



Water Sharing Plan

Lower Murray-Darling Basin Unregulated and Alluvial Water Sources

Background document



Publisher

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The NSW Office of Water manages the policy and regulatory frameworks for the state's surface water and groundwater resources, to provide a secure and sustainable water supply for all users. It also supports water utilities in the provision of water and sewerage services throughout New South Wales.

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***Water Sharing Plan for the Lower Murray-Darling Unregulated and Alluvial Water Sources –
Background document***

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Introduction

Water sharing plans are being progressively developed for rivers and groundwater systems across New South Wales following the introduction of the *Water Management Act 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 about 80 per cent of water extracted in NSW under the management and licensing provisions of the *Water Management Act 2000*. In recent years, water sharing 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 *Water Management Act 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 subcatchment, or in the case of groundwater systems, cover a particular type of aquifer, such as fractured rock. These river basin or aquifer macro plans will generally apply to catchments or aquifers where there is less intensive water use.

The *Water Sharing Plan for the Lower Murray-Darling Unregulated and Alluvial Water Sources 2012* defines water management rules for the unregulated catchments of the Lower Darling River – from Tilpa to the Murray River, and the Lower Murray River – from the confluence with the Murrumbidgee, downstream to the South Australian border. The plan also includes the Lower Darling alluvial groundwater source. The regulated water sources are already covered by the *Water Sharing Plan for the NSW Murray and Lower Darling Regulated Water Sources 2004*. Fractured rock, porous rock and other miscellaneous alluvial groundwater sources are covered by other plans under development.

The water sharing rules that the plan focuses on are:

- environmental water rules – the share of the water reserved for the environment
- access rules to determine when extraction is allowed (for example above a set river flow rate)
- dealing rules to control the trade of water, both the transfer of share components of an access licence and assignment of water allocation between access licences, as well as changing the location for water extraction.

In developing environmental water rules, access rules and dealing rules, other water management rules are considered, including:

- long-term average annual extraction limits – a growth-in-use assessment and management tool
- rules for granting access licences – what types of licences may be granted
- rules for granting works approvals – what types of set back conditions are required.

This document provides background to the development of the rules in the plan and includes:

- the purpose of the statutory plan
- a physical description of the Lower Murray and Lower Darling catchments including land and water use
- the process of plan development including scope, history and basis for decisions
- the relationship between the plan and the Basin Plan
- the use of adaptive management
- the activities associated with implementation, monitoring and review of the plan.

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.

The objectives of the plan are to:

- protect the important water dependent environmental, Aboriginal cultural and heritage values
- protect basic landholder rights
- manage water extraction from the rivers and the closely linked aquifers to ensure equitable sharing between users
- provide opportunities for market based trading of licences and water allocations
- provide flexibility for licensed water users in how they can use their water
- allow for adaptive management, that is, to allow changes to the plan to be made as a result of more information that will become available during the life of the plan.

This document is part of a range of material available specifically on the plan including:

- the *Water Sharing Plan for the Lower Murray-Darling Unregulated and Alluvial Water Sources* – a legal instrument written in its required statutory format
- rules summary sheets for each water source summarising the management rules.

In addition, general information on the macro planning process is available in the water sharing plans section of the NSW Office of Water website www.water.nsw.gov.au and 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
- *Water sharing plans – Inland NSW unregulated and alluvial water sources – Overview* – explains the key sections of the plans in plain English
- Information on setting rules for water sharing plans.

Purpose of the plan

Why water sharing plans are being prepared

Expansion of water extraction across NSW in the 20th 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.

Water sharing plans provide a legal basis for sharing water between the environment and consumptive purposes. Under the *Water Management Act 2000* a plan for 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 rights. 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.

Water sharing plans also recognise the economic benefits that commercial users such as irrigation and industry can bring to a region. Upon commencement of water sharing plans, licences held under the *Water Act 1912* are converted to access licences and works/water use approvals under the *Water Management Act 2000*, effectively separating water rights from land. 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 *Water Management Act 2000*, plans also set rules so that commercial users can also continue to operate productively. In general, access licences under the *Water Management Act 2000* are granted in perpetuity, thus providing greater security of the water entitlement. Water sharing plans also define the access rules for commercial users for 10 years providing all users with greater certainty regarding sharing arrangements².

Scope of the plan

The plan covers two discrete water resources: unregulated water and alluvial groundwater³. Incorporating these resources into the one plan recognises the significant level of hydraulic connectivity between them, and allows for the development of water sharing rules that are linked and are equitable within and between these resources.

Within the boundaries of this plan, groundwater is also found in porous rock, fractured rock and miscellaneous alluvial aquifers. These aquifer types are less connected with surface water and are therefore dealt with in separate groundwater plans.

The plan defines two 'water sources' within the Murray-Darling Basin; an unregulated water source and an alluvial groundwater source (Appendix 1). The plan does not define any extraction management units or management zones.

² The terms *security* and *reliability* are used differently across different jurisdictions. Sometimes they are used interchangeably. The National Water Commission encourages the adoption of nationally consistent terminology as defined in the National Water Initiative and in the glossary of this background document. The definitions in the glossary relate to National Water Initiative-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.

³ Alluvial aquifers are underground layers of permeable water-bearing unconsolidated materials (gravel, sand, silt or clay) from which groundwater can be usefully extracted. Alluvial aquifers are located underneath river floodplains.

Benefits for water users

With the introduction of the plan, a number of benefits will flow to water users including:

- greater certainty for water users – the plan sets out the water sharing arrangements for a 10 year period
- clear trading and access rules which will help foster trading
- automatic conversion of licences in the plan area to perpetual water access licences providing greater security for water users – meaning the volumetric water access licences do not have to be renewed, however approvals for the works used to extract water under these access licences will need to be renewed.

The plan recognises the economic benefits to the region that are generated by commercial users such as irrigators and industry. It sets rules so that commercial users can continue to operate productively.

Environmental considerations

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

Unregulated streams

Rivers naturally experience a range of flows. These various flows are necessary for different hydrologic, geomorphic, biological and chemical processes to occur. Flood flows are required to scour channels, rework sediments, water floodplains and associated forests; medium flows oxygenate water and allow fish passage; and low flows maintain connectivity and assists species survival. To preserve a healthy river ecosystem, this range of stream flows must be maintained.

Unregulated streams in western NSW experience long periods of no flow interspersed with rare flows of varying magnitude. Fauna and flora have evolved with these conditions and depend heavily on river pools and lagoons which provide refuge during the extended periods of low rainfall and runoff. This plan focuses on water management in pools and lagoons.

Alluvial groundwater

Aquifers can store large volumes of water, often accumulated over thousands, or even tens of thousands of years; this is referred to as 'storage'. The volume of water in storage is recharged in a number of ways depending on the type of the groundwater system. Recharge usually comes from rainfall, surface water bodies such as rivers, or via flow from adjacent aquifers. Under the plan, only a proportion of recharge is available for extraction. The remainder of recharge is reserved for the environment. Limiting the volume of use to a proportion of recharge is intended to reduce the risk of unsustainable groundwater extraction in the long term.

Most of the bores in the alluvial aquifer alongside the Lower Darling River are located in a freshwater lens within the aquifer. This lens extends some 500 metres from the riverbanks on either side of the Darling River. The water in the alluvial aquifer outside the freshwater lens is considerably more saline (5,000 to 50,000 $\mu\text{S}/\text{cm}$). Over-extraction from the freshwater lens will encourage saline water to move into the freshwater lens and potentially into the river. In light of this, groundwater licences along the Darling are not permitted to extract once water salinity exceeds 3000 $\mu\text{S}/\text{cm}$.

Some groundwater sources 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 sharing plans also include rules on the location of new works and extraction from existing works to protect high-priority groundwater dependent ecosystems, high-priority karst systems and other environmentally sensitive areas such as rivers or streams.

Description of the plan area

The plan covers the catchments of the lower reaches of the Darling River (from Tilpa to the junction with the Murray River) and the NSW catchments of the Murray River from the confluence with the Murrumbidgee River to the South Australian border. The Great Anabranche of the Darling River (the Anabranche) and the associated 'Anabranche Lakes' are also included in this plan. The major population centres in the plan area are Broken Hill, Wilcannia, Wentworth, Dareton, Buronga and Euston (Appendix 1).

The landscape is relatively flat with virtually no bedrock outcrops. The north-western part of the plan area incorporates the Barrier Range which reaches an altitude of 286 metres. The majority of streams in the plan area flow towards the Darling and Murray Rivers, however, the streams to the north and west of the Barrier Range flow towards Lake Frome in South Australia.

Native vegetation is retained over 90 per cent of the plan area, and can be grouped into four broad categories (Westbrooke *et al.* 2004, cited by NSW Office of Water 2011):

- *Riparian vegetation* – river red gum on river banks and immediate floodplain, black box on the outer floodplain, with lignum and nitre goosefoot as floodplain understorey
- *Belah woodlands* – occurring on the sandplains and dunefields, are open woodlands dominated by *Casuarina pauper*, with western rosewood, sugarwood and wilga and an understorey of saltbush, bluebush and copperburs
- *Chenopod shrublands* – dominated by saltbush and bluebush, are found predominantly along the alluvial plains and lakebeds of the Anabranche
- *Mallee shrublands* – are found on the sandplains and dunefields and consist of white mallee, glossy-leaved red mallee and red mallee.

The plan area includes three conservation reserves: Kinchega National Park, Mungo National Park and Lake Nearie Nature Reserve (NSW Office of Water 2011).

Kinchega National Park covers an area of 440 km² bordered by the Darling River to the east and Lake Cawndilla and Lake Menindee to the north and west. The lakes are an important waterbird habitat, with over 30 species being recorded. Kinchega National Park contains many Aboriginal cultural sites as well as historic structures from the previous Kinchega pastoral station.

Mungo National Park includes 900 m² of the Willandra Lakes World Heritage Area which is recognised for its cultural heritage and archaeological value. The park contains archaeological evidence of 40,000 years of Aboriginal occupation, fossil remains of megafauna, and evidence of a reversal in the earth's magnetic field.

Lake Nearie is the deepest of the Anabranche Lakes and thus provides an important refuge for waterbirds during drier periods. The Lake Nearie Nature Reserve covers an area of 43 km² and protects a range of vegetation communities.

Over 269,000 hectares of wetlands and floodplain woodlands have been identified within the plan area (King and Green 1993, cited by NSW Office of Water 2011), including the Anabranche Lakes, with a combined area of 43,000 ha, and which have been listed as a nationally important wetland complex (DEWHA 2010, cited by NSW Office of Water 2011).

The major water storages within the plan area are the Menindee Lakes (1,750 gigalitres) and Lake Victoria (677 gigalitres). These lakes are part of the regulated river system. Water sharing rules have already been determined for these water sources and are defined by the *Water Sharing Plan for the NSW Murray and Lower Darling Regulated Water Sources* (the regulated plan).

Several lagoons along the Murray and Darling Rivers that receive flows from the regulated river system during high stream flows are included in the unregulated plan. These lagoons are Thegoa Lagoon, Peacock Creek, Boeill Lagoon and Neilpo Lagoon. Of these, Thegoa is the largest and has several licensed works.

Land use

Prior to European settlement, the Barkindji people occupied the riparian lands along the Darling River and the Anabranche, from the Murray River upstream to present day Wilcannia (NSW Office of Water 2011). The Darling River, the Anabranche and its lakes are important cultural sites to the local indigenous people. More widely, the Lower Murray-Darling area is tribal country of the Muthi Muthi, Yitha Yitha, Ngyiampaa and Maraura peoples (Lower Murray-Darling CMA website).

The major part of the plan area is used for grazing, predominantly sheep for wool production, with smaller numbers of fat lambs and beef cattle.

Field crops are grown in the plan area. The majority of these crops are grown in the lakebeds along the Darling River and the Anabranche. These lakes receive occasional flood flows, which land managers often take advantage of by sowing crops into the lake beds after the flood waters recede.

Irrigated horticulture commenced in the Sunraysia district in the 1890s. Vineyards and orchards were established at Curlwaa, Dareton and Buronga from the 1920s and later along the lower Darling River with the construction of the Menindee Lakes Scheme in the 1960s.

Besides agriculture, mining is the other major economic activity in the plan area. Broken Hill was founded in 1883, when the world's largest silver ore body was discovered, leading to the establishment of several prospecting companies. Mining of tin, silver, and zinc have contributed substantially to the regional economy. Other mines have been established throughout the plan area, including gypsum and mineral sands.

Climate

The Lower Murray-Darling area experiences a semi-arid climate, with hot summers and mild winters. January is generally the hottest month, with a mean daily maximum temperature of 32.9 °C at Wentworth. July is the coolest month, with a mean daily maximum temperature of 15.6 °C.

Annual rainfall averages 200 millimetres (mm) in the northern part of the plan area and 250 mm in the southern parts. Average annual evaporation ranges from 1,950 mm/year in the south of the plan area to over 2,500 mm/year in the north.

Rainfall shows a winter dominance, with monthly median rainfall ranging from 8.4 mm in December to 18.8 mm in June (Table 1). Rainfall variability is greatest during summer, as shown by the 90th percentile rainfall figures of 77.7 mm in January, compared with 43.2 mm in August.

Table 1: Monthly rainfall - 10th percentile, median and 90th percentile for Pooncarie (Moorara) Station Number 047020, 1884 – 2011.

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
10 th percentile	0.0	0.0	0.0	0.0	0.0	1.0	0.8	0.8	2.0	2.0	0.0	0.0	129.6
Median	9.8	10.2	10.2	9.7	16.4	18.8	15.7	17.3	14.5	14.6	9.4	8.4	247.7
90 th percentile	77.7	58.4	45.0	41.7	56.9	55.1	45.9	43.2	44.6	64.2	54.4	61.2	404.1

Source: Bureau of Meteorology, Climate Data Online.

Monthly evaporation (Table 2) is considerably greater than median rainfall in all months. Therefore, irrigation is required to maintain permanent plantings such as citrus and vines.

Table 2: Monthly evaporation (mm) at Stephens Creek Reservoir, Station Number 047031, 1995–2011.

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
394	305	273	174	105	72	78	118	174	242	288	353	2576

Source: Bureau of Meteorology, Climate Data On-line.

Historical droughts

Annual rainfall in the plan area is highly variable. Annual rainfall totals recorded at Pooncarie (Station Number: 047020) over the period 1884 to 2011 range from 61.5 mm to 766.6 mm. Over this period of record, the annual rainfall was less than 150 mm on 15 occasions. Extended periods of below average rainfall occurred during 1897 to 1902, 1925 to 1930, 1940 to 1945, 1965 to 1967, and 2001 to 2006.

Climate change and variability

The NSW Office of Water has forecast rainfall and runoff across NSW using 15 global climate models for the Intergovernmental Panel on Climate Change, Special Report on Emissions Scenarios A1B climate scenario⁴. The A1B climate scenario indicates a global temperature in 2030 that is 0.9 °C higher than the global temperature in 1990.

Modelling conducted under the CSIRO Murray-Darling Basin Sustainable Yields Project indicates that future runoff in the 'Murray region', which includes the plan area, is likely to decrease rather than increase with climate change projections (CSIRO, 2008). Under the *best estimate 2030 model*, average annual runoff within the Murray region would be reduced by 10 per cent and surface water availability would decrease by 12 per cent (CSIRO, 2008). Under the *wet extreme 2030 model*, the average surface water availability in the Murray Region would increase by seven per cent. Under the *dry 2030 extreme model*, average surface water availability could decrease by 41 per cent (CSIRO, 2008).

Streamflows

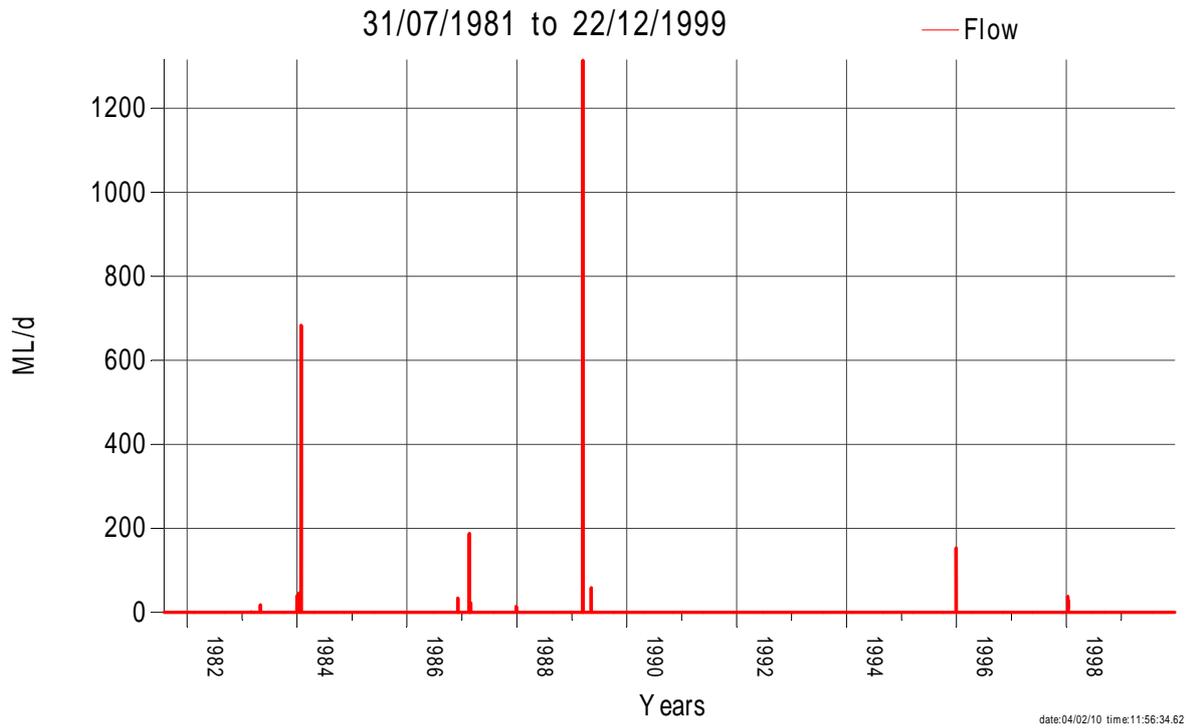
This plan only deals with the unregulated streams in the plan area; the regulated rivers are covered in the *Water Sharing Plan for the NSW Murray and Lower Darling Regulated Water Sources 2004*.

Flows in the unregulated streams in the Lower Murray-Darling area are infrequent. Stream gauging data at Wireyards Creek⁵, a tributary of Stephens Creek, 100 km south east of Broken Hill, show that over the period from 31/7/1981 to 22/12/1999, streamflow occurred for only 30 days (Figures 1 and 2). This represents less than one per cent of all days. Of these flow events, 23 per cent were one megalitre a day or less, 60 per cent between one and 100 megalitres a day, and 17 per cent greater than 100 megalitres a day (Figure 2).

⁴Vaze J., Teng J., Post D., Chiew F., Peraud J-M., Kirono D, (2009), *Future climate and runoff projections (~2030) for New South Wales and Australia Capital Territory*, NSW Department of Water and Energy, Sydney.

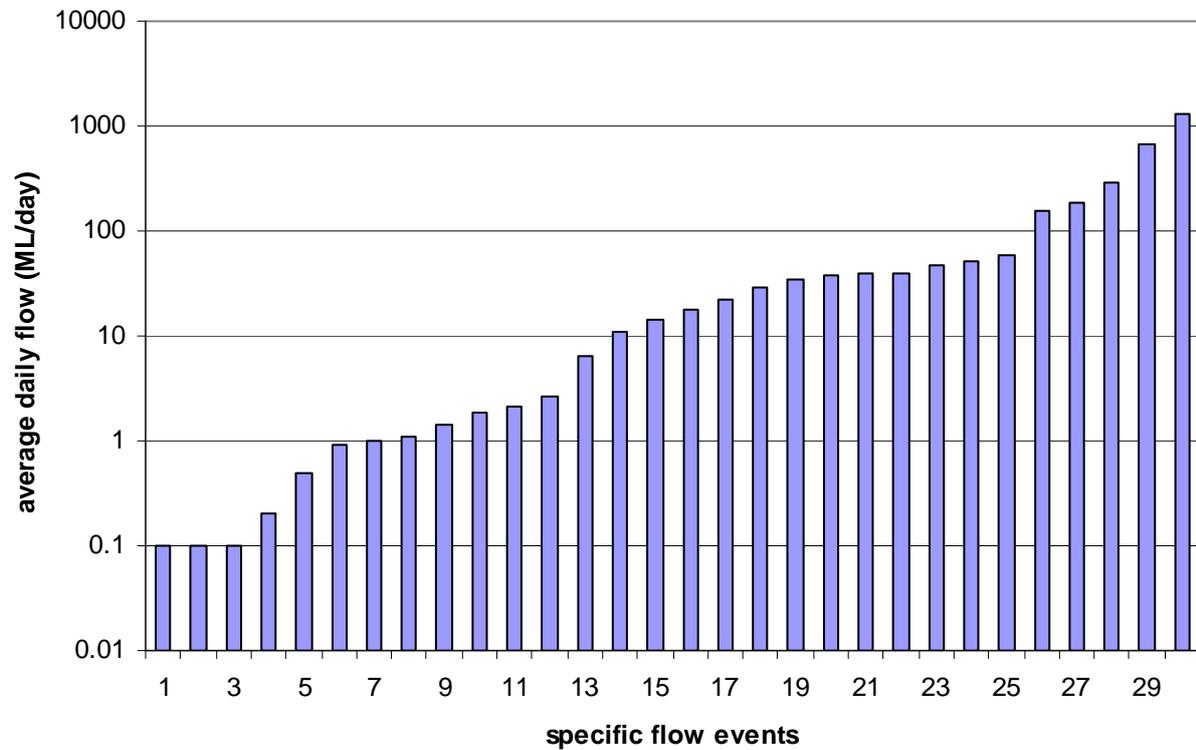
⁵ Wireyards Creek is the only unregulated gauging station in the plan area.

Figure 1: Daily flows at Wireyards Creek at Quondong (Gauging Station: 425028).



Source: HYDSYS, NSW Office of Water.

Figure 2: Mean daily flow for flow events at Wireyards Creek at Quondong (Gauging Station: 425028), 31/7/1981 to 22/12/1999.



Source: HYDSYS, NSW Office of Water.

The stream flow data from Wireyards Creek is consistent with anecdotal evidence and with flow records for the Darling River prior to the construction of the Menindee Lakes Scheme. Prior to the latter's construction, flows in the Darling River ceased on 48 occasions between 1885 and 1960, the longest period being 364 days during 1902-03 (Lloyd 1992 cited by SKM, 2009). Conversely, flood flows travelled the full length of the Anabran on only nine occasions for the period 1890 to 1961 (Withers 1996 cited by SKM, 2009).

Parts of the plan area are occasionally subject to flooding either from localised rainfall or high river flows in the Darling or Murray rivers. Flood flows are important in providing flows along the Anabran, into the Anabran Lakes and into unregulated lagoons along the Murray and Darling rivers.

Groundwater

Two types of groundwater aquifer underlie the Lower Murray-Darling area: alluvial aquifers and porous rock aquifers. A limited area of fractured rock aquifers also occurs in the north-west of the plan area.

This plan only includes the alluvial aquifer adjacent to the Lower Darling River. Water extractions from the deeper porous rock and fractured rock aquifers are covered by the *Water Sharing Plan for the NSW Murray-Darling Basin Porous Rock Groundwater Sources 2011* (the porous rock plan) and the *Water Sharing Plan for the NSW Murray-Darling Basin Fractured Rock Groundwater Sources 2011* (the fractured rock plan).

The alluvial sediments along the Lower Darling River range in width from two to five kilometres from the river channel. Within the alluvium is a freshwater lens, which stretches approximately 500 metres either side of the river channel. This freshwater lens is recharged via flows in the Darling River, rather than rainfall recharge, which is insignificant due to the low rainfall and high evaporation occurring throughout the plan area.

Alluvial aquifers along Murray River are mostly saline and not highly connected to the river, and have been included in the porous rock plan rather than this plan.

Entitlement and use

There are 25 extractive water licences in the area covered by the plan, totalling 3,985 megalitres of entitlement (Table 3). A local water utility access licence will be issued to Essential Energy after the plan commences. The entitlement volume of this licence is currently being determined, but is expected to be 6,300 megalitres.

Table 3: Total entitlement by access licence category for each water source.

Water Source	Domestic and Stock	Local water utility	Unregulated river	Aquifer	Salinity and water table management	TOTAL
Lower Murray Darling Unregulated water source	29	6,300*	2,424	N/A	5,000*	13,753
Lower Murray Darling Alluvial groundwater source	42	0	N/A	748	700*	1,490
TOTAL	71	6,300	2,424	748	5,700	15,243

Source: NSW Office of Water, Licensing Administration System (LAS) database.

* Licence to be issued once plan commences.

Licensed water extraction in the unregulated water source

Local water utility requirements (Essential Energy)

Essential Energy (previously trading as Country Energy), the Local Water Utility for the township of Menindee and the city of Broken Hill, owns and maintains reservoirs on Stephens Creek and Umberumberka Creek. Both reservoirs are catchment dams on 'unregulated' streams. However, Stephens Creek Reservoir also receives regulated water pumped from the Darling River at Menindee.

The works at Stephens Creek Reservoir and Umberumberka Reservoir were not required to be licensed under the *Water Act 1912*. With the commencement of the plan, these works will be licensed under the *Water Management Act 2000*.

Thegoa Lagoon

The majority of unregulated river access licences nominate works that are located on lagoons. Whereas Boeill Lagoon, Neilpo Lagoon and Peacock Creek all have only one licensed water user. Thegoa Lagoon currently has seven licensed extractors. Thegoa Lagoon is located immediately west of Wentworth at the junction of the Murray and Darling rivers, and is the most significant lagoon in the plan area with regards to environmental values and hydrologic stress from extractions. The surface area of the lagoon is about 80 hectares and its capacity is reported to be 770 megalitres (Thegoa Lagoon Management Steering Committee, 2003). The depth of the lagoon is quite variable; following inundation some areas of the lagoon are 0.3 metres deep while the deepest sections are greater than 2.5 metres.

The Lower Murray-Darling CMA and the Murray-Darling Wetlands Working Group are striving to return the lagoon to a more natural cycle of wetting and drying, rather than the continually high water levels experienced during recent decades. The seven licensed works on Thegoa Lagoon have a total entitlement of 1,051 megalitres. One landholder extracts water under basic landholder rights (see below). Prior to commencement of the water sharing plan, licence holders were required to cease pumping once the water level in the lagoon drops below 0.3 metres on the staff gauge.

Water can enter Thegoa Lagoon in two ways; through an approved pipe / regulator at the eastern end of the lagoon, or over the sill of a culvert at the western end of the lagoon. (The catchment area of the lagoon is small and does not provide any significant inflows.) Flows into the lagoon via the western culvert occur only when the Murray River is in flood (50 to 60 gigalitres per day at Wentworth). Flows via the eastern regulator can occur within the normal operating levels of Wentworth weir but are restricted to 16 megalitres per day due to the size of the pipe / regulator. Water has previously been diverted into the lagoon for environmental purposes as well as for extractive uses.

Rufus River Salt Interception Scheme

The Rufus River Salt Interception Scheme includes a number of surface works that fall within this plan. A process for licensing this scheme is currently being determined. Any entitlement that is issued to the surface works will not be included in the long-term annual average extraction limit, nor will the assessment of total annual usage.

Licensed water extraction in the alluvial groundwater source

There are 10 licensed extractive bores located in the Lower Darling Alluvial Groundwater Source. Of these, eight are used for horticultural purposes and have 'drought contingency' conditions; one is a 'standard' horticultural licence; and one is for the Curlwaa groundwater protection scheme.

In response to recent drought conditions over the last decade, the NSW Office of Water issued several licences to horticultural irrigators along the Darling River to extract water from the alluvial aquifer. These licences had 'drought contingency conditions' that only permitted groundwater extractions during periods when water from the regulated system was not available. A further restriction placed on these licences is that only water with a salinity reading of less than 3,000 $\mu\text{S}/\text{cm}$ may be extracted. The objective of this restriction is to prevent over-extraction from the freshwater lens, which could lead to salt water intrusions in to the freshwater lens and into the Darling River channel.

Curlwaa Groundwater Protection Scheme

The Curlwaa Groundwater Protection Scheme consists of several tubewells which are used to lower groundwater levels under the Curlwaa Irrigation District. These tubewells are owned and managed by Western Murray Irrigation and were not required to hold an entitlement under the *Water Act 1912*. With the commencement of the plan, these works will be issued with a salinity and water table management access licence and works approval under the *Water Management Act 2000*. This access licence will be issued with an annual entitlement based on the system capacity (700 megalitres/year).

Basic landholder rights

Water is also extracted from watercourses and alluvial aquifers within the plan area under basic landholder rights (not requiring an access licence) for domestic and stock purposes. The total requirements for domestic and stock rights in the unregulated water source and alluvial groundwater source are estimated to be 5.6 megalitres/day and 2.0 megalitres/day, respectively.

Developing the plan

Project groups

The development of the plan was managed and coordinated by a number of groups: the State Interagency Panel, the Interagency Regional Panel and the State Groundwater Panel.

State Interagency Panel

The State Interagency Panel, has overall responsibility for the statewide strategic direction of water sharing planning, to ensure that adequate resources are available from each agency, and 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 the interagency regional panel, see below, cannot reach agreement or where the issue has statewide significance.

The State Interagency Panel is chaired by the NSW Office of Water, and has representatives from the NSW Office of Water, the Office of the Environment and Heritage (OEH), and agriculture, fisheries and aquaculture specialists from the NSW Department of Primary Industries (NSW DPI). There are also three Catchment Management Authority (CMA) representatives. The NSW Office of Water is responsible for the overall project management.

Interagency regional panel

The plan rules were developed by the Lower Murray Darling Interagency Regional Panel (IRP), which consists of representatives from the NSW Office of Water, OEH and NSW DPI, and observers from the Lower Murray-Darling CMA and Western CMA (Appendix 2). The IRP had access to staff from the agencies to provide technical and scientific information.

The key responsibilities of the IRP were to:

- review the hydrological (water management) units provided by the NSW Office of Water
- assign 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 applicability⁶
- make recommendations on the water access and dealing (trading) rules for each water source
- assist the NSW Office of Water with consultation on the proposed rules
- review submissions, from targeted consultation and public exhibition, and make changes where necessary to the water sharing rules.

A key document that guided the IRP in its decision-making is *Macro water sharing plans – the approach for unregulated rivers. A report to assist community consultation*. This manual explains the method used to classify and set indicative water sharing rules for unregulated streams across NSW.

⁶ This includes reviewing water access conditions imposed on users through announcements or orders under the *Water Act 1912* during low flow conditions.

State Groundwater Panel

The State Groundwater Panel provides a senior-level forum for discussing and resolving a wide range of water planning and policy issues specific to groundwater. The State Groundwater Panel plays a specific role in reviewing and, where appropriate, modifying the outcomes of the regional groundwater assessments and the proposed groundwater sharing rules to ensure consistency across the state for aquifer types.

The group is chaired by the NSW Office of Water and has representatives from OEH, NSW DPI and the CMAs.

The 'macro' process

The 'macro' planning process is the current approach of the NSW Office of Water for developing plans for unregulated rivers and is described in the manual *Macro water sharing plans – the approach for unregulated rivers. A report to assist community consultation*.

Under the macro process, threatened species data contribute to the assessment of instream values, which in turn is used to determine the risks posed to instream values. However, there is a paucity of threatened species data for the unregulated streams in the Lower Murray-Darling area, as most of the data for the plan area relates to the regulated rivers. The IRP decided that it could be misleading to use the macro process to develop indicative rules. Considering the small number of water sources, the IRP deliberated over each water source individually. The IRP maintained the major objective of the macro process of developing rules that balance ecological / environmental, economic and social needs. The IRP used their local knowledge and the expertise of agency staff to negotiate and develop access and trading rules.

Specifically, the IRP considered the impacts of proposed water sharing rules on:

- **environmental needs**, such as protecting lagoon refuges and managing extractions from aquifers to protect freshwater lenses and limit the movement of saline groundwater into surface water streams
- activities that drive the **regional economy** of the Lower Murray-Darling area: mining, irrigated horticulture, cropping, grazing and tourism
- the security and reliability of **town water supplies**.

The IRP worked to develop a water sharing arrangement that could balance these demands. The specifics of these deliberations are covered later in this document.

Policy context

In developing the draft plan, the IRP had to consider and work within a range of policies and government initiatives. This section describes the policy context in which water sharing plans are developed.

National Water Initiative

The NSW Government is a partner to the National Water Initiative which was signed by the Council of Australian Governments (COAG) in June 2004. The National Water Initiative recognises the continuing imperative to increase the productivity and efficiency of Australia's water use, the need to service rural and urban communities, and to ensure the health of river and groundwater systems by establishing clear pathways to return all systems to environmentally sustainable levels of extraction.

The National Water Initiative has a number of relevant requirements for water planning in Clauses 23, 25, 35 to 40, 52, 78, 79 and Schedule E of the intergovernmental agreement (refer to the National Water Commission website www.nwc.gov.au in the Water Reform section for details). This intergovernmental agreement contains provisions on water planning including:

- settling the trade-offs between the competing uses must be based on the best available science and socio-economic analysis, as well as consultation with the community
- ensuring that environmental and other public-benefit outcomes are provided for and achieved through planned and adaptive environmental water on a statutory basis, including actions to sustain high-conservation value rivers, reaches, and groundwater areas
- providing for water trading to enhance water markets
- recognising and addressing surface and groundwater connectivity
- managing local impacts in groundwater areas as well as protecting groundwater dependent ecosystems
- providing for indigenous consultation and aboriginal cultural and commercial entitlements
- assessing and addressing interception
- monitoring and reporting on implementation.

The *Intergovernmental Agreement on a National Water Initiative* sets out outcomes and guidelines and timelines for water plans and planning processes. The National Water Commission is an independent statutory body responsible for providing advice to COAG on the implementation of the National Water Initiative and national water issues and undertakes a biennial assessment of each state's progress with implementation for this purpose.

Natural Resources Commission

The macro plans also comply with the NSW Natural Resources Commission (NRC) statewide standards and contribute to the relevant statewide targets (Table 4) such as Targets 5 and 6 (see www.nrc.gov.au for details) which is a requirement of Priority E4 of the State Plan (see www.nsw.gov.au/stateplan for details). The NRC was established in 2003 to provide the NSW Government with independent advice on natural resource management issues. To achieve this it has developed and recommended a Standard for Quality Natural Resource Management and 13 statewide targets for natural resource management in NSW, which have been embedded in the NSW State Plan. As with the National Water Initiative, the components of the State Standard focus on the use of the best available knowledge, use of 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 is progressing. The NRC reviews plans against this Standard and its associated targets.

Table 4 Contribution of the plan to the relevant NRC statewide targets

Relevant statewide target	Plan's contribution
By 2015 there is an increase in the recovery of threatened species populations and ecological communities (Target 3)	- some access and trading rules developed to help protect water dependent threatened species where these were identified and the risk to these from extraction is high
By 2015 there is an improvement in the condition of riverine ecosystems (Target 5)	- sets a defined share of water for riverine ecosystems - protection of very low flows - trading rules to maintain or reduce entitlement in high value streams - adaptive management, giving the ability to adjust rules once information becomes available or at the end of plan period.
By 2015 there is an improvement in the ability of groundwater systems to support their groundwater dependent ecosystems and designated beneficial uses (Target 6)	- sets distance rules to GDEs for new bores - extractions from alluvial aquifers managed using connected surface water rules - trading rules designed to protect groundwater sources - local area impact management rules
By 2015 there is an improvement in the condition of important wetlands, and the extent of those wetlands is maintained (Target 8)	- trading rules to maintain or reduce entitlement in high conservation value water sources - protection of very low flows - protection of lagoons
Natural resource decisions contribute to improving or maintaining economic sustainability and social well-being (Target 12)	- provides a defined share to water and defined certainty of access - separation of land and water enhances trading and the value of licences - establishment of perpetual and compensable water access licences provides security for business investment - water markets encourage movement of water licences to high value uses - rules developed which consider community dependence on water extraction

Catchment action plans

This plan is consistent with and contributes to the Lower Murray-Darling Catchment Action Plan and the Western Catchment Action Plan, which can be found at the respective websites:

www.lmd.cma.nsw.gov.au and www.western.cma.nsw.gov.au.

Similar to the statewide targets on improvement in riverine ecosystems and the ability of aquifers to support groundwater dependent ecosystems, the plan will contribute to achieving the water catchment target by:

- setting a defined share of water for riverine ecosystems
- protecting very low flows
- implementing trading rules to maintain or reduce entitlement in high conservation value streams
- adopting an adaptive management approach, giving the Minister the ability to adjust rules once information becomes available, or upon remake of the next plan.

One of the CMAs' responsibilities, as observers, is to provide the IRP with advice on the alignment of the proposed classification and extraction limits and rules with the priorities in their catchment action plans.

The Murray-Darling Basin Cap

Water diversions from rivers in NSW progressively increased throughout the last century, but most rapidly in the 1980s. Growth in water diversions:

- takes more water away from the river and may threaten its environmental health
- reduces water available to other legitimate businesses, thus increasing competition and the potential for inequitable access
- reduces flows from upstream river systems into downstream systems.

In 1994, the Murray-Darling Basin Ministerial Council undertook an assessment of water diversions across the Basin. This found that the levels of diversions at that time were placing stress on both the environmental health of our river systems and the reliability of supply to water users, and those diversions were continuing to increase. In response, the Murray-Darling Basin Ministerial Council introduced a diversion limit – the Cap – in 1995.

Schedule F of the Murray-Darling Basin Agreement was then introduced in 1996 and set the operating framework for the Cap. In NSW, the Cap is defined as the average yearly volume of water that would have been diverted under 1993/94 levels of development and management rules. There is no Murray-Darling Basin Ministerial Council Cap on groundwater diversions.

Under the Agreement, water sharing plans are required to be developed to ensure consistency with the Cap. This means that the long-term average annual extraction limit (LTAAEL) for regulated and unregulated water sources must be equal to or less than the Cap. NSW has chosen to divide the surface water Cap into unregulated and regulated components.

In regulated water sources, licences were volume-based and diversions were metered with good records of past use for establishing the Cap. In unregulated water sources, licences were area-based and not metered so the assessment of Cap is more difficult. As part of a volumetric conversion process, irrigation licence holders were surveyed as to the area that they had irrigated over the six year period from 1993/94 and conversion rates developed to establish licensed entitlements and derive average levels of water use. There was no pattern of growth in irrigated areas over the survey period in any of the river systems, so the Cap is based on the information calculated as an average of the yearly assessments over the survey period.

The plan addresses the MDBC Cap by basing the annual extraction limit for the unregulated water source on the estimated annual extraction of water averaged over the period from July 1993 to June 1999.

The Murray-Darling Basin Plan

The Commonwealth *Water Act 2007* requires the Murray-Darling Basin Authority (MDBA) to prepare and oversee a Basin Plan. This plan is a legally enforceable document that provides for the integrated management of all the Basin's water resources. Some of the main functions of the Basin Plan will be to:

- set and enforce environmentally sustainable limits on the quantities of surface water and groundwater that may be taken from Basin water resources
- set Basin-wide environmental objectives, and water quality and salinity objectives
- develop efficient water trading regimes across the Basin
- set requirements that must be met by state water resource plans
- improve water security for all uses of the Basin water resources.

The Basin Plan will provide the new foundation for managing the Basin's water resources in accordance with any rules and plan accreditation criteria established by the MDBA. At the heart of the Basin Plan will be 'sustainable diversion limits', restrictions on the quantities of surface water and groundwater that can be taken from Basin water resources. As the sustainable diversion limits come into effect, they will replace the current Murray-Darling Basin Ministerial Council Cap on diversions in the Basin. They will set limits on the taking of both groundwater and surface water from the Basin.

Further details on the Basin Plan can be found on the MDBA website www.mdba.gov.au in the Basin Plan section.

Other considerations

In addition to formal government policies, there are several objectives that water sharing plans should meet. This section presents these objectives and how the plan addresses the objectives.

Coordinating with other water sharing plans

The plan shares boundaries with the regulated plan and several other unregulated plans, namely the North Western NSW, Intersecting Streams, Barwon-Darling, Lachlan and the Lowbidgee. The plan area is underlain by the *Water Sharing Plan for the NSW Murray-Darling Basin Porous Rock Groundwater Sources 2011* and the *Water Sharing Plan for the NSW Murray-Darling Basin Fractured Rock Groundwater Sources 2011*.

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'.

For the purposes of developing plans for inland aquifer systems in NSW, the NSW Office of Water has defined a highly connected system as a system in which '70 per cent or more of the groundwater extraction volume is derived from stream flow within a single irrigation season'. This is a simplified version of, but still reasonably consistent with, the key findings and conclusions circulated for discussion amongst state jurisdictions by the Murray-Darling Basin Commission (MDBC) in their report *Evaluation of the connectivity between surface water and groundwater in the Murray-Darling Basin*.

As explained earlier, the majority of bores in the Lower Darling Alluvium extract from the fresh water lens which is recharged from stream flows, and as such are considered to be highly connected to the river.

Conversely, there is no significant fresh water lens along the Murray River in the plan area, and as such the alluvial aquifers alongside the Murray River are not considered to be highly connected to surface water.

Defining water extraction limits

Water sharing plans adopt a long-term planning approach to sustainable water use by setting **long-term average annual extraction limits** (LTAELs) for each extraction management unit defined by the plan. Specific extraction management units have not been defined for the plan, so LTAELs have been established for each of the two water sources.

If water usage across the water sources exceeds the LTAEL over a five year period, then the volume of water allocated to each water access licence in that water source will be reduced.

There is some variation across water sharing plans in how LTAAELs are calculated. The specific LTAAELs for this plan are defined later in this document.

In some years, the level of extraction will exceed this LTAAEL, as carryover provisions allow more water extraction in some years as a result of underutilised account water from previous years, or where the LTAAEL has been set at less than the total of entitlements, and climatic variations in extractions can result in total extractions being either over or under the LTAAEL in any one water year. The LTAAEL does not include water taken through interception for farm dams within their harvestable right.

The plan establishes a monitoring, evaluation and review process which will enable the LTAAELs established by this plan to be amended in future plans if the water sharing arrangements in this plan are not maintaining or improving the health of riverine and groundwater dependent ecosystems. Such assessments will require consideration of water sharing externalities such as climatic variability and dry sequences. This adaptive management process is discussed later in this document.

Defining mandatory conditions

The plan sets out a number of provisions that will be applied as mandatory conditions to water access licences and water supply work approvals, developed by other rules contained within the plan. These mandatory conditions are designed to protect the rights of all users in the water source and the environmental water rules of the plan. They cannot be removed or altered unless the plan itself is amended.

Protecting Aboriginal values

Aboriginal cultural values may be affected by water extraction from aquifers and surface waters. Most of the information about flow-related Aboriginal values resides with the Indigenous communities.

The initial consultation sessions provided some insights into Aboriginal cultural values associated with unregulated rivers. Aboriginal communities have indicated that water sharing rules should protect natural instream values. Whilst Aboriginal groups acknowledge the rights of commercial water users, they believe that this entitlement should not be at the expense of the environment. In their view, the priority for plans should be to provide for natural flowing rivers with healthy aquatic biodiversity. This is consistent with the proposed provisions of the plan.

Furthermore, opportunities for granting licences for Aboriginal cultural purposes throughout the Lower Murray-Darling area are included in the plan. These can be used for purposes such as manufacturing traditional artefacts, hunting, fishing, gathering, recreation and ceremonial purposes.

The plan allows for the identification of requirements for significant Aboriginal water dependent cultural sites. The process of identifying these sites and their water requirements is currently being undertaken by NSW Office of Water as part of an extensive consultation program using funding from the National Water Commission.

For more information, see the fact sheet *Macro water sharing plans. Information for Aboriginal water users*, and *Facilitating the engagement of the Aboriginal Community in New South Wales water sharing planning* which are both available on the NSW Office of Water website www.water.nsw.gov.au.

Protecting environmental values

The plan area includes over 269,000 hectares of wetlands and floodplain woodlands, including lignum swamps, black box woodlands and river red gum woodlands (NSW Office of Water 2011). Numerous lagoons alongside the Darling River provide valuable habitat and drought refuge for a range of waterbirds. Twenty-seven threatened bird species have been identified in the plan area, including the bush-curlew, the malleefowl, the Australian bustard, the plains wanderer and the regent parrot (NSW Office of Water 2011). The majority of these species inhabit the riparian woodlands and plains along the Darling River and the Anabranch.

Six species of fish that were previously common in the Lower Murray and Lower Darling rivers are now listed as threatened in the *NSW Fisheries Management Act 1994* (Table 5).

Table 5: Threatened aquatic species in the Lower Murray and Lower Darling rivers.

Scientific name	Common name	Status in NSW
<i>Craterocephalus fluviatilis</i>	Murray hardyhead	Critically endangered
<i>Maccullochella macquariensis</i>	Trout cod	Endangered
<i>Notopala sublineata</i>	River snail	Endangered
<i>Bidyanus bidyanus</i>	Silver perch	Vulnerable
<i>Nannoperca australis</i>	Southern pygmy perch	Endangered
<i>Mogurnda adspersa</i>	Purple spotted gudgeon	Endangered

Source: NSW Office of Water 2011.

The aquatic community of the Lower Darling River is part of the Darling River Endangered Ecological Community⁷ (Darling River EEC, or the *Aquatic ecological community in the natural drainage system of the lowland catchment of the Darling River*). The Darling River EEC includes 21 native fish species and hundreds of native invertebrates (NSW Office of Water 2011).

Although much of the ecological data for the plan area pertains to the regulated system, it is still relevant to the unregulated streams. Unregulated streams and alluvial aquifers provide flows to the regulated system and thus contribute to the health of riparian woodlands and plains. In addition, pools and lagoons on unregulated streams provide important refuge for aquatic birds, invertebrates and fish.

Protecting pools, lagoons or lakes

Pools, lagoons and lakes (collectively referred to as pools) are an important source of water for access licence holders, basic landholder rights holders and communities. Pools also have a key ecological function as a critical refuge and habitat for flora and fauna.

A fundamental principle for the effective management of pools is the NSW Government's River Flow Objective 1 which is to 'protect natural water levels in pools of creeks and rivers and wetlands during periods of no flow'. The *Water Management Act 2000* also requires water sharing plans to protect environmental values by reserving a proportion of water as planned environmental water.

Pools may pose particular management issues and can require rules specifically tailored to address those issues. For example, to maintain pool volumes for a pool within a river, it may be appropriate to establish a rule that requires extraction from the pool to cease when flows drop below a certain level at

⁷ Endangered ecological communities are assemblages of species occupying a particular area (of plant and/or animal communities) that is in danger of becoming extinct. Endangered ecological communities are listed in schedules of the *Threatened Species Conservation Act 1995*.

a reference point in the river. However, for pools that are isolated from the river, the relationship between the volume of water in the pool and the flow at the reference point in the river may not be the most significant management driver. In this case a staff gauge (which measures water level rather than flow-rate) may be a more appropriate means of controlling the volume of water in the pool.

The macro planning approach initially did not generate access rules that differentiate between instream pools and those pools that are isolated from the river or on the floodplain. To overcome this limitation the NSW Office of Water with the State Interagency Panel has developed a policy to assist in developing rules that recognise the varying level of environmental sensitivity, dependence on extraction from these pools and the hydrological character of the pools. The draft policy provided guidance for regional panels in setting water access and trading rules for pools that are covered by unregulated river water sharing plans and represents a refinement of the current macro planning approach in order to allow access and trading rules to be more appropriately, consistently and objectively applied to pools.

The policy distinguishes between pools that are natural and pools that are not natural. For users on non-natural pools the default rule is that access should be subject to existing access arrangements. For users on natural pools the rules resulting from applying the methods in the draft policy define default access rules for when there is no flow or low flows in the rivers in the associated water source. For example, water users on in-river pools must cease pumping when flows at the flow reference point are in the Very Low Flow Class where a Very Low Flow Class has been established, otherwise they may not draw down the pool past a certain point (this point may be as high as the full capacity or such lower level which takes into consideration local hydrological, environmental and socio-economic considerations).

Since it is not practical to identify and create site-specific rules for every natural pool in a water sharing plan area, the focus of the approach is to establish default rules appropriate to different types of pools that can be modified by regional panels in specific circumstances, if justifiable. These default rules will be applied by describing the pools generically in the water sharing plans. Where default rules are not suitable for a given pool or set of pools, interagency regional panels may apply alternate rules.

Under this plan, water must not be taken from a lagoon or pool listed in schedule 5 when the water level is below 50 per cent of its full capacity. Water must not be taken from other off-river natural pools when the water level in the pool is less than 100 per cent of its full capacity. Pools within rivers are protected by cease to pump rules when there is no visible flow at the pump site.

'Full capacity' can be approximated by the greatest pool volume where there is no visible flow out of that pool.

Water sharing plans contain amendment provisions to allow for changes to be made to access and trade rules for a particular pool or category of pool should new information be gained through environmental and/or socio-economic studies relating to pools in a plan area.

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 (endangered ecological community).

The methodology utilised for the identification and scheduling of high-priority groundwater dependent ecosystems (GDEs) in the macro planning process is guided by the NSW State Groundwater-Dependent Ecosystem Policy (DLWC, 2002).

No high priority GDEs have been identified in the plan area.

Protecting basic landholder rights

Under the *Water Management Act 2000*, extraction of water for **basic landholder rights** does not require a water access licence, although in the case of accessing groundwater under these rights, the bore must still be approved by the NSW Office of Water. Basic landholder rights include water for domestic and stock purposes extracted from a water source fronting a landholder's property or from any aquifer underlying the land, harvestable rights and for native title rights.

The principles of the *Water Management Act 2000* also require that water sharing must protect basic landholder rights. The plan does this by including an estimate of the water requirements for basic landholder rights at the start of the plan. There are currently no extractions for native title rights. However, these rights may be activated during the plan's 10 year term.

Furthermore, the access rules apply to licensed water users but not to extractions for basic landholder rights. This in effect affords these basic landholder rights users some additional protection.

Domestic and stock rights can be restricted by the Minister to protect the environment or public health, or to preserve existing basic landholder rights. These restrictions are outside the framework of the plan. The NSW Office of Water is developing a regulation which will limit extractions under domestic and stock rights to a reasonable volume where they are metered, and more clearly define what is considered to be reasonable purposes, which is important where they are not metered.

The estimated volume of basic landholder rights in the plan area draws on the reasonable take and use zones and the domestic and stock consumption allowances from the NSW Office of Water's draft mandatory guidelines for the take and use of water under domestic and stock rights. Consideration is given to both surface and groundwater estimations simultaneously, effectively reducing the double counting of these rights in the estimations. To estimate stock watering use in each water source, land use data was used to determine grazed area and the subsequent volume determined by applying the stock consumption allowance (megalitres per hectare) from the draft mandatory guidelines. Population and housing Census data (ABS) was used to calculate the number of houses in each water source, and the domestic consumption allowance (megalitres per 'house') from the draft guidelines was applied to estimate the total domestic water use for each water source.

The plan provides an estimate of the water requirements for domestic and stock rights within each of the water sources, noting that the volume of water extracted under these rights may increase during the life of the plan. The plan cannot limit or restrict these rights, but the *Water Management Act 2000* itself provides for restrictions on basic landholders rights, through the guidelines.

Addressing water interception activities

A change in land use activities can potentially result in the interception of significant quantities of water. Examples of activities that could impact on water quantity in the plan area are increased farm dam capacity and floodplain harvesting. Under the National Water Initiative, significant interception activities should be accounted for within a plan's extraction limit.

Exemptions for farm dams

Farm dams in the Western Division of NSW currently require an access licence only when they are located on a third (or higher) order stream, irrespective of the dam capacity or purpose.

Unlicensed extraction from farm dams is permitted as a component of the basic landholder rights, called the harvestable right. The full activation of harvestable rights within the area of the plan is considered highly unlikely, therefore the plan allows for an estimate of the current activation of these rights within the extraction limit. The plan cannot actually limit these rights. The provisions relating to

harvestable rights are unaffected by any of the rules identified in the plan. However, the uptake of harvestable rights will be monitored to determine if at any stage total unlicensed dam capacity has increased to a level considered significant in relation to interception and to inform the implementation of the National Water Initiative.

Acknowledgement of floodplain harvesting activities

Floodplain harvesting is the collection, extraction or impoundment of water flowing across floodplains. Floodplain flows can originate from local runoff that has not yet entered the main channel of a river, or from water that has overflowed from the main channel of a stream during a flood.

Floodplain harvesting can generally be characterised as follows:

- diversion or capture of floodplain flows using purpose-built structures or extraction works to divert water into storages, supply channels or fields or to retain flows, or
- capture of floodplain flows originating from outside of irrigated areas using works built for purposes other than floodplain harvesting, or
- opportunistic diversions from floodplains, depressions or wetlands using temporary pumps or other means.

It is intended to establish volumetric entitlements for floodplain harvesting during the life of the plan. The plan may be amended at a later date in order to deal with the management of floodplain harvesting.

Protecting town water supply access

Towns have a higher priority for access to water than other consumptive users. 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. The annual share for every town water supply will be specified on the town's licence.

Considering the infrequent nature of runoff in the plan area, no environmental flow requirements have been placed on Stephens Creek Reservoir or Umberumberka Reservoir.

Demand for town water supply is not expected to change significantly over the life of the plan.

Rules for the Lower Murray-Darling Unregulated Water Source

This section explains the rules for the Lower Murray-Darling Unregulated Water Source as they were presented in the draft plan, how the rules were developed, and the reasoning behind the rules.

Classification method

The classification of water sources was the first step in developing water sharing rules. The plan area was initially defined as eight water sources. Each water source was assessed on the basis of its instream and economic values, and the risks to these values. Ratings of 'high', 'medium' or 'low' were determined for each attribute. 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 to instream values against community dependence. For full details about the classification method, see the document *Macro water sharing plans – the approach for unregulated rivers. A report to assist community consultation*, which is available on the NSW Office of Water's website⁸.

IRP members raised concerns about the lack of environmental data available for unregulated streams in the plan area. The majority of environmental data in the plan area pertains to the regulated streams, including the Anabranch, which occasionally receives flows from the regulated system and flows from the Darling River during flood events. IRP members were concerned that water sources may be incorrectly assessed as having 'low' instream value as a consequence of the lack of environmental data. A statewide recommendation that the instream values of all streams be considered "high" unless proven otherwise was dismissed by the NSW Office of Water working group on the basis that the unregulated streams in the plan area rarely carry low flows – the streams are either in flood or are dry. Adopting 'medium' instream value as a default was dismissed by the IRP as being potentially misleading. Due to the IRP's concerns, the macro classification data has not been presented in this document.

Access rules

In response to the lack of direction provided by the macro classification data, the IRP developed draft water sharing rules by considering each individual licence in the plan area. This proved possible as there are only 13 extractive licences in the plan area. (The majority of water diversions occur under riparian rights.) Of these 13 licences, 12 are located on lagoons and one is located on a creek. The IRP proposed the following access rules for the Lower Murray-Darling Unregulated Water Source:

- a visible flow rule for works extracting from streams
- a 50 per cent drawdown rule for works extracting from identified lagoons.

The IRP proposed a visible flow rule for the unregulated streams on the basis that:

- rules more restrictive than visible flow would be unreasonable (extractions are already restricted to less than one per cent of all days due to the infrequency of flows)
- rules based on measured streamflow would currently not be possible, as there is only one automated gauge on unregulated streams in the plan area
- a visible flow rule closely reflects current practices
- there is only one extractive instream licence in the plan area.

⁸ Refer <http://www.water.nsw.gov.au> for the most recent version of the manual

For licences located on lagoons, the IRP proposed a rule that allows extraction down to 50 per cent by volume of the lagoon. This decision was guided by NSW Office of Water's pools policy which was under development at the time. The IRP proposed a 50 per cent drawdown rule on the basis that:

- 50 per cent drawdown is more restrictive than current access conditions and will provide an increased level of ecological protection
- the rate of drawdown has a greater impact on lagoon ecology rather than the level to which licensed users are permitted to extract
- extractions under basic landholder rights are not restricted by lagoon volume as long as usage complies with the draft mandatory guidelines for the take of water for stock and domestic consumption
- evaporation during summer can readily exceed the total depth of water in the lagoons
- trade of entitlement will not be permitted into lagoons (see trading rules below)
- carryover of allocation will not be permitted for works extracting from lagoons, and
- access to 50 per cent of the water has previously been accepted by a range of stakeholders in other plan areas as 'fair'.

Water accounts and carryover

A water allocation account will be established for each water access licence. Water is credited to the account when an available water determination (see below) 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 flow volumes between years. As such, account management for unregulated river access licences will operate under 'three year accounting rules', subject to compliance with the daily access rules. Licence holders will be permitted 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, the 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 three megalitres 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 per cent (where the share component is expressed as a volume) or two megalitres per unit share (where the 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 per cent of the share component (where this is expressed in megalitres), or one megalitre per unit share (where the share component is expressed in unit shares).

Note that carry over of allocation is not permitted for water access licences that nominate works located on a lagoon.

Managing growth in usage

The LTAAEL for the Lower Murray-Darling Unregulated Water Source is defined as:

- the estimated annual extraction of water averaged over the period from July 1993 to June 1999 under entitlements issued under Part 2 of the *Water Act 1912* in the Lower Murray-Darling Unregulated Water Source, plus
- the estimated annual water requirements pursuant to basic landholder rights, plus
- the estimated annual extraction of water averaged over the period from July 1993 to June 1999 of local water utility access licences in the Lower Murray-Darling Unregulated Water Source.

Guided by NSW Office of Water policy, the IRP proposed that compliance with the LTAAEL be assessed over a five year period with a tolerance of five per cent. That is, if total usage from the water source averaged over any five year period should exceed the LTAAEL by more than five per cent, the level of water allocated may be reduced by adjusting the **available water determination** (AWD).

AWDs are primarily used to credit water into a licence's water allocation account. Specific purpose access licences, such as domestic and stock or local water utility licences, will usually receive 100 per cent of their share component, although in years of exceptional drought, daily access rules may limit extraction so that the full annual entitlement cannot be realised.

The AWD for unregulated river access licences will be one megalitre per unit share, unless a growth in use response is required. However, for the first year of the plan, a one-off announcement of two megalitres per unit share will be made to allow the operation of accounting rules over a three year rolling average.

Access to very low flow

For activities that are considered to be critical to human needs or animal health requirements, extractions during periods of very low flow are permitted. For this plan, very low flows are defined as 'less than visible flow' in unregulated streams, and once the water level has dropped below 50 per cent by volume in scheduled lagoons. Licences with access to very low flows include:

- domestic supply
- town water supply, until major augmentation of the scheme's infrastructure occurs
- fruit washing
- cleaning of dairy plant and processing equipment for the purpose of hygiene
- poultry washing and misting
- cleaning of enclosures used for intensive animal production for the purposes of hygiene.

Note that extractions by landholders under basic landholder rights are also permitted during periods of very low flow.

Trading rules

The water market may offer an effective and equitable way to reallocate water between users. The National Water Initiative sets out guidelines for water trading and these will be largely superseded in the Murray-Darling Basin once the Basin Plan commences. Trading can currently occur either on a permanent or temporary basis. Trading of water entitlements should maximise the flexibility for licence holders to use water to its highest value but should not adversely impact on existing users or the environment.

The IRP recommended that:

- trade of entitlement not be permitted into the Lower Murray-Darling Unregulated Water Source
- trade of entitlement be permitted within the Lower Murray-Darling Unregulated Water Source
- trade of entitlement not be permitted to works extracting from lagoons.

Water supply work approvals and construction of dams

In line with statewide policy, the plan does not permit the granting of water supply work approvals for new in-river dams on streams of third or higher order throughout the plan area. The plan does not change the approval process for the construction of dams on first or second order streams to capture water under landholders' harvestable rights.

Redefining the unregulated water source

Preparation of the plan began in 2005, but due to changing statewide priorities was put on hold until 2010 when the IRP was reconvened. The 2006 draft plan defined eight water sources.

In 2011, after developing the draft access and trade rules for the water sources, the IRP decided to merge these water sources on the basis that six of the eight water sources had no extractive licences, and the same access and trade rules applied to all water sources. The rationale for merging the water sources was to make the plan easier to write, explain and implement.

Rules for the Lower Darling Alluvial Groundwater Source

Defining the groundwater source

In defining the Lower Darling Alluvial Groundwater Source, the IRP decided to include the alluvium alongside the Lower Darling River but not the alluvium alongside Talyawalka Creek or the Anabranche. Although the alluvial deposits alongside all three waterways is thought to be similar in nature, the alluvial aquifers alongside the Darling River are recharged more frequently and to a greater extent due to regular flows passing along the Darling River. In contrast, flows along Talyawalka Creek and the Anabranche are less frequent and of smaller volume. Therefore the opportunities for aquifer recharge are considerably less. The resource potential of these aquifers is reflected in the location of current licensed bores. There are nine licensed bores located in the alluvial aquifers alongside the Darling River, while there are no licensed bores alongside Talyawalka Creek or the Anabranche.

Access rules

As described previously, the majority of bores in this groundwater source were subject to 'drought contingency conditions' under the *Water Act 1912*, which only permitted extractions when:

- the available water determination for the regulated river system was zero, and
- the electrical conductivity of the water extracted was less than 3000 $\mu\text{S}/\text{cm}$.

The IRP recommended that these drought contingency conditions be retained for these bores.

One horticultural licence (60BL216046) that was established prior to the drought contingency licences will retain its current conditions and will not be subject to the zero AWD requirement. However, to protect the freshwater lens from over-extraction and to be consistent with other bores in the alluvial groundwater source, this licence will also only be permitted to extract water with an electrical conductivity of less than 3000 $\mu\text{S}/\text{cm}$.

The tubewells to be nominated by the salinity and water table management access licence held by Western Murray Irrigation will not be subject to the access rules described above.

The rationale underlying the IRP's proposed rules was:

- The freshwater lens from which the horticultural bores extract is only 500 m wide along each side of the river. It is a limited resource and if pumped too hard will result in the movement of saline groundwater into the freshwater lens and ultimately into the river.
- The drought contingency licences were issued to assist orchardists to get through drought periods. The IRP thought that this intent should be retained.
- Since licence 60BL216046 was established prior to the drought contingency licences, the IRP felt that access under this licence should not be dependent on flows in the regulated river system.
- The groundwater extracted by Western Murray Irrigation's tubewells is not for consumptive use. This is a self-regulating mechanism – it would be logical for Western Murray to pump the minimum volume of water required to provide the necessary level of protection for orchards from waterlogging and saline water tables.

Water accounts and carryover

Water accounts will be established for water access licences nominating works in the Lower Darling Alluvial Groundwater Source. No carryover of allocation will be permitted for any works in the groundwater source.

Managing growth in usage

The IRP proposed that the LTAAEL for the Lower Darling Alluvial Groundwater Source be defined as:

- the sum of entitlement, plus
- an estimate of annual water requirements for domestic and stock rights and native title rights.

The IRP recommended that the LTAAEL for the groundwater source be based on entitlement rather than history of extraction, on the basis that all but one of the horticultural licences have “drought contingency conditions” which permit water to be extracted only during years of zero allocation in the regulated river system.

Guided by NSW Office of Water policy, the IRP proposed that compliance with the LTAAEL be assessed over a five year period with a tolerance of 10 per cent. That is, if total usage from the water source averaged over any five year period should exceed the LTAAEL by more than 10 per cent, the AWD for this groundwater source may be reduced.

Trading rules

The IRP recommended that:

- trade of entitlement be permitted between water access licences that nominate works which have ‘drought contingency’ conditions, and
- trade be permitted from 60BL216046 to any water access licence that nominates works which have ‘drought contingency’ conditions (but not vice versa).

No trade is permitted to or from Western Murray Irrigation’s salinity and water table management access licence.

Water supply work approvals

In accordance with the principles of the *Water Management Act 2000*, the plan sets rules to minimise the cumulative impacts resulting from groundwater extraction. To do this, the plan specifies rules which prohibit new or amended works from extracting water within certain distances of other water users, contaminated sites, GDEs and groundwater dependent culturally significant sites. This is to prevent unacceptable or damaging levels of drawdown of water occurring in the local vicinity of these users and sites.

Standard distance rules were developed for the macro plans through internal meetings of regional and state panels consisting of regional groundwater experts and representation from NSW DPI and OEH to incorporate a socio-economic and environmental perspective. These panels compiled sets of distance criteria based on previous studies, substantial local knowledge and experience. This experience included knowledge of analytical and numerical models and their results, such as those used in dryland salinity studies until the late 1990s. A consistent set of rules for common groundwater aquifer types (for example fractured rock, alluvium, coastal sands and porous rock) was then produced by comparing the various rules proposed by the regional panels based on what has worked in the past in similar geological provinces.

For details about the distance rules for each groundwater source covered by the plan, refer to the rules summary sheet.

Consultation

With assistance from the Lower Murray-Darling CMA and the Western CMA, key stakeholders were identified and contacted prior to the public exhibition of the draft plan to ensure that they were aware of the plan and to provide the opportunity to discuss and explain the draft plan. Stakeholders contacted were Country Energy (Essential Energy), the Darling River Action Group, and the Pastoral Association of Western Darling.

Public exhibition of the draft water sharing plan

The draft Plan was publicly exhibited⁹ from 6 December 2010 to 31 January 2011. Copies of the draft plan and supporting documents were exhibited at eight sites across the plan area. Letters were sent to all licence holders and other key stakeholders in the plan area, alerting them to the public exhibition of the plan, inviting them to a public meeting about the plan, and informing them of their options to provide feedback on the draft plan. The public meeting was held on **13 January 2011** at the Gol Gol Hotel.

The objectives of publicly exhibiting the plan were to:

- provide background to stakeholders as to why the water sharing plan is being developed, how it has been developed to date, what rules are proposed in the various areas and how stakeholders can provide feedback
- formally consult with a broad range of stakeholders to explain the proposed water sharing rules and how they will be implemented
- seek local knowledge and expertise – for example, there may be other natural or socio-economic values that have not yet been considered by the Interagency Regional Panel
- get feedback on the practical elements of the proposed water sharing rules - to make certain they are easily implemented by the licence holders
- confirm that there are no unintended outcomes from the plan – it is essential that this be given due consideration before the plan is finalised
- get specific comments on the Minister's notes included in the draft plan.

Thirteen people attended the public meeting, and nine written submissions were received during the public exhibition period.

Refining water sharing rules as a result of public exhibition

The IRP reviewed all submissions as well as matters raised at the meetings and updated data, and as a result made some changes to the rules (Table 6). The IRP 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.

⁹ Public exhibition is the formal exhibition of a draft Plan where the Minister invites submissions on the draft plan and in particular will seek comment on a range of key issues.

Table 6: Changes to water sharing rules as a result of public exhibition.

Water source	Change to water sharing rules	Justification
Lower Murray-Darling Unregulated	Access rules to Thegoa Lagoon were refined. Proposed CTP level of 50 per cent of lagoon volume remained if water enters via the western culvert or is diverted through the eastern regulator as "irrigation water". "Environmental water" diverted via the eastern regulator will not be available for extraction by licence holders if the antecedent water level is less than 50 per cent of the volume.	The public exhibition period allowed further information about Thegoa Lagoon to be collected and considered. The Lower Murray-Darling CMA proposed that different access conditions apply depending on the avenue of water into the lagoon.
Lower Murray-Darling Unregulated	Change to eastern boundary.	Changes to the Lowbidgee plan have resulted in additional land being included in the Lower Murray-Darling area. No water licences exist in this additional area.
Lower Murray-Darling Unregulated	Allow for the granting of salinity and water table management access licences for the Rufus River Salt Interception Scheme. Any entitlement issued to these licences will not be included in the LTAAEL, nor in the assessment of total annual water usage.	These surface water works are part of the system that transfers saline groundwater to the evaporation basin.
Lower Murray-Darling Unregulated	Water allocations cannot be traded into the Great Darling Anabranch unless for environmental purposes.	This was the original intent of the IRP, but was inadvertently not included in the draft plan.
Lower Murray-Darling Unregulated	Extractions under licence 60BL216046 to be restricted to water with electrical conductivity readings of less than 3000 µS/cm.	This condition exists for all other horticultural licences in this water source. The purpose of the condition is to restrict the movement of saline groundwater into the freshwater lenses adjacent to rivers.
Lower Murray-Darling Unregulated	A clause that allows the plan to be amended to allow for future water shepherding has been included.	The NSW Office of Water is currently developing policies and practices to allow shepherding of water. The plan must allow for these future changes, which will facilitate the transferral of environmental water and assist water trading.
Lower Darling Alluvial Groundwater	A salinity and water table management access licence is to be issued to Western Murray Irrigation to allow the continued operation of their groundwater protection tubewells at Curlwaa.	The Curlwaa scheme needs to continue operating to protect citrus groves from elevated water tables. Such schemes require licensing under the <i>Water Management Act 2000</i> .

Adaptive management

Adaptive management is an important part of a water sharing plan. Adaptive management refers to the process of ongoing data collection monitoring, evaluation and review during the life of the plan that either enables plan amendment or remaking of a better plan after ten years. Adaptive management is a requirement of both the *Water Management Act 2000* and the National Water Initiative, and has been allowed for during the life of the plan through amending provisions and establishment of 'limits of change' to the plan.

Where adaptive management is identified further studies may be undertaken within agencies or by external organisations which may assist in informing the review of plan provisions.

Monitoring of plan performance

The NSW Office of Water is also developing a Monitoring, Evaluation and Reporting (MER) Framework. This framework is being developed in collaboration with key stakeholders and will be consistent with the MER needs of the NRC and the NWC. The intention is that the framework can be applied to existing plans and macro plans to enable the development of a specific MER plan.

Performance indicators

The plan includes a number of performance indicators that will be monitored over the 10 year life of the plan.

It is not practicable 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 plan as improved methods are developed.

Plan review

Under the *Water Management Act 2000*, the NRC is required to undertake a review of this plan prior to any decision to extend its term or to make a new plan.

The MER framework to be developed will consider the statutory requirements for the different types of evaluation:

- an audit of the plan, at intervals of no more than five years, for the purpose of ascertaining whether its provisions have been given effect to. This audit is to be carried out by the State Interagency Panel, which has now been appointed by the Minister (for Primary Industries).
- an audit of the plan by the NRC to assess to what extent the water sharing provisions have contributed to the relevant statewide targets, and natural resource standards and targets in the relevant catchment management area. The NRC will call for public submissions when undertaking its review.
- an annual review of Implementation Programs.
- the application of information from the relevant monitoring and evaluation programs to inform progress against the relevant statewide targets and requirements of the NWC under the NWI.

Implementation

Implementation programs

An implementation program may be established that sets out the means by which the objectives of this plan are to be achieved. The process for monitoring of the performance indicators will be outlined in the Implementation Program.

An annual review of the implementation program will be conducted to determine whether the implementation program is being effective in implementing the water sharing provisions. The results of this review will be included in the NSW Office of Water's Annual Report.

Monitoring water extractions

Each water sharing plan establishes the relevant mandatory conditions for extraction, including that all licences undertake measurement of extraction. The NSW Office of Water will develop a measurement of extractions strategy to meet the objectives of the NSW Water Extraction Monitoring Policy.

Measurement of extractions may be via meters or other forms of monitoring devices fitted to approved works, or via alternate monitoring systems, in order to provide water extraction estimates. Different types of devices will be required depending on the nature of the water supply work installation, the size of the work, and the effect that the operation of the work may have on the water source and other water users.

Under the Water Use Monitoring Program, assessment of water sources is being undertaken across the state to identify priority areas of measurement of extractions and to determine the most suitable measurement options. It is likely that this will be implemented in high priority areas initially, with roll out to all water sources over time, as appropriate.

Note: Decisions regarding the timetable for introduction of measurement of extractions are still under consideration. In the interim, water users are encouraged to use other forms of self-measurement to assist them to extract water in compliance with their licence conditions, which will be developed from the relevant plan provisions. Water users may install flow meters of their own volition. Meters need to meet new national water meter standards and be installed in accordance with the manufacturer's specifications

Compliance

The NSW Office of Water will undertake compliance activities as necessary to enforce each individual's licence conditions, which are developed based on the provisions of the plan once it is implemented. Some reliance is placed on local water users to identify inappropriate or unlawful behaviour and report this to the NSW Office of Water. Reports may be made by calling 1800 633 362 or emailing watercompliance@water.nsw.gov.au.

More information is available at the Office of Water website www.water.nsw.gov.au.

Glossary

Many of the terms in this document are defined in the *Water Management Act 2000* and are therefore not redefined here. However, there are some terms that are not and have therefore been defined below to assist with understanding the draft 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 river beds or flood plains.

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.

Connectivity: The capacity of instream biota to move longitudinally in a river system and not be impeded by barriers (e.g. weirs, dams, culverts). Connectivity is important for instream aquatic processes and biota and the conservation of natural riverine systems.

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 (EMU): 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 gauging station: 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.

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 basic landholder rights 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.

Regulated river: A river that is declared by the Ministerial, by order published in the Gazette, to be a regulated river. Typically rivers where state owned storages catch water during wetter periods and the river is used to supply stored water to meet downstream users' orders during dry times are regulated rivers.

Reliability: The frequency with which water allocated under a water access entitlement is able to be supplied in full (referred to in some jurisdictions as 'high security' and 'general security'). Alternately, reliability can also sometimes be measured in terms of long-term average water availability relative to entitlement.

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

Security: The legal status and tenure of a right to access water. This includes the level and assurance that a water access entitlement will provide that which it specifies. Security thus includes the reliability of supply. The range of water access entitlement characteristics detailed in the National Water Initiative contributes to the security of a water access entitlement.

Supplementary water event: A continuous period during which the taking of water from uncontrolled flows under supplementary water access licences or as no-debit access under a Regulated River (general security) access licence is permitted in all or part of a River Water source

Sustainable yield: That percentage which is allowed to be extracted from groundwater after considering the aquifer's ability to recharge and the needs of the environment.

Uncontrolled flow: Flow in excess of that needed to meet the environmental provisions of the plan, basic landholder rights and water orders placed by Regulated River (general security) access licences and higher priority access licences in a water source. These flows originate from tributary inflows or dam spills.

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

Water sharing plan: A plan made under the *Water Management Act 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.

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TLMSC 2003, *Management Plan for Thegoa Lagoon*. Prepared by the Thegoa Lagoon Management Steering Committee.

Appendix 2: Interagency Regional Panel and support staff - membership and expertise

Name	Agency	Role	Expertise
Interagency Regional Panel			
Gary Coady	NSW Office of Water	Agency Representative	Water planning, administration and policy
Tracey Brownbill	NSW Office of Water	Agency Representative	Water planning, administration and policy
Giles Butler	NSW DPI	Agency Representative	Regional experience in water reform programs, agricultural industries, catchment management
Justen Simpson	OE&H	Agency Representative	Regional input to water reforms, biodiversity and threatened species management planning
Ken Harrison	Western CMA	CMA Observer	Regional expertise, catchment management and program implementation
Kelly Fyfe / Leslie Palmer	Lower Murray-Darling CMA	CMA Observer	Catchment management, program development and implementation. Community liaison and engagement
Support staff			
Paula D'Santos	OE&H	Technical Support	Wetland management, Thegoa Lagoon
Peter Winton	NSW Office of Water	Licensing Officer	Local knowledge and expertise. Licensing issues
Lyn Gorham	NSW Office of Water	Licensing Manager	Licensing policy and regional implementation
David Kernebone	NSW Office of Water	Licensing Officer	Local licensing and water use knowledge
Nigel Harriss	NSW Office of Water	Hydrometrics Officer	Local hydrometric and hydrological knowledge
Kylee Wilton	NSW Office of Water	Plan writer	Water planning, administration and policy
Brendan Fletcher	NSW Office of Water	Policy support	Water planning, administration and policy. Plan review
Andrew Craig	NSW Office of Water	Plan coordinator (2010 – 11)	Water planning, policy and facilitation
Digby Jacobs	NSW Office of Water	River Operations	River operations and environmental flows in the Anabranh
Mohammed Alamgir	NSW Office of Water	Hydrogeological support	Local hydrogeological knowledge
Danny Hannon	NSW Office of Water	Hydrometrics support	Local hydrometric and hydrological knowledge
Peter Nankivell	NSW Office of Water	Plan coordinator (2005 – 06)	Water planning and policy
Janine Lonergan	NSW Office of Water	Legal support	Legal advice
Cecilia McMaser	NSW Office of Water	Legal support	Legal advice
Michelle Blazek	NSW Office of Water	Legal support	Review of Order
Kimberley Williamson	NSW Office of Water	Document preparation	Water planning and policy

Appendix 3: Interagency Regional Panel reference materials

Office Datasets

Licensing Administrator System (LAS) – the NSW Office of Water statewide database holding the licence details including volume of entitlement, location details and stream orders.

HYDSYS – a NSW Office of Water statewide database that holds all flow record data.

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

Volumetric Conversion Database (VOLCON) – used to help determine the Peak Daily Demand (PDD) for each water source.

Regional Geographic Information Systems – the NSW Office of Water land use and topographic information.

Central Datasets

Stressed Rivers reports – used as the basis for identifying where there are instream barriers

Threatened species (fish) – Data supplied by NSW DPI

Threatened species (other) – Data supplied by OEH

Index of Social Disadvantage – Australian Bureau of Statistics

Employment in Agriculture - Australian Bureau of Statistics

other Departmental data

National Parks and Wildlife (OEH) statewide atlas – statewide flora and fauna database

NSW Fisheries (NSW DPI) modelled data sets (Fish Community Index, Fish Community Vulnerability)

NSW Fisheries (NSW DPI) freshwater and saltwater recreational fishing database

Other projects/reference material

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