Cardinia Shire Council

Municipal Storm and Flood Emergency Plan

November 2017

“Page Left Intentionally Blank”

Table of Contents

Distribution List

Copy No.	Issue To:		Date
	Position	Organisation	
Original	MEMP Committee Executive Officer	Cardinia Shire Council	
1	Council Office Copy	Cardinia Shire Council	
2	MEMP Committee Executive Officer	Cardinia Shire Council	
3	Municipal Emergency Manager (MEM)	Cardinia Shire Council	
4	MERO	Cardinia Shire Council	
5	MUNICIPAL Recovery Manager (MRM)	Cardinia Shire Council	
6	MERC (Pakenham Police Station)	Victoria Police	
7	RERC	Victoria Police	
8	Station Copy	Victoria Police Pakenham	
9		Victoria Police Koo Wee Rup	
10		Victoria Police Lang Lang	
11	Central Region	VICSES	
12	Emerald Unit	VICSES	
13	Pakenham Unit	VICSES	
14	Team Leader Hydrology and Flood Warnings	Melbourne Water	
15	Flood Warning Manager	Bureau of Meteorology (Flood Warning)	
16		DELWP Powelltown	
17	Ranger in Charge	Parks Victoria Gembrook	
18	Team Leader	Ambulance Victoria (Pakenham branch)	
19	Group Officer	CFA Cardinia Group of Brigades	
20	Group Officer	CFA Dandenong Ranges Group of Brigades	
21	Group Officer	CFA Casey Group of Brigades	
22	Operations Manager	CFA (Southern Metropolitan Region Headquarters)	
23		VicRoads	
24	Manager Emergency Management	Department of Health and Human Services	
25		Power supplier - AusNet Services	
26		Water Retailer - South East Water	
27		Water Retailer – Yarra Valley Water	
28		Spare Copies	

Document Transmittal Form / Amendment Certificate

This Municipal Storm and Flood Emergency Plan (MSFEP) will be amended, maintained and distributed as required by VICSES in consultation with Cardinia Shire Council.

Suggestions for amendments to this MSFEP should be forwarded to the VICSES Regional Office Unit, 6 3-5 Gilda Court, Mulgrave VIC 3170.

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	30/10/2012	C Carter	Format update (minor/test)
2	13/11/2012	M.O'Reilly	
3	12/02/2016	Ross Butler	Update of Appendix A, B, C, F and addition of Appendix G
4	28/072016	Glynn Owen	3 year review/update. Inclusion of Storm Appendix and Sand Bag Arrangements.
5	01/11/2017	K.Carlisle-Stapleton	Minor administrative amendments

This Plan will be maintained on the SES website (www.ses.vic.gov.au) and through linkages from the Cardinia Shire Council website (www.cardinia.vic.gov.au).

List of Abbreviations and Acronyms

The following abbreviations and acronyms are used in the Plan:

AEP	Annual Exceedance 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 and Resource Management Council of Australia and New Zealand
AV	Ambulance Victoria
BoM	Bureau of Meteorology
CEO	Chief Executive Officer
CERA	Community Emergency Risk Assessment
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
EMV	Emergency Management Victoria
EMMV	Emergency Management Manual Victoria
EMT	Emergency Management Team
EO	Executive Officer
FO	Floodway Overlay
FWS	Flood Warning System
FZ	Floodway Zone
IC	Incident Controller
ICC	Incident Control Centre
IMT	Incident Management Team
IMS	Incident Management System
EMLO	Emergency Management Liaison Officer
LSIO	Land Subject to Inundation Overlay
MECC	Municipal Emergency Coordination 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
MRM	Municipal Recovery Manager
PMF	Probable Maximum Flood
RCC	Regional Control Centre
RDO	Regional Duty Officer
RERC	Regional Emergency Response Coordinator
SBO	Special Building Overlay
SCC	State Control Centre
SEWS	Standard Emergency Warning System
SHERP	State Health Emergency Response Plan
SOP	Standard Operating Procedure
Victoria Police	Victoria Police
VICSES	Victoria State Emergency Service

Part 1. INTRODUCTION

1.1 Municipal Endorsement

This Municipal Storm and Flood Emergency Plan (MSFEP) has been prepared by the Cardinia Municipal Storm and Flood Management Committee (MSFLMC) and with the authority of the Cardinia Municipal Emergency Management Planning Committee pursuant to Section 20 of the Emergency Management Act 1986 (as amended).

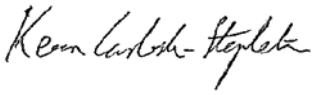
This MSFEP is a sub plan to the Cardinia Municipal Emergency Management Plan (MEMP), is consistent with the Emergency Management Manual Victoria (EMMV) and the Victoria Flood Management Strategy (DNRE, 1998a), and takes into account the outcomes of the Community Emergency Risk Assessment (CERA) process undertaken by the Municipal Emergency Management Planning Committee (MEMPC).

The MSFEP is consistent with the Regional Flood Emergency Plan, Regional Storm Emergency Plan and the State Flood Emergency Plan.

This MSFEP is a result of the cooperative efforts of the Cardinia Storm and Flood and Flood Emergency Planning Committee (MSFEPC) and its member agencies.

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

Endorsement



……

Kevin Carlisle-Stapleton Date November 2017

Chair – Municipal Flood & Storm Subcommittee

The municipality

An outline of Cardinia Shire in terms of its location, demography and other general matters is provided in the MEMP. An outline of the flood threat is provided in **Appendix A** of this Plan.

1.2 Purpose and Scope of this Storm and Flood Emergency Plan

The purpose of this MSFEP is to detail arrangements agreed to for the planning, preparedness, prevention, response to and recovery from flood incidents within the Cardinia Shire

As such, the scope of the Plan is to:

- Identify the storm and flood risk to Cardinia Shire;
- Support the implementation of measures to minimise the causes and impacts of storm and flood incidents within Cardinia Shire;
- Detail response and relief arrangements* including preparedness, incident management, command and control;
- Identify linkages with Local, Regional and State emergency and wider planning arrangements with specific emphasis on those relevant to flood.

* Recovery arrangements are detailed within the Relief and Recovery sub-plan of the MEMP

1.3 Municipal Flood Management Planning Committee

Membership of the Cardinia Municipal Storm and Flood Emergency Management Planning Committee (MFSEMPC) will comprise of the following representatives from the following agencies and organisations:

- VICSES (Regional Officer – Emergency Management) **(Chair)**,
- Cardinia Shire Council **(Administrative Support)**,
- VICSES Local Unit Controllers (Pakenham and Emerald)
- Victoria Police (i.e. Municipal Emergency Response Coordinator)
- Catchment Management Authority (Melbourne Water);

Department of Environment, Land, Water and Planning (DELWP) (as required)

- Ausnet services
- Other agencies as required

1.4 Responsibility for Planning, Review and Maintenance of this Plan

This MSFEP must be maintained in order to remain effective.

VICSES, through the Storm and Flood Emergency Planning Committee, has responsibility for preparing, reviewing, maintaining and distributing this plan.

The Cardinia MFSEMPC will meet at least twice within a calendar year.

The plan should be reviewed and, where necessary, arrangements and information contained in it should be amended, including:

- following any new flood study;
- following a change in non-structural and/or structural flood mitigation measures;
- after the occurrence of a significant storm or flood event within the municipality.

1.5 Endorsement of the Plan

The MSFEP is endorsed by the MEMPC as a sub-plan of the MEMP.

The MSFEP will be circulated to MFSEMPC members prior to seeking acceptance of the draft plan.

Upon acceptance, the plan is forwarded to the MEMPC for endorsement with the recommendation to include the MSFEP as a sub-plan of the MEMP.

Part 2. PREVENTION / PREPAREDNESS ARRANGEMENTS

2.1 Community Awareness for all Types of Storm and Flooding

Details of this MSFEP will be released to the community through local media, the FloodSafe and StormSafe programs, websites (VICSES and the municipality) upon formal adoption by Cardinia Shire MEMPC.

VICSES (with the support of Cardinia Shire Council and Melbourne Water) have the responsibility to coordinate community education programs and engagement for flooding and storm related events within the Cardinia Shire Council, e.g. local flood guides and public events.

A community education plan (CEP) to support the Storm and Flood Emergency Plan has been developed in conjunction with VICSES local units. VICSES local units will lead the delivery of the CEP with support from Cardinia Shire Council and VICSES Regions.

2.1.1 Community Resilience

A key objective of the Storm and Flood Emergency Plan and in particular the CEP is to increase the community's ability to make informed decisions related to storm and flood emergencies.

Key to this is:

- information – providing the public with accurate and relevant information before an emergent event, and accurate and timely information during an event to allow them to make sound decisions.
- community confidence – developing a culture of confidence during an event in both the agency's ability to deal with the event and community's strength to recover from it.

VICSES, in partnership with Cardinia Shire Council, will develop locality-specific resilience programs (such as door knocks and local flood guides) for at-risk areas.

2.2 Structural Flood Mitigation Measures

The following structural flood-mitigation measures exist within the Municipal area:

- levees
- retarding basins

Refer to **Appendix A** for detailed information about these structural flood-mitigation measures.

2.3 Non-structural Flood Mitigation Measures

2.3.1 Exercising the Plan

Arrangements for exercising this Plan will be at the discretion of the MEMPC. The plan should be exercised at least once per 3 years (within the life of the plan) and/or reviewed after a significant event.

2.3.2 Storm and Flood Warnings

Arrangements for flood warnings are contained within the state flood emergency plan (http://www.ses.vic.gov.au/prepare/em-planning/state-plans), Part 3 of the EMMV and on the Bureau of Meteorology website (http://www.bom.gov.auhttp://www.bom.gov.au).

Specific details of local storm and flood warning system arrangements are included in **Appendix E**.

2.3.3 Flood Observers

Flood observers, where established, have a critical role in collecting local information and intelligence, and communicating this intelligence to VICSES to inform their response operations. VICSES then distribute this flood intelligence to agencies to inform their activities within the response phase, and to municipalities to inform their activities during the event. In the future flood observers are also likely to be utilised to provide local knowledge into the development of Flood emergency planning, a role not regularly performed at present.

Although not yet formally established within Cardinia Shire, the formation of a network of accredited flood observers is likely. This would allow for real-time gathering of on flood behaviour along a stream system, and provide a network for the distribution of information and warnings to the community along the stream system.

To be successful this network is likely to take advantage of existing support agency resources and structures, such as CFA Brigades. However, the use of appropriately trained and endorsed community members to undertake these flood observer roles is also possible.

Part 3. RESPONSE ARRANGEMENTS

3.1 Introduction

3.1.1 Activation of Response

Storm and flood response arrangements may be activated by the VICSES Central Region Duty Officer (RDO) or Incident Controller (IC).

The VICSES RDO/IC will activate agencies as required and documented in the VICSES Central Region and State Storm Emergency Plans State Flood Emergency Plan.

3.1.2 Responsibilities

There are a number of agencies with specific roles that will act in support of VICSES and provide support to the community in the event of a serious storm or flood within Cardinia Shire. These agencies will be engaged through the Emergency Management Team (EMT).

The general roles and responsibilities of supporting agencies are as agreed within the Cardinia MEMP, Part 7 of the EMMV, VICSES Central Region Flood Emergency Plan and State Flood and Storm Emergency Plans (http://www.ses.vic.gov.au/prepare/em-planning/state-plans).

3.1.3 Municipal Emergency Coordination

The IC will ensure that there is **early** contact with Cardinia Shire Council's Municipal Emergency Resources Officer (MERO).–

The IC/Incident Management Team (IMT) will liaise closely with the EMT throughout the event. The EMT will comprise (but will not be limited to) the:

- MERO;
- MERC; and
- other agencies and organisations as required.

3.1.4 Tiers of Control

Most flood incidents are of local concern and an appropriate response can usually be coordinated using local resources.

However, when these local resources are fully committed, state government arrangements provide for further resources to be made available, firstly from within the region and then on a state-level basis. Resourcing and event escalation arrangements are described in Part 3 of the EMMV.

3.2 Strategic Control Priorities

To provide guidance to the IMT, the following strategic control priorities will form the basis of incident action planning processes.

1. **Protection and preservation of life is paramount** – this includes:

    a. Safety of emergency services personnel; and

    b. Safety of community members, including vulnerable community members and visitors/tourist 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 supports community resilience.

4. **Protection of residential property** as a place of primary residence.

5. **Protection of assets supporting individual livelihoods and economic production** that support individual and community financial sustainability.

6. **Protection of environmental and conservation values** that considers the cultural, biodiversity, and social values of the environment;

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

3.3 Command, Control and Coordination

The Command, Control and Coordination arrangements in this MFEP must be consistent with those detailed in the VICSES Central Region Flood and Storm Emergency Plans and State Flood and Storm Emergency Plans. For further information, refer to Part 3 of the EMMV.

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

3.3.1 Control

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

Section 7.1 of the EMMV prepared under the *Emergency Management Act 1986 (as amended)* identifies VICSES as the control agency for storm and flood. It identifies DELWP as the control agency responsible for “dam safety, water and sewerage asset-related incidents” and other emergencies

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

3.3.2 Incident Controller (IC)

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

3.3.3 Incident Control Centre (ICC)

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

Pre-determined ICC locations are:

- Mulgrave;
- Ferntree Gully;
- Woori Yallock;
- Dandenong;
- Kangaroo Ground; and
- Sunshine.

3.3.4 Divisions and Sectors

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

Pre-determined Division Command locations for events within Cardinia Shire are:

- Pakenham Emergency Services Complex, 780 Princess Highway, Pakenham; and
- Emerald Fire Station, 5 Emerald Monbulk Road, Emerald.

Pre-determined Sector Command locations are to be allocated on a as needs basis.

3.3.5 Incident Management Team (IMT)

The IC will form an IMT in line with AIIMS principles.

Refer to Part 3 of the EMMV for guidance on IMTs.

3.3.6 Emergency Management Team (EMT)

The IC will establish a multi-agency EMT to assist the storm or flood response. The EMT will consist of key personnel (with appropriate authority) from stakeholder agencies and relevant organisations. EMTs need to be informed of strategic issues related to incident control and be able to provide high-level strategic guidance and policy advice to the IC in developing incident management strategies.

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

Refer to Part 3 of the EMMV for guidance on EMTs.

3.3.7 Consequence Management Team (CMT)

Under Part 7 (Emergency Management Agency Roles) of the EMMV it is EMV that has the responsibility to co-ordinate relief and recovery planning at state level. The Department of Health and Human Services is responsible for coordination at regional level.

At a municipal level this function carried out by Local Government.

To assist with this co-ordination role, Cardinia Shire Council has established a CMT

One of the key components of effective emergency management is the management of the consequences of an event.

To manage consequence effectively there must be:

- prevention of further impact of an event once that event is controlled;
- thorough understanding of the measures taken to protect public health and safety and to restore essential community services;
- an appreciation of the potential impacts and consequence of decisions taken; and
- effective strategies to provide emergency relief and recovery to communities, neighbourhoods, families and individuals affected by emergencies

Cardinia Shire Council's CMT, under the direction of the Municipal Emergency Manager (MEM) is drawn together from expertise across Council and with agencies and organisations with responsibilities to manage the consequence of an emergency.

3.3.8 On Receipt of a Flood Watch / Severe Weather Warning

The IC or VICSES Region Duty Officer (RDO) (until an incident controller is appointed) will ensure actions are undertaken as defined within the flood intelligence cards (**Appendix C**). General considerations by the IC/VICSES RDO will be as follows.

- Review storm and flood intelligence to assess likely event consequences.
- Monitor weather and flood information (www.bom.gov.au).
- Assess Command and Control requirements.
- Review local resources and consider needs for further resources regarding personnel, property protection, rescue and air support
- Notify and brief appropriate officers. This includes RCC (if activated), SCC (if activated) and other emergency services through the EMT.
- Advise local government emergency management duty officer.
- Assess ICC readiness including staffing of IMT, and activate 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 storm and flood-mitigation works are being checked by owners.
- Develop and issue incident action plan (if required).
- Develop and issue situation report (if required).

3.3.9 On Receipt of the First and Subsequent Storm and Flood Warnings

The VICSES RD or theIC will ensure actions are undertaken as defined within the flood intelligence cards (**Appendix C**). General considerations by the IC/VICSES RDO will be as follows.

- Obtain situational awareness of **current** and **predicted** flood levels. Are floodwaters rising, peaking or falling?
- Advise local government emergency management duty officer.
- 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; and
    - the characteristics of the populations at risk.
- Determine what the at-risk community need to know and what they need to do as the flood develops. *(Determine what information is to hand and what gaps in information exist – this will inform the messaging that is feasible and when it is to be delivered)*
- Warn the at-risk community of the risks. This means 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 flood levels may be;
    - public safety advice;
    - who to contact for further information; and
    - 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

When predictions or intelligence indicate that communities, neighbourhoods and/or households may become isolated, VICSES will advise the community through their media connections of the need to stock up their essential flood-survival items and food supply.

Further information can be found in the Victorian Warning Protocol (https://www.emv.vic.gov.au/publications/victorian-warnings-protocol-august-2013)

3.4 Community Information and Warnings

Guidelines for the distribution of community information and warnings are contained in the VICSES Central Region Storm and Flood Emergency Plans and State Flood Emergency Plan.

Formal community information and warnings communication methods available include:

- One Source One Message (OSOM);
- emergency Alert;
- phone messages (including SMS);
- sirens;
- agency websites;
- VICSES Flood Storm Information Line;
- radio and television;
- two-way radio;
- mobile and fixed public address systems;
- verbal messages (i.e. Doorknocking);
- variable message signs (i.e. road signs); and
- community meetings.

Informal methods could also include:

- newspapers;
- email;
- telephone trees;
- Community Flood Observers;
- fax stream;
- newsletters;
- letter drops;
- social media and/or social networking sites (e.g. Twitter, Facebook).

Refer to **Appendix 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 the responsibility to assist VICSES to warn individuals within the community, including activation of flood warning systems where they exist. Responsibility for public information, including media briefings related to the response activities rests with VICSES as the Control Agency.

Other agencies such as CFA, DELWP and Victoria Police may be requested to assist VICSES with the communication of community storm and/or flood warnings.

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

The Department of Health and Human Services will disseminate information regarding public health precautions during and after the event.

3.5 Media Communication

The IC, through the Public Information Unit established at the ICC, will manage media communication. If the ICC is not established, the RDO will manage all media communication. Cardinia Shire will work with the IC to ensure that consistent and timely messaging occurs.

3.6 Impact assessment

An impact assessment can be conducted in accordance with Part 3 of the EMMV to assess and record the extent and nature of damage caused by the storm or flooding. This information may

then be used to provide the basis for further needs assessment and recovery planning by applicable recovery agencies.

Victoria Police is responsible for coordinating the collection, collations and dissemination of IA information on a whole-of-government basis. The IC is responsible for activating Victoria Police to undertake this function.

The purpose, function and conduct of IAs is outline in the State Flood Emergency Plan. All IAs should be conducted in accordance with Part 3 of the EMMV

The IC is responsible for co-ordinating the collection, collation and dissemination of Impact Assessment information.

Further information on IA can be found in Part 3 of the EMMV.

3.7 Preliminary Deployments

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

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 VICSES Central Region Storm and Flood Emergency Plans and State Storm and Flood Emergency Plans.

When conducting pre-event planning for flash floods the following steps should be followed (in the order as given).

1. Determine if there are barriers to evacuation by considering warning time, safe routes, resources available etc.;

2. Should evacuation should be the adopted strategy, it must be supported by public information, capability and a rescue contingency plan;

3. Where it is likely people will become trapped by floodwaters, 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 and to telephone 000 if they require rescue.

4. For buildings known to be structurally unsuitable 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.

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

Refer to **Appendix C** for response arrangements for flash flood events. Refer to VicRoads website for road closure information (http://alerts.vicroads.vic.gov.au).

3.9 Evacuation

In Victoria, evacuation is largely voluntary. However, in particular circumstances legislation provides some emergency services with authority to remove people from areas or prohibit their entry.

The decision to recommend or warn people to prepare to evacuate or to evacuate immediately rests with the IC, in conjunction with Victoria Police and, where possible, the EMT. It is the choice of individuals as to how they respond to this recommendation.

It is key that Council is involved in the decision-making process for evacuation as it has the responsibility to co-ordinate relief and recovery arrangements at a local level, which includes the establishment and maintenance of relief .

Once the decision to evacuate is made, Victoria Police are responsible for the coordination of the evacuation process where possible. VICSES and other agencies will assist where practical. VICSES is responsible for the development and communication of evacuation warnings in a timely fashion.

Victoria Police and/or Australian Red Cross may take the responsibility of registering people affected by an emergency, including those who have been evacuated, typically using Register.Find.Reunite.

Refer to Part 3 of the EMMV and the Evacuation Guidelines for guidance on evacuations for flood emergencies.

Refer to **Appendix D** of this Plan for detailed evacuation arrangements for Cardinia Shire.

3.10 Flood Rescue

Victoria Police, as the designated Control Agency for water rescue, co-ordinates rescues undertaken during flood events.

In order to activate water rescue services, VICSES as a Control Agency for overall flood response, will identify areas at risk of requiring rescue and notify the Officer in Charge of the Water Police Search and Rescue Squad to request pre-deployment of rescue resources to those areas.

In conducting rescues Victoria Police may require the assistance of appropriately trained and equipped personnel. In these circumstances, appropriately trained and equipped VICSES units or other agencies 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 should be undertaken prior to the commencement of Rescue operations (if not already conducted prior to the event).

Rescue is considered a high-risk activity for both rescuers and affected person(s) and should only be under taken by those competent and capable of undertaking it. It is an activity that is undertaken when all other strategies have failed and only as a last resort.

A dynamic risk assessment should always be undertaken before attempting a rescue in a flood environment.

Flood-specific rescue resources available for use within Cardinia Shire are detailed in **Appendix D.**

3.11 Aircraft Management

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

Air support operations will be conducted under the control of the IC in line with State Aircraft Policy 01– Air Operations..

3.12 Resupply

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

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

Council is responsible for the provision of relief across the Shire and resupply is a component of relief.

Where it is operationally safe to do so, VICSES may assist with the transport of essential items to isolated communities and assist with logistics functions. Resupply arrangements are to be included as part of the emergency relief arrangements as outlines in the Cardinia MEMP.

3.13 Essential Infrastructure and Property Protection

Essential infrastructure and property (e.g. roads and rail, energy supply, water and sewerage, communications etc.) may be affected in the event of a storm or flood.

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

Sandbag supplies are available through the VICSES Regional Headquarters and/or at hardware stores. The IC will determine the priorities related to the use of sandbags, which will be consistent with strategic priorities.

If sandbags are becoming limited in supply, then priority will be given to protection of essential infrastructure. If time permits, request for supplementary supply should be carried out in line with the *Cardinia Municipal Relief and Recovery Sub Plan and Appendix H- Sandbag Arrangements*.

Note: If the construction of temporary levees is considered by the Incident Controller to be necessary to preserve such essential infrastructure, then this must be done in consultation with the CMA, LGA and / or Victoria Police.

Refer **to Appendix C** for further specific details of essential infrastructure requiring protection and **Appendix H** for the location of sandbag collection point(s).

3.14 Disruption to Services

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

3.15 Road Closures

Cardinia Shire, Victoria Police and VicRoads will carry out their formal functions of road closures. This includes the observation and placement of warning signs and road blocks to its designated local and regional roads, bridges, walking and bike trails. Victoria Police may liaise with and advise Cardinia Shire Council and VicRoads of the need to erect warning signs and/or close roads and bridges under its jurisdiction. VicRoads is responsible for designated main roads and highways and councils are responsible for the designated local and regional road network.

VicRoads, Victoria Police and the Cardinia Shire Council will communicate community information regarding road closures as outlined in the Cardinia MEMP.

Council and VICSES should advise VicRoads when roads are reopened.

See also VicRoads Traffic alert webpage (http://alerts.vicroads.vic.gov.au/).

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.

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

3.17 Waste Water related Public Health Issues and Critical Sewerage Assets

South East Water and Yarra Valley Water are the responsible agencies for water and sewerage in Cardinia Shire Council.

Inundation of septic tanks and sewerage pump stations may result in significant health risks.

Where this has occurred or is likely, the responsible agency for the critical sewerage asset will:

- Advise VICSES of the security of sewerage assets to assist preparedness and response activities in the event of flood;
- Take necessary steps to preserve the functioning of these assets
- Advise the IC of the risk or actual inundation of sewerage or septic systems.

It is the responsibility of the Cardinia Shire Council Environmental Health Officer and/or the EPA to inspect and report to the Council's MERO and the ICC on any significant health risks related to flooding.

Council have mapping available on their GIS systems to identify properties that have septic tanks.

3.18 After Action Review

VICSES will coordinate the after-action review arrangements of storm and flood response operations as soon as practical following a significant event.

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

Part 4. EMERGENCY RELIEF AND RECOVERY ARRANGEMENTS

4.1 General

Arrangements for recovery from a storm or flood incident within Cardinia Shire are detailed in the Cardinia Shire MEMP and/or the Municipal Relief and Recovery Sub-plan.

Relief is the co-ordinated process of providing immediate life support and other essential needs to affected individuals and the community, and is primarily the responsibility of the municipality.

4.2 Initiating Emergency Relief

The IC determines the need for Emergency Relief services in accordance with Part 4 of the EMMV. ICs are responsible for ensuring that relief arrangements have been considered and implemented where required under the State Emergency Relief and Recovery Plan.

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

The designated relief centres identified for the provision of relief use during floods are detailed in the MEMP Relief and Recovery Sub Plan. However, Cardinia Shire's consequence management approach means that relief may delivered away from these identified fixed bases.

4.3 Recovery

Properly carried out, the process of relief also begins the process of recovery by stemming the impact of the event and the re-establishing societal norms and functions as much as is possible.

Recovery pertains to the rebuilding and reinstatement of the:

- social and community environment;
- built environment;
- natural environment; and
- economic environment.

The Department of Health and Human Services is the key partner in recovery, along with the Departments of Environment, Land, Water and Planning, and the Department of Economic Development, Jobs, Transport and Resources.

The arrangements for recovery from a flood incident within Cardinia Shire are included in the Cardinia MEMP Relief and Recovery Sub-plan and are monitored on behalf of the MEMP Committee by the Relief and Recovery Subcommittee.

4.4 Animal Welfare

Matters relating to the welfare of livestock, companion animals and wildlife, including veterinary euthanasia, in the recovery phase is the responsibility of DEDJTR.

Requests for assistance with stranded livestock is also co-ordinated by DEDJTR.

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

Relocation and placement of pets should be considered when establishing a relief centre.

4.5 Transition from Response to Recovery

VICSES, as the Control Agency, is responsible for ensuring effective transition from response to recovery in line with the Cardinia MEMP and Part 3 of the EMMV.

APPENDIX A – FLOOD THREATS FOR CARDINIA SHIRE

GENERAL

The Cardinia municipality is an outer-metropolitan fringe council located east of Melbourne, its western boundary id approximately 55 km from the CBD and it has an area of just over 1,280 km^2. The first European settlements within the municipality were in the late 1830s and since then the region has changed from a predominantly rural district to one that is a mixture of agriculture, lifestyle farming and urban areas. Cardinia Shire Council is home to more than 90,000 residents living in approximately 28,000 houses. 36,000 of these residents live in Pakenham, the shire's largest town.

Cardinia Shire straddles the eastern portion of the Dandenong Ranges, being part of the Great Dividing Range. The shire is bounded by Bunyip River to the east, Cardinia Creek to the west and Western Port Bay to the south. Parts of the upper Woori Yallock Creek catchment fall within the shire's boundary to the north, around Cockatoo and Emerald.

The dominant features of the shire are the steep ranges in the north and the lowlands of the extensive Koo Wee Rup Swamp, formed from a depressed basin between the Tyabb Fault and Heath Hill Fault. While these features extend outside the municipal boundary, the Koo Wee Rup Swamp of the lowland is a dominant landscape feature of the region; covering more than 400 km^2, with extensive flat areas surrounding the swamp.

The northern region of the municipality contains the southern slopes of the Dandenong Ranges. These steep slopes are the headwaters for a number of waterways in the municipality.

The southern catchments include the Lang Lang River and its tributaries. These stream systems descend onto the plains around Koo Wee Rup Swamp. The waterways of the lower catchments have been directed into channels which have overbank flows across the floodplains.

Typically, the flatter regions became a deposition zone for the larger catchments that drain into the area. This has formed a series of connected wetlands and continuous network of channels across the terrain that gave rise to the extensive peat swamps and lowland terrain of today.

RIVERINE FLOODING

Large, severe floods within the municipality generally occur as a result of a moist, warm airflow from northern Australia bringing moderate to heavy rainfall over a period of 12 hours or more following a prolonged period of general rainfall. The period of general rainfall "wets up" the catchments and (partially) fills both the on-stream dams and the natural floodplain storage. These factors combine to increase the run-off generated during the subsequent period of heavy rainfall.

Large but less-severe floods result from sequences of cold fronts during winter and spring that progressively wetten the catchments and fill the on-stream dams and natural floodplain storage. Prolonged moderate-to-heavy rain leads to major flooding.

FLASH FLOODING AND OVERLAND FLOWS

Short-duration, high-intensity rainfall (usually associated with thunderstorms) can also cause localised flooding within the municipality, along overland flow paths, when the local urban drainage system surcharges. 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 and localised damage can be severe.

High-intensity rainfall, such as that associated with thunderstorms giving average rainfall rates of more than 20mm/hour for an hour or more, is likely to lead to flash flooding and/or overland flows across the urbanised parts of the municipality.

Blocked or capacity-impaired stormwater drains can also lead to overland flows and associated flooding: the drain surcharges and excess water flows above ground.

TIDAL FLOODING AND STORM SURGES

Waterways within the municipality, which outfall into Western Port Bay, can be affected by tidal influences. In extreme cases, where flood waters and very low atmospheric pressures occur simultaneously, predicted levels can vary significantly. Depending on the hydraulic gradient of the flow in waterways, there is the potential for flood waters and high tide to back up water in these low-lying areas.

DESCRIPTION OF MAJOR WATERWAYS and DRAINS

The major waterways and drains within or bordering Cardinia Shire are as follows.

Melbourne Water Drains and Waterways	Suburb/s	Melbourne Water Drains and Waterways	Suburb/s
Adams Creek	Lang Lang	Macclesfield Creek	Avonsleigh
Adams Creek North Branch	Lang Lang	Maisey Drain	Iona and Modella
Adams Creek South Branch	Lang Lang	Maisey Extension Drain	Iona and Modella
Adams Drain	Cardinia	Malcolms Road Ext Drain	Catani
Ararat Creek	Nar Nar Goon, Nar Nar Goon North, Pakenham Upper and Tynong	Manks Road Drain East	Dalmore and Koo Wee Rup
Avonsleigh Creek	Avonsleigh	Manks Road Drain West	Dalmore
Back Creek	Gembrook	Martin Drain	Longwarry
Back Creek South East	Maryknoll, Nar Nar Goon, Nar Nar Goon North and Tynong North	Maryknoll Trib Of Back Creek	Nar Nar Goon North and Tynong North
Ballarto Road East Drain	Pakenham South	Mc Gregors Drain	Koo Wee Rup, Pakenham and Pakenham South
Ballarto Road West Drain	Pakenham South and Rythdale	Mcclures Drain	Bayles
Bastin #1 Drain	Bunyip and Longwarry	Mcdermids Drain	Modella
Bastin #2 Drain	Bunyip	Mcdonalds Catch Drain	Koo Wee Rup and Pakenham South
Batchelor Drain	Bunyip and Longwarry	Mcdonalds Drain	Koo Wee Rup and Pakenham South
Battys Island Drain	Cora Lynn and Tynong	Mcdonalds Drain #6	Catani
Beaconsfield Reservoir Drain	Beaconsfield Upper and Officer	Mcdonalds Road Drain	Pakenham
Beaconsfield Township Catchment Drain	Beaconsfield	Mcdonalds Road Drain North	Catani and Iona

Melbourne Water Drains and Waterways	Suburb/s	Melbourne Water Drains and Waterways	Suburb/s
Beaconsfield Township Corridor Drain	Beaconsfield	Mcgregor Road D.S.	Officer South and Pakenham
Bennets Road Drain	Catani	Mcgregors Catch Drain	Dalmore, Koo Wee Rup and Pakenham South
Berry Lane Drain	Bunyip	Mcivor Road and Miles Road Drain	Bunyip
Bessie Creek	Nar Nar Goon North and Pakenham Upper	Mckays Drain	Koo Wee Rup
Bethunes Road Drain	Koo Wee Rup	Mckenzies and Twelve-Ten Drains	Vervale
Billow Creek	Gembrook	Mckillops Drain	Cora Lynn
Bladens Drain	Koo Wee Rup	Mcnabs Road Drain	Bayles and Catani
Bourke Creek	Cockatoo, Dewhurst, Emerald, Mount Burnett and Pakenham Upper	Mcnamaras Drain	Koo Wee Rup
Bowdens Drain	Cardinia and Dalmore	Menzies Creek	Emerald
Brisbane Creek	Beaconsfield, Beaconsfield Upper and Guys Hill	Milligans Road Drain	Cora Lynn
Brownbills Drain	Garfield	Modella Road Drain	Modella
Bunyip Main Outfall Drain	Bayles, Bunyip, Cora Lynn, Garfield, Iona, Koo Wee Rup, Koo Wee Rup North, Long Warry, Nar Nar Goon and Vervale	Monomeith Drain	Caldermeade, Catani, Monomeith and Yannathan
Bunyip Modella Road Drain	Bunyip, Iona and Modella	Moomba Creek	Gembrook
Bunyip River (Lower)	Bunyip, Bunyip North, Gembrook, Longwarry, Longwarry North and Tonimbuk	Morris Creek	Gembrook
Bunyip Showground Drain	Bunyip	Mount Ararat Drain	Nar Nar Goon and Pakenham
Calverts Drain	Tynong	Muddy Creek	Emerald
Camerons Drain	Catani and Cora Lynn	Muddy Creek	Menzies Creek
Cannibal Creek	Bunyip North, Garfield North and Tynong North	Murray Road Drain	Bunyip, Cora Lynn, Iona and Vervale
Cardinia Catch Drain	Cardinia, Dalmore and Koo Wee Rup	No. 6 Yallock Drain	Bayles, Catani, Iona and Modella
Cardinia Creek (Lower)	Beaconsfield, Beaconsfield Upper, Cardinia, Emerald, Guys Hill, Officer and Officer South	Nash Creek	Gembrook
Cardinia Road Drain	Officer, Officer South, Pakenham and Pakenham South	No.5 Yallock Drain	Bayles, Catani, Monomeith and Yannathan
Carses Drain	Iona	North West Catch Drain	Cora Lynn, Koo Wee Rup, Koo Wee Rup North, Nar Nar Goon and Vervale
Catani Drain	Catani	Northern Boundary Drain	Nar Nar Goon, Pakenham and Pakenham South
Clark Creek	Gembrook	Northern Boundary Extn Drain	Garfield, Nar Nar Goon and Tynong
Coast Road Drain	Koo Wee Rup	No. 4 Yallock Drain	Bayles, Cora Lynn, Koo Wee Rup and Monomeith
Cochranes Drain	Koo Wee Rup	No. 7 Yallock Drain	Bayles, Cora Lynn, Iona and Modella
Cockatoo Creek	Avonsleigh, Cockatoo, Gembrook, Mount Burnett	O'Briens Drain	Bayles and Yannathan

Melbourne Water Drains and Waterways	Suburb/s	Melbourne Water Drains and Waterways	Suburb/s
	and Nangana		
Coles Drain	Bayles	Officer Creek	Officer
Convent Road Drain	Cora Lynn and Nar Nar Goon	Officer South Drain	Officer and Officer South
Cook Drain	Bunyip and Longwarry	Old Deep Creek Levee	Pakenham and Pakenham South
Costellos Drain	Cora Lynn	Old Lang Lang River	Caldermeade, Heath Hill, Lang Lang and Yannathan
Coxs Drain	Bayles	O'Neils Drain	Catani and Yannathan
Creek 2504	Lang Lang	O'Neils Road Drain	Beaconsfield
Cruddens Grip	Iona	Pakenham Creek Drain	Pakenham
Cunninghams Drain	Tynong	Pancake Creek	Cockatoo, Gembrook and Nangana
Curries Drain	Iona and Modella	Parish Road Drain	Iona, Longwarry and Modella
Daleys Road Drain	Koo Wee Rup	Pattersons Drain	Koo Wee Rup
Davidsons Creek	Beaconsfield and Officer	Pecks Road Drain	Bayles
Dawson Road Ext Drain	Modella	Phillips Road Drain	Bayles
Deep Creek (Lower)	Dalmore, Koo Wee Rup, Pakenham, Pakenham South and Rythdale	Pitts Road Drain	Iona and Vervale
Deep Creek Catch Drain	Dalmore, Koo Wee Rup, Pakenham South and Rythdale	Quigleys Road Drain	Cora Lynn
Deep Creek South Drain	Pakenham	Quirks Creek	Officer and Pakenham
Denhams Road Drain	Koo Wee Rup	Railway Borrow Drain	Bayles and Catani
Diamond Creek South East	Gembrook, Tonimbuk and Tynong North	Railway Road Drain	Koo Wee Rup
Dingo Creek	Tonimbuk	Regans Road Drain	Nar Nar Goon
Dyer Creek	Gembrook	Ridgeways Drain	Cardinia
Eastern Drain Drain	Pakenham	Roxburghs Drain	Cora Lynn and Iona
Egans Drain (2962)	Bayles and Koo Wee Rup	Russell Creek	Gembrook
Egertons Road Drain	Dalmore	Rythdale Drain	Pakenham South and Rythdale
Eight Mile Drain	Nar Nar Goon	Sandy Creek	Heath Hill
Eleven Mile Drain	Cora Lynn, Garfield, Tynong and Vervale	Sardine Creek	Gembrook
Ellet Road Drain	Pakenham South	Scanlons Drain	Bayles and Catani
Endicotts Drain	Bunyip	Searle Gully	Gembrook
Fallon Drain	Iona	Seven Acres Creek	Gembrook
Fifteen Mile Drain	Bunyip	Seven Mile Drain	Nar Nar Goon
Fincks Road Drain	Bayles	Shepherd Creek	Gembrook and Nangana
Five Mile Drain	Koo Wee Rup North, Pakenham and Pakenham South	Shepherd Creek East Branch	Gembrook
Flanningans Creek	Gembrook	Shepherd Creek West Branch	Gembrook
Fogartys Drain	Pakenham South	Sidebottoms Road Drain	Iona
Fogartys Road Drain	Pakenham South	Simpsons Road Drain	Iona and Vervale
Forbes Road Trib Of Back Creek	Maryknoll, Nar Nar Goon North and Tynong North	Sinclairs Road Drain	Cora Lynn
Fourteen Mile Drain	Garfield and Iona	Sixteen Mile Drain	Bunyip
Gardiners Drain	Modella	Smedleys Creek	Gembrook
Gembrook Creek	Cockatoo, Gembrook and	Soldiers Drain	Longwarry

Melbourne Water Drains and Waterways	Suburb/s	Melbourne Water Drains and Waterways	Suburb/s
	Mount Burnett		
Giles Road Drain	Dalmore and Koo Wee Rup	Soldiers Road East Drain	Pakenham South and Rythdale
Gleesons Road Drain	Tynong	Soldiers Road West Drain	Rythdale
Grays Drain	Koo Wee Rup	South East Main Catch Drain	Bayles, Cora Lynn, Koo Wee Rup and Koo Wee Rup North
Greaves Drain	Catani	Southern Boundary Drain	Bayles and Koo Wee Rup
Griffiths Drain	Bayles, Cora Lynn, Koo Wee Rup and Koo Wee Rup North	Stanlakes Road Drain	Lang Lang
Griggs Drain	Tynong	Stoney Creek	Beaconsfield Upper
Gully Drain	Bunyip and Longwarry	Strafford Lane Drain	Bunyip
Gum Scrub Creek	Cardinia, Dalmore, Officer, Officer South and Rythdale	Swains Drain	Catani and Yannathan
Gunns Drain	Garfield and Vervale	Taplins Road Drain	Catani and Iona
Hagelthornes Drain	Koo Wee Rup, Pakenham South and Rythdale	Taylors East Drain	Catani
Hall Drain	Koo Wee Rup North and Nar Nar Goon	Taylors West Drain	Bayles and Yannathan
Hall Road Yallock Drain	Bayles and Yannathan	Tea Tree Creek	Bunyip, Bunyip North and Garfield
Hamilton Creek	Garfield North	Ten Mile Drain (Nine Mile Rd)	Cora Lynn, Nar Nar Goon and Tynong
Hancocks Gully	Nar Nar Goon, Nar Nar Goon North and Pakenham	Thirteen Mile Drain	Garfield and Vervale
Harold Creek	Gembrook	Thompsons Drain	Bunyip and Longwarry
Haunted Gully Creek	Officer	Tomahawk Creek	Gembrook
Head Creek	Gembrook	Toomuc Creek (Lower)	Cardinia, Dalmore, Dewhurst, Koo Wee Rup, Officer South, Pakenham, Pakenham South, Pakenham Upper and Rythdale
Heads Road (Osheas) Drain	Catani	Tooradin Inlet Drain	Cardinia and Dalmore
Hein Creek	Beaconsfield Upper and Pakenham	Tooradin Inlet East Catch Drain	Cardinia
Himbecks Drain	Koo Wee Rup	Tooradin Inlet West Catch Drain	Cardinia
Hogans Road Drain	Bayles	Tooradin Road Drain	Dalmore
Holts Drain	Heath Hill and Modella	Triangle Creek	Gembrook
Hornbuckles Road and Extn Drain	Catani	Two Mile Creek West	Bunyip North, Garfield North and Tonimbuk
Humphries Road Drain	Catani and Iona	Tynong Creek	Gembrook and Tynong North
Island Road East Drain	Koo Wee Rup	Tynong Road Drain	Nar Nar Goon and Tynong
Island Road West Drain	Koo Wee Rup	Walford Creek	Beaconsfield Upper
Jetty Lane Drain	Lang Lang	Walford Creek	Dewhurst
Johnsons Drain	Koo Wee Rup	Walford Creek	Pakenham Upper
Jonas Creek	Gembrook	Walkers Road Drain	Garfield and Vervale
Kennedy Creek	Pakenham	Walkers Road Drain Extension	Bunyip and Garfield
Kitchen Creek	Beaconsfield Upper, Pakenham and Pakenham Upper	Walley Drain	Bunyip

Melbourne Water Drains and Waterways	Suburb/s	Melbourne Water Drains and Waterways	Suburb/s
Knights Road Drain	Longwarry	Walshs Drain	Catani
Koo-Wee-Rup South Drain	Koo Wee Rup	Watsons Road Drain	Bayles
Lang Lang River (Lower)	Caldermeade, Heath Hill, Lang Lang and Yannathan	Wattle Creek	Avonsleigh, Cockatoo and Emerald
Langridge St Drain	Beaconsfield Upper	West Dalmore Road Drain	Cardinia, Dalmore and Koo Wee Rup
Lias Road Drain	Nar Nar Goon and Pakenham South	Whittas Road Drain	Nar Nar Goon
Linehams Drain	Iona and Modella	Wilkinsons Drain	Bayles
Link Creek	Gembrook	William Wallace Creek	Gembrook
Little Lang Lang River Sth Branch	Lang Lang	Worlley Creek	Gembrook
Little Lang Lang River	Lang Lang and Lang Lang East	Worships Road Drain	Pakenham South
Little Yannathan Road Dr (2941)	Cora Lynn, Iona, Longwarry, Modella and Vervale	Wrights Drain	Bunyip and Longwarry
Lone Pine Road Drain	Bunyip and Garfield	Yallock Creek	Bayles, Caldermeade, Koo Wee Rup and Monomeith
Longwarry Drain	Bunyip and Longwarry	Yallock Cut and Levee	Caldermeade and Monomeith
Longwarry Recreational Drain	Longwarry		

Table A1 – Melbourne Water Drains and Waterways within or bordering Cardinia Shire

The Bunyip River, also known as the Bunyip Main Drain, consists of the Tarago and Bunyip River systems, which converge above the Princes Highway near the township of Bunyip. These systems extend from the head waters within the Bunyip State Forest and Black Snake Range. This part of the Bunyip River catchment is largely natural.

The Bunyip Main Drain, below the Princes Highway, is a mostly man-made channel, which extends from just above the Princes Highway at Bunyip down through the Koo Wee Rup township to Western Port Bay. At Cora Lynn, the Yallock Outfall Drain (diversion channel) was constructed in 1956 to alleviate the pressure of high level flood waters at Koo Wee Rup. This outfall drain diverts water directly to Western Port Bay at Monomeith.

The Lang Lang River is the second-largest waterway in the municipality and it extends from the head waters near Ranceby and Poowong and meets Western Port Bay near the Lang Lang township. The river's bed and banks are in semi-natural condition but some man-made interventions are present along its course, mainly below Yannathan.

The Cardinia, Deep and Toomuc Creek catchments are also significant waterways within the municipality, in terms of flooding impacts to the community. These waterways have been significantly modified in their lower reaches.

See **Appendix G** for Catchment Schematics on these waterways.

FLOOD-MITIGATION SYSTEMS

Flood mitigation has predominantly been developed in the form of eight retarding basins and 35 levees. These flood-mitigation systems are as follows. To view their locations and connecting waterway/drainage systems, see mapping in **Appendix F**.

RETARDING BASINS

Melbourne Water Retarding Basin	On Drain/ Waterway	Area	Storage Capacity	Spillway Crest Level	Full Supply Level	Embankment Crest Level	ANCOLD Hazard Rating	Houses In Flow Path (dam breach)	Melway Reference
Cardinia Creek	Cardinia Creek, Beaconsfield	39.67 ha	850 ML	46.1m AHD	Unknown	49.5m AHD	High C	Unknown	131 K2
Cardinia Creek Drop Structure	Cardinia Creek, Officer South	15.5 ha	200 ML	29.1m AHD	29.1m AHD	31.2m AHD	Low	Unknown	214 B11
Cardinia Road Wetlands	Cardinia Road Drain, Officer	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	215 D6
Deep Creek	Deep Creek, Pakenham	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	317 J9
Edenbrook Park	Toomuc Creek, Pakenham	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	215 H10
Rix Road Wetland	Cardinia Road Drain, Officer	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	215 C8
Shearwater Wetland	Cardinia Road Drain, Pakenham	2.64 ha	16.9 ML	29.5m AHD	29.5m AHD	29.5m AHD	Very Low	0	215 E5
Tyalla Way	Cardinia Road Drain, Pakenham	Unknown	Unknown	31.5m AHD	31.5m AHD	33.75m AHD	Very Low	0	215 E4

Table A2 – Melbourne Water Retarding Basins within Cardinia Shire

LEVEES

Levee	Reach	Side	Levee Height	Levee Length	Expected Level of Protection	ANCOLD Hazard Rating	Consequences of Failure	VicMap Central Reference
Cardinia Creek	Upstream of Ballarto Road to Island Rd	West	3m	4.8m	Unknown	Low	1 house and agricultural land flooded	6763 A12-6822 D1
Cardinia Creek	Upstream of Ballarto Road to Island Rd	East	2m	4.7m	Unknown	Unknown	Unknown	6763 A12-D15
Cardinia / Gum Scrub Creek Outfall	Island Road to Manks Rd	West	4m	1.6m	Unknown	Low	2 houses and agricultural land flooded	6822 D1-D2
Cardinia / Gum Scrub Creek Outfall	Manks Road to Railway Line	West	3m	1.6m	Unknown	Low	3 houses, 2 industrial buildings and agricultural land flooded	6822 D2-D4

Levee	Reach	Side	Levee Height	Levee Length	Expected Level of Protection	ANCOLD Hazard Rating	Consequences of Failure	VicMap Central Reference
Cardinia / Gum Scrub Creek Outfall	Railway Line to Sth Gippsland Highway	West	3m	2.0m	Unknown	Low	2 industrial buildings and agricultural land flooded	6822 D4-D6
Cardinia / Gum Scrub Creek Outfall	Sth Gippsland Highway to Westernport Bay	West	Unknown	0.2m	Unknown	Very Low	Agricultural land flooded	6822 D6
Deep Creek	Five Mile Road to McDonalds Drain Rd	East	1m	2.7m	Unknown	Very Low	Agricultural land flooded	526A5 - 6763 K10
Deep Creek	McDonalds Drain Road to Pakenham KooWeeRup Rd	East	2m	2.2m	Unknown	Very Low	Agricultural land flooded	6763 K10 - H10
Deep Creek	Pakenham KooWeeRup Road to McGregor Rd	East	3m	2.4m	Unknown	Low	3 houses, 1 Industrial building and agricultural land flooded	6763 H10 - F11
Toomuc / Deep Creek Outfall	Wenn Road to Hagelthorns Drain	East	2m to 3m	3.9m	Unknown	Low	2 houses and agricultural land flooded	6763 E12 - D15
Deep Creek	McGregor Road to Railway Rd	East	3m	8.7m	Unknown	Low	6 houses and agricultural land flooded	6763 F11 – 6822 D4
Northern Boundary Drain	Ararat Creek to Eight Mile Rd	South	2m	1.8m	Unknown	Significant	3 houses, 7 industrial buildings and agricultural land flooded	526 D5 - 6764 G10
Northern Boundary Drain	Eight Mile Road to Five Mile Rd	South	2m	4.5m	Unknown	Low	3 houses, 1 industrial buildings and agricultural land flooded	6764 G10 - C11
Northern Boundary Drain	Five Mile Road to McDonalds Drain Rd	South	2m	3.0m	Unknown	Low	3 houses, 2 industrial buildings and agricultural land flooded	6764 C11 - 6763K11
McDonalds Drain	McDonalds Drain Road to Bunyip Main Drain	East	3m	6.3m	Unknown	Unknown	Agricultural land and farm properties flooded	6763 K11 - 6822 J2
McDonalds Drain	McDonalds Drain Road to Bunyip Main Drain	West	3m	6.4m	Unknown	Unknown	Agricultural land and farm properties flooded	6763 K11- 6822J2
Bunyip Main Drain	13 Mile Road to Cora Lynne	South	Unknown	6.0m	Unknown	Low	3 houses and agricultural land flooded	6765 D12- 6764J13
Bunyip Main Drain	13 Mile Road to Cora Lynne	North	Unknown	4.7m	Unknown	Significant	27 houses, 2 industrial buildings and agricultural land flooded	6765 C12- 6764 H13
Bunyip Main Drain	Cora Lynne to Ballarto Rd	North	2.5m	6.4m	Unknown	Significant	14 houses, 9 industrial buildings and agricultural land flooded	6764 H13- 6764 B15
Bunyip Main Drain	Cora Lynne to Ballarto Rd	South	2.5m	6.4m	Unknown	Significant	10 houses, 13 industrial buildings and agricultural land flooded	6764 H13- 6764 B15
Bunyip Main Drain	Ballarto Road to Railway Line	North	4m	6.6m	Unknown	Significant	4 houses, 12 industrial buildings and agricultural land flooded	6764 B15- 6822 G4

Levee	Reach	Side	Levee Height	Levee Length	Expected Level of Protection	ANCOLD Hazard Rating	Consequences of Failure	VicMap Central Reference
Bunyip Main Drain	Ballarto Road to Railway Line	South	4m	6.6m	Unknown	Significant	45 houses, 19 industrial buildings and agricultural land	6764 B15 - 6822 G4
Bunyip Main Drain	Railway Line to Sth Gippsland Highway	North	3m	2.3m	Unknown	Very Low	Agricultural land flooded	6822 G4-F6
Bunyip Main Drain	Railway Line to Sth Gippsland Highway	South	3m	2.3m	Unknown	Very Low	Agricultural land flooded	6822 G4-F6
Bunyip Main Drain	Sth Gippsland Highway to Westernport Bay	North	1m	1.4m	Unknown	Very Low	Agricultural land flooded	6822E6-D7
Bunyip Main Drain	Sth Gippsland Highway to Westernport Bay	South	1m	2.0m	Unknown	Very Low	Agricultural land flooded	6822E7-F8
Yallock Outfall	Cora Lynne to Bayles	West	2m	4.8m	Unknown	Significant	13 houses, 8 industrial buildings and agricultural land flooded	6764H14-6823F2
Yallock Outfall	Cora Lynne to Bayles	East	2m	5.0m	Unknown	Low	6 houses, 1 industrial building and agricultural land flooded	6764H14-6823F2
Yallock Outfall	Bayles to Railway Line	West	2m	7.8m	Unknown	Low	4 houses, 5 industrial buildings and agricultural land flooded	6823F2-6822J6
Yallock Outfall	Bayles to Yallock Straight Cut	East	2m	3.3m	Unknown	Low	2 houses, 1 industrial building and agricultural land flooded	6823F2-6823C4
Yallock Outfall	Yallock Straight Cut to Railway Line	East	2m	3.6m	Unknown	Very Low	Agricultural land flooded	6823C4-6822K6
Yallock Outfall	Railway Line to Sth Gippsland Highway	West	2m	0.8m	Unknown	Very Low	Agricultural land flooded	6822J6
Yallock Outfall	Yallock Straight Cut from Railway Line to Sth Gippsland Highway	East	2m	0.4m	Unknown	Very Low	Agricultural land flooded	6822K6
Yallock Outfall	Sth Gippsland Highway to Westernport Bay	West	1m	2.5m	Unknown	Very Low	Agricultural land flooded	6822J6-G8
Yallock Outfall	Sth Gippsland Highway to Westernport Bay	East	1m	2.2m	Unknown	Very Low	Agricultural land flooded	6822K6-H8

Table A3 – Levees within Cardinia Shire

FLOOD WARNING SYSTEM

Within Cardinia Shire, Melbourne Water has 17 hydrographic monitoring sites along the municipality's seven major waterways. These are outlined in the table below. There are also monitors upstream from Longwarry North along the Tarago River. These gauges can be monitored online through Melbourne Water (http://www.melbournewater.com.au/waterdata/rainfallandriverleveldata/Pages/Rainfall-and-river-level-new.aspx) or through the Bureau of Meteorology (http://www.bom.gov.au/cgi-bin/wrap_fwo.pl?IDV60201.html).

Hydrographic Monitoring Station	Station No.	Location	Owner	Gauge Type	Mapping Ref
Bunyip River at Headworks	228207A	Along the Aqueduct Track in Gentle Annie. Eastern side of the River	Melbourne Water	Stream Level and Rain	VicMap Central 6699 K6
Bunyip River at Tonimbuk	228212	Western bank of the River off Jolley Road, Tonimbuk	Melbourne Water	Stream Level and Rain	VicMap Central 6700 B14
Bunyip River d/s Cannibal Creek, Longwarry North	228255A	Western bank of the river 700m down an unnamed road off Morrison Road, Longwarry North	Melbourne Water	Stream Level and Rain	VicMap Central 6766 A6
Bunyip River at Iona	228213A	North side of the drain at Fourteen Mile Road, Iona	Melbourne Water	Stream Level and Rain	VicMap Central 6765 E11
Bunyip River at Cora Lynn Ford	228380A	Southeast corner of the Bunyip Main and No. 4 Yallock Drains Junction on Main Drain Road South, Cora Lynn	Melbourne Water	Stream Level	VicMap Central 6764 J13
Bunyip River at Koo Wee Rup	228395A	Along Bunyip Main Drain at Disused Railway Bridge 100m South of Station St, Koo Wee Rup	Melbourne Water	Stream Level and Rain	VicMap Central 6822 G4
Yallock Outfall at Murray Road, Cora Lynn	228225A	West Bank of No.4 Yallock Drain at Murray Road Bridge, Cora Lynn	Melbourne Water	Stream Level	VicMap Central 6764 G15
Lang Lang River at Heads Road, Yannathan	228209B	Northern side of River 500m down unnamed road off Heads Road, Yannathan	Melbourne Water	Stream Level and Rain	VicMap Central 6824 A9
Emerald (Cardinia Reservoir)	586033	Along Road 7 at Cardinia Reservoir, Emerald	Melbourne Water	Rain	Melway 126 G10
Cardinia Creek d/s Cardinia Reservoir, Beaconsfield Upper	228258A	North side of the creek at end of Duffys Road, Beaconsfield Upper	Melbourne Water	Stream Level	Melway 210 C3
Cardinia Creek Drop Structure, Officer South	228382A	Eastern bank of the creek within the Drop Structure R/B, Officer South	Melbourne Water	Stream Level and Rain	Melway 214 C12
Cardinia Creek at Chasemore Road, Cardinia	228228A	Western bank of the creek at Chasemore Road, Clyde North	Melbourne Water	Stream Level and Rain	VicMap Central 6762 K11
Gum Scrub Creek at Princes Highway, Officer	228365A	At Princes Highway Bridge, in the centre median strip, Officer	Melbourne Water	Stream Level and Rain	Melway 215 A4
Pakenham Upper	586201	70m Southwest of Shelton and Huxtable Roads Intersection, Pakenham Upper	Melbourne Water	Rain	Melway 313 G10
Toomuc Creek at Princes Highway, Pakenham West	228217C	At Princes Highway Bridge, in the centre median strip, Pakenham	Melbourne Water	Stream Level	Melway 215 K4
Kennedy Creek at Kennedy Road, Pakenham	228364A	West bank of the creek on Kennedy Road, Pakenham	Melbourne Water	Stream Level	Melway 317 G3
Deep Creek u/s of Princes Highway, Pakenham East	228363A	West side of the creek 900m north of Princes Highway	Melbourne Water	Stream Level	Melway 318 C5

Table A4 – Hydrographic Monitoring Stations within Cardinia Shire

Other gauges located in adjoining municipalities that may assist in flood warning for the Tarago River and Lang Lang River are as follows.

Hydrographic Monitoring Station	Station No.	Location	Owner	Gauge Type	Mapping Ref
Berwick	586199	Beaumont Road, Berwick	Melbourne Water	Rain	Melway 111 G2
Nayook	228804A	End of McIntyre Road, Nayook	Melbourne Water	Rain	VicMap Central 6701 F4
Tarago River East Branch at Neerim	228238A	East bank of the river, 200m north of Elton Road, Neerim	Melbourne Water	Stream Level and Rain	VicMap Central 6701 G7
Tarago River at Neerim	228206B	East bank of the river at Elton Road, Neerim	Melbourne Water	Stream Level	VicMap Central 6701 G8
Tarago Reservoir	586198	East side of Tarago Reservoir Road, Neerim South	Melbourne Water	Rain	VicMap Central 6701 H14
Tarago River at Neerim South	228219C	East bank of the river at Jindivick – Neerim South Road, Neerim South	Melbourne Water	Stream Level	VicMap Central 6701 G15
Tarago River at Drouin West	228201B	North bank of the river 80m west of Fisher Road, Drouin West	Melbourne Water	Stream Level and Rain	VicMap Central 6766 H7
Upper Lang Lang	586196	North side of Drouin – Korumburra Road, Poowong East	Melbourne Water	Rain	VicMap Central 6878 G7

Table A5 – Hydrographic Monitoring Stations within adjacent Municipalities to Cardinia Shire

There are currently five Melbourne Water flood warning gauges on the Bunyip River, Lang Lang River, Cardinia Creek and Gumscrub Creek that could be used to assist with public safety through the issuing of flood warnings. Those gauges with flood class levels established are outlined below. The Bureau of Meteorology (the Bureau) does not issue formal flood warnings for the Toomuc, Kennedy and Deep Creeks due to their rapid response to rainfall.

Hydrographic Monitoring Station	River / Creek Flood Class Level (m)		
	Minor	Moderate	Major
Bunyip River at Iona	2.1m	5.0m	6.0m
Bunyip River at Cora Lynn Ford	3.1m	4.1m	4.5m
Lang Lang River at Heads Road, Yannathan	3.5m	4.0m	4.9m
Cardinia Creek at Chasemore Road, Cardinia	2.7m	3.0m	3.4m
Gumscrub Creek at Princes Highway, Officer	2.1m	2.6m	-

Table A6 – Hydrographic Monitoring Stations with established Flood Class Levels for Cardinia Shire

At these sites the Bureau, in consultation with Melbourne Water, will issue flood warnings if levels reach certain points (Table A6). This warning will be placed on the Bureau's website (**http://www.bom.gov.au/vic/warnings/index.shtml**). While Cardinia Shire Council monitors these warnings in times of high rainfall, there are no specific guidelines to advise how these situations should be responded to.

HISTORIC FLOODS

Significant floods (with high flood-gauge levels and likely flooding consequences to property and infrastructure) to have occurred within Cardinia Shire are as follows (Table A7).

Event	Bunyip River at Iona		Bunyip River at Cora Lynn	Bunyip River at Koo Wee Rup		Cardinia Creek at Cardinia		Gumscrub Creek At Officer		Toomuc Creek at Pakenham West
	Rainfall	Stream Level	Stream Level	Rainfall	Stream Level	Rainfall	Stream Level	Rainfall	Stream Level	Stream Level
Normal Water Level	-			-		-		-		
Minor Flood Class	-	2.1m	3.1m	-	-	-	2.7m	-	2.1m	-
Moderate Flood Class	-	5.0m	4.1m	-	-	-	3.0m	-	2.6m	-
Major Flood Class	-	6.0m	4.5m	-	-	-	3.4m	-	-	-
1891	-	-	-	-	-	-	-	-	-	-
April 1900	-	-	-	-	-	-	-	-	-	-
April 1901	-	-	-	-	-	-	-	-	-	-
June 1911	-	-	-	-	-	-	-	-	-	-
October 1923	-	-	-	-	-	-	-	-	-	-
August 1924	-	-	-	-	-	-	-	-	-	-
1st December 1934	170mm / 48hrs	-	-	-	-	-	-	192mm / 48 hrs	-	-
April 1935	-	-	-	-	-	-	-	-	-	-
October 1937	-	-	-	-	-	-	-	-	-	-
November 1956	-	-	-	-	-	-	-	-	-	-
September 1956	-	-	-	-	-	-	-	-	-	-
November 1971	-	7.20m	-	-	-	-	-	-	-	-
15th May 1974	-	4.14m	-	-	-	-	3.98m	-	-	-
18th September 1975	-	3.03m	-	-	-	-	1.86m	-	-	-
29th July 1977	-	3.20m	-	-	-	-	1.60m	-	-	-
10th August 1978	-	3.17m	-	-	-	-	1.71m	-	-	0.75m
20th November 1978	-	3.00m	-	-	-	-	2.42m	-	-	1.07m
22nd August 1981	-	3.41m	-	-	-	-	1.85m	21mm / 18 hrs	1.85m	0.93m

Event	Bunyip River at Iona		Bunyip River at Cora Lynn	Bunyip River at Koo Wee Rup		Cardinia Creek at Cardinia		Gumscrub Creek At Officer		Toomuc Creek at Pakenham West
	Rainfall	Stream Level	Stream Level	Rainfall	Stream Level	Rainfall	Stream Level	Rainfall	Stream Level	Stream Level
Normal Water Level	-			-		-		-		
Minor Flood Class	-	2.1m	3.1m	-	-	-	2.7m	-	2.1m	-
Moderate Flood Class	-	5.0m	4.1m	-	-	-	3.0m	-	2.6m	-
Major Flood Class	-	6.0m	4.5m	-	-	-	3.4m	-	-	-
14th September 1983	-	3.40m	-	-	-	-	1.98m	25mm / 17 hrs	2.19m	0.95m
17th October 1983	-	3.02m	-	-	-	-	2.92m	64mm / 30 hrs	2.43m	1.08m
29th July 1984	-	3.24m	-	-	-	-	1.31m	30mm / 78 hrs	1.36m	0.90m
19th September 1984	-	5.61m	-	-	-	-	4.44m	107mm / 60 hrs	**2.68m**	1.64m
7th November 1985	-	3.68m	-	-	-	-	0.75m	61mm / 67 hrs	2.18m	1.28m
29th July 1987	-	3.31m	-	-	-	-	3.50m	65mm / 25 hrs	2.44m	1.31m
11th June 1989	-	3.10m	-	-	-	-	3.07m	74mm / 40 hrs	2.35m	1.28m
28th October 1989	-	4.10m	-	-	-	-	2.07m	38mm / 29 hrs	2.43m	1.24m
31st October 1989	-	4.18m	-	-	-	-	2.47m	35mm / 16 hrs	2.36m	1.15m
12th October 1990	-	6.28m	-	-	-	-	4.09m	71mm / 20 hrs	2.43m	1.59m
18th September 1991	-	3.27m	-	-	-	-	2.03m	42mm / 36 hrs	2.17m	1.06m
11th October 1992	-	3.27m	-	-	-	-	1.72m	50mm / 60 hrs	2.05m	0.99m
16th September 1993	-	5.28m	-	-	-	-	2.81m	45mm / 33 hrs	2.07m	1.16m
12th June 1995	40mm / 73 hrs	3.25m	-	-	-	-	0.95m	24mm / 79 hrs	1.57m	0.78m
23rd October 1995	60mm / 83 hrs	3.81m	-	-	-	55mm / 83 hrs	1.26m	55mm / 84 hrs	2.33m	0.97m
6th November 1995	33mm / 50 hrs	3.32m	-	-	-	-	1.41m	62mm / 72 hrs	2.06m	1.03m
30th July 1996	40mm / 19 hrs	5.95m	2.62m	-	-	31mm / 13 hrs	3.62m	39mm / 21 hrs	2.41m	1.49m
8th August 1996	29mm / 46 hrs	3.33m	1.61m	-	-	25mm / 37 hrs	0.57m	15mm / 34 hrs	0.84m	0.78m
1st October 1996	12mm / 22 hrs	3.16m	1.51m	-	-	27mm / 17 hrs	1.28m	25mm / 28 hrs	1.73m	1.14m
13th November 2004	41mm / 7 hrs	5.36m	1.68m	34mm / 7 hrs	3.78m	30mm / 7 hrs	3.14m	41mm / 7 hrs	2.60m	1.46m
3rd February 2005	78mm / 24 hrs	3.49m	-	101mm / 25 hrs	3.13m	118mm / 25 hrs	3.20m	148mm / 27 hrs	2.43m	1.57m
13th September 2005	25mm / 19 hrs	2.27m	3.15m	19mm / 19 hrs	2.61m	15mm / 19 hrs	0.39m	19mm / 16 hrs	0.46m	0.54m
28th September 2009	29mm / 19 hrs	2.66m	3.41m	17mm / 9 hrs	3.20m	16mm / 9 hrs	0.84m	30mm / 18 hrs	1.40m	0.86m

Event	Bunyip River at Iona		Bunyip River at Cora Lynn	Bunyip River at Koo Wee Rup		Cardinia Creek at Cardinia		Gumscrub Creek At Officer		Toomuc Creek at Pakenham West
	Rainfall	Stream Level	Stream Level	Rainfall	Stream Level	Rainfall	Stream Level	Rainfall	Stream Level	Stream Level
Normal Water Level	-			-		-		-		
Minor Flood Class	-	2.1m	3.1m	-	-	-	2.7m	-	2.1m	-
Moderate Flood Class	-	5.0m	4.1m	-	-	-	3.0m	-	2.6m	-
Major Flood Class	-	6.0m	4.5m	-	-	-	3.4m	-	-	-
31st October 2010	42mm / 16 hrs	2.56m	3.21m	46mm / 21 hrs	3.12m	51mm / 20 hrs	2.11m	69mm / 21 hrs	1.91m	1.11m
21st December 2010	36mm / 17 hrs	2.65m	3.34m	16mm / 16 hrs	3.14m	12mm / 6 hrs	0.43m	10mm / 6 hrs	0.71m	0.59m
5th February 2011	175mm / 28 hrs	**7.33m**	**4.63m**	77mm / 27 hrs	**4.89m**	99mm / 27 hrs	**4.87m**	203mm / 29 hrs	2.66m	**2.19m**
12th April 2011	33mm / 7 hrs	2.29m	3.26m	42mm / 9 hrs	2.81m	29mm / 7 hrs	0.71m	33mm / 8 hrs	0.79m	0.81m
11th August 2011	15mm / 8 hrs	2.27m	3.14m	14mm / 11 hrs	2.74m	13mm / 11 hrs	0.47m	14mm / 10 hrs	0.58m	0.62m
30th September 2011	29mm / 6 hrs	2.27m	3.18m	27mm / 6 hrs	2.89m	31mm / 6 hrs	0.71m	36mm / 6 hrs	0.75m	0.72m
10th November 2011	52mm / 7 hrs	3.87m	3.76m	32mm / 8 hrs	3.75m	22mm / 7 hrs	0.80m	27mm / 7 hrs	1.21m	0.91m
27th November 2011	45mm / 17hrs	3.92m	3.78m	31mm / 15 hrs	3.81m	35mm / 16 hrs	1.29m	51mm / 17 hrs	1.52m	0.95m
26th May 2012	32mm / 12 hrs	2.49m	3.73m	26mm / 11 hrs	3.13m	20mm / 8 hrs	0.78m	27mm / 13 hrs	0.84m	0.71m
5th June 2012	12mm / 6 hrs	2.55m	3.41m	32mm / 16 hrs	3.09m	-	1.39m	-	1.97m	0.95m
22nd June 2012	58mm / 26 hrs	4.91m	4.19m	75mm / 27 hrs	4.41m	76mm / 26 hrs	2.92m	-	2.34m	1.15m
3rd July 2012	13mm / 11 hrs	2.23m	3.29m	6mm / 6 hrs	2.77m	11mm / 4 hrs	0.77m	-	1.29m	0.84m

Table A7 – Selection of Historical Flood Events along Waterways in Cardinia Shire

EVENT SUMMARY

1891 – Major regional rainfall and flooding

April 1900 – two-day period of rainfall resulted in extensive flooding of the Koo Wee Rup Swamp that resulted in crop loss and inundation of roads and houses

April 1901 – heavy rainfall over a three-day period in the upper catchments caused extensive flooding of the Koo Wee Rup Swamp

June 1911 – heavy rainfall in the upper catchments resulted in flooding in the southern and central parts of the Koo Wee Rup Swamp to a depth of 1.5 metres

October 1923 – large flood event that destroyed crops and inundated the Koo Wee Rup Swamp, with water nearly two metres at Cora Lynn

August 1924 – heavy rainfall over the northern ranges, exceeding 300 mm, caused most of the swamp area to be inundated to a depth of over 1.5 metres

November and December 1934 – more than 700 mm of rainfall across three days caused extensive and prolonged flooding across the Koo Wee Rup Swamp area. More than 1,000 people were displaced and infrastructure, including the Gippsland railway and major roads, was severely damaged.

April 1935 – flood within five months of the previous flood

October 1937 – rainfall in excess of 600 mm caused the Koo Wee Rup Swamp to flood extensively again

November 1956 – heavy rain and flooding

September 1959 – heavy rainfall in the upper catchments caused flood waters to cover key bridges, but widespread flooding was prevented through protection works

November 1971 – heavy rainfall in excess of 200 mm over three days caused flooding in many tributaries and districts

July 1996 – widespread flooding in the Koo Wee Rup Swamp with overbank flows upstream of Iona causing extensive flood damage to crops

February 2011 – heavy rainfall across the Officer–Pakenham area, with more than 150 mm rainfall in 8 hours causing extensive flooding

June 2012 – heavy rainfall with widespread flooding across Koo Wee Rup, Bayles, Lang Lang and Modella causes damage to crops and roads

DAM FAILURE

Flooding resulting from failure of the following dams is likely to cause significant structural and community damage within Cardinia Shire. See Dam Failure in Section 3 of this plan for more information. Note that if the storage capacity is reached and water flows over the spillway, this is not to be referred to as a flow release or a storage breach or failure.

Melbourne Water Dam	Location	Owner	Dam Capacity	Full Supply Level	Melway Reference
Cardinia Reservoir	Emerald	Melbourne Water	286,911 ML	167.03m AHD	126H12
Beaconsfield Nature Conservation Reserve Reservoir	O'Neil Road, Beaconsfield	Melbourne Water	Unknown	Unknown	212 H7

Table A8 – Melbourne Water Reservoirs that pose a risk to Cardinia Shire from Dam Failure

Service reservoirs located within the Shire:

Service Reservoir	Location	Owner	Material	Reservoir Capacity	Mapping Reference
Beaconsfield	Whiteside Road, Beaconsfield	South East Water	Unknown	Unknown	Melway 214 D1
Beaconsfield Upper	McKenzie Road, Beaconsfield Upper	South East Water	Unknown	Unknown	Melway 211 B10
Bunyip	Nar Nar Goon - Longwarry Road, Bunyip	South East Water	Unknown	Unknown	VicMap Central 6765 H8
Bunyip	Abeckett Road, Bunyip	South East Water	Unknown	Unknown	VicMap Central 6765 K7
Cockatoo	Aspect Avenue, Cockatoo	Yarra Valley Water	Unknown	Unknown	Melway 311 C7
Emerald North Tank	Oak Crescent, Emerald	Yarra Valley Water	Unknown	Unknown	Melway 125 G11
Garfield North	Princes Freeway, Garfield North	South East Water	Unknown	Unknown	VicMap Central 6765 D5
Gembrook	Main Street, Gembrook	Yarra Valley Water	Unknown	Unknown	Melway 312 H10
Koo Wee Rup	Tower Road, Koo Wee Rup	South East Water	Unknown	Unknown	VicMap Central 6822 H4
Lang Lang	McDonalds Track, Lang Lang	South East Water	Unknown	Unknown	VicMap Central 6823 E12
Lang Lang	Westernport Road, Lang Lang	South East Water	Unknown	Unknown	VicMap Central 6823 G11
Officer	Hughendon Road, Officer	South East Water	Unknown	Unknown	Melway 212 J4
Pakenahm Steel Tank	Mellane Road, Pakenham	Melbourne Water	Steel Tank	16 ML	Melway 318 B2
Pakenahm Storage Reservoir	Mullane Road, Pakenham	Melbourne Water	Unknown	Unknown	Melway 318 B1
Pakenham	Ahern Road, Pakenham	South East Water	Unknown	Unknown	Melway 317 E2
Tynong Tank	Fogarty Road, Tynong North	South East Water	Unknown	Unknown	Melway 304 C12

Table A9 – Melbourne Water Service Reservoirs in Cardinia Shire

Council owned/managed dams.

Dam	Location	Owner	Material	Reservoir Capacity	Mapping Reference
Stewarts Road	Stewart's Road, Emerald	Cardinia Shire Council	Unknown	Unknown	125 J10
Lilliput Lane Reserve	Lilliput Lane (off Army Road), Pakenham Upper	Cardinia Shire Council	Unknown	Unknown	315 H10
Pepi's Land Dam	West side of Beaconsfield-Emerald Road, Emerald	Cardinia Shire Council	Unknown	Unknown	127 F6

APPENDIX B – TYPICAL FLOOD PEAK TRAVEL TIMES

In using the information contained in this Appendix, consideration needs to be given to the time of travel of the flood peak. 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 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.

Where negative values are shown in the table below this indicates that a flood peak may be expected at the gauge downstream before a separate flood peak is experienced at the upstream gauge. This phenomenon may be due to the location of the thunderstorm passing through the catchment between the two gauges, or because of the urban environment found downstream causing floodwaters to enter the waterway quicker than those in a more rural setting upstream. Lastly this may be because of the existence of a retarding basin between the two gauges.

1. Typical travel times

Location From (gauge)	Location To (gauge)	Typical Travel Time	Comments
CARDINIA CREEK			
Officer South	Cardinia	Between 1 min to 2 hours	
BUNYIP and TARAGO RIVERS			
Headworks	Iona	Between 4 and 18 hours	Inflows from Tarago River likely to impact on travel time.
Tonimbuk		Between (-16) and 8 hours	Tonimbuk is just as likely to peak after Iona as before even though it is located upstream. Therefore flood peak travel times between these gauges should be used with caution. Inflows from Tarago River likely to impact on travel time.
Longwarry North		Between (-6) and 6 hours	Longwarry North may peak after Iona even though it is located upstream. Therefore flood peak travel times between these gauges should be used with caution. Inflows from Tarago River likely to impact on travel time.
Neerim South		Between 8 and 20 hours	Inflows from Bunyip River likely to impact on travel time.
Drouin West		Between (-2) and 10 hours	Drouin West may peak after Iona even though it is located upstream. Therefore flood peak travel times between these gauges should be used with caution. Inflows from Bunyip River likely to impact on travel time.
Iona	Cora Lynn Ford	Between 1 min to 2 hours	
	Koo Wee Rup	Between 4 and 7 hours	

Table B1 – Typical Flood Travel Times between gauges on Cardinia Creek and Bunyip River

2. Historical travel times

Flood Event	Location From (gauge)	Location To (gauge)	Flood Peak Travel Time	Flood Class at
CARDINIA CREEK				**CARDINIA**
16th September 1993	Officer South	Cardinia	Cardinia peaked 1 hour before Officer South	Minor
30th July 1996	Officer South	Cardinia	1 hour	Major
13th November 2004	Officer South	Cardinia	1 hour	Moderate
3rd February 2005	Officer South	Cardinia	1 hour	Moderate
31st October 2010	Officer South	Cardinia	2 hours	Below Minor
5th February 2011	Officer South	Cardinia	2 hours	Major
22nd June 2012	Officer South	Cardinia	1 hour	Minor
BUNYIP and TARAGO RIVERS				**IONA**
29th July 1977	Tonimbuk	Iona	Iona peaked 4 hours before Tonimbuk	Minor
	Neerim South		18 hours	
	Drouin West		10 hours	
10th August 1978	Tonimbuk	Iona	10 hours	Minor
	Neerim South		21 hours	
	Drouin West		8 hours	
20th November 1978	Tonimbuk	Iona	Iona peaked 8 hours before Tonimbuk	Minor
	Neerim South		12 hours	
	Drouin West		Iona peaked 2 hours before Drouin West	
22nd August 1981	Headworks	Iona	4 hours	Minor
	Tonimbuk		Iona peaked 17 hours before Tonimbuk	
	Neerim South		10 hours	
	Drouin West		1 hour	
14th September 1983	Headworks	Iona	11 hours	Minor
	Tonimbuk		Iona peaked 2 hours before Tonimbuk	
	Neerim South		8 hours	
	Drouin West		4 hours	
17th October 1983	Headworks	Iona	9 hours	Minor
	Tonimbuk		Iona peaked 10 hours before Tonimbuk	
	Neerim South		15 hours	
	Drouin West		Iona peaked 2 hours before Drouin West	
19th September 1984	Headworks	Iona	3 hours	Moderate
	Tonimbuk		1 hour	
	Neerim South		8 hours	
	Drouin West		3 hours	
7th November 1985	Headworks	Iona	5 hours	Minor
	Tonimbuk		Iona peaked 6 hours before Tonimbuk	
	Neerim South		11 hours	
	Drouin West		1 hour	
29th July 1987	Headworks	Iona	4 hours	Minor
	Tonimbuk		Iona peaked 16 hours before Tonimbuk	

Flood Event	Location From (gauge)	Location To (gauge)	Flood Peak Travel Time	Flood Class at
	Neerim South		13 hours	
	Drouin West		8 hours	
11th June 1989	Headworks	Iona	11 hours	Minor
	Tonimbuk		Iona peaked 4 hours before Tonimbuk	
	Neerim South		18 hours	
	Drouin West		3 hours	
28th October 1989	Headworks	Iona	11 hours	Minor
	Tonimbuk		Iona peaked 3 hours before Tonimbuk	
	Neerim South		15 hours	
	Drouin West		4 hours	
31st October 1989	Headworks	Iona	12 hours	Minor
	Tonimbuk		Iona peaked 3 hours before Tonimbuk	
	Neerim South		18 hours	
	Drouin West		7 hours	
12th October 1990	Headworks	Iona	4 hours	Major
	Tonimbuk		Iona peaked 4 hours before Tonimbuk	
	Neerim South		10 hours	
	Drouin West		6 hours	
18th September 1991	Headworks	Iona	7 hours	Minor
	Tonimbuk		Iona peaked 11 hours before Tonimbuk	
	Neerim South		14 hours	
	Drouin West		3 hours	
11th October 1992	Headworks	Iona	6 hours	Minor
	Tonimbuk		4 hours	
	Neerim South		13 hours	
	Drouin West		4 hours	
16th September 1993	Headworks	Iona	16 hours	Moderate
	Tonimbuk		4 hours	
	Neerim South		20 hours	
	Drouin West		9 hours	
12th June 1995	Headworks	Iona	11 hours	Minor
	Tonimbuk		7 hours	
	Neerim South		10 hours	
	Drouin West		4 hours	
23rd October 1995	Headworks	Iona	4 hours	Minor
	Tonimbuk		Less than 1 hour	
	Neerim South		15 hours	
	Drouin West		Iona peaked 3 hours before Drouin West	
6th November 1995	Headworks	Iona	11 hours	Minor
	Tonimbuk		6 hours	
	Neerim South		15 hours	
	Drouin West		Less than 1 hour	
30th July 1996	Headworks	Iona	4 hours	Moderate
	Tonimbuk		Iona peaked 13 hours before Tonimbuk	
	Neerim South		9 hours	

Flood Event	Location From (gauge)	Location To (gauge)	Flood Peak Travel Time	Flood Class at
	Drouin West		7 hours	
	Iona	Cora Lynn Ford	1 hour	
8th August 1996	Headworks	Iona	6 hours	Minor
	Tonimbuk		2 hours	
	Neerim South		13 hours	
	Drouin West		3 hours	
	Iona	Cora Lynn Ford	Less than 1 hour	
1st October 1996	Headworks	Iona	9 hours	Minor
	Tonimbuk		3 hours	
	Neerim South		12 hours	
	Drouin West		1 hour	
	Iona	Cora Lynn Ford	Less than 1 hour	
13th November 2004	Headworks	Iona	8 hours	Moderate
	Tonimbuk		7 hours	
	Longwarry North		3 hours	
	Neerim South		13 hours	
	Drouin West		6 hours	
	Iona	Cora Lynn Ford	2 hours	
		Koo Wee Rup	5 hours	
3rd February 2005	Headworks	Iona	17 hours	Minor
	Tonimbuk		5 hours	
	Longwarry North		Less than 1 hour	
	Neerim South		19 hours	
	Iona	Koo Wee Rup	6 hours	
13th September 2005	Headworks	Iona	Less than 1 hour	Minor
	Tonimbuk		Iona peaked 8 hours before Tonimbuk	
	Longwarry North		Less than 1 hour	
	Neerim South		19 hours	
	Drouin West		5 hours	
	Iona	Cora Lynn Ford	Less than 1 hour	
		Koo Wee Rup	4 hours	
28th September 2009	Headworks	Iona	20 hours	Minor
	Tonimbuk		Iona peaked 3 hours before Tonimbuk	
	Longwarry North		2 hours	
	Neerim South		15 hours	
	Drouin West		2 hours	
	Iona	Cora Lynn Ford	5 hours	
		Koo Wee Rup	6 hours	
31st October 2010	Headworks	Iona	12 hours	Minor
	Tonimbuk		3 hours	
	Longwarry North		Iona peaked 1 hour before Longwarry North	
	Neerim South		15 hours	
	Drouin West		Iona peaked 5 hours before Drouin West	
	Iona	Cora Lynn Ford	1 hour	
		Koo Wee Rup	4 hours	
21st December 2010	Headworks	Iona	18 hours	Minor

Flood Event	Location From (gauge)	Location To (gauge)	Flood Peak Travel Time	Flood Class at
	Tonimbuk		3 hours	
	Longwarry North		3 hours	
	Neerim South		12 hours	
	Drouin West		12 hours	
	Iona	Cora Lynn Ford	1 hour	
		Koo Wee Rup	5 hours	
5th February 2011	Headworks	Iona	9 hours	Major
	Tonimbuk		8 hours	
	Longwarry North		6 hours	
	Neerim South		13 hours	
	Drouin West		8 hours	
	Iona	Cora Lynn Ford	2 hours	
		Koo Wee Rup	Less than 1 hour	
12th April 2011	Headworks	Iona	7 hours	Minor
	Tonimbuk		Iona peaked 2 hours before Tonimbuk	
	Longwarry North		Iona peaked 7 hours before Longwarry North	
	Neerim South		11 hours	
	Drouin West		1 hours	
	Iona	Cora Lynn Ford	2 hours	
		Koo Wee Rup	7 hours	
11th August 2011	Headworks	Iona	7 hours	Minor
	Tonimbuk		3 hours	
	Longwarry North		2 hours	
	Neerim South		13 hours	
	Drouin West		4 hours	
	Iona	Cora Lynn Ford	Less than 1 hour	
		Koo Wee Rup	7 hours	
30th September 2011	Headworks	Iona	9 hours	Minor
	Tonimbuk		3 hours	
	Longwarry North		2 hours	
	Neerim South		13 hours	
	Drouin West		2 hours	
	Iona	Cora Lynn Ford	Cora Lynn Ford peaked 1 hour before Iona	
		Koo Wee Rup	5 hours	
10th November 2011	Headworks	Iona	13 hours	Minor
	Tonimbuk		6 hours	
	Longwarry North		4 hours	
	Neerim South		20 hours	
	Drouin West		10 hours	
	Iona	Cora Lynn Ford	1 hour	
		Koo Wee Rup	4 hours	
27th November 2011	Headworks	Iona	10 hours	Minor
	Tonimbuk		1 hour	
	Longwarry North		2 hours	
	Neerim South		16 hours	
	Drouin West		Less than 1 hour	
	Iona	Cora Lynn Ford	1 hour	

Flood Event	Location From (gauge)	Location To (gauge)	Flood Peak Travel Time	Flood Class at
		Koo Wee Rup	6 hours	
26th May 2012	Headworks	Iona	11 hours	Minor
	Tonimbuk		Iona peaked 17 hours before Tonimbuk	
	Longwarry North		Iona peaked 6 hours before Tonimbuk	
	Neerim South		3 hours	
	Drouin West		2 hours	
	Iona	Cora Lynn Ford	2 hours	
		Koo Wee Rup	6 hours	
5th June 2012	Headworks	Iona	5 hours	Minor
	Tonimbuk		18 hours	
	Longwarry North		9 hours	
	Neerim South		9 hours	
	Drouin West		3 hours	
	Iona	Cora Lynn Ford	1 hour	
		Koo Wee Rup	7 hours	
22nd June 2012	Headworks	Iona	7 hours	Minor
	Tonimbuk		4 hours	
	Longwarry North		2 hours	
	Neerim South		11 hours	
	Drouin West		7 hours	
	Iona	Cora Lynn Ford	1 hour	
		Koo Wee Rup	5 hours	
3rd July 2012	Headworks	Iona	4 hours	Minor
	Tonimbuk		Iona peaked 4 hours before Tonimbuk	
	Longwarry North		Iona peaked 6 hours before Longwarry North	
	Neerim South		7 hours	
	Drouin West		Iona peaked 1 hour before Drouin West	
	Iona	Cora Lynn Ford	5 hours	
		Koo Wee Rup	6 hours	

Table B2 – Historical Flood Travel Times between gauges on Cardinia Creek and the Bunyip River

APPENDIX C1 – CARDINIA CREEK FLOOD EMERGENCY PLAN

OVERVIEW OF FLOODING CONSEQUENCES

Beaconsfield, Officer and Cardinia are located approximately 45km southeast of Melbourne in a mixed environment, with residential, business and industrial areas as well as both old and newly established precincts. Cardinia Creek is the prominent watercourse in the area, flowing from the Cardinia Reservoir to the north. High-intensity, short-duration rainfall events can cause flash flooding in and around Beaconsfield and Cardinia, while prolonged rainfall may see Cardinia Creek flood. The area sees moderate to fast water movement in the areas north of Beaconsfield to slower water movement in and around Officer South, Cardinia and Dalmore. As a result flooding may last for several days around Ballarto Road. See mapping in **Appendix F** for more insight into flooding in the area.

WARNING TIMES

Warnings are available for flooding expected along Cardinia Creek at Chasemore Road, Cardinia. At this point Melbourne Water does not provide any flood-warning service for other hydrographic/telemetry (river gauges) within the municipality due to the generally short warning times available.

Hydrographic Monitoring Station	Station No.	Location	Owner	Gauge Type	Melway Ref
Emerald (Cardinia Reservoir)	586033	Along Road 7 at Cardinia Reservoir, Emerald	Melbourne Water	Rain	Melway 126 G10
Cardinia Creek d/s Cardinia Reservoir, Beaconsfield Upper	228258A	North side of the creek at end of Duffys Road, Beaconsfield Upper	Melbourne Water	Stream Level	Melway 210 C3
Berwick	586199	Beaumont Road, Berwick	Melbourne Water	Rain	Melway 111 G2
Cardinia Creek Drop Structure, Officer South	228382A	Eastern bank of the creek within the Drop Structure R/B, Officer South	Melbourne Water	Stream Level and Rain	Melway 214 C12
Cardinia Creek at Chasemore Road, Cardinia	228228A	Western bank of the creek at Chasemore Road, Clyde North	Melbourne Water	Stream Level and Rain	VicMap Central 6762 K11

Table C1.1 – Hydrographic Monitoring Stations within the Cardinia Creek catchment

These gauges may provide some warning of expected flooding. See the Melbourne Water website (http://www.melbournewater.com.au/waterdata/rainfallandriverleveldata/Pages/Rainfall-and-river-level-new.aspx) for more information on these gauges. It is advised that residents monitor the Bureau's website (http://www.bom.gov.au/) and the VICSES website (http://www.ses.vic.gov.au) for any thunderstorm, flood or severe weather warnings present for their area.

AREAS OF FLOOD RISK

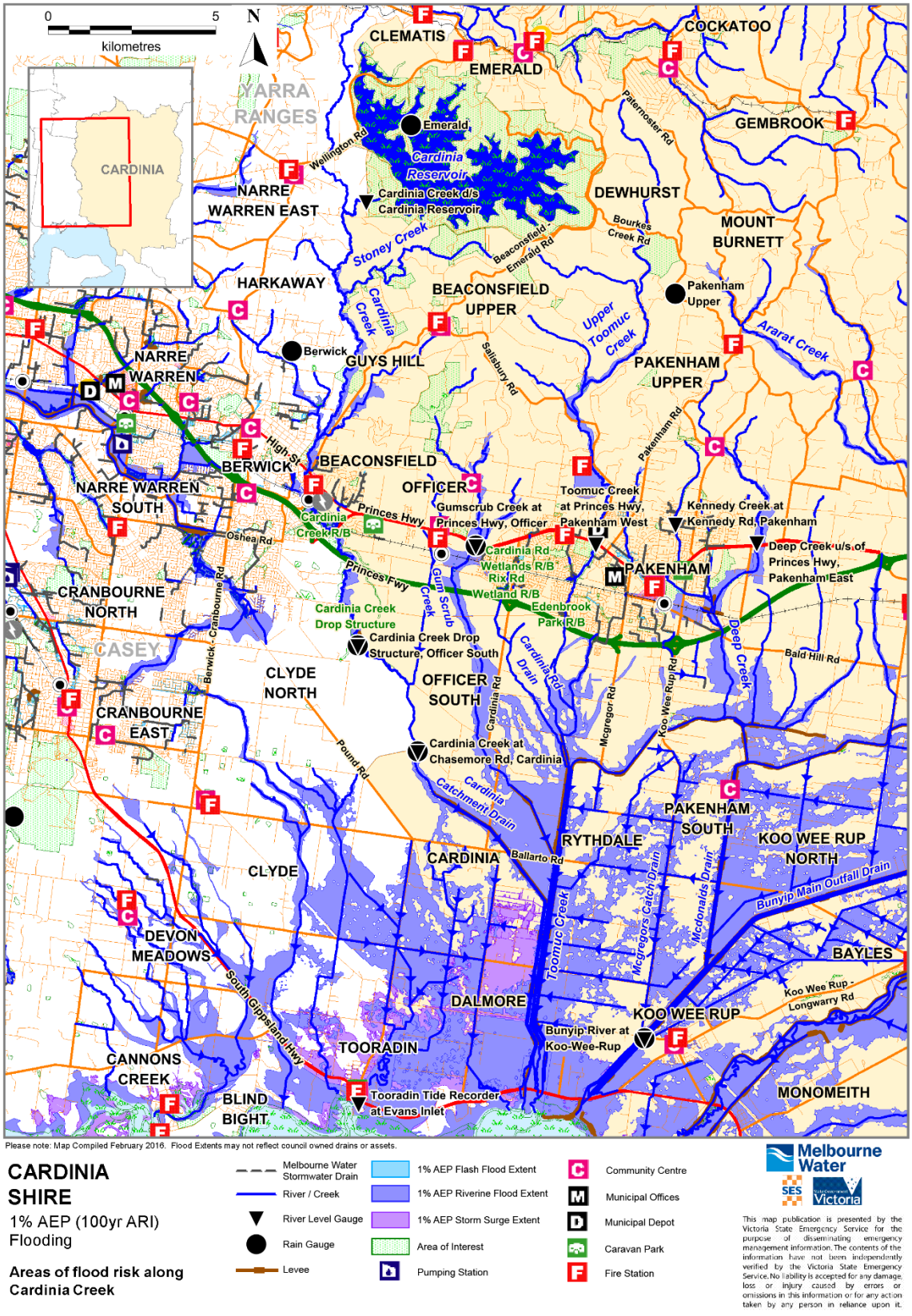


Figure C1 – Areas of flood risk around the Cardinia Creek in Cardinia Shire

PROPERTIES AT FLOOD RISK

Properties listed in the table below are at risk from flooding during a 1% **annual exceedance probability (**AEP) event. As more intelligence becomes available, this list may change.

Properties (residences, businesses and public use) at risk from flooding during a 1% AEP event

Street No. at Risk	Street	Suburb	Along Melbourne Water Watercourse	Flood Risk Type
10	Myrtle Grove	Guys Hill	Brisbane Creek	Riverine
216	Beaconsfield - Emerald Road	Beaconsfield	Brisbane Creek	Riverine
218	Beaconsfield - Emerald Road	Beaconsfield	Brisbane Creek	Riverine
236	Beaconsfield - Emerald Road	Beaconsfield	Brisbane Creek	Riverine
238	Beaconsfield - Emerald Road	Beaconsfield	Brisbane Creek	Riverine
260	Beaconsfield - Emerald Road	Beaconsfield	Brisbane Creek	Riverine
266	Beaconsfield - Emerald Road	Beaconsfield	Brisbane Creek	Riverine
270	Beaconsfield - Emerald Road	Beaconsfield	Brisbane Creek	Riverine
274	Beaconsfield - Emerald Road	Beaconsfield	Brisbane Creek	Riverine
205	Beaconsfield - Emerald Road	Beaconsfield	Cardinia Creek	Riverine
795	Cardinia Road	Cardinia	Cardinia Creek	Riverine
815	Cardinia Road	Cardinia	Cardinia Creek	Riverine
860	Cardinia Road	Cardinia	Cardinia Creek	Riverine
865	Cardinia Road	Cardinia	Cardinia Creek	Riverine
870	Cardinia Road	Cardinia	Cardinia Creek	Riverine
2305	Ballarto Road	Cardinia	Cardinia Creek	Riverine
2485	Ballarto Road	Cardinia	Cardinia Creek	Riverine
2505	Ballarto Road	Cardinia	Cardinia Creek	Riverine
2525	Ballarto Road	Cardinia	Cardinia Creek	Riverine
2565	Ballarto Road	Cardinia	Cardinia Creek	Riverine
2571	Ballarto Road	Cardinia	Cardinia Creek	Riverine
130	Gowan Lea Road	Dalmore	Cardinia Creek	Riverine
145	Gowan Lea Road	Dalmore	Cardinia Creek	Riverine
3400	South Gippsland Highway	Koo Wee Rup	Cardinia Creek	Riverine
3420	South Gippsland Highway	Koo Wee Rup	Cardinia Creek	Riverine
3440	South Gippsland Highway	Koo Wee Rup	Cardinia Creek	Riverine

Totals
26

Table C1.2 – Properties at risk of flooding along the Cardinia Creek catchment in Cardinia Shire

ISOLATION

Properties located in Cardinia around Ballarto Road may experience some manner of isolation when Cardinia Creek and Gum Scrub creek are in flood. Ballarto Road to the east; Cardinia Road to the north; and the southern end of Dalmore Road to the south will most likely be inaccessible during a large flood from Cardinia Creek and Gum Scrub Creek. Ballarto Road to the west will most likely have water over the road but may still be accessible by 4X4 vehicles. Some localised short-duration isolation may also occur due to flash flooding.

ESSENTIAL INFRASTRUCTURE

During an event see Public Transport Victoria's website (http://ptv.vic.gov.au/live-travel-updates/) for details on delays or alterations to services.

Apart from the roads outlined below (in tables C1.3 and C1.4), all other essential infrastructure and services areas around Cardinia Creek are expected to remain unaffected by flooding during a 1% AEP (100yr average recurrence interval) event.

ROAD CLOSURES

The following roads are subject to closure during flooding around Cardinia Creek in Beaconsfield Upper, Beaconsfield, Officer South, Cardinia and Dalmore. Check the VicRoads website (alerts.vicroads.vic.gov.au) for more details.

VicRoads Roads flooded in a 1% AEP (100yr ARI) event
• Ballarto Road, Cardinia between the Cardinia Catchment Drain and Wenn Road
• Beaconsfield-Emerald Road, Beaconsfield flooded at Brisbane Creek crossing and at Fieldstone Boulevard intersection
• Princes Freeway, Officer at Cardinia Creek crossing
• South Gippsland Highway, Koo Wee Rup at Cardinia Creek crossing

Table C1.3 – VicRoads possible road closures during a flooding event

Cardinia Shire Council Roads flooded in a 1% AEP (100yr ARI) event	
BEACONSFIELD	**DALMORE**
• Fieldstone Boulevard	• Gowan Lea Road
• Kenilworth Avenue	**GUYS HILL**
• Lukedenn Drive	• Luke Place
• Payne Road	• Quamby Road
CARDINIA	**KOO WEE RUP**
• Cardinia Road	• Prestons Road

Table C1.4 – Cardinia Shire Council possible road closures during a flooding event

FLOOD MITIGATION

RETARDING BASINS

Melbourne Water Retarding Basin	On Drain/ Waterway	Area	Storage Capacity	Spillway Crest Level	Full Supply Level	Embankment Crest Level	ANCOLD Hazard Rating	Houses In Flow Path (dam breach)	Melway Reference
Cardinia Creek	Cardinia Creek, Beaconsfield	39.67 ha	850 ML	46.1m AHD	Unknown	49.5m AHD	High C	Unknown	131 K2
Cardinia Creek Drop Structure	Cardinia Creek, Officer South	15.5 ha	200 ML	29.1m AHD	29.1m AHD	31.2m AHD	Low	Unknown	214 B11

Table C1.5 – Melbourne Water Retarding Basins within the Cardinia Creek catchment in Cardinia Shire

LEVEES

Melbourne Water Levee	Reach	Side	Levee Height	Levee Length	Expected Level of Protection	ANCOLD Hazard Rating	Houses at risk behind Levee	VICMap Central Reference
Cardinia Creek	Upstream of Ballarto Road to Island Rd	West	3m	4.8m	Unknown	Low	1 house and agricultural land flooded	6763 A12-6822 D1
Cardinia Creek	Upstream of Ballarto Road to Island Rd	East	2m	4.7m	Unknown	Unknown	Unknown	6763 A12-D15
Cardinia / Gum Scrub Creek Outfall	Island Road to Manks Rd	West	4m	1.6m	Unknown	Low	2 houses and agricultural land flooded	6822 D1-D2
Cardinia / Gum Scrub Creek Outfall	Manks Road to Railway Line	West	3m	1.6m	Unknown	Low	3 houses, 2 industrial buildings and agricultural land flooded	6822 D2-D4
Cardinia / Gum Scrub Creek Outfall	Railway Line to South Gippsland Highway	West	3m	2.0m	Unknown	Low	2 industrial buildings and agricultural land flooded	6822 D4-D6
Cardinia / Gum Scrub Creek Outfall	South Gippsland Highway to Westernport Bay	West	Unknown	0.2m	Unknown	Very Low	Agricultural land flooded	6822 D6

Table C1.6 – Melbourne Water Levees in the Cardinia Creek Catchment in Cardinia Shire

SEWERAGE INFRASTRUCTURE

No Melbourne Water Sewerage Pumping Stations or Emergency Relief Points are expected to be within the vicinity of floodwaters during severe flood events around Cardinia Creek. However, it is possible several un-sewered properties are located within the catchment.

COMMAND, CONTROL and COORDINATION

VICSES will assume overall control of the response to flood incidents. Other agencies will be requested to support operations as detailed in this Plan. Control and coordination of a flood incident shall be carried out at the lowest effective level and in accordance with the State Emergency Response Plan (EMMV Part 3). During significant events, VICSES will conduct incident management using multi-agency resources.

FLOOD IMPACTS and REQUIRED ACTIONS

The table below (C1.7) is a breakdown of the number of properties flooded in a 1% AEP (100yr ARI) event. Refer to the following intelligence cards for Beaconsfield, Officer South and Cardinia for more detail.

Land Use Flooded in a 1% AEP Event	Total
Residential	0
Business	0
Industrial	0
Public Land	3
Rural	23
Total	**26**

Table C1.7 – Breakdown of likely land use flooded in the Cardinia Creek Catchment in Cardinia Shire during a 1% AEP event

FLOOD INTELLIGENCE CARD – BEACONSFIELD AND BEACONSFIELD UPPER (UNGAUGED)

Version 2 – February 2016

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.

This Flood Intelligence Card publication is presented by the Victoria State Emergency Service for the purpose of disseminating emergency management information. The contents of the information have not been independently verified by the Victoria State Emergency Service. No liability is accepted for any damage, loss or injury caused by errors or omissions in this information or for any action taken by any person in reliance upon it.

CLOSEST RAIN GAUGE	**Berwick**
LOCATION	**Beaumont Road, Berwick**
MELWAY REF:	**111 G2**

GAUGE NUMBER	**586199**
GAUGE TYPE	**Rain**
TELEMETRIC/MANUAL	**Telemetric**

Design Rainfall Depths (mm) – *Indication of Possible Flooding*	**Annual Exceedance Probability (% AEP)**	**Consequence / Impact**	**Operational Considerations**
42mm in 1 hour; 56mm in 2 hours; 65mm in 3 hours; 85mm in 6 hours 110mm in 12 hours; or 146mm in 24 hours; Note: rainfall depths are a very rough method of estimating flood events and have been used due to the ungauged nature of the catchment. This should be used as a guide only.	1% AEP (100 year ARI)	**Properties at Flood Risk** **10 Properties in Total** **Brisbane Creek** • 10 Myrtle Grove, Guys Hill • 216, 218, 236, 238, 260, 266, 270 and 274 Beaconsfield – Emerald Road, Beaconsfield **Cardinia Creek** • 205 Beaconsfield – Emerald Road, Beaconsfield **Community Infrastructure Flooded** • Beaconsfield Berwick Pet Resort at 236 Beaconsfield – Emerald Road, Beaconsfield **Water Over Road** **Brisbane Creek** • Luke Place, Guys Hill • Quamby Road, Guys Hill • Payne Road, Beaconsfield • Lukedenn Drive, Beaconsfield **Cardinia Creek**	VICSES State and Region to provide warnings to the community and other agencies. VICSES will provide warnings using OSOM and SMSER as required based on the predications provided by BoM regarding flood levels and the risk of Flash Flooding. The Central Duty officer in conjunction with the Regional Agency Commander will maintain operational awareness and form an appropriate response arrangement to suit the level of incident. Council to provide road closure signage if required.

Design Rainfall Depths (mm) – *Indication of Possible Flooding*	Annual Exceedance Probability (% AEP)	Consequence / Impact	Operational Considerations
		• Beaconsfield-Emerald Road, Beaconsfield flooded at Brisbane Creek crossing and at Fieldstone Boulevard intersection • Fieldstone BoulevaRoad, Beaconsfield • Kenilworth Avenue, Beaconsfield	VicRoads and Council to provide road closure signage if required.
164mm in 16 hours	5th February 2011 Flood Level Peak	**Event Summary** • 1 property flooded along Beaconsfield-Emerald Rd • Payne Road access cut by Brisbane Creek flooding • Water over Princes Highway in Beaconsfield	VICSES to respond as per request by request basis. VicRoads and Council to provide road closure signage if required.

FLOOD INTELLIGENCE CARD – OFFICER SOUTH GAUGE, CARDINIA CREEK

Version 2 – February 2016

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.

This Flood Intelligence Card publication is presented by the Victoria State Emergency Service for the purpose of disseminating emergency management information. The contents of the information have not been independently verified by the Victoria State Emergency Service. No liability is accepted for any damage, loss or injury caused by errors or omissions in this information or for any action taken by any person in reliance upon it.

LOCATION	**Eastern bank of Cardinia creek within the Drop Structure Retarding Basin, Officer South**
MELWAY REFERENCE:	**214 C12**
STREAM:	**Cardinia Creek**
GAUGE NUMBER:	**228382A**
GAUGE ZERO:	**27.270m AHD**
GAUGE TYPE	**Stream Level and Rain**

MINOR:	**Not Established**
MODERATE:	**Not Established**
MAJOR	**Not Established**
LEVEE HEIGHT:	**N/A**
TELEMETRIC/MANUAL	**Telemetric**
HIGHEST RECORDED FLOOD:	**3.38m (5th February 2011)**

Creek Height	Annual Exceedance Probability (% AEP)	Consequence / Impact	Operational Considerations
2.0m		• Drop Structure (Weir) Starts Operating	
	1% AEP (100yr ARI) Flood Level	**Water Over Road** • Princes Freeway, Officer at Cardinia Creek crossing	VicRoads and Council to provide road closure signage if required.
3.38m	5th February 2011 Flood Level Peak		

FLOOD INTELLIGENCE CARD – CARDINIA GAUGE, CARDINIA CREEK

Version 2 – February 2016

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.

This Flood Intelligence Card publication is presented by the Victoria State Emergency Service for the purpose of disseminating emergency management information. The contents of the information have not been independently verified by the Victoria State Emergency Service. No liability is accepted for any damage, loss or injury caused by errors or omissions in this information or for any action taken by any person in reliance upon it.

LOCATION	**Western bank of the creek at Chasemore Road, Clyde North**
VICMAP REFERENCE:	**Central 6762 K11**
STREAM:	**Cardinia Creek**
GAUGE NUMBER:	**228228A**
GAUGE ZERO:	**7.93m AHD**
GAUGE TYPE	**Stream Level and Rain**

MINOR:	**2.7m**
MODERATE:	**3.0m**
MAJOR	**3.4m**
LEVEE HEIGHT:	**3.6m**
TELEMETRIC/MANUAL	**Telemetric**
HIGHEST RECORDED FLOOD:	**4.87m (5th February 2011)**

Creek Height	Flood Class or Annual Exceedance Probability (% AEP)	Consequence / Impact	Operational Considerations
2.7m	**MINOR FLOOD LEVEL**		VICSES State and Region to provide warnings to the community and other agencies. VICSES will provide warnings using OSOM and SMSER as required based on the predications provided by BoM regarding flood levels and the risk of Flash Flooding. The Central Duty officer in conjunction with the Regional Agency Commander will maintain operational awareness and form an appropriate response arrangement to suit the level of incident.
3.0m	**MODERATE FLOOD LEVEL**		VICSES State and Region to provide warnings to the community and other agencies. VICSES will provide warnings using OSOM and SMSER as required based on the predications provided by BoM regarding flood levels and the risk of Flash Flooding. The Central Duty officer in

Creek Height	Flood Class or Annual Exceedance Probability (% AEP)	Consequence / Impact	Operational Considerations
			conjunction with the Regional Agency Commander will maintain operational awareness and form an appropriate response arrangement to suit the level of incident.
3.4m	**MAJOR FLOOD LEVEL**		VICSES State and Region to provide warnings to the community and other agencies. VICSES will provide warnings using OSOM and SMSER as required based on the predications provided by BoM regarding flood levels and the risk of Flash Flooding. The Central Duty officer in conjunction with the Regional Agency Commander will maintain operational awareness and form an appropriate response arrangement to suit the level of incident.
3.6m		• Approximate Height of Levees downstream either side of Ballarto Road	
4.44m	19th September 1984 Flood Level Peak		
4.87m	5th February 2011 Flood Level Peak	**Event Summary** • Ballarto Road Access cut between Cardinia Creek and Deep Creek. • Water over Ballarto Road west of Cardinia township cutting access to non 4X4 vehicles. • 3 properties flooded on Ballarto Rd	VicRoads and Council to provide road closure signage if required. VICSES to respond as per request by request basis.
5.22m	1% AEP (100yr ARI) Flood Level (Major)	**Properties at Flood Risk** **16 Properties in Total** • 795, 815, 860, 865 and 870 Cardinia Road, Cardinia • 2305, 2485, 2505, 2525, 2565, 2571 Ballarto Road, Cardinia • 130 and 145 Gowan Lea Road, Dalmore • 3400, 3420 and 3440 South Gippsland Highway, Koo Wee Rup **Water Over Road** • Cardinia Road, Cardinia • Ballarto Road, Cardinia between the Cardinia Catchment Drain and Wenn Road • Gowan Lea Road, Dalmore • Prestons Road, Koo Wee Rup • South Gippsland Highway, Koo Wee Rup at Cardinia Creek crossing	VICSES to respond as per request by request basis. VicRoads and Council to provide road closure signage if required.

APPENDIX C2 – GUMSCRUB, TOOMUC, KENNEDY and DEEP CREEKS FLOOD EMERGENCY PLAN

OVERVIEW OF FLOODING CONSEQUENCES

Pakenham, Officer and Pakenham South are located approximately 50km southeast of Melbourne in a mixed environment with residential, business and industrial areas as well as both old and newly established precincts. Pakenham is flanked by Toomuc Creek on its western edge and Deep Creek on its eastern edge. Flowing through the centre of town are Pakenham and Kennedy Creeks. Gum Scrub Creek flows through Officer. High-intensity, short-duration rainfall events can cause flash flooding in and around Pakenham and Officer with Pakenham Creek generally the first watercourse to flood, while prolonged rainfall may see Gum Scrub, Toomuc Creek, Kennedy Creek and Deep Creek flood. The area sees moderate to slow water movement due to the mixed nature of gently undulating terrain and flatter areas. Flooding might as a result may last several days. See mapping in **Appendix F** for more insight into flooding in the area.

WARNING TIMES

Warnings are available for flooding expected along Gumscrub Creek at Officer. Melbourne Water does not provide any flood warning service at this point for other hydrographic/telemetry (river gauges) within the municipality due to the generally short warning times available.

Hydrographic Monitoring Station	Station No.	Location	Owner	Gauge Type	Melway Ref
Pakenham Upper	586201	70m Southwest of Shelton and Huxtable Roads Intersection, Pakenham Upper	Melbourne Water	Rain	Melway 313 G10
Gum Scrub Creek at Princes Highway, Officer	228365A	At Princes Highway Bridge, in the centre median strip, Officer	Melbourne Water	Stream Level and Rain	Melway 215 A4
Toomuc Creek at Princes Highway, Pakenham West	228217C	At Princes Highway Bridge, in the centre median strip, Pakenham	Melbourne Water	Stream Level	Melway 215 K4
Kennedy Creek at Kennedy Road, Pakenham	228364A	West bank of the creek on Kennedy Road, Pakenham	Melbourne Water	Stream Level	Melway 317 G3
Deep Creek u/s of Princes Highway, Pakenham East	228363A	West side of the creek 900m north of Princes Highway	Melbourne Water	Stream Level	Melway 318 C5

Table C1.1 – Hydrographic Monitoring Stations within the Gumscrub, Toomuc, Kennedy and Deep Creek catchments

These gauges may provide some warning of expected flooding. See the Melbourne Water website for more information on these gauges (http://www.melbournewater.com.au/waterdata/rainfallandriverleveldata/Pages/Rainfall-and-river-level-new.aspx). It is advised that residents monitor the Bureau of Meteorology's website (http://www.bom.gov.au) and the VICSES website (http://www.ses.vic.gov.au) for any thunderstorm, flood or severe weather warnings present for their area.

AREAS OF FLOOD RISK

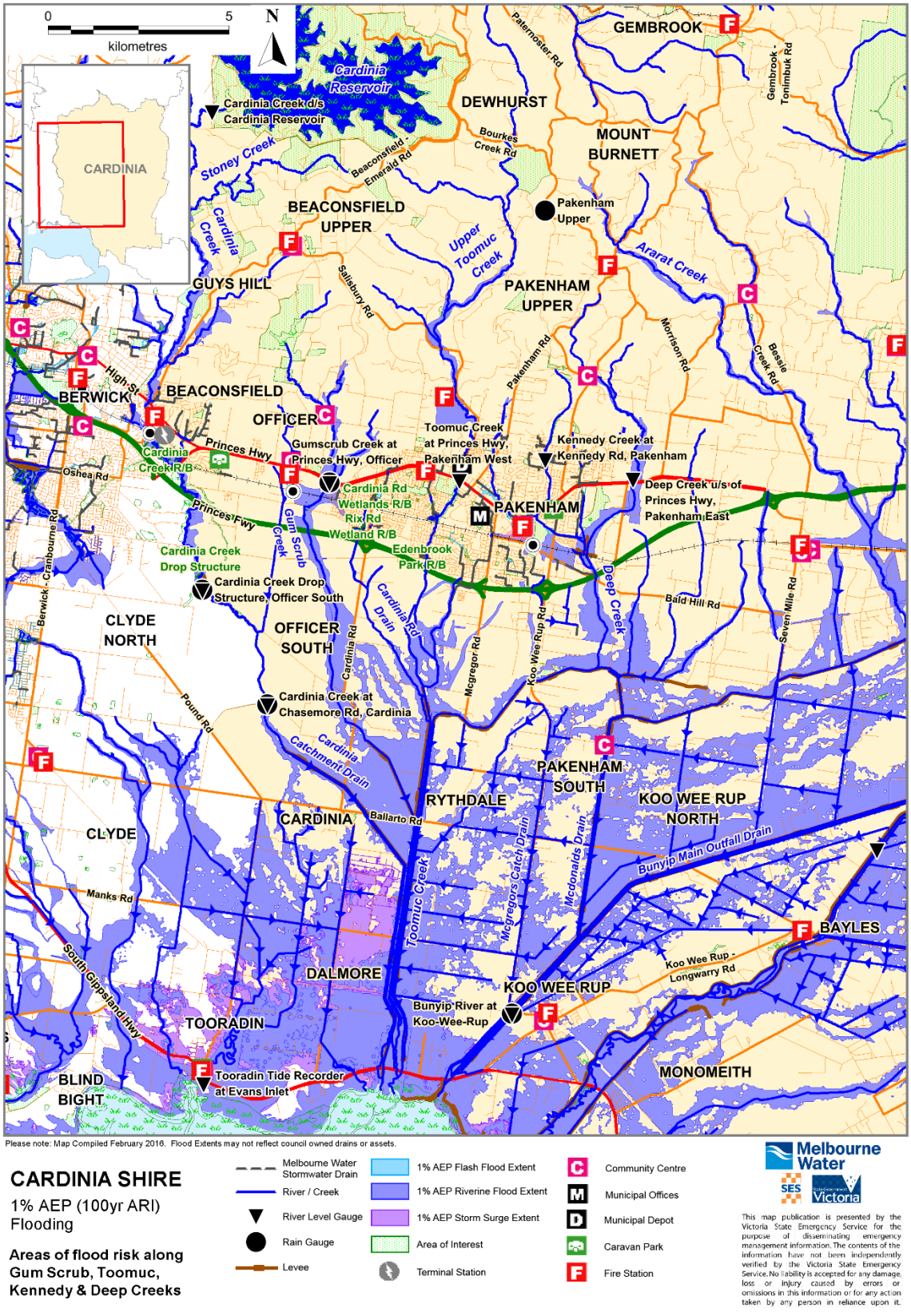


Figure C2 – Areas of flood risk around Officer, Pakenham and Pakenham South in Cardinia Shire

PROPERTIES AT FLOOD RISK

Properties listed in the table below are at risk from flooding. This list may grow as more intelligence becomes available.

Properties (Residences, Businesses and Public Use) at risk from Flooding during a 1% AEP event

Street No. at Flood Risk	Street	Suburb	Along Melbourne Water Watercourse	Flood Risk Type
3	Anfield Court	Officer	Gum Scrub Creek	Riverine
4	Anfield Court	Officer	Gum Scrub Creek	Riverine
5	Anfield Court	Officer	Gum Scrub Creek	Riverine
6	Anfield Court	Officer	Gum Scrub Creek	Riverine
7	Anfield Court	Officer	Gum Scrub Creek	Riverine
8	Anfield Court	Officer	Gum Scrub Creek	Riverine
9	Anfield Court	Officer	Gum Scrub Creek	Riverine
10	Anfield Court	Officer	Gum Scrub Creek	Riverine
11	Anfield Court	Officer	Gum Scrub Creek	Riverine
12	Anfield Court	Officer	Gum Scrub Creek	Riverine
13	Anfield Court	Officer	Gum Scrub Creek	Riverine
85	Army Settlement Road	Pakenham	Deep Creek	Riverine
3	Balaton Drive	Pakenham	Pakenham Creek	Flash
5	Balaton Drive	Pakenham	Pakenham Creek	Flash
2525	Ballarto Road	Cardinia	Gum Scrub Creek	Riverine
2565	Ballarto Road	Cardinia	Gum Scrub Creek	Riverine
2571	Ballarto Road	Cardinia	Gum Scrub Creek	Riverine
2805	Ballarto Road	Pakenham South	McDonalds Catchment Drain	Riverine
2855	Ballarto Road	Pakenham South	McDonalds Catchment Drain	Riverine
2895	Ballarto Road	Pakenham South	McDonalds Catchment Drain	Riverine
2900	Ballarto Road	Pakenham South	McDonalds Catchment Drain	Riverine
3130	Ballarto Road	Pakenham South	McDonalds Catchment Drain	Riverine
3155	Ballarto Road	Pakenham South	McDonalds Catchment Drain	Riverine
3165	Ballarto Road	Pakenham South	McDonalds Catchment Drain	Riverine
3170	Ballarto Road	Pakenham South	McDonalds Catchment Drain	Riverine
3215	Ballarto Road	Pakenham South	McDonalds Catchment Drain	Riverine
3245	Ballarto Road	Pakenham South	McDonalds Catchment Drain	Riverine
3295	Ballarto Road	Pakenham South	McDonalds Catchment Drain	Riverine
8	Bellerive Avenue	Officer	Gum Scrub Creek	Riverine
19	Bellerive Avenue	Officer	Gum Scrub Creek	Riverine
12	Bellerive Avenue	Officer	Gum Scrub Creek	Riverine
14	Bellerive Avenue	Officer	Gum Scrub Creek	Riverine
15	Bellerive Avenue	Officer	Gum Scrub Creek	Riverine
16	Bellerive Avenue	Officer	Gum Scrub Creek	Riverine
17	Bellerive Avenue	Officer	Gum Scrub Creek	Riverine
18	Bellerive Avenue	Officer	Gum Scrub Creek	Riverine
20	Bellerive Avenue	Officer	Gum Scrub Creek	Riverine
22	Bellerive Avenue	Officer	Gum Scrub Creek	Riverine
24	Bellerive Avenue	Officer	Gum Scrub Creek	Riverine
26	Bellerive Avenue	Officer	Gum Scrub Creek	Riverine
28	Bellerive Avenue	Officer	Gum Scrub Creek	Riverine

Street No. at Flood Risk	Street	Suburb	Along Melbourne Water Watercourse	Flood Risk Type
30	Bellerive Avenue	Officer	Gum Scrub Creek	Riverine
24	Brown Road	Pakenham	Toomuc Creek	Riverine
55	Cameron Way	Pakenham	Pakenham Creek	Flash
59	Cameron Way	Pakenham	Pakenham Creek	Flash
61	Cameron Way	Pakenham	Pakenham Creek	Flash
25	Canty Lane	Pakenham	Deep Creek	Riverine
590	Cardinia Road	Officer South	Gum Scrub Creek	Riverine
720	Cardinia Road	Officer South	Gum Scrub Creek	Riverine
21	Carey Crescent	Pakenham	Pakenham Creek	Flash
23	Carey Crescent	Pakenham	Pakenham Creek	Flash
25	Carey Crescent	Pakenham	Pakenham Creek	Flash
160	Deep Creek Road	Pakenham	Deep Creek	Riverine
76	Ebony Drive	Pakenham	Pakenham Creek	Flash
78	Ebony Drive	Pakenham	Pakenham Creek	Flash
80	Ebony Drive	Pakenham	Pakenham Creek	Flash
82	Ebony Drive	Pakenham	Pakenham Creek	Flash
84	Ebony Drive	Pakenham	Pakenham Creek	Flash
86	Ebony Drive	Pakenham	Pakenham Creek	Flash
88	Ebony Drive	Pakenham	Pakenham Creek	Flash
90	Ebony Drive	Pakenham	Pakenham Creek	Flash
92	Ebony Drive	Pakenham	Pakenham Creek	Flash
70	Ellett Road	Pakenham South	McDonalds Catchment Drain	Riverine
7	Fairway Court	Pakenham	Deep Creek	Riverine
8	Fairway Court	Pakenham	Deep Creek	Riverine
9	Fairway Court	Pakenham	Deep Creek	Riverine
10	Fairway Court	Pakenham	Deep Creek	Riverine
11	Fairway Court	Pakenham	Deep Creek	Riverine
12	Fairway Court	Pakenham	Deep Creek	Riverine
14	Fairway Court	Pakenham	Deep Creek	Riverine
209	Five Mile Road	Pakenham South	McDonalds Catchment Drain	Riverine
270	Five Mile Road	Pakenham South	McDonalds Catchment Drain	Riverine
275	Five Mile Road	Pakenham South	McDonalds Catchment Drain	Riverine
305	Five Mile Road	Pakenham South	McDonalds Catchment Drain	Riverine
310	Five Mile Road	Pakenham South	McDonalds Catchment Drain	Riverine
26	Georgetown Way	Officer	Gum Scrub Creek	Riverine
28	Georgetown Way	Officer	Gum Scrub Creek	Riverine
30	Georgetown Way	Officer	Gum Scrub Creek	Riverine
32	Georgetown Way	Officer	Gum Scrub Creek	Riverine
34	Georgetown Way	Officer	Gum Scrub Creek	Riverine
36	Georgetown Way	Officer	Gum Scrub Creek	Riverine
38	Georgetown Way	Officer	Gum Scrub Creek	Riverine
40	Georgetown Way	Officer	Gum Scrub Creek	Riverine
42	Georgetown Way	Officer	Gum Scrub Creek	Riverine
44	Georgetown Way	Officer	Gum Scrub Creek	Riverine
365	Hall Road	Pakenham South	McDonalds Catchment Drain	Riverine
12	Isaac Court	Pakenham	Kennedy Creek	Riverine

Street No. at Flood Risk	Street	Suburb	Along Melbourne Water Watercourse	Flood Risk Type
10	James Street	Pakenham	Pakenham Creek	Flash
11	James Street	Pakenham	Pakenham Creek	Flash
21	Jarrah Court	Pakenham	Pakenham Creek	Flash
520	Koo Wee Rup Road	Pakenham South	McDonalds Catchment Drain	Riverine
48	Leigh Drive	Pakenham	Pakenham Creek	Flash
50	Leigh Drive	Pakenham	Pakenham Creek	Flash
54	Leigh Drive	Pakenham	Pakenham Creek	Flash
56	Leigh Drive	Pakenham	Pakenham Creek	Flash
35	Leppitt Road	Pakenham	Toomuc Creek	Riverine
90	Leppitt Road	Pakenham	Toomuc Creek	Riverine
2	Loz Court	Pakenham	Pakenham Creek	Flash
3	Loz Court	Pakenham	Pakenham Creek	Flash
4	Loz Court	Pakenham	Pakenham Creek	Flash
5	Loz Court	Pakenham	Pakenham Creek	Flash
1	Madison Place	Officer	Gum Scrub Creek	Riverine
3	Madison Place	Officer	Gum Scrub Creek	Riverine
4	Madison Place	Officer	Gum Scrub Creek	Riverine
5	Madison Place	Officer	Gum Scrub Creek	Riverine
6	Madison Place	Officer	Gum Scrub Creek	Riverine
7	Madison Place	Officer	Gum Scrub Creek	Riverine
8	Madison Place	Officer	Gum Scrub Creek	Riverine
9	Madison Place	Officer	Gum Scrub Creek	Riverine
10	Madison Place	Officer	Gum Scrub Creek	Riverine
11	Madison Place	Officer	Gum Scrub Creek	Riverine
12	Madison Place	Officer	Gum Scrub Creek	Riverine
13	Madison Place	Officer	Gum Scrub Creek	Riverine
15	Madison Place	Officer	Gum Scrub Creek	Riverine
17	Madison Place	Officer	Gum Scrub Creek	Riverine
19	Madison Place	Officer	Gum Scrub Creek	Riverine
21	Madison Place	Officer	Gum Scrub Creek	Riverine
23	Madison Place	Officer	Gum Scrub Creek	Riverine
25	Madison Place	Officer	Gum Scrub Creek	Riverine
27	Madison Place	Officer	Gum Scrub Creek	Riverine
400	McDonalds Drain Road	Pakenham South	McDonalds Catchment Drain	Riverine
450	McDonalds Drain Road	Pakenham South	McDonalds Catchment Drain	Riverine
480	McDonalds Drain Road	Pakenham South	McDonalds Catchment Drain	Riverine
500	McDonalds Drain Road	Pakenham South	McDonalds Catchment Drain	Riverine
600	McDonalds Drain Road	Pakenham South	McDonalds Catchment Drain	Riverine
620	McDonalds Drain Road	Pakenham South	McDonalds Catchment Drain	Riverine
640	McDonalds Drain Road	Pakenham South	McDonalds Catchment Drain	Riverine
660	McDonalds Drain Road	Pakenham South	McDonalds Catchment Drain	Riverine
680	McDonalds Drain Road	Pakenham South	McDonalds Catchment Drain	Riverine
700	McDonalds Drain Road	Pakenham South	McDonalds Catchment Drain	Riverine
770	McDonalds Drain Road	Pakenham South	McDonalds Catchment Drain	Riverine
830	McDonalds Drain Road	Pakenham South	McDonalds Catchment Drain	Riverine
940	McDonalds Drain Road	Pakenham South	McDonalds Catchment Drain	Riverine

Street No. at Flood Risk	Street	Suburb	Along Melbourne Water Watercourse	Flood Risk Type
946	McDonalds Drain Road	Pakenham South	McDonalds Catchment Drain	Riverine
970	McDonalds Drain Road	Pakenham South	McDonalds Catchment Drain	Riverine
980	McDonalds Drain Road	Pakenham South	McDonalds Catchment Drain	Riverine
1020	McDonalds Drain Road	Pakenham South	McDonalds Catchment Drain	Riverine
18	Mill Street	Pakenham	Toomuc Creek	Riverine
19	Mill Street	Pakenham	Toomuc Creek	Riverine
26	Natanya Drive	Pakenham	Kennedy Creek	Riverine
25	Oaktree Drive	Pakenham	Deep Creek	Riverine
114	Officer Road	Officer	Gum Scrub Creek	Riverine
120	Officer Road	Officer	Gum Scrub Creek	Riverine
140	Officer Road	Officer	Gum Scrub Creek	Riverine
2	Old Trafford Way	Officer	Gum Scrub Creek	Riverine
3	Old Trafford Way	Officer	Gum Scrub Creek	Riverine
4	Old Trafford Way	Officer	Gum Scrub Creek	Riverine
5	Old Trafford Way	Officer	Gum Scrub Creek	Riverine
6	Old Trafford Way	Officer	Gum Scrub Creek	Riverine
7	Old Trafford Way	Officer	Gum Scrub Creek	Riverine
8	Old Trafford Way	Officer	Gum Scrub Creek	Riverine
9	Old Trafford Way	Officer	Gum Scrub Creek	Riverine
10	Old Trafford Way	Officer	Gum Scrub Creek	Riverine
11	Old Trafford Way	Officer	Gum Scrub Creek	Riverine
125	Peck Road	Officer	Gum Scrub Creek	Riverine
35	Pommel Street	Pakenham	Pakenham Creek	Flash
1/917	Princes Highway	Pakenham	Toomuc Creek	Riverine
2/917	Princes Highway	Pakenham	Toomuc Creek	Riverine
3/917	Princes Highway	Pakenham	Toomuc Creek	Riverine
136	Princes Highway	Pakenham	Pakenham Creek	Flash
1/3-5	Purton Road	Pakenham	Toomuc Creek	Riverine
2/3-5	Purton Road	Pakenham	Toomuc Creek	Riverine
3/3-5	Purton Road	Pakenham	Toomuc Creek	Riverine
4/3-5	Purton Road	Pakenham	Toomuc Creek	Riverine
5/3-5	Purton Road	Pakenham	Toomuc Creek	Riverine
6/3-5	Purton Road	Pakenham	Toomuc Creek	Riverine
7-3-5	Purton Road	Pakenham	Toomuc Creek	Riverine
8/3-5	Purton Road	Pakenham	Toomuc Creek	Riverine
6	Purton Road	Pakenham	Toomuc Creek	Riverine
1/8	Purton Road	Pakenham	Toomuc Creek	Riverine
2/8	Purton Road	Pakenham	Toomuc Creek	Riverine
20	Racecourse Road	Pakenham	Pakenham Creek	Flash
14	Ryan Road	Pakenham	Deep Creek	Riverine
19	Ryan Road	Pakenham	Deep Creek	Riverine
26	Ryan Road	Pakenham	Deep Creek	Riverine
30	Ryan Road	Pakenham	Deep Creek	Riverine
36	Ryan Road	Pakenham	Deep Creek	Riverine
40	Ryan Road	Pakenham	Deep Creek	Riverine
46	Ryan Road	Pakenham	Deep Creek	Riverine

Street No. at Flood Risk	Street	Suburb	Along Melbourne Water Watercourse	Flood Risk Type
50	Ryan Road	Pakenham	Deep Creek	Riverine
60	Ryan Road	Pakenham	Deep Creek	Riverine
70	Ryan Road	Pakenham	Deep Creek	Riverine
33	Sir Thomas Drive	Pakenham	Pakenham Creek	Flash
35	Sir Thomas Drive	Pakenham	Pakenham Creek	Flash
10	Soldiers Road	Pakenham South	McDonalds Catchment Drain	Riverine
15	Templeton Crescent	Pakenham	McGregor Road Drain	Flash
17	Templeton Crescent	Pakenham	McGregor Road Drain	Flash
19	Templeton Crescent	Pakenham	McGregor Road Drain	Flash
23	Templeton Crescent	Pakenham	McGregor Road Drain	Flash
3	Tiffany Close	Pakenham	Kennedy Creek	Riverine
70	Tipperary Circuit	Pakenham	Kennedy Creek	Riverine
20	Toomuc Valley Road	Pakenham	Toomuc Creek	Riverine
24	Toomuc Valley Road	Pakenham	Toomuc Creek	Riverine
635	Toomuc Valley Road	Pakenham Upper	Toomuc Creek	Riverine
250-256	Toomuc Valley Road	Pakenham Upper	Toomuc Creek	Riverine
325	Toomuc Valley Road	Pakenham Upper	Toomuc Creek	Riverine
5	Torre Road	Pakenham	Kennedy Creek	Riverine
22	Windermere Boulevard	Pakenham	Pakenham Creek	Flash
24	Windermere Boulevard	Pakenham	Pakenham Creek	Flash
26	Windermere Boulevard	Pakenham	Pakenham Creek	Flash

Total
200

Table C2.2 – Properties at risk of flooding along the Gum Scrub, Pakenham, Kennedy and Deep Creek catchments in Cardinia Shire

ISOLATION

No major isolation risks exist for Officer, Pakenham and Pakenham South. If access via Princes Freeway or Princes Highway becomes closed for a period, routes via Pakenham Road or Army Road to the north may still remain passable. Pakenham Road has the potential to become flooded at the Pakenham Creek Bridge. Some localised short-duration isolation may occur due to flash flooding during a 1% AEP (100yr ARI) event.

ESSENTIAL INFRASTRUCTURE

- **The Metro and V/Line Railway Line** are likely to flood east of Officer Station, Officer, during a Moderate Flood Event (2.7m on the Officer Gauge, Gum Scrub Creek)

- **Toomuc Valley CFA Station** could have access cut to non-4X4 vehicles via Toomuc Valley Road and Brown Road from the east at 2.20m on the Pakenham West Gauge, Toomuc Creek

- **Pakenham Railway Station** could become impacted by flooding, either restricting access by trains in both directions or by restricting pedestrian access to the station via Railway Avenue or Bald Hill Road during a 1% AEP event along Pakenham Creek

During an event, see Public Transport Victoria's website (http://ptv.vic.gov.au/live-travel-updates) for details on delays or alterations to services.

Apart from the roads outlined below, all other essential infrastructure and services areas around Officer, Pakenham and Pakenham South are expected to remain unaffected by flooding during a 1% AEP (100yr ARI) event.

ROAD CLOSURES

The following roads are subject to closure during flooding around Officer, Pakenham and Pakenham South. Check the VicRoads website (alerts.vicroads.vic.gov.au) for more details.

VicRoads Roads flooded in a 1% AEP (100yr ARI) event
• Ballarto Road, Cardinia between Cardinia Road and Wenn Road
• Ballarto Road, Pakenham South between McDonalds Drain Road East and Fechner Road
• Pakenham Road, Pakenham at Syme Road
• Princes Highway, Eastbound Lane at Deep Creek crossing, Pakenham
• Princes Highway, Westbound Lane at various sections between Deep Creek and Gum Scrub Creek, Pakenham
• Princes Highway, Officer at Gum Scrub Creek crossing, Officer
• Princes Highway North Lane between Deveney Street and The Avenue, Pakenham
• Racecourse Road, Pakenham between Cameron Way and the Railway Line

Table C2.3 – VicRoads Possible Road Closures during a flooding event

Cardinia Shire Council Roads flooded in a 1% AEP (100yr ARI) event			
CARDINIA	**PAKENHAM**	• Hein Road	• Railway Avenue
• Fowler Road	• Bald Hill Road	• Hill Street	• Ryan Road
• Wenn Road	• Barrington Drive	• Holt Place	• Sir Thomas Drive
OFFICER	• Bate Close	• Hosking Court	• Station Street
• Anfield Court	• Ben Drive	• Howey Road	• Templeton Crescent
• Arena Parade	• Brown Road	• James Street	• The Avenue
• Bellerive Avenue	• Cameron Way	• Jarrah Court	• Toomuc Valley Road
• Brown Road	• Campbell Street	• John Street	• Wakenshaw Crescent
• Georgetown Way	• Cantle Close	• Kennedy Road	• Webster Way
• Harold Street	• Canty Lane	• King Street	**PAKENHAM SOUTH**
• Lecky Road	• Carlyle Street	• Leigh Drive	• Ellett Road
• Madison Place	• Deep Creek Road	• Leppitt Road	• Five Mile Road
• Officer Road	• Duncan Drive	• Manna Gum Drive	• Hall Road
• Old Trafford Way	• Ebony Drive	• McDonalds Drain Road	• McDonalds Drain Road
OFFICER SOUTH	• Embrey Court	• Mill Street	• Soldiers Road
• Cardinia Road	• Fairway Court	• Neverland Boulevard	**PAKENHAM UPPER**
• Patterson Road	• Falcon Place	• Nicholas Court	• Army Settlement Road
• Watson Road	• Flower Street	• Osborn Grove	• Crosby Road
	• Harness Place	• Pommel Street	• Shelton Road
	• Heidi Court	• Purton Road	

Table C2.4 – Cardinia Shire Council Possible Road Closures during a flooding event

FLOOD MITIGATION

RETARDING BASINS

Melbourne Water Retarding Basin	On Drain/ Waterway	Area	Storage Capacity	Spillway Crest Level	Full Supply Level	Embankment Crest Level	ANCOLD Hazard Rating	Houses In Flow Path (dam breach)	Melway Reference
Cardinia Road Wetlands	Cardinia Road Drain, Officer	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	215 D6
Deep Creek	Deep Creek, Pakenham	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	317 J9
Edenbrook Park	Toomuc Creek, Pakenham	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	215 H10
Rix Road Wetland	Cardinia Road Drain, Officer	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	215 C8
Shearwater Wetland	Cardinia Road Drain, Pakenham	2.64 ha	16.9 ML	29.5m AHD	29.5m AHD	29.5m AHD	Very Low	0	215 E5
Tyalla Way	Cardinia Road Drain, Pakenham	Unknown	Unknown	31.5m AHD	31.5m AHD	33.75m AHD	Very Low	0	215 E4

Table C2.5 – Melbourne Water Retarding Basins within the Gum Scrub, Pakenham, Kennedy and Deep Creek catchments in the Cardinia Shire

LEVEES

Melbourne Water Levee	Reach	Side	Levee Height	Levee Length	Expected Level of Protection	ANCOLD Hazard Rating	Houses at risk behind Levee	Melway Reference
Deep Creek	Five Mile Road to McDonalds Drain Road	East	1m	2.7m	Unknown	Very Low	Agricultural land flooded	526A5 - 6763 K10
Deep Creek	McDonalds Drain Road to Pakenham KooWeeRup Rd	East	2m	2.2m	Unknown	Very Low	Agricultural land flooded	6763 K10 - H10
Deep Creek	Pakenham KooWeeRup Road to McGregor Rd	East	3m	2.4m	Unknown	Low	3 houses, 1 Industrial building and agricultural land flooded	6763 H10 - F11
Toomuc / Deep Creek Outfall	Wenn Road to Hagelthorns Drain	East	2m to 3m	3.9m	Unknown	Low	2 houses and agricultural land flooded	6763 E12 - D15
Deep Creek	McGregor Road to Railway Rd	East	3m	8.7m	Unknown	Low	6 houses and agricultural land flooded	6763 F11 – 6822 D4
Northern Boundary Drain	Ararat Creek to Eight Mile Rd	South	2m	1.8m	Unknown	Significant	3 houses, 7 industrial buildings and agricultural land flooded	526 D5 - 6764 G10
Northern Boundary Drain	Eight Mile Road to Five Mile Rd	South	2m	4.5m	Unknown	Low	3 houses, 1 industrial buildings and agricultural land flooded	6764 G10 - C11

Northern Boundary Drain	Five Mile Road to McDonalds Drain Rd	South	2m	3.0m	Unknown	Low	3 houses, 2 industrial buildings and agricultural land flooded	6764 C11 - 6763K11
McDonalds Drain	McDonalds Drain Road to Bunyip Main Drain	East	3m	6.3m	Unknown	Unknown	Agricultural land and farm properties flooded	6763 K11 - 6822 J2
McDonalds Drain	McDonalds Drain Road to Bunyip Main Drain	West	3m	6.4m	Unknown	Unknown	Agricultural land and farm properties flooded	6763 K11- 6822J2

Table C2.6 – Melbourne Water Levees in the Gum Scrub, Pakenham, Kennedy and Deep Creek catchments in Cardinia Shire

SEWERAGE INFRASTRUCTURE

No Melbourne Water Sewerage Pumping Stations or Emergency Relief Points expected to be within the vicinity of flood waters during severe flood events around Cardinia Creek. It is possible a number of unsewered properties are located within the catchment.

COMMAND, CONTROL and COORDINATION

VICSES will assume overall control of the response to flood incidents. Other agencies will be requested to support operations as detailed in this Plan. Control and coordination of a flood incident shall be carried out at the lowest effective level and in accordance with the State Emergency Response Plan (EMMV Part 3). During significant events, VICSES will conduct incident management using multi-agency resources.

FLOOD IMPACTS and REQUIRED ACTIONS

The table below is a breakdown of the number of properties flooded in a 1% AEP (100yr ARI) event. Refer to the following intelligence card(s) for Gum Scrub Creek, Pakenham Creek, Kennedy Creek and Deep Creek for more details.

Land Use Flooded in a 1% AEP Event	Total
Residential	115
Business	0
Industrial	12
Public Land	1
Rural	72
Total	**200**

Table C2.7 – Breakdown of likely land use flooded in the Gum Scrub, Pakenham, Kennedy and Deep Creek catchments in Cardinia Shire during a 1% AEP event

FLOOD INTELLIGENCE CARD – OFFICER GAUGE, GUM SCRUB CREEK

Version 2 – February 2016

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.

This Flood Intelligence Card publication is presented by the Victoria State Emergency Service for the purpose of disseminating emergency management information. The contents of the information have not been independently verified by the Victoria State Emergency Service. No liability is accepted for any damage, loss or injury caused by errors or omissions in this information or for any action taken by any person in reliance upon it.

LOCATION	**At Princes Highway Bridge, in the centre median strip, Officer**
MELWAY REFERENCE:	**215 A4**
STREAM:	**Gum Scrub Creek**
GAUGE NUMBER:	**228365A**
GAUGE ZERO:	**33.80m AHD**
GAUGE TYPE	**Stream Level and Rain**

MINOR:	**2.1m**
MODERATE:	**2.6m**
MAJOR	**Not Established**
LEVEE HEIGHT:	**Unknown**
TELEMETRIC/MANUAL	**Telemetric**
HIGHEST RECORDED FLOOD:	**19th September 1984**

Creek Height	Flood Class or Annual Exceedance Probability (% AEP)	Consequence / Impact	Operational Considerations
2.1m	**MINOR FLOOD LEVEL**		VICSES State and Region to provide warnings to the community and other agencies. VICSES will provide warnings using OSOM and SMSER as required based on the predications provided by BoM regarding flood levels and the risk of Flash Flooding. The Central Duty officer in conjunction with the Regional Agency Commander will maintain operational awareness and form an appropriate response arrangement to suit the level of incident.
2.6m	**MODERATE FLOOD LEVEL**		VICSES State and Region to provide warnings to the community and other agencies. VICSES will provide warnings using OSOM and SMSER as required based on the predications provided by BoM regarding flood levels and the risk of Flash Flooding. The Central Duty officer in

Creek Height	Flood Class or Annual Exceedance Probability (% AEP)	Consequence / Impact	Operational Considerations
			conjunction with the Regional Agency Commander will maintain operational awareness and form an appropriate response arrangement to suit the level of incident.
2.66m	5th February 2011 Flood Level Peak (Moderate)	**Event Summary** • Princes Highway cut at Gum Scrub Creek • Princes Fwy cut at Gum Scrub Creek • The residential estate west of Cardinia Road experienced flooding when overland flows were retarded north of the railway acting as a levee, causing a backup	VicRoads to consider lane closures and warning signs on freeway and highway VICSES to respond to requests on case by case basis
2.7m	1% AEP (100yr ARI) Flood Level (Moderate)	**Properties at Flood Risk** **73 Properties in Total** • 114, 120 and 140 Officer Road, Officer • 125 Peck Road, Officer • 2, 3, 4, 5, 6, 7, 8, 9, 10 and 11 Old Trafford Way, Officer • 1, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 15, 17, 19, 21, 23, 25 and 27 Madison Place, Officer • 3, 4, 5, 6, 7, 8, 9, 10, 11, 12 and 13 Anfield Court, Officer • 8, 19, 12, 14, 15, 16, 17, 18, 20, 22, 24, 26, 28 and 30 Bellerive Avenue, Officer • 26, 28, 30, 32, 34, 36, 38, 40, 42 and 44 Georgetown Way, Officer • 590, 720 Cardinia Road, Officer South • 2525, 2565 and 2571 Ballarto Road, Cardinia **Community Infrastructure Flooded** • Officer Public Hall on Tivendale Road, Officer **Essential Infrastructure Impacted** • The Metro and V/Line Railway Line likely flooded east of Officer Station, Officer **Water Over Road** • Officer Road, Officer near Peterson Road Intersections • Brown Road, Officer at Gum Scrub Creek crossing • Princes Highway, Officer at Gum Scrub Creek crossing • Arena Parade, Officer • Madison Place, Officer • Old Trafford Way, Officer • Anfield Court, Officer	VICSES to respond to requests on case by case basis Council to consider contacting CoM to ensure emergency preparedness plan enacted. **PTV** In any location that has more than 10 centimetres of water over tracks services will stop and operate either side of it. Track personnel will attend to see if the blockage can be cleared. Affected services would be terminated at shunting points either side of the flooding until deemed safe to resume by an attending operations office Latest train disruptions can be monitored through: https://www.ptv.vic.gov.au/live-travel-updates

Creek Height	Flood Class or Annual Exceedance Probability (% AEP)	Consequence / Impact	Operational Considerations
		• Bellerive Avenue, Officer • Georgetown Way, Officer • Harold Street, Officer • Lecky Road, Officer • Cardinia Road, Officer South between Lecky Road and Patterson Road and between Wenn Road and Ballarto Road, Cardinia • Watson Road, Officer South • Patterson Road, Officer South near Cardinia Road • Wenn Road, Cardinia • Fowler Road, Cardinia • Ballarto Road, Cardinia between Cardinia Road and Wenn Road	Council to provide road closure signage if required.

FLOOD INTELLIGENCE CARD – PAKENHAM WEST GAUGE, TOOMUC CREEK

Version 2 - February 2016

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.

This Flood Intelligence Card publication is presented by the Victoria State Emergency Service for the purpose of disseminating emergency management information. The contents of the information have not been independently verified by the Victoria State Emergency Service. No liability is accepted for any damage, loss or injury caused by errors or omissions in this information or for any action taken by any person in reliance upon it.

LOCATION	**At Princes Highway Bridge, in the centre median strip, Pakenham**
MELWAY REFERENCE:	**215 K4**
STREAM:	**Toomuc Creek**
GAUGE NUMBER:	**228217C**
GAUGE ZERO:	**41.12m AHD**
GAUGE TYPE	**Stream Level**

MINOR:	**Not Established**
MODERATE:	**Not Established**
MAJOR	**Not Established**
LEVEE HEIGHT:	**N/A**
TELEMETRIC/MANUAL	**Telemetric**
HIGHEST RECORDED FLOOD:	**2.19m (5th February 2011)**

Creek Height	Annual Exceedance Probability (% AEP)	Consequence / Impact	Operational Considerations
2.19m	5th February 2011 Flood Level Peak	**Event Summary** • Outlook Centre on Toomuc Valley Road, Pakenham flooded	
2.20m		**Properties at Flood Risk** **18 Properties in Total** • 20 and 24 Toomuc Valley Road, Pakenham • 18 and 19 Mill Street, Pakenham • 1-3/917 Princes Highway, Pakenham • 1-8/3-5, 6 and 1-2/8 Purton Road, Pakenham **Community Infrastructure Flooded** • Outlook Centre on Toomuc Valley Road, Pakenham **Essential Infrastructure Impacted** • Toomuc Valley CFA Station could have access cut to non 4X4 vehicles via Toomuc Valley Road and Brown Road from the east **Water Over Road** • Brown Road at Toomuc Valley Road , Pakenham	VICSES to respond to requests on case by case basis Outlook Community Centre to implement emergency plan and contact SES for assistance if required. CFA monitor and keep IC informed of ability to continue service. CFA to consider the need to relocate services/resources.

Creek Height	Annual Exceedance Probability (% AEP)	Consequence / Impact	Operational Considerations
		• Toomuc Valley Road, Pakenham at Outlook Centre • Purton Road, Pakenham • Mill Street, Pakenham • Carlyle Street, Pakenham	
3.0m		**Water Over Road** • Shelton Road, Pakenham Upper • Leppitt Road, Pakenham • Hein Road, Pakenham	Council to provide road closure signage if required.
3.16m	1% AEP (100yr ARI) Flood Level	**Properties at Flood Risk** **6 New at Level; 24 Properties in Total** • 635 Toomuc Valley Road, Pakenham Upper • 35 and 90 Leppitt Road, Pakenham • 24 Brown Road, Pakenham • 250-256 and 325 Toomuc Valley Road, Pakenham **Water Over Road** • Watson Road, Officer South	VICSES to respond to requests on case by case basis Council to provide road closure signage if required. •

FLOOD INTELLIGENCE CARD – PAKENHAM CREEK (UNGAUGED)

Version 2 - February

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.

This Flood Intelligence Card publication is presented by the Victoria State Emergency Service for the purpose of disseminating emergency management information. The contents of the information have not been independently verified by the Victoria State Emergency Service. No liability is accepted for any damage, loss or injury caused by errors or omissions in this information or for any action taken by any person in reliance upon it.

CLOSEST RAIN GAUGE	**Pakenham Upper**
LOCATION	**70m Southwest of Shelton and Huxtable Roads Intersection, Pakenham Upper**
MELWAY REF:	**313 G10**

GAUGE NUMBER	**586201**
GAUGE TYPE	**Rain**
TELEMETRIC/MANUAL	**Telemetric**

Design Rainfall Depths (mm) – *Indication of Possible Flooding*	**Annual Exceedance Probability (% AEP)**	**Consequence / Impact**	**Operational Considerations**
21mm in 10 mins; 33mm in 30 mins; 41mm in 1 hour; 55mm in 2 hours; 64mm in 3 hours; or 84mm in 6 hours Note: rainfall depths are a very rough method of estimating flood events and have been used due to the ungagged nature of the catchment. This should be used as a guide only.	1% AEP (100 year ARI)	**Properties at Flood Risk** **40 Properties in Total** • **Pakenham Creek Drain** • 2, 3, 4 and 5 Loz Court, Pakenham • 136 Princes Highway, Pakenham • 10 and 11 James Street, Pakenham • 20 Racecourse Road, Pakenham • 21, 23 and 25 Carey Crescent, Pakenham • 3 and 5 Balaton Drive, Pakenham • 22, 24 and 26 Windermere BoulevaRoad, Pakenham • 48, 50, 54 and 56 Leigh Drive, Pakenham • 21 Jarrah Court, Pakenham • 76, 78, 80, 82, 84, 86, 88, 90 and 92 Ebony Drive, Pakenham • 33 and 35 Sir Thomas Drive, Pakenham • 35 Pommel Street, Pakenham • 55, 59 and 61 Cameron Way, Pakenham • **McGregor Road Drain**	VICSES State and Region to provide warnings to the community and other agencies. VICSES will provide warnings using OSOM and SMSER as required based on the predications provided by BoM regarding flood levels and the risk of Flash Flooding. The Central Duty officer in conjunction with the Regional Agency Commander will maintain operational awareness and form an appropriate response arrangement to suit the level of incident. VICSES to respond to requests on case by case basis DET to implement emergency plan if

Design Rainfall Depths (mm) – *Indication of Possible Flooding*	Annual Exceedance Probability (% AEP)	Consequence / Impact	Operational Considerations
		• 15, 17, 19 and 23 Templeton Crescent, Pakenham **Community Infrastructure Flooded** • St Patricks Catholic Primary School on The Avenue, Pakenham may become flooded across the sports oval and The Avenue Carpark. Access to School via The Avenue and Howey Road may become cut. Entrance via Princes Highway expected to remain clear • Cardinia Waters Retirement Village may be isolated by floodwaters along Racecourse Road and Neverland Boulevard **Essential Infrastructure Impacted** • Pakenham Railway station could become impacted by flooding, either restricting access by trains in both directions or by restricting pedestrian access to the station via Railway Avenue or Bald Hill Road **Water Over Road** • **Pakenham Creek Drain** • Pakenham Road, Pakenham at Syme Road • Howey Road, Pakenham • The Avenue, Pakenham • Princes Highway, Pakenham Northern Lanes between Deveney Street and The Avenue • James Street, Pakenham • John Street, Pakenham • King Street, Pakenham • Flower Street, Pakenham • Station Street, Pakenham • Railway Avenue, Pakenham • Webster Way, Pakenham at Belvedere Crescent • Racecourse Road, Pakenham between Cameron Way and the Railway Line • Campbell Street, Pakenham • Neverland BoulevaRoad, Pakenham • Embrey Court, Pakneham • Hill Street, Pakenham • Ben Drive, Pakenham • Leigh Drive, Pakenham • Jarrah Court, Pakenham • Ebony Drive, Pakenham • Sir Thomas Drive, Pakenham	required Retirement Village to implement emergency plan if required PTV to implement emergency plan if required Council and VICROADs to provide road closure signage if required.

Design Rainfall Depths (mm) – *Indication of Possible Flooding*	Annual Exceedance Probability (% AEP)	Consequence / Impact	Operational Considerations
		• Pommel Street, Pakenham • Heidi Court, Pakenham • Nicholas Court, Pakenham • Cantle Close, Pakenham • Barrington Drive, Pakenham • Harness Place, Pakenham • Cameron Way, Pakenham **McGregor Road Drain** • Templeton Crescent, Pakenham • Hosking Court, Pakenham • Wakenshaw Crescent, Pakenham • Duncan Drive, Pakenham at McGregor Road **Deep Creek South Drain** • Holt Place, Pakenham • Falcon Place, Pakenham	
203mm in 29 hours	5th February 2011 Flood Event	**Event Summary** • Princes Highway, Pakenham cut at 14:00 05/02/11 from Pakenham Creek to McDonalds Restaurant • Northern Lane of Princes Highway flooded acting as a levee east to Pakenham Creek. Depth of 0.6m alongside the Highway at 14:30 05/02/11 • King St flooded behind the old Pakenham Racecourse and Showgrounds (now residential estate). Area was flooded up to the northern side of the Pakenham Railway Line. Southern side was dry. • Beacon Hills College inundated by 0.5m water • Syme Road flooded from Pakenham Creek • Leigh Drive flooded, affecting properties • Properties on Ebony Dr flooded as floodwaters travelled down from Leigh Drive and water backed up after hitting the Princes Highway. • Jarrah Ct and Cobram Court flooded • Ryan Road and Fairway Court flooded • Sir Thomas Street, Pommel Street and Nicholas Court flooded	

FLOOD INTELLIGENCE CARD – PAKENHAM GAUGE, KENNEDY CREEK

Version 2 – February 2016

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.

This Flood Intelligence Card publication is presented by the Victoria State Emergency Service for the purpose of disseminating emergency management information. The contents of the information have not been independently verified by the Victoria State Emergency Service. No liability is accepted for any damage, loss or injury caused by errors or omissions in this information or for any action taken by any person in reliance upon it.

LOCATION	**West bank of the creek on Kennedy Road, Pakenham**
MELWAY REFERENCE:	**317 F3**
STREAM:	**Kennedy Creek**
GAUGE NUMBER:	**228364A**
GAUGE ZERO:	**44.986m AHD**
GAUGE TYPE	**Stream Level**

MINOR:	**Not Established**
MODERATE:	**Not Established**
MAJOR	**Not Established**
LEVEE HEIGHT:	**N/A**
TELEMETRIC/MANUAL	**Telemetric**
HIGHEST RECORDED FLOOD:	**2.08m (18th September 1984)**

Creek Height	Annual Exceedance Probability (% AEP)	Consequence / Impact	Operational Considerations
1.85m	5th February 2011 Flood Level Peak	**Event Summary** • Corner of Cameron Way and Barrington Dr flooded • Isaac Court flooded • Racecourse Road flooded • Tipperary Circuit flooded alongside Kennedy Creek • Corner of Natanya Drive and Ayesha Rise flooded	VICSES State and Region to provide warnings to the community and other agencies. VICSES will provide warnings using OSOM and SMSER as required based on the predications provided by BoM regarding flood levels and the risk of Flash Flooding. The Central Duty officer in conjunction with the Regional Agency Commander will maintain operational awareness and form an appropriate response arrangement to suit the level of incident.
3.83m	1% AEP (100yr ARI) Flood Level	**Properties at Flood Risk** **5 Properties in Total** • 26 Natanya Drive, Pakenham • 5 Torre Road, Pakenham • 3 Tiffany Close, Pakenham • 70 Tipperary Circuit, Pakenham	VICSES to respond to requests on case by case basis

Creek Height	Annual Exceedance Probability (% AEP)	Consequence / Impact	Operational Considerations
		• 12 Isaac Court, Pakenham **Community Infrastructure Flooded** • Cardinia Waters Retirement Village may be isolated by floodwaters along Racecourse Road and Neverland Boulevard **Water Over Road** • Kennedy Road, Pakenham • Manna Gum Drive, Pakenham • Osborn Grove, Pakenham • Racecourse Road, Pakenham between Cameron Way and the Railway Line • Neverland BoulevaRoad, Pakenham	Retirement Village to implement emergency plan if required Council to provide road closure signage if required. •

FLOOD INTELLIGENCE CARD – PAKENHAM EAST GAUGE, DEEP CREEK

Version 2 – February 2016

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.

This Flood Intelligence Card publication is presented by the Victoria State Emergency Service for the purpose of disseminating emergency management information. The contents of the information have not been independently verified by the Victoria State Emergency Service. No liability is accepted for any damage, loss or injury caused by errors or omissions in this information or for any action taken by any person in reliance upon it.

LOCATION	**West side of the creek 900m north of Princes Highway**
MELWAY REFERENCE:	**318 C5**
STREAM:	**Deep Creek**
GAUGE NUMBER:	**228363A**
GAUGE ZERO:	**40.40m AHD**
GAUGE TYPE	**Stream Level**

MINOR:	**Not Established**
MODERATE:	**Not Established**
MAJOR	**Not Established**
LEVEE HEIGHT:	**2.8m**
TELEMETRIC/MANUAL	**Telemetric**
HIGHEST RECORDED FLOOD:	**2.35m (5th February 2011)**

Creek Height	Annual Exceedance Probability (% AEP)	Consequence / Impact	Operational Considerations
1.9m		**Water Over Road** • North Lane of Princes Highway at Deep Creek crossing	VicRoads to monitor Highway and road conditions and close lanes if required
1.93m	1% AEP (100yr ARI) Flood Level	**Properties at Flood Risk** **21 Properties in Total** • 85 Army Settlement Road, Pakenham • 160 Deep Creek Road, Pakenham • 14, 19, 26, 30, 36, 40, 46, 50, 60 and 70 Ryan Road, Pakenham • 7, 8, 9, 10, 11, 12 and 14 Fairway Court, Pakenham • 25 Oaktree Drive, Pakenham • 25 Canty Lane, Pakenham **Community Infrastructure Flooded** • Pakenham and District Golf Club on Oaktree Drive, Pakenham **Water Over Road** • Crosby Road, Pakenham Upper	VICSES State and Region to provide warnings to the community and other agencies. VICSES will provide warnings using OSOM and SMSER as required based on the predications provided by BoM regarding flood levels and the risk of Flash Flooding. The Central Duty officer in conjunction with the Regional Agency Commander will maintain operational awareness and form an appropriate response arrangement to suit the level of incident. VICSES to respond to requests on case by case basis Council to provide road closure signage if

Creek Height	Annual Exceedance Probability (% AEP)	Consequence / Impact	Operational Considerations
		• Army Settlement Road, Pakenham Upper • Deep Creek Road, Pakenham • Canty Lane, Pakenham • Ryan Road, Pakenham • Fairway Court, Pakenham • Bate Close, Pakenham • Bald Hill Road, Pakenham at Deep Creek crossing • McDonalds Drain Road, Pakenham	required. •
2.35m	5th February 2011 Flood Level Peak	**Event Summary** • Intersection of Pakenham Road and Crosby Road flooded	Council and VICROADS to provide road closure signage if required.
2.5m		**Water Over Road** • Overtopping of Deep Creek at various points may cause flooding along Deep Creek Road and across Princes Highway	Council and VICROADS to provide road closure signage if required. •
2.8m		• Levee Bank at Canty Lane, Pakenham South (Melway 318B7) overtopped	VICSES to respond to requests on case by case basis •
3.0m		**Water Over Road** • South Lane of Princes Highway at various sections between Deep Creek and Gum Scrub Creek	• VicRoads to monitor Highway and road conditions and close lanes if required

FLOOD INTELLIGENCE CARD – McDONALDS CATCHMENT DRAIN, PAKENHAM SOUTH (UNGAUGED)

Version 2 – February 2016

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.

This Flood Intelligence Card publication is presented by the Victoria State Emergency Service for the purpose of disseminating emergency management information. The contents of the information have not been independently verified by the Victoria State Emergency Service. No liability is accepted for any damage, loss or injury caused by errors or omissions in this information or for any action taken by any person in reliance upon it.

CLOSEST RAIN GAUGE	**Bunyip River at Koo Wee Rup**
LOCATION	**Along Bunyip Main Drain at Disused Railway Bridge 100m South of Station St, Koo Wee Rup**
VICMAP REF:	**Central 6822 G4**

GAUGE NUMBER	**228395A**
GAUGE TYPE	**Rain**
TELEMETRIC/MANUAL	**Telemetric**

Design Rainfall Depths (mm) – *Indication of Possible Flooding*	**Annual Exceedance Probability (% AEP)**	**Consequence / Impact**	**Operational Considerations**
41mm in 1 hour; 53mm in 2 hours; 62mm in 3 hours; 78mm in 6 hours; 100mm in 12 hours; or 128mm in 24 hours Note: rainfall depths are a very rough method of estimating flood events and have been used due to the ungagged nature of the catchment. This should be used as a guide only.	1% AEP (100 year ARI)	**Properties at Flood Risk** **37 Properties in Total** • 400, 450, 480, 500, 600, 620, 640, 660, 680, 700, 770, 830, 940, 946, 970, 980 and 1020 McDonalds Drain Road, Pakenham South • 70 Ellett Road, Pakenham South • 10 Soldiers Road, Pakenham South • 520 Koo Wee Rup Road, Pakenham South • 2805, 2855, 2895, 2900, 3130, 3155, 3165, 3170, 3215, 3245 and 3295 Ballarto Road, Pakenham South • 209, 270, 275, 305 and 310 Five Mile Road, Pakenham South • 365 Hall Road, Pakenham South **Water Over Road** • McDonalds Drain Road, Pakenham • Hall Road, Pakenham South • Ellett Road, Pakenham South • Soldiers Road, Pakenham South • Five Mile Road, Pakenham South • Ballarto Road, Pakenham South between McDonalds Drain Road East and	VICSES State and Region to provide warnings to the community and other agencies. VICSES will provide warnings using OSOM and SMSER as required based on the predications provided by BoM regarding flood levels and the risk of Flash Flooding. The Central Duty officer in conjunction with the Regional Agency Commander will maintain operational awareness and form an appropriate response arrangement to suit the level of incident. VICSES to respond to requests on case by case basis Council to provide road closure signage if required.

Design Rainfall Depths (mm) – *Indication of Possible Flooding*	Annual Exceedance Probability (% AEP)	Consequence / Impact	Operational Considerations
		Fechner Road	

APPENDIX C3 – BUNYIP RIVER and BUNYIP MAIN OUTFALL DRAIN FLOOD EMERGENCY PLAN

OVERVIEW OF FLOODING CONSEQUENCES

Koo Wee Rup, Cora Lynn, Iona and Bayles are located approximately 60km southeast of Melbourne in a predominantly rural town setting. The Bunyip River is the prominent watercourse in the area, flowing from the northeast. Due to the flat terrain that dominates this part of Cardinia Shire, many open-channel drainage systems have been installed to help move water out into the Western Port Bay. High-intensity, short-duration rainfall events can cause flash flooding in and around Koo Wee Rup, Cora Lynn, Iona and Bayles, while prolonged rainfall may see the Bunyip River and surrounding open-water channels flood. Due to its flat terrain, the area sees slow water movement due to the flat terrain. Flooding as a result may last for a number of days or weeks. See mapping in **Appendix F** for more insight into flooding in the area.

WARNING TIMES

Warnings are available for flooding expected along the Bunyip River at Iona and Cora Lynn Ford. Melbourne Water does not provide any flood warning service at this point for other hydrographic/telemetry (river gauges) within the municipality due to the generally short warning times available.

Hydrographic Monitoring Station	Station No.	Location	Owner	Gauge Type	Mapping Ref
Bunyip River at Headworks	228207A	Along the Aqueduct Track in Gentle Annie. Eastern side of the River	Melbourne Water	Stream Level and Rain	VicMap Central 6699 K6
Bunyip River at Tonimbuk	228212	Western bank of the River off Jolley Road, Tonimbuk	Melbourne Water	Stream Level and Rain	VicMap Central 6700 B14
Bunyip River d/s Cannibal Creek, Longwarry North	228255A	Western bank of the river 700m down an unnamed road off Morrison Road, Longwarry North	Melbourne Water	Stream Level and Rain	VicMap Central 6766 A6
Bunyip River at Iona	228213A	North side of the drain at Fourteen Mile Road, Iona	Melbourne Water	Stream Level and Rain	VicMap Central 6765 E11
Bunyip River at Cora Lynn Ford	228380A	Southeast corner of the Bunyip Main and No. 4 Yallock Drains Junction on Main Drain Road South, Cora Lynn	Melbourne Water	Stream Level	VicMap Central 6764 J13
Bunyip River at Koo Wee Rup	228395A	Along Bunyip Main Drain at Disused Railway Bridge 100m South of Station St, Koo Wee Rup	Melbourne Water	Stream Level and Rain	VicMap Central 6822 G4
Yallock Outfall at Murray Road, Cora Lynn	228225A	West Bank of No.4 Yallock Drain at Murray Road Bridge, Cora Lynn	Melbourne Water	Stream Level	VicMap Central 6764 G15
Nayook	228804A	End of McIntyre Road, Nayook	Melbourne Water	Rain	VicMap Central 6701 F4
Tarago River East Branch at Neerim	228238A	East bank of the river, 200m north of Elton Road, Neerim	Melbourne Water	Stream Level and Rain	VicMap Central 6701 G7
Tarago River at Neerim	228206B	East bank of the river at Elton Road, Neerim	Melbourne Water	Stream Level	VicMap Central 6701 G8
Tarago Reservoir	586198	East side of Tarago Reservoir Road, Neerim South	Melbourne Water	Rain	VicMap Central 6701

Hydrographic Monitoring Station	Station No.	Location	Owner	Gauge Type	Mapping Ref
					H14
Tarago River at Neerim South	228219C	East bank of the river at Jindivick – Neerim South Road, Neerim South	Melbourne Water	Stream Level	VicMap Central 6701 G15
Tarago River at Drouin West	228201B	North bank of the river 80m west of Fisher Road, Drouin West	Melbourne Water	Stream Level and Rain	VicMap Central 6766 H7

Table C3.1 – Hydrographic Monitoring Stations within the Bunyip River catchment

These gauge may provide some warning of expected flooding. See the Melbourne Water website for more information on these gauges (http://www.melbournewater.com.au/waterdata/rainfallandriverleveldata/Pages/Rainfall-and-river-level-new.aspx). It is advised that residents monitor the Bureau of Meteorology's website (http://www.bom.gov.au/) and the VICSES website (http://www.ses.vic.gov.au) for any thunderstorm, flood or severe weather warnings present for their area.

AREAS OF FLOOD RISK

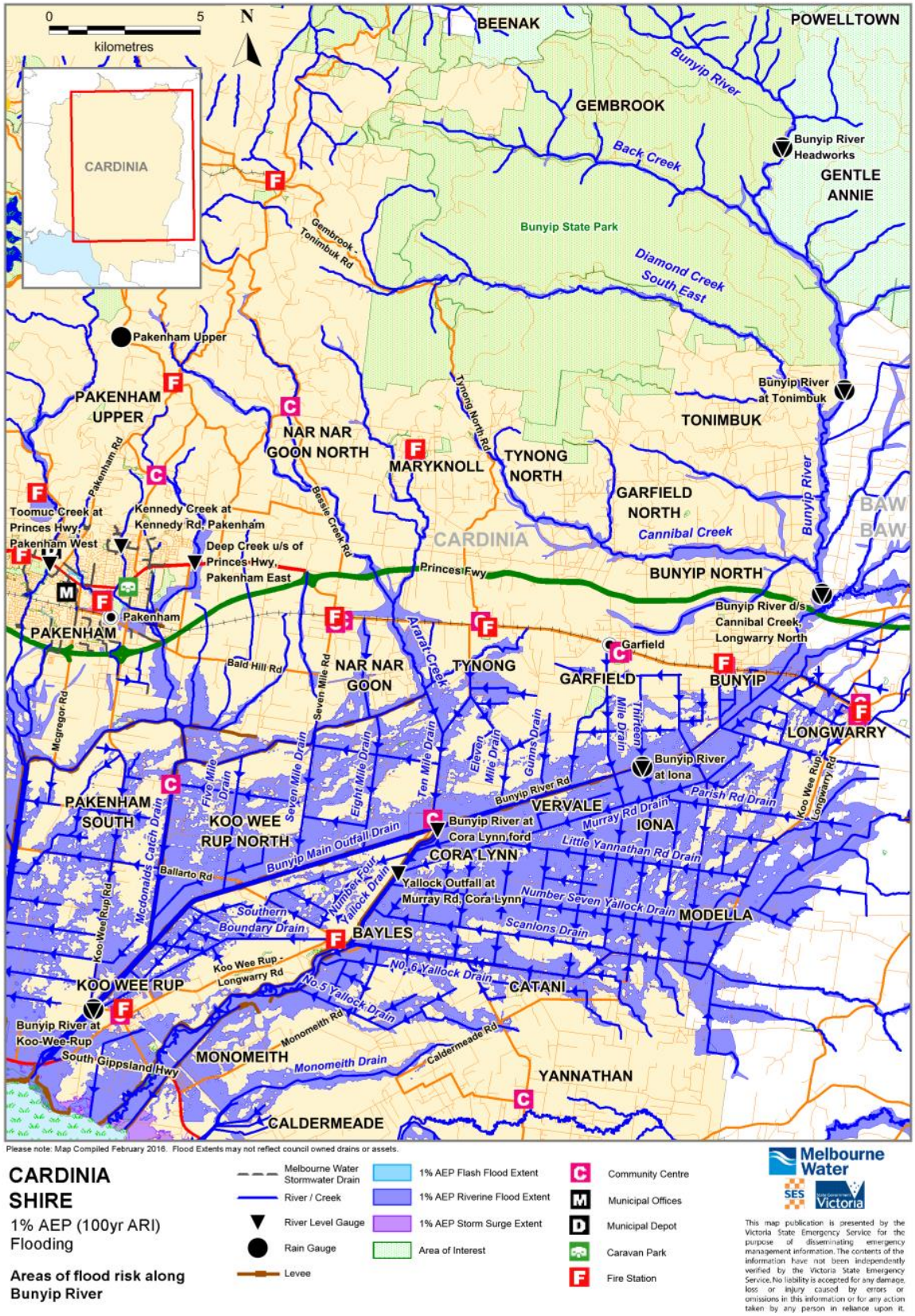


Figure C3 – Areas of flood risk around the Bunyip River and Bunyip Main Outfall Drain in Cardinia Shire

PROPERTIES AT FLOOD RISK

No data at this stage is available in regards to risk from above-floor inundation in the Koo Wee Rup, Cora Lynn, Iona and Bayles region. Properties listed in the table below are at risk from property flooding. This list may change as more intelligence becomes available.

Properties (Residences, Businesses and Public Use) at risk from Flooding during a 1% AEP event

Street No. at Flood Risk	Street	Suburb	Along Melbourne Water Watercourse	Flood Risk Type
286	Abeckett Road	Bunyip	Bunyip River	Riverine
8	Drake Court	Bunyip	Bunyip River	Riverine
4	Alexandra Avenue	Koo Wee Rup	Koo Wee Rup South Drain	Riverine
6	Alexandra Avenue	Koo Wee Rup	Koo Wee Rup South Drain	Riverine
3/7	Alexandra Avenue	Koo Wee Rup	Koo Wee Rup South Drain	Riverine
8	Alexandra Avenue	Koo Wee Rup	Koo Wee Rup South Drain	Riverine
10	Alexandra Avenue	Koo Wee Rup	Koo Wee Rup South Drain	Riverine
12	Alexandra Avenue	Koo Wee Rup	Koo Wee Rup South Drain	Riverine
1	Amber Street	Koo Wee Rup	Southern Boundary Drain	Riverine
3	Amber Street	Koo Wee Rup	Southern Boundary Drain	Riverine
5	Amber Street	Koo Wee Rup	Southern Boundary Drain	Riverine
7	Amber Street	Koo Wee Rup	Southern Boundary Drain	Riverine
9	Amber Street	Koo Wee Rup	Southern Boundary Drain	Riverine
11	Amber Street	Koo Wee Rup	Southern Boundary Drain	Riverine
13	Amber Street	Koo Wee Rup	Southern Boundary Drain	Riverine
15	Amber Street	Koo Wee Rup	Southern Boundary Drain	Riverine
17	Amber Street	Koo Wee Rup	Southern Boundary Drain	Riverine
3370	Ballarto Road	Koo Wee Rup North	Five Mile Drain	Riverine
3155	Ballarto Road	Bayles	Phillips Road Drain	Riverine
3165	Ballarto Road	Bayles	Phillips Road Drain	Riverine
3170	Ballarto Road	Bayles	Phillips Road Drain	Riverine
3215	Ballarto Road	Bayles	Phillips Road Drain	Riverine
3245	Ballarto Road	Bayles	Phillips Road Drain	Riverine
3295	Ballarto Road	Bayles	Phillips Road Drain	Riverine
3370	Ballarto Road	Bayles	Phillips Road Drain	Riverine
3515	Ballarto Road	Bayles	Phillips Road Drain	Riverine
3520	Ballarto Road	Bayles	Phillips Road Drain	Riverine
3545	Ballarto Road	Bayles	Phillips Road Drain	Riverine
3555	Ballarto Road	Bayles	Phillips Road Drain	Riverine
3575	Ballarto Road	Bayles	Phillips Road Drain	Riverine
3585	Ballarto Road	Bayles	Phillips Road Drain	Riverine
3675	Ballarto Road	Bayles	Phillips Road Drain	Riverine
6	Barnes Way	Koo Wee Rup	Koo Wee Rup South Drain	Riverine
8	Barnes Way	Koo Wee Rup	Koo Wee Rup South Drain	Riverine
9	Barnes Way	Koo Wee Rup	Koo Wee Rup South Drain	Riverine
10	Barnes Way	Koo Wee Rup	Koo Wee Rup South Drain	Riverine
12	Barnes Way	Koo Wee Rup	Koo Wee Rup South Drain	Riverine
14	Barnes Way	Koo Wee Rup	Koo Wee Rup South Drain	Riverine
25	Bastin Road	Bunyip	Batchelor Drain	Riverine
10	Bastin Road	Bunyip	Batchelor Drain	Riverine

Street No. at Flood Risk	Street	Suburb	Along Melbourne Water Watercourse	Flood Risk Type
85	Bastin Road	Bunyip	Batchelor Drain	Riverine
245	Bastin Road	Bunyip	Batchelor Drain	Riverine
2	Bellairs Place	Koo Wee Rup	Koo Wee Rup South Drain	Riverine
4	Bellairs Place	Koo Wee Rup	Koo Wee Rup South Drain	Riverine
5	Bellairs Place	Koo Wee Rup	Koo Wee Rup South Drain	Riverine
6	Bellairs Place	Koo Wee Rup	Koo Wee Rup South Drain	Riverine
8	Bellairs Place	Koo Wee Rup	Koo Wee Rup South Drain	Riverine
10	Bellairs Place	Koo Wee Rup	Koo Wee Rup South Drain	Riverine
12	Bellairs Place	Koo Wee Rup	Koo Wee Rup South Drain	Riverine
310	Bennett Road	Cora Lynn	Sinclairs Road Drain	Riverine
315	Bennett Road	Cora Lynn	Sinclairs Road Drain	Riverine
340	Bennett Road	Cora Lynn	Sinclairs Road Drain	Riverine
415	Bennett Road	Cora Lynn	Sinclairs Road Drain	Riverine
95	Berry Lane	Bunyip	Berry Lane Drain	Riverine
120	Berry Lane	Bunyip	Berry Lane Drain	Riverine
7	Blackfish Drive	Koo Wee Rup	Southern Boundary Drain	Riverine
15	Blackfish Drive	Koo Wee Rup	Southern Boundary Drain	Riverine
17	Blackfish Drive	Koo Wee Rup	Southern Boundary Drain	Riverine
10	Bollen Way	Koo Wee Rup	Koo Wee Rup South Drain	Riverine
12	Bollen Way	Koo Wee Rup	Koo Wee Rup South Drain	Riverine
14	Bollen Way	Koo Wee Rup	Koo Wee Rup South Drain	Riverine
16	Bollen Way	Koo Wee Rup	Koo Wee Rup South Drain	Riverine
17	Bollen Way	Koo Wee Rup	Koo Wee Rup South Drain	Riverine
18	Bollen Way	Koo Wee Rup	Koo Wee Rup South Drain	Riverine
19	Bollen Way	Koo Wee Rup	Koo Wee Rup South Drain	Riverine
20	Bollen Way	Koo Wee Rup	Koo Wee Rup South Drain	Riverine
22	Bollen Way	Koo Wee Rup	Koo Wee Rup South Drain	Riverine
23	Bollen Way	Koo Wee Rup	Koo Wee Rup South Drain	Riverine
24	Bollen Way	Koo Wee Rup	Koo Wee Rup South Drain	Riverine
25	Bollen Way	Koo Wee Rup	Koo Wee Rup South Drain	Riverine
26	Bollen Way	Koo Wee Rup	Koo Wee Rup South Drain	Riverine
27	Bollen Way	Koo Wee Rup	Koo Wee Rup South Drain	Riverine
1	Boormani Court	Koo Wee Rup	Southern Boundary Drain	Riverine
4	Boormani Court	Koo Wee Rup	Southern Boundary Drain	Riverine
5	Boormani Court	Koo Wee Rup	Southern Boundary Drain	Riverine
6	Boormani Court	Koo Wee Rup	Southern Boundary Drain	Riverine
7	Boormani Court	Koo Wee Rup	Southern Boundary Drain	Riverine
575	Boundary Drain Road	Bayles	Southern Boundary Drain	Riverine
745	Boundary Drain Road	Bayles	Southern Boundary Drain	Riverine
1	Boundary Drain Road	Koo Wee Rup	Bunyip Main Outfall Drain	Riverine
3	Boundary Drain Road	Koo Wee Rup	Bunyip Main Outfall Drain	Riverine
5	Boundary Drain Road	Koo Wee Rup	Bunyip Main Outfall Drain	Riverine
7-9	Boundary Drain Road	Koo Wee Rup	Southern Boundary Drain	Riverine
19	Boundary Drain Road	Koo Wee Rup	Southern Boundary Drain	Riverine
23	Boundary Drain Road	Koo Wee Rup	Southern Boundary Drain	Riverine
29	Boundary Drain Road	Koo Wee Rup	Southern Boundary Drain	Riverine

Street No. at Flood Risk	Street	Suburb	Along Melbourne Water Watercourse	Flood Risk Type
31	Boundary Drain Road	Koo Wee Rup	Southern Boundary Drain	Riverine
33	Boundary Drain Road	Koo Wee Rup	Southern Boundary Drain	Riverine
35	Boundary Drain Road	Koo Wee Rup	Southern Boundary Drain	Riverine
37	Boundary Drain Road	Koo Wee Rup	Southern Boundary Drain	Riverine
39	Boundary Drain Road	Koo Wee Rup	Southern Boundary Drain	Riverine
41	Boundary Drain Road	Koo Wee Rup	Southern Boundary Drain	Riverine
43	Boundary Drain Road	Koo Wee Rup	Southern Boundary Drain	Riverine
75	Boundary Drain Road	Koo Wee Rup	Southern Boundary Drain	Riverine
85	Boundary Drain Road	Koo Wee Rup	Southern Boundary Drain	Riverine
95	Boundary Drain Road	Koo Wee Rup	Southern Boundary Drain	Riverine
105	Boundary Drain Road	Koo Wee Rup	Southern Boundary Drain	Riverine
109	Boundary Drain Road	Koo Wee Rup	Southern Boundary Drain	Riverine
111	Boundary Drain Road	Koo Wee Rup	Southern Boundary Drain	Riverine
115	Boundary Drain Road	Koo Wee Rup	Southern Boundary Drain	Riverine
125	Boundary Drain Road	Koo Wee Rup	Southern Boundary Drain	Riverine
129	Boundary Drain Road	Koo Wee Rup	Southern Boundary Drain	Riverine
131	Boundary Drain Road	Koo Wee Rup	Southern Boundary Drain	Riverine
135	Boundary Drain Road	Koo Wee Rup	Southern Boundary Drain	Riverine
225	Boundary Drain Road	Koo Wee Rup	Southern Boundary Drain	Riverine
245	Boundary Drain Road	Koo Wee Rup	Southern Boundary Drain	Riverine
295	Boundary Drain Road	Koo Wee Rup	Southern Boundary Drain	Riverine
311	Boundary Drain Road	Koo Wee Rup	Southern Boundary Drain	Riverine
325	Boundary Drain Road	Koo Wee Rup	Southern Boundary Drain	Riverine
345	Boundary Drain Road	Koo Wee Rup	Southern Boundary Drain	Riverine
35	Boxshall Road	Bayles	Number Four Yallock Drain	Riverine
55	Boxshall Road	Bayles	Number Four Yallock Drain	Riverine
1255	Bunyip River Road	Iona	Bunyip Main Outfall Drain	Riverine
1275	Bunyip River Road	Iona	Bunyip Main Outfall Drain	Riverine
1285	Bunyip River Road	Iona	Bunyip Main Outfall Drain	Riverine
1325	Bunyip River Road	Iona	Bunyip Main Outfall Drain	Riverine
895	Bunyip River Road	Vervale	Bunyip Main Outfall Drain	Riverine
955	Bunyip River Road	Vervale	Bunyip Main Outfall Drain	Riverine
995	Bunyip River Road	Vervale	Bunyip Main Outfall Drain	Riverine
1215	Bunyip River Road	Iona	Bunyip Main Outfall Drain	Riverine
815-835	Bunyip River Road	Vervale	Bunyip Main Outfall Drain	Riverine
315	Bunyip River Road	Cora Lynn	Bunyip Main Outfall Drain	Riverine
525	Bunyip River Road	Cora Lynn	Bunyip Main Outfall Drain	Riverine
595	Bunyip River Road	Cora Lynn	Bunyip Main Outfall Drain	Riverine
625	Bunyip River Road	Cora Lynn	Bunyip Main Outfall Drain	Riverine
55	Bunyip River Road	Nar Nar Goon	Bunyip Main Outfall Drain	Riverine
91	Bunyip River Road	Nar Nar Goon	Bunyip Main Outfall Drain	Riverine
455	Bunyip River Road	Cora Lynn	Bunyip Main Outfall Drain	Riverine
465	Bunyip River Road	Cora Lynn	Bunyip Main Outfall Drain	Riverine
225	Bunyip-Modella Road	Bunyip	Bunyip Modella Road Drain	Riverine
255	Bunyip-Modella Road	Bunyip	Bunyip Modella Road Drain	Riverine
325	Bunyip-Modella Road	Bunyip	Bunyip Modella Road Drain	Riverine

Street No. at Flood Risk	Street	Suburb	Along Melbourne Water Watercourse	Flood Risk Type
415	Bunyip-Modella Road	Bunyip	Bunyip Modella Road Drain	Riverine
420	Bunyip-Modella Road	Iona	Bunyip Modella Road Drain	Riverine
450	Bunyip-Modella Road	Iona	Bunyip Modella Road Drain	Riverine
455	Bunyip-Modella Road	Iona	Bunyip Modella Road Drain	Riverine
465	Bunyip-Modella Road	Iona	Bunyip Modella Road Drain	Riverine
485	Bunyip-Modella Road	Iona	Bunyip Modella Road Drain	Riverine
490	Bunyip-Modella Road	Iona	Bunyip Modella Road Drain	Riverine
710	Bunyip-Modella Road	Iona	Bunyip Modella Road Drain	Riverine
730	Bunyip-Modella Road	Iona	Bunyip Modella Road Drain	Riverine
735	Bunyip-Modella Road	Iona	Bunyip Modella Road Drain	Riverine
66	Carses Road	Iona	Sidebottoms Road Drain	Riverine
95	Carses Road	Iona	Sidebottoms Road Drain	Riverine
90	Daleys Road	Koo Wee Rup	Johnsons Drain	Riverine
105	Daleys Road	Koo Wee Rup	Johnsons Drain	Riverine
115	Daleys Road	Koo Wee Rup	Johnsons Drain	Riverine
135	Daleys Road	Koo Wee Rup	Johnsons Drain	Riverine
63	Denham Road	Koo Wee Rup	Southern Boundary Drain	Riverine
65	Denham Road	Koo Wee Rup	Southern Boundary Drain	Riverine
66	Denham Road	Koo Wee Rup	Southern Boundary Drain	Riverine
67	Denham Road	Koo Wee Rup	Southern Boundary Drain	Riverine
68	Denham Road	Koo Wee Rup	Southern Boundary Drain	Riverine
460	Dessent Road	Iona	Roxburghs Drain	Riverine
1	Diamond Drive	Koo Wee Rup	Southern Boundary Drain	Riverine
2	Diamond Drive	Koo Wee Rup	Southern Boundary Drain	Riverine
3	Diamond Drive	Koo Wee Rup	Southern Boundary Drain	Riverine
4	Diamond Drive	Koo Wee Rup	Southern Boundary Drain	Riverine
5	Diamond Drive	Koo Wee Rup	Southern Boundary Drain	Riverine
495	Eleven Mile Road	Cora Lynn	Bunyip Main Outfall Drain	Riverine
514	Eleven Mile Road	Cora Lynn	Bunyip Main Outfall Drain	Riverine
3	Emerald Crescent	Koo Wee Rup	Southern Boundary Drain	Riverine
4	Emerald Crescent	Koo Wee Rup	Southern Boundary Drain	Riverine
5	Emerald Crescent	Koo Wee Rup	Southern Boundary Drain	Riverine
6	Emerald Crescent	Koo Wee Rup	Southern Boundary Drain	Riverine
7	Emerald Crescent	Koo Wee Rup	Southern Boundary Drain	Riverine
8	Emerald Crescent	Koo Wee Rup	Southern Boundary Drain	Riverine
9	Emerald Crescent	Koo Wee Rup	Southern Boundary Drain	Riverine
10	Emerald Crescent	Koo Wee Rup	Southern Boundary Drain	Riverine
11	Emerald Crescent	Koo Wee Rup	Southern Boundary Drain	Riverine
12	Emerald Crescent	Koo Wee Rup	Southern Boundary Drain	Riverine
13	Emerald Crescent	Koo Wee Rup	Southern Boundary Drain	Riverine
14	Emerald Crescent	Koo Wee Rup	Southern Boundary Drain	Riverine
15	Emerald Crescent	Koo Wee Rup	Southern Boundary Drain	Riverine
17	Emerald Crescent	Koo Wee Rup	Southern Boundary Drain	Riverine
19	Emerald Crescent	Koo Wee Rup	Southern Boundary Drain	Riverine
21	Emerald Crescent	Koo Wee Rup	Southern Boundary Drain	Riverine
23	Emerald Crescent	Koo Wee Rup	Southern Boundary Drain	Riverine

Street No. at Flood Risk	Street	Suburb	Along Melbourne Water Watercourse	Flood Risk Type
25	Emerald Crescent	Koo Wee Rup	Southern Boundary Drain	Riverine
27	Emerald Crescent	Koo Wee Rup	Southern Boundary Drain	Riverine
30	Evans Road	Bunyip	Longwarry Drain	Riverine
330	Fechner Road	Koo Wee Rup North	Bunyip Main Outfall Drain	Riverine
65	Fechner Road	Koo Wee Rup North	Bunyip Main Outfall Drain	Riverine
75	Fechner Road	Koo Wee Rup North	Bunyip Main Outfall Drain	Riverine
175	Fechner Road	Koo Wee Rup North	Bunyip Main Outfall Drain	Riverine
200	Fechner Road	Koo Wee Rup North	Bunyip Main Outfall Drain	Riverine
330	Fechner Road	Koo Wee Rup North	Bunyip Main Outfall Drain	Riverine
31	Fincks Road	Bayles	Fincks Road Drain	Riverine
35	Fincks Road	Bayles	Fincks Road Drain	Riverine
50	Fincks Road	Bayles	Fincks Road Drain	Riverine
60	Fincks Road	Bayles	Fincks Road Drain	Riverine
65	Fincks Road	Bayles	Fincks Road Drain	Riverine
70	Fincks Road	Bayles	Fincks Road Drain	Riverine
80	Fincks Road	Bayles	Fincks Road Drain	Riverine
85	Fincks Road	Bayles	Fincks Road Drain	Riverine
90	Fincks Road	Bayles	Fincks Road Drain	Riverine
110	Fincks Road	Bayles	Fincks Road Drain	Riverine
135	Fincks Road	Bayles	Fincks Road Drain	Riverine
85	Five Mile Road	Pakenham South	Five Mile Drain	Riverine
209	Five Mile Road	Pakenham South	Five Mile Drain	Riverine
270	Five Mile Road	Pakenham South	Five Mile Drain	Riverine
305	Five Mile Road	Pakenham South	Five Mile Drain	Riverine
310	Five Mile Road	Pakenham South	Five Mile Drain	Riverine
80	Gunn Road	Garfield	Gunns Drain	Riverine
365	Hall Road	Pakenham South	Five Mile Drain	Riverine
43A	Henry Street	Koo Wee Rup	Southern Boundary Drain	Riverine
44	Henry Street	Koo Wee Rup	Southern Boundary Drain	Riverine
45	Henry Street	Koo Wee Rup	Southern Boundary Drain	Riverine
46	Henry Street	Koo Wee Rup	Southern Boundary Drain	Riverine
63	Henry Street	Koo Wee Rup	Southern Boundary Drain	Riverine
115	Hogans Road	Bayles	Hogans Road Drain	Riverine
3	Jade Avenue	Koo Wee Rup	Southern Boundary Drain	Riverine
4	Jade Avenue	Koo Wee Rup	Southern Boundary Drain	Riverine
5	Jade Avenue	Koo Wee Rup	Southern Boundary Drain	Riverine
6	Jade Avenue	Koo Wee Rup	Southern Boundary Drain	Riverine
7	Jade Avenue	Koo Wee Rup	Southern Boundary Drain	Riverine
8	Jade Avenue	Koo Wee Rup	Southern Boundary Drain	Riverine
9	Jade Avenue	Koo Wee Rup	Southern Boundary Drain	Riverine
10	Jade Avenue	Koo Wee Rup	Southern Boundary Drain	Riverine
11	Jade Avenue	Koo Wee Rup	Southern Boundary Drain	Riverine
12	Jade Avenue	Koo Wee Rup	Southern Boundary Drain	Riverine
2	John Street	Koo Wee Rup	Koo Wee Rup South Drain	Riverine
4	John Street	Koo Wee Rup	Koo Wee Rup South Drain	Riverine
8	John Street	Koo Wee Rup	Koo Wee Rup South Drain	Riverine

Street No. at Flood Risk	Street	Suburb	Along Melbourne Water Watercourse	Flood Risk Type
10	John Street	Koo Wee Rup	Koo Wee Rup South Drain	Riverine
190	Koo Wee Rup Road	Koo Wee Rup	McGregors Drain	Riverine
200	Koo Wee Rup Road	Koo Wee Rup	McGregors Drain	Riverine
755	Koo Wee Rup-Longwarry Road	Catani	Number Six Yallock Drain	Riverine
765	Koo Wee Rup-Longwarry Road	Catani	Number Six Yallock Drain	Riverine
730	Koo Wee Rup-Longwarry Road	Catani	Number Six Yallock Drain	Riverine
750	Koo Wee Rup-Longwarry Road	Catani	Number Six Yallock Drain	Riverine
770	Koo Wee Rup-Longwarry Road	Catani	Number Six Yallock Drain	Riverine
780	Koo Wee Rup-Longwarry Road	Catani	Number Six Yallock Drain	Riverine
830	Koo Wee Rup-Longwarry Road	Catani	Number Six Yallock Drain	Riverine
850	Koo Wee Rup-Longwarry Road	Catani	Number Six Yallock Drain	Riverine
870	Koo Wee Rup-Longwarry Road	Catani	Number Six Yallock Drain	Riverine
905	Koo Wee Rup-Longwarry Road	Catani	Number Six Yallock Drain	Riverine
960	Koo Wee Rup-Longwarry Road	Catani	Number Six Yallock Drain	Riverine
970	Koo Wee Rup-Longwarry Road	Catani	Number Six Yallock Drain	Riverine
990	Koo Wee Rup-Longwarry Road	Catani	Number Six Yallock Drain	Riverine
6	Lapis Street	Koo Wee Rup	Southern Boundary Drain	Riverine
8	Lapis Street	Koo Wee Rup	Southern Boundary Drain	Riverine
10	Lapis Street	Koo Wee Rup	Southern Boundary Drain	Riverine
12	Lapis Street	Koo Wee Rup	Southern Boundary Drain	Riverine
14	Lapis Street	Koo Wee Rup	Southern Boundary Drain	Riverine
16	Lapis Street	Koo Wee Rup	Southern Boundary Drain	Riverine
18	Lapis Street	Koo Wee Rup	Southern Boundary Drain	Riverine
20	Lapis Street	Koo Wee Rup	Southern Boundary Drain	Riverine
22	Lapis Street	Koo Wee Rup	Southern Boundary Drain	Riverine
23	Lapis Street	Koo Wee Rup	Southern Boundary Drain	Riverine
24	Lapis Street	Koo Wee Rup	Southern Boundary Drain	Riverine
25	Lapis Street	Koo Wee Rup	Southern Boundary Drain	Riverine
580	Little Road	Iona	Sidebottoms Road Drain	Riverine
450	Little Road	Iona	Sidebottoms Road Drain	Riverine
1970	Main Drain Road	Vervale	Bunyip Main Outfall Drain	Riverine
1380	Main Drain Road	Cora Lynn	Bunyip Main Outfall Drain	Riverine
1420	Main Drain Road	Cora Lynn	Bunyip Main Outfall Drain	Riverine
1450	Main Drain Road	Cora Lynn	Bunyip Main Outfall Drain	Riverine
1500	Main Drain Road	Cora Lynn	Bunyip Main Outfall Drain	Riverine
1510	Main Drain Road	Cora Lynn	Bunyip Main Outfall Drain	Riverine
1580	Main Drain Road	Cora Lynn	Bunyip Main Outfall Drain	Riverine
180	Main Drain Road	Koo Wee Rup	Bunyip Main Outfall Drain	Riverine
210	Main Drain Road	Koo Wee Rup	Bunyip Main Outfall Drain	Riverine
220	Main Drain Road	Koo Wee Rup	Bunyip Main Outfall Drain	Riverine
230	Main Drain Road	Koo Wee Rup	Bunyip Main Outfall Drain	Riverine
270	Main Drain Road	Koo Wee Rup	Bunyip Main Outfall Drain	Riverine
290	Main Drain Road	Koo Wee Rup	Bunyip Main Outfall Drain	Riverine
320	Main Drain Road	Koo Wee Rup	Bunyip Main Outfall Drain	Riverine
360	Main Drain Road	Koo Wee Rup	Bunyip Main Outfall Drain	Riverine
380	Main Drain Road	Koo Wee Rup	Bunyip Main Outfall Drain	Riverine

Street No. at Flood Risk	Street	Suburb	Along Melbourne Water Watercourse	Flood Risk Type
420	Main Drain Road	Koo Wee Rup	Bunyip Main Outfall Drain	Riverine
430	Main Drain Road	Koo Wee Rup	Bunyip Main Outfall Drain	Riverine
40	McCraws Road	Catani	Taplins Road Drain	Riverine
155	McDonalds Drain Road	Koo Wee Rup	McDonalds Catchment Drain	Riverine
175	McDonalds Drain Road	Koo Wee Rup	McDonalds Catchment Drain	Riverine
195	McDonalds Drain Road	Koo Wee Rup	McDonalds Catchment Drain	Riverine
205	McDonalds Drain Road	Koo Wee Rup	McDonalds Catchment Drain	Riverine
400	McDonalds Drain Road	Koo Wee Rup	McDonalds Catchment Drain	Riverine
500	McDonalds Drain Road	Koo Wee Rup	McDonalds Catchment Drain	Riverine
600	McDonalds Drain Road	Koo Wee Rup	McDonalds Catchment Drain	Riverine
620	McDonalds Drain Road	Koo Wee Rup	McDonalds Catchment Drain	Riverine
660	McDonalds Drain Road	Koo Wee Rup	McDonalds Catchment Drain	Riverine
680	McDonalds Drain Road	Koo Wee Rup	McDonalds Catchment Drain	Riverine
700	McDonalds Drain Road	Koo Wee Rup	McDonalds Catchment Drain	Riverine
770	McDonalds Drain Road	Koo Wee Rup	McDonalds Catchment Drain	Riverine
10	McDonalds Road	Catani	McDonalds Road Drain North	Riverine
200	McDonalds Road	Catani	McDonalds Road Drain North	Riverine
2	Mickle Street	Koo Wee Rup	Koo Wee Rup South Drain	Riverine
4	Mickle Street	Koo Wee Rup	Koo Wee Rup South Drain	Riverine
4A	Mickle Street	Koo Wee Rup	Koo Wee Rup South Drain	Riverine
14	Mickle Street	Koo Wee Rup	Koo Wee Rup South Drain	Riverine
3	Milla Way	Koo Wee Rup	Southern Boundary Drain	Riverine
4	Milla Way	Koo Wee Rup	Southern Boundary Drain	Riverine
5	Milla Way	Koo Wee Rup	Southern Boundary Drain	Riverine
6	Milla Way	Koo Wee Rup	Southern Boundary Drain	Riverine
7	Milla Way	Koo Wee Rup	Southern Boundary Drain	Riverine
8	Milla Way	Koo Wee Rup	Southern Boundary Drain	Riverine
9	Milla Way	Koo Wee Rup	Southern Boundary Drain	Riverine
10	Milla Way	Koo Wee Rup	Southern Boundary Drain	Riverine
11	Milla Way	Koo Wee Rup	Southern Boundary Drain	Riverine
12	Milla Way	Koo Wee Rup	Southern Boundary Drain	Riverine
13	Milla Way	Koo Wee Rup	Southern Boundary Drain	Riverine
14	Milla Way	Koo Wee Rup	Southern Boundary Drain	Riverine
15	Milla Way	Koo Wee Rup	Southern Boundary Drain	Riverine
17	Milla Way	Koo Wee Rup	Southern Boundary Drain	Riverine
18	Milla Way	Koo Wee Rup	Southern Boundary Drain	Riverine
19	Milla Way	Koo Wee Rup	Southern Boundary Drain	Riverine
20	Milla Way	Koo Wee Rup	Southern Boundary Drain	Riverine
21	Milla Way	Koo Wee Rup	Southern Boundary Drain	Riverine
22	Milla Way	Koo Wee Rup	Southern Boundary Drain	Riverine
24	Milla Way	Koo Wee Rup	Southern Boundary Drain	Riverine
26	Milla Way	Koo Wee Rup	Southern Boundary Drain	Riverine
28	Milla Way	Koo Wee Rup	Southern Boundary Drain	Riverine
30	Milla Way	Koo Wee Rup	Southern Boundary Drain	Riverine
32	Milla Way	Koo Wee Rup	Southern Boundary Drain	Riverine
34	Milla Way	Koo Wee Rup	Southern Boundary Drain	Riverine

Street No. at Flood Risk	Street	Suburb	Along Melbourne Water Watercourse	Flood Risk Type
1/25	Moody Street	Koo Wee Rup	Southern Boundary Drain	Riverine
2/25	Moody Street	Koo Wee Rup	Southern Boundary Drain	Riverine
115	Moody Street	Koo Wee Rup	Southern Boundary Drain	Riverine
117	Moody Street	Koo Wee Rup	Southern Boundary Drain	Riverine
119	Moody Street	Koo Wee Rup	Southern Boundary Drain	Riverine
121	Moody Street	Koo Wee Rup	Southern Boundary Drain	Riverine
123	Moody Street	Koo Wee Rup	Southern Boundary Drain	Riverine
125	Moody Street	Koo Wee Rup	Southern Boundary Drain	Riverine
127	Moody Street	Koo Wee Rup	Southern Boundary Drain	Riverine
129	Moody Street	Koo Wee Rup	Southern Boundary Drain	Riverine
130	Moody Street	Koo Wee Rup	Southern Boundary Drain	Riverine
131	Moody Street	Koo Wee Rup	Southern Boundary Drain	Riverine
132	Moody Street	Koo Wee Rup	Southern Boundary Drain	Riverine
133	Moody Street	Koo Wee Rup	Southern Boundary Drain	Riverine
134	Moody Street	Koo Wee Rup	Southern Boundary Drain	Riverine
135	Moody Street	Koo Wee Rup	Southern Boundary Drain	Riverine
136	Moody Street	Koo Wee Rup	Southern Boundary Drain	Riverine
137	Moody Street	Koo Wee Rup	Southern Boundary Drain	Riverine
138	Moody Street	Koo Wee Rup	Southern Boundary Drain	Riverine
139	Moody Street	Koo Wee Rup	Southern Boundary Drain	Riverine
141	Moody Street	Koo Wee Rup	Southern Boundary Drain	Riverine
935	Murray Road	Bunyip	Murray Road Drain	Riverine
1115	Murray Road	Bunyip	Murray Road Drain	Riverine
835	Murray Road	Iona	Murray Road Drain	Riverine
725	Murray Road	Vervale	Murray Road Drain	Riverine
35	Murray Road	Cora Lynn	Number Four Yallock Drain	Riverine
455	Murray Road	Cora Lynn	Number Four Yallock Drain	Riverine
20	Murray Road	Cora Lynn	Murray Road Drain	Riverine
310	Murray Road	Cora Lynn	Murray Road Drain	Riverine
1542	Nar Nar Goon-Longwarry Road	Bunyip	Bunyip Main Outfall Drain	Riverine
1550	Nar Nar Goon-Longwarry Road	Bunyip	Bunyip Main Outfall Drain	Riverine
1560	Nar Nar Goon-Longwarry Road	Bunyip	Bunyip Main Outfall Drain	Riverine
680-690	Nine Mile Road	Cora Lynn	Bunyip Main Outfall Drain	Riverine
650	Nine Mile Road	Cora Lynn	Ten Mile Drain	Riverine
700	Nine Mile Road	Cora Lynn	Ten Mile Drain	Riverine
706	Nine Mile Road	Cora Lynn	Ten Mile Drain	Riverine
710	Nine Mile Road	Cora Lynn	Ten Mile Drain	Riverine
140	Number Five Drain Road	Monomeith	Number Five Yallock Drain	Riverine
275	Number Five Drain Road	Bayles	Number Five Yallock Drain	Riverine
60	Number Four Drain Road	Bayles	Number Four Yallock Drain	Riverine
80	Number Four Drain Road	Bayles	Number Four Yallock Drain	Riverine
160	Number Four Drain Road	Bayles	Number Four Yallock Drain	Riverine
170	Number Four Drain Road	Bayles	Number Four Yallock Drain	Riverine
200	Number Four Drain Road	Bayles	Number Four Yallock Drain	Riverine
510	Number Seven Drain Road	Catani	Number Seven Yallock Drain	Riverine
740	Number Seven Drain Road	Catani	Number Seven Yallock Drain	Riverine

Street No. at Flood Risk	Street	Suburb	Along Melbourne Water Watercourse	Flood Risk Type
90	Number Seven Drain Road	Bayles	Number Seven Yallock Drain	Riverine
130	Number Seven Drain Road	Bayles	Number Seven Yallock Drain	Riverine
215	Number Seven Drain Road	Cora Lynn	Number Seven Yallock Drain	Riverine
195	Pitt Road	Iona	Pitts Road Drain	Riverine
360	Pitt Road	Iona	Pitts Road Drain	Riverine
470	Pitt Road	Iona	Pitts Road Drain	Riverine
485	Pitt Road	Iona	Pitts Road Drain	Riverine
526	Pitt Road	Iona	Pitts Road Drain	Riverine
560	Pitt Road	Vervale	Pitts Road Drain	Riverine
4	Quinny Street	Koo Wee Rup	Southern Boundary Drain	Riverine
5	Quinny Street	Koo Wee Rup	Southern Boundary Drain	Riverine
6	Quinny Street	Koo Wee Rup	Southern Boundary Drain	Riverine
7	Quinny Street	Koo Wee Rup	Southern Boundary Drain	Riverine
8	Quinny Street	Koo Wee Rup	Southern Boundary Drain	Riverine
9	Quinny Street	Koo Wee Rup	Southern Boundary Drain	Riverine
10	Quinny Street	Koo Wee Rup	Southern Boundary Drain	Riverine
11	Quinny Street	Koo Wee Rup	Southern Boundary Drain	Riverine
12	Quinny Street	Koo Wee Rup	Southern Boundary Drain	Riverine
14	Quinny Street	Koo Wee Rup	Southern Boundary Drain	Riverine
16	Quinny Street	Koo Wee Rup	Southern Boundary Drain	Riverine
2/224	Rossiter Road	Koo Wee Rup	Bunyip Main Outfall Drain	Riverine
232	Rossiter Road	Koo Wee Rup	Bunyip Main Outfall Drain	Riverine
3	Ruby Avenue	Koo Wee Rup	Southern Boundary Drain	Riverine
4	Ruby Avenue	Koo Wee Rup	Southern Boundary Drain	Riverine
5	Ruby Avenue	Koo Wee Rup	Southern Boundary Drain	Riverine
6	Ruby Avenue	Koo Wee Rup	Southern Boundary Drain	Riverine
7	Ruby Avenue	Koo Wee Rup	Southern Boundary Drain	Riverine
8	Ruby Avenue	Koo Wee Rup	Southern Boundary Drain	Riverine
9	Ruby Avenue	Koo Wee Rup	Southern Boundary Drain	Riverine
10	Ruby Avenue	Koo Wee Rup	Southern Boundary Drain	Riverine
11	Ruby Avenue	Koo Wee Rup	Southern Boundary Drain	Riverine
12	Ruby Avenue	Koo Wee Rup	Southern Boundary Drain	Riverine
13	Ruby Avenue	Koo Wee Rup	Southern Boundary Drain	Riverine
14	Ruby Avenue	Koo Wee Rup	Southern Boundary Drain	Riverine
15	Ruby Avenue	Koo Wee Rup	Southern Boundary Drain	Riverine
16	Ruby Avenue	Koo Wee Rup	Southern Boundary Drain	Riverine
17	Ruby Avenue	Koo Wee Rup	Southern Boundary Drain	Riverine
18	Ruby Avenue	Koo Wee Rup	Southern Boundary Drain	Riverine
19	Ruby Avenue	Koo Wee Rup	Southern Boundary Drain	Riverine
21	Ruby Avenue	Koo Wee Rup	Southern Boundary Drain	Riverine
23	Ruby Avenue	Koo Wee Rup	Southern Boundary Drain	Riverine
23-25	Salmon Street	Koo Wee Rup	Southern Boundary Drain	Riverine
27	Salmon Street	Koo Wee Rup	Southern Boundary Drain	Riverine
29-31	Salmon Street	Koo Wee Rup	Southern Boundary Drain	Riverine
125	Scanlons Drain Road	Bayles	Scanlons Drain	Riverine
165	Scanlons Drain Road	Bayles	Scanlons Drain	Riverine

Street No. at Flood Risk	Street	Suburb	Along Melbourne Water Watercourse	Flood Risk Type
235	Scanlons Drain Road	Bayles	Scanlons Drain	Riverine
295	Scanlons Drain Road	Bayles	Scanlons Drain	Riverine
1010	Seven Mile Road	Koo Wee Rup North	Bunyip Main Outfall Drain	Riverine
1020	Seven Mile Road	Koo Wee Rup North	Bunyip Main Outfall Drain	Riverine
970	Seven Mile Road	Koo Wee Rup North	Seven Mile Drain	Riverine
1010	Seven Mile Road	Koo Wee Rup North	Bunyip Main Outfall Drain	Riverine
1020	Seven Mile Road	Koo Wee Rup North	Bunyip Main Outfall Drain	Riverine
3130	Seven Mile Road	Koo Wee Rup North	Bunyip Main Outfall Drain	Riverine
2	Silver Way	Koo Wee Rup	Southern Boundary Drain	Riverine
3	Silver Way	Koo Wee Rup	Southern Boundary Drain	Riverine
4	Silver Way	Koo Wee Rup	Southern Boundary Drain	Riverine
5	Silver Way	Koo Wee Rup	Southern Boundary Drain	Riverine
6	Silver Way	Koo Wee Rup	Southern Boundary Drain	Riverine
7	Silver Way	Koo Wee Rup	Southern Boundary Drain	Riverine
8	Silver Way	Koo Wee Rup	Southern Boundary Drain	Riverine
9	Silver Way	Koo Wee Rup	Southern Boundary Drain	Riverine
10	Silver Way	Koo Wee Rup	Southern Boundary Drain	Riverine
11	Silver Way	Koo Wee Rup	Southern Boundary Drain	Riverine
12	Silver Way	Koo Wee Rup	Southern Boundary Drain	Riverine
13	Silver Way	Koo Wee Rup	Southern Boundary Drain	Riverine
14	Silver Way	Koo Wee Rup	Southern Boundary Drain	Riverine
15	Silver Way	Koo Wee Rup	Southern Boundary Drain	Riverine
16	Silver Way	Koo Wee Rup	Southern Boundary Drain	Riverine
17	Silver Way	Koo Wee Rup	Southern Boundary Drain	Riverine
18	Silver Way	Koo Wee Rup	Southern Boundary Drain	Riverine
19	Silver Way	Koo Wee Rup	Southern Boundary Drain	Riverine
20	Silver Way	Koo Wee Rup	Southern Boundary Drain	Riverine
21	Silver Way	Koo Wee Rup	Southern Boundary Drain	Riverine
22	Silver Way	Koo Wee Rup	Southern Boundary Drain	Riverine
23	Silver Way	Koo Wee Rup	Southern Boundary Drain	Riverine
24	Silver Way	Koo Wee Rup	Southern Boundary Drain	Riverine
25	Silver Way	Koo Wee Rup	Southern Boundary Drain	Riverine
27	Silver Way	Koo Wee Rup	Southern Boundary Drain	Riverine
29	Silver Way	Koo Wee Rup	Southern Boundary Drain	Riverine
31	Silver Way	Koo Wee Rup	Southern Boundary Drain	Riverine
33	Silver Way	Koo Wee Rup	Southern Boundary Drain	Riverine
35	Silver Way	Koo Wee Rup	Southern Boundary Drain	Riverine
37	Silver Way	Koo Wee Rup	Southern Boundary Drain	Riverine
250	Simpson Road	Iona	Simpsons Road Drain	Riverine
270	Simpson Road	Iona	Simpsons Road Drain	Riverine
510	Simpson Road	Iona	Simpsons Road Drain	Riverine
95	South Bank Road	Bunyip	Bunyip Main Outfall Drain	Riverine
115	South Bank Road	Bunyip	Bunyip Main Outfall Drain	Riverine
195	South Bank Road	Bunyip	Bunyip Main Outfall Drain	Riverine
3545	South Gippsland Highway	Koo Wee Rup	Bunyip Main Outfall Drain	Riverine
3500	South Gippsland Highway	Koo Wee Rup	Bunyip Main Outfall Drain	Riverine

Street No. at Flood Risk	Street	Suburb	Along Melbourne Water Watercourse	Flood Risk Type
3535	South Gippsland Highway	Koo Wee Rup	Bunyip Main Outfall Drain	Riverine
3670	South Gippsland Highway	Koo Wee Rup	Koo Wee Rup South Drain	Riverine
3775	South Gippsland Highway	Koo Wee Rup	Koo Wee Rup South Drain	Riverine
3830	South Gippsland Highway	Koo Wee Rup	Koo Wee Rup South Drain	Riverine
3870	South Gippsland Highway	Koo Wee Rup	Koo Wee Rup South Drain	Riverine
3940	South Gippsland Highway	Koo Wee Rup	Koo Wee Rup South Drain	Riverine
172-180	Station Street	Koo Wee Rup	Bunyip Main Outfall Drain	Riverine
224	Station Street	Koo Wee Rup	Bunyip Main Outfall Drain	Riverine
10	Strafford Lane	Bunyip	Strafford Lane Drain	Riverine
15	Strafford Lane	Bunyip	Strafford Lane Drain	Riverine
20	Strafford Lane	Bunyip	Strafford Lane Drain	Riverine
44	Strafford Lane	Bunyip	Strafford Lane Drain	Riverine
46	Sybella Avenue	Koo Wee Rup	Koo Wee Rup South Drain	Riverine
47	Sybella Avenue	Koo Wee Rup	Koo Wee Rup South Drain	Riverine
48	Sybella Avenue	Koo Wee Rup	Koo Wee Rup South Drain	Riverine
49	Sybella Avenue	Koo Wee Rup	Koo Wee Rup South Drain	Riverine
50	Sybella Avenue	Koo Wee Rup	Koo Wee Rup South Drain	Riverine
51	Sybella Avenue	Koo Wee Rup	Koo Wee Rup South Drain	Riverine
52	Sybella Avenue	Koo Wee Rup	Koo Wee Rup South Drain	Riverine
53	Sybella Avenue	Koo Wee Rup	Koo Wee Rup South Drain	Riverine
85	Sybella Avenue	Koo Wee Rup	Koo Wee Rup South Drain	Riverine
100	Sybella Avenue	Koo Wee Rup	Koo Wee Rup South Drain	Riverine
130	Sybella Avenue	Koo Wee Rup	Koo Wee Rup South Drain	Riverine
150	Sybella Avenue	Koo Wee Rup	Koo Wee Rup South Drain	Riverine
105	Taplins Road	Catani	Taplins Road Drain	Riverine
110	Taplins Road	Catani	Taplins Road Drain	Riverine
145	Taplins Road	Catani	Taplins Road Drain	Riverine
250	Taplins Road	Catani	Taplins Road Drain	Riverine
375	Temby Road	Iona	Fallon Drain	Riverine
335	Thirteen Mile Road	Garfield	Thirteen Mile Drain	Riverine
345	Thirteen Mile Road	Garfield	Thirteen Mile Drain	Riverine
365	Thirteen Mile Road	Garfield	Thirteen Mile Drain	Riverine
1	Ti-Tree Lane	Koo Wee Rup	Southern Boundary Drain	Riverine
2	Ti-Tree Lane	Koo Wee Rup	Southern Boundary Drain	Riverine
3	Ti-Tree Lane	Koo Wee Rup	Southern Boundary Drain	Riverine
165	Toner Road	Cora Lynn	Number Four Yallock Drain	Riverine
210	Toner Road	Cora Lynn	Number Four Yallock Drain	Riverine
2	Tower Road	Koo Wee Rup	Bunyip Main Outfall Drain	Riverine
10	Tower Road	Koo Wee Rup	Bunyip Main Outfall Drain	Riverine
54	Townley Road	Koo Wee Rup	Koo Wee Rup South Drain	Riverine
80	Wally Road	Bunyip	Walley Drain	Riverine
4	William Street	Koo Wee Rup	Southern Boundary Drain	Riverine
6	William Street	Koo Wee Rup	Southern Boundary Drain	Riverine
7	William Street	Koo Wee Rup	Southern Boundary Drain	Riverine
8	William Street	Koo Wee Rup	Southern Boundary Drain	Riverine
9	William Street	Koo Wee Rup	Southern Boundary Drain	Riverine

Street No. at Flood Risk	Street	Suburb	Along Melbourne Water Watercourse	Flood Risk Type
10	William Street	Koo Wee Rup	Southern Boundary Drain	Riverine
12	William Street	Koo Wee Rup	Southern Boundary Drain	Riverine
14	William Street	Koo Wee Rup	Southern Boundary Drain	Riverine

Total
503

Table C3.2 – Properties at risk of flooding along the Bunyip River catchment in Cardinia Shire

ISOLATION

Koo Wee Rup, Cora Lynn, Bayles and Iona all have the potential to become isolated for a period of time in an intense rainfall event. All major and local roads are at risk from overtopping including the South Gippsland Highway, Koo Wee Rup-Longwarry Road, Ballarto Road, Koo Wee Rup Road and Bunyip River Road. Areas of Koo Wee Rup town are expected to remain relatively dry during major flooding events. See mapping in **Appendix F** for where these areas are likely to be. Some localised short-duration isolation may occur due to flash flooding.

ESSENTIAL INFRASTRUCTURE

- **Koo Wee Rup Hospital** is at risk from isolation during a 1% AEP flooding event in Koo Wee Rup. Access roads such as Rossiter Road, Koo Wee Rup-Longwarry Road, Sybella Ave and South Gippsland Highway are all at risk of closure during a major flooding event. The hospital is expected to remain relatively dry.

- The Koo Wee Rup **Police Station** and **CFA Fire Station** could become isolated if local roads become inundated.

- The **Telephone Exchange** in Bayles could become isolated from the closure of Ballarto Road, Main Drain Road and Koo Wee Rup-Longwary Road due to floodwaters.

During an event see Public Transport Victoria's website (http://ptv.vic.gov.au/live-travel-updates) for details on delays or alterations to services.

Apart from the roads outlined below, all other essential infrastructure and services areas around Koo Wee Rup, Cora Lynn, Iona and Bayles are expected to remain unaffected by flooding during a 1% AEP (100yr ARI) event.

ROAD CLOSURES

The following roads are subject to closure during flooding around Koo Wee Rup, Cora Lynn, Iona and Bayles. Check the VicRoads website (alerts.vicroads.vic.gov.au) for more details.

VicRoads Roads flooded in a 1% AEP (100yr ARI) event
• Ballarto Road, Koo Wee Rup between McDonalds Drain Road East and Seven Mile Road
• Koo Wee Rup - Longwarry Road, Bayles
• Koo Wee Rup - Longwarry Road, Modella near Fallon Road
• Koo Wee Rup - Longwarry Road, Modella near Glover Road
• Koo Wee Rup Bypass, Koo Wee Rup
• Rossiter Road, Koo Wee Rup at the Koo Wee Rup Bypass
• South Gippsland Highway, Koo Wee Rup
• Sybella Avenue, Koo Wee Rup

Table C3.3 – VicRoads Possible Road Closures during a flooding event

Cardinia Shire Council Roads flooded in a 1% AEP (100yr ARI) event			
BAYLES	• Dessent Road	• Barnes Way	• Silver Way
• Boxshall Road	• Eleven Mile Road	• Bellairs Place	• Ti-Tree Lane
• Finks Road	• Main Drain Road	• Blackfish Drive	• Tower Road
• Hogans Road	• Main Drain Road South	• Bladens Road	• Townley Road
• McClures Road	• Murray Road	• Bollen Way	• William Street
• Number Four Drain Road East	• Toner Road	• Boormani Court	**KOO WEE RUP NORTH**
• Number Seven Drain Road	**GARFIELD**	• Boundary Drain Road	• Bunyip River Road
• Scanlons Drain Road	• Brownhill Road	• Catani Avenue	• Hall Road
• School Road	• Lone Pipe Road	• Daleys Road	• Seven Mile Road
BUNYIP	**GEMBROOK**	• Denhams Road	**MODELLA**
• Anderson Road	• Aqueduct Track	• Diamond Drive	• Glover Road
• Bastin Road	• Bunyip River Road	• Emerald Grove	**MONOMEITH**
• Berry Lane	**IONA**	• Fechner Road	• Number Five Drain Road
• Drake Court	• Bunyip-Modella Road	• Henry Street	**NAR NAR GOON**
• Enticott Road	• Carses Road	• Hudson Lane	• Convent School Road
• Evans Road	• Fallon Road	• Jade Avenue	• Hall Road
• McIvor Road	• Little Road	• John Street	• Whitta Lane
• South Bank Road	• Main Drain Road	• Lapis Street	**PAKENHAM SOUTH**
• Strafford Lane	• Murray Road	• Main Drain Road South	• Five Mile Road
• Wally Road	• Number Seven Drain Road	• McDonalds Drain Road	• McDonalds Drain Road East
CATANI	• Parish Road	• McDonalds Drain Road East	**VERVALE**
• Caldermeade Road	• Pitt Road	• McKays Road	• Bunyip River Road
• Hornbuckle Road	• Simpson Road	• Mickle Street	• Dessent Road
• Humphries Road	• Temby Road	• Milla Way	• Gunn Road
• Taplins Road	**KOO WEE RUP**	• Moody Street	• Main Drain Road South
CORA LYNN	• Alexandra Avenue	• Quinny Street	• Murray Road
• Bennett Road	• Amber Lane	• Ruby Avenue	• Walker Road
• Bunyip River Road	• Bailey Boulevard	• Salmon Street	

Table C3.4 – Cardinia Shire Council Possible Road Closures during a flooding event

FLOOD MITIGATION

LEVEES

Levee	Reach	Side	Levee Height	Levee Length	Expected Level of Protection	ANCOLD Hazard Rating	Consequences of Failure	VicMap Central Reference
Bunyip Main Drain	13 Mile Road to Cora Lynne	South	Unknown	6.0m	Unknown	Low	3 houses and agricultural land flooded	6765 D12-6764J13
Bunyip Main Drain	13 Mile Road to Cora Lynne	North	Unknown	4.7m	Unknown	Significant	27 houses, 2 industrial buildings and agricultural land flooded	6765 C12-6764 H13
Bunyip Main Drain	Cora Lynne to Ballarto Rd	North	2.5m	6.4m	Unknown	Significant	14 houses, 9 industrial buildings and agricultural land flooded	6764 H13-6764 B15
Bunyip Main Drain	Cora Lynne to Ballarto Rd	South	2.5m	6.4m	Unknown	Significant	10 houses, 13 industrial buildings and agricultural land flooded	6764 H13-6764 B15
Bunyip Main Drain	Ballarto Road to Railway Line	North	4m	6.6m	Unknown	Significant	4 houses, 12 industrial buildings and agricultural land flooded	6764 B15-6822 G4
Bunyip Main Drain	Ballarto Road to Railway Line	South	4m	6.6m	Unknown	Significant	45 houses, 19 industrial buildings and agricultural land	6764 B15 - 6822 G4
Bunyip Main Drain	Railway Line to South Gippsland Highway	North	3m	2.3m	Unknown	Very Low	Agricultural land flooded	6822 G4-F6
Bunyip Main Drain	Railway Line to South Gippsland Highway	South	3m	2.3m	Unknown	Very Low	Agricultural land flooded	6822 G4-F6
Bunyip Main Drain	South Gippsland Highway to Westernport Bay	North	1m	1.4m	Unknown	Very Low	Agricultural land flooded	6822E6-D7
Bunyip Main Drain	South Gippsland Highway to Westernport Bay	South	1m	2.0m	Unknown	Very Low	Agricultural land flooded	6822E7-F8
Yallock Outfall	Cora Lynne to Bayles	West	2m	4.8m	Unknown	Significant	13 houses, 8 industrial buildings and agricultural land flooded	6764H14-6823F2
Yallock Outfall	Cora Lynne to Bayles	East	2m	5.0m	Unknown	Low	6 houses, 1 industrial building and agricultural land flooded	6764H14-6823F2
Yallock Outfall	Bayles to Railway Line	West	2m	7.8m	Unknown	Low	4 houses, 5 industrial buildings and agricultural land flooded	6823F2-6822J6
Yallock Outfall	Bayles to Yallock Straight Cut	East	2m	3.3m	Unknown	Low	2 houses, 1 industrial building and agricultural land flooded	6823F2-6823C4
Yallock Outfall	Yallock Straight Cut to Railway Line	East	2m	3.6m	Unknown	Very Low	Agricultural land flooded	6823C4-6822K6

Levee	Reach	Side	Levee Height	Levee Length	Expected Level of Protection	ANCOLD Hazard Rating	Consequences of Failure	VicMap Central Reference
Yallock Outfall	Railway Line to Sth Gippsland Highway	West	2m	0.8m	Unknown	Very Low	Agricultural land flooded	6822J6
Yallock Outfall	Yallock Straight Cut from Railway Line to Sth Gippsland Highway	East	2m	0.4m	Unknown	Very Low	Agricultural land flooded	6822K6
Yallock Outfall	Sth Gippsland Highway to Westernport Bay	West	1m	2.5m	Unknown	Very Low	Agricultural land flooded	6822J6-G8
Yallock Outfall	Sth Gippsland Highway to Westernport Bay	East	1m	2.2m	Unknown	Very Low	Agricultural land flooded	6822K6-H8

Table C3.5 – Melbourne Water Levees in the Bunyip River Catchment in Cardinia Shire

SEWERAGE INFRASTRUCTURE

No Melbourne Water Sewerage Pumping Stations or Emergency Relief Points are expected to be within the vicinity of flood waters during severe flood events around the Bunyip River and Yallock Outfall. It is possible a number of un-sewered properties are located within the catchment.

COMMAND, CONTROL and COORDINATION

VICSES will assume overall control of the response to flood incidents. Other agencies will be requested to support operations as detailed in this Plan. Control and coordination of a flood incident shall be carried out at the lowest effective level and in accordance with the State Emergency Response Plan (EMMV Part 3). During significant events, VICSES will conduct incident management using multi-agency resources.

FLOOD IMPACTS AND REQUIRED ACTIONS

The table below is a breakdown of the number of properties flooded in a 1% AEP (100yr ARI) event. Refer to the following intelligence card(s) for Headworks, Tonimbuk, Longwarry North, Iona, Cora Lynn and Koo Wee Rup for more details.

Land Use Flooded in a 1% AEP Event	Total
Residential	251
Special Use	146
Industrial	0
Public Land	1
Rural	105
Total	**503**

Table C3.6 – Breakdown of likely land use flooded in the Bunyip Catchment in Cardinia Shire during a 1% AEP event

FLOOD INTELLIGENCE CARD – HEADWORKS GAUGE, BUNYIP RIVER

Version 2 – February 2016

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.

This Flood Intelligence Card publication is presented by the Victoria State Emergency Service for the purpose of disseminating emergency management information. The contents of the information have not been independently verified by the Victoria State Emergency Service. No liability is accepted for any damage, loss or injury caused by errors or omissions in this information or for any action taken by any person in reliance upon it.

LOCATION	**Along the Aqueduct Track in Gentle Annie. Eastern side of the River**
VICMAP REFERENCE:	**Central 6699 K6**
STREAM:	**Bunyip River**
GAUGE NUMBER:	**228207A**
GAUGE ZERO:	**122.10m AHD**
GAUGE TYPE	**Stream Level and Rain**

MINOR:	**Not Established**
MODERATE:	**Not Established**
MAJOR	**Not Established**
LEVEE HEIGHT:	**N/A**
TELEMETRIC/MANUAL	**Telemetric**
HIGHEST RECORDED FLOOD:	**1.33m (3rd February 2005)**

River Height	Annual Exceedance Probability (% AEP)	Consequence / Impact	Operational Considerations
0.5m		• Expect Minor Flood Level reached at Iona within 1 – 24 hours	VICSES State and Region to provide warnings to the community and other agencies. VICSES will provide warnings using OSOM and SMSER as required based on the predications provided by BoM regarding flood levels and the risk of Flash Flooding. The Central Duty officer in conjunction with the Regional Agency Commander will maintain operational awareness and form an appropriate response arrangement to suit the level of incident.
Unknown	1% AEP (100yr ARI) Flood Level	**Water Over Road** • Aqueduct Track, Gembrook at River crossings • Bunyip River Road, Gembrook at River crossing	Council to provide road closure signage if required.

FLOOD INTELLIGENCE CARD – TONIMBUK GAUGE, BUNYIP RIVER

Version 2 – February 2016

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.

This Flood Intelligence Card publication is presented by the Victoria State Emergency Service for the purpose of disseminating emergency management information. The contents of the information have not been independently verified by the Victoria State Emergency Service. No liability is accepted for any damage, loss or injury caused by errors or omissions in this information or for any action taken by any person in reliance upon it.

LOCATION	**Western bank of the River off Jolley Road, Tonimbuk**
VICMAP REFERENCE:	**Central 6700 B14**
STREAM:	**Bunyip River**
GAUGE NUMBER:	**228212A**
GAUGE ZERO:	**58.360m AHD**
GAUGE TYPE	**Stream Level and Rain**

MINOR:	**Not Established**
MODERATE:	**Not Established**
MAJOR	**Not Established**
LEVEE HEIGHT:	**N/A**
TELEMETRIC/MANUAL	**Telemetric**
HIGHEST RECORDED FLOOD:	**2.63m (5th February 2011)**

River Height	Annual Exceedance Probability (% AEP)	Consequence / Impact	Operational Considerations
Unknown	1% AEP (100yr ARI) Flood Level	**Water Over Road** • Bunyip River Road, Gembrook at River crossing	Council to provide road closure signage if required.

FLOOD INTELLIGENCE CARD – LONGWARRY NORTH GAUGE, BUNYIP RIVER

Version 2 – February 2016

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.

This Flood Intelligence Card publication is presented by the Victoria State Emergency Service for the purpose of disseminating emergency management information. The contents of the information have not been independently verified by the Victoria State Emergency Service. No liability is accepted for any damage, loss or injury caused by errors or omissions in this information or for any action taken by any person in reliance upon it.

LOCATION	**Western bank of the river 700m down an unnamed road off Morrison Road, Longwarry North**
VICMAP REFERENCE:	**Central 6766 A6**
STREAM:	**Bunyip River**
GAUGE NUMBER:	**228255A**
GAUGE ZERO:	**23.970m AHD**
GAUGE TYPE	**Stream Level and Rain**

MINOR:	**Not Established**
MODERATE:	**Not Established**
MAJOR	**Not Established**
LEVEE HEIGHT:	**N/A**
TELEMETRIC/MANUAL	**Telemetric**
HIGHEST RECORDED FLOOD:	**8.99m (5th February 2011)**

River Height	Annual Exceedance Probability (% AEP)	Consequence / Impact	Operational Considerations
2.2m		• Minor flooding expected at Iona	VICSES State and Region to provide warnings to the community and other agencies. VICSES will provide warnings using OSOM and SMSER as required based on the predications provided by BoM regarding flood levels and the risk of Flash Flooding. The Central Duty officer in conjunction with the Regional Agency Commander will maintain operational awareness and form an appropriate response arrangement to suit the level of incident.
Unknown	1% AEP (100yr ARI) Flood Level	**Properties at Flood Risk** **2 Properties in Total** • 286 Abeckett Road, Bunyip • 8 Drake Court, Bunyip **Water Over Road**	VICSES to respond to requests on case by case basis

River Height	Annual Exceedance Probability (% AEP)	Consequence / Impact	Operational Considerations
		• Drake Court, Bunyip	Council to provide road closure signage if required.

FLOOD INTELLIGENCE CARD – IONA GAUGE, BUNYIP RIVER

Version 2 – February 2016

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.

This Flood Intelligence Card publication is presented by the Victoria State Emergency Service for the purpose of disseminating emergency management information. The contents of the information have not been independently verified by the Victoria State Emergency Service. No liability is accepted for any damage, loss or injury caused by errors or omissions in this information or for any action taken by any person in reliance upon it.

LOCATION	**North side of the drain at Fourteen Mile Road, Iona**
VICMAP REFERENCE:	**Central 6765 E11**
STREAM:	**Bunyip River**
GAUGE NUMBER:	**228213A**
GAUGE ZERO:	**20.88m AHD**
GAUGE TYPE	**Stream Level and Rain**

MINOR:	**2.1m**
MODERATE:	**5.0m**
MAJOR	**6.0m**
LEVEE HEIGHT:	**10.0m approx.**
TELEMETRIC/MANUAL	**Telemetric**
HIGHEST RECORDED FLOOD:	**7.33m (5th February 2011)**

River Height	Flood Class or Annual Exceedance Probability (% AEP)	Consequence / Impact	Operational Considerations
1.8m		• Gates closed at Cora Lynn Ford	VICSES State and Region to provide warnings to the community and other agencies. VICSES will provide warnings using OSOM and SMSER as required based on the predications provided by BoM regarding flood levels and the risk of Flash Flooding. The Central Duty officer in conjunction with the Regional Agency Commander will maintain operational awareness and form an appropriate response arrangement to suit the level of incident. Melbourne Water close gate across Cora Lynn Ford following release of minor flood level warning
2.1m	**MINOR FLOOD LEVEL**	**Water Over Road** • Main Drain Road, Cora Lynn at Cora Lynn Ford	Council to provide road closure signage if required.

River Height	Flood Class or Annual Exceedance Probability (% AEP)	Consequence / Impact	Operational Considerations
4.73m	20% AEP (5yr ARI) Flood Level (Minor)	• Flooding occurring in paddocks and rural properties as backing up occurs alongside many roadways in the area which act as levees	VICSES to respond to requests on case by case basis
5.0m	**MODERATE FLOOD LEVEL**	**Properties at Flood Risk** **11 New at Level; 11 Properties in Total** • 1255, 1275, 1285 and 1325 Bunyip River Road, Iona • 895, 955 and 995 Bunyip River Road, Vervale • 225, 255, 325 and 415 Bunyip-Modella Road, Bunyip **Water Over Road (over 0.3m depth)** • Bunyip – Modella Road, Iona between Main Drain Road South and Koo Wee Rup – Longwarry Road • Little Road, Iona	VICSES to respond to requests on case by case basis Council to provide road closure signage if required.
5.4m	10% AEP (10 year ARI) (Moderate)	**Properties at Flood Risk** **9 New at Level; 20 Properties in Total** • 420, 450, 455, 465, 485, 490, 710, 730, 735 Bunyip-Modella Road, Iona **Water Over Road (over 0.3m depth)** • Gunn Road, Vervale • Walker Road, Vervale	VICSES to respond to requests on case by case basis Council to provide road closure signage if required.
5.94m	30th July 1996 Flood Level Peak	**Event Summary** • Levee overtopped downstream of gauge at Ballarto Rd. Maintenance works have since heightened the levee at this point.	
6.0m	**MAJOR FLOOD LEVEL** 5% AEP (20 year ARI)	Properties at Flood Risk 16 New at Level; 36 Properties in Total • 1215 Bunyip River Road, Iona • 250, 270 and 510 Simpson Road, Iona • 195, 360, 470, 485 and 526 Pitt Road, Iona • 560 Pitt Road, Vervale • 935 and 1115 Murray Road, Bunyip • 835 Murray Road, Iona • 725 Murray Road, Vervale • 510 and 740 Number Seven Drain Road, Catani Community Infrastructure Flooded • St Joseph's Catholic Church, Bunyip River Road, Iona	VICSES to respond to requests on case by case basis Council to consider contacting Church on 59425293 to ensure they are aware of situation.

River Height	Flood Class or Annual Exceedance Probability (% AEP)	Consequence / Impact	Operational Considerations
		Essential Infrastructure Impacted • Possible Overtopping of Levee System downstream of gauge between Cora Lynn and Ballarto Road and along the Yallock Outfall to Bayles. Note that the condition of drain will vary the height at which levees are overtopped (e.g. amount of silt and vegetation in drain) Water Over Road (over 0.3m depth) • Murray Road, Iona, Vervale and Cora Lynn • Main Drain Road South, Iona, Vervale and Cora Lynn • Bunyip River Road, Iona, Vervale and Cora Lynn • Fallon Road, Iona • Carses Road, Iona	VICSES to consider monitoring of levee system. Council to provide road closure signage if required.
6.6m	2% AEP (50 year ARI) (Major)	**Properties at Flood Risk** **1 New at Level; 37 Properties in Total** • 580 Little Road, Iona **Community Infrastructure Flooded** • Little Road Chapel on Little Road, Iona **Water Over Road (over 0.3m depth)** • Parish Road, Iona between Murray Road, and Bunyip – Modella Road • Pitt Road, Iona • Humphries Road, Catani • Simpson Road, Iona	VICSES to respond to requests on case by case basis Council to provide road closure signage if required.
7.33m	5th February 2011 Flood Level Peak	**Event Summary** • 175mm of Rain over 28hrs • 6,000 evacuation orders given for Iona, Cora Lynn, Koo Wee Rup and Bayles • A number of properties in Iona town were inundated, dozens more isolated • Large numbers of farmers' crops affected by floodwaters • Levee upstream of Iona was overtopped, limiting flooding downstream at Koo Wee Rup • St Joseph's Church inundated along with neighbouring properties northeast of Bunyip River Road and Fourteen Mile Road intersection • Broiler farms on Eleven Mile Road Inundated • Floodwaters level with road at Walker Road Bridge • Farms Inundated south of Bunyip River along Murray Road between Iona and Cora Lynn	VICSES State and Region to provide warnings to the community and other agencies. VICSES will provide warnings using OSOM and SMSER as required based on the predications provided by BoM regarding flood levels and the risk of Flash Flooding. The Central Duty officer in conjunction with the Regional Agency Commander will maintain operational awareness and form an appropriate response arrangement to suit the level of incident.
7.65m	1% AEP (100yr ARI)	**Properties at Flood Risk**	VICSES to respond to requests on case by case

River Height	Flood Class or Annual Exceedance Probability (% AEP)	Consequence / Impact	Operational Considerations
	Flood Level (Major)	**38 New at Level; 75 Properties in Total** • 1542, 1550 and 1560 Nar Nar Goon – Longwarry Road, Bunyip • 95, 115 and 195 South Bank Road, Bunyip • 80 Wally Road, Bunyip • 95 and 120 Berry Lane, Bunyip • 10, 15, 20 and 44 Strafford Lane, Bunyip • 25 Bastin Road, Bunyip • 10, 85 and 245 Parish Road, Iona • 30 Evans Road, Bunyip • 450 Little Road, Iona • 375 Temby Road, Iona • 66 and 95 Carses Road, Iona • 10 and 200 McDonalds Road, Catani • 105, 110,145 and 250 Taplins Road, Catani • 40 McCraws Road, Catani • 250, 270 and 510 Simpson Road, Iona • 460 Dessent Road, Iona • 1970 Main Drain Road, Vervale • 335, 345 and 365 Thirteen Mile Road, Garfield • 80 Gunn Road, Garfield **Water Over Road (over 0.3m depth)** • South Bank Road, Bunyip • Anderson Road, Bunyip • Wally Road, Bunyip (floods under train overpass) • Enticott Road, Bunyip • Berry Lane, Bunyip • Strafford Lane, Bunyip • Bastin Road, Bunyip • Evans Road, Bunyip • McIvor Road, Bunyip • Brownbill Road, Garfield • Lone Pine Road, Garfield near Gunn Road • Koo Wee Rup – Longwarry Road, Modella near Fallon Road • Koo Wee Rup – Longwary Road, Modella near Glover Road • Glover Road, Modella	basis Council to provide road closure signage if required.

River Height	Flood Class or Annual Exceedance Probability (% AEP)	Consequence / Impact	Operational Considerations
		• Number Seven Drain Road, Iona • Hornbuckle Road, Catani • Taplins Road, Catani • Caldermeade Road, Catani • Temby Road, Iona • Dessent Road, Vervale and Cora Lynn	
10.0m		• Approximate Levee Height at gauge	

FLOOD INTELLIGENCE CARD – CORA LYNN GAUGE, BUNYIP RIVER

Version 2 – February 2016

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.

This Flood Intelligence Card publication is presented by the Victoria State Emergency Service for the purpose of disseminating emergency management information. The contents of the information have not been independently verified by the Victoria State Emergency Service. No liability is accepted for any damage, loss or injury caused by errors or omissions in this information or for any action taken by any person in reliance upon it.

LOCATION	**Southeast corner of the Bunyip Main and No. 4 Yallock Drains Junction on Main Drain Road South, Cora Lynn**
VICMAP REFERENCE:	**Central 6764 J13**
STREAM:	**Bunyip River**
GAUGE NUMBER:	**228380A**
GAUGE ZERO:	**11.360m AHD**
GAUGE TYPE	**Stream Level**

MINOR:	**3.1m**
MODERATE:	**4.1m**
MAJOR	**4.5m**
LEVEE HEIGHT:	**5.3m**
TELEMETRIC/MANUAL	**Telemetric**
HIGHEST RECORDED FLOOD:	**4.63m (5th February 2011)**

River Height	Flood Class or Annual Exceedance Probability (% AEP)	Consequence / Impact	Operational Considerations
2.2m		• Top of rock dam across the Bunyip River	
3.07m		**Water Over Road** • Main Drain Road at Cora Lynn Ford	Melbourne Water close gate across Cora Lynn Ford following release of minor flood level warning .
3.1m	**MINOR FLOOD LEVEL**		VICSES State and Region to provide warnings to the community and other agencies. VICSES will provide warnings using OSOM and SMSER as required based on the predications provided by BoM regarding flood levels and the risk of Flash Flooding. The Central Duty officer in conjunction with the Regional Agency Commander will maintain operational awareness and form an appropriate response arrangement to suit the level of incident.

River Height	Flood Class or Annual Exceedance Probability (% AEP)	Consequence / Impact	Operational Considerations
4.1m	**MODERATE FLOOD LEVEL**	**Water Over Road (over 0.3m depth)** • Number Seven Drain Road, Bayles • Koo Wee Rup – Longwarry Road, Bayles • School Road, Bayles near Koo Wee Rup – Longwarry Road between the Yallock Outfall Drain and School Road • Finks Road, Bayles • Number Five Drain Road, Monomeith	Council to provide road closure signage if required.
4.5m	**MAJOR FLOOD LEVEL**	**Properties at Flood Risk** **55 Properties in Total** • 815-835 Bunyip River Road, Vervale • 315, 525, 595 and 625 Bunyip River Road, Cora Lynn • 55 and 91 Bunyip River Road, Nar Nar Goon • 1010 and 1020 Seven Mile Road, Koo Wee Rup North • 680-690 Nine Mile Road, Cora Lynn • 1380, 1420, 1450, 1500, 1510 and 1580 Main Drain Road, Cora Lynn • 495 and 514 Eleven Mile Road, Cora Lynn • 165 and 210, Toner Road, Cora Lynn • 35 and 455 Murray Road, Cora Lynn • 310, 315, 340 and 415 Bennett Road, Cora Lynn • 115 Hogans Road, Bayles • 125, 165, 235 and 295 Scanlons Drain Road, Bayles • 755, 765, 730, 750, 770, 780 and 830 Koo Wee Rup-Longwarry Road, Catani • 215 Number Seven Drain Road, Cora Lynn • 60, 80, 160, 170 and 200 Number Four Drain Road, Bayles • 31, 35, 50, 60, 65, 70, 80, 85, 90 and 110 Fincks Road, Bayles • 140 Number Five Drain Road, Monomeith **Community Infrastructure Flooded** • Cora Lynn Reserve and Public Hall, Nine Mile Road, Cora Lynn **Water Over Road (over 0.3m depth)** • Bunyip River Road, Vervale, Cora Lynn and Koo Wee Rup North • Main Drain Road South, Vervale, Cora Lynn and Koo Wee Rup • Eleven Mile Road, Cora Lynn South of Main Drain Road South	VICSES to respond to requests on case by case basis • Council to consider contacting the Reserve/Hall CoM to implement emergency plan Council to provide road closure signage if required.

River Height	Flood Class or Annual Exceedance Probability (% AEP)	Consequence / Impact	Operational Considerations
		• Murray Road, Cora Lynn at the Murray Road Bridge and between Bennetts Road and Toner Road • Hogans Road, Bayles • Toner Road, Cora Lynn • McClures Road, Bayles • Scanlons Drain Road, Bayles between Number Four Drain Road East and McClures Road • Number Four Drain Road East, Bayles • Boxshall Road, Bayles • Convent School Road, Nar Nar Goon • Whitta Lane, Nar Nar Goon • Hall Road, Nar Nar Goon • Five Mile Road, Pakenham South • Seven Mile Road, Koo Wee Rup North between Bunyip River Road and Fechner Road • Ballarto Road, Koo Wee Rup between McDonalds Drain Road East and Seven Mile Road	
4.63m	5th February 2011 Flood Level Peak (Major)	**Event Summary** • 6,000 evacuation orders given for Iona, Cora Lynn, Koo Wee Rup and Bayles • Koo Wee Rup-Longwarry Road cut at the Yallock Outfall Bridge in Bayles • Properties flooded along Murray Road • Residences on eastern side of Seven Mile Road flooded • Residences on Convent School Road flooded	VICSES State and Region to provide warnings to the community and other agencies. VICSES will provide warnings using OSOM and SMSER as required based on the predications provided by BoM regarding flood levels and the risk of Flash Flooding. The Central Duty officer in conjunction with the Regional Agency Commander will maintain operational awareness and form an appropriate response arrangement to suit the level of incident.
5.3m	1% AEP (100yr ARI) Flood Level (Major)	**Properties at Flood Risk** **22 New at Level; 78 Properties in Total** • 455 and 465 Bunyip River Road, Cora Lynn • 650, 700, 706 and 710 Nine Mile Road, Cora Lynn • 970 Seven Mile Road, Koo Wee Rup North • 3370 Ballarto Road, Koo Wee Rup North • 90 and 130 Number Seven Drain Road, Bayles • 20 and 310 Murray Road, Cora Lynn • 850, 870, 905, 960, 970 and 990 Koo Wee Rup – Longwarry Road, Catani • 35 and 55 Boxshall Road, Bayles	VICSES to respond as per request by request basis. • VICSES to consider monitoring of levee system.

River Height	Flood Class or Annual Exceedance Probability (% AEP)	Consequence / Impact	Operational Considerations
		• 135 Fincks Road, Bayles • 275 Number Five Drain Road, Bayles **Essential Infrastructure Impacted** • Possible overtopping of levee along Murray Road **Water Over Road (over 0.3m depth)** • Dessent Road, Cora Lynn • Bennett Road, Cora Lynn	Council to provide road closure signage if required.

FLOOD INTELLIGENCE CARD – KOO WEE RUP GAUGE, BUNYIP RIVER

Version 2 – February 2016

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.

This Flood Intelligence Card publication is presented by the Victoria State Emergency Service for the purpose of disseminating emergency management information. The contents of the information have not been independently verified by the Victoria State Emergency Service. No liability is accepted for any damage, loss or injury caused by errors or omissions in this information or for any action taken by any person in reliance upon it.

LOCATION	**Along Bunyip Main Drain at Disused Railway Bridge 100m South of Station St, Koo Wee Rup**
VICMAP REFERENCE:	**Central 6822 G4**
STREAM:	**Bunyip River**
GAUGE NUMBER:	**228395A**
GAUGE ZERO:	**0.00m AHD**
GAUGE TYPE	**Stream Level and Rain**

MINOR:	**Not Established**
MODERATE:	**Not Established**
MAJOR	**Not Established**
LEVEE HEIGHT:	**Unknown**
TELEMETRIC/MANUAL	**Telemetric**
HIGHEST RECORDED FLOOD:	**4.89m (5th February 2011)**

River Height	Annual Exceedance Probability (% AEP)	Consequence / Impact	Operational Considerations
2.9m		• Overtopping of North West Drain (which runs parallel to Bunyip River)	VICSES State and Region to provide warnings to the community and other agencies. VICSES will provide warnings using OSOM and SMSER as required based on the predications provided by BoM regarding flood levels and the risk of Flash Flooding. The Central Duty officer in conjunction with the Regional Agency Commander will maintain operational awareness and form an appropriate response arrangement to suit the level of incident.
4.41m	June 2012 Flood Event Level	**Event Summary** • Localised moderate flooding occurred in Koo Wee Rup, associated with the Boundary Road Drain. 6 properties were flooded in Catani and around 25-30 properties in Koo Wee Rup were evacuated as a precautionary measure • Properties flooded along Salmon St, Ti Tree La, Blackfish Dr and Henry St	VICSES State and Region to provide warnings to the community and other agencies. VICSES will provide warnings using OSOM and SMSER as required based on the predications provided by BoM regarding flood levels and the risk of Flash Flooding. The Central Duty officer in

River Height	Annual Exceedance Probability (% AEP)	Consequence / Impact	Operational Considerations
			conjunction with the Regional Agency Commander will maintain operational awareness and form an appropriate response arrangement to suit the level of incident.
4.76m	1% AEP (100yr ARI) Flood Level	**Properties at Flood Risk** **349 Properties in Total** • 3130, 3155, 3165, 3170, 3215, 3245, 3295, 3370, 3515, 3520, 3545, 3555, 3575, 3585 and 3675 Ballarto Road, Bayles • 575 and 745 Boundary Drain Road, Bayles • 65, 75, 175, 200 and 330 Fechner Road, Koo Wee Rup North • 85, 209, 270, 305 and 310 Five Mile Road, Pakenham South • 365 Hall Road, Pakenham South • 155, 175, 195, 205, 400, 500, 600, 620, 660, 680, 700 and 770 McDonalds Drain Road, Koo Wee Rup • 190 and 200 Koo Wee Rup Road, Koo Wee Rup • 90, 105, 115 and 135 Daleys Road, Koo Wee Rup • 180, 210, 220, 230, 270, 290, 320, 360, 380, 420 and 430 Main Drain Road, Koo Wee Rup • 1, 3, 5, 7-9, 19, 23, 29, 31, 33, 35, 37, 39, 41, 43, 75, 85, 95, 105, 109, 111, 115, 125, 129, 131, 135, 225, 245, 295, 311, 325 and 345 Boundary Drain Road, Koo Wee Rup • 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 27, 29, 31, 33, 35 and 37 Silver Way, Koo Wee Rup • 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 17, 19, 21, 23, 25 and 27 Emerald Grove, Koo Wee Rup • 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 21 and 23 Ruby Street, Koo Wee Rup • 1, 2, 3, 4 and 5 Diamond Drive, Koo Wee Rup • 1/25, 2/25, 115, 117, 119, 121, 123, 125, 127, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139 and 141 Moody Street, Koo Wee Rup • 3, 4, 5, 6, 7, 8, 9, 10, 11 and 12 Jade Avenue, Koo Wee Rup • 1, 3, 5, 7, 9, 11, 13, 15 and 17 Amber Street, Koo Wee Rup • 63, 65, 66, 67 and 68 Denham Road, Koo Wee Rup • 6, 8, 10, 12, 14, 16, 18, 20, 22, 23, 24 and 25 Lapis Street, Koo Wee Rup • 4, 5, 6, 7, 8, 9, 10, 11, 12, 14 and 16 Quinny Street, Koo Wee Rup • 3, 4, 5, 6, 7, 8 , 9, 10, 11, 12, 13, 14, 15, 17, 18, 19, 20, 21, 22, 24, 26, 28, 30, 32 and 34 Milla Way, Koo Wee Rup • 2 and 10 Tower Road, Koo Wee Rup	VICSES to respond as per request by request basis.

River Height	Annual Exceedance Probability (% AEP)	Consequence / Impact	Operational Considerations
		• 1, 2 and 3 Ti-Tree Lane, Koo Wee Rup • 7, 15 and 17 Blackfish Drive, Koo Wee Rup • 1, 4, 5, 6 and 7 Boomani Court, Koo Wee Rup • 43A, 44, 45, 46 and 63 Henry Street, Koo Wee Rup • 23-25, 27 and 29-31 Salmon Street, Koo Wee Rup • 4, 6, 7, 8, 9, 10, 12 and 14 William Street, Koo Wee Rup • 172-180 and 224 Station Street, Koo Wee Rup • 2, 4, 8 and 10 John Street, Koo Wee Rup • 54 Townley Street, Koo Wee Rup • 2, 4, 4A and 14 Mickle Street, Koo Wee Rup • 4, 6, 3/7, 8, 10, and 12 Alexandra Avenue, Koo Wee Rup • 2, 4, 5, 6, 8, 10 and 12 Bellairs Place, Koo Wee Rup • 46, 47, 48, 49, 50, 51, 52, 53 and 85, 100, 130 and 150 Sybella Avenue, Koo Wee Rup • 10, 12, 14, 16, 17, 18, 19, 20, 22, 23, 24, 25, 26 and 27 Bollen Way, Koo Wee Rup • 6, 8, 9, 10, 12 and 14 Barnes Way, Koo Wee Rup • 2/224 and 232 Rossiter Road, Koo Wee Rup • 3545, 3500, 3535, 3670, 3775, 3830, 3870 and 3940 South Gippsland Highway, Koo Wee Rup **Community Infrastructure Flooded** • St John the Baptist Primary School on Station Street, Koo Wee Rup with Sports Grounds Flooded • Westernport Nursing Home on Koo Wee Rup-Longwarry Road, Koo Wee Rup affected by isolation of Koo Wee Rup town **Essential Infrastructure Impacted** • Koo Wee Rup Hospital possibly affected by access issues resulting from South Gippsland Highway being cut, along with local roads; Rossiter Road west of the Hospital; Sybella Ave; Koo Wee Rup Road; and Koo Wee Rup-Longwarry Road in Bayles. Hospital itself expected to remain relatively dry • The Koo Wee Rup Police Station and CFA Fire Station could become isolated if local roads become inundated. • The Telephone Exchange in Bayles could become isolated from the closure of Ballarto Road, Main Drain Road and Koo Wee Rup-Longwarry Road due to floodwaters **Water Over Road (Over 0.3m Depth)** • Ballarto Road, Koo Wee Rup between McDonalds Drain Road East and Seven Mile Road • Seven Mile Road, Koo Wee Rup North between Bunyip River Road and Fechner Road • Five Mile Road, Pakenham South	DET/School to implement emergency plans if required Hospital and Nursing Home to consider implementing emergency plans. For information on possible evacuation triggers refer to Appendix D. VICTORIA POLICE and CFA to monitor and keep IC informed of ability to continue service. VICTORIA POLICE and CFA to consider the need to relocate services/resources. VICSES to consider protection of telephone exchange if time permits. • VICROADs/Council to provide road closure

River Height	Annual Exceedance Probability (% AEP)	Consequence / Impact	Operational Considerations
		• Hall Road, Koo Wee Rup North • McDonalds Drain Road East, Pakenham South and Koo Wee Rup • McDonalds Drain Road, Koo Wee Rup between Fechner Road and Railway Road • Fechner Road, Koo Wee Rup • McKays Road, Koo Wee Rup • Main Drain Road South, Koo Wee Rup • Bladens Road, Koo Wee Rup near Boundary Drain Road • Daleys Road, Koo Wee Rup at Main Drain Road South and Boundary Drain Road Intersections • Boundary Drain Road, Koo Wee Rup near Denhams Road and near Hudson Lane • Denhams Road, Koo Wee Rup • Silver Way, Koo Wee Rup • Emerald Cresent, Koo Wee Rup • Ruby Avenue, Koo Wee Rup • Moody Street, Koo Wee Rup • Diamond Drive, Koo Wee Rup • Jade Avenue, Koo Wee Rup • Amber Lane, Koo Wee Rup • Lapis Street, Koo Wee Rup • Milla Way, Koo Wee Rup • Quinny Street, Koo Wee Rup • Tower Road, Koo Wee Rup • Hudson Lane, Koo Wee Rup • Blackfish Drive, Koo Wee Rup • Ti-Tree Lane, Koo Wee Rup • Henry Street, Koo Wee Rup • Boomani Court, Koo Wee Rup • Salmon Street, Koo Wee Rup • William Street, Koo Wee Rup • John Street, Koo Wee Rup • Townley Road, Koo Wee Rup • Mickle Street, Koo Wee Rup • Alexandra Avenue, Koo Wee Rup • Bellairs Place, Koo Wee Rup • Bailey BoulevaRoad, Koo Wee Rup	signage if required.

River Height	Annual Exceedance Probability (% AEP)	Consequence / Impact	Operational Considerations
		• Sybella Avenue, Koo Wee Rup • Bollen Way, Koo Wee Rup • Barnes Way, Koo Wee Rup • Catani Avenue, Koo Wee Rup • South Gippsland Highway, Koo Wee Rup • Koo Wee Rup Bypass, Koo Wee Rup • Rossiter Road, Koo Wee Rup at the Koo Wee Rup Bypass	
4.88m	February 2011 Flood Event Level	**Event Summary** • 6,000 evacuation orders given for Iona, Cora Lynn, Koo Wee Rup and Bayles • 51 Patients evacuated from Koo Wee Rup Hospital on the potential isolation of the hospital • Residents in Koo Wee Rup township isolated as Sth Gippsland Highway cut along with local access roads surrounding town • Farms Inundated between McDonalds Drain Road, Ballarto Road and Fechner Road	KWR Hospital decided to self evacuate when river level reached 6.7m at Iona. Approx 6 hours required to complete evacuation of 40 patients. 1635-2142 hrs Victoria Police assisted with evacuation.

APPENDIX C4 – LANG LANG FLOOD EMERGENCY PLAN

OVERVIEW OF FLOODING CONSEQUENCES

Lang Lang is located approximately 70km southeast of Melbourne in a predominantly rural town setting. The Lang Lang and Little Lang Lang Rivers are the prominent watercourse in the area, both flowing from the east. The Little Lang Lang River joins The Lang Lang River to the northeast of Lang Lang township. The River then crosses the South Gippsland Highway before discharging into the Western Port Bay. High-intensity, short-duration rainfall events can cause flash flooding in and around Lang Lang, while prolonged rainfall may see the Lang Lang River, the Little Lang Lang River or Adams Creek flood. The area sees moderate to slow water movement as the waterways move from the foothills of Lang Lang East to the flatter lands around Lang Lang. Flooding as a result may last for a number of days around Lang Lang. See mapping in **Appendix F** for more insight into flooding in the area.

WARNING TIMES

Warnings are available for flooding expected along the Old Lang Lang River at Yannathan. Melbourne Water does not provide any flood warning service for other hydrographic/telemetry (river gauges) within the municipality at this point due to the generally short warning times available.

Hydrographic Monitoring Station	Station No.	Location	Owner	Gauge Type	Melway Ref
Lang Lang River at Heads Road, Yannathan	228209B	Northern side of River 500m down unnamed road off Heads Road, Yannathan	Melbourne Water	Stream Level and Rain	VicMap Central 6824 A9
Upper Lang Lang	586196	North side of Drouin – Korumburra Road, Poowong East	Melbourne Water	Rain	VicMap Central 6878 G7

Table C4.1 – Hydrographic Monitoring Stations within the Lang Lang River catchment

These gauge may provide some warning of expected flooding. See the Melbourne Water website (http://www.melbournewater.com.au/waterdata/rainfallandriverleveldata/Pages/Rainfall-and-river-level-new.aspx) for more information on these gauges. It is advised that residents monitor the Bureau of Meteorology's website (http://www.bom.gov.au) and the VICSES website (http://www.ses.vic.gov.au) for any thunderstorm, flood or severe weather warnings present for their area.

AREAS OF FLOOD RISK

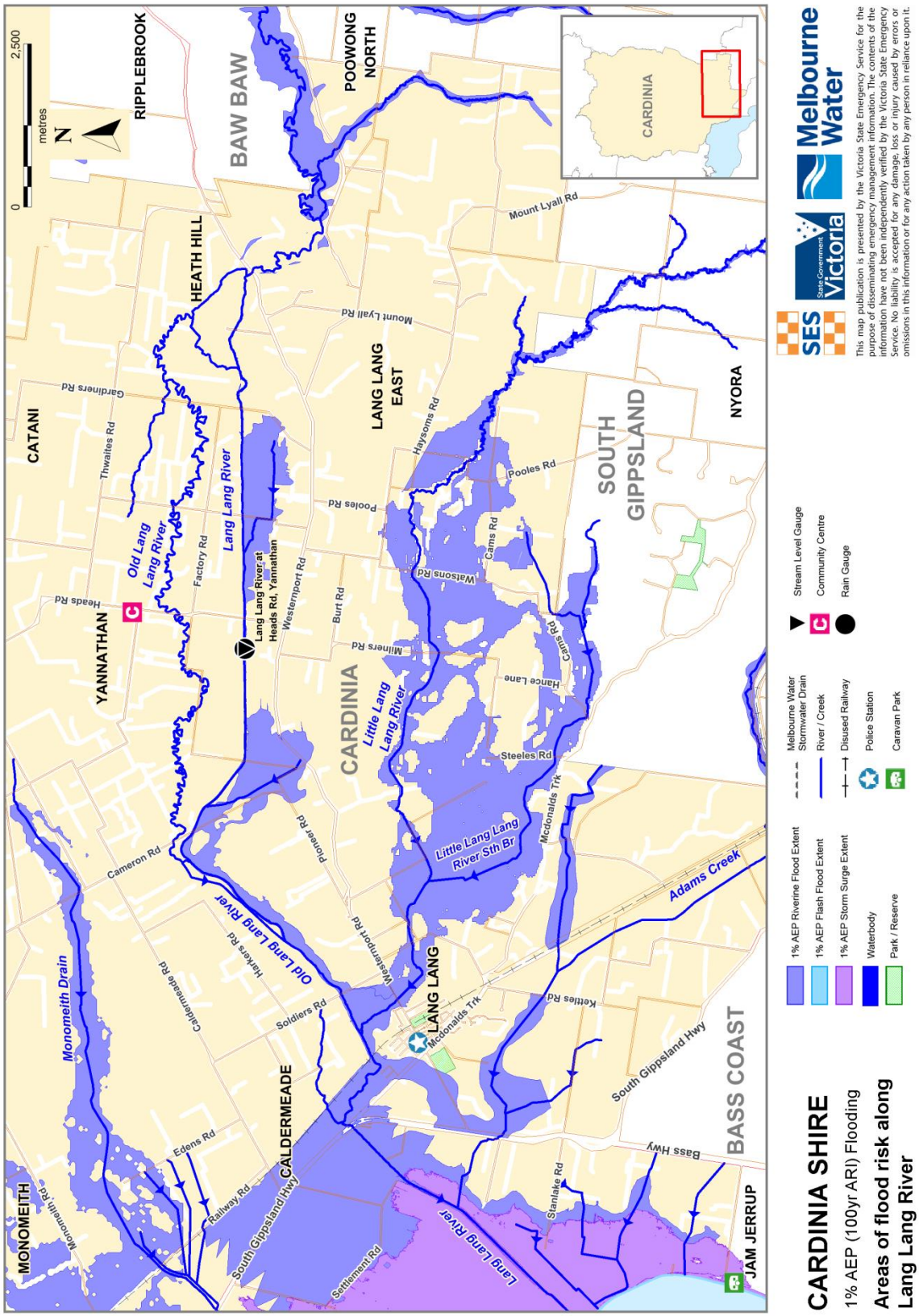


Figure C4 – Areas of flood risk around Lang Lang and Yannathan in Cardinia Shire

PROPERTIES AT FLOOD RISK

Properties listed in the table below are at risk from flooding around Yannathan and Lang Lang. As more intelligence becomes available, this list may grow.

Properties (Residences, Businesses and Public Use) at risk from Flooding during a 1% AEP event

Street No. at Flood Risk	Street	Suburb	Along Melbourne Water Watercourse	Flood Risk Type
30	Caldermeade Road	Caldermeade	Lang Lang River	Riverine
75	McDonalds Road	Caldermeade	Lang Lang River	Riverine
145	McDonalds Road	Caldermeade	Lang Lang River	Riverine
185	McDonalds Road	Caldermeade	Lang Lang River	Riverine
105	McDonalds Track	Lang Lang	Lang Lang River	Riverine
115	McDonalds Track	Lang Lang	Lang Lang River	Riverine
545	McDonalds Track	Lang Lang	Little Lang Lang River	Riverine
230	Milners Road	Lang Lang East	Little Lang Lang River	Riverine
260	Milners Road	Lang Lang East	Little Lang Lang River	Riverine
305	Pooles Road	Lang Lang East	Little Lang Lang River	Riverine
380	Pooles Road	Lang Lang East	Little Lang Lang River	Riverine
144	Settlement Road	Caldermeade	Lang Lang River	Riverine
170	Settlement Road	Caldermeade	Lang Lang River	Riverine
185	Settlement Road	Caldermeade	Lang Lang River	Riverine
190	Settlement Road	Caldermeade	Lang Lang River	Riverine
195	Settlement Road	Caldermeade	Lang Lang River	Riverine
260	Settlement Road	Caldermeade	Lang Lang River	Riverine
300	Settlement Road	Caldermeade	Lang Lang River	Riverine
4385	South Gippsland Highway	Lang Lang	Lang Lang River	Riverine
4440	South Gippsland Highway	Lang Lang	Lang Lang River	Riverine
4585	South Gippsland Highway	Lang Lang	Lang Lang River	Riverine
4655	South Gippsland Highway	Lang Lang	Lang Lang River	Riverine
375	Steeles Road	Lang Lang	Little Lang Lang River	Riverine
705	Westernport Road	Lang Lang	Lang Lang River	Riverine
54	Westernport Road	Lang Lang	Little Lang Lang River	Riverine
223	Westernport Road	Lang Lang	Little Lang Lang River	Riverine
270	Westernport Road	Lang Lang	Little Lang Lang River	Riverine
280	Westernport Road	Lang Lang	Little Lang Lang River	Riverine
55	Wildes Road	Yannathan	Lang Lang River	Riverine

Totals
29

Table C4.2 – Properties at risk of flooding along the Lang Lang catchment in Cardinia Shire

ISOLATION

Lang Lang Township is at risk from having access cut to Koo Wee Rup and the north along the South Gippsland Highway for up to a number of days during a 1% AEP event. Access to the south via the South Gippsland Highway may also be cut for a shorter period if Adams Creek is in flood. However, it is expected that McDonalds Track will remain open. Westernport Road to the east may have water over the road at a number of points, the most likely being the Little Lang Lang River crossing. Some localised short-duration isolation may occur due to flash flooding.

ESSENTIAL INFRASTRUCTURE

During an event see Public Transport Victoria's website (http://ptv.vic.gov.au/live-travel-updates) for details on delays or alterations to services.

Apart from the roads outlined below, all other essential infrastructure and services areas around Yannathan and Lang Lang are expected to remain unaffected by flooding during a 1% AEP (100yr ARI) event.

ROAD CLOSURES

The following roads are subject to closure during flooding around Yannathan and Lang Lang. Check the VicRoads website (alerts.vicroads.vic.gov.au) for more details.

VicRoads Roads flooded in a 1% AEP (100yr ARI) event
• South Gippsland Highway, Lang Lang at Lang Lang River and Adams Creek Bridges
• Westernport Road, Lang Lang west of Heads Road and at the Little Lang Lang River crossing

Table C4.3 – VicRoads Possible Road Closures during a flooding event

Cardinia Council Roads flooded in a 1% AEP (100yr ARI) event			
CALDERMEADE	**LANG LANG**	**LANG LANG EAST**	**POOWONG NORTH**
• Caldermeade Road	• Cams Road	• Milners Road	• Clifton Road
• McDonalds Road	• Hance Lane	• Murphys Road	**YANNATHAN**
• Settlement Road	• McDonalds Track	• Pooles Road	• Patullos Road
HEATH HILL	• Soldiers Road	• Watsons Road	• Wildes Road
• Lyons Road	• Steeles Road		

Table C4.4 – Cardinia Shire Council Possible Road Closures during a flooding event

FLOOD MITIGATION

No formal Retarding Basins, Pumping Stations or Levees exist around the Lang Lang River.

SEWERAGE INFRASTRUCTURE

No Melbourne Water Sewerage Pumping Stations or Emergency Relief Points are expected to be within the vicinity of floodwaters during severe flood events around the Lang Lang River. It is possible a number of un-sewered properties are located within the catchment.

COMMAND, CONTROL and COORDINATION

VICSES will assume overall control of the response to flood incidents. Other agencies will be requested to support operations as detailed in this Plan. Control and coordination of a flood incident shall be carried out at the lowest effective level and in accordance with the State Emergency Response Plan (EMMV Part 3). During significant events, VICSES will conduct incident management using multi-agency resources.

FLOOD IMPACTS and REQUIRED ACTIONS

The table below is a breakdown of the number of properties flooded in a 1% AEP (100yr ARI) event. Refer to the following intelligence card(s) for Yannathan and Lang Lang for more details.

Land Use Flooded in a 1% AEP Event	Total
Residential	3
Business	0
Industrial	0
Public Land	0
Rural	26
Total	**29**

Table C4.5 – Breakdown of likely land use flooded in the Lang Lang Catchment in Cardinia Shire during a 1% AEP event

FLOOD INTELLIGENCE CARD – YANNATHAN GAUGE, LANG LANG RIVER

Version 2 – February 2016

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.

This Flood Intelligence Card publication is presented by the Victoria State Emergency Service for the purpose of disseminating emergency management information. The contents of the information have not been independently verified by the Victoria State Emergency Service. No liability is accepted for any damage, loss or injury caused by errors or omissions in this information or for any action taken by any person in reliance upon it.

LOCATION	**Northern side of River 500m down unnamed road off Heads Road, Yannathan**
VICMAP REFERENCE:	**Central 6824 A9**
STREAM:	**Lang Lang River**
GAUGE NUMBER:	**228209B**
GAUGE ZERO:	**18.96m AHD**
GAUGE TYPE	**Stream Level and Rain**

MINOR:	**3.5m**
MODERATE:	**4.0m**
MAJOR	**4.9m**
LEVEE HEIGHT:	**5.0m**
TELEMETRIC/MANUAL	**Telemetric**
HIGHEST RECORDED FLOOD:	**4.87m (30th July 1996)**

Creek Height	Flood Class or Annual Exceedance Probability (% AEP)	Consequence / Impact	Operational Considerations
3.5m	**MINOR FLOOD LEVEL**		VICSES State and Region to provide warnings to the community and other agencies. VICSES will provide warnings using OSOM and SMSER as required based on the predications provided by BoM regarding flood levels and the risk of Flash Flooding. The Central Duty officer in conjunction with the Regional Agency Commander will maintain operational awareness and form an appropriate response arrangement to suit the level of incident.
3.69m	22nd June 2012 Flood Level Peak		
4.0m	**MODERATE FLOOD LEVEL**		VICSES State and Region to provide warnings to the community and other agencies. VICSES will provide warnings using OSOM and SMSER as required based on the predications

Creek Height	Flood Class or Annual Exceedance Probability (% AEP)	Consequence / Impact	Operational Considerations
			provided by BoM regarding flood levels and the risk of Flash Flooding. The Central Duty officer in conjunction with the Regional Agency Commander will maintain operational awareness and form an appropriate response arrangement to suit the level of incident.
4.87m	30th July 1996 Flood Level Peak		
4.9m	**MAJOR FLOOD LEVEL**	**Water Over Road** • South Gippsland Highway, Lang Lang at Lang Lang River Bridge	• VICROADs to provide road closure signage if required.
5.6m	1% AEP (100yr ARI) Flood Level (Major)	**Properties at Flood Risk** **19 Properties in Total** • 55 Wildes Road, Yannathan • 705 Westernport Road, Lang Lang • 105 and 115 McDonalds Track, Lang Lang • 4385, 4440, 4585 and 4655 South Gippsland Highway, Lang Lang • 30 Caldermeade Road, Caldermeade • 75, 145 and 185 McDonalds Road, Caldermeade • 144, 170, 185, 190, 195, 260 and 300 Settlement Road, Caldermeade **Water Over Road** • Clifton Road, Heath Hill at Pheasant Creek • Lyons Road, Heath Hill • Wildes Road, Yannathan • Patullos Road, Yannathan • Westernport Road, Lang Lang west of Heads Road and at the Little Lang Lang River crossing • Soldiers Road, Lang Lang • McDonalds Track, Lang Lang between Westernport Road and South Gippsland Highway • South Gippsland Highway, Lang Lang at Adams Creek Bridge • Caldermeade Road, Caldermeade between South Gippsland Highway and the Railway Line • Settlement Road, Caldermeade • McDonalds Road, Caldermeade	VICSES to respond as per request by request basis. Council to provide road closure signage if required.

FLOOD INTELLIGENCE CARD – LITTLE LANG LANG RIVER (UNGAUGED)

Version 2 – February 2016

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.

This Flood Intelligence Card publication is presented by the Victoria State Emergency Service for the purpose of disseminating emergency management information. The contents of the information have not been independently verified by the Victoria State Emergency Service. No liability is accepted for any damage, loss or injury caused by errors or omissions in this information or for any action taken by any person in reliance upon it.

CLOSEST RAIN GAUGE	**Upper Lang Lang**
LOCATION	**North side of Drouin – Korumburra Road, Poowong East**
VICMAP REFERANCE:	**Central 6878 G7**

GAUGE NUMBER	**586196**
GAUGE TYPE	**Rain**
TELEMETRIC/MANUAL	**Telemetric**

Design Rainfall Depths (mm) – *Indication of Possible Flooding*	**Annual Exceedance Probability (% AEP)**	**Consequence / Impact**	**Operational Considerations**
30mm in 1 hour; 39mm in 2 hours; 46mm in 3 hours; 61mm in 6 hours; 81mm in 12 hours; or 108mm in 24 hours Note: rainfall depths are a very rough method of estimating flood events and have been used due to the ungagged nature of the catchment. This should be used as a guide only.	5% AEP (20 year ARI)	**Properties at Flood Risk** **1 Property in Total** • 54 Westernport Road, Lang Lang **Community Infrastructure Flooded** • Lang Lang Primary School on Westernport Road, Lang Lang with flooding to sports grounds **Water Over Road** • Pooles Road, Lang Lang East	VICSES State and Region to provide warnings to the community and other agencies. VICSES will provide warnings using OSOM and SMSER as required based on the predications provided by BoM regarding flood levels and the risk of Flash Flooding. The Central Duty officer in conjunction with the Regional Agency Commander will maintain operational awareness and form an appropriate response arrangement to suit the level of incident. DET/School to implement emergency plans if required Council to provide road closure signage if required.

Design Rainfall Depths (mm) – *Indication of Possible Flooding*	Annual Exceedance Probability (% AEP)	Consequence / Impact	Operational Considerations
		• Cams Road, Lang Lang • Westernport Road, Lang Lang at Little Lang Lang Bridge	
35mm in 1 hour; 24mm in 2 hours; 55mm in 3 hours; 73mm in 6 hours; 96mm in 12 hours; or 130mm in 24 hours Note: rainfall depths are a very rough method of estimating flood events and have been used due to the ungagged nature of the catchment. This should be used as a guide only.	2% AEP (50 year ARI)	**Properties at Flood Risk** **9 Properties in Total** • 305 and 380 Pooles Road, Lang Lang East • 230 and 260 Milners Road, Lang Lang East • 375 Steeles Road, Lang Lang • 545 McDonalds Track, Lang Lang • 223, 270 and 280 Westernport Road, Lang Lang **Water Over Road** • Murphys Road, Lang Lang East • Watsons Road, Lang Lang East • Milners Road, Lang Lang East • Hance Lane, Lang Lang • Steeles Road, Lang Lang	VICSES to respond as per request by request basis. • Council to provide road closure signage if required.
40mm in 1 hour; 53mm in 2 hours; 63mm in 3 hours; 83mm in 6 hours; 109mm in 12 hours; or 147mm in 24 hours Note: rainfall depths are a very rough method of estimating flood events and have been used due to the ungagged nature of the catchment. This should be used as a guide only.	1% AEP (100 year ARI)	**Community Infrastructure Flooded** Lang Lang Primary School on Westernport Road, Lang Lang	DET/School to implement emergency plans if required

APPENDIX D – FLOOD EVACUATION ARRANGEMENTS

Phase 1 – Decision to Evacuate

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

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

- properties are likely to become inundated;
- properties are likely to become isolated and occupants are not suitable for isolated conditions;
- public health is at risk 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); and/or
- 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; and

- different stages of an evacuation process.

The table below details triggers for evacuation. If these heights are predicted or are likely to occur evacuation should be considered.

Sector	Gauge	Trigger
Koo Wee Rup Hospital (XX Sector)	Iona	6.7m on Iona gauge prompt self-evacuation

The table below details time required to evacuate established areas – (*under development):*

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.

Evacuation warning messages will be developed and issued by VICSES in consultation with the MERO, MERC, DHHS and other key agencies and expert advice (CMAs and Flood Intelligence specialists).

Phase 3 – Withdrawal

Withdrawal will be controlled by Victoria Police. VICSES will provide advice regarding the most appropriate evacuation routes and locations for at-risk communities to evacuate to.

VICSES, CFA, Ambulance Victoria and local government will provide resources where available to support Victoria Police/VicRoads with route control, and may assist Victoria Police in arranging evacuation transportation.

Victoria Police 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 may be arranged via the MERO.

Possible evacuation routes to be used – (*under development):*

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

Landing zones for aircraft will be determined by the following.

- The Incident Controller will determine the requirements for airborne resources.
- The State Aircraft Desk will deploy and coordinate air resources/
- The pilot in command will determine the safest location to land.

Special needs groups are identified in Council's vulnerable persons register and vulnerable facilities list. Further information on Council's 'residents at risk' register can be obtained from the Council's MEMP or by contacting the MERO or MRM.

Caravans and caravan parks

Caravans may be evacuated. Caravan evacuation will be determined dependant on location and size of event.

Phase 4 – Shelter

Relief centres and/or assembly areas that cater for people's basic needs may be established to meet the immediate needs of people affected by flooding. Relief centres will be determined dependent on the location and size of the event. Relief centres and/or assembly centres that could be utilised are listed in the Cardinia MEMP.

Victoria Police, 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

The need for animal shelter compounds will be determined dependant on location and size of the event.

Council is drafting an Animals in Emergency Plan. When ready, this will be made available on the Council's website.

Phase 5 – Return

Return will be consistent with the *Strategic Plan for the Return of Community*.

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

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

Considerations for deciding whether to evacuate include:

- 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; and
- transportation, particularly for people without access to their own transport

Disruption to services

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

This table will be populated as a more detailed analysis of the flood risk is completed – (*under development):*

Service	Impact	Trigger Point for action	Strategy/Temporary Measures
Railway Line	**Nil train Service for approx. XXXX hours. Alternate services required**		
Telephone Exchange	**Isolation**		
Koo Wee Rup Hospital	**Isolation**	**Current level or level expected to be?**	
Road Closures	**Isolation of properties, long detours (XXX hours+)**		
School Bus Routes			

Essential infrastructure and property protection

Essential infrastructure and properties at risk of inundation have been noted within the Flood Intelligence Cards in **Appendix C**.

For small-scale events sandbags are available for purchase from Bunnings. For larger-scale events sandbag collection points and filling points will be determined, with the community being informed of these points depending on the nature and proximity of the event.

Rescue

There are no identified resources available within Cardinia Shire Council to assist with rescue operations. Agency resources potentially available include:

- aircraft available through the State Aircraft Unit;
- boats available through the VICSES RDO; and
- Victoria Police resources available through the RERC.

APPENDIX E – FLOOD WARNING SYSTEMS

Storm and Flood Warning

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

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 issue 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 use 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.

Local flood warning system arrangements

No local arrangements in place in Cardinia Shire.

APPENDIX F – MAPS

1. Overview

Maps considered useful to flood response are included in this Appendix. They include:

- a map outlining a series of flooding hot spot maps within Cardinia Shire;
- a map showing the Municipal boundary together with the open waterways and underground stormwater drainage pipe network within Cardinia Shire and the 1% AEP (100-year ARI) flood extents (sourced from Melbourne Water GIS); and
- a set of 23 maps showing flooding hot spots within Cardinia Shire together with the 1% AEP (100-year ARI) flood extents (sourced from the Melbourne Water GIS).

Note that:

- The mapping/data provided in this Appendix has been developed from Melbourne Water and other sources and taken from historical records and flood modelling. It may not include more recent data or local anecdotal information. It is planned that the mapping/data be updated as further studies or modelling is completed and other Information obtained.
- Maps showing the Special Building Overlay and Land Subject to Inundation Overlay are included in Cardinia Shire Planning Scheme can be used as a guide to areas that may flood during an event. The 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 (http://planningschemes.dpcd.vic.gov.au).
- Maps showing 1 in 100-year ARI (1% AEP) flood extents and floodways (together with volume, height and water quality data) are shown at the Victorian Water Resources website (http://nremap-sc.nre.vic.gov.au/MapShare.v2/imf.jsp?site=water).

APPENDIX G – CATCHMENT SCHEMATICS

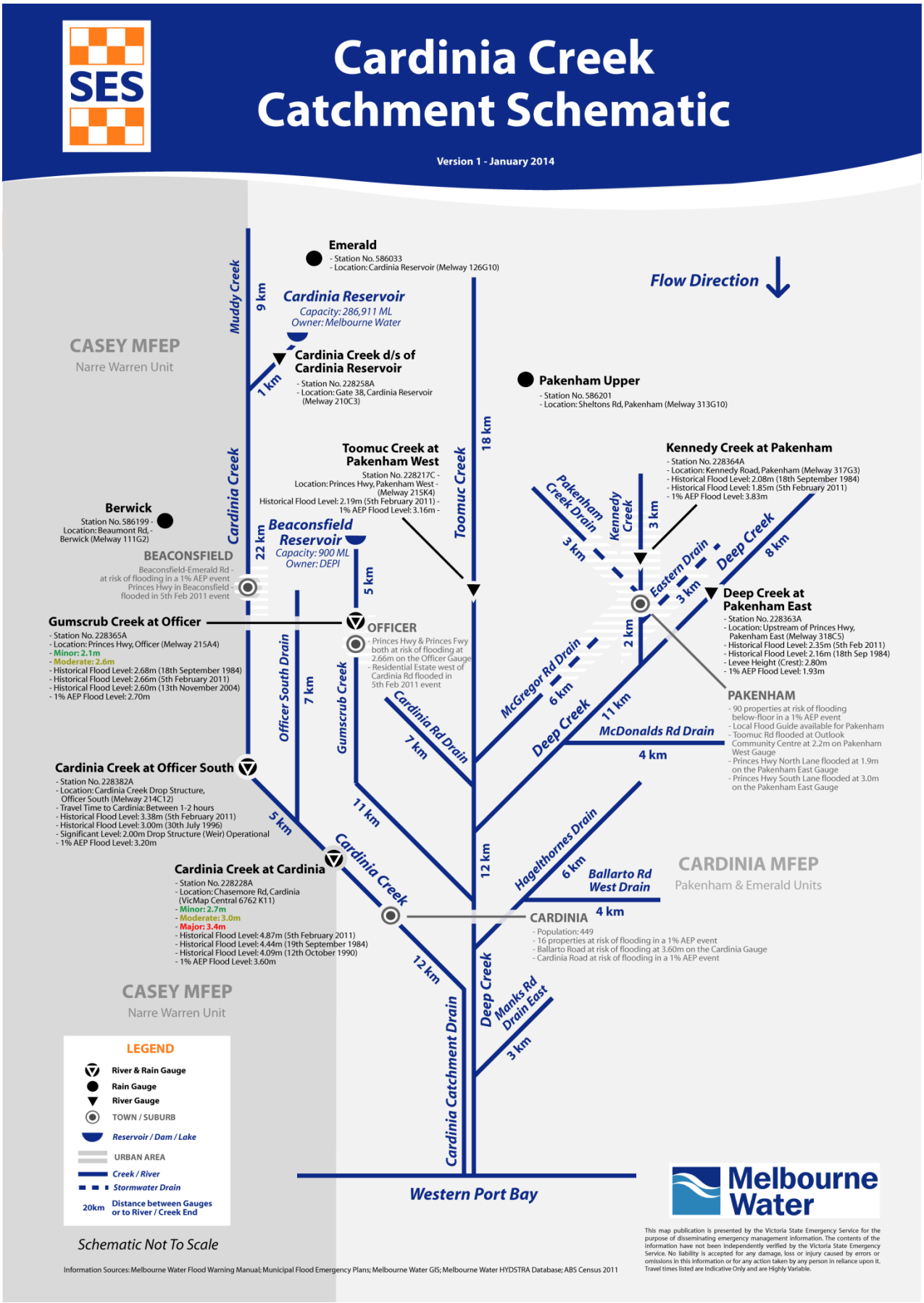
Schematics detailing the drainage catchments relevant for this municipality have been included in this Appendix. Each schematic outlines the drainage system comprising of rivers, creeks or storm-water drains contained within one of the major catchments in the Port Phillip and Westernport Region.

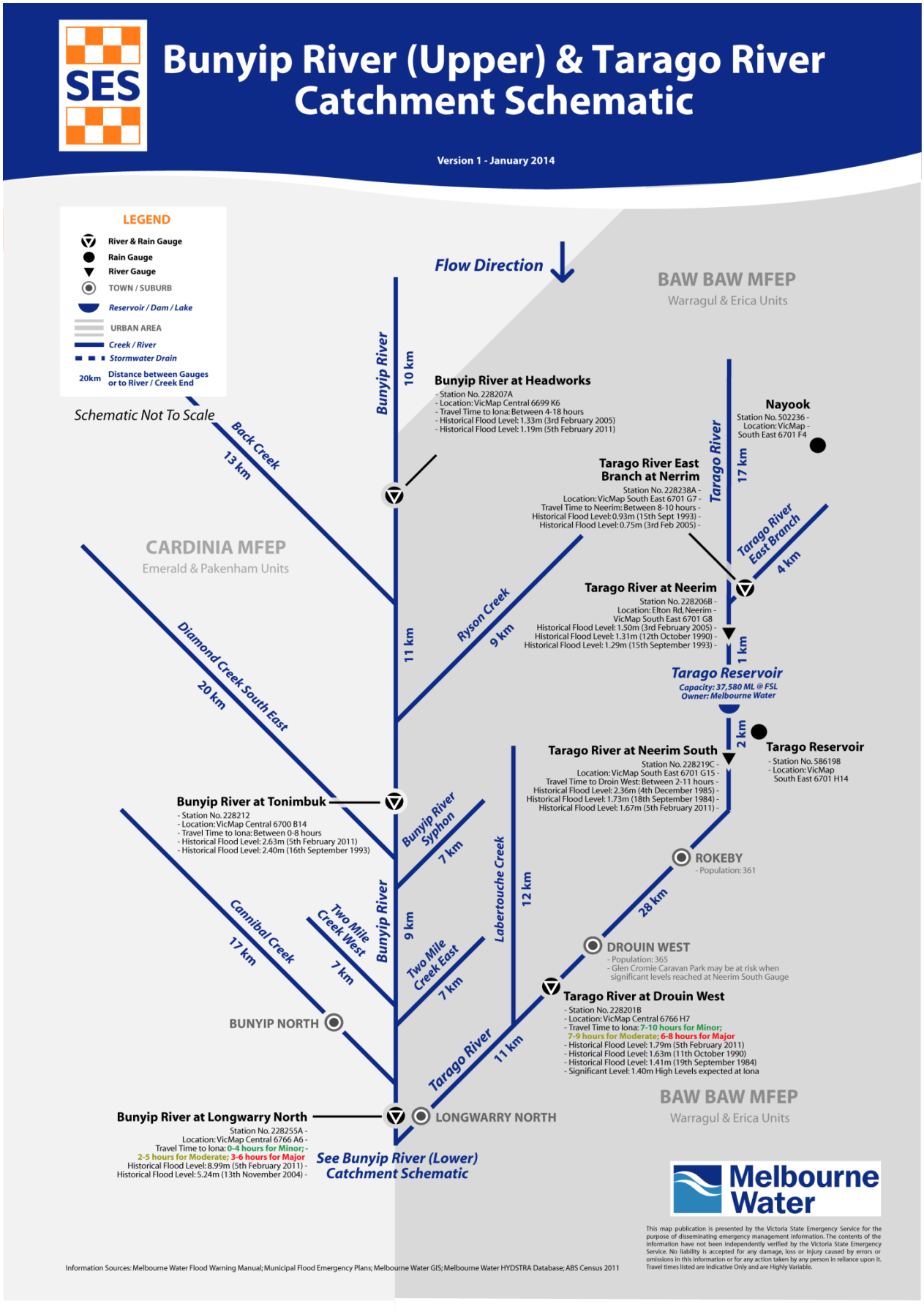
Within each schematic, there are details useful to flood response such as those relating to gauges, towns, rivers, creeks, drains and reservoirs. Historical facts and figures may also be shown.

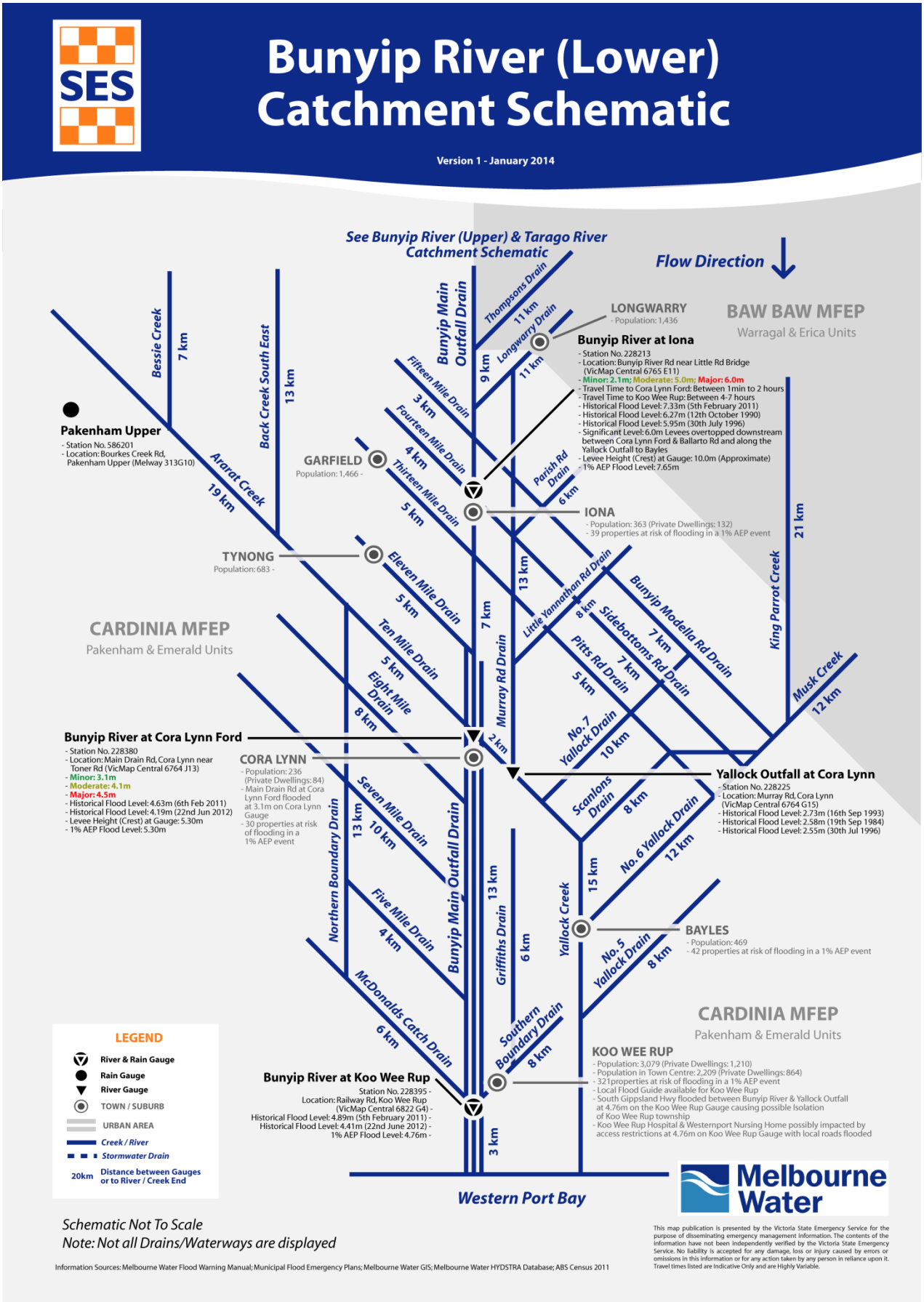
The schematics also detail the response boundaries for SES Units and local government, and provide a reference link to the corresponding Municipal Flood Emergency Plan.

Details within these catchment schematics reflect those contained within either other sections of this Municipal Flood Emergency Plan or refer to other Municipal Flood Emergency Plans. These details have been filtered to contain only key facts. For more information on a gauge, drainage system or town consult the corresponding Flood Emergency Plan

Note that not all waterways or drains are included in the schematics, only those that are likely to contribute to flooding further on along the drainage system. Note also the flow direction; the schematics either flow from the top of the page to the bottom, or vice versa.


Cardinia Creek
Catchment Schematic
Version 1 - January 2014
Flow Direction
Emerald
- Station No. 586033
- Location: Cardinia Reservoir (Melway 126G10)
Cardinia Reservoir
Capacity: 286,911 ML
Owner: Melbourne Water
Cardinia Creek d/s of Cardinia Reservoir
- Station No. 228258A
- Location: Gate 38, Cardinia Reservoir (Melway 210C3)
Pakenham Upper
- Station No. 586201
- Location: Sheltons Rd, Pakenham (Melway 313G10)
CASEY MFEP
Narre Warren Unit
Muddy Creek
9 km
1 km
Cardinia Creek
18 km
Toomuc Creek
Toomuc Creek at Pakenham West
Station No. 228217C -
Location: Princes Hwy, Pakenham West - (Melway 215K4)
Historical Flood Level: 2.19m (5th February 2011) -
1% AEP Flood Level: 3.16m -
Kennedy Creek at Pakenham
- Station No. 228364A
- Location: Kennedy Road, Pakenham (Melway 317G3)
- Historical Flood Level: 2.08m (18th September 1984)
- Historical Flood Level: 1.85m (5th February 2011)
- 1% AEP Flood Level: 3.83m
Pakenham Creek Drain
3 km
Kennedy Creek
3 km
Eastern Drain
3 km
Deep Creek
8 km
Berwick
Station No. 586199 -
Location: Beaumont Rd, - Berwick (Melway 111G2)
22 km
Beaconsfield Reservoir
Capacity: 900 ML
Owner: DEPI
BEACONSFIELD
Beaconsfield-Emerald Rd - at risk of flooding in a 1% AEP event
Princes Hwy in Beaconsfield - flooded in 5th Feb 2011 event
5 km
Deep Creek at Pakenham East
- Station No. 228363A
- Location: Upstream of Princes Hwy, Pakenham East (Melway 318C5)
- Historical Flood Level: 2.35m (5th Feb 2011)
- Historical Flood Level: 2.16m (18th Sep 1984)
- Levee Height (Crest): 2.80m
- 1% AEP Flood Level: 1.93m
Gumscrub Creek at Officer
- Station No. 228365A
- Location: Princes Hwy, Officer (Melway 215A4)
- Minor: 2.1m
- Moderate: 2.6m
- Historical Flood Level: 2.68m (18th September 1984)
- Historical Flood Level: 2.66m (5th February 2011)
- Historical Flood Level: 2.60m (13th November 2004)
- 1% AEP Flood Level: 2.70m
OFFICER
- Princes Hwy & Princes Fwy both at risk of flooding at 2.66m on the Officer Gauge
- Residential Estate west of Cardinia Rd flooded in 5th Feb 2011 event
2 km
Officer South Drain
7 km
Gumscrub Creek
Cardinia Rd Drain
7 km
McGregor Rd Drain
6 km
Deep Creek
11 km
McDonalds Rd Drain
4 km
PAKENHAM
- 90 properties at risk of flooding below-floor in a 1% AEP event
- Local Flood Guide available for Pakenham
- Toomuc Rd flooded at Outlook Community Centre at 2.2m on Pakenham West Gauge
- Princes Hwy North Lane flooded at 1.9m on the Pakenham East Gauge
- Princes Hwy South Lane flooded at 3.0m on the Pakenham East Gauge
Cardinia Creek at Officer South
- Station No. 228382A
- Location: Cardinia Creek Drop Structure, Officer South (Melway 214C12)
- Travel Time to Cardinia: Between 1-2 hours
- Historical Flood Level: 3.38m (5th February 2011)
- Historical Flood Level: 3.00m (30th July 1996)
- Significant Level: 2.00m Drop Structure (Weir) Operational
- 1% AEP Flood Level: 3.20m
5 km
11 km
12 km
Hagelthornes Drain
6 km
Ballarto Rd West Drain
4 km
CARDINIA MFEP
Pakenham & Emerald Units
Cardinia Creek at Cardinia
- Station No. 228228A
- Location: Chasemore Rd, Cardinia (VicMap Central 6762 K11)
- Minor: 2.7m
- Moderate: 3.0m
- Major: 3.4m
- Historical Flood Level: 4.87m (5th February 2011)
- Historical Flood Level: 4.44m (19th September 1984)
- Historical Flood Level: 4.09m (12th October 1990)
- 1% AEP Flood Level: 3.60m
CARDINIA
- Population: 449
- 16 properties at risk of flooding in a 1% AEP event
- Ballarto Road at risk of flooding at 3.60m on the Cardinia Gauge
- Cardinia Road at risk of flooding in a 1% AEP event
12 km
Deep Creek
Manks Rd Drain East
3 km
Cardinia Catchment Drain
CASEY MFEP
Narre Warren Unit
LEGEND
River & Rain Gauge
Rain Gauge
River Gauge
TOWN / SUBURB
Reservoir / Dam / Lake
URBAN AREA
Creek / River
Stormwater Drain
20km Distance between Gauges or to River / Creek End
Western Port Bay
Schematic Not To Scale
Information Sources: Melbourne Water Flood Warning Manual; Municipal Flood Emergency Plans; Melbourne Water GIS; Melbourne Water HYDSTRA Database; ABS Census 2011
Melbourne Water
This map publication is presented by the Victoria State Emergency Service for the purpose of disseminating emergency management information. The contents of the information have not been independently verified by the Victoria State Emergency Service. No liability is accepted for any damage, loss or injury caused by errors or omissions in this information or for any action taken by any person in reliance upon it. Travel times listed are Indicative Only and are Highly Variable.


SES
Bunyip River (Upper) & Tarago River Catchment Schematic
Version 1 - January 2014
LEGEND
River & Rain Gauge
Rain Gauge
River Gauge
TOWN / SUBURB
Reservoir / Dam / Lake
URBAN AREA
Creek / River
Stormwater Drain
20km Distance between Gauges or to River / Creek End
Schematic Not To Scale
Flow Direction
BAW BAW MFEP
Warragul & Erica Units
CARDINIA MFEP
Emerald & Pakenham Units
Bunyip River
10 km
Bunyip River at Headworks
- Station No. 228207A
- Location: VicMap Central 6699 K6
- Travel Time to Iona: Between 4-18 hours
- Historical Flood Level: 1.33m (3rd February 2005)
- Historical Flood Level: 1.19m (5th February 2011)
Back Creek
13 km
Nayook
Station No. 502236 - Location: VicMap - South East 6701 F4
Tarago River
17 km
Tarago River East Branch at Nerrim
Station No. 228238A - Location: VicMap South East 6701 G7 - Travel Time to Neerim: Between 8-10 hours - Historical Flood Level: 0.93m (15th Sept 1993) - Historical Flood Level: 0.75m (3rd Feb 2005) -
Tarago River East Branch
4 km
Tarago River at Neerim
Station No. 228206B - Location: Elton Rd, Neerim - VicMap South East 6701 G8 - Historical Flood Level: 1.50m (3rd February 2005) - Historical Flood Level: 1.31m (12th October 1990) - Historical Flood Level: 1.29m (15th September 1993) -
1 km
Tarago Reservoir
Capacity: 37,580 ML @ FSL
Owner: Melbourne Water
2 km
Tarago Reservoir
- Station No. 586198
- Location: VicMap South East 6701 H14
Tarago River at Neerim South
Station No. 228219C - Location: VicMap South East 6701 G15 - Travel Time to Droin West: Between 2-11 hours - Historical Flood Level: 2.36m (4th December 1985) - Historical Flood Level: 1.73m (18th September 1984) - Historical Flood Level: 1.67m (5th February 2011) -
Ryson Creek
9 km
11 km
Diamond Creek South East
20 km
Bunyip River at Tonimbuk
- Station No. 228212
- Location: VicMap Central 6700 B14
- Travel Time to Iona: Between 0-8 hours
- Historical Flood Level: 2.63m (5th February 2011)
- Historical Flood Level: 2.40m (16th September 1993)
Bunyip River Syphon
7 km
Labertouche Creek
12 km
ROKEBY
- Population: 361
28 km
Bunyip River
9 km
Two Mile Creek West
7 km
Two Mile Creek East
7 km
Cannibal Creek
17 km
DROUIN WEST
- Population: 365
- Glen Cromie Caravan Park may be at risk when significant levels reached at Neerim South Gauge
Tarago River at Drouin West
- Station No. 228201B
- Location: VicMap Central 6766 H7
- Travel Time to Iona: 7-10 hours for Minor; 7-9 hours for Moderate; 6-8 hours for Major
- Historical Flood Level: 1.79m (5th February 2011)
- Historical Flood Level: 1.63m (11th October 1990)
- Historical Flood Level: 1.41m (19th September 1984)
- Significant Level: 1.40m High Levels expected at Iona
BUNYIP NORTH
Tarago River
11 km
BAW BAW MFEP
Warragul & Erica Units
Bunyip River at Longwarry North
Station No. 228255A - Location: VicMap Central 6766 A6 - Travel Time to Iona: 0-4 hours for Minor; - 2-5 hours for Moderate; 3-6 hours for Major Historical Flood Level: 8.99m (5th February 2011) - Historical Flood Level: 5.24m (13th November 2004) -
LONGWARRY NORTH
See Bunyip River (Lower) Catchment Schematic
Melbourne Water
This map publication is presented by the Victoria State Emergency Service for the purpose of disseminating emergency management information. The contents of the information have not been independently verified by the Victoria State Emergency Service. No liability is accepted for any damage, loss or injury caused by errors or omissions in this information or for any action taken by any person in reliance upon it. Travel times listed are Indicative Only and are Highly Variable.
Information Sources: Melbourne Water Flood Warning Manual; Municipal Flood Emergency Plans; Melbourne Water GIS; Melbourne Water HYDSTRA Database; ABS Census 2011


Bunyip River (Lower) Catchment Schematic
Version 1 - January 2014
See Bunyip River (Upper) & Tarago River Catchment Schematic
Flow Direction
LONGWARRY
- Population: 1,436
BAW BAW MFEP
Warragal & Erica Units
Bunyip River at Iona
- Station No. 228213
- Location: Bunyip River Rd near Little Rd Bridge (VicMap Central 6765 E11)
- Minor: 2.1m; Moderate: 5.0m; Major: 6.0m
- Travel Time to Cora Lynn Ford: Between 1min to 2 hours
- Travel Time to Koo Wee Rup: Between 4-7 hours
- Historical Flood Level: 7.33m (5th February 2011)
- Historical Flood Level: 6.27m (12th October 1990)
- Historical Flood Level: 5.95m (30th July 1996)
- Significant Level: 6.0m Levees overtopped downstream between Cora Lynn Ford & Ballarto Rd and along the Yallock Outfall to Bayles
- Levee Height (Crest) at Gauge: 10.0m (Approximate)
- 1% AEP Flood Level: 7.65m
Pakenham Upper
- Station No. 586201
- Location: Bourkes Creek Rd, Pakenham Upper (Melway 313G10)
GARFIELD
Population: 1,466 -
IONA
- Population: 363 (Private Dwellings: 132)
- 39 properties at risk of flooding in a 1% AEP event
TYNONG
Population: 683 -
CARDINIA MFEP
Pakenham & Emerald Units
Bunyip River at Cora Lynn Ford
- Station No. 228380
- Location: Main Drain Rd, Cora Lynn near Toner Rd (VicMap Central 6764 J13)
- Minor: 3.1m
- Moderate: 4.1m
- Major: 4.5m
- Historical Flood Level: 4.63m (6th Feb 2011)
- Historical Flood Level: 4.19m (22nd Jun 2012)
- Levee Height (Crest) at Gauge: 5.30m
- 1% AEP Flood Level: 5.30m
CORA LYNN
- Population: 236 (Private Dwellings: 84)
- Main Drain Rd at Cora Lynn Ford flooded at 3.1m on Cora Lynn Gauge
- 30 properties at risk of flooding in a 1% AEP event
Yallock Outfall at Cora Lynn
- Station No. 228225
- Location: Murray Rd, Cora Lynn (VicMap Central 6764 G15)
- Historical Flood Level: 2.73m (16th Sep 1993)
- Historical Flood Level: 2.58m (19th Sep 1984)
- Historical Flood Level: 2.55m (30th Jul 1996)
BAYLES
- Population: 469
- 42 properties at risk of flooding in a 1% AEP event
CARDINIA MFEP
Pakenham & Emerald Units
KOO WEE RUP
- Population: 3,079 (Private Dwellings: 1,210)
- Population in Town Centre: 2,209 (Private Dwellings: 864)
- 321properties at risk of flooding in a 1% AEP event
- Local Flood Guide available for Koo Wee Rup
- South Gippsland Hwy flooded between Bunyip River & Yallock Outfall at 4.76m on the Koo Wee Rup Gauge causing possible Isolation of Koo Wee Rup township
- Koo Wee Rup Hospital & Westernport Nursing Home possibly impacted by access restrictions at 4.76m on Koo Wee Rup Gauge with local roads flooded
Bunyip River at Koo Wee Rup
Station No. 228395 -
Location: Railway Rd, Koo Wee Rup (VicMap Central 6822 G4) -
Historical Flood Level: 4.89m (5th February 2011) -
Historical Flood Level: 4.41m (22nd June 2012) -
1% AEP Flood Level: 4.76m -
Western Port Bay
LEGEND
River & Rain Gauge
Rain Gauge
River Gauge
TOWN / SUBURB
URBAN AREA
Creek / River
Stormwater Drain
20km Distance between Gauges or to River / Creek End
Schematic Not To Scale
Note: Not all Drains/Waterways are displayed
Information Sources: Melbourne Water Flood Warning Manual; Municipal Flood Emergency Plans; Melbourne Water GIS; Melbourne Water HYDSTRA Database; ABS Census 2011
Melbourne Water
This map publication is presented by the Victoria State Emergency Service for the purpose of disseminating emergency management information. The contents of the information have not been independently verified by the Victoria State Emergency Service. No liability is accepted for any damage, loss or injury caused by errors or omissions in this information or for any action taken by any person in reliance upon it. Travel times listed are Indicative Only and are Highly Variable.
Bessie Creek
7 km
Back Creek South East
13 km
Ararat Creek
19 km
Bunyip Main Outfall Drain
9 km
Thompsons Drain
11 km
Longwarry Drain
11 km
Fifteen Mile Drain
3 km
Fourteen Mile Drain
4 km
Thirteen Mile Drain
5 km
Parish Rd Drain
6 km
Eleven Mile Drain
5 km
Ten Mile Drain
5 km
Eight Mile Drain
8 km
Murray Rd Drain
2 km
7 km
13 km
Little Yannathan Rd Drain
8 km
Sidebottoms Rd Drain
7 km
Pitts Rd Drain
7 km
5 km
Bunyip Modella Rd Drain
7 km
King Parrot Creek
21 km
Musk Creek
12 km
No. 7 Yallock Drain
10 km
Scanlons Drain
8 km
No. 6 Yallock Drain
12 km
15 km
Yallock Creek
No. 5 Yallock Drain
8 km
Seven Mile Drain
10 km
13 km
Northern Boundary Drain
Five Mile Drain
4 km
McDonalds Catch Drain
6 km
Griffiths Drain
6 km
13 km
Southern Boundary Drain
8 km
3 km

APPENDIX H – SANDBAG ARRANGEMENTS

GENERAL

Appropriately placed sandbags can help reduce the impact of flooding to residences, businesses and infrastructure. While sandbags will not completely stop floodwater, they may reduce the amount of water entering properties.

The Incident Controller will determine the priorities related to the use of sandbags, which will be consistent with the strategic priorities and the VICSES Sandbag policy.

If VICSES sandbags are becoming limited in supply, then priority will be given to protection of essential infrastructure. If time permits, requests for supplementary supply should be carried out in line with the Cardinia MEMP.

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

Cardinia Shire Council MERO will liaise with the VICSES Central Region RDO/ IC (as appropriate) to ensure effective coordination of listed resources.

Sandbags will be filled in accordance with the VICSES Sandbag Quick Reference Guide and the VICSES *Statewide Guideline – Sandbags*. A short video depicting the filling procedures and the correct usage of sandbags is available online (https://www.youtube.com/watch?v=-_T--I3b-34andlist=PL428FCA686837ADED). (Sandbagging demonstration- vicsesTV on YouTube).

Sand may be obtained from the suppliers/locations noted below and as stated in the VICSES MOU: Sand Supply.

OPERATIONAL

Sandbag Storage Locations

Sandbags may be obtained from any of the locations as noted below.

Organisation	Location	Number of Sandbags	Estimated Response Time	Contact
Cardinia Shire Council Depot	Depot address	0	0-0.5 hrs business hours 1-2 hrs after hours and weekends	
Pakenham VICSES Unit	780 Princes Highway Pakenham	2000	1Hr	
VICSES Central Region	6/3-5 Gilda Ct Mulgrave	10000	2Hr	Via CTDO
Other				

Table H1- Sandbag storage locations within the Shire of Cardinia and adjoining locations

Sand Suppliers

In large events, or when local supplies have been exhausted, supply will be in accordance with *VICSES- Supplier MOU: Sand Supply*. VICSES Field Operation Guide suggests washed river sand as the preferred material.

A heavy-bodied sand or sandy soil is most desirable for filling sandbags, but any usable material at or near the site has definite advantages. Gravelly or rocky soils are generally poor choices because of their permeability. Filled bags of earth material will deteriorate quickly. Sand/ fill material should be free of salt and contaminants where possible.

Some potential suppliers of sand in the Cardinia Shire may include:

Organisation	Location	Delivery Capability	Restrictions	Contact
Cardinia Shire Council Depot	Depot address	Up to 5m3		1300 787 624
Koo Wee Garden and Soil Supply Pty Ltd	212 Station St, Koo Wee Rup VIC 3981	20m3	Gravel Entrance	59971575
Berwick sand and soil	29 Bald Hill Road Pakenham	30m3		5941 1000
Officer Garden and Building Supplies	405 Princes Highway, Officer	30m3		5943 1229
Soilworx	1150 Koo Wee Rup Road, Pakenham 3810	30m3		5940 4918

Table H2- Sand Suppliers and locations within the Shire of Cardinia and adjoining locations

Sandbag Collection Points

Sandbag collection points may be established at the Incident Controller's discretion and as conditions permit. Collection points will be advised based on the event.

Residents may purchase sandbags or similar from hardware or garden supply stores for protection of residential property or businesses if a sandbag collection point is not available to the public. Residents are advised to check with local hardware supply store regarding availability of sandbags.

Machinery Supply

Plant documented below may be required when undertaking sandbagging operations

Organisation	Asset	Location	Estimated deployment time	Contact
Cardinia Shire Council	Front End Loader Min lift height 2.5m Min Forward reach 60cm Max bucket width 2.5m	Council Depot	30min	130 787 624
Cardinia Shire Council	Small tipper (3 tonnes)	Council Depot	30min	1300 787 624
VICSES	Vehicle/ trailer for sandbag transport	Pakenham SES	30min	Via CTDO
VICSES Central Region	Sandbag Fill Machine	Pakenham SES	1Hr	Via CTDO
VICSES	Forklift	Pakenham SES	1Hr	Via CTDO
VICSES Central Region	Logistics Truck	SES Central Region (Mulgrave)	1Hr	Via CTDO

Table H4- Machinery/ Vehicles required for Sand Supply in Cardinia

Additional resources from Council that could be utilised to aid response include:

- backhoe
- gorklift
- large tipper.

POST-OPERATIONAL

Clean up and disposal

Residents, businesses and essential infrastructure owners will be encouraged to contact Council to determine the safest method for disposal of sandbags. Following a flood event within the municipality, Cardinia Shire Council will facilitate the disposal of sandbags. VICSES will work in conjunction with Cardinia Shire Council to ensure the disposal of used sandbags is dealt with under the Community Recovery arrangements as outlined in the EMMV.

APPENDIX I – SEVERE WEATHER (STORM) EVENTS

2. Overview

Cardinia municipality is susceptible to severe weather events because of a combination of its hilly terrain in the northern half of the municipality; the high number of mature trees located within the municipality; and its proximity to the Dandenong Ranges.

Severe storm activity could result in injuries and increase in road accidents. Damaging wind events will tend to lead to trees down, with damage to the built and natural environment. Obstructions across roads could disrupt services, affect community functioning and have great potential for road traffic delays.

This Appendix uses Request for Assistance data from VICSES to display areas at risk from severe weather events.

3. VICSES requests for assistance

VICSES Service records requests for assistance made by the public during severe weather events. Table 1 below is a breakdown of requests by suburb and damage type during the period July 2009 and January 2016.

Table 1 – Breakdown of Severe Weather Requests for Assistance received by VICSES Pakenham and Emerald Units by suburb

Suburb	VICSES Request for Assistance (July 2009 – Jan 2016)				
	Building Damage	Flooding	Tree Down	Tree Down Traffic Hazard	Rescue Persons Trapped *
Avonsleigh	14	2	33	82	2
Bayles	0	7	9	14	0
Beaconsfield	24	23	34	47	5
Beaconsfield Upper	11	10	64	126	3
Bunyip	11	15	31	54	4
Bunyip North	0	0	0	10	0
Caldermeade	1	3	1	2	0
Cardinia	1	10	7	15	1
Catani	0	3	0	2	0
Clematis	4	1	22	25	0
Cockatoo	85	17	213	326	1
Cora Lynn	2	2	4	3	0
Dalmore	1	1	2	1	0
Dewhurst	2	0	4	19	0
Emerald	91	13	241	340	8
Garfield	6	14	14	55	0
Garfield North	1	1	7	17	0
Gembrook	15	5	47	143	3
Guys Hill	0	0	7	10	0
Heath Hill	1	0	3	28	0
Iona	2	3	2	1	0
Koo Wee Rup	15	24	15	14	3
Koo Wee Rup North		0	0	1	1
Lang Lang	8	3	13	73	2

Lang Lang East	0	0	3	2	0
Longwarry	0	0	0	1	1
Maryknoll	1	1	7	13	0
Menzies Creek	12	2	49	115	3
Modella	1	1	1	0	1
Monomeith	0	0	0	1	0
Mount Burnett	1	0	9	30	0
Nangana	0	0	5	11	0
Nar Nar Goon	2	13	10	51	2
Nar Nar Goon North	2	7	22	132	3
Nyora	0	0	0	1	0
Officer	12	8	17	47	3
Officer South	0	1	0	13	0
Pakenham	256	148	157	188	42
Pakenham South	5	2	2	7	3
Pakenham Upper	11	4	34	151	4
Tonimbuk	0	0	0	26	0
Tooradin	8	3	25	36	1
Tynong	8	21	14	47	5
Tynong North	1	3	12	55	0
Vervale	0	1	0	1	0
Yannathan	0	0	1	19	0

* Rescue Persons Trapped does not include RFAs for Rescue Road Trapped, Rescue Rail Trapped, Rescue Structure Collapse or Rescue High Angle.

**RFAs relating to Assist fire service, Assist police, Message, SES incident other etc. have not been included in the dataset

Table 2 is a breakdown of requests for assistance by date (month) and damage type. High figures during February 2011 are the result of a widespread storm that moved across the state from the North West causing multiple flooding issues. Severe wind events in September 2012 and October 2013 led to many RFAs for Building damage and tree down related issues; issues resulting from storms in August and September 2013 were predominantly due to trees sown and trees across roads.

Table 2 – Breakdown of severe weather requests for assistance received by VICSES Pakenham and Emerald Units within Cardinia Shire by date

	VICSES Request for Assistance (July 2009 – Jan 2016)				
Date	**Building Damage**	**Flooding**	**Tree Down**	**Tree Down Traffic Hazard**	**Rescue Persons Trapped**
Jul 2009	0	0	0	0	0
Aug 2009	0	0	1	0	0
Sep 2009	0	0	0	0	0
Oct 2009	0	0	0	0	0
Nov 2009	0	0	0	0	0
Dec 2009	0	0	0	0	0
Jan 2010	0	0	0	0	0
Feb 2010	0	0	0	0	0
Mar 2010	0	0	0	0	0
Apr 2010	0	0	0	0	0
May 2010	0	0	0	0	0
Jun 2010	2	0	13	17	0
Jul 2010	3	0	6	11	0

Date	VICSES Request for Assistance (July 2009 – Jan 2016)				
	Building Damage	Flooding	Tree Down	Tree Down Traffic Hazard	Rescue Persons Trapped
Aug 2010	5	3	20	34	0
Sep 2010	15	0	26	56	0
Oct 2010	4	10	11	30	0
Nov 2010	4	11	17	37	0
Dec 2010	3	5	7	29	4
Jan 2011	9	4	24	33	0
Feb 2011	30	147	29	66	9
Mar 2011	0	2	6	8	2
Apr 2011	3	0	3	7	1
May 2011	0	0	2	11	2
Jun 2011	12	1	27	42	0
Jul 2011	4	0	11	16	0
Aug 2011	1	0	1	5	0
Sep 2011	5	0	4	13	2
Oct 2011	0	0	3	13	0
Nov 2011	5	19	14	29	1
Dec 2011	2	3	6	15	0
Jan 2012	5	1	12	27	0
Feb 2012	6	8	13	20	2
Mar 2012	4	0	10	33	0
Apr 2012	6	3	14	43	1
May 2012	7	6	7	21	2
Jun 2012	5	34	15	41	2
Jul 2012	2	1	4	10	0
Aug 2012	5	0	10	26	2
Sep 2012	51	0	58	71	1
Oct 2012	1	1	3	8	0
Nov 2012	5	0	3	9	0
Dec 2012	0	1	7	5	0
Jan 2013	4	2	9	1	2
Feb 2013	0	2	8	8	1
Mar 2013	13	0	23	23	1
Apr 2013	0	2	6	3	0
May 2013	5	2	1	1	0
Jun 2013	4	4	3	22	0
Jul 2013	5	1	5	22	0
Aug 2013	9	0	48	89	1
Sep 2013	15	1	30	76	2
Oct 2013	47	0	62	77	0
Nov 2013	1	0	3	18	1
Dec 2013	0	0	7	12	1
Jan 2014	7	3	11	27	0
Feb 2014	4	0	7	24	1
Mar 2014	1	0	2	7	2
Apr 2014	1	1	0	7	0
May 2014	1	1	3	6	0
Jun 2014	15	2	25	37	0
Jul 2014	21	0	31	68	1
Aug 2014	4	0	20	17	1
Sep 2014	30	6	36	18	2
Oct 2014	5	1	8	17	2
Nov 2014	0	0	6	15	0
Dec 2014	5	0	13	18	3
Jan 2015	6	0	16	22	0
Feb 2015	8	2	9	16	0
Mar 2015	1	0	8	9	1
Apr 2015	2	0	0	2	0

Date	VICSES Request for Assistance (July 2009 – Jan 2016)				
	Building Damage	Flooding	Tree Down	Tree Down Traffic Hazard	Rescue Persons Trapped
May 2015	2	0	2	9	0
Jun 2015	1	0	3	7	0
Jul 2015	3	0	4	23	1
Aug 2015	4	3	5	5	0
Sep 2015	2	0	4	8	0
Oct 2015	2	1	4	13	0
Nov 2015	5	0	5	13	0
Dec 2015	7	0	12	30	1
Jan 2016	13	3	15	25	3

4. VICSES requests for assistance mapping

Figure 1 – Breakdown of Severe Weather Requests for Assistance received by VICSES Pakenham and Emerald Units within Cardinia by request type

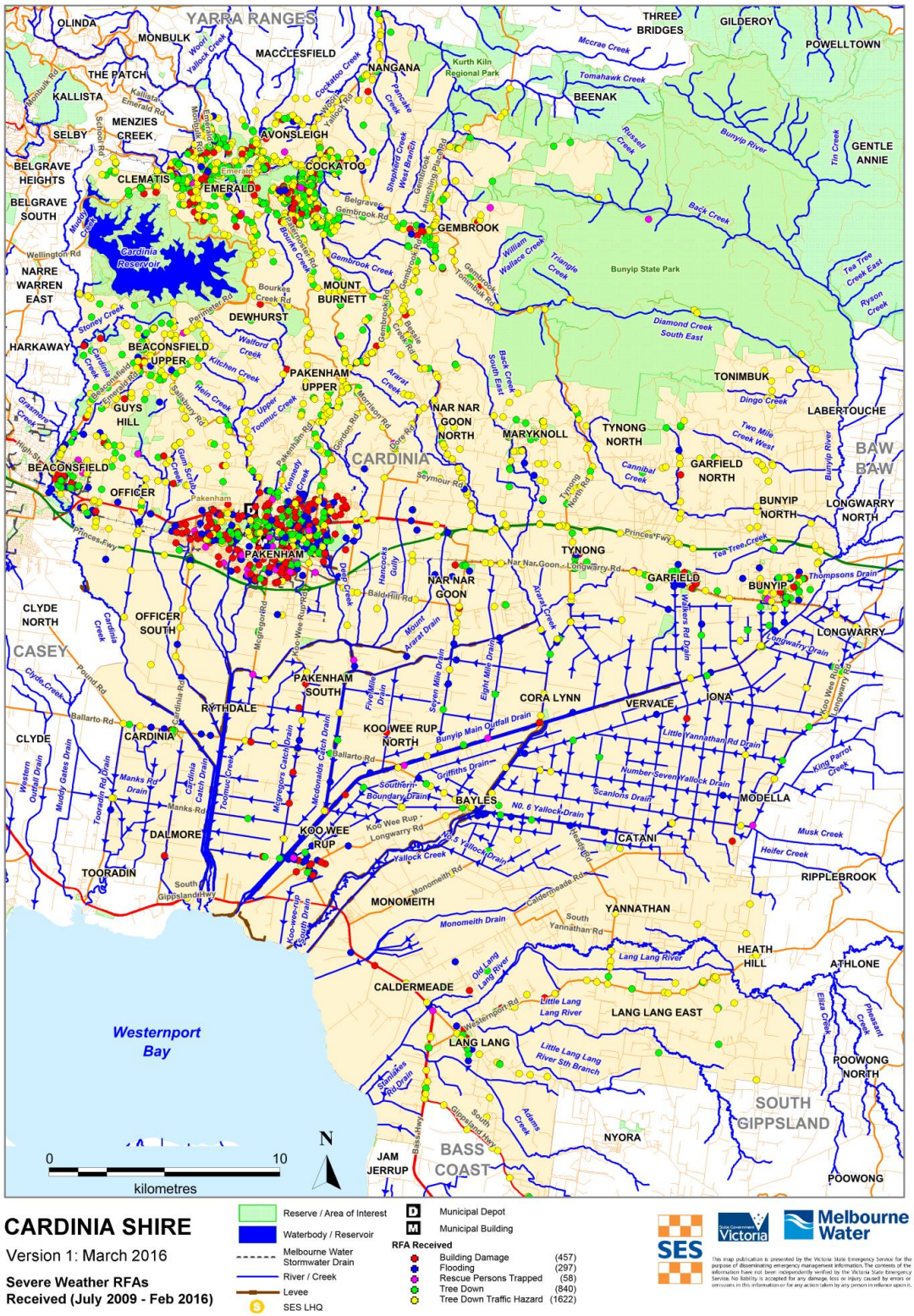


Figure 2 – Breakdown of Severe Weather Requests for Assistance received by VICSES Pakenham and Emerald Units within Cardinia by date