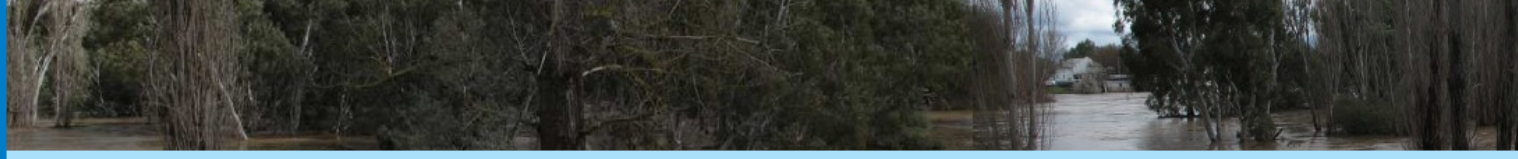
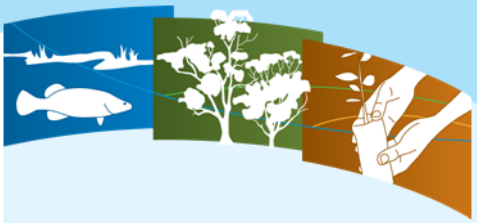


CARISBROOK FLOOD AND DRAINAGE MANAGEMENT PLAN



PUBLIC MEETING
6.30PM, MONDAY 11 FEBRUARY 2013
CARISBROOK SENIOR CITIZENS HALL

BACKGROUND

North Central Catchment Management Authority (CMA) received funding from the local, state and commonwealth governments to prepare the Carisbrook Flood and Drainage Management Plan (the Plan). The purpose of the Plan is to reduce the impact of future flood events on the township of Carisbrook. The Plan will identify key flooding issues in the town, determine flood levels for a range of flood events and recommend works to reduce the risk of future flooding.

North Central CMA is leading the development of the Plan in partnership with the Central Goldfields Shire Council.

A community-based Steering Committee is overseeing the development of the Plan with support from a Technical Working Group consisting of representatives from the North Central CMA, Central Goldfields Shire, VicSES, Goulburn-Murray Water, VicRoads, Department of Sustainability and Environment, Bureau of Meteorology and VicTrack.

PROGRESS OF THE PLAN

The Plan is nearing completion and a public meeting will be held on Monday 11 February 2013 to present the draft Plan to the community which includes a range of works to reduce the future risk of flooding to Carisbrook.

Since the last public meeting, Water Technology, the consultants appointed to prepare the Plan, have been assessing all of the suggestions put forward by the community for reducing the potential flooding risk to Carisbrook.

Prior to finalising the Plan, the Steering Committee is seeking feedback from the community on the different options outlined in this brochure. The preferred 'package of works' is outlined on the final page of this brochure and includes further waterway maintenance, a western floodway and a long term proposal to replace the Pyrenees Highway bridge.

OVERVIEW

- The draft Plan is nearing completion
- A public meeting will be held in Monday 11 February 2013 at the Carisbrook Senior Citizens Hall
- A preferred 'package of works' to reduce the future risk of flooding will be presented to the community at this public meeting
- The Steering Committee is seeking feedback and support from the community before finalising the Plan.

Deep Creek (Tullaroop Creek) downstream of the Pyrenees Hwy, 2012

NORTH CENTRAL Catchment Management Authority
Connecting Rivers, Landscapes, People

CENTRAL GOLDFIELDS SHIRE COUNCIL

WATER TECHNOLOGY
WATER, COASTAL & ENVIRONMENTAL CONSULTANTS

State Government Victoria

CARISBROOK FLOOD AND DRAINAGE MANAGEMENT PLAN

What causes flooding in Carisbrook?

Summary

- Flooding of Carisbrook is caused by a significant rainfall event and can impact the town by:
  - overland flooding from the local catchment between Carisbrook and Maryborough; as well as
  - riverine flooding from McCallums Creek or Deep Creek, or
  - a combination of each.
- Reducing the impact of the runoff from the local catchments to the southwest of town is one of the highest priorities of the Plan.
- Riverine flooding in Carisbrook is in-frequent and currently is only likely to occur on average once every 50 years.

Flooding in Carisbrook is a natural phenomenon caused by significant rain falling over the catchment areas upstream of Carisbrook.

Carisbrook lies at the confluence of McCallums Creek and Tullaroop Creek (Deep Creek) within the wider Loddon River catchment. The combined upstream catchment area of these two waterways is 1240km². To the south-west of Carisbrook lie a number of smaller catchments which feed several small waterways and drains that pass through and around the town. These local catchments have a combined area of approximately 25km².

During the January 2011 flood event, the following estimated peak flows of water were experienced from each of these waterways:

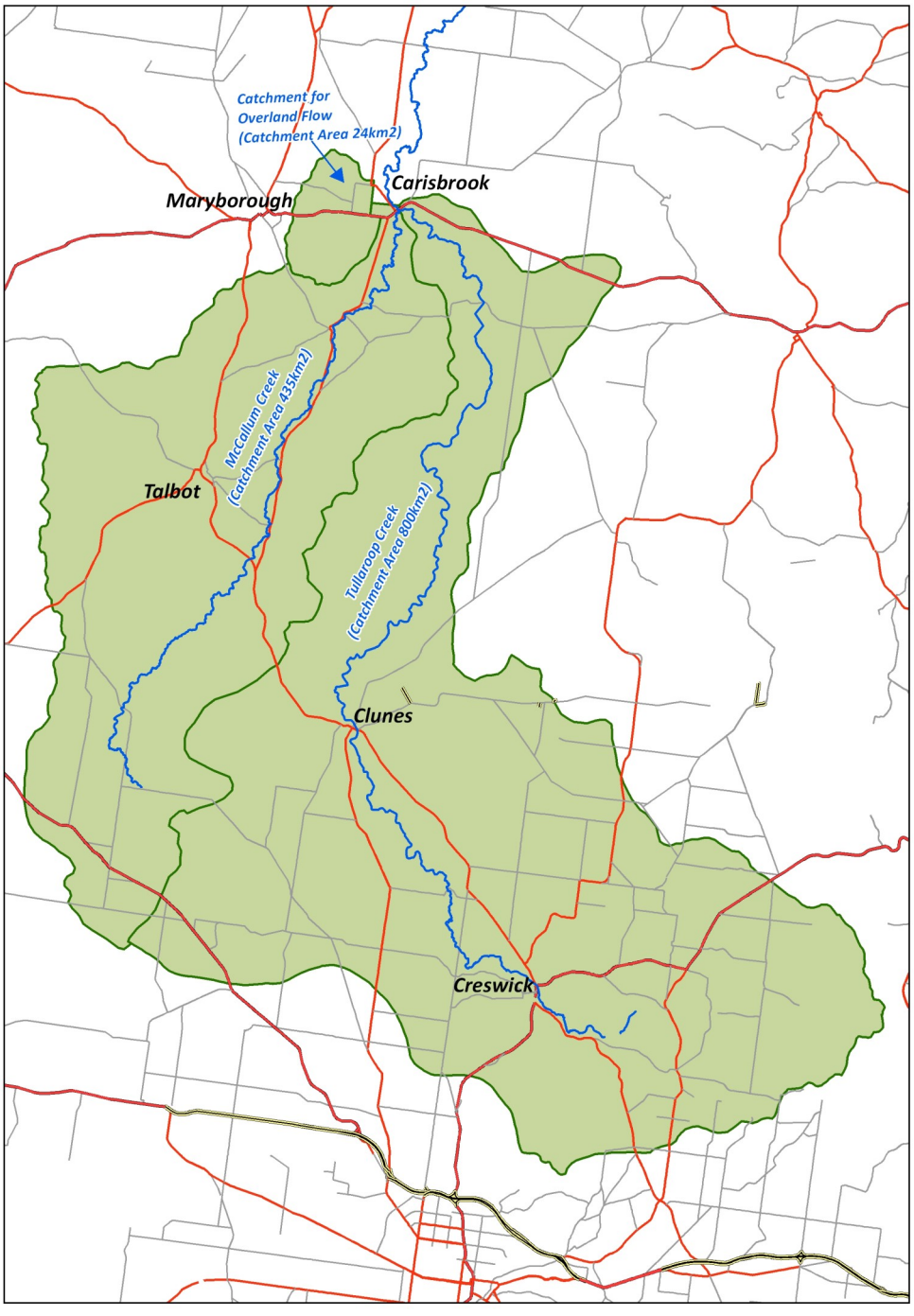
- Tullaroop Creek—34,500 ML/day
- McCallums Creek—65,500 ML/day
- Combined Tullaroop and McCallums Creek— 86,400 ML/day*
- Local Catchments—4,100ML/day

Whilst the flow from the local catchment contributed less than 5% of the total flow that impacted upon the township of Carisbrook., this overland flow is significant and causes frequent flooding to a number of properties in Carisbrook. The Steering Committee has agreed that reducing the impact of this overland flow is one of the highest priorities of the Plan.

The January 2011 flood event was an extreme flood event that has a 0.75% probability of occurring in any given year (or on average once every 135 years). Computer modelling undertaken by Water Technology indicates that Carisbrook currently has a high level of protection from riverine flooding. It would take a flood event with a 2% probability of occurring in any given year (or on average once every 50 years) for Carisbrook to flood.

It is important to note that all of the mitigation options outlined in this brochure have been assessed on the basis that Tullaroop Reservoir is full.

**As the different waterways peaked at different times, the combined flow is less than the sum of the individual peak flows.*



Catchment Areas upstream of Carisbrook

CARISBROOK FLOOD AND DRAINAGE MANAGEMENT PLAN

Maintenance of the waterways

North Central CMA and Council have received a number of complaints from residents regarding the condition of the waterways through Carisbrook. Following the January 2011 flood event, North Central CMA received funding to remove flood debris in the waterway and exotic trees that had choked the waterway in the vicinity of the Pyrenees Highway bridge. This funding is only available following a declared natural disaster and neither North Central CMA nor Central Goldfields Shire currently receive ongoing funding to undertake further works.

However, through the development of the study, the benefit of further clearing and maintenance of the waterway has been assessed. Flood modelling has confirmed what many residents have been saying, that is further clearing of the waterway, in particular upstream of the Pyrenees Highway, will go some way towards lowering flood levels.

The Steering Committee understands the concerns of residents and will be strongly recommending that further clearing works be undertaken within the waterways between Camp Street (on McCallums Creek) through to 500m downstream of the railway line on Deep Creek. The works would involve removal of the exotic trees upstream of the Pyrenees Highway bridge, removal of dead and juvenile native trees/shrubs, pruning of mature eucalyptus trees and general clean-up works. Snags (at or below the water line of the creek) will remain in the deep pools to provide habitat for the fish and other native fauna.

It should be noted that further clearing works will not eliminate the risk of flooding in Carisbrook and will need to be coupled with one or more of the mitigation options outlined in this brochure. It is assumed that each of the mitigation options outlined in this brochure will include further clearing works of the waterways.

Summary

- Further clearing works in the waterways will be a recommendation of the Plan, these works will include:
  - Removal of exotic trees upstream of the Pyrenees Highway bridge;
  - Removal of dead and juvenile native trees/shrubs;
  - General clean up works;
- Flood modelling has shown that water levels upstream of the Pyrenees Highway will be reduced by approximately 250mm due to the waterway maintenance works.
- Estimated Cost of Works: $150,000

Deep Creek prior to CMA's clearing of waterway

Deep Creek after CMA's clearing of waterway in 2011

Improved Flood Warnings

The Steering Committee acknowledges that timely and accurate flood warnings are essential for the Carisbrook community. A key outcome of this plan is developing an accurate flood warning that can be linked to the river gauges upstream of Carisbrook both on Tullaroop Creek and McCallums Creek.

Victoria State Emergency Service (VicSES) will be leading the development of a Floodsafe program for Carisbrook. The development of a Local Flood Guide is part of this approach. This program will utilise the information that has been developed through this plan to assist residents to better prepare for future flood events.

Other initiatives that are being undertaken to improve flood warnings include:

- Better use of local knowledge, especially upstream landowners
- Developing a Local Flood Emergency Plan for Carisbrook

As the Floodsafe program is rolled out better information will become available to enable residents to understand the potential impacts to their properties in future flood events.

MITIGATION OPTIONS TO REDUCE IMPACTS FROM OVERLAND FLOODING

The following two options have been developed to mitigate against overland flooding from the local catchment between Carisbrook and Maryborough. Both of these options are effective in reducing the impacts of the overland flooding. The second of the two options is cheaper as it requires less works and less ongoing maintenance. Mitigation Option A, whilst it is more expensive is the Steering Committee's preferred option. The Steering Committee has concerns that Mitigation Option B by diverting additional water into McCallums Creek may put further pressure on McCallums Creek and properties adjacent to the creek. The Steering Committee is seeking support from the community for Option A before making a final recommendation.

Mitigation Option A – Western Floodway (Preferred Option)

This option involves the construction of a 'Western Floodway' to protect the town from the overland flooding that originates from the local catchments to the southwest of the town. As explained previously, these works would also involve further clearing of the waterways.

The 'Western Floodway' would involve the construction of a 3km long levee extending from the south corner of Belfast Road and the Curraghmoor Road Reserve, continuing northwards past the Pyrenees Highway (running parallel to Pleasant Street), crossing beneath the Railway Line and then into the Crown Land adjacent to the Racing Club. The section between Curraghmoor Road and the railway line has very little natural fall in the topography so would require excavation of a trapezoidal channel (adjacent to the levee that would be up to 750mm deep in places).

The height of the 3km long levee would be on average 0.8m, with a maximum height of 1.6m at the intersection of Belfast and Curraghmoor Roads.

Culverts would need to be installed under the Pyrenees Highway and the railway line and a one-way valve would be installed in the culvert under Landrigan Road (adjacent to the school) to prevent water surcharging back under Landrigan Road in large flood events.

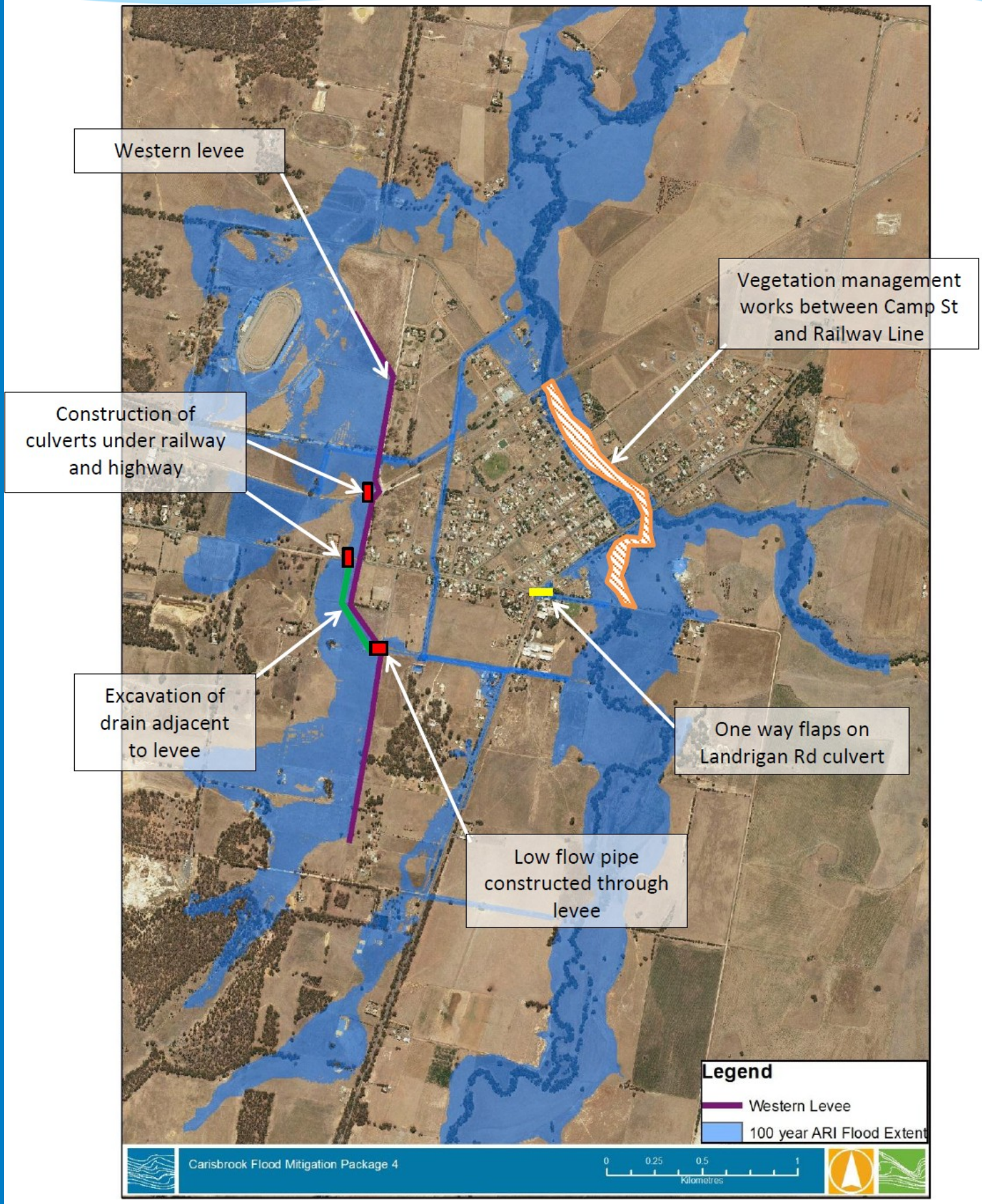
Modelling has shown that this option would protect most of the houses in the town from the local catchment flows and that there would be significant reductions in the flood levels of the main waterways associated with the further clearing works. It is estimated that the flood levels in McCallums Creek upstream of the Pyrenees Highway would reduce by approximately 250mm. These reductions in waterway flood levels are likely to prevent the main breakout of floodwaters from McCallums Creek into the township area from a flood event that has a 1% probability of occurring in any given year (or on average every 100 years).

Because most of the local flow is diverted around the western side of the town there would be no overtopping of the drains at Belfast Road or along the main bluestone drain through the township.

It should be noted that this option would not protect Carisbrook from riverine flooding from events larger than the 100 year flood event (such as occurred in January 2011) where significant flow would still overtop the Pyrenees Highway and flow through the town. This option provides a very high level of protection, however if residents wish to be protected from a repeat of the January 2011 flood event, a levee system such as proposed in Mitigation Option D may need to be considered.

Summary

- Protects the town from the local catchment flows by using a combined earthen levee and channel running north-south to the west of the town
- Collects most of the water that originates from the hills and forest to the southwest of the town and diverts it around the western side of the town
- In combination with vegetation clearing works, this option will provide protection for most of the town from a flood event that would occur on average once every 100 years.
- Estimated cost of construction works: $1.1-$1.5 million


Western levee
Vegetation management works between Camp St and Railway Line
Construction of culverts under railway and highway
Excavation of drain adjacent to levee
One way flaps on Landrigan Rd culvert
Low flow pipe constructed through levee
Legend
Western Levee
100 year ARI Flood Extent
Carisbrook Flood Mitigation Package 4
0
0.25
0.5
1
Kilometres

CARISBROOK FLOOD AND DRAINAGE MANAGEMENT PLAN

Mitigation Option B – Works along Belfast Road

In summary, this option involves the construction of works to hold back overland flows from the local catchment sufficiently so that the existing bluestone drains can cope with the floodwaters. The works include:

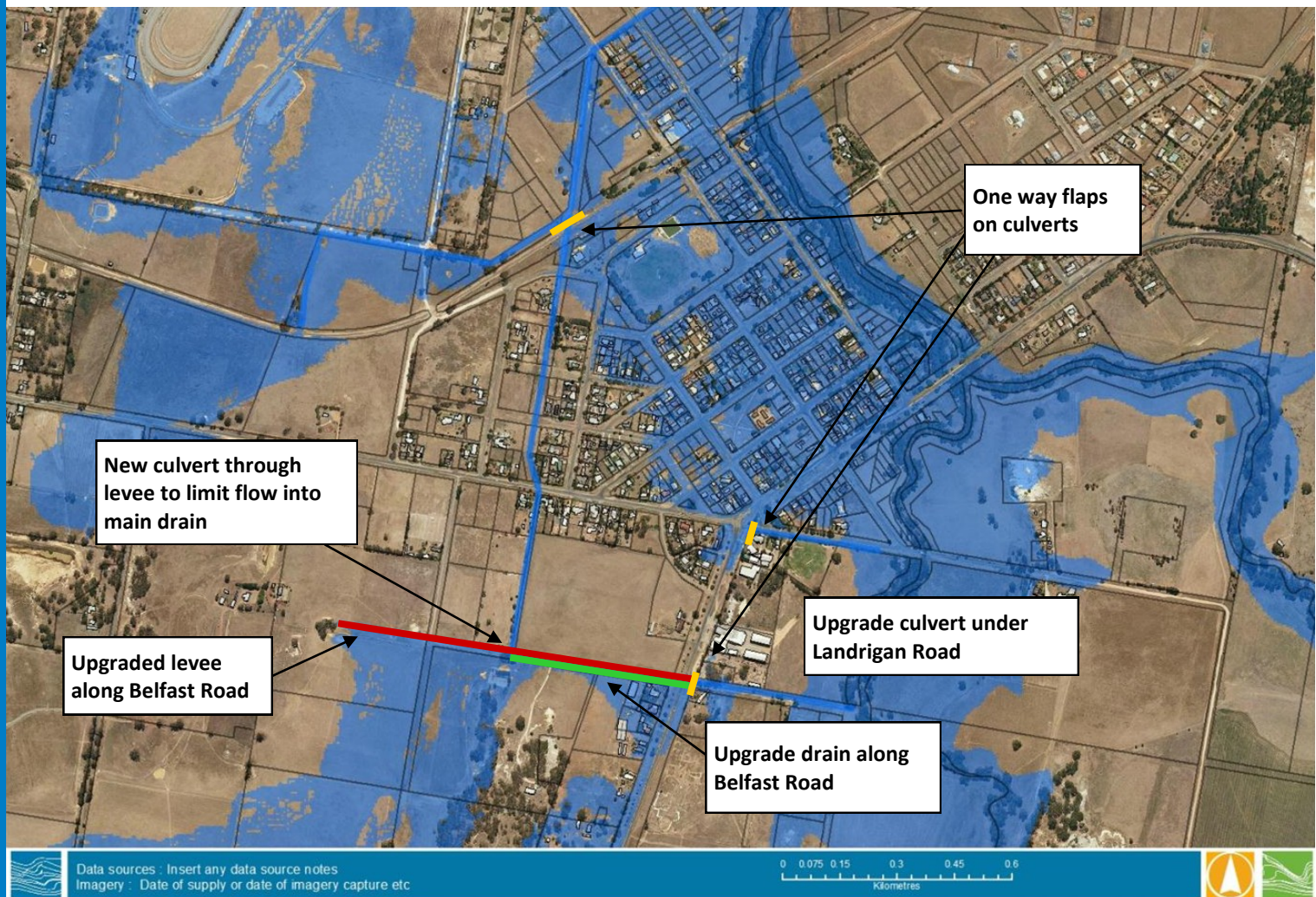
- Belfast Road levee extended and height increased
- Two culverts (750mm) placed at the upstream end of the main north south drain to restrict overland flow into town sufficiently so that the existing bluestone drainage system can carry flows
- Widen and deepen the Belfast Road drain between Landrigan Road and the main drain
- Increase capacity of culvert on Belfast Road drain under Landrigan Road
- Place one way flap valves on a number of culverts around town.

As outlined above this option is effective in reducing the impact of overland flooding. There are however properties and businesses directly south of Belfast Road that will be adversely impacted, as waters will be held back on these properties until overland flows can drain away.

Summary:

- This option achieves protection for the properties that are regularly affected by overland flooding from the local catchment.
- This option does not protect against flooding from the major waterways.
- Additional works/measures will need to be considered to protect those houses/ buildings south of Belfast Road.
- The Steering Committee prefers the Western Floodway option (Option A) as it is less likely to put pressure on McCallums Creek.
- Esimated cost of construction: $350,000

1% AEP (100 year ARI) flood extent with Option B works



CARISBROOK FLOOD AND DRAINAGE MANAGEMENT PLAN

MITIGATION OPTIONS TO REDUCE IMPACTS FROM MAJOR WATERWAYS

The following two options have been developed to mitigate against riverine flooding from McCallums Creek. It is assumed in both of these options that works to reduce the impacts of the overland flooding will also be undertaken (i.e. Option A). It is also assumed that further vegetation management works will be undertaken along the waterways between Camp Street through to 500m downstream of the railway line as detailed previously in this brochure.

Mitigation Option C – Increasing size of Pyrenees Highway bridge

During the January 2011 flood event, local residents noted, and flood modelling has since confirmed, that there was a definite difference in water levels on either side of the Pyrenees Highway bridge. This option involves increasing the size of the opening underneath the road bridge.

Firstly, six additional box culverts each measuring 2.1m x 1.2m were considered. This is the maximum number of additional culverts that could be placed under the existing bridge without affecting its structural integrity. This option had limited benefit and decreased flood levels upstream of the road bridge only marginally.

For any meaningful reduction in flood levels it was determined that the road bridge would need to be fully replaced. The cost associated with replacing the bridge is very expensive.

The Steering Committee acknowledges that this option may be cost prohibitive and unlikely to be funded in the foreseeable future, however will be recommending that when replaced in the future (or if funding becomes available) that a larger bridge is constructed.

Summary:

- A full bridge replacement would be required to reduce flood levels upstream of the Pyrenees Highway
- This Steering Committee will be recommending that when the Pyrenees Highway bridge is replaced in the future (or funding becomes available) a larger bridge be constructed.
- Estimated Cost: $7.5million

Mitigation Option D – Levee

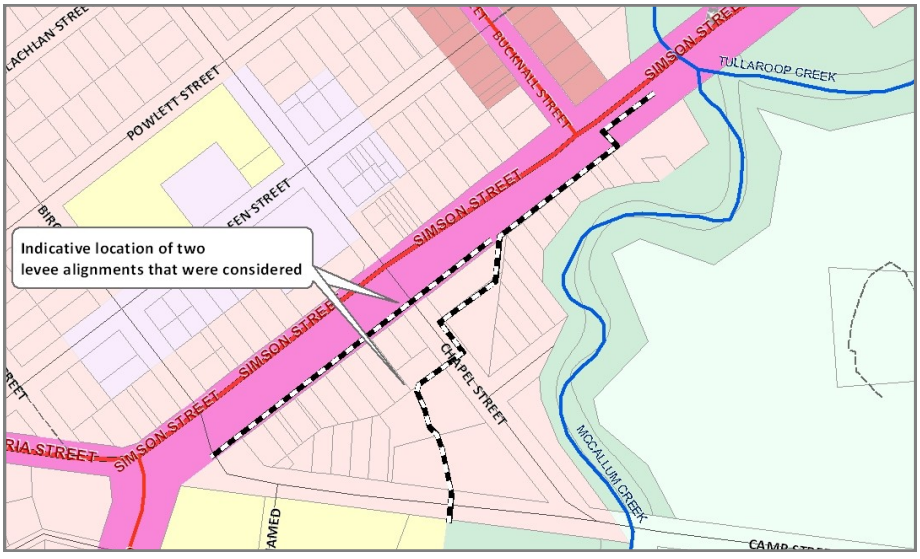
Floodwaters naturally break out of McCallums Creek directly upstream of the Pyrenees Highway. This option involves the construction of a levee to prevent floodwaters from entering the town. Two different alignments for a levee were considered (shown on the map below). In theory, this option may protect the majority of Carisbrook from a repeat of the January 2011 flood event. The Steering Committee could not reach agreement on supporting this option. Concerns from members of the Steering Committee that could not be resolved included:

- Impracticalities in construction;
- Adverse impact on existing residences (some residences will be on the 'wrong side' of the levee).

North Central CMA understands the concerns of members of the Steering Committee, however before this option is fully discarded, it is seeking feedback from the community as to whether it would be satisfied with the level of protection that the preferred 'package of works' would provide or whether the community expects protection against a repeat of the January 2011 flood event.

Summary

- The construction of a levee south of the Pyrenees Highway can in theory protect the majority of Carisbrook from a repeat of the January 2011 flood event.
- The Steering Committee did not reach agreement to support this option.
- Estimated cost: $600,000



CARISBROOK FLOOD AND DRAINAGE MANAGEMENT PLAN

Summary – Preferred Option or 'Package of Works'

The Steering Committee is seeking support from the Carisbrook community for the following recommended 'package of works':

- Construction of the Western Floodway Option (Option A);
- Further clearing and ongoing maintenance of the waterways;

Flood modelling has shown that these works in combination would provide protection for the majority of residences in Carisbrook from a 100 year flood event (that is a flood event that occurs on average once every 100 years or has a 1% chance of occurring in any given year). These works would reduce but not fully protect Carisbrook from a repeat of the January 2011 flood event.

The draft Plan will also recommend that when replaced in the future (or if funding becomes available) that the Pyrenees Highway bridge be increased in size.

Summary:

- The Steering Committee is seeking support for the following 'preferred package of works':
  - Construction of a western floodway;
  - Further clearing and ongoing maintenance of the waterways.

Flood events modelled in preparing the draft plan

Table 1: Modelled Flood Events

10 year event:	Minor flood event — floodwaters begin to affect the rear of the properties along Bucknall Street and Pyrenees Hwy.
20 year event:	Moderate flood event—overland flooding from the local catchment begins to affect some residences and businesses..
50 year event:	Major flood event—Slightly less than the September 2010 flood event.
100 year event:	A flood event between September 2010 and January 2011. This flood event will be the benchmark design standard for setting conditions for new development.
200 year event:	Greater than the January 2011 flood event. It is estimated that the January 2011 flood event was in the order of a 135 year event.

In developing the plan a wide range of on-ground works to reduce the risk of future flooding were suggested by the community and considered by the Steering Committee. These included:

- Using the old Carisbrook Reservoir for storing floodwaters
- Cleaning debris out of the major waterways
- Operation of Tullaroop Reservoir
- Raising of houses
- Redesigning/replacing road and railway bridges
- Temporary Flood Barriers
- Improved flood warnings.

All on-ground works were assessed during a pre-feasibility stage before the four Mitigation Options were developed.

Further information regarding the flood mitigation options is available from North Central CMA's project manager, Adrian Bathgate.

For information contact the North Central CMA on (03) 5440 1896, alternatively via the CMA's website: www.nccma.vic.gov.au

Public Meeting: Monday 11 February 2013

All Carisbrook residents are invited to a public meeting in the Carisbrook Senior Citizens Hall at 6.30pm on Monday 11 February 2013, where the draft plan will be explained in more detail.

If residents wish to discuss the draft Plan following the meeting, employees from North Central CMA will be available to meet one on one. Bookings for one on one meetings are essential and can be made by phoning 5440 1896.