



# Namoi Region

## Water for the Future Strategy

### Volume 2: Analysis and Strategy



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## Acronyms

ABARES	Australian Bureau of Agricultural and Resource Economics and Sciences
AWD	Available Water Determination
CtP	Cease to Pump
DPC	Department of Premier and Cabinet
GAB	Great Artesian Basin
GHG	Green House Gas Emissions
GRP	Gross Regional Product
HEW	Held Environmental Water
IWCM	Integrated Water Cycle Management
JO	Joint Organisation
LGA	Local Government Area
MDBA	Murray Darling Basin Authority
NARClm	NSW and ACT Regional Climate Modelling
PEW	Planned Environmental Water
REDS	Regional Economic Development Strategies
RPA	Resource Plan Area
SAP	Special Activation Precincts
SDL	Sustainable Diversion Limits
WAL	Water Access Licence
WMA 2000	Water Management Act 2000
WSUD	Water Sensitive Urban Design

## 1 Introduction

In January 2019, Namoi Unlimited commissioned a Water for the Future Strategy aimed at identifying the opportunities and constraints associated with regional water resources and use, to both current and future regional development. The strategy has been developed as a two volume report:

- **Volume 1 (Water Resources)** of the report forms the basis of the strategy, providing a review and summary of the strategy development methodology, data, issues and findings related to water use and management within the Namoi region.
- **Volume 2** (this document) provides an analysis of the data and issues identified within Volume 1 and presents the recommended strategy and actions to be undertaken to improve the availability, security and use of water within the region to support its economic growth and development.

### 1.1 Study Area

The five member councils' local government areas (LGAs) of the Namoi Unlimited JO are shown in **Figure 1-1** and **Figure 1-2**. The Namoi JO covers an area over 35,000 km<sup>2</sup> in the New England north-west of New South Wales. The study area ("the Namoi JO") runs predominantly north – south, extending from south of Quirindi to north of North Star, near Boggabilla and the Queensland border. Its western extent stretches from Mullaley, Gunnedah to the eastern boundary of the Walcha LGA and the Carrai National Park (approximately 100km from Port Macquarie). The study area represents some of the most productive and valuable agriculture land within NSW and Australia.

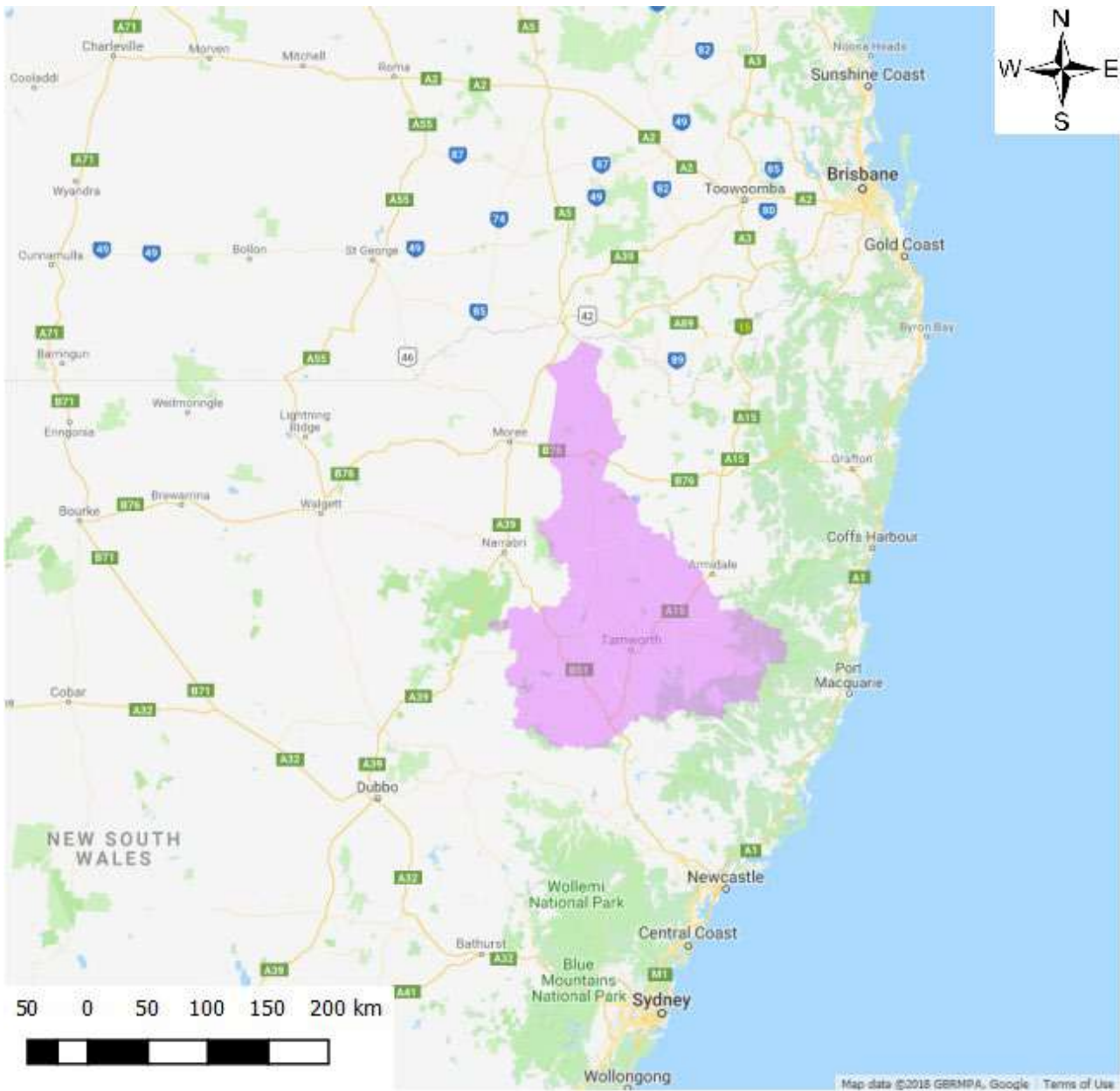


Figure 1-1: Geographic extent of Namoi Unlimited<sup>1</sup>

<sup>1</sup> Imagery from Google Maps

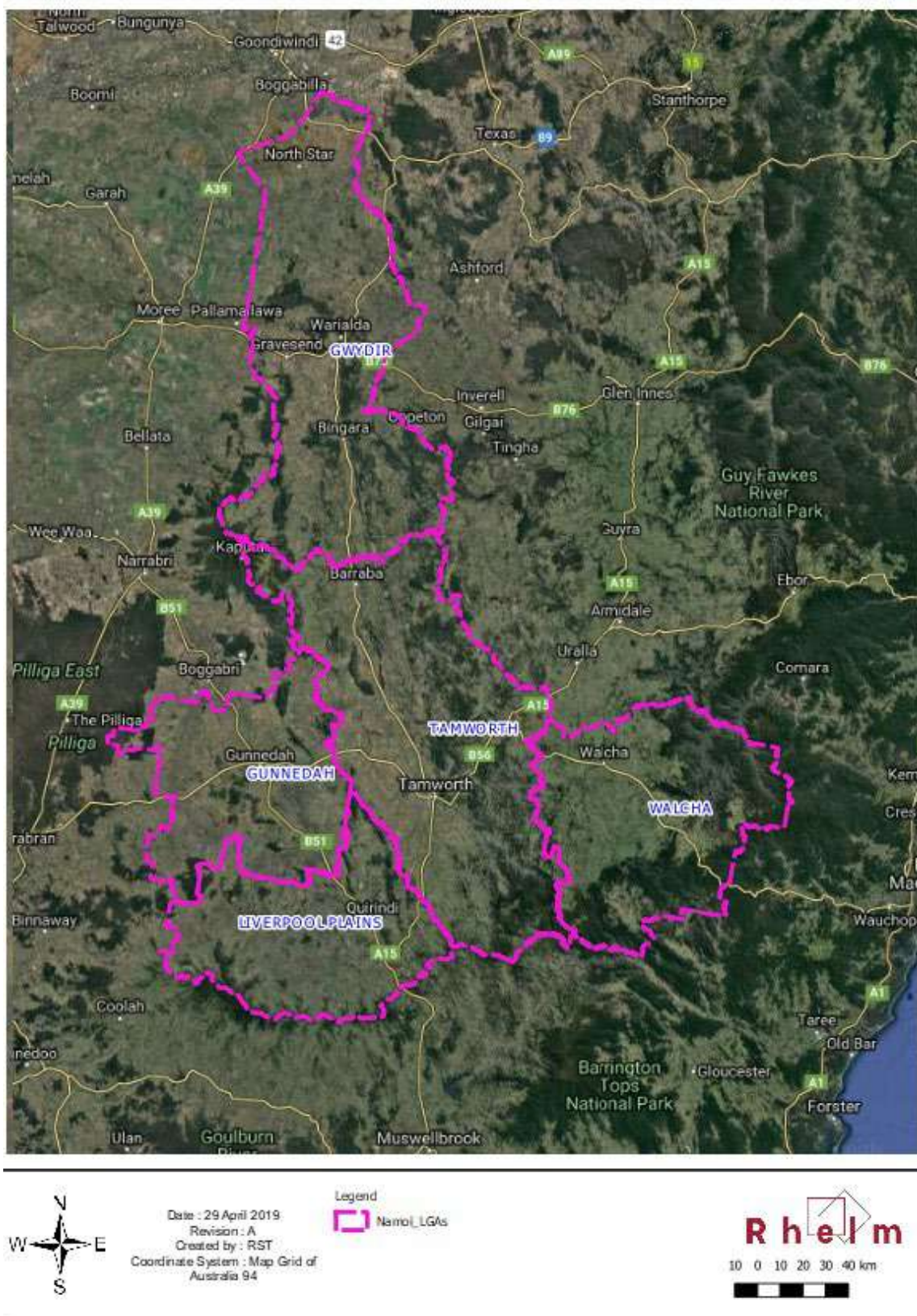


Figure 1-2: Member councils of Namoi Unlimited<sup>2</sup>

<sup>2</sup> Imagery from Google Maps



## 1.2 Namoi Unlimited

The Namoi Joint Organisation of Councils trading as Namoi Unlimited was established in mid-2015 as part of the NSW Government's pilot program to form new entities, called Joint Organisations, to facilitate collaboration among neighbouring Councils.

Namoi Unlimited represents five Local Government Areas located in the New England North West of NSW:

- Gunnedah Shire Council
- Gwydir Shire Council
- Liverpool Plains Shire Council
- Tamworth Regional Council
- Walcha Council.

### 1.2.1 Shaping the Future in the Namoi

Following establishment, Namoi Unlimited undertook a Shaping the Future of the Namoi study (Regional Australia Institute, 2015) to identify those things that had, or would have, the most profound impact on the region into the future and shape the direction and actions of Namoi Unlimited. The report identified six critical future factors:

- National and global cycles in commodity markets
- Maximising innovation in agricultural production
- Seeking international investment, on the right terms
- Engaging the Namoi in major overseas markets
- Urbanisation
- Leveraging regional brand marketing to attract people to live and work in the Namoi.

It was seen that the factors relating to innovation in agriculture, securing investment, engaging in markets, and promotion with a trusted and energised regional brand were the areas in which Local Governments and JOs could be most relevant, proactive and generate positive regional impacts.

### 1.2.2 Namoi Unlimited Strategic Regional Plan

Based on the findings of the Shaping the Future in the Namoi study, Namoi Unlimited developed a Strategic Regional Plan (Namoi Unlimited, 2018a) focused on three, interlinked, Strategic Regional Priorities:

- Water for Future
- Enabled and Connected Infrastructure
- Engaged People Seeking Skills for the Future.

## 1.3 Water for the Future Strategy: Objectives and Purpose

As part of the Water for the Future Strategic Regional Priority, Namoi Unlimited identified the following objectives to be pursued to support the regional plan:

- Audit, analyse, identify and prioritise the key constraints, opportunities and innovations to secure the supply of water for communities, businesses and Local Government.
- Audit, analyse, identify and prioritise opportunities and partnerships for agriculture, agricultural products, commodities, supply and value chains, as well as services.
- Identify the potential impacts of change on agriculture.

- Identify and facilitate opportunities to address change, by diversifying, opening and establishing new markets for producers.

Consistent with these objectives, this Water for the Future Strategy report provides an initial review and consolidation of the strengths, weakness, opportunities and threats to regional economic development in response to current and future water supply, availability and security. The strategy aims to:

- |  |                             |
|--|-----------------------------|
| <ul style="list-style-type: none"> <li>▪ Summarise the existing water sources and uses within the region and how this may change into the future</li> <li>▪ Identify water security and reliability issues within the region and how this may change into the future</li> <li>▪ Evaluate the dependency of the region and economic activities therein on water availability and use</li> </ul>   | Volume 1                    |
| <hr/>  |                             |
| <ul style="list-style-type: none"> <li>▪ Identify the strengths, weakness, opportunities and threats to the region and economic activities therein in response to water supply and demand</li> <li>▪ Provide high-level recommendations for subsequent studies, policies and water infrastructure projects to be considered by the JO and member councils that would support the continued economic prosperity of the region.</li> </ul> | Volume 2<br>(this document) |

#### 1.4 Data Review and Stakeholder Engagement

Due to the importance of the Namoi Region in agricultural production and its role within the NSW economy a significant volume of literature and data exists for the region in terms of land use, economic activity and water resources. In particular, the majority of the project study area (**Figure 1-1**) falls within the headwaters of the Darling River and is captured within the Murray Darling Basin Authority management area, there is an extensive suite of publicly available data and reports regards water management and use. An extensive literature and desktop database study was undertaken as part of the project to collate and categorise the available data of relevance to the region. This was supplemented by data and reports held by the individual member local governments of the JO. Beyond the stakeholder engagement activities undertaken (see **Section 2 of Volume 1**), no primary data acquisition was undertaken to support the development of this strategy document. Rather, it represents a synthesis of current information available at the time of development.

#### 1.5 Structure of Report

This Volume 2 report is broken into the following key sections:

- **Section 1 – Introduction:** A contextualisation of the Water for the Future Strategy.
- **Section 2 – Water Resources:** A brief summary of the water resources within the Namoi JO, based on Volume 1.
- **Section 3 – SWOT:** provides a Strengths, Weakness, Opportunities and Threats (SWOT) analysis for the Namoi region in regard to its water resources and their role in regional economic development.
- **Section 4 – Recommendations:** Based on the outcomes of the SWOT, provides a series of recommendations for future studies, infrastructure works and policies, forming the Water for the Future Strategy.

## 2 Water Resources

The following sections provide a brief summary of the water resources within the Namoi JO as context for this volume of the report. For full details regarding the data, methodology, and findings that support this information refer to **Volume 1**.

### 2.1 Water Management Framework

The water management framework applicable to the Namoi JO is primarily a function of:

- The rainfall catchment areas which support the water sources of the Namoi JO
- The management and access requirements applicable to those catchment areas.

The project study area (**Figure 1-1**) falls within six broad surface water catchment areas (**Figure 2-1**). Of these, the vast majority of the study area falls within the Border Rivers, Gwydir and Namoi River Catchments, with the majority of the member LGAs sharing parts of one or two catchments (**Table 2-1**).

The water resources within and between each of these catchment areas is regulated by a suite of State and Federal management legislation and policies that attempt to balance the right to water of individuals with environmental, agriculture, industry and town demand for water (e.g. Water Sharing Plan, Water Resource Plans, Murray Darling Basin Plan, Water Access Licences etc.). A full analysis of applicable regulations is provided in **Volume 1: Section 4**.

**Table 2-1: Catchment areas within Namoi Unlimited extent**

LGA	Catchment (% of LGA area)					
	Border Rivers	Gwydir	Namoi	Macleay	Hastings	Manning
Gunnedah			100%			
Gwydir	32%	68%				
Liverpool Plains			100%			
Tamworth		2%	95%			3%
Walcha			18%	56%	4%	23%

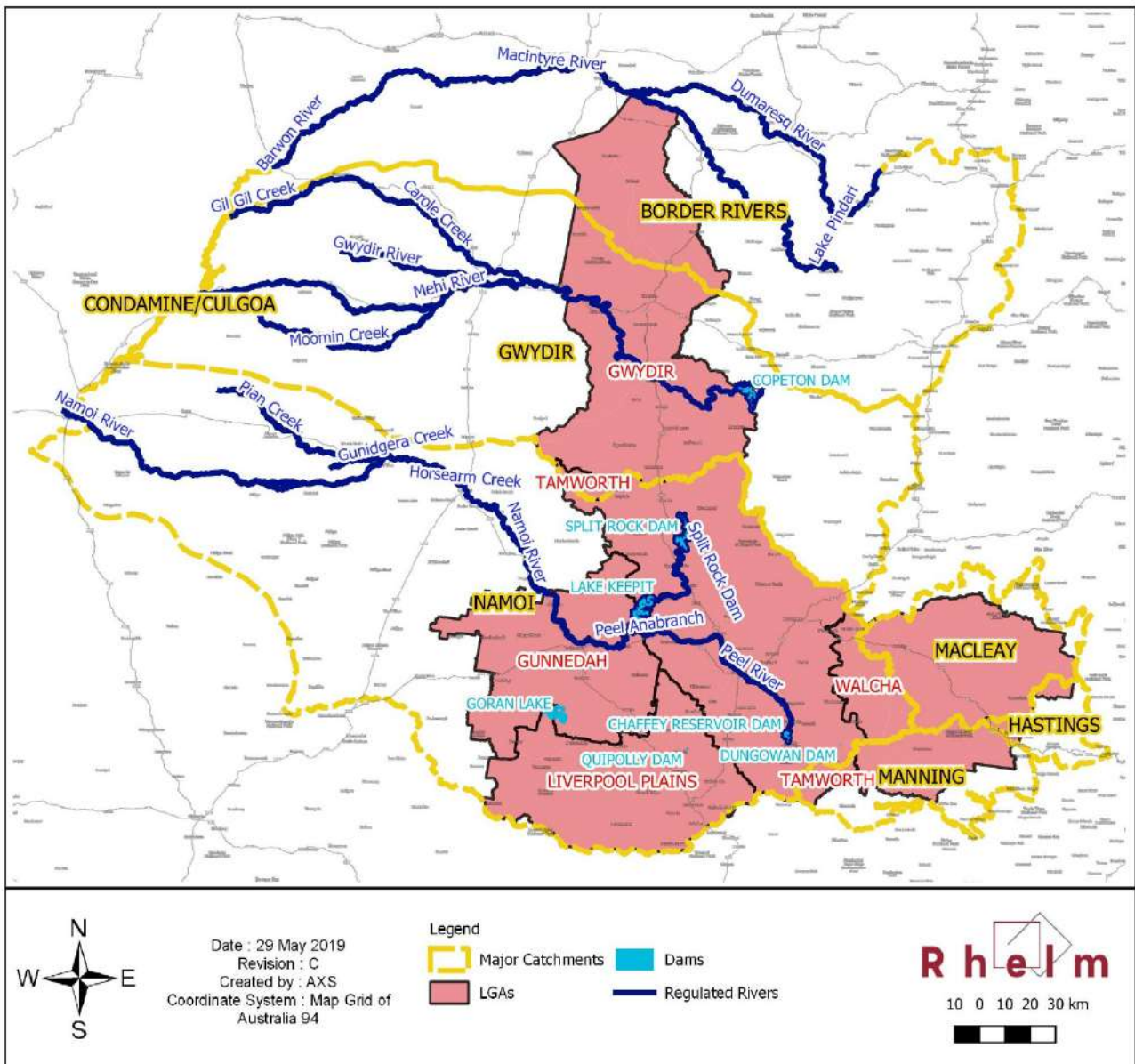


Figure 2-1: Catchment areas within the Namoi Unlimited extent<sup>3</sup>

## 2.2 Water Sources

Within the catchment areas and under the management framework outlined above, there a number of major water sources within the Namoi JO area. The four major water source types in use include:

- **Rainfall, water tanks and farm dams** – water that directly nourishes land or is captured prior to entry into a recognised water course
- **Unregulated rivers** – A recognised river in which downstream flows ARE NOT regulated by a major state-owned storage. Downstream licence holders can access water in accordance with the WAL and applicable Water Sharing Plan (WSP) conditions.

<sup>3</sup> Road imagery from Google Maps

- **Regulated rivers** – A recognised river in which downstream flows ARE regulated by a major state-owned storage and has been Gazetted as such. Downstream licence holders can order water against a held entitlement, in accordance with the WAL and WSP conditions.
- **Groundwater** – Water that occurs beneath the ground surface in the saturated zone. Licence holders can extract water in accordance with the WAL and WSP conditions.

A general overview of these sources of water within the Namoi JO are provided in **Figure 2-2**. A further discussion on these different water sources, and the management of these sources under state and federal levels is provided in **Volume 1: Sections 4 and 5**.

A number of significant pieces of water infrastructure to support both urban and rural water access have been developed, within or immediately adjacent to the Namoi JO. These include:

- Copeton Dam
- Lake Keepit
- Chaffey Dam
- Split Rock Dam
- Dungowan Dam
- Quipolly Dam.

With the exception of Dungowan and Quipolly Dams, which are both town supply infrastructure, these dams provide storage for the regulated rivers within the study area and act as the major surface water regulation points for both agricultural and urban water users. Further discussion on these are provided in **Volume 1: Section 5.5**.

### 2.3 Entitlement and Water Availability

In order to access the water from within these various water sources, individuals and organisations are typically required to obtain a Water Access Licence (WAL) in accordance with the NSW *Water Management Act (2000)*. The WAL dictates the overall volume of water able to be accessed (the licence **Entitlement**) and any conditions regarding how and when this may be accessed in any one year (an annual **Allocation**). In general, the allocation received in any one year has varied between 60%-80% of entitlement volume, across the Namoi JO. **Figure 2-3** and **Figure 2-4** detail overall WAL entitlement across all water sources within the Namoi JO. As the entitlement is accessed at a particular location but may be discharged/used over a broad area, mapping of water entitlement under a WAL adopted a 2.5km radius around each access point location as representative of regional availability.

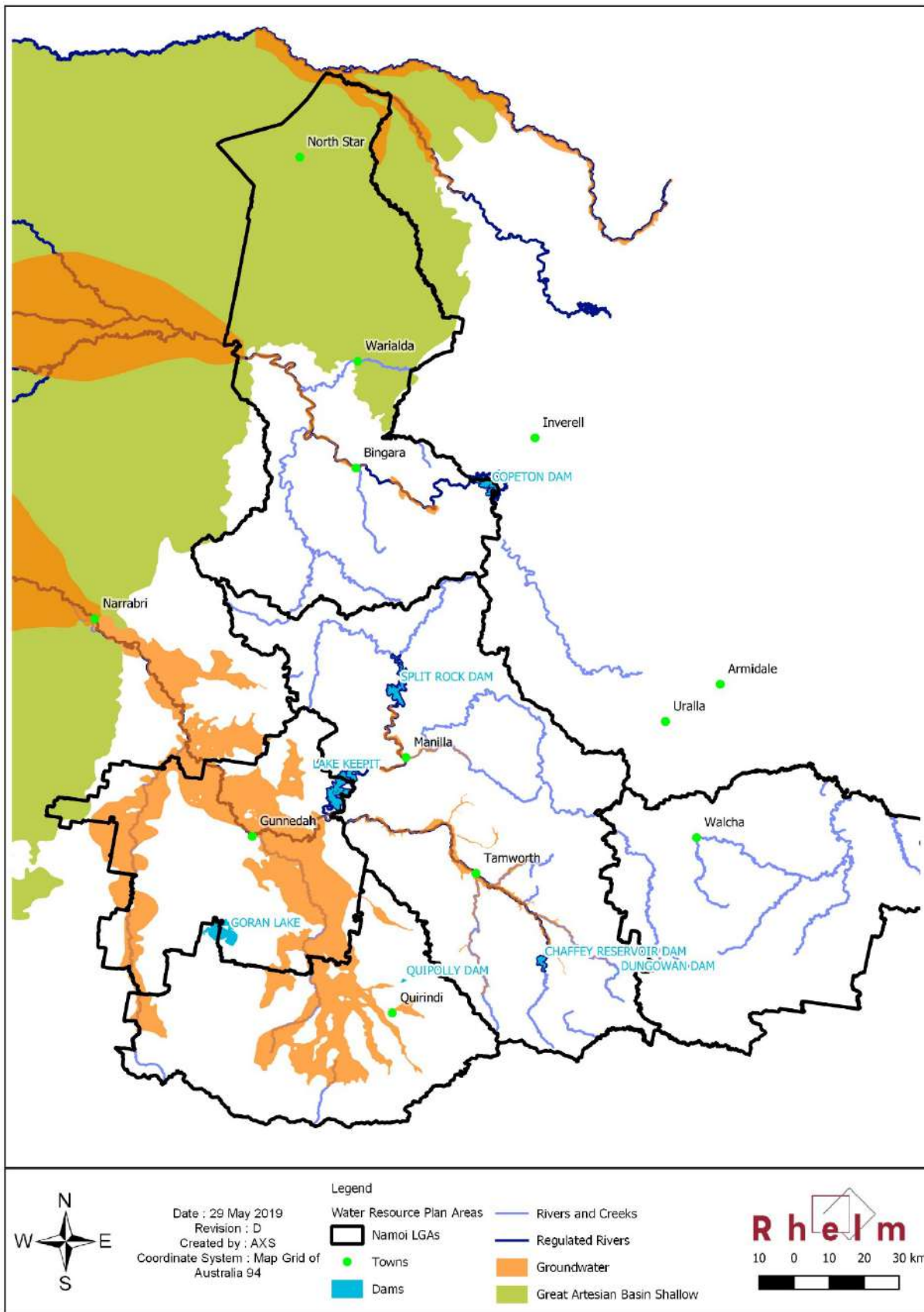


Figure 2-2: Overview of Key Water Sources

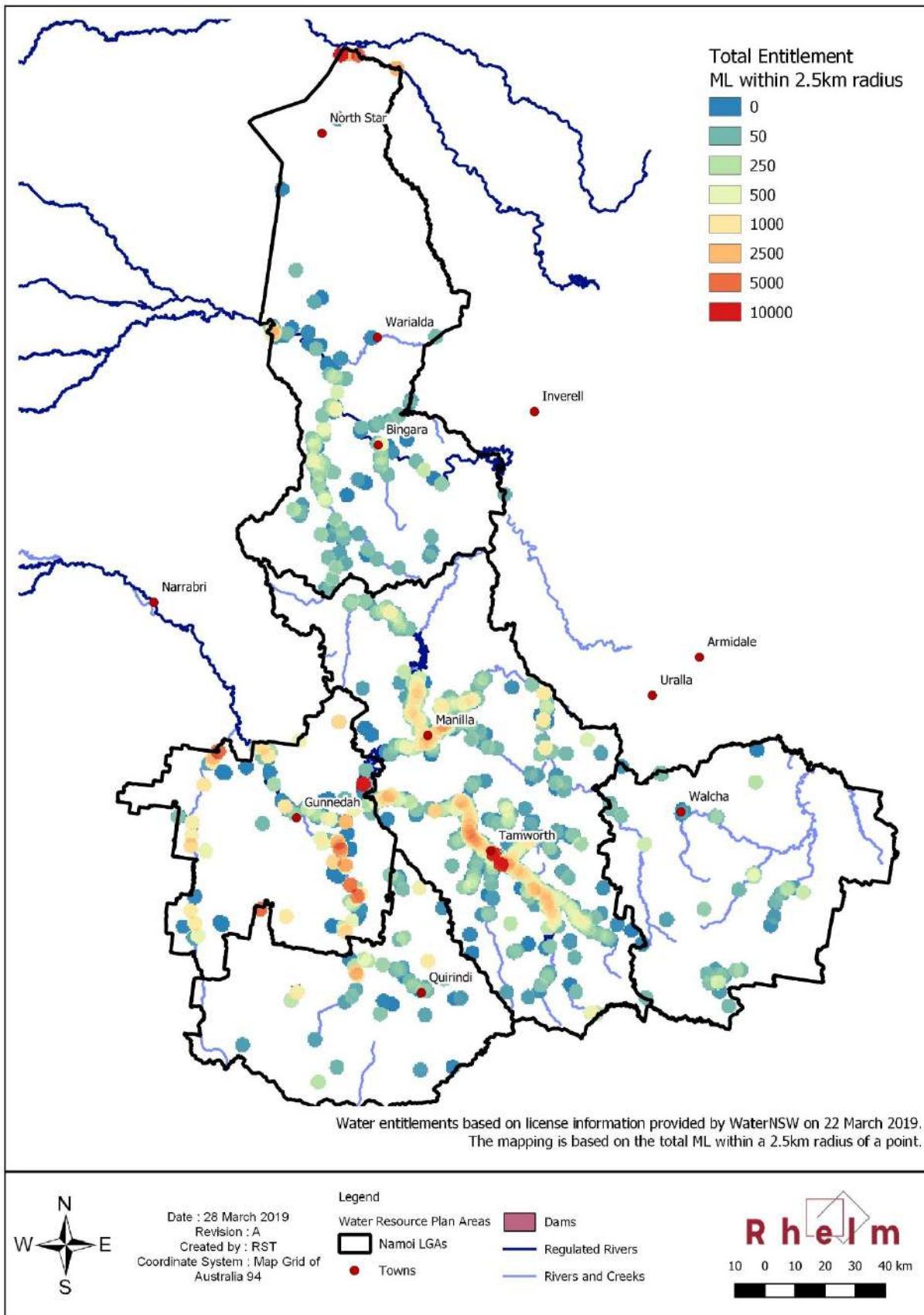


Figure 2-3: Surface Water Entitlement

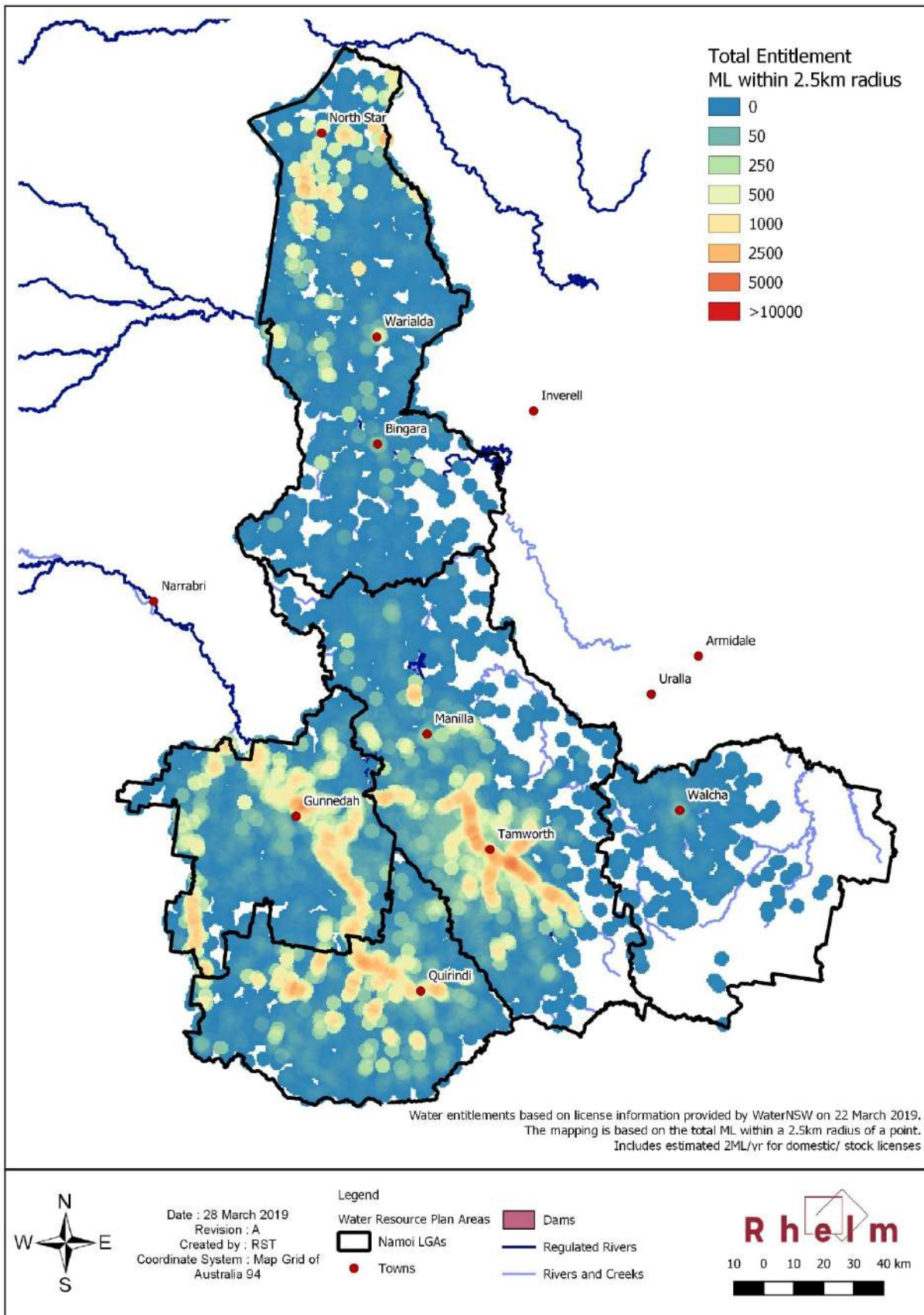


Figure 2-4: Groundwater Entitlement



The culmination of groundwater, surface water and rainwater volumes and entitlement lead to an overall picture of water availability throughout the Namoi JO. Based on the license data and rainfall data, three separate indices were created:

- Groundwater Index – a value of 0 to 1, based on the total entitlement within a 2.5km radius. A value of 1 represents an entitlement of 1,200ML or more.
- Surface Water Index – a value of 0 to 1, based on the total entitlement within a 2.5km radius. As with the groundwater index, a value of 1 represents a total entitlement of 1,200ML or more.
- Rainfall Index – this has a value of 0 to 1, representing a range of 600mm to 900mm of annual rainfall.

A summary of these index values is provided in **Figure 2-5**. Using these three indices, a composite “Water Availability” index was established, as shown in **Figure 2-5**.

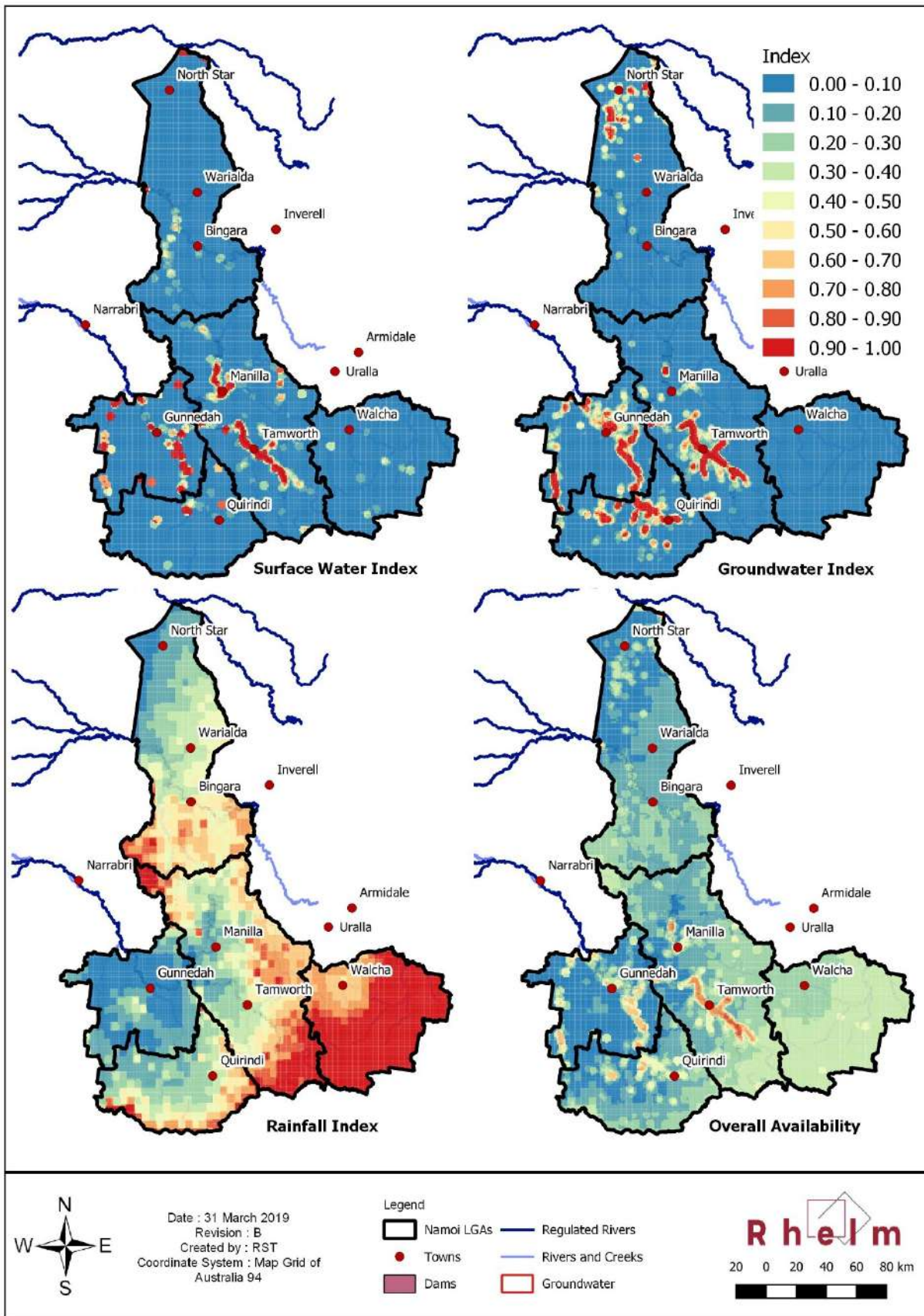


Figure 2-5: Water Availability Index

## 2.4 Water Security

Water security can be defined as the level of confidence that an individual may have in being able to access enough water to satisfy their water demand. This can apply to both current and future water demand levels. The level of water security may be affected both through:

- **Availability (Figure 2-5) and Reliability** – there may not physically be enough water present within the water source to meet the requirement at the time at which it is demanded
- **Accessibility and Cost** – there are barriers (administrative, financial, physical, economic) that prevent the user from accessing a sufficient water source.

Within the Namoi JO there is a complex nexus of these four factors. The fundamental availability and reliability are based on the natural and evolving characteristics of the water sources within the region. However, this is moderated (both positively and negatively) through:

- Competing land use
- Competing water usage and demand
- Management by numerous authorities
- Application of variable Water Sharing Plans and Water Resource Plans and associated entitlements/allocations/extraction levels
- Use of a water market mechanism and associated imperfect market restrictions.

Both the actual and perceived level of water security have the potential to alter the concerns and investment decisions of individuals (e.g. crop choice, land-use choice). However, given the multifaceted nature of water security, it can be difficult to quantify security in a way that is common across all stakeholders. In particular, the accessibility and costs elements associated within water security are often highly location specific. As such the majority of water security assessments focus on availability and reliability as these are primarily characteristics of the water source as opposed to that of the governance structures, economic systems or individual water users. Similarly, this strategy focuses upon the availability and reliability of water resources within the region. For example, the NSW Office of Water (2013) recommended adoption of the “5/10/10 rule” as the basis of defining water security for NSW local water utilities when evaluating whether their available water sources are adequate.

The 5/10/10 design rule requires urban water storages to be sized so as to ensure that full unrestricted urban water demands can be supplied in wet, average and shorter dry periods but that moderate duration, frequency and severity of water conservation measures will be required in extended drought periods. Under this design rule, the total time spent in drought conservation measures should be no more than 5% of the time, measures should not need to be applied in more than 10% of years and when they are applied the water supply system should be able to provide 90% of the unaffected dry year water demand (i.e. 10% average reduction in consumption due to water conservation measures) through simulation of the worst drought on record, starting with storage at the volume at which measures should be applied to satisfy the above 5% and 10% conditions. In essence this means that a resident can be highly confident that in all but the very driest conditions, at worst 90% of demand. Satisfaction of this criteria (for a given demand) indicates that the water source/supply for the urban area is said to provide a secure yield.

In contrast, no such criteria exist for individual agricultural landowners who manage their own water needs and do not necessarily have periods of water conservation forced upon them. Water security for individual landowners is typically associated with availability and reliability from sources as rainfall conditions vary.

Typically, during periods of high rainfall, agricultural landowners have a lower reliance upon regulated or unregulated water sources and decrease their usage<sup>4</sup>, while under periods of low rainfall agricultural landowners will seek to increase their extraction from catchment and groundwater sources to make up for the lack of rain. However, as the various identified water sources are dependent, to a greater/lesser degree, on catchment rainfall, it is often the case that in periods of high-water demand (e.g. drought) there is little water available within the available water sources. Consequently, rather than evaluate secure yield levels, landowners typically consider the frequency in which their full entitlement is available to them as a measure of water security. A water source from which they are able to extract their full entitlement (i.e. allocation is 100%) in every year would be considered a secure supply/ source.

Water security for the Namoi JO was assessed in terms of urban and rural water security reflecting the differing needs and demand drivers. **Volume 1: Sections 6 and 7** provide a detailed breakdown of the water demand, use both current and future scenarios within the Namoi JO. Water Security (particularly for urban areas) is typically defined through undertaking secure yield studies. However, with the exception of Walcha, there are no current secure yield studies for the towns within the Namoi JO or for the region as a whole. Tamworth Regional Council completed a secure yield study in 2016 which requires updating for the latest growth forecasts.

#### 2.4.1 Town Water Security

In the absence of detailed yield studies across the Namoi JO, an assessment was undertaken on water conservation measures that have historically been in place. **Figure 2-6** demonstrates the observed frequency in which urban water conservation measures of at least Level 2 were applied over a ten-year period by the local water utility.

Gunnedah has no record of conservation measures over this period, suggesting that its groundwater sources have both sufficient volume and reliability to meet current forecast demand. Within the other LGAs there is significant variation in the reliability and availability of the water supply between towns. This directly reflects the nature of the primary water source supplying the town. Towns relying on unregulated water sources typically have a much lower water security than those relying on regulated sources or groundwater.

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<sup>4</sup> Though it is noted that large irrigators will often maximise their extraction during high rainfall events and store water themselves for future use.



Figure 2-6: Frequency of water conservation measures within the Namoi JO<sup>5</sup>

### 2.4.2 Rural Water Security

Water security for individual land owners is likely to reflect the observed reliability/availability patterns observed for the various water source types. Land-users with access to more than one water source are able to partially hedge security risk. However, as the four water sources are inter-related the periods in which there is a lack of availability of unregulated waters sources is often associated with increased groundwater dependency, drawdown and reduced accessibility (e.g. additional costs of groundwater pumping from greater depths, higher prices to purchase water), reducing overall security. Although it varies between activities, in general the volumes of rainfall in any one year is the primary factor in the need for extraction / use from any water source. This is particularly the case for lower intensity water users (e.g. livestock) in which under wet conditions there is limited need for extraction to occur.

Security for agricultural land users is ultimately represented by having enough water in any year to satisfy their demand (e.g. 100% secure water supply would mean that drought conditions would not alter their ability to utilise water to satisfy their demand). Currently, the accessibility of water to individual landowners is moderated by their water access licence (WAL) conditions and associated entitlements. In effect, the WAL entitlement represents an upper bound on the volumes of water potentially able to be accessed by an individual. The determination of WAL entitlements is a complex issue and stakeholder engagement activities undertaken as part of this project identified significant concern regarding the allocation of entitlements under the current various WSP and WRP across the Namoi JO. In particular, within the Gunnedah and Liverpool Plain LGAs, reductions in entitlements over the past 20 years are seen to be a key limitation to agricultural activity within the region. This concern reflects the fact that entitlement level needs to be sufficiently high to meet demand with dry and drought conditions, which will typically be substantially higher than the average annual usage volumes.

<sup>5</sup> Data provided by each Local Government as of March 2019. Hatched data indicates that recent upgrade works have been undertaken that may alter the frequency of water conservation measures being applied (e.g. Chaffey dam upgrades)

### 2.4.3 Water Security Issues

A summary of some of the key water security issues and concerns that were identified throughout this project are summarised in **Table 2-2**.

**Table 2-2: Water Security Issues and Concerns**

Issue	Concern	Summary
Water Supply	Groundwater decline	<p>Groundwater sources are recognised as the major source for agricultural activities within the Namoi JO, and the primary water supply source for the majority of towns within the Namoi JO. Stakeholder consultation identified high concerns regarding deteriorating groundwater supplies as a result of both increased dependency under drought conditions and the presence of new operations increasing groundwater usage (e.g. mining activities, proposed abattoirs).</p> <p>As detailed in <b>Section 4 of Volume 1</b>, an observable declining trend in a number of the major groundwater sources and the current drought period has suggested significant drawdown. There is a general assumption that groundwater levels are the responsibility of the State and there is a reliance upon their management. No sustainable yield studies have been undertaken for groundwater sources and limited evaluation of the depth and number of bores currently in operation has been undertaken.</p>
Water Supply	Timing of Water Use and Storage	<p>The timing of water use requirements varies both with season and the use/crop/product. While AWDs may be issued by DPI Water that technically meet the definition of 100% of allocation being made available over the course of the year, it is often the case the landowner water investment decisions required certainty and availability of water supply at other points throughout the year. In particular, not all land-users have the potential to store water, meaning that even when flows released to provide a requested amount, their ability to practically use the water is limited.</p>
Water Supply	Inadequate Entitlement	<p>The State and Federal Governments implementation of The Basin Plan was associated with significant buy back and redistribution of entitlements. In particular, landowners within Gunnedah and Liverpool Plains LGAs noted that the limitation on groundwater entitlements within the region diminished their water security.</p>
Water Supply	Inadequate Sustainable Diversion Limits / Long-Term Average	<p>While the entitlements to landowners may be high, the adopted Sustainable Diversion Limit / Annual Average Extraction Limits, ultimately play a larger role in determining water availability. Stakeholder engagements identified a strong opinion that the applicable limits were</p>

Issue	Concern	Summary
	Annual Extraction Limits	too low, limiting the development of water intensive industries.
Water Market Distortions:		
Demand Management	Sleeper licences	<p>The implementation of a water trading system has the potential to improve water security for individuals (or groups), allowing them to source water when and as required. However, a significant portion of water licences are not used or traded on an annual basis. This limits liquidity in the market and potentially increases trading costs. Non-trading of licences is often associated with:</p> <ul style="list-style-type: none"> <li>• Highly risk averse owners seeking better protection for the future</li> <li>• Individuals utilising water entitlement as a long-term investment</li> <li>• Lack of awareness of trading opportunities / mechanisms</li> <li>• Small / Lifestyle farming activities in which the magnitude of trade and associated transaction costs are high. Similarly, where a farm might have a small amount of “left over” water to trade, but the transaction costs are too high. It is understood that this is a particular problem for groundwater.</li> </ul> <p>With a market system, poor liquidity diminishes the availability and security of water</p>
Demand Management	Market dominance	<p>The implementation of a water trading system has the potential to improve water security for individuals (or groups), allowing them to source water when and as required. However, due to the structure of water trading there is potential for larger water buyers to significantly influence the market for a particular water resource. In particular, the presence of mining companies is anecdotally reported to drive up prices within particular groundwater zones through market dominance (and their ability to pay significantly higher prices). Water price inflation may lead to smaller buyers being unable to access water when required for their production, decreasing reliability.</p> <p>Market dominance is also identified on the Peel River, where Tamworth is a significant entitlement holder, and can limit the overall amount of water available to trade in the much smaller Peel River catchment. Tamworth Regional Council does not currently trade its entitlement.</p>
Demand Management	Valuation of Water	The various water sources provide different values of water. Unregulated surface water represents the cheapest but most unreliable water sources. Groundwater is

Issue	Concern	Summary
		moderately cheap in comparison to regulated water sources and also the most reliable. Within the Namoi JO, farmers and water users undertaking the same activity may pay substantially different prices to do so. High Price water represents an accessibility cost, decreasing the security of water.
Planning	Trade of between environment, town and country water use	The majority of non-local water utility water usage is undertaken as part of General Security Water access licences. General Security water access allocations are determined secondarily after consideration of environmental, town and high security water uses. Where there is a finite extraction limit applied (e.g. a sustainable diversion limit), any increase in environmental or town water supply will often lead to a reduction in the volume of water available for extraction to General Security users; increasing the security of one user at the expense of another.

#### 2.4.4 Water Reliability Index

Based on the available water restriction information between the various water sources, an indicative reliability index was created based on:

- The individual WAL held, type and entitlement
- The water source to which the WAL applies
- The number of days in a 10 year period in which Level 2 water conservation measures occurred for the relevant water source within an LGA.

Full details of the derivation of this index is provided in **Volume 1: Section 8.4**. This does not take into account the severity, nor the degree of allocation reliability, but provides some general broad indication on reliability of water supplies. The results of this analysis are shown in **Figure 2-7**. Ranging from 0 (blue - very poor reliability) through to 1 (red - high water reliability) the geographic distribution of water reliability varies significantly across the Namoi JO. It is considered that this represents a major element of water security along with water availability (**Figure 2-5**).



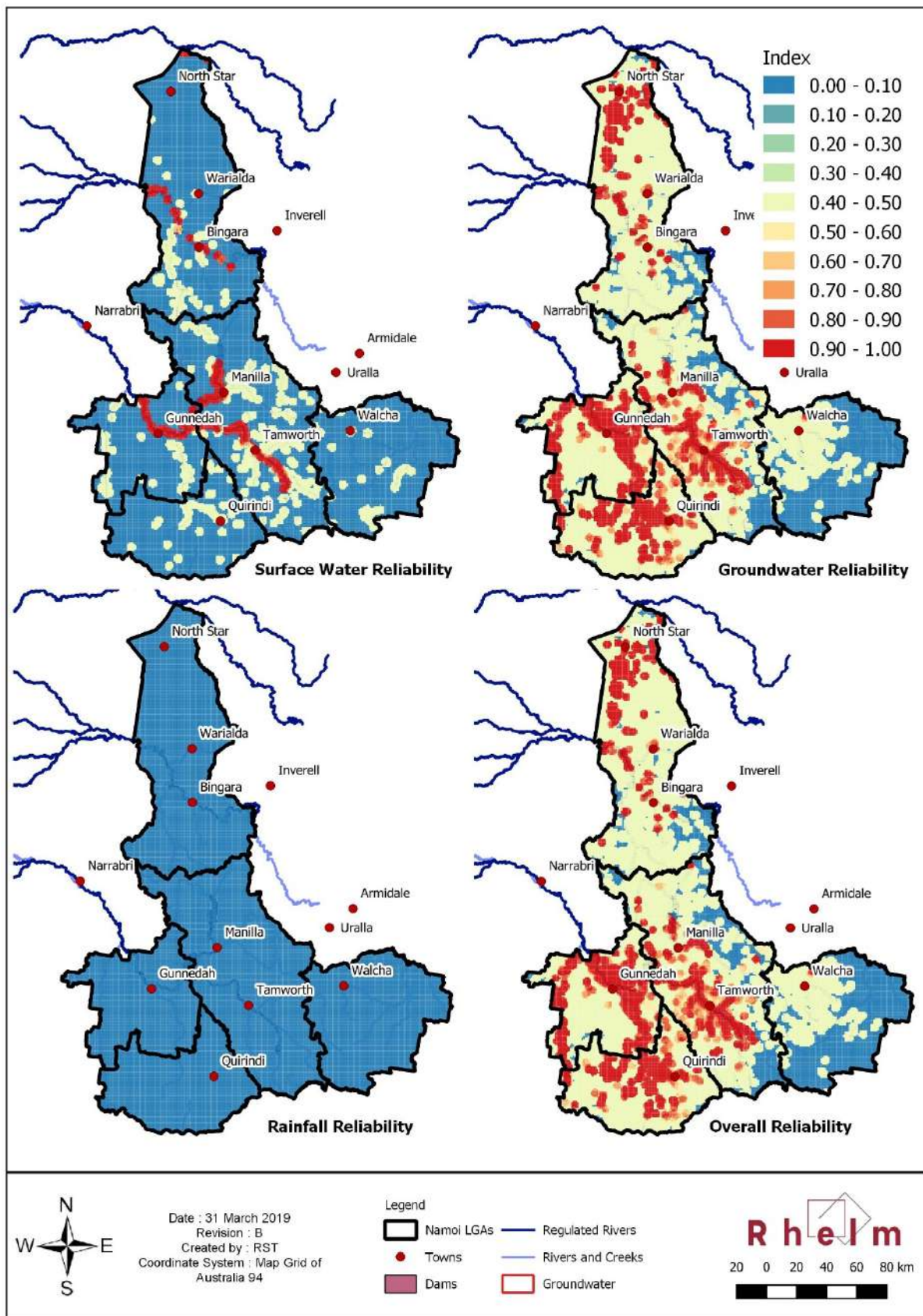


Figure 2-7: Water Reliability Index

### 3 SWOT Analysis for the Namoi Region

A Strengths / Weaknesses / Opportunities / Threats analysis was undertaken for the Namoi JO, evaluating the condition of water resources and their effective utilisation across the region. The aim of the SWOT was to permit the subsequent identification of a practicable list of recommendations (**Section 4**) that Namoi Unlimited may wish to consider as part of its on-going water management activities.

#### 3.1 Strengths & Weaknesses

The strength or weakness of a water resource is not only the amount of water availability/reliability (**Section 2.4**) but also its accessibility/cost; that is, water security is the fundamental measure of a water resource (**Volume 1: Section 8**). Indeed, depending on the water use in question, cheap, dependable and reliable water may be more important than the total volume of water available (e.g. a farmer may be able to be more productive with a small but reliable water supply, than they would with a large but variable supply). To address the uncertainties of defining water security for individuals and capture the performance of the Namoi JO as a whole, a “Water Strength Index” was determined for both rural and town water resources.

##### 3.1.1 Water Strength Index: Rural Water Resources

A rural “water strength index” was created to compare water strength/weakness across the Namoi JO. This was established as a weighted score of the water availability index (**Figure 2-5**) and the water reliability index (**Figure 2-7**). An overview of this water strength index is provided in **Figure 3-1**. This mapping provides a high level indication of the general “strength” of water in different locations, with lower values having a lower water strength, while higher values have a higher water strength.

This type of mapping is useful to understand spatially the relative strengths and weaknesses of water resources within the Namoi JO and consider how this has/will shape water utilisation across the region.

A comparison of the relative productivity of agricultural land (**Volume 1: Section 6**) and the water strength index is provided in **Figure 3-2**. This shows that agricultural practices have generally responded to the water strength throughout the Namoi JO, in addition to other considerations such as transportation, the type of land, and supply chains (such as downstream abattoirs). The comparison shows that the higher water strength around Gunnedah and Liverpool Plains LGAs, generally aligns with the higher productive cropping that occurs in these areas (and which requires a higher water security). This is driven in part by the water security, and in part by land values/opportunity costs, promoting the use of higher production in areas with higher water security (and associated costs).

A similar comparison is provided in **Figure 3-3**, overlaying water strength with intensive agriculture activities. In broad terms, intensive agriculture which requires high localised water use (such as feedlots and poultry) has generally aligned itself with areas of higher water strength, as would be expected. In general terms, this type of mapping provides a useful basis to understand the likely areas (from a water perspective) that intensive agriculture might develop in the future, and this can be overlaid with information on transportation connections and supply chains. It is noted that there are a number of areas of moderate to high water strength in which there are few intensive agricultural activities. These may be locations that are constrained due to other development limitations or represent untapped development opportunities.

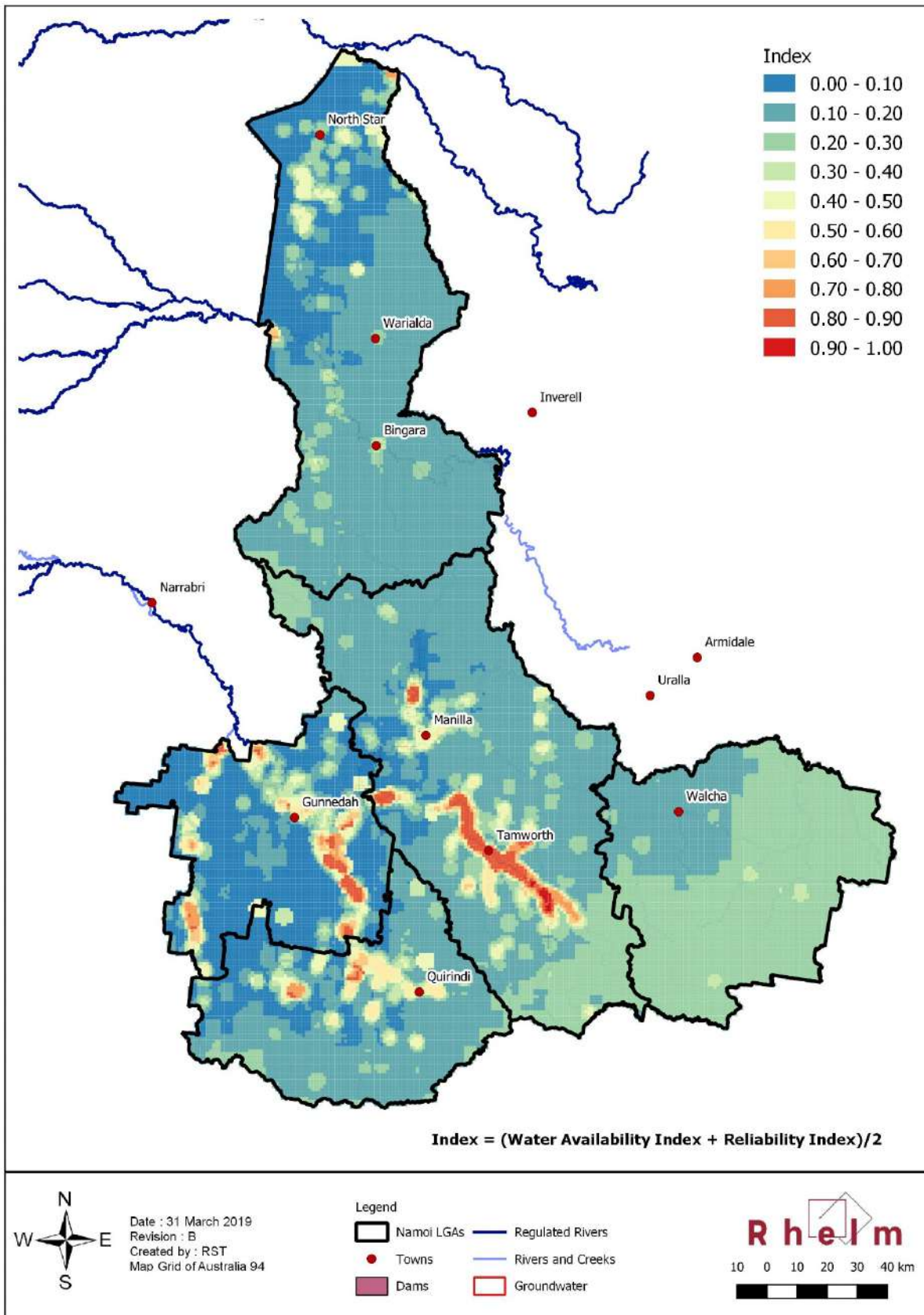


Figure 3-1: Water Strength Index – rural water resources

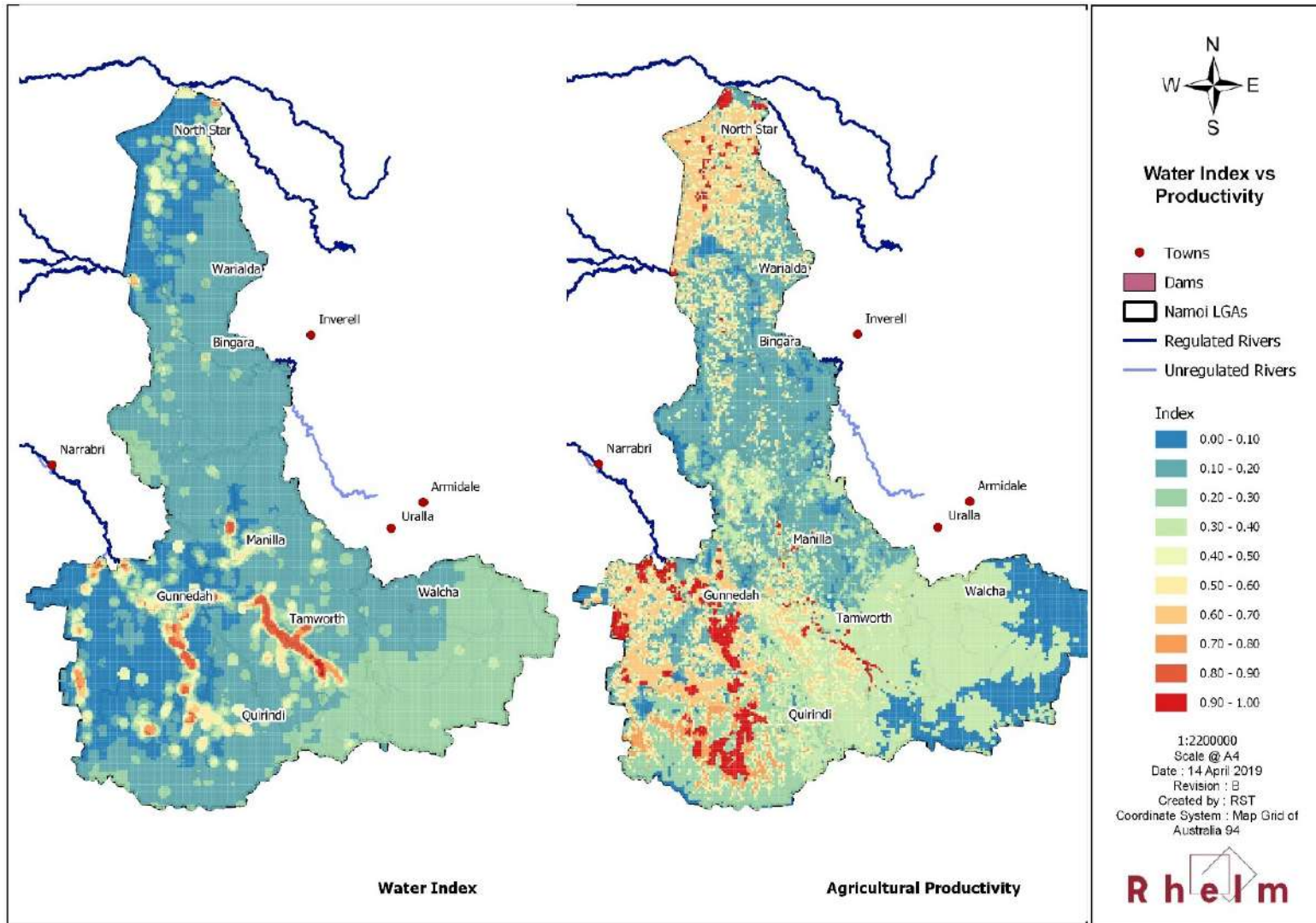


Figure 3-2: Comparison of Water Strength and Agricultural Productivity

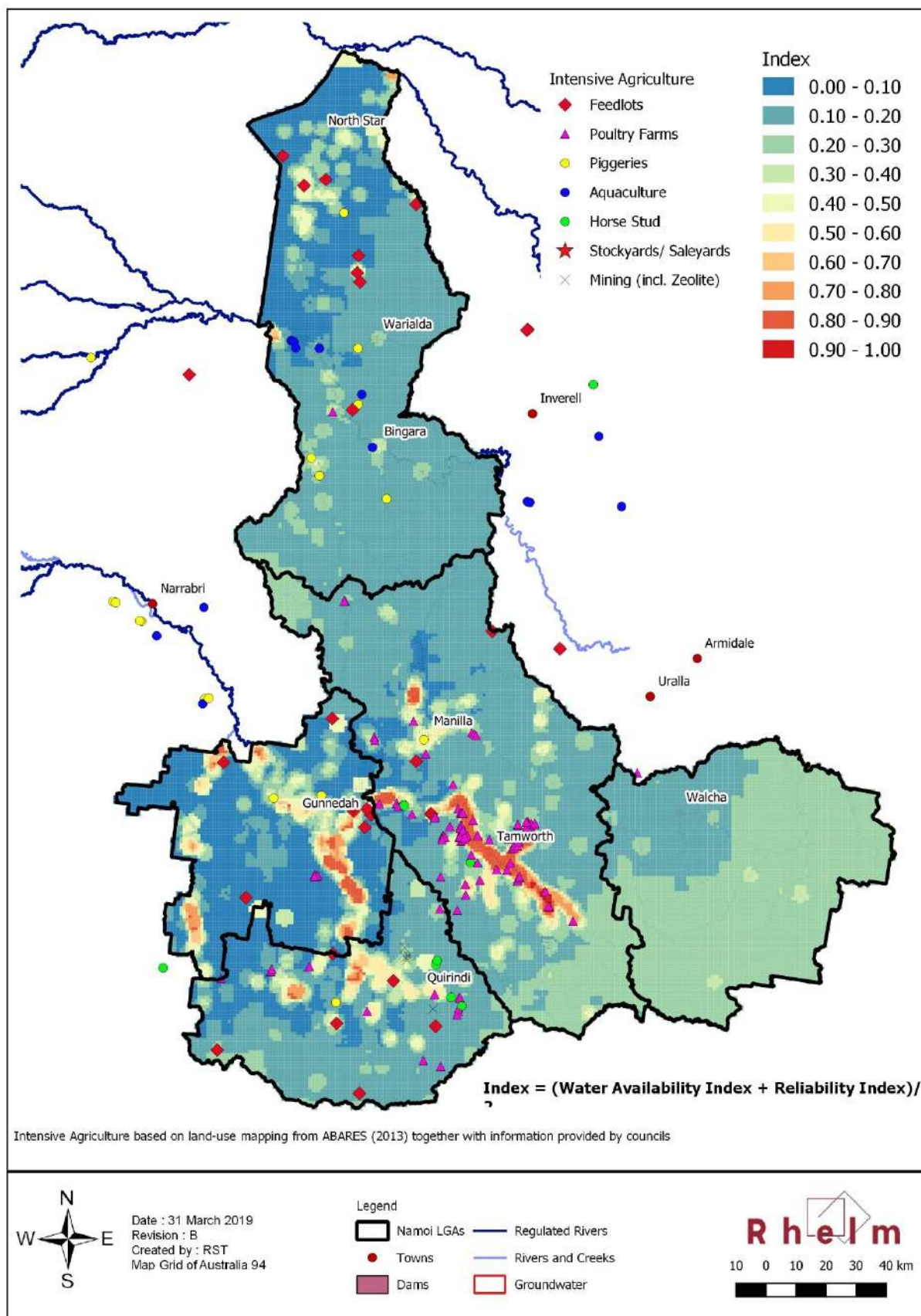


Figure 3-3: Intensive Agriculture & Water Strength Index

### 3.1.2 Water Strength Index: Urban Water Resources

The Rural Water Strength Index above provides a useful measure of overall strength and weakness in regard to water across the Namoi JO as a whole. However, it does not necessarily provide the resolution required to understand the relative strengths and weaknesses within the urban centres across the Namoi JO.

As identified in **Volume 1: Section 6**, not all LGAs or towns have had secure yield or Integrated Water Cycle Management studies undertaken. This makes it difficult to undertake a detailed analysis of comparative water security across the region. Consequently, an Urban Water Strength index was developed to act as a proxy. The index developed as a composite index of:

- Town Water Reliability
- Town Water Availability.

An indicative reliability index, from 0 (constant conservation measures) to 1 (no conservation measures) was created based on the number of days in which Level 2 (or greater) water conservation measures were applied within a reticulated town area over 10 years. This does not take into account the severity of the overall restriction but provides a broad indication on reliability of water supplies. The results of this analysis are shown in **Figure 3-4**. Given the reliance on reliable groundwater resources, Gunnedah has the highest reliability score of all the locations. Werris Creek and Quirindi currently have augmentation works that are in development that will improve the reliability of these supplies and likely increase that score. Similarly, the extent to which the recent upgrades to Chaffey Dam and the impacts to water strength across the Tamworth LGA are not adequately captured within this data.

Water availability was estimated by comparing the current water use to the overall entitlement for an LGA. As town water supply is prioritised over many other water types within the current Water Sharing Plans, this provides an indication of the potential “capacity” available for future growth and expansion. Overlaying this with reliability is shown in **Figure 3-5**. The composite urban Water Strength Index is provided in **Figure 3-6**.

It is noted that this is indicative, and that a detailed yield study would provide a better estimate of overall water security and potential for growth.

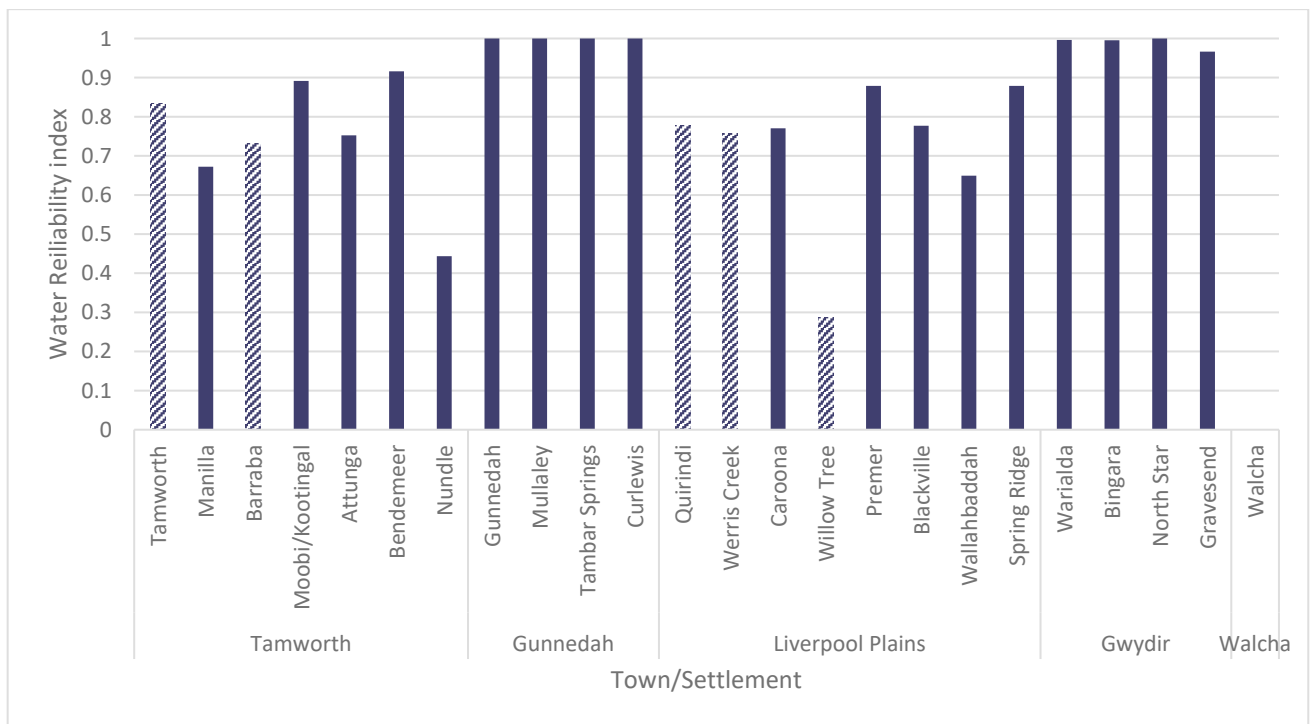


Figure 3-4: Water Reliability Index – Towns<sup>6</sup>

<sup>6</sup> Hatched data indicates recent upgrades have occurred and that the data is likely to under-estimate water reliability scores

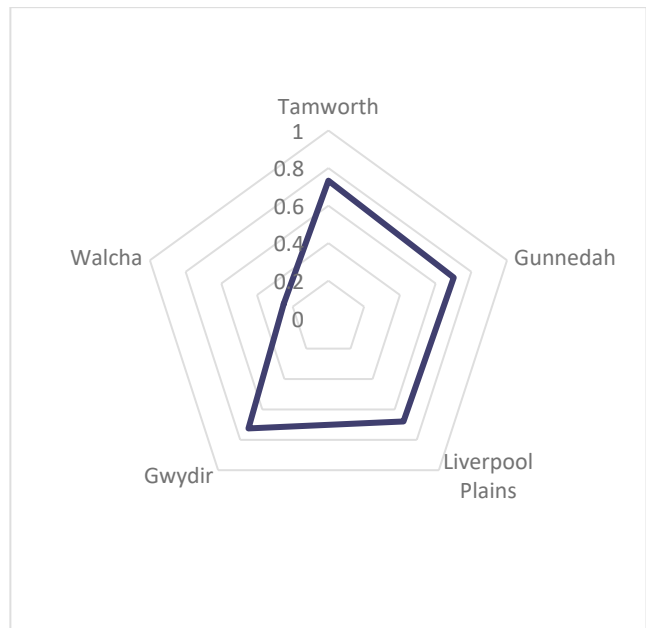
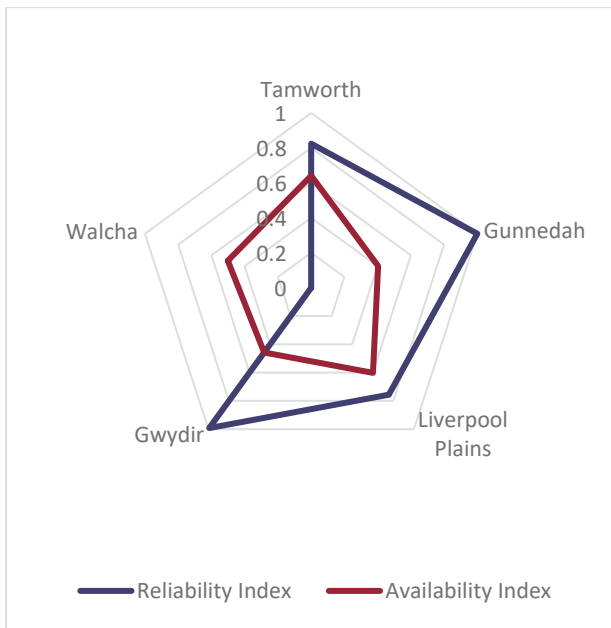


Figure 3-5: Urban Reliability and Availability Index      Figure 3-6. Urban Water Strength Index

### 3.2 Opportunities

There are a number of opportunities in regard to water in the Namoi JO that will improve its overall water strength and support regional economic growth. A brief summary of some of the key opportunities are identified in **Table 3-1**. These have generally been categorised as:

- Demand Management – opportunities related to the reduction in water demand
- Planning – opportunities relative to strategic planning to take advantage of water strength/address water weakness
- Water Supply – opportunities related to water supply infrastructure to enhance water security.

Table 3-1: Opportunities<sup>7</sup>

Opportunity	Comments	Issue
Residential water demand management	Residential water demand throughout the Namoi JO differs ( <b>Volume 1, Section 6.2</b> ). In many locations throughout the Namoi JO, there is relatively higher water use per household. For example, Gunnedah has around 400kL/day compared with Tamworth at around 250kL/day and Walcha at 150kL/day. There is potential to reduce overall demand for water through efficiency measures that may increase the overall longevity of existing supplies and provide flexibility for larger scale industrial or commercial development that may require larger water use.  Given the limited extraction volumes of regulated water sources, any saving in residential usage can flow on to other uses. Residential garden watering within Tamworth is in the order of 2,500 ML per year, comparable to total agricultural utilisation within the Regulated Peel River ( <b>Volume 1, Section 8.3</b> ).	Demand Management

<sup>7</sup> Referencing to Volume 1 throughout this table is simplified. For example, Vol 1, S6 refers to Section 6 of Volume 1.



Opportunity	Comments	Issue
Commercial and industrial water demand management in urban areas	<p>Large commercial and industrial activities can represent the largest users in an urban area (<b>Volume 1, Section 6.2</b>). There is opportunity to explore water efficiency measures in these facilities to reduce overall water demand.</p> <p>In Tamworth, with the development of the Baiada abattoir (<b>Volume 1, Section 7.2</b>), as well as the Glen Artney industrial area, there is potential for water recycling that could be undertaken within this new industrial precinct that could then be shared with the water users in this location.</p>	Demand Management
Water Recycling – Urban	<p>Water recycling is currently used throughout many of the urban areas of the Namoi JO. For example, Tamworth and Gunnedah townships use water from their treatment plants on a nearby farms. This recycling can reduce overall demand on the system. However, the amount of water from the treatment plants is a relatively small proportion of overall irrigation demand in an area.</p> <p>There may be more efficient uses of this recycled water (in terms of the economic output per ML, and the overall volume of recycled water which is typically small for irrigation) (<b>Volume 1, Section 6</b>). This may include treating water to a higher standard (which would increase cost) for reuse on parks or for direct input for Industrial uses. Some examples are provided below:</p> <ul style="list-style-type: none"> <li>• Walcha – Walcha currently does not recycle water due to the treatment plant not meeting sufficient water quality standards for direct contact. However, it may be possible to use sub-surface irrigation of recreational areas (parks) that would allow for this water to be reused. Alternatively, the water may be suitable for uses such as water trucks for watering of gravel roads. The volume of water available is significant in comparison to Walcha’s daily demand;</li> <li>• Tamworth – the treatment plant water is currently used on a nearby farm. However, with the development of the Glen Artney industrial precinct, there may be potential for this water to be reused on this industrial area, if the water treatment can be raised to a sufficient level.</li> <li>• Gunnedah – similar to Tamworth, there may be industrial uses for water that may achieve a higher yield for the water.</li> </ul> <p>The potential for treated water to be reused with industrial or commercial users could be considered in the planning of any industrial or commercial precincts.</p> <p>The potential to adopt and expand stormwater harvesting practices could be an effective method of reducing extraction demand.</p>	Demand Management
Intensive Agriculture	<p>There is a growth in the intensive agriculture sector. Within the Namoi JO, this is understood to be particularly in the poultry sector and feedlots. In both situations, both require water availability and security. As a result, it is likely that these would develop along areas of high water strength as identified in <b>Section 3.1</b>.</p>	Planning

Opportunity	Comments	Issue
	<p>This can be used in conjunction with other planning to assist in facilitating agricultural development within the Namoi JO. This may include consideration of transport access to these areas, and connection with relevant supply chains.</p> <p>Water planning and water strength information should be integrated into overall SAP work that is currently being investigated (<b>Volume 1, Section 7.4</b>).</p>	
Agricultural Trends & New Agricultural industries	<p>Agriculture businesses typically respond to a number of factors including water availability, as well as market forces, transport, downstream supply chains and various input costs. Understanding water strength in the overall Namoi JO provides councils with an understanding of where new agricultural trends may emerge (<b>Volume 1, Section 9</b>).</p> <p>New agriculture that requires higher water use is likely to emerge in areas of high water strength. Conversely, new agriculture that has lower water dependency is likely to develop along areas of lower water strength. Understanding this relationship, together with other considerations such as transport and supply chains, can assist councils in planning and developing infrastructure to facilitate agricultural growth.</p>	Planning
Urban Growth	<p>The majority of the urban areas have sufficient water capacity in a normal year to meet the existing population demands (<b>Volume 1, Sections 7.2 &amp; 8.2</b>). There is potential growth capacity for many of the urban centres in the near term, subject to more detailed yield studies being undertaken.</p>	Planning
Shared Use Water Infrastructure	<p>There has been a significant increase in renewable energy development in Australia, including NSW. Part of the challenge with renewable energy is managing the power input to the grid. One potential solution for this is the use of pumped hydro in conjunction with other renewables (such as a solar farm).</p> <p>There is potential to “join forces” with such developments that require storage, to increase overall water storage capacity within the system. This would increase the potential access to funding for this type of development. A key challenge is that typically there is some competing interest (water use vs keeping water in the dam for pumped hydro).</p>	Water Supply
High Transmission Losses – urban supply	<p>There are relatively high transmission losses for a number of the regulated water supplies (generally greater than 20%) (<b>Volume 1, Section 6.7</b>). Opportunities to reduce these transmission losses would increase the available water for townships. This is particularly relevant to Tamworth, with associated losses along the Peel River between Chaffey Dam and Tamworth, Split Rock and Chaffey Dam (<b>Volume 1, Section 6.7</b>).</p> <p>Infrastructure projects including pipelines and underground storage will help manage this impact (e.g. a pipeline between Chaffey Dam and Dungowan Dam would help Tamworth Regional Council manage losses of direct releases from Chaffey Dam).</p>	Water Supply
Water Trading Efficiencies	<p>A significant portion of water licences are not used or traded on an annual basis (<b>Volume 1, Section 8.3</b>). This limits liquidity in the market</p>	Water Supply

Opportunity	Comments	Issue
	and potentially increases trading costs. Non-trading of licences is often associated with: <ul style="list-style-type: none"> <li>• Highly risk averse owners seeking better protection for the future</li> <li>• Individuals utilising water entitlement as a long-term investment</li> <li>• Lack of awareness of trading opportunities / mechanisms</li> <li>• Small / Lifestyle farming activities in which the magnitude of trade and associated transaction costs are high.</li> </ul> Education and information programs focussed on facilitating water trading opportunities will allow for improved water security to users	
Water Sharing Plan Engagement	There are numerous complexities regarding decision making regarding levels, limits and trading within WSPs. Open and constructive representation of the breadth of water demand and use by local government is required to aid setting/amendments to State water management.	Planning

### 3.3 Threats

There are a number of key threats to water security and the regional water dependent sectors of the economy within the Namoi JO. A summary of some of these key threats are provided in **Table 3-2**, and are classified into one of three categories:

- Availability/ Reliability – threats that may impact on the availability and/ or the reliability of water
- Demand – threats that may result in an increased demand on water, and therefore potential implications for overall water security
- Policy – changes to policy that have potential implications to water and how it is used in the Namoi JO.

Throughout the Namoi JO, there are different levels of potential vulnerability to changes in water availability. A general discussion on potential economic impacts and vulnerability from changes to water availability are provided in **Section 10 of Volume 1**.

**Table 3-2: Threats to Water Security<sup>8</sup>**

Threats	Comments	Issue
Climate Change	There is uncertainty as to the potential changes that might result with climate change ( <b>Volume 1, Section 3.4</b> ). However, the combination of temperature, evapotranspiration and rainfall changes may all have ramifications particularly in the agricultural sector. Different parts of the economy are more susceptible to reductions in water availability, as indicated in the community vulnerability index ( <b>Volume 1, Section 10.1</b> ) and the economic modelling of the Namoi JO ( <b>Volume 1, Section 10.2</b> ), which suggests that for about a 10% reduction in water availability, the economy of the Namoi JO would contract by	Water Supply

<sup>8</sup> Referencing to Volume 1 throughout this table is simplified. For example, Vol 1, S6 refers to Section 6 of Volume 1

Threats	Comments	Issue
	<p>0.4%. It is uncertain how the additional impact of temperature, and the types of crops that this might impact, may affect the economy.</p> <p>The largest part of the economy to be affected by climate change is agriculture, and in particular cotton. Deloitte (2012) suggested that a 10% reduction in water availability might result in around 7% reduction in output from cotton farming. There would also be subsequent “knock-on” effects for downstream industries from agriculture, which would be affected to different degrees (<b>Volume 1, Section 10.2</b>).</p> <p>Lower rainfall and higher temperatures and evapotranspiration will also influence the water supply for the various urban areas in the Namoi JO. Those areas with surface water supplies, rather than groundwater, are also likely to be more susceptible to increases in evaporation due to temperature increases.</p>	
Drought & Prolonged Dry Periods – Historic Planning Impacts	<p>Drought and dryer periods can have a profound effect on the agricultural economy. Deloitte (2012) (<b>Volume 1, Section 10.2</b>) noted that this was likely to be far more significant than the changes that they modelled on climate change and water reductions.</p> <p>The first nearly 20 years of this century has seen a much dryer annual rainfall, with the majority of years seeing below average rainfall (<b>Volume 1, Section 3.2</b>). However, this is not as significant as the dryer period in the earlier part of the 19<sup>th</sup> century, which saw long term annual average rainfall around 100mm lower than the current average annual rainfall, or around a 20% lower rainfall (<b>Volume 1, Section 3.2</b>). This was notably in a period prior to more intense irrigated agriculture (<b>Volume 1, Section 5.5</b>).</p> <p>As with Climate Change, drought and prolonged dry periods will also affect the urban water supplies. Some of the urban centres, such as Gunnedah and Liverpool Plains LGAs, are more resilient to dry periods due to their groundwater supplies (<b>Volume 1, Section 8.2</b>). Tamworth LGA has some resilience due to the relatively large storage at Chaffey and other supplies and provides some buffer for shorter dry periods. Walcha LGA is particularly susceptible to dry periods, due to the very low buffer storage available.</p>	Water Supply
Urban Growth – Residential	<p>Population growth in the urban centres will result in additional water demand. As identified in <b>Volume 1 Section 7.1</b> most of the urban centres are likely to have reasonable water entitlement to accommodate a growth of around 1%pa. However, it is uncertain as to what secure yields are for each of the urban centres as many have not had a yield study undertaken.</p> <p>Tamworth’s current planned growth to 100,000 people will provide additional pressure on its water supplies. A high level estimate (<b>Volume 1, Section 8.2</b>) suggests that Tamworth will reach their secure yield around 25 years earlier in 2035 than the current yield study estimates (Hunter H2O, 2015), due to the change in population growth estimates.</p>	Planning
Urban Growth – Large	<p>New large scale industrial or commercial heavy water users represent a potential threat to water supplies. For example, without mitigation and reuse measures, the proposed Baiada abattoir would represent around</p>	Planning

Threats	Comments	Issue
Industrial/ Commercial	<p>2.5GL/a, or roughly a 25% increase in water demand for Tamworth city and accelerate the need for additional water supplies (Vol 1, S7.2).</p> <p>If there is insufficient “excess” capacity in an urban water supply, this may result in industry identifying alternative locations for development (noting that water is one part of the overall consideration).</p>	
Urban Growth vs Agricultural Growth	<p>For the majority of urban areas in the Namoi JO, the urban water use is relatively small compared to the surrounding agricultural users and therefore increases in population are unlikely to represent a significant impact on surrounding users (<b>Volume 1, Section 6.8</b>).</p> <p>Tamworth, however, is slightly different given its relative dominance in the Peel River Catchment. At present, Tamworth does not use its full allocation (<b>Volume 1, Section 8.3</b>). However, with increasing population there would likely be increased use. This has the potential to erode some of reliability for general security license holders on the Peel River who have lower priority in terms of allocation.</p>	Water Supply
Water Sharing Plan Arrangements	<p>Potential changes to the Water Sharing Plans (and or Water Resource Plans) represent a potential threat to rural, and to a lesser degree, urban water users. Changes that result in reduced allocations (such as long term average annual allocations) and reductions trading ability change agricultural business viability in some catchments.</p>	Planning
High trading costs in Groundwater	<p>High trading costs, particularly in groundwater, for temporary trades results in small volume trades not occurring (<b>Volume 1, Section 8.5</b>). This reduces overall liquidity in the market. This reduces the ability of farmers to buy additional “top up” water in a particular year if needed.</p>	Planning
Valuation of Water	<p>The various water sources across the Namoi JO offer different values of water. Unregulated surface water represents the cheapest but most unreliable water sources. Groundwater is moderately cheap in comparison to regulated water sources and also the most reliable. Within the Namoi JO, farmers and water users undertaking the same activity may pay substantially different prices to do so. Higher water prices represents an accessibility cost, decreasing the security of water, and forfeiting competitive advantage. Decreases in the costs of water access will improve regional competitive advantage in production</p>	Planning
High purchasing power	<p>High purchasing power of some players in the market (e.g. mining) results in an elevation of pricing for temporary water trades (<b>Volume 1, Section 8.5 and 6.4</b>). This, together with the challenge above for trading costs, can lead to additional pricing pressure on agriculture.</p>	Water Supply
Groundwater Reliability	<p>Groundwater reliability, particularly in the Peel River Catchment, and Gunnedah and Liverpool Plains LGAs, has traditionally been very good. However, this current study has been unable to identify overall reliability of these aquifers and this remains uncertain (<b>Volume 1, Section 5.4</b>).</p> <p>While many of the irrigators on Liverpool Plains and Peel River Catchment have deep bores, the domestic and livestock license holders generally have shallower bores. These are generally the first to “run dry” during prolonged dry periods and groundwater drawdown.</p>	Water Supply

Threats	Comments	Issue
	<p>Outside of the “intensive irrigation” areas along the Peel River and around Liverpool Plains, there are a number of other groundwater users, many who use fractured rock groundwater supplies. There is uncertainty as to the reliability of these. During dry periods, such as the current drought, farmers become more heavily reliant on these bores. However, consultation in this project suggests understanding of the perceived reliability of these bores is driven by experience.</p>	
<p>Lack of buffer storage reduces reliability of water supply</p>	<p>Walcha LGA has limited off-stream storage, meaning only a certain amount of water can be captured from their unregulated water supply. This reduces the overall reliability of Walcha’s water supply (<b>Volume 1, Section 8.2</b>).</p> <p>In a similar manner, Tamworth LGA has limited off-stream storage from the Peel River. This can lead to challenges in extracting flows, particularly from bulk water releases from Chaffey, meaning that not all the release can be captured due to the rate of flow and extraction capabilities.</p>	<p>Demand Management</p>
<p>Agricultural adaptation hindered by policy</p>	<p>Agricultural businesses have historically been reasonably good at adapting to changes. For example, increased water availability led to the development of cotton in the Namoi. This relatively high yield crop has focused around the areas of water availability throughout the study area. There have been numerous other examples of new types of crops, including mung beans and turf farming that have been developed in different areas of the Namoi JO to respond to both water availability and other market forces.</p> <p>Changes in agricultural practices, and intensive agriculture in particular, can be dependent upon appropriate government approvals (environmental etc.). This can result in significant costs and time, which are restrictive to small to medium agricultural businesses.</p>	<p>Planning</p>
<p>Lack of diversity in urban water sources - Urban</p>	<p>Some urban centres are reliant on only one water source. For example, Gunnedah is wholly reliant on its groundwater resources. While these have traditionally been very reliable, if this aquifer becomes less reliable or is compromised, then there are no alternatives for water for Gunnedah.</p>	<p>Planning</p>

## 4 Recommendations and Conclusions

Based on the outcomes of the SWOT analysis a preliminary list of recommendations was developed to support the strengthening of water security and the overall economic growth and development of the region. Recommendations were categorised into three broad types:

- Studies and Assessments – Focussed on addressing data gaps and fostering regional improvements in water management
- Planning and Policy – Changes to current practice to strengthen water security
- Infrastructure and Actions – Potential short-term and long-term infrastructure (hard and soft) to strengthen water security.

Recommended short-term priorities (to be completed within the next three years) are flagged with blue shading.

### 4.1 Studies and Assessments

Recommended studies and assessments for consideration are detailed in **Table 4-1**.

**Table 4-1: Studies and Assessments - Recommendations**

No.	Issue	Recommended Response	Relevant LGA
1	Water Security	<p>Conduct/ update secure yield studies. Secure yield studies will quantify whether town water sources and entitlements are sufficient to account for current and forecast growth volumes.</p> <p>The secure yield studies could be accompanied by a review of how forecast future demand requirements will impact upon availability for non-urban water users.</p> <p>As a minimum this could be undertaken for major town centres within each LGA. Sensitivity testing on growth scenarios will be important to gain an understanding of the level of resilience.</p> <p>Further consideration of a regional secure yield study including agricultural demand could be a new and valuable source of information in context of potential regulatory changes.</p>	Whole of JO
2	Water Management	<p>Development / update of the IWCM framework.</p> <p>Besides aiding in establishing a good understanding of water usage and management, completion of IWCM documentation will facilitate applications for and release of funding from State agencies.</p> <p>There may be synergies in procurement for a region wide IWCM update.</p>	Whole of JO
3	Water Management	<p>Update of water demand and drought management studies. The status of these reports varies across the Namoi JO.</p> <p>Besides aiding in establishing a good understanding of water usage and management, completion of IWCM documentation will facilitate applications for and release of funding from State agencies.</p>	Whole of JO

No.	Issue	Recommended Response	Relevant LGA
4	Availability / Reliability	Collaboration with NSW DPI regarding that status and operational conditions of bores across the LGAs and how available data may be better used to inform both councils and individual land-owner water use decisions (e.g. need for investment in deeper bores).	Liverpool Plains Gunnedah Gwydir
5	Demand Management	Undertake a case study cost-benefit analysis of land development trade-offs in regard to agricultural productions options and urban development options.  This will inform decisions regarding expansion of urban water demand use during periods of constrained availability.	Whole of JO
6	Water Management	Whole of life embedded water studies of the key industries within the region to demonstrate how water is captured/recycled within the region. The potential to expand upon previous studies undertaken (e.g. Deloitte, 2012) should be considered.	Whole of JO
7	Water Availability	Review smaller town urban areas and water security and see whether the adequacy of security is consistent with State standards. Preliminary assessment as a result of the Namoi for the Future Strategy indicates that there may be issues with some urban areas within the Namoi JO. It is understood that NSW DPI also maintains level of service requirements for town supply.	Whole of JO
8	Development	Identify those areas of high Water Strength which are not currently associated with high productivity activities. Review other constraints (e.g. topography, road access, proximity, energy) that may limit development.	Whole of JO
9	Water Management	Conduct a review of farmer industry communication and education practices, locally, regionally, nationally and internationally to improve adaptability of practices	Whole of JO
10	Development	Establishment of a more detailed database of land-use activities within LGA areas to aid in understanding of both productivity and water demand.	Whole of JO
11	Development	Assess current and future demand for secondary industries that support Mining and Agricultural activities across the region within urban centres (e.g. provisioning, accommodation). The location of such industries/providers may affect regional town water demand and security.	Whole of JO
12	Development	Refine and update Water Dependency modelling and mapping (e.g. Deloitte 2012) to incorporate water security measures to allow observation and quantification of socio-economic sensitivity to changes in water availability.	Whole of JO

## 4.2 Planning and Policy

Recommended planning and policy changes for consideration are detailed in **Table 4-2**.



Table 4-2: Planning and Policy - Recommendations

No.	Issue	Recommended Response	Relevant LGA
1	Water Management	<p>Development and implementation of Water Sensitive Urban Design (WSUD) policy within urban areas.</p> <p>WSUD is a well-recognised approach to managing water in urban environments in a way that minimises the negative impacts of urbanisation and maximises economic, social and environmental benefits. It has the potential to deliver more liveable cities by providing green space, assisting the management of flood risks and impacts, reducing urban temperatures, maintaining home gardens, higher property values, reducing the flow of pollutants to natural waterways and minimising the need for expensive infrastructure upgrades through reduced water demand.</p> <p>None of the member councils currently maintain comprehensive WSUD policies. There is an opportunity to develop a single WSUD policy for the Namoi JO which would provide savings and efficiencies.</p>	Whole of JO
2	Demand Management	<p>Review the potential for establishment / participation in local or state rebate schemes for householder water systems, e.g.:</p> <ul style="list-style-type: none"> <li>• Water efficient taps/shower heads</li> <li>• Water Tanks</li> <li>• Astro-turf.</li> </ul>	Whole of JO (many LGAs may already apply these)
3	Water Conservation measures	<p>Review whether the permanent water conservations measures may be tightened to reduced net water usage without materially affecting amenity</p>	Whole of JO
4	Planning Approval	<p>Review the current location of areas of water strength / weakness and identify whether current land zonings and permitted activities are consistent with the opportunities afforded by the available water strength. In particular, identify areas in which intensive agriculture may be facilitated by water strength and engage with DPC and DPE regarding opportunities to improve the approvals process (such as the current investigations into the SAP).</p> <p>In particular, a regional approach to planning that considers both upstream and downstream industries and associated water demand is critical. For example, expansion of a chicken abattoir in Tamworth will increase its water demand, as well as increasing water demand for chicken shed production in the surrounding parts of the LGA, which in turn may stimulate grain production and associated water use in other member LGAs</p> <p>Co-location of water intensive industries with supply/recycling locations will also lower costs of water distribution.</p>	Whole of JO

No.	Issue	Recommended Response	Relevant LGA
5	Water Harvesting	<p>Engage with State authorities regarding Council harvesting opportunities.</p> <p>There are restrictions on the ability for all councils to harvest supplementary flows. Easing of these conditions may also require infrastructure improvements to aid in storage of harvested waters.</p> <p>An alternative may be to coordinate with private landowners in suitable geographic locations as to storage/use/access.</p>	Whole of JO
5	Water Markets	<p>Engage with State authorities regarding the potential for councils to more actively trade water allocation/activity, potentially acting as a broker/bank in some scenarios.</p> <p>Councils to review the potential to utilise temporary trading as a way to generate income / regulate supply.</p>	Whole of JO but in particular: Tamworth, Gunnedah and Liverpool Plains
6	Water Security	<p>Council's with council operated water sources (e.g. Dungowan and Quipoly) to consider making water sources available to individual landowners under certain conditions. This may increase liquidity in water trading.</p>	Tamworth Liverpool Plains Gwydir
7	Water Management	<p>Require new commercial/industrial development to include demonstrable water efficiencies measures (e.g. RO systems) to maximise re-use and minimise losses.</p> <p>Where commercial and industrial activities are part of a large new industrial area, such as Tamworth's Glen Artney area, there is potential to have a shared treatment system. In this approach, water rates or development contributions might provide suitable funding for this.</p>	Whole of JO
8	Water Management	<p>Engagement with NSW EPA regarding the potential re-use of wastewater conservation measures/requirements applicable to Councils, with a focus on public recreation areas and roads/construction dust suppression.</p>	Whole of JO
9	Development	<p>Some councils may have a comparative advantage in water security in comparison to other member councils. Regional planning decisions should consider location of water intensive industries that reflects comparative advantage.</p>	Whole of JO
10	Water Security	<p>Councils to undertake a risk-based review of the security of their water supply in terms of diversity of sources, likelihood of failure (e.g. contamination) and management / response actions</p>	Whole of JO

### 4.3 Infrastructure and Actions

Recommended infrastructure and actions for consideration are detailed in **Table 4-3**.

Table 4-3: Infrastructure and Actions - Recommendations

No.	Issue	Recommended Response	Relevant LGA
1	Short Term Water Supply	<p>Walcha requires an additional off stream storage to secure water for the community.</p> <p>The additional storage would provide enhanced management of demand and improve security. Additional extraction volumes may be required at a later date to meet demand. However, additional storage represents the current priority. There is no current proposal to increase the volume of water drawn from the Macdonald River to secure Walcha's supply, even with a new off stream storage.</p> <p>There are two significant unregulated water sources which may be able to be used to supply the additional storage areas: The Macdonald River and Apsley River.</p> <p>Investigations undertaken by Council and NSW Government indicate that use of the Apsley is unlikely to be feasible, and that the use of the Macdonald River may provide more viable options.</p> <p>However, use of the Apsley River as part of the solution (either short-term or long-term), if viable, would be unique to other sources within the Namoi JO extent as the river does not form part of the Murray-Darling system. Consequently, any use of the Apsley River (either from avoided use or cross-catchment supplements) would reduce water demand on the Macdonald River and broader Murray-Darling. Utilising multiple water sources would also increase reliability of supply and protect against contamination impact risk.</p> <p>It is understood that Walcha Council is currently pursuing infrastructure options to address off-stream storage requirements through a process which considers both water sources, the feasibility of options, impacts to downstream water users and potential integration with other industry developments.</p>	Walcha
2	Medium Term Water Supply	<p>Tamworth LGA does not have sufficient water security to meet medium term demand requirements, particularly under the current projected population. Planning for additional water supply in the short term has commenced. Water constraints in the medium term will limit the number of water intensive industrial facilities able to be sustained.</p>	Tamworth
3	Water Supply	<p>Redistribution of recycled waste water from local farm schemes to local commercial / industrial operations where possible. This may be a more efficient water use in some situations.</p> <ul style="list-style-type: none"> <li>For example, in Tamworth the treatment plant water is currently used on a nearby farm. However, with the development of the Glen Artney industrial precinct, there may be potential for this water to be reused on this nearby industrial area, if the water treatment can be raised to a sufficient level.</li> </ul>	Whole of JO (where applicable)

No.	Issue	Recommended Response	Relevant LGA
		Could be applied in other towns with sufficient supply / industry (e.g. potential intensive agriculture opportunities).	
4	Water Supply	<p>A number of towns are dependent upon a single water source, including:</p> <ul style="list-style-type: none"> <li>• Walcha</li> <li>• Bingara</li> <li>• North Star</li> <li>• Carroona</li> <li>• Curlewis</li> <li>• Nundle.</li> </ul> <p>Review opportunities to improve emergency alternatives through additional infrastructure.</p>	Whole of JO
5	Water Security	<p>Consideration of piping and underground storage rather than using surface water flows to minimise transmission losses.</p> <p>For town supplies this could be done via pipeline between dams and other storage areas (e.g. a pipeline from Chaffey Dam to Dungowan Dam for Tamworth Regional Council).</p> <p>This could be linked to either town usage or major irrigation areas.</p>	Whole of JO
6	Water Availability	Establishment of additional bores / stand pipes in regional areas managed by councils but potential accessible to local landowners for domestic / stock watering to improve water reliability.	Whole of JO
7	Water Management	<p>Walcha LGA to review the potential infrastructure requirements (both treatment and distribution) to utilise its waste water treatment storage.</p> <p>The volume of wastewater stored is considerable in comparison to town demand levels.</p>	Walcha
8	Education	<p>Education programs to encourage water trading.</p> <p>There is a lack of liquidity within some of the water trading markets, contributing to higher prices and limited availability. Education of water licence holders as to methods and benefits of trading will facilitate market function (e.g. the waking up of sleeper licences)</p>	Whole of JO
9	Education	Sustainable water use education / campaigns in LGAs in which current water usage is likely to exceed state averages per householder (e.g. Gunnedah and Gwydir).	Gunnedah Gwydir
10	Water Management	<p>Implementation of Stormwater Harvesting initiatives.</p> <p>A number of towns, particularly small towns, are likely to have significant opportunities for implementation of stormwater harvesting infrastructure. This will be dependent on Item 5 in <b>Table 4-2</b>.</p> <p>The need and applicability of this would be assessed as part of the IWCM process</p>	Whole of JO

No.	Issue	Recommended Response	Relevant LGA
11	Long Term Security and Development	<p>In general, the majority of the geographic area of the Namoi JO is unlikely to significantly alter in land-use in the long term unless significant investment in water transfer/reticulation is undertaken.</p> <p>Potential large-scale infrastructure options should continue to be identified and assessed as technology and sources are identified.</p> <p>Review of current options do not identify any immediately viable large-scale options. Those with potential may include:</p> <ul style="list-style-type: none"> <li>• Upgrade of Dungowan Dam in associated with renewable energy / pumped hydropower</li> <li>• Cross-catchment transfer pipeline (Apsley / Manning to the Namoi) in association with other energy ventures.</li> </ul> <p>Both of these may involve significant environmental and social impacts which would need to be considered and managed in order for such a project to proceed.</p> <p>The nature of large-scale infrastructure changes is that they generally will have impacts both positive and negative.</p> <p>Other long-term options exist which should be considered as part of long-term regional planning. It is recommended that long-term planning options be actively reviewed on a periodic basis.</p>	Whole of JO

## 5 Conclusions

The water resources within the Namoi region play a significant role in shaping agricultural activity both within north-west NSW and across the Murray Darling Basin. The Namoi JO is a net exporter of water, capturing the headwaters of the Namoi, Peel and Apsley River systems, and contributing substantially to flows within the Gwydir River system. These river systems and associated alluvium groundwater resources, along with the groundwaters of the Great Artesian Basin form the basis of the majority of irrigated agricultural activity within the region. In particular, the groundwater resources of the Great Artesian Basin and Namoi Alluvium represent the largest and most reliable water sources available for extraction.

The ability for individual landowners to extract water from both ground and surface water resources has been significantly shaped by the Water Sharing Plans and Water Resource Plans adopted by the NSW and federal governments, such that in excess of 70% of water resources are not available for access as they are maintained as part of sustainable diversion limits / annual average extraction limits. In practice, in any given year the available water for extraction exceeds the current usage demand. However, in the majority of years there is sufficient rainfall such that the need for extraction is low. Conflicts and constraints in water demand arise in years of drought during which the need to use a greater proportion of entitlements occurs. However, it is in such times that often there is insufficient overall water volumes in surface water sources and storages to supply the demand volumes, firstly affecting unregulated and then regulated water sources. To date, the groundwater resources, although demonstrating evidence of decline and drawdown, have generally remained secure. However, the longer-term recharge of aquifers following sustained elevated extraction levels remains ill-defined across the Namoi JO.

There is a lack of knowledge regarding the security of water supply for the majority of towns across the Namoi JO, which is of particular concern for those towns solely reliant on regulated river or unregulated river resources such as Walcha and Tamworth. Walcha currently has inadequate water security and requires additional storage areas to be developed. Tamworth is likely to have inadequate water security within the next 20 years, potentially sooner with its forecast residential and industrial growth. There are also a number of individual small towns with elevated risks. The LGAs of Liverpool Plains, Gunnedah and Gwydir have generally higher water security levels due to their reliance on groundwater resources. Quirindi and the surrounding towns in the Liverpool Plains may have the lowest risks associated with water security through its ability to access a diversity of water sources.

However, security into the future is also noted to be a function of scale. For example, a development within a large town may not significantly alter overall security levels, while the same development in a smaller town may use up a larger proportion of any available excess water and rapidly reduce security. This has the potential to affect regional development in situations in which the lack of scalability in water supply in a small regional town may deter large-scale investment (e.g. a mining development may require supporting accommodation to be established, this may be easily accommodated within a larger urban centre but may overwhelm the secure supply of smaller centres).

Agricultural water demand and security differs from that of the urban areas, being heavily shaped by the Water Access Licences of landowners and requirements of applicable Water Sharing Plans. Water strength mapping undertaken and comparison with land-use mapping confirms that market forces currently effectively drive the optimisation of land-use choices to reflect the availability and reliability of water, with highly productive, water intensive activities aligning with the locations of greatest water strength. The mapping does also indicate that there are some areas in which water strength may not being optimised in its use, and areas in which other

factors may be driving land use (e.g. areas of mining are defined primarily by resource extent and secondarily by water access/transport access etc.). Stakeholder engagement indicates, that there are some areas of conflict between urban and agricultural water users, but this is predominantly limited to the Peel River and Tamworth. The majority of other urban areas represent a relatively small water demand in comparison with regional agricultural use.

Stakeholder engagement activities suggest that the ability to have reliable access to water in drier periods is of chief concern. It is reasonable to ask whether an individual agricultural business owner should face a different level of water security in comparison to an individual urban business owner, both of whom obtain water for the same water source, though one directly and the other via a local water utility. Application of secure yield standards to an individual or agricultural region may present further understanding on the adequacy of current water sources. Moreover, planning decisions around the siting of significant industrial or intensive agricultural activities need to consider impacts to both local and regional water demand upstream and downstream, particularly as the Namoi JO pursues an integrated approach to regional development.

The current level of water security and availability is such that the region does not have large quantities of untapped or excess water that can readily be accessed and the opportunity for new large-scale dams with potential to open up new regional industries is low. The most likely significant gains from water supply improvements are likely to be associated with water infrastructure improvements within Walcha. The potential transfer of water from the eastern side of the dividing range (e.g. the Apsley River) to the western side represents potentially the lowest cost way to significantly increase water availability within at least the southern portions of the JO. However, even such an option as this would be economically and regulatorily challenging and beyond the remit of the local councils and the Namoi JO.

Consequently, it is likely that water's role in the economic development of the Namoi region will be gradual and evolutionary in nature, rather than revolutionary as occurred following construction of the large dams in the 1950s and 1960s. The volume and breadth of available resources is such that there remains substantial opportunity for new industries to take advantage of spare capacity/water strength in some locations, particularly within groundwater accessible areas. Locations without groundwater access or access to a regulated river water sources are significantly more constrained, particularly across Walcha LGA, north-eastern Tamworth LGA and southern Gwydir LGA. Such areas remain primarily dependent upon rainfall for water supply and are likely to remain so into the future. The consideration of long-term water security levels, across the Namoi JO, has the potential to significantly shape regional development planning, facilitating the identification of competitive advantages in both agricultural and urban production that the region can leverage off to promote sustainable growth into the future.

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