

Final

Castlemaine, Campbells Creek and Chewton FLOOD MANAGEMENT PLAN 2015



Overview

The Castlemaine, Campbells Creek and Chewton Flood Management Plan is now complete.

The plan provides 10 recommendations which can reduce the community's exposure to flooding.

The plan recommends the construction of a new levee, the upgrade of two existing levees, undertaking minor waterway improvement works in Campbells Creek and developing an ongoing management plan for urban waterways. It also recommends developing a flood warning system and updating the Mount Alexander Planning Scheme. The plan recommends council undertake further investigation and consultation for mitigation options in the Gingell Street area.

The final recommendations were informed by community feedback provided on the Draft Castlemaine, Campbells Creek and Chewton Flood Management Plan of February, 2015.

The plan is now complete and the recommendations will be submitted to the Mount Alexander Shire Council to consider for adoption and future implementation.

North Central Catchment Management Authority (CMA) led the development of the plan, with support from Mount Alexander Shire Council, technical contributions from various statutory agencies and input from community representatives.

Technical work has been undertaken by specialist water consultant GHD.

The project was jointly funded by the Australian and Victorian Governments, Mount Alexander Shire and North Central CMA.



Top: Gingell St, January 2011

Above: Gingell St looking past the Railway Hotel towards Camp Reserve, January 2011. Photos: Mal Brown

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Background

Castlemaine, Campbells Creek and Chewton were impacted by floodwaters in September and November 2010, January, 2011 and again in February, 2012. The January, 2011 flood event is believed to be the highest, or close to the highest, flood on record. Flooding caused damage to businesses, homes and sporting facilities, and caused significant distress and hardship to members of the community. The Rural Water Commission undertook a flood study for a portion of the town in 1986, however the extent of that study was limited, and the techniques available for producing flood information are now much further advanced.

The North Central CMA, in partnership with the Mount Alexander Shire Council, developed the Castlemaine, Campbells Creek and Chewton Flood Management Plan in recognition of the need to identify and reduce the risk of future flooding.

A steering committee with support from a technical working group – including flood specialist consultants GHD – prepared the plan for the community. Six local community volunteers who responded to a December, 2012 invitation represented the community on the steering committee.

A public meeting was held in February, 2013 seeking recent and historic flood information as well as flood mitigation ideas from the community. The information was required to help the construction of a computer-based flood model. The model is calibrated to recent flood events and has the ability to predict a range of potential floods and test various mitigation options suggested by the community (summarised on page 3). Independent flood-modelling experts reviewed the methodology behind the model.



Campbells Creek Winters Ave footbridge in flood, January 2011
Photo: Mal Brown

A draft plan was released in February, 2015 for community review and feedback. The draft plan was mailed to more than 500 residents, with additional copies provided at local post offices. Supporting this release, two consultation sessions were held in March, 2015 to allow community members to discuss the draft plan one-on-one with North Central CMA and Mount Alexander Shire officers. Eighty-nine written submissions were received commenting on various aspects of the draft plan. The feedback received by the community has informed the final recommendations of the plan.

The flood management plan has recommended an assessment and/or upgrade of two existing flood-protection levees as well as the design and implementation of a new levee to protect the worst affected areas of Castlemaine and Campbells Creek. Mitigation options in the Gingell St area require further community consultation beyond the scope of this plan. No mitigation options were determined to be necessary for the Chewton area. The following pages list the recommendations of the plan.

Discussion on calibration – January 2011 and February 2012 flood events

In general, the January, 2011 event was a widespread event which occurred over several days. The February, 2012 event was a localised event which was intense and occurred over a short period of time. Daily rainfall depths were recorded at Castlemaine Prison and used in conjunction with rainfall data collected by members of the community.

Most of the rainfall during the January, 2011 event fell between the 12th and 14th. Over these three days 147.6mm fell, which equates to approximately a 1-in-30 Annual Exceedance Probability (AEP) event (3.3%).

A total of 157mm fell over the two days of the February, 2012 event, which equates to approximately a 1-in-90 AEP event (1.11%). In the two hours from 7.30pm to 9.30pm, 81.7mm fell, which equates to an event rarer than a 1-in-100 AEP (1%) event. It is also worth noting only a small amount (20mm over two days) of rainfall was recorded in the upper portion of the Barkers Creek catchment, with the bulk of the rainfall falling on the Forest Creek catchment in central Castlemaine.

Summary of mitigation options suggested by the community and investigated by the plan

Constructed mitigation options

Flood protection levees – GHD tested a series of new flood protection levees along Barkers Creek, Forest Creek and Campbells Creek. Levees were tested at the following locations with varying success in regards to technical feasibility and cost-benefit principles:

- Two locations along Gingell St. **See Recommendations 1 and 2.**
- Adjacent to the Castlemaine Central Cabin and Van Park to protect the park and properties in Bruce St. **See Recommendation 3.**
- An upgrade and extension of the levee near Elizabeth St, Castlemaine. **See Recommendation 4.**
- An upgrade and extension of the Campbells Creek Township levee. **See Recommendation 5.**
- Minor repair work to the levee next to National School Lane in Campbells Creek. **See Recommendation 6.**
- A new levee at the Central Carpets site is technically feasible, but was demonstrated to have a low economic outcome when expected costs were compared to expected benefit. **Not investigated further.**
- An extension of the levee adjacent to Main Road in Campbells Creek near Moscript St. This was found to provide little benefit to any properties. Local stormwater flooding also affects this section of Main Rd behind the levee. There is no option proposed at this site. **Not investigated further.**
- An option considered removing the levee between Forest Creek and the Western Reserve to engage floodplain storage sooner. This option proved to have very little benefit. **Not investigated further.**

Draft Recommendation 2b – Gingell Street South Levee (2.1 metres). Due to significant community opposition, Recommendation 2b of the draft plan has been abandoned. This option proposed the construction of a 2.1m high levee adjacent to Barkers Creek, opposite the Railway Hotel. The construction of this levee was very strongly opposed by the community, citing concerns for visual amenity, the potential for vandalism and graffiti, and concerns regarding accessibility to the creek, railway station and the town centre. Alternative proposals for this area will be pursued as per **Recommendation 2 of the final plan.**

Increasing flow capacity beneath bridges – A number of bridges were thought to have been holding up water in the catchment and contributing to flooding. The model tested additional capacity beneath bridges at Forest St, Roberts Avenue (pedestrian bridge), Elizabeth St (Castlemaine) and Alexandra St (Campbells Creek). These options were mildly successful in lowering flood levels but did not remove flooding entirely and would incur significant cost to complete the works. **Not investigated further.**

Using storages or dams to prevent flooding – A number of existing storages were assumed empty and a number of new, but smaller, dams were placed in the flood model to try to hold back flood flow. These were found to have little impact on lowering flood levels in the creeks. **Not investigated further.**

Removing existing levees – The existing levees in Campbells Creek, Elizabeth St (Castlemaine) and on Forest Creek adjacent to the Western Reserve were removed to understand their impact on flood behavior. Removing the existing levees created negative flood affects to adjacent properties. Therefore it can be said that the existing levees have a positive effect in preventing flooding and should be retained and/or upgraded to current design standards. **See recommendations 4 and 5.**

Raising houses – Would prevent over-floor flooding to affected properties but does not remove the affects and dangers associated with flooding entirely. This remains a possible longer-term solution but is highly dependent on individual participation, feasibility of construction, cost-benefit analysis and the availability of funding, among other things. May be further considered where levee construction is not achievable or not supported by the wider community.

Non-constructed mitigation options

Vegetation management

The flood model was used to test the effects of removing vegetation from the waterways. This resulted in marginally lower flood levels in the creeks but not significantly enough to prevent over-floor flooding to affected properties. **See recommendations 7 and 8.**

There was some local benefit determined in removing some dense vegetation downstream of the Alexandra St Bridge in Campbells Creek, which may also lower the overall height of the upgraded Campbells Creek Township levee. **See recommendations 5 and 7.**

Flood warning system

It has been strongly suggested a flood warning system be developed for Castlemaine, Campbells Creek and Chewton based on information produced by the plan. **See Recommendation 9.**

Planning scheme overlays

The new flood information produced by the plan is recommended to be included in the Mount Alexander Planning Scheme to manage future land use and development with the floodplains of Barkers Creek, Forest Creek and Campbells Creek. **See Recommendation 10.**

Sandbagging

A number of community members raised the possibility of carrying out targeted sandbagging activities around potentially affected assets prior to the onset of flooding within the urban area. The plan has found flooding within the urban area occurs too quickly to consider sandbagging as a practical solution. Local VICSES members have also expressed concern about their ability to undertake sandbagging activities within such a short time frame and with limited members, even if it was assumed that sand and sandbags were readily available – which they are often not and can be the limiting factor. Permanent structural solutions are considered the best chance for Castlemaine and Campbells Creek to limit their exposure to flooding.

Detailed information on all mitigation options tested in the development of the final plan can be found in the full report, available at www.nccma.vic.gov.au

Recommendation 1 – Gingell Street North levee

Background

The draft plan recommended the construction of a new 1-in-100 Annual Exceedance Probability (AEP) flood protection levee at the northern end of Gingell St, subject to detailed design and consultation with affected property owners and occupiers.

The levee is required to prevent over-floor flooding to six dwellings on the west bank of Barkers Creek in a 1-in-100 AEP flood. The average height of the levee would be one metre, up to a maximum of two metres (not including freeboard). Further investigation would include discussions with adjoining landowners regarding levee alignment, design criteria and any other complementary works that may be required to offset raised flood levels to 9 Walker St.

Consultation

Sixty-two responses were received to the proposal with 37 per cent indicating support for the proposal and 63 per cent opposition. The majority of responses were primarily concerned with visual amenity impacts (20 responses), potential for vandalism and graffiti on the levee (10), potential for rubbish dumping behind the levee (five) and accessibility in and around the new infrastructure (five). A number of those opposed to the levee noted the length of the levee towards the south was extensive and only appeared to extend that far to protect one additional dwelling. Their responses indicated a reduced extent of the levee would retain access to the creek environment and appease visual amenity concerns. The reduction in length of this levee may also make the levee cost-effective, where it previously wasn't (benefit-cost ratio of 0.5 in the draft plan). In summary, community responses indicated a low level of support for the levee as proposed in the draft plan, but provided enough confidence an acceptable alternative could be developed through further consultation between council and the community.

Final Recommendation

- 1a.** That council further investigates the construction of a levee to protect residents from a 1-in-100 AEP event. The location and detailed design parameters should be agreed on in collaboration with landowners and local residents. The extent of the levee should be reduced from the draft proposal to retain access to Barkers Creek and help aesthetic concerns raised by the community. Council's investigation should determine if a reduction in the extent of the levee would provide a cost-effective proposal compared to the draft proposal
- 1b.** That council, in the absence of an acceptable levee proposal, further investigates alternative flood-mitigation measures for this area, in collaboration with landowners and local residents.



Levee location plan



Proposed levee (Riverine flooding only)



Existing conditions (Riverine flooding only)



LEGEND

- Highway
- Sealed road (arterial and local)
- Proposed levee
- Building protected by levee
- Building flooded above floor
- 1% AEP flood extent
- Flow direction vector

0 100 200 Metres

Gingell Street North Levee - 1 in 100 AEP Flood Event

Recommendation 2a – Gingell Street South levee (1 metre)

Background

The draft plan recommended the construction of a new one-metre-high flood-protection levee and associated stormwater management works at the southern end of Gingell St, subject to detailed design and consultation with affected property owners and occupiers. This will provide protection from a 1-in-20 Annual Exceedance Probability (AEP) flood in Barkers Creek and improve existing conditions during a 1-in-100 AEP flood from local stormwater.

The levee is required to prevent flooding to eight private properties (prevents over-floor flooding to five buildings – three dwellings, the Railway Hotel and football change rooms) from flood events up to and including the 1-in-20 AEP flood. The maximum height of the levee would be one metre. Further investigation would include discussions with adjoining owners and occupiers regarding levee alignment, design criteria and any other complementary works that may be required.

It is noted the levee will still overtop for events greater than the 1-in-20 AEP flood and, if so, is likely to create access issues in Gingell St and cause over-floor inundation to a number of properties.

The committee sought feedback on two options for the Gingell St South area. However, due to significant community opposition, Recommendation 2b of the draft plan was abandoned.

Consultation

Sixty-one responses were received to the proposal with 38 per cent indicating support for the proposal and 62 per cent opposition. The primary issues of concern for this levee were around visual amenity (17 responses), vandalism and graffiti (13), accessibility to the creek (8) and connectivity to the railway station and town centre – issues that could be considered common within any urban environment. Alternative options were suggested by the community such as raising houses, constructing temporary flood walls or undertaking sandbagging during flood events. These responses provide support for some form of mitigation options to alleviate flooding within this area. However, the responses suggest any options will require careful consideration of community values and need to be undertaken in close consultation with the community. Discussion with residents indicated an increased level of support could be given if the aesthetic concerns of the levee could be resolved. The committee resolved to provide a revised recommendation to initiate further community consultation on the potential construction of a levee at this location.

Final Recommendation

2a. That council

- i. Further investigates the construction of a levee to protect residents from a 1-in-20 AEP event. The location and detailed design parameters should be agreed on in collaboration with landowners and local residents. Further investigation should include consultation on the appearance of the levee, access to Barkers Creek, retention of access to the train station and Central Business District to alleviate concerns raised by the community.
- ii. In the absence of an acceptable levee proposal, further investigates alternative flood-mitigation measures for this area, in collaboration with landowners and local residents.



Levee location plan



Existing conditions



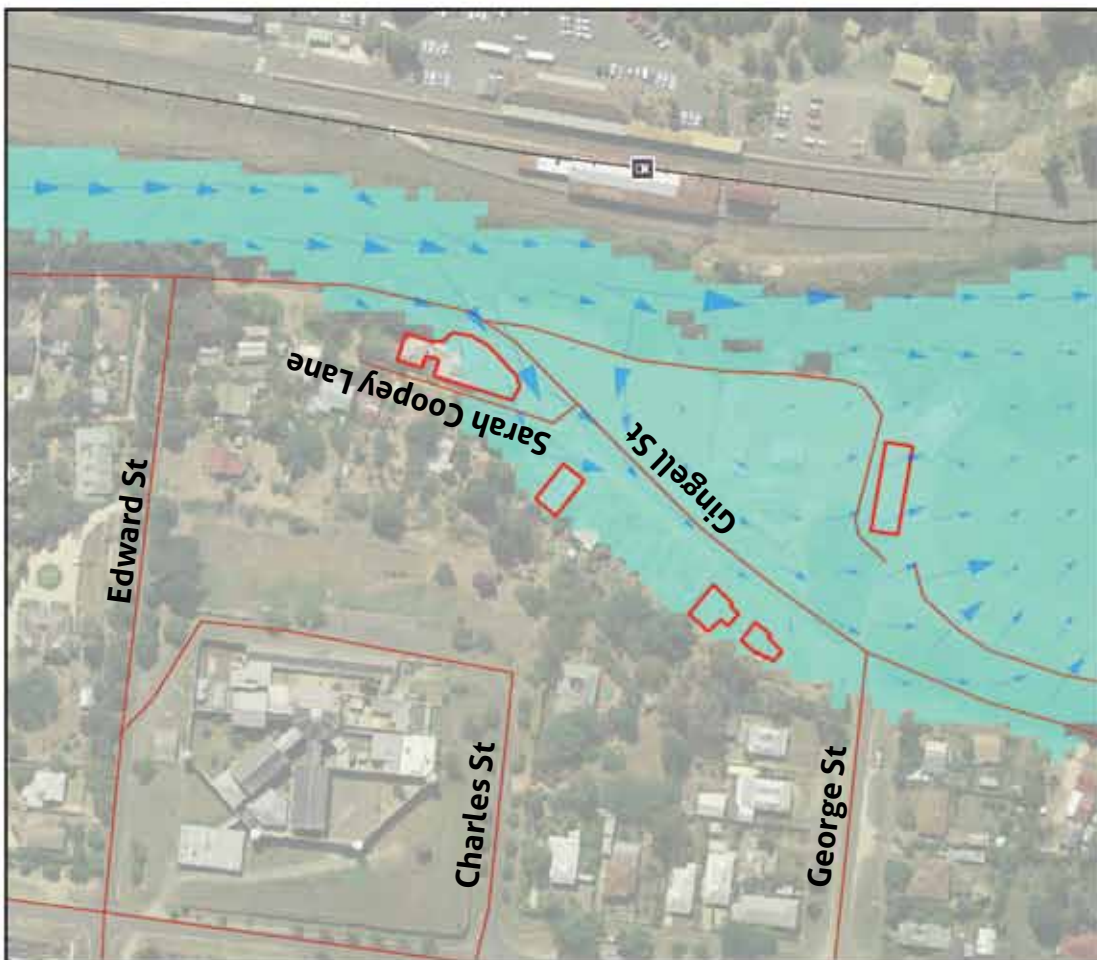
Proposed levee wall

- 2b. That council undertakes detailed design and costing of options which reduce the impacts of local storm water flooding at the southern end of Gingell St. Council should consider storm water upgrades in association with the construction of a levee, however, in the absence of an acceptable levee option, measures which reduce the impacts of storm water should be considered for construction in their own right.

Proposed levee (Riverine flooding only)



Existing conditions (Riverine flooding only)



LEGEND

- Sealed road (arterial and local)
- Flow direction vector
- Proposed levee
- Building protected by levee
- Building flooded above floor
- 5% AEP Flood Extent
- Rail station

0 50 100
Metres

Gingell Street South Levee - 1 in 20 AEP Flood Event

Recommendation 3 – Castlemaine Central Cabin and Van Park and Bruce Street levee

Background

The draft plan recommended the construction of a 1-in-100 Annual Exceedance Probability (AEP) flood-protection levee adjacent to the Castlemaine Central Cabin and Van Park to protect the park and properties in Bruce St from flooding from Forest Creek, subject to detailed design and consultation with affected property owners and occupiers.

The levee is required to protect the Castlemaine Central Cabin and Van Park and 14 neighbouring properties in Bruce and Barker streets. A flood-protection levee built level to the 1-in-100 AEP would prevent three dwellings, three commercial buildings and 26 cabins from over-floor flooding. The average height of this levee would be one metre (not including freeboard). However, the same 1-in-100 AEP protection levee with the standard 600mm of freeboard would prevent over-floor flooding to seven dwellings, seven commercial buildings and 26 cabins in a 0.5% AEP flood event (200 year ARI flood). Detailed design and consultation should strongly consider this scenario when deciding on any final levee height. Some minor compensatory works may be required to offset any increases to flood levels associated with the construction of the levee (which were shown to be minor).

Consultation

Fifty-five responses were received to the proposal with 69 per cent indicating support for the proposal and 31 per cent opposition. Unlike the other levees proposals, this levee is not in an area of high pedestrian traffic and does not form part of the connecting creek trails through Castlemaine. The landowners and residents most affected by this mitigation options are also the ones who will have the most benefit from its construction. Therefore, while all responses were considered in determining a final recommendation, greater emphasis was placed on those who would be most affected and who would most benefit from it in terms of reduced flood risk. That said, only five responses were received from residents directly affected by the implementation of this option. Four responses indicated support for a levee and one indicated support for flood mitigation in general.

Of those who opposed the levee, very few responses provided reasons why they opposed the option. In addition, the nearest opponent was located more than 230 metres from the nearest point of the levee and is separated from the levee by Barkers Creek and its environs, as well as the Bendigo-Melbourne railway line embankment – which stands more than seven metres above the surrounding natural surface level, and is not visibly permeable.

Therefore, in considering the responses from the community, the committee resolved to support moving forward with a levee proposal.

Final Recommendation

The plan recommends the construction of a 1-in-100 AEP flood protection levee adjacent to the Castlemaine Central Cabin and Van Park to protect the park and properties in Bruce St from flooding in Forest Creek, subject to detailed design and consultation with affected property owners and local residents. The construction of the levee should consider the impacts of local stormwater with the levee in place and how to minimise or reduce those impacts.



Levee location plan

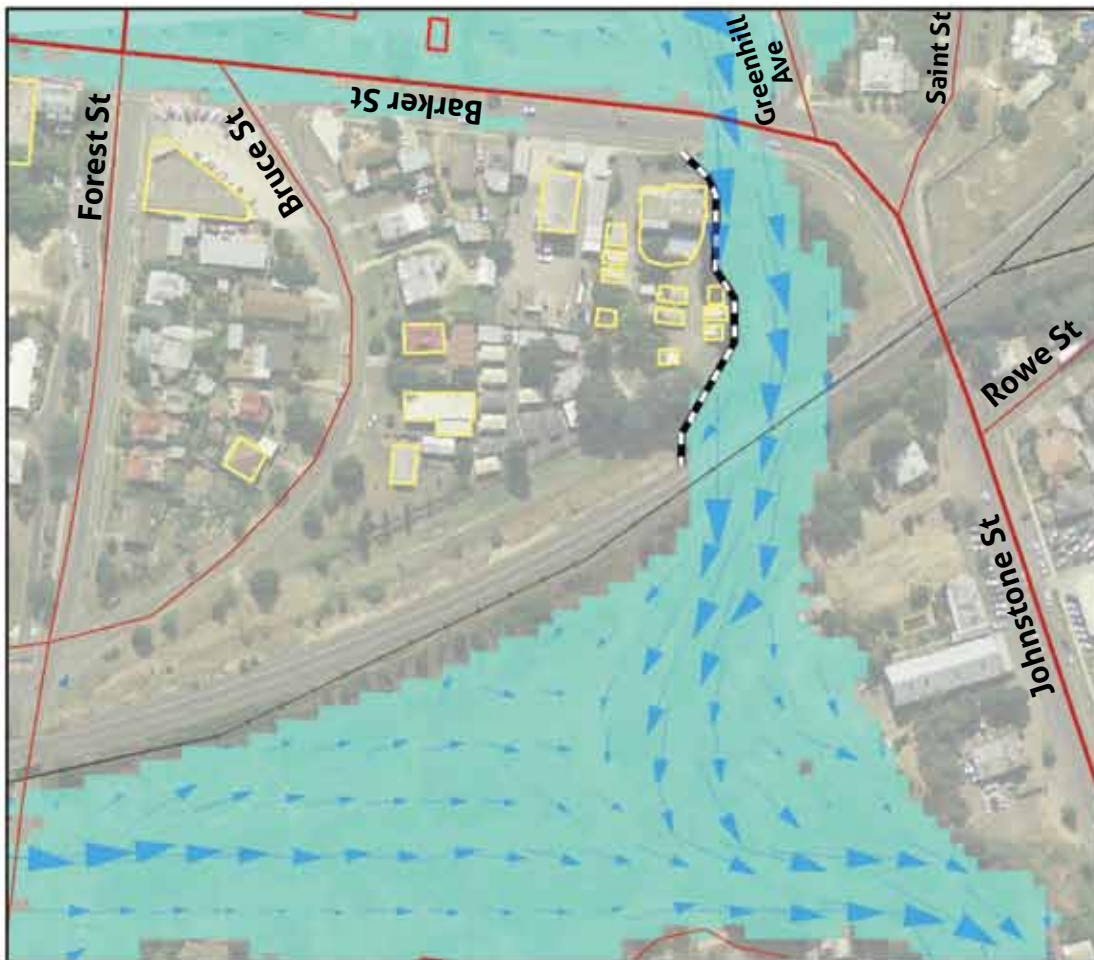


Existing conditions

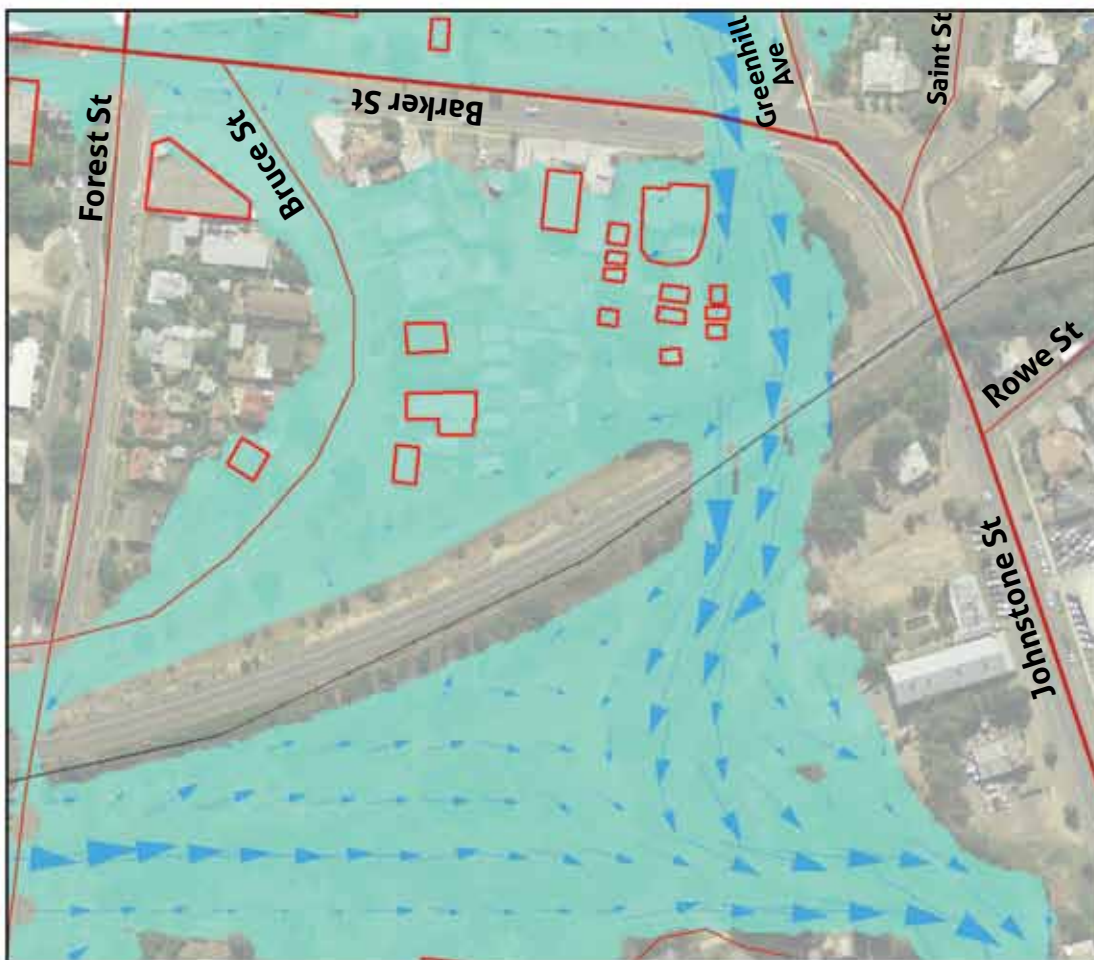


Proposed levee wall

Proposed levee (Riverine flooding only)



Existing conditions (Riverine flooding only)



- LEGEND**
- Highway
 - Sealed road (arterial and local)
 - Proposed levee
 - Building protected by levee
 - Building flooded above floor
 - 1% AEP flood extent
 - Flow direction vector



Bruce Street Levee - 1 in 100 AEP Flood Event

Recommendation 4 – Elizabeth Street (Castlemaine) levee

Background

The draft plan recommended the upgrade and extension of the existing flood protection levee to the north of properties in Elizabeth St to protect properties from a 1-in-100 Annual Exceedance Probability (AEP) flood in Campbells Creek, subject to detailed design and consultation with affected property owners and occupiers.

This levee is required to prevent flooding to 13 private properties from a 1-in-100 AEP flood in Campbells Creek (prevents over-floor flooding to 11 buildings – five dwellings, four commercial buildings and two church buildings). The existing levee includes sections not high enough to prevent flood waters over-topping the levee. The levee also does not extend far enough to prevent flooding invading around the end of the levee, flooding the area behind the levee and affecting properties on either side of Elizabeth St. The average height of the extended section of the levee would be one metre. The existing section of the levee would also need to be raised by an average height of 0.75m to meet current design standards. Some minor compensatory works may be required to offset any increases to flood levels associated with the construction of the levee (which were shown to be minor).

Consultation

Fifty-four responses were received to the proposal with 67 per cent indicating support for the proposal and 33 per cent opposition. Minimal feedback was provided against the proposal and none of the responses were from residents considered local to the area or who would be directly affected by the proposal. Only a small number of responses were from residents who are likely to be directly affected by flooding in the area or benefit from the levee and none of those responses opposed the proposal, subject to conditions. Storm water behind the levee was also raised as a potential issue.

It is acknowledged extending and upgrading the existing levee is not considered cost-effective in its own right (noting the limits of the current assessment), but also the current levee is not formally owned or managed by any authority and therefore the potential for future damage is much greater if the levee is not upgraded and maintained. Council would need to consider whether the levee is required to meet community expectations and whether it would accept the levee as part of a greater, cost-effective flood mitigation scheme for Castlemaine.

Considering the responses provided by the community, the committee resolved to revise its recommendation to require further detailed investigation into the costs of extending and upgrading the levee and to require further consultation with affected property owners and local residents.

Final Recommendation

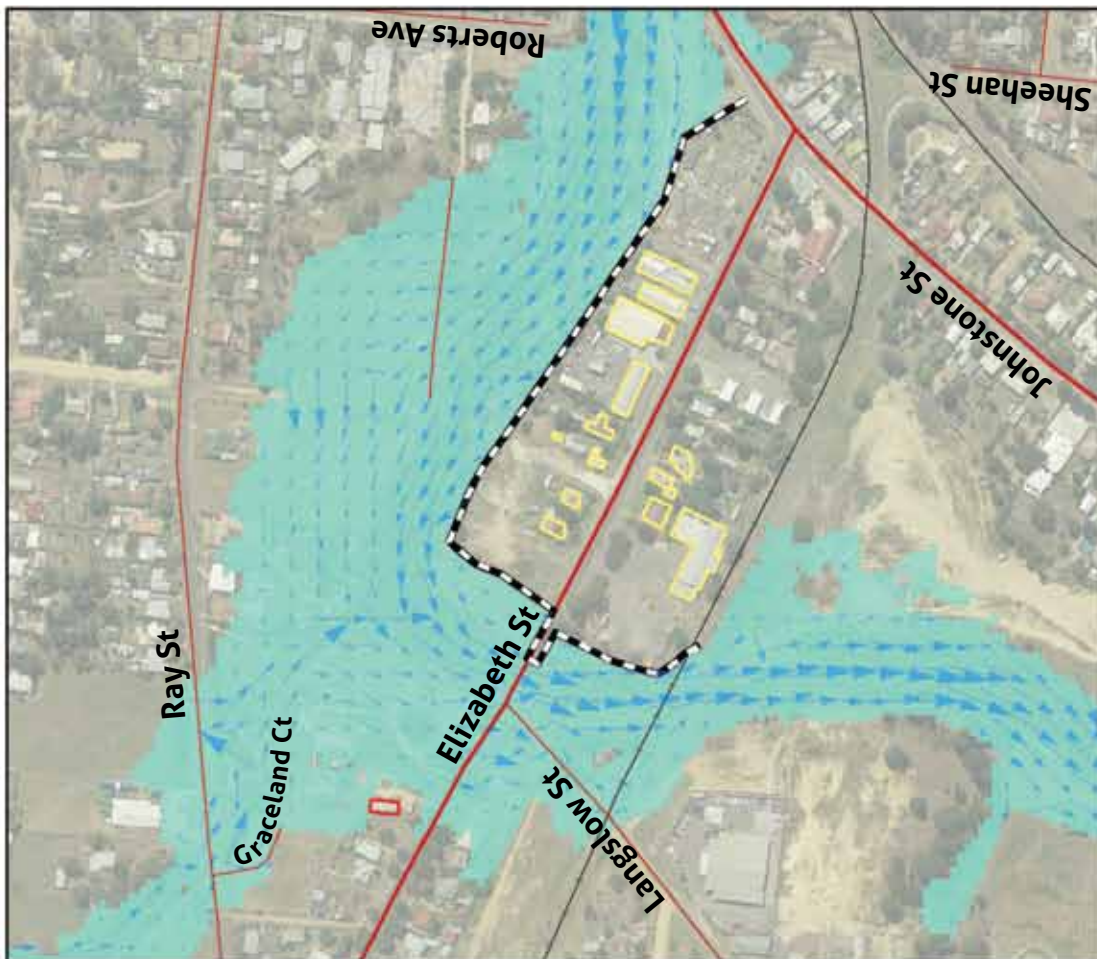
That council further investigates the raising and extending of the existing levee behind properties along Elizabeth St (from the Pyrenees Highway to the railway line), to protect properties from flooding up to and including a 1-in-100 AEP event. The detailed design parameters should be agreed on in collaboration with affected property owners and local residents. The design of the levee should consider the impacts of local storm water with the levee in place and how to minimise or reduce those impacts.



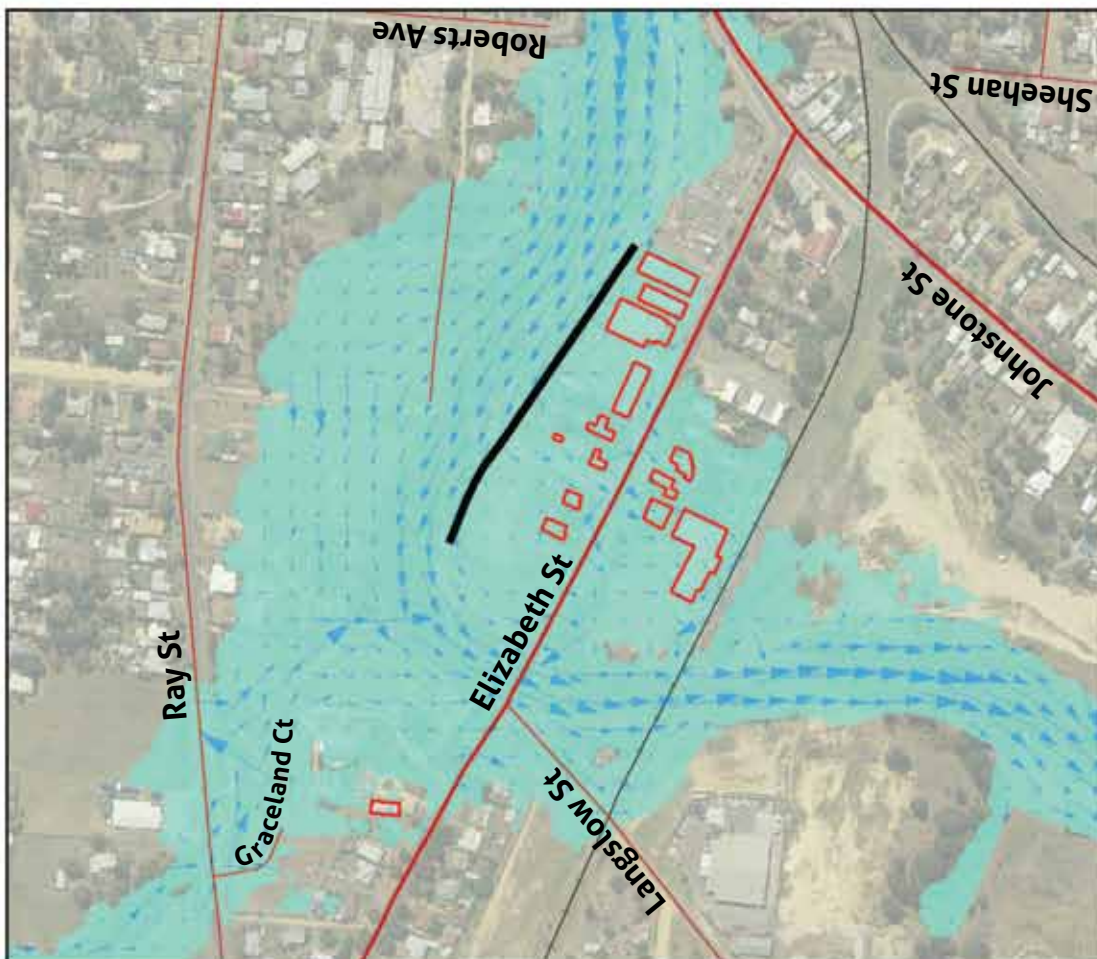
Levee location plan



Proposed levee (Riverine flooding only)



Existing conditions (Riverine flooding only)



0 100 200 Metres

LEGEND

- Highway
- Sealed road (arterial and local)
- Existing levee
- Proposed levee
- Building protected by levee
- Building flooded above floor
- 1% AEP flood extent
- Flow direction vector

Elizabeth Street Levee - 1 in 100 AEP Flood Event

Recommendation 5 – Campbells Creek township levee

Background

The draft plan recommended the upgrade and extension of the existing flood protection levee on the eastern bank of Campbells Creek to protect the township and private properties from a 1-in-100 Annual Exceedance Probability (AEP) flood in Campbells Creek, subject to detailed design and consultation with affected property owners and occupiers.

This levee is required to prevent flooding to 30 private properties from a 1-in-100 AEP flood in Campbells Creek (prevents over-floor flooding to 15 buildings – 14 dwellings and the Campbells Creek Bowling Club). However, the same 1-in-100 AEP flood protection levee with the standard 600mm of freeboard would prevent over-floor flooding to an additional four dwellings in a 1-in-200 AEP flood event. The average height of this levee would be one metre (not including freeboard). Detailed design and consultation should consider this scenario when deciding on any final levee height.

The overall height of this levee could be reduced by the works proposed in **Recommendation 7** and could be considered as a package of works.

Consultation

Forty-seven responses were received to the proposal with 77 per cent indicating support for the proposal and 23 per cent indicating opposition. Four responses were provided by residents directly affected by flooding, all supporting the proposal. Of the total 11 respondents who opposed the proposal, none were directly affected by flooding, none were considered local to Campbells Creek and limited comments were provided to explain their opposition.

In its determination of a final recommendation, the committee also considered the current levee is not formally owned or managed by any authority and therefore the potential for future damage is much greater if the levee is not upgraded and maintained.

Therefore, in considering the responses from the community, the committee resolved to support moving forward with a levee proposal.

Final Recommendation

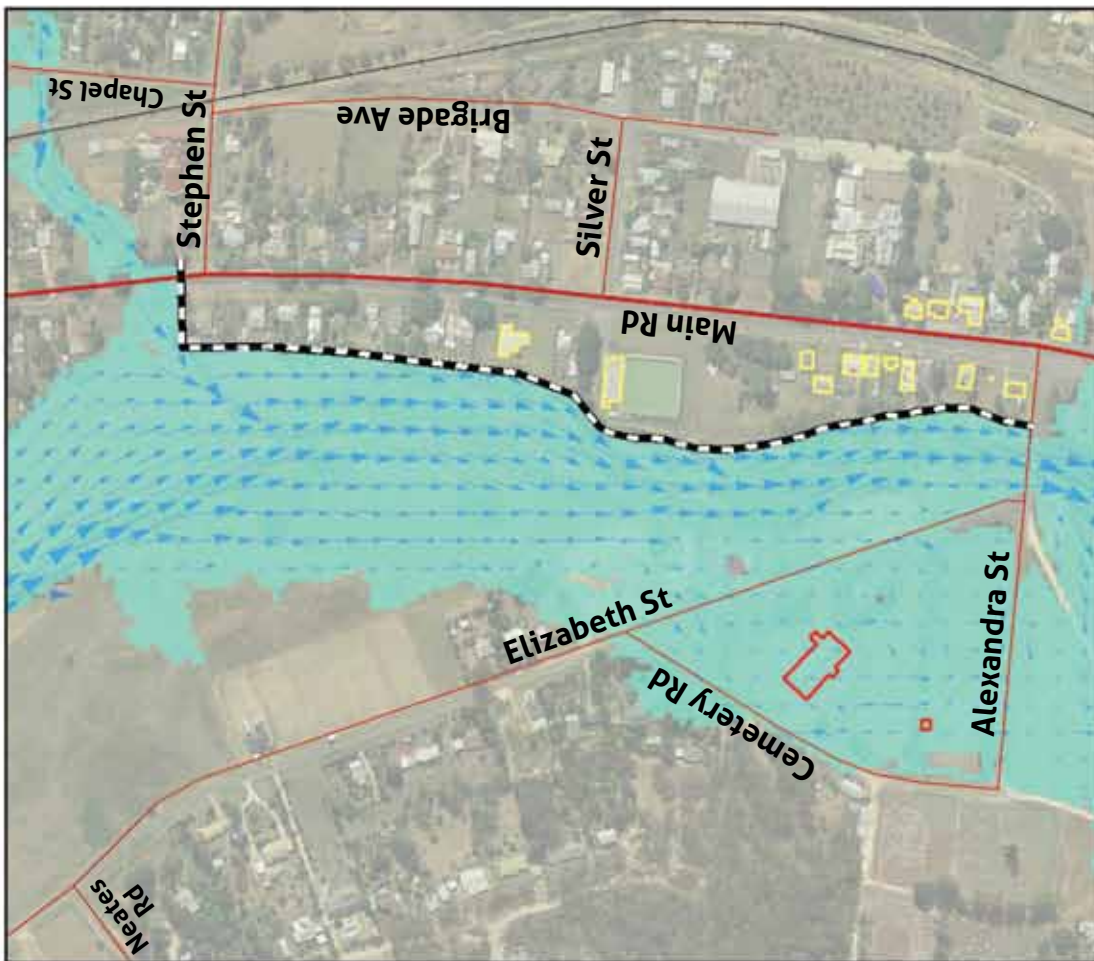
The flood management plan recommends the raising and extending of the existing levee on the eastern bank of Campbells Creek to protect the township and private properties from a 1-in-100 AEP event. The detailed design parameters should be agreed on in consultation with affected property owners and local residents. The design of the levee should consider the impacts on local storm water with the levee in place and how to minimise or reduce those impacts.



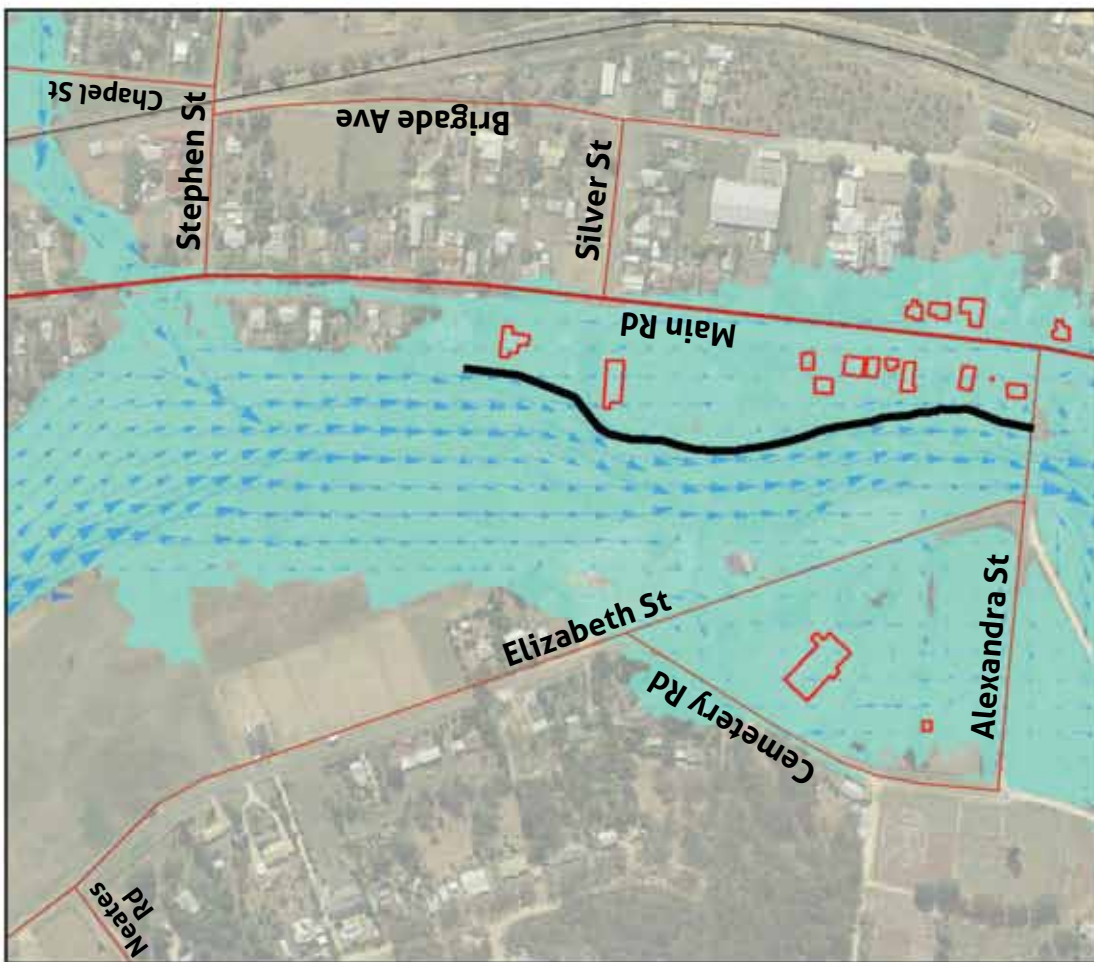
Levee location plan



Proposed levee (Riverine flooding only)



Existing conditions (Riverine flooding only)



0 100 200 Metres

LEGEND

- Highway
- Sealed road (arterial and local)
- Existing levee
- Proposed levee
- Building protected by levee
- Building flooded above floor
- 1% AEP flood extent
- Flow direction vector

Recommendation 6 – National School Lane levee

Background

The draft plan recommended repair and improvement works be undertaken on the existing levee on the east bank of Campbells Creek in the vicinity of National School Lane. The works are aimed at preventing future avulsion of Campbells Creek and reducing peak flood velocities on flood-prone land behind the levee, subject to appropriate permits being obtained and consultation with any affected landowners. Works will include reinstating the levee to its original height and removing vegetation from the levee to maintain its structural integrity into the future.

These works have been requested by community members in the vicinity of the levee in Campbells Creek and the plan has demonstrated that undertaking these works will not have a detrimental impact on any adjacent property owners (in terms of raising flood levels). Undertaking the works will not reduce the flood extent behind the levee (due to backwatering) but will reduce the potential for an avulsion of Campbells Creek as well as substantially reduce flood velocities across private properties during major flood events.

These works are likely to be completed as 'once-only' works to reinstate the levee bank to its original height along its original alignment within the Crown Land boundaries adjacent to Campbells Creek and remove unwanted vegetation growing on the levee.

The committee agrees the completion of any works by Mount Alexander Shire Council or any other agency or authority will not constitute any acceptance of ownership or ongoing management responsibilities. Ongoing maintenance of the levee for flood protection purposes will fall to those considered as beneficiaries of the levee, who will be permitted to access the levee for maintenance purposes under the appropriate permit schemes.

Consultation

Forty-three responses were received to the proposal with 70 per cent indicating support for the proposal and 30 per cent indicating opposition. Of the 13 who opposed the option, only two provided comments against the proposal, stating they could not see its benefits. None of those opposed to the proposal were considered local to the proposal or expected to benefit from it. An additional comment was concerned with the removal of vegetation from the levee. Best-practice levee management would encourage the removal of vegetation to maintain the integrity of the levee. No vegetation in the vicinity of the levee is proposed to be removed unnecessarily.

Therefore, in considering the responses from the community, the committee resolved to adopt the draft recommendation as presented in the draft plan.

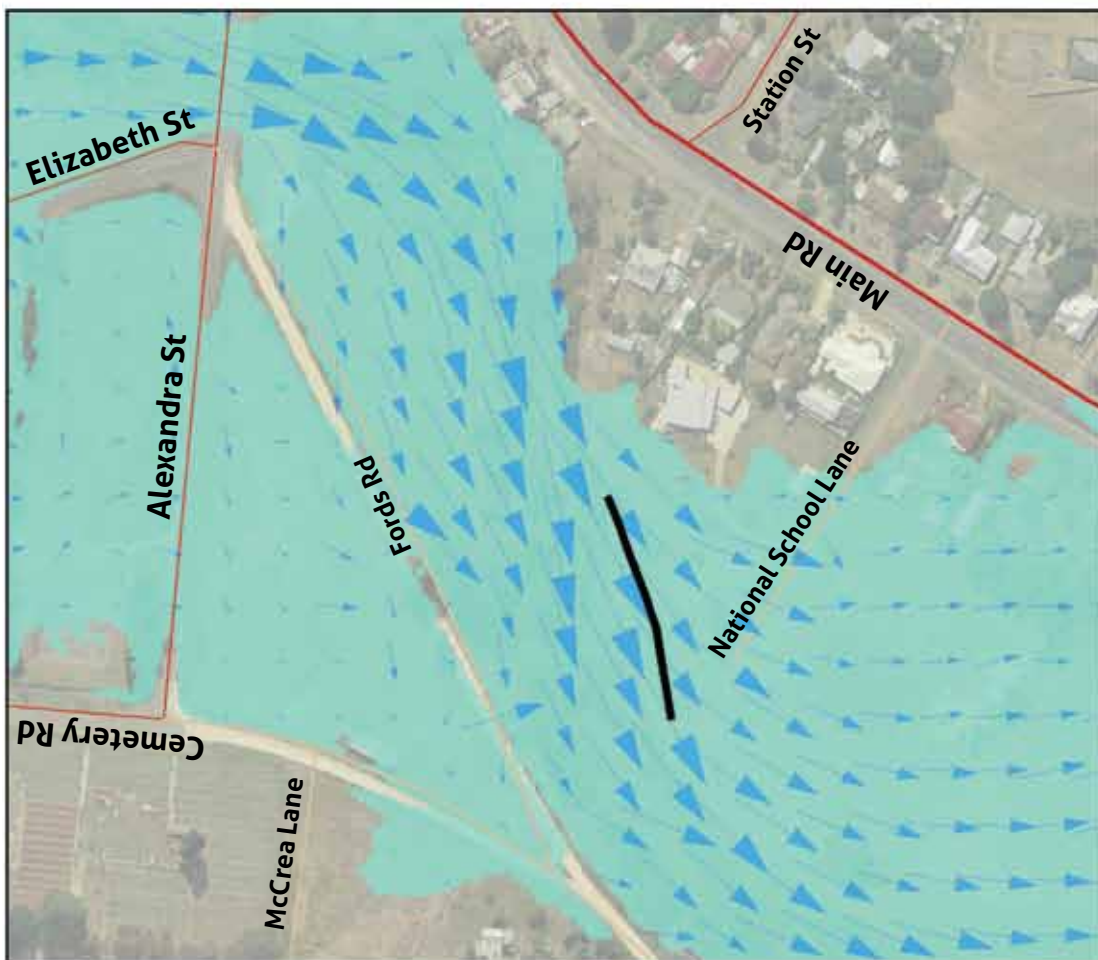
Final Recommendation

The flood management plan recommends repair and improvement works be undertaken on the existing levee on the east bank of Campbells Creek in the vicinity of National School Lane. The works are aimed at reducing the risk of future avulsion of Campbells Creek and reducing peak flood velocities behind the levee. The works are subject to appropriate permits being obtained and are to be undertaken in consultation with any affected landowners.

Proposed levee (Riverine flooding only)



Existing conditions (Riverine flooding only)



0 50 100 Metres

LEGEND

- Highway
- Sealed road (arterial and local)
- Unsealed road
- Existing levee
- Proposed levee
- 1% AEP flood extent
- Flow direction vector

National School Lane Levee - 1 in 100 AEP Flood Event

Recommendation 7 – Campbells Creek improvement works

Background

The draft plan recommended minor waterway improvement works downstream of the Alexandra St bridge in Campbells Creek to improve the conveyance of Campbells Creek and lower flood levels in the vicinity of the Alexandra St bridge crossing.

These works include the removal of eucalyptus saplings that have developed in the middle of Campbells Creek due to the build-up of sediment that has occurred post-floods downstream of the Alexandra St bridge. Some native over-storey eucalyptus trees also exist within this area but are not likely to be removed as part of the works. The removal of the eucalyptus saplings will be beneficial for the conveyance of the creek and to enable the creek to realign itself back towards the western bank and away from private property boundaries on the eastern side of Campbells Creek. The works will also include the removal of exotic vegetation (primarily elm trees) on the east bank to assist the recovery of ground-cover grasses and reduce erosion potential.

These works may also reduce the overall height of the levee proposed in **Recommendation 5** and therefore should be considered as a package of works.



Consultation

Forty-two responses were received to the proposal with 76 per cent indicating support for the proposal and 24 per cent indicating opposition. Of the 10 who opposed the proposal, none were considered local to the proposal and only one respondent provided any comments – that they were not supportive of removing native vegetation from the creeks due to the potential for reduction in water quality and habitat.

More generally, the committee acknowledged the strong representation of community members opposed to removing vegetation in the local creeks and who also work very hard on restoration works within those creeks. The committee used the hydraulic model developed for the plan to demonstrate that some vegetation can cause minor localised impacts on flood levels, but the impacts of flooding are more often determined by the size of a rainfall event, the hydraulic capacity of the local waterway and the proximity of development to the floodplain. It was found that large-scale removal of vegetation from waterways will not eliminate flooding problems. However, in this instance a substantial amount of growth has occurred in this area and the hydraulic model demonstrates these saplings and silt are acting as a blockage. This blockage is raising flood levels to adjacent properties and causing erosion to the eastern creek bank of Campbells Creek, a situation the committee agrees to require short-term intervention.



Consultation with one landowner adjacent to the works also identified the value of the existing elm trees in the area that may be required to be removed as part of the works. These elms are acknowledged as providing significant shade and amenity benefits, but have also been identified as contributing to the erosion problem by preventing the establishment of ground cover on the bank of the creek beneath them. Further discussion with landholders about the elms is identified in the revised recommendation adopted by the committee.

Final Recommendation

The flood management plan recommends minor waterway improvement works downstream of the Alexandra St bridge in Campbells Creek to improve conveyance of Campbells Creek and lower flood levels in the vicinity of the Alexandra St Bridge. The works would be subject to detailed design and consultation with affected property owners and occupiers about the removal of the elm trees.

Recommendation 8 – Strategic planning for urban waterways

Background

The draft plan recommended Mount Alexander Shire Council lead the development of a strategic plan for the urban waterways within Castlemaine, Campbells Creek and Chewton which includes, but is not limited to, the learnings of the flood management plan.

This recommendation describes the need for an overarching strategic plan to assist the planning, management and improvement of urban waterways within Castlemaine, Campbells Creek and Chewton. Mount Alexander Shire Council should lead the development of a strategic plan and be guided by a committee consisting of existing community-based interest groups, relevant agencies or statutory authorities and any other interested individuals. The development of the plan should also involve extensive community consultation. It should take into account any existing plans and reference documents, but bring together all matters regarding flood, fire, walking and cycling strategy, and natural amenity, to name just a few.

Consultation

Fifty-six responses were received to this proposal with 91 per cent indicating support for the proposal and nine per cent opposition. Given the high level of community support the committee resolved to adopt the recommendation as presented in the draft plan.

Final Recommendation

The Flood Management Plan recommends that Mount Alexander Shire Council lead the development of a strategic plan for urban waterways within Castlemaine, Campbells Creek and Chewton which includes, but is not limited to, the learnings of the flood management plan.

Recommendation 9 – Flood warning

Background

The draft plan recommended the development of a flood-warning system for Barkers Creek, Forest Creek and Campbells Creek based on the learnings of the flood management plan.

This recommendation recognises the community desire for advanced warning of the potential for future flood events, to assist the community to prepare for, and respond to, such events. A total flood-warning system should include building community understanding of the potential for flooding in the three creeks, provide early-warning signals a flood event might occur and a list of actions required to facilitate community response when a flood event is occurring. Total flood warning system service needs are assessed via Regional Floodplain Management Strategies.

Consultation

Fifty-two responses were received to this proposal with 94 per cent indicating support for the proposal and six per cent opposition. Given the high level of community support the committee resolved to adopt the recommendation as presented in the draft plan.

Final Recommendation

The flood management plan recommends the development of a flood warning system for Barkers Creek, Forest Creek and Campbells Creek based on the learnings of the plan.

Recommendation 10 – Planning scheme amendment

Background

The draft plan recommended an amendment to the Mount Alexander Planning Scheme to incorporate new flood mapping produced by the plan to identify flood hazard when considering future land use and development.

The recommendation recognises the need to introduce new land management overlays in the Mount Alexander Planning Scheme for the purpose of identifying flood risk and managing future development. The Mount Alexander Shire Council should lead the planning scheme amendment process with support from North Central CMA.

Consultation

Forty-nine responses were received to this proposal with 86 per cent indicating support for the proposal and 14 per cent opposition. Given the high level of community support the committee resolved to adopt the recommendation as presented in the draft plan.

Final Recommendation

The flood management plan recommends an amendment to the Mount Alexander Planning Scheme to incorporate new flood mapping produced by the flood management plan.

Agency responsibilities

North Central CMA

Lead the development of Regional Floodplain Management Strategies, oversee regional drainage and waterway management, coordinate water-quality projects, act as a referral authority for councils with regards to development within the floodplain, provide flood intelligence to VICSES during flood emergencies, coordinate flood studies and floodplain management plans.

Mount Alexander Shire Council

Update planning schemes with relevant flood information, manage flooding issues to reduce risks and impacts, manage local stormwater drainage, manage open space along waterway corridors, implement and maintain flood-warning systems, develop and maintain flood emergency response plans in partnership with VICSES, coordinate community education and awareness of flooding.

VICSES (Victorian State Emergency Service)

Coordinate flood response, assist councils with Municipal Emergency Management Planning, education, awareness, warning systems and emergency-management planning.

Glossary of terms

AEP (Annual Exceedance Probability) – the probability (generally expressed as a percentage) that a flood of a given size will be exceeded in any one year.

Example use: *The floods experienced on Campbells Creek in January 2011 were in the order of magnitude of a 3.3% AEP flood. That is, the January 2011 floods had a 3.3% chance of occurring in any given year (in statistical terms).*

Flooding – this document refers to flooding from a natural waterway. Flooding is a natural process intrinsic to all waterways. Flooding occurs periodically as a result of heavy rainfall within a catchment and is generally defined by the runoff from the rainfall event exceeding the capacity of the bed and banks of a waterway. The effects of flooding can be magnified by the proximity of urban development to natural creeks resulting in damage to roads, residential, commercial and industrial properties.

Stormwater flooding – during severe storms, urban areas can be affected by overland flows if the rainfall run-off exceeds the design capacity of the existing drainage system. This is called stormwater flooding and can occur in areas where there is a high density of existing development and a high potential for flood damage. Stormwater flooding is not the focus of this plan and is the responsibility of Mount Alexander Shire Council (see agency responsibilities opposite).

Levee – an embankment, structure or wall designed to prevent or contain flooding.

Freeboard – a factor of safety above the design flood height, typically used in relation to flood levee crest heights and the setting of floor levels within the floodplain. Freeboard compensates for such things as flood prediction uncertainties, wave action, localised hydraulic effects and the settlement of levees.

Planning scheme – a planning scheme sets out policies and requirements for the use, development and protection of land. There is a planning scheme for every municipality in Victoria. It generally includes state planning policies, local planning policies, zones, overlays, particular provisions and legislated requirements which new uses and developments can be assessed against. The relevant planning scheme for Castlemaine, Campbells Creek and Chewton is the Mount Alexander Planning Scheme.



Disclaimers

This brochure should be read in conjunction with the latest revision of the Report titled "Castlemaine, Campbells Creek and Chewton Flood Management Plan" with document number 224993 and is subject to the assumptions and qualifications contained therein. If the report is yet to be released, these assumptions and qualifications must be confirmed by reference to GHD Pty Ltd.

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Further detailed discussion resulting from the community consultation program can be found in the full report available at www.nccma.vic.gov.au

For more information

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Above: *Gingell St and Camp Reserve, January 2011* Photos: Mal Brown



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