, every day provided pool covers are used	Only between hours of 0700-0900 and between 1800-2000 hrs, every day. Pool covers must be used.	✗ Not permitted	✗ Not permitted
First fill of public swimming pools/spas, including those in motels etc.	✓ Permitted	Only between hours of 0700-0900 and between 1800-2000 hrs, every day	Only with Council permission	Only with Council permission and after water savings elsewhere within property. Covers must be used.	✗ Not permitted	✗ Not permitted
Turf farm irrigation, market gardens	✓ Permitted	✓ Permitted	Irrigation only between 2000-0800 hrs.Business must prepare WSAP.	Business must implement and comply with WSAP	✗ Not permitted	✗ Not permitted
Irrigation of new turf on non-residential premi	Permitted for one week after laying after which level 1 restriction on watering lawns applies	Permitted for one week after laying after which level 2 restriction on watering lawns applies	Permitted for one week after laying after which level 3 restriction on watering lawns applies	✗ Not permitted	✗ Not permitted	✗ Not permitted
Public car and truck wash facilities	✓ Permitted	✓ Permitted	Permitted, but business must prepare WSAP.	Business must implement and comply with WSAP	Business must implement and comply with WSAP	✗ Not permitted
Construction industry eg mortar or concrete r	✓ Permitted	✓ Permitted	✓ Permitted	✓ Permitted	✓ Permitted	✗ Not permitted
Construction - wash down, paint prep, curing	✓ Permitted	✓ Permitted	Permitted, but business must prepare WSAP.	Business must implement and comply with WSAP	Business must implement and comply with WSAP	✗ Not permitted
Cleaning - exterior	Permitted with trigger hoses, any time.	Permitted with pressure trigger hoses, any time.	Permitted with pressure trigger hoses. Business must prepare WSAP.	Business must implement and comply with WSAP	Business must implement and comply with WSAP	✗ Not permitted
Commercial or Government nurseries	✓ Permitted	✓ Permitted	Permitted, but business must prepare WSAP.	Business must implement and comply with WSAP.	Business must implement and comply with WSAP.	✗ Not permitted
Abattoirs	✓ Permitted	✓ Permitted	Permitted, but business must prepare WSAP.	Business must implement and comply with WSAP.	Business must implement and comply with WSAP.	✗ Not permitted
Food or pet food production	✓ Permitted	✓ Permitted	Permitted, but business must prepare WSAP.	Business must implement and comply with WSAP.	Business must implement and comply with WSAP.	✗ Not permitted
Canneries	✓ Permitted	✓ Permitted	Permitted, but business must prepare WSAP.	Business must implement and comply with WSAP.	Business must implement and comply with WSAP.	✗ Not permitted

REGIONAL SYSTEM OF WATER RESTRICTIONS for BATHURST, ORANGE, DUBBO - November 2009 Review

ACTIVITY	WATER RESTRICTIONS					
	LEVEL 1 LOW	LEVEL 2 MODERATE	LEVEL 3 HIGH	LEVEL 4 VERY HIGH	LEVEL 5 EXTREME	LEVEL 6 CRITICAL
NON - RESIDENTIAL WATER USE						
Pet care	✓ Permitted	✓ Permitted	Permitted, but business must prepare WSAP.	Business must implement and comply with WSAP.	Business must implement and comply with WSAP.	Business must implement and comply with WSAP.
Public water features	✓ Permitted	✓ Permitted	Permitted, but WSAP must be prepared.	WSAP must be implemented.	WSAP must be implemented.	✗ Not permitted
Child care	✓ Permitted	✓ Permitted	Permitted, but business must prepare WSAP.	Business must implement and comply with WSAP.	Business must implement and comply with WSAP.	Business must implement and comply with WSAP.
Public parks, gardens, avaries, plant houses,	✓ Permitted	✓ Permitted	Permitted, but business must prepare WSAP.	Business must implement and comply with WSAP.	Business must implement and comply with WSAP.	✗ Not permitted
Schools, technical colleges, colleges, univers	✓ Permitted	✓ Permitted	Permitted, but business must prepare WSAP.	Business must implement and comply with WSAP.	Business must implement and comply with WSAP.	✗ Not permitted
Hospitals, hospices, nursing homes, rehab ce	✓ Permitted	✓ Permitted	Permitted, but business must prepare WSAP.	Business must implement and comply with WSAP.	Business must implement and comply with WSAP.	Business must implement and comply with WSAP
Aged accommodation	✓ Permitted	✓ Permitted	Permitted, but business must prepare WSAP.	Business must implement and comply with WSAP.	Business must implement and comply with WSAP.	Business must implement and comply with WSAP.
Motels, caravan parks, cabins	✓ Permitted	✓ Permitted	Permitted, but business must prepare WSAP.	Business must implement and comply with WSAP.	Business must implement and comply with WSAP.	✗ Not permitted
Hotels, registered clubs	✓ Permitted	✓ Permitted	Permitted, but business must prepare WSAP.	Business must implement and comply with WSAP.	Business must implement and comply with WSAP.	✗ Not permitted
Businesses with cooling towers	✓ Permitted	✓ Permitted	Permitted, but business must prepare WSAP.	Business must implement and comply with WSAP.	Business must implement and comply with WSAP.	✗ Not permitted

NOTES

ODDS & EVENS SYSTEM EXPLAINED

This means that if the street number of your property is odd you can water in accordance with the restrictions on odd days.

If your property has an even number you can water in accordance with the restrictions on even days.

If your property has a range of street numbers then it should be treated as odd or even as per the first number in the range.

For example if your property is 12-15 Smith Street then you can water on even days in accordance with the restrictions.

If your property has no street number then it should be treated as an even property.

For example if your property is "Tara" then you can water on even days in accordance with the restrictions.

WSAP

This refers to a Water Savings Action Plan, an enterprise specific plan to adopt water efficiency prepared in accordance.

with "Guidelines for Water Savings Action Plans", Dept of Energy, Utilities and Sustainability, October 2005.

A copy of this document are now available from offices of the Department of Water and Energy.

At certain levels of restrictions a businesss may be required to prepare a WSAP. The completed WSAP

must be approved by Council. Further water restrictions may permit the continued use of water for that activity

but only if the business strictly complies with its approved WSAP.

TIMES

The times quoted in the restrictions are based on a 24 hour clock.

For example, if the restrictions state 2200 hrs it is equivalent to 10 pm.

Summer Time - refers to Daylight Saving period 2.00am Eastern Standard Time first Sunday in October to Eastern Daylight Saving Time 3.00am first Sunday in April

Winter Time - refers to the period outside of Daylight Saving Time

OTHER SOURCES OF WATER

These restrictions are restrictions that Council is placing on the use of its potable water supply. If the restrictions say " Not permitted"

for a particular use, this means that Council's potable water supply cannot be used for this purpose. Water from another source,

however, could be used for this purpose.

DEFINITIONS

A watering system is any automated system for the watering of lawns by any means.

A microspray irrigation system may be a manual or automatic lawn irrigation system that uses

small sprays known as microsprays to irrigate lawn or gardens.

A drip system is a surface or subsurface, manual or automatic system, that uses a dripper or emitter

to water lawn or gardens.

A soaker hose is a fixed or moveable hose with a series of small openings to water lawn or gardens.

A non fixed sprinkler is an above ground sprinkler that is attached to and supplied with water from a hose or similar

used, automatically or manually, with or without a timer, to irrigate lawn or gardens.

Appendix C

Drought End Use Model

Drought End Use Model

As part of the Centroc Study Regional Drought Plan project a drought end use model was developed.

Water restrictions are often specific to internal and/or external use. The drought end use model is developed to determine the impact of water restrictions in different end uses consumption. The key outcome of the model is the reduction in water consumption by end use in each of the 6 water restriction levels.

The model is based on standard estimated water consumption per person by end use. The percentage of reduction for each end use is assumed based on the definitions of the Bathurst, Orange and Dubbo (BOD) water restriction levels provided in Appendix B.

The data used to populate the model is from the Bathurst Demand Management DSS models developed by SKM for previous projects.

The model allows for assumptions on percentage of external use that goes to irrigation, leakage and "others". Others could for instance be car wash and evaporative cooling. The latter is a variable that changes according to climate and can be a large player in the demand analyses.

The major outcomes of the end use model are the expected residential water consumption per person and expected total annual consumption for each water restriction level.

Input Data

The Triggers were developed on the basis of the following input data:

- total population was estimated on the basis of 2011 Census data on Bathurst Urban Centre locality and an assumed growth rate of 1.2% per year: 32,050
- total number of residential water accounts was estimate on the basis of number of accounts estimated using 2010 data and 1.2% growth per year: 11,508
- total number of commercial and industrial account in 2010 and 1.2% growth per year
- total number of other accounts in 2010 and 1.2% growth per year includes Public, Parks & Open Space, Rural, Other and Unmetered. The Parks & Open Space has zero consumption

Bathurst drought restrictions triggers models were developed based on the level of demand expected at each level of restrictions. This was done using a drought end use model developed for the Centroc Regional Drought Strategy. The following tables list the estimated demand levels at each drought restrictions level, the restrictions levels triggers and the sustainable duration (i.e. number of days of supply remaining) from the Chifley Dam. The sustainable duration provides an idea of how many days of supply Council has stored in case of failure in the rest of the system and there are no other alternatives of supply readily in place.

Table 12: Bathurst Drought Triggers and Restrictions Levels Model

Bathurst Regional Council End Use Demand Model

Year		2,013	(source: Bathurst DSM DSS Light v01a_update May2013)
Population		32,050	(source: 2011 Census data 31,294 Urban centre locality and 1.2%/yr growth)
No. of Residential Accounts:		11,508	(source: 2013 number of accounts estimated using 2010 data and 1.2% growth per year)
Occupancy Rate:		2.8	

Data entry cells
Data calculated cells
assumed values

Residential End Use Breakdown

Internal Consumption

Type of Consumption	Consumption per Person (L/d)	Consumption per Account (L/d)	% of Total Internal
Toilets	21.8	60.6	15.1%
Baths	7.2	20.0	5.0%
Showers	54.3	151.1	37.6%
Taps/Sinks	19.1	53.3	13.3%
Dishwashers	2.0	5.5	1.4%
Washing Machines	32.7	91.2	22.7%
Int. Leakage	7.2	20.1	5.0%
Total Internal	**144.2**	**401.7**	

External Consumption

Type of Consumption	Consumption per Account (L/d)	% of Total External	Centroc
Ext. Irrigation	290.1	65%	80%
Ext. Other	133.9	30%	15%
Ext. Leakage	22.3	5%	5%
Total External	**446.3**	**100%**	

(source: Bathurst DSM DSS Light v01a_upd

Total Observed Consumption

	Average Consumption	% Internal	% External
Total Residential Consumption per Account (L/d)	**848.0**	47.4%	52.6%
Total Residential Consumption (ML/d)	**9.8**		

(source: Climate corrected production data, Bathurst DSM DSS Light v01a_update Sep 2013)

Non-Residential End Use Breakdown

Category	Consumption per Account (L/d)	No. of Accounts	% Internal	% External	Internal Consumption per Account (L/d)	External Consumption per Account (L/d)
Commercial	1,777	758	80%	20%	1,421.6	355.4
Industrial	231,577	10	90%	10%	208,419.3	23,157.7
Other	24,466	231	50%	50%	12,233.0	12,233.0
Total Non-Residential Consumption per Account					**222073.9**	**35746.1**

(source: Climate corrected production data, Bathurst DSM DSS Light v01a_update Sep 2013)
(Source: DSS (Public +Parks & Open Space + Rural+Other+Unmetered) Parks & Open Space consumption = 0)

Total Non-Residential Consumption (ML/d)	**9.3**

System Leakage

Production per person (L/d)	525
Production per person (ML/y)	0.19
Total Production (ML/y)	6141.0
System Leakage (% of total production)	9.0%
System Leakage (ML/y)	552.7

(source: Climate corrected production data, Bathurst DSM DSS Light v01a_update Sep 2013)

End Use Analyses

End Use Summary Table

Description	Category	Internal or External (int or ext)	% of Total Int or Ext	Consumption per Account (L/d)	Annual Consumption per Account (ML/y)
RES Toilets	Residential	int	15.1%	60.6	0.022
RES Baths	Residential	int	5.0%	20.0	0.007
RES Showers	Residential	int	37.6%	151.1	0.055
RES Taps/Sinks	Residential	int	13.3%	53.3	0.019
RES Dishwashers	Residential	int	1.4%	5.5	0.002
RES Washing Machines	Residential	int	22.7%	91.2	0.033
RES Int. Leakage	Residential	int	5.0%	20.1	0.007
RES Ext. Irrigation	Residential	ext	65.0%	290.1	0.106
RES Ext. Other	Residential	ext	30.0%	133.9	0.049
RES Ext. Leakage	Residential	ext	5.0%	22.3	0.008
COM Internal	Commercial	int	80.0%	1421.6	0.519
COM External	Commercial	ext	20.0%	355.4	0.130
IND Internal	Industrial	int	90.0%	208419.3	76.125
IND External	Industrial	ext	10.0%	23157.7	8.458
OTH Internal	Other	int	50.0%	12233.0	4.468
OTH External	Other	ext	50.0%	12233.0	4.468
System Leakage	Leakage				552.7

% Reductions

Restriction Impact (Level 1)	Restriction Impact (Level 2)	Restriction Impact (Level 3)	Restriction Impact (Level 4)	Restriction Impact (Level 5)	Restriction Impact (Level 6)
2.0%	2.0%	2.0%	5.0%	8.0%	10.0%
2.0%	2.0%	2.0%	10.0%	20.0%	20.0%
2.0%	2.0%	2.0%	10.0%	20.0%	20.0%
2.0%	2.0%	5.0%	10.0%	15.0%	20.0%
2.0%	2.0%	5.0%	10.0%	15.0%	20.0%
2.0%	2.0%	5.0%	10.0%	10.0%	20.0%
2.0%	2.0%	5.0%	10.0%	15.0%	20.0%
20.0%	40.0%	60.0%	75.0%	85.0%	95.0%
5.0%	20.0%	35.0%	60.0%	70.0%	100.0%
2.0%	4.0%	8.0%	12.0%	16.0%	20.0%
2.0%	2.0%	5.0%	10.0%	15.0%	20.0%
20.0%	30.0%	45.0%	60.0%	70.0%	80.0%
2.0%	2.0%	5.0%	10.0%	15.0%	20.0%
20.0%	30.0%	45.0%	60.0%	70.0%	80.0%
2.0%	2.0%	5.0%	10.0%	15.0%	20.0%
20.0%	30.0%	45.0%	60.0%	70.0%	80.0%
2.0%	4.0%	8.0%	12.0%	16.0%	20.0%

Source: DSS (Public +Parks & Open Space + Rural+Other+Unmetered) Parks & Open Space consumption = 0

Total Consumption

	(ML/d)	(ML/y)
Total Indoor Demand (Residential + Non-Residential & excluding system leakage	10.6	3,875
Total Outdoor Demand (Residential + Non-Residential & excluding system leaka	8.5	3,091
Total Bulk Demand (Residential + Non-Residential & excluding system leakage)	**19.1**	**6,966**
Total Bulk Demand (Residential + Non-Residential + system leakage)		**7,519**

Total % Reduction for each Level					
1.1%	1.1%	2.4%	5.4%	8.3%	10.8%
7.4%	13.9%	21.3%	28.6%	33.0%	38.9%
8.5%	**15.0%**	**23.6%**	**34.0%**	**41.3%**	**49.7%**
8.1%	**14.2%**	**22.5%**	**32.4%**	**39.4%**	**47.5%**

Target and Expected Residential Water Consumption per Person

Water Restrictions Levels		LEVEL 1 Low	LEVEL 2 Moderate	LEVEL 3 High	LEVEL 4 Very high	LEVEL 5 Extreme	LEVEL 6 Critical
BOD Target Water Consumption (L/Person/d)		260	240	220	200	160	120
Residential Consumption per Person (L/Person/d)	304	**278**	**250**	**219**	**183**	**159**	**129**

Total Annual Demand Analyses

Total Annual Consumption Expected by End Use

Description	Category	Reduction Level 1	Reduction Level 2	Reduction Level 3	Reduction Level 4	Reduction Level 5	Reduction Level 6
RES Toilets	Residential	249.7	249.7	249.7	242.0	234.4	229.3
RES Baths	Residential	82.4	82.4	82.4	75.7	67.2	67.2
RES Showers	Residential	622.4	622.4	622.4	571.6	508.1	508.1
RES Taps/Sinks	Residential	219.4	219.4	212.7	201.5	190.3	179.1
RES Dishwashers	Residential	22.5	22.5	21.9	20.7	19.6	18.4
RES Washing Machines	Residential	375.5	375.5	364.1	344.9	344.9	306.6
RES Int. Leakage	Residential	82.8	82.8	80.2	76.0	71.8	67.6
RES Ext. Irrigation	Residential	975.5	731.6	487.7	304.8	182.9	61.0
RES Ext. Other	Residential	534.6	450.2	365.8	225.1	168.8	0.0
RES Ext. Leakage	Residential	91.9	90.0	86.3	82.5	78.8	75.0
COM Internal	Commercial	385.7	385.7	373.9	354.2	334.5	314.9
COM External	Commercial	78.7	68.9	54.1	39.4	29.5	19.7
IND Internal	Industrial	746.0	746.0	723.2	685.1	647.1	609.0
IND External	Industrial	67.7	59.2	46.5	33.8	25.4	16.9
OTH Internal	Other	1011.5	1011.5	980.5	928.9	877.3	825.7
OTH External	Other	825.7	722.5	567.7	412.9	309.6	206.4
System Leakage	Leakage	541.6	530.6	508.5	486.4	464.3	442.2

Total Actual

Annual Production (ML/y)	Annual Consumption (ML/y)
6,141	**6,966**
including leakage	**7,519**

20.59

Total Annual Consumption Expected

365.25

Total Demand Expected for each Level including System Leakage (ML/y)					
6,914	**6,451**	**5,828**	**5,086**	**4,555**	**3,947**
Total Demand Expected for each Level including System Leakage (ML/d)					
18.93	**17.66**	**15.95**	**13.92**	**12.47**	**10.81**

Ben Chifley Dam		Sustainable Duration			BOD Water Restrictions Level	Total Demand	Water Demand (End Use Model Results)					Water Loss Assumptions				
							(A)					(B)	(C)	(D)	(E)	(F)
Ben Chifley Dam Storage (Supply Triggers)	Dam Usable volume (excld evap & siltation, less dead volume)	No of days supply before the next level (if no inflow)	Cumulative No. of days supply remaining from Dam			(A+ B+ C+ D+ E+ F)	Estimated Total Annual Demand (incl leakage)	Estimated Total Average Daily Demand (Res.& Non-Res.)	End Use Model Reduction at each Level	Residential Consumption per Person (L/Person/d)	Estimated Peak Day Demand	Irrigators Extratction (assuming = Bathurst Demand)	Pan Evaporation at BCD	Seepage (assuming = evaporation) at BCD, BRC advised that dam seepage is negligible	Evapotrans-piration loss in river transfer (assuming constant at all levels)	Avg. loss to groundwater aquifers in river transfer (assuming constant at all levels)
%	ML	days	days	Months		ML/d	(ML/y)	(ML/d)	%	L/person/day	(ML/d)	ML/d	ML/d	ML/d	ML/d	ML/d
100%	30,800										2.		24.12			
> 40%	9,240				0	68.64	7,519	20.59		304	43.4	20.59	24.12	1.00	2.35	
≤ 40%	9,240	27	273	9.1	1	57.25	6,914	18.93	8.1%	278	39.9	18.93	16.33	1.00	2.06	
≤ 35%	7,700	29	246	8.2	2	53.62	6,451	17.66	14.2%	250	37.2	17.66	15.37	1.00	1.93	
≤ 30%	6,160	32	217	7.2	3	47.93	5,828	15.95	22.5%	219	36.6	15.95	13.29	1.00	1.73	
≤ 25%	4,620	22	185	6.2	4	41.37	5,086	13.92	33.7%	183	31.9	13.92	11.03	1.00	1.49	
≤ 22%	3,696	90	163	5.4	5	24.09	4,555	12.47	40.8%	159	28.6	Irrigators stop extraction	9.75	1.00	0.87	
≤ 15%	1,540	73	73	2.4	6	21.03	3,947	10.81	49.1%	129	22.8	Irrigators stop extraction	8.47	1.00	0.76	
Dead volume 10%	3,080	0	0	0.0	-	-	-	-	-	-	-	Irrigators stop extraction	5.40	1.00		

Appendix D

Application for Exemption from Water Restriction and Water Restriction Exemption Permit

(Source: BSC Drought Contingency and Water Supply Emergency Management Plan, April 2007)

BATHURST REGIONAL COUNCIL	Application for exemption from water restrictions Phone: 6333 6100 Fax: 6331 7211
Business Name:	
Business Address:	
Phone:	Fax:
Type of Business:	
Contact Name:	Position:
Water to be used for: (outline any Government or Statutory requirements e.g. health, safety, hygiene reasons)	
Details of Financial Impacts	
Days per week required:	Hours per day required:
Signature:	Date:
Recommendations (Office Use Only)	

A "Bathurst Regional Council Approved Water User" sign will accompany any approved exemptions. This sign is to be prominently displayed at all times.

BATHURST
REGIONAL
COUNCIL

Water Restriction Exemption Permit

Date
Company Name
Company Address

Permit Number:

Site of Restriction Exemption:

Restriction Level:

Type of Exemptions:

Conditions of Exemptions:

- Xxxxx
- Xxxxx
- Xxxxx
- Xxxxx

Other Information:

1. Penalties will apply to any unauthorised activity or breach of the above conditions.
2. The permitted use sign may only be displayed near where the activity takes place.
3. This permit applies to the current phase of water restrictions only.
4. Bathurst Regional Council may audit or inspect the area of operations.
5. Regularly check Council's website for updates on water restrictions, exemptions conditions and penalties.

For more information on water conservation programs and tips to save water visit www.bathurst.nsw.gov.au or www.savewater.com.au

General Manager

Bathurst Regional Council

Appendix E

Macquarie Bogan Unregulated and Alluvial Water Sources Water Sharing Plan

Rules summary sheet
Macquarie River above Burrendong water source

Water sharing plan	Macquarie Bogan Unregulated and Alluvial Water Sources
Plan commencement	4 October 2012
Term of the plan	10 years

Rules summary

The following rules are a guide only. For more information about your actual licence conditions please call the NSW Office of Water, Dubbo on (02) 6884 2560

Access rules	
Macquarie River above Bathurst management zone	
Cease to pump	Pumping is not permitted when Ben Chifley dam is equal to or less than 22% capacity, which equates to the water level being approximately 700 m at the storage gauge. **Note:** 22% of the capacity of Ben Chifley Dam corresponds to Level 5 water restrictions (Bathurst Regional Council). Up to date information on the capacity of the dam is available on the website of Bathurst Regional Council (www.bathurst.nsw.gov.au/environment/water).
Reference point	Ben Chifley dam storage gauge (563008)
Macquarie River between Bathurst and Evans Plains Creek management zone	
Cease to pump	Pumping is not permitted from natural pools when the water level in the pool is lower than its full capacity. **Note:** 'Full capacity' can be approximated by the pool water level at the point where there is no visible flow into and out of that pool. **Note:** Natural pools include in-river pools found within the channels of rivers and creeks and off-river pools located on flood runners, floodplains and effluents e.g. lakes, lagoons and billabongs. **Note:** For pump sites not within a natural pool, the cease to pump rule is when there is no visible flow at that pump site.
Reference point	Individual natural pool
Macquarie River tributaries management zone	
Cease to pump	Pumping is not permitted from natural pools when the water level in the pool is lower than its full capacity. **Note:** 'Full capacity' can be approximated by the pool water level at the point where there is no visible flow into and out of that pool. **Note:** Natural pools include in-river pools found within the channels of rivers and creeks and off-river pools located on flood runners, floodplains and effluents e.g. lakes, lagoons and billabongs. **Note:** For pump sites not within a natural pool, the cease to pump rule is when there is no visible flow at that pump site.
Reference point	Individual natural pool

Access rules	
Amendment provision	The cease to pump threshold and reference point may be amended by the Minister after year five of the plan, if there are adequate flow records established, and the threshold is set at a level that is more than visible flow and equal to or less than the 95th percentile of flows in January.

Note: These access rules do not apply:

1. if the existing *Water Act 1912* entitlement had more stringent access licence conditions. These existing conditions will be carried forward under the plan and are included in appendix 3.
2. to major water utility, local water utility or unregulated river (town water supply) access licences
3. to water taken for domestic consumption by stock and domestic access licences
4. for the first 5 years of the plan to water taken for stock watering by stock and domestic access licences
5. to water taken from existing dams. Any existing licence conditions associated with a dam will be carried forward under the plan.

Trading rules	
Macquarie River above Bathurst management zone	
INTO management zone	Trades are permitted in from the Campbells River downstream management zone in the Campbells River water source.
WITHIN management zone	Trades are permitted, subject to assessment.
Macquarie River between Bathurst and Evans Plains Creek management zone	
INTO management zone	Trades are permitted in from the Campbells River, Fish River, Queen Charlottes Vale Evans Plains Creek, Summerhill Creek, Turon Crudine River, and Winburndale Rivulet water sources, and the Macquarie River above Bathurst and the Macquarie River tributaries management zones.
WITHIN management zone	Trades are permitted, subject to assessment.
Macquarie River tributaries management zone	
INTO management zone	Trades are permitted in from the Campbells River, Fish River, Queen Charlottes Vale Evans Plains Creek, Summerhill Creek, Turon Crudine River, and Winburndale Rivulet water sources, and the Macquarie River above Bathurst and the Macquarie River between Bathurst and Evans Plains Creek management zones.
WITHIN management zone	Trades are permitted, subject to assessment.

More information about the planning process for the Macquarie Bogan Unregulated and Alluvial Water Sources is available at the NSW Office of Water website: www.water.nsw.gov.au.

NOW 11478/16

Appendix F

Executive Summary of Preliminary Assessment of the Potential for Emergency Groundwater Supply

Executive Summary

This report contains the results of a preliminary assessment of the potential use of groundwater for emergency water supply during drought for the City of Bathurst. The report has been prepared as part of an update of the Bathurst Drought Management Plan.

The Bathurst Local Government Area is well serviced with a reliable surface water supply from Chifley and Winburndale Dams, with water released from Chifley Dam for extraction at the Macquarie River at Bathurst being the primary water source. The development of a drought management plan requires the consideration and assessment of a range of actions triggered by indicators of water stress. In the case of Bathurst, the primary indicator is falling water levels in the Chifley Dam.

This report provides additional information on groundwater resources and availability in the vicinity of the Bathurst Local Government Area (LGA) that will allow informed decisions on the potential use of groundwater as an emergency water supply during times of severe drought.

The scope of work for this groundwater assessment was designed to be undertaken in three stages:

- Stage 1 – Current groundwater capability
- Stage 2 – Groundwater potential
- Stage 3 – Preliminary predictive modelling (for operational and system assessment)

The aquifers in the vicinity of Bathurst consist of two broad types: alluvial aquifers along the courses of the major rivers and creeks of the Macquarie River and its tributaries, and fractured rock aquifers hosted as discrete pockets within the bedrock beneath the alluvial systems and comprising the bulk of the geological landscape in the region. The longer term yields from fractured rock bores are anticipated to be quite low and unable to sustain extended periods of pumping. The greatest flow and best groundwater yields are likely to be obtained in the basal gravels of the alluvium.

The most favourable area for groundwater development in the vicinity of Bathurst is the alluvium of the Macquarie River from the confluence of the Fish and Campbells Rivers to the expanse of the Macquarie River floodplain lying immediately downstream from the city.

The fractured rock aquifers surrounding Bathurst are unlikely to provide a viable emergency supply of water due to the low yields anticipated from bores and thus the need for a prohibitively expensive supply network.

Due to the relatively low volumes of recharge expected from the rivers, streams and surrounding fractured rock aquifer, it is likely that any emergency supply of groundwater will require the short-term mining of the stored water rather than any type of sustainable harvesting.

In periods of extreme drought, where minimal recharge can be anticipated, a total volume of groundwater available may range from 3,000 to 10,000 ML, although only 2,500 to 9,000 ML of this water is in the close proximity Macquarie River Alluvium. A simple pumping analysis suggests the alluvium can support pumping rates sufficient for a well-field to extract a significant proportion of required demand under Level 6 water restrictions of 3,750 ML/annum. The same analysis also suggests that the required spacing of wells may reduce the volumes that can be extracted, but at the same time prolonging the supply.

There is currently a moratorium on new bores into the alluvial aquifers of NSW. Provision of water supply for town water supply, however, can be granted an exemption under the *Water Management Act 2000*.

While the preliminary analysis conducted gives some confidence in the ability of alluvial aquifers to make a significant contribution to an emergency drought water supply, there are a number of uncertainties that could be resolved with some additional monitoring, testing and modeling. The following recommendations are made:

- Council should commence a program of medium-term monitoring of alluvium levels and water chemistry over time in the Macquarie River Alluvium in the vicinity of Bathurst. It is suggested that three locations evenly spaced from the confluence of the Campbells and Fish Rivers to the downstream extent of the Macquarie alluvium near Bathurst would provide the information needed.
- Council should conduct pumping tests in bores adjacent and at a distance from the river to determine appropriate specific yield estimates at these some locations over a period of up to two weeks to establish drawdown curves upon which to base estimates of specific yield and transmissivity.
- An integrated numerical surface and groundwater model should be created to provide better estimates of sustainable extractions under both normal and drought conditions.
- A geophysical survey could also be conducted of the alluvium to help delineate zones of preferential yield.

Sydney

Level 1

189 Kent Street

Sydney, NSW, 2000

Tel: 02 9249 5100

Fax: 02 9251 4011

Email: hsc@hydroscience.net.au

Byron Bay

Unit 6

64 Centennial Circuit

Byron Bay, NSW, 2481

Tel: 02 6639 5600

Fax: 02 6680 9319

Based in Sydney and Byron Bay, HydroScience is an Australian consultancy dedicated to serving the water industry in Australia.

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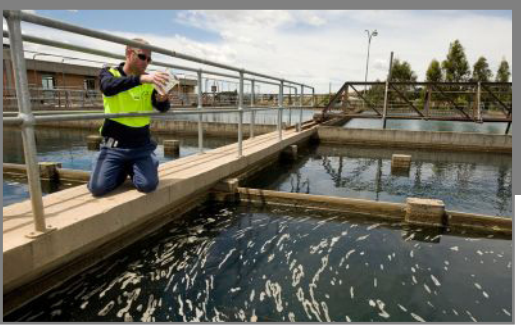

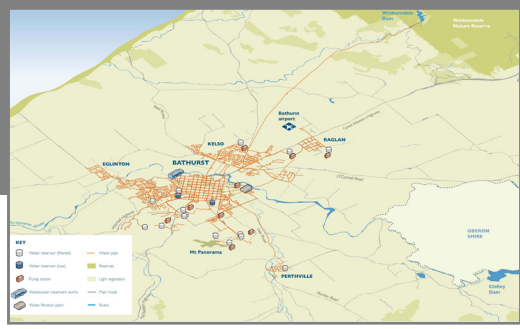

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