MWH

BUILDING A BETTER WORLD

CENTROC WATER SECURITY STUDY

COMPONENT 1: EXISTING INFRASTRUCTURE AUDIT REPORT

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August 2009

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REVISION SCHEDULE

REV. NO.	DATE	DESCRIPTION	PREPARED BY	REVIEWED BY	APPROVED BY
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EXECUTIVE SUMMARY

The Central NSW Regional Organisation of Councils (Centroc) received funding from the NSW Department of Water and Energy (DWE) for a water security study to investigate potential solutions to improve water supply security across the region. The study will have two components:

1. Component 1: An audit of existing infrastructure for bulk water supply; and

2. Component 2: An options paper for improving water supply security. The paper will assess the feasibility of water supply security options considering environmental, social and economic objectives.

This Infrastructure Audit Report forms Component 1 of the Centroc Water Security Study. The primary purpose of this report is to collate the necessary background information to allow water security options to be identified, modelled and assessed. The report provides an overview of the bulk water supplies of the region. This report contains:

- Background context and key project drivers to this water security study which are identified as the severe and ongoing drought in the Murray-Darling Basin (MDB), the need for growth and regional development which leads to significant water shortages for towns and irrigators, the increasing need to share water among the environmental and other users, and the expected impacts of climate change on water resources.

- A definition of the area of study as the Local Government Areas (LGAs) in Central NSW that are member of Centroc. The Centroc region falls within the upper Macquarie River as well as much of the Lachlan River catchments, both of which are part of the MDB. Characteristics of the Centroc study area include:

    - Over 236,000 people in an area of more than 70,000 square kilometres. Centroc is comprised of the local government entities (and their corresponding major water demand nodes) set out in Table Ex-1-1.

Table Ex-1-1: Centroc Local Government Areas and Demand Nodes

LOCAL GOVERNMENT AREAS	DEMAND NODES
Bathurst Regional Council	Bathurst
Blayney Shire Council	Blayney-Carcoar (supplied by CTW)
Boorowa Shire Council	Boorowa
Cabonne Shire Council	Molong Cumnock-Yeoval
Central Tablelands Water	Canowindra-Woodstock Cudal-Cargo-Manildra Gooloogong-Eugowra (towns include those above and Blayney, Millthorpe, Lyndhurst, Mandurama, Carcoar, Canowindra, Grenfell and Quandialla)
Cowra Shire Council	Cowra-Koorawatha
Forbes Shire Council	Forbes
Harden Shire Council	Murrumburrah (supplied by Goldenfields Water)
Lachlan Shire Council	Condobolin Lake Cargelligo
Lithgow City Council	Lithgow-Portland

LOCAL GOVERNMENT AREAS	DEMAND NODES
Oberon Council	Oberon
Orange City Council	Orange
Parkes Shire Council	Parkes-Peak Hill
Upper Lachlan Shire Council	Crookwell
Weddin Shire Council	Grenfell (supplied by Central Tablelands Water)
Wellington Council	Wellington-Geurie
Young Shire Council	Young (supplied by Goldenfields Water)

  - An average annual population growth rate of 0.29% for the region, which is based on Scenario C of the 2006-2031 population demographic projection report completed by the Western Research Institute for Centroc. The growth rate assumes 10% of new mining, health-related and high technology jobs and 5% of other new jobs will be filled by people migrating into the LGA, while the remainder will be filled by the existing workforce.
  - Most of the region's water resources are part of the Macquarie-Castlereagh and Lachlan River systems, including Wyangala Dam, Carcoar Dam and Lake Rowlands in the Lachlan Valley, Burrendong Dam, Windamere Dam and Chifley Dam in the Macquarie Valley, and a number of groundwater systems known as Groundwater Management Units (GMUs) across the region.
  - According to the "best estimate" of climate change from CSIRO's MDB Sustainable Yields Project, surface water availability in the Centroc region will be reduced by 8% in the Macquarie and 11% in the Lachlan systems by 2030. The project also found that current groundwater extraction levels in the region are not sustainable, and that water resource availability will further diminish with increasingly dry climate change scenarios.
  - The water supplies of the Centroc region are neighboured by other water supply networks such as the Shoalhaven system and the Goldenfields Water network.

- The approach taken to collect data for this audit, which includes:
  - The formation of a Project Technical Committee (PTC), comprising of up to two representatives from each Centroc member Council, to facilitate the collection of relevant data via workshops;
  - Establishment of Quickplace, a web-based project collaboration site, to facilitate the collection of data from member Councils and sharing of study outcomes across a broad geography;
  - Review of previous options studies to improve water security in the region, the National and NSW Performance Monitoring Reports for Water Supply and Sewerage, as well as relevant Local, State, Federal water management legislation, guidelines and policies;
  - Development of a matrix of data requirements to monitor progress of data collection and to ensure that data inputs are standardised and comparable between LGAs; and
  - Elimination of data gaps by directly communicating with relevant stakeholders and, where data required did not exist, was inaccessible or was otherwise insufficient, adopting assumptions based on sound, professional engineering judgement.
- A macro-level audit of existing water infrastructure that introduces each Local Water Utility (LWU) and State Water as the legal owners of many of the assets. The audit includes:
  - Major bulk water supply infrastructure such as dams, weirs and lakes;

  - Water supply distribution infrastructures such as transfer mains, pump stations and service reservoirs for bulk and raw water; and
  - Treatment infrastructure such as water treatment plants (WTP), sewage treatment plants (STP) and stormwater harvesting facilities.

- A review of water management approaches, legislations and frameworks currently implemented to manage the demand and supply of urban and non-urban water in the Centroc region, including:
  - Policy and regulatory contexts in the form of the *Water Management Act 2000* at the State Government level and the National Water Initiative (NWI) framework at the national level. DWE is the main body that regulates water and energy management for authorities of LWUs within the Centroc region.
  - Summaries of Bulk Access Regimes under the *Water Management Act 2000* that govern water sharing for the Lachlan and Macquarie systems, including basic landholder rights, requirements for licences and limitations to available water.
  - Water supply pricing for bulk water supplied by State Water Corporation and town water supply/articulation by individual LWUs, including pricing structures, unit charges and typical residential bills.
  - A summary of the demand and drought management programs currently implemented by Centroc LWUs.
- A high level overview of other water related assets that possess economic, environmental, social and cultural value to the community. These include those utilised in irrigation, mining and other large water-using industry, recreational water bodies and their surrounding reserves, national parks and wetlands. These assets help define the catchment context for this study and the potential flow or benefit from some town water security options.

The Project Steering Committee (PSC) and Project Reference Group (PRG), which consisted of representatives from environmental interests, basic rights interests, irrigation interests, mining interests, industry, business and the community, contributed to elements of this report.

CONCLUSIONS

The data compiled in this Infrastructure Audit Report is a precursor to the options identification, modelling and options development work that will be documented in the Component 2 Options Paper. The Options Paper will examine potential solutions to improve water security in the Centroc region. The solutions will consider demand management options as well as infrastructure options. The data collected and reviewed as part of the audit process will form the basis for the development of models, which can be used to quantify the current reliability of water supply, and to examine potential options for addressing areas where improvement of water supply security in the region is required.

LIST OF ACRONYMS

ACRONYM	DEFINITION
ABS	Australian Bureau of Statistics
BRC	Bathurst Regional Council
BSC	Blayney Shire Council
BWSC	Boorowa Shire Council
COAG	Council of Australian Governments
CSC	Cabonne Shire Council
CTW	Central Tablelands Water
CWSC	Cowra Shire Council
DoP	NSW Department of Planning (now part of the Department of Planning & Local Government)
DWE	NSW Department of Water and Energy (now part of the Department of Environment, Climate Change & Water)
EP	Equivalent Population
FSC	Forbes Shire Council
GMU	Groundwater Management Units
HSC	Harden Shire Council
IWRP	Integrated Water Resource Planning
LCC	Lithgow City Council
LGA	Local Government Area
LGSA	Local Government and Shires Association
LSC	Lachlan Shire Council
LWU	Local Water Utility
MDB	Murray-Darling Basin
NWC	National Water Commission
NWI	National Water Initiative
OC	Oberon Council
OCC	Orange City Council
PRG	Project Reference Group
PRG	Project Reference Group
PSC	Parkes Shire Council
PSC	Project Steering Committee
PTC	Project Technical Committee
STP	Sewage Treatment Plant
ULSC	Upper Lachlan Shire Council
WLC	Wellington Council
WRI	Western Research Institute
WSC	Weddin Shire Council
WTP	Water Treatment Plant
YSC	Young Shire Council

GLOSSARY

TERM	DEFINITION
Aquifer	An underground layer of soil, rock or gravel able to hold and transmit water. Bores, spear-points, springs and wells are used to obtain water from aquifers.
Average Dry Weather Flow	The average daily sewage flows and groundwater infiltration that occurs on a daily basis during dry weather only.
Catchment	The area of land drained by a river and its tributaries.
Demand management	Measures, programs or strategies aimed at reducing the consumption of water by reducing the demand for it.
Effluent	The out-flow water or wastewater from a water processing system or device.
Environmental flows	River flows, or characteristics of the river flow pattern that are either protected or created for an environmental purpose, usually the protection of habitat or an ecological process.
Equivalent Persons (EP)	The water supply demand or the quantity and/or quality of sewage discharge for a person resident in a detached house.
Floodplain	Flat land beside a river that is inundated when the river overflows its banks during a flood.
Greenfield Development	New development that occurs in areas that have not previously been significantly developed (e.g. recently cleared land).
Greywater	Wastewater from the hand basin, shower, bath, spa bath, washing machine, laundry tub, and dishwasher.
Groundwater	Underground water filling the voids in rocks; water in the zone of saturation in the earth's crust. See also aquifer.
High Water User	Customer accounts that use more than 5 kL of water per day.
Hydrology	The study of the distribution and movement of water.
Induced Stream Flow Leakage	Leakage from surface water flow to groundwater systems as a result of groundwater usage.
Integrated Water Cycle Management (IWCM)	Planning approach that aims to optimise water, sewer and stormwater management through assessing the urban water system components as interrelated parts of a cycle. IWCM approach was developed for Local Governments in NSW by the Department of Water and Energy.
Nutrients	A source of nourishment. Increased levels of nutrients can degrade waterways through disturbing the natural balance of aquatic ecosystems.
On-site detention	A structure or system designed to capture and temporarily store stormwater so that it can either be released to the drainage system at a controlled rate or reused on-site.
Potable water	Water of a standard fit to drink.
Rainwater tank	Storage tank for collecting rainwater from the roofs of buildings.
Recharge	Water that infiltrates through the soil surface to the watertable.

TERM	DEFINITION
Recycled/ reclaimed water	Sewage effluent or treated stormwater that has been treated to a level where it can be reused.
Reuse	The use of treated sewage effluent or treated stormwater to reduce potable water consumption.
Sewer catchment	An area of land where sewage is collected.
Sewage	The used water supply of a community including water-carried waste matter from homes and businesses.
Sewage Overflow	Discharge of sewage or odour from the sewerage system in the event of wet weather surcharge, mechanical failure, chokes or leakage.
Sewage treatment plant	A facility to treat sewage to produce treated effluent and biosolids.
Sewerage	Drainage system for taking sewage away from the community to a sewage treatment plant.
Source substitution	The use of treated sewage effluent or treated stormwater to replace the use of potable water.
Stakeholder	A person or organisation with an interest in the issue/activity being addressed
Stormwater	Rainfall that flows over hard surfaces in urban areas and is collected in drainage systems for disposal.
Surface water	Water on the surface of the land, for example in rivers, creeks, lakes and dams.
Waters	All natural terrestrial water bodies, including lakes, rivers, wetlands and groundwater.
Water demand	The water needs of a town including homes, commercial and industrial enterprises or businesses and public organisations.
Water quality	The biological, chemical and physical properties of water.
Water supply	The available water sources, water extraction, storage, transfer and treatment systems to supply town water.
Water recycling plant	A facility to treat raw sewage or stormwater to a level where it can be reused.
Water sensitive urban design	Urban design and land use planning that seeks to ensure that development is designed, constructed and maintained so as to minimise impacts on the natural water cycle.
Water treatment plant	A facility to treat raw water to a potable water quality.
WATHNET	Bulk water supply model used to estimate bulk supply levels and security, based on changes in climate and water consumption.
Wastewater	See sewage.

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1. INTRODUCTION

Centroc (Central NSW Councils – see Figure 1-1 and Figure 1-2) has obtained grant funding from the NSW Department of Water and Energy (DWE), which has very recently become part of the new super-department under the Department of Environment, Climate Change & Water, for a Water Security Study. The aim of this feasibility study is to investigate potential solutions to improve water supply security across the Centroc region. The recommendations of the study will consider the timing and method of water extraction, as well as options for the integration of water supply, water conservation and recycling. The study will have two components:

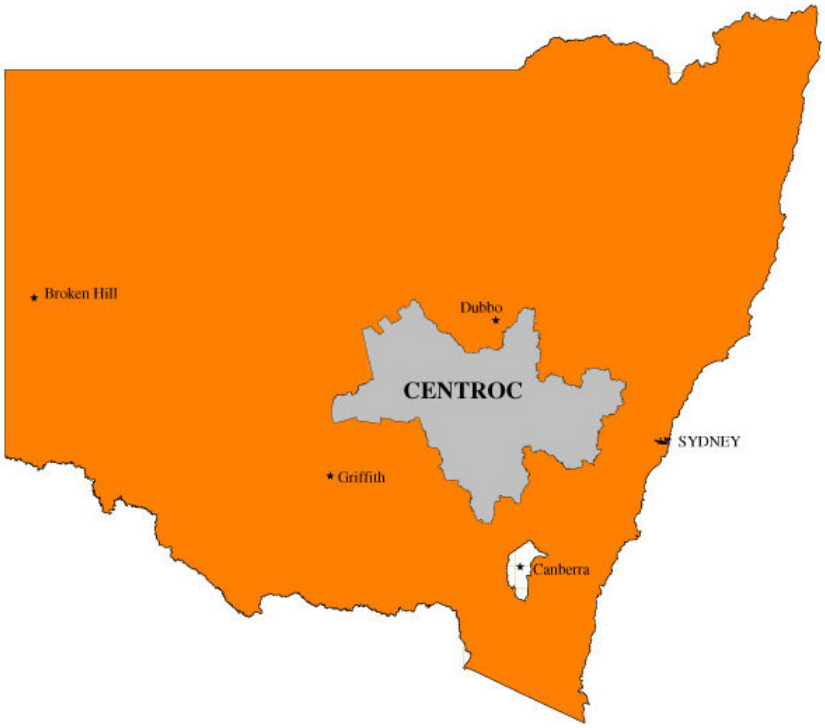
1. Component 1: An audit of existing infrastructure for bulk water supply; and

2. Component 2: An options paper for improving water supply security. The paper will assess the feasibility of water supply security options considering environmental, social and economic objectives.

The completed study will examine the question of urban water security in the context of water use in the total system. Security improvement options will consider the benefits to other water users including irrigation, mining and other interests. A wide range of options from improved water efficiency (urban and irrigation), water recycling, pipeline links, new storages and groundwater supplies will be considered as will the impact of climate change.

This report documents the audit of existing infrastructure for bulk supply and is the outcome of Component 1 of the study. This section of the report sets out the background to the Centroc Water Supply Security Study and the purpose, scope and approach to preparing this Component 1 Report.

Figure 1-1: Central NSW Region (Source: Centroc)[1]



[1] Since these diagrams were produced, Upper Lachlan local government have also joined Centroc. This is not show in Figure 1-1.

Figure 1-2: Central NSW Councils (Source: Centroc)[2]

1.1 BACKGROUND

Central NSW is currently in the grip of an extended drought that covers the entire Murray Darling Basin in which it is situated. A large number of towns, irrigators and mining operations within Central NSW are dependent on the security of water allocations for their social and economic viability. Improvement in water security for these stakeholders will enable the long term growth and development in the region to be sustained.

While the current drought is severe, it is generally acknowledged that water resources have been significantly over-allocated throughout the Murray Darling Basin. This over-allocation has continued since the introduction of the cap on surface water extractions in 1995 with the propagation of groundwater licences, many of which are highly connected to surface water systems. In light of recent climate change, a new water security regime needs to be developed to enable more efficient and effective management of water resources.

The Water Supply Security Study has been brought about by the need to ensure the long-term sustainability of communities and businesses in the region by improving the security of town water supplies, which will have flow on benefits to industry including irrigation and mining. In April 2008, Centroc wrote to the Minister for Water Utilities in its response to the current Inquiry into Water Utilities and raised the issue of the need for a regional approach to water supply security. In response, DWE committed $550,000 towards this study.

[2] Since these diagrams were produced, Upper Lachlan local government have also joined Centroc. This is not show in Figure 1-12.

By avoiding the town by town approach to water supply security, a regionally focussed study has the potential to identify water supply options that may benefit numbers of towns, or mutually benefit other sectors such as irrigation and mining, or benefit the entire region. Similarly, this approach highlights opportunities for cooperation on a regional scale.

The core focus of the study is on town, irrigation and mining water security. The towns and cities in the region hold a small fraction of the total water entitlements, while irrigation holds a significantly larger fraction of entitlements. As a result, the study will examine the question of water security in the context of water use in the total system.

1.2 KEY PROJECT DRIVERS

The need for this study is compelling in light of the characteristics and recent history of the study area. Key features of the study area from a water management perspective include:

- The Central Tablelands district is positioned at the head of the Lachlan River system at high altitude, and as a result has limited backup water supplies in times of drought. A proposal exists for an enlarged storage at Lake Rowlands constructed by building a new dam wall 2.5km away from the existing dam site.

- There are a number of large towns in the region, including Parkes and Orange, which are not located on rivers. This has been a driver for:

  - Inter-basin transfer schemes such as the existing proposals to build pipelines from Burrendong and Wyangala dams to Orange;
  - Increased interest in recycling and harvesting including the scheme to harvest, treat and return stormwater to water supply storages in Orange;
  - Pipeline schemes connecting Parkes and North Parkes Mine to the Lachlan River and a proposed recycling scheme.

- The western area of the region pumps water up hill from the Lachlan River at a considerable annual expense to smaller local councils. The small annual water demand and long pumping distances (such as 160km to Tottenham and 80km to Peak Hill) means that the unit cost of transporting water is uneconomical.

- A history of commitment to integrated water cycle management with Council's including Central Tablelands Water, Orange, Parkes, Bathurst and others having completed, or in the process of completing, such local studies. In addition, a number of the council's of Centroc (including Bathurst, Harden, Oberon, Young, Wellington and Lithgow) are involved in the Local Government and Shire Association (LGSA) water loss management program and other water efficiency and demand management initiatives. Also a history of resource sharing and combined water usage.

- A history of Centroc Local Water Utilities (LWUs) commitment to best-practice management approaches including strategic business planning, full cost recovery and transparency of cross-subsidies, demand and drought management planning and performance reporting.

- Due to ongoing drought conditions in the Lachlan Valley, for the seventh consecutive year of drought and water supply restriction, there was only sufficient water to provide the following Available Water Determinations for the Lachlan Regulated River for the start of the 2008-2009 water year:

  - 70% of entitlement for local water utilities.
  - 20% of entitlement for stock and domestic;
  - High security access licences share component restricted to 0.2 ML per share unit; and

  - A zero allocation for general security licence holders (however, they can access 14 per cent of the opening balance in their 2008-2009 account).

- Normal water sharing rules, designed to protect both the environment's need for water and that of communities and businesses, continue to be suspended for the Lachlan Regulated River Water Source.

- The main irrigation dams are Wyangala, Carcoar, Windamere and Burrendong. Bulk water supply activities on the regulated parts of the Lachlan and Macquarie rivers are managed by State Water. Irrigation activities represent regional economic and social fundamentals. However irrigation operations, particularly in the Lachlan Valley, have been heavily impacted by sustained drought conditions with subsequent constraints on economic and social growth in the associated communities. There are also significant data gaps in relation to irrigation water usage.

- Increased pressure is put on rivers, dams and groundwater resources with continued growth in the mining industry. The region has three existing large mines with significant water needs: Lake Cowal (West Wyalong); North Parkes Mine; and Cadia Mine (Orange) with a number of other mining opportunities being explored in the region (Fifield, Kingsplains, and White Rocks -near Orange).

- The Lachlan and Macquarie river systems are important for wetlands and waterbirds. The Lachlan catchment contains up to 400,000 ha of floodplain wetlands. A number of these have regional, state and national significance. The valley has a history of environmental stress within the river and, in particular, its important wetland areas which has elevated consciousness, and associated water management planning activity, of the need to protect water for the environment. However, concern exists about the appropriate balancing of competing demands for water especially in periods of prolonged drought.

Improvements to water security and management are required not only to address the current issues but also to secure the future of the region. In October 2008, the NSW Department of State and Regional Development published a regional Business Growth Plan for the Central West Region (DSRG, 2008). The plan described the region as one with:

- A population of 175,351 which grew by 0.7 per cent between June 2002 and June 2007;
- Core industries including: agriculture; manufacturing; mining; forestry; retail; education; health and community services;
- New business and industry developments occurring in mining, transport and logistics, agriculture, and timber processing.

Although the definition of the Central West Region covered in the Business Growth Plan is a slightly different composition to the Centroc area, the plan highlighted the need to improve water security for existing and future industry as a significant regional challenge and an area of high priority where high impact strategies are required to address barriers to business investment. Identified strategies included the need to improve security by diversifying source (including reuse and recycle water) and improving management. The plan identified two key strategies which are relevant to the Centroc area:

1. The Oberon Timber Complex Water strategy which is focussing on securing the supply of water for industrial use to four (4) major timber businesses in Oberon drawing on softwood plantations in the Central Tablelands. The scheme will provide town grey water, access bore water and improve water use efficiency. The strategy will assist in the retention of 200 direct jobs and sustaining critical mass for the local timber industry as well as reduce water requirements of industry from Oberon Dam by 50 per cent. The Federal Government and DWE have agreed to provide 100% subsidy on a 50/50 basis for an effluent main from the Oberon Sewage Treatment Plant (STP) to the Timber Complex. This project has recently been put on hold after the Environment Protection Agency (EPA) disallows brine from desalination of effluent to be disposed in the area. No available funds have been identified in the Country Towns Water Supply and Sewerage Program for an Oberon Recycled Water Scheme.
2. Secure bulk water supplies for the Centroc region through investigation and implementation of drought security measures. The plan noted that this strategy would consist of an audit of each Council's water supply system and will look at non urban water supply issues (irrigators, mining, other industry) and environmental flows along rivers as well as the development of an options paper identifying localized solutions for each council as well as possible large scale regional solutions to secure bulk water supplies (e.g. new dams, pipelines, and borefields).

However, this study is also compelling with respect to State and Federal policy positions and initiatives. A thorough understanding and contemplation of the State and Federal water planning and management framework will be required in order to ensure the local and regional solutions identified are consistent with water reform processes in order to ensure continued State and Federal support (and increase the likelihood of financial assistance) for the implementation of the outcomes of the study.

The National Water Commission (NWC) has indicated that the urban water shortages in the current drought and the rush to invest in new urban water infrastructure are evidence of general planning failure. The fundamental National Water Initiative (NWI) outcome of reliable urban water supplies has not been delivered. At a State and Federal level, the following are key areas of concern about historical urban water planning that this study will need to address:

- Need to improve the standard of urban water supply planning especially in relation to the risks of climate change;
- Need for 'policy bans' on any water supply option to be removed and objective consideration be given to all options including recycled water, desalination, rural-to-urban trade, new dams, inter-basin transfers and cross-border transfers;
- Need to encourage diversification towards less climate dependent water supply options;
- Need to encourage fundamental reform to institutional and market arrangements for water supply and to review the role of small and poorly resourced local government in urban water delivery (an issue which the very proposal of Centroc to unite the forces of a number of smaller entities in this study, begins to address);
- Need to ensure environmental water management arrangements and environmental outcomes are occurring; and
- Need to address the serious and growing shortage of skilled water resource professionals in Australia.

1.3 PURPOSE AND SCOPE OF THIS REPORT

Water is of value to communities, businesses, and the environment and there is competition for the available resource. This report documents the water related infrastructure in the Centroc region, with the aim of obtaining an overview of the current regional town water bulk supplies. The review consists of a compilation of all major assets and water management approaches in the study area, including those for the irrigation and mining sectors. The data collected and reviewed as part of the audit process will form the basis for the development of models which can be used to quantify the current reliability of water supply and to examine potential options for addressing areas where improvement of town water supply security in the region is required and to highlight areas where mutual benefit to other sectors, including irrigation and mining, may be possible. As such, this report will be a precursor to the subsequent options paper for improving water supply security addressed in Component 2.

The infrastructure data audit was conducted at a macro level and includes major water related environmental, social and cultural assets with economic significance. The scope of audit encompassed major bulk water supply, distribution, and treatment infrastructure, as well as considering the bulk water regime, water pricing arrangements and demand management programs. The audit excludes non-bulk water supply infrastructure.

1.4 AUDIT APPROACH

The approach to auditing had three main components:

- Collection of desktop data required for Integrated Water Resources Planning (IWRP). Data collection involved consultation with stakeholders;
- Review of data including:
    - Previous studies and other data collected;
    - State and Federal water utility benchmarking data;
    - Local, State and Federal guidelines and policy frameworks for natural resources management; and
- Data categorisation and analysis.

The following are basic data that are essential for Integrated Water Resource Planning (IWRP) implementation:

1. Daily inflow to dams, or level gauging, spill volumes, releases and demands where flow gauging data is not available;
2. Customer consumption records by billing period, including number of accounts to confirm historical population growth and to set the internal/external usage ratio;
3. Bulk water produced, including raw and treated water flow records;
4. Population and employment projection for the forecast horizon;
5. Climate data including rainfall, maximum temperature and evaporation rates; and
6. Likelihood of regional development and its impact on water demand.

For a full list of data requested, see Appendix A: Data Source for a Data Inventory and Gap Analysis matrix.

To facilitate the collection of relevant data, and to achieve some of the project consultation objectives, a Project Technical Committee (PTC) was established as part of the project. Each of the Centroc member Councils was asked to nominate up to two representatives to the PTC.

In a workshop process, the PTC were introduced to the project methodology and associated data requirements. In consultation with the PTC, data to be sourced from the Centroc Council's was identified, including any previous options studies for improving water security in the region such as the Forbes Water Augmentation Report 1978 and more recently the Lake Rowlands augmentation study in 2006. Other sources of data for the audit were the NSW and National Performance Monitoring Reports for Water Supply & Sewerage, which contains information on the performance of Centroc's LWUs.

To facilitate the provision of data and the sharing of study outcomes across a broad geography, a web-based QuickPlace site was established. QuickPlace is an Internet based project collaboration tool that allows information to be instantly and securely shared in an online environment.

Data received from the stakeholders was compiled into standardised categories. Since each LWU was required to provide identical sets of data, the categorising process was used to monitor the progress of data transfer and, at the same time, data gaps. In addition, a matrix that lists the specific data received against individual LWUs was used as a cross-checking tool. By updating the matrix regularly, a summary of data gaps for specific LWUs at any given time was available.

The majority of data requested for the study were available from Centroc, Councils and LWUs. Water demand and quality data for Harden and Young Shire Councils were provided by Goldenfields Water bulk water provider. Data requested are less readily available from some of the smaller Councils, largely due to constraints in terms of resources. The data collection process was also supplemented by information from public sources such as DWE, the Australian Bureau of Statistics (ABS) and Bureau of Meteorology (BOM). Other relevant reports such as previous water security options studies, Integrated Water Cycle Management (IWCM) reports and the Murray-Darling Basin Sustainable Yields Project were obtained from Councils and the Commonwealth Scientific and Industrial Research Organisation (CSIRO).

Data gaps present during the audit were largely eliminated by directly communicating with the corresponding stakeholder to request additional information or sourcing reliable alternative parties for similar information. In cases where the data required did not exist, was inaccessible due to the scope of the study, or was lacking in quality, the gap was noted in the relevant reports and simplifying assumptions were made to substitute or eliminate the need for the data. Other data gaps for demand and hydrology modelling were also resolved using assumptions and professional judgement derived from similarly-sized demand centres, extrapolation of data from the Performance Reports. Approaches in dealing with specific data gaps will be discussed further in the Component 2 report.

2. STUDY AREA

This section of the report describes the broader catchment context and the particular geographic, demographic, economic and water demand characteristics of the project study area.

2.1 CATCHMENT CONTEXT

The Centroc study area encompasses the Upper Macquarie and much of the Lachlan River systems, both of which are located in central-west New South Wales and form part of the Murray Darling Basin (MDB). The MDB, illustrated in consists of the Murray and Darling Rivers – Australia's longest inland rivers – and their tributaries. Eighteen contiguous regions, including the Macquarie and Lachlan Rivers, that comprise the entire MDB are the primary drainage basins of the rivers. Parts of Lithgow City Council, Oberon Council and Upper Lachlan Shire Council also lie in the Hawkesbury (Coxs River) catchment while Harden-Murrumburrah lies within the Murrumbidgee Catchment.

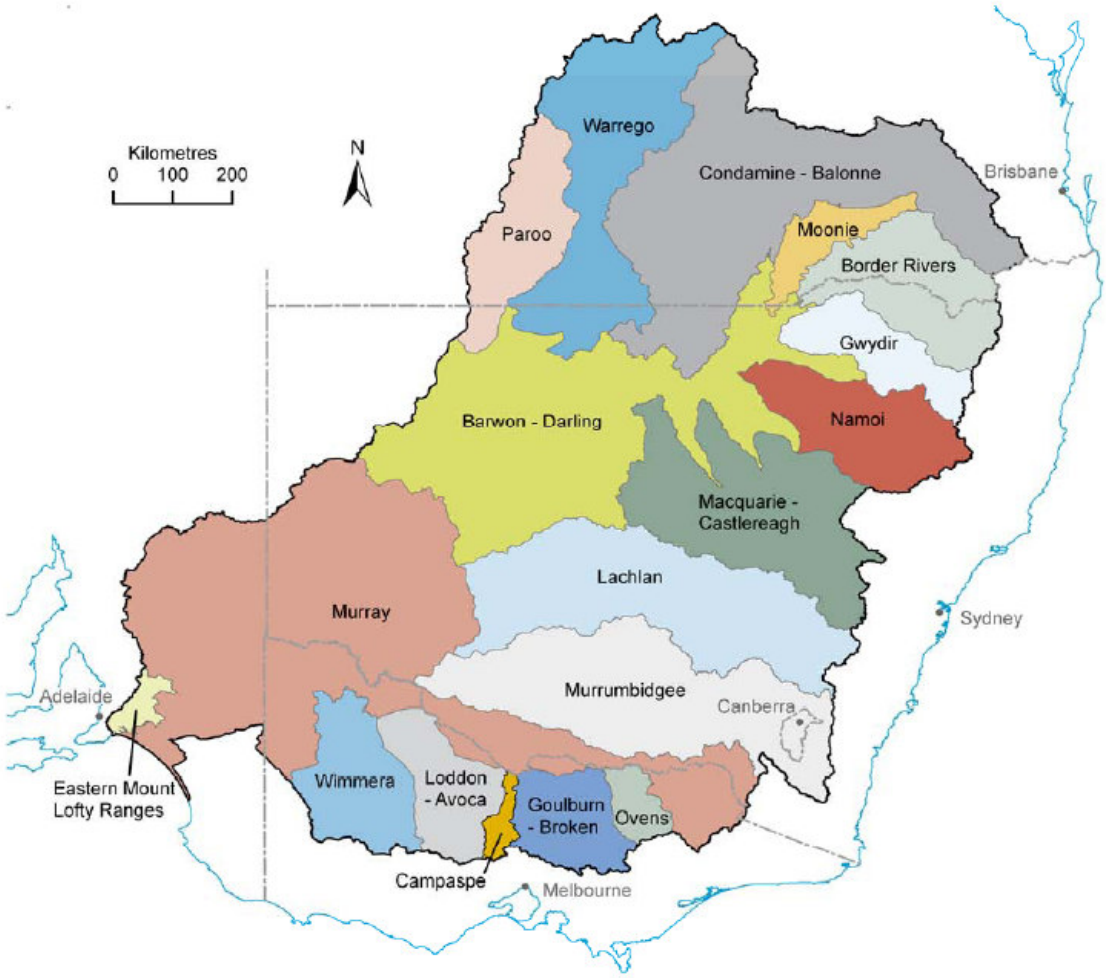


Figure 2-1: Region by Region Map of the Murray-Darling Basin (CSIRO 2008a)

2.2 GEOGRAPHY

Centroc represents over 236,000 people across an area of more than 70,000 square kilometres. Centroc is comprised of the following local government entities:

- Bathurst Regional Council,
- Blayney Shire Council,
- Boorowa Shire Council,
- Cabonne Council,
- Cowra Shire Council,
- Forbes Shire Council,
- Harden Shire Council,
- Lachlan Shire Council,
- Lithgow City Council,
- Oberon Council,
- Orange City Council,
- Parkes Shire Council,
- Upper Lachlan Shire Council
- Weddin Shire Council,
- Wellington Council,
- Young Shire Council and
- Central Tablelands Water County Council.

The geographic scope of the study area encompasses parts of both the Macquarie and Lachlan river valleys. The region spans Tottenham and Wellington to the North, Harden to the South, Lake Cargelligo to the West, and Lithgow to the East. The study area is highlighted in Figure 2-2 below.

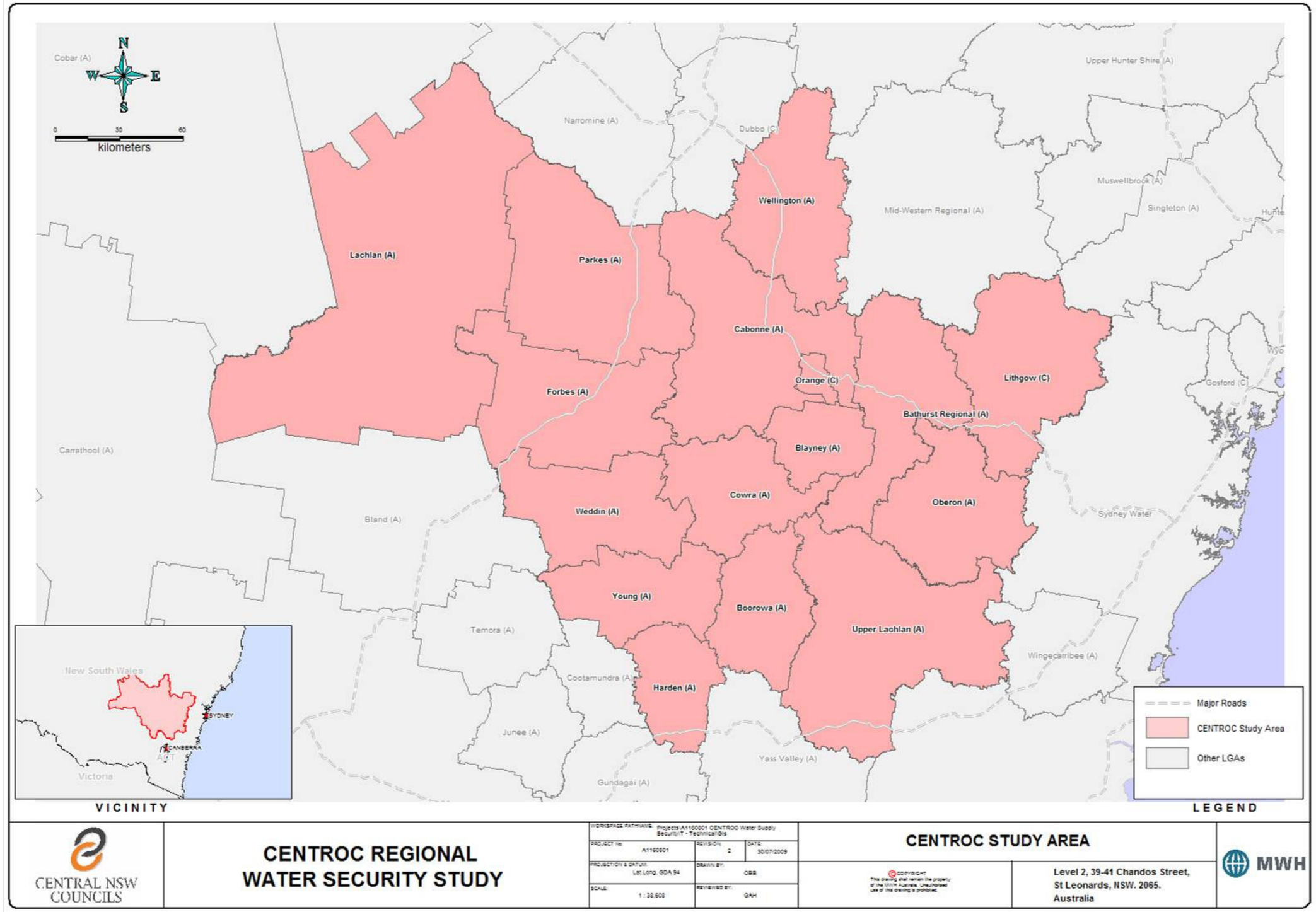


Figure 2-2: Centroc Water Security Study Area

2.3 DEMOGRAPHICS

Centroc commissioned the Western Research Institute (WRI) to provide a population demographic projection report for a 25-year period from 2006 – 2031 (WRI 2008). The report includes comparison with the population projection modelled by the NSW Department of Planning (DoP). The report covers all existing Centroc members. The inputs and assumptions underlying the WRI model are as follows:

- Projections are based on trends in mortality rates by age and gender, fertility rates by age, and historical trends in in-migration and out-migration.
- Estimates of employment, and its associated population impact, are based on information supplied by the Councils regarding future major developments. These developments are evenly divided across a ten-year interval. A multiplier is then applied to each employment sector to provide assessment of flow-on employment. The sectors that Councils expect to have an impact on population in the regions are highlighted in Table 2-1 below.

Table 2-1: Potential Employment Growth Sectors in Centroc

LGA	POTENTIAL GROWTH SECTORS
Bathurst	Mining, retail, manufacturing and industrial parks
Blayney	Transport, agriculture, mining and health
Boorowa	Mining and agriculture
Cabonne	Mining, construction and hospitality
Cowra	Mining, manufacturing and retail
Forbes	Retail, health, manufacturing and agriculture
Harden	Mining, health and agriculture
Lachlan	Agriculture
Lithgow	Hospitality and mining
Oberon	Hospitality and retail
Orange	Health, retail and mining
Parkes	Transport, health, retail and mining
Upper Lachlan	Health and mining
Weddin	Mining and health
Wellington	Public administration, utility and retail
Young	Health, mining, agriculture and retail

- Three projection scenarios based on varying levels of flow-on employment:

  Scenario A. 100% of new mining, health-related and high technology jobs and 50% of other new jobs are assumed to be filled by people migrating into the LGA. The remainder is assumed to be filled by the existing workforce.

  Scenario B. 50% of new mining, health-related and high technology jobs and 25% of other new jobs are assumed to be filled by people migrating into the LGA. The remainder is assumed to be filled by the existing workforce.

  Scenario C. 10% of new mining, health-related and high technology jobs and 5% of other new jobs are assumed to be filled by people migrating into the LGA. The remainder is assumed to be filled by the existing workforce.

Table 2-2 summarises the 2006 population census data and future projections for all Centroc members. The mid-range Scenario B is adopted by the Centroc Board for general strategic planning purposes. Scenario B has an average annual growth of 0.54% between 2011 and 2031. However, following agreement with the PSC and aligning with projections from the NSW Department of Planning, the modelling in this study will adopt the population growth rate projection based on Scenario C.

Table 2-2: Population Statistics for the Centroc Study Area

SOURCE	2006 DATA	2011 PROJECTION	2021 PROJECTION	2031 PROJECTION
ABS Census Data	194,418	-	-	-
DoP Projections (2005)	-	206,610	212,230	217,680
WRI Scenario A	-	215,691	249,944	254,720
WRI Scenario B	-	211,189	231,254	235,389
WRI Scenario C	-	207,584	216,287	219,886

The breakdown of the assumed average annual growth rates and population projections by Local Government Area based on Scenario C are summarised in Table 2-3 below. Parkes, Orange and Young were identified as the region with the highest average annual growth while populations in Boorowa, Upper Lachlan and Harden were expected to be stagnant.

Table 2-3: Population Statistics for Individual Centroc Local Government Areas

LGA	2006 CENSUS DATA	2011 PROJECTION	2021 PROJECTION	2031 PROJECTION	AVERAGE ANNUAL GROWTH RATE
Bathurst	37,542	39,100	41,387	41,959	0.37%
Blayney	6,891	7,110	7,376	7,494	0.27%
Boorowa	2,390	2,402	2,416	2,374	-0.06%
Cabonne	12,907	13,186	13,539	13,550	0.14%
Cowra	13,025	13,070	13,297	13,438	0.14%
Forbes	9,755	9,844	10,035	10,133	0.15%
Harden	3,725	3,742	3,755	3,749	0.01%
Lachlan	6,927	7,043	7,319	7,634	0.40%
Lithgow	20,650	20,915	21,289	21,048	0.03%
Oberon	5,260	5,409	5,655	5,679	0.24%
Orange	37,009	38,015	40,508	41,690	0.46%
Parkes	14,846	15,109	15,941	16,635	0.48%
Upper Lachlan	7,347	7,435	7,468	7,406	-0.02%
Weddin	3,793	3,837	3,957	3,923	0.11%
Wellington	8,406	8,514	8,795	9,119	0.34%
Young	12,488	12,852	13,548	14,054	0.45%

DWE has also identified a number of Aboriginal communities located within Centroc that are part of the Department's Aboriginal Water Supply and Sewerage Program. The program is aimed at raising the standard of operation and maintenance of water and sewerage infrastructure of Aboriginal communities across NSW. The communities located within Centroc and the water service provisions proposed by the program are listed in Table 2-4 below.

Table 2-4: Aboriginal Communities Located Within Centroc (DWE, 2009a)

LWU	COMMUNITY LOCATION	NUMBER OF PROPERTIES	POPULATION	PROPOSED SERVICE PROVISION
Cowra Shire Council	Eramble	19	~200	Town water supply
Lachlan Shire Council	Murrin Bridge	34	~150	Bulk water supply
	Boona Road	5	~30	Town water supply
	Willow Bend	16	~50	Town water supply
Parkes Shire Council	Peak Hill	5	~20	Bulk water supply
Wellington Council	Nanima Reserve	20	~60	Dual supply, potable water supply

2.4 ECONOMY

The economy of the Centroc region is largely driven by the agriculture, mining, retail and manufacturing mix of industries (CNSWA 2007).

2.4.1 AGRICULTURE

Crop production and grazing form the core agricultural industry in Central NSW, with horticulture and viticulture also building a presence in the region (CNSWA 2007). In 2001, agricultural activities were worth a total of over $1 billion, while the sale of livestock and crops was valued at $250 million and $200 million respectively (ABARE 2008). Irrigated agriculture activities in the Centroc region are concentrated in the Jemalong and Wyldes Plains district along the Lachlan River, while horticultural activities are found near Orange along the Macquarie River. Irrigated commodities account for approximately $150 million per year or 15% of the total value of agricultural production in the Lachlan catchment (DPI 2003). In the Macquarie catchment, irrigated agriculture activities contribute to $300 million in gross domestic product (GDP) to the region and employ around 1,000 people in the valley.

2.4.2 MINING

Mining of copper, coal and gold underpins the region's economy, with Newcrest and Northparkes Mining Limited being the major players in the mining industry. The mining industry as a whole contributes approximately $550 million annually into the Centroc region and continues to be one of the most heavily prospected areas in NSW (see Figure 2-3).

Newcrest's Cadia Valley operation employs 1,000 individuals and is Australia's largest gold mine (CTW 2006). The Cadia Valley mines contributed $643 million to the GDP and $40 million to household income in the Central West in 2004/05. Northparkes mine provide jobs to 550 individuals in the region and is the largest employer in Parkes and surrounds (NM 2007). The operations earned $583 million in revenue, contributed to $16 million to household income, and spent $78 million on materials, goods and services in Central NSW in 2007.

A number of mineral deposit sites for potential future extraction have also been identified within the Centroc region, including the Golden Cross Resources Copper Hill project near Molong, expansions by Newcrest at Ridgeway Deeps near Orange and the Northparkes E48 development (ABARE 2009).

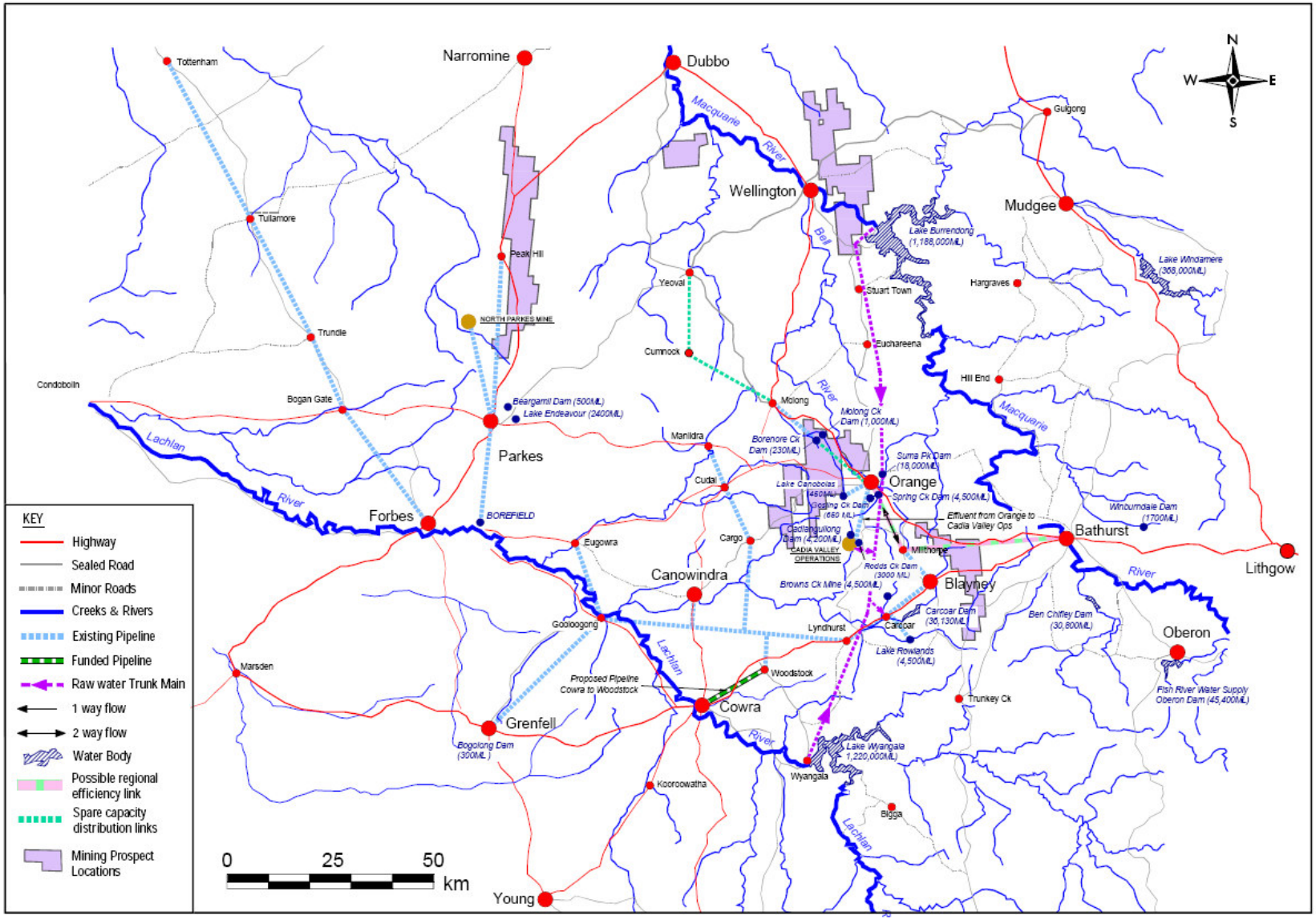


Figure 2-3: Mining Prospect Locations in the Centroc Region (Centroc 2009)

2.4.3 MANUFACTURING

The manufacturing industry in the region builds upon its strong agricultural base with a sizeable food and beverage processing sector worth approximately $700 million out of a total of $1.4 billion in manufacturing in 2007. Manufacturing also contributes to over $200 million in wages to households in the region.

2.5 WATER RESOURCES & CLIMATE CHANGE

Most of the major water resources in the Centroc region are part of 2 key systems – the Macquarie-Castlereagh (from here on referred to as the Macquarie) and Lachlan River systems. A number of water resources within Centroc are also part of the Murrumbidgee system and Upper Coxs sub-catchment. In addition, there is a potential to link water sources from outside the region, such as the Murrumbidgee and Shoalhaven water networks, into the Centroc networks.

The Macquarie River system is based around the Macquarie, Castlereagh and Bogan Rivers, with the Macquarie Marshes located at the lower end of the region (CSIRO 2008b). Figure 2-4 illustrates the land use types in the Macquarie region. The Macquarie is a regulated river with large storages including the Burrendong Dam near Wellington and Windamere Dam on the Cudgegong River. Chifley Dam on the Macquarie River also provides irrigation diversions to surrounding sites.

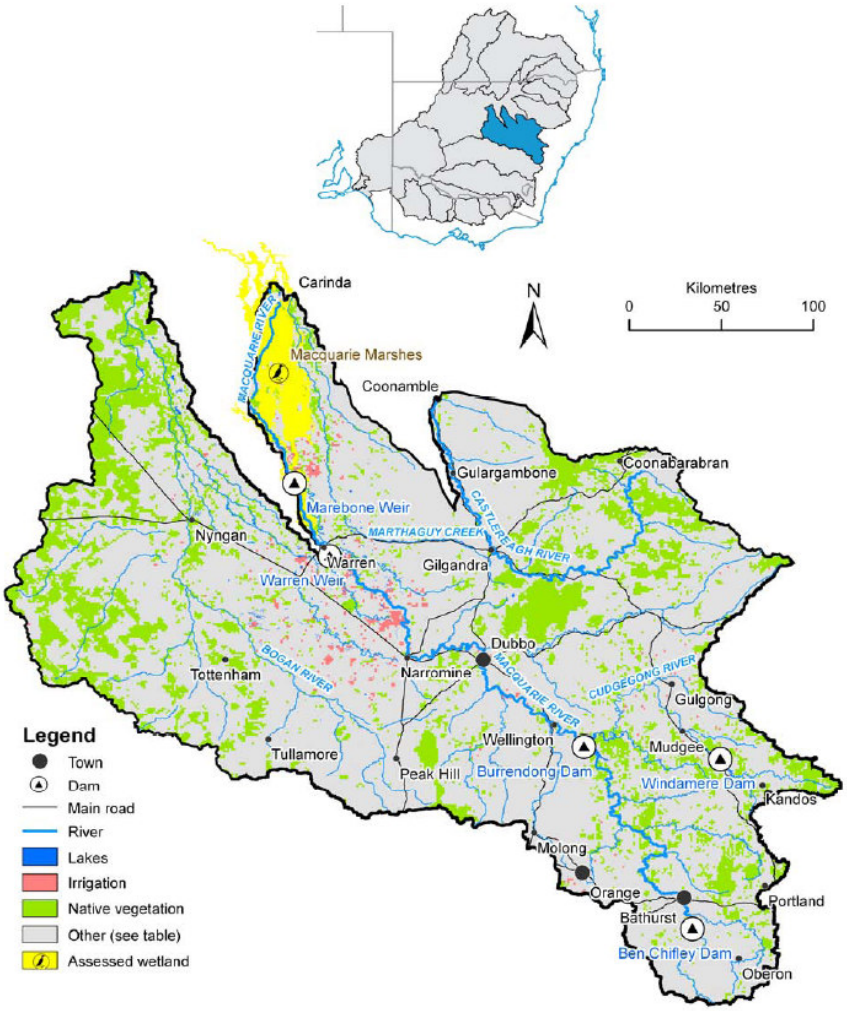


Figure 2-4: Dominant Land Use in the Macquarie-Castlereagh Region (CSIRO 2008b)

The primary groundwater extraction is from fractured rock aquifers, minor alluvial systems in the Lachlan Ford Belt highlands and broad alluvial plains north and west of Narromine, underlain by sedimentary Great Artesian Basin aquifers. Fifteen State Government recognised groundwater systems known as Groundwater Management Units (GMU) cover the entire region, although the most useable low salinity groundwater is restricted to the Gunnedah Formation within Lower Macquarie Alluvium GMU. Recharge of the Gunnedah Formation is from the overlying Narrabri Formation. GMUs in the Macquarie region are identified in Figure 2-5.

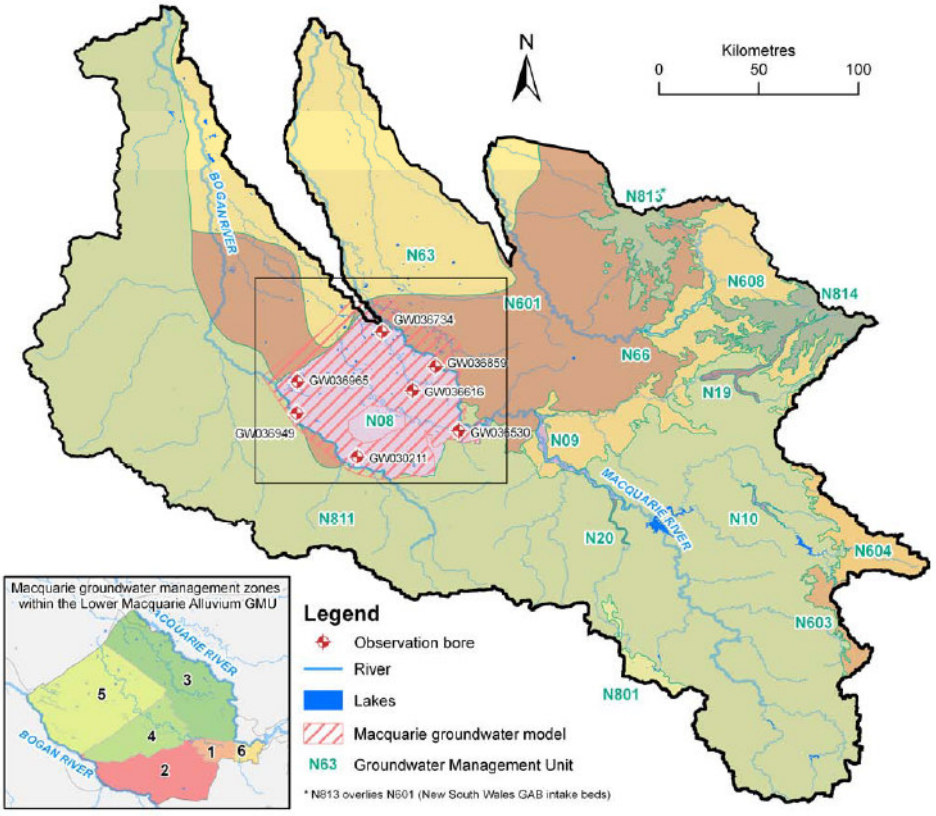


Figure 2-5: Groundwater Management Units in the Macquarie-Castlereagh Region (CSIRO 2008b)

The Lachlan River system revolves around the Lachlan River and includes the nationally significant Booligal Wetlands and Great Cumbung Swamp on the lower reaches of the region (CSIRO 2008c). Figure 2-6 illustrates the layout and land use types in the Lachlan region. The major tributary streams of the Lachlan River include the Abercrombie, Boorowa, Belubula and Crookwell Rivers, and Mandagery and Willandra Creeks. Wyangala Dam, located upstream of Cowra at the confluence of the Lachlan and Abercrombie Rivers, is the major water storage in the region. Lake Rowlands, which supplies water to a number of towns across the Centroc region, is situated on the unregulated Coombing Creek – a tributary of the Belubula and Lachlan Rivers. The primary source of groundwater resources in the Lachlan region are the Lower and Upper Lachlan alluvial aquifers. Groundwater levels in the fractured rock aquifers of the Lachlan region show a broad correlation with long-term climate – rising level trends of the mid-1990s and falling level trends during the current extended drought. Six GMUs subdivides the Lachlan region for management purposes. Figure 2-7 identifies the locations of GMUs in the region.

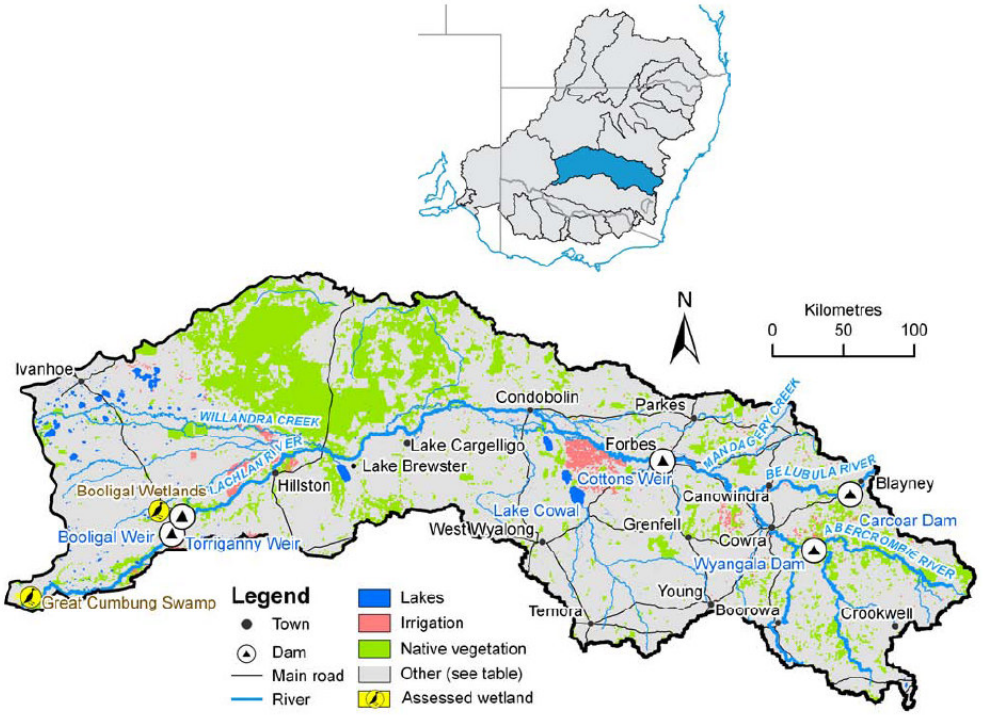


Figure 2-6: Dominant Land Use in the Lachlan Region (CSIRO 2008b)

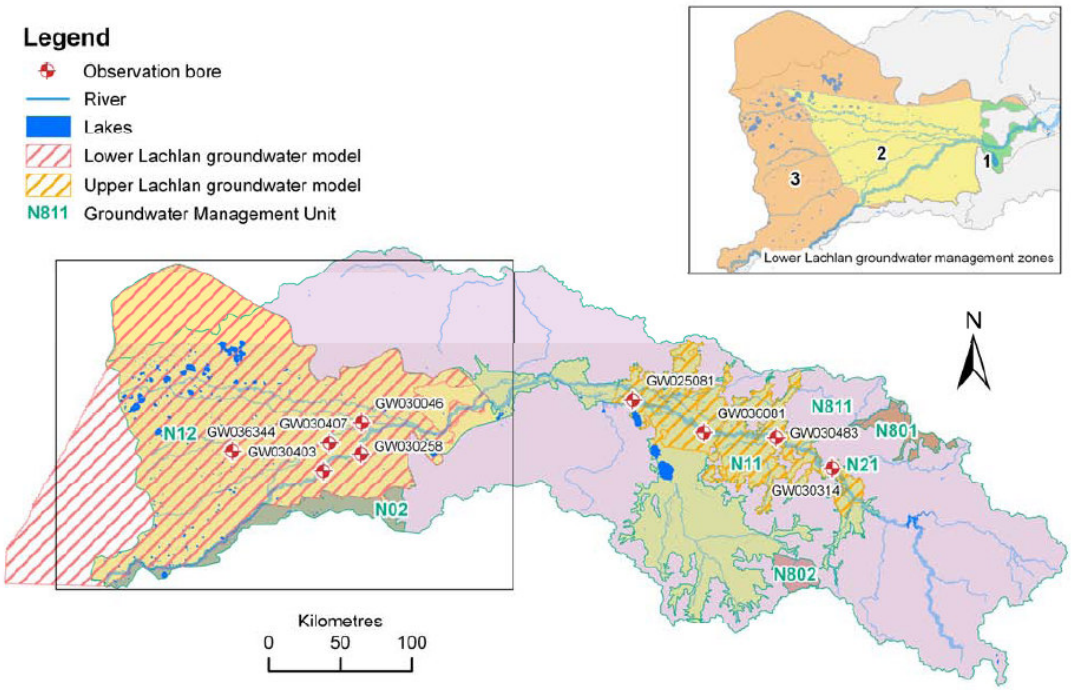


Figure 2-7: Groundwater Management Units in the Lachlan Region (CSIRO 2008c)

Water resource availability in the MDB, including the Macquarie and Lachlan study areas, is relatively scarce. This scarcity is likely to be exacerbated by future water resource developments. Investigation into water availability for specifically the Macquarie and the Lachlan River systems was conducted as part of the CSIRO Murray-Darling Basin Sustainable Yields Project (CSIRO 2008a). The project highlights the urgent need for consideration of regional water management approaches and found diminishing water resource availability in the Basin, including the Lachlan and Macquarie systems, particularly with increasingly dry climate change scenarios.

The Murray-Darling Basin (MDB) Sustainable Yields Project was commissioned by the CSIRO to assess the sustainable yields of surface and groundwater systems for the 18 regions within the MDB, including the Lachlan and Macquarie River systems in which the Centroc region is located (CSIRO 2008A). The report is the most recent sustainable yields study to encompass the Centroc area and also includes assessment of potential climate impacts on the water system in the area. The project conducts rigorous and detailed basin-scale assessment of the anticipated impacts of climate change, catchment development and increasing groundwater extraction on the availability and use of water resources. Modelling to be conducted for the Options Paper will utilise inputs from this study.

The MDB study involved comprehensive hydrologic modelling, including rainfall-runoff and groundwater recharge across whole MDB, fully linked modelling of all major river and groundwater systems and their connections to surface water systems. The study constructs forecast models of water availability based on four scenarios:

1. A baseline scenario based on the historical climate from mid-1895 to mid-2006 and the current level of water resource development.
2. A second scenario based on the climate of 1997 to 2006 to evaluate the consequence of long-term continuation of the recent severe drought in south eastern Australia and provides a reference point for the climate change scenario.
3. A third scenario based on climate change by 2030, using 3 global warming levels and 15 of the global climate models from the fourth assessment report of the Intergovernmental Panel on Climate Change (IPCC 2007).
4. A fourth scenario based on consideration of likely future development and the 2030 climate. Development includes growth in farm dam capacity, expansion of commercial forestry plantations and increases in groundwater extraction.

The key findings of the MDB Sustainable Yields study that are relevant to this study are as follows:

- The severe drought experienced in 1997 to 2006 in the MDB and Centroc region would occur once in more than 300 years without climate change, but is expected to become increasingly common as evident in the worsening drought conditions in 2007 and 2008.
- The impacts of climate change by 2030 is uncertain, but surface water availability across the entire MDB is likely to decline than increase, especially in the south of the MDB where the Lachlan and Macquarie River systems are located. The decline in surface water availability based on the median climate change scenario is 8% in the Macquarie system and 11% in the Lachlan system.
- The median water availability decline would reduce total surface water use by 4 percent under current water sharing arrangements, but will reduce flow at the Murray mouth by 24 percent. In volumetric terms, the majority of the impact of climate change will be borne by the environment rather than consumptive water users.
- Groundwater currently represents 16 percent of total water use in the MDB but could increase to over 25 percent by 2030 under current water sharing arrangements. One quarter of current groundwater use will eventually be sourced directly from induced stream flow leakage which is equivalent to 4 percent of current surface water consumption. The project found that current groundwater use is unsustainable in the lower Macquarie and upper and lower Lachlan GMUs and will lead to major drawdowns in groundwater levels in the absence of management intervention.

The key drivers and outcomes of the MDB project present a macro-level assessment of water availability and further underline the need for comprehensive water management in the Basin by taking into account potential future climate change impacts. Drawing on the outcomes of the CSIRO study, this water security study will provide further information on the impact of climate change on town water supply security in the Centroc region.

Findings of current key water resources in the Macquarie and Lachlan systems from the CSIRO study are shown in Table 2-5.

Table 2-5: Water Resources in the Macquarie and Lachlan 2004/05

SYSTEM	SURFACE WATER AVAILABILITY	SURFACE WATER USE[3]	GROUNDWATER AVAILABILITY	GROUNDWATER USE (ESTIMATE)
Macquarie	1,579 GL/year	371 GL/year	No data	182 GL/year
Lachlan	1,139 GL/year	321 GL/year	No data	236 GL/year

The 2004/05 resource development levels shown in both the Macquarie and Lachlan are considered to be moderately-high. Current average surface water net diversions, or extractive water use, for the Macquarie and Lachlan are 24% and 28% of the available water respectively. The study predicts that, according to its "best estimate" of climate change, surface water availability will be reduced by 8% in the Macquarie and 11% in the Lachlan regions by 2030.

Estimate of groundwater use from the MDB study for the Macquarie equates to 33% of total regional water use and 14% of the MDB groundwater extraction. Groundwater usage estimate in the Lachlan equates to nearly half of total water use and 14% of the MDB groundwater extraction. The study indicates that, under its "best estimate" climate change impacts, these levels of extraction are not sustainable, yet are expected to increase significantly in the future. Projection of developments for 2030 is expected to increase groundwater extraction by 125% (to 410GL/year) in the Macquarie and by 86% (to 440GL/year) in the Lachlan.

Water resources outside the Lachlan and Macquarie systems relevant to Centroc are found in the Upper Coxs River sub-catchment and the Murrumbidgee system. The Upper Coxs River sub-catchment, which is part of the Hawkesbury-Nepean system, contains the Coxs River, Farmers Creek, Marangaroo Creek and Thompsons Creek (HN 2008). Major water storages comprise of Lake Wallace, Lake Lyell, Thompsons Creek Dam and the smaller Farmers Creek Dam. In addition to providing town water supply, these storages serve the needs of Delta Electricity to provide the very significant electricity generation industry in the area.

The Centroc area is also adjacent to the Murrumbidgee system at the southern part of Harden. Burrinjuck Dam near Yass and Blowering Dam near Tumut provide water to over 10,000km of irrigation channels, as well as town water supply to Harden and Young via Goldenfields Water (MCMA 2006). The Shoalhaven scheme, with its Tallow Dam and Lake Yarrunga, is located south-west of the Centroc region and is also a neighbouring water resource.

Other alternative water resources for the region can also be derived from wastewater or stormwater recycling, and water saved through demand management and efficiency programs. Resources in these forms may not be new available resources but will play a significant contribution to improving water security of Centroc's communities.

2.6 WATER DEMAND

Extractive water demand exists across the urban and other economic producers in the region including the agriculture and mining sectors.

[3] Extractive water use only, does not include diversions for environmental flow

2.6.1 URBAN

The key urban demand nodes for water served by the Local Water Utilities (LWUs) in Centroc, and their corresponding water supply sources, have been identified in Table 2-6. These key nodes were determined based on their potential role in developing a regional water security strategy. Demand forecasting and options modelling for the study will be constructed based on these nodes. Figure 2-8 maps the locations of the urban demand nodes in the Centroc region that are involved in this study.

Table 2-6: Urban Water Demand Nodes and Water Supply Sources

LOCAL WATER UTILITIES	DEMAND NODES	WATER SUPPLY SOURCES
Bathurst Regional Council	Bathurst	Chifley Dam Winburndale Dam Macquarie River Weir
Blayney Shire Council	Blayney-Carcoar (supplied by CTW)	LWU does not provide water supply; see CTW
Boorowa Shire Council	Boorowa	Booroowa Dam
Cabonne Shire Council	Molong	Molong Creek Dam Borenore Creek Dam
	Cumnock	Bell River Weir
	Yeoval	Buckinbah Creek Weir Yeoval bore (emergency) Rainwater tanks
Central Tablelands Water	Blayney-Carcoar (supplied by CTW) includes Blayney, Millthorpe, Carcoar, Lyndhurst, Mandurama, Garland	Lake Rowlands Blayney bore
	Canowindra-Woodstock	Lake Rowlands Bangaroo bores (emergency back-up only)
	Cudal-Cargo-Manildra	Lake Rowlands
	Grenfell	Lake Rowlands Gooloogong bores (peak) Bangaroo bores (emergency)
	Gooloogong-Eugowra	Lake Rowlands (Eugowra only) Gooloogong bores (peak demand only)
Cowra Shire Council	Cowra-Koorawatha	Wyangala Dam Lake Rowlands (via CTW)
Forbes Shire Council	Forbes	Lachlan River offtake Forbes bores
Harden Shire Council	Murrumburrah	Goldenfields Water Scheme
Lachlan Shire Council	Condobolin	Goobang Creek Weir Condobolin bore
	Lake Cargelligo	Lachlan River weir
Lithgow City Council	Lithgow-Portland	Farmers Creek Dam Clarence Colliery Transfer (mine water) Fish River Water Scheme (supplement)
Oberon Council	Oberon	Oberon Dam Duckmaloi Weir (currently fully utilised by Delta Electricity)
Orange City Council	Orange	Suma Park Dam Spring Creek Dam
Parkes Shire Council	Parkes-Peak Hill	Endeavour Dam Beargamil Dam Bogan River Weir (Peak Hill only, raw water) Parkes and Peak Hill bores Lachlan River intake (Lachlan River borefield)

LOCAL WATER UTILITIES	DEMAND NODES	WATER SUPPLY SOURCES
Upper Lachlan Shire Council	Crookwell	Crookwell (Kentgrove) Dam Crookwell bores
Weddin Shire Council	Grenfell (supplied by CTW)	LWU does not provide water supply, see CTW
Wellington Council	Wellington-Geurie	Burrendong Dam Mumbil bores - Bell River Aquifer
Young Shire Council	Young	Goldenfields Water Scheme

2.6.2 AGRICULTURAL

There are a number of major irrigation companies with considerable demand for water. Table 2-7 sets out the main irrigation water users in the Macquarie and Lachlan regions. The majority of irrigation in the Macquarie region is around the Macquarie River (ABARE 2008). These are concentrated downstream from Narromine and Warren, while more scattered irrigated horticulture activities occur around Orange. Irrigation in the Lachlan is dependent on water from below Wyangala Dam or from groundwater bores. Irrigation activities, mostly cereal crops and pasture production, are concentrated in the Jemalong and Wyldes Plains districts west of Forbes, as well as around Cowra. Figure 2-4 and Figure 2-6 previously shown highlight the irrigation areas within these two regions.

Table 2-7: Irrigation Water Demand

CATCHMENT	TOTAL WATER DEMAND[4]	
Macquarie River	Extraction Licences (2006/07)	
	Groundwater (broadacre)	698 ML/farm
	Groundwater (horticulture)	127 ML/farm
	General security (broadacre)	1,157 ML/farm
	General security (horticulture)	15 ML/farm
	High security (broadacre)	10 ML/farm
	High security (horticulture)	N/A
	Unregulated (broadacre)	N/A
	Unregulated (horticulture)	96 ML/farm
	Total unregulated rivers licensed entitlement	115,749 ML
	Water Consumption (2006/07)	
	Water applied to crops and pasture (broadacre)	603 ML/farm
	Water applied to crops and pasture (horticulture)	132 ML/farm
Lachlan	Extraction Licences (2006/07)	
	Groundwater (all farm types)	246 ML/farm
	General security (all farm types)	562 ML/farm
	High security (all farm types)	98 ML/farm
	Supplementary (all farm types)	24 ML/farm
	Total unregulated rivers licensed entitlement	31,659 ML
	Water Consumption (2006/07)	
	Water applied to crops and pasture (broadacre)	603 ML/farm
	Water applied to crops and pasture (horticulture)	132 ML/farm
	Water application rate (broadacre)	4 ML/ha
	Water application rate (horticulture)	2 ML/ha

[4] ABARE 2008, IPART 2006

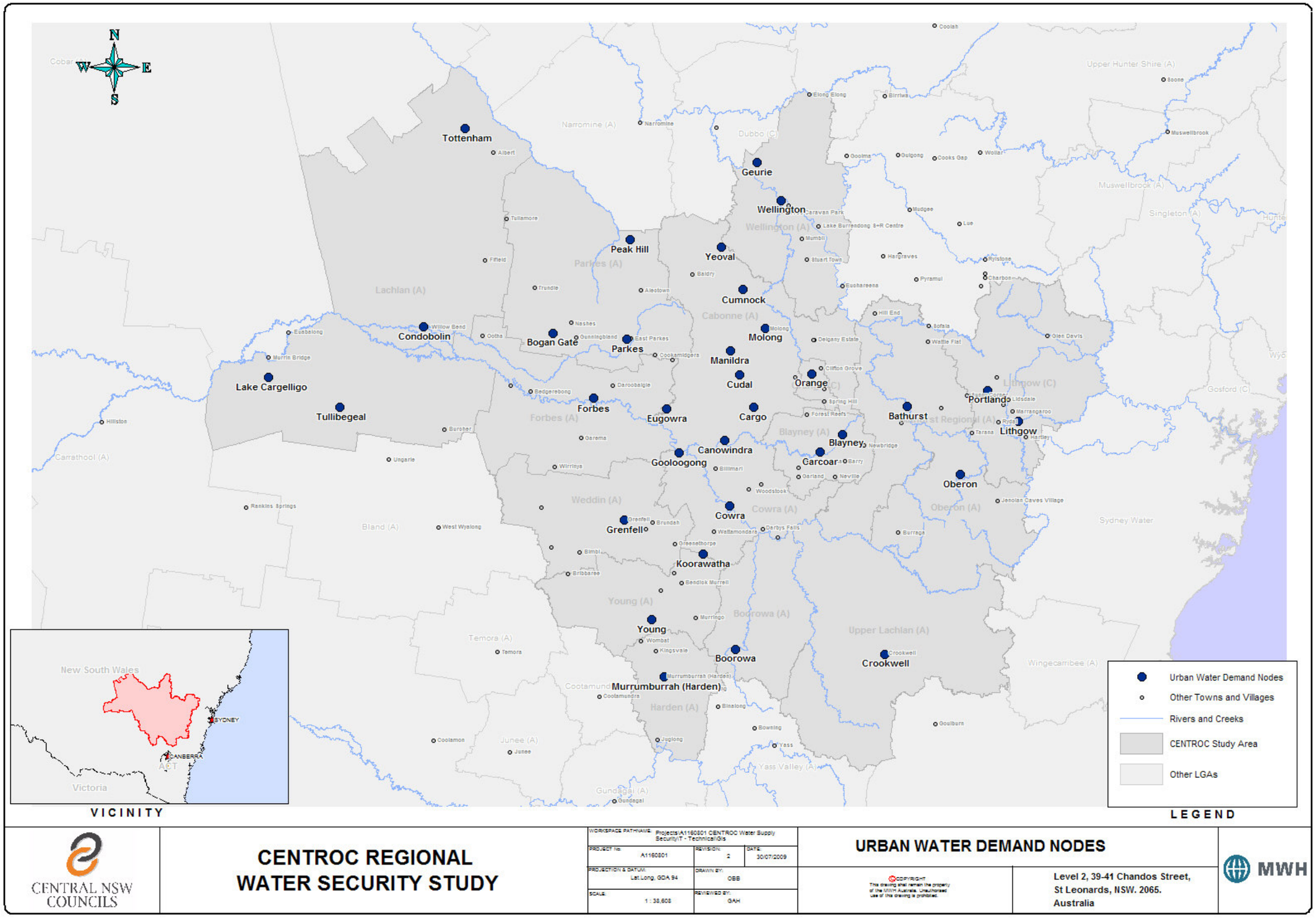


Figure 2-8: Locations of Key Urban Demand Nodes in the Centroc Region

2.6.3 MINING

There are a number of major mining players with considerable demand for water as the industries continue to expand in the region. Table 2-8 sets out the main mining water users in the Macquarie and Lachlan regions. The information is based on historical demand and does not take into account changes in demand or the demand of additional entrants to the sector.

Major mining operations in the Centroc area consists of Newcrest's Cadia Valley gold mines located near Orange and Northparkes mines near Peak Hill. Barrick Gold's Cowal mines are located just outside the area of study in Bland, but source some of its water supply from the Jemalong Irrigation Channel via the Lachlan River.

Table 2-8: Mining Water Demand

CATCHMENT	WATER USERS	WATER DEMAND	
Macquarie	Newcrest - Cadia Valley Mines (CHPL 2009)	Extraction Licences (2007/08)	
		General security entitlement (Belubula River)	4,080 ML/a
		Unregulated high security entitlement (Belubula River)	3,125 ML/a
		On-site extraction (Cadiangullong Dam/Flyers Ck Weir)	4,200 ML/a
		Groundwater extraction licence (bores)	371 ML/a
		Groundwater extraction licence (dewatering)	931 ML/a
		Water Consumption (2007/08)	
		On-site recycling	32,520 ML/a
		Orange recycled effluent	3,650 ML/a
		Blayney recycled effluent and dewatering	1,700 ML/a
		Groundwater bores	354 ML/a
		Underground mine and exploration decline dewatering	487 ML/a
		Licensed extraction (Belubula River)	1,550 ML/a
		Licensed surface water (Cadiangullong/Flyers Ck)	1,600 ML/a
		Total water demand estimate	40,150ML/a
		Total losses (residual tailings moisture, evaporation, etc)	8,240 ML/a
	Northparkes Mines (NM 2007)	Water Consumption (2007)	
		Fresh water (30% Lachlan River and 70% groundwater)	3,506ML/a
Lachlan	Barrick Gold – Lake Cowal Mines (GAPL 2008)	Water Consumption (Average)	
		External water demand (following E42 modification)	3,650 ML/a
		Pit dewatering (groundwater inflow)	365 ML/a
		Saline groundwater supply borefield	365 ML/a
		Temporary entitlements purchased (Lachlan River)	1,430 ML/a
		Bland Creek palaeochannel borefield	1.130 ML/a

3. EXISTING INFRASTRUCTURE ASSETS

This section of the report describes the ownership and nature of the water supply related infrastructure assets of the study area including those owned by the Centroc local governments and those owned and operated by the NSW State Government via State Water.

3.1 LOCAL WATER UTILITIES

LWUs are responsible for the sustainable provision and management of water supply and sewerage services to the community on behalf of the Councils. In addition to this core functionality, LWUs can currently assume two different management and operational structures:

1. Business units of General Purpose Local Government Councils; or
2. Single purpose County Councils.

All Centroc LWUs are General Purpose Councils, with the exception of Central Tablelands Water which acts as a LWU to supply water to a number of Councils. An overview of each Centroc LWU is set out in Table 3-1.

Table 3-1: Centroc Local Water Utilities (LWUs)

LWU	FUNCTIONS	OVERVIEW DESCRIPTION
Bathurst Regional Council	General Purpose Council with water supply, reticulation and sewerage LWU functions	Bathurst Regional Council (BRC), located on the Macquarie River, serves an area of 3,815 square kilometres and a population of approximately 38,000 residents (BRC 2008). The city of Bathurst is the main urban centre in the LGA. Council provides water supply and sewerage services to over 14,000 connections (DWE 2008). The major water supply for the Bathurst region is sourced from Chifley Dam and Winburndale Dam (BRC 2009a, 2009b). Water is treated mainly from a 60ML/day Water Treatment Plant (WTP) and sewage is treated from a 55,000 Equivalent Population (EP) STP in Bathurst.
Blayney Shire Council	General Purpose Council with sewerage LWU function only	Blayney Shire Council (BSC), located on the Lachlan River, serves an area of 1,525 square kilometres and a population of approximately 6,600 residents. The town of Blayney is the main urban centre in the LGA. Council provides sewerage service only to over 1,500 connections (DWE 2008). Water supply is sourced from Lake Rowlands via Central Tablelands Water to the Blayney-Carcoar-Millthorpe system. BSC treats its sewage at a 7,000EP STP in Blayney.
Boorowa Shire Council	General Purpose Council with water supply, reticulation and sewerage LWU functions	Boorowa Shire Council (BWSC), located on the Lachlan River, serves an area of 2,600 square kilometres and a population of 2,500 (BWSC 2007). The town of Boorowa is the main urban centre in the LGA. Council provides water supply services to 500 connections and sewerage services to over 600 connections (DWE 2008). The main water supply is sourced from catchments established on the Boorowa and Lachlan Rivers. Water is treated at a 3ML/day WTP and sewage is treated from a 3,500EP STP in Boorowa.
Cabonne Shire Council	General Purpose Council with water supply, reticulation and sewerage LWU functions	Cabonne Shire Council (CSC), located on both the Lachlan and Macquarie Rivers, serves an area of 6,000 square kilometres and a population of over 2,000 residents (SCS 2008a). The towns of Molong, Canowindra, Cudal, Cargo, Manildra, Eugowra, Cumnock and Yeoval are the main urban centres in the LGA. Council provides water supply service to 1,100 connections and sewerage services to 2,300 connections (CSC 2008a). Water supply is sourced mainly from the Molong Creek Dam, Borenore Creek Dam and Molong Creek Weir. Canowindra, Eugowra, Cargo, Cudal and Manildra are served by the CTW scheme via Lake Rowlands. Water is treated mainly at the 2.3ML/day Molong WTP and sewage is treated from the 2000EP Molong STP, 2500EP Canowindra STP and 550EP Eugowra STP.

LWU	FUNCTIONS	OVERVIEW DESCRIPTION
Central Tablelands Water	Local Water Utility supplying Councils with water supply and reticulation functions	Central Tablelands Water (CTW) is the trading name adopted by Central Tablelands County Council. CTW provide water services to a large area ranging from Blayney to the east to Grenfell in the west. CTW provides potable water to a population of approximately 11,500 in 14 towns and villages (CTW 2008A). CTW is the LWU for Blayney, Weddin and most of Cabonne Councils. Water supply is distributed to 5,200 connections in the region and is sourced mainly from Lake Rowlands (DWE 2008). CTW also sells bulk water to Cowra Shire Council for the villages of Woodstock and Gooloogong. CTW is not responsible for provision of sewerage services.
Cowra Shire Council	General Purpose Council with water supply, reticulation and sewerage LWU functions	Cowra Shire Council (CWSC), located on the Lachlan River, serves an area of 2,800 square kilometres and a population of 13,100 residents (CWSC 2008a). The town of Cowra is the main urban centre in the LGA. CWSC provides water supply services to 5,000 connections and sewerage services to 3,500 connections within Cowra, as well as some communities in the shires of Weddin and Young (DWE 2008). The Aboriginal community at Eramble, consisting of approximately 200 residences, is also connected to the town's water supply. The major water supply is sourced from Wyangala Dam and the Lachlan River. Water is treated at a 28 ML/day Cowra WTP and sewage is treated at a 10,000EP Cowra STP.
Forbes Shire Council	General Purpose Council with water supply, reticulation and sewerage LWU functions	Forbes Shire Council (FSC), located on the Lachlan River, serves an area of 4,700 square kilometres and a population of over 8,500 (FSC 2008). The town of Forbes is the main urban centre in the LGA. Water supply and sewerage services are provided to 3,200 connections (DWE 2008). Water supply is sourced from the Lachlan River, supplemented by groundwater bores. Water is treated at a 26ML/day Forbes WTP and sewage is treated by a 12,000EP Forbes STP.
Harden Shire Council	General Purpose Council with water reticulation and sewerage LWU functions	Harden Shire Council (HSC), located on the Murrumbidgee River, serves an area of 1,870 square kilometres and a population of 3,700 (HSC 2008a). The town of Harden Murrumburrah is the main urban centre in the LGA. HSC provides water supply services to 1,800 connections and sewerage services to 1,000 connections (DWE 2008). Water supply is sourced from Burrinjuck and Blowering Dams via Goldenfields Water County Council. As such, no WTP exists in Harden while sewerage is treated at the 4000EP Harden STP.
Lachlan Shire Council	General Purpose Council with water supply, reticulation and sewerage LWU functions	Lachlan Shire Council (LSC), located on the Lachlan River, serves an area of over 15,000 square kilometers and a population of 7,200 residents (LSC 2008a). The towns of Tottenham, Lake Cargelligo, Tullibigeal and Condobolin are the main urban centres in the LGA. LSC provides water supply and sewerage services to 2,500 connections (DWE 2008). This includes provision of bulk water supply to Aboriginal communities at Murrin Bridge, and town water supply to Boona Road and Willow Bend. Water supply is sourced mainly from the Goobang Creek Weir and the State Water owned Lake Cargelligo. Water is treated at the 7.5ML/day Condobolin WTP, 4.5ML/day Lake Cargelligo WTP and a 1.1ML/day Tottenham WTP. Sewage is treated by a 4000EP Condobolin STP, 2000EP Lake Cargelligo STP and 1000EP Tottenham STP.
Lithgow City Council	General Purpose Council with water supply, reticulation and sewerage LWU functions	Lithgow City Council (LCC), located on the Coxs River, serves an area of 4,551 square kilometres and a population of 19,750 (LCC 2009b). The city of Lithgow and two townships of Portland and Wallerawang are the main urban centres in the LGA. LCC provides water supply and sewerage services to over 7,000 connections (DWE 2008). LCC sources its main water supply from Oberon Dam and Duckmaloi Weir via the Fish River Water Scheme (FRWS), supplemented by Farmers Creek Dam. FRWS also provides bulk water supply to a number of other consumers including Delta Electricity, Sydney Catchment Authority and Oberon Council. Water is treated by a 15ML/day Oaky Park WTP, while sewage is treated by the 23,000EP Lithgow STP, 3300EP Wallerawang STP and 2500EP Portland STP.

LWU	FUNCTIONS	OVERVIEW DESCRIPTION
Oberon Council	General Purpose Council with water supply, reticulation and sewerage LWU functions	Oberon Council (OC), located on the Fish River, serves an area of 3,660 square kilometres and a population of over 5,000 residents (OC 2008). The town of Oberon is the main urban centre in the LGA. OC provides water and sewerage services to over 1,200 connections (DWE 2008). Water supply is sourced from Oberon Dam and Duckmaloi weir via the Fish River Water Scheme. Water is treated at a 6.5ML/day Oberon WTP and sewage is treated at a 7300EP Oberon STP.
Orange City Council	General Purpose Council with water supply, reticulation and sewerage LWU functions	Orange City Council (OCC) serves an area of 284 square kilometres and a population of over 37,000 residents (ABS, 2008). The city of Orange is the main urban centre in the LGA. OCC provides water and sewerage services to over 15,000 connections in the region (DWE 2008). The major water supply sources are Suma Park and Spring Creek Dam. Upstream of Spring Creek Dam is the Gosling Creek Dam, which is currently used for recreational purposes only. Water is treated at a 38ML/day Icely Road WTP while sewage is treated at the 60,000EP Orange STP and 1000EP Spring Hill STP.
Parkes Shire Council	General Purpose Council with water supply, reticulation and sewerage LWU functions	Parkes Shire Council (PSC), located north of the Lachlan River on Goobang Creek and Bogan River, serves an area of 5,920 square kilometres and a population of over 10,000 residents (PSC 2008a). The town of Parkes and Peak Hill are the main urban centres in the LGA. PSC provides water supply services to 6,000 connections and sewerage services to 5,000 connections (DWE 2008). Peak Hill is also home to an Aboriginal community of approximately 20 residences. Water supply is sourced from the Upper Lachlan groundwater system via a borefield and from Endeavour Dam on Goobang Creek. Water is treated at the 8.6ML/day Parkes WTP and sewage is treated at a 14,500EP Parkes STP and 2,000EP Peak Hill STP.
Upper Lachlan Shire Council	General Purpose Council with water supply, reticulation and sewerage LWU functions	Upper Lachlan Shire Council (ULSC), located on the Lachlan River, serves an area of 7,100 square kilometres and a population of 7,500 residents (ULSC 2008). The town of Crookwell is the main urban centre in the LGA. ULSC provides water supply services to 1,850 connections and sewerage services to 1,400 connections (DWE 2008). Water supply is sourced from the Crookwell (Kentgrove) Dam. Water is treated at the 3ML/day Crookwell WTP and 1.3ML/day Taralga WTP, while sewage is treated at 5000EP Crookwell STP and 1000EP Gunning STP. A 400EP STP is under construction at Taralga.
Weddin Shire Council	General Purpose Council with sewerage LWU function only	Weddin Shire Council (WSC), located south of the Lachlan River, serves an area of 3,425 square kilometres and a population of 3,700 residents (WSC 2008a). The town of Grenfell is the main urban centre in the LGA. WSC provides sewerage services only to 970 connections (DWE 2008). CTW provide reticulation functions to Weddin Shire Council. WSC treats its sewage at a 2,500EP Grenfell STP.
Wellington Council	General Purpose Council with water supply, reticulation and sewerage LWU functions	Wellington Council (WLC), located on the Macquarie and Bell River, serves an area of 4,100 square kilometres and a population of 9,200 residents (WLC 2008). The towns of Wellington and Geurie are the main urban centre in the LGA. Council provides water supply services to 2,800 connections and sewerage services to 2,400 connections (DWE 2008). WSC also provides water to approximately 20 residences in the Aboriginal community at Nanima Reserve. The major water supply source is Burrendong Dam. Water is treated at the 14.6ML/day Wellington STP and 1.5ML/day Geurie WTP, while sewage is treated at the 8000EP Wellington STP. A new sewage scheme will be commissioned in Geurie in 2009/10 to treat sewage collected in town at the Geurie STP. Sewage collected at Nanima is treated at the Nanima oxidation pond treatment works.
Young Shire Council	General Purpose Council with water reticulation and sewerage LWU functions	Young Shire Council (YSC), located between the Lachlan and Murrumbidgee Rivers, serves an area of 2,670 square kilometres and a population of 12,500 (OCSE 2008). The town of Young is the main urban centre in the LGA. Council provides sewerage services only to 3,600 connections (DWE 2008). Water supply is mainly sourced from Burrinjuck Dam and Murrumbidgee River via Goldenfields Water County Council. Sewage is treated via a 7000EP Young STP.

3.2 STATE WATER

State Water is NSW's rural bulk water delivery corporation. A number of bulk water supply assets on the Upper Lachlan and Macquarie River Systems, such as the Wyangala, Windamere, Carcoar and Burrendong Dams within the Centroc region, are owned and operated by State Water.

The Fish River Scheme, which provides water from Oberon Dam and Duckmaloi Weir to Lithgow City Council, Oberon Council, Delta Electricty and the Sydney Catchment Authority, is operated by State Water (LCC 2009b). State Water also monitors water usage for some town water supplies, industry, irrigation, stock and domestic use, riparian and environmental flows, as well as manages customer accounts and bulk water charges for the infrastructure.

The scope of State Water's role in managing regulated river systems includes (State Water 2009):

- Delivering allocated water and environmental flows;
- Coordinating water ordering;
- Measuring water usage and managing water accounts and bills;
- Process water allocation assignments;
- Managing delivery restrictions and demand management;
- Ensuring compliance with water ordering and metering standards; and
- Take compliance action, such as suspension of licences, for overuse of allocation or non-payment.

State Water's role does not include:

- Determining water availability/allocations or environmental flows;
- Issuing and administering licences or setting licence conditions;
- Setting water prices or water sharing plan rules;
- Take compliance action for unlicensed works and extractions; and
- Permanent trades or directly sell water.

3.3 BULK WATER SUPPLY INFRASTRUCTURE

Table 3-2 is a compilation of bulk water supply sources, including town dams, weirs and lakes in the Centroc area, while Table 3-3 sets out a summary of groundwater bores in the region. Table 3-2 also includes water storages owned by the electricity, irrigation and mining industry. The majority of data for this section have been sourced from each respective Council via the QuickPlace collaboration site, and supplemented by inputs from DWE, State Water and the Australian Natural Resources Atlas (ANRA). Data gaps present in this section will be addressed in the Options Paper by estimation using simplifying assumptions based on professional engineering judgement, complemented by a Digital Terrain Model (DTM) and GIS approach. The locations of the bulk water supply infrastructures identified in the audit are mapped in Figure 3-1. No comprehensive groundwater bore mapping data was available for the purposes of this study.

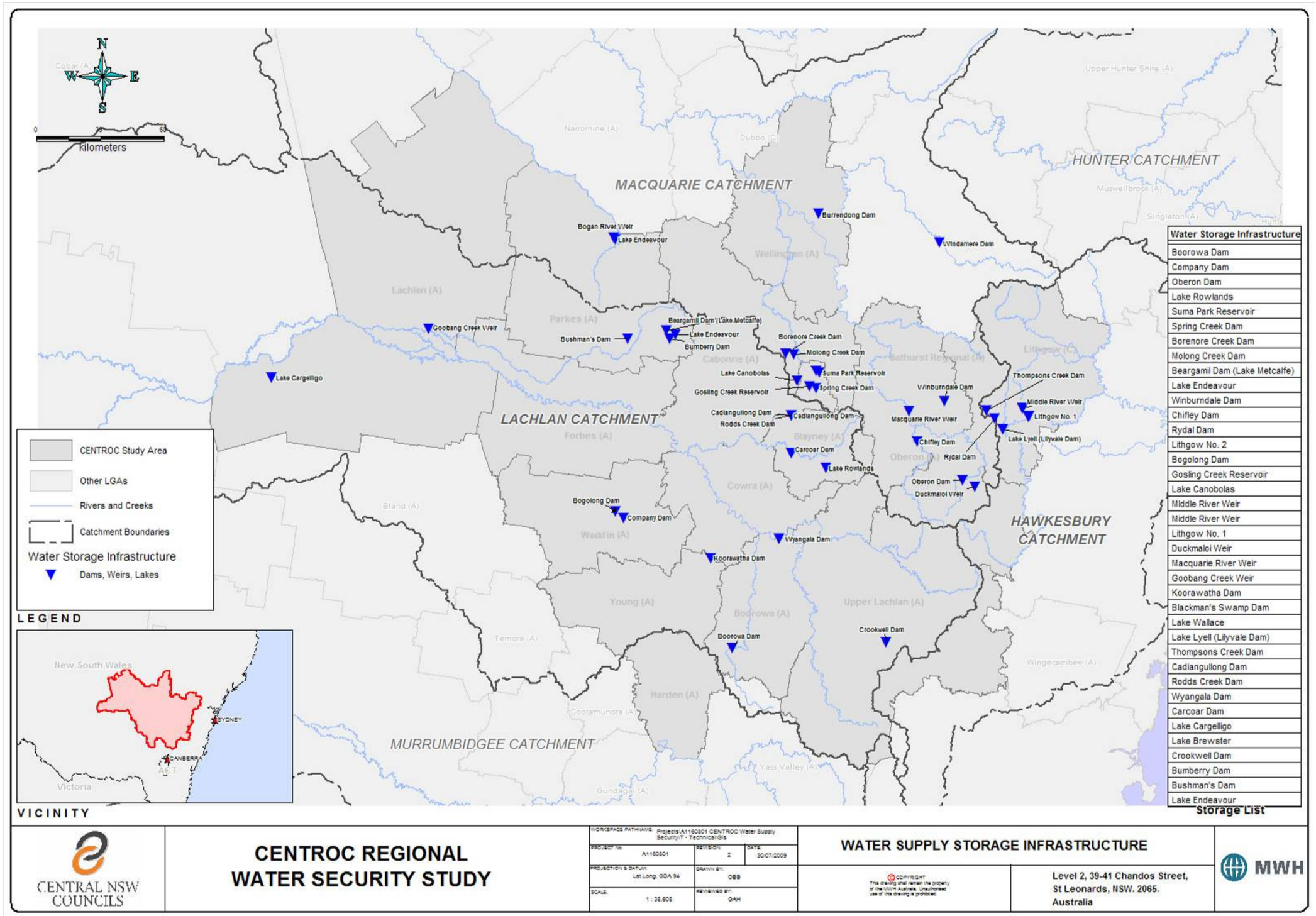


Figure 3-1: Locations of Water Supply Storage Infrastructure in the Centroc Region

Table 3-2: Bulk Water Supply Infrastructure - Storages

OWNERSHIP	ASSET	CAPACITY (ML - FSL)	HEIGHT (M)	MAXIMUM DEPTH (M)	SURFACE AREA (HA)	LOCATION (LONG, LAT)	YEAR BUILT	CATCHMENT	PRIMARY PURPOSE	REFERENCE
Bathurst Regional Council	Chifley Dam	30,800	34	N/A	245	149.38 E 33.62 S	1956/ 2001	Campbells River (Macquarie)	Town water supply	BRC 2009a
	Winburndale Dam	1,700	22	N/A	21.7	149.46 E 33.23 S	1936	Winburndale Rivulet (Macquarie)	Park watering, industrial. Emergency town supply	BRC 2009b
	Macquarie River Weir	10	1.5	N/A	2.1	149.6 E 33.4 S	1991	Macquarie River	Town water supply, irrigation	DWE 2009c
Boorowa Shire Council	Boorowa Dam	335	5	N/A	18.4	148.7 E 34.4 S	1937	Boorowa River (Lachlan)	Town water supply	DWE 2009c
Cabonne Shire Council	Molong Creek Dam	1,000	16	N/A	22.9	149 E 33.2 S	1986	Molong Creek (Macquarie)	Town water supply	CSC 2008b
	Borenore Creek Dam	230		N/A	6.5	148.9 E 33.25 S	1928	Borenore Creek (Macquarie)	Town water supply	CSC 2008b
Central Tablelands Water	Lake Rowlands	4,500	20	20	80	149 E 33.65 S	1953	Coombing Creek (Lachlan)	Town water supply	ANRA 2007 CTW 2007
	Bogolong Dam	360	11	N/A	7.6	148.1 E 33.9 S	1934	Bogolong Creek (Lachlan)	Backup; taken out of operation in 2000 due to poor quality	DWE 2009c
Cowra Shire Council	Koorawatha Dam	200	9	N/A	0.6	148.6 E 34.1 S	1899	Bang Bang Creek (Lachlan)	Recreation; offline due to siltation	DWE 2009c
Delta Electricity	Lake Wallace	4,300	14	-[5]	-	142.91 E 32.45 S	-	Coxs River (Hawkesbury-Nepean)	Power station	DE 2006 DWE 2005
	Lake Lyell (Lilyvale Dam)	33,500	50	-	-	150.07 E 33.51 S	-	Coxs River (Hawkesbury-Nepean)	Power station	DE 2006 DWE 2005
	Thompsons Creek Dam	27,500	54	N/A	-	149.99 E 33.43 S	-	Thompsons Creek (Hawkesbury-Nepean)	Power station	DE 2006 DWE 2005
Forbes Shire Council	Lachlan River Weir @ Hillston	-	-	N/A	-	-	-	Lachlan River	Town water supply, irrigation	ANRA 2007

[5] - denotes bulk water supply infrastructure data that are not available or were not provided for the Audit

OWNERSHIP	ASSET	CAPACITY (ML - FSL)	HEIGHT (M)	MAXIMUM DEPTH (M)	SURFACE AREA (HA)	LOCATION (LONG, LAT)	YEAR BUILT	CATCHMENT	PRIMARY PURPOSE	REFERENCE
Lachlan Shire Council	Goobang Creek Weir	-	3.5	N/A	3.1	147.2 E 33.1 S	1897	Goobang Creek (Lachlan)	Town water supply	DWE 2009c
Lithgow City Council	Lithgow No.1	77	12	N/A	5	150.2 E 33.5 S	1896	Farmers Creek (Hawkesbury-Nepean)	Out of operation	DWE 2009c
	Lithgow No.2	440	26	N/A	5.1	150.2 E 33.5 S	1907	Farmers Creek (Hawkesbury-Nepean)	Town water supply	DWE 2009c
Newcrest Mining Limited	Cadiangullong Dam	4,200	44	-	-	149.0 E 33.45 S	-	Cadiangullong Creek (Macquarie)	Mining	NML 2006
	Rodds Creek Dam	3,700	-	-	-	149.0 E 33.45 S	-	Rodds Creek (Macquarie)	Mining	NML 2006
Oberon Council	No existing infrastructure									
Orange City Council	Suma Park Dam	18,000	31	N/A	159	149.93 E 30.16 S	1959	Summer Hill Creek (Macquarie)	Town water supply	OCC 2009a
	Spring Creek Dam	4,500	16	N/A	91	149.92 E 30.18 S	1931	Spring Creek and Gosling Creek (Macquarie)	Town water supply	OCC 2009a
	Gosling Creek Dam	650	8	N/A	16	149.1 E 33.3 S	1890	Gosling Creek (Macquarie)	Recreation	DWE 2009c
	Lake Canobolas	450	13	-	12.5	149.0 E 33.3 S	1918	Molong Creek (Macquarie)	Recreation	DWE 2009c
	Blackmans Swamp Creek Dam	-	-	N/A	7	149.1 E 33.3 S	2008	Blackmans Swamp Creek (Macquarie)	Stormwater harvesting	DWE 2009c
Parkes Shire Council	Bogan River Weir @ Peak Hill	570	-	N/A	33	148.1 E 32.7 S	-	Bogan River (Lachlan)	Town water supply (raw only), recreation	ANRA 2007
	Lake Endeavour	2,400	21	-	48	148.42 E 33.11 S	1940	Goobang Creek (Lachlan)	Town water supply, mining	ANRA 2007
	Bushman's Creek Weir	3.5	1	NA	0.8	148.2 E 33.1 E	-	Bushman's Creek (Lachlan)	Recreation, stormwater control	DWE 2009c
	Beargamil Dam (Lake Metcalfe)	500	16	N/A	11	148.4 E 33.1 S	1924	Beargamil Creek (Lachlan)	Town water supply, mining	DWE 2009c

OWNERSHIP	ASSET	CAPACITY (ML - FSL)	HEIGHT (M)	MAXIMUM DEPTH (M)	SURFACE AREA (HA)	LOCATION (LONG, LAT)	YEAR BUILT	CATCHMENT	PRIMARY PURPOSE	REFERENCE
	Bumberry Dam	300	-	N/A	7	148.4 E 33.1 S	1897	Bumberry Creek (Lachlan)	Recreation	DWE 2009c DWE 2009d
State Water Corporation	Windamere Dam	368,000	69	N/A	-	149.75 E 32.72 S	1984	Cudgegong River (Macquarie)	Town water supply, irrigation, stock	NSWWI 2008
	Burrendong Dam	1,188,000	76	50	7,200	149.14 E 32.60 S	1967	Macquarie River	Town water supply, irrigation, stock, hydro-electricity	NSWWI 2008
	Wyangala Dam	1,220,000	85	N/A	5,390	148.94 E 33.97 S	1971	Lachlan River	Town water supply, irrigation, stock, hydro-electricity	NSWWI 2008
	Carcoar Dam	36,130	52	41	390	149 E 33.61 S	1970	Belubula River (Lachlan)	Irrigation, stock	NSWWI 2008
	Lake Cargelligo	35,900	N/A	-	1,440	146.37 E 33.29 S	1902	Lachlan River	Town water supply, irrigation	NSWWI 2008
	Lake Brewster	153,000	N/A	3.5	6,500	143.51 E 37.48 S	1950	Lachlan River	Town water supply	NSWWI 2008
	Oberon Dam	45,400	-	N/A	354	149.85 E 33.7 S	1949	Lake Oberon (Fish River)	Town water supply, irrigation, power station	LCC 2009b
	Duckmaloi Weir	20	-	N/A	-	149.93 E 33.75 S	-	Duckmaloi Creek (Fish River)	Power station	LCC 2009b DWE 2009d
Upper Lachlan Shire Council	Crookwell Dam	450	15	N/A	-	149.5 E 34.4 S	1932	Kentgrove Creek (Lachlan)	Town water supply, irrigation	DWE 2009c
Weddin Shire Council	Company Dam	95	5	N/A	3.3	148.2 E 33.9 S	1867	Emu Creek (Lachlan)	Recreation	DWE 2009c

Table 3-3: Bulk Water Supply Infrastructure - Groundwater Bores

LGA	LOCATION	NO. OF BORES IDENTIFIED	TOTAL CAPACITY (ML)	PRIMARY PURPOSE	QUALITY	CATCHMENT	REFERENCE
Bathurst	No existing infrastructure						
Blayney	Blayney	1 (owned by CTW)	0.6	Town water supply	Low quality	Belubula River	CTW 2008b CMJA 2009
Boorowa	-						
Cabonne	Eugowra	1 (ownership with the Rural Fire Service	-[6]	Rural Fire Service	Very low quality	Lachlan River	CSC 2008d CMJA 2009
	Yeoval	3	-	Emergency supply	-	Lachlan River	CMJA 2009 CSC 2008d
Cowra	Gooloogong	2 (owned by CTW)	3.0	Backup supply	High quality	Lachlan River	CTW 2008b CMJA 2009
	Bangaroo	2 (owned by CTW)	3.0	Emergency supply	Low quality	Lachlan River	CTW 2008b CMJA 2009
	Billimari	-	-	-	-	Lachlan River	OCC 2009d
Forbes	Forbes	1 in development, 3 in concept stage	-	Town water supply	-	Lachlan River	CTW 2008b CMJA 2009
Harden	-						
Lachlan	-						
Lithgow	-						
Oberon	-						
Orange	Spring Hill/ Lucknow	3	11 (ML/a)	Town water supply	-	Macquarie River	OCC 2009b
Parkes	Parkes-Peak Hill	6	-	Town water supply (Parkes and Peak Hill)	-	Lachlan River	CTW 2008b CMJA 2009
Upper	Crookwell	2	365 (ML/a)	Emergency supply	High quality	Lachlan River	CMJA 2009

[6] - denotes bulk water supply infrastructure data that are not available or were not provided for the Audit

LGA	LOCATION	NO. OF BORES IDENTIFIED	TOTAL CAPACITY (ML)	PRIMARY PURPOSE	QUALITY	CATCHMENT	REFERENCE
Lachlan	Dalton	2	5.0	Town water supply	Low quality	Lachlan River	CMJA 2009 ULSC 2004
	Taralga	2	100 (ML/a)	Town water supply	High quality	Wollondilly	ULSC 2004
Weddin	-						
Wellington	Wellington	1	-	Emergency supply to Wellington	High quality	Macquarie River	CMJA 2009 WLC 2007
	Geurie	1	-	Emergency supply to Geurie	High quality	Macquarie River	CMJA 2009 WLC 2007
	Mumbil	3	-	Town water supply	High quality	Bell River	CMJA 2009 WLC 2007
	Caves	1	-	Town water supply	-	Bell River	CMJA 2009 WLC 2007
Young	-						

3.4 WATER SUPPLY DISTRIBUTION INFRASTRUCTURE

This section outlines existing infrastructure for the distribution of untreated and treated town water supply to the key demand nodes in the Centroc region, including:

- Layout of water supply distribution infrastructure (major only) in Figure 3-2;
- Raw water transfer pipes in Table 3-4;
- Raw water pumping stations in Table 3-5;
- Raw water reservoirs in Table 3-6;
- Treated water transfer pipes in Table 3-7;
- Treated water pumping station in Table 3-8; and
- Treated water reservoirs in Table 3-9.

Data for this section was compiled from information provided by individual Councils via the QuickPlace collaboration site and GIS data from DWE. Data gaps that were critical to the modelling and assessment to be conducted for the Options Paper will be resolved via inputs from PRG and PTC review, as well as assumptions based on professional engineering judgement.

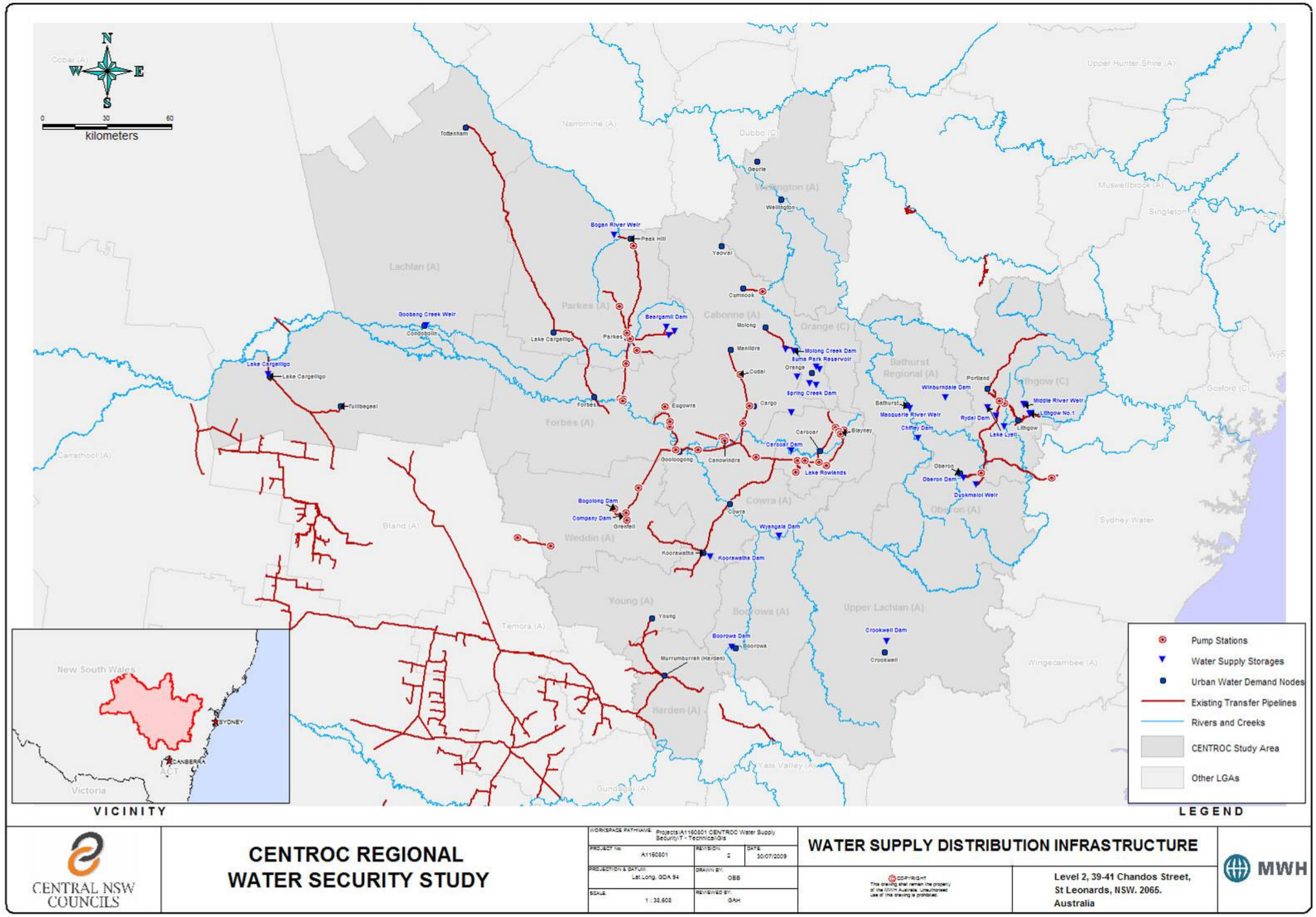


Figure 3-2: Layout of Major Water Supply Distribution Infrastructure in the Centroc Region

Table 3-4: Raw Water Supply Distribution Infrastructure – Transfer Pipes

LGA	LOCATION	FROM	TO	LENGTH (KM)	PIPE SIZE (MM)	PIPE MATERIAL	NOTES	REFERENCE
Bathurst	Bathurst	Winburndale Dam	Bathurst WTP	21.1	300	Wood stave/ Hobas/PE	Raw water for park and industrial applications	BRC 2009b
Blayney	Lake Rowlands	Lake Rowlands	Carcoar WTP	4.5	375	CI[7]	CTW Trunk main 'A' Gravity main	CTW 2008b
		Lake Rowlands	Blayney WTP	13.3	300	AC	CTW Trunk main 'X' Rising main	CTW 2008b
				1.6	375	CI		
Booorowa	Boorowa	Boorowa River Weir	Boorowa WTP	0.2	-[8]	-	N/A	BWSC2008
Cabonne	Molong	Molong Creek Dam	Molong Creek Weir	2.9	225	UPVC	N/A	CSC 2008d
		Molong Creek Weir	Peter's Pit	3.1	200	UPVC	Dual main	CSC 2008d
				3.1	200	AC		
		Borenore Creek Dam	Peter's Pit	2.3	150	CICL	N/A	CSC 2008d
		Peter's Pit	Gabb's Pit	8.6	150	CICL	Dual main	CSC 2008d
				8.6	200	AC		
		Gabb's Pit	Mitchell Highway Crest	2.5	150	CICL	Dual main	CSC 2008d
				2.5	200	UPVC		
		Mitchell Highway Crest	Rotary Park Junction	1.0	250	UPVC	N/A	CSC 2008d
		Rotary Park Junction	Railway Bridge	0.5	150	CICL	Dual main	CSC 2008d
				0.5	200	UPVC		
		Railway Bridge	Gidley Street Reservoir	0.5	150	CICL	Dual Main	CSC 2008d
				0.5	200	UPVC		
		Gidley Street Reservoir	Water Treatment Plant	0.2	200	AC	N/A	CSC 2008d
	Cumnock	Bell River Weir	Cumnock	4.3	100	AC	Rising main	CSC 2008d
				4.1	150	AC	Gravity main	CSC 2008d
	Yeoval	Buckinbah Creek	Yeoval	2.8	150	AC	Rising main	CSC 2008d
Cowra	Cowra	Lachlan River offtake	Cowra WTP	1.3	500	DICL	N/A	CWSC 2009a
Forbes/ Lachlan	Forbes-Tottenham	Forbes	Tottenham	158.7	-	-	N/A	DWE 2009d

[7] CI = Cast Iron, AC = Asbestos Cement, UPVC = Unplasticised Polyvinylchloride, CICL = Cast Iron Cement Lined, DICL = Ductile Iron Cement Lined, PE = Polyethylene

[8] - denotes water supply distribution infrastructure data that are not available or were not provided for the Audit

LGA	LOCATION	FROM	TO	LENGTH (KM)	PIPE SIZE (MM)	PIPE MATERIAL	NOTES	REFERENCE
Lachlan	Lake Cargelligo	Lower Lachlan River Bore	Lake Cargelligo	8.1	-	-	N/A	DWE 2009d
Oberon	Oberon	Oberon Dam	Duckmaloi WTP	10.5	-	-	N/A	LCC 2008c
Orange	Orange	Suma Park Dam	Icely Road WTP	4.2	600	Steel	110m lift	OCC 2009a
		Spring Creek Dam	Spring Creek WTP	2.3	300	CI	N/A	OCC 2009a
		Gosling Creek Dam	Spring Creek WTP	2.2	300	CI	N/A	DWE 2009d
Parkes	Parkes	Upper Lachlan River Bore	Parkes	29.1	2 x 375	DICL	N/A	DWE 2009d
		Lake Endeavour	Parkes	23.0	2 x 300	-	N/A	DWE 2009d
		Lake Metcalf	Parkes	21.4	250	-	N/A	DWE 2009d
		Parkes	Northparkes Mines	24.6	300	-	N/A	DWE 2009d
Upper Lachlan	Crookwell	Kentgrove Creek	Crookwell WTP	-	-	-	N/A	ULSC 2004
	Taralga	Woolshed Creek	Taralga	1.2	150	AC	N/A	ULSC 2009
	Gunning	Lachlan River	Gunning	3.5	200	AC	N/A	ULSC 2009
	Dalton	Dalton Bores	Dalton Reservoir	1.2	100	PE	N/A	ULSC 2009
Weddin	Quandialla	Bland	Quandialla	16.7	100	uPVC	N/A	DWE 2009d
Wellington	Mumbil	Bell River	Mumbil	0.2	150	DICL	Rising Main	WLC 2009
				0.6	150	CI		
				1.7	150	AC		
				0.1	200	DICL		
	Geurie	Macquarie River	Geurie WTP	2.4	150	DICL	Rising Main	WLC 2009

Table 3-5: Raw Water Supply Distribution Infrastructure – Pumping Stations

LGA	LOCATION	ASSET	DESTINATION	CAPACITY (ML/DAY)	REFERENCE
Bathurst	No existing infrastructure				
Blayney	Lake Rowlands	Lake Rowlands Pumping Station	Blayney WTP	6.0	CTW 2008b DWE 2009d
Boorowa	Boorowa River	Boorowa River Weir Pumping Station	Boorowa WTP	-[9]	DWE 2009d
Cabonne	Molong	Wellington Street Pumping Station	Molong WTP	-	CSC 2008b
	Cumnock	Bell River Pump Station	High Level Reservoir	-	CSC 2008d
	Yeoval	Buckinbah Creek Pump Station	Yeoval and North Yeoval Reticulation	-	CSC 2008d
Cowra	Lachlan River	Lachlan River Offtake Pumping Station	Cowra WTP	18.0	DWE 2009d
Forbes	Forbes	Forbes Pumping Station	Botfield Reservoir	-	PSC 2006
	Forbes	New Grenfell Road Bore	Forbes	-	DWE 2009d
Lachlan	Condobolin	Goobang Creek Pumping Station	Condobolin WTP	3.9	LSC 2008b
		Condobolin Bore No.1 Pumping Station	Condobolin WTP	4.3	LSC 2008b
	Lake Cargelligo	Lake Wet Well Pumping Station	Lake Cargelligo WTP	5.6	LSC 2008b
	Albert	Albert Booster Pump	Tottenham Reservoir	0.6	PSC 2000
Lithgow	Clarence	Clarence Colliery Pump Station	Wollongambie River	-	LCC 2008c
Oberon	Oberon Dam	Oberon Dam Pump Station	Duckmaloi WTP	-	LCC 2008b
Orange	Orange	Suma Park Pump Station	Icely Road WTP	-	DWE 2009d
		Spring Creek Pump Station	Spring Creek WTP	-	OCC 2009d
Parkes	Parkes	Pump Station No. 3	Church Street Reservoir and Parkes WTP	-	PSC 2006
		Northparkes Mine Pump Station (High Street)	Goonumbla Balance Tank	-	PSC 2006

[9] - denotes water supply distribution infrastructure data that are not available or were not provided for the Audit

LGA	LOCATION	ASSET	DESTINATION	CAPACITY (ML/DAY)	REFERENCE
		Goonumbla Booster	Northparkes Mine	-	PSC 2006
		Orange Rd Booster	Parkes WTP	-	PSC 2006
	Forbes	Pump Station No. 2	Tullamore and Albert Hill Reservoir	-	PSC 2009
Upper Lachlan	Kentgrove Dam	Kentgrove Dam Pump Station	Crookwell	2.0	DWE 2009d ULSC 2009
	Gunning	Lachlan River Pump Station	Gunning	-	ULSC 2009
	Taralga	Woolshed Creek Pump Station	Taralga	-	ULSC 2009
	Dalton	Dalton Bores Pump Station x 2	Dalton Reservoir	-	ULSC 2009
Weddin	Bogolong Dam	Bogolong Dam Pump Station	Grenfell	-	DWE 2009d
Wellington	Mumbil	Bell River Pump Station	Mumbil	0.4	WLC 2009
	Guerie	Macquarie River Pump Station	Geurie WTP	1.7	WLC 2009

Table 3-6: Raw Water Supply Distribution Infrastructure – Service Reservoirs

LGA	LOCATION	ASSET	CAPACITY (ML)	YEAR BUILT	CONSTRUCTION MATERIAL	PURPOSE	REFERENCE
Bathurst	Bathurst	Reservoir No. 3	3.8	1893	Concrete	Raw water storage	DWE 2009d
		Reservoir No. 5	0.8	1936	Concrete	Raw water storage	DWE 2009d
Boorowa	Boorowa	Boorowa Reservoir	-[10]	-	-	Raw water storage	DWE 2009d
Cabonne	Molong	Wellington Street Railway Reservoir	1.0	-	-	Raw water storage	CSC 2008b
	Cumnock	High Level Reservoir	23.0	-	Earthen	Raw water storage	CSC 2008d
Forbes	Forbes	Turners Hill Reservoir	-	-	-	Raw water storage	PSC 2000
Lachlan	Tottenham	Leg of Mutton Reservoir	55.0	1990	Earthen	Raw water storage	LSC 2008b
	Albert	Albert Hill Reservoir	0.7	1954	Concrete	Raw water storage	PSC 2000 LSC 2008b
Lithgow	No existing infrastructure						
Oberon	No existing infrastructure						
Orange	No existing infrastructure						
Parkes	Parkes	Church Street Process Water Reservoir	-	-	-	Raw water storage	PSC 2006
		Balance Tank No. 1a	-	-	-	Raw water storage	PSC 2006
		Balance Tank No. 1b	-	-	-	Raw water storage	PSC 2006
		Balance Tank No. 2a	-	-	-	Raw water storage	PSC 2006
		Balance Tank No. 2b	-	-	-	Raw water storage	PSC 2006
		Botfield Reservoir	-	-	-	Raw water storage	PSC 2000
		Goonumbla Balance Tank	-	-	-	Raw water storage	PSC 2009
Upper Lachlan	Taralga	Taralga Off-Stream Storage	25.0	-	Earthen	Raw water storage	ULSC 2009

[10] - denotes water supply distribution infrastructure data that are not available or were not provided for the Audit

LGA	LOCATION	ASSET	CAPACITY (ML)	YEAR BUILT	CONSTRUCTION MATERIAL	PURPOSE	REFERENCE
Wellington	No raw water storage						
Weddin	No existing infrastructure or no data provided						
Young	No existing infrastructure or no data provided						

Table 3-7: Treated Water Supply Distribution Infrastructure – Transfer Pipes

LGA	LOCATION	FROM	TO	LENGTH (KM)	PIPE SIZE (MM)	PIPE MATERIAL	NOTES	REFERENCE
Bathurst	No existing transfer pipes – 67km of trunk mains ranging from 200 to 600mm for reticulation							
Blayney	Carcoar	Carcoar WTP	Mandurama	6.6	250	CI[11]	CTW Trunk main 'B'	CTW 2008b
		Carcoar Filtration Plant	Browns Creek Reservoir	19.7	200	CI	CTW Trunk main 'D'	CTW 2008b
	Mandurama/ Gooloogong	Mandurama	Gooloogong	19.5	225	CI	CTW Trunk main 'C'	CTW 2008b
				15.9	225	Steel		
				25.6	200	Steel		
				8.7	250	Steel		
	Blayney	Browns Creek Reservoir	Hill Street Reservoir	3.2	150	CI	CTW Trunk main 'E'	CTW 2008b
		Browns Creek Reservoir	Millthorpe	8.3	150	CI	CTW Trunk main 'F'	CTW 2008b
		Trunk main 'C'	Belubula River	5.6	150	Steel	CTW Trunk main 'U'	CTW 2008b
Cabonne	Cumnock	High Level Reservoir	Town Service Reservoir	4.0	150	AC	N/A	CSC 2008d
	Yeoval	Buckinbah Creek Weir Pumping station	Town Reservoir	2.8	150	AC	Disinfection facility is located at the creek bank	CSC 2008d
	Eugowra	Trunk main 'C'	Eugowra Reservoir	20.0	150	AC	CTW Trunk main 'L'	CTW 2008b
	Cudal/ Manildra	Belubula River	Cudal	28.3	150	CI	CTW Trunk main 'U'	CTW 2008b DWE 2009d
		Cudal	Gray's Hill	3.8	150	UPVC		
		Gray's Hill	Manildra	8.8	100	CI		
				8.8	150	UPVC		
Cowra	Moorbel	Trunk main 'C'	Moorbel Reservoir	4.2	200	UPVC	CTW Trunk main 'V'	CTW 2008b
	Cowra	Trunk main 'C'	Woodstock	13.3	150	CI	N/A	DWE 2009d
		Woodstock	Cowra	20.4	150	CI/UPVC	Bulk water supply line via CTW	DWE 2009d

[11] CI = Cast Iron, AC = Asbestos Cement, UPVC = Unplasticised Polyvinylchloride, CICL = Cast Iron Cement Lined, DICL = Ductile Iron Cement Lined

LGA	LOCATION	FROM	TO	LENGTH (KM)	PIPE SIZE (MM)	PIPE MATERIAL	NOTES	REFERENCE
		Cowra	Wattamondara	14.9	-[12]	-	N/A	DWE 2009d
		Wattamondara	Koorawatha	11.2	-	-	N/A	DWE 2009d
		Koorawatha	Greenethorpe	17.0	-	-	N/A	DWE 2009d
		Greenethorpe	Brundah	18.7	-	-	N/A	DWE 2009d
		Bendick Murrell	Wirrimah	6.3	-	-	N/A	DWE 2009d
		Koorawatha	Bendick Murrell	13.8	-	-	N/A	DWE 2009d
Harden	Murrumburrah	Juqiong	Murrumburrah	39.3	-	-	N/A	DWE 2009d
		Murrumburrah	Galong	22.4	-	-	N/A	DWE 2009d
		Murrumburrah	Young	31.8	-	-	N/A	DWE 2009d
		Murrumburrah	Wallendbeen	19.3	-	-	N/A	DWE 2009d
Lachlan	Condobolin	Condobolin WTP	Town Reservoir	0.6	300	CICL	N/A	LSC 2008b
	Lake Cargelligo	Lake Cargelligo	Tullibigeal	45.0	150	UPVC	N/A	DWE 2009d
		Lake Cargelligo	Weethalle	25.8	200	AC	N/A	LSC 2008b
				25.8	150	AC	N/A	LSC 2008b
		Lake Cargelligo	Murrin Bridge	15.0	75	AC	Operated and maintained by Murrin Bridge Local Aboriginal Council	LSC 2008b
Lithgow/ Oberon	Lithgow/ Oberon	Duckmaloi WTP	Wallerawang	40.0	-	-	State Water assets (Fish River Water Supply); gravitates with booster pumps at Narrowneck and Mt Piper	DWE 2009d
		Wallerawang	Lithgow	12.5	-	-		DWE 2009d
		Lithgow	Wallerawang	14.0	-	-		DWE 2009d
		Wallerawang	Portland	9.0	-	-		DWE 2009d
		Portland	Cullen Bullen	8.0	-	-		DWE 2009d

[12] - denotes water supply distribution infrastructure data that are not available or were not provided for the Audit

LGA	LOCATION	FROM	TO	LENGTH (KM)	PIPE SIZE (MM)	PIPE MATERIAL	NOTES	REFERENCE
		Cullen Bullen	Glen Davies	36.0	-	-		DWE 2009d
		Duckmaloi WTP	Katoomba	45.0	-	-	To Leura reservoirs	DWE 2009d
Orange	Orange	Icely Road WTP	Town Reservoirs and Reticulation	N/A	N/A	N/A	N/A	OCC 2009d
	Orange	Spring Creek WTP	Town Reservoirs and Reticulation	N/A	N/A	N/A	N/A	OCC 2009d
Parkes	Parkes	Parkes	Peak Hill	20.9	200	-	N/A	DWE 2009d
				22.7	225	-	N/A	DWE 2009d
	Forbes-Parkes	Forbes	Tullamore	92.5	200	-	N/A	PSC 2009
	Parkes	Parkes	Cookamidgera	16.5	100	AC	N/A	PSC 2009
Upper Lachlan	Crookwell	Kentgrove Dam	Crookwell	4.0	250	DICL	N/A	ULSC 2009
Weddin	Gooloogong-Grenfell	Gooloogong	Grenfell	35.3	200/250	Steel	CTW Trunk main 'K'	CTW 2008b
Wellington	Wellington	Wellington	Barton Reservoir	4.9	150	DICL	Trunk main	WLC 2009
		Barton Reservoir	Mid-Western Correctional Centre	3.9	200	PVC		
		Wellington	Nanima Village	1.9	80	AC		
Young	No existing infrastructure or no data provided							

Table 3-8: Treated Water Supply Distribution Infrastructure – Pumping Stations

LGA	LOCATION	ASSET	DESTINATION	CAPACITY (ML/DAY)	YEAR BUILT	REFERENCE
Bathurst	No existing infrastructure (10 pumping station for reticulation)					
Blayney	Carcoar	Booster #1 Pump Station	Trunk Main 'D'	1.6	2002	CTW 2008b
	Blayney/ Mandurama	Browns Creek Pump Station	Millthorpe Reservoir	0.8	2007	CTW 2008b
		Newry Downs Pump Station	Booster into trunk main 'C'	7.1	2003	CTW 2008b
		Sugarloaf Road Pump Station	Booster into trunk main 'C'	6.0	2003	CTW 2008b
		Canomodine Pump Station	Booster into trunk main 'U'	1.8	1996	CTW 2008b
Boorowa	No existing infrastructure or no data provided					
Cabonne	Molong	Gidley Street Reservoir Pumping Station	Low level reticulation; high level reservoir	-	-[13]	CSC 2008b
	Yeoval	Buckinbah Creek Weir Pumping Station	Town Reservoir	-	-	CSC 2008b
	Eugowra	Trunk main 'L' Booster Pump	Eugowra	2.1	2001	CTW 2008b
	Cargo	Cargo Pump Station	Cargo Reservoir	0.3	1956	CTW 2008b
	Cudal	Cudal Booster Pump Station	Cudal Reservoir or trunk main 'U'	2.1	2004	CTW 2008b
	Canowindra	Canowindra Pump Station	Moorbel Reservoir or reticulation	1.0	1970	CTW 2008b
Cowra	Canowindra	Canowindra Booster Pump (owned by CTW)	Gooloogong	-	1977	CTW 2009d
Harden	Murrumburrah	Prunevale Booster Pump Station	Prunevale Reservoir	0.4	-	HSC 2008b
		Aurville Booster Pump Station	Aurville Reservoir	0.3	-	HSC 2008b
		Cunningar Booster Pump Station	Galong Reservoir	0.4	-	HSC 2008b
Lachlan	Lake Cargelligo	Baileys Street Pumping Station	16 Mile Street	0.7	2003	LSC 2008b
		16 Mile Street Pumping Station	Tullibigeal Reservoir	0.6	2003	LSC 2008b

[13] - denotes water supply distribution infrastructure data that are not available or were not provided for the Audit

LGA	LOCATION	ASSET	DESTINATION	CAPACITY (ML/DAY)	YEAR BUILT	REFERENCE
		Tullibigeal Booster	Tullibigeal	0.6	2003	LSC 2008b
	Tottenham	Leg of Mutton	Town reticulation	1.1	1994	LSC 2008b
Lithgow	No existing infrastructure or no data provided					
Oberon	No existing infrastructure					
Parkes	Parkes	Peak Hill Booster	Peak Hill Service Reservoirs	-	-	PSC 2006
	Parkes	Mugincoble Pump Station	Cookamidgera Reservoir	-	-	PSC 2009
	Trundle	Trundle Pump Station	Tullamore Reservoir	-	-	PSC 2009
	Trundle	Trundle Booster Pump	Tullamore and Albert Hill Reservoir			
Upper Lachlan	Crookwell	Crookwell WTP Pump Station	Crookwell reservoirs	2.0	-	ULSC 2009
Weddin	Grenfell	McDonalds Lane Pump Station	Grenfell	2.6	1998	CTW 2008b
Wellington	Wellington	Tin Bridge Pump Station	Barton Service Reservoir	1.2	2003	WLC 2009
	Wellington	Gobolion Street Pump Station	Nanima Hill Service Reservoir	1.2	1991	WLC 2009
	Geurie	Geurie Booster Pump Station	Geurie Street Reservoir	1.1	1992	WLC 2009
Young	No existing infrastructure or no data provided					

Table 3-9: Treated Water Supply Distribution Infrastructure – Service Reservoirs

LGA	LOCATION	ASSET	CAPACITY (ML)	YEAR BUILT	CONSTRUCTION MATERIAL	PURPOSE	REFERENCE
Bathurst	Bathurst	Reservoir No. 4	9.1	1933	Concrete	Storage and supply to reticulation	DWE 2009d
		Reservoir No. 6	9.1	1955	Concrete	Storage and supply to reticulation	DWE 2009d
		Reservoir No. 7	9.1	1967	Concrete	Storage and supply to reticulation	DWE 2009d
		Reservoir No. 8	12.1	1987	Steel	Storage and supply to reticulation	DWE 2009d
		Reservoir No. 9	13.7	1983	Steel	Storage and supply to reticulation	DWE 2009d
		Reservoir No. 10	13.6	1977	Concrete	Storage and supply to reticulation	DWE 2009d
		Reservoir No. 11	3.9	1984	Steel	Storage and supply to reticulation	DWE 2009d
		Reservoir No. 13A	-	1970s	Concrete	Storage and supply to reticulation	DWE 2009d
		Reservoir No. 13B	-	1970s	Concrete	Storage and supply to reticulation	DWE 2009d
		Reservoir No. 13C	-	1970s	Concrete	Storage and supply to reticulation	DWE 2009d
		Reservoir No. 13D	-	1970s	Concrete	Storage and supply to reticulation	DWE 2009d
		Reservoir No. 13E	-	1970s	Concrete	Storage and supply to reticulation	DWE 2009d
		Reservoir No. 15	2.2	1993	Steel	Storage and supply to reticulation	DWE 2009d
		Reservoir No. 17	13.1	1995	Concrete	Storage and supply to reticulation	DWE 2009d
		Windamere Road No. 14	0.1	1990	Concrete	Storage and supply to reticulation	DWE 2009d
		Wentworth Estate No. 18	0.7	1999	Concrete		
Blayney	Blayney	Plumb Street Reservoir	0.9	1958	Reinforced concrete	Storage and supply to reticulation	CTW 2008b
		Hill Street Reservoir	1.1	1930	Reinforced concrete	Storage and supply to reticulation	CTW 2008b
		Browns Creek Reservoir	0.2	1954	Reinforced concrete	Storage and supply to Browns Creek Pumping Station	CTW 2008b
		Patricks Reservoir	0.5	1975	Reinforced concrete	Storage and supply to reticulation	CTW 2008b
	Carcoar	Carcoar Reservoir	0.7	1954	Reinforced concrete	Storage and supply to reticulation	CTW 2008b
	Millthorpe	Millthorpe Reservoir	1.4	1954	Reinforced concrete	Storage and supply to reticulation	CTW 2008b
	Mandurama	Mandurama Reservoir	0.9	1954	Reinforced concrete	Storage and supply to reticulation	CTW 2008b
	Lyndhurst	Lyndhurst Reservoir	0.7	1954	Reinforced concrete	Storage and supply to reticulation	CTW 2008b
Cabonne	Eugowra	Eugowra Reservoir	1.4	1955	Reinforced concrete	Storage and supply to reticulation	CTW 2008b
		Hill St Reservoir	0.5	2006	Reinforced concrete	Storage and supply to reticulation	CTW 2008b
	Molong	Gidley Street Clearwater Reservoir	1.4	-	Reinforced concrete	Storage and supply to reticulation	CSC 2008b
	Cargo	Cargo Reservoir	0.7	1958	Reinforced concrete	Storage and supply to reticulation	CTW 2008b

LGA	LOCATION	ASSET	CAPACITY (ML)	YEAR BUILT	CONSTRUCTION MATERIAL	PURPOSE	REFERENCE
	Cudal	Cudal Reservoir	0.2	1956	Reinforced concrete	Storage and supply to reticulation	CTW 2008b
		Gray's Hill Reservoir	2.3	1962	Reinforced concrete	Balance tank for trunk main 'U' and storage for Cudal	CTW 2008b
	Manildra	Manildra Reservoir	0.5	-	Reinforced concrete	Storage and supply to reticulation	CTW 2008b
	Moorbel	Moorbel Reservoir	1.1	1955	Reinforced concrete	Storage and supply to reticulation and Canowindra Reservoir	CTW 2008b
	Canowindra	Canowindra Reservoir	0.9	1955	Reinforced concrete	Storage and supply to reticulation	CTW 2008b
Cowra	Cowra	Cowra 01	4.4	-	-	Storage and supply to reticulation	CWSC 2009b
		Cowra 02	4.5	-	-	Storage ands supply to reticulation	CWSC 2009b
		Cowra 03	1.2	-	-	Storage ands supply to reticulation	CWSC 2009b
		Cowra 04	1.2	-	-	Storage ands supply to reticulation	CWSC 2009b
		Cowra 05	2.7	-	-	Storage ands supply to reticulation	CWSC 2009b
	Darby Falls	Derby Falls 10	0.3	-	-	Storage ands supply to reticulation	CWSC 2009b
	Gooloogong	Gooloogong 15	0.2	-	-	Storage ands supply to reticulation	CWSC 2009b
		Gooloogong 16	0.2	-	-	Storage ands supply to reticulation	CWSC 2009b
	Koorawatha	Koorawatha 40	1.0	-	-	Storage ands supply to reticulation	CWSC 2009b
	North Cowra	North Cowra 07	9.0	-	-	Storage ands supply to reticulation	CWSC 2009b
	Wattamondara	Wattamondara 29	0.2	-	-	Storage ands supply to reticulation	CWSC 2009b
	Woodstock	Woodstock 11	0.7	-	-	Storage ands supply to reticulation	CWSC 2009b
	Wyangala	Wyangala 37	0.2	-	-	Storage ands supply to reticulation	CWSC 2009b
Forbes	No existing infrastructure or no data provided						
Harden	Murrumburrah	Demondrille Reservoir	1.5	-	Reinforced concrete	Storage and supply to reticulation	HSC 2009
		Bobbara Reservoir	3.0	-	Reinforced concrete	Storage and supply to reticulation	HSC 2009
		Aurville	0.2	-	Steel	Storage and supply to reticulation	HSC 2009
Lachlan	Condobolin	Reservoir No. 1	1.1	1940	Reinforced concrete	Storage and supply to reticulation	LSC 2008b
		Reservoir No. 2	3.4	1953	Reinforced concrete	Storage and supply to reticulation	LSC 2008b
		Reservoir No. 3	6.8	1966	Reinforced concrete	Storage and supply to reticulation	LSC 2008b
	Lake Cargelligo	Reservoir No. 1	0.7	1949	Reinforced concrete	Storage and supply to reticulation	LSC 2008b
		Reservoir No. 2	4.0	2003	Reinforced concrete	Storage and supply to reticulation	LSC 2002
		16 Mile Reservoir	0.2	1967	Reinforced concrete	Storage and supply to reticulation	LSC 2008b
	Tottenham	Reservoir No. 1	0.5	1954	Reinforced concrete	Storage and supply to reticulation	LSC 2008b
	Tullibigeal	Reservoir No. 1	0.1	1970	Reinforced concrete	Storage and supply to reticulation	LSC 2008b
		Reservoir No. 2	0.1	1970	Reinforced concrete	Storage and supply to reticulation	LSC 2008b

LGA	LOCATION	ASSET	CAPACITY (ML)	YEAR BUILT	CONSTRUCTION MATERIAL	PURPOSE	REFERENCE
		Reservoir No. 3	0.1	1970	Reinforced concrete	Storage and supply to reticulation	LSC 2008b
		Reservoir No. 4	0.3	2004	Reinforced concrete	Storage and supply to reticulation	LSC 2008b
Lithgow	No existing infrastructure or no data provided						
Oberon	Oberon	Reservoir No. 1	3.0	-	Reinforced concrete	Storage and supply to reticulation	OC 2009
		Reservoir No. 2	1.1	-	Reinforced concrete	Storage and supply to reticulation	
Orange	Orange	Beech Crescent	9.1	1971	Steel	Storage and supply to reticulation	OCC 2009d
		Sharp Road	10.0	1985	Steel	Storage and supply to reticulation	OCC 2009d
		Spring Creek	4.6	1931	Reinforced concrete	Storage and supply to reticulation	OCC 2009d
		Rosewood	9.1	1971	Steel	Storage and supply to reticulation	OCC 2009d
			20.0	2001	Reinforced concrete	Storage and supply to reticulation	OCC 2009d
		Icely Road	9.1	1959	Steel	Storage and supply to reticulation	OCC 2009d
			20.0	1985	Reinforced concrete	Storage and supply to reticulation	OCC 2009d
		Cargo Road	2.3	1918	Reinforced concrete	Storage and supply to reticulation	OCC 2009d
	Spring Hill/ Lucknow	Spring Hill Reservoir	0.5	N/A	Reinforced concrete	Storage and supply to reticulation	OCC 2009d
		Lucknow Reservoir	0.2	N/A	Reinforced concrete	Storage and supply to reticulation	OCC 2009d
	Cadia	Balance Tank 1	3.0	1998	Reinforced concrete	Storage and supply for mine site consumption	OCC 2009d
		Balance Tank 2	1.5	1998	Reinforced concrete	Storage and supply for mine site consumption	OCC 2009d
Parkes	Parkes	Old Barton Street Reservoir	4.5	1968	-	Storage and supply to reticulation	PSC 2009
		New Barton Street Reservoir	10.0	1987	-	Storage and supply to reticulation	
		High Street Reservoir	4.5	1968	-	Storage and supply to reticulation	
		Nash's Balance Tank	-	1967	-	Balance tank for Peak Hill transfer	
	Botfield	Botfield Reservoir	0.9	1962	-	Balance tank for Trundle and Tullamore supply	
	Cookamidgera	Cookamidgera Reservoir	0.2	-	-	Storage and supply to reticulation	
	Trundle	Trundle Reservoir	1.5	1993	-	Storage, supply and balance to reticulation	PSC 2009
	Tullamore	Tullamore Reservoir	2.2	1965	-	Storage and supply to reticulation	
	Northparkes Mines	Potable Water Reservoir	-	-	-	Potable water reservoir	DWE 2009d
	Peak Hill	Service Reservoirs	2.9	-	-	Storage and supply to reticulation	

LGA	LOCATION	ASSET	CAPACITY (ML)	YEAR BUILT	CONSTRUCTION MATERIAL	PURPOSE	REFERENCE
Upper Lachlan	Crookwell	Hay Street Reservoir (1)	1.4	-	Reinforced concrete	Storage and supply to reticulation	ULSC 2009
		Hay Street Reservoir (2)	4.0	-	Steel	Storage and supply to reticulation	
	Gunning	Gunning Reservoir	1.0	-	Reinforced concrete	Storage and supply to reticulation	
	Dalton	Dalton Reservoir	0.4	-	Reinforced concrete	Storage and supply to reticulation	
Weddin	Grenfell	Grenfell North Reservoir	4.6	1960	Reinforced concrete	Balance tank for trunk main 'K' and storage and supply for Grenfell	CTW 2008b
		Grenfell West Reservoir	1.4	1950	Reinforced concrete	Storage and supply to reticulation	
		Grenfell East Reservoir	0.5	1990	Reinforced concrete	Storage and supply to reticulation	
Wellington	Wellington	Bushrangers Creek Reservoir	-	-	-	Storage and supply to reticulation	WLC 2007
		Reservoir No. 1	1.8	1910	Reinforced concrete	Storage and supply to reticulation	WLC 2009
		Reservoir No. 2	1.8	1939	Reinforced concrete	Storage and supply to reticulation	
		Reservoir No. 3	1.8	1955	Reinforced concrete	Storage and supply to reticulation	
		Reservoir No. 4	4.0	1974	Reinforced concrete	Storage and supply to reticulation	
		Reservoir No. 5	4.3	1991	Reinforced concrete	Storage and supply to reticulation	
		Reservoir No. 6	0.8	1970	Reinforced concrete	Storage and supply to reticulation	
		Reservoir No. 7	1.9	2003	Reinforced concrete	Storage and supply to reticulation	
	Geurie	Reservoir No. 1	0.7	1955	Reinforced concrete	Storage and supply to reticulation	
		Reservoir No. 2	1.2	1992	Reinforced concrete	Storage and supply to reticulation	
	Mumbil	Reservoirs	0.4	1982	Reinforced concrete	Storage and supply to reticulation	
Young	No existing infrastructure or no data provided						

3.5 TREATMENT INFRASTRUCTURE

This section details infrastructure in the Centroc region that are used for town water and wastewater treatment purposes. It includes:

- Layout of water, sewage and stormwater treatment infrastructure in Figure 3-3;
- Water treatment plants (WTP) in Table 3-10;
- Sewage treatment plants (STP) in Table 3-11; and
- Stormwater harvesting facilities in Table 3-12.

Data for this section was compiled from information provided by individual Councils via the QuickPlace collaboration site, including previous water security options study reports, and GIS data from DWE. Data gaps that were critical to the modelling and assessment to be conducted for the Options Paper will be resolved via inputs from PRG and PTC review, as well as assumptions based on professional engineering judgement.

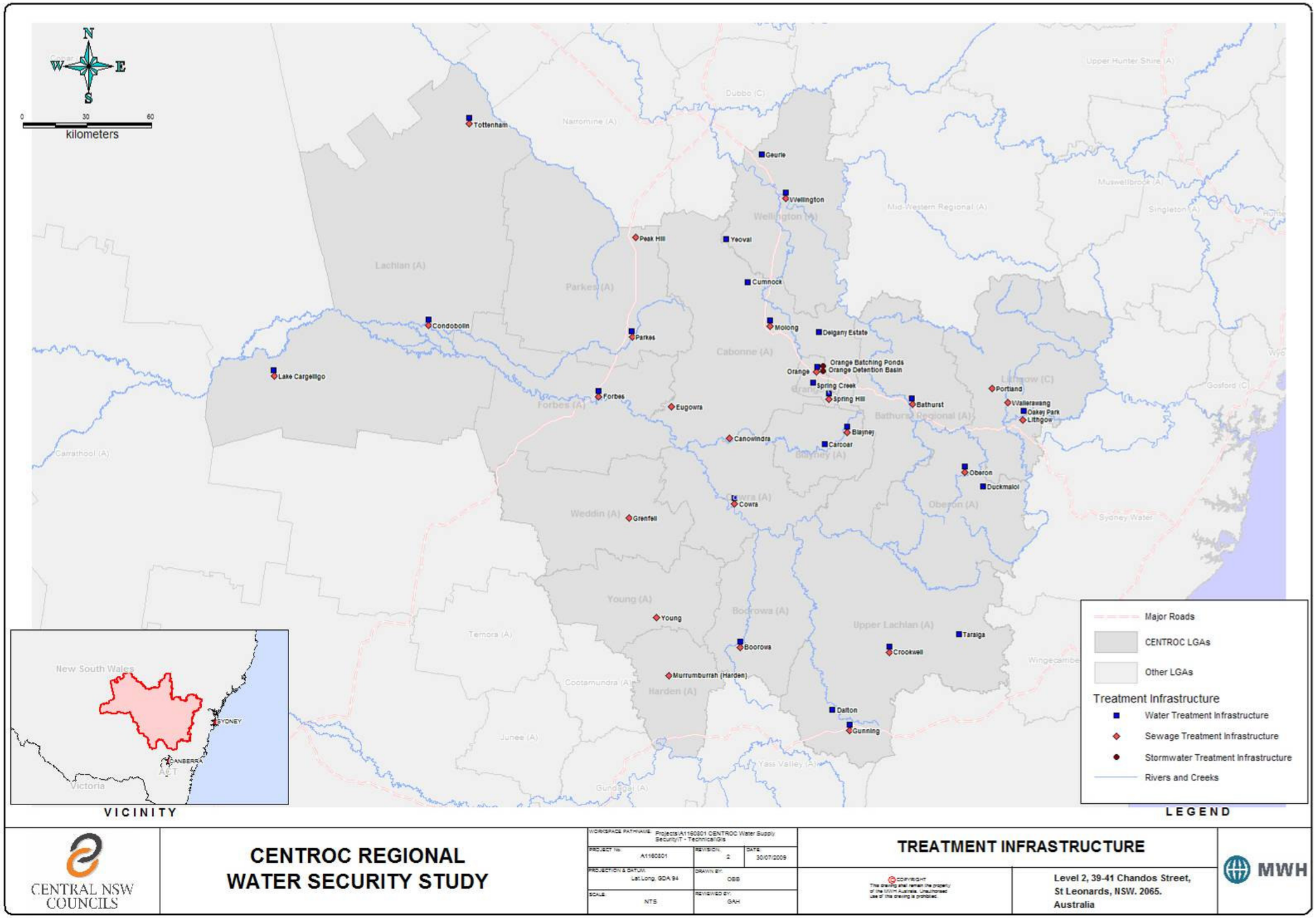


Figure 3-3: Layout of Water, Sewage and Stormwater Treatment Infrastructure in the Centroc Region

Table 3-10: Water Supply Treatment Infrastructure

LOCATION	ASSET	YEAR BUILT	CAPACITY (ML/DAY)	TREATMENT PROCESS	VOLUME TREATED (ML) [14]	SOURCE	NOTES	REFERENCE
Bathurst	Bathurst WTP	1989	60.0	Conventional	6,565	Macquarie River/Chifley Dam	Energy consumption from Planet Footprint reports	DWE 2007
Blayney	Carcoar WTP (owned by CTW)	2002	9.0	Dissolved air filtration	1,397	Lake Rowlands	N/A	DWE 2007
	Blayney WTP (owned by CTW)	1966	6.0	Conventional	585	Lake Rowlands	N/A	DWE 2007
Boorowa	Boorowa WTP	1993	3.0	Lagoon sedimentation	-	Boorowa River	N/A	DWE 2007
Cabonne	Molong WTP	1986	2.3	Conventional	218	Molong Creek Dam	N/A	CSC 2008e DWE 2007
	Cumnock WTP	-	2.0	Chlorination only	33	Bell River	Non-potable groundwater	CSC 2008e DWE 2007
	Yeoval WTP	-	0.8	Chlorination only	66	Buckinbah Creek Weir	Non-potable groundwater	CSC 2008e DWE 2007
	Delgany WTP	-	1.4	Chlorination only	5	-	Non-potable groundwater	DWE 2007
Cowra	Cowra WTP	1987	28.0	Conventional	2,536	Wyangala Dam	N/A	DWE 2007
	Wyangala WTP	-	-	-	-	-	-	CWSC 2009b
Forbes	Forbes WTP	1966	26.0	Conventional	2,472	Lachlan River	N/A	DWE 2007
Lachlan	Condobolin WTP	1941	7.5	Conventional	-	Goobang Creek Weir	N/A	LSC 2008b DWE 2007
	Lake Cargelligo WTP	1930	4.5	Conventional	-	Lake Cargelligo	N/A	LSC 2008b DWE 2007

[14] DWE Performance Reporting 07/08

LOCATION	ASSET	YEAR BUILT	CAPACITY (ML/DAY)	TREATMENT PROCESS	VOLUME TREATED (ML) [14]	SOURCE	NOTES	REFERENCE
	Tottenham WTP	1994	1.1	Direct filtration, lagoon sedimentation	-	Lachlan River	N/A	LSC 2008b
Lithgow	Oaky Park WTP	1985	15.0	Chlorination only	1,326	Farmers Creek Dam	N/A	DWE 2007
Oberon	Oberon WTP	2001	6.5	Microfiltration	732	Oberon Dam	Bulk supply from Fish River Water Scheme	DWE 2007
	Duckmaloi WTP	1991	15.0	Lagoon sedimentation	-	Fish River	N/A	DWE 2009d
Orange	Icely Road WTP	1982	38.0	Conventional process, ozonation	5,423	Suma Park Dam	N/A	DWE 2007
	Spring Creek WTP	1931	12.0	Conventional	-	Spring Creek Dam	Non-operational after 2005/06	DWE 2007
	Spring Hill/Lucknow WTP	-	0.8	Chlorination only	68	Spring Hill	Groundwater	DWE 2007
Parkes	Parkes WTP	1987	8.6	Conventional	2,497	Lachlan River	N/A	DWE 2007
Upper Lachlan	Crookwell WTP	1990	3.0	Conventional	320	Kentgrove Creek Dam	N/A	DWE 2007
	Gunning WTP	-	2.0	Chlorination only	50	-	Groundwater	DWE 2007
	Dalton WTP	1977	1.0	Chlorination only	20	-	N/A	DWE 2007
	Taralga WTP	-	1.3	Direct filtration, UV disinfection	35	-	N/A	DWE 2007
Wellington	Wellington WTP	1993	14.6	Lagoon sedimentation	1,099	Burrendong Dam	N/A	DWE 2007
	Geurie WTP	1994	1.5	Lagoon sedimentation	138	Burrendong Dam	N/A	DWE 2007
Young	No existing infrastructure							

Table 3-11: Sewage Treatment Infrastructure

LOCATION	ASSET	YEAR BUILT	CAPACITY (EP)	TREATMENT PROCESS	STANDARD	VOLUME TREATED (ML) [15]	DISCHARGE LOCATION	REUSE	REFERENCE
Bathurst	Bathurst STP	1998	55,000	Intermittent extended aeration, biological nutrient removal	Tertiary	3,100	Macquarie River	STP	ATSE 2004 DWE 2007 BRC 2009c
Blayney	Blayney STP	1991	7,000	Intermittent extended aeration	Advanced secondary	260	Cadia Gold Mine	Mine	ATSE 2004 DWE 2007 BSC 2009
Boorowa	Boorowa STP	-	3,430	Trickling filter	Secondary	-[16]	Boorowa River	-	ATSE 2004 DWE 2007 OCSE 2008
Cabonne	Molong STP	1979	2,000	Intermittent extended aeration	Advanced secondary	-	Molong Creek	-	ATSE 2004 CSC 2008f DWE 2007
	Canowindra STP	1978	2,500	Trickling filter	Secondary	150	Belubula River	Golf courses, sports field	ATSE 2004 CSC 2008f DWE 2007
	Eugowra STP	1999	550	Oxidation pond, maturation pond	Secondary	50	-	Agricultural	ATSE 2004 CSC 2008f DWE 2007
Cowra	Cowra STP	1977	10,000	Trickling filter	Secondary	636	Lachlan River	N/A	ATSE 2004 DWE 2007
Forbes	Forbes STP	2005	12,000	Continuous extended aeration	Tertiary	680	-	Agricultural	ATSE 2004 DWE 2007
Harden	Harden Murrumburrah STP	1937	4,000	Trickling filter	Secondary	180	Murrimboola Creek	Golf courses, sports fields, parks	ATSE 2004 DWE 2007
Lachlan	Condobolin STP	1982	4,000	Intermittent extended aeration, trickling filter	Advanced secondary	370	Lachlan River	Golf course, STP	ATSE 2004 DWE 2007
	Tottenham STP	1979	1,000	Intermittent extended aeration	Advanced secondary	-	-	-	ATSE 2004 DWE 2007

[15] DWE Performance Reporting 07/08
[16] - denotes water supply, sewage or stormwater treatment infrastructure data that were not available or are not provided for the Audit

LOCATION	ASSET	YEAR BUILT	CAPACITY (EP)	TREATMENT PROCESS	STANDARD	VOLUME TREATED (ML) [15]	DISCHARGE LOCATION	REUSE	REFERENCE
	Lake Cargelligo STP	1981	2,000	Intermittent extended aeration	Advanced secondary	-	Lachlan River	-	ATSE 2004 DWE 2007
Lithgow	Lithgow STP	1987	23,000	Trickling filter	Tertiary	-	Farmers Creek (Warragamba Dam)	-	ATSE 2004 DWE 2007 LCC 2008a LCC 2008c
	Portland STP	1990	2,500	Trickling filter	Tertiary	-	Limestone Creek (Darling River System)	Industrial (planned)	ATSE 2004 DWE 2007 LCC 2008c
	Wallerawang STP	1966	3,300	Trickling filter	Tertiary	-	Pipers Flat Creek/Adams Creek (Warragamba Dam)	Industrial	ATSE 2004 LCC 2008b LCC 2008c
Oberon	Oberon STP	1989	7,300	Trickling filter	Secondary	370	-	-	ATSE 2004 DWE 2007
Orange	Orange STP	1989	60,000	Trickling filter, continuous extended aeration	Advanced secondary	3,900	Blackmans Swamp Creek	Mine, industrial	ATSE 2004 DWE 2007
	Spring Hill STP	1990	1,000	Continuous extended aeration, oxidation pond	Advanced secondary	335	-	Agricultural	ATSE 2004 DWE 2007
Parkes	Parkes STP	1936	14,500	Trickling filter	Advanced secondary	700	Goobang Creek	Golf courses, race course	ATSE 2004 DWE 2007
	Peak Hill STP	1983	2,200	Trickling filter	Advanced secondary	170	-	Golf course	ATSE 2004 DWE 2007
Upper Lachlan	Crookwell STP	1996	5,000	Trickling filter, intermittent extended aeration	Advanced secondary	-	Crookwell River	Mine	ATSE 2004 DWE 2007 OCSE 2008
	Gunning STP	-	1,000	Intermittent extended aeration	Advanced secondary	-	Meadow Creek	-	ATSE 2004 DWE 2007 OCSE 2008
	Taralga STP (under construction)	-	400	Intermittent extended aeration	Advanced secondary	N/A	-	Agricultural	ULSC 2009

LOCATION	ASSET	YEAR BUILT	CAPACITY (EP)	TREATMENT PROCESS	STANDARD	VOLUME TREATED (ML) [15]	DISCHARGE LOCATION	REUSE	REFERENCE
Weddin	Grenfell STP	1943	2,500	Trickling filter	Secondary	190	-	Sports fields, parks	ATSE 2004 DWE 2007
Wellington	Wellington STP	2006	8,000	Intermittent extended aeration	Tertiary	550	Bushranger's Creek	Wellington showground	DWE 2007
Young	Young STP	1970	7,000	Trickling filter	Secondary	700	-	Golf courses	ATSE 2004 DWE 2007

Preliminary investigations into stormwater harvesting have been conducted for the Orange and Parkes communities as an option to reduce reliance on potable water sources.

OCC has completed Stage 1 construction of the Blackmans Swamp Creek Stormwater Harvesting Scheme in March 2009 and is currently trialling (commissioning) its operation. The scheme consists of the infrastructure shown in Table 3-12. Stormwater is drawn from the Blackmans Swamp Creek and pumped to a newly constructed 200 ML holding pond, then into batching ponds for treatment, settling and testing. Water is combined with supply at Suma Park Dam which is subsequently treated to potable standard at the Icely Road WTP. Stage 2 of the scheme, which was estimated to cost $1.5 million (2008), will see the construction of a weir and harvesting pond on the Blackmans Swamp Creek to augment the annual stormwater harvest yield to approximately 2,190 ML/annum (OCC 2008b). Preliminary investigation is being undertaken for a possible Stage 3, which will involve excavation of the harvesting pond site to increase storage capacity. In addition, OCC has also identified a number of additional on-site detention basins on East Orange Creek, Kinross Playing Field and Rifle Range Creek that can be used as stormwater harvesting sites (OCC 2008a). Cumulatively, they have the capacity to provide up to 600 ML of non-potable source of water or to be passed through a treatment plant for future potable water use.

PSC has identified, in its IWCM, the Parkes brick pit as a potential site for stormwater harvesting to supplement its recycled water supply network (MWH 2005). The Council is also evaluating stormwater harvesting as an additional water supply source to maximise security following capping of the Lachlan River allocation. It was noted by the PSC that stormwater harvesting may not be a feasible option for Parkes due to the large distance between the brick pit harvesting site and the town's bulk water storage.

Table 3-12: Stormwater Treatment Infrastructure – Blackmans Swamp Creek Scheme

ASSET	YEAR BUILT	CAPACITY	TREATMENT PROCESS	REFERENCE
Blackmans Swamp Creek Pump Station	2009	450 L/s	N/A	OCC 2008b
Orange Detention Basin	2009	200 ML	Storage and settling	OCC 2008b
Orange Batching Ponds	2009	34 ML	Chlorine dosing and testing; includes 200 micron filtration prior to ponds; flocculant dosing in ponds	OCC 2008b
Gross Pollutant Trap @ Dalton St	2009	N/A	Solids removal	OCC 2008b
Gross Pollutant Trap @ Margaret Stevenson	2009	N/A	Solids removal	OCC 2008b
Icely Road WTP	1982	38 ML/day	Conventional process; ozonation	OCC 2008b
Blackmans Swamp Creek Weir (Stage 2)	TBA	40 ML	N/A	OCC 2008b
Blackmans Swamp Creek Harvesting Pond (Stage 2)	TBA	40 ML	Storage only	OCC 2008b

4. WATER MANAGEMENT APPROACHES

This section of the report overviews the water management approaches of various regulatory contexts as they apply to the LWUs of the Centroc region. It introduces the role of the NWC and DWE as key regulators and policy agencies.

4.1 POLICY AND REGULATORY CONTEXT FOR WATER MANAGEMENT

The *Water Management Act 2000* is the overarching legislative framework that regulates water management in NSW (with the exception of water sources that form part of Sydney's water supply and the Snowy Hydro). The Act is administered by the Department of Environment, Climate Change and Water.

The majority of both the Lachlan and Macquarie-Cudgegong Rivers, which are the major river systems in the Centroc region, are regulated under the Act. The water sharing plans (WSP) created under the Act define the water market and allocations for these rivers. The pursuit of town water security in this study must operate within the bounds of these legislated plans. Bulk Access Regime of each WSP is set out in Section 4.3.

At the national level, the NWC is the regulatory body responsible for driving progress towards sustainable management and consumption of Australia's water resources under a framework for water reform known as the NWI (NWC 2008). Established under the *National Water Commission Act 2004*, the Commission advises the Council of Australian Governments (COAG) and the Australian Government on national water issues and the progress of the NWI.

The NWI is a blueprint for water-related policies, signed in 2004 by COAG, to improve Australia's management of water resources over a ten-year period. The Initiative outlines current imperatives in improving water management and security, and embodies a cohesive national approach to manage, measure, plan for, price and trade water resources. The objective of the policy blueprint is to achieve "nationally compatible market, regulatory and planning based system of managing surface and groundwater resources for rural and urban use that optimises economic, social and environmental outcomes".

The signing of the NWI represents shared commitments by governments to:

- Prepare water plans with provision for environment;
- Deal with over-allocation or stress in water systems;
- Introduce registers of water rights and standards for water accounting;
- Expand trade in water;
- Improve pricing for water storage and delivery; and
- Meet and manage urban water demands.

The NWI identifies and monitors the progress of eight key elements for regulatory action that are critical in progressing water reform in Australia. The key elements are:

1. Water access entitlement and planning;
2. Water markets and trading;
3. Best practice water pricing;
4. Integrated management of water for environmental and other public benefit outcomes;
5. Water resource accounting;
6. Urban water reform including reforming the role of local government in service provision;

7. Knowledge and capacity building; and
8. Community partnership and adjustment.

NWC assesses progress on the implementation of water-related reforms via ongoing Biennial Assessment of progress to COAG and the National Competition Policy reporting. The most recent of these are the Second Biennial Assessment in 2009 and the 2007 National Competition Policy assessment.

As part of the water reform framework established by the NWI, NSW has developed an Implementation Plan which sets out actions that the State Government has already completed as well as plans for future implementation of actions to progress the key elements of NWI. The Plan highlights fundamental reforms to the NSW water management framework under the *Water Management Act 2000* and further reforms under *Water Management Amendment Act 2004*. Of particular importance to Centroc under the reforms are the creation and registration of fully tradeable water access licences, separate from land title and water works and use approvals. These water access licences will allow for movement of water supply across the Centroc area, such as via a regional water grid. The *Water Act 2007* was passed by the Federal Government. A central element of this legislation is the creation of a Basin Plan for the MDB. The objective of the plan is to define:

- Sustainable diversion limits;
- Environmental water and actions to deliver the planned environmental outcomes;
- Water quality and salinity management targets and a plan of action to deliver the intended outcomes; and
- A basin-wide approach to trading water rights.

The plan will be developed taking into account water resource, environmental, social, cultural and economic considerations.

This Federal framework for water management relates to the Centroc study in a number of ways:

- Water resource management approaches need to be considered regionally as well as locally;
- Solutions to town security need to be consistent with water trading and sharing plans;
- The identification and assessment of options for town water security need to consider other water users including other economic activity and the environment; and
- That the management of water needs to be effective and efficient, informed by market and competition rather than artificial administrative boundaries.

4.2 LOCAL WATER UTILITY REGULATION

DWE was established in April 2007 to coordinate water and energy management in NSW, including the regulation of LWUs. DWE has a role in delivering the Government's policy and reform agenda for the water and energy sectors in NSW. The Department assumes an advisory role in policy, legislation, regulation, technical and management, as well as enforcement function in water and energy industries.

More specifically, DWE provides key services (broadly expected to remain similar as DWE is merged into the super-department of Environment, Climate Change & Water) in the following categories:

1. Water management
    - Liaising with other States and the Commonwealth to ensure protection of NSW's interests in interstate water sharing arrangement;
    - Preparing statutory plans to share water between users and the environment;
    - Administering water licences and approvals, assessing resource availability, allocating available water to licensees, monitoring compliance and, where necessary, taking appropriate enforcement action;
    - Developing and implementing water trading rules to support effective market operation;
    - Advising on plans and strategies for the protection and enhancement of watercourses, riparian corridors and groundwater dependent ecosystems; and
    - Monitoring and evaluating water resource quantity and quality, and associated ecosystems.
2. Urban water utilities
    - Planning and policy development for urban water industries;
    - Coordination and review of the Metropolitan Water Plan;
    - Facilitating water recycling across NSW;
    - Leadership, guidance and technical assistance in best-practice management, operation and maintenance for non-metropolitan urban water utilities;
    - Overseeing and monitoring LWU performance; and
    - Funding and technical advice for backlog water and sewerage infrastructure and emergency drought assistance.
3. Energy supply and use
    - Promoting and maintaining competition in energy supply markets;
    - Development of national energy market frameworks in partnership with other States;
    - Electricity and gas network monitoring;
    - Provision of advice to the Government on greenhouse and low emission generation technologies and policies;
    - Implementation of consumer protection policies for residential and small business energy customers.
    - Administration and oversight of energy rebate programs
    - Developing and implementing nationally consistent state level planning, preparation, response and recovery policy and plans, for electricity, natural gas, liquid fuels and metropolitan water supply disruptions in NSW.

The specific services of DWE are guided by the legislation it administers, the Government's policy and reform agenda, and the NSW State Plan, which provides strategic direction for NSW with specific goals in water and energy.

In September 2007, on behalf of the Government, DWE commenced an Independent Inquiry into Secure and Sustainable Urban Water Supply and Sewerage Services for Non-Metropolitan NSW. The review is also consistent with Federal requirements on states to examine the role of local government in urban water service provision. The aim of the Inquiry is to assess the performance of LWUs in light of the challenges that are facing them by analysing performance data, inviting public submissions and holding hearings across NSW. The subsequent report, published in December 2008, has provided the following recommendations:

- Aggregation of the current 106 LWUs into 32 regional groups that are broadly based on submissions provided by stakeholders and represent catchments to a greater degree than present.
- Three organisational structure options to be considered for the regional groups:

- Binding alliance;
- Council-owned regional water corporation; and
- Status quo for some large general purpose councils and county councils.

Through Centroc, the Councils of the central region have put a case to the government with respect to reform. The Councils broadly recognise the need for structural change, but advocate the change should be informed by the outcomes of the Water Security Study. In the interim, the member Councils are continuing to implement DWE Best-Practice initiatives.

4.3 BULK ACCESS REGIME

The *Water Management Act 2000* details water sharing plans and management of water sources in NSW. The Act also provides for a system of licences and approvals for:

- Water access;
- Water use; and
- Water management works.

Bulk access regimes for the Macquarie and Lachlan Valley (NSW Legislation 2006a & 2006b) are documented in the *Water Sharing Plan for the Macquarie and Cudgegong Regulated Rivers Water Source 2003* and the *Water Sharing Plan for the Lachlan Regulated River Water Source 2003*, respectively, as discussed below. It is important to note however, some parts of both catchments are not presently covered by water sharing plans. Those parts illustrated as regulated in Figure 4-2 and Figure 4-1 as covered by sharing plans. The bulk access regime will be incorporated in the hydrologic modelling to be undertaken in Component 2 of this study.

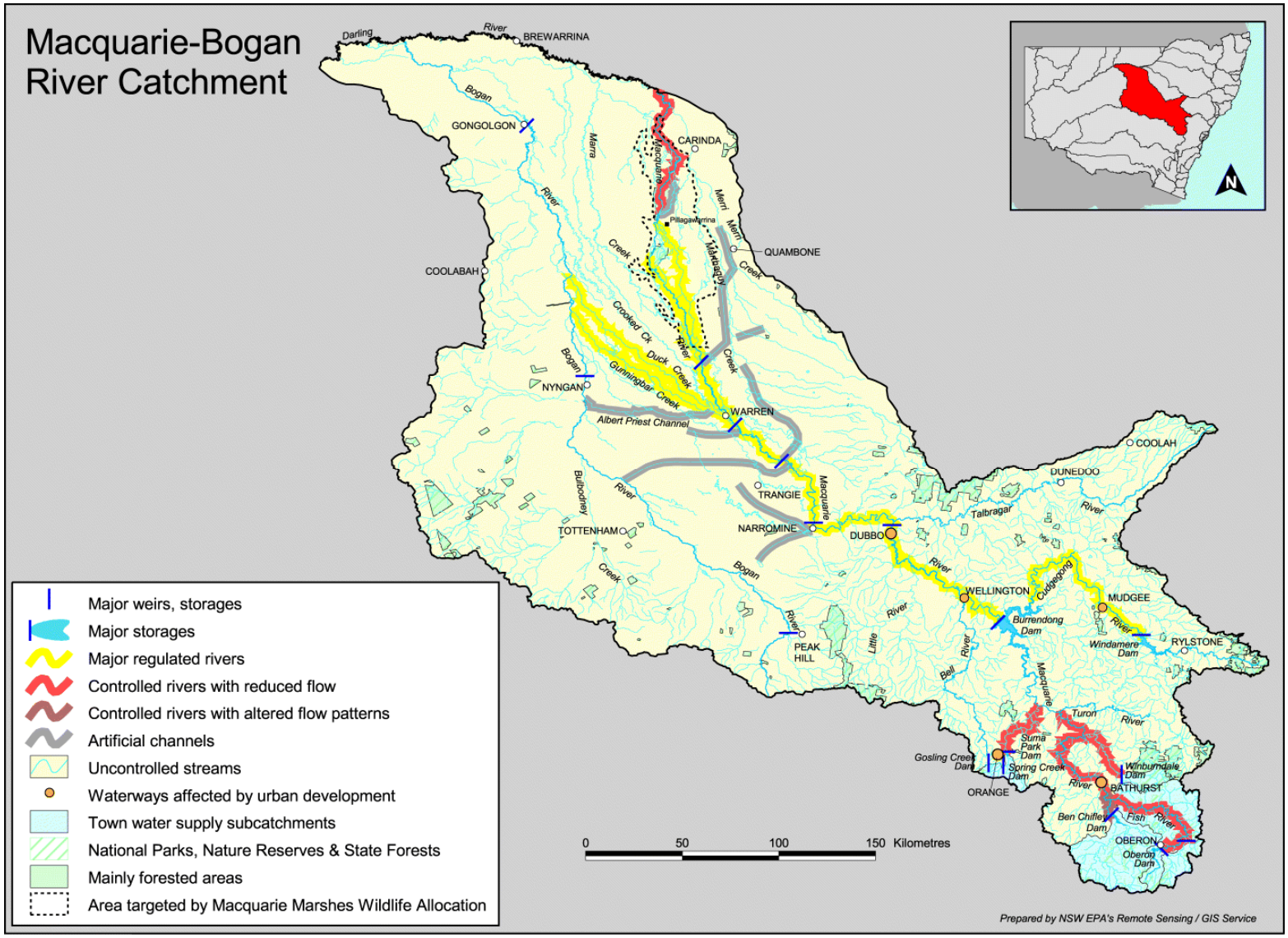


Figure 4-1: Extent of Regulation of the Macquarie-Bogan River (DECC 2009)

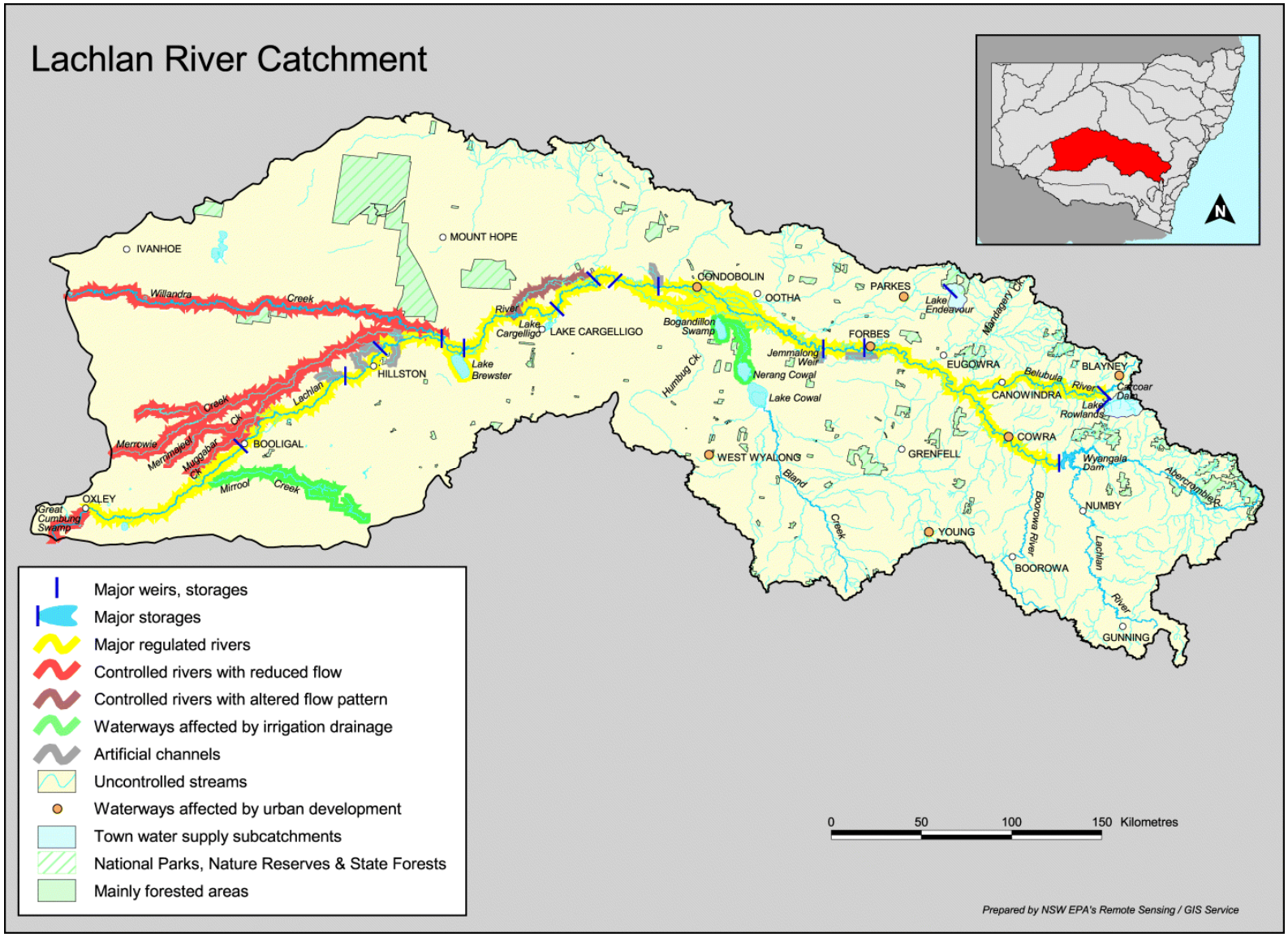


Figure 4-2: Extent of Regulation of the Lachlan River (DECC 2009)

4.3.1 MACQUARIE VALLEY

A summary of water provisions for the environment, landholder rights, access licence requirements and available water limits for the Macquarie Valley are provided in Table 4-1.

Table 4-1: Bulk Access Regime – Macquarie Valley

SECTION	CLAUSE	KEY ELEMENTS
Environmental water provision	Planned environmental water	- Long term extraction limit: 391,900ML per year - Water availability managed as specified in *Compliance with the long-term extraction limit* clause of the Plan to prevent extraction exceeding the long term limit
	Adaptive environmental water	- An access licence holder may, at any time, commit all or part of their licence as adaptive environmental water - At the commencement of the Plan, there were no access licences committed to an environmental purpose
Basic landholder rights	Domestic and stock rights	- Water requirement of domestic and stock rights holders was estimated at 1,200ML/y at the commencement of the Plan - Exercise of domestic and stock rights may vary during the term of the Plan, or the Minister may order a restriction under section 328 of the Act - Water supply system shall be managed so that it would be capable of maintaining supply through a repeat of the worst period of low inflows
	Native title rights	- There were no holders of native title rights at the commencement of the Plan - Exercise of native title rights may increase during the term of the Plan
Requirements for water under access licences	Share component of access licences	- Domestic and stock: 14,265 ML/y - Local water utility: 22,681 ML/y - Regulated river (high security): 19,419 unit shares, at up to 1ML/unit share for 100% allocation - Regulated river (general security): 632,428 unit shares at up to 1ML/unit share for 100% allocation - Supplementary water: 50,000 unit shares, at up to 1ML/unit share for 100% allocation - Total requirements for water under access licences in each category may change during the term of the Plan

SECTION	CLAUSE	KEY ELEMENTS
Limit to the availability of water	Long-term extraction limit	- The long-term extraction limit for the water source is the lesser of: (a) the long term average annual extraction limit (391,900 ML) from (i) water storages, private water management infrastructure and cropping mix that existed in 1999/2000 (ii) share component existing at the commencement of this plan (iii) maximum crop area and crop planting behaviour representative of Cap under Schedule F of the Murray Darling Basin Agreement (iv) environmental water provisions specified in this Plan (v) other water management rules applying at the commencement of this plan (b) the long term average annual extraction from this water source that would occur under baseline conditions used for assessment of Cap under Schedule F of the Murray Darling Basin Agreement (433,000 ML) - Assessment of the long-term extraction limit and current long-term average annual extraction shall be carried out at the end of each water year - The volume of supplementary water, and if necessary regulated river (general security), access licences shall be reduced if the current long-term average annual water extraction exceeds the extraction limit by an amount or time frame specified in the Plan
	Available water determination	- The available water determination for domestic and stock and local water utility access licences made for the commencement of each water year shall be, but not exceed, 100% of share component if possible - The available water determination for high and general security regulated river access licences made for the commencement of each water year shall be 1 ML/unit share if possible - Available water determinations made for regulated rivers (high and general security) access licences shall take into account: (a) environmental provisions established in the Plan (b) requirements for domestic and stock rights (c) requirements for native title rights (d) requirements for domestic and stock access licences (e) requirements for local water utility access licences (f) volumes remaining in water allocation account from previous determinations (g) water losses associated with holding and delivery of water and appropriate volume to meet these losses (h) any other relevant matters

4.3.2 LACHLAN VALLEY

A summary of water provisions for the environment, landholder rights, access licence requirements and available water limits for the Lachlan Valley are provided in Table 4-2.

Table 4-2: Bulk Access Regime – Lachlan Valley

SECTION	CLAUSE	KEY ELEMENTS
Environmental water provision	Planned environmental water	- Long term extraction limit: 305,000ML per year - Water availability managed as specified in *Maintaining compliance with the long-term extraction limit* clause of the Plan to prevent extraction exceeding the long term limit
	Adaptive environmental water	- An access licence holder may, at any time, commit all or part of their licence as adaptive environmental water - At the commencement of the Plan, there are no access licences committed to an environmental purpose
Basic landholder rights	Domestic and stock rights	- Water requirement of domestic and stock rights holders was estimated at 4,211ML/y at the commencement of the Plan - Exercise of domestic and stock rights may vary during the term of the Plan, or the Minister may order a restriction under section 328 of the Act - Water supply system shall be managed so that it would be capable of maintaining supply through a repeat of the worst period of low inflows
	Native title rights	- There were no holders of native title rights at the commencement of the Plan - Exercise of native title rights may increase during the term of the Plan
Requirements for water under access licences	Share component of access licences	- Domestic and stock: 13,100 ML/y - Local water utility: 15,539 ML/y - Regulated river (high security): 26,472 unit shares, at up to 1ML/unit share for 100% allocation - Regulated river (general security): 592,847 unit shares, at up to 1ML/unit share for 100% allocation - Regulated river (conveyance): 17,911 unit shares, at up to 1ML/unit share for 100% allocation - Supplementary water: no authorised extraction - Total requirements for water under access licences in each category may change during the term of the Plan

SECTION	CLAUSE	KEY ELEMENTS
Limit to the availability of water	Long-term extraction limit	- The long-term extraction limit for the water source is the lesser of: (a) the long term average annual extraction limit (305,000 ML) from (i) water storages, private water management infrastructure and cropping mix that existed in 1999/2000 (ii) share component existing at the commencement of this plan (iii) maximum crop area and crop planting behaviour representative of Cap under Schedule F of the Murray Darling Basin Agreement (iv) application of water management rules defined in the Plan (b) the long term average annual extraction from this water source that would occur under baseline conditions used for assessment of Cap under Schedule F of the Murray Darling Basin Agreement (315,000 ML) - Assessment of the long-term extraction limit and current long-term average annual extraction shall be carried out at the end of each water year - The volume of supplementary water, and if necessary regulated river (general security), access licences shall be reduced if the current long-term average annual water extraction exceeds the extraction limit by an amount or time frame specified in the Plan
	Available water determination	- The available water determination for domestic and stock and local water utility access licences made for the commencement of each water year shall be, but not exceed, 100% of share component if possible - The available water determination for high and general security regulated river access licences made for the commencement of each water year shall be 1 ML/unit share if possible - Available water determinations made for regulated rivers (high and general security) access licences shall take into account: (a) environmental provisions established in the Plan (b) requirements for domestic and stock rights (c) requirements for native title rights (d) requirements for domestic and stock access licences (e) requirements for local water utility access licences (f) volumes remaining in water allocation account from previous determinations (g) water losses associated with holding and delivery of water and appropriate volume to meet these losses (h) any other relevant matters

4.4 WATER SUPPLY PRICING

Pricing structures and charges for bulk and town water supply for the individual Centroc LWUs are listed and discussed here. Pricing of water resources is a water management approach that aims to cover the costs of their provision and to send signals to consumers to encourage efficient use. Data in this section were obtained from the Performance Monitoring Reports 2006/07 and 2007/08 as well as the IPART Bulk Water Pricing report for State Water Corporation charges.

4.4.1 BULK WATER

Table 4-3: Water Supply Pricing Structure – Bulk Water (Regulated Rivers)[17]

REGION	PRICING STRUCTURE	FIXED CHARGE (% REVENUE)	USAGE CHARGE (% REVENUE)	HIGH SECURITY TO GENERAL SECURITY ENTITLEMENT CHARGE RATIO
Macquarie Valley	Two-tier entitlement charge (high & general security)	40	60	1.88
Lachlan Valley		40	60	2.45

4.4.2 TOWN WATER

Table 4-4: Water Supply Pricing Structure – Town Water[18]

COUNCIL	PRICING STRUCTURE	FIXED CHARGE ($)	USAGE CHARGE 1ST STEP	USAGE CHARGE 2ND STEP	TYPICAL RESIDENTIAL BILL ($/ASSESSMENT)
Bathurst Regional Council	Inclining block (2009/10 data)	125	$1.25/kL for <250kL	$1.88/kL for >250kL	400
Blayney Shire Council	Refer to CTW	N/A	N/A	N/A	N/A
Boorowa Shire Council	Two-part	388	125c/kL for all usage		857
Cabonne Council	Inclining block	182	130c/kL for <300kL	290c/kL for >300kL	392
Central Tablelands Water	Inclining block	124	135c/kL for <450kL	202c/kL for >450kL	399
Cowra Shire Council	Inclining block	255	105c/kL for <600kL	200c/kL for >600kL	524
Forbes Shire Council	Inclining block	140	64c/kL for <600kL	96c/kL for >600kL	459
Harden Shire Council	Inclining block	280	120c/kL for <350kL	150c/kL for >350kL	660
Lachlan Shire Council	Inclining block	265	93c/kL for <450kL	140c/kL for >450kL	601
Lithgow City Council	Inclining block	206	85c/kL for <500kL	160c/kL for >500kL	342
Oberon Council	Two-part	100	108c/kL for all usage		267
Orange City Council	Inclining block	106	146c/kL for <450kL	219c/kL for >450kL	577

[17] IPART 2006
[18] DWE 2008 Performance Reporting (2007/08 data)

COUNCIL	PRICING STRUCTURE	FIXED CHARGE ($)	USAGE CHARGE 1ST STEP	USAGE CHARGE 2ND STEP	TYPICAL RESIDENTIAL BILL ($/ASSESSMENT)
Parkes Shire Council	Inclining block (2008/2009 data)	295	95c/kL for <365kL	200c/kL for >365kL	520
Upper Lachlan Council	Inclining block	420	110c/kL for <250kL	150c/kL for >250kL	661
Weddin Shire Council	Refer to CTW	N/A	N/A	N/A	N/A
Wellington Council	Inclining block	183	150c/kL for <300kL	181c/kL for <500kL	602
Young Shire Council	Inclining block	175	125c/kL for <300kL	170c/kL for >300kL	451

4.5 DEMAND MANAGEMENT PROGRAMS

Demand and drought management programs implemented by Centroc LWUs for the urban and non-urban regions are listed here. The management of demand is used to ensure water use is efficient and to potentially delay new capital expenditure on supply options. Data in this section were obtained via the Performance Monitoring Reports and LWUs' drought management plans where available.

4.5.1 TOWN WATER

Table 4-5 sets out any demand and drought management programs in relation to town water currently implemented by each Centroc member Council.

Table 4-5: Demand Management Programs – Town Water

COUNCIL	DEMAND MANAGEMENT	DROUGHT MANAGEMENT	REFERENCE
Bathurst Regional Council	Customer and public education program, Waterwise member, two-tier water charging system to reward customers using <250kL/a, quarterly customer billing	5-stage water restriction system	DWE 2007
Blayney Shire Council	Refer to CTW	Refer to CTW	DWE 2007
Boorowa Shire Council	Full pay-for-use pricing, quarterly customer billing	7-stage water restriction system	DWE 2007
Cabonne Council	Customer and public education program, effluent/stormwater reuse, leakage reduction program, Waterwise member, semi-annual customer billing	No drought management plan at present	DWE 2007
Central Tablelands Water	Customer and public education program, leakage reduction program, full pay-for-use pricing, Waterwise member, free showerhead exchange program, quarterly customer billing	8-stage water restriction system	CTW 2007 DWE 2007
Cowra Shire Council	Public education program, full pay-for-use pricing, Waterwise member, 4-monthly (ie 3 times per year) customer billing	Implemented; no further details obtained	DWE 2007
Forbes Shire Council	Customer and public education program, retrofit program, free garden mulch, considering rebate for water efficient shower heads, building code program, effluent reuse, quarterly customer billing	Implemented; no further details obtained	DWE 2007
Harden Shire Council	Leakage reduction program, full pay-for-use pricing, effluent/stormwater reuse, yearly customer billing	No drought management plan at present	DWE 2007

COUNCIL	DEMAND MANAGEMENT	DROUGHT MANAGEMENT	REFERENCE
Lachlan Shire Council	Public education program, full pay-for-use pricing, retrofit program under investigation, restrictions	No drought management plan at present	DWE 2007
Lithgow City Council	Customer and public education program, Waterwise member, full pay-for-use pricing, restrictions	6-stage water restriction system	DWE 2007 LCC 2009a
Oberon Council	Customer education program, leakage reduction program, full pay-for-use pricing, restrictions	7-stage water restriction system, penalties for non-compliance	DWE 2007 OC 2007
Orange City Council	Customer and public education program, rebates for water tanks, full pay-for-use pricing, Waterwise member, restrictions, quarterly customer billing, water loss management program (LGSA and Water Directorate), shower head exchange program, leakage reduction program	5-stage water restriction system, penalties for non-compliance, alternative water sources to be explored at critical stage	DWE 2007 OCC 2008a
Parkes Shire Council	Customer education program, leakage reduction program, effluent/stormwater reuse, restrictions, 4-monthly customer billing, IWCM strategies, non-potable water supply for stock, road works and swimming pools	6-stage water restriction system, penalties for non-compliance	DWE 2007 PSC 2006
Upper Lachlan Council	Semi-annual customer billing, full pay-for-use pricing, water restrictions, leakage reduction program.	Implemented; no further details obtained	DWE 2007
Weddin Shire Council	Refer to CTW	Refer to CTW	DWE 2007
Wellington Council	Customer and public education program, leakage reduction program, retrofit program, full pay-for-use pricing, Waterwise member, restrictions, quarterly customer billing	Implemented; no further details obtained	DWE 2007
Young Shire Council	Customer and public education, full pay-for-use pricing, Waterwise member, effluent/stormwater reuse, building code program, separate metering of new and some existing multi-unit developments, quarterly customer billing	No drought management plan at present	DWE 2007

4.5.2 OTHER WATER USERS

Table 4-6 sets out any current and proposed demand management programs for non-town water users such as irrigators.

Table 4-6: Demand Management Programs – Other Water Users

DEMAND MANAGEMENT PROGRAMS	DESCRIPTION	RELEVANT REGIONS	REFERENCE
Strengthening Basin Communities	Funding is available to systematically assess the risks and implications associated with climate change, with a particular focus on water availability, and then review existing plans or develop new plans to take account of these risks and implications. Funding will be available for local government to review and update existing plans or develop new plans, such as: • Corporate management and financial plans; • Community and economic/tourism development plans; • Development strategies and land use plans; • Natural resource and environmental plans • Infrastructure and asset plans (including water savings plans); and • Risk assessment and management plans (including climate risk).	Macquarie and Lachlan Valleys	DEWHA 2009a
Regulated River Metering	Up to $90 million available to replace 6,000 existing meters with new high-accuracy, tamper-proof and low maintenance meters. This program is available to diverters on regulated rivers and will be implemented by State Water and DWE.	Macquarie and Lachlan Valleys	DEWHA 2009a
Groundwater and Unregulated River Metering	Up to $131 million available for installation and upgrading of about 9,500 meters on groundwater and unregulated sources. This program will be implemented by DWE.	Macquarie and Lachlan Valleys	DEWHA 2009a
Private Irrigation Infrastructure Operators Program	Plan submitted to the Federal Government in June 2009. Program will be available to Private Infrastructure Irrigation Water Providers only. This is a 2-step program where irrigation water providers must first develop modernisation plans for their district to indicate water saving approaches, such as infrastructure upgrades and improvement in water delivery systems. $650M available fund is allocated for the program over 8 years. At least 50% of water savings is expected to be returned to the Government.	Macquarie and Lachlan Valleys	LVW 2009 DEWHA 2009a
Restoring the Balance in the Murray-Darling Basin Program	The Australian Government has committed $3.1 billion over 10 years to purchase water entitlements in the Murray-Darling Basin. Purchasing of entitlements has been underway since 2007. 24 GL was purchased at $34.4 million in 2007/08, while $37.4 million worth of entitlements are being pursued for 2008/09 ($16.9 million high security, $20.5 million medium or low security). The Government also offers up to $150,000 as a special exit payment, along with other transitional assistance, to eligible irrigators on 40 hectares or less who agree to sell all their water entitlements to the Commonwealth.	Macquarie and Lachlan Valleys	DEWHA 2009a
On-Farm Irrigation Efficiency Program	Program is available to improve on-farm efficiency for individual irrigators. The Commonwealth has run a pilot program and is about to launch a Southern Basin Program, which includes the Lachlan Valley, with $300M available in four funding rounds over 3 years. The Lachlan CMA pilot projects involved converting furrow irrigation to centre pivot on 460 ha (yielding 938 ML benefit for the Government) and on farm modernisation plan (yielding 76 ML benefit for the Government).	Lachlan Valley only	LVW 2009 DEWHA 2009a

DEMAND MANAGEMENT PROGRAMS	DESCRIPTION	RELEVANT REGIONS	REFERENCE
Water Smart Australia	Program targeting large-scale projects that contribute towards smart water technologies and/or improve and refine management practices. $1.6 billion committed by the Government over 5 years until 2010. As a general guide, the minimum level of funding available for a project is $1 million, and the maximum duration is 4 years.	Macquarie and Lachlan Valleys	DEWHA 2009a
Driving Reform in the Basin	Program supports Australian Government contributions to the operation and water reform functions of the Murray-Darling Basin Authority, including those under the Water Act. It also gives the NWC and Australian Competition and Consumer Commission (ACCC) specific roles and functions under the Water Act. $646 million is available in funding and the program is administered by DEWHA and ACCC.	Macquarie and Lachlan Valleys	DEWHA 2009a
Raising National Water Standards	Program offers support for projects that are improving Australia's national capacity to measure, monitor and manage water resources. A total of $214 million is directed at activities across three strategic investment areas: • Advancing the implementation of NWI; • Improving integrated water management across Australia; and • Improving knowledge and understanding of our water resources.	Macquarie and Lachlan Valleys	DEWHA 2009a

5. OTHER ECONOMIC WATER ASSETS

This section outlines the broad asset information for irrigation, mining and other large water-using industry in the Centroc region. The aim of this section is to recognise the value of water for non-town supply purposes and to set the catchment context of this study.

Asset data for this section are presented in Table 5-1 and have been collected from Councils' inputs, the Australian Bureau of Agricultural and Resource Economics (ABARE), and industrial representatives of the PRG. As the purpose of this study is to improve town water supply, the data provided is high level only.

Table 5-1: Other Economic Water Assets

ASSET	DESCRIPTION	VALUES	WATER SOURCE	MANAGEMENT	REFERENCE
Lachlan region irrigation storages	Irrigation of cereal crops, pastures, hay, wine grapes, cotton, horticultural crops and livestock	Avg. farm cash income: $73,000 Avg. farm profit/(loss): ($37,950) Rate of return: 0.9% Total water entitlements held: 930ML per farm (average) Market value of total water entitlements: $531,624 Water application rate: 3ML/ha	Carcoar Dam, Wyangala Dam (Lachlan River)	State Water	ABARE 2008
Macquarie region irrigation storages	Irrigation of cotton, cereal crops, pasture, hay and horticultural crops	Avg. broadacre farm cash income: $60,500 Avg. broadacre farm profit/(loss): ($55,690) Avg. horticulture farm cash income: ($61,680) Avg. horticulture farm profit/(loss): ($126,800) Total water entitlements held: 2,137ML per farm (average) Market value of total water entitlements: $1,518,541 Water application rates: - broadacre 4ML/ha - horticulture 2ML/ha	Burrendong and Windamere Dams (Macquarie River)	State Water	ABARE 2008
Delta Electricity's (DE) major water storages	Water extraction for use as process and cooling water at DE's Wallerawang and Mt Piper power stations.	Capacity: Wallerawang 2 x 5,00MW (coal), Mt Piper 2 x 7,00MW (coal) and 350kW (hydro) Water entitlements: up to 23,000 ML/year from the Coxs River, commencing on 1 July and concluding on 30 June Provisions: if DE's Minimum Annual Quantity from the Fish River Water Supply is reduced by >30%, DE is entitled to an additional 2,000 ML/year from the Coxs River water source Total sales revenue : $1,008m in 07/08 (all stations)	Thompson's Creek Dam, Wallerawang Dam, Lake Wallace, Lake Lyell, Duckmaloi Weir, Farmers Creek Dam (Coxs River), Oberon Dam (Fish River)	Extraction rules in accordance to LCC's Drought Management Plan, *Energy Services Corporations Act 1995*, *State Owned Corporations Act 1989*, Water Management Licence issued by Water Administration Ministerial Corporation	DE 2006 LCC 2009b DWE 2009e
Cadia Valley Gold Mines	Open pit gold and copper mining site operated by Newcrest Mining Limited	Total surface water extraction licence: 11,405ML/annum Make-up water requirement: 20ML/day Orange effluent reuse: 10ML/day	Cadiangullong Dam, Rodds Creek Dam, Tailings Dam	Strategies investigated by Newcrest to ensure long term water security	NML 2006
Northparkes Mines	Underground and open pit copper mining site operated by Rio Tinto (80%) and Sumitomo Group (20%)	Mining lease land area: 1,630 ha Fresh water use: 3506ML (in 2007) Water supply source: 70% bore, 30% river water (in 2007) Recycled water use: 20-35% of tailings water recovered and recycled (in 2007)	Lachlan Valley borefields, onsite recycled water, rain and surface water harvesting	Site hydrology and water balance modelling used as management tool; promoting water awareness amongst employees; setting water use reduction targets.	NM 2007

ASSET	DESCRIPTION	VALUES	WATER SOURCE	MANAGEMENT	REFERENCE
Barrick Gold-Lake Cowal Mine	Open pit gold mining site located approximately 32km north of West Wyalong.	Production: 5,400kg gold (in 2008) Production value: US$129 million (in 2008) Mineral reserves estimate: equivalent to 79,000kg gold Process water usage: 10ML/day (modified process)	Bland Creek borefield, Jemalong Irrigation Channel (Lachlan River), on-site recycling and reuse	Site hydrology and water balance modelling used as management tool; options to use alternative water sources; Cowal water management program	Barrick 2008

6. ENVIRONMENTAL, SOCIAL AND CULTURAL ASSETS

This section sets out information on water related assets in the Centroc region that possess environmental, social and cultural value. The aim of this section is to recognise the value of water to the environmental, social and cultural aspects of the region. Identifying these assets also helps in setting the catchment context of this study.

Asset data for this section are presented in Table 6-1and have been collected from Councils' inputs, the NSW Department of Natural Resources (NSWNR), the Department of Environment, Water, Heritage and the Arts (DEWHA), Macquarie Marshes Management Committee (MMMC). As the purpose of this study is to improve town water security, the data provided is intended only for the purposes of broad characterisation of these environmental, social and cultural assets.

Table 6-1: Water Related Environmental, Social and Cultural Assets

ASSET	DESCRIPTION	VALUES	WATER SOURCE	MANAGEMENT	LISTING	REFERENCE
Gosling Creek Dam/ Reserve	Reserve area around Gosling Creek Dam is being developed as recreational facilities, including pedestrian and cycle ways, playground and a bird hive. The area has also been progressively reclaimed for bush regeneration work and is home to the native Wiradjuri people.	Capacity: 650ML Surface Area: 16 ha	Gosling Creek	OCC	N/A	OCC 2009c
Lake Canobolas	Reserve area around Lake Canobolas is used for recreational purposes including picnic facilities, playgrounds, sailing boats and canoeing, swimming and fishing on the lake. Nearby is Mt Canobolas, which is a popular tourist attraction.	Capacity: 450ML Surface area: 12.5 ha	Molong Creek	OCC	N/A	OCC 2009c
Goobang National Park	Goobang National Park is located 30km North East of Parkes and is one of NSW's newest National Parks. The Park incorporates Hervey, Curumbenya and Bumberry mountain ranges and surrounding country. Bushwalking, bird watching and camping are popular recreational activities in the park. The Park is also a valuable wildlife habitat with more than 300 plant species have been recorded, including 40 species of orchids.	Area: 42,600 ha	Goobang Creek	PSC	National Parks & Wildlife Service NSW	PSC 2008b
Lake Brewster	Lake Brewster is a large shallow basin, located on the floodplain of the Lachlan River between Lake Cargelligo and Hillston. The lake is an important refuge habitat, supporting large numbers of waterbirds, and is also used for recreational purposes such as boating and fishing.	Area: 6,500 ha Storage: 153,400 ML FSL Elevation: 140m ASL Average rainfall: 355mm/a	Lachlan River	State Water, Department of Land and Water Conservation; Water Reserve; gazetted as a Wildlife Refuge	Directory of Important Wetlands in Australia	NSWNR 2009
Lake Cowal/ Wilbertroy Wetlands	Lake Cowal is the largest natural lake in the Lachlan River catchment. The lake provides an important drought refuge, a major rookery site for ibis and pelicans. It also serves scientific and recreational purposes, and is an important sacred region for the native Wiradjuri residents.	Area: 20,500 ha Elevation: 210m ASL Average rainfall: 480mm/a	Bland Creek, Lachlan River	Plan of Management prepared by Department of Land and Water Conservation	Directory of Important Wetlands in Australia	NSWNR 2009

ASSET	DESCRIPTION	VALUES	WATER SOURCE	MANAGEMENT	LISTING	REFERENCE
Lachlan Swamp	Lachlan Swamp includes Lake Waljeers, Peppermint Swamp, Lake Bullogal and Ryans Lake. The wetlands are considered to be a good example of River Red Gum/Black Box vegetation association in Western NSW. The area supports large numbers of waterbirds when flooded.	Area: 6,600 ha Elevation: 70-80m ASL Average rainfall: 346-360mm/a	Lachlan River	Draft Water Management Plan for Wetlands of the Lachlan Valley Floodplain prepared by Department of Land and Water Conservation	Directory of Important Wetlands in Australia	NSWNR 2009
Lake Merrimajeel/ Murrumbidgil Swamp	Murrumbidgil Swamp is a site of intensive research by National Parks and Wildlife Service and CSIRO Division of Wildlife and Ecology. The importance of wetting/drying cycles to wetland health was established at the swamp.	Area: 300 ha Elevation: 100m ASL Average rainfall: 355mm/a	Merrimajeel Creek	Landholders, State Forests, Department of Land and Water Conservation	Directory of Important Wetlands in Australia	NSWNR 2009
Booligal Wetlands	Booligal Wetlands consist of low gradient braided channels situated on the distributaries of the Lachlan River. The wetlands are renowned for waterbirds in the area during and following floods. The Booligal Wetlands provide a natural example of inland floodplain wetlands and accommodates several large Aboriginal tribes along its rivers.	Area: 5,000 ha Elevation: 100m ASL Average rainfall: 355mm/a	Merrimajeel Creek, Merrowie Creek, Muggabah Creek	Landholders, Department of Land and Water Conservation	Directory of Important Wetlands in Australia	NSWNR 2009
The Great Cumbung Swamp	The Great Cumbung Swamp comprises the terminal drainage swamp of the Lachlan River and surrounding floodplain. The swamp represents a good example of the terminal reed swamps, and associated floodplain vegetation. The area also provides drought refuge and supports large numbers of water birds.	Area: 16,000 ha (4,000 ha common reed) Elevation: 70m ASL Average rainfall: 360mm/a	Baconian Swamp, Lachlan River	Landholders, Department of Land and Water Conservation	Directory of Important Wetlands in Australia, Register of the National Estate	NSWNR 2009
Cuba Dam	Cuba Dam is located in the middle reaches of Merrowie Creek, which is a distributary of the Lachlan River. The impoundment of this wetland has made it suitable for ibis. The area accommodates several large Aboriginal tribes along its rivers.	Area: 1,680 ha Elevation: 80m ASL Annual rainfall: 360mm/a	Merrowie Creek, Lachlan River	Landholders, Department of Land and Water Conservation	Directory of Important Wetlands in Australia	NSWNR 2009

ASSET	DESCRIPTION	VALUES	WATER SOURCE	MANAGEMENT	LISTING	REFERENCE
Merrowie Creek	Merrowie Creek is a distributary of the Lachlan River, leaving the river near Hillston. The creek spreads into a series of channel beyond Cuba Dam before flowing into Tarwong Lakes, some of which interconnects with Box Creek. The area provides habitat for waterfowls and is surrounded by River Red Gum, Lignum, Nitre Goosefoot and Black Box.	Area: 2,500 ha Elevation: 80m ASL Average rainfall: 360mm/a	Lachlan River	Landholders, Department of Land and Water Conservation	Directory of Important Wetlands in Australia	NSWNR 2009
Bogandillon Swamp	Bogandillon Swamp is an ephemeral shallow swamp located 20km south-east of Condobolin. The swamp supports large numbers of waterfowls, pink eared ducks and other species of waterbirds.	Area: 4,600 ha	Lachlan River	Landholders, Department of Land and Water Conservation	Register of the National Estate	DEWHA 2009c
Macquarie Marshes	The Macquarie Marshes is a large non-terminal wetland in Central West NSW. The marshes form an important habitat for waterbird and support extensive cattle grazing industry. The area also holds historical significance with respect to Aboriginal and European occupation. The variety of habitats, animals, and high significance of areas for waterbirds make the marshes a valuable scientific research and teaching site.	Area: 200,000 ha Wildlife Allocation (WLA): 50,000 ML high security, 75,000 ML general security	Macquarie River (Central West Catchment)	Macquarie Marshes Management Committee, NSW National Parks and Wildlife Service (12%), private owners (88%)	Wetlands of International Importance	NSWNR 2009 CWC 2007 MMMC 2005
Lake Burrendong	Lake Burrendong, including Cudgegong Dam, provides recreational value in the form of fishing and water activities, bushwalking, camping and picnic areas. The area is also home to a mass of native subtropical vegetation and local bird life.	Area: 3,300 ha	Macquarie River (Central West Catchment)	Department of Land and Water Conservation	State Recreation Area	WLC 2009
Chifley Dam	Chifley Dam provides water recreation facility to the central west region, including on-site cabins, beach area, sports facilities, and various water activities such as fishing, sailing, rowing and water skiing.	Capacity: 30,800ML Area: 380 ha	Macquarie River	Bathurst Regional Council	N/A	BRC 2009d

7. CONCLUSIONS

This Component 1 Infrastructure Audit Report is a precursor to the Component 2 Options Paper which will assess potential solutions to improve water security in the Centroc region. The data collected and reviewed as part of the audit process will form the basis for the development of models which can be used to quantify the current reliability of water supply and to examine potential options for addressing areas where improvement of town water supply security in the region is required.

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APPENDIX A: DATA INVENTORY AND GAP ANALYSIS

APPENDIX A - DATA INVENTORY & GAP ANALYSIS

Table A-1 sets out the information that was requested from the participating LWUs and other information sources. The LWUs provided the available information as documented in the table. Although some data gaps exist, best-practice management strategies are in place to address these gaps over time.

Table A-1: Inventory of Data Requirements (source: Data Inventory & Gap Check Rev A.doc, as at 10th July 2009)

ITEM	DESCRIPTION	SOURCE	BRC	BSC		BWSC	CSC		CTW					CWSC	FSC	HSC	LSC		LCC	OC	OCC	PSC		ULSC	WSC	WLC	YSC
			Bathurst	Blayney	Mandurama	Boorowa	Molong	Cumnock-Yeoval	Carcoar	Canowindra	Cudal-Cargo-Manildra	Grenfell	Goolongong-Eugowra	Cowra	Forbes	Harden-Murrumburrah	Condobolin	Lake Cargelligo	Lithgow	Orange	Oberon	Parkes	Peak Hill	Crookwell	Grenfell	Wellington	Young
A. Demographic Data																											
A1	Historical Population served with water and wastewater: • by supply scheme • Preferably from 1991 to 2006 Census.	Councils Local Water Utilities	✓	✓		×	✓		✓					✓	✓	✓	×		×	✓	✓	✓		✓	×	✓	×
A2	Population and Employment Forecasts	Councils Local Water Utilities	✓	✓		✓	✓		✓ CTW does not oversee population/ employment; see customer LGAs					✓	✓	✓	✓		✓	✓	✓	✓		✓	✓	✓	✓
A3	Regional Development Project Information with indication of likelihood (High, Medium or Low).	Councils	✓ None expected	✓ but no indication of likelihood		✓ but no indication of likelihood	✓		✓ No recent start ups or closures					✓ None expected	✓	✓ but no indication of likelihood	×		✓	✓	✓ None expected	✓		✓ but no indication of likelihood	✓ None expected	✓	✓ None expected
A4	Central West Transport Study Population and Employment Forecasts	Centroc	✓	✓		✓	✓		✓					✓	✓	✓	✓		✓	✓	✓	✓		✓	✓	✓	✓
A5	Census data – Urban Centres and Localities in the Region – historical population and dwellings by dwelling type, average household income.	Australian Bureau of Statistics	✓	✓		✓	✓		✓					✓	✓	✓	✓		✓	✓	✓	✓		✓	✓	✓	✓
A6	Information on key industry start-ups or closures. Historical data	Councils Local Water Utilities	✓	✓		×	✓		✓ No recent start ups or closures					No recent start ups or closures	✓	✓	No recent start ups or closures		✓	No recent start ups or closures	×	×		No recent start ups or closures	No recent start ups or closures	✓	×
B Water Demand and Quality Data																											
B1	Historical Bulk Water Production • By supply scheme • Daily preferable • Monthly acceptable • 5 years min – >10 years preferable	Councils Local Water Utilities	✓ Daily 1993-2006	✓ Supplied by CTW		×	✓ Weekly 15 years		✓ Weekly 5 years					✓ Daily 7 years	Monthly 15 years	Supplied by Goldenfields	✓ Daily 5-8 years		✓ Daily 10 years	✓ Monthly 5 years	✓ Daily 17 years	✓ Monthly 12 years		×	Supplied by CTW	✓ Daily 15 years	Supplied by Goldenfields
B2	Historical Wastewater Flows • By wastewater treatment plant scheme • Daily preferable • Monthly acceptable • 5 years min – >10 years preferable	Councils Local Water Utilities	✓	✓ Although some data gaps present		×	✓ Weekly 10 years		✓ No wastewater services provided					✓ Daily 15 years	✓ Daily 10 years	Data gaps present; only 2005/06 data provided	✓ Daily 5-8 years		✓ Monthly 12 years	×	✓ Daily 8 years	✓ Daily 5 years		×	×	Data gaps; daily 3 years	×
B3	Customer Consumption by Customer Category	Councils Local Water Utilities	✓	✓ Although not segregated by customer category		×	✓		✓					✓	Not segregated by customer category	✓	✓		×	✓	✓	✓		Not segregated by customer category	Supplied by CTW	✓	Supplied by Goldenfields
B4	Historical Irrigation Data	Department of Water and Energy	✓ Obtained from various sources																								
B5	Water Licensing Information	Department of Water and Energy	✓ Obtained from the NSW Legislation register																								

ITEM	DESCRIPTION	SOURCE	BRC	BSC		BWSC	CSC		CTW					CWSC	FSC	HSC	LSC		LCC	OC	OCC	PSC		ULSC	WSC	WLC	YSC
			Bathurst	Blayney	Mandurama	Boorowa	Molong	Cumnock-Yeoval	Carcoar	Canowindra	Cudal-Cargo-Manildra	Grenfell	Goolongong-Eugowra	Cowra	Forbes	Harden-Murrumburrah	Condobolin	Lake Cargelligo	Lithgow	Orange	Oberon	Parkes	Peak Hill	Crookwell	Grenfell	Wellington	Young
B6	Historical Irrigation Water Use	Department of Water and Energy	High level only (catchment wide); difficult to find region or user specific data																								
B7	Historical Water Quality	Councils Local Water Utilities	Data from NSW Dept of Health	✓		×	×		×					✓	Data gaps present	×	×		✓	×	×	×		✓ Taralga Report	×	×	×
C GIS Data (Mapinfo Format)																											
C1	Existing key infrastructure pipeline location, elevation	Centroc	✓	✓		✓	✓		✓					✓	✓	✓	✓		✓	✓	✓	✓		✓	✓	✓	✓
C2	Topographic, contour and cadastral data	Centroc	✓	✓		✓	✓		✓					✓	✓	✓	✓		✓	✓	✓	✓		✓	✓	✓	✓
C3	Major Assets – Water and Wastewater Treatment Plants	Centroc	✓	✓		✓	✓		✓					✓	✓	✓	✓		✓	✓	✓	✓		✓	✓	✓	✓
C4	Land use layers	Department of Water and Energy	Not available																								
C5	Water licence location by type and entitlement	Department of Water and Energy	✓ Non-GIS data obtained from various sources																								
C6	Soil type layers	Department of Water and Energy	Not available																								
D Climate																											
D1	SILO Data Drill for each urban centre.	SILO	✓	✓		✓	✓		✓					✓	✓	✓	✓		✓	✓	✓	✓		✓	✓	✓	✓
D2	NSW Rainfall station data set	Bureau of Meteorology	✓	✓		✓	✓		✓					✓	✓	✓	✓		✓	✓	✓	✓		✓	✓	✓	✓
D3	Local rainfall records not held by the Bureau of Meteorology	Councils	✓ No additional data available	✓		✓ No additional data available	✓		✓					✓ No additional data available	✓	✓ No additional data available	✓		✓ No additional data available	✓ No additional data available	✓	✓		✓	✓ No additional data available	✓	✓ No additional data available
E Hydrologic Modelling																											
E1	Update of NSW Pinneena Stream Flow Data Set	NSW Water Information	✓	✓		✓	✓		✓					✓	✓	✓	✓		✓	✓	✓	✓		✓	✓	✓	✓
E2	Sacramento Catchment Models	Department of Water and Energy	Not available.																								
E3	IQQM Models. Key information includes: • Stream reach characteristics • Urban demands • Irrigation demands • Stream losses • On-farm storage	Department of Water and Energy	Model outputs only																								
F Asset Data																											
F1	Pipeline information: • Diameter: • Length; • Pipe type/class • Direction of flow	Councils, Water Utilities	✓	✓		✓ Pipe diameter/ type data missing	✓		✓					✓ Pipe diameter/ type data missing	✓ Pipe diameter/ type data missing	✓	✓		✓ Pipe diameter/ type data missing	✓ Pipe diameter/ type data missing	✓	✓		✓ Pipe diameter/ type data missing	✓ Pipe diameter/ type data missing	✓ Pipe diameter/ type data missing	✓	✓ Pipe diameter/ type data missing
F2	Pumping station information: • Power: • Pump type/configuration	Councils, Water Utilities	✓	✓		✓ Power use data missing	✓		✓					✓ Power use data missing	✓Power use data missing	✓	✓ Power use data missing		✓	N/A State Water owned	✓ Power use data missing	✓		✓ Power use data missing	✓ Power use data missing	✓	✓ Power use data missing

ITEM	DESCRIPTION	SOURCE	BRC	BSC		BWSC	CSC		CTW					CWSC	FSC	HSC	LSC		LCC	OC	OCC	PSC		ULSC	WSC	WLC	YSC
			Bathurst	Blayney	Mandurama	Boorowa	Molong	Cumnock-Yeoval	Carcoar	Canowindra	Cudal-Cargo-Manildra	Grenfell	Goolongong-Eugowra	Cowra	Forbes	Harden-Murrumburrah	Condobolin	Lake Cargelligo	Lithgow	Orange	Oberon	Parkes	Peak Hill	Crookwell	Grenfell	Wellington	Young
F3	Water treatment plant capacities and treatment trains • Including planned upgrades (cost capacity and planned date)	Councils, Water Utilities	✓ No planned upgrade identified	✓ No WTP; Supplied by CTW		✓ No planned upgrade identified	✓		✓ No planned upgrade identified					✓ No planned upgrade identified	✓ No planned upgrade identified	✓ No WTP; supplied by Goldenfields	✓ No planned upgrade identified		✓	✓	✓	✓		✓ No planned upgrade identified	✓ No planned upgrade identified	✓	✓ No WTP; supplied by Goldenfields
F4	Wastewater treatment plant capacities and treatment processes • Including planned upgrades (cost capacity and planned date)	Councils, Water Utilities	✓ No planned upgrade identified	✓		✓ No planned upgrade identified	✓		✓ No STP; water supply services only					✓ No planned upgrade identified	✓ No planned upgrade identified	✓ No planned upgrade identified	✓ No planned upgrade identified		✓	✓	✓	✓		✓ No planned upgrade identified	✓ No planned upgrade identified	✓	✓ No planned upgrade identified
F5	Dams • Storage capacity • Capacity/stage/area relationships • Estimated yield	Councils, Water Utilities	✓	✓ Supplied by CTW		✓ No stage/ storage curve	✓		✓ Stage/storage curve in Drought Management Plan					✓ State Water data (Wyangala Dam)	✓ State Water data (Wyangala Dam)	✓Supplied by Goldenfields	✓ No stage/ storage curve; State Water data (Lake Cargelligo)		✓ No stage/ storage curve	✓ No stage/ storage curve; State Water data (Oberon Dam)	✓	✓		✓ No stage/ storage curve	✓ Supplied by CTW	✓ State Water data (B'dong Dam)	✓ Supplied by Goldenfields
F6	Water treatment and transfer costs • By water supply scheme • Electricity • Chemicals	Councils, Water Utilities	✓ Costs lumped into totals provided	✓ Supplied by CTW		×	✓		✓ Costs lumped into total					✓	×	✓ Supplied by Goldenfields	×		×	✓	✓	✓		×	Supplied by CTW	✓	✓ Supplied by Goldenfields
F7	Wastewater treatment and transfer costs • By Wastewater treatment plant catchment • Electricity • Chemicals	Councils, Water Utilities	✓ Costs lumped into totals provided	✓		×	✓		✓ No STP; water supply services only					✓	×	×	×		×	✓	✓	✓		×	×	✓	×
F8	Existing Proposed Non-Grid Electricity Options: • Uses • Capacity	Councils, Water Utilities	✓ None proposed	✓ None proposed		×	✓ None proposed		✓ None proposed					×	×	✓ None proposed	✓ None proposed		✓ None proposed	✓ None proposed	✓ Methane co-gen proposed	✓ None proposed		✓ Wind farms	✓ None proposed	✓ None proposed	×
G Relevant Other Reports																											
G1	Murray Darling Basin Sustainable Yields Project Reports	CSIRO	✓	✓		✓	✓		✓					✓	✓	✓	✓		✓	✓	✓	✓		✓	✓	✓	✓
G2	Integrated Water Cycle and Demand Management Strategy Reports	Local Water Utilities	✓	✓ IWCM		×	×		✓					✓ DMS only	×	×	Not available		×	IWCM Concept Study finished in 2007	✓	✓		×	IWCM in progress	Not available	×
G3	Reports/Investigations into Supply Security options: • Enlarging Lake Rowlands • Orange Stormwater Harvesting • Cowra – Woodstock Pipeline	Centroc Local Water Utilities	✓ Bathurst-Orange Growth Area Water Supply – Short List Options Report 1977	✓ N/A		✓ N/A	✓ N/A		✓ Western Research Institute Needs Study – New Lake Rowlands Storage; Central Tablelands Historic Document 1961; proposed mining information					×	✓ Forbes Water Augmentation Report 1978	N/A	N/A		N/A	✓ Community Water Supplies Investigation Report 1976	✓ Orange City Council Stormwater Harvesting Options Study; Community Water Supplies Report 1976	N/A		N/A	N/A	N/A	N/A
G4	Proposed Water Supply/Recycling Scheme Information (may not have formal supporting reports)	Centroc Local Water Utilities	✓ Greywater reuse Effluent reuse Etc.	✓ See CTW		×	✓		✓ Western Research Institute Needs Study – New Lake Rowlands Storage; Central Tablelands Historic Document 1961					✓ 2 emergency water resource reports	✓ Forbes-Parkes-Gooloogong Pipeline Option 2008	✓ Effluent recycling scheme	✓ Options to improve lake quality; bore development		×	✓ Alternative supply source option study	✓	✓		×	See CTW	✓	×
		Common reports: Lachlan Valley Dam Sites – Preliminary Estimates of Streamflow and System Yields 1980;																									