

# Carroll to Boggabri Floodplain Management Plan

September 2006

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## **Acknowledgments**

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## PREAMBLE

The NSW Government's Flood Prone Land Policy is aimed at providing solutions to existing flooding problems as well as ensuring that new development within flood prone areas is compatible with the prevailing flood risk and does not create additional flooding problems in other areas.

Under this Policy, the *Department of Natural Resources* (hereafter DNR) manage the rural flood risk within NSW for those areas west of the Great Dividing Range. This is through the administration of *Part 8 of the Water Act 1912*, under which the *Carroll to Boggabri Floodplain Management Plan* (hereafter the *Carroll - Boggabri FMP*) is to be adopted and gazetted.

The development of the *Carroll – Boggabri FMP* has progressed through the following three stages:

1. *Flood Study* - technical assessment of the nature and extent of flooding;
2. *Floodplain Management Study* - evaluates management options for the floodplain giving consideration to hydraulic, environmental, social and economic issues;
3. *Floodplain Management Plan* - outlines strategies to manage flood risk and flood management issues, and support the natural functions of the floodplain environment.

This report has been prepared by Webb, McKeown & Associates and Gunnedah Management Consultants on behalf of the *Carroll to Boggabri Floodplain Management Committee* (hereafter *Carroll – Boggabri FMC*) and the *Department of Natural Resources*.

The *Carroll to Boggabri Flood Study* and Compendium of Data report (January 2003) and the *Carroll to Boggabri Floodplain Management Study* (FMS) report (September 2005), document in detail all of the investigations leading to the preparation of the *Carroll – Boggabri FMP*.

Preparation of this Floodplain Management Plan is jointly funded by the *Natural Heritage Trust* and the NSW Government.

## 1.0 INTRODUCTION

### 1.1 Vision Statement

To develop a rural Floodplain Management Plan that will mitigate flooding, manage development to ensure that the functions of the floodplain are sustainable in all aspects and that the FMP is compatible with the needs of the surrounding community.

### 1.2 Background

Completed by Snowy Mountain Engineering Corporation (SMEC) in 2003, the *Carroll - Boggabri Flood Study* included the collection and review of data to define the nature and extent of flooding within the FMP area. Survey data was used to develop a computer hydraulic model of the catchment.

In the *Carroll - Boggabri Floodplain Management Study*, data was collected and reviewed. From this, flood related issues of greatest concern to the community were identified. **Figure 1** (Appendix B) indicates the extent of the FMP area.

The aim of The Floodplain Management Plan is to outline management measures for the floodplain that are hydraulically, environmentally and economically sustainable as well as being accepted and supported by the community. Appropriate timing and prioritising of the management actions for dealing with the issues raised in the study have been developed to achieve the objectives defined by the Vision Statement and within the scope of the Floodplain Management Principles.

### 1.3 FMP Area

The *Carroll to Boggabri FMP area* (**Figure 1**, Appendix B), lies within the Namoi River Basin in northern New South Wales. It commences at the village of Carroll, downstream of the confluence of the Peel and Namoi Rivers, and extends north and west, past Gunnedah, to the town of Boggabri. The area of study lies primarily within the Gunnedah Shire, except for a small area near Boggabri, which lies within Narrabri Shire.

The Namoi River Basin is located west of the Great Dividing Range in northern New South Wales, forming part of the Barwon-Darling River system. It is bounded by the Nandewar Range to the north, the Great Dividing Range to the east and the Warrumbungle Range to the south. Extending over 350kilometres from the head of the McDonald River westward to Walgett, the basin covers some 43,000 square kilometres (SMEC, 2003).

The Namoi River rises in the New England Plateau of the Great Dividing Range. The main headwater tributaries of the basin include the MacDonald, Manilla, Peel and Mooki Rivers. The Mooki River joins the Namoi just upstream of Gunnedah and Coxs Creek joins the Namoi at Boggabri. The catchments of the Mooki River, Coxs Creek and the Namoi River between Keepit Dam and Boggabri form the region known as the Liverpool Plains. The Namoi River has a catchment area at the village of Carroll

of 10,500km<sup>2</sup> and 17,000km<sup>2</sup> at the town of Gunnedah. The catchment of the Mooki River is about 7,000km<sup>2</sup>, and the Peel River at Carroll Gap 4,700km<sup>2</sup>.

## 2.0 LEGISLATION and POLICY OVERVIEW

The management of the Namoi River floodplain must be undertaken within the current legislative and policy framework. A brief summary of the relevant legislation and policy is presented below. A more detailed overview of the legislative and policy framework for floodplain management is provided in the *Carroll-Boggabri Floodplain Management Study* report. Where possible, potential future changes have also been considered.

### 2.1 The Flood Prone Land Policy

The primary objective of the NSW Government's *Flood Prone Land Policy (2005)* is to reduce the impacts and financial losses caused by flooding. The policy is specifically structured to provide solutions to existing flooding problems in rural and urban areas. In addition, the Policy provides a means of ensuring that any new development is compatible with the flood hazard and does not create additional flood problems in other areas. The *Floodplain Development Manual (2005)*, supports the policy and outlines a merit approach to floodplain management.

### 2.2 Water Act 1912 and Water Management Act 2000

Floodplain management in western rural areas of New South Wales are administered by *Department of Natural Resources (DNR)* under Part 8 of the *Water Act 1912*. Part 8 makes provisions to control rural works that affect, or are likely to affect, flooding and/or floodplain functions. Part 8 was amended in 1999 to allow for more strategic control of rural flood control works through the preparation of FMPs and a more streamlined and resource efficient approval process.

The *Water Management Act 2000* has been produced during the preparation of the *Carroll – Boggabri FMS and FMP*, following State Government reform of water legislation. It should be noted that the new *Water Management Act 2000* is not yet in operation, and while it will eventually replace the current *Water Act 1912*, the *Water Management Act 2000* and the *Water Act 1912* will not operate side by side.

The water licensing provisions of the new *Water Management Act 2000* have also not yet been implemented and it is envisaged that Part 8 of the *Water Act 1912*, under which the *Carroll-Boggabri Floodplain Management Plan* is currently regulated, will continue to operate for some time.

### 2.3 Additional Floodplain Management Controls

There are several additional legislative acts and policies that are relevant to floodplain management and the approval process of flood control works. The majority of these relate to floodplain environmental matters such as flora and fauna, wetlands, threatened species, and fish habitat.

Of particular importance are the *Environmental Planning and Assessment Act 1979* and *Environmental Planning and Assessment Regulation Act 2000*. As the determining authority for flood

control works, DNR is required to assess the environmental impact of proposed works under Part 5 of the *Environmental Protection Act 1979*.

## 2.4 Relevant Management Plans

The *Carroll-Boggabri FMP* should be viewed as one component of the integrated catchment planning process, with other components including:

- State Water Management Outcomes Plan;
- Draft Catchment Blueprint for the Namoi Catchment Management Plan;
- Water Sharing Plan for the Phillips Creek, Mooki River, Quirindi Creek and Warrah Creek Water Sources 2003;
- Water Sharing Plan for the Upper Namoi and Lower Namoi Regulated River Water Sources 2003;
- Liverpool Regional Vegetation Management Plan (draft in preparation);
- Water Sharing Plan for the Upper and Lower Namoi Groundwater Sources 2003 Order.

### 3.0 FLOODPLAIN MANAGEMENT PRINCIPLES

The *Carroll-Boggabri FMP* has been prepared in conjunction with the local community and under the direction of the *Carroll-Boggabri FMC*. The Committee was formed in line with the general principles and policies of the NSW Government's *Floodplain Development Manual (2005)* and its predecessors, the *Floodplain Management Manual (2001)* and the *Floodplain Development Manual (1986)*.

The following set of guiding principles was formulated by the Committee for incorporation into the Floodplain Management Plan:

- Floodplain management should encourage sustainable (social, economic and ecological) management of all natural resources on the floodplain. It should balance the various interests to ensure compatible and ecologically sustainable use of this important resource;
- The Management Plan shall have due regard for government policy and legislation;
- The Management Plan should balance the implications of actions from one generation to another, such that the environment of one generation does not unreasonably gain or suffer from the development decisions or activities of another;
- The Management Plan should formally adopt community-owned strategies to provide a FMP of management for the floodplain;
- Environmental issues related to the rural floodplain management plan need to be identified and investigated. This includes developing strategies for environmentally sensitive areas in order to maintain and improve the diversity of floodplain ecosystems;
- Any system of defined floodways should conform as closely as is reasonable to the natural drainage pattern after taking into account the existing floodplain development. Should the community agree, there may be scope to depart from the natural/historical drainage pattern, provided it is hydraulically, economically and environmentally feasible;
- Defined floodways must possess adequate hydraulic capacity and continuity to enable the orderly passage of floodwaters through the floodplain;
- Floodplain development should not cause significant redistribution of floodwater and allowance should be made to ensure that existing local drainage behaviour is maintained;
- There should be no detrimental impact from floodplain development on any individual landholder or community infrastructure including changes in peak flood levels and changed drainage times;
- The exit of floodwaters from defined floodways should be at rates and depths similar to those which would have been experienced under natural/historical conditions and should discharge as close as practicable to the location of natural/historical floodways;

- Sufficient pondage must be retained on the developed floodplain so that flood peak travel time is not unduly accelerated to downstream areas nor flood height increased;
- Velocities of flood flow in defined floodways should be minimised and be of an order which would not cause erosion or increased siltation under various land uses;
- Storm blow out areas from developed areas must be proportionally aligned to the natural drainage system.

## 4.0 HYDRAULIC ASSESSMENT OVERVIEW

### 4.1 Overview

The *Carroll to Boggabri Flood Study* was completed by SMEC in January 2003. The following information on flood behaviour and historical flooding has been taken from that Study.

The SMEC Flood Study developed the existing computer hydraulic model (MIKE11 v3.1) that had been created by DNR (then *Department of Land and Water Conservation - DLWC*) to address flooding issues in Carroll and Gunnedah themselves. SMEC converted the model to MIKE11 Version 2000, incorporating available rural data including cross sections derived from the Airborne Laser Survey (ALS). Information derived from the computer hydraulic modelling includes flood flow distribution, flood levels and flow velocities for four historical events within the floodplain.

The Airborne Laser Survey (ALS) was also utilised as part of this Study. The flood level results from the model were “draped” over the digital terrain model produced by the survey data to obtain a representation of the depth of flooding across the study area. From this, flowpaths were identified and floodways defined.

Refer to the *Carroll to Boggabri Flood Study* and *Floodplain Management Study* for more detailed information regarding the computer hydraulic modelling, including input data, calibration and flood behaviour results.

### 4.2 Design Flood Event

Following investigation of the historical floods in the study area, and the modelling done by SMEC for the Flood Study (2003), it was determined that no single flood adequately represents the floodway capacity across the whole study area. This is due to a number of factors, including that some critical flowpaths (particularly in the vicinity of the village of Carroll) do not start operating until floods reach approximately a 20 year recurrence interval. In addition, flood behaviour is significantly influenced by not only the magnitude and timing of the contributions of the Namoi and Mooki Rivers, but also the flow behaviour of the Peel River and local storage systems, such as Keepit Dam.

It was therefore determined that in order to account for this scope of flood behaviour, the following combination of criteria should be adopted.

- floodways must have adequate capacity for the 1984 flood,
- floodways must be able to convey 25% of the 1955 flows.

This aims to ensure that landholders can protect crops up to the 15 to 20 year level while flow paths, that only operate in larger events are still left partially open. In many locations these criteria produce very similar results. Refer to Department of Natural Resources (Floodplain Unit – Tamworth Regional Office) for Map indicating Peak Flow 1955 and 1984.

### 4.3 The FMP Floodway Network

The most contentious issue with landholders in the study area is the impacts that flood protection and other structural works on the floodplain may have on the distribution, attenuation and velocity of floodwaters. In order to properly analyse the situation and determine the impacts, clear determination of the natural flow paths for floodwaters across the study area was required. Following this determination, the optimum location for floodways for the existing floodplain topography could more easily be determined.

The method for defining the floodways is described in the *Carroll – Boggabri FMS* and the outcomes are indicated on **Figure 3** (Appendix B) of the FMP. The floodways are designed to allow the orderly passage of the design flood through the floodplain. It should be noted that the floodways have been defined at the strategic level and the accuracy of them at the property level is relatively coarse.

While structural works within the defined floodway areas are not prohibited, it is unlikely they will be approved due to the need to maintain natural flooding patterns to these areas for hydraulic and environmental requirements. Minor works may be approved if it can be demonstrated that they will not adversely affect the requirements of the floodplain and do not contradict the objectives of the FMP.

Works within these areas may be defined as non-complying works and as such, will be subjected to a detailed investigation of potential impacts, as well as the advertisement of the application with potential third party objections sought. Further information about this process is described in Section 9.2.

## 5.0 ENVIRONMENTAL ASSESSMENT

The flow regime of a river helps to shape the river and link it with the floodplain. The *Carroll to Boggabri Floodplain Management Plan* directly influences the floodplain environment through the definition of floodway areas and the restriction of structural works, to ensure that areas of floodplain are not detrimentally excluded from flood flow and inundation. These undertakings will assist in allowing the orderly passage of flood flow through the catchment, improve the inundation and drainage processes of the floodplain and ensure flood dependent ecosystems are sufficiently supported.

**Table 1** provides a summary of the issues addressed in the floodplain environmental section of the *Carroll – Boggabri FMS*. The summary identifies management practices that are incorporated in the FMP and which will assist in improving the overall environmental health of the catchment as well as their anticipated impacts. Refer to *Carroll – Boggabri FMS* for more detail on each of the below issues.

**Table 1:** Environmental Assessment Summary

Issue	Anticipated Impacts of Carroll-Boggabri FMP
<b>Soils</b>	<p>By restricting structural works on the floodplain, flood flow through the catchment will be maintained, as well as ensuring that inundation and drainage of the soils occur. The inundation of the floodplain will replenish the soils with new sediments, nutrients and moisture, which will in turn improve soil structure and reduce problems such as shrinkage, cracking and waterlogging.</p> <p>By maintaining defined floodway areas, the orderly passage of the flood flow will be assured, which will help improve velocity and flow concentration conditions and reduce the potential for scour and erosion.</p>
<b>Vegetation</b>	<p>It is recommended that landholders maintain adequate buffer zones along significant waterway channels to help reduce weed infestation encourage native vegetation growth and minimise land degradation.</p> <p>The identification of designated floodway areas will improve flood inundation and drainage processes, which will assist in improving the overall health of native vegetation stands in the study area.</p>
<b>Wetlands</b>	<p>Designated floodway areas will ensure that flood flow is maintained across the study area, which will assist in improving the productivity and biodiversity of the lagoons and wetland areas (<b>Figure 2</b>).</p>
<b>Cultural Heritage</b>	<p>The FMP will bring to the local community's attention the importance of sites and artefacts of Aboriginal significance and that anyone who knowingly destroys them can be prosecuted.</p>
<b>Fauna</b>	<p>The maintenance of the flood regime across the study area will help improve the quality and quantity of native vegetation and wetland areas. In turn, the habitats of fauna within the study area, particularly that of threatened species such as the koalas, will be improved in terms of quality and availability.</p> <p>Maintaining a defined floodway network will improve connectivity between the floodplain and the river to ensure that fish can access the floodplain during flood events.</p>

<b>Issue</b>	<b>Anticipated Impacts of Carroll-Boggabri FMP</b>
<b>Water Quality</b>	<p>As discussed above, the orderly passage of flood flow across the floodplain will reduce the potential for scour and erosion, which will assist in minimising sedimentation and water turbidity.</p> <p>The encouragement of best management practices in relation to pesticides and other chemical usages will also assist in improving the overall water quality of the area.</p>
<b>Groundwater</b>	<p>The objective of the FMP is to conform as closely as possible to the natural processes of the floodplain. The achievement of this objective will increase the likelihood of groundwater recharge areas being inundated during flood times. The improved flood inundation processes will also benefit areas prone to shallow water tables and hence to salinity issues.</p>

## 6.0 FLOODPLAIN MANAGEMENT FMP – ACTIONS

The key actions to be implemented as part of the FMP are categorised and shown in **Table 2 & Table 3**. The priorities have been assigned based on discussion with the *Carroll – Boggabri FMC* and the majority of these actions require an ongoing or long-term timeframe to complete, however the implementation of each may begin immediately.

### 6.1 Timetable

The timetable assigned to the works detailed in **Table 2 & Table 3** was determined with the assistance of the *Carroll – Boggabri FMC*. The following should be noted with regard to the timeframes identified:

- **Immediate** – work that needs to be carried out immediately after the FMP being signed off by the Minister.
- **12 months** - work that needs to be undertaken within 12 months of the FMP being signed off by the Minister. They include works that should be undertaken in order to rectify existing problems prior to the next significant flood event.
- **6 months** – work that needs to be undertaken within 6 months of the FMP being signed off by the Minister. While they are considered less critical and require minor works, they are still significant in terms of the effective floodplain functioning.
- **Ongoing** – Continuous work that needs to be undertaken after the FMP having been signed off by the Minister. While they are considered less critical and require minor works, they are still significant in terms of the effective floodplain functioning.

**Table 2:** Floodplain Management FMP Actions

Issue	Action	Priority	Timing	Responsibility	Performance Indicators
<b>Education</b>	<ul style="list-style-type: none"> <li>Improve community awareness of the requirements for obtaining permission to build structural works on the floodplain</li> </ul>	High	6 months	Committee/DNR	<ul style="list-style-type: none"> <li>a successful, functioning floodplain works approval process</li> <li>improved landholder understanding of the works approval process</li> </ul>
	<ul style="list-style-type: none"> <li>Improve individual landholders awareness of the implications of any alteration to the natural surface in relation to impacts on flood flow</li> </ul>	High	6 months	Committee/DNR	
<b>Land Management</b>	<ul style="list-style-type: none"> <li>Maintain fence lines to prevent the build up of vegetation and soil.</li> </ul>	High	6 months	Landholders	<ul style="list-style-type: none"> <li>no increase in fences</li> <li>remnant netting fences removed</li> <li>minimised debris buildup on floodplain</li> <li>minimised ponding of water on floodplain</li> </ul>
	<ul style="list-style-type: none"> <li>Avoid concentration of flow by fence lines. Remove non-essential fences from the floodplain. Where possible netting fences should be removed, and replaced with wire fences.</li> </ul>	Medium	12 months	Landholders	
	<ul style="list-style-type: none"> <li>Minimise the build-up of debris on the floodplain as much as possible</li> </ul>	Medium	ongoing	Landholders	
<b>Farming Practice</b>	<ul style="list-style-type: none"> <li>Continue to encourage the use of minimum/zero till and downhill farming, or “technology that is appropriate to the conditions”.</li> </ul>	High	ongoing	Landholders	<ul style="list-style-type: none"> <li>decreased working of soil</li> <li>minimised debris buildup on floodplain</li> <li>increased groundcover on floodplain</li> </ul>
	<ul style="list-style-type: none"> <li>Increase ground cover where possible.</li> </ul>	Medium	12 months	Landholders	
	<ul style="list-style-type: none"> <li>Encourage management practices that reduce the mobility / size of stubble.</li> </ul>	Medium	12 months	Landholders	
<b>Infrastructure</b>	<ul style="list-style-type: none"> <li>Implement development criteria to ensure that structural works on the floodplain are built in ways to minimise the impact they have on flood flows, height and redistribution</li> </ul>	High	Immediate	DNR	<ul style="list-style-type: none"> <li>Clear and easy to follow floodplain works application and approval process</li> </ul>
	<ul style="list-style-type: none"> <li>Recognise that landholders can protect those parts of their property that contain high value infrastructure such as houses, workshops, sheds and pumps and implement appropriate criteria for this purpose.</li> </ul>	High	Immediate	DNR	
	<ul style="list-style-type: none"> <li>Council to ensure a regular maintenance program is implemented for road drainage systems.</li> </ul>	Medium	12 months/ongoing	Council	<ul style="list-style-type: none"> <li>successful management of culvert and table drain blockages</li> </ul>
<b>Riparian Areas</b>	<ul style="list-style-type: none"> <li>Decrease the disturbance to creek and river banks in non-flood times.</li> </ul>	High	ongoing	Landholders	<ul style="list-style-type: none"> <li>decreased bank erosion</li> <li>well established riparian areas</li> </ul>
	<ul style="list-style-type: none"> <li>Establish riparian buffer areas.</li> </ul>	Medium	12 months	Landholders	
	<ul style="list-style-type: none"> <li>Stabilise creek banks by artificial means in areas that are dangerous or place permanent infrastructure at risk.</li> </ul>	Medium	12 months	Landholders	

**Table 3:** Pending Part 8 Applications – Recommendations (refer to **Figure 4:** Appendix B)

Issue	Action	Priority	Timing	Responsibility	Performance Indicators
<b>Calrossi -</b> 90CW810824	<ul style="list-style-type: none"> <li>Approve with conditions and compliance assurance</li> </ul>	High	6 months	DNR	
<b>Calrossi - East/West Floodway (2004)</b>	<ul style="list-style-type: none"> <li>Do not approve in current form</li> </ul>	High	n/a	DNR	
<b>Milchengowrie South -</b> 90CW800292	<ul style="list-style-type: none"> <li>Ensure compliance is maintained and the floodway in the north-east corner of the property is kept clear as detailed on Part 8 Licence.</li> </ul>	High	6 months	DNR	
<b>Dialyn -</b> 90CW801407	<ul style="list-style-type: none"> <li>Approve with modifications (if application still current)</li> </ul>	High	6 months	DNR	
<b>Frogmore Park -</b> 90CW810909	<ul style="list-style-type: none"> <li>Approve</li> </ul>	High	6 months	DNR	
<b>Frogmore South -</b> 90CW810748	<ul style="list-style-type: none"> <li>Review application with respect to Ruvigne application (90CW801381)</li> </ul>	High	n/a	DNR	<ul style="list-style-type: none"> <li>Require further information pending resolution of dispute discussion currently underway between landholder and DNR as at 10/04/05</li> </ul>
<b>Ruvigne -</b> 90CW801381	<ul style="list-style-type: none"> <li>Review application with respect to Frogmore South application (90CW810748)</li> </ul>	High	n/a	DNR	
<b>Ruvigne -</b> 90CW810653	<ul style="list-style-type: none"> <li>Approve if compliant with FMP criteria</li> </ul>	High	n/a	DNR	
<b>Nayla</b> 90CW810603	<ul style="list-style-type: none"> <li>Further discussions required prior to approval with regards to local drainage issues particularly discussions with immediate neighbours'</li> </ul>	High	6 months	Landholder	
<b>Gunnible</b>	<ul style="list-style-type: none"> <li>Plant orange trees taking into regard recommended measures</li> </ul>	High	n/a	Landholder	

## 7.0 RELATED MANAGEMENT ISSUES

### 7.1 FMP Review

Any Floodplain Management Plan adopted by the Minister under the *Water Management Act 2000* is required to be reviewed at 5 yearly intervals in order to determine whether their provisions adequately implement the water management principles of the Act. We also recommend a review of the FMP after any event close to or exceeding the design flood.

### 7.2 Best Management Practices

Best management practices can be implemented across the floodplain to assist in minimising the negative impacts of flooding, soil erosion and poor water quality. These practices include:

- increase vegetation cover wherever possible, particularly around environmentally sensitive and erosion risk areas;
- undertake conservation farming practices for cultivated areas;
- landholders should be aware of and implement best management practices in relation to the use of pesticides and other chemicals, particularly in relation to drift zones when spraying.

### 7.3 Riparian Buffer Zones

A riparian zone is a zone of variable width on either side of the flow channel, as indicated on **Figure 2** (Appendix B). In this case, the setback would ensure that no farming or grazing is undertaken, except in the form of managed grazing. It is recommended in the Management Study that a riparian buffer zone be established and maintained along the main water courses to help maintain the integrity of the banks and the general health of the creeks and the adjacent cultivated land.

The *Rivers and Foreshores Improvement Act 1948* (which may carry over to the *Water Management Act 2000*) allows for the protection of riparian zones and is the appropriate mechanism for active management to restore these areas. The Carroll – Boggabri FMP complements the Plan by enabling flood connectivity to these areas.

Landholders will benefit from maintaining adequate buffer zones in terms of improving water quality, as well as minimising land degradation and restoration expenses. For information regarding the *Rivers Foreshores Improvement Act 1948* contact your local DNR office.

## 8.0 FMP IMPLEMENTATION

### 8.1 General

The *Carroll – Boggabri FMC* considers that a coordinated approach to the implementation of the FMP will allow the hydraulic and environmental benefits of the recommendations to be maximised throughout the catchment. Landholders are encouraged to undertake appropriate landuse management practises and undertake the required modifications to proposed and existing works as detailed in **Table 2**.

The community is encouraged to implement those parts of the FMP that require changes as soon as practicable. Adjoining landholders are also encouraged to carry out any works or actions together to avoid an isolated and piecemeal approach to the management of the floodplain.

### 8.2 Responsibility

The following stakeholders have direct or indirect roles in the implementation of the FMP:

#### ***Landholders***

The landholders will be the major beneficiaries of a successful implementation of the Floodplain Management Plan and accordingly, many of the actions to be executed as part of the FMP are the responsibility of individual landholders. The FMP recognises, however, that often the beneficiary of individual activities are downstream of the action and it is for this reason that the FMP must be accepted and implemented with a whole catchment/community mind set.

#### ***Carroll – Boggabri Floodplain Management Committee***

The *Carroll-Boggabri Floodplain Management Committee* has an advisory role in the implementation of the FMP. The Committee is also responsible for communicating the FMP to the community, ensuring that the objectives, required actions and anticipated outcomes are clear and understood by all individual landholders.

#### ***Department of Natural Resources***

DNR has an ongoing role to foster the sustainable management of floodplains in NSW and as such has an ongoing role to assist the community with the implementation and approval of work under this FMP. It is also the responsibility of DNR to provide technical advice and support, as well as processing and approving all applications for flood control works under Part 8 of the *Water Act 1912*.

#### ***Council***

Council has a responsibility to ensure that roadworks and other public infrastructure are built and maintained in accordance with the objectives of the FMP and principles of the *Floodplain Development Manual (2005)*. The majority of the study area falls under Gunnedah Shire Council; however there is a small area in the north of the catchment which is within the Narrabri Shire.

## 8.3 Approval of Flood Control Works

This section deals with the process and requirements when applying for work to be undertaken on the floodplain. Works referred to as flood control works are defined under the *Water Act 1912* as 'controlled works' and include earthworks, embankments, levees, access roads, irrigation channels and dams. This FMP relates to control works within the Gazetted floodplain.

This section deals with five major aspects of the controlled works approval process on the floodplain. These are:

- the works that require approval;
- the application process;
- the determination process (undertaken by DNR);
- how to maintain compliance; and
- the general criteria for approval of works (in addition to the FMP).

### 8.3.1 Works that Require Approval

Controlled works require approval under the *Water Act 1912* and are defined as:

- An earthwork, embankment or levee that is situated, or proposed to be constructed on land that:
  - is, or forms part of, the bank of a river or lake; or is within a floodplain; or
- Any work that is situated, or proposed to be constructed, on land that:
  - is, or forms part of, the bank of a river or lake; or is within a floodplain; and
  - is declared by order of the Ministerial Corporation published in the Gazette to be a controlled work;
- An earthwork, embankment or levee, wherever situated or proposed to be constructed that:
  - affects, or is reasonably likely to affect, the flow of water to or from a river or lake; and
  - is used or is to be used for, or has the effect or likely effect of, preventing land from being flooded by water; or
- Any work, wherever situated or proposed to be constructed, that:
  - affects or is reasonably likely to affect the flow of water to or from a river or lake;
  - is used or is to be used, or has the effect or likely effect of, preventing land from being flooded by water; and
  - is declared by order of the Ministerial Corporation published in the Gazette to be a controlled work.

It should be noted that the amended Act has expanded the location of works that need to be licensed, including works which affect the flow of floodwater to or from a river. Therefore works situated or proposed some distance away from a river, which are in the path of floodwaters will need to be licensed. While controlled works include earthworks, embankments and levees, these works could also include access roads, farm storage, irrigation channels and dams. Landholders should therefore contact their local DNR office for clarification in the first instance.

### 8.3.2 Applying for Approval

The following is an outline of the steps required by an applicant when applying for approval of a flood control work on the floodplain:

- Step 1 - Obtain an application form.
- Step 2 - Discuss your proposal with neighbouring landholders to gauge their concerns.
- Step 3 - Contact a DNR Floodplain Licensing Officer to arrange a site inspection, discuss the application and get advice on the information required for the approval process.
- Step 4 - Gather supporting information, including the information contained in this Floodplain Management Plan. Your application may require you to supply detailed technical information and assessment. This should be determined early in the preparation of the application.
- Step 5 - Fill in an application form. Complete additional information requirements on the form including condition of the existing environment, vegetation, streams and soil.
- Step 6 - Lodge the application form, with the supporting information and application fee, at your local DNR office.

### 8.3.3 Determination Process

All applicants for works under Part 8 of the *Water Act 1912* must proceed through a set process prior to DNR determining the application under Section 171 of the Act. This process includes (but is not limited to):

#### ***Section 166C of the Water Act 1912***

DNR must have regard to the matters for general consideration outlined in Section 166C including:

- The contents of any relevant FMP or any other relevant Government policy;
- The need to maintain the natural flood regimes in wetlands and related ecosystems and the preservation of any habitat animals (including fish) or plants that benefit from periodic flooding;
- The effect or likely effect on water flows in downstream river sections;
- Any geographical features, or other matters of Aboriginal interest that may be affected by a controlled work;
- The effect or likely effect of a controlled work on existing dominant floodways or exits from floodways, rates of flow, flood water levels and the duration of inundation;
- The effect or likely effect of a controlled work on the passage flow and distribution of flood waters;
- The protection of the environment; and
- Any other matters relating to the desirability or otherwise of a controlled work.

### ***Floodplain Management Plan***

DNR must consider the *Carroll-Boggabri FMP* and information contained within, including principles, assessment criteria and any other recommendations.

### ***Part 5 of the Environmental Planning and Assessment Act 1979***

All proposals must undergo assessment under Part 5 of the EP&A Act. The factors to be considered include (but are not limited to):

- Any environmental impact on a community;
- Any environmental impact on the ecosystem of a locality;
- Any reduction of the aesthetic, recreational, scientific or other environmental quality or value of a locality;
- Any impact on the habitat of protected fauna;
- Any endangering of any species of animal, plant, or other form of life, whether living on land, in water or in the air;
- Any degradation of the quality of the environment;
- Any reduction in the range of beneficial uses of the environment; and
- Any cumulative environmental effect with other existing or likely future activities.

### ***Additional Information***

DNR must consider any investigation information that has been provided by the applicant.

### ***Possible Determinations***

DNR will inform the applicant at the earliest opportunity of the determination of an application for a work. Under the *Water Act 1912*, there are three (3) possible determinations:

- approval of the application;
- approval of the application subject to conditions; and
- refusal of the application.

There are provisions with the *Water Act 1912* for a corporation or individual to object to the granting of a flood control work if their interest(s) may be affected by the approval. There are also provisions for an applicant and/or objector to appeal against the determination to the Land and Environment Court. Refer to the *Water Act 1912* for further details regarding these matters.

### **8.3.4 Maintaining Compliance**

The amended *Water Act 1912* strengthened DNR's ability to deal with unauthorised works. Under Part 8 of the Act, it is a prosecutable offence to:

- construct a flood control work other than in accordance with an approval that is in force; or
- fail to comply with the conditions of an approval.

Where prosecution is not considered necessary, DNR has the following options:

- to issue a stop work order where a person is engaging in any activity that is an offence under Part 8; or
- to apply to the Land and Environment Court for an injunction restraining a threatened or apprehended offence or the continuation of an offence.

By way of a notice served on the occupier of the land, DNR can require the occupier to carry out work for the purpose of removing, modifying, repairing or rendering ineffectual any unauthorised controlled work. In addition, DNR can require the occupier to carry out other work of a remedial nature, such as work to correct or restore any alterations caused to water flow by the unauthorised controlled work.

If an occupier fails to comply with such a requirement, DNR can carry out the work and recover the expenses incurred from the occupier or from the person who constructed the controlled work in contravention to Part 8. However, a person distressed by such a decision is able to appeal against the decision to the Land and Environment Court.

## 8.4 Assessment Criteria for Flood Control Works on the Floodplain

This section provides a guide to the expectations of DNR when assessing future works. The following criteria are general assessment criteria in addition to the specific criteria listed in the FMP as determined by the Floodplain Management Committee.

### 8.4.1 History (*for existing flood control works only*)

- **Complying Works** - works that comply with the existing guidelines (that is, this FMP) will normally be accepted, unless additional information and/or flood observations illustrate that the works may have a significant adverse impact on flood flows.
- **Concerns and Objections** - any on-going concerns and/or objections from neighbouring landholders must be taken into consideration during the assessment process.

### 8.4.2 Socio-economic

- **Disruption to Daily Life** - unless previously agreed between all affected landholders, works should not result in significant disruption to the daily life of surrounding land holders (for example property access).
- **Health Impact** - works should not impose negative health impacts or stress on surrounding landholders.
- **Cost of the Works** - is the associated cost and benefit(s) of undertaking the work(s) warranted? In some cases it may be necessary to undertake a cost/benefit analysis (a preliminary assessment may be adequate) in order to weigh up the hydraulic and/or environmental benefit(s) of undertaking the work(s) against the required expenditure. This must be determined through consultation with the affected stakeholders and DNR.

- **Infrastructure Damage** - works should not pose any detrimental impact on community infrastructure including increases in peak flood levels and drainage times.
- **Equity** - previous agreements between landholders regarding floodways should hold when a new landholder buys in. That is the onus is on the new landholder (the 'buyer beware' principle). This is a legal issue and not one that the FMP attempts to cover, however it is strongly suggested that written proof regarding these agreements be kept in case a legal issue arises.

#### 8.4.3 Ecological

- **Floodplain Flora and Fauna** - works should not isolate flood dependent stands of vegetation from flood flow. The potential impact on habitat availability and threatened species may need to be assessed.
- **Soil Condition and Structure** - works should not impose negative impacts on soil structure or condition. For example, works should not increase the potential for scour or erosion and should not block flow to significant areas of floodplain soils.
- **Fish Passage** - works should not significantly block or restrict the free passage and migration of fish within the floodplain environment.
- **Cultural Sites** - unless an agreement has been reached with the National Parks and Wildlife Service and the local Aboriginal Lands Council, works should not destroy or damage any Aboriginal site or relic and should not block or restrict the delivery of flood flows to sacred and carved trees that rely on flooding regimes.
- **Groundwater Recharge** - works should not block or restrict flood flow to identified groundwater recharge areas.

#### 8.4.4 Flooding Behaviour

- **Natural Flooding Characteristics** - works should not result in a significant departure from the natural flooding or drainage pattern of the floodplain (after taking into account the existing floodplain development).
- **Hydraulic Capacity** - works should not reduce the hydraulic capacity and continuity of floodway areas (should enable the orderly passage of floodwaters through the floodplain).
- **Pondage and Flow Duration** - works should not significantly impact on pondage duration on the developed floodplain or cause flood peak travel time to unduly accelerate to downstream users.
- **Redistribution** - acceptable increases in flood heights and percentage redistribution of peak flood discharges, as a result of structural works on the floodplain, should be assessed against the conditions given for complying works in Section 9 of this *Floodplain Management Plan*. Applications for works that do not meet the requirements will be considered as non-complying works and must be subject to the more detailed Part 8 approval process.

- Flow Velocities** – flood control works should not significantly increase velocities of flood flow in areas flooded by the design flood. Velocities should be of an order that does not significantly increase erosion and siltation under various land uses. **Table 4** indicates the maximum permissible velocity determined by the Committee. It should be noted however that the Flood Study shows that in the majority of the floodplain, the velocity of flood flow is already greater than that which will cause significant erosion.

**Table 4:** Maximum Permissible Velocity per Ground Conditions

Ground Conditions	Maximum Permissible Velocity (m/s)
Crop	0.6
Bare Soil	0.4
Native Grass	0.8

## 9.0 COMPLYING and NON-COMPLYING WORKS

As detailed in Section 8, all applications for flood control works will be processed by DNR under Part 8 of the *Water Act 1912* and will be assessed as either complying or non-complying works with regard to the *Carroll-Boggabri Floodplain Management Plan*. Regardless of whether a proposed work is complying or non-complying, an application for approval under Part 8 is required and the determination process outlined in Section 8.3.3 must be undertaken.

### 9.1 Requirements for Complying Works

Work that meets the following technical requirements outlined in **Table 4**, are considered to be complying with the intent of the FMP. This would include the construction or modification of flood mitigation levees, roads, irrigation headwalls and any other structures or earthworks. For further information on the development of these criteria refer to the *Carroll to Boggabri Floodplain Management Study*.

**Table 5:** Complying Works Criteria

<b><u>Complying Works Criteria</u></b>	
Maximum average height of structural works (levees, ditches etc)	<ul style="list-style-type: none"> <li>• 0.5 m above ground level</li> <li>• 10% structure can exceed average maximum height</li> <li>• works constructed parallel to flow are preferred</li> </ul>
Set back of structures from boundaries	<ul style="list-style-type: none"> <li>• General = 5 m + 1 in 4 batter criteria</li> <li>• High Value = 100 m from adjoining property (with existing property exemptions)</li> </ul>
Designated floodways	<ul style="list-style-type: none"> <li>• No structures</li> <li>• 'any cropping must be compatible with assumed Manning's 'n' conditions for the floodways'</li> </ul>
Maximum Impact on Adjacent Properties	<ul style="list-style-type: none"> <li>• 100 mm</li> <li>• 'drainage to be within 24 hours of natural/existing drainage time'</li> </ul>
Maximum amount of land where structures exclude floodwaters (as of date of FMP)	<ul style="list-style-type: none"> <li>• Minimum of 20% of property must be kept clear with drainage paths maintained</li> <li>• High Value (house etc)</li> <li>• Lots &lt; 20ha = 10%</li> <li>• Lots &gt; 20 ha = 2 ha or 1% (whichever greater)</li> <li>• Any obstruction or development in flowpaths must comply with other complying works criteria</li> </ul>
Maximum velocity in floodways	<ul style="list-style-type: none"> <li>• Maximum 50% increase to 0.5m/s</li> </ul>
Acceptable amount of redistribution/attenuation	<ul style="list-style-type: none"> <li>• Maximum 10% cumulative and 5% individual redistribution of flows onto adjacent property</li> </ul>

### 9.1.1 Existing Works

All areas of the floodplain have been examined and the existing works assessed.

A number of areas were identified as 'hotspots' by the community (FMC). These were individually assessed as part of the Study. These areas were:

#### **Dead Mans Gully**

Any proposed construction of floodways through the Dead Mans Gully area should be in accordance with the guidelines outlined in the FMP to ensure that natural flow volumes are maintained through any individual property.

Any future works will need to be individually investigated, including computer hydraulic modelling that demonstrates a maximum impact of 100 mm or less on neighbouring properties.

#### **'Longacres' Irrigation Channel**

Monitoring and assessment of the 'Longacres' irrigation channel to confirm maximum impact of the finished structure.

#### **Native Revegetation**

Any native species revegetation program should ensure that the planting of stands of trees or other vegetation should not block allocated floodways or cause significant impact to the redistribution of flood flow.

In addition, a number of pending Part 8 Licence applications was investigated. A detailed description of these assessments is included in the *Carroll-Boggabri Floodplain Management Study* and the recommended actions summarised in **Table 3** of the FMP.

## 9.2 Non-Complying Works

An application for a work will be deemed as non-complying if DNR is not satisfied that the work is in accordance with the principles of the FMP. Non-complying works may be approved after a detailed investigation of the hydraulic, environmental, social and economic impacts of the proposal. It is the applicant's responsibility to organise and pay a suitably qualified consultant to undertake the investigation. DNR will provide direction and guidance for the selection of a suitable consultant. The criteria for assessing flood control works are included in Section 8.4. Where the requested supporting information is not furnished, DNR can refuse to deal with the application.

Applications for non-complying works must be advertised and third party objections sought prior to the determination of the application. If an objection is received that cannot be resolved, compulsory mediation will be required. DNR may request additional supporting information from the party who lodged the objection and failure to provide such information may result in the objection being rejected.

A number of guidelines have been established by the Committee to assist DNR in the determination of applications. Unacceptable impacts of non-complying works are:

- more than a 10% cumulative and 5% individual increase of flows onto other landholders property (for the design flood);
- an increase in flood level of more than 100 mm on other landholders property;

- more than a negligible (10 mm) increase in flood level on any house dwelling;
- more than 50% increase for velocities up to 0.5 m/s.

### 9.3 Roads and Railways

Roads and Railways (and associated bridges, road works and railway works) vested in Local or State Government transport agencies are prescribed works under Part 8 of the *Water Act 1912* and the regulations of the *Water Management Act 2000*. While these works do not require an approval under these pieces of legislation, agencies are required to assess the impacts of these works under the *Environmental Planning and Assessment Act 1979*.

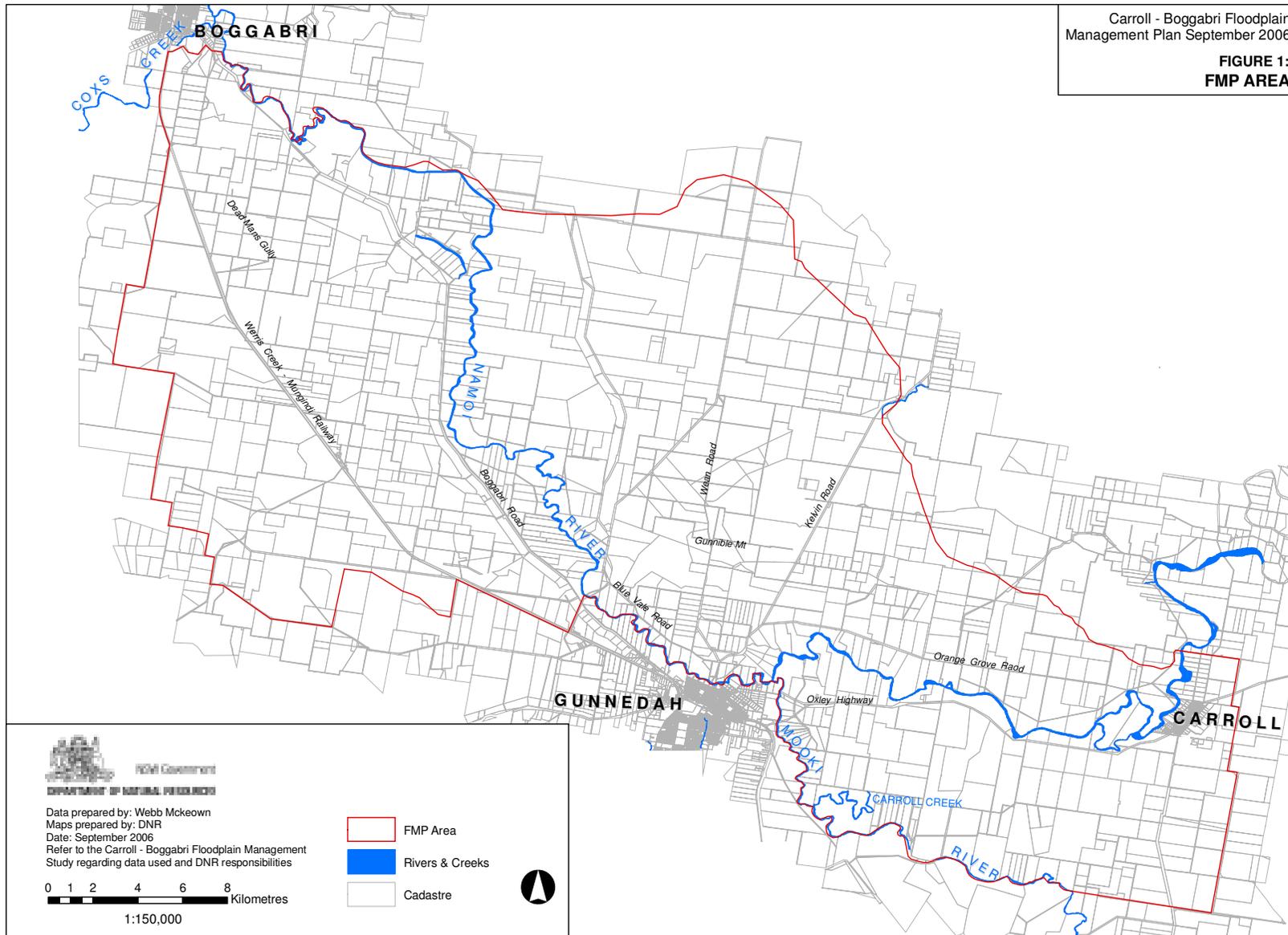
## 10.0 APPENDICES

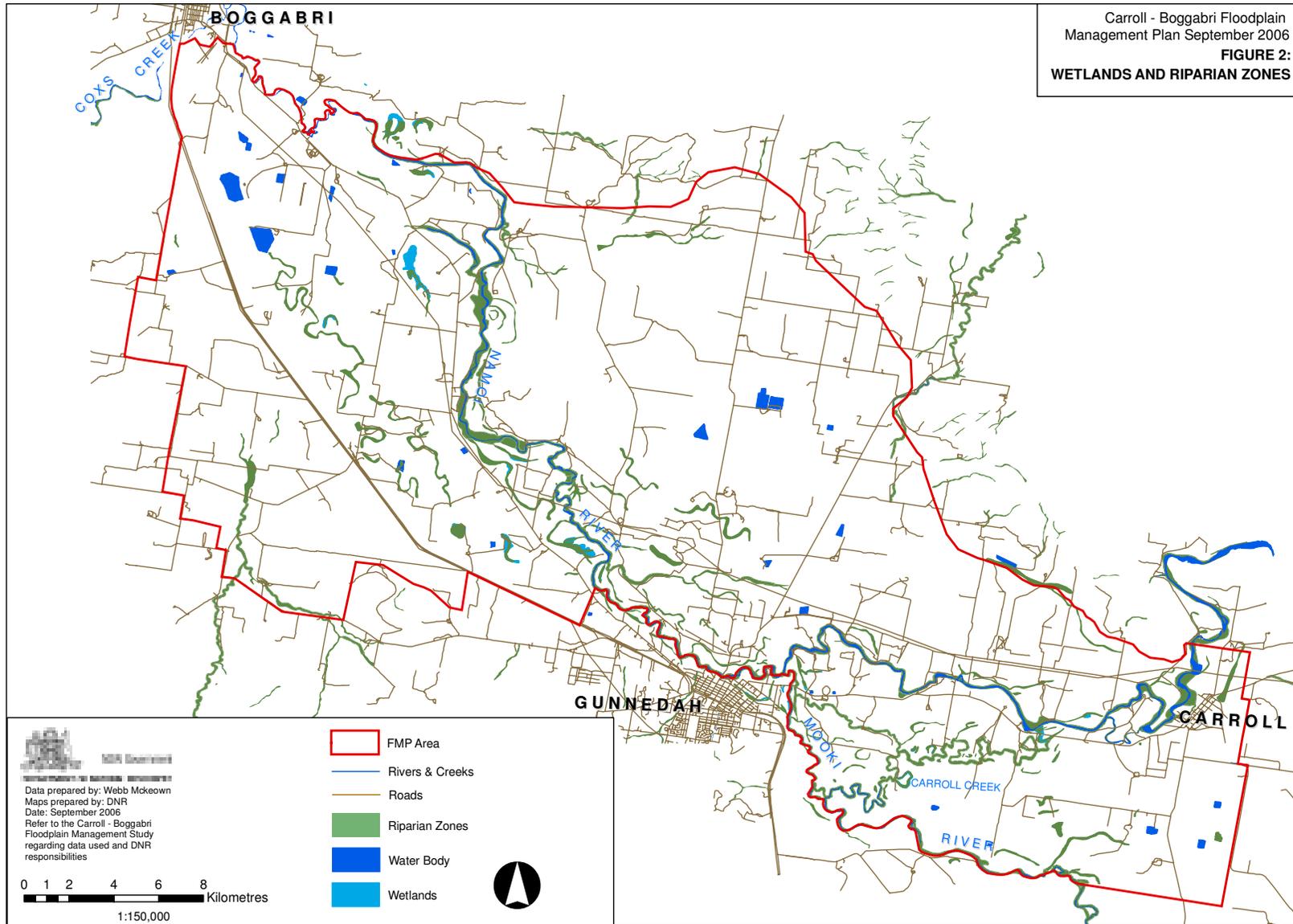
### APPENDIX A – GLOSSARY AND ABBREVIATIONS

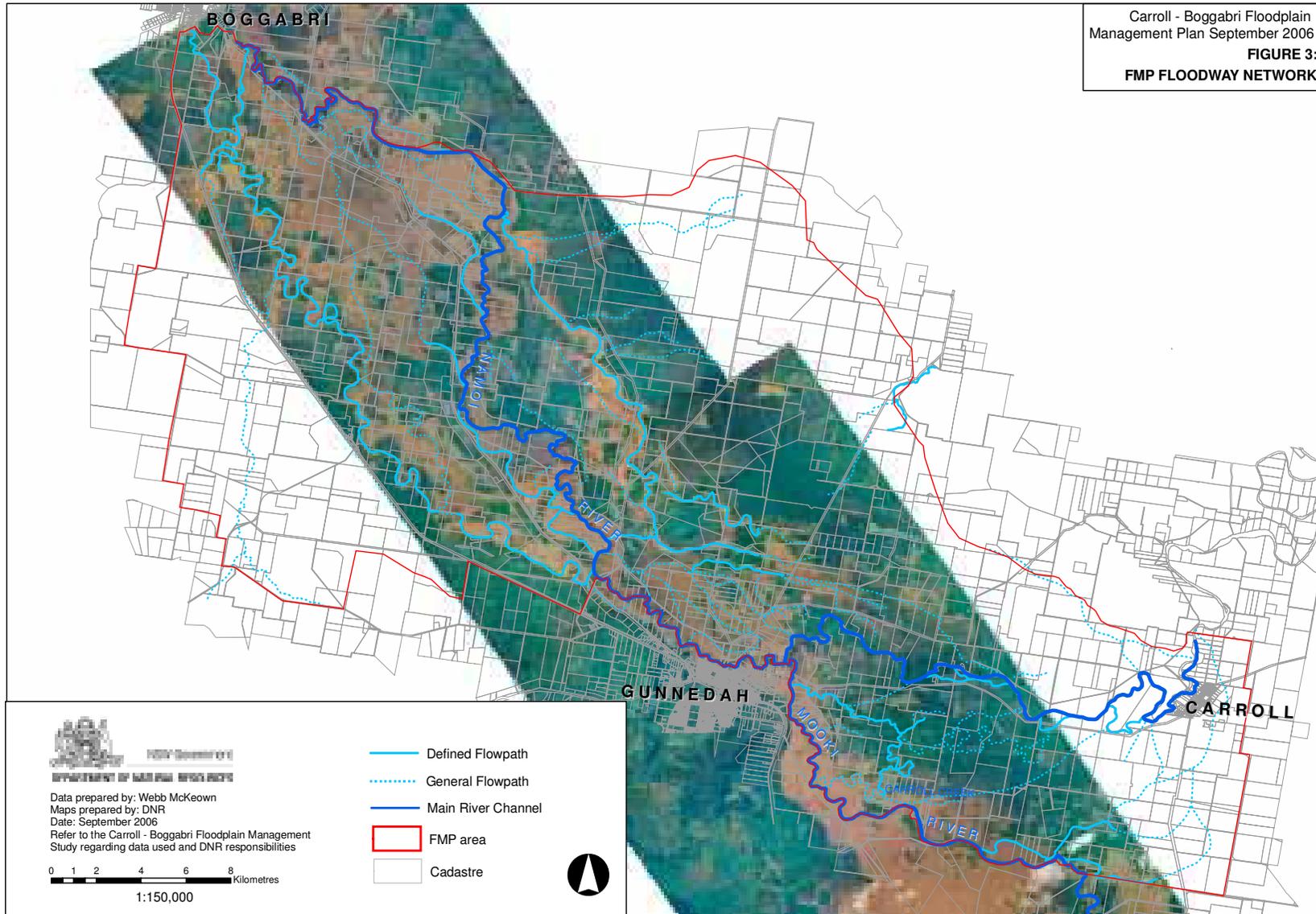
GLOSSARY	
Term	Definition
Annual Exceedance Probability	The chance of a flood of a given or larger size occurring in any one year, usually expressed as a percentage (%). For example, a flood with an AEP of 5% means there is a 5% chance that a flood of same size or larger will occur in any one year
Annual Recurrence Interval	The long-term average number of years between the occurrence of a flood as big as or larger than, the selected event. For example, floods with a discharge great as, or greater than, the 20 year ARI flood event will occur on average once every 20 years
Calibration	The process by which a hydrologic or hydraulic model is adjusted so that it best represents the real world situation that the model is intended to simulate
Cross-Section	A section survey that describes/illustrates the shape of a section of land or waterway.
Cumecs	An abbreviation for cubic metres per second (m <sup>3</sup> /s)
Design Event	The flood event adopted as the basis for planning and controlling development
Discharge	The rate of flow of water measured in terms of volume per unit time, cumecs
Flood	Relatively high stream flow when water overtops the natural or artificial banks or a stream and spreads over adjoining land
Flood control works	Works referred to as flood control works are defined under the <i>Water Act 1912</i> as 'controlled works'. Controlled works require approval under the Act and are defined in Section 11.4.2 of the FMP.
Flood Hazard/Risk	Potential for damage to property or persons due to flooding
Floodplain	The portion of a river valley, adjacent to the river channel, which is covered with water when the river floods. It includes the area inundated by all floods up to the probable maximum flood. Where floodplain is referred to under the <i>Water Act</i> it means 'Designated Floodplain' which has been legally licensed.
Floodways	Those areas where a significant volume of water flows during floods. They are often aligned with obvious naturally defined channels. Floodways are areas which, even if partially blocked would cause a significant redistribution of flood flow and are often areas of deeper flow or higher velocities
Hydraulics	Term given to the study of water flow in waterways
Management Plan	A document including, as appropriate, both written and diagrammatic information describing how a particular area of land is to be used and managed to achieve defined objectives
Peak Discharge	The maximum discharge occurring during a flood event
Runoff	The amount of precipitation which ends up as streamflow
Unsteady Flow	Flow type that occurs when discharge and depth vary with time

ABBREVIATIONS	
Abbreviation	Definition
AEP	Annual Exceedance Probability
AHD	Australian Height Datum
ARI	Annual Recurrence Interval
DNR	Department of Natural Resources
FMC	Floodplain Management Committee
FMP	Floodplain Management Plan
FMS	Floodplain Management Study
LGA	Local Government Area
NHT	Natural Heritage Trust
WAMC	Water Administration Ministerial Corporation

## APPENDIX B – FIGURES 1 – 4







Carroll - Boggabri Floodplain Management Plan September 2006  
**FIGURE 3:**  
**FMP FLOODWAY NETWORK**



Data prepared by: Webb McKeown  
 Maps prepared by: DNR  
 Date: September 2006  
 Refer to the Carroll - Boggabri Floodplain Management Study regarding data used and DNR responsibilities

0 1 2 4 6 8 Kilometres  
 1:150,000

- Defined Flowpath
- ⋯ General Flowpath
- Main River Channel
- FMP area
- Cadastre



