Buloke Shire Council Municipal Flood Emergency Plan

A Sub-Plan of the Municipal Emergency Management Plan

Version 2.4 (Revision 4), June 2019

As at 03/12/2019 16:57

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Distribution List

Copy No.	Issue To:		Date
	Name	Organisation	
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	357 Broadway, Wycheproof	Council Office Copy	
	Cr David Pollard	MEMP Committee Chairman	
		Buloke MERO	
	Coordinator Asset Planning & Delivery	Buloke Deputy MERO	
		Buloke MRM	
		MERC (Charlton Police Station)	
		RERC	
	Officer In Charge	Charlton Police Station	
	TBA	Deputy MERC (Donald Police Station)	
	Regional Manager	VICSES North West RHQ	
	Regional Officer Emergency Management	VICSES North West Region Swan Hill Office	
	Divisional Command Point	Wycheproof CFA/SES facility	
	Controller	VICSES Wycheproof Unit	
	Controller	VICSES Birchip Unit	
		North Central Catchment Management Authority	
		Mallee Catchment Management Authority	
	Elma Kazazic	Bureau of Meteorology (Flood Warning)	
		DELWP (Swan Hill Office)	
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	Captain	CFA Donald	
	Captain	CFA Charlton	
	Captain	CFA Culgoa	
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		Grampians Wimmera Mallee Water	
	OIC Ambulance Victoria	Sea Lake Branch	
	Controller	St Arnaud	
	Regional Manager	Mid West Region	
	Russell Amery	MFEP Community Member	

	Greg Nunn	MFEP Community Member	
	Peter Watts	MFEP Community Member	
	Paul Fennell	Wimmera CMA	
	Brenten Hogan	Grampians Wimmera Mallee Water	
	Cameron Warne	MFEP Community Member	

Document Transmittal Form / Amendment Certificate

This Municipal Flood Emergency Plan (MFEP) will be amended, maintained and distributed as required by VICSES in consultation with the Buloke Shire Council. Suggestions for amendments to this Plan should be forwarded to VICSES North West Region, Swan Hill Office PO. Box 1700, Swan Hill Vic, or via email to northwest.office@ses.vic.gov.au.
Amendments listed below have been included in this Plan and promulgated to all registered copyholders.

Amendment Number	Date of Amendment	Amendment Entered By	Summary of Amendment
1			Full initial issue of Municipal Flood Sub-Plan Version 1.1
2			Full re-issue of amended Municipal Flood Emergency Plan
2.2	12 December 2016	Warren Hemopo	Post full re-issue of amended Municipal Flood Emergency Plan on Crisisworks (https://buloke.mecccentral.com)
2.3	10 July 2017	Warren Hemopo	Post full re-issue of amended Municipal Flood Emergency Plan on Crisisworks (https://buloke.mecccentral.com)
2.4	17 June 2019	Peter Patterson	New schematic and amendments to flood heights for Avoca River, map of new levees at Donald and inclusion of Flash Flood information for Birchip.

This Plan will be maintained by Council and VICSES North West Region and be available on the following websites www.ses.vic.gov.au or www.buloke.vic.gov.au.

List of Abbreviations & Acronyms

The following abbreviations and acronyms are used in the Plan:

AEP	Annual Exceedence Probability
AHD	Australian Height Datum (the height of a location above mean sea level in metres)
AIIMS	Australasian Inter-service Incident Management System
AoCC	Area of Operations Control Centre / Command Centre
ARI	Average Recurrence Interval
ARMCANZ	Agricultural & Resource Management Council of Australia & New Zealand
AV	Ambulance Victoria
BOM	Bureau of Meteorology
CEO	Chief Executive Officer
CERM	Community Emergency Risk Management
CFA	Country Fire Authority
CMA	Catchment Management Authority
RERC	Regional Emergency Response Coordinator
RERCC	Regional Emergency Response Coordination Centre
DEDJTR	Department of Economic Development, Jobs, Transport and Resources
DELWP	Department of Environment, Land, Water and Planning
DHHS	Department of Health and Human Services
EMMV	Emergency Management Manual Victoria
EMT	Emergency Management Team
EO	Executive Officer
FO	Flood Overlay
FWS	Flood Warning System
FZ	Flood Zone
IC	Incident Controller
ICC	Incident Control Centre
IEMT	Incident Emergency Management Team
IMT	Incident Management Team
IMS	Incident Management System
EMLO	Emergency Management Liaison Officer
LSIO	Land Subject to Inundation Overlay
MOCC	Municipal Operations Command Centre
MEMP	Municipal Emergency Management Plan
MEMPC	Municipal Emergency Management Planning Committee
MERC	Municipal Emergency Response Coordinator
MERO	Municipal Emergency Resource Officer
MFB	Metropolitan Fire and Emergency Services Board
MFEP	Municipal Flood Emergency Plan
MFEPC	Municipal Flood Emergency Planning Committee
MRM	Municipal Recovery Manager
PV	Parks Victoria
PMF	Probable Maximum Flood
RC	Regional Controller
RCC	Regional Control Centre
RDO	Regional Duty Officer
REMT	Regional Emergency Management Team
SBO	Special Building Overlay

SC	State Controller
SCC	State Control Centre
SEWS	Standard Emergency Warning System
SHERP	State Health Emergency Response Plan
SOP	Standard Operating Procedure
VicPol	Victoria Police
VICSES	Victoria State Emergency Service

Part 1. INTRODUCTION

1.1 Endorsement

This Municipal Flood Emergency Plan (MFEP) has been prepared by Buloke Shire Municipal Flood Emergency Planning Committee (MFEPC), with the authority of the Buloke Shire Council pursuant to Section 20 of the Emergency Management Act 1986 (as amended) and Parts 6 & 7 of the Emergency Management Manual Victoria (EMMV).

The MFEPC has consulted with the Buloke communities about the arrangements contained within this plan.

Specific flood emergency response arrangements are to be developed for the communities of Charlton, Donald and Culgoa.

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

The Municipal Flood Emergency Plan is consistent with the Regional Flood Emergency Plan and the State Flood Emergency Plan.

This MFEP is a result of the cooperative efforts of the MFEPC, member agencies and community resilience participation.

This Plan is endorsed by the MFEPC, and the MEMPC, as a sub-plan to the MEMP.

Provisional Endorsement, Subject to formal acceptance by Buloke MEMPC.

Signed:…… Date……
Cr David Pollard
Chair
Buloke Shire Municipal Flood Emergency Planning Committee

Approved by Victoria State Emergency Service North West Region

Signed: …… Date……
Mr John Parker
Regional Manager
North West Region
Victoria State Emergency Service

1.2 The Municipality

1.2.1 General

Covering an area of 8,020 square kilometres, the Buloke Shire Council is situated in the North-Western part of Victoria, includes five main townships of Sea Lake, Wycheproof, Charlton, Donald and Birchip. Smaller townships within the municipality include Nandaly, Berriwillock, Culgoa, Nullawil and Watchem.

1.2.1.1. Topography

The South East corner of the Shire consists mainly of hilly country, from which extensive rainfall run off feeds the Avoca River system, which includes the Lalbert and Tyrrell Creek. There are numerous road floodway's both on the Calder Highway, arterial and local roads, which are flooded by these stream flows. The Donald area of the Shire is also affected by flood flows of the Avon-Richardson River. This area is identified as the "wedge shape" being bound by the Donald Stawell road and Sunraysia Highway, with the Laen Cope Cope road closed for up to 3 months during major flood events. The area is well serviced by a good network of roads, with the Sunraysia and Calder Highways being the main North-South links.

1.2.1.2. Climate

Average rainfall is in the range of 280 – 550mm per year, with mild to hot summers and occasional frosts during winter.

1.2.1.3. Geographical description of relevant rivers:-

Avoca River

The Avoca River forms part of the Southern boundary of the Municipality. The Avoca River has a long history of flood events dating back to last century, recorded flood events began in 1870. The flood of record was in 1939 prior to levee banks, after levee banks 1956, 1964, 1973, 1975, 1981, 1983, 1988, 1995. Three significant flood events occurred in September and November of 2010 and January 2011.

Charlton Township is partly protected by a 5% AEP (1 IN 20 year ARI) flood event levee bank to the south-west of the township. Inundation of rural land adjacent to the river occurs between Coonooer Bridge and Ninyeunook.

The Bureau of Meteorology provides flood forecasting information this information can be found at: www.bom.gov.au/vic/flood/

Avon-Richardson River

The Avon-Richardson River catchment consists of an extensive network of streams in central Victoria covering an area of 3,300 km^2, the river itself is approximately 25 km in length. The river flows through the township of Donald, terminating at Lake Buloke (i.e. does not flow into the sea, and is often land locked by geographical features).
Wimmera River overflow at Swedes Cutting (east of Glenorchy) directs flood water into the Richardson River north-west of Bismark. The Avon and Richardson Rivers converge at Banyena.

The Avon-Richardson River has a long history of flooding dating back to last century with recorded flood events in 1909, 1918, 1956, 1975, 1992, September and November 2010.
The highest recorded flood event was January 2011 which was 200mm higher than the previous flood of record (1909).
Grampians, Wimmera Mallee Water provides guidance flood forecasting information in relation to the Rich-Avon Weir.
Flood waters from the Avon-Richardson River affect various lands adjacent to the River.

Lalbert & Tyrrell Creek

The Lalbert and Tyrrell Creeks are part of the Avoca River floodplain and were used by Grampians Wimmera Mallee Water as part of their stock and domestic water channel delivery system. Both Creeks overflow in larger floods, will have a flow-on effect further downstream, impacts will vary depending on stream flows. During the 2010 and 2011 flooding events, these creek systems impacted South Wycheproof and Culgoa area's to various degrees:
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1.2.2 Vulnerable Areas

Buloke Shire can experience flooding in various parts of the Municipality. Streams and drainage courses affecting the Municipality are described in Section 1.2 (**See Maps at Appendix F).**

In addition to flooding from streams, a number of areas of the Municipality flood as a result of stormwater flows exceeding the capacity of drainage systems in urban areas to cater for these flows.

Charlton and Donald are particularly susceptible to flooding of this nature, Wycheproof may also experience this type of flooding in extreme circumstances.

The township of Birchip may experience flash flooding issues as a consequence of significant rainfall in or around the local town area.

A large number of rural residences within the municipality will be isolated during a moderate to major flood event, the details of these properties are contained in Appendix G.

The following is a description of the particular flooding issues experienced within the Municipality.

1.2.2.1. Avoca River & Charlton Township

The lower reaches of the river (i.e. downstream of Charlton) pass through the relatively flat lands of the Riverine Flood Plain. This land has been extensively cleared for agriculture. The urban area of Charlton is partly protected by a 5% AEP (1 in 20 ARI) levee bank. In the event of the Avoca River experiencing a major flood, extensive flooding is expected to occur necessitating appropriate action to be taken. The Charlton township experiences large flooding events after a long period of general rainfall which fills the natural floodplain storage, followed by moderate to heavy rainfall over a period of 12 hours or more.

Typically, the flood peak occurs two or so days after the heavy rain.

During the 1939, 56, 87, 90, 95 and 2010/11 floods, outlying areas of Charlton were flooded and various roads were closed including:

- Calder Highway (Woosang)
- Calder Highway between Charlton and Quarry Hill,
- Calder Highway between Wycheproof-Charlton

- Charlton – St Arnaud Road,
- Boort-Wycheproof road at Avoca River and Tyrrell Creek,
- Boort-Charlton Road. at Charlton and Lake Marmal,
- Donald – Swan Hill Road at Dumosa.
- Sea Lake – Swan Hill Road
- Nullawil – Quambatook Rd.

During the 2010/11 flooding events, 80% of the town was affected mainly to the south of the Avoca River Bridge

1.2.2.2. Avon Richardson River & Donald Township

During the 2010/11 flood events the following roads streets and houses that are known to be affected include:-

- Camp and Byrnes Streets are closed
- Donald South, Donald Avon Plains and Laen Cope Cope Roads are closed
- Corack Road between the Caravan Park and Showgrounds has water over it to depth of 600mm and would require road closure signage

1.2.3 History of Flood Events

Periodical flooding of the Avoca and Avon Richardson Rivers and local streams has over the years generated the most significant of all emergencies within the Buloke Shire area.

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1.2.3.1 History of Flood Events in Charlton and Donald

The most recent series of flood events occurred between September 2010 and January 2011

The Buloke Shire Council Planning Scheme identifies areas subject to flooding throughout the Shire. This information is shown in the form of overlays to the Planning Scheme maps.

The Planning Scheme maps identify land subject to flooding in two categories:-

- Flood overlay
- Land subject to inundation overlay.

It should be noted that the areas shown on the maps are based on information supplied by the DELWP flood planning maps for the Buloke Shire and from local knowledge.

The information is incomplete for certain sections of the Shire and so care needs to be taken when using this information.

The flood overlay plans can be found in Appendix F and can also be viewed at the Buloke Shire Council Office at 367 Broadway, Wycheproof.

Data relating to floods can be obtained from various sources as listed below:-

- The Regional and Local State Emergency Service
- Grampians Wimmera Mallee Water
- North Central, Mallee and Wimmera Catchment Management Authorities
- Buloke Shire Council
- Department Environment, Land, Water and Planning (DELWP).

- A summary of the information from these agencies has been used to formulate this MFEP.

An outline of the flood threat is provided in Appendix A of this MFEP.

1.3 Purpose and Scope of this Municipal Flood Emergency Plan

The purpose of this MFEP is to detail arrangements agreed for the planning, preparedness/prevention, response, relief and recovery from flood incidents within the Buloke Shire,

As such, the scope of the Plan is to:

- Identify the Flood Risks;
- Support the implementation of measures to minimise the causes and impacts of flood incidents;
- Detail Response and Recovery arrangements including preparedness, Incident Management, Command, Control and Coordination;
- Identify linkages with Local, Regional and State emergency and wider planning arrangements with specific emphasis on those relevant to flood.

1.4 Municipal Flood Emergency Planning Committee (MFEPC)

Membership of the Municipal Flood Emergency Planning Committee (MFEPC) will comprise of the following representatives from the following agencies and organisations:

- .Councillor **(Chair)**
- VICSES Regional Officer – Emergency Management
- VICSES Unit Controller Wycheproof/Birchip
- Municipal Emergency Resource Officer (MERO)
- Municipal Emergency Response Co-ordinator (MERC)
- North Central Catchment Management Authority
- Mallee Catchment Management Authority
- Wimmera Catchment Management Authority
- Country Fire Authority District 18 as required
- Department of Health and Human Services (DHHS) as required
- Department of Environment, Land, Water and Planning as required
- Grampians Wimmera Mallee Water
- Bureau of Meteorology as required,
- Local community representatives
- Other agencies as required

1.5 Responsibility for Planning, Review & Maintenance of this Plan

This Municipal Flood Emergency Plan must be maintained in order to remain effective.

Buloke Shire Council and VICSES through the MFEPC has responsibility for preparing, reviewing, maintaining and distributing this MFEP.

The MFEPC will meet on at least two occasions per year, with the preferred dates being the First Friday in March and August.

The plans should be reviewed:

- Following any new flood study;
- Change in non-structural and/or structural flood mitigation measures;
- After the occurrence of a significant flood event to review and where necessary, amend arrangements and information contained in this MFEP.

1.6 Endorsement of the MFEP

The MFEP will be circulated to members of the MFEPC to seek acceptance of the revised plan.

Upon acceptance, the MFEP will be forwarded to the MEMPC for endorsement with the recommendation to include the revised MFEP as a sub-plan of the MEMP.

1.7 Adoption of the MFEP

Upon MEMPC endorsement, the revised MFEP shall be presented to Council for adoption.

Part 2. PREVENTION / PREPAREDNESS ARRANGEMENTS

2.1 Community Awareness for all Types of Flooding

The MFEP will be released to the community through local media, the FloodSafe program, websites (VICSES and the Municipality) upon formal adoption by the Buloke Shire.

VICSES with the support of the Buloke Shire will coordinate community education programs for flooding within the Council area (e.g. FloodSafe / StormSafe).

A Community Education Plan (CEP) to support this MFEP will be developed in conjunction with local VICSES Units. Local VICSES Units will lead the delivery of the CEP with support from the Buloke Shire and VICSES North West Region.

2.2 Structural Flood Mitigation Measures

The following summary of structural flood mitigation measures exist within the Council area:

A number of formal and informal levees exist within the municipality. Some of these levees have been constructed to contain floodwaters within rivers and streams, whilst others have been established to prevent floodwaters impacting properties.

2.2.1 Donald

2.2.1.1 A new levee system has been constructed (to 600 mm < 1% event) on the Richardson River adjacent to the Donald township this was identified in the flood and drainage management plan and covers the following sections:

2.2.1.2

Levee 1- Donald Swimming Pool

Earthen levee which protects properties (approximately Campbell to South Streets) adjacent to swimming pool area from Richardson River

Levee 2 – Township

Earthen levee to protect properties north-east of Richardson River (approximately Blair Street to Sunraysia Highway and earthen/retaining wall levee south-east of Richardson River (adjacent to Riverside Motel).

Levee 3 – Johnson Goodwin Village

Earthen/retaining wall levee to protect properties west of Richardson River (Johnson Goodwin Village and north of Camp Street)

Levee 4 – Elizabeth Street

Earthen levee to protect properties east of Richardson River (adjacent to Elizabeth Street)

There are 2 gaps in the new levee system this is due to council and major roads intersecting the banks. Options are currently being investigated to “filling” in these gaps during a flood emergency this includes the construction of a temporary levee.

Appendix F2, page 142, shows the extent and gaps of the new levee system

2.2.2 Charlton

2.2.2.1 The south of the township is partly protected by a small 300 metre long levee which provides up to the 5% AEP (1 in 20 year ARI) flood protection. The protection this levee offers is minimal.

2.2.2.2 The Charlton flood and drainage management plan proposes construction of new levees, creek crossing works and minor drainage improvements, as follows:

Levee 1 – Township ring levee (priority treatment)

Earthen levee to protect properties from Calder Highway (adjacent to Boort Charlton Road) to Arundell Street (east of Avoca River)

Levee 2 – Township northern levee (priority levee)

Earthen levee to protect properties from Borung Highway to Calder Highway (north of Avoca River)

Creek crossing works – Charlton St Arnaud Road

Reinstatement of Gowar Creek floodway

Minor drainage improvements

Regrading of open swale and piped urban stormwater drains to mitigate against flash flooding; and incorporation of piped non-return riverine flooding past urban levees.

There are no retarding basins within the municipality, notwithstanding there are a number of river weirs, weir pools and stream in-line dams.

Refer to appendix C for detailed information of structural flood mitigation measures.

2.3 Non-structural Flood Mitigation Measures

2.3.1 Exercising the MFEP

Arrangements for exercising this MFEP will be at the discretion of the MEMPC and MFEPC. This MFEP should be regularly exercised, preferably on an annual basis. Refer to Part 6, Section 6.2 of the EMMV for guidance.

2.3.2 Flood Warning

Arrangements for flood warning are contained within the State Flood Emergency Plan; the EMMV (Part 3.11); Victorian Warning Protocol; Australian Government Bureau of Meteorology (**BOM**) Service Level Specification for Flood Forecasting and Warning Services of Victoria; and on the BOM website at www.bom.gov.au/vic/flood/

Specific details of local flood warning system arrangements are provided in appendix E.

2.3.3 Flood Observers

Flood Observers provide a means of gathering information in real time on flood behaviour along a stream system, and a network for the distribution of community information and warnings to the community along the stream system.

The following arrangements for Flood Observers have been established:

- An informal network of flood observers has been established along the Avoca River system this involves local landholders and farmers who have a good understanding of river flows and behaviour around their properties
- At this stage there is no agreed formal structure/process on how this intelligence is passed on and this needs to be further developed.
- The following interim process has been developed. On the issue of a moderate to major flood warning the nominated Divisional Command location will arrange to contact the observers and this will be the conduit for information flow.

Part 3. RESPONSE ARRANGEMENTS

3.1 Introduction

3.1.1 Activation of Response

Flood emergency response arrangements may be activated by the North West Regional Duty Officer (RDO) VICSES or the Incident Controller.
The VICSES Incident Controller/RDO will activate agencies as required and documented in the North West Regional Flood Emergency Plan.

3.1.1.1 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 flood within the Buloke Shire. These agencies will be engaged through the EMT.
Roles and responsibilities of supporting agencies are as agreed within the MFEP, MEMP, EMMV (Part 7 'Emergency Management Agency Roles'), Regional Flood Emergency Plan and State Flood Emergency Plan, respectively.

3.1.2 Municipal Operations Command Centre (MOCC)

Liaison with the MOCC will be through the Division/Sector Command where established and through Municipal involvement in the Incident Emergency Management Team, in particular via the Municipal Emergency Response Coordinator (MERC). The VICSES RDO / ICC will liaise with the MOCC via a Council or LGA EMLO if no Division/Sector Command is established.
The function, location, establishment and operation of the MOCC will be as detailed in the MEMP.

3.1.3 Escalation

Most 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 the EMMV (Part 3 'State Emergency Response Plan' – section 3.12).

3.2 Strategic Control Priorities

To provide guidance to the Incident Management Team (IMT), the following strategic control priorities shall form the basis of incident action planning processes:

1. Protection and preservation of life is paramount - this includes:
   a. Safety of emergency services personnel
   b. Safety of community members including vulnerable community members and visitors/tourists located within the incident area
2. Issuing of community information and community warnings detailing incident information that is timely, relevant and tailored to assist community members make informed decisions about their safety
3. Protection of critical infrastructure and community assets that support community resilience
4. Protection of residential property as a place of primary residence
5. Protection of assets supporting individual livelihoods and economic production that supports individual and community financial sustainability
6. Protection of environmental and conservation values that consider the cultural, biodiversity, and social values of the environment

Circumstances may arise where the Incident Controller is required to vary these priorities, with the exception being that the protection of life should remain the highest. This shall be done in consultation with the Regional and/or State Controller and relevant stakeholders based on sound incident predictions and risk assessments.

3.3 Control, Command & Coordination

The, Control, Command and Coordination arrangements in this MFEP must be consistent with those detailed in Regional and State Flood Emergency Plans. For further information, refer to the EMMV, Part 3- Sections 3.2-3.7.

The specific details of the Control, Command and Coordination arrangements for this MFEP are to be provided in Appendix C.

3.3.1 Control

Functions 5(a), 5(b) 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.
The EMMV (Part 7), 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
All flood emergency response activities within the Buloke Shire including those arising from a dam failure or retarding basin/levee bank failure or incident will therefore be under the control of the appointed Incident Controller, or his/her delegated representative.

3.3.2 Incident Controller (IC)

An Incident Controller (IC) will be appointed by the VICSES (as the legislated Control Agency) to control 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 and provide direction to supporting agency commanders. The Incident Controller responsibilities are as defined in the EMMV (Part 3 – Section 3.5 'Control).

3.3.3 Incident Control Centre (ICC)

As required, the Incident Controller will establish an Incident Control Centre (ICC) from where 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 Incident Control Centre locations are:

Level 3

- Bendigo Cnr Midland Highway and Taylor Street Epsom (DELWP complex)
- Mildura Cnr 11th Street and Koorlong Avenue (DELWP complex)

Level 2

- Swan Hill 17 Rutherford Street (North West SES Regional Office)
- Kerang 58 Fitzroy Street (CFA District 20 HQ)

3.3.4 Divisions and Sectors

To ensure that effective Command and Control are in place, the Incident Controller may establish Divisions and Sectors depending upon the complexity of the event and resource capacities.

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

Division	Sector
Wycheproof	Wycheproof
	Donald
	Charlton
	Culgoa
	Birchip

Pre-determined Division Command locations are:

- Wycheproof Joint SES/CFA building 69-71 Dempsey Street Wycheproof

Pre-determined Sector Command locations are:

- Donald
- Charlton
- Culgoa
- Wycheproof
- Birchip

3.3.5 Incident Management Team (IMT)

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

Refer to 3.5 of the EMMV for guidance on IMTs and Incident Management Systems (IMSs).

3.3.6 Emergency Management Team (EMT)

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

Organisations, including the Buloke Shire, are required within the EMT and will be requested to 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 the EMMV (Part 3 – Section 3.7.4) for guidance on EMTs.

3.3.7 On Receipt of a Flood Watch / Severe Weather Warning

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

- Review flood intelligence to assess likely flood consequences
- Monitor weather and flood information – www.bom.gov.au
- Assess Control, Command and Coordination 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 and other emergency services through the EMT.
- Assess ICC readiness (including staffing of IMT and EMT) and open if required
- Ensure flood bulletins and community information are prepared and issued to the community
- Monitor watercourses and undertake reconnaissance of low-lying areas
- Develop media and community information management strategy
- Ensure flood mitigation systems/works are being checked by owners/operators
- Develop and issue incident action plan, if required
- Develop and issue situation report, if required

3.3.8 On Receipt of the First and Subsequent Flood Warnings

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

- Develop an appreciation of current flood levels and predicted levels.
- Confirm whether floodwaters are 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

3.4 Community Information and Warnings

Guidelines for the distribution of community information and warnings are contained in the State Flood Emergency Plan.

Community information and warnings communication methods available include:

- Emergency Alert
- Phone messages (including SMS)
- Radio, Community Radio and Television
- Two-way radio
- Mobile and fixed public address systems
- Sirens
- Verbal Messages (i.e. Doorknocking)
- Agency Websites
- VICSES Flood Storm Information Line
- Variable Message Signs (i.e. road signs)
- Community meetings
- Newspapers
- Email
- Telephone trees
- Community Flood Wardens
- Fax Stream
- Newsletters
- Letter drops
- Social media and/or social networking sites (i.e. twitter and/or face book)

Refer to Appendix C and E for the specific details of how community information and warnings are to be provided.
The release of flood bulletins and information with regard to response activities at the time of a flood event is the responsibility of VICSES, as the Control Agency.

Council has a responsibility to assist VICSES to warn individuals and the community, this may include the activation of flood warning systems, where they exist.

Responsibility for public information, including media briefings, rests with VICSES as the Control Agency.

Other agencies such as CFA, DELWP and VICPOL may be requested to assist VICSES with the communication of community flood warnings.

In cases where severe flash flooding is predicted, dam failure is likely or flooding necessitating evacuation of communities is predicted, the Incident Controller may consider the use of the Emergency Alert System and Standard Emergency Warning System (SEWS).

DHHS will coordinate information regarding public health and safety precautions.

3.5 Media Communication

The Incident Controller through the Information Unit established at the ICC will manage Media communication. If the ICC is not established the RDO will manage all media communication.

3.6 Initial Impact assessment

An initial impact assessment (IAA) will be conducted in accordance with Part 3 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 Council, DHHS and recovery agencies.

3.7 Preliminary Deployments

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

3.8 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 Flood Emergency Plan.

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 advising them not to attempt to flee by entering floodwater if they become trapped, and that it may be safer to seek the highest point within the building or surrounding area and to telephone 000 if they require rescue. This advice needs to be provided even when evacuation may be possible, due the likelihood that not all community members will evacuate.
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.

During a flash flood it will often be difficult, due the rapid development of flooding, to establish emergency relief centres ahead of actually triggering the evacuation as is normal practice but this is insufficient justification for not adopting evacuation.

3.9 Evacuation

The decision to recommend or warn people to prepare to evacuate or to evacuate immediately rests with the Incident Controller.

Once the decision is made, VicPol are responsible for the management of the evacuation process. 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 the EMMV (Part 3 – Section 3.11.2) and the Evacuation Guidelines for guidance of evacuations for flood emergencies.

Refer to Appendix D of this Plan for detailed evacuation arrangements for Buloke Shire (nb: this is yet to be completed)

3.10 Flood Rescue

Victoria Police are the responsible agency for rescue from land or water within Victoria.

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.

NOTE: There are no specialised Swift Water Rescue resources within the Buloke Shire. Should these resources be required they will need to be accessed through the ICC/VICSES Regional Duty Officer.

3.11 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 Incident Controller.

The Incident Controller may request aircraft support through the State Air Desk located at the State Control Centre who will establish priorities.

Suitable airbase facilities are located at (nb: refer to MEMP Maps 17-22):

- Charlton Aerodrome, Charlton/St Arnaud Road (nb the road may be inundated during a Major flood event)
- Helipad located at the Charlton Hospital, 2 Learmonth Street, Charlton
- Charlton Secondary School Oval, at Davies Street, Charlton
- Grainflow facility at Windsor Avenue, Charlton
- Helipad located at the Donald Hospital Cnr, Donald-Stawell Road & Sunraysia Highway
- Donald Aerodrome at Jeffcott Road, Donald.

3.12 Resupply

Communities, neighbourhoods or households can become isolated during floods as a consequence of road closures or damage to roads, bridges, floodways 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.

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

Refer to Appendix C for further specific details of essential infrastructure requiring protection and Appendices F5 and I for location of sandbag filling/distribution point(s).

3.14 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 Buloke Shire.

3.15 Road Closures

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

VICROADS and the Buloke Shire will communicate community information regarding road closures.

3.16 Dam 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.

Although there are no major dams with potential to cause structural and community damage within the Municipality, however in the flood event of 1973 the feed lot dam ruptured which did

cause some major issues as it flowed into the Yeungroon Creek system, the main impact was on the rural community downstream.

3.17 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 responsible 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 Buloke Shire Environmental Health Officer to inspect and report to the MERO and the ICC on any water quality issues relating to flooding (nb this may be done in consultation with Grampians Wimmera Mallee Water).

3.18 After Action Review

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

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

Part 4. EMERGENCY RELIEF AND RECOVERY ARRANGEMENTS

4.1 General

Arrangements for recovery from a flood incident are detailed in the MEMP.

4.2 Emergency Relief

The decision to recommend the opening of an emergency relief centre rests with the Incident Controller. Incident Controllers are responsible for ensuring that relief arrangements have been considered and implemented where required under the State Emergency Relief and Recovery Plan (EMMV, Part 4).
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 the EMMV (Part 4 Section 6) for details of the range of emergency relief services that may be provided.
Identified Relief Centres including locations and the contact details of each are contained within the MEMP.

Details of the relief arrangements are contained 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 DEDJTR.

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

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

The following facilities are available should they be required;

- Buloke Shire pound Wycheproof (domestic animals only, minimal capacity)
- Wycheproof Sale Yards (capacity for sheep only)
- Temporary yarding facilities (Birchip)
- Portable yarding facilities

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 the EMMV (Part 3 Section 3.13).

An Officer of VICSES will be appointed to undertake the role of Transition Officer.

APPENDIX A1 – FLOOD THREATS FOR THE AVOCA RIVER

1. General

The part of the Avoca River catchment within Buloke Shire extends from Coonooer Bridge (4.4km upstream of Yawong Weir) downstream to approximately 12km north (downstream) of the Boort-Wycheproof Road (i.e. Ninyeunook), all of Tyrrell Creek and parts of Lalbert Creek (i.e. from Ninyeunook to the Rural City of Swan Hill boundary).

It is noted that:

- The west bank of the Avoca River upstream of Coonooer Bridge (as far as Dooboobetic) is within the **Shire of Northern Grampians**
- The east bank of the Avoca River upstream of Coonooer Bridge and is within the **Shire of Loddon**
- The Avoca River, Back Creek, Mosquito Creek and the Avoca Flood Course (i.e. Mosquito Creek) downstream from Ninyeunook and parts of the middle reaches of Lalbert Creek including most of the Tyrrell Marshes and the right bank of the creek from Towaninny down to and including Lake Lalbert are within the **Shire of Gannawarra**
- Approximately 25km of the right bank of Lalbert Creek below Lake Lalbert and the whole of Lalbert Creek for the last 25km or so to Lake Timboram are within the **Rural City of Swan Hill**.

2. Riverine Flooding

Generally, a wet catchment and a period of heavy rain are required to produce flooding along the Avoca River, particularly at Charlton. While the whole town is at risk from severe flooding, the status of crop growth in the floodplain, particularly to the south-east of town, can have an impact on flood levels at Charlton. A mature crop will tend to slow floodwaters resulting in some increase in levels over a similar event when land is fallow.

Large floods generally occur as a result of either:

2.1 Heavy rainfall lasting for 12 hours or more such as can occur when warm moist airflow from north western or northern Australia is dragged down and across north-western Victoria (e.g. January 2011)

2.2 A period of very heavy rain following a prolonged period of general rainfall that has “wetted up” the catchment and filled a good portion of the natural floodplain storage

2.3 Moderate to heavy rainfall associated with a slow moving or complex low pressure system after a prolonged period of general rainfall, such as can result from sequences of cold fronts during winter and spring.

Such events occur predominantly during late spring and summer months and may cause widespread flooding.

3. Flash Flooding and Overland Flows

Short duration, high intensity rainfall (usually associated with severe thunderstorms or small scale weather systems that are locally intense and slow moving) can also cause flash flooding at Charlton. Such events, which are mainly confined to the summer months, do not generally create widespread flooding since they only last for a short time and affect limited areas. Flooding from these storms occurs with little warning.

High intensity rainfall such as associated with thunderstorms giving average rainfall rates of typically more than 30 mm/hour sustained over a period of 30 minutes (i.e. 15mm of rain) or so is likely to lead to high flows in the local drainage channels and Charlton’s stormwater drainage system, even following a period of dry weather.

4. Drainage Hot Spots

Drainage hot spots have been documented for Charlton as follows:

- Gowar Creek overflow (crossing Wright Street between Driver Education Centre and Trotting training track; Menzies Street, High Street, Davies Street, under railway line and Gunyah Flat Road)
- Menzies Street and Watson Street
- Halliday Street
- Davies Street and Marlo Court
- To the south of Calder Highway around Fanning Street and Watson Street
- Grieves Street stormwater outfall
- Learmonth Street outfall
- Armstrong Street (intersection culverts)
- Orr Street (river back-flow at intersection with Rutherford Street
- Wright Street (between Driver Ed Centre and Harness training track)
- Open drain between Wright Street and Watson Street
- Open drain between Wright Street and Donald Street
- Menzies Street drain (Menzies Street to Watson Street)
- Town drain between Watson Street to High Street
- Town drain between High Street to Railway Dam
- Open drain (Railway Dam to Common stormwater re-use dams and overflow to river)

5. Overview of Catchment and Flood Behaviour – Avoca River

The Avoca River catchment has an area of 14,200km^2 of which only around 27% (3,833km^2) is upstream (south) of Charlton. This part of the catchment contributes the majority of runoff.

Apart from the township areas of **Charlton** and **Wycheproof** (and **Culgoa** on Tyrrell Creek), land use across the catchment is primarily agricultural: predominantly grazing and broad acre cropping. There are no major water supply dams within the Avoca River catchment.

The Avoca River rises in the Pyrenees Ranges (the western extension of the Great Dividing Range) near Amphitheatre. From there it flows north past Avoca, to the east of St Arnaud through a relatively narrow floodplain that is confined by the surrounding hills. From Yawong Weir downstream to approximately halfway to Charlton, flooding is confined to a corridor that expands from around 500m to 2.5km in width (refer to the flood extent maps in Appendix F1). As the Avoca approaches Charlton, the topography flattens to form a wide and undefined floodplain with a number of channel braids some of which link to Gowar and Yeungroon Creeks.

Yeungroon Creek is a small ephemeral watercourse which originates in the foot-hills of Mt Yawong, approximately 21km south of Charlton and a branch originating at Yeungroon East with the confluence north of Nine Mile Road. The creek is located to the south-east of Charlton and runs approximately parallel to the Avoca River as it passes to the east of Charlton.

The area between Five Mile and Clarks Roads tends to flatten out and pool with the main creek crossing Clarks Road, Yeungroon Road (south of Calder Highway), Calder Highway (east of Yeungroon Road and the railway line viaduct (east of Boort Charlton Road); whilst an anabranch crosses Yeungroon Road (south of Quarry Road), Quarry Road (east of Yeungroon Road), Calder Highway (west of 3CV Lane) and the railway line viaduct (west of 3CV Lane)

Its confluence with the Avoca River is downstream from the town (upstream of the river gauge downstream of the town). The anabranch confluence with the Avoca River is downstream from the town (downstream of the river gauge downstream of the town). The creek runs through agricultural land that has been levelled for soil conservation and/or farming purposes for much of its length, leaving the channel poorly defined (nb generally identified by alignment with Box-trees).

Gowar Creek is a small ephemeral watercourse which originates in the foot-hills of Mt Gowar, approximately 16km south of Charlton. The creek runs northerly crossing Nine Mile Road; Seven

Mile Road; Five Mile Road; Back St Arnaud Road; and Charlton St Arnaud Road. Its confluence with the Avoca River is upstream of the town. The creek runs through agricultural land that has been levelled for soil conservation and/or farming purposes for much of its length, leaving the channel poorly defined (nb generally identified by alignment with Box-trees).

Downstream from Charlton, the terrain is significantly flatter. Further, the Avoca River is perched such that the main river channel, when in flood, overflows its banks to feed the various effluent watercourses. The capacity of the main river channel reduces markedly with distance downstream from Charlton. At the same time, the amount of flood storage in the effluent watercourses increases significantly.

The natural pattern of flooding has been modified considerably by works (e.g. levees and cuts) on the main Avoca River channel. These works affect the natural distribution of overflows to the eastern and western effluent streams.

There are two main distributaries: **Tyrrell Creek** and **Lalbert Creek**. Both creeks flow northwest from the Avoca River catchment. Tyrrell Creek has a well-defined channel for most of its length and terminates at Lake Tyrrell. Flood extent is around 500m for all except very large floods (i.e. bigger than September 1983). Lalbert Creek flows through Lake Lalbert and into Lake Timboram (refer to schematic in Appendix F1).

During small floods of greater than 20% AEP (i.e. around the 2 or 3 year ARI event at Yawong Weir), overflow occurs downstream from Charlton into the eastern streams from the east bank and into Lalbert Creek on the west bank. Overflows into Lalbert Creek reach a maximum at around the 20% AEP (5 year ARI) event. As flood size increases, overflows begin to occur into the "higher level" effluent streams of Tyrrell Creek and the upper reaches of the eastern streams (e.g. Mosquito Creek and Eastern Floodplains Stream). The overflows to Tyrrell Creek occur between Teddywaddy and Glenloth with the majority occurring within about 3km of the junction of the Calder Highway and the Charlton–Glenloth Road. During large floods (e.g. September 1983), the proportion of flow entering Tyrrell Creek and the eastern streams increases to greater than 80% of the total flow. Overflow from Tyrrell Creek into Cooroopajerup Creek reportedly surrounded Wycheproof during the August 1909 flood. During the 2011 flood, the Cooroopajerup Creek flooding again surrounded Wycheproof and areas north to Dumosa.

For the "lower level" overflows, in particular into Lalbert Creek, the major difference between a small flood and a large flood in those areas is the duration of flooding (see comments below about flood attenuation). Hence the extent of flooding is more a function of antecedent conditions and the duration of overflow at the maximum level than of the flow itself. It is noted that:

- Overflows in the area from Glenloth to the Boort - Wycheproof Road enter relatively well defined flood courses' feeding into the Tyrrell Marshes.
- The Tyrrell Marshes drain into Lalbert Creek which, below the Wycheproof – Goshen Channel, becomes a well-defined channel and has a relatively narrow floodplain as far as Tittybong. From Tittybong to Lake Lalbert and beyond, a distance of some 20km, the floodplain widens considerably. The main Lalbert Creek channel is however generally confined within levees.
- **Haddons Creek**, a major effluent over-flow watercourse for both Lalbert and Tyrrell Creeks, merging Lalbert Creek approximately 10km downstream (west) from Lake Lalbert and Tyrrell Creek (adjacent to the Nullawil North Road causeway).
- Beyond the Haddons Creek over-flow, Lalbert Creek flows north and west in a well-defined channel. Further downstream the floodplain is much wider for a reach of approximately 15km beyond which the Creek is once again well-defined up to the point of discharge into Lake Timboram. Tyrrell Creek flows west and north to terminate at Lake Tyrrell.

Back Creek is an effluent watercourse fed by overflows directly from the Avoca River and also from Lalbert Creek. It consists of a number of regulated and unregulated drainage paths.

The Avoca River has a low base flow and typically terminates at Lake Bael Bael and the Avoca Marshes (1st, 2nd and 3rd Marsh). The Avoca only reaches the Murray River during very large floods (e.g. January 2011). This is achieved through the main flow channel (very low capacity) direct to the Little Murray River and via the floodway that flows into Lake Boga and from there into the Little Murray River. Refer to schematic diagram of the Avoca River system in Appendix F1.

In summary, flood behaviour upstream from Charlton is relatively simple while downstream it is complicated. The complication arises from the Avoca watercourse being perched with a declining channel capacity together with extensive flood storage in the effluent watercourses and their relative location along the Avoca River.

- **Declining river capacity**. The Avoca River main channel capacity declines to 40% of its capacity at Charlton with only 12km downstream (at Teddywaddy) where the first major effluent overflows into Tyrrell Creek and the eastern streams. Channel capacity continues to reduce until at Mosquito Creek is only around 1% of the capacity at Charlton.
- **Overflow conditions**: The perched main channel means that the condition of the Avoca River banks is critical to the distribution of overflows between the eastern streams and the western effluent watercourses (Tyrrell Creek or Lalbert Creek).
- **Flood attenuation**: An extensive floodplain providing storage and groundwater infiltration ensures that flood attenuation is considerable (e.g. peak flood flow at Quambatook is typically around 20% of the flow at Yawong Weir). Thus antecedent rainfall and flooding conditions and the flood volume are more important than the peak flow. Water levels in Lake Bael Bael and the Marshes etc. prior to a flood have a significant impact on flood attenuation further downstream.

Marmal Creek is not connected to the Avoca River but is located to the east of the river near Charlton (see schematic in Appendix F1). It is an intermittent stream that drains the western flank of the Wedderburn Hills, foothills of Nine Mile and Richmond Plains and flows into Lake Marmal. Lake Marmal overflows to the north east during large floods or after an extended period of wet weather. In times of a major flood as in 2011, the water from this system joined the water from the Avoca just to the north of Charlton (near Jeruk River Road) and joined the north-east floodplain streams at Glenloth East and Ninyeunook.

During major flooding events, Marmal Creek floodwaters close major and local roads including Calder Highway (Woosang), Barrakee Road (Barrakee) and Boort Charlton Road (Lake Marmal and Narrewillock). Historically, when floodwaters of the Yeungroon Creek close the Calder Highway (east of Charlton) the only all-weather road access to the north is via Buckrabanyule and Narrewillock but if the Marmal Creek floodwaters close Boort-Charlton Road, all all-weather access roads in this area, from Calder Highway to the north will be closed.

6. Overview of Levees and other Structures

Levee construction along the Avoca River and some of the effluent streams has had a major impact on the natural distribution of flood flows.

Avoca River Levees. Between Glenloth and Elders Bridge, a relatively low nearly continuous levee is located on the western bank of the river. It blocks a number of overflows.

Other Levees. The lower reaches of both the eastern streams and Lalbert Creek are confined by levees which significantly reduce waterway capacity.

Flood Regulators and Designed Overflows. There are a number of regulators and cut channel overflows from the Avoca River and some of the effluent waterways. The more important of these include:

- Eastern Floodplain Stream – Avoca River overflow from Boort Wycheproof Road and confluence with Mosquito Creek (near Narrewillock Quambatook Road)
- The Sills (Mosquito Creek off-take from Avoca River)
- The Canal – a cut channel from the Avoca River and Lalbert Creek overflow
- Kops Orchard Regulator – from the Avoca River to Back Creek
- The Back Creek Regulator

Road and Channel Crossings. The most important of these are the Boort – Wycheproof Road, the Wycheproof – Goshen Channel and the Waranga Western Channel. There is also a significant

crossing immediately east of Charlton on the Calder Highway, where the Yeungroon Creek crosses the Highway.

Railway Viaducts. There are four railway viaducts: Avoca River Crossing, Gunyah Flat Road (formerly known as Stock Route Lane), Yeungroon Creek and Yeungroon Creek Anabranch (west of 3CV Lane)

7 Infrastructure

7.1 Overview

Major infrastructure within the Avoca River catchment includes State highways (e.g. the Calder Highway and Borung Highway), State arterial roads (e.g. Charlton–St Arnaud Road, Boort–Charlton Road, Boort–Wycheproof Road, St Arnaud-Wycheproof Road, Donald Swan Hill Road), regional rail links (the Korong Vale-Kulwin Line, via Charlton, Wycheproof and terminating at Sea Lake).

7.2 Major Roads

Dependant on flood magnitude the following roads (and bridges) may be inundated.

- Calder Highway at Woosang (Marmal Creek)
- Calder Highway east of Charlton (Yeungroon Creek)
- Calder Highway at Charlton
- Calder Highway at various locations north of Charlton
- Borung Highway at Charlton
- Charlton St Arnaud Road upstream of Charlton
- Boort Charlton Road downstream from Charlton
- Boort Charlton Road near Lake Marmal (Marmal Creek)
- Boort Wycheproof Road east of Wycheproof (Tyrrell Creek)
- Boort Wycheproof Road at Avoca River
- Boort Wycheproof Road east of Jeruk River Road (Eastern floodplain stream)

Many minor roads in and around Charlton as well as further up and down the catchment will also be inundated.

7.3 Other Infrastructure

See Appendices C and I for suggested actions.

Mobile network telephone towers – none known

Telephone Exchange

- 14 Camp Street - telephone services to Charlton were disrupted during the January 2011 flood when the telephone exchange lost mains power and the backup generator ran out of fuel.

Wastewater treatment plant

- Charlton St Arnaud Road - unlikely to be flooded.

Sewer pump stations

- Rear of 7 Armstrong Street - inundated during large flood events (e.g. January 2011)
- 5 Baden Powell Drive - inundated during large flood events (e.g. January 2011)

Water pump stations

- 20 Donald road - was affected by the January 2011 flood.

Electrical power kiosks/zone sub-stations (cabinets)

- Corner Calder Highway and Boort Charlton Road - the electrical sub-station was impacted by the January 2011 flood and power was lost to Charlton as well as to 85% of Buloke Shire for up to 5 days. Power to residences and businesses in Northern Grampians Shire was also cut. The loss of power caused communications failures – mobile phone, internet, etc.

Community facilities at Charlton – the CBD including all retail and entertainment facilities (e.g. January 2011).

- Police Station (12 Camp Street) - closed during September 2010 and January 2011
- CFA fire station (2 Halliday Street) - closed during January 2011
- Town Hall (9-11 Armstrong Street) – floor safe but access from the street through water during January 2011
- Municipal Offices (1 High Street) – inundated during January 2011
- Council works depot (17 Watson Street) – inundated during January 2011
- Charlton Hospital and Charlton Bush Nursing Hospital (2-4 Learmonth Street) relocated following January 2011
- Ambulance station (2 Learmonth Street) – relocated with new hospital
- Charlton Kindergarten/Maternal and Child Health Centre (1 Armstrong Street) - observed during January 2011
- Community theatre (30-34 High Street) – low areas inundated during January 2011
- Gordon park Precinct including the swimming pool, bowling club, caravan park and playground (1-7 Mildura Way) – significant inundation during January 2011.
- Museum (1 High Street)
- Sporting clubs including Charlton Park (Mildura Way, including main recreation reserve including the tennis club and harness racing club).
- Travellers Rest Caravan Park (10 John Curtain Drive)
- Local airstrip (Charlton St Arnaud Road) - observed during January 2011and road access likely to be cut-off during major flood events
- Helipad (2 Learmonth Street) developed with new hospital
- Schools
    - Charlton Secondary College (33-49 Davies Street) – observed during January 2011
    - Charlton Preschool (1 Armstrong Street) – observed during January 2011
    - St Joseph's Primary School (25 Watson Street) - observed during January 2011

Railway Line and Viaducts – damaged by the Avoca River and Yeungroon Creek during January 2011.

Yawong Weir

Charlton River Beautification Weir and Downstream Charlton Weir

Historic Floods

The largest flood recorded at Charlton to date occurred late on the 14th and early on the 15th January 2011. The recorded peak flood height of around 8.7m at the James Paterson Bridge was around 0.35m higher than the next largest recorded flood in August 1909. Other large floods occurred in September 1870, December 1933, April 1939 and May 1956 and on 6th September 2010. A number of other significant but smaller floods have occurred in the past 140 plus years (see Figure A1-1). On average there is more than one major flood event per decade with attendant damage to property and disruption to productivity.

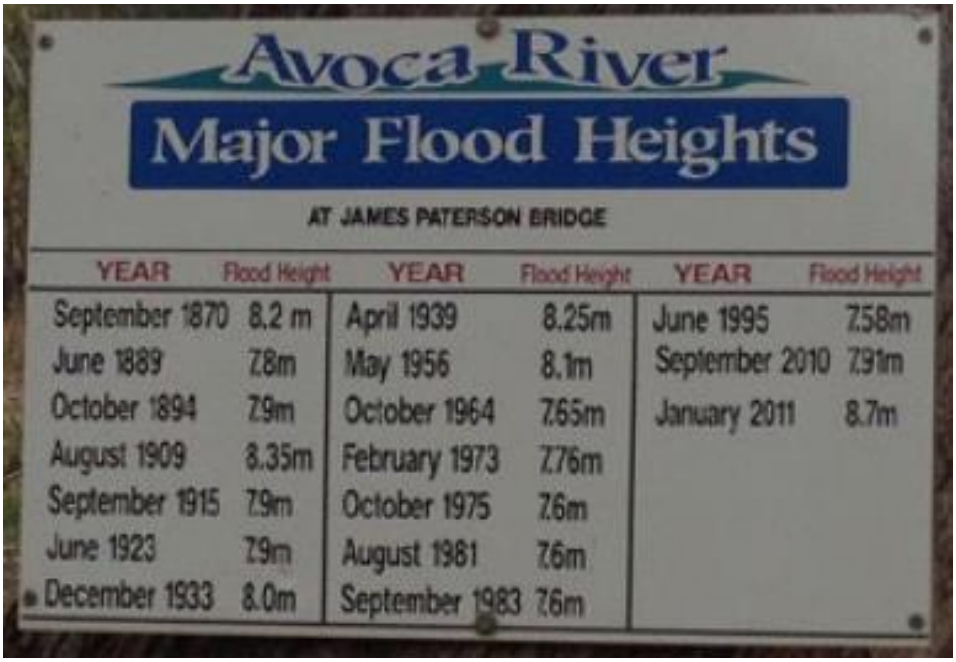


Figure A1-1: Major flood heights at the James Paterson Bridge, Charlton (Courtesy of NCCMA)

Charlton was inundated on three separate occasions during the floods of 2010 and 2011: in September and November of 2010 and again in January 2011.

While records of flood impacts are not available for the older floods, old newspaper articles such as those on the front page of *The Sun* on Friday May 18, 1956 do provide some insights into the impact of flooding on the town.

September 2010 flood
Heavy rain was recorded in the Avoca River catchment from late Friday 3rd into Saturday 4th as a result of the deepening of a low pressure system over South Australia and its passage into Bass Strait. The highest daily falls for the month, were mostly recorded on the 4th (e.g. Charlton, 47.2mm; Avoca, 62.4mm).

The river peaked at 5.64m at Yawong Weir, 7.91m at the Charlton Town gauge and 7.30m at the Charlton Downstream gauge.

Around 70% of the town was inundated. 83 properties were flooded over-floor including the Police Station. The Calder Highway and the Boort and St Arnaud roads were closed.

November 2010 flood
Heavy rain was recorded on the 13th and 14th as a low developed over Victoria. Another trough and low moved across the State on the 26th and 27th leading to more heavy rain across the western half of the State. Monthly rainfall totals across the northwest were mostly very much above average.

At Charlton 11.4mm of rain was recorded on the 27th with a further 50.4mm recorded on the 28th. However, rainfall distribution for this event was unusual with low rainfall totals in the upper catchment of around 30 - 40mm compared with 60 – 80mm in the mid and lower catchment, and a maximum rainfall depth of 101mm recorded at Burkes Flat.

The river peaked at 5.07m at Yawong Weir, 7.17m at the Charlton Town gauge and 7.09m at the Charlton Downstream gauge.

Two (2) propertied were inundated in Charlton.

January 2011 flood
The extreme rainfall observed during the month was generated by the passing of complex and persistent low pressure systems. A broad slow moving trough centred over western Victoria and a ridge of high pressure to the south of Tasmania were the main drivers for the rainfall which

commenced on Sunday 9th January. The two systems created exceptionally humid conditions and unstable easterly flow across Victoria. The trough strengthened on Wednesday 12th and developed into a low pressure system over eastern South Australia on Thursday 13th as a high pressure system moved into the Tasman Sea. The low pressure system cleared the State on Friday evening after adding an additional 50mm to 100mm of rain.

Conditions across the Avoca River catchment prior to 10th January were dry. Nevertheless, the Avoca catchment received between 180mm and 220mm of rain for the month. The highest daily falls were mostly recorded on the 14th (e.g. Charlton, 66.2mm) although Avoca recorded 67mm on the 12th which exceeded the previous highest recorded January daily rainfall total.

The January 2011 event resulted in the highest flood levels experienced at Charlton and levels similar to August 1909 at Yawong Weir. Both the river and rain gauges at Yawong Weir were drowned during the event. The peak flood height recorded at Charlton was higher than 8.7m at the James Paterson Bridge and around 0.35m higher than in August 1909, the next largest recorded flood.

369 properties were affected with more than 270 residences and 15 businesses flooded over-floor (80% of the town and 95% of the businesses along High Street: some houses were deemed uninhabitable). Damage to the Charlton Hospital was so severe it had to be replaced. Flood waters remained in town for up to 3 days and longer in rural areas. Along with the damage caused to residences and businesses, there was also significant damage to public infrastructure including roads, the railway line and power assets.

Figure A1-2: Charlton township during the January 2011 flood (source: Herald-Sun website)

Figure A1-3: Charlton township, showing extent of the January 2011 flood (source: DSE)

Dam Failure

Failure of dams or retarding basins is not a consideration as there are no major storages (i.e. capacity of 1,000ML or more) within the Avoca River catchment.

Flood Inundation Mapping

Flood inundation maps have also been produced by BMT WBM (October 2013) for the Avoca River around and at Charlton for the 10, 20, 50, 100 and 200 year ARI flood events as well as for the PMF event. A subset of those maps is included in this MFEP at Appendix F1.

The Buloke Planning Scheme shows areas along watercourses likely to be inundated by a 1% AEP (100-year ARI) flood event where detailed flood mapping has been completed, as LSIO. While it is not practical to reproduce the LSIO as an attachment to this Plan, hard copies are available from the Municipality. They are also available in hard copy form and as PDF digital copies at the MECC/MOCC and in digital form at the DELWP website www.dpcd.vic.gov.au/planningschemes.

Coarse flood extent maps were also developed in 2000 as part of a state-wide Flood Data Transfer Project (FDTP) (DNRE, 2000). Although this flood extent mapping has a low level of accuracy the maps can be a useful guide to highlight areas subject to flooding where detailed mapping is not yet available. The associated reports provide guidance on likely accuracies and associated confidence in delineations.

Floor Level Information

A flood study has been completed for Charlton. The study delivered a series of flood inundation and extent maps for a range of different sized flood events (see Appendix F1). The study also delivered a list of properties likely to experience below and above-floor inundation for each of these events.

That information is included in Appendix C1. It is possible that properties in addition to those listed will be flooded in larger floods.

Digital Flood Extent Datasets and Flood Photography

The Victorian Flood Data (VFD) datasets (available from North Central CMA) contain a significant quantity of flood information in GIS format. For the Avoca River at Charlton this includes a number of surveyed flood levels from the September and November 2010 and January 2011 floods. These levels are also available from the North Central CMA.

A number of ground level still photographs are available from the North Central CMA for the September and November 2010 events and for the January 2011 event. Buloke Shire also has a large number of photographs from these events as well.

The North Central CMA and Buloke Shire also hold a variety of other datasets that include:

- Contour and survey information, including LiDAR data (Shire does not hold LiDAR data).
- Drainage and road infrastructure (i.e. bridge, culverts and urban drainage systems) data.
- Digital cadastral information.
- Flood and non-flood aerial photography (Shire does not hold aerial flood photography) that includes:
  - September 1983 flood aerial oblique photography
  - September 1988 flood oblique aerial colour photographic mosaics
  - June 1995 flood vertical aerial colour photographic mosaics
  - September 2010 aerial photography (not at time of peak)
  - January 2011 aerial photography (not at time of peak)

Fig A1-4 Gauge on the Avoca River Upstream South side of the Charlton Bridge

Flood Intelligence Cards – see Appendix C1

All flood intelligence records are approximations. This is because no two floods at a location, even if they peak at the same height, will have identical impacts. Flood intelligence cards detail the relationship between flood magnitude and flood consequences and provide practical guidance on appropriate flood response actions. Further information about flood intelligence and its use can be found in the Australian Emergency Management Manuals flood series at http://www.ema.gov.au and in particular in Manual 20 “Flood Preparedness”.

APPENDIX A2 –
FLOOD THREATS FOR THE AVON-RICHARDSON RIVER

1. General

The lower reaches of the Richardson River from Rich Avon downstream to and including Lake Buloke are within Buloke Shire.

It is noted that:

- The upper reaches of the Avon-Richardson rivers upstream of Rich Avon are within the **Shire of Northern Grampians**; and
- A small section of the Richardson River catchment is within the **Shire of Yarriambiack**.

2. Donald

2.1 Overview

Donald is located approximately 150 km north west of Bendigo and is a small rural township (approx. 1355 residents based on the 2011 Census) on the Avon-Richardson River. The town is generally of low relief and surrounding land use mainly agriculture. The Avon-Richardson catchment encompasses an area of approximately 3000 km2.

Grampians Wimmera Mallee Water is the agency responsible for the control of all activities relating to the Rich-Avon Weir.

A newly constructed strategic levee system has been constructed at Donald which is designed to 600 above the 1% ARI event, there are 2 identified gaps (where main arterial roads cross) in the levee, options are currently being investigated on the best way of filling these in during a flood event.

2.2 Flood Behaviour History (prior to construction of the new levee)

The following section gives a brief description of the riverine flood characteristics in Donald for each design event prior to construction of the new levee.

5 year ARI Event
• Water overtops Camp Street;
• No properties flooded above floor level.

10 year ARI Event
• Swimming pool infrastructure inundated;
• Properties along Byrne Street are inundation affecting some external buildings;
• Sport field inundation;
• No properties flooded above floor level;
• Flood extent comparable to the December 2010 event.

20 year ARI Event
• Swimming pool inundated;
• Two properties flooded above the floor level, one being the Donald Motor Lodge;
• Flood extent comparable to the September 2010 event.

50 year ARI Event
• Four properties flooded above the floor level, one being the Riverside Motel;
• Camp Street sewer pump station inundated.

100 year ARI Event
• Goodwin Village inundated with above floor flooding
• Ten properties flooded above the floor level, including the garage and the Chinese restaurant;
• Elizabeth Street sewer pump station inundated.

200 year ARI Event
• Sunraysia Highway overtopped;
• The flood levels increase by approximately 200 – 300 mm compared to the 100 year ARI;
• Additional units in the Goodwin Village experience over floor flooding;
• Fourteen properties flood above the floor level.

11 January 2011
Prior to the January 2011 flood event, the highest recorded flood was in 1909 where the main street of Donald and a number of businesses, houses and rural properties were severely impacted. The January 2011 flood event was in the order of 200 mm higher than the flood in 1909. In January 2011 approximately 180 mm fell over the catchment over a four day period from the 11th of January until the 14th January.

The January 2011 riverine flood caused:
- Over floor flooding of fourteen buildings include two motels and.
- Loss of power for up to five days due to flooding of the Charlton sub-station.
- The Donald township to be cut in half by floodwater for two days with the Sunraysia Highway overtopped.
- State highways to be cut off and extensive damage to roads surrounding the town.
- Flooding of the Johnson-Goodwin retirement village.
- Flooding of community infrastructure including the Donald Swimming Pool, Heritage Walking Trail, Cricket Club Rooms, Apex Park, Hockey Club and Archery Club.
- The Camp Street and Elizabeth Street Sewer Pump Station were flooded.
- Extensive damage to surrounding agricultural land including crops and homesteads.

2.3 Warning Times
The flood warning time for Donald is in the order 24 hours depending on the rainfall event. The travel time between Banyena gauge and the Donald gauge is 22 hours. The travel time between Donald gauge and the Sunraysia Highway bridge is approximately 6 hours. The Bureau of Meteorology (BoM) is reviewing (June-July 2016) the flood warning/prediction services capability for Donald.

2.4 Areas Affected
Maps at Appendix A provide guidance on where flooding is likely to occur within Donald for flood events ranging from the 5 year ARI event up to the 200 year ARI event.

2.5 Properties Affected prior to new levee being constructed
A summary of the number of properties likely to be inundated over-floor is provided in Section 1.6. It is recommended that the list is used in conjunction with the flood inundation maps (see Appendix A2).
In January 2011, 14 buildings experience over floor flooding from riverine and a local rainfall event. The September 2010 event was not as severe and would have resulted in the inundation of approximately 2 buildings from riverine flows if no intervention had taken place.

2.6 Flood Mitigation
Flood intelligence must have regard for changes within the catchment that modify likely flood behaviour (e.g. mitigation works that reduce the severity of flood risk). There are no formal flood mitigation works in place at Donald. A small levee does however exist on the eastern side of the Richardson River between Blair Street and the Sunraysia Highway which is a walking path.

2.7 Flood Impacts and Required Actions
Refer to the Flood Intelligence card in Appendix C2.

Note: Users of the flood intelligence card should consider rainfall depth and gauge levels at locations in the vicinity of Donald, and across the upper catchment. These should be used as an indicative tool at Section 1.6 in order to better appreciate the likely severity of flooding and its impacts in the town.

Local data and / or data from the BoM website (http://www.bom.gov.au/) should be used. It is suggested that the following sites, available from the BoM website, will provide useful indicative rainfall data:

- Archdale Junction
- Coonooer Bridge
- Charlton Downstream
- Navarre Field

Also the following river gauges will provide some useful information Richardson River U/S Donald.

- Donald upstream
- Rich Avon upstream
- Banyena
- Carrs Plains

The Wimmera River (Glenorchy) river gauge may be useful for determining the Wimmera River/Dunmunkle Creek flood overflow into Swedes Cutting (nb may be picked up at Banyena if this gauge is operating).

Fig A2-1 Bullocks Head reference point on the Avon-Richardson River at the end of Blair Street.

3. Control, Command and Coordination

Full Details of Control, Command and Coordination arrangements are contained in section 3.3 (page 10) of this Emergency Plan.

4. Flood Intelligence Card, Property Inundation List and Flood Guidance Tool

4.1 Introduction

Notes:

1. While flood intelligence cards provide guidance on the relationship between flood magnitude and flood consequences, flood intelligence records are approximations. This is because no two floods at a location, even if they peak at the same height, will have identical impacts. Further, the hydrologic and hydraulic modelling that underpins much of the intelligence detailed below is informed by a number of assumptions and approximations that are unlikely to be replicated exactly during a flood event. Actual impacts under similar rainfall conditions are therefore expected to be similar but may not be exactly the same: there are likely to be some differences. More details about flood intelligence and its use can be found in the Australian Emergency Management Manuals flood series at http://www.ema.gov.au and in particular in Manual 20 “Flood Preparedness”.

2. All levels, impacts and actions listed in the following flood intelligence card may need to be adjusted to better reflect experience.

3. Minor flooding: Causes inconvenience. Low-lying areas next to watercourses are inundated which may require the removal of stock and equipment.
Minor roads may be closed and low-level bridges submerged.

4. Moderate flooding: In addition to the above, the evacuation of some houses may be required. Main traffic routes may be covered. The area of inundation is substantial in rural areas requiring the removal of stock.

5. **Major flooding**: In addition to the above, extensive rural areas and/or urban areas are inundated. Properties and towns are likely to be isolated and major traffic routes likely to be closed. Evacuation of people from flood affected areas may be required.

APPENDIX A3 – FLOOD THREATS FOR TYRRELL CREEK SYSTEM

1. Overview.

The township of Culgoa is located in north western Victoria on the Calder Highway, the closest major township is Swan Hill (60 km to the north east). Culgoa is located within the Buloke Shire Council (BSC) and Mallee Catchment Management Authority (MCMA) management areas.

Culgoa is located on Tyrrell Creek, a distributary of the Avoca River. Tyrrell Creek off-takes from the Avoca River downstream of Charlton and continues through to Lake Tyrrell. The waterway is ephemeral only flowing after significant rainfall or Avoca River floods. On the Avoca River downstream of the Tyrrell Creek off-take, Lalbert Creek also distributes flood water to the north.

The Avoca River is within the North Central Catchment Management Authority management area. The Avoca River and Tyrrell Creek both received significant flows during January 2011. These flows caused flooding in numerous regional communities across Victoria including Culgoa.

Generally, the Tyrrell Creek is reported to flow every 3-4 years[1]. The waterway experiences long dry periods with local residents reporting no flow between the late 1930's until the flood observed across the state in 1956. Anecdotally, Tyrrell Creek witnessed flows in 1960, 1964, 1968, 1973, 1974, 1975, 1988, 1992, 1995/96 with no flows observed until the most recent January 2011 event, which was the largest event in living memory in Culgoa.

During January 2011 Culgoa received two flood peaks, the first generated by Tyrrell Creek's catchment area, the second a distributary flow from the Avoca River.
The township of Culgoa has a much shorter warning time for the first flow peak in Tyrrell Creek than the second. However, the second peak is most likely to cause significant inundation of private and public land. The warning time for a flow distributed to Culgoa from the Avoca River is significant allowing members of the community and emergency services to be prepared for a flood event. There is also a strong indicator of potential future flooding with the flooding of Charlton on the Avoca River providing an indicator that flooding may impact Culgoa.

Small flows can be generated in Tyrrell Creek from rainfall within the Tyrrell Creek catchment. These flow events are generated by moderate rainfall events with flow in the Avoca River not at a sufficient height to distribute water to Tyrrell Creek.

A large flow in Tyrrell Creek will most likely be generated by a significant rainfall event in the Avoca River catchment, which will likely fall on the Tyrrell Creek catchment also. The rainfall falling on the Tyrrell Creek catchment will likely generate an initial smaller peak flow in Tyrrell Creek, followed by another peak from the Avoca River distributary flows. If the flood event in the Avoca River is of sufficient magnitude this second peak in Tyrrell Creek resulting from the distributary flows is likely to be the largest. These two flow peaks are unlikely to occur concurrently in Culgoa due to difference in time it is expected to take for Tyrrell Creek catchment runoff to reach Culgoa and Avoca River catchment runoff to reach the Tyrrell Creek off-take and then flow to Culgoa.

This also means that when the Avoca River distributary flow is passing through Tyrrell Creek the waterway is likely already experiencing some flow from the Tyrrell Creek catchment. All the creek pools will have been filled and any initial infiltration into the channel bed has already occurred. This increases the proportion of the Avoca River distributary flow which

[1] GHD, 2007 - Lalbert and Tyrrell Creeks Management Plan, Landholder Responses to Questionnaire Regarding History, Ecology, Cultural Heritage and Conservation of Lalbert and Tyrrell Creeks

reaches Culgoa and significantly reduces the potential attenuation along Tyrrell Creek, so the second peak may travel much faster than the first peak.

2. Major cause of flooding

2.1 Impacting Waterways.:

Inundation in Culgoa is driven by flows in Tyrrell Creek; these flows can be generated from two major sources:

- Tyrrell Creek catchment rainfall, which leads to runoff directly entering the waterway; and
- Avoca River flows distributed to Tyrrell Creek at the off-take point downstream of Charlton.

Tyrrell Creek has a large catchment area in its own right at 1,720 km^2, however much of this catchment is of very low grade, generally has relatively low surface moisture and low/moderate average rainfall. The catchment is also predominantly agricultural with a very low fraction impervious. Due to these factors the catchment is not likely to generate large flows alone.

The Avoca River catchment is significantly larger, steeper in its upper reaches and is subject to generally higher soil moisture levels and higher average rainfalls. Avoca River catchment area as classified by the Murray Darling Basin Authority (MDBA) upstream of Charlton is 3,042 km^2.

2.2 Impacting infrastructure.

There are two major hydraulic structures impacting on inundation and flow through Culgoa, the Calder Highway Bridge and the Culgoa-Watchupga Road Bridge.

The Calder Highway Bridge (figure A3 -1) is a four span concrete deck bridge. The waterway cross section under the bridge is relatively flat with little height to the bridge obvert other than a formed section of channel on the southern side, which was previously used to pass regulated flows for stock and domestic purposes. The channel is no longer used for the controlled transfer of water.

The Culgoa-Watchupga Road Bridge is a concrete span bridge and was reconstructed following the 2011 floods. The bridge road deck is raised from the surrounding floodplain making it significantly higher than the waterway. This gives the bridge a large capacity with breakouts from Tyrrell Creek likely to flow around the bridge rather than overtopping it. There are several buildings located to the south west of the road bridge which are significantly lower than the bridge deck level.

Fig A3-1. Calder Hwy Bridge

3. Rainfall and Stream flow data

3.1 Rainfall

There are numerous daily rainfall gauges around Culgoa and in the Tyrrell Creek catchment. However there is a lack of sub-daily rainfall gauges with the closest gauges Charlton and Swan Hill Airport.

The closest daily rainfall gauges to the Culgoa township are located at:

- Culgoa
- Berriwillock
- Lalbert
- Birchip
- Quambatook South

3.2 Stream flow

There are no stream flow gauges on Tyrrell Creek with the closest stream flow gauges located on the Avoca River at Charlton DS and Quambatook. The Charlton DS gauge is located upstream of the Tyrrell Creek off-take point, while Quambatook is located downstream of both Tyrrell Creek and Lalbert Creek off-take points.

One instantaneous recording on Tyrrell Creek at Warne was made during January 2011, with a reading of 14,000 ML/d at 11am 17th January 2011; this was slightly after the flood peak.

APPENDIX F4 – FLOOD THREATS DUNMUNKLE CREEK SYSTEM

Dunmunkle Creek

The Dunmunkle Creek catchment is estimated to be just over 1200km^2. The exact catchment extent is a point of much argument particularly in the northern lower reaches where the final destination of flows has been modified to improve water transfers of the stock and domestic channel water supply system.

Large rainfall and high inflows result in the distribution of flows from the Wimmera River to the Dunmunkle Creek, at the creek's off-take immediately east of Glenorchy, and through another breakout to the north-west of Glenorchy. The creek flows through Rupanyup continuing north into the southern Mallee. Flows also leave the Wimmera River upstream of Dunmunkle Creek, through Swedes Cutting that connects to Swedes Creek, a tributary of the Richardson River – eventually flowing to Donald.

Dunmunkle Creek also drains its own narrow localised catchment, with Wimmera River outflows the dominant flood causing mechanism. Dunmunkle Creek is a highly modified waterway having previously been part of the Grampians Wimmera Mallee Water (GWMWater) Stock and Domestic supply system.

Major modification to the landscape through the removal of the stock and domestic channel system had an effect upon the distribution of flood flows in 2011. Further works have taken place since this point and are expected to influence the direction, depth, velocity and extent of future events.

A flood investigation is currently underway to more fully understand the effects of floods in this catchment.

APPENDIX A5 – BIRCHIP STORM/FLASH FLOOD

1 Overview

The township of Birchip is located in north western Victoria on the Sunraysia Highway, the closest major township is Swan Hill (approximately 75 km to the north east). Birchip is located within the Buloke Shire Council (BSC) and Mallee Catchment Management Authority (MCMA) management areas.

The Birchip Township and surrounds are not susceptible to a riverine flooding event but due to the topography of the area but the township is at risk of flash flooding events, as the area is relatively flat and the main drainage system consists of culverts that divert and move water away from the township. This usually occurs when rain falls in excess of 50 mm within a 30 to 40 minute period occur as the water cannot move through the system quickly enough and tends to back up

History shows that the area has had events occurring as far back at 1921 where there have been rainfalls of < 50mm over a 24 hour period. The issue with the township is when this rainfall occurs over a short period of time.

During these types of event the water is not able to dissipate or drain away quickly enough, this causes the water to build up and therefor the depth increases, this is most prevalent during high intensity short duration events as occurred in 2018.

Historical events include:

1975 - 24th Oct	rainfall of 63.2mm
1978 - 18th May	rainfall of 60.2 mm
1989 – 10th May	rainfall of 59.8 mm
1996 – 16th Feb	rainfall of 77.0 mm
2011 – 14th Jan	rainfall of 70.0 mm
2017 – 21st Apr	rainfall of 60.0 mm
2018 – 13th Dec	rainfall of 127.0 mm

Summary of impact from the December 2018 Storm Event
31 Properties affected with water either around or under the premises.
3 properties impacted (inundation of property) @:
17 and 19 Corack Road
20 Birchip – Watchem Rd
23 Campbell St

Also a significant number of business were affected in the township, the damage was primarily related to the rain event (not flash flooding) premises affected include:

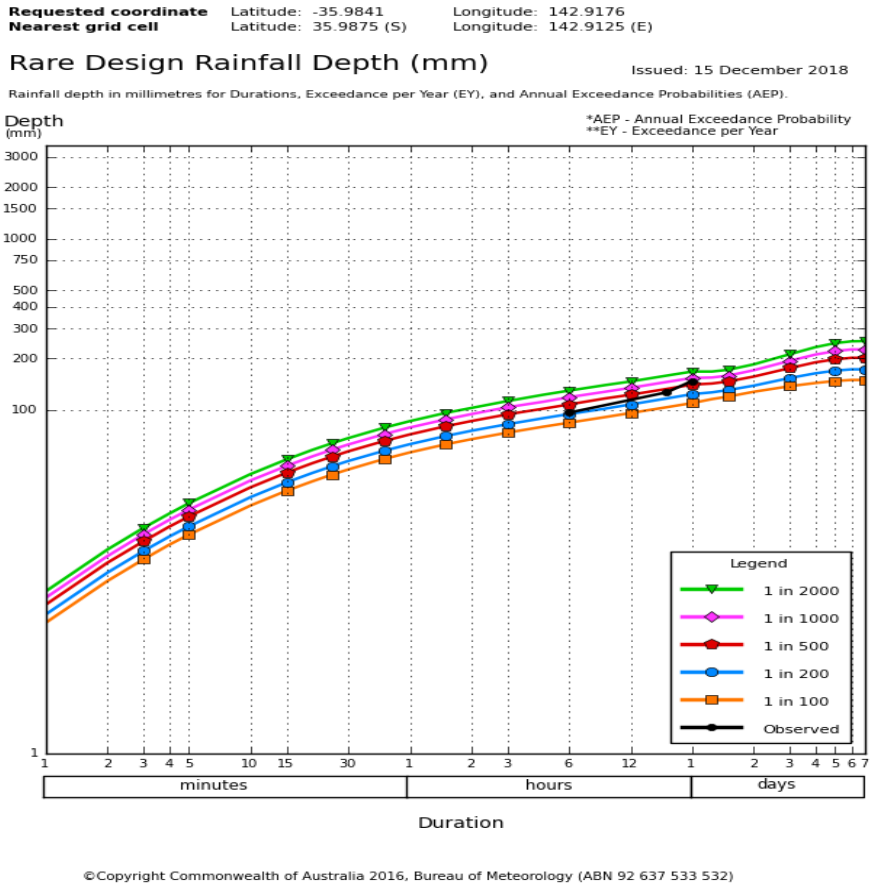
- Birchip Newsagency.
- Birchip Hotel.
- The Mallee Shearing Shed.
- Mallee Branded.
- Supermarket.
- Birchip Hardware.
- Mad Mallee Crafts.
- Pop Up Shop.
- Birchip Pharmacy.
- Exquisite Cashmere.
- Wimmera Mallee Accounting Pty Ltd.
- Birchip Café.
- Landmark.
- Lips Transport.
- O'Donnell's Café.
- Birchip Cropping Group.

- Birchip Post Office.
- Commercial Hotel.
- O'Connor's.

Other damaged reported (up to 20th December 2018) include;

- Stock losses of >1000 with damage bill expected to exceed $150,000.
- Significant fencing damage throughout the area.
- Significant damage to local road networks

Rainfall chart from the December 2018 event.
Information received from the NCCMA indicates that this event equates to a storm event of somewhere between 1 in 500 to a 1 in 1000 year event (a 0.2 to a 0.1 % Annual Reoccurrence Interval Event).



Appendix F4 page 150 provides a guidance map for the flash flooding hotspots at Birchip.

APPENDIX B – TYPICAL FLOOD RISE, RECESSION AND PEAK TRAVEL TIMES

In using the information contained in this Appendix, it must be remembered that the time of travel of a flood peak will be influenced by antecedent conditions. Runoff will be generated from a wet catchment more quickly than from a dry catchment. Similarly, a flood on a 'dry' waterway will generally travel more slowly than a flood on a 'wet' waterway (e.g. the first flood after a dry period will travel more slowly than the second flood in a series of floods). Hence, recent rainfall and flood history, soil moisture and forecast weather conditions all need to be considered when using the following information to direct flood response activities.

Note that flooding will start some time ahead of the time indicated by the following travel times – these are the time between the flood peaks at respective sites.

Avoca River floods travel reasonably slowly within the main stream. Rates of rise at Yawong Weir and Charlton can be as high as 500mm/hour in the early stages of a big flood as water levels first begin to rise but are generally no more than 200mm/hour once levels exceed the minor flood level. The rate of rise at Charlton is usually faster than at Yawong Weir. The rate of rise at both locations slows once water has broken out onto the floodplain and slows further as it nears the peak. Levels at or near peak can extend for a considerable time. The initial rate of fall from a peak is similarly slow and is typically 3 to 4 times slower than the rate of rise for a similar flow rate or stage but then speeds up to around half the rate of rise experienced at equivalent levels for the event.

Location From	Location To	Typical Timings	Comments
RIVERINE FLOODING – Avoca River			
Floods are characterised by a reasonably quick rise until water breaks out into the floodplain. It then slows and slows further as it nears the peak. Peaks can extend for a considerable time and recessions are around 3 to 4 slower than the rate of rise initially but speed up to about half the rate of rise experienced at equivalent levels for the event. The further down the catchment the longer the peak and the slower the recession. A second flood on the river will travel faster than a flood on a dry river and a big flood will in general travel faster than a small flood.			
Start of rainfall	Yawong Weir	~ 20 hours	To start of rise - wet catchment.
		50 – 60 hours	To start of rise - dry catchment.
		30 to 60 hours	From start of rise to peak – generally bigger floods will rise quicker but may take longer to reach peak
Start of rainfall	Charlton	24 hours or so	To start of rise - wet catchment.
		60 hours +	To start of rise - dry catchment.

Location From	Location To	Typical Timings	Comments
		30 to 50 hours	From start of rise to peak – generally bigger floods will rise quicker but may take longer to reach peak
Yawong Weir	Charlton	10 to 30 hours Average ~16 hours	The bigger the flood and / or the wetter the catchment the closer travel time will be to 10 hours. Time between peaks in January 2011 was around 11 hours.
Charlton	Sills	18 to 40+ hours Average ~ 30 hours	The bigger the flood the closer travel time will be to 18 hours.
Charlton	Glenloth	24 hours	The bigger the flood the closer travel time will be to 3.5 days. Time between peaks in January 2011 was around 3.5 days.
Glenloth	Boort - Wycheproof Rd	24 hours	
Boort – Wycheproof Rd	Quambatook	2 – 3 days	
RIVERINE FLOODING – Avon-Richardson River			
Banyena Gauge	Donald Gauge	22 hours	Travel and Warning time will depend on the rain fall event
Donald Gauge	Sunraysia Highway	6 hours approx	
RIVERINE FLOODING – Tyrrell Creek system			
Nb: Travel time will be variable depending on flows within the Avoca system, time of year, density of crops etc			

Location From	Location To	Typical Timings	Comments
Avoca River Charlton town gauge	Nullawil North Road	63 hours approx. 82 hours approx.	This time is calculated from flood peak at Charlton town gauge to onset at Tyrrell Creek floodway (nb: is based on the September 2016 flood event) This time is calculated from flood peak at Charlton town gauge to peak at Tyrrell Creek floodway
Avoca River Charlton town gauge	Culgoa Watchupga Road bridge (Culgoa)	122 hours approx.	This time is calculated from flood peak at Charlton town gauge to flood peak at Culgoa Watchupga Road bridge (nb: during the subsequent flood 3 weeks later, flood waters peaked at Culgoa 4 days after peak at Charlton town gauge)
Culgoa Watchupga Road bridge (Culgoa)	Renneys Road	30 hours approx. 58 hours approx.	This time is calculated from flood peak at Culgoa Watchupga Road bridge gauge to onset at Tyrrell Creek floodway (nb: is based on the September 2016 flood event) This time is calculated from flood peak at Culgoa Watchupga Road bridge gauge to peak at Tyrrell Creek floodway

APPENDIX C1 – CHARLTON
COMMUNITY FLOOD EMERGENCY MANAGEMENT PLAN

1. Overview

A wet catchment and a period of heavy rain are generally required to produce flooding at Charlton although the January 2011 flood occurred following record rainfall off a dry catchment.

Charlton is located on the Avoca River floodplain near the centre of the catchment on the Calder Highway around 250km northwest of Melbourne and around 20km downstream (to the north) from Yawong Weir. The town straddles the Avoca River with the CBD and main residential area situated on the right (east) side of the river. The area has little topographic relief although the ground to the right (east) side of the river is lower than that on the west which leaves the town susceptible to flooding. Further, the floodplain in the general vicinity of Charlton narrows, the gradient decreases and the capacity of the Avoca River also decreases. These factors combine to exacerbate the flood risk at Charlton.

In addition there are a number of other significant hydraulic influences in and around Charlton. These include three road and rail bridges that cross the Avoca River; a boarded river beautification weir located downstream of the town centre; and a railway embankment which crosses the entire width of the floodplain downstream of the town centre.

When river channel capacity is exceeded, flooding results adjacent to the river and along a number of flood effluent paths including Gowar Creek and Yeungroon Creek. Breakout flows from the Avoca River feed directly into both creek systems. Flooding in the local creeks is initially confined to the creek alignments but then it breaks out to inundate low lying land and initiate flow in secondary floodplain channels.

Gowar Creek breaks out in numerous locations including north (downstream) of the Five Mile Road where it joins Yeungroon Creek. Charlton is afforded some protection from breakouts from Gowar Creek further north (downstream) by the Charlton - St Arnaud Road. It is of note that breakout flows from the Avoca River feed directly into the Gowar Creek system and overflows from the Gowar Creek feed into the Yeungroon Creek system.

Local runoff to the immediate south of Charlton is fed into the Avoca River by the Gowar Creek system. This creek crosses the Charlton - St Arnaud Road through 10 x 450mm circular culverts. When flows exceed the capacity of these culverts, it is directed towards Charlton (nb: Government funding has been provided to reinstate a floodway/causeway at this location). The Gowar Creek system is also directly fed by breakout flows from the Avoca River from around the junction of Five Mile Road and the Charlton - St Arnaud Road.

It should be noted that the majority of the Charlton floodplain, which includes the Gowar Creek and Yeungroon Creek floodplains, supports broad acre cropping or grazing. The time of year and crop status can influence the rate at which flood waters rise and fall. A flood when crops are near to harvest will tend to travel a little slower and thus rise more slowly, be a little higher, maintain the peak longer and fall more slowly than the same flood immediately after harvest. Should a flood occur just after harvest a large amount of debris could be wash into the system creating abnormal flood conditions.

Topography within the town is quite flat. This limits the effectiveness of local drainage measures resulting in ponding of water during rain events.

The initial response (rise) at the Charlton downstream gauge is often the result of the initial response from the Yeungroon Creek catchment (nb: the Yeungroon Creek anabranch flows

into the Avoca further downstream of the Charlton downstream gauge). In general terms and under general rain conditions (as distinct from thunderstorms), the quicker this occurs after the start of rain the more likely it is that:

- The catchment is wet;
- Runoff will occur more quickly and in greater volumes than might normally be expected;
- The river will start to rise at Charlton closer to 25 hours from start of rain rather than the more normal 40 to 60 hours; and
- The flood will be bigger rather than smaller (though obviously the depth of rainfall and its spatial and temporal distribution will drive flood severity).

2. Overview of Flooding Consequences – Riverine Flooding

2.1 Flood Impacts

2.1.1 The 20 % AEP (5-year ARI) event

Yawong Weir	Charlton Town Gauge	Charlton Downstream
5.11m	7.41m	7.10m

The 20% AEP design event does not cause the Avoca River or local creek systems to impact on Charlton. Some localised flooding / ponding of stormwater does however occur in town but is the result of the lack of fall in the local drainage system.

In the rural areas there are locations where flow breaks out of the Avoca River. These flows are however contained within anabranch channels. They are either stored in the channels or re-enter the main river channel. One location where this occurs is between Yawong Weir and Nine Mile Road. Breakouts from the Gowar Creek results in the inundation of properties adjacent to the main drainage path through town, south of the Calder Highway (i.e. Wright Street to Gunyah Flat Road and back into the river downstream of the 'Common' dams.

Flow from the Yeungroon Creek system is generally contained to the east side of the Charlton - St Arnaud Road (it does not enter town). During large flood events, the Yeungroon will divide just north of Five Mile Road. The main part of Yeungroon Creek crosses Yeungroon Road adjacent to the Calder Highway, crosses Calder Highway, Boort Charlton Road downstream of the railway line and discharges to the Avoca River downstream of Charlton (upstream of the Charlton downstream river gauge). The anabranch of the Yeungroon Creek crosses the Yeungroon Road (south of Clark Road), Quarry Road (east of Yeungroon Road), Calder Highway (west of 3CV Lane), Borung Charlton Road, Boort Charlton Road and discharges into the Avoca River downstream from the Charlton downstream gauge.

There are no breakout flows from the Avoca River across into the Yeungroon Creek system during the 20% AEP event.

2.1.2 The 10% AEP (10-year ARI) event

Yawong Weir	Charlton Town Gauge	Charlton Downstream
5.38m	7.80m	7.24m

Flow breaks out from the Avoca River at several locations between Nine Mile Road and Seven Mile Road and enters the Gowar Creek system.

Breakout flows from the Avoca also enter the Gowar Creek system near the Five Mile Road and Charlton - St Arnaud Road intersection. In turn, flow breaks out of Gowar Creek and enters Charlton from the south adjacent to the Driver Education Centre. This results in the minor inundation of properties adjacent to the main drainage path through town and along Learmonth, Menzies, Donald and Wright Streets. There is also some inundation as local capacity along the main drainage path through town is exceeded.

Flow from the Yeungroon Creek system is contained to the east side of the Charlton - St Arnaud Road, with the exception of high flows crossing the Back St Arnaud Road at the culverts. This flow joins Gowar Creek before being returned to the Avoca River.

2.1.3 First impact on the CBD and residential areas

Flooding of the Charlton CBD and main residential area begins between the 10% AEP and 5% AEP (10-year ARI and 20-year ARI) flood events.

2.1.4 The 5% AEP (20-year ARI) event

Yawong Weir	Charlton Town Gauge	Charlton Downstream
5.58m	8.03m	7.38m

During the 5% AEP design event, flow breaks out of the Avoca River at numerous locations into both the Yeungroon and Gower creek systems. Breakouts into the former occur to the east of the bank between Nine Mile Road and the Five Mile Road / Charlton - St Arnaud Road intersection while breakouts to the latter occur at the Five Mile Road – Charlton - St Arnaud Road intersection.

The majority of flow entering Charlton occurs as the Avoca River overtops its banks adjacent to the town. Water also enters town from the south adjacent to the Driver Education Centre as a result of the flow breakouts from Gower Creek that become established at lower flows. Most of Charlton is inundated.

Flow from Gowar Creek system is contained to the east side of the Charlton - St Arnaud Road and does not enter Charlton, with the exception of flows crossing the Charlton - St Arnaud Road at the culverts as the capacity of the culverts is exceeded. That water is directed along the Charlton - St Arnaud Road towards town.

2.1.5 The 2% AEP (50-year ARI) event

Yawong Weir	Charlton Town Gauge	Charlton Downstream
5.84m	8.26m	7.56m

The 2% AEP design event inundates most of Charlton with substantial over-floor flooding. The inundation results from significant overland flows from the south (upstream) and directly from the Avoca River adjacent to town. The overland flows from the south result from breakouts from the Avoca River into the Yeungroon and Gowar creek system that become established at lower flows. In addition, flows overtop the Charlton - St Arnaud Road.

2.1.6 The 1% AEP(100-year ARI) event

Yawong Weir	Charlton Town Gauge	Charlton Downstream
6.03m	8.42m	7.68m

The 1% AEP design event impacts on Charlton in a similar but more severe manner as the 2% AEP event. Overland flows develop in the same way as for smaller floods but flow volumes and thus depths and impacts are larger. To some extent the increased flow is driven by the transfer of some flow from the Yeungroon Creek system into the Gowar Creek system which contributes to the overland flow that enters Charlton from the south.

2.1.7 The 0.5% AEP (200-yearARI) event

Yawong Weir	Charlton Town Gauge	Charlton Downstream
6.23m	8.57m	7.81m

The mechanisms leading to flooding at Charlton are the same as for the 2% AEP and 1% AEP events. Depths and impacts are however more severe.

2.1.8 The PMF event

Yawong Weir	Charlton Town Gauge	Charlton Downstream
9.05m	10.69m	9.67m

In the PMF event the entire floodplain, including Charlton experiences severe flooding with uniform depths exceeding one metre across the entire study area.

2.1.9 Historical Flood comparisons

Historical chart is currently under review and will be included once completed.

2.2 Areas Affected

Maps at Appendix F1 provide guidance on where flooding is likely to occur.

The Avoca floodplain narrows and its gradient decreases while the capacity of the Avoca River also decreases in the general vicinity of Charlton. The town straddles the Avoca River with the CBD and main residential area situated on the right (east) side of the river. This side of the river is marginally lower than that on the left (west) side. The town is susceptible to flooding. High hazard areas are generally confined to the deeper areas of flow associated with waterways and the anabranch channels in the floodplain. See maps at Appendix F1.

2.3 Properties Affected

2.3.1 Summary

A summary of the number of properties likely to be flooded at Charlton and the number likely to be inundated over-floor is provided in Section 7.4 of this Appendix.

2.3.2 Detailed List

A list of these properties along with the expected depth of over-ground flooding and the likely depth of over-floor inundation is provided in Section 7.5 of this Appendix**. It is strongly recommended that the list is used in conjunction with the flood inundation maps (see Appendix F1).**

2.3.3 Update of List of Properties Likely to be Flooded

The list of properties likely to be flooded (with corresponding levels and indication of over-floor flood depth) should be updated within twelve (12) weeks of a flood. Update should occur with information collected as part of post-flood information recording activities and as may be collected as a consequence of the event debrief. Information on the collective experience of the IMT should also be gathered and utilised.

2.4 Isolation

The main access roads for Charlton are the:

- Calder Highway
  - from Bendigo – access is often compromised by flooding in other catchments at the same time as flooding in the Avoca (egg Marmal Creek at Woosang)
  - from the north – access is cut between Charlton and Wycheproof (e.g. November 2010)
- Borung Highway – provides access from the west through Donald
- Charlton – St Arnaud Road upstream (south) of Charlton.
- Boort – Charlton Road downstream (north-east) from Charlton.

Local roads further up the catchment are likely to be impassable for a day or more.

The Wycheproof – Charlton and Inglewood – Charlton railway line is also overtopped at Charlton somewhere around the 20-year ARI flood event (i.e. 8.03m on the Charlton Town gauge).

A detailed list of isolated properties is located at the rear of Appendix G (page 136). This list includes occupied rural residences aligned with the land subject to inundation planning overlay.

2.5 Essential Infrastructure

Essential infrastructure at Charlton, other than the Calder Highway, includes health, electricity, telephone, internet / communications, water and sewer services. All are compromised during large floods (e.g. January 2011). See Figure C1-1 (page 43).

Note that flooding of the Charlton CBD and main residential area begins between the 10% AEP and 5% AEP (10-year ARI and 20-year ARI) flood events. Community facilities affected include:

- Police Station (closed during September 2010 and January 2011)
- CFA fire station(closed during January 2011)
- Town Hall, Municipal Offices and Council works depot
- Charlton Hospital and Charlton Bush Nursing Hospital (inundated during January 2011)
- Ambulance station
- Charlton Kindergarten/Maternal and Child Health Centre (observed during January 2011)
- Community theatre and Museum
- Swimming pool and sporting clubs including Charlton Park (main recreation reserve, tennis club) and Gordon Park based clubs.
- Gordon Park and Travellers Rest Caravan Parks
- Local airstrip (observed during January 2011)
- Schools - Charlton Secondary College (both campuses), Charlton Preschool, Charlton Early Childhood, St Joseph's Primary School (all observed during January 2011.

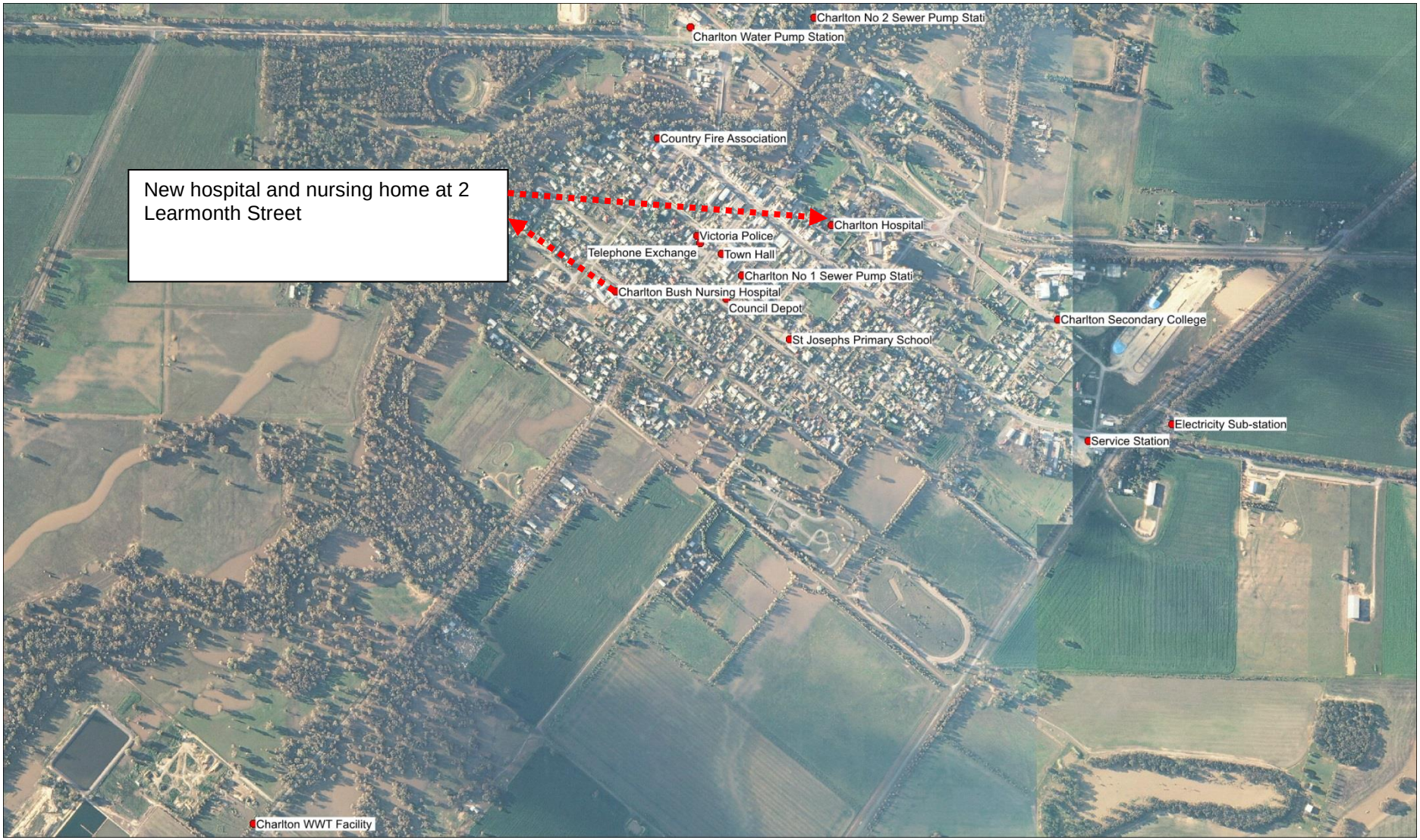


Figure C1-1: Location of essential infrastructure at Charlton

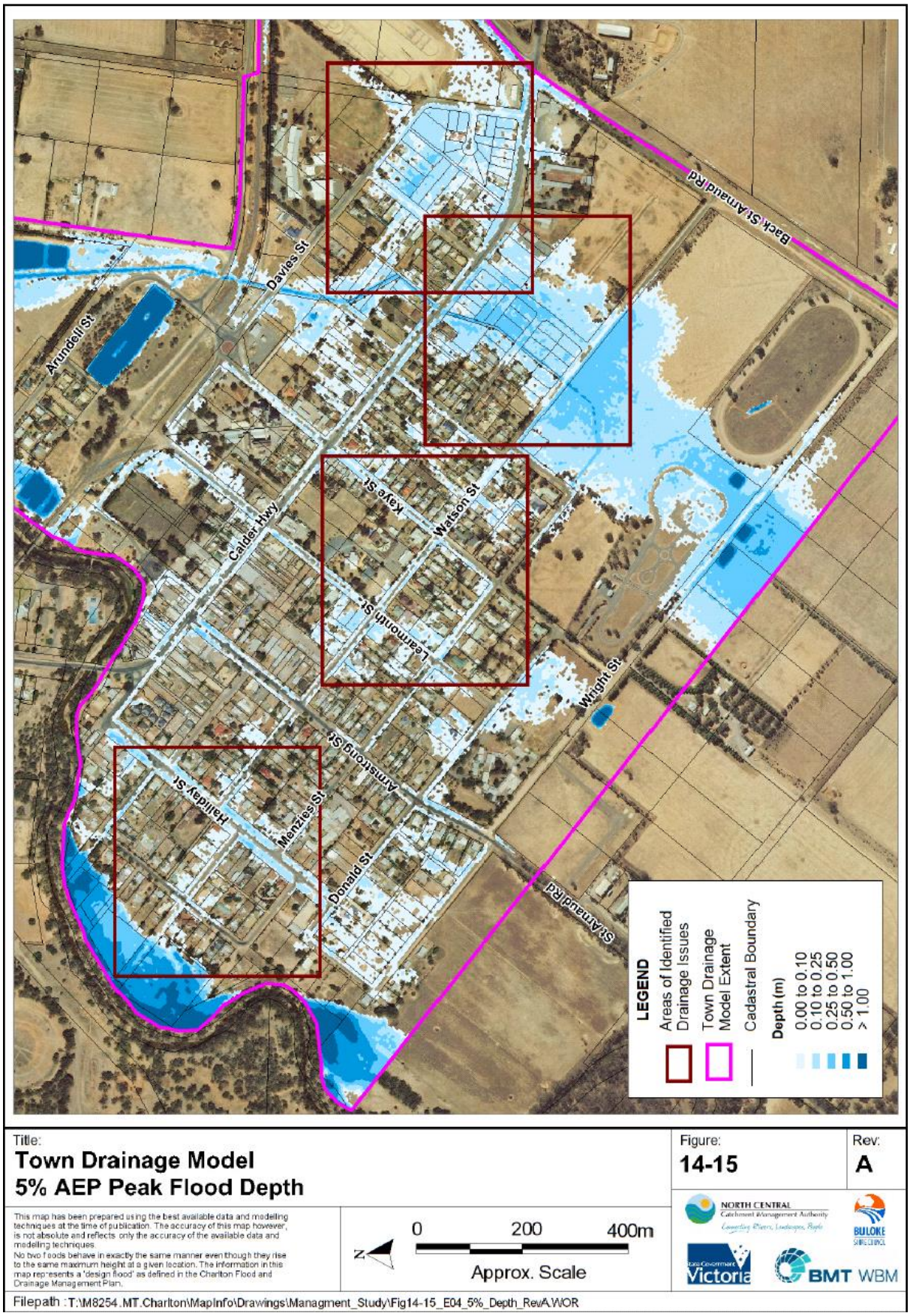


Figure C1-2: Stormwater drainage hot spots locations in Charlton: stormwater flood depths for the 5% AEP event

2.6 Warning times

The flood warning lead time for Charlton is considered to be of order 15 to 24 hours depending on the rain producing weather system and size of flood - see Appendix B.

Overview of Flooding Consequences – Stormwater Flooding

2.7 Flood Impacts

There are four main areas (hot spots) within Charlton identified as being subject to drainage issues during local rainfall events:

- **Watson Street** - water ponds in the table drains along Watson Street due to the lack of grade on the drain and blockages caused by driveways and roads. Council is in the process of removing the blockages caused by driveways;
- **Halliday Street** – water ponds in Halliday Street most likely because increased tail water levels in the Avoca River prevent discharge through the piped drainage system. It is also possible that water surcharges through the drainage system, from the river, into the town.
- **Davies Street and Marlo Court** - the area around Marlo Court is drained by a series of pipes to the Davies Street pumping station (and pump) which in turn discharges to the main flow path through town.
- **To the south of the Calder Highway around Fanning Street and Watson Street** - Overland flow from the south enters town between the Driver Education Centre and the practice trotting track. This flow originates from the local catchment north of Gower Creek and flows through town along the main flow path to the Avoca River.

Figure C1-2 shows the location of these areas together with the peak stormwater flooding depths for the 5% AEP design event.

Flood Mitigation

2.8 General

Flood intelligence MUST have regard for changes within the catchment that modify likely flood behaviour (e.g. mitigation works that reduce the severity of flood risk).

2.9 Flood Protection Levees

There is small levee (estimated at no more than 0.5m high) at Charlton around 200m – 400m south of the town on the right bank of the Avoca River between the river and the Charlton – St Arnaud Road where the river comes closest to the road. It is understood that the levee is owned by Council. As assessment of the condition of the levee or its design standard has not been undertaken. The levee has very little influence on flood behaviour or on flooding within town. Some work has been done to the levee since the 2011 flooding event. Council have engaged (May 2016) consultants to investigate and design Charlton flood and drainage mitigation levees and associated works.

2.10 Drainage Works

There are no flood specific drainage works at Charlton other than the existing town stormwater drainage system.

Flood Impacts and Required Actions

Refer to the following Flood Intelligence Card and indicative flood guidance tool.

Control, Command and Coordination

The Control, Command and Coordination arrangements in this MFEP will be as detailed in the EMMV.

All flood emergency response activities within Buloke Shire will be under the Control of the VICSES Regional Duty Officer / Incident Controller. Buloke will continue to carry out the normal functions of Council (ie road authority)

An EMT may be established by the Incident Controller in accordance with the EMMV.

An ICC will be established by the Control Agency (i.e. VICSES) for the control functions in response to any flood emergency event within the Municipality. It will be operated in accordance with this flood emergency plan and associated VICSES arrangements.

The ICC for Buloke Shire and any response agency Divisional or Sector Commands will be located as detailed in the VICSES Loddon Mallee Region Flood Emergency Plan.

Flood Intelligence Card, Property Inundation List and Flood Guidance Tool

2.11 Introduction

The BoM currently provides a flood forecasting service for Charlton with forecasts provided for the Charlton downstream gauge. This gauge is a short distance downstream from town and is site used by BoM for Charlton flood prediction/warning services. The gauge is also a very good indicator of likely downstream flooding and of the likelihood of flows into Cooroopajerup Creek, Lalbert Creek and Tyrrell Creek.

While there is a gauge at the Calder Highway Bridge in town (the James Paterson Bridge), there are no established arrangements for reading the Charlton town gauge: monitoring occurs on an ad-hoc basis.

The Charlton Flood and Drainage Study (BMT WBM, 2013) demonstrated that due to catchment and flow characteristics, flood behaviour at Yawong Weir is a good indicator of likely flood conditions at Charlton. BoM are reviewing infrastructure requirements to provide reliable flood warning/prediction services for Charlton.

An indicative relationship that links the flood inundation maps produced by the Charlton Flood and Drainage Study and flood levels at Yawong Weir, the Charlton town gauge and the Charlton downstream gauge has been developed and is included below. While the relationship has been labelled '**indicative'** it can be used to inform response, provides an indication of likely flood levels at the Charlton gauges if a forecast is not available and allows people to answer the question "what does this forecast (or river level) mean for me".

Unless there are unusual circumstances, actions as per the Flood Intelligence Card should be initiated as soon as the BoM issues a flood forecast / warning or as soon as the indicative tool below suggests that flooding is likely. Response can be escalated if forecast or the tool indicates an increase in the expected severity of flooding.

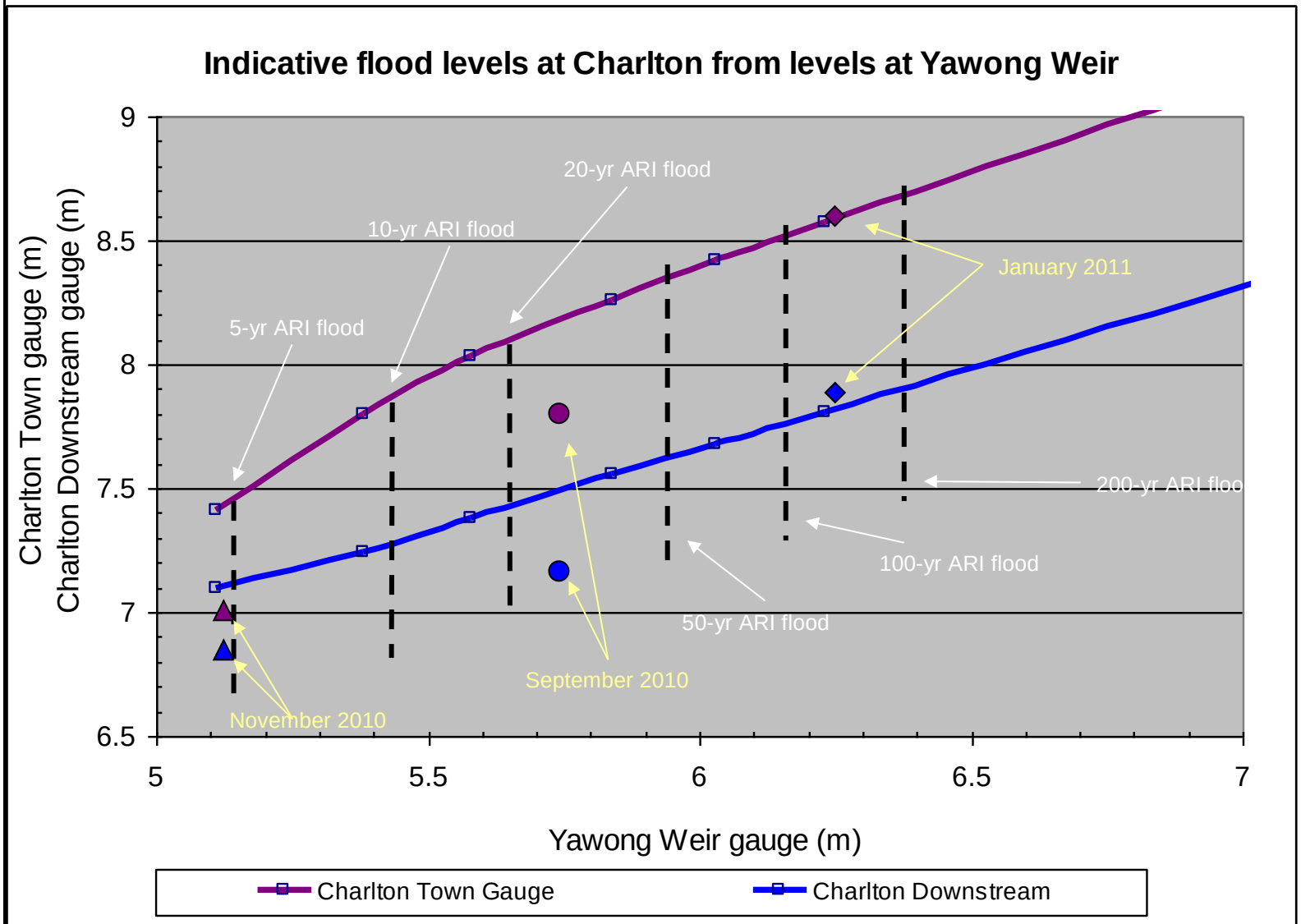
After a flood event:

- Plot the peak levels recorded at Yawong Weir, Charlton Town and Charlton downstream on the indicative tool;
- Update the flood intelligence card below;
- Update the flood history in Appendix A1 with an overview of the event, antecedent conditions and other relevant information.

Notes:

1. While flood intelligence cards provide guidance on the relationship between flood magnitude and flood consequences, flood intelligence records are approximations. This is because no two floods at a location, even if they peak at the same height, will have identical impacts. Further, the hydrologic and hydraulic modelling that underpins much of the intelligence detailed below is informed by a number of assumptions and approximations that are unlikely to be replicated exactly during a flood event. Actual impacts under similar rainfall conditions are therefore expected to be similar but may not be exactly the same: there are likely to be some differences. More details about flood intelligence and its use can be found in the Australian Emergency Management Manuals flood series at http://www.ema.gov.au and in particular in Manual 20 "Flood Preparedness".
2. All levels, impacts and actions listed in the following flood intelligence card and graph may need to be adjusted to better reflect experience.

2.12 Indicative Flood Guidance Tool



5-yr ARI: Localised stormwater flooding in town. Breakouts confined to anabranch channels.

10-yr ARI: Breakouts into Yeungroon and Gowar creek systems. Flooding into town from the south adjacent to the Driver Education Centre.

20-yr ARI: Most of the CBD and residential area on east side of town are inundated.

50-yr ARI: Most of Charlton inundated with substantial over-floor flooding due to overland flows from the south and from the Avoca River adjacent to town.

100-yr ARI: No change to flooding mechanisms but result is deeper flooding and more severe impacts.

200-yr ARI: Flooding is deeper and impacts more severe.

2.13 Flood Intelligence Card – Riverine Flooding

Water Level (m)			AEP of flood	Consequence / Impact	Action Actions may include (but not limited to) evacuation, closure of roads, sandbagging, issue of warnings and who is responsible
Yawong Weir	Charlton Town	Charlton Downstream			
	USING THIS INTELLIGENCE CARD. Consider the flood inundation map deemed the most appropriate for the forecast flood level - either as provided by BoM or deduced from the tool at Section 7.2. Review all consequences and actions in this table, from the first row down to the approximate expected severity of flooding. Initiate all actions in a logical sequence. Note that that some actions may need to be initiated in an order that is different from their relative placement in this table.				
	The status of crops on the floodplain to the south and east of Charlton (including the Yeungroon and Gowar Creek floodplains) can cause higher flood levels at Charlton – crops can cause water to travel a little slower and thus rise more slowly, be a little higher, maintain the peak longer and fall more slowly than the same flood after harvest or without a crop. High flows in Yeungroon and Gowar Creeks can further complicate flood behaviour around and immediately downstream from Charlton (i.e. cause higher levels than might be expected - January 2011) High flows in Marmal Creek can create severe flash flooding of the Calder Highway (Woosang) and cause significant traffic disruption (September 2010 and January 2011)				
	The Back St Arnaud Road is referred to as the Charlton – St Arnaud Road throughout this document.				
				Forecast excess of 25mm rainfall in Avoca catchment Flash flooding to Yeungroon Creek Flash flooding to Marmal Creek	◦ Remove all Charlton Weir boards from 2 central bays ◦ Monitor rainfall and water levels ◦ Monitor BOM website ◦ Establish Crisisworks incident ◦ Level 2 MOCC activation (remote) ◦ Establish incident traffic management plan mapping ◦ Monitor floodways and need for road closures/signage

Water Level (m)			AEP of flood	Consequence / Impact	Action Actions may include (but not limited to) evacuation, closure of roads, sandbagging, issue of warnings and who is responsible
Yawong Weir	Charlton Town	Charlton Downstream			
	USING THIS INTELLIGENCE CARD. Consider the flood inundation map deemed the most appropriate for the forecast flood level - either as provided by BoM or deduced from the tool at Section 7.2. Review all consequences and actions in this table, from the first row down to the approximate expected severity of flooding. Initiate all actions in a logical sequence. Note that that some actions may need to be initiated in an order that is different from their relative placement in this table.				
	The status of crops on the floodplain to the south and east of Charlton (including the Yeungroon and Gowar Creek floodplains) can cause higher flood levels at Charlton – crops can cause water to travel a little slower and thus rise more slowly, be a little higher, maintain the peak longer and fall more slowly than the same flood after harvest or without a crop. High flows in Yeungroon and Gowar Creeks can further complicate flood behaviour around and immediately downstream from Charlton (i.e. cause higher levels than might be expected - January 2011) High flows in Marmal Creek can create severe flash flooding of the Calder Highway (Woosang) and cause significant traffic disruption (September 2010 and January 2011)				
	The Back St Arnaud Road is referred to as the Charlton – St Arnaud Road throughout this document.				
				Forecast in excess of 40mm rainfall in Avoca catchment Flash flooding to Yeungroon Creek Flash flooding to Marmal Creek	◦ Remove all Charlton Weir boards from all bays ◦ Monitor rainfall and water levels ◦ Monitor EM-COP website ◦ Monitor emergency broadcasters
	3.3			After Charlton Town gauge reaches 3.3m, expect water to breakout over the Avoca River east bank at the Boort-Wycheproof Road	◦ Monitor rainfall and water levels. ◦ Monitor need for road closures/signage ◦ Confirm sand and sandbag stocks
3.0	4.0	3.5		Minor flood levels. Boort – Wycheproof Road will be overtopped.	◦ Monitor rainfall and water levels. ◦ Consult Travellers Rest Caretaker (advise flood prediction) ◦ Monitor Gordon Park Campers

Water Level (m)			AEP of flood	Consequence / Impact	Action Actions may include (but not limited to) evacuation, closure of roads, sandbagging, issue of warnings and who is responsible
Yawong Weir	Charlton Town	Charlton Downstream			
	USING THIS INTELLIGENCE CARD. Consider the flood inundation map deemed the most appropriate for the forecast flood level - either as provided by BoM or deduced from the tool at Section 7.2. Review all consequences and actions in this table, from the first row down to the approximate expected severity of flooding. Initiate all actions in a logical sequence. Note that that some actions may need to be initiated in an order that is different from their relative placement in this table.				
	The status of crops on the floodplain to the south and east of Charlton (including the Yeungroon and Gowar Creek floodplains) can cause higher flood levels at Charlton – crops can cause water to travel a little slower and thus rise more slowly, be a little higher, maintain the peak longer and fall more slowly than the same flood after harvest or without a crop. High flows in Yeungroon and Gowar Creeks can further complicate flood behaviour around and immediately downstream from Charlton (i.e. cause higher levels than might be expected - January 2011) High flows in Marmal Creek can create severe flash flooding of the Calder Highway (Woosang) and cause significant traffic disruption (September 2010 and January 2011)				
	The Back St Arnaud Road is referred to as the Charlton – St Arnaud Road throughout this document.				
	4.0			Up to around this level, flow is contained in the Avoca River and Mosquito Creek channels. Will result in flows in Lalbert Creek and Back Creek.	◦ Monitor rainfall and water levels
5.0	5.9	5.0		Moderate flood levels.	◦ Monitor rainfall and water levels.
	5.9			Flow will start in Tyrrell Creek.	◦ Evacuate Gordon Park Caravans/campers ◦ Raise fridge from floor of Gordon Park camp kitchen
	6.8			Expect significant flow in Tyrrell Creek. Expect flow in Mosquito Creek / North-East flood plains stream / Avoca Flood Course.	◦ Monitor rainfall and water levels. ◦ Monitor Gowar Creek overflow northwards into Back St Arnaud Road side cuts. Consider temporary levee and temporary floodway to divert floodwaters to Yeungroon Creek via Clark Road (likely to flood Calder Highway causeway at Yeungroon Creek)

Water Level (m)			AEP of flood	Consequence / Impact	Action Actions may include (but not limited to) evacuation, closure of roads, sandbagging, issue of warnings and who is responsible
Yawong Weir	Charlton Town	Charlton Downstream			
	USING THIS INTELLIGENCE CARD. Consider the flood inundation map deemed the most appropriate for the forecast flood level - either as provided by BoM or deduced from the tool at Section 7.2. Review all consequences and actions in this table, from the first row down to the approximate expected severity of flooding. Initiate all actions in a logical sequence. Note that that some actions may need to be initiated in an order that is different from their relative placement in this table.				
	The status of crops on the floodplain to the south and east of Charlton (including the Yeungroon and Gowar Creek floodplains) can cause higher flood levels at Charlton – crops can cause water to travel a little slower and thus rise more slowly, be a little higher, maintain the peak longer and fall more slowly than the same flood after harvest or without a crop. High flows in Yeungroon and Gowar Creeks can further complicate flood behaviour around and immediately downstream from Charlton (i.e. cause higher levels than might be expected - January 2011) High flows in Marmal Creek can create severe flash flooding of the Calder Highway (Woosang) and cause significant traffic disruption (September 2010 and January 2011)				
	The Back St Arnaud Road is referred to as the Charlton – St Arnaud Road throughout this document.				
5.3	7.5	7.0		Major flood level at Yawong Weir. Major flood level at Charlton Town gauge Major flood level at Charlton Downstream	◦ Level 3 MOCC activation ◦ Monitor rainfall and water levels. ◦ Activate stream observers (particularly date, time, location for onset and peak flooding) ◦ Monitor urban storm water outlets into river for consideration of temporary blockages/levees and pumps: ▪ Orr Street (at Rutherford Street) ▪ Grieves Street (at flap valve outlet) ◦ Monitor water depths over the Calder Highway ◦ Determine Buloke EMLO requirement at ICC; and Divisional Command ◦ Consider media communication needs ***'one source – one message'***

Water Level (m)			AEP of flood	Consequence / Impact	Action Actions may include (but not limited to) evacuation, closure of roads, sandbagging, issue of warnings and who is responsible
Yawong Weir	Charlton Town	Charlton Downstream			
	USING THIS INTELLIGENCE CARD. Consider the flood inundation map deemed the most appropriate for the forecast flood level - either as provided by BoM or deduced from the tool at Section 7.2. Review all consequences and actions in this table, from the first row down to the approximate expected severity of flooding. Initiate all actions in a logical sequence. Note that that some actions may need to be initiated in an order that is different from their relative placement in this table.				
	The status of crops on the floodplain to the south and east of Charlton (including the Yeungroon and Gowar Creek floodplains) can cause higher flood levels at Charlton – crops can cause water to travel a little slower and thus rise more slowly, be a little higher, maintain the peak longer and fall more slowly than the same flood after harvest or without a crop. High flows in Yeungroon and Gowar Creeks can further complicate flood behaviour around and immediately downstream from Charlton (i.e. cause higher levels than might be expected - January 2011) High flows in Marmal Creek can create severe flash flooding of the Calder Highway (Woosang) and cause significant traffic disruption (September 2010 and January 2011)				
	The Back St Arnaud Road is referred to as the Charlton – St Arnaud Road throughout this document.				
5.07	7.17			Peak of November **2010** flood at Yawong Weir was at ~9.47pm on 28Nov10. Peak at Charlton Downstream was 7.09m at ~2.20am on 30Nov10.	◦ Monitor overland flow adjacent to Wright Street, Charlton (particularly between Driver Education Centre and Harness training track) ◦ Consider public meetings ◦ Community engagement strategy

Water Level (m)			AEP of flood	Consequence / Impact	Action Actions may include (but not limited to) evacuation, closure of roads, sandbagging, issue of warnings and who is responsible
Yawong Weir	Charlton Town	Charlton Downstream			
	USING THIS INTELLIGENCE CARD. Consider the flood inundation map deemed the most appropriate for the forecast flood level - either as provided by BoM or deduced from the tool at Section 7.2. Review all consequences and actions in this table, from the first row down to the approximate expected severity of flooding. Initiate all actions in a logical sequence. Note that that some actions may need to be initiated in an order that is different from their relative placement in this table.				
	The status of crops on the floodplain to the south and east of Charlton (including the Yeungroon and Gowar Creek floodplains) can cause higher flood levels at Charlton – crops can cause water to travel a little slower and thus rise more slowly, be a little higher, maintain the peak longer and fall more slowly than the same flood after harvest or without a crop. High flows in Yeungroon and Gowar Creeks can further complicate flood behaviour around and immediately downstream from Charlton (i.e. cause higher levels than might be expected - January 2011) High flows in Marmal Creek can create severe flash flooding of the Calder Highway (Woosang) and cause significant traffic disruption (September 2010 and January 2011)				
	The Back St Arnaud Road is referred to as the Charlton – St Arnaud Road throughout this document.				
5.11 (147.81m AHD)	7.41 (129.0m AHD)	7.1 (126.7m AHD)	20% AEP (5-yr ARI)	Localised stormwater flooding in town – most around Watson & Wilson Sts. Breakouts confined to anabranch channels. Water against the Charlton - St Arnaud Road, Back St Arnaud Road and River Road. Patches of shallow water encroaching onto the Calder Highway, east of town (Yeungroon Creek and Marmal Creek) A large number of properties likely to be isolated for several days. Likely to impact properties adjacent to Tyrrell Creek at Culgoa	◦ Level 4 MOCC activation ◦ Sandbag properties 110, 114a and from 134 to 142 High Street. ◦ Monitor properties for sandbagging at 2-4 Mildura Way; and 58 Mildura Way ◦ Monitor water over the Calder Highway. ◦ Contact telecommunications and power providers to ensure security of assets, and that equipment is operational. ◦ Contact Grampians Wimmera Mallee water to ensure security of potable water and sewage. ◦ Consider prepositioning of generators for Sewerage and storm water pumps. ◦ Monitor river overflow from Common stormwater re-use under railway line and back into town drain (7.5m river)

Water Level (m)			AEP of flood	Consequence / Impact	Action Actions may include (but not limited to) evacuation, closure of roads, sandbagging, issue of warnings and who is responsible
Yawong Weir	Charlton Town	Charlton Downstream			
	USING THIS INTELLIGENCE CARD. Consider the flood inundation map deemed the most appropriate for the forecast flood level - either as provided by BoM or deduced from the tool at Section 7.2. Review all consequences and actions in this table, from the first row down to the approximate expected severity of flooding. Initiate all actions in a logical sequence. Note that that some actions may need to be initiated in an order that is different from their relative placement in this table.				
	The status of crops on the floodplain to the south and east of Charlton (including the Yeungroon and Gowar Creek floodplains) can cause higher flood levels at Charlton – crops can cause water to travel a little slower and thus rise more slowly, be a little higher, maintain the peak longer and fall more slowly than the same flood after harvest or without a crop. High flows in Yeungroon and Gowar Creeks can further complicate flood behaviour around and immediately downstream from Charlton (i.e. cause higher levels than might be expected - January 2011) High flows in Marmal Creek can create severe flash flooding of the Calder Highway (Woosang) and cause significant traffic disruption (September 2010 and January 2011)				
	The Back St Arnaud Road is referred to as the Charlton – St Arnaud Road throughout this document.				
	7.55			Peak of **September 2016** flood in Charlton. Peak at Charlton Town Gauge was 7.55m at ~12:15pm on 17 September 2016. Peak of 6 October 2016 flood in Charlton was 7.23m (i.e. approximately 0.32m less that flood 3 weeks earlier but due to density of crops, Tyrrell Creek flood at Springfield was higher during the second flood	◦ Monitor river overflow back through Common and under Gunyah Flat Road rail viaduct to ensure town drain not flooding in reverse (nb: may require temporary levee blocking town drain and setting up pumps to transfer urban storm water over temporary levee) ◦ Monitor properties for sandbagging at: ▪ 135 Calder Highway ▪ 27 Clifton Street ▪ 10, 16 and 30 Ellenwood Avenue ▪ 7 Fanning Street ▪ 1, 9, 11 and 15 Gunyah Flat Road ▪ 111, 152-156 and 177 High Street (Commercial premises) ▪ 7 Jenkins Street ▪ 1 Lundy Street ▪ 30 Rutherford Street

Water Level (m)			AEP of flood	Consequence / Impact	Action Actions may include (but not limited to) evacuation, closure of roads, sandbagging, issue of warnings and who is responsible
Yawong Weir	Charlton Town	Charlton Downstream			
	USING THIS INTELLIGENCE CARD. Consider the flood inundation map deemed the most appropriate for the forecast flood level - either as provided by BoM or deduced from the tool at Section 7.2. Review all consequences and actions in this table, from the first row down to the approximate expected severity of flooding. Initiate all actions in a logical sequence. Note that that some actions may need to be initiated in an order that is different from their relative placement in this table.				
	The status of crops on the floodplain to the south and east of Charlton (including the Yeungroon and Gowar Creek floodplains) can cause higher flood levels at Charlton – crops can cause water to travel a little slower and thus rise more slowly, be a little higher, maintain the peak longer and fall more slowly than the same flood after harvest or without a crop. High flows in Yeungroon and Gowar Creeks can further complicate flood behaviour around and immediately downstream from Charlton (i.e. cause higher levels than might be expected - January 2011) High flows in Marmal Creek can create severe flash flooding of the Calder Highway (Woosang) and cause significant traffic disruption (September 2010 and January 2011)				
	The Back St Arnaud Road is referred to as the Charlton – St Arnaud Road throughout this document.				
5.38 (148.0m AHD)	7.80 (129.4m AHD)	7.3 (126.9m AHD)	10% AEP (10-yr ARI)	Breakouts occurring into Gowar and Yeungroon Creek systems. Water against the Charlton - St Arnaud Road, Back St Arnaud Road and Boort - Charlton Road. Flooding into town from the south (Gowar Creek) adjacent to the Driver Education Centre. Minor inundation of properties adjacent to the main drainage path through town and along Learmonth, Menzies, Donald and Wright Streets, although 4 properties likely to be flooded over-floor. Patches of shallow water encroaching onto the Calder Highway, east of town.	◦ Consider establishing ERC (nb: consider back-up power generation) ◦ Monitor Tyrrell Creek flow towards Culgoa ◦ Consider the Sandbagging 4 x properties in High Street and Rutherford Street. ◦ Monitor water over the Calder Highway and other main roads. ◦ Place “Water over road” signs and consider closing roads. ◦ Consider evacuation of Charlton. ◦ Consider how to maintain functioning of Hospital. ◦ Infrastructure considerations as per 10% AEP ◦ Monitor Cooroopajerup Creek flow towards Wycheproof

Water Level (m)			AEP of flood	Consequence / Impact	Action Actions may include (but not limited to) evacuation, closure of roads, sandbagging, issue of warnings and who is responsible
Yawong Weir	Charlton Town	Charlton Downstream			
	USING THIS INTELLIGENCE CARD. Consider the flood inundation map deemed the most appropriate for the forecast flood level - either as provided by BoM or deduced from the tool at Section 7.2. Review all consequences and actions in this table, from the first row down to the approximate expected severity of flooding. Initiate all actions in a logical sequence. Note that that some actions may need to be initiated in an order that is different from their relative placement in this table.				
	The status of crops on the floodplain to the south and east of Charlton (including the Yeungroon and Gowar Creek floodplains) can cause higher flood levels at Charlton – crops can cause water to travel a little slower and thus rise more slowly, be a little higher, maintain the peak longer and fall more slowly than the same flood after harvest or without a crop. High flows in Yeungroon and Gowar Creeks can further complicate flood behaviour around and immediately downstream from Charlton (i.e. cause higher levels than might be expected - January 2011) High flows in Marmal Creek can create severe flash flooding of the Calder Highway (Woosang) and cause significant traffic disruption (September 2010 and January 2011)				
	The Back St Arnaud Road is referred to as the Charlton – St Arnaud Road throughout this document.				
				CBD and residential area on east side of town begin to flood.	◦ Implement evacuation plan if not already done. ◦ Close local roads. ◦ Close Calder Highway.
	7.91			Peak of **September 2010** flood in Charlton. Peak at Charlton Downstream was 7.3m at ~11.45pm on 6Sept10. 83 properties flooded over-floor in Charlton and 70% of the town inundated including the Police Station. Calder Highway and Boort and St Arnaud Roads closed.	◦ Monitor rainfall and water levels ◦ Monitor Tyrrell Creek flow towards Culgoa ◦ Monitor Cooroopajerup Creek flow towards Wycheproof

Water Level (m)			AEP of flood	Consequence / Impact	Action Actions may include (but not limited to) evacuation, closure of roads, sandbagging, issue of warnings and who is responsible
Yawong Weir	Charlton Town	Charlton Downstream			
	USING THIS INTELLIGENCE CARD. Consider the flood inundation map deemed the most appropriate for the forecast flood level - either as provided by BoM or deduced from the tool at Section 7.2. Review all consequences and actions in this table, from the first row down to the approximate expected severity of flooding. Initiate all actions in a logical sequence. Note that that some actions may need to be initiated in an order that is different from their relative placement in this table.				
	The status of crops on the floodplain to the south and east of Charlton (including the Yeungroon and Gowar Creek floodplains) can cause higher flood levels at Charlton – crops can cause water to travel a little slower and thus rise more slowly, be a little higher, maintain the peak longer and fall more slowly than the same flood after harvest or without a crop. High flows in Yeungroon and Gowar Creeks can further complicate flood behaviour around and immediately downstream from Charlton (i.e. cause higher levels than might be expected - January 2011) High flows in Marmal Creek can create severe flash flooding of the Calder Highway (Woosang) and cause significant traffic disruption (September 2010 and January 2011)				
	The Back St Arnaud Road is referred to as the Charlton – St Arnaud Road throughout this document.				
5.58 (148.2m AHD)	8.03 (129.6m AHD)	7.4 (127.0m AHD)	5% AEP (20-yr ARI)	Numerous breakouts into the Gowar and Yeungroon Creek systems. River Road, Yeungroon Road, Five Mile Road, Seven Mile Road and Nine Mile Road, Boort – Charlton Road, Calder Highway impassable? Railway line inundated in town. Most of Charlton is inundated. 36 properties likely to be flooded over-floor. Majority of flow entering town comes from the Avoca River as it overtops its banks adjacent to the town. Water also enters town from the south adjacent to the Driver Education Centre from Gower Creek.	◦ Infrastructure considerations as per 5% AEP
5.64				Peak of **September 2010** flood at Yawong Weir was ~11.45pm on 5Sept10.	◦

Water Level (m)			AEP of flood	Consequence / Impact	Action Actions may include (but not limited to) evacuation, closure of roads, sandbagging, issue of warnings and who is responsible
Yawong Weir	Charlton Town	Charlton Downstream			
	USING THIS INTELLIGENCE CARD. Consider the flood inundation map deemed the most appropriate for the forecast flood level - either as provided by BoM or deduced from the tool at Section 7.2. Review all consequences and actions in this table, from the first row down to the approximate expected severity of flooding. Initiate all actions in a logical sequence. Note that that some actions may need to be initiated in an order that is different from their relative placement in this table.				
	The status of crops on the floodplain to the south and east of Charlton (including the Yeungroon and Gowar Creek floodplains) can cause higher flood levels at Charlton – crops can cause water to travel a little slower and thus rise more slowly, be a little higher, maintain the peak longer and fall more slowly than the same flood after harvest or without a crop. High flows in Yeungroon and Gowar Creeks can further complicate flood behaviour around and immediately downstream from Charlton (i.e. cause higher levels than might be expected - January 2011) High flows in Marmal Creek can create severe flash flooding of the Calder Highway (Woosang) and cause significant traffic disruption (September 2010 and January 2011)				
	The Back St Arnaud Road is referred to as the Charlton – St Arnaud Road throughout this document.				
5.84 (148.54m AHD)	8.26 (129.8m AHD)	7.5 (127.1m AHD)	2% AEP (50-yr ARI)	Most of Charlton inundated with substantial over-floor flooding due to overland flows from the south and from the Avoca River adjacent to town. 425 properties wet (227 of the properties in Charlton) with 149 likely to be flooded over-floor. Most roads impassable. Railway line inundated. Charlton - St Arnaud Road overtopped and impassable.	◦ Infrastructure considerations per 2% AEP
6.03 (148.73m AHD)	8.42 (130.0m AHD)	7.7 (127.3m AHD)	1% AEP (100-yr ARI)	No change to flooding mechanisms but result is deeper flooding and more severe impacts. 426 properties affected (many of the properties in Charlton) with 266 likely to be flooded over-floor	◦ Infrastructure considerations per 1% AEP
6.09				Peak of **January 2011** flood at Yawong Weir at ~4.45pm on 14Jan11.	◦

Water Level (m)			AEP of flood	Consequence / Impact	Action Actions may include (but not limited to) evacuation, closure of roads, sandbagging, issue of warnings and who is responsible
Yawong Weir	Charlton Town	Charlton Downstream			
	USING THIS INTELLIGENCE CARD. Consider the flood inundation map deemed the most appropriate for the forecast flood level - either as provided by BoM or deduced from the tool at Section 7.2. Review all consequences and actions in this table, from the first row down to the approximate expected severity of flooding. Initiate all actions in a logical sequence. Note that that some actions may need to be initiated in an order that is different from their relative placement in this table.				
	The status of crops on the floodplain to the south and east of Charlton (including the Yeungroon and Gowar Creek floodplains) can cause higher flood levels at Charlton – crops can cause water to travel a little slower and thus rise more slowly, be a little higher, maintain the peak longer and fall more slowly than the same flood after harvest or without a crop. High flows in Yeungroon and Gowar Creeks can further complicate flood behaviour around and immediately downstream from Charlton (i.e. cause higher levels than might be expected - January 2011) High flows in Marmal Creek can create severe flash flooding of the Calder Highway (Woosang) and cause significant traffic disruption (September 2010 and January 2011)				
	The Back St Arnaud Road is referred to as the Charlton – St Arnaud Road throughout this document.				
6.23 (148.93m AHD)	8.57 (130.2m AHD)	7.8 (127.4m AHD)	0.5% AEP (200-yr ARI)	Flooding is deeper and impacts more severe. 427 properties affected with 337 likely to be flooded over-floor (only around 100 or so properties not flooded over-floor).	◦ Infrastructure considerations per 0.5% AEP

Water Level (m)			AEP of flood	Consequence / Impact	Action Actions may include (but not limited to) evacuation, closure of roads, sandbagging, issue of warnings and who is responsible
Yawong Weir	Charlton Town	Charlton Downstream			
	USING THIS INTELLIGENCE CARD. Consider the flood inundation map deemed the most appropriate for the forecast flood level - either as provided by BoM or deduced from the tool at Section 7.2. Review all consequences and actions in this table, from the first row down to the approximate expected severity of flooding. Initiate all actions in a logical sequence. Note that that some actions may need to be initiated in an order that is different from their relative placement in this table.				
	The status of crops on the floodplain to the south and east of Charlton (including the Yeungroon and Gowar Creek floodplains) can cause higher flood levels at Charlton – crops can cause water to travel a little slower and thus rise more slowly, be a little higher, maintain the peak longer and fall more slowly than the same flood after harvest or without a crop. High flows in Yeungroon and Gowar Creeks can further complicate flood behaviour around and immediately downstream from Charlton (i.e. cause higher levels than might be expected - January 2011) High flows in Marmal Creek can create severe flash flooding of the Calder Highway (Woosang) and cause significant traffic disruption (September 2010 and January 2011)				
	The Back St Arnaud Road is referred to as the Charlton – St Arnaud Road throughout this document.				
	8.7	8.05		Peak of **January 2011** flood in Charlton. Peak at Charlton Downstream was 8.05m at ~3.45am on 15Jan11. 369 properties inundated, 270 houses and 15 businesses flooded over-floor. Community infrastructure and communications badly affected. Loss of power supply and phone and internet services. Calder Highway and other roads closed. A large number of rural properties isolated for several days 2 of these properties would have over floor flooding. A list of locations where isolation may occur is contained in **Appendix G on page 137**.	◦
9.05	10.69		PMF		

2.14 Summary of Properties Flooded

Summary of number of flood affected properties in Charlton EXISTING CONDITIONS						
	Design Flood AEP (%)					
	20%	10%	5%	2%	1%	0.5%
Level at Yawong Weir	**5.11**	**5.38**	**5.58**	**5.84**	**6.03**	**6.23**
Level at Charlton Downstream	**7.1**	**7.24**	**7.38**	**7.56**	**7.68**	**7.81**
Level at Charlton Town gauge	**7.41**	**7.80**	**8.03**	**8.26**	**8.42**	**8.57**
Equivalent level in mAHD at Charlton Town gauge	129.05	129.44	129.67	129.90	130.06	130.21
Number of properties flooded above floor	0	4	36	149	266	337
Number of properties flooded below floor only	135	216	367	276	160	90
Total number of flooded properties	137	220	402	425	426	427

2.15 Detailed List of Properties Flooded

Charlton - EXISTING CONDITIONS It is suggested that this table be used in conjunction with the flood inundation maps													
LEGEND		Within 100mm of flooding over-floor						Depth of over-floor flooding					Comments
Location (Number & Street)	Depth of flooding on the property for each ARI						Depth of over-floor flooding for each ARI						
	5yr	10yr	20yr	50yr	100yr	200yr	5yr	10yr	20yr	50yr	100yr	200yr	
	7.41	7.80	8.03	8.26	8.42	8.57	7.41	7.80	8.03	8.26	8.42	8.57	
1A ARMSTRONG STREET			0.18	0.46	0.59	0.73					0.08	0.21	
3 ARMSTRONG STREET			0.13	0.40	0.54	0.67					0.00	0.14	
4 ARMSTRONG STREET		0.04	0.40	0.67	0.80	0.94			0.13	0.40	0.53	0.67	
3 ARMSTRONG STREET			0.08	0.37	0.51	0.64					0.06	0.20	
6 ARMSTRONG STREET			0.26	0.53	0.67	0.81				0.21	0.35	0.49	
9-11 ARMSTRONG STREET			0.03	0.32	0.46	0.60							
9-11 ARMSTRONG STREET			0.04	0.33	0.47	0.61							
10 ARMSTRONG STREET			0.15	0.40	0.53	0.67							
12 ARMSTRONG STREET			0.34	0.51	0.62	0.76						0.13	
14 ARMSTRONG STREET			0.30	0.47	0.58	0.71						0.11	
16 ARMSTRONG STREET			0.27	0.44	0.55	0.68					0.04	0.17	
18 ARMSTRONG STREET			0.36	0.54	0.64	0.77					0.03	0.16	
19 ARMSTRONG STREET				0.33	0.47	0.61					0.04	0.18	
21 ARMSTRONG STREET			0.05	0.24	0.39	0.53							
22 ARMSTRONG STREET			0.36	0.56	0.66	0.80						0.07	

Charlton - EXISTING CONDITIONS

It is suggested that this table be used in conjunction with the flood inundation maps

LEGEND		Within 100mm of flooding over-floor		Depth of over-floor flooding							Comments
Location (Number & Street)	Depth of flooding on the property for each ARI						Depth of over-floor flooding for each ARI						
	5yr	10yr	20yr	50yr	100yr	200yr	5yr	10yr	20yr	50yr	100yr	200yr	
	7.41	7.80	8.03	8.26	8.42	8.57	7.41	7.80	8.03	8.26	8.42	8.57	
23 ARMSTRONG STREET		0.09	0.21	0.38	0.52	0.67							
24 ARMSTRONG STREET			0.32	0.52	0.63	0.76						0.03	
25 ARMSTRONG STREET				0.24	0.39	0.53							
27 ARMSTRONG STREET			0.11	0.24	0.40	0.53							
28 ARMSTRONG STREET			0.28	0.41	0.53	0.67							
29 ARMSTRONG STREET			0.28	0.41	0.57	0.70							
30 ARMSTRONG STREET			0.23	0.37	0.49	0.62							
31 ARMSTRONG STREET			0.27	0.40	0.55	0.68							
33 ARMSTRONG STREET			0.11	0.21	0.38	0.52							
34 ARMSTRONG STREET			0.22	0.36	0.50	0.63				0.07	0.22	0.34	
35 ARMSTRONG STREET			0.28	0.35	0.46	0.59			0.03	0.10	0.21	0.34	
36 ARMSTRONG STREET			0.18	0.46	0.55	0.64							
37 ARMSTRONG STREET			0.24	0.32	0.43	0.54							
38 ARMSTRONG STREET			0.17	0.30	0.41	0.51							
39 ARMSTRONG STREET			0.13	0.27	0.32	0.44							
40 ARMSTRONG STREET			0.39	0.46	0.54	0.64						0.01	
41 ARMSTRONG STREET			0.23	0.30	0.35	0.47							

Charlton - EXISTING CONDITIONS

It is suggested that this table be used in conjunction with the flood inundation maps

LEGEND		Within 100mm of flooding over-floor						Depth of over-floor flooding					
Location (Number & Street)	Depth of flooding on the property for each ARI						Depth of over-floor flooding for each ARI						Comments
	5yr	10yr	20yr	50yr	100yr	200yr	5yr	10yr	20yr	50yr	100yr	200yr	
	7.41	7.80	8.03	8.26	8.42	8.57	7.41	7.80	8.03	8.26	8.42	8.57	
42 ARMSTRONG STREET			0.56	0.64	0.72	0.82					0.04	0.13	
43 ARMSTRONG STREET			0.29	0.38	0.44	0.55							
44 ARMSTRONG STREET			0.49	0.58	0.67	0.76							
46 ARMSTRONG STREET			0.49	0.59	0.68	0.78							
48 ARMSTRONG STREET			0.50	0.60	0.68	0.77							
50 ARMSTRONG STREET			0.44	0.56	0.63	0.72							
1 ARUNDELL SQUARE		0.25	0.44	0.64	0.74	0.83						0.08	
2 ARUNDELL SQUARE		0.12	0.25	0.42	0.51	0.59							
3 ARUNDELL SQUARE			0.13	0.34	0.43	0.52							
5 ARUNDELL SQUARE			0.14	0.32	0.41	0.49							
6 ARUNDELL SQUARE			0.49	0.52	0.55	0.60							
7 ARUNDELL SQUARE			0.33	0.52	0.61	0.69				0.01	0.10	0.18	
9 ARUNDELL SQUARE			0.27	0.47	0.57	0.65					0.05	0.13	
11-13 ARUNDELL SQUARE			0.33	0.46	0.52	0.58						0.02	
15 ARUNDELL SQUARE			0.39	0.55	0.63	0.70						0.06	
17 ARUNDELL SQUARE			0.30	0.50	0.59	0.67				0.13	0.22	0.30	

Charlton - EXISTING CONDITIONS

It is suggested that this table be used in conjunction with the flood inundation maps

LEGEND		Within 100mm of flooding over-floor		Depth of over-floor flooding							Comments
Location (Number & Street)	Depth of flooding on the property for each ARI						Depth of over-floor flooding for each ARI						
	5yr	10yr	20yr	50yr	100yr	200yr	5yr	10yr	20yr	50yr	100yr	200yr	
	7.41	7.80	8.03	8.26	8.42	8.57	7.41	7.80	8.03	8.26	8.42	8.57	
8 BADEN POWELL DRIVE	0.18	0.47	0.64	0.82	0.91	1.00						-0.04	
39 BORUNG HIGHWAY	0.10	0.59	0.82	1.08	1.24	1.39				0.01	0.17	0.32	
135 CALDER HIGHWAY	0.72	1.17	1.31	1.76	1.78	1.84							
1-5 CAMP STREET	0.15	0.15	0.41	0.70	0.85	1.00				0.05	0.21	0.36	
4 CAMP STREET			0.34	0.62	0.76	0.90				0.22	0.36	0.50	
6 CAMP STREET			0.38	0.62	0.76	0.91						0.09	
7 CAMP STREET			0.35	0.62	0.76	0.91					0.01	0.16	
8 CAMP STREET			0.22	0.47	0.61	0.75					0.06	0.20	
9 CAMP STREET			0.34	0.61	0.76	0.90				0.13	0.27	0.41	
10 CAMP STREET			0.19	0.44	0.58	0.72						0.11	
11 CAMP STREET			0.19	0.46	0.60	0.74							
12 CAMP STREET			0.19	0.43	0.57	0.70				0.15	0.28	0.42	
13 CAMP STREET			0.24	0.50	0.64	0.78				0.05	0.19	0.33	
14 CAMP STREET			0.26	0.51	0.64	0.77							
15 CAMP STREET			0.38	0.63	0.77	0.91					0.09	0.23	
17 CAMP STREET			0.37	0.64	0.78	0.92			0.03	0.30	0.44	0.58	
9-13 CLIFTON STREET	0.43	0.80	0.93	1.09	1.18	1.26							

Charlton - EXISTING CONDITIONS

It is suggested that this table be used in conjunction with the flood inundation maps

LEGEND		Within 100mm of flooding over-floor		Depth of over-floor flooding							Comments
Location (Number & Street)	Depth of flooding on the property for each ARI						Depth of over-floor flooding for each ARI						
	5yr	10yr	20yr	50yr	100yr	200yr	5yr	10yr	20yr	50yr	100yr	200yr	
	7.41	7.80	8.03	8.26	8.42	8.57	7.41	7.80	8.03	8.26	8.42	8.57	
19 CLIFTON STREET	0.36	0.75	0.86	1.03	1.11	1.17							
27 CLIFTON LANE	0.71	1.19	1.35	1.49	1.57	1.65							
38 DAVIES STREET				0.38	0.55	0.69					0.01	0.14	
40 DAVIES STREET				0.32	0.49	0.62						0.09	
46 DAVIES STREET	0.25	0.26	0.37	0.54	0.70	0.83							
48 DAVIES STREET	0.19	0.20	0.31	0.47	0.62	0.75						0.02	
50 DAVIES STREET	0.28	0.29	0.39	0.55	0.69	0.82			0.07	0.22	0.37	0.50	
54 DAVIES STREET	0.21	0.22	0.33	0.44	0.55	0.69							
60 DAVIES STREET			0.25	0.40	0.54	0.68				0.01	0.15	0.29	
2-4 DONALD STREET			0.39	0.67	0.82	0.96				0.23	0.38	0.51	
5 DONALD ROAD					0.13	0.29							
6-8 DONALD STREET			0.33	0.60	0.76	0.89			0.02	0.30	0.45	0.58	
7 DONALD ROAD				0.46	0.62	0.80							
10-12 DONALD STREET			0.34	0.59	0.74	0.86				0.21	0.36	0.49	
11 DONALD ROAD	0.49	0.90	1.15	1.41	1.57	1.73						0.10	
13 DONALD ROAD	0.49	0.91	1.16	1.42	1.58	1.74				0.06	0.22	0.38	
6/13 DONALD STREET			0.19	0.32	0.44	0.57				0.01	0.13	0.25	

Charlton - EXISTING CONDITIONS

It is suggested that this table be used in conjunction with the flood inundation maps

LEGEND		Within 100mm of flooding over-floor						Depth of over-floor flooding						
Location (Number & Street)	Depth of flooding on the property for each ARI						Depth of over-floor flooding for each ARI						Comments
	5yr	10yr	20yr	50yr	100yr	200yr	5yr	10yr	20yr	50yr	100yr	200yr	
	7.41	7.80	8.03	8.26	8.42	8.57	7.41	7.80	8.03	8.26	8.42	8.57	
14 DONALD STREET			0.32	0.50	0.65	0.77					0.01	0.12	
15 DONALD STREET			0.19	0.30	0.42	0.54							
16 DONALD STREET			0.37	0.46	0.61	0.73							
17 DONALD STREET			0.26	0.41	0.45	0.58					0.03	0.16	
18 DONALD STREET			0.35	0.44	0.55	0.67							
20 DONALD STREET			0.41	0.50	0.60	0.70							
22-40 DONALD STREET		1.52	1.94	2.02	2.09	2.22						0.02	
27 DONALD STREET		0.35	0.42	0.53	0.70	0.86					0.06	0.22	
10 ELLENWOOD AVENUE		1.54	1.68	1.85	1.95	2.03				0.15	0.25	0.34	
16 ELLENWOOD AVENUE		0.39	0.52	0.70	0.79	0.87							
26 ELLENWOOD AVENUE			0.32	0.59	0.77	0.91					0.08	0.22	
27 ELLENWOOD AVENUE				0.55	0.73	0.86					0.08	0.22	
30 ELLENWOOD AVENUE	0.23	0.51	0.65	0.81	0.90	0.97				0.07	0.16	0.23	
33 ELLENWOOD AVENUE			0.39	0.61	0.79	0.93							
1 FANNING STREET			0.20	0.48	0.66	0.79						0.07	
2 FANNING STREET			0.27	0.53	0.69	0.82					0.01	0.13	
3 FANNING STREET			0.14	0.44	0.61	0.75					0.02	0.15	

Charlton - EXISTING CONDITIONS

It is suggested that this table be used in conjunction with the flood inundation maps

LEGEND		Within 100mm of flooding over-floor			Depth of over-floor flooding						
Location (Number & Street)	Depth of flooding on the property for each ARI						Depth of over-floor flooding for each ARI						Comments
	5yr	10yr	20yr	50yr	100yr	200yr	5yr	10yr	20yr	50yr	100yr	200yr	
	7.41	7.80	8.03	8.26	8.42	8.57	7.41	7.80	8.03	8.26	8.42	8.57	
4 FANNING STREET		0.07	0.31	0.57	0.73	0.86					0.03	0.16	
5 FANNING STREET			0.27	0.56	0.74	0.88				0.16	0.34	0.47	
6 FANNING STREET	0.14	0.16	0.40	0.66	0.83	0.95					0.07	0.20	
7 FANNING STREET			0.32	0.62	0.80	0.93			0.14	0.44	0.61	0.75	
8-10 FANNING STREET	0.33	0.36	0.58	0.85	1.01	1.13				0.01	0.17	0.30	
9 FANNING STREET	0.12	0.13	0.33	0.62	0.79	0.92				0.01	0.17	0.31	
11 FANNING STREET	0.22	0.23	0.42	0.71	0.88	1.01				0.02	0.19	0.31	
4 GRIEVES STREET			0.29	0.59	0.75	0.90					0.03	0.18	
5 GRIEVES STREET			0.18	0.48	0.63	0.77				0.07	0.22	0.35	
1 GUNYAH FLAT ROAD	0.36	0.37	0.47	0.54	0.57	0.62							
9 GUNYAH FLAT ROAD		0.34	0.56	0.62	0.68	0.74						0.02	
11 GUNYAH FLAT ROAD				0.61	0.67	0.74				0.06	0.12	0.19	
15 GUNYAH FLAT ROAD			0.66	0.78	0.84	0.90						0.02	
17 GUNYAH FLAT ROAD			0.36	0.48	0.56	0.62							
19 GUNYAH FLAT ROAD			0.41	0.54	0.62	0.69							
1 HALLIDAY STREET		0.05	0.36	0.63	0.78	0.92				0.10	0.25	0.40	
2 HALLIDAY STREET			0.33	0.58	0.73	0.87				0.20	0.34	0.49	

Charlton - EXISTING CONDITIONS

It is suggested that this table be used in conjunction with the flood inundation maps

LEGEND		Within 100mm of flooding over-floor		Depth of over-floor flooding							Comments
Location (Number & Street)	Depth of flooding on the property for each ARI						Depth of over-floor flooding for each ARI						
	5yr	10yr	20yr	50yr	100yr	200yr	5yr	10yr	20yr	50yr	100yr	200yr	
	7.41	7.80	8.03	8.26	8.42	8.57	7.41	7.80	8.03	8.26	8.42	8.57	
3 HALLIDAY STREET	0.02	0.13	0.45	0.72	0.87	1.01			0.04	0.31	0.46	0.60	
4-6 HALLIDAY STREET	0.21	0.21	0.41	0.68	0.83	0.98							
4-6 HALLIDAY STREET	0.26	0.26	0.46	0.73	0.89	1.04				0.09	0.25	0.40	
5 HALLIDAY STREET	0.04	0.13	0.45	0.72	0.88	1.02				0.10	0.26	0.40	
7 HALLIDAY STREET			0.18	0.45	0.60	0.75						0.13	
8 HALLIDAY STREET	0.22	0.22	0.43	0.70	0.85	1.01				0.26	0.41	0.56	
10 HALLIDAY STREET	0.24	0.25	0.45	0.73	0.89	1.04				0.13	0.28	0.43	
11 HALLIDAY STREET			0.28	0.56	0.71	0.86						0.04	
12 HALLIDAY STREET	0.15	0.15	0.35	0.64	0.80	0.95					0.01	0.15	
16 HALLIDAY STREET			0.38	0.67	0.83	0.98				0.28	0.44	0.59	
18 HALLIDAY STREET			0.35	0.66	0.82	0.97				0.28	0.44	0.59	
5/20-22 HALLIDAY STREET	0.11	0.11	0.33	0.66	0.82	0.96				0.32	0.48	0.63	
24 HALLIDAY STREET			0.27	0.63	0.79	0.93					0.04	0.19	
26-28 HALLIDAY STREET			0.29	0.60	0.74	0.88				0.14	0.28	0.42	
32 HALLIDAY STREET			0.29	0.61	0.76	0.90						0.03	
34-36 HALLIDAY STREET			0.27	0.67	0.82	0.95					0.13	0.27	

Charlton - EXISTING CONDITIONS

It is suggested that this table be used in conjunction with the flood inundation maps

LEGEND		Within 100mm of flooding over-floor						Depth of over-floor flooding					
Location (Number & Street)	Depth of flooding on the property for each ARI						Depth of over-floor flooding for each ARI						Comments
	5yr	10yr	20yr	50yr	100yr	200yr	5yr	10yr	20yr	50yr	100yr	200yr	
	7.41	7.80	8.03	8.26	8.42	8.57	7.41	7.80	8.03	8.26	8.42	8.57	
38-40 HALLIDAY STREET			0.42	0.65	0.79	0.93					0.08	0.22	
HIGH STREET	0.05	0.05	0.38	0.65	0.78	0.91				0.03	0.16	0.29	
HIGH STREET			0.25	0.51	0.64	0.77				0.02	0.14	0.27	
1 HIGH STREET		0.11	0.41	0.67	0.81	0.96				0.03	0.18	0.32	
2A HIGH STREET		0.06	0.38	0.61	0.74	0.88				0.01	0.14	0.27	
3 HIGH STREET		0.18	0.44	0.73	0.88	1.03					0.07	0.22	
5 HIGH STREET			0.13	0.41	0.55	0.70				0.20	0.35	0.49	
7 HIGH STREET			0.14	0.43	0.58	0.72				0.23	0.38	0.52	
7 HIGH STREET			0.14	0.44	0.59	0.73				0.17	0.32	0.46	
7 HIGH STREET				0.33	0.46	0.60				0.21	0.35	0.48	
8 HIGH STREET		0.08	0.40	0.66	0.81	0.95					0.01	0.14	
9 HIGH STREET			0.42	0.70	0.84	0.97				0.24	0.38	0.51	
7/10-14 HIGH STREET			0.44	0.69	0.83	0.97				0.02	0.16	0.30	
1A/10-14 HIGH STREET			0.30	0.53	0.66	0.80					0.09	0.22	
1A/10-14 HIGH STREET		0.02	0.33	0.57	0.70	0.83					0.09	0.22	
11 HIGH STREET			0.30	0.57	0.70	0.83				0.27	0.39	0.53	
13 HIGH STREET		0.13	0.46	0.74	0.86	0.99				0.25	0.38	0.51	

Charlton - EXISTING CONDITIONS

It is suggested that this table be used in conjunction with the flood inundation maps

LEGEND		Within 100mm of flooding over-floor						Depth of over-floor flooding						
Location (Number & Street)	Depth of flooding on the property for each ARI						Depth of over-floor flooding for each ARI						Comments
	5yr	10yr	20yr	50yr	100yr	200yr	5yr	10yr	20yr	50yr	100yr	200yr	
	7.41	7.80	8.03	8.26	8.42	8.57	7.41	7.80	8.03	8.26	8.42	8.57	
15-17 HIGH STREET		0.24	0.56	0.83	0.96	1.09				0.21	0.34	0.47	
18-22 HIGH STREET			0.41	0.65	0.78	0.92				0.20	0.33	0.47	
19 HIGH STREET		0.33	0.65	0.92	1.05	1.18				0.21	0.34	0.47	
19 HIGH STREET		0.25	0.59	0.85	0.97	1.10			0.15	0.41	0.53	0.66	
21 HIGH STREET		0.38	0.71	0.98	1.11	1.24				0.25	0.38	0.51	
27-29 HIGH STREET		0.43	0.76	1.03	1.15	1.28			0.14	0.40	0.53	0.66	
24-26 HIGH STREET			0.22	0.47	0.60	0.74				0.20	0.32	0.46	
25 HIGH STREET		0.49	0.82	1.08	1.21	1.34			0.21	0.47	0.60	0.73	
28 HIGH STREET			0.33	0.60	0.74	0.87				0.01	0.14	0.28	
28 HIGH STREET			0.21	0.48	0.61	0.75				0.25	0.38	0.52	
31 HIGH STREET		0.25	0.58	0.85	0.98	1.11			0.19	0.46	0.59	0.72	
1/33 HIGH STREET		0.22	0.57	0.84	0.97	1.10					0.09	0.22	
36-40 HIGH STREET			0.39	0.65	0.78	0.91			0.03	0.29	0.42	0.56	
36-40 HIGH STREET			0.46	0.73	0.87	1.01			0.06	0.33	0.47	0.61	
37 HIGH STREET		0.28	0.64	0.91	1.03	1.16				0.05	0.17	0.30	
39-41 HIGH STREET			0.29	0.56	0.68	0.81						0.03	
42-44 HIGH STREET			0.37	0.63	0.76	0.90			0.02	0.28	0.41	0.54	

Charlton - EXISTING CONDITIONS

It is suggested that this table be used in conjunction with the flood inundation maps

LEGEND		Within 100mm of flooding over-floor		Depth of over-floor flooding							Comments
Location (Number & Street)	Depth of flooding on the property for each ARI						Depth of over-floor flooding for each ARI						
	5yr	10yr	20yr	50yr	100yr	200yr	5yr	10yr	20yr	50yr	100yr	200yr	
	7.41	7.80	8.03	8.26	8.42	8.57	7.41	7.80	8.03	8.26	8.42	8.57	
42-44 HIGH STREET			0.35	0.61	0.75	0.88			0.01	0.27	0.41	0.54	
42-44 HIGH STREET			0.42	0.69	0.82	0.95				0.23	0.36	0.49	
42-44 HIGH STREET		0.10	0.45	0.72	0.85	0.98				0.04	0.17	0.30	
49 HIGH STREET			0.23	0.56	0.71	0.84					0.05	0.19	
53 HIGH STREET			0.31	0.69	0.82	0.94						0.01	
55 HIGH STREET				0.63	0.76	0.87						0.08	
56-58 HIGH STREET			0.17	0.44	0.56	0.69				0.02	0.14	0.27	
56-58 HIGH STREET			0.21	0.47	0.59	0.72					0.11	0.24	
60-62 HIGH STREET			0.20	0.46	0.58	0.71					0.07	0.20	
61-67 HIGH STREET				0.42	0.54	0.66						0.09	
64A HIGH STREET				0.32	0.44	0.56							
66 HIGH STREET			0.10	0.32	0.45	0.58						0.12	
68 HIGH STREET		0.08	0.14	0.36	0.48	0.61						0.12	
69-71 HIGH STREET				0.40	0.53	0.66				0.01	0.14	0.27	
73-77 HIGH STREET			0.08	0.37	0.50	0.63				0.01	0.13	0.26	
73-77 HIGH STREET				0.34	0.47	0.60				0.10	0.23	0.36	
73-77 HIGH STREET			0.03	0.32	0.46	0.58				0.18	0.31	0.44	

Charlton - EXISTING CONDITIONS

It is suggested that this table be used in conjunction with the flood inundation maps

LEGEND		Within 100mm of flooding over-floor		Depth of over-floor flooding							Comments
Location (Number & Street)	Depth of flooding on the property for each ARI						Depth of over-floor flooding for each ARI						
	5yr	10yr	20yr	50yr	100yr	200yr	5yr	10yr	20yr	50yr	100yr	200yr	
	7.41	7.80	8.03	8.26	8.42	8.57	7.41	7.80	8.03	8.26	8.42	8.57	
74 HIGH STREET		0.17	0.26	0.42	0.56	0.70				0.12	0.25	0.39	
79-81 HIGH STREET				0.23	0.36	0.48				0.18	0.31	0.44	
79-81 HIGH STREET				0.22	0.35	0.48				0.17	0.30	0.42	
76-78 HIGH STREET		0.10	0.19	0.32	0.47	0.62			0.02	0.15	0.31	0.45	
80 HIGH STREET		0.11	0.19	0.32	0.47	0.61			0.05	0.18	0.33	0.47	
85-89 HIGH STREET				0.14	0.27	0.39				0.03	0.16	0.28	
86-90 HIGH STREET	0.05	0.22	0.27	0.41	0.55	0.68				0.01	0.15	0.28	
91-93 HIGH STREET				0.18	0.36	0.50							
92 HIGH STREET		0.22	0.27	0.38	0.53	0.68						0.06	
101 HIGH STREET				0.34	0.55	0.70						0.01	
102-104 HIGH STREET	0.17	0.19	0.33	0.50	0.69	0.83			0.02	0.20	0.39	0.53	
103 HIGH STREET				0.46	0.66	0.81						0.14	
105 HIGH STREET				0.49	0.68	0.83					0.06	0.21	
106 HIGH STREET	0.27	0.30	0.42	0.61	0.79	0.94						0.11	
107 HIGH STREET			0.16	0.58	0.79	0.94						0.06	
109 HIGH STREET			0.14	0.48	0.70	0.85					0.20	0.35	
110 HIGH STREET	0.26	0.27	0.42	0.63	0.82	0.97		0.07	0.21	0.43	0.62	0.77	

Charlton - EXISTING CONDITIONS

It is suggested that this table be used in conjunction with the flood inundation maps

LEGEND		Within 100mm of flooding over-floor		Depth of over-floor flooding							Comments
Location (Number & Street)	Depth of flooding on the property for each ARI						Depth of over-floor flooding for each ARI						
	5yr	10yr	20yr	50yr	100yr	200yr	5yr	10yr	20yr	50yr	100yr	200yr	
	7.41	7.80	8.03	8.26	8.42	8.57	7.41	7.80	8.03	8.26	8.42	8.57	
111 HIGH STREET	0.26	0.27	0.35	0.62	0.85	1.00			0.06	0.34	0.56	0.72	
112 HIGH STREET	0.19	0.23	0.37	0.59	0.78	0.92					0.13	0.27	
113 HIGH STREET	0.29	0.30	0.41	0.69	0.89	1.04				0.05	0.26	0.40	
114 HIGH STREET	0.33	0.39	0.54	0.75	0.94	1.09					0.16	0.30	
114 HIGH STREET	0.30	0.34	0.49	0.70	0.90	1.05		0.08	0.22	0.44	0.64	0.79	
115 HIGH STREET	0.30	0.31	0.42	0.70	0.90	1.04				0.09	0.29	0.44	
116 HIGH STREET	0.32	0.37	0.52	0.75	0.94	1.09		0.03	0.17	0.40	0.59	0.74	
117 HIGH STREET	0.40	0.41	0.52	0.80	1.00	1.14					0.14	0.28	
118 HIGH STREET	0.24	0.29	0.44	0.67	0.86	1.01					0.11	0.26	
119 HIGH STREET	0.46	0.46	0.57	0.85	1.05	1.19				0.22	0.41	0.55	
120 HIGH STREET		0.11	0.26	0.46	0.64	0.78				0.19	0.38	0.52	
121 HIGH STREET	0.46	0.47	0.58	0.86	1.06	1.20					0.08	0.23	
122 HIGH STREET			0.22	0.44	0.62	0.76					0.01	0.14	
123-125 HIGH STREET	0.44	0.44	0.57	0.85	1.05	1.19					0.08	0.22	
124 HIGH STREET	0.03	0.08	0.34	0.56	0.73	0.87					0.04	0.17	
126 HIGH STREET	0.11	0.21	0.42	0.65	0.82	0.94					0.14	0.27	
127 HIGH STREET	0.44	0.44	0.57	0.85	1.04	1.18				0.17	0.36	0.50	

Charlton - EXISTING CONDITIONS

It is suggested that this table be used in conjunction with the flood inundation maps

LEGEND		Within 100mm of flooding over-floor		Depth of over-floor flooding							Comments
Location (Number & Street)	Depth of flooding on the property for each ARI						Depth of over-floor flooding for each ARI						
	5yr	10yr	20yr	50yr	100yr	200yr	5yr	10yr	20yr	50yr	100yr	200yr	
	7.41	7.80	8.03	8.26	8.42	8.57	7.41	7.80	8.03	8.26	8.42	8.57	
128 HIGH STREET	0.30	0.32	0.54	0.79	0.95	1.07				0.14	0.30	0.43	
129 HIGH STREET	0.47	0.48	0.63	0.90	1.08	1.22				0.13	0.32	0.46	
130 HIGH STREET	0.16	0.19	0.41	0.66	0.82	0.94			0.07	0.32	0.48	0.60	
132 HIGH STREET	0.19	0.22	0.44	0.68	0.84	0.96					0.08	0.20	
134 HIGH STREET	0.39	0.41	0.64	0.90	1.06	1.18				0.16	0.32	0.44	
135 HIGH STREET	0.38	0.38	0.57	0.81	0.99	1.12					0.16	0.29	
137 HIGH STREET	0.57	0.59	0.88	1.12	1.30	1.43				0.15	0.33	0.46	
138 HIGH STREET	0.28	0.30	0.53	0.79	0.95	1.07				0.11	0.28	0.40	
139 HIGH STREET	0.11	0.20	0.54	0.79	0.95	1.08						0.06	
140 HIGH STREET	0.19	0.21	0.43	0.70	0.86	0.98			0.20	0.47	0.63	0.75	
142 HIGH STREET	0.23	0.26	0.48	0.75	0.91	1.03				0.08	0.24	0.36	
143-145 HIGH STREET			0.51	0.74	0.89	1.01				0.11	0.26	0.38	
144 HIGH STREET	0.28	0.30	0.53	0.79	0.95	1.07				0.08	0.24	0.36	
148-150 HIGH STREET		0.17	0.40	0.66	0.83	0.94			0.12	0.39	0.55	0.67	
149 HIGH STREET			0.26	0.51	0.68	0.80					0.06	0.18	
151 HIGH STREET			0.03	0.23	0.44	0.60						0.03	
152-156 HIGH STREET			0.32	0.59	0.75	0.87			0.20	0.47	0.63	0.75	

Charlton - EXISTING CONDITIONS

It is suggested that this table be used in conjunction with the flood inundation maps

LEGEND		Within 100mm of flooding over-floor		Depth of over-floor flooding								Comments
Location (Number & Street)	Depth of flooding on the property for each ARI						Depth of over-floor flooding for each ARI						
	5yr	10yr	20yr	50yr	100yr	200yr	5yr	10yr	20yr	50yr	100yr	200yr	
	7.41	7.80	8.03	8.26	8.42	8.57	7.41	7.80	8.03	8.26	8.42	8.57	
153 HIGH STREET			0.19	0.39	0.58	0.80							
155 HIGH STREET			0.21	0.39	0.57	0.77					0.07	0.27	
157 HIGH STREET			0.15	0.32	0.50	0.67					0.16	0.33	
158-164 HIGH STREET			0.23	0.49	0.65	0.77				0.07	0.23	0.34	
159 HIGH STREET			0.15	0.31	0.48	0.64					0.01	0.17	
161 HIGH STREET			0.23	0.38	0.54	0.69							
166-186 HIGH STREET			0.33	0.55	0.66	0.72						0.03	
177 HIGH STREET			0.28	0.43	0.57	0.70				0.14	0.27	0.41	
1 JENKINS STREET			0.28	0.45	0.61	0.73						0.01	
2 JENKINS STREET			0.17	0.39	0.56	0.69							
3 JENKINS STREET			0.23	0.38	0.56	0.69						0.03	
4 JENKINS STREET	0.12	0.13	0.32	0.48	0.65	0.78					0.16	0.30	
7 JENKINS STREET		0.12	0.48	0.65	0.83	0.97				0.13	0.31	0.44	
8 JENKINS STREET	0.17	0.18	0.28	0.48	0.66	0.79						0.13	
9 JENKINS STREET			0.39	0.60	0.78	0.91					0.01	0.14	
10 JENKINS STREET	0.22	0.23	0.34	0.52	0.69	0.83						0.06	
11 JENKINS STREET			0.27	0.49	0.67	0.80					0.10	0.23	

Charlton - EXISTING CONDITIONS

It is suggested that this table be used in conjunction with the flood inundation maps

LEGEND		Within 100mm of flooding over-floor		Depth of over-floor flooding								Comments
Location (Number & Street)	Depth of flooding on the property for each ARI						Depth of over-floor flooding for each ARI						
	5yr	10yr	20yr	50yr	100yr	200yr	5yr	10yr	20yr	50yr	100yr	200yr	
	7.41	7.80	8.03	8.26	8.42	8.57	7.41	7.80	8.03	8.26	8.42	8.57	
12 JENKINS STREET	0.28	0.28	0.39	0.57	0.74	0.88					0.09	0.22	
13 JENKINS STREET			0.16	0.39	0.56	0.69						0.10	
15 JENKINS STREET			0.13	0.35	0.52	0.65						0.02	
17 JENKINS STREET			0.17	0.36	0.53	0.66							
2 KAYE STREET	0.32	0.37	0.83	0.98	1.19	1.32					0.06	0.19	
7 KAYE STREET	0.34	0.35	0.41	0.64	0.85	0.99							
10 KAYE STREET	0.15	0.26	0.31	0.49	0.67	0.82						0.12	
12 KAYE STREET	0.19	0.30	0.35	0.54	0.72	0.87					0.01	0.15	
11 KAYE STREET	0.20	0.24	0.37	0.56	0.75	0.89					0.18	0.32	
13 KAYE STREET	0.23	0.27	0.40	0.59	0.78	0.93				0.10	0.28	0.43	
14 KAYE STREET	0.17	0.28	0.33	0.52	0.71	0.85					0.05	0.19	
15 KAYE STREET	0.24	0.28	0.41	0.61	0.80	0.95					0.16	0.30	
16 KAYE STREET	0.12	0.23	0.28	0.48	0.67	0.81					0.09	0.23	
17 KAYE STREET	0.21	0.25	0.39	0.59	0.78	0.93					0.12	0.27	
18 KAYE STREET	0.07	0.19	0.33	0.49	0.67	0.82				0.01	0.20	0.35	
19 KAYE STREET	0.19	0.23	0.37	0.57	0.76	0.91				0.16	0.35	0.50	
20 KAYE STREET	0.13	0.26	0.34	0.46	0.66	0.81						0.01	

Charlton - EXISTING CONDITIONS

It is suggested that this table be used in conjunction with the flood inundation maps

LEGEND		Within 100mm of flooding over-floor		Depth of over-floor flooding							Comments
Location (Number & Street)	Depth of flooding on the property for each ARI						Depth of over-floor flooding for each ARI						
	5yr	10yr	20yr	50yr	100yr	200yr	5yr	10yr	20yr	50yr	100yr	200yr	
	7.41	7.80	8.03	8.26	8.42	8.57	7.41	7.80	8.03	8.26	8.42	8.57	
21 KAYE STREET	0.10	0.15	0.30	0.49	0.68	0.83					0.15	0.30	
23 KAYE STREET	0.27	0.30	0.45	0.64	0.83	0.98					0.05	0.20	
1/24 KAYE STREET		0.26	0.40	0.50	0.68	0.84					0.13	0.28	
1/24 KAYE STREET		0.15	0.27	0.37	0.56	0.72					0.13	0.29	
25 KAYE STREET	0.20	0.22	0.38	0.59	0.77	0.92					0.09	0.24	
26 KAYE STREET		0.23	0.35	0.46	0.64	0.81					0.14	0.30	
27 KAYE STREET	0.17	0.19	0.34	0.56	0.75	0.90				0.16	0.35	0.50	
29 KAYE STREET	0.26	0.26	0.37	0.60	0.79	0.95					0.16	0.32	
29A KAYE STREET	0.13	0.15	0.28	0.48	0.67	0.83				0.03	0.22	0.38	
31 KAYE STREET		0.16	0.30	0.51	0.71	0.87					0.19	0.35	
32 KAYE STREET		0.31	0.36	0.47	0.64	0.81							
32 KAYE STREET		0.33	0.40	0.51	0.66	0.82							
33 KAYE STREET		0.18	0.26	0.47	0.68	0.84				0.02	0.23	0.40	
4 LEARMONTH STREET		0.39	0.53	0.76	0.88	1.00						0.04	
6 LEARMONTH STREET				0.26	0.36	0.50					0.03	0.17	
1/8 LEARMONTH STREET		0.05	0.12	0.25	0.40	0.54					0.06	0.20	
4/8 LEARMONTH STREET		0.02	0.07	0.22	0.36	0.50					0.11	0.24	

Charlton - EXISTING CONDITIONS

It is suggested that this table be used in conjunction with the flood inundation maps

LEGEND		Within 100mm of flooding over-floor		Depth of over-floor flooding							Comments
Location (Number & Street)	Depth of flooding on the property for each ARI						Depth of over-floor flooding for each ARI						
	5yr	10yr	20yr	50yr	100yr	200yr	5yr	10yr	20yr	50yr	100yr	200yr	
	7.41	7.80	8.03	8.26	8.42	8.57	7.41	7.80	8.03	8.26	8.42	8.57	
12 LEARMONTH STREET	0.08	0.13	0.20	0.32	0.48	0.62							
14 LEARMONTH STREET	0.24	0.29	0.36	0.49	0.67	0.82					0.09	0.25	
16 LEARMONTH STREET	0.24	0.29	0.36	0.50	0.67	0.82						0.14	
18 LEARMONTH STREET	0.26	0.31	0.38	0.52	0.68	0.84					0.13	0.28	
20 LEARMONTH STREET	0.33	0.38	0.45	0.59	0.76	0.91					0.15	0.31	
22 LEARMONTH STREET	0.34	0.39	0.46	0.60	0.77	0.93					0.08	0.24	
23 LEARMONTH STREET		0.26	0.33	0.46	0.63	0.78						0.02	
24 LEARMONTH STREET	0.17	0.27	0.32	0.44	0.62	0.78							
26 LEARMONTH STREET	0.34	0.43	0.49	0.61	0.79	0.95						0.11	
LUNDY STREET		0.33	0.56	0.72	0.81	0.89			0.10	0.27	0.36	0.43	
7 LUNDY STREET	0.99	1.46	1.74	1.92	2.01	2.09							
15 MARLO COURT	0.04	0.04	0.15	0.30	0.44	0.57					0.04	0.18	
3 MENZIES STREET			0.68	0.95	1.09	1.23					0.08	0.22	
3A MENZIES STREET			0.15	0.44	0.58	0.71				0.12	0.25	0.38	
4-8 MENZIES STREET			0.32	0.61	0.76	0.88				0.24	0.40	0.52	
7 MENZIES STREET			0.22	0.41	0.54	0.67							
9 MENZIES STREET			0.36	0.56	0.68	0.81					0.02	0.15	

Charlton - EXISTING CONDITIONS

It is suggested that this table be used in conjunction with the flood inundation maps

LEGEND		Within 100mm of flooding over-floor		Depth of over-floor flooding							Comments
Location (Number & Street)	Depth of flooding on the property for each ARI						Depth of over-floor flooding for each ARI						
	5yr	10yr	20yr	50yr	100yr	200yr	5yr	10yr	20yr	50yr	100yr	200yr	
	7.41	7.80	8.03	8.26	8.42	8.57	7.41	7.80	8.03	8.26	8.42	8.57	
10 MENZIES STREET			0.21	0.41	0.55	0.68						0.01	
11 MENZIES STREET			0.45	0.66	0.77	0.91					0.08	0.21	
12 MENZIES STREET			0.22	0.41	0.43	0.57						0.06	
13 MENZIES STREET			0.18	0.29	0.42	0.57					0.06	0.21	
14 MENZIES STREET		0.15	0.36	0.44	0.54	0.70						0.05	
15-17 MENZIES STREET			0.37	0.48	0.61	0.76						0.00	
16 MENZIES STREET		0.24	0.45	0.51	0.62	0.77						0.02	
18 MENZIES STREET		0.36	0.43	0.54	0.72	0.88					0.01	0.17	
19 MENZIES STREET	0.06	0.15	0.26	0.37	0.55	0.71						0.11	
20 MENZIES STREET		0.35	0.42	0.53	0.69	0.85					0.16	0.32	
21 MENZIES STREET	0.17	0.26	0.37	0.47	0.65	0.82					0.05	0.22	
22 MENZIES STREET		0.51	0.58	0.69	0.86	1.02							
23 MENZIES STREET	0.41	0.50	0.58	0.70	0.88	1.05					0.10	0.26	
24 MENZIES STREET		0.48	0.55	0.66	0.83	0.99					0.04	0.20	
26 MENZIES STREET		0.37	0.44	0.55	0.72	0.87					0.04	0.20	
28 MENZIES STREET		0.36	0.42	0.53	0.69	0.84					0.14	0.30	
29 MENZIES STREET		0.33	0.42	0.55	0.73	0.90					0.07	0.23	

Charlton - EXISTING CONDITIONS

It is suggested that this table be used in conjunction with the flood inundation maps

LEGEND		Within 100mm of flooding over-floor						Depth of over-floor flooding					Comments
Location (Number & Street)	Depth of flooding on the property for each ARI						Depth of over-floor flooding for each ARI						
	5yr	10yr	20yr	50yr	100yr	200yr	5yr	10yr	20yr	50yr	100yr	200yr	
	7.41	7.80	8.03	8.26	8.42	8.57	7.41	7.80	8.03	8.26	8.42	8.57	
31 MENZIES STREET		0.30	0.39	0.51	0.69	0.85					0.06	0.22	
33-35 MENZIES STREET		0.21	0.31	0.43	0.60	0.77					0.13	0.29	
37 MENZIES STREET		0.34	0.44	0.55	0.73	0.90						0.09	
39 MENZIES STREET		0.28	0.39	0.63	0.84	1.00					0.27	0.44	
41 MENZIES STREET		0.21	0.32	0.58	0.78	0.95						0.12	
43 MENZIES STREET		0.26	0.36	0.62	0.83	0.99					0.17	0.33	
45 MENZIES STREET		0.23	0.33	0.59	0.79	0.96					0.07	0.23	
47 MENZIES STREET		0.28	0.38	0.65	0.85	1.01					0.02	0.19	
49 MENZIES STREET		0.35	0.47	0.70	0.91	1.07					0.10	0.26	
5-7 MILDURA WAY	0.44	0.80	0.98	1.18	1.28	1.37				0.12	0.21	0.30	
5-7 MILDURA WAY		0.50	0.66	0.86	0.94	1.03				0.14	0.23	0.32	
6 MILDURA WAY	0.30	0.71	0.95	1.20	1.35	1.51				0.10	0.26	0.41	
8-12 MILDURA WAY	0.46	0.87	1.11	1.36	1.53	1.68							
9 MILDURA WAY		0.14	0.28	0.46	0.56	0.68							
11 MILDURA WAY				0.08	0.18	0.27							
15 MILDURA WAY	0.76	1.09	1.28	1.47	1.57	1.66							
17 MILDURA WAY	0.78	1.09	1.27	1.46	1.56	1.65							

Charlton - EXISTING CONDITIONS

It is suggested that this table be used in conjunction with the flood inundation maps

LEGEND		Within 100mm of flooding over-floor		Depth of over-floor flooding							Comments
Location (Number & Street)	Depth of flooding on the property for each ARI						Depth of over-floor flooding for each ARI						
	5yr	10yr	20yr	50yr	100yr	200yr	5yr	10yr	20yr	50yr	100yr	200yr	
	7.41	7.80	8.03	8.26	8.42	8.57	7.41	7.80	8.03	8.26	8.42	8.57	
19 MILDURA WAY	0.84	1.14	1.33	1.53	1.63	1.72							
21 MILDURA WAY	0.78	1.13	1.33	1.52	1.61	1.70							
23 MILDURA WAY	0.86	1.28	1.48	1.67	1.76	1.85							
25 MILDURA WAY	0.79	1.20	1.43	1.60	1.69	1.80							
27 MILDURA WAY	0.73	1.14	1.37	1.55	1.64	1.72							
29 MILDURA WAY	0.75	1.15	1.39	1.57	1.66	1.75							
39 MILDURA WAY	0.10	0.73	1.01	1.19	1.27	1.36							
50 MILDURA WAY						0.29							
58 MILDURA WAY	0.49	0.91	1.05	1.19	1.27	1.35				0.12	0.19	0.28	
2 ORR STREET	0.14	0.14	0.35	0.64	0.80	0.95				0.25	0.41	0.56	
5 ORR STREET	0.28	0.32	0.54	0.81	0.97	1.13					0.12	0.27	
6 ORR STREET	0.07	0.07	0.28	0.57	0.73	0.88						0.11	
7 ORR STREET	2.53	2.60	2.84	3.10	3.26	3.42			0.01	0.26	0.42	0.57	
8 ORR STREET	0.14	0.14	0.36	0.64	0.80	0.96			0.03	0.31	0.48	0.63	
1-3 RUTHERFORD ST			0.39	0.70	0.86	1.01					0.04	0.19	
4 RUTHERFORD ST	1.12	1.55	1.80	2.06	2.22	2.37							
5 RUTHERFORD ST			0.27	0.61	0.78	0.93					0.06	0.22	

Charlton - EXISTING CONDITIONS

It is suggested that this table be used in conjunction with the flood inundation maps

LEGEND		Within 100mm of flooding over-floor		Depth of over-floor flooding							Comments
Location (Number & Street)	Depth of flooding on the property for each ARI						Depth of over-floor flooding for each ARI						
	5yr	10yr	20yr	50yr	100yr	200yr	5yr	10yr	20yr	50yr	100yr	200yr	
	7.41	7.80	8.03	8.26	8.42	8.57	7.41	7.80	8.03	8.26	8.42	8.57	
6 RUTHERFORD ST	0.85	1.29	1.54	1.80	1.96	2.11			0.01	0.26	0.42	0.57	
7 RUTHERFORD ST			0.17	0.53	0.69	0.84				0.16	0.32	0.47	
8 RUTHERFORD ST	0.27	0.72	0.97	1.23	1.38	1.53							
9 RUTHERFORD ST			0.24	0.54	0.71	0.86					0.08	0.23	
10 RUTHERFORD ST	0.07	0.52	0.77	1.03	1.18	1.33					0.06	0.21	
13 RUTHERFORD ST			0.17	0.45	0.60	0.74					0.13	0.27	
14 RUTHERFORD ST	0.46	0.91	1.16	1.43	1.58	1.72							
15 RUTHERFORD ST			0.17	0.48	0.62	0.76						0.01	
16 RUTHERFORD ST			0.17	0.42	0.57	0.72				0.19	0.34	0.48	
17 RUTHERFORD ST			0.18	0.52	0.67	0.81					0.09	0.23	
19 RUTHERFORD ST			0.17	0.55	0.70	0.84						0.12	
21 RUTHERFORD ST				0.50	0.66	0.80					0.01	0.14	
20-22 RUTHERFORD ST		0.39	0.64	0.90	1.05	1.20					0.13	0.27	
24-26 RUTHERFORD ST	0.27	0.72	0.98	1.24	1.40	1.54				0.14	0.29	0.43	
28 RUTHERFORD ST	0.17	0.62	0.90	1.17	1.32	1.47						-0.01	
30 RUTHERFORD ST	0.10	0.55	0.84	1.12	1.27	1.41		0.38	0.67	0.94	1.10	1.24	
1 WATSON STREET			0.21	0.48	0.62	0.76						0.05	

Charlton - EXISTING CONDITIONS

It is suggested that this table be used in conjunction with the flood inundation maps

LEGEND		Within 100mm of flooding over-floor		Depth of over-floor flooding							Comments
Location (Number & Street)	Depth of flooding on the property for each ARI						Depth of over-floor flooding for each ARI						
	5yr	10yr	20yr	50yr	100yr	200yr	5yr	10yr	20yr	50yr	100yr	200yr	
	7.41	7.80	8.03	8.26	8.42	8.57	7.41	7.80	8.03	8.26	8.42	8.57	
2 WATSON STREET	0.15	0.15	0.36	0.63	0.78	0.92				0.24	0.39	0.53	
3 WATSON STREET			0.20	0.47	0.61	0.75							
4 WATSON STREET			0.28	0.56	0.70	0.84				0.02	0.16	0.30	
5 WATSON STREET			0.20	0.46	0.60	0.74							
6 WATSON STREET			0.29	0.57	0.71	0.84				0.04	0.18	0.31	
7 WATSON STREET			0.25	0.51	0.64	0.78						0.06	
10 WATSON STREET			0.23	0.50	0.63	0.77					0.03	0.16	
11 WATSON STREET			0.24	0.48	0.62	0.76				0.09	0.23	0.37	
12 WATSON STREET			0.21	0.41	0.54	0.67			0.03	0.23	0.36	0.49	
13 WATSON STREET			0.10	0.32	0.46	0.60							
14 WATSON STREET			0.23	0.41	0.53	0.66						0.05	
16 WATSON STREET			0.31	0.49	0.60	0.73						0.11	
18 WATSON STREET			0.31	0.49	0.60	0.74							
19 WATSON STREET	0.27	0.32	0.39	0.54	0.71	0.87					0.02	0.18	
20 WATSON STREET		0.10	0.14	0.37	0.49	0.64					0.02	0.18	
22 WATSON STREET	0.27	0.37	0.42	0.54	0.73	0.90				0.08	0.28	0.44	
24 WATSON STREET	0.28	0.38	0.43	0.55	0.73	0.89					0.16	0.32	

Charlton - EXISTING CONDITIONS

It is suggested that this table be used in conjunction with the flood inundation maps

LEGEND		Within 100mm of flooding over-floor		Depth of over-floor flooding							Comments
Location (Number & Street)	Depth of flooding on the property for each ARI						Depth of over-floor flooding for each ARI						
	5yr	10yr	20yr	50yr	100yr	200yr	5yr	10yr	20yr	50yr	100yr	200yr	
	7.41	7.80	8.03	8.26	8.42	8.57	7.41	7.80	8.03	8.26	8.42	8.57	
25 WATSON STREET		0.28	0.34	0.46	0.64	0.79							
25 WATSON STREET	0.13	0.40	0.45	0.58	0.76	0.91						0.04	
26 WATSON STREET	0.33	0.42	0.47	0.59	0.77	0.93				0.02	0.20	0.36	
28 WATSON STREET	0.25	0.34	0.39	0.51	0.69	0.85				0.07	0.25	0.41	
30 WATSON STREET	0.31	0.42	0.47	0.58	0.76	0.91						0.13	
31 WATSON STREET			0.27	0.51	0.70	0.85				0.10	0.28	0.43	
32 WATSON STREET		0.14	0.23	0.34	0.51	0.67							
33 WATSON STREET	0.17	0.24	0.45	0.70	0.89	1.04				0.16	0.35	0.49	
34-36 WATSON STREET		0.21	0.31	0.42	0.59	0.75							
35 WATSON STREET	0.22	0.28	0.50	0.75	0.94	1.09					0.14	0.28	
37 WATSON STREET	0.22	0.28	0.50	0.75	0.94	1.09				0.10	0.29	0.43	
38 WATSON STREET		0.23	0.32	0.43	0.60	0.76				0.07	0.24	0.39	
39 WATSON STREET			0.20	0.45	0.63	0.78					0.16	0.31	
40 WATSON STREET		0.17	0.26	0.36	0.54	0.69					0.13	0.29	
42 WATSON STREET		0.09	0.27	0.37	0.54	0.70						0.14	
44 WATSON STREET	0.02	0.11	0.28	0.38	0.56	0.71			0.02	0.12	0.30	0.45	
46 WATSON STREET		0.09	0.27	0.36	0.54	0.69						0.05	

Charlton - EXISTING CONDITIONS

It is suggested that this table be used in conjunction with the flood inundation maps

LEGEND		Within 100mm of flooding over-floor		Depth of over-floor flooding								Comments
Location (Number & Street)	Depth of flooding on the property for each ARI						Depth of over-floor flooding for each ARI						
	5yr	10yr	20yr	50yr	100yr	200yr	5yr	10yr	20yr	50yr	100yr	200yr	
	7.41	7.80	8.03	8.26	8.42	8.57	7.41	7.80	8.03	8.26	8.42	8.57	
52 WATSON STREET	0.13	0.15	0.25	0.47	0.67	0.82				0.03	0.23	0.38	
54 WATSON STREET		0.21	0.31	0.54	0.73	0.89				0.15	0.34	0.50	
56 WATSON STREET		0.24	0.33	0.56	0.75	0.91				0.07	0.27	0.42	
60 WATSON STREET		0.26	0.35	0.59	0.78	0.93					0.08	0.23	
62 WATSON STREET		0.22	0.32	0.55	0.74	0.89					0.03	0.18	
64 WATSON STREET		0.30	0.40	0.63	0.82	0.96				0.05	0.24	0.38	
1 WILSON STREET			0.23	0.48	0.66	0.80			0.03	0.28	0.46	0.60	
2 WILSON STREET	0.11	0.16	0.31	0.52	0.72	0.86			0.05	0.27	0.46	0.60	
3 WILSON STREET			0.22	0.47	0.64	0.77						0.04	
4 WILSON STREET	0.09	0.15	0.29	0.52	0.71	0.85					0.05	0.19	
5 WILSON STREET			0.22	0.47	0.64	0.77					0.02	0.15	
6 WILSON STREET	0.09	0.15	0.29	0.53	0.72	0.86					0.18	0.32	
7 WILSON STREET			0.20	0.45	0.63	0.76						0.11	
8 WILSON STREET			0.25	0.51	0.69	0.83						0.11	
9 WILSON STREET			0.15	0.40	0.57	0.70					0.08	0.21	
10 WILSON STREET		0.11	0.30	0.53	0.71	0.85					0.07	0.21	
11 WILSON STREET			0.20	0.47	0.65	0.78					0.14	0.27	

Charlton - EXISTING CONDITIONS

It is suggested that this table be used in conjunction with the flood inundation maps

LEGEND		Within 100mm of flooding over-floor		Depth of over-floor flooding							Comments
Location (Number & Street)	Depth of flooding on the property for each ARI						Depth of over-floor flooding for each ARI						
	5yr	10yr	20yr	50yr	100yr	200yr	5yr	10yr	20yr	50yr	100yr	200yr	
	7.41	7.80	8.03	8.26	8.42	8.57	7.41	7.80	8.03	8.26	8.42	8.57	
12 WILSON STREET		0.01	0.22	0.46	0.64	0.78					0.01	0.14	
13 WILSON STREET			0.10	0.37	0.55	0.69					0.14	0.28	
14 WILSON STREET			0.21	0.46	0.64	0.79			0.07	0.32	0.50	0.64	
3 WRIGHT STREET			0.28	0.41	0.55	0.69				-0.04	0.10	0.24	
6-20 WRIGHT STREET			0.35	0.48	0.60	0.73					-0.05	0.08	
19 WRIGHT STREET			0.59	0.72	0.80	0.89					-0.04	0.05	

APPENDIX C2 – DONALD
COMMUNITY FLOOD EMERGENCY MANAGEMENT PLAN

1. Overview

Donald is located approximately 150 north-west of Bendigo and is a small rural township of approx. 1355 residences (2011 ABS) on the Avon-Richardson River. The town is generally of low relief and surrounding land use is mainly agriculture. The Avon Richardson catchment encompasses an area of approximate 3000 square km.

The Avon-Richardson River flows in a northerly direction into Lake Buloke which is a terminal lake (Endorheic), these are bodies of water that do not flow into the sea. The topography and location of Lake Buloke prevents its drainage to the ocean.
This means that the main outflow pathways of this lake are chiefly through evaporation and seepage.

A wet catchment and a period of heavy rain are generally required to produce flooding at Donald although the January 2011 flood occurred following record rainfall off a dry catchment.

When river channel capacity is exceeded, flooding results adjacent to the river and along a number of flood effluent paths Flooding in the local creeks is initially confined to the creek alignments but then it breaks out to agricultural holdings.

The time of year and crop status can influence the rate at which flood waters rise and fall. A flood when crops are near to harvest will tend to travel a little slower and thus rise more slowly, be a little higher, maintain the peak longer and fall more slowly than the same flood immediately after harvest. Should a flood occur just after harvest a large amount of debris could be wash into the system creating abnormal flood conditions.

Topography within the town is quite flat. This limits the effectiveness of local drainage measures resulting in ponding of water during rain events.

The initial response (rise) at the Donald upstream gauge (i.e. Laen Cope Cope Road) is often the result of the initial response from the Avon Richardson catchment. In general terms and under general rain conditions (as distinct from thunderstorms), the quicker this occurs after the start of rain the more likely it is that:

- The catchment is wet;
- Runoff will occur more quickly and in greater volumes than might normally be expected;
- The river will start to rise at Donald close to 24 hours from start of rain event; and
- The flood will be bigger rather than smaller (though obviously the depth of rainfall and its spatial and temporal distribution will drive flood severity).

Fig D-1 Avon-Richardson River January 2011, 2 days after peak at Donald.

2. Overview of Flooding Consequences – Riverine Flooding

a. Flood Impacts

i. The 20 % AEP (5-year ARI) event

Richardson River U/S Donald	Water Level at Bullocks Head (mAHD)	
3.69	111.64	

The 20% AEP design event does not cause the Avon Richardson River impact significantly on Donald. Some localised flooding / ponding of stormwater does however occur in town but is the result of the lack of fall in the local drainage system.

Minor inundation will occur in Camp Street with no inundation of properties above floor level.

ii. The 10% AEP (10-year ARI) event

Richardson River U/S Donald	Water Level at Bullocks Head (mAHD)	
3.82	111.92	

Flow breaks out from the Avon-Richardson River at several locations.

Some infrastructure in Donald affected including the swimming pool, sporting field and some external buildings in Byrne Street. No properties flooded above floor level.

Flooding of properties in Donald CBD area begins between the 10% AEP and 5% AEP (10-year ARI and 20-year ARI) flood events.

iii. The 5% AEP (20-year ARI) event

Richardson River U/S Donald	Water Level at Bullocks Head (mAHD)	
4.07	112.21	

iv. First significant impact on the CBD and residential areas

During the 5% AEP design event, flow breaks out of the Avon-Richardson at numerous locations along the river banks.

There will be impacts on the township of Donald this includes the inundation of the swimming pool and the sporting field, and 1 property in Wood Street being inundated to above floor level.

v. The 2% AEP (50-year ARI) event

Richardson River U/S Donald	Water Level at Bullocks Head (mAHD)	
4.31	112.48	

The 2% AEP design event has similar consequences as the 5% event,

With the inundation of the swimming pool, sporting field and 2 properties in Wood Street

vi. The 1% AEP(100-year ARI) event

Richardson River U/S Donald	Water Level at Bullocks Head (mAHD)	
4.51	112.72	

The 1% AEP design event impacts on Donald in a similar but more severe manner as the 2% AEP event. Overland flows develop in the same way as for smaller floods but flow volumes and thus depths and impacts are larger. Johnson Goodwin Village, 9 properties including the Riverside Motel and garage will be inundated to above floor level, and the Elizabeth Street sewer pump station will also be inundated

vii. The 0.5% AEP (200-yearARI) event

Richardson River U/S Donald	Water Level at Bullocks Head (mAHD)	
4.86	112.95	

The mechanisms leading to flooding at Donald are the same as for the 2% AEP and 1% AEP events. Depths and impacts are however more severe, with water levels increasing to between 200 and 300 mm compared to the 1% event.

b. Areas Affected

Maps at Appendix F2 provide guidance on where flooding is likely to occur.

c. Properties Affected

d. Summary

A summary of the number of properties likely to be flooded at Donald and the number likely to be inundated over-floor is provided in Section 3 of this Appendix.

e. Detailed List

A detailed list with accurate floor height data is to be compiled for inclusion within the plan.

f. Update of List of Properties Likely to be Flooded

The list of properties likely to be flooded (with corresponding levels and indication of over-floor flood depth) should be updated within twelve (12) weeks of a flood. Update should occur with information collected as part of post-flood information recording activities and as may be collected as a consequence of the event debrief. Information on the collective experience of the IMT should also be gathered and utilised.

g. Isolation

The main access roads for Donald are the:

- Sunraysia Highway
  - from St Arnaud– During major flooding events the road will be cut at Donald.
  - from Birchip to the north

- Borung Highway – provides access from the north but only to the northern side of Donald during major flood events

Local roads further up the catchment are likely to be impassable for a day or more.

A detailed list of isolated properties is located at the rear of Appendix G (page 139)

h. Essential Infrastructure

Essential infrastructure at Donald, other than the Sunraysia Highway, includes health, electricity, telephone, internet / communications, water and sewer services. All are compromised during large floods (e.g. January 2011). See Figure C2-1.

3 Recent Strategic Levee Works to protect Donald Township

Sometime after the flooding event of 2011 a flood study was undertaken of the Donald and surrounds to investigate and provide recommendations regarding the construction of a strategic levee system to protect the Donald Township from future events.

The Buloke Shire was successful in receiving funding to undertake this project. This resulted structure being completed in 2016 but due to the nature of the area there are 2 identified gaps in the strategic levee these are primarily where roads bisect the banks.
Work is still being undertaken on developing arrangements to construct 2 temporary levees, where these roads intersect the constructed levee banks.
One of these temporary structures is in kit form which can be constructed in minimal time across the ???? road, the other is still under development as it needs to be constructed where the Sunraysia HWY intersects a section of levee.

The information below should be used as a guide to determine what the impact to Donald would be if the levee overtops or for some reason the temporary levees are unable to be constructed prior to the impact of a flood event.

See Appendix F2 page 143 for Plan of Donald Levee and the identified gaps to be filled.

3. Flood Intelligence Card, Property Inundation List and Flood Guidance Tool.

3.1 Introduction

1. While flood intelligence cards provide guidance on the relationship between flood magnitude and flood consequences, flood intelligence records are approximations. This is because no two floods at a location, even if they peak at the same height, will have identical impacts. Further, the hydrologic and hydraulic modelling that underpins much of the intelligence detailed below is informed by a number of assumptions and approximations that are unlikely to be replicated exactly during a flood event. Actual impacts under similar rainfall conditions are therefore expected to be similar but may not be exactly the same: there are likely to be some differences. More details about flood intelligence and its use can be found in the Australian Emergency Management Manuals flood series at; https://www.ema.gov.au and in particular Manual 20 " Flood Preparedness".
2. All levels, impacts and actions listed in the following flood intelligence cards may need to be adjusted to reflect better experience.
3. **Minor Flooding**: Causes inconvenience. Low lying area's next to watercourses are inundated which may require the removal of stock and equipment, some minor roads may be closed and low level bridges submerged.
4. **Moderate Flooding**: In addition to the above, the evacuation of some houses may be required. Main traffic routes may be covered. The area or inundation is substantial in rural areas requiring the removal of stock.
5. **Major Flooding**; In addition to the above, extensive rural areas and/or urban areas are inundated. Properties and towns are likely to be isolated and major traffic routes likely to be closed. Evacuation of people from the flood affected areas may be required.

3.2 Flood Intelligence Card

Water Level at Richardson River U/S Donald	AEP of flood	Water level at Bullocks Head (mAHD)	Consequence / Impact	Action Actions may include (but not limited to) evacuation, road closures, sandbagging, issue of warnings and who is responsible.
^ Indicates that this level is higher than any recorded level and therefore has a greater uncertainty				
USING THIS INTELLIGENCE CARD. Consider the flood inundation map deemed most appropriate for the forecast flood level- either as provided by BoM or ascertained using the information in this guidance tool. Review all consequences and actions in this table, from the first row down to the approximate expected severity of flooding. Initiate all actions in a logical sequence. Note that some actions may need to be initiated in an order that is different from their relative placement in this table.				
It is important that the decision to mobilise to remove furniture etc from buildings is make early and that, in general. It should be noted that sandbagging may not be an option as this would depend on a number of factors during a flood event.				
Proposed Minor Flood Level 3.69	20% AEP (5-yr ARI)	111.64	Water overtops Camp Street. • No properties flooded above floor level.	• Monitor rainfall and water levels. • Refer to indicated maps and impacts in order to develop an appreciation of the likely scale of the flood event. • Contact Telecommunications and power providers to ensure security of assets, and equipment is operational. • Contact Grampians Wimmera Mallee water to ensure security of potable water and sewage.
December 2010 - 3.72			• Level at Banyena Gauge – 4.21 • Level at Rich Avon Weir – 3.49	
3.82	10 % AEP (10-yr ARI)	111.92	• Swimming pool infrastructure inundated • Properties along Byrne Street are inundated affection some external buildings. • Sport field inundated. • Apex Park inundated. • No properties flooded above floor level.	• Continue to monitor rainfall and water levels. • Refer to indicated maps and impacts in order to develop and appreciation of the likely scale of the flood event. • Secure any additional resourcing requirements, action may include assisting properties along Byrne Street. • Provision of sandbags (in accordance with VICSES policy) to affected properties. • Provide community warnings and information in relation to conditions, sandbag and sand locations, road closures etc.
October 1996		3.84	• Level at Banyena Gauge 4.35	

Proposed Moderate Flood level		112.09	• Level at Banyena Gauge – 4.47 • Level at Rich Avon Weir – 3.8	• Refer to maps in order to develop an appreciation of the likely scale of the flood event.

Flood Intelligence Card

Water Level at Richardson River U/S Donald	AEP of flood	Water level at Bullocks Head (mAHD)	Consequence / Impact	Action Actions may include (but not limited to) evacuation, road closures, sandbagging, issue of warnings and who is responsible.
^ Indicates that this level is higher than any recorded level and therefore has a greater uncertainty				
USING THIS INTELLIGENCE CARD. Consider the flood inundation map deemed most appropriate for the forecast flood level- either as provided by BoM or ascertained using the information in this guidance tool. Review all consequences and actions in this table, from the first row down to the approximate expected severity of flooding. Initiate all actions in a logical sequence. Note that some actions may need to be initiated in an order that is different from their relative placement in this table.				
It is important that the decision to mobilise to remove furniture etc from buildings is make early and that, in general. It should be noted that sandbagging may not be an option as this would depend on a number of factors during a flood event.				
September 2010 – 3.9				• Investigate properties along Byrne Street that may be affected. • Check resource requirements, sand and sandbags. • Check maps for possible inundation locations. • Consider need for possible evacuations. • Donald Motor Lodge and 1 Wood Street would need to be sandbagged.
4.07^	5% AEP (20–yr ARI)	112.21	• Swimming pool inundated • Two properties flooded above floor level. • 1 Wood Street • Donald Motor Lodge (28 Wood St)	• Continue to monitor rainfall and water levels. • Refer to maps and impacts in order to develop an appreciation of the likely scale of the flood event. • Provide warnings and advice to affected and potentially affected communities regarding situation. • Consider need for possible evacuations. • Identify possible and suitable relief centres. • Check with Grampians Wimmera Mallee Water re sewerage pumping station, and verify their contingencies.

Flood Intelligence Card

Water Level at Richardson River U/S Donald	AEP of flood	Water level at Bullocks Head (mAHD)	Consequence / Impact	Action Actions may include (but not limited to) evacuation, road closures, sandbagging, issue of warnings and who is responsible.
^ Indicates that this level is higher than any recorded level and therefore has a greater uncertainty				
USING THIS INTELLIGENCE CARD. Consider the flood inundation map deemed most appropriate for the forecast flood level- either as provided by BoM or ascertained using the information in this guidance tool. Review all consequences and actions in this table, from the first row down to the approximate expected severity of flooding. Initiate all actions in a logical sequence. Note that some actions may need to be initiated in an order that is different from their relative placement in this table.				
It is important that the decision to mobilise to remove furniture etc from buildings is make early and that, in general. It should be noted that sandbagging may not be an option as this would depend on a number of factors during a flood event.				
Proposed Major Flood Level – 4.31	2% AEP (50-yr ARI)	112.48	• Camp Street sewer pump station inundated. • Goodwin Village Complex and Unit 29 inundated. • Four properties flooded above floor level (in addition to Goodwin Village) • Donald Motor Lodge (28 Wood Street) • Riverside Motel (3 Wood Street) • 1 Wood Street • 2 Wood Street	• Continue to monitor rainfall ad water levels. • Refer to mapping to gauge possible impacts and an appreciation of the likely scale of the event. • Identify resources requirements to assist with sandbagging and possible evacuation. • Keep all but no essential vehicles out of the flooded areas. • Maintain records of flood impact. • Seek advice from the municipality and Vic Roads re road closures. • Implementation of evacuation plans • Check with Grampians Wimmera Mallee Water re sewerage pumping station, and verify their contingencies.
4.51^	1% AEP (100-yr ARI)	112.72	• Goodwin Village inundated with above floor flooding. • Elizabeth Street sewer pump station inundated. • Flooding of community infrastructure including Heritage Walking Trial, Cricket Club Rooms, Apex Park, Hockey Club and Archery Club. • Ten properties flooded above floor level (in addition to Goodwin Village • Donald Motor Lodge & Chinese Restaurant (28 Wood Street) • Riverside Motel (3 Wood Street) • Properties at 1, 2, 4, 10, 16, 18 Wood Street. • 3-5 Elizabeth Street	• Continue to monitor rainfall and water levels. • Check available maps for indication of impact area. • Keep all but essential vehicles out of flood areas. • Check on stocks of sand and sandbags replenish if required. • Maintain records of flood impact. • Discuss closure of Sunraysia Hwy with Vic Roads. • Provide warnings and advice to affected and potentially affected community regarding situation and the need for evacuation.

Flood Intelligence Card

Water Level at Richardson River U/S Donald	AEP of flood	Water level at Bullocks Head (mAHD)	Consequence / Impact	Action Actions may include (but not limited to) evacuation, road closures, sandbagging, issue of warnings and who is responsible.
^ Indicates that this level is higher than any recorded level and therefore has a greater uncertainty				
USING THIS INTELLIGENCE CARD. Consider the flood inundation map deemed most appropriate for the forecast flood level- either as provided by BoM or ascertained using the information in this guidance tool. Review all consequences and actions in this table, from the first row down to the approximate expected severity of flooding. Initiate all actions in a logical sequence. Note that some actions may need to be initiated in an order that is different from their relative placement in this table.				
It is important that the decision to mobilise to remove furniture etc from buildings is make early and that, in general. It should be noted that sandbagging may not be an option as this would depend on a number of factors during a flood event.				
Flood Peak January 2011 – 4.65		112.86	• Level at Banyena Gauge – 4.99 • Donald Township is cut in half by floodwater with the Sunraysia Highway overtopped. • Flooding of community infrastructure including Heritage Walking Trial, Cricket Club Rooms, Apex Park, Hockey Club and Archery Club. • Garage inundated.	• Check available mapping for inundation overlays. • Provide warnings and advice to affected and potentially affected community regarding situation and the need for evacuation.
4.86^	0.5% AEP (200-yr ARI)	112.95	• Sunraysia Highway overtopped. • The flood levels increase by approximately 200 -300 mm compared to the 100 ARI event. • Goodwin Village inundated above floor level. • **Fourteen properties inundated above floor level.** • Donald Motor Lodge (28 Wood St) • Riverside Motel (3 Wood St) • Garage (5 Wood St) • Properties at 1, 2, 4, 10, 12, 16, 18, 36-38 and 40-42 Wood Street. • 3-5 Elizabeth Street.	• Continue to monitor rainfall and water levels, to provide an appreciation of the likely scale of the flood event. • Refer to maps F2 (page 130) • Provide warnings and advice to potentially affected properties regarding situation and the need for evacuation. • Restrict access to all but essential vehicles. • Ensure security of affected areas. • Consult Vic Roads on the closure of the Sunraysia Highway. • Continue to provide warnings and advice to affected and potentially affected community.

3.3 Summary of Properties Flooded.

Summary of number of properties in Donald affected by flooding events, Note this is under existing conditions						
	Design Flood AEP %					
	20% (5 yr)	10% (10 yr)	5% (20 yr)	2% (50 yr)	1% (100 yr)	0.5% (200 yr)
Water Level at Richardson River U/S of Donald	3.69	3.82	4.07	4.31	4.51	4.68
Number of properties flooded above floor.	0	0	2	5	11	15
Number of properties flooded below floor only	45	55	60	67	71	80
Total number of flood affected properties	45	55	62	72	82	95

APPENDIX C3 - CULGOA COMMUNITY FLOOD EMERGENCY PLAN.

1. Overview.

The township of Culgoa is located in north western Victoria on the Calder Highway, the closest major township is Swan Hill, 60 km to the north-east. Culgoa is located within the Buloke Shire Council (BSC) and Mallee Catchment Management Authority (MCMA) management areas.

Culgoa is located on Tyrrell Creek, a distributary of the Avoca River. Tyrrell Creek off-takes from the Avoca River downstream of Charlton and continues through to Lake Tyrrell. The waterway is ephemeral only flowing after significant rainfall or Avoca River floods.
On the Avoca River downstream of the Tyrrell Creek off-take, Lalbert and Back Creeks also distribute flood water to the north.

The Avoca River is within the North Central Catchment Management Authority management area. The Avoca River,
Lalbert, Back and Tyrrell Creeks all received significant flows during January 2011. These flows caused flooding in numerous regional communities across Victoria including Culgoa.

Generally, the Tyrrell Creek is reported to flow every 3-4 years[2]. The waterway experiences long dry periods with local residents reporting no flow between the late 1930's until the flood observed across the state in 1956. Anecdotally, Tyrrell Creek witnessed flows in 1960, 1964, 1968, 1973, 1974, 1975, 1988, 1992, 1995/96 with no flows observed until the January 2011 event, which was the largest event in living memory in Culgoa.

During January 2011 Culgoa received two flood peaks, the first generated by Tyrrell Creek's catchment area, the second a distributary flow from the Avoca River.
The township of Culgoa has a much shorter warning time for the first flow peak in Tyrrell Creek than the second. However, the second peak is most likely to cause significant inundation of private and public land. The warning time for a flow distributed to Culgoa from the Avoca River is significant allowing members of the community and emergency services to be prepared for a flood event. There is also a strong indicator of potential future flooding with the flooding of Charlton on the Avoca River providing an indicator that flooding may impact Culgoa.

Small flows can be generated in Tyrrell Creek from rainfall within the Tyrrell Creek catchment. These flow events are generated by moderate rainfall events with flow in the Avoca River not at a sufficient height to distribute water to Tyrrell Creek.

A large flow in Tyrrell Creek will most likely be generated by a significant rainfall event in the Avoca River catchment, which will likely fall on the Tyrrell Creek catchment also. The rainfall falling on the Tyrrell Creek catchment will likely generate an initial smaller peak flow in Tyrrell Creek, followed by another peak from the Avoca River distributary flows. If the flood event in the Avoca River is of sufficient magnitude this second peak in Tyrrell Creek resulting from the distributary flows is likely to be the largest. These two flow peaks are unlikely to occur concurrently in Culgoa due to difference in time it is expected to take for Tyrrell Creek catchment runoff to reach Culgoa and Avoca River catchment runoff to reach the Tyrrell Creek off-take and then flow to Culgoa.

This also means that when the Avoca River distributary flow is passing through Tyrrell Creek the waterway is likely already experiencing some flow from the Tyrrell Creek catchment. All the creek pools will have been filled and any initial infiltration into the channel bed has already occurred. This increases the proportion of the Avoca River distributary flow which

[2] GHD, 2007 - Lalbert and Tyrrell Creeks Management Plan, Landholder Responses to Questionnaire Regarding History, Ecology, Cultural Heritage and Conservation of Lalbert and Tyrrell Creeks

reaches Culgoa and significantly reduces the potential attenuation along Tyrrell Creek. So the second peak may travel much faster than the first peak.

2. Overview of Flooding Consequences – Riverine Flooding-Tyrrell Creek.

a. Areas Affected

Maps at Appendix F3 provide guidance on where flooding is likely to occur.

b. Properties Affected

2.1 Summary

A summary of the number of properties likely to be flooded at Culgoa and the number likely to be inundated over-floor is provided in Section 3 of this Appendix.

2.2 Detailed List

A detailed list with accurate floor height data is to be compiled for inclusion.

2.3 Update of List of Properties Likely to be Flooded

The list of properties likely to be flooded (with corresponding levels and indication of over-floor flood depth) should be updated within twelve (12) weeks of a flood. Update should occur with information collected as part of post-flood information recording activities and as may be collected as a consequence of the event debrief. Information on the collective experience of the IMT should also be gathered and utilised.

c. Isolation

The main access roads for Culgoa are the:

- Calder Highway
  - from Wycheproof– During major flooding events the road will be cut at Warne.
- Culgoa Lalbert Rd – provides access from the east but during major flood events, this road may also be inundated.

Local roads further up the catchment are likely to be impassable for a day or more.

d. Essential Infrastructure

Essential infrastructure at Culgoa, other than the Calder Highway, includes health, electricity, telephone, internet / communications, water and septic sewerage services. All are compromised during large floods (e.g. January 2011).

Fig C3-1 Aerial photo of Culgoa Township during January 2011 event.

3 Flood Intelligence Card

Water Level AHD at Calder Highway Bridge (Warne)			Consequence / Impact	Action Actions may include (but not limited to) evacuation, road closures, sandbagging, issue of warnings and who is responsible.
^ Indicates that this level is higher than any recorded level and therefore has a greater uncertainty				
USING THIS INTELLIGENCE CARD. Consider the flood inundation map deemed most appropriate for the forecast flood level- either as provided by BoM or ascertained using the information in this guidance tool. Review all consequences and actions in this table, from the first row down to the approximate expected severity of flooding. Initiate all actions in a logical sequence. Note that some actions may need to be initiated in an order that is different from their relative placement in this table.				
It is important that the decision to mobilise to remove furniture etc from buildings is make early and that, in general. It should be noted that sandbagging may not be an option as this would depend on a number of factors during a flood event.				
16 January 2010 – 78.5 m			• Impact to low lying rural land with no impact to residential properties • Calder Highway at Warne overtopped. • Calder Highway Bridge at Culgoa overtopped.	• Continue to monitor rainfall and water levels. • Refer to indicated maps and impacts in order to develop and appreciation of the likely scale of the flood event. • Arrange with Vic Roads and/or council for road closures.
15 January 2011 – 79m			• Impact to low lying rural land with no impact to residential properties	• . Continue to monitor rainfall and water levels. • Refer to indicated maps and impacts in order to develop and appreciation of the likely scale of the flood event. • Arrange with Vic Roads and/or council for road closures.
22 September 2016 3.04m (79.24m AHD)			• Cabin at 9 Culgoa Watchupga Road under threat from over floor flooding • Shed at 45 Main Street becomes flooded over floor (gravel)	• Update MFEP • Monitor water under Culgoa Hall supper room for impacts against structural integrity
September 2010 – 79.5			• Significant inundation of rural property, 3 properties in Culgoa inundated above floor level, a number of properties isolated. • 13-17 Main Street partially inundated • 6 Lalbert Road above floor inundation. • 15 Watchupga Road above floor inundation • 27 Cecil Street	• Continue to monitor rainfall and water levels. • Refer to indicated maps and impacts in order to develop and appreciation of the likely scale of the flood event. • Arrange with Vic Roads and/or council for road closures. • Secure any additional resourcing requirements, action may include assisting affected community • Provision of sandbags (in accordance with VICSES policy) to affected properties. • Provide community warnings and information in relation to conditions, sandbag and sand locations, road closures etc.

APPENDIX D - FLOOD EVACUATION ARRANGEMENTS [to be completed]

NOTE THIS APPENDIX IS TO BE COMPLETED

It should be noted that the Incident Controller will consider evacuations as part of the planning process.

Phase 1 - Decision to Evacuate

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 to conduct the evacuation;
- Time 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;
- Resources required to conduct the evacuation;
- Resources 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.

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 table below details triggers for evacuation, if these heights are predicted or are likely to occur evacuation should be considered

Sector	Gauge	Trigger

The table below details time required to evacuate established areas.

Sector	Likely time required for evacuation (including resource assumptions)

Phase 2 – Warning

Warnings may include a warning to prepare to evacuate and a warning to evacuate immediately. Once the decision to evacuate has been made, the at-risk community will be warned to evacuate. Evacuation warnings can be disseminated via methods listed in part 3 of this plan.
[Amend following as appropriate (i.e. if a relevant Local Evacuation Plan exists]: Evacuation warning messages will be developed and issued by VICSES in consultation with the MERO, MERC, DHHS and other key agencies and expert advice (CMA's and Flood Intelligence specialists).

Phase 3 – Withdrawal

Withdrawal will be controlled by VICPOL. VICSES will provide advice regarding most appropriate evacuation routes and locations for at-risk communities to evacuate to, etc.
VICSES, CFA, AV and Local Government will provide resources where available to support VICPOL/VICROADS 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 - [insert arrangements].
Possible Evacuation Routes to be used:

Sector	Evacuation Route	Evacuation route closure point and gauge height of closure

Landing zones for helicopters are located at:

- [list]

Special needs groups will be/are identified in Council's vulnerable persons register (VPR). This can be done through community network organisations. Further information on Council's 'residents at risk' register can be obtained from Crisisworks (MECC Central)

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. The flood relief centres and/or Assembly Areas are listed in the table below:

Sector	Relief Centre/Assembly Area (include address)	Comments

Alternatively these maybe listed in the MEMP [if in MEMP, provide reference details]
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. These facilities may be located at locations detailed below and coordinated by [Enter Name] or provide reference to MEMP.

Sector	Animal Shelter (include address)	Comments

Caravans

Caravans maybe evacuated to the following locations:

Sector	Caravan evacuation location (include address)	Comments

Phase 5 – Return

Return will be consistent with the Strategic Plan for the Return of Community
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, water treatment plant affecting potable water supplies etc.
[List facilities, trigger point for action and strategy to be employed]

Service	Impact	Trigger Point for action	Strategy/Temporary Measures

Essential Community Infrastructure and Property Protection

Essential Community Infrastructure and properties (e.g. residences, businesses, roads, power supply etc.) that require protection are:
[List facilities, trigger point for action and strategy to be employed]

Facility	Impact	Trigger Point for action	Strategy/Temporary Measures

Buloke Shire Council will establish a sandbag collection point at locations to be determined (i.e. relevant to each flood emergency event)

Rescue

Municipal Resources are available within Buloke Shire to assist with rescue operations are detailed in the MEMP
Known high-risk areas/communities (i.e. low-lying islands) where rescues might be required are included in this plan

APPENDIX E – FLOOD WARNING SYSTEMS

Flood Warning Products

Flood Warning products and Flood Class Levels can be found on the BoM website. Flood Warning products include Severe Thunderstorm Warnings, Severe Weather Warnings, Flood Watches and Flood Warnings.

Severe Thunderstorm and Severe Weather Warnings

The BoM can forecast the environment in which severe thunderstorms or small scale weather systems that are locally intense and slow moving may occur and provides a generalised service to that effect. However, it is not yet scientifically possible to predict individual flash flooding events except on time scales of tens of minutes at the very best.

The BoM issues warnings of flash flooding when it becomes apparent that an event has commenced which may lead to flash flooding or when flash flooding has commenced.

Flood Watches

Flood watches are issued by the BoM to notify communities and other stakeholders within broad areas (rather than specific catchments) of the potential flood threat from a developing weather situation. They provide a 'heads up' of likely flooding.

Flood watches are based on an assessment of the developing weather situation and indicators of current catchment wetness. They provide generalised statements about expected forecast rainfall totals, the current state of the catchments within the target area and the streams at risk from flooding. Instructions for obtaining rain and stream level observations and access to updated Watches and Warnings are also included.

Normally, the BoM would issue a Flood Watch 24 to 36 hours in advance of any likely flooding and issue updates as required. If at any time during that period there was an imminent threat of floods occurring, the Flood Watch would be upgraded to a Flood Warning.

Flood Warnings

Overview

Flood Warnings are firm predictions of flooding based on actual rainfall and river height information as well as the results of stream flow based models of catchment behaviour that take account of antecedent conditions (i.e. the 'wetness' of the catchment, storage levels within dams, etc) and likely future rainfall. Releases from dams are an essential input to such models.

Flood warnings are categorised as 'minor', 'moderate' or 'major' (see BoM website for an explanation of these terms and current flood class levels) and indicate the expected severity of the flood for agreed key locations along the river. More specifically, flood warnings usually include:

- Rainfall amounts for selected locations within and adjacent to the catchment;
- River heights and trends (rising, steady, falling) at key locations within the catchment;
- Outflows (in ML/d) from any major dams within the catchment;
- Forecasts of the height and time of flood peaks at key locations;
- Weather forecast and the likely impact of expected rainfall on flooding; and
- A warning re-issue date and time.

Note 1: The term "local flooding" may be used for localised flooding resulting from intense rainfall over a small area.

Note 2: The term "significant rises" may be used in the early stages of an event when it is clear that river levels will rise but it is too early to say whether they will reach flood level.

Additional information (e.g. weather radar and satellite images as well as updated rain and river level information) can also be obtained from the Bureau's website (www.bom.gov.au/hydro/flood/vic) or for the cost of a local call on ☎ 1300 659 217.

On receipt on an Initial or Urgent Flood Warning, the VICSES Regional Office at Swan Hill (or the after hours Regional Duty Officer) will send out the warning via email, in most cases nominated representatives of affected organisations will also receive an SMS message, advising of the warning being issued. In the case of all subsequent warnings, copies of the information will be forwarded via email. Organisations to which flood watches and warnings for the Avoca and Avon/Richardson rivers will be distributed are included at Attachment 1 to this Appendix.

All flood watches and warnings are available on the BoM website (www.bom.gov.au).

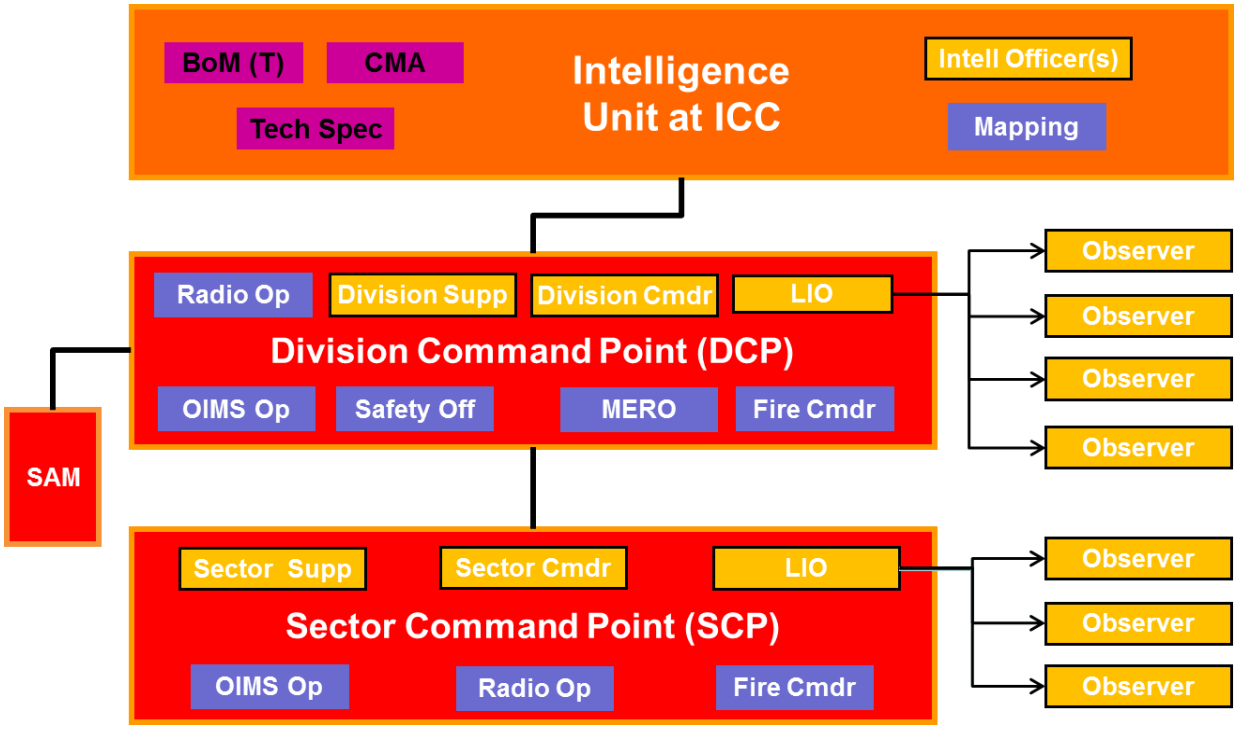


Figure 1: Intelligence Unit Information Flow

1 Flood Bulletins

VICSES distributes flood emergency information to the media through "Flood Bulletins". Flood Bulletins provide BoM Flood Warning information as well as information regarding possible flood consequences and safety advice, not contained in BoM Flood Warning products. VICSES uses the title Flood Bulletin to ensure emphasis is placed on BoM Flood Warning product titles.

The relevant VICSES Region Headquarters or the established ICC will normally be responsible for drafting, authorizing and issuing Flood Bulletins, using the One Source, One Message system.

Flood Bulletins should refer to the warning title within the Bulletin header, for example Flood Bulletin for Major Flood Warning on Avoca River.

Flood Bulletins should follow the following structure:

- What is the current flood situation;
- What is the predicted flood situation;
- What are the likely flood consequences;
- What should the community do in response to flood warnings;
- Where to seek further information;
- Who to call if emergency assistance is required.

Note Where possible the following information should be included in all messaging:

The anticipated or current visual gauge height and whether the river is rising or falling:

- **For Charlton, the Charlton Bridge Gauge for the Avoca,**
- **For Donald:**
  - **the Donald Upstream manual gauge on the Richardson River (Laen Cope Cope Road)**
  - **The Rich Avon Road manual gauge**

It is important that the description of the predicted flood situation is consistent with and reflects the relevant BoM Flood Warning.

Flood Bulletins should be focused on specific gauge (or in the absence of gauges, catchment) reference areas, that is the area in which flood consequences specifically relate to the relevant flood gauge.

Flood Bulletins should be prepared and issued after receipt of each Flood Watch and Flood Warning from the BoM, or after Severe Weather or Thunderstorm Warnings indicating potential for severe flash flooding.

Flood Bulletins should also contain relevant local flood information, and may also include information on local trends based on best available information at the time of release.

To ensure Flood Bulletins are released in a timely manner, standardised Flood Bulletins may be drafted based on different scenarios, prior to events occurring. The standardised Flood Bulletins can then be adapted to the specifics of the event occurring or predicted to occur.

1.1 Avoca River

The BoM currently provides a flood forecasting service for Charlton with forecasts provided for the Charlton downstream gauge. This gauge is a short distance downstream from town but, because of site and floodplain characteristics and flood behaviour affected by the railway embankment, it is not fully representative of what is happening in town. The events of September 2010 and January 2011 clearly demonstrated this. The gauge is however a very good indicator of likely downstream flooding and of the likelihood of flows into Cooroopajerup Creek, Lalbert Creek, Tyrrell Creek, North-East floodplains stream and the Mosquito Creek.

1.2 Avon-Richardson River

There is currently no specific flood warning systems or arrangements in place for the Avon-Richardson River catchment or for Donald.

GWM Water has a dial in telemetry river gauge located on the Richardson River at the Rich-Avon Weir west of the Donald Stawell Road which can provide some useful intelligence. The phone number for this gauge is located in the planning committee contact list.

1.3 Tyrrell Creek System

There is currently no specific flood warning systems or arrangements in place for the Tyrrell Creek system. The systems on the Avoca River may provide some advice and information of the probability of flooding within the Tyrrell Creek system.

2 Flood Bulletins

VICSES distributes flood emergency information to the media through “Flood Bulletins”. Flood Bulletins provide BoM Flood Warning information as well as information regarding possible flood consequences and safety advice, not contained in BoM Flood Warning products. VICSES uses the title Flood Bulletin to ensure emphasis is placed upon BoM Flood Warning product titles.

The relevant VICSES Region Headquarters or the established ICC will normally be responsible for drafting, authorizing and issuing Flood Bulletins, using the One Source, One Message (OSOM) system.

Flood Bulletins should refer to the warning title within the Bulletin header.

Flood Bulletins should follow the following structure:

- What is the current flood situation;
- What is the predicted flood situation;
- What are the likely flood consequences;
- What should the community do in response to flood warnings;
- Where to seek further information;
- Who to call if emergency assistance is required.

It is important that the description of the predicted flood situation is consistent with and reflects the relevant BoM Flood Warning.

Flood Bulletins should be focused on specific gauge (or in the absence of gauges, catchment) reference areas, that is the area in which flood consequences specifically relate to the relevant flood gauge.

Flood Bulletins should be prepared and issued after receipt of each Flood Watch and Flood Warning from the BoM, or after Severe Weather or Thunderstorm Warnings indicating potential for severe flash flooding.

To ensure Flood Bulletins are released in a timely manner, standardised Flood Bulletins may be drafted based on different scenarios, prior to events occurring. The standardised Flood Bulletins can then be adapted to the specifics of the event occurring or predicted to occur.

3 Local Flood Warning System Arrangements

3.1 Avoca River

There are a large number of outlet control structures along the Avoca River and associated watercourses and channels. These need to be set or operated. Local arrangements exist for this to occur as water levels rise but arrangements are not clear.

The North Central CMA has a summary of:

- The contact persons for each of the operated structures;
- The levels / class of flooding at which the regulator or control structure is operated; and
- What needs to be done, and when.

3.2 Avon-Richardson River

There are no specific local flood warning systems or arrangements currently in place for this river system.

4 Flood Class Levels

The occurrence of a certain class of flooding at one point in a catchment will not necessarily lead to the same class of flooding at other points – for example along the main river and its tributary creeks or along a drainage network's overland flow paths. This is because the floodplain physiography and use (and thus flood impact) varies along the river or flow path and also because antecedent conditions combined with where and how rainfall occurs (both in time and space) will drive how a flood develops and progresses.

It is emphasised that the flood class levels quoted in the table below refer to that part of the watercourse where the flood effects can be related to the gauge reading.

It is important to remember that flood impact is dependent on more than the peak height or flow. The rate of rise, duration, extent and season of flooding are also important. For this reason, flood class levels can only be considered as a guide to flood severity.

Note that it is likely that not all sites for which flood class levels exist will automatically be provided with a quantitative flood forecast by the BoM. It is understood that sites will be classified on the basis of flood risk and consequence. The lower rated sites will receive a quantitative warning service only: BoM will issue warnings that advise only of the exceedence (or likely exceedence) of flood class levels along with the class of flooding expected. A detailed flood forecast will not be provided for those sites.

	Flood Class Levels					
	Minor		Moderate		Major	
Yawong Weir – rural community		**3.0**		**5.0**		**5.3**
Yawong Weir – Charlton		**4.5**[1]		**5.1**[2]		**5.3**[3]
Charlton town						
Charlton town Gauge		**4.0**[1]		**5.9**[2]		**7.5**[3]
Charlton Downstream – rural community flow on affect to Quambatook.		**3.5**		**5.0**		**7.0**

[1] Determined following consideration of impacts of November 2010 and similar floods.

[2] Corresponds closely to the 5-year ARI (20% AEP) flood event.

[3] Corresponds closely to the 10-year ARI (10% AEP) flood event and a little below September 2010 flood levels.

Details of relevant gauges

Station No	River / Creek	Station	Flood Class Levels (m)			Gauge Zero AHD (m)	Comments
			Minor	Moderate	Major		
408206	Avoca River	Archdale Junction	---	---	---	198.495	
408200	Avoca River	Yawong Weir	3.0	5.0	5.3	142.719	Rain gauge at site.
408900	Avoca River	Charlton Town Gauge	4.0	5.9	7.5	121.64	Check availability of PAL gauge
408212	Avoca River	Charlton Downstream	3.5	5.0	7.0	119.57	Good indicator for downstream flooding but not for the town.

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APPENDIX F1 – MAPS FOR CHARLTON

Overview

Maps considered useful to flood response at Charlton are included in this Appendix. They comprise:

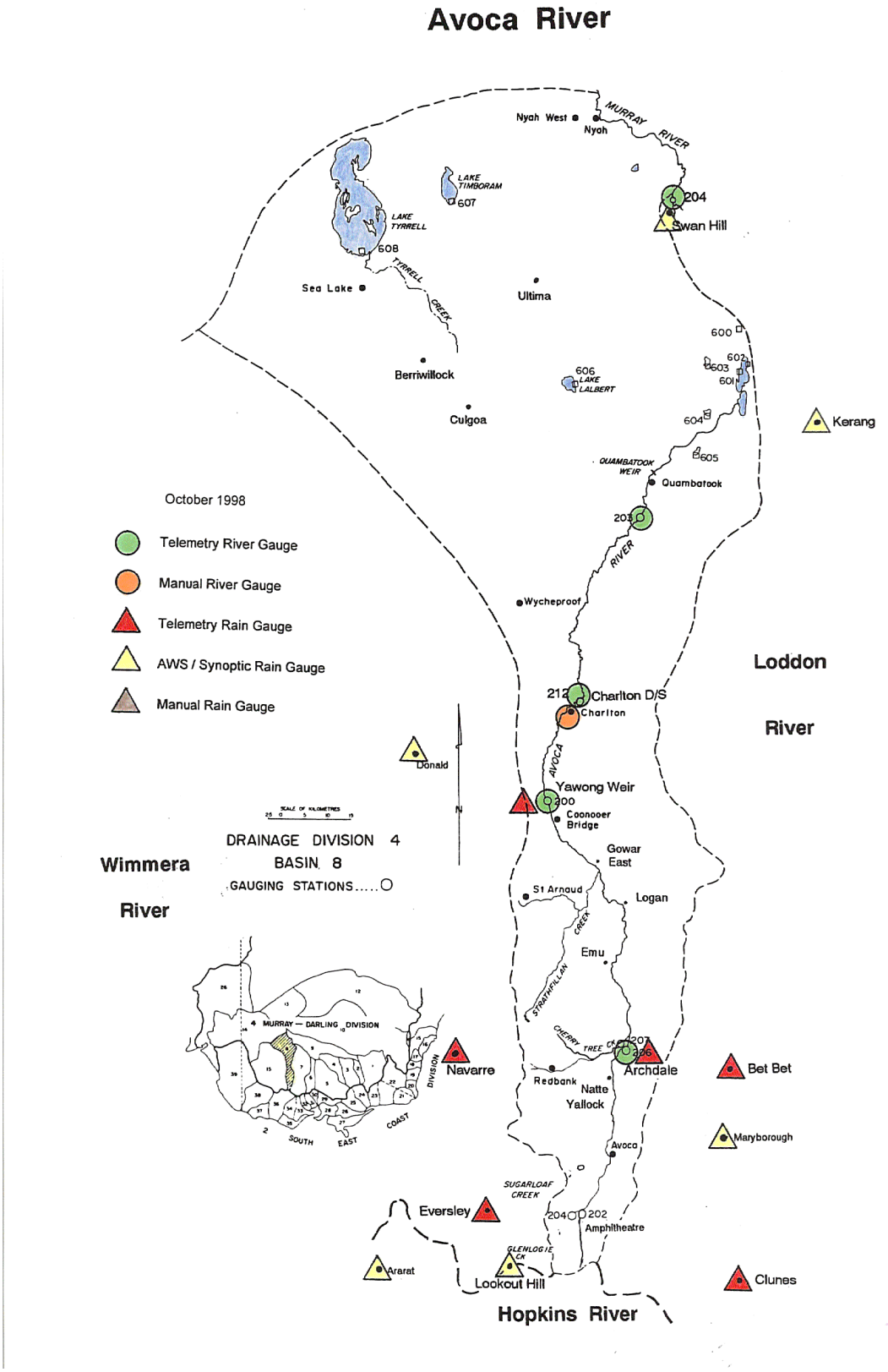
- A set of maps showing flood extents and depths for each of the design flood events considered (i.e. 5, 10, 20, 50, 100 and 200 year ARI and PMF[3]) by BMT WBM when delivering the Charlton Flood and Drainage Management Plan (BMT WBM, October 2013).
- Maps showing flood extent and depth for the September 2010 flood (BMT WBM, October 2013).
- Maps showing flood extent and depth for the January 2011 flood (BMT WBM, October 2013).

Note that:

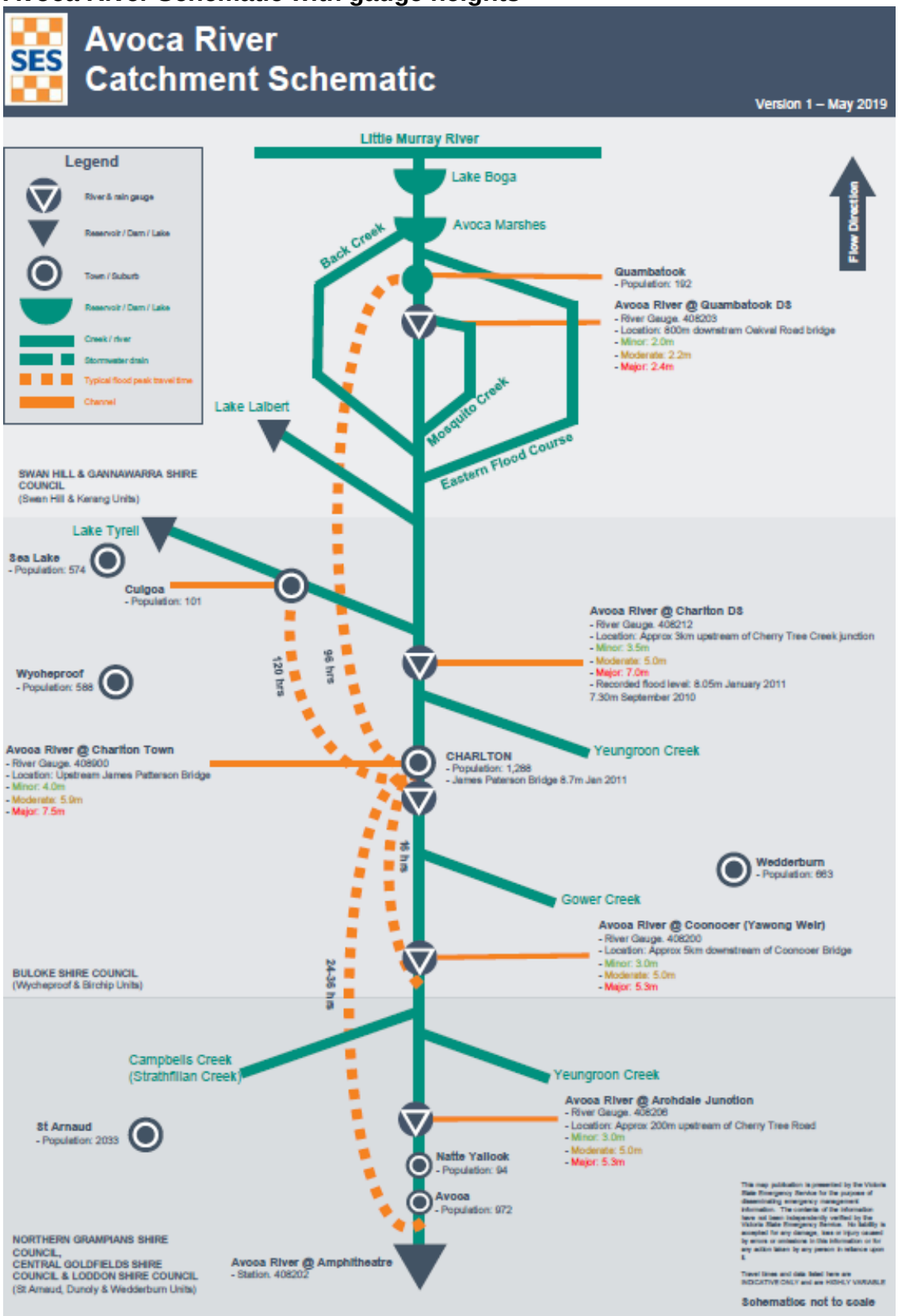
- Maps are included in the deliverables from the Charlton Flood and Drainage Management Plan (BMT WBM, October 2013) as a Map Atlas and are available from the North Central CMA or Council, that show:
  - Properties flooded over-floor along with depths and extents;
  - Flood levels to AHD within Charlton (useful for checking whether roads or infrastructure will be flooded);
  - Flood hazard (based on consideration of depth and velocity) for each of the design events considered;
  - Flood velocities.
- Maps showing the Land Subject to Inundation Overlay are included in the Buloke Planning Scheme and can be used as a guide to areas that may flood during an event. These maps can be found in hard copy form at the Council's main office or online at the Department of Planning and Community Development website (see the list of references in Appendix G).
- Maps showing 100-year ARI (1% AEP) flood extent and floodway's (together with volume, height and water quality data) are shown at the Victorian Water Resources website (see the list of references in Appendix G).

[3] Probable Maximum Flood (PMF) – this is the flood that results from the Probable Maximum Precipitation (PMP).

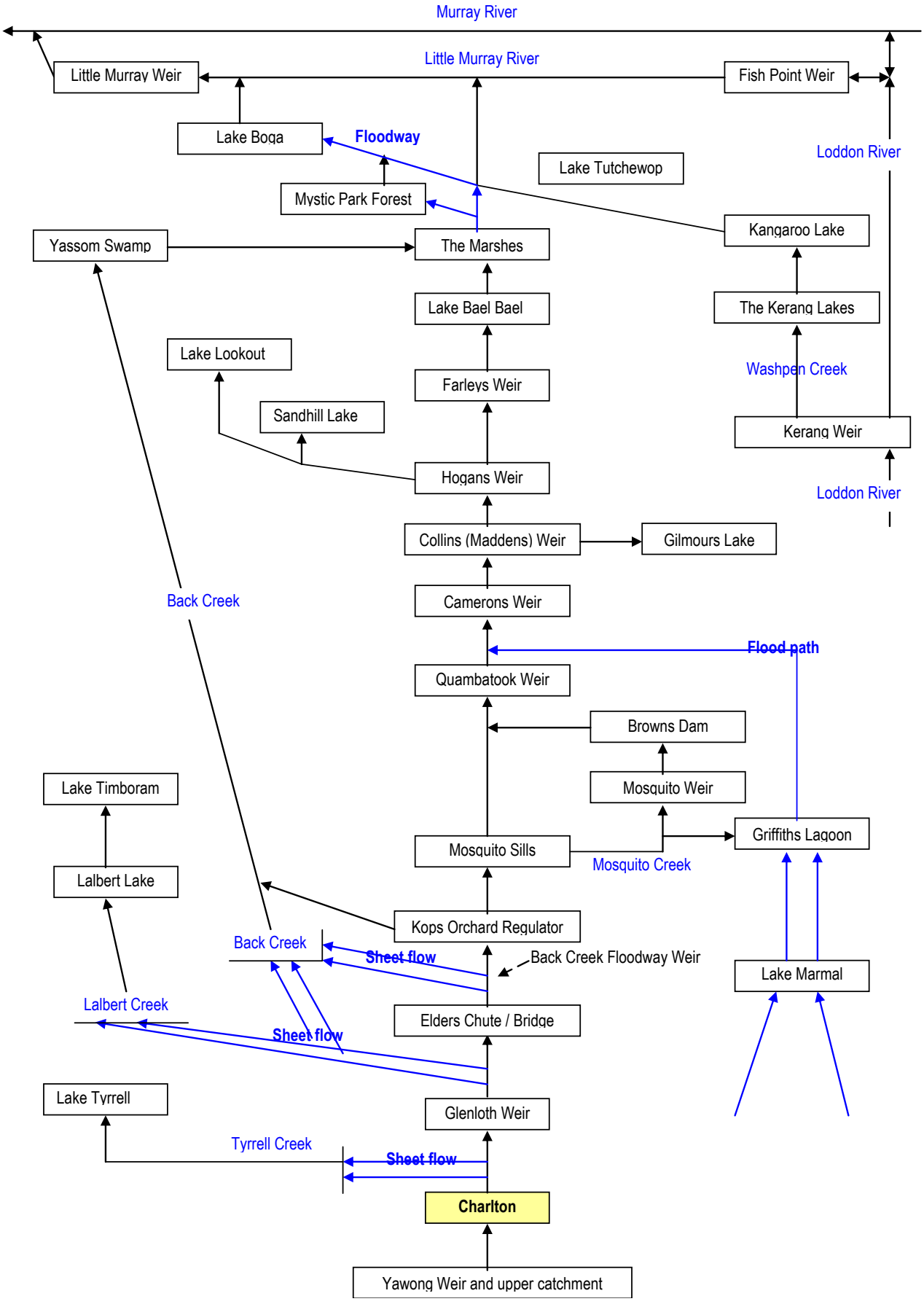
2 AVOCA RIVER CATCHMENT



Avoca River Schematic with gauge heights



Schematic Diagram of the Avoca River downstream from Charlton



Maps of Charlton

Figure F1-1 Charlton January 2011 inundation

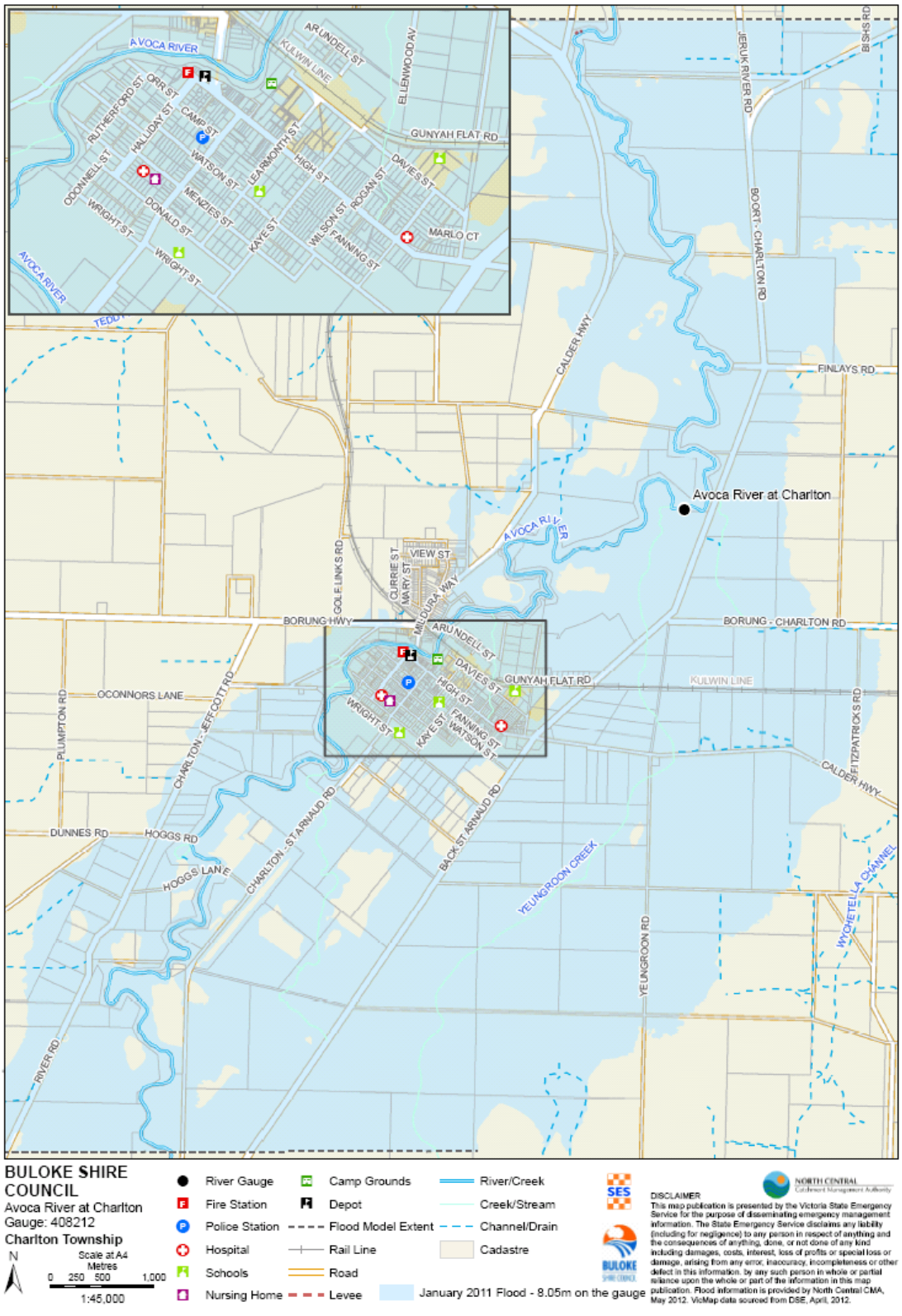


Figure F1.2 Maps showing flood extents and depths for the January 2011 event (sourced from Charlton Flood and Drainage Management Plan, October 2013)

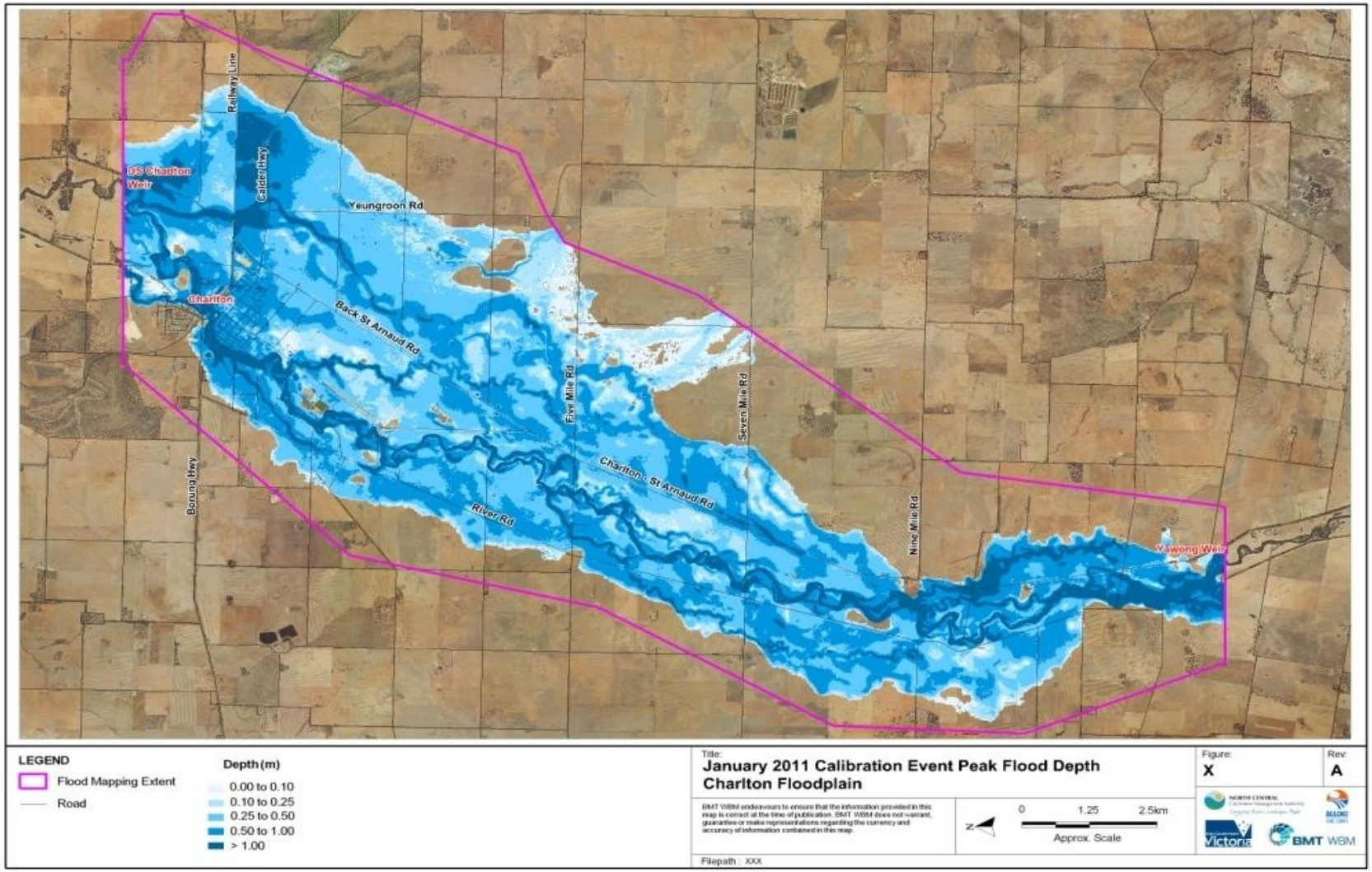


Figure F1.3 Maps showing flood extents and depths at Charlton for the January 2011 event (sourced from Charlton Flood and Drainage Management Plan, October 2013)

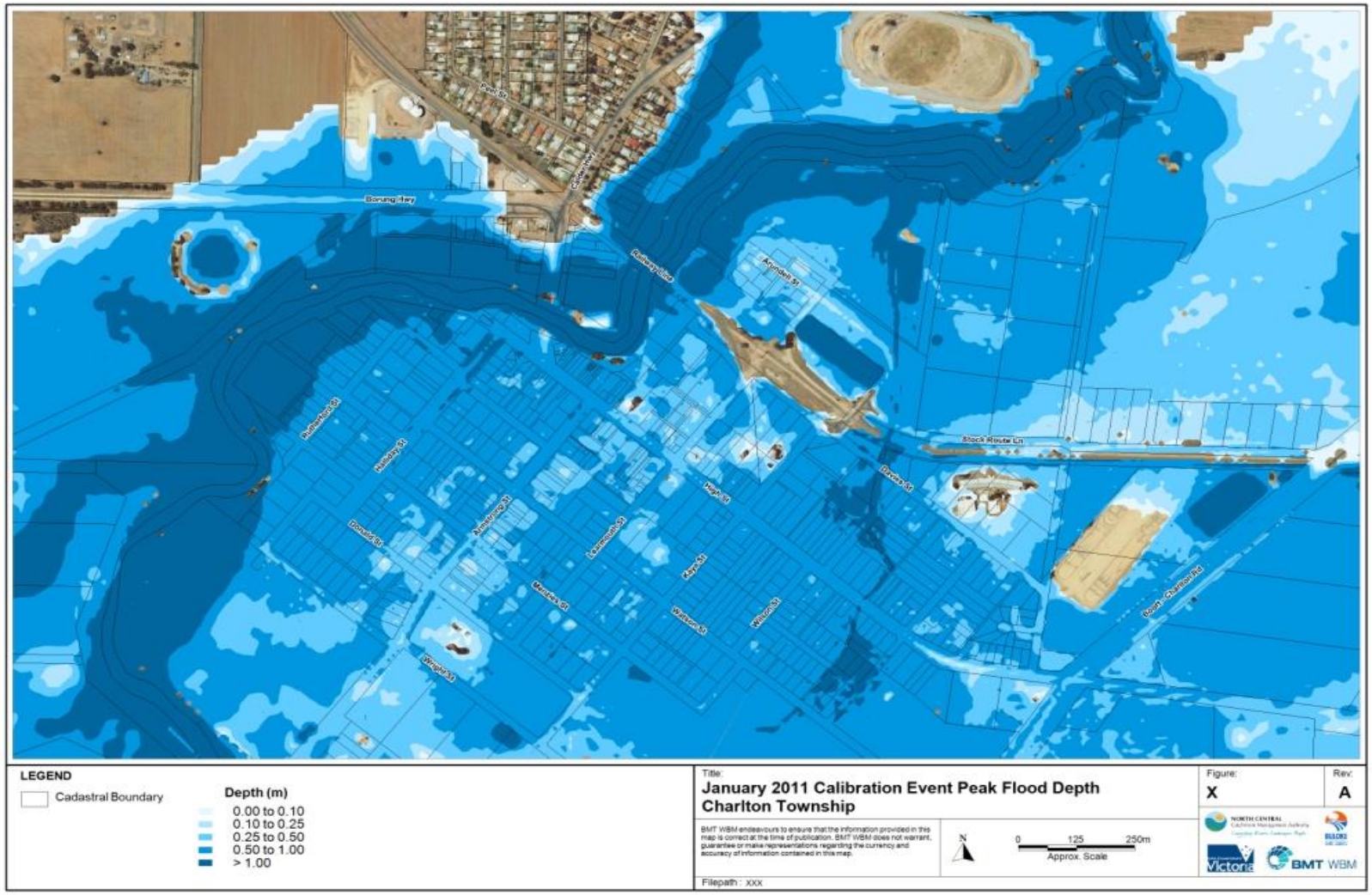


Figure F1.4 Maps showing flood extents and depths for the September 2010 event (sourced from Charlton Flood and Drainage Management Plan, October 2013)

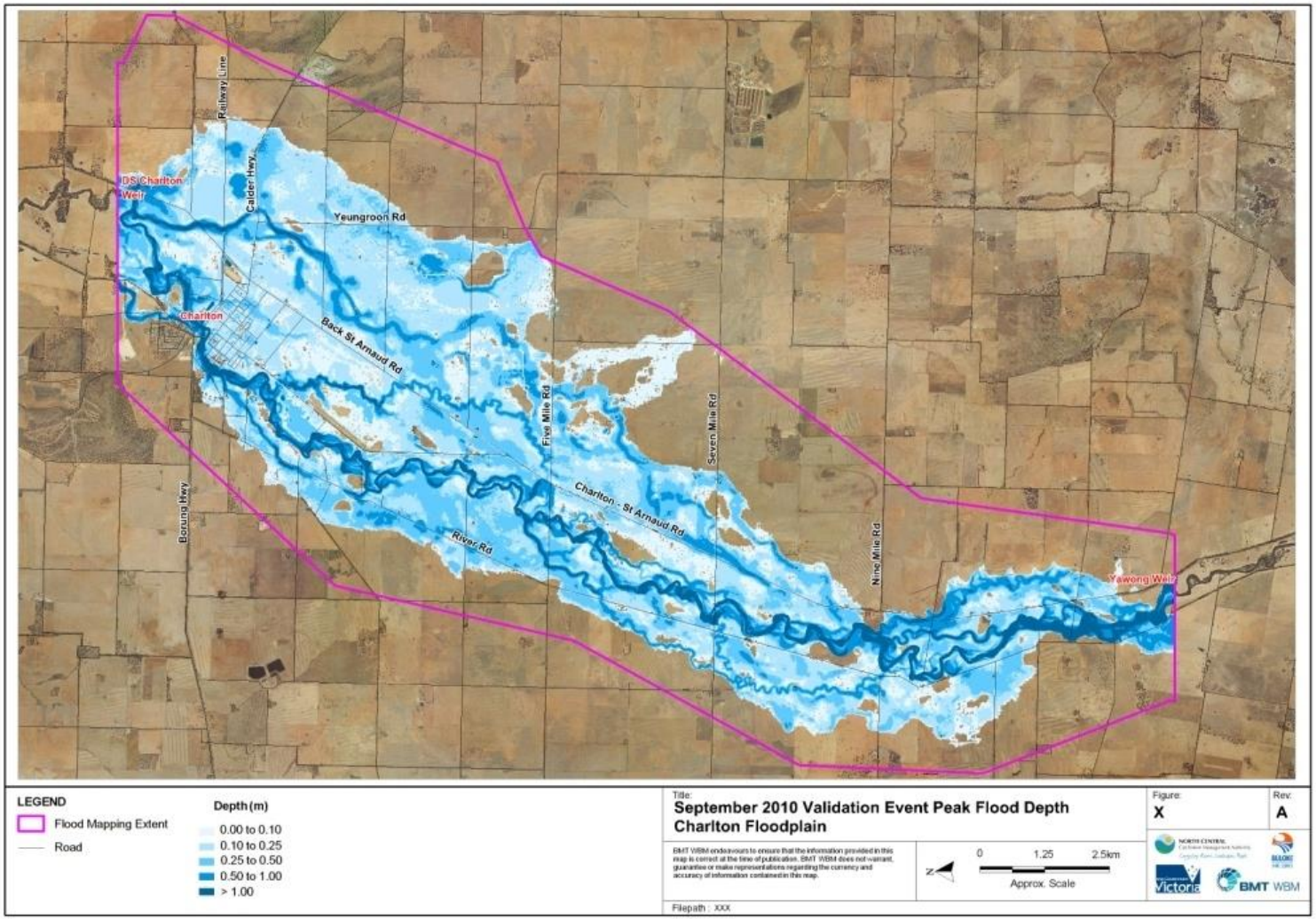


Figure F1.5 Maps showing flood extents and depths at Charlton for the September 2010 event (sourced from Charlton Flood and Drainage Management Plan, October 2013)

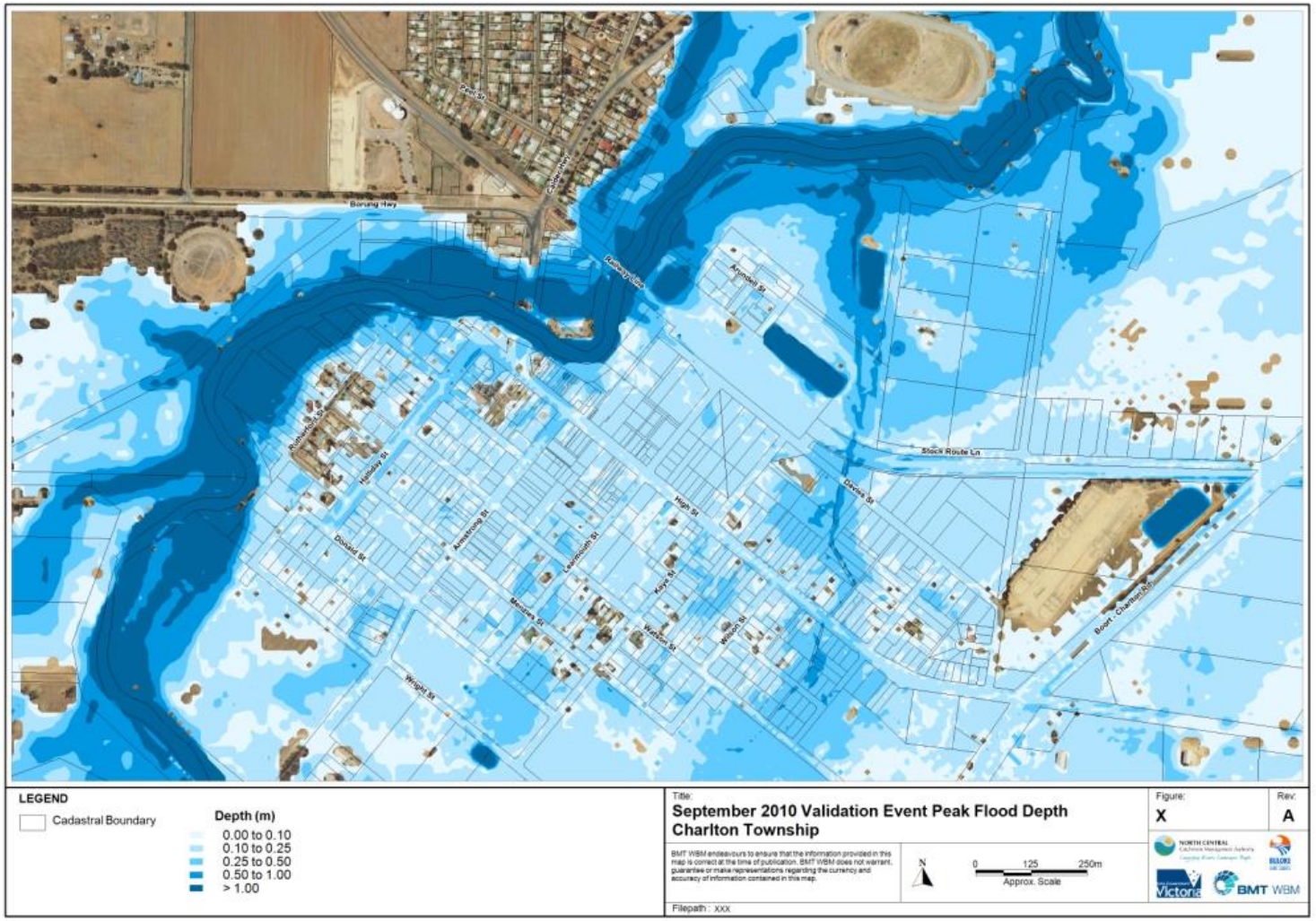


Figure F1.6 Maps showing flood extents and depths (sourced from Charlton Flood and Drainage Management Plan, October 2013)

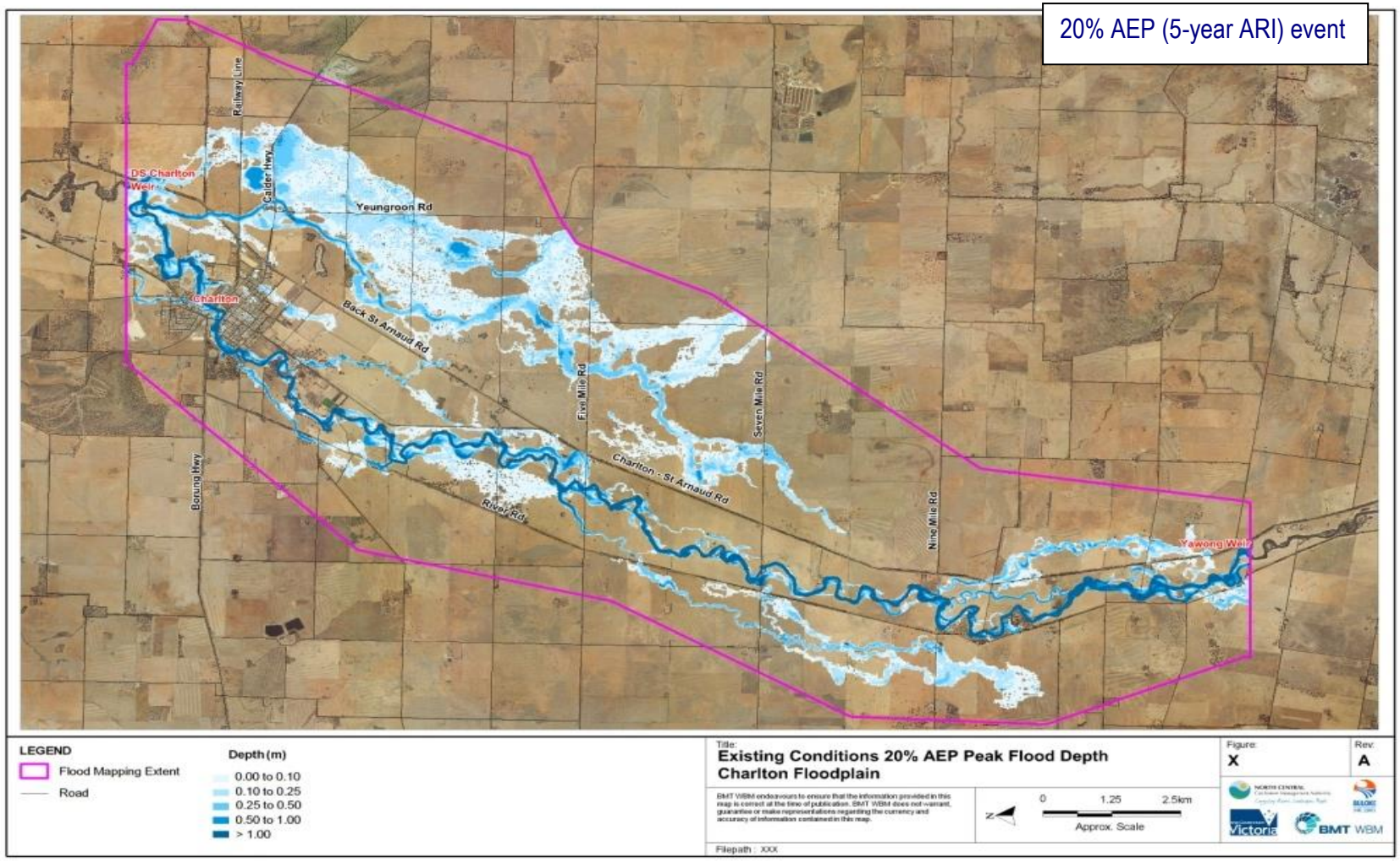


Figure F1.7 Maps showing flood extents and depths at Charlton for 5 year ARI event (sourced from Charlton Flood and Drainage Management Plan, October 2013)

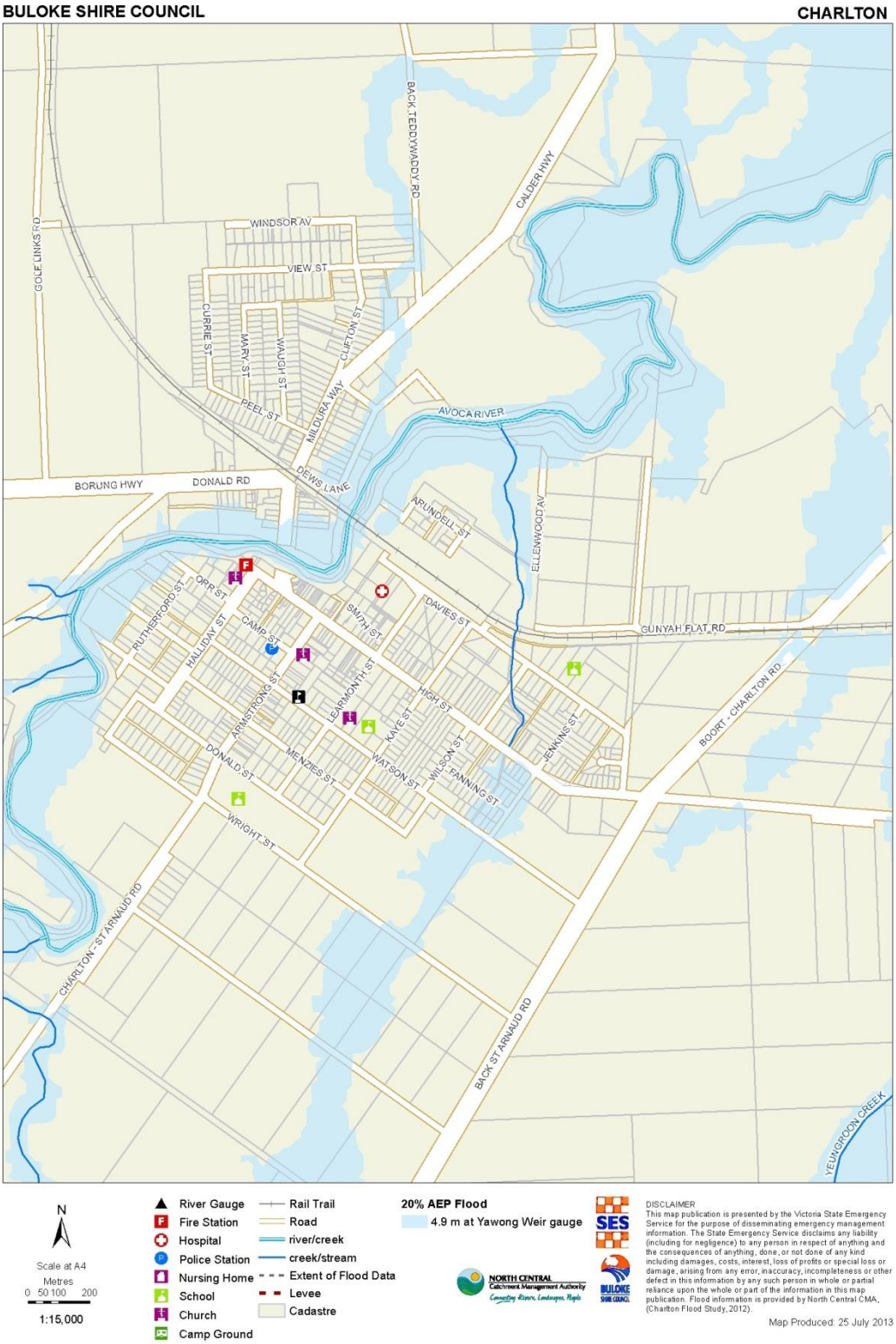


Figure F 1.8 Maps showing flood extents and depths (sourced from Charlton Flood and Drainage Management Plan, October 2013

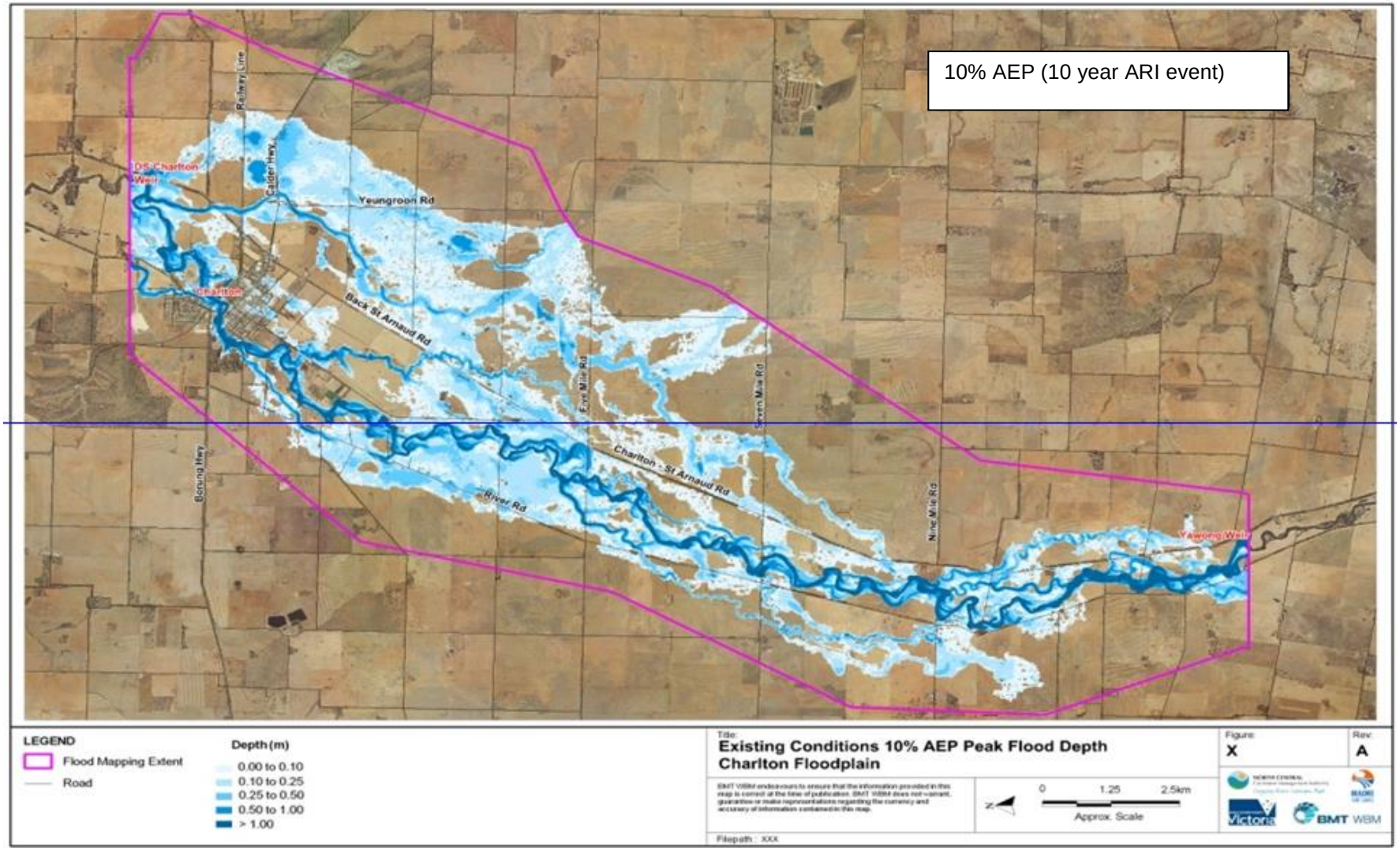


Figure F1.9 Maps showing flood extents and depths at Charlton for 10 year ARI event (sourced from Charlton Flood and Drainage Management Plan, October 2013)

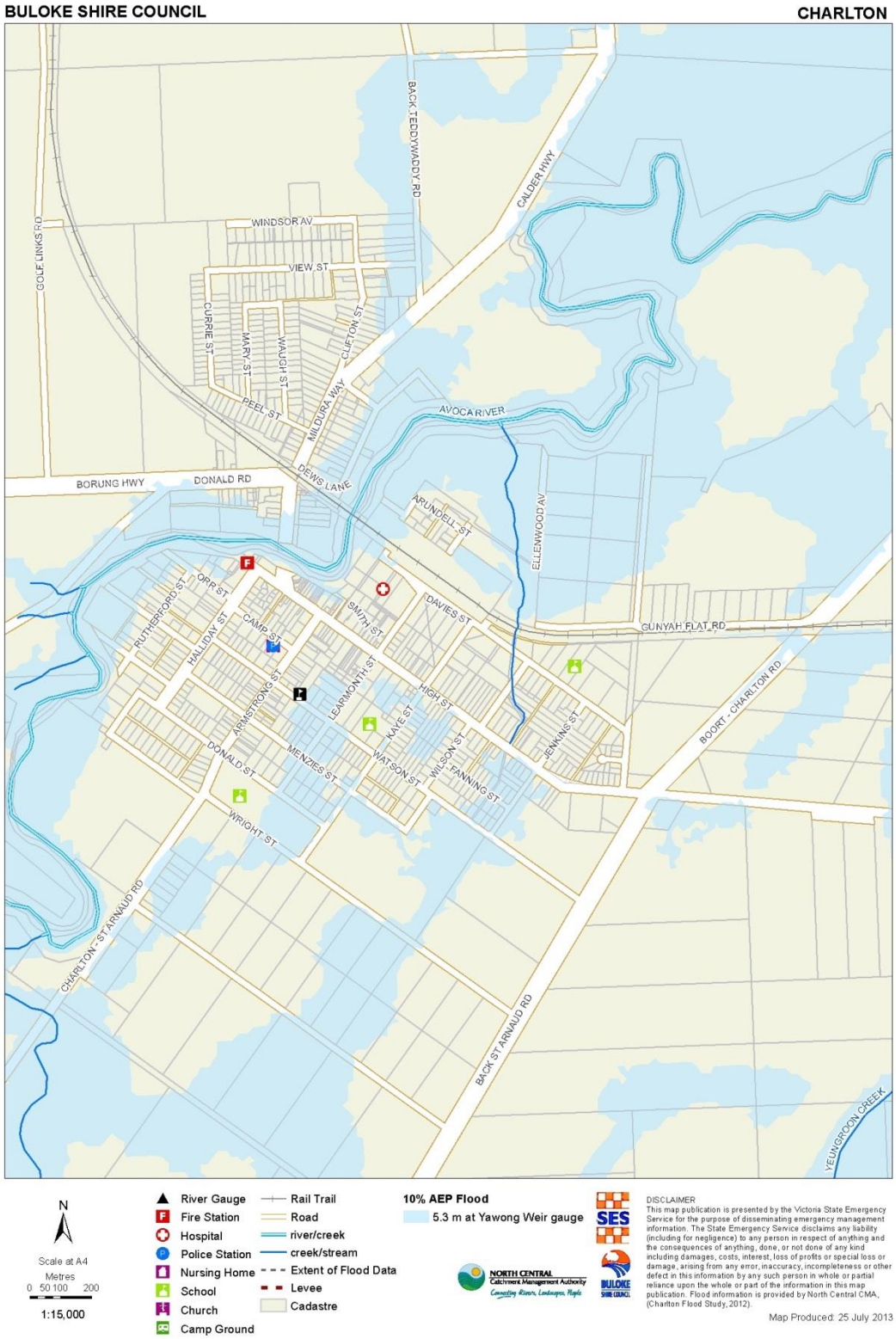


Figure F 1.8 Maps showing flood extents and depths (sourced from Charlton Flood and Drainage Management Plan, October 2013)

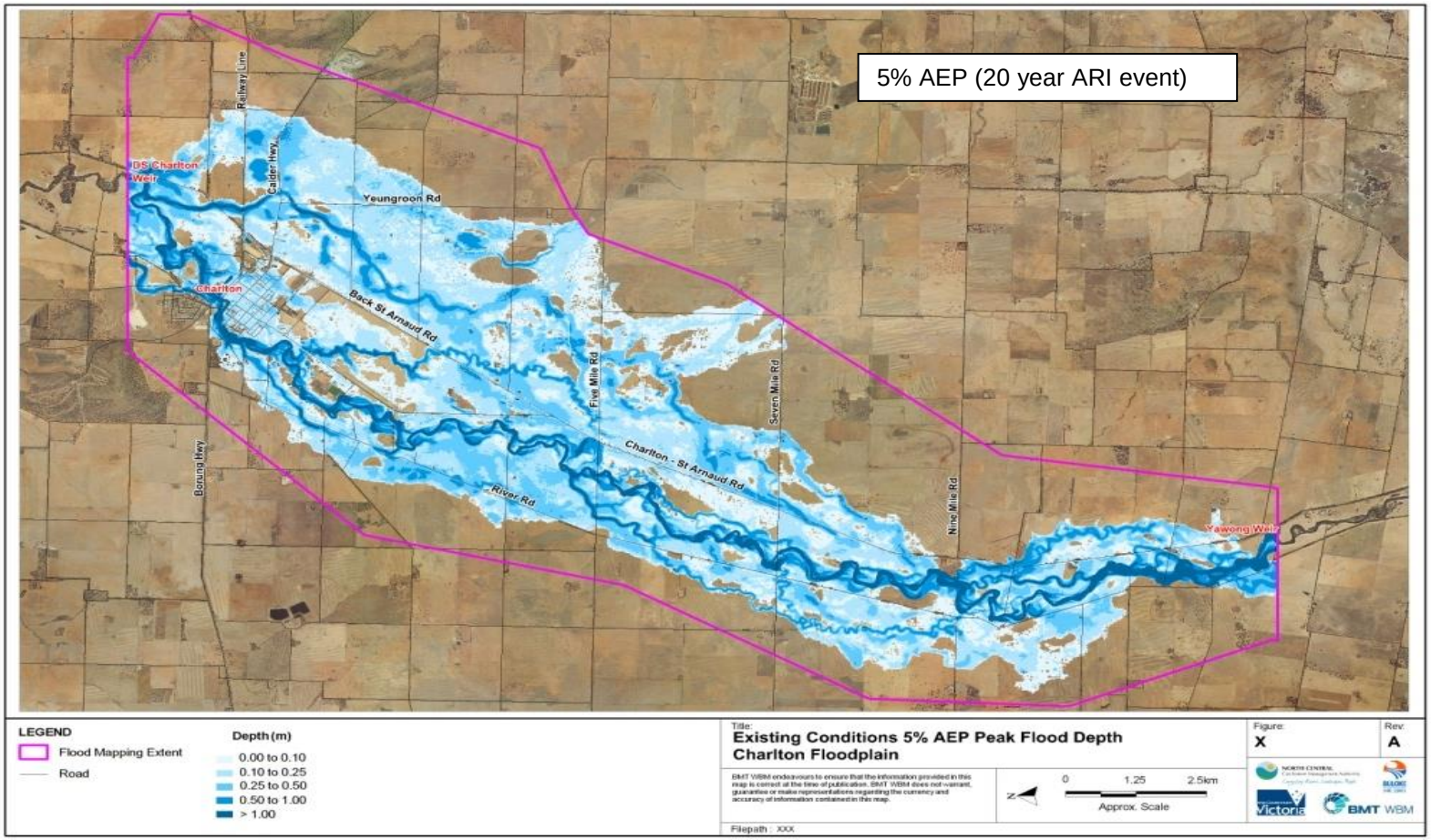


Figure F 1.9 Maps showing flood extents and depths at Charlton for 20 year ARI event (sourced from Charlton Flood and Drainage Management Plan, October 2013)

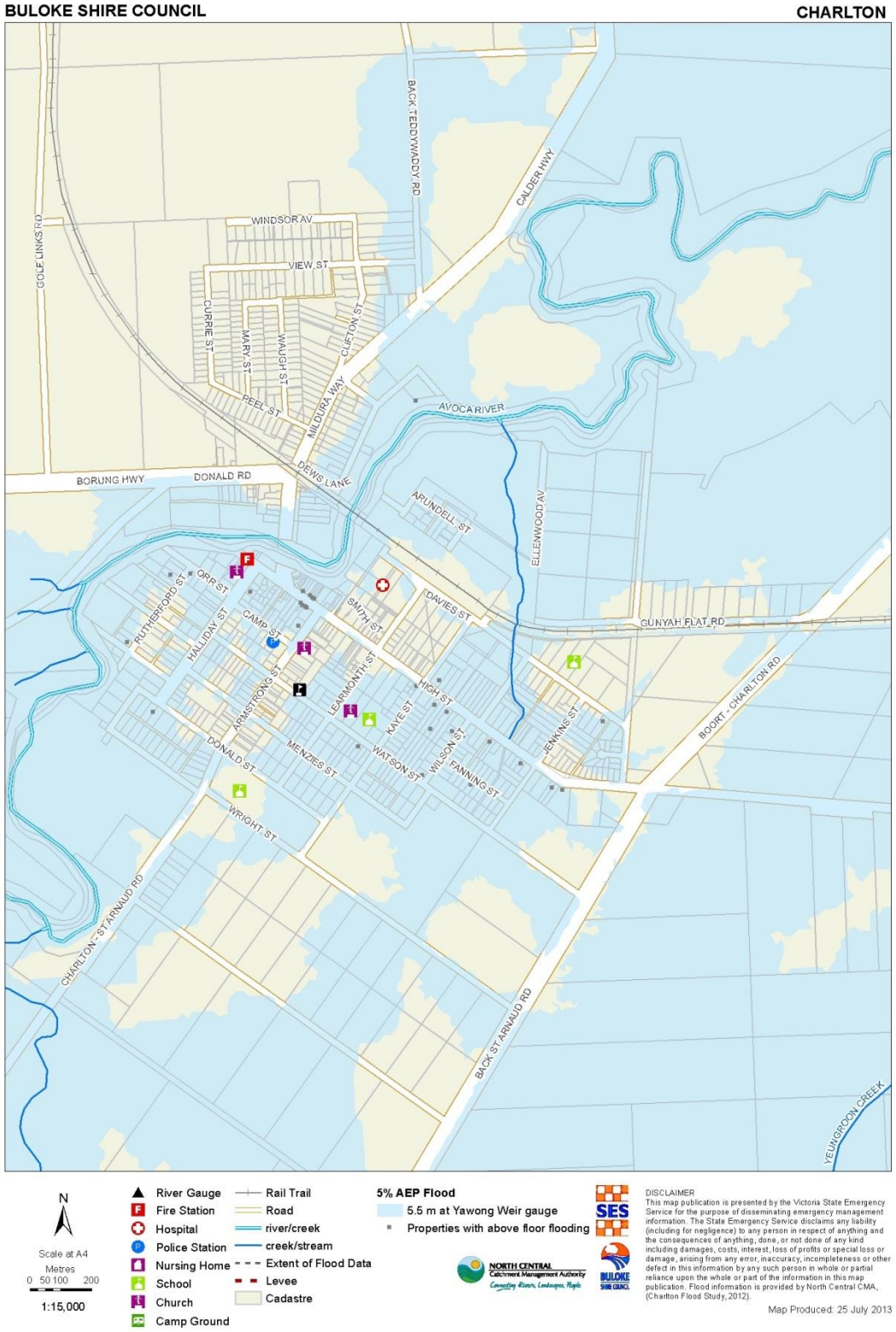


Figure F 1.10 Maps showing flood extents and depths (sourced from Charlton Flood and Drainage Management Plan, October 2013)

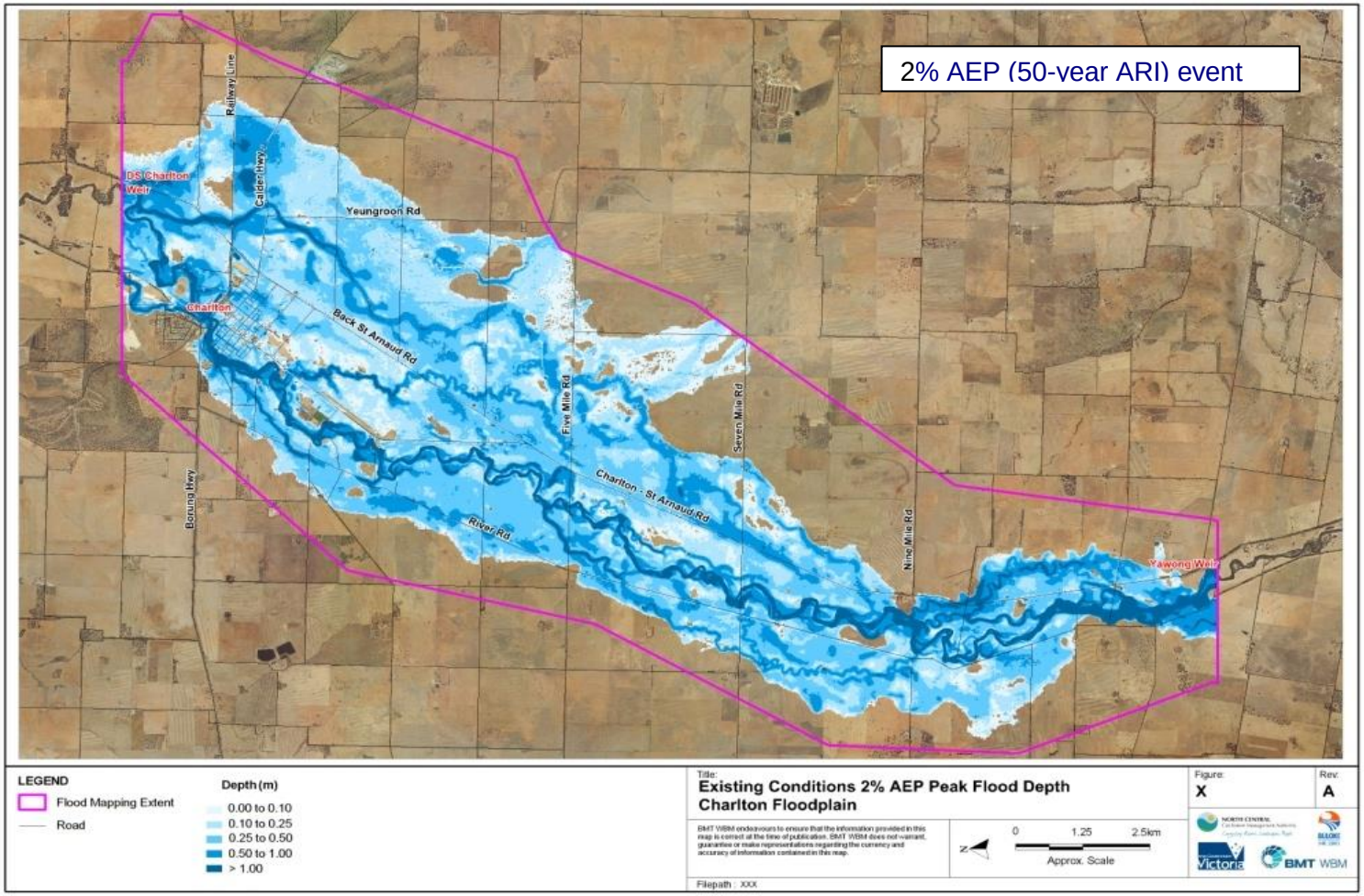


Figure F 1.11 Maps showing flood extents and depths at Charlton for 50 year ARI event (sourced from Charlton Flood and Drainage Management Plan, October 2013)

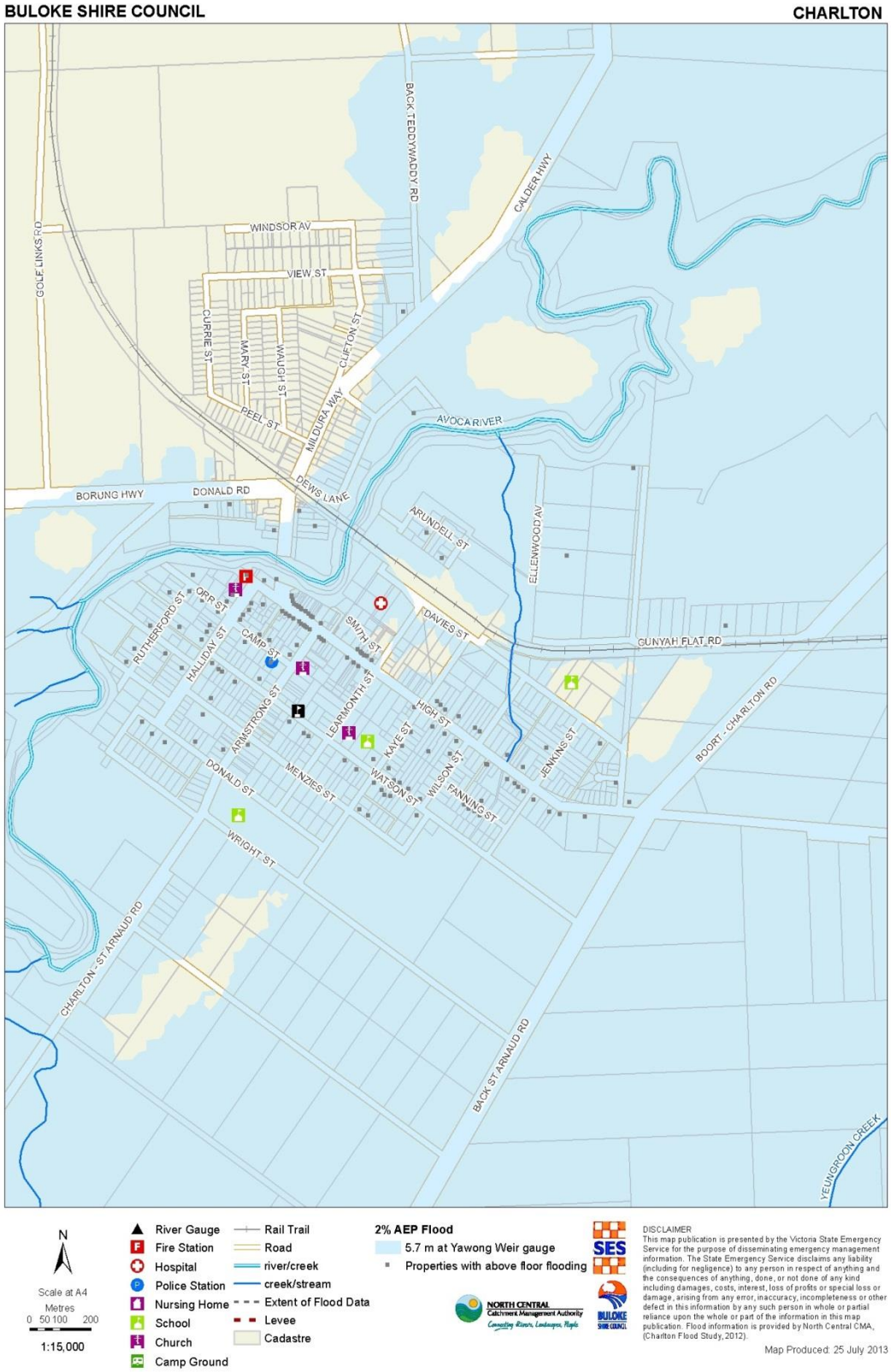


Figure F 1.12 Maps showing flood extents and depths (sourced from Charlton Flood and Drainage Management Plan, October 2013)

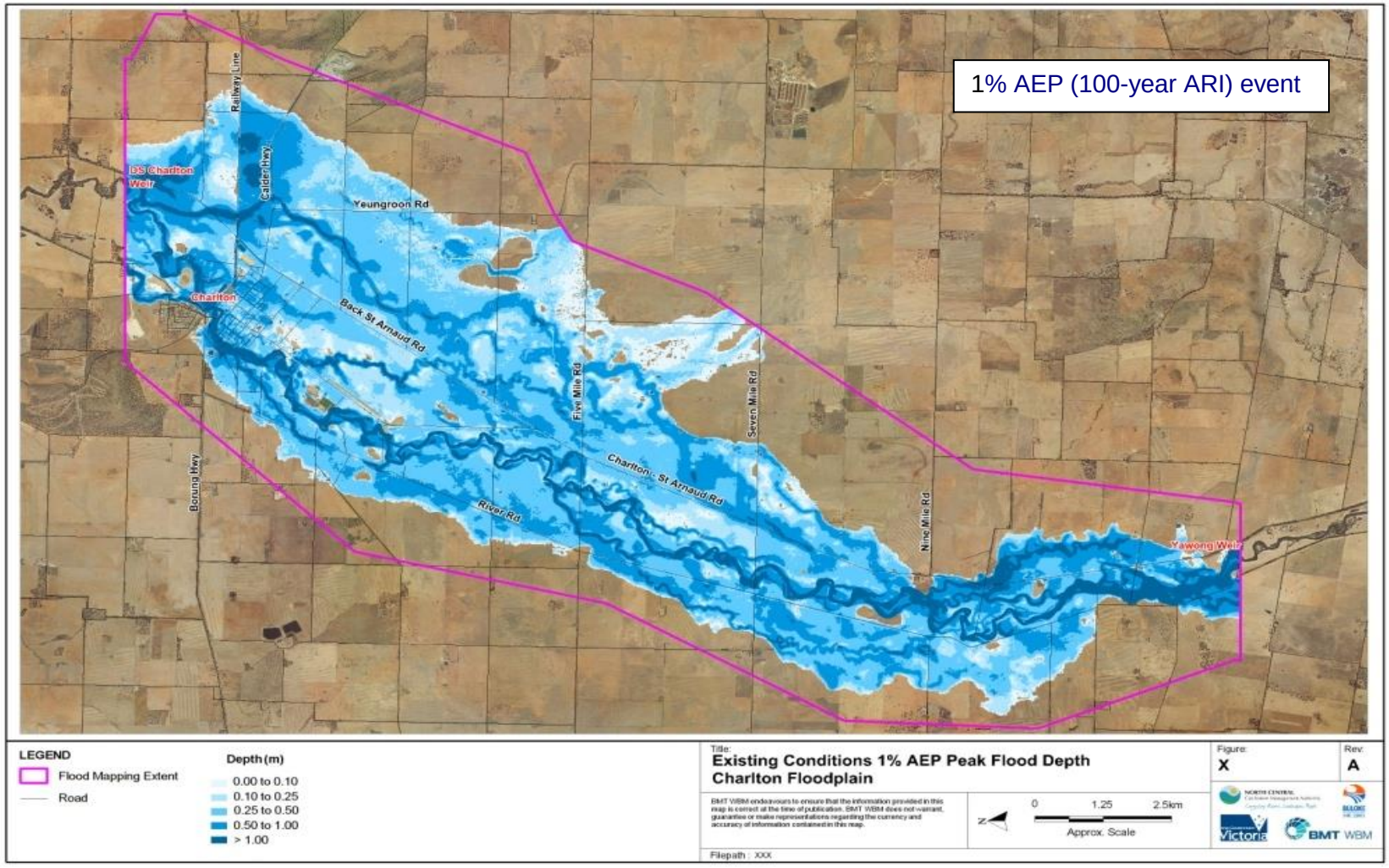


Figure F 1.13 Maps showing flood extents and depths at Charlton for 100 year ARI event (sourced from Charlton Flood and Drainage Management Plan, October 2013)

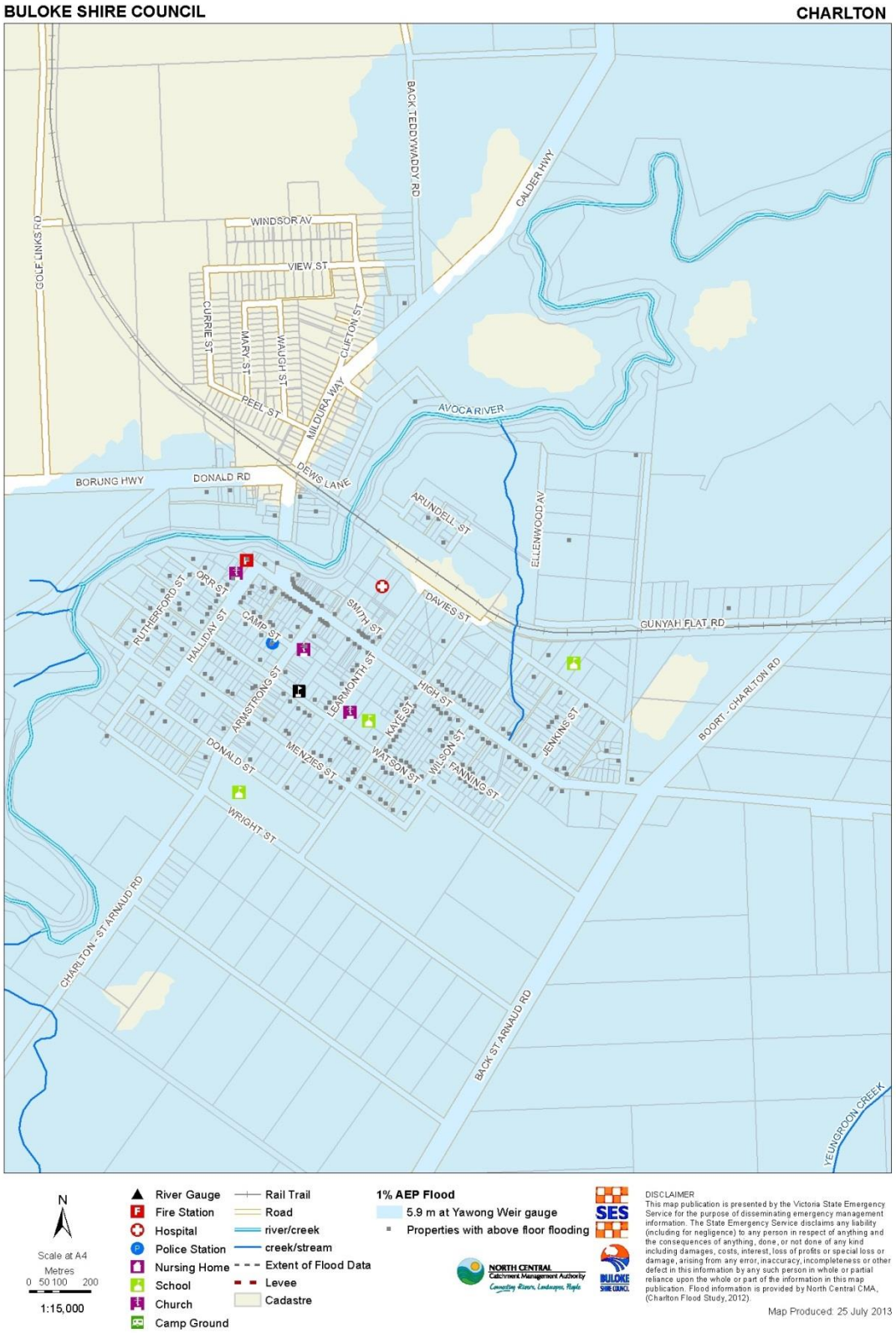


Figure F 1.14 Maps showing flood extents and depths (sourced from Charlton Flood and Drainage Management Plan, October 2013)

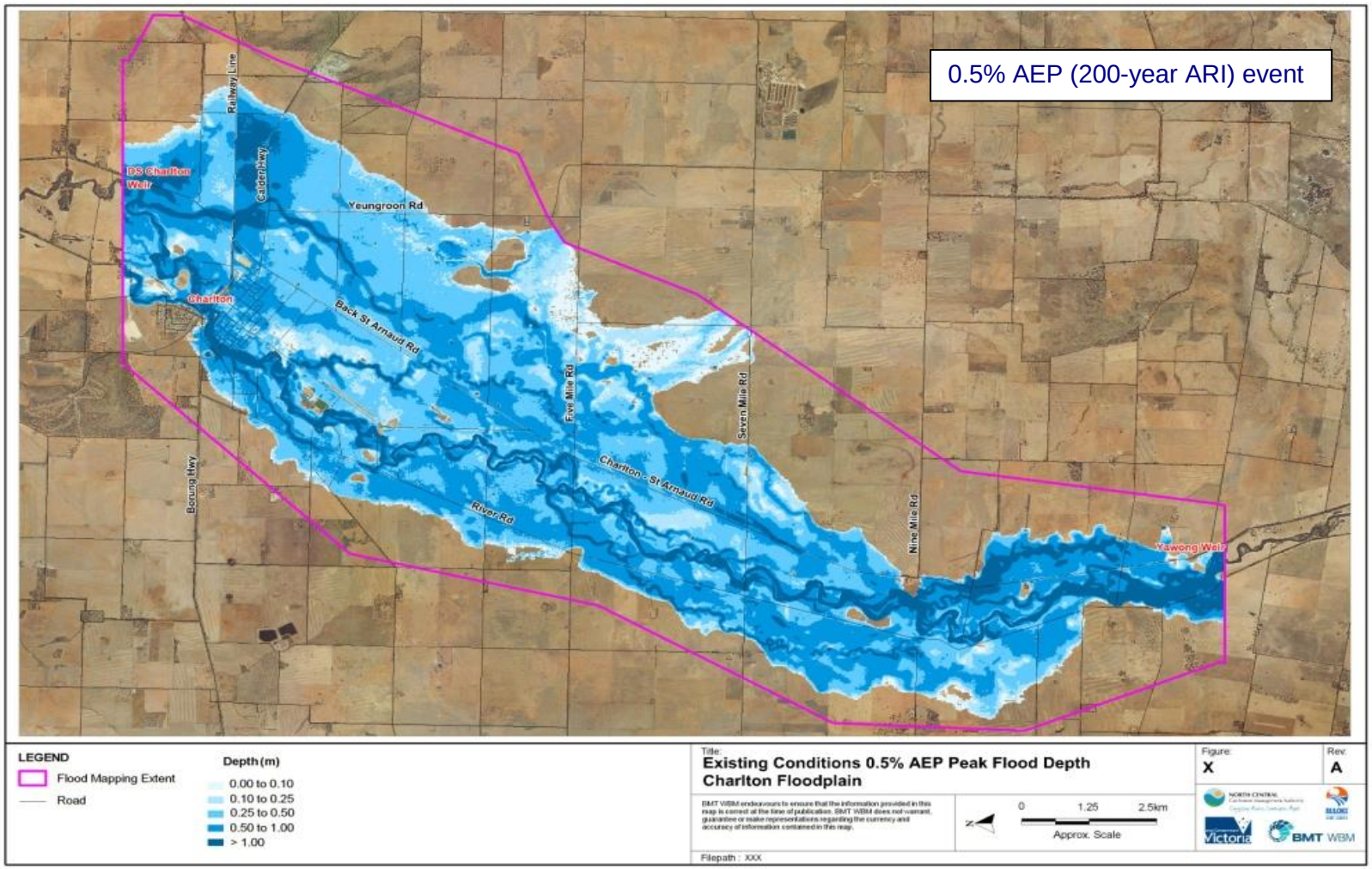
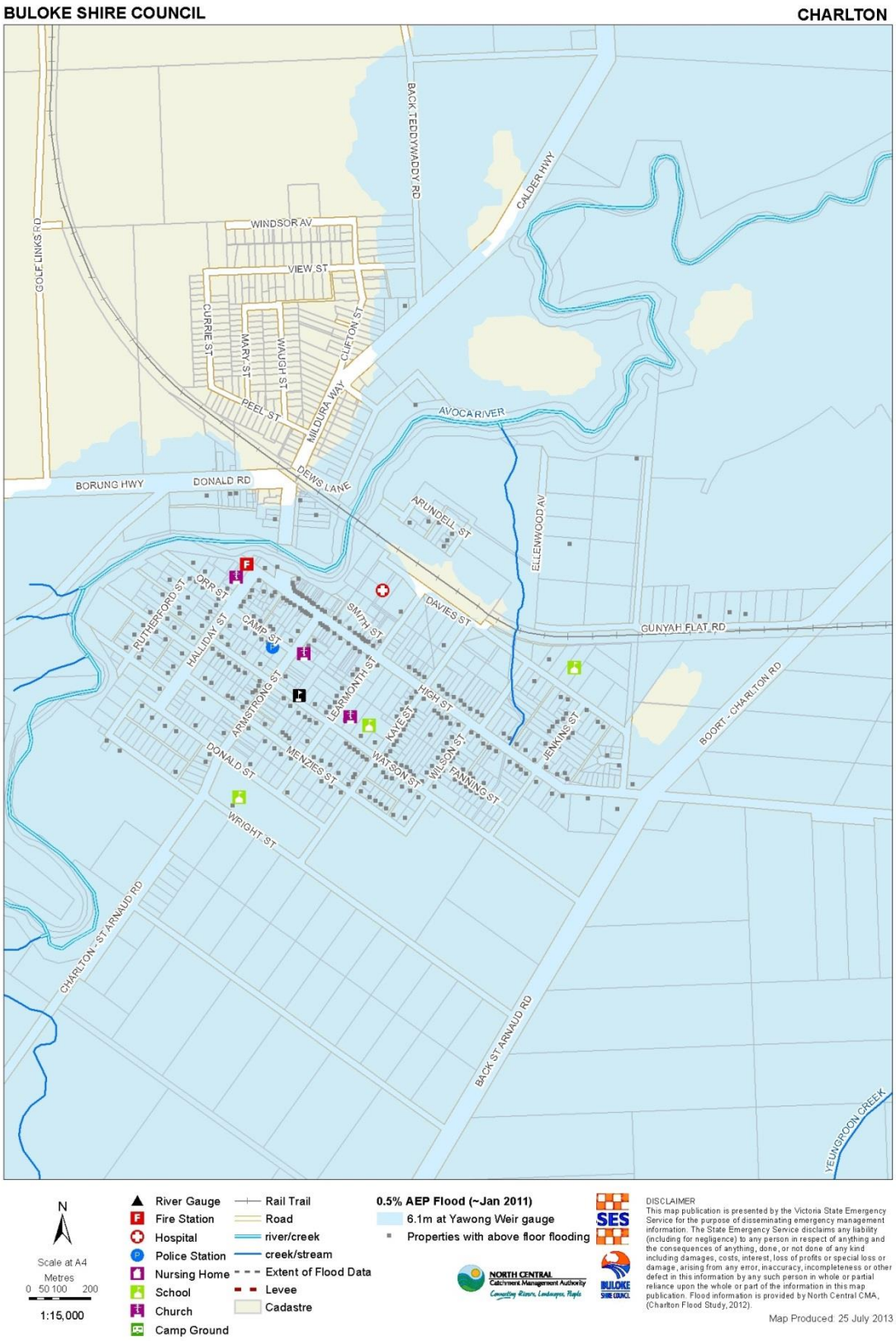


Figure F 1.15 Maps showing flood extents and depths at Charlton for 200 year ARI event (sourced from Charlton Flood and Drainage Management Plan, October 2013)



APPENDIX F2 – MAPS FOR DONALD

Overview

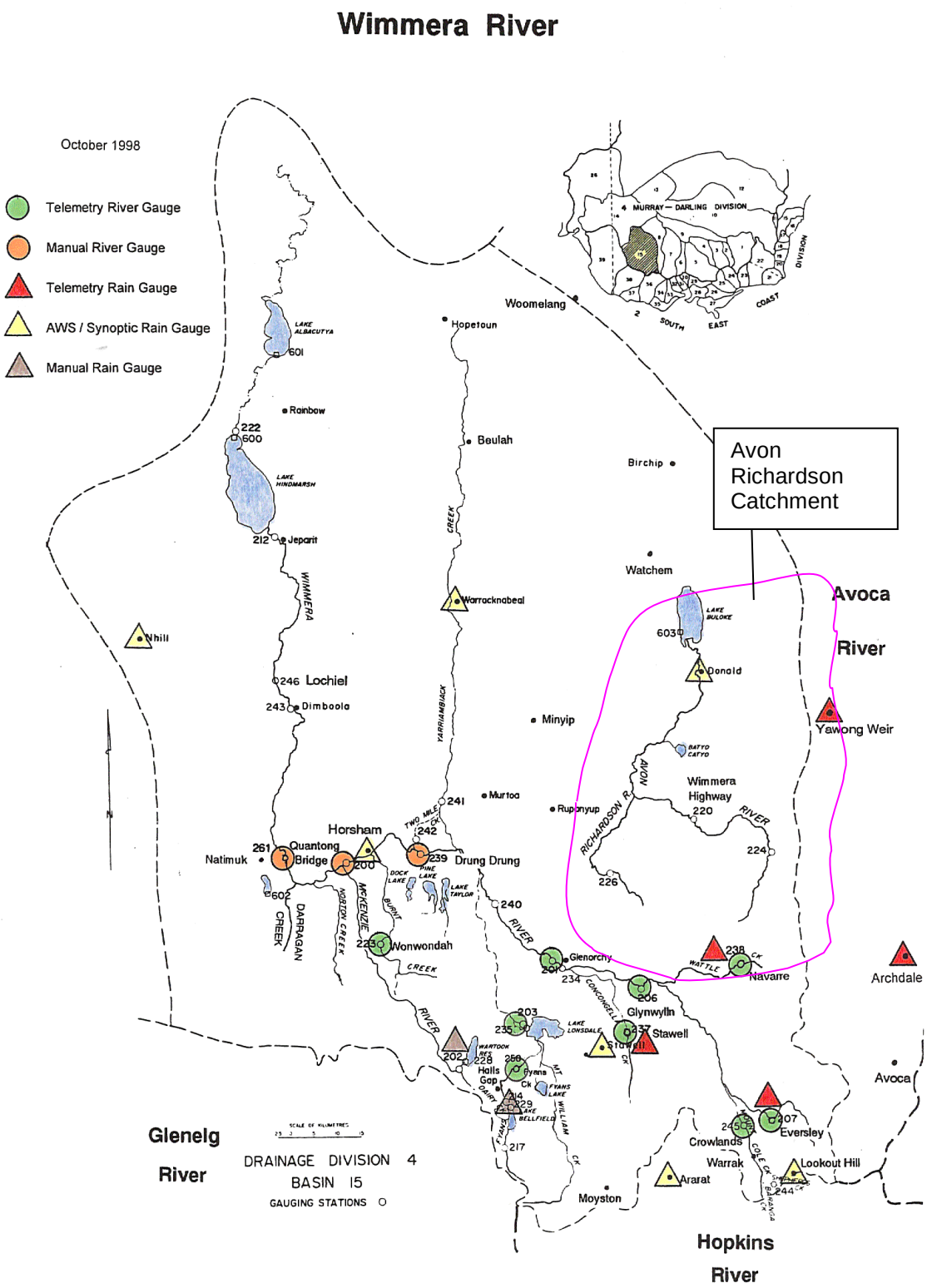
Maps considered useful to flood response at Donald are included in this Appendix. They comprise:

- Catchment overview map
- To be added later A set of maps showing flood extents and depths for each of the design flood events considered (i.e. 5, 10, 20, 50, 200 year ARI and PMF.
- Maps showing flood extent and depth for the September 2010 flood (GHD July 2013).
- Maps showing flood extent and depth for the January 2011 flood (GHD July 2013).

Note that:

- Maps are included in the deliverables from the Donald Flood and Drainage Management Plan (GHD July 2013) as a Map Atlas and are available from the Mallee CMA or Council, that show:
  - Properties flooded over-floor along with depths and extents;
  - Flood levels to AHD within Donald (useful for checking whether roads or infrastructure will be flooded);
  - Flood hazard (based on consideration of depth and velocity) for each of the design events considered;
  - Flood velocities.
- Maps showing the Land Subject to Inundation Overlay are included in the Buloke Planning Scheme and can be used as a guide to areas that may flood during an event. These maps can be found in hard copy form at the Council's main office or online at the Department of Planning and Community Development website (see the list of references in Appendix I).
- Maps showing 100-year ARI (1% AEP) flood extent and floodways (together with volume, height and water quality data) are shown at the Victorian Water Resources website (see the list of references in Appendix I).

AVON-RICHARDSON RIVER CATCHMENT



MAP SHOWING EXTENT OF NEW STRATEGIC LEVEE FOR DONALD TOWNSHIP

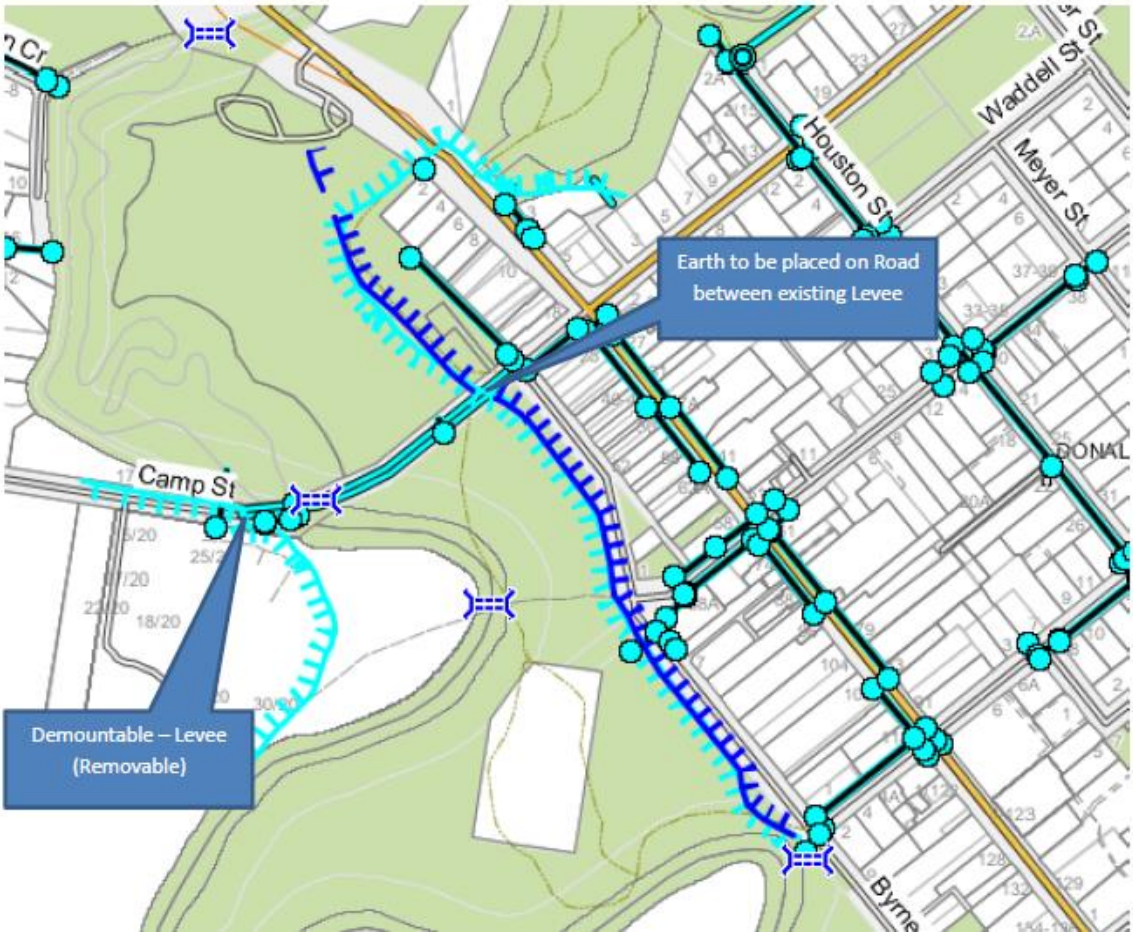
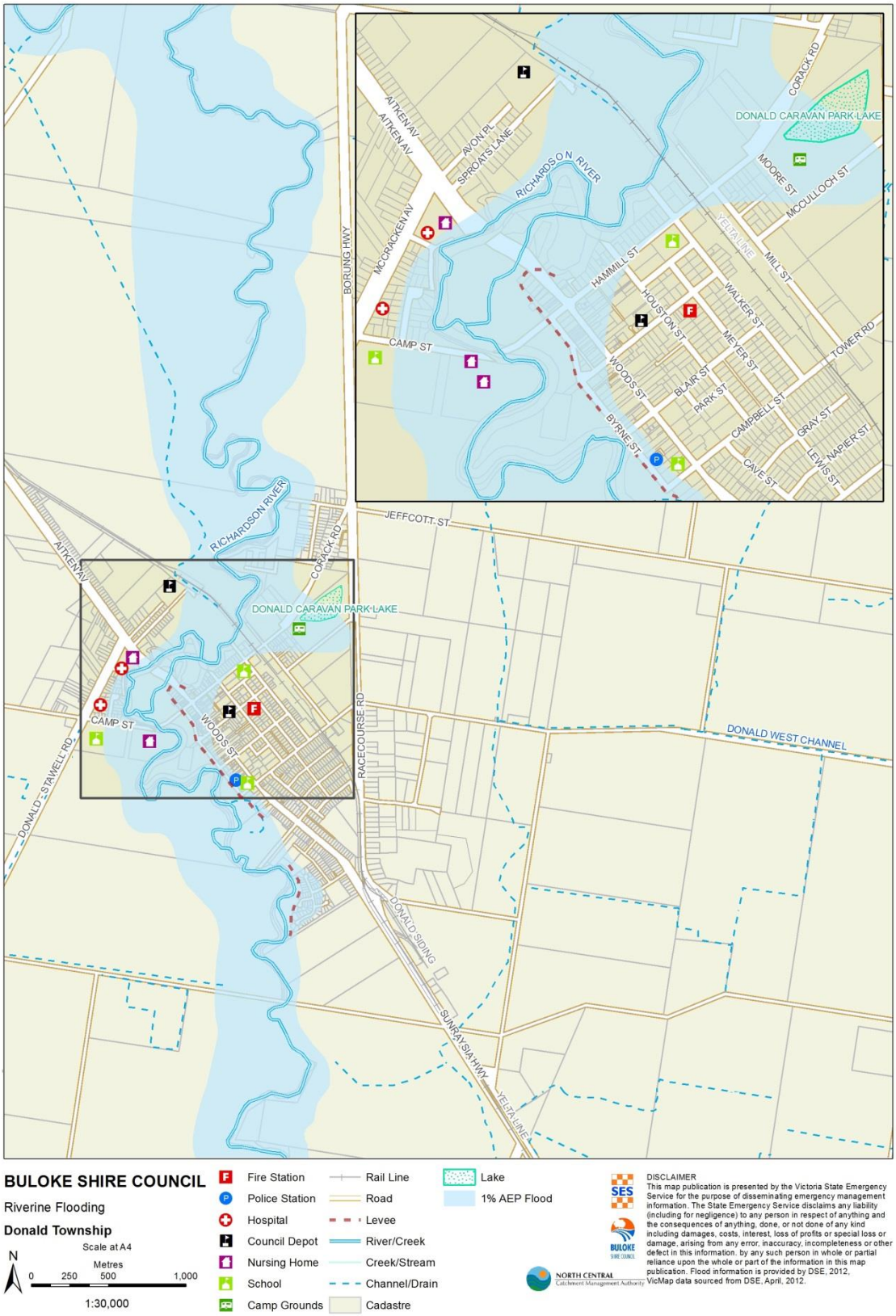


Figure F 2.1 Maps showing flood extents at Donald for 100 year ARI event



APPENDIX F3 – MAPS FOR CULGOA

1. Overview

Maps and aerial overlay photos considered useful to flood response at Culgoa are included in this Appendix. They comprise:

- A set of maps showing flood extents and various depths for based on the January 2011 flood event (GHD July 2013).

Note that:

- Maps are included in the deliverables from the Culgoa Flood Investigation August 2013 (Water Technology) further information is available from the Mallee CMA or Council, that show:
  - Properties flooded over-floor along with depths and extents;
  - Flood hazard (based on consideration of depth and velocity)
  - Flood velocities.
- Maps showing the Land Subject to Inundation Overlay are included in the Buloke Planning Scheme and can be used as a guide to areas that may flood during an event. These maps can be found in hard copy form at the Council's main office or online at the Department of Planning and Community Development website (see the list of references in Appendix I).
- Maps showing flood extent and floodway's based on the January 2011 flood event (together with volume, height and water quality data) are shown at the Victorian Water Resources website (see the list of references in Appendix I).

Figure F 3.1 Maps showing flood extents at Culgoa for the January 2011 flood event.

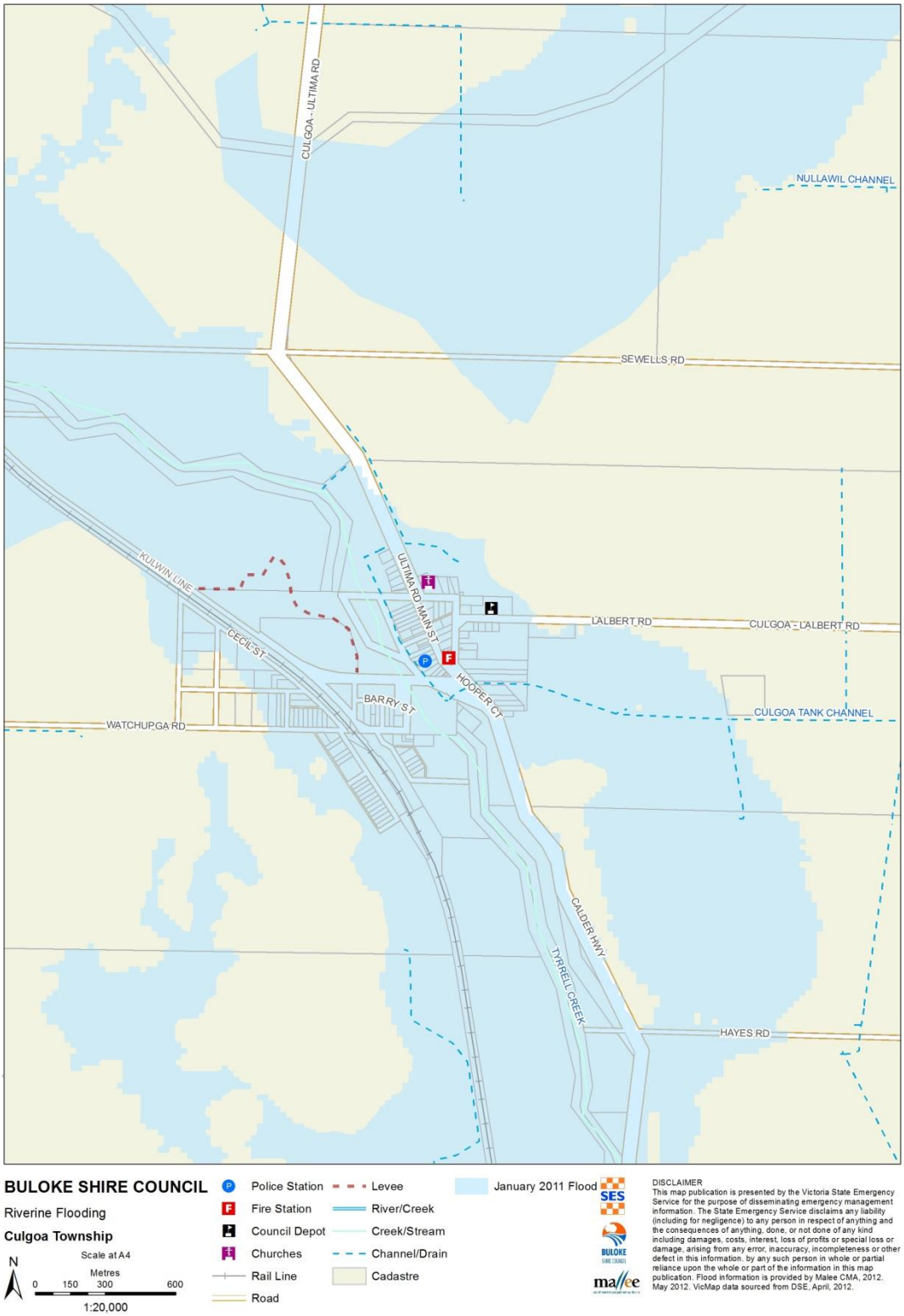


Figure F3.2 Map showing Estimated flood Extents at Culgoa

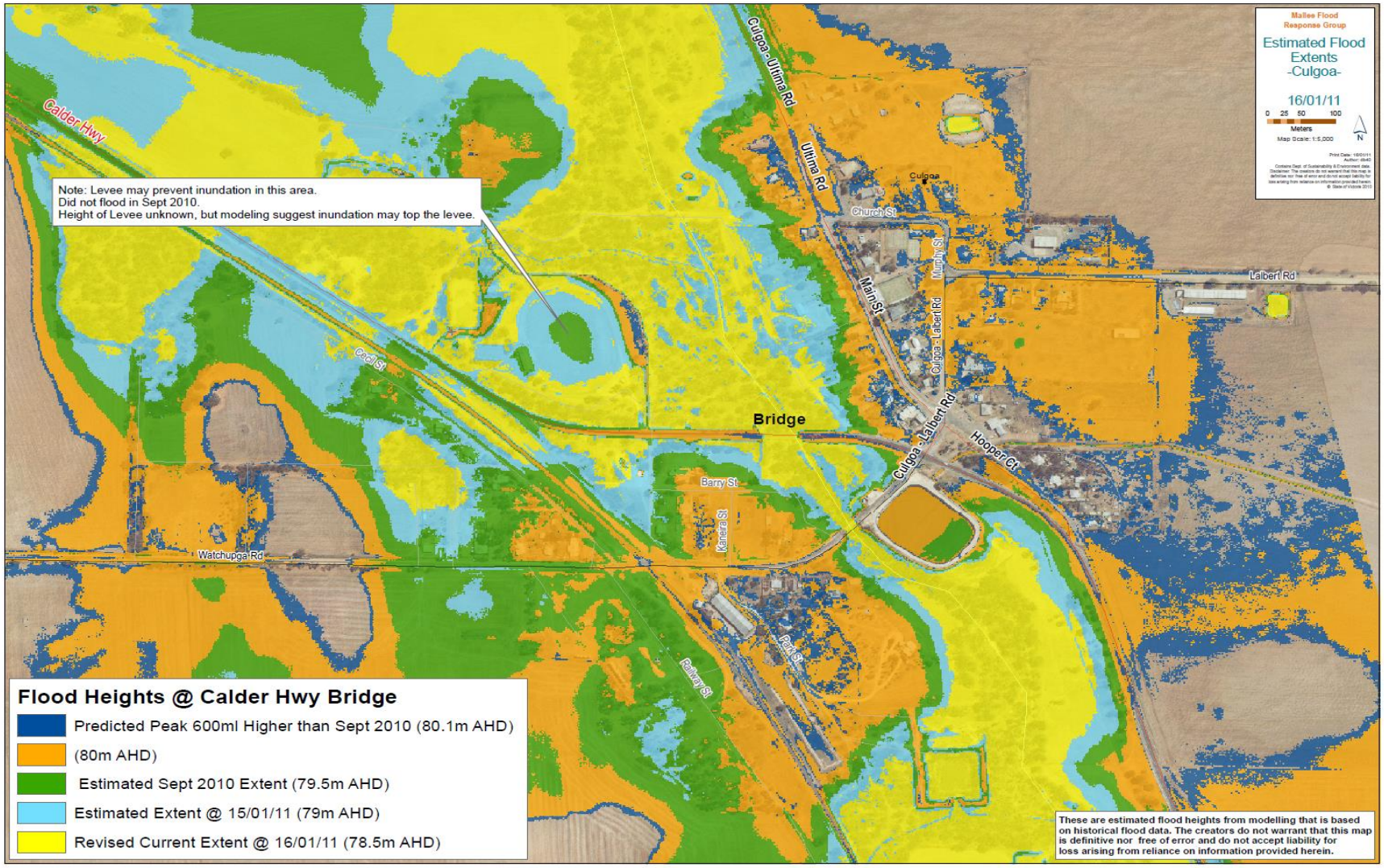


Figure F3.3 Map showing Observed Flood Extent at Culgoa for January 2011 event.

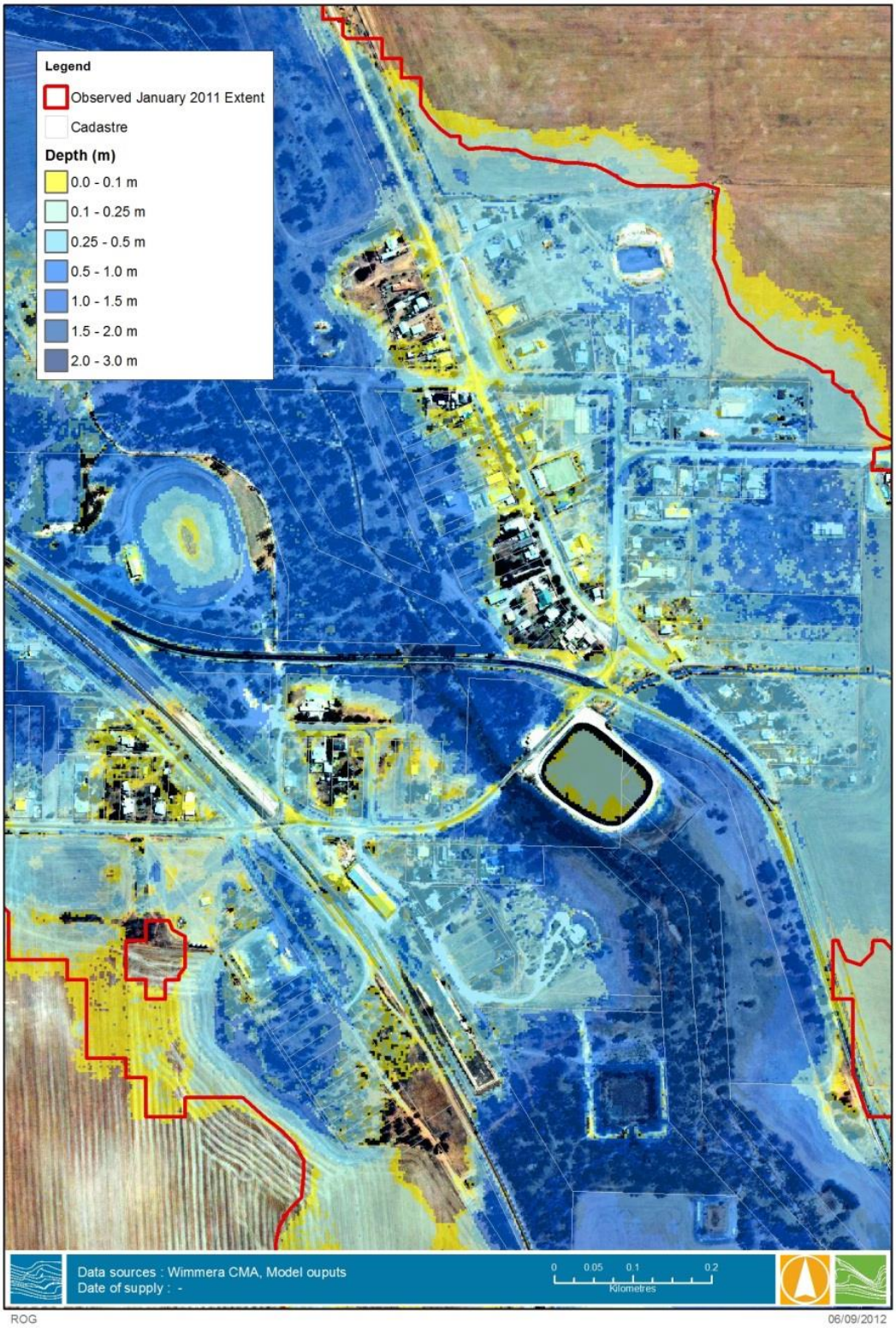


Figure F3.4 Map showing Observed Flood Extent at Culgoa for January 2011 event.

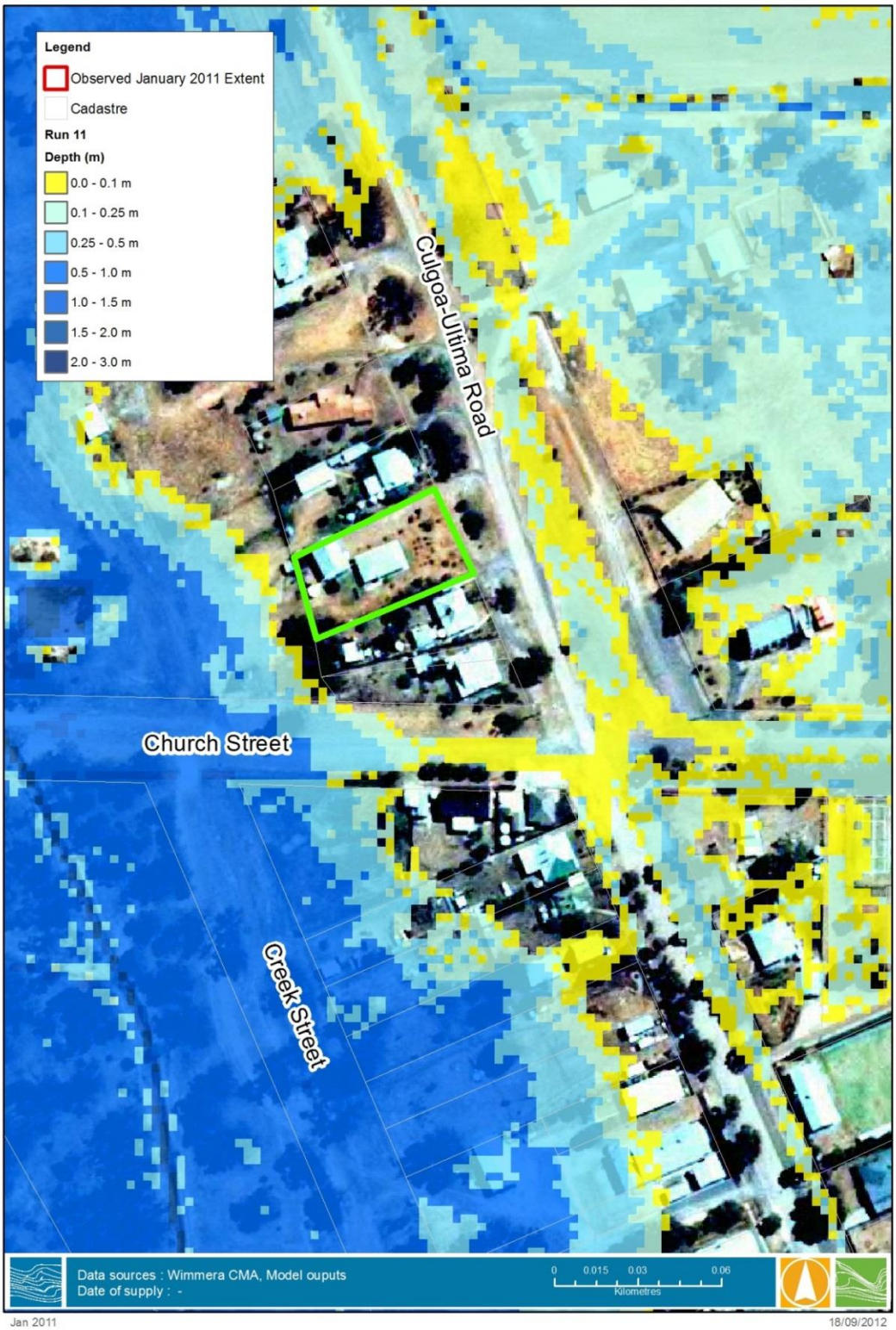
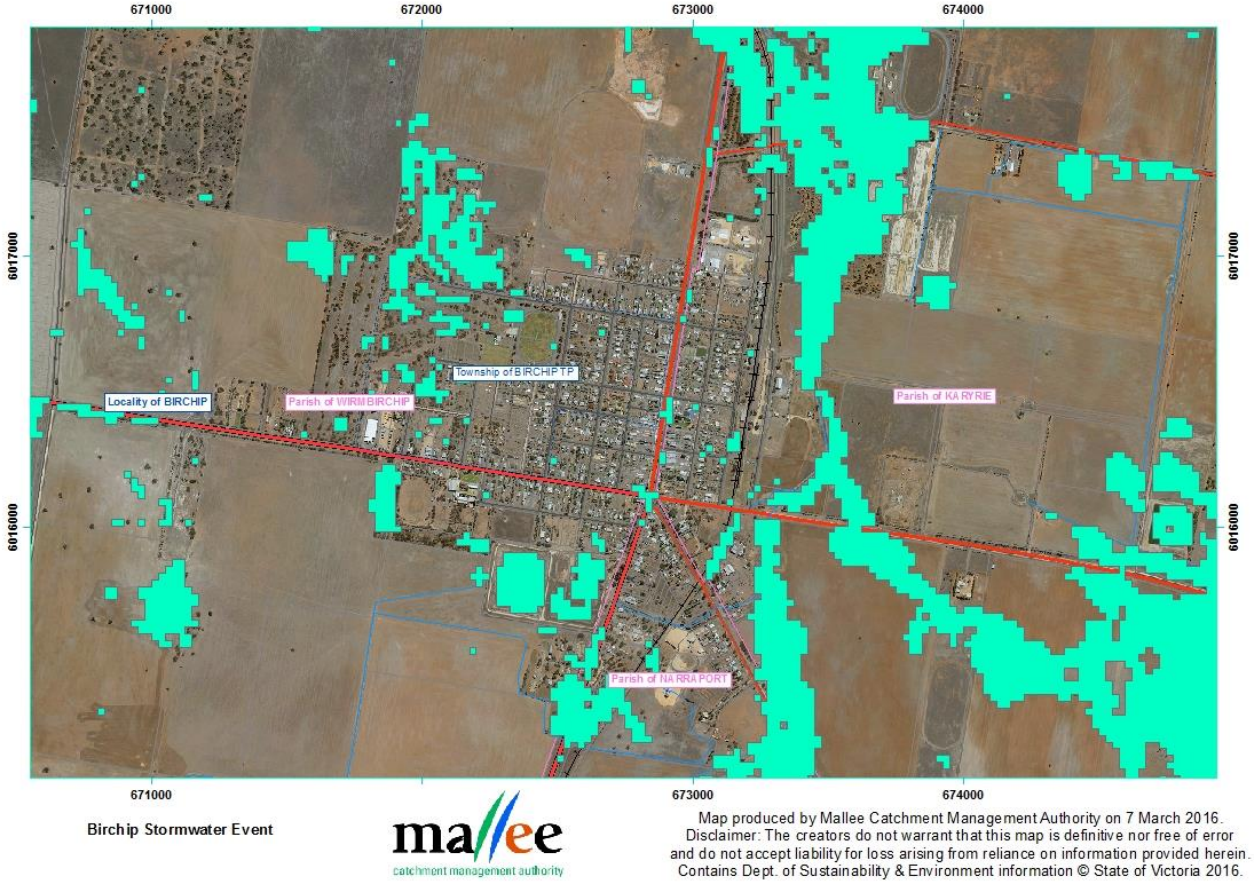


Figure F3.5 Map showing 10 year ARI model results

APPENDIX F4 – HOT SPOT MAP FOR BIRCHIP

Figure 4.1 Flash flood hotspots at Birchip December 2018



Note: 13th December 2018, 127 mm of rainfall over a 17 hour period this equates to a <1 in 500 year event.

APPENDIX G - ISOLATED RURAL LOCATIONS

The following is a list of locations that will have a number of properties isolated this could be anything from 1 to 7 days depending on how prolonged and the severity of the event.
Note a large number of these properties will be isolated at the **Moderate and higher flood levels**.
There is a need to ensure appropriate and timely information is provided to this community.

This list is not all inclusive or comprehensive and should be used to provide guidance to emergency management personnel as to the locations of potentially isolated properties.

AVON-RICHARDSON RIVER
South East of Sunraysia Highway

1180 Laen - Cope - Cope Road, COPE COPE
1219 Laen – Cope - Cope Road, COPE COPE
465 Donald – Avon - Plains Road, COPE COPE
845A Donald – Avon Plains Road, COPE COPE
85 Grewars Road, COPE COPE
2171 Traynors Lagoon Road, COPE COPE
4 Memorial Lane, COPE COPE
139 Middle Settlement Road, RICH AVON
286 Middle Settlement Road, RICH AVON
343 Gil Gil Road, GIL GIL
508 Watchem Lake Road, WATCHEM

MARMAL CREEK
Woosang – Barrakee – Lake Marmal

2120 Calder Highway, WOOSANG
501 Barrakee Road, BARRAKEE
483 Barrakee Road, BARRAKEE
662 Borung Charlton Road, BARRAKEE
615 Borung Charlton Road, BARRAKEE
469 Borung Charlton Road, CHARLTON
361 Findlays Road, CHARLTON
1023 Barrakee Road, CHARLTON
339 Bishs Road, NARREWILLOCK
505 Bishs Road, NARREWILLOCK
199 A Blairs Road, NARREWILLOCK
704 A Blairs Road, BUCKRABANYULE
367 Edwards Road, NARREWILLOCK
201 McGraths Road, NARREWILLOCK
285 McGraths Road, NARREWILLOCK
485 Marmal North Road, LAKE MARMAL
662 Marmal North Road, LAKE MARMAL
104 Reeds Road, GLENLOTH EAST

AVOCA RIVER
Coonooer Bridge-Yeungroon-Charlton

12 Yeungroon-Coonooer Road, COONOOER BRIDGE
2421 Charlton-St Arnaud Road, COONOOER BRIDGE
2114 Charlton-St Arnaud Road, COONOONER BRIDGE
1488 Charlton-St Arnaud Road, COONOOER BRIDGE
1422 Charlton-St Arnaud Road, YEUNGROON
136 Back St Arnaud Road, CHARLTON
1302 Yeungroon Road, CHARLTON
2923 Calder Highway, CHARLTON

East of the Avoca River-Calder Highway to Jeruk

35 Finlays Road, CHARLTON
71 Jeruk River Road, TEDDYWADDY
329 Jeruk River Road, TEDDYWADDY
21 Flynns Road, NARREWILLOCK
540 Rowlings Road, NARREWILLOCK
100 Glenloth Road, GLENLOTH
525 Glenloth Road, NARREWILLOCK
600 Glenloth Road, NARREWILLOCK
112 Marmal Church Road, NARREWILLOCK (Note House will be inundated)
115 Fradds Road, GLENLOTH EAST
2959 Boort - Wycheproof Road, BUNGULUKE
228 Jeruk River North Road, JERUK
468 Jeruk River North Road, JERUK

West of Avoca River, Charlton to Ninyeunook

337 Judds Road, TEDDYWADDY
340 Judds Road, CHARLTON
248 Judds Road, CHARLTON
218 Charlton Glenloth Road, TEDDYWADDY
418 Charlton Glenloth Road, TEDDYWADDY
895 Charlton Glenloth Road, GLENLOTH
448 Glenloth Calder Road, GLENLOTH
210 Cossars Road, BUNGULUKE
110 Coats Road, BUNGULUKE
3405 Boort Wycheproof Road, BUNGULUKE
3510 Boort Wycheproof Road, BUNGULUKE
3844 Boort Wycheproof Road, BUNGULUKE

NORTH-EAST FLOODPLAINS STREAM AND MOSQUITO CREEK

North of Wycheproof – Boort Road

50 Boyds Road, NINYEUNOOK
63 Tunstalls Road, NINYEUNOOK
Properties along:
Charlton-Boort – Wycheproof Road
Narrewillock – Quambatook Road
Jeruk Road
Charlton - Swan Hill Road
Coats Road
Reeds Road
James Road
Kalpienung - Dumosa Road

LALBERT CREEK

North of Boort Wycheproof Road to Tyrrell Downs

2157 Charlton Swan Hill Road, BUNGULUKE
360 Ross Road, JERUK
1967 Culgoa Lalbert Road (Holloways Road), WANGIE
93 McIntyres Road, WANGIE
449 Lalbert Lake Road, WANGIE
628 Tomamichels Road, SPRINGFIELD
645 Tomamichels Road, SPRINGFIELD

TYRRELL CREEK

Fig Tree Bend (Teddywaddy) to Lake Tyrrell

757 Back Teddywaddy Road, TEDDYWADDY
1204 Teddywaddy Road, TEDDYWADDY
1235 Teddywaddy Road, TEDDYWADDY
900 Calder Highway, TEDDYWADDY
63 Nicholls Road, TEDDYWADDY

84 Nicholls Road, TEDDYWADDY
1870 Calder Highway, WYCHEPROOF
358 Coles Road, WYCHEPROOF
707 Mackies Road, WYCHEPROOF
229 Pelligrinos Road, WYCHEPROOF
269 Pelligrinos Road, WYCHEPROOF
360 Elstons Road, WYCHEPROOF
23 Blacks Lane, DUMOSA
688 Nullawil North Road, KALPIENUNG
729 Nullawil North Road, WARNE
1243 Warne Road, WARNE
3986 Calder Highway, CULGOA
40 Railway Street, CULGOA
25 Park Street, CULGOA
2 Watchupga Road, CULGOA
9-11 Watchupga Road, CULGOA
10 Watchupga Road, CULGOA
15 Watchupga Road, CULGOA
17 Watchupga Road, CULGOA
9 Barry Street, CULGOA
13 Barry Street, CULGOA
15 Barry Street, CULGOA
538 Renneys Road, BERRIWILLOCK
577 Renneys Road, BERRIWILLOCK

COOROOPAJERUP CREEK
Teddywaddy to Dumosa

2112 Charlton Thalia Road, TEDDYWADDY WEST
2115 Calder Highway, WYCHEPROOF
408 Calder Highway, WYCHEPROOF
1222 Calder Highway, DUMOSA
62 Black Gate Road, DUMOSA
4710 Donald Swan Hill Road, DUMOSA

APPENDIX H – ACTION ITEMS AIDE MEMOIRE

The following list comprises of the types of resources and activities the municipality should consider and / or provide upon the flood triggers listed below.

River and Gauge	Height
Avoca River @ Yawong Weir	Moderate flood 3.4 meters
Avoca River @ Charlton D/S gauge	Moderate flood 5.0 meters

Note: Moderate flood level decided due to follow up rains.

The list below is not intended to be exhaustive but rather to act as a prompt to the Municipal Emergency Resource Officer and/or the Emergency Management Group acting on behalf of the municipality:-

Information Systems:

- Computer facilities, laptops, dongles, iPAD's including chargers
- Flood Response Guidelines, brochures, newsletters
- Adequate telephone lines including priority status
- Mobile telephones, satellite phones, two-way radios including chargers
- Fax machines
- One-stop shop
- Local area flood bulletins
- Situation reports
- Website to include Flood Information and/or link to emergency.vic.gov.au
- Social Media – Facebook and Twitter

Reconnaissance:

Inspect Council assets including levees, bridges, roads, culverts, properties, storm water pumps.

- Consider Aerial surveillance
- Observer group activated

Warnings:

- Dissemination – locally
- Observers (update to all observers)

MOCC / Evacuation / Relief Centre Council Staff:

- Staff rostering, families
- Book basic accommodation for staff
- Give staff a break before flood hits i.e.. to get their own personal issues sorted

Municipal Operations Command Centre (MOCC)

- Upon request from Coordinator
- Liaison Officer to Wycheproof Divisional Command Centre
- Location – primary / secondary / other

MOCC Manager to establish:-

- Crisisworks (MECC Central)
- Standard Operating Procedures (SOP's), layout, etc.
- Staffing of MOCC
- Communications systems
- Security
- Liaison Officers
- Information technology
- Media area
- Whiteboards, local maps
- Affection area, maps, road closures
- Phone, fax, radio, TV
- Registry/filing area
- Tea, coffee, meals
- Emergency power (hire generator)
- Stationary

Road Closures:

- Signage, barricades, diversions detours
- Notification to Emergency Services to public / media
- Liaison with Vic Roads
- Details displayed in MOCC
- Council website / Facebook

Asset Protection:

- Essential services, Council assets, critical infrastructure

Sand / Sandbags:

- Municipal stock of sandbags and sand for essential services (approx 20,000 sandbags)
- Determine locations and establish sand stocks
- Check operation and location of sandbag filling machine
- Private stock (VICSES)

Evacuation & Relief Centres:

- Location - see Municipal Emergency Management Plan
- Staffing and management
- Registration (Red Cross)
- Feeding, material needs
- Relocation (Evacuation to Relief Centre)
- Reunion, return, Recovery

Livestock:

- Transportation
- Yarding
- Feeding, registration
- Personnel needed to manage
- Milking
- Management of pets at evacuation/relief centres

Fuel Arrangements:

- Safe and secure supply – unleaded, diesel and aviation fuel

Caravan Parks:

- Notify, Implement their Emergency Management Plans, relocate

Essential Commodities:

- Food and water
- Power, gas, sewerage
- Communications
- Medical supplies
- Generators

Equipment:

- Loaders, trucks, excavators
- List of contractors

Public Education:

- Self-protection
- Consider ethnic groups, aged Vulnerable People
- Listen to / read daily warnings
- Sand bagging education
- Media, bulletins, recorded message service
- Information desk
- Social Media
- Community Meetings
- Establish contact with other organisations media staff and also community representatives

Consider Recovery:

- Consider recovery early
- Recovery Committee(s)
- Health and Human Services (Regional)
- See Municipal Plan regarding services available locally
- Public information regarding acquisition of recovery support / assistance
- Be in contact with DHHS to have supplies (i.e.. bed ready for relief centres)

– MUNICIPAL AIDE MEMOIR
Sandbagging of Critical Infrastructure

Buloke Shire Council has a stock of sandbags (approx. 10,000 sandbags), a sandbag filling machine, and sand for the protection of critical infrastructure during a flood. Strategic locations for sand and sandbags will be decided upon and determined by the nature of the flood. VICSES are the responsible authority for providing sandbags for private properties as per the VICSES sandbag policy.

The following critical infrastructure will be sandbagged depending on the nature of the flood.

Water Supply

- Charlton Filtration Plant (Grampians Wimmera Mallee Water)
- Donald Filtration Plant (Grampians Wimmera Mallee Water)

Water Treatment

- Charlton Sewerage Lagoons and pump stations (Grampians Wimmera Mallee Water)

Electricity

- Charlton Substation (SPAusNet) – this substation affects Charlton District

Telecommunications

- Charlton Exchange
- Donald Exchange

Stormwater Pump Stations

- Charlton
- Donald

AGENCY	DETAILS/ACTIONS/ADVICE	ADVISED		NAME	DATE
		YES	NO		
VICSES	Community information and community warnings detailing incident have been disseminated to all potentially affected areas.				
VICSES	Advice provided across all agencies regarding the personnel safety.				
VICSES	Identified Divisional Command location tested and available.				
VICSES	Prepositioning of appropriate resources to potentially affected Sector locations.				
VICSES					
Powercor	Advised of situation so appropriate measures can be implemented to ensure security/business continuity of assets potentially affected				
Grampians Wimmera Mallee Water	Advice regarding situation, so appropriate measures can be implemented to ensure security of their assets.				
Council	Advised of situation so appropriate measures can be implemented and any required actions for storm water infrastructure, pumps, penstocks and arrange local road closures etc				
Country Fire Authority Division HQ	Advice regarding situation, so appropriate measures can be implemented to ensure security of their assets.				
Telstra / Telecommunications providers	Advice regarding situation, so appropriate measures can be implemented to ensure security of their assets.				
Hospitals	Advice regarding situation, so appropriate measures can be implemented to ensure security of their assets.				
Ambulance Victoria	Advice regarding situation, so appropriate measures can be implemented to ensure security of their assets.				

APPENDIX I – SANDBAGS

This applies to the procurement, storage, distribution, use and disposal of sandbags during flood emergencies, primarily Riverine flood events. Flash Flood events, due to their quick nature, will be directed by the local VICSES Unit.

1. Use of sandbags

Sandbags can be used to block doorways, drains and other openings into properties as well as to weigh-down manhole covers, garden furniture and to block sinks, toilets and bath drains to prevent water backing up. They have proven to be successful in keeping water out for short periods of time.

Sandbagging is not always the most effective option and should be considered in the context of this Flood Emergency Plan which includes alternatives for managing flood risk. Other alternatives include moving possessions to higher places, securing objects so they do not float away and placing valuables in water tight containers. During a flood event he Incident Controller and operational staff in the flood affected community will assess the overall risk to communities and allocate sandbag resources based on risk.

2. Responsibilities

VICSES responsibilities include:

- The management of the state-wide procurement and storage of sandbags for flood emergencies
- Providing sandbags to local areas for distribution based on requirements identified in the MFEP
- Identifying distribution arrangements in the MFEP
- Community education and awareness on sandbag management and safe use
- Identifying Critical Infrastructure and Community Critical Facilities in the MFEP
- Providing a support role in flood recovery.

Council responsibilities include:

- Together with VicSES, monitor and maintain the MFEP
- Providing a support role during flood response
- Identifying Community Critical Facilities at a municipal level
- Procuring sandbags to protect council owned facilities including Community Critical Facilities managed by council
- Providing locations, plant and equipment, where available and capable, to support sandbagging operations as agreed in the MFEP
- Coordinating the clean-up and community recovery arrangements

Community Critical Facility owners' responsibilities include:

- Working with VICSES to develop an effective flood mitigation plan for their property as part of the MFEP with a priority for permanent structures.

Other 'Response' agencies responsibilities include:

- Supporting VICSES in their response role.

Residential and commercial property owners' responsibilities include:

- Understanding their own flood risk
- Preparing an emergency plan for their home or business
- Procurement and storage of sandbags to protect their own property

- Filling and movement of sandbags to protect their property
- Seek advice from their local council regarding the removal of sandbags from their property, as part of the community recovery

3. Community and business education

VICSES has an established community education program to support community and business in responding to flood emergencies (see www.ses.vic.gov.au/prepare/floodsafe).

VICSES will use the existing community education tools and programs (such as the Local Flood Guides and the FloodSafe program) to promote:

Practical information on:

- The purpose, use and disposal of sandbags (see www.ses.vic.gov.au/prepare/floodsafe/floodsafe-resources/sandbag-reference-guide)
- Obtaining sandbags
- Safety considerations e.g. OHS, manual handling, safe use and disposal
- Alternative flood mitigation strategies to sandbagging
- Where to get information – VicEmergency 1800 226 226
- The responsibilities of critical infrastructure owners, businesses and private individuals to understand their flood risk and develop a flood plan

Key messages:

- Emergency response agencies will not always have the capacity to provide sandbags due to other competing priorities
- Businesses and individuals need to understand the flood risk to their property and, where appropriate, develop a Flood Emergency Plan
- Sandbagging is only one way of protecting properties against floodwater and not always the most effective option. Sandbagging should be considered in the context of a Flood Emergency Plan which considers alternatives for managing flood risk.

4. Procurement of sandbags

VICSES

VICSES will maintain a supply of sandbags to support the effective readiness and response to flood emergencies as identified in this MFEP.

The number of sandbags required at a State and regional level will be determined from information provided through the MFEP planning process. There may be occasions where the supply of sandbags is limited and priorities for distribution will need to be determined through local emergency management arrangements.

VICSES will maintain the current cross-border and mutual aid arrangements for flood emergencies. VICSES will also work with local councils to access the resource sharing arrangements established between councils during emergencies.

Council

Council will procure sandbags to protect council owned facilities including Community Critical Facilities managed by council

Residential and commercial property owners'

Sandbags and sand may be obtained (purchased) from the following locations:
The owner of a property may purchase their own sand and sandbags for their own use.
There are known local providers of sandbags for purchase within Buloke Shire. It is known that the Bunnings chain of stores do carry and sell sandbags.

5. Storage of sandbags

VICSES
Sandbags will be stored by VICSES in appropriate locations across the municipality. VICSES will monitor the condition of all its sandbags for deterioration.

VICSES sandbags storage locations and initial quantities are as follows:

Wycheproof VICSES Local Headquarters (LHQ)	2000 bags (minimum)
Birchip VICSES Local Headquarters (LHQ)	400 bags
Swan Hill VICSES Local Headquarters (LHQ)	4000 bags (minimum)

Additional sandbag supplies are held at the North West (Loddon Mallee) VICSES Regional Offices, located in Bendigo & Swan Hill. These can be accessed for replenishment or additional requirements. Additional sandbags will be supplied to these locations in the lead up to a flood event.

Council
Sandbags will be stored at appropriate Council locations across the municipality. Council will monitor the condition of all its sandbags for deterioration.

Council sandbags storage locations and quantities are as follows:

- Council works depot – Charlton 14,000 bags
- Council works depot – Donald 5,000 bags
- Council works depot Culgoa 1,000 bags

6. Distribution of sandbags

Priorities
The Incident Controller may make sandbags and sand available for flood mitigation activities during declared flood emergencies.

Sandbags will be issued consistent with the Strategic Control Priorities within the State Flood Emergency Plan, in the following order of priority to protect:

1. Critical Infrastructure and Community Critical facilities identified:
   (a) in the MFEP or
   (b) by the Incident Management Team

2. Residential properties identified in the potential flood area

3. Commercial properties identified in the potential flood area

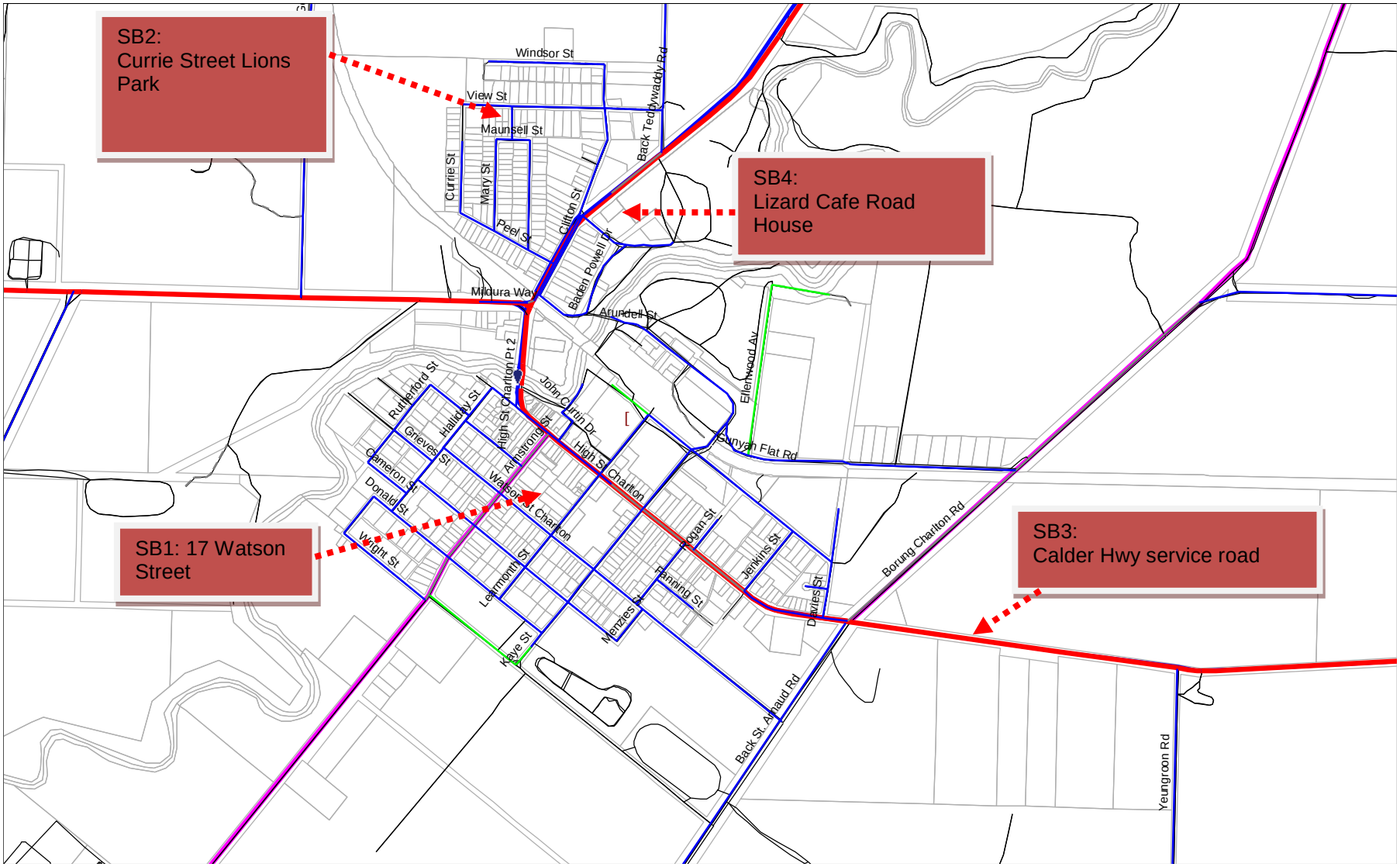
4. Environmental and conservation areas identified in the potential flood area.

Properties identified as being outside the potential flood area, will be referred to an alternative source of sandbags (e.g. local hardware store or sandbag supplier) by VICSES.

Distribution Points
Sand bag filling/distribution stations shall be determined for each flood incident. Separate stations will be established for public (managed by VicSES) and Council/community properties (managed by Council).

The MERO (in consultation with the Incident Controller) shall determine sandbagging stations within Buloke.

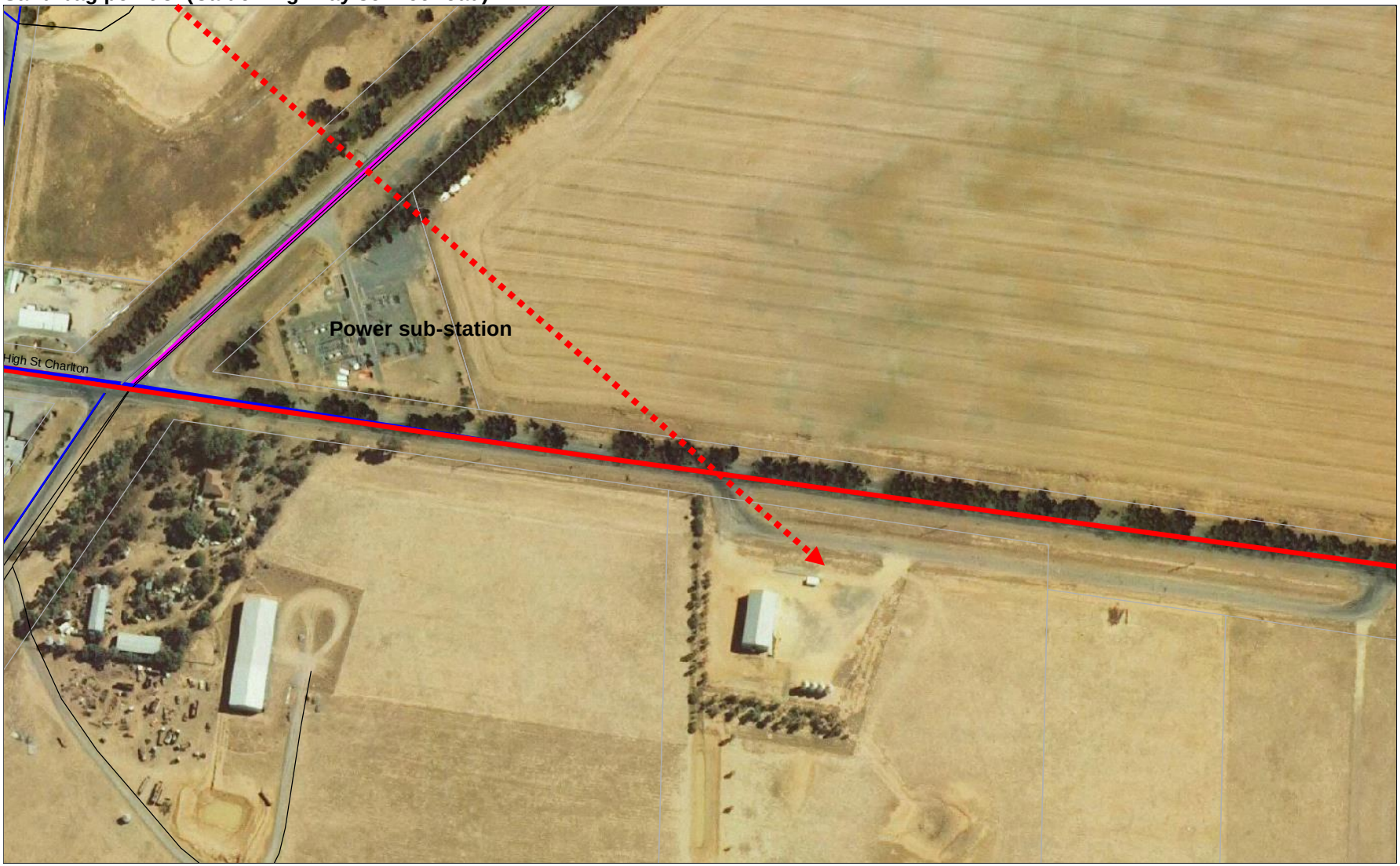
Sandbag filling/collection locations



Sand bag point 1: (block to east of works depot)

Sand bag point 2: (Lions Park – adjacent to water tower)

Sand bag point 3: (Calder Highway service road)



Sand bag point 4: (Calder Highway adjacent to Lizard Cafe road house)

These sites will be managed by VICSES, supported by council/groups/clubs/organisations
Maps showing forecast affected areas will be provided by ICC
Residents etc. within the affected area will be allocated sandbags
Recording/tracking of bag numbers and locations will occur.

The Floodsafe Sandbag Quick Reference Guide (see www.ses.vic.gov.au/prepare/floodsafe/floodsaferesources/sandbag-reference-guide) provides details to community members about the indicative number of sandbags required for residential property protection and guidance on the safe use, for the filling and laying of sandbags.

As part of the response arrangements, the Incident Controller will track the distribution of sandbags through the Incident Management Team (IMT). This information will be provided to the recovery team as part of the transition from response to recovery.

Provision of sand
VICSES
VICSES will have plans in place to acquire sand through its own supply arrangements and where necessary through the emergency management arrangements. These arrangements will be identified in the MFEP. Sand suppliers may be identified in the MFEP.

Council
Council will have plans in place to acquire sand through its own supply arrangements:

- Reeves Earthmoving Pty Ltd
- Donald Sand and Soil

During a localised non declared flood event, sand will be procured by the local responding VICSES Unit. During a declared flood event, sand will be procured via the Incident Control Centre

7. Disposal and relocation of used sandbags

Sandbags may be contaminated after use and local councils should ensure that clean up and disposal is considered as part of recovery. Removal and disposal of sandbags used for flood mitigation shall be dealt with under the clean up and community recovery arrangements as outlined in the Emergency Management Manual Victoria. The disposal of sandbags is a shared responsibility between different agencies.

Incident Controllers will provide information on sandbag locations to councils, to assist with clean-up. VICSES will continue to work with relevant agencies to develop protocols for the safe and environmentally responsible disposal of sandbags.

APPENDIX J – MUNICIPAL FLOOD EMERGENCY PLANNING COMMITTEE CONTACT LIST

Confidential not for wide distribution

APPENDIX K – REFERENCES AND INTEL SOURCES

The following studies maybe useful in understanding the nature of flooding within Buloke Shire.

- BMT WBM (2013): *Charlton Flood and Drainage Management Plan – Volume 1. Flood Study*, October 2013.
- BMT WBM (2013): *Charlton Flood and Drainage Management Plan – Volume 2. Management Plan*, October 2013.
- Camp Scott Furphy Pty Ltd, (1985): *Avoca Floodplain Management Study*, March 1985
- Camp Scott Furphy Pty Ltd, (1987): *Avoca River Flood Mitigation Study*, December 1987
- Charlton Weir operating rules as developed by the Shire Engineer, of the former Shire of Charlton, Buloke Shire.
- Egis Consulting (2000): *Avon-Richardson Floodplain Management Plan,* June 2000.
- GHD (2013): *Donald Flood and Drainage Plan*. July 2013.
- Lake Marmal Floodplain Management Plan
- SKM (1998): *Avon-Richardson Floodplain Management Study,* February 1998.
- Smith, N. (1992): *Recent Hydrological Changes in the Avoca River Catchment*, December, 1992, Report No 84 prepared for Water Division, Department of Conservation and Natural Resources by Nicola Smith, Department of Geography and Environmental Science, Monash University.
- Avoca River Hydrologic Study (2006)
- Local landholders and community representatives on the Buloke Flood Emergency Planning Committee.

Other sources of information of direct relevance to the Municipality include:

- http://www.nccma.vic.gov.au northcentral
  North Central Catchment Management Authority for various references
- http://planningschemes.dpcd.vic.gov.au/index.html
  Department of Planning and Community Development for planning scheme flood maps
- http://www.vicwaterdata.net/vicwaterdata/home.aspx
  for historical data on water quality, river heights and flows
- http://www.bom.gov.au
  Bureau of Meteorology for river gauge readings and flood warnings
- http://www.floodvictoria.vic.gov.au
  for information on historic floods in Victoria – VERY USEFUL
- http://www.ses.vic.gov.au
  Victoria State Emergency Service
- http://www.dse.vic.gov.au/fire-and-other-emergencies
  Department of Sustainability and Environment emergency management.
- COUNCIL, NCCMA and VICSES Geographical Information System (GIS) – these contain layers showing drainage assets, flooding extents, flood related call-out locations, roads, title boundaries and other useful information.

Relevant but more general references include:

- Agricultural and Resource Management Council of Australia and New Zealand (ARMCANZ) (2000), Standing Committee on Agriculture and Resource Management (SCARM) Report No 73: *Floodplain Management in Australia, Best Practice Principles and Guidelines*.
- Bureau of Meteorology (1996): *Bureau of Meteorology Policy on the Provision of the Flash Flood Warning Service.* May 1996.
- Department of Natural Resources and Environment (DNRE) (2000): *Flood Data Transfer Project* – – Flood Data and Flood Planning Maps as well as Flood Mapping and

River Basin Reports.

- Department of Sustainability and Environment (DSE) (2008): *Victoria Caravan Parks Flood Emergency Management Plan Template and Guidelines*. (Two documents) March 2008.
- Victorian Flood Management Strategy 1997-2007
- Emergency Management Act 1986
- Emergency Management Manual Victoria, 1997 Edition
- http://www.ema.gov.au
  Emergency Management in Australia
  - Managing the Floodplain, Manual 19, EMA 2009
  - Flood Preparedness, Manual 20, EMA 2009
  - Flood Warning, Manual 21, EMA 2009
  - Flood Response, Manual 22, EMA 2009
  - Emergency Management Planning for Flood Affected by Dams, Manual 23, EMA 2009
- Buloke Shire Municipal Emergency Management Plan
- Water Act 1989
- Flood Warning Station Information Manual - February 1999