

Dubbo City Council Drought Management Plan



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Dubbo City Council

Drought Management Plan

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Executive Summary

This Plan

This Dubbo City Council (DCC) 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 purpose of this plan is to review Council's existing drought management plan (2005), incorporate the Alliance restrictions levels as recommended in the 2010 LMWUA Regional Drought Management Plan and provide a strategic mechanism for managing water supply in the DCC Local Government Area (LGA) during periods of drought.

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 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

This plan is approved by Council and it gives authority to Council's General Manager, in consultation with the Mayor, to declare drought and implement the actions herein described.

DCC sources surface water from the Macquarie River and groundwater from seven bores south of Dubbo. Water from these sources is connected to Council's only water supply scheme which services the township of Dubbo and the villages of Brocklehurst, Wongarbron and Ballimore. The John Gilbert water treatment plant has a current capacity of 80 ML/d.

This drought management plan has been prepared with a view of provide Council with a comprehensive drought management strategy. The NSW Local Government PPRR (Prevention, preparation, response and recovery) emergency management approach has been applied. This approach is expected to provide a more strategic and systematic drought management process to reduce risk to the community and the environment. It involves effectively integrating implementation strategies before (i.e. prevent and prepare), during and after drought events with particular emphasis on response and recovery.

Drought Prevention Strategy

Drought prevention actions are proactive measures that LWUs can undertake in order to increase coping capacity. Prevention actions may be activated/ implemented prior to drought or during drought declared stages. This will be determined at Council's discretion. Preventative actions recommended to DCC are provided in section 6.

Preparedness

Being prepared for drought is essential to lessen the effect and to enhance the capacity of Council and the community to cope with the consequences of drought. Council should have action plans in place ready to be implemented and have ongoing activities to prepare Council staff and the community for those situations, such as training exercises, monitoring and consultation. This is provided in section 7.

Drought Triggers

The water restrictions will be activated when the groundwater and high security surface water allocations levels determined by the NSW Office of Water (NOW) drop to specified levels. Beyond this trigger criteria Council shall decide to commence drought actions as Council sees fit, for example when other nearby councils are in drought.

The DCC drought triggers for implementing drought restrictions are summarised in Table 1. The targeted residential water consumption per person in Dubbo at each water restriction level is also listed below.

Table 1: Dubbo Proposed Water Restrictions Triggers

Supply		Water Restrictions Levels	Demand
Triggers *			Target Residential Consumption (L/person/d)
Macquarie River Allocation ^(High security licences)	Borefields Allocation		
100%	100%	No restriction	382
70%	50%	Level 1 Low	336
60%	50%	Level 2 Moderate	301
50%	50%	Level 3 Moderate to High	295
45%	50%	Level 4 High	245
40%	40%	Level 5 Very High	195
35%	30%	Level 6 Extreme	177

Note * Either the river or borefield criteria can trigger the restriction, not both.

Water Restrictions Definitions

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

Drought Management Team Roles and Responsibilities

Having an identified drought management team allows development of drought management skills and responsibilities prior to the event. The 'Drought Management Team' (DMT) consists of an Incident Manager, Operations Coordinator, Communications Coordinator and the respective teams they control. Table 7 in section 82 lists the roles and their responsibilities during an incident.

Recovery Strategy

The recovery process is set out to support affected communities in the reconstruction of the physical infrastructure and the restoration of emotional, social, economic and physical wellbeing. The DCC recommended recovery action plan is provided in section 9.

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1 Introduction

1.1 General

The Dubbo City Council (DCC) 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.

Dubbo is a member of the Lower Macquarie Water Utilities Alliance (LMWUA) and as a member of the Alliance DCC is committed to comply with their agreements and support the neighbouring councils in times of need, if possible.

The purpose of this plan is to review Council's existing drought management plan (2005), incorporate the Alliance restriction s levels as recommended in the 2010 LMWUA Regional Drought Management Plan and provide a strategic mechanism for managing water supply in the DCC Local Government Area (LGA) during periods of drought.

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 in place and be ready to implement their plan when drought conditions arise. This plan satisfies the guidelines requirement. A copy of NSW Office of Water's Best-Practice Guidelines Drought Management checklist is included in Appendix A.

1.2 This Plan

This drought management plan (DMP) provides a combination of long-term and short-term management actions to respond to drought incidents and lists who is responsible for acting upon those situations. The aims of this plan are:

- ❑ 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
- ❑ Outline procedures to Council staff so as to respond to and mitigate issues drought related
- ❑ Enable timely warning to appropriate personnel to implement appropriate actions
- ❑ To document how DCC will manage the water supply scheme during water shortages due to drought

This plan has several 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

1.3 The Innovative Drought Management Process

The NSW Local Government has adopted some emergency management approaches to manage emergencies. One of the approaches is known as the Comprehensive approach or PPRR (Prevention, preparation, response and recovery) approach. The PPRR management process is a continuous process which involves effectively integrating implementation strategies before (i.e. prevent and prepare), during and after drought events with particular emphasis on response and recovery.

Droughts are by their nature a slow moving emergency. In order to provide Council with a comprehensive drought management strategy, the PPRR principles have been applied in the preparation of this plan. This approach is expected to provide a more strategic and systematic drought management process to reduce risk to the community and the environment. Below is the circle of drought management stages.



Figure 1: PPRR Drought Management Process

An overview of the four phases is provided below:

1. Prevention

This phase consists of taking actions to reduce or eliminate the likelihood or effects of drought related issues. The occurrence of the water availability reduction due to drought is unlikely to be preventable. It is therefore important to understand the climate patterns, water sharing plans rules, past drought events and their impacts to the water supply system. It is also very important, especially during drought, to monitor water availability and demand to ensure a secure water supply to customers and/or activate pre-determined supply and/or demand actions (i.e. Response phase). DCC's monitoring requirements are outlined in section 73.

In some circumstances the acquisition of capital works, such as building additional water storage, might minimise the effects of drought. Some prevention actions recommended for DCC are provided in section 6.

2. Preparedness

The development of this drought management plan is a key step in the preparedness phase of the drought management approach. This is about developing strategies for drought situations before an incident to ensure effective response and recovery. The purposes of being prepared for drought and emergencies are to lessen the effect and to enhance the capacity of Council and the community to cope with the consequences of drought situations. DCC's recommended drought preparation actions are provided in section 7.

3. Response

This phase consists of having appropriate actions in place to control, contain or minimise the impacts of an incident. Having a set of actions ready to be implemented, such as activating water restrictions, allows Council to respond to the problem in a timely manner and to ensure the immediate consequences of an event are minimised. A great deal of this report is devoted to identify the actions once drought has been triggered. DCC's drought response strategy is provided in section 8.

4. Recovery

This phase includes measures which support Council and the community affected by emergencies in the restoration of 'normal' water supply conditions. It provides actions to assist the community and business to recover from the impacts of drought. Having a pre-developed drought recovery process assists Council in minimising disruption and recovery time. DCC's recovery strategy is provided in section 9.

This plan describes the actions that Council shall use in the prevention, preparedness, response and recovery stages of a drought incident.

Background Information

2 Dubbo Water Supply Scheme

2.1 Location

Dubbo is located around 350 km north-west of Sydney on the western plains. It is one of the largest urban centres within the Macquarie-Castlereagh region. It has become one of the state’s largest inland cities with an estimated residential population of approximately 40,500 and this number is continuing to increase at a steady rate of 1%.



Figure 2: Location Map

2.2 Existing Water Supply Scheme

Council owns and operates one water supply scheme which services the township of Dubbo and the villages of Brocklehurst, Wongarbon and Ballimore.

Dubbo Water Supply Scheme (WSS) sources surface water from the Macquarie River (releases from Burrendong Dam) and from seven bores located in South of Dubbo. Both water sources are connected to the existing John Gilbert water treatment plant (WTP) (capacity ~ 80 ML/d) and treated water is stored at the two clear water tanks located at the WTP. The water is then transferred to the service reservoirs located at West Dubbo, Central Dubbo and East Dubbo and then gravity feed to the reticulation system. The town has around 82 ML of total service reservoir storage providing the town with approximately 1 day emergency storage at the peak rate. Dubbo water supply scheme layout plan is provided in Figure 3.

The serviced population as in June 2013 was approximately 34,500 people. Council expects this population to increase to approximately 48,400 in 2044 (i.e. 40% increase).

The water quality in the Macquarie River is highly variable. Water quality is influenced by flows in the unregulated Bell River which joins the Macquarie River downstream of Burrendong Dam. The quality of water sourced from groundwater, while uniformly hard, is good. There is a little variability of groundwater quality.

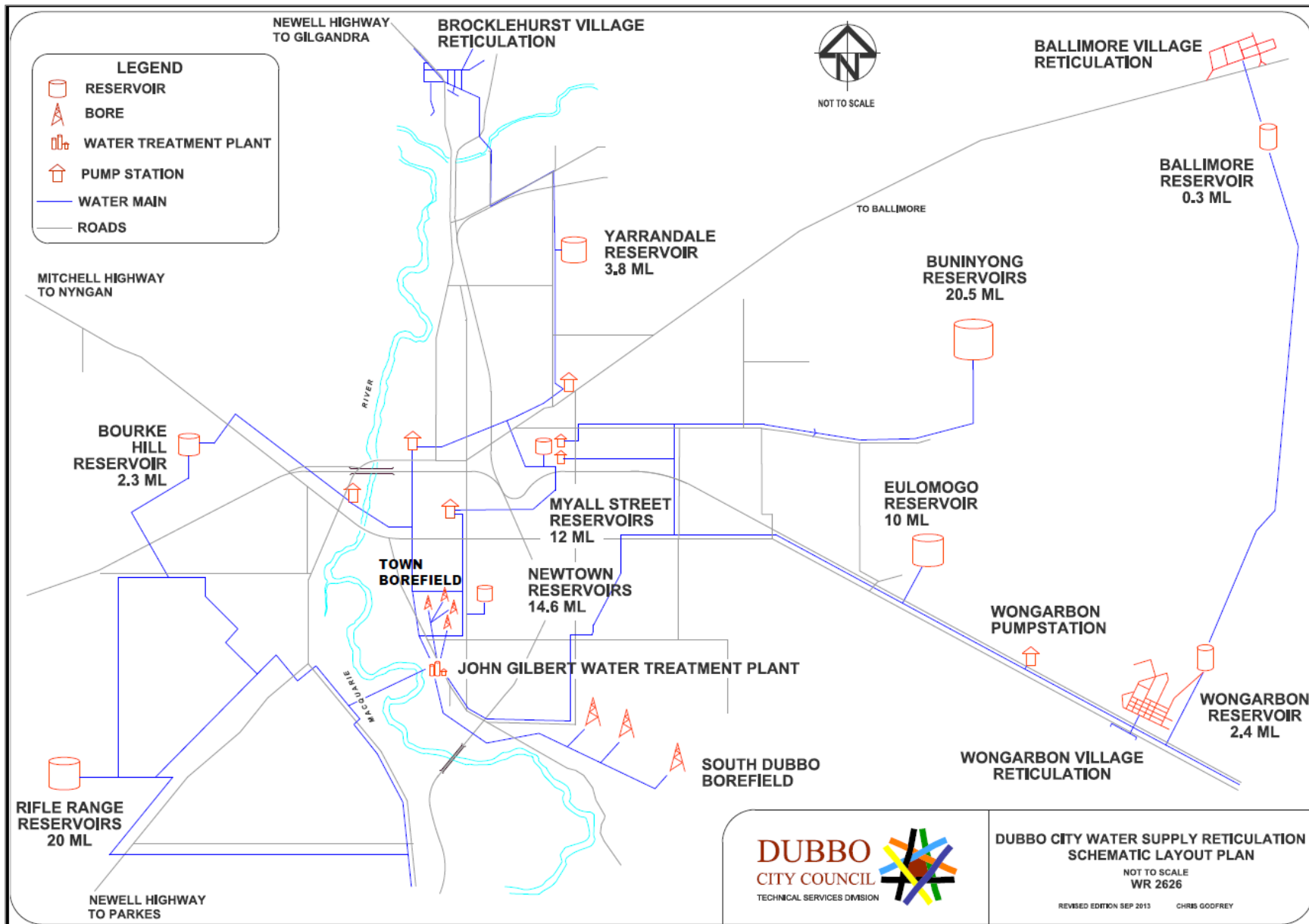


Figure 3: Dubbo Water Supply Scheme Layout Plan

2.3 Existing Water Sources

2.3.1 Macquarie River

The Macquarie River is a regulated river controlled by intentional water releases from the Burrendong Dam which is situated 40 kilometres upstream of Dubbo Township. The NSW State Water controls the operation of Burrendong Dam. A weir built in the 1940s provides a weir pool for Council to extract raw water through the two raw water pumps located at the weir pool.

Burrendong Dam holds 1,188,000 ML when completely full. Dubbo and the other towns on the Macquarie River use less than 2% of the annual volume of water that flows down the river valley. Water available to the towns (from the Macquarie system) is determined by the Water Sharing Plan allocations for each town water supply system. The DCC town water entitlement is 8,700 ML/year released from Burrendong Dam (water access licence 80UA700006). (Source: Dubbo Demand Management Plan, April 2010).

2.3.2 Burrendong Dam Drought History

The great majority of the water supplied to Dubbo from the Macquarie River is sourced from State Water's Burrendong Dam located upstream of Dubbo and Wellington.

State Water staff (Source: email 5 November 2014) have advised that:

"Since commissioning, Burrendong Dam levels have dropped below 10% of conservation capacity about 5 times (June 1995, Jan 1998, Apr 2003, May 2004 and Jan 2007). And got closer to 10% twice, May 1983:11.2%, Feb 2010: 10.5%.

Since the introduction of volumetric allocation in the Macquarie Cudgegong in Sept 1981 the allocation for Town Water Supply has been reduced below 100% only once, in 2007-08. "

State Water Staff have provided historical data on the Burrendong Dam's volumes. These have been graphed in Figure 4.

The graph clearly illustrates the fact that the extremely low levels in 2007 were not dissimilar to 1998 and that from 1994 to 1998 and from 2003 to 2010 the dam volumes were often low.

This graph indicates how vital drought management planning is to Dubbo City Council.

When Burrendong is at very low levels releases of water to the Macquarie Rive to supply major towns such as Dubbo have very large impacts on the dam's sustainable supply.

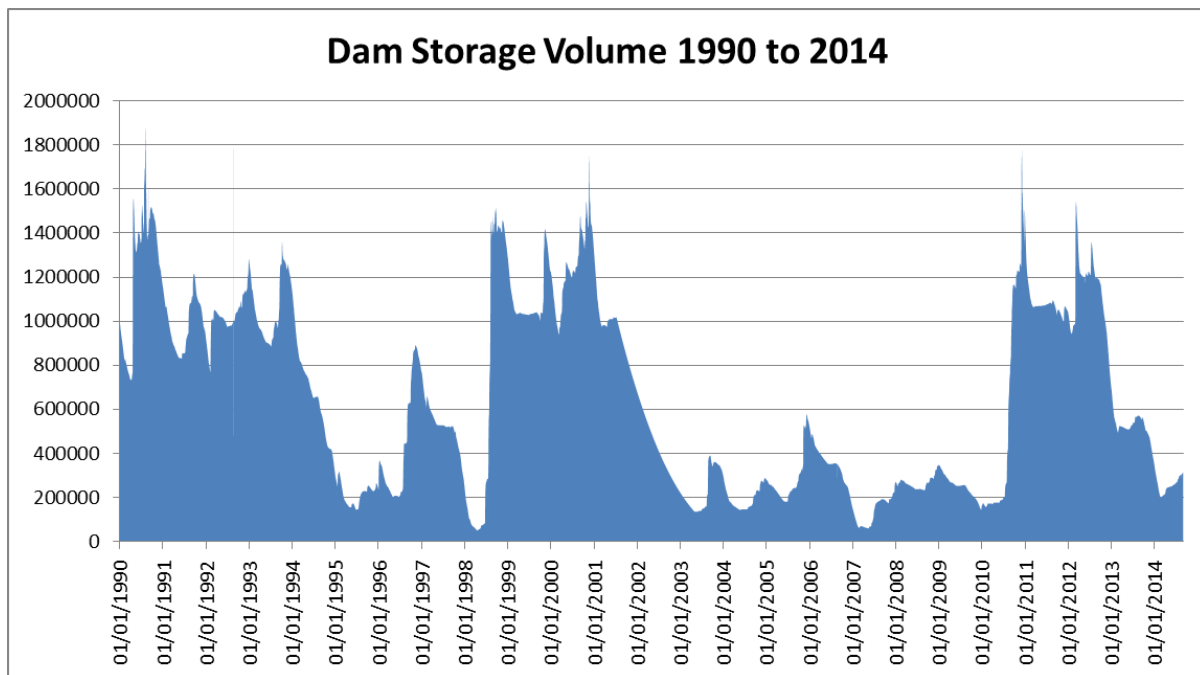


Figure 4: Burrendong Dam Historical Volumes

2.3.3 Groundwater

The Upper Macquarie Alluvium groundwater resource covers 414 km² and is located in the Upper Macquarie catchment area. Currently, there is no groundwater sharing plan for the Upper Macquarie Alluvium Groundwater source. A macro groundwater sharing plan is expected to be implemented in the near future (Source: Dubbo Demand Management Plan, April 2010).

Council holds seven town water bore licences with a total water extraction limit of 3,850 ML/year (See Table 2).

Table 2: Summary of Bore Water Licenses

WAL* Number	Bore Filed	Annual Extraction Limit (ML/Year)	Maximum Licence Yield (L/s)
80BL241650	Shibbles Bores 1	Combined Allocation 3850 ML/year	65
80BL239439	Shibbles Bores 2		45.6
80BL106337	Wheelers Lane Bore		59.2
80BL109158	Harpers Bore		33
80BL109156	Thorby Avenue Bore		32
80BL109155	Ronald Street Bore		32
80BL109157	Driftwells Bore		30

* WAL – Water Access Licence

2.3.4 Groundwater Options

In May 2010 GHD prepared the “Dubbo City Council Report for Groundwater Supply Strategy”. The Executive Summary of this report is in Appendix F.

Dubbo City Council commissioned the report in support of development a Groundwater Supply and Drought Management Strategy. It is a hydrogeological investigation of the alluvial aquifer which underlies the Upper Macquarie River in the vicinity of Dubbo. The primary objective of the study was to:

- ❑ Identify and appraise alternative schemes involving abstraction of groundwater resources from the Macquarie River alluvium within the study area to assist with meeting Dubbo’s drought specific and ongoing urban water demands; and
- ❑ Provide a specific strategy to guide DCC toward implementation of preferred schemes

Two potential expansion areas to the south of Dubbo and to the west of the Macquarie River have been identified.

Predictions suggest that DCC could achieve a sustainable increase in the total yield of their groundwater operations to around 100% of current full entitlement levels (i.e. 4300 ML/yr.) through:

- ❑ The acquisition of additional entitlements totalling over 4300 ML/yr. (or 11.7 ML/d) i.e. effectively doubling the current entitlement to around 8600 ML/yr. to allow council to extract 4300 ML/yr. whilst maintaining abstraction at less than 50% of the revised full entitlement; and
- ❑ Splitting abstraction evenly between the existing borefield and the new potential borefield areas to the south

The 2010 report’s strategic recommendations were:

- ❑ Step drawdown tests are recommended in each of the operational DCC bores in order to confirm maximum feasible yields (i.e. the ‘engineering yield’)
- ❑ A suitable borefield management plan should be developed for the DCC operations including a Wellhead Protection Plan
- ❑ Further investigations to confirm the thickness of the alluvial aquifer and potential borehole yields in the two potential expansion areas identified in the current study
- ❑ Engage a suitably experienced and qualified water trader to further investigate the feasibility of acquiring additional groundwater entitlements in the area
- ❑ Consider opportunities for and impediments to managed aquifer recharge

2.4 Water Demand

2.4.1 Current and Historical Water Usage

The current breakdown of Dubbo water supply consumption by customer type is shown in Figure 5. 69% of the potable water is used by residential customers, followed by 11% and 10% by commercial and other (i.e. parks and gardens, sport fields, Council’s buildings and farmland) customer category, respectively. This indicates that drought restrictions should mainly target these customer categories.

The historical water consumption breakdown by each customer category over the past nine years is showed in Figure 6. 2006/07 was a drought year (i.e. drought restriction level 2 adopted – see section 33), and even though there were restrictions in place for 6 months, that was the highest annual demand recorded. There are a few potential reasons for this high demand in 2006/07:

- ❑ Severe drought, thus increasing irrigation to keep the vegetation alive and increase usage of evaporative coolers (i.e. currently about 65% of the residential customers have evaporative coolers)
- ❑ Lack of commitment and compliance with water restrictions. Council should implement drought restriction monitoring (see section 73) to ensure the customers comply with water reductions actions
- ❑ Error in the data records. Water consumption figures from 2004 until 2008 are from DCC 2010 Demand Management Plan and data from 2009 onwards is from Council’s water tariff data base. Council may check the accuracy of the data

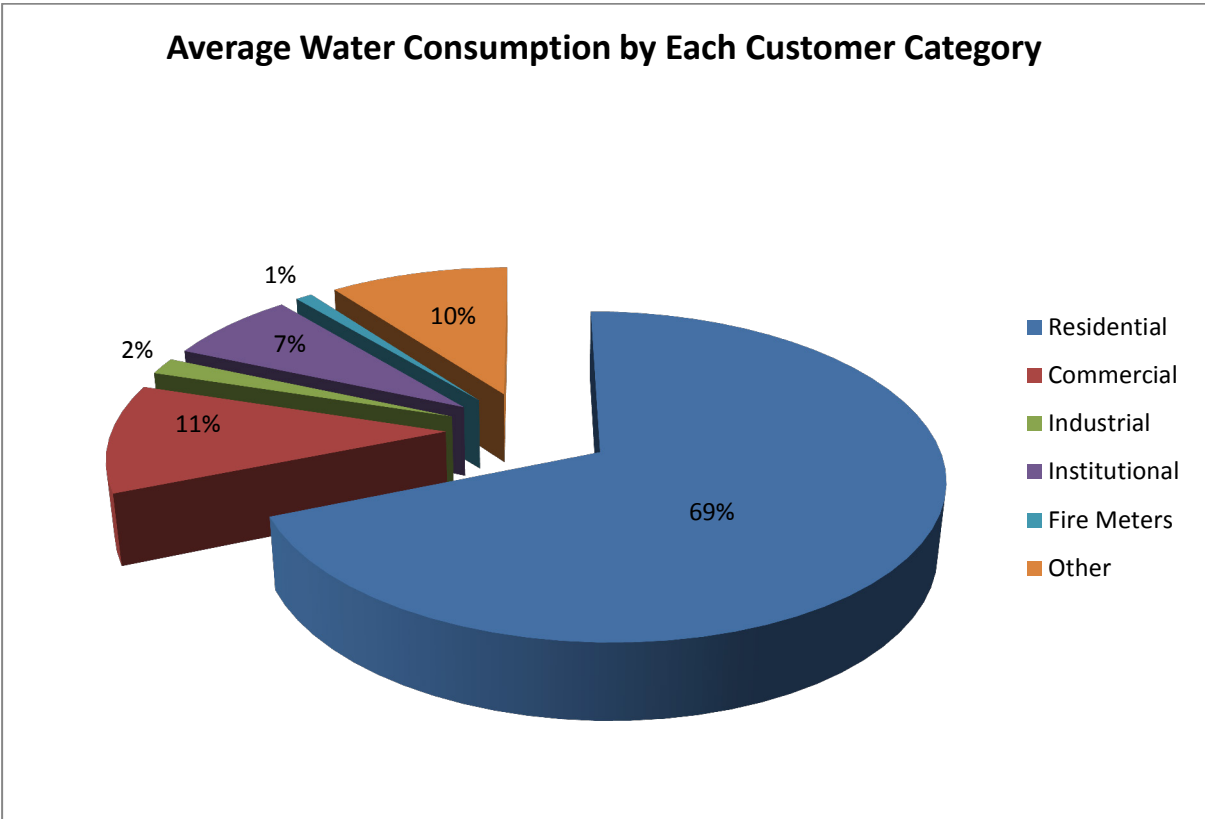


Figure 5: Average Annual Water Consumption by Each Customer Category

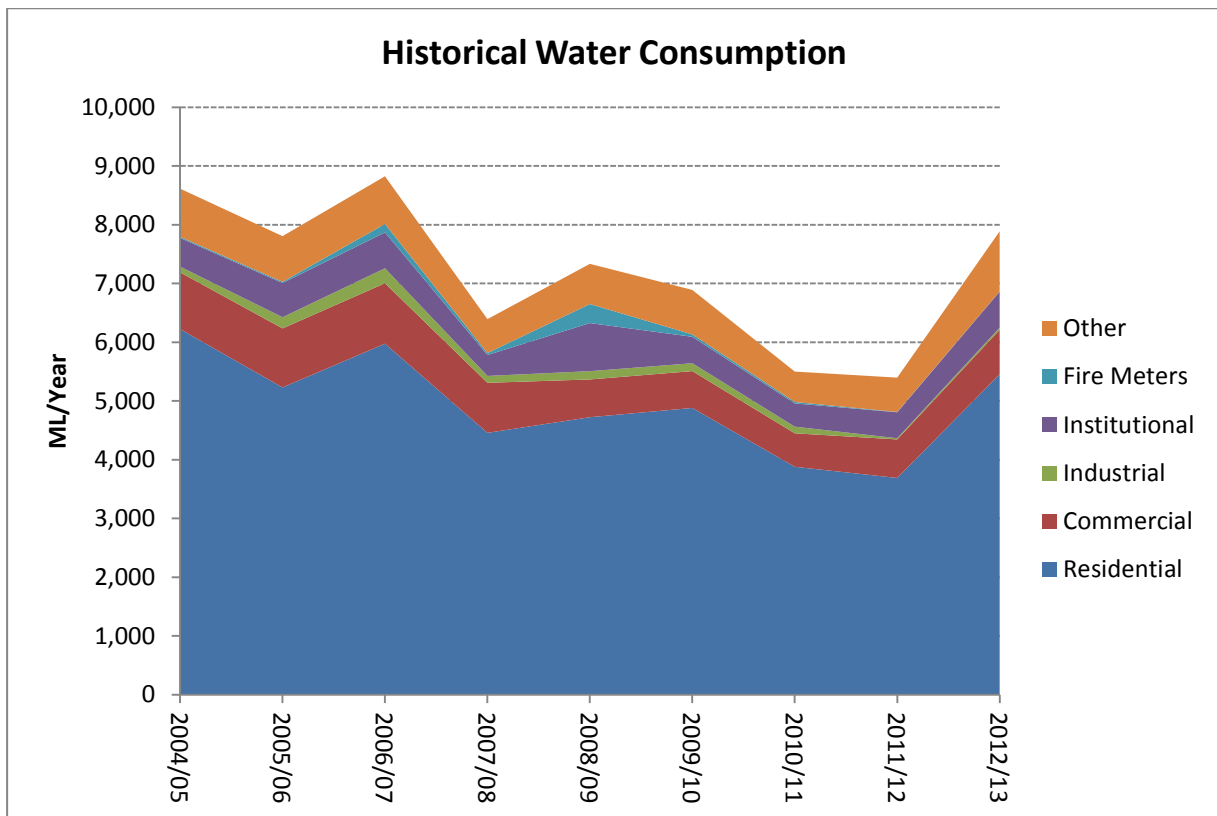


Figure 6: Water Consumption Trend from 2004 to 2013

The 2012/13 average annual residential water supplied (i.e. 365 kL/property/year) is higher than the state wide median for inland LWUs of 257 kL per property. The average annual residential water supplied in Dubbo in the last few years is provided in Table 3.

Table 3: Dubbo Average Annual Residential Demand (kL/property/year)

	2008/09	2009/10	2010/11	2011/12	2012/13
Average annual demand	331	329	263	249	365

Source: NSW Office of Water, Benchmarking Reports

The high residential water consumption in Dubbo makes it harder for the residential users to achieve the BOD (Bathurst, Orange and Dubbo) target water consumption (see section 8.3.2) during water restrictions. Council should closely monitor the residential demand in each stage of water restrictions to ensure reduction in consumption due to the demand-side actions implementation.

2.4.2 Top Water Consumers

The top 10 water users in Dubbo are listed in Table 4.

Table 4: Top Water Users

Customer	Customer Type	Average Annual Consumption
Dubbo Base Hospital	Institutional	94 ML
ST Johns High School	Institutional	34 ML
Mags – Macquarie Anglican Grammar School	Institutional	28 ML
South Dubbo Public School	Institutional	27 ML
Christian School	Institutional	22 ML
Fussy Cat Pet Foods	Industrial	22 ML
Fletchers - Farmland	Industrial	21 ML
Retirement Village Aged Care	Residential	21 ML
TAFE White St Campus	Institutional	19 ML
Macquarie Inn	Commercial	19 ML
Horizon's Village – Aged Care Accommodation	Residential	18 ML

Most of the larger water users in Dubbo are institutional and industrial customers. Hospitals are normally the last water users to have restrictions in place. It is recommended that DCC approaches these major water users in advance of drought to make special arrangements for water restrictions during droughts. For example, Council could meet in a non-drought period, with major industrial users or parks and Landcare services to discuss possible voluntary early actions to reduce non-essential consumption e.g. garden irrigation.

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 services, production and/or staffing levels. Council should take this into consideration when preparing special arrangements with each customer.

Other considerations with respect to restrictions are:

- ❑ Lower levels of water restrictions will try to avoid key customers whom the community does not want to see targeted in the early parts of the drought. These include nursing homes, hospitals and some large business
- ❑ Higher levels of water restriction will seek that all sectors bear the impact of any water restrictions but planning should be such that these levels (which hopefully will not be reached except in short term system emergencies such as the loss or part of the treatment plant) won't be required
- ❑ Having exemptions in place for those that do not readily fit within the restrictions systems such as hospitals and shift workers

2.4.3 Dry Year Annual Demand Analyses

A rainfall data analyses was undertaken using daily rainfall SILO data to identify the driest year for the period analysed. It turned out that 2012/13 was the driest year of the past 5 years and based on Council's records it is also the year with the highest annual demand within the period analysed.

DCC's Demand Management Plan (November 2014) contains Dubbo's annual demand analyses including climate corrected demand to estimate the impacts of climate on demand. Table 5 outlines the outcomes of these analyses. The climate corrected annual demand in 2012/13 is lower than the actual demand because that is the expected demand if the weather was relatively 'normal' (i.e. average climate conditions). In other words the climate correction model 'normalizes' the demand.

Table 5: Annual Demand in Dubbo

	2008/09	2009/10	2010/11	2011/12	2012/13
Rainfall	552.8	696.3	719.2	827.0	436.5
Observed (ML/year)	7,825	8,361	6,672	6,414	9,069
Climate Corrected (ML/year)	7,727	8,394	7,807	7,748	8,041

For the purposes of this drought management plan a dry year annual baseline demand analysis is undertaken to demonstrate the potential severity of drought in water demand. This is a conservative approach that Council may take into consideration when planning for drought. Figure 7 shows the baseline demand forecast which is based on the climate corrected demand, from the Demand Management Plan. It also shows the baseline forecast based on the historical dry year demand. The latter is the worst case scenario, it assumes that demand will remain high due to potential increased temperature and lower rainfall events. Both analyses assume population growth rate of 0.8%. These baseline forecasts assume Council will not implement any further demand management measures.

DCC currently holds total town water extraction licenses of 12,550 ML/year, comprising 8,700 ML/year in surface water extraction licenses and 3,850 ML/year in groundwater extraction licenses. Based on the estimated sustainable yield of the aquifer, concerns over aquifer drawdown have led to DCC adopting on voluntary groundwater extraction limit in the past (shown in Figure 7). This situation may occur again in the future.

The conclusion from this preliminary analysis is that if severe climate conditions occur in the future Council may expect high demand and potential drawdown of aquifers leading to potential lack of water availability. Therefore Council should consider having drought strategies in place as described in section 6 of this document and perhaps the implementation of some water conservation measures.

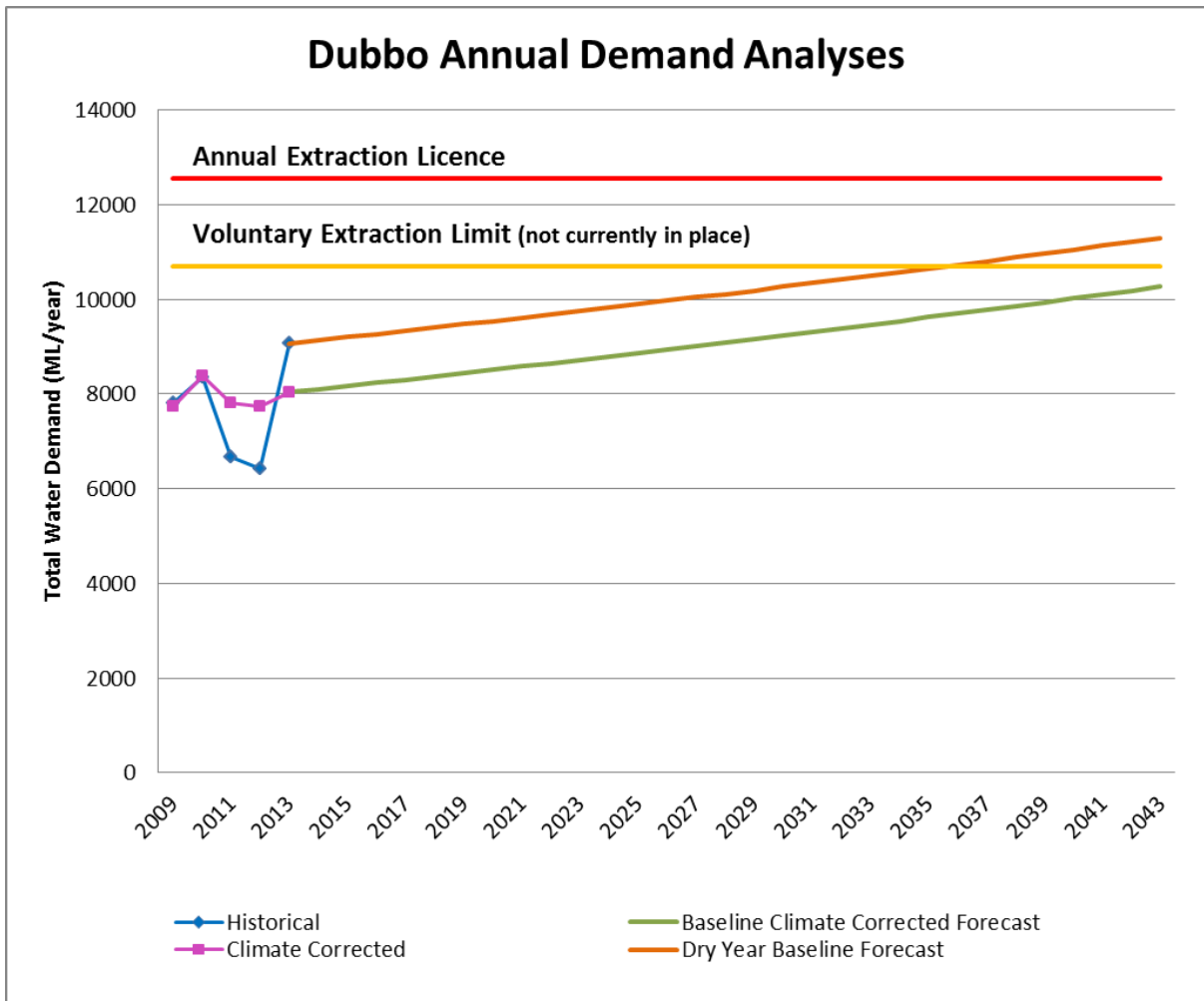
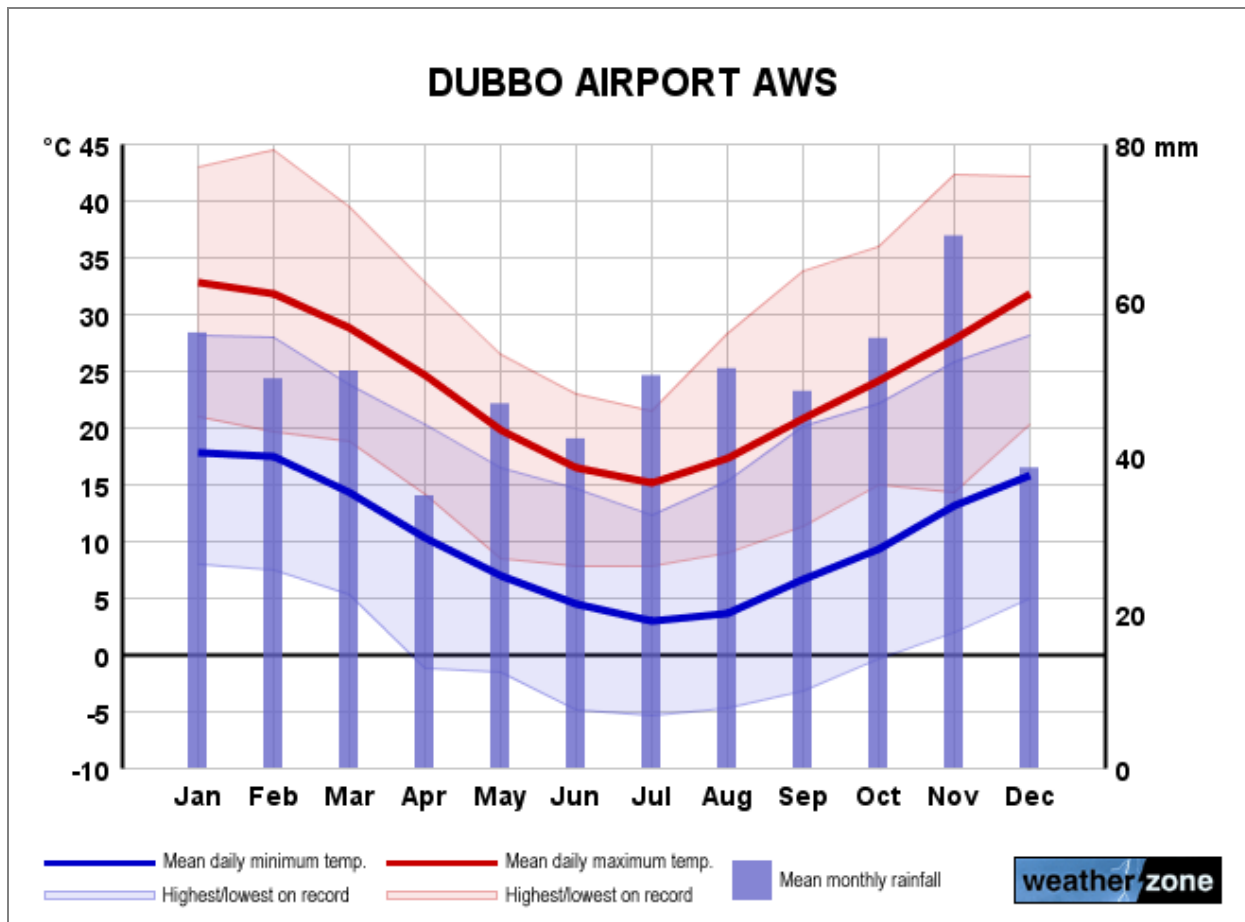


Figure 7: Dubbo Annual Demand Analyses

3 Climate

3.1 Rainfall, Evaporation and Temperature

Dubbo's maximum temperatures regularly exceed the 40°C mark during the summer months. It has an annual rainfall of around 600mm and evaporation figures of approximately 1.8 m/year. Council estimates that approximately 65% of the residential homes have evaporative air coolers fitted and there are a significant number of backyard swimming pools somewhat ensuring that Dubbo residents will have a higher need for water, than their coastal counterparts.



3.2 Climate Change

A rainfall-runoff modelling with climate change projections was developed as part of the 2008 CSIRO Water Availability in the Macquarie-Castlereagh report. The outcomes of the modelling based on estimated future climate indicate that future runoff in the Macquarie-Castlereagh region is more likely to decrease than increase. The key messages from the report that are relevant to this study are:

- ❑ Sixty percent of the modelling results show a decrease in runoff and 40 percent of the results show an increase in runoff. The best (median) estimate is a 6 percent reduction in mean annual runoff by ~2030 relative to ~1990. The extreme estimates from the high global warming scenario range from a 25 percent reduction to a 30 percent increase in average annual runoff. The extreme estimates from the low global warming scenario range from an 8 percent reduction to an 8 percent increase in average annual runoff

- ❑ Under the best estimate (or median) 2030 climate scenario there would be reductions of 8 percent in water availability, 9 percent in end-of-system flows and 4 percent in diversions overall. General security water use would decrease by 4 percent. High security irrigation would increase by 4 percent due to increased evapotranspiration and reduced rainfall and town water supply would be unaffected. The climate extremes for 2030 indicate that under the wet extreme there would be increases of 25 percent in water availability, 12 percent in total diversions and 41 percent in end-of-system flows. The dry extreme there would be decreases of 25 percent in water availability, 16 percent in total diversions and 28 percent in end-of-system flows. High security town water supply would be reduced by 2 percent and high security irrigation use would increase by 9 percent

The 2011 report for Strengthening Basin Communities – Enhancing Dubbo’s Irrigation System states that climate change projections for Dubbo suggest:

- ❑ “Average annual temperatures could increase by up to 3°C by 2050
- ❑ Summer rainfall could increase by approximately 1 percent, whereas autumn rainfall might decrease by up to 2 percent. However, winter and spring rainfall could decrease by up to 12 percent by 2030. These trends are likely to intensify by 2050; and
- ❑ Average annual runoff is projected to decrease by up to 13 percent by 2030. This reduction is linked to a number of variables including reduced rainfall, higher evaporation and lower soil moisture. Summer and autumn runoff are unlikely to change significantly, while winter and spring will experience a considerable decline. This trend is likely to intensify after 2030”

It is important to note that these changes in rainfall and runoff mentioned in the 2011 report, describe potential changes to averages. As such, small changes in averages could ‘mask’ more significant changes to rainfall variability or extremes. At the time of writing the 2011 report, specific projections relating to seasonality of runoff and frequency and duration of extreme dry and wet periods were not available. However:

- ❑ Rainfall in the Dubbo region is projected to become more variable. There will be fewer rainy days, but rain will fall in more intense bursts; and
- ❑ Flood-producing rainfall events are likely to increase in frequency and intensity. Changes to short, intense rainfall events are likely to increase flooding from smaller urban streams and drainage systems

3.3 Drought Restrictions History

Dubbo had a few droughts during the 1980’s and 1990’s; however restrictions were implemented only in the early 1980’s. There are no records of water restrictions between 1998 and 2002. From there onwards the following restrictions were recorded:

- ❑ 2002/03 – 2 December to 3 January, voluntary water restrictions
- ❑ 2003/04 – December to January, voluntary water restrictions
 - Avoid using all watering systems or sprinklers between 9am and 7pm (excluding drip irrigation systems)
 - Do not hose hard surfaces at any time, except where required for firefighting
- ❑ 2004 – 6 to 8 January and 6 to 7 February, mandatory restriction due to distribution and treatment problems (no specific water restriction level identified)
- ❑ 2005/06 – December to January, voluntary water restrictions (no specific water restriction level identified)

- ❑ 2006 – 6 to 9 January, compulsory restrictions. Council did not formally adopt any policy on water restriction levels:
 - No external watering between 9 am and 6 pm
 - Only hand held hoses allowed outside these times
 - No filling of swimming pools
- ❑ 2006 – 9 January, compulsory restrictions introduced. Council did not formally adopt any policy on water restriction levels:
 - House number odds and evens system. Sprinklers and watering systems allowed between 6am to 9am and 7pm to 10pm). Restrictions introduced due to heat wave
- ❑ 2006/07 – 1 October 2006 to 31 March 2007, Level 2 water restrictions adopted:
 - Odds & evens system, 3 hours of watering allowed during am and pm
- ❑ 2008/09 – 1 December 2008 to 28 February 2009, Level 1 water restrictions

3.4 Effects of Restrictions on Water Demand

Figure 8 shows the historical per capita water production in Dubbo. The graph shows that water consumption during restrictions level 2 and 1 in 2006/07 and 2008/09, respectively, have not significantly reduced.

Based on historical data it is unfair to say whether restrictions are efficient in Dubbo water supply system or not. Council should have a monitoring program in place (see section 73) to closely review daily water consumption and reduction during drought to ensure the sustainability of the water supply system.

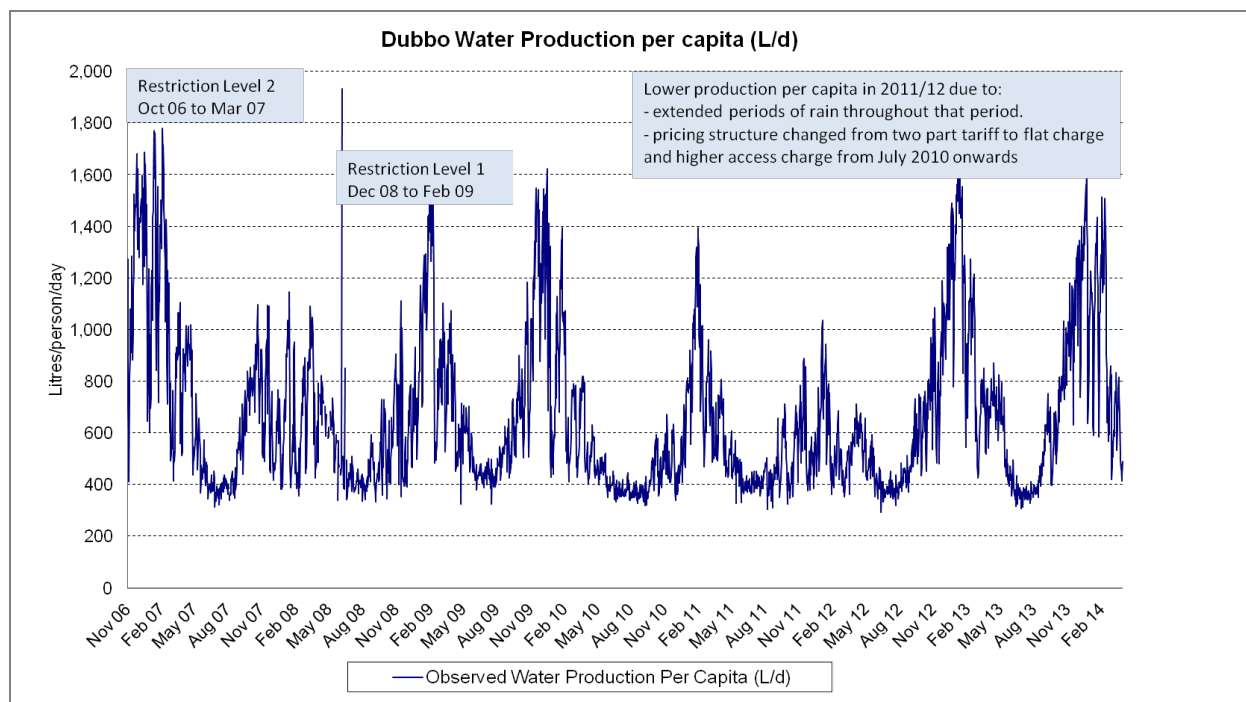


Figure 8: Historical Per capita Water Production

4 Regulatory Framework

4.1 Dubbo City Council

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

Under the Local Government Act (1993) Section 637, "a person who wilfully or negligently wastes or misuses water from a public water supply, or causes any such water to be wasted, is guilty of an offence". The maximum penalty which can apply is:

- ❑ Maximum penalty: 20 penalty units
- ❑ Current (as per September 2014) penalty unit: \$110

Consumers who are identified breaching water restrictions in place may have their supply cut off or restricted by Council in accordance with Clause 144 of the Local Government (General) Regulation (2005).

This plan is administered by the Council. During drought, this plan will be overseen by the Council's Drought Management Team (see section 82). The implementation of this Drought Management Plan will be the responsibility of the Drought Incident Manager.

4.2 NSW Office of Water

4.2.1 General

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 NSW 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. Since the introduction of the Water Management Act 2000, NOW is preparing water sharing plans for rivers and groundwater systems across New South Wales.

4.2.2 Water Sharing Plans

By setting the rules for how water is allocated for the next 10 years, a water sharing plan provides a decade of security for the environment and water users. This not only ensures that water is specifically provided for the environment through a legally binding plan, but also allows licence holders, such as irrigators who require fairly large volumes of water, to plan their business activities.

Water allocation in Dubbo is governed by the Macquarie and Cudgegong Regulated Rivers Water Source Water Sharing Plan. This water sharing plan is due for extension/replacement in July 2014. In May 2014, the Minister approved the extension of the plan until its date of replacement (by 1 July 2015 or sooner). The water sharing plan contains various rules including: environmental water rules, access licence dealing rules, rules for access licences, rules for water supply work approvals, rules for making available water determinations, and water allocation account rules. Detailed information about the plan is provided on NOW's website (<http://www.water.nsw.gov.au/Water-management/Water-sharing-plans/Plans-commenced/Water-source/Macquarie-and-Cudgegong-Regulated-Rivers/default.aspx>)

Council's Water and Sewer Strategic Business Plan (2013/14) states that the proposed water sharing plan (Macquarie and Cudgegong Regulated Rivers) and the Murray Darling Basin Plan may reduce Dubbo's existing water licences.

4.3 Trading Water within the Alliance

As stated in the Regional Drought Management Plan there is a wide range in water demand, allocation and climate, and hence drought impact across the Alliance members. Transfer of rights to allocated water within the Alliance offer a partial solution to the worst effects of percentage allocation reductions. At present there is the option of councils trading water to each other within a licence extraction year. It is understood that some informal transfers may have already been in operation. Unfortunately regulations preclude trading for periods of longer than one year.

4.4 Fire Fighting Requirements

In spite of the water restriction actions, 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.

5 Water Security and Drought Related Issues

One of the issues listed in the 2011 Report for Strengthening Basin Communities is the reduced reliability and security of surface supply and aquifers. The report states that Burrendong Dam levels were below 50 percent from 2002/03 to 2005/06 and below 30 percent from 2006/07 to 2009/10, with a record low of less than 5 percent in February 2007. Level 2 water restrictions were implemented during 2007-08 in response to these low storage levels.

Due to the increasing severity of the drought, the (then) Minister for Climate Change, Environment and Water suspended the water sharing plan in July 2007, and reduced the commencing allocation from Council's river licence from 8,700 ML/year to 6,090 ML/year (i.e. 70%), which is a reduction of 2,610 ML/year. The commencing allocation is a target allocation, which, in general, will not be reduced in that corresponding water allocation year. However, this allocation can be increased any time under a favourable situation. On 21 December 2007, the DCC allocation was increased to 80% and the full allocation was restored on 3 January 2008 as a result of significant rainfall in the catchment.

It is possible that a decrease in rainfall and runoff, combined with an increase in rainfall variability, and frequency and severity of drought may cause a recurrence of low storage levels or possibly more severe water shortages at Burrendong Dam. In this case, it is likely that both town water and general security (i.e. used at Council's open spaces) allocations would be reduced, limiting the surface water availability to DCC.

DCC largely relies on surface water supplies for its urban water supply system, with 70 to 80 percent of potable water being sourced from the Macquarie River and a minimum of 20 percent sourced from groundwater. Although the alluvial aquifer provided a stable source of water supply over the last four decades, long term declining trends are occurring in some areas in response to groundwater pumping. In particular, groundwater levels in the Hennessey Road area, the location of the South Dubbo Borefield, fell up to 18 m since commencement of monitoring in the early 1970s.

An increase extreme rainfall variability and frequency and severity of drought will exacerbate the trend of falling water levels and reduce the reliability and security of DCC's surface and groundwater resources. A recurrence of low storage levels in Burrendong Dam and a declining reliability and security of groundwater sources will leave DCC vulnerable to significant water shortages. A sustained low storage event would mean that severe water restrictions may need to be implemented (Source: Dubbo City Council Report for Strengthening Basin Communities - Planning Study Business Case - Water Use Efficiency, October 2011).

There is a concern that the proposed water sharing plan (Macquarie and Cudgong Regulated Rivers) currently under review, may reduce Dubbo's existing water licences (Source: DCC Strategic Business Plan, 2013/14).

Prevention

6 Drought Prevention Strategy

Drought prevention actions are proactive measures that LWUs can undertake in order to increase coping capacity. Prevention actions may be activated/implemented prior to drought or during drought declared periods. This will be determined at Council's discretion.

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 alternative water resources available within DCC LGA are scarce. Some of these alternative water resources require short-term actions that Council may quickly implement in case of emergency or at initial stages of drought. Some are long-term actions which may require several studies (i.e. environmental studies, concept and detailed design) therefore requiring a long timeframe before implementation. Some prevention actions that DCC may consider are:

6.1 Short-term Actions

6.1.1 Voluntary Water Restrictions

When a water sources availability is approaching the level that would trigger the implementation of water restrictions, Council may start a pre-activation of voluntary water restrictions (i.e. Implementation of water conservation measures).

Council may use the media to communicate the importance of using saving water measures, especially in times approaching drought.

6.1.2 Drought Water Pricing

DCC implemented a flat charge water pricing structure in 2010/2011. Council should consider the increase of the water charge, before and/or during drought declared periods to discourage water use. The use of a flat scarcity pricing structure could be implemented in times of water scarcity.

Council shall monitor how the price increase impacts demand during dry periods to assess the effectiveness of this action.

6.1.3 Obtaining Additional Groundwater and River Licences

Council has existing town water licences and a number of general security licences. In years of drought the allocations for general security licences are reduced, often to zero. General security licences have carry over provisions under the existing water sharing plan. In cases of critical water shortage, some of this carry over may still be available. General security licences may be purchased on the market..

High security licences are also reduced in drought years but often only to 70% while town water licences are often not reduced below their face value. Council could buy high security licences. In December 2009 Council purchased 33 megalitres of high security water licences at a unit cost of

\$3,400 per megalitre. The problem remains that these licences do not have the security of town water supply licences. Buying, or selling, town water supply licences is not permitted.

Council could consider purchasing additional groundwater from other groundwater extractors and this program could be accelerated during drought years. However, purchasing groundwater entitlement does not solve the problem if the aquifer cannot yield amounts required without impacting others. Potentially the costs of this water will be high, but when compared to the costs to the community of implementing high levels of water restrictions, taking such an action may still be worthwhile. Accessing a reliable groundwater source is the long term solution.

These processes can take considerable time and initial approaches need to be made to the larger irrigators in close proximity to Dubbo to determine if appropriate contractual arrangements can be reached in times of need.

Council has engaged a consultant, Aither, to assist Council with the management of its water licence portfolio. This will facilitate Council's entry into the water market where it may buy, sell and trade in temporary licences allocations. Council may also transfer licences to General Security to take advantage of General Security carry over provisions as a drought security measure. Carry overs are not available for town water security licences. As part of this work, Council will develop and abide by a code of contact for water trading.

See Appendix E for further details including costings from the Dubbo Options for Water Supply Sustainable Report (May 2009).

6.1.4 New Borefield

The need for new borefield(s) is essentially to survive a future drought of record when the river ceases to flow for days or weeks at a time. The need for these borefield(s) arose from a Drought Security Study.

In reality, if and when these borefields are developed, Council will use them for day to day to supply town demand. However Council will have gone down that track not because they are needed to service town growth, but because the new borefields will disconnect Council from reliance on the river during that inevitable drought of record. The borefields are economically justifiable because the alternative is a pipe all the way back to Burrendong Dam (section 6.2.1), which is much more expensive (3 to 5 times more).

Council may, subject to existing powers of veto of existing bore owners, drill a bore for town water use. Bores for town water use are excluded from the Murray Darling Cap. Council is presently undertaking a groundwater study with a view to acquiring additional groundwater resources in the future. (Source: DCC Water and Wastewater SBP 2013/14).

For further information about this option refer to Dubbo City Council Report for Groundwater Supply Strategy - Interim Groundwater Supply Evaluation (2010). The executive summary of this report is provided in Appendix F.

6.2 Long-term Actions

6.2.1 Pipeline from Burrendong Dam to Dubbo via Wellington

A long-term option may be to construct a pipeline from Burrendong Dam to Dubbo via Wellington. This option can't be readily implemented to minimise the impacts of drought. However it can be considered as a preventative drought management measure.

During extreme drought when Lake Burrendong is very low this pipeline would be expected to extend supply by radically reducing transfer losses to Wellington and Dubbo. The 2010 Regional Drought Management Plan proposed a raw water supply pipeline from Burrendong Dam to Dubbo probably via Wellington. This is one of the 4 options identified for increasing water supply to Dubbo in the Dubbo Options for Water Supply Sustainable report (May 2009). See Appendix E for further details including costings from the 2009 report.

6.2.2 Piping Groundwater from Narromine or Gilgandra to Dubbo

A long-term option for Dubbo is to pipe water from groundwater sources. These will not be affected unduly by predicted medium term climate change impacts, such as reduced rainfall, increased evaporation, longer storage time exfiltration losses that would reduce Burrendong Dam yields.

The townships of Gilgandra and Narromine access high quality water from aquifers. Subject to detailed hydro geological studies and more detailed engineering analysis it is possible that such aquifers could also supply town water to Dubbo and its dependent villages. Extraction rates from such aquifers would be expected to be able to meet average day demand with the need for additional storage at Dubbo to cover peak day demand.

In these options it is assumed that the raw water would require no treatment prior to pumping to Dubbo for treatment and distribution. A transfer storage tank would be required at the bore field prior to pumping to Dubbo. Transfer of water at average day demand would require additional storage at Dubbo for peak day demand.

Preliminary assessments of these options made in 2009 estimated "order of costs" as follows:

- ❑ At average day demand from Gilgandra \$77M.
- ❑ At average day demand from Narromine \$51M.

(For more detail see Appendix E: Summarising the DCC Water Supply Options for Water Supply Sustainability, DRAFT, 26 May 2009)

6.2.3 Off Stream Storage

Building a large off stream storage and divert river flows into it to assist with years when a full river allocation is not available is an option considered in the 2005 DCC Drought Management Plan. This option might be attractive if there were no other options available as it will have problems such as:

- ❑ Evaporation, mandating a very deep storage
- ❑ Finding an ideal location, as the size of the storage pond would be large
- ❑ Knowing when to fill the storage
- ❑ Keeping the storage clean when it is not full of water
- ❑ The potential blight on the landscape the storage could pose

According to the 2005 report a 3GL storage would, in conjunction with the aquifer, translate into restrictions not needing to exceed level 3 and probably not exceeding level 2 except for short durations. The storage would have dimensions of the order of 600m x 250m x 20m deep. Such a storage pond might be able to be used for leisure activities, but clearly a long detailed environmental study would be required and the economics of such a scheme are dubious given the high levels of water security (Source: 2005 DCC Drought Management Plan).

This option would require a detailed environmental study and detailed design. Even though this option would take several years to be implemented it should be investigated and considered as a preventative measure to minimise the impacts of drought.

6.2.4 Aquifer Recharge

Council staff has advised that due to climate conditions (i.e. current and predicted, see section 3) and the potential availability of surface water sources, aquifer recharge in the region is a possibility. This option will require further analyses and negotiations by DCC and the appropriate government bodies.

Council should seek for regulatory permits when drought conditions arise or earlier, if it is appropriate.

Preparedness

7 Preparedness

7.1 Overview

Being prepared for drought is essential to lessen the effect and to enhance the capacity of Council and the community to cope with the consequences of drought. That means Council should have action plans in place ready to be implemented and have ongoing activities to prepare Council staff and the community for those situations, such as training exercises, monitoring and consultation.

The major benefits of being prepared for incidents or having a sound drought management plan are:

- ❑ Have a pre-determined and agreed list of actions to be taken in case of drought situations allowing for an effective implementation of those actions
- ❑ Allows Council to promptly obtain drought funds with relevant authorities
- ❑ Have well defined protocols of drought restriction activation and escalation

This plan documents Council's preparedness in regards to incidents affecting town water supply. The actions described in this plan have been endorsed by Council, therefore in case of emergencies, the appointed Council's staff can quickly activate relevant personnel required to take actions to respond to the problem or quickly implement the pre-determined drought response actions outlined in section 8. The following sections describe some of the ongoing activities that Council should undertake in order to be prepared for drought situations.

7.2 Exercising Drought Management

To ensure the ongoing effectiveness of this plan and to prepare staff for emergency situations a periodic program for exercising drought management should be developed by Council and implemented annually in conjunction with Council's other emergency training programs. These exercises could be more in the nature of "hypothetical" in which Councillors were aware of how the drought would proceed. The exercise could predict the number of applications for exemptions and detail the administration burden.

Incident exercising is used to train staff and evaluates the effectiveness of incident planning in an environment (i.e. for drought outside a drought event) where lessons can be applied to make improvements. It is envisaged that DCC would run desktop exercisers to trial organisational readiness to respond according to this plan. Council's local emergency management officer should work with Council's water staff to ensure these exercises utilise the Council's emergency management systems.

Council should also attach to this plan all relevant technical information (i.e. design, operational, maintenance plans) about Council's water supply system. This is to ensure that in case of emergencies all relevant information is in one document facilitating an effective and prompt response to the problem.

7.3 Monitoring

Continuously monitoring of the water sources and water supply scheme is essential to understand the performance of the water sources and their capability of supplying demand. Monitoring of these parameters assists Council in preparing for unconventional situations. In order to ensure a safe and sustainable water supply in Dubbo, the following monitoring is required.

- ❑ Potable water daily demand
- ❑ Daily monitoring of water supply source:
 - Water level at bores
 - Macquarie River flows
 - Dam water level
- ❑ Daily temperature and rainfall
- ❑ Licence allocations

7.4 Consultation

7.4.1 Community Engagement

Engagement with the community is a critical element of an effective drought management program, as it ensures customer acceptance and behavioural changes, required to reduce water demand.

Council should also envisage to inform the community about the Drought Management Plan and the drought action plans in place. This will assist the community to understand the criticality of drought management actions and the need to conserve water. Council may also involve the community (i.e. Council workshops and/or media releases) in the development and review of this plan to obtain community feedback and incorporate that into an evolving plan.

7.4.2 Government Consultation

Consultation on the implementation of the Drought Management Plan would be expected to be with:

- ❑ NSW Office of Water
- ❑ All LMWUA members
- ❑ NSW Department of Health (especially in relation to water quality)
- ❑ Macquarie Catchment Management Committee

7.4.3 Other Surface Water Users

DCC should meet with the other downstream users on a regular basis, and explore areas of common interest in respect to longer term drought management.

Response

8 Drought Response Strategy

The response strategy consists of having appropriate actions in place to control, contain or minimise the impacts of drought incidents. 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 Management Team.

The following sections describe DCC response strategy during drought incidents.

8.1 Drought Strategy Activation Plan

8.1.1 Overview

The drought response strategy will be activated in an event when the water supply is affected due to natural climate conditions. The main scenarios that would activate a drought management response and introduction of supply restrictions include:

- ❑ Failure of supply from water source(s)
- ❑ Concentrations of algae or suspended material in the source water due to lack of water in the source as a consequence of drought

The 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. An overview of the drought strategy activation plan is provided in Figure 9.

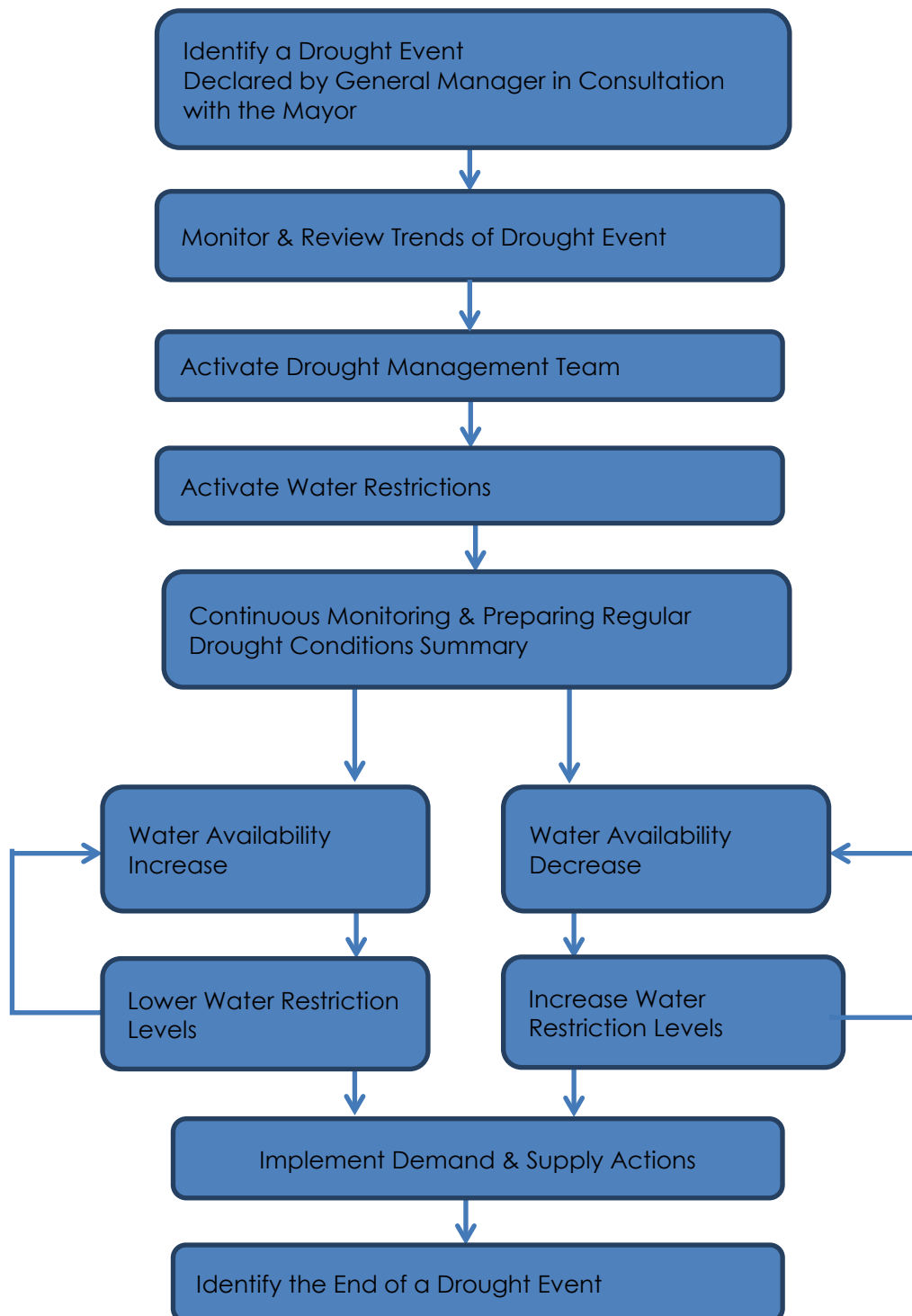


Figure 9: Drought Strategy Activation Flow Diagram

8.1.2 Drought Triggers

Triggers are the situations that will cause the water restriction level to be declared or in other words, the situations that will activate the response strategy plan. DCC triggers are based on progressive reductions in water availability from both surface and groundwater sources. The expected triggers for implementing drought restrictions in Dubbo are provided in Table 6. These triggers are estimates and if the derived demand reduction is not achieved by introduction of the restriction level, the next level should be applied.

The proposed water restriction triggers have been developed on the basis of groundwater and high security surface water allocations levels determined by the NSW Office of Water (NOW). NOW is responsible for advising Council (i.e. by letter) when allocations change. Due to the nature of the Dubbo water sources and based on past drought experiences and previous water allocation cuts; two sets of triggers are used for implementing restrictions in Dubbo. This means that restrictions will be applied when one of the two triggers are activated. For example, if the Macquarie River allocation is between 70% and 61% or if the bores allocation/yield is 50%, then DCC will implement restrictions level 1.

Table 6 lists Dubbo water supply system drought triggers levels.

Table 6: Dubbo Proposed Water Restrictions Triggers

Supply ¹		Water Restrictions Levels	Demand
Triggers ³			Target Residential Consumption (L/person/d)
Macquarie River Allocation ^(High security licences)	Borefields Allocation		
100%	100%	No restriction	382 ²
70%	50%	Level 1 Low	336
60%	50%	Level 2 Moderate	301
50%	50%	Level 3 Moderate to High	295
45%	50%	Level 4 High	245
40%	40%	Level 5 Very High	195
35%	30%	Level 6 Extreme	177

1 Supply Triggers provided by Council

2 Estimated using average of last 4 years of annual residential consumption

3 Either the river or borefield criteria can trigger the restriction, not both.

The reduction in target residential consumption shown in Table 6 is estimated based on the demand-side actions (i.e. water restrictions) implemented in each level of restriction.

8.2 Drought Management Team Roles and Responsibilities

DCC General Manager (GM), in consultation with the Mayor, can proclaim this drought management plan to be in force once GM believes the triggers have been triggered. The GM should also ensure effective communication and liaison with all key stakeholders and authorities during drought. When drought is declared Council should develop a drought staff resources plan to identify how sustainable workloads can be ensured during drought periods.

It is important to establish a drought management team (DMT) 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. Council has a Water and Sewerage Working Party (WSWP) which is a Committee of Council. Once the GM proclaims the drought, the WSWP becomes the DMT. The DMT may hold regular meetings and is authorised to issue media releases on its own authority. Reports from the WSWP go to Council. The composition of the WSWP is as follows:

- ❑ Mayor
- ❑ Councillors
- ❑ General Manager
- ❑ Director Technical Services
- ❑ Director Environmental Services
- ❑ Director Organisational Services
- ❑ Manager Water Supply and Sewerage

Table 7 describes the main DMT's roles and responsibilities. It is Council responsibility to provide an appropriate incident training to make sure nominated personal are aware of their responsibilities in a drought event.

Table 7: DMT Roles and Preliminary Responsibilities

Role	Responsibility
General Manager	<ul style="list-style-type: none"> ▪ In consultation with the Mayor, officially declare a Drought Incident ▪ Activate and deactivate the Drought Management Team (DMT) ▪ Lead the DMT
Drought Incident Manager: Manager Water Supply and Sewerage Responsible for coordinating the overall incident response	<ul style="list-style-type: none"> ▪ 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

Role	Responsibility
	<p>taken</p> <ul style="list-style-type: none"> ▪ 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
Role	Incident Responsibility
<p>Operations Coordinator: Water Operations Engineer</p> <p>Responsible for the link between the Drought Management Team and Council's operational activities and technical resources</p>	<ul style="list-style-type: none"> ▪ 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
<p>Communications Coordinator: Water Client Services</p> <p>Responsible for an appropriate, timely and consistent delivery of messages to staff, customers, regulators, media and other stakeholders.</p>	<ul style="list-style-type: none"> ▪ 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)
<p>Support Officer: Business Support Technical Officer</p> <p>Responsible to provide general support to the DMT</p>	<ul style="list-style-type: none"> ▪ 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

Role	Incident Responsibility
<p>Operations Team: Water Operations Section</p> <p>Provided there are sufficient human resources available, this includes all staff within Council mobilized to perform actions in the field and the office in response to an incident.</p>	<ul style="list-style-type: none"> ▪ 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 dam water levels, flows in the river, daily water demand, impact of restrictions on water consumptions, etc.
<p>Communications Team: Customer Service Centre within the Organisational Services Division</p> <p>This includes all staff within council mobilized to communicate with any of the relevant stakeholders during drought</p>	<ul style="list-style-type: none"> ▪ 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.

The responsible personnel and their respective responsibilities in each level of water restrictions are listed in Table 8.

Table 8: Drought Strategy Responsible Personnel & Actions

Water Restriction Levels	Appointed Drought Manager	Alternative Personnel (When the 1 st personnel option is not available)	Actions
Responsible Personnel (in order of ascending incident escalation)			
Level 1	Manager Water Supply and Sewerage	Water Operations Engineer	<ul style="list-style-type: none"> ▪ Appoint Drought Management Team ▪ Activate drought strategy and impose water restrictions ▪ Prepare regular drought progress summary for Council use
Level 2	Manager Water Supply and Sewerage	Water Operations Engineer	<ul style="list-style-type: none"> ▪ Activate drought strategy and impose water restrictions ▪ Prepare regular drought progress summary for Council use

Water Restriction Levels	Appointed Drought Manager	Alternative Personnel (When the 1 st personnel option is not available)	Actions
Responsible Personnel (in order of ascending incident escalation)			
Level 3	Manager Water Supply and Sewerage	Water Operations Engineer	<ul style="list-style-type: none"> ▪ Activate drought strategy and impose water restrictions ▪ Prepare regular drought progress summary for Council use
Level 4	Manager Water Supply and Sewerage	Water Operations Engineer	<ul style="list-style-type: none"> ▪ Activate drought strategy and impose water restrictions ▪ Prepare regular drought progress summary for Council use Advise General Manager and Councillors
Level 5	Manager Water Supply and Sewerage	Water Operations Engineer	<ul style="list-style-type: none"> ▪ 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	Manager Water Supply and Sewerage	Water Operations Engineer	<ul style="list-style-type: none"> ▪ 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 responsible personnel listed above are for general guidance. The water and wastewater manager and/or the Director of Engineering Services may appoint another staff to undertake tasks as appropriate.

8.3 Demand-Side Action Plan

8.3.1 Water Restrictions

The water restrictions aim to reduce water demand by customer through 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.

In November 2009 the LMWUA agreed to adopt a standard set of drought restriction definitions known as BOD restrictions. The BOD restrictions comprise of 6 levels of restrictions with specific demand-side actions for each level. A comprehensive list of the water restrictions levels and their definitions are provided in Appendix B.

Parks and Landcare Services (PLCS) owns and operates some sport fields, parks and gardens throughout the LGA. PLSC have set their own water restrictions definitions and the level of water reduction expected for each level of restriction (assuming 8mm per day precipitation). The PLSC plans are inconsistent with the DCC's adopted water restrictions which treat municipal parks and gardens like customers, requiring them to lodge a Water Savings Action Plan (WSAP). To address BOD restrictions requirements, PLSC should develop and keep up to date WSAP or equivalent documentation which dovetails into BOD restrictions and are acceptable to DCC water restrictions requirements. The PLCS restrictions are provided in Appendix C.

The Alliance members aim to operate in a synchronized manner during drought to avoid confusion amongst the customers but most importantly to ensure a safe supply of town water across the region. Dubbo water supply system is the largest within the Alliance; therefore there are expectations that Dubbo would take a leadership role in implementing drought restrictions in the region (i.e. Lower Macquarie Water Utilities Alliance). (Source: Dubbo Drought Management Plan 2005).

Due to the lack of alternate water supply sources, DCC should ensure the demand-side actions are thoroughly implemented to reduce consumption during drought.

8.3.2 Demand Targets

Targets are the demand levels that the water restriction levels aim to achieve. An end use model was used to estimate the average daily per capita demand targets expected in each level of restriction in Dubbo. A copy of the end use model results, including the estimated demand per capita (see Table 6) in each level of restrictions is provided in Appendix D.

8.4 Supply-Side Action Plan

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. Supply-side actions are actions taken by Council aimed to supporting the restrictions as well as preparing for worsening situations. Community information should form part of these actions, even when not specifically listed.

8.4.1 Staged Action-Plan

Drought management supply-side actions should be implemented while the community, guided by Council's request, takes action (i.e. demand-side actions) 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. DCC alternate water supply options are described in section 6.

Table 9 lays out how supply actions preparation might be brought on line as restriction levels are increased.

Table 9: Possible Staged Drought Supply-Side Actions

Restrictions	Supply-Side Actions
Level 1	<ul style="list-style-type: none"> ▪ Consider drought water pricing and estimate appropriate water charges ▪ Investigate the availability of additional water licences ▪ Investigate the short-term use of effluent for road works (subject to approval), if required by RMS (RTA) – this action can be activated at any level. ▪ Inform community on a regular basis on drought status ▪ Stop flushing of Council mains and reservoir cleaning
Level 2	<ul style="list-style-type: none"> ▪ Implement drought water pricing ▪ Enact short term emergency water licences ▪ Give approval (if appropriate) and provide access to RMS (RTA) to source effluent water for road works
Level 3	<ul style="list-style-type: none"> ▪ Begin investigation of pipeline from Burrendong Dam to Dubbo ▪ Investigate new bores locations and obtain approval from NOW (if available)
Level 4	<ul style="list-style-type: none"> ▪ Concept design of pipeline from Burrendong Dam to Dubbo ▪ Start drilling bores (if available) ▪ Investigate the option of an off stream storage
Level 5	<ul style="list-style-type: none"> ▪ Detailed design of pipeline from Burrendong Dam to Dubbo ▪ Connect new bores to the water supply scheme ▪ Concept design of an off stream storage
Level 6	<ul style="list-style-type: none"> ▪ Construct pipeline from Burrendong Dam to Dubbo ▪ Detailed Design and Construct an off stream storage

8.4.2 Water Carting

Full water cartage to Dubbo City has been found to be impractical, unworkable and very expensive. In 2005 Council has costed water carting for Dubbo City and this is not a viable option.

The 2010 Regional Drought Management Plan stated that water cartage to Dubbo is unlikely to be required with two separate supplies. However with increasing water consumption in the event that there was no river discharge the bores should just be able to maintain level 6 restrictions. Supplementary topping up of the city’s water supply could be made by water carters but this would require around 200 to 300 tankers a day just to raise the city from level 5, to level 4. That is if a source of water could be found and as such this concept is clearly impractical, if not impossible.

However water cartage from Dubbo to the villages within the LGA and the region around Dubbo forms a key component of the Regional Drought Management Plan for those smaller villages without a reticulated water supply. The villages that may require water carting from Dubbo and their indicative requirements are provided in Table 10.

Table 10: Winter and Summer Daily Demands

Council	Winter (ML/d)	Summer (ML/d)	2008/9 Annual (ML)	Population served (2006)
Bourke	3	13	2,245	2,044
Brewarrina	1.5	6.5	786	1,121
Wellington (excluding Geurie)	3.3 (Note 1)	8 (Note 1)	1,442 (Drought Plan minimum consumption)	6,300 (7/ 8 TBL)
Narromine	1.5 (Note 2)	6.8	1,942	3,600
Warren	1	3.5	628	1,654
Bogan	1.3	5	727(CC)	2,369
Cobar	1.5 (Note 2)	5 (Note 2)	1,511	4,339
Total	28.1	112.8	17,313	56,572

Note 1 (Source: E.Poga April 2010). Note 2 (Source: M.Parmeter April 2010).

The winter demand provides a reasonable assumption of the internal use levels during drought. This is similar to a high level of restrictions.

(Source: Lower Macquarie Water Utilities Alliance, Regional Drought Management Plan 2010).

8.5 Monitoring During Drought

In order to ensure a safe and sustainable water supply in Dubbo, the following monitoring is required, during drought. Some of the items listed below are recorded on a regular basis as part of Council's water business requirements.

- ❑ Potable water daily demand
- ❑ Daily monitoring of Macquarie River flows
- ❑ Weekly or monthly water level at bores Daily temperature and rainfall
- ❑ Monitoring impact of restrictions on water consumptions
- ❑ Monitoring of potential alternative water supply sources
- ❑ Water source quality:
 - Electrical conductivity(monthly)
 - Total Dissolved Solids (monthly)
 - pH (daily)
 - Alkalinity (monthly)
 - Algae levels (daily)
 - Taste and odour (on complaint)
 - Chemical analysis (monthly)
 - Microbial analysis(weekly)

These monitoring are not envisaged to be for the public. Their aim is to keep council staff informed of the water availability during drought and the water quality of the sources to ensure a safe and sustainable supply. However in previous drought, Council released, on a daily basis, water consumption data from the previous 24 hrs to communicate the public about their response to water restrictions. DCC should envisage continuing this strategy during next drought events as it emphasizes the need for the customers to implement the water restrictions actions.

Council should also periodically review this plan in order to determine if the demand targets (see section 8.3.2) are being achieved. This will allow Council to determine if the drought response strategy in place is appropriate. If the success of the strategy is not being achieved, Council should assess and modify the action plans accordingly.

8.6 Water Restrictions Communication Strategy

Once a decision has been made to enter into water restrictions in the Dubbo area, this decision needs to be quickly and effectively communicated to the wider community in a timely and effective manner.

Notice of water restrictions or change in level of restrictions may be given via:

- Advertisements on radio, television and any other electronic media
- Getting popular electronic media programs to also repeat the restriction's advice
- Advertisements in the local daily paper
- Signs to be placed on major roadways advertising that the town is under restrictions, not just to residents but also to visitors and to reinforce the message that all persons need to play their part
- Place copies of the restriction's notice on common noticeboards around the town
- Have the restrictions explained in schools so that the message gets taken home
- Letterbox drop of the notice and Council Brochure or mail out to all residents and business. Include these with local water authority bills
- Rangers carrying additional brochures to be passed out where they initially warn residents
- Mayor to make several community presentations
- Council officers to make presentations at range of community group meetings
- Develop a program to make hotel and motel guests aware of the restrictions in place

In addition, media releases and interviews 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.

Recovery

9 Recovery Strategy

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. The end of the drought should start with the General Manager recommending to Council that the declaration of a drought be revoked. Once the drought is revoked, the drought management team again becomes the Water Sewer Working Party and staff are released to their normal duties.

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 completed within 2 weeks of the completion of a critical drought event which will include a de-briefing exercise convened by the recovery co-ordinator. The post drought event report must then be submitted to the General Manager within 30 working days.

A drought recovery survey will be developed to evaluate the recovery process needed 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 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 outcomes of 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.

When the drought period is considered over and the conditions return to normal, the following actions are to be considered:

- Restoring water supply demand
- Lifting water restrictions
- Reviewing drought management plan and actions in the light of experience
- Insurance compensation
- Provide public aid to compensate loss of revenue
- Liaise with tax office to provide tax relief (reduction or delay of payment deadline)
- Develop rehabilitation/recovery programs based on drought recovery survey
- Ensure fire control programs are in place
- Assist community in resolving conflicts

The DCC recovery co-ordinator should also work with Council to assist the community to return to pre-drought water consumption, if appropriate. This is an option to be considered because the water supply provides social amenity and the LWUs financial sustainability is based on this.

Appendices

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	<input checked="" type="checkbox"/> Covers all major issues, objectives, planning, strategies and monitoring for existing essential supplies of water to the service area(s). <input checked="" type="checkbox"/> 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. <input checked="" type="checkbox"/> Includes the existing water supply system(s) in the service area(s) and a locality map. B. <input checked="" type="checkbox"/> Includes history of past droughts. C. <input checked="" type="checkbox"/> 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. <input checked="" type="checkbox"/> Identifies key objectives required to maintain a basic/restricted supply to all users. There is a need to consider social and environmental impacts. B. <input checked="" type="checkbox"/> Tailor strategies relevant to the service areas. C. <input checked="" type="checkbox"/> 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	<p>A. <input checked="" type="checkbox"/> 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).</p> <p>B. <input checked="" type="checkbox"/> Identification of any properties, businesses, other LWUs etc. that may seek water in times of drought.</p> <p>C. <input checked="" type="checkbox"/> Identification of all water requirements. Identify the normal and minimum potable and non-potable water requirements.</p> <p>D. <input checked="" type="checkbox"/> Identify water dependent industry/businesses, any fire fighting requirements and opportunities for recycled water use.</p> <p>E. <input checked="" type="checkbox"/> Includes a description and plan of all water supply schemes in the service area(s).</p> <p>F. <input checked="" type="checkbox"/> Includes height/storage volume and height/surface area graphs for all water supply dams and weirs.</p> <p>G. <input checked="" type="checkbox"/> Historical performance of rivers, dams, weirs and bores in previous droughts.</p> <p>H. <input checked="" type="checkbox"/> Includes the average rainfall figures and evaporation rates.</p>
<p>Note: All data to be specified on a daily basis.</p>	
5. Plan	<p>A. <input checked="" type="checkbox"/> Demand management options.</p> <p>B. <input checked="" type="checkbox"/> Restriction strategies including means and methods for the enforcement of restrictions and the expected results of imposing restrictions.</p> <p>C. <input checked="" type="checkbox"/> 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.</p> <p>D. <input checked="" type="checkbox"/> Availability of alternative water sources (including estimated costs and times to implement).</p> <p>E. <input checked="" type="checkbox"/> Water cartage options.</p> <p>F. <input checked="" type="checkbox"/> Identify legislation, local laws and council policies affecting the contingency arrangements.</p> <p>G. <input checked="" type="checkbox"/> Links to water sharing plans/committees, water management plans/committees, irrigators, etc.</p>

Drought Management – Check List

Topic	Outcome Achieved
	H. <input checked="" type="checkbox"/> Impact of extraction on downstream stakeholders.
	I. <input checked="" type="checkbox"/> Impact of reduced flows in watercourses.
	J. <input checked="" type="checkbox"/> Level of prediction and intervention.
	K. <input checked="" type="checkbox"/> Identify human resource requirements.
6. Monitoring During Drought	A. <input checked="" type="checkbox"/> Daily monitoring of demands.
	B. <input checked="" type="checkbox"/> Daily monitoring of water supply sources (dams, bores and streams).
	C. <input checked="" type="checkbox"/> Monitoring impact of restrictions on consumption
	D. <input checked="" type="checkbox"/> Monitoring the electrical conductivity, alkalinity and algae levels in the water sources.
7. Consultation	<input checked="" type="checkbox"/> Comprehensive media strategy and public consultation.
	<input checked="" type="checkbox"/> Regular consultation with appropriate government agencies (DWE, DECC, NSW Health etc).
8. Operation of Drought Management Plan (DMP)	A. <input checked="" type="checkbox"/> DMP should discuss, analyse and identify any impact on other regions and localities ie. upstream, downstream or conjunctive water users.
	B. <input checked="" type="checkbox"/> DMP should demonstrate a sustainable strategy that considers all other stakeholders.
	C. <input checked="" type="checkbox"/> 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	220 litres/person/day	200 litres/person/day	160 litres/person/day	120 litres/person/day
RESIDENTIAL WATER USE						
Watering of Lawns <i>Note: Subject to varying Summer and Winter Times</i> 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 <i>Note: Subject to varying Summer and Winter times</i>	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 <i>Note: Subject to varying Summer and Winter times</i>	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 <i>Note: Subject to varying Summer and Winter times</i>	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 premises	Permitted for one week after laying after which level 1 restriction on watering laws applies	Permitted for one week after laying after which level 2 restriction on watering laws applies	Permitted for one week after laying after which level 3 restriction on watering laws 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	✓ 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			OTHER SOURCES OF WATER			
This means that if the street number of your property is odd you can water in accordance with the restrictions on odd days.			These restrictions are restrictions that Council is placing on the use of its potable water supply. If the restrictions say "Not permitted"			
if your property has an even number you can water in accordance with the restrictions on even days.			for a particular use, this means that Council's potable water supply cannot be used for this purpose. Water from another source,			
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.			how ever, could be used f or this purpose.			
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.			DEFINITIONS			
			A watering system is any automated system or the watering of lawns by any means.			
WSAP			A microspray irrigation system may be a manual or automatic lawn irrigation system that uses			
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.			small sprays known as microsprays to irrigate lawn or gardens.			
A copy of this document are now available from offices of the Department of Water and Energy.			A drip system is a surface or subsurface, manual or automatic system that uses a dripper or emitter			
At certain levels of restrictions a business 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.			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.			
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						

Appendix C

PLCS Water Restrictions for Sport Fields and Parks and Gardens

PLCS Water Restrictions

Asset Type	Assets Being Irrigated at			Source						Usage (kL/d) mm/day	Cum Usage (kL/d)	No Restrictions	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	
	Name	Asset No.	Area (m ²)	Primary	Number	Secondary	Number	Meter	Meter										
Sporting Facilities	Victoria Park 1	401	30150	Bore	80PT970045 - WAL35043			?		241	241	Victoria Park 1	Victoria Park 1	Victoria Park 1	Victoria Park 1	Victoria Park 1	Victoria Park 1		
	Victoria Park 2	402	23980	Bore	80PT970045 - WAL35043	Town		?		192	433	Victoria Park 2	Victoria Park 2	Victoria Park 2	Victoria Park 2	Victoria Park 2	Victoria Park 2		
	Victoria Park 3	403	10349	Bore	80PT970045 - WAL35043	Town		?		83	516	Victoria Park 3	Victoria Park 3	Victoria Park 3	Victoria Park 3	Victoria Park 3	Victoria Park 3		
	Apex Oval	404	39896	Bore	80PT970864 - WAL35092	Town		?		319	835	Apex Oval	Apex Oval	Apex Oval	Apex Oval	Apex Oval (field only)	Apex Oval (field only)		
	Barden Park	406	40470					?		324	1159	Barden Park	Barden Park	Barden Park	Barden Park	Barden Park	Barden Park		
	Lady Cutler Ovals	407	115089		Macquarie River Pump	80AL703755	Macquarie River Pump	80AL703755			921	2079	Lady Cutler Ovals	Lady Cutler Ovals	Lady Cutler Ovals	Lady Cutler Ovals	Lady Cutler Ovals		
	Lady Cutler East Ovals	416	60080		Town		Macquarie River Pump	80AL703755	?		481	2560	Lady Cutler East Ovals	Lady Cutler East Ovals	Lady Cutler East Ovals	Lady Cutler East Ovals	Lady Cutler East Ovals		
	Lady Cutler South Ovals	420	52535		Macquarie River Pump	80AL703755	Caprais Bore				420	2980	Lady Cutler South Ovals	Lady Cutler South Ovals	Lady Cutler South Ovals	Lady Cutler South Ovals	Lady Cutler South Ovals		
	East Dubbo Sporting Complex	409	67604		Bore	80PT970045 - WAL35043					541	3521	East Dubbo Sporting Complex	East Dubbo Sporting Complex	East Dubbo Sporting Complex	East Dubbo Sporting Complex			
	Hans Clavan Fields	410	30662		Macquarie River Pump		Macquarie River Pump				245	3767	Hans Clavan Fields	Hans Clavan Fields	Hans Clavan Fields	Hans Clavan Fields			
	Nita McGrath Courts	411	20649		Bore	80PT970864 - WAL35092					165	3932	Nita McGrath Courts	Nita McGrath Courts	Nita McGrath Courts	Nita McGrath Courts			
	John McGrath Fields	412	40393		Bore	80PT970864 - WAL35092					323	4255	John McGrath Fields	John McGrath Fields	John McGrath Fields	John McGrath Fields			
	Bob Dowling Ovals	414	41143		Bore	80PT970864 - WAL35092					329	4584	Bob Dowling Ovals	Bob Dowling Ovals	Bob Dowling Ovals	Bob Dowling Ovals			
	Katrina Gibbs	417	26506		Bore	80PT970864 - WAL35092					212	4796	Katrina Gibbs	Katrina Gibbs	Katrina Gibbs	Katrina Gibbs			
	Spears Drive Park	21	14207		Town				?		114	4910	Spears Drive Park	Spears Drive Park	Spears Drive Park				
	Pioneer Park	413	80554		Town				?		644	5554	Pioneer Park	Pioneer Park	Pioneer Park				
	South Dubbo Oval	408	40085		Town				?		321	5875	South Dubbo Oval	South Dubbo Oval	South Dubbo Oval				
	Jubilee Oval	405	48820		Town				?		391	6265	Jubilee Oval	Jubilee Oval	Jubilee Oval				
	Ollie Robbins Oval	419	20080		Bore	80PT970045 - WAL35043	Town		?		161	6426	Ollie Robbins Oval						
	TOTAL WATER USAGE (kL/day) Sporting Facilities									6426	6426	6426	6265	6265	4796	2980	1159	0	

Asset Type	Assets Being Irrigated at																		
	Name	Asset No.	Area (m ²)	Source						Usage (kL/d) mm/day	Cum Usage (kL/d)	No Restrictions	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	
				Primary	Number	Secondary	Number	Meter	Meter										
Park & Gardens	Elston Park	451	40470	Bore	80PT970045 - WAL35043	Town			?		324	324	Elston Park	Elston Park	Elston Park	Elston Park	Elston Park	Elston Park	
	Victoria Park	450	115700	Bore	80PT970045 - WAL35043	Town			?		926	1249	Victoria Park	Victoria Park	Victoria Park	Victoria Park	Victoria Park	Victoria Park	
	Shoyeon		9041	Town					?		72	1322	Shoyeon	Shoyeon	Shoyeon	Shoyeon	Shoyeon	Shoyeon	
	Sir Roden Cutler Park	5	128490	Town					?		1028	2350	Sir Roden Cutler Park	Sir Roden Cutler (top section)	Sir Roden Cutler (top section)	Sir Roden Cutler (top section)	Sir Roden Cutler (top section)	Sir Roden Cutler (top section)	
	Theresa Maliphant Park	11	16500	Bore	80PT970864 - WAL35092	Town			?		132	2482	Theresa Maliphant Park	Theresa Maliphant Park (top)	Theresa Maliphant Park (top)	Theresa Maliphant Park (top)	Theresa Maliphant Park (top)	Theresa Maliphant Park (top)	
	Wahroonga Park	6	11810	Backwash					?		94	2576	Wahroonga Park	Wahroonga Park	Wahroonga Park	Wahroonga Park	Wahroonga Park	Wahroonga Park	
	Biodiversity Garden	?	4119	Town					?		33	2609	Biodiversity Garden	Biodiversity Garden	Biodiversity Garden	Biodiversity Garden			
	Lions Park West Park	452	93900								751	3360	Lions Park West Park	Lions Park West Park	Lions Park West Park				
	Macquarie Lions Park	4	7602	Bore							61	3421	Macquarie Lions Park	Macquarie Lions Park	Macquarie Lions Park				
	Elizabeth Park (ex. Shoyeon and Biodiversity Garden)	27	88300	Town									Elizabeth Park (ex. Shoyeon and Biodiversity Garden)						
	Buckingham Drive Park	?	16150								706	4127	Buckingham Drive Park						
	Manera Heights Park	?	9780	Town					?		78	4335	Manera Heights Park						
	South Dubbo Park	?	103800	Town					?		830	5165	South Dubbo Park						
	Daphne Park	10	7967						?		64	5229	Daphne Park						
	Riverbank Park	12	110545						?		884	6113	Riverbank Park						
	Lunar Park	13	20220						?		162	6275	Lunar Park						
	Michael Duffy Park	14	3864						?		31	6306	Michael Duffy Park						
	Drift Wells Park	15	1632						?		13	6319	Drift Wells Park						
	Bob Montgomery Park	16	1392						?		11	6330	Bob Montgomery Park						
	Jubilee Park		1240						?		10	6340	Jubilee Park						
	Muller Park	19	12140						?		97	6437	Muller Park						
	Sommerlea Park	20	3650						?		29	6466	Sommerlea Park						
	Tarlow Park	22	900						?		7	6474	Tarlow Park						
	Red Hill Park	?	13040						?		104	6578	Red Hill Park						
	Douglas Mawson Park	?	100300						?		802	7380	Douglas Mawson Park						
	Turnberry Park	28	6420						?		51	7432	Turnberry Park						
	Bob Jane Park	61	558						?		4	7436	Bob Jane Park						
	Tidy Towns Park	62	5119						?		41	7477	Tidy Towns Park						
	Clarisbrook Park	360	2999						?		24	7501	Clarisbrook Park						
	Cormorant Crescent Park	49	793						?		6	7508	Cormorant Crescent Park						
	Jack William Park	43	3881						?		31	7539	Jack William Park						
	Kurrajong Estate Park	?	2317						?		19	7557	Kurrajong Estate Park						
Yarrawonga Park	?	5453						?		44	7601	Yarrawonga Park							
Wambool Park	?	28360						?		227	7828	Wambool Park							
Brian Dickens Park	?	24760						?		198	8026	Brian Dickens Park							
TOTAL WATER USAGE (kL/day) Parks & Gardens										8026		8026	3421	3421	2609	2576	1322	0	
TOTAL WATER USAGE (ML/day) PLCS												14.5	9.7	9.7	7.4	5.6	2.5	0.0	
RESIDENTIAL WATER USAGE (L/person/day)												260	240	220	200	160	120		

Appendix D

Drought End Use Model

Drought End Use Model

A drought end use model was used to estimate the reduction in water consumption in each of the water restriction levels. The model estimates the reduction in consumption based on specific internal and external uses.

The model is based on standard estimated water consumption per person for each end use, such as toilet flushing, dishwashing and irrigation uses. The percentage of reduction for each end use in each level of water restriction is assumed based on the definitions of the Bathurst, Orange and Dubbo water restriction levels provided in Appendix B.

The data used to populate the model is from the Dubbo Demand Management Decision Support System model developed by HydroScience for the DCC Demand Management Plan.

The model allows for assumptions on percentage of external use that goes to irrigation, leakage and “others”. The category “others” include, for instance 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 key input data used are:

- ❑ 2011/13 population: 34,471
- ❑ Residential water accounts: 13,116
- ❑ Commercial water accounts: 1,275
- ❑ Industrial water accounts: 6
- ❑ Others (includes Institutional, Parks & Open Space, Rural, fire meters and DCC meters): 546

Dubbo drought restrictions triggers model was developed based on the level of demand expected at each level of restrictions (i.e. BOD target water consumption).

Appendix E

Water Supply Options Summary

Dubbo - Major Drought Supply Options

In 2009 DCC prepared a draft options study to identify major alternative drought supply options. The following section summarises the 2009 options from the draft report.

“In 2006/2007, water demand was high due to seasonal weather patterns and the city came close to exceeding its surface water allocation when it extracted 8501 megalitres of surface water. This presented Council’s water managers with the question of how the City was to obtain additional water resources to ensure future high demand could be accommodated in future years if growth and the drought were to continue.

Water in NSW belongs to the Crown at all times and only the Crown can issue licenses to extract and use water from natural systems. Surface water licenses are issued with different levels of security. Council’s town water licenses are the acknowledged highest security. The Crown, however, reserves the right even to reduce the allocation from the “face value” of the town water licenses for the 2007/2008 water year.”

The combination of coming close to the water extraction licence limits and the potential reduction in allocation led DCC to develop 4 potential major headwork’s supply options.

The 4 options considered were:

- ❑ Option 1 – Increase Macquarie River Extraction Licence
- ❑ Option 2 - Increase extraction from South Dubbo bore field
- ❑ Option 3 - Direct piping from Lake Burrendong
- ❑ Option 4 - Access Raw Water Sources beyond Dubbo City Boundaries

All four options assumed a capacity to transfer at average day demand of 35.6 ML/d.

Option 1 – Increase Macquarie River Extraction Licence

Dubbo City Council currently holds a licence to extract 8,700 ML per year from the Macquarie River. In 2009 the expected water demand in approximately 20 years was 15,000 ML per year.

If all the increase in water allocation is to be extracted from the river then Council would need to acquire an additional 4,300 ML/year in town water allocation licence. This is dependent on Council being able to continue extraction from the South Dubbo Borefields at the current rate of 2,000 ML/year. If the bore fields become unreliable then the additional river allocation required would be 6,300 ML/year to give the total of 15,000 ML/year.

In 2009 there was no direct mechanism in current legislation for the acquisition of additional town water allocations. Council was negotiating with the Department of Water and Energy (Now the NSW Office of Water) on ways that additional town water allocations might be achieved.

The mechanism was assumed to involve gifting from the Minister in exchange for retirement of General Security licences in an “appropriate” ratio yet to be determined. Modelling of the storage was assumed to be necessary to finalise the quantity (if any) that may be transferred from general allocation to high security town water supply.

However the draft report stated that: "The acquisition of additional high security allocations from the Macquarie River for town water supply will not guarantee Dubbo water supply into the future and an alternative source of water must be available in case of emergency as highlighted in the report on water carting.

It must be noted that holding town water supply licences do not guarantee that the full allocation may be accessed in any given year. While town water allocations have the highest priority, yearly allocation will be governed by prevailing climatic conditions and dictated by Government."

The 2009 order of cost for this option was \$7.5 M.

Option 2 - Increase extraction from South Dubbo bore field

In 2009 Council had 6 bores into a ground water aquifer in South Dubbo. One bore had recently been shut down due to nearby contamination. The 2009 current extraction rate from the remaining 5 bores was 2,000 ML/year or an average of 400 ML/year per bore.

Other licensed holders also extracted water from this aquifer.

If the increase in water allocation was to be achieved via additional ground water extraction in this aquifer, additional bores would have been needed to be constructed to give a total groundwater yield of 6,300 ML/year.

Issues of apparent drawdown in existing bores in the aquifer south of Dubbo would need to be addressed and new bores drilled to give an additional 4,300 ML/yr. At the 2009 extraction rate this would require an additional 11 bores plus one spare. There was some doubt as to whether this aquifer could sustain such an increase in extraction rate.

Council has engaged consultants to investigate the aquifer at Butlers Fall on the Macquarie River upstream of Dubbo as a possible site for additional water extraction. The site was also to be assessed if suitable for aquifer storage and recovery (ASR).

It was assumed that if the site was suitable for ASR, licences would be required to extract water from the river to store in the aquifer. Licences could be low security allocations where pumping could only occur during the wetter years but this would have some risk given recent and predicted climate changes.

It was noted that general water licence allocations had, in 2009, been at 0%. It was assumed that there was the opportunity, in the wetter years, to transfer any town water allocation not used to be transferred to the ASR but most likely additional high security licences would be required for the project to be sustainable. The Butlers Fall option was expected to be costed as part of the consultant's report.

The 2009 order of cost for this option was \$17 M.

Option 3 - Direct piping from Lake Burrendong

An option to reduce water losses due to evaporation and in-stream exfiltration in the river transfer of water from Burrendong to Dubbo is to directly pipe water from Lake Burrendong to John Gilbert Water Treatment Plant.

Such an option would only be viable if Council could gain a significant credit for the water that would be saved from the current practice of in-stream transfer. However the supply would be subject to yearly allocations similar to Option 1 above.

Analyses of this option was undertaken for the delivery of peak day demand (PDD) and average day demand (ADD) direct from Wellington to Dubbo via the line of river and via the highway.

The existing supply to Dubbo comes via flow down the river and hence there is the opportunity to transfer that flow via a pipeline along the river. Another route for a pipeline is along the highway from Wellington but this would involve pumping.

The 2009 orders of cost of this option were:

- ❑ At peak day demand via line of river \$167 M
- ❑ At average day demand via line of river \$83 M
- ❑ At peak day demand via highway \$ 63M
- ❑ At average day demand via highway \$ 35M

Option 4 - Access Raw Water Sources beyond Dubbo City Boundaries

In 2009 a prediction as a result of climate change was that on average rainfall will decrease in catchments currently supplying inflow to water storages serving Dubbo and other towns and villages relying on flow in the Macquarie River. This would have significant impacts on the supply of water to Dubbo resulting in less water being available from Lake Burrendong.

It is not simply a matter of constructing larger dams as there will be less water to store in them and the flows collected in the good seasons would be stored longer and hence be wasted to evaporation and exfiltration.

This option (4) is for Dubbo to seek water that will not be affected unduly by medium term climate change but of course any water source would be degraded by over utilisation.

In 2004 the Murray-Darling Basin Commission (MDBC) published a report Murray-Darling Basin Groundwater Status 1990-2000: The report concentrated on the status of ground water in the Murray-Darling Basin, it also shed insight into the status of the Great Artesian Basin (GAB) and its importance in the development of areas within the Murray-Darling Basin.

The GAB consists of a number of aquifer systems and the report states that “together they represent a virtually inexhaustible supply of usable groundwater”. The GAB is an artesian water supply characterised by high temperatures and pressures with a high mineral content.

The GAB area that was of interest as a potential water source for Dubbo is the river catchments identified in the MDBC report as the Central West area. This area consists of the Castlereagh and Macquarie-Bogan River catchments and includes the following hydrogeological subsystems:

- ❑ Central West Highlands
- ❑ Great Artesian Basin
- ❑ Gunnedah Subsystem
- ❑ Narrabri Subsystem

The MDBC report stated that the licensed allocation for the Lower Macquarie Alluvium (Narrabri and Gunnedah Subsystems) is 154,021 ML/annum but the sustainable yield is only 48,200 ML/annum with usage quoted at 34,006 ML/annum. This compares with the demand for Dubbo alone of 15,000 ML/annum.

The report gave no detail as to the availability of water from the GAB below the Gunnedah and Narrabri subsystems in the Surat Sub-basin in the immediate vicinity of the Lower Macquarie except to say that the Surat Basin generally is experiencing significant extraction stress.

Despite the rather gloomy outlook for groundwater extraction in this area, it is essentially the result of poor management over the previous decades due to a virtually complete lack of understanding of the system. With increasing knowledge of the GAB and its subsystems a sustainable model for water extractions was expected to be developed and would be expected to include water for urban use.

The townships of Gilgandra and Narromine access high quality water from aquifers. Subject to detailed hydro geological study, it is possible that such aquifers could also supply town water to Dubbo and its dependent villages. Extraction rate from such aquifers would be at average day demand with additional storage at Dubbo to cover peak day demand.

The 2009 order of cost of this option was:

- ❑ At average day demand from Gilgandra \$77 M
- ❑ At average day demand from Narromine \$51 M

Appendix F

**GHD Dubbo City Council -Report for Groundwater Supply Strategy -Interim
Groundwater Supply Evaluation -May 2010 - Executive Summary**

Executive Summary

This is an interim report to be used for preliminary planning considerations prior to release of the main groundwater supply evaluation report.

GHD has undertaken a hydrogeological investigation of the alluvial aquifer which underlies the Upper Macquarie River in the vicinity of Dubbo. This work was commissioned by Dubbo City Council (DCC) and aims to support development of a Groundwater Supply and Drought Management Strategy for the city.

The primary objective of the study was to:

- ▶ Identify and appraise alternative schemes involving abstraction of groundwater resources from the Macquarie River alluvium within the study area to assist with meeting Dubbo's drought specific and ongoing urban water demands; and
- ▶ Provide a specific strategy to guide DCC toward implementation of preferred schemes.

Critical to the evaluation of water supply strategies was the development of a numerical model of the alluvial groundwater system from which Dubbo extracts a significant portion of its water supply.

The alluvial groundwater system ranges mainly from 2 to 4 km in width and extends to depths of up to 60 m. Productive aquifers generally occur at depths between 30 and 45 m, and are recharged from river leakage, inflow from the underlying bedrock and infiltration from rainfall.

DCC operates seven bores, in two 'borefields', that extract groundwater from the alluvial aquifer for town supply. The licensed entitlements for these bores total 4,391 ML, with 3,850 ML dedicated for domestic water supply. An 'active' entitlement level of 4,255 ML was been assumed for this project, based on the bores currently in operation. To enable secure access to groundwater in the future, DCC requested the following options to be evaluated:

- ▶ Alternate groundwater abstraction patterns from existing bores;
- ▶ Identification of potential locations for and development of a new bore field(s); and/or,
- ▶ Procurement of additional groundwater allocations from existing water users.

Evaluation of groundwater abstraction scenarios and their associated impacts on groundwater levels and baseflow to the Macquarie river has indicated that:

1. Continued extraction under current arrangements of a 50% announced allocation is potentially sustainable (however, it is acknowledged that this does not provide DCC with sufficient groundwater access for the long term);
2. Extraction by DCC at full entitlement levels is unsustainable in the long term;
3. Extraction by DCC at full entitlement levels, combined with procurement of an additional 4255 ML of entitlement from other groundwater users within the model area, and spreading abstraction across an additional eight bores in two proposed borefields, has the potential to be sustainable. DCC abstraction may still create unacceptable impacts on a neighbouring bore (GW800402), but this could be resolved through procuring the licence for the potentially impacted bore, or careful site selection and borefield operation.

The options of borefield expansion and entitlement procurement may be further investigated and implemented independently, but are best looked upon as linked components of a potential program for

increased security of groundwater extraction. Groundwater entitlement procurement could occur from anywhere within the study area and be of some benefit to DCC by removing a component of existing or potential groundwater extraction that is contributing to impacts upon flows in the Macquarie River. However, the benefits are greater if procurement is targeted towards any areas of proposed borefield expansion. In this case, additional benefits may be realised, including:

- ▶ Reduced extraction and groundwater drawdown in the local area; and
- ▶ If the full entitlement is procured, removal of a potentially impacted party that could pose a social constraint to extraction by DCC.

A staged approach to an alternative groundwater abstraction strategy is recommended, commencing with investigation of Proposed Borefield A. Licensed entitlement procurement and aquifer conditions should be further investigated before establishment of an operational borefield to share extraction with the existing DCC borefields. Expansion to Proposed Borefields B and C would only then be undertaken on a needs basis following a review of operations and associated benefits and impacts.

Appendix G

Summary of M.Parmeters Notes (27 January 2015) Regarding Option 3 – Piping from Burrendong Dam to Dubbo

The following is a summary of comments provided by Matt Parmeter from NSW Office of Water in relation to Option 3 discussed in the Drought Management Plan.

Background

Cease to flow events Prior to Burrendong Dam operations

Between 1881 and 1966 the Macquarie River at Dubbo experienced numerous cease to flow events however on four occasions these events exceeded 78 days.

Table AG1: Four extensive Dubbo cease to flow events (1885 to 1966)

Year	Period	Number of Consecutive days
1889	January to April	90
1912	March to June	92
1914	January to March	78
1940	January to April	83
Total		1,082

Burrendong Dam History

Commenced in 1958 and completed in 1967, the Burrendong Dam is a major dam on the Macquarie River, within the Macquarie Valley, approximately 30 kilometres (19 mi) southeast of Wellington.

Burrendong Dam drought history

Burrendong Dam has reached low levels in the past:

- ❑ 1.4% in April 1998
- ❑ Between 2.2% and 2.3% for about 3 months (approximately 100 days) between February and May 2007.

Long- Term Planning of Burrendong to Dubbo Pipeline

Some preliminary work has been done on this option in the 2009 study and other reports.

It is recommended that, due to the longer term strategic value of option 3, Council should undertake further investigation work of a pipeline from Burrendong Dam to Dubbo, to more fully determine the construction costs, the drought security benefits, possible pipeline routes, and other project constraints.

Council should seek additional government funding of up to \$250K from Government sources to evaluate this option more fully.

Rough Notes on Burrendong Dam to Dubbo Pipeline

Dubbo and Wellington Town Water Supply Demand in extreme drought

An estimate of Dubbo's and Wellington's water demand under extreme drought (Level 5 or 6 water restrictions) was made by assuming no appreciable outside residential watering. This situation was assumed to have similarities with the town's consumption during the middle of winter, when it may be assumed that there is little outside watering.

Dubbo's average July 2010 consumption was 12.85ML/day. Dubbo's July 2010 peak day consumption was 15.09ML and the minimum day was 11.43ML.

Wellington's mid-winter demand was estimated as 2ML/day.

Therefore the 2010 total demand for the two towns under extreme drought was estimated as 15ML/day.

Potential Pipeline Routes

A number of pipeline routes were illustrated with maps and contours for the Burrendong to Wellington Section:

- ❑ Option 1 – River Route – Northern side (29km)
- ❑ Option 2 – River Route- Southern side (29km)
- ❑ Option 3 – River Route -Northern and Southern side (29km)
- ❑ Option 4 – Road Route -Northern and Southern side (31km)
- ❑ Option 5 – Road Route (28km)
- ❑ Option 6 – River Route -Northern side (25km)

A number of pipeline routes were illustrated with maps and contours for the Wellington to Dubbo Sections:

- ❑ Option 1 – Wellington WTP to Dubbo WTP River Route (53km)
- ❑ Option 2 – Wellington WTP to Dubbo WTP River Route (55km)
- ❑ Option 3 – Wellington WTP to Dubbo WTP West River Route (61km)
- ❑ Option 4 – Wellington WTP to Dubbo WTP Road Route (55km)

Discussion of Pipeline Materials

There was a discussion of the relative merits of steel versus GRP (fibreglass) pipe in recent projects at Moruya and Wingecaribee.

Pipeline Hydraulics - Burrendong to Wellington

Preliminary analysis was performed for pumped or gravity operation of a pipeline using a river route from Burrendong to Wellington then on to Dubbo. PVC piping was assumed.

For drought use Maximum flowrate (2010), 15 ML/day is 173L/s (over 24 hours – 86,400s) or 208L/s (20 hours - 72,000s).

For DN 575 PVC-m class 12 (ID 585mm) assume the pipe distance from Burrendong to Wellington is 29kms with a 20 metre dynamic head giving a 205 L/s flowrate.

Friction Loss is $20\text{m}/29\text{kms} = .7\text{m}/\text{km} = .76\text{m}/\text{s}$.

Pipeline Hydraulics - Wellington to Dubbo

For DN 575 PVC-m class 12 (ID 585mm) assume the pipe distance from Wellington to Dubbo is 55kms with 40 metres dynamic head giving a 210L/s flowrate.

Friction Loss is $40\text{m}/55\text{kms} = .73\text{m}/\text{km}$, velocity = .78 m/s.

Operation from Burrendong Header Tank to Dubbo

For DN 575 PVC-m class 12 (ID 585mm) assume the pipe distance is 85kms with 60 metres dynamic head giving a 206L/s flowrate.

Friction Loss is $60\text{m}/85\text{kms} = .7\text{m}/\text{km}$, velocity $=.77\text{ m/s}$.

Table AG1: Impact of Low Dam Levels on Gravity Operation – Burrendong to Dubbo

Burrendong Dam - Percentage full	3%	10%	20%	100%
Fall(m)	5	10	15	35
Flow (L/s)	52	77	96	153
Flow (ML/20 hr. day)	3.7	5.5	6.9	11
Velocity(m/s)	.2	.29	.36	.57

The hydraulic calculations showed that the flow is very sensitive to the route chosen.

This would mean moving the pipeline off the road and onto private land (for approx. 5 kms) to keep the pipe below 310m AHD and go around hills.

Arrangements at Burrendong Dam and Wellington WTP

Diagrams were provided showing potential arrangements of header and balance tanks at each site.

Notes on pipe selection

Based on information from Cobar Council's assessment of pipe materials a number of points were mentioned:

- ❑ There was a similarity between the Burrendong to Dubbo pipeline (85kms of 600mm pipe) and the Albert Priest Channel project length and size (60kms of 575mm pipe).
- ❑ Therefore similar pipe type could be assumed
- ❑ Problems with metal bends and fittings working with PVC pipes need to be investigated

Water Resources of the Macquarie River valley (1966)

Excerpts of this report were provided to give insights into the nature of drought on the Macquarie River during drought times.

For reference NOW provided:

- ❑ Tables of discharges at Wellington from 1909 to 1966
- ❑ Tables of discharges at Dubbo from 1885 to 1966
- ❑ Tables of discharges at Narromine from 1901 to 1966

Reference Rates Costing of pipe (laid) 85km of 600mm pipe

2003 Reference Rates Manual:

- ❑ 600mm DICL Contract Rate \$320/m
- ❑ Reference Rate: \$405/m
- ❑ 600mm Steel Contract Rate= \$371/m
- ❑ Reference Rate = \$470/m

The reference rate includes SID 15% and contingencies 10%.

August 2009 update

2003 to 2009 = 1.36

Approximate Pipe Costing

Using the most expensive reference rate

$\$470/\text{m} * 1000\text{m}/\text{km} * 1.36 * 85\text{km} = \54M for the pipe in the ground.

Extras costs include land purchase, pumping stations, river crossings. Therefore a base case of \$60M dollars (in 2009) has been assumed.

Further Work for Options Study

To prepare the options study the following should be considered:

- ❑ As a general comment, the consultant should satisfy themselves that:
 - The various facts and items in the report are correct
 - The overall philosophy ;and the identification and characteristics of the problems is correct (that is that the right problems have been identified and they are correctly described)
- ❑ That the pipeline would work in two modes – normal and drought.
 - That the majority of the time it will be in normal mode. In normal times, the pipeline will usually operate under gravity; with some occasional pumped/ gravity use for maintenance and flushing purposes (e.g. once a fortnight putting a short flush through).
 - In drought mode, when it has to carry maximal flowrates (15ML/day plus), then it will operate under pumped /gravity (a head of 40-60m).
- ❑ In normal operation mode, flowing under gravity (assuming this is possible), then the river pipeline routes (the only ones that would work under gravity; assuming the dam pressure can be utilised) are very sensitive to small changes in height along the pipeline route. Therefore checking the feasibility of the river routes and keeping the pipe as low as possible along the proposed routes (Options 1 to 3) is important.
- ❑ Pages from the Cowra to Central tablelands Water Pipeline plan were attached for information.
- ❑ The Options consultant should identify which parts of the route are in road reserves and which parts are on private land, listing the private owners.
- ❑ The consultant should , in the desktop study, identify parts of the route requiring vegetation clearing and which areas present construction difficulties (i.e. very steep slopes or where a hill meets a river)
- ❑ The consultant could improve on the cost estimation in these notes by including:
 - Land purchase
 - Power costs
 - Pump station and header tank costs
 - River crossings etc.
- ❑ The consultant could put all this information plus their own information into a formal report
- ❑ Other works could include:
 - Examination of difficulty of construction by river journey inspection
 - Reconnaissance survey by surveyors – using a 4WD and GPS along suggested pipeline routes

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