INDEX OF REPORTS OF THE BLAYNEY SHIRE COUNCIL MEETING HELD ON MONDAY 24 OCTOBER 2016

INFRASTRUCTURE SERVICES REPORTS

Floodplain Risk Management Study and Draft Floodplain Risk Management Plan for Blayney

Blayney Shire Council

Draft

October 2016

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Floodplain Risk Management Study and Draft Floodplain Risk Management Plan for Blayney

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01		1st Draft	MR, AH	A Hossain	A Hossain
02	14/10/2016	2nd Draft	AH	A Hossain	A Hossain

Cover photo: Henry Street during flood of 19 August 2010, photograph provided by Blayney Shire Council

Foreword

The primary objective of the New South Wales Government's Flood Prone Land Policy is to reduce the impact of flooding and flood liability on individual owners and occupiers of flood prone property, and to reduce private and public losses resulting from floods, utilising ecologically positive methods, wherever possible. Under the Policy, the management of flood prone land remains the responsibility of local government.

The policy provides for a floodplain management system comprising the following five sequential stages:

Data Collection	Involves compilation of existing data and collection of additional data
Flood Study	Determines the nature and extent of the flood problem
Floodplain Risk Management Study	Evaluates management options in consideration of social, ecological and economic factors relating to flood risk with respect to both existing and future development
Floodplain Risk Management Plan	Involves formal adoption by Council of a plan of management for the floodplain
Implementation of the Plan	Implementation of flood, response and property modification measures (including mitigation works, planning controls, flood warnings, flood preparedness, environmental rehabilitation, ongoing data collection and monitoring by Council)

Blayney Shire Council proposes to develop a floodplain risk management plan for Blayney to address the existing, future and continuing flood problems, in accordance with the NSW Floodplain Development Manual (2005).

A report entitled "Blayney Flood Study" was prepared by Jacobs Group Australia Pty Ltd (Sinclair Knight Merz merged with Jacobs in December 2013) in June 2015 for Blayney Shire Council to address outcomes from the first and second stages of the floodplain risk management process. This report represents the third stage of the management process and has been prepared for Council by Jacobs. The report identifies social and economic impacts of flooding in Blayney. The report identifies both structural and non-structural measures for floodplain risk management. A set of floodplain management measures is recommended for consideration by Council and other stakeholders.

Contents

Executive Summary

The Town of Blayney is located in the Central West region of New South Wales approximately 240km west of Sydney in the Blayney Shire Council area. Blayney Township (population 3,355 at the 2011 census) is the urban centre of Blayney Shire and provides the administrative, commercial, retail and industrial centre for the Shire. Blayney is strategically located on the junction of the Mid-Western Highway and the road between Orange and Goulburn. It is also located on the intersection of the Main Western Railway and the Blayney – Demondrille Railway, which provides a link between the Western and Southern lines, providing direct rail access into Melbourne.

The town of Blayney is located in the upper reaches of the Belubula River catchment, part of the larger Lachlan River basin, so flooding occurs with little or no warning, other than the contributory rain. Flooding from both mainstream and overland flooding is an issue for the town. Severe weather events in September and December 2010 and March 2012 resulted in the Belubula River and its tributaries all experiencing high flows which caused damage to the infrastructure including roads and bridges. Roads were closed in the town due to elevated water levels and SES attended houses in the area.

A Flood Study Report was prepared (Jacobs 2015) to define the flood behaviour for a range of flood events up to and including the probable maximum flood. Community consultations, review of the relevant planning and legislations, flood damage assessment and identification and assessment of flood mitigation measures have been undertaken as part of this study to formulate a Draft Floodplain Risk Management Plan (FRMP) for consideration by the Floodplain Management Committee and Blayney Shire Council.

Measures considered in the Draft Floodplain Risk Management Plan for Blayney are provided below.

Measures considered	Required Funding	Features of the Measure	Recommended Priority Rankings
1. Update the Local Flood Plan for Blayney.	SES costs	• SES to update the flood intelligence for the town of Blanyey and monitor flood behaviour in Abattoir Creek and the Belubula River. • SES to update the Local Flood Plan for Blayney utilising information in this study and the Blayney Flood Study Report (Jacobs 2015).	**High Priority:** this measure has a high priority for inclusion in the FRMP. It does not require Government funding and it has a high priority in terms of managing flood risk to people.
2. Implement controls over future residential development/ re-development in flood prone areas in Blayney.	Council costs	• Floor levels of new residential developments are to be located at the adopted Flood Planning Level (1% AEP flood levels plus the adopted freeboard). • No development or re-development is to be approved on floodways and Major Overland Flowpaths identified in the Blayney Floodplain Risk Management Study (Jacobs 2016). • All new residential buildings within the Flood Planning Area are to be	**High Priority:** this measure has a high priority for inclusion in the FRMP. It does not require additional local Government funding.

Measures considered	Required Funding	Features of the Measure	Recommended Priority Rankings
		constructed using flood compatible materials to withstand hydrostatic pressures and debris load • Council to provide information on flooding in Section 149 certificate • A cumulative flood impact assessment is to be undertaken for all development applications involving significant earthworks within the Blayney Flood Planning Area. • Evaluation of development proposals to use data presented in the Blayney Flood Study Report (Jacobs 2015) and in this FRMS, 2016 • Council to develop a stormwater management strategy to implement principles of water sensitive urban design for the town of Blayney.	
3. Provide flood signage and flood depth indicators at major roads crossing to enhance flood education and preparedness.	$15,000	• Provide flood signage and flood depth indicators at major roads crossing within the study area (approximately 30 signs)	**High Priority:** this measure would improve flood education and flood preparedness for residents and has a high priority in terms of managing flood risk to people.
4. Protect existing development from overland flooding.	$0.20 Million	• Initial investigations and assessments required in the preparation of concept design and cost estimates for the required works involving flood retarding basins.	**High Priority:** this measure would ensure that concept design and cost estimates are prepared to improve flood affection to existing developments from overland flooding.
5. Voluntary house purchase/ voluntary house raising	$0.65 Million	• Initial investigation to identify willingness of owners for voluntary house purchase/raising of two residential properties and voluntary house raising of one residential property impacted by mainstream flooding. • Capital costs of voluntary purchase	**Medium Priority:** this measure would ensure that no residential buildings are damaged in the 1% AEP event by mainstream flooding. A high priority is to be given to the initial investigation so that the

Measures considered	Required Funding	Features of the Measure	Recommended Priority Rankings
		and demolition and landscaping of two properties and voluntary house raising of one residential property.	preference of property owners are known and the cost of managing flood risk to properties can be finalized.

Important note about this report

The sole purpose of this report and the associated services performed by Jacobs is to prepare a Floodplain Risk Management Study report for the township of Blayney in accordance with the scope of services set out in the contract between Jacobs and Blayney Shire Council (hereafter Council). That scope of services, as described in this report, was developed with the Council.

In preparing this report, Jacobs has relied upon, and presumed accurate, any information (or confirmation of the absence thereof) provided by the Council and/or from other sources. Except as otherwise stated in the report, Jacobs has not attempted to verify the accuracy or completeness of any such information. If the information is subsequently determined to be false, inaccurate or incomplete then it is possible that our observations and conclusions as expressed in this report may change.

Jacobs derived the data in this report from information sourced from the Council (if any) and/or available in the public domain at the time or times outlined in this report. The passage of time, manifestation of latent conditions or impacts of future events may require further examination of the project and subsequent data analysis, and re-evaluation of the data, findings, observations and conclusions expressed in this report. Jacobs has prepared this report in accordance with the usual care and thoroughness of the consulting profession, for the sole purpose described above and by reference to applicable standards, guidelines, procedures and practices at the date of issue of this report. For the reasons outlined above, however, no other warranty or guarantee, whether expressed or implied, is made as to the data, observations and findings expressed in this report, to the extent permitted by law.

This report should be read in full and no excerpts are to be taken as representative of the findings. No responsibility is accepted by Jacobs for use of any part of this report in any other context.

All topographic data used in this study were sourced from a LiDAR survey and a ground survey which were undertaken by third parties engaged by the Council. Undertaking independent checks on the accuracy of the topographic data was outside Jacobs scope of work for this study.

This report has been prepared on behalf of, and for the exclusive use of, Jacobs's Client, and is subject to, and issued in accordance with, the provisions of the contract between Jacobs and the Client. Jacobs accepts no liability or responsibility whatsoever for, or in respect of, any use of, or reliance upon, this report by any third party.

1. Introduction

1.1 Background

The Town of Blayney is located in the Central West region of New South Wales approximately 240km west of Sydney in the Blayney Shire Council area. Blayney Township (population 3,355 at the 2011 census) is the urban centre of Blayney Shire Council (hereafter Council) and provides the administrative, commercial, retail and industrial centre for the Shire. Blayney is strategically located on the junction of the Mid-Western Highway and the road between Orange and Goulburn. It is also located on the intersection of the Main Western Railway and the Blayney – Demondrille Railway, which provides a link between the Western and Southern lines and direct rail access to Melbourne.

The town is located in the upper reaches of the catchment, so flooding occurs with little or no warning, other than the contributory rain. Severe weather events in September and December 2010 and March 2012 resulted in the Belubula River and its tributaries all experiencing high flows which caused damage to infrastructure including roads and bridges. Roads were closed in the town due to elevated water levels and SES attended houses in the area.

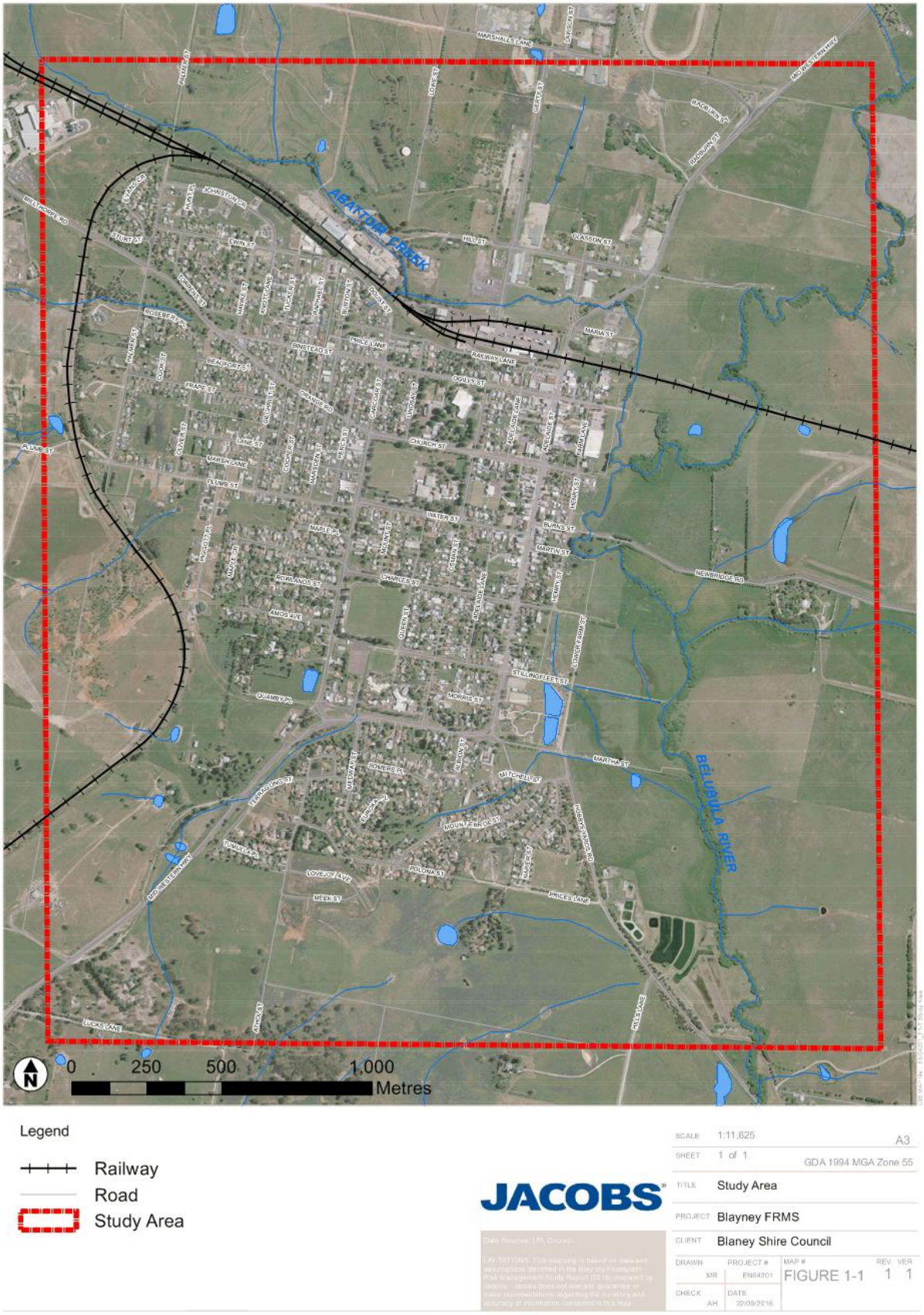
Council proposes to develop a Floodplain Risk Management Plan for the Town of Blayney to address the existing, future and continuing flood risk. Council wishes to develop formal floodplain risk management strategies to provide an appropriate level of protection for the community. Further, Council wishes to develop formal emergency management strategies to effectively manage the continuing flood risk for Blayney. Hence, Council proposes to develop a Floodplain Risk Management Plan in phases, in accordance with the NSW Government's (2005) Floodplain Development Manual. Initial investigations (including data collection and review of all relevant data) and a Flood Study, are components of the first phase (Phase 1). A Floodplain Risk Management Study (the Study) and Plan (the Plan) will be developed in the second phase (Phase 2), with the Plan being implemented in the third phase (Phase 3).

Sinclair Knight Merz (operating as Jacobs since December 2013) was engaged by Council in May 2013 to develop a Floodplain Risk Management Plan for the Town of Blayney encompassing all activities in Phases 1 and 2. This report details outcomes from Phase 2 (Floodplain Risk Management Study and Draft Floodplain Risk Management Plan) of the project.

1.2 Study Area

The town of Blayney sits in the Belubula River valley, part of the larger Lachlan River basin, and is surrounded by rolling hills that range from 890m to 930m above sea level and falling to the river corridor at approximately 850m to 860m. The town generally drains from west to east, with the major watercourse being the Belubula River running north to south along the eastern edge of the urban area (catchment size approximately 120km^2 upstream of the town). Remaining watercourses are either drainage channels or intermittent watercourses that generally run from the higher elevations to the north and west towards the Belubula River in the east. The only other named watercourse is Abattoir Creek (sometimes referred to as Farm Creek and with an approximate catchment area of 20km^2), which rises in the rural lands and undulating hills to the north west and drains along the northern edge of town, north of the Main Western Railway, before joining the Belubula River. As a result of this pattern of watercourses and the catchment topography there are potential drainage/flooding issues present in Blayney.

The study area for Blayney is presented in **Figure 1-1** which shows that the urban area is generally a typical grid pattern running in a north-south and east-west direction. Blayney is the key centre in the Blayney Shire with a variety of land uses including business, industrial, community and residential land uses and open space and recreation.



Legend

Railway

Road

Study Area

SCALE	1:11,625 A3
SHEET	1 of 1
	GDA 1994 MGA Zone 55
TITLE	Study Area
PROJECT	Blayney FRMS
CLIENT	Blaney Shire Council
DRAWN MR	PROJECT # EN04201
MAP #	FIGURE 1-1
REV.	1
VER	1
CHECK AH	DATE 22/09/2016

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1.3 Overall Objectives

Council needs to develop a Floodplain Risk Management Plan (FRMP) for Blayney, to address the existing, future and continuing flood problems, in accordance with the NSW Floodplain Development Manual (2005). To meet the requirements of the Manual, Council needs a FRMP in order to:

- Reduce the flood hazard and risk to people and property in the existing community;
- Provide valuable flood intelligence to assist State Emergency Service (SES) in updating Local Flood Plans for the township;
- Protect, maintain and, where possible, enhance the river and floodplain environment, and
- Ensure flood management decisions integrate the social, economic and environmental considerations.

The study was undertaken in three phases. Major activities undertaken in each phase are provided in the following sections.

1.3.1 Phase 1

Initial Investigations (Stage 1)

- Undertake a comprehensive site inspection;
- Review of all relevant documents, data and reports;
- Undertake a comprehensive consultation with the local community, Council and relevant agencies;
- Collate and assess all data and information required to satisfy this brief including the current status of the material;
- Identify any "gaps" in the available data including surveys required to complete the study and update all information as required, with the approval of the Council.

Flood Study (Stage 2)

- Establish appropriate hydrologic model/s of both the Belubula River and the sub-catchments for overland flooding assessment to be used in the estimation of design floods for riverine and overland flooding and /or modelling of flood storages;
- Establish appropriate hydraulic model/s for the Belubula River, Abattoir Creek and overland flowpaths within the study area, to be used in the estimation of design flood levels and modelling of any preferred/ recommended flood mitigation measures;
- Identification of flood velocities and flood levels for 0.5%, 1%, 5% and 20% annual exceedance probability (AEP) events and the probable maximum flood (PMF);
- Mapping of flood extents and peak velocities for all investigated design events

1.3.2 Phase 2 Floodplain Risk Management Study and Plan (Stages 3 & 4)

- Flood mapping including preparing hydraulic and true hazard categorisation mapping for the 1% AEP event and preparing a provisional Flood Planning Area map (based on the 1% AEP flood levels with a freeboard).
- An assessment of potential flood management and mitigation measures in order to achieve improvements necessary to meet the required service levels. Such measures may include flood modification (eg. levees, bypass floodways, retarding basins, channel modifications etc.), property modifications (eg. development control, rezoning, voluntary purchase of high hazard properties, house floor raising, flood proofing etc) and response modification (eg. flood education, flood preparedness, flood warning, local flood plans etc.);
- Estimates of the flood damages in the design floods and annual average damages and their net present worth;

- An economic assessment of the floodplain management measures based on life cycle costs and benefits;
- Completed application for financial assistance for all recommended mitigation and/or management objectives.

1.3.3 Phase 3 Floodplain Risk Management Plan Implementation

Council is responsible for implementation of the Floodplain Risk Management Plan.

1.4 Report Structure

The outcome of the Floodplain Risk Management Study and draft Plan (Phase 2) as described in **Section1.3.2** of this report and the outcome from the Phase 1 was produced in the SKM 2013 report.

The report has been divided into the following sections:

- Executive Summary
- Section 1: introduces the study
- Section 2: provides background information on catchment characteristics and land use for the study area
- Section 3: details community consultation process and outcomes from the consultation
- Section 4: provides a review on the relevant legislation and planning
- Section 5: details flood behaviour
- Section 6: assesses flood damages
- Section 7: provides an overview on floodplain risk management measures
- Section 8: provides details on the identified floodplain risk management measures for Blayney
- Section 9: provide details on the Draft Floodplain Risk Management Plan for endorsement by Council
- Section 10: acknowledges input provided by others in completing the study
- Section 11: provides details on references citied in this report
- Section 12: provides the glossary of terms
- Appendix A: contains the Newsletter and Questionnaire sent to residents
- Appendix B: includes flood results including flood extents, velocity maps and flood profiles

2. Background

2.1 Catchment Characteristics

The major watercourse adjacent to the town of Blayney is the Belubula River which runs along the eastern edge of the urban area. The remainder of the watercourses are either drainage channels or intermittent watercourses that generally run from the higher elevations to the north and west towards the Belubula River in the east. The only other named watercourse is Abattoir Creek located north of the Main Western Railway. As a result of this pattern of watercourses and the catchment topography there are potential drainage/flooding issues present in Blayney.

Belubula River is a perennial river which is part of the Lachlan River catchment. Belubula River rises south of Vittoria, mid-way between Bathurst and Orange and generally flows south and west. It is joined by eight minor tributaries before flowing east of the township of Blayney and then through Lake Carcoar where its flow is regulated, before reaching its mouth at the Lachlan River east of Gooloogong. Carcoar Dam, constructed in 1970, is a 52m high concrete arch dam with a capacity of 35800 ML (www.statewater.com.au). Water stored in Carcoar Dam is used for irrigation, stock and domestic usage, town water supply and water conservation. The full supply level of the dam is at RL 847.2 mAHD which is located approximately 10m below the bed level of the Belubula River in Blayney. This means that the flood levels in Blayney are unlikely to be impacted by backwater flooding due to Carcoar Dam.

2.2 Land Use

The majority of the catchment area of the Belubula River upstream of Blayney was cleared for agriculture, primarily grazing. A part of Vittoria State Forest is located along the upper northern catchment of the river. Abattoir Creek is a major tributary which joins the river near Blayney. The bed level of the Belubula River drops approximately 670m over its 165km course (grade of approximately 0.4%).

2.3 Effects of Flooding on the Community

During the severe weather events of September and December 2010, and March 2012 the Belubula River and its tributaries all experienced high flows causing damage to infrastructure including roads and bridges. Roads closed in the Town of Blayney due to elevated water levels included Hobbys Yards Road (MR390), Farm Lane, Henry Street and Newbridge Road. State Emergency Services (SES) attended houses in the Farm Lane and Henry Street area.

The Abattoir Creek catchment rises to the north-west of Blayney, through the undulating hills of rural lands, before entering the more built up area alongside the Main Western Railway in the vicinity of the old abattoir located at the western end of Hills Street. At the western end of the Intermodal Terminal at Blayney Railway station it joins with an unnamed water course from the urban area to the south of the Newcrest dewatering facility, prior to travelling east toward St Joseph's Central School, located north of the railway line at the intersection of Adelaide and Hill Streets. The school has been affected by overland flows along Abattoir Creek, in recent years, and most notably on 1 June 1990.

An unnamed water course that meets Abattoir Creek rises to the west of the Blayney-Demondrille Railway through rural lands before entering the piped stormwater system, before day lighting at the intersection of Burton and Smith Streets and passing under the Main Western Railway at the western end of the Intermodal Terminal. Residents have previously complained about ongoing development in the catchment, generating larger overland flows between Burton and Doust Streets exceeding the capacity of the drainage path.

The area to the south-west of Blayney on the western side of the Blayney- Demondrille Railway is generally directed to a single culvert under the railway, despite three culverts existing, and toward the piped system in the vicinity of the intersection Plumb Street and Piggot Place. On 21 December 2007, residents were affected by overland flows causing over floor flooding to dwellings at the lower end of Piggott Place.

To the south of Blayney, there are two drainage paths that carry flows into the urbanised environment. A catchment drains alongside the Mid-Western Highway through open flow paths, before crossing the highway in the vicinity of the Blayney Ambulance Station and passing along a concrete lined open channel to Stillingfleet Street into the piped network. The recently developed Highlands Estate to the south of Polona Street delivers

stormwater to a natural watercourse running behind properties to the west of Mount Errol Street before crossing Hobbys Yards Road. Residents complained to Council about surcharging of the stormwater pit at Polona Street.

2.4 Availability of Data

Details on the availability of data for this study are described in the Blayney Flood Study Report (Jacobs 2015). A preliminary assessment was undertaken utilising the LiDAR data to identify properties which would be subject to above floor flooding in the 1% AEP event. As part of this study floor levels of 185 buildings were connected to AHD by Geolyse Pty Ltd in March 2016. The surveyed floor levels are more reliable than that estimated using the LiDAR data.

3. Community Consultation

The local community have a key role to play in the development and ongoing implementation of a Floodplain Risk Management Plan. Engaging the community early in the project provides people with the opportunity to actively contribute to the flood risk management process. This is important for Blayney as residents experienced severe flooding in 2007 and 2010, 2012 and have local knowledge of the area, which can be useful when understanding the flood behaviour.

3.1 Consultation Process

The Community consultation process involved the following steps:

- At the start of the study, an Inception Meeting was held with the floodplain management committee (FMC), government agencies and Jacobs. This meeting was used to establish the project, agree to the study program and obtain relevant data for the project;
- Consultation letters were sent to key stakeholders;
- A community questionnaire was distributed to residents to gauge their experience of flooding and their opinions on flood-related issues. A copy of the questionnaire is included in **Appendix A**.

3.2 Community Questionnaire

A community consultation process was initiated to obtain flood information for past events. This involved sending a newsletter and a questionnaire (included in **Appendix A**) to residents and landowners within the study area in Blayney. The newsletter introduced the floodplain management process to the residents of the area, described the purpose of the questionnaire and provided the residents with contacts for their responses. The questionnaire was prepared in consultation with Council to help identify flooding issues for the study area and to provide reliable flood information to assist in the validation of the hydrologic and hydraulic computer models.

The flood information that was requested included:

- General information, such as:
  - Residents from the Study Area
  - Ownership of the residence
  - How long residents lived at the property
- Specific flood information, such as:
  - Experience on flooding in residence and/or at work
  - Location and depth of flood water in the worst flood experienced
  - Duration of flooding
  - Flood damages to residence and business
  - Disruption to vehicular access to residence during flooding
  - Assistance required by residents from SES during flooding
  - Flooding to residence made worse by works on other properties or by construction of roads or other structures
  - Identify information (eg. flood photographs, newspaper clippings, flood marks etc) that can be provided to the Consultant
  - Residents intention for further development on their lands

- Ranking of development types for protection against flooding
- Ranking of potential flood mitigation measures

Any comments on any other issues associated with this study

3.2.1 Summary of Responses to Flood Questionnaire

In total 220 questionnaires were sent to residents of Blayney with reply paid envelopes and sixteen (16) responses were received from the community to the questionnaire and all respondents were residents of the study area. One response was received from Blayney Hospital. A summary of responses is provided in the following paragraphs.

Residency status (Question 1)

All respondents were residents of Blayney.

Length of Residency in Blayney and Business Activity (Questions 2-4)

Respondents lived in Blayney between 3 months to 45 years with an average residency of 17 years. Two (2) respondents managed a business located within the study area.

Experiences of Flooding (Questions 5-12)

Five (5) respondents experienced flooding during the flood events of 1973, 2007, 2011, 2012 and 2013. Three (3) respondents experienced flooding in their houses, two (2) respondents experienced flooding at their workplace and one (1) respondent experienced flooding elsewhere and the depth of flooding varied between 0.3m to 1.2m. Two respondents reported that the duration of flooding was less than 2 hours and one respondent identified the duration of flooding being less than six hours and another respondent identified the duration of flooding more than one day.

Three respondents identified minor flood damage to garden, lawn and backyard whilst one respondent identified minor damage to external wall of the house. One respondent identified minor damage to property fence.

Two (2) respondents identified that vehicular access to their properties were cut off and one business identified loss of income due to road closure by flood waters.

Flood Affection to properties due to works (Questions 13 - 14)

Three (3) respondents identified that flood impact on their properties was aggravated due road works and new developments along Newbridge Road, south of Polona Street and Smith Street.

Intention of Respondents for further development (Question 15)

Nine (9) respondents were not expecting to undertake any further developments on their lands and three (3) respondents were expecting to undertake minor extensions to their properties.

Priority for protecting different types of developments from flooding (Question 16)

Respondents were asked to rank different types of development for protection against flooding. Nine (9) respondents gave the emergency facilities (Hospital, Police Station, etc.) the greatest priority for protection against flooding, whilst five (5) respondents assigned the highest priority for protection of residential properties against flooding.

Priority for flood mitigation measures (Question 17)

Eight (8) respondents identified flood protection of house/business as the greatest priority. Three (3) respondents identified flood warning as their greatest priority and three (3) respondents assigned their highest priorities to providing an emergency flood free access to properties.

Willingness to provide additional information (Question 18)

Willows in the Belubula River were a major concern to a respondent.

Contact details for respondents (Question 19)

Fourteen (14) respondents provided their contact details.

4. Legislation and Planning

4.1 Background

This section provides an overview on the NSW flood risk management framework and existing policies and planning controls applicable to Blayney and recommends the way forward to develop a Floodplain Risk Management Plan.

4.2 NSW Flood Risk Management Framework

4.2.1 Objectives and Approach

The primary objective of NSW Flood Risk Management (FRM), as expressed within the NSW Flood Prone Lands Policy (Floodplain Development Manual 2005, page 1) is as follows:

"*To reduce the impact of flooding and flood liability on individual owners and occupiers of flood prone property, and to reduce private and public losses resulting from floods, utilising ecologically positive methods wherever possible*."

Within the scope of this report, the relevance of the above objective is primarily to ensure that the Floodplain Risk Management Plan (FRMP) for Blayney does not lead to increased flood risk to property and persons and that the planning controls and emergency management planning provisions proposed to achieve this outcome form part of a consistent and coordinated strategy to reduce flood risks.

4.2.2 NSW FRM Policy and Guidelines

The NSW Flood Prone Land Policy is produced within Section 1.1 of the Floodplain Development Manual (FDM 2005). This policy is consistent with that first introduced in 1984, which places the primary responsibility for implementation on local councils. This provides the opportunity for FRM to be integrated within council's normal planning processes. The NSW Government provides financial and technical assistance, and indemnity is provided in Section 733 of the Local Government Act 1993, subject to acting in "good faith" - being performance in accordance with the principles and guidelines of the FDM unless proven otherwise.

The FDM requires a merit approach to be adopted for the purposes of formulating a FRMP that provides a basis for decision making in the floodplain. This is in recognition that flood prone land is a valuable resource which should not be unnecessarily sterilised by the rigid application of prescriptive criteria, and to equally avoid the approval of inappropriate proposals. The merit approach is defined as follows:

"The merit approach weighs socio-economic, ecological and cultural impacts of land use options for different flood prone land areas together with flood damage, hazard and behaviour implications, and environmental protection and wellbeing of the State's rivers and floodplains."

The NSW Flood Prone Land Policy and the FDM provide a platform for the management of floodplains in a manner that follows a risk management approach. Consistent with this approach the FDM defines the floodplain for the purposes of establishing the broadest area potentially at risk from flooding for the preparation of studies and ultimately the FRMP, as follows:

"Floodplain means: Area of land which is subject to inundation by floods up to and including the probable maximum flood event, that is, flood prone land."

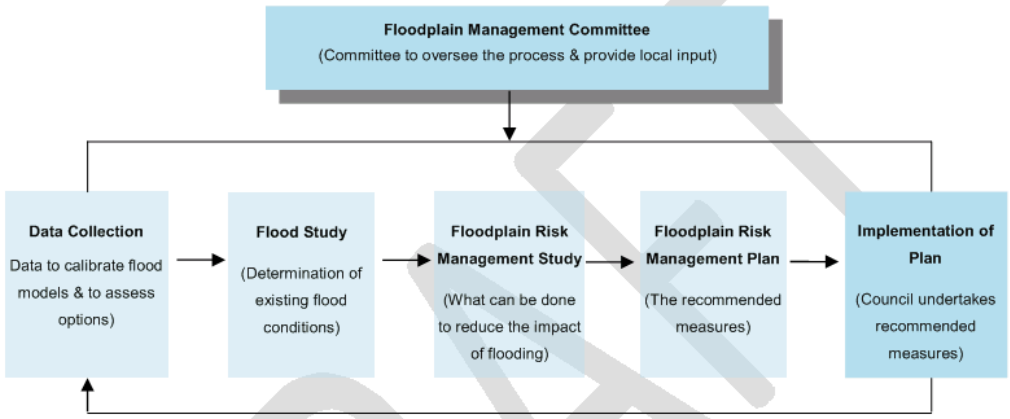
"Flood prone land means: Land susceptible to flooding by the PMF event. Flood prone land is synonymous with flood liable land."

"Probable maximum flood means: The PMF is the largest flood that could conceivably occur at a particular location; usually estimated from probable maximum precipitation, where applicable, snow melt, coupled with the worst flood producing catchment conditions. Generally, it is not physically or economically possible to provide

complete protection against this event. The PMF defines the extent of flood prone land that is the floodplain. The extent, nature and potential consequences of flooding associated with a range of events rarer than the flood used for designing mitigation works and controlling development, up to and including the PMF event should be addressed in a floodplain risk management study."

The FDM is a manual which provides guidance with regard to how to implement the NSW Flood Prone Land Policy. The FDM requires the level of flood risk acceptable to the community is to be determined through a process overseen by a committee comprised of local elected representatives, community members and state and local Government officials (including the SES). This process is shown in **Figure 4-1**.

The ultimate outcome is the preparation of a Floodplain Risk Management Plan (FRMP), which is a plan formally adopted by a local council in accordance with the NSW Flood Prone Land Policy. FRMPs should have an integrated mix of management measures that address existing, future and continuing risk.



- **Figure 4-1 NSW FRM Process (Adapted from FDM 2005)**

4.2.3 2007 Flood Planning Guideline

On January 31, 2007 the NSW Planning Minister announced a new guideline for development control on floodplains (the "Flood Planning Guideline"). An overview of the new Guideline and associated changes to the Environmental Planning and Assessment Act, 1979 (EPA Act) and Environmental Planning and Assessment Regulation 2000 (Regulation) was issued by the Department of Planning in a Circular dated January 31, 2007 (Reference PS 07-003). The Flood Planning Guideline issued by the Minister in effect relates to a package of directions and changes to the EPA Act, Regulation and FDM.

This Flood Planning Guideline provides an amendment to the Manual. The Guideline confirms that unless there are "exceptional circumstances", Councils are to adopt the 100 year flood as the flood planning level (FPL) for residential development, with the exception of some sensitive forms of residential development such as seniors living housing. The Guideline does provide that controls on residential development above the 100 year flood may be imposed subject to an "exceptional circumstance" justification being agreed to by the Department of Natural Resources (now the Office of Environment and Heritage -OEH) and the Department of Planning (now the Department of Planning and Environment - DPE) prior to the exhibition of a Draft LEP or Draft DCP.

The Flood Planning Guideline provides various potentially ambiguous statements in regard to what is the Residential FPL for the purposes of applying the directions in the Guideline. The DPE has advised that the reference to the FPL is a reference to both the 100 year flood plus freeboard (typically 0.5 metres). The Guideline only applies to the introduction of "new" controls and does not rescind pre-existing controls.

4.2.4 Relationship with EPA Legislation

The plan-making processes under the EPA Act, such as for a Local Environmental Plan (LEP) and a Development Control Plan (DCP) operate independently of the preparation of FRMPs under the FDM. While these two processes could be overlapped, it has been the usual practice to undertake the processes separately. Ultimately the planning recommendations of the FRMP will need to be reflected in planning instruments and policies brought into force in accordance with the EPA Act.

Ultimately the planning recommendations of the FRMP will need to be reflected in planning instruments and policies brought into force in accordance with the EPA Act. Accordingly the FRMP can provide appropriate input to the EPA Act planning processes in three ways:

- Providing direction at a local (and state) strategic planning level in addressing FRM (e.g. where urban growth should occur and the distribution of land uses therein);
- Recommending development controls to be incorporated in appropriate planning instruments (e.g. LEPs and DCPs) to mitigate the risk to development where permitted in the floodplain; and
- Ensuring that the planning controls and associated documents (e.g. S149 Planning Certificates) contribute to ensuring the community is appropriately informed about the flood risk.

To understand how these FRMP outcomes may be best achieved, the existing EPA Act framework and guidelines that relate to FRM are discussed later in this section.

4.3 Existing Policies & Planning Controls

The imposition of planning controls can be an effective means of managing flood risks associated with future development (including redevelopment). Such controls might vary from prohibiting certain land uses to specifying development controls such as minimum floor levels and building materials.

In principle, the degree of restriction that is imposed on development due to flooding relates to the level of risk that the community is prepared to accept after balancing economic, environmental and social considerations. In practice, the planning controls that may ultimately be imposed are influenced by a complex array of considerations including state imposed planning policy and directions, existing local planning strategies and policies and ultimately the acceptability of conditions that could be imposed through the development application process.

The following provides an outline of policy that is potentially relevant because it either directs the FRM planning controls that could be adopted or affects the way flood risk is identified in the planning controls.

4.3.1 State Environmental Planning Policies

A State Environmental Planning Policy (SEPP) is a planning document prepared in accordance with the EPA Act and eventually approved by the Minister, which deals with matters of significance for environmental planning for the State. Clause 1.19 of the Codes SEPP has been amended so that land identified as 'flood control lot' is no longer excluded from the application of the General Housing Code. Instead, specified development and development standards have been added to the General Housing Code for development on low hazard flood control lots. The development standards have been designed to ensure that complying development is not allowed on high hazard or high risk flood control lots including floodways, flood storage areas, a flowpath or areas identified in local flood plans as high hazard or high risk.

4.3.2 Climate Change Policies

Climate change is expected to have adverse impacts upon rainfall intensities which may have a significant influence on flood behaviour in Blayney. Blayney is located inland and hence sea level rise would have no impact on flood behaviour.

Scientific data regarding the effect of climate change on rainfall intensities is not sufficiently advanced to provide specific guidance for the assessment of flood risk. No relevant planning benchmarks have been adopted by Government related to rainfall intensity changes. However, NSW Government guidelines recommend the undertaking of a sensitivity analysis, which assumes nominal increases in rainfall intensities of 10%, 20% and 30%.

A preliminary assessment indicates that a 10% increase in rainfall intensity for the 2% AEP event would be similar to the 1% AEP intensity and a 30% increase in rainfall intensity for the 5% AEP event would be similar to the 1% AEP intensity. A detailed assessment of the impact of climate change was outside the scope of this study.

4.3.3 Section 117 Directions

Ministerial directions pursuant to Section 117(2) of the EPA Act specify matters which local councils must take into consideration in the preparation of LEPs. Direction 4.3, as currently applies, deals specifically with flood [liable] prone land and has the following two objectives:

"(a) To ensure that the development of flood prone land is consistent with the NSW Government's Flood Prone Land Policy and the principles of the Floodplain Development Manual, 2005.

(b) To ensure that the provisions of an LEP on flood prone land is commensurate with flood hazard and includes consideration of the potential flood impacts both on and off the subject land".

The Direction applies to all councils that contain flood prone land when an LEP proposes to "*create, remove or alter a zone or provision that affects flood prone land*." In such cases, the Direction requires draft LEPs to ensure the following:

(4) *A planning proposal must include provisions that give effect to and are consistent with the NSW Flood Prone Land Policy and the principles of the Floodplain Development Manual 2005 (including the Guideline on Development Controls on Low Flood Risk Areas).*

(5) *A planning proposal must not rezone land within the flood planning areas from Special Use, Special Purpose, Recreation, Rural or Environmental Protection Zones to a Residential, Business, Industrial, Special Use or Special Purpose Zone.*

(6) *A planning proposal must not contain provisions that apply to the flood planning areas which:*

a. *permit development in floodway areas,*

b. *permit development that will result in significant flood impacts to other properties,*

c. *permit a significant increase in the development of that land,*

d. *are likely to result in a substantially increased requirement for government spending on flood mitigation measures, infrastructure or services, or*

e. *permit development to be carried out without development consent except for the purposes of agriculture (not including dams, drainage canals, levees, buildings or structures in floodways or high hazard areas), roads or exempt development.*

(7) *A planning proposal must not impose flood related development controls above the residential flood planning level for residential development on land, unless a relevant planning authority provides adequate justification for those controls to the satisfaction of the Director-General (or an officer of the Department nominated by the Director-General).*

(8) *For the purposes of a planning proposal, a relevant planning authority must not determine a flood planning level that is inconsistent with the Floodplain Development Manual 2005 (including the*

Guideline on Development Controls on Low Flood Risk Areas) unless a relevant planning authority provides adequate justification for the proposed departure from that Manual to the satisfaction of the Director-General (or an officer of the Department nominated by the Director-General).

4.3.4 Local Environmental Plan (LEP)

Blayney Local Environmental Plan 2012 applies to the township of Blayney. The township of Blayney contains land within a number of standard zones such as B2 Local Centre, B5 Business Development, R1 General Residential, R5 Large Lot Residential, IN1 General Industrial, IN2 Light Industrial, RE1 Public Recreation, RU2 Rural Landscape, and SP2 Infrastructure Facilities. These zones are shown in **Figure 4-2**.

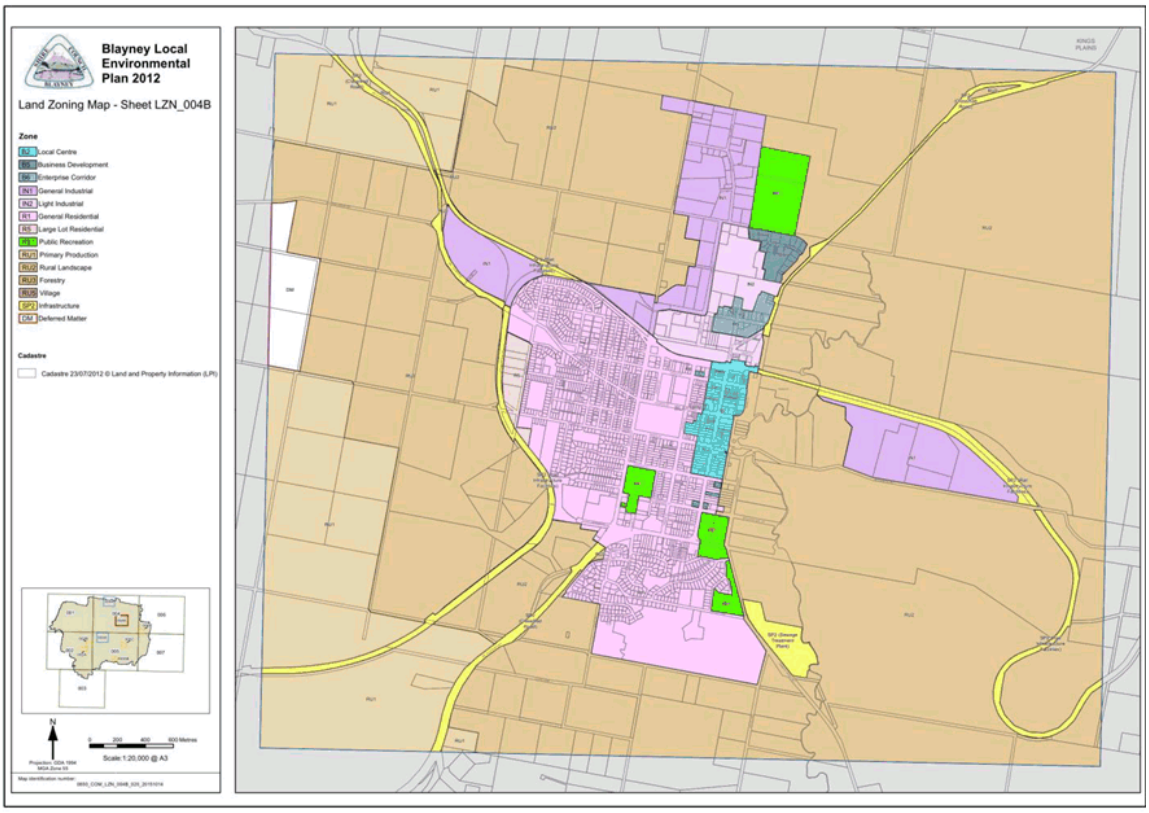


Figure 4-2 Blayney LEP 2012 Zoning Map

Additional local provisions identified in the LEP include clauses on flood planning and stormwater:

Flood planning:

(1) The objectives of this clause are as follows:

(a) to minimise the flood risk to life and property associated with the use of land,

(b) to allow development on land that is compatible with the land's flood hazard, taking into account projected changes as a result of climate change,

(c) to avoid significant adverse impacts on flood behaviour and the environment.

(2) This clause applies to:

(a) land identified as "Flood planning area" on the Flood Planning Map (refer **Figure 4-3**) *and*

(b) other land that is flood liable land.

(3) Development consent must not be granted to development on land to which this clause applies unless the consent authority is satisfied that the development:

(a) is compatible with the flood hazard of the land, and

(b) will not significantly adversely affect flood behaviour resulting in detrimental increases in the potential flood affectation of other development or properties, and

(c) incorporates appropriate measures to manage risk to life from flood, and

(d) will not significantly adversely affect the environment or cause avoidable erosion, siltation, destruction of riparian vegetation or a reduction in the stability of river banks or watercourses, and

(e) is not likely to result in unsustainable social and economic costs to the community as a consequence of flooding.

(4) A word or expression used in this clause has the same meaning as it has in the Floodplain Development Manual (ISBN 0 7347 5476 0) published by the NSW Government in April 2005, unless it is otherwise defined in this clause.

Council needs to amend its LEP to apply the model local provisions clause 6.1 (flood planning) based on the flood planning area map. Part of this model local provision requires the identification of a freeboard area for the definition of "flood planning level". Council should amend its LEP to apply the model local provisions clause 6.1 (flood planning) to all lands located within the flood planning area defined in this study. Council should adopt the flood planning levels defined in this study based on the following freeboards above the 1% AEP flood levels:

- 0.5m for areas impacted by mainstream flooding; and
- 0.3m for areas impacted by overland flooding.

Stormwater:

(1) The objective of this clause is to minimise the impacts of urban stormwater on land to which this clause applies and on adjoining properties, native bushland and receiving waters.

(2) This clause applies to all land in residential, business and industrial zones.

(3) Development consent must not be granted to development on land to which this clause applies unless the consent authority is satisfied that the development:

(a) is designed to maximise the use of water permeable surfaces on the land having regard to the soil characteristics affecting on-site infiltration of water, and

(b) includes, if practicable, on-site stormwater retention for use as an alternative supply to mains water, groundwater or river water, and

(c) avoids any significant adverse impacts of stormwater runoff on adjoining properties, native bushland and receiving waters, or if that impact cannot be reasonably avoided, minimises and mitigates the impact.

Figure 4-3 Flood Planning Map defined in Blayney LEP 2012

4.3.5 Development Control Plan (DCP)

Currently there are 6 DCPs for Blayney Shire covering certain land uses (e.g. medium density housing and rural residential development) and specific places (e.g. North Blayney industrial area; Millthorpe, Carcoar and North Millthorpe residential areas). Council is in the process of preparing a comprehensive DCP and a Draft DCP will be available for public exhibition and comment during 2016. Once adopted by Council the new DCP will work alongside the Blayney LEP 2012 to create a comprehensive set of controls for development in the Blayney Shire, which would replace the earlier documents.

4.3.6 Section 149 Certificates

Council under the provisions of Section 149 of the Environmental Planning and Assessment Act 1979 issues Certificates which are also known as zoning certificates. The certificate provides information on planning controls and any development restrictions which may apply to a particular parcel of land within the Council area. They are usually required upon the sale or purchase of a property.

There are two types of certificates:

- 149 (2) Certificate - Provides information about the zoning of the property, the relevant state, regional and local planning controls, other planning affectations such as heritage, land contamination and road widening and whether or not complying development can be carried out on the land.
- 149 (2) & (5) Certificate - Provides additional advice regarding demolition, foreshore building lines, other heritage considerations and general advice.

Given that information on flooding for the study area is available to Council from this study, Council should include information on flooding in Section 149 Certificates. In particular, information on flood levels, flood hazards and FPL is to be included in Section 149 Certificates.

4.4 Other Environmental Legislation

4.4.1 Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth)

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is administered by the Commonwealth Department of the Environment, Water, Heritage and the Arts and aims to ensure that actions likely to have a significant impact on matters of national environmental significance are subject to a rigorous assessment and approval process. Matters of national significance that may be impacted by flood control works include Ramsar wetlands, nationally threatened species and ecological communities, and migratory species. An assessment of the potential impacts on matters of national environmental significance, as defined and listed under the EPBC Act, would need to be undertaken before any flood control works are implemented.

4.4.2 Fisheries Management Act 1994 (NSW)

The *Fisheries Management Act 1994* (FM Act) is administered by the Fisheries division of the NSW Department of Primary Industries. The broad objectives of the FM Act are to conserve, develop and share the fishery resources of NSW for the benefit of present and future generations. Floodplains provide important spawning, nursery and feeding habitat for a number of native freshwater fish species. The Act makes provision for the conservation of key fish habitats (including floodplains) through habitat protection plans, and for the conservation of threatened species, populations and ecological communities of fish.

Most fish species undertake local or large-scale migration, with some species such as golden perch and silver perch migrating onto the floodplain to spawn. The Act requires that NSW Fisheries be notified whenever any barrier to fish passage is constructed, altered or modified. The Act also requires a permit from NSW Fisheries for dredging and reclamation works on wetlands and floodplains. These works may include the construction of levees, drains, storages and other works.

4.4.3 National Parks and Wildlife Act 1974 (NSW)

The NSW National Parks and Wildlife Service (NPWS), a division of the OEH, is responsible for the protection and care of Aboriginal relics, the protection and care of native fauna, and the protection of native plants under the *National Parks and Wildlife Act 1974* (NPW Act). The NPW Act also allows for the establishment, preservation and management of areas of cultural, environmental and archaeological significance.

Of particular relevance to flood control works, it is an offence to knowingly destroy or disturb any Aboriginal site or relic in NSW. Aboriginal sites that may be relevant to the outcomes of the Floodplain Risk Management Plan would include any carved or scarred trees that may rely on flooding for their longevity and any sites of spiritual significance that are sustained by periodic flooding. An Aboriginal archaeological and cultural heritage assessment, to identify the presence of and potential impacts on Aboriginal objects and sites of Aboriginal cultural significance within the floodplain, would need to be undertaken before any flood control works are implemented.

4.4.4 Threatened Species Conservation Act 1995 (NSW)

The *Threatened Species Conservation Act 1995* (TSC Act) is administered by the OEH and provides for the protection of threatened species, populations, ecological communities, and their habitats (with the exception of fish and marine plants). The Act ensures that threatened species are taken into consideration during the development planning process and in decision making by authorities. Threatened species whose ecology may depend on flood inundation will be an important consideration when identifying environmentally important areas and determining outcomes in the FRMP.

In relation to development assessment, the provisions of the TSC Act are linked to the EP&A Act. Specifically, Section 5A of the EP&A Act identifies the factors that must be taken into account in determining whether there

is likely to be a significant impact on threatened species, populations or ecological communities, or their habitats (the 'Seven Part Test'). An assessment of the potential impacts on threatened species, populations and ecological communities would need to be undertaken before any flood control works are implemented.

4.4.5 Dams Safety Act 1978 (NSW)

The Dams Safety Act 1978 is administered by the NSW Dams Safety Committee (DSC). The DSC interprets its statutory role as being to ensure the safety of dams and their storage reservoirs in order to adequately protect the interests of the community. It is the responsibility of the DSC to define its requirements for the safety of dams and their storages and to ensure compliance by owners with those requirements. The DSC will prescribe those dams with the potential for a failure which could have a significant adverse effect on community interests.

4.5 Current Gaps or Limitations of Planning Instruments

Neither Blayney Shire LEP 2012 nor DCPs refers to planning controls for floodplain risk management. Council needs to adopt a flood policy to control development/re-development in the town of Blayney. As a minimum, Council needs to adopt the following planning controls for all lands located within the Flood Planning Area:

- Floor levels of all new residential buildings or buildings proposed for development/ redevelopment are to be located above the 1% AEP flood levels with an appropriate freeboard;
- All new/redeveloped buildings are to constructed with flood compatible materials to withstand the hydrostatic force and flow velocity;
- New developments or redevelopments should not impact on flooding of neighbouring properties;
- Council to issue Section 149 certificates to property owners containing information on flooding; and
- A detailed flood assessment should be undertaken for new developments or redevelopments which have the potential to impact on flooding.

5. Flood Behaviour

5.1 Existing Condition

The existing flooding conditions were investigated and reported in the "Blayney Flood Study" report (Jacobs 2015). Available LiDAR data and a ground survey were the main source of topographic data utilised in the flood study. The topographic data was used in the development of a hydrologic model using XP-RAFTS program and a hydraulic computer model using TUFLOW. An available RORB hydrologic model for the catchment area of Carcoar Dam and the XP-RAFTS hydrologic model for the urban areas of the township of Blayney were utilised in the estimation of rainfall runoff from the catchment area of the Belubula River. Rainfall runoff simulated by the hydrology models were utilised in the TUFLOW model to define peak water levels, flood depths and velocities with the study area for the 20%, 5%,1%, 0.5% annual exceedance probability (AEP) events and the probable maximum flood (PMF). Flood depths and flood level contours are included in the Blayney Flood Study" report (Jacobs 2015).

A review of the map indicates widespread shallow flooding in the central area of Blayney bounded by Adelaide Street, Water Street, Carcoar Street and Mid Western Highway in the 20% AEP event. Shallow flooding occurs for in the 20% AEP event along Henry Street, Martin Street, Mitchell Street, Mount Errol Street, Hobbys Yards Road, Polona Street, Napier Street, Plumb Street, Orange Road, Ogilvy Street and a number of other streets within the township of Blayney implying that the township can be inaccessible by car from Orange, Bathurst and Carcoar in a 20% AEP flood event

In the case of the 5% AEP event, more extensive flooding occurs along the Belubula River than the 20% AEP event. Extents of flooding along Abattoir Creek and unnamed water courses running through the township are generally similar to the 20% AEP event.

The flood extent for the 1% AEP event is similar to that for the 5% AEP event with increased depth of flooding in the 1% AEP event. In the case of the 1% AEP event a number of properties in central Blayney and northern Blayney are subject to flood depths of 0.2m to 0.5m. A number of the properties are subject to flooding up to 1m depth in the 0.5% AEP event.

A review of the modelling results for the PMF event indicated instability in the TUFLOW model results and hence it was necessary to update the TUFLOW model for the PMF event as part of this study. During the PMF event, a number of streets in the central and northern parts of Blayney are subject to flooding up to 1m in depth and more than 2m depth of flooding occurs along Mid Western Highway, Farm Lane and Henry Street. Bathurst is completely inaccessible by road and Orange may only be accessible by trucks and large vehicles during the PMF event.

The flood maps for the 20%, 5%, 1% and 0.5% AEP events and the updated PMF event are included in **Appendix B**. A cutoff depth of 150mm has been applied to all flood maps. Updated peak water level profiles in the Belubula River and Abattoir Creek are also included in **Appendix B.**

5.2 Hydraulic Categorisation

Hydraulic categories classify the floodplain based on its hydraulic function. Hydraulic categories for Blayney have been delineated based upon the 1% AEP flood event. The three flood hydraulic categories identified in the *Floodplain Development Manual* (NSW Government, 2005) are:

- Floodway, where the main body of flow occurs and blockage could cause redirection of flows. Generally characterised by relatively high flow rates; depths and velocities;
- Flood storage, characterised by deep areas of floodwater and low flow velocities. Floodplain filling of these areas can cause adverse impacts to flood levels in adjacent areas; and
- Flood fringe, areas of the floodplain characterised by shallow flows at low velocity.

There is no firm guidance on hydraulic parameter values for defining these hydraulic categories, and appropriate parameter values may differ from catchment to catchment. For example, the minimum threshold flows and depths which might define a floodway in an urban overland flow catchment may be markedly lower than those for a large lowland river due to the different scale of flooding. For Blayney, the criteria outlined in **Table 5-1** was employed.

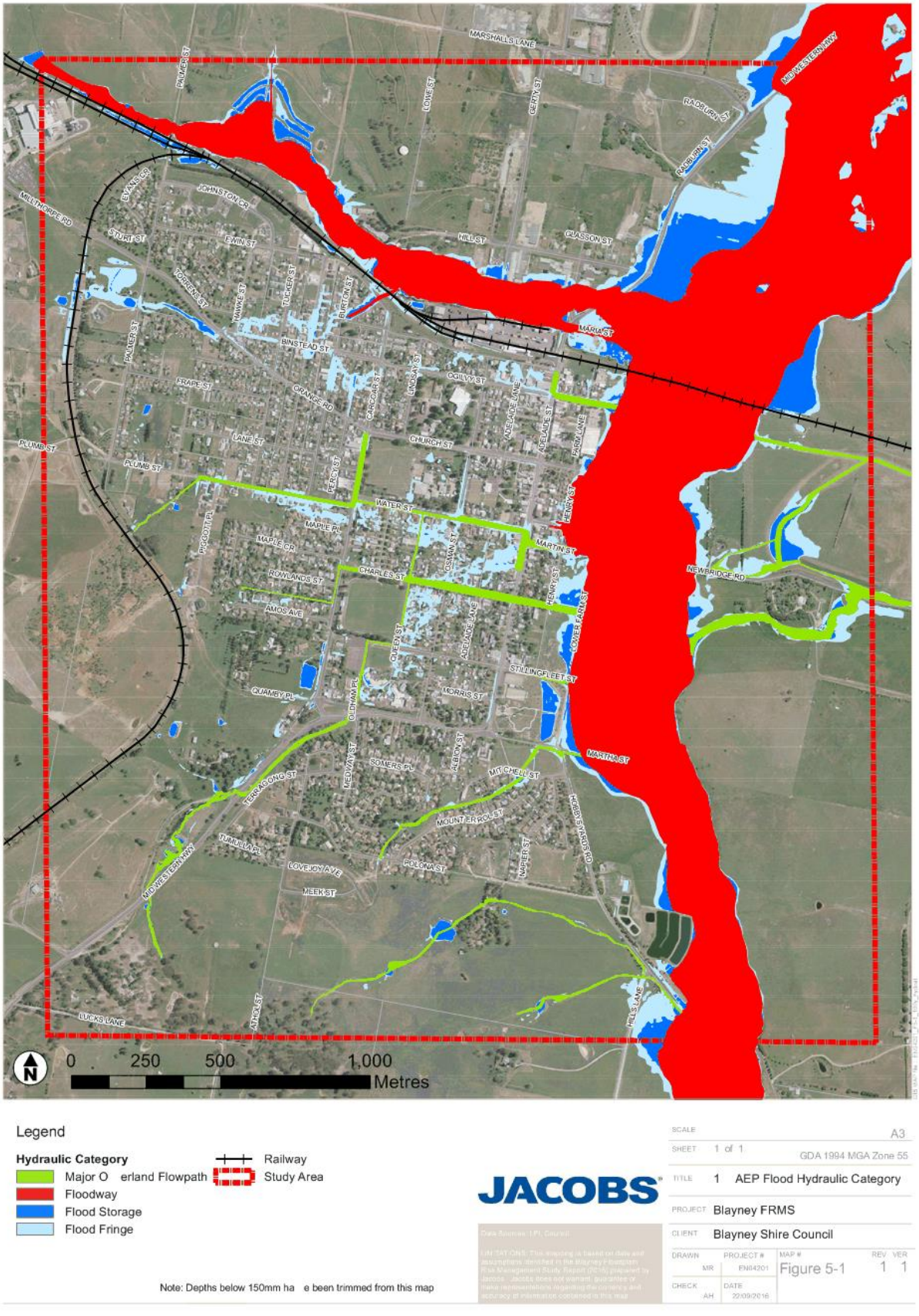
Table 5-1 Hydraulic Categories Criteria

Hydraulic Category	Criteria
Floodway	Area within the 1% AEP flood extent where a significant portion of the flow is conveyed. This was calculated based on a number of criteria[1] and joined to form a continuous floodway. Using the defined floodway and Major Overland Flowpath (MOF), an encroachment analysis was undertaken and the increase in the 1% AEP flood level was confirmed to be no more than 0.1m.
Flood Storage	Area within the 1% AEP flood extent, outside the Floodway, where depth > 0.5m.
Flood Fringe	Area within the 1% AEP flood extent outside the Floodway and Flood Storage areas. Flood depths below 150mm were trimmed from the flood fringe.

1 A combination of peak velocity (V), peak depth (D) and velocity-depth product (VD) was used as a preliminary delineation of the floodway. The following criteria was applied to the peak 1% AEP flood results:

- [VD > 0.25 and V > 0.25] or [V > 1]
- [VD > 0.5 and V > 0.5] or [V > 1]

These results were also compared with the 20% AEP flood extent and the 1% AEP high hazard area. Based on engineering judgement, a synthesis of these four criteria were used to delineate a continuous floodway. The delineated floodway was then refined through an encroachment analysis, whereby the delineated floodway was used as the domain for the two-dimensional hydraulic model and run for the 1% AEP flood event. The peak flood levels were compared to quantify the increase in flood level. The aim is to achieve an increase in flood level of no more than 0.1m. This iterative process was used to achieve the final delineated floodway. The hydraulic categories are mapped in **Figure 5-1**.



Legend

Hydraulic Category

- Major O erland Flowpath
- Floodway
- Flood Storage
- Flood Fringe

- Railway
- Study Area

Note: Depths below 150mm ha e been trimmed from this map

JACOBS

SCALE	A3
SHEET	1 of 1
	GDA 1994 MGA Zone 55
TITLE	1 AEP Flood Hydraulic Category
PROJECT	Blayney FRMS
CLIENT	Blayney Shire Council
DRAWN MR	PROJECT # EN84201
MAP #	Figure 5-1
REV	1
VER	1
CHECK AH	DATE 22/09/2016

5.3 Hazard Categorisation

The TUFLOW modelling results were used to delineate the preliminary flood hazard areas for the study area from interpretation of the 5% and 1% AEP event results, based on the hydraulic hazard category diagram presented in the *Floodplain Development Manual* (DECC, 2005), shown in **Figure 5-2**. The TUFLOW model calculates the hazard rating at each cell and computational time step, rather than calculating the rating based on the peak depth and peak velocity, which may not necessarily coincide.

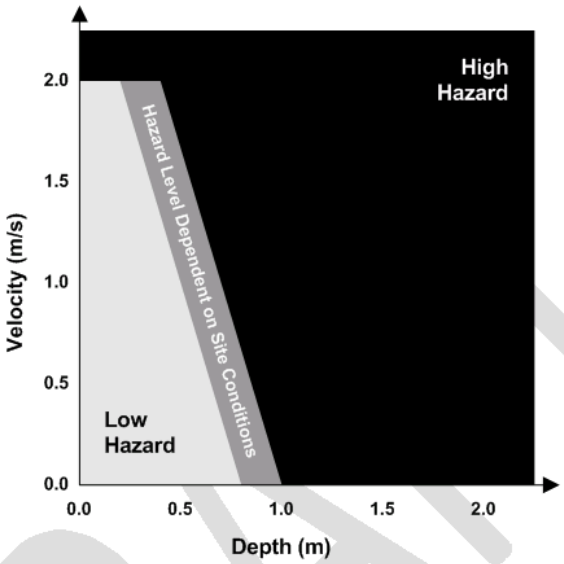
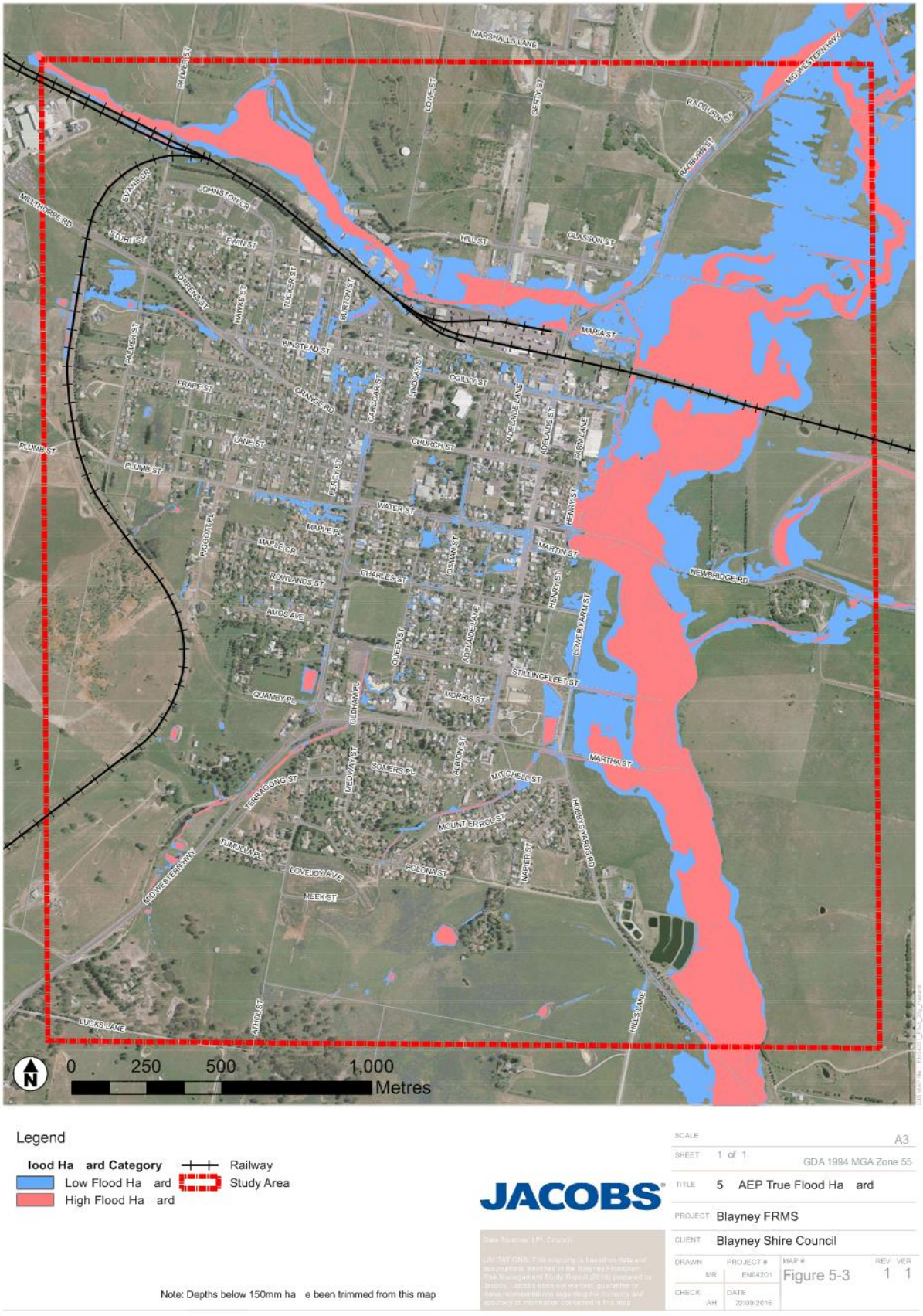


Figure 5-2 Hydraulic Hazard Category Diagram (adapted from the *NSW Floodplain Development Manual*)

The preliminary flood hazard map has been revised to determine the 'true' hazard. The flood hazard for the 20% and 1% AEP events has been determined based on the peak depth and peak velocity (as defined in **Figure 5-2**). Other factors, such as isolation, effective warning time, flood readiness, etc. have been considered in determining the 'true' hazard for these events. The flood hazard maps for the 5% and 1% AEP flood events are shown in **Figure 5-3** and **Figure 5-4** respectively. The flood hazards for the 5% AEP event are generally restricted to the Belubula River and Abattoir Creek, with some isolated areas where there is deep ponding of water and along designated drainage channels. The flood hazards for the 1% AEP event for Blayney are generally low for the majority of the overland flooding that occurs through the town, with some areas of high hazard flooding along designated drainage channels, the lower portion of Water Street and Martin Street, and a section of Plumb Street and Binstead Street. The Belubula River and Abattoir Creek contain the majority of high hazard area which encroaches on the town.



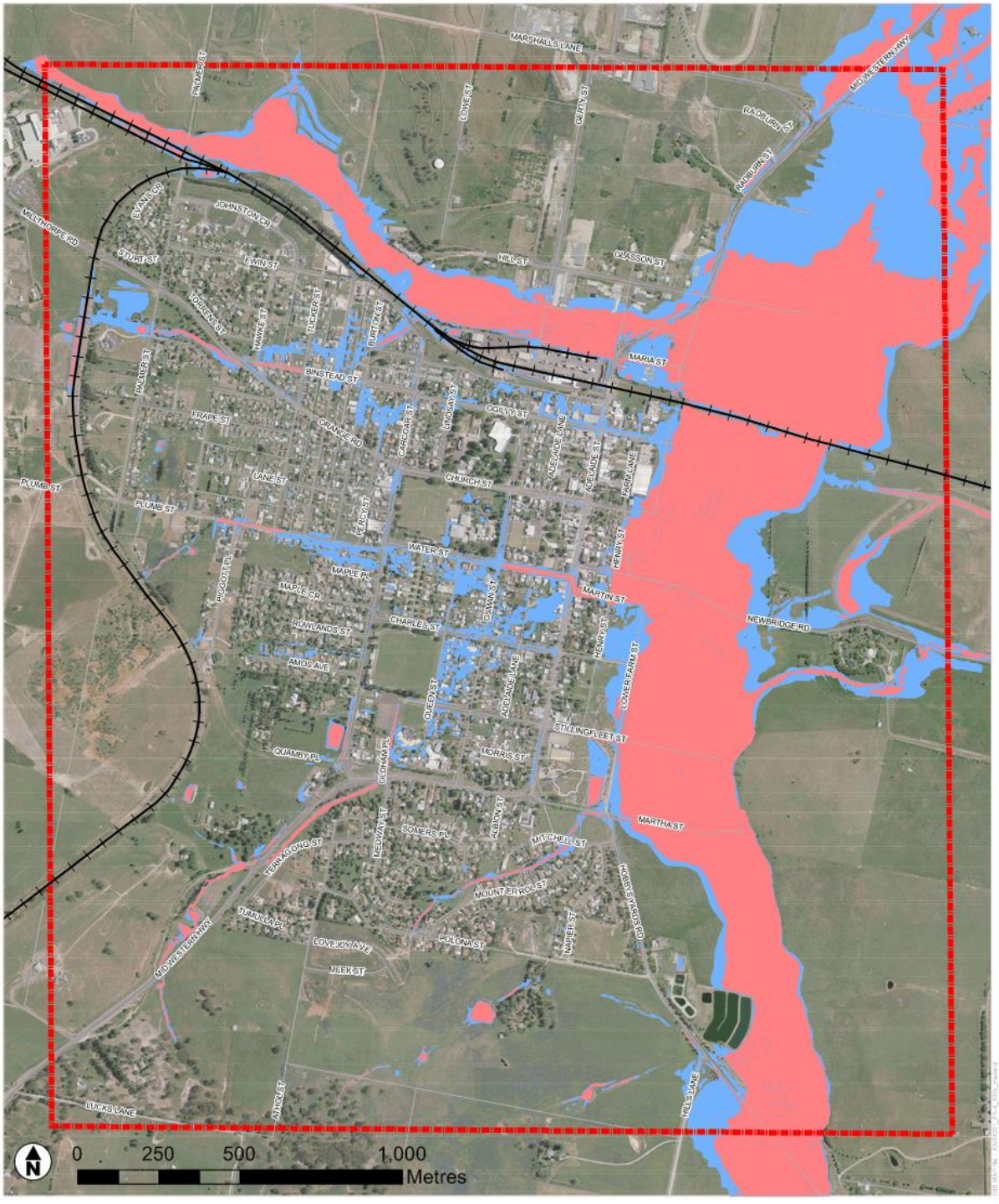
Legend

lood Ha ard Category
Low Flood Ha ard
High Flood Ha ard
Railway
Study Area

Note: Depths below 150mm ha e been trimmed from this map

JACOBS

SCALE	A3
SHEET	1 of 1
	GDA 1994 MGA Zone 55
TITLE	5 AEP True Flood Ha ard
PROJECT	Blayney FRMS
CLIENT	Blayney Shire Council
DRAWN MR	PROJECT # EN04201
MAP #	Figure 5-3
REV	1
VER	1
CHECK AH	DATE 22/09/2016



Legend

lood Ha ard Category

Low Flood Ha ard

High Flood Ha ard

Railway

Study Area

Note: Depths below 150mm ha e been trimmed from this map

JACOBS

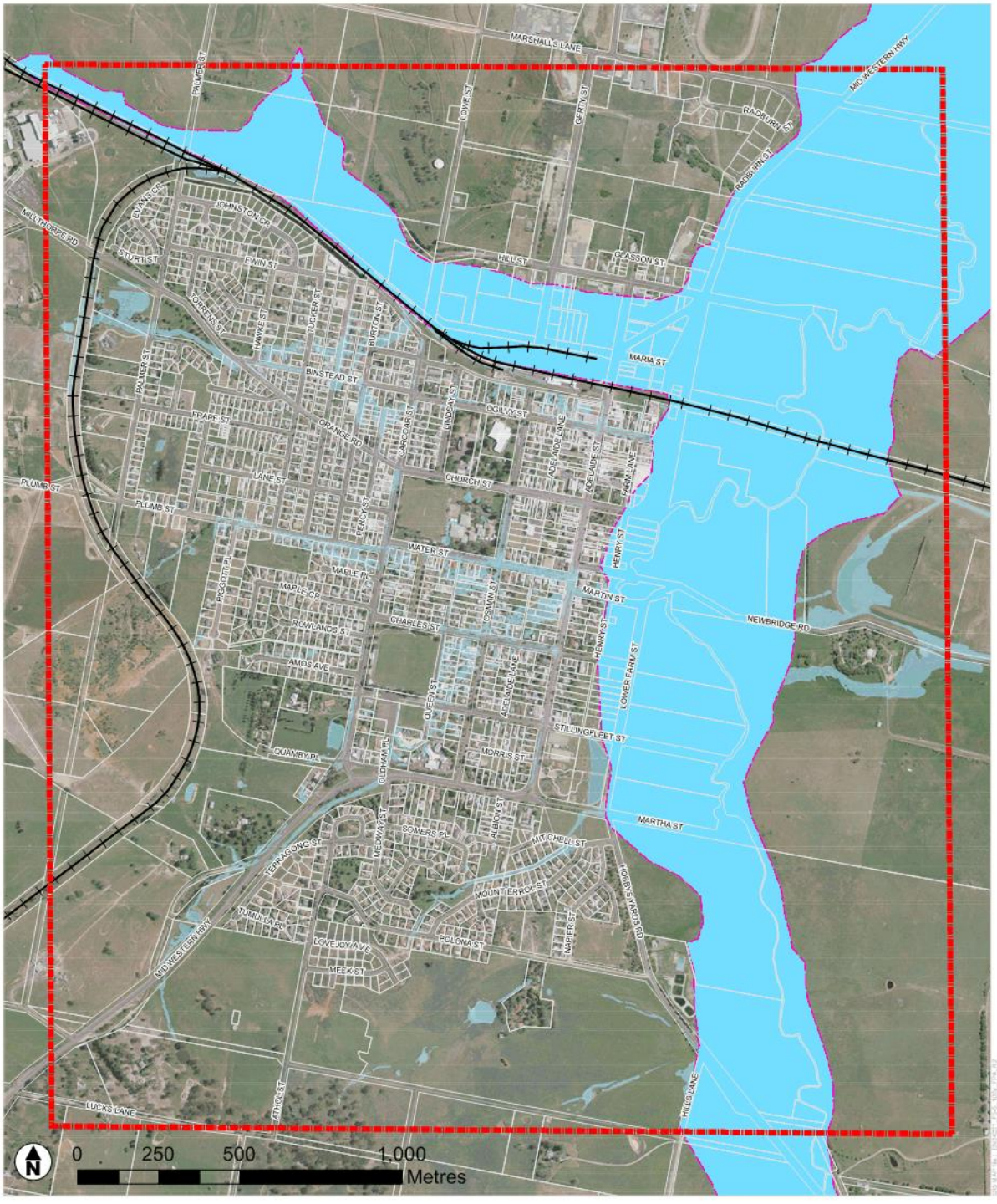
SCALE	A3
SHEET	1 of 1
	GDA 1994 MGA Zone 55
TITLE	1 AEP True Flood Ha ard
PROJECT	Blayney FRMS
CLIENT	Blayney Shire Council
DRAWN MR	PROJECT # EN04201
MAP #	Figure 5-4
REV VER	1 1
CHECK AH	DATE 22/09/2016

5.4 Flood Planning Area

The flood planning area (FPA) is defined by the extent of the area below the flood planning level (usually the 1% AEP flood plus freeboard) and delineates the area and properties where flood planning controls are proposed, for example, minimum floor levels to ensure that there is sufficient freeboard of building habitable floor levels above the 1% AEP flood. Other controls may be considered, such as policies on fence construction or rezoning.

A freeboard of 0.5m is often selected for defining the flood planning level on mainstream floodplains, however, a reduced freeboard of 0.3m may be more appropriate in areas affected by overland flows. Since Blayney is subject to both mainstream and overland flooding, a combination of freeboards has been considered in defining the flood planning area. A freeboard of 0.5m has been used for those areas affected by mainstream flooding of the Belubula River and Abattoir Creek. Flood depths below 150mm were filtered out of the flood results as well as small areas of isolated and shallow inundation that could be considered 'drainage' issues rather than 'flooding'.

The flood planning area map for Blayney is shown in **Figure 5-5**, based on the 1% AEP flood level plus 0.5m freeboard for mainstream flooding and the 1% AEP flood extent subject to overland flooding. It is recommended that a 0.3m freeboard be added to the 1% AEP flood level to define the flood planning level on lands subject to overland flooding identified in **Figure 5-5**.



Legend

- Mainstream Flood Planning Area
- O erland Flood Planning Area
- Cadastre
- Railway
- Study Area

Note: Depths below 150mm ha e been trimmed from this map

JACOBS

SCALE	A3
SHEET	1 of 1
	GDA 1994 MGA Zone 55
TITLE	Flood Planning Area
PROJECT	Blayney FRMS
CLIENT	Blayney Shire Council
DRAWN MR	PROJECT # EN04201
MAP #	Figure 5-5
REV	1
VER	1
CHECK AH	DATE 14/10/2016

5.5 Flood Emergency Response

Flood emergency response is an important outcome of the Floodplain Risk Management Process. The State Emergency Service (SES) will use the information contained in the studies to update the Blayney Shire Local Flood Plan.

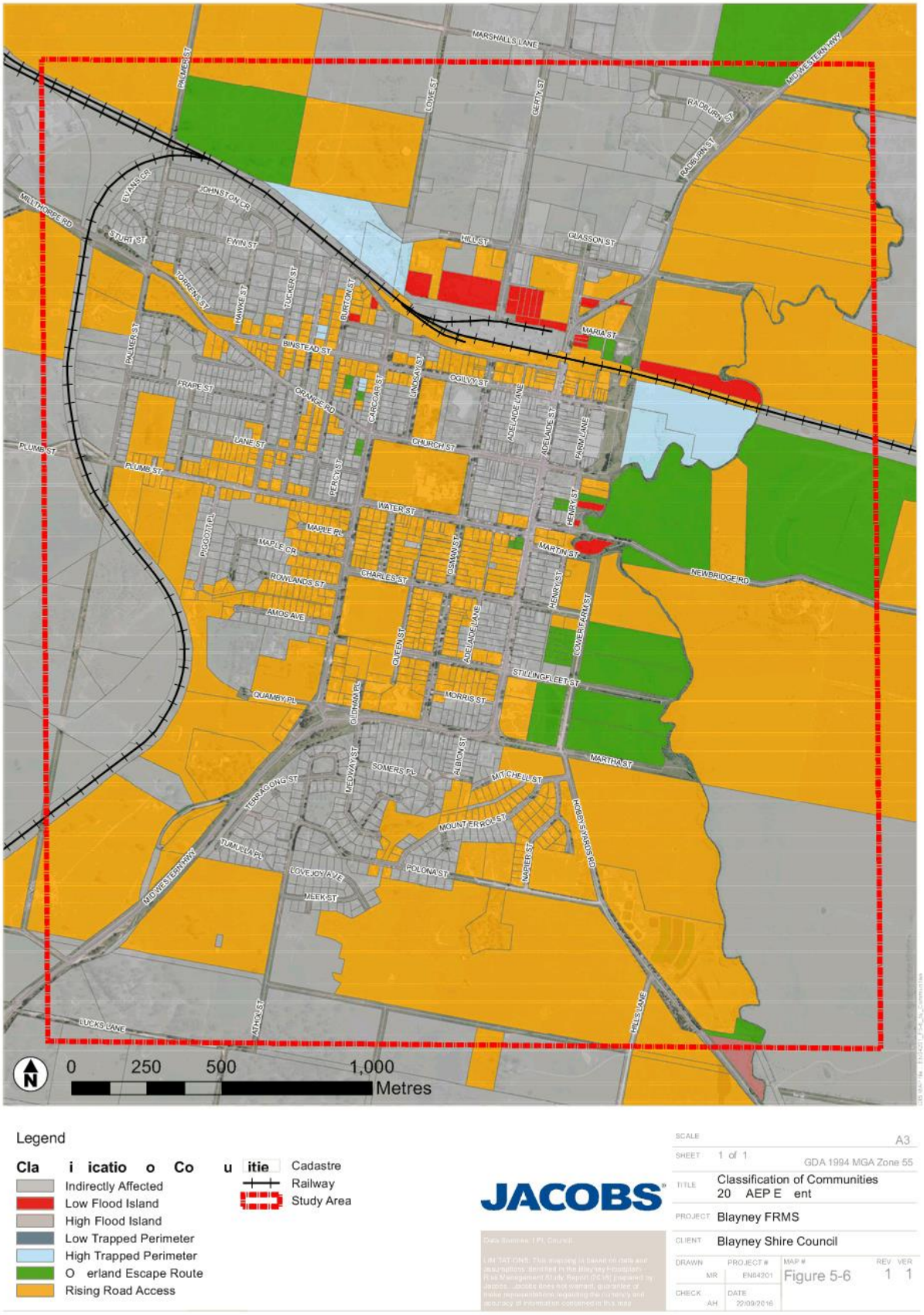
Areas within the catchment have been classified based on the floodplain risk management guideline *Flood Emergency Response Planning – Classification of Communities* (DECC, 2007). The classification indicates the relative vulnerability of different areas of the catchment and considers the ability to evacuate certain parts of the community. The classification has been undertaken for the 20% AEP, 1% AEP and PMF events, with mapping provided in **Figure 5-6**, **Figure 5-7** and **Figure 5-8** respectively.

The categories identified included:

- Indirectly Affected: Areas which are not flood affected and whose access is not cut-off, but may be affected by flood impacts to services and infrastructure in the area.
- Rising Road Access: Areas that become inundated by flooding which can be evacuated by vehicles on roads with continuously rising grade to high ground.
- Overland Escape Route: Areas where vehicular access is cut-off but can be evacuated on foot to high ground.
- High Trapped Perimeter: Areas which are partially or wholly above the peak flood level but whose evacuation routes are cut-off. These areas are not surrounded by flood waters but there may be a physical barrier preventing evacuation overland.
- Low Trapped Perimeter: Areas which are above the peak flood level during early stages of the flood, and which become submerged as the flood peaks, cutting off evacuation routes and there may be a physical barrier preventing evacuation overland.
- High Flood Island: Areas which are above the peak flood level but surrounded by flood waters and whose evacuation routes are cut-off.
- Low Flood Island: Areas which are surrounded by flood waters during early stages of the flood, and which become submerged as the flood peaks.

The guideline is largely geared towards classification of communities in mainstream floodplains with longer flooding response times. Hence some assumptions were made to suit the shorter-duration overland flooding which is present in Blayney:

- For overland escape routes, the maximum depth considered safe for humans is 0.5m (for children) and/ or a maximum velocity of 3m/s (AR&R 2016).
- For vehicle evacuation to be possible it was considered that a depth of approximately 0.2-0.3m was the limit of stability for small passenger cars, subject to the velocity of flows (AR&R 2016).
- Some properties are located on overland flow paths and their dwellings become surrounded by flooding. While there may be a rising road or overland evacuation routes available, due to the rapid rise in flood level, there may be insufficient warning time before the dwelling is surrounded by floodwaters and subsequently inundated. These areas were treated as 'low flood islands'.
- It was considered that all residential properties have fences that are barriers to overland escape routes as they may be too high for some members of the community to climb. For example if a property has flooding in the front yard and it cuts off street access then an overland escape route would not be possible through the sides or rear of the property and hence it would be a 'high trapped perimeter' classification.



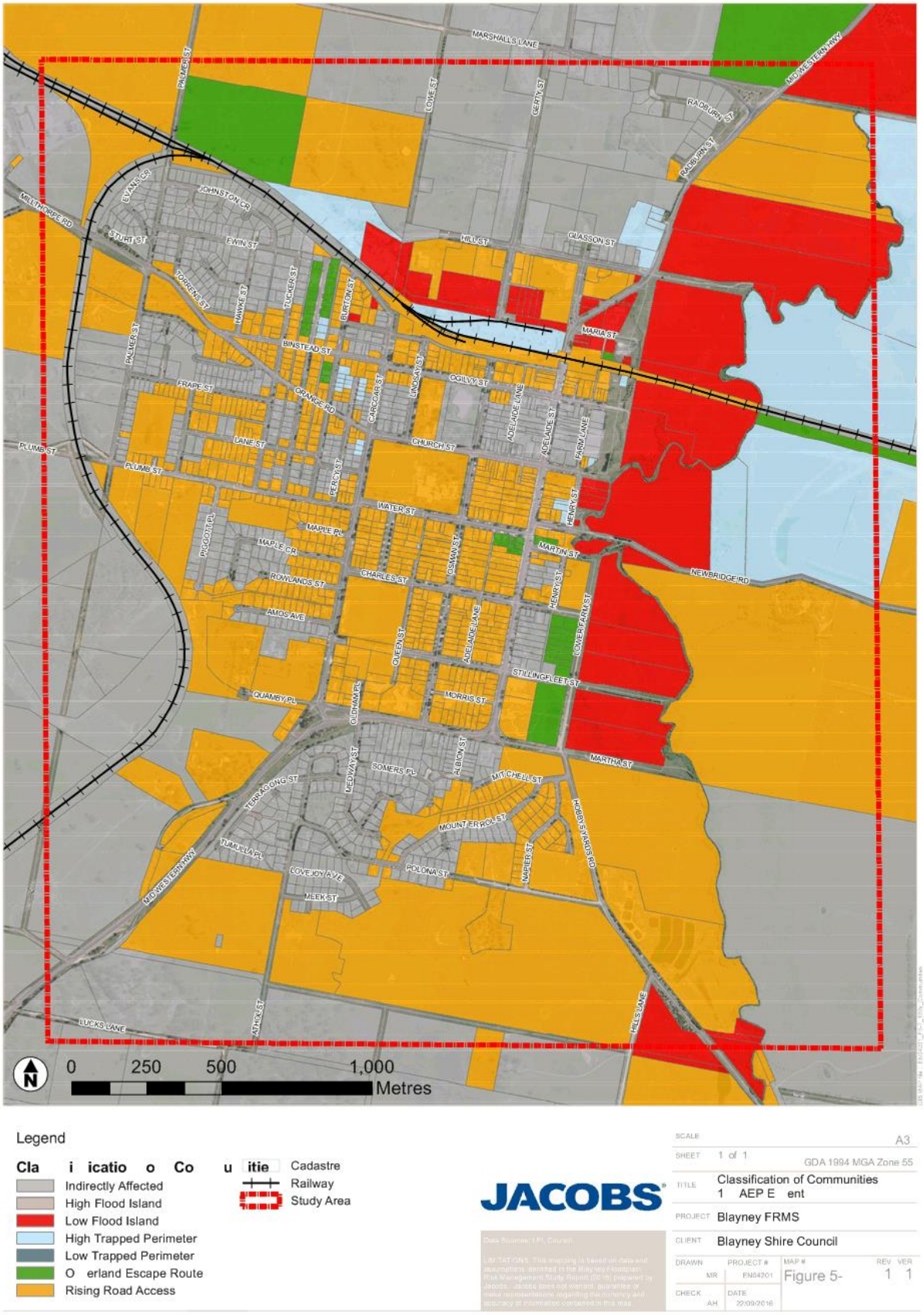
Legend

Cla i icatio o Co u itie

- Indirectly Affected
- Low Flood Island
- High Flood Island
- Low Trapped Perimeter
- High Trapped Perimeter
- O erland Escape Route
- Rising Road Access
- Cadastre
- Railway
- Study Area

JACOBS

SCALE	A3
SHEET	1 of 1
	GDA 1994 MGA Zone 55
TITLE	Classification of Communities 20 AEP E ent
PROJECT	Blayney FRMS
CLIENT	Blayney Shire Council
DRAWN MR	PROJECT # EN04201
MAP #	Figure 5-6
REV	1
VER	1
CHECK AH	DATE 22/09/2016



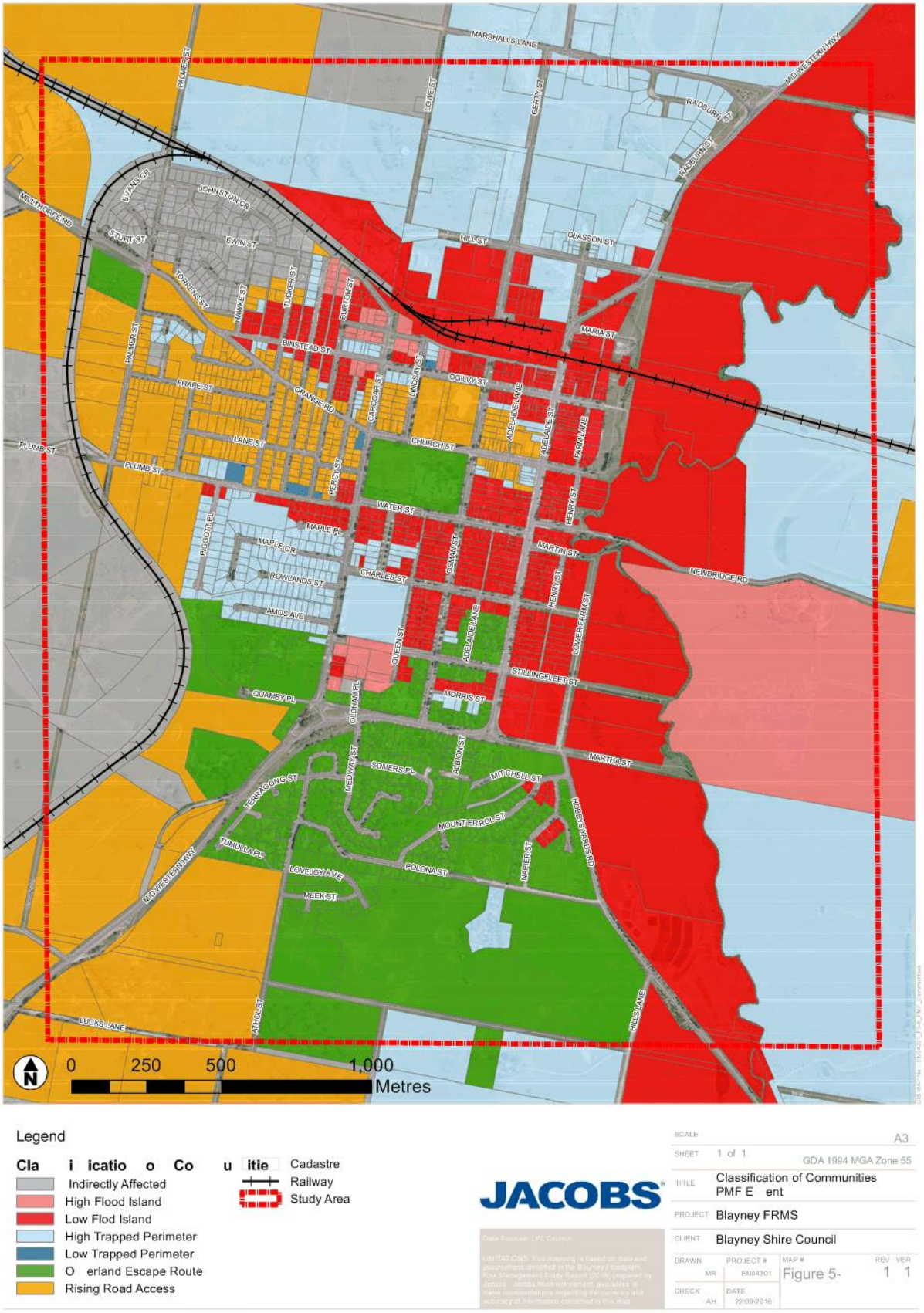
Legend

Cla i icatio o Co u itie

- Indirectly Affected
- High Flood Island
- Low Flood Island
- High Trapped Perimeter
- Low Trapped Perimeter
- O erland Escape Route
- Rising Road Access
- Cadastre
- Railway
- Study Area

JACOBS

SCALE	A3
SHEET	1 of 1
	GDA 1994 MGA Zone 55
TITLE	Classification of Communities 1 AEP E ent
PROJECT	Blayney FRMS
CLIENT	Blayney Shire Council
DRAWN MR	PROJECT # EN04201
MAP #	Figure 5-
REV	1
VER	1
CHECK AH	DATE 29/09/2016



Legend

Cla i icatio o Co u itie

- Indirectly Affected
- High Flood Island
- Low Flod Island
- High Trapped Perimeter
- Low Trapped Perimeter
- O erland Escape Route
- Rising Road Access
- Cadastre
- Railway
- Study Area

JACOBS

SCALE	A3
SHEET	1 of 1
	GDA 1994 MGA Zone 55
TITLE	Classification of Communities PMF E ent
PROJECT	Blayney FRMS
CLIENT	Blayney Shire Council
DRAWN MR	PROJECT # EN04201
MAP #	Figure 5-
REV	1
VER	1
CHECK AH	DATE 22/09/2016

- High Flood Island and High Trapped Perimeter are generally not a serious concern for Blayney, since the duration of overland flooding is expected to be relatively short. These areas do not require evacuation.
- Properties with full vehicular access to the street that were not affected by flooding have been classed as 'indirectly affected' since there may be impacts to them such as damaged road infrastructure, loss of normal transport links, electricity supply, water supply, sewage or telecommunication services.

There are five main roads that lead in to/out of Blayney – the Mid Western Highway to the north, Millthorpe Road to the west, Mid Western Highway to the south-west, Hobbys Yard Road to the south-east and Newbridge Road to the east. All of these roads experience some degree of flooding. Each of these routes is discussed below:

Mid Western Highway to the north: Abattoir Creek starts to overtop the Mid Western Highway in the 1% AEP flood event, but with approximately 0.2m of floodwater over the road, should remain trafficable. In the 0.5% event the flooding is more extensive over the road and may not be trafficable by small vehicles but will be accessible by larger vehicles and emergency services. In the PMF event this access route is completely cut off.

Millthorpe Road to the west: Millthorpe Road / Orange Road experiences minor flooding in the 0.5% AEP event, but remains trafficable. In the PMF event, flood depths are typically between 0.2 and 0.35m between Binstead Street and Beaufort Street. While small vehicles may not be able to cross this, it is assumed that larger vehicles and emergency services will be able to use this road. This road is also subject to overland flooding, so the road is expected to be flooded for a relatively short period of time. For the purpose of the classification of communities, it is assumed that this road is a viable evacuation route.

Mid Western Highway to the south-west: This road only experiences flooding in the PMF event. Floodwater overtops the road near Patrick Close, with depths between 0.2 and 0.3m. It is expected that this would be trafficable. The road (which becomes Martha Street) acts as a flowpath between Medway Street and Adelaide Street and is unlikely to be trafficable. Flooding also occurs along Carcoar Street which would restrict access to this evacuation route.

Hobbys Farm Road to the south-east: The bridge over the Belubula River remains accessible in events up to and including the 0.5% AEP event. The bridge deck is overtopped in the PMF event. There is a breakout flow of the Belubula River, however, to the north-west of the bridge that is inundated in the 20% AEP event to a depth of just over 0.3m. While the road may be trafficable to large vehicles and emergency services, the route is entirely cut off south of Hills Lane in events larger than the 20% AEP.

Newbridge Road to the east: Newbridge Road crosses the Belubula River and heads east from the town. While the bridge is only overtopped in the PMF event, breakout flows from the Belubula River overtop the road to the east of this crossing in the 20% AEP event, with flood depths between 0.2 and 0.3m. This route may be trafficable by vehicles in the 20% event, but is completely cut off in events larger than this.

Since the majority of the flooding issues in Blayney is due to short-duration overland flooding, it is considered more important that flood affected properties are able to access higher ground to avoid floodwaters rather than evacuation out of the town. Properties classes as 'high trapped perimeter' or high flood island' do not pose a significant problem since the residents would have access to higher ground in the event of a flood and will not be displaced for long due to the short duration of overland flooding expected in Blayney. Properties with 'rising road access' provide the best method of evacuation for those who are required to evacuate. Overland escape routes provide the next best option, where evacuation can occur on foot. 'Low flood island' and 'low trapped perimeter' properties are those of most concern, as if they do not evacuate when flooding starts to occur, they may be trapped in their dwelling.

Access to the Blayney district hospital is only compromised in the PMF event, with Martha Street and Osman Street experiencing inundation. An appropriate evacuation centre within the town is Blayney Public School and the Centrepoint Sport and Leisure Centre. The school and leisure centre have large buildings that could temporarily accommodate residents if required. The site remains flood-free in the PMF event and accessible via the Church Street / Orange Road / Millthorpe Road route.

5.6 Flooding with Future Development

Blayney Settlement Strategy (2012) estimated that approximately 382 lots/dwellings could be made available for development within 2036 on existing vacant land for infill development which was considered adequate to satisfy the demand for residential uses over the next 20 years.

It is recommended that a detailed flood study be undertaken to address any flooding issues that may occur as a result of new residential development on existing vacant lands. On-site retention/detention is to be considered to maintain site runoff at pre-development level.