



Natural
Resources
Commission

Review of Water Sharing Plans Due to Expire in 2017 or 2018

April 2016



Enquiries

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List of acronyms

GDE	Groundwater Dependent Ecosystem
LLS	Local Land Services
LTAAEL	Long-term Average Annual Extraction Limit
SDL	Sustainable Diversion Limit
WRP	Water Resource Plan
WSP	Water Sharing Plan

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Table of Contents

Executive summary	1
1 Overview of water sharing plans	3
1.1 Current structure of water management in NSW	3
1.2 Relationship to the Murray-Darling Basin Plan	3
2 Water sharing plan reviews	5
2.1 The Commission's review role	5
2.2 DPI Water's review scope	7
2.3 Which water sharing plans does the review cover?	7
2.4 Drought conditions	12
2.5 Evidence sources	13
3 Review findings	15
3.1 Inland alluvial aquifer plans	15
3.2 Water Sharing Plan for the Paterson Regulated River Water Source	27
4 Recommendations	33
4.1 Priorities	33
4.2 Additional improvement areas	36
4.3 Sustainable diversion limits and the Basin Plan	37
Attachment A - Water sources covered by the water sharing plans	38
Attachment B - Summary of public submissions	39

Executive summary

Water sharing plans are statutory instruments under the *Water Management Act 2000* that typically have a ten year term. They prescribe how water is managed to achieve sustainable water management that supports economic, social, cultural and environmental outcomes.

Seven water sharing plans are approaching expiry in June 2017 or June 2018. Six plans apply to inland alluvial aquifers in the Murray-Darling Basin and one to a coastal regulated river. The approaching expiry of the plans triggers Section 43 A of the *Water Management Act 2000*, requiring the Natural Resources Commission (the Commission) to review plan achievements to date. The Act specifically requires the Commission to report on:

- the extent to which water sharing provisions have materially contributed to the achievement, or the failure to achieve, state priorities for Local Land Services (within the meaning of the *Local Land Services Act 2013*) that relate to natural resource management
- whether changes to these provisions are warranted.

The Minister for Lands and Water is to consider this report and any recommendations when deciding to extend the term of a plan or make a new plan.

At the time of this review, Local Land Services was finalising strategic plans and state priorities, and was using transitional Catchment Action Plans to guide investment. The Commission therefore referred to key national, state and regional policies and plans to identify the following desired outcomes from water sharing plans:

- productive and resilient water-dependent industries
- secure long-term water supplies for urban and rural communities
- healthy and resilient water-dependent ecosystems.

The review was undertaken with limited information on outcomes in regard to four key areas: model recalibrations, aquifer water level recovery trends (at the water source scale), identification of environmental values and Aboriginal cultural values. These knowledge gaps affected the Commission's capacity to assess some aspects of plan implementation and make recommendations regarding plan provisions. DPI Water is currently working to remedy these knowledge gaps and update information underpinning the plans. Water level recovery trends and model recalibrations require further work as a priority. This information is important and, once available, will provide a more comprehensive understanding of whether plan provisions have achieved objectives.

Inland alluvial aquifer water sharing plans

The Commission recommends replacing the inland alluvial water sharing plans to incorporate current science and knowledge, improve monitoring and reporting, and deliver better outcomes for all water users. New plans should incorporate the numerous positive developments achieved by the current ones.

Despite limited information, there are several ways the plans have contributed to the three desired outcomes identified for the review.

Inland alluvial water sharing plans are contributing to water dependent industries by supporting economically efficient use of water, and providing certainty about entitlements and extraction limits. This has assisted with business planning over the life of the water sharing plans. The plans have also helped support communities and industries in areas that do not have direct access to

surface water, and in buffering the impacts of drought. However, stakeholder submissions indicate that phased reductions in water entitlements in line with the sustainable yield of the aquifers, appear to have impacted on communities that depend on irrigation.

The review recognises the role of the water sharing plans in protecting aquifer health and associated values, however, their contribution to water dependent ecosystems and Aboriginal cultural values is unclear, primarily as these values are still being identified. DPI Water is in the process of clarifying this information. At the time of this review, the Aboriginal Water Initiative team faced uncertainty about funding for identification of water-dependent Aboriginal cultural values. This funding is important, and should be sustained to identify these values and update plan provisions accordingly.

Water Sharing Plan for the Paterson Regulated River Water Source

Overall, the *Water Sharing Plan for the Paterson Regulated River Water Source 2007* is of value to the water users, communities and the environment that the water source supports. The Commission recommends that any replacement plan should incorporate current science and knowledge, and to ensure consistency with the *Water Sharing Plan for the Hunter Regulated River Water Source* that is currently undergoing replacement. Specifically, the model underpinning the plan does not reflect current climatic data or up-to-date information on development in the Paterson valley that may influence water use. Water-dependent Aboriginal cultural values are also yet to be identified, and submissions suggest there should be greater flexibility to use planned environmental water for cultural purposes.

Recommendation to the Minister

The Commission recommends **replacement of the seven water sharing plans** through:

- ten recommendations specific to the six plans governing inland alluvial aquifers in the Murray-Darling Basin
- six recommendations specific to the *Water Sharing Plan for the Paterson Regulated River Water Source 2007* (in the Hunter region)
- four recommendations applying to all seven plans and any future water sharing plans.

Replacing the water sharing plans creates opportunities to:

- deliver better water sharing outcomes for all stakeholders
- ensure current science and knowledge is at the forefront of water planning and reform
- address monitoring, evaluation and reporting issues which could improve knowledge of plan outcomes into the future
- improve community involvement in water planning by incorporating local knowledge
- improve consistency with other plans, including those that are currently being replaced.

A final consideration for this review is that water sharing plans are part of a broader framework of water reform. Water sharing plans that govern water sources in the Murray-Darling Basin will become components of water resource plans required under the Murray-Darling Basin Plan. Replacement of inland alluvial water sharing plans will therefore provide an opportunity to address water resource plan accreditation requirements.

1 Overview of water sharing plans

Water sharing plans are statutory instruments under the *Water Management Act 2000*. They establish rules for how water in a particular water source is shared and managed to achieve sustainable water management that supports economic, social, cultural and environmental outcomes. They are an instrument for addressing risks to the long-term sustainability of water sources, and the communities and ecosystems that these water sources support.

Six water sharing plans are due to expire in June 2017 and an additional plan is due to expire in June 2018 (*Water Sharing Plan for the Lower Lachlan Groundwater Source*). Any amendments or replacement water sharing plans should refer to the progress made to date, the future relationship between these plans and the national agenda, and the governing bodies described in this section.

1.1 Current structure of water management in NSW

As shown in **Figure 1**, a number of NSW agencies are involved in water sharing plan implementation, including:

- **DPI Water** is responsible for surface and groundwater management in NSW, including the development and implementation of statutory water sharing plans.
- **Water NSW** manages bulk water delivery in accordance with plan provisions, manages water allocation accounts and assignments, maintains and operates water delivery infrastructure, and monitors compliance.
- **Local Land Services (LLS)** has a statutory role to consider water sharing plans when developing its state strategic plan and local strategic plans for each LLS region. Local strategic plans can also include provisions relating to water quality. Such provisions may help improve the condition of NSW water resources and water dependent ecosystems.
- **Office of Environment and Heritage** – the Minister for the Environment has a concurrence role for making water sharing plans. The Minister and the Office of Environment and Heritage are also responsible for managing Environmental Contingency Allowances (provided under the water sharing plans) and NSW environmental water holdings (acquired through purchases on the water market).

1.2 Relationship to the Murray-Darling Basin Plan

As mentioned above, an important factor affecting this review of NSW's water sharing plans is that they will become part of an interjurisdictional framework. Specifically, water sharing plans for water sources in the Murray-Darling Basin will form components of the new water resource plans that NSW committed to when it agreed in February 2014 to implement the Murray-Darling Basin Plan (the Basin Plan). The state, through its key agency DPI Water, committed to developing water resource plans for accreditation by the Commonwealth Minister responsible for water (see **Figure 1**). These plans will serve to better align Basin-wide with state-based water resource management.

The Basin Plan establishes sustainable diversion limits that come into effect when the applicable water resource plans commence. Sustainable diversion limits define the volume of water that can be taken for human use from Basin water sources, and reflect an environmentally sustainable level of take (as required under the Commonwealth *Water Act 2007*).

Given water sharing plans will form a component of the water resource plans, the plans will need to address a number of Basin Plan accreditation requirements while continuing to fulfil their current role. Meeting Basin Plan requirements will require other documents that complement the

water sharing plans. The water resource plans will likely include relevant water sharing plan(s), relevant policies and strategies, an overview report and index. DPI Water is responsible for developing these products and is responsible for delivering 22 water resource plans by 1 July 2019.

Reviews of water sharing plans that apply to water sources in the Murray-Darling Basin also have the potential to improve consistency and compliance with NSW legislation and Commonwealth water legislation, and deliver better outcomes.

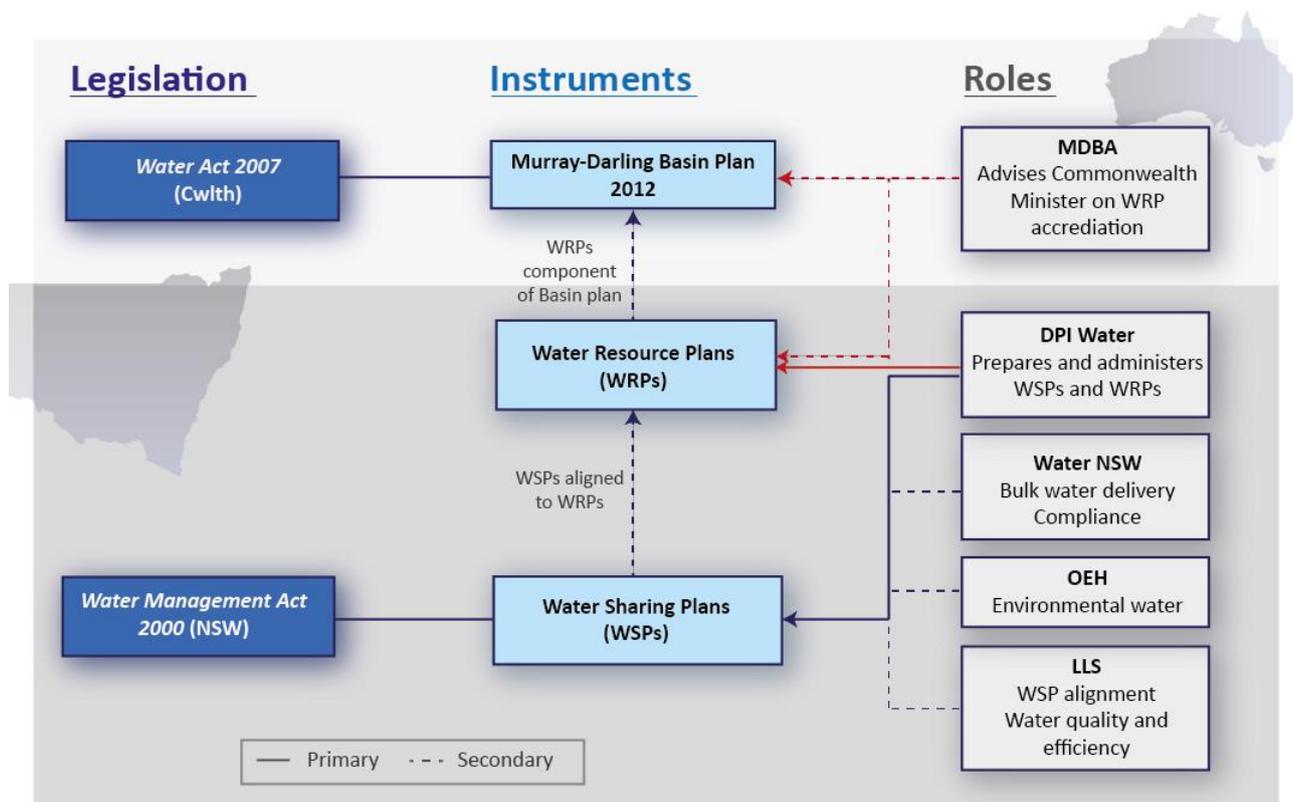


Figure 1: Implementation of water sharing plans (WSPs) and water resource plans (WRPs)

2 Water sharing plan reviews

2.1 The Commission's review role

In 2013, the Commission reviewed 31 water sharing plans, including 14 plans that govern water sources in the Murray-Darling Basin.¹ These plans were found to be an improvement on water sharing arrangements in place prior to plan commencement (2004), and likely contributed to state-wide natural resource management targets. The Commission also found that there was some alignment between these plans and natural resource plans (Catchment Action Plans) developed by Catchment Management Authorities.² However, the ability of the Commission to assess the extent of materiality of this contribution was limited by a lack of information on water sharing plan outcomes. The Commission recommended replacement of these plans, indicating that consumptive users and the environment would benefit, and reporting that improvements to monitoring, evaluation and reporting would help to address knowledge gaps.

Since this inaugural review of water sharing plans by the Commission, the institutional context for water planning and natural resource management has evolved in the following key ways:

- NSW is participating in implementation of the Basin Plan and is committed to developing 22 Basin Plan consistent Water Resource Plans by 1 July 2019
- Catchment Management Authorities have been replaced by Local Land Services (LLS). The new agency has taken over the CMA natural resource management role and additional responsibilities including agricultural advisory services, biosecurity and emergency management

Amendments to the *Water Management Act 2000*, following the establishment of LLS, saw the Commission's review role shift to reporting on how water sharing provisions have contributed to the achievement of priorities for LLS, and whether changes are necessary. Specifically section 43A of the Act requires the Commission to report on:

- the extent to which water sharing provisions have materially contributed to the achievement, or the failure to achieve, State priorities for Local Land Services (within the meaning of the *Local Land Services Act 2013*) that relate to natural resource management
- whether changes to these provisions are warranted.

These reviews will inform the Minister's decision on whether to extend or replace the current plans.

The Act also requires the Commission to call for submissions to inform the review and to consider any other relevant national, state-wide or regional government policies or agreements that apply to the catchment management area.

At the time of this review LLS was finalising its State Strategic Plan, local strategic plans and a draft water policy. These documents were not publicly available when the Commission was scoping its review. In their place, the Commission derived key outcomes from policies, plans and agreements relevant to LLS and water management, which are considered current State-wide priorities that relate to natural resource management. The goals and strategies in the draft strategic plans align with the outcomes derived by the Commission for the review. The Commission also

¹ Natural Resources Commission, 2013, *Review of 2004 water sharing plans*, June 2013, Sydney. Available: <http://www.nrc.nsw.gov.au/water-sharing-plan-reviews>

² The Commission's first review of water sharing plans examined alignment of Catchment Management Authorities' Catchment Action Plans with water sharing plans.

adopted the following definition of natural resource management for the purpose of this review. It reflects the broader roles of LLS and diverse values of water resources:

Natural resource management encompasses the stewardship of water, land, vegetation and other natural resources for multiple purposes, including agricultural production, town water supply, conservation, recreation, cultural values and uses, and a range of other services. Balancing these competing services and sustaining natural resources for the long-term is essential so that quality of life of both present and future generations is enhanced.

Policies, plans and agreements considered in scoping this water sharing plan review include the National Water Initiative, Murray-Darling Basin Plan, NSW Agriculture Industry Action Plan, NSW Aquifer Interference Policy and the Performance Standard for LLS.

The Commission's analysis of these policies helped to develop the following economic, social, cultural and environmental outcomes expected from a sound water sharing plan:

- productive and resilient water-dependent industries
- secure long-term water supply for rural and urban communities (this includes basic landholder rights, native title rights, water for sustaining cultural values and town water supply)
- healthy and resilient water-dependent ecosystems.

Evaluation questions used to assess the contribution of water sharing plans to these outcomes and to identify plan improvements that would lead to better outcomes, while also addressing Basin Plan requirements are set out in **Figure 2**.

The *Water Sharing Plan for the Lower Murray Groundwater Source* also requires the Commission to consider the following when conducting its review:

- the outcomes of recalibration and refinement of the groundwater management model for the area this plan applies to (including any resulting changes to the estimated recharge figure), and the impact that any variation in irrigation losses may have on the estimated recharge of this groundwater system
- the outcomes of further studies of the groundwater dependency of ecosystems both within and beyond the groundwater resource.³

However, DPI Water had not completed a model recalibration at the time of this review.

³ Department of Land and Water Conservation and PPK Environment and Infrastructure Pty Ltd, 2000, *Identification of Groundwater Dependent Ecosystems within Groundwater Management Area 016*

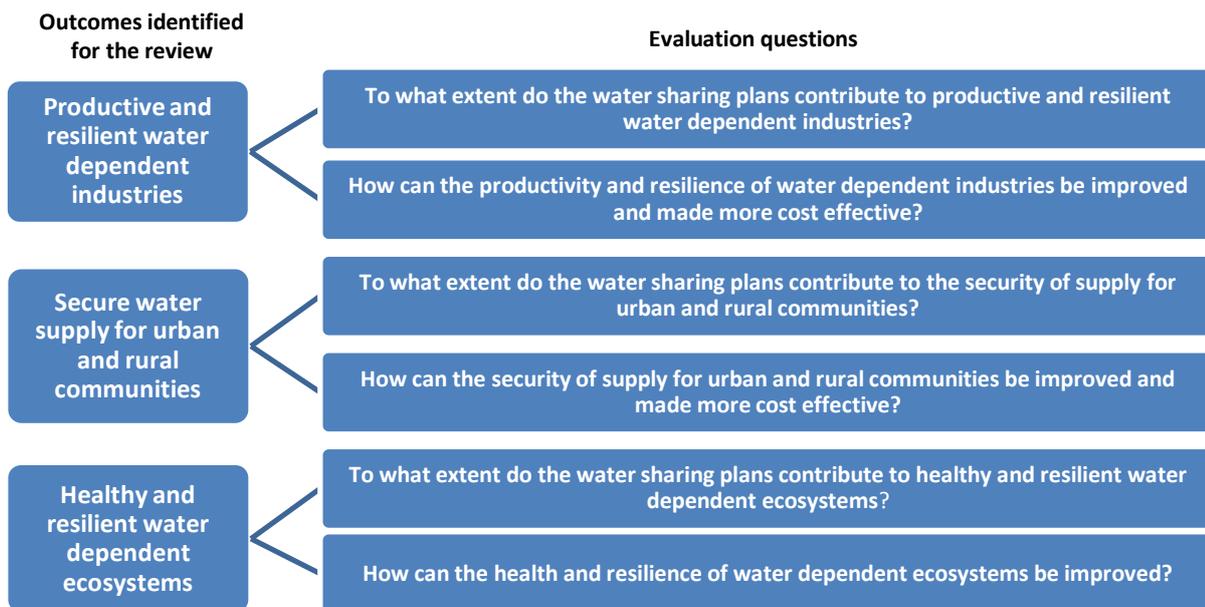


Figure 2: Outcomes and evaluation questions formulated for the review of water sharing plans

2.2 DPI Water's review scope

DPI Water will provide separate advice to the Minister based on its own investigations into three broad areas: the clarity, practicality and consistency of plans; opportunities to reduce risks; and methods of improving plan outcomes. If the Minister decides to make new plans, DPI Water will be responsible for developing them while ensuring that any new plans for water sources in the Murray-Darling Basin address requirements set out in the Basin Plan.

2.3 Which water sharing plans does the review cover?

The review examined seven water sharing plans that are approaching the end of their 10-year term:

- six inland alluvial aquifer plans in the Murray-Darling Basin:
 - Lower Gwydir Groundwater Source 2003 (commenced in 2006)
 - Lower Lachlan Groundwater Source 2003 (commenced in 2007)
 - Lower Macquarie Groundwater Sources 2003 (commenced in 2006)
 - Lower Murray Groundwater Source (commenced in 2006)
 - Lower Murrumbidgee Groundwater Sources 2003 (commenced in 2006)
 - Upper and Lower Namoi Groundwater Sources 2003 (commenced in 2006)
- Paterson Regulated River Water Source 2007

Plan areas are shown in **Figure 3**. Information on the water sources that these plans cover is provided in **Attachment A**.

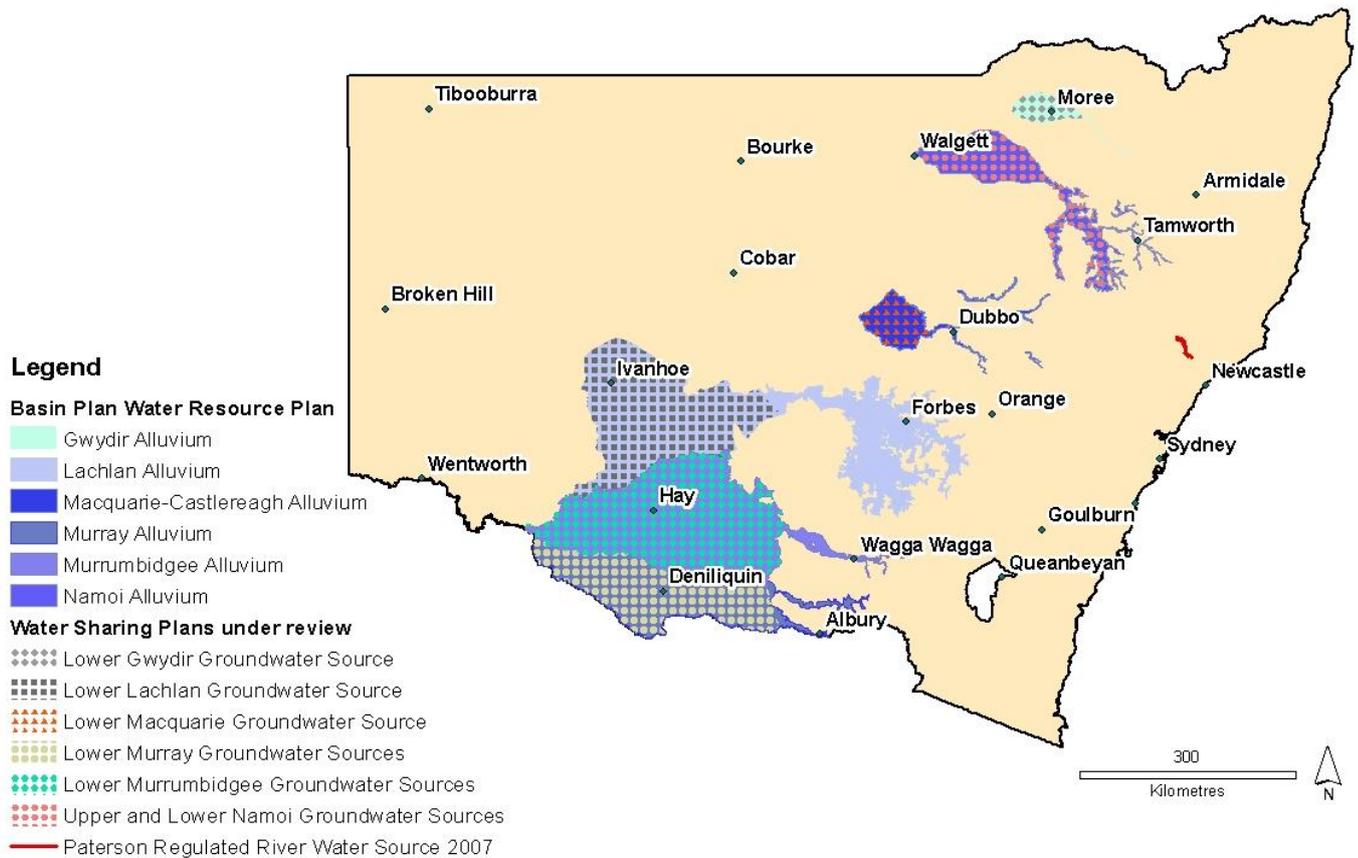


Figure 3: Location of the water sharing plans under review and corresponding water resource plan areas from the Murray-Darling Basin Plan

2.3.1 Water sharing plans governing inland alluvial aquifers

The inland alluvial aquifers to which the above-listed water sharing plans apply have a history of groundwater use, primarily associated with the development of irrigation in inland New South Wales and the broader Murray-Darling Basin.⁴ These aquifers are an important resource for industries and communities that may be partially or entirely dependent on groundwater. Rising competition for surface water and the benefit of these aquifers as a valuable alternative supply when surface water becomes scarce, have contributed to a growth in groundwater development in the State’s existing irrigation areas.⁵

Groundwater development reached a critical threshold before the introduction of the water sharing plans. Entitlements were greater than was considered sustainable and, in some cases,

⁴ Based on analysis of agricultural water sources (surface water and groundwater only), groundwater as a source of agricultural water in the Murray-Darling Basin remained above 20 percent between 2010-11 and 2013-14, peaking at 27 percent in 2013-14. These figures are based on analysis of Australian Bureau of Statistics data - 4618.0 - *Water Use on Australian Farms*.

⁵ Turrall, H. and Fullagar, I., 2006, Institutional directions in Australia, p.320 - 361. In Giordano, M. and Villholth, K. (eds.) *The agricultural groundwater revolution: opportunities and threats to development*. International Water Management Institute. Wallingford, Oxfordshire, U.K.

extraction exceeded the sustainable yield of the water source.⁶ For example, the Lower Namoi groundwater source, with a sustainable yield of 95,000 megalitres per year, had total yearly allocations that were 221 percent of this value (213,264 megalitres per year), and extraction was 125 percent (118,849 megalitres per year).⁷ This posed a significant threat to long-term use of the aquifer by agricultural enterprises and other industries, aquifer health and dependent ecosystems. As a result, entitlements were reduced to bring extraction rates back to sustainable levels.

A state-wide aquifer risk assessment used to identify management priorities and inform policy implementation, also informed the development of groundwater water sharing plans.⁸ Aquifers were classified according to their risk of over extraction and risks to water quality. Five of the six groundwater management areas covered by the inland alluvial plans under review were categorised as high risk systems. The Lower Lachlan aquifer was categorised as medium risk. More recently, risk assessments are being used to inform the development of water resource plans required under the Murray-Darling Basin Plan.

Water reforms including entitlement reductions, introduction of water sharing plans and the Murray-Darling Basin Plan aim to address risks associated with over-allocation and manage water use within sustainable levels (see **Figure 4**). The Achieving Sustainable Groundwater Entitlements program, announced in 2005, established a process for achieving sustainable groundwater use through reducing entitlements. The Australian and NSW Governments provided \$135 million in financial assistance to those affected by entitlement reductions. The program was used as the basis for reducing entitlements towards a sustainable level.

Table 1 outlines the entitlement reductions that occurred across each valley.

The inland alluvial water sharing plans formalised the entitlement reductions sought under the Achieving Sustainable Groundwater Entitlements program. Each licence holder was issued with a new tradeable aquifer access licence under these plans. Licence holders with a history of extraction greater than their assigned aquifer access licence share were issued non-tradeable supplementary water access licences. This supplementary licence category provides a mechanism for phasing in reducing entitlements to a sustainable level over the 10-year period of the water sharing plans. Water access under this licence category progressively diminishes over the life of the plans to zero.

⁶ NSW Office of Water, 2015, *Achieving Sustainable Groundwater Entitlements Program*. NSW Office of Water. Accessed March 2015. Available: http://www.water.nsw.gov.au/water-management/water-sharing/plans_commenced/achieving-sustainable-groundwater-entitlements-program

⁷ Natural Resources Management Standing Committee, 2002, *Case examples of managing over allocated groundwater systems*. Occasional paper. Natural Resource Management Standing Committee, Canberra.

⁸ *ibid*

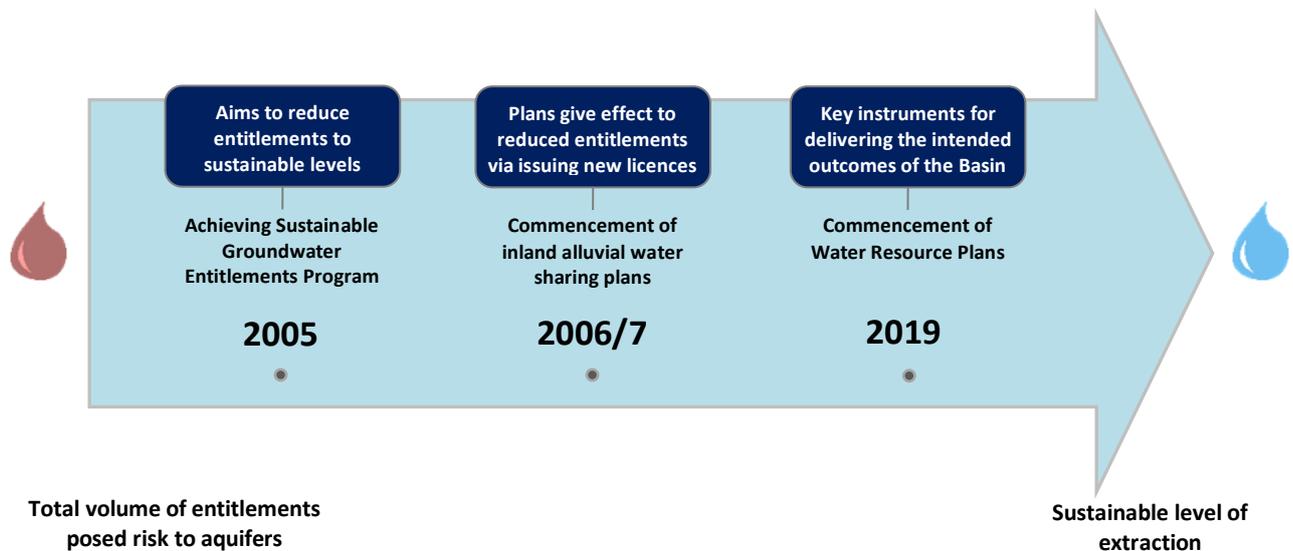


Figure 4: Path towards sustainable management of groundwater

Table 1 Reduction in entitlements under the Achieving Sustainable Groundwater Entitlements Program

Groundwater management area	Pre-plan entitlements (ML)	Entitlements under water sharing plan (ML)	Reduction (ML)	Reduction (%)
Lower Gwydir	65,885	28,719	37,166	56
Lower Lachlan	206,455	105,654	100,801	49
Lower Murray	267,440	83,580	183,860	69
Lower Murrumbidgee	512,409	267,500	244,909	48
Lower Macquarie	133,730	65,524	68,206	51
Upper and Lower Namoi	438,475	167,102	271,373	62
Total	1,624,394	718,079	906,315	56

Source: DPI Water

As outlined in Chapter 1, the six plans under review will become components of water resource plans under the Murray Darling Basin Plan. Sections 10.18 – 10.21 of the Basin Plan set out important accreditation requirements that relate to sustainable use and management of groundwater. These include considering:

- significant hydrological connectivity to surface water
- aquifer integrity:
 - hydraulic relationships between surface water systems, between groundwater systems and within the groundwater systems
 - water quality, including salinity and other water quality issues
- priority environmental assets and priority ecosystem functions that depend on groundwater.

Information continues to be captured across these areas. For example, the identification of high priority groundwater dependent ecosystems is underway. It is hoped that this information will be available to inform the water resource plans. Any remaining knowledge gaps must be explicit and prioritised so that they can be actioned over the course of Basin Plan implementation.

2.3.2 Water Sharing Plan for the Paterson Regulated River Water Source

The Water Sharing Plan for the Paterson Regulated River includes the regulated reaches of the Paterson River, from the upper reaches of Lostock Dam and associated tributaries, to the tidal limit of the Paterson River (see Figure 5). The Allyn River is the major tributary of the Paterson River. The headwaters of these rivers rise in Barrington Tops National Park (Paterson River) and Chichester State Forest (Allyn River).⁹ Major industries in this catchment include forestry, dairy, beef cattle and poultry production, although the dairy and timber industries have experienced a decline in recent years.¹⁰

The Paterson/Allyn river system is one of three major tributaries to the Hunter Estuary, accounting for approximately 19 percent of inflows.¹¹ The Hunter and Williams rivers account for approximately 56 and 25 percent of inflows to the Hunter Estuary. Freshwater flows from these systems provide a range of benefits for the Hunter Estuary, such as reducing salinity levels. The Paterson River also supports town water supply, irrigation, stock watering and domestic use.

Five percent of the river's average annual flow is available for consumptive use¹². Demand for the resource generally peaks over summer – autumn when river flows are historically low.

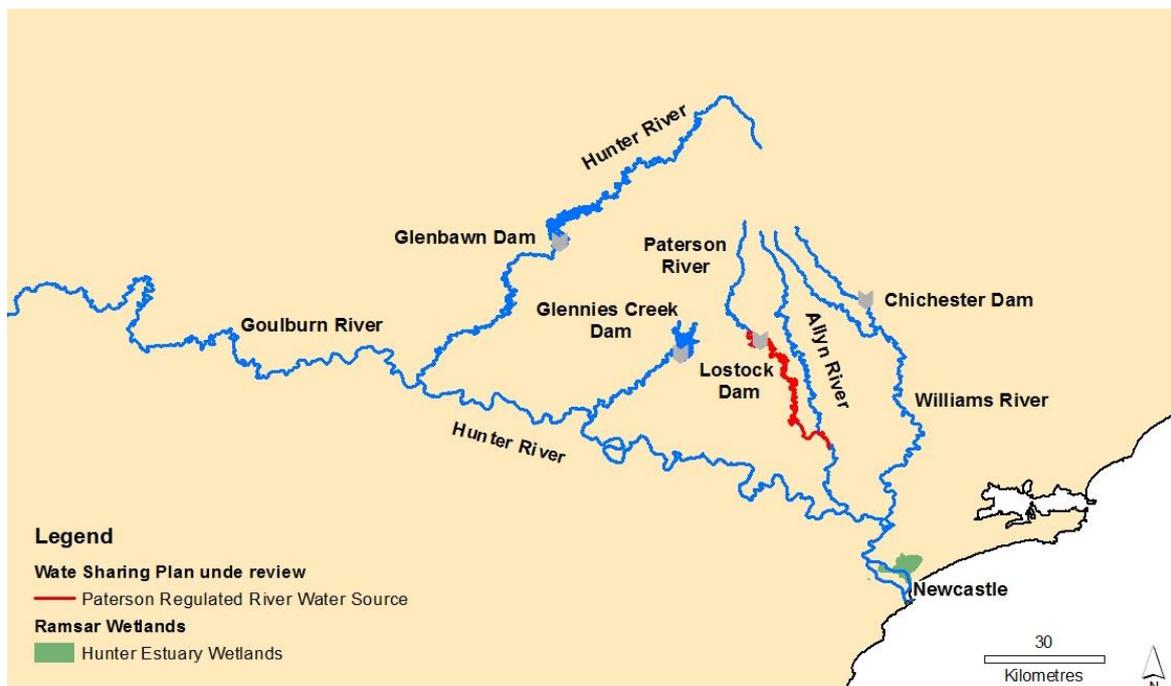


Figure 5: Location of the Paterson Regulated River water source

⁹ Hunter Water, 2011, Paterson and Allyn Rivers. Available: <http://www.hunterwater.com.au/Water-and-Sewer/Water-Supply/Dams-and-Catchments/Paterson-and-Allyn-Rivers.aspx>. Accessed

¹⁰ The Hunter Valley Research Foundation, 2008, *Dungog Shire Council and the Tillegra Dam project: Economic profile, dynamics and potential impacts paper*. Prepared for Planning Workshop Australia. Available: <http://www.dungog.nsw.gov.au/sites/dungog/files/public/images/documents/dungog/mig/5042-Appendix2EconomicProfile.pdf>

¹¹ Kingsford, R. 2010, *Recent trends in the Hunter River Estuary – implications for the proposed building of Tillegra Dam*. University of New South Wales. Sydney. Available: <https://www.ecosystem.unsw.edu.au/files/Hunter-Estuary-salinity1.pdf>

¹² Approximately 95 percent of yearly flows are protected to support the maintenance of environmental health.

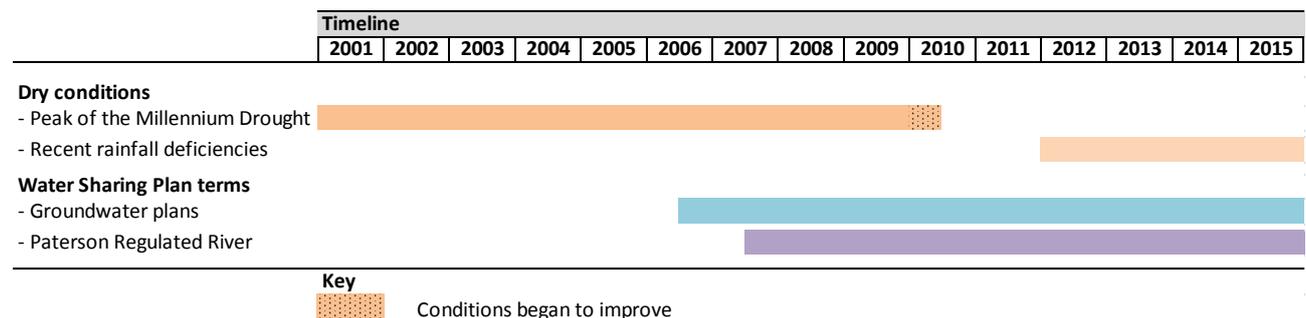
2.4 Drought conditions

Drought conditions have prevailed for a substantial portion of the term of the water sharing plans under review (see **Figure 6**). The Millennium Drought, which began in late 1996 and continued to mid-2010, resulted in prolonged dry conditions across much of southern Australia, including the Murray-Darling Basin (the Basin). The peak of the Millennium Drought, between 2001 and 2009, severely affected the Basin and also much of eastern Australia¹³ (see **Figure 7**).

Rainfall deficiencies and declines in surface water had a significant impact on communities that depend on irrigation. The decline in river flows and reservoir storage resulted in markedly less irrigated agriculture.¹⁴ For example, cotton production in the Namoi valley fell below 200,000 bales in the peak of the Millennium Drought (2008), but exceeded 750,000 bales in 2012 after the drought broke, reflecting the direct relationship between water availability and cotton production.¹⁵ Perennial crops such as oranges, which rely on more secure water rights, were also affected as the drought intensified, with production 32 percent lower in 2003 – 2007 compared to 1999 – 2002.¹⁶

According to the Bureau of Meteorology, rainfall conditions in recent years (2012 – 2015) reflect characteristics of long-term drought trends - a decline in rainfall in southern parts of Australia; including parts of NSW.

This review examines how the water sharing plans assisted industry and communities affected by drought.



Note: The Water Sharing Plan for the Lower Lachlan Groundwater Source commenced in 2007.

Figure 6: Occurrence of drought conditions over the term of the water sharing plans

¹³ Bureau of Meteorology, 2015, *Recent rainfall, drought and southern Australia's long-term rainfall decline*. Available: <http://www.bom.gov.au/climate/updates/articles/a010-southern-rainfall-decline.shtml>

¹⁴ van Dijk, A. I.J.M., Beck, H.E., Crosbie, R.S., de Jeu, R.A.M., Liu, Y.Y., Prodger, G.M., Timbal, B. and Viney, N.R. 2013, The Millennium Drought in Southeast Australia (2001 – 2009): Natural and human causes, and implications for water resources, ecosystems, economy and society. *Water Resources Research*, 49(2): 1040 – 1057.

¹⁵ Roth, G. And Vogel, S. 2013, *Drought and irrigation water availability impacts on small businesses in Wee Waa, NSW. Cotton Catchment Communities CRC*.

¹⁶ van Dijk, A. I.J.M., Beck, H.E., Crosbie, R.S., de Jeu, R.A.M., Liu, Y.Y., Prodger, G.M., Timbal, B. And Viney, N.R. 2013, The Millennium Drought in Southeast Australia (2001 – 2009): Natural and human causes, and implications for water resources, ecosystems, economy and society. *Water Resources Research*, 49(2): 1040 – 1057.

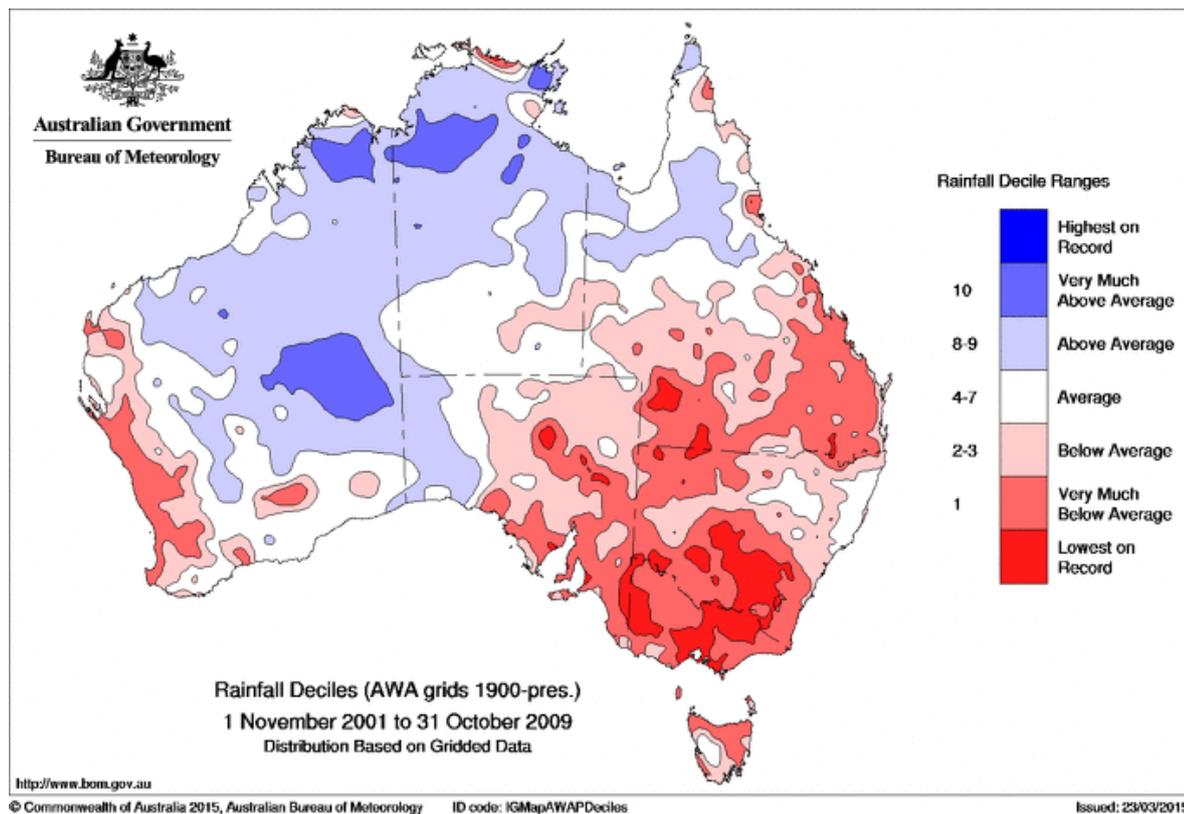


Figure 7: Rainfall deciles during the peak of the Millennium drought¹⁷

2.5 Evidence sources

The availability and quality of evidence has been the primary limiting factor in assessing the material contribution of the water sharing plans to the outcomes identified for this review. This limitation was noted when the Commission first reviewed water sharing plans in 2013, and led to a qualitative review of evidence being undertaken for that report.

The current review uses quantitative and qualitative evidence to help build an understanding of the response of water resources, users and the environment to water sharing provisions, including:

- **Water trade and use data** – data held in the NSW Water Register was analysed to determine how water trade supports water-dependent industries, particularly when inland NSW was affected by the Millennium Drought.
- **Public submissions** – the Commission and DPI Water jointly called for public submissions and received 28 submissions to inform their respective reviews. A summary of submissions is provided in **Attachment B**.
- **Assessment of implementation of the National Water Initiative** – this report by the former National Water Commission assesses the extent to which NSW's water sharing plans meet National Water Initiative outcomes and identifies a number of knowledge gaps.
- **DPI Water reports and implementation audits** – these include the 2012 audit report on inland alluvial aquifer plans; 2007 – 2012 Paterson Regulated River water sharing plan audit report card; 2006 – 2008 progress report on water sharing in the major inland alluvial aquifers; the latest status and summary reports, and valley progress reports.

¹⁷ Bureau of Meteorology, 2015, *Recent rainfall, drought and southern Australia's long-term rainfall declines*.

- **DPI Water resource condition reports** – prepared in accordance with the Water Management Partnership Agreement between NSW and the Commonwealth Government for the Lower Murrumbidgee and Upper Namoi groundwater sources.
- **Integrated Monitoring of Environmental Flows (IMEF) program** – this program included a study of the response of salinity levels in the Hunter Estuary to environmental flows. DPI Water is replacing its monitoring programs with an ecological performance and assessment strategy to target investment towards priority systems and knowledge needs.
- **Other relevant literature** – reports by the National Centre for Groundwater Research and other relevant scholarly articles.

The Commission also sought information on water level recovery trends associated with plan implementation. The extent of aquifer recovery or stabilisation from pre-plan levels could not be definitely answered without further analysis of groundwater level data by DPI Water.

DPI Water is currently undertaking plan evaluations and assessment of water level recovery trends. Upon completion, this information will provide a more comprehensive understanding of whether plan provisions have achieved desired outcomes and should inform plan replacements if they are recommended by the Minister. The evaluations of plan performance focuses on whether plan rules were implemented and their appropriateness, efficiency and effectiveness.

3 Review findings

In the cases of the six inland alluvial water sharing plans and the Paterson River plan, the Commission found that progress had been made towards several desired outcomes, such as providing certainty around entitlements and encouraging economically efficient use of water. However, data gaps left uncertainty around a number of aspects of plan implementation. Key gaps which led to inconclusive evidence are identified in this chapter.

3.1 Inland alluvial aquifer plans

3.1.1 Key findings

The Commission identified a number of ways the six inland alluvial water sharing plans are contributing to the three review outcomes. These are listed in **Figure 8**.



Figure 8: Ways the inland alluvial aquifer water sharing plans contribute to desired outcomes

Despite the progress made, the Commission found that:

- **Initiatives to address critical knowledge gaps are ongoing and have therefore not been available to date to support plan improvements** - key actions from the Implementation Plan gazetted for these plans have not progressed in time to inform the current plans. DPI Water has advised that work is progressing and should be available to inform potential replacement plans.

- **Updates to system models based on water level, use and climate data** - This is critical for taking account of the extreme drought, the last decade of water level and water use data, and changing land practices and use that warrant review of recharge estimates. By periodically revising its numerical models, DPI Water can re-estimate groundwater recharge volumes and further inform water planning decisions. DPI Water anticipates that all planned model improvements for Lower Lachlan, Lower Gwydir, Lower Murray, and Lower Macquarie will be completed in 2016. Work on the model for Lower Murrumbidgee has not yet progressed due to resourcing issues.
 - **Identification of high priority groundwater ecosystems in the water sharing plans** - Uncertainties remain around whether plan provisions have protected high-priority groundwater-dependent ecosystems, and whether provisions should be changed. This is due to delays in identifying and monitoring these ecosystems. The *Water Sharing Plan for the Lower Murrumbidgee Groundwater Source* identifies prior streams as high priority GDEs, but monitoring of their condition is not evident.

DPI Water advised that work is underway to identify groundwater-dependent ecosystems, with preliminary lists of groundwater-dependent vegetation developed for Namoi, Border Rivers, Gwydir, Lachlan and Central West (Macquarie) areas.
 - **Groundwater dependent cultural values are yet to be identified** - Work is underway to address this knowledge gap in the original plans. To date, the Aboriginal Water Initiative (founded in 2012 by DPI Water to engage indigenous communities in water planning and identifying cultural values) has prioritised the need to identify surface water values over groundwater dependent cultural values. This is because surface water could be managed to protect these values. The initiative is currently funded up to 2015-16, and may require further funding.
- **Up-to-date analysis of water level trends across water sources is not readily available** - this gap in data makes it unclear whether plan provisions are adequate for managing water levels. Hydrographs are available for individual bores, but trends in water level recovery at the water source scale from plan commencement to 2015 are not currently publicly available.
 - **Amendment provisions are not consistent across plans** - for example, the *Water Sharing Plan for the Lower Murray Groundwater Source* does not include the same provisions as other plans that allow recharge volumes and environmental water provisions to be amended. DPI Water advised that this does not prevent amendments to this plan as the Minister may request changes, however, the Commission considers consistency in amendment provisions would still be appropriate.
 - **Balancing the needs and requirements of multiple groundwater users is complex** - for example, submissions to the review raised the challenges that Narromine Council is facing in identifying a suitable bore location for more reliable access to groundwater sources for town water supply (and to help the council to access its full entitlement). Plan rules aim to mitigate third party impacts on irrigation bores from such a proposal.

3.1.2 Productive and resilient water dependent industries

Groundwater is an important resource to Australian industries and the communities in which these industries operate, with an economic value as high as \$33.8 billion.¹⁸ Mining accounts for the majority of this economic value (74 percent), followed by irrigated agriculture (11 percent). By contrast, irrigated agriculture is the largest volume user of groundwater in Australia, accounting

¹⁸ Deloitte Access Economics, 2013, *Economic value of groundwater*. Prepared for the National Centre for Groundwater Research and Training.

for approximately 60 percent of annual groundwater use, followed by manufacturing and other industries (17 percent) and mining (12 percent).

Agriculture is the main user of groundwater in NSW. Usage varies from year to year due to a range of factors, such as surface water availability, climate and commodity prices. In 2013-14, groundwater use on farms accounted for 14 percent of agricultural water use in NSW (631,900 megalitres).¹⁹ The six inland water sharing plans cover the majority of this groundwater use.

Groundwater holds diverse values for industry and the community. This becomes increasingly evident during periods of drought when it may be the only available water source and is used to supplement or replace surface water supply, depending on seasonal requirements.²⁰ The value of water and impacts of scarcity are not universal across a catchment.²¹ Some communities can adapt to such change, but others are less resilient, including smaller, more remote communities that rely on irrigated agriculture.²² Towns with more diverse industry profiles are generally less susceptible to reductions in water availability than those heavily dependent on irrigated agriculture.²³

Submissions to the review reflect this difference in adaptability, indicating that the water sharing plans severely impacted irrigation-dependent communities when groundwater entitlements were reduced. A number of submissions also described instances where some irrigators determined their enterprises were no longer viable.

Relevant water sharing plan provisions

Water sharing provisions relevant to productive and resilient water-dependent industries include:

- **long-term average annual extraction limit** – this is the sustainable limit of extraction, and compliance with this limit is managed through the making of available water determinations
- **distance restrictions for new and replacement bores** – licences for new or replacement bores must comply with minimum distance rules between neighbouring bores, aiming to protect existing water users from the potential of localised draw-downs and other potential impacts
- **carryover provisions** – the ability to roll over a portion of unused allocations from one year to the next, assisting businesses to cope with climatic variability from year to year
- **trade provisions** – allow for allocation and entitlement trades that assist with managing water portfolios
- **local management areas** – capacity to define local management areas with a range of options for locally managing extraction in the area to prevent localised excessive water level decline and resulting in impacts on water users, water quality or GDEs.

Review findings

Carryover provisions were recognised in multiple submissions as important for encouraging efficient and effective use of water. By transferring a proportion of their unused allocation from one water year to the next, water users could respond better to seasonal variations and benefit

¹⁹ Australian Bureau of Statistics, 2015, *4618.0 Water use on Australian Farms, 2013-14.* Australian Bureau of Statistics. <http://www.abs.gov.au/AUSSTATS/abs@.nsf/Lookup/4618.0Main+Features12013-14?OpenDocument>

²⁰ Tsur, Y. and Graham-Tomasi, T, 1991, The buffer value of groundwater with surface water supplies. *Journal of Environmental Economics and Management*, 21: 201-224.

²¹ Deloitte Access Economics, 2012, *The value of water to Namoi catchment.* Report prepared for Namoi Councils.

²² John Storer, Judith Stubbs and Associates. 2012. Relationships demonstrated between the cotton industry and communities. In Cotton Catchment Communities CRC (eds) *The Australian cotton water story - a decade of research and development* p:121-123

²³ *ibid.*

from favourable commodity prices. By storing water in the aquifer until it is needed, entitlement holders can reduce the evaporation and transmission losses that would otherwise occur if pumped to surface storage. This provision would need to be carefully exercised to mitigate spikes in water use during dry periods. Submissions also noted the potential for inequity, with carryover allowances and annual use limits being more restrictive in some plans than others. These inconsistencies reflect the negotiations made with committees during the development of these plans.

Trade provisions within the water sharing plans provide a number of benefits for water dependent industries and their communities. Usage and trade of groundwater was prevalent during the Millennium Drought, when surface water availability declined (see Figure 9)²⁴. This trade helped buffer the impacts of drought on some high value plantings, such as orchards and vineyards.²⁵ Stakeholders also indicated that users purchased water soon after the water sharing plans came into effect, to rebalance their water portfolios in response to entitlement reductions. In short, water trade helped irrigators respond to change, using the flexibility in water markets to make production decisions²⁶ while benefiting from clarity around entitlements.

Demand for groundwater declined when the Millennium Drought broke in 2010-2011. This trend was most noticeable in the Lower Murrumbidgee, Lower Murray and Lower Lachlan, partly due to widespread flooding in the region.²⁷ Groundwater demand in the Lower Gwydir remained high due to the drier conditions. Groundwater trade has spiked again over the past three years with the return of drier conditions, and reductions in supplementary access.

Anecdotal evidence indicates irrigators may rely on water markets to finish crops where in-crop rainfall does not eventuate. However, the cost and time taken to draw groundwater are considerations in this decision.

Access to groundwater under the water sharing plans also supports agriculture in semi-arid landscapes or areas where it is not feasible to pump surface water.²⁸ For example, one farm in the Namoi region uses groundwater and in-crop rainfall to grow irrigated cotton and dryland winter crops.²⁹ Having been affected by entitlement reductions under the Achieving Sustainable Groundwater Entitlements Program, the family could use groundwater trade to rebuild their water portfolio and return close to pre-plan production levels. However, purchases of these water entitlements were costly due to competition with other water users, including coal mines.³⁰

²⁴ Analysis prepared by Aither for the 2015 water sharing plan review.

²⁵ Qureshi, M.E., Reeson, A. Reinelt, P. Brozovic, N. and Whitten, S. 2012, Factors determining the economic value of groundwater. *Hydrogeology Journal*, 20(15): 821-829.

²⁶ National Water Commission, 2010, *The impacts of water trading in the southern Murray-Darling Basin: an economic, social and environmental assessment*, National Water Commission, Canberra.

²⁷ NSW State of the Environment Report 2012: Water chapter

²⁸ Qureshi, M.E., Reeson, A. Reinelt, P. Brozovic, N. and Whitten, S. 2012, Factors determining the economic value of groundwater. *Hydrogeology Journal*, 20(15): 821-829.

²⁹ National Water Commission, 2012, *Water trading: an irrigator's perspective. Irrigator case study series: The Warnock family – Narrabri, New South Wales*.

³⁰ *ibid.*

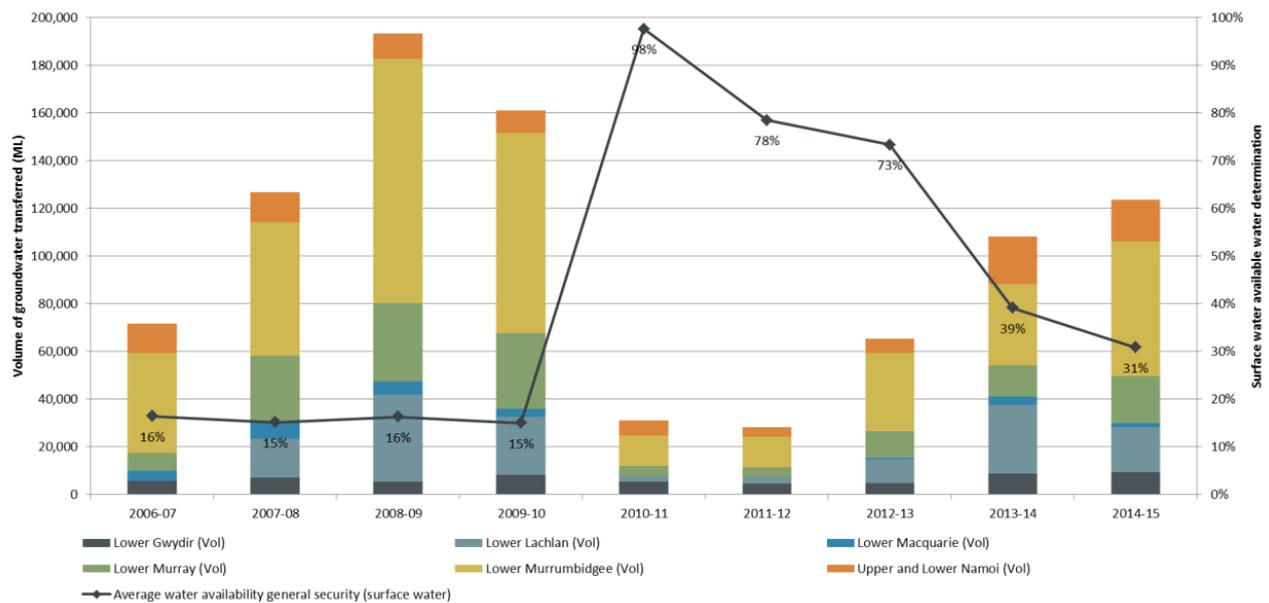


Figure 9: Relationship between groundwater transfers (allocation trade) and surface water availability

Local management provisions are an important tool for managing extraction, with multiple submissions indicating they should be retained in the inland alluvial aquifer plans. Declaration of these areas aims to address localised drawdown, with trade restrictions preventing trade into the declared area. To date, local impact areas have been declared within the Lower Murrumbidgee Groundwater Source and the Upper and Lower Namoi Groundwater Sources.³¹ Two local impact areas were declared in the Lower Murrumbidgee in 2007 due to declining water levels and seasonal drawdowns.³² According to DPI Water, trade restrictions combined with the breaking of the drought and reduced demand for groundwater have assisted in suspending water level declines and seasonal fluctuations.³³

Each water sharing plan has its own beneficial use categories, providing a baseline for managing and protecting water quality and an indication of suitability of groundwater for agricultural purposes e.g. growing certain crops. Salinity is used as an indicator of beneficial use categories.³⁴ This indicator came under the spotlight recently when a study into the hydrogeochemistry and risks to groundwater quality from extraction found increasing salinity for a number of bores in the Upper Namoi, Lower Namoi, Lower Murray and Lower Murrumbidgee, impacting the beneficial use of this water as potable (insufficient data was available for the Lower Macquarie).³⁵ As a result, bores in the Upper Namoi Groundwater Management Area changed from water suitable for irrigation to water suitable for stock. Similarly, increasing salinity levels at some bores in the Lower Namoi Groundwater Management Area mean that water is no longer suitable for cotton.

³¹ NSW Office of Water, 2012, *Report to the Minister on audit of inland alluvial water sharing plans which commenced in 2006*.

³² Kumar, P.E. 2013, *Groundwater trading and management of local impacts – Lower Murrumbidgee Deep Groundwater Source*. NSW Office of Water, Sydney.

³³ *ibid*.

³⁴ *The Australian and New Zealand Guidelines for Fresh Water and Marine Water Quality (ANZECC/ARMCANZ 2000)* provide salinity ranges for irrigation and stock water supply, whilst the Australian Drinking Water Guidelines (NHMRC 2011) provide the range for drinking water.

³⁵ NSW Office of Water (2011), *Characterisation of hydrogeochemistry and risks to groundwater quality*,

Contribution of Local Land Services to water-dependent industries

Although Local Land Services does not currently have a direct role in the implementation of the inland alluvial water sharing plans, the agency provides an extension role in relation to sustainable farming practices. This aligns with the outcome of productive and resilient water dependent industries, and includes the delivery of water efficiency programs in some regions. Such programs are implemented at the regional level depending on the nature of agricultural enterprises operating within a region.

Submissions to the water sharing plan review also indicated that Local Land Services may be able to assist landholders with advice on broader issues such as rising energy costs that discourage the adoption of water efficient practices.

3.1.3 Secure long-term water supply for urban and rural communities

For the purpose of this review, secure long-term water supply encompasses the range of services and values that groundwater provides to communities (outside of water dependent industries).

Relevant water sharing plan provisions

Each inland alluvial aquifer plan includes provisions to allow groundwater for:

- basic landholder rights such as stock and domestic purposes.
- Native Title rights (remain at zero megalitres)
- protection of groundwater-dependent cultural values
- town water supply.

Review findings

Basic landholder rights – domestic and stock use

Water sharing plans incorporate knowledge about basic landholder usage rights at the time they are developed. Each plan includes provisions that allow priority access to groundwater as a basic landholder right, consistent with the requirements of the *Water Management Act 2000*. However, limited information is available on the volumes of actual take for stock and domestic purposes, primarily because metering of standalone stock and domestic bores is not required in New South Wales. This makes it difficult to quantify the extent to which this category supports rural communities. It is also difficult to quantify the proportion of this groundwater use relative to other categories of use.

Stock and domestic rights contribute to the wellbeing of rural communities by providing families and individuals with water for basic needs such as cooking and cleaning, and enabling them to live in areas without access to surface water. This right also enables landholders to run stock irrespective of their proximity to surface water. Groundwater extraction for watering stock is primarily driven by stocking rates, which in turn depends on the capacity and condition of the land used for grazing.³⁶

This category of water use is historically considered low risk in terms of its impact on groundwater resources, making up around 2 – 3 percent of the extraction limits according to DPI Water.

³⁶ Sinclair Knight Merz, CSIRO and the Bureau of Rural Sciences, 2010, *Surface and/or groundwater interception activities initial estimates*. National Water Commission, Canberra, p.58.

However, the National Water Commission report indicates that the cumulative impacts of stock and domestic bore use on groundwater can be significant.³⁷

Domestic and stock use of groundwater has the potential to grow in proportion to other uses, particularly if dry conditions prevail or land use changes.³⁸ Taking water under basic landholder water rights is classed as an interception activity (an activity that captures water that would otherwise flow into the aquifer and connected surface waters) under the National Water Initiative, and it is unclear whether this is being properly measured and managed as an interception activity.³⁹

DPI Water commenced development of guidelines for the reasonable use of water for domestic and stock purposes (basic landholder rights) in 2009, but these guidelines are not yet publicly available. This work is important in managing water sources for the benefit of all water users. A 2009 progress report on the inland alluvial water sharing plans did not provide a timeframe for the Reasonable Use Guidelines.⁴⁰ However, the 2012 audit of the inland alluvial water sharing plans recommended that these guidelines be finalised.⁴¹ Once completed, these guidelines are expected to specify a volume considered reasonable for extraction under basic landholder rights, along with any other new knowledge. Basic landholder rights figures are expected to be updated should plan remakes occur.

Cultural values and uses of water

Each inland alluvial water sharing plan recognises the spiritual, customary and social values of water to Aboriginal people. However, based on stakeholder submissions and other evidence, the extent to which the plans are contributing to protecting Aboriginal cultural values of groundwater is limited by:

- **Inconsistent plan objectives and provisions to protect groundwater dependent cultural values** – stakeholder submissions indicate this inconsistency impacts the ability of Traditional Owners to allow the continuity and enhancement of Indigenous cultural practices, stories, traditions and knowledge relating to groundwater. The Murray Lower Darling Rivers Indigenous Nations submission calls for plan objectives and intent to be consistent with the United Nations Declaration on the Rights of Indigenous Peoples and relevant sections of the Convention on Biological Diversity
- **Delays in identifying groundwater dependent cultural values** – DPI Water's Aboriginal Water Initiative is engaging Indigenous communities in water planning and identifying cultural values. The Commission understands that the agency prioritises the identification of surface water over groundwater dependent cultural values. The initiative also faces uncertain funding beyond 2016.
- The plans state that 'collection of information on the values associated with water is considered the first step in addressing the objects of the Act,' and specify a timeframe of five years for achieving this for each groundwater source.⁴² Given the uncertainty of funding, it is

³⁷ Sinclair Knight Merz, CSIRO and the Bureau of Rural Sciences, 2010, *Surface and/or groundwater interception activities initial estimates*. National Water Commission, Canberra, p.58.

³⁸ Department of Sustainability and Environment, 2009, *Protecting water users and the environment from uncontrolled growth in stock and domestic use: Northern region sustainable water strategy*. Victorian Department of Sustainability and Environment, Melbourne.

³⁹ *Ibid.*

⁴⁰ NSW Department of Water and Energy, 2008, *Water sharing in the major inland alluvial aquifers: progress report 2006 to 2008*. NSW Department of Water and Energy, Sydney.

⁴¹ NSW Department of Primary Industries Office of Water, 2012, *Report to the Minister on audit of the inland alluvial water sharing plans which commenced in 2006*. NSW Department of Primary Industries, Office of Water, Sydney.

⁴² See Appendix 2 of water sharing plan.

important that the agency leverages information gained through the development of the Basin Plan as a basis for identifying groundwater dependent cultural values.

- **A lack of reporting on relevant performance indicators** – submissions indicate a lack of transparency regarding progress in collecting information on groundwater-dependent cultural values (a key performance indicator in all plans under review). It is also unclear how this information informs plan implementation.

Moving forward, there is a need to ensure that Indigenous stakeholders are formally engaged in any plan remakes and the development of Water Resource Plans (required under the Basin Plan).

Town water supply

Provision of secure water supply for country towns is critical for sustaining communities in rural New South Wales. Water sharing plans reflect this by:

- prioritising access to water for towns over commercial licences
- ensuring that the full allocation of town water supply is achieved for a given water year, except when extreme drought conditions prevent this from occurring.

Based on data provided by DPI Water, total local water utility groundwater usage in each water source remains within licence entitlements (see **Figure 10**). Each of the inland alluvial aquifer plans includes at least one water source that supports town water supply. Local councils and county councils primarily hold the local water utility licences and aquifer (town water supply) licences under these plans. **Table 2** lists the local water utilities with licences.

Table 2 Local water utilities with licences under inland alluvial water sharing plans

Water sharing plan	Local water utility
Lower Gwydir Groundwater Source	Moree Plains Shire Council, Gwydir Shire Council
Upper and Lower Namoi Water Sources	Liverpool Plains Shire Council
Lower Lachlan Groundwater Sources	Carathool Shire Council, Central Darling Shire Council , Hay Shire Council, Lachlan Shire Council
Lower Macquarie Groundwater Source	Narromine Shire Council , Warren Shire Council
Lower Murray Groundwater Source	Conargo Shire Council, Murray Shire Council Lawson Water Supply Company Pty Ltd
Lower Murrumbidgee Groundwater Source	Carathool Shire Council, Murrumbidgee Shire Council
Upper and Lower Namoi Water Sources	Gunnedah Shire Council, Liverpool Plains Shire Council, Narrabri Shire Council, Walgett Shire Council

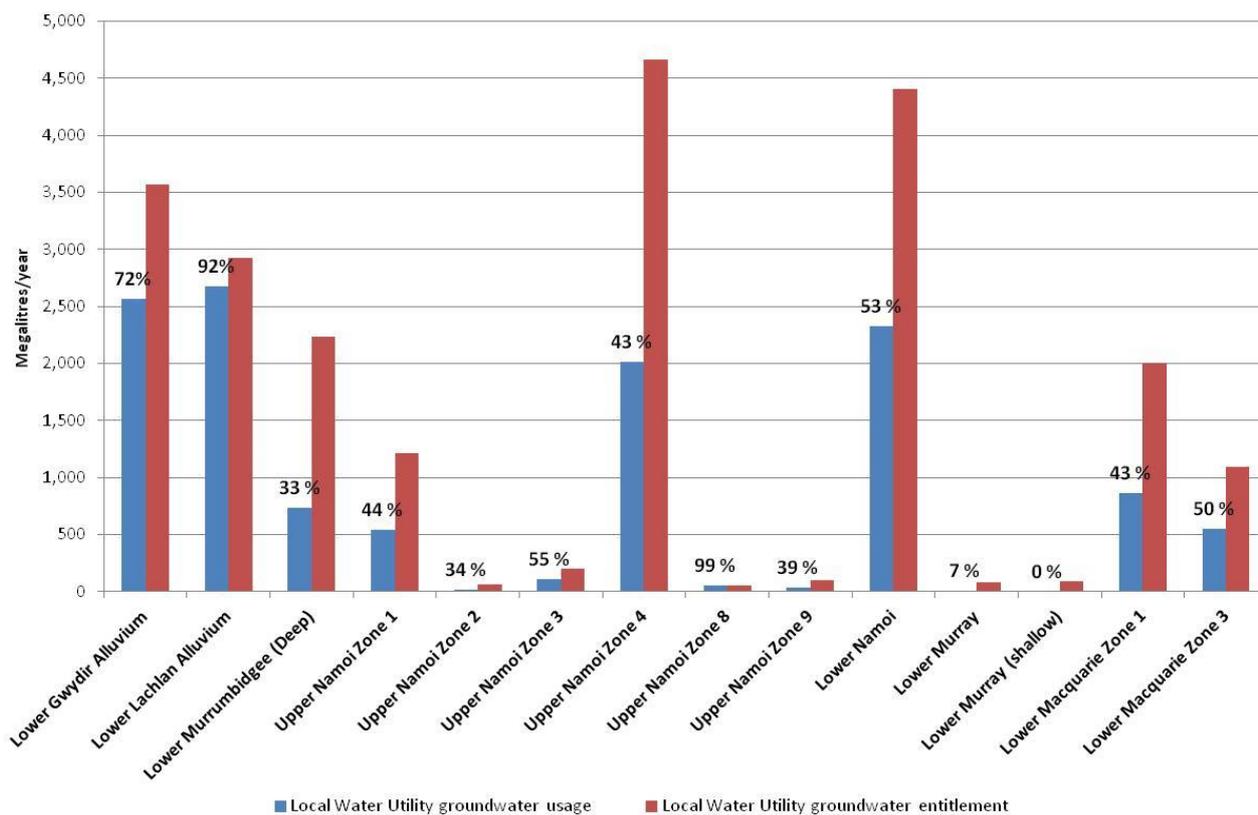


Figure 10: Groundwater use by local water utilities

There are instances where councils could not access their full allocation, as aquifer levels declined during drought conditions. Narromine Council is one of these. In its 2012-2013 annual report, the council prioritised the construction of an additional bore near Narromine to service town water supply needs,⁴³ but has not yet been able to identify a suitable bore location. This is primarily because distance restrictions in the *Water Sharing Plan for the Lower Macquarie Groundwater Sources* aim to protect third parties by preventing a bore from being sunk close to town where existing irrigation bores may be impacted. Adding to this is that capital and operating costs become prohibitive the further a water supply bore is from town.

3.1.4 Healthy and resilient water dependent ecosystems

Many ecosystems depend at least partly on groundwater, its quality and aquifer integrity. These include wetlands, terrestrial vegetation, river channels (where low flows come from groundwater) and microfauna that inhabit the groundwater. These ecosystems face increased risk if groundwater levels, quality or flow direction are altered.

Relevant water sharing plan provisions

Section 3(b) of the *Water Management Act 2000* provides for the protection, enhancement and restoration of water sources, associated ecosystems, ecological processes, biological diversity and water quality. The Act requires water to be shared to protect the water source and its dependent ecosystems. It also provides the statutory framework for implementing the *NSW State Groundwater Dependent Ecosystem Policy 2002*.⁴⁴ Water sharing plans give effect to the objects of the Act and this

⁴³ Aither, 2014, *Water licence advisory services, strategic needs assessment*. Report prepared for the Lower Macquarie Water Utilities Alliance.

⁴⁴ Department of Land and Water Conservation, 2002, *The NSW State Groundwater Dependent Ecosystems Policy – A component policy of the NSW State Groundwater Policy Framework Document*.

policy by establishing environmental water provisions (planned environmental water and adaptive environmental water), and identifying and protecting high priority groundwater dependent ecosystems (GDEs).

Relevant provisions to protect alluvial aquifers and associated ecosystems include:

- **planned environmental water** - allocated for the fundamental health of the water source and associated GDEs.
 - all plans under review protect the long-term average storage component of groundwater sources by setting a long-term average annual extraction limit (LTAAEL)
 - all plans except for the Water Sharing Plan for the Lower Murray Groundwater Source protect a proportion of average annual recharge for the environment.⁴⁵ This proportion may be reviewed in light of new information on groundwater ecosystem dependency.
- **adaptive environmental water** – can be committed via inclusion of adaptive environmental water conditions in an aquifer access licence. There is currently no adaptive environmental water committed under any licences for the six plans under review. Therefore, this plan provision could not be assessed.
- **identification of high priority groundwater dependent ecosystems** – each plan under review includes a schedule for listing high priority GDEs. It can be updated to include the latest information on priority GDEs. Distance restrictions for new bores help to protect listed high priority GDEs from groundwater extraction.
- **distance restrictions** – plan rules specify the minimum distance of bores from GDEs (including rivers and streams). These rules help to prevent current and future extraction and reduce the risk of contamination sources impacting these ecosystems.
- **local impact management** – plans allow for designation of local management areas and rules to manage localised drawdown or address water quality issues.

Review findings

Based on information from DPI Water, groundwater use in most valleys is being managed within the plan extraction limits, with the exception of the Lower Gwydir and the Upper Namoi. In the Lower Gwydir, the three year rolling average extraction between 2012-13 and 2014-15 exceeded compliance conditions of the plan's extraction limit.⁴⁶ Some zones in the Upper Namoi displayed similar trends for the same period. DPI Water will continue to monitor extraction from these water sources. Plan provisions enable the agency to tailor available water determinations to return total extraction to the specified limit, should the average extraction for three consecutive years exceed the overall average limit by more than 5 percent. Submissions to the review indicate that alternative, more flexible methods should be used to assess compliance with the extraction limit.

Further investigation is needed to determine the extent of recovery of the aquifers since plan implementation. Because analysis of water level trends in response to plan implementation (2006 – 2015) is yet to be completed, it is unclear whether adequate action has been taken to address declining water levels.

⁴⁵ The Water Sharing Plan for the Lower Murray does not have a proportion of average annual recharge set aside because no GDEs have been identified to date in this water source, and the system is artificially recharged through irrigation leakage.

⁴⁶ DPI Water, 2015, *Lower Gwydir Groundwater Source summary report 2006 – 2015*. Prepared by DPI Water, Sydney. Available: http://www.water.nsw.gov.au/__data/assets/pdf_file/0007/563452/lower-gwydir-groundwater-source-summary-report-2006-2015.pdf

Aquifer health and recovery

Indicators of groundwater health include the direction of groundwater flow (which can change depending on extraction or other disturbances), water quality and water level trends. Water level monitoring is the primary groundwater health indicator used by DPI Water to report on implementation of the inland alluvial aquifer plans, and is listed as a performance indicator within these plans. Limited information is publicly available on aquifer integrity.

Information on water level recovery trends for the period of plan implementation up to 2015 was limited. Reports prepared by DPI Water to date primarily include hydrographs from specific monitoring bores. These graphs are useful for illustrating trends at a local scale, but are not optimal for illustrating trends across a water source. Water level recovery trend maps provide a visual tool for determining what is happening across a water source. DPI Water has used such maps in reporting, but they do not cover the relevant period.

It is difficult to draw conclusions on water level recovery trends following plan implementation. Water level data is still being analysed by DPI Water to determine water level recovery trends pre- and post-plan implementation. Data is being progressively analysed for representative bores and work is ongoing to present trends at the water source scale (spatially).

It is unlikely that water levels will return to pre-development levels in some groundwater sources, however, the water sharing plans are expected to assist in recovery and stabilisation.

Multiple factors are likely influencing water level recovery in the inland alluvial aquifers, including:

- climatic factors that affect aquifer recharge and influence demand for groundwater e.g. the Millennium drought
- aquifer characteristics
- phased reductions in entitlements and associated adjustments in extraction

Based on these factors, it is important to have a methodology and sufficient timespan to analyse trends. Furthermore, the impact of reducing entitlements will most likely be apparent beyond the term of the current water sharing plans. Further data is therefore needed to confirm whether aquifer recovery or stabilisation is occurring.

Groundwater dependent ecosystems

Information on groundwater dependent ecosystems (GDEs) was limited at the commencement of the inland alluvial water sharing plans. The National Groundwater Committee reported over 10 years ago the need to characterise and value GDEs to allow for identification and protection of priority GDEs.⁴⁷ When the National Water Commission reviewed the science underpinning the *Water Sharing Plan for the Lower Lachlan Groundwater Source*, it also recommended studies to identify the occurrence of GDEs and reported on the difficulties of reliably developing provisions for GDEs without further scientific studies.⁴⁸

Research into the dependency of ecosystems on groundwater is relatively limited compared to surface water dependence⁴⁹, even though National Water Initiative provisions apply equally to

⁴⁷ National Groundwater Committee, 2004, *Knowledge gaps for groundwater reforms: a strategic directions paper for water researchers based on the outcomes of a national workshop held in Canberra, 12 – 13 November 2013*. p. 7.

⁴⁸ Natural Resources Commission, 2006, *Scientific review: Lower Lachlan Groundwater Sharing Plan*, November 2006.

⁴⁹ Tomlinson, M (2011), *Ecological water requirements of groundwater systems – a knowledge and policy review*. Waterlines report, National Water Commission, Canberra.

both sources.⁵⁰ These knowledge gaps must be bridged to improve water planning. The Implementation Program gazetted for the inland alluvial aquifer plans provided the steps for addressing knowledge gaps of GDEs and assigning priority based on environmental, cultural and heritage values.⁵¹ It proposed studies that would provide the basis for amendments to environmental water provisions in these water sharing plans.

Another issue affecting GDEs is that adaptive management provisions are not consistent between plans. All plans, except the Lower Murray Groundwater Plan, allow for amendments based on new information about GDEs. However, these provisions have not been implemented to date, despite regional studies to identify GDEs in the Namoi and the development of a National Atlas for identifying GDEs across Australia:

- The former Namoi Catchment Management Authority commissioned its own study of GDEs in the Namoi catchment to address knowledge gaps identified through the upgrade of its Catchment Action Plan.⁵²
- The National Water Commission funded the development of the National Atlas of Groundwater Dependent Ecosystems⁵³, a national inventory of ecosystems dependent on groundwater.

The GDE mapping methodology used in the development of the Atlas had a number of limitations. For example, the broad-scale coverage of the project required trade-offs in the level of analysis, resulting in some GDEs not being identified or being misrepresented.⁵⁴ DPI Water indicated that these trade-offs did not suitably identify high priority GDEs for inclusion in water sharing plans. The agency has since commenced its own project to identify the location of potential GDEs across NSW, determine their ecological values and identify the location of high priority GDEs for inclusion in water sharing plans and water resource plans.⁵⁵ Risk assessments are also underway that consider the ecological value of GDEs and associated threats. These projects will inform future water planning, including potential plan replacements. It is unclear why this research and analysis hasn't been undertaken by DPI Water to date. However, it should be advanced as soon as practical.

Submissions to this review expressed concern that the environmental objectives of the water sharing plans have not been achieved, and referred to the ecological decline of River Red Gum forests during the Millennium Drought. Studies of River Red Gum forests in the Chowilla floodplain clearly indicated that this vegetation community relies on soil water and groundwater connected to surface water, rather than on groundwater directly.⁵⁶ The dependency of these ecosystems on groundwater must be considered in any future plan replacements. River Red Gum forests should also be included as high priority GDEs in relevant water sharing plans.

⁵⁰ National Water Commission, 2009, *Biennial assessment*. National Water Commission, Canberra.

⁵¹ New South Wales Government Gazette, no. 30. 5 February 2010. *Implementation Program for the major inland alluvial aquifer water sharing plans*.

⁵² Namoi Catchment Management Authority, 2012, *Namoi Catchment Action Plan 2010 – 2020*. Available: http://archive.ils.nsw.gov.au/__data/assets/pdf_file/0010/496513/archive_12-namoi-catchment-action-plan-2010-2020.pdf

⁵³ Richardson, S., Irvine, E., Froend, R., Boon, P., Berber, S. and Bonneville, B. 2011, *Australian groundwater-dependent ecosystems toolbox*. Natural Water Commission, Canberra.

⁵⁴ Sinclair Knight Merz, 2012, *Atlas of Groundwater Dependent Ecosystems (GDE Atlas), Phase 2: Identifying and mapping GDEs*. Prepared for the National Water Commission.

⁵⁵ Personal communications, Dr Jodie Debrovic, NSW DPI Water

⁵⁶ CSIRO, 2012, *Fundamental floodplain salinisation processes and timeframes*. Available: <http://www.clw.csiro.au/research/rivers/flows/floodplain/riverredgum.html>. Accessed 17 July 2015.

Another submission proposed that given the absence of high priority GDEs in the majority of the groundwater plans, there is value in revisiting recharge figures to identify opportunities to enhance social, cultural and economic outcomes.⁵⁷

3.2 Water Sharing Plan for the Paterson Regulated River Water Source

3.2.1 Key findings

The Commission identified a number of ways that the Water Sharing Plan for the Paterson Regulated River Water Source is contributing to the desired outcomes identified for the review. These are listed in **Figure 11**. The Commission also found that water use remains well within the plan's extraction limit. The limit should remain clearly defined, to ensure that total take of water will not surpass sustainable levels.



Figure 11: Benefits of Water Sharing Plan for the Paterson Regulated River Water Sources

However, the Commission also identified a number of areas for improvement. Key issues identified through the course of this review include:

- **Inconsistencies with neighbouring plans** - the plan is not consistent with provisions in the recently drafted Water Sharing Plan for the Hunter regulated River Water Source which will likely to contribute to better outcomes.

⁵⁷ Macquarie River Food and Fibre submission.

- **Model underpinning the plan has not been updated with new information** – the system model does not reflect current climatic data or up-to-date information on development in the Paterson valley that may impact on water use and water user behaviour. DPI Water advised that modelling is underway to inform end of system flow targets currently in the water sharing plan.
- **Water dependent Aboriginal cultural values have not been identified** - specific values are yet to be identified.
- **Extraction for the purposes of town water supply appears to be increasing.**
- **The plan's environmental contingency allowance lacks strong governance** - lack of an active Environmental Water Advisory Group means there are no formal arrangements in place for administering and managing the Plan's environmental contingency allowance.⁵⁸ The environmental water provision has not been implemented since 2007.

3.2.2 Productive and resilient water dependent industries

The Paterson Valley is in the Hunter region of NSW. Land in the region is primarily used for grazing and cropping, but the region's economic contribution stems from a wide range of agricultural commodities.

The majority of the Paterson River traverses the shire of Dungog, where it supports a number of agricultural businesses. Historically, irrigation has been used primarily for growing pasture and lucerne⁵⁹ and this continues to be the case.⁶⁰ In 2006, the estimated value of agricultural production (excluding horses) in Dungog Shire was \$91 million.⁶¹

Relevant water sharing plan provisions

Water sharing provisions relevant to productive and resilient water dependent industries include:

- **long-term average annual extraction limit** of 11,175 megalitres – this is the sustainable limit of extraction in the valley, with compliance being managed through setting available water determinations
- **carryover provisions** - allow general security licence holders to roll over a portion of their water allocation to the next water year
- **trade provisions** - permit water trade within the water source (the plan does not permit trade outside of the water source)
- **end-of-system flows** - provide benefits for water users in the Hunter estuary (see below).

⁵⁸ Note that the Environmental Water Advisory Group was responsible for the environmental contingency allowances provisions in the Paterson and Hunter Regulated River water sharing plans.

⁵⁹ Hope, M., 2003, *NSW Mid-coast region irrigation profile – incorporating Hunter, Manning, Karuah and Central Coast catchments*. NSW DPI Water.

⁶⁰ Australian Bureau of Statistics, 2012, *46180DO010_20101 Water use on Australian farms 2010-11*. Released at 11:30am, Friday 21 December 2012.

⁶¹ Data sourced from NSW Department of Primary Industries, 2013, *Upper Hunter Region Agricultural Profile: Factsheet No. 1*, NSW Department of Primary Industries, June 2013.

Review findings

The Integrated Quantity and Quality Model used in developing the plan has not been updated with current development in the catchment and climate information.⁶² The plan requires that the model is used to assess compliance with the long term average annual extraction limit. However, water use has remained well below the extraction limit since plan commencement in 2007, indicating that supply is currently greater than demand for water in the region (see **Figure 12**). It is highly unlikely that the extraction limit will be exceeded, minimising any risk associated with delays in updating the model.

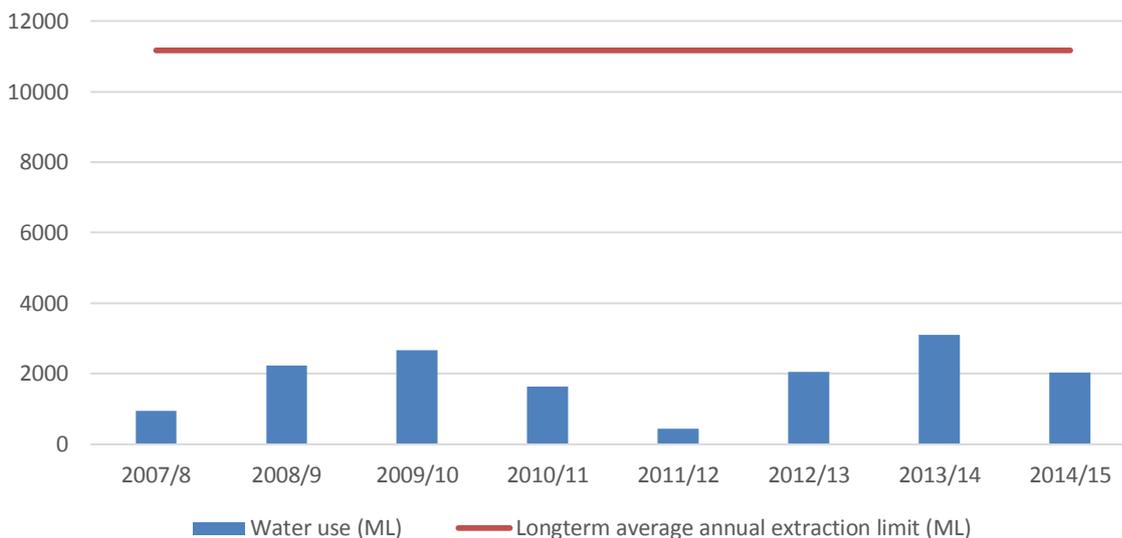


Figure 12: Water use in the Paterson Regulated River relative to the plan’s long-term average annual extraction limit

Low water use relative to the extraction limit may explain the relatively small volumes of trade in the Paterson Regulated River water source since the plan commenced in 2007. As at May 2015, only two valid water allocation trades and fewer than 10 entitlement trades have occurred during this time. Water use also reflects the main land uses within the catchment, being pasture and lucerne production for stock feed, both of which use relatively low water volumes.

Audit reporting also indicates that minimum flow targets for end of system flows have been met since plan commencement.⁶³ These end of system flow targets are intended to deliver minimum flows and associated benefits to the Paterson River and Hunter estuary. They have helped water users in the region’s tidal area by increasing the frequency of periods when water quality is suitable for irrigation. Submissions to the water sharing plan review indicated that water quality within the tidal reaches of the system has remained suitable for irrigation since plan commencement.

Ensuring sufficient end of system flows to maintain salinity levels suitable for agricultural use was a concern raised in submissions to the water sharing plan review, particularly during the higher demand periods over summer.

⁶² NSW Office of Water, 2013, *Paterson regulated river water sharing plan audit report card. Prepared for the period between 1 July 2007 and 30 June 2012.*

⁶³ NSW Office of Water, 2013, *Audit of implementation – Paterson regulated river water sharing plan audit report card.* NSW Department of Primary Industries, Office of Water.

3.2.3 Secure long-term water supply for urban and rural communities

For the purpose of this review, secure long-term water supply encompasses the range of services and values that surface water from the Paterson Regulated River provides to communities (outside of water dependent industries).

Relevant water sharing plan provisions

The plan includes provisions to allow water for:

- **basic landholder rights** – stock and domestic purposes as well as Native Title rights
- **specific purpose access licence (subcategory "Aboriginal cultural")** – for Aboriginal cultural purposes
- **town water supply** – growth in use provisions, pursuant of section 66 (3) and 66(4) of the *Water Management Act 2000* allow for review of a local water utility's share component should growth in population occur.

Review findings

Basic landholder rights – domestic and stock use

The *Water Management Act 2000* provides landholders on river frontage with a right to take and use water for domestic and stock purposes with a licence and without metering of use. In preparing the plan, the water requirements for this purpose were estimated and allowed for in allocation and operational rules. The latest audit report for the Paterson Regulated River assumes that, as daily flow targets have been met 100 percent of the time, basic landholder rights have been met⁶⁴. This indicates that the plan is contributing to the security of supply for domestic and stock purposes.

Basic landholder rights – Native Title rights

There are currently no Native Title rights in the water source.⁶⁵

Cultural values and uses of water

The water sharing plan includes provisions that recognise the Aboriginal cultural values associated with the water source. However, the plan lacks specific cultural values and their water requirements. There are also currently no Aboriginal cultural access licences for the water source.

Town water supply

Hunter Water holds a local water utility licence to draw water from the Paterson River. The share component is currently set at 75 megalitres per year in the water sharing plan. Water use has remained below this volume since the water sharing plan commenced, indicating that it is contributing to secure town water. As water use under this licence appears to be increasing (see **Figure 13**), future plans should establish guidance around a growing town water supply.

⁶⁴ ibid

⁶⁵ ibid

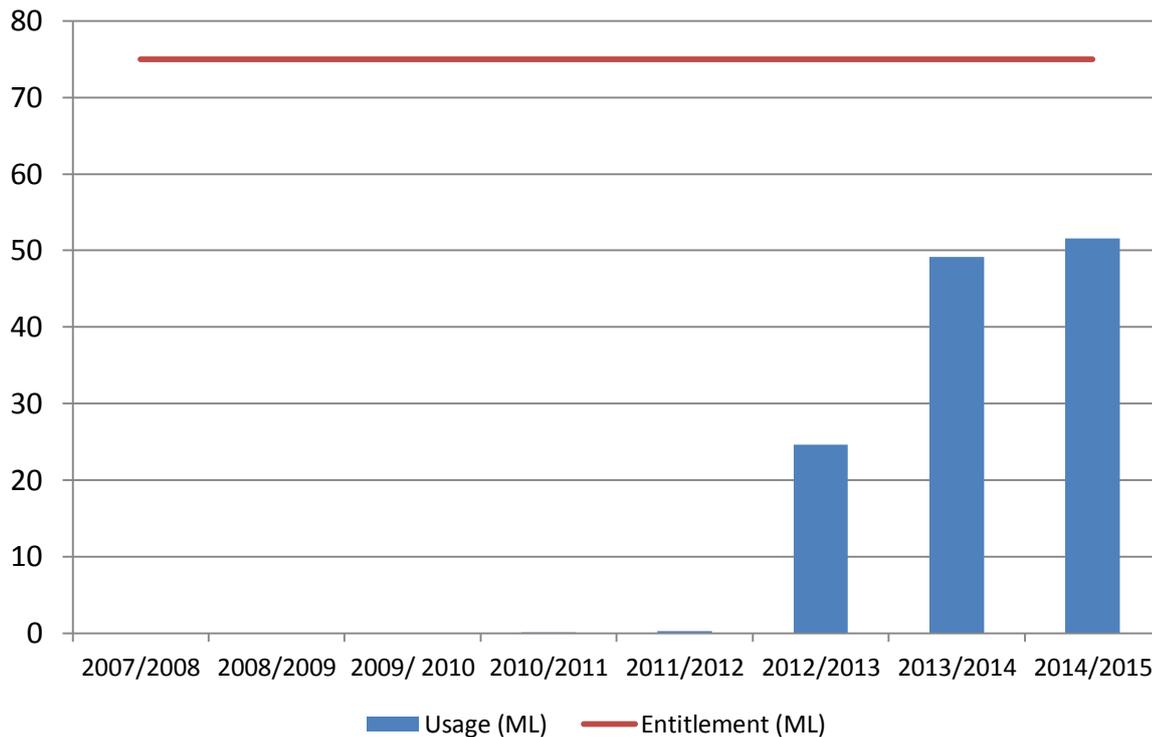


Figure 13: Contribution of the Paterson Regulated River to town water supply⁶⁶

3.2.4 Healthy and resilient water dependent ecosystems

The Paterson River is an important tributary of the Hunter River, providing freshwater inflows to the Hunter estuary. Environmental flow provisions in the Water Sharing Plan for the Paterson Regulated River Water Source have the potential to contribute towards healthy and resilient water dependent ecosystems within the freshwater reaches of the Paterson River, but also the Paterson tidal pool and Hunter Estuary.

Relevant water sharing plan provisions

- **Planned environmental water:**
 - **long-term average annual extraction limit** – the plan sets a limit on annual extraction of 11,156 megalitres per year, to preserve approximately 95 percent of long-term average flows for maintenance of ecosystem health.
 - **reserving an environmental contingency allowance (ECA) in Lostock Dam** – 2,000 megalitres of water is reserved at the start of each water year, to be released in the event of critical environmental events and for environmental benefits. The Hunter and Paterson Environmental Water Advisory Group are to advise on its use.
 - **minimum flow targets for end of system flows** - these targets may be changed by the Minister in accordance with Clause 62 of the plan (based on further studies of the environmental requirements of the estuary).
- **Adaptive environmental water** – licensed water entitlements may be committed for environmental purposes by an adaptive environmental water condition. No such commitments exist for the Paterson Regulated River Water Source.

⁶⁶ Raw data provided by DPI Water

Review findings

The Plan is contributing to the health of the Paterson River and Hunter Estuary, including the management of salinity levels. However, environmental water governance is lacking due to an inactive Environmental Water Advisory Group. This is potentially impacting on the use and benefits of the environmental contingency allowance provisioned in the plan. No releases under the Plan's environmental contingency allowance have occurred since February 2007 when a release took place as part of a scientific study. It is unclear if the lack of releases may be attributed to the lack of good governance, constraints in how the contingency is used, or other factors.

DPI Water's Integrated Monitoring of Environmental Flows program was designed to assess the ecological benefits of environmental flows in NSW regulated rivers. Maintaining estuary health is one of the desired outcomes of implementing environmental flow rules in the water sharing plans for the Hunter and Paterson Regulated Rivers. Modelling of salinity in the Hunter estuary was commissioned under the Integrated Monitoring of Environmental Flows program to assess this outcome,⁶⁷ and salinity was adopted as a surrogate indicator of estuary health. This is because changes in salinity can result in changes in estuarine assemblages to more salt-tolerant species. Modelled changes in the salinity structure of the Hunter, Paterson and Williams river estuary found that plan rules have a small effect on salinity.

The last release of environmental water contingency allowance water took place in February 2007, to measure the benefits of environmental releases on fish assemblages. The 1,400 megalitres released over six days did not significantly change fish species abundance or assemblage when compared to nearby unregulated and regulated tributaries.⁶⁸ No further releases from the environmental water contingency allowance account have occurred since this time. According to a submission to the review, this is due to the lack of a formal release program and identified environmental benefits.

An audit of the Water Sharing Plan for the Paterson Regulated River Water Source recommended the establishment of an Environmental Water Advisory Group for the Hunter and Paterson rivers to advise on the use of the environmental contingency allowance.⁶⁹ A submission to the water sharing plan review indicated the group developed a draft framework for administering and implementing environmental water allowances from the Hunter and Paterson regulated river plans. However, the group was suspended after two meetings amid agency restructures and the framework was not adopted. Governance of the environmental water allowance in both plans is lacking as a result. This may impact environmental outcomes.

The *Water Sharing Plan for the Paterson Regulated River Water Source* recognises that factors outside of the plan influence water quality, such as land use and thermal pollution. Effective landscape management in the Paterson River catchment is critical to mitigating water quality issues, and is subject to other planning processes.

⁶⁷ Williams, B., 2010, *IMEF Hunter estuary studies – modelling of salinity in the Hunter estuary, including the Williams and Paterson Rivers*.

⁶⁸ Rolls, R.J., Boulton, A.J. and Maxwell, S.E. 2010, Response by fish assemblages to an environmental flow release in a temperate coastal Australian river: a paired catchment analysis. *River Research and Applications*,

⁶⁹ NSW Office of Water, 2013, *Audit of implementation – Paterson regulated river water sharing plan audit report cards*. Prepared for the period between 1 July 2007 and 30 June 2012.

4 Recommendations

Based on the review findings, the Commission recommends replacing the seven water sharing plans. The cost of doing so is justified by the likely improvement in social, economic, cultural and environmental outcomes, and opportunity to align the inland alluvial aquifer plans with the national Murray-Darling Basin Plan. New water sharing plans can create opportunities to:

- deliver better water sharing outcomes for all stakeholders
- ensure current science and knowledge is at the forefront of water planning and reform
- address monitoring, evaluation and reporting issues which could help improve knowledge of plan outcomes in the future
- improve community involvement in water planning
- improve consistency with other plans, including those that are currently being replaced.

Specific areas recommended to be addressed in the process of developing and implementing replacement plans are set out below.

4.1 Priorities

Water sharing plans governing inland alluvial aquifers

This section recommends 10 major areas for improvement if the six inland alluvial aquifer water sharing plans undergo replacement.

1. **Incorporate best available information and address knowledge gaps** - priority should be given to:
 - A. including results from groundwater model recalibrations underway by DPI Water, including current information on groundwater levels, water user behaviour and climate data
 - B. identification and inclusion of high priority groundwater dependent ecosystems and their minimum watering requirements, drawing on studies currently underway by DPI Water
 - C. identification and inclusion of groundwater dependent cultural values and their watering requirements, through further engagement under the Aboriginal Water Initiative (see **Recommendation 6**).
2. **Adaptive management** - existing knowledge gaps and uncertainties necessitate a precautionary approach to managing groundwater and adaptive management to deliver ecological benefits.⁷⁰ As our collective knowledge of system behaviour deepens and while knowledge of environmental and cultural water requirements is in its early stages, it is essential that the plans can incorporate knowledge improvements. Adaptive management provisions should be retained in plan replacements so that amendments can be made as new information becomes available. Best practice adaptive management requires consideration of how proposed amendments may impact the certainty that these plans provide for licence holders.

⁷⁰ Tomlinson, M., 2011, *Ecological water requirements of groundwater systems: a knowledge and policy review*. Waterlines report series 68. Natural Water Commission, Canberra.

3. **Improve plan consistency where appropriate** - where there are no reasons for differences plan provisions should be the same, including:
 - A. Allow for greater consistency in adaptive management provisions.
 - B. Adopt consistent objectives, performance indicators and provisions to protect groundwater dependent cultural values (particularly in a context where objectives and provisions currently vary between the six inland alluvial water sharing plans).
4. **Review carryover provisions in water sharing plans to improve plan outcomes** - subject to assessment of periodic drawdown risk, increase carryover and annual use limits, especially for plans where current limits are more restrictive, to maximise potential benefits for water dependent industries.
5. **Consider introducing greater flexibility for towns to access town water supply** - provide more flexible provisions that allow for variation in minimum distance rules and allow impacts to be addressed by a broad range of options.
6. **Improve Aboriginal cultural outcomes**
 - A. Secure funding to continue the Aboriginal Water Initiative beyond 2015 - 2016 - DPI Water's Aboriginal Water Initiative is highly regarded for its success in engaging Aboriginal people in water planning; however funding is uncertain beyond 2015 - 2016⁷¹. Further funding will assist in resourcing the identification of groundwater dependent cultural values not yet identified in the inland alluvial water sharing plans.
 - B. Prioritise effort to engage Aboriginal people and better understand and protect groundwater dependent cultural values - DPI Water advised that effort to date had focused on cultural values dependent on surface water.
 - C. Leverage knowledge of Aboriginal cultural values gained through the Basin Plan process
 - D. Incorporate cultural knowledge and groundwater dependent cultural values into replacement plans.
7. **Align water sharing plans with relevant Basin Plan requirements** - the inland alluvial water sharing plans are a component of the suite of documents that will comprise water resource plans required under the Basin Plan. Their replacement provides an opportunity to ensure consistency with relevant accreditation requirements.
8. **Collaborate with key partners and stakeholders**
 - A. Continue to work collaboratively with adjacent jurisdictions to align planning and management of shared water resources - for example, working with Goulburn-Murray Water under the Murray Groundwater Group inter-jurisdictional agreement to deliver a more coordinated approach to groundwater resource management and share knowledge regarding water resources connected to the Lower Murray Groundwater Source.
 - B. Adopt a stakeholder engagement model that enables local knowledge and perspectives to be considered in plan replacements and development of water resource plans. Submissions to the water sharing plan review support use of stakeholder reference panels over interagency reference panels.

⁷¹ National Water Commission, 2014, *A review of Indigenous involvement in water planning, 2013*. National Water Commission, Canberra.

- C. Tailor engagement according to the risks posed to the water source. For example, risks may be heightened during drought or when hotspots (areas of localised drawdown or water quality issues) emerge.
9. **Consider the impacts of climate change on the availability and suitability of water in the long term** – this should include consideration of impacts on water quality (for example, rising salinity), industry and landscape health.
10. **Consider land use changes** – in particular, increases in extractive industries and how they might affect water availability, quality and aquifer integrity.

Water Sharing Plan for the Paterson Regulated River Water Source

This section recommends six major areas for improvement when preparing and implementing the replacement Water Sharing Plan for the Paterson Regulated River Water Source.

1. **Incorporate best available information and address knowledge gaps** – priority should be given to update the Plan’s Integrated Quantity and Quality Model with data that reflects current levels of development in the catchment and recent climate data. Information sources should also include specific water dependent cultural values. DPI Water advised that modelling work is underway that will inform the review of end of system flow targets currently in the plan.
2. **Robust monitoring and evaluation** – review performance indicators included in the water sharing plan, including their relevance, practicality, cost-effectiveness and reporting arrangements
3. **Review governance arrangements for environmental water management** – assess the purpose, role and structure of the inactive Environmental Water Advisory Group established for the Hunter Regulated River system (including the Paterson Regulated River). Consider a cost-effective governance arrangement to drive better outcomes from environmental water allowances provided in regulated river water sharing plans in the Hunter River catchment.
4. **Ensure consistency with rules in adjoining water sharing plan replacements**

The Water Sharing Plan for the Hunter Regulated River Water Source was reviewed in 2013, and is undergoing plan replacement in accordance with the Minister’s recommendation. DPI Water has released a draft plan. Submissions sought consistency between the rules proposed under the draft plan and the Water Sharing Plan for the Paterson Regulated River Water Source. For example, the draft plan for the Hunter Regulated River includes new provisions that permit use of environmental contingency allowance for servicing environmental assets or environmental functions of Aboriginal cultural significance.⁷²
5. **Improve Aboriginal cultural outcomes**
 - A. Engage with Hunter Local Land Services to determine how the Aboriginal Community Advisory Group established by the agency can assist in identifying water dependent cultural values.
 - B. Incorporate identified values into replacement water sharing plan.
6. **Collaborate with key partners and stakeholders and facilitate meaningful engagement** – adopt a stakeholder engagement model that enables local knowledge and perspectives to be considered in plan replacement.

⁷² DPI Water, 2015, *Draft Water Sharing Plan for the Hunter Regulated River Water Source – Report Card for the Hunter Regulated River Water Source*, August 2015. Available: http://www.water.nsw.gov.au/__data/assets/pdf_file/0006/572091/Draft-report-card-Hunter.pdf

4.2 Additional improvement areas

The following four additional improvements are recommended as enablers for more robust and transparent water planning into the future..

1 Provide for cost effective research, monitoring and evaluation

- A. Prioritise investigations, monitoring and analysis to address critical knowledge needs, such as groundwater recharge, groundwater and surface water connectivity, groundwater dependent ecosystems, groundwater dependent cultural values.
- B. Review performance indicators included in the water sharing plans, including their relevance, practicality, cost-effectiveness and reporting arrangements.
- C. Develop and implement robust condition monitoring for groundwater dependent ecosystems. Consider including bio-indicators to understand how condition of groundwater dependent ecosystems is responding to plan implementation.

2 Improve reporting

- A. Consider the reporting needs of stakeholders - consult with stakeholders to identify their reporting needs and expectations. Review monitoring, evaluation and reporting arrangements in light of this feedback. This may potentially lead to changes to performance indicators within water sharing plans and may require greater focus on social and economic outcomes associated with plan implementation.
- B. Comply with reporting obligations - map out agency reporting obligations and ensure that reporting occurs as per these requirements. This includes reporting on plan implementation and performance at regular intervals, with reporting delivered consistently across plans.
- C. Improve analysis and reporting on plan outcomes - identify and implement best practice analytical tools for assessing plan outcomes. DPI Water collects a wealth of groundwater level data from monitoring bores and reports hydrographs for a selection of bores in its status and summary reports. Spatial expression of data from all monitoring bores may provide further insight regarding trends across a water source and should help to highlight hotspots e.g. areas of localised drawdown and trends over time.

3 Share information

- A. Timely and ready access to information - ensure that the information which underpins the water sharing plans and decision-making is readily available to stakeholders and is available in a timely manner.
- B. Foster information sharing with the Murray-Darling Basin Authority, particularly where new knowledge is relevant to the sustainable diversion limits (SDLs) contained within the Basin Plan. Plan provisions allow for adjustment of groundwater SDLs (and surface water SDLs).

4 Update relevant policies

- A. Review components of the NSW State Groundwater Policy Framework and consider their relevance going forward.
- B. Include a definition and criteria for identifying high priority GDEs for inclusion in water sharing plans.

4.3 Sustainable diversion limits and the Basin Plan

The Basin Plan sets limits on the quantities of water that can be taken on a sustainable basis from water resources within the Murray-Darling Basin. These are called sustainable diversion limits (SDLs). The SDLs represent the sustainable level of take before key environmental assets, ecosystem functions and environmental outcomes may be compromised. For groundwater systems, the SDLs represent a risk-based approach to the potential impacts of groundwater extraction on aquifer productivity over time, as well as groundwater dependent ecosystems, surface water connectivity and groundwater quality.

For the six groundwater plans covered by this review, the Murray-Darling Basin Authority adopted long-term average extraction limits from the water sharing plans. These reflect entitlement reductions sought by the NSW Government under the Achieving Sustainable Groundwater Entitlements Program. The logic for this approach is that the outcomes of this program have not yet been assessed and a lack of clarity remains around whether the entitlement reductions are sufficient for returning groundwater use towards sustainable levels of extraction.

Under Section 23A of the Commonwealth *Water Act 2007*, the Murray-Darling Basin Authority (the MDBA) may propose adjusting the SDL for a groundwater SDL resource unit. This would be based on new or improved information relating to the groundwater resources in the unit or factors relevant to setting of the SDL. This can include new knowledge of recharge rates; connectivity with surface water; changes in water use; and changes in policy and planning settings. The extent of the adjustment is based on whether the MDBA is satisfied that the proposed new SDL represents an environmentally sustainable level of take. DPI Water advised the Commission it will continue to work with the MDBA and share new knowledge that may support adjustments to the SDLs.

Attachment A - Water sources covered by the water sharing plans

Water sharing plan	Water sources covered by the plan
Water Sharing Plan for the Lower Gwydir Groundwater Source	Includes all water contained in the unconsolidated alluvial sediment aquifers associated with the Gwydir River, its tributaries, and effluents downstream of Gravesend.
Water Sharing Plan for the Lower Lachlan Groundwater Source	Includes all waters contained in the Lower Lachlan unconsolidated alluvial aquifers.
Water Sharing Plan for the Macquarie Groundwater Sources	Includes all water contained in the unconsolidated alluvial aquifers and the sandstone aquifers of the Great Artesian Basin within the area to which this Plan applies.
Water Sharing Plan for the Lower Murray Groundwater Source	Includes all water contained in the Calivil, Renmark, and the Lower Shepparton unconsolidated alluvial aquifers deeper than 12 metres below the ground surface.
Water Sharing Plan for the Lower Murrumbidgee Groundwater Sources	Includes all water contained in the Shepparton, Calivil and Renmark unconsolidated alluvial aquifers.
Water Sharing Plan for the Upper Namoi and Lower Namoi Groundwater Sources	Include all water contained in the unconsolidated alluvial sediment aquifers associated with the Namoi River and its tributaries. Include Upper Namoi Zones 1 – 12 and the Lower Namoi Groundwater Source.
Water Sharing Plan for the Paterson Regulated River Water Source	Includes waters between the banks of the Paterson River (upper limit of Lostock Dam and its tributaries, to the tidal limit); and the unconsolidated alluvial sediments underlying the river and land (within 40 metres of the top of the bank).

Attachment B - Summary of public submissions

Public submissions are a vital source of information for the Commission's water sharing plan reviews. These submissions help build an understanding of the outcomes achieved through plan implementation, identify plan limitations and where changes to plan provisions may be warranted.

The Commission and NSW DPI Water jointly called for submissions to inform their respective water sharing plan reviews. This process was undertaken in accordance with the Commission's statutory role. Letters outlining the review and submission process were sent to licence holders and key stakeholder groups, inviting them to comment on the plans under review. The submission period was open for eight weeks (12 June to 7 August 2015).

The Commission received and considered 28 public submissions from a range of stakeholders, including water user groups, licence holders, local water utilities, LLS, Aboriginal organisations and environmental groups. The Commission would like to thank stakeholders for their input.

Overall, the submissions indicate that plan replacements are warranted, particularly to incorporate current knowledge and address Murray-Darling Basin Plan requirements. The resounding message from submissions is that the long-term health and resilience of water sources is largely reliant on applying best available science to inform their management.

Submissions also reflect underlying systemic issues regarding transparency, communication and resourcing that have impacted stakeholder confidence in water planning.

Summary of submissions regarding the inland alluvial aquifer water sharing plans

Desired outcome	Key issues raised in submissions
Productive and resilient water dependent industries	<ul style="list-style-type: none"> ▪ Mitigating the impacts of drought – submissions and analysis of trade data indicate the plans helped irrigators through the Millennium Drought. ▪ Assisting farm planning – plans provide confidence in terms of planning within the 10 year life of the plans, but not for long-term planning and investment, despite issuing of licences in perpetuity. ▪ Carryover provisions support efficient and effective water use – these plan provisions provide groundwater users with the flexibility to respond to seasonal and climatic influences, but should be more equitable between plans. ▪ Dealing rules (entitlement and allocation trade): <ul style="list-style-type: none"> - Trade provisions are beneficial for irrigators. They assist in managing water portfolios and business planning, and should be retained in plans. - Assessment processes and the timing of available water determinations have impacted dealings (until recently, water allocations transfers could only occur when annual allocation was known, limiting forward planning). Recent amendments to the <i>NSW Water Management Act 2000</i> allow forward trading up to 10 years. - Geographic restrictions on trade between zones, for example in the Lower Macquarie water sources, require review. ▪ Local impact management – local impact rules are beneficial and should apply equally to irrigators and local water utilities. ▪ Concerns over changing land use – submissions raised associated risks to

groundwater and potential impacts on existing water users and communities, indicating that the current plans do not adequately address such risks. For example, potential impacts of coal seam gas and open cut mining on groundwater quality and supply in the Namoi; or increase in permanent plantings in the Lower Lachlan that require more reliable long term water supply compared to annual cropping enterprises.

- Entitlement reductions and plan extraction limits:
 - Multiple submissions raised concerns over reductions in entitlements and impacts on individuals and communities dependent on irrigation.
 - Some submissions recognised the intent of this initiative, but indicated the process lacked transparency and led to inequitable outcomes.
 - Submissions proposed increasing extraction limits to improve social, cultural and economic outcomes in instances where a portion of recharge was reserved for environmental purposes, but no clear water dependent environmental values had yet been identified.
- Lack of consistency in plan provisions - some regions have more restrictive rules than others. Submissions indicated that the logic behind this lacks transparency. For example, carry over allowances and annual use limits are more restrictive in some plans than others.
- Submissions indicated that water sharing plans and associated outcomes for water dependent industries could be improved by:
 - conducting five and ten year reviews (as required in the plans) that facilitate incremental improvements to the plans
 - addressing Basin Plan requirements for water resource plans, including, but not limited to identifying and listing interception activities (such as mining) which have the potential to have significant impacts on water resources and other users
 - providing greater flexibility for new replacement bores, for example ensuring there is more flexibility around distance restrictions
 - reviewing distance restrictions for new bores and assessment on a case-by-case basis
 - allowing for access licences to be amalgamated
 - allowing for management of water resources at the appropriate scale and greater recognition of groundwater connectivity with surface water
 - ensuring that existing provisions for managing local impacts apply to all licence categories, such as water access licence holders and local water utility licence holders
 - strengthening provisions that protect aquifer integrity and water quality.

Secure long term water supply for urban and rural communities

- Update basic landholder rights based on current information – domestic and stock needs may have changed since the development of the plans.
 - Issues affecting town water supply:
 - Distance restrictions are impacting site selection for a new bore near Narromine for water supply purposes. Existing irrigation bores in close proximity to the town restrict the location of a new bore. Capital and operating costs become prohibitive the further the bore is from town.
 - It was suggested that an urban water supply footprint could be included in the water sharing plans, whereby new bores would be prioritised for
-

town water supply purposes.

- Distance restrictions for new bores should be reviewed and potentially relaxed for town water supply bores.
- Enable the sharing of unused allocations with towns that are struggling to meet water supply needs.
- Improving cultural outcomes:
 - The plans recognise the cultural values of groundwater, but no specific cultural values have been identified to date. It is not appropriate to assume that planned environmental water will protect cultural and spiritual values.
 - Provisions for protecting water dependent cultural values are not sufficient or consistent between plans.
 - Plan objectives and intent should be consistent with the United Nations Declaration on the Rights of Indigenous Peoples and relevant sections of the Convention on Biological Diversity.
 - Information on progress against performance indicators is not readily available, hence it is unclear whether progress is being made in collecting information on groundwater dependent cultural values.
 - Aboriginal stakeholders should be formally engaged in any plan remakes and the development of water resource plans.

Healthy and resilient water dependent ecosystems

- Define what constitutes a high priority groundwater dependent ecosystem – a definition is missing from legislation and policy frameworks, yet plans include protection measures for these assets.
 - Environmental water provisions:
 - Incorporate knowledge of the location and water requirements of groundwater dependent ecosystems - multiple submissions highlighted ongoing knowledge gaps that were first identified when the plans were prepared. Submissions noted the need to address these gaps to tailor strategies and rules to help protect these ecosystems.
 - Include River Red Gums as groundwater dependent ecosystems and include appropriate provisions for their protection.
 - Revisit aquifer recharge provisions across plans and adjust environmental water provisions accordingly. All plans under review, except for the Lower Murray Groundwater plan, include provisions for a portion of recharge to protect and support groundwater dependent ecosystems. New knowledge of aquifer recharge may warrant changes to such provisions, or lack thereof in the case of the Lower Murray plan.
 - Consider surface and groundwater connectivity – surface and groundwater plans would be greatly improved if the latest knowledge on surface and groundwater connectivity informs plan rules.
 - Maintain a precautionary approach to plan rules underpinned by limited knowledge, such as planned environmental water.
 - Improve water quality monitoring across water sources and establish salinity baselines, where appropriate.
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Summary of submissions regarding the Water Sharing Plan for the Paterson Regulated River

Desired outcome	Key issues raised in submissions
All outcomes	<ul style="list-style-type: none"> Rules should be reviewed and updated for consistency with rules in the <i>Water Sharing Plan for Hunter Regulated River Water Source</i> that is undergoing replacement. A variety of plan rules have been redrafted for the Hunter plan that will provide equity and more flexibility for water users. Limited reporting is available on plan implementation and how the regulated river system is responding to plan provisions, including environmental flows. The model underpinning the plan has not been revised with up-to-date information on development in the Paterson valley or climatic data.
Productive and resilient water dependent industries	<ul style="list-style-type: none"> Trade should not be permitted outside of the water source (this is currently the case). End-of-system flow provisions are benefiting water users along the Paterson tidal pool by maintaining low salinity levels. They should be retained in the water sharing plan.
Secure long term water supply for urban and rural communities	<ul style="list-style-type: none"> Any replacement plan should be consistent with the newly defined uses of planned environmental water in the draft <i>Water Sharing Plan for Hunter Regulated River Water</i>, including for cultural purposes.
Healthy and resilient water dependent ecosystems	<ul style="list-style-type: none"> Planned environmental water has only been used once in February 2007 as part of a study into the benefits of environmental flows for fish assemblages. Planned environmental water lacks governance, a formal release program and clear environmental benefits. An Environmental Water Advisory Group was established in 2012 to administer environmental water in the Hunter Regulated and Paterson Regulated rivers, but this group became inactive in 2013 amidst government restructures. A robust accountability framework for implementing planned environmental water should be a priority for plan replacement. Hunter LLS is interested in being represented on the Environmental Water Advisory Group.

Other issues raised by submissions

- Climate variability** – consider the latest information on climate variability, including data captured over the life of the current water sharing plans. This should include consideration of risks to the health of the water source and security of entitlements.
- Evaluation of reductions in entitlements** – submissions sought information on reductions in entitlements under the Achieving Sustainable Groundwater Entitlements Program. In particular, to understand what has been achieved through these reductions and whether these reductions are appropriate given current knowledge.
- Changes to the scope of the Commission’s review** – submissions acknowledge the change in the Commission’s review role with the enactment of the *NSW Local Land Services Act 2013*

and suggested it should be more explicit. They also indicated there is no clear publicly available definition of what constitutes 'state priorities for local land services'. One submission proposed that the Commission's statutory role should explicitly require the review of water sharing plans against:

- The NSW *Water Management Act 2000*
 - the Murray-Darling Basin Plan
 - the latest scientific evidence
 - principles of ecologically sustainable development
 - relevant intergovernmental agreements and policies specified by the Commission when a review takes place.
- **Improve reporting** – submissions expressed concerns over the adhoc nature of reporting on plan implementation and resource condition, indicating it requires improvement.
 - **Greater transparency of processes and knowledge gaps** – for example, the process associated with available water determinations. Greater transparency will help build stakeholder confidence regarding water planning.
 - **Constraints to sustainable agriculture** – submissions suggested that the Commission and local service delivery agencies, such as LLS, should consider constraints to sustainable agricultural production, including rising energy costs and implications for water efficient practices such as pressurised irrigation systems.
 - **Harnessing local knowledge in future planning** – ensure that future water planning effectively engages local communities and utilises their technical and practical knowledge, particularly in addressing Basin Plan requirements.