Lower Gingham Watercourse Floodplain Management Plan

June 2006
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PREAMBLE

The Lower Gingham Watercourse Floodplain Management Plan (hereafter the Lower Gingham Watercourse FMP) has been prepared by the Water Administration Ministerial Corporation (hereafter WAMC) under Part 8 of the Water Act 1912 in conjunction with the local community. The Natural Heritage Trust (NHT) and the NSW Government provided funding for the project.

Please note, that the Department of Natural Resources (hereafter DNR) acts on behalf of WAMC for all matters relating to Part 8 of the Water Act 1912. WAMC is the body who prepares, adopts and administers FMPs, as well as receives and determines Part 8 applications. It is WAMC, not DNR that administers the Act and makes decisions under the Act.

The Lower Gingham Watercourse floodplain forms part of the Lower Gwydir Wetlands, a significant natural resource that traditionally is very important to Aboriginal Kamilaroi people long before the arrival of Europeans. More recently the wetlands supported a highly productive grazing industry. Since the construction of Copeton dam in 1976 landuse in the region has changed from predominantly grazing to include development of farming and irrigation operations. Consequently recent flooding in the region has triggered the uncoordinated construction of unapproved crop protection works. The study area contains two Ramsar Wetlands areas, indicating the international significance of the region. The potential impact of these land management changes on the long-term sustainability of the Gwydir Wetlands necessitates a strategic planning approach, involving a range of stakeholders from the region.

DNR has initiated the development of an integrated multi faceted Water Management Plan for the Gwydir Wetlands. The Water Management Plan for the Gwydir Wetlands (under Part 3 Water Management Act 2000) aims to improve management of issues affecting environmental health, including management of wetlands, surrounding vegetation and water resources in respect to the equitable resource sharing of water. It will establish clear conservation priorities and reduced social tension between landholders (irrigators and graziers) over water sharing and use. The Lower Gingham Watercourse FMP will be one component of the proposed Water Management Plan, focussing on flooding patterns and how infrastructure, bank construction and land use may affect these patterns. The FMP will be autonomous in its analysis of flood flows and how they are affected by land management and flood control works, but will be integrated within the Gwydir Wetlands Water Management Plan.

The Lower Gingham Watercourse FMP has been prepared in accordance with processes outlined in the NSW Government’s Floodplain Management Manual (2001), and its predecessor the 1986 Floodplain Development Manual. The preparation of the FMP was overseen by the Lower Gingham Floodplain Management Committee (hereafter the Lower Gingham Watercourse FMC), which comprises representatives from the community, various stakeholder groups and government agencies.

The FMP aims to minimise the flood risk faced by occupiers of the floodplain and to support the natural functions of the floodplain environment by providing a framework to improve the current drainage of the floodplain system and resolve landuse management issues. The FMP ensures due regard for government policy and legislation, including no significant impact on Ramsar Wetlands. Implementation of the plan will provide the community with greater security against flood risk and will allow for the sustainable management of flood-dependent ecosystems.

Development of the Lower Gingham Watercourse FMP has progressed through three (3) primary phases -

- Data Collection and Flood Study – defines the nature and extent of flooding and flood-related issues (hydraulic, environmental, and cultural) in technical terms;
- Floodplain Management Study – evaluates management options in consideration of social, environmental, and economic factors, in order to address existing and future flood risk and flood management issues; and
- FMP – adopts community-owned strategies to manage flood risk and flood management issues, and support the natural functions of the floodplain environment.
1.0 INTRODUCTION

1.1 Overview

An FMP is the hub of an effective floodplain management process that should be developed on the basis of a detailed technical analysis of flood flow and conform with the NSW Government’s (2001) Floodplain Management Manual, and its predecessor the 1986 Floodplain Development Manual. In formulating the Lower Gingham Watercourse FMP a detailed evaluation of all factors that affect and are affected by the use of flood prone land was undertaken. This includes consideration of hydraulic, environmental, cultural and socio-economic factors.

The Lower Gingham Watercourse FMP aims to:

- Provide a floodway network that will improve the current drainage of the floodplain system and allow for the orderly passage of flood flows;
- Balance the expressed requirements of landholders with the requirement to minimise the impact of floodplain development on natural flood flow patterns and ecological functions; and
- Be part of an integrated Water Management Plan focussing on flooding patterns and how these could be affected by land use and infrastructure development.

The FMP incorporates the key points and main outcomes of the Lower Gingham Watercourse Data Collection and Flood Study and the Lower Gingham Watercourse Floodplain Management Study. The Floodplain Management Study deals with many issues including legislative/policy matters and the floodplain environment, in substantial detail. The reader should refer to Data Collection and Flood Study or the Floodplain Management Study where background and greater detail is sought.

Once adopted under the provisions of Part 8 of the Water Act 1912, the FMP must be considered by DNR when reviewing and determining approval applications for flood control works under the Act or its forthcoming replacement the Water Management Act 2000.

1.2 Vision Statement

Implementation of Lower Gingham Watercourse FMP will provide the community with greater security against flood risk and allow for the sustainable management of agricultural lands and flood-dependent ecosystems.

1.3 Objectives

The primary objectives of the Lower Gingham Watercourse Floodplain Management Plan are to:

- Coordinate floodplain development in order to minimise adverse changes to surface flow patterns;
- Develop and adopt floodplain management principles and development assessment criteria;
- Increase the sustainable social, economic and ecological benefits of using the floodplain; and
- Improve and maintain the diversity and well being of native riverine and floodplain ecosystems that depend on regular flood inundation.

1.4 The Draft FMP Area

1.4.1 Overview

This FMP is concerned with the floodplain of the Lower Gingham Watercourse. As shown on Figure 1, the draft FMP area stretches approximately 24 km along Gingham Watercourse from the Gingham Bridge on the Weemelah to Gingham Road to the Morialta Junction on the Morialta Road. It covers an area of approximately 310 km², with the centroid of the area approximately 75 km north west of Moree.
The Lower Gwydir River Floodplain (Gingham Watercourse Effluent) is a designated floodplain under Section 166 of the Water Act 1912. As such, the ‘draft FMP area’ referred to and identified in Figure 1 is a designated floodplain under the Act for which Part 8 provisions apply.

The draft FMP area lies at the western end of the Lower Gwydir Wetlands, one of the most extensive wetland systems in north west New South Wales. Records of its importance as waterbird habitat date back to the 1920s and 30s, waterbird breeding events following more recent flooding in the summers of 1995/1996, 1996/1997 and spring of 1998 reinforcing these earlier observations. The majority of the draft FMP area is privately owned, with two Ramsar listed Wetland areas totalling approximately 200 ha on the properties ‘Windella’ and ‘Crinolyn’ providing the only perpetual wetland conservation in the area. The draft FMP area lies entirely within the Local Government Area of Moree Plains Shire.


1.4.2 Flooding

The hydrology of the Lower Gingham Watercourse draft FMP area is linked to the occurrence of rainfall and runoff in the upper Gwydir catchment. The delta like drainage pattern of the Lower Gwydir floodplain means flooding originates from the Gwydir River at the Gwydir Raft, west of Moree. From the raft flood flows split between the Lower Gwydir River and Gingham Watercourse. The lack of a high volume channel in the Gingham means even moderate flows spread over the floodplain and terminate within watercourse. In larger events flood waters invariably travel overland through the channel country until they reach the Barwon River.

In general terms the flooding pattern within the Lower Gingham Watercourse draft FMP area is as follows:

1. Floodwaters enter the draft FMP area either along the Gingham Watercourse channel or overland between the Gingham Bridge and the Gingham Road. Upon crossing the Gingham Bridge Road flows are initially confined to four main floodways by high ridge areas.

2. Approximately six kilometres downstream from the Gingham Bridge these ridges give way to an expansive floodplain, causing floodwaters to initially spread out over “Molladree”, “Brafferon”, and “Townsby”. The main flood flow then continues west along the Gingham Channel through “Windella”, “Macleans” and finally leaving the draft FMP area after travelling through “Wongwie” and over the Morialta Road.

3. Most of the flood flow is confined to this central floodway by the northern ridgeline, remnant from earlier fluvial landscapes, which extends the entire length of the draft FMP area. In a large flood a small proportion of flow breaks north at “Yarrawa” and meanders through the old fluvial channels. The first significant floodway is to the south of the Gingham Watercourse through “Eulindra”, “Crinolyn”, over the Watercourse Road, and continuing southwest to meet flow from the Gwydir River. A second floodway occurs further to the west, and flows southwest through “Macleans” then over the Morialta Road.

Throughout the Gingham Watercourse system, depths of inundation on the floodplain are not large, being generally only about 0.3 metres, except in the defined depressions and swamps. Traditionally the extremely flat overland grades combine with dense stands of native vegetation to reduce flow velocity and cause widespread long duration flooding.
Figure 1: Lower Gingham Watercourse Floodplain Management Plan June 2006
2.0 LEGISLATION AND POLICY

The management of the lower Gingham Watercourse floodplain must be undertaken within the current legislative and policy framework. A brief summary of the relevant primary pieces of legislation and policy is presented below. Refer to the Lower Gingham Watercourse Floodplain Management Study for a detailed overview of the legislation and policy framework for floodplain management.

2.1 The Flood Prone Land Policy

The primary objective of the Government’s Flood Prone Land Policy is to reduce the impacts of flooding on individual owners/occupiers of flood prone land, and to reduce private and public losses caused by flooding. A central tenet of the policy is that land use proposals for flood prone land be treated within the framework of a strategically generated floodplain risk management plan prepared using a merit approach. The Floodplain Management Manual (2001) supports the policy and outlines a merit approach to floodplain management.

2.2 Water Act 1912 and Water Management Act 2000

DNR takes the lead role for floodplain management in the western rural areas of NSW through its administration of Part 8 of the Water Act 1912. Part 8 was gazetted in 1984 and 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 amended Water Act provides for a broader consideration of issues in the approval of existing and proposed flood control works and strengthens WAMC’s ability to deal with unauthorised works.

Recently the State Government initiated wide-ranging reform of water legislation, with the outcome being the new Water Management Act 2000. While the water licensing and flood control provisions of the Water Management Act are not yet in operation, the new Act will eventually replace the Water Act.

2.3 Additional Floodplain Management Controls

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

The Environmental Planning and Assessment Act (1979) is of particular importance. In determining applications for flood control works, DNR is required to assess the environmental impact of the works under Part 5 of the Act. Other relevant legislation includes:

- Native Vegetation Conservation Act 1997 and Native Vegetation Act 2003;
- Fisheries Management Act 1994;
- National Parks and Wildlife Act 1974;
- Rivers and Foreshores Improvement Act 1948; and
- Commonwealth Environmental Protection and Biodiversity Conservation Act 2000.

An aspect of the Commonwealth Environmental Protection and Biodiversity Conservation Act (2000) is the protection provided to Ramsar Wetlands. Part 3, ss. 16 and 17B of the Act imposes approval and assessment requirements on activities that are likely to have a significant impact on the ecological character of a declared Ramsar wetland.

Natural resource management policy that supported decision-making in the draft FMP included the State Rivers and Estuaries Policy 1993, which provides a framework for the sustainable use, conservation and management of rivers, the Wetlands Management Policy 1996, State Groundwater Dependent Ecosystems Policy 2002 and the Water Quality and River flow interim Environmental Objectives for the Gwydir River Catchment 1999.

2.4 Relevant Management Plans

Following recent natural resource reforms in NSW, catchment action plans that consolidate existing natural resource management plans and provide long-term direction for investment in natural resources, will be prepared. The Border Rivers / Gwydir Catchment Management Authority will work with local communities to
prepare the Border Rivers / Gwydir Catchment Action Plan. The *Lower Gingham Watercourse FMP* should be viewed as one component of the integrated planning process, with other components including:

- Water Sharing Plan for the Gwydir Regulated River Water Source;
- Gwydir Catchment Action Plan (in progress);
- State Water Management Outcome Plan;
- Gwydir Watercourse Plan of Management; and
- Water Quality and river flow Interim Environmental Objectives for the Gwydir River Catchment.
3.0 FLOODPLAIN MANAGEMENT PRINCIPLES

An FMP typically incorporates a network of defined floodways to cater for flood flows, provide flood mitigation, encourage sustainability and maintain flooding to flood-dependent ecosystems. It needs to adhere to an overall set of management principles. The principles adopted by the Lower Gingham Watercourse FMC are listed below:

- Defined floodways must possess adequate hydraulic capacity and continuity to enable the orderly passage of floodwaters through the floodplain.
- 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.
- Floodway areas should be equitably allocated consistently with natural/historical flowpaths.
- Environmental issues related to the floodplain management plan need to be identified and investigated including developing strategies for flood dependent ecosystems such as wetlands, riparian vegetation, and any other environmentally sensitive areas.
- The exit of floodwaters from defined floodways should be at rates and depths similar to those that 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 the flood peak travel time is not unduly accelerated to downstream users or its 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.
- There should be no detrimental impact from floodplain development on any individual landholder or community infrastructure including increases in peak flood levels and increased drainage times.
- Floodplain development should not cause significant redistribution of floodwater.
- Should the community agree, there may be scope to depart from the natural/historical drainage pattern, provided it is hydraulically and environmentally feasible.
- Have due regard for government policy and legislation.

These principles are adhered to and reflected within the FMP through adopted assessment criteria and will be applied by DNR (on behalf of WAMC) when considering Part 8 applications under the Water Act.
4.0 DEVELOPMENT ASSESSMENT CRITERIA

4.1 Overview

In order to apply the floodplain management principles, the Lower Gingham Watercourse FMC developed and adopted specific hydraulic, environmental and socio-economic criteria. Such criteria support the decision making process and assist in balancing flood risk, socio-economic and environmental factors.

Assessment criteria can be applied when assessing proposed modifications or proposed new flood control works under Part 8 of the Water Act 1912. In this manner, criteria provide a consistent approach by ensuring all issues are considered and can assist in formulating approval conditions. While the criteria cannot make the final decision when assessing proposals, they can ensure that all issues will be considered. Ultimately an informed decision has to be reached by DNR (on behalf of WAMC).

The adopted assessment criteria are based on the 1971 Design Flood Event (Refer to Section 5.2), however larger events may need to be considered.

4.2 Adopted Criteria

4.2.1 Historical (for existing flood control works only)

- **Complying Works** – works that comply with the ‘original’ Carole Creek Guidelines and previous approvals will normally be accepted, unless additional information and/or flood observations illustrate that the works 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.

4.2.2 Socio-Economic

- **Disruption to Daily Life** – flood control works should not result in significant disruption to the daily life of surrounding landholders (for example property access).

- **Health Impact** – flood control works should not impose potential negative health impacts or stress on surrounding landholders.

- **Cost of the Works** – is the associated cost and benefit of undertaking the works 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 of undertaking the works against the required expenditure. This must be determined through consultation with the affected stakeholders and DNR.

- **Infrastructure Damage** – flood control works should not impose detrimental impact on any individual landholder or on community infrastructure including increases in peak flood levels and drainage times.

- **Equity**
  - A landholder’s development proposal cannot limit the future potential of other landholders to develop.
  - All current landholders should be allowed a reasonable area of protection depending on flood pattern across their property. This does not mean that all holdings will get an equal share and some may only be allowed stock refuge areas.
  - 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 Lower Gingham Watercourse FMP attempts to cover, however, it is strongly suggested that written proof regarding these agreements be kept in case a legal issue arises.
4.2.3 Ecological

- **Wetland Connectivity** – flood control works should not block or restrict natural flowpaths or floodways that fed wetland areas nor alter the flooding regime to these areas; and
  - flood control works should not have a significant impact on the ecological character of Ramsar wetlands.

- **Floodplain Flora and Fauna** – flood control 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** – flood control works should not impose negative impacts on soil structure or condition. For example, works should not increase the potential for scour and erosion and should not block flow to significant areas of floodplain soils.

- **Fish Passage** – flood control 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 NSW NPWS and the local Aboriginal Lands Council, flood control works should not destroy or damage any Aboriginal site or relic and should not block or restrict the delivery of flood flows to scarred and carved trees that rely on flooding regimes.

4.2.4 Flooding Behaviour

- **Natural Flooding Characteristics** – the natural flooding and drainage pattern of the floodplain should be maintained.

- **Hydraulic Capacity** – flood control 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** – flood control 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 flood control works, should be assessed against the following guideline values:
  - An increase in flood levels on a neighbours boundary be a maximum of 0.15 m; and
  - No significant redistribution of the peak discharge - less than 2% for individual works and 5% cumulative be used to guide the assessment of proposed or existing flood control works.

Each case should be assessed individually against the above guideline values and a more satisfactory outcome may be achieved by holding discussions with all affected landholders. Applications for works that exceed the above redistribution guidelines will be considered as non-complying works and must be subject to the Part 8 approval application process. Such works will generally not be approved unless an agreement has been reached between the applicant, DNR and downstream landholders and the relevant environmental criteria met.

- **Flow Velocities** – flood control works should not significantly increase velocities of flood flow in defined floodways. Velocities should be of an order that does not significantly increase erosion and siltation under various landuses. The figures in Table 1 are used as the maximum/limiting flow velocities. As a general rule, velocities should not increase by more than 50% from the pre-development flow velocities.

### Table 1: Assessment Criteria – Maximum Permisable Velocities

<table>
<thead>
<tr>
<th>Ground Condition</th>
<th>Maximum Permissible Velocity (m/s)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bare soil</td>
<td>0.4</td>
</tr>
<tr>
<td>Crop</td>
<td>0.6</td>
</tr>
<tr>
<td>Native tussocky grass</td>
<td>0.8</td>
</tr>
</tbody>
</table>

* Values based on soil classification of medium to heavy clay, highly pedal with moderate dispersibility (Source: Soil Conservation Service of NSW)
5.0 HYDRAULIC ASSESSMENT

5.1 Overview

Implementation of floodplain management principles and criteria requires a detailed understanding and knowledge of flooding behaviour within the draft FMP area. To supplement available information on historical flood event, computer-based hydraulic models can be used to simulate flooding behaviour. Information derived from hydraulic modelling includes flood flow distribution, flood levels, and flood flow velocities within the floodplain.

A hydraulic model can also be used to assess the impact on flood behaviour of structural management options and any proposed flood control works (earthworks, embankments or levees). The hydraulic impact of existing and proposed flood control works in the Lower Gingham Watercourse system was determined using a numeric model known as RMA-2, which is a commercially available engineering package. RMA-2 is a two-dimensional finite element hydrodynamic model used for the simulation of river and floodplain flows. The model is widely used throughout Australia and overseas.

Refer to the Lower Gingham Watercourse Data Collection and Flood Study for detailed information regarding the hydraulic modelling of the Lower Gingham Watercourse floodplain system including input data and calibration methods.

5.2 Design Flood Event

The ‘design event’ is the flood event adopted as the basis for planning and controlling development on flood liable land. The Lower Gingham Watercourse FMC determined that the 1971 flood should be adopted as the design event for the Lower Gingham Watercourse floodplain system. The FMC wished to cater for larger flood events and the 1971 event is considered a significantly large event, particularly in terms of volume and duration. Although the 1971 event was not as large as the 1955 event it provides the most comprehensive and available hydrologic and hydraulic data.

With regard to size, the 1971 flood has been determined to be 1 in 20 year event at Yarraman Bridge Gauging Station. This size flood is referred to as a 20-year Annual Recurrence Interval (hereafter ARI) event or a 5% Annual Exceedence Probability (hereafter AEP) event. Larger floods, including the 100-year ARI event (1% AEP) were also modelled and taken into consideration. Refer to Appendix A for the definition of ARI and AEP.

5.3 Modelling Procedure

The RMA-2 modelling for the Lower Gingham Watercourse FMP involved three distinct phases:

- ‘Pre-Development’ Conditions – involved modelling the floodplain system prior to the commencement of landuse change from grazing to cropping and associated development. The modelling was undertaken in order to obtain information on the natural flooding behaviour within the draft FMP area.

- ‘Existing’ Conditions – involved modelling the floodplain system after the area had experienced significant change, that is, as the floodplain is today. The modelling was undertaken in order to quantify any changes to the natural flooding characteristics within the draft FMP area.

- ‘Proposed’ Conditions – modelling of the floodplain system with various structural management options in order to determine an optimised solution. The issues were treated collectively in order to determine the impact on surrounding areas and the cumulative impact.

The models are well suited to predicting the change in flood behaviour due to existing or proposed floodplain development and was combined with outcomes of the floodplain environment review (Refer to Section 6.0) to aid the Lower Gingham Watercourse FMC in their decision-making process.
6.0 ENVIRONMENTAL ASSESSMENT

6.1 Overview

A number of the floodplain management principles and criteria promote a system of floodways based on natural drainage patterns and so underpin the requirements of the floodplain environment. More specifically one principle specifies environmental considerations in the plan:

“Environmental issues related to the floodplain management plan need to be identified and investigated including developing strategies for flood dependent ecosystems such as wetlands, riparian vegetation, and any other environmentally sensitive areas.”

To ensure these principles relating to the floodplain environment were addressed by the FMP a review of floodplain environment issues that directly relate to the construction of flood control works was undertaken and documented in the Lower Gingham Watercourse Data Collection and Flood Study. The environmental assessment outcomes were used to:

- Identify and assess natural flood flow paths of the draft FMP area;
- Aid design (along with hydrologic, hydraulic and socio-economic considerations) of the Lower Gingham Watercourse FMP Floodway Network;
- Help develop (along with hydrologic, hydraulic and socio-economic considerations) management outcomes for existing works that do not comply with Lower Gingham Watercourse FMP recommendations; and
- Ensure that proposed management measures in the Lower Gingham Watercourse FMP can be assessed against the principles of the plan and natural resource management policy.

6.2 Environmentally Sensitive Areas

A major component of the review of floodplain environmental issues was to identify Environmentally Sensitive Areas. These are areas on the Lower Gingham Floodplain draft FMP area with key environmental and / or cultural features that rely on flooding to sustain essential ecological processes. They include:

- Wetlands and flood dependent vegetation;
- Floodplain vegetation sensitive to flood regime change;
- Ramsar Wetlands;
- Watercourses;
- Threatened species habitat;
- Groundwater recharge areas; and
- Aboriginal sites (eg. scarred trees).

Environmentally sensitive areas are identified from existing vegetation and flood mapping, studies, aerial photography, and ground truthing. Identifying these areas recognises that some parts of the floodplain have higher environmental value and support a greater proportion of ecological functions that occur during floods. Accordingly, environmentally sensitive areas have been given special consideration in the decision-making processes in the development of the Lower Gingham Watercourse FMP. Refer to Figure 4 (Appendix B) for mapping of environmentally sensitive areas in the Lower Gingham Watercourse draft FMP area. Refer to the Lower Gingham Watercourse Data Collection and Flood Study and Floodplain Management Study for detailed information regarding the environmentally sensitive areas found in the draft FMP area.
7.0 FLOOD CONTROL WORKS – PROPOSALS AND MODIFICATIONS

7.1 General

In order to finalise an adopted FMP Floodway Network for the lower Gingham Watercourse draft FMP area, identified floodplain management issues needed to be investigated and resolved. These issues included existing flood control works that were identified during the consultation phase as possibly resulting in flooding problems, as well as proposed new flood control works. Mapping of environmentally sensitive areas and hydraulic modelling were undertaken and the adopted assessment criteria were applied in order to determine the best possible options. Several options for allowable flood control works were considered by the Lower Gingham Watercourse FMC, model results and discussions of those options are Floodplain management issues are listed in Table 2 and shown on Figure 2 (Appendix B). After consideration of several options of allowable flood control works the Lower Gingham Watercourse FMC adopted the option presented in this Plan.

It is important to remember that all proposed and existing flood control works within the draft FMP area require approval under Part 8 of the Water Act 1912. Where a work does not have an approval, DNR may take the relevant action(s) under the Act.

With regard to the issues outlined in Table 2, please note the following:

- Landholders proposing the new works outlined in Table 2 are required to lodge a Part 8 application for approval prior to any construction activities. The identified structural requirements should be incorporated into the engineering design of the work(s) and where necessary will be included as approval conditions under Section 176A of the Water Act 1912;
- Minor works identified in Table 2, such as banks and stock refuges of limited size, may not require Part 8 approval, however, DNR must be notified prior to the commencement of construction activities relating to minor works;
- Modifications to existing approved works identified in Table 2 will be administered through modifying the Part 8 approval under Section 176A of the Water Act 1912; and
- With regard to unapproved works, directions for remedial work(s) may be used as a means of encouraging landholders to bring the subject work(s) within the Water Act 1912 by lodging an application for approval that is complying (refer to Section 11.6.1) with the FMP. It is envisaged that the approval process for complying works will be more expedient.

Please refer to Sections 11.4, 11.5 and 11.6 for further details regarding approval of flood control works and administration of the FMP under the Water Act 1912.

7.2 Timetable

The timetable assigned to the works detailed in Table 2 was determined with the assistance of the Lower Gingham Watercourse FMC. The following should be noted with regard to the timeframes identified:

- 12 months - modification works that need 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.
- Landholder Discretion - it has been determined that these proposed works will not have a significant impact on surrounding properties provided the attached conditions are followed and as such landholders may contact DNR and lodge a Part 8 application at their discretion.
- Further Investigation - these issues have not been fully resolved and require further investigation.
Table 2: Flood Control Works: Proposed New and Modifications

<table>
<thead>
<tr>
<th>Issue</th>
<th>Concern(s)</th>
<th>Timetable*</th>
<th>Determination</th>
<th>Responsibility</th>
</tr>
</thead>
</table>
| Proposed New Flood Control Works | Ad hoc construction of flood control works:  
- May cause redistribution of floodwaters and significant change in flood height | Landholder Discretion | Lodge a Part 8 application that complies with the FMP Floodway Network. | Landholder |
| Proposed New Flood Control Works in Areas that Require Flooding | Proposed construction of flood control works:  
- May cause redistribution of flood flow and significant change in flood height; and  
- Will alienate flood dependent vegetation remnants from beneficial flooding inundation. | Landholder Discretion | Lodge a Part 8 application and include the following provisions:  
- Development in accordance with the FMP Floodway Network; and  
- Ensure provision for beneficial flood inundation of isolated flood dependent vegetation remnants. | Landholder |
| Minor Temporary Flood Control Works | Uncoordinated construction of minor temporary works (ie. levees) to protect selected areas of dryland cropping during small flood events may result in flood redistribution. | Landholder Discretion | Such temporary banks may not be constructed. All works need to be approved by the DNR. | Landholders |
| Limited Height Roads with Causeways | Proposed construction of flood control works:  
- Would disrupt floodplain connectivity by creating a barrier to floodplain fauna with limited dispersion ability; and  
- May cause redistribution of flood flow. | Landholder Discretion | Minor works may not require Part 8 approval but are subject to following conditions:  
- Contact DNR prior to any construction activities;  
- Exclude all flood control works (incl. raised roads) from the core Gingham Watercourse region, shown in Figure 2 (Appendix B).  
- Outside core area roads should be height restricted to 15 cm above natural surface level, with causeways recommended in 200 m per kilometre of raised road, but no less than 100 m per kilometre. | Landholder |
| Minor Stock refuges and Infrastructure Works | Proposed construction of flood control works:  
- May cause redistribution of flood flow. | Landholder Discretion | Minor works, stock refuges and infrastructure banks, may not require Part 8 approval but are subject to following condition:  
- Should not be constructed in sensitive areas, have a maximum area of 20ha, but allowed unlimited height;  
- DNR must be notified prior to construction of works. | Landholder |
| Watercourse Cross-ings and Instream Flow/ Erosion Control Works | Construction of Instream Control Works needs to be licensed with relevant Department. | Landholder Discretion | Instream control works that do not require Part 8 approval but:  
- Approval required under Part 2 of the Water Act 1912 or Section 3a Rivers and Foreshores Improvement Act 1948 and Sections 218-220 of the Fisheries Management Act 1994. | Landholder in conjunction with DNR and NSW Fisheries |
Table 2: Flood Control Works: Proposed New and Modifications (Continued)

<table>
<thead>
<tr>
<th>Issue</th>
<th>Concern(s</th>
<th>Timetable*</th>
<th>Required Modification of Works</th>
<th>Responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>“Eastwood” Carole Creek Guideline Area</td>
<td>▪ Future development of the original Carole Creek Floodplain Guideline area on the property “Eastwood” may cause significant flood flow redistribution onto neighbouring properties.</td>
<td>12 months</td>
<td>▪ Amend original guideline area on “Eastwood” to reduce the effect on flood flow distribution. Move southern guideline boundary approximately 550m to north.</td>
<td>DNR in conjunction with Landholder</td>
</tr>
<tr>
<td>Supply Channels</td>
<td>▪ Above ground supply channels that encroach onto the floodway network may result in flood flow redistribution.</td>
<td>12 months</td>
<td>▪ Irrigation supply channels on the property “Wongwie” to be lowered to the licence conditions of 0.15 metres (6”) above ground level.</td>
<td>Landholders</td>
</tr>
<tr>
<td>“Boyanga” / “Molladree”</td>
<td>▪ Flood control works on “Molladree” cause localised flow redistribution onto neighbouring property “Boyanga”.</td>
<td>12 months</td>
<td>▪ Realign southern corner of existing “Molladree” development in an attempt to minimise redistribution.</td>
<td>Landholder</td>
</tr>
<tr>
<td>Weemelah - Gingham Road</td>
<td>▪ Weemelah to Gingham Road causeway constricts flood flows to northern floodway.</td>
<td>12 months</td>
<td>▪ Suggested that works are required along the Weemelah to Gingham Road, widen existing causeway south of “Boyanga” access road.</td>
<td>Moree Plains Shire Council in conjunction with Landholders</td>
</tr>
<tr>
<td></td>
<td>▪ Access road to “Boyanga” homestead may redistribute flood flow to northern floodway.</td>
<td></td>
<td>▪ After investigation and discussion with Landholders it was concluded “Boyanga” access road does not require modification (refer to Section 8.4.5 of the FMS for further detail).</td>
<td></td>
</tr>
</tbody>
</table>
| “Crinolyn” Training Bank on Gingham Watercourse | ▪ Training bank on "Crinolyn" may cause redistribution of flood flow; and  
▪ Natural flow events that once spread out over the floodplain, including “Crinolyn” Ramsar Wetland, are now confined in the Gingham Channel. | Further Investigation | ▪ Remove training bank from the Watercourse; and  
▪ Investigate installation of instream erosion/flow control structures that also provide fish passage at key locations along the Lower Gingham Channel (approval required under Section 3a of the Rivers and Foreshore Improvement Act 1948 and Sections 218-220 of the Fisheries Management Act 1994). | Landholder in conjunction with DNR                                           |

* time period from when the FMP is signed off by the Minister
8.0 THE FMP FLOODWAY NETWORK

The FMP Floodway Network is identified on Figure 3 (Appendix B) and delineates areas of the floodplain that allow the orderly passage of the 1971 flood event (approx. 20 year ARI).

The FMP Floodway Network is required to achieve natural flood flow distribution for two primary requirements:

- Hydraulic Requirement – this area of the Floodway Network is required to allow the orderly passage of flood flow through the Lower Gingham Watercourse system and onto downstream floodplain environments; and

- Environmental Requirement – this area of the Floodway Network is required to ensure all identified flood sensitive areas or flood-dependent ecosystems of conservation value are exposed to the flooding regime in order to maintain their long-term sustenance and regeneration.

While flood control works proposed within the FMP Floodway Network are not prohibited, it is unlikely that they will be approved due to the need to maintain flooding patterns to these areas for hydraulic and/or environmental requirements. Works proposed within the floodway network will be identified as non-complying works. Refer to Section 11.6 for details regarding complying and non-complying works. Proposed future flood control works (i.e. flood protection) should be planned for areas outside the FMP Floodway Network.
9.0 ENVIRONMENTAL REVIEW

9.1 Overview

The Lower Gingham Watercourse FMP affects the floodplain environment primarily through defining a floodway network that conforms as closely as is reasonable to the natural drainage pattern of the floodplain. This allows for the orderly passage of flood flow through the system, as well as inundation of flood-dependent ecosystems.

When assessing the environmental impact of the FMP, current floodplain conditions were used as a basis for comparison. Figure 4 (Appendix B) illustrates the relationship of the FMP Floodway Network with the Environmentally Sensitive Area mapping. Impacts of the FMP were assessed at a strategic level (as opposed to property level) by considering the potential impacts on components of the floodplain environment. Refer to the Lower Gingham Watercourse Phase A Report, and Floodplain Management Study for a detailed environmental assessment.

9.2 Environmental Review Summary

Table 3 summarises the findings of the environmental review undertaken in order to determine the anticipated impacts of the Lower Gingham Watercourse FMP on components of the floodplain environment.

<table>
<thead>
<tr>
<th>Anticipated Impacts of the Lower Gingham Watercourse FMP</th>
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<tbody>
<tr>
<td>Soils</td>
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<tr>
<td>Flooding benefits floodplain soils by contributing moisture, sediment and nutrients. These soils gain their porosity and structure through a wetting and drying cycle. The FMP will maintain core floodplain inundation and so maintain soil condition and stability within the FMP Floodway Network. In addition the FMP will allow the orderly passage of flood flow through the system, which will maintain the flow, pattern and so minimise scour and erosion.</td>
</tr>
<tr>
<td>Vegetation</td>
</tr>
<tr>
<td>Vegetation communities adapted to periodic wetting and drying cycles depend, to varying degrees, on periodic flooding for their long-term sustenance. Figure 4 (Appendix B) shows flood dependent native vegetation, incorporated as Environmentally Sensitive Areas, in the draft FMP area in relation to the FMP Floodway Network. The FMP ensures that the majority of flood-dependent vegetation lies within the floodway limits thus ensuring that flood access to this vegetation will be maintained and that regeneration and ongoing health of the vegetation is facilitated. Endangered Ecological Communities (listed under the Threatened Species Conservation Act 1994), namely Carbeen Open Forest, often associated with ‘Fluvial Sand Ridges’, have also been included within the FMP Floodway Network. There are some isolated stands of mature Coolibah and Belah trees that lie outside the floodway network. These stands are currently in areas cleared for irrigation and dryland cropping, and are depicted in Figure 4 (Appendix B) as ‘Degraded Coolibah Remnant’. To preserve the future viability of these mature trees and their habitat value the FMP requires that landholders wishing to construct flood control works (i.e. protect from flooding) in these areas must ensure provision for beneficial flood inundation of these isolated flood dependent vegetation remnants. Because of existing land use, inclusion of these stands in the floodway network was not considered to be a practical option.</td>
</tr>
<tr>
<td>Wetlands</td>
</tr>
</tbody>
</table>
| Four broad wetland types were identified in the draft FMP area, including inland floodplain lakes and lagoons, Lignum swamp, inland floodplain meadows and inland floodplain woodlands. These wetland types have been incorporated into the Environmentally Sensitive Areas and are all within the Floodway Network limits, as illustrated in Figure 4 (Appendix B). The FMP Floodway Network also ensures that flood control works (i.e. levees) are excluded from the January 1996 flood extent, refer to Figure 4 (Appendix B). This area was considered to be wetland under the Gwydir Watercourse Plan of Management 2001-2011, and an exclusion zone for any development that might affect the passage of flood flows through the Watercourse. As a result, implementation of the plan will ensure that flood flow connectivity to these wetlands is maintained and that the productive capacity and life cycle processes...
supported by periodic flooding of the wetlands are maintained.

<table>
<thead>
<tr>
<th>Ramsar Wetlands</th>
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<tbody>
<tr>
<td>The FMP attempts to protect the ecological character of the Declared Ramsar wetlands on “Windella” and “Crinolyn”. The adopted FMP Floodway Network:</td>
</tr>
<tr>
<td>▪ ensures that flood control works are not constructed where they may cause destruction to or substantially modify the wetlands and re-enforces DNR’s compliance capability regarding construction of unauthorised flood control works;</td>
</tr>
<tr>
<td>▪ provides a strategic proactive approach to floodplain management, an instrument to resolve community conflict relating to flood control works, and provides landholders with an acceptable exposure to flood risk, without a substantial change to the volume, timing, duration and frequency of surface water flood flows to and within the wetlands;</td>
</tr>
<tr>
<td>▪ maintains flood flow connectivity to flood dependent ecosystems that provide habitat and are critical to the lifecycle of native species found in the wetlands;</td>
</tr>
<tr>
<td>▪ allows the orderly passage of flood flow through the system, maintains core floodplain inundation, reducing the potential for scour and erosion, and will therefore minimise any substantial change flood control works may have on the physico-chemical status of the wetlands.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Fauna</th>
</tr>
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<tbody>
<tr>
<td>Fauna surveys undertaken between 1997 and 2001 found the Gwydir Watercourse floodplain to support a wide range of fauna species. These include species that depend directly on flooding for maintenance of their life cycles (eg. waterbirds, frogs, invertebrates and fish) and species that rely on floodplain vegetation (eg. honeyeaters and reptiles). Twenty-three threatened fauna species and 16 migratory bird species are known to occur in the area, with an additional fifteen threatened species that could potentially inhabit the area. The FMP will ensure that flood flow connectivity to identified wetlands and viable floodplain vegetation is maintained or restored, thereby improving habitat quality and availability for fauna species.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Fish</th>
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</thead>
<tbody>
<tr>
<td>Fourteen native fish species, including the vulnerable Silver Perch and endangered populations of Olive Perchlet and Purple-spotted Gudgeon are known or expected to inhabit the Gingham Watercourse floodplain. The inundated floodplain provides important food resources for these species as well as nursery habitat for Golden Perch and Silver Perch that spawn in response to flooding. Provisions under the FMP ensure flood connectivity between the watercourse and the floodplain. Requirements on raised roads, causeway and floodway velocities are in accordance with NSW Fisheries and National Guidelines and maximum swim capacity of fish found in the area. The raised road exclusion zone in the Watercourse proper will further aid fish passage or access to spawning and feeding locations along the Gingham Watercourse and the adjacent floodplain.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Water Quality</th>
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</thead>
<tbody>
<tr>
<td>The FMP will allow the orderly passage of flood flow through the system, reducing the potential for scour and erosion, and enhance surface water quality by minimising sedimentation and water turbidity. The FMP will maintain core floodplain inundation, which will benefit areas that are prone to shallow watertables (eg. wetlands) and hence any salinity issues.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Groundwater</th>
</tr>
</thead>
<tbody>
<tr>
<td>The FMP will assist in maintaining the natural groundwater recharge by aiming to achieve a natural flood flow distribution and floodplain inundation. If further information on natural recharge areas becomes available, the FMP Floodway Network may need to be altered to ensure that they are exposed to natural flooding.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cultural Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>One Aboriginal site has been recorded in the draft FMP area. It is highly likely that additional sites of Aboriginal significance exist (undiscovered) in the draft FMP area. Scarred and / or carved trees may be species adapted to cycles of wetting and drying that depend on periodic flooding for their long-term health. The FMP includes known scarred / carved trees and all viable floodplain vegetation within the floodway network. As a result, the FMP ensures that flood flow connectivity to Aboriginal sites that may rely on flooding is maintained.</td>
</tr>
</tbody>
</table>
9.3 **Downstream Floodplains**

It is anticipated that the *Lower Gingham Watercourse FMP* will benefit downstream floodplain environments due to the following:

- The FMP attempts to provide a floodway network that conforms as closely as is reasonable to the natural flood pattern of the floodplain and allows the orderly passage of flood flow through the Lower Gingham Watercourse system and onto downstream floodplain environments; and

- The FMP will maintain where practicable the natural connectivity between the draft FMP area and downstream floodplains by ensuring that there are no significant barriers to flood flow. The downstream boundaries of the draft FMP area will be largely open and as such promote the free passage of flood flow to downstream floodplains.

These features indicate that the FMP will maintain flow velocity and will retain near natural flood flow distribution. It is anticipated that implementation of the FMP will not adversely influence the hydrological regime and flooding characteristics of downstream floodplains. It will ensure the long-term maintenance of flood flow to downstream floodplains and assist in maintaining productivity and biodiversity.

9.4 **Instream Works**

The only instream works identified in the draft FMP area were several piped crossings. Tyreel Weir is the main work upstream of the draft FMP area that may restrict the free passage of fish in the Gingham Watercourse. The *NSW Weir Review Committee* is coordinating a weir review process that will include a consideration of fishway requirements for all weirs in NSW and subsequently lead to an enhanced environmental outcome. Under the *Water Management Act 2000*, instream works are classified as ‘controlled activities’ for which an approval is required.

It is recommended that DNR, in conjunction with NSW Fisheries, undertake a field review of all instream works within the draft FMP area immediately after implementation of the new approvals system under the Act. The review should identify and prioritise the works in terms of environmental impact, particularly fish passage. A strategy should then be developed in consultation with individual landholders to modify or replace problem works to meet NSW Fisheries requirements. The NSW Fisheries publication *Policy and Guidelines for Bridges, Roads, Causeways and Similar Structures (1999)* and the *National Guidelines for ‘Fish Friendly’ Crossings and Culverts* should be referred to.

9.5 **SWMOP Target NO. 25**

Target No. 25 of the *State Water Management Outcomes Plan* (hereafter SWMOP) is “action taken to (re)connect at least 60 percent of the natural 1 in 5 year flooded area to the river for 11 key rural floodplains” (NSW Government 2002:62). The *Lower Gingham Watercourse Floodplain* is identified as one of these key rural floodplains. Based on available information, it is anticipated that the *Lower Gingham Watercourse FMP* will meet the target due to the following:

- Flood frequency analysis for the Lower Gingham Watercourse system shows a 1 in 5 year flood event would largely be contained within the January 1996 flood extent, approximately a 3-5 year ARI. The FMP will ensure that these areas remain unimpeded by flood control works, with all identified wetlands located within the floodway network and exposed to the flooding regime. This indicates that the FMP will ensure connection of the majority of the 1 in 5 year flooded area to the watercourse.

- The FMP Floodway Network will be designed to allow the orderly passage of the 1970’s type flood discharge (1 in 20 year event). Information from the 1984, 1998 and 2000 flood events was included in the hydraulic and environmental investigations. These floods were significant events, and by making allowance for the passage of this larger event it is considered that all lower flow paths relevant to the SWMOP target will be unobstructed.
10.0 RELATED MANAGEMENT ISSUES

10.1 Monitoring

10.1.1 Flood Monitoring
Any surface water management scheme will require monitoring in mainstream flood and local catchment flow events to assess performance efficiency, identify problem areas and whether any modifications or are required. An effective monitoring program will require input from both DNR and landholders. The following is recommended:

- DNR should undertake aerial photography, survey, collation of environmental data, stream gauging and flow measurements; and

- Where safe to do so landholders should observe the performance of their part of the floodway network, including marking high flood levels, estimating flow velocities, and taking photographs. Landholders should also collate environmental data such as the extent of floodplain vegetation regeneration, and waterbird and fish observations.

Refer to Lower Gingham Watercourse Floodplain Management Study for detailed advisory notes on flood monitoring

10.1.2 FMP Review
FMP’s adopted as Minister’s Plans under the Water Management Act 2000 are required to be reviewed at 5 yearly intervals in order to determine whether their provisions adequately implement the water management principles of the Act. In addition to this requirement, it is recommended that the Lower Gingham Watercourse FMP be reviewed after the incidence of a 1 in 20 year flood event through the system. This review process would include reconvening the FMC in order to consult the various interest groups on their opinion of the flood event and the performance efficiency of the FMP Floodway Network.

10.2 Artificial Flooding
There may be occasions when certain conditions require, as specified in the Water Sharing Plan for the Gwydir Regulated River, to release an Environmental Contingency Allowance (ECA) into the Gingham Watercourse. Under Section 15 of the Plan the ECA may be used for the following purposes;

- to support a colonially nesting native bird breeding event that has been initiated in the Gwydir Wetlands following a natural flood inundation;
- to provide additional inundation in the Gingham and Lower Gwydir Wetlands during or following periods of extended dry climatic conditions;
- to provide short term inundation of the wetlands to promote germination of water hyacinth as part of a weed management strategy involving a wetting and drying cycle;
- to support native fish habitat and populations;
- to support threatened species;
- to support invertebrates and other aquatic species;
- to maintain aquatic ecosystem health;
- to provide flows for environmental purposes in effluent streams, and;
- to provide inundation of higher level benches in the river reaches between Copeton Dam and the Gwydir River at Gravesend.

It is the role of the Gwydir Environmental Contingency Allowance Operations Advisory Committee (ECAOAC) to advise the Department of Natural Resources in respect to the objective, volumes required and timing of any ECA releases into the Gingham or Lower Gwydir Watercourses. A member of the Gingham Association represents the interests of the landholders in the Watercourse and that person will advise the committee if there are any impediments or issues affecting the release of the ECA. If when an ECA release
is recommended, it is the responsibility of State Water to advise landholders and Moree Plains Shire Council of its imminent release.

10.3 Best Management Practices

It is the responsibility of all landholders to cooperate in minimising the negative impacts of soil erosion and degraded water quality. Practices that can be implemented for land and stream management include:

- Undertake conservation farming practices for cultivated area, include reduced or zero tillage, stubble retention and well-designed erosion control works;
- Undertake opportunity cropping for the efficient utilisation of soil profiles (avoid a long fallow period and utilise seasonal conditions);
- Retain tailwater and stormwater on irrigation farms (refer to the document *Australian Cotton Industry Best Management Practices* published by the Cotton Research and Development Corporation 2000);
- Avoid farming and over-grazing of core watercourse, lagoons and depressions; and
- Improve stream management practices to reduce bed lowering, bank erosion and siltation (refer to DNRs *Riverwise* notes).

10.4 Road Raising

For work undertaken on regional roads, the local council should follow the procedure set out in Section 29 of the *Roads Act 1993*. Under the Act, local councils are required to go through a public consultation process before undertaking the proposal. Landholders may make submissions to the council with respect to the proposed road levels. After considering any submissions, the roads authority may decide to proceed with the proposal, with or without alteration, or to abandon the proposal.

For work undertaken on Shire Roads, a simplified informal procedure is usually adopted. Within Moree Plains Shire, a formal design is usually not carried out. The new construction is typically based on the existing road levels and the final levels determined on-site. At the construction phase, Council’s superintendent approaches landholders to discuss matters that may affect their interests and their suggestions and objections are considered as appropriate. This procedure is currently under review and the Council is investigating the possibilities of improving the public consultation process.

Although not bound by the relevant legislation, local councils are committed to considering the FMP when planning road works. The *Lower Gingham Watercourse FMP* assessed the adequacy of road causeways in the draft FMP area, and where needed has provided recommendation for causeway modifications (Refer to Section 7.0).
11.0 IMPLEMENTATION STRATEGY

11.1 General
The Lower Gingham Watercourse 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. Such an approach will eliminate the historical piecemeal approach to floodplain management. Landholders are encouraged to undertake appropriate landuse management practices and undertake the required modifications to existing flood control works as detailed in Table 2 as soon as possible.

The implementation of the Lower Gingham Watercourse FMP is currently regulated under Part 8 of the Water Act 1912. It should be seen as one of a set of complementary strategies being developed within the DNR Barwon Region for natural resource management. The FMP is a component of the catchment planning process where other components include the Namoi catchment action plan, catchment blueprint and water sharing plans. It should be considered in conjunction with the broader components of catchment planning and recognising the natural resource links within the larger catchment.

11.2 Performance Assessment
To measure the success of the Lower Gingham Watercourse FMP, DNR will refer to the detailed performance indicators that will be developed as part of a state floodplain management policy. These indicators will be closely linked with the FMP objectives and will largely be based on monitoring and assessment information as outlined above and detailed in the Floodplain Management Study.

There are a number of data sources that can used to report on the performance indicators such as flood monitoring, audit of complying flood control works and results from fauna and flora surveys. While interrogation of these data sources will yield detailed indicators, the following broad indicators are provided to give the reader an understanding:

- Minimal disruption to the passage of flood waters within the defined draft FMP area;
- Natural flooding regimes maintained to identified wetlands and other flood-dependent ecosystems; and
- Increased security against flood risk.

11.3 Responsibilities
The following stakeholder groups have roles within the implementation phase of the Lower Gingham Watercourse FMP:

- **Lower Gingham Rural FMC**
  - Oversee the implementation of the FMP under the amended Part 8 of the Water Act 1912.

- **DNR**
  - Oversee the implementation of the FMP under the amended Part 8 of the Water Act 1912;
  - Provide technical assistance for proposals for flood control works within the floodplain system;
  - Review and determine proposals for flood control works within the floodplain system;
  - Undertake further investigation into issues that have not been fully resolved; and
  - Monitor future flood events and the performance of the floodway network.

- **Local Landholders**
  - Undertake the required modifications to existing flood control works as detailed in Table 2 as soon as possible;
  - Undertake sustainable landuse management practices, including the recommendations in Section 7.0;
Ensure that relevant legislation and policy controls are adhered to and if necessary approval obtained from DNR for flood control work proposals; and
- Monitor future flood events and the performance of the floodway network.

- **Local Landcare Group(s)**
  - Promote appropriate landuse management practices; and
  - Undertake a maintenance role.

- **Local Councils**
  - Undertake (where necessary) road level adjustments and causeway construction.

### 11.4 Approval of Flood Control Works

#### 11.4.1 General

All activities associated with flood control works are administered under the relevant sections of Part 8 of the *Water Act 1912*. In short, please note the following:

1. All flood control works require an approval under Part 8 of the Act (refer to Section 11.4.2 below for definition);
2. All Part 8 applications for new and existing (unapproved) works within the draft FMP area will be determined in accordance with the FMP and Part 8 of the Act; and
3. Any existing unauthorised works for which a Part 8 application is not lodged, may be served a notice under Section 180D of the Act for removal or DNR may consider prosecution action.

Refer to Section 11.5 for further details regarding unauthorised works and Part 180D of the *Water Act 1912*.

#### 11.4.2 Works that Require Approval

Works referred to as flood control works are defined under the *Water Act 1912* as 'controlled works'. Controlled works require approval under the Act 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, and
  - 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 by 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.

11.4.3 Applying for Approval
The following is an outline of the steps required by an applicant in applying for approval a flood control work:

**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. 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 the application form. Complete additional information requirements on the form including condition of the existing environmental, vegetation, streams and soil.

**Step 6** - Lodge the application form, with the supporting information and application fee, at your local DNR office.

11.4.4 Determination Process
All applications for flood control 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 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 (but not limited to):
  - 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 the passage, flow and distribution of flood waters;
  - 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 protection of the environment; and
  - Any other matters relating to the desirability or otherwise of a controlled work.

- **Part 5 of the Environmental Planning and Assessment Act 1979**
  All proposals must undergo assessment under Part 5. The factors to be considered include (but 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.
- **Floodplain Management Plan** - DNR must consider the FMP and information contained within the FMP including principles, assessment criteria, and any recommendations.

- **Additional Information** - DNR must consider any investigation information that has been provided by the applicant.

### 11.4.5 Possible Determinations

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

- Approval of the application;
- Approval of the application subject to conditions; or
- Refusal of the application.

There are provisions within 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.

### 11.4.6 Typical Approval Conditions

The following is a list of typical conditions that can be attached to an approval. Please note that this list is not exhaustive and conditions more specific to the property and proposal are likely.

- Works may be constructed on the property ‘X’ in accordance with the location, nature, heights, floodway width and boundary corridors as specified in the plan.
- The works shall be constructed and maintained in a manner that will minimise the possibility of damage being occasioned by them, or resulting from them, to any public or private interest.
- If during the currency of this approval a floodplain investigation by DNR reveals that the work(s) should be modified in the public interest so as to permit a more satisfactory flow of water within the floodplain, the landholder shall upon receipt of notice by DNR modify the work(s) in accordance with such notice.
- The height of the controlled work(s) between the points marked ‘A’ and ‘B’ on the plan shall not exceed ‘X’ metres above the natural surface level.
- The controlled works between the points marked ‘B’ and ‘C’ on the plan shall be set back not less than ‘X’ metres from the nearest boundary of the property.

### 11.5 Unauthorised Flood Control Works

The amended *Water Act 1912* strengthened DNRs ability to deal with unauthorised works. An unauthorised work is where:

- There is no approval in force with respect to a controlled work;
- A controlled work has been constructed in contravention of an approval; or
- A controlled work does not comply with the conditions to which an approval is subject.

In the instance of an unauthorised work, any one or more of the following types of work may be directed to be carried out by a notice under Section 180D of the *Water Act 1912*:

(a) Work to remove, modify, repair or restore the controlled work or to render the work ineffectual;
(b) Work to repair any damage caused by the controlled work (including any damage caused to any specified land, structure, river, lake or vegetation, or to the environment);

(c) Work to ensure that any specified land, structure, river, lake or vegetation, or the environment, will not be damaged or adversely affected or further damaged or adversely affected, by the controlled work;

(d) Without limiting paragraphs (a)–(c), work to correct or restore any alteration caused by the controlled work to the flow of water in, to or from, or the quantity of water contained in, any specified river or lake.

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. DNR is not required to give any prior notice of its decision to exercise these powers. A person distressed by such a decision is be able to appeal against the decision to the Land and Environment Court.

11.6 **Complying and Non-Complying Works**

Once the Lower Gingham Floodplain FMP has been adopted, applications for flood control works under Part 8 of the Water Act 1912 will be assessed by DNR as either complying works or non-complying works with regard to the FMP. 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 11.4 is necessary.

11.6.1 Complying Works

Under Section 168B(2) of the Water Act 1912, a flood control work is to be assessed as a complying work if DNR is satisfied that the work complies with the FMP for the area in which the work is situation or proposed to be constructed. Within the Lower Gingham Watercourse draft FMP area a work complies with the FMP if:

- The work is or is proposed to be located outside the FMP Floodway Network as illustrated on Figure 4 (Appendix B); and

- The work does not trigger any issues when considering the adopted assessment criteria detailed in Section 4.0.

When lodging the Part 8 application, the applicant will be required to provide the necessary technical details to demonstrate that the application is a complying work. Where an existing unapproved or proposed flood control work is determined to be complying and the required environmental assessment is satisfactory, it is envisaged that the approval process will be more expedient. For example, the application for approval will be determined by DNR without the need for advertising or third part objections.

11.6.2 Non-Complying Works

Under Section 168B(3) of the Water Act 1912, a flood control work is to be assessed as a non-complying work if DNR is not satisfied that the work complies with the FMP for the area in which the work is situation or proposed to be constructed. Within the Lower Gingham Watercourse draft FMP area a work is non-complying if:

- The work is or is proposed to be located within the FMP Floodway Network as illustrated in Figure 3 (Appendix B); and/or

- The work triggers one or more issues when considering the adopted assessment criteria detailed in Section 4.0.

Non-complying works may be approved after a detailed investigation of the hydraulic, environmental, social and economic impacts of the proposal. The cumulative impact of the proposal on flooding characteristics will need to be comprehensively addressed. It is important to understand that it is the applicant’s responsibility to organise a suitably qualified consultant to undertake the investigation and pay for the investigation. DNR will provide direction and guidance for the consultant. 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, with failure to do so possibly resulting in the objection being rejected.

11.6.3 Roads

Roads (and associated bridges and road works) vested in Local Government 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.
## APPENDIX A – GLOSSARY AND ABBREVIATIONS

### GLOSSARY

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual Exceedance Probability</td>
<td>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.</td>
</tr>
<tr>
<td>Annual Recurrence Interval</td>
<td>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.</td>
</tr>
<tr>
<td>Calibration</td>
<td>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.</td>
</tr>
<tr>
<td>Cross-Section</td>
<td>A section survey that describes/illustrates the shape of a section of land or waterway.</td>
</tr>
<tr>
<td>Cumeics</td>
<td>An abbreviation for cubic metres per second (m$^3$/s)</td>
</tr>
<tr>
<td>Discharge</td>
<td>The rate of flow of water measured in terms of volume per unit time, cumeics</td>
</tr>
<tr>
<td>Flood</td>
<td>Relatively high stream flow when water overtops the natural or artificial banks or a stream and spreads over adjoining land</td>
</tr>
<tr>
<td>Flood control works</td>
<td>Works referred to as flood control works are defined under the Water Act 1912 as ‘controlled works’. Controlled works require approval under the Act and are defined in Section 11.4.2 of the FMP.</td>
</tr>
<tr>
<td>Flood Hazard/Risk</td>
<td>Potential for damage to property or persons due to flooding</td>
</tr>
<tr>
<td>Floodplain</td>
<td>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 water Act it means ‘Designated Floodplain’ which has been legally licensed.</td>
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<tr>
<td>Floodways</td>
<td>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</td>
</tr>
<tr>
<td>Hydraulics</td>
<td>Term given to the study of water flow in waterways</td>
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<tr>
<td>Management Plan</td>
<td>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</td>
</tr>
<tr>
<td>Peak Discharge</td>
<td>The maximum discharge occurring during a flood event</td>
</tr>
<tr>
<td>Runoff</td>
<td>The amount of precipitation which ends up as streamflow</td>
</tr>
<tr>
<td>Unsteady Flow</td>
<td>Flow type that occurs when discharge and depth vary with time</td>
</tr>
</tbody>
</table>

### ABBREVIATIONS

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>AEP</td>
<td>Annual Exceedance Probability</td>
</tr>
<tr>
<td>AHD</td>
<td>Australian Height Datum</td>
</tr>
<tr>
<td>ARI</td>
<td>Annual Recurrence Interval</td>
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<td>DNR</td>
<td>Department of Natural Resources</td>
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<td>FMC</td>
<td>Floodplain Management Committee</td>
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<td>FMP</td>
<td>Floodplain Management Plan</td>
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<td>FMS</td>
<td>Floodplain Management Study</td>
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<td>LGA</td>
<td>Local Government Area</td>
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<td>NHT</td>
<td>Natural Heritage Trust</td>
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<tr>
<td>WAMC</td>
<td>Water Administration Ministerial Corporation</td>
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APPENDIX B – FIGURES AND MAPS
Figure 2: Flood Control Works Proposals and Modifications

- Realign existing levee
- Supply Channel: Lower and maintain channel to approval specifications
- Raised Roads: Limit height to 15cm above ground level and provide 200m of causeway in every 1000m of road
- Suggest Shire increases capacity of causeway south of "Boyanga" access road
- Modify existing term end and investigate because of river embayeement south of town in"
- Raised Roads: Limit height to 15cm above ground level and provide 200m of causeway in every 1000m of road
- Core Wetland Area and Exclusion Area - no raised roads

Lower Gingham Watercourse Floodplain Management Plan
June 2006
Lower Gingham Watercourse Floodplain Management Plan June 2006

Figure 3: FMP Floodway Network

Draft Lower Gingham Watercourse Floodplain Management Plan
June 2006

Kilometres
1:90 000

Prepared by DNR
Date Printed: May 2006

Note to Lower Gingham Watercourse Floodplain
Management Study for data & mapping data

Department of Natural Resources
Figure 4: FMP Floodway Network and Environmentally Sensitive Areas

Lower Gingham Watercourse Floodplain Management Plan

June 2006

Department of Natural Resources