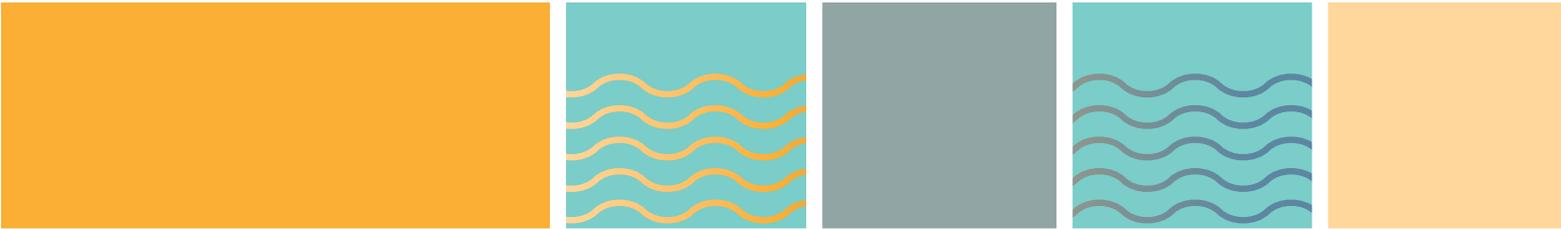


WATER SHARING PLAN

# Coffs Harbour Area unregulated and alluvial water sources

Background document

August 2009



WATER SHARING PLAN  
Coffs Harbour Area unregulated and alluvial water sources  
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## Introduction

Water sharing plans (WSPs) are being progressively developed for rivers and groundwater systems across the State following the introduction of the *Water Management Act 2000*. A number of plans have already been completed. These plans protect the health of our rivers, while also providing water users with the greater certainty over future access to water and increased trading opportunities.

Water sharing plans for the majority of the State's unregulated rivers and groundwater systems are now being completed using a 'macro' or broader-scale river catchment or aquifer system approach, although the principles, objectives and management arrangements remain the same as the plans developed for a smaller area or water source. Unregulated rivers are those which do not have their flows regulated by major state-administered dams. Most water users on unregulated rivers rely on natural flows for their water supply.

The water sharing plan for the Coffs Harbour Area unregulated and alluvial (the Plan) area covers 13 water sources. The key rules in the Plan specify when licence holders can access water and how water can be traded.

This background document to the Coffs Harbour WSP outlines:

- the purpose of the statutory Plan
- intended outcomes of the Plan
- a description of the Plan area
- the process of Plan development
- the use of adaptive management
- activities associated with implementation of the This document is part of a range of material available specifically on the Coffs Harbour Area WSP including:
  - *The Water Sharing Plan for the Coffs Harbour Area Unregulated and Alluvial Water Sources 2009* (the legal plan written in its required statutory format)
  - *A guide to the Water Sharing Plan* (a plain English version explaining the key Plan sections and rules)
  - Report cards for each water source detailing background information on the water sources classification and the proposed management rules.

In addition the following general information is also available on the macro planning process:

- The Community Manual *Macro Water Sharing Plans: The approach for unregulated rivers. Report to assist community consultation* – explains the method used to classify and set water sharing rules for unregulated streams across the State
- *Guidelines for Surface Water Sharing Plan Report Cards* – explains the information presented in report cards
- *Setting the water sharing rules* – a one page brochure which outlines the key steps for developing the rules.

## Purpose of the Plan

### Why are water sharing plans (WSPs) being prepared?

#### To provide certainty for the environment and water users

Continued expansion of water use across NSW has placed many water sources in the State at the limit of available water. This has seen increasing competition between water users, (towns, farmers, industries and irrigators) for access to water. In addition, this has placed pressure on the health and biological diversity of our rivers and aquifers.

Under the *Water Management Act*, the sharing of water must firstly protect the health of the water source and its dependent ecosystems, followed by basic landholder rights. Amongst licensed water users, priority is then given to water utilities and licensed stock and domestic use, ahead of commercial purposes such as irrigation and industry.

#### To facilitate water trading

WSPs set the rules by which irrigation licences can be traded. It is expected that over time, there will be an enhanced water market, where licences will be traded both permanently and temporarily.

There are also a number of macro water sharing plans currently being prepared for groundwater aquifer systems across the State. These include coastal sand, fractured rock and porous rock aquifers.

### Why a macro approach to water planning?

Macro water sharing plans (referred to hereafter as ‘macro plans’) are water sharing plans which apply to a number of water sources across catchments or different types of aquifers. In July 2004, 31 water sharing plans commenced in New South Wales, bringing these water sources and some 80 per cent of the water extracted in New South Wales under the management and licensing provisions of the *Water Management Act*.

The macro planning process is designed to develop broader-scale water sharing plans covering most of the remaining water sources in the State. Each macro plan covers a large river basin (not a single sub-catchment), or in the case of groundwater systems, cover a particular type of aquifer (e.g. fractured rock) across the State. These river basin or aquifer macro plans will generally apply to catchments or aquifers where there is less intensive water use.

Macro plans are being developed through a process involving technical assessments, classification and development of water sharing rules by regional panels and a state groundwater panel.

## Intended outcomes of the WSP

The objectives of the Coffs Harbour Area WSP are to:

- protect the important water dependent environmental, Aboriginal, cultural and heritage values
- protect basic landholder rights
- manage the river to ensure equitable sharing between users
- provide opportunities for market-based trading of licences and water allocations
- provide flexibility for licence users in how they can use their water
- allow for adaptive management, that is, to allow changes to be made when more information is available.

## Benefits for water users

With the introduction of the WSP, a number of benefits flow to water users:

- Greater certainty for water users – the Plan sets out the water sharing arrangements for a 10 year period.
- The Plan will facilitate trading of licences (and water allocations) – clear trading and access rules will help foster trading on unregulated rivers.
- Commercial licences in the Plan area will automatically become perpetual access licences, meaning they do not have to be renewed. Approvals for the works used to extract water under these access licences will need to be reviewed.

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

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

<b>Water source</b>	<b>Description</b>
Boambee Creek	Relatively high value of production from irrigation (horticulture).
Bonville Creek	Relatively high value of production from irrigation (horticulture).
Coffs Creek	Relatively high value of production from irrigation (horticulture).
Korora Basin	Relatively high value of production from irrigation (horticulture).
Woolgoolga Creek	Relatively high value of production from irrigation (horticulture).

## Environmental outcomes

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

Within the Coffs Harbour water sharing plan area, there are 10 Extraction Management Units (EMUs) proposed. Within these 10 EMUs the total annual volume of water licensed for extraction is 3,103 megalitres (ML) compared to an average annual flow from all rivers systems of approximately 155,000 ML per year.

In the largest EMU, Corindi River, the total annual volume of water licensed for extraction is 182 ML compared to an estimated average annual flow of 52,600 ML per year. There is no licensed extraction in two EMUs, Station Creek and Arrawarra. The Plan also imposes restrictions of access on days when flows are low to protect the environment. This is achieved by establishing 'cease to pump' rules that describe when water must not be extracted, depending on the amount of flow in the river on any day.

Even though the total annual volume of water extracted in each EMU is relatively low compared to average annual flows, most of the demand for water from unregulated systems usually occurs at those times when stream flow is low. In order to protect a proportion of some of these very low flows for the environment, the Plan also imposes new restrictions on access on days when flows are low. This is achieved by establishing 'cease to pump' rules that describe when water must not be extracted, depending on the amount of flow in the river on any day. Whilst there is only limited research on the importance of protecting very low flows, there is a body of evidence that suggests 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. Additionally, it should be noted that although many streams naturally stopped flowing in dry times, it is the increased frequency and duration of drying, as a result of extraction that has potential to impact on stream ecosystems.

Seven water sources were identified as having high instream value (see Table 2). For these water sources, water trading will be limited so that there is no increase in water entitlement, and in some cases trading rules aim to decrease entitlement.

**Table 2 Water sources with a high instream value (based on initial assessment)**

<b>Water Source</b>	<b>Description</b>
Bonville Creek	<ul style="list-style-type: none"> <li>• 6 threatened frog species.</li> <li>• 8 threatened bird species.</li> <li>• High recreation value.</li> <li>• Significant area of National Park.</li> </ul>
Corindi River	<ul style="list-style-type: none"> <li>• 1 threatened fish species.</li> <li>• 4 threatened frog species.</li> <li>• 4 threatened bird species.</li> <li>• High diversity.</li> <li>• High recreation value.</li> <li>• Significant area of National Park.</li> </ul>
Dirty Creek	<ul style="list-style-type: none"> <li>• 1 threatened fish species.</li> <li>• 2 threatened frog species.</li> <li>• 3 threatened bird species.</li> <li>• Minimal disturbance to in stream condition.</li> <li>• Significant area of National Park.</li> </ul>
Double Crossing Creek	<ul style="list-style-type: none"> <li>• 3 threatened frog species.</li> <li>• 5 threatened bird species.</li> <li>• Significant area of National Park.</li> </ul>
Korora Basin	<ul style="list-style-type: none"> <li>• 3 threatened frog species.</li> <li>• 3 threatened bird species.</li> <li>• Significant area of National Park.</li> </ul>

Water Source	Description
Station Creek	<ul style="list-style-type: none"> <li>• 4 threatened frog species.</li> <li>• 11 threatened bird species.</li> <li>• High diversity.</li> <li>• High recreation value.</li> <li>• Significant area of National Park.</li> </ul>
Woolgoolga Creek	<ul style="list-style-type: none"> <li>• 5 threatened frog species.</li> <li>• 6 threatened bird species.</li> <li>• 1 threatened wet flora species.</li> <li>• High recreation value.</li> <li>• Significant area of National Park.</li> </ul>

Appendix 6 details the threatened species considered when assessing the water source values.

Note: This only included species that are likely to be sensitive to extraction.

At least five water sources in the Plan area had no existing cease to pump condition when flows are low. In others water sources, only a proportion of licenses were subject to access rules. When the Plan commences, all irrigation licences in all water sources will be subject to cease to pump rules.

## Description of the Plan area

### Description

Coffs Harbour is located on the NSW mid-north coast, approximately 600 kilometres north of Sydney. The Plan covers 13 small coastal catchments from Pine-Bundageree Creek in the south to Station Creek in the north. The upper parts of each catchment have steep dramatic topography, quickly flattening out as the Creeks become short estuaries and then flow into the ocean. The most distinctive feature of these coastal catchments are the estuaries and lagoons, with impressive headlands and many beaches.

The Coffs Harbour area is a prominent tourist destination, where visitors come to enjoy a relatively clean and natural environment, with impressive forests and high value estuaries. Most of the catchments are steep with only small areas of flat land along the creek valleys. The area has been recognised as having high biological diversity with significant ecosystems in rainforests, moist eucalypt forests, coastal heaths, estuarine wetlands, headland rock platforms and coral and alga marine habitats. The area is particularly rich in wildlife and includes a variety of threatened species of plants and animals.

### Climate

The climate of the Coffs Harbour area is generally warm and sub-tropical, with warm wet summers and mild and relatively dry winters. Average rainfall is high (around 1,700 millimetres per year) and variable. Surface runoff is nearly double the average for coastal NSW. The majority of rainfall occurs in summer and autumn months. The inland coastal mountain range receives more rain than the coast as moist onshore winds are forced to rise resulting in convection rainfall. Average maximum temperatures range from 19°C in winter to 27°C in summer.

### Landuse history

Human settlement has tended to follow the flatter coastal plain, headlands and valley floors. Forests in the valleys were logged, followed by farming and banana growing. In more recent times the banana industry has been declining and restructuring, while tourism has increased in importance. Over 60,000 people live in the Coffs Harbour Council area and this is projected to increase to 80,000 by 2016 (Coffs Harbour City Council 2004).

Town water supplies are currently drawn from the Orara River (west of these coastal catchments) and stored in Karangi Dam. A large regional water supply project is current underway whereby an off-stream storage is being built near Coutts Crossing in the Clarence valley and will provide town water supplies for the lower Clarence valley and Coffs Harbour area until 2030.

### Industry

Primary industries are important activities in the Coffs Harbour Region. Historically, forestry and timber milling, beef cattle production and fishing have been the major primary industries, with a decline in activities associated with dairying and banana production (Coffs Harbour City Council 2004). Forestry production continues to be a significant activity in the Coffs Harbour LGA area with over 35 per cent of the land owned by NSW State Forests (Coffs Harbour City Council 2004). In recent times, more intensive agricultural and horticultural activities have developed and these include blueberries and raspberries, organic fruit and vegetables and native cut flower production (Coffs Harbour City Council 2004).

## Plan development process

### Project groups

#### Project Control Group

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

The PCG is chaired by the Department of Water and Energy (DWE). The group has representatives from the DWE, Departments of Environment and Climate Change (DECC), and Primary Industries (DPI). There are also three Catchment Management Authority (CMA) representatives. DWE is responsible for overall project management.

#### The Regional Panel

The Plan rules were initially developed by the North Coast Regional Panel (the Panel). This is an inter-agency group consisting of representatives from DWE, DPI, DECC and the Northern Rivers CMA (as an observer). Appendix 1 lists the names of the North Coast Regional Panel representatives and their areas of expertise. The Panel had access to staff from the agencies to provide technical and scientific information. The key roles of the panel were to:

- review the hydrological units or water sources
- assign economic, social and environmental values and undertake classification for each water source
- review the suitability of existing licence conditions
- make recommendations on the water access and trading rules for each water source
- assist CMAs with the public consultation on the proposed rules
- review submissions and make changes, where necessary to the draft water sharing rules.

An Independent Facilitator was engaged to chair the meetings and guide the decision-making process. The Panel used a consensus decision-making approach and where agencies had particular issues those issues will be highlighted during the public consultation period for specific attention. An Independent Facilitator was not involved in the later Panel meetings which were focused on the clarification and finalisation of draft Plan provisions.

## The policy context

There are a number of policies and initiatives that impact on and direct the development of water sharing plans. Water sharing plans are required to be guided by the River Flow Objectives, as stated in the NSW State Water Management Outcomes Plan. In 1997, the NSW Government undertook a public process of developing water quality and river flow objectives for NSW unregulated river catchments. The relevant river flow objectives for the unregulated rivers for the Coffs Harbour Area WSP area aim to:

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

The rules in the Coffs Harbour Area WSP were developed based on these objectives (refer Appendix 5 for detail).

The macro plans are consistent with the **National Water Initiative** (see [www.nwc.gov.au](http://www.nwc.gov.au) for details). This intergovernmental agreement includes provisions on water planning and specifies:

- Recognises that settling the trade-offs between the competing outcomes of secure ecological and resource security outcomes will require best available science and socio-economic analysis, as well as community input.
- Ensures the achievement of the environmental and other public benefit outcomes, including arrangements necessary to sustain high conservation value rivers, reaches, and groundwater areas.
- Ensures that environmental and other public-benefit outcomes are achieved, including actions to sustain high-conservation value rivers, reaches, and groundwater areas.

The macro plans comply with the **NSW Natural Resource Commission (NRC) statewide standards** and contribute to the relevant statewide targets (see [www.nrc.nsw.gov.au](http://www.nrc.nsw.gov.au) for details). The NRC was established in 2003 to develop statewide natural resource management standards and targets and to review the water sharing plans against these targets. As with the National Water Initiative, the state standards 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.

**Table 3 Contribution of the Coffs Harbour Area WSP to the NRC statewide targets**

<b>Relevant statewide target</b>	<b>Contribution by Coffs Harbour Area WSP</b>
By 2015 there is an improvement in the condition of riverine ecosystems.	<ul style="list-style-type: none"> <li>• Set a defined share of water for riverine ecosystems.</li> <li>• Protection of very low flows.</li> <li>• Trading rules to maintain or reduce entitlement in high value streams.</li> <li>• Adaptive management, giving the ability to adjust rules once information becomes available.</li> </ul>
By 2015 there is an improvement in the condition of important wetlands, and the extent of those wetlands is maintained.	<ul style="list-style-type: none"> <li>• Trading rules to maintain or reduce entitlement in high-value coastal water sources.</li> </ul>
By 2015 there is an improvement in the condition of estuaries and coastal lake ecosystems.	<ul style="list-style-type: none"> <li>• Rules to be developed for tidal pool areas based on the environmental requirements of estuaries.</li> <li>• Commence to flow rules introduced to protect first flush to estuaries.</li> </ul>
Natural resource decisions contribute to improving or maintaining economic sustainability and social well-being.	<ul style="list-style-type: none"> <li>• Plans provide a defined share to water and defined security of access.</li> <li>• Water markets encourage movement of water licenses to high-value uses.</li> <li>• Rules developed which consider community dependence on water extraction.</li> </ul>
By 2015 there is an increase in threatened species populations and ecological communities.	<ul style="list-style-type: none"> <li>• Some access and trading rules were developed to protect water dependent threatened species where these were identified and the risk to these from extraction was high.</li> </ul>

This Plan is consistent with and contributes to the Northern Rivers **Catchment Action Plan** (March 2006, Catchment Action Plan, Northern Rivers CMA).

## Policies specific to water sharing plans

### Aboriginal Community Development access licences

Many of our rivers already have a high number of irrigation licences, and are generally judged to be 'stressed', particularly during dry times when, for example, river flows are low. This effectively prevents the issuing of any new water licences on these 'stressed' rivers. However in some of our coastal rivers, higher and more reliable flows are common and provide an opportunity for licences to be granted for Aboriginal Community Development activities, provided this additional extraction would not negatively impact on ecological values that are dependent on high flows. In these coastal catchments, Aboriginal Community Development licences may be issued which allow water to be pumped from rivers during the higher flows, and stored in farm dams or tanks, to be used as needed. It is important to note that higher flows are not just peak or flood flows but also include flows that occur for 50 per cent of the time.

Aboriginal Community Development access licences are not recommended in any water sources in the Coffs Harbour area as high flows are not considered capable of supporting additional commercial scale extraction.

### High flow conversion

Many of our coastal unregulated rivers suffer severe competition for water during dry spells. These extended periods of low flow tend to be when water users compete most strongly for access to dwindling flows and pools. Instream values can also be stressed during these low flow periods as wildlife is concentrated and water quality can deteriorate. Therefore, there is merit in incentive schemes that attempt to move extraction out of the low flows and into the higher flows, as an attempt to improve environmental conditions.

By changing water use from periods of low flow to periods of relatively higher flow, over time, streams may be de-stressed and river conditions may improve. An incentive is required though, as low flow extraction is cheap and convenient – water users simply pump the water when it's available. To utilise higher flows, generally it would be necessary to construct on-farm storage. Water could then be pumped during periods of higher flow and stored and used at a later time. This is a much more expensive approach to irrigation but can provide enhanced security for water users.

The incentive through the Plan is to allow those pumpers that convert to higher flows to be granted additional volumes of water. In the Plan it is proposed that for every one unit of an unrestricted licence surrendered, 2.5 units of higher flow entitlement will be granted.

Given that the purpose of the higher flow conversions is to 'de-stress' low flows in our coastal river systems, a detailed assessment was undertaken to ensure that there is an overall environmental benefit achieved.

The conversion has been recommended in specified water sources only if the following criteria are met:

- The water source is classified as having important instream values at high risk from extraction or in water sources having high hydrological stress.
- There are adequate mechanisms in place to ensure the surrendered low flow is reserved for the environment.

- There is a no highly sensitive estuary (for example an ICOLL) or other identified high flow sensitive feature such as a wetland within the Extraction Management Unit.
- There is no existing high flow stress (i.e. significant extraction already in the high flows).
- The conversion would not significantly impact on tidal pool users or Town Water Supplies.

High flow conversions have been recommended for Bonville Creek and Corindi River. Other water sources in the Coffs Harbour are considered incapable of supporting commercial scale extraction from high flows.

## Classification method

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

This classification method took into account:

- the amount of water licensed for extraction
- the impact of extraction on rivers and estuaries
- the associated uses from this extraction
- the social and economic impacts of restricting extraction.

Specifically the classification process involved assessment of factors, including:

- instream values; for example, threatened fish that are likely to be affected by extraction
- the risk to instream values posed by the existing or increased extraction
- the hydrologic stress, which is the amount of water licensed for extraction relative to river flow
- the extraction value, which is the economic value of the water licensed for extraction
- the economic dependence of the local community on activities dependent on licensed water extraction
- the sensitivity of estuaries to the removal of freshwater inflows
- basic landholder rights and town water supplies
- whether the existing water sharing rules are adequate to manage the risk to instream values and basic landholder rights
- NSW Government policy.

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

The classification assisted in determining the optimal balance between extraction and retention of water instream for each water source. These broad-scale relative assessments showed where water sharing rules needed to strongly protect valuable natural assets by limiting extraction or to provide for extraction by water users where there is significant community dependence on extraction. Generic indicative rules were developed for each classification for each matrix to expedite the development of the water sharing plans by the panels. Where necessary, the panels refined these indicative rules to reflect local circumstances. The ‘value’ matrix was used to develop trading rules and the ‘risk’ matrix used to develop the water access rules. The final classifications determined by the Panel for all water sources (both value and risk matrices) have been summarised in Appendix 3.

It is important to note that the matrix approach was used as an ‘indicative tool’ to develop initial classifications. While these classifications guided the water sharing rules, a major role of the Panel was to use the local knowledge of panel members to check whether the final classifications were realistic. Amendments to both the classifications and the management rules by the Panel were based on local and technical knowledge of the water sources. In addition, the approach did not include some information which was added by the Panel, such as extraction for town water supplies and the economic values of water extraction that were not considered in the classification process.

For full details about the classification method, see the document *Macro water sharing plans. The approach for unregulated rivers. Report to assist community consultation* which is available on the DWE website.

## Aboriginal values

Aboriginal cultural values could be affected by water extraction from rivers. Most information about flow-related Aboriginal values resides in Indigenous communities. These communities will be targeted during the public exhibition period, to determine whether the proposed water sharing rules adequately protect Aboriginal cultural values. For more information see the fact sheet *Macro water sharing plans. Information for Aboriginal water users*, available on the DWE website.

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

## Exceptions to the generic classification approach

As mentioned a major role of the Panel was to use the local knowledge of panel members to check whether the final classifications were realistic. Table 4 lists the changes to classifications made by the Panel.

**Table 4** Refined Classifications based on Panel Knowledge (refer to Appendix 3)

Water source	Change to classification	Justification
Dirty Creek	Value classification changed from g-a	The Panel questioned the low instream value as DPI data suggested Pigmy Perch would be present in this water source. This was investigated and the data confirmed the threatened species is present and the water source is considered a key location.

## Other considerations

### Estuaries

Estuarine values can be threatened by water extraction. Some estuaries are highly sensitive to freshwater inflows, whilst others are quite resilient to changed inflows. The size and shape of estuaries vary and this, combined with the amount of freshwater inflows, determines the estuaries overall sensitivity to freshwater extraction. Where possible, extractions will be tightly capped in estuaries found to be highly sensitive to freshwater inflows.

An analysis was undertaken by a DWE expert panel to determine how sensitive each of the states estuaries are to changes to freshwater inflows.

Table 5 summarises the inflow sensitivities for the Coffs Harbour area estuaries.

**Table 5 Inflow sensitivities for the Coffs Harbour area estuaries**

<b>Name</b>	<b>Inflow sensitivity – low flows</b>	<b>Inflow sensitivity – high flows</b>
Arararra River	Medium	Medium
Boambee Creek	Medium	Medium
Bonville Creek	Medium	Medium
Coffs Creek	Low	Medium
Corindi River	Medium	Medium
Double Crossing Creek	High	High
Korora Basin	High	High
Moonee Creek	Medium	Medium
Station Creek	High	High
Woolgoolga Creek	High	High

## Water interception activities

Changed land-use activities can intercept significant quantities of water. Examples of this are an increased farm dam capacity in a catchment or significant areas of new forestry plantations. Under the National Water Initiative, significant interception activities will require a water access licence.

The Coffs Harbour area is considered an area in which there are no significant water interception activities anticipated within the life of the Plan. There are significant areas of the catchment covered by State Forests, including some small areas of hardwood plantation. The majority of the State Forests within the catchment are managed with selective logging techniques, resulting in minimal change to catchment hydrology.

Plantation developments are controlled in NSW under the Plantations Afforestation Act and will be monitored in the Coffs Harbour catchments, and assessed to determine if water access licences are required for new plantations.

Farm dams require an access licence only when:

- they are located on a third order (or greater) river, irrespective of the dam capacity or purpose
- if they exceed the maximum harvestable right for the property, which is equivalent to 10 per cent of the mean annual runoff
- if they are on a permanent (spring fed) first and second order streams.

The provisions relating to harvestable rights are unaffected by any of the rules identified in a macro water sharing plan. The volume of licensed farm dams was considered in determining hydrologic stress and access rules.

## Surface water – groundwater interactions

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

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

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

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

The aquifer types and groundwater sources that occur within the Coffs Harbour water sharing plan and their connectivity characteristics are given in Table 6. It is based on principles and recommendations in *Towards a National Framework for Managing the Impacts of Groundwater and Surface Water Interaction in Australia* by Sinclair Knight Merz (2006).

**Table 6 Connectivity between aquifer types and surface water**

<b>Aquifer type</b>	<b>Water sources</b>	<b>Level of connection between surface and groundwater</b>	<b>Level of impact on instream values</b>	<b>Estimated travel time between groundwater and unregulated river</b>
Coastal sands	Coffs Harbour Coastal, Sands and all unregulated rivers	Significant (tidal section only)	Low due to connection with saline water	Days to months
Up-river Alluvial	All unregulated rivers	Significant	High due to impact on base flows	Day to months
Coastal Floodplain Alluvial	Most unregulated river water sources except Dirty Creek, Corindi River, Red Bank River and Arrawarra Creek	Low – moderate (tidal section only)	Low since not major contributor and low level of connection	Season
Fractured rock	All unregulated rivers	Low – moderate	Low since not major contributor	Years to decades

## Alluvial aquifers

Alluvial aquifers are often connected to their parent streams. The degree of connectivity is dependant amongst other things, on the type of alluvial material within the aquifer. For example, groundwater in alluvial aquifers consisting of coarse materials such as sands and gravels strongly interacts with adjoining surface waters. However, groundwater in aquifers consisting of finer alluvial materials such as silts and clays, displays a weaker connection with the surface waters.

Based on differences in alluvial material and therefore degree of connectivity, the alluvial aquifers in the Coffs Harbour Area unregulated river and alluvial aquifer water sharing plan have been grouped into two different categories, both of which show connectivity to surface waters.

- Shallow 'upriver' alluvial aquifers – these are characterised by coarse materials and are generally located in the upstream part of the catchment. These aquifers are strongly connected to the adjoining stream and the travel time between ground and surface waters is short.
- Coastal floodplain alluvial aquifers – characterised by interspersed silts, clays and fine sands and are located further downstream within the catchment where the alluvial floodplain flattens and widens. Compared to the upriver alluvial aquifers, the connection between ground and surface waters is weaker and therefore the travel time between these waters are longer.

For this plan, the boundary between the coastal floodplain and the shallow upriver alluvial aquifers is the tidal limit. This limit generally coincides with a change in slope, and a fining of the alluvial material, resulting in changes to the degree of connectivity between the ground and surface waters.

The proposed water sharing rules for licences in alluvial aquifers are based on the following principles:

- A recognition that in alluvial river reaches, the surface and groundwater is considered to be a single resource.
- Minimise the impacts of groundwater extraction on surface water through:
  - management of distance of bore placement from rivers
  - application of access rules to bores located close to rivers.
- Encourage a reduction in hydrologic stress from unregulated rivers by allowing conversion from unregulated river to alluvial groundwater licences.
- Allow trading of groundwater licences.
- Minimise and manage any local impacts such as groundwater pollution or drawing down of the water table as a result of groundwater extraction.
- Manage extractions and growth in use to a predetermined limit, in parallel with surface water extraction limit.
- Protect groundwater dependant ecosystems.

## Groundwater dependent ecosystems

Groundwater dependent ecosystems (GDEs) are ecosystems which have their species composition and natural ecological processes determined to some extent by the availability of groundwater.

The Coffs Harbour Area Unregulated and Alluvial Water Sources Water Sharing Plan includes water sharing rules for the highly connected alluvial groundwater. An initial assessment has been undertaken to determine whether there are any significant GDEs reliant on the alluvial groundwater. Possible GDEs in alluvial groundwater include:

- cave systems
- wetlands
- endangered ecological communities.

### **Cave systems**

Caves ecosystems are below the ground surface and at groundwater discharge areas and as such tend to be totally dependent on groundwater. Groundwater dependent cave ecosystems are typically associated with limestone and support an abundant variety of fauna such as crustacea and macro-invertebrates. Entire families of creatures are known to exist in these systems, some of which have been extinct from the surface for millennia. These caves are rich in biodiversity and it is important to ensure that groundwater extraction doesn't impact on that biodiversity.

The initial assessment found no cave systems in the Coffs Harbour WSP area.

### **Wetlands**

Groundwater dependent wetland ecosystems are typically areas where the water table is at the surface, or periodically at the surface. While the degree of groundwater dependency is variable, groundwater plays a critical role in wetlands found on alluvial floodplains. Many wetlands are extremely species rich with a mixture of plants and animals and are often considered to have high conservation value.

The initial assessment found no high priority groundwater dependent wetlands on the alluvial floodplains in the Coffs Harbour WSP area.

### **Endangered Ecological Communities**

An endangered ecological community (EEC) is an assembly of species occupying a particular area (plant or animal communities) that is in danger of becoming extinct. These EECs are listed in schedules to the *Threatened Species Conservation Act (1995)*. In the case of plant communities, where these forests/woodlands occur on alluvial floodplains, it is possible that the vegetation relies to some extent on groundwater to sustain transpiration and growth. Groundwater extraction can effectively lower the water table, having a negative impact on the vegetation community.

The initial assessment found no groundwater dependent EECs for the Coffs Harbour WSP area.

### **Water Sharing Rules for GDEs**

GDE identification and assessment is an ongoing process. In the event that new significant GDEs are found in the Coffs Harbour WSP area, consideration will be given to adding these during the life of the WSP. In this event, new or replacement bores will not be permitted within a buffer zone around the new GDE. Existing bores are not affected by the buffer zones and are able to continue operating (i.e. within the existing conditions of their access licences).

## Water sharing rules

Water sharing rules that the classification process focused on consist of:

- access rules – which determine at what flow levels extraction is allowed
- dealing rules – which control:
  - the trade of water, both transfer of access licence and assignment of water allocation between access licences
  - change of water sources
  - the location for extraction.

Other management rules are considered in the development of the Plan such as:

- extraction limits – which set the total volume of water that can be extracted annually from the water source or water management zone
- rules for granting new entitlement – what types of access licences may be granted
- rules for granting works approvals – what types of set back conditions are required
- system operation rules – what types of rules are required for major storages (where relevant).

For details about the proposed water sharing rules for each water source covered by the Plan, refer to the Water Source Report Cards, available on the [www.dwe.nsw.gov.au](http://www.dwe.nsw.gov.au).

### Developing the access and dealings rules

The Panel used local knowledge and expertise in applying the water sharing rules. For example:

- Existing local water sharing rules were examined to determine whether they achieved the required level of environmental protection and provided for basic rights.
- Local studies or information from regional staff in areas such as irrigation (DPI) or aquatic ecology (DWE) were included.
- Extractions patterns by local water and major utilities were examined.
- Consideration was given to see if the estuary at the end of the system necessitated additional catchment-wide protection.

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

The Panel also considered the ability to manage and monitor flow in a water source. For example, where there was no flow gauging station they assessed the risks to the water source, and either:

- recommended new gauges be installed for high-risk or highly stressed water sources, or
- looked at alternatives such as ‘staff’ gauges (which measure river height but not flow) or visible flow references where the risk to instream values was low.

They also considered any known specific requirements of threatened species in relation to key reproductive needs, migration or other particular ecological activities.

The Panel recommended a staged approach to change, so as to limit adverse social and economic impacts. In essence, this proposes that water users be given time to adapt to new rules. Where the existing rules were not consistent with the Panel’s recommended rules, the degree of immediate change (and hence the

effect on extractors) was limited to the next higher level of rule in the first instance, unless a higher level of protection could be achieved with minimal socio-economic impact. The Panel then determined a timeframe and the further steps required to achieve the recommended rules during the life of the Plan.

Once the proposed water sharing rules were determined, a check was done to ensure that the rules integrate well and are practical across the catchment.

In some water sources, local water users have daily and hourly pumping restrictions or other arrangements to conserve water during dry times. While these have often been very effective in sharing water between license holders, they have not been enforceable via licence conditions. During targeted consultation, there was support by water users to continue using these arrangements in the majority of water sources, and as a result these were incorporated into the access rules of the WSP where possible.

## Granting Aboriginal Community Development access licences

A detailed assessment was undertaken to determine where it may be appropriate to grant Aboriginal Community Development licences. It was decided that no new licences would be granted in any water source due to high instream values and modest flows above the 50th percentile.

## High flow conversions

Water sources in the Coffs Harbour Area WSP where applications for high flow conversions will be considered are Bonville Creek and Corindi River.

## Exceptions to the generic rule approach

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

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

It was recognised that local interpretation of the indicative water sharing rules was very important. For example, the rule of 'no pumping from pools when pool drops to a specified height' was regarded as inappropriate in these systems due to small pool sizes and the numerous numbers of pools, and was not consistent with River Flow Objectives (pools need to be maintained for drought refuge). In these instances the Panel adopted a rule of 'no pumping from pools where there is no visible inflow and outflow'.

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

There were no changes to the indicative access rules proposed for the water sources with the Coffs Harbour area. For several water sources no rule other than cease to pump when there is no visible flow could be recommended due to the absence of gauging stations. However in many cases visible flow approximates the level the indicative rule.

## Consultation

The classifications and the Panel's recommended rules underwent targeted consultation with water users and specific interest groups<sup>1</sup> before the Plan was drafted. Formal public exhibition<sup>2</sup> of the draft Plan ensured a wider public consultation.

So that individual and groups can see how key issues raised during consultation were dealt with by the Panel, a section titled 'Matters Raised During Consultation' has been added to the report card for each water source.

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

CMAs will manage the consultation process throughout the State, and will ensure that all stakeholders and interested parties have an opportunity to examine and comment on the proposed water sharing rules. In particular, the Northern Rivers CMA will be looking for stakeholders to provide:

- local knowledge and expertise – for example, there may be natural or socio-economic values that may be more apparent to locals
- feedback on the practical elements of the proposed water sharing rules, to make certain they are easily implemented
- check that there are no unintended outcomes from the plans – local stakeholders have the expertise to advise on how these rules will work on-ground – it is essential that this is given due consideration before the Plans are finalised.

### Targeted consultation on the draft rules

Targeted consultation on the proposed rules for the Coffs Harbour Area WSP began in late 2005 and finished in mid 2006 (Table 7). The objectives of this consultation were:

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

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<sup>1</sup> 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.

<sup>2</sup> Public exhibition is the formal exhibition of the draft Plan where the Minister invites submissions on the draft Plans and in particular will seek comment on a range of key issues.

**Table 7 Key groups consulted**

Date	Group	Location
January 2006	Representatives from key interest group including water uses, industry, environmental and Aboriginal organisations.	Coffs Harbour
February 2006	Town Water Supply – North Coast Water, Coffs Harbour, Clarence, Bellingen and Armidale Councils.	Coffs Harbour
March 2006	License holders and general public.	Coffs Harbour
May 2006	Aboriginal Community Support Officers (CMA) and representatives from Aboriginal communities.	Nambucca

The Northern Rivers CMA encouraged stakeholders to submit their comments in writing. A total of nine submissions were received as a result of the targeted consultation in the Coffs Harbour area. These were reviewed by the Panel and changes were made to information where appropriate.

## Refining water sharing rules as a result of targeted consultation

The Panel reviewed the submissions as well as matters raised at the meetings and as a result made some changes to the initial rules. Table 8 outlines the changes to the proposed rules as a result of the consultation.

**Table 8 Changes to water sharing as a result of targeted consultation**

Water source	Change to classification	Justification
Bonville Creek	Conversion to high flow access license permitted.	As a result of issues raised during consultation the Panel recommended that high flow conversions be permitted in the water source to allow irrigators more flexibility with their water entitlement.

## Public exhibition of the draft rules

Public exhibition of the proposed rules was held in the Coffs Harbour Area WSP during January and February 2009. The objectives of this consultation were:

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

One public meeting was held in Coffs Harbour during the public exhibition period. Information about the draft WSP was provided to Aboriginal stakeholders and Local Government as part of the public exhibition process.

A total of four submissions were received as a result of the public exhibition. No amendments were made to the draft rules as a result of public exhibition.

## **Adaptive management**

Adaptive management is an important part of a water sharing plan. The term refers to making provision within the Plan to change the access or trading rules in response to new information obtained during the 10 year life of the Plan. Adaptive management is a requirement of both the Water Management Act and the National Water Initiative.

## **Research opportunities**

The planning process has identified a number of areas for research opportunities both at a state and regional level. In order to better assess trade-offs, integrated hydrological/ecological studies and socio-economic models are required. Also assessing Aboriginal cultural values and an investigation into the Coffs Harbour River estuary including economic valuation and hydraulic behaviour (in response to freshwater inflows) are examples of research opportunities.

It is intended that a statewide research prospectus be developed that reflects research needs and knowledge gaps across all macro plans once they have been drafted. Opportunities for a collaborative approach to research with organisations such as universities and co-operative research centres will be explored.

## Monitoring and review

### Monitoring

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

DWE is currently developing a Monitoring Evaluation Reporting (MER) Framework. This framework will be developed in collaboration with key stakeholders, and be consistent with the MER needs of the Natural Resource Commission and the National Water Commission. The intention is that the framework can be applied to existing water sharing plans, macro water sharing plans, and the SWMOP to enable the development of a specific MER 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. A risk assessment approach will be used to identify specific issues and high risk water sources where detailed MER needs to occur.

An Implementation Program is to be established that sets out the means by which the provisions of this Plan are to be achieved. The monitoring of the performance indicators will be detailed in the Implementation Program.

### Plan review

The Natural Resources Commission will undertake a review of this Plan prior to any decision to extend its term or to make a new plan.

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

- The Plan will be audited at intervals of no more than five years, for the purpose of ascertaining whether its provisions are effective. This audit is to be carried out by an audit panel appointed by the Minister (for Natural Resources).
- The Plan will be audited by the Natural Resource 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 Resource Commission will call for public submissions when undertaking its review.
- Annual review of Implementation Programs.
- Review of the SWMOP every five years.
- In addition, information from the relevant monitoring and evaluation programs should inform progress against the relevant statewide targets and requirements of the National Water Commission under the National Water Initiative.

## Implementation

### Implementation programs

An Implementation Program is to be established that sets out the means by which the provisions of this Plan are to be achieved. The process for monitoring of the performance indicators will be outlined in the Implementation Program. An annual review of the Implementation Program will be conducted to determine whether the program is being effective in implementing the water sharing provisions. The results of this review will be included in DWE's Annual Report.

### Monitoring water extractions

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

Measurement of use may be via meters or other forms of monitoring devices fitted to approved works, or via alternative monitoring systems, in order to provide water extraction estimates.

In relation to monitoring devices, different types of devices will be required depending on the nature of the water supply work installation, the size of the work, and the effect that the operation of the work may have on the water source and other water users.

It is anticipated that assessment of water sources will be undertaken across the State to identify priority areas of measurement of use and to determine the most suitable measurement options. It is likely that this will be implemented in high priority areas initially, with roll out to all water sources over time, as appropriate.

Note: Decisions regarding the timetable for introduction of measurement of use are still under consideration. In the interim, water users are encouraged to use other forms of self-measurement to assist them to extract water in line with Plan provisions.

### Compliance

DWE will undertake compliance activities as necessary to enforce the provisions of the Plan once it is implemented. Some reliance is placed on local water users to identify inappropriate or unlawful behaviour and report this to the Department.

## Appendices

### Appendix 1: North Coast Regional Panel – membership and expertise

Name	Agency	Role	Expertise
<b>Regional Panel</b>			
Dave Miller	DWE	Agency representative	Water policy, planning and administration, geomorphology, stream management/ecology. Project management and facilitation.
John Williams	NSW DPI	Agency representative	Regional experience in water reform programs, water quality problems especially acid drainage, coastal agricultural industries, catchment management and interagency coordination.
Adam Smith	DECC	Agency representative	Regional input to water reforms, catchment plans and investments, biodiversity and threatened species management planning.
Ian Simpson	NRCMA	CMA observer	Catchment management, program development and implementation, project management, soil conservation, land management and riparian restoration. Community liaison and engagement.
<b>Support Staff</b>			
Richard Swinton	NSW DPI	Technical support/ alternative representative	Resource management, water policy development, farm systems and enterprises, farm management and economics, irrigation systems and management, extension and communications, water sharing plan development and implementation.
Marcus Riches	NSW DPI	Technical support	Fisheries management and conservation issues, threatened species, biological/environmental research, local knowledge of flow behaviour of catchments, WSP development and implementation.
Roland Bow	DECC	Technical support/ alternative representative	Technical and management expertise in research, aquaculture, commercial fisheries, compliance and conservation, fisheries management and aquaculture.
Peter Lloyd Jones	DECC	Technical support/ alternative representative	Measuring ecological response of environmental flows, regional input and delivery of water reforms/water sharing plan development, input into State water policy development.
Michael Healey	DWE	Technical support/ acting macro coordinator	Aquatic ecologist, knowledge of flow requirements for freshwater biota, regional knowledge of flow dependent biota, water sharing plan development and implementation.
Peter Hackett	DWE	Technical support (licensing)	Licensing officer, local knowledge of water users, WUAs, local access arrangements and reference points.
Nicky Smith	DWE	Macro coordinator	Water policy and planning, WSP development and implementation, facilitation and project management.
Neil Dufty		Independent facilitator	Qualified educator and earth scientist, experienced facilitator in NRM planning, former chair of water management committees.

## Appendix 2: Reference material used by the North Coast Regional Panel

Licensing Administrator System (LAS) – DWE state-wide database holding the licence details including volume of entitlement, location details and stream orders.

Hydsys – Hydsys is a DWE state-wide database that holds all flow record data. Flow records are available for most water sources in the Northern Rivers area.

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

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

Regional Geographic Information Systems – DWE 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 DPI.
- Threatened species – other. Data supplied by DECC.
- Index of Social Disadvantage – Australian Bureau of Statistics.
- Employment in Agriculture – Australian Bureau of Statistics.
- Roy et al. 2001. Structure and Function of South-eastern Australian estuaries.

### Other agency data

- National Parks and Wildlife (DECC) state-wide atlas. State-wide 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.

### Other projects/reference material

- Australian Greenhouse Office (March 2004 version). NSW Forest Extent 1972-2002. Australian Greenhouse Office, Canberra. Data set used to determine % cover and width of riparian zones.
- Boulton, A., Smolders, K, Turner, B. and Bell, D.(2003). *Land-use, drought, and river condition in the Coffs Harbour and Nambucca catchments, northern NSW Final Report*. Ecosystem Management and Botany, University of New England Armidale NSW.
- Harris, J. H. and Gehrke, P. C. (eds) (1997). *Fish and Rivers in Stress: The NSW Fish Survey*. NSW Fisheries, Cronulla, Sydney.
- National Heritage Trust (2002). *Australian Catchment, River and Estuary Assessment 2002*, Volumes 1 & 2. National Land and Water resources Audit, Canberra. Data used included aquatic biota (macroinvertebrate/AUSRIVAS) index.
- NSW DPI Agriculture web site for crop gross margins: <http://www.agric.nsw.gov.au/reader/budget>.
- Pierson WL, Bishop K, Van Senden D, Horton PR, Adamantilis CA. 2002. Environmental Water Requirements to Maintain Estuarine Processes. *Environmental Flows Initiative Technical Report Number 3*. National Heritage Trust, Canberra.
- Roy PS et al. 2001. Structure and Function of South-eastern Australian Estuaries. *Estuarine, Coastal and Shelf Science* 53: 351–384.

- Trewin, D. (2001), *Census of Population and Housing: Socio-Economic Indexes for Areas (SEIFA)*. Australian Bureau of Statistics, Canberra.
- Some Key References cited (indicative only):
  - Coffs Harbour City Council. (2004). Coffs Harbour City Population Profile.
  - Coffs Harbour City Council. (2004). Coffs Harbour State Of The Environment Report 2004: Comprehensive Report.
  - Cohen, T., Reinfelds, I. and Brierley, G.J. (1998). *River styles in Coffs Harbour-Kalang catchment*. Report completed for N.S.W. Department of Land and Water Conservation on behalf of Macquarie Research Limited.
  - DLWC (1999). *Coffs Harbour Catchments Stressed Rivers Report*. NSW Department of Land and Water Conservation, Sydney.
  - HRC, (2003). *Independent Inquiry into North Coast Rivers Final Report*. Healthy Rivers Commission, Sydney.

## Appendix 3: Classification summary

### Value matrix

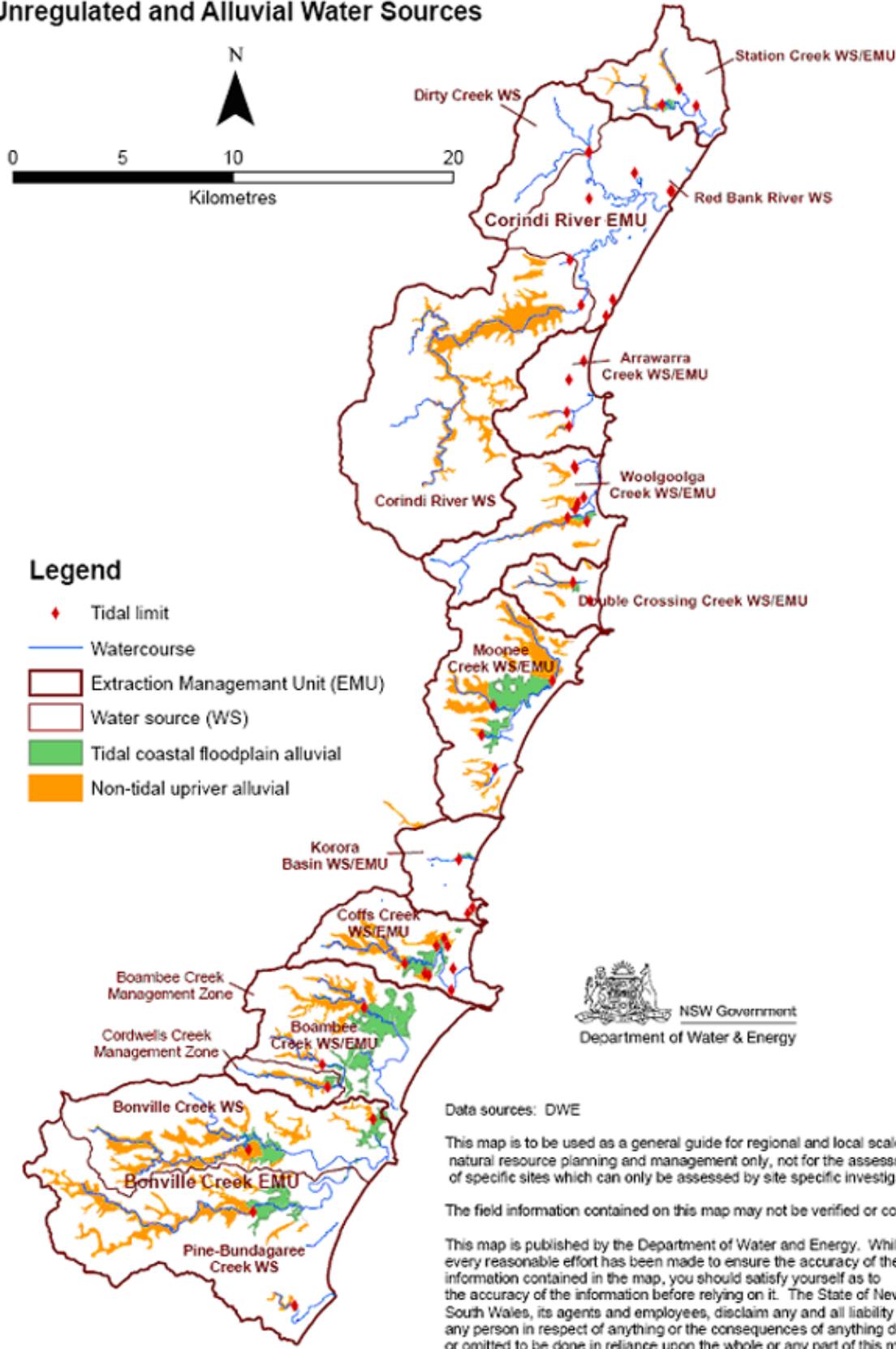
<b>High instream values</b>	<b>A</b> Dirty Creek, Station Creek	<b>B</b>	<b>C</b> Bonville Creek, Corindi River, Double Crossing Creek, Korora Basin, Woolgoolga Creek
<b>Medium instream values</b>	<b>D</b> Arrawarra Creek	<b>E</b>	<b>F</b> Boambee Creek, Coffs Creek, Moonee Creek, Pine-Bundagaree Creek, Red Bank River
<b>Low instream values</b>	<b>G</b>	<b>H</b>	<b>I</b>
	<b>Low hydrologic stress of hydrologic risk</b>	<b>Medium hydrologic stress of hydrologic risk</b>	<b>High hydrologic stress of hydrologic risk</b>

### Risk matrix

<b>High risk to instream values</b>	<b>A</b>	<b>B</b> Corindi River, Double Crossing Creek	<b>C</b> Korora Basin, Woolgoolga Creek
<b>Medium risk to instream values</b>	<b>D</b> Moonee Creek	<b>E</b> Pine-Bundagaree Creek	<b>F</b> Boambee Creek, Bonville Creek, Coffs Creek
<b>Low risk to instream values</b>	<b>G</b> Arrawarra Creek, Dirty Creek, Red Bank Creek, Station Creek	<b>H</b>	<b>I</b>
	<b>Low dependence on extraction</b>	<b>Medium dependence on extraction</b>	<b>High dependence on extraction</b>

## Appendix 4: Water sharing plan area map

### Coffs Harbour Water Sharing Plan Area Unregulated and Alluvial Water Sources



## Appendix 5: Contribution to the river flow objectives

Levels of assessed contribution:

FULL – contributes to objective in full.

HIGH – while not fully contributing to objective is considered a good level of contribution.

PARTIAL – goes some way to contributing to the objective.

LOW – only small degree of contribution to the objective.

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

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

	Protect pools in dry times	Protect natural low flows	Protect important rises in water levels	Maintain wetland and floodplain inundation	Mimic natural drying in temporary waterways	Maintain natural flow variability	Maintain natural rates of change in water levels	Manage groundwater for ecosystems	Minimise effects of weirs and other structures	Minimise effects of dams on water quality	Make water available for unforeseen events	Maintain or rehabilitate estuarine processes and habitats
Ararawarra Creek	FULL	FULL	FULL	FULL	N/A	FULL	FULL	PARTIAL	N/A	N/A	N/A	FULL
Boambee Creek	HIGH	PARTIAL	HIGH	HIGH	N/A	PARTIAL	PARTIAL	PARTIAL	N/A	N/A	N/A	HIGH
Bonville Creek	HIGH	PARTIAL	HIGH	HIGH	N/A	PARTIAL	PARTIAL	PARTIAL	N/A	N/A	N/A	HIGH
Coffs Creek	HIGH	PARTIAL	HIGH	HIGH	N/A	PARTIAL	PARTIAL	PARTIAL	N/A	N/A	N/A	HIGH
Corindi River	HIGH	HIGH	HIGH	HIGH	N/A	HIGH	HIGH	PARTIAL	N/A	N/A	N/A	HIGH
Dirty Creek	FULL	FULL	FULL	FULL	N/A	FULL	FULL	PARTIAL	N/A	N/A	N/A	LOW
Double Crossing Creek	HIGH	HIGH	HIGH	HIGH	N/A	HIGH	HIGH	PARTIAL	N/A	N/A	N/A	HIGH
Korora Basin	HIGH	PARTIAL	HIGH	HIGH	N/A	PARTIAL	PARTIAL	PARTIAL	N/A	N/A	N/A	HIGH
Moonee Creek	HIGH	HIGH	HIGH	HIGH	N/A	HIGH	HIGH	PARTIAL	N/A	N/A	N/A	HIGH

	<b>Protect pools in dry times</b>	<b>Protect natural low flows</b>	<b>Protect important rises in water levels</b>	<b>Maintain wetland and floodplain inundation</b>	<b>Mimic natural drying in temporary waterways</b>	<b>Maintain natural flow variability</b>	<b>Maintain natural rates of change in water levels</b>	<b>Manage groundwater for ecosystems</b>	<b>Minimise effects of weirs and other structures</b>	<b>Minimise effects of dams on water quality</b>	<b>Make water available for unforeseen events</b>	<b>Maintain or rehabilitate estuarine processes and habitats</b>
Pine-Bundagaree Creek	HIGH	HIGH	HIGH	HIGH	N/A	HIGH	HIGH	PARTIAL	N/A	N/A	N/A	HIGH
Red Bank River	HIGH	HIGH	HIGH	HIGH	N/A	HIGH	HIGH	PARTIAL	N/A	N/A	N/A	HIGH
Station Creek	FULL	FULL	FULL	FULL	N/A	FULL	FULL	PARTIAL	N/A	N/A	N/A	FULL
Woolgoolga Creek	HIGH	HIGH	HIGH	HIGH	N/A	HIGH	HIGH	PARTIAL	N/A	N/A	N/A	HIGH

## Appendix 6: Identified threatened species

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

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

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

Threatened Species	Arrawarra Creek	Boambee Creek	Bonville Creek	Coffs Harbour Creek	Corindi River	Dirty Creek	Double Crossing Creek	Korora Basin	Moonee Creek	Pine-Bundagaree Creek	Red Bank River	Station Creek	Woolgoolga Creek
<b>Fish species</b>													
Oxleyan pygmy perch	✓				✓	✓							
<b>Frog</b>													
Booroolong Frog**			✓										
Giant Barred Frog**	✓	✓	✓	✓	✓		▯	✓	✓	✓	✓	▪	✓
Green and Golden Bell Frog**	✓	✓	✓						✓	✓	✓	✓	
Green-thighed Frog**	✓				✓	✓			✓	✓	✓	✓	✓
Olongburra Frog**	✓	✓		✓			✓		✓		✓	✓	✓
Pouched Frog**		✓	✓	✓	✓					✓			
Stuttering Frog**		✓	✓	✓				✓		✓			✓
Tusked Frog													
Wallum Froglet**	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
<b>Bird</b>													
Australasian Bittern		✓	✓									✓	
Beach Stone-curlew			✓								✓	✓	
Black Bittern**	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Black-necked Stork**	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Blue-billed Duck							✓						
Brolga					✓				✓		✓	✓	
Collared Kingfisher				✓									✓
Comb-crested Jacana			✓				✓		✓		✓		✓
Freckled Duck													✓
Great Knot											✓	▪	

<b>Threatened Species</b>	<b>Arrawarra Creek</b>	<b>Boambee Creek</b>	<b>Bonville Creek</b>	<b>Coffs Harbour Creek</b>	<b>Corindi River</b>	<b>Dirty Creek</b>	<b>Double Crossing Creek</b>	<b>Korora Basin</b>	<b>Moonee Creek</b>	<b>Pine-Bundagaree Creek</b>	<b>Red Bank River</b>	<b>Station Creek</b>	<b>Woolgoolga Creek</b>
Greater Sand Plover											✓	✓	
Lesser Sand Plover												✓	
Osprey**	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Painted Snipe												✓	
Sanderling											✓	✓	
Terek Sandpiper												✓	
<b>Wet flora species</b>													
Cassia brewsteri var. marksiana				✓									
Eleocharis tetraquetra		✓											
Phaius australis		✓		✓									✓
Ravine Orchid				✓									

**Disclaimer**

The Department of Environment and Climate Change (DECC) has provided assessments on the presence of threatened species and their sensitivity to extraction to inform the classification of water sources through the Macro Water Sharing Planning process.

The assessments were undertaken for the specific purpose of developing an initial classification of water sources. They were based on the most accurate and relevant data/ information sourced and analysed at the time.

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

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