



# Review of 2004 water sharing plans

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## Enquiries

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## List of acronyms

CMA	Catchment Management Authority
NRC	Natural Resources Commission

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**Attachment 1 – Water sharing plans due to expire in 2014**

**Attachment 2 – Summary of public submissions**

**Attachment 3 – Regional summaries**

# 1 Executive summary

As per section 43A of the *Water Management Act 2000* (NSW) (the Act), the Natural Resources Commission (NRC) has reviewed 31 water sharing plans due to expire in 2014. This report presents the NRC's findings and recommendations to the Minister for Primary Industries (the Minister) regarding:

- the extent to which the plans comply with the NSW *Standard for Quality Natural Resource Management* (the Standard) and contribute towards state-wide targets, as expressed at a regional scale in catchment action plans
- the alignment of water and natural resource management planning to improve overall landscape health, productivity and resilience
- the implications of the Murray-Darling Basin Plan (the Basin Plan)
- whether changes to the water sharing plans are warranted.

The NRC found that it is likely the plans have contributed to the state-wide targets by:

- providing certainty around water allocations, entitlements and extraction levels
- supporting trade to encourage economically efficient water use
- setting aside water for the environment and working towards more natural flow patterns
- making progress in the recognition of Aboriginal cultural water values.

However, the NRC's capacity to assess the extent or materiality of this contribution has been limited by a lack of available information on the outcomes of these plans.

Analysis against the Standard indicates that these plans are an improvement on arrangements in place prior to 2004. However, more can still be done to improve monitoring, evaluation and reporting; increase transparency; address issues around risk; integrate surface and groundwater management; and minimise constraints on the carryover, trade and use of environmental water.

Overall, there is a weight of evidence indicating that replacing the plans would benefit both consumptive users and the environment. However, for plans within the Murray-Darling Basin, the replacement of any water sharing plans should be carefully timed to avoid duplication of effort and ensure the efficient use of government and community resources.

The NRC's full recommendations are set out in **Section 1.1**, supported by opportunities for improvement – including improvements that may not require plan replacement – in **Chapter 5**.

Considering water sharing plans in a broader context, investment in NSW's water resources will be most effective if the plans' intended outcomes align with the landscape values and management priorities set out in catchment action plans. Recent catchment action plan upgrades, led by NSW Catchment Management Authorities (CMAs), have generally improved the alignment between water sharing plans and catchment action plans.

The NSW Office of Water should continue to collaborate and share information with CMAs as they transition to the Local Land Services model. Better alignment between water sharing plans and future local strategic plans will promote more efficient and co-ordinated on-ground action, and maximise the benefits from Government investment in natural resource management.

## 1.1 Recommendations

Table 1: Summary of recommendations

### Recommendations

#### 1 For plans outside the Murray-Darling Basin:

- The NRC recommends replacing regulated river, unregulated river and groundwater plans outside the Murray-Darling Basin, to:
  - address monitoring, evaluation and reporting issues
  - where possible, update the plans in light of new knowledge
  - bring the plans in line with current best practice, including merging plans covering small, less intensively used water sources into 'macro' plans that prioritise management across catchments or aquifer groups based on risk, and improve the integrated management of connected ground and surface water sources
  - include provisions for Aboriginal community development water access licences in line with current policy guidelines.

#### 2 For plans within the Murray-Darling Basin:

- There is evidence that, as above, there would be benefit in replacing water sharing plans in the Basin. However, if the NSW Government plans to implement the Basin Plan, the NRC considers that:
  - to avoid multiple planning processes, the Minister should extend the plans in the Basin until they can be remade to meet Basin Plan water resource planning requirements, as required by 2019 (*note: this may require changes to the Act*).
  - plans with trading provisions that may not meet Basin Plan requirements (such as the Murrumbidgee Regulated River Water Source plan) may need to be replaced or amended by 1 July 2014 when Basin Plan trading requirements come into effect
  - in the meantime, issues around monitoring, evaluation and reporting should be addressed as soon as possible, resulting in better information about plan outcomes to inform the plan replacement processes triggered by the Basin Plan and the transition to water resource plans
  - other areas for improvement that can be addressed independently of a plan replacement process (refer to **Chapter 5** of this report) should be addressed as soon as possible.
- The NRC recommends that it is appropriate for the Minister to take into account the Office of Water's advice on operational issues before making a final decision on the plans in the Murray-Darling Basin. The Minister may decide there is sufficient benefit in immediately addressing the issues raised in the Office of Water's advice, in which case the Minister may decide to replace some or all of the plans within the Basin in 2014.

## 1.2 Report structure

The remainder of this report explains the NRC's findings and recommendations in more detail:

- **Chapter 2** gives an overview of water sharing plans and their links to regional planning
- **Chapter 3** explains the NRC's role and review scope, and the sources of evidence used
- **Chapter 4** presents the findings of the NRC's assessment
- **Chapter 5** outlines opportunities for further improving water sharing planning.

## 2 NSW water sharing plans

The NSW Government's *Water Management Act 2000* (the Act) gives effect to national water reforms including the 1994 Council of Australian Governments' national water reform framework and the 2004 National Water Initiative.

The Act represents the first consistent, state-wide legislation to protect and manage all waters in NSW, and aims to deliver social, cultural, economic and environmental benefits to the state by:

- encouraging sustainable and efficient water use, particularly through water trading
- promoting equitable sharing of water to support healthy, productive water sources
- seeking to integrate water management with other natural resource management.

The Act is primarily being implemented via the NSW Office of Water's water sharing plans, which are progressively phasing out previous water management arrangements established under the *Water Act 1912* (NSW).

### 2.1 Overview of water sharing plans

Water sharing plans establish a set of rules for how water in a particular water source is allocated and managed, with the aim of achieving sustainable water management that supports economic, social, cultural and environmental outcomes.

The Office of Water administers the water sharing plans; however, as **Table 2** shows, there are a range of organisations with roles and responsibilities relating to water sharing plans.

**Table 2: Summary of roles and responsibilities relating to water sharing plans**

Organisation	Roles and responsibilities
NSW Office of Water	<p>The Minister for Primary Industries administers water sharing plans. Under this Minister, the Office of Water, which is part of the Department of Primary Industries:</p> <ul style="list-style-type: none"> <li>▪ coordinates plan development and ensures the plans are statutorily compliant</li> <li>▪ implements the plan provisions, including being responsible for available water determinations, licence applications, system operations procedures, regulations, compliance on licences and approvals and monitoring, evaluation and reporting</li> <li>▪ prepares regular progress reports on implementation activities and water management under the plans, and conducts audits of the implementation of plan provisions (at least every five years, as required by section 44 of the Act).</li> </ul>
State Water Corporation	<ul style="list-style-type: none"> <li>▪ Delivers bulk water according to plan provisions, manages water accounts, processes water allocation assignments and manages and operates infrastructure.</li> <li>▪ Takes compliance action for overuse of water allocations.</li> </ul>
Office of Environment and Heritage	<p>The Minister for the Environment has a concurrence role for water sharing plans. Under this Minister, the Office of Environment and Heritage:</p> <ul style="list-style-type: none"> <li>▪ manages Environmental Contingency Allowances (provided under the water sharing plans) and NSW environmental water holdings (acquired through purchases on the water market).</li> </ul>

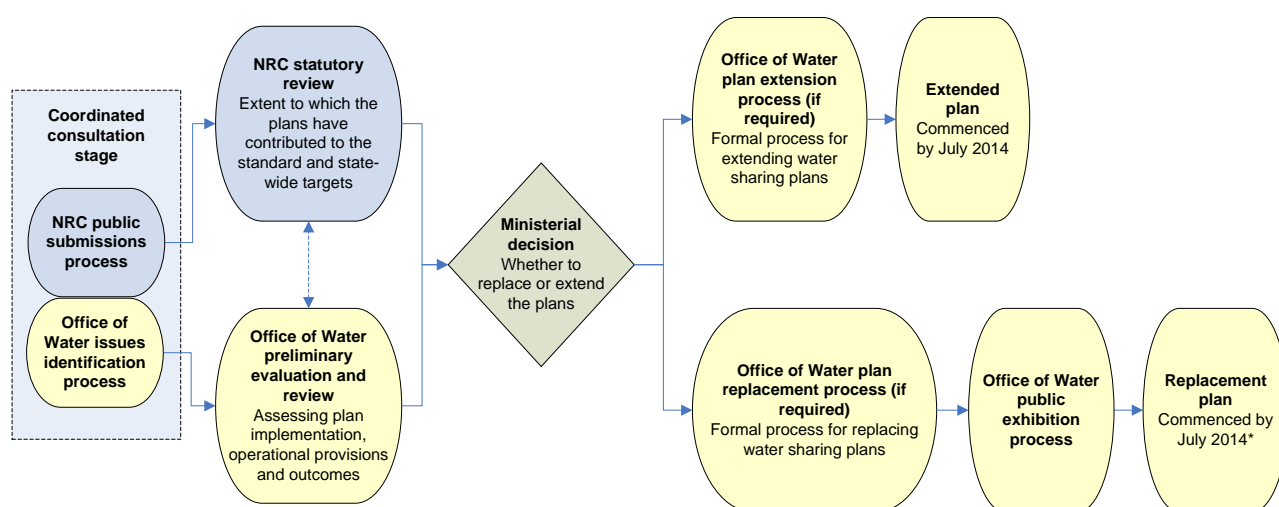
Organisation	Roles and responsibilities
Natural Resources Commission	<ul style="list-style-type: none"> <li>Reviews the plans' contribution to state-wide natural resource management standard and targets, and advises the Minister for Primary Industries on whether the plans should be extended or replaced (under section 43A of the Act).</li> </ul>
National Water Commission	<ul style="list-style-type: none"> <li>Assesses water planning in all states and territories to determine progress in implementing the National Water Initiative.</li> </ul>
Murray-Darling Basin Authority	<ul style="list-style-type: none"> <li>Sets a Cap (upper limit) for surface water diversions within the Murray-Darling Basin. NSW implements the Cap through the water sharing plans. By 2019, the Cap will be replaced by the Murray-Darling Basin Plan sustainable diversion limits.</li> </ul>

The first round of water sharing plans commenced in 2004, with plans for 31 priority surface and ground water systems across NSW (see **Attachment 1** for a list and map of plans). Fourteen of the 31 plans fall within the Murray-Darling Basin; the remainder are in coastal regions.

After the 2004 plans were developed, the Office of Water adopted a 'macro planning' process for less intensively used unregulated river and groundwater sources. In this process, the Office of Water classifies the water sources' environmental and economic values and risks, and uses these to determine the level of management required. Water sources may also be aggregated into broader management units. The Office of Water is developing these plans via interagency panels that are informed by targeted stakeholder consultation and public exhibition processes.

## 2.2 What happens when the plans expire?

Water sharing plans apply for 10 years from their commencement, which means the 31 plans implemented in 2004 are due to expire in 2014. Before each plan expires, the Minister will determine if the water sharing plan needs to be replaced or, on the recommendation of the NRC under section 43A of the Act, extended for a further ten years. **Figure 1** shows the steps supporting this process.



\* If the Minister decides to replace a plan then the existing plan may be extended until the commencement of a replacement plan, or until the first anniversary of the date the plan would otherwise have expired, whichever occurs first. This means that for the 2004 water sharing plans, the existing plan could be in place until 1 July 2015.

**Figure 1: Process for extending or replacing water sharing plans**

## 2.3 Relationship between water and catchment management planning

Water is a key factor supporting the economic, social, cultural and environmental values of NSW's landscapes. Managing this vital resource in a way that supports these values in the long term is challenging, and requires alignment between policy frameworks, investments and stakeholder actions to ensure progress towards shared objectives.

In NSW, the state-wide targets provide shared, high-level objectives for natural resource management so that all stakeholders are working towards the same outcomes. The state-wide targets most relevant to water sharing plans are as follows:

- **Water** – by 2015, there is an improvement in the:
  - condition of riverine ecosystems
  - ability of groundwater systems to support groundwater dependent ecosystems and designated beneficial uses
  - condition of important wetlands, and the extent of those wetlands is maintained
  - condition of estuaries and coastal lake ecosystems.
- **Community** – natural resource decisions contribute to improving or maintaining economic sustainability and social well-being.
- **Biodiversity** – by 2015, there is an increase in the:
  - number of sustainable populations of a range of native fauna species
  - recovery of threatened species, populations and ecological communities.

The NSW Government's *NSW 2021* state plan also contains a target to protect rivers, wetlands and coastal environments by improving the environmental health of wetlands and catchments through actively managing water for the environment.<sup>1</sup> The *NSW 2021* plan identifies water sharing plans as a means for achieving this target.

The Standard supports progress towards state-scale targets by promoting consistent, high-quality natural resource management practices across NSW.

At the regional scale, there are areas of common purpose between water sharing plans and other plans and policies, such as catchment action plans and land use plans. For instance, these plans and policies may all include a shared interest in sustaining water-dependent ecosystems or maintaining the economic, social and cultural values of water in the regional community.<sup>2</sup>

Broad objectives within the water sharing plans serve to highlight the links between water, catchment and land use planning, because the water sharing plan provisions are often just one factor affecting the achievement of these objectives. For example, provisions to protect low water flows might only achieve their desired in-stream habitat outcomes if action is taken to actively manage other factors that may lead to habitat degradation, such as stock access or water quality.<sup>3</sup>

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<sup>1</sup> NSW Government (2011), *NSW 2021 – A plan to make NSW number one*. At [www.2021.nsw.gov.au](http://www.2021.nsw.gov.au).

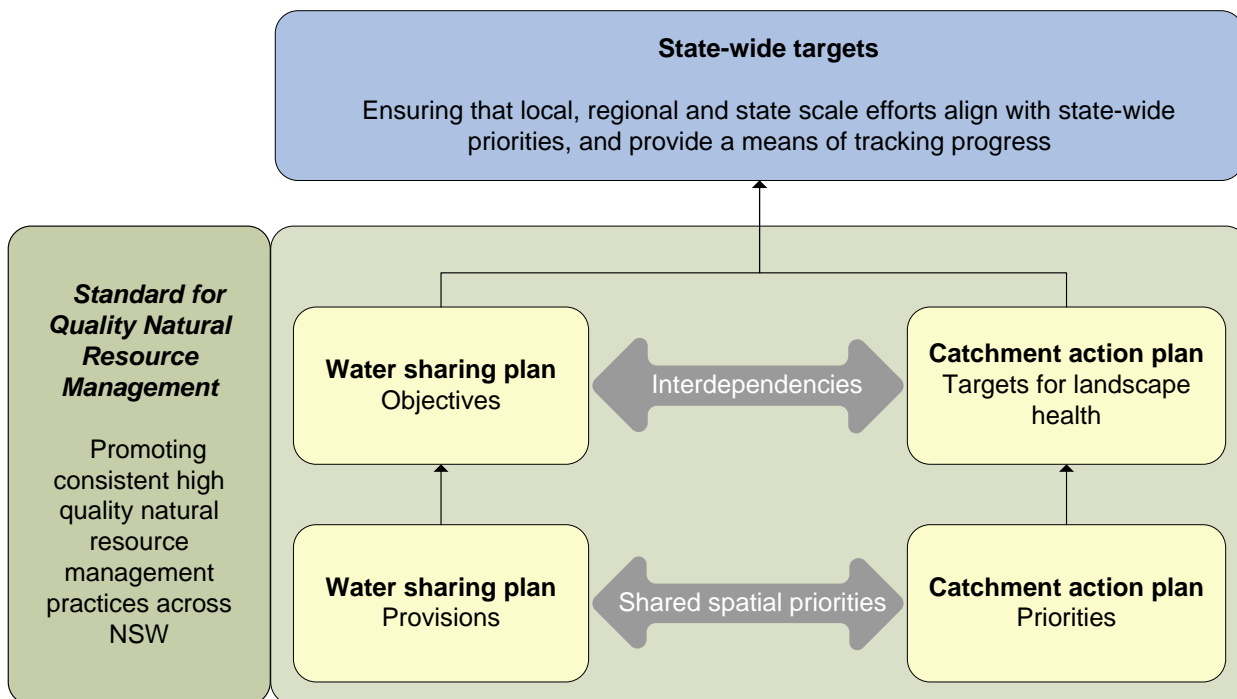
<sup>2</sup> Hamstead, M. (2010) *Alignment of water planning and catchment planning*, Waterlines report, National Water Commission, Canberra.

<sup>3</sup> Ibid.



To maximise the benefits of investment in NSW's water resources, the outcomes being sought through water sharing plan provisions should align with the landscape values and management priorities identified in catchment action plans. This alignment should be a two-way process, whereby knowledge generated through each planning process informs the other – for example, through ongoing development of shared spatial information about regional priorities.

**Figure 2** illustrates how water sharing plans and catchment action plans, underpinned by the Standard, should contribute to the state-wide targets to achieve efficient and effective management of land and water assets.



**Figure 2: Relationships between water sharing plans, catchment action plans and the Standard and state-wide targets**

A pilot project was undertaken in the Hunter valley to determine an appropriate framework for aligning regional catchment and water planning.<sup>4</sup> The project concluded that alignment is most effective if:

- planners can identify objectives that apply to both plans, for example, objectives around improving the condition of water-dependent ecosystems
- there are governance arrangements in place for coordination between CMAs and the Office of Water
- there is a shared process and information base for assessing the condition of, value of and risk to aquatic ecosystems (which led to the development of the River Condition Index)
- the priorities identified in assessing aquatic condition, values and risks are spatially expressed at an appropriate scale
- planners develop logic maps showing how both instruments can address the identified priorities and objectives.

<sup>4</sup> Ibid.

### 3 NRC's review of water sharing plans

The NRC's review role was added to the Act in 2004 to allow for the possibility of extending the current water sharing plans beyond their 10-year term, and to allow the Minister to consider the effectiveness of water sharing plans in relation to overall landscape health. This promotes a more integrated approach to landscape management by recognising that water is one part of the wider system supporting landscape health, productivity and resilience.

#### 3.1 Review scope

Section 43A of the Act requires that, before making a decision to extend or replace a water sharing plan, the Minister must consider a report provided by the NRC reviewing the extent to which the plans have materially contributed to achieving the Standard and natural resource management targets in the relevant region, and whether changes to the plans are warranted.

It is important to note that the Standard, targets and catchment action plans were not in place when the 2004 water sharing plans were created. The institutional context for water planning and catchment management has further evolved since the 2004 plans were made, including:

- the development of the overarching Murray-Darling Basin Plan (the Basin Plan)
- a shift towards adjusting the balance in water sharing by purchasing water rights, leading to a rapid increase in acquired environmental water by the NSW and Australian governments, and ongoing changes to the management of environmental water
- a greater appreciation of risks around climate uncertainty and variability
- the cessation of the *State Water Management Outcomes Plan*
- upgrades of the first catchment action plans
- the announcement that Catchment Management Authorities will transition to the Local Land Services model.

There has not yet been an opportunity to adapt the water sharing plans in response to these changes.

Given this context and the specific requirements of the Act, the NRC's review focuses on the:

- extent to which the 2004 water sharing plans comply with the Standard and contribute towards state-wide targets, as expressed at a regional scale in catchment action plans
- alignment of water planning and natural resource management planning to improve overall landscape health, productivity and resilience
- implications of the Basin Plan, and the possible need to transition from water sharing plans to water resource plans (incorporating sustainable diversion limits) by 2019.

The NRC's review was also informed by wider NSW Government policies and priorities, including *NSW 2021* and the transition to the Local Land Services model.<sup>5</sup> Within this context, the NRC developed three guiding principles – better regional outcomes, integrated and efficient governance and evidence-based decision-making – that were used to identify opportunities for plan improvement.

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<sup>5</sup> NSW Government (2011), op. cit.

## 3.2 Reviews by the NSW Office of Water

Importantly, the Act does not direct the NRC to address all issues or policy questions relating to the replacement or extension of water sharing plans. A range of operational issues lie outside the NRC's review scope and are currently being investigated by the Office of Water, as part of the Office of Water's legislative role in developing and implementing water sharing plans.

The Office of Water will provide separate advice to the Minister based on its own investigations into whether the current water sharing plan provisions are appropriate and practicable, and whether plan outcomes can be improved. If the Minister decides that the plans should be replaced, the Office of Water will be responsible for developing the replacement plans.

## 3.3 Evidence sources

The NRC's issues paper anticipated that the available data on ecological, economic, social or cultural outcomes – used to assess whether water sharing plans have made a material contribution to state-wide targets – could be variable.<sup>6</sup> Assessment against state and regional natural resource management targets is further complicated by the Standard, targets and catchment actions plans not being in place when the water sharing plans were developed.

As a result, the NRC conducted a qualitative review informed publicly available evidence from:

- **public submissions** – more than 170 public submissions were jointly gathered by the NRC and Office of Water to inform their respective reviews. The submissions can be accessed via the NRC's website.<sup>7</sup> **Attachment 2** provides a summary of the issues raised.
- **National Water Commission assessments** – these assessments provide evidence of the extent to which NSW's water sharing plans meet National Water Initiative outcomes.
- **Office of Water progress reports and implementation audits**– the Office of Water has produced progress reports providing updates on ecological and socio-economic performance monitoring, and audits of the implementation of plan provisions.
- **NRC assessments of upgraded catchment action plans** – the NRC has assessed the extent of alignment between catchment action planning and water sharing planning.
- **the Sustainable Rivers Audit** – this is a monitoring program assessing river health indicators in the Murray-Darling Basin.

The Office of Water is currently evaluating the appropriateness, efficiency and effectiveness of the 31 plans under review. The results of these evaluations were not available to inform the NRC's review; however, the NRC considers these results should be made publicly available as soon as possible, to inform any potential community engagement on changes to the plans.

In addition, the public submission process identified a range of water planning issues that lie outside the scope of the NRC's review, but which should be investigated if the water sharing plans are to be replaced. The Office of Water has access to these public submissions.

Submissions that raised issues unrelated to water planning – such as issues around specific water licences, or concerns about pollution of water sources or possible illegal activity – will be addressed by the Office of Water or have been forwarded to the relevant agency.

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<sup>6</sup> NRC (2013), *Issues Paper – reviewing water sharing plans*, Sydney.

<sup>7</sup> <http://nrc.nsw.gov.au/Workwedo/WaterSharingPlanReviews.aspx>.

## 4 Review findings

### 4.1 Extent of contribution to state-wide targets

The knowledge base for the 31 water sharing plans under review has improved since they were developed in 2004. However, the NRC's capacity to assess whether the plans are achieving their objectives or making a material contribution towards the state-wide targets was limited by the monitoring, evaluation and reporting information available during the assessment period. National Water Commission reports also indicated that a lack of information about outcomes would likely be an issue when assessing older plans in most jurisdictions, including NSW.<sup>8</sup>

There are various reasons for this lack of information, including:

- **monitoring, evaluation and reporting framework of the 2004 plans** – the National Water Commission and Office of Water have both indicated that the original plan objectives were unspecific and hard to measure and that data collected may not be fit for purpose.
- **extent of alignment with other planning processes** – the Standard, state-wide targets and catchment action plans were not in place in 2004, meaning objectives within the 2004 water sharing plans lack clear alignment with applicable state and regional objectives.
- **impact of externalities** – based on early draft Office of Water evaluations, it appears external factors such as climate, thermal pollution, catchment and land use activities are hindering the measurement of plan-related environmental outcomes within the 10 year plan timeframe. There is also a lack of data on possible social and cultural externalities.
- **plan suspension** – five of the seven regulated river plans and two unregulated river plans were suspended due to drought, some for multiple years. During these times, critical water needs are a priority for water managers and the intended plan provisions are not always implemented, which affects the likelihood of achieving the plan outcomes.
- **limited data collection** – a lack of metering has prevented the measurement of water extraction in coastal aquifers and unregulated river systems, while a lack of water use development data has prevented assessment against long-term average annual extraction limits for regulated river water sources.
- **institutional change** – some elements of NSW's monitoring, evaluation and reporting framework for water management, such as the *State Water Management Outcomes Plan* and *Integrated Monitoring of Environmental Flows* program, ceased or experienced funding cuts.
- **limited knowledge base** – when the plans were developed in 2004 there was limited understanding of the environmental watering requirements of most systems (with some exceptions, such as the Macquarie and Gwydir). This knowledge is improving over time.

To meet its statutory obligation, the NRC reviewed the first round of catchment action plans to identify goals, objectives and targets towards which the 2004 water sharing plans may have contributed. The NRC also reviewed publicly available information on plan implementation and outcomes to determine the plans' potential or likely contribution to regional targets.<sup>9</sup>

The regional summaries in **Attachment 3** summarise this analysis for the water sharing plans under review, grouped by catchment management area in NSW.

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<sup>8</sup> National Water Commission (2011), *National water planning report card 2011*, Canberra.

<sup>9</sup> <http://www.water.nsw.gov.au/Water-management/Water-sharing-plans/Auditing-and-reporting/auditing-and-reporting>.

Overall, while it was not possible to assess the extent of the plans' contribution to the state-wide targets using the available information, it is reasonable to assume the 2004 water sharing plans are contributing to the achievement of the state-wide targets in terms of:

- **clarity of water entitlements** – by including water allocations, extraction limits, account management, carryover arrangements and supplementary and uncontrolled flow access, to support more sustainable extraction and allow licence holders to plan their water use
- **planned environmental water provisions** – by setting water aside for the environment and ensuring flows are moving back towards a more natural hydrograph, including through rules that protect high and low flows to maintain seasonal flow variation
- **provisions supporting trade of water** – which allow greater flexibility where appropriate, and more optimal use of water to help achieve better social and economic outcomes
- **greater recognition of the Aboriginal cultural values of water** – via rules that support identified cultural values, and by providing for water licences for Aboriginal cultural purposes (all plans) and Aboriginal community development (where feasible).

For example, the plans are contributing to the state-wide targets through:

- **environmental contingency allowances** – providing environmental water releases for targeted outcomes, such as waterbird breeding in the Ramsar-listed Gwydir Wetlands
- **tradeable and secure allocations** – National Water Commission analysis of socio-economic benefits in the southern Murray-Darling Basin shows that water trading allows irrigators to manage risk, cash flow and debt; supports forward business planning; and helps facilitate business growth and development<sup>10</sup>
- **supporting cultural access** – the water sharing plan for the Murrumbidgee Regulated River water source provides up to 2,150 megalitres of high-security water for Aboriginal cultural purposes in the Murrumbidgee valley.

The NRC's analysis also indicates some potential shortcomings that may be hampering the ability of the plans to effectively contribute to state-wide targets, including instances where:

- **some plans have overly restrictive or complicated environmental water storage and use rules** – for example, the Macquarie and Cudgegong Regulated Rivers plan restricts how water from the environmental water allowance can be used.
- **there is limited monitoring and compliance** – lack of metering is an issue in unregulated river and groundwater sources, preventing the implementation of – and compliance with – daily flow-sharing provisions.
- **some plans have restrictive trade provisions, or introduced barriers to trade** – the Murrumbidgee Regulated River plan includes cut-off dates for temporary water trade that have impacted water users. In other instances, plan suspensions, trading bans or embargoes, and modification to trade rules are likely to have disrupted confidence in the plans and undermined some of the benefits being derived from the Basin water markets.
- **plans were unable to deal with extreme climatic circumstances** – in many areas, drought has resulted in plan suspension and alternative rules being put in place – for example, providing greater access to low flows in unregulated rivers and changes to some planned environmental water rules in regulated rivers.

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<sup>10</sup> National Water Commission (2009), *Australian Water Reform 2009: Second biennial assessment of progress in implementation of the National Water Initiative*, Canberra.

## 4.2 Compliance with the Standard

Complementing the assessment of the plans' contribution to the state-wide targets, the NRC has drawn on the evidence outlined in **Section 3.3** to assess how well the plans meet the components of the Standard (see **Table 3**). In doing so, the NRC assessed the processes used to develop and implement the plans. The assessment findings apply generally to all 31 plans.

The assessment found that the current water sharing plans improve on the water management arrangements in place prior to 2004. However, it is likely that the plans' ability to contribute to the state-wide targets may be hampered by:

- non-specific plan objectives and performance indicators that are not clearly linked to evaluation questions
- limited monitoring, evaluation and reporting, especially in unregulated river and groundwater systems
- lack of transparency around risks and trade-offs within the plan, and the evidence and assumptions that underpin these decisions, which may mean stakeholders are not aware of the purpose or value of some plan provisions
- insufficient transparency and robustness around how the plans deal with extreme climatic circumstances or unprecedented events, in particular relating to the critical water planning arrangements put in place when a plan is suspended
- limited integration of unregulated river and groundwater plans in some areas
- variable alignment with catchment action planning.

NSW has made significant progress in water planning since the 2004 plans were developed.<sup>11</sup> For unregulated river and groundwater sources, the Office of Water's macro planning process addresses some of the issues in **Table 3**; in particular, around prioritisation according to risk, documentation of evidence and integrated management of surface and ground water sources.

**Table 3: Summary of the 2004 water sharing plans' compliance with the components of the Standard**

Component	Comments on the 2004 water sharing plans' compliance with the Standard
<b>Collection and use of knowledge</b>	<ul style="list-style-type: none"> <li>▪ The 2004 water sharing plans were based on hydrological, socioeconomic and environmental assessments, although there was limited information about some surface and groundwater systems at that time.</li> </ul>
<b>Determination of scale</b>	<ul style="list-style-type: none"> <li>▪ Management of ground and surface water should be integrated where possible.</li> <li>▪ Some public submissions identified a possible need for greater state-scale policy direction (such as a revised <i>State Water Management Outcomes Plan</i>, or otherwise).</li> </ul>
<b>Community engagement</b>	<ul style="list-style-type: none"> <li>▪ Local River Management Committees made recommendations to the then Minister to assist in the development of the draft plans. This generally meant there was good community involvement in preparing the plans, although some submissions indicated a lack of transparency about final Ministerial decisions.</li> <li>▪ There was ongoing engagement with key stakeholders through Environmental Water Advisory Groups, and in regulated river systems through State Water Customer Service Committees.</li> </ul>

<sup>11</sup> National Water Commission (2011), op. cit.

Component	Comments on the 2004 water sharing plans' compliance with the Standard
<b>Opportunities for collaboration</b>	<ul style="list-style-type: none"> <li>▪ Collaboration between the Office of Water and CMAs was variable, but has been improved through the catchment action plan upgrade process and use of shared spatial information to identify river health priorities (see <b>Section 4.3</b>).</li> <li>▪ There is also collaboration across government and with landholders via Environmental Water Advisory Groups, and with licence holders on ongoing operational matters, for example through State Water Customer Service Committees (for regulated rivers).</li> </ul>
<b>Risk management</b>	<ul style="list-style-type: none"> <li>▪ The 2004 plans improve on the previous arrangements, by setting rules and extraction limits in an attempt to mitigate the risks of unsustainable extraction, and by prioritising plans that apply to higher-risk water sources (for example, regulated rivers). However, there is no supporting documentation to show how risk – for example, the risks associated with allocating water for different uses within a plan – is considered and addressed in decision-making processes.</li> <li>▪ Daily flow sharing was supposed to be implemented in most unregulated rivers, starting in high priority areas with high community dependence and high risk to dependent ecosystems, but has not yet commenced in any rivers.</li> <li>▪ Extreme climatic conditions led to some water sharing plans being suspended, including in five of the seven regulated rivers. This raised issues around the transparency and robustness of critical water planning arrangements put in place while the plans were suspended. The Act has now been amended to allow for suspension of parts of the plans, if required, rather than only providing for suspension of the whole plan.</li> <li>▪ In 2007, implementation priorities in the unregulated rivers underwent a macro planning risk assessment, identifying where plan rules may need to change.</li> </ul>
<b>Monitoring and evaluation</b>	<ul style="list-style-type: none"> <li>▪ While the National Water Commission and Office of Water have produced water planning report cards (plan quality) and implementation audits, respectively, some submissions criticised the lack of public reporting on plan outcomes.</li> <li>▪ Plan objectives are often broad and non-specific and performance indicators are not clearly linked to evaluation questions. Assessing against these objectives and indicators would require considerable effort. New plan objectives, performance indicators and monitoring, evaluation and reporting frameworks are required.</li> <li>▪ There is also a lack of coordination across monitoring programs, issues regarding a lack of gauging (particularly in unregulated river systems), and absent or anecdotal compliance monitoring, all of which makes it difficult to assess how effectively plans have been implemented or their outcomes achieved.</li> </ul>
<b>Information management</b>	<ul style="list-style-type: none"> <li>▪ The plans, a plain English guide to each plan and audit and progress reports are available on the Office of Water website. However, there is limited documentation of the 2004 plan development process that was undertaken by River Management Committees. For example, there is little information about the evidence that informed decision-making and how the Committees considered and addressed risks and trade-offs associated with the plans.</li> <li>▪ Some submissions criticised the lack of available information on plan outcomes, or identified that the timing of supplementary water access information affected their ability to plan effectively and access water.</li> <li>▪ Critical water planning communiqués (produced at least monthly, often more frequently when plans were suspended) gave information during critical water planning.</li> </ul>

### 4.3 Alignment with upgraded catchment action plans

The NRC's review has considered how water sharing plans and upgraded catchment action plans can be better aligned to promote landscape health, productivity and resilience.

As explained in **Section 2.3**, these plans should be aligned to maximise efficiency and return on the investment of public funds, while still recognising their different roles:

- **water sharing plans** – manage water in the landscape and deal with competing demands
- **catchment action plans** – identify water-dependent values in the landscape and assign management priorities for maintaining and improving these values.

As part of the recent catchment action plan upgrades, CMAs were expected to improve the alignment between catchment action plans and a range of relevant state-wide plans and policies, including water sharing plans.<sup>12</sup>

The NRC has assessed the upgraded catchment action plans for all 11 CMA regions.<sup>13</sup> The Minister has currently approved seven of the upgraded catchment action plans, and will decide whether to approve the four remaining upgraded plans by 30 June 2014.<sup>14</sup>

Overall, the NRC's assessments found that CMAs and the Office of Water have made progress in aligning water and catchment planning, in particular by using shared data to align river health priorities within the upgraded catchment action plans and water sharing plans.

To inform the upgrades, the Office of Water provided CMAs with River Condition Index data as a platform for identifying shared priorities for improving river health.<sup>15</sup> The River Condition Index was originally developed by the Office of Water as part of a pilot project focusing on aligning catchment and water planning in the Hunter valley.<sup>16</sup> The index is based on a number of different data sources, and can incorporate additional data supplied by CMAs.

The extent to which the Office of Water's shared priority data has been used to inform the catchment action plan upgrades can be summarised as follows:

- Three CMAs (Hawkesbury-Nepean, Hunter-Central Rivers and Western CMAs) used the full suite of River Condition Index indices to identify river health priorities.
- Six CMAs (Border Rivers-Gwydir, Central West, Lachlan, Namoi, Northern Rivers and Southern Rivers CMAs) used selected River Condition Index indices (including River Styles® indices for geomorphic condition) to identify priority river reaches. This led to some differences between the Office of Water and catchment action plans' water planning priorities, which will be addressed as the catchment action plans are implemented.
- Two CMAs (Murray and Murrumbidgee CMAs) deferred use of the River Condition Index until they implement the upgraded catchment action plans, at which point the Office of Water's spatial products can be used to inform investment planning.

<sup>12</sup> NRC (2012), *Framework for assessing and recommending upgraded Catchment Action Plans*, Sydney.

<sup>13</sup> <http://nrc.nsw.gov.au/Workwedo/Catchmentactionplanreviews.aspx>.

<sup>14</sup> The Minister has approved the Border Rivers-Gwydir, Central West, Hunter-Central Rivers, Murrumbidgee, Namoi, Northern Rivers and Southern Rivers upgraded catchment action plans. The Minister is yet to approve the Hawkesbury-Nepean, Lachlan, Murray and Western upgraded catchment action plans.

<sup>15</sup> Healey, M., Raine, A., Parsons, L., and Cook, N. (2012), *River Condition Index in New South Wales: Method development and application*, NSW Office of Water, Sydney.

<sup>16</sup> Hamstead, M. (2010), op cit.



- The Murray CMA adopted its own approach to identifying strategic priorities for aquatic systems by mapping important assets identified by the community, priorities for Commonwealth environmental watering and information from NSW Fisheries.
- Some CMAs used additional spatial products to support their analysis, for example:
  - Namoi CMA combined the River Condition Index with Office of Water priority mapping for floodplain function to identify priorities for river and floodplain health
  - Western CMA used mapping of fish biodiversity, threatened fish observations and community priorities to support its analysis of river and wetland priorities.

The variable uptake of the Office of Water's shared spatial information was due to:

- limitations in the CMA areas or valleys covered by the different indices comprising the River Condition Index, for example if layers were only available for part of a CMA area
- scale issues associated with the index – the index can only be applied to fourth-order streams or greater
- limited access to appropriate benchmark data, such as riparian vegetation condition data
- concerns regarding a lack of field assessment and data validation, and about mapping errors and inconsistencies.

More information about the CMAs' use of the Office of Water's shared priority data is detailed in the regional summaries in **Attachment 3**.

Looking forward, the Office of Water intends to continue working with CMAs to:

- improve the shared spatial information on river health priorities, including collaborating to address current impediments to the CMAs' use of this information
- maintain collaborative relationships in implementing the catchment action plans and replacing the water sharing plans if this occurs
- ensure shared data is used in the potential replacement of water sharing plans and to develop more detailed implementation priorities and specific projects under the catchment action plans
- help ensure the NSW Government's various regulatory frameworks, investments and interventions in water and catchment management complement each other.

Spatial tools such as the Office of Environment and Heritage's Land Management Database also provide a powerful means of assessing alignment of actions and objectives in the future. Catchment Management Authorities use this database to spatially record and attribute investment in on-ground and capacity-building natural resource management activities. This tool can be used to track where interventions are occurring in relation to shared priority areas identified within the catchment action plans and water sharing plans.

It is also expected that the upgraded catchment action plans may undergo further adaptation following the transition of CMAs into Local Land Service organisations on 1 January 2014. The Local Land Services organisation should focus on further improving alignment between water sharing plans and future local strategic plans over time, capitalising on relationships built during the catchment action plan upgrade process.

## 4.4 Murray-Darling Basin Plan considerations

### 4.4.1 Extension or replacement

The Murray-Darling Basin Plan is an important factor influencing the NRC's advice on whether changes to water sharing plan provisions are warranted.

The Basin Plan, if implemented in NSW, effectively requires NSW water sharing plans within the Basin to meet the requirements of water resource plans by 2019, including sustainable diversion limits. The Murray-Darling Basin Authority is currently working with state governments to develop guidance on Water Resource Plan requirements and how to achieve the sustainable diversion limits. The Murray-Darling Basin Authority has indicated that these future requirements should not impede necessary improvements in state water planning.

The NRC is concerned about the potential for duplication of planning processes in the Basin areas. For example, if the Minister decides to replace the water sharing plans in 2014, there is a risk that a second planning process may be necessary before 2019 to meet any additional water resource plan requirements. As a result, key considerations when deciding whether to extend or replace the plans in the Basin are timing, and whether there are enough benefits to potentially warrant replacing the plans twice in the space of five years (between 2014 and 2019).

Given the amount of institutional change, uncertainty and 'reform fatigue' in the Basin, there was support within some public submissions for extending the existing plans and addressing any identified issues within the plans during the transition to water resource plans before 2019.

The NRC also supports this option, as it promotes the most efficient use of government and community resources. However, the NRC notes that Basin Plan trading requirements will come into effect by 1 July 2014. Water sharing plans within the Basin that include trading provisions that may not meet Basin Plan requirements (such as the Murrumbidgee Regulated River Water Source plan) may need to be replaced or amended by this deadline.

If plans in the Basin are extended pending the development of water resource plans, the Office of Water should, wherever possible, seek to make the improvements listed in **Chapter 5** that may not require plan replacement. In particular, a better monitoring and evaluation framework should be put in place to inform plan replacements in the transition to water resource plans.

### 4.4.2 Legislative impacts

Regardless of whether the plans are extended or replaced in the Basin, current legislation may need to be amended, as it currently requires plans to be implemented or extended for 10-year periods. If the Basin Plan is implemented, the legislation may need to be amended to allow water sharing plans to transition to water resource plans prior to 2019.

### 4.4.3 Consideration of best available information

The Basin Plan, by identifying new sustainable diversion limits, has also generated new evidence about the optimal water balance within some Basin catchments. To avoid duplicating the work of the Murray-Darling Basin Authority, the NRC did not comprehensively review the findings and requirements within the Basin Plan. However, where the current water sharing arrangements do not meet the sustainable diversion limit requirements, a review of plan provisions taking into account new science from the Basin Plan should be undertaken as part of water sharing plan replacement processes in the Basin.

## 5 Opportunities for improvement

The NRC assessed the requirements of the Standard in the context of water sharing planning, and in the context of wider NSW Government policies and priorities, including *NSW 2021*.<sup>17</sup> This analysis identified three guiding principles for the review, namely:

- **better regional outcomes** – managing water in the context of the wider landscape, recognising that water sharing plans contribute to broader social, economic, cultural and environmental outcomes in the region
- **integrated and efficient governance** – making the best use of existing institutions and legislation to maximise return on investment, minimise duplication and help make progress towards shared regional priorities
- **evidence-based decision making** – using best available knowledge to inform and improve how water is managed.

This chapter provides tables outlining the opportunities for improvement against these principles, informed by the NRC’s review findings presented in detail in **Chapter 4**.

In some cases, achieving these improvements will require replacing the current plan. However, in many instances these outcomes could be improved without changing the water sharing plan provisions, by focusing on areas such as better collaboration and more targeted monitoring and evaluation.

### 5.1 Better regional outcomes

Table 4: Opportunities for better regional outcomes

Better regional outcomes	
Improvements that may not require replacing the 2004 water sharing plans	
<b>1</b>	<b>Encourage collaboration</b> – CMAs and the Office of Water should work together to coordinate water planning and management with the implementation of upgraded catchment action plans.
<b>2</b>	<b>Understand impacts of changing resource use</b> – investigate regional issues raised in submissions regarding the impact of changing land use, the sustainability of local industries and the increased use of environmental water. For instance, some submissions raised concerns about: <ul style="list-style-type: none"> <li>▪ potential impacts to groundwater and/or stream base flows due to over-allocation and new consumptive industries</li> <li>▪ water trading possibly leading to increased water use by newer industries, which may then impact the amount of water available for agricultural production</li> <li>▪ the impact of environmental flows on private property in the floodplain.</li> </ul>

<sup>17</sup> NSW Government (2011), op. cit.

## Better regional outcomes

### Improvements that may require replacing the 2004 water sharing plans

- 3 **Strengthen alignment** – continue to align water sharing planning with natural resource and land use planning, for instance by:
  - using the replacement of water sharing plans and the development or adaptation of regional plans under Local Land Services as opportunities to strengthen alignment between the plans
  - aligning any replacement plans in the Lower Hunter with the Lower Hunter Water Plan that is being developed to set the strategic direction for the region’s urban water planning.
- 4 **Improve Aboriginal cultural outcomes** - include provisions for Aboriginal community development water access licences in line with current policy guidelines, and continue to facilitate Aboriginal engagement in water planning by identifying and supporting cultural water requirements.
- 5 **Address local issues** – the Office of Water should investigate local issues raised in submissions. For example, more than 70 submissions indicated that the community was concerned about the current classification of Lake Cargelligo as a man-made water storage, and that the current water sharing plan provisions do not protect the social, cultural, environmental and economic benefits of the lake.
- 6 **Recognise connections within the landscape** – National Water Initiative guidelines recommend assuming that ground and surface water sources are connected, unless it can be otherwise established.<sup>18</sup> The Office of Water should consider merging the unregulated river and groundwater plans established in 2004 into the relevant macro plans where appropriate, to improve the integrated management of ground and surface water sources. The National Water Commission has developed a framework to help water planners manage connected water sources.<sup>19</sup>
- 7 **Improve the capacity for water sharing plans to deal with extreme or unprecedented events** - as much as possible, water sharing plans should protect the integrity of issued allocations even in extreme dry events, and should clearly define the circumstances under which normal access to issued allocations may be restricted. The Act amendments allowing suspension of only parts of the plan should help address this issue.
- 8 **Adopt best practice for considering risks** – for unregulated river and groundwater plans the consideration of risk can be improved by merging the plans into macro plans where appropriate. Regulated rivers may not be merged in macro plans, but should still demonstrate more clearly how risks are considered, prioritised and addressed within the plan and planning process. This may include undertaking risk assessments and identifying a range of future water use and availability scenarios during situational analysis and when assessing and deciding strategies and rules (as per the National Water Initiative Guidelines).<sup>20</sup>

There should be a focus on risks to the integrity of water entitlements, allocations and other rights, such as specified environmental water provisions. The risk assessment should help identify alternative arrangements that could be applied during critical water planning, and clarify the limitations of water management in meeting water needs so stakeholders can identify the extent that they need to manage their own risks beyond the scope of the water sharing plan.

Risks identified within the plans should be linked to the plans’ monitoring, evaluation and reporting framework. Monitoring should be put in place that gives clarity about the outcomes of management decisions that are identified as potentially leading to greater risks.

<sup>18</sup> National Water Commission (2010a), *National Water Initiative Policy Guidelines for Water Planning and Management 2010*, Canberra.

<sup>19</sup> National Water Commission (2010b), *National framework for integrated management of connected groundwater and surface water systems*, Canberra.

<sup>20</sup> National Water Commission (2010a), op. cit.

## 5.2 Integrated and efficient governance

Table 5: Opportunities for integrated and efficient governance

Integrated and efficient governance	
Improvements that may not require replacing the 2004 water sharing plans	
1	<p><b>Address operational issues</b> – investigate issues identified in submissions that would improve regional outcomes and may be addressed without amending the 2004 water sharing plans. These may include:</p> <ul style="list-style-type: none"><li>▪ codifying established water management practices, capacity constraints and channel capacity sharing arrangements</li><li>▪ improving supplementary water access procedures (including timing of announcements)</li><li>▪ delivering water from dams and weirs in a way that minimises downstream impacts, or allows for more natural delivery of replenishment flows.</li></ul>
2	<p><b>Increase transparency around the plans</b> – stakeholder engagement on water sharing issues could be improved by providing better publicly-accessible documentation of:</p> <ul style="list-style-type: none"><li>▪ the decision making process – including any trade-offs made and risks considered, and the justification for the position selected. Due to the period of time elapsed since the 2004 water sharing plans were developed, this information may not be available for the current plans, but should be documented in subsequent planning processes</li><li>▪ the scientific assessments and modelling used in developing the plan, and of the scientific knowledge or assumptions underpinning identified causal relationships</li><li>▪ prioritised knowledge gaps, with a view to addressing them through the relevant plan’s monitoring and evaluation framework</li><li>▪ issues raised during consultation, and the Government’s responses to these issues</li><li>▪ the plan’s logic diagrams, performance indicators, evaluation criteria and monitoring strategies</li><li>▪ implementation tasks, timelines and responsibilities</li><li>▪ monitoring and evaluation outputs, including timely periodic reports on plan implementation and outcomes.</li></ul>
3	<p><b>Improve transparency when plans are suspended</b> – there is insufficient transparency and robustness in critical water planning arrangements. As identified in the Office of Water’s audit report for the 2004 water sharing plans:</p> <ul style="list-style-type: none"><li>▪ the decision making processes used under critical water planning arrangements should be better articulated at the commencement of this process</li><li>▪ appropriate consultation should occur prior to decisions being made</li><li>▪ the rationale for any new water management arrangements should be documented.<sup>21</sup></li></ul>

<sup>21</sup> NSW Office of Water (2012), *Report to Minister on audit of water sharing plans which commenced on 1 July 2004*, Sydney.

## Integrated and efficient governance

### Improvements that may require replacing the 2004 water sharing plans

- 4 **Minimise plan constraints** – by investigating opportunities to minimise restrictions on:
  - the ability of environmental water managers to make the best use of environmental contingency allowances and environmental water licences, by reviewing provisions around storage and timing of environmental water releases
  - the ability of licence holders to optimise economic outcomes, by reviewing trading limitations and carry-over provisions for seasonal allocations.
- 5 **Support meaningful community engagement** – by ensuring that:
  - key collaborative partners and community stakeholders are involved in developing the replacement plans, including having an opportunity to understand and contribute to the selection of objectives and provisions, rather than just being presented with a draft of the final report
  - the methods and intensity of engagement reflect the overall risk associated with the water sharing plans
  - an appropriate level of engagement is maintained when implementing the plans, particularly during periods of high water stress.

## 5.3 Evidence-based decision making

Table 6: Opportunities for improving evidence-based decision making

### Evidence-based decision making

#### Improvements that may not require replacing the 2004 water sharing plans

- 1 **Focus monitoring and analysis on critical knowledge needs** - the Office of Water should continue to prioritise its work towards improving water sharing plan monitoring and evaluation frameworks. This should include:
  - identifying key policy and evaluation questions and using these to drive targeted monitoring and evaluation programs, as recommended in the NRC's review of NSW resource condition monitoring, evaluation and reporting<sup>22</sup>
  - defining and clearly distinguishing broader collaborative outcomes compared to the more specific outcomes that facilitate them (for example, economic production is a broader outcome, facilitating water trade is a more specific outcome)
  - identifying performance indicators that can be measured over the life of the water sharing plan
  - developing workable monitoring programs to measure performance indicators. Where necessary, this may also include measuring indicators that trigger identified risk responses.

These improved frameworks may nest within current monitoring and evaluation frameworks, to clarify the objectives and performance indicators set out in the 2004 water sharing plans. These frameworks should also be made publicly accessible.
- 2 **Deliver timely and relevant information** – develop evaluation reports that are designed to provide useful, easily understood information for decision makers and the public, and make them available to the public in a timely manner.

<sup>22</sup> NRC (2012), *Review of NSW resource condition monitoring, evaluation and reporting – Final report*, Sydney.

### Evidence-based decision making

- 3 **Share information** – the Office of Water and CMAs should continue to develop and use shared spatial information on river health priorities. They should also investigate other opportunities to collaborate with agencies and organisations across local, state and national scales to streamline data collection for performance monitoring and evaluation.
- 4 **Continue to improve modelling capacity** – ensure system models follow best practice and allow for testing of the integrity of allocation arrangements under a range of future water availability and use scenarios, particularly in regulated rivers.

### Improvements that may require replacing the 2004 water sharing plans

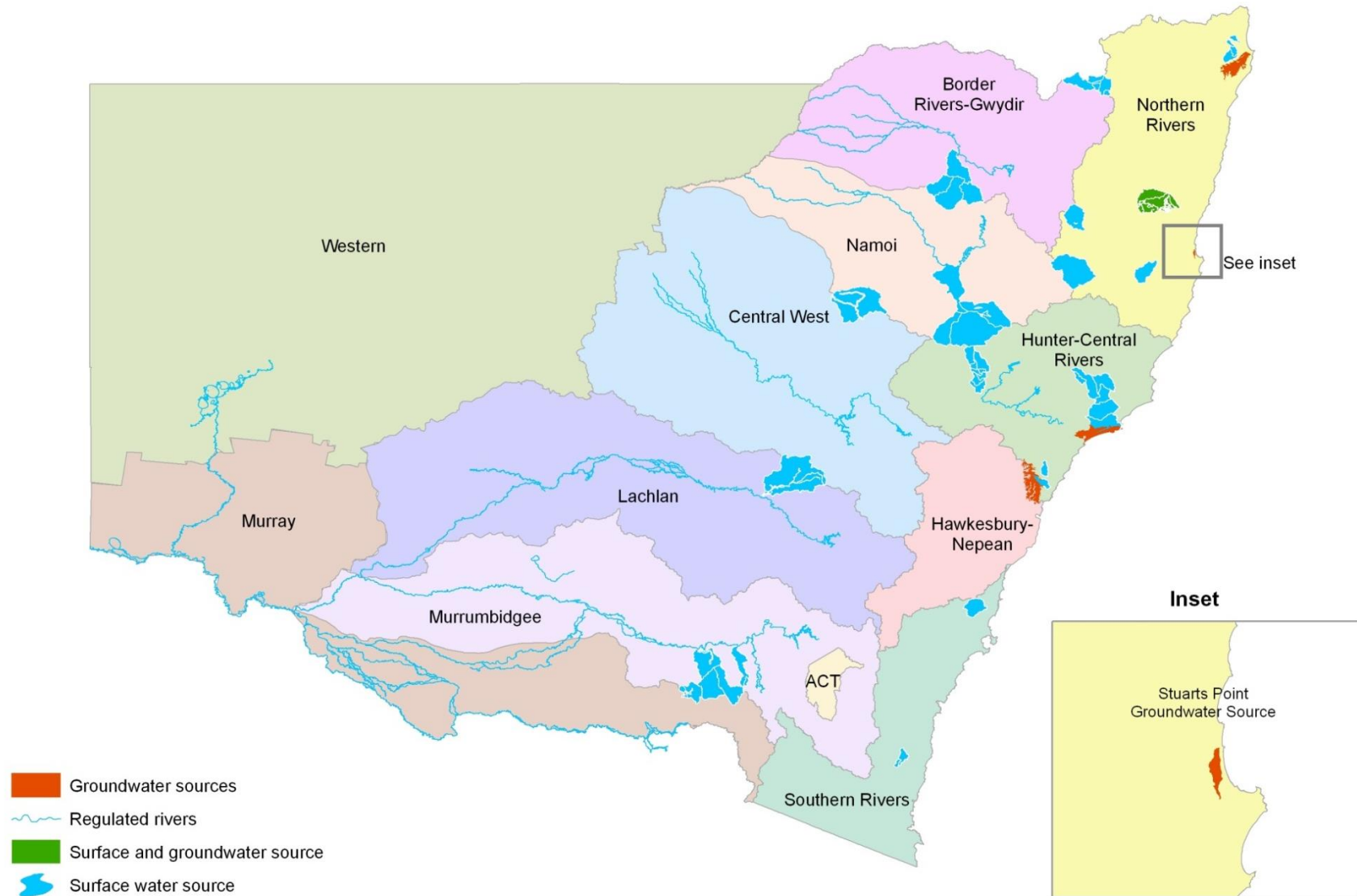
- 5 **Incorporate new knowledge** – plan provisions should be reviewed in light of new knowledge being generated via the Aboriginal Water Initiative, research results, cease-to-pump field verifications and updated threatened species listings.  
This review of water sharing plan provisions should also take into account new science from the Murray-Darling Basin Plan, including the evidence supporting sustainable diversion limits.
- 6 **Consider resourcing requirements** – plans should not be put in place without ensuring there are adequate resources to properly implement them and support effective, fit-for-purpose monitoring, evaluation and reporting. To ensure efficient use of resources, the water sharing plans should be allocated strategically, for example, to areas under the highest stress or with the most development.
- 7 **Ensure monitoring, evaluation and reporting frameworks are adaptable** – this may involve moving detailed information about the monitoring, evaluation and reporting framework out of the relevant water sharing plan and nesting these details within a separate plan or regulation so it may be more easily adapted and improved over time.

## Attachment 1 – Water sharing plans due to expire in 2014

### List of water sharing plans due to expire in 2014

CMA region	Water sharing plans due to expire in 2014
Border Rivers-Gwydir	Gwydir Regulated River Water Source Rocky Creek, Cobbadah, Upper Horton and Lower Horton Water Sources Tenterfield Creek Water Source
Central West	Castlereagh River above Binnaway Water Source Macquarie and Cudgegong Regulated Rivers Water Source
Hunter-Central Rivers	Hunter Regulated River Water Source Jilliby Jilliby Creek Water Source Karuah River Water Source Ourimbah Creek Water Source Tomago Tomaree Stockton Groundwater Sources Wybong Creek Water Source
Hawkesbury-Nepean	Kulnura Mangrove Mountain Groundwater Sources
Lachlan	Lachlan Regulated River Water Source Mandagery Creek Water Source
Murrumbidgee	Adelong Creek Water Source Murrumbidgee Regulated River Water Source Tarcutta Creek Water Source
Murray	New South Wales Murray and Lower Darling Regulated Rivers Water Sources Upper Billabong Water Source
Namoi	Phillips Creek, Mooki River, Quirindi Creek and Warrah Creek Water Sources Upper Namoi and Lower Namoi Regulated River Water Sources
Northern Rivers	Alstonville Plateau Groundwater Sources Apsley River Water Source Commissioners Waters Water Source Coopers Creek Water Source Dorrigo Plateau Surface Water Source and Dorrigo Basalt Groundwater Source Stuarts Point Groundwater Source Toorumbec Creek Water Source Upper Brunswick River Water Source
Southern Rivers	Kangaroo River Water Source Wandella Creek Water Source





**Map of water sharing plans due to expire in 2014**

## Attachment 2 – Summary of public submissions

The Natural Resources Commission (NRC) and the NSW Office of Water invited submissions to inform their respective water sharing plan reviews. Over 170 submissions were received, and can now be accessed via the NRC's website:

<http://nrc.nsw.gov.au/Workwedo/WaterSharingPlanReviews.aspx>

Just over half the responses came from community members or local landholders, with the next largest group of respondents being irrigator and commercial stakeholders. Some submissions focused on providing feedback on state or regional matters, whereas others identified one or more plan-specific issues relating to 20 of the 31 water sharing plan areas under review.

The submissions identify a wide range of issues across local, regional and state scales. The following summary aims to provide an overview of the kinds of issues raised in the submissions, but it is not exhaustive. For more detailed information on issues relevant to a specific water sharing plan area, or the state-wide issues raised, visit the NRC website to view the submissions in full.

In summary, submissions raised the following issues.

- **Plan extension** – some submissions called for the current plans to be extended as:
  - **the plans are achieving their intended social, economic, cultural and environmental outcomes** – for instance by providing secure or well defined tradeable entitlements and making broad contributions to improved environmental outcomes
  - **more time is needed to determine plan outcomes** – more work needs to be done in setting and evaluating plan objectives, particularly where plans have been suspended
  - **there are uncertainties around the Murray-Darling Basin Plan** – submissions, particularly from irrigator groups, indicate there has been a great deal of water planning uncertainty in the Murray-Darling Basin already, and that it may be prudent to extend plans until they can be transitioned to meet Basin Plan requirements rather than risk multiple plan replacement processes over a relatively short period of time.
- **Changes to plan provisions** – for example, some submissions suggested changes to:
  - **rules governing extraction** – including daily flow sharing, cease to pump rules, trading rules, carryover and water allocation account rules and access to supplementary water
  - **environmental water management** – including simplified and flexible specification of environmental contingency allowances, delivery of ordered water so as to mimic natural variability, revisions to end-of-system flow rules and dam minimum release rules, and protection of environmental water as it passes down rivers
  - **Aboriginal cultural access** – improving how Aboriginal cultural needs are addressed
  - **reflect new information since 2004** – including updated river modelling.

- **Changes to plan implementation** – for example, some submissions suggested changes to:
  - **communication and available information** – including timely announcement of supplementary water access, publishing progress towards trigger points for trading rules and water account limits so that licence holders are able to plan accordingly, and compiling a register of buyers and sellers to assist trading in smaller systems
  - **monitoring arrangements** – some submissions called for groundwater monitoring by telemetry to assist in implementation of plan rules, although others opposed installation of meters in unregulated rivers because of cost and water pressure impacts
  - **implementation of some plan provisions** – for example, extraction rights for priority water users in the Pian-Gunidgera system
  - **environmental watering** – in particular, to consider the impact of environmental watering events on floodplain farms.
- **Issues with current water access and sharing arrangements** – for example, some submissions discussed:
  - **tradeoffs and access for different user groups** – for example, businesses in towns compared to those outside town, priority access for specific water users (such as town water or critical industries), diversion of water from inland rivers towards the east or where water requirements to meet a town's water needs could be replaced with more efficient alternatives
  - **rule consistency** – calls for consistent rules for upstream and downstream water users, across different zones in a water source or between adjoining rivers, and for environmental contingency allowances to be treated the same as water licences
  - **distribution of flow** – for example, provision of replenishment flows to effluents and anabranches of regulated rivers
  - **water reductions** – calls for surface and groundwater users within a region to be subject to similar water reductions and compensation arrangements
  - **access to new licences** – for example, questions around why new stock and domestic licences are being issued while issuing new licences for other purposes is not allowed
  - **recognition of non-consumptive water use** – requests for the ability to receive allocation credits for water returned to rivers.
- **Water to support local values** – for instance, some submissions raised concerns over:
  - **community amenity** – a number of submissions indicated that the classification of Lake Cargelligo as man-made should be changed, and that the Lake should be given a water allocation to reflect its social, cultural, environmental and economic benefits
  - **sustainability of local industries** – groundwater and/or stream base flows in specified areas potentially being impacted through over-allocation and new consumptive industries
  - **land use change** – water trading possibly leading to increased water use by newer industries, which may impact on the water available for agricultural production.
- **Adaptability in extreme climatic events** – some submissions emphasised the need to avoid plan suspensions and make plans better able to cope with periods of extreme drought, particularly in relation to critical water supply.

- **Governance arrangements** – submissions discussed the following:
  - **advisory groups** – there is support for Environmental Contingency Allowance Advisory Committees and Environmental Flows Reference Groups, but calls for broader community representation on those committees
  - **clearer governance arrangements** – stakeholders have reported that governance of water management and catchment management in NSW is complex and not well defined or explained; that roles, responsibilities and coordination arrangements are not understood; and that ongoing change makes this worse.
- **Documentation and access to information** – for example, submissions called for:
  - **accessibility** – plain English versions of water sharing plans
  - **explanation of methods used** – for example, explaining how available water determinations are made
  - **information about how the plans are working** – for instance, information on the current level of water use compared to the sustainable level of water use, how the plan would prevent the sustainable level being exceeded, or, if already exceeded, how the level of water use would be reduced
  - **access to real time information** – real time access to groundwater level and quality information.
- **Plan objectives and monitoring, evaluation and reporting** – submissions commented on:
  - **plan logic and objective setting** – the internal logic and evaluation criteria for water sharing plans could be improved, for instance clear explanations of the linkages between provisions and the expected outcomes
  - **monitoring and assessment** – requests for better means for monitoring and reporting on environmental outcomes, and concern about cuts to government monitoring and assessment programs (Sustainable Rivers Audit and Integrated Monitoring of Environmental Flows (IMEF)) and the adequacy of agency resources to collect meaningful monitoring information
  - **recognition of knowledge gaps** – plans should state prioritised knowledge gaps with a view to their being addressed and funded during plan implementation
  - **accessibility of information** – monitoring and assessment of achievement of environmental, social and economic outcomes, including research done under the IMEF program, should be publicly accessible
  - **state-scale strategic guidance** – calls for the now lapsed State Water Management Outcomes Plan to be remade to provide clear guidance for water plans in relation to objectives and priorities.
- **Opportunities for greater integration** – submissions suggested the following:
  - **merging plans** – rolling unregulated river plans into the broader scale macro plans that surround them, integrating floodplain harvesting into Gwydir and Namoi regulated river plans, and including management of effluents and anabranches of the Lachlan and Macquarie Rivers in the regulated river plans, as they are dependent on the regulated rivers for water
  - **aligning plans** – for example, aligning regulated river and aquifer planning with lower Hunter water supply planning that is currently underway, and reducing areas of overlap between water sharing plans and other water approvals

- **recognising water quality** – greater consideration of water quality in river plans, in particular in relation to salinity offsets and return flows
- **state-scale strategic direction** – calls for development of an overarching strategy for addressing river and catchment health to guide both water and catchment action plans.
- **Feedback on the water sharing plan review and replacement processes** – submissions raised discussion around:
  - **opportunities to input when the water plans are remade** – stakeholders asked for a considered and comprehensive community engagement process in remaking the plans
  - **access to information** – several submissions noted that the community should be given access to information currently being compiled by agencies on the effectiveness of the plans before being asked to comment, rather than have this come out later
  - **non-government stakeholder representation on the interagency panels** – stakeholders requested greater stakeholder input in the panels that will review and endorse revised water plans
- **Feedback on the assessment framework for water sharing plans** – within the submissions there are:
  - concerns that:
    - the NRC’s review against the Standard for Quality Natural Resource Management is about process not results
    - the state-wide natural resource management targets are too general
    - catchment action plan targets are either irrelevant, or too general, and may have an uncertain future due to current Local Land Service re-structuring
  - calls to remake the State Water Management Outcomes Plan, potentially to include targets along the lines of the Murray-Darling Basin Authority’s hydrologic indicators, and use this as a basis for assessing effectiveness of water plans
  - proposals that water plans should be evaluated against criteria derived from the National Water Initiative.
- **Submissions on a range of other water issues** – a number of water management issues that are not managed through water sharing plans were also raised, including:
  - **issues around specific licences** - reports that issues relating to conditions on specific water licences had not been properly addressed and were causing hardship
  - **separation of land and water rights** – concern that the separation of land and water rights was impacting on the ability of some existing land uses such as agriculture to access water
  - **concerns about pollution of water sources** - for example, concern about potential pollution of water sources from identified industries and activities
  - **concerns about possible illegal activity** – a few cases were raised where there was concern that water may be being taken or used unlawfully
  - **changes to fee structure** – replacing fixed annual fees with fees based on volume taken.

## Attachment 3 - Regional summaries

The following regional summaries:

- provide an overview of each catchment management region's water resources, major water users and key water-dependent assets
- outline key issues affecting each region's water resources
- identify which water sharing plans in the region are under review
- describe how water sharing plans may have contributed to natural resource management targets in Catchment Action Plans (CAPs)
- discuss the alignment of catchment and water planning, particularly the effectiveness of the upgraded CAPs in improving alignment with water sharing plans.

## Limitations

A number of factors constrain the NRC's ability to determine the extent of material contribution of water sharing plans to natural resource management outcomes. Please refer to **Section 4.1** of the report for further details.

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## Inland catchments

### Border Rivers-Gwydir

2004 water sharing plans under review (see Figure 1)	
Water sharing plan	Overview
Gwydir Regulated River Water Source	<ul style="list-style-type: none"> <li>The plan area includes regulated reaches of the Gwydir River downstream of Copeton Dam to the junction of the Gwydir River and its effluent streams with the Barwon River.</li> <li>The plan was not suspended during the drought.</li> </ul>
Rocky Creek, Cobbadah, Upper Horton and Lower Horton Water Sources (unregulated)	<ul style="list-style-type: none"> <li>The plan area has four management zones and includes the Horton River and its tributaries to a flow reference point upstream of the junction with the Gwydir River.</li> <li>The Office of Water (formerly the Department of Water and Energy) has assessed this water source as having a medium community dependence on extraction, and low environmental risk.<sup>1</sup></li> <li>The Office of Water is considering merging this plan into the Water Sharing Plan for the NSW Gwydir Unregulated and Alluvial Water Sources.</li> </ul>
Tenterfield Creek Water Source (unregulated)	<ul style="list-style-type: none"> <li>The plan area has five management zones and includes Tenterfield Creek and its tributaries upstream of the Dumaresq River. Water is primarily used for irrigation, and extraction is greatest in summer.<sup>2</sup></li> <li>The plan is an implementation priority for the Office of Water as the water source has a high community dependence on extraction and high environmental risk.</li> <li>The Office of Water is considering merging this plan into the Water Sharing Plan for the NSW Border Rivers, Unregulated and Alluvial Water Sources.</li> </ul>

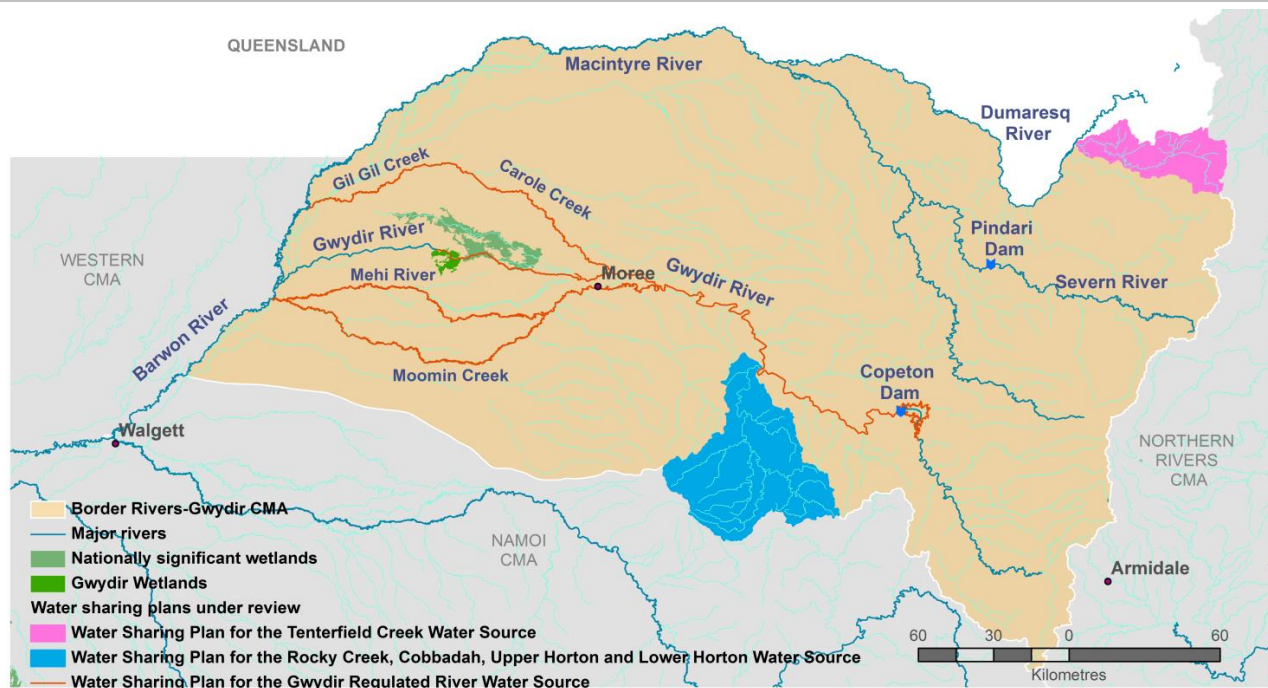


Figure 1: Water sharing plans under review in the Border Rivers-Gwydir region

<sup>1</sup> NSW Department of Water and Energy (2009), *Water sharing in unregulated rivers: progress report 2004 to 2008*. Prepared by the NSW Department of Water and Energy, Sydney.

<sup>2</sup> NSW Office of Water (2012), *Water resources and management overview – Border Rivers catchment*. NSW Office of Water, Sydney.

## Catchment overview

- **Catchment area:** Approximately 50,000 square kilometres (including the Border Rivers and Gwydir valleys).
- **Major waterways:** The Dumaresq, Severn and Macintyre rivers are the main waterways in the Border Rivers valley and the Gwydir and Horton rivers in the Gwydir valley.
- **Major storages:** The two largest storages in the catchment, Copeton and Pindari dams, are located on the Gwydir and Severn rivers respectively. They have storage capacities of 1,364,000 and 312,000 megalitres respectively. Copeton Dam provides irrigation water, town water supply (for Bingara and Gravesend) and environmental releases. Pindari Dam is used for irrigation water and town water supply, as well as stock, domestic and industrial purposes.
- **Groundwater:** Groundwater is drawn from alluvial aquifers and the porous rocks of the Great Artesian Basin, and is generally high quality, with the exception of a small brackish area in the lower Gwydir catchment. Groundwater development is limited in the upper Border Rivers valley where the geology is fractured rock.
- **Major towns:** Major regional towns include Moree, Glen Innes, Inverell and Tenterfield.
- **Land use:** Grazing, dryland cropping and horticulture are the dominant land uses in the catchment, followed by irrigated agriculture (cotton, fruit, vegetables, grapes and lucerne), forestry and conservation.
- **Major water users:** Water entitlements are primarily held for agricultural production and environmental purposes. Major agricultural water users include cotton, broadacre cropping, hay and vegetable production. In 2010–11, cotton had the greatest volume of water applied for irrigated agricultural production (482,853 megalitres).<sup>3</sup> The Australian and NSW governments have environmental water holdings in the Border Rivers and Gwydir valleys. As at 31 May 2013, the Commonwealth Environmental Water Office had registered entitlements totalling 16,239 megalitres in the Border Rivers valley (with the majority of holdings in Queensland) and 109,000 megalitres in the Gwydir valley.<sup>4</sup> As at 31 October 2012, the NSW Office of Environment and Heritage had 17,092 megalitres of general security and 441 megalitres of supplementary access holdings under various water recovery programs.<sup>5</sup>
- **Water-dependent environmental values:** The rivers and wetlands of the Border Rivers and Gwydir valleys provide habitat for a variety of fauna and flora, including waterbirds and threatened fish such as the silver perch. The region also includes the Darling River Endangered Ecological Community, listed under the *Fisheries Management Act 1994* (NSW). The Ramsar-listed Gwydir Wetlands (Lower Gwydir and Gingham watercourses), and the nationally significant Morella Watercourse/Boobera Lagoon/Pungboulal Lagoon complex are located in the catchment. The Gwydir Wetlands system is recognised as one of Australia's key breeding areas for colonially nesting water birds.<sup>6</sup> Boobera Lagoon holds high cultural significance.<sup>7</sup>
- **River health:** The 2008–10 Sustainable Rivers Audit rated the Border Rivers and Gwydir valley river ecosystems as in poor health.<sup>8</sup>

## Key issues affecting the region's water resources

### River regulation

- Flow patterns in the Border Rivers and Gwydir valleys have been significantly altered to secure the supply of water for irrigation, and stock and domestic use.<sup>9</sup>
- Water resource development that followed the construction of Copeton and Pindari dams resulted in a number of changes to the delivery of water, particularly to the Gwydir Wetlands in the lower catchment.

<sup>3</sup> Australian Bureau of Statistics (2012), *Gross value of irrigated agricultural production, 2010-11*. Data source: 4610055008DO002\_201011.

<sup>4</sup> Commonwealth Environmental Water Office (2013), *Commonwealth Environmental Water Holdings*, as at 31 May 2013, [www.environment.gov.au/ewater/about/holdings.html](http://www.environment.gov.au/ewater/about/holdings.html), accessed 5 June 2013.

<sup>5</sup> NSW Office of Environment and Heritage (2013), *NSW Environmental Water Holdings to 31 October 2012*. [www.environment.nsw.gov.au/environmentalwater/waterpurchase.htm](http://www.environment.nsw.gov.au/environmentalwater/waterpurchase.htm), accessed 5 June 2013.

<sup>6</sup> NSW Office of Water (2010), *Environmental flow response and socio-economic monitoring: Gwydir River progress report 2009*. Prepared by the NSW Office of Water, Sydney.

<sup>7</sup> Green, D., Ali, A., Petrovic, J., Burrell, M., Moss, P. (2012), *Water resources and management overview: Border Rivers catchment*. NSW Office of Water, Sydney, p. 8.

<sup>8</sup> Davies, P., Stewardson, M., Hillman, T., Roberts, J. and Thoms, M. (2013), *Sustainable Rivers Audit 2: The ecological health of the rivers in the Murray-Darling Basin at the end of the Millennium Drought (2008–2010)*, volume 3. Report prepared for the Murray-Darling Basin Authority by the Independent Sustainable Rivers Audit Group.

<sup>9</sup> Wilson, G.G., Bickel, T.O., Berney, P.J. and Sissne, J.L. (2009), *Managing environmental flows in an agricultural landscape: the lower Gwydir floodplain – a report to the Australian Government Department of the Environment, Water, Heritage and the Arts*. Prepared by the University of New England and Cotton Catchment Communities Cooperative Research Centre, Armidale, New South Wales.



- Provisions in the water sharing plan for the Gwydir Regulated River were introduced to share water between the environment (including the Gwydir Wetlands) and water users.

#### Climatic variability (extremes of drought and flood)

- Between 1999 and 2009, annual river flows were below the long-term average because of extended drought.<sup>10</sup>
- Drought conditions broke in 2010, when higher than average annual flows were recorded in the Gwydir River.
- 2004 water sharing plans for the Gwydir and Border Rivers valleys were not suspended, despite drought conditions prevailing for much of the life of the plans.

#### Coal seam gas exploration (emerging issue)

- Coal seam gas exploration is a recent development in the region. There are tenements in the headwaters of the Border Rivers.<sup>11</sup>
- Given there is limited knowledge of the region's groundwater resources and dependent ecosystems, it is difficult to ascertain the effects of exploration activities on the region's water resources.
- Impacts may arise from aquifer drawdown and the redistribution of water could lead to water quality issues.<sup>12</sup>

### Contribution to regional targets in the first Border Rivers-Gwydir CAP

- The CAP included a suite of biophysical targets for the region's riverine, wetland and groundwater assets.
- Priority areas associated with a number of these targets spatially align with the 2004 water sharing plans under review. For example:
  - the water sharing plan for the Gwydir Regulated River includes specific environmental water provisions for the Ramsar-listed Gwydir Wetlands that were prioritised, under a CAP target, for maintenance and improvement of wetland condition
  - this plan also spatially aligns with the regionally significant Mallowa Wetlands, which were identified as a priority for improvement of wetland condition in the CAP
  - the water sharing plan for Rocky Creek, Cobbadah, Upper Horton and Lower Horton Water Sources spatially aligns with the Lower Horton priority sub-catchment mapped in the CAP following a riverine condition assessment. A number of river targets relate to this sub-catchment.
- Given this spatial alignment, it is likely that implementing the 2004 water sharing plans may have contributed progress towards river and wetland CAP targets. However, from the available information, it is difficult to infer how much the water sharing plans have contributed progress towards these CAP targets and whether plan provisions are sustaining water-dependent values.
- The water sharing plans may have contributed towards CAP targets for improving water quality (including stream salinity), riparian vegetation, native aquatic biodiversity and wetland condition by:
  - protecting low flows in unregulated rivers via cease-to-pump rules (although these rules were changed to visible flow rules during the drought, when flows fell below cease-to-pump levels for an extended period)
  - establishing extraction limits in the Gwydir River so that approximately 56 per cent of yearly flows (based on a long-term average) are preserved for maintaining environmental health
  - releasing environmental flows from the environmental contingency allowance set aside in Copeton Dam in all years except 2005–06, when the Environmental Contingency Allowance Operations Advisory Committee deemed it was necessary to hold this water in reserve
  - establishing minimum daily flows, although these flows were partially met during dry years (2004–11) due to operational difficulties and inefficiencies associated with delivering low water volumes.
- The following achievements indicate that the water sharing plans likely made positive contributions towards the CAP targets:
  - In 2008–09, natural flow events combined with environmental contingency allowance releases into the Lower Gingham and Lower Gwydir led to increased growth of aquatic and terrestrial plants that competed with and reduced weed cover (lippia), increased biodiversity, and improved habitat for amphibians, birds and macroinvertebrates.
  - In 2011–12, an environmental contingency allowance release of 16,500 megalitres to the Gwydir Wetlands extended inundation from natural flows and supported frog and bird breeding.

<sup>10</sup> Office of Water (2011), *Water resources and management overview – Gwydir catchment*. Office of Water, Sydney.

<sup>11</sup> Moran, C., and Vink, S. (2010), *Assessment of impacts of the proposed coal seam gas operations on surface and groundwater systems in the Murray-Darling Basin*. Centre for Water in the Minerals Industry, Sustainable Minerals Institute, University of Queensland. Prepared for the Australian Government Department of Sustainability, Environment, Water, Population and Communities

<sup>12</sup> Ibid.

- Field verification to assess the adequacy of cease-to-pump rules in meeting the environmental objectives set out in the Water Sharing Plan for Rocky Creek, Cobbadah, Upper Horton and Lower Horton Water Sources has commenced.<sup>13</sup>

### Alignment of the upgraded Border Rivers-Gwydir CAP with water sharing plans

- The CMA worked collaboratively with the Office of Water and a range of water interest groups – including industry representatives such as the Gwydir Valley Irrigators Association, and Aboriginal groups – to include strategies and priorities in the upgraded CAP that aim to contribute to improved water resource management.
- The Office of Water was represented on the CAP Technical Advisory Group and helped guide the CMA in using the agency's data (the River Styles® assessment, which examines geomorphic condition).
- Using Office of Water data was an effective means of identifying and aligning priorities for river health, and resulted in a shared understanding of which river reaches require restoration, rehabilitation or protection. However, the plan could be improved by including the Office of Water's in-stream value mapping.
- While priority river reaches are explicit in the plan, priority wetlands are not well defined. It is understood that the CMA has a number of data sources for internationally and nationally significant wetlands, wetlands of cultural significance, and groundwater flow systems mapping that could help define these priorities, particularly with respect to wetlands that can receive environmental water.
- The upgraded CAP also includes strategic goals to achieve balanced hydrological systems and measurable targets for the region's social-ecological landscapes, consistent with the intent of the water sharing plans. The CAP includes targets that complement the water sharing plans, for example, targets for improving riparian stability and in-stream habitat quality in priority river reaches.
- The CAP lists delivery partners against each strategic goal.
- Given that regional priorities are well defined in the CAP, it provides a good foundation for aligning with future water planning.
- However, the plan does not explain how monitoring, evaluation and reporting against targets will occur, which is necessary for assessing the material contribution of the water sharing plans towards these targets.

### Future directions

- The CAP's alignment with water sharing plans could be improved if the CMA incorporates additional spatial data such as in-stream value mapping and wetland priorities into future planning.
- Sharing information (for example, about culturally significant water-dependent assets) with the Office of Water could also benefit any potential replacement water sharing plans.
- The CMA is working collaboratively with delivery partners, including representatives from the Office of Water, to develop an implementation plan for the upgraded CAP.
- The CMA is also working with its partners to develop a regional monitoring, evaluation and reporting strategy that facilitates data sharing; incorporates the actions of delivery partners responsible for contributing to CAP targets; and establishes regular progress reviews.

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<sup>13</sup> NSW Office of Water (2013), *Audit of implementation - Unregulated river water sharing plan audit report cards. Prepared for the period between 1 July 2009 and 30 June 2012.* NSW Office of Water, Sydney.

# Murray

## 2004 water sharing plans under review (see Figure 2)

Water sharing plan	Overview
NSW Murray and Lower Darling Regulated Rivers Water Sources	<ul style="list-style-type: none"> <li>The plan area comprises the Murray River from the upper limit of Hume Dam to the South Australian border, and the Darling River from Lake Wetherell (Menindee Lakes) to the upper limit of the Wentworth Weir Pool.</li> <li>The plan was suspended 10 November 2006 and recommenced 16 September 2011.</li> <li>Inter-valley and inter-state trading restrictions were introduced due to limited water availability and associated difficulties delivering purchased water.<sup>14</sup></li> </ul>
Upper Billabong Water Source (unregulated)	<ul style="list-style-type: none"> <li>The plan area comprises Upper Billabong Creek and its tributaries, to a flow reference point upstream of the Yarra Yarra Creek confluence.</li> <li>The Office of Water (formerly the Department of Water and Energy) has assessed this water source as having a low community dependence on extraction, and low environmental risk.<sup>15</sup></li> <li>The Office of Water is considering merging this plan into the ater Sharing Plan for the Murrumbidgee Unregulated and Alluvial Water Sources.</li> </ul>

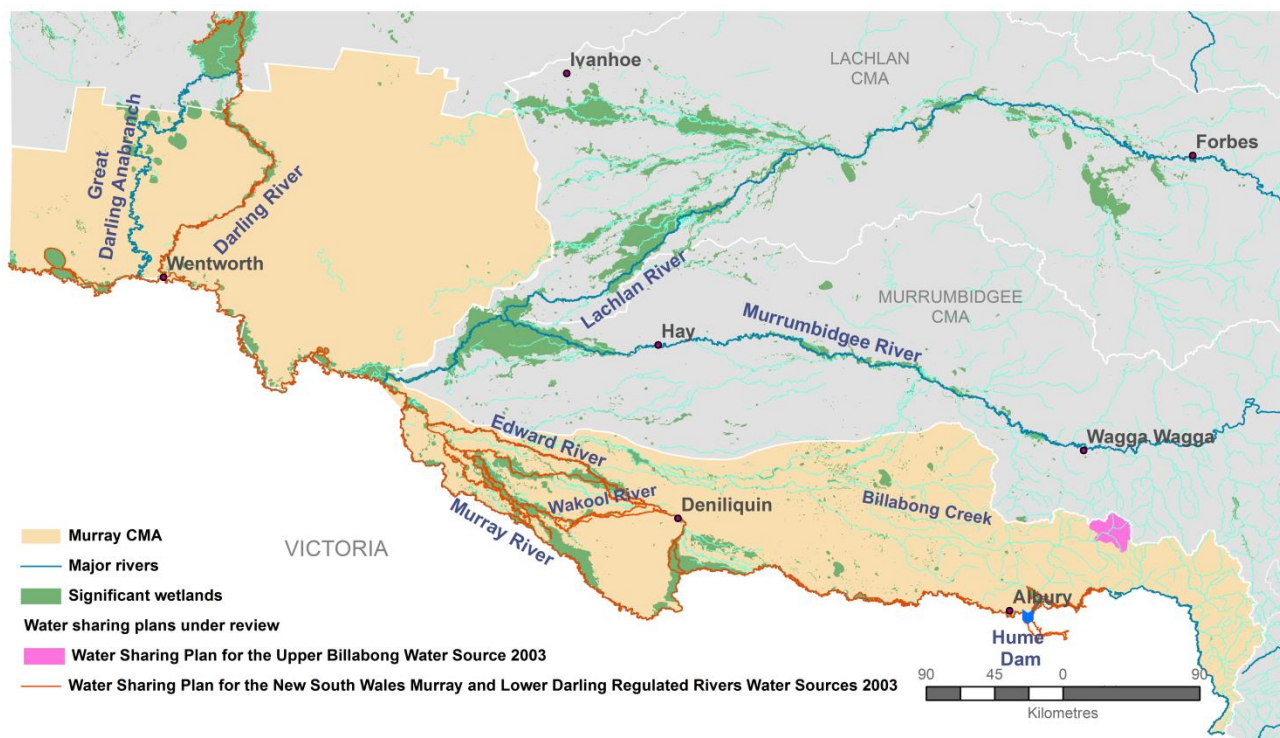


Figure 2: Water sharing plans under review in the Murray region

<sup>14</sup> NSW Office of Water (2013), *Audit of implementation - Regulated river water sharing plan audit report cards. Prepared for the period between 1 July 2009 and 30 June 2012.* NSW Office of Water, Sydney.

<sup>15</sup> NSW Department of Water and Energy (2009), *Water sharing in unregulated rivers: progress report 2004 to 2008.* Prepared by the NSW Department of Water and Energy, Sydney.

## Catchment overview

- **Catchment area:** 35,170 square kilometres (NSW Murray).
- **Major waterways:** Murray River and its tributaries including the Darling River, the Edward-Wakool river system and Billabong-Yanco system.
- **Major storages:** The Murray River is regulated by a series of dams and weirs. The largest storage in the catchment is located on the Mitta Mitta River (in Victoria). The second-largest storage, Hume Dam, is located on the Murray River in NSW and has a capacity of 3,038,000 megalitres. Lake Mulwala, created by the construction of Yarrowonga Weir, has a capacity of 117,500 megalitres and allows the diversion of water to the NSW and Victorian mid-Murray irrigation systems.
- **Groundwater:** The region includes the Lower Murray Alluvial aquifer system, Western Murray Porous Rock and Lower Darling Alluvium groundwater sources. Salt interception schemes operate in the region to reduce salinity in the Murray River.
- **Major towns:** The region includes the city of Albury and regional towns of Corowa, Moama, Deniliquin, Tocumwal, Holbrook, Balranald, Moulamein, Jerilderie and Wentworth.
- **Land use:** The Murray region includes a range of agricultural enterprises. Dryland and irrigated agriculture – including rice, dairy, grains, and fruit and vegetable production – make a significant contribution to the region's economy.
- **Major water users:** Water entitlements are primarily held for agricultural production and environmental purposes. The main agricultural water users in the region are in the Murray Irrigation Area, West Corrgan Irrigation District and a number of other private irrigation schemes. Rice and dairy account for a high proportion of farm businesses (approximately 75 per cent). These industries have a high dependency on irrigation, as do citrus and grain crops.<sup>16</sup> In 2010–11, the greatest volume of water applied for irrigated agricultural production was for rice (341,672 megalitres).<sup>17</sup> As at 31 May 2013, the Commonwealth Environmental Water Office had registered entitlements totalling 654,598 megalitres in the Murray valley (of which 294,878 megalitres accounted for holdings in NSW) and 492 megalitres in the Lower Darling.<sup>18</sup> A total of 221,487 megalitres was acquired under the Living Murray NSW Market Purchase Measure, for management by the Murray-Darling Basin Authority.<sup>19</sup>
- **Water-dependent environmental values:** The catchment includes a diversity of high-value riverine habitats and wetlands, including the Murray, Edward-Wakool and Billabong-Yanco systems, and the Ramsar-listed NSW Central Murray Forests. The region also includes the Murray River and Darling River Endangered Ecological Communities listed under the *Fisheries Management Act 1994* (NSW). There are three icon sites in the region recognised under the Living Murray Initiative: the River Murray channel, which has significant in-stream values; the Barmah-Millewa Forest, which is the largest river red gum forest in Australia; and the Gunbower-Koondrook-Perricoota forests that traverse the border between New South Wales and Victoria.
- **River health:** The 2008–10 Sustainable Rivers Audit rated the river health of the upper, mid and lower Murray valleys as poor.<sup>20</sup>

## Key issues affecting the region's water resources

### River regulation

- The hydrology of the river system has been altered over time by the construction of weirs and dams, including Hume Dam on the Murray River and Dartmouth Dam on the Mitta Mitta River in Victoria.
- River regulation has enabled water managers to deliver water for irrigation and other purposes, in volumes and during periods that are not in sequence with natural flows.
- Provisions in the water sharing plan for NSW Murray and Lower Darling Regulated Rivers aim to mitigate the impacts of river regulation and achieve a number of environmental objectives such as reinstating more natural wetting and drying, increasing river and floodplain connectivity, improving riverine habitats and supporting the recovery of native species.

<sup>16</sup> Murray-Darling Basin Authority (2010), *Community profile: NSW Central Murray irrigation region*. Prepared for the Murray-Darling Basin Authority by Marsden Jacob Associates, May 2010.

<sup>17</sup> Australian Bureau of Statistics (2012), *Gross value of irrigated agricultural production 2009–10: volume of water applied*. Data source: 461055008DO002.

<sup>18</sup> Commonwealth Environmental Water Office (2013), *Commonwealth Environmental Water Holdings*, as at 31 May 2013. [www.environment.gov.au/ewater/about/holdings.html](http://www.environment.gov.au/ewater/about/holdings.html), accessed 5 June 2013.

<sup>19</sup> NSW Office of Environment and Heritage (2013), *NSW Environmental Water Holdings to 31 October 2012*. [www.environment.nsw.gov.au/environmentalwater/waterpurchase.htm](http://www.environment.nsw.gov.au/environmentalwater/waterpurchase.htm), accessed 5 June 2013.

<sup>20</sup> Davies, P., Stewardson, M., Hillman, T., Roberts, J. and Thoms, M. (2013), *Sustainable Rivers Audit 2: The ecological health of the rivers in the Murray-Darling Basin at the end of the Millennium Drought (2008–2010)*, volume 3. Report prepared for the Murray-Darling Basin Authority by the Independent Sustainable Rivers Audit Group.

### Water reforms and interstate water sharing

- Water from the Murray River system is shared between NSW, Victoria and South Australia. Agreements were in place during the drought to manage available water between these states.
- The Murray-Darling Basin Plan defines sustainable limits on water extraction in the region. Concerns regarding reduced water availability under the Basin Plan have prompted a regional focus on water efficiency projects for environmental water recovery.<sup>21</sup>

### Climatic variability (extremes of drought and flood)

- There have been extremes of drought and flood throughout the life of the 2004 water sharing plans.
- Prolonged drought conditions resulted in suspension of the plan for the NSW Murray and Lower Darling Regulated Rivers, and affected water availability for agricultural production and the environment.
- There was a significant increase in water use for irrigated agricultural production at the end of the drought, with the volume of water applied increasing from 318,124 megalitres in 2009–10 to 524,110 megalitres in 2010–11.
- During the drought, water use for rice production declined and water was primarily applied to grow pasture for livestock grazing.<sup>22</sup> Following the drought, water use for rice production increased – the gross value of rice production reached \$75.5 million in 2010–11.<sup>23</sup>
- Since 2010, there has been significant natural flooding, complemented by targeted use of environmental water.

### Mining (emerging issue)

- There is increasing interest in mineral and coal deposits in the Murray region, particularly in the western part of the catchment. The draft Murray Catchment Action Plan 2013–2023 explains that mining operations will need to consider environmental issues.<sup>24</sup>

## Contribution to regional targets in the first Murray CAP

- The CAP included a suite of biophysical targets for the region's riverine, wetland and groundwater assets, and demonstrated the relationships between these resources.
- However, the CAP targets were not geographically specific, making it difficult to determine how the water sharing plans under review may have directly contributed to CAP targets.
- Inclusion of a management target for the coordination of environmental water management and complementary actions demonstrates that the CMA understood how the outcomes of environmental watering (facilitated through water sharing plans) could be enhanced by appropriate investment in on-ground works.
- However, based on available information, it is difficult to draw conclusions on the outcomes of implementing these water sharing plans and their adequacy for sustaining key water-dependent values.
- While it is difficult to draw conclusions on how the water sharing plans under review have contributed progress towards CAP targets, the plans may have led to an improvement in the flow regimes of surface water systems, and the condition of riparian and aquatic habitats (including wetlands) by:
  - establishing extraction limits on the amount of water taken from the Murray and Darling systems and Billabong Creek Water Sources
  - facilitating environmental releases from the Barmah-Millewa Environmental Water Account, which have contributed to wetland health in the Barmah-Millewa Forest and supported waterbird breeding events in 2006–07 and 2008–09 (when water was made available through critical water planning arrangements)
  - providing adaptive environmental water through licensing of water for environmental purposes.
- Water trade was enhanced through the introduction of water sharing plan provisions and the *Water Management Act 2000* (NSW), which allowed water to be purchased for environmental purposes by programs such as The Living Murray and the Commonwealth Environmental Water Holder (adaptive environmental water).
- Adaptive environmental water releases made available through such programs may have also contributed towards achieving CAP targets.

<sup>21</sup> Murray CMA (2013), *Draft Catchment Action Plan 2013–2023*. Prepared by the Murray-Catchment Management Authority.

<sup>22</sup> Australian Bureau of Statistics (2011), *Gross Value of Irrigated Agricultural Production, 2000-01 to 2009-10*. Data source: 4610055008DO002\_200001200910.

<sup>23</sup> Australian Bureau of Statistics (2012), *Gross value of irrigated agricultural production, 2010-11*. Data source: 4610055008DO002\_201011.

<sup>24</sup> Murray CMA (2013), *Draft Catchment Action Plan 2013–2023*. Prepared by the Murray-Catchment Management Authority.

- There has been limited monitoring in the Upper Billabong Creek catchment to understand how the water sharing plan has contributed to regional outcomes. This is partly due to drought conditions making it difficult to collect sufficient data to inform the field verification.

### Alignment of the upgraded Murray CAP with water sharing plans

- The CMA undertook stakeholder mapping to identify and engage with key government, industry and agricultural stakeholders including the Commonwealth Environmental Water Holder, Murray-Darling Basin Authority, State Water, irrigator groups (such as Murray Irrigation) and community groups, to identify and refine priorities for the region.
- The CMA worked collaboratively with the Office of Water in distinguishing the role of water sharing plans from that of the CAP, and included targets and actions that are complementary to the region's water sharing plans and the NSW Aboriginal Water Initiative.
- The draft upgraded CAP includes a map of priority aquatic systems, developed from mapping assets identified by the community, priorities for Commonwealth environmental watering and information provided by NSW Fisheries.
- Spatial data from the Office of Water's River Condition Index did not inform mapping of priority aquatic systems; however, the CMA plans to use the Office of Water's spatial data to inform its investment strategy.
- Reduced access to water for productive purposes was a critical constraint raised by community representatives in developing the draft CAP.<sup>25</sup>
- In response to this concern, the draft CAP includes a management target and associated actions to improve irrigation water delivery and water use efficiency, to support diverse and profitable local communities.
- However, baselines for measuring progress towards these targets need to be developed, and are important for future assessments of how water sharing plans are contributing progress towards CAP targets.

### Future directions

- Alignment with water sharing plans should improve if the CMA uses the River Condition Index data for its investment planning.
- The information base used to identify aquatic systems in the draft CAP could be used to inform water sharing plan replacements.
- Roles and responsibilities of key delivery partners will need to be clearly defined as part of investment planning to ensure the water sharing plans can effectively contribute to regional outcomes.

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<sup>25</sup> Murray CMA (2013), *Approach to Catchment Action Plan development*. Prepared by the Murray-Catchment Management Authority.

# Murrumbidgee

## 2004 water sharing plans under review (see Figure 3)

Water sharing plan	Overview
Murrumbidgee Regulated River Water Source	<ul style="list-style-type: none"> <li>The plan area includes the upper reaches of Burrinjuck and Blowering water storages, to the junction with the Murray River.</li> <li>The plan was suspended on 10 November 2006 due to drought conditions, and recommenced on 16 September 2011.</li> </ul>
Adelong Creek Water Source (unregulated)	<ul style="list-style-type: none"> <li>The plan area includes Adelong Creek and its tributaries, to a flow reference point downstream of the town of Tumblong.</li> <li>The Office of Water (formerly the Department of Water and Energy) has assessed this water source as having a high community dependence on extraction, and a medium environmental risk.<sup>26</sup></li> <li>Drought conditions resulted in cease-to-pump levels being reached the majority of the time between October 2006 and April 2007.<sup>27</sup></li> <li>The Office of Water is considering merging this plan into the Water Sharing Plan for the Murrumbidgee Unregulated and Alluvial Water Sources.</li> </ul>
Tarcutta Creek Water Source (unregulated)	<ul style="list-style-type: none"> <li>Tarcutta Creek Water Source is a highly developed system of the Murrumbidgee River valley that has been delineated into three management zones.</li> <li>The Office of Water (formerly the Department of Water and Energy) has assessed this water source as having a high community dependence on extraction, and a medium environmental risk.</li> <li>Data collection has been attempted in the Tarcutta Creek catchment; however, conditions have not been suitable for collecting sufficient data to inform the field verification of low-flow provisions.</li> <li>The Office of Water is considering merging this plan into the Water Sharing Plan for the Murrumbidgee Unregulated and Alluvial Water Sources.</li> </ul>

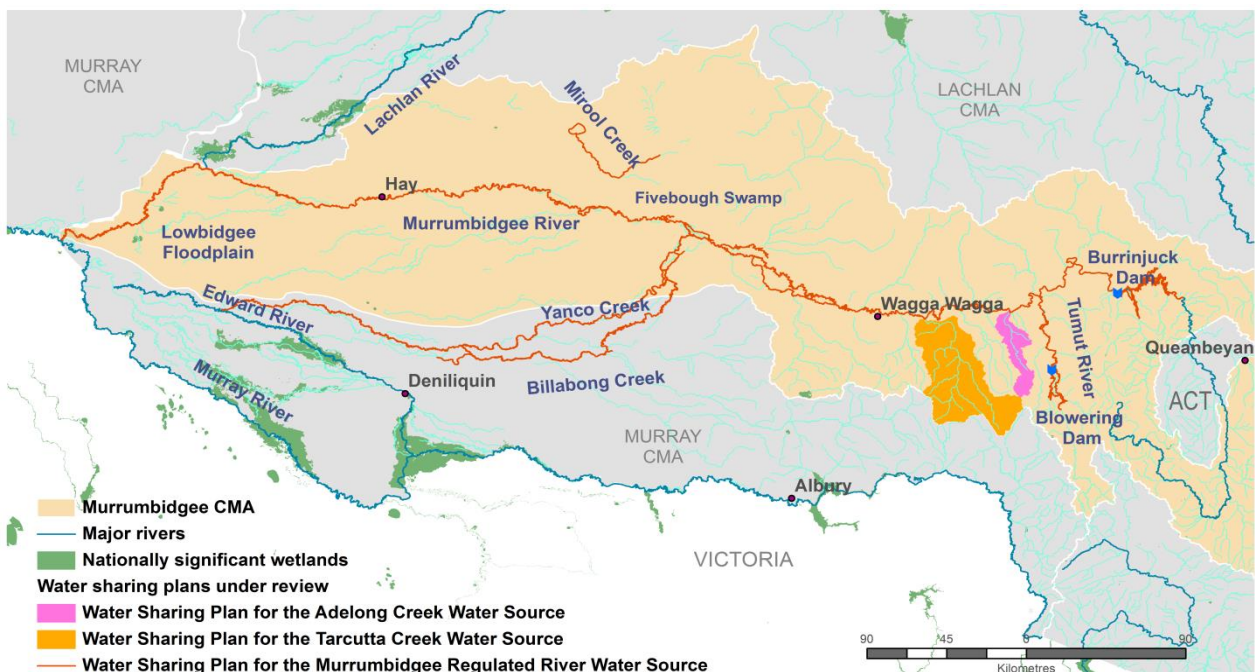


Figure 3: Water sharing plans under review in the Murrumbidgee region

<sup>26</sup> NSW Department of Water and Energy (2009), *Water sharing in unregulated rivers: progress report 2004 to 2008*. Prepared by the NSW Department of Water and Energy, Sydney.

<sup>27</sup> Ibid.

## Catchment overview

- **Catchment area:** 84,000 square kilometres.
- **Major waterways:** The Murrumbidgee River extends 1,465 kilometres and is the second-longest river in the Murray-Darling Basin.<sup>28</sup> The largest tributary is the Tumut River and the largest effluent stream is Yanco Creek. Other key tributaries include the Naas, Molonglo, Queanbeyan, Cotter and Yass rivers.
- **Major water storages:** The two largest storages, Blowering and Burrinjuck dams, are located in the upper catchment and have capacities of 1,628,000 and 1,028,000 megalitres respectively.<sup>29</sup> Their purpose is to provide bulk water for irrigation, flood mitigation and hydropower. A number of other storages in the region also produce hydropower and form part of the Snowy Hydroelectric Scheme.
- **Groundwater:** Groundwater is used by industry and agriculture. Most licence holdings are for the middle to lower alluvial aquifers where groundwater quality and volume are most suitable. Groundwater is highly saline in the far west of the catchment and has limited use.
- **Major towns:** The region includes Australia's capital city (Canberra) and the urban centre of Wagga Wagga. Other major regional towns include Griffith, Leeton, Hay, Yass, Tumut and Cooma.
- **Land use:** The region supports a range of agricultural enterprises including dryland grazing, cereal cropping and irrigated agriculture (rice, cotton, wine grapes, fruit and vegetable production), and is one of Australia's major rice-growing areas.<sup>30</sup>
- **Major water users:** Water entitlements are primarily held for agricultural production and environmental purposes. The primary agricultural water users in the region reside in the Murrumbidgee and Coleambally irrigation areas. Water availability is a major economic driver in the region. In 2010–11, the greatest volume of water applied for irrigated agricultural production was for rice (405,479 megalitres).<sup>31</sup> The Australian and NSW governments have environmental water holdings in the Murrumbidgee valley. As at 31 May 2013, the Commonwealth Environmental Water Office had registered entitlements totalling 232,867 megalitres.<sup>32</sup> As at 31 October 2012, the NSW Office of Environment and Heritage had 27,676 megalitres of general security, 5,679 megalitres of supplementary access and 7,962 megalitres of unregulated holdings under various water recovery programs.<sup>33</sup>
- **Water-dependent environmental values:** The catchment includes a diversity of riverine habitats and wetlands of regional, national and international significance. The Murrumbidgee River below Burrinjuck Dam and the Tumut River below Blowering Dam, as well as all their tributaries and branches, are included in the Murray River Endangered Ecological Community listed under the *Fisheries Management Act 1994* (NSW). The most extensive area of floodplain wetland remaining in the valley and Australia's second-largest river red gum forest is on the Lowbidgee Floodplain.<sup>34</sup> The Mid Murrumbidgee Wetlands and Lowbidgee Floodplain complex are listed on the *Directory of Important Wetlands in Australia*, and Fivebough and Tuckerbil Swamp complex is listed under the Ramsar Convention.
- **River health:** The 2008–10 Sustainable Rivers Audit rated the Murrumbidgee valley river ecosystem in poor health.<sup>35</sup>
- **Cultural water:** The Murrumbidgee was the first valley in NSW where a cultural access licence was established under water sharing plan provisions for cultural watering purposes.

<sup>28</sup> Geoscience Australia (2012), *GEODATA TOPO-250K database – longest rivers*.

[www.ga.gov.au/education/geoscience-basics/landforms/longest-rivers.html](http://www.ga.gov.au/education/geoscience-basics/landforms/longest-rivers.html), accessed [10 April 2013].

<sup>29</sup> State Water Corporation (2013), *State Water storages*. [www.statewater.com.au/Water%20delivery/Dams](http://www.statewater.com.au/Water%20delivery/Dams), accessed 10 April 2013.

<sup>30</sup> Rice Growers Australia (2013), *Growing rice in Australia*. [www.rga.org.au/about-rice/growing-rice.aspx](http://www.rga.org.au/about-rice/growing-rice.aspx), accessed 10 April 2013.

<sup>31</sup> Australian Bureau of Statistics (2012), *Gross value of irrigated agricultural production, 2010–11: volume of water applied*. Data source: 4610055008DO002\_201011.

<sup>32</sup> Commonwealth Environmental Water Office (2013), *Commonwealth Environmental Water Holdings*, as at 31 May 2013. [www.environment.gov.au/ewater/about/holdings.html](http://www.environment.gov.au/ewater/about/holdings.html), accessed 5 June 2013.

<sup>33</sup> NSW Office of Environment and Heritage (2013), *NSW Environmental Water Holdings to 31 October 2012*. [www.environment.nsw.gov.au/environmentalwater/waterpurchase.htm](http://www.environment.nsw.gov.au/environmentalwater/waterpurchase.htm), accessed 5 June 2013.

<sup>34</sup> Green, D., Petrovic, J., Moss, P. and Burrell, M. (2011), *Water resources and management overview: Murrumbidgee catchment*. NSW Office of Water, Sydney.

<sup>35</sup> Davies, P., Stewardson, M., Hillman, T., Roberts, J. and Thoms, M. (2013), *Sustainable Rivers Audit 2: The ecological health of the rivers in the Murray-Darling Basin at the end of the Millennium Drought (2008–2010)*, volume 3. Report prepared for the Murray-Darling Basin Authority by the Independent Sustainable Rivers Audit Group.



## Key issues affecting the region's water resources

### River regulation

- The Murrumbidgee River system is regulated by a series of dams and weirs from Burrinjuck Dam to the junction with the Murray River. Blowering Dam regulates the largest tributary, Tumut River.
- While these storages help to manage the supply of water for irrigation and other purposes, river regulation led to a decline in flows reaching the Lower Murrumbidgee Floodplain by as much as 60 per cent.<sup>36</sup>

### Climatic variability (extremes of drought and flood)

- The Murrumbidgee valley has experienced extremes of drought and flood over the life of the 2004 water sharing plans.
- Drought conditions from 2002 to 2010 led to the suspension of the water sharing plan for the Murrumbidgee Regulated River Water Source in 2006, indicating that the plan did not have the flexibility to deal with the extreme conditions.
- Drought conditions over consecutive years affected agricultural productivity, with the gross value of the region's irrigated agricultural production falling from around \$500 million in 2001 to around \$195 million in 2006.<sup>37</sup>
- Reduced wetland inundation during the drought also affected the availability of habitat for migratory birds and threatened flora and fauna, including the endangered southern bell frog.<sup>38</sup>
- In December 2010, flood conditions led to inundation of riverfed wetlands, including the southern bell frog habitat. Flooding on the Lowbidgee Floodplain reached the Murray River in January 2011.
- Increased water availability contributed to an increase in irrigated agriculture, with a gross value of \$526.5 million in 2010–11.<sup>39</sup>

### Water trading

- Temporary and permanent trading on water markets helped to mitigate some of the impacts of drought on farming communities; however, socioeconomic outcomes for the region were potentially impacted by time-based restrictions on temporary trade of general and high-security allocations in the Murrumbidgee Regulated River Water Source.

### Changing demographics

- Population growth in the upper catchment around Canberra is increasing water demand and affecting water quality. The population of Queanbeyan and Yass local government areas grew by 40 per cent and 28.2 per cent respectively between 2001 and 2011.<sup>40</sup>

### Water reforms

- According to the upgraded Murrumbidgee CAP, the Basin Plan and water buybacks are perceived by the community as key threats to businesses and agricultural enterprises, and to future development opportunities in the valley.

## Contribution to regional targets in the first Murrumbidgee CAP

- The CAP for the Murrumbidgee included a range of targets for the region's riverine, wetland and groundwater assets, and for its socioeconomic and cultural well-being.
- Implementation of the 2004 water sharing plans may have contributed progress towards a number of these CAP targets, including geographically specific targets for reducing salinity levels in the Murrumbidgee River. However, based on available information, it is difficult to infer how water sharing plans have contributed progress towards CAP targets and whether water sharing plans are sustaining water-dependent values.
- The water sharing plans may have contributed progress towards the region's river, wetland and cultural targets by:
  - protecting low flows in unregulated rivers (the Adelong and Tarcutta Creek Water Sources) via cease-to-pump rules (cease-to-pump rules were triggered in Adelong Creek during the drought)
  - establishing extraction limits in the Murrumbidgee Regulated River Water Source to preserve flows for

<sup>36</sup> Kingsford, R.T. & Thomas, R.F. (2004), Destruction of wetlands and waterbird populations by dams and irrigation on the Murrumbidgee River in arid Australia, *Environmental Management* 34: 383–396

<sup>37</sup> Murray-Darling Basin Authority (2010), *Community profile: Murrumbidgee irrigation region*. Prepared for the Murray-Darling Basin Authority by Marsden Jacob Associates, May 2010.

<sup>38</sup> Sinclair Knight Merz (2012), *Environmental water delivery: Murrumbidgee valley*. Prepared for the Commonwealth Environmental Water Holder, January 2012.

<sup>39</sup> Australian Bureau of Statistics (2012), *Gross value of irrigated agricultural production, 2010–11*. Data source: 4610055008DO002\_201011.

<sup>40</sup> Murrumbidgee CMA (2013), *Catchment Action Plan 2013*. Prepared by Murrumbidgee Catchment Management Authority.

maintaining environmental health

- releasing environmental flows from environmental contingency allowance accounts
- providing end-of-system flow targets for the Murrumbidgee Regulated River, although these targets were relaxed during drought conditions while the plan was suspended
- making water available for cultural purposes (through cultural access licences).
- The following achievements indicate possible positive contributions to the CAP targets:
  - Environmental releases from environmental contingency allowance accounts before and during plan suspension (under critical water planning arrangements) helped to support key wetlands and threatened species. For example, releases in 2008–09 assisted the southern bell frog in key Lowbidgee Wetlands, while releases in 2009–10 and 2010–11 supported waterbird rookeries, inundated the Ramsar-listed Fivebough Swamp, sustained river flows and improved river–wetland connectivity.
  - A cultural access licence established under the water sharing plan for the Murrumbidgee Regulated River enabled up to 2,150 megalitres of high-security water to be used for cultural purposes. The licence, which is administered by the CMA on behalf of the Murrumbidgee Traditional Custodians Advisory Group, was used to inundate lignum wetlands (on land held by the Nari Nari Tribal Council) to support ecosystem health, manufacturing of traditional artefacts and cultural teaching.
- Field verification of very low flow provisions is underway for Tarcutta Creek and will help determine if these provisions are appropriate for providing refuge areas during dry periods.

### Alignment of the upgraded Murrumbidgee CAP with water sharing plans

- The CMA demonstrated a good understanding of the role of water in the landscape, and the role of water sharing plans in protecting river health and providing access for consumptive purposes.
- The CMA elected not to incorporate specific local interventions relating to water sharing plans into the upgraded CAP due to the uncertainties around the emerging Basin Plan and how it will potentially affect water sharing plans. Instead, the upgraded CAP includes broad goals and outcome statements.
- Shared priorities for coordinated action to improve aquatic ecosystem condition are not explicit in the CAP, even though the CMA engaged key water interest groups including government agencies, local councils, irrigator groups (Murrumbidgee Irrigation and Coleambally Irrigation) and Aboriginal representatives.
- Spatial priorities for improving the condition of aquatic ecosystems are not clearly expressed in the CAP and the Office of Water’s spatial data does not appear to have informed the CAP. However, the CMA indicated that it will use the Office of Water’s data to inform its Annual Implementation Plan and 10 Landscape Action Plans.
- The lack of clear spatial priorities limits the ability of the plan to meaningfully guide coordinated actions that achieve shared objectives for aquatic ecosystems and better return on investment.
- As a result, the Office of Water is seeking to work collaboratively with the CMA during the CAP implementation phase to develop spatial priorities and ensure these align with water planning.
- Despite this, the CAP does recognise how water efficiency measures can support farm businesses to optimise productivity through efficient use of water allocations, and how Aboriginal knowledge can guide management of the cultural access licence held in the valley.

### Future directions

- The CMA aims to improve knowledge about water-dependent ecosystems, including wetlands, to identify significant assets. It has advised that Landscape Action Plans for each of the 10 landscapes defined in the CAP will identify riverine priorities using data from the Office of Water.
- The CMA’s Landscape Action Plans will need to include specific targets against which outcomes can be measured. They should support alignment with water sharing plans as long as they contain measurable targets and clear priorities for coordinated action, and define roles and responsibilities.
- Timeframes for the development of these Landscape Action Plans are unclear. They may not be available to inform potential replacement water sharing plans.
- The CMA plans to work collaboratively with the Office of Water to examine how River Condition Index data can be adopted during the CAP implementation phase.

# Lachlan

## 2004 water sharing plans under review (see Figure 4)

Water sharing plan	Overview
Lachlan Regulated River Water Source	<ul style="list-style-type: none"> <li>The plan area encompasses the regulated sections of the Lachlan River, from the upper limit of Wyangala Dam to the Murrumbidgee River.</li> <li>The plan was suspended on 1 July 2004 and recommenced on 16 September 2011.</li> </ul>
Mandagery Creek Water Source (unregulated)	<ul style="list-style-type: none"> <li>The plan area comprises six management zones covering Mandagery Creek and its tributaries, including Bourimbla, Lower Boree, Mid Mandagery, Lower Mandagery and Upper Boree creeks.</li> <li>The Office of Water (formerly the Department of Water and Energy) has assessed this water source as having medium community dependence and a low environmental risk.<sup>41</sup></li> <li>The Office of Water is considering merging this plan into the Water Sharing Plan for the Lachlan Unregulated and Alluvial Water Sources.</li> </ul>

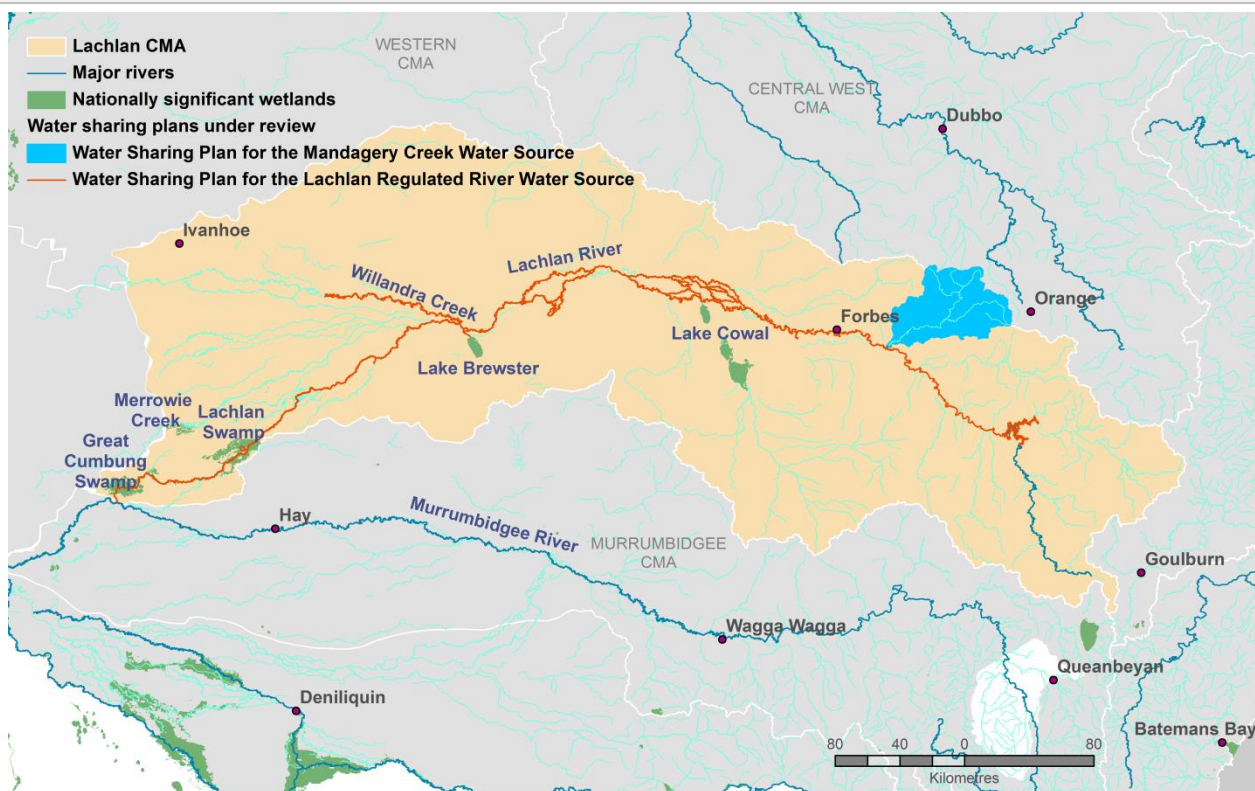


Figure 4: Water sharing plans under review in the Lachlan region

## Catchment overview

- **Catchment area:** 90,000 square kilometres.
- **Major waterways:** The area’s major waterways are the Lachlan River and its tributaries, including Abercrombie, Crookwell, Belubula and Borowra rivers, and Tuena, Back and Mandagery creeks. The lower catchment comprises a series of effluent streams, of which Willandra Creek is the largest. The system terminates in the Great Cumbung Swamp, but flows from the Lachlan can reach the Murrumbidgee River during a major flood.
- **Major water storages:** Wyangala Dam and a number of weirs regulate the Lachlan River. Wyangala Dam has a

<sup>41</sup> NSW Department of Water and Energy (2009), *Water sharing in unregulated rivers: progress report 2004 to 2008*. Prepared by the NSW Department of Water and Energy, Sydney.

storage capacity of 1,220,000 megalitres and supplies water for irrigation, industry, town supply, stock and domestic use, and the environment<sup>42</sup>. Carcoar Dam regulates Belubula River, a major tributary of the Lachlan, and has a capacity of 36,000 megalitres. There are two large off-river storages in the catchment (Lake Brewster and Lake Cargelligo), which are used to meet water requirements in the lower valley. A large proportion of community submissions argued that the classification of Lake Cargelligo as a man-made lake should be changed, and that it should be given a water allocation that reflects its social, cultural, environmental and economic benefits.

- **Groundwater:** There are high-yielding alluvial aquifers in the western part of the catchment, of moderate to high quality. These aquifers support irrigation around Hillston.
- **Major towns:** The region includes the major rural towns of Cowra, Parkes, Forbes and Young, and smaller towns of Crookwell, Boorowa, Canowindra, Hillston, Molong, Temora, West Wyalong, Lake Cargelligo and Condobolin.
- **Land use:** The region supports a range of agricultural enterprises. More than 75 per cent of the catchment is used for grazing. Other land uses include dryland cropping, irrigation, forestry and conservation.
- **Major water users:** Water entitlements are primarily held for agricultural production and environmental purposes. Major agricultural water users are based around the Jemalong Wyldes Plain Irrigation District and Hillston. Lucerne, maize and pasture are the most commonly grown crops. In 2010–11, the greatest volume of water applied for irrigated agricultural production was for cotton (37,587 megalitres) and hay (21,234 megalitres).<sup>43</sup> The Australian and NSW governments have environmental water holdings in the Lachlan valley. As at 31 May 2013, the Commonwealth Environmental Water Office had registered entitlements totalling 87,656 megalitres in the Lachlan valley.<sup>44</sup> As at 31 October 2012, the NSW Office of Environment and Heritage had 1,000 megalitres of high security, 24,569 megalitres of general security and 184 megalitres of unregulated holdings under various water recovery programs.<sup>45</sup>
- **Water-dependent environmental values:** The riverine habitats and diverse wetlands of the Lachlan valley provide habitats for a range of flora and fauna, including threatened and migratory species. The region also includes the Lachlan River Endangered Ecological Community, listed under the *Fisheries Management Act 1994* (NSW). There are significant wetlands along the river system. The catchment includes nine nationally significant wetlands including Lake Brewster, Lake Cowal and the Wilbertroy Wetlands, Booligal Wetland, Cuba Dam, Great Cumbung Swamp, Lachlan Swamp (Part of Mid-Lachlan Wetlands), Lake Merrimajeel and Murrumbidgee Swamp, and Merrowie Creek (Cuba Dam to Chillichil Swamp). Lakes Brewster and Cargelligo were modified for use as off-river storages.<sup>46</sup>
- **River health:** The 2008–10 Sustainable Rivers Audit rated the Lachlan valley river ecosystem as in very poor health.<sup>47</sup>

## Key issues affecting the region's water resources

### River regulation

- The Lachlan River system is regulated from the upper limit of Wyangala Dam to the junction with the Murrumbidgee River (see Figure 4).
- Floodplain connectivity, wetland health and the riparian zone have been adversely affected by river regulation and agricultural production in the Lachlan catchment.<sup>48</sup>

<sup>42</sup> NSW Office of Water (2012), *Water resources and management overview – Lachlan catchment*. NSW Office of Water, Sydney.

<sup>43</sup> Australian Bureau of Statistics (2012), *Gross value of irrigated agricultural production, 2010–11: volume of water applied*. Data source: 4610055008DO002\_201011.

<sup>44</sup> Commonwealth Environmental Water Office (2013), *Commonwealth Environmental Water Holdings*, as at 31 May 2013. [www.environment.gov.au/ewater/about/holdings.html](http://www.environment.gov.au/ewater/about/holdings.html), accessed 5 June 2013.

<sup>45</sup> NSW Office of Environment and Heritage (2013), *NSW Environmental Water Holdings to 31 October 2012*. [www.environment.nsw.gov.au/environmentalwater/waterpurchase.htm](http://www.environment.nsw.gov.au/environmentalwater/waterpurchase.htm), accessed 5 June 2013.

<sup>46</sup> Green, D., Petrovic, J., Moss, P. and Burrell, M. (2011), *Water resources and management overview: Lachlan catchment*, NSW Office of Water, Sydney.

<sup>47</sup> Davies, P., Stewardson, M., Hillman, T., Roberts, J. and Thoms, M. (2013), *Sustainable Rivers Audit 2: The ecological health of the rivers in the Murray-Darling Basin at the end of the Millennium Drought (2008–2010)*, volume 3. Report prepared for the Murray-Darling Basin Authority by the Independent Sustainable Rivers Audit Group.

<sup>48</sup> Barma Water Resources in association with Thurtell, L. and Wettin, P. (2011), *Environmental Water Delivery: Lachlan River*. Prepared for Commonwealth Environmental Water, Department of Sustainability, Environment, Water, Population and Communities, Canberra.

- Environmental water provisions in the 2004 water sharing plan for the Lachlan Regulated River were designed to improve the health of the region's water-dependent environmental assets. However, the plan was suspended for the majority of its duration.

#### Climatic variability (extremes of drought and flood)

- There was a prolonged drought from late 2000 to 2010. The extreme conditions led to the suspension of the water sharing plan for the Lachlan Regulated River Water Source on the same day it commenced (1 July 2004). The plan did not recommence until 16 September 2011.
- During the drought, the gross value of irrigated agricultural production fell to \$120.29 million in 2009–10 and increased to \$163.14 million towards the end of the drought when there was improved confidence in water availability and trade (2010–11).<sup>49</sup>
- Inundation of the Booligal Wetlands river red gum forest has been less frequent since the river system was regulated. Drought conditions appear to have accelerated the decline of the tree canopy. The tree canopy reportedly decreased by 85 per cent between 1993 and 2008, accelerating over 2005–08.<sup>50</sup>

#### Contribution to regional targets in the first Lachlan CAP

- The CAP included a number of biophysical targets that the water sharing plans may have helped to progress. However, it is difficult to draw specific conclusions on the contributions made by the water sharing plans and their adequacy for supporting water-dependent values from available information.
- The CAP also included a specific target for managing surface water sources in accordance with water sharing plans for the Lachlan Regulated River and Mandagery Creek Water Sources. It is likely that implementing these water sharing plans would have contributed progress towards this target.
- However, the water sharing plan for the Lachlan Regulated River may have had a limited influence on CAP targets as the plan was suspended for seven years and a number of environmental provisions were not met during this time.
- The water sharing plans may have contributed progress towards the region's river and wetland targets (mainly when drought conditions eased for the regulated river), by:
  - protecting low flows in the unregulated Mandagery Creek Water Source via cease-to-pump rules
  - establishing extraction limits in the Lachlan Regulated River Water Source to preserve flows for maintaining environmental health
  - triggering release of translucent flows for environmental purposes; however, trigger levels for translucent flows were rarely met during the drought, and when they were met (in 2005 and 2010–2011), the plan was still suspended (translucent releases were made in the 2011–2012 water year when the plan recommenced)
  - triggering credits for environmental contingency allowance accounts (20,000 megalitres split between Wyangala Dam and Lake Brewster), although credits to these accounts were not made until water availability improved in 2010–2011
  - triggering credits for a water quality allowance account to address particular water quality issues such as salinity levels and algal blooms, although this did not occur until water availability improved in 2010–2011
  - restricting water access licences during dry periods.
- The following achievements indicate that the water sharing plan may have made positive contributions to the CAP targets:
  - Environmental flow releases supported a major bird breeding event in Booligal Wetlands.
  - Small environmental flow releases during drought conditions – while the plan for the Lachlan Regulated River was suspended – helped to support drought-affected vegetation including river red gums and deep-rooted plants in the nationally significant Booligal Wetland and the Great Cumbung Swamp.
  - While there were no translucent releases when the water sharing plan was suspended, large tributary inflows below Wyangala Dam in September, October and November 2010 meant that water flowed past Brewster Weir as unregulated flows.
  - Translucent flows released from Wyangala Dam from June–July 2012 in accordance with planned environmental water provisions in the water sharing plan for the Lachlan Regulated River Water Source provided a nearer to natural flow regime.

<sup>49</sup> Australian Bureau of Statistics (2012), *Gross value of irrigated agricultural production, 2010–11: GVAI*. Data source: 4610055008DO002\_201011.

<sup>50</sup> Armstrong, J.L., Kingsford, R.T. and Jenkins, K.M. (2009), *The effect of regulating the Lachlan River on the Booligal Wetlands – the floodplain river red gum swamps*. University of New South Wales,

### Alignment of the upgraded Lachlan CAP with water sharing plans

- The CMA demonstrated a good understanding of the role of water sharing plans, and how on-ground activities can help achieve outcomes identified in water sharing plans and the draft upgraded CAP.
- Building relationships with the Office of Water, Fisheries NSW and the Office of Environment and Heritage – and sharing information with these agencies – helped the CMA align the draft upgraded CAP with relevant state policies and plans, including water sharing plans.
- Using the Office of Water’s River Styles® data as well as fish hotspot data from Fisheries NSW provided a good basis for mapping which river reaches require intervention.
- However, spatial prioritisation could be improved by including the Office of Water’s in-stream value mapping.
- The draft upgraded CAP does not define priority wetlands as clearly as priority river reaches, but priority wetlands are listed as significant sites for each landscape that comprises the Lachlan region.
- The draft upgraded CAP also identifies culturally significant sites, including those that have water-dependent values, and includes a goal for improving Aboriginal people’s connection to culture and country through knowledge sharing.
- In summary, the spatial analysis that informed the CAP upgrade provides guidance on where priority actions should occur.
- The draft upgraded CAP includes a logical hierarchy of goals, targets and actions for addressing priority issues for the region’s aquatic systems, although priority areas for action could be better articulated in the body of the plan.
- The draft upgraded CAP identifies that implementing the Lachlan Environmental Water Management Plan through the Lachlan River Working Group will contribute towards the CAP’s goal for aquatic systems.
- The draft upgraded CAP also includes examples of performance measures that should be tracked to assess achievement of CAP targets. These performance measures will require suitable benchmarks for assessing achievements and improving accountability.

### Future directions

- The CMA recognises that further investigation is necessary to identify high-value groundwater-dependent ecosystems, and is working with the Office of Water to address this knowledge gap and align land management practices accordingly.
- The CMA is working with the Office of Water to incorporate in-stream value mapping and other spatial data into its investment prioritisation tool, which should improve alignment with water sharing plans.
- Sharing information, such as culturally significant water-dependent values, with the Office of Water could also benefit potential water sharing plan replacements.

# Namoi

## 2004 water sharing plans under review (see Figure 5)

Water sharing plan	Overview
Upper Namoi and Lower Namoi Regulated River Water Sources	<ul style="list-style-type: none"> <li>The plan area comprises the regulated reaches between Split Rock Dam and Keepit Dam, downstream of Keepit Dam to the Barwon River.</li> <li>The plan was not suspended during the drought that affected the region between 2001 and 2010.</li> </ul>
Phillips Creek, Mooki River, Quirindi Creek and Warrah Creek Water Sources (unregulated)	<ul style="list-style-type: none"> <li>The plan area includes tributaries that enter the regulated reach of the Namoi River via Mooki River.</li> <li>The Office of Water (formerly the Department of Water and Energy) has assessed this water sources as having a high community dependence and low environmental risk.<sup>51</sup></li> <li>Drought conditions limited the collection of data to inform field verification of the plan’s low-flow provisions.</li> <li>The Office of Water is considering merging this plan into the Water Sharing Plan for the Namoi Unregulated and Alluvial Water Sources.</li> </ul>

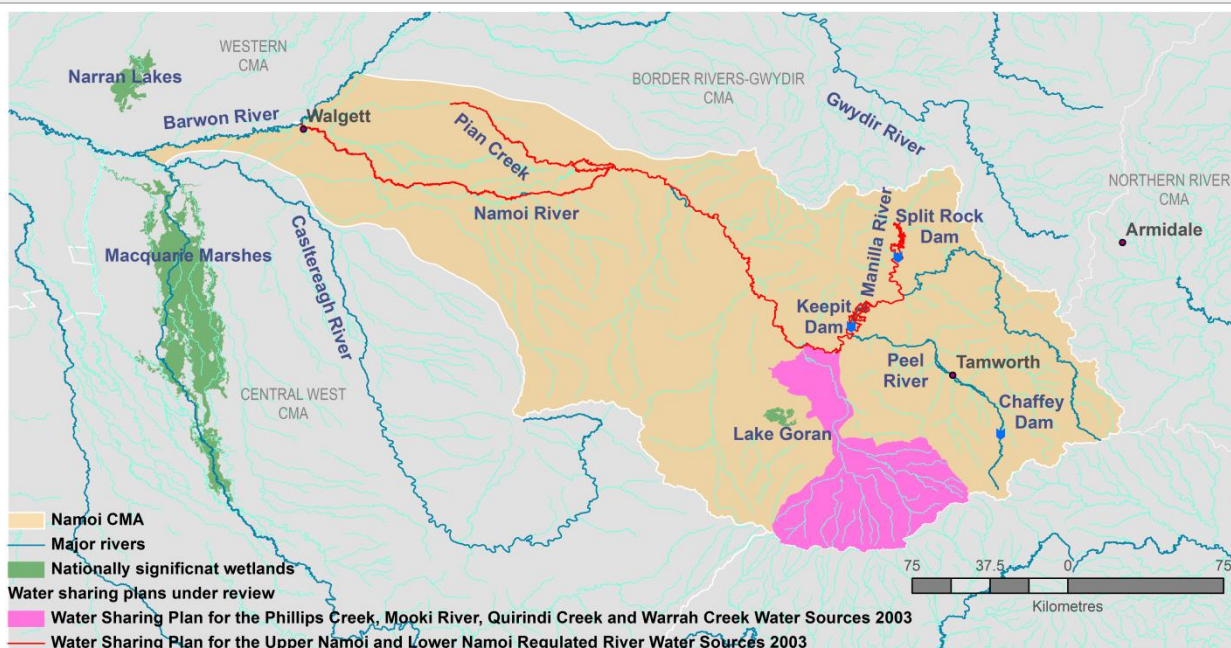


Figure 5: Water sharing plans under review in the Namoi region

### Catchment overview

- **Catchment area:** 42,000 square kilometres.
- **Major waterways:** The Namoi River receives inflows from a number of tributaries, including Cox’s Creek and Mooki, Peel, Cockburn, Manilla and McDonald rivers, upstream of Boggabri township; and Narrabri, Baradine and Boheme creeks downstream of Boggabri. The lower catchment comprises anabranches and effluent channels, including the Pian and Gunidgera creeks.
- **Major water storages:** Keepit, Chaffey and Split Rock dams regulate the Namoi River and its tributaries, the Peel and Manilla rivers. These storages have capacities of 426,000, 62,000 and 397,000 megalitres respectively, and are primarily managed to provide water for irrigation. Chaffey Dam supplements Tamworth’s town water supply.
- **Groundwater:** The region has two high-yielding alluvial aquifers known as the Lower Namoi Groundwater Source and Upper Namoi Groundwater Source, which have good water quality and are used for irrigation. The western part of the Namoi catchment is underlain by aquifers of the Great Artesian Basin, where water is more saline and not suitable for irrigation.
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<sup>51</sup> NSW Department of Water and Energy (2009), *Water sharing in unregulated rivers: progress report 2004 to 2008*. Prepared by the Department of Water and Energy, Sydney.

- **Major towns:** The majority of the region's population resides in the major regional centre of Tamworth, and in the Gunnedah and Narrabri townships. Smaller towns in the region include Barraba, Manilla, Quirindi, Walgett, Wee Waa and Werris Creek.
- **Land use:** The region supports a range of agricultural enterprises. More than 60 per cent of the catchment is used for sheep and cattle grazing.<sup>52</sup> Broadacre crops, wheat and cotton are grown on the floodplain. There are forestry and conservation areas in the middle of the catchment, and there are mining operations near Gunnedah and Narrabri.
- **Major water users:** Water entitlements are primarily held for agricultural production and environmental purposes. Agricultural industries – particularly the irrigation industries that account for 48 per cent of the gross value of agricultural production – rely on surface water and groundwater. The region has one of the highest levels of groundwater extraction in the Murray-Darling Basin, and the highest level of groundwater development.<sup>53</sup> In 2010–11, the greatest volume of water applied for irrigated agricultural production was for cotton (262,837 megalitres).<sup>54</sup> The Australian Government has environmental water holdings in the Namoi valley. As at 31 May 2013, the Commonwealth Environmental Water Office had registered entitlements totalling 6,203 megalitres (general security in the upper and lower Namoi).<sup>55</sup>
- **Water-dependent environmental values:** The Namoi River channel supports a diversity of water-dependent ecosystems, including a number of threatened aquatic species. The regulated reaches of the Namoi River are included in the Darling River Endangered Ecological Community listed under the *Fisheries Management Act 1994* (NSW). More than 1,800 natural wetlands have been mapped in the region.<sup>56</sup> One wetland of national significance, Lake Goran, is located in the Namoi valley. Lake Goran is not a riverfed wetland and therefore is not directly influenced by the 2004 water sharing plans. Lake Goran is mainly filled by large flood events from the Coomoo Coomoo and Yarraman creeks.
- **River health:** The 2008–10 Sustainable Rivers Audit rated the Namoi valley river ecosystem as in poor health.<sup>57</sup>

## Key issues affecting the region's water resources

### Mining and extractive industries

- According to the upgraded Namoi CAP, the community perceives mining and extractive industry development as a key issue with the potential to markedly change the region's social and ecological systems.
- Mining activities and mineral and gas extraction are continuing to expand in the Namoi region, particularly near Gunnedah and Narrabri.<sup>58</sup>
- While the development of coal, mineral and gas operations provide opportunities for economic growth in the region, it also places pressure on the region's natural resources, including water.<sup>59</sup>

### Climatic variability (extremes of drought and flood)

- The Namoi valley was affected by a prolonged drought that resulted in below-average stream flow for nine years between 2001 and 2010. Water sharing plans for the valley were not suspended, despite these conditions. Groundwater resources provided a buffer during the drought conditions.
- The drought affected the gross value of irrigated agricultural production, particularly cotton production. In the midst of the drought, the gross value of irrigated agricultural production fell to \$161.96 million in 2009–10 and increased to \$341.83 million at the end of the drought.<sup>60</sup>

<sup>52</sup> Green, D., Petrovic, J., Moss, R. and Burrell, M. (2011), *Water resources and management overview: Namoi catchment*, NSW Office of Water, Sydney.

<sup>53</sup> Murray-Darling Basin Authority (2010), *Community profile: Namoi irrigation region*. Prepared for the Murray-Darling Basin Authority by Marsden Jacob Associates, May 2010.

<sup>54</sup> Australian Bureau of Statistics (2012), *Gross value of irrigated agricultural production, 2010–11: volume of water applied*. Data source: 4610055008DO002\_201011.

<sup>55</sup> Commonwealth Environmental Water Office (2013), *Commonwealth Environmental Water Holdings*, as at 31 May 2013. [www.environment.gov.au/ewater/about/holdings.html](http://www.environment.gov.au/ewater/about/holdings.html), accessed 5 June 2013.

<sup>56</sup> Eco Logical Australia (2008), *Namoi wetland assessment and prioritisation project*. Prepared for Namoi Catchment Management Authority.

<sup>57</sup> Davies, P., Stewardson, M., Hillman, T., Roberts, J. and Thoms, M. (2013), *Sustainable Rivers Audit 2: The ecological health of the rivers in the Murray-Darling Basin at the end of the Millennium Drought (2008–2010)*, volume 3. Report prepared for the Murray-Darling Basin Authority by the Independent Sustainable Rivers Audit Group.

<sup>58</sup> Murray-Darling Basin Authority (2010), *Community profile: Namoi irrigation region*. Prepared for the Murray-Darling Basin Authority by Marsden Jacob Associates, May 2010.

<sup>59</sup> Namoi CMA (2011), *Namoi Catchment Action Plan 2010–2020*, Prepared by Namoi Catchment Management Authority.

<sup>60</sup> Australian Bureau of Statistics (2012), *Gross value of irrigated agricultural production, 2010–11: GVAI*. Data source: 4610055008DO002\_201011.



## River regulation

- Dams on the Namoi, Peel and Manilla rivers – and weirs along the Namoi River – have significantly altered surface water flows and affected hydrological connectivity.<sup>61</sup>
- The water sharing plans established environmental flow provisions to maintain flows in the lower reaches of the Namoi valley, maintain wetland and floodplain inundation, and retain natural flow variability.

## Contribution to regional targets in the first Namoi CAP

- The Namoi CAP included targets for the region's biophysical assets and socioeconomic well-being.
- The 2004 water sharing plans may have contributed progress towards a number of CAP targets, including:
  - the geographically specific target for improving the suitability of surface water for irrigation, raw drinking water and aquatic ecosystems
  - the target for improving the economic stability and well-being of people in the Namoi catchment.
- From the available information, it is difficult to infer how much water sharing plans have contributed towards CAP targets and whether plan provisions are sustaining water-dependent values. The contribution of water sharing plans to CAP targets was potentially limited during the drought as the dry conditions affected implementation of the water sharing plans, including compliance with extraction limits for the Namoi River. The dry conditions also meant that travel times for flows to move through the system were longer than expected, and limited environmental monitoring of surface waters.<sup>62</sup>
- Although it is difficult to draw conclusions on the extent to which water sharing plans have contributed progress towards CAP targets, the plans may have made a positive contribution towards regional natural resource management and socio-economic outcomes by:
  - protecting low flows in the unregulated Phillips Creek, Mooki River, Quirindi Creek and Warrah Creek Water Sources, through cease-to-pump rules
  - establishing extraction limits in the Upper Namoi and Lower Namoi Regulated River Water Source to preserve flows for maintaining environmental health
  - setting minimum flow targets for the Namoi Regulated River
  - limiting access to supplementary flows for environmental purposes
  - enhancing the tradability of water access licences (permanent trade) and water allocations (temporary trade) that would have helped to buffer economic impacts
  - protecting basic landholder rights to water, also helping to mitigate impacts of the drought.
- The following achievement indicates that the water sharing plan may have positively contributed progress towards CAP targets:
  - The Office of Water's Wetting of Terrestrial Organic Matter project, part of the Integrated Monitoring of Environmental Flows Program, demonstrated that wetting the riparian zone during flooding led to a substantial increase in dissolved organic carbon in aquatic environments, which is important for supporting riverine food webs.<sup>63</sup> This study has helped to build an understanding of the importance of protecting supplementary flow events provided by environmental flow provisions within the water sharing plan.

## Alignment of the upgraded Namoi CAP with water sharing plans

- The Namoi CMA upgraded its CAP in 2010 and prioritised alignment with relevant water sharing plans as part of the strategic planning process.
- The upgraded CAP was informed by a comprehensive suite of spatial data products from the Office of Water, increasing the degree of alignment between the CAP and water plans. For example, the CMA used the agency's mapping of priorities for floodplain functions, geomorphic condition and recovery potential (the River Styles<sup>®</sup> assessment).
- Using this common spatial data helped identify shared priorities for improving river and floodplain health. The CMA elected to focus investment on river reaches that have a good geomorphic condition and where there is a risk to in-stream value from disturbance, physical form or extraction.
- The upgraded CAP also includes critical thresholds that underpin water-themed CAP targets. It defines thresholds for surface-water quantity, geomorphic condition, recruitment of riparian vegetation, beneficial use of

<sup>61</sup> Green, D., Petrovic, J., Moss, P. and Burrell, M. (2011), *Water resources and management overview: Namoi catchment*. NSW Office of Water, Sydney.

<sup>62</sup> NSW Office of Water (2011), *Environmental flow response and socio-economic monitoring: Namoi valley progress report – 2009*, NSW Office of Water, Sydney.

<sup>63</sup> Ibid.

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aquifers, groundwater levels and wetland health. These thresholds provide an important baseline against which change and improvements can be measured.

- The critical thresholds do not appear to be informed by the information used to develop water sharing plans for the Namoi region; the Office of Water questioned the evidence base used to set the thresholds.
- CAP targets for the region's water resources are measurable and relate to the defined critical thresholds. For example, "by 2020, there is an improvement in the condition of those riverine systems that have not crossed defined geomorphic thresholds as at the 2010 baseline".
- Actions defined for each CAP target logically refer to spatial maps, providing a good foundation for communicating priorities. The CAP also identifies delivery partners and lead organisations for each action, clarifying who will participate in implementing the CAP.
- Although the CAP was developed before the Aboriginal Water Initiative was developed, it communicates a clear commitment to improve access to country (including water) for the Aboriginal community.
- The inclusion of clear spatial priorities and targets in the CAP increases the ability to align future water planning with regional natural resource management priorities.

### Future directions

- The CMA is undertaking a number of investigations to address knowledge gaps regarding the hydraulics and operation of the Namoi River and groundwater interactions.
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## Central West

2004 water sharing plans under review (see Figure 6)	
Water sharing plan	Overview
Macquarie and Cudgegong Regulated Rivers Water Source	<ul style="list-style-type: none"> <li>The plan area includes the regulated reaches of the Macquarie and Cudgegong rivers, and Gunningbar, Duck, Crooked and Bulgeraga creeks.</li> <li>The plan was suspended on 27 July 2007, and recommenced 16 September 2011.</li> </ul>
Castlereagh River above Binnaway Water Source (unregulated)	<ul style="list-style-type: none"> <li>The plan area includes the Castlereagh River and its tributaries to the town of Binnaway. The area comprises six management zones.</li> <li>The Office of Water (formerly the Department of Water and Energy) has assessed this water source as having a medium community dependence on extraction, and a low environmental risk.<sup>64</sup></li> <li>The Office of Water is considering merging this plan with the Water Sharing Plan for the Castlereagh (below Binnaway) Water Source.</li> </ul>

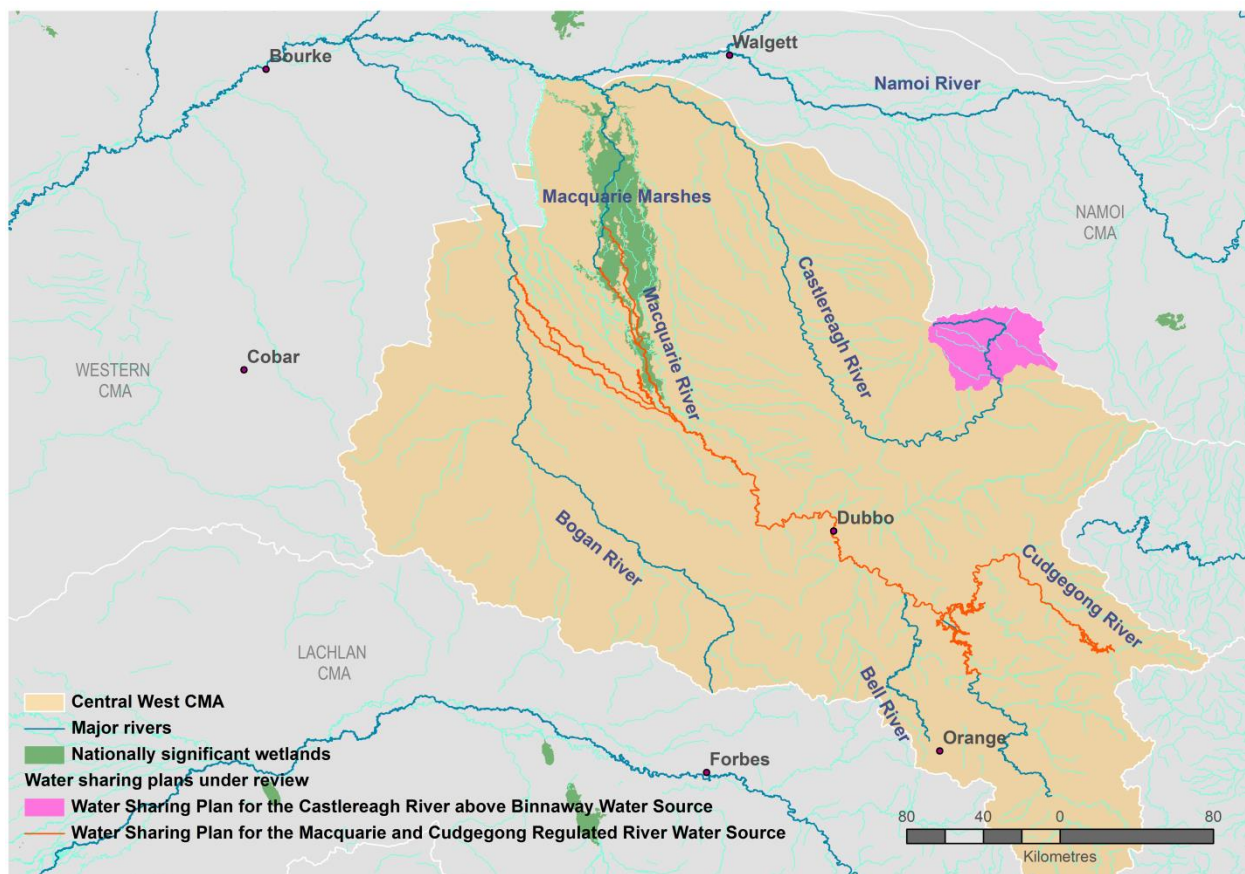


Figure 6: Water sharing plans under review in the Central West region

### Catchment overview

- Catchment area:** 84,842 square kilometres.
- Major waterways:** The catchment includes the Castlereagh, Bogan and Macquarie river valleys. The Castlereagh is an unregulated system, whereas the Macquarie-Bogan valley is heavily regulated. The Macquarie River receives inflows from its major tributary, the Cudgegong River, at Burrendong Dam. The unregulated reaches of the Cudgegong River receive inflows from Lawsons, Wyaldra and Meroo Creeks, while the Macquarie River receives significant unregulated inflows from Bell, Little and Talbragar rivers.

<sup>64</sup> NSW Department of Water and Energy (2009), *Water sharing in unregulated rivers: progress report 2004 to 2008*. Prepared by the NSW Department of Water and Energy, Sydney.

- **Major water storages:** Burrendong and Windamere dams are the largest water storages in the catchment, with capacities of 1,190,110 and 353,000 megalitres respectively. These dams regulate flows in the Macquarie and Cudgegong rivers, and are primarily managed to provide irrigation water and flood mitigation. Smaller water storages such as Oberon, Ben Chifley and Suma Park dams provide town water supply for Oberon, Lithgow, Bathurst and Orange.
- **Groundwater:** Alluvial aquifers are an important source of groundwater in the Macquarie and Castlereagh valleys, for stock, domestic, irrigation and town water supplies. The upper catchment of the Macquarie and Bogan systems is underlain by low-yielding fractured rock, while the alluvial aquifers in the Bogan catchment are low-yielding and of a poor quality for consumptive use.
- **Major towns:** Major towns include Dubbo, Bathurst, Orange and Oberon in the Macquarie-Bogan valley, and Coonabarabran, Gilgandra and Coonamble in the Castlereagh valley.
- **Land use:** The region supports a range of agricultural enterprises. More than 80 per cent of the catchment is used for grazing. Dryland cropping and irrigated agriculture occur in the Macquarie-Bogan valley. Grapes for wine production are grown in Mudgee and Orange districts.<sup>65</sup>
- **Major water users:** In the Castlereagh valley, water is primarily used for stock watering, dryland agriculture and town water supply. Water entitlements in the Macquarie-Cudgegong system are held for agricultural production and environmental purposes. Water use for agricultural production primarily comprises private irrigation schemes, particularly around Dubbo, Narromine and Warren, predominantly for growing cotton if adequate water is available. In 2010–11, the greatest volume of water applied for irrigated agriculture was used for cotton production (141,813 megalitres).<sup>66</sup> The Australian and NSW governments have environmental water holdings in the Macquarie-Cudgegong system. As at the 31 May 2013, the Commonwealth Environmental Water Office had registered entitlements totalling 116,430 megalitres.<sup>67</sup> As at 31 October 2012, the NSW Office of Environment and Heritage had 48,419 megalitres of general security, 1,451 megalitres of supplementary access, 2,980 megalitres of unregulated holdings under various water recovery programs.<sup>68</sup>
- **Water-dependent environmental values:** The regulated reaches of the Macquarie, Cudgegong, Castlereagh and Bogan rivers form part of the Darling River Endangered Ecological Community listed under the *Fisheries Management Act 1994* (NSW). The Macquarie River system supports a diversity of water-dependent ecosystems including the Ramsar-listed Macquarie Marshes and eight other nationally significant wetlands.
- **River health:** The 2008–10 Sustainable Rivers Audit rated the Castlereagh valley and Macquarie valley river ecosystems as in poor and very poor health respectively.<sup>69</sup>

## Key issues affecting the region's water resources

### River regulation

- Regulation of the Macquarie River by Burrendong Dam and a series of weirs have reduced the frequency and duration of low- to medium-flow events reaching the Macquarie Marshes.<sup>70</sup>
- Provisions in the 2004 water sharing plan for the Macquarie and Cudgegong Regulated Rivers Water Source support the delivery of environmental water to the Macquarie Marshes in a more variable and nearer-to-natural way.

### Climatic variability (extremes of drought and flood)

- The Macquarie-Bogan valley was affected by a prolonged drought for nine years until 2010, when above-average annual flows were recorded.
- During the drought, the gross value of irrigated agricultural production fell to \$144.15 million (in 2009–10) and increased to \$191.89 million towards the end of the drought when there was improved confidence in water availability and trade (in 2010–11)<sup>71</sup>.

<sup>65</sup> Green, D., Petrovic, J., Moss, P. and Burrell, M. (2011), *Water resource and management overview: Macquarie-Bogan catchment*. NSW Office of Water, Sydney.

<sup>66</sup> Australian Bureau of Statistics (2012), *Gross value of irrigated agricultural production, 2010–11: volume of water applied*. Data source: 4610055008DO002\_201011.

<sup>67</sup> Commonwealth Environmental Water Office (2013), *Commonwealth Environmental Water Holdings*, as at 31 May 2013. [www.environment.gov.au/ewater/about/holdings.html](http://www.environment.gov.au/ewater/about/holdings.html), accessed 5 June 2013.

<sup>68</sup> NSW Office of Environment and Heritage (2013), *NSW Environmental Water Holdings to 31 October 2012*. [www.environment.nsw.gov.au/environmentalwater/waterpurchase.htm](http://www.environment.nsw.gov.au/environmentalwater/waterpurchase.htm), accessed 5 June 2013.

<sup>69</sup> Davies, P., Stewardson, M., Hillman, T., Roberts, J. and Thoms, M. (2013), *Sustainable Rivers Audit 2: The ecological health of the rivers in the Murray-Darling Basin at the end of the Millennium Drought (2008–2010)*, volume 3. Report prepared for the Murray-Darling Basin Authority by the Independent Sustainable Rivers Audit Group.

<sup>70</sup> Hogendyk, G. (2007), *The Macquarie Marshes: an ecological history*. Institute of Public Affairs, Occasional Paper, September 2007.

## Contribution to regional targets in the first Central West CAP

- The Central West CAP included a number of river, wetland and groundwater targets that may have been influenced by implementing the 2004 water sharing plans currently under review.
- Priority areas associated with a number of these targets spatially align with the 2004 water sharing plans or provisions within these plans. For example, the CAP included:
  - a target for maintaining and improving the health of the Ramsar-listed Macquarie Marshes (and other important wetlands), while the water sharing plan for the Macquarie and Cudgegong Regulated Rivers contains provisions for improving environmental outcomes in the Macquarie Marshes
  - a water quality and salinity target for specific points along the river that may be influenced by flows made available as a result of both of the water sharing plans under review.
- However, based on available information, it is difficult to infer how water sharing plans have contributed progress towards CAP targets and whether plan provisions are sustaining water-dependent values.
- The water sharing plans may have contributed progress towards river and wetland targets for the region by:
  - establishing water extraction limits for the Macquarie and Cudgegong Regulated River Water Sources, allowing approximately 73 per cent of flows in the river to be protected for environmental purposes
  - accruing and releasing water from environmental water allowance accounts
  - establishing cease-to-pump rules (in the water sharing plan for the Castlereagh River above Binnaway Water Source).
- Environmental releases from the Macquarie and Cudgegong Regulated River water sharing plan's environmental water allowance accounts delivered environmental outcomes while the plan was active and suspended. For example:
  - releases in 2005–06 led to successful waterbird breeding before the plan was suspended.
  - releases in 2007–08, when the plan was suspended, helped to mitigate the impacts of drought on wetland health, with two releases supporting the Macquarie Marshes and waterbird breeding.

## Alignment of the upgraded Central West CAP with water sharing plans

- The Central West CMA used the CAP upgrade as an opportunity to improve alignment of the plan with the region's water sharing plans.
- Alignment with water sharing plans was based on the pilot catchment and water planning alignment project undertaken for the Hunter region (which used the River Condition Index).
- At the time it developed the CAP, the Central West CMA found that the Office of Water's River Condition Index mapping did not provide the scale or coverage needed to identify priorities based on risks to in-stream values. As a result, the Office of Water's River Styles® mapping provided the spatial data for identifying priority river reaches.
- The CAP upgrade contributed to successful alignment with water planning by:
  - applying an alignment logic that identified common objectives for river health
  - spatially mapping shared priorities for improving river health, based on shared data (priority river reaches were identified from the Office of Water's River Styles® mapping)
  - recognising factors that contribute to CAP and water sharing plan implementation, such as a focus on river rehabilitation and protection, knowledge generation, effective community engagement, and robust monitoring and assessment
  - including clear goals and measurable targets that complement water sharing plans; for example, targets for maintaining priority wetlands and rivers in good condition.
- The upgraded CAP also appropriately identifies that water sharing plans contribute to managing priority river reaches and groundwater-dependent ecosystems.
- Furthermore, listing CAP delivery partners against priority actions for water-related targets clarifies who is responsible implementing the CAP.
- An integrated approach to improving river health means that the CMA and the Office of Water have a common set of maps for informing investment, and a clear understanding of CAP roles and functions.<sup>72</sup> For example, the CAP guides investment in river rehabilitation, while the water sharing plans limit water extraction.

<sup>71</sup> Australian Bureau of Statistics (2012), *Gross value of irrigated agricultural production, 2010–11: GVAI*. Data source: 4610055008DO002\_201011.

<sup>72</sup> Central West CMA (2011), *Central West Catchment Action Plan Support Document 2011–2021, Section 5: Alignment of government plans and policies*. [cw.cma.nsw.gov.au/AboutUs/2011capconsultation.html](http://cw.cma.nsw.gov.au/AboutUs/2011capconsultation.html), accessed 3 May 2013.

## Future directions

- The CAP recognises a gap in knowledge about the region’s groundwater-dependent ecosystems. It also includes an action to identify priority groundwater-dependent ecosystems, and to understand their resilience and interactions with groundwater.
  - This action corresponds with research being undertaken by the Office of Water to better understand groundwater-dependent ecosystems and inform water sharing plans. This research will provide a good foundation for aligning water management activities and shared investment.
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## Western

### 2004 water sharing plans under review (see Figure 7)

Water sharing plan	Overview
NSW Murray and Lower Darling Regulated River water sources	<ul style="list-style-type: none"> <li>The plan area comprises the Murray River from Hume Dam to the South Australian border, and the Darling River from Lake Wetherell (Menindee Lakes) to the upper limit of the Wentworth Weir Pool.</li> <li>The plan was suspended on 10 November 2006, and recommenced on 16 September 2011.</li> <li>Inter-valley and inter-state trading restrictions were introduced due to limited water availability and associated difficulties delivering purchased water.<sup>73</sup></li> </ul>

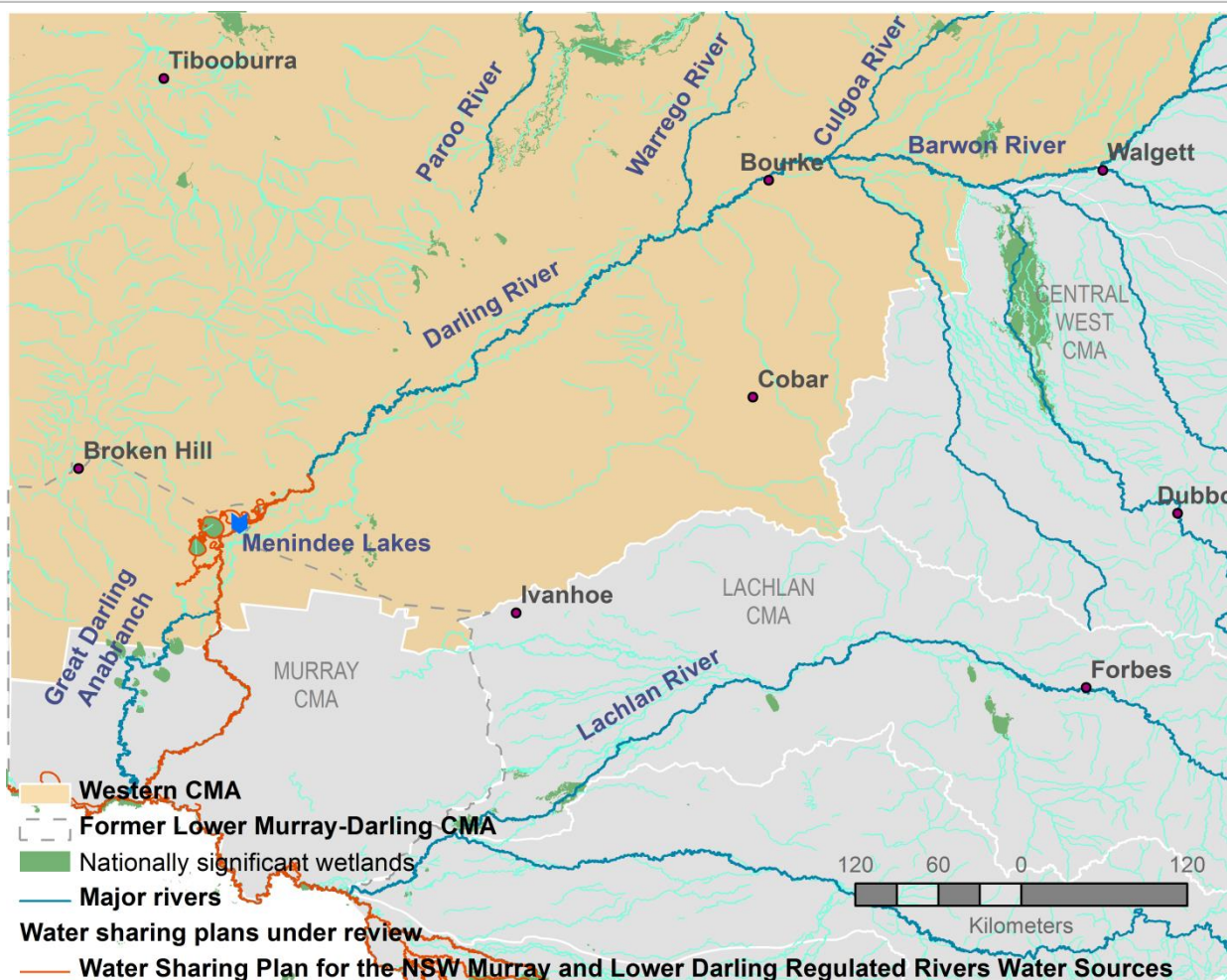


Figure 7: Water sharing plans under review in the Western region

### Catchment overview

- Catchment area:** 250,000 square kilometres. The region recently incorporated approximately 20,000 square kilometres from the former Lower Murray-Darling CMA region (see Figure 7).
- Major waterways:** The region comprises a number of river systems including the Barwon-Darling, Culgoa, Paroo, Warrego, Narran, Bokhara, Birrie and Bulloo Overflow systems, and part of the Bogan River.
- Major water storages:** The region includes the Menindee Lakes complex located near Broken Hill. Menindee Lakes comprises four large natural lakes and several smaller interconnected lakes that have been modified for

<sup>73</sup> NSW Office of Water (2013), *Audit of implementation - Regulated river water sharing plan audit report cards. Prepared for the period between 1 July 2009 and 30 June 2012.* NSW Office of Water, Sydney..

water storage. The lakes supply town water to Broken Hill, irrigation in the Lower Darling River; stock and domestic requirements along the Darling Anabranch; and supplement flows to the River Murray. They have a combined storage capacity of 1,731,000 megalitres.

- **Groundwater resources:** There is a high reliance on groundwater from the Great Artesian Basin as levels in surface water storages are unpredictable in the semi-arid to arid conditions experienced in the Western region. Groundwater is a source of stock and domestic water across much of the catchment.
- **Major towns:** Major regional centres include Bourke, Broken Hill, Cobar, Lightning Ridge, Walgett, Wilcannia and Brewarrina.
- **Land use:** The Western region comprises an extensive rangelands system that is primarily used for grazing for sheep, cattle and goats. Dryland and irrigated agriculture, mining, tourism and nature conservation also occur in the Western region.
- **Major water users:** The water resources of the Western region support livestock grazing and irrigated agriculture. Surface water from the Barwon-Darling river system provides water for town supply and supports irrigated agriculture including cotton, citrus, grapes and vegetables. In 2010–11, cotton production had the highest volume of water used for irrigated agricultural production (82,343 megalitres).<sup>74</sup> The Australian government holds water entitlements for environmental purposes. As at 31 May 2013, the Commonwealth Environmental Water Office had registered entitlements totalling 22,275 megalitres in the Barwon-Darling system and 17,826 in the Warrego river system.<sup>75</sup>
- **Water-dependent environmental values:** The riverine habitats and diverse wetland types of the Western region provide habitat and refuge for a variety of native flora and fauna, including migratory birds. The region also includes the Darling River Endangered Ecological Community listed under the *Fisheries Management Act 1994* (NSW). There are nationally and internationally important wetlands throughout the region's landscapes, including several wetlands listed under the Directory of Important Wetlands in Australia, and three Ramsar-listed wetlands (Paroo River Wetlands, Lake Pinaroo (Fort Grey Basin) and Narran Lakes).
- **River health:** The 2008–10 Sustainable Rivers Audit rated the Warrego, Paroo and Darling river valleys as in moderate, good and poor health respectively.<sup>76</sup>

## Key issues affecting the region's water resources

### River regulation

- The majority of the rivers in the northern part of the Western CMA region are unregulated.
- Menindee Lakes storages regulate flows downstream to the Darling River and to the Darling Anabranch.
- The large storage system provides water for NSW, Victoria and South Australia, so sharing water between these states – for consumption and environmental purposes – is a key management issue.
- The storage system forms part of the water sharing plan for the NSW Murray and Lower Darling Regulated Rivers. Plan provisions stipulate how releases from this storage system may be made for environmental and consumptive purposes.

### Climatic variability (extremes of drought and flood)

- The region was affected by a severe drought between 2001 and 2010, which resulted in extremely low river flows.
- Limited water availability meant that the water sharing plan for NSW Murray and Lower Darling Regulated Rivers was suspended and critical water planning arrangements took effect to protect town water supply, critical industries and river health.
- The water sharing plan recommenced on 16 September 2011, when water availability had improved. Flooding during 2010–11 led to the surcharge of Menindee Lakes over 2011–12. Storages were drawn down during the irrigation season; however, another flood in April 2012 returned the storages to a surcharged volume.<sup>77</sup>

<sup>74</sup> Australian Bureau of Statistics (2012), *Gross value of irrigated agricultural production, 2010–11: GVAI*. Data source: 4610055008DO002\_201011.

<sup>75</sup> Commonwealth Environmental Water Office (2013), *Commonwealth Environmental Water Holdings*, as at 31 May 2013. [www.environment.gov.au/ewater/about/holdings.html](http://www.environment.gov.au/ewater/about/holdings.html), accessed 5 June 2013.

<sup>76</sup> Davies, P., Stewardson, M., Hillman, T., Roberts, J. and Thoms, M. (2013), *Sustainable Rivers Audit 2: The ecological health of the rivers in the Murray-Darling Basin at the end of the Millennium Drought (2008–2010)*, volume 3. Report prepared for the Murray-Darling Basin Authority by the Independent Sustainable Rivers Audit Group.

<sup>77</sup> Burrell, M., Moss, P., Nguyen, K., Petrovic, J. and Ali, A., (2012), *General purpose water accounting report 2011–2012: Lower Darling Catchment*, NSW Department of Primary Industries, Sydney.



### Contribution to regional targets in the first Western CAP

- The majority of the NSW Murray and Lower Darling Regulated River Water Sharing Plan area falls within the Murray CMA region, with a small portion falling in the Western CMA region.
- There has been no assessment of the water sharing plan's contribution to targets in the Western CAP as the portion of the water sharing plan area that falls within the Western CMA region was formerly in the Lower-Murray Darling CMA region (see Figure 7). The northern part of the Lower Murray-Darling CMA area was incorporated into the Western CMA in October 2012 as part of CMA amalgamations.
- The likely effectiveness of this plan has been substantively covered in the assessment against the original Murray Catchment Action Plan.

### Alignment of the upgraded Western CAP with water sharing plans

- The draft Western CAP effectively aligns with water planning targets through a suite of maps of river and wetland priorities that are based on shared data.
- The CMA worked collaboratively with the Office of Water, Fisheries NSW and the Office of Environment and Heritage to identify priorities for the region's aquatic systems, and indicators of success.
- The draft CAP includes a map of high-value aquatic assets, including biodiversity hotspots and in-stream values derived from data provided by NSW Fisheries and the Office of Water. High-priority areas are defined as those areas with high fish biodiversity, threatened fish and/or high in-stream values.
- Priority river reaches for investment are mapped in the draft CAP, based on a common set of data from the Office of Water (the River Styles® assessment, which maps geomorphic condition and recovery potential).
- The draft CAP also includes a map of interim priority wetlands derived from community-identified priority wetlands, Ramsar-listed sites, and sites listed on the Directory of Important Wetlands in Australia.
- These maps provide a strong foundation for understanding where actions need to occur to achieve draft CAP goals and targets, and water sharing plan objectives.
- The draft CAP also includes water-related targets of which two are measurable; however, these targets do not strongly relate to the spatial priorities expressed in the mapping.
- Delivery partners are listed against each CAP goal. The collaborative relationships between the CMA and these delivery partners should lead to effective CAP implementation.

### Future directions

- The CMA's draft CAP demonstrates a commitment to future water planning by providing information on high-value river reaches as part of the water sharing plan process.

## Coastal catchments

### Southern Rivers

#### 2004 water sharing plans under review (see Figure 8)

Water sharing plan	Overview
Kangaroo River Water Source (unregulated)	<ul style="list-style-type: none"> <li>The plan covers the Kangaroo River and its tributaries (including but not limited to Barrengarry and Brogers creeks) to a flow reference point near the Kangaroo Valley township.</li> <li>The Office of Water (formerly the Department of Water and Energy) has assessed this water source as having a high community dependence on extraction, and a high environmental risk.<sup>78</sup></li> <li>Field verification of ecological health found that the plan’s cease-to-pump rules should be increased to maintain fundamental ecosystem health.<sup>79</sup></li> <li>The Office of Water is considering merging this plan into the Water Sharing Plan for the Greater Metropolitan Region Unregulated Water Sources.</li> </ul>
Wandella Creek Water Source (unregulated)	<ul style="list-style-type: none"> <li>The plan area encompasses Wandella Creek and its tributaries, to the confluence with the Tuross River.</li> <li>The Office of Water (formerly the Department of Water and Energy) has assessed this water source as having a medium community dependence on extraction, and a low environmental risk.</li> <li>Field verification of the plan’s low flow provisions has commenced.<sup>80</sup></li> <li>The Office of Water is considering merging this plan into the Water Sharing Plan for the Tuross Unregulated and Alluvial Water Sources.</li> </ul>



Figure 8: Water sharing plans under review in the Southern Rivers region

<sup>78</sup> NSW Department of Water and Energy (2009), *Water sharing in unregulated rivers: progress report 2004 to 2008*. Prepared by the NSW Office of Water, Sydney.

<sup>79</sup> NSW Office of Water (2013), *Audit of implementation - Unregulated river water sharing plan audit report cards*. Prepared for the period between 1 July 2009 and 30 June 2012. NSW Office of Water, Sydney.

<sup>80</sup> Ibid.

## Catchment overview

- **Catchment area:** 29,000 square kilometres, extending three nautical miles offshore.
- **Major waterways:** The region includes the Minnamurra, Kangaroo, Bega, Shoalhaven, Clyde, Deua, Tuross, Brogo, Moruya, Bemboka Towamba, Genoa and Snowy rivers.
- **Major water storages:** The majority of rivers in the Southern Rivers region are unregulated. However, there are storages in the Snowy catchment (the Snowy Hydroelectric Scheme), along the Shoalhaven River (Tallowa Dam), and the Brogo Dam, which services the regulated Brogo River and the Lower Bega River.
- **Groundwater:** Fractured rock aquifers in the Bega valley are generally low-yielding. The highest utilised aquifer in the Bega valley is an alluvial aquifer (Bega Sands borefield). Water is drawn from the alluvial aquifer for irrigation and town water supply.<sup>81</sup>
- **Land use:** The region includes large areas of public land used for conservation, tourism and forestry. A number of agricultural enterprises operate in the region, including dairy and beef, and oysters leases and fishing around the region's estuaries. Grazing for wool production, prime lamb and beef production occurs on the tablelands and foothills of coastal catchments.
- **Major water users:** Water is primarily used for industrial, agricultural and residential purposes. Irrigation in the Bega valley is mostly used to produce pasture for dairy farming. For 2010–11, the greatest volume of water applied for irrigated agriculture was to grow pasture for livestock grazing (11,166 megalitres).<sup>82</sup>
- **Water-dependent environmental values:** The rivers, estuaries, marine waters and wetlands of the region hold significant environmental, cultural, recreational and economic values, including providing habitats for a number of threatened species such as the endangered Macquarie perch. The region includes several wetlands of national significance, including Waldron's Swamp and Nargal Lake, which are the only two examples of coastal lagoons on sand plains listed on the Directory of Important Wetlands in Australia.<sup>83</sup> The region also includes the Ramsar-listed Blue Lake, which is situated in Kosciuszko National Park; and Brogo River, which is declared as a wild river in near-pristine condition and is protected under the *National Parks and Wildlife Act 1974* (NSW).

## Key issues affecting the region's water resources

### River regulation

- The majority of the coastal rivers in the Southern Rivers region are unregulated.
- However, several systems have storages to secure town water supply (Shoalhaven River), support hydroelectric power production (the Snowy River) and irrigation (Brogo and Lower Bega rivers).

### Population growth

- Population growth may place pressure on the region's water resources and is an important consideration in water resource planning for the Southern Rivers region, particularly considering the growth of coastal towns and rural development.

### Adequate environmental flows

- According to the upgraded Southern Rivers CAP, delivering environmental flows to support river health is a priority for the region.
- The water sharing plans for the region's water resources include environmental flow provisions to support the health of the region's rivers.

### Climate variability

- Past drought conditions have had significant adverse impacts on the communities and environmental assets of the Southern Rivers region.
- As most of the rivers in the region are unregulated, water users rely on natural flows that were very low during the 1998–2010 drought. Extraction limits and low flow (cease-to-pump) thresholds in the unregulated river water sharing plans were designed to protect environmental values during such low-flow conditions.

### Streambank erosion

- According to the upgraded Southern Rivers CAP, damage to sensitive riverbank vegetation and streambed erosion are important management issues for the region, and have reduced water quality in a number of coastal streams.

<sup>81</sup> NSW Office of Water (2011), *Water Sharing Plan for the Bega and Brogo Rivers Area Regulated, Unregulated and Alluvial Water Sources – Background*. Prepared by the NSW Office of Water, Sydney.

<sup>82</sup> Australian Bureau of Statistics (2012), *Agricultural census 2011: water use on Australian farms, 2010–11*. Data source: 46180DO018\_201011.

<sup>83</sup> Southern Rivers CMA (2013), *Southern Rivers Catchment Action Plan 2023 Paper: Water*. Technical paper prepared for the Southern Rivers Catchment Action Plan upgrade.

### Contribution to regional targets in the first Southern Rivers CAP

- The CAP included a suite of biophysical targets for the region's rivers, wetlands, estuaries and groundwater resources. A limited number of these targets are geographically defined.
- The water sharing plans for Wandella Creek and Kangaroo River water sources may have contributed towards achieving river and wetland targets, and potentially groundwater targets (to the extent that surface water-groundwater interactions exist within the plan areas).
- Based on the available information, it is difficult to draw conclusions on the benefits these water sharing plans have had regarding river, wetland and groundwater CAP targets; however, the plans may have helped improve water quality, stream habitat and ecosystem condition by:
  - establishing cease-to-pump rules
  - protecting planned environmental water through licensing.
- However, limited ecological and flow monitoring diminishes confidence in the potential contribution these water sharing plans may have made towards achieving CAP targets.
- The operation of the Kangaroo River and Wandella Creek water sharing plans may have positively contributed to broad socioeconomic outcomes in the region by:
  - establishing temporary and permanent water license trading in both water sharing plan areas
  - introducing rules and regulations pertaining to water allocation, which may have positively contributed to the income of irrigators with a high dependency on water for farming, especially in the Kangaroo River Water Source.

### Alignment of the upgraded Southern Rivers CAP with water sharing plans

- The recent upgrade of the Southern Rivers CAP, combined with the CMA's previous experience developing water sharing plans, provided a good platform for aligning catchment and water planning.
- The CMA used its knowledge of water sharing plans to map out which water sharing plan objectives are relevant to the CAP, and worked collaboratively with the Office of Water to identify riverine priorities for the region.
- The CMA adopted the Office of Water's River Styles® data (assessment of geomorphic condition and recovery potential) to identify spatial priorities, and defined which river reaches are a priority for river works. This mapping could be improved by incorporating in-stream values from the Office of Water.
- The CAP also includes a map of fish biodiversity hotspots, as well as prioritised barriers to fish passage and estuary management priorities that have been developed using agency data (from NSW Fisheries and the Office of Environmental and Heritage).
- The CAP target for maintaining and improving the condition of priority freshwater, estuarine and marine assets clearly relates to mapped spatial priorities, and is also underpinned by a strategy for equitably sharing water between people and the environment, which will be realised by implementing current and future water sharing plans.
- Strategies in the CAP also support ongoing information sharing, which will be fundamental for improved alignment between catchment and water planning.
- In summary, the CAP demonstrates a good understanding of the role of water sharing plans in supporting environmental values and consumptive users, and is well aligned with these values, as evidenced by clear spatial mapping that can inform future water planning.
- However, CAP targets are qualitative and would be more measurable if they were more specific. Measurability is important for assessing the contribution of water sharing plans towards the achievement of CAP targets.

### Future directions

- Alignment between CMA and Office of Water priorities could be improved by incorporating in-stream value mapping to identify high-value and high-risk water sources (or river reaches).
- The CMA should negotiate detailed roles and responsibilities for actions as part of the CAP implementation process.

## Hunter-Central Rivers

### Water sharing plans under review (see Figure 9)

Water sharing plan	Overview
Hunter Regulated River Water Source	<ul style="list-style-type: none"> <li>The plan area comprises the regulated reaches of the Hunter River and its tributaries, from the upper storage limit of Glennies Creek and Glenbawn Dam water storages to the Hunter River estuary (near Greta).</li> <li>The plan was suspended on 29 November 2006, and recommenced on 20 February 2009.</li> <li>While the plan was suspended, limits on extraction were relaxed and minimum daily flow targets were reduced in recognition of the level of inflows to the estuary during a flood in 2007, and to help offset restrictions on allocations from the dams.<sup>84</sup></li> <li>A key consideration when the plan was suspended was the reliability of supply for industry, in particular for power generation.</li> </ul>
Jilliby Jilliby Creek Water Source (unregulated)	<ul style="list-style-type: none"> <li>The plan area includes Jilliby Jilliby Creek and its tributaries upstream of the junction with the Wyong River.</li> <li>The Office of Water (formerly the Department of Water and Energy) has assessed this water source as having high community dependence and a medium environmental risk.<sup>85</sup></li> <li>Flows in Jilliby Jilliby Creek did not reach cease-to-pump levels during the drought conditions between July 2004 and June 2008.</li> <li>The Office of Water is considering merging this plan into the Water Sharing Plan for the Central Coast Unregulated Water Sources.</li> </ul>
Karuah River Water Source (unregulated)	<ul style="list-style-type: none"> <li>The plan area includes the Telegherry, Upper Karuah, Mid Karuah, Mammy Johnsons and Lower Karuah rivers.</li> <li>The Office of Water has assessed the management zones that comprise the water source. The Upper Karuah zone was assessed as having a medium community dependence and high environmental risk; the Mammy Johnsons and Central Karuah zones were assessed as having medium community dependence and medium environmental risk; and the Lower Karuah and Port Stephens zones were assessed as having a low community dependence and low environmental risk.</li> <li>The Office of Water is considering merging this plan into the Water Sharing Plan for the Lower North Coast Unregulated and Alluvial Water Sources.</li> </ul>
Ourimbah Creek Water Source (unregulated)	<ul style="list-style-type: none"> <li>The plan includes Ourimbah Creek and its tributaries, to the Wyong Council Downstream Weir.</li> <li>The Office of Water has assessed this water source as having high community dependence and a low environmental risk.</li> <li>The plan was suspended on 22 December 2006 when rules were relaxed to address a critical water shortage for the Gosford-Wyong Joint Water Supply, and recommenced on 9 April 2010.</li> <li>The Office of Water is considering merging this plan into the Water Sharing Plan for the Central Coast Unregulated Water Sources.</li> </ul>
Tomago Tomaree Stockton Groundwater Sources	<ul style="list-style-type: none"> <li>The Tomago, Tomaree and Stockton Groundwater Sources are coastal sand aquifers covering an area of 275 square kilometres.</li> <li>The Office of Water is considering merging this plan into the Water Sharing Plan for the North Coast Coastal Sands Groundwater Sources.</li> <li>A number of studies have been undertaken to ascertain sustainable levels of groundwater extraction.<sup>86</sup></li> </ul>

<sup>84</sup> NSW Department of Water and Energy (2009), *Water sharing in the Hunter Regulated River: progress report 2004 to 2008*. Prepared by the NSW Department of Water and Energy, Sydney.

<sup>85</sup> NSW Department of Water and Energy (2009), *Water sharing in unregulated rivers: progress report 2004 to 2008*. Prepared by the NSW Department of Water and Energy, Sydney.

<sup>86</sup> Ibid.

Wybong Creek Water Source (unregulated)	<ul style="list-style-type: none"> <li>▪ The plan area includes Wybong Creek and its tributaries to a flow reference point upstream from the junction of Wybong Creek and Goulburn River.</li> <li>▪ The Office of Water has assessed this water source as having high community dependence and a low environmental risk.</li> <li>▪ The plan was suspended on 18 August 2006 due to drought conditions and the impacts of cease-to-pump rules on licences extractors (irrigators were subject to these conditions for more than 200 consecutive days).</li> <li>▪ The plan has remained suspended and amendments to these rules have been proposed.</li> <li>▪ Between 2005 and 2008, the Wybong Creek plan area experienced the highest permanent trading (based on megalitres traded) of any of the 20 unregulated plans that commenced in 2004.</li> <li>▪ The Office of Water is considering merging this plan into the Water Sharing Plan for the Hunter Unregulated and Alluvial Water Sources.</li> </ul>
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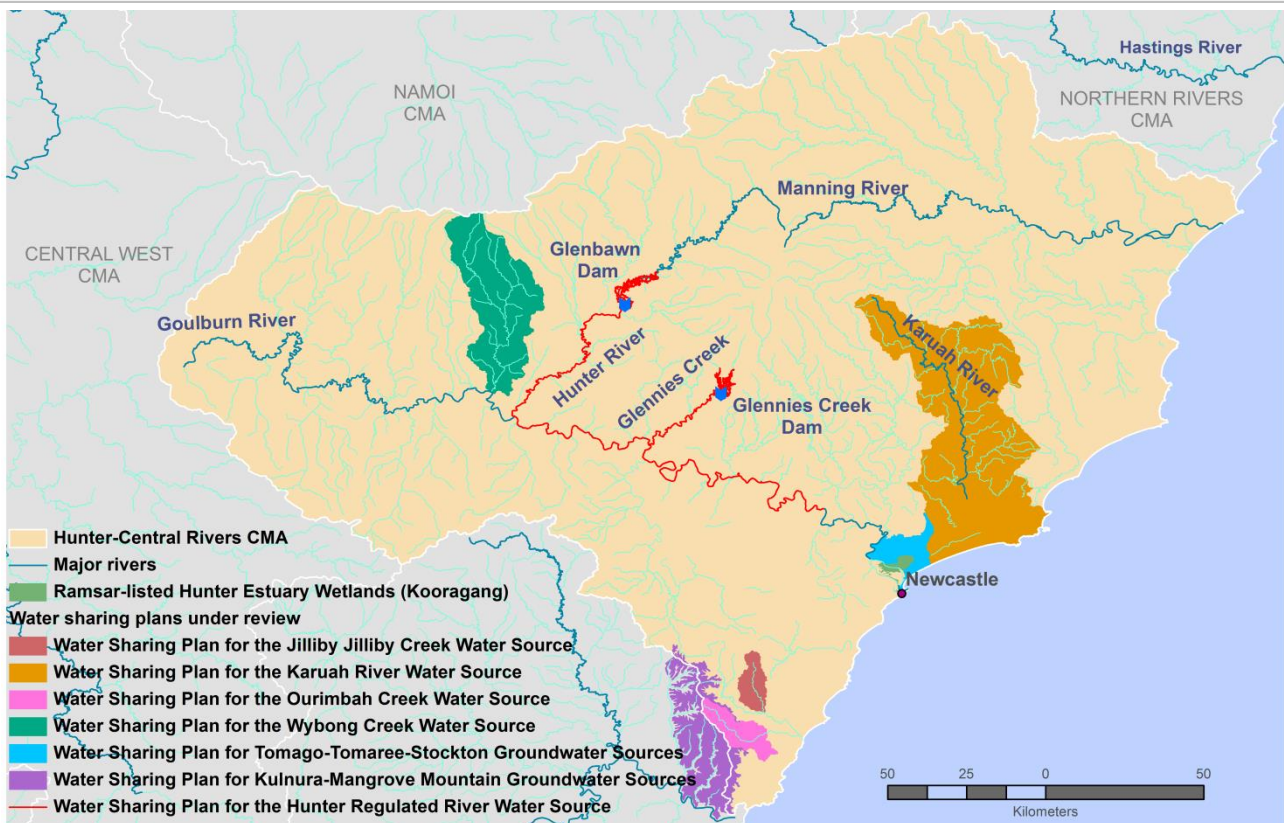


Figure 9: Water sharing plans under review in the Hunter-Central Rivers region

### Catchment overview

- **Catchment area:** Approximately 37,000 square kilometres.
- **Major waterways:** Major waterways in the region include the unregulated Manning and Karuah rivers, and the regulated Hunter River and its major tributaries the Goulburn, Paterson and Williams rivers.
- **Major water storages:** Glenbawn Dam on the Hunter River and Glennies Creek Dam are the largest water storages in the catchment, with capacities of 749,840 and 283,000 megalitres respectively.
- **Groundwater:** Groundwater sources in the Hunter-Central Rivers region include alluvial aquifers and sand aquifers on the coastal fringe (such as the Tomago, Tomaree and Stockton sand aquifers), and porous rock aquifers associated with the Sydney Basin.
- **Major towns:** Major towns include the city of Newcastle, and regional centres of Maitland, Muswellbrook,

Singleton, Scone and Raymond Terrace.

- **Land use:** The catchment supports agricultural industries, forestry, mining and urban development. Around 44 per cent of the region is managed for grazing of modified pastures, 8 per cent is managed for forestry, and over 17 per cent of the catchment is reserve.<sup>87</sup> Coal mining mainly takes place on the central valley floor.
- **Major water users:** Major water users in the region include power generation, agriculture (grazing, cropping, dairy, viticulture, horticulture and equine), mining and extractive industries, town water supply, fisheries, aquaculture, forestry and tourism. The largest water user in the region is Macquarie Generation, which requires an annual average of 72,000 megalitres to operate Bayswater and Liddell Power Stations.<sup>88</sup> In 2010–11, the greatest volume of water applied for irrigated agriculture was for livestock grazing (48,404 megalitres).<sup>89</sup>
- **Water-dependent environmental values:** The Hunter River and its tributaries hold significant environmental and cultural values, as does the Hunter River estuary. Wetlands of national and international significance, including the Ramsar-listed Hunter River Wetlands, are located in the catchment.

## Key issues affecting the region's water resources

### River regulation

- The Hunter River, and key tributaries such as the Paterson and Williams rivers, are regulated by a series of dams and weirs that have altered the freshwater inflows that reach the Hunter Estuary.
- River regulation has enabled water managers to deliver water for irrigation and other purposes in volumes and during periods that are not in sequence with natural flows.
- Environmental flow provisions in the plan for the Hunter Regulated River Water Source aim to support the health of the Hunter Estuary. Plan rules aim to protect the initial freshwater inflows that enhance carbon and nutrient movement in the estuary.<sup>90</sup> Water sharing plan provisions also help improve the salinity structure of the estuary.<sup>91</sup>

### Climatic variability (extremes of drought and flood)

- The Hunter valley has experienced extremes of drought and flood over the life of the 2004 water sharing plans.
- Drought conditions that prevailed from 2002 to 2008 led to extremely low natural river flows and low dam storage levels. Consequently, the water sharing plans for the Hunter Regulated River, Ourimbah Creek and Wybong Creek Water Sources were suspended.

### Population growth

- The population of the Hunter-Central Rivers region continues to grow and is placing pressure on the region's natural resources, including water. The rate of growth and integration with urban water supply planning should be considered in water planning processes.
- In 2011, population growth in the Lake Macquarie and Newcastle local government areas was the largest outside of Sydney.<sup>92</sup>

### Mining and extractive industries

- Mining and extractive industries are expanding in the region.
- According to the upgraded Hunter-Central Rivers CAP, these industries pose a threat to the region's natural resources, in particular the integrity of aquifers and surface water resources.

## Contribution to regional targets in the first Hunter-Central Rivers CAP

- The CAP included a suite of biophysical targets for the region's rivers, wetlands and estuaries, but it did not include any groundwater targets.
- The majority of these targets were not geographically defined, in part due to a decision process used to identify priority areas for investment during the CAP implementation phase.
- The CAP identified Myall Lakes and the Hunter Estuary Wetlands as priorities for conservation, indicating that

<sup>87</sup> Hunter-Central Rivers CMA (2013), *Hunter-Central Rivers Catchment Action Plan 2013–2023*. Hunter-Central Rivers CMA, Paterson.

<sup>88</sup> NSW Office of Water (2011), *Macquarie Generation: water licensing package*, NSW Office of Water, Sydney.

<sup>89</sup> Australian Bureau of Statistics (2012), *Gross value of irrigated agricultural production, 2010–11: volume of water applied*. Data source: 4610055008DO002\_201011.

<sup>90</sup> NSW Office of Water (2011), *Environmental flow response and socio-economic monitoring Hunter Valley, Central and Lower North Coast – progress report 2010*. Prepared by the NSW Office of Water, Sydney.

<sup>91</sup> Ibid.

<sup>92</sup> Lake Macquarie and Newcastle local government areas have experienced the largest population growth outside of Sydney, and the Maitland and Cessnock local government areas have experienced the largest population growth in inland NSW (Hunter CMA 2013). However, population decline in some rural areas is affecting agricultural productivity and community well-being (Hunter CMA 2013).

CAP targets for wetland protection and enhancement relate to these water-dependent assets. However, the available information does not confirm whether the water sharing plans have benefited these wetlands.

- Although spatial alignment with CAP targets is unclear, the water sharing plans may have contributed to the improvement of stream habitats, the health of riparian vegetation and estuary processes by:
  - establishing an annual average extraction limit for the Hunter Regulated River Water Source that conserves roughly 80 per cent of flows for the environment
  - delivering minimum daily flows for the Hunter River, although these flows were relaxed during the drought, and the NRC received submissions suggesting that this water sharing plan provision should be modified to better reflect climatic conditions and achieve intended outcomes
  - protecting initial flows to the Hunter Estuary, which according to studies in 2010, delivers substantial amounts of organic carbon that increase bacterioplankton growth and zooplankton numbers
  - protecting low flows in unregulated rivers by establishing cease-to-pump rules, although these rules were changed to visible flow rules in some systems during the drought.
- There are provisions for an environmental contingency allowance in the water sharing plan for the Hunter Regulated River; however, no releases have been made from these accounts since the plan commenced. As such, this environmental water provision would not have contributed progress towards CAP targets.
- An Environmental Contingency Advisory Committee was recently established for the Hunter Regulated River, to develop rules for using water accrued under the environmental contingency allowance.
- Saline incursions and poor water quality (low dissolved oxygen) were observed in the Hunter Estuary during the drought. The increased salinity levels highlight the complexities of defining rules for estuarine systems, particularly given that the estuary receives inflows from multiple river systems.
- It is possible that the water sharing plan for the Tomago Tomaree Stockton Groundwater Sources contributed to positive outcomes in the Hunter-Central Rivers region; however, there were issues regarding the specification of extraction limits early in the plan's operation. There is also a risk of seawater incursion into the aquifer system and limited knowledge of groundwater-dependent ecosystems.

### Alignment of the upgraded Hunter-Central Rivers with water sharing plans

- The upgraded CAP is underpinned by collaboration and information sharing between government agencies (including the Office of Environment and Heritage, and the Office of Water) and the CMA.
- The CMA's involvement in a pilot project for aligning catchment and water planning provided a good foundation for the CAP upgrade. Lessons from implementing a suite of alignment mechanisms that recognise how water sharing plans and CAPs can contribute to maintaining and improving the condition of freshwater aquatic ecosystems were instrumental to the CAP upgrade.<sup>93</sup>
- In particular, sharing data on river condition and risks to in-stream values (from the Office of Water's River Condition Index) and spatially presenting this information provided a strong basis for aligning the CAP with water sharing plans.
- The CMA used the River Condition Index in conjunction with a range of other spatial data sources to inform mapping of priority areas where action should be taken to protect and improve water quality, and to map priority river reaches for protection and improvement.
- The upgraded CAP included four discrete maps to address specific queries, specifically:
  - where actions should be undertaken to improve water quality
  - where effort should be focused to manage groundwater assets (including groundwater-dependent ecosystems from water sharing plans)
  - where effort should be focused to protect and improve wetland condition and function
  - priority river reaches needing protection or improvement.
- The CMA also worked collaboratively with the Office of Water to understand how the River Condition Index could be improved, specifically identifying:
  - the importance of data validation
  - a need for better data coverage (for example, the importance of reliable riparian vegetation condition data for the entire CMA area)
  - limitations in applying the index to different stream orders (it can only be applied to fourth-order streams or greater).

<sup>93</sup> Hamstead, M. (2010), *Alignment of water planning and catchment planning*, Waterlines report, National Water Commission, Canberra.



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- The CMA and the Office of Water also worked as part of an ‘aquatic-theme team’ to identify priorities and develop goals, strategies and targets that complement the intent of water sharing plans, including strategies relevant to achieving Aboriginal cultural outcomes in water landscapes.
  - However, the upgraded CAP lacks targets against which outcomes can be measured, which makes it difficult to determine the extent to which the water sharing provisions materially contribute towards CAP targets.

#### Future directions

- The CMA is developing measurable targets as part of its CAP implementation plan.
  - The CMA is working collaboratively with the Office of Water to address gaps in the River Condition Index.
  - The Office of Water has also identified a number of knowledge gaps that need to be addressed so that outcomes can be measured and attributed to water sharing plan provisions.<sup>94</sup> These gaps include:
    - determination of the salinity regime needed to support Ramsar-listed wetlands
    - identification of the inflow regime required to support fish recruitment
    - identification of the inflow regime needed to support and maintain extractive user rights for estuary tidal-pool pumpers.
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<sup>94</sup> NSW Office of Water (2011), *Environmental flow response and socio-economic monitoring Hunter Valley, Central and Lower North Coast – progress report 2010*. Prepared by the NSW Office of Water, Sydney, p. 37.

# Hawkesbury-Nepean

## 2004 water sharing plans under review (see Figure 10)

Water sharing plan	Overview
Kulnura Mangrove Mountain Groundwater Sources	<ul style="list-style-type: none"> <li>The water sharing plan covers an area of 506 square kilometres between Mount Simpson, Gosford, Spencer and Pearl Beach (on the NSW Central Coast), and comprises eight management zones.</li> <li>Groundwater-level monitoring undertaken between 2005 and 2012 indicates that water use has remained within sustainable limits.<sup>95</sup></li> <li>The Office of Water recently amended the plan by increasing planned environmental water for six of the eight groundwater sources covered by the plan, and correspondingly decreasing the long-term average annual extraction limit to protect base flows, particularly during low flows.</li> <li>The Office of Water is considering merging this plan into the Water Sharing Plan for the North Coast Fractured and Porous Rock Groundwater Sources.</li> </ul>

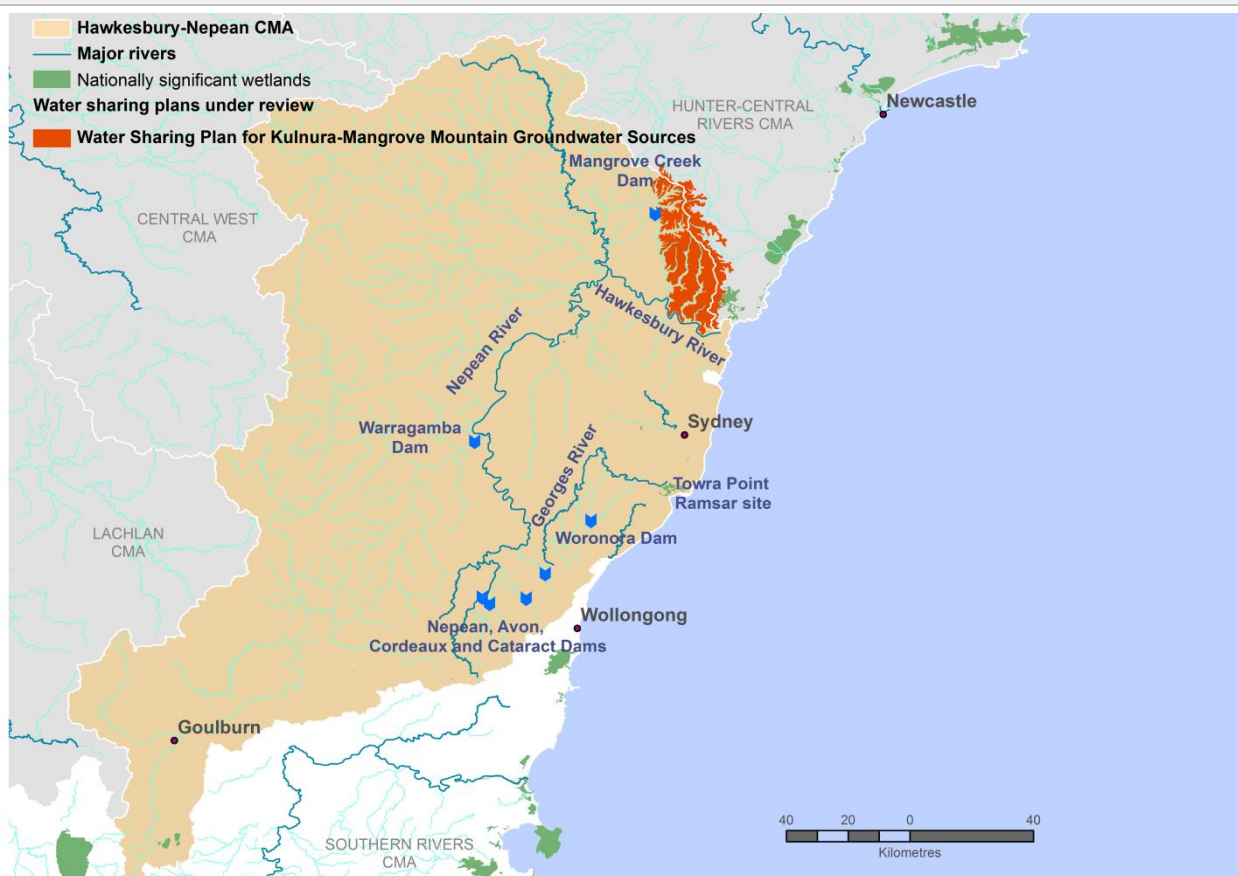


Figure 10: Water sharing plans under review in the Hawkesbury-Nepean River region

### Catchment overview

- Catchment area:** 24,470 square kilometres.
- Major waterways:** Major waterways in the region include the Hawkesbury, Nepean, Wollondilly, Mulwaree, Tarlo, Wingecarribee, Nattai, Coxs, Kowmung, Grose, Capertee, Colo, Macdonald, Parramatta, Georges, Woronora and Hacking rivers.
- Major water storages:** The region includes a number of dams that provide water for Greater Sydney, including Avon, Cataract, Cordeaux and Upper Nepean, Warragamba and Woronora dams, and Mangrove Creek Dam on the NSW Central Coast.

<sup>95</sup> NSW Office of Water (2013), *Audit of implementation - Groundwater water sharing plan audit report cards. Prepared for the period between 1 July 2009 and 30 June 2012.* NSW Office of Water, Sydney.

- **Groundwater:** Groundwater resources are important for agriculture and are of high quality underneath the Southern Highlands. However, some parts of the region have experienced a decline in groundwater levels, notably Thirlmere Lakes (perched lakes located in the Southern Highlands).<sup>96</sup> Open-cut and longwall mining may influence groundwater movement and impact on groundwater dependent ecosystems, particularly in the southern part of the region.<sup>97</sup>
- **Major towns:** The region includes the city of Sydney and surrounding metropolitan areas, and the regional centres of Goulburn and Lithgow.
- **Land use:** The region is subject to a range of land uses including urban residential; drinking water catchment (a substantial portion of the region is classified as a Special Area, which is set aside for protecting drinking water storages); conservation; industry; dryland and irrigated agriculture (cut flowers, fruit and vegetable production); and forestry.
- **Major water users:** The largest water user in the region is Sydney Water Corporation, which provides potable water to the Sydney Metropolitan Area. Other major water users in the region include local councils, and the irrigated agriculture, fishing and oyster industries.
- **Water-dependent environmental values:** The region comprises diverse riverine, estuarine and wetland habitats, and includes Sydney Harbour and the Ramsar-listed Towra Point Reserve. Three rivers from the region have been declared as wild rivers in near-pristine condition and are protected under the *National Parks and Wildlife Act 1974* (NSW), including the Colo, Grose and Kowmung rivers. The region's rivers provide habitats for a number of threatened species including the endangered Macquarie perch and endangered invertebrates (the Sydney hawk dragonfly and Adam's emerald dragonfly).

### Key issues affecting the region's water resources

#### River regulation

- Flows patterns in a number of the region's rivers have been modified by dams and weirs, primarily to capture water for Greater Sydney's drinking water supply.
- Persistent low-flow conditions, which are attributed to river regulation, are being managed by implementing environmental flow provisions in water sharing plans.
- Environmental flow requirements for Warragamba Dam are currently being investigated.

#### Urban expansion

- Sydney's population growth and urban expansion is placing pressure on the region's water resources.
- According to the upgraded Hawkesbury-Nepean CAP, more intensive land use and land subdivision to accommodate a growing population are most prominent in the Greater Western Sydney area and the Sydney-Canberra corridor.
- The impacts of this growth should be considered in water planning.

#### Mining and extractive industries

- Longwall coal mining has affected stream bed stability and led to cracking in the Cataract and Bargo rivers.<sup>98</sup>

### Contribution to regional targets in the first Hawkesbury-Nepean CAP

- The area covered by the Kulnura Mangrove Mountain water sharing plan lies to the north of the Hawkesbury-Nepean catchment.
- The water sharing plan may have contributed progress towards the Hawkesbury-Nepean CAP groundwater target for improving the ability of groundwater systems to support groundwater-dependent ecosystems.
- Hawkesbury-Nepean CAP targets pertaining to rivers and wetlands may have been influenced by this water sharing plan to the extent that surface water and groundwater are connected.
- However, based on the available evidence it is difficult to draw specific conclusions about how the water sharing plan contributed towards regional targets, or the adequacy of the plan in supporting water-dependent values.
- The water sharing plan for Kulnura Mangrove Mountain Groundwater Sources may have contributed positively towards improving vegetation, wetland function and ecosystem support by:
  - establishing a long-term average annual extraction limit of 8,000 megalitres, although monitoring of extraction is limited, so compliance with this provision is unknown
  - setting planned environmental water provisions at 22,372 megalitres per year
  - regulating bore licensing, which potentially mitigates impacts on groundwater-dependent ecosystems.

<sup>96</sup> Thirlmere Lakes Inquiry Committee (2012), *Independent inquiry into Thirlmere Lakes, draft report*, 12 May 2012.

<sup>97</sup> Hawkesbury-Nepean CMA (2013), *Draft Hawkesbury-Nepean Catchment Action Plan 2013–2023*.

<sup>98</sup> Kay, D., Barbato, J., Brassington, G. and de Somer, B. (2006), *Impacts of longwall mining to rivers and cliffs in the Southern Coalfield*, 2006 Coal Operators' Conference.

- A decline in water levels between 2002 and 2007 coincided with extended drought conditions, with water levels recovering between 2007 and 2009 following a return to wetter climatic conditions.
  - Groundwater-level monitoring indicates that groundwater use in all groundwater sources covered by the water sharing plan remained within sustainable limits between 2005 and 2012.
  - Although sustainable groundwater use can be inferred from monitoring groundwater levels, the absence of water extraction monitoring and assessment – and an absence of information about water use – reduces the ability to determine the specific outcomes from the water sharing plan.
  - The Kulnura Mangrove Mountain Groundwater Sources water sharing plan may have positively affected broad socioeconomic outcomes within the Hawkesbury-Nepean CMA region by establishing:
    - the availability of four different classes of water access licences
    - permanently and temporarily tradeable water access licences, as well as options to lease licences.
- However, surveys of irrigators in the area suggest a declining level of support for or confidence in water sharing plan provisions from 2006–09.

### Alignment of the upgraded Hawkesbury-Nepean CAP with water sharing plans

- Key government organisations – including the Office of Environment and Heritage, Office of Water, Sydney Catchment Authority and some local councils – were engaged in the CAP upgrade and helped to identify priorities for the region’s aquatic assets.
- The draft CAP articulates the relevance of the NSW Metropolitan Water Plan and water sharing plans for the Greater Metropolitan Region, Central Coast and Kulnura Mangrove Mountain Groundwater Sources.
- Furthermore, spatial priorities for the region’s aquatic assets have been identified using datasets from the Office of Water (River Condition Index) and the Office of Environment and Heritage Index of Estuary Condition.
- The draft CAP recognises that using the River Condition Index provides an opportunity to align CAP strategies and water planning, and identifies how the index can be improved by incorporating water quality data.
- Sharing this spatial data provides a good foundation for identifying shared priorities for improving aquatic health. However, the absence of spatially related and measurable targets limits the ability to align future water planning with the draft CAP, and then determine the extent to which water sharing plans materially contribute to achieving CAP targets.
- The draft CAP includes a strategy to help Aboriginal people manage projects across culturally significant landscapes and values. This strategy could potentially incorporate culturally significant water-dependent assets.

### Future directions

- Further work is required to better align CAP strategies and water planning for the region.
- It is also important to establish auditable targets against which to evaluate the contribution of water sharing plans to CAP targets.

## Northern Rivers

### Water sharing plans under review (see Figure 11)

Water sharing plan	Overview
Alstonville Plateau Groundwater Sources	<ul style="list-style-type: none"> <li>The plan covers highland basalt aquifers covering an area of 391 square kilometres between Lismore and Ballina, and comprises six management zones.</li> <li>Two of the management zones in the plan area are considered to be over-allocated.<sup>99</sup></li> <li>The Office of Water is considering merging this plan into the Water Sharing Plan for the North Coast Fractured and Porous Rock Groundwater Sources.</li> </ul>
Apsley River Water Source (unregulated)	<ul style="list-style-type: none"> <li>The plan area includes the Apsley River and its tributaries, to the confluence with the Macleay River.</li> <li>The Office of Water (formerly the Department of Water and Energy) has assessed this water source as having a low community dependence on extraction, and a low environmental risk.<sup>100</sup></li> <li>The Office of Water is considering merging this plan into the Water Sharing Plan for the Macleay Unregulated and Alluvial Water Sources.</li> </ul>
Commissioners Waters Water Source (unregulated)	<ul style="list-style-type: none"> <li>The plan area includes Commissioners Waters and its tributaries, to the junction with the Macleay River.</li> <li>The Office of Water has assessed this water source as having high community dependence and a medium environmental risk.</li> <li>The Office of Water is considering merging this plan into the Water Sharing Plan for the Macleay Unregulated and Alluvial Water Sources.</li> </ul>
Toorumbie Creek Water Source (unregulated)	<ul style="list-style-type: none"> <li>This plan area includes Toorumbie Creek and its tributaries upstream of the junction with the Macleay River.</li> <li>The Office of Water has assessed this water source as having low community dependence and a low environmental risk.</li> <li>The Office of Water is considering merging this plan into the Water Sharing Plan for the Macleay Unregulated and Alluvial Water Sources.</li> </ul>
Coopers Creek Water Source (unregulated)	<ul style="list-style-type: none"> <li>Coopers Creek Water Source comprises the Upper Coopers Creek Management Zone, which has high in-stream values, and the Lower Coopers Creek Management Zone, which has a high concentration of economic production.</li> <li>The Office of Water has assessed this water source as having high community dependence and a high environmental risk.</li> <li>The plan's objectives, cease-to-pump rules and trading rules were amended in 2011 to improve social and economic outcomes, and to support the endangered eastern freshwater cod.</li> <li>The Office of Water is considering merging this plan into the Water Sharing Plan for the Richmond River Area Unregulated, Regulated and Alluvial Water Sources.</li> </ul>
Dorrigo Plateau Surface Water Source and Dorriggo Basalt Groundwater Source	<ul style="list-style-type: none"> <li>The plan applies to unregulated rivers on the Dorriggo Plateau including the Upper Nymboida River, Bielsdown River, Wild Cattle Creek and Blicks River; and the underlying basalt aquifer.</li> <li>A cultural access licence has been established under this plan.</li> <li>The Office of Water is considering merging the groundwater component of this plan into Water Sharing Plan for the North Coast Fractured and Porous Rock Groundwater Sources, and the surface water component into the Water Sharing Plan for the Clarence Unregulated and Alluvial Water Sources.</li> </ul>

<sup>99</sup> Northern Rivers CMA (2012), *Regional State of the Environment 2012 for the Northern Rivers Catchment Management Authority region of New South Wales*. Prepared by Northern Rivers CMA, Grafton, p. 96

<sup>100</sup> NSW Department of Water and Energy (2009), *Water sharing in unregulated rivers: progress report 2004 to 2008*. Prepared by the NSW Department of Water and Energy, Sydney.

Stuarts Point Groundwater Source	<ul style="list-style-type: none"> <li>▪ The plan applies to a coastal sand aquifer covering an area of 1,480 hectares between Grassy Head and the Macleay River estuary.</li> <li>▪ The Office of Water is considering merging this plan into the Water Sharing Plan for the North Coast Coastal Sands Groundwater Sources.</li> </ul>
Upper Brunswick River Water Source (unregulated)	<ul style="list-style-type: none"> <li>▪ The plan area includes the Upper Brunswick River and its tributaries upstream of the junction with the Brunswick River.</li> <li>▪ The Office of Water has assessed this water source as having medium community dependence and a medium environmental risk.</li> <li>▪ The Office of Water is considering merging this plan into the Water Sharing Plan for the Brunswick Unregulated and Alluvial Water Sources.</li> </ul>

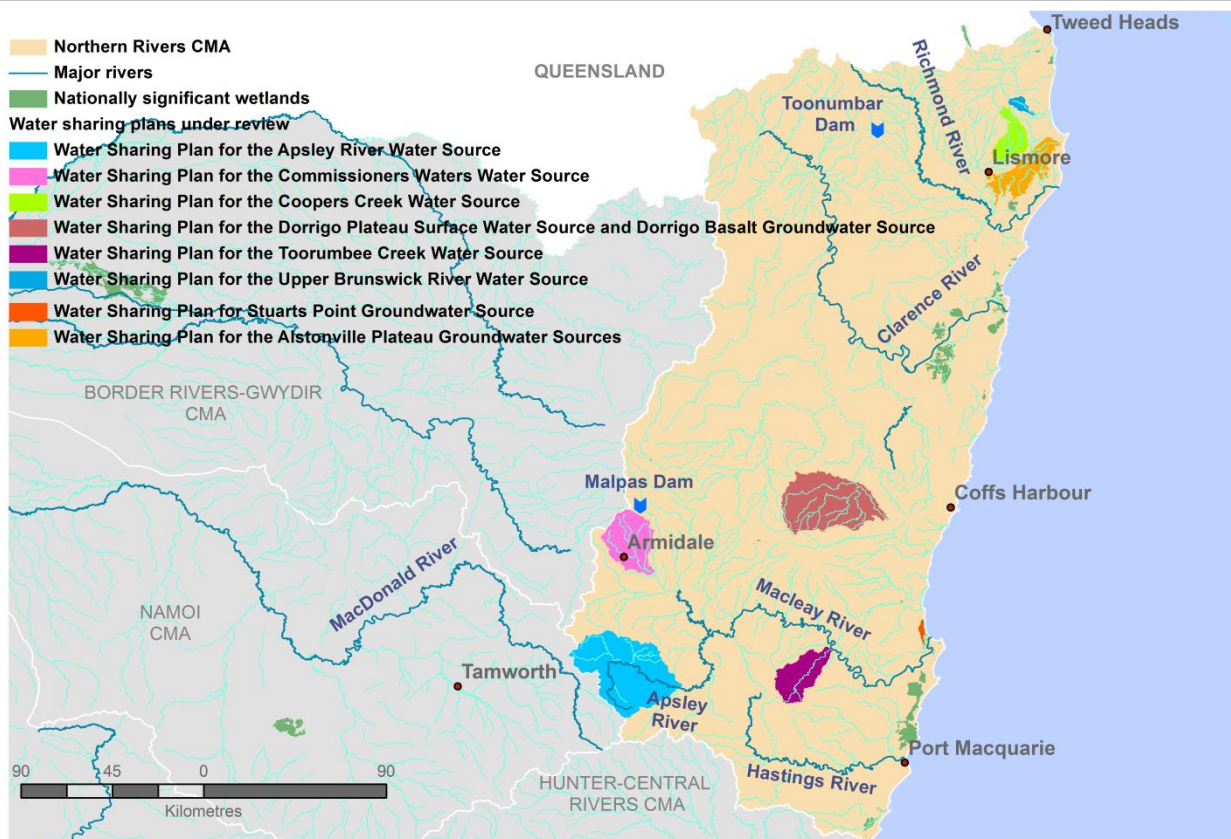


Figure 11: Water sharing plans under review in the Northern Rivers region

### Catchment overview

- **Catchment area:** 50,000 square kilometres.
- **Major waterways:** The main waterways in the area are the Macleay River and its tributaries (including Apsley, Chandler, Styx, Tia, Dyke and Yarrowitch rivers, and the Commissioners Waters); the Manning River; the Clarence River and its major tributaries including the Mann, Nymboida and Orara Rivers; Richmond River and its major tributary the Wilsons River; and Brunswick River and its major tributary Mullumbimby Creek.
- **Major water storages:** The majority of rivers on the NSW north coast are unregulated. Toonumbar Dam located on Iron Pot Creek near Kyogle, and Malpas Dam (which supplies Armidale) are the largest storages in the region, with capacities of approximately 11,000 and 13,000 megalitres respectively.
- **Major towns:** The area’s major towns are Armidale, Coffs Harbour, Byron Bay, Grafton, Lismore, Port Macquarie and Tweed Heads.
- **Groundwater:** The region’s groundwater sources support ecosystem functions and consumptive uses. For example, Kempsey sourced nearly 40 per cent of its water from groundwater sources in 2011–2012. The Northern Rivers CMA considers two management zones in the area covered by the plan for Alstonville Plateau Groundwater Source to be over-allocated.<sup>101</sup>

<sup>101</sup> Northern Rivers CMA (2012), *Regional State of the Environment 2012 for the Northern Rivers Catchment Management Authority region of New South Wales*. Prepared by Northern Rivers CMA, Grafton, p. 96.

- **Land use:** Major land uses in the area include grazing, forestry, fruit and vegetable production, urban and rural residential development, nature conservation and tourism.
- **Major agricultural water users:** In 2010–11, the greatest volume of water applied for irrigated agriculture was used to grow pasture for livestock grazing (7,229 megalitres) and to support fruit production (5,163 megalitres).
- **Water-dependent environmental values:** The Northern Rivers region includes a diversity of riverine and coastal habitats, and wetlands of regional and national significance. The region's rivers provide habitats for a number of threatened species, including but not limited to the endangered eastern freshwater cod and the Oxleyan pygmy perch. Several wetlands within the region are listed on the Directory of Important Wetlands in Australia, and a number of rivers have been declared as wild rivers in near-pristine condition and are protected under the *National Parks and Wildlife Act 1974* (NSW). They include Washpool Creek in the Clarence River Basin, and Forbes and Upper Hastings rivers in the Hastings River Basin.
- **Cultural water:** A cultural access licence has been established under the water sharing plan for the Dorrigo Plateau Surface Water Source and Dorrigo Basalt Groundwater Source.

### Key issues affecting the region's water resources

#### Climate variability

- Climate variability is affecting the region, as demonstrated by drought and flood events over the course of the 2004 water sharing plans.
- Drought conditions affected the shallow aquifer included in the Alstonville Groundwater Source, although water-level changes recorded in the aquifer over 2008–09 matched modelled water-level changes on the basis of climate and usage.<sup>102</sup>

#### Water extraction

- The upgraded Northern Rivers CAP recognises water extraction as a threat to water quality, the hydrological flow regime and the region's aquatic biota.

#### Land use diversification and intensification

- According to the upgraded Northern Rivers CAP, the region is undergoing significant changes in land use, with urban expansion, peri-urban development and more intense production placing pressure on the region's landscapes.

### Contribution to regional targets in the first Northern Rivers CAP

- The CAP included a suite of biophysical targets and targets for the socioeconomic well-being of the region's communities.
- These targets were not geographically defined, making it difficult to determine how the water sharing plans under review have directly contributed progress towards these targets.
- Furthermore, based on available information, it is difficult to draw conclusions on the outcomes of implementing these water sharing plans, and their adequacy for sustaining key water-dependent values.
- The unregulated water sharing plans (which cover Apsley River, Commissioners Waters, and the Toorumbie, Coopers Creek and Upper Brunswick River Water Sources) may have positively contributed to river-related targets by establishing water extraction rules and cease-to-pump levels. For example, field verification of the low-flow (cease-to-pump) rules for the Coopers Creek Water Source indicates that current flow rules provide good aquatic habitat connectivity, and protect aquatic sponges and macroinvertebrates sensitive to changes in water levels.<sup>103</sup>
- However, there is currently insufficient information to assess the ecological sustainability of water sharing plans for the Apsley River, Commissioners Waters, Torrumbee Creek, the Upper Brunswick River and the Dorrigo Plateau Surface Water Sources in any detail.
- It is also difficult to assess how groundwater sharing plans have contributed towards natural resource management outcomes, particularly as groundwater monitoring does not occur in all water sources (Stuarts Point and Alstonville Plateau Groundwater Sources are currently monitored).
- These plans may have contributed progress towards to groundwater-related targets from the Northern Rivers CAP by:
  - establishing extraction conditions and limits
  - facilitating environmental allowances for the Alstonville Plateau Groundwater Source.

<sup>102</sup> NSW Office of Water (2011), *Environmental flow response and socio-economic monitoring: North Coast progress report 2009*, NSW Office of Water, Sydney.

<sup>103</sup> Ibid.

- Although drought conditions would have influenced the extent to which water sharing plans contributed to socioeconomic outcomes, the water sharing plans may have contributed towards social and cultural benefits through:
  - specific provisions for cultural water, which led to the establishment of an Aboriginal cultural access licence for extracting up to 10 megalitres from the Dorrigo Basalt Groundwater Source
  - permanent trade for water licences in unregulated water sources.

### Alignment of the upgraded Northern Rivers CAP with water sharing plans

- The NSW Office of Water participated in the CAP upgrade as a representative on the plan's Technical Reference Panel.
- One of the Panel's roles was to consider how the CAP aligns with the region's water sharing plans.
- The Office of Water's involvement in the CAP upgrade provides a good foundation for implementing the CAP.
- The CMA used the River Styles® assessment of geomorphic condition and recovery potential to assess the health of the region's rivers. This resulted in some inconsistencies with the Office of Water's priorities for the region.
- The CMA plans to work collaboratively with the Office of Water to address these issues, and has indicated that mapping could be improved during the CAP implementation phase. Specifically, the CMA plans to reconcile its sub-catchment mapping, where applicable, with relevant spatial data such as the Office of Water's River Condition Index and the national hydrology geofabric.<sup>104</sup>
- The upgraded CAP is designed to complement the region's water sharing plans and includes a broad target to maintain and improve landscape health and function in priority sub-catchments.
- Broad targets are supported by measurable indicators of success and more specific sub-targets for maintaining or improving river and wetland health in priority sub-catchments.
- The sub-targets and indicators provide a basis for assessing the future contribution of water sharing plans to CAP targets.
- The CAP identifies delivery partners for CAP actions, clarifying who is responsible for implementing the plan.
- The Office of Water is identified as a delivery partner for actions that may be influenced by implementing water sharing plans – such as reinstating appropriate hydrological regimes for floodplains, wetlands, backswamps and estuaries, and improving the extent and connectivity of terrestrial, aquatic and marine habitats.

### Future directions

- Alignment with water sharing plans could be enhanced by incorporating additional and improved spatial data such as in-stream value mapping and wetland priorities into future planning.

<sup>104</sup> Northern Rivers CMA (2012), *Natural resource health and community capacity for the sub-catchments of the Northern Rivers region; Catchment Action Plan 2013 – 2023, technical paper no. 2*. Draft for public comment.



