



NSW Government

DEPARTMENT OF NATURAL RESOURCES

Narrabri – Wee Waa Floodplain Management Plan

September 2005



Department of Natural Resources



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Prepared by:

Department of Natural Resources
Barwon Regional Office
Level 3, Noel Park House
155-157 Marius Street
Tamworth NSW 2340

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PREAMBLE

The *Narrabri – Wee Waa Floodplain Management Plan* (hereafter the *Narrabri – Wee Waa FMP*) has been prepared by the *Water Administration Ministerial Corporation* (hereafter WAMC) under Part 8 of the *Water Act 1912* and in accordance with the processes outlined in the NSW Governments *Floodplain Development Manual (2005)*. The preparation of the FMP was overseen by the *Narrabri – Wee Waa Floodplain Management Committee* (hereafter FMC), which comprises representatives from the community, various stakeholder groups and government agencies. Funding for the project was provided by the *Natural Heritage Trust (NHT)* and the *NSW Government*.

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.

Since the completion of Keepit Dam in 1960 significant irrigation development has occurred within the Narrabri – Wee Waa floodplain system. During the flood events of 1964, 1971 and 1974, the area suffered several major setbacks during its period of growth with large crop and stock losses. This triggered the development of several guideline documents ('original guidelines') around 1975 to coordinate the construction of flood control works. The 'original guidelines' have served as the main references when reviewing development applications, however they now require revision in order to be consistent with the needs of sustainable natural resource management.

The Narrabri – Wee Waa floodplain is now showing signs of stress related to alterations in flood flow patterns and landuse practices. As such it was considered necessary to undertake a new floodplain management study for the Narrabri – Wee Waa floodplain area. Once adopted, the *Narrabri – Wee Waa FMP* will replace the guideline documents. FMPs have a greater community involvement in identifying catchment issues and developing management strategies that are consistent with and reflect natural resource policies within the integrated catchment management framework. Such strategies also attempt to balance resource sustainability with social and economic objectives.

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

- 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 – outlines strategies to manage flood risk and flood management issues, and support the natural functions of the floodplain environment.

1.0 INTRODUCTION

1.1 Overview

A 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 *Floodplain Development Manual (2005)*. In formulating the *Narrabri – Wee Waa 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 *Narrabri – Wee Waa 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; and
- Balance the expressed requirements of landholders with the requirement to minimise the impact of floodplain development on natural flood flow patterns and ecological functions.

The FMP incorporates the key points and main outcomes of the *Narrabri – Wee Waa Flood Study* and the *Narrabri – Wee Waa 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 Floodplain Management Study where background and/or greater detail are 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 the *Narrabri – Wee Waa 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 *Narrabri – Wee Waa FMP* 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 Study Area

1.4.1 Overview

This FMP is concerned with the floodplain of the Namoi River from downstream of Narrabri (Mollee Weir) in the east to approximately Merah North (Doreen Lane) in the west. This study area, as identified in Figure 1, is located within a designated floodplain under Section 166 of the *Water Act 1912*. It stretches approximately 50 kilometres along the Namoi River and covers an area of approximately 800 square kilometres within the Local Government Area (hereafter LGA) of Narrabri Shire.

The study area is characterised by very flat terrain with elevations dropping approximately 1 metre per 1500 metres (0.067%) generally in an east to west direction. Small variations in contours are associated with drainage lines and alluvial depositions along stream courses.

Following the construction of Keepit Dam in 1960 and the introduction of cotton, the Namoi River Valley experienced a major shift in agriculture from low intensity to high intensity landuse. The area of irrigated cotton in the valley expanded from 25 hectares in 1961 to approximately 30,000 hectares in 1984. The majority of landholders in the Narrabri - Wee Waa system now practice cropping, with the dominant system being cotton and cereal crop rotation. Some grazing still occurs but is gradually becoming less common.

Refer to the Floodplain Management Study for a detailed overview of the floodplain environment.

1.4.2 Flooding

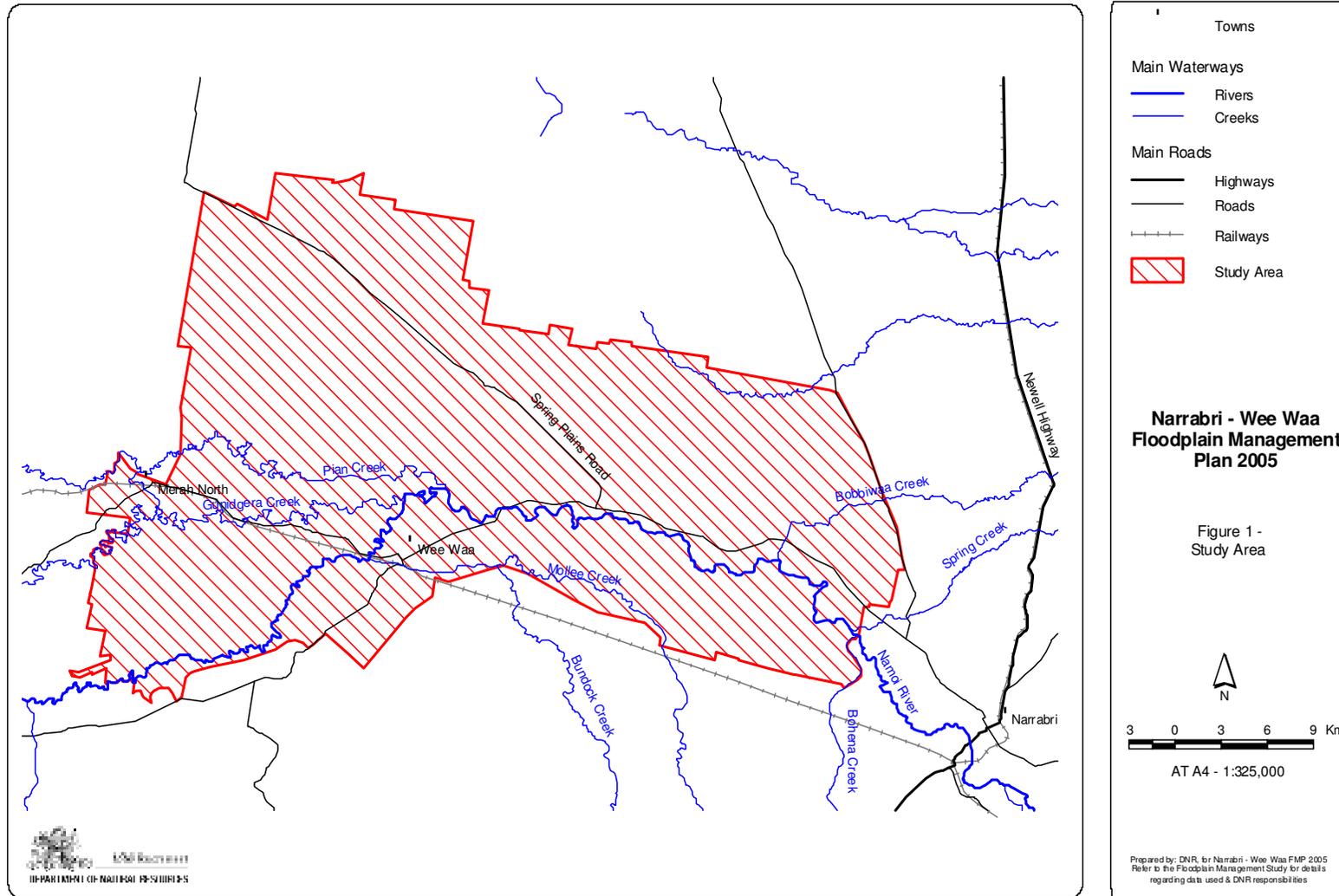
The Narrabri – Wee Waa study area has floodwater contributions from several major drainage lines including Namoi River, Bobbiwaa Creek, Spring Creek, Bohena Creek and Mollee Creek. The Namoi River is the primary drainage channel and conveys runoff into the study area from the upstream catchments.

Significant floods are not uncommon in the Namoi Valley with the most recent event being November 2000. Downstream of Narrabri, the carrying capacity of the Namoi River is significantly reduced and subsequently floodwaters spread out through an effluent system over a vast floodplain.

The main cause of flooding between Narrabri and Wee Waa is headwaters of the Namoi Valley. If floodwater from the upper catchment is contained within the Namoi River floodplain itself, significant dispersal of floodwater does not occur until the area of Myall Vale, which is approximately 10 km upstream of Wee Waa. This type of flood pattern results in major outflow on both banks of the river.

Flow from the Bohena Creek and Pilliga Scrub area can also contribute to flooding within the study area. This flood flow joins the Namoi River both upstream and downstream of Wee Waa.

Refer to the Flood Study for detailed information regarding flooding within the study area.



2.0 LEGISLATION AND POLICY OVERVIEW

The management of the Narrabri – Wee Waa 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 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 Development Manual (2005)* supports the policy and outlines a merit approach to floodplain management.

2.2 Water Act 1912 & 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 strengthened WAMC's ability to deal with unauthorised works.

At the time of preparing this FMP 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 flora and fauna, wetlands, threatened species, and fish habitat.

Of particular importance is the *Environmental Planning and Assessment Act 1979*. As the determining authority for flood control works, DNR is required to assess the environmental impact of the all proposed works under Part 5 of the Act.

2.4 Relevant Management Plans

Floodplain management comes under the umbrella of catchment planning. The *Narrabri – Wee Waa FMP* should be viewed as one component of the integrated planning process, with other components including -

- Water Sharing Plan for the Namoi Regulated River Water Source;
- Namoi Catchment Blueprint; and
- State Water Management Outcome Plan.

3.0 HYDRAULIC ASSESSMENT OVERVIEW

3.1 Overview

Investigation of flooding and floodplain management issues requires a detailed understanding and knowledge of flooding behaviour within the study area. To supplement available information on historical flood events, computer-based hydraulic models can be used to simulate flooding behaviour. Models can be used to assess the impact on flooding behaviour of existing flood control works and proposed structural management options. Information derived from models includes flood flow distribution, levels and velocities.

The hydraulic modelling of the Narrabri – Wee Waa system was undertaken using a fully dynamic, one-dimensional model known as the Danish Hydraulic Institute's MIKE 11 model. MIKE 11 is a commercially available engineering package specifically designed for river and floodplain systems. The program has built in functions for handling hydraulic structures such as culverts and weirs.

Refer to the Flood Study for detailed information regarding the hydraulic modelling of the system including input data and calibration methods.

3.2 Design Event

The 'design event' is the flood event adopted as the basis for planning and controlling development on flood liable land. The *Narrabri – Wee Waa FMC* determined that the 1971 flood should be adopted as the design event for the Narrabri – Wee Waa 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. This event was also selected as there is generally a good understanding of the 1971 flood behaviour among the community.

With regard to size, the 1971 flood has been determined to be 1 in 25 year event at Mollee Gauging Station. This size flood is referred to as a 25-year annual recurrence interval (hereafter ARI) event or a 4% 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.

3.3 Modelling Procedure

Modelling for the Narrabri – Wee Waa study area involved two phases:

- **Flood Study Modelling -**
 - **Pre-Development Conditions Modelling** - modelling of the floodplain system prior to the commencement of landuse change from grazing to cropping and development. The modelling was undertaken in order to obtain information on the natural flooding behaviour within the study area; and
 - **Existing Conditions Modelling** - modelling of the floodplain system after the area had experienced significant irrigation development. The modelling was undertaken in order to quantify any changes to the natural flooding characteristics within the study area.
- **Floodplain Management Study Modelling** - areas with flood-related issues were modelled with various modifications in order to determine potential and optimised solutions. In most instances, issues were treated collectively in order to determine the impact on surrounding areas and any cumulative impacts. Identified issues included –
 - Specific issues raised by the FMC and community with regard to the existing floodway network; and
 - Areas where significant disparities were identified between the flooding behaviour of the pre-development conditions model and the existing conditions model.

The models are well suited to predicting the change in flood behaviour due to existing or proposed floodplain development and served as an aid to the FMC in their decision making process.

4.0 FLOODPLAIN MANAGEMENT PRINCIPLES

An FMP typically aims to cater for flood flows, provide flood mitigation, encourage sustainability and maintain flooding to flood-dependent ecosystems. It will need to adhere to an overall set of management principles. The principles adopted by the *Narrabri – Wee Waa 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 (between adjacent landholders) 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.
- Socio-economic issues relating to floodplain management need to be identified and investigated. This includes considering both tangible damages (financial in nature and can be readily measured in monetary terms) and intangible damages (includes increase levels of emotional stress, physical illness and disruption to daily life).
- Should the community agree there may be scope to depart from the natural/historical drainage pattern, provided it is hydraulically and environmentally feasible.

These principles are adhered to and reflected within the FMP through adopted assessment criteria and will be applied by DNR when considering Part 8 applications under the *Water Act*.

It is noted that some of the above principles are difficult to achieve and may not be practically possible due to the history of floodplain development in the area.

5.0 DEVELOPMENT ASSESSMENT CRITERIA

5.1 Overview

In order to apply the floodplain management principles the *Narrabri – Wee Waa FMC* developed and adopted specific hydraulic, environmental and socio-economic criteria. Such criteria support the decision making process and assists 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 under Part 8 of the *Water Act 1912*.

The adopted assessment criteria are based on the 1971 flood event (design event) and/or an equivalent recurrence interval flood for local flows. Larger events may also need to be considered.

5.2 Adopted Criteria

5.2.1 Historical (for existing flood control works only)

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

5.2.2 Socio-Economic

- **Disruption to Daily Life** – unless previously agreed between all affected landholders, flood control works should not result in significant disruption to the daily life of surrounding landholders (eg. 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(s) of undertaking the work(s) warranted? In some cases it may be necessary to undertake a cost/benefit analysis (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** – flood control works should not pose detrimental impact on any individual landholder or 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.

It should be noted that one development proposal cannot limit the future potential of other landholders to develop.

5.2.3 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.
- **Floodplain Flora & Fauna** – flood control works should not isolate flood-dependent ecosystems from flood flow. The potential impact on habitat availability and threatened species may need to be assessed.

- **Soil Condition & 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 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.
- **Groundwater Recharge** – flood control works should not block or restrict flood flow to identified groundwater recharge areas.

5.2.4 Flooding Behaviour

- **Natural Flooding Characteristics** - flood control works should not result in a significant departure from the natural flooding pattern of the floodplain (after taking into account existing floodplain development).
- **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 & 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.
- **Works in Floodways** – generally proposed flood control works will not be approved within the FMP Floodway Network, with the exception of access roads below 0.3 metres above ground level and supply channels at or below ground level (assuming that such works do not result in significant redistribution or trigger other assessment criteria).
- **Redistribution** – acceptable increases in peak flood levels and percentage peak flow redistribution, as a result of flood control works, should be assessed against the following guideline values:
 - Increase in peak levels on a neighbours boundary to be a maximum of 10% (up to the limit of 10 cm) of the pre-development levels; and
 - Percentage peak redistribution to be a maximum of 2% of the pre-development distribution.

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.

Please note that it is at DNRs discretion whether or not to consider or approve any proposed work that results in a peak flood level increase of more than 20 cm or results in a percentage redistribution of more than 5%.

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

Table 1 - Assessment Criteria – Maximum Permissible Velocities

Ground Condition	Maximum Permissible Velocity (m/s)*
Bare soil	0.4
Crop	0.6
Native tussocky grass	0.8

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

6.0 FLOODPLAIN MANAGEMENT ISSUES

In order to finalise the FMP Floodway Network detailed in Section 7.0 and illustrated on Figure 4, identified floodplain management issues needed to be investigated and addressed. Refer to the Floodplain Management Study for further details regarding the identified issues.

6.1 General Issues

The following sections primarily highlight issues that should be considered and where necessary addressed in order to rectify existing problems prior to the next significant flood event and are significant in terms of effective floodplain functioning. The investigations of these issues involve hydraulic modelling and consideration of the assessment criteria detailed above in order to determine effective remedial strategies.

6.1.1 Unauthorised Works

For the purposes of this section, an unauthorised work is a flood control works that have been constructed other than in accordance with an approval that is in force under Part 8 of the *Water Act 1912*.

In order to improve flooding and floodplain management issues, all unauthorised flood control works within the study area must be modified or repaired to render the work in accordance with its Part 8 approval conditions. This is the responsibility of individual landholders.

6.1.2 Supply Channels

Supply channels that encroach into the FMP Floodway Network have the potential to redistribute flood flow. Although the impact from an individual channel may not be of concern, the cumulative impact of all supply channels above ground level within the study area is likely to contribute to significant downstream distribution issues.

Unless otherwise approved by DNR, all existing and proposed supply channels that encroach into the FMP Floodway Network must be lowered to ground level with the spoil removed. This is the responsibility of individual landholders. Where necessary, this requirement will be attached to new applications and renewal applications for supply channels as an approval condition under Part 8 of the *Water Act 1912*.

6.1.3 Levees Adjacent to Roads

In some locations within the study area, particularly along the Narrabri – Wee Waa Road, levees have been constructed immediately adjacent / parallel to roads. Where this is the case the levee and road both act as weirs, restricting the passage of flow and increasing upstream water levels during flood events. This has significant impacts with regards to flood flow distribution.

In order to alleviate and/or avoid the impact of these structures on flood flow distribution, existing and proposed levees that are located immediately adjacent to roads and where the road must remain the hydraulic control are to be modified or constructed to a limited height. This height is to be calculated as the height of the road minus the slope/gradient of the surrounding land -

$$\text{Maximum Levee Height} = \text{Road Crest Level} - (\text{Separation Distance} / \text{Slope})$$

Where necessary, this requirement will be attached to new applications and renewal applications for levee developments as an approval condition under Part 8 of the *Water Act 1912*. It is the responsibility of the individual landholders to lower existing levee developments that are identified by DNR to be critical.

6.1.4 Wee Waa Levee

The Wee Waa levee was designed to cater for a 1971-type flood event plus a one (1) metre freeboard (safety factor). The design crest profile of the levee was compared against the crest profile of the levee surveyed in 2002 by the Department of Public Works Services (DPWS). This comparison indicated that while the levee has not experienced any slumping, the design and constructed levels are not consistent with the original design parameter.

As such the *Narrabri Shire Council* should review the design and constructed levels of the Wee Waa levee in order to:

- (a.) Ensure a consistent one metre freeboard during a 1971-type flood event (design event). This will subsequently ensure levee integrity and protection during such events; and/or
- (b.) Determine if the 1971 design parameter is still appropriate.

6.1.5 Large Event Risk Management

This issue is primarily concerned with the fact during significant flood events, the levees in critical areas will result in redistribution of flow towards Wee Waa before being over-topped.

During March 2003 DNR surveyed levee crest heights upstream of Wee Waa. The surveyed levee crest heights were compared against the 1971 and 100-year ARI simulated flood events. This comparison indicated that the surveyed levees will over-top during a 100-year event, however will hold strong during a 1971-type flood event.

In order to maintain protection during small to medium sized flood events, while allowing over-topping in larger less common events, the following is required in the area identified on Figure 2:

- All existing rural levees must be maintained at their current height; &
- All proposed rural levees must be constructed at a height that is consistent with the surrounding levees and at a height that allows overtopping in a 100-year ARI flood event.

Farm storages and house levees that do not encompass normal farming land are except from this requirement.

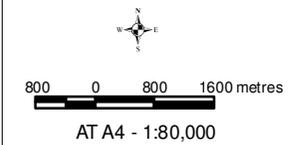
This is an interim measure until:

- The design crest levels of the Wee Waa Levee are revised; and
- As per Section 6.2.2, further investigation is undertaken and appropriate modification works and/or management measures are developed.



**Narrabri - Wee Waa
Floodplain Management
Plan 2005**

Figure 2 -
Limited Height Area



Prepared by: DNR, for Narrabri - Wee Waa FMP 2005
Refer to the Floodplain Management Study for details
regarding data used & DNR responsibilities

6.2 Further Investigation

The issues detailed in the following sections primarily related to the need to define a floodway network that achieves natural flood flow distribution and allows the orderly passage of flood flow through the system. Related matters include maintaining core floodplain inundation and flood-access to flood-dependent ecosystems.

6.2.1 Illaroo Creek Area

Assessment of the Illaroo Creek area was undertaken in order to determine the impact of existing flood control works on the carrying capacity of the creek. Prior to floodplain development the subject section of Illaroo Creek flooded at a width of approximately 600 metres. However flood control works have restricted sections of the creek to a minimum width of 60 metres. Residents to the north of the subject area have identified this issue, maintaining that during previous flooding events their rural residential allotments have been experiencing increased flood flow and water levels.

Subsequent to this FMP, an implementation study will further investigate this issue in terms of undertaking stakeholder consultation and considering the socio-economic viability of undertaking modification works. Figure 3 identifies the area of interest that the implementation study will focus on with regard to achieving natural flood flow distribution and considering the following management options:

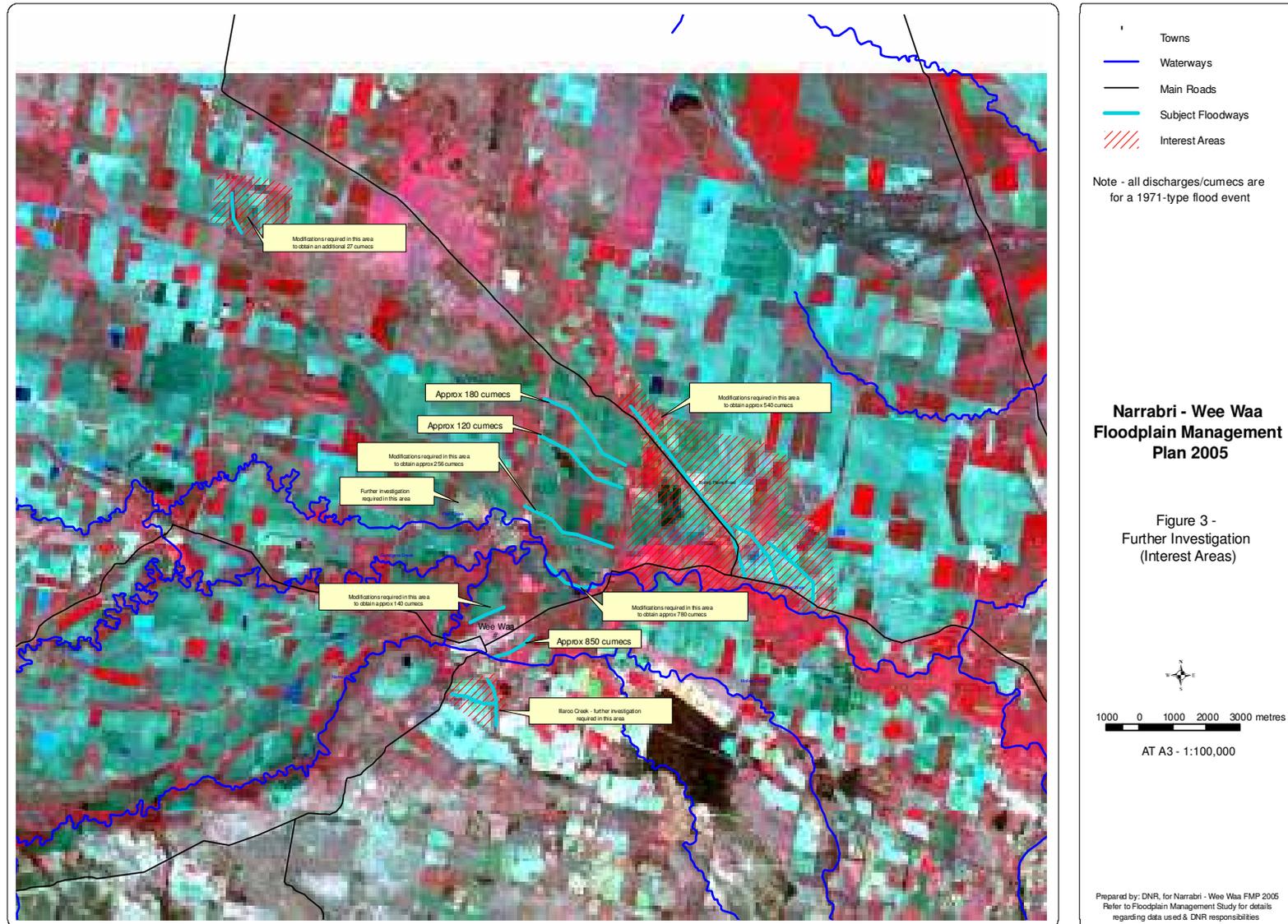
- No modification works to be undertaken;
- Specific modifications works to be undertaken by the landholder in an attempt to improve flow distribution; and/or
- Relevant stakeholders reach a compromise with regards to modification works in an attempt to improve flow distribution.

6.2.2 General Flood Flow Redistribution

Hydraulic modelling of the study area under pre-development conditions and existing conditions identified significant flood flow redistribution within the floodplain system. This redistribution is largely due to existing flood control works that restrict and/or block the passage of flow and subsequently impact upon flood flow distribution, water levels and flow velocities. Of particular concern is the increased flood flow being redistributed towards Wee Waa Lagoon and Doreen Lane:

- **Wee Waa Lagoon**
Modelling results indicate that upstream flood control works are restricting flood flow to the north-west and subsequently redistributing flows towards Wee Waa. This is primarily of concern as it is a significant disparity from the natural flood flow distribution and it is placing increased pressure on the Wee Waa levee. Under existing floodplain conditions, the following observations are made with regard to the Wee Waa levee:
 - A 1971-type flood event may enter the one (1) metre freeboard of the levee in particular locations, however there is minimal risk of overtopping; and
 - A 100-year ARI flood event may overtop the Wee Waa Levee unless a combination of risk management actions are implemented, such as limiting the height of rural levees upstream of Wee Waa and revising the design crest level of the Wee Waa Levee.
- **Northern Doreen Lane**
Modelling results indicate that during a 1971-type flood event the northern Doreen Lane area is experiencing significantly increased flood flow. This redistribution is largely due to upstream existing flood control works that have restricted and/or blocked the passage of flow and subsequently resulted in increased flood flow being pushed out to Doreen Lane.

Subsequent to this FMP, an implementation study will further investigate this issue in terms of undertaking comprehensive stakeholder consultation, detailed hydraulic modelling and considering the socio-economic viability of modification work options/proposals. Figure 3 identifies the areas of interest that the implementation study will focus on with regard to achieving natural flood flow distribution.



7.0 THE FMP FLOODWAY NETWORK

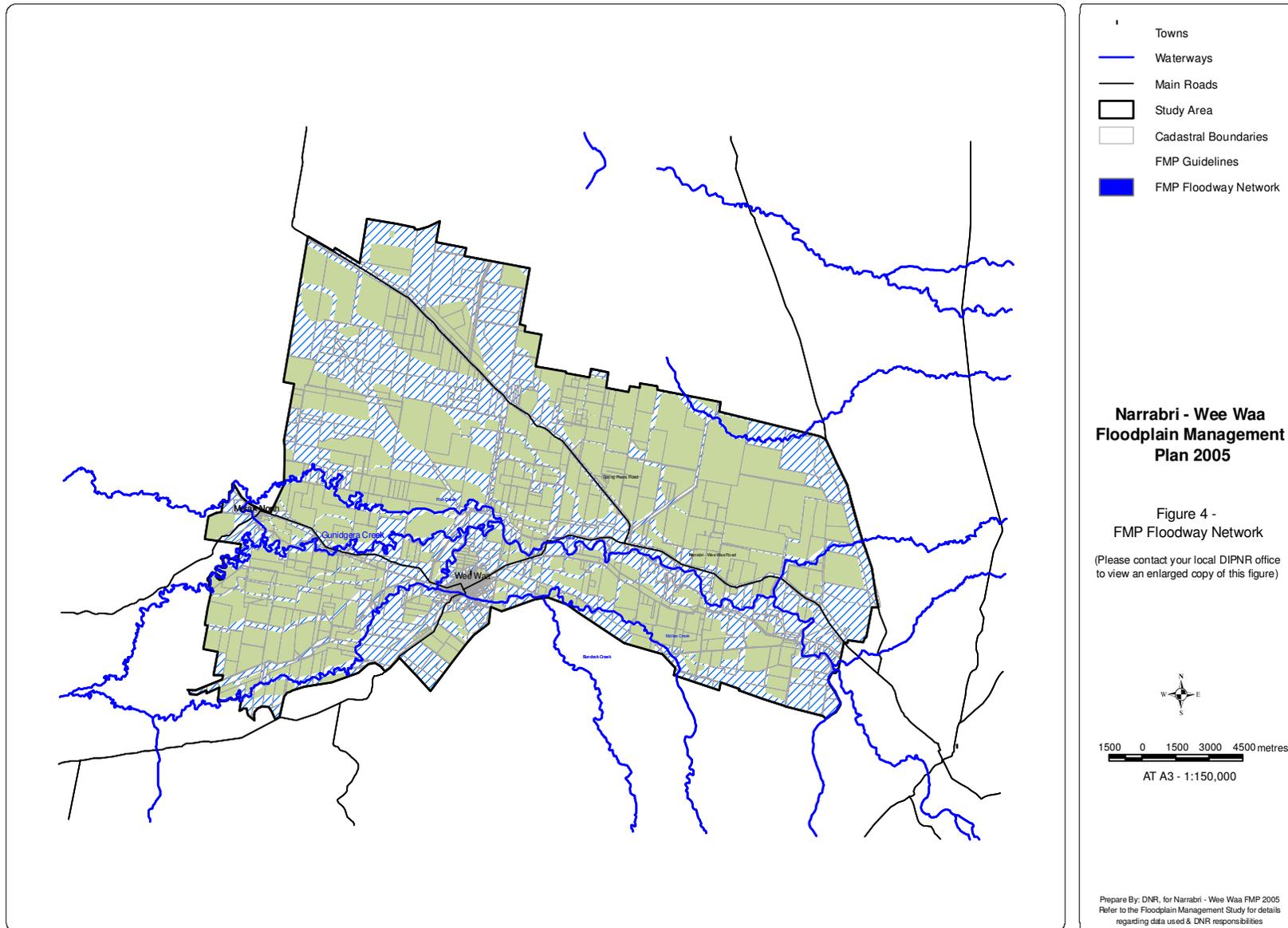
The FMP Floodway Network is identified on Figure 4 and delineates areas of the floodplain that allow the orderly passage of the 1971 flood event (25 year ARI). The floodway network has been designed at the strategic level and the accuracy of it at the property level is relatively coarse.

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

- Hydraulic Requirements – floodway network is required to establish and maintain the orderly passage of flood flow through the Narrabri – Wee Waa system and onto downstream floodplain environments; and
- Environmental Requirements – floodway network is required to ensure all identified flood-dependent ecosystems of conservation value are exposed to the flooding regime in order to improve 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 natural 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 10.6 for details regarding complying and non-complying works.

The area of potential future development (flood protection) is that area outside the FMP Floodway Network. These areas are defined as the FMP Guidelines and are also identified on Figure 4. These guideline areas are presented differently to the 'original guidelines' which were illustrated as a set of purple lines.



8.0 ENVIRONMENTAL ASSESSMENT

8.1 Overview

The *Narrabri - Wee Waa FMP* will influence the floodplain environment through aiming for a floodway network that achieves natural flood flow distribution. This will subsequently allow for the orderly passage of flood flow through the system, as well as maintain core floodplain inundation and flood-access to flood-dependent ecosystems.

When assessing the environmental impact of the *Narrabri – Wee Waa FMP*, current floodplain conditions were used as the benchmark. The following sections summarise the anticipated impact(s) of the FMP on components of the floodplain environment. Refer to the Floodplain Management Study for a detailed description of the floodplain environment and a detailed environmental assessment.

8.2 Environmental Assessment Summary

Table 2 summarises the findings of the environmental assessment undertaken in order to determine the anticipated impact(s) of the *Narrabri – Wee Waa FMP* on components of the floodplain environment.

Table 2 – Environmental Assessment Summary

Anticipated Impacts of the <i>Narrabri – Wee Waa FMP</i>	
Soils	<p>Flooding benefits floodplain soils by contributing moisture, sediment and nutrients. These soils regain their porosity and structure through a wetting and drying cycle. The FMP will maintain core floodplain inundation and as such will assist in maintaining soil condition and stability within the FMP Floodway Network.</p> <p>In addition the FMP will allow the orderly passage of flood flow through the system, reducing the potential for scour and erosion. It should be noted that the FMP Floodway Network is designed for the orderly passage of a 1971-type flood event (1 in 25 year event). A larger event would likely result in localised erosion and scour due to the overtopping of flood control works.</p>
Vegetation	<p>Vegetation stands containing Coolibah and River Red Gum are adapted to periodic wetting and drying cycles, and depend (to varying degrees) on periodic flooding for their long term sustenance.</p> <p>Field inspections identified that within the study area floodplain vegetation is now largely limited to riparian areas, some defined floodways and road reserves. Figure 5 illustrates a 1999 satellite image of the study area overlaid with the FMP Floodway Network and as evident all riparian areas, defined floodways and road reserves lie within the floodway limits. This ensures that flood access to floodplain vegetation will be maintained and that regeneration and ongoing health of the vegetation is facilitated.</p>
Wetlands	<p>Within the study area, most wetland areas are either small lagoons/depressions that only become inundated during flood events or are areas that have been hydrologically modified to service the cotton industry. Naturally functioning and healthy wetlands are adapted to a regime of wetting and drying. Nutrient cycling, invertebrate life cycles and aquatic plant life cycles are also linked to this regime. Major alterations to the regime reduce ecological productivity and biodiversity in the wetlands.</p> <p>Figure 5 illustrates wetlands in relation to the FMP Floodway Network and as evident all of the wetlands are within the floodway limits. This ensures 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.</p>
Fauna	<p>Although there have been no fauna surveys carried out, the <i>Narrabri – Wee Waa</i> floodplain is expected to support a range of species including up to 42 threatened species and 2 migratory waterbird species that potentially inhabit the area. Wetlands and floodplain vegetation provide key habitat for these species. The FMP will ensure that flood flow connectivity to identified wetlands and floodplain vegetation is maintained, thereby improving habitat quality and availability for fauna species.</p>
Fish	<p>12 native fish species, including the threatened Silver Perch and endangered populations of Olive Perchlet and Purple-Spotted Gudgeon are known or expected to inhabit the <i>Narrabri – Wee Waa</i> floodplain. The inundated floodplain provides important flood resources for these species as well as nursery habitat for Golden Perch and Silver Perch that spawn in response to flooding. The FMP will maintain core floodplain inundation and will ensure that flood connectivity between the river and the floodplain is maintained. This will assist in maintaining fish passage and access to spawning and feeding locations.</p>

Water Quality	The FMP will allow the orderly passage of flood flow through the system, reducing the potential for scour and erosion and subsequently improving surface water quality by minimising sedimentation and turbidity. In addition the FMP will maintain core floodplain inundation which will assist in minimising existing and future salinity issues by flushing salts from the soil surface and leaching salts through the soil profile.
Groundwater	The FMP will assist in maintaining and improving natural groundwater recharge by aiming to achieve a more natural flood flow distribution and maintaining core floodplain inundation. This will increase the likelihood (and duration) of natural groundwater recharge areas being subjected to flood flow inundation. If further information on natural recharge areas becomes available, the FMP may need to be altered to ensure that they are exposed to natural flooding.
Cultural Significance	2 Aboriginal sites have been recorded within the study area. It is highly likely that additional sites of significance exist (undiscovered) within the study area. Scarred/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 floodplain vegetation within the floodway network. As a result, the FMP ensures that flood connectivity to Aboriginal sites that may rely on flooding is maintained.

8.3 Instream Works

There are a number of low-level instream works within the study area that may restrict the free passage of fish. 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*, these 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 study 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 with NSW Fisheries approved structures. The NSW Fisheries publication *Policy and Guidelines for Bridges, Roads, Causeways and Similar Structures* (1999) should be referred to.

8.4 Downstream Floodplains

It is anticipated that the *Narrabri – Wee Waa FMP* will have a positive influence on downstream floodplain environments through –

- Achieving a more natural flood flow distribution through the Narrabri – Wee Waa system and onto downstream floodplain environments, and allowing the orderly passage of flood flow through the Narrabri – Wee Waa system and onto downstream floodplain environments; and
- Improving the connectivity between the study area and downstream floodplains by ensuring that there are no significant barriers to flood flow. The downstream boundaries of the study area will be largely open and as such promote the free passage of flood flow to downstream floodplains.

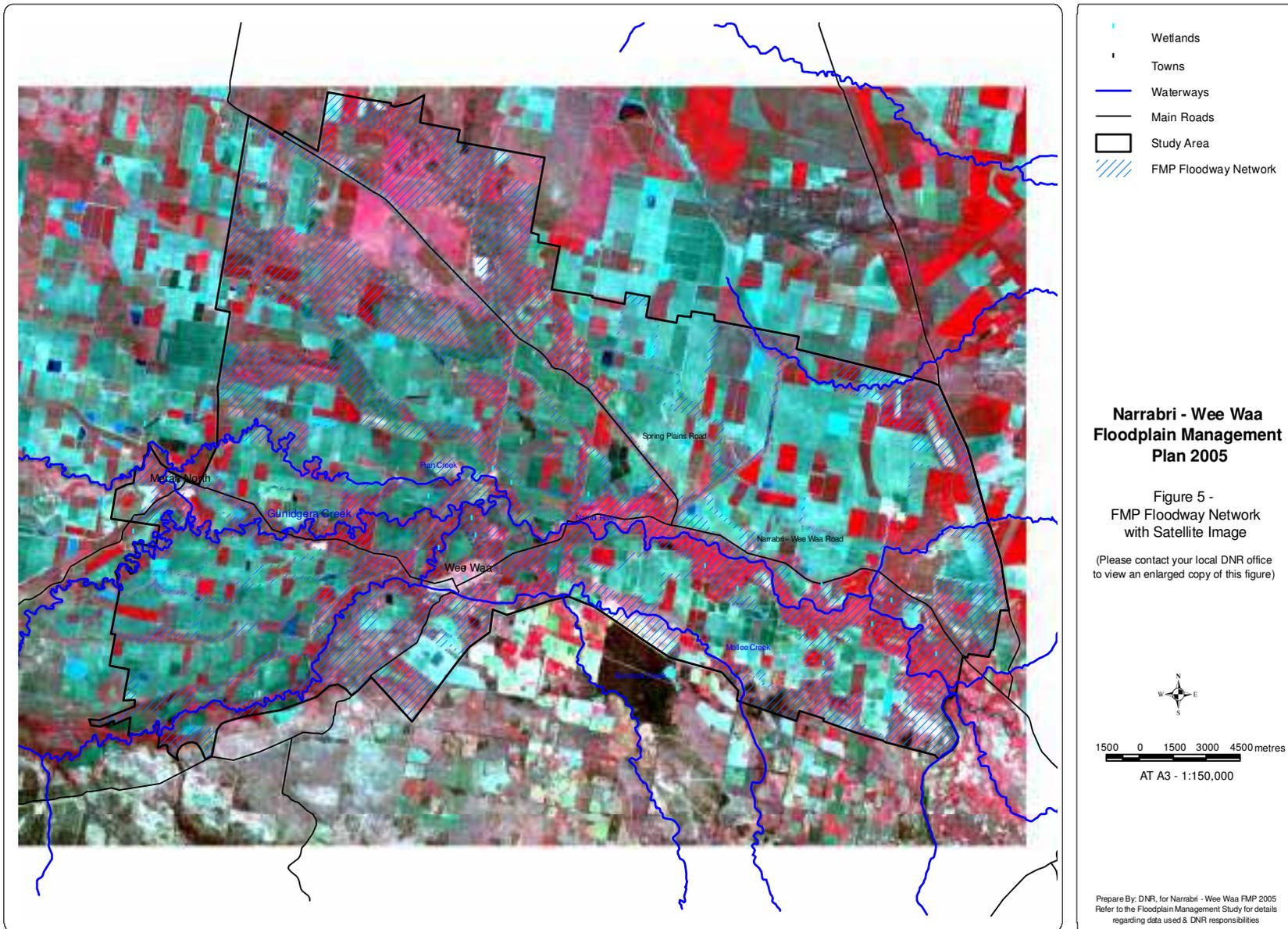
It is anticipated that implementation of the FMP will have a positive influence on the hydrological regime and flooding characteristics of downstream floodplains. It will ensure the long-term maintenance of flood flow to downstream floodplains and assist in maintaining productivity and biodiversity.

8.5 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 *Namoi River Floodplain (Narrabri to Wee Waa)* is identified as one of these key rural floodplains.

Based on available information, it is anticipated that the *Narrabri – Wee Waa FMP* will meet the target due to the following:

- Within the Narrabri – Wee Waa system a 1 in 5 year flood event would largely be contained within the watercourses and adjacent depressions. The FMP will ensure that these areas are open, 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 watercourses.
- Information regarding smaller flood events was obtained from several events that have occurred within the study area. This information will ensure that the lower flow paths that would be active in a 1 in 5-year event will be identified and remain unobstructed in the FMP.
- The FMP Floodway Network will be designed to allow the orderly passage of the 1971 flood discharge (1 in 25 year event). Information from the 1955, 1984, 1998 and 2000 flood events was included in the hydraulic and environmental investigations. These floods were significant events, with the 1955 (1 in 50 year) event covering most of the floodplain and in many parts was the largest event in living memory. By making allowance for the passage of such a large event, it is considered that all lower flow paths relevant to the SWMOP target will be unobstructed.



9.0 RELATED ISSUES AND MANAGEMENT PRACTICES

9.1 Landuse Management

9.1.1 General

In order to maintain and enhance the natural attributes of the floodplain environment, the following management activities should be considered:

- Establish and maintain a minimum riparian vegetation buffer zone along all waterways. This should be undertaken in accordance with the recommendations of the Catchment Management Authority (CMA);
- Increase permanent vegetation cover with locally occurring native species, especially around environmentally sensitive and erosion risk areas;
- Preserve all remnant vegetation (including dead trees and fallen timber) and remove competitive weeds;
- Exclude or limit stock from remnant vegetation and wetland areas in order to maintain and protect vegetation structure and diversity of habitat, as well as reduce soil compaction;
- Minimise chemical use in the vicinity of wetlands and undertake chemical activities (storing, loading and mixing) within a controlled or bunded area;
- Undertake nutrient balance calculations in order to apply only as much fertiliser as the crop requires and limit or avoid the use of residual chemicals when cropping floodways; and
- Undertake best management practices.

9.1.2 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 & Development Corporation 2000);
- Avoid farming and grazing of gullies and depressions; and
- Improve stream management practices to reduce bed lowering, bank erosion and siltation (refer to DNRs *Riverwise* notes).

9.2 Maintenance of Floodways

To ensure the integrity of flow distribution, floodways/waterways and buffer zones require on-going maintenance. Siltation and growth of dense vegetation will reduce the operational efficiency and channel capacity of floodways/waterways and in turn will increase flood flow breakouts.

Those proposing to undertake regrowth control as a form of floodway maintenance should contact their local DNR office and/or local Catchment Management Authority (CMA). The method of thinning should be one that minimises soil disturbance and reduces damage to non-target species. It is equally important that floodways be maintained and regularly inspected for damage, with identified problems promptly fixed. Such maintenance should include slashing and desilting activities.

9.3 Monitoring

9.3.1 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 identify whether any modifications or upgrades 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 gaugings 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 the Floodplain Management Study for detailed advisory notes on flood monitoring

9.3.2 FMP Review

FMPs 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 *Narrabri – Wee Waa FMP* be reviewed after the incidence of a 1 in 20 year flood event through the system. This review process may 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 floodway network.

9.4 Road Raising

For any work undertaken on regional roads, state and national highways, the local council should follow 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. The public consultation process should include newspaper advertisements and public notices, along with making the proposal available for public viewing. Landholders may make submissions with respect to proposed road levels. After considering any submissions the roads authority may decide to proceed, with or without alteration, or abandon the proposal.

For work undertaken on Shire Roads, a simplified informal procedure is usually adopted. For example, a new construction is usually based on existing levels of the road and the final levels determined on-site. At the construction phase, Councils should approach landholders to discuss matters that may affect their interests and their suggestions and objections are incorporated as appropriate.

Prior to undertaking any work on public roads, the local council should consider the aim of achieving and maintaining natural flood flow distribution. Councils need to consider the potential impact(s) of road works for all flood sizes on a cumulative basis and for the entire floodplain system, not simply on a local scale.

Although not bound by relevant legislation, local councils should consult DNR and consider the FMP for the area in which the work is proposed when planning roads works.

9.5 Riparian Buffer Zones

Landholders will benefit from maintaining adequate riparian buffer zones in terms of improving water quality, minimising land degradation and restoration expenses. The *Narrabri – Wee Waa FMP* aims to allow for the protection of riparian zones by enabling flood connectivity to these areas. Landholders are encouraged to regress from the riparian areas and undertake revegetation and conservation.

For more information regarding riparian buffer zones contact your local DNR office and/or local Catchment Management Authority (CMA).

10.0 IMPLEMENTATION STRATEGY

10.1 Implementation Study

Due to the complexity of the study area, once the *Narrabri – Wee Waa FMP* has been publicly exhibited and adopted it will be followed by an Implementation Study. The implementation study is likely to involve comprehensive landholder consultation, additional hydraulic modelling and socio-economic assessment of the issues identified in this FMP as requiring further investigation (as indicated on Figure 3). The study will aim to develop an on-ground implementation strategy, which has stakeholder consensus, for modification works found necessary in order to achieve natural flooding distribution.

10.2 Funding

The Narrabri – Wee Waa FMC proposes that all modifications to approved flood control works found necessary by the FMP and/or the implementation study be funded by government bodies. The FMC considers that the funding must cover modification costs, any actual loss to the land value of the property due to required modification works and costs associated with relocating irrigation infrastructure due to required modification works.

10.3 Performance Assessment

To measure the success of the *Narrabri – Wee Waa 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 be 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 study area;
- Natural flooding regimes maintained to identified wetlands and other flood-dependent ecosystems; and
- Increased security against flood risk.

10.4 Approval of Flood Control Works

10.4.1 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;
2. All Part 8 applications for new and existing (unapproved) works within the study 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 10.5 for further details regarding unauthorised works and Part 180D of the *Water Act 1912*.

10.4.2 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, & that is declared by order of the Ministerial Corporation published in the Gazette to be a controlled work, or
- 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, &
 - 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 for, or has the effect or likely effect of, preventing land from being flooded by water, &
 - 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. As such works situated or proposed some distance away from a river that are in the path of floodwaters will need to be licensed.

10.4.3 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 and discuss your proposal with neighbouring landholders.

Step 2 - 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 3 - Gather supporting information as your application will require you to supply technical information.

Step 4 - Fill in the application form. Complete additional information requirements on the form including condition of the existing surrounding environmental.

Step 5 - Lodge the application with the supporting information and application fee at your local DNR office.

10.4.4 Determination Process

All applications under Part 8 of the *Water Act 1912* must proceed through a set process prior to DNR (on behalf of WAMC) 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; and
 - The protection of the environment.
- **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 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 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.

10.4.5 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 an application approval if their interest(s) are 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.

10.4.6 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.

10.5 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 able to appeal against the decision to the Land and Environment Court.

10.6 Complying & Non-Complying Works

Once the *Narrabri – Wee Waa 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 10.4.4 is necessary.

10.6.1 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 situated or proposed to be constructed. Within the Narrabri – Wee Waa study 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; &
- The work does not trigger any issues when considering the adopted assessment criteria detailed in Section 5.0.

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 party objections.

10.6.2 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 situated or proposed to be constructed. Within the Narrabri – Wee Waa study area a work is non-complying if:

- The work is or is proposed to be located within the FMP Floodway Network as illustrated on Figure 4; &/or
- The work triggers one or more issues when considering the adopted assessment criteria detailed in Section 5.0.

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.

10.6.3 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*.

APPENDIX A – GLOSSARY & 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 as 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
Cumecs	An abbreviation for cubic metres per second (m ³ /s)
Discharge	The rate of flow of water measured in terms of volume per unit time, for example cumecs
Flood	Relatively high stream flow when water overtops the natural or artificial banks or a stream and spreads over adjoining land
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
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
Gauging Station	A place on a river or stream at which the stage is routinely measured, either daily or continuously, and where the discharge is measured from time to time so as to develop a relationship between water level and discharge.
Flood Slope	The slope of the water surface elevation along the direction of flow
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

ABBREVIATIONS	
Abbreviation	Definition
AEP	Annual Exceedance Probability
AHD	Australian Height Datum
ARI	Annual Recurrence Interval
CMA	Catchment Management Authority
DNR	Department of Natural Resources
EIS	Environmental Impact Statement
FMC	Floodplain Management Committee
FMP	Floodplain Management Plan
LEP	Local Environmental Plan
LGA	Local Government Area
NHT	Natural Heritage Trust
NPWS	National Parks and Wildlife Service
SEPP	State Environmental Planning Policy