Pyrenees Shire

FLOOD EMERGENCY PLAN

A Sub-Plan of the Municipal Emergency Management Plan

For Pyrenees Shire Council
and
VICSES Ararat, Ballarat and Maryborough Units

Version 2, March 2020

PYRENEES SHIRE

VICTORIA State Government

SES

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Distribution of MFEP

Once endorsed and signed the, MFEP should be distributed to all MFEP committee members, MEMPC Chair, council, MERO, Deputy MERO, Representatives from; BoM, CMA, DELWP, Parks Victoria, Ambulance Victoria, VicRoads, DHHS, relevant utilities, MFB, MERC, RERC, Police station, VICSES Units, VICSES Regional office, CFA Brigades, CFA Regional office.

Document Transmittal Form / Amendment Certificate

This Municipal Flood Emergency Plan (MFEP) will be amended, maintained and distributed as required or every 3 years facilitated by VICSES in consultation with the Municipal Emergency Management Planning Committee (MEMPC)

Suggestions for amendments to this Plan should be forwarded to VICSES Regional Office via MidWest@ses.vic.gov.au.

The VICSES MFEP template 5.3 was used to develop this Plan.

Amendments listed below have been included in this Plan and updated as a new version.

Amendment Number	Date of Amendment	Amendment Entered By	Summary of Amendment
0.1	November 2018	Tony Grimme	Draft Version
1	December 2019	Clare Mintern	Rewrite the report.
2	March 2020	Clare Mintern	Incorporate feedback from Pyrenees MEMPC.

This Plan will be maintained on the VICSES website at www.ses.vic.gov.au/get-ready/your-local-flood-information and Pyrenees Shire website https://www.pyrenees.vic.gov.au/page/HomePage.aspx

List of Abbreviations & Acronyms

The following abbreviations and acronyms are used in the Plan			
AAR	After Action Review	**IIA**	Initial Impact Assessment
AEP	Annual Exceedance Probability	**IEMT**	Incident Emergency Management Team
AHD	Australian Height Datum (the height of a location above mean sea level in metres)	**IFD**	Intensity Frequency Duration
AIDR	Australian Institute of Disaster Resilience	**JSOP**	Joint Standard Operations Procedure
AIIMS	Australasian Inter-service Incident Management System	**IMS**	Incident Management System
AoCC	Area of Operations Control Centre / Command Centre	**LSIO**	Land Subject to Inundation Overlay
ARI	Average Recurrence Interval	**MEMO**	Municipal Emergency Management Officer
ARMCANZ	Agricultural & Resource Management Council of Australia & New Zealand	**MEMP**	Municipal Emergency Management Plan
AV	Ambulance Victoria	**MEMPC**	Municipal Emergency Management Planning Committee
BOM	Bureau of Meteorology	**MERC**	Municipal Emergency Response Coordinator
CEO	Chief Executive Officer	**MERO**	Municipal Emergency Resource Officer
CERA	Community Emergency Risk Assessment	**MFB**	Metropolitan Fire Brigade
CFA	Country Fire Authority	**MFEP**	Municipal Flood Emergency Plan
CMA	Catchment Management Authority	**MFEPC**	Municipal Flood Emergency Planning Committee
RERC	Regional Emergency Response Coordinator	**MRM**	Municipal Recovery Manager
RERCC	Regional Emergency Response Coordination Centre	**PMF**	Probable Maximum Flood
DHHS	Department of Health and Human Services	**RAC**	Regional Agency Commander
DJPR	Department of Jobs, Precincts and Regions	**RCC**	Regional Control Centre
DELWP	Department of Environment, Land, Water and Planning	**RDO**	Regional Duty Officer
EMLO	Emergency Management Liaison Officer	**SAC**	State Agency Commander
EMMV	Emergency Management Manual Victoria	**SBO**	Special Building Overlay
EMT	Emergency Management Team	**SCC**	State Control Centre
ERC	Emergency Relief Centre	**SDO**	State Duty Officer
EO	Executive Officer	**SERP**	State Emergency Response Plan
FO	Floodway Overlay	**SEWS**	Standard Emergency Warning Signal

Part 1. Introduction

1.1 Approval and Endorsement

This Municipal Flood Emergency Plan (MFEP) has been prepared by VICSES, Glenelg Hopkins, Wimmera and North Central CMA and Pyrenees Shire Council staff and with the authority of the Pyrenees Municipal Emergency Management Planning Committee (Pyrenees MEMPC) pursuant to Section 20 of the Emergency Management Act 1986 (as amended).

VICSES staff has undertaken consultation with the Pyrenees staff, Glenelg Hopkins, Wimmera and North Central CMA's staff and Ararat, Ballarat and Maryborough VICSES Unit members regarding the arrangements contained within this plan.

This MFEP is a sub plan to the Pyrenees Shire Emergency Management Plan (MEMP), is consistent with the Emergency Management Manual Victoria (EMMV) and the Victorian Floodplain Management Strategy (2016), and takes into account the outcomes of the Community Emergency Risk Assessment (CERA) process undertaken by the Municipal Emergency Management Planning Committee (MEMPC).

The MFEP is consistent with the Mid West Regional Flood Emergency Plan (RFEP) and the State Emergency Response Plan (SERP) – Flood sub-plan.

This MFEP is a result of the cooperative efforts of the MFPC and its member agencies.

This Plan is approved by the VICSES Regional Manager.

This Plan is endorsed by the Pyrenees MEMPC as a sub-plan to the MEMP.

Approval

Stephen Warren Date 18 March 2020

Grampians Mid West Region VICSES Regional Manager

Endorsement

Kathy Bramwell Date 20 March 2020

Chair – Municipal Emergency Management Planning Committee

Purpose and Scope of this Flood Emergency Plan

The purpose of this MFEP is to detail arrangements agreed for managing a flood emergency before, during and after it occurs or potentially occurs within the Pyrenees Shire.

As such, the scope of the Plan is to:

- Identify the local flood risk;
- Support the implementation of mitigation and planning measures to minimise the causes and impacts of flooding;
- Detail emergency management arrangements;
- Identify linkages with Local, Regional and State emergency and wider planning arrangements with a specific emphasis on those relevant to flood.

1.2 Municipal Flood Planning Committee (MFPC)

Membership of the Pyrenees Flood Planning Committee (MFPC) comprises of the following representatives from the following agencies and organisations:

- VICSES (i.e. Unit Controller & Regional Officer – Emergency Management) (Chair),
- Council (i.e. Municipal Emergency Manager, Drainage Engineer, Statutory Planning Officer)
- Victoria Police (i.e. Municipal Emergency Response Co-ordinator) (MERC),
- Catchment Management Authority (CMA), - Glenelg Hopkins, Wimmera and North Central
- Department of Health and Human Services (DHHS) as required,
- Department of Environment, Land, Water and Planning (DELWP) as required,
- GWMWater
- Bureau of Meteorology as required,
- Local community representatives and
- CFA

1.3 Responsibility for Planning, Review & Maintenance of this Plan

This MFEP must be maintained in order to remain effective.

VICSES through the MFPC has responsibility for facilitating the preparation, review, maintenance and distribution of this plan.

The MFPC will meet at least once per year. The plan should be reviewed following:

A new flood study;

A significant change in flood mitigation measures;

After the occurrence of a significant flood event within the Municipality;

Or if none of the above occur, every 3 years.

Part 2. BEFORE: Prevention / preparedness arrangements

2.1 Community Engagement and Awareness

Details of this MFEP will be released to the community through; local media, any FloodSafe engagement initiatives and websites (VICSES and the Municipality) upon formal adoption by VICSES and the Municipality

VICSES with the support of the Pyrenees Shire and the Glenelg Hopkins, Wimmera and North Central CMA's will coordinate targeted community flood engagement programs within the council area.

Refer to appendix H (LFG and FloodSafe Information. Attach any broader FloodSafe details).

2.2 Structural Flood Mitigation Measures

There are no formal structural flood mitigation measures within the Pyrenees Shire Council.

2.3 Non-structural Flood Mitigation Measures

2.3.1 Exercising the Plan

Arrangements for exercising this Plan will be at the discretion of the MEMPC. It is recommended that the MFEP is exercised on annual basis and reviewed in line with Section 1.4.

2.3.2 Flood Warning

Arrangements for Bureau issued Flood Watch and Flood Warning products are contained within the SERP Sub Plan – Flood (www.ses.vic.gov.au/em-sector/vicses-emergency-plans) and on the Bureau of Meteorology (BoM) website www.bom.gov.au.

Details on Warnings issued by VICSES through VicEmergency and VICSES channels are outlined in **Appendix E.**

2.3.3 Local Knowledge

Community Observers provide local knowledge to VICSES and the Incident Control Centre regarding local insights and the potential impacts and consequences of an incident and may assist with the dissemination of information to community members.

Specific details of arrangements to capture local knowledge are provided in **Appendix H.**

Part 3. DURING: Response arrangements

3.1 Introduction

3.1.1 Activation of Response

Flood response arrangements may be activated by the Regional Duty Officer (RDO) VICSES – Mid West Region or Regional Agency Commander (RAC).

The VICSES Incident Controller (IC)/RDO will activate agencies as required as documented in the State Emergency Response Plan - Flood.

3.1.2 Responsibilities

There are a number of agencies with specific roles that will act in support of VICSES and provide support to the community in the event of a serious flood within the Pyrenees Shire. These agencies will be engaged through the IEMT (Incident Emergency Management Team) when enacted or via the RAC when the IEMT is not enacted.

The general roles and responsibilities of supporting agencies are as agreed within the: MEMP, EMMV (Part 7 'Emergency Management Agency Roles') and SERP Sub Plan - Flood and Regional Flood Emergency Plan.

3.1.3 Emergency Coordination Centre or equivalent

If established, liaison with the emergency coordination centre will be through the established Division/Sector Command and through Municipal involvement in the IEMT, in particular the Municipal Emergency Response Coordinator (MERC). The VICSES RDO / ICC will liaise with the centre directly if no Division/Sector Command is established.

The function, location, establishment and operation of an emergency coordination centre if relevant will be as detailed in the MEMP.

3.1.4 Escalation

Many flood incidents are of local concern and an appropriate response can usually be coordinated using local resources. However, when these resources are exhausted, the State's arrangements provide for further resources to be made available, firstly from neighbouring Municipalities (on a regional basis) and then on a State-wide basis.

Resourcing and event escalation arrangements are described in Part 3 of the EMMV.

3.2 The six C's

Arrangements in this MFEP must be consistent with the 6 C's detailed in State and Regional Flood Emergency Plans and the MEMP. For further information, refer to Part 3 of the EMMV.

- **Command:** Overall direction of response activity in an emergency.
- **Control:** Internal direction of personnel and resources within an agency.
- **Coordination:** Bringing together agencies and resources to ensure effective preparation for response and recovery.
- **Consequence:** Management of the effect of emergencies on individuals, communities, infrastructure and the environment.
- **Communication:** Engagement and provision of information across agencies and proactively with the community around preparation, response and recovery in emergencies.
- **Community Connection:** Understanding and connecting with trusted networks, leaders and communities around resilience and decision making.

Specific details of arrangements for this plan are to be provided in **Appendix C**.

3.2.1 Control

Functions 5(a) and 5(c) at Part 2 of *the Victoria State Emergency Service Act 1986 (as amended)* detail the authority for VICSES to plan for and respond to flood.

Part 7 of the EMMV prepared under the *Emergency Management Act 1986 (as amended)*, identifies VICSES as the Control Agency for flood. It identifies DELWP as the Control Agency responsible for "dam safety, water and sewerage asset related incidents" and other emergencies. A more detailed explanation of roles and responsibilities is provided in later sections of Part 7 of the EMMV.

All flood response activities within the Pyrenees Shire including those arising from a dam failure or retarding basin / levee bank failure incident will therefore be under the control of the appointed IC, or delegated representative.

3.2.2 Incident Controller (IC)

An Incident Controller (IC) will be appointed by the VICSES (as the Control Agency) to command and control available resources in response to a flood event on the advice of the Bureau of Meteorology (or other reliable source) that a flood event will occur or is occurring. The IC responsibilities are as defined in Part 3 of the EMMV.

3.2.3 Incident Control Centre (ICC)

As required, the IC will establish an Incident Control Centre (ICC) from which to initiate incident response command and control functions. The decision as to if and when the ICC should be activated, rests with the Control Agency (i.e. VICSES).

Pre-determined ICC locations are available in the MEMP.

3.2.4 Divisions and Sectors

To ensure that effective Command and Control arrangements are in place, the IC may establish Divisions and sectors depending upon the complexity of the event and resource capacities.

The following Divisions and Sectors may be established where applicable to assist with the management of flooding within the Municipality:

Incident Level	ICC / ICP	Division	Division Control Point	Sector	Sector Control Point
Level 2-3	Ballarat ICC	Ararat	Beaufort CFA Local Command Facility	Beaufort CFA	TBD as needed
Level 2-3	Ballarat ICC	Ararat	Beaufort CFA Local Command Facility	Landsborough CFA	TBD as needed
Level 2-3	Ballarat ICC	Ararat	Beaufort CFA Local Command Facility	Avoca CFA	TBD as needed
Level 2-3	Ballarat ICC	Ararat	Beaufort CFA Local Command Facility	Raglan CFA	TBD as needed
Level 2-3	Ballarat ICC	Ararat	Beaufort CFA Local Command Facility	Lexton CFA	TBD as needed
Level 2-3	Ballarat ICC	Ararat	Beaufort CFA Local Command Facility	Waubra CFA	TBD as needed
Level 1	Beaufort CFA				
Level 1	Landsborough CFA				
Level 1	Avoca CFA				
Level 1	Raglan CFA				
Level 1	Lexton CFA				
Level 1	Waubra CFA				

3.2.5 Incident Management Team (IMT)

The IC will form an Incident Management Team (IMT).

Refer to Part 3 of the EMMV for guidance on IMTs and Incident Management Systems (IMSs).

3.2.6 Incident Emergency Management Team (IEMT)

The IC will establish a multi-agency Incident Emergency Management Team (IEMT) to assist the flood response. The IEMT consists of key personnel (with appropriate authority) from stakeholder agencies and relevant organisations who need to be informed of strategic issues related to incident control. They are able to provide high level strategic guidance and policy advice to the IC for consideration in developing incident management strategies.

Organisations, including the Pyrenees Shire, required within the IEMT will provide an Emergency Management Liaison Officer (EMLO) to the ICC if and as required as well as other staff and / or resources identified as being necessary, within the capacity of the organisation.

Refer to 3 of the EMMV for guidance on IEMTs.

3.2.7 On Receipt of a Flood Watch / Severe Weather Warning

SOP008 and SOP009 outline in detail the actions to be undertaken upon receipt of a Flood Watch/Flood Warning or Severe Weather Warning. VICSES RDO (until an incident controller is appointed) or IC will undertake actions as defined within the flood intelligence cards (**Appendix C**). General considerations by the IC/VICSES RDO will be as follows:

- Review flood intelligence to assess likely flood consequences
- Monitor weather and flood information – www.bom.gov.au
- Assess Command and Control requirements.
- Review local resources and consider needs for further resources regarding personnel, property protection, flood rescue and air support
- Notify and brief appropriate officers. This includes Regional Control Centre (RCC) (if established), State Control Centre (SCC) (if established), Council, other emergency services through the EMT.
- Assess ICC readiness (including staffing of IMT and IEMT) and open if required
- Ensure flood warnings and community information is prepared and issued to the community where required
  - Flood (Riverine and flash) Warnings are managed by the RDO/RAC
  - Severe Weather/ Thunderstorm warnings are managed by SDO/SAC
- Develop media and public information management strategy
- Monitor watercourses and undertake reconnaissance of low-lying areas
- Ensure flood mitigation works are being checked by owners
- Develop and issue incident action plan, if required
- Develop and issue situation report, if required

3.2.8 On Receipt of the First and Subsequent Flood Warnings

VICSES RDO (until an incident controller is appointed) or IC will undertake actions as defined within the flood intelligence cards **(Appendix C).** General considerations by the IC/VICSES RDO will be as follows:

- Develop an appreciation of current flood levels and predicted levels. Are floodwaters, rising, peaking or falling?
- Review flood intelligence to assess likely flood consequences.
- Consider:
  - What areas may be at risk of inundation?
  - What areas may be at risk of isolation?
  - What areas may be at risk of indirect affects as a consequence of power, gas, water, telephone, sewerage, health, transport or emergency service infrastructure interruption?
  - The characteristics of the populations at risk
- Determine what the at-risk community need to know and do as the flood develops.
- Warn the at-risk community including ensuring that an appropriate warning and community information strategy is implemented including details of:
  - The current flood situation
  - Flood predictions
  - What the consequences of predicted levels may be
  - Public safety advice
  - Who to contact for further information
  - Who to contact for emergency assistance
- Liaise with relevant asset owners as appropriate (i.e. water and power utilities)
- Implement response strategies as required based upon flood consequence assessment.
- Continue to monitor the flood situation – www.bom.gov.au/vic/flood/
- Continue to conduct reconnaissance of low-lying areas

3.3 Initial Impact assessment

Initial impact assessments will be conducted in accordance with Part 3 section 5.2.5 of the EMMV to assess and record the extent and nature of damage caused by flooding. This information may then be used to provide the basis for further needs assessment and recovery planning by DHHS and recovery agencies.

3.4 Preliminary Deployments

When flooding is expected to be severe enough to cut access to towns, suburbs and/or communities the IC will consult with relevant agencies to ensure that resources are in place if required to provide emergency response. These resources might include emergency service personnel, food items and non-food items such as medical supplies, shelter, assembly areas, relief centres etc.

3.5 Response to Flash Flooding

Emergency management response to flash flooding should be consistent with the guideline for the emergency management of flash flooding contained within the State Emergency Response Plan - Flood.

When conducting pre-event planning for flash floods the following steps should be followed, and in the order as given:

1. Determine if there are barriers to evacuation by considering warning time, safe routes, resources available and etc;
2. If evacuation is possible, then evacuation should be the adopted strategy and it must be supported by a public information capability and a rescue contingency plan;
3. Where it is likely people will become trapped by floodwaters due to limited evacuation options safety advice needs to be provided to people at risk. Advice should be given to not attempt to flee by entering floodwater if they become trapped, it may be safer to seek the highest point within the building and to telephone 000 if they require rescue.
4. For buildings known to be structurally un-suitable an earlier evacuation trigger will need to be established (return to step 1 of this cycle).
5. If an earlier evacuation is not possible then specific preparations must be made to rescue occupants trapped in structurally unsuitable buildings either pre-emptively or as those people call for help.
6. Contact the Pyrenees Shire MERC and MERO at the earliest opportunity to allow for relief preparation to commence.

Due to the rapid development of flash flooding it will often be difficult, to establish relief centres ahead of actually triggering the evacuation. This is normal practice but this is insufficient justification for not adopting evacuation.

Refer to **Appendix C** for response arrangements for flash flood events.

3.6 Evacuation

The IC decides whether to warn people to evacuate or if it is recommended to evacuate immediately.

Once the decision is made VicPol are responsible for the management of the evacuation process where possible. VICSES and other agencies will assist where practical. VICSES is responsible for the development and communication of evacuation warnings.

VicPol and/or Australian Red Cross may take on the responsibility of registering people affected by a flood emergency including those who have been evacuated.

Refer to EMMV Part 8, Appendix 9 and the Evacuation Guidelines for guidance of evacuations for flood emergencies.

Refer to **Appendix C** of this Plan and the MEMP for additional local evacuation considerations for the municipality.

3.7 Flood Rescue

VICSES may conduct flood rescues. Appropriately trained and equipped VICSES units or other agencies that have appropriate training, equipment and support may carry out rescues.

Rescue operations may be undertaken where voluntary evacuation is not possible, has failed or is considered too dangerous for an at-risk person or community. An assessment of available flood rescue resources (if not already done prior to the event) should be undertaken prior to the commencement of Rescue operations.

Rescue is considered a high-risk strategy to both rescuers and persons requiring rescue and should not be regarded as a preferred emergency management strategy. Rescuers should always undertake a dynamic risk assessment before attempting to undertake a flood rescue.

Victoria Police Rescue Coordination Centre should be notified of any rescues that occur: (03) 9399 7500

The following resources are available to assist the Pyrenees Shire with rescue operations:

- Flood Rescue boats are located at Ballarat, Stawell and Ararat Units.
- Ararat and Ballarat SES/CFA have a land based Swift Rescue Team.
- HEMS 4 Rescue helicopter is located at the Warrnambool Airport.

3.8 Aircraft Management

Aircraft can be used for a variety of purposes during flood operations including evacuation, resupply, reconnaissance, intelligence gathering and emergency travel.

Air support operations will be conducted under the control of the IC

The IC may request aircraft support through the State Air Desk located at the SCC will establish priorities.

Suitable airbase facilities are located at:

- Stawell Aerodrome, off Aerodrome Road, Stawell.
- Ararat Aerodrome, Aerodrome Road, Western Highway, east of Ararat.

3.9 Resupply

Communities, neighbourhoods or households can become isolated during floods as a consequence of road closures or damage to roads, bridges and causeways. Under such circumstances, the need may arise to resupply isolated communities/properties with essential items.

When predictions/intelligence indicates that communities, neighbourhoods and/or households may become isolated, VICSES will advise businesses and/or households that they should stock up on essential items.

After the impact, VICSES can support isolated communities through assisting with the transport of essential items to isolated communities and assisting with logistics functions.

Resupply operations are to be included as part of the emergency relief arrangements with VICSES working with the relief agencies to service communities that are isolated.

3.10 Essential Community Infrastructure and Property Protection

Essential Community Infrastructure and Property (e.g. residences, businesses, roads, power supply etc.) may be affected in the event of a flood.

The Pyrenees Shire Council maintains a small stock of sandbags that will be made available at community collection point at Beaufort Council Depot. The Pyrenees Shire Council also deliver sandbags as needed to Landsborough, Avoca, Raglan, Lexton and Waubra CFA stations as needed, refer to **Appendix I** for further details. These details will be advertised by both VICSES and Pyrenees Shire at appropriate times prior to and during an event. Back-up supplies are available through the VICSES Regional Headquarters. The IC will determine the priorities related the use of sandbags, which will be consistent with the strategic priorities.

If VICSES sandbags are becoming limited in supply, then priority will be given to protection of Essential Community Infrastructure. Other high priorities may include for example the protection of historical buildings.

Property may be protected by:

- Sandbagging to minimise entry of water into buildings
- Encouraging businesses and households to lift or move contents
- Construction of temporary levees in consultation with the CMA, LGA and VICPOL and within appropriate approval frameworks.

The IC will ensure that owners of Essential Community Infrastructure are kept advised of the flood situation. Essential Community Infrastructure providers must keep the IC informed of their status and ongoing ability to provide services.

Contact your local VICSES representative for the most current Sandbag Guidelines or download it from IMT Toolbox in EMCOP- Operations.

Refer to **Appendix C** for further specific details of essential infrastructure requiring protection and location of sandbag collection points.

3.11 Disruption to Services

Disruption to services other than essential community infrastructure and property can occur in flood events. Refer to **Appendix C** for specific details of likely disruption to services and proposed arrangements to respond to service disruptions in the Pyrenees Shire.

3.12 Road Closures

Pyrenees Shire and Regional Roads will carry out their formal functions of road closures including observation and placement of warning signs, road blocks etc. to its designated local and regional roads, bridges, walking and bike trails. Pyrenees Shire staff should also liaise with and advise Regional Roads as to the need or advisability of erecting warning signs and / or of closing roads and bridges under its jurisdiction. Regional Roads are responsible for designated main roads and highways and councils are responsible for the designated local and regional road network.

Regional Roads and the Pyrenees Shire will communicate community information regarding road closures. Information will be updated on the VIC Traffic website: https://traffic.vicroads.vic.gov.au/

Refer to **Appendix C** for specific details of potential road closures.

3.13 Dam Spilling/ Failure

DELWP is the Control Agency for dam safety incidents (e.g. breach, failure or potential breach / failure of a dam), however VICSES is the Control Agency for any flooding that may result.

DELWP have developed Dam Safety Emergency Plans for municipalities where it is applicable.

Major dams with potential to cause structural and community damage within the Municipality are contained in **Appendix A**.

3.14 Waste Water related Public Health Issues and Critical Sewerage Assets

Inundation of critical sewerage assets including septic tanks and sewerage pump stations may result in water quality problems within the Municipality. Where this is likely to occur or has occurred the responsibility agency for the critical sewerage asset should undertake the following:

Advise VICSES of the security of critical sewerage assets to assist preparedness and response activities in the event of flood;

Maintain or improve the security of critical sewerage assets;

Check and correct where possible the operation of critical sewerage assets in times of flood;

Advise the ICC in the event of inundation of critical sewerage assets.

It is the responsibility of the Pyrenees Shire Environmental Health Officer to inspect and report to the MERO and the ICC on any water quality issues relating to flooding.

3.15 Access to Technical Specialists

VICSSES Manages contracts with private technical specialists who can provide technical assistance in the event of flood operations or geotechnical expertise. Refer to VICSES SOP061 for the procedure to engage these specialists.

3.16 After Action Review

VICSES will coordinate the after action review arrangements of flood operations as soon as practical following an event.

All agencies involved in the flood incident should be represented at the after action review.

Part 4. AFTER: Emergency relief and recovery arrangements

4.1 General

Arrangements for recovery from a flood incident within the Pyrenees Shire is detailed in the Pyrenees Shire MEMP.

4.2 Emergency Relief

The decision to recommend the opening of an emergency relief centre sits with the IC. The IC is responsible for ensuring that relief arrangements have been considered and implemented where required under the State Emergency Relief and Recovery Plan (Part 4 of the EMMV).

The range and type of emergency relief services to be provided in response to a flood event will be dependent upon the size, impact, and scale of the flood. Refer to Part 4of the EMMV for details of the range of emergency relief services that may be provided.

Suitable relief facilities identified for use during floods are detailed in **Appendix D** and the MEMP.

Details of the relief arrangements are available in the MEMP.

4.3 Animal Welfare

Matters relating to the welfare of livestock and companion animals (including feeding and rescue) are to be referred to DJPR.

Requests for emergency supply and/or delivery of fodder to stranded livestock or for livestock rescue are passed to DJPR.

Matters relating to the welfare of wildlife are to be referred to DELWP.

4.4 Transition from Response to Recovery

VICSES as the Control Agency is responsible for ensuring effective transition from response to recovery. This transition will be conducted in accordance with existing arrangements as detailed in Part 3 of the EMMV or location of the transition arrangements are available in the MEMP

Appendix A: Flood threats for the Pyrenees

This Appendix provides a broad overview of flood risk within the Municipality. Detailed flood risk information for individual communities is detailed in **Appendix C.**

Currently flood studies are being undertaken for Avoca, Natte Yallock, Amphitheatre and the Upper Mount Emu Creek Catchment. Also a more detailed Flood Study is being undertaken for Raglan. When available the results from these studies will be included into this Plan.

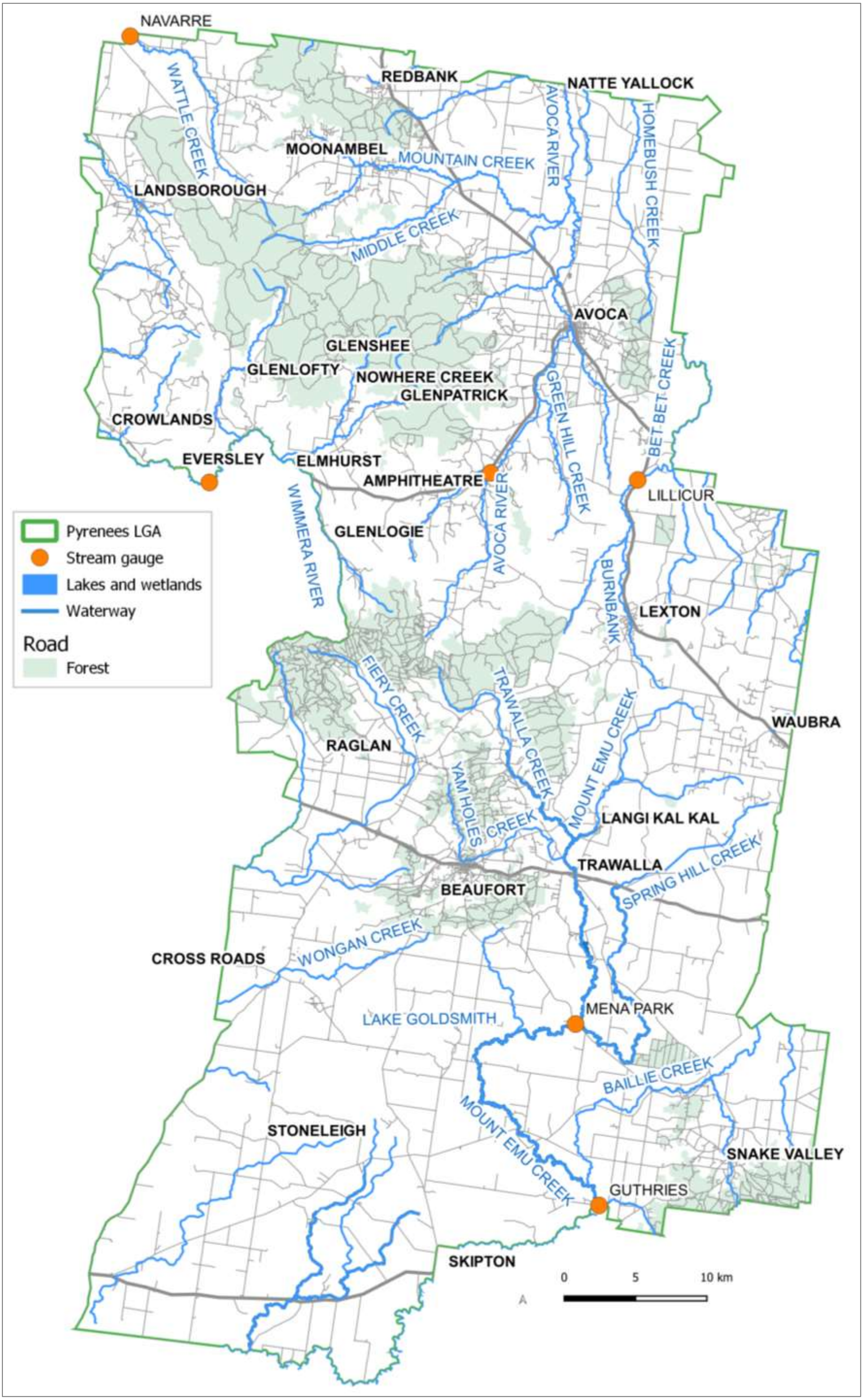
5.1 Stormwater and Riverine Flooding

The Pyrenees Shire has a long history of riverine flood events that have caused substantial damages to the local infrastructure (e.g. roads and bridges) and agriculture (e.g. fencing). Towns impacted by riverine flooding include Beaufort, Landsborough, Barkly, Avoca, Natte Yallock Amphitheatre, Lexton, Raglan, Glenpatrick, Glenlofty, Crowlands, Nowhere Creek and Waubra. While there is a high number of buildings at risk of flooding in Natte Yallock and Beaufort, other towns only have a few buildings at risk of flooding. Due to the steep terrain flooding can develop quickly with little warning time available. The Pyrenees Shire's road network is frequently significantly impacted by flooding. Road access is often cut as a result of heavy rainfall events, leaving a large number of people isolated.

While Beaufort and other towns in the Pyrenees Shire are prone to stormwater flooding, no stormwater flood mapping has been undertaken. Within Beaufort heavy local rainfall centered over the town is known to result stormwater flooding, this will exacerbate riverine flooding.

Riverine flood events within Pyrenees Shire have been frequent over the last decade. The most recent flood event was recorded in 2016, refer to a list of significant flood events below.

Year	Description
September 2016	Minor flood impacts to Avoca, Natte Yallock, Lexton, Raglan, Waubra, Beaufort and towns in the Upper Wimmera River Catchment causing access to be cut to minor and major roads. No buildings were impacted.
January 2011	This was the largest flood event on record in the Upper Wimmera River Catchment. This flood event caused significant damage to buildings and infrastructure in Beaufort, Natte Yallock, Raglan, Waubra, Avoca, Landsborough, Crownlands and other towns within the Upper Wimmera River Catchment. Some outbuildings were flooded over 0.5m deep in Beaufort.
2010	Minor flood impacts to Avoca, Natte Yallock, Lexton, Waubra, Raglan, Beaufort and towns in the Upper Wimmera River Catchment causing access to be cut to minor and major roads. No buildings were impacted.
1996	Minor flood impacts to towns in Beaufort, Lexton and the Upper Wimmera River Catchment causing access to be cut to minor and major roads.
1992	Minor flood impacts to Beaufort, Lexton and Raglan causing access to be cut to minor and major roads.
1988	Minor flood impacts to towns in the Upper Wimmera River Catchment causing access to be cut to minor and major roads.
1983	Minor flood impacts to towns in Beaufort and the Upper Wimmera River Catchment causing access to be cut to minor and major roads.
1981	Minor flood impacts to towns in Beaufort and the Upper Wimmera River Catchment causing access to be cut to minor and major roads.
1973	Minor flood impacts to towns in the Upper Wimmera River Catchment causing access to be cut to minor and major roads.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WATTLE CREEK
REDBANK
NATTE YALLOCK
AVOCA RIVER
HOMEBUSH CREEK
MOONAMBEL
MOUNTAIN CREEK
LANDSBOROUGH
MIDDLE CREEK
AVOCA
GLENSHEE
GLENLOFTY
NOWHERE CREEK
GLENPATRICK
GREEN HILL CREEK
BET BET CREEK
CROWLANDS
EVERSLEY
ELMHURST
AMPHITHEATRE
LILLICUR
WIMMERA RIVER
GLENLOGIE
AVOCA RIVER
BURNBANK
LEXTON
Pyrenees LGA
Stream gauge
Lakes and wetlands
Waterway
Road
Forest
FIERY CREEK
TRAWALLA CREEK
MOUNT EMU CREEK
WAUBRA
RAGLAN
YAM HOLES CREEK
LANGI KAL KAL
TRAWALLA
SPRING HILL CREEK
BEAUFORT
WONGAN CREEK
CROSS ROADS
LAKE GOLDSMITH
MENA PARK
BAILLIE CREEK
MOUNT EMU CREEK
STONELEIGH
SNAKE VALLEY
GUTHRIES
SKIPTON
0
5
10 km
A

5.2 Major Waterways

The major waterways within the Pyrenees Shire Council are listed in the table below.

Waterway	Description
Yam Holes Creek	Yam Holes Creek drains the Musical Gully State Forrest north of Beaufort, and has a catchment area of 27 km^2. Yam Holes Creek is the main waterway through Beaufort, and connects with the Mount Emu Creek 10 km downstream of Beaufort. Yam Holes Creek frequently causes flooding in Beaufort. Rapid rises in floodwater can occur 2 to 4 hours after rainfall. Flood levels can peak 6 to 9 hours after rainfall.
Mount Emu Creek	The upper reaches of the Mount Emu Creek drains the hills south of Lexton. Mount Emu Creek then flows south through Langi Kal Kal, Trawalla and Mena Park. Yam Holes Creek joins the Mount Emu Creek 10 km downstream of Beaufort.
Wimmera River	The Wimmera River is located to the west of the Pyrenees Shire Council. It originates south of Elmhust in the Mount Cole State Forrest. Towns impacted by flooding within the upper Wimmera Catchment area include Elmhust, Glenpatrick, Glenlofty, and Crowlands. This part of the catchment has very steep terrain, rapid rises in floodwater in the Wimmera River and adjacent tributaries can occur with 2 to 6 hours from rainfall. The flood peak may occur within 4 to 12 hours from rainfall.
Avoca River	The upper reach of the Avoca River drains the norther section of Mount Lonarch and the Ben Major State Forrest and flows north through Amphitheatre and Avoca. Towns impacted by flooding within the upper Avoca River Catchment area include Amphitheatre, Avoca and Natte Yallock. This part of the catchment has very steep terrain, rapid rises in floodwater in the Avoca River and adjacent tributaries can occur with 2 to 6 hours from rainfall. The flood peak may occur within 6 to 9 hours from rainfall.
Fiery Creek	The upper reach of the Fiery Creek is located to the east of the Pyrenees Shire. Fiery Creek regularly causes flooding in Raglan. Due to the small catchment area upstream of Raglan 64 km^2, there is little warning time for Raglan, flooding can occur within 6 to 15 hours from rainfall.
Howard Creek (Native Youth Creek)	Howard Creek originates in the mountains of the Great Dividing Range and flows north west through Landsborough before it joins Wattle Creek downstream of Navarre. Howard Creek is also known as Native Youth Creek. The upper part of the catchment is relatively steep with numerous well defined flow paths.

5.3 Building Damages

Refer to the table below for property and building damages for flood events within the Pyrenees Shire Council. The table also provides an indication of when a Level 2 and 3 Incident Control Centre (ICC) will be required, based on the number of above floor damages.

Average Recurrence Interval (ARI)	Total number of properties at risk of flooding (buildings flooded above floor)					Total damages for the Pyrenees Shire Council
	Beaufort (Appendix C1)	Lexton (Appendix C2)	Raglan (Appendix C3)	Upper Wimmera River (Appendix C4)	Waubra (Appendix C5)	
5	181 (21)			2 (0)		181 (21)
10	197 (32)			7 (0)		197 (32)
20	209 (39)			9 (0)		209 (39)
50	211 (44)			15 (1)		211 (44)
100	214 (52)	38 (2)*	29 (4)*	27 (2)	53 (1)*	361 (61)
Probable Maximum Flood	261 (211)			51 (11)		312 (222)

*No floor level survey was undertaken, buildings at risk of flooding were estimated using flood mapping recently undertaken by the Pyrenees Shire Council (Utilis 2018 & 2019). Refer to Sections C2, C3 and C5 for more details.

Level 2 ICC

Level 3 ICC

5.4 Dams Spill / Failure

Significant dams or lakes that influence flooding within Pyrenees Shire Council area are listed below.

Dam	Owner	Full Supply Volume	Comments
Beaufort Lake	Pyrenees Shire Council	260 ML	Beaufort Lake is a recreational storage located on Cemetery Creek, on the southern edge of Beaufort. During the 2010 and 2011 flood events Beaufort Lake spilled and contributed to flooding Beaufort. Some scour of the Lake wall raised concerns of council around potential failure. Repair works of the wall have been undertaken. For more details regarding the influence of Beaufort Lake on flooding refer to Appendix C1.

5.5 Levees

No levees have been constructed within the Pyrenees Shire Council as part of formal structural flood mitigation works.

Appendix B: Typical flood peak travel times

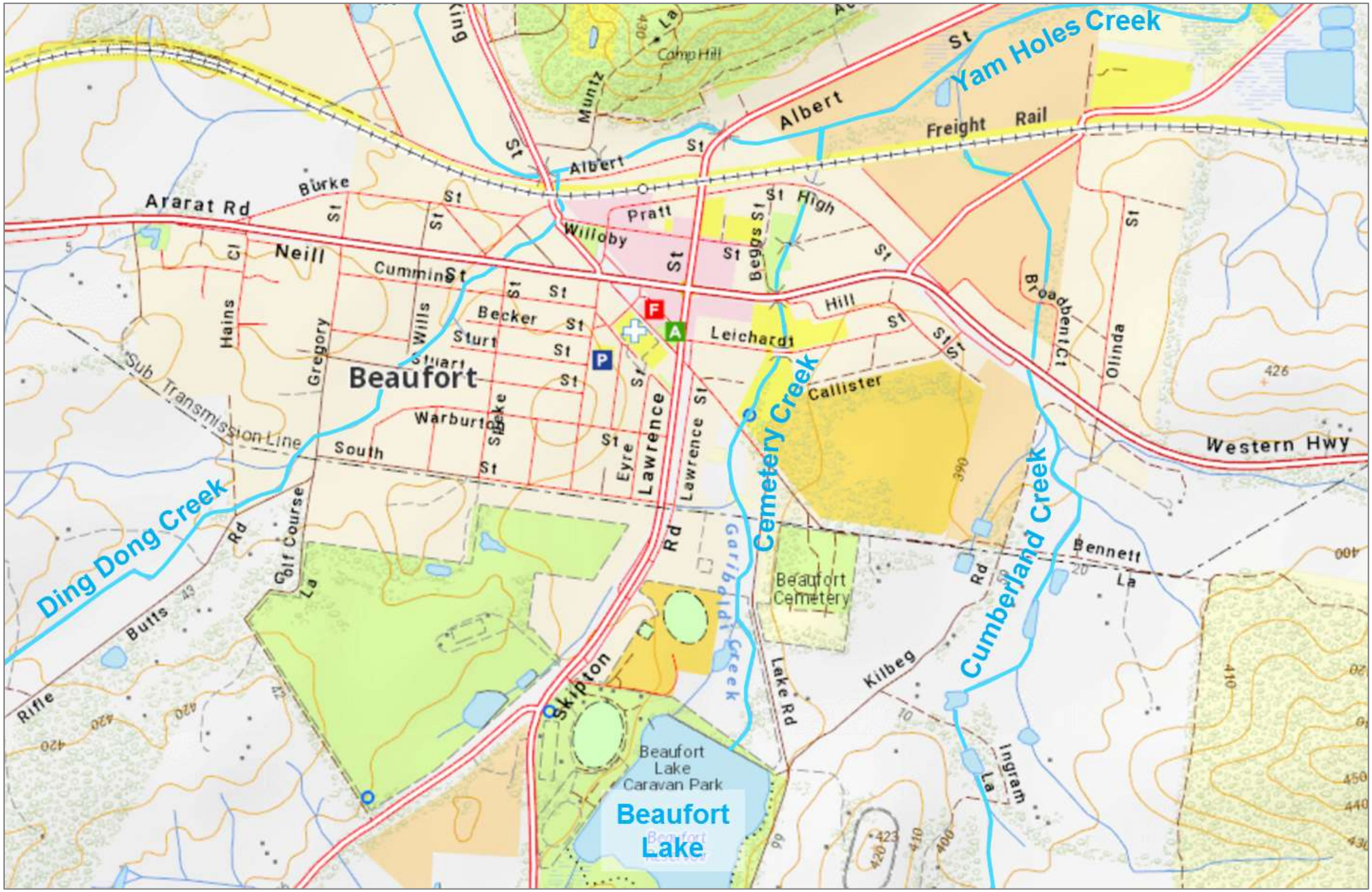
Location From	Location To	Typical Travel Time	Comments	Duration
Landsborough and Barkly (Howard Creek and Wattle Creek)				
Start of rainfall (upper catchment)	Landsborough	2 - 6 hours	begin to rise from normal levels	1 day
Start of rainfall (upper catchment)	Landsborough	3 - 12 hours	to peak	
Waubra (Mount Greencock Creek)				
Start of rainfall (upper catchment)	Waubra	2 - 6 hours	begin to rise from normal levels	1 day
Start of rainfall (upper catchment)	Waubra	3 - 12 hours	to peak	
Eversley (Wimmera River)				
Start of rainfall (upper catchment)	Eversley	2 - 6 hours	begin to rise from normal levels	1 day
Start of rainfall (upper catchment)	Eversley	4 - 12 hours	to peak	
Beaufort (Yam Holes Creek)				
Start of rainfall (upper catchment)	Beaufort	3 - 6 hours	begin to rise from normal levels	1 day
Start of rainfall (upper catchment)	Beaufort	6 - 9 hours	to peak	
Avoca (Avoca River)				
Start of rainfall (upper catchment)	Avoca	3 - 6 hours	begin to rise from normal levels	1 day
Start of rainfall (upper catchment)	Avoca	6 - 9 hours	to peak	

Lexton (Burnbank Creek)				
Start of rainfall (upper catchment)	Lexton	3 - 6 hours	begin to rise from normal levels	1 day
Start of rainfall (upper catchment)	Lexton	6 - 12 hours	to peak	
Nowhere Creek, Glenpatrick, Eversley, Crowlands (Wimmera River and tributaries)				
Start of rainfall (upper catchment)	Eversley	3 - 10 hours	begin to rise from normal levels	1 day
Start of rainfall (upper catchment)	Eversley	8 - 12 hours	to peak	
Raglan (Fiery Creek)				
Start of rainfall (upper catchment)	Raglan	6 - 15 hours	begin to rise from normal levels	1 day
Start of rainfall (upper catchment)	Raglan	10 - 20 hours	to peak	

Appendix C1: Beaufort Flood Emergency Plan

Beaufort is located 45km west of Ballarat at the confluence of Ding Dong, Cemetery Creek (also known as Garibaldi Creek), Cumberland Creek and Yam Holes Creek. The combined catchment area of these waterways is approximately 49 km^2. Yam Holes Creek being the main waterway, a tributary of Mount Emu Creek.

Yam Holes Creek upstream of Beaufort has large areas available for floodplain storage which help to attenuate flood flows. Cemetery Creek has a significant recreational storage, Beaufort Reservoir. Beaufort Lake has a maximum storage volume of 297 ML (TMG 2004). During the 2010 and 2011 flood events Beaufort Lake spilled and contributed to flooding in Beaufort.


Yam Holes Creek
Albert St
Freight Rail
Ararat Rd
Burke St
Pratt St
Willoby St
Beggs St
High St
Neill St
Cummins St
Becker St
Sturt St
Stuart St
Hains St
Gregory St
Wills St
Beaufort
Hill St
Leichardt St
Callister St
Broadbent Ct
Olinda St
Western Hwy
Sub Transmission Line
Warburton
South St
Eyre St
Lawrence St
Cemetery Creek
Ding Dong Creek
Golf Course La
Butts Rd
Rifle
Garibaldi Creek
Beaufort Cemetery
Cumberland Creek
Bennett Rd
Skipton St
Lake Rd
Kilbeg
Ingram La
Beaufort Lake Caravan Park
Beaufort Lake

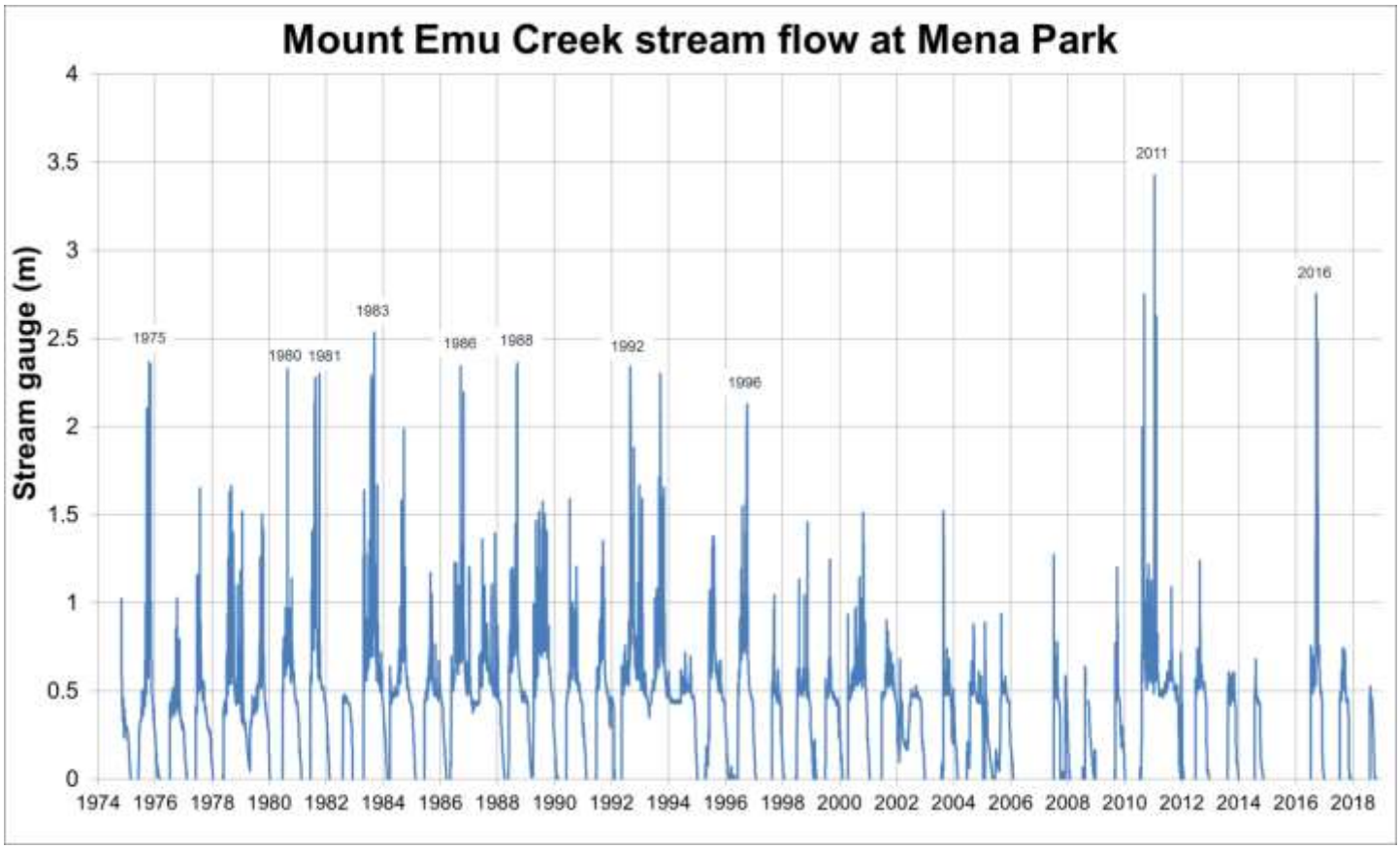
Historic Flood Events

Given there are no stream gauges available upstream of Beaufort, the Mena Park gauge located on the Mount Emu Creek, 22km downstream of Beaufort was used to estimate historic flood events that have occurred in Beaufort. Refer to the graph below.

Beaufort has experienced frequent and extensive flood events, refer to the graph below. Significant flood events have occurred in 1975, 1980, 1981, 1983, 1986, 1988, 1992, 1996, 2011 and 2016.

The January 2011 flood event was the largest recent flood event on record. Rainfall records indicate 96.8mm fell over a day, this was the highest rainfall recorded at Beaufort for 120 years. This flood event caused considerable damage to buildings, roads and bridges, including the Pyrenees Shire Offices (Lawrence Street), Beaufort Ambulance Station (Havelock Street) and the Hains Windscreen building (Neill Street). Over 70 properties were impacted by flooding, 39 buildings inundated over floor. The Beaufort Lake dam overtopped by around 300mm during the event which led to some concerns regarding possible failure. There was some damage to the dam wall which has since been repaired. Refer to the flood photos below.

For more details refer to the Beaufort Flood Intelligence Card below.



Flooding surrounding an Antiques Store in Neill Street, Beaufort during the 2011 flood event.

Flooding surrounding an Antiques Store in Neill Street, Beaufort during the 2011 flood event.

Flooding surrounding Beaufort Motors in Neill Street, Beaufort during the 2011 flood event.

Flooding along Neill Street (Western Highway), Beaufort during the 2011 flood event.

Flooding along Garibaldi Creek adjacent to Beggs Street, Beaufort during the 2011 flood event.

Flooding along Garibaldi Creek adjacent to Beggs Street, Beaufort during the 2011 flood event.

Beaufort Flood Behaviour

Areas of most significant flood depth are along Cemetery Creek downstream from Lake Beaufort, the northern part of the town (i.e. the area south or upstream of the railway line) between the Western Highway (Neil Street) and the railway lines in the Cemetery Creek and Cumberland Creek catchments and the downstream portion of Yam Holes Creek.

The Cemetery Creek catchment contributes most of the flows upstream of the railway line and also contributes the greatest potential damage to property, predominantly along its channel.

Ding Dong Creek, due to its relatively small catchment size, is mostly contained within its drainage channel and poses little threat to property.

Flows break out at the downstream end of Cumberland Creek. However, this is mostly due to the large backwater pool caused by flows down Cemetery Creek.

The constructed part of the Yam Holes Creek channel has insufficient capacity to convey 100 year flows and water breaks out upstream of the Beaufort-Amphitheatre Road. The large floodplain downstream of the town and adjacent to Yam Holes Creek becomes inundated from the 5 year flood event.

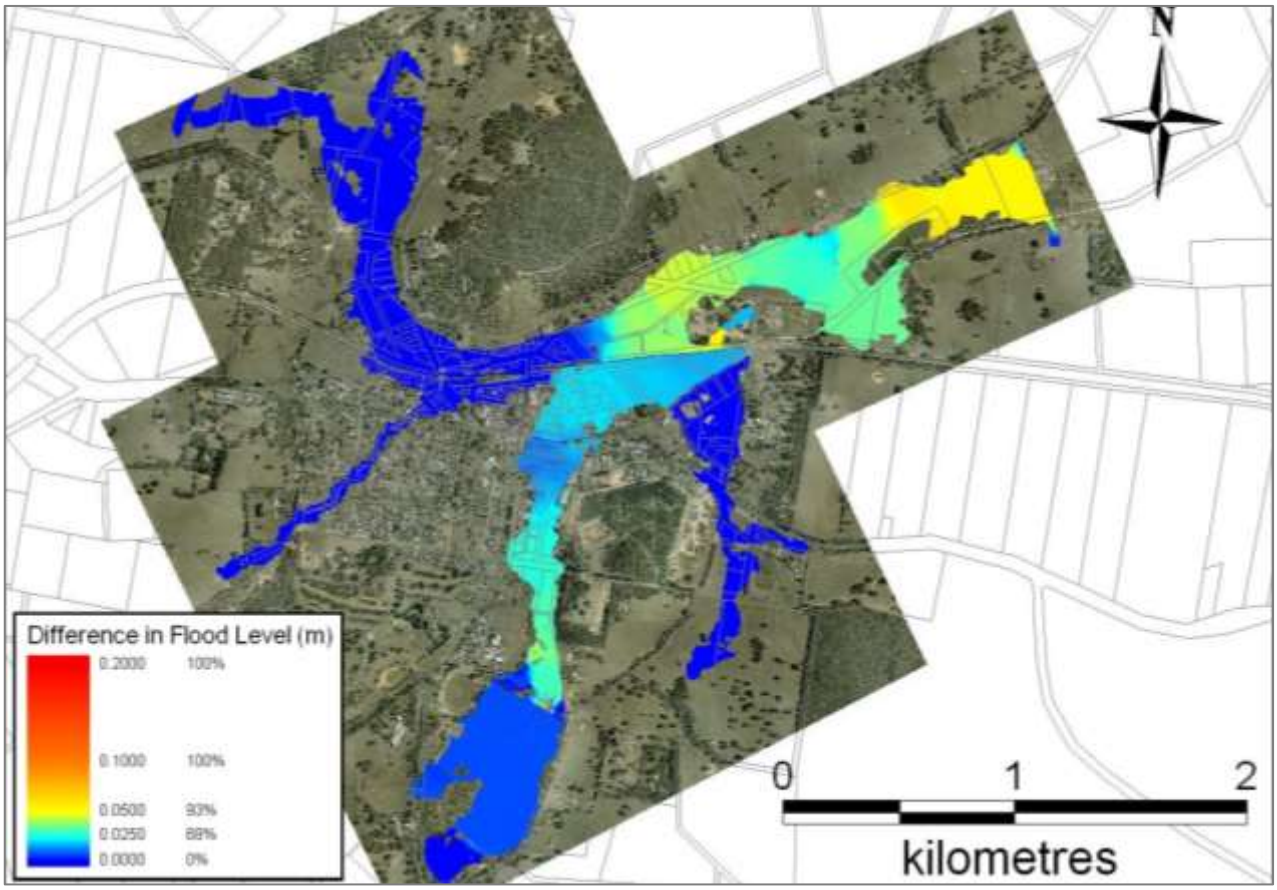
Influence of Lake Beaufort

During the 2010 and 2011 flood events Beaufort Lake spilled and contributed to flooding Beaufort. During a 5 year event flooding surrounding Lake Beaufort may start to impact the grounds of the Beaufort Lake Caravan Park. During a 100 year flood event the flood depth can increase to 0.45m depth, refer to the map below.

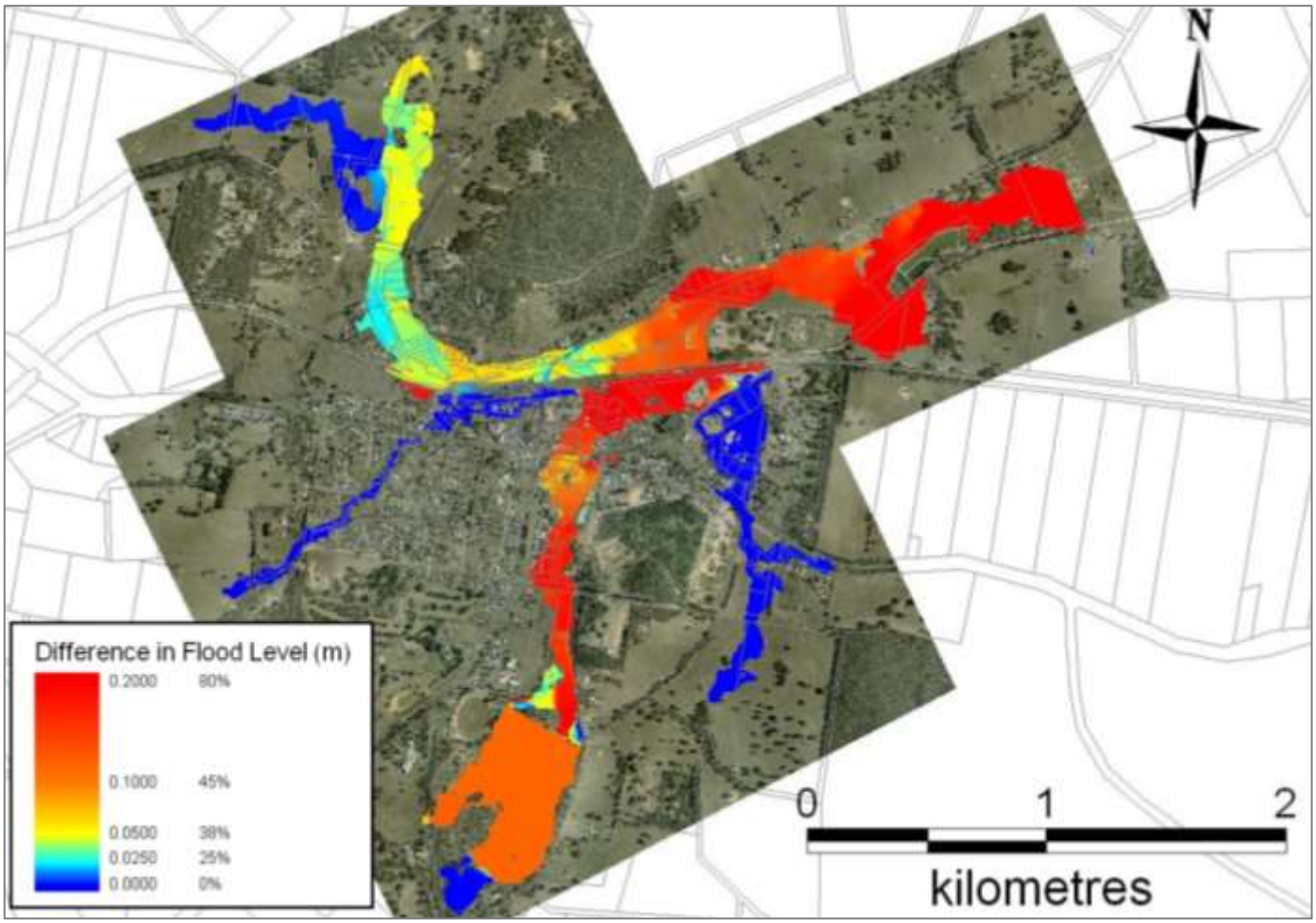
During the January 2011 flood event, some scour of the Lake wall raised concerns of council around potential failure. Repair works of the wall have been undertaken (Water Technology 2008).

Flooding surrounding Beaufort Lake during a 100 year flood event (Water Technology 2008).

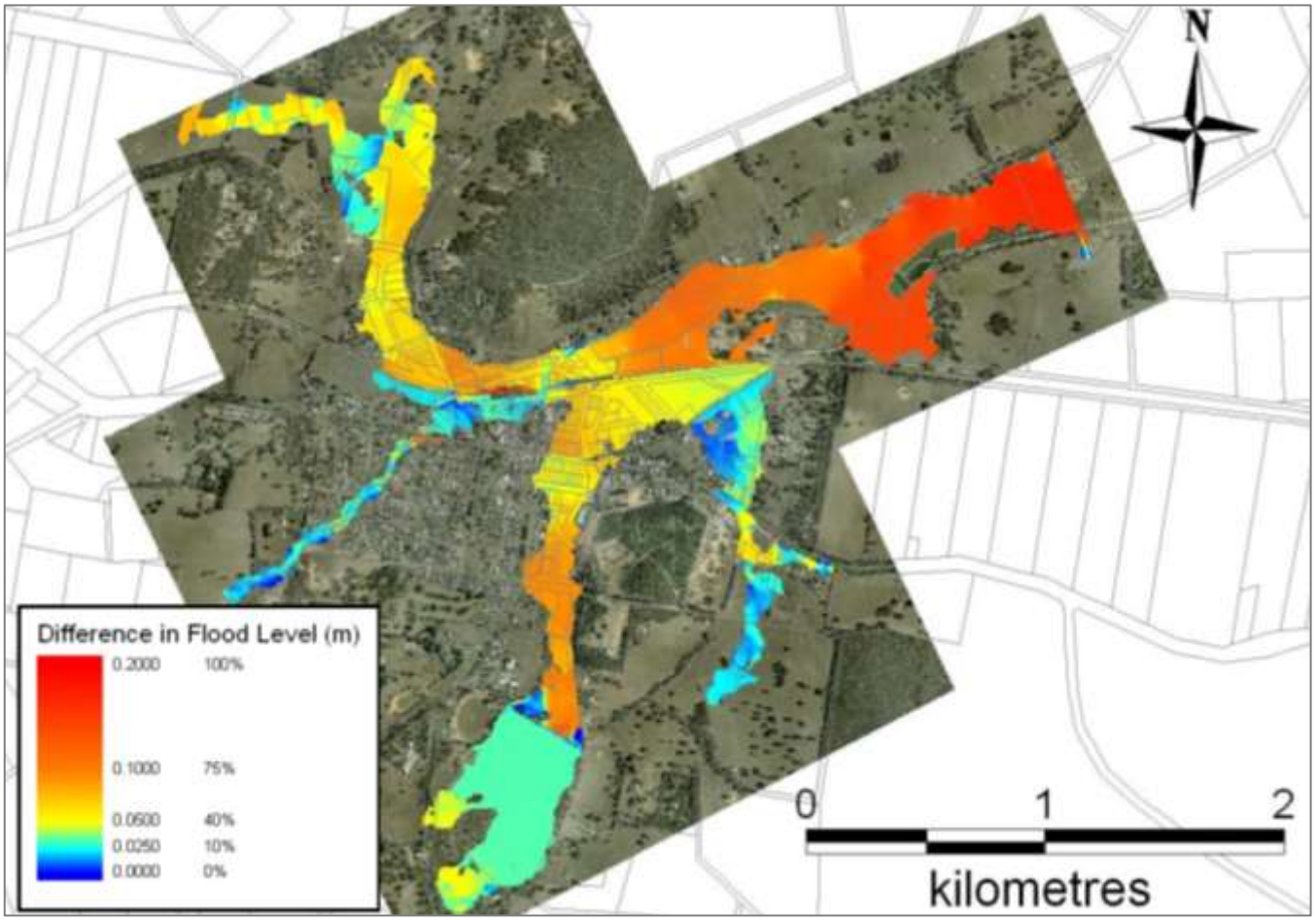
All Beaufort design flood mapping (Water Technology 2008) assumes that Lake Beaufort would be full at the beginning of a flood event. The results of sensitivity testing of the initial Beaufort Lake levels indicate the initial Lake levels have the greatest influence for smaller floods (i.e. 10 year flood) and have little effect on larger events (100 year flood events). For a 10 year flood event, if the initial water level of Lake Beaufort is reduced by 0.5m, this reduces 55% of the downstream flood extent by more than 100 mm. Flood inundation levels are significantly reduced along Cemetery Creek and Yam Holes Creek, including a minor change on Yam Holes Creek upstream of Cemetery Creek. Refer to the map below.



For a 100 year flood event, if the initial water level of Lake Beaufort is reduced by 0.5m, this reduces 93% of the downstream flood extent by less than 50mm. Flood inundation depths appear to have been slightly affected along Cemetery Creek and Yam Holes Creek downstream of Cemetery Creek. Refer to the map below.



Sensitivity testing was also carried out on the effect of a 20% increase in inflows for the whole catchment. This showed an increase in water depth by less than 100mm for 75% of the flood extent. The majority of the increases occur along the lower section of Yam Holes Creek, along with minor increases along the upper section of Yam Holes Creek and along Cemetery Creek. Refer to the map below.



Infrastructure that Impact Flooding

Culverts, drains and bridge structures capacity constraints have a significant influence on the depth and extent of flooding. There is a difference in water surface in the 100 year event of approximately 0.5m at the railway bridge on Cemetery Creek, and approximately 0.8m difference through the culverts on Cumberland Creek. Due to the small size of bridges and culverts, flooding can be exacerbated by blockages at bridges and from obstructions to overland flow. Close attention during a flood event needs to be paid to ensure that these culvers and bridges are not blocked by debris during a flood event. Consideration needs to be given to having machinery available to remove debris should the need arise, particularly following a prolonged dry period. Works within a waterway during a flood is a high risk activity and all due care needs to be taken to ensure it is conducted safely.

Stormwater Flooding Impacts

In addition to riverine flooding, heavy local rainfall may exceed the capacity of the pipes and drains that convey stormwater, causing overland flooding. While no stormwater flood modelling has been undertaken for Beaufort, there were a number of buildings were reported to be impacted by stormwater flooding during the January 2011 flood event. Buildings impacted by stormwater flooding includes the Beaufort Ambulance Station and council office buildings in Lawrence Street.

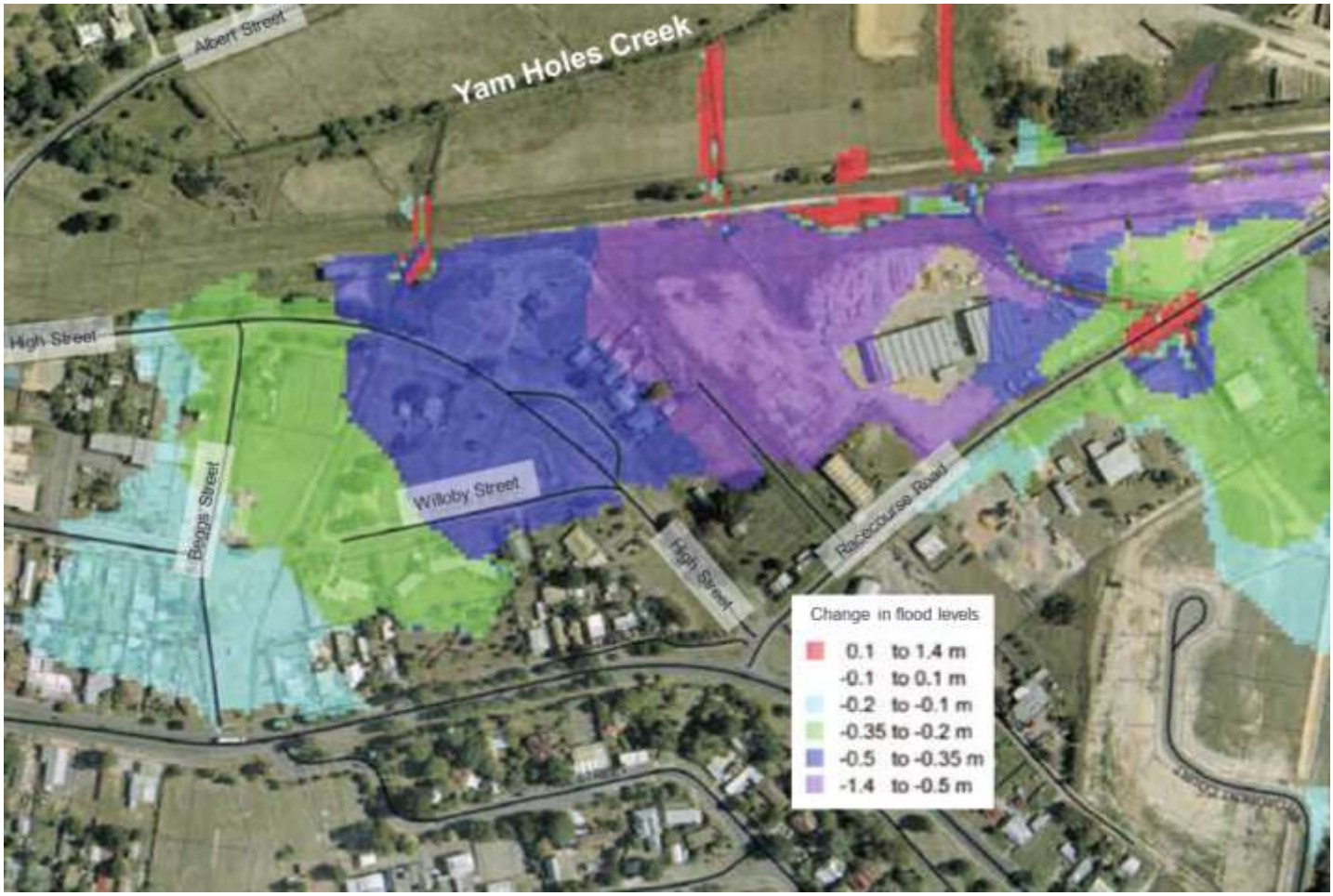
Beaufort Flood Mitigation Works

Since the January 2011 flood event the Pyrenees Shire Council have undertaken significant mitigation works to reduce riverine flood impacts in Beaufort. These works include increasing the capacity of culverts at four locations on the railway embankment where Cemetery Creek joins Yam Holes Creek, refer to the map below. These works were completed in 2013. Before and after photos below of one of the works locations are shown below. Design flood mapping has been updated to include these mitigation works for the 100 year design flood event.

Beaufort railway embankment drainage before the mitigation works (VicTrack).

Beaufort railway embankment drainage, expanded to a 25m section of nine culverts (VicTrack).

The implementation of these mitigation works, increasing the culvert capacity under the railway line significantly reduces the flood levels on the southern (upstream) side. For a 100 year event flood levels are reduced between 0.5m to 1.4m. Refer to the map below showing the changes to flood levels.



Changes to flood levels as a result of increasing the Railway culvert capacity (Pyrenees Shire Council).

Beaufort Flood Warning Time

Flooding in Beaufort can develop quickly form heavy localised rainfall, due to the steep topography and small size of the catchment upstream of Beaufort (49 km^2). Buildings in Beaufort may experience above floor flooding in a relatively short time after onset of rain, rapid rises in floodwater can occur within 3 to 6 hours after rainfall. The floodwater peak may occur 6 to 9 hours from rainfall.

Due to the short warning time available and if possible, it's important to door knock houses with high over floor flood risk when high rainfall events are predicted to lead to flooding. Refer to the Beaufort Flood Intelligence Card below for rainfall flood triggers.

Although the Mena Park stream gauge is downstream of Beaufort and doesn't provide flood warning it does provide a relative measure of the flood event magnitude.

Rainfall gauges that provide flood warning for Beaufort include the Beaufort rain gauge (daily rainfall gauge), Mena Park rain gauge (daily rainfall gauge) and the Beaufort Sheepwash gauge (pluviograph, indicates rainfall intensity) 7km south west of Beaufort.

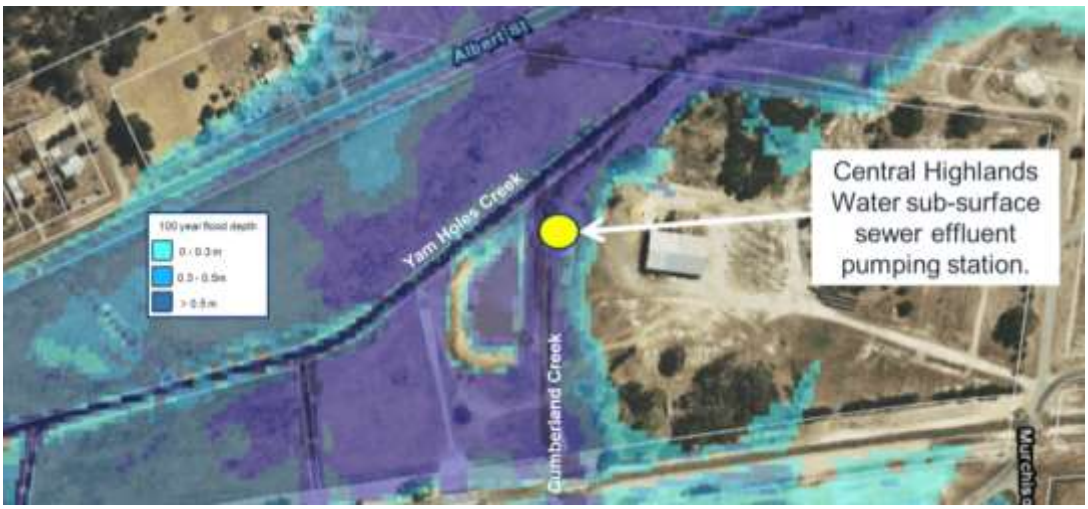
Roads and Buildings Isolated

Access is cut to a large number of buildings and roads to the north and south of Beaufort during a 5 year flood event. Areas particularly susceptible to flooding include areas along Cemetery Creek, downstream of Beaufort Lake and the northern section of Beaufort, between the Western Highway and the railway line. Refer to the Beaufort Flood Intelligence Card and flood impact maps below for locations impacted. Major isolation can occur on the closure of the Western Highway. This occurred during the January 2011 flood event, flooding overtopped the highway to a depth of over 300mm.

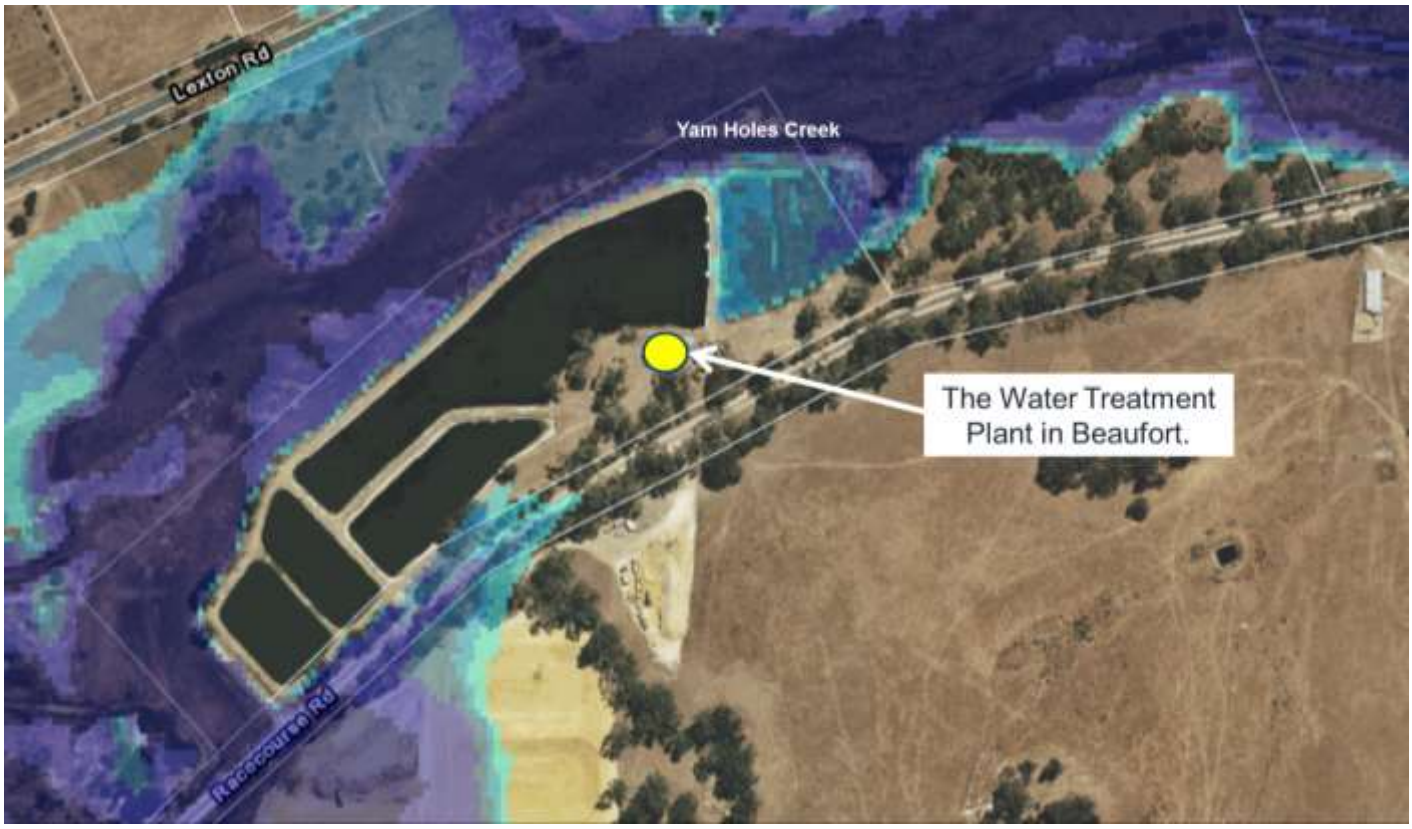
Beaufort Sewer Pumping Station

The Central Highlands Water sub-surface Sewer Pumping Station is located adjacent to Yam Holes Creek, refer to the map below. The Pumping Station may be impacted by flooding during a 5 year flood event. If the Sewer Pumping Station fails the system can still operate via gravity during a flood event. However a significant amount of sewerage is likely to discharge into Yam Holes Creek. Actions recommended to be undertaken to ensure the Sewer Pumping Station continues to operate during flood events (if it is safe to do so);

- Review any points that have potential to be compromised from the flooding predictions.
- Sandbag manholes and potential known points of infiltration to protect flooding the system if possible.
- Sandbag the Sewer Pumping Station site to protect the infiltration of water into the wet well /valve pit.
- Sand bag to protect the Sewer Pumping Station control cabinet.



The containment bunds associated with the Beaufort water treatment plant, located at 125 Racecourse Road provide protection from flood events to above a 100 year ARI. Refer to the map below.



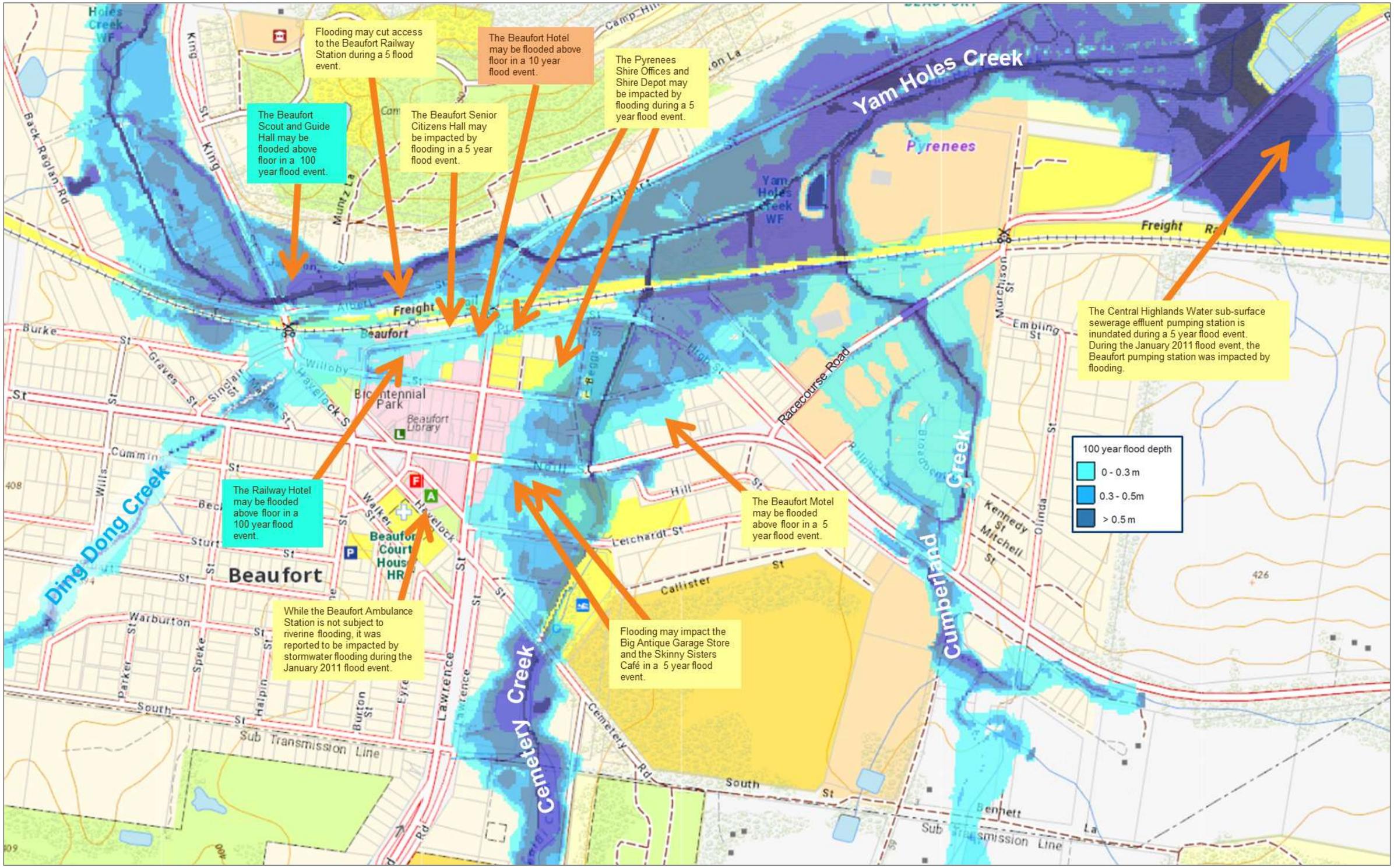
Flood Impacts and Actions Required

Key assets at risk of flooding in Beaufort are listed in the table below.

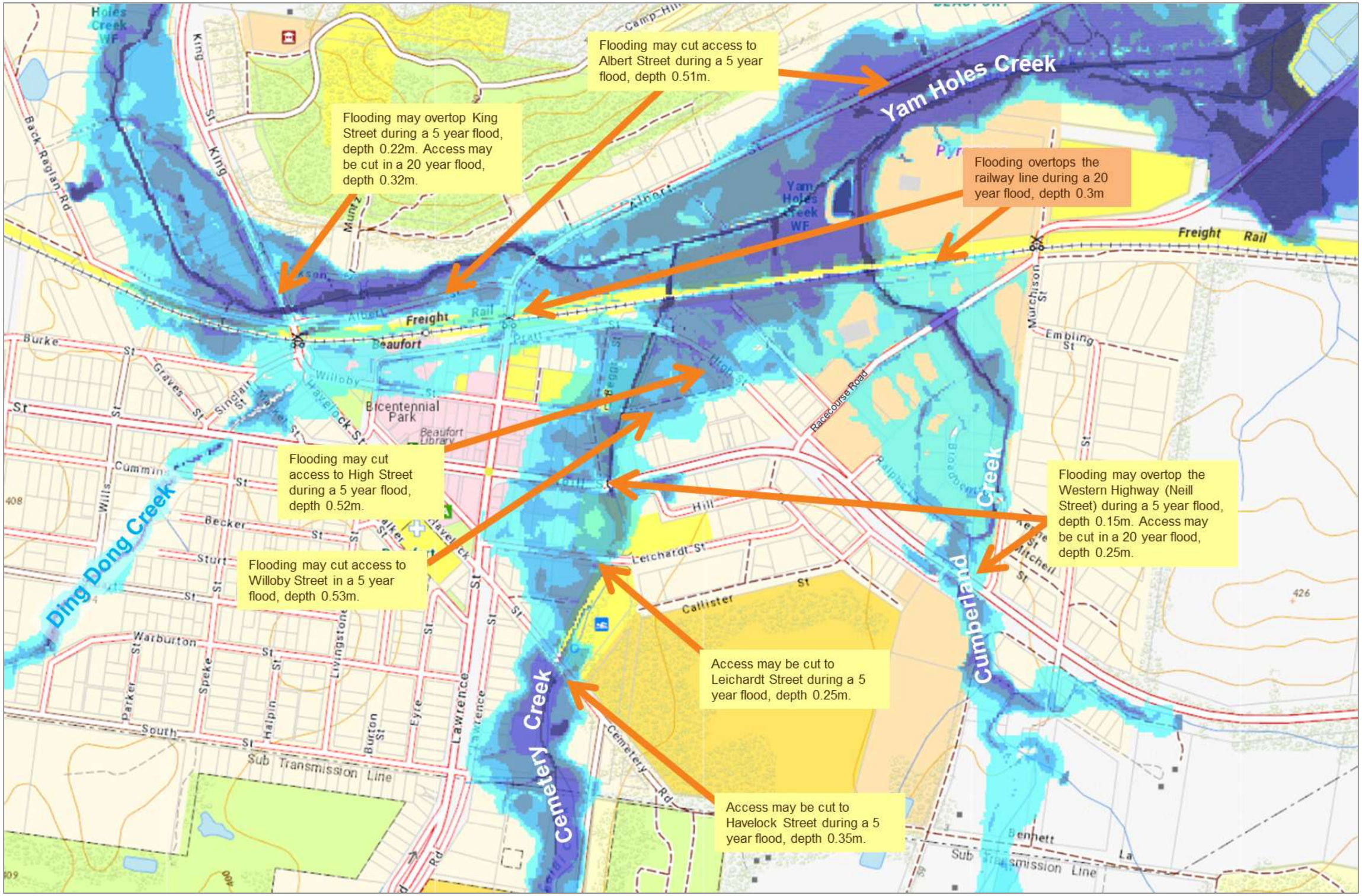
Asset register				
Asset Name and location	**Average Recurrence Interval (ARI)**	**Consequence / Impact**	**Mitigation/ Action**	**Lead Agency**
Beaufort Ambulance Station, 25 Havelock Street.	Stormwater flooding in January 2011	During the January 2011 flood event the Beaufort Ambulance Station was impacted by flooding.	Undertake evacuations as needed.	Victoria Police
21 buildings are flooded over floor, refer to intelligence card and damages map for locations.	5 year flood	21 buildings are flooded above floor adjacent to Yam Holes Creek, Garibaldi Creek (also known as Cemetery Creek) and Cumberland Creek.	Sandbag buildings and undertake evacuations as needed.	VICSES Victoria Police
The Beaufort Senior Citizens Hall, 27 Pratt Street, Beaufort.	5 year flood	The grounds of the Beaufort Senior Citizens Hall may be impacted by flooding during a 5 year flood event.	Undertake evacuations as needed.	Victoria Police
The Beaufort Railway Station, 28 Pratt Street, Beaufort.	5 year flood	Access to the Beaufort Railway Station may be impacted by flooding during a 5 year flood event.	Undertake evacuations as needed.	Victoria Police
The Pyrenees Shire Offices (5 Lawrence Street) and Shire Depot (corner of Willoby Street and Beggs Street), Beaufort.	5 year flood	The Pyrenees Shire Offices and Shire Depot Beaufort may be impacted by flooding during a 5 year flood event. Beggs Street access to the Shire Depot is also cut.	Undertake evacuations as needed.	Victoria Police
Beaufort Hotel, 12 Neill Street, Beaufort.	5 year flood	The Beaufort Hotel may be flooded above floor during a 5 year flood event.	Sandbag buildings and undertake evacuations as needed.	VICSES Victoria Police
The Central Highlands Water sub-surface sewer pumping station, adjacent to Yam Holes Creek (refer to the map above).	5 year flood	The Central Highlands Water sub-surface sewage effluent pumping station may start to be impacted during a 5 year flood event.	Undertake actions listed above to ensure it continues to operate.	Central Highlands Water
The Big Antique Garage Store and the Skinny Sisters Café, Neill Street, Beaufort.	5 year flood	The Big Antique Garage Store and the Skinny Sisters Café may be impacted by flooding during a 5 year flood event. Beggs Street access to the Shire Depot is also cut.	Undertake evacuations as needed.	Victoria Police
King Street, adjacent to Yam Holes Creek, Beaufort.	5 year flood	Flooding may overtop King Street in a 5 year flood event. Access may be cut in a 20 year flood event, depth 0.32m.	Deploy road closure signs as needed.	Council
Albert Street, adjacent to Yam Holes Creek, Beaufort.	5 year flood	Flooding may cut access to Albert Street in a 5 year flood event, depth 0.51m.	Deploy road closure signs as needed.	Council
Western Highway (Neill Street), adjacent to Yam Holes Creek and Cumberland Creek, Beaufort.	5 year flood	Flooding may overtop Western Highway (Neill Street) in a 5 year flood event, depth 0.15m. Access may be cut in a 20 year flood event, depth 0.25m.	Deploy road closure signs as needed and undertake traffic management.	Regional Roads Victoria
High Street, adjacent to Cemetery Creek, Beaufort.	5 year flood	Flooding may cut access to High Street in a 5 year flood event, depth 0.52m.	Deploy road closure signs as needed.	Council
Willoby Street, adjacent to Cemetery Creek, Beaufort.	5 year flood	Flooding may cut access to Willoby Street in a 5 year flood event, depth 0.53m.	Deploy road closure signs as needed.	Council
Leichardt Street, adjacent to Cemetery Creek, Beaufort.	5 year flood	Flooding may cut access to Leichardt Street in a 5 year flood event, depth 0.25m.	Deploy road closure signs as needed.	Council
Havelock Street, adjacent to Cemetery Creek, Beaufort.	5 year flood	Flooding may cut access to Leichardt Street in a 5 year flood event, depth 0.25m.	Deploy road closure signs as needed.	Council

Buildings are isolated in Neill, High, Willoby, Leichardt and Havelock Streets. Refer to flood extent maps below.	5 year flood	Access/egress to a large number of building may be cut during a 5 year flood event in Neill, High, Willoby, Leichardt and Havelock Streets.	Evacuate all buildings that have access cut.	Victoria Police
Beaufort Hotel, 23 Pratt Street, Beaufort.	10 year flood	The Beaufort Hotel may be flooded above floor during a 5 year flood event.	Sandbag building and undertake evacuations as needed.	VICSES Victoria Police
Beaufort Railway Line, adjacent to Lawrence Street, Beaufort.	20 year flood	Flooding may overtop Beaufort Railway Line in a 20 year flood event, depth 0.30m.	VLine suspend trains until flooding subsides.	Council
The Beaufort Scout and Guide Hall, 3 King Street, Beaufort.	100 year flood	The Beaufort Scout and Guide Hall may be flooded above floor during a 100 year flood event.	Undertake evacuations as needed.	Victoria Police
Railway Hotel, 35 Pratt Street, Beaufort.	100 year flood	The Railway Hotel may be flooded above floor during a 100 year flood event.	Sandbag building and undertake evacuations as needed.	VICSES Victoria Police

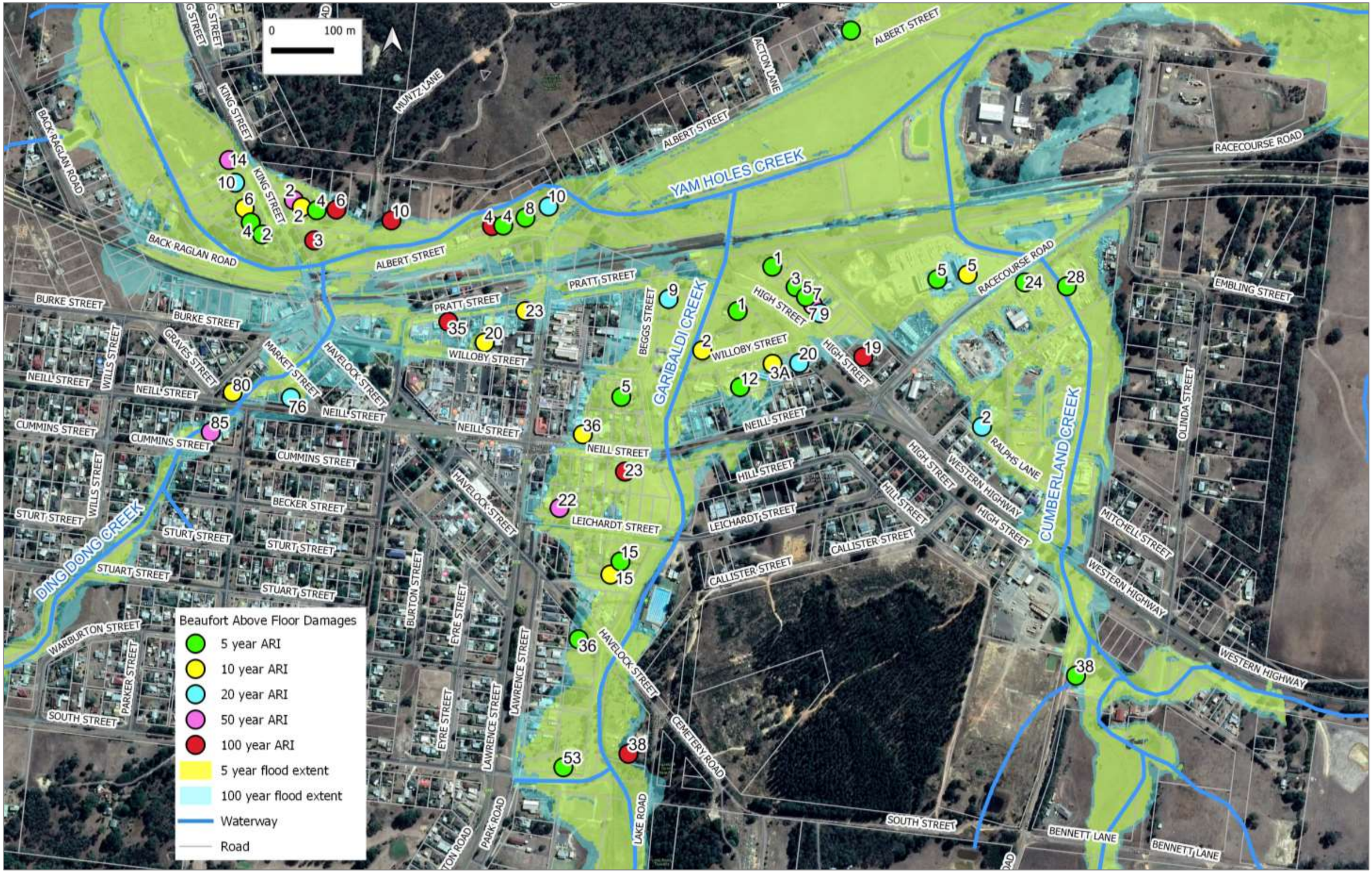
For more detailed information regarding buildings and roads impacted refer to the Beaufort Flood Intelligence Card and flood impact maps below. Also refer to the Beaufort flood depth maps in **Appendix F,** a list of flood observers in **Appendix H** and community sandbag collection point in **Appendix I.**



Beaufort assets impacted by flooding with the 100 year flood depth map (Water Technology 2008).



Beaufort roads impacted by flooding with the 100 year flood depth map (Water Technology 2008).



Beaufort above floor damages over a range of design flood events (Water Technology 2008).

Beaufort Flood Intelligence Card (Yam Holes Creek)

Flood travel time	Time between rainfall and steep rise in flood levels 3 - 6 hours Time between rainfall to flood peak 6 - 9 hours Riverine flooding duration: 20 hours

Observed rainfall (mm) Water Tech 2017	Mount Emu Creek, Mena Park gauge height 236213 (m)	Mount Emu Creek at Mena Park Design Flows (ML/d) Water Tech 2008	Average Recurrence Interval (ARI)	Yam Holes Creek at Beaufort Design Flows (ML/d)	Inverleigh damages total number properties flooded (above floor)	Consequence / Impact	Houses/ buildings flooded / isolated	Roads Impacted	Action
~21 mm in 1 hour to ~50 mm in 12 hours		2,938	5	4,864	181 (21)	Central Highlands Water Sewer Pumping Station may start to be impacted. Properties to the north and south become isolated. Shire Offices in Lawrence Street is impacted. 21 buildings flooded above floor including the Beaufort Motel (12 Neill Street). The grounds of the Beaufort Lake Caravan Park may start to be impacted by flooding. Flooding may cut access to High Street, Albert Street, Leichardt Street, Willoby Street and Havelock Street.	21 buildings may by flooded above floor: x3 Racecourse Rd (5, 24, 28), x2 Albert St (4, 8), x2 Neill St (12, 27), Beaufort-Lexton Rd, 36 Havelock St, 53 Lawrence St, 4 Jackson St, 5 Willoby St, 15 Leichardt St, 38 Olinda St, 1 Pratt St, x2 King St (2, 4), x3 High St (1, 3, 5).	Racecourse Road depth 0m High Street depth 0.52m Albert Road depth 0.53m Leichardt Street depth 0.25m King Street depth 0.22m Neil Street (Western Highway) depth 0.15m Willoby Street 0.53m Havelock Street depth 0.35m Railway line depth 0m	VICSES sandbag buildings as needed. Access is cut to a significant number of buildings, Victoria Police evacuate buildings as needed. Clear debris from waterway crossings, drains and culverts as needed. Council deploy road closure signs and undertake traffic management as needed.
60-75 mm over several days			1983	4,924					
	2.799	3,080	September 2010						
	2.989	3,740	September 2016						
~26 mm in 1 hour to ~59 mm in 12 hours	3.089	4,234	10	5,875	197 (32)	Additional 11 buildings flooded above floor including the Beaufort Hotel (23 Pratt St) and the Hains Windscreens (36 Neill Street). Beaufort Reservoir levels impact flooding for smaller events, ie 10 year events, not 100 year events. If initial water level is reduced by 0.5m this reduced 55% of flood extent by more than 100mm. Flooding may cut access to King Street.	11 additional buildings may by flooded above floor: x3 Willoby St (2, 3A, 20), 23 Pratt St, x2 Neill St (36, 80), 6 King St, 15 Leichardt St, 2 Jackson St, 5 Racecourse Rd.	Racecourse Road depth 0.05m High Street depth 0.58m Albert Road depth 0.64m Leichardt Street depth 0.32m King Street depth 0.25m Neil Street (Western Highway) depth 0.18m Willoby Street 0.57m Havelock Street depth 0.38m Railway line depth 0m	
~31 mm in 1 hour to ~68 mm in 12 hours	3.299	5,530	20	7,353	209 (39)	Additional 7 buildings flooded above floor. Flooding overtops the Beaufort Railway Line to a depth of 0.30m, trains should be stopped. Flooding may cut access to Neill Street (Western Highway).	x7 additional buildings may by flooded above floor: x2 High St (9, 20), 10 Albert St, 9 Pratt St, 76 Neill St, 10 King St, 2 Ralphs Ln.	Racecourse Road depth 0.1m High Street depth 0.64m Albert Road depth 0.76m Leichardt Street depth 0.41m King Street depth 0.32m Neil Street (Western Highway) depth 0.25m Willoby Street 0.64m Havelock Street depth 0.42m Railway line depth 0.32m	suspend VLine trains until flooding subsides. Regional Roads Victoria to deploy road closure signs and undertake traffic management for the Western Highway.
~38 mm in 1 hour to ~80 mm in 12 hours	3.479	7,258	50	9,012	211 (44)	Additional 5 buildings flooded above floor.	5 additional buildings may be flooded above floor: 14 King St, 2 Jackson St, 7 High St, 22 Leichardt St, 85 Neill St.	Racecourse Road depth 0.15m High Street depth 0.69m Albert Road depth 0.77m Leichardt Street depth 0.57m King Street depth 0.5m Neil Street (Western Highway) depth 0.30m Willoby Street 0.68m Havelock Street depth 0.47m Railway line depth 0.68m	Refer to actions listed above.
96.8mm over a day			January 2011			The Western Highway was overtopped by 300mm, cutting access and isolating the north of Beaufort from the south. Over 70 properties were impacted by flooding, 39 buildings flooded over floor.	Buildings impacted by flooding: Pyrenees Council Offices (5 Lawrence Street), Beaufort Ambulance Station (Havelock Street), Antique Big Garage (Neill Street), Hains Windscreens (Neill Street).		

~71.6 mm in 6 hours to ~90 mm in 12 hours	3.569	8,381	100	10,653	214 (52)	8 buildings flooded above floor including the Beaufort Scout and Girl Guide Hall (3 King Street) and the Railway Hotel (35 Pratt Street). Flooding may cut access to Racecourse Road.	8 additional buildings may by flooded above floor: x2 Jackson St (6, 10), 19 High St, 23 Neill St, 4 Albert St, 38 Havelock St, 35 Pratt St, King St.	Racecourse Road depth 0.24m High Street depth 0.75m Albert Road depth 1.15m Leichardt Street depth 0.68m King Street depth 1.15m Neill Street depth 0.38m Willoby Street depth 0.72m Havelock Street depth 0.53m Railway line depth 1.06m	Refer to actions listed above.
			Probable Maximum Flood		261 (211)				Refer to actions listed above.

Beaufort Property Inundation Table (Water Technology 2008)

No	Address	Depth of building over floor flooding for each ARI event (m)					Building type
		5	10	20	50	100	
1	1 High St	0.8	0.97	1.11	1.17	1.22	Detached house
2	3 High St	0.62	0.78	0.92	0.98	1.03	Detached house
3	24 Racecourse Rd	0.56	0.6	0.63	0.66	0.68	Factory / warehouse
4	4 Albert St	0.39	0.44	0.5	0.56	0.63	Detached house
5	12 Neill St	0.26	0.42	0.55	0.61	0.67	Beaufort Motel – No 1
6	Beaufort-Lexton Rd	0.24	0.32	0.44	0.54	0.66	Detached house
7	36 Havelock St	0.24	0.29	0.35	0.42	0.49	Detached house
8	53 Lawrence St	0.2	0.27	0.35	0.43	0.52	Detached house
9	4 Jackson St	0.19	0.28	0.38	0.47	0.57	Detached house
10	12 Neill St	0.17	0.29	0.43	0.49	0.54	Beaufort Motel – No 2
11	8 Albert St	0.17	0.21	0.27	0.32	0.38	Detached house
12	28 Racecourse Rd	0.17	0.21	0.24	0.27	0.3	Store
13	5 Willoby St	0.15	0.22	0.32	0.39	0.46	Detached house
14	15 Leichardt St	0.13	0.17	0.22	0.27	0.34	Detached house – No 2
15	38 Olinda St	0.11	0.18	0.26	0.33	0.39	Rural residential with house
16	27 Neill St	0.1	0.12	0.15	0.19	0.23	Café Car Park (no building)
17	5 Racecourse Rd	0.08	0.25	0.39	0.44	0.49	Processing plant – No 1
18	1 Pratt St	0.08	0.25	0.38	0.44	0.5	Detached house
19	4 King St	0.05	0.08	0.13	0.18	0.24	Detached house
20	5 High St	0.04	0.21	0.34	0.41	0.45	Detached house
21	2 King St	0.03	0.07	0.12	0.17	0.23	Detached house
22	2 Jackson St		0.42	0.52	0.59	0.67	Detached house – No 2
23	5 Racecourse Rd		0.26	0.39	0.45	0.49	Processing plant – No 2
24	2 Willoby St		0.13	0.26	0.33	0.38	Detached house
25	Willoby St		0.07	0.2	0.26	0.32	Unspecified – transportation
26	23 Pratt St		0.07	0.09	0.12	0.14	Beaufort Hotel
27	3A Willoby St		0.05	0.18	0.24	0.3	Detached house
28	20 Willoby St		0.04	0.07	0.09	0.11	Detached house
29	80 Neill St		0.02	0.08	0.12	0.16	Unused Service station
30	36 Neill St		0.01	0.07	0.13	0.2	Hains Windscreens
31	6 King St		0.01	0.06	0.11	0.17	Detached house
32	15 Leichardt St		0.01	0.05	0.09	0.13	Detached house – No 1
33	9 Pratt St			0.13	0.19	0.25	Detached house
34	9 High St			0.1	0.17	0.21	Detached house
35	20 High St			0.05	0.11	0.16	Detached house
36	10 Albert St			0.05	0.09	0.14	Detached house
37	76 Neill St			0.05	0.08	0.11	Detached house
38	10 King St			0.01	0.06	0.11	Detached house
39	2 Ralphs Ln			0.01	0.02	0.03	Stop and dwelling – No 2
40	14 King St				0.04	0.09	Detached house
41	2 Jackson St				0.03	0.13	Detached house – No 1
42	7 High St				0.03	0.08	Detached house

No	Address	Depth of building over floor flooding for each ARI event (m)					Building type
		5	10	20	50	100	
43	22 Leichardt St				0.02	0.07	Detached house
44	85 Neill St				0.01	0.07	Detached house
45	3 King St					0.1	Beaufort Scout and Guide Hall
46	10 Jackson St					0.07	Detached house
47	6 Jackson St					0.06	Detached house
48	19 High St					0.05	Rural residential with house
49	23 Neill St					0.04	Unused Service station
50	4 Albert St					0.02	Detached house
51	38 Havelock St					0.01	Detached house
52	35 Pratt St					0.01	Railway Hotel

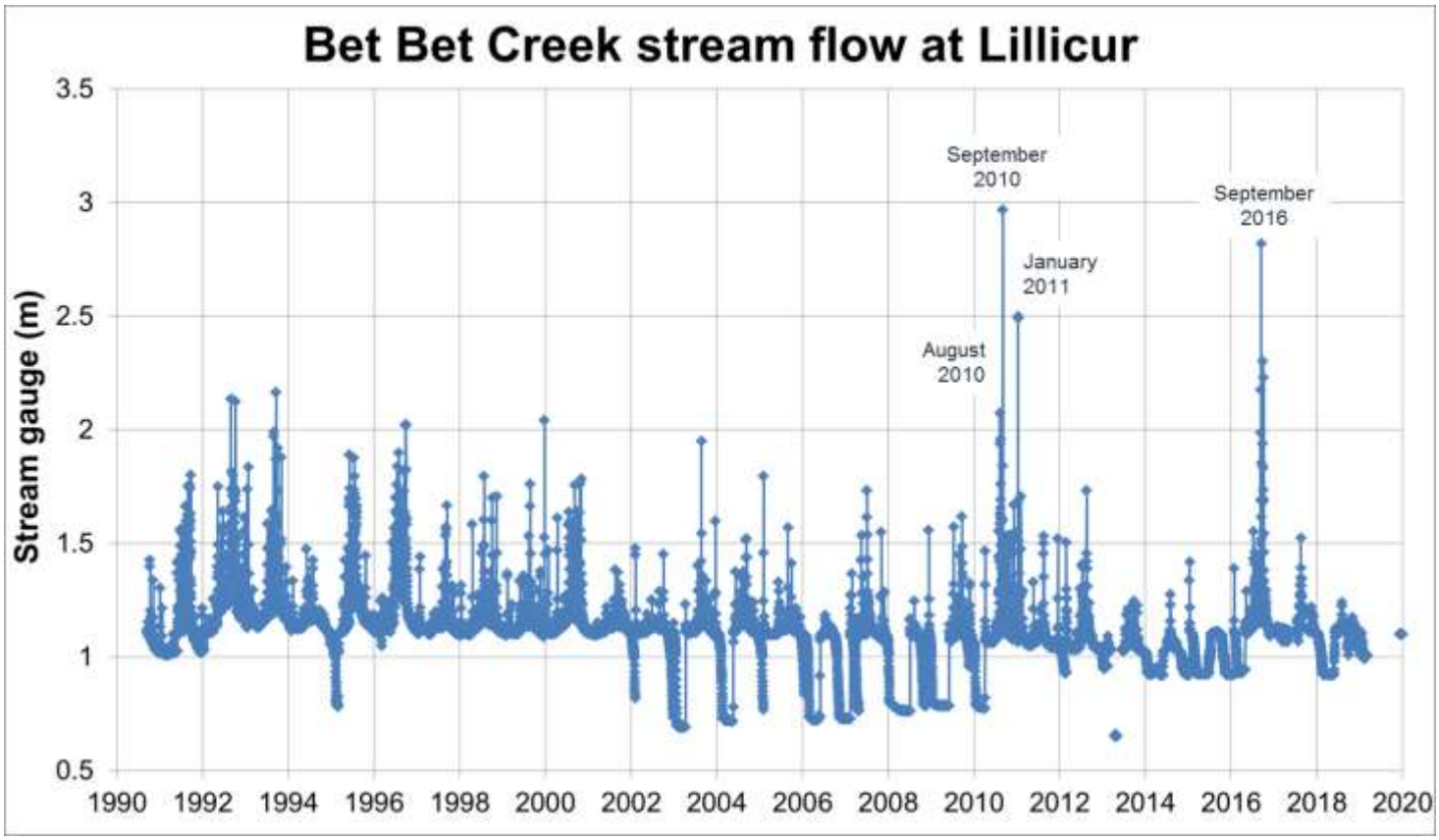
Appendix C2: Lexton Flood Emergency Plan

Lexton has experienced frequent riverine flooding from the Burnbank Creek. The upper reach of Burnbank Creek is located to the south of Lexton. Creek has a very small catchment area upstream of Lexton, approximately 45 km^2. Burnbank Creek flows from the south of Lexton, during flood events it receives significant inflows from upstream tributaries of Burnbank Creek.

Historic Flood Events

Given there are no stream gauges upstream of Lexton a stream gauge at Lillicur along the Bet Bet Creek, 10 km downstream of Lexton was used to infer historic flood events that have occurred in Lexton. Burnbank Creek is a tributary of Bet Bet Creek.

The graph below indicates that Lexton has been subject to irregular riverine flood events, significant recently flood events have occurred in August 2010, September 2010, January 2011 and September 2016.



The September 2010 flood event was the largest recent flood event. Rainfall records indicate 74 mm fell over three days. Although the rainfall within the catchment wasn't significant the condition of the catchment was very wet due to flooding occurring one month prior to this event. This flood event caused considerable damages to roads and bridges. Refer to the flood photos below.

Flooding along Burnbank Creek adjacent to Anderson Street, Lexton during the 2016 flood event (Utilis 2018).

Flooding along Burnbank Creek on the corner of the Sunraysia Highway and Williamson Street (looking south), Lexton during the 2016 flood event (Utilis 2018).

Flooding along Burnbank Creek on the corner of the Sunraysia Highway and Williamson Street (looking east), Lexton during the 2016 flood event (Utilis 2018).

Lexton Flood Behaviour

During flood events Burnbank Creek splits Lexton in half, cutting access between the east and west of Lexton. A number of smaller tributaries have the potential to further split Lexton into segments.

The limited drainage infrastructure within Lexton has a significant influence on the depth and extent of flooding. A number of major and minor roads that traverse the floodplain act as levees and block the passage of floodwater and exacerbate flooding. The Sunraysia Highway is the most significant and sits on a raised embankment approximately 0.5m high.

Close attention during flood events needs to be paid to ensure that the drains and bridges are not blocked by debris during a flood event. Consideration needs to be given to having machinery available to remove debris should the need arise, particularly following a prolonged dry period.

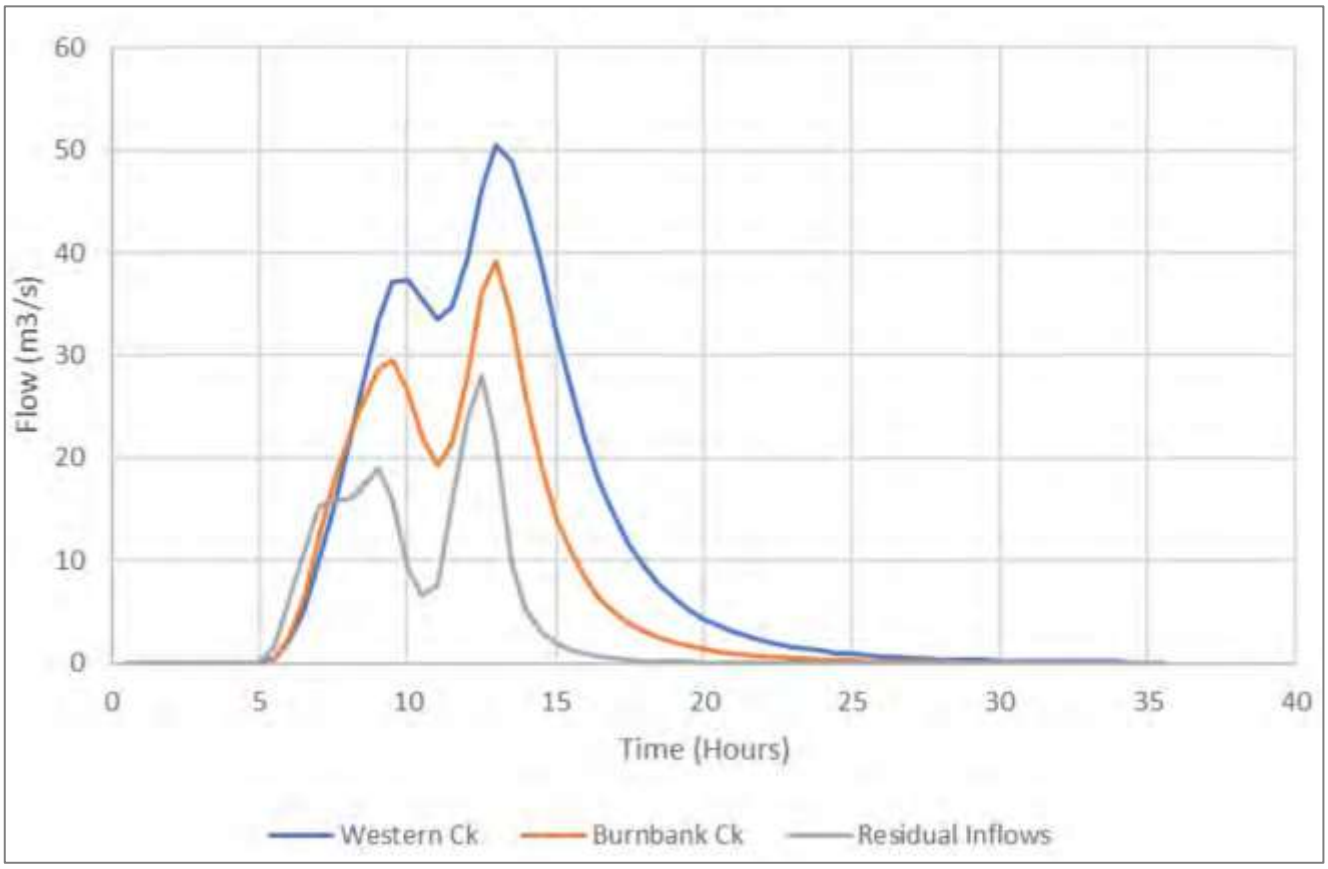
There is limited stormwater infrastructure within Lexton, roads are drained using table drains. Local heavy rainfall is likely to exacerbate riverine flooding.

The Preliminary Lexton Flood Study (Utilis 2018) indicates that 12 buildings may be at risk of over floor flooding during a 100 year flood event. During smaller flood events it's expected that no buildings are likely to be subject to over floor flooding.

Warning Time

There are no stream gauges that provide floor warning for Lexton. Flooding can develop quickly in Lexton from heavy rainfall in the upper Burnbank Creek Catchment. Rapid rises in floodwater within Lexton can occur within 3-6 hours from rainfall. The time between heavy rainfall in the upper catchment and the flood peak at Lexton may be between 6 to 12 hours. Refer to the graph below.

It is important to note that all floods are different, and different rainfall patterns falling on dry or wet catchments may respond differently. The streamflow and travel time numbers below should be used as a guide only.



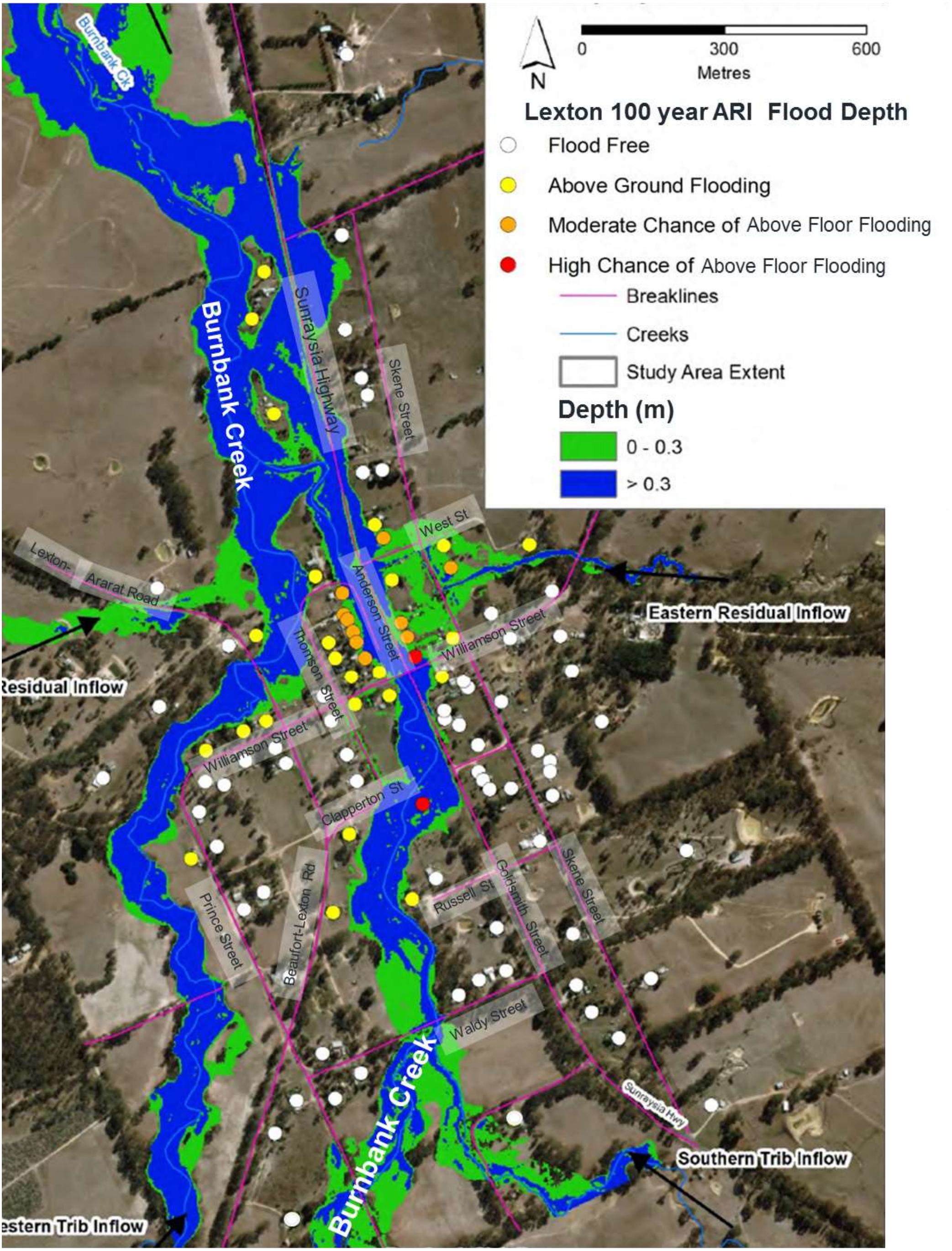
Peak flows in the Burnbank Creek and tributaries during a 100 year design flood event (Utilis 2018).

Lexton Flood Impacts and Required Actions

Flood mapping from the Lexton Preliminary Flood Study (Utilis 2018) was used to asses flood impacts to buildings and roads. Only the 100 year ARI flood mapping was completed as part of this study. Given no floor level survey was undertaken, buildings at risk of flooding were estimated using the flood mapping developed as part of the Lexton Preliminary Flood Study (Utilis 2018). It's important to note the information used to develop flood risk estimates below has a low level of accuracy and should be used as a guide only. This information should be used in conjunction with local knowledge. Key assets that may be at risk of flooding in Lexton are listed in the table below.

Asset register				
Asset Name and location	**Average Recurrence Interval (ARI)**	**Consequence / Impact**	**Mitigation/ Action**	**Lead Agency**
2 buildings may be impacted by flooding, Refer to the intelligence card and asset impact map below.	100 year flood	2 buildings may be impacted by flooding from adjacent Burnbank Creek its tributaries.	Undertake evacuations as needed.	Victoria Police
Sunraysia Highway (Goldsmith Road), Lexton	100 year flood	Access may be cut by flooding to the Sunraysia Highway (Goldsmith Road) during a 100 year flood event.	Deploy road closure signs as needed	Regional Roads Victoria
Lexton-Ararat Road, Lexton	100 year flood	Access may be cut by flooding to the Lexton-Ararat Road during a 100 year flood event.	Deploy road closure signs as needed	Council

For more detailed information regarding buildings and roads impacted refer to the Lexton Flood Intelligence Card and flood damages/impact map below.



Lexton buildings and roads that may be impacted by flooding (Utilis 2018).

Lexton Flood Intelligence Card

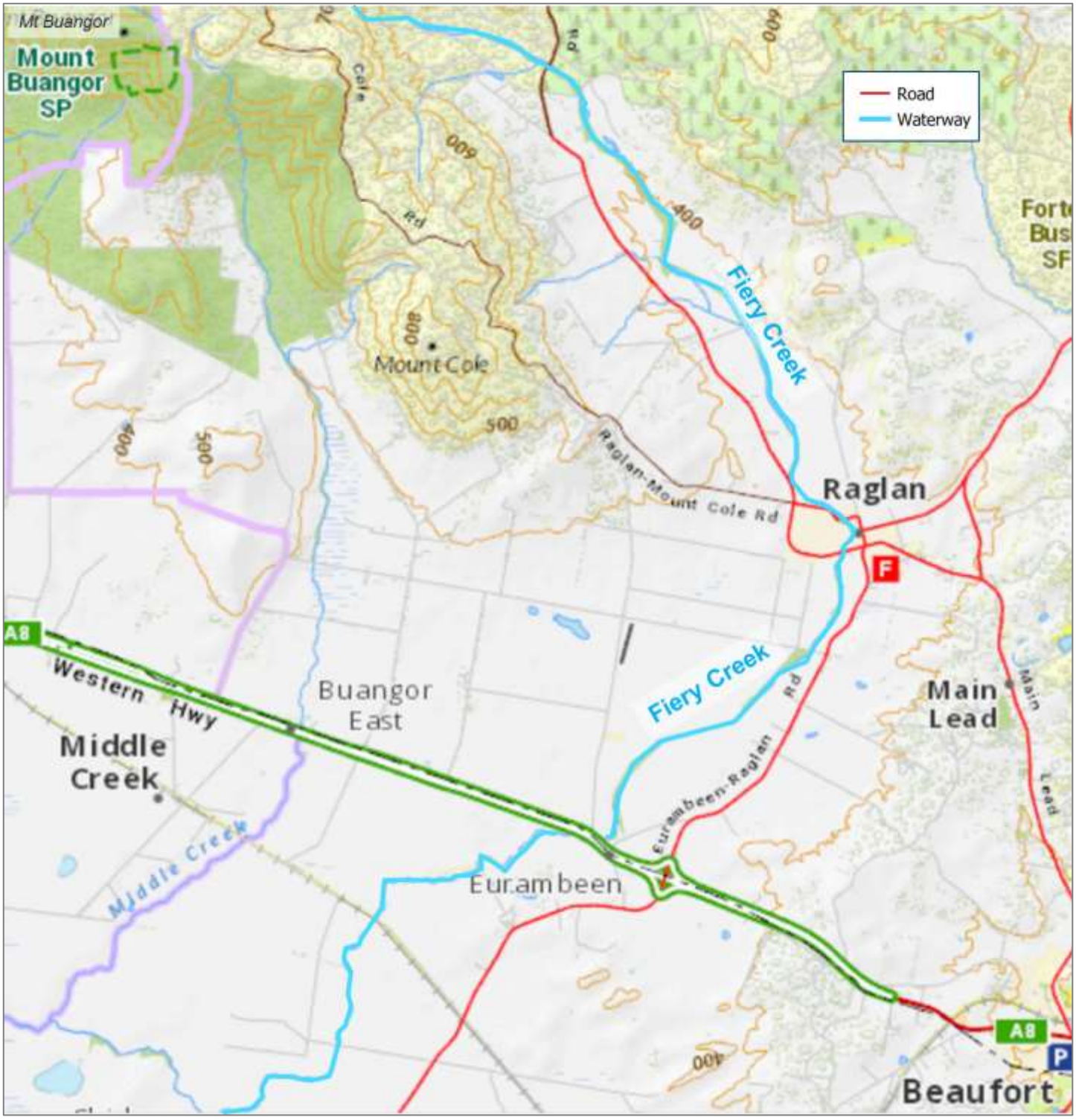
Flood travel time	Time from start of rain to steep rise in floodwater 3- 6 hours Time from start of rain to Lexton peak 6 - 12 hours Riverine flooding duration: 1 day

Rainfall Intensity Triggers	Average Recurrence Interval (ARI)	^Lexton estimated damages (Utilis 2018)	Lexton Flows (ML/d) (Utilis 2018)	Consequence / Impact	Houses/ buildings flooded / isolated	Roads Impacted	Action
~21 mm in 1 hour to ~50 mm in 12 hours	5						VICSES activate ground observers to take photos and record flood levels at key crossings. Council clear debris from waterway crossings, drains and culvers as needed.
~25 mm in 1 hour to ~59 mm in 12 hours	10						Refer to actions listed above.
~30 mm in 1 hour to ~69 mm in 12 hours	20						Refer to actions listed above.
~37 mm in 1 hour to ~82 mm in 12 hours	50						Refer to actions listed above.
~43 mm in 1 hour to ~93 mm in 12 hours	100	38 (2)	8,881	2 buildings may be impacted by over floor flooding. Access to main and minor roads may be cut, these roads include the Sunraysia Highway, Lexton-Ararat Road and the Lexton-Talbot Road.	2 buildings may be impacted by over floor flooding; 3550 Sunraysia Highway/Goldsmith Street and, 3521 Sunraysia Highway/Goldsmith Street. In addition to the buildings listed above, building that may be isolated: 3607 Goldsmith Street.	Access may be cut to; Sunraysia Highway (Goldsmith Street), Lexton-Ararat Road, Lexton-Talbot Road, Skene Street, Thompson Street, William Street, Anderson Street,	VICSES sandbag as needed. Victoria Police evacuate buildings as needed. Council and Regional Roads Victoria to deploy road closure signs as needed.
74 mm over 3 days	September 2010			This flood event caused significant damage to buildings, roads and bridges. Due to the catchment being very wet as a result of flooding in August, this is the largest recent flood event that has impacted Lexton.			
76 mm over 3 days	September 2016						
223 mm over 5 days	January 2011						

^Damages have been estimated using flood mapping from the Lexton Preliminary Flood Study (Utilis 2018).

Appendix C3: Raglan Flood Emergency Plan

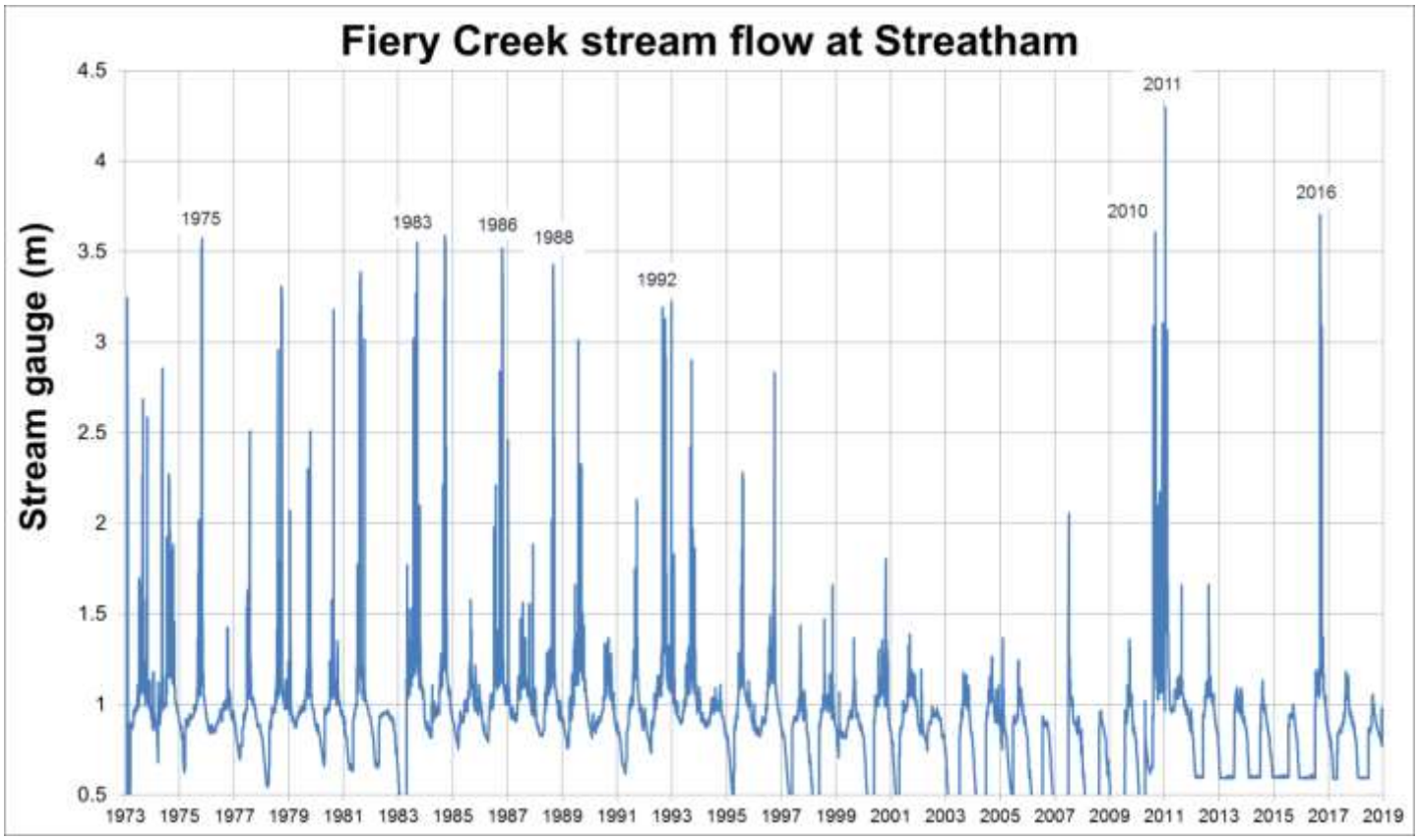
Raglan is located in the upper reach of the Fiery Creek Catchment and has experienced frequent riverine flooding. Fiery Creek drains the southern section of the Mount Buangor State Park and Mount Cole, it has a very small catchment area upstream of Raglan, approximately 64 km^2. Refer to the map below. Fiery Creek flows south from Raglan through to Streatham and eventually joins the Hopkins River.



Historic Flood Events

Given there are no stream gauges upstream of Raglan a stream gauge at Streatham along the Fiery Creek, 56km downstream of Raglan was used to infer historic flood events that have occurred in Raglan.

The graph below indicates that Raglan has been subject to extensive and frequent riverine flood events. Significant recently flood events have occurred in 1973, 1975, 1978, 1981, 1983, 1984, 1986, 1988, 1992, 1996, 2010, 2011 and 2016.



The January 2011 flood event was the largest recent flood event. Rainfall records indicate 220 mm fell over three days. In addition to the significant rainfall a factor that contributed to magnitude of this flood event was the very wet condition of the catchment prior to this flood event, there was a sequence of flood event that occurred prior to this event. This flood event caused considerable damages to buildings, roads and bridges. Refer to the flood photos below.

Flooding across the Fiery Creek Bridge, Raglan during the January 2011 flood event (source: Lorraine Thomson).

Flooding from Fiery Creek, Raglan during the January 2011 flood event (source: Lorraine Thomson).

Raglan Flood Behaviour

During flood events Fiery Creek splits Raglan in half, cutting access between the east and west of Raglan.

There is limited drainage infrastructure within Raglan. A number of major and minor roads that traverse the floodplain act as levees and block the passage of floodwater and exacerbate flooding. The Raglan-Elmhurst Road is the most significant and sits on a raised embankment approximately 0.3m high.

Close attention during flood events needs to be paid to ensure that the drains and bridges are not blocked by debris during a flood event. Consideration needs to be given to having machinery available to remove debris should the need arise, particularly following a prolonged dry period.

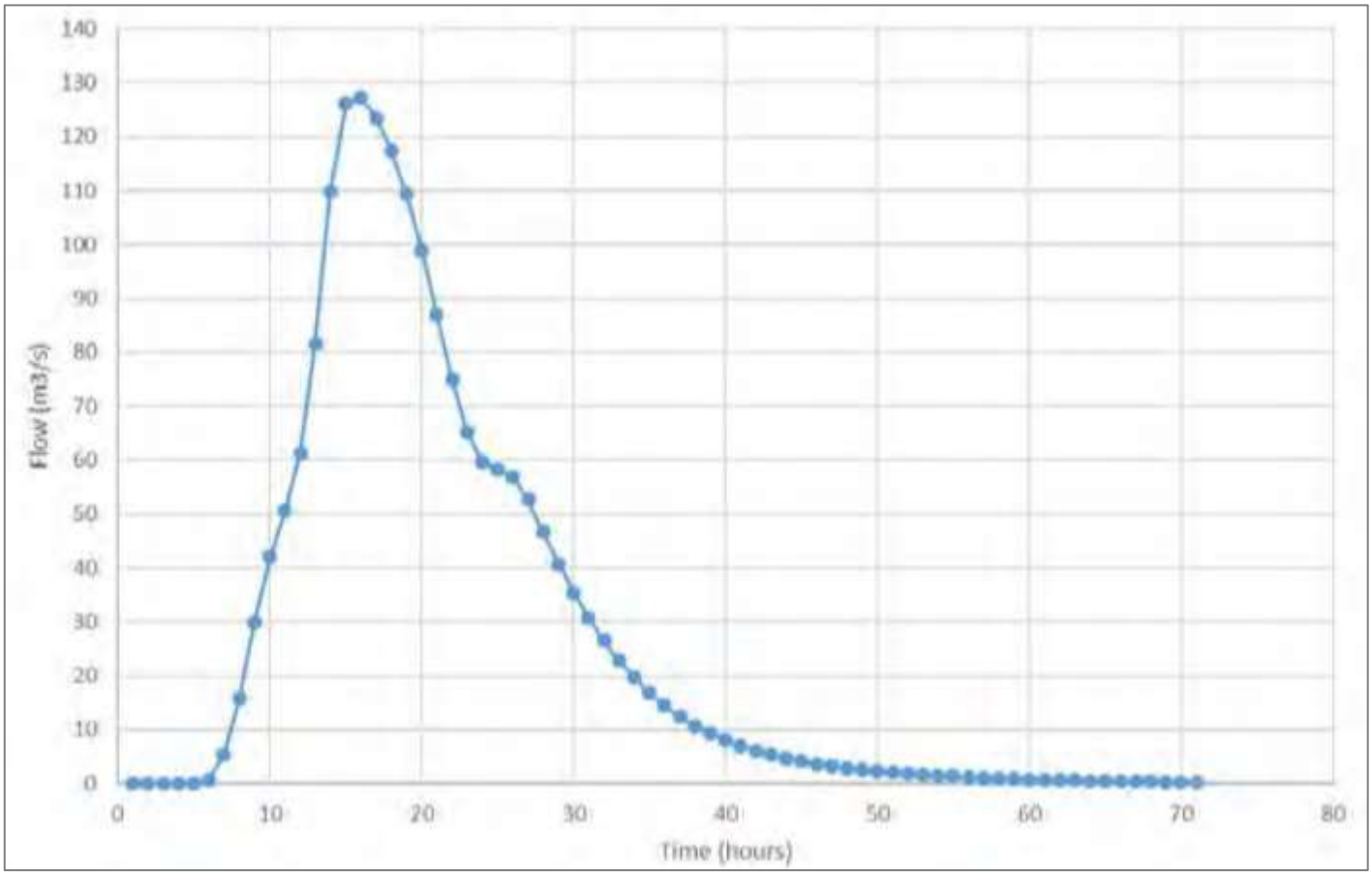
There is limited stormwater infrastructure within Raglan, roads are drained using table drains. Local heavy rainfall is likely to exacerbate riverine flooding.

The Preliminary Raglan Flood Study (Utilis 2018) indicates that 12 buildings may be at risk of over floor flooding during a 100 year flood event. During smaller flood events it's expected that no buildings are likely to be subject to over floor flooding.

Warning Time

There are no stream gauges that provide flood warning for Raglan. Flooding can develop quickly in Raglan from heavy rainfall in the upper Fiery Creek Catchment. Rapid rises in floodwater within Raglan can occur within 6-15 hours from rainfall. The time between heavy rainfall in the upper catchment and the flood peak at Raglan may be between 10 to 20 hours. Refer to the graph below.

It is important to note that all floods are different, and different rainfall patterns falling on dry or wet catchments may respond differently. The streamflow and travel time numbers below should be used as a guide only.



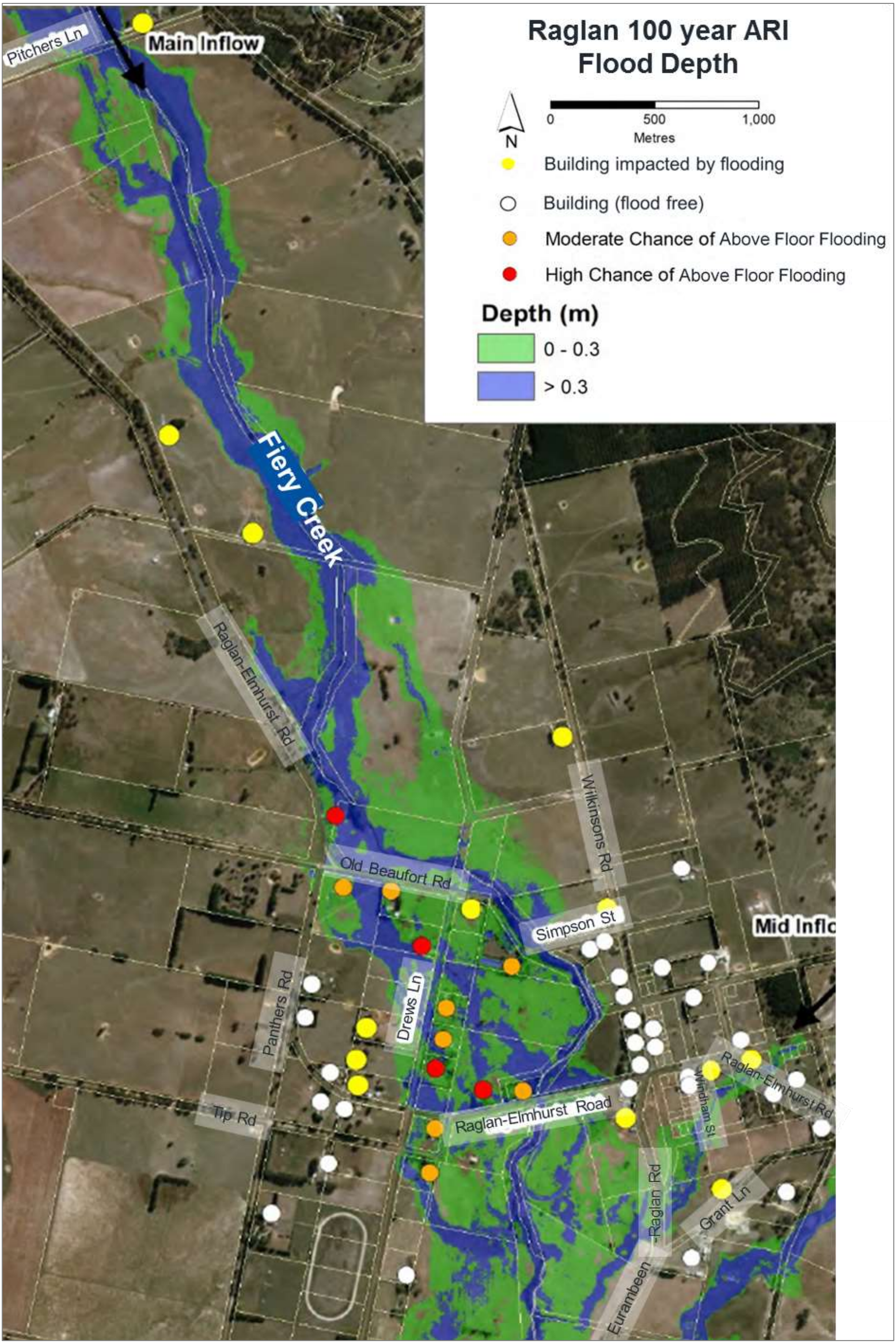
Peak flows in Fiery Creek at Raglan during a 100 year design flood event (Utilis 2018).

Raglan Flood Impacts and Required Actions

Flood mapping from the Raglan Preliminary Flood Study (Utilis 2018) was used to asses flood impacts to buildings and roads. Only the 100 year ARI flood mapping was completed as part of this study. Given no floor level survey was undertaken, buildings at risk of flooding were estimated using the flood mapping developed as part of the Raglan Preliminary Flood Study (Utilis 2018). It's important to note the information used to develop these flood risk estimates below has a low level of accuracy and should be used as a guide only. This information should be used in conjunction with local knowledge. Key assets that may be at risk of flooding in Raglan are listed in the table below.

Asset register				
Asset Name and location	**Average Recurrence Interval (ARI)**	**Consequence / Impact**	**Mitigation/ Action**	**Lead Agency**
4 buildings may be impacted by flooding, refer to the intelligence card and asset impact maps below.	100 year flood	4 buildings may be impacted by flooding from adjacent Fiery Creek.	Undertake evacuations as needed.	Victoria Police
Raglan-Elmhust Road, Raglan	100 year flood	Access may be cut by flooding to Raglan-Elmhust Road during a 100 year flood event.	Deploy road closure signs as needed	Regional Roads Victoria
Old Beaufort Road, Raglan	100 year flood	Access may be cut by flooding to the Old Beaufort Road during a 100 year flood event.	Deploy road closure signs as needed	Council

For more detailed information regarding buildings and roads impacted refer to the Raglan Flood Intelligence Card and flood damages/impact map below.



Raglan buildings and roads that may be impacted by flooding (Utilis 2018).

Raglan Flood Intelligence Card

Flood travel time	Time from start of rain to steep rise in floodwater 6- 15 hours Time from start of rain to Raglan peak 10 - 20 hours Riverine flooding duration: 1 day

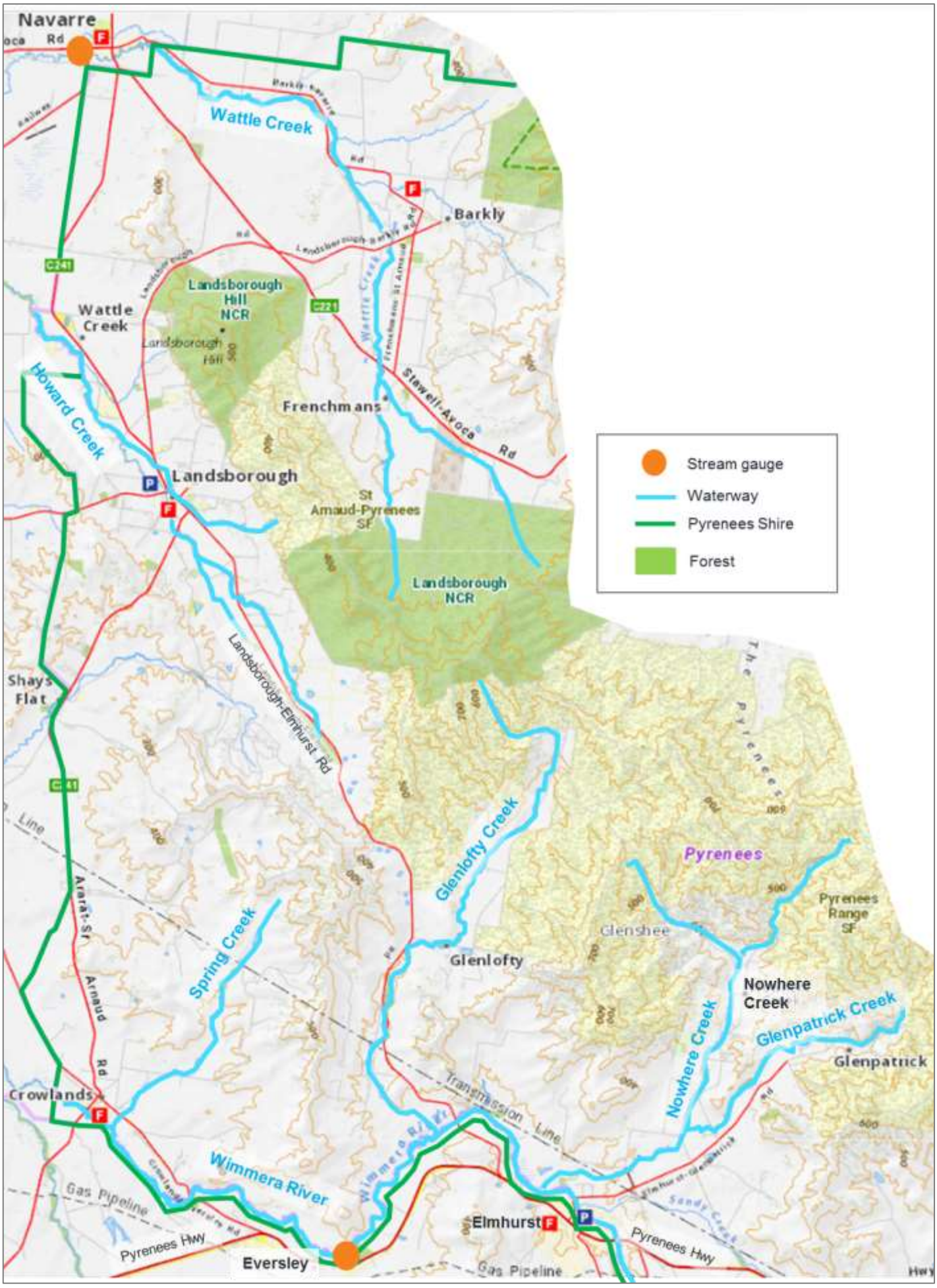
Rainfall Intensity Triggers	Average Recurrence Interval (ARI)	^Raglan estimated damages (Utilis 2018)	Raglan Flows (ML/d) (Utilis 2018)	Consequence / Impact	Houses/ buildings flooded / isolated	Roads Impacted	Action
~21 mm in 1 hour to ~49 mm in 12 hours	5						VICSES activate ground observers to take photos and record flood levels at key crossings. Council clear debris from waterway crossings, drains and culvers as needed.
~25 mm in 1 hour to ~58 mm in 12 hours	10						Refer to actions listed above.
~31 mm in 1 hour to ~67 mm in 12 hours	20						Refer to actions listed above.
~38 mm in 1 hour to ~80 mm in 12 hours	50						Refer to actions listed above.
~43 mm in 1 hour to ~91 mm in 12 hours	100	29 (4)	10,998	4 buildings may be impacted by flooding. Access to main and minor roads may be cut, these roads include the Raglan-Elmhurst Road, Old Beaufort Road and Drews Lane, Pitchers Lane. .	4 buildings may be impacted by flooding; X2 Drews Lane (154,189) and x2 Raglan-Elmhurst Road (14, 238).	Access may be cut to; Raglan-Elmhurst Road, Old Beaufort Road and Drews Lane, Pitchers Lane.	VICSES sandbag as needed. Victoria Police evacuate buildings as needed. Council and Regional Roads Victoria to deploy road closure signs as needed.
98 mm over 2 days	September 2010			This flood event caused significant damage to buildings, roads and bridges. Due to the catchment being very wet as a result of flooding a sequence of flood events prior to this event.			
104 mm over 4 days	September 2016						
220 mm over 3 days	January 2011						

^Damages have been estimated using flood mapping from the Raglan Preliminary Flood Study (Utilis 2018).

Appendix C4: Upper Wimmera River Catchment: Landsborough, Glenpatrick, Nowhere Creek, Elmhust, Navarre (south east) Flood Emergency Plan

A small section of the Upper Wimmera River Catchment is located to the north west of the Pyrenees Shire. The Upper Wimmera River Catchment drains the northern section of Mount Cole and the Pyrenees Ranges. Towns impacted by flooding include Landsborough, Glenpatrick, Elmhurst, Nowhere Creek, Glenlofty, Crownlands, Eversley and to the south east of Navarre. The main waterway within the Wimmera River Catchment is the Wimmera River, other waterways include Wattle Creek, Howard (Native Youth Creek), Glenlofty Creek, Nowhere Creek, Glenpatrick Creek and Spring Creek.

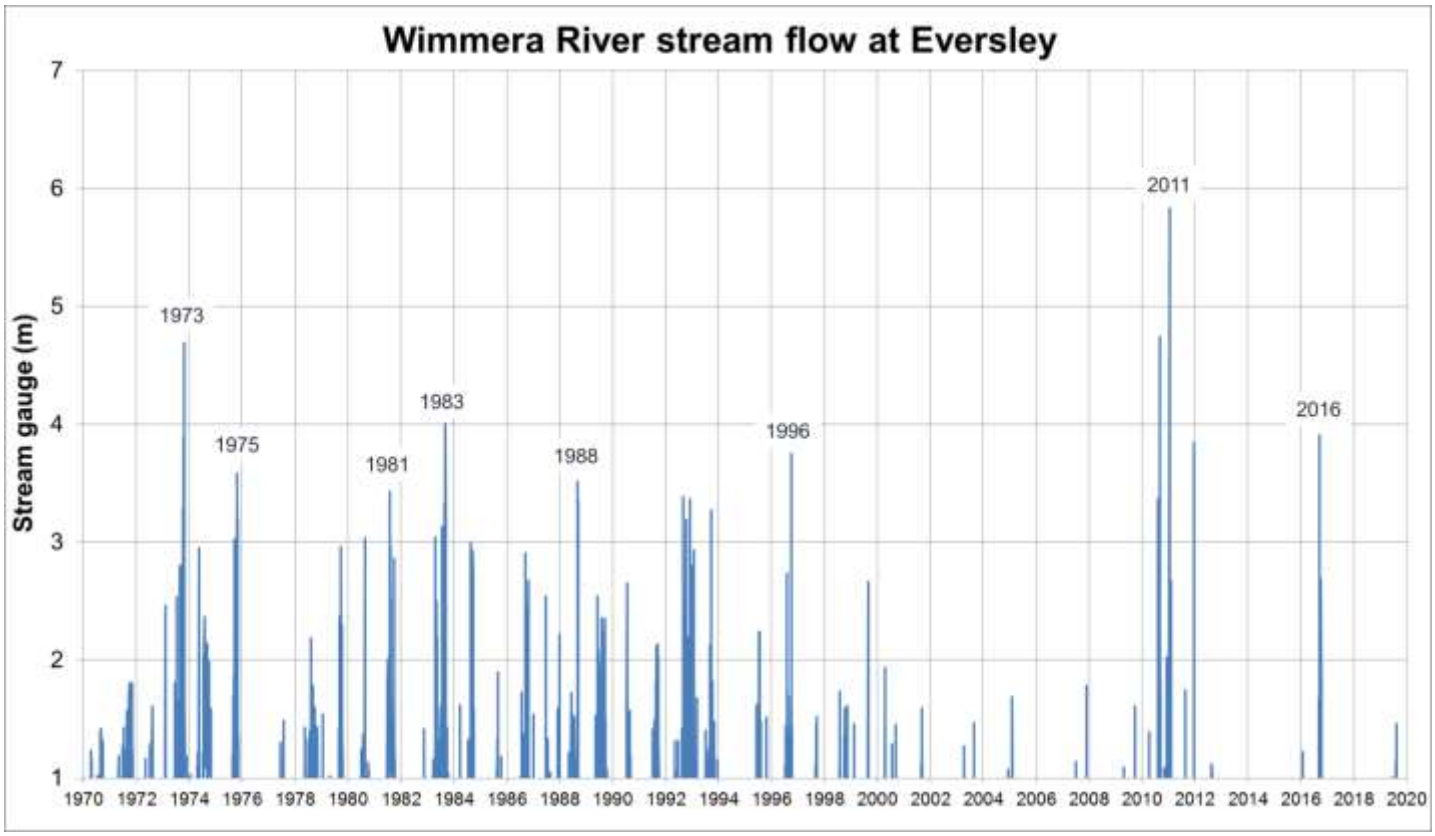
The Wimmera River catchment area within the Pyrenees Shire is approximately 820 km^2. Most of the Catchment area comprises steep mountainous terrain, so when soils are saturated runoff from heavy rainfall leads to rapid flooding with little warning time. Stream rises in the Wimmera River can occur at Eversley between 2 to 6 hours after rainfall.


Navarre
Wattle Creek
Barkly
Landsborough Hill NCR
Wattle Creek
Howard Creek
Frenchmans
Stawell-Avoca Rd
Landsborough
St Arnaud-Pyrenees SF
Landsborough NCR
Shays Flat
Landsborough-Elmhurst Rd
Glenlofty Creek
Pyrenees
Pyrenees Range SF
Glenshee
Glenlofty
Spring Creek
Nowhere Creek
Glenpatrick Creek
Glenpatrick
Crowlands
Wimmera River
Transmission Line
Gas Pipeline
Elmhurst
Pyrenees Hwy
Eversley
Stream gauge
Waterway
Pyrenees Shire
Forest

Historic Flood Events

The upper Wimmera River Catchment has been subject to extensive and frequent riverine flood events. Significant flood events have occurred in 1909, 1910, 1973, 1975, 1981, 1983, 1988, 1992, 1996, 2010, 2011 and 2016, refer to the graph below.

The January 2011 flood event was the largest recent flood event. Rainfall records indicate 177 mm fell over two days in Landsborough. This flood event caused considerable damages to buildings, roads and bridges. Flooding caused deep inundation of many main and minor roads. The high floodwater velocities caused erosion and significant damage to the road network. Sections of the Crowlands Bridge on the St Arnaud-Ararat Road were washed away. The Glenlofty Creek Bridge on the Landsborough-Elmhust Road was also damaged. Many stream gauges were significantly damaged including parts of the Eversley gauge was washed away.



Wimmera River stream flow records indicate the frequency of flood events that have occurred.

Flood Behaviour

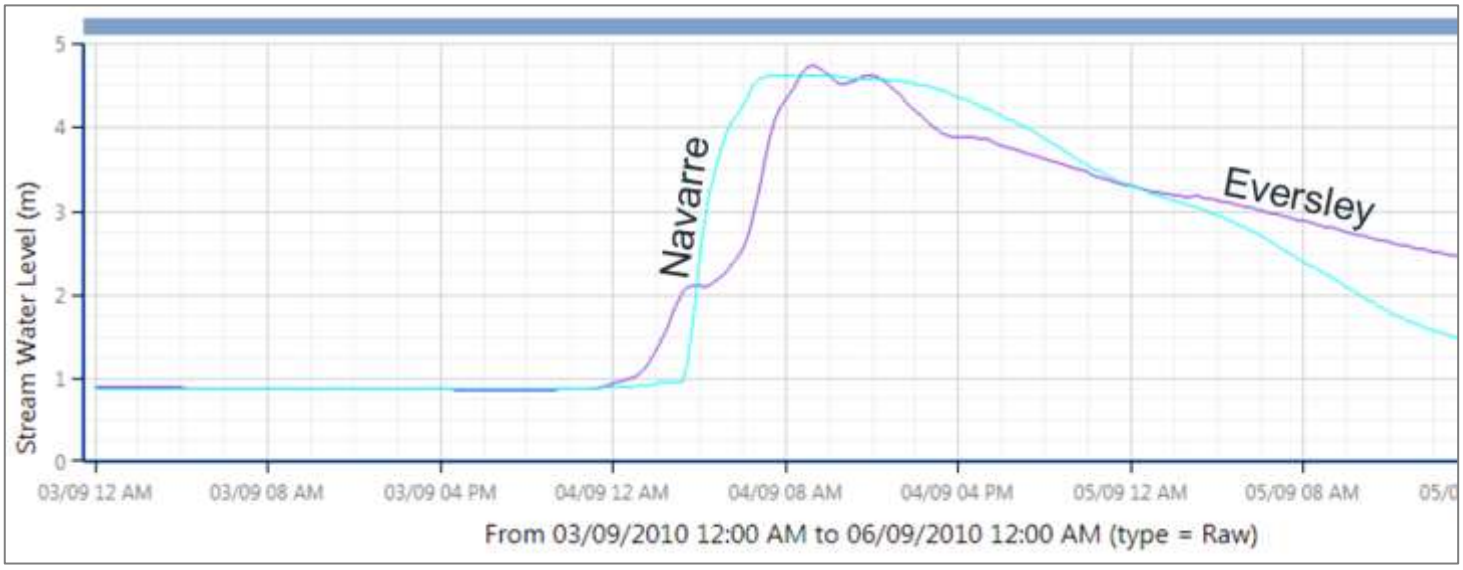
In the upper parts of the Catchment surrounding Nowhere Creek, Landsborough and Glenpatrick the terrain is relatively steep with well-defined flow paths. In the lower parts surrounding Crowlands, the topography flattens to form a wide and relatively undefined floodplain. Due to the very steep terrain flooding can develop quickly with little warning time available.

Within Landsborough flooding is largely contained within the banks of Native Youth Creek and Malakoff Creek during the 20 year flood event. Shallow flooding also starts to overtop Burke Street. During a 100 year flood event, flooding significantly breaks out of these waterway impacting adjacent properties and roads. Flooding cuts access to Burke Street, depth 0.33m.

Within the Upper Wimmera River Catchment a very small number of buildings are at risk of flooding. The road network is often significantly impacted by flooding. Shallow flooding starts to overtop a large number of main roads during a 5 year flood event. Road access may start to be cut during a 20 year flood event, leaving a large number of towns isolated. During a 20 year flood event access is cut to the Crowlands-Eversley Road, Nowhere Creek Road and Ararat-St Arnaud Road. During a 50 year flood event access is cut to the Elmhurst-Glenpatrick Road, Barkly-Navarre Road and Stawell-Avoca Road. Refer to road impact maps below.

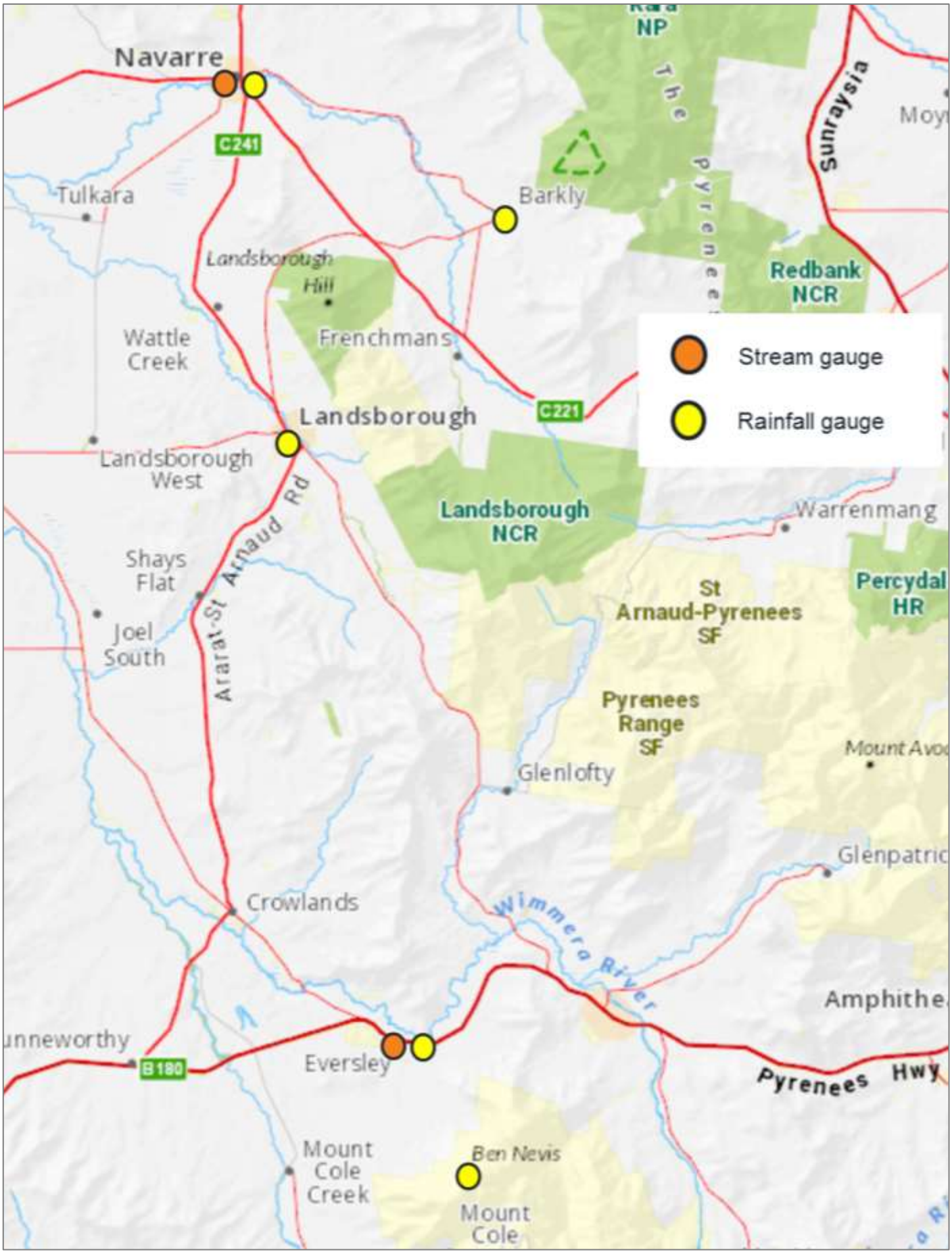
Warning Time

Flooding can develop quickly in the upper Wimmera River Catchment. Rapid rises in floodwater can occur within 2-6 hours from rainfall, refer to the Navarre gauge response in the graph below. The time between heavy rainfall in the upper catchment and rise in streamflow at the Eversley gauge is between 3 to 10 hours. The Eversley gauge is expected to peak between 8 to 12 hours after the start of heavy rainfall.



It is important to note that all floods are different, and different rainfall patterns falling on dry or wet catchments may respond differently. The streamflow and travel time numbers below should be used as a guide only.

While stream and rainfall gauges provide little warning due to the very short flood travel times available they provide an indication of flood magnitude and the stream gauges are useful to track the flood peak through the catchment. Stream gauges are located at Navarre and Eversley. Rainfall gauges are located in Barkly, Landsborough, Navarre, Eversley and Ben Nevis. Refer to the map below.

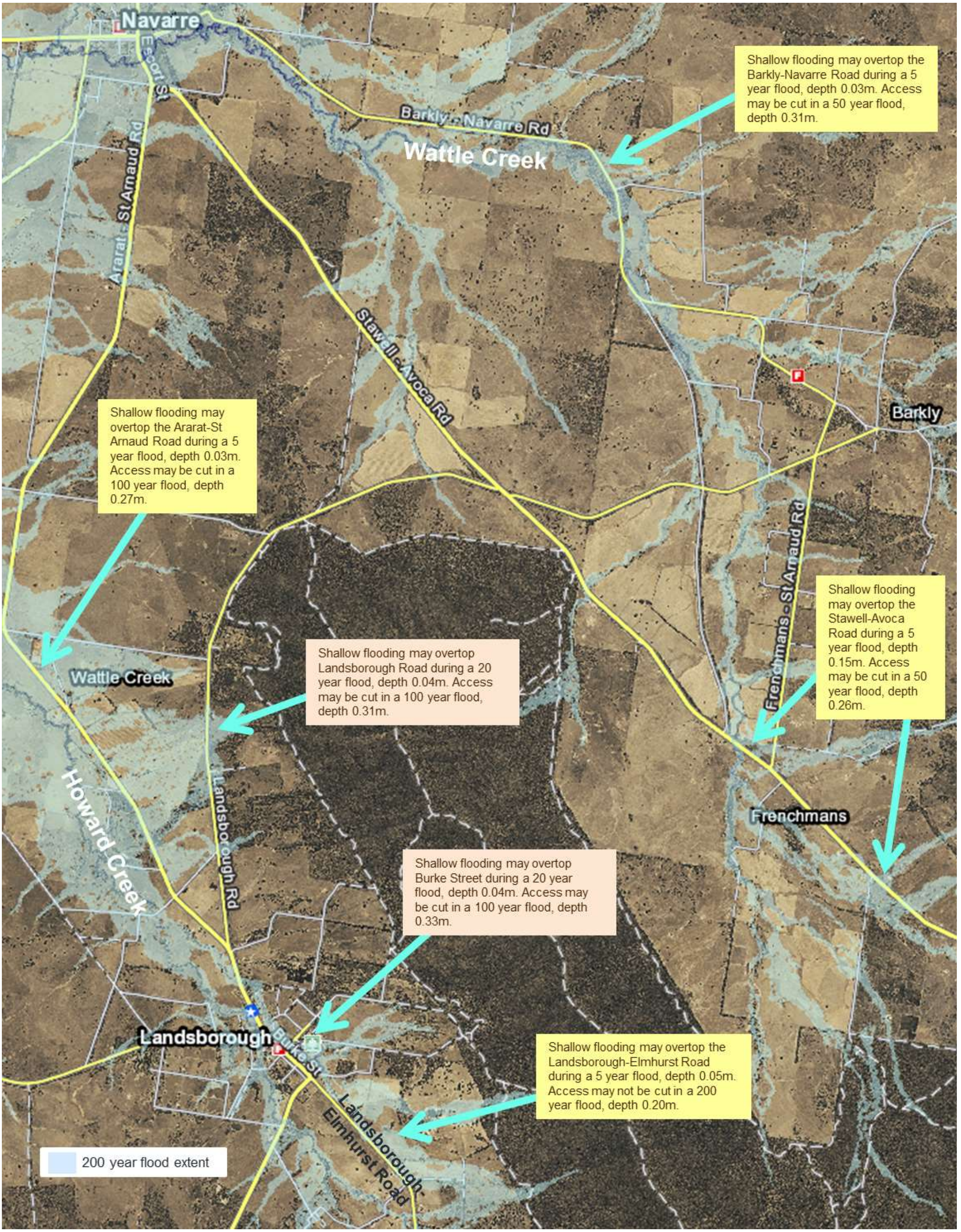

Navarre
C241
Tulkara
Barkly
Landsborough Hill
Redbank NCR
Wattle Creek
Frenchmans
Stream gauge
Rainfall gauge
Landsborough
C221
Landsborough West
Landsborough NCR
Warrenmang
Shays Flat
Arnaud-St Arnaud Rd
St Arnaud-Pyrenees SF
Percydal HR
Joel South
Pyrenees Range SF
Glenlofty
Crowlands
Wimmera River
Eversley
B180
Pyrenees Hwy
Mount Cole Creek
Ben Nevis
Mount Cole

Flood Impacts and Required Actions

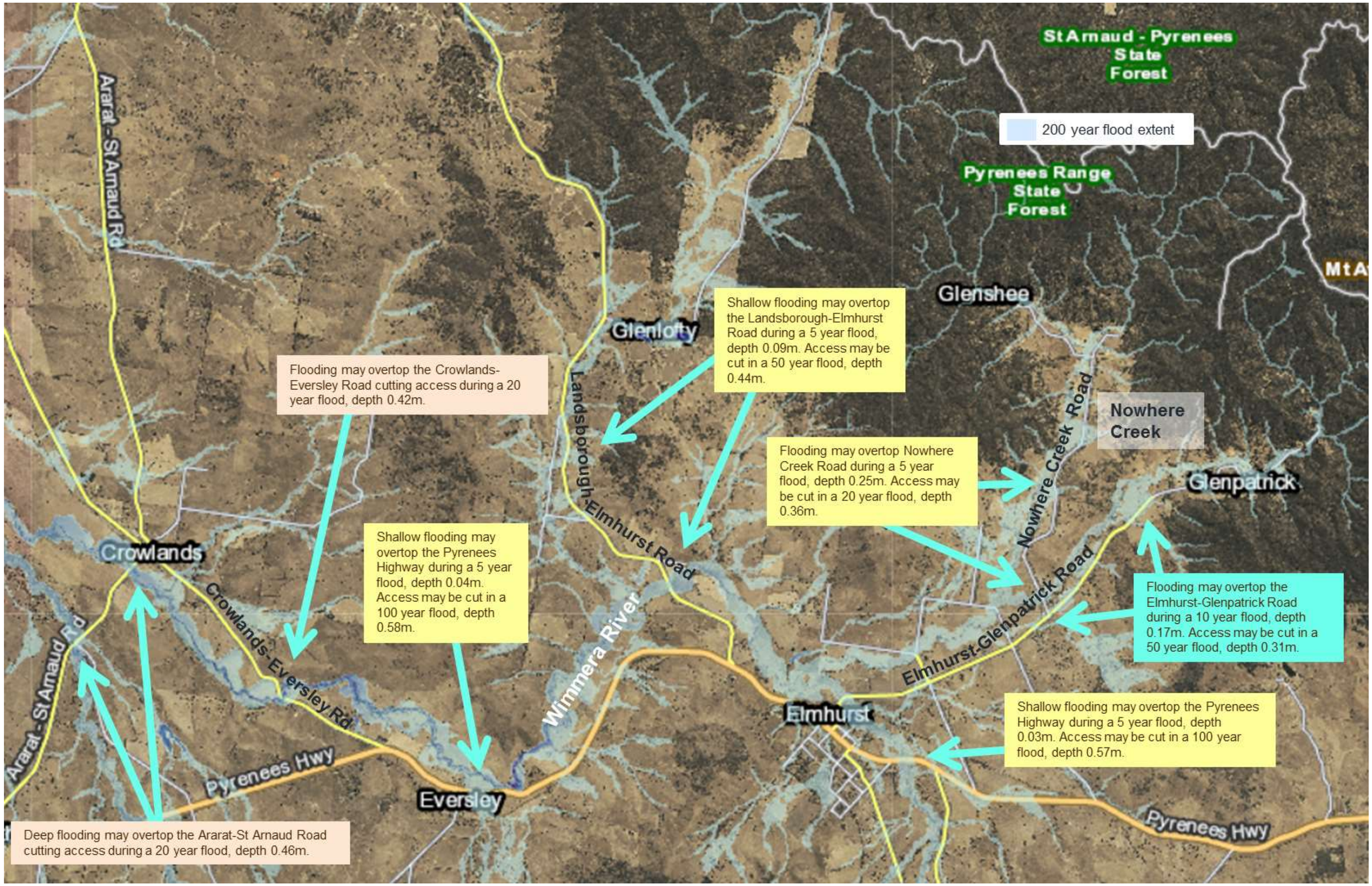
The mapping developed by the Upper Wimmera River Flood Investigation (BMT 2014) was used to provide a flood risk summary provided below. Key assets at risk of flooding in the Upper Wimmera River Catchment are listed in the table below.

Asset register				
Asset Name and location	**Average Recurrence Interval (ARI)**	**Consequence / Impact**	**Mitigation/ Action**	**Lead Agency**
Landsborough Recreation Reserve Oval and Tennis Courts are impacted, McKinlay Street, Landsborough	5 year flood	Landsborough Recreation Reserve Oval and Tennis Courts are impacted by flooding.	Undertake evacuations as needed.	Victoria Police
Ararat-St Arnaud Road adjacent to Howard Creek, downstream of Landsborough.	5 year flood	Shallow flooding may overtop Ararat-St Arnaud Road during a 5 year flood event, depth 0.03m. Access may be cut in a 100 year flood, depth 0.27m.	Deploy road closure signs as needed.	Council
Nowhere Creek Road adjacent to Nowhere Creek.	5 year flood	Flooding may overtop the Nowhere Creek Road during a 5 year flood event, depth 0.25m. Access may be cut during a 20 year flood event, depth 0.36m.	Deploy road closure signs as needed.	Council
Barkly-Navarre Road, east of Navarre.	5 year flood	Shallow flooding may overtop the Barkly-Navarre Road during a 5 year flood event, depth 0.03m. Access may be cut during a 50 year flood event, depth 0.31m.	Deploy road closure signs as needed.	Council
The Pyrenees Highway may be cut adjacent to Eversley and Elmhurst.	5 year flood	Shallow flooding may overtop the Pyrenees Highway during a 5 year flood event, depth 0.04m. Access may be cut during a 100 year flood event, depth 0.57m.	Deploy road closure signs and undertake traffic management as needed.	Regional Roads Victoria
Elmhurst-Glenpatrick Road adjacent to Glenpatrick Creek.	10 year flood	Flooding may overtop the Elmhurst-Glenpatrick Road during a 10 year flood event, depth 0.17m. Access may be cut during a 50 year flood event, depth 0.31m.	Deploy road closure signs as needed.	Council
Crowlands Eversley Road adjacent to the Wimmera River.	20 year flood	Flooding may overtop and cut access to the Crowlands Eversley Road during a 5 year flood event, depth 0.42m.	Deploy road closure signs as needed.	Council
Burke Street, Landsborough.	20 year flood	Shallow flooding may overtop Burke Street during a 20 year flood event, depth 0.04m. Access may be cut during a 100 year flood event, depth 0.33m.	Deploy road closure signs as needed.	Council
A building at 281 Wattle Creek Road, Wattle Creek. Refer to the damages maps below for the location.	50 year flood	A building 281 Wattle Creek Road may be flooded over floor.	Sandbag buildings and undertake evacuations as needed.	VICSES Victoria Police
Two additional buildings at 2861 Ararat-St Arnaud Road and 620 Nowhere Creek are impacted by flooding. Refer to the damages maps below for the locations	100 year flood	Two additional buildings may be flooded over floor.	Sandbag buildings and undertake evacuations as needed.	VICSES Victoria Police

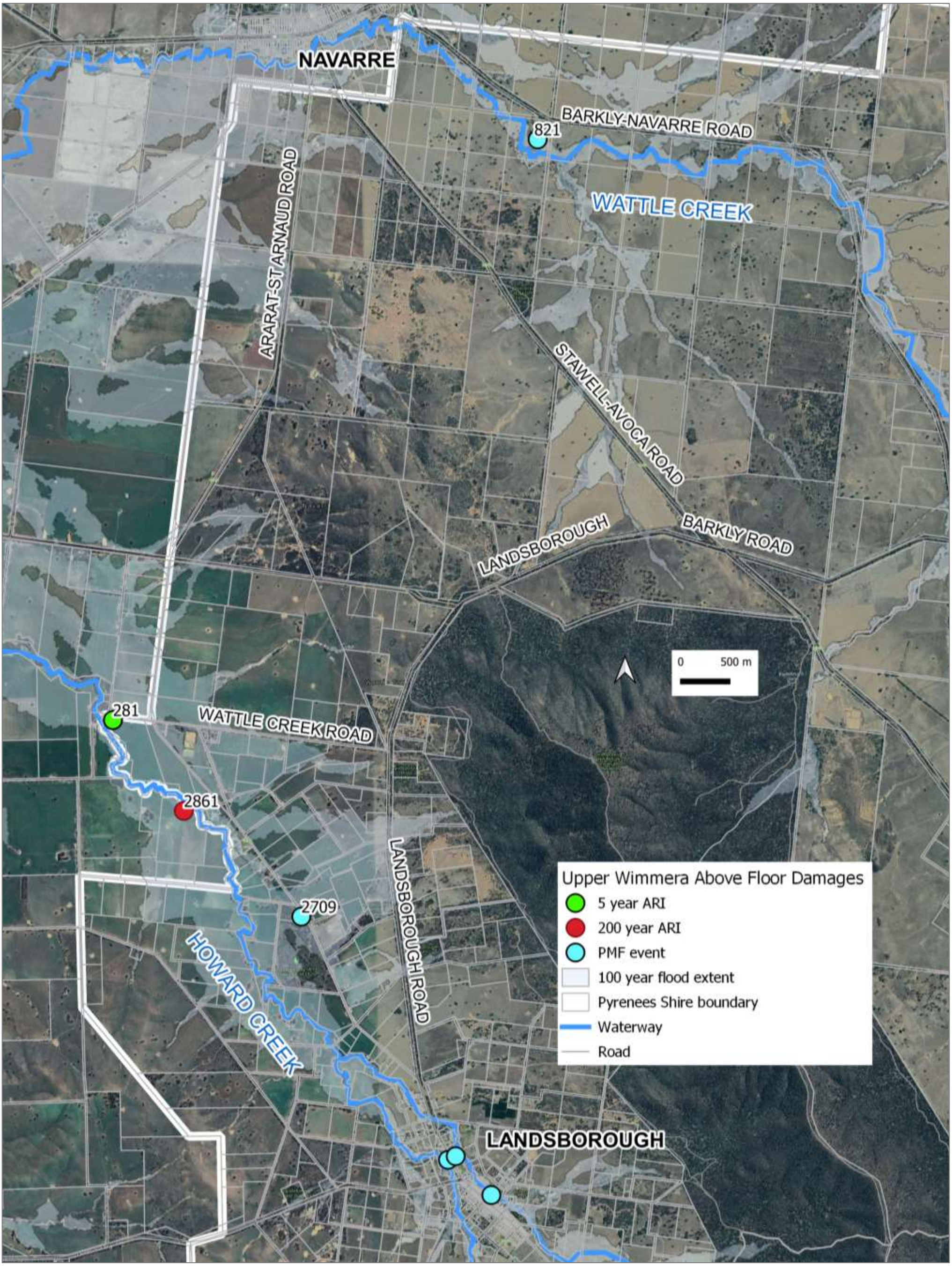
For more detailed information regarding buildings and roads impacted refer to the Upper Wimmera River Catchment Flood Intelligence Cards and flood damages/impact maps below. Also refer to a list of flood observers in **Appendix H** and community sandbag collection points in **Appendix I**.



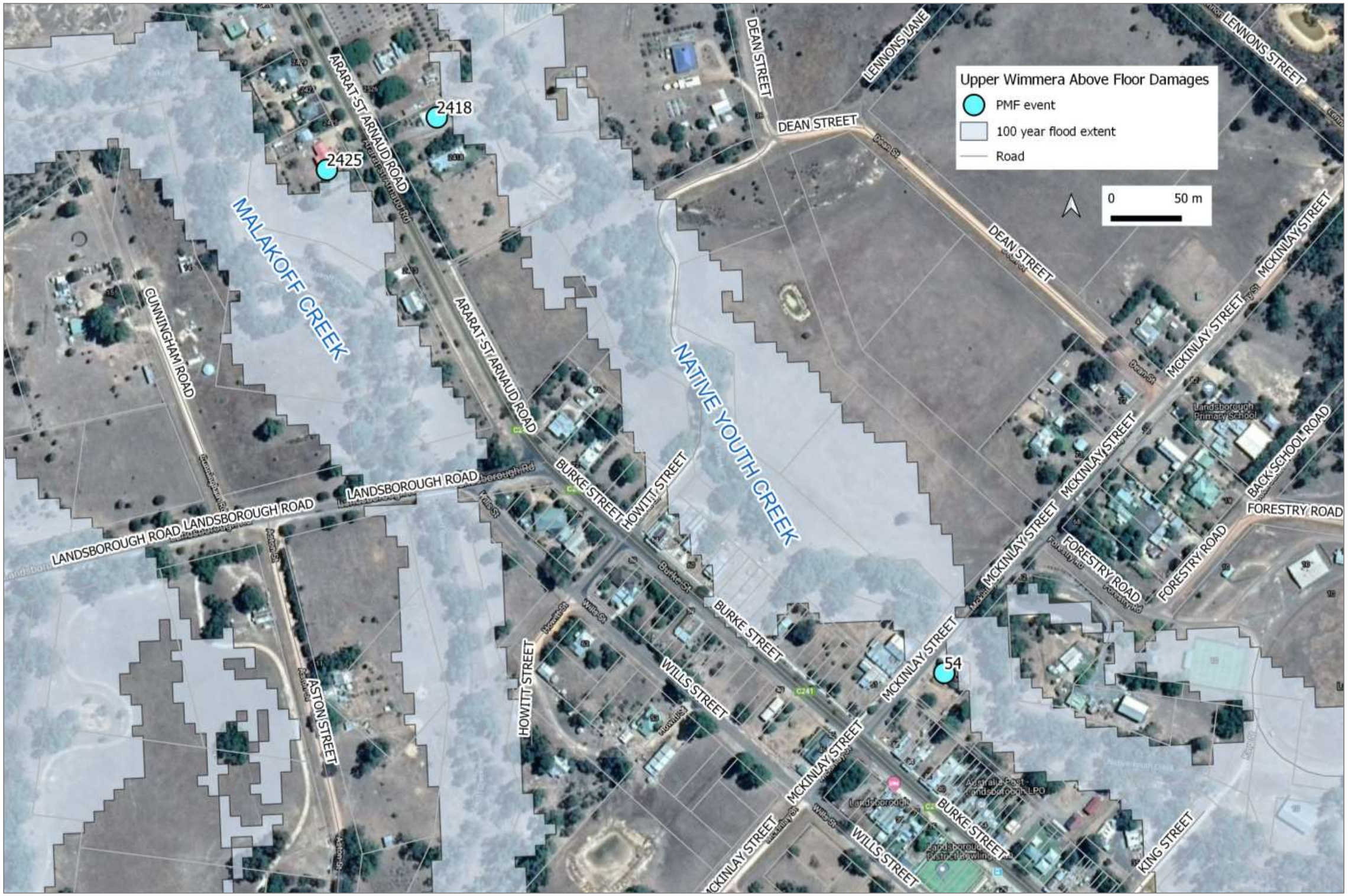
Upper Wimmera River Catchment roads impacted by flooding with the 200 year flood depth map (BMT 2014).



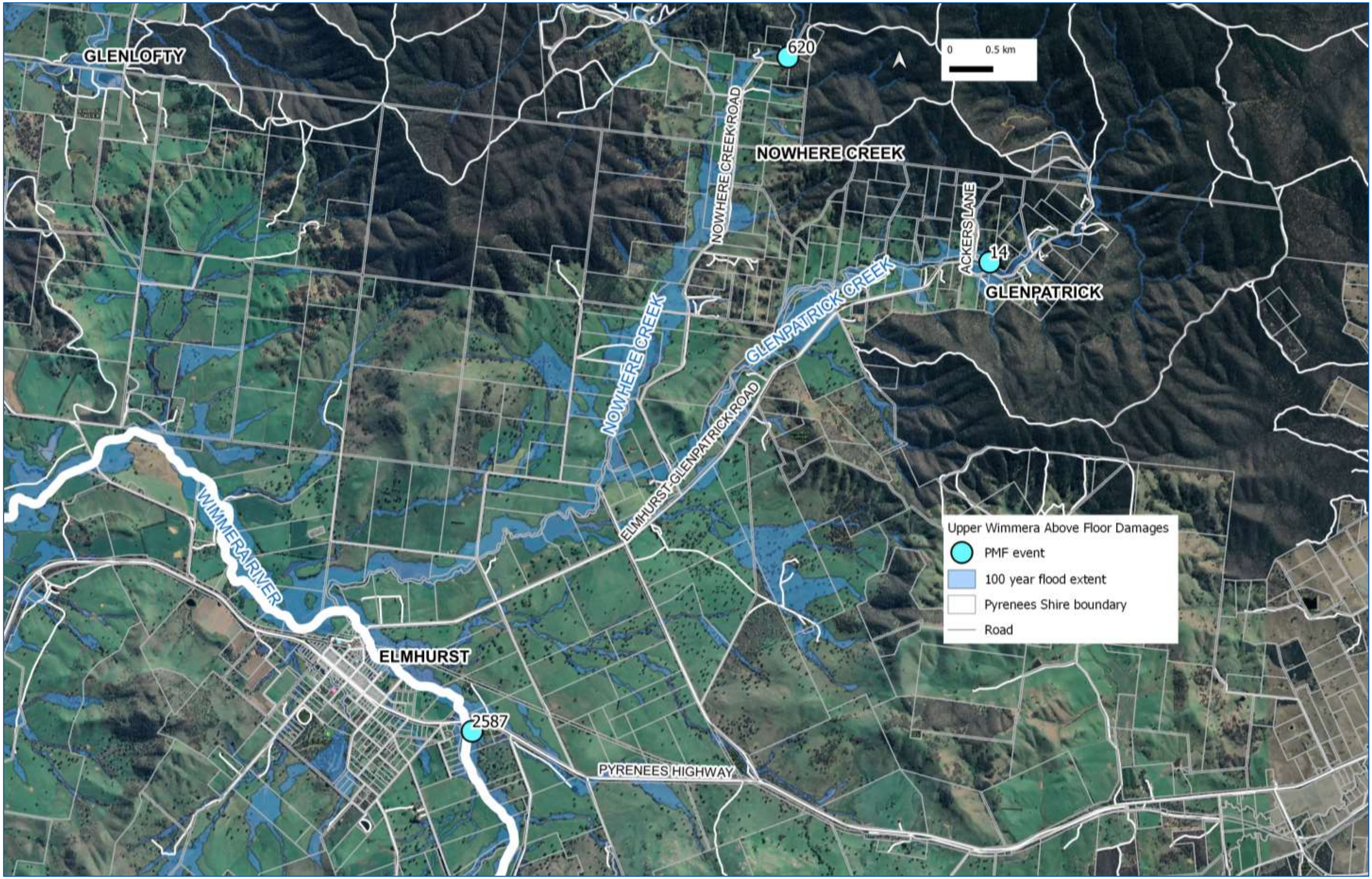
Upper Wimmera River Catchment roads impacted by flooding with the 200 year flood depth map (BMT 2014).



Upper Wimmera River Catchment above floor damages with the 100 year flood extent (BMT 2014).



Landsborough Upper Wimmera River Catchment above floor damages with the 100 year flood extent (BMT 2014).



Upper Wimmera River Catchment above floor damages with the 100 year flood extent (BMT 2014).

Upper Wimmera Catchment Flood Intelligence Card (Landsborough and south east of Navarre within the Pyrenees Shire)

Flood travel time	Time from start of rain to steep rise in floodwater 2 - 6 hours Time between start of rain to peak at Landsborough and Navarre peak 3 - 12 hours Riverine flooding duration: 1 day							
Design rainfall at Landsborough (mm) BOM IFD	**Wattle Creek at Navarre gauge height 415238 (m)**	**Average Recurrence Interval (ARI) (BMT 2014)**	**Wattle Creek at Navarre Design Flows (ML/d) (BMT 2014)**	**Upper Wimmera estimated damages Landsborough and Navarre (within Pyrenees)**	**Consequence / Impact**	**Houses/ buildings flooded / isolated**	**Roads Impacted**	**Action**
~60mm in 12 hours to ~90mm in 48 hours	3.3	5	4,060	0 (0)	Floods develop and rise quickly in the Upper Wimmera Catchment. Water begins to accumulate along the sides of roads, and on the upstream side of larger roads. Flooding breaks out of Native Youth Creek, Malakoff Creek and Wattle Creek causing nuisance flooding.		Ararat-St Arnaud Road depth 0.03m Burke Street (Landsborough) depth 0m Barkly-Navarre Road depth 0.03m Landsborough-Elmhust Road depth 0.05m Landsborough Road depth 0m Stawell-Avoca Road depth 0.15m	Council deploy road closure signs as needed.
~70mm in 12 hours to ~100mm in 48 hours	4.12	10	5,616	1 (0)	Flooding on the smaller local roads getting more extensive and a little deeper.		Ararat-St Arnaud Road depth 0.10m Burke Street (Landsborough) depth 0m Barkly-Navarre Road depth 0.07m Landsborough-Elmhust Road depth 0.08m Landsborough Road depth 0m Stawell-Avoca Road depth 0.16m	Refer to action listed above
~80mm in 12 hours to ~120mm in 48 hours	4.35	20	6,912	2 (0)			Ararat-St Arnaud Road depth 0.18m Burke Street (Landsborough) depth 0.04m Barkly-Navarre Road depth 0.13m Landsborough-Elmhust Road depth 0m Landsborough Road depth 0.05m Stawell-Avoca Road depth 0.17m	VICSES activate ground observers to take photos and record flood levels at key crossings. Council clear debris from waterway crossings, drains and culvers as needed.
~95mm in 12 hours to ~140mm in 48 hours	4.44	50	8,467	3 (1)		1 building may be flooded above floor surrounding Wattle Creek: 281 Wattle Creek Road.	Ararat-St Arnaud Road depth 0.21m Burke Street (Landsborough) depth 0.16m Barkly-Navarre Road depth 0.31m Landsborough-Elmhust Road depth 0.1m Landsborough Road depth 0.16m Stawell-Avoca Road depth 0.26m	VICSES sandbag buildings as needed. Where access may be cut to buildings, Victoria Police evacuate buildings as needed.
~110mm in 12 hours to ~160mm in 48 hours	4.48	100	9,412	4 (1)	Most main roads surrounding Landsborough may be impassable: Landsborough Road, Ararat-St Arnaud Road, McKinlay Street, King Street and Howitt Street.		Ararat-St Arnaud Road depth 0.27m Burke Street (Landsborough) depth 0.33m Barkly-Navarre Road depth 0.49m Landsborough-Elmhust Road depth 0.16m Landsborough Road depth 0.31m Stawell-Avoca Road depth 0.33m	Council and Regional Roads Victoria to deploy road closure signs and undertake traffic management as needed.
	4.51	200	13,220	5 (2)	More extensive flooding along Native Youth Creek, Malakoff Creek and Wattle Creek may impact access/egress to adjacent properties. All main roads likely to be impassable.	1 additional building may be flooded above floor surrounding Wattle Creek: 2861 Ararat-St Arnaud Road.	Ararat-St Arnaud Road depth 0.35m Burke Street (Landsborough) depth 0.37m Barkly-Navarre Road depth 0.67m Landsborough-Elmhust Road depth 0.20m Landsborough Road depth 0.37m Stawell-Avoca Road depth 0.35m	Refer to actions listed above
	4.63	September 2010			No buildings flooded over floor, roads were damaged.			
	4.64	September 2016			No buildings flooded over floor, roads were damaged.			
141.5mm over 3 days at Navarre. 177mm over 2 days in Landsborough.	4.77*	January 2011		6 (3)	Significant number roads and fences were impacted by flooding. There were also significant stock losses throughout the region. Due to a large amount of debris blocking the Native Youth Creek Bridge adjacent to McKinley Street a house at 54 McKinley Street was at risk of flooding.			
	4.8	500	18,662	6 (3)				Refer to actions listed above
		Probable Maximum Flood	90,115	9 (8)		5 additional buildings may be flooded above floor: East of Navarre: 821 Barkly-Navarre Road, Landsborough: 2418 Ararat-St Arnaud Road, 2425 Ararat-St Arnaud Road and 2709 Ararat-St Arnaud Road and 54 McKinley Street.		Refer to actions listed above

*Estimated height from debri marks as gauge failed.

Upper Wimmera Catchment Flood Intelligence Card (Crowlands, Eversley, Nowhere Creek, Glenpatrick)

Flood travel time	Time from start of rain to steep rise in floodwater 3 - 10 hours Time between start of rain to peak at Eversley peak 8 - 12 hours Riverine flooding duration: 1 day

Design rainfall at Eversley (mm) BOM IFD	Wimmera River at Eversley gauge height 415207 (m)	Average Recurrence Interval (ARI) (BMT 2014)	Wimmera River at Eversley Design Flows (ML/d) (BMT 2014)	Upper Wimmera River Catchment estimated damages	Consequence / Impact	Houses/ buildings flooded / isolated	Roads Impacted	Action
~47mm in 12 hours to ~74mm in 48 hours	3.12	5	4,924	2 (0)	Floods develop and rise quickly in the Upper Wimmera River Catchment. Water begins to accumulate along the sides of roads, and on the upstream side of larger roads. Flooding breaks out of the Wimmera River, Glenpatrick Creek, Nowhere Creek and Glenlofty Creek causing nuisance flooding.		Elmhurst-Glenpatrick Road depth 0m Pyrenees Highway at Elmhurst depth 0.03m Pyrenees Highway at Eversley depth 0.04m Nowhere Creek Road depth 0.25m Landsborough-Elmhurst Road at Glenlofty depth 0.09m Crowlands-Eversley Road at Crowlands depth 0m Ararat-St Arnaud Road at Crowlands depth 0m	VICSES activate ground observers to take photos and record flood levels at key crossings.
~56mm in 12 hours to ~89mm in 48 hours	3.54	10	7,689	7 (0)	Flooding on the smaller local roads getting more extensive and a little deeper.		Elmhurst-Glenpatrick Road depth 0.17m Pyrenees Highway at Elmhurst depth 0.12m Pyrenees Highway at Eversley depth 0.13m Nowhere Creek Road depth 0.36m Landsborough-Elmhurst Road at Glenlofty depth 0.09m Crowlands-Eversley Road at Crowlands depth 0m Ararat-St Arnaud Road at Crowlands depth 0m	Council clear debris from waterway crossings, drains and culvers as needed. Council deploy road closure signs as needed.
~66mm in 12 hours to ~105mm in 48 hours	3.88	20	10,454#	9 (0)	Flooding cuts access to minor and major roads, including the Ararat-St Arnaud Road at Crowlands, Crowlands-Eversley Road and Nowhere Creek Road.		Elmhurst-Glenpatrick Road depth 0.24m Pyrenees Highway at Elmhurst depth 0.15m Pyrenees Highway at Eversley depth 0.16m Nowhere Creek Road depth 0.44m Landsborough-Elmhurst Road at Glenlofty depth 0.16m Crowlands-Eversley Road at Crowlands depth 0.42m Ararat-St Arnaud Road at Crowlands depth 0.46m	Where access may be cut to buildings, Victoria Police evacuate buildings as needed.
	3.91	September 2016						
~79mm in 12 hours to ~126mm in 48 hours	4.39	50	15,552#	15 (0)	Flooding cuts access to minor and major roads, including the Elmhurst-Glenpatrick Road and Landsborough-Elmhurst Road south of Glenlofty.		Elmhurst-Glenpatrick Road depth 0.31m Pyrenees Highway at Elmhurst depth 0.25m Pyrenees Highway at Eversley depth 0.25m Nowhere Creek Road depth 0.51m Landsborough-Elmhurst Road at Glenlofty depth 0.44m Crowlands-Eversley Road at Crowlands depth 0.83m Ararat-St Arnaud Road at Crowlands depth 0.66m	Refer to actions listed above
	4.74	September 2010						
~89mm in 12 hours to ~143mm in 48 hours	4.93	100	21,513#	27 (1)	Towns within this area have minimal flood risk, one building is inundated. Access to most towns is cut by flooding, including several sections of the Pyrenees Highway (adjacent to Eversley and Elmhurst refer to the maps above for locations).	1 building may be flooded above floor; 620 Nowhere Creek Road, Nowhere Creek.	Elmhurst-Glenpatrick Road depth 0.38m Pyrenees Highway at Elmhurst depth 0.57m Pyrenees Highway at Eversley depth 0.58m Nowhere Creek Road depth 0.60m Landsborough-Elmhurst Road at Glenlofty depth 0.60m Crowlands-Eversley Road at Crowlands depth 1.08m Ararat-St Arnaud Road at Crowlands depth 0.79m	Council and Regional Roads Victoria to deploy road closure signs and undertake traffic management along the Pyrenees Highway as needed. VICSES sandbag building as needed.
~100mm in 12 hours to ~161mm in 48 hours	5.43	200	28,512#	36 (1)	More extensive flooding along all major and minor roads.		Elmhurst-Glenpatrick Road depth 0.54m Pyrenees Highway at Elmhurst depth 0.87m Pyrenees Highway at Eversley depth 0.87m Nowhere Creek Road depth 0.63m Landsborough-Elmhurst Road at Glenlofty depth 0.83m Crowlands-Eversley Road at Crowlands depth 1.28m Ararat-St Arnaud Road at Crowlands depth 0.93m	Refer to actions listed above
142mm over 3 days at Eversley. 152mm over 3 days at Ben Nevis.	5.83	January 2011		36 (1)				
		500	40,003#					Refer to actions listed above
		Probable Maximum Flood	201,744	51 (3)	Two additional buildings may be flooded over floor.	2 additional buildings may be flooded above floor: 14 Ackers Lane Glenpatrick and 2587 Pyrenees Highway Elmhurst.		Refer to actions listed above

*Estimated height from debri marks as gauge failed.

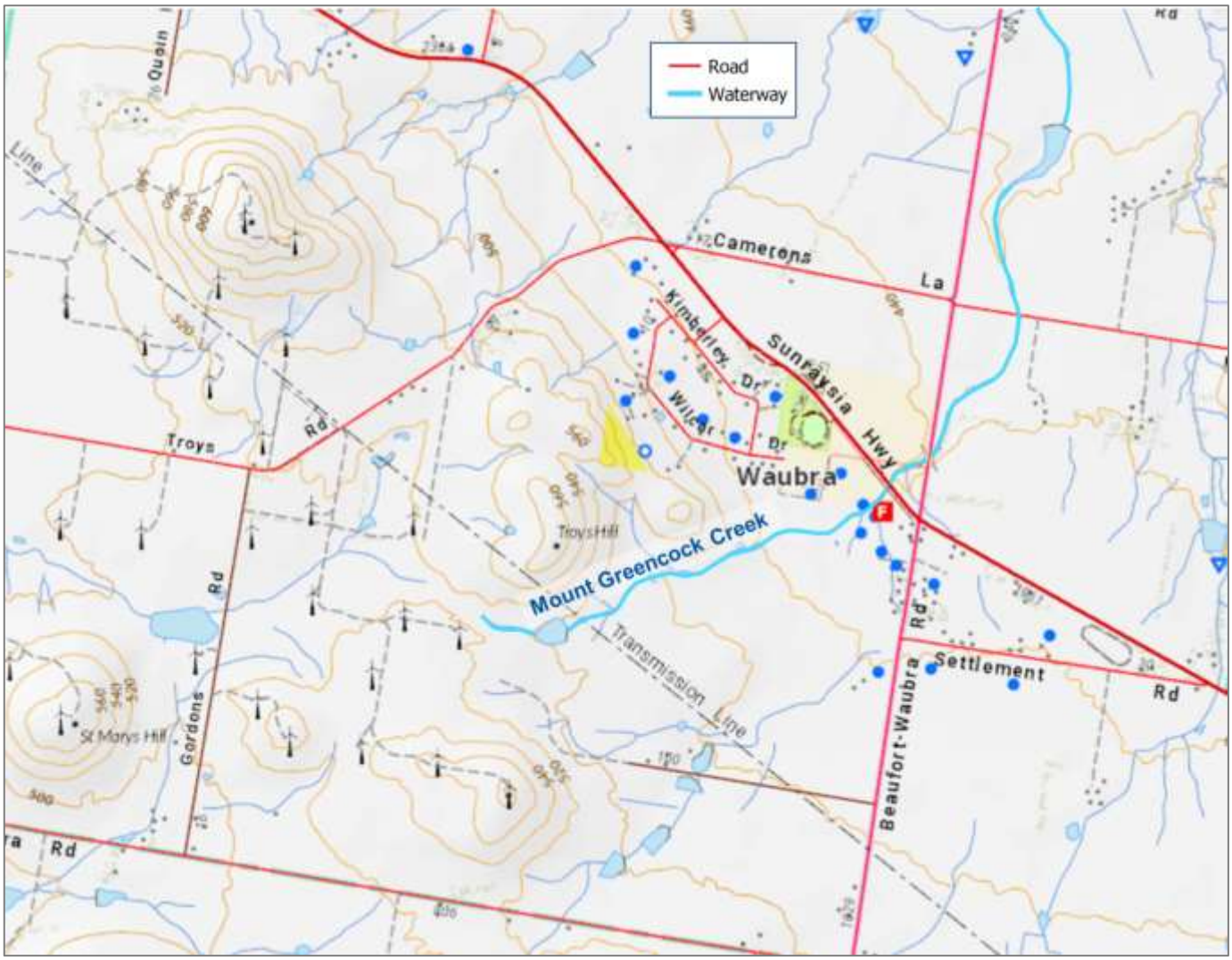
Rating extrapolated due to insufficient gaugings

Upper Wimmera River Catchment Property Inundation Table (BMT 2014)

No	Address		Within ~100mm of flooding over-floor					
		Depth of building over floor flooding for each ARI event (m)						
		5	10	20	50	100	200	PMF
1	281 Wattle Creek Road, Wattle Creek				0.13	0.19	0.27	0.66
2	620 Nowhere Creek Road, Nowhere Creek					0.14	0.22	1.04
3	2861 Ararat-St Arnaud Road, Wattle Creek						0.02	0.18
4	2587 Pyrenees Highway, Elmhurst							0.67
5	2425 Ararat-St Arnaud Road, Landsborough							0.63
6	821 Barkly-Navarre Road, Navarre							0.55
7	2418 Ararat-St Arnaud Road, Landsborough							0.16
8	14 Ackers Lane, Glenpatrick							0.09
9	54 McKinley Street, Landsborough							0.08
10	2709 Ararat-St Arnaud Road, Landsborough							0.01

Appendix C5: Waubra Flood Emergency Plan

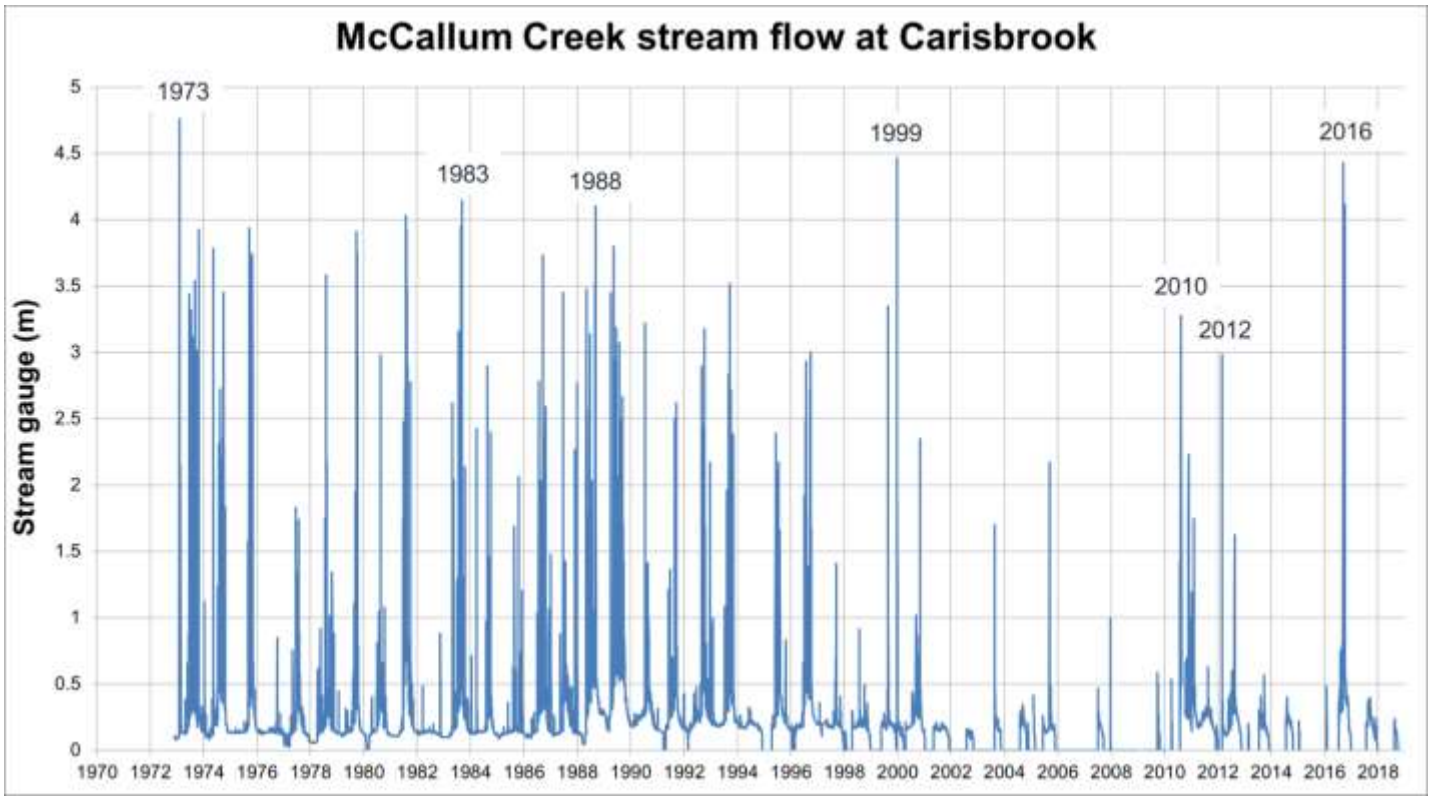
Waubra is located 32 km north west of Ballarat along the Sunraysia Highway. Waubra has experienced frequent riverine flooding from Mount Greencock Creek. Mount Greencock Creek has a very small catchment, approximately 10 km^2, draining the hills to the south west of Waubra, refer to the map below. Mount Greencock Creek flows north from Waubra and joins McCallum Creek 7 km downstream.



Historic Flood Events

Given there are no stream gauges upstream of Waubra a stream gauge at Streatham along the Fiery Creek, 56km downstream of Waubra was used to infer historic flood events that have occurred in Waubra.

The graph below indicates that Waubra has been subject to frequent riverine flood events, significant recently flood events have occurred in 1973, 1975, 1978, 1981, 1983, 1984, 1986, 1988, 1992, 1996, 1999, 2010, 2012 and 2016.



The September 2016 flood event was the largest recent flood event. Rainfall records indicate 99 mm fell over three days. This flood event caused damages to buildings, roads and bridges.

Waubra Flood Behaviour

During flood events Mount Greencock Creek splits Waubra in half, cutting access between the east and west of Waubra. The northern end of town has no defined waterways that flow through town, however it is likely that some overland flow would come off the upslope hills.

There is limited drainage infrastructure within Waubra. A number of major and minor roads that traverse the floodplain act as levees and block the passage of floodwater and exacerbate flooding. The Sunraysia Highway is the most significant and sits on a raised embankment approximately 0.5m high.

Warning Time

There are no stream gauges that provide floor warning for Waubra. Flooding can develop quickly in Waubra from heavy rainfall in the upper Mount Greencock Creek Catchment. Rapid rises in floodwater within Waubra can occur within 2-6 hours from rainfall. The time between heavy rainfall in the upper catchment and the flood peak at Waubra may be between 3 to 12 hours. Refer to the graph below.

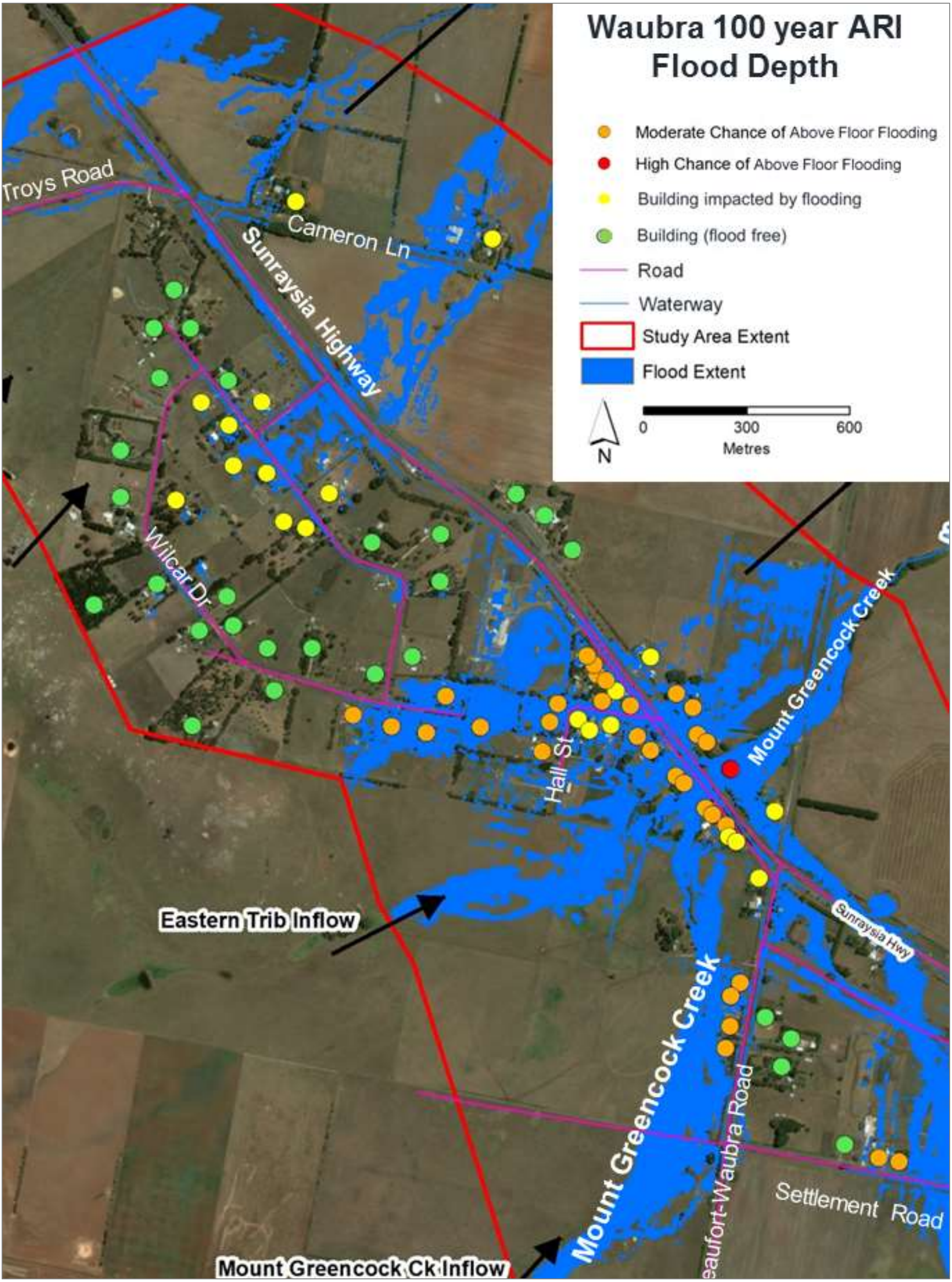
It is important to note that all floods are different, and different rainfall patterns falling on dry or wet catchments may respond differently. The streamflow and travel time numbers below should be used as a guide only.

Waubra Flood Impacts and Required Actions

Flood mapping from the Waubra Preliminary Flood Study (Utilis 2019) was used to asses flood impacts to buildings and roads. Only the 100 year ARI flood extent mapping was completed as part of this study. Given no floor level survey was undertaken, buildings at risk of flooding were estimated using the flood mapping developed as part of the Waubra Preliminary Flood Study (Utilis 2019). It's important to note the information used to develop these flood risk estimates below has a low level of accuracy and should be used as a guide only. Key assets at risk of flooding in Waubra are listed in the table below.

Asset register				
Asset Name and location	**Average Recurrence Interval (ARI)**	**Consequence / Impact**	**Mitigation/ Action**	**Lead Agency**
Waubra Post Office, 2081 Sunraysia Highway, Waubra.	100 year flood	The Waubra Post Office may experience below floor flooding from the adjacent Mount Greencock Creek.	Undertake evacuations as needed.	Victoria Police
Holy Trinity Church (1 Hall Street), Waubra	100 year flood	The Holy Trinity Church may experience below floor flooding from the adjacent Mount Greencock Creek.	Undertake evacuations as needed.	Victoria Police
A house at 2048 Sunraysia Highway may be impacted by flooding, refer to the intelligence card and asset impact map below.	100 year flood	A house at 2048 Sunraysia Highway may be impacted by flooding from the adjacent Mount Greencock Creek.	Undertake evacuations as needed.	Victoria Police
Sunraysia Highway, Waubra	100 year flood	Access may be cut by flooding to Waubra-Elmhust Road during a 100 year flood event.	Deploy road closure signs as needed	Regional Roads Victoria
Beaufort-Waubra Road, Waubra	100 year flood	Access may be cut by flooding to the Beaufort-Waubra Road during a 100 year flood event.	Deploy road closure signs as needed	Council

For more detailed information regarding the building and roads impacted refer to the Waubra Flood Intelligence Card and flood damage map below.



Waubra buildings and roads that may be impacted by flooding (Utilis 2019).

Waubra Flood Intelligence Card

Flood travel time	Time from start of rain to steep rise in floodwater 2- 6 hours Time from start of rain to Waubra peak 3 - 12 hours Riverine flooding duration: 1 day

Rainfall Intensity Triggers	Average Recurrence Interval (ARI)	^Waubra estimated damages (Utilis 2019)	Waubra Flows (ML/d) (Utilis 2019)	Consequence / Impact	Houses/ buildings flooded / isolated	Roads Impacted	Action
~21 mm in 1 hour to ~49 mm in 12 hours	5						VICSES activate ground observers to take photos and record flood levels at key crossings. Council clear debris from waterway crossings, drains and culvers as needed.
~25 mm in 1 hour to ~58 mm in 12 hours	10						Refer to actions listed above.
~31 mm in 1 hour to ~67 mm in 12 hours	20						Refer to actions listed above.
~38 mm in 1 hour to ~80 mm in 12 hours	50						Refer to actions listed above.
~43 mm in 1 hour to ~91 mm in 12 hours	100	53 (1)	3,948	A house may be impacted by over floor flooding. Buildings that may experience below floor flooding including the Holy Trinity Church (1 Hall Street), Waubra Post Office (2081 Sunraysia Highway). Flooding may impact the Waubra Recreation Reserve oval and tennis courts and Bowling Club. Access to main and minor roads may be cut, these roads include the Sunraysia Highway, Beaufort-Waubra Road, Hall Street, Settlement Road and Wilcar Drive.	A house may be impacted by flooding at 2048 Sunraysia Highway.	Access may be cut to; Sunraysia Highway, Beaufort-Waubra Road, Hall Street, Settlement Road and Wilcar Drive	VICSES sandbag as needed. Victoria Police evacuate buildings as needed. Council and Regional Roads Victoria to deploy road closure signs as needed.
65 mm over 2 days	September 2010			This flood event caused damage to buildings, roads and bridges. Due to the catchment being very wet as a result of flooding a sequence of flood events prior to this event.			
99 mm over 3 days	September 2016						
240 mm over 4 days	January 2011			This flood event caused damage to buildings, roads and bridges. Due to the catchment being very wet as a result of flooding a sequence of flood events prior to this event.			

^Damages have been estimated using flood mapping from the Waubra Preliminary Flood Study (Utilis 2019).

Appendix D: Flood evacuation arrangements

Phase 1 - Decision to Evacuate

The decision to evacuate is to be made in consultation with the MERO, MERC, DHHS, Health Commander and other key agencies and expert advice (CMA's and Flood Intelligence specialists).

The Incident Controller may make the decision to evacuate an at-risk community under the following circumstances:

- Properties are likely to become inundated;
- Properties are likely to become isolated and occupants are not suitable for isolated conditions;
- Public health is at threat as a consequence of flooding and evacuation is considered the most effective risk treatment. This is the role of the Health Commander of the incident to assess and manage. Refer to the State Health Emergency Response Plan (SHERP) for details);
- Essential services have been damaged and are not available to a community and evacuation is considered the most effective risk treatment.

The following should be considered when planning for evacuation:

- Anticipated flood consequences and their timing and reliability of predictions;
- Size and location of the community to be evacuated;
- Likely duration of evacuation;
- Forecast weather;
- Flood Models;
- Predicted timing of flood consequences;
- Time required and available to conduct the evacuation;
- Evacuation priorities and evacuation planning arrangements;
- Access and egress routes available and their potential flood liability;
- Current and likely future status of essential infrastructure;
- Is cross border assistance required or evacuation to another municipality relief centre?;
- Resources required and available to conduct the evacuation;
- Shelter including Emergency Relief Centres, Assembly Areas etc.;
- Vulnerable people and facilities;
- Transportation;
- Registration
- People of CALD background and transient populations;
- Safety of emergency service personnel;
- Different stages of an evacuation process.

Phase 2 – Warning

Warnings may include a warning to 'prepare to evacuate' and a warning to 'evacuate now'. Once the decision to evacuate has been made, the at-risk community will be warned to evacuate. Evacuation warnings should be disseminated via methods listed in section 3.3 of this plan.

Phase 3 – Withdrawal

VICPOL is the responsible agency for evacuation. VICSES will provide advice regarding most appropriate evacuation routes and locations for at-risk communities to evacuate to.

VICSES, CFA, AV and Local Government will provide resources where available to support VICPOL/ REGIONAL ROADS with route control and may assist VICPOL in arranging evacuation transportation.

VICPOL will control security of evacuated areas.

Evacuees will be encouraged to move using their own transport where possible. Transport for those without vehicles or other means will be arranged.

Landing zones for helicopters are located at:

- Ballarat Airport (if access is not cut by flooding)
- Ballarat Base Hospital

Special needs groups will be/are identified in Council's 'vulnerable persons register'. This can be done through community network organisations.

Phase 4 – Shelter

Relief Centres and/or assembly areas which cater for people's basic needs for floods may be established to meet the immediate needs of people affected by flooding

VICPOL in consultation with VICSES will liaise with Local Government and DHHS (where regional coordination is required) via the relevant control centre to plan for the opening and operation of relief centres. This can best be achieved through the Emergency Management Team (EMT).

Animal Shelter

Animal shelter compounds will be established for domestic pets and companion animals of evacuees.

Phase 5 – Return

The Incident Controller in consultation with VICPOL will determine when it is safe for evacuees to return to their properties and will arrange for the notification of the community.

VicPol will manage the return of evacuated people with the assistance of other agencies as required.

Considerations for deciding whether to evacuate include:

- Current flood situation;
- Status of flood mitigation systems;
- Size and location of the community;
- Access and egress routes available and their status;
- Resources required to coordinate the return;
- Special needs groups;
- Forecast weather;
- Transportation particularly for people without access to transport

Disruption to Services

Disruption to a range of services can occur in the event of a flood. This may include road closures affecting school bus routes, truck routes, water treatment plant affecting potable water supplies etc.

Appendix E: Public Information and Warnings

VICSES uses EM-COP Public Publishing to distribute riverine and flash flood warnings in Victoria. The platform enables automatic publishing to the VicEmergency app, website and hotline (1800 226 226). Communities can also access this information through VICSES social media channels (Victoria State Emergency Service on Facebook and VICSES News on Twitter) and emergency broadcasters, such as Sky News TV and various radio stations (current list available via the EMV website).

VICSES Regions (or ICCs where established) lead the issuing of warnings for riverine flood events when pre-determined triggers are met (issuing of a BOM Flood Watch or Warning), and share locally tailored information via the standard VICSES communication channels (social media, traditional media, web and face to face). These activities are coordinated by the VICSES RDO and approved by the VICSES RAC, or the PIO and IC respectively (when an ICC is active).

If verified reports are received of flash flooding posing, or resulting in, a significant threat to life or property, VICSES Regions (or ICCs) will issue a flash flood warning product via EM-COP.

VICSES at the state tier (or SCC Public Information Section) plays an important role in sharing riverine and flash flood information via state-based standard communication channels.

During some emergencies, VICSES may alert communities by sounding a local siren, or by using the Emergency Alert (EA) platform to send an SMS to mobile phones or a voice message to landlines. The use of sirens for higher-end warnings has been pre-determined, and mapped to relevant warning templates in EM-COP.

EM-COP Public Publishing Business Rules for Riverine and Flash Flood are available in the **Public Information tab of the IMT Toolbox,** providing further guidance on specific triggers, roles and responsibilities. VICSES SOP057 and JSOP 04.01 provide further guidance.

EMERGENCY ALERT. BE WARNED. BE INFORMED.	**EMERGENCY ALERT** As required, subject to individual circumstances, weather conditions, potential impacts and duration. Refer VICSES SOP057.	As required, based on conditions, changed conditions or impacts of the flood event. Circumstances which warrant the use of EA include: • EA is likely to contribute to saving lives and property • EA is likely to be the most effective way to warn the community in an actual or likely emergency • Alternative channels have been considered and alone may not achieve objectives • Time is of the essence and specific action following the receipt of the warning is required The message is of critical importance and needs to be delivered to a specific geographic area
Pre-populated Pyrenees Shire Emergency Alert key messages for a severe flash flood event High velocity floodwater may cause risk to life for pedestrians and motorist. Access to main roads may be cut. Advise to shelter in place if it is safe to do so. The flood peak is likely to pass within 20 hours.		

	**EMERGENCY ALERT** As required, subject to individual circumstances, weather conditions, potential impacts and duration. Refer VICSES SOP057.	As required, based on conditions, changed conditions or impacts of the flood event. Circumstances which warrant the use of EA include: • EA is likely to contribute to saving lives and property • EA is likely to be the most effective way to warn the community in an actual or likely emergency • Alternative channels have been considered and alone may not achieve objectives • Time is of the essence and specific action following the receipt of the warning is required The message is of critical importance and needs to be delivered to a specific geographic area

Pre-populated Pyrenees Shire Emergency Alert key messages for a severe flash flood event
The BOM have issued a Severe Weather Waring: Heavy Rain

Heavy rainfall forecast by the BOM may lead to Flash Flooding ???. Falls are expected to be between ???mm and ???mm. Locally heavier falls are possible due to embedded thunderstorms that could cause severe flooding.

Locations which may be affected include: **Beaufort, Landsborough, Avoca, Natte Yallock, Amphitheatre, Wattle Creek, Barkly, Lexton, Raglan, Waubra, Glenlofty, Nowhere Creek, Eversley, Crowlands and Glenpatrick.**

Widespread flooding may occur.
Keep clear of creeks and storm drains
Stay clear of fast moving floodwater. Floodwater is expected to rise quickly and will cause risk to life for pedestrians and motorist.
Flooding may cause extensive inundation of buildings.
Properties are likely to be isolated. If your property is impacted by flooding, we advise you to shelter in place if it is safe to do so.
The flood peak is likely to pass quickly, within 2 to 15 hours.
Floodwater may cut access to main roads, avoid driving until the storm and floodwater has subsided.

Waterways likely to be affected include:

- **Wimmera River**
- **Avoca River**
- **Fiery Creek**
- **Yam Holes Creek**
- **Wattle Creek**
- **Howard Creek**
- **Native Youth Creek**
- **Malakoff Creek**
- **Cemetery Creek**
- **Cumberland Creek**
- **Ding Dong Creek**
- **Burnbank Creek**
- **Mountain Creek**
- **Mount Greencock Creek**
- **Nowhere Creek**
- **Glenpatrick Creek**
- **Glenlofty Creek**

SES advises that all community members should:
Never walk, ride or drive through floodwater, Never allow children to play in floodwater, Stay away from waterways and stormwater drains during and after heavy rain, Keep well clear of fallen power lines Be aware that in fire affected areas, rainfall run-off into waterways may contain debris such as ash, soil, trees and rocks, and heavy rainfall increases the potential for landslides and debris across roads.

For emergency assistance contact the SES on 132 500.

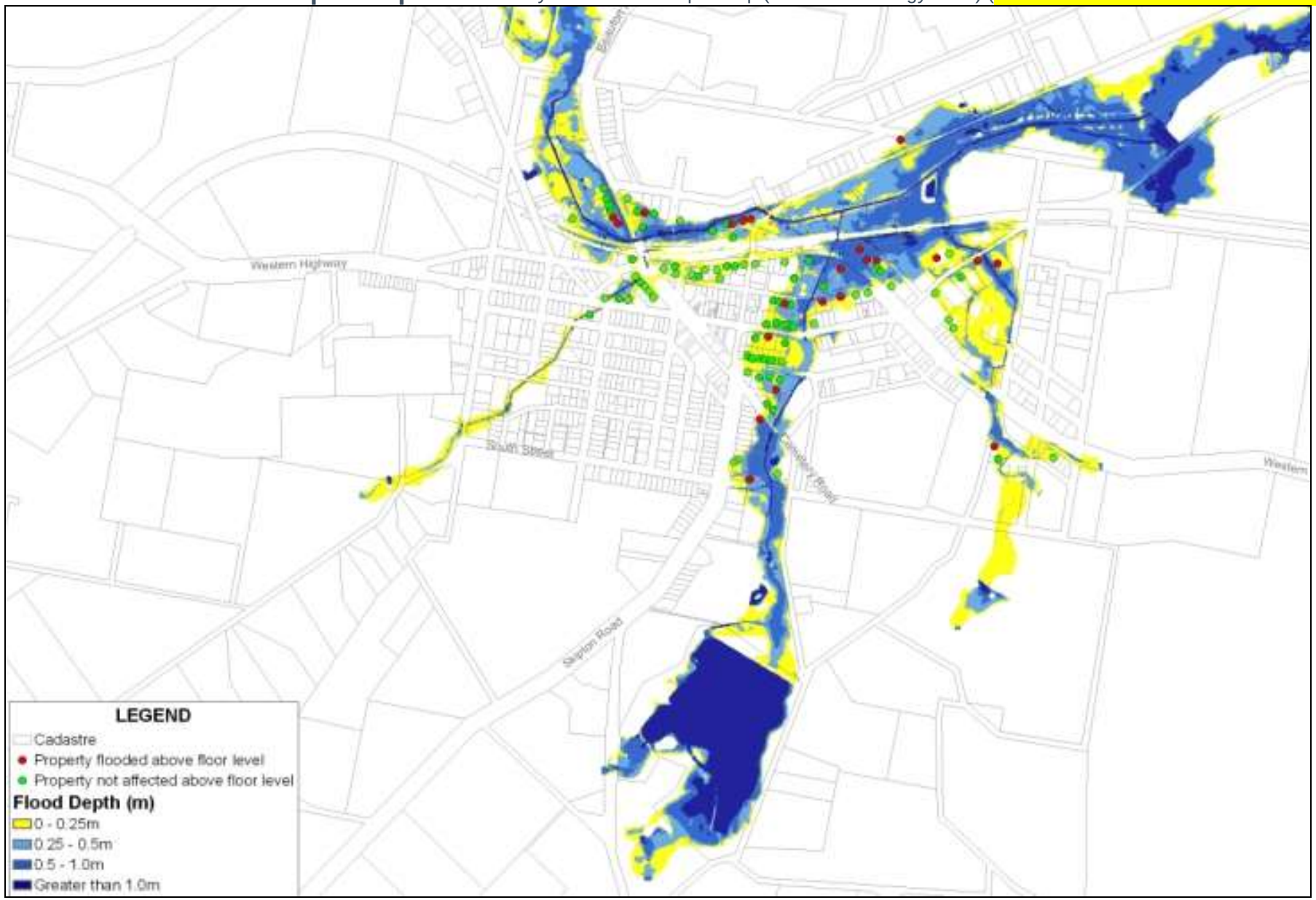
Current Road and Traffic Information is available at the VicRoads website: http://traffic.vicroads.vic.gov.au

Weather Forecast:

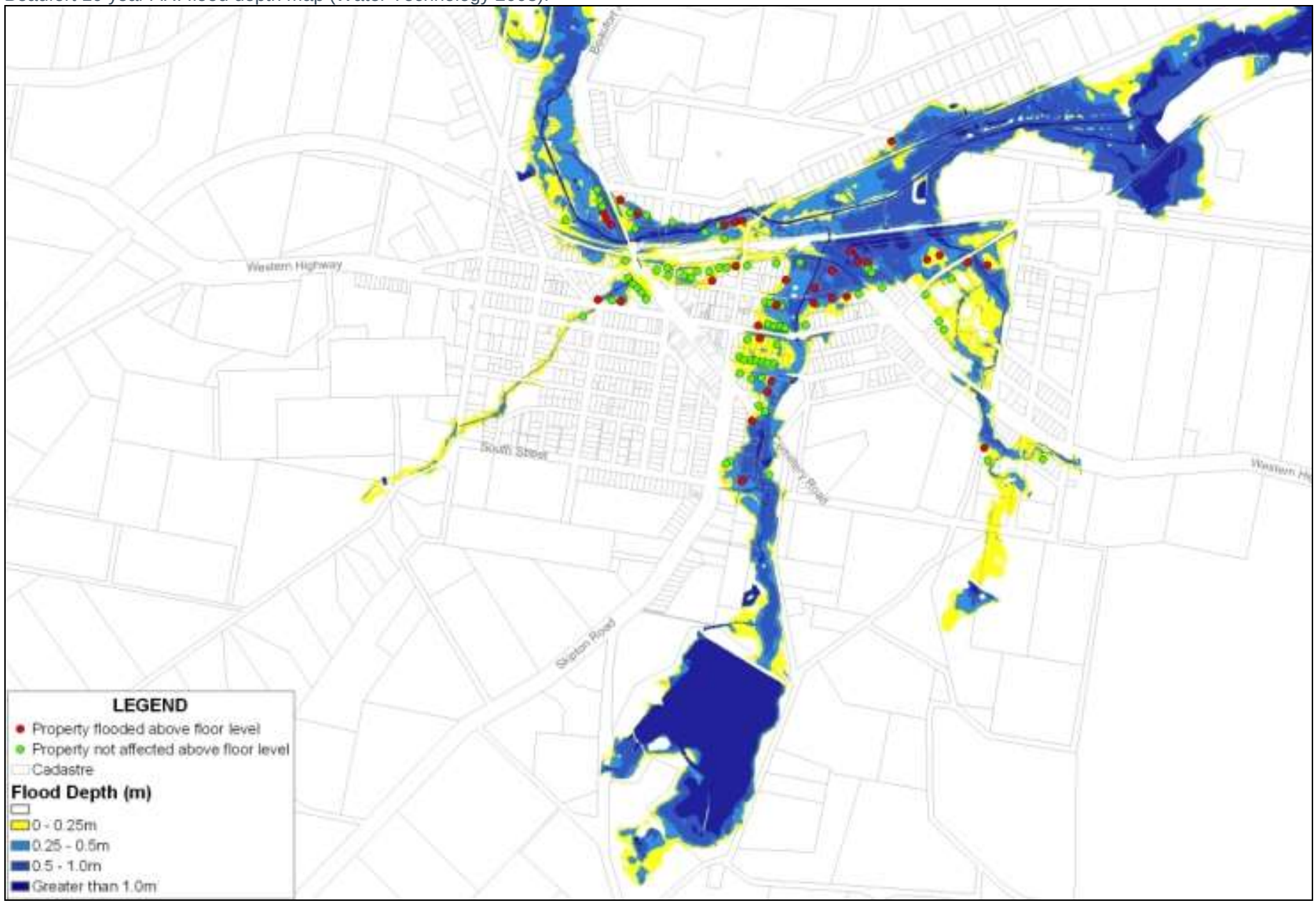
For the latest weather forecast see http://www.bom.gov.au/vic/forecasts/

Appendix F: Flood Maps

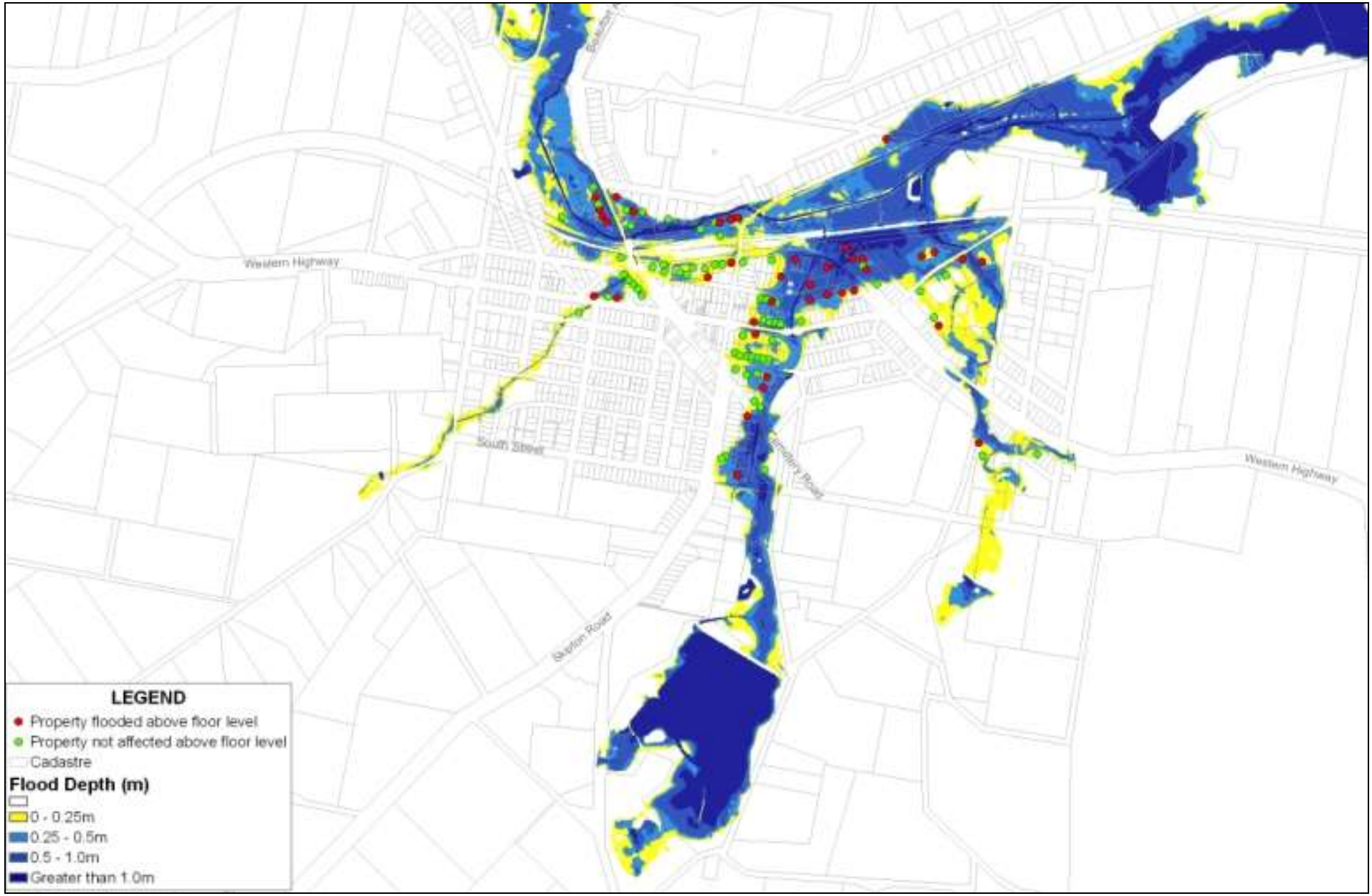
1.1. Beaufort Flood Depth Maps. Beaufort 5 year ARI flood depth map (Water Technology 2008).(TOO LOW RESOLUTION NEED TO BE REPLACED)



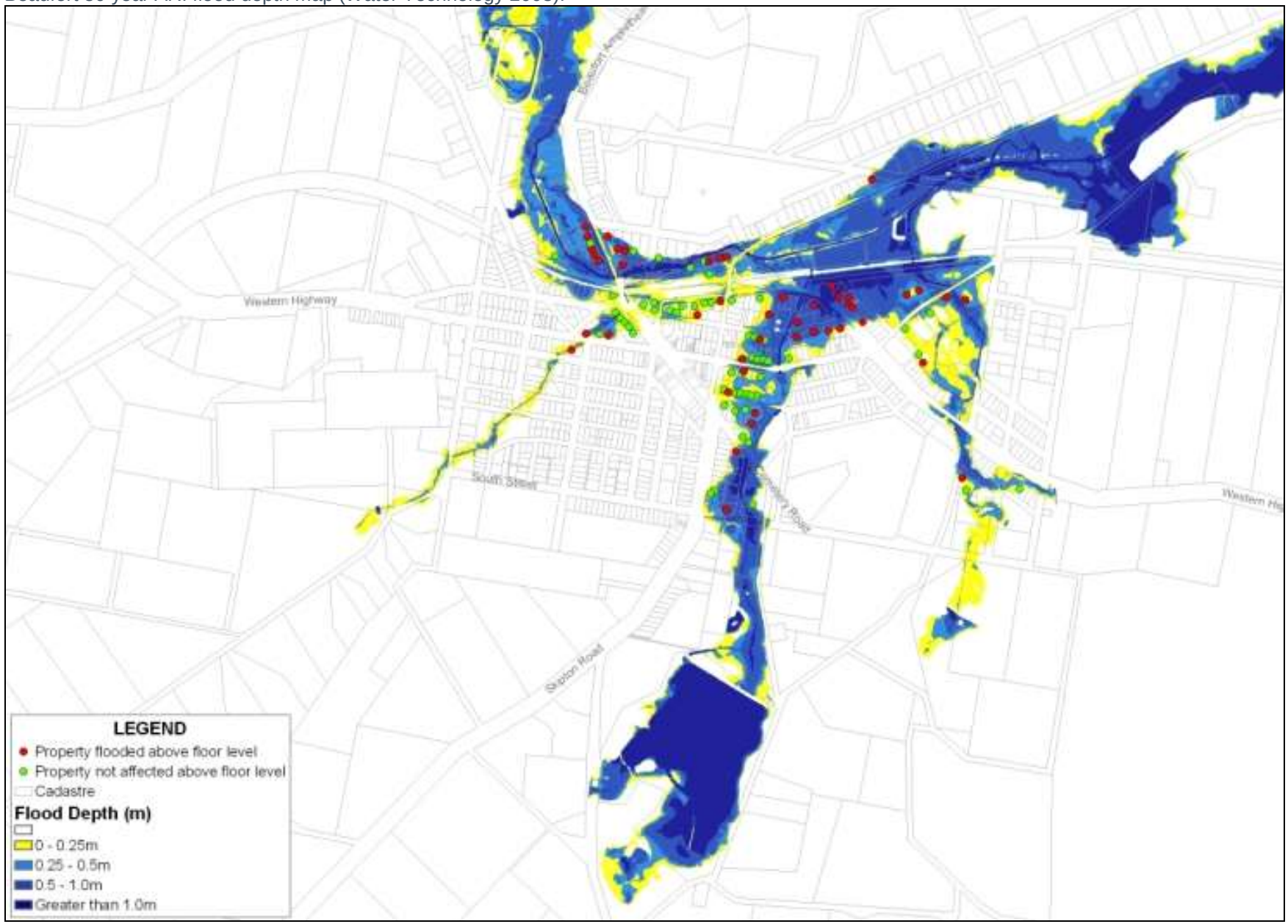
Beaufort 10 year ARI flood depth map (Water Technology 2008).



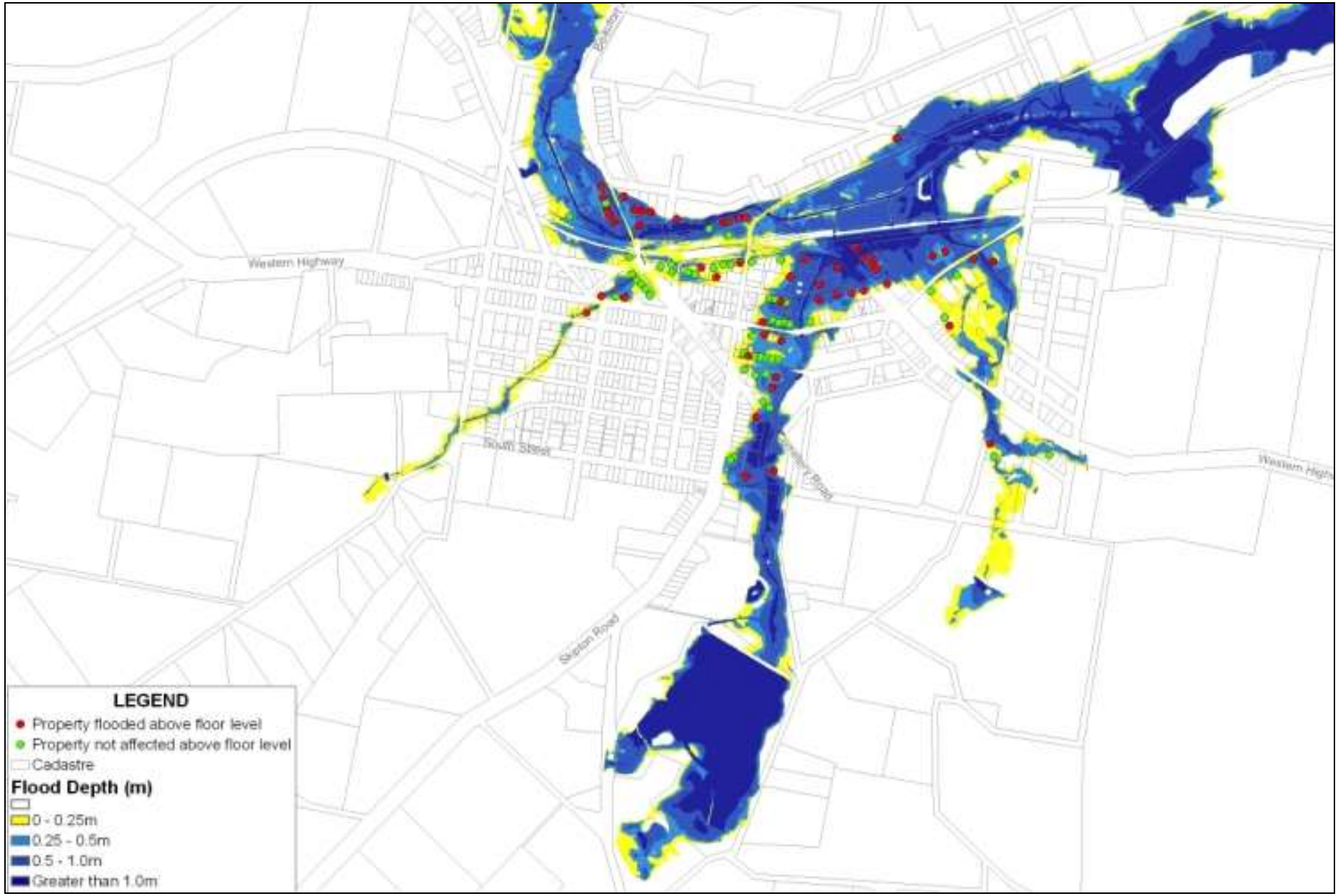
Beaufort 20 year ARI flood depth map (Water Technology 2008).



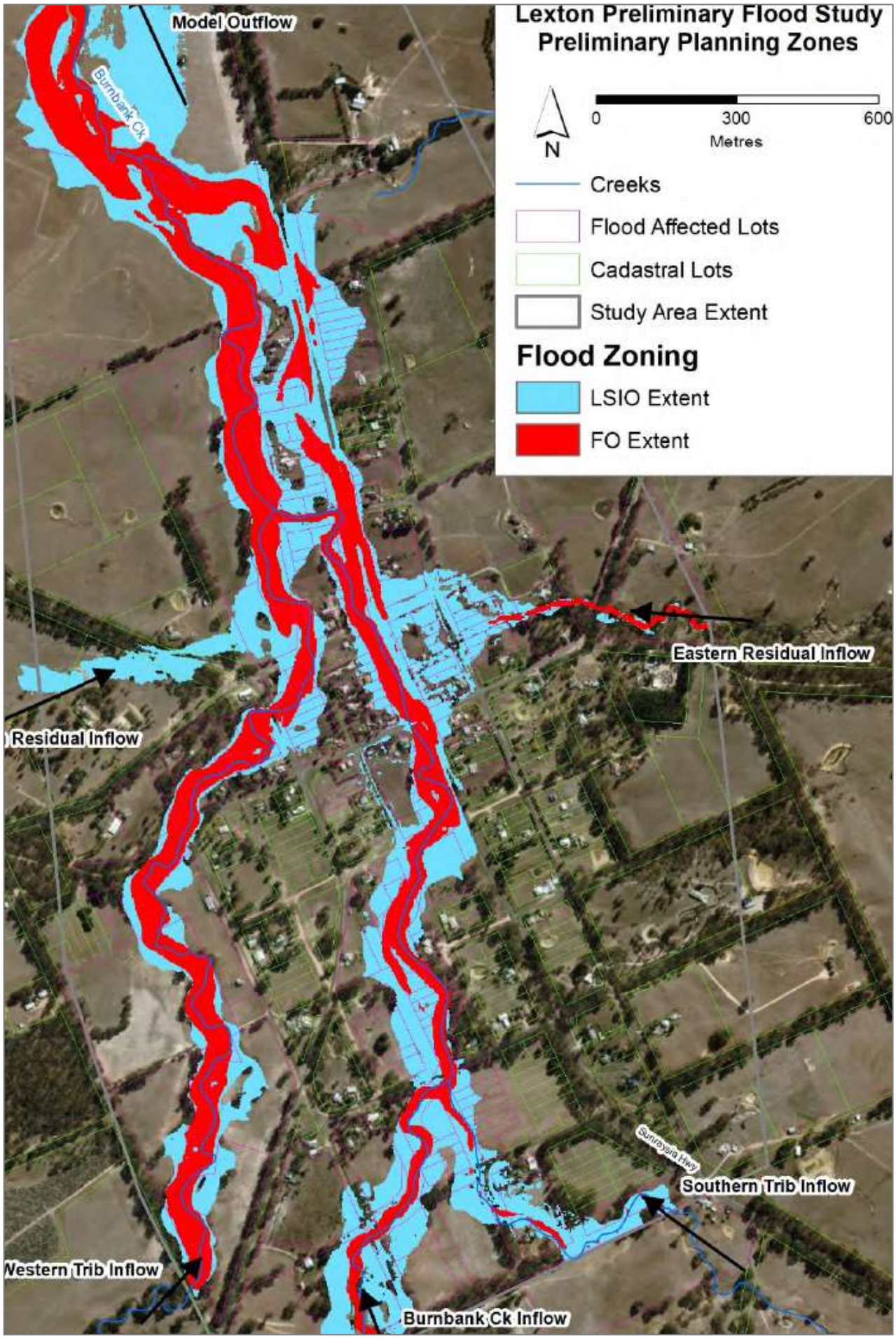
Beaufort 50 year ARI flood depth map (Water Technology 2008).



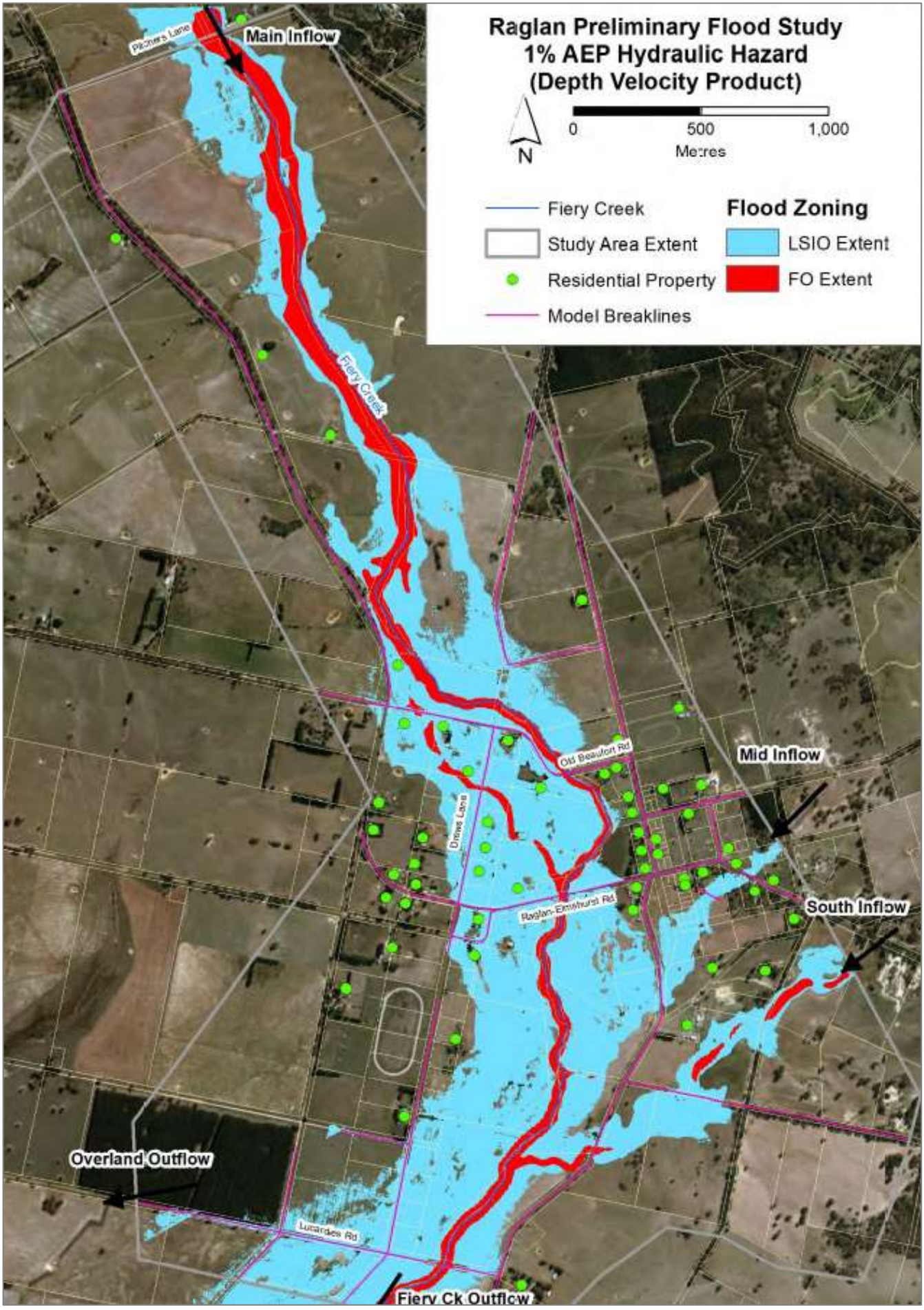
Beaufort 100 year ARI flood depth map (Water Technology 2008).



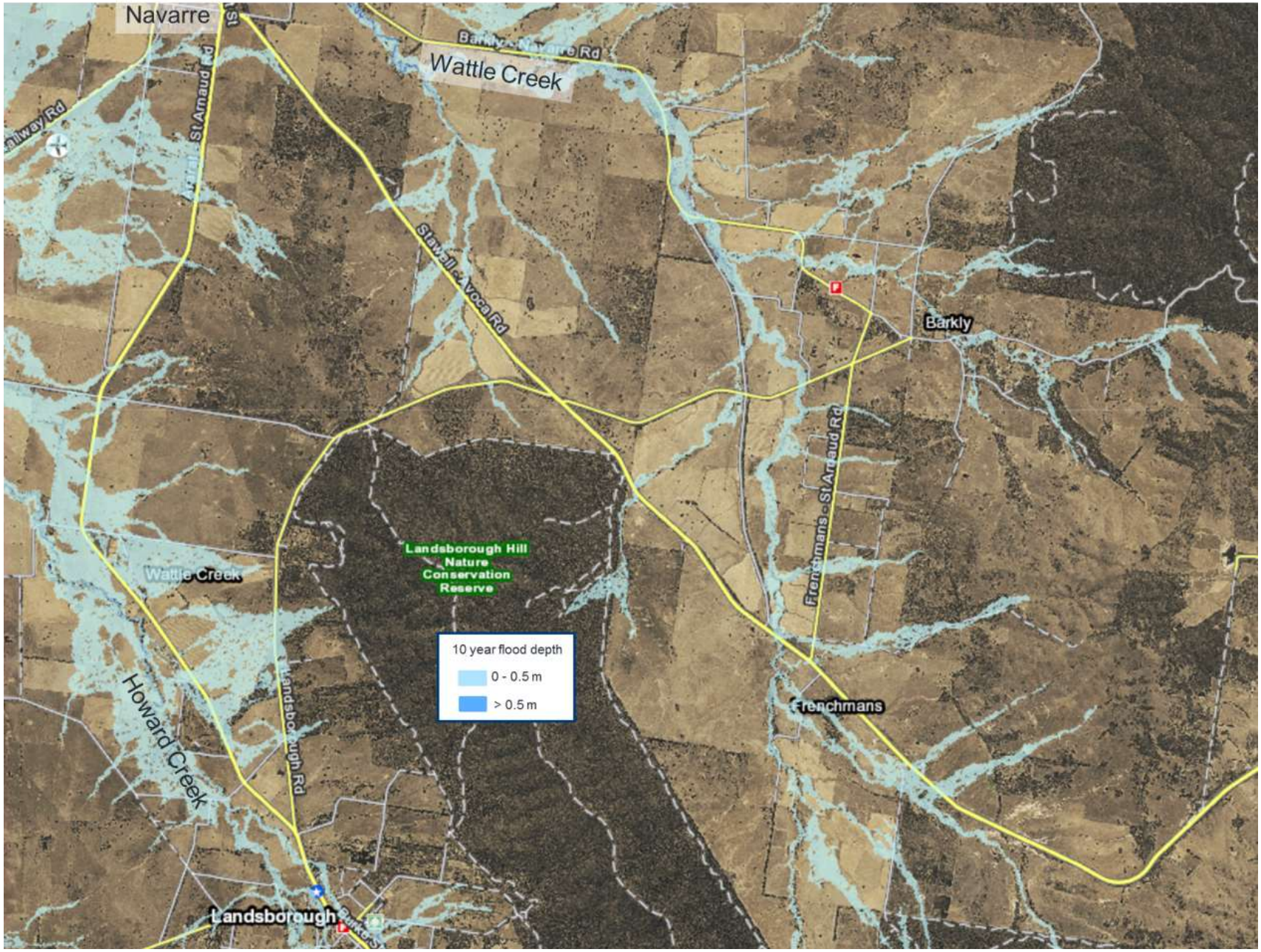
1.2. Lexton 100 year ARI flood extent map (Utilis 2018).



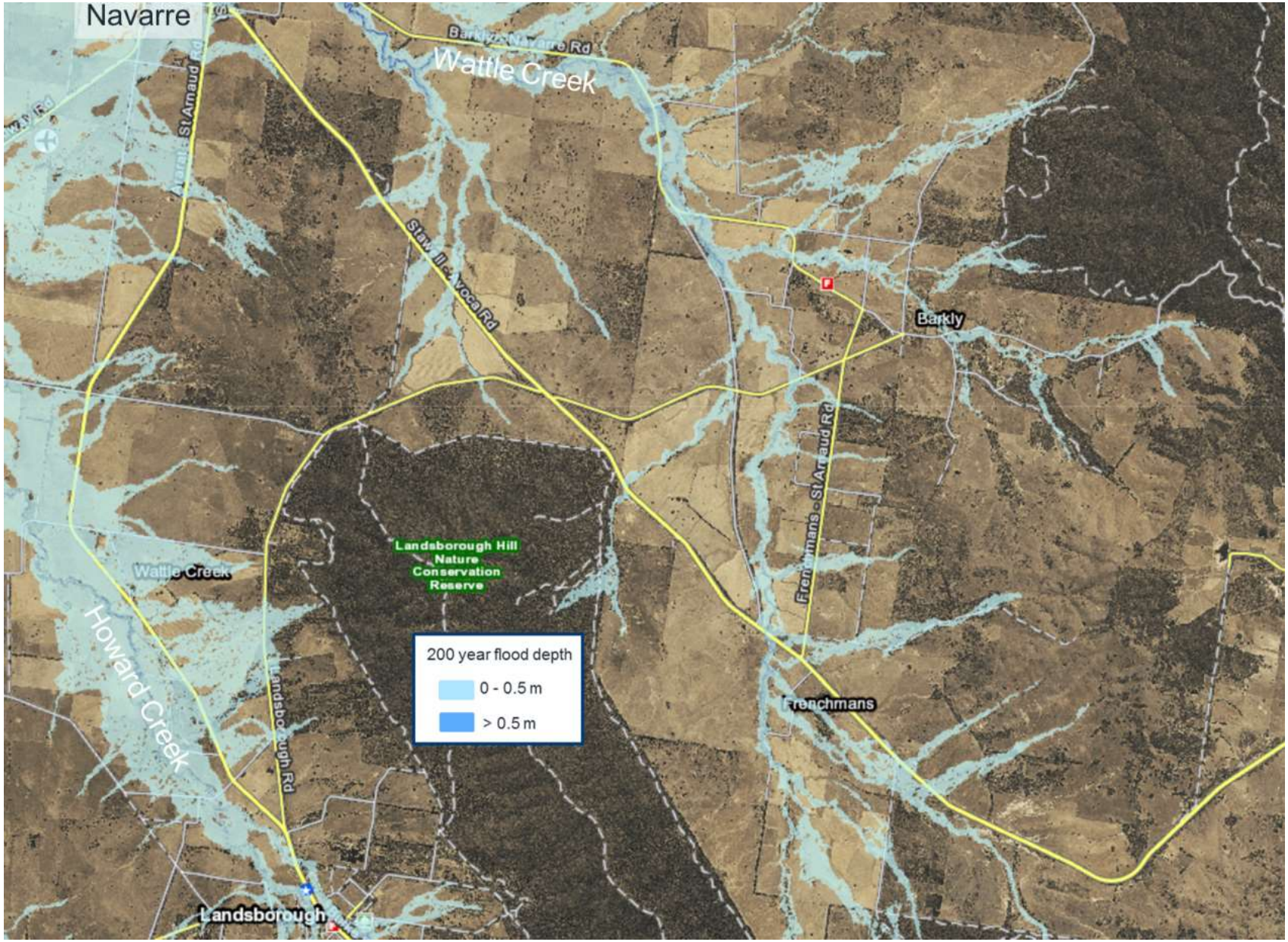
1.3. **Raglan** 100 year ARI flood extent map (Utilis 2018).



Upper Wimmera River Catchment (north) 10 year ARI flood extent map (Water Technology 2014).



Upper Wimmera River Catchment (north) 200 year ARI flood extent map (Water Technology 2014).

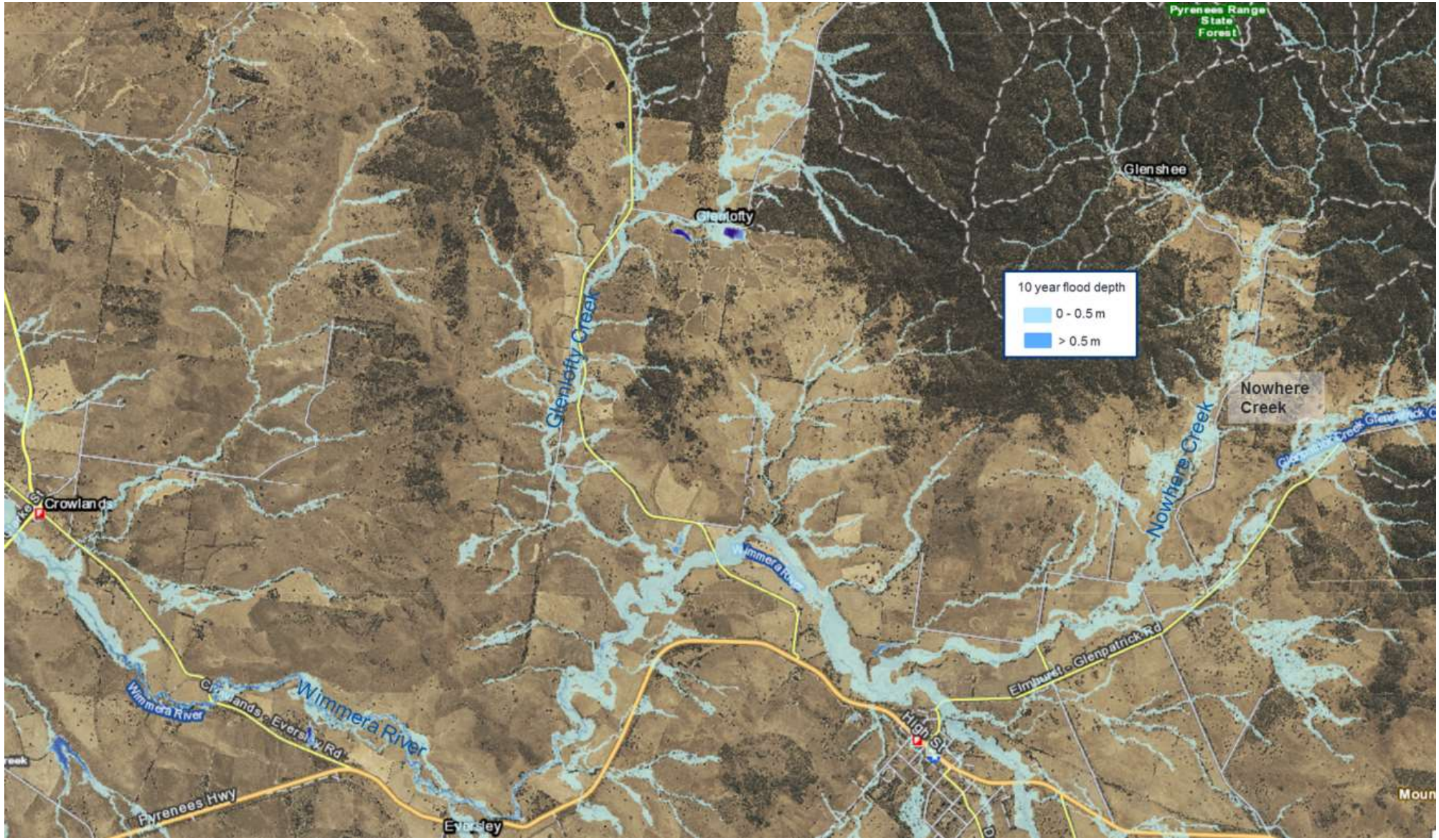


Landsborough 5 year ARI flood extent map (Water Technology 2014).

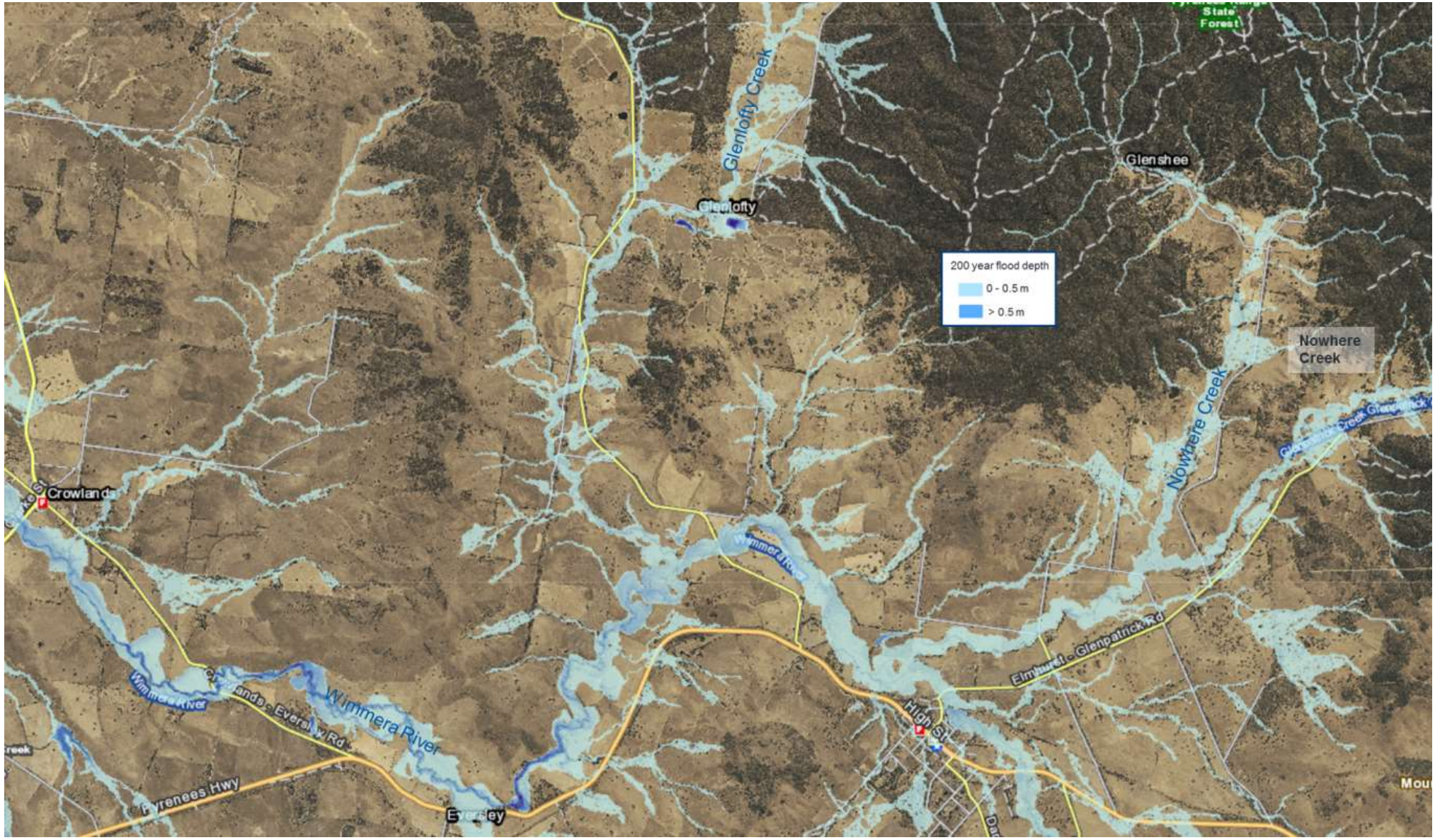
Landsborough 20 year ARI flood extent map (Water Technology 2014).

Landsborough 200 year ARI flood extent map (Water Technology 2014).

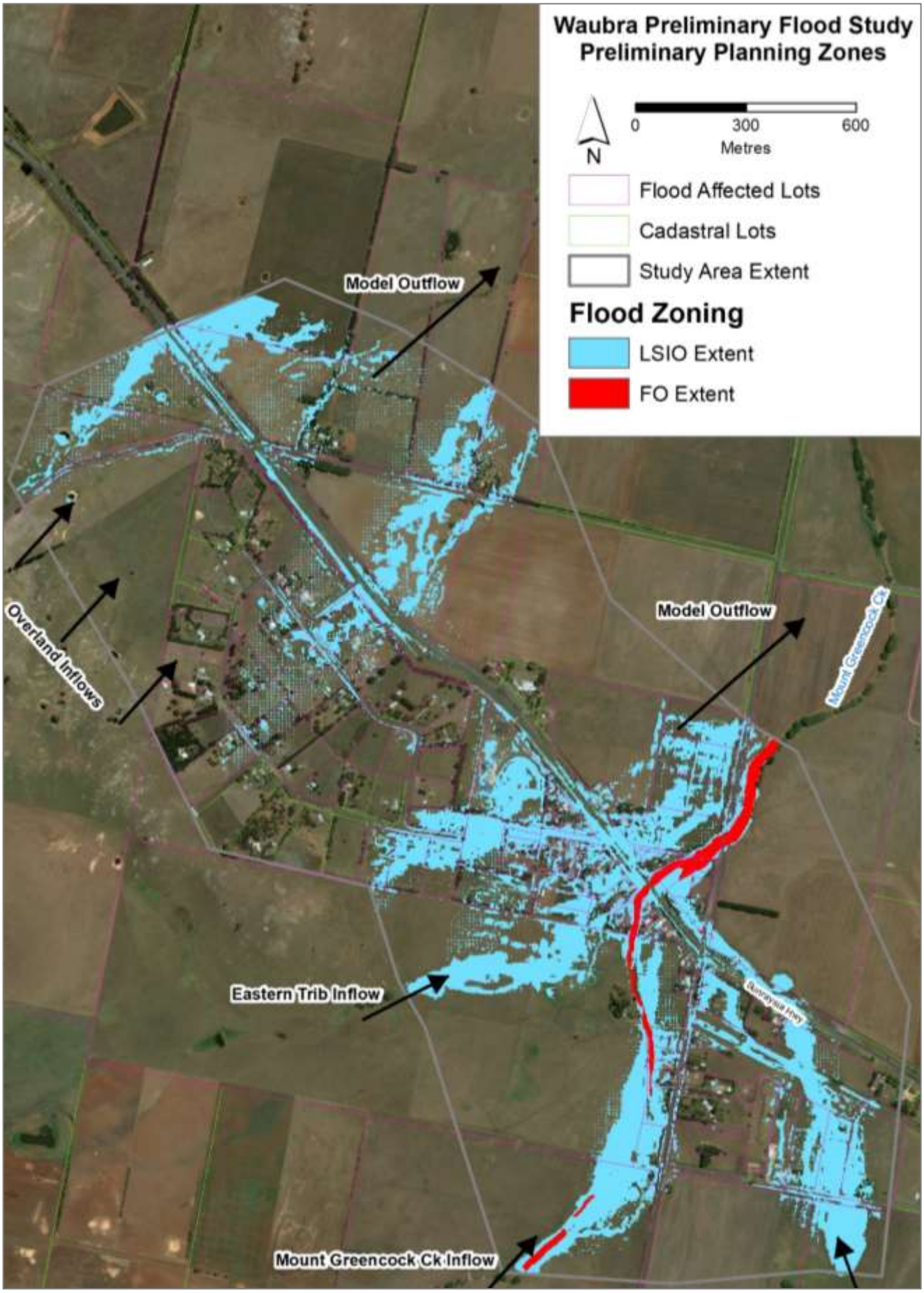
Upper Wimmera River Catchment (south) 10 year ARI flood extent map (Water Technology 2014).



Upper Wimmera River Catchment (south) 200 year ARI flood extent map (Water Technology 2014).



1.4. **Waubra** 100 year ARI flood extent map (Utilis 2019).

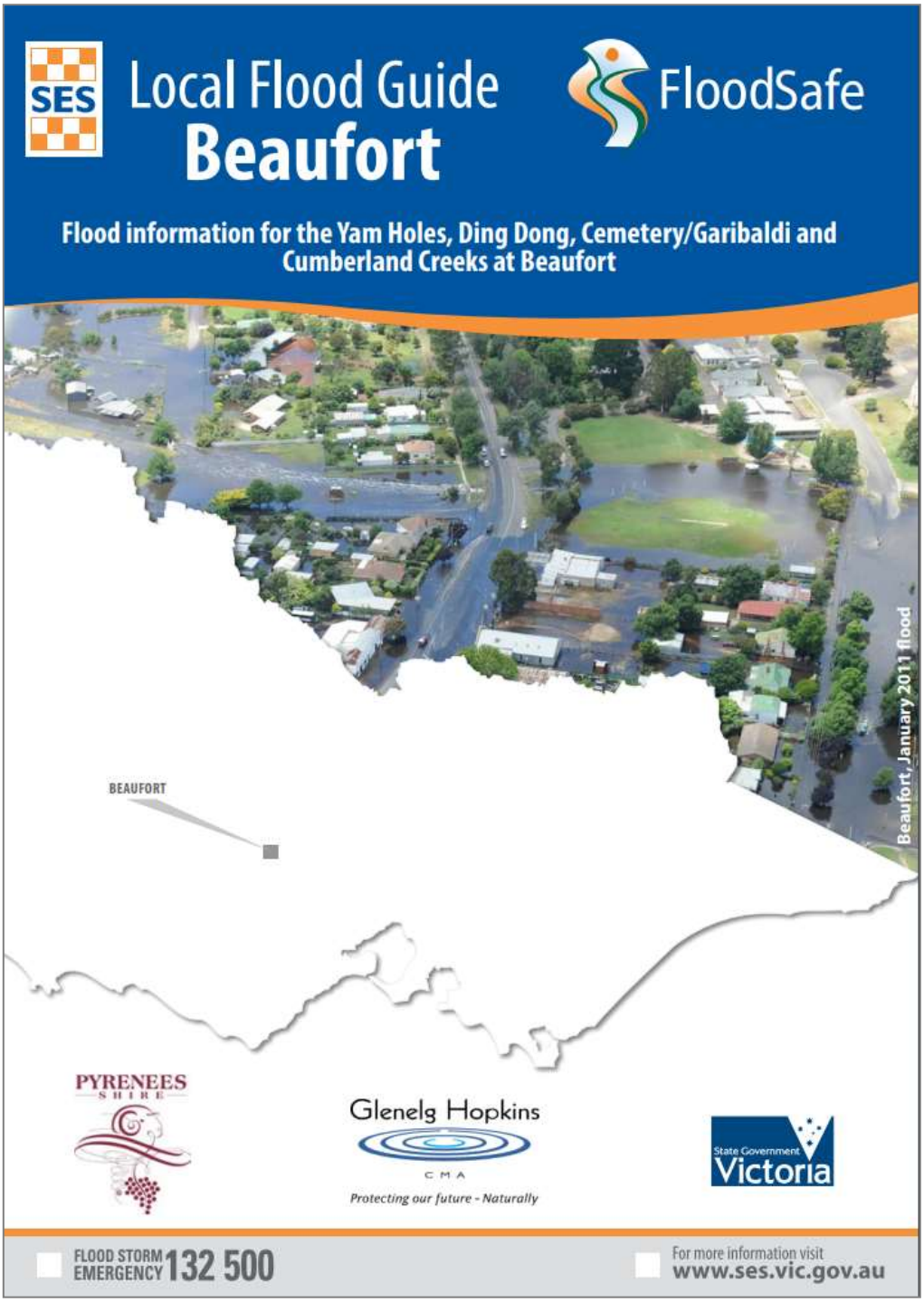


Appendix G: Local flood information

Two Local Flood Guides have been developed for the Pyrenees Shire Council;

- Refer to the link below for the Beaufort Local Flood Guide

https://www.ses.vic.gov.au/documents/112015/135215/Beaufort+Local+Flood+Guide.pdf/9d3860cc-3026-485b-989a-4ab2d868178a



Appendix H: Local knowledge arrangements

As control agency for flood in Victoria, VICSES is committed to ensuring the incorporation of local knowledge in decision making before, during and after incidents.

Information from community sources including but not limited to observations, historical information and information about current and possible consequences of an incident may be utilised to help inform the process of incorporating local knowledge into decision making during an incident. Community observers and agency staff will help support this process.

For the Pyrenees region community observers identified are:

Town	Observer Details	Community Observer Name	Contact Details
Beaufort	Beaufort CFA	David Gerrard	0412 700 812
Beaufort	Beaufort CFA	Colin Gerrard	0409 365 431
Beaufort	Beaufort CFA	Peter Gerrard	0438 393 103
Beaufort	Beaufort CFA	Rod McErvale	0429 497 230
Beaufort	Beaufort CFA	Craig McInnes	0428 375 443
North of Beaufort (on the Mt Emu Creek)	Beaufort CFA	Ashley McErvale	0408 995 218
Natte Yallock	Natte Yallock Primary School Principle	Kane Tolliday	5462 2386
Avoca	Avoca CFA	Aaron McHoul	0438 653 387
Avoca	Avoca CFA	Adam Beissert	0422 053 368
Avoca	Avoca CFA	Daryl Wardlaw	0418 384 869
Avoca	Avoca CFA	Brian Bearpark	0438 653 690
Landsborough	Pyrenees Shire Councillor	Cr Robert Vance	0447 384 500
Landsborough	Landsborough CFA	Garry Leslie	0488 929 950
Landsborough	Landsborough CFA	Peter Browne	0417 378 702
Landsborough	Landsborough CFA	Chris Sirre	0408 997 477
Landsborough	Landsborough CFA	Jason Hyde	0458 569 239
Lexton	Lexton CFA	Steven Wheeler	0438 667 217
Lexton	Lexton CFA	Darrell Robson	0418 302 920
Lexton	Lexton CFA	Ben Briody	0437 744 068
Lexton	Lexton CFA	Bryce Karslake	0429 920 888
Waubra	Waubra Post Office Manager	Karen Hinchliffe	5343 5300
Raglan	Raglan CFA	Bruce Tiley	0439 001 635
Raglan	Raglan CFA	Ian Crick	0428 497 213

Raglan	Raglan CFA	Adin Gillingham	0448 582 695
Raglan	Raglan CFA	Jeffrey Jarman	0419 880 354
Raglan	Raglan CFA	Trevor Thomson	0458 297 277
Mount Emu Creek, Lake Goldsmith Museum, Trawalla	President of the Lake Goldsmith Museum Committee	Trevor Oliver	0407 539 041

Appendix I: Pyrenees Community Sandbag Collection Points

Triggers to start prefilling sandbags and setting up community sandbag collection points;

- BOM flood watch has been issued for the town/catchment area
- Significant rainfall is predicted for the town/catchment area (greater than 50mm)
- BOM has high certainty the rainfall event will impact a town/catchment area listed below.
- Flooding is immanent

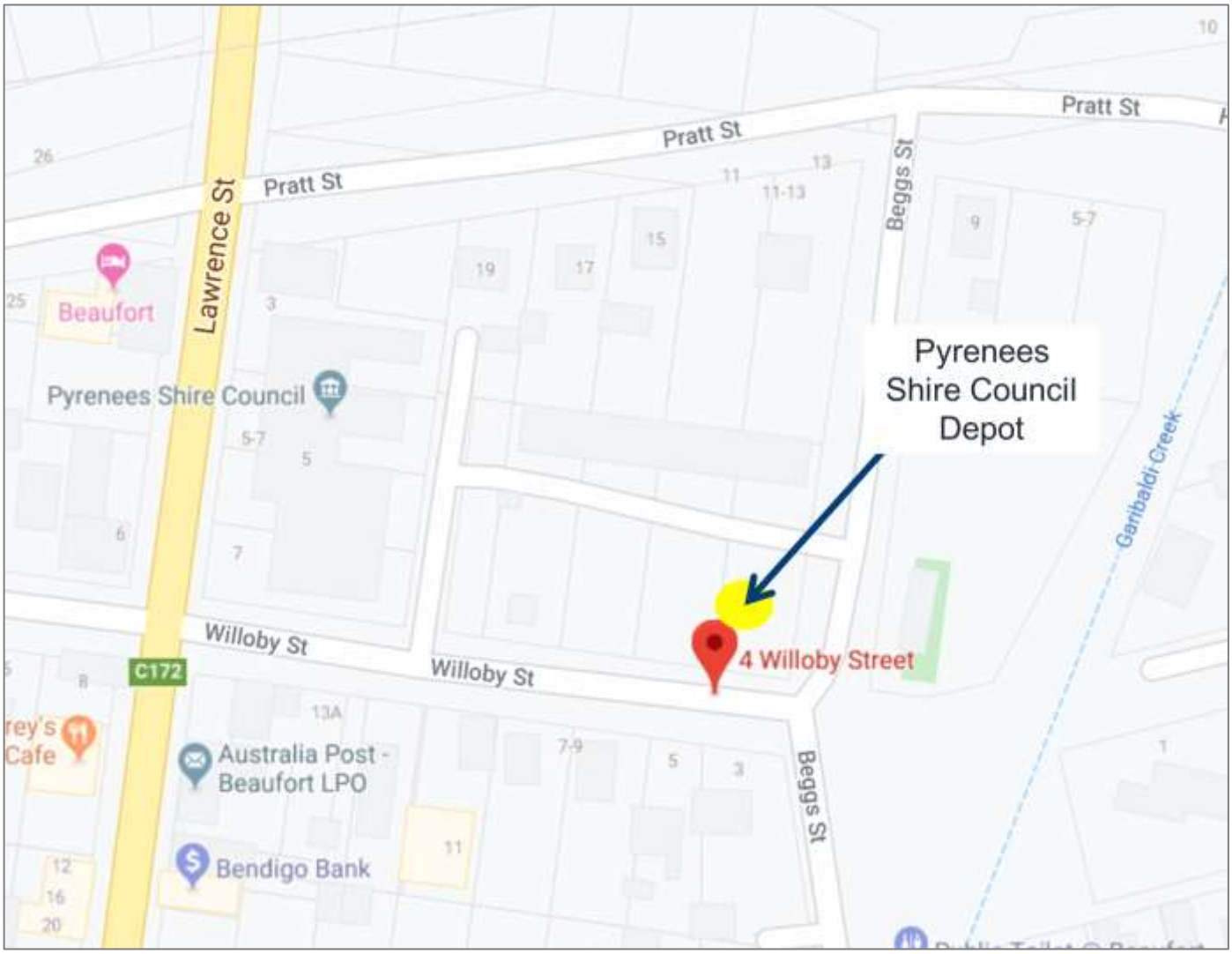
When needed community sandbag collection point will be set up at;

- Pyrenees Shire Council Depot: 4 Willoby Street, Beaufort.

Refer to the list below of key tasks that may be undertaken to prepare sandbag filling and community sandbag collection point.

Agency	Task Description
VICSES	Deliver sandbags to the council depot or other nominated sandbag filling point to prefill the sandbags.
Pyrenees Shire	Deliver sand to the community sandbag collection point as needed. Deliver sandbags to the Landsborough, Avoca, Raglan, Lexton and Waubra CFA stations as needed.
Pyrenees Shire / VICSES / CFA	Deliver prefilled sandbags either directly to buildings that need to be sandbagged or to the nominated community Sandbag collection point. Provide staff/volunteers to set up the community sandbag point. Provide staff/volunteers to distribute prefilled sandbags to the community.
Pyrenees Shire / VICSES	Notify the community of the location of the community sandbag collection point via local radio and social media channels.

Beaufort sandbag filling and community collection point: the Pyrenees Shire Council Depot, 4 Willoby Street, refer to map below.



References

Water Technology (2019): Mount Emu Creek Flood Investigation Calibration Report.

Utilis (2018): Lexton Preliminary Flood Study.

Utilis (2018): Raglan Preliminary Flood Study.

Utilis (2019): Waubra Preliminary Flood Study.

Water Technology (2008): Beaufort Flood Study Report.