WATER MANAGEMENT

Replacement water sharing plan manual

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Acknowledgements

NSW acknowledges Aboriginal people as Australia's First Peoples, practising the oldest living culture on earth, and as the Traditional Owners and Custodians of the lands and waters.

The NSW Department of Planning and Environment understands the need for consultation and inclusion of Traditional Owner knowledge, values and uses in water quality planning to ensure we are working towards equality in objectives and outcomes.

The department is committed to continuing to build new relationships and fostering strong partnerships with our First Nations people.

The department thanks working group members from other government agencies, including the Department of Primary Industries, Department of Planning and Environment – Environment, Energy and Science, the Natural Resources Access Regulator and WaterNSW for their continued collaboration throughout the water sharing plan development process.

Contents

Introduction

Water sharing plans are key legal instruments for sharing water in New South Wales (NSW). Each plan is in place for 10 years, after which it may be extended or replaced with a new plan. When a plan is replaced, it is updated to include new information, and policy and legislative changes.

This manual outlines the processes that the Department of Planning and Environment has used in replacing the plans for groundwater and unregulated river water sources. It is an update on the information outlined in the:

- *Macro water sharing plans – the approach for unregulated rivers: A report to assist community consultation*[1]
- *Macro water sharing plans – the approach for groundwater: A report to assist community consultation*[2]
- *Macro water sharing plans – the approach for unregulated rivers: Access and trading rules for pools.*

These reports were used to guide the development of water sharing plans from 2011. We have changed the processes for replacing plans as a result of our adaptive approach to planning. As noted throughout this manual, we are still using some methods described in the above reports.

This manual describes planning methods for developing replacement water sharing plans for unregulated coastal and inland areas, and for groundwater outside the Murray–Darling Basin. It does not discuss planning methods for developing replacement water sharing plans for regulated river sources.

Although the content in this manual is correct at the time of writing, we are continually updating our methods and policies in response to the latest research and information. You should refer to water sharing plan background documents for the most recent and specific methods used to prepare each plan.

Current status of water sharing plans

Background of plans

Water sharing plans were developed for rivers and groundwater in NSW after the introduction of the *Water Management Act 2000* (WM Act). These plans establish environmental water rules to protect rivers and groundwater and to identify the water requirements for basic landholder rights (BLRs) and for extraction under access licences.

The plans also establish long-term limits on water extraction and rules that govern the trade of water. The first plans began in 2004, and plans are now in place for all rivers and groundwater in NSW. These plans include those that are part of water resource plans prepared under the *Water Act 2007* and the Basin Plan 2012.

Review and replacement process

Under the WM Act, water sharing plans have a 10-year duration. Since 2014, water sharing plans in NSW have been reaching the end of their first 10-year plan term. We have been extending or replacing these plans as they expire.

[1] NSW Office of Water, 2011, *Macro water sharing plans—the approach for unregulated rivers: A report to assist community consultation*, NSW Government.
[2] NSW Office of Water, 2011, *Macro water sharing plans—the approach for groundwater: A report to assist community consultation*, NSW Government.

During the life of a plan, it will undergo review at least twice, as follows:

- The implementation of the plan will be audited in the first five years of the plan under Section 44 of the WM Act.
- The performance of the plan will be reviewed in the last five years of the plan under Section 43A of the WM Act.

The NSW Natural Resources Commission is the independent body that audits and reviews water sharing plans. The Section 44 audits aim to identify where improvements are necessary to implement the plan rules. The Section 43A review is to determine whether the plan is achieving the intended environmental, social and economic outcomes.

The commission reports the findings of Section 44 audits and Section 43A reviews to the NSW Minister for Lands and Water to help decide whether to extend a plan for another 10 years or to replace it. If the minister recommends replacing the plan, the department considers the commission's recommendations when developing the replacement plan.

When we extend an existing plan, we prolong it for another 10 years. When an existing plan expires, we replace it with a new one. The replacement plan may continue some provisions (legal conditions) of the previous one and introduce new provisions. When a plan is due to be replaced, the minister may extend it by as much as two years to develop the replacement plan. Appendix 1 lists replaced plans. This manual refers to plans that we are in the process of replacing or plans that we will replace in the future as 'replacement plans'.

Under the WM Act, the minister may consolidate one or more management plans. Several plans that have been replaced were consolidated with other plans. Appendix 1 also indicates which plans have been consolidated. The 'Policy updates and legislative changes' section of this manual discusses the consolidation of plans in more detail.

Table 1 is a schedule of the water sharing plans approaching their expiry (and that have been approved for or may be approved for replacement, at the time of publishing).

Table 1. Schedule of expiry for water sharing plans

Expiry year (30 June expiry date*)	Water sharing plan
2020 The NSW Natural Resources Commission review recommended replacing these plans, so they have been extended for two years.	Coastal plans: • Water Sharing Plan for the Hunter Unregulated and Alluvial Water Sources 2009 • Water Sharing Plan for the Central Coast Unregulated Water Sources 2009 • Water Sharing Plan for the Coffs Harbour Area Unregulated and Alluvial Water Sources 2009 • Water Sharing Plan for the Lower North Coast Unregulated and Alluvial Water Sources 2009 Inland plans: • Water Sharing Plan for the Peel Regulated River Water Source 2010
2021 The commission review recommended replacing these plans, so they have been extended for two years.	Coastal plans: • Water Sharing Plan for the Richmond River Area Unregulated, Regulated and Alluvial Water Sources 2010 • Water Sharing Plan for the Murrah–Wallaga Area Unregulated and Alluvial Water Sources 2010 • Water Sharing Plan for the Towamba River Unregulated and Alluvial Water Sources 2010 • Water Sharing Plan for the Tweed River Area Unregulated and Alluvial Water Sources 2010 • Water Sharing Plan for the Bega and Brogo Rivers Area Regulated, Unregulated and Alluvial Water Sources 2011 • Water Sharing Plan for the Greater Metropolitan Region Unregulated River Water Sources 2011 • Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources 2011 Inland plans: • No plans are due to expire in 2021
2022	Coastal plans: • No plans are due to expire in 2022 Inland plans: • Water Sharing Plan for the Castlereagh River Unregulated River Water Sources 2011 • Water Sharing Plan for the Intersecting Streams Unregulated River Water Sources 2011 • Water Sharing Plan for the Murray Unregulated River Water Sources 2011 • Water Sharing Plan for the Lower Murray–Darling Unregulated River Water Source 2011 • Water Sharing Plan for the North Western Unregulated and Fractured Rock Water Sources 2011 • Water Sharing Plan for the NSW Border Rivers Unregulated River Water Sources 2012

Expiry year (30 June expiry date*)	Water sharing plan
2023	Coastal plans: • No plans are due to expire in 2023 Inland plans: • Water Sharing Plan for the Barwon–Darling Unregulated River Water Source 2012 • Water Sharing Plan for the Belubula Regulated River Water Source 2012 • Water Sharing Plan for the Gwydir Unregulated River Water Sources 2012 • Water Sharing Plan for the Lachlan Unregulated River Water Sources 2012 • Water Sharing Plan for the Namoi and Peel Unregulated Rivers Water Sources 2012 • Water Sharing Plan for the Murrumbidgee Unregulated River Water Sources 2012 • Water Sharing Plan for the Macquarie Bogan Unregulated Rivers Water Sources 2012
2026	Coastal plans: • Water Sharing Plan for the North Coast Fractured and Porous Rock Groundwater Sources 2016 • Water Sharing Plan for the North Coast Coastal Sands Groundwater Sources 2016 • Water Sharing Plan for the Macleay Unregulated and Alluvial Water Sources 2016 • Water Sharing Plan for the Clarence River Unregulated and Alluvial Water Sources 2016 • Water Sharing Plan for the Clyde River Unregulated and Alluvial Water Sources 2016 • Water Sharing Plan for the Deua River Unregulated and Alluvial Water Sources 2016 • Water Sharing Plan for the Hunter Regulated River Water Source 2016 • Water Sharing Plan for the Snowy Genoa Unregulated and Alluvial Water Sources 2016 • Water Sharing Plan for the South Coast Groundwater Sources 2016 • Water Sharing Plan for the Tuross River Unregulated and Alluvial Water Sources 2016 Inland plans: • Water Sharing Plan for the Gwydir Regulated River Water Source 2016 • Water Sharing Plan for the Lachlan Regulated River Water Source 2016 • Water Sharing Plan for the Macquarie and Cudgegong Regulated Rivers Water Source 2016 • Water Sharing Plan for the Murrumbidgee Regulated River Water Source 2016 • Water Sharing Plan for the New South Wales Murray and Lower Darling Regulated Rivers Water Sources 2016 • Water Sharing Plan for the Upper Namoi and Lower Namoi Regulated River Water Sources 2016

Expiry year (30 June expiry date*)	Water sharing plan
2027	Coastal plans: • Water Sharing Plan for the Nambucca Unregulated and Alluvial Water Sources 2016 Inland plans: • No plans are due to expire in 2027
2029	Coastal plans: • Water Sharing Plan for the Hastings Unregulated and Alluvial Water Sources 2019 • Water Sharing Plan for the Paterson Regulated River Water Source 2019 Inland plans: • No plans are due to expire in 2029
2030	Coastal plans: • Water Sharing Plan for the Bellinger River Area Unregulated and Alluvial Water Sources 2020 Inland plans: • Water Sharing Plan for the Darling Alluvial Groundwater Sources 2020 • Water Sharing Plan for the Gwydir Alluvial Groundwater Sources 2020 • Water Sharing Plan for the Lachlan Alluvial Groundwater Sources 2020 • Water Sharing Plan for the Macquarie–Castlereagh Groundwater Sources 2020 • Water Sharing Plan for the Murray Alluvial Groundwater Sources 2020 • Water Sharing Plan for the Murrumbidgee Alluvial Groundwater Sources 2020 • Water Sharing Plan for the Namoi Alluvial Groundwater Sources 2020 • Water Sharing Plan for the NSW Border Rivers Alluvial Groundwater Sources 2020 • Water Sharing Plan for the NSW Great Artesian Basin Groundwater Sources 2020 • Water Sharing Plan for the NSW Great Artesian Basin Shallow Groundwater Sources 2020 • Water Sharing Plan for the NSW Murray–Darling Basin Fractured Rock Groundwater Sources 2020 • Water Sharing Plan for the NSW Murray–Darling Basin Porous Rock Groundwater Sources 2020

* The plan may be extended for as long as two years from date of expiry to replace the plan.

Steps for plan replacement

Table 2 outlines the phases for plan replacement and actions necessary in each phase.

Table 2. Steps for plan replacement

Phase	Actions
Phase 1: Department review of water sharing plan	• Identify stakeholders • Review S44 audit report • Collate known issues from a range of sources • Consult with internal and interagency working groups • Conduct targeted consultation if necessary
Phase 2: Natural Resources Commission review of water sharing plan	• Consider Natural Resources Commission review • Review Natural Resources Commission recommendations for extension or replacement • If commission recommends plan extension, follow request for extension process

Phase 3: Plan updates	• Update data used in current plan, including groundwater-dependent ecosystem (GDE) identification, socioeconomics, basic landholder and native title rights, licensed entitlement, flow reference points, flow classes, maps, risk assessment
	• Option analysis for proposed rules:
	  ○ Prepare papers for discussion with internal and external working groups
	  ○ Meet with internal and external stakeholders
	• Finalise draft plan updates

Phase 4: Draft water sharing plan	• Finalise draft plan by:
	  ○ providing drafting instructions to legal staff that describe changes proposed and why
	  ○ updating schedules to incorporate updated information
	  ○ Parliamentary Counsel's Office drafts the plan
	• Department's Policy team reviews, following comments from the department's Legal team
	• Regional water senior officers' group review
	• Executive approves draft plan for public exhibition
	• **For inland water sharing plans**, the proposed changes should be discussed with the Murray-Darling Basin Authority (MDBA) with the longer-term view of amending the relevant water resource plan.'

Phase	Actions
Phase 5: Prepare water sharing plan for public exhibition	• Create email address for submissions • Finalise draft maps • Draft plan fact sheets, including frequently asked questions and proposed changes • Draft brief for water sharing plan package • Draft water sharing plan package • Executive approves draft plan package for public exhibition • **For inland water sharing plans,** changes to the water resource plan are also put in the public exhibition package

Phase 6: Public exhibition	• Prepare for public exhibition:
	  ○ Create website advising of public exhibition and submission process
	  ○ Create media release advising of public exhibition
	• Begin public exhibition
	• Hold public meetings
	• Public exhibition closes
	• Review submissions (collate and document issues raised)

Phase 7: Update draft water sharing plan	• Reassess options as necessary • Consult with internal and interagency working groups as necessary • Conduct targeted consultation if necessary • Prepare recommendations • Update water sharing plan • Planning manager and director approves • Regional water senior officers group reviews and endorses • Update background document • **For inland water sharing plans**, the draft changes to the water resource plan are also updated and discussed with the MDBA in response to public exhibition
Phase 8: Water sharing plan approval and gazettal	• Draft package for approval to begin water sharing plan • Create proclamation (if needed for example, when there is a new water source) • Brief created for executive and minister's approval • Agreement from the NSW Minister for Environment and Heritage • Draft and send media release • Minister signs water sharing plan amendment order • Parliamentary Counsel's Office gazettes water sharing plan • **For inland water sharing plans**, the process of amending the relevant WRP should be undertaken

Phase	Actions
Phase 9: Preparation for release of water sharing plan	• Update website – remove public exhibition information • Update background document on website • Update rule summary sheets on website • Ready water sharing plan for upload on website • Ready maps for upload on website
Phase 10: Water sharing plan begins	• Begin water sharing plan • Plan is published on the NSW legislation website

Other drivers of change

The Natural Resources Commission's review in the second half of the plans' 10-year term is a key driver for changes to the plans. Other key drivers include:

- Murray Darling Basin Plan 2012 – water sharing plans are the primary legislative tool to align management of inland water resources with the Basin Plan requirements. Water resource plans are part of how the Basin Plan is implemented and build on the requirements in water sharing plans.

  The water resource plans set a sustainable diversion limit that cannot be exceeded over time. Where the provisions of a water sharing plan meet the requirements of the Basin Plan, the water resource plan references and adopts those provisions.
- Contemporary water resource policy – plans are adjusted to ensure they align with current policy to improve how we reach water resource management objectives across the state. Changes can be purely administrative or more substantial.
- Improvements to our data and knowledge.

When we make changes, we aim to address the requirements of the above drivers. The provisions must also be practical and legally accurate. Finally, we make changes to better meet water sharing plan objectives, and modernise and simplify the plans so they are easier to understand.

Updates to our planning approach for replacing plans

Building on the macro-planning approach

Approach to developing the first round of plans

Before 2010, water sharing plans were developed for individual water sources. For example, Kangaroo River and Tarcutta Creek each had their own plan. These water sources were often a single catchment or aquifer within a larger river or groundwater system. Water sharing rules within these plans were based on environmental and economic assessments for these individual water sources.

Similarly, for regulated rivers, particularly in inland NSW, data, assessment methods and rules were unique to each catchment. Water sharing rules in these plans did not reflect state-wide policy on the sharing of surface water and groundwater across NSW.

The individual approach for each plan meant that water sharing plans didn't guarantee consistency or equity in water sharing across NSW. At the same time, the approach was arduous and resource-intensive.

As water sharing plans had to be developed for all surface and groundwater water sources across NSW, we replaced this approach with the macro-planning approach.

The macro-planning approach

In 2010, the NSW Government developed and applied a standard 'macro' planning approach[3] to developing water sharing rules for unregulated rivers and groundwater. This approach was to complete a single assessment to determine access and trade rules for multiple water sources.

While developing this approach, the NSW Government also developed a suite of policies to guide the sharing of surface water and groundwater. These new policies helped deal with the many questions that emerged while developing the first round of plans that could not be answered at that time.

The macro-planning approach assessed the risks to, and values of, water sources to determine the most suitable draft access and trade rules. For groundwater, the approach also helped determine long-term volumes of water for extraction and the environment. The macro-planning approach risk assessment considered environmental, economic and social factors. The risk assessment used state-wide data sets to estimate the values of each factor for all water sources.

For unregulated rivers, we then analysed the data to provide indicative ratings of:

- in-stream ecological value
- hydrologic stress (the amount of water extracted relative to low flow)
- risk that extraction of water poses to water source ecosystems
- economic dependence of an area on water extraction.

This approach determined indicative access rules[4] and trade rules for each of the water sources. Local departmental staff responsible for fisheries, agriculture and the environment who were familiar with the water sources then reviewed indicative ratings and rules. We used their findings to help develop draft risk ratings and water sharing rules, then publicly exhibited these and used them

[3] Refer to NSW Office of Water, 2011, *Macro water sharing plans—the approach for unregulated rivers: A report to assist community consultation*, NSW Government, for a full description of the approach as it applies to unregulated rivers and groundwater.
[4] Including surface water cease-to-take and commence-to-take rules.

for targeted consultation. Where necessary, we amended the rules to address matters raised during public exhibition before the minister gazetted the plan as an enforceable statutory plan.

For groundwater, we also assessed the volume of recharge to a groundwater system and the risks to the groundwater system from extraction. We used these results to set long-term limits on take of groundwater and the amount of water reserved for the environment.

We also set the rules for groundwater systems based on their level of connectivity with surface water systems. Where surface water and groundwater were highly connected, we considered using surface water access rules for groundwater access. To determine distance rules for new groundwater works, our assessment also looked at protecting:

- existing groundwater users
- high-priority groundwater-dependent ecosystems (GDEs)
- Aboriginal culturally significant sites that are groundwater-dependent.

New planning approach

The macro-planning approach had the advantages of being transparent, standardised and uniformly applied across hundreds of water sources. However, there were limits to the precision of spatial data, estimates of the risk of extraction and the range of risks that we assessed.

As a result, the department developed a new risk-assessment approach. When developing replacement water sharing plans, we assess risks at a water source level for each plan. We also review the earlier macro-planning approach results for the plan and update data to assist in making decisions for the replacement plan.

The ‘Updated methods in response to new information’ section of this manual further discusses the new risk-assessment approach.

Principles for water sharing plan replacement

Under Section 43A of the WM Act, the Natural Resources Commission’s review of plans considers ‘the extent to which the water sharing plan provisions have materially contributed to the achievement of, or failure to achieve, environmental, social and economic outcomes and whether those changes to the provisions are warranted’.

The department contributes to the commission’s review process and considers the recommendations of the review report.

If the commission recommends the replacement of a plan, the department considers the recommendations, completes a complementary departmental review and updates the current plan content. Often, the departmental review takes place before or at the same time as the commission’s review.

These steps are to ensure that the department addresses the requirements for replacing a plan. Any replacement must consider the original requirements for water sharing plan provisions under Section 20 of the WM Act:

(a) the establishment of environmental water rules for the area or water source

(b) the identification of requirements for water within the area, or from the water source, to satisfy BLRs

(c) the identification of requirements for water for extraction under access licences

(d) the establishment of access licence dealing rules for the area or water source

(e) the establishment of a bulk access regime for the extraction of water under access licences, in keeping with the rules referred to in paragraphs (a) and (d) and the requirements referred to in paragraphs (b) and (c).

Key principles of the department's complementary review include:

- The review will seek to improve the efficiency and effectiveness of water sharing arrangements by targeting areas where new information shows the rules:
    a. could be improved
    b. are no longer appropriate
    c. have had unintended impacts
    d. have identified implementation difficulties.
- The review will use a collaborative approach to ensure it considers the views of all stakeholders when reassessing water sharing arrangements.
- The review, in line with the principles of the WM Act, will seek to balance social, cultural, economic and environmental needs of the community and catchments.
- Changes will seek to ensure that environmental outcomes of the plan are maintained or enhanced.
- Changes that affect water users will be minimised where possible.
- Changes to water sharing arrangements in water sources in the Murray–Darling Basin will meet the requirements set out in the Basin Plan 2012.

We use the findings of the review to develop the replacement plan.

Scope for water sharing plan replacement

The Natural Resources Commission holds the statutory responsibility for the formal review of water sharing plans. However, the department's review has a deliberately broad scope to investigate issues and determine whether the plan has met required outcomes or whether changes are necessary.

Issues in scope

To determine which issues are in scope, we use the commission's review and other sources, including stakeholder feedback, to prepare a list of known water sharing plan issues. An internal water sharing plan working group assesses this list, working with other subject matter experts as necessary, to decide whether the issues are within the scope of the replacement process.

The scope of the review will consider, but is not limited to, the factors Table 3 describes.

Table 3. In-scope considerations and sources for information

In-scope considerations	Potential information sources
New information that shows the current water sharing arrangements are no longer appropriate or could be improved	Section 44 audits; Section 43A reviews; monitoring, evaluation and reporting; plan suspensions; plan amendment register; stakeholder feedback; issues register
New information that informs update of plan provisions	Information relating to new infrastructure, socio-economic data, water user behaviour, risk assessments, threatened species information, GDEs, BLRs, water entitlements, Aboriginal water-dependent values and uses
Changes in policy or other legislation	Critical infrastructure legislation, departmental policies, *Water Act 2007* and Basin Plan 2012 requirements
Water sharing arrangements that have had unintended impacts or have not achieved intended outcomes	Section 43A reviews, plan suspension, plan amendment register, stakeholder feedback, issues register
Implementation issues	Section 44 audit, Section 43A reviews, plan suspension, plan amendment register, stakeholder feedback, issues register
Studies or amendments specified in the water sharing plan	Implementation program, individual study reports, amendment register
Amendments required to carry out regional water strategies or metropolitan water strategies	Strategy documentation

Out of scope

The department has also developed criteria for what is out of scope to simplify setting the remit of the review. These criteria can help refine the list of issues considered in scope later in the planning process, as we examine issues and their effects become clearer.

The department uses the criteria in Table 4 to assess whether an issue is out of scope. We may add other criteria when relevant.

Table 4. Assessment criteria for identifying whether an issue is out of scope

Assessment criteria	Comment/Example
Does the issue relate to water charges, costs, infrastructure proposals, operational activities or a licensing matter?	Issues that a water sharing plan cannot address
Is another program or process addressing the issue, or is it the responsibility of another department?	Improving alternative water supplies for specific towns, drainage management
Does the issue require time and resources beyond the time frame to review the water sharing plan?	A study on the effects of climate change in a particular valley
Is the issue consistent with the current legislative and policy framework?	Allowing the building of harvestable rights dams on third-order streams
Does the issue contradict a Basin Plan 2012 requirement (inland water sharing plans only)?	Restriction of trade that discriminates against one category of licence

Project governance

The department develops replacement plans based on advice from several project teams, including those in planning, policy, modelling and science. We also collaborate on the plans with other agencies in interagency working groups. In addition to the department, the agencies involved in developing replacement plans include, but are not limited to:

- Department of Primary Industries – Fisheries
- Department of Primary Industries – Agriculture
- Department of Planning and Environment – Environment, Energy and Science
- WaterNSW
- Natural Resources Access Regulator.

Once we develop and publicly exhibit a plan, it must be endorsed and approved to begin (Figure 1).

Figure 1. Water sharing plan governance

*Minister for Lands and Water seeks concurrence from Minister for Environment and Heritage

Policy updates and legislative changes

Consolidating water sharing plans

Section 45A of the WM Act allows for the consolidation of two or more management plans. We look for opportunities to consolidate water sharing plans where it is practical.

The benefits of consolidation can include:

- greater consistency of approach to water sharing between water sources
- alignment of the boundaries of water sharing plans with regional water strategies; if possible, this would remove potential legal or planning impediments to developing and adopting demand-and-supply measures in regional water strategies
- alignment of NSW water planning boundaries with Basin Plan 2012 planning boundaries
- reduced departmental resource demands and duplication of tasks.

The department acknowledges that consolidating plans may raise stakeholder concerns. Some of these may be about:

- **increased town water supply transfers between plan areas**. However, the high priority of town water supply, particularly during drought, means that water transfers between plan

areas for town water supply would likely be developed anyway. Consolidating plans better establishes the legal arrangements for inter-basin transfers

- **potential for increased trade**. However, trade may occur only between areas that are hydrologically connected, and water sources of a plan area are usually hydrologically disconnected from those water sources of an adjacent plan area. Trades between water sources of consolidated plans would be prohibited unless they are hydrologically connected
- **potential for inequity when plans merge**. Each plan had its own macro-planning approach risk assessment, which rated each water source against others within the plan area. It is likely that if the water sharing plan areas combine, there will be disparities in the risk and value ratings, as well as access and trade rules for water sources of both plan areas.

  For example, a water source with the highest ecological value in the individual water sharing plan would receive a high in-stream value rating. However, once the water sharing plans combine, this water source might have only a moderate in-stream value rating compared with water sources within the new, larger water sharing plan area. This might mean that water sources with similar characteristics in different water sharing plans have different access and trade rules once the plans merged. Using the new risk assessment completed on the water resources of the new plan area as a whole would likely mitigate this in part.

The department assesses whether plans should be consolidated on a case-by-case basis. We also consider the recommendations of the Natural Resources Commission when deciding whether to consolidate plans.

Considering other forms of take in replacement water sharing plans

Previous plans were inconsistent in how they considered water take by harvestable rights or take via interception by plantation forestry in the long-term average annual extraction limit (LTAAEL). Similarly, there was no consistent approach for considering other forms of take in the 'Requirements for water' section of the plans.

To ensure the replacement plans are consistent, we have taken an overarching approach to considering these forms of take, which this manual details below.

Harvestable rights

In some parts of NSW, water take under harvestable rights is a significant form of take. Landholders in coastal-draining catchments of NSW can capture up to 30% of the average regional rainwater run-off from their property in harvestable right dams built on temporary minor streams, hillsides and gullies. Central and Eastern Division landholders in catchments which are not coastal-draining can take up to 10% of average annual regional rainfall run-off. In the Western Division of NSW, 100% of average rainfall run-off can be captured.

A volumetric estimate of this form of take will be specified in replacement coastal unregulated plans in the relevant 'Requirements for water' section of the plan.

As part of amending inland water sharing plans to meet the requirements of water resource plans, take under harvestable rights was considered in the LTAAEL. Further, replacement unregulated coastal plans will also include harvestable rights within the LTAAEL.

Inland replacement plans will include a description of this take in the LTAAEL and later move to a volumetric estimate.

Plantation forestry

Rainfall run-off and aquifer recharge are reduced in areas of plantation forestry, compared with other land-use types, such as broad acre agriculture.[5]

Under the National Water Initiative, NSW is committed to principles to manage the interception of water by plantation forestry. The specific commitments vary based on whether water resources in a catchment are fully allocated or not.

There is currently no documented state policy on the accounting and management of interception by plantations. NSW has previously committed to meeting the requirements of the National Water Initiative within its existing management framework.

NSW assessed the risks in 2010 and concluded that plantations do not pose a significant threat to water availability in NSW. The plantation industry has not grown significantly since 2009.[6] NSW continually monitors changes for significant expansion over and above 2009 levels in the plantation industry. If significant growth in the industry or its water use occurs, water take by plantation forestry will form part of the LTAAEL.

We do not currently consider interception of water by plantation forestry to be significant water take in NSW. NSW also does not consider it a form of water take that should be licensed. As such, it is not specified in the 'Requirements for water' section of the plans or the LTAAEL.

Replacement plans include an amendment provision so that we may make changes to the plans if NSW finalises a new policy on accounting or managing interception by plantations during the plan period.

Policies for other water management frameworks

A range of water management frameworks manage water in NSW. These include, but are not limited to:

- The NSW State Water Strategy
- regional water strategies
- the Marine Estate Management Strategy
- urban water management plans and strategies
- water resource plans
- long-term (environmental) water plans.

The 'Links to other water management frameworks' section describes these frameworks and their relationship to water sharing plans in more detail.

Other water management frameworks may create policies. We will review these policies and consider their effects when replacing water sharing plans.

Sustainable diversion limits

Inland systems

Both the Basin Plan 2012 and the Murray–Darling Basin Authority (MDBA) were established under the *Water Act 2007*. The MDBA determined that the existing level of water extraction for the basin in 2009 was 13,623 GL. The MDBA also determined that the long-term sustainable diversion limit was approximately 10,873 GL per year, or 2,750 GL lower than the 2009 baseline extraction level.

[5] Prosser, I and Walker, P 2009, *A review of plantations as a water intercepting land use in South Australia*, CSIRO.
[6] Australian Bureau of Agricultural and Resource Economics and Sciences 2020, 'Plantation and log supply', accessed from www.agriculture.gov.au/abares/research-topics/forests/forest-economics/plantation-and-log-supply#australian-plantation-statistics-2020-update

The Australian Government has since committed to recovering the additional 2,750 GL of water for the environment through a combination of licence buybacks, water recovery and efficiency projects. Any project needs to make sure that it balances environmental, social and economic outcomes.

The Basin Plan sets sustainable diversion limits, which state how much water can be used in the Murray–Darling Basin while still providing water for the environment. The sustainable diversion limits aim to ensure there is sufficient water to maintain the environmental health of the Murray–Darling Basin by limiting the amount of water that users can extract from the basin and considering the social and economic impacts of water recovery.

Under the requirements of the Basin Plan, the department is developing supply and efficiency measure projects (also known as sustainable diversion limit adjustment mechanism projects) to facilitate recovery of water for the environment and productive use.

Sustainable diversion limits for surface water are specified as a long-term average annual water use at a sustainable diversion limit unit level and on a basin-wide scale. Apart from the Barwon–Darling River and Intersecting Streams, the Basin Plan sustainable diversion limit applies to a combination of take from the regulated and unregulated rivers and streams.

For most groundwater water sharing plans, the sustainable diversion limit is equal to the LTAAEL. Where the LTAAEL was greater than the sustainable diversion limit and the number of entitlements was less than the sustainable diversion limit, we amended the water sharing plan to reflect the sustainable diversion limit.

We assess compliance with the LTAAEL according to the rules of the relevant water sharing plan. This involves calculating the average annual extraction each year over the previous five-year period. Non-compliance occurs when this calculated average annual extraction exceeds the LTAAEL by either 5% or 10%, as set out in the water sharing plan.

Coastal systems

Coastal unregulated water sharing plans need not follow the requirements of the Basin Plan. Despite this, it is best practice for the plans to set and explicitly reference a sustainable limit for water extraction.

Work is currently underway to determine what a sustainable LTAAEL would be for each water source. The ‘Method for setting LTAAELs’ section of this manual discusses this further.

NSW non-urban water metering framework

The NSW Government put a metering framework in place in December 2017 to measure and monitor non-urban water take in NSW. The government developed this framework in response to the *Independent investigation into NSW water management and compliance*[7] and the *Murray–Darling Basin Water Compliance Review*.[8]

The metering framework aims to improve the standard and coverage of non-urban water meters in NSW.

[7] Matthews, Ken 2017, *Independent investigation into NSW water management and compliance—final report,* www.industry.nsw.gov.au/__data/assets/pdf_file/0019/131905/Matthews-final-report-NSW-water-management-and-compliance.pdf

[8] Murray–Darling Basin Authority 2017, *The Murray–Darling Basin Water Compliance Review*, www.mdba.gov.au/sites/default/files/pubs/MDB-Compliance-Review-Final-Report.pdf

The metering framework comprises the:

- NSW non-urban water metering policy
- metering-related provisions of the Water Management (General) Regulation 2018
- metering-related provisions of the WM Act.

Under the WM Act, a metering condition is imposed on water take. It requires metering equipment to be installed, used and properly maintained on some water supply works.

The Water Management (General) Regulation 2018 sets out the requirements of all holders of approvals, licences and entitlements who are subject to the metering condition. It also prescribes which holders are exempt from the metering condition. The regulation also contains requirements for duly qualified persons, telemetry, record-keeping and reporting rules, and a process for faulty meters.

The department administers the metering framework under delegation from the minister. The policy and the metering-related provisions of the WM Act and the Water Management (General) Regulation 2018 began on 1 December 2018. Some parts of the regulation relating to new and replacement meters, faulty meters and inactive works began on 1 April 2019. The remainder of the framework will roll out in stages from 1 December 2020 to 1 December 2023.

Under sections 17(c) and 100 of the WM Act, a water sharing plan sets conditions to which water licences and approvals are subject. For metering, the plans set out the requirements for water supply work approvals to have mandatory conditions for the installation, use and maintenance of compliant metering equipment. The plans also set out the requirement for the approval holder to notify the minister in the event of a condition breach. Visit www.industry.nsw.gov.au/water/metering for more information on the non-urban metering framework and your obligations to meter water extraction.

Links to other water management frameworks

NSW Water Strategy

The NSW Government has developed a 20-year, state-wide NSW Water Strategy to improve the resilience of the state's water resources over the coming decades. Implementation of the NSW Water Strategy will address key challenges and opportunities for water management and service delivery across the state and set the strategic direction for the NSW water sector over the long-term. The strategy will:

- guide water service delivery and resource management across NSW
- build on the progress made from previous reforms and set the direction to keep improving
- identify key challenges, opportunities, strategic priorities and actions for the whole of NSW
- clearly articulate the water resource management and service delivery framework and policy context for NSW, including how the Murray–Darling Basin Plan and state-wide, regional, metropolitan and local strategic water policy and planning frameworks work together.

The NSW Water Strategy and the regional and metropolitan water strategies do not replace statutory instruments (such as water sharing plans). They set the agenda for water management and service delivery into the future. They are designed to contribute to water management outcomes aligned with the objects and principles of:

- the WM Act
- the NSW Government's priorities
- NSW's commitments under the Murray–Darling Basin Plan, the National Water Initiative, and other commitments such as the Great Artesian Basin Strategic Management Plan.

The NSW Water Strategy outlines seven priorities, and actions taken by the NSW Government in each priority area. Under these priorities, the strategy will improve water sharing plans by:

- enhancing modelling
- reviewing the regulation of domestic and stock landholder rights
- making sure non-urban water take is accurately measured
- working with Aboriginal people to maintain and preserve water-related cultural sites and landscapes
- investing in long-term and effective monitoring, evaluation, reporting and research
- working with communities to better understand and improve system connectivity
- reviewing water allocation and water sharing in response to new climate information
- improving the operation and transparency of water trade.

Regional water strategies

Regional water strategies aim to understand how much water a region will need to meet future demand, the challenges and choices involved in meeting those needs, and the actions we can take to manage risks to water availability. They have a 20- to 40-year planning horizon.

Using new climate data, each regional water strategy will develop a portfolio of options that meets one or more of the objectives of the regional water strategies. Once each strategy is finalised, each option will be further developed. Depending on the scale and type, some options will need to be approved through extensive planning approval pathways.

The options within regional water strategies will work within, or recommend changes to, the policies and plans that guide how water resources are managed in NSW. Despite this, water sharing plans continue to be the legal instruments for managing water resources in the state.

It is possible that the new modelling data gathered through regional water strategies and the options developed will inform changes to water sharing plans. More specifically, it is possible that changes to water sharing plans will be informed by the:

- new modelling data for climate variability and climate change risks gathered through regional water strategies
- outcomes of community engagement that are providing a better understanding of future water requirements.

We will consider other work for the regional water strategies, including updates to socio-economic data, while developing replacement water sharing plans.

When strategy options may trigger amendments to a water sharing plan in that specific region, the timing of these amendments would depend on a range of factors, including the:

- further development and implementation of regional water strategies
- rules for amending the water sharing plan
- timing for reviewing and remaking a water sharing plan
- requirements under the planning approvals.

For water sharing plans within the Murray–Darling Basin, there are further concerns. If changes are required to water sharing arrangements accredited as part of the water resource plan, the MDBA will need to reassess these changes to ensure they meet Basin Plan 2012 requirements.

Water resource plans

NSW is preparing 20 water resource plans (9 surface and 11 groundwater plans) as part of implementing the Basin Plan across surface and groundwater. The water resource plans ensure the implementation of sustainable diversion limits for our water resources. Water resource plans

set out arrangements for sharing water for consumptive use, establish rules to meet environmental and water quality objectives, and account for potential and emerging risks to water resources.

Water resource plans are assessed and accredited by Australian Government as meeting the requirements of the Basin Plan. Water sharing plans made under NSW legislation cover the entire NSW portion of the Murray–Darling Basin. The water sharing plans remain the primary legal framework for how water is accessed and shared.

The water resource plans list the relevant water sharing plans for the area in Schedule A. As part of the water resource plan development process, a small number of key provisions of water sharing plans were amended to meet the requirements of the Basin Plan.

Long-term (environmental) water plans

The department's Environment, Energy and Science division developed long-term environmental water plans to meet Basin Plan requirements. These plans draw on local, traditional and scientific knowledge to guide the management of water for the environment over the long term.

The department developed nine plans covering the NSW Murray–Darling Basin catchments and set objectives for 5, 10 and 20-year time frames. The plans set objectives, targets and watering requirements for key plants, waterbirds, fish and system functions.

Water sharing plans include provisions for the environment through the LTAAEL, access rules, trading rules and environmental water holdings.

Marine Estate Management Strategy

The Marine Estate Management Strategy is a framework for protecting the marine estate. It responds to priority threats to water quality, habitats and biodiversity of NSW's coastal waters and estuaries. The strategy also aims to maximise community benefit derived from the marine estate.

Initiatives of the strategy are:

- improving water quality and reducing litter
- delivering healthy coastal habitats with sustainable use and development
- planning for climate change
- protecting the Aboriginal cultural values of the marine estate
- reducing impacts on threatened and protected species
- ensuring sustainable fishing and aquaculture
- enabling safe and sustainable boating
- enhancing social, cultural and economic benefits
- delivering effective governance.

Coastal water sharing plan objectives relate to several initiatives that the strategy outlines. By protecting water quality and native fish species and managing connected waters, including estuaries, coastal water sharing plans are contributing to the initiatives of the strategy.

The NSW Department of Primary Industries – Fisheries implements the strategy. Our department collaborates with the Department of Primary Industries – Fisheries on the water sharing plan interagency working groups. This creates more opportunities to ensure coastal water sharing plans are supporting the objectives and initiatives of the strategy.

Urban water management

Water sharing plans set share components of licences for town water supply. Some plans also set system operation rules, including rules for releases from town water supply infrastructure, such as dams or weirs.

The water sharing plans for the Greater Sydney and Newcastle metropolitan regions are uniquely complex. Metropolitan water utilities in the Hunter and the Greater Sydney metropolitan area implement water plans for drought security and future water supply. These are the:

- Lower Hunter Water Plan – this plan was written in 2014 and provides options for drought security and includes actions to supply, save and substitute water.
- Metropolitan Water Plan for Sydney – this plan was written in 2017 to ensure there is enough water to meet Sydney's needs, withstand drought and accommodate population growth. It outlines how it aims to optimise existing water supplies, details of water efficiency and conservation programs, actions to manage drought and a summary of new water supply options if necessary.

The Lower Hunter Water Plan and the Metropolitan Water Plan are due to be replaced in the coming years as the Lower Hunter Water Security Plan and the Greater Sydney Water Strategy, respectively. We will consider the effects of these plans when we develop the replacement water sharing plans.

If a water utility needs to augment their town water supply, the corresponding water sharing plan may need to be amended to account for extra share components, new infrastructure, or both.

Updated methods in response to new information

This section summarises our processes for developing replacement plans based on the availability of new information.

Natural Resources Commission recommendations

The Natural Resources Commission must review plans approaching expiry and report to the Minister for Lands and Water on the plans' success or failure in achieving the objectives and whether changes are necessary.

If a plan needs replacing, the commission will provide recommendations to improve the plan in the review report. These recommendations help guide the department in developing the replacement plan. The department may adopt the recommendations but is not required to do so. The department will weigh up the costs and benefits of the recommendations when deciding whether to adopt a recommendation.

The Natural Resources Commission calls for public submissions during the water sharing plan review process through its website (www.nrc.nsw.gov.au). The commission publishes its final review document on this website.

Monitoring, evaluation and reporting framework

The NSW Water Management Monitoring, Evaluation and Reporting Framework[9] coordinates activities conducted by multiple agencies in relation to NSW water management. Monitoring, evaluation and reporting (MER) activities also contribute to a broader understanding of water management, and river and wetland health over time.

Objectives, strategies and performance indicators

The objectives and strategies of plans provide a clear description of what the plan is aiming to achieve, a roadmap to achieving them, and a framework for the evaluation of plan success or effectiveness. To enable meaningful evaluations, the development of plan objectives should show clear links between what a plan can control via water management strategies and the desired economic, social/cultural or environmental outcomes for the plan area.

Under Section 35 of the *NSW Water Management Act 2000* (WM Act), a water sharing plan (WSP) must include a vision, objectives, strategies and performance indicators to describe its intent, provide direction to its rules and measure its success.

The plan's objectives, strategies and performance indicators are shaped by the MER framework to ensure sound policy, planning and regulatory decision-making during future evaluation of the plans.

Risk-based approach

The MER framework uses a risk-based approach. As part of the plan replacement process, we conduct a risk assessment.

Risk-based management assists water managers to prioritise and direct time and effort to monitor, mitigate, or respond to the factors that pose the highest overall risks. It ensures that management is targeted, efficient and effective, and when used adaptively, is an excellent tool for determining where future management and monitoring effort is required**.** We have been implementing a risk-based water planning process in unregulated rivers since 2004, in the form of risk assessments.

[9] Department of Planning, Industry and Environment 2018. *NSW Water Management Monitoring, Evaluation and Reporting Framework.* NSW Government publication.

The risk assessment provides risk-based information as part of our adaptive management approach to water sharing plans.

Risk assessments for inland water sharing plans

The department, in line with the requirements of the Basin Plan 2012, developed surface water and groundwater risk assessments to guide the development of water resource plans. The risk assessments use cause, threat and impact pathways to consider a variety of risks to the condition and continued availability of surface water and groundwater resources. Risk outcomes were based on assessing the likelihood of a cause occurring and the consequences of impacts. We adopted the following definitions for risk assessments in the Murray–Darling Basin:

- likelihood – the probability that a cause will result in a threat; it is not a sign of the size of the threat but rather conveys the probability that the threat will be significant
- consequence – the loss of value for an impacted parameter.

We assessed the risk outcomes with current strategies and water sharing rules, as per the WM Act and the relevant water sharing plans in place. The risk assessments outlined the management actions and mechanisms available to address risks.

As part of the inland risk assessments, we review all medium and high risks to water sources to determine whether existing strategies adequately address them or if modifications or new strategies are necessary. If the existing strategies adequately address a risk, we deem it tolerable.

A risk may be intolerable if it cannot be mitigated due to a range of constraints, including infrastructure, third-party economic or social impacts, or sustainable diversion limits. We will further develop this tolerability assessment as new information becomes available.

Risk assessments for coastal water sharing plans

We used a similar risk assessment process to the one for inland water resource plans in replacing unregulated, regulated and alluvial coastal water sharing plans. This new approach gives reach-scale outcomes based on fine-scale, high-ecological-value-aquatic-ecosystems (HEVAE)[10] data and reach-scale hydrologic information.

The new approach allows for more precise and nuanced interpretation than the previous macro-planning approach. We also used additional risk categories, such as risks associated with climate change and risks to the environment and water users from poor water quality. Appendix 2 provides an overview of the new risk-assessment approach.

The risk assessments review available work on estuaries within the plan boundaries.

The new approach provides improved evidence for decision-making, including:

- ratings of the ecological value at the reach scale
- ratings of the likelihood of insufficient water for freshwater ecosystems for different parts of the flow regime
- ratings of hydrologic risk for different parts of the flow regime
- analysis of a wider range of threats to flow alteration – that is, licensed extraction, BLRs, interception and climate change.

The coastal plan risk assessments do not identify which risks are tolerable and which are not. We assess tolerability through the planning assessment for coastal areas using an approach similar to that for inland risk assessments.

[10] Healey M, Raine A, Lewis A, Hossain B, Hancock F, Sayers J, Foster J and Dabovic J. 2018, *Applying the High Ecological Value Aquatic Ecosystem (HEVAE) Framework for Riverine Ecosystems,* NSW Department of Industry.

The risk assessments categorise the ecological value (consequence) and the likelihood of extraction affecting the ecological value and come up with a risk rating.

Rule changes using the new risk assessment

We use the current risk assessment to triage proposed rules for unregulated surface water coastal and inland replacement plans. This triage process recognises the improvements in assessing ecological and hydrological risks and incorporates this information when developing rules.

We note that there may be a perceived risk that this approach does not account for social and economic considerations to the same level as environmental. However:

- the WM Act requires us to prioritise the environment under normal conditions, so this is the initial basis for assessment
- stakeholders have an opportunity to have their say through the Natural Resources Commission review process and through targeted and public consultation.

We use three parameters from the risk assessment in decision-making for rule changes or rule development for replacement plans:

- consequence – ecological value
- likelihood – likelihood of extraction impacting ecological value
- risk – combination of consequence and likelihood.

We created flowcharts that summarise these three parameters as tools for decision-making. Appendix 3 provides these flowcharts and focuses on the risks to freshwater ecosystems and water quantity.

The replacement water sharing plan working group reviews the results of the planning assessment using the flowchart decision-making tool. Internal and interagency groups also review the results. Additional considerations for determining rule changes include:

- local knowledge of the water source and water management issues
- further investigation of the risk and causes
- better understanding of actual usage and impacts
- the ability to manage the impacts of extraction through water sharing arrangements.

We will incorporate these into decisions about new rules and provisions.

Water management area boundaries

Water management boundaries (management zones and water sources) in the plans may change when developing the replacement plan. Boundaries may change as a result of new information, such as the installation of new monitoring gauges or new trading provisions.

As part of replacing the plans, we will review management zones to assess whether they are appropriate. Where a plan has unnecessary management zones, we may remove these. On the other hand, if an unregulated water source is large and the existing flow reference point is insufficient for the entire water source, we may divide it into management zones. Management zones may also change to implement or dissolve trade restrictions.

In coastal water sharing plans, surface water plan limits typically align with the ‘mangrove limit’ to include any tidal pools within the water sharing plan. However, where this is impractical – for example, due to the absence of mangroves or high salinity – surface water plan limits can be set to a locally relevant point for a given watercourse.

We will also review the boundaries of groundwater water sources and ensure we have considered any new information. Groundwater plan limits will extend to the coast and could include water in alluvium, coastal sands or underlying hard rock.

Managing coastal floodplain alluvial groundwater sources

Coastal floodplain alluvial groundwater is shallow groundwater that is downstream of the tidal limit of a coastal river. During the first round of water sharing plans, the aim was to manage coastal floodplain alluvial groundwater under a separate plan that managed all coastal floodplain alluvial groundwater. Since then, the department has chosen to include floodplain alluvial groundwater within the local surface water sharing plan.

Coastal floodplain alluvial groundwater is treated as its own water source in a plan. We use the groundwater macro-planning approach risk and value assessment, as it is a new water source in replacement plans.[11] The assessment considers risks of groundwater extraction to high-priority GDEs, to socio-economic considerations and to the groundwater source itself.

The assessment also identifies measures to mitigate those risks, such as water sharing rules. The risk assessment sets volumes of water for the environment and extractive use, including planned environmental water and the LTAAEL. For the method of calculating the LTAAEL in coastal floodplain alluvial water sources, see ‘Method for setting LTAAELs’.

Basic landholder rights (BLRs)

Domestic and stock rights

Since the development of the first water sharing plans, which began before 2003, numerous methods have been followed to estimate water requirements for domestic and stock basic landholder rights.

These methods were superseded by a standard NSW approach to support the development of surface and groundwater macro sharing plans in 2010. In 2020, the same method used in the development of macro water sharing plans was adopted for estimating the water requirements of domestic and stock basic landholder rights.

The 2020 estimates may differ from estimates in the current water sharing plans due to changes in land use, population density and the availability of more accurate spatial data.

This approach is subject to improvements in data, new information, new studies and method refinement.

Appendix 5 provides a detailed description of the method. We may modify this approach for plans in the metropolitan areas due to their complexity and limited use of water for stock.

Harvestable rights

Harvestable rights allow landholders to collect as much as 30% of the average annual regional rainfall run-off from their property in the Eastern and Central divisions. Landholders in coastal-draining catchments of NSW can capture up to 30% of the average regional rainwater run-off from their property in harvestable right dams built on temporary minor streams, hillsides and gullies. Central and Eastern Division landholders in catchments that are not coastal draining can take up to 10% of average annual regional rainfall run-off.

In the Western Division, landholders can capture 100% of the average regional rainfall run-off on their property and use this water on-farm. The harvestable right aims to satisfy essential farm needs, such as stock and household water. It can also be used for any purpose, including commercial irrigation.

[11] Refer to NSW Office of Water, 2011, *Macro water sharing plans—the approach for groundwater: A report to assist community consultation*, NSW Government, for the macro approach for groundwater.

Replacement unregulated coastal plans will include a numerical estimate of maximum harvestable rights. Inland replacement plans will include a descriptive estimate of harvestable rights take until a volume is estimated.

Native title rights

If native title has been determined under the *Commonwealth Native Title Act 1993*, and the native title determination applies to land and water, you can take and use water for the purposes specified in the native title determination without a water licence, water supply work approval (unless the work is a dam or bore), or water use approval. This is called your *native title right*.

If you have a native title right, you can use the water you take for purposes specified in the native title determination such as:

- manufacturing traditional artefacts
- hunting, fishing and gathering
- recreational, cultural and ceremonial purposes.

Native title rights will be included in water sharing plans where they are determined and relate to water.

Licensed water requirements

The 'Requirements for water' section of water sharing plans sets the amount of water licensed for extraction in each water source. Licensed entitlement[12] may have changed throughout the 10-year term of the last plan, meaning this section of a water sharing plan requires updating.

Licensed water requirements are updated using the WaterNSW Water Licensing System. A search of the area that the water sharing plan covers identifies licences located in water sources of the plan. The licences are grouped into their licence category, which includes (but is not limited to):

- domestic and stock access licences
- local water utility access licences
- major utility access licences
- aquifer access licences
- aquifer (high-security) access licences (groundwater plans only)
- aquifer (general-security) access licences (groundwater plans only)
- unregulated river access licences (surface water plans only).

Specific-purpose access licences are also reviewed to identify any changes to entitlement. The replacement plan includes updated values for share components.

Water Act 1912 licences

In NSW, water take and its use are managed through a licensing framework under the WM Act. Previously, licences were managed under the *Water Act 1912.* Most licences were converted from the *Water Act 1912* to the WM Act, but some licences have not yet been converted.

When a replacement water sharing plan begins, if a *Water Act 1912* licence in the water sharing plan area authorised:

- the taking of an unspecified volume of water from a water source, then the *Water Act 1912* licence is not converted

[12] As expressed in share components.

- the construction and use of a work for drainage, then the *Water Act 1912* licence is not converted for the drainage work
- an aquifer interference activity, then the *Water Act 1912* licence is not converted for the aquifer interference activity
- the taking of water, or a work or activity that does not require a water access licence or approval under the WM Act, then the *Water Act 1912* licence is not converted and no longer has effect.

The department completes licence conversions and also manages legislation relevant to licence conversions. WaterNSW provides customer services relating to licence conversions. Please visit www.industry.nsw.gov.au/water/licensing-trade/licences/licence-conversions for more information.

Method for setting LTAAELs

The department is currently reviewing the method of defining LTAAELs. A common recommendation in coastal and inland plan reviews by the Natural Resources Commission is that replacement coastal plans should have extraction limits that are volumetric, sustainable and include all diversions.

The National Water Initiative also states that governments must ensure that water is allocated and used to achieve socially and economically beneficial outcomes in an environmentally sustainable manner.

The department is currently assessing opportunities and challenges in setting ecologically sustainable LTAAELs while maintaining social, economic and cultural outcomes. In the interim, coastal unregulated plans will set two numerical LTAAELs – low flow and higher flow LTAAELs. This is to ensure that there is no increase in extractions from low flows where the majority of ecological impacts from extraction are felt. This approach allows additional extraction from higher flows to encourage extraction from higher flows rather than lower flows.

Currently, the LTAAEL of a surface water source is:

- inland – the estimated average annual extraction of water from 1993 to 1999, plus estimates of native title rights and domestic and stock rights
- coastal – the sum of all existing access licences, plus native title rights and domestic and stock rights. Over time, as we replace plans, this will also include harvestable rights. Where high-flow access licence conversions are allowed, there is also an allowance for an increase in the LTAAEL. This method for calculating an LTAAEL will change in replacement coastal plans. It will be replaced with two types of LTAAEL comprising:
    - standard LTAAEL for low-flow extraction. This is the sum of entitlement, domestic and stock basic landholder rights, native title rights and an estimate of maximum harvestable rights, all at the start of the plan. This LTAAEL also includes the increase in entitlement as a result of licence conversions from *Water Act 1912* to WM Act, the change in entitlement as a result of correcting locations of licences placed in the wrong extraction management unit.
    - higher flow LTAAEL for higher flow extraction. This is the sum of unregulated river (high flow) access licences, share components which could be converted to unregulated river (high flow) access licences, Aboriginal Community Development licences, specific-purpose access licences which can only take in high flows, licences which extract from large in-river dams (such as town water supply dams) that are required to pass low flows and water held in harvestable rights dams that is above 10% of property run-off where low flows can be passed (using a low-flow bypass for example).

The LTAAEL of a groundwater source, by type, is:

- coastal upriver alluvial groundwater – due to the highly connected nature of upriver alluvial groundwater, the unregulated water source standard LTAAEL includes this type of groundwater.
- coastal floodplain alluvial groundwater – this alluvial groundwater is less connected than other forms of alluvial groundwater and is considered its own water source. As such, it has its own LTAAEL, which is calculated using the macro planning approach to groundwater risk assessment (see Appendix 4).
- fractured rock, porous rock, coastal sands, NSW North West and groundwater sources overlying the Great Artesian Basin – LTAAEL is calculated using the macro planning approach to groundwater risk assessment
- Murray–Darling Basin alluvial, comprising two methods:
    - LTAAEL applied to water sources (both highly and less highly connected) is based on the best estimate of average usage over a specified period for these systems
    - LTAAEL set at an estimate of the annual extraction of entitlement and estimated requirements for BLRs.

Access rules

Plans set rules for the extraction of water. These are referred to as access rules, and they encompass a number of rules with differing names. Access rules and their meaning are described in Table 5.

Table 5 Access rules and their meaning

Access rule	Meaning
Cease to pump	The level of river flow at which a licence holder must stop pumping or extracting water.
Commence to pump	The level of river flow when a licence holder can begin pumping after a cease-to-pump event.
Flow classes	Classes represent river flows. These can be expressed as very low flow, A, B, C or D class – the very low flow class being the lowest flows, and D class being the highest flows. The very low flow class is associated with the cease-to-pump rule, for example, when river flows are within the very low flow class, cease to pump applies.
Individual daily extraction component	The volume of water that may be extracted daily by an individual licence holder in a particular flow class.
Total daily extraction limit	The volume of water that may be extracted daily under access licences in a particular flow class.

Access rules may change while developing the replacement surface water sharing plans due to several factors. These include:

- risk assessment findings
- community consultation
- water quality
- GDE identification
- socio-economic impacts of current rules
- new gauges.

If these factors do not change in a particular plan, the access rule will remain the same in the plan.

As part of developing the replacement plans, we calculate flow duration tables using observed flow data. The additional 10 years of data since the start of the plan can help identify any changes to the flow in the river for each access rule (that is, the top or bottom of the flow class).

Flow duration tables help us understand river flows. Flows are expressed as percentiles. For each access rule, we can identify what percentile flow it is. We do not change the access rules if there is a change to the flow percentile since the start of the first plan, but we may specify the percentile in the plan to document how flows in the river have changed.

For example, a plan has an access rule that states water users must cease to pump when flow in a river is less than or equal to 4 ML per day. The flow exceedance percentile for 4 ML per day will be identified using updated flow duration tables, and the percentile may be included as a note in the plan or in the plan's background document. Appendix 6 includes the method for creating flow duration tables.

Adding flow classes to a water source means that specific-purpose access licences can be added to the plan. This includes access licences for unregulated river high flow and Aboriginal community development licences[13] that can extract water only in high flows[14] and so can be applied for only in water sources with gauges. Some replacement plans will introduce flow classes if a new telemetered gauge with at least 10 years of reliable data has been installed in a water source.

Reviewing trade opportunities

Trade opportunities in unregulated coastal and inland systems across NSW are limited or absent in some areas. This lack of flexibility inhibits development and makes it difficult to license existing historical take. It also locks in the status quo and does not allow water entitlements to be traded out of high-value areas or into highly productive areas.

Trading rules in the current plans were set using the macro planning approach for unregulated rivers and groundwater.[15] This led to the limitations on trading in unregulated river systems.

We will investigate a revised approach for trade while developing replacement plans. This approach will seek to enable trading in unregulated rivers in NSW. The trade review will evaluate the levels of entitlement that could be traded into a water source without unreasonably risking riverine ecology and effects on water users. Risk in this case is a function of the level of consequence and the likelihood of that consequence occurring.

We developed a method for trade review for the Namoi unregulated rivers system in 2016. We are considering this method for use throughout NSW, and a consultant has independently reviewed it. We are considering any recommendations from the consultant on the method and developing a

[13] In coastal plans only.
[14] In C class flows.
[15] Refer to NSW Office of Water, 2011, *Macro water sharing plans—the approach for unregulated rivers: A report to assist community consultation*, NSW Government, and NSW Office of Water, 2011, *Macro water sharing plans—the approach for groundwater: A report to assist community consultation*, NSW Government.

final method. Once we finalise the method, we will roll out the trade review for use throughout NSW.

In the interim, review of trading rules in coastal plans looks at changes in the ecological value of the water sources within the plan. Where values have reduced, trade may be enabled. Generally, upstream trade is not allowed unless there is a no net-gain rule in place (entitlement must be traded out before it can be traded in).

Floodplain management

The government is currently implementing the NSW Floodplain Harvesting Policy across six northern inland designated floodplains: Border Rivers valley, Gwydir valley, Upper Namoi valley, Lower Namoi valley, Macquarie valley and Barwon–Darling valley. This process will issue floodplain harvesting access licences in regulated and unregulated river water sources. The relevant water sharing plans will include rules for these licences.

The take of water from floodplain harvesting activities is already built into the relevant water sharing plans for the northern inland valleys of NSW. The LTAAELs specified in these water sharing plans includes the take of water associated with floodplain harvesting activities within the plan.

As well as the LTAAEL, rules will apply to floodplain harvesting access licences once they are issued. We will amend the relevant water sharing plans to incorporate these rules, which relate to:

- share components for floodplain harvesting access licences, or the total entitlements per water source at a specified time
- compliance with extraction or diversion limits, or how any new growth in floodplain harvesting is managed
- available water determinations, including how allocation accounts will be credited each water year
- account management, or the limits on annual take and ability to carry over allocations
- accounting for the take of on-farm contaminated run-off when an access licence account has insufficient allocations
- trade, including permanent and temporary trade
- mandatory conditions for access licences and water supply works
- access arrangements
- amendment provisions to allow for adjustment of rules based on monitoring, evaluation and reporting.

We will monitor and evaluate to ensure floodplain harvesting access licences are achieving intended environmental and cultural outcomes.

Social and economic considerations

During the early phases of plan development, we collect information about the social, economic and cultural characteristics of a plan area. This information allows us to understand the social, economic and cultural environment of a plan to assist in making decisions during plan development.

Once rule changes have been proposed, we consider the socio-economic, cultural and environmental impacts of the change, and this will inform the final decision about whether to adopt the change.

We identify the socio-economic, cultural and environmental effects of potential changes through interagency, community and stakeholder engagement. To understand the effects, we need the views of a broad range of representatives, including extractive water users, Aboriginal and environmental groups, and others.

The department engages with stakeholders using:

- interagency working groups
- stakeholder advisory panels
- public consultation
- targeted stakeholder consultation
- expert opinion
- other options, where appropriate.

The aim is to understand the effects of different options, and how these effects will be distributed in the plan area and between plan areas. Where necessary, we may assess the options against the objectives in two stages: preliminary and detailed assessment.

The preliminary phase assesses the identified impacts and further defines the characteristics of the different options. This process helps determine whether the socio-economic, cultural or environmental effects are significant. Where this is the case, we complete a more detailed examination.

The preliminary assessment completes a qualitative comparison of the relative effects of the options, using current management rules as a baseline and input from consultation.

Where this qualitative assessment indicates effects may be significant, we complete a more detailed examination of socio-economic, cultural and environmental effects. This may involve a more detailed cost-benefit analysis of rules or combinations of rules.

Groundwater-dependent ecosystems

Previous water sharing plans included a list of high-priority groundwater-dependent ecosystems (GDEs) and distance rules related to water extraction near those GDEs. We identified these high-priority GDEs through a desktop study of known high-conservation-value GDEs.

These included:

- wetlands listed under the Ramsar Convention
- vegetation listed under state legislation
- karst conservation areas listed under state legislation.

We also identify GDEs by reviewing literature, known record databases and GIS records. GDEs we identified this way were not classified as high priority, and we left them out of the plan. Further study of identified GDEs was meant to be completed during the life of the plan.

We are now using a new method to identify GDEs for replacement plans. We now identify the location of likely groundwater-dependent vegetation using a range of data sources as indirect indicators. We also use published scientific knowledge to build a decision-rule spatial model[16], which is now a key tool to identify GDEs for water sharing plans. To assess the priority of GDEs, we determine an ecological value for the vegetation GDEs using the HEVAE framework.

[16] Dabovic, J, Dobbs, L, Byrne, G, Raine, A 2019, 'A new approach to prioritising groundwater dependent vegetation communities to inform groundwater management in New South Wales', *Australian Journal of Botany,* Issue 67, pp 397–413.

The plan includes a map showing high-priority GDEs and where there are known high-priority GDEs, the plan also lists these. The plan includes distance rules for water supply works approvals to protect the known high-priority GDEs. Where a GDE is highly likely to exist, the department will assess if it is a high-priority GDE when a user applies for a works approval within a restricted distance.

Connectivity of water within and between systems

Water sharing plans aim to acknowledge the connectivity of water. Connectivity of water can include the relationship between:

- regulated and unregulated systems
- upriver freshwater, tidal pools and downstream estuaries
- surface water and groundwater.

Acknowledging these relationships can help create rules that address all parts of the system and their interconnectedness. This can help identify risks to areas outside the water sharing plan area, too, including risks to downstream users and the environment.

Connectivity in surface water plans

The updated environmental objectives in the surface water plans aim to protect connectivity:

- between and within water sources, including surface water and groundwater, and downstream fish passages
- between tidal pools, connected estuaries and connected upstream water sources.

The water sharing plan details strategies to protect connectivity. It also includes performance indicators to measure success of those strategies.

The new unregulated risk-assessment approach considers connectivity of water within the plan area. It identifies risks at different flow levels of the water source, such as zero flows (no flow), low flows, fresh flows and high flows.

When flows in a river cease, the pools within the riverbed become disconnected. This restricts the movement of fish and affects a range of water quality processes. As such, pools are typically sensitive to the impacts of low and zero flow, and reduced flows can affect in-stream ecological values. Recognising risks around low and zero flow allows us to mitigate these risks.

Connectivity of surface water throughout a river is important for fish movement and good water quality. Identifying risks of zero and low flows creates an opportunity to implement mitigation measures to reduce risks of losing connectivity.

The coastal unregulated plan risk assessments also consider connectivity by identifying the risks of insufficient water for estuarine ecosystems at the end of the system and the impacts on marine parks.

Connectivity in groundwater plans

Groundwater water sharing plans acknowledge the connectivity of surface water and groundwater. Where there are high levels of connectivity between the groundwater source and surface water, the groundwater water sharing plan can place restrictions on access to that groundwater source.

The restrictions may include allowing extraction through a specific licence category, or a cease-to-pump rule directly related to the corresponding surface water sharing plan. These restrictions aim to manage risks to surface water as a result of groundwater extraction.

New water delivery infrastructure

Currently, NSW is progressing business cases for several large infrastructure projects such as dams, dam augmentations and weirs with the aim of providing greater water security for local water utilities. The department has been involved in discussions on management of water such as how the LTAAEL will be adhered to, considerations of planned environmental water and other relevant watering plan rules.

New information

New studies and information can assist in our decision-making when developing replacement plans. New information can come from research advances since the last version of the plans.

The new risk-assessment approach uses the latest information in its method, including threatened species data that is continually updated. New information often influences new processes. One example is the improved method for identifying GDEs, which became available as a result of greater knowledge of how to use spatial technology to identify them.

We will update replacement plans as new research happens, and we will include studies and new information specific to each water sharing plan in the plan's background document.

The consultation approach

Aboriginal engagement

Water sharing plans acknowledge Aboriginal values around water and make provisions available for Aboriginal people to access water. These provisions include:

- Aboriginal cultural water access licences – these licences may provide up to 10 ML of water for personal, domestic, cultural and spiritual purposes
- Aboriginal community development water access licence – these licences are available in some areas of NSW to support Aboriginal enterprises; these licences and the water they access must benefit the community in a way that fosters economic and social development
- native title rights – a native title holder can take and use water to exercise native title rights without needing an access licence, a water supply work approval or a water use approval.

Our Aboriginal engagement aims to ensure the recognition of Aboriginal people and communities as key stakeholders and to enable effective participation in water management.

The draft NSW Water Strategy includes a key priority to improve water management outcomes for Aboriginal people. The draft strategy recognises there are important issues that need to be addressed at a state-wide level to better enable the exercise of Aboriginal people's rights and access to water, within the Murray–Darling Basin and in coastal regions of NSW. The strategy outlines the following actions for achieving the priority:

1. Establish a partnership agreement with the Aboriginal Water Coalition
2. Strengthen the role of First Nations in water planning and management
3. Develop a state-wide Aboriginal water strategy
4. Provide Aboriginal ownership of and access to water for cultural and economic purposes
5. Work with First Nations to improve shared water knowledge
6. Work with Aboriginal people to maintain and preserve water-related cultural sites and landscapes.

One of the commitments in the draft NSW Water Strategy is the co-design of a state-wide Aboriginal Water Strategy that will identify a program of measures to deliver on Aboriginal People's water rights and interests in water management.

Aboriginal engagement involves ensuring Aboriginal communities can be informed, provide feedback and collaborate on the water sharing plan replacements. Future engagement involves implementing the Aboriginal Water Strategy to build meaningful relationships with Aboriginal stakeholders for a long-term collaborative approach.

In inland water sources, our future Aboriginal engagement will seek to build on the information provided as part of First Nations engagement for the development of water resource plans.

Government stakeholders

We seek expertise from other government agencies while developing water sharing plans. We consult with other agencies through officer-level interagency working groups that feed directly into developing the plan. A more senior group of agency staff advises on decision-making and ultimately endorses the plans as we finalise them.

As the 'Project governance' section of this manual describes, the agencies the department collaborates with during plan development include, but are not limited to:

- Department of Primary Industries – Fisheries
- Department of Primary Industries – Agriculture

- Department of Planning and Environment – Environment, Energy and Science
- WaterNSW
- Natural Resources Access Regulator
- MDBA (inland plans)
- Commonwealth Environmental Water Office (inland plans).

We will contact other government agencies for plan-specific expertise as necessary.

Targeted consultation

While developing replacement water sharing plans, we may complete targeted consultation:

- on issues identified during the life of the previous plan, to inform plan replacement
- when we are seeking early information from key water users on how the plan has been working, to inform plan replacement
- as part of the replacement process, ahead of formal public consultation, to test possible rule changes.

This would occur when we need feedback from specific stakeholders, such as local council. When necessary, we will contact stakeholders directly to discuss the issue relevant to the stakeholder or stakeholder group.

Public exhibition

We will publicly exhibit replacement water sharing plans for feedback on proposed changes to a plan. We seek submissions from the public through submission forms and emails, and we make the draft replacement plans available on our website.

We typically hold public consultation meetings in locations relevant to the water sharing plan or online when COVID-19 makes face-to-face meetings impracticable. Department representatives familiar with the draft water sharing plan attend to answer questions from community members about the proposed changes to the plan.

The department then considers submissions received during public exhibition. Where issues raised in submissions are within the scope of the water sharing plan replacement, they may prompt changes to the draft water sharing plan.

We publish submissions on the water sharing plans to the department website when submitters give consent to do so.

Table 6. Time line for plan replacement

Plan expiry date	Proposed replacement date*	Plan (Note: All Murray–Darling Basin groundwater plans were replaced this year, so are not due until 2031)	Audit date Year 5 date shown	Review date Year 10 date shown	Replacement date
2026	2028	Gwydir Regulated River	2022	30 June 2026	TBC
2026	2028	Upper Namoi and Lower Namoi Regulated River	2022	30 June 2026	TBC
2026	2028	Macquarie and Cudgegong Regulated River	2022	30 June 2026	TBC
2023	2025	Belubula Regulated River	2022	30 June 2023	TBC
2026	2028	Lachlan Regulated River	2022	30 June 2026	TBC
2026	2028	NSW Murray and Lower Darling Regulated River	2022	30 June 2026	TBC
2026	2028	Murrumbidgee Regulated River	2022	30 June 2026	July 2020–July 2021
2022	2022	Central Coast Unregulated and Alluvial	Complete	30 June 2020	July 2021–July 2022
2022	2022	Coffs Harbour Area Unregulated and Alluvial	Complete	30 June 2020	July 2021–July 2022
2022	2022	Hunter Unregulated and Alluvial	Complete	30 June 2020	July 2021–July 2022
2022	2022	Lower North Coast Unregulated and Alluvial	Complete	30 June 2020	July 2021–July 2022
2021	2022	Bega and Brogo/Murrah–Wallaga Regulated, Unregulated and Alluvial	Complete	30 June 2021	July 2020–June 2022
2021	2022	Richmond Unregulated, Regulated and Alluvial	Complete	30 June 2021	July 2020–June 2022
2021	2022	Towamba River Unregulated	Complete	30 June 2021	July 2020–June 2022
2021	2022	Tweed River Unregulated and Alluvial	Complete	30 June 2021	July 2020–June 2022
2021	2023	Greater Metropolitan Region Unregulated River	Complete	30 June 2021	July 2021–June 2023
2021	2023	Greater Metropolitan Region Groundwater	Complete	30 June 2021	July 2021–June 2023

Plan expiry date	Proposed replacement date*	Plan (Note: All Murray–Darling Basin groundwater plans were replaced this year, so are not due until 2031)	Audit date Year 5 date shown	Review date Year 10 date shown	Replacement date
2022	2022	Intersecting Streams Unregulated	Complete	30 June 2022	July 2021–June 2023
2022	2022	Lower Murray–Darling Unregulated	Complete	30 June 2022	July 2021–June 2023
2022	2022	Murray Unregulated	Complete	30 June 2022	July 2021–June 2023
2022	2023	Castlereagh Unregulated	Complete	30 June 2022	July 2021–June 2023
2022	2023	North West Unregulated and Fractured Rock	Complete	30 June 2022	July 2021–June 2023
2022	2023	NSW Border Rivers Unregulated	Complete	30 June 2022	July 2021–June 2023
2023	2022	Barwon–Darling Unregulated	Complete	30 June 2023	July 2020–Dec 2022
2023	2023	Belubula Regulated River	Complete	30 June 2023	July 2022–June 2024
2023	2023	Gwydir Unregulated	Complete	30 June 2023	July 2020–June 2024
2023	2023	Lachlan Unregulated	Complete	30 June 2023	July 2022–June 2024
2023	2023	Macquarie Bogan Unregulated	Complete	30 June 2023	July 2022–June 2024
2023	2023	Murrumbidgee Unregulated	Complete	30 June 2023	July 2022–June 2024
2022	2022	Peel Regulated River	Complete	30 June 2022	July 2020–June 2022
2023	2023	Namoi and Peel Unregulated Rivers	Complete	30 June 2023	July 2022–June 2024
2026	2026	Brunswick Unregulated and Alluvial	Complete	30 June 2026	July 2024–June 2026
2026	2026	Clarence River Unregulated and Alluvial	Complete	30 June 2026	July 2024–June 2026
2026	2026	Clyde River Unregulated and Alluvial	Complete	30 June 2026	July 2024–June 2026

Plan expiry date	Proposed replacement date*	Plan (Note: All Murray–Darling Basin groundwater plans were replaced this year, so are not due until 2031)	Audit date Year 5 date shown	Review date Year 10 date shown	Replacement date
2026	2026	Hunter Regulated River	Complete	30 June 2026	July 2024–June 2026
2026	2026	North Coast Fractured and Porous Rock	Complete	30 June 2026	July 2024–June 2026
2026	2026	North Coast Coastal Sands	Complete	30 June 2026	July 2024–June 2026
2026	2026	Snowy Genoa Unregulated and Alluvial	Complete	30 June 2026	July 2024–June 2026
2026	2026	South Coast Groundwater Sources	Complete	30 June 2026	July 2024–June 2026
2026	2026	Tuross River Unregulated and Alluvial	Complete	30 June 2026	July 2024–June 2026
2026	2026	Macleay River Unregulated and Alluvial	Complete	30 June 2026	July 2024–June 2026
2026	2026	Deua River Unregulated and Alluvial	Complete	30 June 2026	July 2024–June 2026
2027	2027	Nambucca Unregulated and Alluvial	Complete	30 June 2027	July 2025–June 2027
2029	2029	Hastings Unregulated and Alluvial	2024	30 June 2029	July 2027–June 2029
2029	2029	Paterson Regulated River	2024	30 June 2029	July 2027–June 2029

* Where proposed date is beyond expiry date, we propose to request an extension for up to two years to replace the plan. Time frame will depend on the timely availability of the Natural Resources Commission review to inform replacement or extension.

Glossary and abbreviations

Term	Definition
Aquifer	An underground layer of water-bearing permeable rock or unconsolidated materials (gravel, sand, silt or clay) from which groundwater can be usefully extracted. The volume of water stored in an aquifer, the rate at which water can recharge, the volume of water extracted from it, and the rate at which water can move through the aquifer, are all controlled by the geologic nature of the aquifer.
Basin Plan	The Basin Plan 2012; this plan is a piece of legislation that sets the amount of water that users can take from the Murray–Darling Basin each year.
Cap rock	Hard impervious rock overlying and often sealing in a deposit of oil, gas, coal or water.
BLR	Basic landholder right; identified as domestic and stock rights, native title rights and harvestable rights
GDE	Groundwater-dependent ecosystem; an ecosystem that relies on groundwater for their species composition and their natural ecological processes
GL	Gigalitre
LTAAEL	Long-term average annual extraction limit: the long-term average annual volume of water (expressed in megalitres per year) in a water source available to be lawfully extracted or otherwise taken under access licences and BLR requirements
Mangrove limit	The point in a river where mangroves can grow due to presence of brackish water from the interaction of saline water from the ocean and freshwater from the river.
ML	Megalitre
NWI	National Water Initiative
Ramsar Convention	The Ramsar Convention on Wetlands of International Importance is a treaty between nations aimed at conserving wetlands.
Replacement plans	Water sharing plans at the end of their 10-year plan term that have not been extended and are undergoing the replacement process. This term also includes those plans that will be replaced in the future.
Share component	An entitlement to a given number of shares of the available water in a specified water source. The share component on an access licence certificate is expressed as a unit share. The share component of a specific-purpose access licence (for example, local water utility, major water utility, and domestic and stock) is expressed in megalitres.
WM Act	*Water Management Act 2000*

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Versions

Version		Date
1	First published	January 2022

Appendix 1

Status of water sharing plans

Table 7. Water sharing plans in NSW that have been replaced or consolidated

Plan	Plan replaced as	Plan replaced as	Region
Water Sharing Plan for the Adelong Creek Water Source 2003	Water Sharing Plan for the Murrumbidgee Unregulated and Alluvial Water Sources 2012 (plans consolidated)	Water Sharing Plan for the Murrumbidgee Unregulated Water Source 2012 (plan split)	Inland
		Water Sharing Plan for the Murrumbidgee Alluvial Water Sources 2020 (plan split and consolidated with others)	
Water Sharing Plan for the Apsley River Water Source 2003	Water Sharing Plan for the Macleay Unregulated and Alluvial Water Sources 2016 (plans consolidated)	n/a	Coastal
Water Sharing Plan for the Barwon Darling Unregulated and Alluvial Water Sources 2012	Water Sharing Plan for the Barwon Darling Unregulated Water Sources 2012 (plan split)	n/a	Inland
	Water Sharing Plan for the Darling Alluvial Water Sources 2020 (plan split and consolidated with others)		
Water Sharing Plan for the Bellinger River Area Unregulated and Alluvial Water Sources 2008	Water Sharing Plan for the Bellinger River Area Unregulated and Alluvial Water Sources 2020	n/a	Coastal
Water Sharing Plan for the Belubula Regulated River Water Source 2012	n/a	n/a	Inland
Water Sharing Plan for the Bega and Brogo Rivers Area Regulated, Unregulated and Alluvial Water Sources 2011	n/a	n/a	Coastal
Water Sharing Plan for the Brunswick Unregulated and Alluvial Water Sources 2016	n/a	n/a	Coastal
Water Sharing Plan for the Castlereagh River above Binnaway Water Source 2003	Water Sharing Plan for the Castlereagh River Unregulated and Alluvial Water Sources 2011 (plans consolidated)	Water Sharing Plan for the Castlereagh Unregulated Water Source 2011 (plan split)	Inland

Plan	Plan replaced as	Plan replaced as	Region
		Water Sharing Plan for the Macquarie -Castlereagh Groundwater Sources 2020 (plan split and consolidated with others)	
Water Sharing Plan for the Clarence River Area Unregulated and Alluvial Water Sources 2016	n/a	n/a	Coastal
Water Sharing Plan for the Clyde River Unregulated and Alluvial Water Sources 2016	n/a	n/a	Coastal
Water Sharing Plan for the Coffs Harbour Area Unregulated and Alluvial Water Sources 2009	n/a	n/a	Coastal
Water Sharing Plan for the Commissioners Waters Water Source 2003	Water Sharing Plan for the Macleay Unregulated and Alluvial Water Sources 2016 (plans consolidated)	n/a	Coastal
Water Sharing Plan for the Coopers Creek Water Source 2003	Water Sharing Plan for the Richmond River Area Unregulated, Regulated and Alluvial Water Sources 2010 (plans consolidated)	n/a	Coastal
Water Sharing Plan for the Deua Unregulated and Alluvial Water Sources 2016	n/a	n/a	Coastal
Water Sharing Plan for the Dorrigo Plateau Surface Water Source and Dorrigo Basalt Groundwater Source 2003	Water Sharing Plan for the North Coast Fractured and Porous Rock Groundwater Sources 2016 (plans consolidated) Water Sharing Plan for the Clarence River Unregulated and Alluvial Water Sources 2016 (plans consolidated)	n/a	Coastal
Water Sharing Plan for the Greater Metropolitan Region Unregulated River Water Sources 2011	n/a	n/a	Coastal
Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources 2011	n/a	n/a	Coastal
Water Sharing Plan for the Gwydir Regulated River Water Source 2002	Water Sharing Plan for the Gwydir Regulated River Water Source 2016	n/a	Inland
Water Sharing Plan for the Hastings Unregulated and Alluvial Water Sources 2019	n/a	n/a	Coastal

Plan	Plan replaced as	Plan replaced as	Region
Water Sharing Plan for the Hunter Regulated River Water Source 2003	Water Sharing Plan for the Hunter Regulated River Water Source 2016	n/a	Coastal
Water Sharing Plan for the Hunter Unregulated and Alluvial Water Sources 2009	n/a	n/a	Coastal
Water Sharing Plan for the Intersecting Streams Water Sources 2011	Water Sharing Plan for the Intersecting Stream Unregulated Water Sources 2011 (plan split)	n/a	Inland
	Water Sharing Plan for the Darling Alluvial Groundwater Sources 2020 (plan split and consolidated with others)		
Water Sharing Plan for the Jilliby Jilliby Creek Water Source 2003	Water Sharing Plan for the Central Coast Unregulated Water Sources 2009 (plans consolidated)	n/a	Coastal
Water Sharing Plan for the Kangaroo River Water Source 2003	Water Sharing Plan for the Greater Metropolitan Region Unregulated River Water Sources 2011 (plans consolidated)	n/a	Coastal
Water Sharing Plan for the Karuah River Water Source 2003	Water Sharing Plan for the Lower North Coast Unregulated and Alluvial Water Sources 2009 (plans consolidated)	n/a	Coastal
Water Sharing Plan for the Kulnura Mangrove Mountain Groundwater Sources 2003	Water Sharing Plan for the North Coast Fractured and Porous Rock Groundwater Sources 2016 (plans consolidated)	n/a	Coastal
Water Sharing Plan for the Lachlan Regulated River Water Source 2003	Water Sharing Plan for the Lachlan Regulated River Water Source 2016	n/a	Inland
Water Sharing Plan for the Lower Gwydir Groundwater Source 2003	Water Sharing Plan for the Lower Gwydir Groundwater Source 2019	Water Sharing Plan for Gwydir Alluvial Groundwater Sources 2020 (plan consolidated with others)	Inland
Water Sharing Plan for the Lower Lachlan Groundwater Sources 2003	Water Sharing Plan for the Lachlan Alluvial Groundwater Sources 2020 (plan consolidated with others)	n/a	Inland
Water Sharing Plan for the Lower Macquarie Groundwater Sources 2003	Water Sharing Plan for the Lower Macquarie Groundwater Sources 2019	Water Sharing Plan for the Macquarie–Castlereagh Groundwater Sources 2020 (plan consolidated with others)	Inland

Plan	Plan replaced as	Plan replaced as	Region
Water Sharing Plan for the Lower Murray Groundwater Source 2003	Water Sharing Plan for the Lower Murray Groundwater Source 2019	Water Sharing Plan for the Murray Alluvial Groundwater Sources 2020 (plan consolidated with others)	Inland
Water Sharing Plan for the Lower Murray Shallow Groundwater Source 2012	Water Sharing Plan for the Murray Alluvial Groundwater Sources 2020	n/a	Inland
Water Sharing Plan for the Murray Unregulated and Alluvial Water Sources 2011	Water Sharing Plan for the Murray Unregulated Water Sources 2011 (plan split)	n/a	Inland
	Water Sharing Plan for the Murray Alluvial Groundwater Sources 2020 (plan split and consolidated with others)		
Water Sharing Plan for the Lower Murray Darling Unregulated and Alluvial Water Sources 2011	Water Sharing Plan for the Lower Murray Darling Unregulated Water Sources 2011 (plan split)	n/a	Inland
	Water Sharing Plan for the Murray Alluvial Groundwater Sources 2020 (plan split and consolidated with others)		
Water Sharing Plan for the Lower Murrumbidgee Groundwater Sources 2003	Water Sharing Plan for the Lower Murrumbidgee Groundwater Sources 2019	Water Sharing Plan or the Murrumbidgee Alluvial Groundwater Sources 2020 (plan consolidated with others)	Inland
Water Sharing Plan for the Macleay Unregulated and Alluvial Water Sources 2016	n/a	n/a	Coastal
Water Sharing Plan for the Macquarie Bogan Unregulated and Alluvial Water Sources 2011	Water Sharing Plan for the Macquarie Bogan Unregulated Water Sources 2011 (plan split)	n/a	Inland
	Water Sharing Plan for the Macquarie-Castlereagh Groundwater Sources 2020 (plan split and consolidated with others)		
Water Sharing Plan for the Macquarie and Cudgegong Regulated Rivers Water Source 2003	Water Sharing Plan for the Macquarie and Cudgegong Regulated Rivers Water Source 2016	n/a	Inland
Water Sharing Plan for the Mandagery Creek Water Source 2003	Water Sharing Plan for the Lachlan Unregulated and Alluvial Water Sources 2012	Water Sharing Plan for the Lachlan Unregulated Water Sources 2012 (split)	Inland

Plan	Plan replaced as	Plan replaced as	Region
		Water Sharing Plan for the Lachlan Alluvial Groundwater Sources 2020 (consolidated with others)	
Water Sharing Plan for the Murrah-Wallaga Area Unregulated and Alluvial Water Sources 2010	n/a	n/a	Coastal
Water Sharing Plan for the Murrumbidgee Regulated River Water Source 2003	Water Sharing Plan for the Murrumbidgee Regulated River Water Source 2016	n/a	Inland
Water Sharing Plan for the Nambucca Unregulated and Alluvial Water Sources 2016	n/a	n/a	Coastal
Water Sharing Plan for the North Western Unregulated and Fractured Rock Water Sources 2011	n/a	n/a	Inland
Water Sharing Plan for the NSW Border Rivers Regulated River Water Sharing Plan 2009	Water Sharing Plan for the NSW Border Rivers Regulated River Water Sharing Plan 2021	n/a	Inland
Water Sharing Plan for the NSW Great Artesian Basin Groundwater Sources 2008	Water Sharing Plan for the NSW Great Artesian Basin Groundwater Sources 2020	n/a	Inland
Water Sharing Plan for the NSW Great Artesian Basin Shallow Groundwater Sources 2011	Water Sharing Plan for the NSW Great Artesian Basin Shallow Groundwater Sources 2020	n/a	Inland
Water Sharing Plan for the NSW Murray and Lower Darling Regulated Rivers Water Sources 2016	n/a	n/a	Inland
Water Sharing Plan for the NSW Murray Darling Basin Fractured Rock Groundwater Sources 2012	Water Sharing Plan for the NSW Murray Darling Basin Fractured Rock Groundwater Sources 2020	n/a	Inland
Water Sharing Plan for the NSW Murray Darling Basin Porous Rock Groundwater Sources 2012	Water Sharing Plan for the NSW Murray Darling Basin Porous Rock Groundwater Sources 2020	n/a	Inland
Water Sharing Plan for the New South Wales Murray and Lower Darling Regulated Rivers Water Sources 2003	Water Sharing Plan for the New South Wales Murray and Lower Darling Regulated Rivers Water Sources 2016	n/a	Inland

Plan	Plan replaced as	Plan replaced as	Region
Water Sharing Plan for the Ourimbah Creek Water Source 2003	Water Sharing Plan for the Central Coast Unregulated Water Sources 2009 (plans consolidated)	n/a	Coastal
Water Sharing Plan for the Paterson Regulated River Water Source 2007	Water Sharing Plan for the Paterson Regulated River 2019	n/a	Coastal
Water Sharing Plan for the Peel Valley Regulated, Unregulated, Alluvium and Fractured Rock Water Sources 2010	Water Sharing Plan for the Peel Regulated River Water Source 2010	n/a	Inland
	Water Sharing Plan for the Namoi and Peel Unregulated Rivers Water Sources 2012		
	Water Sharing Plan for the Namoi Alluvial Groundwater Sources 2020		
	Water sharing Plan for the NSW DB Fractured Rock Groundwater Sources 2020		
Water Sharing Plan for the Phillips Creek, Mooki River, Quirindi Creek and Warrah Creek Water Sources 2003	Water Sharing Plan for the Namoi Unregulated and Alluvial Water Sources 2012	Water Sharing Plan for the Namoi and Peel Unregulated Water Sources 2012 (plan split and consolidated with others)	Inland
		Water Sharing Plan for the Namoi Alluvial Groundwater Sources 2020 (plan split and consolidated with others)	
Water Sharing Plan for the Richmond River Area Unregulated, Regulated ad Alluvial Water Sources 2010	n/a	n/a	Coastal
Water Sharing Plan for the Rocky Creek, Cobbadah, Upper Horton and Lower Horton Water Source 2003	Water Sharing Plan for the Gwydir Unregulated and Alluvial Water Sources 2012	Water Sharing Plan for the Gwydir Unregulated Water Sources 2012 (plan split)	Inland
		Water Sharing Plan for the Gwydir Alluvial Groundwater Sources 2020 (plan split and consolidated with others)	
Water Sharing Plan for the Snowy Genoa Unregulated and Alluvial Water Sources 2016	n/a	n/a	Coastal
Water Sharing Plan for the South Coast Groundwater Sources 2016	n/a	n/a	Coastal

Plan	Plan replaced as	Plan replaced as	Region
Water Sharing Plan for the Stuarts Point Groundwater Source 2003	Water Sharing Plan for the North Coast Coastal Sands Groundwater Sources 2016 (plans consolidated)	n/a	Coastal
Water Sharing Plan for the Tarcutta Creek Water Source 2003	Water Sharing Plan for the Murrumbidgee Unregulated and Alluvial Water Sources 2012	Water Sharing Plan for the Murrumbidgee Unregulated Water Sources 2012 (plan split)	Inland
		Water Sharing Plan for the Murrumbidgee Alluvial Groundwater Sources 2020 (plan split and consolidated with others)	
Water Sharing Plan for the Tenterfield Creek Water Source 2003	Water Sharing Plan for the NSW Border Rivers Unregulated and Alluvial Water Sources 2012	Water Sharing Plan for the NSW Border Rivers Unregulated Water Sources 2012 (plan split)	Inland
		Water Sharing Plan for the NSW Border Rivers Alluvial Groundwater Sources 2020 (plan split)	
Water Sharing Plan for the Tomago Tomaree Stockton Groundwater Sources 2003	Water Sharing Plan for the North Coast Coastal Sands Groundwater Sources 2016 (plans consolidated)	n/a	Coastal
Water Sharing Plan for the Towamba River Unregulated and Alluvial Water Sources 2010	n/a	n/a	
Water Sharing Plan for the Toorumbee Creek Water Source 2003	Water Sharing Plan for the Macleay Unregulated and Alluvial Water Sources 2016 (plans consolidated)	n/a	Coastal
Water Sharing Plan for the Tweed River area Unregulated and Alluvial Water Sources 2010	n/a	n/a	Coastal
Water Sharing Plan for the Tuross River Unregulated and Alluvial Water Sources 2016	n/a	n/a	Coastal
Water Sharing Plan for the Upper and Lower Namoi Groundwater Sources 2003	Water Sharing Plan for the Upper and Lower Namoi Groundwater Sources 2019	Water Sharing Plan for the Namoi Alluvial Groundwater Sources 2020 (consolidated with others)	Inland
Water Sharing Plan for the Upper Billabong Water Source 2003	Water Sharing Plan for the Murrumbidgee Unregulated and Alluvial Water Sources 2012	Water Sharing Plan for the Murrumbidgee Unregulated Water Sources 2012 (plan split)	Inland

Plan	Plan replaced as	Plan replaced as	Region
		Water Sharing Plan for the Murrumbidgee Alluvial Groundwater Sources 2020 (plan split and consolidated with others)	
Water Sharing Plan for the Upper Brunswick River Water Source 2003	Water Sharing Plan for the Brunswick Unregulated and Alluvial Water Sources 2016 (plans consolidated)	n/a	Coastal
Water Sharing Plan for the Upper Namoi and Lower Namoi Regulated River Water Sources 2003	Water Sharing Plan for the Upper Namoi and Lower Namoi Regulated River Water Sources 2016	n/a	Inland
Water Sharing Plan for the Wandella Creek Water Source 2003	Water Sharing Plan for the Tuross River Unregulated and Alluvial Water Sources 2016 (plans consolidated)	n/a	Coastal
Water Sharing Plan for the Wybong Creek Water Source 2003	Water Sharing Plan for the Hunter Unregulated and Alluvial Water Sources 2009 (plans consolidated)	n/a	Coastal

Appendix 2

Updated risk assessment framework

Risk assessment framework

To manage NSW water resources, it is important to identify risks to the volume and quality of the resource, and subsequent risks to the users and the environment that rely on the resource. Risk assessment is a well-understood and accepted approach for managing natural resources. The consequences of impacts on natural resources are often hard to predict. Therefore, risk assessment relies on the probabilities of impacts occurring.

NSW has been implementing risk-based water planning processes since the late 1990s, including the Stressed Rivers Assessments in 1998 (Department of Land and Water Conservation, 1998a), the Aquifer Risk Assessment (Department of Land and Water Conservation, 1998b) and the macro water planning process developed in 2004 to complete water sharing plans across the state (NSW Office of Water2011.

The risk assessment framework adopts a cause/threat/impact model that describes the pathway for impacts to a receptor. This approach provides a systematic way to identify a range of factors that may lead to an impact. It is also consistent with the internationally recognised risk standard that considers both likelihood and consequence.

Causes have the potential to induce a threat to various extents, depending on the characteristics of the water resource. Table 8 summarises the causes, threats and impacts we considered in this assessment.

Table 8. Summary of causes, threats and impacts we considered in this risk assessment

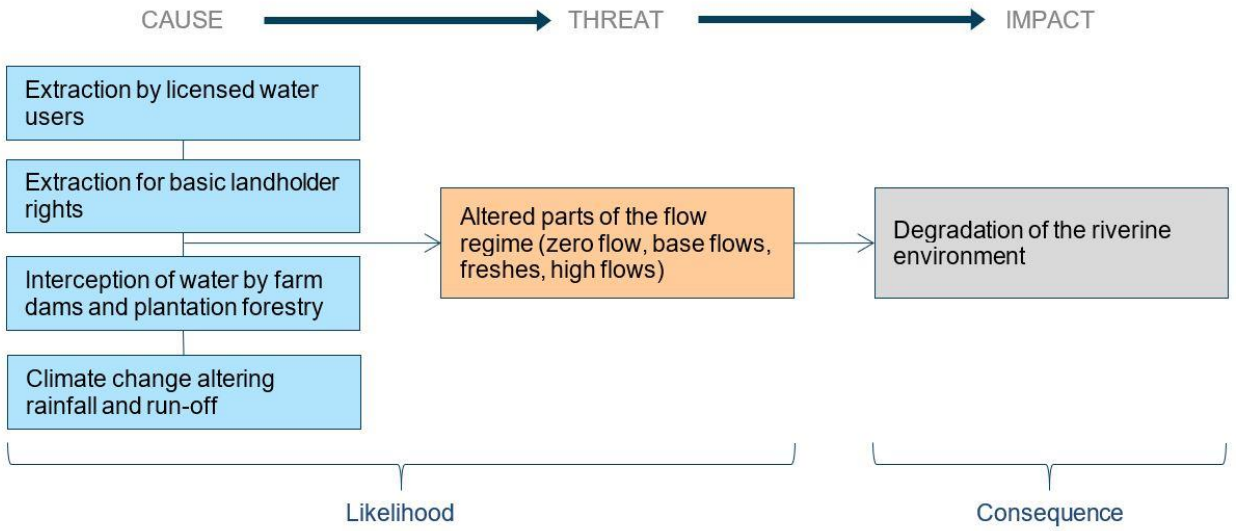
Cause	Threat	Impact
• Regulation of river flows by dams and weirs • Extraction by licensed water users • Extraction for BLRs • Interception of water by farm dams, mining and plantation forestry • Climate change altering rainfall, run-off and recharge to groundwater • Land management changes effecting landscape processes	• Altered parts of the flow regime (zero flow, base flows, freshes, high flows) • Reduced connected alluvial groundwater levels • Poor water quality (temperature depression, suspended matter, nutrients, dissolved oxygen, pH, salinity) • Decline in groundwater levels	• Degradation of the riverine environment • Degradation of the connected groundwater-dependent environment • Degradation of the estuarine environment • Loss of water suitable in quality for use

The risk level of an impact is a function of the **likelihood** of a cause and threat occurring, and the **consequence** of the impact on the receptor. For this risk assessment, we have adopted the following definitions:

- likelihood – the probability that a cause will result in a threat. It is not an indication of the size of the threat but rather conveys the probability that the threat will be significant
- consequence – the loss of value for an impacted receptor.

Figure 2 illustrates an example of how the cause/threat/impact model and likelihood/consequence standard have been combined for risks arising from river regulation and surface water extraction.

Figure 2. Example of an impact pathway for identifying the risks to the environment associated with altering parts of the flow regime



A risk formula is developed from the impact pathway that elaborates on the response or causation model and the metrics that are used to quantify (or qualify) the consequence, and the likelihood of that consequence (Table 9).

Table 9. Formula for deriving risk to in-stream riverine environmental assets from altering the flow regime

Risk **equals**	**consequence and**	**likelihood**
There is a risk of insufficient water being available to maintain key ecosystem functions in unregulated rivers.	This risk may lead to loss of in-stream riverine ecological values.	This loss would stem from an altered flow regime caused by water extraction, interception, and climate change.

We calculate risk levels using a standard risk assessment matrix (Figure 3). However, specific risk matrices may have been developed for some risks.

Figure 3. Standard risk assessment matrix

		Likelihood		
		Low	Medium	High
Consequence	Very low	Low	Low	Low
	Low	Low	Low	Medium
	Medium	Low	Medium	High
	High	Low	Medium	High
	Very high	Medium	High	High

How is this risk assessment related to the macro planning approach?

This risk assessment builds on our previously used macro planning approach by:

- assessing likelihood and consequence at a river-reach scale as opposed to a catchment or sub-catchment (water source) scale
- assessing the risk of impact on different parts of the hydrograph (for example, low flows, freshes and high flows)
- considering additional causes of flow alteration.

Using this approach means that some water sources may have a risk category different from those determined when the initial water sharing plans were written.

What is the scope of this risk assessment?

Coastal

This risk assessment evaluates current or future risks that directly relate to the quantity or quality of water in the water source. This risk assessment includes risk mitigation strategies that can be implemented through the water sharing plan – for example, improving flow for fish passage – for discussion in future options assessment workshops. Where mitigation strategies are not available through a water sharing plan, they are identified in the risk assessment but not considered further – for example, managing land-use practices.

This risk assessment evaluates:

- risks of insufficient water for freshwater riverine ecosystems
- risks of poor water quality for freshwater riverine ecosystems
- consequences of insufficient water for GDEs connected to the rivers
- risks of insufficient water for estuarine ecosystems
- risk of unsuitable water quality for other water uses (irrigation and recreation).

There are some risks to water sharing plan outcomes that this assessment will not address. This assessment **does not** evaluate:

- risks of change in water quality for GDEs connected to the rivers
- risks of poor water quality for estuarine ecosystems
- risks of insufficient water or poor water quality for Aboriginal values and uses
- risks of insufficient water for stock and domestic uses
- risks of insufficient water for consumptive uses
- risks of insufficient water and poor water quality for other social and economic outcomes
- risks raised by stakeholders during targeted consultation by the department.

Inland

NSW completed risk assessments to meet the Basin Plan requirements as part of developing water resource plans. Based on these requirements, the criteria adopted for including cause/threat/impact combinations in this assessment are that:

- the risk directly relates to a change in the water resource, which may change the quantity or quality of the resource
- risks for which the cause or threat would be mitigated by using NSW water management tools, such as rules within a water sharing plan.

We have not qualitatively assessed risks identified in the Basin Plan that do not have an apparent cause/threat/impact pathway in a water resource context. Rather, we have provided appropriate commentary to document a clear rationale. Alternatively, we reference other supporting documents. Establishing the time frame for the risk assessment determines the point from which we will assess the potential for impact. As the Basin Plan requires, this risk assessment identifies and assesses current and future risks.

We have adopted the following definitions:

- current risk – the risk that exists before the start of the water sharing plans and before the application of any new or altered water management actions and mechanisms and strategies. We have assessed current risk with the existing water sharing plan rules based on the WM Act set in place
- future risk – this risk may affect the condition or continued availability of water resources during or subsequent to the 10-year term of relevant water sharing plans. We also assess future risk with the existing water sharing plan or WM Act-based strategy set in place. Future risks that we have assessed include risk to the environment and to licensed water users from growth in water use by BLRs (both domestic and stock, and farm dam interception), interception activities (including plantation forestry and farm dams) and climate change.

As noted above, many water management actions and mechanisms are already in place that may adequately address risk. The purpose of this risk assessment is therefore to review the risks and associated management measures for current and future effectiveness, and to verify whether the level of water resource management matches the level of risk.

Limitations and uncertainties

This risk assessment uses the best data currently available. We use quantitative state-wide data where possible to maintain consistency between water sharing plan areas. If not available, we may use qualitative or local data sets. We may also use data not currently available for all areas but that is part of an ongoing program and provides significant benefit to the risk assessment – for example, NSW coastal climate change risk assessments.

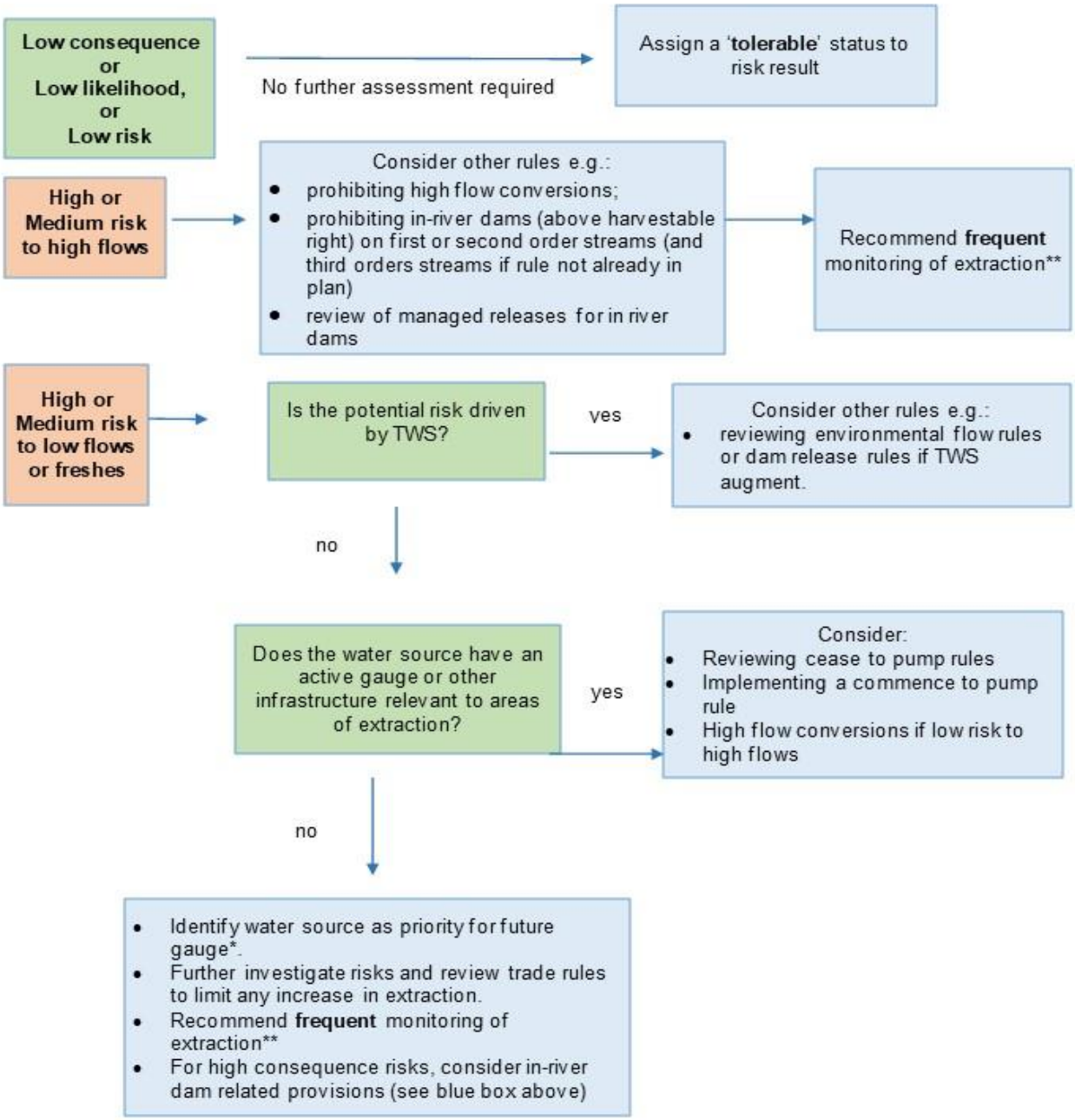
Appendix 3

Planning assessment decision tools

The coastal planning and assessment decision tool uses consequence, likelihood and risk from the risk assessment. When there is a low consequence, low likelihood or low risk, there is no further assessment required. When there is high or medium risk to high flows, rules can be considered to mitigate these risks, including prohibiting high flow conversions, prohibiting in-river dams or reviewing managed releases for in-river dams. If these cannot be implemented due to lack of a gauge, recommend frequent monitoring of extraction in the water source. When there is high or medium risk to low flows or fresh flows, determine whether the potential risk is driven by town water supply. If it is, consider reviewing environmental flow rules or dam release rules. If risk is not driven by town water supply, determine whether there is an active gauge or other infrastructure which could be used in areas of extraction. If there is, consider reviewing cease to pump rules, implementing a commence to pump rule or high flow conversions if there is low risk to high flows. If there is no gauge, identify the water source as a priority for the implementation of a gauge in the future, further investigate risks, review trade rules and recommend frequent monitoring of extraction.

Figure 4 illustrates the process for identifying if rule changes are necessary for coastal replacement water sharing plans.

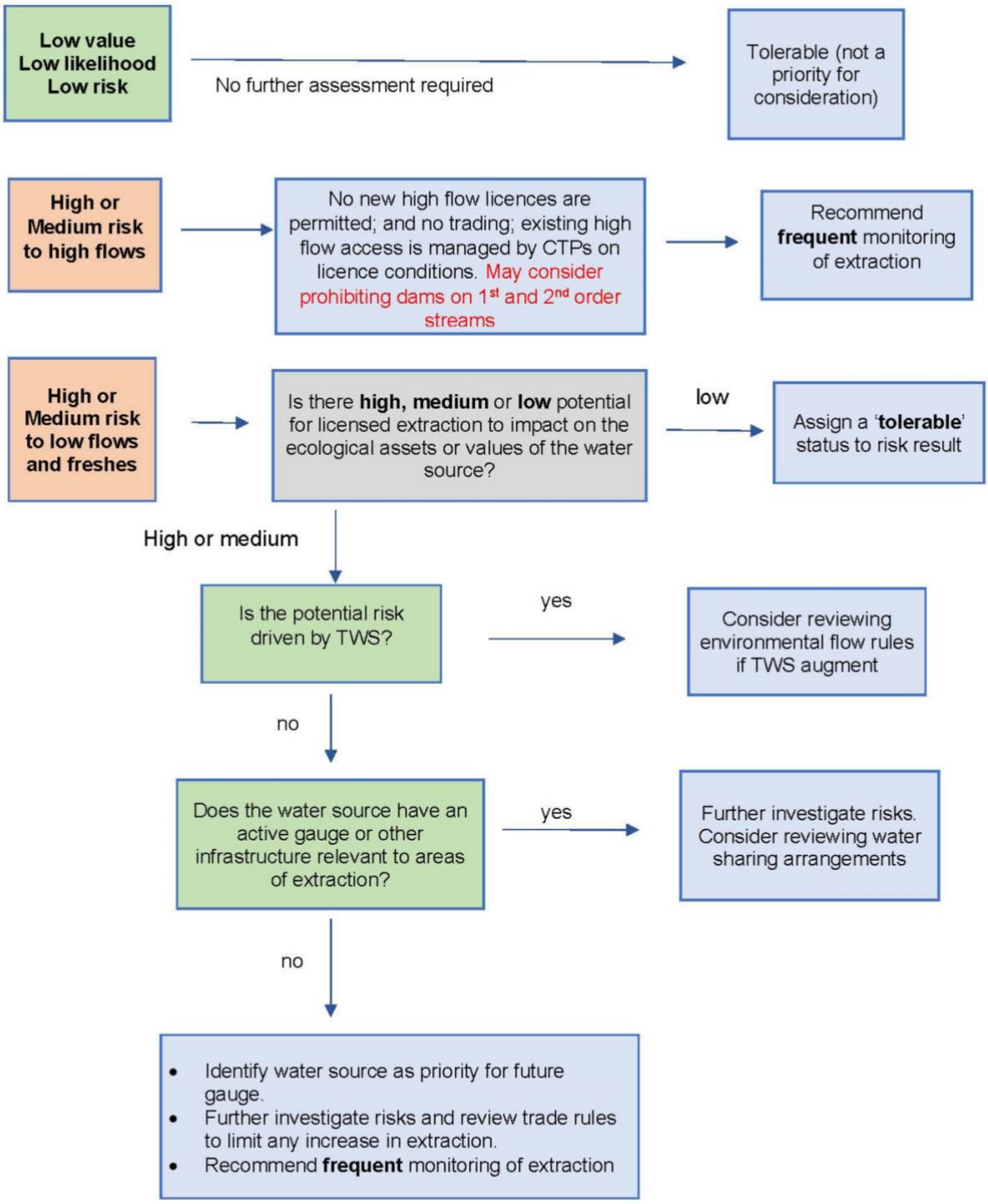
Figure 4. Coastal planning assessment to identify need for rule changes



The inland planning and assessment decision tool uses value, likelihood and risk from the risk assessment. When there is a low consequence, low likelihood or low risk, there is no further assessment required. When there is high or medium risk to high flows, rules can be considered to mitigate these risks, including prohibiting high flow licences, prohibiting trading and consider prohibition of dams on first and second order streams. If these cannot be implemented due to lack of a gauge, recommend frequent monitoring of extraction in the water source. When there is high or medium risk to low flows or fresh flows, determine whether there is high, medium or low potential for licenced extraction to impact on ecological assets or values of the water source. If there is low potential, no further assessment is required. If there is high or medium potential, determine whether it is driven by town water supply. If it is, consider reviewing environmental flow rules if the local water utility augments. If the potential risk is not driven by town water supply, determine whether there is an active gauge or other infrastructure which could be used in areas of extraction. If there is, consider reviewing water sharing arrangements. If there is no gauge, identify the water source as a priority for the implementation of a gauge in the future, further investigate risks, review trade rules and recommend frequent monitoring of extraction.

Figure 5 illustrates the process that applies to inland planning assessments. These determine rule changes for inland replacement water sharing plans.

Figure 5. Inland planning assessment to identify need for rule changes



Appendix 4

Table 10. Method of calculating the LTAAEL for coastal floodplain alluvial groundwater sources

Factor	How factor was calculated
Rainfall recharge	Average rainfall over the water sharing plan area is calculated, excluding national parks and drains. An infiltration factor of 10% is applied. This figure considers climate change predictions (using NARCliM, the NSW and ACT Regional Climate Modelling project) in the estimate of recharge over the life of the plan.
Risk assessment factor	An ecological/socio-economic risk assessment is conducted, and a percentage of rainfall recharge is reserved as planned environmental water. The remaining portion is available for extraction.
Planned environmental water	This volume is equal to the percentage of rainfall recharge that the risk assessment determines, plus all rainfall recharge in national park areas and drains.
LTAAEL	The water available for extraction based on the risk assessment factor.
Current and future water needs	Current entitlement and estimated BLR are calculated. An estimate of future growth is determined, and a 10% buffer is applied to ensure enough water is protected for future water needs, wherever possible.
Unassigned water	Calculated as ‘water for extraction’ multiplied by 80%. If this is less than current and future water needs, then there is no unassigned water available. If the calculation shows that current and future water needs are less than 80% of the LTAAEL, then unassigned water exists in the water source and may be made available through a controlled allocation.

Appendix 5

Method used to estimate water requirements of domestic and stock basic landholder rights

The values for Basic Landowner Rights (BLR) in the unregulated water sharing plans have been estimated using both spatial and empirical data held by the Department of Planning and Environment and the Australian Bureau of Statistics, following the process approved by the Planning Reference Group (PRG). The estimates may differ from estimates in the current water sharing plans due to changes in land use, changes in population and the availability of more accurate data.

Surface water sources

Surface water BLR is associated with river frontage. To estimate the volume of water used to meet stock and domestic surface water BLR requirements, a buffer zone is applied around the river that determines the area of land that would be entitled to riparian (river frontage) BLR.

Step 1. Identify all water sources in the water sharing plan area and separate out the regulated rivers from the unregulated rivers.

Apply the below method to each water source separately. This will result in a regulated river BLR figure and an unregulated river BLR figure.

Step 2. Determine buffer zones.

The buffer zone is determined by applying a standard distance around streams based on the location of the stream within NSW and the stream order. The size of the buffer zone is determined from the draft Reasonable Use Guidelines Zone map (figure 1) and the Stream Orders by Zone (Table 1). Stream orders were selected for each zone based on the stream's reliability to provide basic rights for the majority of the year on average.

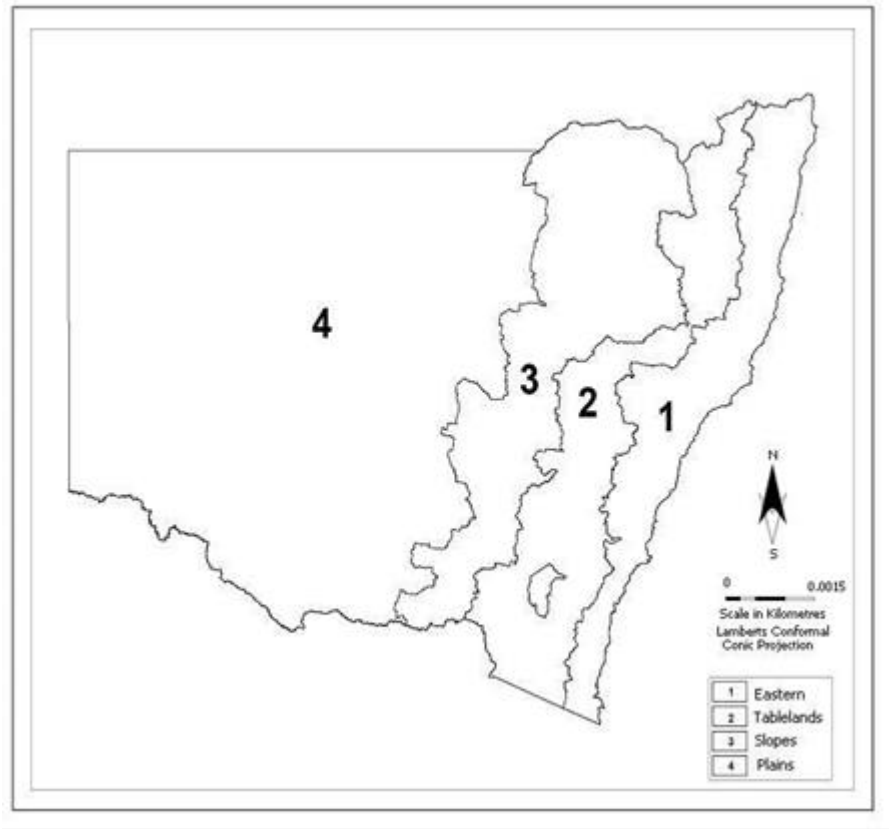


Figure 1: Reasonable Use Guidelines Zone Map

Table 1: Stream orders by Zone

Zone	Stream order	Buffer (m)
Eastern	3rd and above	400
Tablelands	3rd and above	400
Slopes	4th and above	400
Plains	5th and above	1,000

For example, a buffer zone of 400 m would be applied to a 3rd order or larger stream in the Eastern Zone of the state.

Step 3. Calculate domestic use (ML/yr)

It is assumed that domestic use within urban areas is provided by reticulated town water supply and covered by surface water and/or groundwater licences. Private surface water extraction for domestic consumption in urban areas is assumed to be negligible.

Within each buffer zone determined in step 2, remove the urban areas.

Overlay the NSW Address Database, also known as GURAS, data held by Crown Lands.

Determine the number of dwellings in the remaining (non-urban) area of the buffer zone by counting the number of unique properties identified in the GURAS data set. This assumes that on average there is one house per property and multiple houses on a single property are balanced out by properties that are unoccupied.

Multiply the number of dwellings by the domestic consumption allowances for rural land (Table 2) to determine the rural domestic BLR volume for the buffer zone.

Table 2: Domestic water consumption for rural lots (per year) from the Reasonable Use Guidelines by zone.

Zone	Rural consumption (ML/yr)
Eastern/Coast	1.0
Tablelands	1.1
Slopes	1.4
Plains	2.1

The rural domestic BLR volume will be partly met by groundwater and partly by surface water.

Multiply the rural domestic BLR volume by the surface water percentage in (Table 3) to determine the proportion of surface water use within the buffered areas of each water source.

Surface water reliability is generally higher in coastal regions, so it is assumed that within the buffer zone the bulk of water extracted would be from surface water with equal portions of connected alluvial groundwater and deeper groundwater.

Table 3: Assumed water use by region by source

Zone	Groundwater	Surface water
Eastern	Alluvials 10% Other 10%	80%
Tablelands	Alluvials 20% Other 10%	70%
Slopes	Alluvials 20% Other 10%	70%
Plains	Alluvials 30% Other 30%	40%

Step 4. Calculate Stock Use (ML/yr)

Stock use was calculated by determining the area of grazing within each buffer zone for each water source.

The grazed area excludes urban areas, as it is assumed that any use within an urban area will be minor and would be accounted for as part of any local water utility licence.

Within each buffer zone determined in step 2 remove the urban areas.

Determine the area of grazing within the non-urban area of each buffer zone by calculating the area of native pastures (unimproved), improved pastures and irrigated pastures for each water source from the NSW Landuse data of 2013 that is in the SEED database.

Multiply the area of each type of pasture by the stock watering allowances for rural land (Table 4) to determine the stock use volume for that type of pasture in the water source. This takes into account the different stock water requirements in different parts of the state.

Sum the stock watering allowances for each type of pasture within the water source to get a total stock water BLR figure for the water source.

Table 4: Stock watering allowance by zone from the draft reasonable use guidelines.

Zone	Pasture type	Take Allowance (ML/ha)
Eastern	Unimproved pasture	0.025
	Improved pasture	0.045
Tablelands	Unimproved pasture	0.020
	Improved pasture	0.045
Slopes	Unimproved pasture	0.015
	Improved pasture	0.045
Plains	Unimproved pasture	0.010
	Improved pasture	0.020
All zones	Irrigated pasture	0.050

Step 5. Calculate total BLR requirements for the surface water source.

Sum the domestic BLR figure calculated in step 3 and the total stock BLR figure in step 4 to determine the total BLR figure for each surface water source. Sum each water source to determine BLR for regulated and unregulated water sources in the water sharing plan area.

Groundwater water sources

NOTE: This method does not apply to the Coastal Floodplain Alluvial Groundwater Water Sources.

Step 1. Determine the 'groundwater relevant area' of the water source.

For each groundwater source, remove the urban areas that are supplied by reticulated town water and remove the buffer areas determined in the surface water source methodology. The remaining area is the 'groundwater relevant area' for BLR usage.

Step 2. Calculate Domestic Use (ML/yr)

For domestic use in the 'groundwater relevant area' of the groundwater source, calculate the number of houses by counting the number of unique properties identified in the GURAS property addressing data held by Crown Lands within the 'groundwater relevant area' of each water source.

Calculate the domestic groundwater BLR requirement in each groundwater source by multiplying the total number of houses by the domestic consumption by rural lots in table 2 and then the proportion of BLR that is groundwater dependent in table 3.

Step 3. Calculate Stock Use (ML/yr)

Within the 'groundwater relevant area' for each groundwater source, identify the area of unimproved, improved, and irrigated grazed pasture using the NSW Landuse data of 2013 that is in the SEED database.

Calculate the stock watering requirements by multiplying the area of each type of pasture by the stock watering allowances for rural land (Table 4) to determine the stock use volume for that water source.

As some of the stock BLR figures will be provided by surface water, calculate the volume of groundwater stock BLR by using the percentage figures by zone in Table 5.

Table 5: Estimated percentage of stocked area with significant reliance on groundwater by zone.

Zone	Stock: significant reliance on groundwater (%)
Eastern/Coast	15%
Tablelands	40%
Slopes	50%
Plains	80%

Step 4. Calculate total BLR for each groundwater water source.

Sum the domestic BLR figure calculated in step 2 and the total stock BLR figure in step 3 to determine the total BLR figure for each groundwater water source.

Coastal floodplain alluvials

Count the number of BLR bores within each water source that were identified through WLS searches and spatial mapping surveys.

For each bore that is for ‘Stock’ or ‘Domestic’ use, only an annual extraction of 1 ML BLR is assumed.

For each bore that was for ‘Stock and Domestic’ use, an annual extraction of 2 ML BLR is assumed.

Sum these two volumes to determine the total known BLR.

Expert opinion advises that the total known BLR represents approximately two-thirds of all groundwater BLR extraction, as there is a significant amount on unlicensed groundwater extraction such as unauthorised spear points.

Multiply the total known BLR figure by 150% to account for unknown BLR to give the total BLR figure for the water source.

Groundwater reliance percentages

The assumptions made for estimating reliance on groundwater by zone outside the areas that are assumed to be using primarily river and creek water are explained as follows.

For the Eastern/coastal zone, high rainfall suggests water tanks and dams are likely to be used over groundwater. Access to groundwater in coastal sands areas is assumed to be by a large number of spear points. The assumptions are:

- domestic – assume 10%
- stock - assume 15%.

For the Tablelands zone, relatively reliable rainfall suggests dams and water tanks are likely to be used over groundwater. In general, groundwater access gives low yields with varying quality. The assumptions are:

- domestic – assume 25% of houses within the water source would use primarily groundwater over rainwater
- stock – assume 40% of the grazed area within the water source would use primarily groundwater for stock watering over dams.

For the Slopes zone, less reliable rainfall suggests dams and water tanks are still likely to be used over groundwater where possible. In general, groundwater access gives varying yields with varying quality. The assumptions are:

- domestic - assume 35% of houses within the water source would use primarily groundwater over rainwater
- stock - assume 50% of the grazed area within the water source would use primarily groundwater for stock watering over dams.

For the Plains zone, unreliable rainfall suggests groundwater will be used over dams and water tanks. In general, groundwater access gives varying yields with varying water quality. The assumptions are:

- domestic – assume 60% of houses within the water source would use primarily groundwater over rainwater; in some areas, groundwater is unfit for human consumption
- stock - assume 80% of the grazed area within the water source would use primarily groundwater for stock watering over dams.

Great Artesian Basin proper—alluvials and cap rock

The method we use to estimate water take for BLRs in the Great Artesian Basin is different from that we use for other parts of NSW. This is due to the climate, the dependence on groundwater and the landscape differences with the rest of the state.

The 2020 replacement plan for the Great Artesian Basin Groundwater Sources used a new method for estimating BLR. The department engaged consulting firm Klohn Crippen Berger to evaluate BLR estimates for the NSW portion of the Great Artesian Basin. The firm reviewed previous approaches to estimate BLR for the NSW groundwater sources and approaches used in the Queensland plans for the Great Artesian Basin. Klohn Crippen Berger then adapted these, based on data availability and suitability, and recommended a new method for including BLR estimates in the new water sharing plan.

The recommended method combined the methods for estimating BLR in the current water sharing plan, the department's current BLR estimation method and that used in the Queensland portion of the Great Artesian Basin. This recommended method also discounted the water take from overlying groundwater sources and watercourses in estimating BLR.

The Klohn Crippen Berger report, available on our website, describes specific details of the method adopted for the 2020 Great Artesian Basin Water Sharing Plan.[17]

[17] Klohn Crippen Berger 2020, *Estimate of Basic Landholder Rights Requirements and Abstraction for the NSW Great Artesian Basin Groundwater Sources,* report prepared for the Department of Planning, Industry and Environment.

Appendix 6

Method for creating water sharing plan flow duration curves and tables

Flow data for replacement plans can incorporate an additional 10 years of flow data, which means new flow duration tables can help understand the flow in the river. This guide aims to help planners create flow duration curves and tables.

Step 1 – Determine which gauges to get further information on

- Look at available gauges using data sources including
    - WaterNSW Real time data website www.waternsw.com.au/waterinsights/real-time-data
    - Pineena www.industry.nsw.gov.au/water/science/maps/water-monitoring-stations
    - Talk to WaterNSW
    - You may also consider discussing with ecohydrologist, or others who have local knowledge.
- Only use gauges with at least 10 years of data
- Consider location of gauge in the catchment and relative to water extraction. If more than one gauge in a water source, the best locations are downstream of most extraction and near the end of the water source
- Consider if the gauge is suitable to measure low flows (through discussion with WaterNSW)
- Consider reliability of gauge (through discussion with WaterNSW)

Step 2. – Request cleansed flow data

When you have your list of gauges you want to use for WSP replacement ask Dani (Coastal) or Julie (Inland) to send a 'cleansed flow data' request to the modelling team.

For each gauge which requires data, determine whether there is a major dam (for example, TWS, hydro power station) within its catchment, and what year the dam was complete. Only request data after that time as this represents the flow in the system now.

- At the moment the cleansing rules that the modelling team apply are:
    - Remove years where 20% or less of data was available for that calendar year
    - Remove 'not release quality/missing' data – that is, only consider periods that have either good quality or no QA code
    - Where the gauge is downstream of major infrastructure (weir, dam etc), only consider periods after this was implemented (as above step, Planning to identify gauges this is relevant for and to provide dates where appropriate)
    - Remove repeat values (where there was clearly a gauge function issue)

Step 3 – Analyse your flow data

Data provided will be raw data.

Use the spreadsheet tool which turns raw data into flow duration tables. Once raw data has been inserted into the spreadsheet, it will generate an exceedance curve and a table showing both annual and monthly flows for key exceedance percentiles.

- Whether you are updating rules or not it is important to compare current cease to pumps to the flow duration curves based on cleansed data.
- The planning reference group has determined

- If there are no other drivers for changed access rules, the ML/day cease to pump in the current plan will remain as the ML/day cease to pump figure in the new plan and the percentile figures will be removed from the plan.

This could mean that the percentile has gone up or down. This is important for us to know so we can see the impact of the rule on the environment and water users but a change in percentile alone will not result in a change in cease to pump rule unless there is a large discrepancy in percentiles.