# Exhibition of:
# Council resolution 13.2

At an ordinary Gunnedah Shire Council meeting on April 17, 2024, Council resolved to place on public exhibition, for 28 days, the following Council resolution:

- That Council adopt the Demand Management Plan 2024 & Drought Management Plan 2024. 2.
- That Demand Management Plan 2024 & Drought Management Plan 2024 on public notification for a period of 28 days.

Submissions should be received no later than 5pm on **Wednesday, May 16**, 2024.
If you have feedback on the resolutions on exhibition, please submit via the following methods:

- Email council@infogunnedah.com.au. Please include your name and contact details.
- Complete an online form via the Contact Us section of Council's website.
- Post your submission to Gunnedah Shire Council, PO Box 63, Gunnedah, 2380 or hand it over the counter at Council's Administration Building at 63 Elgin Street, Gunnedah.

Please be aware that if you make a submission, other people may have access to your comments. This may be as a result of a report to a Council meeting or as part of an application under the *Government Information (Public Access) Act 2009*. Further details are available on request from Council.

Submissions will be considered in Gunnedah Shire Council's adoption of the plans and program.

For further information, contact Council on (02) 6740 2100.

**Eric Groth**
**GENERAL MANAGER**

# Gunnedah Shire Council

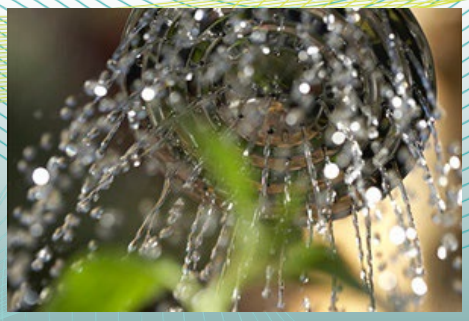
# Demand Management Plan

2024 Revision

January 2024

Presented by Beca Hunter $H_2O$

ABN 16 602 201 552



# Report Details

| | |
|---|---|
| **Report Title** | Gunnedah Shire Council: Demand Management Plan |
| **Project No.** | 5852-021 |
| **Status** | 2024 Revision |
| **Enquiries** | Steve McAleer<br>M: 0400 442 668<br>E: Steve.McAleer@beca.com |

## Document History and Status

| Revision | Report Status | Prepared by | Reviewed by | Approved by | Issue Date |
|---|---|---|---|---|---|
| A | Revision | F.Lutkie | S.McAleer | S.McAleer | 22 Feb 2024 |

# Overview and Purpose

This 2024 version of the Demand Management Plan has been prepared as an update to the previous 2020 version which was preceded by the 2017 and 2006 iterations.

The Demand Management Plan has been prepared in accordance with NSW Department of Primary Industries – Water (now Department of Planning, Industry and Environment (DPIE)) requirements, as documented in their Best Practice Management of Water Supply and Sewerage Guidelines (DWE, 2007). With the recent implementation of the Regulatory and Assurance Framework for Local Water Utilities (DPIE, 2022), Demand Management can now be integrated within Council's broader strategic planning processes, including within the Integrated Planning and Reporting Framework. However, Council considers it more practical to have a standalone Demand Management Plan that can be reviewed and updated as required.

The fundamental objective of preparing and adopting a Demand Management Plan is to encourage efficient water use through the adoption of various demand management measures. This Plan outlines the various water conservation measures that are to be employed by Council to ensure that town water demand levels are both efficient and sustainable. By employing effective demand management measures, Council can expect significant reductions in water supply system capital and operating costs, along with the environmental and social benefits associated with maximising urban water efficiencies.

This Demand Management Plan has been developed and updated in association with a Drought Management Plan, which focuses on both the demand and supply side measures to be employed during drought periods. Consequently, during drought periods there is an overlap between the two plans.

The Demand Management Plan and all rebates and offers contained within are only applicable to customers connected to the reticulated town water supply systems operated by Council.

***DEMAND MANAGEMENT PLAN - DOCUMENT CONTROL TABLE***

| ***Revision*** | ***Revision Date*** *(from when Revision Applies)* | ***Resolved by Council*** *(date of Council Meeting)* |
|---|---|---|
| *Draft Report (for public exhibition)* | | |
| *Final Report* | | |

# Contents

# Appendices



# Figures



# Tables

# 1 Introduction

Demand management is an essential component of modern water resource planning and management. The implementation of a comprehensive Demand Management Program provides benefits to customers, Council and the environment, including:

- Reduced customer costs due to water savings (lower water and wastewater charges) and energy savings (lower energy charges)
- Reduced long-term costs for providing water due to avoided or delayed water supply infrastructure
- Reduced environmental impacts due to lower water extractions and lower energy usage

This Demand Management Plan has been prepared by Gunnedah Shire Council (GSC) to ensure a structured and consistent approach is taken for the promotion of demand management initiatives across the region. The Plan includes Council's Demand Management Program, which includes a range of water conservation measures that Council will be targeting to ensure that future town water demand levels are both efficient and sustainable.

The Plan is only applicable to customers connected to the reticulated water supply systems operated by GSC, which includes systems operated in the following towns:

- Gunnedah
- Curlewis
- Mullaley
- Tambar Springs

Management of water supply in NSW is administered by the *Water Management Act 2000, Water Act 1912* and *Local Government Act 1993*. Demand management planning is an essential component of the NSW Government's *Best Practice Management of Water Supply and Sewerage Guidelines* (DWE, 2007) for local water utilities. This Demand Management Plan has been prepared in accordance with these guidelines and the associated Water Conservation and Demand Management Check List.

This Plan contains the following sections:

*Section 2* contains a brief review of historical demands and considers the key influences on demands.

*Section 3* contains a summary of current situation with water demands, including a breakdown of demands, benchmark data for residential consumption, water loss estimates and an overview of current demand management initiatives.

*Section 4* contains 30-year demand forecasts for each water supply system.

*Section 5* contains a summary of the Demand Management Program along with further details for each demand management measure.

*Section 6* outlines the steps for implementing and monitoring the Demand Management Program.

*Section 7* contains the references to this report.

# 2 Historical Water Use

Historical water consumption is typically influenced by a variety of factors, including:

- Prevailing climatic conditions and climate change (refer to **Appendix A**)
- Residential and non-residential development
- Planning regulations for new developments
- Demand management measures
- Restriction rules during periods of drought
- Living standards, incomes and lifestyle factors.

The total annual water production for the Gunnedah water supply system since 2013/14 is shown in Figure 2-1, based on bore production data extracted from SCADA. The average water production over the last 10 years was 2,591 ML/a, with production ranging from 1,900 ML in 2021/22 to 3,330 ML in 2018/19. The town of Curlewis was connected to the Gunnedah water supply system in early 2019; data from the five most recent years therefore includes the additional water produced to supply Curlewis (estimated at around 80 ML/yr on average).

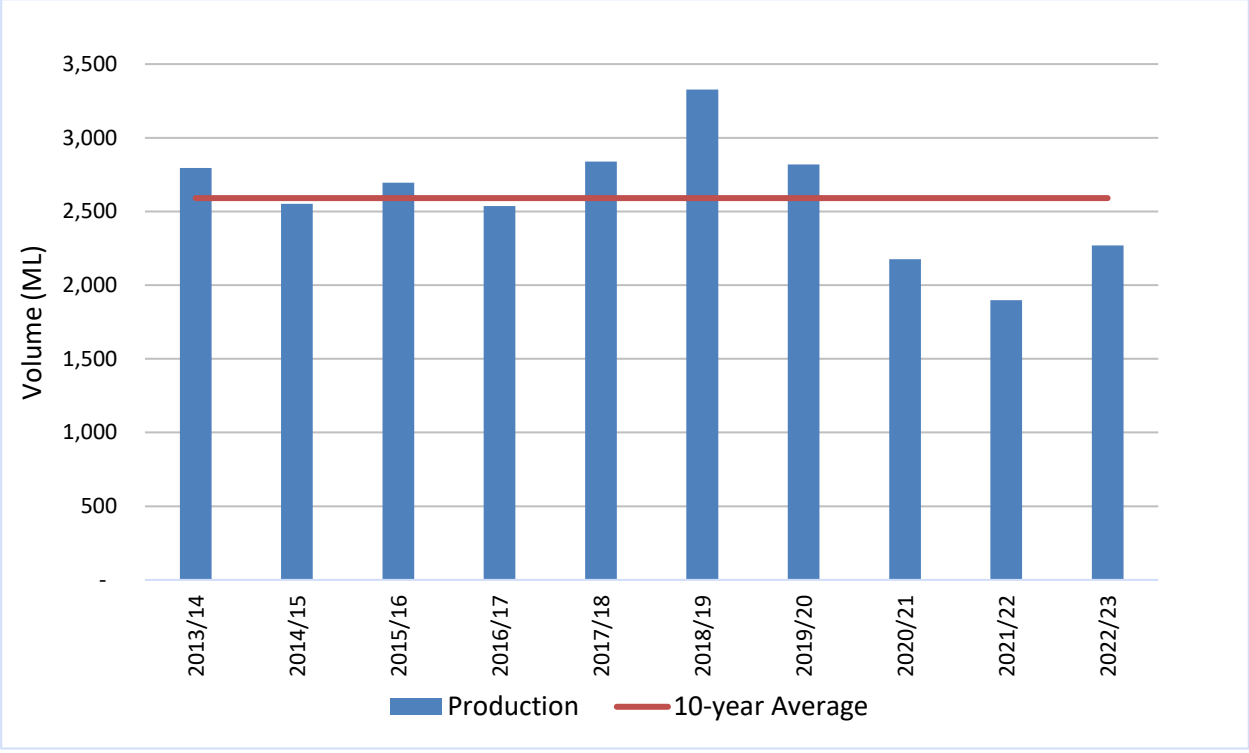



**Figure 2-1 Annual Treated Water Production – Gunnedah Water Supply (10 years)**

The average annual residential usage since 2013/14 is shown in Figure 2-2. The average residential usage has ranged from 225 kL/property in 2021/22 to 445 kL/property in 2018/19, with a 10-year average of 370 kL/ property. The 10-year average has decreased, from 380 kL/property to 370 kL/property since the last revision of the Demand Management Plan, however, advice from Gunnedah Shire Council has indicated that approximately 20% of water meters have malfunctioned and billing data is not representative of actual demand. Excluding the previous three years, the 10-year average increases to 386 kl/a.

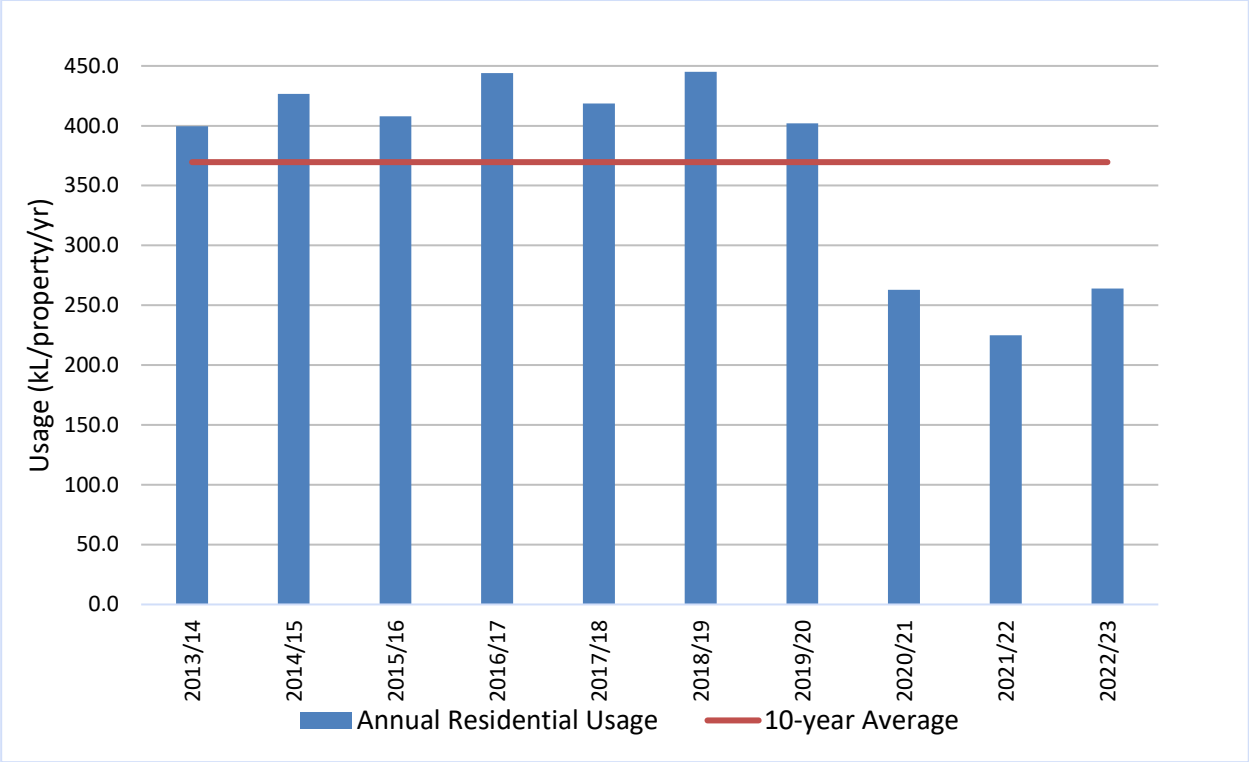



**Figure 2-2 Average Annual Residential Usage per Property – Gunnedah Shire Council (10 years)**

Prevailing climatic conditions, particularly maximum temperatures and rainfall during summer months, have a significant impact on water consumption – particularly residential outdoor water usage. GSC's annual water production figures indicate that demands are heavily influenced by climatic conditions with demands significantly decreasing in wetter years (e.g. 2020/21). A comparison of annual water production and annual rainfall is provided in Figure 2-3. Until the activation of restrictions in January 2020 for a period of four months, GSC had not imposed water restrictions during the last 10 years apart from Permanent Water Conservation Measures (refer Section 3.5).

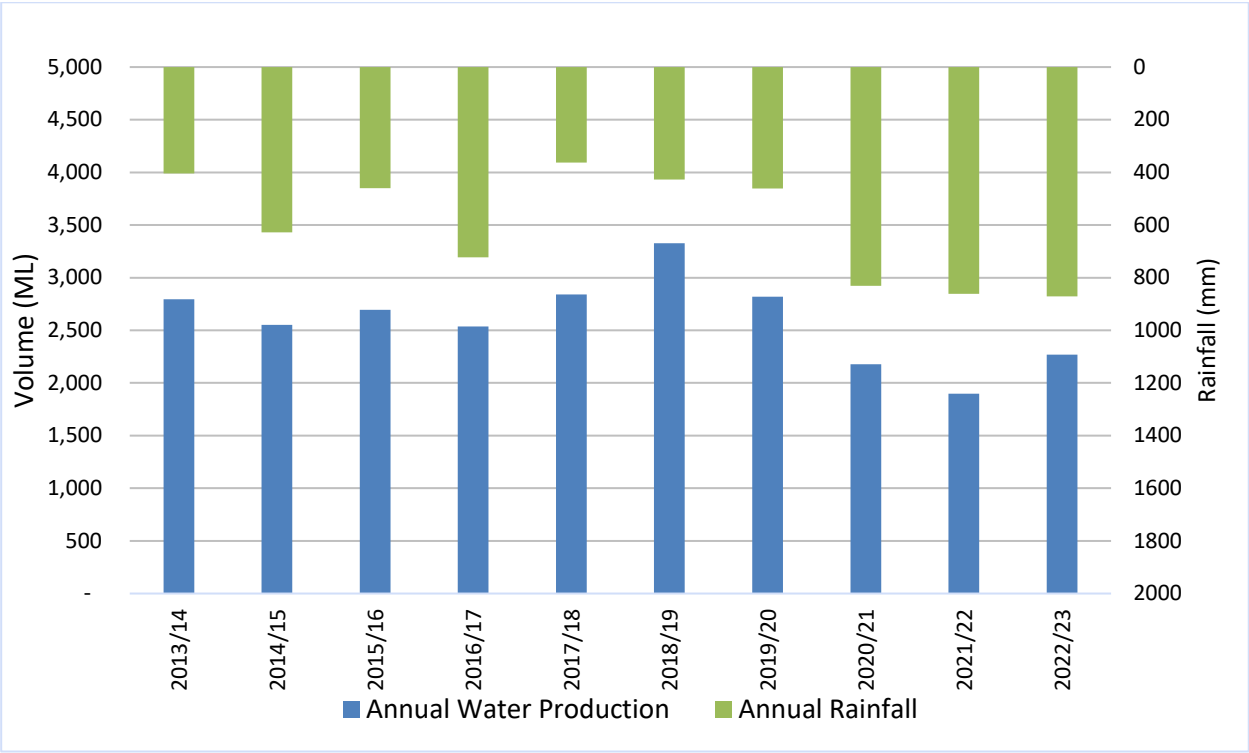



**Figure 2-3 Comparison of Annual Water Production and Annual Rainfall**

# 3 How Water is Currently Used

## 3.1 Demand Categories

The breakdown of current water consumption by major demand type for the combined water supply systems is shown in Figure 3-1.

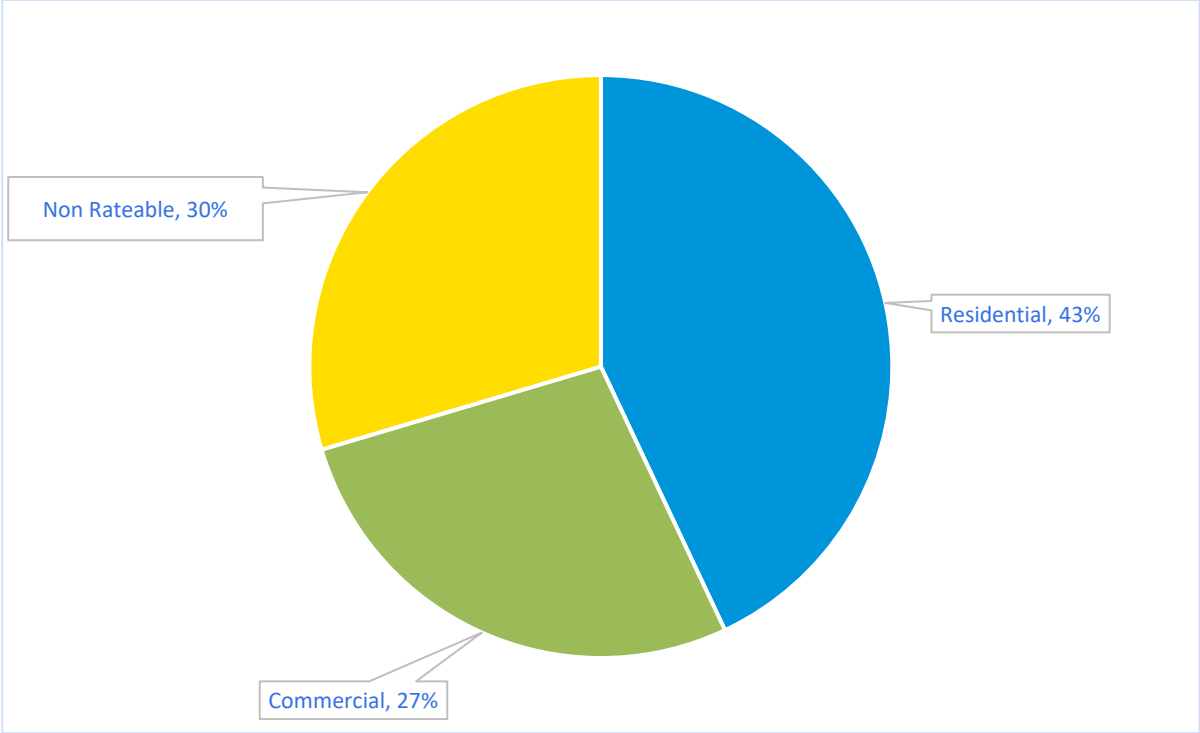



**Figure 3-1 GSC Water Supply Systems – Consumption by Major Demand Type (2022/23)**

An analysis of metered water consumption by demand category was undertaken for the Gunnedah and Curlewis town water supply system and is shown in Table 3-1. It is assumed in this analysis that the available metering data is representative of the data missing from failed meters, as advised by GSC.

**Table 3-1 Gunnedah/ Curlewis Water Supply System – Metered Consumption by Category (2022/23)**

| Demand Category | 2022/23 Consumption (ML/a) | % of Total Consumption | Connections | Consumption per Connection (kL/a/property) |
|---|---|---|---|---|
| Residential | 976 | 55.5% | 3,661 | 267 |
| Commercial | 622 | 35.4% | 540 | 1,152 |
| Non-Rateable | 160 | 9.1% | 77 | 2,078 |
| **TOTALS** | **1,758** | **100%** | **4,278** | |

A simplified analysis of metered water consumption by demand category was also undertaken for the remaining small town water supply systems and is included on Table 3-2.

**Table 3-2 Small Town Water Supply Systems – Metered Consumption Summary (2022/23)**

| System | 2022/23 Total Consumption (ML/a) | Proportion Residential | Residential Consumption per Connection (kL/a/dwelling) | Total Consumption per Connection (kL/a/property) |
|---|---|---|---|---|
| Mullaley & Tambar Springs | 15.7 | 69% | 125 | 153 |

Typical residential consumption per property is lower in the villages than in Gunnedah due to both lower water quality and less garden and outdoor usage. Many properties in the villages have rainwater tanks for drinking water supply, due to lower quality town water supply.

## 3.2 Benchmarking of Residential Consumption

Benchmarking of residential consumption was undertaken using performance data from 2021/22 from across the state (Department of Planning, Industry and Environment, 2019) as shown on Figure 3-2. DPIE's LWU performance reporting was not available for 2022/23.

GSC's average residential consumption for 2021/22 was 225 kL/property, based on DPIE's LWU performance reporting. GSC's residential consumption was approximately 1.4 times the state-wide median of 157 kL/yr, even when a significant portion of metered data is not available. Consumption is high in Gunnedah Shire due to the relatively dry climate conditions experienced in the region and the resulting increase in irrigation requirements and high use of evaporative coolers. Residential blocks tend to be large with extensive lawn coverage (Woodlots & Wetlands Pty Ltd, 2010), and there are a large number of properties with pools. Prior to January 2020, water restrictions had not been imposed over the previous 15 years.

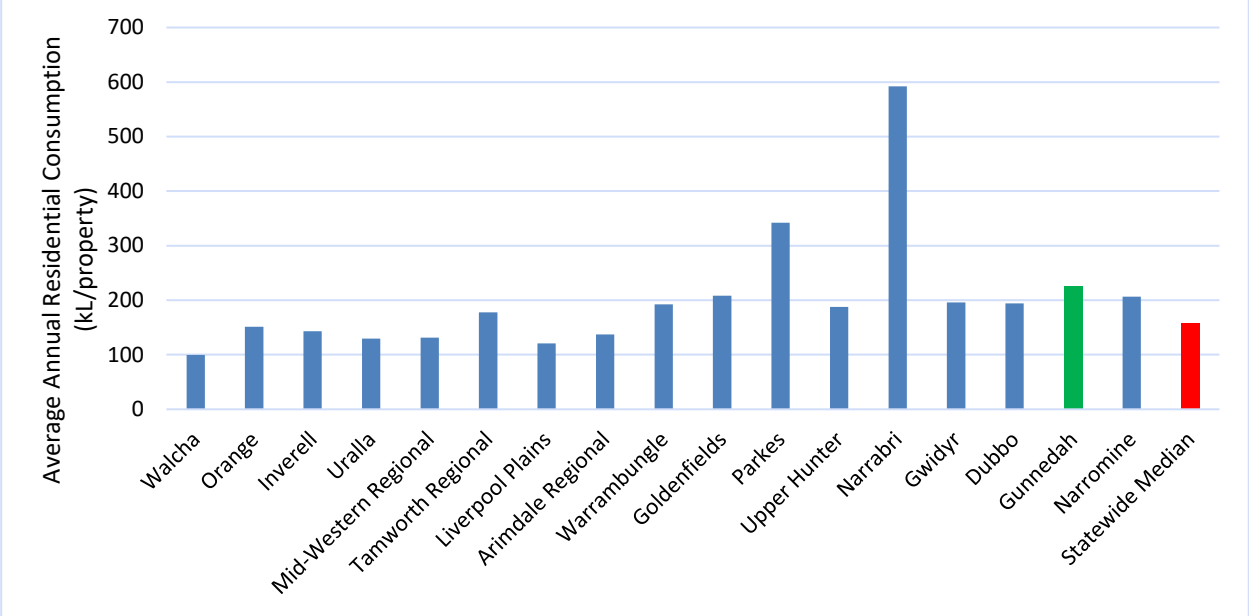



**Figure 3-2 2021/22 NSW Benchmarking Data for Residential Consumption**

## 3.3 Residential End-Use

In the absence of local residential end-use metering data to provide an accurate estimate of end-use consumptions, typical values have been adopted based on recent end-use studies conducted across Australia. These studies have typically been undertaken by large metropolitan water utilities that were coastal based. However, while external

water usage and evaporative coolers usage can differ substantially across Australia, particularly when comparing coastal areas to inland areas, the breakdown of internal usage is generally relatively consistent across water utilities.

The key assumptions used in developing the residential end-use breakdown were:

- Total household usage was assumed to be 386 kL/a based on the 10-year average, excluding the last three years where metering failures have resulted in lower consumption data
- Internal household usage (excluding evaporating coolers) was assumed to be 150 kL/a (about 39% of total consumption)
- Internal consumption breakdown was based on typical values from recent end-use studies across Australia
- Evaporative cooler usage was estimated to be around 30 kL/a per household, which equates to around 1,500 hr operation time per annum (assuming average consumption of 20 L/hr)
- Outdoor water usage (primarily irrigation) was assumed to be the remainder of water usage after accounting for internal usage and evaporative cooler usage.

Figure 3-3 shows the assumed breakdown of residential end-use that has been adopted for the purposes of assessing demand management options.

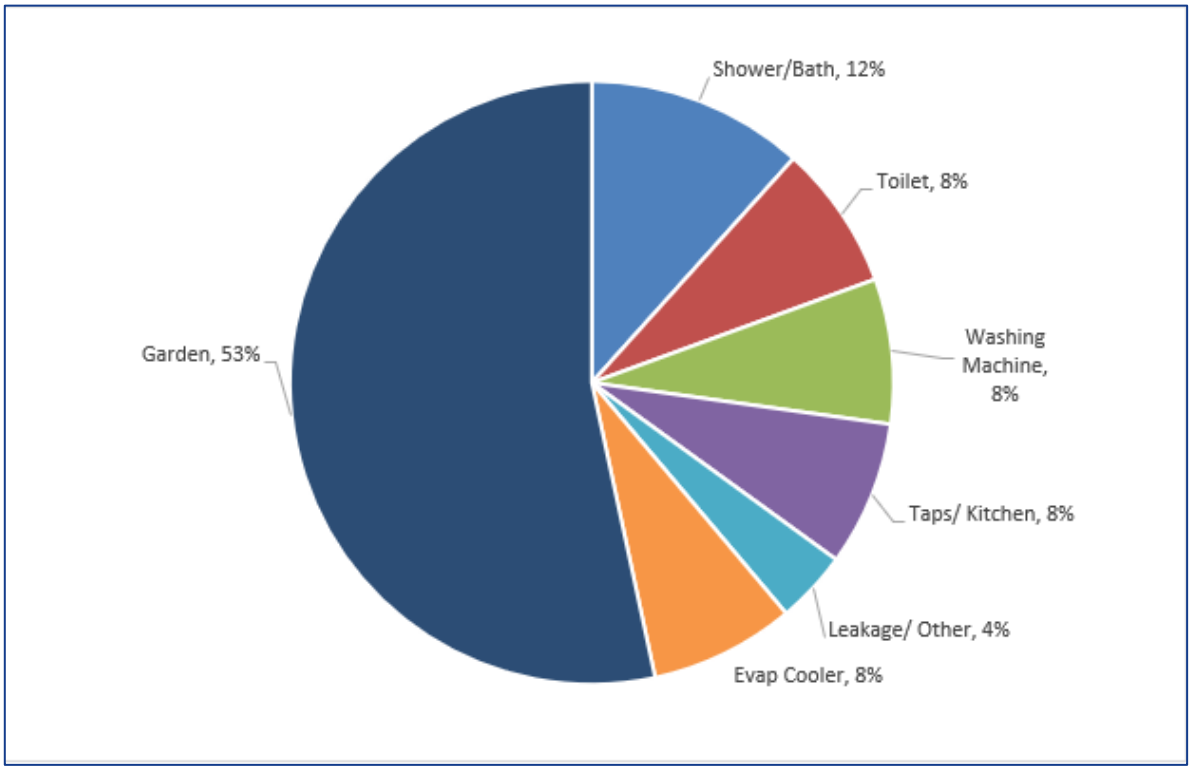



**Figure 3-3 End-Use for Residential Properties based on 386 kL/a per household (Estimate Only)**

## 3.4 Water Losses / Non-Revenue Water (NRW)

For the NSW Performance Monitoring Reporting (NOW, 2015), DPI Water has adopted the following terms used by the International Water Association (IWA) to define key components of losses from a water supply system:

1 **Physical / real losses**: including leakage and overflows from all parts of the water supply system

2 **Apparent losses**: including metering inaccuracies and unauthorised consumption (theft)

3 **Unbilled authorised consumption**: including water used by the local water utility for operational reasons, water used for firefighting and water supplied free of charge

Water losses are generally defined as physical / real losses plus apparent losses, while non-revenue water (NRW) is generally defined as water losses plus unbilled authorised consumption and can be calculated from the difference

between water production (metered flow into a water supply system) and metered consumption (metered flow from the water supply system to the end user).

Key water loss indicators are included in NSW LWU Performance Monitoring data and reports. In 2013/14 GSC's reported water losses were higher than the State-Wide medians for both real loss and NRW, however in the 2021/22 GSC were less than the median on both measures. This indicates that relative performance has markedly improved, although there are still opportunities to reduce Non-Revenue Water given that some similar Councils are reporting lower ratios of NRW to total supply.

## 3.5 Current Demand Management Measures

GSC is a supporter of Smart Water Advice, along with six other Namoi council members. A link to the Smart Water Advice website is provided on GSC's website, and provides information to the community on water sustainability and water savings tips.

In 2019 council implemented Automatic Meter Reading (AMRs) at all connected properties to provide real-time water consumption data. Currently customers are unable to access the live data, provided by Taggle. Customer Service staff, when workloads permit, contact property owners as a courtesy only where the real time data supplied by Taggle indicates that consistent leaks of over 50 L/ hr are present. The majority of property owners have engaged a plumber to locate and fix the leaks. There is no current data on the amount of water saved.

# 4 Future Water Use

## 4.1 Gunnedah Water Supply

Demand forecasts have been estimated based on assumed future residential usage and growth figures and associated non-residential growth (see **Appendix B** for more details). Three demand scenarios have been determined – low, average and high.

The higher bound scenario assumed an annual residential usage of 460 kL/property based on most recent drought conditions. The average demand scenario has assumed an annual residential usage of 410 kL/property. The lower bound demand scenario adopted 360 kL/property. The 10-year average of 387 kL/yr is similar to the low and average scenarios. These upper and lower bound annual residential usage figures represent the level of uncertainty associated with predicting future demand levels. It was assumed that residential demands accounted for 60% of total consumption with non-residential (commercial and non-rateable categories) accounting for the remaining 40%.

In addition to the three residential usage scenarios, three dwelling growth rates have been adopted. The average scenario growth was assumed to be 0.3% pa (2022 NSW DPE Population Projections). A lower bound growth rate of 0.1% pa and a higher bound growth rate of 0.6% pa were also adopted.

The projected bulk water demands shown in Table 4-1 are based on the residential usage and growth assumptions discussed above and also include allowance for growth of non-residential demands (such as commercial, institutional and industrial) in line with residential growth and water loses of 10% (see **Appendix B**).

**Table 4-1 Projected Bulk Water Demands – Gunnedah and Curlewis Water Supply (30 years)**

| Demand Scenario | Annual Demand for Bulk Water (ML/a) | | | |
|---|---|---|---|---|
| | 2023 (Existing) | 2033 (+10yr) | 2043 (+20yr) | 2053 (+30yr) |
| **Low** (360kL/a, 0.1%pa) | 2,420 | 2,440 | 2,470 | 2,490 |
| **Average** (410kL/a, 0.3% pa) | 2,750 | 2,790 | 2,92 | 3,010 |
| **High** (460kLa/, 0.6% pa) | 3,090 | 3,280 | 3,480 | 3,690 |

The projections indicate that if the demand levels seen in the recent drought were to continue, and dwelling growth rates occurred in line with the high growth scenario (i.e. 0.6% per year), the Gunnedah water demand would not exceed the ground water allocation of 3,900 ML/a by 2053, as shown in Figure 4-1.

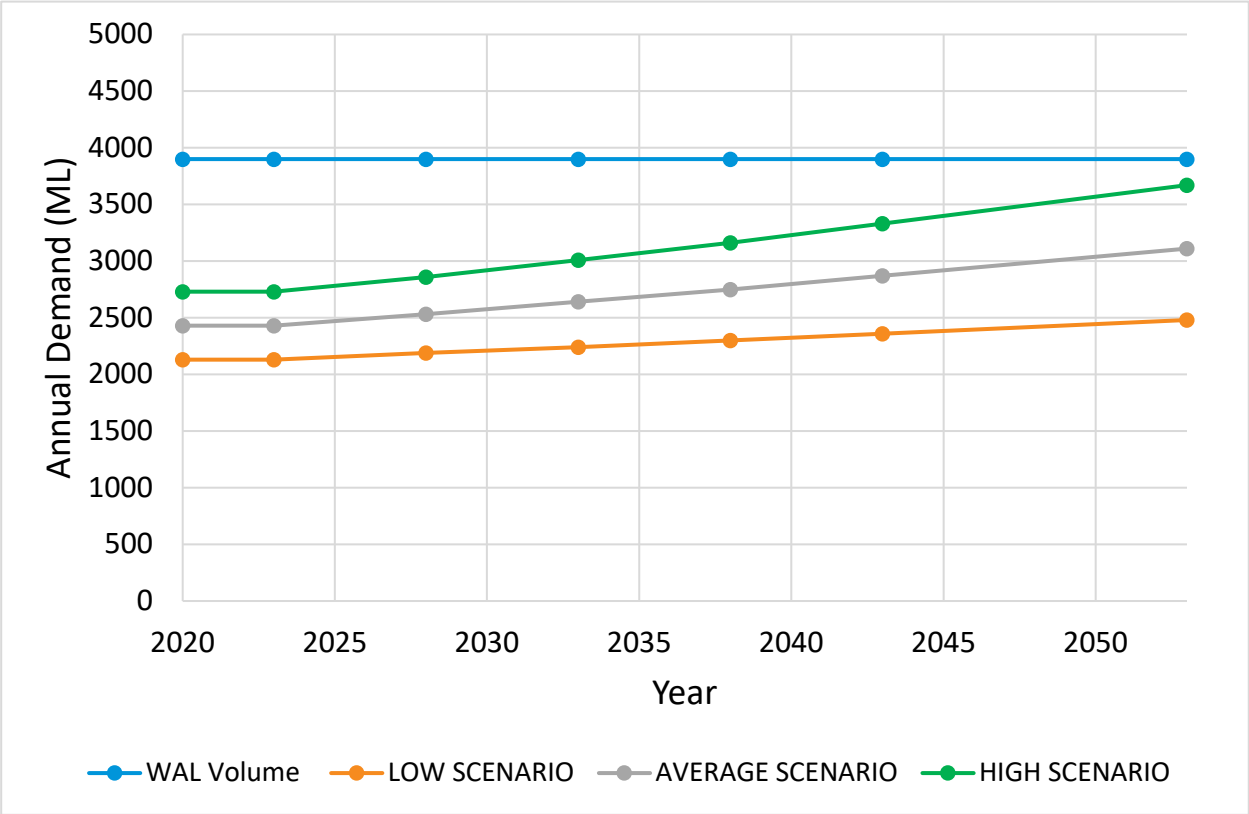



**Figure 4-1 Comparison of Projected Bulk Water Demands and Groundwater Allocation (Gunnedah and Curlewis)**

## 4.2 Villages Water Supply Systems

Minimal growth in water consumption is expected in Mullaley and Tambar Springs, as GSC has indicated that there are minimal population growth expectations for these villages. Additionally, there are no planned commercial or industrial developments that would increase annual water demand. Current annual demand in both villages is significantly less than the groundwater allocation, as shown in Table 4-2.

**Table 4-2 Bulk Water Demands –Village Water Supply Systems**

| Water Supply System | Annual Demand (ML) | Annual Demand Growth Rate | Groundwater Allocation (ML/a) |
|---|---|---|---|
| Mullaley | 17 | 0.0% | 59 |
| Tambar Springs | 14 | 0.0% | 42 |

# 5 Demand Management Program

The proposed demand management program is outlined in Table 5-1.

**Table 5-1 Demand Management Program**

| Demand Management Measure | Details / Timing | Customers Targeted | Estimated Council Program Cost* ($ pa) |
|---|---|---|---|
| **Community Awareness Program / Pricing** | • Continuation and ongoing development of Community Awareness Program, including:<br>1. Participation in National Water Week by providing links on Council's website to relevant information<br>2. Participate in School Education Program by providing links on Council's website to relevant information<br>3. Customer water accounts to include comparisons to benchmark usage, year to date consumption and water efficiency tips.<br>4. Provide link to Smart Water Advice website from Council's website<br>• All customers, including Council owned properties, are metered and AMRs have recently been implemented allowing Council access to real-time data.<br>• Bulk water production is continuously metered via SCADA<br>• Maintain strong water conservation signals through the continued use of tiered water usage pricing<br>• Customers are billed a minimum 4 times per year (some larger customers are billed at monthly intervals) | All | **$5k** |
| **Non-Residential Large User Audits** | • Large User Audits for Council owned parks (one per year) | Council owned properties | **$3k** |
| **Regulation & Planning Controls** | The following regulation and planning controls will contribute to water savings over the life of the Program:<br>• BASIX<br>• WELS Rating Scheme<br>• Smart Approved WaterMark Program | New Residential + New Fittings / Appliances | *(Costs included in Community Awareness Program)* |

| Demand Management Measure | Details / Timing | Customers Targeted | Estimated Council Program Cost* ($ pa) |
|---|---|---|---|
| **Water Loss Management** | Water Loss Management Program, which includes:<br>• Metering of all properties / connections via AMR<br>• Proactive approach to leak management on private properties via AMR and Customer Services<br>• 10-year Meter replacement program<br>• Annual water loss assessment using daily data available from SCADA and AMR systems<br>• Periodic inspection of key assets for leaks | All water supply systems | *(Costs already included in Water Operations Budget)* |
| **Water Recycling** | • Use of recycled effluent from the Gunnedah STP at the cotton farm, whilst not potable substitution, reduces groundwater extraction for irrigation purposes | | |

More details on the estimated program costs and water savings are included in **Appendix C**.

## 5.1 Current and Proposed Initiatives

### Community Awareness Program / Pricing

A Community Awareness Program will continue to be provided by Council. The awareness program will include internet resources. The awareness program will also need to be consistent with similar programs that have been developed and implemented by other Namoi Unlimited member councils.

The Community Awareness Program includes:

1. Setting up of avenues for the community to access resources on water efficiency, including Smart Water Advice linked from Council's website
2. Providing links on Council's website during National Water Week.
3. Customer water accounts that include water efficiency tips and provide information on customer's water usage relative to water efficient benchmarks, and year to date consumption indicating remaining water consumption until the second & third pricing tier is reached.

The initial implantation of a comprehensive Community Awareness Program should see water savings of up to 5% reduction in residential usage. The ongoing development of the program is needed to maintain the savings associated with the reduction in residential usage. A relaxation of the Community Awareness Program is likely to result in a gradual increase in residential usage over time, as inefficient water habits are once again adopted.

A strong water conservation signal should also be maintained through the use of Best Practice Pricing, including tiered water usage tariffs.

### Non-Residential Large User Audits

Council has indicated that any non-residential large user audits would be restricted to Council owned property. A non-residential audit program will be implemented with the aim of auditing one Council property per year. The audit program will be based on the guidelines for Water Savings Action Plans, prepared by DPIE. The purpose of Water Savings Action Plans is to identify and help deliver cost effective water savings in a practical, effective and flexible way. The initial audit and subsequent preparation of the Water Savings Actions Plan would be undertaken by Council.

As one of the region's largest users, the Water Saving Actions Plan would set an example to the other large users and the community in general. It is important that Council sets the example for water efficiency for the whole community, particularly in high visibility areas such as watering of parks and gardens.

## Regulation and Planning Controls

Council should actively support and implement various state and national based regulation and planning controls that promote water efficient products, practices and developments. Key regulation and planning controls that should be supported and promoted by the Community Awareness Program include:

- **BASIX**: The NSW Government has implemented residential building planning controls that require all new homes to be water and energy efficient. New homes are generally required to install water efficient fittings, have indigenous garden species and install a rainwater tank.

- **WELS Rating Scheme**: The State and Federal Government have implemented the Water Efficient Labelling & Standards (WELS) rating scheme which applies national mandatory water efficiency labelling (up to 6 Stars) and minimum performance standards to household water-using products.

- **Smart Approved WaterMark Program**: This program was established by four associations (Australia Water Association, Irrigation Australia, Nursery and Garden Industry and Water Services Association of Australia) as a nationally endorsed, non-compulsory water efficiency labelling scheme for products and services which primarily help reduce outdoor water use.

## Water Loss Management

Physical / real losses are generally the largest component of water losses. They are primarily an operation and maintenance issue and are therefore generally the losses that are targeted in a demand management program. Water losses are best managed by way of a Water Loss Management Program (which often is a component of a more comprehensive Asset Management Program).

The Water Loss Management Program will focus on the following areas:

- Metering of all properties and connections, including all public facilities, parks and gardens, standpipes and Council's water and sewer facilities (e.g. pumping stations).
- A residential Water Meter Replacement Program – residential water meters are typically replaced every 8-12 years. All water meters were recently replaced with the implementation of Council's AMR system.
- An assessment of annual water loss is undertaken for the NSW Performance Reporting based on the preceding 12 months of metering data. Improved data collection (i.e. daily production and consumption data available from Council's SCADA and AMR system) will allow a more accurate assessment of water losses.

## Smart Meters

In 2019 council installed smart meters at all properties which allow for instantaneous consumption readings.

In addition to providing increased awareness to customers about their consumption behaviours, Customer Services, as a courtesy only, are using data from the system to inform customers when workloads permit of leaks on private properties.

# 5.2 Future Initiatives

A list of potential future demand management initiatives that could be considered in the future (potentially in 5 – 6 years' time when the Demand Management Program is reviewed and updated), is included below:

- Implement Water Savings Actions Plans at Council owned properties such as parks.
- Further use of data from smart meters to better understand customer behaviours and develop targeted customer education program.

# 6 Implementation and Monitoring

This Demand Management Plan outlines the various demand management measures that have been adopted by Council and will be employed to encourage water efficiency across the water supply systems that are operated by Council. The development of implementation plans and ongoing monitoring of the individual programs are critical to the success of the Demand Management Plan.

Any new demand management measures will require an implementation plan to be developed and documented by Council to ensure the successful setup and delivery of the specific program. The implementation plan would cover the following key areas:

1. Program objectives and duration
2. Identify key people responsible for implementing the program
3. Identify any specific training needs
4. Develop more detailed budgets, including identifying other resourcing requirements (need to develop annual budgets for the life of the program)
5. Develop a communication strategy (in association with Community Awareness Program)
6. Scheduling and specific requirements for monitoring and evaluation

For demand management measures that have been previously implemented by Council, these measures are unlikely to need a specific implementation plan unless the nature of the program has changed significantly or other issues such as additional training or monitoring have been identified.

Regular monitoring, evaluation and review will be required for each individual program, as well as the overall Demand Management Program. Monitoring and evaluation of individual programs should include consideration of key outcomes (e.g. water savings, participation rates, customer satisfaction) and key processes (e.g. ease of implementation, Council costs / resources to run program). Monitoring and evaluation of the full Demand Management Program should also be undertaken to assess effectiveness of the combined programs and how they relate to each other.

Annual progress reports on the Demand Management Program will be prepared in association with a progress report on Water Loss Management. The progress report will include the outcomes of regular monitoring and an evaluation of the ongoing effectiveness of the programs. Where necessary, adjustments and/or enhancements should be made to the program based on the annual progress reports.

The Demand Management Plan should be reviewed every 2 – 3 years and updated as circumstances change.

# 7 References

DECCW. (2010). *NSW Climate Impact Profile: The impacts of climate change on the biophysical environment of New South Wales.* Sydney: Department of Environment, Climate Change and Water NSW.

Department of Planning, Industry and Environment. (2019). *2018-19 LWU performance monitoring data and report.*

DPIE. (2020, July). *Adapt NSW*. Retrieved from Understanding and Adapting to Climate Change: climatechange.environment.nsw.gov.au

DWE. (2007). *Best-Practice Management of Water Supply & Sewerage.* Sydney: NSW Government - Dept of Water & Energy.

Hunter H2O. (2015). *Namoi Councils Drought Management Plan Template.* Namoi Water Alliance: Hunter H2O.

HWA. (2014). *Namoi Councils - Review of Water Restrictions Policy.* Namoi Councils: Hunter Water Australia.

ISF. (2008). *Guide to Demand Management.* WSAA: Institute for Sustainable Futures.

NOW. (2015). *2013-14 NSW Water Supply and Sewerage Benchmarking Report.* NSW Department of Primary Industries: NSW Office of Water.

NOW. (2015). *2013-14 NSW Water Supply and Sewerage Performance Monitoring Report.* NSW Department of Primary Industries: NSW Office of Water.

OEH. (2015, September). *Climate Change Impacts on Surface Runoff & Recharge to Groundwater.* Sydney: NSW Office of Environment & Heritage. Retrieved from Adapt NSW (Office of Environment & Heritage).

OEH. (2016, September). *Adapt NSW*. Retrieved from Office of Environment & Heritage: http://climatechange.environment.nsw.gov.au/

OEH. (2016, September). *Murray Murrumbidgee Climate Change Snapshot.* Retrieved from Adapt NSW (Office of Environment & Heritage): http://climatechange.environment.nsw.gov.au/Climate-projections-for-NSW/Climate-projections-for-your-region/Murray-Murrumbidgee-Climate-Change-Downloads

Woodlots & Wetlands Pty Ltd. (2010). *Integrated Water Cycle Management Strategy.*

# Appendix A
# Location and Climate

## Appendix A – Location and Climate

GSC serves a population of over 13,000 people, over an area of around 5,000 km$^2$ on the Liverpool Plains, within the Namoi River catchment. In addition to the towns and villages that have reticulated water supply systems (Gunnedah, Curlewis, Mullaley and Tambar Springs) there are several other villages located within the local government area that do not have formal water supply systems, including Carroll, Breeza and Kelvin. The nearest towns to Gunnedah that are outside of the GSC area are Tamworth (around 80 km east), Quirindi (around 60 km south-east) and Narrabri (around 100 km north-west).

The Gunnedah Region experiences a dry sub–humid climate. Temperatures are warm to hot in summer with relatively low humidity, mild in autumn and spring and cool to mild in winter. Rainfall is generally lower over the autumn and winter months and highest in summer months due to a predominance of summer storms.

Median rainfall in Gunnedah is 570.8 mm per annum, average annual evaporation is 4.8 mm per day, and the mean maximum daily temperature is 26.3ºC. Monthly climate statistics for Gunnedah are included in Table A1.

**Table A1 Climate Statistics – Gunnedah Airport (Site No. 055202)**

| Climate Statistic | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Annual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Median Rainfall (mm)** | 36.4 | 49.4 | 47.9 | 15.8 | 28.4 | 36.0 | 23.8 | 26.9 | 30.6 | 50.4 | 48.3 | 67.8 | 561.6 |
| **10%ile Rainfall (mm)** | 11.6 | 12.4 | 8.1 | 0.2 | 0.3 | 9.4 | 6.3 | 4.2 | 3.8 | 9.3 | 13.0 | 20.9 | 353.2 |
| **Mean Daily Evap (mm)*** | 7.7 | 6.9 | 5.9 | 4.4 | 2.7 | 1.9 | 1.9 | 2.8 | 4.0 | 5.4 | 6.7 | 7.8 | 4.8 |
| **Mean Max. Temp (ºC)** | 34.6 | 33.1 | 30.2 | 26.4 | 21.7 | 18.0 | 17.5 | 19.6 | 23.6 | 27.5 | 30.4 | 32.6 | 26.3 |

*Note: Mean Daily Evaporation was taken from Gunnedah Resource Centre (Site No. 055024)*

It is widely accepted that future climate changes could impact water supply systems through changing frequency and duration of rainfall, as well as an increase in evaporation. While estimating the impacts associated with future climate change is very difficult and is an evolving science, recent studies have started to provide some indication of the potential climate impacts. However, modelling to-date has focused more on changes in average monthly or annual statistics and less on the duration and frequency of extreme events, which is more critical for drought management.

According to the CSIRO State of the Climate 2022, Australia's climate has warmed by an average of 1.47 ± 0.24 °C since 1910, and April to October rainfall in Southeastern Australia has decreased by 10% since the 1990s. The previous decade was the warmest on record and 2019 is the warmest year on record.

The Adapt NSW website (setup by the former NSW Office of Environment and Heritage, now part of NSW Department of Planning, Industry and Environment), includes climate projections for NSW as well as more specific catchment-based projections. An extract from the *New England North West Climate Change Snapshot* (OEH, 2016) is included below:

> Based on long-term (1910–2011) observations, temperatures have been noted to have been increasing since about 1970, with higher temperatures experienced in recent decades.
>
> The New England and North West Region is projected to continue to warm during the near future (2020–2039) and far future (2060–2079), compared to recent years (1990–2009). The warming is projected to be on average about 0.7°C in the near future, increasing to about 2.2°C in the far future. The number of high temperature days is projected to increase, with fewer potential frost risk nights anticipated.
>
> The warming trend projected for the region is large compared to natural variability in temperature and is of a similar order to the rate of warming projected for other regions of NSW.

## Appendix A – Location and Climate

The region currently experiences considerable rainfall variability across the region and from year-to-year and this variability is also reflected in the projections.

Currently, the biggest concern for local water utilities is the potential impact that climate change may have on rainfall patterns and volumes, and in turn how this will impact surface runoff and groundwater recharge rates. The latest estimates of hydrological climate change impacts are included in a recent report by the NSW Office of Environment and Heritage (OEH, 2015), which lists near future (2020 – 2039) and far future (2060 – 2079) estimates for rainfall, surface runoff and groundwater recharge for major river catchments across NSW. Hydrological climate change estimates for the Namoi River catchment are included in Table A2.

**Table A2 Hydrological Climate Change Impacts – Gwydir River (OEH, 2015)**

| Region | Percentage Change in Mean Annual: | | | | | |
|---|---|---|---|---|---|---|
| | Rainfall | | Surface Runoff | | Groundwater Recharge | |
| | Near Future | Far Future | Near Future | Far Future | Near Future | Far Future |
| Namoi River | +0.7% | +7.9% | +4.1% | +25.5% | -7.0% | +11.8% |

The table reflects the level of uncertainty surrounding climate change, with rainfall predicted to increase slightly in the near future and then further increase in the far future. Surface runoff is predicted to increase slightly in the near future, but increase significantly (around 25%) in the far future. However, groundwater recharge rates are predicted to fall in the near future, but then increase again in the far future.

While the table gives some indication of the potential changes in mean annual rainfall, streamflow and groundwater recharge rates, the potential impact on water resources (including groundwater systems) is more difficult to predict, as the future nature of rainfall patterns is unknown. Climate change models have been used to estimate changes in seasonal rainfall patterns; however, these models are not currently capable of predicting future extreme rainfall patterns, such as flooding and drought events. Therefore, predictions on the future impact on water resources are currently very limited, as they generally do not consider future climate variability, particularly climate extremes.

# Appendix B
# Demand Projections

# GUNNEDAH & CURLEWIS WATER SUPPLY - DEMAND PROJECTIONS

| DEMAND PROJECTIONS ML/a<br>LOW SCENARIO | | | | Residential Dwelling Growth<br>Residential Consumption | | | 0.10% pa<br>360 kL pa | |
|---|---|---|---|---|---|---|---|---|
| **DEMAND COMPONENT** | **Growth Rate** | **2020** | **2023** | **2028** | **2033** | **2038** | **2043** | **2053** |
| Residential | 0.50% | 1,339 | 1,318 | 1,325 | 1,331 | 1,338 | 1,345 | 1,358 |
| Non-Residential | 0.50% | 893 | 879 | 883 | 887 | 892 | 896 | 905 |
| Losses (10%) | NA | 223 | 220 | 221 | 222 | 223 | 224 | 226 |
| **TOTAL** | | **2,450** | **2,420** | **2,430** | **2,440** | **2,450** | **2,470** | **2,490** |

| DEMAND PROJECTIONS ML/a<br>AVERAGE SCENARIO | | | | Residential Dwelling Growth<br>Residential Consumption | | | 0.30% pa<br>410 kL pa | |
|---|---|---|---|---|---|---|---|---|
| **DEMAND COMPONENT** | **Growth Rate** | **2020** | **2023** | **2028** | **2033** | **2038** | **2043** | **2053** |
| Residential | 0.30% | 1,525 | 1,501 | 1,524 | 1,547 | 1,570 | 1,594 | 1,642 |
| Non-Residential | 0.30% | 1,017 | 1,001 | 1,016 | 1,031 | 1,047 | 1,062 | 1,095 |
| Losses (10%) | NA | 254 | 250 | 254 | 258 | 262 | 266 | 274 |
| **TOTAL** | | **2,800** | **2,750** | **2,790** | **2,840** | **2,880** | **2,920** | **3,010** |

| DEMAND PROJECTIONS ML/a<br>HIGH SCENARIO | | | | Residential Dwelling Growth<br>Residential Consumption | | | 0.60% pa<br>460 kL pa | |
|---|---|---|---|---|---|---|---|---|
| **DEMAND COMPONENT** | **Growth Rate** | **2020** | **2023** | **2028** | **2033** | **2038** | **2043** | **2053** |
| Residential | 1.00% | 1,711 | 1,684 | 1,735 | 1,788 | 1,842 | 1,898 | 2,015 |
| Non-Residential | 1.00% | 1,140 | 1,123 | 1,157 | 1,192 | 1,228 | 1,265 | 1,343 |
| Losses (10%) | NA | 285 | 281 | 289 | 298 | 307 | 316 | 336 |
| **TOTAL** | | **3,140** | **3,090** | **3,180** | **3,280** | **3,380** | **3,480** | **3,690** |

| **DWELLING PROJECTIONS** | **Growth Rate** | 2020 | 2023 | 2028 | 2033 | 2038 | 2043 | 2053 |
|---|---|---|---|---|---|---|---|---|
| Low | 0.10% | 3,719 | 3,661 | 3,679 | 3,698 | 3,716 | 3,735 | 3,772 |
| Average | 0.30% | 3,719 | 3,661 | 3,716 | 3,772 | 3,829 | 3,887 | 4,005 |
| High | 0.60% | 3,719 | 3,661 | 3,772 | 3,887 | 4,005 | 4,126 | 4,381 |

# VILLAGES WATER SUPPLY - DEMAND PROJECTIONS

| **Water Supply System** | **Annual Demand Growth Rate** | **2020** | **2025** | **2030** | **2035** | **2040** | **2045** | **2050** |
|---|---|---|---|---|---|---|---|---|
| Mullaley | 0.00% | 17 | 17 | 17 | 17 | 17 | 17 | 17 |
| Tambar Springs | 0.00% | 14 | 14 | 14 | 14 | 14 | 14 | 14 |

# Appendix C
# Estimated Costs & Water Savings

## Appendix C – Estimated Costs & Water Savings

**Table C1 Direct Costs & Water Savings Associated with Demand Management Program (over 3 years)**

| Demand Management Measure | Assumptions (Costs & Benefits) | Council Direct Costs (over 3 years) | Estimated Water Savings (over 3 years) |
|---|---|---|---|
| **Community Awareness Program / Pricing** | • Costs include marketing costs (pamphlets, advertising, handouts, etc) and membership to Smart Water Advice (no additional staff costs have been included)<br>• Benefits assumed to be 5% reduction in residential usage in Gunnedah in the years the community awareness program is operating (130 ML/a) | $15K | 390 ML |
| **Non-Residential Large User Audits & Savings** | • Costs include an allowance for 1 audit pa ($3K each) plus an allowance of $10K pa to implement a Water Savings Action Plan in Years 2 & 3<br>• Benefits are based on an assumed 5% reduction in the consumption of the target user group by year 3 (i.e. 5% of 60 ML) | $29K | 4 ML |
| **Permanent Water Conservation Measures** | • Costs and benefits have been included in the Community Awareness Program | *(Costs included in Community Awareness Program)* | *(Savings assessed in Community Awareness Program)* |
| **Regulation & Planning Controls** | • No direct costs to Council<br>• Benefits are based on around 35 new houses pa and a reduction in water consumption of 35% compared to the average house in Gunnedah | 0 | 29 ML |
| **Water Loss Management** | • Benefits are based on an assumed 1.5% reduction in water losses (ie reduce from around 13% to 11.5%) by year 3 (ie 1.5% of 2,591 ML (10-year average)) | *(Costs already included in Water Operations Budget)* | 38 ML |
| **Proactive Leak Detection** | • Benefits are assumed based on annual water savings of 2.5% of total production (i.e. 2.5% of 2,591 ML) | *(Costs already included in Water Operations Budget)* | 65 ML |
| **TOTALS (over 3 years)** | | **$44k** | **526 ML** |

Assuming total savings of 526 ML over 3 years and direct program costs of $44k, the unit cost of the program to GSC is around $0.08/kL (based on a simplified analysis). This compares favourably with the current water usage charge of $3.81/kL (tier 1, 2023/24).

Additional upfront and ongoing costs to the community, businesses and government have not been considered and additional benefits, including the deferral of capital works, reduced energy costs and reduced costs for wastewater treatment have also not been considered.

# Gunnedah Shire Council

## Drought Management Plan

Revision 2 (2024 Update)

21 February 2024

Prepared by Beca Hunter $H_2O$

ABN 16 602 201 552

# Report Details

| | |
|---|---|
| **Report Title** | Gunnedah Shire Council: Drought Management Plan |
| **Project No.** | 5852-021 |
| **Status** | Revision 2 (2024 Update) |
| **File Location** | P:\Gunnedah SC\5852-011 Review and Update Drought Management Plan\2. Tasks\1. Update Drought Management Plan\Gunnedah Drought Management Plan (Feb 2022 Revision) updated.docx |
| **Enquiries** | Steve McAleer<br>M: 0400 442 668<br>E: Steve.McAleer@beca.com |

## Document History and Status

| Revision | Report Status | Prepared by | Reviewed by | Approved by | Issue Date |
|---|---|---|---|---|---|
| A | Draft | C Smith | G Long | G Long | 13/03/17 |
| B | Final Draft | C Smith | GSC | G Long | 26/04/17 |
| C | Adopted | C Smith | GSC | GSC | 19/07/17 |
| D | Revision 1 | A Dwyer | C Smith | GSC | 10/02/22 |
| E | Revision 2 | K. Dharmasena GSC | M. Ludlow GSC | GSC | 26/9/23 |
| F | Revision 3 | F. Lutkie | S. McAleer | S. McAleer | 21/02/24 |

# Overview & Purpose

This 2024 revision of the Drought Management Plan has been prepared as an update to the previous 2017 and 2022 versions of the plan. The 2022 version followed unprecedented dry conditions in 2019 and early 2020, and the implementation of water restrictions for the first time in January 2020.

The 2017 revision of the Drought Management Plan was delivered as a major update to the previous Plan, which was originally prepared in 2006. The 2017 Plan was based on a template that was prepared for the Namoi Water Alliance by Hunter H2O for the purpose of providing a consistent approach to drought management across the Namoi Region (Hunter H2O, 2015). The template was prepared following the adoption of a regional water restrictions policy (HWA, 2014) by Namoi Water Alliance member councils in late 2014.

The Drought Management Plan has been prepared in accordance with NSW Department of Planning, Industry and Environment (DPIE) requirements as documented in their Best Practice Management of Water Supply and Sewerage Guidelines (DWE, 2007). With the recent implementation of the Regulatory and Assurance Framework for Local Water Utilities (DPIE, 2022), Drought Management can now be integrated within Council's broader strategic planning processes, including within the Integrated Planning and Reporting Framework. However, Council considers it more practical to have a standalone Drought Management Plan that can be reviewed and updated as required.

The Plan outlines the various demand and supply side drought response actions that should be employed at various stages during an extended drought period. The Plan also outlines Council's water restrictions policy and documents various backup supply sources and emergency supply options. The fundamental objective of preparing and adopting a Drought Management Plan is to minimise the risk of the community running out of water and ensuring there is always sufficient water available to satisfy the basic needs of the community.

***DROUGHT MANAGEMENT PLAN - DOCUMENT CONTROL TABLE***

| ***Revision*** | ***Revision Date*** *(from when Revision Applies)* | ***Resolved by Council*** *(date of Council Meeting)* |
|---|---|---|
| *2017 Major Update* | 19 July 2017 | 12 July 2017 |
| Revision 2 (2024 Update) | 21 February 20224 | |

# Contents

## Appendices



## Figures



## Tables

# 1 Introduction

This Drought Management Plan has been prepared by Gunnedah Shire Council (GSC) to ensure that a structured and transparent approach is taken for the management of drought impacts on Council's town water supply systems. The Plan outlines the various demand and supply side drought response actions that should be employed at various stages during an extended drought period. The Plan also outlines Council's water restrictions policy and documents various backup supply sources and emergency supply options.

The fundamental objective of preparing and adopting a Drought Management Plan is to minimise the risk of the community running out of water and to ensure there is always sufficient water available to satisfy the basic needs of the community. The Plan is only applicable to customers connected to the reticulated water supply systems operated by Council, which includes systems operated in the following towns:

- Gunnedah
- Curlewis
- Mullaley
- Tambar Springs

Management of water supply in NSW is administered by the *Water Management Act 2000, Water Act 1912* and *Local Government Act 1993*. Drought management planning is an essential component of the NSW Government's *Best Practice Management of Water Supply and Sewerage Guidelines* (DWE, 2007) and the *Regulatory and Assurance Framework for Local Water Utilities* (DPIE, 2022). This Drought Management Plan has been prepared in accordance with the Best Practice guidelines and the associated Drought Management Check List.

This Plan contains the following sections:

*Section 2* contains a description of the water supply systems that are covered by the Plan, including a brief review of previous drought experience.

*Section 3* contains an overview of the operating environment for the Plan, including consideration of climatic conditions, water resources and potential downstream impacts.

*Section 4* contains a discussion on pre-drought planning measures, including consideration of demand management measures, system operating rules, data collection and long-term supply strategies.

*Section 5* contains the Drought Management Action Plans, which set out the actions to be taken during each drought response level, including the application of water restrictions.

*Section 6* outlines the post-drought actions that should be undertaken, including regular review and updating of the Plan.

*Section 7* contains the references to this report.

# 2 Water Supply Systems

This Drought Management Plan is applicable to the reticulated water supply systems that are owned and operated by Council, as listed in Table 2.1 below and shown in Figure 2.1.

**Table 2.1 Summary of GSC Water Supply Systems**

| Water Supply System | Population Served * | Number of Connected Properties ** | Average Daily Consumption (ML/d) *** | Average Annual Consumption (ML/a) *** | Groundwater Allocation (ML/a) |
|---|---|---|---|---|---|
| Gunnedah & Curlewis | 13,708 | 4,586 | 5.8 | 2,115 | 3,900 |
| Mullaley | ~75 | 45 | 0.05 | 19 | 59 |
| Tambar Springs | ~100 | 72 | 0.05 | 18 | 42 |

*Notes: Data references - * LWU Performance Monitoring (2021/22) and Census Data (2021), ** Council MiWater data (2022), *** 3 Year Average (2020/21 – 2022/23)*

Council maintains a groundwater allocation of 198 ML/a from the Curlewis bores but this water source has not been used since the connection of Curlewis to the Gunnedah system in 2019.


**Figure 2.1 Locality Plan – GSC Water Supply Systems**

## 2.1 System Overview

An overview of each water supply system is included on Table 2.2 below, including brief details on groundwater sources and bores. All systems source raw water from groundwater bores that are located within the Upper Namoi Groundwater Source (DIPNR, 2003) and raw water is subject to disinfection (chlorination) only, before transfer to reticulation reservoirs or directly into the water supply system.

**Table 2.2 Overview of GSC Water Supply System Sources**

| Groundwater Source | No. of Bores | Details |
|---|---|---|
| **GUNNEDAH WATER SUPPLY SYSTEM (including supply to Curlewis from mid-2019)** | | |
| Upper Zone 4, Namoi Valley (Keepit Dam to Gin's Leap) | 9 | – 4 bores located off Studdy Lane, north of Namoi River (3, 4, 5 & 6)<br>– 4 bores located off Orange Grove Rd, north of Namoi River (7, 8, 9 & 10)<br>– 1 bore located off Wean Rd, north of Namoi River (11)<br>– Bore pumping capacity ranges from 10 to 140 L/s<br>– 8 storage reservoirs in Gunnedah (24 ML)<br>– 2 storage reservoirs in Curlewis (1.0 ML)<br>– 3,900 ML/a entitlement *(WAL12605)*<br>– New centralised water treatment facility (fluoridation and disinfection) |
| **FORMER CURLEWIS WATER SUPPLY SOURCE** | | |
| Upper Zone 3, Mooki Valley (Breeza to Gunnedah) | 2 | – Bores and storage reservoirs have been decommissioned<br>– 198 ML/a entitlement *(WAL12543)* |
| **MULLALEY WATER SUPPLY SYSYEM** | | |
| Upper Zone 2, Cox's Creek (Mullaley to Boggabri) | 2 | – 2 bores located off Oxley Highway, west of Cox's Creek<br>– Bore pumping capacity is around 3 L/s<br>– 1 small storage reservoir (0.19 ML)<br>– 59 ML/a entitlement *(WAL12513)* |
| **TAMBAR SPRINGS WATER SUPPLY SYSYEM** | | |
| Upper Zone 9, Cox's Creek (Upstream of Mullaley) | 2 | – 2 bores located of Smith Rd, west of Cox's Creek<br>– Bore pumping capacity is around 5 L/s<br>– 4 small storage reservoirs (0.17 ML)<br>– 42 ML/a entitlement *(WAL12958)* |

Further details on the water supply systems are included in Appendix B, including a discussion on system performance during previous droughts and any supply related problems.

# 3 Operating Environment

Drought Management Plans need to be tailored to adequately consider the prevailing operating environment conditions that are relevant to each individual water supply system. While there is a need to have some level of uniformity across the region for some drought response actions (e.g. specific rules associated with water restrictions), there is also a need to have tailored drought management strategies that are specific to the individual water supply system and the surrounding environment that it operates within (e.g. triggers for activating water restrictions).

This section provides a brief summary of the various operating environment factors that need to be considered in both the preparation and operation of the Drought Management Plan, including:

- Location & Climate
- Water Resources
- Additional Demands During Drought Periods
- Potential Downstream / Environmental Impacts

## 3.1 Location & Climate

GSC serves a population of over 13,000 people, over an area of around 5,000 km$^2$ on the Liverpool Plains, within the Namoi River catchment. In addition to the towns and villages that have reticulated water supply systems (Gunnedah, Curlewis, Mullaley and Tambar Springs) there are several other villages located within the local government area that do not have formal water supply systems, including Carroll, Breeza and Kelvin. The nearest towns to Gunnedah that are outside of the GSC area are Tamworth (around 80 km east), Quirindi (around 60 km south-east) and Narrabri (around 100 km north-west).

The Gunnedah Region experiences a dry sub–humid climate. Temperatures are warm to hot in summer with relatively low humidity, mild in autumn and spring and cool to mild in winter. Rainfall is generally lower over the autumn and winter months and highest in summer months due to a predominance of summer storms.

Median rainfall in Gunnedah is 570.8 mm per annum, average evaporation is 4.8 mm per day, and the mean maximum daily temperature is 26.3°C. Monthly climate statistics for Gunnedah are included in Table 3.1 below.

**Table 3.1 Climate Statistics – Gunnedah Airport (Site No. 055202)**

| Climate Statistic | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Annual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Median Rainfall (mm)** | 36.4 | 49.4 | 47.9 | 15.8 | 28.4 | 36.0 | 23.8 | 26.9 | 30.6 | 50.4 | 48.3 | 67.8 | 561.6 |
| **10%ile Rainfall (mm)** | 11.6 | 12.4 | 8.1 | 0.2 | 0.3 | 9.4 | 6.3 | 4.2 | 3.8 | 9.3 | 13.0 | 20.9 | 353.2 |
| **Mean Daily Evap (mm)*** | 7.7 | 6.9 | 5.9 | 4.4 | 2.7 | 1.9 | 1.9 | 2.8 | 4.0 | 5.4 | 6.7 | 7.8 | 4.8 |
| **Mean Max. Temp (°C)** | 34.6 | 33.1 | 30.2 | 26.4 | 21.7 | 18.0 | 17.5 | 19.6 | 23.6 | 27.5 | 30.4 | 32.6 | 26.3 |

*Note: Mean Daily Evaporation was taken from Gunnedah Resource Centre (Site No. 055024)*

It is widely accepted that future climate changes could impact water supply systems through changing frequency and duration of rainfall, as well as an increase in evaporation. While estimating the impacts associated with future climate change is very difficult and is an evolving science, recent studies have started to provide some indication of the potential climate impacts. However, modelling to-date has focused more on changes in average monthly or annual statistics and less on the duration and frequency of extreme events, which is more critical for drought management.

According to the CSIRO State of the Climate 2022, Australia's climate has warmed by an average of 1.47 ± 0.24 °C since 1910, and April to October rainfall in Southeastern Australia has decreased by 10% since the 1990s. The previous decade was the warmest on record and 2019 is the warmest year on record.

The Adapt NSW website (setup by the former NSW Office of Environment and Heritage, now part of NSW Department of Planning, Industry and Environment), includes climate projections for NSW as well as more specific catchment-based projections. An extract from the *New England North West Climate Change Snapshot* (OEH, 2016) is included below:

> Based on long-term (1910–2011) observations, temperatures have been noted to have been increasing since about 1970, with higher temperatures experienced in recent decades.
>
> The New England and North West Region is projected to continue to warm during the near future (2020–2039) and far future (2060–2079), compared to recent years (1990–2009). The warming is projected to be on average about 0.7°C in the near future, increasing to about 2.2°C in the far future. The number of high temperature days is projected to increase, with fewer potential frost risk nights anticipated.
>
> The warming trend projected for the region is large compared to natural variability in temperature and is of a similar order to the rate of warming projected for other regions of NSW.
>
> The region currently experiences considerable rainfall variability across the region and from year-to-year and this variability is also reflected in the projections.

Currently, the biggest concern for local water utilities is the potential impact that climate change may have on rainfall patterns and volumes, and in turn how this will impact surface runoff and groundwater recharge rates. The latest estimates of hydrological climate change impacts are included in a recent report by the NSW Office of Environment and Heritage (OEH, 2015), which lists near future (2020 – 2039) and far future (2060 – 2079) estimates for rainfall, surface runoff and groundwater recharge for major river catchments across NSW. Hydrological climate change estimates for the Namoi River catchment are included in Table 3.2.

**Table 3.2 Hydrological Climate Change Impacts – Namoi River (OEH, 2015)**

| Region | Percentage Change in Mean Annual: | | | | | |
|---|---|---|---|---|---|---|
| | Rainfall | | Surface Runoff | | Groundwater Recharge | |
| | Near Future | Far Future | Near Future | Far Future | Near Future | Far Future |
| Namoi River | +0.7% | +7.9% | +4.1% | +25.5% | -7.0% | +11.8% |

The table reflects the level of uncertainty surrounding climate change, with rainfall predicted to increase slightly in the near future and then further increase in the far future. Surface runoff is predicted to increase slightly in the near future, but increase significantly (around 25%) in the far future. However, groundwater recharge rates are predicted to fall in the near future, but then increase again in the far future.

While the table gives some indication of the potential changes in mean annual rainfall, streamflow and groundwater recharge rates, the potential impact on water resources (including groundwater systems) is more difficult to predict, as the future nature of rainfall patterns is unknown. Climate change models have been used to estimate changes in seasonal rainfall patterns; however, these models are not currently capable of predicting future extreme rainfall patterns, such as flooding and drought events. Therefore, predictions on the future impact on water resources are currently very limited, as they generally do not consider future climate variability, particularly climate extremes.

## 3.2 Water Resources

The GSC local government area is located within the Namoi River catchment in North West NSW. The Namoi River catchment drains an area of around 42,000 km$^2$ and is bounded by the Great Dividing Range in the east, the Liverpool and Warrumbungle Ranges in the south, and the Nandewar Ranges and Mt Kaputar to the North. Major tributaries of the Namoi River include Coxs Creek and the Mooki, Peel, Cockburn, Manilla, and Macdonald Rivers, all of which join the Namoi upstream of Boggabri.

There is an extensive groundwater system within the Namoi Valley and it is this groundwater system that all water supply systems serviced by GSC source their water from. The Upper Namoi Groundwater Sources (see Figure 3.1 on page 8) includes 12 alluvium groundwater sub-zones located upstream (south-east) of Narrabri. Together with the Lower Namoi Groundwater Source (located downstream of Narrabri), these two major groundwater source areas are presently covered by the *Water Sharing Plan for the Namoi Alluvial Groundwater Sources (2020).* This revision of the Water Sharing Plan commenced on 1 July 2020 (with a 10-year term) and also covers the Manilla Alluvial Groundwater Source, the Peel Alluvium Groundwater Source and the Upper Namoi Tributary Alluvial Groundwater Sources.

The Upper Namoi Groundwater Sources include groundwater contained within unconsolidated alluvium aquifers associated with the Namoi River and its tributaries, including the Mooki River and Cox's Creek. The alluvial sediments are generally defined by two layers; the shallower Narrabri formation (up to 30 to 40 m) and the more productive deeper Gunnedah formation (40 to 100 m, up to 170 m at it deepest). These formations consist mainly of sand, gravel and clay and their thickness is largely controlled by the bedrock topography. The total area of alluvium is approximately 3,000 km$^2$ (NOW, 2012).

A key objective of the original 2006 Water Sharing Plan was to reduce total extractions in the Upper Namoi Groundwater Sources to less than 122 GL/a by 2016-17, to reduce extractions to below estimated maximum sustainable extraction rates (generally referred to as the long-term average annual extraction limit or LTAAEL). Prior to the commencement of the original Water Sharing Plan, groundwater entitlements exceeded 300 GL and at the commencement of the plan, entitlements were reduced to 122 GL, with supplementary access licences provided temporarily, to assist users to progressively adjust to the reduced entitlement volumes. As of 2015-16, the share component of supplementary water has been reduced to zero. The plan includes long-term extraction limits for each groundwater zone based on estimated recharge rates, as well as rules for adjusting the maximum amount of water that may be made available if this limit is being exceeded.

The LTAAEL for the Upper Namoi Groundwater Sources (sub-zones 1 to 12), as listed in the 2020 Water Sharing Plan, have increased slightly from the original 2006 Water Sharing Plan (by less than 2%) and are now in line with the sustainable diversion limits (SDLs) specified in Schedule 4 of the Murray-Darling Basin Plan, which came into force in late 2012 (known as *Basin Plan 2012*). The *Basin Plan 2012* sets long-term average SDLs, for each surface water and groundwater source, that reflect an environmentally sustainable level of water use and required the new SDLs to be in place by 2019.

The LTAAEL for each groundwater sub-zone that GSC has a local water utility water access licence for, along with recent annual groundwater extractions, are shown in Table 3.3. The table shows that total

groundwater extractions for the four sub-zones were very high in 2018-19 due to the extreme dry conditions and exceeded the LTAAEL for sub-zones 2, 3 and 4. The LTAAEL was also exceeded in 2019-20 for Curlewis due to the ongoing drought, but not elsewhere. The table also shows that the five-year averages for all sub-zones is below the LTAAEL.

**Table 3.3 Upper Namoi Groundwater Sources – Sub-Zone Extraction Limits versus Usage**

| Sub-Zone | Town Water Supply Entitlements (ML/a) | LTAAEL (ML/a) | Annual Groundwater Extractions (ML/a) | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | 2018-19 | 2019-20 | 2020-21 | 2021-22 | 2022-23 | 5 Year Average |
| 2 | **Mullaley (59)** | **7,327** | 7,524 | 6,577 | 3,507 | 1,744 | 2,717 | **4,414** |
| 3 | **Curlewis – backup (198)** | **17,499** | 21,620 | 18,276 | 4,884 | 2,922 | 8,122 | **11,165** |
| 4 | **Gunnedah (3,900),** *Boggabri (760)* | **26,121** | 28,215 | 21,650 | 13,098 | 8,784 | 14,909 | **17,331** |
| 9 | **Tambar Springs (42),** *Premer (55)* | **11,441** | 5,289 | 4,948 | 2,480 | 1,974 | 2,570 | **3,452** |

A review of historical groundwater levels in the vicinity of town water supply bores for Gunnedah, as monitored by DPIE Water, shows there has been some decline in groundwater levels over the past 50 years, with monitoring bores near Gunnedah typically showing around a 5m decline in water levels (see Appendix C). However, the decline appears to have steadied over the last decade and the groundwater level has risen since the end of the last drought period, most likely in part due to the introduction of the original Water Sharing Plan in 2006, which set diversion limits in line with estimated recharge rates.

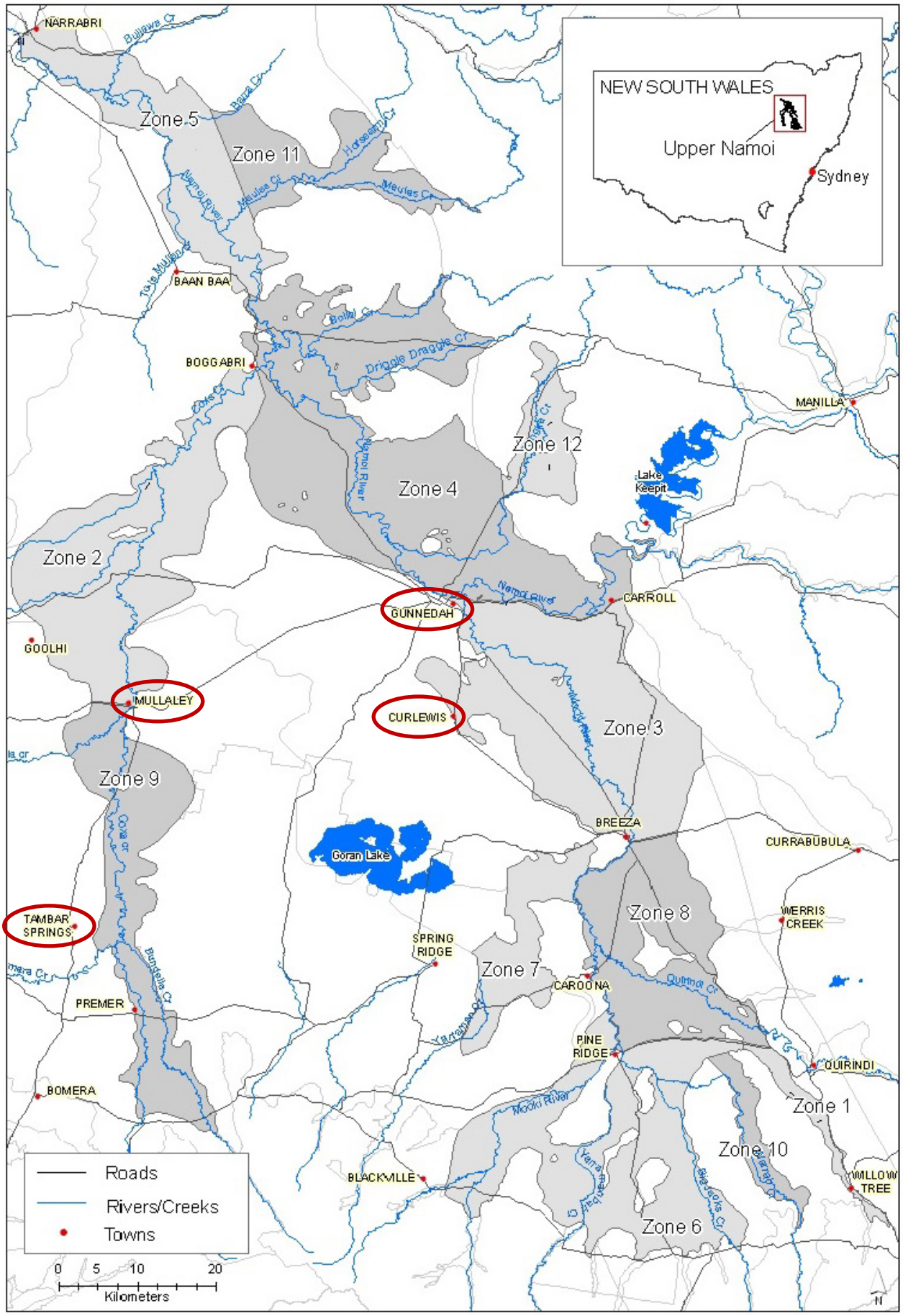



**Figure 3.1 Upper Namoi Groundwater Source and Sub-Zones (NOW, 2012)**

## 3.3 Additional Demands During Drought Periods

Villages that may seek water during drought periods are listed in Table 3.4, along with an estimate of the potential demands during drought periods based on water carting. The villages of Carroll, Kelvin & Emerald Hill have non potable supplies via water filling stations with small stock and domestic 1 ML bores supplying 30kL water tanks with booster pumps that supply the filling stations.

**Table 3.4 Villages without Reticulated Town Water Supply**

| Village / Locality | Approximate Population | Potential Demand During Drought (kL/d)* |
|---|---|---|
| Carroll | 305 | 12 |
| Breeza | 124 | 5 |
| Kelvin | 182 | 3 |
| Emerald Hill | 137 | 11 |

*Note: * Based on 80 L/person/day for water carting (NOW, 2009)*

## 3.4 Potential Downstream / Environmental Impacts

It is important that Council liaises with relevant government agencies and other large users (e.g. local irrigators) during drought periods to ensure that water resources are effectively managed at a whole of catchment level. Potential downstream impacts for each water supply system are included in the table below.

**Table 3.5 Potential Downstream Impacts During Drought Periods**

| Water Supply System | Potential Downstream Impacts |
|---|---|
| Gunnedah and Curlewis | • Groundwater extractions may have an impact on streamflows in the Namoi River during drought periods and also may impact other groundwater users; however, this is generally managed by the Water Sharing Plan process |
| Mullaley / Tambar Springs | • Negligible impacts as relatively minor extractions are sourced from a large groundwater aquifer source |

# 4 Pre-Drought Planning

While this Drought Management Plan focuses primarily on the response actions to be undertaken during a drought, the extent of the various impacts of drought (including economic, social and environmental impacts) will be driven in part by the effectiveness of a range of pre-drought planning and management activities.

This section provides a brief summary of the key activities that need to be in place at the beginning of any given drought period. The activities include:

- Implementation of demand management measures to ensure efficient management of water supply
- The adoption of appropriate system operating rules to ensure efficient operation of the system
- Regular data collection and system monitoring so that sufficient evidence is available in assessing the impacts of a drought
- The adoption of long term supply strategies to ensure that systems are capable of supplying future demands
- A funding strategy to assist in management of the costs associated with drought periods.

Each of these pre-drought planning activities is discussed further in the following sections.

## 4.1 Demand Management Program

Council revised its Demand Management Plan in conjunction with this revised Drought Management Plan. The revised Demand Management Plan includes several water conservation initiatives, including an ongoing community awareness program, Council water audits, regulation and planning controls, and a Water Loss Management Program (including annual water loss assessments).

## 4.2 System Operating Rules

Efficient operation of water supply systems is an important pre-emptive strategy for managing droughts. Due to the difficulty in predicting future drought conditions, it is important that groundwater levels are not drawn down excessively during non-drought periods as a result of inefficient operation of the system, as this would reduce the security of a supply system in the event of a drought and consequently worsen the impacts of drought.

System operating rules that are in place to ensure that groundwater levels are not drawn down excessively include:

- Regular monitoring of bore levels (with and without pumping)
- Review Scada draw down data on bores to check performance and identify any operational issues
- A water pumping model is being constructed to give Council its most efficient way of pumping water from its bore fields to the WTP
- Council's two largest bores (8 & 9), both located within 500 m of each other on Orange Grove Road, can now be operated together including No 7 Bore and the new No 10 High Production Bore, Council will have to monitor the draw down and static levels of its Orange grove bore field to ensure local groundwater levels are not drawn down excessively.

## 4.3 System Monitoring

Regular monitoring of water supply sources, extractions, production, consumption and climate is critical to understanding how well a water supply system is operating and whether there are any problems or potential future problems. Regular data collection becomes even more critical during drought periods as supply sources are stressed and the water supply situation can deteriorate.

Table 4.1 below includes a list of key monitoring sites and the minimum (or normal) data collection requirements.

**Table 4.1 Minimum Monitoring Requirements (Normal Operation)**

| Monitoring Type | Data Type/s | Frequency of Monitoring | Responsibility |
|---|---|---|---|
| Groundwater Bores | - Groundwater levels<br>- Groundwater extraction rates | Real time via SCADA | GSC |
| Groundwater Monitoring Bores | - Groundwater levels | Every 2 months | DPIE |
| Customers | - Consumption (metered) | Real time via AMRs; billed quarterly | GSC |
| Climate | - Rainfall<br>- Evaporation | Daily | BOM |

*Notes: * Council recently upgraded the monitoring capabilities at all groundwater bore locations within Gunnedah, including connecting all sites to telemetry, which provides real time data (bore levels and flows). All properties have recently been connected to an Automatic Meter Reading (AMR) system which provides real time data (consumption). Customers are billed quarterly.*

## 4.4 Long Term Supply Strategies

All water supply systems should be designed to cope with at least a repeat of the worst drought on record. Larger systems (>1,000 people) should be designed to cope with more severe drought conditions than the worst on record, on the basis that the climate data for Australia is relatively limited (i.e. generally around 100 years), and it is reasonable to assume that a more severe drought than the worst on record could occur.

All water supply systems operated by GSC are currently considered secure, with all systems operating normally during the severe drought conditions that were experienced across much of NSW in the mid-2000's. Level 1 water restrictions were introduced for the first time in January 2020 in response to the unprecedented dry conditions experienced in 2019. Water levels in TWS bores dropped below the levels recorded in the previous summer and there was concern about the ongoing high levels of demand. Bore levels have recovered following significant rainfall in February and reduced demands in the following months.

Namoi Unlimited, a Joint Organisation of Councils in New South Wales, engaged Beca Hunter H2O in 2021 to develop the Regional Town Water strategy for 17 regional towns in the Namoi region which included Gunnedah, Tambar Springs and Mullaley. The strategy included a current and future 30-year assessment of water demand and assessment of the water security and vulnerabilities, as well as a council Action Plan to address current and future risks.

## 4.5 Resource & Funding Strategy

The costs associated with managing drought can have a significant impact on Council's finances, due to a variety of factors, including:

- Reduced revenue due to water consumption reductions associated with enforcing restrictions, particularly in the mid to late stages of the drought. This would be partly offset by revenue from higher than average water consumption levels in the lead-up to the drought and in the early stages of the drought.
- Additional costs associated with Council activities, including running an ongoing community awareness campaign, increased frequency of supply and demand monitoring, liaison with government agencies and other stakeholders and policing of restrictions.
- Increased capital and operating expenditure associated with investigation, implementation and running of backup and emergency supply options.

Historically, budgeting for drought periods has not been a concern for GSC as water supply systems were considered very secure and generally continued to operate normally during drought periods. However, the recent drought event indicates that GSC needs to consider budgeting for drought conditions as it is possible that further water restrictions will need to be implemented and/or backup water supply options will need to be investigated and possibly implemented in the future.

Any costs associated with managing droughts should be tracked and be available to report to Council, government regulators, DPIE Water and the community (if required). These costs can then be used as a justification for further investment in long-term supply strategies and other drought management planning initiatives. If required, drought emergency funding may also be available through DPIE Water to manage depleted supplies, investigate and implement emergency capital works or to cart water.

# 5 Drought Management Action Plans

Drought Management Actions Plans (DMAP) set out the actions to be taken during each drought response level. There are five drought response levels (Levels 1 to 5), with each level having a set of suggested actions to be undertaken during that phase of the drought, including an associated set of water restrictions.

## 5.1 Overview

The "All Systems" DMAP (see Table 5.2) outlines the common actions that should be undertaken by Council at various drought response levels, including:

- The application of water restrictions and associated enforcement and issuing of fines
- Community awareness campaign and liaison with non-residential large water users
- Monitoring of water supply sources and town water demands
- Liaison with authorities and local irrigators
- Development and/or review of backup/emergency supply options

Specific DMAPs (see Table 5.3) have also been prepared for each of the individual water supply systems, outlining additional specific actions to be undertaken in that system, generally related to the investigation and implementation of backup and emergency supply options. The DMAPs also nominate primary and secondary (or supplementary) supply sources for each of the drought response levels.

### Drought Response Levels

A general description of the five drought response levels is provided below. More details on the various actions and water restrictions that are relevant to each level are included in Sections 5.2 and 5.3 below.

**Level 1 (Low)** – This is the first level of water restrictions and is more focused on general awareness, rather than trying to achieve significant reductions in usage. The key measure is to limit the hours that sprinklers can be used and generally, the impact on residences and their gardens would be relatively minor. Actions are mainly preparatory measures that activate the Drought Management Plan and its various components.

**Level 2 (Moderate)** – This level includes a ban on sprinklers and a time limit for drippers and hoses. The focus is on reducing usage back below typical levels for that time of year and the measures are likely to cause a moderate level of inconvenience to the community, without necessarily having significant impacts on most lawns and gardens. Key actions include setting up more regular liaison with key government stakeholders and preparing backup supply sources.

**Level 3 (High)** – This level includes banning all forms of outdoor watering other than buckets and may have a more significant impact on lawns and gardens and cause a fairly major inconvenience to most residences. The aim is to reduce usage well below typical levels while still allowing lawns and gardens to be maintained, albeit at a base level. Key actions include more focus on issuing warning and fines for violation of restrictions, stepping up the awareness campaign and notifying DPI Water of the intention to investigate and if necessary implement backup supply and/or emergency supply options.

**Level 4 (Very High)** – This severe level of water restrictions includes banning all outdoor watering (residential) in order to reduce usage and may have a major impact on lawns and gardens, including loss of lawns and gardens. The reestablishment of lawns and gardens after an extended period of severe restrictions would impose a relatively high cost on residences and therefore, the application of Level 4 restrictions or higher would only occur in very rare circumstances. Key actions include activating backup supply options, investigation / design emergency supply options, stepping up issuing of fines for violation of restrictions and recalling all Water Management Plans.

**Level 5 (Emergency)** – This extreme level of restrictions would involve an all-out campaign to reduce usage by eliminating all non-essential usage and would have a major impact on nearly all residences and businesses. Residences may be asked to reduce shower times, limit washing machine loads and limit the use of evaporative coolers. Businesses may be asked to restrict water usage to only essential services, with the possible shutting down of non-essential, water dependent services. Key actions include implementing emergency response / supply options and an all-out community water reduction appeal.

## Triggers & Water Consumption Targets

The DMAPs for each of the water supply systems include primary triggers for initiating each drought response level, as well as total system water consumption targets for those levels. Secondary triggers such as water quality incidents, major regional drought events and failure to achieve water consumption targets are also suggested. Water consumption targets are average annual consumptions and may need to be adjusted for seasonal patterns (where appropriate). To assist with this, peak week consumption targets have also been included for Gunnedah water supply system. Note that once outdoor usage is banned (Levels 4 and 5), consumption targets become fixed daily targets due to the reduced influence from seasonal factors.

The basis for water consumption targets is shown on Table 5.1

**Table 5.1 Water Consumption Targets (Average Annual Consumption)**

| Drought Response Level | | Residential Consumption Target | Non-Residential Consumption Target | Total Consumption Target (70/30 split) |
|---|---|---|---|---|
| 1 | Low | 95% | 100% | 95% |
| 2 | Moderate | 85% | 90% | 90% |
| 3 | High | 75% | 85% | 80% |
| 4 | Very High | 65% | 80% | 70% |
| 5 | Emergency | 50% | 75% | 60% |

In considering the easing of water restrictions, Council will take into consideration water supply demand, projected demand, level and security of bulk water sources, catchment parameters, seasonal conditions, and seasonal outlook. The easing of water restrictions will generally not be implemented where it is likely that the revised restrictions will not be sustained for more than four weeks before tighter restrictions have to be re-imposed. Suggested triggers for easing restrictions are included in the DMAPs.

## Drought Management Team

To assist in the undertaking of actions included in the DMAPs and to ensure the successful implementation of the greater Drought Management Plan, Council should assemble a Drought Management Team at the commencement of drought response level 1. The team should include representatives from key Council departments.

## Communication

A key aspect in ensuring the successful implementation of the Drought Management Plan is the communication strategy. A community awareness campaign is vital for ensuring the community is made aware of actions that directly impact them, such as water restrictions and any associated fines and exemptions, and the activation of backup or emergency supply sources and any associated changes in water quality.

The community also needs to be given advice on how to minimise the impact of various water restrictions (including options for household recycling of water) and advice on saving water around the home in general. It is important that the community is kept up-to-date with the status of water supply sources (including river flows and dam storage volumes) and are given some idea of the consequences of not achieving target reductions in water consumption.

Liaison with key government agencies is another important component of the communication strategy. Key agencies include NSW Department of Planning, Industry and Environment (DPIE) (previously Department of Primary Industries – Water), NSW EPA, NSW Health, North West Local Land Services and WaterNSW. It is particularly important that the relevant agencies be informed when significant impacts on the community, the environment or other stakeholders are expected as a result of actions arising from implementation of the plan.

In most systems, liaison with local irrigators is also important, to ensure they are aware of any impacts they may be having on the town water supplies and conversely, to make sure they are aware of the potential impacts that Council's actions, arising from the implementation of the plan, may have on them.

## Monitoring

Regular monitoring of groundwater bore levels (static and draw-down), water extractions and production, and monitoring of actual water consumption compared to target are critical during drought periods. The data obtained from this monitoring provides important feedback on the effectiveness of the various drought response levels and will generally be the basis for moving between drought response levels. Council is now well positioned to provide regular monitoring of bore levels, extractions, production, and consumption following the implementation of the SCADA system and AMR systems.

## Emergency Supply Options

After each of the water supply system DMAPs, emergency supply sources (referred to in the action plans) are listed in order of preference. More details on these alternative sources are included in the Appendix D.

## 5.2 Action Plans

The Drought Management Action Plans (DMAPs) for "All Systems" is included in the table below, followed by more specific DMAPs for each individual water supply system.

**Table 5.2 Drought Management Action Plan (All Systems)**

| Drought Response Level | Actions |
|---|---|
| **1 Low** | • Activation of Drought Management Plan<br>• Implement Level 1 Water Restrictions<br>• Establish a drought budget to track ongoing drought management costs<br>• Establish a Drought Management Team to oversee the implementation of the Drought Management Plan<br>• Review DMAP to ensure it is up-to-date, including a review of backup / emergency supply options<br>• Prepare community awareness campaign and begin implementation (media advertising, social media, Council's internet page)<br>• Review major existing Water Restriction Exemptions and update where necessary<br>• Initiate regular (at least monthly) liaison with key government agencies (DPIE, WaterNSW) and local irrigators (where appropriate)<br>• Weekly review of groundwater bore levels, water extractions and monitoring of actual water consumption compared to target (monitor where applicable) |
| **2 Moderate** | • Implement Level 2 Water Restrictions<br>• Further implement community awareness campaign<br>• Consider issuing warnings and fines for violation of restrictions<br>• Continue regular (1 monthly) liaison with key government agencies (DPI Water, WaterNSW) and local irrigators (where appropriate)<br>• Weekly review of groundwater bore levels, water extractions and monitoring of actual water consumption compared to target (monitor where applicable)<br>• Review all existing Water Restriction Exemptions and update where necessary |
| **3 High** | • Implement Level 3 Water Restrictions<br>• More focus on the issuing of warnings and fines for violation of restrictions<br>• Step-up community awareness campaign & meet with large non-residential users to discuss options for water reduction<br>• Twice-weekly review of groundwater bore levels, water extractions and monitoring of actual water consumption compared to target (monitor where applicable)<br>• Regular (monthly) liaison with key government agencies and local irrigators (where appropriate)<br>• Notify DPIE of intention to investigate backup / emergency supply options and seek drought assistance<br>• Assess appropriateness of exemptions allowed under existing Water Restriction Exemptions |
| **4 Very High** | • Implement Level 4 Water Restrictions<br>• Step-up the issuing of warnings and fines for violation of restrictions<br>• Step-up community awareness campaign, including non-residential water reduction appeal<br>• Daily review of groundwater bore levels, water extractions and monitoring of actual water consumption compared to target (monitor where applicable)<br>• Regular (weekly) liaison with key government agencies and local irrigators (where appropriate)<br>• Recall all Water Restriction Exemptions |
| **5 Emergency** | • Implement Level 5 Water Restrictions<br>• Strict issuing of warnings and fines for violation of restrictions<br>• All-out community water reduction appeal – minimum essential usage only<br>• Regular (fortnightly) meetings with large water users to discuss ongoing water reduction options<br>• Consider temporary closure of non-essential, high water dependant services<br>• Daily review of groundwater bore levels, water extractions and monitoring of actual water consumption compared to target (monitor where applicable)<br>• Regular (twice-weekly) liaison with key government agencies and local irrigators (where appropriate), including liaising with DPI Water re: emergency response options<br>• Implementation of emergency response / supply options |

## Gunnedah and Curlewis Water Supply System

**Table 5.3 Drought Management Action Plan (Gunnedah)**

| Drought Response Level | Primary Trigger* (10-day average water consumption) | Average Day Water Usage Target** (ML/d) | Additional Actions |
|---|---|---|---|
| **1 Low** | 10 ML/d Demand or 18 ML/d Production Capacity | 6.1 | |
| **2 Moderate** | 13 ML/d Demand or 17 ML/d Production Capacity | 5.8 | • Target 10% non-residential usage reduction |
| **3 High** | 15 ML/d Demand or 15 ML/d Production Capacity | 5.2 | • Target 15% non-residential usage reduction<br>• Investigate emergency supply options |
| **4 Very High** | 17 ML/d Demand or 13 ML/d Production Capacity | 4.5 | • Target 20% non-residential usage reduction<br>• Undertake design and seek approval to implement emergency supply options |
| **5 Emergency** | 18 ML/d Demand or 10 ML/d Production Capacity | 3.9 | • Target 25% non-residential usage reduction<br>• Implement emergency supply options |

*Notes:* ** Primary trigger is measured by production volume or production capacity. Secondary triggers include failure to achieve water usage targets, major regional drought events & major water quality incidents*

*** Average Day Water Usage Targets are based on five-year average annual consumptions*

The primary trigger is based on the level of demand in the community or the production capacity of the bore field. The intent of the restriction is to drive a more sustainable use of water by reducing consumption levels, and/or to ensure the community uses water sustainably when water in the environment is depleted. The introduction of restrictions will follow sustained in periods of high demand or low production capacity and be introduced for a minimum period of four-weeks to allow time for the community to adjust to the restriction requirements and change water usage behaviours. If a decrease in demand is not forthcoming or production capacity is not restored, restrictions will remain. If the 10-day average consumption is greater than the primary trigger for the next restriction level, or production capacity depletes to the next trigger level, the next level of restrictions will be introduced.

Secondary triggers include monitoring of regional groundwater levels. Where the rate of depletion of the regional aquifers is high and consumption levels are elevated, Council may introduce restrictions or increase the restriction level to promote sustainable use of the regional water supply.

### Easing Restrictions

Restrictions will be eased when 10-day average demand levels are below the preceding trigger level and the current restriction level has been in place for a minimum period of four weeks.

## Mullaley Water Supply System

**Table 5.4 Drought Management Action Plan (Mullaley)**

| Drought Response Level | Primary Trigger* | Average Water Usage Target** (ML/d) | Additional Actions |
|---|---|---|---|
| **1 Low** | Bore pumps and reservoir unable to meet demands | 0.049 | |
| **2 Moderate** | | 0.047 | |
| **3 High** | | 0.042 | • Investigate emergency supply options |
| **4 Very High** | | 0.036 | • Undertake design and seek approval to implement emergency supply options |
| **5 Emergency** | | 0.031 | • Implement emergency supply options |
| Emergency Supply Options | | | |
| 1. *Additional Groundwater Bores*<br>2. *Water Carting from Gunnedah* | | | |

*Notes:* ** Secondary triggers include consideration of the drought response level for other water supply systems operated by GSC & major water quality incidents*

*** Usage targets are average annual consumptions and should be adjusted for seasonal patterns*

Specific primary triggers have not been nominated for Mullaley. It is expected that primary triggers will be based on the ability of the system to supply the prevailing water supply demands. If demands start to exceed production capacity (due to high demand levels and/or reduced production capacity), the next drought response level (and associated water restrictions) should be triggered. In the case of both bores being unavailable (due to power outage or total failure of both bores), drought response level 5 (Emergency) would be implemented immediately.

### Easing Restrictions

The Council decision for easing water restrictions at Mullaley will be based on water demands, bore levels (improving), catchment parameters, seasonal conditions and seasonal outlook.

## Tambar Springs Water Supply System

**Table 5.5 Drought Management Action Plan (Tambar Springs)**

| Drought Response Level | Primary Trigger* | Average Water Usage Target** (ML/d) | Additional Actions |
|---|---|---|---|
| **1 Low** | Bore pumps and reservoir unable to meet demands | 0.047 | |
| **2 Moderate** | | 0.044 | |
| **3 High** | | 0.039 | • Investigate emergency supply options |
| **4 Very High** | | 0.035 | • Undertake design and seek approval to implement emergency supply options |
| **5 Emergency** | | 0.030 | • Implement emergency supply options |
| Emergency Supply Options | | | |
| *1. Additional Groundwater Bores*<br>*2. Water Carting from Gunnedah* | | | |

*Notes:* ** Secondary triggers include consideration of the drought response level for other water supply systems operated by GSC & major water quality incidents*

*** Usage targets are average annual consumptions and should be adjusted for seasonal patterns*

Specific primary triggers have not been nominated for Tambar Springs. It is expected that primary triggers will be based on the ability of the system to supply the prevailing water supply demands. If demands start to exceed production capacity (due to high demand levels and/or reduced production capacity), the next drought response level (and associated water restrictions) should be triggered. In the case of both bores being unavailable (due to power outage or total failure of both bores), drought response level 5 (Emergency) would be implemented immediately.

### Easing Restrictions

The Council decision for easing water restrictions at Tambar Springs will be based on water demands, bore levels (improving), catchment parameters, seasonal conditions and seasonal outlook.

## 5.3 Water Restrictions

Water restrictions corresponding to each Drought Response Level are summarised on the table below, with the full list of measures included in Appendix A. Water restrictions are generally based on a common set of measures adopted by the Councils associated with the Namoi Water Alliance. The adoption of a common set of water restrictions across the Namoi Region allows for a consistent and simplified communication process and reduces confusion in the community.

**Table 5.6 Summary of Water Restrictions (Residential)**

| Category | 1<br>Low | 2<br>Moderate | 3<br>High | 4<br>Very High | 5<br>Emergency |
|---|---|---|---|---|---|
| **Residential Gardens & Lawns Watering** | Fixed hoses & sprinklers limited to two hours per day.<br>Water between 6-8 pm during DST.<br>Water between 5-7 pm all other times | Fixed hoses & sprinklers banned<br>Hand held hoses restricted to water between 6-8 pm during DST.<br>Water between 5-7 pm all other times | Fixed hose, sprinklers & hand held hoses banned<br>Buckets restricted to water between 6-8 pm during DST.<br>Water between 5-7 pm all other times | No watering at any time | No watering at any time |
| **Washing Down (including vehicles)** | Wash down hard / paved surfaces with high pressure hose only | Hoses restricted to water between 6-8 pm during DST.<br>Water between 5-7 pm all other times | No hoses<br>Buckets restricted to water between 6-8 pm during DST.<br>Water between 5-7 pm all other times | No washing down at any time | No washing down at any time |
| **Swimming Pools & Spas** | Permit required for filling pools over 2,000L | Permit required for filling pools over 2,000L<br>Top up via hoses only between 6-8 pm during DST.<br>Water between 5-7 pm all other times | Permit required for filling pools over 2,000L<br>Top up via hoses only between 6-8 pm during DST.<br>Water between 5-7 pm all other times | Filling & topping up prohibited | Filling & topping up prohibited |
| **Residential Consumption Target (% reduction)** | 5% | 15% | 25% | 35% | 50% |

Refer to Appendix A for a detailed list of water restrictions.

### Compliance with Water Restrictions

Periods of water restrictions and use of appliances in accordance with water restrictions in place will be policed by Council officers.

Under the Local Government Act 1993 the maximum penalty that may be applied for a breach of imposed water restrictions is $2,200 for corporations and $220 for individuals.

## 5.4 Emergency Response Measures

In the event of a severe water shortage which has resulted in primary and backup supply sources failing or approaching failure, emergency response measures will need to be implemented. These measures may include supply side measures (emergency supplies) and/or demand side measures (emergency demand management) and they would be implemented in association with Level 5 Emergency water restrictions. Both supply side and demand side emergency response measures are outlined further below.

### Emergency Supplies

Key emergency supply options have been identified for each system and are listed in Drought Management Action Plans (Section 5.1), with further details in Appendix D. Emergency supply options include additional groundwater bores (all systems) and water carting (all systems except Gunnedah).

Emergency supply options generally need to be implemented very quickly and any pre-construction planning and design work should generally be undertaken prior to reaching the Level 5 drought response level to ensure the emergency supply source can be activated expeditiously.

For all towns / village systems, water carting would be the last resort emergency supply option. Due to the high costs involved, it would only be implemented if all other emergency response measures failed.

**Water Carting**

Carting of water to towns and villages may be necessary to provide basic town water needs during an emergency – in the event that all other emergency supply measures have failed. It is anticipated that such arrangements would only be required for a short period in conjunction with water rationing to allow the local water source to recover. Water cartage is generally not considered a practical emergency supply options for larger towns (approximately 10,000 or more people) and therefore is not a viable option for Gunnedah.

It is anticipated that water carting to Mullaley and Tambar Springs could be achieved using a single truck (e.g. milk tanker). An estimate of the quantities of water that may need to be carted is included in the following section in Table 5.8. Supplies would generally be sourced from Gunnedah.

Government assistance towards the cost of water cartage has historically been available from the NSW Government via DPIE, but is subject to quantities and cartage arrangements being agreed with DPIE. If the security of a town supply appears to be threatened, the regional staff of DPIE can assist Council with undertaking an initial assessment of the system and advise on the best cartage arrangements; however, Council will be required to seek quotations from contractors for the carting. An application to DPIE should contain the following:

- A copy of a technical report prepared by Council/DPIE following the initial assessment
- Details of any consideration given to, or steps taken towards, establishing an emergency supply from another source
- The location of the new source of water to be used, the method of cartage proposed, the number of loads and frequency
- The cost of purchase and transportation of water
- Copies of all correspondence with transport contractors on the subject of cartage

Guidelines for determining minimum supply requirements are contained in the DPIE document *Drought Relief for Country Towns* (NOW, 2009).

## Emergency Demand Management

In the event of severe water shortage, external residential water use would be stopped altogether by way of restrictions and indoor water use would need to be reduced through persuasive advertising and community education campaigns. Emergency response strategies should only be considered when all other options have been exhausted, and should be applied in conjunction with Level 5 water restrictions.

Once Level 5 water restrictions are introduced, Council will consider a range of actions for implementation, including the following emergency response measures:

- More frequent analysis of water consumption data from Council's AMR system to facilitate the imposition and monitoring of targets/allowances for residential water use. It is envisaged that a residential usage target of around 150 L/person/day (based on what has been achievable in other cities/towns during severe water restrictions) would initially be implemented and gradually reduced if necessary.
- The above measures would be implemented in conjunction with a major publicity campaign urging reductions in residential internal water use, with a focus on shorter showers, washing machines only being used for full loads and reduced operation of evaporative air conditioners.
- Investigation of properties that are consistently exceeding usage targets and not showing a significant reduction in water usage over time.

### Rationing

In the event that Level 5 Water Restrictions do not sufficiently reduce system demands to sustainable levels (based on the prevailing drought conditions), water rationing will need to be considered. The key objective of rationing would be to reduce water consumption to minimum essential supply requirements only. For residential properties that normally have access to reticulated water, a minimum essential supply requirement of 100 L/p/day has been adopted. For non-residential properties, most businesses and industries would be required to reduce water consumption to minimum essential usage only and in some cases, non-essential businesses may be asked to temporarily cease operations until drought conditions improve.

An estimate of the essential supply requirements for each water supply system is included in Table 5.8. While the estimates included in the table are considered useful for initial emergency planning purposes, more accurate assessments of minimum essential supply requirements should be undertaken as Council approaches drought response level 5 based on the time of year, achievements to-date with reducing water consumption and a reassessment of essential businesses and industries.

**Table 5.7 Minimum Essential Supply Requirements**

| Water Supply System | Population Served | Residential Essential Supply Requirement (L/p/day) | Residential Essential Supply Requirement (kL/d) | Non-Residential Essential Supply Requirement* (kL/d) | MINIMUM ESSENTIAL SUPPLY REQUIREMENT (kL/d)** |
|---|---|---|---|---|---|
| Gunnedah & Curlewis | 13,708 | 100 | 1,370 | 635 | 2,005 |
| Mullaley | ~75 | 100 | 8 | 15 | 23 |
| Tambar Springs | ~100 | 100 | 10 | 8 | 18 |

*Notes:* ** Non-residential essential supply requirement assumed to be around 70% of average requirements*

***An allowance for water losses should also be included when considering total water production requirements*

# 6 Post-Drought Actions

## 6.1 Post-Drought Evaluation & Revision

Once the drought has broken and water supply systems return to normal operating conditions, a review needs to be undertaken of the effectiveness of the Drought Management Plan. The post-drought evaluation should include:

- A review of both supply side and demand side actions, including their effectiveness and timing, should be undertaken for each system and documented.
- An assessment should be made of the impact of drought management actions (including water restrictions) on various stakeholders, including the community.
- An assessment of the impact of drought management actions on Council should also be undertaken.
- Community response to the imposition of various restrictions should be sought, including feedback on the effectiveness of the Community Awareness Campaign, how they managed the impacts of drought and any suggested changes / modifications to water restrictions.
- Feedback should also be sought from various government agencies and other stakeholders, including local irrigators.

Based on this review of the previous drought and any feedback received, the Drought Management Plan will need to be revised to include issues that were not previously considered and potentially modified to improve the future management of droughts.

## 6.2 Regular Review & Update of the Plan

In addition to evaluation and revision after each period of drought, regular reviews of the Drought Management Plan should be undertaken at least every 5 years. Plans should be updated with the latest information on water supply systems, including any augmentations that have occurred, changes to operating rules and up-to-date water consumption data and flow / level monitoring data for water sources. Plans should also be updated after any major changes / augmentations to water supply systems.

# 7 References

DIPNR. (2003). *Water Sharing Plan for the Upper and Lower Namoi Groundwater Sources 2003.* Sydney: NSW Dept Infrastructure and Natural Resources.

DPI Water. (2016). *2014-15 NSW Water Supply and Sewerage Performance Monitoring Report.* Sydney: NSW Department of Primary Industries.

DPIE. (2020, July). *Adapt NSW*. Retrieved from Understanding and adapting to climate change in NSW: http://climatechange.environment.nsw.gov.au/

DWE. (2007). *Best-Practice Management of Water Supply & Sewerage.* Sydney: NSW Government - Dept of Water & Energy.

Hunter H2O. (2015). *Namoi Councils Drought Management Plan Template.* Namoi Water Alliance: Hunter H2O.

HWA. (2014). *Namoi Councils - Review of Water Restrictions Policy.* Namoi Councils: Hunter Water Australia.

MDBA. (2016, August). *Progress on Water Recovery*. Retrieved from Murray-Darling Basin Authority: http://www.mdba.gov.au/managing-water/environmental-water/progress-water-recovery

NOW. (2009). *Drought Relief for Country Towns* . Sydney: NSW Office of Water.

NOW. (2012). *Upper Namoi Groundwater Source - Status Report 2011.* Sydney: NSW Dept of Primary Industries, Office of Water.

OEH. (2015, September). *Climate Change Impacts on Surface Runoff & Recharge to Groundwater.* Sydney: NSW Office of Environment & Heritage. Retrieved from Adapt NSW (Office of Environment & Heritage).

OEH. (2016, September). *Murray Murrumbidgee Climate Change Snapshot.* Retrieved from Adapt NSW (Office of Environment & Heritage): http://climatechange.environment.nsw.gov.au/Climate-projections-for-NSW/Climate-projections-for-your-region/Murray-Murrumbidgee-Climate-Change-Downloads

# Appendix A
# Water Restrictions Policy

## Appendix A –Water Restrictions Policy

| CATEGORY | LEVEL 1<br>Low | LEVEL 2<br>Moderate | LEVEL 3<br>High | LEVEL 4<br>Very High | LEVEL 5<br>Emergency |
|---|---|---|---|---|---|
| RESIDENTIAL GARDENS & LAWN WATERING | Fixed Hoses & Sprinklers Banned except 6-8pm during DST. Water between 5-7 all other times | Fixed Hoses & Sprinklers Banned Hand held hoses restricted to 2hrs per day | Fixed Hoses & Sprinklers and hand held hoses banned<br><br>Buckets restricted to 2 hrs per day | No watering at any time | No watering at any time |
| WASHING DOWN (including vehicles) | Wash down hard/paved surfaces with high pressure hose only | Hoses restricted to 2 hrs per day | No hoses. Buckets restricted to 2 hrs per day | No watering at any time | No watering at any time |
| SWIMMING POOLS& SPAS - PRIVATE | Permit required for filling pools over 2000 litres | Permit required for filling pools over 2000 litres. Top up via hoses only 2 hrs per | Permit required for filling pools over 2000 litres. Top up via hoses only2 hrs per day | Filling and Topping up Prohibited | Filling and Topping up Prohibited |
| PUBLIC PARKS AND GARDENS | Fixed Hoses & Sprinklers Banned except for 6 hrs/day | Fixed Hoses & Sprinklers Banned except for 3 hrs/day | Fixed Hoses & Sprinklers Banned Hand held hoses only | Fixed Hoses & Sprinklers Banned Hand held hoses allowed 3hrs/day | No watering at any time |
| PUBLIC SPORTS GROUNDS AND | Main Parks to be watered at night | Limited watering only | Auto sprinklers 1hr max/line. Every second night Hand held hoses in other parks only. | Fixed Hoses & Sprinklers Banned Hand held hoses allowed 3hrs/day | No watering at any time |
| BOWLING/GOLF CLUBS | No Restriction | Fixed Hoses & Sprinklers Banned except for 2 hrs/day | Fixed Hoses & Sprinklers Banned except for 2 hrs every 2nd day | Fixed Hoses & Sprinklers Banned Hand held hoses allowed 1hr/day | No watering at any time |
| SCHOOLS AND HEALTH CARE PREMESISE REQUIRING DAY STAFF FOR MAINTENANCE | Fixed Hoses & Sprinklers Banned except for 6 hrs/day | Fixed Hoses & Sprinklers Banned except for 3 hrs/day | Fixed Hoses & Sprinklers Banned Hand held hoses only | Fixed Hoses & Sprinklers Banned Hand held hoses allowed 3hrs/day | No watering at any time |
| NURSERIES ETC | No Restriction | Fixed Hoses & Sprinklers Banned except for 4hrs/day | Fixed Hoses & Sprinklers Banned except for 2 hrs/ day | Fixed Hoses & Sprinklers Banned. Hand held hoses allowed 2hr/day | Fixed Hoses, Sprinklers& Hand held hoses Banned Bucket Water Only |
| AUTO FLUSH TOILETS | No Restriction | On Timers Banned. On Demand okay | On Timers Banned. On Demand okay | On Timers Banned. On Demand okay | On Timers Banned. On Demand okay |
| COMMERCIAL CAR WASH | No Restriction | No Restriction | Time Restricted by Negotiation | Time Restricted by Negotiation | Car wash closed |

## Appendix A –Water Restrictions Policy

| | | | | | |
|---|---|---|---|---|---|
| TRUCK WASH AT SALEYARDS | No Restriction | No Restriction | Time Restricted by Negotiation | Banned except as required by law | Closed |
| INDUSTRIAL USE (MAJOR) | No Restriction | No Restriction | Restricted by Negotiation | Restricted by Negotiation | Special Council Permission by Negotiation |
| WATER CARTAGE FROM STANDPIPE | No Restriction | No Restriction | Domestic Use Only | Domestic Use Only during working Hours | Domestic Use Only during working Hours |

# Appendix B
# Water Supply Systems Details

# Gunnedah Water Supply System

Gunnedah water supply system sources raw water from 8 groundwater bores, as shown on Figure B1 and in Table B1. Four bores are located off Studdy Lane (3, 4, 5 & 6), three bores are located off Orange Grove Rd (7, 8 & 9) and one bore is located off Wean Road 11. Water from the bores treated via newly built centralised chemical dosing plant with chlorine and fluoride.

**Table B1 Groundwater Bore Details – Gunnedah**

| Bore No. | Location | Pump Capacity (L/s) | Bore Depth (m) | Typical Depth to Groundwater (m) | |
|---|---|---|---|---|---|
| | | | | Static | Draw Down |
| 3 | Campbell Rd | 18 | 39.3 | 10 – 13 | 14 – 18 |
| 4 | Campbell Rd | 18 | 31.0 | 10 – 14 | 15 – 17 |
| 5 | Campbell Rd | 17 | 22.5 | 10 – 14 | 14 – 17 |
| 6 | Campbell Rd | 50 | 41.5 | 10 – 14 | 18 – 27 |
| 7 | Orange Grove Rd | 38 | 73.0 | 8 – 14 | 22 – 33 |
| 8 | Orange Grove Rd | 142 | 133.5 | 12 – 20 | 20 – 35 |
| 9 | Orange Grove Rd | 108 | 132 | 12 – 20 | 30 – 40 |
| 11 | Wean Rd | 27 | 21.5 | 9 – 13 | 13 – 15 |

A review of historical groundwater levels in the vicinity of town water supply bores for Gunnedah, as monitored by DPIE Water, shows there has been some decline in groundwater levels over the past 50 years, with monitoring bores near Gunnedah typically showing around a 5m decline in water levels (see Appendix C). However, the decline appears to have steadied and the groundwater level increased over the last decade, most likely in part due to the introduction of the Water Sharing Plan which set diversion limits in line with estimate recharge rates. The groundwater levels recorded by DPIE Water in the monitoring bores generally compares well with groundwater levels recorded by GSC in town water bores.

Since the installation of the Orange Grove Rd bores in the mid 1990's, water restrictions were not applied in Gunnedah as a result of drought conditions until January 2020, when Level 1 restrictions were applied.

## Appendix B – Water Supply Systems Details

The Gunnedah and Curlewis water supply system has eight water reservoirs with a combined capacity of 22.7 ML:

- South Street Reservoir – 3.2 ML (TWL 300.9 m)
- Links Road Reservoir 1 – 2.1 ML (TWL 340.8 m)
- Links Road Reservoir 2 – 9.7 ML (TWL 340.8 m)
- Apex Reservoir 1– 0.7 ML (TWL 340.8 m)
- Apex Reservoir 2 – 4.0 ML (TWL 340.7 m)
- Gallen Reservoir – 2.0 ML (TWL 380.7 m)
- Curlewis Reservoirs – 2 x 0.5 ML (TWL 317.8 m)

There are four main water supply zones supplied by the water reservoirs:

- South Street Reservoir services the South Street Zone, which is the lowest pressure zone
- Links Rd Reservoirs and the Apex Reservoirs service the Links Rd / Apex Zone, which is the middle pressure zone. The Links Rd/ Apex reservoirs also supplies the Curlewis reservoirs.
- Gallen Reservoir services the Gallen High Zone, which is the highest-pressure zone and is boosted from the Links Rd / Apex Zone via the Links Road WPS (21.7 L/s).
- The Curlewis Reservoirs service Curlewis.


**Figure B1** **Gunnedah and Curlewis Water Supply System – Overview Plan**

## Curlewis Water Supply System (Decommissioned)

The Curlewis bores and bore pumps have recently been decommissioned following the connection of Curlewis to the Gunnedah water supply system in 2019.

## Mullaley Water Supply System

Mullaley water supply system sources raw water from two groundwater bores, as shown on Figure B2 and in Table B2. The bores are located off the Oxley Highway, to the west of the town and are treated via disinfection with chlorine only. Historically, both bores have been reliable.

**Table B2 Groundwater Bore Details – Mullaley**

| Bore No. | Location | Pump Capacity (L/s) | Bore Depth (m) | Typical Depth to Groundwater (m) | |
|---|---|---|---|---|---|
| | | | | Static | Draw Down |
| 1 | Oxley Highway | 3.8 | 23 | 5 – 10 | 10 – 15 |
| 2 | Oxley Highway | 2.8 | 23.7 | 5 – 10 | 10 – 15 |

Mullaley water supply system has one water reservoir that is located to the south of the town and services a single supply zone:

- Mullaley Reservoir – 0.19 ML


**Figure B2 Mullaley Water Supply System – Overview Plan**

## Tambar Springs Water Supply System

The Tambar Springs water supply system sources raw water from two groundwater bores, as shown on Figure B3 and in Table B3. The bores are located off Smith Road, to the east of the town and are treated via disinfection with chlorine only. Historically, both bores have been reliable.

**Table B3 Groundwater Bore Details – Tambar Springs**

| Bore No. | Location | Pump Capacity (L/s) | Bore Depth (m) | Typical Depth to Groundwater (m) | |
|---|---|---|---|---|---|
| | | | | Static | Draw Down |
| 1 | Smith Rd | 5 | 64 | 5 – 10 | 7 – 15 |
| 2 | Smith Rd | 5 | 62.8 | 5 – 10 | 7 – 15 |

Tambar Springs water supply system has four small water reservoirs with a combined capacity of 0.17 ML:

- Tambar Springs 1, 2 & 3 Reservoirs – 0.05 ML each
- Quarry Street Reservoir – 0.02 ML, which services a small high pressure zone

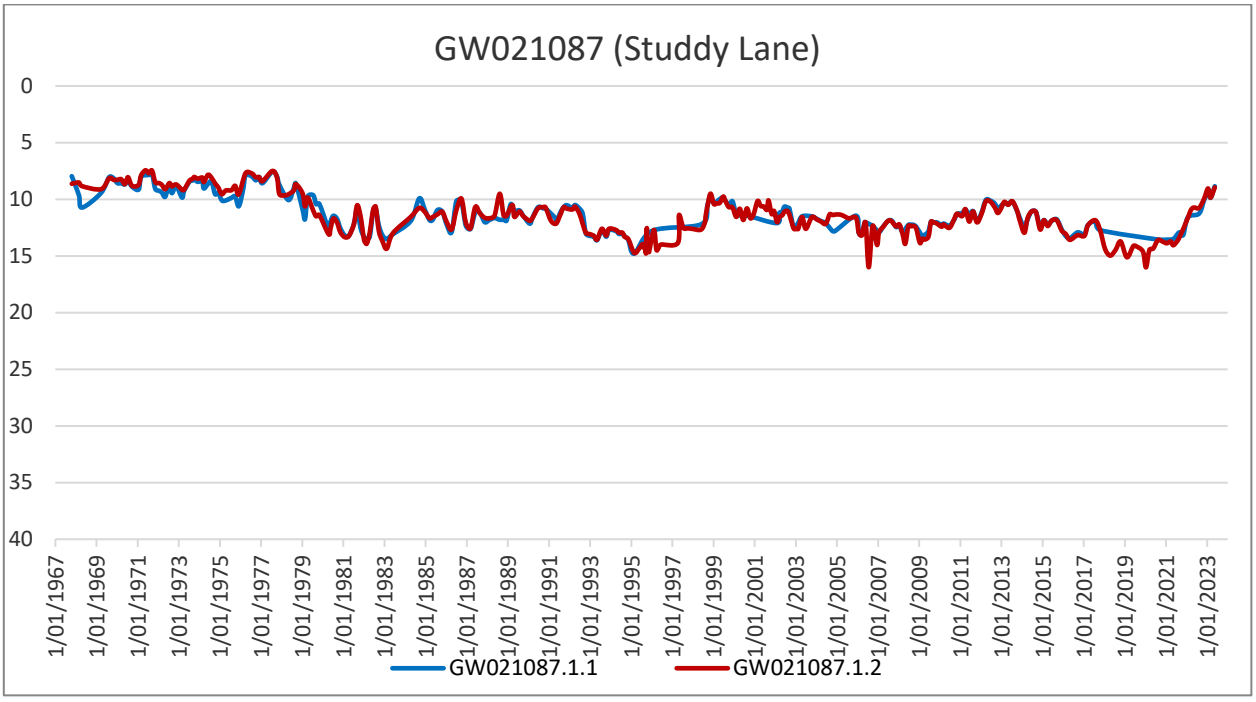

**Figure B3 Tambar Springs Water Supply System – Overview Plan**

# Appendix C
# Historical Groundwater Levels

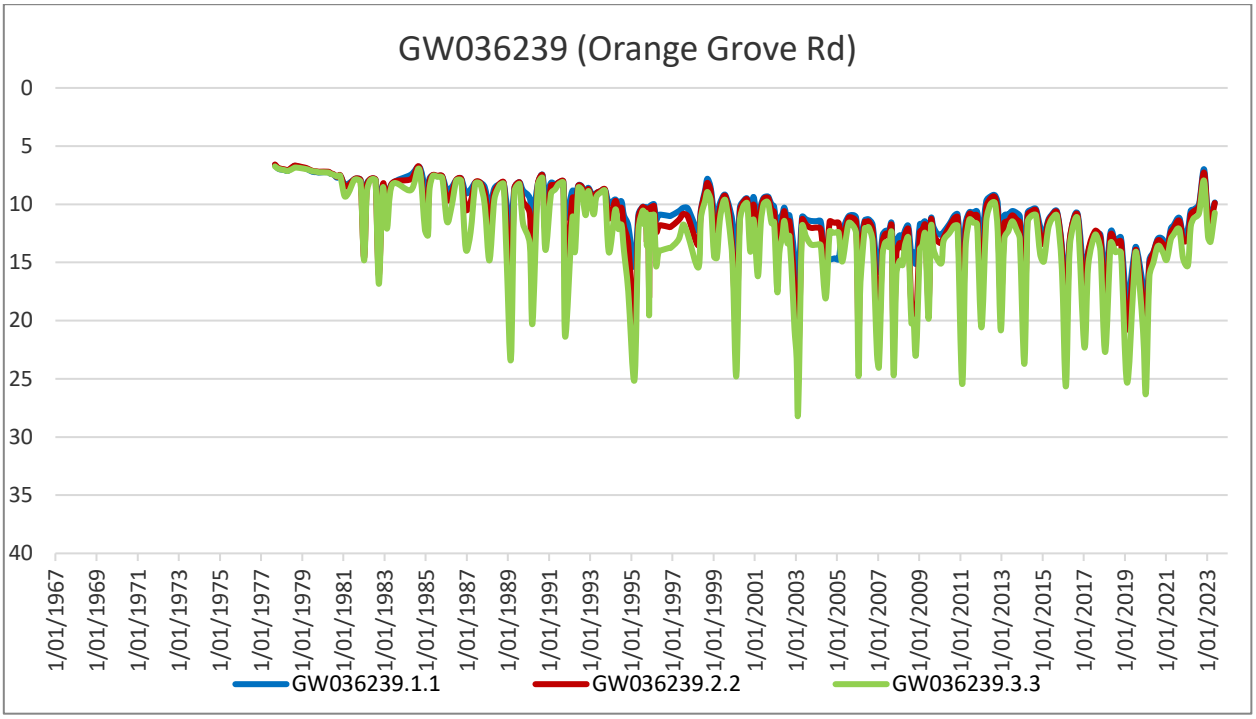
## Appendix C – Historical Groundwater Levels

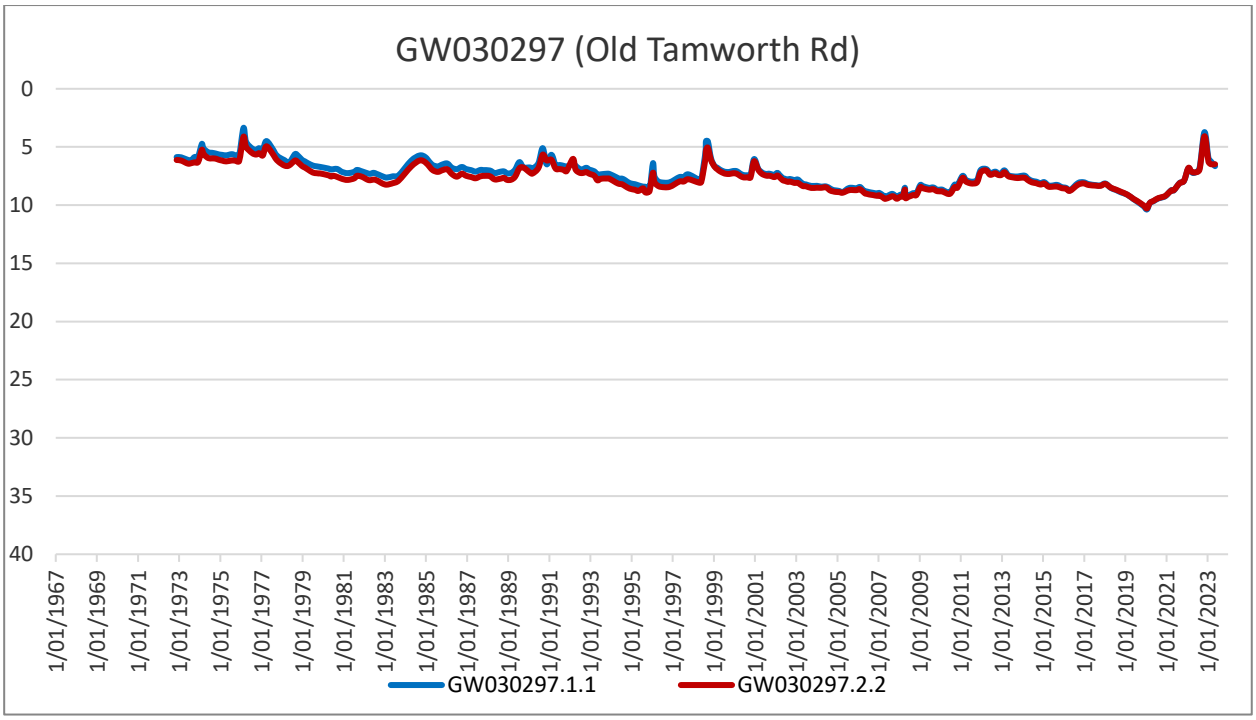
Historical groundwater levels (generally taken 5 – 6 times per year) as measured by DPI Water monitoring bores:

- GW021087 – monitoring bore located on Studdy Lane, within the general vicinity of Gunnedah town water bores 3, 4, 5 & 6.
- GW036239 – monitoring bore located on Orange Grove Lane, within the general vicinity of Gunnedah town water bores 7, 8 & 9.
- GW030297 – monitoring bore located on Old Tamworth Rd.
- GW036197 – monitoring bore located at the eastern end of Curlewis Common Rd, around 1.3 km north-east of Curlewis town water bores 1 & 2.

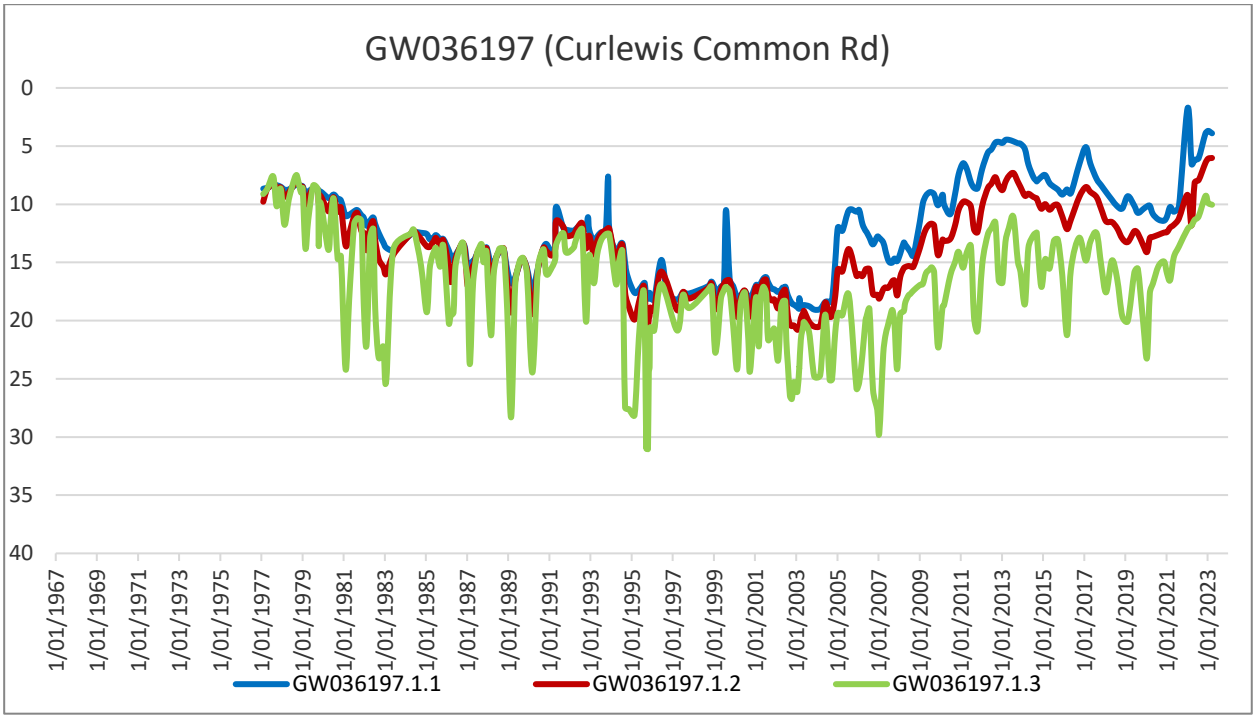


## Appendix C – Historical Groundwater Levels



## Appendix C – Historical Groundwater Levels



# Appendix D
# Emergency Supply Options

# Emergency Supply Options

A summary of the emergency supply options that are available for each water supply system is included below.

**Gunnedah and Curlewis**

1. *Additional Groundwater Bores*

   Additional groundwater bores could be investigated and tested if the existing bores were unavailable. Kelvin Road has been identified as a potential site for future groundwater investigations.

   The site of the former groundwater bores in Curlewis could also be considered (at least to provide emergency supply to Curlewis), with GSC still holding a licence for up to 198 ML/a from this groundwater source. Note that the former groundwater bores were decommissioned and backfilled and therefore bores would need to be reinstated.

   In the event of groundwater contamination affecting all existing Gunnedah bores, consideration should be given to investigating groundwater sites in adjacent groundwater systems / zones. Note that existing Gunnedah bores are located in the Upper Namoi Zone 4 groundwater source (which is generally located north of Gunnedah) and directly to the south and east of Gunnedah lies the Upper Namoi Zone 3 groundwater source (which was the source for the former Curlewis groundwater bores).

2. *River Extraction from Namoi River (if sufficient water is available)*

   An alternative to building a pipeline to Keepit Dam is to release flows into the Namoi River and pump from a temporary weir close to Gunnedah. With this option, there is the potential for significant losses to underlying groundwater systems between the dam and Gunnedah.

   Similar to the pipeline options, this option is dependent on the availability of water from Keepit Dam and temporary access to bulk water would need to be negotiated with DPIE and NRAR.

   The following infrastructure would be required for this option:

   - Temporary weir across Namoi River (in vicinity of new WTP on Kelvin Road) and release from Keepit Dam and pump from weir river intake at weir to temporary WTP (at the new WTP site)
   - Temporary package WTP added to the proposed new WTP to deliver treated water to reticulation system.

3. *Water Carting*

   While water carting would not normally be considered to be a primary emergency supply option for a town the size of Gunnedah, water carting of up to 2 ML/d could potentially be feasible for a short period of time. Note that water carting can cost around $20,000/ML and for 2 ML/d, this equates to around $280,000 per week.

   Raw water could be carted from Keepit Dam if there is sufficient water available, instead of building a pipeline or releasing flows into the Namoi River. Other potential sources of water for carting would include Tamworth (potable water or raw water) or Copeton Dam. For options that involve carting raw water, additional treatment may be required.

   To supply up to 2 ML/d, it is expected that around 80 round trips would be required per day (assuming 25 kL tankers) over a 16 hour shift. Tankers could deliver water to the site of the

proposed new WTP (on Kelvin Road) where additional treatment may be required before supplying water into the reticulation network.

The approximate distance via road from Keepit Dam to Gunnedah is 40 km via the Oxley Highway, around 0.5 hours driving time, each way. Water carting from Tamworth would involve around 1 hour driving time, while carting from Copeton Dam would involve a driving time of at least 2.5 hours (each way).

### Mullaley and Tambar Springs

1. *Additional Groundwater Bores*

   Additional groundwater bores could be investigated and tested if the existing bores were unavailable.

2. *Water carting from Gunnedah*

   In the event of a total water failure in these small towns, water could be carted from Gunnedah. It is expected that around six to seven tankers (25 kL capacity) would be required each week for each village. Tankers would likely deliver water to the existing reservoirs and additional temporary disinfection would need to be added to the water supply systems.