Warracknabeal and Brim Flood Investigation - Flood Intelligence Report

September 2016

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Cover Photo: Aerial imagery of the flooding on 20th January 2011 in Warracknabeal, Wimmera CMA.

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1. INTRODUCTION

1.1 Project Scope and Objectives

The Warracknabeal and Brim Flood Investigation included several major mapping and reporting deliverables. This report is the Warracknabeal and Brim Flood Investigation Flood Intelligence Report. This report allows for an update of the Yarriambiack Shire Council (YSC) Flood Response Plan covering Yarriambiack Creek from Jung to Galaquil East Road north of Brim.

The report includes sections which allow for an update of Appendices A, B, C, D, E and F. These updates include specific information about the Yarriambiack Creek area including the communities of Warracknabeal, Brim, Lah, Kellalac and Jung. This report was written with Sections A to F in the SES Municipal Flood Emergency Plan template revised October 2011. This allows for sections to be 'cut and paste' into the Yarriambiack Shire Council Flood Emergency Plan without the need for major formatting but additional detail may be required.

The report was written as a non-operational report providing a background to historic floods, potential flood impacts and flood sources along Yarriambiack Creek for Yarriambiack Shire Council, Wimmera Catchment Management Authority (WCMA), Victoria State Emergency Services (VICSES), Victoria Police (VICPOL) and other services. This report should be read and understood prior to a flood event and used only as a reference document to confirm flood response actions required.

1.2 Project Area

The study area covers Yarriambiack Creek from the Wimmera Highway at Jung to Galaquil East Road north of Brim, as shown in Figure 1-1. Most recently the area was affected in December 2010 and in January 2011, when large areas of agricultural land and homes were impacted.

There are several rainfall gauges and one streamflow gauge within the study area.

Rainfall gauges include:

- Warracknabeal Museum (78077) - Daily
- Warracknabeal *Ailsa* (78000) – Daily
- Warracknabeal (78077) – Sub daily
- Warracknabeal *Earlstan* (078038) – Daily

Other sub daily rainfall gauges are located in close proximity to Yarriambiack Creek are Horsham (AWS), Longerenong and Drung Drung.

The only streamflow gauge within the study area is Yarriambiack Creek at Wimmera Highway (Jung). However there are Wimmera River streamflow gauges which can provide information on the flows expected in Yarriambiack Creek, these include Wimmera River at Glynwylln and Wimmera River at Glenorchy.

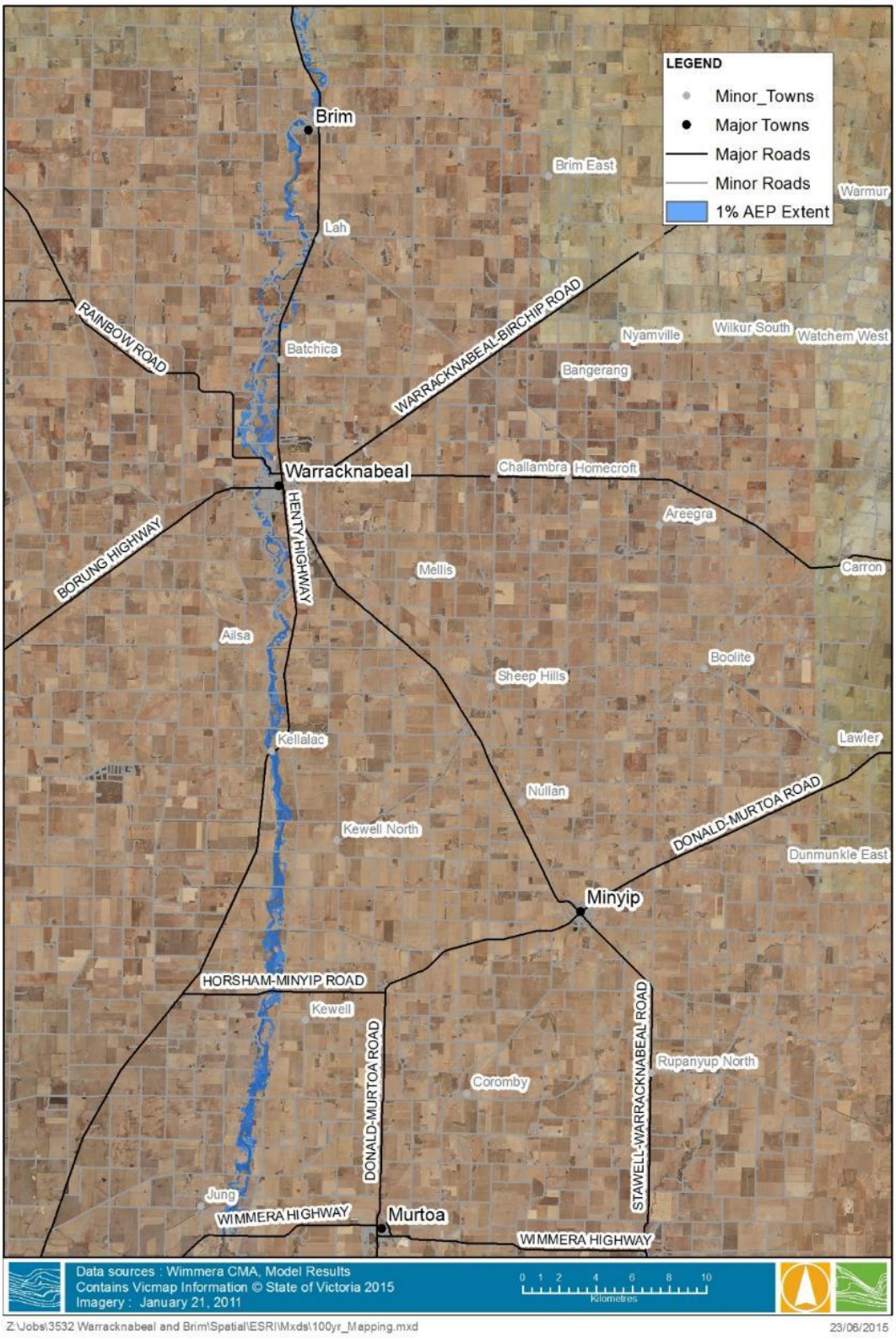

Figure 1-1 Observed January 2011 extent (data provided by the Wimmera CMA)

1.3 General

Flooding within the study area and along Yarriambiack Creek can be driven by both direct rainfall on localised catchments causing stormwater inundation and flooding in the Wimmera River causing a flow distribution to Yarriambiack Creek.

Historically, stormwater inundation has only been an issue in the townships of Warracknabeal and Brim with larger populations and urban drainage networks.

There are several previous flood studies covering the study area including:

- SMEC (2001) – Assessment of the impact of priority structures on natural flow regimes and flooding in Yarriambiack Creek (Parts 1 and 2)[1]
- WBM (2003) - Yarriambiack Creek Flood Investigation Study
- Bureau of Meteorology (2004) - Wimmera River Basin URBS Model
- Kellogg Brown & Root (2004) – Yarriambiack Creek Management Plan
- Water Technology (2007) - Warracknabeal and Beulah Flood Study
- Water Technology (2009) - Wimmera River and Yarriambiack Creek Flows Study
- Water Technology (2012) - Water Technology – Beulah Flood Investigation
- Water Technology (2011) - Wimmera Region Flood Report - January 2011
- Water Technology (2015) – Warracknabeal and Brim Flood Investigation

This report is based on model results from the Warracknabeal and Brim Flood Investigation for which this report is a component, however all of the previous studies were used as background information in the preparation of this report.

1.4 Historic Floods

Yarriambiack Creek has been impacted by the following flood events:

- August 1909;
- August 1981;
- September 1983;
- September 2010; and
- January 2011.

The January 2011 event is recognised as the largest event on record and is discussed throughout this report.

1.4.1 January 2011

Rainfall

High rainfall totals were recorded across the Wimmera River and Yarriambiack Creek catchments between the 9th and the 15th of January 2011. The Warracknabeal Museum daily rainfall gauge recorded rainfall totals of 77, 38 and 36 mm on Monday the 10th, Wednesday the 12th and Friday the 14th of January respectively, as shown in Figure 1-2.

Direct runoff caused localised flooding in and around Warracknabeal and Brim after the initial rainfall. The Warracknabeal daily rainfall record for January 2011 is shown in Figure 1-2.

[1] SMEC, 2001 - Assessment of the impact of priority structures on natural flow regimes and flooding in Yarriambiack Creek (Parts 1 and 2)

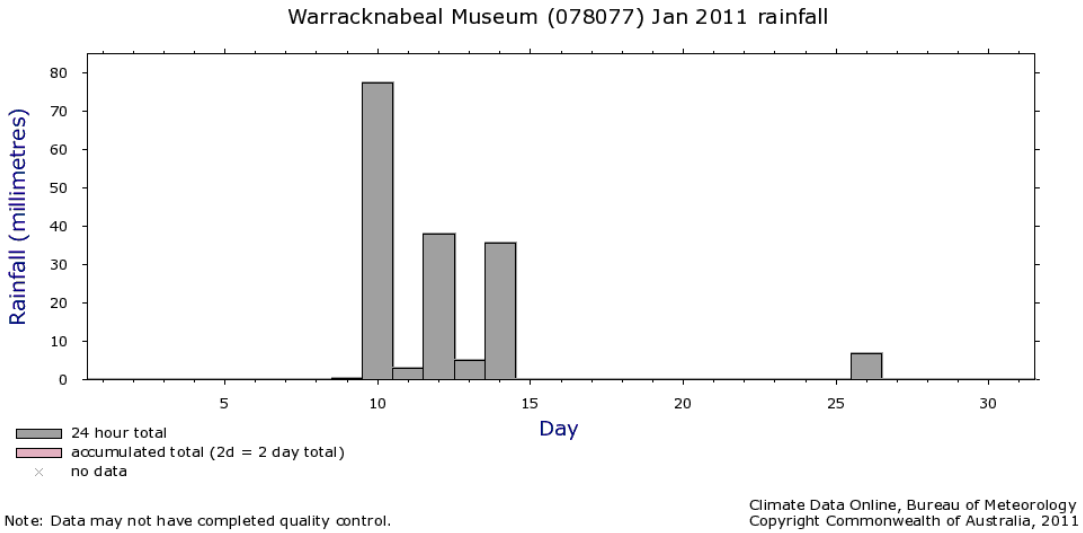

Figure 1-2 Warracknabeal Museum daily rainfall records (1st – 31st January 2011)[2]

Streamflow

The Wimmera River gauge at Glenorchy reached a peak flow rate during January 2011 of 451 m^3/s at 7:30 am on the 15th January 2011, the highest gauging on record. The January 2011 peak flow at Glenorchy was estimated as between a 1% and 0.5% AEP event using flood frequency analysis undertaken as part of the Warracknabeal and Brim Flood Investigation[3], determining the 1% and 0.5% AEP flows as 424 m^3/s (36,637 ML/d) and 482 m^3/s (41,611 ML/d) respectively.

The Yarriambiack Creek gauge at the Wimmera Highway recorded a peak flow rate of 37 m^3/s at 12:40 am on 17 January 2011 and was also the highest recording in the gauge record. This remained the peak flow recorded in the DELWP record at the time of this reports production. However, a re-assessment of the gauge rating completed during the Warracknabeal and Brim Flood Investigation[3] revised this flow to 63.4 m^3/s. The revision was due to topographic changes at the gauge and the length of time since the last rating was completed.

Flood Mitigation

During the January 2011 flood a significant system of flood protection levees were constructed at Warracknabeal. It is estimated approximately 6 km levee was constructed using earth moving equipment and over 50,000 sandbags were used in flood protection measures. An approximation of the levee extent is shown in Section 5. Approximately 117 homes were sandbagged. It is estimated 5 houses and a childcare centre were inundated[4]. A relief and recovery centre was opened by DHS at Warracknabeal.

Inundation

Flooding on Yarriambiack Creek began on Tuesday the 18th through to Thursday the 20th of January, peaking in Warracknabeal at approximately 10:45 am on Wednesday the 19th of January.

During January 2011 stormwater flooding was observed in both Warracknabeal and Brim, on Thursday the 13th and Friday the 14th of January with riverine flooding occurring from Tuesday the 18th through to Thursday the 20th of January, peaking on the 19th.

The stormwater inundation observed in Warracknabeal during January 2011 is shown in Figure 1-3 with flood inundation in Warracknabeal on the 20th January 2011 shown in Figure 1-4 and inundation in Brim occurring on the 21st of January shown in Figure 1-5.

[2] BoM – Climate Data Online (http://www.bom.gov.au/climate/data/)
[3] Warracknabeal and Brim Flood Investigation (Water Technology, 2015)
[4] Wimmera Region Flood Report – January 2011 (Water Technology, 2011)

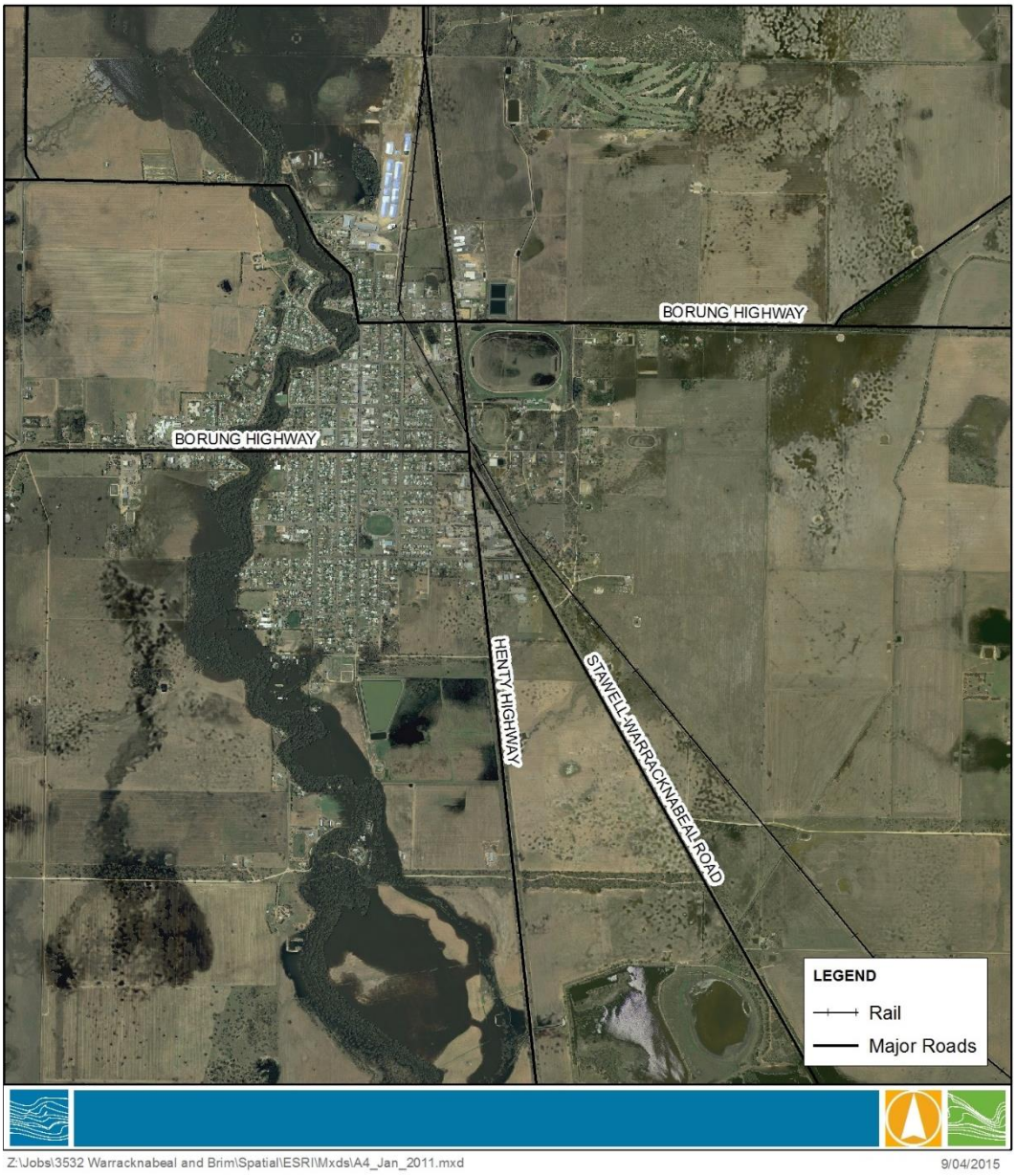

Figure 1-3 Warracknabeal – January 2011 stormwater inundation

Figure 1-4 Warracknabeal – January 2011 flood inundation and mitigation

Figure 1-5 Brim – January 2011 flood inundation

1.5 Description of Major Waterways and Drains

1.5.1 Riverine Flooding

Flooding along Yarriambiack Creek is driven by high flows in the Wimmera River, with the Wimmera River distributing water to Yarriambiack Creek. During high flows some of this distribution returns to the Wimmera River via Two Mile Creek, however, Two Mile Creek has the capacity to distribute flow from the Wimmera River to Yarriambiack Creek early in a flood event, and then the direction of flow is reversed as Two Mile Creek passes flood water back from Yarriambiack Creek to the Wimmera River. The relationship between the Wimmera River, Yarriambiack Creek and Two Mile Creek is shown in Figure 1-6[3].

Typically high flows in Yarriambiack Creek are driven by high rainfall totals in the upper Wimmera River catchment. There are several stream flow gauges along the Wimmera River that can provide early guidance to the expected flooding along Yarriambiack Creek, these include the Wimmera River at Glynwylln (415206) and Wimmera River at Glenorchy (415201). This can then be verified at the Yarriambiack Creek at Murtoa (Wimmera Highway) (415241) gauge. The location of these gauges is shown in Figure 1-7.

Flood extents, depth and hazard maps are available for a range of design events for Yarriambiack Creek, extending from the Wimmera Highway at Jung to Galaquil East Road north of Brim. Maps of this inundation are shown in Section 5, these maps have been produced from modelling completed during the Warracknabeal and Brim Flood Investigation[3].

There are two major townships along Yarriambiack Creek within the Wimmera CMA area; Warracknabeal and Brim. There are also three minor communities at Jung, Kellalac and Lah and numerous rural properties impacted by flooding in Yarriambiack Creek.

1.5.2 Stormwater Flooding

Stormwater induced flooding from local catchment runoff is likely to cause minor inundation of road and agricultural land. Risk to built assets is greatest in and around the major townships of Warracknabeal and Brim. Stormwater modelling of these township was completed during the Warracknabeal and Brim Flood Investigation and is presented in the following sections.

Stormwater events are not anticipated to cause inundation of dwellings or prevent access to private property outside of Warracknabeal and Brim due to the very flat terrain resulting in low depths and velocities. However access may be limited in some locations due to boggy ground conditions.

Warracknabeal

Warracknabeal suffered from stormwater inundation in several locations across town during January 2011, these included:

- Borung Highway
- Gardiner Street
- McIntyre Street
- Asquith Reserve

Stormwater modelling of the township has also indicated stormwater could become an issue in several other streets between Gardiner Street and Lyle Street. Stormwater modelling of the 2 hour 1% AEP event[3] is shown in Figure 1-8.

Brim

Brim has two localised catchment areas; immediately to the south of the township, between Yarriambiack Creek and the Henty Highway and east of the Henty Highway contributing water to north of the township.

Stormwater can cause damage and below floor inundation to properties at the eastern end of Swan Street and both the eastern and western ends of King Street.

The areas impacted by stormwater in Brim are shown in Figure 1-9, with model results showing the 2 hour 1% AEP stormwater inundation[3].

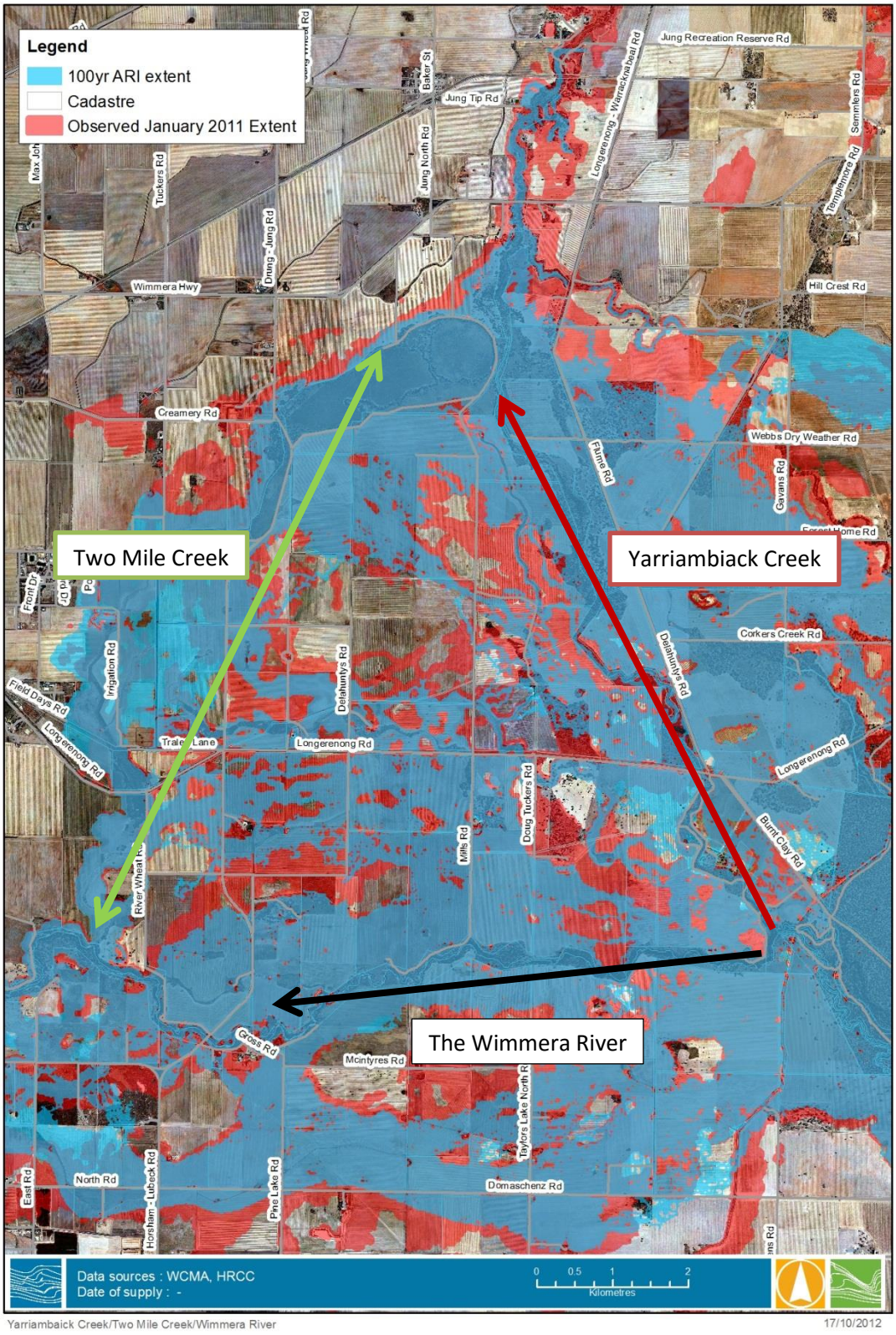

Figure 1-6 Interaction between the Wimmera River, Yarriambiack Creek and Two Mile Creek

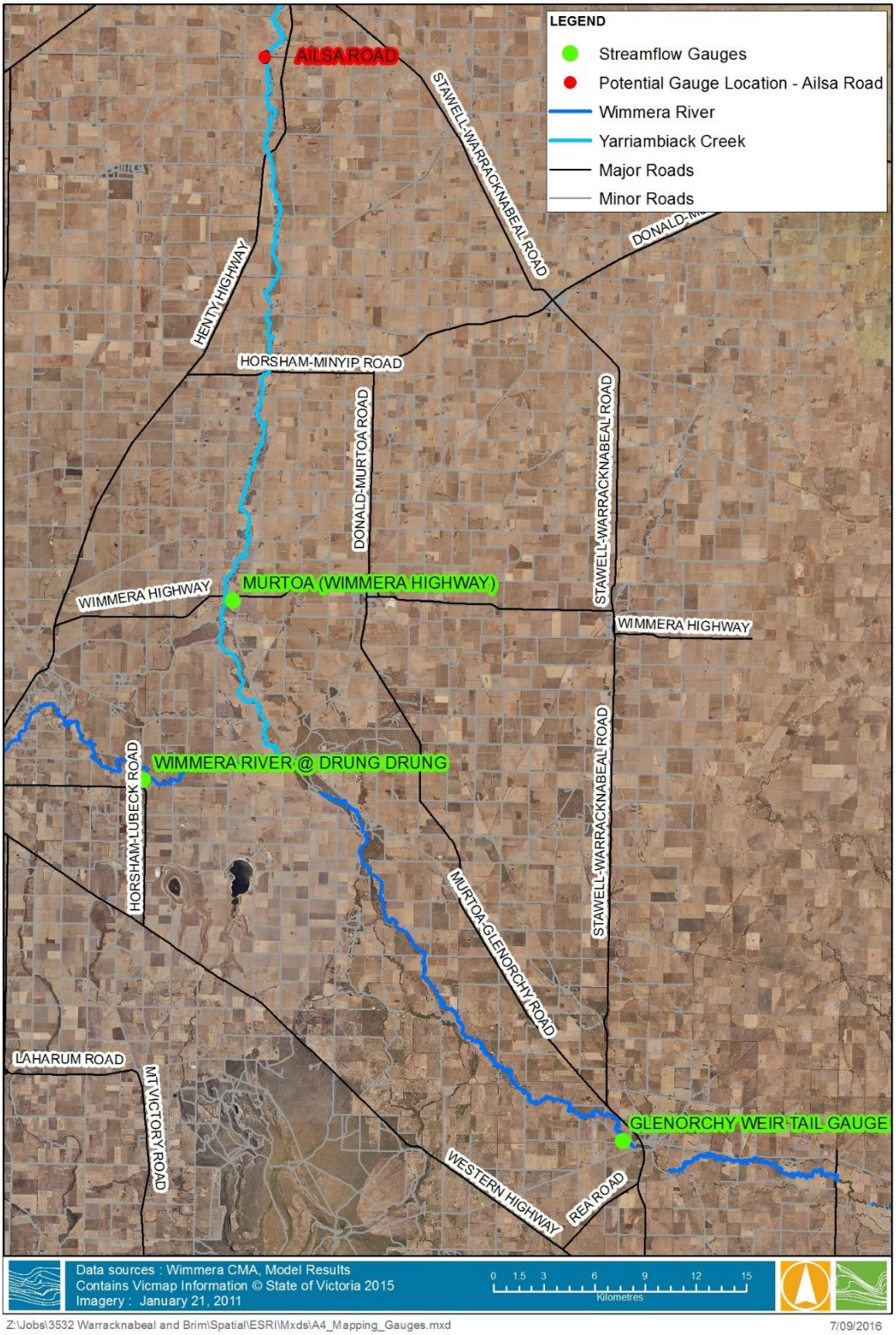

Figure 1-7 Streamflow gauge locations

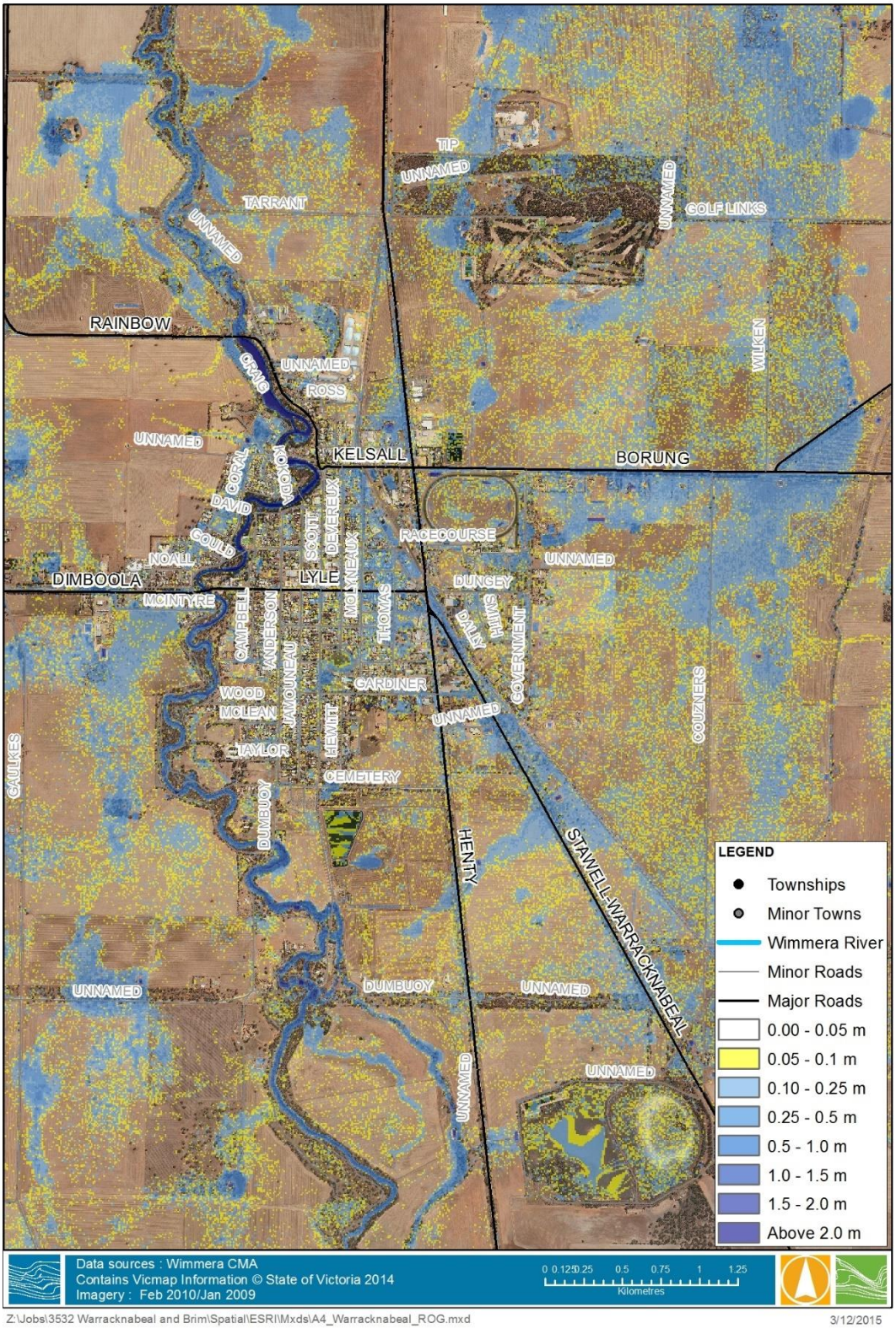

Figure 1-8 Warracknabeal – Stormwater impacted areas

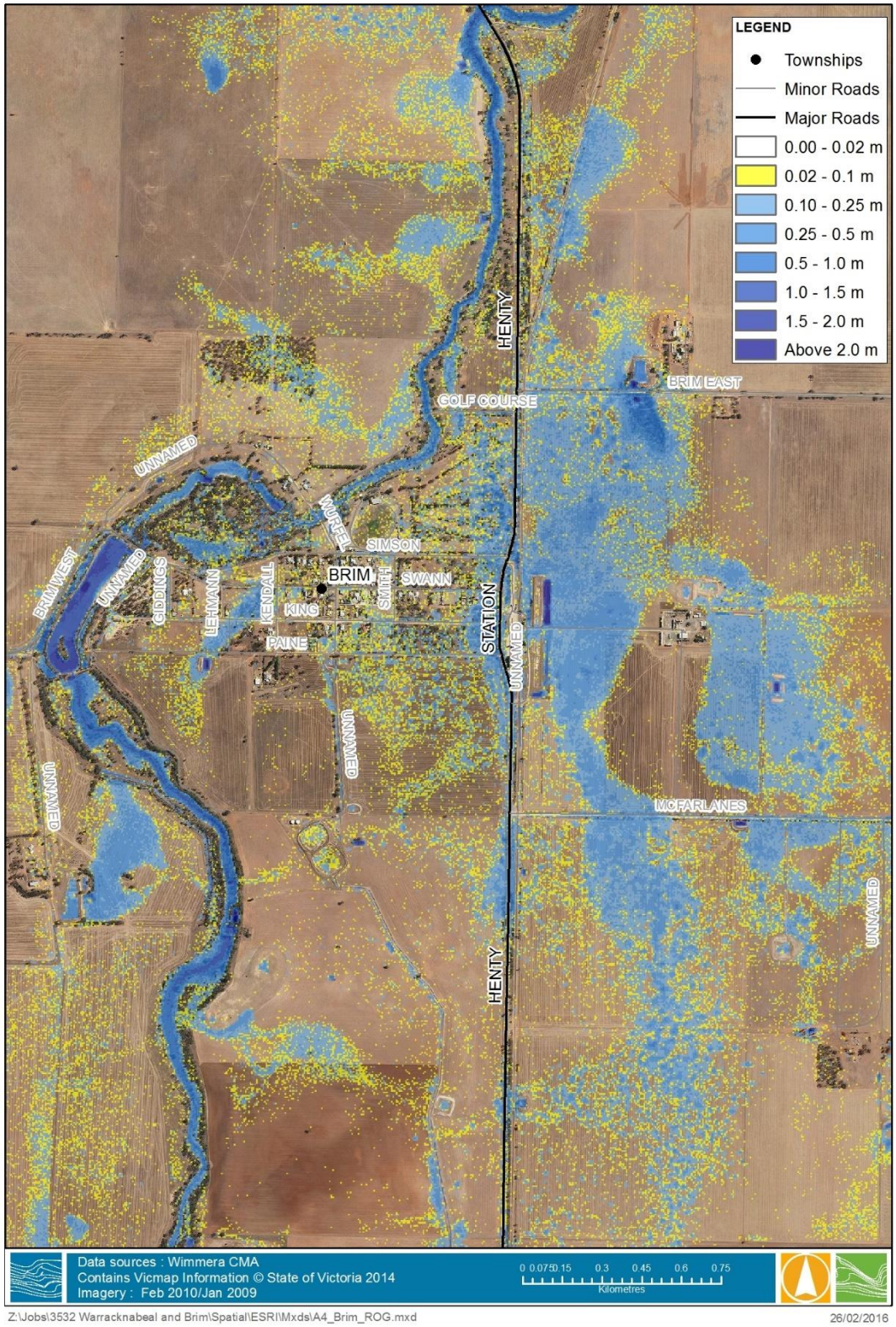

Figure 1-9 Brim – Stormwater impacted areas

1.6 Dam Failure

There are numerous minor water storages located along Yarriambiack Creek and in the localised catchment including:

- Jung Weir
- Warracknabeal Weir
- Brim Weir
- Warracknabeal Winter Storage

However, there are no storages along and no potential for storages to be used as flood mitigation other than allowing water to flow freely through them and none are considered a threat for dam failure. Water storages along Yarriambiack Creek and within the immediate Yarriambiack Creek catchment are shown below in Table 1-1.

Table 1-1 Water storages along Yarriambiack Creek

Location	Owner	Comments
Jung Weir	Yarriambiack Shire Council	Non operational
Warracknabeal Weir	Yarriambiack Shire Council	Operational on Yarriambiack Creek
Brim Weir	Yarriambiack Shire Council	Operational on Yarriambiack Creek
Warracknabeal Winter Storage	GWMWater	Non-operational offline

1.7 Other Infrastructure

1.7.1 Levees

During January 2011 a very comprehensive levee system was constructed protecting Warracknabeal, with several of these remaining. These levees were formalised by Yarriambiack Shire Council. The location of the remnant levees is shown in Figure 1-11, the levees have been constructed into grassed earthen mounds or walking tracks as shown in Figure 1-10[3].

Figure 1-10 Remnant sections of levee (Water Technology)

Levees in Brim were also constructed during January 2011, however these levees were not required during January 2011 and modelling undertaken during the Warracknabeal and Brim Flood Investigation[3] has shown they are unnecessary up to a 0.5% AEP event. The levees remained in place at the time of this reports production and are shown in Figure 1-12.

Figure 1-11 Warracknabeal Remnant Levees

Figure 1-12 Brim Remnant Levees (not required up to a 0.5% AEP event)

The Warracknabeal and Brim Flood Investigation[3] determined an optimised levee design based on the levees constructed during January 2011 and the modelling results. The levee was designed to the 1% AEP design flood height with a 100 mm freeboard in permanent sections with temporary sections protecting to the 0.5% AEP event. At the time of this reports production the design levees had not

been constructed and were not guaranteed funding. The design levee alignment is shown in Figure 1-13 and was shown to protect 54 buildings from above flood inundation in Warracknabeal in a 0.5% AEP event with one remaining inundated. No buildings were shown as flooded worse as a result of the levee.

Figure 1-13 Warracknabeal design levee alignment

1.7.2 Channels

During January 2011 there were several irrigation channels that interacted with the Yarriambiack Creek Floodplain influencing drainage and floodwater. A number of these channels have since been removed or modified post January 2011 but may still require attention during a flood event.

Channels with the potential to cause significant impact on flood levels and extents listed south to north are:

- Kellalac Channel (Decommissioned)
- Whitton Supply Channel (Decommissioned)
- Craigs Channel (Decommissioned)

Even though these channels were decommissioned they may be providing a drainage path for localised catchment flows. Maps shown in Section 5 detail the location of these channels prior to decommissioning.

Under no circumstance should irrigation channels be filled/excavated/blocked or altered in any way preceding or during a flood event without a full understanding of the potential consequences and approval from the relevant authority.

1.7.3 Roads

During a large flood event there are numerous roads that will be inundated and potentially un-trafficable.

Isolation of residents along Yarriambiack Creek area can occur via inundation of several major roads, the below lists these roads with reference to when they may require closure in the flood consequence tables included in Section 3.4, road locations which may be inundated include:

  - Wimmera Highway at Murtoa
  - Minyip Horsham Road at Yarriambiack Creek Bridge
  - Henty Highway at several potential locations including Kellalac, Lah, north of Brim (two locations)
  - Borung Highway at Warracknabeal
  - Jeparit Warracknabeal Road at Warracknabeal

Several minor roads may also be inundated by Yarriambiack Creek flood flows including:

- South of Warracknabeal
  - Jung Recreation Reserve Road
  - Greenhills Road
  - Banyena Pimpinio Road
  - Drillers Road
  - Daveys Road
  - Minyip Dimboola Road
  - Yarriambaick Creek Drive
  - Roses Road
  - Mayberrys Road
  - Moloneys Road
  - Ailsa Road
  - Bell Road
  - Dumbouy Road
- Warracknabeal Township
  - Asquith Reserve
  - Warunda Avenue
  - The Avenue
  - Craig Avenue
  - Menin Avenue
  - Coral Avenue

    - Phillips Street
- North of Warracknabeal
    - Tarrant Road
    - Morella Road
    - Coutts Lane
    - Bangerang Road West
    - Batchica Lane
    - Batchica West Road
    - Neumann Lane
    - Exchange Road
    - Lah West Road
- Brim
    - Brim West Road
    - Wurfel Road
    - Golf Course Road
    - Wardles Road West
    - Baums Road
    - Galaquil West Road

The following table includes a list of major roads that were inundated during the January 2011 flood event, this information was provided by VicRoads

Date/Time	Location
17/01/2011 11:43 AM	Henty Hwy, b/t Beulah & Brim, including townships
17/01/2011 01:13 PM	Henty Hwy – b/t Warracknabeal & Beulah
17/01/2011 2:11 PM	Stawell-Warracknabeal Rd b/t Stawell & Warracknabeal
17/01/2011 04:14 PM	Jeparit-Warracknabeal Rd, at Yarriambiack Ck at the Nth end of Warracknabeal township
18/01/2011 11:01 AM	Henty hwy b/t Minyip-Dimboola Rd & Warracknabeal
18/01/2011 02:01 PM	Henty hwy b/t Warracknabeal & Beulah
18/01/2011 02:01 PM	Stawell -Warracknabeal b/t Warracknabeal & Minyip
18/01/2011 10:59 PM	Warracknabeal - Rainbow Rd – b/t Jeparit - Warracknabeal Rd & Henty Hwy
19/01/2011 12:09 PM	Jeparit-Warracknabeal Rd b/t Warracknabeal-Rainbow Rd inter. at Crymelon & Henty Hwy

1.7.4 Stormwater Surcharge

There are numerous stormwater pipes and pits throughout the Warracknabeal township, all eventually draining to Yarriambiack Creek. During flood events in Yarriambiack Creek flood water is able to flow backwards through the stormwater network and surcharge through the stormwater pits into suburban areas. To prevent this occurring on a permanent basis Yarriambiack Shire Council have installed non return valves on a number of their stormwater outlets, however at the time of this reports production the type of outlets used were still being trialled.

If no non return valves are installed on a stormwater network, stormwater pits can be sandbagged to prevent surcharging. This must be completed around the pit creating an open unpressurised opening as it was noted during January 2011 issues were created by sandbag placed directly on top of or in stormwater pits. To gain an understanding of the stormwater pits require sandbagging, a relationship between Yarriambiack Creek water levels and the stormwater outlets was developed and linked to each pit. This identified which pits had levels below the Yarriambiack Creek height at their corresponding pipe outlet for each AEP. From this the pits that require sandbagging were highlighted, as shown in Section 5

2. TYPICAL FLOOD PEAK TRAVEL TIMES (APPENDIX B)

Definitive information on the time it takes rainfall associated with severe weather or thunderstorm activity to develop into runoff and therefore streamflow is highly dependent on antecedent conditions and difficult to estimate due to a lack of pluviographs in the Wimmera River upper catchment. The timing of flood flows in Yarriambiack Creek is based largely on stream gauging in the Wimmera River and verification of those flows at the Yarriambiack Creek gauge at the Wimmera Highway.

The speed a flood hydrograph moves along a waterway is dependent on antecedent conditions and the magnitude of the flood, (i.e. is it travelling within channel, or out on the floodplain). A flood on a 'dry' watercourse will generally travel more slowly than a flood on a 'wet' watercourse (e.g. the first flood after a dry period will travel more slowly than the second flood in a series of floods) and big floods tend to travel faster than small floods. In large floods often the front of the peak may come through reasonably quickly as it travels through the channel, then the peak will come later as the floodplain flow travels a little slower. Hence, the size of the flood, recent flood history, soil moisture and forecast weather conditions all need to be considered when using the following information to direct flood response activities.

Wimmera River floods travel slowly within the main stream – the rate of rise is slow, peaks are long and flat and the rate of fall is generally around 3 to 5 times the rate of rise.

The reality that a community at risk can be inundated before the peak of the flood can be overlooked. In the past, efforts have concentrated on estimating and forecasting the time of the peak, however this can sometimes be detrimental. Messaging should focus on the expected extent and timing of inundation with respect to upstream areas and the broader Yarriambiack Creek floodplain, warning can focus on the progression of floodwater along Yarriambiack Creek ensuring monitoring of the progress of a flood. The below table shows the timing of peak inundation in Warracknabeal will occur approximately 2 days after it is observed at the Wimmera Highway, and timing of the peak inundation will occur in Brim a further 1-2 days later.

Figure 2-1 and Figure 2-2 below show the flood timing for the January 2011 and September 2010 event at gauges along the Wimmera River and distributed to Yarriambiack Creek respectively.

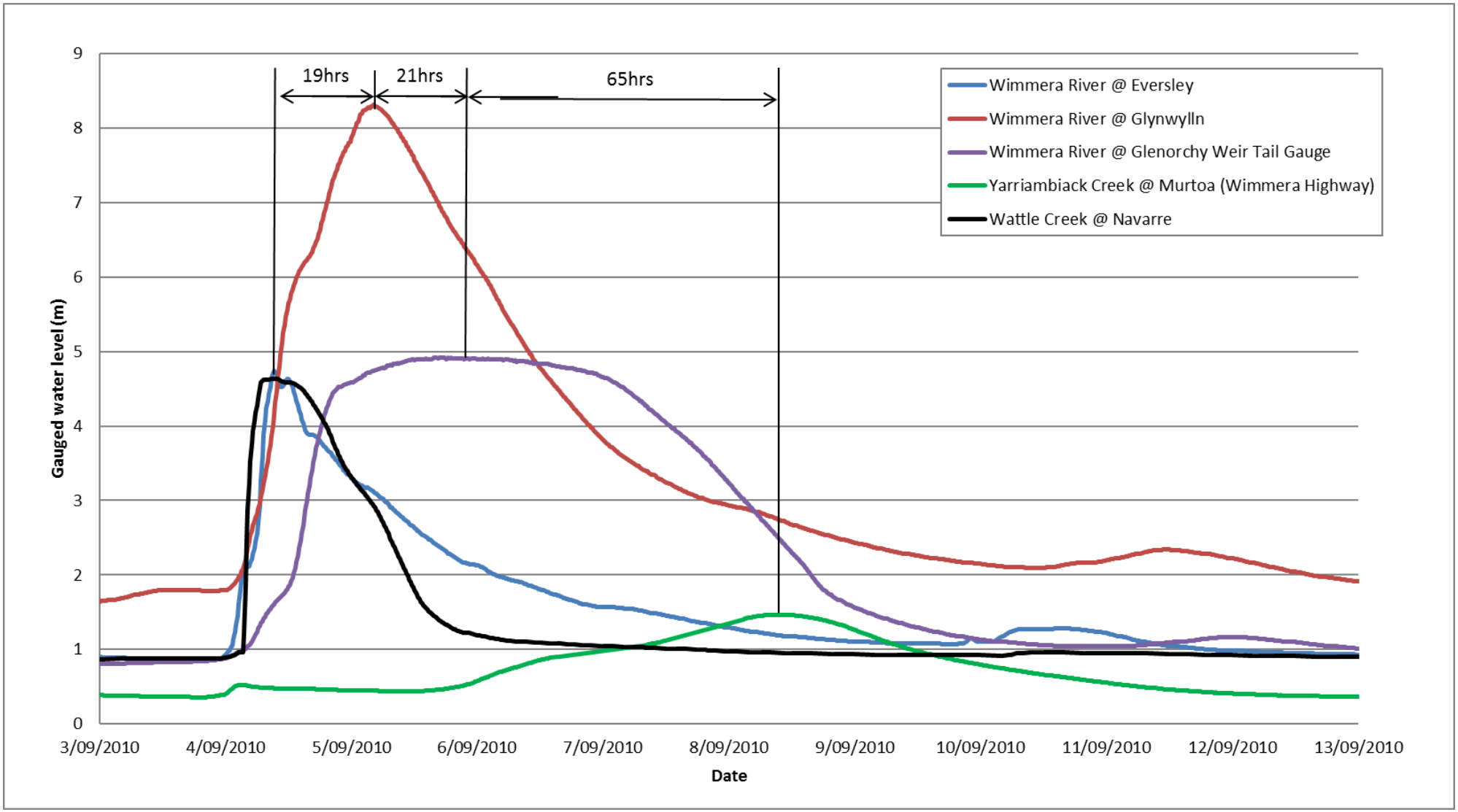

Figure 2-1 January 2011 - Gauged water levels and travel times

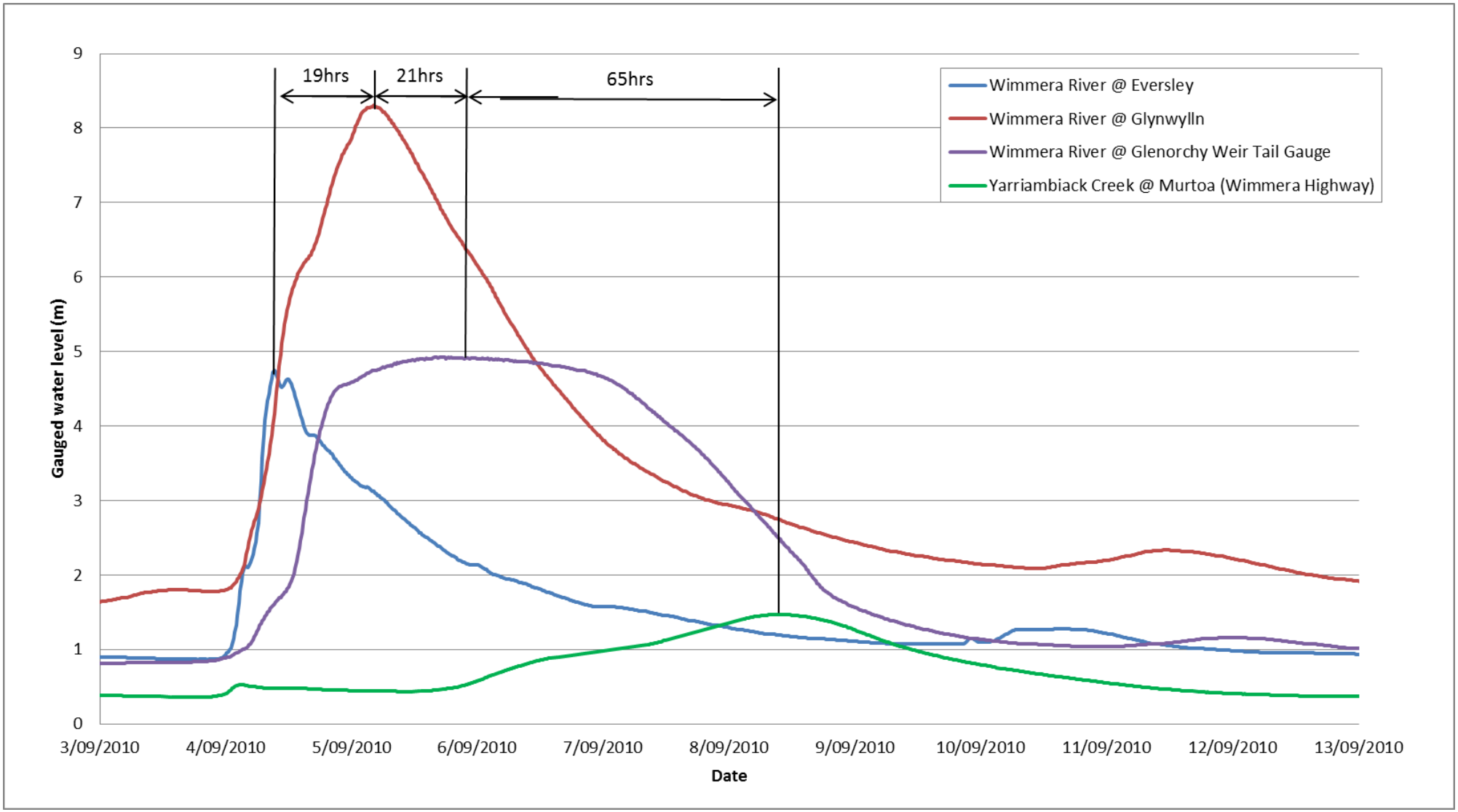

Figure 2-2 September 2010 - Gauged water levels and travel times

Location From	Location To	Typical Travel Time	Comments
RIVERINE FLOODING – Wimmera River			
Floods are characterised by long flat peaks and slow recessions although the rise can be quite sharp, particularly at Glenorchy and upstream. 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 (upper catchment)	-	0	
Eversley	Glynwylln	7 – 19 hours	
Glynwylln	Glenorchy	18 – 30 hours	
Glenorchy	Drung Drung	45 – 60 hours	Travel time of Mount William Creek depends on the storage volume available in Lake Lonsdale, flood peaks can coincide, causing floodwaters to join across the Wimmera floodplain and the lower reaches of the Mount William floodplain.
Glenorchy	Jung	2 - 3 days	
Glenorchy	Horsham	3 to 4 days	High flows from MacKenzie River and Darragan & Norton Creeks are likely to slow travel time and increase peak at Horsham due to backwater effects – this can slow the travel time during a big flood.
RIVERINE FLOODING – Mount William Creek			
Start of rainfall (upper catchment)	Mokepilly	24-36 hrs	Travel time can vary due to the spatial distribution of rainfall to the east. Rainfall distribution can vary due to the topography. .
Mokepilly	Lake Lonsdale (DS)	12-36 hrs	Travel time can vary due to the contribution of Fyans Creek and storage volume available in Lake Bellfield as well as the storage volume available in Lake Lonsdale.
Lake Lonsdale (DS)	Dadswells Bridge	12-24 hrs	

Table 2-1 below documents travel times observed during the most recent events on the Wimmera River with time zero the peak timing at Eversley. Travel times were calculated as the time that the **peak** of the event takes to move from one gauge to the next. Note that the onset of flooding can occur before the peak water level occurs. CMA/DELWP knowledge should be used for additional travel time information where flood warning gauges are not available. The travel time between the Glenorchy and Murtoa gauges for the September 2010 and January 2011 events was 54 and 65 hrs respectively. Given the large difference in the magnitude of these events these travel times are quite similar.

Table 2-1 Timing of peak flow on the Wimmera River for historic events – Timing beginning ae the Wimmera River at Eversley streamflow gauge

Reach	January 2011	September 2010
Wimmera River at Eversley	0	0
Wimmera River at Glynwylln	9.5 hrs	19 hrs
Wimmera River at Glenorchy	22.5 hrs	40 hrs
Yarriambiack Creek at Murtoa (Wimmera Highway)	77 hrs	105 hrs
Yarriambiack Creet at Ailsa Road	113 hrs	169 hrs
Yarriambiack Creek at Warracknabeal	123 hrs	193 hrs
Yarriambiack Creek at Brim	161 hrs	321 hrs

3. YARRIAMBIACK CREEK FLOOD EMERGENCY PLAN – INCLUDING JUNG, KELLALAC, WARRACKNABEAL, LAH AND BRIM (APPENDIX C)

3.1 Overview of Flooding Consequences

Flooding of Yarriambiack Creek impacts the communities of Jung, Kellalac, Warracknabeal, Lah and Brim. The most densely populated areas along Yarriambiack Creek are Warracknabeal and Brim with a number of farm houses distributed along Yarriambiack Creek.

Inundation from direct catchment rainfall can cause flooding of properties below floor in both Warracknabeal and Brim, this was observed during January 2011 and Rain-on-Grid modelling of their respective catchments completed as part of the Warracknabeal and Brim Flood Investigation[3].

High flows in the Wimmera River has the potential to cause flooding in Yarriambiack Creek. Flooding of Yarriambiack Creek north of the Wimmera Highway is expected to begin approximately 36-48 hrs after flooding in Glenorchy, the impact of high Wimmera River flows on Yarriambiack Creek can be monitored at the Yarriambiack Creek at Murtoa (Wimmera Highway) gauge. For a more detailed understanding of travel time refer to Section 2.

The number of properties impacted for a range of design events is shown below in Table 3-1, the design events are outlined for the Wimmera River at Glenorchy and Yarriambiack Creek at Murtoa (Wimmera Highway).

Table 3-1 Summary of flood affected properties along Yarriambiack Creek

Summary of number of flood affected properties along Yarriambiack Creek between the Wimmera Highway at Jung and East Galaquil Road north of Brim (including Warracknabeal) EXISTING CONDITIONS						
	Design Flood AEP (%)					
	20	**10**	**5**	**2**	**1**	**0.5**
Discharge at Wimmera River Gauge @ Glenorchy (ML/d)	14,531	19,884	25,020	31,667	36,648	41,611
Gauge height at Wimmera River Gauge @ Glenorchy (m)	4.68	4.81	4.89	4.96	5.01	5.05
Discharge at Yarriambiack Creek @ Murtoa (Wimmera Highway) (ML/d)	905	1,166	1,743	3,368	5,028	6,567
Gauge height at Yarriambiack Creek @ Murtoa (Wimmera Highway) (m)	0.843	0.95	1.21	2.17	2.30	2.39
AHD height at the Yarriambiack Creek @ Ailsa Road (potential gauge location)	114.31	114.37	114.42	114.49	114.56	114.62
AHD height at the Warracknabeal Weir @ Rainbow Road	107.46	107.94	108.01	108.24	108.37	108.51
Residential Buildings Flooded Above Floor	0	0	0	4	11	46
Commercial Buildings Flooded Above Floor	0	0	0	1	3	9
Properties Flooded Below Floor	3	3	8	73	163	238
Total Properties Flooded	**3**	**3**	**8**	**78**	**177**	**293**

Other infrastructure may be impacted a summary of this infrastructure covering all AEPs includes:

- The Jung Transfer Station may be impacted by nearby inundation
- Access to the Kellalac Fire Station (CFA) can be blocked from the west due to inundation of Minyip Dimboola Road
- St Marys Primary School in Warracknabeal is inundated during a range of flood events beginning at a 2% AEP event
- Warracknabeal Memorial Kindergarten is in close proximity to the inundation extent during floods greater than a 1% AEP
- Warracknabeal Special Development School is in close proximity to the inundation extent during large floods
- Warracknabeal Town Hall is inundated below floor during flood events greater than a 1% AEP event
- Access to the following services may be limited for residents on the **eastern side** of Yarriambiack Creek as there is potential for crossings of Yarriambiack Creek to be closed:
    - Warracknabeal Public Hospital
    - Warracknabeal Lodge Nursing Home
    - Warracknabeal Neighbourhood House and Learning Centre
    - Yarriambiack Lodge Hostel
- Access to the following services may be limited for residents on the **western side** of Yarriambiack Creek as there is potential for crossings of Yarriambiack Creek to be closed:
    - Yarriambaick Shire Council
    - Warracknabeal SES LHQ
    - Warracknabeal Ambulance Station
    - Warracknabeal Fire Station (CFA)
    - Warracknabeal Police Station
    - Warracknabeal Community Centre
- Access to Lah Fire Station (CFA) may be limited due to closure of the Henty Highway

There is significant isolation risk for residents along Yarriambiack Creek. Given the large area covered in this study, reporting the risk of isolation along Yarriambiack Creek was separated into six segments:

- Wimmera Highway to Horsham Minyip Road;
- Horsham Minyip Road to Warracknabeal;
- Warracknabeal
- Warracknabeal to Brim;
- Brim; and
- Brim to Galaquil Road East

These isolations are largely due to road closures and/or inundation of private access.

Due to the warning time available, evacuation of community members at a higher risk should be possible. If there is an unexpected rainfall event causing localised stormwater inundation evacuation via private property may be possible, however consent and advice from the landholder should be sought prior to accessing private land.

3.1.1 Wimmera Highway to Horsham Minyip Road

The reach of Yarriambiack Creek from the Wimmera Highway to Horsham Minyip Road is the first area to be inundated. There are nine dwellings along Yarriambiack Creek in this section, none of these are inundated above or below floor in a 0.5% AEP event. Access to Horsham and Murtoa is likely to be available for eight of these properties with one isolated immediately north of Green Hills Road. Internal access tracks to two properties is also inundated, however given the nature of these properties it is likely other internal farm roads could be used.

A map of the properties in close proximity to Yarriambiack Creek is shown in Section 5.

3.1.2 Horsham Minyip Road to Warracknabeal

There are five dwellings along Yarriambiack Creek between Horsham Minyip Road and Warracknabeal (Dumbouy Road). Four of these properties are likely to have access to either Horsham or Murtoa. Two properties are isolated, one of the isolated properties is also flooded below floor during 1% and 0.5% AEP events.

The isolated property is located on Yarriambiack Creek (eastern side) immediately north of Daveys Road. The property flooded below floor for 1% and 0.5% AEP events is located on Yarriambiack Creek (western side) immediately north of Roses Road.

3.1.3 Warracknabeal (Dumbouy Road to Rainbow Road)

Within Warracknabeal there are 55 buildings shown as flooded above floor in the 0.5% AEP event. These buildings are located in the following streets, listed south to north:

- Dumbuoy Road (1 - The Rusty Nail)
- Asquith Reserve (4)
- McIntyre Street (1)
- Lyle Street (3)
- Warunda Street (7)
- The Avenue (3)
- Anderson Street (1)
- Craig Avenue (12)
- Tobruk Avenue (2)
- Coral Avenue (2)
- Kokoda Avenue (2)
- Mennin Avenue (3)
- Rainbow Road (4)
- Devereux Street (2)
- Bowman Street (6)
- Kellsall (1)
- Clifford (1)

There are also numerous properties flooded below floor in the above streets and therefore maybe isolated. On the southern fringe of Warracknabeal there are two properties on Dumbuoy Road and six on Cemetery Road that are isolated in a 0.5% AEP event.

Residents on the western side of Yarriambiack Creek may be able to evacuate Warracknabeal via the Borung Highway to either Dimboola or Horsham (via Blue Ribbon Road). It is likely that if Yarriambiack Creek is experiencing flooding Horsham and Dimboola may also, however access to the Wimmera Base Hospital in Horsham will not be affected by floodwater.

3.1.4 Warracknabeal to Brim

There are no buildings flooded above or below floor by flooding of Yarriambiack Creek between Warracknabeal and Brim. There are seven dwellings in close proximity to the 0.5% AEP flood extent, four of these are isolated due to inundation of internal access tracks.

The dwellings isolated by flooding of Dunmunkle Creek are located off the following roads (listed south to north):

- Exchange Road
- Lah West Road
- Witneys Road (2)

3.1.5 Brim

There are no buildings flooded above or below floor by flooding of Yarriambiack Creek in Brim up to a 0.5% AEP event. There are two dwellings potentially isolated from the Brim township due to

inundation, one south of the township off Brim West Road (which could most likely evacuate via rural farm paddocks and north of the township off Wurfel Road.

Residents of Brim can become isolated via inundation of the Henty Highway immediately north of Brim and south of Lah. However, evacuation via Lah, and Lah Angle Road to Warracknabeal (likely to also be inundated) and other towns east of Yarriambiack Creek.

3.1.6 Brim to Galaquil Road East

There are no buildings flooded above floor up to the 0.5% AEP event between Brim and Galaquil Road East. There is one dwelling flooded below floor at 1% and 0.5% AEP events accessed off the Henty Highway south of Ryans Road.

There are six buildings in close proximity to the 0.5% AEP flood extent with all isolated from access to the Henty Highway. Four are likely to be able to access other roads via farm tracks while one on the western side of Yarriambiack Creek is completely surrounded by flood water in the 0.5% AEP event.

3.2 Flood Mitigation

There are no formally recognised flood mitigation schemes in operation along Yarriambiack Creek, but as discussed in Section 1.7.1, there are levees in place in both the Warracknabeal and Brim townships. These levees are remnant to those constructed during the January 2011 flood response. Remnant levees in Warracknabeal and have been formalised into permanent structures by Yarriambiack Shire Council. Remnant levees in Brim were determined as unnecessary during the Warracknabeal and Brim Flood Investigation[3]. The remnant levees in Warracknabeal and Brim are shown in Section 5.

The Warracknabeal and Brim Flood Investigation also completed detailed designs for new and upgraded existing levees in Warracknabeal, these levees protect all but one property in Warracknabeal from below and above floor inundation without adversely impacting other residents. This property is the Rusty Nail and requires site specific protection.

At the time of this reports production the levees were not constructed and funding had not been sourced however if the levees were constructed as temporary levees immediately prior to a flood event in Warracknabeal they would be required to follow the same alignment and design heights as determined in the design. The detailed levee designs are shown in Section 5.

3.3 Flood Impacts and Required Actions

Refer to the following Flood Intelligence Card. Note that users of the flood intelligence card should consider rainfall depth and rates at locations in the vicinity of Yarriambiack Creek when at risk of stormwater inundation and streamflow gauges when at risk of floodwater inundation. Local data and 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:

- Hopetoun Airport (77010)
- Warracknabeal (78077)
- Horsham AWS (79100)
- Longerenong AWS (79028)

It is also suggested the following sites be used to provide stream flow data:

- Key streamflow gauges:
  - Yarriambiack Creek at Murtoa (Wimmera Highway) (415241)
  - Wimmera River at Glenorchy (415232)
- Additional Streamflow gauges
  - Wimmera River at Eversley (415207)
  - Wimmera River at Glynwylln (415206)
  - Mt. William Creek at Lake Lonsdale D/S (415203)

- Wimmera River at Drung Drung (415239)

3.4 Flood Intelligence Card and Property Inundation List

3.4.1 Introduction

There are a range of water level and streamflow gauges within the Wimmera River and Yarriambiack Creek catchments. Actions are driven by predicted levels referenced to the Yarriambiack Creek streamflow gauge at Murtoa (Wimmera Highway). Predictions for this gauge will be made based on observed levels at the following gauges:

- Wimmera River at Eversley (415207)
- Wimmera River at Glynwylln (415206)
- Mt William Creek at Lake Lonsdale D/S (415203)
- Wimmera River at Glenorchy (415201)

When a predicted flood height or flow is made for the Glenorchy gauge this can be transferred to the Murtoa (Wimmera Highway) gauge as a preliminary estimate to the magnitude of the event which could occur. This detail is shown in Table 3-1, and in the mapping shown in Section 5.

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.

Table 3-2 Yarriambiack Creek Flood Intelligence Card

Discharge at Yarriambiack Creek at Murtoa	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
▪ It is important that sand and sandbags are available for residents along Yarriambiack Creek at a range of locations specific for their use and made available to residents as soon as possible after it becomes apparent that flooding is likely. These sandbags should be made available from early morning to late evening from several locations as some areas will be isolated and allow sandbagging to continue outside general office hours. Residents using sandbags need to be aware of the correct way to lay sandbags and also be aware that due to the length of inundation some water will pass through the bags. Pumps may be used to remove this water if an area of ground is able to be excavated to create a low point to pump water from. ▪ The location of road closures should be confirmed using the maps shown in Section 5 and an on ground assessment.			
USING THIS INTELLIGENCE CARD. Obtain the predicted level at the Yarriambiack Creek gauge at Murtoa (Wimmera Highway), this will relate directly to the Wimmera River gauge at Glenorchy. The general relationship between the Glenorchy and Murtoa gauges is shown below this table (Table 3-2). Consider the appropriate flood inundation map. 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 remembering that water will rise quickly and that some actions may need to be initiated in an order that is different from their relative placement in this table.			
Note that: ○ Mapping and flood modelling have been based flooding in Yarriambiack Creek only and the potential for a rainfall event occurring at the same time as flood inundation must be considered. ○ It is likely stormwater runoff may cause localised inundation prior to floodwater arriving, this will recede.			
905 ML/d (0.843 m)	20% AEP (5-year ARI)	Yarriambiack Creek remains relatively confined to the channel, some breakouts into vegetated areas including: • Immediately north of Banyena Pimpinio Road (south of the Golf Course) • Immediately south of Horsham-Minyip Road (agricultural paddock) • Several flood runners between Horsham Minyip Road and Daveys Road • Between Mayberrys Road and Moloneys Road (over topping of Moloneys Road in several locations east of the Yarriambiack Creek channel to depths of up to 30cm) • Immediately south of Dumbuoy Road (overtopping in several locations	Warn residents along Yarriambiack Creek localised inundation is likely. No major assets are likely to require flood protection measures. Consider closing minor Yarriambiack Creek crossings, worst impacted crossings are Moloneys Road and Dumbuoy Road with numerous locations overtopping. Provide specific warnings to the properties on Dumbuoy Road isolation is possible (in particular the Rusty Nail - surrounded by flood water). Provide general warnings to rural residents living along Yarriambiack Creek access to their properties may be limited via minor

Discharge at Yarriambiack Creek at Murtoa	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
		• Agricultural inundation between Tarrent Road and Morella Road (western side of Yarriambiack Creek) • Quarry west of Yarriambiack Creek at Lah There is one property isolated during a 20% AEP flood event due to inundation of Dumbouy Road, immediately south of Warracknabeal (The Rusty Nail). Numerous minor road crossings of Yarriambiack Creek are likely to be inundated, as well as private crossings.	Yarriambiack Creek crossings and an alternate route through agricultural paddocks should be considered. Monitor water levels at Yarriambiack Creek crossings and broader floodplain and timing flows at the Yarriambiack Creek at Murtoa (Wimmera Highway) and Wimmera River at Glenorchy streamflow gauges.

Discharge at Yarriambiack Creek at Murtoa	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
1,166 ML/d (0.95 m)	10% AEP (10-year ARI)	The flood extent is similar to the 20% AEP (5-year ARI) event with only a small increase in Wimmera River flow. Flood pattern remains the same with a slight increase in depth and extent. The flood extent is increased most in the areas of: • Banyena Pimpinio Road • Depth of inundation at Moloneys Road increased by around 5cm. • Inundation of Ailsa Road at several locations at depths less than 10cm. • Roses Road (multiple points of inundation – inundation isolating a dwelling on Yarriambiack Creek north of Roses Road, shallow less than 20cm) • Flood runners between Tarrant Road and Morella Road • Immediately upstream of the Brim Weir pool No major additional roads have been inundated; however depth of inundation has increased by 50-150mm depending on location.	Consider closing rural crossings of Yarriambiack Creek dependent on individual flood risk and monitoring inundation. Provide specific warning to resident north of Roses Road isolation is possible with inundation on multiple points of their access. Continue to monitor and update residents of Dumbuoy Road they are likely to be isolated. Monitor water levels throughout the area and timing flows in at all streamflow gauges.

Discharge at Yarriambiack Creek at Murtoa	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
1,743 ML/d (1.205 m)	5% AEP (20-year ARI)	The flood extent shows several additional breakouts from the 10% AEP (10-year ARI) event, including: • Between Schaches Road and Banyena Road • Banyena Road is inundated at multiple locations • Drillers Road is inundated at multiple locations (provides access to one property) • Yarriambiack Drive is inundated at several locations • Inundation of Roses Road has increased (isolation of one property in very close proximity to flood water) • Moloneys Road inundation increased by 10cm. • Inundation of Ailsa Road increased on the eastern side • Increase in inundation extent downstream of Cemetery Road • Inundation upstream of the Warracknabeal Weir Pool increases to a low area to the west • Water breaks out of Yarriambiack Creek downstream of Warracknabeal Weir and enters the industrial area immediately north of the township. • Morella Road inundated at several locations and minor depths less than 0.2 m • Overtopping of the Henty Highway south of Ryans Road at depths less than 0.2 m. • Inundation in very close proximity (<10m) to a property east of the Henty Highway immediately south of Ryans Road, potential to be flooded below floor. • Property west of the Henty Highway north of Ryans Road isolated. Inundation depths have generally increased by 10-20cm in 10% AEP (10-year ARI) levels.	Consider closing rural crossings of Yarriambiack Creek dependent on individual flood risk and monitoring inundation. Specific attention should be paid to: • Banyena Road • Drillers Road • Moloneys Road • Ailsa Road Provide specific warnings and construct Levee 09 protecting the industrial area north of Warracknabeal (see Section 5) Provide specific warnings and provide sandbags to the property immediately north of Roses Road, west of Yarriambiack Creek. Provide specific warnings to residents north of Brim in close proximity to Ryans Road they are likely to be isolated with one dwelling potentially subject to below floor inundation. Provide sandbags to property potentially inundated below floor on immediately south of Ryans Road (accessed on the eastern side of the Henty Highway) Continue to monitor and update residents of north of Roses Road they are likely to be inundated Continue to monitor and update residents of Dumbuoy Road they are likely to be isolated. Monitor water levels throughout the area and timing flows in at all streamflow gauges.

Discharge at Yarriambiack Creek at Murtoa	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
3,368 ML/d (2.171 m)	2% AEP (50-year ARI)	The flood extent shows an increase in inundation from the 5% AEP event (20-year ARI). The major changes in impacts are: • Greenhills Road inundated at several locations with a property west of Greenhills Road potentially isolated surrounded by flood water • Horsham Minyip Road inundated in several locations at depths up to 25cm • One property to the east immediately north of Daveys Road surrounded by flood water and isolated • Minyip Dimboola Road inundated for a significant length (greater than 500 m – depths up to 25cm) • Yarriambiack Drive inundated for a significant length (greater than 250 m – depths up to 30cm) • Property immediately north of Roses Road inundated below floor (west of Yarriambiack Creek), depths on Roses Road to the west of the property access are greater than 0.5m, up to 0.15m to the east • Inundation of the Henty highway at Kellalac at depths up to 20cm • Several inundation points of Mayberrys Road, depths up to 60cm • Significant inundation of Ailsa Road (greater than 500 m) at shallow depths less than 15cm • One property flooded below floor north of Dumbuoy Road (The Rusty Nail) • Significant increase in inundation west of Cemetery Road with two properties inundated below floor and one property isolated in Cemetery Road • Two properties inundated below floor in Asquith Avenue • Inundation up McIntyre Road at depths up to 30cm	Close all rural crossings of Yarriambiack Creek Close Horsham Minyip Road at Yarriambiack Creek Broad scale flood mitigation levees are required in Warracknabeal including the following – • Levee 01 – Preventing below floor inundation in Cemetery Avenue • Levee 05 – Preventing above and below floor inundation in Warunda Avenue • Levee 13 – Preventing below floor inundation in Asquith Reserve • Levee 11 – Preventing inundation in Craig Avenue and Kokoda Avenue • Levee 06 – Preventing inundation in Asquith Avenue • Levee 10 - preventing inundation in Craig Avenue See Section 5 for mapping of each levee section. Continue to monitor and update residents on Yarriambiack Creek north of Warracknabeal.

Discharge at Yarriambiack Creek at Murtoa	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
		• Significant increase in inundation along Warunda Avenue with eight properties inundated, five below floor, three above. Inundation of the access to this area • Significant inundation in Kokoda Avenue with 6 properties flooded below floor and one above • Significant inundation in Craig Avenue, up to 30cm, with twelve properties flooded below floor south of Menin Street and three north of Menin Street • One property in Asquith Avenue inundated below floor • Significant inundation through the industrial area north of Warracknabeal, one property flooded above floor • Significant inundation of Baums Road (greater than 300 m) • Isolation of two properties north of Ryans Road, both east and west of the Henty Highway	

Discharge at Yarriambiack Creek at Murtoa	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
5,028 ML/d (2.303 m)	1% AEP (100-year ARI)	Similar to January 2011 flood when extensive damage was caused to both residential and agricultural land – refer to Wimmera CMA estimated extent. In Warracknabeal a significant levee was constructed during January 2011 which largely mitigated the potential damages. The extent is similar to that of the 2% AEP (50-year ARI) event with no change to the properties inundated south of Warracknabeal, aside from greater depths. There are several increases to the number of properties inundated in Warracknabeal including: • Water in very close proximity or flooding under floor of all Cemetery Road properties west of Dumbuoy Road • Water flooding sheds and in close proximity to a property at the western end of Wood Street • Two buildings in Asquith Reserve flooded above floor with a further four flooded below floor and several in very close proximity to inundation • Two buildings in McIntyre Street flooded below floor • Four buildings flooded below floor in Lyle Street on the northern side, two on the southern side including the Covent. • Water is flooding in and around St Mary's Catholic Primary School potentially flooding buildings below floor • One building flooded below floor in Fong Tong Avenue but all properties at risk of below floor inundation • Three dwellings in Warunda Avenue flooded above floor, all properties either flooded below floor or in very close proximity to inundation • One property in The Avenue flooded above floor, all properties either flooded below floor or in very close	Consider closing the Henty Highway Additional to the levee sections listed in for the 2% AEP event, construct the following levees – • Levee 02 – Preventing above floor inundation of a shed (inundation of this area is slightly exacerbated (2 cm) due to the construction of levees further downstream) • Levee 04 – Preventing inundation of the school and Campbell Street See Section 5 for mapping of each levee section. Continue to monitor and update residents on Yarriambiack Creek north of Warracknabeal.

Discharge at Yarriambiack Creek at Murtoa	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
		proximity to inundation (large increase inundation extent on the 2% AEP event) • A backwater is now occurring up Anderson Street with the potential to flood properties below floor • There is a large increase inundation on the 2% AEP event west of Yarriambiack Creek, in and around Symes Street, Menin Avenue, Kokoda Avenue, Tobruk Avenue, David Street and Alamein Avenue. There are four dwellings flooded below floor, one three in Craig Avenue and on in Kokoda Avenue. There are properties flooded below floor in all streets and avenues north of Elizabeth Street. Access to the western side of Warracknabeal is limited with inundation in all streets. • Northern end of Craig Avenue inundated, depths up to 0.3m • Inundation at the industrial area north of Warracknabeal is inundated with one building flooded above floor and likely to be numerous other properties flooded below floor • Floodwater is now sitting against the Henty Highway south of Morella Road and inundating the highway at Darts Road • An overland flow path west of Yarriambiack Creek is enabled, floodwater flows from Batchica West Road, flows parallel to Yarriambiack Creek and stops flowing south of Hood Road. • Flood water is in very close proximity to a dwelling west of Yarriambiack Creek on Batchica West Road. • The overland flow path causes isolation of two properties on Witneys Road, one on Lah West Road and one on	

Discharge at Yarriambiack Creek at Murtoa	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
		Exchange Road. Inundation is close to each dwelling and associated sheds. • The Henty Highway is inundated south of Lah Angle Road at depths up to 20cm • Brim West Road west of the Brim weir pool is inundated • Inundation and isolation has worsened along the Henty Highway at Ryans Road at depths up to 20cm • Overland flow south of Ryans Road is occurring creating an additional flow path to the north east of Yarriambiack Creek.	

Discharge at Yarriambiack Creek at Murtoa	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
6,567 ML/d (5.05 m)	0.5% AEP (200-yr ARI)	South of the Henty Highway at Kellalac the inundation extent is similar to that of the 1% AEP event with all minor and major roads over topping. All property isolation is the same with greater depths preventing access. Changes to inundation from the 1% AEP event include: • An additional overland flow path south of Bell Road on the western side of Yarriambiack Creek • An additional breakout from Yarriambiack Creek north of Werrigar Street causes isolation of one property at the far western end of Lynch Street • Floodwater is impaction all of McIntyre Street with Dimboola Road properties experiencing flooding at the rear • Three properties in Dimboola Road inundated below floor west of Yarriambiack Creek • Four properties in Asquith Reserve flooded above floor • One property in McIntyre Street flooded below floor • All properties between Warunda Drive and Yarriambiack Creek are flooded below floor, three flooded above floor in Lyle Street • Seven properties in Warunda Avenue flooded above floor, one below • All properties in The Avenue flooded above or below floor, three above • Inundation in Anderson Street has increased to flood all properties between the Avenue and Woolcock Street below floor, one below • All properties on the western side of Yarriambiack Creek north of Elizabeth Street are at high risk of below floor	Almost all crossings of Yarriambiack Creek will now be closed. Construct all levees shown in Section 5 Continue to monitor and update all residents on Yarriambiack Creek.

Discharge at Yarriambiack Creek at Murtoa	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
		inundation, propertied are flooded above floor in all streets • A breakout from Yarriambiack Cree at Asquith Avenue has over topped Rainbow Road and inundated properties on Kelsall Street (seven below floor) Bowman Street (nine below floor, five above floor), Devereux Street (one below floor, two above floor), Clifford Street (13 below floor), Railway Road (three below floor), Schickerling Street (one above floor, one below floor) and east of the Henty Highway (one below floor). This inundation does not occur in the 1% AEP event and is a significant extension in inundation. A significant depth of flood water accumulates on the western side of the Henty Highway with the road over topping. • The grain storage facility is impacted with one building flooded above floor • The Henty Highway is inundated to a much greater extent south of Goads Road • Properties on Witneys Road experience much greater inundation around buildings with some sheds potentially flooded North of Brim the flood extent and depth have increased with a similar pattern of inundation. All road major and minor in the vicinity of Yarriambiack Creek are likely to be inundated including the Henty Highway at several locations.	

Table 3-3 Wimmera River flows at Glenorchy – Rating 19

AEP	ARI	Gauge Level (m)	Gauge Flow (ML/d)
20%	5 year	4.68	14,531
10%	10 year	4.81	19,884
5%	20 year	4.89	25,020
2%	50 year	4.96	31,667
1%	100 year	5.01	36,648
0.5%	200 year	5.05	41,611

Table 3-4 Yarriambiack Creek flows at Murtoa (Wimmera Highway) – Rating developed during this project

AEP	ARI	Gauge Level (m)	Gauge Flow (ML/d)
20%	5 year	0.843	905
10%	10 year	0.95	1,166
5%	20 year	1.205	1,743
2%	50 year	2.171	3,368
1%	100 year	2.303	5,028
0.5%	200 year	2.386	6,567

Table 3-5 Detailed List of Properties Flooded (Existing conditions. i.e. no levee)

Legend **Building within 50m of flood extent**

Buildings flooded above floor or within 100mm of being flooded above floor are highlighted in bold RED
Positive numbers indicate depth of flooding above floor, negative numbers indicate depth of flooding below floor

Location			Depth above OR below floor for each AEP					
House No.	Street Name	Notes	5yr	10yr	20yr	50yr	100yr	200yr
0	ALAMEIN AVE	STUMPS, CLADDING	-	-	-	-	-	-
3	ALAMEIN AVE	STUMPS, FIBRO	-	-	-	-	-	-0.253
4	ALAMEIN AVE	STUMPS, CLADDING	-	-	-	-	-	-0.326
6	ALAMEIN AVE	STUMPS, BRICK	-	-	-	-	-	-0.236
8	ALAMEIN AVE	STUMPS, HARDI PLANK	-	-	-	-	-	-0.209
10	ALAMEIN AVE	STUMPS, WEATHERBOARD	-	-	-	-	-	-
12	ALAMEIN AVE	STUMPS, WEATHERBOARD	-	-	-	-	-	-
2	ANDERSON	SLAB, BRICK	-	-	-	-	-	-
3	ANDERSON	STUMPS, WEATHERBOARD	-	-	-	-	-	-0.155
4	ANDERSON	SLAB, BRICK	-	-	-	-	-	-
5	ANDERSON	STUMPS, WEATHERBOARD	-	-	-	-	-0.214	-0.106

Location			Depth above OR below floor for each AEP					
House No.	Street Name	Notes	5yr	10yr	20yr	50yr	100yr	200yr
6	ANDERSON	STUMPS, WEATHERBOARD	-	-	-	-	-	-
7	ANDERSON	STUMPS, WEATHERBOARD	-	-	-	-	-	-0.285
8	ANDERSON	STUMPS, WEATHERBOARD	-	-	-	-	-	-
9	ANDERSON	STUMPS, CLADDING	-	-	-	-	-	-0.246
11	ANDERSON	DIRT, IRON (SHED)	-	-	-	-	-	**0.193**
12	ANDERSON	STUMPS, WEATHERBOARD	-	-	-	-	-	-
14	ANDERSON	STUMPS, WEATHERBOARD	-	-	-	-	-	-
15	ANDERSON	STUMPS, WEATHERBOARD	-	-	-	-	-	-0.165
18	ANDERSON	STUMPS, WEATHERBOARD	-	-	-	-	-	-0.405
19	ANDERSON	STUMPS, CLADDING	-	-	-	-	-	-0.295
20	ANDERSON	STUMPS, WEATHERBOARD	-	-	-	-	-	-0.28
21	ANDERSON	STUMPS, WEATHERBOARD	-	-	-	-	-	-0.276
22	ANDERSON	STUMPS, WEATHERBOARD	-	-	-	-	-	-
26	ANDERSON	STUMPS, WEATHERBOARD	-	-	-	-	-	-
24	ANDERSON ST	House	-	-	-	-	-	-

Location			Depth above OR below floor for each AEP					
House No.	Street Name	Notes	5yr	10yr	20yr	50yr	100yr	200yr
0	ASQUITH AVE	DIRT, IRON (SHED)	-	-	-	-	**0.127**	**0.206**
0	ASQUITH AVE	STUMPS, FIBRO	-	-	-	-	-0.554	-0.464
1	ASQUITH AVE	STUMPS, CLADDING	-	-	-	-0.349	-0.192	**-0.073**
5	ASQUITH AVE	STUMPS, BRICK	-	-	-	-	-0.477	-0.361
7	ASQUITH AVE	STUMPS, BRICK	-	-	-	-	-	-0.441
9	ASQUITH AVE	STUMPS, BRICK	-	-	-	-	-	-0.342
11	ASQUITH AVE	STUMPS, BRICK	-	-	-	-	-	-0.224
13	ASQUITH AVE	STUMPS, WEATHERBOARD	-	-	-	-	-	-
15	ASQUITH AVE	SLAB, BRICK	-	-	-	-	-	-
0	ASQUITH RES RD	STUMPS, WEATHERBOARD	-	-	-	-0.155	**0.041**	**0.15**
1	ASQUITH RES RD	SLAB, BRICK	-	-	-	-	-	-
4	ASQUITH RES RD	STUMPS, CLADDING	-	-	-	-0.175	**0.022**	**0.132**
6	ASQUITH RES RD	STUMPS, WEATHERBOARD	-	-	-	-	**-0.038**	**0.073**
10	ASQUITH RES RD	STUMPS, RENDERED	-	-	-	-	-0.146	**-0.036**
12	ASQUITH RES RD	SLAB, BRICK	-	-	-	-	-	-

Location			Depth above OR below floor for each AEP					
House No.	Street Name	Notes	5yr	10yr	20yr	50yr	100yr	200yr
14	ASQUITH RES RD	STUMPS, HARDI PLANK	-	-	-	-	-0.309	-0.189
18	ASQUITH RES RD	STUMPS, CLADDING	-	-	-	-	**-0.064**	**0.056**
20	ASQUITH RES RD	SLAB, BRICK	-	-	-	-	-	-
22	ASQUITH RES RD	SLAB, BRICK	-	-	-	-	-	-
28	ASQUITH RES RD	STUMPS, HARDI PLANK	-	-	-	-	-	-
0	BATCHICA WEST RD		-	-	-	-	-	-
4166	BORUNG HWY	Shed	-	-	-	-	-	-
0	BOWMAN	STUMPS, WEATHERBOARD	-	-	-	-	-	-0.328
0	BOWMAN	STUMPS, IRON (SHED)	-	-	-	-	-	-0.15
0	BOWMAN	SLAB, IRON (SHED)	-	-	-	-	-	-
0	BOWMAN	STUMPS, WEATHERBOARD	-	-	-	-	-	-0.403
0	BOWMAN	SLAB, IRON (SHED)	-	-	-	-	-	-
0	BOWMAN	STUMPS, IRON (SHED)	-	-	-	-	-	-
0	BOWMAN	VACANT LOT	-	-	-	-	-	**0.444**
0	BOWMAN	SLAB, BRICK	-	-	-	-	-	-

Location			Depth above OR below floor for each AEP					
House No.	Street Name	Notes	5yr	10yr	20yr	50yr	100yr	200yr
1	BOWMAN	STUMPS, WEATHERBOARD	-	-	-	-	-	-0.278
2	BOWMAN	STUMPS, RENDERED	-	-	-	-	-	-0.18
2	BOWMAN	SLAB, IRON (SHED)	-	-	-	-	-	**0.167**
2	BOWMAN	STUMPS, HARDI PLANK	-	-	-	-	-	**-0.114**
3	BOWMAN	STUMPS, CLADDING	-	-	-	-	-	-0.324
4	BOWMAN	STUMPS, WEATHERBOARD	-	-	-	-	-	-0.152
5	BOWMAN	STUMPS, WEATHERBOARD	-	-	-	-	-	-0.302
9	BOWMAN	STUMPS, BRICK	-	-	-	-	-	-0.233
11	BOWMAN	STUMPS, CLADDING	-	-	-	-	-	**0.024**
13	BOWMAN	STUMPS, CLADDING	-	-	-	-	-	0.174
15	BOWMAN	STUMPS, CLADDING	-	-	-	-	-	**0.064**
26	BOWMAN	SLAB, IRON (SHED)	-	-	-	-	-	-
36	BOWMAN	STUMPS, CLADDING	-	-	-	-	-	-
38	BOWMAN	SLAB, BRICK	-	-	-	-	-	-
3	BURMA AVE	STUMPS, WEATHERBOARD	-	-	-	-	-	-

Location			Depth above OR below floor for each AEP					
House No.	Street Name	Notes	5yr	10yr	20yr	50yr	100yr	200yr
1520	CANNUM FIVE CHAIN RD		-	-	-	-	-	-
0	CEMETARY RD	SLAB, IRON (SHED)	-	-	-	-	-	-
0	CEMETARY RD	STUMPS, WEATHERBOARD	-	-	-	-	-	-
0	CEMETARY RD	STUMPS, CLADDING	-	-	-	-	-	-
0	CEMETARY RD	STUMPS, BRICK	-	-	-	-0.633	-0.497	-0.386
0	CEMETARY RD	SLAB, IRON (SHED)	-	-	-	-	-	-
3	CEMETARY RD	STUMPS, FIBRO	-	-	-	-	-	-
1	CEMETERY RD	House	-	-	-	-	-	-
1	CLIFFORD	STUMPS, WEATHERBOARD	-	-	-	-	-	**0.176**
3	CLIFFORD	STUMPS, WEATHERBOARD	-	-	-	-	-	**-0.064**
5	CLIFFORD	STUMPS, WEATHERBOARD	-	-	-	-	-	-0.113
6	CLIFFORD	STUMPS, WEATHERBOARD	-	-	-	-	-	-0.152
7	CLIFFORD	STUMPS, WEATHERBOARD	-	-	-	-	-	-0.173
8	CLIFFORD	STUMPS, CLADDING	-	-	-	-	-	-0.323
9	CLIFFORD	STUMPS, HARDI PLANK	-	-	-	-	-	-0.142

Location			Depth above OR below floor for each AEP					
House No.	Street Name	Notes	5yr	10yr	20yr	50yr	100yr	200yr
10	CLIFFORD	STUMPS, WEATHERBOARD	-	-	-	-	-	-0.332
11	CLIFFORD	STUMPS, HARDI PLANK	-	-	-	-	-	-0.173
12	CLIFFORD	STUMPS, WEATHERBOARD	-	-	-	-	-	-0.223
13	CLIFFORD	STUMPS, WEATHERBOARD	-	-	-	-	-	-0.263
15	CLIFFORD	STUMPS, HARDI PLANK	-	-	-	-	-	-0.383
16	CLIFFORD	STUMPS, HARDI PLANK	-	-	-	-	-	**-0.083**
17	CLIFFORD	STUMPS, WEATHERBOARD	-	-	-	-	-	-0.284
19	CLIFFORD	STUMPS, HARDI PLANK	-	-	-	-	-	-
0	CORAL AVE	STUMPS, CLADDING	-	-	-	-	-	-0.25
1	CORAL AVE	STUMPS, WEATHERBOARD	-	-	-	-	-	-
2	CORAL AVE	STUMPS, WEATHERBOARD	-	-	-	-	-0.241	**-0.077**
4	CORAL AVE	STUMPS, WEATHERBOARD	-	-	-	-	-0.102	**0.055**
5	CORAL AVE	STUMPS, WEATHERBOARD	-	-	-	-	-	-0.112
6	CORAL AVE	STUMPS, CLADDING	-	-	-	-	-0.112	**0.041**
7	CORAL AVE	STUMPS, WEATHERBOARD	-	-	-	-	-	-0.229

Location			Depth above OR below floor for each AEP					
House No.	Street Name	Notes	5yr	10yr	20yr	50yr	100yr	200yr
8	CORAL AVE	SLAB, BRICK	-	-	-	-	-0.202	**-0.055**
11	CORAL AVE	STUMPS, WEATHERBOARD	-	-	-	-	-	-0.318
13	CORAL AVE	STUMPS, RENDERED	-	-	-	-	-	-
15	CORAL AVE	STUMPS, WEATHERBOARD	-	-	-	-	-	-0.229
17	CORAL AVE	STUMPS, WEATHERBOARD	-	-	-	-	-0.334	-0.21
0	CRAIG AVE	SLAB, BRICK	-	-	-	-	-	-
0	CRAIG AVE	SLAB, BRICK	-	-	-	-	-	-
0	CRAIG AVE	SLAB, BRICK	-	-	-	-	-	**-0.018**
0	CRAIG AVE	SLAB, BRICK	-	-	-	-	-0.16	**-0.037**
0	CRAIG AVE	STUMPS, CLADDING	-	-	-	-0.233	**-0.04**	**0.076**
0	CRAIG AVE	SLAB, BRICK	-	-	-	-	-	-
0	CRAIG AVE	STUMPS, BRICK	-	-	-	-0.163	**-0.018**	**0.091**
0	CRAIG AVE	STUMPS, BRICK	-	-	-	-	-	-
2	CRAIG AVE	STUMPS, WEATHERBOARD	-	-	-	-	-	-
4	CRAIG AVE	STUMPS, RENDERED	-	-	-	-	-	-

Location			Depth above OR below floor for each AEP					
House No.	Street Name	Notes	5yr	10yr	20yr	50yr	100yr	200yr
6	CRAIG AVE	STUMPS, WEATHERBOARD	-	-	-	-	-	-
8	CRAIG AVE	SLAB, BRICK	-	-	-	-	-	-0.087
16	CRAIG AVE	STUMPS, WEATHERBOARD	-	-	-	-	-	-
30	CRAIG AVE	STUMPS, BRICK	-	-	-	-	-	-
32	CRAIG AVE	STUMPS, WEATHERBOARD	-	-	-	-	-	-
36	CRAIG AVE	STUMPS, BRICK	-	-	-	-	-	-
38	CRAIG AVE	STUMPS, BRICK	-	-	-	-	-	-
40	CRAIG AVE	STUMPS, BRICK	-	-	-	-	-	-
42	CRAIG AVE	STUMPS, BRICK	-	-	-	-	-	-
44	CRAIG AVE	SLAB, BRICK	-	-	-	-	-	-
46	CRAIG AVE	SLAB, BRICK	-	-	-	-	-	0.022
48	CRAIG AVE	STUMPS, BRICK	-	-	-	-	-	-
52	CRAIG AVE	SLAB, BRICK	-	-	-	-	-	0.098
54	CRAIG AVE	SLAB, BRICK	-	-	-	-	-	-
56	CRAIG AVE	STUMPS, HARDI PLANK	-	-	-	-	-	-

Location			Depth above OR below floor for each AEP					
House No.	Street Name	Notes	5yr	10yr	20yr	50yr	100yr	200yr
59	CRAIG AVE	STUMPS, WEATHERBOARD	-	-	-	-	-	-
60	CRAIG AVE	STUMPS, WEATHERBOARD	-	-	-	-	-	-0.331
61	CRAIG AVE	STUMPS, WEATHERBOARD	-	-	-	-	-	-0.232
62	CRAIG AVE	STUMPS, CLADDING	-	-	-	-	-	-0.53
63	CRAIG AVE	STUMPS, CLADDING	-	-	-	-	-0.322	-0.219
64	CRAIG AVE	STUMPS, RENDERED	-	-	-	-	-0.194	**-0.09**
65	CRAIG AVE	STUMPS, BRICK	-	-	-	-	-0.171	**-0.064**
66	CRAIG AVE	STUMPS, CLADDING	-	-	-	-	-0.141	**-0.035**
67	CRAIG AVE	STUMPS, WEATHERBOARD	-	-	-	-0.305	-0.157	**-0.048**
70	CRAIG AVE	STUMPS, BRICK	-	-	-	-0.325	-0.182	**-0.074**
72	CRAIG AVE	STUMPS, BRICK	-	-	-	-0.527	-0.387	-0.28
74	CRAIG AVE	STUMPS, RENDERED	-	-	-	-0.324	-0.184	**-0.076**
76	CRAIG AVE	STUMPS, WEATHERBOARD	-	-	-	-0.169	**-0.025**	**0.084**
78	CRAIG AVE	STUMPS, WEATHERBOARD	-	-	-	-0.103	**0.04**	**0.15**
80	CRAIG AVE	STUMPS, CLADDING	-	-	-	-0.126	**0.017**	**0.127**

Location			Depth above OR below floor for each AEP					
House No.	Street Name	Notes	5yr	10yr	20yr	50yr	100yr	200yr
82	CRAIG AVE	STUMPS, WEATHERBOARD	-	-	-	-0.081	0.062	0.174
84	CRAIG AVE	STUMPS, BRICK	-	-	-	-	-0.195	-0.082
86	CRAIG AVE	STUMPS, WEATHERBOARD	-	-	-	-0.188	-0.041	0.074
88	CRAIG AVE	STUMPS, WEATHERBOARD	-	-	-	-0.177	-0.031	0.082
90	CRAIG AVE	STUMPS, CLADDING	-	-	-	-0.172	-0.036	0.079
91	CRAIG AVE	SLAB, BRICK	-	-	-	-	-0.167	-0.047
92	CRAIG AVE	STUMPS, BRICK	-	-	-	-0.489	-0.35	-0.237
94	CRAIG AVE	STUMPS, CLADDING	-	-	-	-	-0.275	-0.165
96	CRAIG AVE	STUMPS, HARDI PLANK	-	-	-	-	-	-0.188
98	CRAIG AVE	STUMPS, WEATHERBOARD	-	-	-	-	-0.315	-0.178
100	CRAIG AVE	STUMPS, BRICK	-	-	-	-	-	-0.134
108	CRAIG AVE	STUMPS, BRICK	-	-	-	-	-0.157	-0.032
110	CRAIG AVE	SLAB, BRICK	-	-	-	-	-	-
112	CRAIG AVE	STUMPS, WEATHERBOARD	-	-	-	-	-0.174	-0.05
114	CRAIG AVE	STUMPS, WEATHERBOARD	-	-	-	-	-0.186	-0.064

Location			Depth above OR below floor for each AEP					
House No.	Street Name	Notes	5yr	10yr	20yr	50yr	100yr	200yr
116	CRAIG AVE	STUMPS, CLADDING	-	-	-	-0.321	-0.115	**0.008**
118	CRAIG AVE	STUMPS, WEATHERBOARD	-	-	-	-0.38	-0.172	**-0.048**
122	CRAIG AVE	House	-	-	-	-	-	-
126	CRAIG AVE	SLAB, BRICK	-	-	-	-	-	-
132	CRAIG AVE	SLAB, BRICK	-	-	-	-	-	-
962	DAVEYS RD		-	-	-	-	-	-
1081	DAVEYS RD		-	-	-	-	-	-
0	DAVID	SLAB, IRON (SHED)	-	-	-	-	-	-
0	DEVEREUX	SLAB, IRON (SHED)	-	-	-	-	-	-
3	DEVEREUX	STUMPS, RENDERED	-	-	-	-	-	**0.076**
5	DEVEREUX	STUMPS, WEATHERBOARD	-	-	-	-	-	**0.085**
3	DIMBOOLA RD	House	-	-	-	-	-	-
5	DIMBOOLA RD	STUMPS, CLADDING	-	-	-	-	-	-
5	DIMBOOLA RD	House	-	-	-	-	-	-
9	DIMBOOLA RD	STUMPS, WEATHERBOARD	-	-	-	-	-	-

Location			Depth above OR below floor for each AEP					
House No.	Street Name	Notes	5yr	10yr	20yr	50yr	100yr	200yr
11	DIMBOOLA RD	STUMPS, BRICK	-	-	-	-	-	-
19	DIMBOOLA RD	STUMPS, WEATHERBOARD	-	-	-	-	-	-
19	DIMBOOLA RD	STUMPS, WEATHERBOARD	-	-	-	-	-	-
33	DIMBOOLA RD		-	-	-	-	-	-
39	DIMBOOLA RD		-	-	-	-	-	-
9	DIXON ST		-	-	-	-	-	-
0	DUMBOUY RD	SLAB, BRICK	-	-	-	-	-	-
56	DUMBOUY RD	House	-	-	-	-	-	-
153	DUMBOUY RD		-	-	-	-	-	-
179	DUMBOUY RD		-	-	-	-	-	-
35	DUMBOUY RD	House	-	-	-	-	-	-0.004
189	DUMBOUY ROD	Restaurant	-	-	-	-	-	0.204
1	ELIZABETH AVE	SLAB, BRICK	-	-	-	-	-	-
2	ELIZABETH AVE	STUMPS, FIBRO	-	-	-	-	-	-
3	ELIZABETH AVE	SLAB, BRICK	-	-	-	-	-	-

Location			Depth above OR below floor for each AEP					
House No.	Street Name	Notes	5yr	10yr	20yr	50yr	100yr	200yr
5	ELIZABETH AVE	SLAB, BRICK	-	-	-	-	-	-
7	ELIZABETH AVE	SLAB, BRICK	-	-	-	-	-	-
11	ELIZABETH AVE	SLAB, BRICK	-	-	-	-	-	-
4	FONG TONG AV	Motel	-	-	-	-	-	0.072
2	FONG TONG AVE	SLAB, BRICK	-	-	-	-	-	-
3	FONG TONG AVE	SLAB, BRICK	-	-	-	-	-0.232	-0.098
4	FONG TONG AVE	SLAB, BRICK	-	-	-	-	-	-
1125	GREENHILLS RD		-	-	-	-	-	-
234	HENTY HWY	Shed	-	-	-	-	-	-0.187
2560	HENTY HWY		-	-	-	-	-	-
2690	HENTY HWY	House	-	-	-	-	-0.282	-0.218
2787	HENTY HWY	House	-	-	-	-	-	-
2787	HENTY HWY		-	-	-	-	-	-
0	HENY HWY	SLAB, IRON (SHED)	-	-	-	-	-	-
0	JAMOUNEAU	STUMPS, WEATHERBOARD	-	-	-	-	-	-

Location			Depth above OR below floor for each AEP					
House No.	Street Name	Notes	5yr	10yr	20yr	50yr	100yr	200yr
2	JAMOUNEAU	STUMPS, WEATHERBOARD	-	-	-	-	-	-
4	JAMOUNEAU	SLAB, BRICK	-	-	-	-	-	-
6	JAMOUNEAU	SLAB, IRON (SHED)	-	-	-	-	-	-
8	JAMOUNEAU	STUMPS, BRICK	-	-	-	-	-	-
10	JAMOUNEAU	STUMPS, WEATHERBOARD	-	-	-	-	-	-
12	JAMOUNEAU	VACANT LOT	-	-	-	-	-	-
14	JAMOUNEAU	STUMPS, BRICK	-	-	-	-	-	-
2	JAMOUNEAU ST	House	-	-	-	-	-	-
12	JAMOUNEAU ST		-	-	-	-	-	-
0	JEPARIT RD	STUMPS, WEATHERBOARD	-	-	-	-	-	-0.266
0	JEPARIT RD	SLAB, IRON (SHED)	-	-	-	-	-	-
0	JEPARIT RD	SLAB, BRICK (SHED)	-	-	-	-	**0.088**	**0.166**
1	JEPARIT RD	STUMPS, HARDI PLANK	-	-	-	-	-	-0.253
3	JEPARIT RD	STUMPS, CLADDING	-	-	-	-	-	-0.246
5	JEPARIT RD	STUMPS, WEATHERBOARD	-	-	-	-	-	-

Location			Depth above OR below floor for each AEP					
House No.	Street Name	Notes	5yr	10yr	20yr	50yr	100yr	200yr
7	JEPARIT RD	STUMPS, WEATHERBOARD	-	-	-	-	-	-
8	JEPARIT RD	SLAB, BRICK	-	-	-	-	-	-
9	JEPARIT RD	STUMPS, WEATHERBOARD	-	-	-	-	-	-
0	KELSALL	STUMPS, CLADDING	-	-	-	-	-	-0.104
0	KELSALL	STUMPS, CLADDING	-	-	-	-	-	-0.044
0	KELSALL	SLAB, IRON (SHED)	-	-	-	-	-	-
2	KELSALL	STUMPS, BRICK	-	-	-	-	-	-0.445
4	KELSALL	STUMPS, BRICK	-	-	-	-	-	-
5	KELSALL	STUMPS, BRICK	-	-	-	-	-	-
6	KELSALL	STUMPS, FIBRO	-	-	-	-	-	-0.063
7	KELSALL	SLAB, BRICK	-	-	-	-	-	-
8	KELSALL	STUMPS, BRICK	-	-	-	-	-	-0.035
9	KELSALL	STUMPS, BRICK	-	-	-	-	-	-
11	KELSALL	STUMPS, BRICK	-	-	-	-	-	-
13	KELSALL	STUMPS, CLADDING	-	-	-	-	-	-

Location			Depth above OR below floor for each AEP					
House No.	Street Name	Notes	5yr	10yr	20yr	50yr	100yr	200yr
16	KELSALL	STUMPS, WEATHERBOARD	-	-	-	-	-	-0.373
18	KELSALL	STUMPS, HARDI PLANK	-	-	-	-	-	-0.146
20	KELSALL	STUMPS, WEATHERBOARD	-	-	-	-	-	-0.185
26	KELSALL	SLAB, IRON (SHED)	-	-	-	-	-	**0.174**
32	KELSALL	STUMPS, WEATHERBOARD	-	-	-	-	-	-0.226
1	KOKODA AVE	STUMPS, WEATHERBOARD	-	-	-	-	-	-0.141
1	KOKODA AVE	SLAB, BRICK	-	-	-	**0.033**	**0.173**	**0.282**
2	KOKODA AVE	STUMPS, CLADDING	-	-	-	-	-	-0.179
2	KOKODA AVE	STUMPS, WEATHERBOARD	-	-	-	-	-	**-0.124**
2	KOKODA AVE	STUMPS, CLADDING	-	-	-	-	-	-0.327
3	KOKODA AVE	STUMPS, RENDERED	-	-	-	-0.349	-0.203	**-0.094**
4	KOKODA AVE	STUMPS, WEATHERBOARD	-	-	-	-	-0.33	-0.226
5	KOKODA AVE	STUMPS, WEATHERBOARD	-	-	-	-0.412	-0.268	-0.159
6	KOKODA AVE	STUMPS, WEATHERBOARD	-	-	-	-	-0.312	-0.206
7	KOKODA AVE	STUMPS, WEATHERBOARD	-	-	-	-0.217	**-0.072**	**0.037**

Location			Depth above OR below floor for each AEP					
House No.	Street Name	Notes	5yr	10yr	20yr	50yr	100yr	200yr
8	KOKODA AVE	STUMPS, WEATHERBOARD	-	-	-	-	-	-0.212
9	KOKODA AVE	STUMPS, WEATHERBOARD	-	-	-	-0.342	-0.202	**-0.094**
10	KOKODA AVE	STUMPS, FIBRO	-	-	-	-	-	-
11	KOKODA AVE	STUMPS, WEATHERBOARD	-	-	-	-0.506	-0.372	-0.266
12	KOKODA AVE	STUMPS, WEATHERBOARD	-	-	-	-	-	-0.168
13	KOKODA AVE	STUMPS, WEATHERBOARD	-	-	-	-	-0.253	-0.148
15	KOKODA AVE	STUMPS, BRICK	-	-	-	-	-	-0.153
17	KOKODA AVE	STUMPS, FIBRO	-	-	-	-	-0.365	-0.256
19	KOKODA AVE	STUMPS, WEATHERBOARD	-	-	-	-	-0.312	-0.202
0	LYLE	STUMPS, BRICK	-	-	-	-	-0.201	-0.123
0	LYLE	STUMPS, BRICK	-	-	-	-	-	-0.225
4	LYLE	SLAB, BRICK	-	-	-	-	-	-
6	LYLE	House	-	-	-	-	-	-
8	LYLE	SLAB, BRICK	-	-	-	-	-	**-0.066**
10	LYLE	STUMPS, BRICK	-	-	-	-	-	-

Location			Depth above OR below floor for each AEP					
House No.	Street Name	Notes	5yr	10yr	20yr	50yr	100yr	200yr
12	LYLE	STUMPS, CLADDING	-	-	-	-	-	-
2	LYLE ST	SLAB, CLADDING	-	-	-	-	-	0.089
4	LYLE ST	HOUSE	-	-	-	-	-0.07	0.085
9	LYLE ST	School	-	-	-	-	-0.424	-0.336
13	LYLE ST		-	-	-	-	-	-
0	McINTYRE	STUMPS, HARDI PLANK	-	-	-	-	-0.325	-0.203
3	MCINTYRE ST	Note: Vacant Block	-	-	-	-	-0.122	0.002
1	MENIN AVE	STUMPS, WEATHERBOARD	-	-	-	-	-0.063	0.077
3	MENIN AVE	STUMPS, WEATHERBOARD	-	-	-	-	-0.053	0.082
4	MENIN AVE	STUMPS, WEATHERBOARD	-	-	-	-	-	-0.286
5	MENIN AVE	STUMPS, WEATHERBOARD	-	-	-	-	-	-0.011
6	MENIN AVE	STUMPS, FIBRO	-	-	-	-	-	-0.304
7	MENIN AVE	SLAB, FIBRO	-	-	-	-	-	0.217
0	PHILLIPS	SLAB, BRICK	-	-	-	-	-	-
0	PHILLIPS	SLAB, BRICK	-	-	-	-	-	-

Location			Depth above OR below floor for each AEP					
House No.	Street Name	Notes	5yr	10yr	20yr	50yr	100yr	200yr
1	PHILLIPS	SLAB, BRICK	-	-	-	-	-	-
0	RAILWAY	SLAB, IRON (SHED)	-	-	-	-	-	-
0	RAILWAY	STUMPS, IRON (SHED)	-	-	-	-	-	-0.12
111	ROSES RD	House	-	-	-	-	-0.619	-0.56
0	SCHICKERLING ST	SLAB, IRON (SHED)	-	-	-	-	-	**0.078**
0	SCOTT	STUMPS, BRICK	-	-	-	-	-	-
10	SIMSON	BRIM REC, RESERVE,	-	-	-	-	-	-
0	SYMES AVE	STUMPS, CLADDING	-	-	-	-	-0.176	**-0.037**
2	SYMES AVE	STUMPS, HARDI PLANK	-	-	-	-	-	-
0	TEICHELMAN CT	House	-	-	-	-	-	-
0	THE AVENUE	SLAB, RENDERED	-	-	-	-	-	-
0	THE AVENUE	Bowls Club	-	-	-	-	-	-
1	THE AVENUE	STUMPS, WEATHERBOARD	-	-	-	-	-	-0.349
3	THE AVENUE	STUMPS, CLADDING	-	-	-	-	-	-0.23
5	THE AVENUE	STUMPS, WEATHERBOARD	-	-	-	-	-	-0.24

Location			Depth above OR below floor for each AEP					
House No.	Street Name	Notes	5yr	10yr	20yr	50yr	100yr	200yr
7	THE AVENUE	STUMPS, CLADDING	-	-	-	-	-0.121	0.003
9	THE AVENUE	STUMPS, WEATHERBOARD	-	-	-	-	-0.06	0.061
11	THE AVENUE	STUMPS, WEATHERBOARD	-	-	-	-	-0.257	-0.138
13	THE AVENUE	SLAB, BRICK	-	-	-	-0.026	0.135	0.246
19	THE AVENUE	SLAB, BRICK	-	-	-	-	-	-
0	TOBRUK AVE	SLAB, BRICK	-	-	-	-	-	-
1	TOBRUK AVE	STUMPS, WEATHERBOARD	-	-	-	-	-	-
2	TOBRUK AVE	STUMPS, BRICK	-	-	-	-	-	-0.187
3	TOBRUK AVE	STUMPS, WEATHERBOARD	-	-	-	-	-	-
4	TOBRUK AVE	STUMPS, CLADDING	-	-	-	-	-0.165	0.007
8	TOBRUK AVE	STUMPS, HARDI PLANK	-	-	-	-	-0.026	0.144
12	TOBRUK AVE	SLAB, BRICK	-	-	-	-	-	-
0	WARRACKNABEAL JEPARIT RD	SLAB, IRON (SHED)	-	-	-	-	-	-
31	WARRACKNABEAL JEPARIT RD	SLAB, FIBRO	-	-	-	-	-	-
33	WARRACKNABEAL JEPARIT RD	SLAB, IRON (SHED)	-	-	-	-	-	-

Location			Depth above OR below floor for each AEP					
House No.	Street Name	Notes	5yr	10yr	20yr	50yr	100yr	200yr
33	WARRACKNABEAL JEPARIT RD	SLAB, IRON (SILO)	-	-	-	-	-	0.225
35	WARRACKNABEAL JEPARIT RD	STUMPS, WEATHERBOARD	-	-	-	-	-	-
39	WARRACKNABEAL JEPARIT RD	DIRT, IRON (SHED)	-	-	-	0.063	0.13	0.176
1	WARUNDA AVE	SLAB, BRICK	-	-	-	-	-	-
1	WARUNDA AVE	SLAB, BRICK	-	-	-	0.063	0.217	0.338
3	WARUNDA AVE	SLAB, BRICK	-	-	-	0.063	0.217	0.34
5	WARUNDA AVE	SLAB, BRICK	-	-	-	0.073	0.228	0.351
5	WARUNDA AVE	STUMPS, BRICK	-	-	-	-	-	-
7	WARUNDA AVE	SLAB, BRICK	-	-	-	-0.247	-0.092	0.031
9	WARUNDA AVE	SLAB, BRICK	-	-	-	-0.209	-0.051	0.075
11	WARUNDA AVE	SLAB, BRICK	-	-	-	-0.408	-0.249	-0.122
13	WARUNDA AVE	SLAB, BRICK	-	-	-	-0.277	-0.118	0.01
9	WATSON	STUMPS, FIBRO	-	-	-	-	-	-
10	WATSON	STUMPS, FIBRO	-	-	-	-	-	-
11	WATSON	STUMPS, FIBRO	-	-	-	-	-	-

Location			Depth above OR below floor for each AEP					
House No.	Street Name	Notes	5yr	10yr	20yr	50yr	100yr	200yr
12	WATSON	STUMPS, FIBRO	-	-	-	-	-	-
14	WATSON	STUMPS, FIBRO	-	-	-	-	-	-
18	WATSON	STUMPS, WEATHERBOARD	-	-	-	-	-	-
20	WATSON	STUMPS, CLADDING	-	-	-	-	-	-
2	WERRIGAR ST	HOUSE	-	-	-	-	-	-
11	WERRIGAR ST	CHILDCARE CENTRE,	-	-	-	-	-	-
43	WHITNEYS RD		-	-	-	-	-	-
106	WHITNEYS RD		-	-	-	-	-	-
0	WOOD	STUMPS, WEATHERBOARD	-	-	-	-	-	-
0	WOODBINE	SLAB, BRICK	-	-	-	-	-	-
0	WOOLCOCK	STUMPS, BRICK	-	-	-	-	-	-
1	WOOLCOCK	STUMPS, BRICK	-	-	-	-0.158	**-0.006**	**0.113**
2	WOOLCOCK	STUMPS, RENDERED	-	-	-	-	-0.27	-0.173
3	WOOLCOCK	STUMPS, CLADDING	-	-	-	-	-	-0.158
4	WOOLCOCK	STUMPS, WEATHERBOARD	-	-	-	-0.293	-0.16	**-0.056**

Location			Depth above OR below floor for each AEP					
House No.	Street Name	Notes	5yr	10yr	20yr	50yr	100yr	200yr
5	WOOLCOCK	STUMPS, WEATHERBOARD	-	-	-	-	-	-0.311
6	WOOLCOCK	STUMPS, HARDI PLANK	-	-	-	-	-0.392	-0.289
7	WOOLCOCK	STUMPS, BRICK	-	-	-	-	-	-0.369
8	WOOLCOCK	STUMPS, BRICK	-	-	-	-	-	-0.302
9	WOOLCOCK	STUMPS, CLADDING	-	-	-	-	-	-0.278
10	WOOLCOCK	STUMPS, WEATHERBOARD	-	-	-	-	-	-
10	WOOLCOCK	HOUSE	-	-	-	-	-	-
14	WOOLCOCK	STUMPS, WEATHERBOARD	-	-	-	-	-	-

3.5 Streamflow Gauges

3.5.1 Overview

The townships of Brim and Warracknabeal can be impacted by stormwater and flooding of Yarriambiack Creek.

There are several rainfall gauges that can be monitored to determine the likelihood of stormwater impacts. These are discussed below.

There are also a number of streamflow gauges which can be monitored to determine the likelihood of flood inundation. These are listed below and are discussed in detail individually later in this section.

- Wimmera River at Glynwylln
- Wimmera River at Glenorchy
- Mt. William Creek at Lake Lonsdale D/S
- Yarriambiack Creek at Murtoa (Wimmera Highway)

The gauges of most significance for Yarriambiack Creek are the Yarriambiack Creek at Murtoa and Wimmera River at Glenorchy.

3.5.2 Storm water and rainfall gauging

To monitor inundation that may occur as a direct result of stormwater rainfall gauging must be monitored. There are numerous daily rainfall gauges in the vicinity of Warracknabeal and Brim; however these will only provide a rainfall total for the 24hrs prior to 9am on the recorded date.

There are also a number of instantaneous rainfall gauges which record the rate of rainfall in mm/hr (Automatic Weather Station (AWS) rainfall gauges). Pluviograph rainfall gauges that are relevant to Yarriambiack Creek are shown in the table below, with details on the gauge included:

Gauge Name	Gauge No.	Average Annual Rainfall (mm)	Highest Daily Total (mm)	Start of record
Hopetoun Airport	77010	312	75 (12th Jan 2011)	2004
Nhill AWS	78015	326	64.4 (12th Jan 2011)	2003
Wimmera River US Dimboola	578004	410	131.6 (7 Nov 1957)	1882
Horsham AWS	79100	379	101.4 (12 Jan 2011)	1997
Longerenong AWS	79028	417	97 (12 Jan 2011)	1860
Stawell AWS	79105	493	86.6 (14 Jan 2011)	1996

Live readings from these gauges are available online via the BoM website –

http://www.bom.gov.au/vic/flood/rain_river.shtml

http://www.bom.gov.au/cgi-bin/wrap_fwo.pl?IDV60148.html

3.5.3 Key Streamflow Gauges

Wimmera River at Glynwylln

Location –At the Glynwylln Road bridge

Gauge Zero –Unavailable

Flood Class Levels – Unavailable

Flood Frequency –

Gauge Height at Current Site (m)	Flow at Current Site (ML/d)	ARI (1 in X Years)
Greater than 9.0 m	64,195	100
8.59	48,300	50
7.87	31,450	25
6.97	21,340	10
6.01	13,220	5

Flood History –

Gauge Height at Current Site (m)	Flow at Current Site (ML/d)	Date
8.63*	37,987	January 2011
8.31	34,200	September 2010
7.47	24,700	September 1988
7.40	24,000	August 1982

* Derived Level

Wimmera River at Glenorchy

Location –2 km downstream Stawell Rupanyup bridge

Gauge Zero –163.779 m AHD

Flood Class Levels –

Flood Class	Gauge Height at Current Site (m)	Flow at Current Site (ML/d)	ARI (1 in X Years)
Minor	4.00	7,000	2
Moderate	4.75	14,100	5
Major	4.90	19,300	9

Flood Frequency –

Gauge Height at Current Site (m)	Flow at Current Site (ML/d)	AEP (%)
4.68	14,531	20
4.81	19,884	10
4.89	25,020	5
4.96	31,667	2

5.01	36,648	1
5.05	41,611	0.5

Flood History –

Gauge Height at Current Site (m)	Flow at Current Site (ML/d)	Date
5.03	39,527	January 2011
4.97	25,200	September 1988
4.97	24,700	October 1973

Yarriambiack Creek at Murtoa (Wimmera Highway)

Location –Wimmera Highway at Jung

Gauge Zero – 130.875

Flood History –

The table below shows a change in the relationship between gauge height and gague flow. This is due to changes in the gauge rating curve between the flow events.

Gauge Height at Current Site (m)	Flow at Current Site (ML/d)	Date
2.335	5,470	January 2011
2.06	1,715	September 1983
2.057	1,712	August 1981

Note: 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. More details about flood intelligence and its use can be found in the Australian Emergency Management Manuals flood series.

3.5.4 Additional Streamflow Gauges

Mt. William Creek at Lake Lonsdale D/S

Location –At the the outlet structure on LakeLonsdale

Gauge Zero –Unavailable

Flood Class Levels –Unavailable

Flood Frequency –

Gauge Height at Current Site (m)	Flow at Current Site (ML/d)	ARI (1 in X Years)
2.85	44,200	100
2.60	26,200	50
2.35	14,900	25
1.83	6,480	10
1.35	3,120	5

Flood History –

Gauge Height at Current Site (m)	Flow at Current Site (ML/d)	Date
2.654	38,530	January 2011
188.40*	27,300	August 1909
188.18*	16,300	September 1915

* Exact gauge location is unknown and levels aren't comparable to existing gauge location

4. FLOOD WARNING SYSTEMS (APPENDIX E)

4.1 Flood Warning

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

4.2 Flood Bulletins

VICSES distributes flood emergency information to the media through "Flood Bulletins". Flood Bulletins provide Bureau of Meteorology Flood Warning information as well as information regarding possible flood consequences and safety advice, not contained in Bureau of Meteorology 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 system.

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

It is important that the description of the predicted flood situation is consistent with and reflects the relevant Bureau of Meteorology 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 Bureau of Meteorology, 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.

4.3 Local Flood Warning System Arrangements

YSC to include details of any local flood warning systems or arrangements.

5. MAPS (APPENDIX F)

Flood Intelligence Maps are provided detailing likely affected areas including properties, essential community infrastructure, roads, identification of evacuation routes, likely evacuation route closure locations, assembly areas, emergency relief centres etc. under different flood scenarios.