



NSW Government
DEPARTMENT OF NATURAL RESOURCES

Upper Yarraman Creek Floodplain Management Plan

August 2006



Acknowledgments

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Upper Yarraman Creek Floodplain Management Plan August 2006

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PREAMBLE

The *Upper Yarraman Creek Floodplain Management Plan* (hereafter the *Upper Yarraman Creek FMP*) has been prepared in accordance with the process outlined in the NSW Government's *Floodplain Development Manual (2005)* and its predecessors the *2001 Floodplain Management Manual* and the *1986 Floodplain Development Manual*. The preparation of the FMP was overseen by the *Upper Yarraman Creek Floodplain Management Committee* (hereafter the *Upper Yarraman Creek FMC*), which comprises representatives from the community, various stakeholder groups and government agencies.

The NSW State Government's Flood Policy provides a framework to ensure the sustainable use of floodplain environments. The policy is specifically structured to provide solutions to existing flooding problems in rural and urban areas. In addition, the policy provides a means of ensuring that any new development is compatible with the flood hazard and does not create additional flooding problems in other areas (Refer to Appendix A for definition of flood hazard).

The NSW State Government's Flood policy provides for technical and financial support by the Government through the following sequential stages:

1. *Flood Study*
 - determine the nature and extent of the flood problem.
2. *Floodplain Management Study*
 - evaluates management options for the floodplain in respect of both existing and proposed development.
3. *Floodplain Management Plan*
 - adopts community owned strategies to manage flood risk and flood management issues, and support the natural functions of the floodplain environment.
4. *Implementation of the FMP*

This report has been prepared by Webb McKeown & Associates and Gunnedah Management Consultants, on behalf of the *Upper Yarraman Creek Floodplain Management Committee* and the *Department of Natural Resources* (hereafter DNR).

Rural Floodplain Management Plans aim to strategically manage existing and proposed flood control works so that flood risk is minimised while taking into account the social, economic and ecological values of the floodplain. Flood control works include privately-owned works such as levees, channel banks and roads that can affect the distribution of floodwaters (refer to Appendix A for detailed definition of control works).

DNR must consider relevant rural floodplain management plans when assessing applications for flood control works under the amended *Part 8 of the Water Act (1912)* or under the forthcoming regulations of the *Water Management Act 2000*. The DNR acts on behalf of the *Water Administration Ministerial Corporation* (hereafter the WAMC) under *Part 8 of the Water Act 1912*. The WAMC is the body who prepares, adopts and administers FMP's, administers the Act as well as receives and determines Part 8 applications. The Natural Heritage Trust and the NSW State Government jointly provided funding for this project.

1.0 INTRODUCTION

1.1 Overview

In the *Upper Yarraman Creek Flood Study* (hereafter FS) and *Floodplain Management Study* (hereafter FMS), data was collected and reviewed, a hydraulic computer model was established and flood related issues of greatest concern to the community were identified. **Figure 1** (Appendix B) indicates the extent of the FMP area and identifies the management options that were presented in the FMS.

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

In undertaking the establishment of the *Upper Yarraman Creek Floodplain Management Plan* it should be recognised that Yarraman Creek is a dynamic watercourse that has moved across the floodplain over time. The soils of the Yarraman Creek floodplain are highly mobile and it is probable that the Creek will shift again in the future. Any plans for the floodplain should therefore incorporate an awareness of this characteristic.

1.2 Vision Statement

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

1.3 Floodplain Management Principles

The *Upper Yarraman Floodplain Management Plan* is being prepared in conjunction with the local community and under the direction of the Yarraman Creek Floodplain Management Committee. The Committee was formed in line with the general principles and policies of the *Floodplain Development Manual* (2005) and its predecessors, the *Floodplain Management Manual* (2001) and the *Floodplain Development Manual* (1986). The following set of guiding principles was formulated by the Committee for incorporation into the Floodplain Management Plan:

- The FMP should recognise that the predominant land use in the area is for agricultural purposes and should balance the implications of actions from one generation to another, such that the environment of one generation does not unreasonably suffer from the development decisions or activities of another.

- Defined floodways must possess adequate hydraulic capacity and continuity to enable the orderly passage of floodwaters through the floodplain and should conform as closely as is reasonable to the natural drainage pattern after taking into account the existing floodplain development.
- Environmental issues related to the management of a rural floodplain need to be identified and investigated including developing strategies for environmentally sensitive areas.
- The FMP shall have due regard for government policy and legislation.
- Should the community agree, the FMP may provide scope to depart from the natural/historical drainage pattern, provided it is hydraulically, economically and environmentally feasible and that there is no detrimental impact from floodplain development on any individual landholder or community infrastructure, including increases in peak flood levels or increasing drainage times.

To properly achieve these objectives, a number of further guidelines, specifically in relation to the hydraulic principles for the floodplain, are indicated below:

- Floodplain development should not cause significant redistribution of floodwater.
- 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.
- Sufficient pondage must be retained on the developed floodplain so that flood peak travel time is not unduly accelerated to downstream areas nor flood height increased.
- The exit of floodwaters from defined floodways should be at rates and depths similar to those which would have been experienced under natural/historical conditions and should discharge as close as practicable to the location of natural/historical floodways.

1.4 Background

The *Upper Yarraman Creek Flood Study* and *Floodplain Management Study* were undertaken simultaneously and presented as one complete document. The Flood Study included the collection and review of data to define the nature and extent of flooding. Both hydrologic and survey data were used to establish a hydraulic model of the catchment. The model was then used to determine design floods. During the Floodplain Management Study process, the community was consulted about the flood related issues of greatest concern to them. The FMS identifies and discusses appropriate management options for dealing with these issues.

1.5 FMP Area

The Yarraman Creek catchment is within the Liverpool Plains. Indicated in **Figure 1** (Appendix B), the specific area of the FMP is bounded by the Warrumbungle Range in the south and the Carroona to Spring Ridge Road in the north. The total FMP area includes the entire floodplain and catchment, an area of approximately 51 500 hectares (515 square kilometres). The area of study falls under the control of the Quirindi Shire Council (Liverpool Plains Council as of mid 2004).

Within this large study area, the focus has been on the floodplain, defined for this study as the area with slopes of less than 2%. The upper catchment was included in the study area in order to understand the processes and causes of some issues on the floodplain.

The catchment is characterised by fertile black self-mulching soils which support dryland farming, irrigated cropping and cattle grazing. The rich soils make the Liverpool Plains one of the most productive areas for agriculture in NSW.

The main watercourses in the catchment area are Yarraman Creek, Kickerbell Creek, Camerons Creek, Campbells Creek and Ryemere Gully. Yarraman Creek is the primary watercourse. In the upper catchment the creek is reasonably well defined. In the lower floodplain the creek becomes less confined and during flood events breaks out and forms alternative channels. Downstream of the Spring Ridge-Caroon railway line, flow from Yarraman Creek follows two main paths. The first portion follows Native Dog Gully to the Mooki River, while the other portion joins the flow from Coomo Coomo Creek in the direction of Lake Goran.

Refer to Section 5 of the *Upper Yarraman Creek FS* and *FMS* for further details regarding environmental issues within the FMP area.

2.0 LEGISLATION & POLICY OVERVIEW

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

2.1 The Flood Prone Land Policy

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

2.2 Water Act 1912 & Water Management Act 2000

Floodplain management in western rural areas of New South Wales are administered by DNR under 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 *Water Management Act 2000* has been produced during the preparation of this Study and Plan, following NSW State Government reform of water legislation. It should be noted that the new *Water Management Act 2000* is not yet in operation, and while it will eventually replace the current *Water Act 1912*, the *Water Management Act 2000* and the *Water Act 1912* will not operate side by side.

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

2.3 Additional Floodplain Management Controls

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

Of particular importance are the *Environmental Planning and Assessment Act 1979* and *Environmental Plan and Assessment Regulation Act 2000*. As the determining authority for flood control works, DNR is required to assess the environmental impact of proposed works under Part 5 of the Act (EPA 1979).

2.4 Relevant Management Plans

The *Upper Yarraman Creek FMP* should be viewed as one component of the integrated catchment planning process, with other components including:

- Yarraman Creek River Care Plan;
- Water Sharing Plans;
- Namoi Catchment Action Plan

3.0 HYDRAULIC ASSESSMENT OVERVIEW

3.1 Overview

Implementation of floodplain management measures required an understanding of flooding behaviour within the study area. 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.

The RUBICON computer hydraulic model for the Upper Yarraman Creek floodplain has been set up to simulate the main Yarraman Creek channel as well as the overbank channels and floodplain. The steeper sections of the catchment upstream of Yarraman North were modelled using HEC-RAS. It should be noted that it was not practicable to define and survey the complex array of gullies and flood runners which exist within the study area as apart from anything else, these features are constantly changing due to natural processes. Accordingly, the hydraulic modelling provide a broad overview of flood behaviour within the floodplain. In addition, because of the transient nature of the floodplain and the relatively shallow depth, no major flowpaths could be defined. There are no permanent flowpaths other than Yarraman and Kickerbell Creeks.

Refer to the *Upper Yarraman Creek Flood Study and Floodplain Management Study* report for detailed information regarding the hydraulic modelling, including input data and calibration methods.

3.2 Design Flood Event

The 'design event' is the flood event adopted as the basis for planning and controlling development on flood liable land. The *Upper Yarraman Creek Floodplain Management Committee* has adopted the 5 year Annual Recurrence Interval (hereafter ARI) flood as the Flood Mitigation Standard (Design Flood) for this catchment as an event of this magnitude would cause significant overbank flooding in the lower floodplain areas. Refer to **Appendix A** for the definition of ARI and design event.

4.0 FLOODPLAIN MANAGEMENT PLAN – ACTIONS

Table 1: Floodplain Management Action Plan

Type of Action	Action	Priority	Timing	Responsibility	Performance Indicators
Education	• Improve community awareness in the requirements for obtaining permission to build control works on the floodplain.	High	6 months	Committee/DNR	• a successful, functioning control works approval process.
	• Improve individual landholders awareness of the implications of any alteration to contour banks on their land.	High	6 months	Committee/DNR	
Land Management	• Prevent prolonged ponding of flood water.	High	Ongoing	Land holders	<ul style="list-style-type: none"> • no increase in fences, • remnant netting fences removed, • increase in response cropping, • minimised debris build up on floodplain, • minimised ponding of water on floodplain, • increased and controlled native vegetation, • less weeds in riparian zone.
	• Adopt or implement response cropping where possible.	High	Ongoing	Land holders	
	• Maintain fence lines to prevent the build up of vegetation and soil.	High	Ongoing	Land holders	
	• Avoid concentration of flow by fence lines, contour banks etc. Where possible netting fences should be removed and replaced with wire fences. Non-essential fences should be removed from the floodplain.	Medium	12 months	Land holders	
	• Minimise the build up of debris on the floodplain as much as possible.	Medium	Ongoing	Land holders	
	• Access tracks should have approximately 20m of low level “causeway” every 100m or so to allow for flow of water.	Medium	landholder discretion	Land holders	
	• Contour banks should be individually assessed prior to any construction, modification or removal.	Medium	Ongoing	Land holders	
	• Grow native vegetation where possible.	Medium	12 months	Land holders	
	• If necessary, establish deep rooted perennials above waterlogged sites or saline outbreaks.	Medium	Ongoing	Land holders	
• Re-vegetate any saline areas using salt tolerant species.	Medium	12 months	Land holders		
Farming Practice	• Continue to encourage the use of minimum/zero till and downhill farming, or “technology that is appropriate to the conditions”.	High	Ongoing	Land holders	<ul style="list-style-type: none"> • decreased working of soil, • improved water use efficiency, • minimised debris buildup on floodplain, • increased ground cover on
	• Maximise water use efficiency.	High	6 months	Land holders	
	• Encourage responsible farming practices with respect to chemicals (drift zones).	High	6 months	Land holders	
	• Encourage management practices that reduce the mobility/size of stubble.	Medium	12 months	Land holders	
	• Increase groundcover where possible.	Medium	12 months	Land holders	

Type of Action	Action	Priority	Timing	Responsibility	Performance Indicators
					floodplain.
Infrastructure	<ul style="list-style-type: none"> The existing railway culverts over Yarraman Creek should be replaced by a design incorporating wider cells. An attempt should be made to address this issue within the next 2 years and achieve the desired outcome within the next 5 years. 	High	2-5 years	Railways	<ul style="list-style-type: none"> appropriately designed culvert waterway.
	<ul style="list-style-type: none"> The other existing railway culverts should also be replaced by a design incorporating wider cells should the opportunity arise. 	Medium	2-5 years		
Maintenance	<ul style="list-style-type: none"> A system which ensures that the railway culverts remain unblocked during a flood must be in place to allow for efficient drainage of the floodwaters from the floodplain. This should include an investigation into the effectiveness of the installation of flood debris structures. 	High	ongoing	Railways	<ul style="list-style-type: none"> successful management of culvert blockage, minimised ponding and flooding in vicinity of railway culverts, minimised debris buildup on floodplain, decreased bank erosion in gravel extraction areas.
	<ul style="list-style-type: none"> A consistent maintenance program needs to be developed and implemented at the railway culverts. During times of flood, the intensity of this maintenance program needs to be increased. 	High	ongoing	Railways	
	<ul style="list-style-type: none"> Shire to slash/graze/maintain sides of roads and to minimise the build up of Council roads. 	Medium	12 months/ongoing	Council	
	<ul style="list-style-type: none"> Roads perpendicular to the flow can be built with slight "causeway" depressions to allow the passage of flow across floodplain, as long as it does not result in the concentration of flow. 	Medium	Council discretion	Council	
	<ul style="list-style-type: none"> Gravel extraction should be minimised, and discontinued in active parts of the creek system. 	Medium	12 months	Council/Landholders	
Riparian Zone	<ul style="list-style-type: none"> Stabilise creek banks by artificial means in areas that are dangerous or place permanent infrastructure at risk. 	High	6 months	Land holders	<ul style="list-style-type: none"> decreased bank erosion, well established riparian areas.
	<ul style="list-style-type: none"> Decrease disturbance to the banks in non-flood times. 	High	ongoing	Land holders	
	<ul style="list-style-type: none"> Establish riparian buffer zones and encourage managed grazing/slashing where feasible. 	High	6 months	Land holders	
	<ul style="list-style-type: none"> River Oaks that are causing water diversion between the banks and consequent damage to the banks should be removed. 	Medium	12 months	Land holders/DNR	

5.0 RELATED MANAGEMENT ISSUES

5.1 FMP Review

Any Floodplain Management Plan adopted by the Minister under the *Water Management Act 2000* is required to be reviewed at 5 yearly intervals in order to determine whether their provisions adequately implement the water management principles of the Act. It is also recommended that a review of the FMP after an event close to or exceeding the design flood (5yr ARI) occur.

5.2 Best Management Practices

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

- Increase vegetation cover where possible, particularly around environmentally sensitive and erosion risk areas.
- Undertake conservation farming practices for cultivated areas.

5.3 Riparian Buffer Zone

A riparian zone is a zone of variable width on either side of the flow in a channel. In this case, the setback would ensure that no farming or grazing is undertaken within this zone, except in the form of managed grazing. It has been recommended in the Management Study (FMS - Bank Stability) that riparian buffer zones be established and maintained along the main watercourses (Yarraman Creek and Kickerbell Creek) to help maintain the integrity of the banks and the general health of the creeks and the adjacent cultivated land.

Landholders will benefit from maintaining adequate buffer zones in terms of improving water quality, minimising land degradation and restoration expenses.

During the discussion of management options and the establishment of the Management Plan Actions, the FMC agreed that a set distance for the riparian buffer zone along the main watercourses would be appropriate. A set distance along the creek would allow simplicity in the implementation and management of the zones.

The Committee agreed that an appropriate set distance would be 40 metres. This would fall into line with the current legislation, and allow for easy understanding of what is required by the FMP in regards to works allowed within the riparian zone, as defined by the *Rivers and Foreshores Improvement Act 1948*, which may carry over to the *Water Management Act 2000*. While the legislation may be changing, the distance is still consistent with best management practices for native vegetation and land management in the area. A zone of this width should gain community acceptance due to its consistency with prior guidelines.

Due to the dynamic nature of the Yarraman floodplain, and the changing nature of the flow paths and braided streams that form during flood events, it is not feasible to establish clearly defined riparian zones in areas besides the main creeks.

6.0 PLAN IMPLEMENTATION

6.1 General

A coordinated approach to the implementation of the recommendations outlined in the FMP will allow the maximum floodplain benefit to be achieved.

The community is encouraged to implement those parts of the FMP that require changes in the riparian zone as soon as practical to avoid the FMP objectives being frustrated by future changes in direction. Works outside the riparian zone are less susceptible to being frustrated by changes in legislation, planning and policy. Adjoining landholders are also encouraged to carry out any works or actions together to avoid an isolated and piecemeal approach to the management of the floodplain

6.2 Responsibility

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

Landholders

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

Upper Yarraman Creek Floodplain Management Committee

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

Department of Natural Resources

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

Council

Council has a responsibility to ensure that roadworks and other public infrastructure are built and maintained in accordance with the objectives of the FMP and principles of the Floodplain Management Manual.

Railways

The Railway Infrastructure Corporation has a responsibility to provide an ongoing maintenance program for their railway culverts and should also have a long term plan to replace culverts, as discussed in the Floodplain Management Study and recommended in the FMP (see **Table 1**).

6.3 Approval of Flood Control Works

Currently, there are no flood control works requiring approval in the FMP area. However, as a future resource, this section deals with the process and requirement when applying for work to be undertaken on the floodplain. Works referred to as flood control works are defined under the *Water Act 1912* as 'controlled works' and include earthworks, embankments, levees, access roads, irrigation channels and dams. The FMP relates to control works within the floodplain, being those flatter areas below a 2% ground slope, as indicted on **Figure 1**.(Appendix B).

6.3.1 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, including works that affect the flow of floodwater to or from a river. Therefore works situated or proposed some distance away from a river, which are in the path of floodwaters will need to be licensed.

While controlled works include earthworks, embankments and levees, these works could also include access roads, farm storage, irrigation channels and dams. Landholders should therefore contact their local DNR office for clarification in the first instance.

6.3.2 Applying for Approval

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

- Step 1 - Obtain a Part 8 application form from DNR
- Step 2 - Discuss your proposal with neighbouring landholders to gauge their concerns.
- Step 3 - Contact a DNR Floodplain Licensing Officer to arrange a site inspection, discuss the application and get advice on the information required for the approval process.
- Step 4 - Gather supporting information, including the information contained in this Floodplain Management Plan. Your application may require you to supply detailed technical information and assessment. This should be determined early in the preparation of the application.
- Step 5 - Fill in a Part 8 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.

6.3.3 Determination Process

All applicants 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:

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

Floodplain Management Plan

DNR must consider the *Upper Yarraman Creek FMP* and information contained within, including principles, assessment criteria and any other recommendations.

Part 5 of the Environmental Planning and Assessment Act 1979

All proposals must undergo assessment under Part 5. 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.

Additional Information

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

Possible Determinations

DNR will inform the applicant at the earliest opportunity of the determination of an application for a 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, and
- Refusal of the application.

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

6.3.4 Maintaining Compliance

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

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

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

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

By way of a notice served on the occupier of the land, DNR can require the occupier to carry out work for the purpose of removing, modifying, repairing or rendering ineffectual any unauthorised controlled

work. In addition, DNR can require the occupier to carry out other work of a remedial nature, such as work to correct or restore any alterations caused to water flow by the unauthorised controlled work.

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

6.4 Assessment Criteria for Flood Control Works

This section provides a guide for the expectations when assessing future flood control works.

6.4.1 History

- **Complying Works** - works that comply with the existing guidelines (that is, the FMP) will normally be accepted, unless additional information and/or flood observations illustrate that the works have 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.
-

6.4.2 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 land holders (for example property access).
- **Health Impact** - flood control works should not impose negative health impacts or stress on surrounding landholders.
- **Cost of the Works** - is the associated cost and benefit(s) of undertaking the work(s) warranted? In some cases it may be necessary to undertake a cost/benefit analysis (a preliminary assessment may be adequate) in order to weigh up the hydraulic and/or environmental benefit(s) of undertaking the work(s) against the required expenditure. This must be determined through consultation with the affected stakeholders and DNR.
- **Infrastructure Damage** - 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.

6.4.3 Ecological

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

6.4.4 Flooding Behaviour

- **Natural Flooding Characteristics** - flood control works should not result in a significant departure from the natural flooding or drainage pattern of the floodplain (after taking into account the existing floodplain development).
- **Hydraulic Capacity** - 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.
- **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 conditions given for complying works in Section 7 of this *Floodplain Management Plan*. Applications for works that do not meet the requirements will be considered as non-complying works and must be subject to Part 8 approval.
- **Flow Velocities** - flood control works should not significantly increase velocities of flood flow in areas flooded by the design flood (5y ARI). Velocities should be of an order that does not significantly increase erosion and siltation under various land uses. Refer to **Table 2**.

Table 2: Maximum Permissible Velocity per Ground Conditions

Ground Condition	Maximum Permissible Velocity (m/s)
Bare Soil	0.4
Crop	0.6

It should be noted, however, that in the majority of the floodplain, the velocity of flood flow is already greater than that which will cause significant erosion.

7.0 COMPLYING & NON- COMPLYING WORKS

As detailed in Section 6, all applications for flood control works will be processed by DNR under Part 8 of the *Water Act 1912* and will be assessed as either complying or non-complying works with regard to the *Upper Yarraman Creek Floodplain Management Plan*. Regardless of whether a proposed work is complying or non-complying, an application for approval under Part 8 is required and the determination process outlined in above must be undertaken.

7.1 Requirements for Complying Works

Work that meets the following technical requirements are considered to be complying with the intent of the FMP. This would include the construction or modification of flood mitigation levees, roads, irrigation headwalls, dams and any other structures or earthworks.

The works have been divided into three areas - within the riparian zone, roads and access tracks and outside the riparian zone. As discussed in Section 5.3, the riparian zone is a 40 metre buffer area from the watercourse (Yarraman Creek and Kickerbell Creek).

Refer to Section 6.6 and Figure 12 of the *Upper Yarraman Creek FS & FMS* for further details regarding Flood Network (Flowpaths and Floodrunners), or contact DNR – Floodplain Unit Barwon Region.

7.1.1 Work Outside the Riparian Zone

Works outside the riparian zone are considered to comply with the FMP if they meet the following conditions:

1. The height of the structure is less than 100 mm above normal ground level.
2. The total area of the structures is less than 20% of the floodplain extending on their side of Yarraman Creek.
3. The width of any structure section taken perpendicular to Yarraman Creek and Kickerbell Creek is less than 100 m.
4. Does not concentrate flow by more than 20% in the design flood (5 year ARI).

Condition 1 is relaxed for high value structures (houses, workshops and pump enclosures, etc.) so that they can be protected with high level walls on the proviso that:

- the dimension of the structure perpendicular to Yarraman Creek is less than 25 m;
- the enclosed area of the structure is less than 2500 m².

These requirements have been implemented to assist in reducing the average velocity increases to less than 20% and reducing the potential increase in flood levels to less than 100 mm on the floodplain during the design flood. A schematic diagram of these requirements is indicated on **Figure 2** (Appendix B).

7.1.2 Construction of Roads and Access Tracks

Roads and access tracks can act as levees and can cause significant diversion of flow. It is not practical to limit their length as landholders must have access through their properties.

Roads are considered complying provided they are no more than 100mm above ground level and a 20 meter length of road is constructed at ground level every 100metres. Where practical, the construction of roads or access tracks at ground level is encouraged.

7.1.3 Works in the Riparian Zone

The only works that are considered to comply with the FMP that are within the riparian zone are those works already approved by DNR under Part 8, existing works which are detailed in this FMP (Section 7.1.4) or works that have been recommended in the *Yarraman Creek River Care Plan (1996)*.

In some cases the landholder may be required to provide the necessary technical details to demonstrate that the application is a complying work. Where an existing or proposed flood control work is complying and the required environmental assessment is satisfactory, it is envisaged that the determination 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.

It should also be noted that, until recently, under the *Rivers and Foreshores Improvement Act (1948)*, proposed works within the riparian zone (defined by the Act as within 40 metres of the top of bank of protected waters, ie natural and artificial water bodies), may have required a Part 3A permit. A Part 3A permit is generally required for any excavation on, in or under protected land, or for removal of material (eg. soil or rock) from protected land, or to do anything that might obstruct or detrimentally affect water flow (eg. structures or fill). Each permit has conditions that are specific to the type of activity being undertaken to ensure there are no adverse impacts upon the riverine environment and to manage an environmentally acceptable outcome.

These Part 3A permit requirements will carry over to the new *Water Management Act 2000* when it becomes fully operational, although at this stage it is not clear whether the 40 metre buffer zone will remain. The potential requirement of such a permit for any proposed works within the riparian zone should be discussed with DNR prior to the application process.

7.1.4 Existing Works

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

The following existing works were raised as potential issues. They have been specifically investigated and are identified as acceptable as part of the FMP:

- A series of contour banks and waterways near Bald Hill which were built in the 1970's with assistance from the Soil Conservation Service. These structures define the current catchment boundary but still allow overflow from Coomoo Coomoo Creek into the Yarraman Catchment.

- The levee around “Amaroo” homestead and workshop facilities.
- Irrigation Development at .

There are also a number of contour banks and flood drainage works that exist on the fringe of the floodplain that are also acceptable as part of the FMP. **Figure 3** (Appendix B) provides an overview of the study area indicating the existing works on the floodplain that are acceptable to the FMP.

It has been concluded from the investigation of the works identified above as well as the overall floodplain that presently, there are no works that are considered unacceptable with regard to issues addressed in the FMP.

7.2 Non-Complying Works

An application for a flood control work will be deemed as non-complying if DNR is not satisfied that the work is in accordance with the principles of the FMP. Non-complying works may be approved after a detailed investigation of the hydraulic, environmental, social and economic impacts of the proposal. It is the applicant's responsibility to organise and pay a suitably qualified consultant to undertake the investigation. DNR will provide direction and guidance for the selection of a suitable consultant. The criteria for assessing flood control works is included in Section 6.4. Where the requested supporting information is not furnished, DNR can refuse to deal with the application.

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

A number of guidelines have been established by the Committee to assist DNR in the determination of applications.

Unacceptable impacts of non-complying works are:

- more than a 5% diversion of flows onto other landholders' property in a design flood (5 year ARI);
- an increase in flood level of more than 100mm (up to and including a 100 year ARI flood) on other landholders' property;
- any increase in flood level on any household dwelling or other high value structure (eg machinery shed, pump house etc.); and
- more than 20% increase in the average of velocity of flood flow across the floodplain

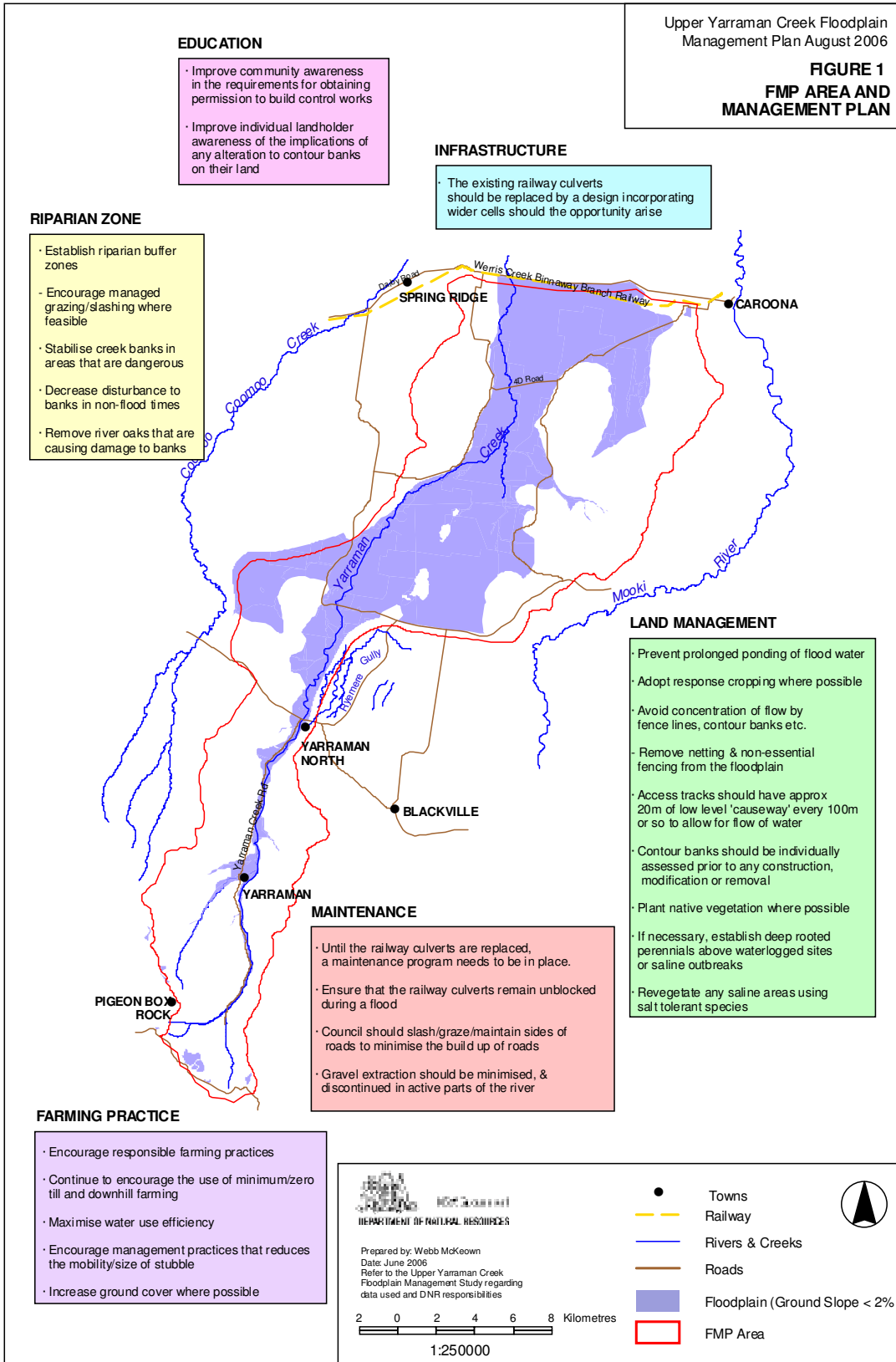
8.0 APPENDICES

APPENDIX A – GLOSSARY AND ABBREVIATIONS

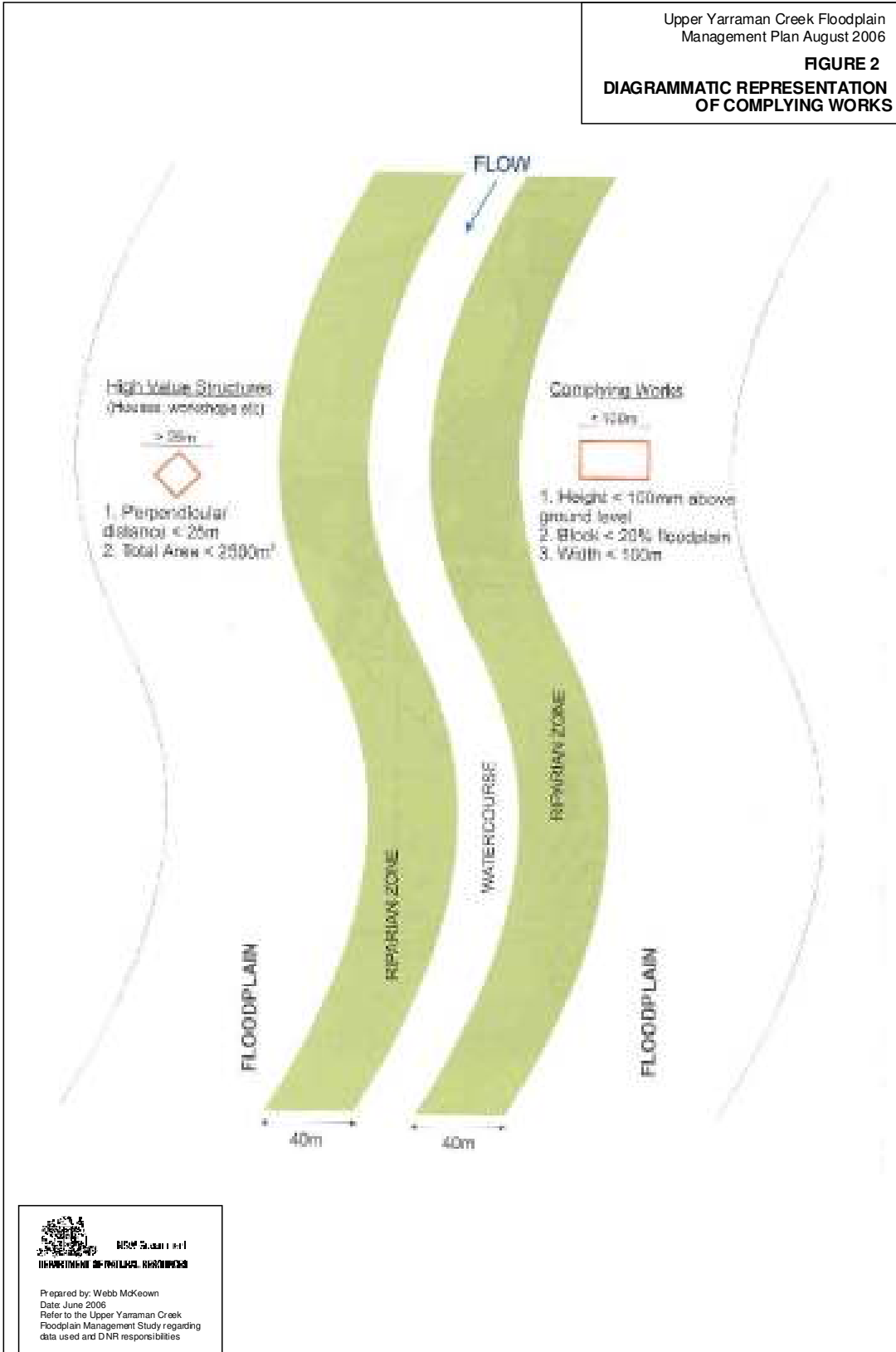
GLOSSARY	
Term	Definition
Annual Exceedance Probability	The chance of a flood of a given or larger size occurring in any one year, usually expressed as a percentage (%). For example, a flood with an AEP of 5% means there is a 5% chance that a flood of same size or larger will occur in any one year
Annual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


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

APPENDIX B – FIGURES 1 – 3



Upper Yarraman Creek Floodplain Management Plan August 2006
FIGURE 2
DIAGRAMMATIC REPRESENTATION
OF COMPLYING WORKS



 **DEPARTMENT OF NATURAL RESOURCES**
 Prepared by: Webb McKeown
 Date: June 2006
 Refer to the Upper Yarraman Creek Floodplain Management Study regarding data used and DNR responsibilities

