



Department of
Primary Industries
Water

Water Sharing Plan for the Lower North Coast Unregulated and Alluvial Water Sources

Background document for amended plan 2016



Published by the NSW Department of Primary Industries, Water

Water Sharing Plan for the Lower North Coast Unregulated and Alluvial Water Sources - Background document for amended plan 2016

First published in November 2016

Incorporates amendments to the plan following inclusion of the Karuah River Water Source

More information

This report may be cited as:

Betteridge L., Rabbidge T., (2016) Water Sharing Plan for the Lower North Coast Unregulated and Alluvial Water Sources: Background document for amended plan 2016, NSW Department of Primary Industries, Sydney

www.dpi.nsw.gov.au

Acknowledgments

Cover image: Little Manning River in Woko National Park, John Spencer/ OEH

© State of New South Wales through the Department of Trade and Investment, Regional Infrastructure and Services, 2016. You may copy, distribute and otherwise freely deal with this publication for any purpose, provided that you attribute the NSW Department of Primary Industries as the owner.

Disclaimer: The information contained in this publication is based on knowledge and understanding at the time of writing (November 2016). However, because of advances in knowledge, users are reminded of the need to ensure that information upon which they rely is up to date and to check currency of the information with the appropriate officer of the Department of Primary Industries or the user's independent adviser.

Contents

Introduction	1
An amended plan for the unregulated Lower North Coast catchments	2
Purpose of the Plan.....	3
Why are water sharing plans (WSPs) being prepared?.....	3
Benefits for water users	3
Environmental considerations.....	4
Unregulated streams.....	4
Scope of the Plan.....	5
Water Management Units	5
Objectives of the Plan	9
Description of the Plan area.....	10
Climate.....	11
Land use history.....	11
High environmental value areas	11
Estuaries	14
Industry and water use.....	15
Policy framework.....	17
The Water Management Act 2000	17
Access Licence Dealing Principles	17
National Water Initiative	18
Natural Resource Commission targets	18
Catchment Action Plans.....	18
NSW water planning policies and considerations	19
Role of the panels	23
Consultation to inform rule development	24
Water sharing rules for unregulated water sources	26
Water source classification	26
Planned environmental water	27
Requirements for water.....	27
Access rules for unregulated water sources	28
Dealings (trading) rules in unregulated water sources.....	29
Exceptions to the generic rule approach.....	30
Refining the access rules for the Karuah River Water Source.....	30
Managing extractions.....	32

Granting new access licences	34
Water sharing rules for alluvial groundwater sources	36
Surface water – groundwater interactions	36
Alluvial aquifers	36
Groundwater dependent ecosystems	38
Amendment provisions	39
Monitoring of plan performance	39
Plan review	42
Glossary	43
Appendices	45
Appendix 1: Hunter Regional Panel	1
Appendix 2: Reference material used by the Hunter Regional Panel	3
Appendix 3: Refined classifications based on Regional Panel knowledge	4
Appendix 4: Summary of final classifications recommended by Regional Panel	6
Appendix 5: Changes to water sharing rules based on Regional Panel knowledge	7
Appendix 6: Changes to water sharing rules based on targeted consultation	9
Appendix 7: Changes to water sharing rules based on public exhibition	10
Appendix 8: Map of the plan area	13
Appendix 9: Contribution to the river flow objectives	14
Appendix 10: Identified threatened species	16

Tables

Table 1: Water sources with a high level of economic dependence	4
Table 2: Water management units in the amended Lower North Coast water sharing plan	7
Table 3: Water sources with a high instream value (based on initial assessment)	12
Table 4: Inflow sensitivities for the Lower North Coast catchments	15
Table 5: Key groups consulted in Lower North Coast targeted consultation.....	25
Table 6: Indicative access rules for rivers and creeks under the macro approach	29
Table 7: Connectivity between aquifer types and surface water	37
Table 8: Water sources where adaptive management applies	40

Introduction

Water sharing plans are being progressively developed for rivers and groundwater systems across the State following the introduction of the Water Management Act 2000 (WMA 2000). These plans protect the health of our rivers and groundwater while also providing water users with perpetual access licences, equitable conditions, and increased opportunities to trade water through separation of land and water. In July 2004, 31 plans commenced in NSW, bringing these water sources and some 80 per cent of water extracted in NSW under the management and licensing provisions of the WMA 2000.

In recent years, plans for the unregulated¹ rivers and groundwater systems have been completed using a macro or broader-scale river catchment or aquifer system approach. Approximately 95 per cent of the water extracted in NSW is now covered by the WMA 2000. The macro planning process is designed to develop water sharing plans covering most of the remaining water sources across NSW. Each macro plan covers a large river basin rather than a single sub-catchment, or in the case of groundwater systems, cover a particular type of aquifer (e.g. fractured rock). These river basin or aquifer macro plans will generally apply to catchments or aquifers where there is less intensive water use.

General information on the macro planning process is available in the water sharing plans section of the DPI Water website www.water.nsw.gov.au. This includes:

- Macro water sharing plans - the approach for unregulated rivers. A report to assist community consultation – explains the method used to classify and set water sharing rules for unregulated streams across the state
- Macro water sharing plans - the approach for unregulated rivers. Access and trading rules for pools – explains the method used to set access and trading rules for pools within unregulated sources across the state
- Macro water sharing plans - the approach for groundwater. A report to assist community consultation – explains the macro approach to groundwater methodology, including assessment of risk and determination of sustainability indexes for aquifers

This document provides background to the development of the rules in the *Water Sharing Plan for the Lower North Coast Unregulated and Alluvial Water Sources* (here after the Lower North Coast water sharing plan) including amendments made in 2016 to incorporate the Karuah River which was previously covered by a separate water sharing plan. This document is part of a range of material available specifically on the Lower North Coast water sharing plan including:

- The *Water Sharing Plan for the Lower North Coast Unregulated and Alluvial Water Sources 2009* - a legal instrument written in its required statutory format
- Water sharing plans - Inland NSW unregulated and alluvial water sources – Overview - a plain English version of the plan explaining the key Plan sections and rules
- Rule summary sheets for each water source summarising the proposed management rules.

¹ The supply of water in unregulated rivers is typically not controlled by releases of water from dams but rather is dependent solely on rainfall and natural river flows.

An amended plan for the unregulated Lower North Coast catchments

Until July 2016, the *Water Sharing Plan for the Lower North Coast Unregulated and Alluvial Water Sources 2009* comprised 21 water sources that covered a large percentage of the water extraction within the lower north coast area. The Karuah catchment was excluded as it was subject to the earlier *Water Sharing Plan for the Karuah River Water Source 2003*.

The Karuah water sharing plan was included in the first round of water sharing plans developed in NSW. In 2013, following a review of the plan by the NSW Natural Resources Commission, in conjunction with the Department of Primary Industries, Water (DPI Water), the NSW Minister for Primary Industries approved the replacement of the plan. The plan, which commenced in 2004, was due to be replaced by June 2016.

The Minister directed that any proposed changes must be permitted under the WMA 2000, and also need to consider the significant amount of consultation which was undertaken in their initial development.

In line with the review outcome that there would be no change to the intent of the existing plan rules, the *Water Sharing Plan for the Lower North Coast Unregulated and Alluvial Water Sources 2009* has been amended to include water sharing rules for the Karuah River Water Source.

The merging of the replacement plan for the Karuah River water source with the current *Water Sharing Plan for the Lower North Coast Unregulated and Alluvial Water Sources* is consistent with the “macro” planning approach i.e. one water sharing plan covering all unregulated water sources within a catchment. It has also allowed the opportunity to bring both plans into line with the current legislative and policy framework for water sharing in NSW.

Changes to the provisions of the 2003 Karuah plan have occurred for a number of reasons including: changes to policy, updates to legislation, updated data, outcomes of audits, and stakeholder requests. As the provisions in these plan areas have been operating for over a decade, and the initial plans were developed in close consultation with stakeholder groups, DPI Water has aimed to avoid unnecessary changes and focus on improving provisions based on the information sources mentioned above.

Purpose of the Plan

Why are water sharing plans (WSPs) being prepared?

Expansion of water extraction across NSW in the twentieth century has placed most valleys at or close to the limit of sustainable water extraction. This has seen increasing competition between water users (towns, farmers, industries and irrigators) for access to water. This has also placed pressure on the health and biological diversity of our rivers and aquifers.

In December 2000, the NSW parliament passed the *Water Management Act 2000* (WMA 2000) which has the overall objective of “sustainable and integrated management of the State’s water for the benefit of both present and future generations” (DLWC 2001). Water sharing plans play a major role in achieving this objective by providing a legal basis for sharing water between the environment and consumptive water users.

Under the WMA 2000, the sharing of water must protect the water source and its dependent ecosystems and must protect basic landholder rights. Sharing or extraction of water under any other right must not prejudice these. Therefore, sharing water to licensed water users is effectively the next priority for water sharing. Among licensed water users, priority is given to water utilities and licensed stock and domestic use, ahead of commercial purposes such as irrigation and other industries.

Plans also recognise the economic benefits that commercial users such as irrigation and industry can bring to a region. Upon commencement access licences held under the Water Act 1912 are converted to access licences under the WMA 2000 and land and water rights are separated. This facilitates the trade of access licences and can encourage more efficient use of water resources. It also allows new industries to develop as water can move to its highest value use.

In conjunction with the WMA 2000, plans also set rules so that commercial users can also continue to operate productively. In general, commercial licences under the WMA 2000 are granted in perpetuity, providing greater commercial security of water access entitlements. Plans also define the access rules for commercial users for 10 years providing all users with greater certainty regarding sharing arrangements¹.

Benefits for water users

The introduction of water sharing plans will benefit water users by providing:

- greater certainty by setting water sharing arrangements for a 10 year period
- clear trading and access rules which will help foster trading of water
- greater security with existing water licences converted to perpetual water access licences under the WMA 2000

The Plan recognises the economic benefits of commercial users such as irrigators and industry to the region. It sets rules so that commercial users can continue to operate productively. Three of the water sources covered by the Plan were classified as having a high economic dependence on commercial extraction (see Table 1).

¹ Security versus reliability. These terms are used differently across different jurisdictions, often interchangeably. The National Water Commission encourages the adoption of nationally consistent terminology based on the National Water Initiative. The definitions in the glossary relate to NWI-consistent use of these terms. In summary, security provides better tenure for an entitlement and does not necessarily provide greater reliability as this is determined by seasonal and climatic conditions.

Table 1: Water sources with a high level of economic dependence

Water source	Description
Lower Manning	Relatively high value of extraction due to regional town water supply extractions.
Lower Barrington/Gloucester	Relatively high value of irrigation for improved pasture and lucerne.
Upper Gloucester	Relatively high value of irrigation for improved pasture and lucerne.

Environmental considerations

Water sharing plans are required to reserve water for the overall health of the river and to protect specific ecosystems that depend on river flows, such as wetlands, lakes, estuaries and floodplains. This share of water reserved for the environment is also intended to sustain the river system's aquatic fauna and flora.

Unregulated streams

Rivers naturally experience a range of flows which are necessary for different hydrologic, geomorphic, biological and chemical processes to occur. Flood flows are required to scour channels, rework sediments, and inundate floodplains; medium flows oxygenate water and allow fish passage; and low flows maintain connectivity and assist the survival of aquatic and riparian flora and fauna. To preserve a healthy river system this range of stream flows must be maintained.

In order to protect a proportion of these low flows for the benefit of the environment, the water sharing plan imposes access restrictions on days when stream flows are low. This is achieved by establishing cease-to-pump rules that require users to stop taking water when flows fall below a set level. All surface water licences will be subject to cease to pump rules (excluding licences held by local water utilities, licensed stock and domestic users, and licences used for food safety and essential dairy care¹).

Each unregulated water source was classified as having either high, medium or low instream values. Appendix 3 details the features considered when assessing the water source values that are impacted by extraction. High instream value water sources are, by default, protected by the plan by not allowing any trades in. Trades are allowed into some water sources with lower value in order to encourage the movement of extraction from high to lower environmental value areas.

Alluvial groundwater sources

Aquifers are underground layers of water-bearing permeable rock or unconsolidated materials (gravel, sand, silt or clay) from which groundwater can be extracted. Aquifers can store large volumes of water, often accumulated over thousands, or tens of thousands of years. Water enters (or recharges) aquifers via rainfall, surface flows from rivers and lakes, or flow from adjacent aquifers. Water sharing plans aim to achieve sustainable groundwater extraction by limiting extractions to a proportion of the aquifer recharge. The remainder of the recharge is reserved for the environment.

¹ There are limited exemptions for licensed stock and domestic and town water supply purposes which allow access to very low flows. See section "Access to very low flow"

Some alluvial aquifers are highly connected to surface water, so that taking water from one source affects the other. In groundwater systems defined as ‘highly connected’ environmental water may also be provided through linked cease-to-pump rules to ensure taking groundwater does not adversely affect surface water flows.

Water sources are defined as ‘highly connected’ if 70 per cent or more of groundwater pumped in an irrigation season is derived from stream flow (see section on managing surface water and groundwater connectivity).

Scope of the Plan

The amended water sharing plan covers the water resources of the Lower North Coast Water Management Area. Incorporating both these resources into the one plan recognises their interaction and allows for the development of water sharing rules that are linked and are equitable within and between these resources.

The two water resources are:

- the unregulated rivers – now comprising twenty three discrete water sources which cover all of the rivers and streams in the Lower North Coast Water Management Area
- the groundwater in the upriver alluvial aquifer

The plan does not cover

- any water contained in alluvial sediments downstream of the tidal limit in these water sources, excluding the Karuah River Water Source and the Karuah River Alluvial Groundwater Source. (Note: This exclusion applies to the Manning River Tidal Pool Water Source, Myall Lakes Water Source, Coolongolook River Water Source, Wallamba River Water Source and part of the Manning Estuary Tributaries Water Source)
- any water contained in the coastal sands in these water sources
- any water contained in fractured rock aquifers and basement rocks in these water sources
- rivers, lakes, estuaries and wetlands downstream of the mangrove limit, except Khappinghat Creek in the Wallamba River Water Source and Myall Lakes in the Myall Lakes Water Source.

Water Management Units

Water sharing plans are developed using various ‘water management units’: water sources, management zones and extraction management units.

The plan area is divided into water sources, which often coincide with sub-catchment boundaries. It is at the water source level that water sharing rules are developed. There are 23 water sources in the Lower North Coast Unregulated and Alluvial water sharing plan. Of these, 22 are surface water sources and one is a groundwater source.

Water sources can be subdivided into management zones where finer resolution of rules is required. There are 18 management zones within the plan.

Where appropriate, extraction management units (EMUs), consisting of one or several water sources, may be specified for the purpose of establishing a geographic area over which long-term average annual extraction limits (LTAAELs) apply. There are three EMUs in the plan.

A map of the plan area is provided in Appendix 1 and a list of the water management units are provided below in

Table 2.

Table 2: Water management units in the amended Lower North Coast water sharing plan

New water sources shaded in grey

Extraction management unit	Water source	Management zone
Manning Extraction Management Unit	Avon River Water Source	
	Lower Barrington/Gloucester Rivers Water Source	Lower Barrington River Upper Reaches Management Zone
		Lower Barrington River Management Zone
		Lower Gloucester River Management Zone
	Upper Barrington River Water Source	Upper Barrington River Headwaters Management Zone
		Upper Barrington River Management Zone
	Bowman River Water Source	Bowman River above Craven Creek Junction Management Zone
		Craven Creek Management Zone
		Lower Bowman River Management Zone
	Cooplacurripa River Water Source	Cooplacurripa River Headwaters Management Zone
		Cooplacurripa River Management Zone
	Dingo Creek Water Source	
	Upper Gloucester River Water Source	Upper Gloucester River Headwaters Management Zone
		Upper Gloucester River Management Zone
Lower Barnard River Water Source	Lower Barnard River Upper Reaches Management Zone	
	Lower Barnard River Management Zone	
Manning Estuary Tributaries Water Source	Landsdowne River Management Zone	
	Dawson River Management Zone	
	Cedar Party Creek Management Zone	
	Manning Estuary Tributaries Management Zone	

Extraction management unit	Water source	Management zone
Manning Extraction Management Unit (continued)	Manning River Tidal Pool Water Source	
	Lower Manning River Water Source	
	Mid Manning River Water Source	
	Myall Creek Water Source	Upper Myall River Management Zone
		Tidal Myall River Management Zone
		Crawford River Management Zone
	Nowendoc River Water Source	Nowendoc River Headwaters Management Zone
		Nowendoc River downstream of Cooplacurripa River Confluence Management Zone
	Rowleys River Water Source	Rowleys River Headwaters Management Zone
		Rowleys River Management Zone
Upper Barnard River Water Source		
Upper Manning River Water Source	Upper Manning River Headwaters Management Zone	
	Upper Manning River Management Zone	
Great Lakes Extraction Management Unit	Myall Lakes Water Source	
	Myall River Water Source	
	Coolongolook River Water Source	Wang Wauk River Management Zone
		Upper Coolongolook River Management Zone
		Tidal Coolongolook River Management Zone
	Wallamba River Water Source	Khappinghat Creek Management Zone
Upper Wallamba River Management Zone		
Tidal Wallamba River Management Zone		
Karuah River Extraction Management Unit	Karuah River Water Source	Karuah Upriver Management Zone
		Karuah Estuarine Management Zone
	Karuah River Alluvial Groundwater Source	Karuah Upriver Groundwater Management Zone
		Karuah Estuarine Groundwater Management Zone

Objectives of the Plan

The objectives of the Lower North Coast water sharing plan are to:

- protect, preserve, maintain and enhance the important river flow dependent and high priority groundwater dependent ecosystems of these water sources
- protect, preserve, maintain and enhance the Aboriginal, cultural and heritage values of these water sources
- protect basic landholder rights
- manage these water sources to ensure equitable sharing between users
- provide opportunities for enhanced market based trading of access licences and water allocations within environmental and system constraints
- provide water allocation account management rules which allow sufficient flexibility in water use
- contribute to the maintenance of water quality
- provide recognition of the connectivity between surface water and groundwater
- adaptively manage these water sources
- contribute to the “environmental and other public benefit outcomes” identified under the “Water Access Entitlements and Planning Framework” in the Intergovernmental Agreement on a National Water Initiative (2004).

Description of the Plan area

The Lower North Coast catchments are located on the southern end of the mid north coast of NSW. The Plan area is bounded by the Hastings River basin to the north and north west, and the Hunter Valley to the south and west and comprises the catchments of the Manning and Karuah rivers and the Great Lakes.

The Manning River, with a length of over 250 kilometres and an average annual discharge to the sea of 2,530,000 ML, has a catchment of about 8,420 square kilometres. The river flows from a plateau of the Mount Royal Range north of the Barrington Tops at a height of 1,570m. and then traverses relatively mountainous country with steep sided valleys until its confluence with the Gloucester River. Alluvial flats along the Manning are small and very sparsely located.

The main western tributary of the Manning, the Barnard River, rises in the Great Dividing Range. As with the Manning, most of the Barnard River traverses rugged mountainous country with little alluvial development along its entire course. The Nowendoc River rises to the east of Black Sugarloaf at an elevation of about 1,460 m and traverses hilly to undulating country from its headwaters downstream to the Nowendoc village.

The Barrington and Gloucester rivers rise in the Barrington Tops and Gloucester Tops respectively. The upper sections of these rivers also transverse steep rugged country and enter a larger alluvial floodplain south west of Barrington and Gloucester respectively.

The river then flows in an easterly or south-easterly direction through alluvial valleys before traversing the coastal riverine plain zone. The coastal fringes are characterised by extensive low riverine plains of sand dunes, swamps, lagoons and other sand deposits. Myall Lake, Boolambayte Lake, the Broadwater, and adjacent wetland systems are notable features.

The Great Lakes consist of Wallis Lake, Smith Lake and the Myall Lakes and have a catchment occupying approximately 2,110 square kilometres. Smith Lake is an intermittently closed and open lake (ICOLL), much smaller than the other two lake systems, with only very small tributary streams of very little average annual flow. Wallis Lake is a large lake with two major tributaries, Wallamba River and Coolongolook River. The Wang Wauk River is the major tributary of the Coolongolook. Myall Lakes is a series of closely linked lakes with the upper Myall River flowing into the most downstream lake, Bombah Broadwater, and the lower Myall River linking the Bombah Broadwater to Port Stephens near the ocean entrance. The upper Myall River provides a large proportion of the fresh water input to the Lakes with most influence on Bombah Broadwater.

Freshwater inflow impacts on the functioning of an estuarine ecosystem to different extents. The Manning River estuary has medium sensitivity to inflows (large catchment area provides freshwater flushing, however, saline gradient may move upstream with low flow extractions in upper catchments). The Wallis Lake coastal lagoons have a low sensitivity to inflows (saline lagoon areas), the Myall Lakes have a high inflow sensitivity (freshwater/brackish water lake) and the intermittently opening estuaries such as Khappinghat and Smiths Lakes are also highly sensitive to inflows. The reduction of freshwater inflows to estuaries due to upstream water allocation may increase upstream saline intrusion, cause hyper-salinity, reduce nutrient and organic inputs required for primary production, change biological structure and function, and alter the physical features of the estuary mouth.

In the south, the Karuah catchment is drained mainly by the Karuah and Myall Rivers south to Port Stephens. The Karuah catchment area is approximately 4,480 square kilometres. The upper catchment is characterised by narrow valley floors (less than one kilometre) bound by steep ridges, and consists of the upper reaches of the Myall and Karuah Rivers. Extending

20 kilometres upstream from the coastline, the middle section of the Karuah valley comprises the middle and lower reaches of the river, floodplains and adjacent rolling lands. This zone, characterised by wide river valleys in the lower reaches (up to seven kilometres) and narrow valleys in the higher reaches (1.5 kilometres), drains the extensive system of north-south ridge lines. (Refer to maps in Appendix 8).

Climate

In general, rainfall in the plan area decreases from east to west. The highest rainfall is received in the Comboyne Plateau and Barrington Tops areas, with average annual rainfall of 1,735 millimetres (mm). Rainfall at Manning Point averages 1,369 mm/year and at Karuah averages 1,130 mm/year, whereas the average annual rainfall at Gloucester is 978 mm. On average the highest total rainfall occurs in January to March.

Land use history

The Worimi and Biripai Aboriginal people occupied the Great Lakes, Karuah and Manning areas for countless generations. They lived in harmony with their environment, balancing the need for natural resources such as food and shelter and protecting the health of the rivers, lakes and forests.

The first contact for these people with Europeans was in 1790. Subsequent European settlement saw the large areas of the catchments cleared for timber and grazing activities. A significant proportion of the catchment lies within Myall Lakes National Park and State Forests. The area historically had one of the highest concentrations of dairy farms, however, this has declined in recent years.

Changes that have occurred to the streams of the Manning Valley since European settlement have been well documented (Hunter, Karuah and Manning Catchments, State of the Rivers and Estuaries Report – 2000). Indeed many coastal streams in south eastern Australia have undergone significant change. In summary, these changes include channel incision (or deepening) into its floodplain, channel widening, and channel shortening. The outcome of this is that channels have greater capacity for erosion and sediment transport, and tend to be more uniform in their nature (Brooks 1999).

High environmental value areas

Water sharing plans are required to reserve water for the overall health of the river and aquifer. This is to protect specific ecosystems that depend on river flows and alluvial groundwater levels, such as instream aquatic ecosystems, wetlands, lakes, estuaries and floodplains and groundwater dependent ecosystems. The share of water reserved for the environment is intended to sustain the aquatic fauna and flora.

Most of the flows in the Lower North Coast unregulated rivers are protected from extraction. The total volume of surface water licensed for extraction in the Manning River catchment (the Manning EMU) is only 78,100 megalitres (ML), compared to an annual average flow of 2,530,000 ML. Similarly for the Great Lakes EMU where the total volume of surface water licensed for extraction is only 2,000 ML, compared to an annual average flow of 610,000 ML.

The Plan also imposes new restrictions on access on days when flows are low in order to protect the environment. This is achieved by establishing 'cease to pump' rules that describe when water must not be extracted, depending on the amount of flow in the river on any day.

Eighteen water sources were identified as having high instream value (see Table 3). For these water sources, water trading will be limited so that there is no increase in water entitlement, and in some cases trading aims to decrease entitlement. Where these values are at risk from extraction, the cease to pump rule tends to be conservative. Appendix 10

details the threatened species considered when assessing the water source values (note this only included species that are likely to be sensitive to extraction).

Table 3: Water sources with a high instream value (based on initial assessment)

New water source is shaded in grey

Water source	Description
Lower Manning	<ul style="list-style-type: none"> • 5 threatened frog species. • 1 threatened bird species. • Riparian vegetation in good condition. • Good fish community integrity. • The ecology value of the river for invertebrates is deemed to be moderate (AUSRIVAS).
Lower Barrington /Gloucester	<ul style="list-style-type: none"> • 5 threatened frog species. • 2 threatened bird species. • Good fish community integrity. • The ecology value of the river for invertebrates is deemed to be moderate (AUSRIVAS).
Bowman	<ul style="list-style-type: none"> • 6 threatened frog species. • 1 threatened bird species. • Riparian condition in moderate condition. • Good fish community integrity. • The ecology value of the river for invertebrates is deemed to be high (AUSRIVAS).
Upper Barrington	<ul style="list-style-type: none"> • 7 threatened frog species. • Riparian zone in moderate condition. • Good fish community integrity. • Drought refuge for platypus and other aquatic plants and animals. • The ecology value of the river for invertebrates is deemed to be moderate (AUSRIVAS).
Upper Gloucester	<ul style="list-style-type: none"> • 6 threatened frog species. • 1 threatened bird species. • Significant wet fauna species. • Drought refuge for platypus and other aquatic plants and animals. • The ecological value of the river for invertebrates is deemed to be moderate (AUSRIVAS).
Myall River	<ul style="list-style-type: none"> • 5 threatened frog species. • 2 threatened bird species. • Riparian vegetation in good condition. • Integrity of the fish community is good. • Drought refuge for platypus and other aquatic plants and animals. • The ecology value of invertebrates in the river is deemed to be moderate (AUSRIVAS).

Myall Lakes	<ul style="list-style-type: none"> • 6 threatened frog species. • 3 threatened bird species. • Riparian vegetation in good condition. • Integrity of the fish community is good. • Drought refuge for platypus and other aquatic plants and animals. • The ecology value of invertebrates in the river is deemed to be low (AUSRIVAS).
Coolongolook	<ul style="list-style-type: none"> • 5 threatened frog species. • 4 threatened bird species. • Riparian vegetation in moderate condition. • Integrity of the fish community is good. • Drought refuge for platypus and other aquatic plants and animals.
Wallamba	<ul style="list-style-type: none"> • 5 threatened frog species. • 3 threatened bird species. • Riparian vegetation in moderate condition. • Integrity of the fish community is good. • Drought refuge for platypus and other aquatic plants and animals. • The ecology value of the river for invertebrates is deemed to be moderate (AUSRIVAS).
Rowleys	<ul style="list-style-type: none"> • 7 threatened frog species. • Riparian vegetation in good condition. • Good fish community integrity. • Drought refuge for platypus and other water plants and animals. • The ecology value of the river for invertebrates is deemed to be moderate (AUSRIVAS).
Cooplacurripa	<ul style="list-style-type: none"> • 6 threatened frog species. • Riparian vegetation in good condition. • Good fish community integrity. • Drought refuge for platypus and other water plants and animals. • The ecology value of the river for invertebrates is deemed to be moderate (AUSRIVAS).
Nowendoc	<ul style="list-style-type: none"> • 7 threatened frog species. • Riparian vegetation in moderate condition. • Good fish community integrity. • Drought refuge for platypus and other water plants and animals. • The ecology value of invertebrates in the river is deemed to be moderate (AUSRIVAS).
Myall Creek	<ul style="list-style-type: none"> • 7 threatened frog species. • Riparian vegetation in good condition. • Good fish community integrity. • Drought refuge for platypus and other water plants and animals. • The ecology value of invertebrates in the river is deemed to be moderate (AUSRIVAS).

Upper Barnard	<ul style="list-style-type: none"> • 5 threatened frog species. • Riparian vegetation in moderate condition. • Good fish community integrity. • Drought refuge water plants and animals. • The ecology value of the river for invertebrates is deemed to be high (AUSRIVAS).
Lower Barnard	<ul style="list-style-type: none"> • 6 threatened frog species. • Riparian vegetation in moderate condition. • Good fish community integrity. • Drought refuge for platypus and other water plants and animals. • The ecology value of the river for invertebrates is deemed to be moderate (AUSRIVAS).
Upper Manning	<ul style="list-style-type: none"> • 7 threatened frog species. • Riparian vegetation in moderate condition. • Good fish community integrity. • Drought refuge for platypus and other water plants and animals. • The ecology value of invertebrates in the river is deemed to be high (AUSRIVAS).
Mid Manning	<ul style="list-style-type: none"> • 6 threatened frog species. • Riparian vegetation in moderate condition. • Good fish community integrity. • The ecology value of the river for invertebrates is deemed to be moderate (AUSRIVAS).
Karuah	<ul style="list-style-type: none"> • 5 threatened frog species. • 3 threatened bird species. • Riparian vegetation in poor condition. • Good fish community integrity. • The ecology value of the river for invertebrates is deemed to be moderate (AUSRIVAS).

Estuaries

Estuary specialists from the former Office of Water and Office of Environment and Heritage (OEH) have assessed each of the state's estuaries to determine how sensitive they are to changes in freshwater inflows (DWE 2009).

The assessment ranks the sensitivity of estuaries based on their physical attributes – size, shape and the ratio of catchment size to the surface area of the estuary. Small estuaries, such as the coastal lagoons within the Brunswick plan area tend to be highly sensitive to inflow variations, with most being only intermittently connected to the ocean. Open mature wave dominated barrier estuaries such as the Brunswick River are generally less sensitive to inflow variations. As they mature and infill with sediment they tend to become long and narrow 'river' estuaries.

Table 4 lists the sensitivity of each of the estuaries in the Plan area. The method used for assessing estuary sensitivity is detailed in '*Macro water sharing plans – the approach for unregulated rivers. A report to assist community consultation*'.

Table 4: Inflow sensitivities for the Lower North Coast catchments

Name	Groundwater sensitivity	Low flow inflow sensitivity	High flow inflow sensitivity
Manning River Estuary	Medium	Medium	Medium
Khappinghat Creek	High	High	Medium
Wallis Lake, Proper	Medium	Low	Low
Wallis, Wallamba River	Medium	Medium	Medium
Wallis, Coolongolook River	Medium	Medium	Medium
Wallis, Wallingat River	Medium	Medium	Medium
Smiths Lake	Medium	High	High
Myall Lakes, Upper	High	High	High
Myall Lakes, Lower	High	High	High
Myall River Estuary	Medium	Medium	Medium
Karuah River Estuary, Upper	Medium	Low	Low
Port Stephens & Lower Karuah	Medium	Low	Low
Tilligerry Creek	Medium	Medium	Medium

The tidal pool is a part of the upper estuary that is essentially fresh, despite being affected by daily tidal movements. In the lower north coast area, the Manning River has a fairly significant tidal pool that sustains some commercial extraction. This is in the main trunk of the river, directly downstream of Wingham. Extraction from the tidal pool has the potential to impact on estuary values so further investigations will be undertaken during the life of the water sharing plan to determine adequate protection measures.

The other estuaries listed in Table 4 only have temporary tidal pools, generally immediately after high flow events.

Industry and water use

Significant industries in the area include oyster farming, forestry, fisheries, beef and dairy production, manufacturing, tourism, and coal and gravel quarries.

Major population centres include Gloucester, Wingham, Taree, Karuah and Foster-Tuncurry. Seasonal populations increase significantly in the coastal and mountainous areas from tourism due to the natural beauty of the area and the close proximity to major urban centres such as Sydney and Newcastle.

In the Great Lakes catchments (including the Myall Lakes, Myall River, Coolongolook River and Wallamba River water sources) the major settlements of Foster and Tuncurry are supplied with water from outside the catchment, principally from the Manning River. Hawks Nest and Tea Gardens rely on groundwater and Bulahdelah takes water from the Crawford River. In the Manning River catchments, domestic water for residents of the lower Manning centres of Taree and Wingham is sourced predominantly from the Manning River, via Bootawa Dam. Gloucester draws its water directly from the Barrington River. MidCoast

Water provides water to Stroud and the Stroud Road area via an off-stream storage connected to the Karuah River.

Hunter Water supplies a small volume of bulk treated water to Midcoast Water customers in Karuah.

There are no significant on-stream storages on the Manning River although Macquarie Generation has constructed the Barnard River diversion scheme in the upper catchment. The diversion is designed to supply the power stations of the Hunter with water in times of drought.

Licensed water extraction in the Lower North Coast catchments totals approximately 87,869 ML of entitlement from 758 surface water licences and 992 ML of entitlement from 15 ground water licences including 20,000 ML/year for major utilities (Macquarie Generation) and 17,256 ML/year for local water utilities(e.g. Midcoast Water, Gloucester Shire Council).

Stock and domestic (basic landholder right) access to water is estimated at 4,580 ML/year. The majority of licences are used for irrigation, which supports the farming of beef and dairy cattle.

Policy framework

A number of national, state and regional plans and policies have guided the development of water sharing plans for NSW, including:

- *Water Management Act 2000*
- *Access Licence Dealing Principles Order 2004*
- National Water Initiative
- Natural Resource Commission state-wide targets
- Catchment Action Plans
- NSW water planning policies and other considerations

The Water Management Act 2000

The *Water Management Act 2000* (WMA 2000) is based on the concept of ecologically sustainable development i.e. managing current development so that it will not threaten the availability of resources for future generations. The WMA 2000 recognises the need to allocate water for the environmental health of our rivers and groundwater systems, while also providing licence holders with more secure access to water and greater opportunities to trade water through the separation of water access from land title.

Water sharing plans are the main tool through which the WMA 2000 achieves its objective. The major changes required to water management have meant that the WMA 2000 has been progressively implemented, and the *Water Act 1912* progressively phased out as water sharing plans commence.

The latest copy of the [WMA 2000](#) is available from the NSW government legislation website.

Access Licence Dealing Principles

The *Access Licence Dealing Principles Order 2004* (hereafter referred to as the Dealing Principles) draws on the objects and water management principles of the WMA 2000 and provides state-wide guidance and rules for applications to undertake water dealings including trade.

The Dealing Principles specify that dealings must consider:

- the impacts on other water users
- the impacts on the water source
- the impacts on indigenous, cultural, heritage and spiritual matters
- maximising social and economic benefits

The Dealing Principles specify rules for different types of dealings (such as conversion to a new category, subdivision, consolidation, assignment of rights or allocation, changing water sources, amending extraction components and interstate dealings). They specify the requirements that must be met for a dealing to be permitted, and the conditions under which a dealing is prohibited.

Water sharing plans must be consistent with the Dealing Principles. Water sharing plans can also put additional restrictions in place such as restricting trade into a particular area due to its environmental values or hydrologic stress.

National Water Initiative

The National Water Initiative (NWI) was signed by the Council of Australian Governments (COAG) in June 2004. Through the NWI, governments across Australia, including NSW, have agreed on actions to achieve a more cohesive national approach to managing, measuring, planning, pricing and trading water. The NWI recognises the continuing need to increase the productivity and efficiency of Australia's water use, whilst servicing rural and urban communities, and ensuring the health of river and groundwater systems.

The NWI sets out guidelines, outcomes and timelines for water plans and planning processes. Until 2014 the NWI was implemented and monitored by the National Water Commission, an independent statutory body responsible for providing advice to COAG on national water issues. The Commission was responsible for undertaking a biennial assessment of each state's progress with implementing the NWI.

The role of the National Water Commission ceased in December 2014 and some of its water management functions were transferred to other agencies. Assessment of progress in the implementation of the NWI will be transferred to the Productivity Commission.

Natural Resource Commission targets

The Natural Resource Commission (NRC) was established in 2003 to provide the NSW Government with independent advice on natural resource management issues. To achieve this, the NRC has developed a Standard for Quality Natural Resource Management, along with 13 state-wide targets for natural resource management which have been embedded in the NSW State Plan. The Standard is designed to apply to natural resource management at all scales including at the state, regional, catchment and local level.

The NRC's Standard requires the use of the best available knowledge, appropriate information management systems, delivery of integrated outcomes, engagement of the community and regular monitoring, measuring, evaluation and reporting to specify how delivery of the targets are progressing. The NRC reviews water sharing plans against this standard and its associated targets. In 2013 the NRC reviewed 31 water sharing plans that were due to expire in 2014 and provided advice to the Minister for Primary Industries.

In 2012 the NRC reviewed the state-wide standard and targets, including monitoring, evaluation and reporting arrangements in NSW. They recommended five new state-wide targets that provide a sharper focus on the key long-term issues of concern to the Government and community and revised the monitoring, evaluation and reporting strategy to support the implementation of the new targets.

Catchment Action Plans

Catchment action plans are statutory, non-regulatory plans that were previously prepared by the state's catchment management authorities under the *Catchment Management Authorities Act 2003* (now repealed). In January 2014 the NSW Government established Local Land Services (LLS) and transferred the functions of catchment management authorities into this new organisation to provide agricultural support, natural resource management and emergency management to rural communities through a single organisation. The Hunter Local Land Services will be responsible for continuing the delivery of natural resource management programs within the plan area, including catchment management plans.

NSW water planning policies and considerations

A number of policies and guidelines have been developed since commencement of the WMA 2000. These policies have arisen in response to specific water management issues that need to be considered during the development of water sharing plans. These policies directly influence the planning process and the formulation of water sharing rules.

Protecting pools, lagoons and lakes

Pools in NSW can provide an important source of water for licence holders, landholders and communities. Pools also have a key ecological function as a critical refuge and habitat for flora and fauna. For the purpose of this policy a pool refers to any lentic water bodies (standing water) within or associated with unregulated rivers in NSW, including water bodies that fall within the definition of a lake according to the Dictionary of the WMA 2000 (the exception is tidal pools and estuaries).

The policy document *Macro water sharing plans – the approach for unregulated rivers. Access and trading rules for pools* can be found on the DPI Water website www.water.nsw.gov.au. This document provides guidance for Interagency Regional Panels in setting water access and trading rules for pools that are covered by unregulated river water sharing plans.

The general approach is to establish a default access rule where no draw down is allowed below full pool capacity for the majority of pools. This default rule may be reviewed where it is justifiable and feasible to do so, to allow limited access to pools based on local hydrological, environmental and socio-economic considerations.

Default rules vary depending on the pool type. Generally the default rule for artificial pools is to adopt the existing licence conditions; however in some circumstances where this may not be appropriate, alternate rules will need to be developed. For natural pools, the default rule requires users to stop pumping when the pool is less than its full capacity (approximated by the greatest pool volume at which there is no visible flow leaving the pool).

The plan process does allow for more lenient access rules to be set if the default rules would significantly impact on current irrigation operations.

Managing surface water and groundwater connectivity

A key objective of the National Water Initiative is 'recognition of the connectivity between surface and groundwater resources and connected systems managed as a single resource'. Most alluvial aquifers have a relatively high degree of connectivity with their associated surface water sources. Accordingly, most alluvial water sources are included in a water sharing plan that covers both surface water and its connected alluvial groundwater. Conversely, most porous rock, fractured rock and coastal sands aquifers are considered to have a lesser degree of connectivity and are included in groundwater-specific plans.

Consistent with the state-wide approach, extraction from highly connected aquifer access licences that relate more closely to the regulated river will be managed annually, via AWDs, whilst highly connected aquifer access licences that related more closely to unregulated water sources will be managed via unregulated river cease-to-pump rules.

The document *Macro water sharing plans – the approach for groundwater. A report to assist community consultation* provides further information about the principles used to develop water sharing rules for groundwater sources.

Protecting basic landholder rights

As defined under the WMA 2000, basic landholder rights (BLR) consist of domestic and stock rights, harvestable rights and native title rights. Water may be extracted under these rights without the need for a water access licence; although where groundwater is accessed under a domestic and stock right, the bore must still be approved by DPI Water.

The WMA 2000 requires that water sharing must protect BLR. The plan does this by identifying the requirements for domestic, stock and native title rights at the start of the plan and considering these requirements when designing the rules for licensed water extraction. The access rules for licensed water extractions do not apply to water extracted under BLR, thus affording priority to BLR users.

The requirements of harvestable rights have been inherently considered in the water sharing process, as access rules are based on river flows that result after harvestable rights extractions have occurred. There are currently no extractions for native title rights, however the plan allows for these rights should they be activated during the plan's ten year term.

The Lower North Coast water sharing plan provides an estimate of the water requirements for BLR within each water source, noting that these rights may increase during the life of the plan. The water sharing plan cannot limit or restrict these rights, but the WMA 2000 provides for restrictions on BLR through the development of mandatory guidelines.

Protecting town water supply access

Under the WMA 2000, extractions for town water supply are afforded a higher priority than extractions for commercial purposes such as irrigation. Water sharing plans recognise this priority by ensuring that a full share of water is allocated for annual town water supplies except where exceptional drought conditions prevent this. Local water utilities such as local councils are issued with local water utility access licences. The WMA 2000 allows for annual trade but not permanent trade of entitlement between local water utility access licences.

Any development of new water storages in the plan area must be undertaken within the bounds of the plan. The plan is not prescriptive in endorsing any particular option since economic considerations vary over time. Instead, the plan sets a framework within which development of future water supplies can occur in a sustainable manner.

Protecting Aboriginal values

Aboriginal people have a spiritual, customary and economic relationship with land and water that provides an important insight into natural resource management. The NSW Government established the Aboriginal Water Initiative in 2012 to facilitate effective engagement with Aboriginal communities in the water sharing process and ensure that measurable Aboriginal water outcomes are achieved. The Initiative aims to build Aboriginal peoples' capacity to participate as water users, protect their rights to water, maintain a healthy environment, and take full advantage of economic opportunities.

Water sharing plans recognise the importance of rivers and groundwater to Aboriginal culture. The plans allow Aboriginal communities to apply for water access licences for cultural purposes such as manufacturing traditional artefacts, hunting, fishing, gathering, recreation and for cultural and ceremonial purposes. Aboriginal cultural licences can also be used for drinking, food preparation, washing and watering domestic gardens. The WSP allows for the granting of cultural licences, limited to 10 ML/yr per application, for Aboriginal cultural purposes throughout the Lower North Coast's unregulated catchments.

For further information refer to *Our Water Our Country. An information manual for Aboriginal people and communities about the water reform process* which is available from the DPI Water website www.water.nsw.gov.au.

River flow objectives

In 1997 the NSW Government developed water quality and river flow objectives for NSW unregulated river catchments. The development of the rules in the initial Lower North Coast WSP 2009 was guided by these River Flow Objectives, as per the then NSW State Water Management Outcomes Plan. The relevant river flow objectives adopted for the unregulated rivers for the Lower North Coast WSP area (refer Appendix 9 for detail) aimed to:

- protect natural low flows
- protect natural water levels in pools of creeks, rivers and wetlands during periods of no flow
- protect a proportion of moderate flows, 'freshes' and high flows
- maintain or rehabilitate estuarine processes and habitats
- maintain groundwater within natural levels, and variability, critical to surface flows or ecosystems.

Water interception activities

Changes in land use activities can potentially result in the interception of significant quantities of surface runoff and throughflow. Activities that can impact on water quantity include the development of significant areas of new forestry plantations or increased farm dam capacity in a catchment. Under the NWI, significant interception activities should be accounted for within a plan's extraction limit. The Lower North Coast is considered an area in which there is no significant water interception activities anticipated within the life of the Plan

Forestry expansion

Large areas of the catchment are covered by National Parks and State Forests. State Forests are managed with selective logging technique, resulting in minimal change to catchment hydrology. Some plantation forests are anticipated but are not considered to have a significant impact on river flow at the water source or catchment level.

Instream dams

Farm dams currently require an access licence when:

- they are located on a third order (or greater) river, irrespective of capacity or purpose;
- they exceed the maximum harvestable right dam capacity for the property, which enables the capture of ten per cent of the mean annual run-off from the property, or
- they are on a permanent (spring fed) first or second order stream.

Unlicensed extraction from farm dams that doesn't match any of the above criteria may be permitted under "harvestable rights", a component of the basic landholder rights. The full activation of harvestable rights within the area of the plan is considered highly unlikely.

Water sharing plans cannot restrict the volume of water collected under harvestable rights¹ but can place restrictions on instream dams – dams that are located on streams of third order or higher. Under state-wide policy the construction of new instream dams is prohibited in those water sources in which high instream values have been identified.

¹ The maximum harvestable right dam capacity is calculated based on providing the ability to harvest 10% of the mean annual runoff from the landholder's property. It is determined using a calculator provided on the DPI Water website, with input parameters being property location and property size.

Floodplain harvesting activities

Floodplain harvesting is the collection, extraction or impoundment of water flowing across floodplains, excluding the following types of water extraction:

- taking of water under any other type of water access licence that is not a floodplain harvesting access licence or an applicable water access licence exemption
- taking of water under a basic landholder right, including the harvesting of rainwater runoff
- runoff of irrigation water and stormwater which is subsequently captured in tailwater return systems or other means in accordance with licence conditions or methods which have been approved by DPI Water.

The practice of floodplain harvesting does not generally apply in coastal systems. Generally however, if applicable in unregulated river water sources, floodplain harvesting has mostly already been recognised and licensed during the conversion of area based water licences to volume based licences. However, further volumetric entitlements, measurement and long-term limits for floodplain harvesting may be established in the future under the NSW Floodplain Harvesting Policy which is currently under development.

Developing the water sharing plan

DPI Water is responsible for implementing the WMA 2000, including developing water sharing plans for the state's water resources. DPI Water established several interagency panels to assist with the development of water planning policies and water sharing plans.

The Lower North Coast Unregulated water sharing plan was prepared based on:

- indicative rules generated by a risk and values classification,
- the deliberations of the Regional Panel, and
- feedback from stakeholders during targeted consultation and public exhibition.

This section describes the various panels and outlines the process of developing the Lower North Coast Unregulated water sharing plan including the risks and values classification, refinement of the indicative rules based on panel deliberations, and targeted consultation and exhibition of the draft plan.

Role of the panels

State Interagency Panel

The State Interagency Panel has overall responsibility for the strategic direction of the macro water sharing planning project, to make certain that adequate resources are available and to ensure that the varying policy and statutory requirements of the relevant NSW Government agencies are met. The State Interagency Panel also has the role of making water sharing decisions in cases where regional panels cannot reach agreement.

The State Interagency Panel is chaired by DPI Water and comprises representatives from DPI Water, OEH, Local Land Services (formerly catchment management authorities), and agriculture, fisheries and aquaculture specialists from the NSW Department of Primary Industries (DPI). DPI Water is responsible for the overall project management.

Interagency Regional Panels

Interagency Regional Panels were established to develop water sharing plans. Regional panels consist of two representatives from DPI (one from DPI Water and another representing agricultural and fisheries interests), and one representative from OEH. A representative from Local Land Services attends meetings as an observer to provide advice on consultation issues and other matters within their areas of expertise.

Appendix 1 lists the names of the Hunter Regional Panel representatives and their areas of expertise, and lists their colleagues who they had access to for specific technical and scientific information.

The key responsibilities of the Regional Panel were to:

- ensure water sharing rules are consistent with state policy
- review the water management units provided by DPI Water
- review economic, social and environmental values and undertake risk and value assessments to classify each unregulated water source
- review existing and generic water sharing rules as to their applicability
- make recommendations on water access and dealing rules for each water source
- assist with consultation on the proposed rules

- review submissions from targeted consultation and public exhibition, and make changes where necessary to the water sharing rules.

The Regional Panel used local knowledge and expertise in developing and recommending the water sharing rules through a consensus decision-making approach.

Consultation to inform rule development

The Panel's proposed draft rules underwent targeted consultation with water users and specific interest groups before the Plan was drafted. Formal public exhibition of the draft Plan ensured wider public consultation.

The former Catchment Management Authorities assisted with the public consultation process, to ensure that all stakeholders and interested parties had an opportunity to examine and comment on the proposed water sharing rules. In particular, stakeholders were encouraged to provide:

- Local knowledge and expertise – for example, there may be other natural or socio-economic values that have not yet been considered by the Regional Panel
- Feedback on the practical elements of the proposed water sharing rules - to make certain they are easily implemented by the licence holders
- Confirmation that there are no unintended outcomes from the plan – it is essential that this be given due consideration before the plan is finalised
- Specific comments on the Minister's notes included in the draft plan

While developing the macro plans, the participating agencies identified areas where better data was needed for making future water planning decisions. Similarly, the community might suggest areas where further analysis or data gathering is required. This local input is essential in the finalisation of the draft Plans.

Targeted consultation on the Lower North Coast plan

Targeted consultation on the proposed rules was held in the Lower North Coast plan area in late 2005 – early 2006 (Table 5). The objectives of this consultation were:

- to provide background to stakeholders as to why the macro plans were being developed, how they were developed, what rules were proposed in the various areas and how stakeholders could provide feedback
- to provide a 'first opportunity' to informally consult with key stakeholders to test the suitability of the proposed water sources and management zones, flow reference points and access and trading rules.

A total of six submissions were received as a result of the targeted consultation. These were reviewed by the Panel.

An additional meeting was held in Taree in September 2006 as part of the Groundwater Macro Water Sharing Planning process, providing an overview of the proposed management rules for aquifers. This covered the proposed alluvial aquifer management which was still under a separate water sharing plan at the time, but has since been included in this Plan.

The Panel reviewed all submissions as well as matters raised at the meetings and as a result made some changes to the initial rules. Appendix 6 outlines the changes to the proposed rules as a result of the consultation. The Panel responded to all submissions so that individuals and groups could see the outcomes of their submissions in relation to the Panel's deliberations.

Table 5: Key groups consulted in Lower North Coast targeted consultation

Date	Group	Location
October 2005	Hunter Aboriginal Community and Environment Network	Tocal
November 2005	Manning Valley Water Users Association (WUA), Dingo Creek WUA, Gloucester Valley WUA and Landcare	Wingham, Gloucester
November 2005	Midcoast Water	Taree
November 2005	General Public	Taree
June 2006	Hunter Aboriginal Community and Environment Network	Singleton
June 2006	Nature Conservation Council	Singleton
June 2006	Manning tidal pool water users	Taree

Public exhibition of the Lower North Coast plan

Public exhibition of the proposed rules was held in the Lower North Coast WSP area in late 2007. The objectives of this consultation were:

- to provide background to stakeholders as to why the macro plans were being developed, how they were developed, what rules were proposed in the various areas and how stakeholders could provide feedback
- to formally consult with a broad range of stakeholders to test the suitability of the proposed water sources and management zones, flow reference points and access and trading rules.

Two public briefings were held at Taree and Gloucester during the public exhibition period. A total of 45 submissions were received as a result of the public exhibition. These were reviewed by the Panel.

The Panel reviewed all submissions as well as matters raised at the meetings and as a result made some changes to the rules. Appendix 7 outlines the changes to the proposed rules as a result of the consultation.

The Panel provided a general response to all submissions so that individuals and groups could see the outcomes of the review of submissions in relation to amendments to the Plan

Consultation for replacement of the Karuah plan

Public submissions regarding the Karuah River water sharing plan were called for in 2012. These submissions and additional information were collated and reviewed in 2013. A report was submitted to the Minister recommending these plans be replaced. No submissions specifically relating to the Karuah River were received.

Due to the minor changes proposed and the expected associated minimal impact, there was no formal public consultation or exhibition process undertaken with the remaking and merging of the Karuah WSP. In 2015 however, all affected water users received a letter with a phone contact for inquiries and an address for the submission of any written comments. Included with this correspondence was an information package comprising a Report Card, a fact sheet detailing the proposed changes and a map of the area affected.

Water sharing rules for unregulated water sources

The Lower North Coast water sharing plan establishes a framework for water sharing that defines:

- planned environmental water to protect instream environmental values
- water that is required to meet BLR
- flow classes and daily access rules for managing licensed extraction from unregulated rivers and alluvial aquifers (including domestic and stock, local water utilities, unregulated river access licences and aquifer access licences)
- access licence dealing rules, which control the trade of water within or into other water sources.
- long-term extraction limits and available water determinations (AWDs) for each water source
- rules for granting access licences
- rules for water allocation accounts
- rules for water supply work approvals

The following sections provide further background on each of these components, and outline the information and methods used in developing the specific water sharing rules.

Water source classification

The 'macro planning' process is the current approach of DPI Water to developing plans for unregulated rivers and is described in the report *Macro water sharing plans - the approach for unregulated rivers*, available on the DPI Water website..

As part of this process a classification is made, which assists in determining the optimal balance between extraction and retention of water instream, for each water source. These broad-scale relative assessments show where water sharing rules are needed to strongly protect valuable natural assets by limiting extraction or to provide for extraction by water users where there is significant community dependence on extraction.

The Panel classified each water source as high, medium or low on the basis of its instream and economic values and the risks to these values. Two matrices were developed – the first being the 'value matrix' which rated a water source's instream value against its hydrologic stress. The second was the 'risk matrix' which rated the risk of extraction to instream values against community dependence on extraction.

Specifically the classification process involves assessing:

- instream values (such as threatened fish species) and the risk to these values posed by existing or increased extraction
- hydrologic stress, based on the demands for licensed extraction relative to river flows
- the risk to instream values posed by extractions
- extraction value, a qualitative assessment of the economic value of the agriculture which relies on the water licensed for extraction
- the economic dependence of the local community on activities requiring licensed water extraction
- the sensitivity of estuaries to the removal of freshwater inflows.

Generic, indicative rules were developed for each classification for each matrix to expedite the development of the water sharing plans by the panel. Where necessary, the panel refined these indicative rules to reflect local circumstances. The 'value' matrix was used to develop trading rules and the 'risk' matrix used to develop the water access rules. The final classifications determined by the Panel for all water sources (both value and risk matrices) have been summarised in Appendix 4.

It is important to note that the matrix approach was used as an 'indicative tool' to develop initial classifications. While these classifications guided the water sharing rules, a major role of the Panel was to use the local knowledge of panel members to check whether the final classifications were realistic.

A large range of reference material was used in addition to the knowledge of Panel members and technical support staff. The reference material is listed in Appendix 2.

Exceptions to the generic classification

The Hunter was used as a pilot region for the development of macro water sharing plans within the State. Accordingly, in undertaking the classification process and in the development of plans, the Hunter Regional Panel worked through a number of iterations of both the assessment process and the related classification of water sources. This was due to changes and improvements made to the guidance used to assist Panels in the classification process.

Classifications for some water sources changed several times as a result of improvements to the classification process. Details of changes to classifications made by the Panel are documented in Appendix 3.

Planned environmental water

The water sharing plan identifies and protects water for environmental purposes in each water source. This is defined as 'planned environmental water' and consists of water that is remaining within the stream or aquifer after water has been taken for BLR and access licences in accordance with the rules of the plan.

In unregulated streams planned environmental water is generally delivered through two mechanisms:

- On a daily basis environmental water is protected through the implementation of cease-to-pump rules and total daily extraction limits which are applied to water access licences.
- On an annual basis environmental water is protected through the establishment of long term average annual extraction limits.

The Regional Panel set cease-to-pump rules for each water source in the plan area which are discussed in the section on daily flow rules. For water sources where cease-to-pump rules could not be practically linked to a gauging station, the plan applies simple visual rules to protect environmental water such as a 'no visible flow' rule, and no pumping from instream or off-river pools when the pool is less than full capacity.

Requirements for water

The water sharing plan defines all of the licensed and unlicensed requirements for water within the Lower North Coast plan area.

Basic landholder rights (BLR), which comprises access to water for domestic and stock purposes and for native title rights, must be provided for and protected within a water sharing plan. The water sharing plan provides an estimate of the water requirements for domestic

and stock rights within each water source. BLR requirements were estimated using the number of properties with river frontage in each water source, and estimated water usage based on property size, climatic region and land use.

Access rules for unregulated water sources

Prior to the commencement of the 2009 plan for the Lower North Coast at least nine water sources in the Plan area had no existing licence conditions requiring pumping to cease when flows were low. In others, only a small proportion of licenses were subject to flow rules. In general, access licences relating to groundwater extraction focused on annual limits rather than daily management.

Upon commencement of the Lower North Coast plan in 2009, all surface water licences in all unregulated water sources became subject to access (cease-to-pump) rules (excluding licences listed in Schedule 5 of the plan). These rules vary depending on where a licence is located within the plan area. These rules also apply to any users extracting from the alluvial aquifer within 40 metres (m) of the river from year six of the Plan recognising the high degree of connectivity between the alluvial aquifer and river flows. More detailed information can be found on individual rule summary sheets available on the DPI Water website..

Under the macro planning process, generic access rules are determined by balancing the risk to instream values (a product of instream value and hydrologic stress) and the community dependence on extraction. It is important to note that the macro approach was used as an 'indicative tool' to develop initial classifications. While these classifications guided the water sharing rules, a major role of the Regional Panel was to use the local knowledge of panel members to check whether these classifications were realistic.

For example the Regional Panel considered:

- existing local water sharing rules, to determine whether they achieved the required level of environmental protection and provided for basic rights
- local studies or information from regional staff in areas such as irrigation (DPI Agriculture) or aquatic ecology (DPI Water)
- extraction patterns by local water and major utilities

In some instances, indicative rules were further refined if site specific information was available.

Minimal changes were made to the access and trading rules for the Karuah River water source as part of its merging into the Lower North Coast plan as this water source had been through its own process during the development of the 2004 water sharing plan.

Access rules for rivers and creeks

The macro approach results in a set of indicative access rules otherwise known as cease-to-pump (CTP) rules. There are generally four rule levels that can be applied depending on the instream value and community dependence on extraction (Table 6).

In some water sources, local water user associations have hourly pumping restrictions or other arrangements to conserve water during dry times. While these have often been very effective in sharing water between license holders, they are voluntary and have not been enforceable via licence conditions. The Plan applies cease to pump rules across all water sources where extraction is occurring.

Table 6: Indicative access rules for rivers and creeks under the macro approach

Rule level	Indicative cease-to-pump rule	Indicative environmental rule	Instream value	Community dependence
1	No pumping unless flows exceed a specified level at the reference point	Consider commence-to-pump rule	High	Low
2	No pumping unless there is a visible flow at the reference point	Consider commence-to-pump rule	↑	↓
3	No pumping if it draws down the pool	Consider commence-to-pump rule		
4	Exception to no drawing down pools rule for example allow pool drawdown to a specified level		Low	High

Access rules for pools, lagoons and lakes

The indicative rule for all instream natural pools where visible flow at the pump site is the only access rule in the water source or management zone is “no drawdown below full capacity”. For water sources where the indicative access rule is set at a reference point other than the pump site (for example a road bridge, or gauging station), the no drawdown rule for instream pools described above does not apply, and the access rule for the water source or management zone does apply.

Dealings (trading) rules in unregulated water sources

Trading rules under the macro planning process are guided by the following principles:

- Where instream values are considered high, trades are either not permitted or only allowed into high flows.
- Where a water source is under high hydrologic stress no trades are permitted into the water source.
- Trades into downstream water sources are permitted regardless of stress or instream value, as long as the water sources have a direct hydrologic connection.
- Trading within water sources is generally permitted, however in some areas trading may be restricted to protect high value areas or to limit demand in areas where competition for water is already high.

As a result of these principles, trades are not permitted into many unregulated water sources across the plan area. High instream value water sources are protected by prohibiting trades or limiting trades into only higher volume flows. Trades are allowed into some water sources with lower value in order to encourage the movement of extraction from high to lower environmental value areas. Trades between water sources have been permitted in some circumstances where there is a direct hydrologic connection but only within individual EMUs.

Exceptions to the generic rule approach

In reviewing the indicative rules proposed for each water source the Panel used their local knowledge to refine access and trading rules where appropriate. Amendments made were based on factors such as:

- available infrastructure (e.g. river gauges)
- available management systems (e.g. ability to manage the rules)
- existing management rules (e.g. existing licence conditions or water users' association management rules)
- whether the highly variable nature of the water source required differing management rules.

The Panel recognised that local interpretation of the indicative water sharing rules was very important. For example, the rule of 'no pumping from pools when pool drops to a specified height' was regarded as inappropriate in coastal systems due to small pool sizes and the numerous numbers of pools, and was not consistent with River Flow Objectives (pools need to be maintained for drought refuge). In these instances the Panel adopted a rule of 'no pumping from pools where there is no visible inflow and outflow'. This approach has been more recently formalised as the applicable statewide pool access policy under the Macro Water Planning process.

With respect to trading rules, the Hunter Panel initially did not allow for 'no net gain' trades¹ at the commencement of the Plan, proposing no trading into these water sources instead, due to the difficulty in effectively administering this type of transfer at the time.

These types of trades were generally considered for water sources with low to medium instream values and high hydrologic stress/risk. However, the Panel amended this proposal post public exhibition due to concerns from water users and introduction of management systems to administer such trades.

In water sources where the existing access rule was more stringent than the indicative rule, generally the existing access rule was adopted, given that there should be no adverse social or economic impact as there would be no change to current operations. In these circumstances the Panel acknowledged that many of the rules had been negotiated by water users, had been in place for a long period of time and seemed to be adequately protecting values while providing security for water users.

Appendix 5 outlines the changes made to the initial access and trading rules by the Panel.

Refining the access rules for the Karuah River Water Source

Management zones

The former *Water Sharing Plan for the Karuah River Water Source 2003*, established and defined five management zones:

Zone 1 - Telegerry River management zone (Telegerry River and all of its tributaries)

Zone 2 - Upper Karuah River management zone (Karuah River and all its tributaries that enter Karuah River upstream of Stroud Weir, excluding Mammy Johnsons River)

¹ 'no net gain trades' means that a trade cannot increase entitlement in a water source to a level above that at the start of the Plan

Zone 3 - Mid Karuah River management zone (Karuah River and all its tributaries that enter Karuah River downstream of Stroud Weir, but upstream of the Booral flow monitoring site)

Zone 4 - Mammy Johnsons River management zone (Mammy Johnsons River and all its tributaries)

Zone 5 - Lower Karuah River management zone (Karuah River and all its tributaries that enter Karuah River downstream of the Booral flow monitoring site)

These five management zones were previously established, together with the trading (dealing) rules, to ensure that all trades occurred in a downstream direction. However, there had been little or no trade during the term of the water sharing plan, and any future proposed trade would need to be assessed before it could proceed. It was therefore considered that the retention of the existing management zones was not warranted

The former five management zones were simplified into two management zones by combining existing zones 1, 2, 3 and 4 and combining zone 5 with the currently excluded lower area of the Karuah River Water Source. The Booral gauge is the dividing point between the two new management zones.

Removal of daily and individual extraction limits

The former *Water Sharing Plan for the Karuah River Water Source 2003* contained detailed rules that specified flow classes and total daily extraction limits. There have been no objections or comments made regarding the access limits or requests made to modify these provisions over the past 10 years.

While these provisions have yet to be fully implemented due to the lack of the implementation of a metering requirement, the intentions of the earlier Water Management Committee with respect to flow classes and TDELs will be retained. However their implementation will only be enabled subject to the establishment of a metering requirement. The new plan therefore includes an amendment clause enabling the establishment, amendment, removal or reinstatement of flow classes and TDELs at a future time if required.

Amendment of access rules

As the continuation of the previous management regime for the Karuah River water source is acceptable to water users, its intent will be applied to the new management zones as follows.

- For the Karuah Upriver Management Zone,
 - a cease to pump (CTP) of 3.5 ML for the upriver management zone, with a 24 hour delay once flows are > 3.5 ML (no change from current access rule)
 - the existing access rules relating to the Stroud Fishway be retained.
- For the Karuah Estuarine Management Zone, a CTP of no visible flow (no change from current access rule).

The no visible flow cease to pump limit is defined as follows:

Pumping is not permitted from natural pools when the water level in the pool is lower than its full capacity.

Natural pools include in-river pools found within the channels of rivers and creeks and off-river pools located on flood runners, floodplains and effluents e.g. lakes, lagoons and billabongs. In this case 'full capacity' can be approximated by the pool water level at the point where there is no visible flow into and out of that pool. For the minority of pump sites not

within a natural pool, these licences will be required to cease to pump when there is no visible flow at that pump site.

Inclusion of permission for high flow conversion of licences

Since the Karuah River water sharing plan commenced in 2004, the NSW Government has agreed on a policy for converting unregulated river licences in the coastal catchments to high flow only access licences. The policy applies a conversion rate of 1:2, that is, for every 1 unit of unregulated river licence share surrendered, 2 unit shares of high flow only access will be granted.

This policy will now be permitted in the Karuah River water source, initially up to 500 ML at the rate of 1:2 in years 1–5 of the plan. Subject to review, further entitlement may be converted up to a maximum of 2,530 ML.

Inclusion of alluvial groundwater and permission, subject to assessment, to convert surface water licences to alluvial licences

A further change in policy since 2004 is to include the management of upriver and floodplain alluvial aquifers in the unregulated surface water sources. Annual extraction in these alluvial aquifers is to be managed in parallel to the surface water through the unregulated river water sharing plan. All upriver and coastal floodplain alluvial licences will be subject to surface water access rules from year 6 of the amended water sharing plan.

For the Karuah River Water Source this change now permits the opportunity to convert a surface water licence to an alluvial aquifer access licence, subject to assessment.

Inclusion of permission for Aboriginal Community Development Licences

Consistent with a policy change since 2004, the plan now permits applications for Aboriginal Community Development Licences within the Karuah River Water Source.

Other changes

Other minor amendments have been made to clarify existing rules and to simplify the overall plan. These do not change the intent of any rules and are aimed at standardising clauses to make them consistent with the latest water sharing plans and legislative framework.

Managing extractions

Long Term Average Annual Extraction Limit

There are three Extraction Management Units (EMUs) within the Lower North Coast Unregulated WSP (refer to Table 2). Each EMU sets its own Long Term Average Annual Extraction Limit (LTAAEL) to which extractions will be managed.

LTAAEL in the replacement water sources

The Karuah River EMU consists of the Karuah River Water Source and the Karuah River Alluvial Groundwater Source. The entitlements for these water sources were included in the LTAAEL for the 2004 Karuah water sharing plan.

Growth in use

To protect the water set aside for the environment and the supply to existing users, it is important to control any growth in water used over time that is above the limit specified in the plan i.e. growth in extractions above the LTAAEL. For the three EMUs of the Lower North Coast, a reduction in allocated water may be triggered if the average annual usage over any

three year period exceeds the LTAAEL by more than five per cent. Reductions in allocation will be implemented by reducing the available water determination (AWD).

Available water determinations

Available water determinations (AWDs) are primarily used to credit water into a licence water allocation account. Specific purpose access licences such as domestic and stock or local water utility access licences, will be permitted to extract 100% of their share component, except in years of exceptional drought. During periods of extremely low stream flow, daily access rules may limit extraction so that the full annual entitlement cannot be realised.

AWDs are also used to manage growth in extractions above the LTAAEL, that is, if growth occurs then the maximum AWD will be reduced to less than 1 ML per unit share in order to manage growth.

The AWD for unregulated river access licences will be 1 ML per unit share, unless a growth-in-use response is required. However for the first year of the plan, a one-off announcement of 2 ML per unit share will be made to allow the operation of three year accounting rules described below.

Carryover and water accounts

A water allocation account will be established for each water access licence. Water is credited to the account when an AWD is made, and debited when water is extracted. A licence holder's account is not permitted to go into debit.

Unregulated rivers have enormous variation in annual flows between years. It is therefore important to allow this variability to be reflected in accounting practices. Unregulated river access licence account management will operate under three year accounting rules. Available water determinations combined with the carryover allowance will enable licence holders to use up to twice their water allocation in a year provided that over a consecutive three year period they do not exceed the sum of their water allocations for those three years.

For the first three years of the plan, this maximum volume that may be taken may not exceed a volume equal to three times the access licence share component (where this is expressed in megalitres), or 3 ML per unit share (where the share component is expressed in unit shares). This restriction in the first three years is due to the allocation of 200% (where share component is expressed as a volume) or 2 ML per unit share (where share component is expressed in unit shares), made in the first year of the plan to allow the operation of these accounting rules from year one of the plan.

The maximum amount of unused water allocation that can be carried over from one water year to the next in unregulated river access licence accounts will be 100% of the share component (where this is expressed in megalitres), or 1 ML per unit share (where share component is expressed in unit shares).

Granting new access licences

Consistent with the WMA 2000, the Lower North Coast water sharing plan does not permit the granting of new unregulated river access licences. Any new commercial development must purchase entitlement from existing access licences consistent with the dealing rules defined in the water sharing plan. The water sharing plan does however permit the granting of several other categories of access licence including: Aboriginal community development, Aboriginal cultural, domestic and stock licences and high flow only access licences.

Aboriginal Community Development licences

Aboriginal community development licences can be used for commercial activities owned/operated by Aboriginal people. Although many rivers in the plan area already have a high number of irrigation licences, and are generally judged to be 'stressed', some systems have higher and more reliable flows. These provide an opportunity for licences to be granted for Aboriginal commercial activities, provided this additional extraction would not negatively impact on ecological values that are dependent on high flows.

In these catchments, Aboriginal community development licences may be issued which allow water to be pumped from rivers during the higher flows. Since granting these licences would mean less water remains in the river to meet environmental needs, the plan limits the total volume that can be extracted for Aboriginal commercial purposes. The limit is a proportion of the river flow, and will never exceed 500 ML/year per water source.

For the Lower North Coast water sharing plan, provision is made for the granting of Aboriginal community development licences in the following water sources:

- Dingo Creek
- Lower Manning River
- Lower Barrington/Gloucester Rivers
- Upper Gloucester River
- Mid Manning River
- Karuah River

Aboriginal cultural access licences

Aboriginal cultural access licences of up to 10 ML per year may be granted to Aboriginal persons or Aboriginal communities for any personal, domestic or communal purpose such as drinking, washing, gardening, making traditional artefacts, or for recreation or ceremonial purposes. The water sharing plan allows for the granting of these licences in any water source.

High flow conversions

Many coastal unregulated rivers suffer severe competition for water during dry spells. These extended periods of low flow tend to be when water users compete most strongly for access to dwindling flows and pools. Instream values can also be stressed during these low flow periods as wildlife is concentrated and water quality can deteriorate.

By changing water use from periods of low flow to periods of relatively higher flow, over time, streams may be de-stressed and river conditions may improve. However, in order to utilise higher flows, it is generally necessary to construct on-farm storage.

As an incentive, the Lower North Coast water sharing plan provides for irrigators that convert to higher flows to be granted additional volumes of water ie. for every one unit of an unrestricted licence surrendered, 2.5 units of higher flow entitlement will be granted.

State-wide guidelines recommend that high flow conversions only be adopted in specified water sources if:

- the water source is classified as having important instream values at high risk from extraction or in water sources having high hydrological stress
- there are adequate mechanisms in place to ensure the surrendered low flow is reserved for the environment
- there is a no highly sensitive estuary or other identified high flow sensitive feature such as a wetland within the EMU
- there is no significant extraction already occurring in high flow periods

Water sources where high flow conversions have been recommended include the Avon River, Dingo Creek, Mid Manning River, Lower Manning River, Lower Barrington/ Gloucester Rivers and the Upper Gloucester River.

Water sharing rules for alluvial groundwater sources

There are a number of macro water sharing plans prepared for groundwater aquifer systems across the State including for, coastal sand, fractured rock and porous rock aquifers. While these are separate water sharing plans, there will be instances where plans must consider the inter-linkages of the water resources, for example in alluvial groundwater systems where the stream flow and groundwater are often closely linked.

Accordingly the Lower North Coast water sharing plan has considered both unregulated river flows and highly connected upland alluvial groundwater which occurs above the tidal limit.

Surface water – groundwater interactions

Groundwater and surface waters are often inextricably linked. The actual connections between surface and groundwater systems vary significantly between systems. For example, surface waters recharging alluvial aquifers may emerge again at a discharge point in the river within hours. In contrast water recharging aquifers of the Great Artesian Basin may not discharge for some tens of thousands of years. The connection characteristics need to be considered in linking surface water and groundwater planning, because in some cases, the same resource is being accessed.

For the purposes of water sharing, aquifer types have been grouped into four basic categories:

- Porous rock aquifers found in rock formations such as sandstone or limestone. Groundwater occurs within the pore space in the rock matrix.
- Fractured rock aquifers found in rock formations such as granite or basalt. Groundwater in these rocks occurs mainly within the fractures and joints.
- Coastal sand aquifers, where groundwater is contained in the pore spaces in the unconsolidated sand sediments.
- Alluvial aquifers, where groundwater is contained in the pore spaces in the unconsolidated floodplain material.

The level of connectivity, the relative level of impact and the timing of connection have been considered in developing both the unregulated river and the associated groundwater sharing plans for the LNC area. One of the key factors in determining the sustainable yield for various aquifers is the downstream values in associated streams.

The aquifer types and groundwater sources that occur within the Lower North Coast water sharing plan and their connectivity characteristics are given in Table 7. It is based on principles and recommendations in *Towards a National Framework for Managing the Impacts of Groundwater and Surface Water Interaction in Australia* by Sinclair Knight Merz (2006).

Alluvial aquifers

The alluvial aquifers in the Lower North Coast water sharing plan have been grouped into two categories depending on the type of alluvial material and degree of connectivity with surface water:

The **shallow 'upriver' alluvial aquifers** are characterised by coarse materials, such as sands and gravels, and relatively short travel times between surface and ground. These aquifers are considered to be 'highly connected' to their parent streams. The water sharing rules for the upriver alluvial aquifers are covered in this Lower North Coast unregulated and alluvial water sharing plan.

Table 7: Connectivity between aquifer types and surface water

Aquifer type	Water sources	Level of connection between surface and groundwater	Level of impact on instream values	Estimated travel time between groundwater and unregulated river
Coastal sands	Manning Coastal Sands	Significant (tidal section only)	Low as connection with saline water	Days to months
Up-river Alluvial	All unregulated rivers	Significant	High due to impact on base flows	Day to months
Coastal Floodplain Alluvial	Manning Coastal Floodplain	Low – moderate (tidal section only)	Low as not major contributor and low level of connection	Season
Fractured rock	New England Fold Belt	Low – moderate	Low as not major contributor	Years to decades
Porous Rock	Clarence-Moreton Basin Sandstones	Low – moderate	Low as not major contributor	Years to decades

The **coastal floodplain alluvial aquifers** tend to have relatively fine materials, often interspersed with silt and clay layers, with only a small amount of inter-change between the surface and groundwater. Since the alluvial aquifers that occur on the coastal floodplains (i.e. those downstream of the tidal limit) of the Lower North Coast are just low to moderately connected to their parent streams, it was not considered necessary to fully integrate the surface water and groundwater sharing rules for these systems.

The tidal limit is a useful boundary between the coastal and upriver alluvial systems on the Manning, Myall, Wallamba and Coolongolook Rivers. On the Lansdowne River, a weir has been placed across the river downstream of the historical tidal limit. For the purpose of water sharing, the boundary between the coastal and upriver alluvial systems will be the Lansdowne weir (the current tidal limit) since the weir influences groundwater levels and groundwater pumping influence water levels in the weir.

The proposed water sharing rules for the highly connected upriver alluvial systems will be based on the following principles:

- Extend the unregulated river water sources to include the up-river shallow alluvial aquifers.
- Manage to a single long term annual extraction limit for the unregulated and up-river shallow alluvial groundwater. This would be based on the sum of existing unregulated and alluvial groundwater entitlement, plus basic landholder rights, plus exemptions such as Aboriginal community development or town water purposes (where these apply).
- Extend the Extraction Management Unit to cover both the surface water and the up-river shallow alluvial groundwater.
- Manage growth in use through a common set of available water determinations for both surface and groundwater users.
- Permit within water source licence conversion, assignment or allocation of surface to groundwater licences but not the reverse (i.e. one way only).

- Manage the trade of alluvial groundwater licences with the same trading rules as the adjoining surface water. In effect, this would prohibit trading into areas identified as having high instream values, or are characterised as high hydrological stress.
- Manage existing bores located within 40 m of an unregulated river to surface water access rules, from year six of the Plan, except access licences for stock and domestic, local water utilities, food safety or essential dairy care. This represents a significant change for water users. Accordingly, the new rule will not commence until year six, in order to give water users time to adjust their operations.
- Prohibit new bores within 40 m of first and second order streams, except for bores as a result of a conversion of an unregulated river access licence, unless they are drilled into the underlying parent material, and the slotted intervals of the production bore commences deeper than 30 m, and the applicant can demonstrate that the bore will have minimal impact on base flows in the stream.
- Prohibit new bores within 40 m of a third order or higher stream except for bores as a result of a conversion of an unregulated river access licence.
- Allow new bores within 40 m of an unregulated river (but only as a result of the conversion of an unregulated river licence) in which case the surface water daily access rules will apply immediately.
- Apply the standard local impact rules for alluvial groundwater and the standard provisions for newly identified Groundwater Dependent Ecosystems.

Groundwater dependent ecosystems

Groundwater dependent ecosystems (GDEs) are ecosystems which have their species composition and natural ecological processes determined to some extent by the availability of groundwater. GDEs can include cave systems, springs, wetlands and groundwater dependent Endangered Ecological Communities.

High priority GDEs are identified during the planning process and are listed in a schedule to the plan. The Regional Panel then has the opportunity to review and amend the GDE list as well as the rules that have been developed to protect them based on their expertise. The list of high priority GDEs compiled at this stage can be amended as further GDEs are identified during the life of the plan.

The Lower North Coast water sharing plan includes water sharing rules for the highly connected alluvial aquifers. Water sharing rules have been designed to protect significant GDEs where they are known to occur on the alluvial aquifers.

Where highly connected GDEs are known to occur these are identified within the WSP and rules included such that new or replacement bores will not be permitted within a buffer zone around the GDE. Existing bores are not affected by the buffer zones and are able to continue operating (i.e. within the existing conditions of their access licences).

Adaptive management

Adaptive management refers to the practice of change in response to new information such as monitoring or some other improvement in understanding. In the case of water sharing plans, such information could include socio-economic studies, hydrological modelling, ecological studies and information about Aboriginal cultural values.

Adaptive management is a requirement of both the WMA 2000 and the National Water Initiative, and has been allowed for during the life of the Lower North Coast Unregulated water sharing plan through the inclusion of amendment provisions. These provisions allow some aspects of the water sharing plan to be changed within defined limits. Specific amendment provisions are discussed below.

Monitoring, evaluation and reporting are key activities for the adaptive management of water sharing plans. Further information on these is provided below.

Amendment provisions

Standard amendments that apply to all water sharing plans include:

- amending water sources, management zones or extraction management units
- establishing new or additional flow classes in any water source where management zones are added or amended
- amending water sources for which dams on third order streams or higher will not be granted
- amending requirements for metering or record keeping in relation to licensed access works
- updating information in Schedules or deleting them if no longer required.

In fourteen of the Lower North Coast unregulated water sources, adequate information to develop water sharing rules which could fully manage the risk to instream values and/or protect community dependencies was lacking. In these cases, further analysis or data collection will be undertaken during the life of the Plan (see Table 8). This work includes additional monitoring or studies on surface water flows and tidal pool behaviour, salinity levels and estuarine water requirements.

Monitoring of plan performance

DPI Water has developed a Monitoring, Evaluation and Reporting Framework in collaboration with key stakeholders. The framework conforms to NSW and Commonwealth government guidelines for monitoring, evaluation and reporting, and demonstrates an adaptive management approach to water planning required under the principles of the WMA 2000. The evaluation framework aims to inform the community of the outcomes of water sharing plans, and to collate the results of various legislatively required evaluations and relevant knowledge to inform the review of the water sharing plans. The framework will assess the inputs, outputs and outcomes of the water sharing plans and their operations. The assessment will consider:

- the process of plan development (appropriateness)
- the performance of the plan during operation (efficiency)
- the socio-economic, environmental and cultural outcomes of the plan (effectiveness).

Table 8: Water sources where adaptive management applies

Water source	Adaptive management
Access rules	
Upper Barrington, Upper Gloucester, Bowman, Lower Barrington/Gloucester, Dingo, Lower Manning, Mid Manning, Upper Manning, Avon, Manning Estuary Tributaries	Determination of the cease and commence to pump levels in these water sources is based on field verification and the review of relevant studies on environmental requirements and socio-economic impacts of any recommended access rules.
Wallamba (Upper Wallamba River Management Zone only)	Determination of cease (at or below the 95th percentile flow) and commence to pump levels, and A class flow levels in this water source is based on installation of an appropriate gauging station and sufficient data collection to develop appropriate access rules.
Manning River Tidal Pool	It is recognised that tidal pool water sources are different systems from those upstream. Tidal influences and salinity may impact on the ability of users to extract water generally more than instantaneous flow levels. Further studies are required in this water source to determine the appropriate location for the installation of a salinity probe, or other relevant infrastructure, and assessment of the users and extraction within the water source. Access rules will be determined, and trading rules reviewed based on the outcomes of these studies.
Lower Barrington/Gloucester, Lower Manning, Myall River	Access rules may be amended in these water sources during the term of this Plan based on augmentation of the local water utility.
Lower Barrington/Gloucester (Lower Barrington River Management Zone only)	Determination of cease and commence to pump levels in this water source is based on installation of an appropriate gauging station and sufficient data collection to develop appropriate access rules.
Dingo, Upper Gloucester, Upper Manning	In some water sources gauging stations have not been installed for a significant period and further time is required for data collection and assessment prior to the determination of access rules. The determination of cease to pump and commence to pump levels, and review of B Class flows at the 50th percentile in these water sources is based on sufficient data collection.
Trading rules	
Manning River Tidal Pool	Trading rules for this water source (within and into/out of) may be introduced/amended in association with the development of access rules for these water sources once further studies have been completed on estuary requirements and information obtained on extraction levels.
Bowman Creek	Trading rules for this water source (within) may be amended to no net gain based on the outcomes of further studies on flow access rules.

The main strategies in place to assist in evaluating water sharing plans include:

- assessment of performance indicators (using an Environmental Flows Monitoring and Modelling program)
- an audit of plans and
- review of each plan at the end of its ten year term.

Performance indicators

Part 2 of the water sharing plan includes a number of standard performance indicators that will be monitored over the life of the water sharing plan. It is not practical to monitor all issues in all water sources. The performance indicators identify that monitoring will be undertaken for specific issues in key water sources. The actual procedure for monitoring each indicator may change over the period of the water sharing plan as improved methods are developed.

In order to assess performance indicators, DPI Water has established an Environmental Flows Monitoring and Modelling program which is designed to make the results of environmental flow studies more transferable between water sources and to develop more generic relationships between flow, hydraulics and ecological responses. This will enable a more efficient and effective evidence based approach to support monitoring and evaluation of water sharing plans in NSW.

Audit

The WMA 2000 requires that water sharing plans be audited regularly, at intervals of not more than five years, to determine whether the provisions of the plan are being implemented. Under section 44 of the Act the Minister for Natural Resources, Lands and Water must appoint an Audit Panel to undertake this review.

The Audit Panel reflects the membership of the State Interagency Panel for water sharing and comprises representatives from DPI Water, OEH, DPI and LLS. Representatives from the NSW Natural Resources Commission and NSW Fisheries are invited to participate in the audit process as observers.

Reflecting the requirements of the WMA 2000 the focus of the audit is on the extent to which the provisions in the plan have been implemented. The audit does not attempt to assess the outcomes or effectiveness of the plan in achieving its objectives (this is considered by the DPI Water through its monitoring and evaluation process).

When conducting an audit the panel will review a range of analysis and material provided by DPI Water to:

- identify patterns of implementation activities across water source types, across plans and types of water sharing plan provisions
- identify actions required to address instances of partial and non-implementation
- develop broad recommendations for improving the implementation of existing plans and the robustness of new plans
- identify opportunities for linking the audit findings with other related processes, particularly the review of catchment action plan targets.

Plan review

At the end of the water sharing plan's 10 year life the Minister may, on recommendation by the NRC (under Section 43A of the WMA 2000), extend a water sharing plan for another 10 years or replace the plan. An extension does not allow for any changes to the water sharing plan. If any changes are proposed, then a replacement water sharing plan needs to be prepared.

The WMA 2000 requires that when deciding whether to extend or replace an existing plan, the Minister must consider

- the most recent audit of water sharing plans conducted under section 44
- a report from the NRC prepared within the previous five years, on the extent to which the water sharing plan has contributed to relevant state-wide natural resource management standards and targets of the relevant LLS catchment action plan.

Under the WMA 2000 a water sharing plan may be extended for 12 months past the expiry date of the plan to allow for a replacement plan to be prepared.

Glossary

Many of the terms in this document are defined in the WMA 2000 and are therefore not redefined here. However, there are some terms not included in the legislation that are defined below to assist with understanding the water sharing plan.

Account water: The balance in an access licence water allocation account at a particular time. An access licence water allocation account records water allocations accrued under the licence as well as water allocations taken, assigned or re-credited. The operation of the account is also governed by rules for the carrying over of credits from one accounting period to the next and rules for the maximum credit that may be allowed to accumulate in the account as established in a water sharing plan.

Alluvial, alluvium: Sediment deposited by a stream of running water, in particular along riverbeds or floodplains.

Aquifer: An underground layer of water-bearing permeable rock or unconsolidated materials (gravel, sand, silt or clay) from which groundwater can be usefully extracted. The volume of water stored in an aquifer, the rate at which water can recharge, the volume of water extracted from it, and the rate at which water can move through the aquifer are all controlled by the geologic nature of the aquifer.

Conversion factor: The adjustment factor that is to be applied to share components when they are cancelled and reissued in a different water source and vice versa, or as a different category. It is designed to allow movement of water from one water source to another or from one licence category to another whilst minimising the impacts on third parties of such movements. These impacts result in that the value of a unit of share component (in terms of the average water allocations) that result from it may vary from one water source to another or from one licence category to another.

Critical habitat: Areas of habitat (land or water) that are crucial to the survival of particular threatened species, populations or communities.

Cumulative impact: The combined impact of all surface water extraction.

Ecological values: The intrinsic or core attributes associated with naturalness, diversity, rarity and special features, but excluding representativeness used to classify water sources for apportioning water management rules.

Endangered ecological communities: Ecological communities listed in Schedule 1 of the *Threatened Species Conservation Act 1995* or Schedule 4 of the *Fisheries Management Act 1994*.

Ephemeral: Temporary or intermittent; for instance, a creek or wetland which dries up periodically.

Extraction of water: Removal of water from a river for off-stream storage or consumptive use.

Extraction management unit: A group of water sources; defined for the purpose of managing long-term annual average extraction.

Flow classes: The range of daily flow rates in a river which provides the framework for sharing water on a daily basis.

Flow duration curve: A plot that shows the percentage of time that flow in a stream is likely to equal or exceed some specified value of interest.

Flow gauge: A device used to measure the height of a river, from which the flow in the river can be calculated.

Flow reference point: The site from which the flow data is calculated to determine the rates associated with a flow class and then to implement the daily access rules during the life of the plan.

Full capacity: The volume of water that is impounded in the pool, lagoon or lake when the level of water in the pool, lagoon or lake is at the highest water level where there is no visible flow out of that pool.

Groundwater: The water beneath the earth's surface that has filtered down to the zone where the earth or rocks are fully saturated.

Groundwater dependent ecosystems: Ecosystems that rely on groundwater for their species composition and their natural ecological processes.

Individual daily extraction limit (IDEL): The daily volume limit that may apply for a particular licence holder for each flow class. The IDEL will be specified as part of the extraction component on the access licence. It establishes a share of the TDEL for that flow class.

Instream refuge habitat: Stream habitat containing pools that retain water for longer periods of time during drought and low flow. Instream biota will migrate to these more permanent habitats to survive.

Long-term average annual extraction limit (LTAAEL): The target for total extractions (under all water access licences plus an estimate of BLR within an EMU) which is used to assess whether growth-in-use has occurred. The actual annual extractions (metered plus estimated) are averaged over a fixed period of time defined by the water sharing plan when comparing with the LTAAEL. If the fixed period of time is greater than one water year, then in any one water year, extractions can exceed the LTAAEL without triggering a growth-in-use response.

Macro water sharing plans: Plans which apply to a number of water sources across catchments or different types of aquifers. The macro planning process is designed to develop broader-scale plans covering most of the remaining water sources in NSW.

Management zone: An area within a water source used for defining the location of applicability of water sharing rules, but secondary to the water source. A management zone is more likely to be designated where local dealing restrictions are in place or where 'cease-to-pump' rules for works approvals apply.

Pools: Lentic water bodies (standing water), including anything falling within the definition of a "lake" found in the Dictionary of the WM Act, except for tidal pools and estuaries.

Riparian: Relating to or living or located on the bank of a natural watercourse, such as a river or stream.

Total daily extraction limit (TDEL): The total limit on the daily volume of water that access licence holders in a particular category can take from a flow class. It is the sum of all the IDELs in that flow class.

Visible flow: The continuous downstream movement of water that is perceptible to the eye.

Water sharing plan: A plan made under the WMA 2000, which sets out the rules for sharing water between the environment and water users within whole or part of a water management area or water source

Water year: The 12 months running from 1 July to 30 June.

Appendices

Appendix 1: Hunter Regional Panel

Regional Panel

Name	Agency	Role	Expertise
Regional Panel			
Allan Raine (formerly Brian Gardoll and Mark Mignanelli)	DPI Water	Agency representative	Coastal riparian vegetation ecology, rapid assessment of stream health; fluvial geomorphology.
John Wilson	DPI	Agency representative	DPI regional input to water reforms, agriculture, catchment management and land use/strategic planning.
Richard Bath	OEH	Agency representative	DEC regional input to water reforms, catchment hydrology research, remote sensing, biodiversity.
Sharon Vernon (formerly Garry Hunt)	Former CMA	CMA observer	Catchment management, riparian vegetation and wetland ecology, fluvial geomorphology.
Neville Pavan	Former CMA	CMA observer (Central Coast component of the Greater Metropolitan Region WSP)	Catchment management, project management and implementation of programs in soil and land management, and riparian restoration. Former HNCMA representative for water issue coordination.

Technical support staff

Name	Agency	Role	Expertise
Roland Bow	OEH	Technical support/alternate representative	Technical and management expertise in research, aquaculture, commercial fisheries, compliance and conservation, fisheries management and aquaculture.
Gavin Doyle	OEH	Technical support/alternate representative	Fluvial geomorphology, catchment management, fluvial/estuarine sedimentology, biogeography, plant ecology.
Scott Carter	DPI Fisheries	Technical support/alternate representative	Fisheries management and conservation issues, threatened species, biological/environmental research, local knowledge of flow behaviour of catchments, WSP development and implementation.
Danny Norris	DPI	Technical support/alternate representative	Water policy implementation including water use, enterprise management and basic structural adjustment strategies for water users, water licensing, groundwater/surface water interactions, flow data analysis, local knowledge of flow behaviour of catchments, WSP development and implementation.
Sandra Mitchell	DPI Water	Technical support	Knowledge of flow and water quality relationships, WSP development and implementation, ecological habitat in relation to flow, monitoring.
Mark Simons	DPI Water	Technical support	Hydrologist – flow data analysis, hydrology, local knowledge of flow behaviour of catchments, WSP development and implementation, policy driver for connected systems, major utility licensing arrangements.
Jon Sayers	DPI Water	Technical support	Hydrologist – flow data analysis, hydrology, local knowledge of flow behaviour of catchments, WSP development and implementation, high flow policy development, water user background knowledge, local utility licensing arrangements.
John Williams	DPI Water	Technical support (groundwater)	Groundwater analysis and hydrology.
Brian McDougall	DPI Water	Technical support (licensing)	Licensing officer, local knowledge of water users, WUAs and local access arrangements.
Lyndal Betteridge	DPI Water	Macro coordinator	Water policy and planning, utility planning arrangements, WSP development and implementation, project management.
Neil Dufty		Independent facilitator	Qualified educator and earth scientist, experienced facilitator in NRM planning, former chair of water management committees.

Appendix 2: Reference material used by the Hunter Regional Panel

Central data sets

- Stressed rivers reports – used as the basis for identifying where there are instream barriers.
- Threatened fish species - data supplied by DPI Fisheries.
- Other threatened species – data supplied by OEH.
- Index of Social Disadvantage – Australian Bureau of Statistics.
- Employment in Agriculture – Australian Bureau of Statistics.
- Roy *et al.* 2001. Structure and Function of South-eastern Australian estuaries.

DPI Water regional data sets

TRITON Water Quality database – DWE state wide database holding all corporate water quality data. Data was available for most basic parameters (i.e. EC, pH, temp, TP, TN) for the majority of water sources. DWE has an ongoing regional water quality monitoring network.

Hydsys – Hydsys is a DWE statewide database that holds all flow record data. Flow records are available for most water sources in the Lower North Coast (LNC) area.

RiverStyles Mapping – Riverstyles mapping has been completed for most of the LNC area. It is based on the nationally-adopted method developed by Macquarie University. Maps are produced of Riverstyle / Geomorphic Condition / Recovery Potential. The information was used to assess issues such as drought refuge (pools), habitat heterogeneity, etc to inform the development of flow rules.

AUSRIVAS – LNC area has a number of AUSRIVAS sampling sites (water quality). The data was used in the spreadsheet to help assess river health.

Regional Groundwater Monitoring Network – DWE is developing a regional groundwater monitoring network to be used to monitor alluvial groundwater levels and assess stream/surface water connectivity.

Riparian vegetation mapping – riparian vegetation extent has been mapped across the LNC area. This was used to help determine other (non-extractive) influences on river health.

Current projects

Assessing response of macroinvertebrates to changes in wetted area and loss of microhabitat. Project being undertaken in the Karuah River involving differentiation between habitat requirements of riffle biota, and relating habitat loss to flow levels.

Internal PhD examining the distribution of freshwater mussels and the impacts of changes to their habitat on distribution and abundance.

Other projects

Determination of environmental flow requirements for lower Manning – project being undertaken for Midcoast Water by Dr Keith Bishop.

Appendix 3: Refined classifications based on Regional Panel knowledge

Water source	Change to classification	Justification
Myall River	Risk classification changed from A-D	<p>The Panel revised the risk to instream values from high to medium to reflect that it is high flows, rather than low flows that provide greatest environmental benefit to estuarine areas within the river, Myall Lakes and other associated wetlands.</p> <p>Although this outcome differs to the results of Table 3, it is based on more detailed studies that have been undertaken on Myall Lakes in relation to freshwater inflows and phytoplankton succession.</p>
Coolonglook	Risk classification changed from B-E	The Panel revised the risk to instream values from high to medium to reflect that many identified values relate to estuarine wetlands with little or no reliance on low flows.
Wallamba	Risk classification changed from B-E	The Panel revised the risk to instream values from high to medium to reflect that many identified values relate to estuarine wetlands which have little or no reliance on flows, whether high or low.
Manning Estuary Tributaries	Value classification changed from c-f Risk classification changed from B-E	<p>The Panel revised the instream value from high to medium as most values are associated with saline estuarine environments in tidal areas with little or no reliance on low flows.</p> <p>The Panel revised risk to instream value from high to medium as most values are associated with saline estuarine environments in tidal areas with little or no reliance on low flows.</p>
Dingo	Risk classification changed from C-E	<p>The Panel revised the risk to instream values from high to medium as most values are located in headwater areas where little or no extraction occurs.</p> <p>The Panel revised the level of economic dependence from high to moderate to reflect the more opportunistic nature of irrigation.</p>
Rowleys	Value classification changed from d-a	The Panel revised the instream value from medium to high to reflect the intact nature of Rowleys River and its riparian zone.
Cooplicurripa	Value classification changed from d-a	The Panel revised the instream value from medium to high to reflect the intact nature of Cooplicurripa River and its riparian zone.
Nowendoc	Value classification changed from d-a Risk classification changed from H-G	<p>The Panel revised the instream value from medium to high to reflect the intact nature of Nowendoc River and its riparian zone.</p> <p>The Panel revised the economic dependence from medium to low to reflect the opportunistic nature of extraction in this area (predominantly irrigation of pastures for beef cattle farming) and the limited risk to extractors. There are only a small number of licences and relatively small entitlement.</p>
Myall Creek	Value classification changed from d-a	The Panel revised the instream value from medium to high to reflect the intact nature of Myall Creek and its riparian zone.
Upper Barnard	Value classification changed from d-a	The Panel revised the instream value from medium to high to reflect the intact nature of the upper Barnard River and its riparian zone.

Lower Barnard	Value classification changed from d-a Risk classification changed from H-G	The Panel revised the instream value from medium to high to reflect the intact nature of the lower Barnard River and its riparian zone. The Panel revised the economic dependence from medium to low to reflect the opportunistic nature of extraction in this area (predominantly irrigation of pastures for beef cattle farming) and the limited risk to extractors. There are only a small number of licences and relatively small entitlement.
Upper Manning	Value classification changed from f-c Risk classification changed from E-D	The Panel revised the instream value from medium to high to reflect the intact nature of the upper Manning River. The Panel revised the economic dependence from medium to low to reflect the opportunistic nature of extraction in this area (predominantly irrigation of pastures for beef cattle farming) and the limited risk to extractors. There are only a small number of licences and relatively small entitlement.
Mid Manning	Value classification changed from f-b Risk classification changed from H-G	The Panel revised the instream value from medium to high to reflect the intact nature of the mid Manning River, and its high habitat value for Australian Bass. The Panel revised the economic dependence from medium to low to reflect the opportunistic nature of extraction and the limited risk to extractors.
Lower Manning	Value classification changed from f-c Risk classification changed from I-F	The Panel revised the classification of instream values from medium to high to reflect the intact nature of the Lower Manning River, the habitat in and around the tidal reaches of the Manning Estuary and its high habitat value for Australian Bass. The Panel revised the risk to instream value from low to medium to reflect increased extraction for town water supply and value of the water source for Australian Bass and flows to the estuary.
Bowman	Value classification changed from f-c	The Panel revised the classification of instream value from medium to high to reflect the intact nature of this water source.
Upper Gloucester	Value classification changed from f-c Risk classification changed from C-F	The Panel revised the instream value from medium to high to reflect the intact nature of the riparian zone and the high value Australian Bass habitat. The Panel revised the risk to instream value from high to medium as majority of very high values contained within National Park where there is no extraction.

Appendix 4: Summary of final classifications recommended by Regional Panel

Value matrix

High instream values	A Upper Barrington, Myall Lakes, Cooplacurripa, Upper Barnard Myall Creek, Lower Barnard Rowleys, Nowendoc	B Mid Manning	C Myall River, Coolongolook, Wallamba, Lower Barrington/Gloucester, Upper Manning, Upper Gloucester, Lower Manning, Bowman
Medium instream values	D	E	F Manning Estuary Tributaries, Dingo
Low instream values	G	H	I Avon, Manning River Tidal Pool
	Low hydrologic stress of hydrologic risk	Medium hydrologic stress of hydrologic risk	High hydrologic stress of hydrologic risk

Risk matrix

High risk to instream values	A	B	C
Medium risk to instream values	D Upper Manning, Myall River	E Coolongolook, Manning Estuary Tributaries, Wallamaba, Dingo, Bowman, Avon	F Lower Barrington/Gloucester, Upper Gloucester, Lower Manning, Manning River Tidal Pool
Low risk to instream values	G Coplacurripa, Myall Lakes, Upper Barnard, Nowendoc, Lower Barnard, Myall Creek, Rowleys, Mid Manning	H Upper Barrington	I
	Low dependence on extraction	Medium dependence on extraction	High dependence on extraction

Appendix 5: Changes to water sharing rules based on Regional Panel knowledge

Water source	Change to water sharing rules	Justification
Myall River	The access rule identified through the classification process required the CTP to be set at or below the 90th percentile. Due to lack of infrastructure this could not be achieved. The CTP was set at no visible flow at the end of the management unit as the 95th percentile equated to 0 MLday.	Due to lack of infrastructure a CTP of 'no visible flow at the end of the mgt unit' was proposed with a 24 hour delay rule prior to pumping commencing to provide for estuary protection.
Myall Lakes	No generic access rules were recommended as there were no irrigation licenses.	As there are no existing irrigation licences in the water source the panel decided a generic access rule was not warranted. Trading rules which do not allow any trading into the water source further protect the high instream values.
Coolonglook	The access rule identified through the classification process required the CTP to be set at or below the 90th percentile. Due to lack of infrastructure this could not be achieved. The CTP was set at no visible flow at the end of the management unit as the 95th percentile equated to 0 MLday.	Due to lack of infrastructure a CTP when no visible flow at the end of the mgt unit was proposed with a 24 hour delay rule prior to pumping commencing to provide for estuary protection.
Wallamba	Access rules identified through the classification process were not adopted by the Panel due to lack of infrastructure.	Due to lack of infrastructure, a visible flow at the end of the mgt unit was proposed with a 24 hour delay rule to provide for estuary protection. The Plan allows for movement of the CTP equivalent to the 95th percentile by year five if deemed necessary.
Manning Estuary	Trading rules identified through classification process were adopted (i.e. not net trades) but the introduction of such trades is tied to appropriate management systems being available.	The Plan allows for amendment of rules to allow no net trades into the water source based on available management systems during Plan term as per the classification process.
Dingo	Trading rules identified through classification process were adopted (i.e. not net trades) but the introduction of such trades is tied to appropriate management systems being available	The Plan allows for amendment of rules to allow no net trades into the water source based on available management systems during Plan term as per the classification process.
Upper Manning	The access rule identified through the classification process required the CTP to be set at or below the 90th percentile. The panel recommended the CTP be set at 95th percentile.	The Panel considered that a CtP at the 95th percentile provided sufficient protection, and was consistent with flow rules for similar neighbouring water sources.
Mid Manning	Trading rules identified through the classification process (i.e. no trades allowed into or upstream of water source) were not adopted by the Panel.	Transfers are proposed into the water source from upstream catchments to allow greater trading opportunities. The panel agreed that any potential impacts from extraction will be the same whether in this water source, or the water source(s) upstream.
Lower Manning	Trading rules identified through the classification process (i.e. no trades allowed into or upstream of water source) were not adopted by the Panel.	Transfers are proposed into the water source from upstream catchments to allow greater trading opportunities. The panel agreed that any potential impacts from extraction will be the same whether in this water source, or the water source(s) upstream.

Lower Barrington/ Gloucester	Trading rules identified through the classification process (i.e. no trades allowed into or upstream of water source) were not adopted by the Panel.	Transfers are proposed into the water source from upstream catchments to allow greater trading opportunities. The panel agreed that any potential impacts from extraction will be the same whether in this water source, or the water source(s) upstream.
Manning River Tidal Pool	The trading rule identified through the classification process allowed No Net Gain trades into the water source. The panel proposed no trading into the water source until a management system to monitor trading was in place.	The Plan allows for amendment of rules to allow no net trades into the water source based on available management systems during Plan term as per the classification process.

Appendix 6: Changes to water sharing rules based on targeted consultation

Water source	Change to water sharing rules	Justification
Manning Estuary Tributaries	No changes were proposed by water users or interest groups to the proposed rules during the targeted consultation period. However, the Manning River Tidal Pool was removed as a management zone and made a separate water source.	Due to the differing nature of this area, the Panel felt that by creating a separate water source, it would allow greater finesse in management.
Dingo, Upper Manning, Mid Manning, Lower Manning, Lower Barrington/ Gloucester, Bowman, Upper Barrington, Upper Gloucester	<p>In line with comments made in the submissions, the Panel has proposed that a study will be undertaken to determine the environmental requirements of the river and assess this against social and economic needs of water uses.</p> <p>The CTP will be based on the findings of the study, with the intention that it is completed by year five of the Plan. The final cease to pump figure will be within a range between the 99th percentile flow and the 95th percentile flow (state policy level).</p> <p>As a default if the study is not completed by year six, a CTP level set at the 98th percentile will be introduced until such time as a CTP level is determined by the study. This must be within the ten year term of the Plan.</p>	<p>Submissions were received on the proposed cease to pump level by water users in the Lower Manning, Upper Gloucester and Dingo Creek water sources. As a result the proposed rules were amended to provide for further studies to determine the environmental requirements of the river and assess this against social and economic needs of water users.</p> <p>The default position of the 98th percentile flow recognised the need for improved environmental protection and risks of studies not being completed in time for rule introduction from year six.</p> <p>These bounds to change recognise the levels identified by water users (around the 99th percentile flow) and the statewide policy default position of the 95th percentile flow.</p> <p>While the submissions related specifically to the Lower Manning River, Upper Gloucester River and Dingo Creek water sources, the Panel adopted a consistent approach for all water sources where there was high environmental values and a high level of demand on the river flow (Bowman River, Mid Manning River, Upper Barrington River, Dingo Creek, Lower Barrington/Gloucester Rivers, Upper Gloucester River, Lower Manning River and the Upper Manning River water sources).</p>
Lower Barnard	<p>No changes were proposed by water users or interest groups to the proposed rules during the targeted consultation period. However changes have been made to the access rules for the Lower Barnard River Upper Reaches Management Zone.</p> <p>These amendments provide consistency with water users in the Upper Barnard River Water Source, which use the same gauging station.</p>	Amendments were made to provide consistency with water users in the Upper Barnard River Water Source, which use the same gauging station, and to ensure the current higher cease to pump for the major utility is not altered.

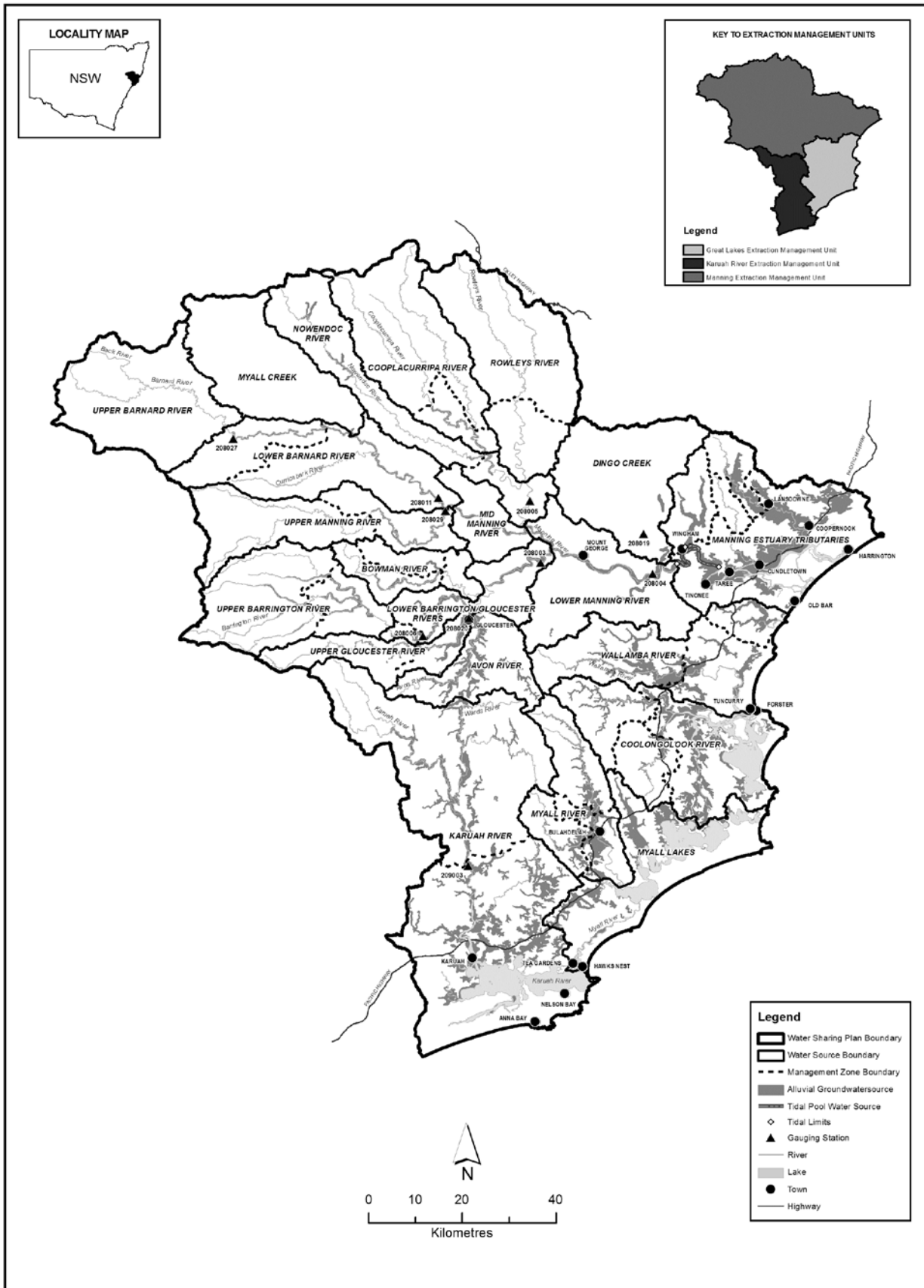
Appendix 7: Changes to water sharing rules based on public exhibition

Water source	Change to water sharing rules	Justification
Nowendoc River, Upper Barrington River. Lower Barrington/Gloucester Rivers, Wallamba River	Amendment to water source or management zone boundaries.	It is acknowledged that in setting management zone and water source boundaries amendments may be required where the boundaries have been developed at too coarse a level. These issues are often not identified until such time as licence conversion to the Water Management Act 2000 is being prepared or it is identified through the consultation process. The Panel has recommended that management zone and water source boundaries were amended in a number of water sources to ensure that individuals' properties or access are not divided between management zones or water sources. The Plan will allow for further amendment of boundaries if required.
All	Provision for amendment of flow classes based on introduction of Flow Accreditation Scheme(s).	Many submissions indicated that landholders felt that there was not recognition of the significant positive environmental outcomes achieved on farm through, e.g. nutrient management, tree planting, efficient irrigation systems etc. It is recognised that water sharing is one of many processes which can improve river health. The Panel has recommended that a provision is included in the Plan that allows for cease to pump provisions to be amended in instances where Flow Accreditation Schemes are implemented, similar to the pilot scheme in the Williams River in the Hunter catchment. This allows for variable cease to pump levels for accredited and non accredited farmers.
All	Provision for amendment of management zones based on removal of instream structures resulting in change to tidal limits.	The Panel has recommended that an amendment provision is included in the Plan such that when an instream structure is removed (e.g. weir) that has an impact on the tidal limit that amendment may be made to the water source and/or management zone boundary and affected licence holders have their licence conditions updated.
Avon, Manning Estuary Tributaries, Bowman, Dingo, Upper Manning, Upper Gloucester	Amendment to proposed flow classes to allow for further field verification.	<p>A number of submissions raised concerns regarding the appropriateness of the proposed cease to pump provisions proposed for these water sources. Often this was related to the presence of groundwater, or proposed restrictions on pumping of pools.</p> <p>Due to high flow conditions in the catchment in recent months further field verification was not able to be carried out prior to submission of the Plan for gazettal. However in recognition of this the Panel has recommended that the initial flow rules (for years one to five of the Plan) proposed for these water sources are removed (effectively this means for the first five years of the Plan extraction is based on existing licence conditions). Further studies and field verification are to be undertaken during this time to determine appropriate access rules. In the Upper Manning River, Upper Gloucester River, Dingo Creek and Bowman Creek Water Sources a cease to pump will be introduced at year six of the Plan however the lower bound of change for the possible cease to pump has been amended to visible flow rather than the 99 percentile flow level. In all sources a pool inflow/outflow rule will be introduced from year six of the Plan.</p>

Upper Barrington	Reference to flow reference point.	It is noted that the 'Forbesdale' river gauge is commonly referred to as 'Rocky Crossing' by locals. The Panel has recommended that the name of the gauge is formally changed in the DWE gauging network (if possible) and have inserted a note in the Plan in the interim to clarify that the Rocky Crossing gauge is the gauge that is being referred to for the flow reference point.
Wallamba, Coolongoolook, Myall River	Provision for amendment of flow reference points based on field verification.	Comment was received that the proposed flow reference point at Dargavilles Crossing in the Wallamba River Water Source was not appropriate. The Panel has recommended that further investigation is undertaken by the Department to determine whether a more appropriate site is available and include this in the Plan at that time. Similar work may be required in the Coolongoolook and Myall River Water Sources.
Bowman	Provision for review of trading rules within the water source based on field verification.	In the Bowman River Water Source amendment provisions were recommended to allow for the introduction of no net transfers during the Plan term following further studies or field verification (this is likely to be associated with work done to determine appropriate access rules within the Bowman).
(from) Lower Manning River, Mid Manning River, Lower Barrington Gloucester Rivers, Nowendoc River (downstream of Cooplacurripa River Confluence Management Zone), Manning Estuary Tributaries	Provision for no net trading in an upstream direction.	A number of submissions indicated that the proposed trading rules which provided for transfers between many water sources in a downstream direction only could potentially result in a water source losing all its entitlement and having a resultant socio-economic impact. The Panel has recommended that no net gain transfers (that is a transfer where the specified volume of water traded out a system is allowed to be traded back into a system) are allowed between water sources. This does exclude the headwater management zones and the Upper Barnard and Myall Creek water sources where transfer rules will remain limited as per the draft Plan.
Avon	Provision for high flow conversion to occur.	Provision for high flow conversion has been identified for a limited number of water sources within the Plan area. A number of submissions requested that such conversions be permitted within the Avon River water source. While originally not recommended for the Avon River based on assessment of entitlement levels and flow characteristics, the Panel has now recommended that high flow conversion is permitted in the Avon however it is important to note that the existing gauge located in this water source does not currently record flows (it records height only). Any high flow conversion will be triggered by the Gloucester River at Gloucester gauge until such time as sufficient gauging of flow is undertaken to allow the Avon River gauge to be used.
All	Inclusion of notes highlighting ongoing role of Water User Associations.	The Panel recognised that WUAs will continue to play an important role in water sharing, especially during low flows. It is acknowledged that in continuing to manage water sharing between users, WUAs will assist in implementation of the Plan provisions through reducing the frequency that the cease to pump in very low flows is reached. The Panel has recommended that a note is included within the Plan to outline the ongoing role of WUAs and amendment provisions in the Plan are strengthened to ensure that water users are involved in consultation on amendments to access and transfer rules.

<p>Dingo, Lower Manning, Mid Manning, Upper Gloucester, Lower Barrington/ Gloucester, Upper Manning</p>	<p>Inclusion of notes highlighting work of other organisations which may inform Plan amendment.</p>	<p>The Plan currently specifies that studies to verify the cease to pump levels will consider relevant studies including, but not limited to, studies completed by Midcoast Water in relation to estuarine flow requirements. The Panel has recommended that a note is included within the Plan which reiterates that other work being undertaken by organisations, e.g. by the Great Lakes Shire Council in the Smiths, Myall, Wallis Lakes and tributaries, can help inform the amendment of the cease to pump provisions.</p>
<p>Dingo, Lower Manning, Mid Manning, Upper Gloucester, Lower Barrington/Gloucester, Upper Manning, Avon, Manning Estuary Tributaries, Bowman</p>	<p>Support role of agencies in collation of socio-economic information to help inform decision making re Plan amendments.</p>	<p>It is recognised that in undertaking further studies to help define cease to pump provisions for the second half of the Plan that a range of information will need to be collected to assist in decision making. This includes not only the environmental requirements of the river and downstream estuaries but also the potential impact of rules proposed on individuals. The Plan specifies the need to consider socio-economic impacts of any recommendation and this will require consultation with relevant individuals and groups to determine these impacts. The Panel has recommended that the Department of Primary Industries assists the Department in working with groups to help compile this information.</p>

Appendix 8: Map of the plan area



March 2015

Appendix 9: Contribution to the river flow objectives

Levels of assessed contribution:

FULL – contributes to objective in full. HIGH – while not fully contributing to objective is considered a good level of contribution. PARTIAL – goes some way to contributing to the objective. LOW – only small degree of contribution to the objective.

Note that for some systems while there may be no specific rule for each river flow objective the extent to which the rules, annual extraction limits and the risk to values contributed to the objectives was considered, and a specific rule developed only where necessary.

(*) Note that for the tidal pool water source although rules have not yet been developed the following assessment is based on the intent of the rules. Tidal pool is assessed against the RFOs based on rules intended to maintain natural variability of salinity levels, and protect from significant salt water intrusion.

	Protect pools in dry times	Protect natural low flows	Protect important rises in water levels	Maintain wetland and floodplain inundation	Mimic natural drying in temporary waterways	Maintain natural flow variability	Maintain natural rates of change in water levels	Manage groundwater for ecosystems	Minimise effects of weirs and other structures	Minimise effects of dams on water quality	Make water available for unforeseen events	Maintain or rehabilitate estuarine processes and habitats
Avon	FULL	LOW	PARTIAL	HIGH	N/A	HIGH	HIGH	FULL	N/A	N/A	N/A	LOW
Manning River Tidal Pool*	HIGH	PARTIAL	PARTIAL	HIGH	N/A	HIGH	HIGH	PARTIAL	N/A	N/A	N/A	HIGH
Dingo, Rowleys, Cooplicurripa, Nowendoc, Myall Creek, Upper Barnard, Lower Barnard, Upper Manning, Upper Barrington, Upper Gloucester, Lower Barrington/ Gloucester, Bowman, Mid Manning, Lower Manning	FULL	FULL	PARTIAL	HIGH	N/A	HIGH	HIGH	HIGH	N/A (Lower Barnard – Partial)	N/A	N/A	HIGH

	Protect pools in dry times	Protect natural low flows	Protect important rises in water levels	Maintain wetland and floodplain inundation	Mimic natural drying in temporary waterways	Maintain natural flow variability	Maintain natural rates of change in water levels	Manage groundwater for ecosystems	Minimise effects of weirs and other structures	Minimise effects of dams on water quality	Make water available for unforeseen events	Maintain or rehabilitate estuarine processes and habitats
Wallamba, Myall River, Coolongolook, Manning Estuary Tributaries	FULL	PARTIAL	HIGH	HIGH	N/A	HIGH	HIGH	FULL	N/A	N/A	N/A	HIGH
Myall Lakes	FULL	FULL	FULL	FULL	N/A	FULL	FULL	FULL	N/A	N/A	N/A	FULL

Appendix 10: Identified threatened species

It is important to note that the macro water sharing plan process is concerned with protecting in stream water values that relate to extraction. Therefore, only threatened species that are likely to be sensitive to extraction have been considered when assessing the water source values.

It should also be noted that some threatened species, such as the Eastern Freshwater Cod, are highly sensitive to low flow extraction, whilst other threatened species, such as plants that occur in the riparian zone, are less sensitive. Accordingly, threatened species considered to be highly sensitive to low flows are given a highly priority for protection.

The table below shows threatened species that are known or expected to occur in each water source.

Threatened species	Manning Estuary	Dingo	Rowleys	Cooplicurripa	Nowendoc	Myall Creek	Upper Barnard	Lower Barnard	Upper Manning	Mid Manning	Lower Manning	Lower Barrington/ Manning	Bowman	Upper Barrington	Gloucester	Avon	Port Stephens	Lower Karuah	Central Karuah
Macroinvertebrates																			
Adams Emerald Dragonfly																			
Frog																			
Booroolong Frog	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓				
Davies Tree Frog		✓	✓		✓	✓	✓		✓					✓	✓				
Giant Barred Frog	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓			✓
Giant Burrowing Frog																			
Glandular Frog	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			
Green and Golden Bell Frog	✓												✓				✓	✓	
Green-thighed Frog	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Littlejohns Frog																			
Olongburra Frog	✓																		

Red-crowned Toadlet																				
Southern Bell Frog																			✓	
Sphagnum Frog	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓								
Stuttering Frog	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Wallum Froglet	✓																		✓	
Bird																				
Australasian Bittern	✓																		✓	
Black Bittern	✓	✓										✓	✓						✓	
Black-necked Stork	✓										✓	✓			✓	✓	✓	✓	✓	
Blue-billed Duck																				
Comb-crested Jacana	✓																			✓
Freckled Duck																				
Magpie Goose	✓																			
Wet flora species																				
<i>Phaius australis</i> (Southern Swamp Orchid)																				
<i>Maundia triglochinosides</i>																			✓	

Disclaimer

The Department of Environment and Climate Change (DECC) has provided assessments on the presence of threatened species and their sensitivity to extraction to inform the classification of water sources through the Macro Water Sharing Planning process. The assessments were undertaken for the specific purpose of developing an initial classification of water sources. They were based on the most accurate and relevant data/ information sourced and analysed at the time.

Initial classifications were a first step to inform panel deliberations. Panels considered a range of information and used local knowledge in determining a final classification. The assessments are not absolute – for example the absence of threatened species for an assessment does not necessarily mean the threatened species are not present.

These assessments should not be used for any purpose other than classification of catchment management units as part of the Macro Water Sharing Planning process.