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Water Sharing Plan for the Macquarie Bogan Unregulated and Alluvial Water Sources

Background document



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Water Sharing Plan for the Macquarie Bogan Unregulated and Alluvial Water Sources: background document

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Introduction

Water sharing plans (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 some 80 per cent of water extracted in NSW under the management and licensing provisions of the *Water Management Act 2000*.

In recent years, plans for the unregulated¹ rivers and groundwater systems have been completed using a 'macro' or broader-scale river catchment or aquifer² system approach. Over 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 (for example 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 Macquarie Bogan Unregulated and Alluvial Water Sources* (the plan) covers 30 unregulated surface water sources that are grouped into one extraction management unit (EMU) and four alluvial groundwater sources (refer Appendix 1).

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 Macquarie and Bogan catchments including land and water use
- the process of plan development including scope, history and basis for decisions
- the activities associated with implementation, monitoring and review of the plan

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

- the *Water Sharing Plan for the Macquarie Bogan Unregulated and Alluvial Water Sources* - a legal instrument written in its required statutory format
- the Water sharing plans – Inland unregulated and alluvial water sources – Overview – a plain English version of the plan explaining the key sections and rules
- rules summary sheets for each water source detailing the proposed 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. Information available for download or viewing includes:

- *Macro water sharing plans – the approach for unregulated rivers. A report to assist community consultation* – explains the method used to classify and set water sharing rules for unregulated streams across the state
- *Macro water sharing plans – the approach for unregulated rivers. Setting access and trading rules for pools* – explains the method used to set water sharing rules for pools in unregulated water sources across the state

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.

² An aquifer is an underground layer of water-bearing permeable rock or unconsolidated materials (gravel, sand, silt or clay) from which groundwater can be usefully extracted.

- *Macro water sharing plans – the approach for groundwater. A report to assist community consultation* – explains the method used to classify and set water sharing rules for groundwater across the state
- *Setting rules for water sharing plans* – information outlining the key steps for developing the rules.

Purpose of the plan

Why are water sharing plans 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.

Under the *Water Management Act 2000*, the sharing of water must protect the water source and its dependent ecosystems and must protect basic landholder rights. Sharing or extraction of water under any other right must not prejudice these 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. Plans provide a legal basis for sharing water between the environment and consumptive purposes.

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

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

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.

Environmental considerations

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

Unregulated water sources

To be healthy and reproduce successfully, the plants and animals that live in rivers and streams need floods (very high flows), freshes (high flows) and dry spells (very low flows). The environmental flow rules are designed to ensure the plants and animals in streams continue to experience all these different types of flow events.

There is evidence to suggest that low flows are essential for maintaining water quality, allowing passage over riffles for fish and other fauna to pools used for drought refuge, and maintaining those parts of aquatic ecosystems that are most productive. For example, the faster flowing riffle areas between pools usually contain the highest abundance and diversity of aquatic fauna.

In order to protect a proportion of these low flows for the benefit of the environment, the plan imposes new access restrictions on days when flows are low. This is achieved by establishing 'cease-to-pump' (CtP) rules that require users to stop taking water when flow declines below a set level. When the plan commences, surface water licences in all unregulated water sources will be subject to CtP rules (excluding licences held by town water suppliers, local water utilities, licensed stock and domestic users, and licences used for food safety and essential dairy care³).

In addition, 'commence-to-pump' rules applied in some water sources ensure that freshes are available to the environment by requiring users to only recommence taking water once flow has increased above a specified level.

Each unregulated water source was classified as having either high, medium or low instream values. Appendix 2 details the features considered when assessing the water source values that are impacted by extraction. High instream value water sources are, by default, protected by the plan by not allowing any trades in. Trades are allowed into some water sources with lower value in order to encourage the movement of extraction from high to lower environmental value areas.

Alluvial groundwater sources

An aquifer is an underground layer of water-bearing permeable rock or unconsolidated materials (gravel, sand, silt or clay) from which groundwater can be usefully extracted. 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.

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 CtP rules to ensure taking groundwater does not adversely affect surface water flows.

The plan also includes 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.

³ There are limited exemptions for licensed stock and domestic and town water supply purposes which allow access to very low flows. See section "Access to very low flow"

Scope of the plan

The plan covers two separate water resources, within what is known as the Central West water management area. Incorporating all of these resources into the one plan recognises their interaction and allows for the development of water sharing rules that are linked and are equitable within and between these resources. The plan does not cover the Macquarie and Cudgegong Regulated Rivers Water Source.

The two water resources (located within the Murray-Darling Basin) are:

- the unregulated rivers – these cover most of the rivers in the Macquarie River catchment and all of the Bogan River catchment.
- the Bell, Cudgegong, Talbragar and Upper Macquarie alluvial groundwater sources i.e the groundwater in the remaining major alluvial aquifers not already covered by a water sharing plan

The remaining less highly connected aquifers are covered by separate water sharing plans, including the:

- *Water Sharing Plan for the Lower Macquarie Groundwater Sources*
- *Water Sharing Plan for the NSW Great Artesian Basin Groundwater Sources*
- *Water Sharing Plan for the NSW Great Artesian Basin Shallow Groundwater Sources*
- *Water Sharing Plan for the NSW Murray-Darling Basin Porous Rock Groundwater Sources*
- *Water Sharing Plan for the NSW Murray-Darling Basin Fractured Rock Groundwater Sources*

Water management units

Water sharing plans cover the following hydrological units:

Where appropriate, an **extraction management unit** (EMU), consisting of one or several water sources, is specified for the purpose of establishing a geographic area over which the long-term average annual extraction limit (LTAEL) applies.

The plan contains one EMU which covers all 30 unregulated surface water sources. There are also four separate alluvial water sources included in the plan area which each have their own LTAEL.

Water sources are used to define where water sharing rules apply. As specified above there are 34 water sources within the plan area.

Water sources can be further subdivided into **management zones** where finer resolution of rules is required. Within this plan there are 15 management zones.

For more information about water management units refer to Water Sharing Rules section of this document.

Description of the plan area

The area covered by the plan (refer Appendix 1) comprises the Macquarie catchment and the adjoining Bogan catchment and in total contains 30 unregulated water sources covering an approximate area of 74,000 square kilometres, as well as four alluvial groundwater sources. The plan area is located in the central west of NSW and includes the major towns of Dubbo, Orange, Bathurst and Mudgee. The plan area is bounded to the east by the Great Dividing Range, to the north by the Castlereagh catchment and the Barwon-Darling River, to the west by the Intersecting Streams catchment of Yanda Creek and to the south by the Lachlan catchment. The region varies from steep terrain in the east to open plains in the west. Elevations across the catchment range from 1,300 metres in the mountains south of Bathurst to less than 100 metres near Brewarrina in the far north of the catchment. Below Dubbo, the valley is predominantly comprised of flat alluvial plains with elevations less than 300 metres. (Green D., Petrovic J., Moss P., Burrell M. (2011))

The Macquarie River begins in the Great Dividing Range downstream of the joining of the Fish and Campbells rivers and flows north-west to its confluence with the Cudgegong River at Burrendong Dam. Downstream of Burrendong Dam, the river is regulated⁴ and flows through Wellington and Dubbo. The Bogan catchment lies to the south of the Macquarie catchment and the unregulated Bogan River runs parallel to the Macquarie River.

Like many of the western flowing rivers in NSW, the flow in the Macquarie River decreases with distance downstream once it enters the flat alluvial floodplains of the lower valley.

In contrast the flow in the Bogan River increases with distance downstream, as a result of the regulated supplies of water that enter the lower Bogan River via the Albert Priest Channel, Gunningbar Creek and Duck Creek. The headwaters of the Bogan River are in Goobang National Park, close to Bogan Gate and Peak Hill. The Bogan catchment has no regularly flowing tributaries but includes many ephemeral creeks (EPA 1997).

At Narromine a complex system of anabranches and effluent creeks connecting the Macquarie, Bogan and Barwon-Darling rivers commences. The Ramsar-listed Macquarie Marshes are located towards the end of the catchment, from which the unregulated Macquarie River emerges to join the Castlereagh then flow into the Barwon River near Brewarrina.

The Cudgegong River below Windamere Dam and the Macquarie River below Burrendong Dam are regulated rivers and extraction from these rivers is governed by the *Water Sharing Plan for the Macquarie and Cudgegong Regulated Rivers Water Source*.

High environmental value areas

The Macquarie Marshes, a non-terminal wetland situated at the lower end of the region, is one of the most important and largest wetlands in the Murray-Darling Basin. The Marshes are commonly divided into the northern marsh and southern marsh and cover an area of approximately 200,000 hectares. The southern marsh consists of a series of individual wetland systems, including Back, Buckiinguy, Monkey and Monkeygar swamps, and Mole Marsh. The northern marsh consists of extensive areas of Common Reed and River Red Gum woodlands (ANCA, 1993). There is a nature reserve of 18,143 hectares along with another 583 hectares on private property at 'Wilgara' that constitute the Ramsar site (Environment Australia, 2001).

⁴ 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.

The land tenure is mostly freehold with the exception of the Nature Reserve. Land use is predominantly grazing where the wetland provides highly valuable forage areas. There is some cultivation, including cotton irrigation, adjacent to the Marshes.

Aside from the Macquarie Marshes, there are no other listed wetlands of significance within the catchment, although several areas of known wetlands may be locally significant. These include hanging swamps in the upper tableland areas and floodplain wetlands, particularly the cowl system north of Narromine. A small portion of the Greater Blue Mountains World Heritage Area occurs within the eastern margin of the catchment.

Twenty-six of the 30 unregulated surface water sources within the plan area were identified as having high instream values. Water sources identified as having high instream value tend to be those water sources where threatened species are present. The instream value of all 30 unregulated river water sources is listed in Appendix 2.

Land use history

The Wiradjuri people were the original inhabitants of the upper and middle catchment. On the western plains the Bogan River formed the boundary between the Wongaibon people to the west and the Wailwan people in the east. (Green D., Petrovic J., Moss P., Burrell M. (2011).

The Macquarie catchment previously supported a complex mosaic of forests, temperate and semi-arid woodlands, wetlands, shrublands, heaths and grasslands. Large scale clearing and subsequent degradation has reduced many of these vegetation communities to isolated remnants on the less fertile and productive soils.

John Oxley was commissioned to explore the course of the Macquarie River in 1817. European settlements began from 1818 and first spread along the river systems and alluvial flats where there was good pasture for cattle and the heavy work of land clearance could be avoided. As the main river frontages were taken up, settlement spread along the river tributaries into the ranges.

Pastoralists soon became aware of the agricultural potential of the river flats and many began to grow wheat and other crops in addition to running cattle and sheep. As the population of the region increased during the gold rush, meat prices soared and there was also increased demand for wheat and other crops. Increased stock numbers led to further occupation of land and to accommodate this ongoing development pastoralists cleared what was left of the uncleared land in the area, sinking wells, building dams and fencing the land as they went (HO and DUAP 1996).

The arrival of the railways from Sydney in 1877 and the ability to transport food quickly to central markets saw increased diversity in agricultural production.

Cotton, although introduced with the First Fleet in 1788 and experiencing a short boom during the American Civil War in the 1860s, did not take off until the 1970s in the Macquarie valley.

The Upper Macquarie catchment, around Orange, is now a well known fruit growing district, producing apples, pears, and many stone fruits such as cherries, peaches, apricots and plums. In recent years, a large number of vineyards have been planted in the area for a rapidly expanding wine production industry.

In the Wellington district, grazing is still widespread but the fertile river flats of the Macquarie and Bell rivers are intensively cropped. Market gardens produce vegetables, irrigated fodder and cash crops, including lucerne, maize, and peas. Much of the land in the area is used for mixed farming of winter cereals, cattle and sheep, but there are also several dairies. (AMBS 2008).

The whole bioregion today is a major producer of cattle, sheep, wool, wheat and other cereals, as well as a wide range of fruits and vegetables. (NSW NPWS 2003).

Water flow in the unregulated streams is highly variable, and irrigated agriculture has responded to this variability either by building farm dams or by supplementing river water with groundwater.

The predominant land use in the region is dryland pasture used for livestock grazing. Cotton and wheat crops are grown on the western plains.

Clearing has also made way for urban development, which is now scattered across the catchment. Today about 180,000 people live in the Macquarie and Bogan catchments, over half of this in the major urban areas of Dubbo, Orange, Mudgee and Bathurst but also in numerous rural towns and villages throughout the catchment. (Green D., Petrovic J., Moss P., Burrell M. (2011).

National parks and reserves protect nearly 1,300 km² of habitat within the Macquarie Bogan catchments. Most of the protected areas are found in the upper catchment, and with the exception of the Macquarie Marshes Nature Reserve there are few areas managed for conservation in the lower valley.

The Macquarie Marshes Nature Reserve comprises three parcels of land totalling over 181 km². The reserve was gazetted in 1971 on an area of land previously set aside in 1900 for the preservation of game (NPWS 1993). The reserve protects the core wetland areas that are most frequently flooded, and contains samples of all the habitat types typical of the marshes. Significant wetland areas are also located outside the nature reserve on private land, including extensive river red gum woodlands and some of the largest water bird rookeries in the marshes. In 2008 the Australian Government purchased the adjacent property of Pillicawarina which will add an additional 10 per cent to the area and connect the north and south portions of the nature reserve.

Climate

The greater Macquarie catchment has a semi-arid climate and a summer-dominant rainfall pattern in the north, tending to a winter-dominant rainfall pattern in the south.

Annual rainfall decreases from east to west, while evaporation and temperature increase. Average annual rainfall in the Macquarie Bogan catchment ranges from over 1,200 millimetres in the south-east to around 300 millimetres in the north-west. Rainfall across most of the lower catchment averages 300-500 millimetres per year. Mean annual rainfall decreases in a westerly direction from 674 millimetres around Mudgee to 355 millimetres at Bourke.

Rainfall is evenly distributed throughout the year in the Macquarie. Rainfall variability increases from east to west and summer rainfall is generally more variable than winter rainfall.

At higher elevations in the east, temperatures vary from a winter average minimum of 0 °C to a summer average maximum of 25 °C. Further west at Bourke, the average winter minimum temperature is around 3 °C, ranging up to an average maximum summer temperature of 37 °C.

Extended drought periods were recorded for the Macquarie Valley in 1902 to 1915 and the exceptionally severe drought 1935 to 1946. A severe drought was also experienced more recently during 2001 to 2009.

Groundwater

Bores completed in the fractured and porous rock units that form the landscape of the slopes and tablelands of the Macquarie region are typically low yielding and sufficient for domestic and stock supplies only. In contrast, suitably constructed bores or wells in the unconsolidated alluvial aquifers associated with the present day river systems are able to supply much higher yields sufficient for irrigation, town water and other commercial supplies.

The highest yielding bores in the region are within the alluvium of the Macquarie River to the north and west of Narromine. In this area the floodplain opens out across a broad area and the underlying alluvium is up to 120 metres deep. Upstream of Narromine the floodplain is constrained by the valley slopes which limits the width of the alluvium however its depth is still sufficient to enable high yielding bores to be installed along the river reach upstream to Wellington. Other smaller but important areas of alluvium are associated with the floodplains of the Cudgegong, Talbragar and Bell rivers. The depth of alluvium in these valleys is up to 15 metres, 60 metres and 20 metres respectively (S Hamilton 2012, pers. comm., 11 Sept).

The Macquarie region accounts for around 8 per cent of the total metered groundwater use in NSW.

The salinity of the groundwater in the alluvium is generally low, making it suitable for most stock, domestic and irrigation purposes. However in the lower parts of the catchment downstream of Warren and through much of the Bogan catchment, groundwater is brackish to saline and suitable only for limited stock use

Analysis of river cross sections and groundwater levels indicate whether the groundwater and surface water are hydraulically linked and also whether the river is losing or gaining groundwater along the reach. This is indicated by the relative height of the water table compared to the river bed. This can vary both spatially and temporally with seasonal water table fluctuations and pumping influences.

Upstream of Narromine the Macquarie River loses water to the alluvium along most of its length with areas of intense pumping causing the water table to drop below the river bed.

The Cudgegong River is highly connected and the water table responds rapidly to changes in the river flows. It is both a losing and gaining river. Upstream of Mudgee near Appletree the river loses water to the alluvium but at the downstream end of the water source near Wilbertree, the alluvium pinches out and then discharges back into the river. Groundwater monitoring in the alluvium of Lawsons Creek, which joins the Cudgegong River at Mudgee, indicates this is also a highly connected alluvial system.

The Bell River is also both a losing and gaining system. The upper reaches of the river receives baseflow from groundwater in times of low rainfall. Where the alluvial flats broaden out this baseflow gradually diminishes as the river loses flow to the alluvium. Observations from landholders of the area suggest that as the river flow and aquifer are closely linked, groundwater yields, sufficient for irrigation supplies, is limited in most wells to periods when the Bell River is running and up to eight weeks after it ceases to flow. The exceptions are in the vicinity of Neurea and just upstream of Wellington township.

The unregulated Talbragar and Coolaburragundy rivers are largely ephemeral with the water table below the river bed for the majority of their reaches. During periods of flow after heavy rain they lose water to the groundwater temporarily raising the water table in the vicinity of the river which then may flow back to the river when the river level drops. However they are not groundwater driven systems and do not receive long periods of groundwater baseflows and consequently these rivers cease to flow during dry times (S Hamilton 2012, pers. comm., 11 Sept).

Entitlement and use

There are approximately 1,427 water licences in the area covered by the plan, totaling about 264 342 megalitres of entitlement. This entitlement is divided between unregulated surface water and alluvial groundwater. The majority of licences are used for irrigation, with a significant proportion also used for town water supply. There has been an embargo on granting new surface water licences across NSW in the unregulated catchments since 1995. Alluvial aquifers were embargoed in 2008.

Current water entitlement across the water sources within the plan area is listed in Table 1.

Table 1 Total entitlement and number of licences for each water source (approximate)

Water source	Entitlement (shares)	Number of licences
Unregulated water sources		
Backwater Boggy Cowal	4449	20
Bell River	7878	108
Bulbodney Grahway Creek	7795	47
Burrendong Dam Tributaries	579	13
Campbells River	2116	57
Coolbaggie Creek	470	4
Cooyal Wialdra Creek	820	29
Ewenmar Creek	1299	15
Fish River	18080	49
Goolma Creek	0	0
Lawsons Creek	1499	32
Little River	2347	37
Lower Bogan River	42844	57
Lower Macquarie River	51934	33
Lower Talbragar River	1701	14
Macquarie River above Burrendong	25611	107
Marra Creek	374.5	18
Marthaguy Creek	4458	44
Maryvale Geurie Creek	737	5
Molong Creek	5598	122
Piambong Creek	974	14
Pipeclay Creek	426	14
Queen Charlottes Vale Evans Plains Creek	1908	54
Summerhill Creek	12228	96
Turon Crudine River	328	15
Upper Bogan River	2821	39
Upper Cudgegong River	6462	49
Upper Talbragar River	382	9
Wambangalong Whylandra Creek	169	5
Winburndale Rivulet	1636	30
Alluvial groundwater sources		
Bell alluvial	4362	51

Water source	Entitlement (shares)	Number of licences
Cudgegong alluvial	13595	78
Talbragar alluvial	5812	26
Upper Macquarie alluvial	32648	136

Water is also extracted from watercourses and aquifers within the plan area through basic landholder rights (not requiring a licence).

Water extraction in the unregulated water sources

The majority of the unregulated surface water licences are located in the upper catchment, for example Bell River, Molong Creek, Summerhill Creek and Macquarie River above Burrendong water sources, but licensed volumes are generally lower. The majority of licensed entitlement by volume is located in the lower end of the catchment, in the Lower Bogan River and Lower Macquarie River water sources, mainly due to large volumes attributed to special additional (high flow) access licences.

Irrigation is far less prominent in the unregulated Macquarie and Bogan catchments than along the Macquarie regulated river. Irrigated agriculture relies on supplies that are variable and small.

Vegetables are grown in selected pockets along the Macquarie River (for example, around Wellington). Wine grapes are irrigated in the tablelands around Mudgee and Orange and in the Bell water source around Bathurst. Vegetable growers tend to be opportunistic and production rates vary accordingly.

Fodder, seed crops and cotton are grown in the Lower Macquarie and Bogan catchments. Some enterprises are located in the Bogan catchment but are fed by water that is channeled overland from the Macquarie River.

Detailed water use is not available in the unregulated rivers because there is not yet broad scale metering in these water sources. NSW is exploring this issue through the Water Use Monitoring Program.

Four of the 30 unregulated water sources covered by the plan were classified as being of high economic significance to local communities due to their dependence on commercial water extraction (see table 2)

Table 2 Water sources with a high level of economic dependence

Water source	Description
Fish River	A number of users growing lucerne, potatoes, nurseries.
Macquarie River above Burrendong	Mix of lucerne and fodder, some users are looking at storages. The rest is high-value market garden, used to be orchards. Pine plantations
Molong Creek	Lots of licences, high value permanent plantings
Queen Charlottes Vale Evans Plains Creek	Market gardens towards end of water source and lucerne at the top. Sand mining and dairy on Evans plains creek. Good soils, provide for Sydney markets

Water extraction in the alluvial groundwater sources

Many towns including Coolah, Dubbo, Dunedoo, Geurie, Mudgee, Mumbil and Wellington obtain some or all of their water supply from groundwater in the alluvial water sources. Groundwater is also an important source of irrigation water with the main crops irrigated by groundwater ranging from improved pasture, vegetable, orchards and vines in the east through lucerne to mainly cotton and oilseed in the west.

In the Bell alluvial groundwater source usage patterns are driven by water availability, that is, groundwater is only extracted when the river is flowing or soon after it ceases to flow.

There is only limited irrigation supplies actively pumped from the Cudgegong alluvial groundwater source as pumping from the river itself is generally preferred. Groundwater is used as a supplementary town water supply for Mudgee.

In the Talbragar alluvial groundwater source the majority of extraction occurs west of the junction of the Coolaburragundy and Talbragar Rivers. Five kilometres downstream of Dunedoo the water quality and hence usage declines and the bores in the lower reaches below the water source do not extract for irrigation purposes.

The Upper Macquarie alluvial groundwater source is the largest of the groundwater systems covered by this plan. The larger volumes of licensed entitlement can be supported due to its far greater storage volume because of the depth and extent of the alluvium. It consequently has a much greater buffering capacity during times of drought than the smaller alluvial groundwater sources. Irrigation supplies are possible from the entire reach of this water source.

Detailed water use is available in the Upper Macquarie and the Cudgegong alluvial water sources as both these areas have a history of water metering. In the Bell and the Talbragar alluvial groundwater sources there is not yet comprehensive metering undertaken although in recent years usage in these valleys is being assessed by State Water Corporation.

Local water utility requirements

A number of town water supplies are located within the area covered by the plan. Towns, such as Dubbo may also receive additional supplies from the regulated river. Major surface water supplies include Bathurst, Orange, Rylstone and Nyngan/Cobar (supplied via the Albert Priest Channel from the Macquarie River), but there are also significant town water supplies for Mudgee and Dubbo in the Cudgegong alluvial and Upper Macquarie alluvial groundwater sources respectively.

Table 3 indicates that extractions for town water supplies can be a considerable proportion of the total entitlement within some water sources, for example Macquarie River above Burrendong and the Cudgegong alluvial. In some of the water sources where water is extracted for town water supply, competition for water during low flows can become an issue between agricultural users and the local water utility. In these cases, water utilities can access very low flows, when other users are suspended.

Table 3 Town water supplies, location and entitlement volume

Water source	Water supply	Council / other	Entitlement (ML/ year)
Bell River	Cumnock	Cabonne Shire	80
	Euchareena	Wellington	15
Bulbodney Grahway Creek	Nyngan	Bogan Shire	1290
	Coolabah, Girilambone	Bogan Shire	34
	Cobar	Cobar Shire	600
Cooyal Wialdra Creek	Gulgong	Mid Western Regional	111
Fish River	Tarana	Greater Lithgow	15
Little River	Yeoval	Cabonne Shire	102
Macquarie above Burrendong	Bathurst	Bathurst Regional	17,500
Molong Creek	Molong	Cabonne Shire	502
Summerhill Creek	Orange	Orange City	7,800
Upper Bogan River	Tomingley	Narromine Shire	22
	Tullamore	Parkes Shire	10
Upper Cudgegong River	Rylstone	Mid Western Regional	2,500
Winburndale Rivulet	Bathurst	Bathurst Regional	1,000
Bell alluvial	Mumbil	Wellington	70
Cudgegong alluvial	Mudgee	Mid Western Regional	3,000
Talbragar alluvial	Leadville	Leadville Town Improvement Assoc.	6
	Dunedoo	Warrumbungle Shire	400
	Coolah	Warrumbungle Shire	650
Upper Macquarie alluvial	Dubbo	Dubbo City	4,000
	Geurie	Wellington	120
	Wellington	Wellington	350

Ben Chifley Dam, on Campbells River, is used to supply water to the town of Bathurst.

Major water utility requirements

The Fish River Water Supply Scheme (the Scheme) supplies water to Oberon and Lithgow (both primarily out of Oberon Dam), the Sydney Catchment Authority (for a number of townships in the Blue Mountains) and Delta Electricity for power generation. The latter two stakeholders also access water from the Duckmaloi weir to supplement their water supply. There are also numerous 'minor customers' that extract water from the Scheme for domestic supply. The Scheme is operated by State Water.

In July 2010, water levels in Oberon Dam were reaching critical levels (less than 10%). The former Minister for Water asked the Office of Water to undertake a review of the Scheme's water sharing arrangements and develop some recommendations which would provide enhanced water security for the township of Oberon, whilst minimising any impacts on other stakeholders within the Scheme. The Office of Water commissioned comprehensive modeling of the current water sharing arrangements and the potential implications of some alternate arrangements. The results of this modeling informed a number of possible modifications to the sharing arrangements.

These modifications have been discussed at length with each of the key stakeholders and as a result, Office of Water developed a total of 36 changes to improve the water sharing arrangements within the Scheme. A report outlining the review is available on the website www.water.nsw.gov.au under Urban water > Local water utilities.

In summary, the recommendations:

- secure Oberon's water supply through:
 - a bigger share of water in the Scheme
 - reduced constraints on Oberon's access at mid-range storage levels
 - increased constraints on other stakeholders' access at very low storage levels, which take into account that they have alternate water supply options and better take into account their essential requirements during periods of extreme water shortage
 - establishment of a new Level eight constraint on access for other stakeholders when Oberon Dam's net storage drops to five per cent of full supply.
- modify the share of water in the Scheme for Lithgow, which recognises its historical under-utilisation
- enhance access to Duckmaloi weir for both Sydney Catchment Authority and Delta to reduce the pressure on Oberon Dam and offset the impacts of reduced access to Oberon Dam for these two stakeholders
- do not change access for the 'minor customers'
- clarify the water licensing arrangements with State Water
- provide some guidance for on-going governance arrangements
- provide a framework for longer term water sharing arrangements.

The plan, the Water Access Licence and the Works approvals allow these changes to be implemented.

Policy framework

The NOW is responsible for implementing the *Water Management Act 2000*, including developing water sharing plans for the state's water resources. The NOW has established several interagency panels to assist with the development of water planning policies and the preparation of water sharing plans.

State Interagency Panel

The State Interagency Panel (SIP) 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 SIP also has the role of making water sharing decisions in cases where the IRP cannot reach agreement or where the issue has statewide significance.

The SIP is chaired by the NSW Office of Water and comprises representatives from the Office of Water, the NSW Office of Environment and Heritage (OEH), catchment management authorities (CMAs), and agriculture, fisheries and aquaculture specialists from the NSW Department of Primary Industries (DPI). The Office of Water is responsible for the overall project management.

State Groundwater Panel

The State Groundwater Panel (SGP) was established to oversee the development of policy for the macro water sharing planning process for groundwater. The Panel has members from Office of Water, the NSW Office of Environment and Heritage (OEH), and from the NSW Department of Primary Industries (DPI). Catchment management authorities are also represented by an inland and coastal representative.

The Panel provides a senior level forum for discussing and resolving a wide range of water planning and policy issues specific to groundwater. In particular the SGP developed statewide distance criteria which IRPs use as a starting point when considering distance rules for groundwater sources.

The SGP is a subcommittee of the SIP.

Interagency Regional Panel

Interagency Regional Panels (IRP) were established to development water sharing plans. IRPs consist of two representatives from Department of Primary Industries (DPI): one from NOW and another DPI representative covering both agricultural and fisheries interest, and one representative from OEH.

A representative from the relevant CMA(s) will also attend meetings (as an Observer) so that they can provide advice on consultation issues and other matters within their areas of expertise.

Appendix 3 lists the names of the Macquarie-Bogan IRP representatives and their areas of expertise, and also lists their colleagues who they had access to for specific technical and scientific information.

The key responsibilities of the IRP are to:

- consider relevant policy matters and ensure water sharing rules are consistent with state policy
- review the hydrological (water management) units provided by the 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 applicability⁵
- make recommendations on the water access and dealing (trading) rules for each water source
- assist the CMA with consultation on the proposed rules
- review submissions, from targeted consultation and public exhibition, and make changes where necessary to the water sharing rules.

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

Policy

There are a number of legislative and policy documents that impact on and direct the development of plans. These include:

- National Water Initiative
- *Water Management Act 2000*
- *Access Licence Dealing Principles Order 2004*
- Murray Darling Basin Cap Agreement
- The Basin Plan (*Commonwealth Water Act 2007*)
- Natural Resource Commission's statewide targets
- Central West Catchment Action Plan

National Water Initiative

The NSW Government is a partner to the National Water Initiative (NWI) which was signed by the Council of Australian Governments (COAG) in June 2004. The NWI 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 NWI sets out guidelines, outcomes 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 NWI and national water issues and undertakes a biennial assessment of each state's progress with implementing the NWI for this purpose.

Water Management Act 2000

The object of the *Water Management Act 2000* is the sustainable and integrated management of the state's water for the benefit of both present and future generations.

The *Water Management Act 2000* was passed by the NSW Parliament in December 2000, establishing a complete new statutory framework for managing water in NSW. For the first time, NSW had comprehensive water legislation to guide our water management activities.

The *Water Management Act 2000* is based on the concept of ecologically sustainable development – development today that will not threaten the ability of future generations to meet their needs.

⁵ This includes reviewing water access conditions imposed on users through announcements or orders under the *Water Act 1912* during low flow conditions.

The *Water Management Act 2000* was driven by the need for NSW to secure a sustainable basis for water management for several reasons:

During the 1990's NSW was at the limits of its available water resources – new licences for commercial purposes could no longer be issued across most of NSW and a limit had been placed on the total volume of water that can be extracted across the inland of NSW under the Murray–Darling Basin Cap.

The decline in the health of our rivers, groundwater, floodplains and estuaries was being seen through increasing water quality problems, loss of species, wetland decline and habitat loss.

As a result the *Water Management Act 2000* recognises the need to allocate and provide water for the environmental health of our rivers and groundwater systems, while also providing licence holders with more secure access to water and greater opportunities to trade water through the separation of water licences from land. The main tool the Act provides for managing the State's water resources are water sharing plans. These are used to set out the rules for the sharing of water in a particular water source between water users and the environment and rules for the trading of water in a particular water source.

Because of the major changes required by the legislation, the Act has been progressively implemented. Since 1 July 2004 the new licensing and approvals system has been in effect in those areas of NSW covered by operational water sharing plans – these areas cover most of the State's major regulated river systems and therefore the largest areas of water extraction. As water sharing plans are finalised and commenced for the rest of the state, the licensing provisions of the Act are introduced extending the benefits for the environment of defined environmental rules and for licence holders of perpetual water licences and greater opportunities for water trading.

The latest copy of the [Water Management Act 2000](#) is available from the NSW government legislation site.

Access licence Dealing Principles Order 2004

The Access Licence Dealing Principles Order (commonly referred to as the Ministers Dealing Principles) commenced in 2004. It draws on the objects and water management principles of the *Water Management Act 2000* and provides State-wide guidance and rules for applications to undertake water dealings including trade.

The Minister's Dealing Principles specify that dealings must consider:

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

Rules for specific types of access licence dealings (such as conversion to a new category, subdivision, consolidation, assignment or rights or allocation, changing water sources, amending extraction components and interstate dealings) are also included. The Minister's Dealing Principles specify when a dealing is prohibited and what requirements must be met in order for a dealing to be permitted.

Water sharing plans must be consistent to the Minister's Dealing Principles. Water sharing plans can also put additional restrictions in place such as restricting trade into a particular area due to its environmental value or hydrological stress.

Murray-Darling Basin Cap Agreement

The combined Macquarie-Castlereagh region covers 6.9 per cent of the total area of the Basin and is subject to agreements and statutes which cover water management within the Basin. The plan for the Macquarie Bogan therefore has to be developed within the context of the Basin and existing commitments to water sharing.

In 1994, the Murray-Darling Basin Ministerial Council (MDBMC) 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 that diversions were continuing to increase. In response, the MDBMC introduced a diversion limit – the Cap – in 1995.

Schedule F of the Murray-Darling Basin Agreement (the 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 MDBMC Cap on groundwater diversions.

Under the Agreement, 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 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 Cap for unregulated surface water in the Macquarie Bogan is assessed and reported on at the combined Macquarie-Castlereagh-Bogan valley scale and any growth management actions required will also be applied at this scale.

The Basin Plan (*Commonwealth Water Act 2007*)

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 limits on the quantities of surface water and groundwater that can be taken from Basin water resources. These are known as 'sustainable diversion limits' (SDLs). As the

SDLs 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. At the time of publishing this document, NSW was still engaged in negotiations with the MDBA in regard to bringing the SDLs into effect.

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

Natural Resource Commission's statewide targets

Water sharing plans also comply with the Natural Resources Commission (NRC) statewide standards and contribute to the relevant statewide targets such as Targets 5 and 6 (see www.nrc.gov.au for details) which is a requirement of the State Plan under Goal 22 (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 NWI, 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.

Central West Catchment Action Plan

This plan is consistent with and contributes to the Central West Catchment Action Plan (CAP). The CAP can be found on the Central West CMA website www.cw.cma.nsw.gov.au. The Central West CAP water theme includes two catchment goals:

- **Catchment Goal Water 1** - CGW1 - Improve the condition of water dependant ecosystems (rivers/wetlands/GDE's) to good condition and stable state
- **Catchment Goal Water 2** - CGW2 - Contribute to achieving balanced use, efficiency, movement and connectivity of water within the catchment landscape and improve water quality

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 CMA's responsibilities, as observer, is to provide the IRP with advice on the alignment of the proposed classification and extraction limits and rules with the priorities in their CWCAP.

Other considerations

There are a number of state policy issues that require consideration with the development of this plan and the associated water sharing rules.

Protecting pools, lagoons and lakes

Pools in NSW can provide an important source of water for licence holders, landholders and communities. Pools also have a key ecological function as a critical refuge and habitat for flora and fauna.

Pools include lentic water bodies (standing water) in or associated with unregulated rivers, including anything falling within the definition of a “lake” found in the Dictionary of the *Water Management Act 2000*, except for tidal pools and estuaries.

‘Macro water sharing plans – the approach for unregulated rivers. Access and trading rules for pools’ can be found on the Office of Water website www.water.nsw.gov.au. This document has been developed to provide additional guidance for IRPs in setting water access and trading rules for pools that are covered by unregulated river water sharing plans.

The approach uses an assessment of the environmental values of the pools to select rules that adequately protect these values while not having a disproportionate effect on water availability for extraction. Because 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 adopted is to establish a default access rule of no draw down below full pool capacity for the majority of natural pools. ‘Full capacity’ can be approximated by the greatest pool volume where there is no visible flow out of that pool. The default rule may then be modified by IRPs in specific circumstances if it is justifiable and feasible to do so to allow limited access to pools based on local hydrological, environmental and socio-economic considerations.

Different default rules apply depending on the pool type. Artificial pools created by structures are treated differently to natural pools. Generally the default rule for artificial pools is to adopt the existing licence conditions, however there may be some circumstances where the default rule may not be appropriate and alternate rules will need to be developed.

Managing surface water and groundwater connectivity

A key objective of the NWI is ‘recognition of the connectivity between surface and groundwater resources and connected systems managed as a single resource’.

Most alluvial aquifers have some level of connectivity with their associated surface water sources. Accordingly, most alluvial water sources are included in a water sharing plan that covers both surface water and its connected alluvial groundwater. Conversely, most porous rock, fractured rock and coastal sands aquifers are considered to have a lesser degree of connectivity and are covered by groundwater-specific plans.

In the Basin, it is generally not practical for groundwater and surface water to be treated as one water source due to the MDBMC Cap, as the Cap does not apply to groundwater sources within the Basin.

Consistent with the statewide approach, extraction from highly connected aquifer access licences that relate more closely to the regulated river will be managed annually, via AWDs, whilst highly connected aquifer access licences that related more closely to unregulated water sources may be managed daily, for eg. linked to unregulated river CtPs (see below “*access rules*”).

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

Protecting basic landholder rights

Under the *Water Management Act 2000*, basic landholder rights (BLR) are made up of domestic and stock rights, harvestable rights and native title rights. Water may be extracted under these rights without the need for a water access licence, although in the case of accessing groundwater under a domestic and stock right, the bore must still be approved by the Office of Water.

The principles of the *Water Management Act 2000* require that water sharing must protect BLR. The plan does this by identifying the water requirements for domestic and stock and native title rights at the start of the plan and taking these requirements into consideration when designing rules for licensed water extractions. As the access rules for water access licences do not apply to BLR users this provides BLR users with a higher level priority of water access. The requirements of harvestable rights have been inherently considered as the design of access rules is also based on river flows that result after harvestable rights extractions have occurred. There are currently no extractions for native title rights. However, these rights may be activated during the plan's ten year term.

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 plan provides an estimate of the water requirements for domestic and stock rights within each of the water sources, noting that 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 development of mandatory guidelines.

Protecting town water supply access

Towns have a higher priority for access to water than commercial licences. 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. Towns may be able to sell part of their annual account water to other towns but, unlike commercial users, will not be able to sell the licence outright.

In unregulated surface water and groundwater sources, towns will not need to change their existing water access arrangements unless their infrastructure is upgraded. In this case, when a major augmentation of the works occurs, town water utilities will need to meet conditions specified in the plan to ensure that there is enough water flowing to protect the environment and consider any potential impacts on other consumptive users.

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

Protecting Aboriginal Values

Aboriginal people have a spiritual, customary and economic relationship with land and water that provides an important insight into natural resource management. The NSW Government is determined to ensure that Aboriginal culture is maintained across the state and that Aboriginal communities benefit from the new opportunities that the water market will bring.

Macro plans recognise the importance of rivers and groundwater to Aboriginal culture. The plans will allow Aboriginal communities to apply for a water access licence for cultural purposes such as manufacturing traditional artifacts, hunting, fishing, gathering, recreation, and for cultural and ceremonial purposes. An Aboriginal cultural licence can also be used for drinking, food preparation, washing, and watering domestic gardens. These cultural licences are limited to 10 megalitres per year per application.

Further input is sought from the Aboriginal community during the development of the plan to identify water dependent cultural assets which may be relevant for consideration in the development of the plan, or to determine the level of interest in licences for cultural use. For more information, see the fact sheet *Macro water sharing plans - Information for Aboriginal water users*, which is available on the Office of Water website www.water.nsw.gov.au.

Water interception activities

A change in land use activities can potentially result in the interception of significant quantities of water. Examples of activities that can impact on water quantity include increased farm dam capacity or the development of significant areas of new forestry plantations in a catchment. Under the National Water Initiative (NWI), significant interception activities should be accounted for within a plan's extraction limit.

Acknowledgement of floodplain harvesting activities

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

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

Floodplain harvesting works can generally be put into two categories:

- Purpose-built works specifically built to facilitate floodplain harvesting, including pumps, structures or other works that divert water into or from storages, supply channels, depressions or otherwise impound flows.
- Works built for multiple purposes that have the effect of facilitating floodplain harvesting, such as:
 - levees, conveying works and off-river storages constructed in billabongs or depressions
 - below-ground level channels from which the water is delivered into storages.

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.

In unregulated river water sources, floodplain harvesting has generally already been recognised and licensed as part of the process that converted area based water licences to volume based licences.

However, further volumetric entitlements, measurement and long-term limits for floodplain harvesting may be established in the future under the NSW Floodplain Harvesting Policy which was under-development at the time of publishing.

Risk of interception through forestry expansion

The projected growth in commercial forestry plantations in the Macquarie-Castlereagh is considered negligible (CSIRO, 2008).

In river dams

Under the NSW weirs policy on river dams on third order streams or greater are permitted subject to:

- the Farm Dams Policy (harvestable rights)
- the NSW Weirs Policy
- a minimal harm test under the *Water Management Act 2000*.

Under the Farm Dams Policy, a farm dam that is less than the maximum harvestable rights dam capacity is considered a basic landholder right and can be built on a first or second order stream without the need for a water access licence.

Under the NSW Weirs Policy, the construction of new weirs is discouraged, but can be done where “it can be demonstrated that the primary component of the proposal is necessary to maintaining the essential social and economic needs of the affected community” (DLWC, 1997).

Assuming the instream storage can meet these criteria then an application could be made and these would be assessed against the minimal harm test under the *Water Management Act 2000*.

The plan will not permit applications for dams in water sources with high instream values. See appendix 2.

Exemptions for farm dams

Farm dams currently require an access licence when:

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

Unlicensed extraction from farm dams that doesn't match any of the above criteria 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. The plan cannot actually limit these rights. The provisions relating to harvestable rights are unaffected by any of the rules identified in the plan.

Developing the plan

The plan rules were developed by the Macquarie Bogan IRP based on consensus decision making. The approach used for setting the plan rules involved the consideration of government policy and then rule refinement according to local knowledge and expertise.

Different methods were used to develop water sharing rules for surface water and groundwater sources. Information about how rules were developed for surface water and groundwater systems is provided below, as well as how these rules were modified by the IRP or changed as result of consultation.

Consultation to inform rule development

The IRPs initial draft rules underwent targeted consultation with specific interest groups⁶ and water users where significant changes in management were proposed before the plan was drafted. Formal public exhibition⁷ of the draft plan ensured wider public consultation.

While developing the plan, the participating agencies (the Office of Water, OEH, DPI and the CMAs) identified areas where better data was needed for making future water planning decisions. Similarly, the community might have suggested areas where further analysis or data gathering is required.

CMAs help with the public consultation process, and ensure that all stakeholders and interested parties have an opportunity to examine and comment on the proposed water sharing rules. In particular, stakeholders were encouraged to provide:

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

Targeted consultation on the draft rules

Targeted consultation on the proposed rules for the draft plan began in July 2010 and finished in early 2011. The objectives of this consultation were:

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

⁶ Targeted consultation refers to informal consultation held with key stakeholders to test the suitability of the proposed water sharing rules and provide feedback on the rules potential impacts.

⁷ 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.

During the planning process the following organisations were consulted to gather additional information to assist rule development:

- Bathurst Regional Council
- Bogan Shire Council

Public exhibition of the draft water sharing plan

Public exhibition of the draft water sharing plan was held from 1 September to 21 October 2011, with six public meetings held across the plan area. The objectives of this consultation were:

- to provide background to stakeholders as to why the water sharing plan was being developed, how it has been developed to date, what rules were proposed in the various areas and how stakeholders could provide feedback
- to formally consult with a broad range of stakeholders to explain the proposed water sharing rules and how they will be implemented
- to seek feedback in writing from stakeholders and the general community about the proposed water sharing rules.

Seventy-six written submissions were received from a wide range of stakeholders. The IRP reviewed all the submissions and consequently made changes to the draft water sharing rules proposed. During this review process, if updated data became available, it was also incorporated into the planning process. Information about how the rules were refined is detailed in 'Refining the rules for local circumstances' below.

Negotiated Outcomes

A critical aspect of developing water sharing rules is talking to stakeholders about the proposed rules and how they will effect water users and local communities. This local input was essential in developing the final recommendations for the plan. In some areas water users worked with NOW staff, providing information and discussing management options and possible impacts before final recommendations were made.

Water sharing rules for unregulated water sources

Water sharing rules that the IRP focused on:

- rules for the protection of a specific environmental asset
- access rules – which determine at what flow levels, river heights, proportion of full capacity of a pool or times extraction is allowed
- dealing rules – which control the trade of water (both permanent transfer of access licence entitlements and temporary assignment of water allocation between access licences, the change of water sources and the location for extraction).

Other management rules that were considered in the development of the plan include:

- extraction limits – which set the total volume of water that can be extracted on a long-term average annual basis from the water source
- assessing growth – how growth in diversions are assessed

These rules form the basis of mandatory conditions on water access licences and approvals.

Classification method

The 'macro planning' process is the approach of the Office of Water to developing plans for unregulated rivers and is described in *Macro water sharing plans – the approach for unregulated rivers. A report to assist community consultation*⁸ (the manual).

The process for the development of the water sharing rules involves weighing up the risk to instream natural values against community dependence on irrigated agriculture for each water source. The assessment also included hydrologic stress, which is the amount of water extracted relative to river flow.

The macro approach has been used to guide the IRP in its development of water sharing rules that consist of:

- access rules – which determine at what flow levels, river heights, proportion of full capacity of a pool or times extraction can occur
- dealing rules – which control the trade of water (both permanent transfer of access licence entitlements and temporary assignment of water allocation between access licences)

There are 30 unregulated water sources in the plan area, 27 in the Macquarie and three within the Bogan catchment. Initial classification of the unregulated water sources was undertaken in line with the macro classification process. Based on this classification and the indicative rules, the Macquarie Bogan IRP recommended draft access and trading rules for each of the 30 unregulated water sources.

Protecting high instream values

The Macquarie Bogan catchment contains a significant number of threatened flora and fauna species, some of which are sensitive to water extraction (listed in Appendix 2). All of these species were considered when assessing the instream values of the water sources, which guided access rules.

The Macquarie Marshes Nature Reserve is listed on the Ramsar list of wetlands of international importance. The marshes are one of the largest semi-permanent wetlands in south-east Australia. The Ramsar listed area covers 18,150 hectares. See the Lower Macquarie River water source under 'Refining the rules for local circumstances'.

Water sources with high instream values will be given special protection in the plan via a 'no trades in' rule, with the exception of trades from upstream water source. This means that no further increase in water entitlement is allowed in these areas.

Access rules

Under the macro planning process, generic access rules are determined by balancing the risk to instream values (a product of instream value and hydrologic stress) and the community dependence on extraction. The assumption under the macro approach for inland unregulated catchments is that hydrologic stress in each water source is 'high', unless specific information indicates otherwise. This is a reasonable assumption given that:

- most inland unregulated streams have been embargoed since the early 1990's and
- Stressed River Assessments⁹ show consistent scores of 'high' stress across the inland unregulated streams.

⁸ the document is available on the Office of water website www.water.nsw.gov.au in the macro water sharing plan section

⁹ "Stressed River Assessment Report" for various catchments, NSW Department of Land and Water Conservation. Sydney 1999

Table 2 Generic access rules for rivers and creeks under the macro approach

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

For the majority of water sources, pumping is not permitted from natural pools when the water level in the pool is lower than its full capacity. This basic rule could only be recommended due to:

- many existing licences have no access rules; therefore any change to access should be incremental to allow irrigators time to adjust.
- lack of appropriate reference points (for example river gauges) other than the pump site

This access rule provides protection of natural pools which are important for drought refuge, as well as domestic and stock water supplies.

Dealings rules

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

- Where instream values are considered high, no trades are permitted into that water source.
- Where a water source is under high hydrologic stress (which is a default assumption, because of the lack of flow and usage data available) no trades are permitted into the water source.
- Trades into downstream water sources are permitted regardless of stress or instream value, as long as the water sources have a direct hydrologic connection.
- Trades through a regulated river are not permitted, for example a licence cannot be traded from an unregulated water source upstream of the regulated reach to a water source downstream of the regulated reach.
- Trading within water sources is generally permitted, however in some areas trading may be restricted to protect high value areas or to limit demand in areas where competition for water is already high.

As a result of these principles, trades are not permitted into many unregulated water sources across the plan area.

Trades between water sources have been permitted in some circumstances where there is a direct hydrologic connection (for example some trades are permitted from Molong Creek water source to Bell River water source, Upper Talbragar River water source to part of the Lower Talbragar River water source, and from upstream water sources into the Macquarie above Burrendong water source).

It is important to note that the macro approach is used only as a tool to develop indicative rules and it's an important role of the IRP to use the local knowledge of panel members to check whether these rules are realistic.

Refining the rules for local circumstances

Some water sources have unique circumstances that require additional consideration and negotiation. Often these water sources are split into management zones to allow better management of specific areas. The water sources listed below have water sharing rules that differ from the default approach, and have been designed specifically for that area. In some cases these rules were developed by the IRP, however in many cases the initial rule was changed as a result of feedback received during consultation.

Bell River Water Source

The upper reaches of the Bell River are considered to have higher instream value than areas in the lower reaches. In recognition of this the IRP recommended no trades be permitted into the area above the confluence with Molong Creek to protect the higher value area and minimise the impact on existing water users.

Trades are permitted from above the confluence to below the confluence. Trades are also permitted within the downstream and the upstream areas, subject to assessment.

Trades are permitted into the water source from Molong Creek water source, below the confluence of Molong Creek with the Bell River to provide irrigators with some additional trading opportunities.

Bulbodney Grahway Creek Water Source

The water source was split into 3 zones, allowing greater flexibility to develop locally specific rules. The Bulbodney Grahway Management Zone includes the Bogan River from the confluence with Bulbodney Creek to the confluence with Whitbarrow Creek all its tributaries. The upper and lower Nyngan weir pools have been zoned separately to reflect their different nature and use.

Upper Nyngan Weir Pool and Lower Nyngan Weir Pool management zones

The upper weir pool is licensed to the Bogan Shire Council for the purpose of town water supply which includes 1,342 ML of unregulated entitlement. The weir pool is used to supply the towns of Cobar and Nyngan with town water. A number of unregulated licence holders also extract water from the weir pools for irrigation.

The aim of the IRP when developing water sharing rules for the upper weir pool was to ensure town water supplies are protected.

The IRP determined that the existing licence conditions do not provide adequate protection for town water supplies (TWS), as existing conditions do not restrict access to the weir pool when regulated water has been diverted for TWS purposes.

The lower weir pool has social and recreational values for the town of Nyngan, as the pool is used for water sports and is an important local tourist attraction. It has been reported during consultation that the economic and social benefits of the lower weir pool are very important to the local community. The lower weir pool is not used for TWS.

Existing conditions currently allow 100% drawdown of the lower pool, which will impact on the frequency of the weir spilling with consequent effects on downstream stock and domestic users. The storage capacity of the lower weir pool is estimated by Bogan Shire Council (M Ryan, 2010 pers comms., 11 March) to be approximately 400ML.

Based on information from licensing staff, the IRP initially proposed a commence to pump rule for both pools set at 56ML/day at the Neurie Plains gauge **and** visible flow downstream of the lower weir pool. These rules were presented to water users during targeted consultation, who raised serious concerns about the level of impact these rules would have on their irrigation operations.

As a result of the strong response from water users the IRP amended the rule to allow some drawdown (25cm in the upper weir pool and 10 cm in the lower weir) to give more opportunity for irrigators to access water as well as providing protect for TWS in the upper weir pool and recognising the importance of the recreation value of the lower weir pool. Based on comments received from targeted consultation the IRP included a commence to pump rule which restricts access until 72 hours after a flow has occurred at Summerlea Bridge.

The proposed rules were discussed with water users and Bogan Shire Council again during public exhibition of the draft plan and a lengthy written submission from water users was provided in response. Further negotiation and discussion was undertaken with water users and Bogan Shire Council and as a result the following rules were recommended by the IRP.

- A CtP for the upper weir pool be set at 70cm below the sill of the weir, rather than the 25cm proposed in the draft WSP. In effect, this will allow water users to access some of the water stored in the weir pool (which may at any time be a mixture of unregulated flows and contributions of regulated water delivered through the Albert Priest Chanel) but it will also provide a reasonable level of protection for TWS.
- A CtP for the lower weir pool be set at 50% of the pools capacity, a significant increase from the 20% proposed in the draft WSP.
- A commence to pump rule for both pools be triggered when a flow has occurred in the Bogan River at the Neurie Plains gauge and a flow has spilled over the sill of the lower weir pool. The 72 hour delay proposed in the draft WSP has been removed.
- A provision be included in the plan which allows water users who hold Macquarie regulated river entitlement to access this water in the Nyngan Weir Pools after it has been delivered through the Albert Priest Channel. The provision will exempt Regulated River licence holders from some of the restrictions applying to unregulated river licences in the Nyngan Weir Pools if they can demonstrate they have met a number of administrative requirements.
- Trading between the weir pools be permitted but no trading from outside the pools will be permitted into the pools. The IRP agreed any increase in entitlement in the weir pool through a trade would impact on the existing users and place further pressure on the TWS.
- An amendment provision allows for the access and trading rules to be amended if TWS are not being protected.

Campbells River and Macquarie River above Burrendong Water Sources

Ben Chiffley Dam is located in the Campbells River Water Source and supplies town water to Bathurst and surrounding villages. Water is released from the dam, and delivered to the weir in Bathurst where the TWS extraction occurs. There are a significant number of licences between the dam and the weir at Bathurst. The IRP recommended the water sources be zoned below the dam to allow better water management of this area.

Campbells River downstream management zone (Campbells River Water Source) and Macquarie River above Bathurst management zone (Macquarie River above Burrendong Water Source)

Licensed water users below the Ben Chiffley Dam benefit from the flows released for town water and have developed their irrigation operations around the enhanced flows that result from the releases. This area is considered to be a high value agricultural area producing vegetables, lucerne and other crops.

As flows between the dam and the weir at Bathurst are directly influenced by town water releases, the access conditions for licensed water users in this reach (Campbells River Downstream and Macquarie River above Bathurst management zones) have been designed to protect TWS by suspending access when dam levels drop significantly.

Bathurst Regional Council operate the dam in accordance with their drought contingency and water supply emergency management plan, which includes specified triggers for water restrictions based on the capacity of dam. In conjunction with advice from Bathurst Regional Council, the IRP recommended a CtP rule be triggered when Ben Chifley Dam reaches 22% storage, which coincides with Level 5 Water Restrictions. This level equates to 2 years town water supply in times when water availability is low.

Historically dam levels have not fallen below 40% capacity and therefore the impact on license holders is likely to be minimal.

The recommended trading rule allows trading between the Campbells River Downstream Management Zone and the Macquarie River above Bathurst Management Zone only. This rule provides irrigators with trading opportunities while ensuring trading does not increase pressure on Bathurst's town water supplies.

Macquarie River between Bathurst and Evans Plains Creek management zone (Macquarie River above Burrendong Water Source)

This management zone includes the Macquarie River from Bathurst weir to the confluence with Evans Plains Creek and was created when the CtP rules for the downstream management zone were changed to a percentile flow at a telemetric gauge. For the Macquarie River between Bathurst and Evans Plains Creek, where flows are influenced by daily releases from the Bathurst Water Treatment Plant, it was considered inappropriate to manage the entire area based on a flow in the river a distance downstream. The recommended CtP rule does not permit drawing down of pools.

Macquarie River Tributaries management zone (Macquarie River above Burrendong Water Source)

The IRP revisited the CtP rules for the perennial water sources in the plan area following comment from public exhibition that proposed CtPs were too lenient. The IRP agreed to change their recommendation for the Macquarie River Tributaries Management Zone source as a result. The CtP rule for this management zone will change to the 95th percentile (not before year 5) once flow records can be established at a telemetric gauge.

Fish River Water Source

The Fish River Water Supply Scheme (the Scheme), operated by State Water Corporation is located in the Fish River water source. The scheme provides water for a number of towns in the Central Tablelands including Oberon, as well as two power stations owned by Delta Electricity.

In July 2010, the Minister for Water announced a review of the water sharing arrangements for the Fish River scheme. The review was undertaken concurrently with the development of the plan. As a result of the review, the Office of Water recommended a suite of changes to both the water sharing and governance arrangements of the scheme. The recommendations out of the review were approved and released by the Minister for Water.

The Fish River Water Supply Scheme will be exempt from the "no new in-river dams" rule which applies in the water source, but will be subject to a stringent assessment process. This change was made to ensure the Plan aligned with the recommendations of the review.

The Plan includes the following amendments which allow other recommendations of the review to be implemented:

- Specify different account management rules for the major utility licence in the Fish River Water Source following a review that determines:
 - 1) the functions or operations of State Water are unnecessarily restricted by the original account management rules and
 - 2) different account management rules would not have adverse impacts on other water users or the environment.
- Specify different dealing rules for Fish River Water if State Water can demonstrate such rules will have no more than minimal impacts on, but not limited to:
 - 1) Bathurst City Councils water supplies and inflows into Burrendong Dam
 - 2) The water source, noting high instream environmental values in Duckmaloi Creek
 - 3) Other unregulated water users in the EMU for any growth in use response that could result from dealings into the water source.

Lower Bogan River Water Source

The IRP initial recommendations for trading in the Bogan system did not permit trading into the Lower Bogan Water Source based on the significant amount of entitlement which already existed in the water source. Feedback received from water users during public exhibition stated more opportunities for trade were needed to provide business flexibility. Based on these comments the IRP reconsidered the trading rules and recommended trading between the three water sources, Upper Bogan, Bulbodney Grahway and Lower Bogan water sources, within the Bogan System be permitted (excluding the Nyngan weir pool management zones).

Lower Macquarie River Water Source

The Macquarie Marshes are located in this water source which is an internationally recognised Ramsar wetland. The IRP agreed to zone the water source, allowing greater flexibility to develop locally specific rules for these high value areas.

Lower Macquarie upstream management zone

A CtP threshold of 500 megalitres per day at the Oxley Station gauge (421022) has been recommended for the Lower Macquarie River Upstream management zone, which covers the area above and including both the northern and southern marshes. This rule has been based on existing licence conditions which were designed to protect flows into the marshes to inundate the wetland sites, before unregulated extraction can commence.

The IRP also recommended no trading into this zone. Trading within is permitted in a downstream direction only to encourage extraction to move downstream of the high value wetland areas.

Gum Cowal management zone

No trading into this zone was recommended. Trading within is permitted in a downstream direction only, to ensure there is no increase in extraction upstream stream of the Ramsar wetlands located in this management zone. Based on feedback received during targeted consultation, the IRP agreed to change the trading rules for Marthaguy Creek water source to provide licence holders with more trading opportunities. The change allows licence holders in Gum Cowal management zone to trade into Marthaguy Creek Water Source as well as the Lower Macquarie Downstream Management Zone. Concern was raised during public exhibition that licence holders may be unintentionally restricted moving existing works within their own property, as a result of the “downstream only” trading rule. The

IRP agreed this was an unintended outcome of the trading rule which is designed to restrict trades upstream of the wetland. The IRP acknowledged the rules need to be practical and licence holders should have flexibility to change the location of works within their property. The rule was changed to allow works to be installed upstream as long as they remain on the same Lot and DP.

Lower Macquarie River downstream management zone

The recommended trading rule for this management zone permits trades from the Lower Macquarie River Upstream management zone, the Gum Cowal management zone and the Marthaguy Creek water source as the streams have a direct hydrologic connection.

Any new entitlement traded into the area will have a CtP rule of 50ML/day at Bells Bridge gauge. This is because:

- the CtP is at a minimum level (ie no drawdown of pools). The IRP agreed any new entitlement traded into the area should have a more stringent CtP.
- low flows used for stock and domestic purposes will be better protected, and
- it is consistent and equitable as some existing licences already have a 50 ML/day CtP conditions.

Lower Talbragar Water Source

The recommended trading rule is trades permitted from the Upper Talbragar River water source into the main trunk of the Talbragar River (within the Lower Talbragar Water Source) only, to minimise the impact of extraction on the smaller spring fed creeks in the upper reaches, which are considered to have high environmental value.

Marthaguy Creek Water Source

The draft trading rules for Marthaguy Creek did not allow any trades into the water source due to the high instream value. During targeted consultation, water users were concerned that the draft trading rules were too restrictive and needed to provide more opportunities. After considering the comments from water users the IRP agreed to allow trading between Marthaguy Creek water source and the Lower Macquarie Downstream Management Zone. Trading is also permitted from the Gum Cowal Management Zone into Marthaguy Creek water source.

Molong Creek Water Source

The recommended trading rule is “no trades permitted into the water source” to protect the high instream values and minimise the impact on existing water users. The IRP also further restricted trading within the water source by not permitting trades from below the confluence with Borenore Creek to above the confluence of Borenore Creek due to the high instream values in the upper catchment and the high hydrologic stress within the water source.

Queen Charlottes Vale Evans Plains Creek Water Source

The lower reaches of Queen Charlottes Vale and Evans Plains Creeks consist of sandy beds with flow generally disappearing into the ground during dry periods. These lower reaches are considered to have lower instream values, but are an important agricultural area, predominantly vegetable growing. Based on this information the lower sections have been zoned to allow better management of the area.

As a result of the flows disappearing into the sandy substrate, licence holders in the lower reaches have traditionally had to excavate the creek bed to access water flowing within the sandy deposits. In recognition of this requirement, in the draft plan, the IRP recommended managing extractions by limiting the size of the creek bed excavations based on draft Ministerial Guidelines.

Considerable feedback was received from licence holders during public exhibition who raised concerns about the practicality of the proposed rules. The IRP agreed not to specify batters for excavations, instead setting a maximum depth of 1m (below the existing bed level) and base area is no more than 4 square meters for excavations. The depth may be increased if it can be determined the depth would not result in greater impact on the water source. The rule is intended to recognise the importance of local agricultural by allowing licence holders to continue current practice.

Trading is not permitted into the Queen Charlottes Vale Evans Plains Creek Downstream management zone so there is no increase in environmental stress. Trades will not be permitted between Evans Plains catchment and the Queen Charlottes Vale catchment, as there is no hydrologic connection between the creeks.

Upper Cudgegong River Water Source

Mid Western Regional Council raised concerns during exhibition about extractions from Rylstone Dam impacting on the town water supply. In response to these concerns the IRP set a CtP rule for licences located on Rylstone Dam based on an existing licence condition. Licence holder must stop pumping when the water level in the dam drops below 1.22m from the top of the spillway. It was also recommended that no trading is permitted into Rylstone Dam impoundment. These rules are designed to protect the reliability of the dam for town water supplies.

Upper Bogan River Water Source

The IRP's initial recommendations did not permit trading into the Upper Bogan Water Source based on the significant amount of entitlement which already exists in the water source. Feedback received from water users during public exhibition stated more opportunities for trade was needed to provide business flexibility. Based on these comments the IRP reconsidered the trading rules and recommended trading between the 3 water sources, Upper Bogan, Bulbodney Grahway and Lower Bogan water sources, be permitted (excluding the Nyngan weir pool management zones).

Special additional high flow licences (SAL)

Traditionally SALs have had access restricted to only higher unregulated river flows. This was done through more restrictive licence conditions.

The NSW Office of Water policy for managing SALs requires a growth in use (GIU) response that recognises the lesser right of this licence category. The majority of comments received during public exhibition on SALs did not support the preferential reduction of AWDs for SALs if a growth in use response is required, as they consider the SALs to be an important component of their irrigation operations.

The IRP agreed that if a GIU response is triggered, AWDs for SALs should be reduced at a greater rate than other licences, however the level of impact should not be severe. The AWD for SALs will be equal to 80% of the AWD for unregulated river access licences in a GIU response. It was also noted that whilst the likelihood of GIU response within the term of this plan is very low, the framework may be carried forward into future WSPs.

The IRP also recommended trading of SALs be restricted to within the water source or management zone, which ever is applicable, and conversions of category are prohibited.

Exemptions to access rules

Access to very low flow

Those activities that are considered critical human needs or animal health requirements are permitted to continue to access water when the CtP applies. Licences with access to very low flows include:

- domestic supply
- stock supply for first 5 years of the plan, after which the CtP rule will apply
- town water supply, until major augmentation of the schemes 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.

Users of basic landholders rights are also exempt from the CtP.

Managing extraction

Long term average annual extraction limit

The Macquarie Bogan Unregulated Rivers Extraction Management Unit (EMU) includes the 30 unregulated water sources within the Macquarie and Bogan catchments. Extractions from all unregulated water sources within the EMU are managed collectively under a long-term average annual extraction limit (LTAAEL).

For surface water in inland NSW the LTAAEL is based on the Murray-Darling Basin Ministerial Council (MDBMC) Cap which was introduced in 1995 to halt growth in extractions across the basin.

The LTAAEL for the Macquarie Bogan Unregulated Rivers EMU is equal to the total of the estimated annual extraction of water averaged over the period from July 1993 to June 1999; plus an estimate of annual extraction of water under domestic and stock rights and native title rights in this EMU, at the commencement of this plan.

Growth in use

To protect the water set aside for the environment and the supply to existing users, it is important to control any growth in water used over time that is above the limit specified in the plan ie. growth in extractions above the LTAAEL. The IRP had some scope in determining how growth was assessed for each EMU including the period of time extractions are averaged over, and the amount of tolerance permitted in order to allow for climatic variations.

For the Macquarie Bogan Unregulated Rivers EMU a growth-in-use response will be triggered if the average annual usage over five years exceeds the LTAAEL by more than five per cent.

This decision was based on the knowledge that rivers and streams in the western slopes and plains experience high variability in flows which results in high variability in extraction. Increasing the period of time extractions are averaged over minimizes the impacts of climatic variability and the risk of growth being falsely triggered. Based on this principle a 5 year averaging period, rather than a three year averaging period was chosen for the EMU.

Available water determination (AWD)

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

Available water determinations (AWD) are also used to manage growth in extractions above the LTAAEL, that is if growth occurs then the maximum AWD will be reduced to less than 1 megalitre per unit share in order manage growth.

The AWD for unregulated river access licences will be 1 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 three year accounting rules described below.

If a growth in use response is required AWD for Special Additional (High Flow) Licences will be reduced to 80% of the AWD for unregulated river licences. These rules for managing growth recognise the lesser right of this licence category compared to other unregulated river licences.

Carryover and water accounts

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

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

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

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

Example of unregulated river access licence three year accounting rules

An example of three year accounting for an unregulated river access licence holder with a share component of 50 shares is shown in Table 4 .

Table 4 Example of unregulated river access licence accounting rules

Year	Account balance (ML at start of year)	AWD (ML/unit share)	Usage (ML)	Account balance (ML at end of year)	Carryover (ML)
1	0	2	0	100	50*
2	50	1	50	50	50
3	50	1	100**	0	0
4	0	1	0***	50	50

* Only 50 ML can be carried over as carryover is limited to 1 ML/unit share. The remaining 50 ML is forfeited

** 100 ML is also the maximum that can be extracted in this year , that is, twice the allocation for the year which is 2x 50 ML = 100 ML

*** Although with the AWD there is 50 ML in the account, no water is available for extraction as the maximum extraction over three years is the sum of AWDs in those 3 years which in this example is 150 ML and this was extracted in year 2 and 3 so no extraction can occur in year 4

Water sharing rules for alluvial groundwater sources

Water sharing rules that the IRP focused on:

- access rules – for highly connected groundwater sources, access rules linked to surface water rules may apply
- dealing rules – which control the trade of water (both permanent transfer of access licence entitlements and temporary assignment of water allocation between access licences, the change of water sources and the location for extraction).
- extraction limits – which set the total volume of water that can be extracted on a long-term average annual basis from the water source

Other management rules that were considered in the development of the plan include:

- assessing growth – how growth in diversions are assessed
- rules for granting works approvals – what types of set back conditions are required
- rules for the protection of a specific environmental asset

These rules form the basis of mandatory conditions on water access licences and approvals.

Managing Connectivity

For the purposes of developing plans for inland aquifer systems in NSW, the 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” (MDBC, 2008)

There are four alluvial groundwater sources in the plan area. Using the above definitions of connectivity, the Bell, Cudgegong and Talbragar alluvial groundwater sources will be treated as ‘highly connected’, whilst the Upper Macquarie alluvial groundwater source will be treated as ‘less highly connected’ as less than 70 per cent of usage is derived from the streamflow over an irrigation season.

Access rules

For highly connected water sources, specific rules that recognise that the same water resource is both above and below the ground surface may be applied. Aquifers that are highly connect to unregulated surface water sources may be linked to the surface waters daily access rules. Aquifers highly connected to regulated surface water sources may be linked to annual management through linked AWDs.

In unregulated water sources, groundwater extraction can be linked to the adjacent surface water access rule, with a time lag of between 14 and 28 days. The time lag recognises the delayed impact that groundwater pumping has on river flows.

In order to implement lagged surface water CtP rules to aquifer access licences, the relevant CtP rules must relate to a telemetered gauge. The relevant surface water sources (Bell River, Lawsons Creek and Upper Talbragar River) are ephemeral and the CtPs are ‘no drawing down of pools’. This is not a practical rule to manage groundwater extraction. No access rules can therefore be applied to the respective highly connected alluvial groundwater sources.

Cudgegong is highly connected to the Cudgegong Regulated River. To recognise the connection between the river and the groundwater source a component of the AWD for the Cudgegong Alluvial Management Zone will be linked to the Cudgegong Regulated River AWD for high security access licences. See section on “Available Water Determination” below for more details.

Dealings

Dealings (trading) rules are intended to provide for efficient water markets whilst recognizing and protecting the needs of the environment and third-part interests. In most macro plans, dealings area allowed within a groundwater source but not into or out of the groundwater source.

Consistent with the Ministers’ dealing principles there is no trading permitted between the four alluvial groundwater sources covered by the water sharing plan for the Macquarie Bogan Unregulated and Alluvial water sources.

For the Cudgegong Alluvial groundwater source trade is also prohibited between the Lawsons Creek Alluvial Management Zone, which is not linked to surface water rules, and the Cudgegong Alluvial Management Zone which is linked to the river’s high security AWDs. Trade between the two zones is prohibited, as both areas are heavily committed in terms of total entitlement.

Rules for water supply works 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/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 draw down of water occurring in the local vicinity of these users and sites.

A standard set of distance criteria for common groundwater aquifer types (for example fractured rock, alluvium, coastal sands and porous rock) was produced by comparing the various rules in similar geological provinces. The standard rules were then endorsed by the State Groundwater Panel.

This process has resulted in consistent rules across aquifer types considered the most current thinking in terms of managing local impacts of extraction and protecting GDEs. However, the plan development process allows for changes to the rules to cater for local conditions. The distance criteria may be altered due to a number of different factors, such as lot size where property sizes may lead to different interference distance criteria, aspects of the local hydrology and groundwater dependence of town water.

In the plan, regional staff made draft recommendations on rules for the plan which were then compared against the standard rules. The IRP then made a final decision as to which rule would be adopted, striving to remain consistent with the standard rules where possible while being sensitive to any unique attributes of the groundwater sources in the plan area.

For new works there are rules to:

- minimise interference between neighboring works
- locate works away from contaminated sites
- protect water levels in groundwater dependent ecosystems (GDEs)
- protect groundwater dependent culturally significant sites
- manage surface and groundwater connectivity
- manage temporary local impacts that may affect water levels, water quality and aquifer integrity.

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 EECs.

High priority GDEs are identified during the planning process and are listed in a schedule to the plan. The IRP then has the opportunity to review and amend the GDE list as well as the rules that have been developed to protect them based on their expertise.

The list of high priority GDEs compiled at this stage can either be amended after year five of the plan as further GDEs are identified or during the life of the plan on submission to and approval by the Minister.

No GDE's have been identified for the four alluvial groundwater sources included in the Macquarie Bogan Unregulated and Alluvial Water Sharing Plan.

Refining the rules for local circumstances

Some groundwater sources have unique circumstances that require additional consideration and negotiation. The groundwater source listed below has water sharing rules that differ from the generic approach and have been developed specifically for that area. In some cases these rules were developed by the IRP, however in many cases the initial rule was changed as a result of feedback received during consultation.

Upper Macquarie Alluvial Water Source

A service station site in Dubbo has been declared a site of significant risk of harm to human health and the environment, due to storage tanks leaking and contaminating an area of alluvial groundwater. Advice from Office of Water's hydrogeologists indicated a greater buffer (than the standard 250m) distance would be required to ensure groundwater pumping did not interfere with the contaminated site. Based on this information, water supply works will not be permitted within 500m of the contaminant plume from this site.

Managing Extraction

Long term average annual extraction limit (LTAAEL)

For this and other similar plan areas, NSW has resolved that the long-term average annual extraction limit for highly connected and alluvial groundwater resources within NSW's portion of the Murray-Darling Basin shall be set equal to current average usage. This is based on the principle that current levels of groundwater pumping are considered to be having acceptable impacts on surface water sources. Any extraction beyond this level will result in additional impact on the rivers, groundwater dependent ecosystems and other users of these connected water resources.

LTAAELs have been determined for each of the four alluvial groundwater sources as detailed below.

Bell alluvial groundwater source

The LTAAEL for the Bell alluvial is 3,299 megalitres per year, defined by the sum of:

- an estimate of usage from bores supplied by State Water and water users; plus,
- an estimate of basic landholders rights .

The Bell Alluvial water source is not metered and usage estimates in the initial planning stages was based on State Water surveys conducted during 2008/09 and 2009/10.

During public exhibition of the draft plan, the Minister sought feedback on the LTAAEL for the Bell alluvium. Comments raised concerns about the LTAAEL suggesting it under estimated usage and would not allow historic usage patterns to be replicated without triggering a growth-in-use response. There were questions about the accuracy of usage surveys and suggestions that LTAAEL did not allow for climatic (and therefore irrigation) variation. Further consultation was undertaken with water users, and irrigators provided estimates of usage.

Given the IRP's lack of confidence in the original LTAAEL, and the good response during exhibition, the IRP agreed to increase the LTAAEL (by 33%) based on new usage information provided by water users.

Cudgegong alluvial groundwater source

The LTAAEL for the Cudgegong alluvial is 2,533 megalitres per year, defined by the sum of:

- average usage (2000/01 – 2009/10) from bores metered by State Water; plus,
- an estimate of basic landholders rights; plus,
- an estimate of usage from perpetual bores (currently with no volumetric entitlement).

The LTAAEL was based on the sum of each individual's maximum 5 year average usage over the metered period from 2000 to 2010.

Talbragar alluvial groundwater source

The LTAAEL for the Talbragar alluvial is 3,473 megalitres per year, defined by the sum of:

- an estimate of usage from bores supplied by State Water and water users; plus,
- an estimate of basic landholder rights.

The Talbragar alluvial water source is not fully metered and usage estimates in the initial planning stages were based on State Water surveys conducted during 2008/09 and 2009/10.

During public exhibition of the draft plan, the Minister sought feedback on the LTAAEL for the Talbragar alluvial. Comments raised concerns about the LTAAEL, suggesting it under estimated usage and would not allow historic usage patterns to be replicated without triggering a growth-in-use response. They also questioned whether the LTAAEL allowed for climatic (and therefore irrigation) variation. In order to be more representative of maximum average usage, the IRP recommended the LTAAEL be increased by 30%, based on further analysis of metered usage data between 2002 and 2006.

Upper Macquarie alluvial groundwater source

The LTAAEL for the Upper Macquarie alluvial is 17,935 megalitres per year, defined by the sum of:

- average usage (2000/01 to 2009/2010) from bores metered by State Water; plus,
- an estimate of basic landholder rights; plus,
- an estimate of usage from perpetual bores (currently with no volumetric entitlement).

The LTAAEL was based on the sum of each individual's maximum 5 year average usage over the metered period from 2000 to 2010.

Growth in use

Extractions are managed to the LTAAEL. Should growth in extraction above the LTAAEL be assessed to have occurred, an appropriate growth-in-use response will be taken. The current statewide position is to set the LTAAEL for highly connected and alluvial systems at current average usage. Therefore, the growth-in-use response described in the plan is one which allows for the 'peaks' and 'troughs' of usage above and below the average, over the period from which the LTAAEL has been defined, to be replicated.

In the Macquarie and Bogan catchments where flows and consequently, the recharging of alluvial aquifers vary considerably a five year averaging period and an exceedance threshold of 10 % was recommended by the IRP. The longer averaging period and increased threshold was chosen by the IRP to minimise the impacts of climatic variability.

As such, a response is triggered if the average annual usage over a period of five years exceeds the LTAAEL by more than 10 per cent.

Supplementary water access licences (SWALs)

In many inland alluvial groundwater sources, entitlement is significantly greater than the long-term average annual extraction limit (LTAAEL) set by water sharing plans. If extractions increase beyond the LTAAEL and a growth in use response is triggered, the AWD will be reduced to wind back extractions. This reduction in the AWD would impact those users that have historically used a significant proportion of their entitlement.

Supplementary water access licences (SWALs) can be used to provide some short term protection against the impacts of growth in use for highly active users by preferentially distributing a proportion of the available water to individuals with a history of extraction (HoE). This will allow historic water use patterns to be maintained with limited need to purchase additional water in the short term. This is a temporary measure to help active users adjust and will be phased out by year 10 of the plan when SWALs will be cancelled.

In the Upper Macquarie and Cudgegong groundwater sources SWALs will only be implemented in either of these groundwater sources if the average extraction exceeds the LTAAEL by 10% or more and a reduction in an AWD (i.e. less than 0.8ML/share) is required to bring average extractions back to the LTAAEL.

SWALs are not permitted to be traded and any unused volume associated with a SWAL cannot be carried over from one water year to the next.

An individual's SWAL share component is based on their maximum average use over a consecutive five year period between 2000 and 2010. The share component for each individual SWAL is listed as a schedule in the plan.

Available water determination

Available water determinations are primarily used to credit water into a licence's water allocation account. AWDs will be applied differently for the licences within the Cudgegong management zone within the Cudgegong alluvial groundwater source and the remainder of the alluvial groundwater sources within the plan area.

The available water determination (AWD) for a water source is used to manage growth in extractions above the LTAAEL. If growth is assessed to have occurred, then maximum AWDs will be reduced to respond to this growth, that is, a maximum AWD of less than 1 megalitre per unit share.

Cudgegong alluvial management zone

To recognise the connection between the Cudgegong alluvial groundwater source and the Cudgegong regulated river, the AWD for licences within the Cudgegong management zone has two components

- a river recharge component (this is based on the percentage of the Cudgegong alluvial groundwater source LTAAEL derived from river recharge) that will fluctuate in accordance with the availability of resources in the regulated river, that is, if the AWD for high security licences within the Cudgegong regulated river is zero then this portion of the AWD for the Cudgegong management zone would also be zero, and
- a rainfall and other recharge component (this is based on the percentage of the LTAAEL derived from rainfall/ other sources of recharge) that will be consistently available on a long-term average basis.

The river recharge component will be linked to the AWD for Cudgegong regulated river (high security) access licences. This is in recognition of the need to not increase regulated river losses during periods of reduced surface water availability. If these losses were allowed to exacerbate, then this potentially impacts future allocations for high priority surface water licences. Linking AWDs will therefore protect against increasing losses from the Cudgegong regulated river to the groundwater, during times of reduced allocations for in the Cudgegong regulated river. The AWDs for the Cudgegong management zone will be based on 60 per cent of the AWD for the Cudgegong Regulated River (high security) access licence AWD, plus 40 per cent of the aquifer access licence AWD or lower amount as a result of a growth in use response.

The percentage of the AWD linked to the regulated river has been based on an assessment of the level of impact the previous pumping distribution had on the Cudgegong River. This indicated that approximately 60 percent of the water extracted under an average annual pumping season either originates from the regulated river or intercepts groundwater flow that would otherwise be discharged into the river.

Lawsons Creek management zone and all other alluvial groundwater sources

For those aquifer access licences in the Lawsons Creek management zone within the Cudgegong alluvial groundwater source or any other alluvial groundwater source in the plan area, AWDs will credit water annually to accounts, generally 1ML/unit share, or lower as a result of a growth in use response.

Carryover and water accounts

No carryover of entitlement from one year to the next is allowed in any of the groundwater sources and the maximum amount of water permitted to be taken from this water source in any one water year is equal to the water allocation accrued in the water access licence account for that water year. There are two reasons for this approach:

- These alluvial groundwater have a relatively small storage volume to entitlement to LTAAEL ratio, and
- The water sources are fully committed in terms of the level of entitlements compared to the LTAAEL. Consequently the total volume of water credited into accounts at the start of each water year is much greater than the LTAAEL and individuals are able to pump more than their individual proportion of the LTAAEL due to the number of unused licences.

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.

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.

Amendment Provisions

There are a number of amendment provisions which allow the plan to be changed as a result of further studies or to allow implementation of specific rules. The amendment provisions detailed in this section were part of the rule development process undertaken by the IRP. There may be other general amendment provisions included in the plan which are not mentioned in this document. Please refer to the plan for a full list of amendment provisions.

Bell River Water Source

The Wellington Caves are located on the Bell River and are an important environmental asset. Current information suggests that the caves are dependent on groundwater rather than surface water flows, however future research may determine surface water flows are important to the karst system. To ensure the proposed rules do not have an adverse impact on the health of the caves an amendment provision has been included in the plan which allows the access and trading rules to be changed to better protect the caves, if warranted.

Protection of regulated releases

The *Water Sharing Plan for the Macquarie and Cudgegong Regulated Rivers Water Source* (the Regulated Plan), commenced in 2004. The Regulated Plan contains provisions for the delivery of environmental water, as well as stock and domestic replenishment flows to unregulated water sources below the regulated river, which the plan must protect. Under the Water Act 1912 the regulated releases are protected by various methods, including through licence conditions, by formal order and various ad hoc arrangements where licence holders ring State Water before they can pump.

To ensure these flows are protected, the Minister may make an order under section 324 of the Act to temporarily restrict or suspend the taking of water, if the Minister is satisfied that it is the public interests to do so.

The plan also includes an amendment provision which allows the plan to be amended if the flows are not being adequately protected by the proposed access rules.

Sunset provision for pool pumpers

The Plan for the Macquarie Bogan Alluvial Water Sources contains an amendment provision which allows licence holders to apply for an exemption from the CtP within the first three years of the plan if they can demonstrate a traditional reliance on accessing water from below the CtP, ie their irrigation operations have traditionally drawn down pools. A draw down rule may be based on verified historical usage patterns.

Exemption for stock watering

Stock and domestic access licences are exempt from the CtP rules for the first five years of the plan, when water is being taken for the purpose of stock watering. The plan includes an amendment provision which allows this exemption to be extended beyond the five year period. The plan may be amended if the outcomes of a review demonstrate the CtP rules will cause unacceptable socio-economic impacts.

Evaluation of plan performance

The evaluation framework for water sharing plans is currently being developed. The objectives of the project are:

- Inform the community of the results from the 10 year operation of water sharing plans
- Collate the results of the various legislatively-required evaluations, along with other relevant learnings to inform the remake of water sharing plans.

The evaluation framework will use a system of “program logic” to organise the inputs, outputs and outcomes from water sharing plans and their operation. Evaluation questions and monitoring indicators allow assessment of these steps to rate a water sharing plan for its:

- Process of development (appropriateness)
- Performance during operation (efficiency)
- Socio-economic environmental and cultural outcomes (effectiveness).

The Office of Water’s approach conforms to NSW and Commonwealth government guidelines for monitoring, evaluation and reporting, and demonstrates the adaptive management approach to water planning required under the principles of the NSW *Water Management Act, 2000*. The Office has also chosen to organise the evaluation questions and monitoring indicators using the NSW Natural Resource Commission’s auditable standard for natural resource management.

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.

The WSP Environmental Flows Monitoring and Modelling program has been designed to make the results of environmental flows studies more transferable between water sources and to develop more generic relationships between flow, hydraulics and ecological responses. In adopting this approach it enables a more efficient and effective evidence-based approach to support monitoring and evaluation requirements of NSW water sharing plans and identifies specific knowledge gaps to allow further investigative work to be prioritised.

Plan review

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

The Evaluation framework 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.
- An audit of the Plan by the Natural Resources Commission to assess to what extent the water sharing provisions have contributed to the relevant state wide targets, and natural resource standards and targets in the relevant catchment management area. The Natural Resources Commission will call for public submissions when undertaking its review.

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 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.

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 (FRP): 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 (GDEs): Ecosystems that rely on groundwater for their species composition and their natural ecological processes.

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 (MZ): 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 (MZ) is more likely to be designated where local dealing restrictions are in place or where 'CtP' rules for works approvals apply.

Pools: Lentic water bodies (standing water), including anything falling within the definition of a "lake" found in the Dictionary of the *Water Management Act 2000*, except for tidal pools and estuaries.

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

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

Water sharing plan (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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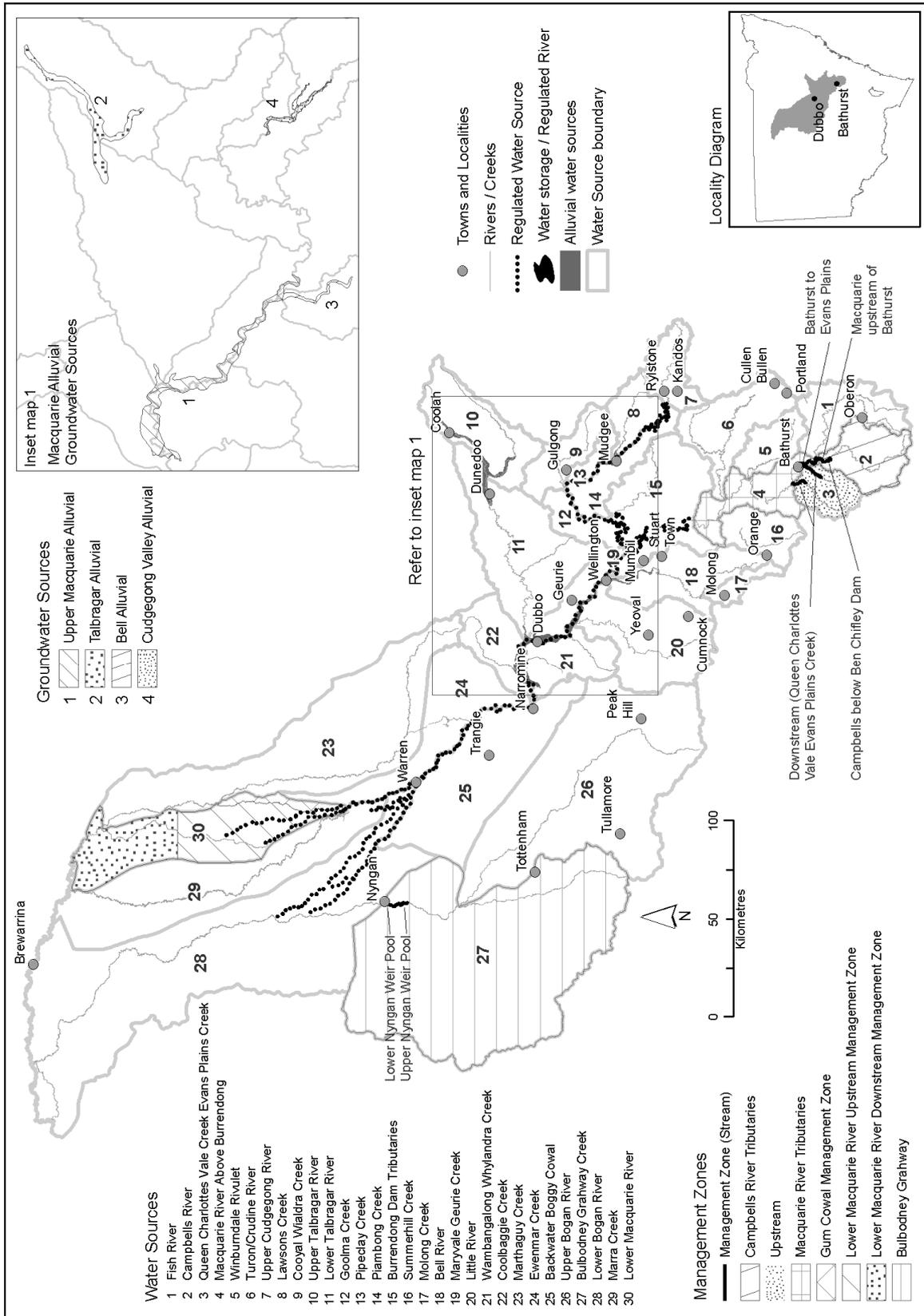
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Appendices

Appendix 1: Water sharing plan map



Appendix 2: Identified threatened species

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

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

The table below shows the number of threatened species that are known (K) or expected (E) to occur in each water source.

Water source	Instream value overall	Threatened fish species		Threatened frog species		Threatened macro-invertebrate species		Threatened bird species		Other threatened fauna		Threatened wet flora species		Endangered ecological communities	
		E	K	E	K	E	K	E	K	E	K	E	K	E	K
Backwater Boggy Cowal	High	4	2	0	0	0	0	0	7	0	0	0	0	0	1
Bell River	High	4	2	0	2	0	3	3	5	1	1	3	2	1	0
Bulbodney Grahway Creek	High	3	2	0	0	0	0	1	6	0	0	0	0	0	1
Burrendong Dam Tributaries	High	4	3	0	2	0	3	2	6	1	1	3	2	0	1
Campbells River	High	4	1	0	4	0	3	4	2	0	1	1	1	0	0
Coolbaggie Creek	Med	5	0	0	0	0	0	4	4	1	0	2	0	1	0
Cooyal Wialdra Creek	High	5	1	1	6	1	4	2	6	0	2	0	4	0	1
Ewenmar Creek	Med	4	1	0	0	0	0	0	8	1	0	2	0	0	2
Fish River	High	4	1	2	3	0	4	6	1	0	2	0	4	0	0
Goolma Creek	High	4	3	0	1	1	1	1	7	0	1	1	2	0	1
Lawsons Creek	High	5	1	0	5	0	2	2	6	0	2	0	4	0	0
Little River	High	5	2	0	1	1	1	1	7	0	1	1	2	1	0
Lower Bogan River	High	1	4	0	0	0	0	0	7	0	0	0	0	1	1
Lower Macquarie River	High	3	2	0	0	0	0	0	7	0	0	0	0	1	1
Lower Talbragar River	High	3	2	0	1	1	1	0	8	1	1	3	2	1	0
Macquarie River above Burrendong	High	3	3	3	2	1	3	0	8	0	2	0	5	0	0
Marra Creek	High	4	1	0	0	0	0	0	7	0	0	0	0	1	1
Marthaguy Creek	High	3	2	0	0	0	0	0	7	0	0	0	0	1	1
Maryvale Geurie Creek	High	3	3	0	1	1	1	0	8	0	1	1	2	0	1
Molong Creek	High	4	1	0	1	1	1	1	7	0	1	1	2	0	0
Piambong Creek	High	5	2	0	1	1	1	1	7	0	1	1	2	0	1
Pipeclay Creek	High	5	2	0	1	1	1	1	7	0	1	1	2	0	1
Queen Charlottes Vale Evans Plains Creek	High	4	1	1	4	1	3	2	5	0	2	0	4	0	0
Summerhill Creek	High	5	1	0	1	1	1	3	4	1	1	3	1	0	0
Turon Crudine River	High	3	2	4	2	1	3	1	7	1	1	3	2	0	0
Upper Bogan River	Med	5	0	0	1	1	1	0	8	0	1	1	2	0	1
Upper Cudgegong River	High	3	2	0	7	0	4	1	7	0	2	0	4	0	0
Upper Talbragar River	High	3	1	1	2	2	3	0	8	0	2	0	4	0	1
Wambangalong Whylandra Creek	Med	4	1	0	1	1	1	0	8	1	1	3	2	0	1
Winburndale Rivulet	High	4	1	3	2	1	3	3	4	0	2	0	4	0	0

Disclaimer: The Office of Environment and Heritage (OEH) has provided assessments on the presence of threatened species and their sensitivity to extraction to inform the classification of water sources through the Macro Water Sharing Planning process. The assessments were undertaken for the specific purpose of developing an initial classification of water sources. They were based on the most accurate and relevant data/ information sourced and analysed at the time. Initial classifications were a first step to inform IRP deliberations. IRPs considered a range of information and used local knowledge in determining a final classification. The assessments are not absolute – for example the absence of threatened species for an assessment does not necessarily mean the threatened species are not present. These assessments should not be used for any purpose other than classification of catchment management units as part of the Macro Water Sharing Planning process.

Appendix 3: Interagency regional panel and support staff - membership and expertise

Name	Agency	Role	Expertise
Interagency Regional Panel			
Dave Miller	NSW Office of Water	Agency Representative	Water planning/administration/policy. Geomorphology. Riparian management. Stream ecology/restoration.
Greg Marwick	DPI	Agency Representative	Agricultural research and extension, water planning, vegetation planning, natural resource management and emergency management.
Debbie Love	OEH	Agency Representative	Regional input to water reforms, catchment plans and investments, biodiversity and threatened species management planning.
Jessica Brown/ Laura McKinley	CWCMA	CMA Observer	Catchment management, program development and implementation, project management, soil conservation, land management and riparian restoration. Community liaison and engagement.
Support Staff			
Tim Hosking	OEH	Alternate Representative	Terrestrial and wetland ecology, Land use planning, Environmental engineering and science.'
Julie Lovell	NSW Office of Water	Plan coordinator	Water planning/administration/policy.
Emily Turner	NSW Office of Water	Plan support	Water planning/administration/policy.
Richard Wheatley	NSW Office of Water	Technical Support (licensing)	Water licensing / policy / administration. Environmental review / Impact assessment. Agronomy and Irrigation
Sue Hamilton	NSW Office of Water	Technical Support (hydrogeology)	Groundwater, groundwater planning and policy.

Appendix 4: Interagency regional panel reference materials

Office Data Sets

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

Hydsys – Hydsys is an Office of Water statewide database that holds all flow record data. Flow records are available for most water sources in the Central West area.

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

Regional Geographic Information Systems – the Office of Water Land use and topographic information

Central Data Sets

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

Threatened species (fish) – Data supplied by NSW fisheries within the DPI.

Threatened species (other) – Data supplied by OEH.

Index of Social Disadvantage – Australian Bureau of Statistics.

Employment in Agriculture - Australian Bureau of Statistics

Other Agency Data

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

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

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