MEMORANDUM

To Break O'Day Council

From Julian Skipworth, Water Technology

Date 27 September 2018

Subject St Marys Flood Risk Study – Raising the Flat Road Bridge Mitigation Scenarios

1 OVERVIEW

This memorandum presents the results of additional mitigation scenarios for the St Marys Flood Risk Management Study which involved:

- Scenario I - Raising the Flat Road Bridge over St Marys Rivulet by 500mm
- Scenario J - Raising the Flat Road Bridge over St Marys Rivulet by 750mm
- Scenario K - Raising the Flat Road Bridge over St Marys Rivulet by 1000mm

The aim of the mitigation works are to reduce the hydraulic constriction that currently occurs at the bridge which contributes to flood water overtopping Main Street in larger flood events.

Details regarding the modelled scenarios and the results of the modelling are provided below.

2 SCENARIO I – RAISING THE FLAT ROAD BRIDGE OVER ST MARYS RIVULET BY 500MM

2.1 Scenario Details

This scenario involved raising The Flat Ridge Bridge by 500mm from its current position. The bridge currently consists of a 950mm deep slab which has a deck level of 261.12 m AHD, and so in the modelled scenario was raised to 261.62m AHD. The approaches to the bridge were modified to produce a constant grade from existing levels over approximately 13 metres either side of the bridge.

The scenario was modelled for the 1% and 10% AEP events and the results shown below in Figure 2-1 through to Figure 2-4.

2.2 Scenario Results

The results of the modelling are presented in two difference plots (Figure 2-1 and Figure 2-2) and depth plots (Figure 2-3 and Figure 2-4). The plots show the impact on flood levels compared to current conditions. The results show that:

- Raising by 500mm has some good benefit in the 10% AEP event in stopping Main St from overtopping. The flood extent is significantly reduced, and upstream water levels are more than 300mm lower. Main Street becomes flood-free in this event and there is also less flooding across The Flat roadway either side of the bridge.

- In the 1% AEP event the works have a much smaller benefit. There is a reduction in flood level of approximately 100mm immediately upstream of the bridge and across two small pockets across Main Street. Elsewhere along Main Street flood levels are 20-30mm lower. Main Street remains overtopped to depths of 400-450mm at the deepest point.
- The results shown no adverse impacts to properties in the vicinity of the bridge in either the 10% or 1% AEP event.

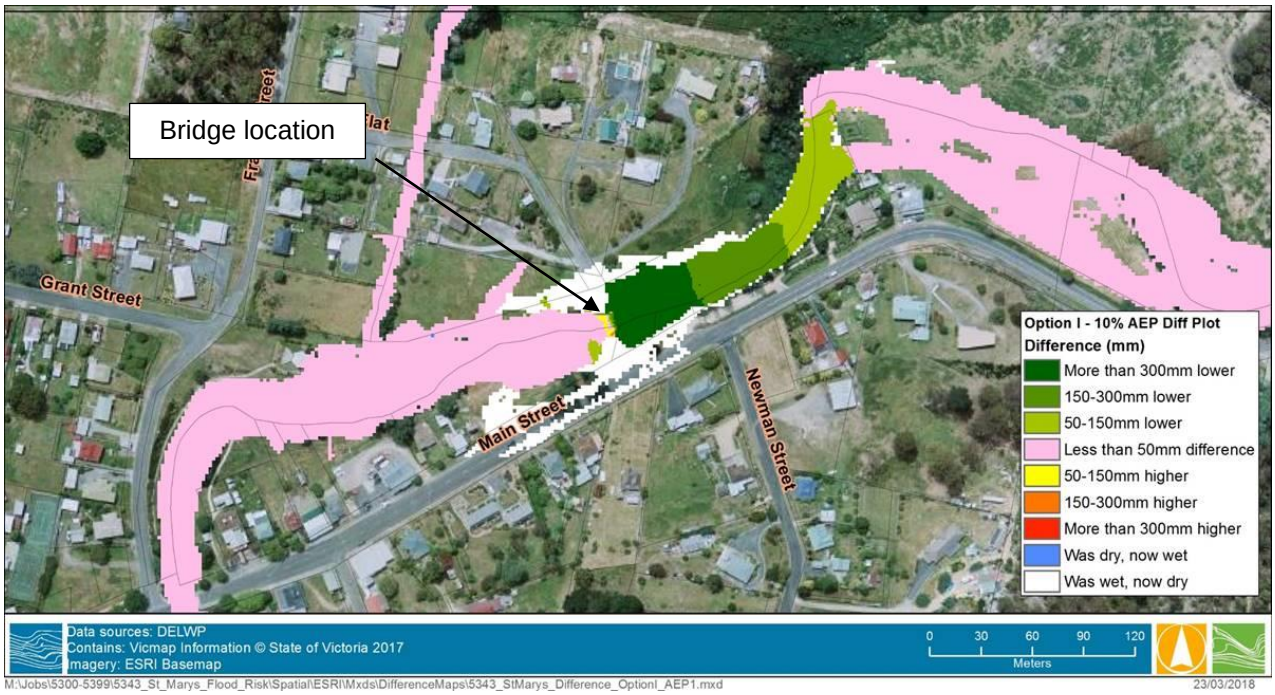

Figure 2-1 Option I (500mm raised bridge), 10% AEP Difference Plot, shows good benefit with Main St no longer overtopped

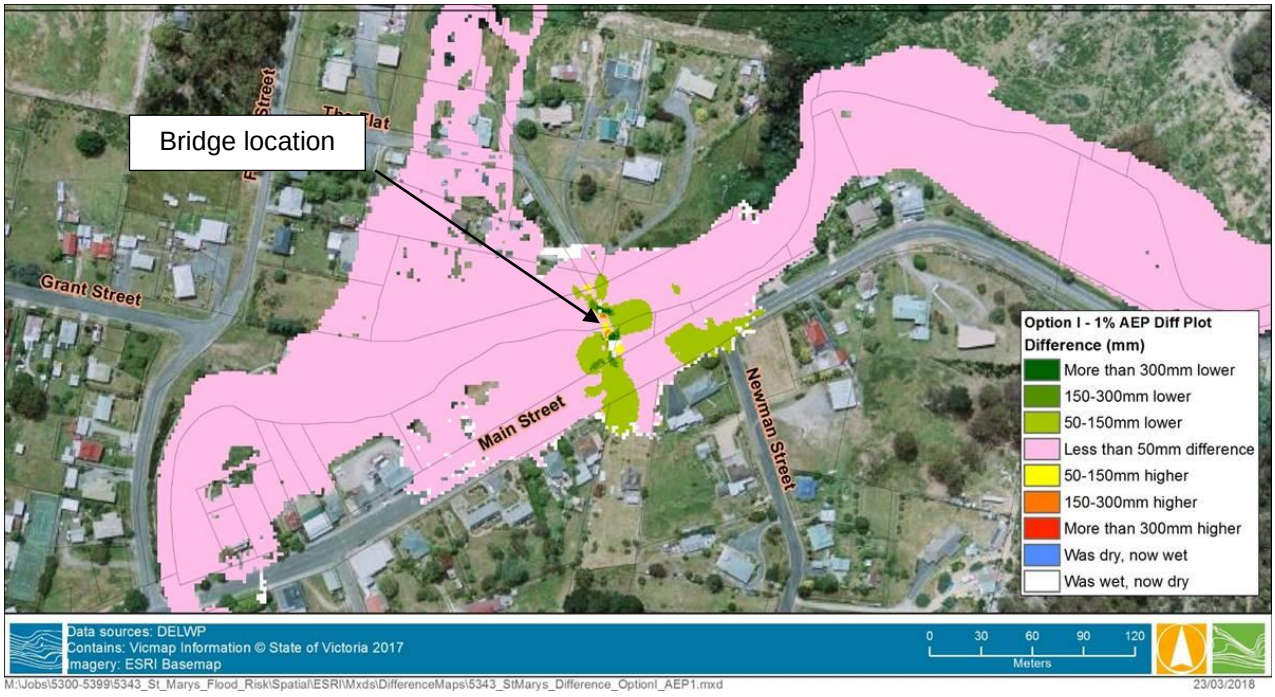

Figure 2-2 Option I (500mm raised bridge), 1% AEP Difference Plot, shows limited benefit, slightly reduced flood levels across Main St

Figure 2-3 Option I (500mm raised bridge), 10% AEP Depth Map

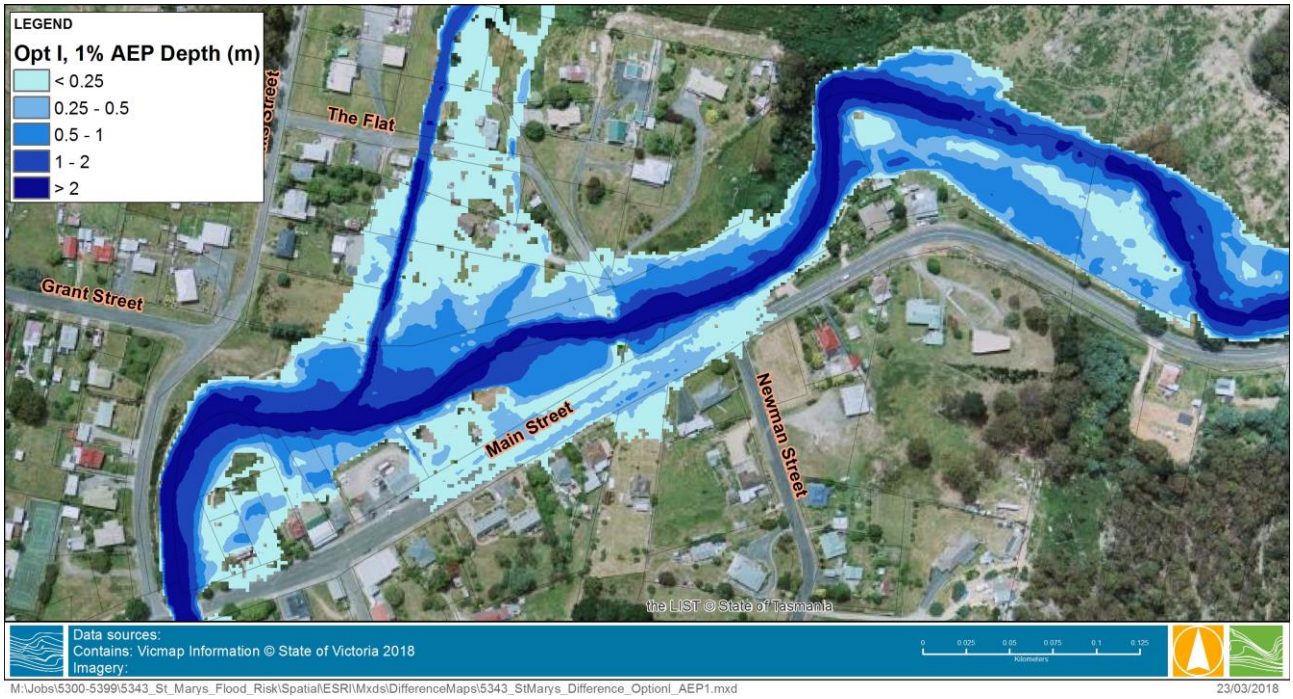

Figure 2-4 Option I (500mm raised bridge), 1% AEP Depth Map

3 SCENARIO J – RAISING THE FLAT ROAD BRIDGE OVER ST MARYS RIVULET BY 750MM

3.1 Scenario Details

This scenario involved raising The Flat Ridge Bridge slab by 750mm from its current position. The bridge consists of a 950mm deep slab which currently has a deck level of 261.12 m AHD, and so raised to 261.87m AHD in this scenario. As with the previous scenario the approaches to the bridge were modified to produce a constant grade from existing surface levels over a distance of approximately 13 metres either side of the bridge.

The scenario was modelled for the 1% and 10% AEP events and the results shown below in Figure 3-1 through to Figure 3-4.

3.2 Scenario Results

The results of the modelling are presented in difference plots (Figure 3-1 and Figure 3-2) and depth plots (Figure 3-3 and Figure 3-4) below. The difference plots shown the impact on flood levels compared to current conditions. The results show that:

- Raising by 750mm has very similar benefit in the 10% AEP event as raising by 500mm in that it stops Main St from overtopping. As with the previous scenario the flood extent is significantly reduced, and upstream water levels are more than 300mm lower. Main Street becomes flood-free in this event.
- In the 1% AEP event the works have a greater benefit in this scenario compared to raising by 500mm. There is a reduction in flood level of approximately 70-80mm across the full 220m length of the overtopped section of Main Street. The maximum depth across the Main St overtop reduces from approximately 450mm to 370mm along the road centreline with the bridge works.

- The results shown no adverse impacts to properties in the vicinity of the bridge in either the 10% or 1% AEP event.

Overall the results show that raising the bridge by 750mm achieves a similar benefit in the 10% AEP event but more benefit in the 1% AEP event compared to raising by 500mm.

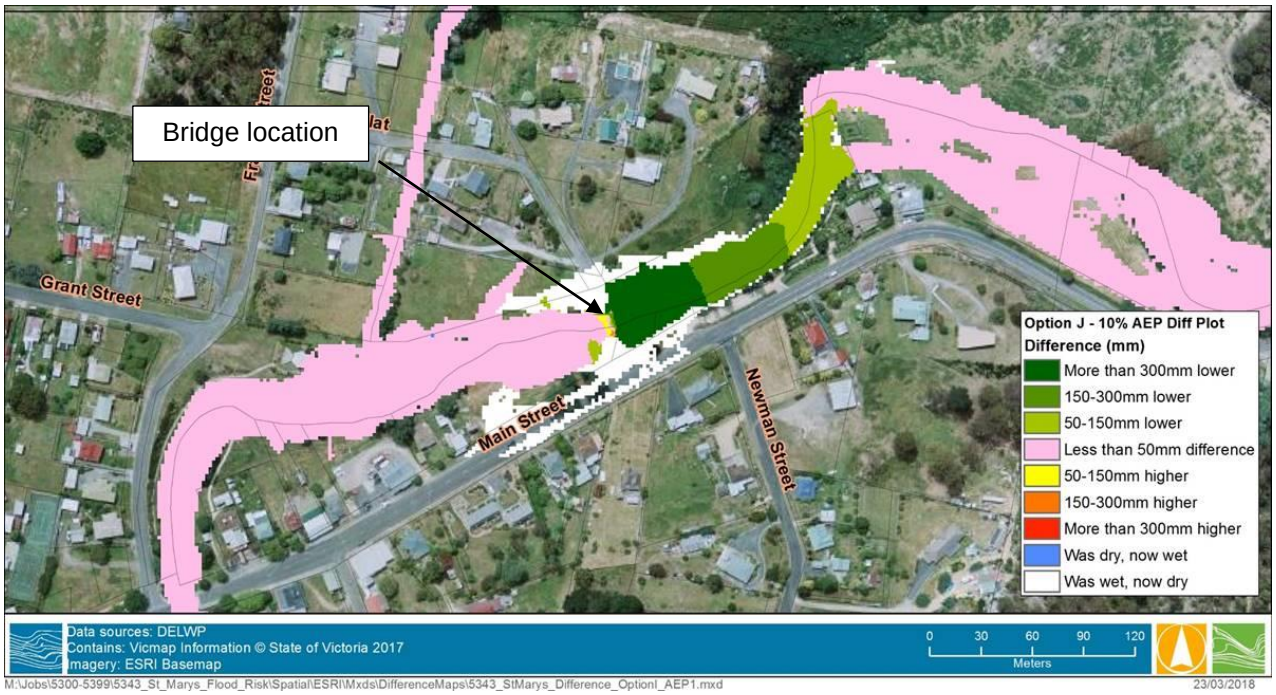

Figure 3-1 Option J (750mm raised bridge), 10% AEP Difference Plot, shows good benefit with Main St no longer overtopped (same benefit as 500mm raise)

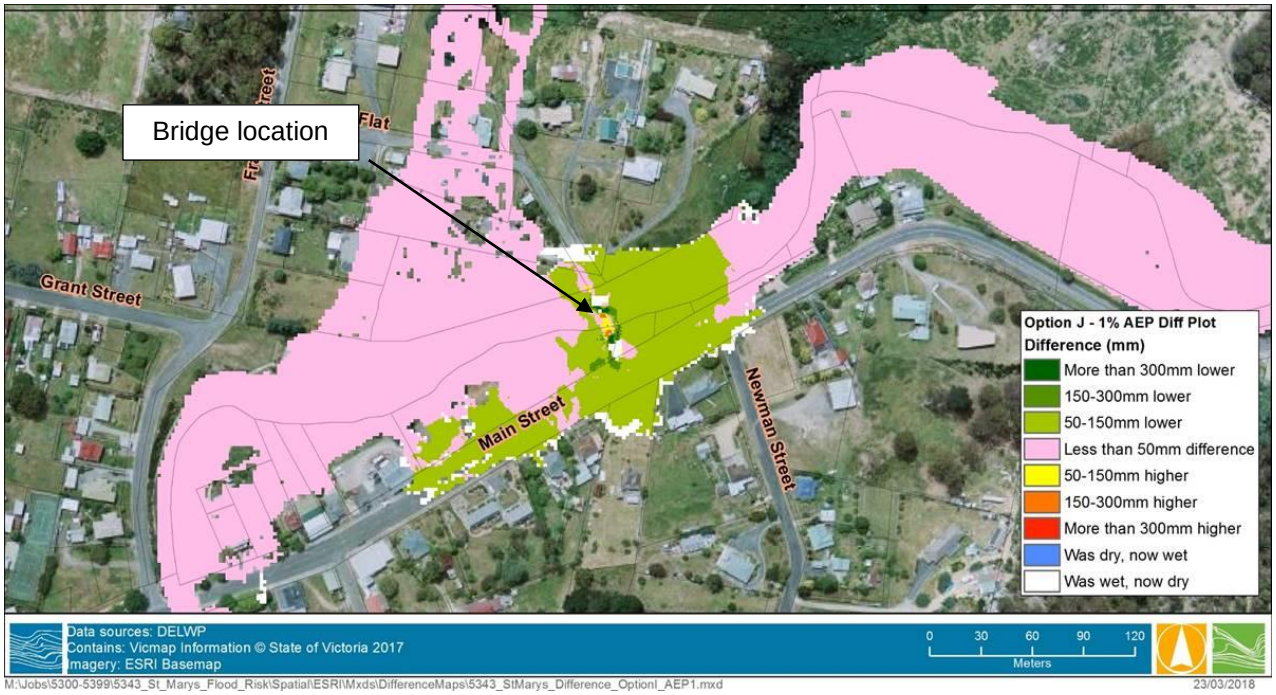

Figure 3-2 Option H (750mm raised bridge), 1% AEP Difference Plot, shows some benefit, reduced flood levels of 70-80mm along 220m stretch of Main St overtop

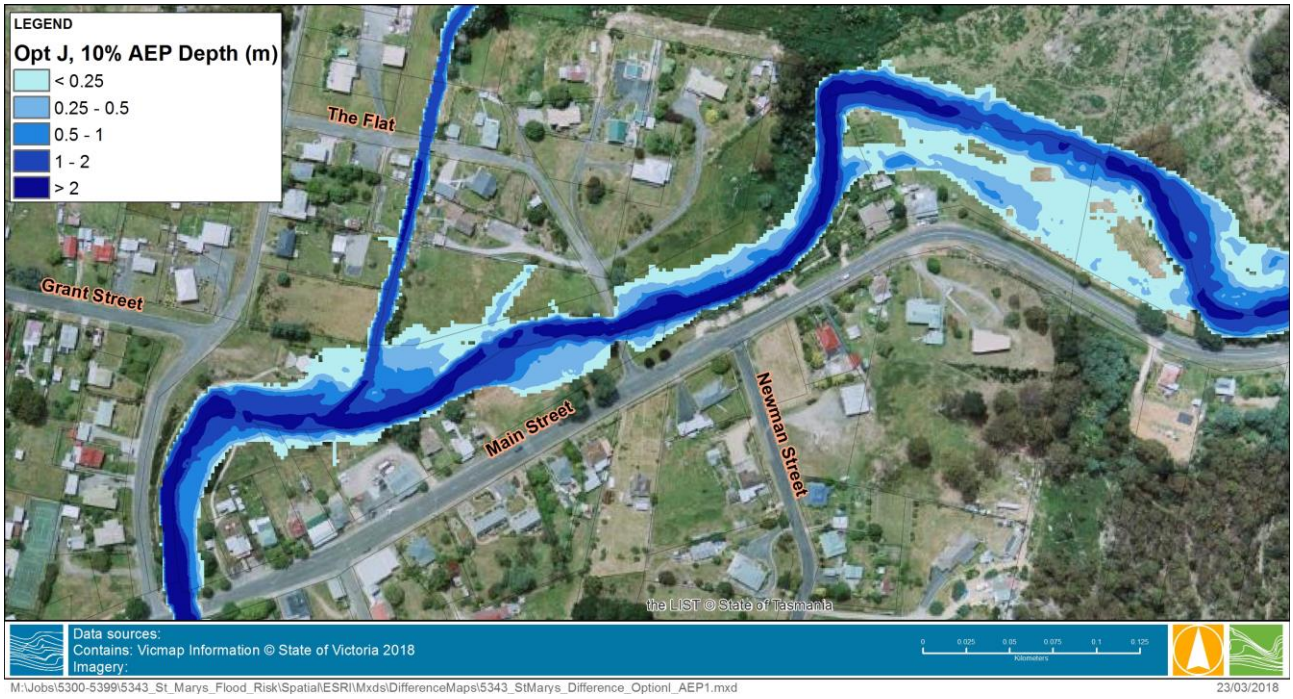

Figure 3-3 Option J (750mm raised bridge), 10% AEP Depth Map

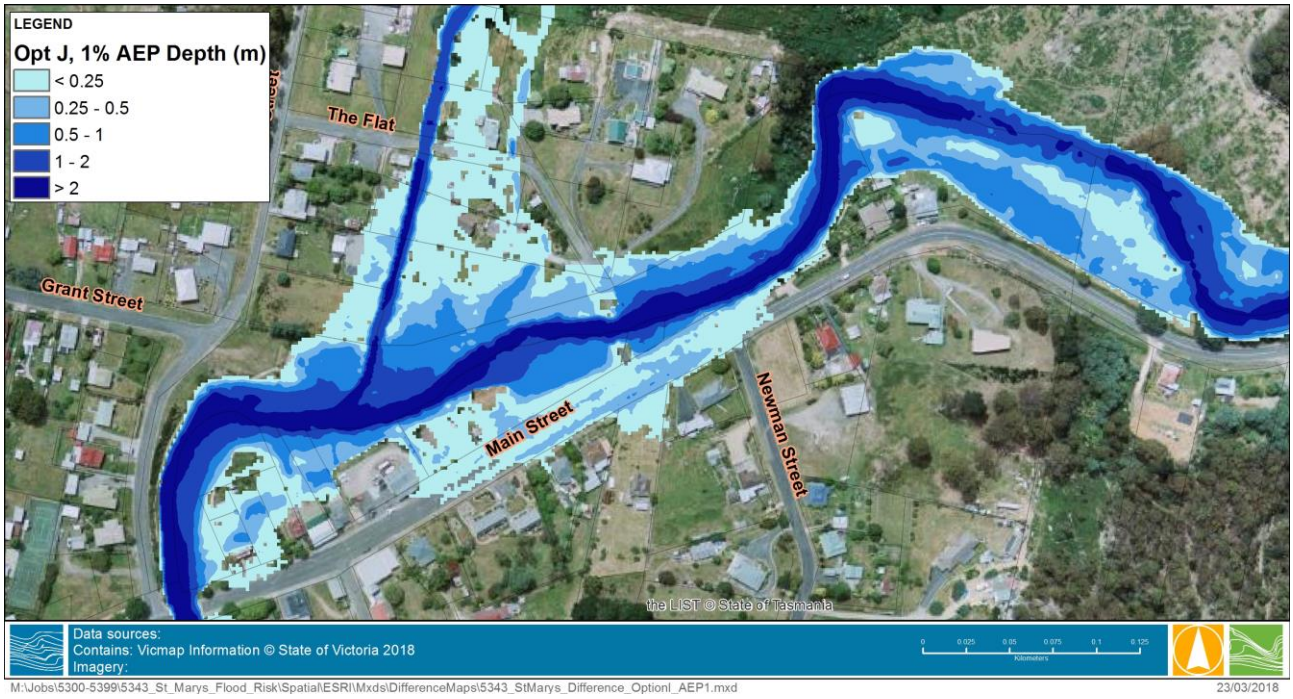

Figure 3-4 Option J (750mm raised bridge), 1% AEP Depth Map

4 SCENARIO K – RAISING THE FLAT ROAD BRIDGE OVER ST MARYS RIVULET BY 1000MM

4.1 Scenario Details

This scenario involved raising The Flat Ridge Bridge slab by 1000mm from its current position. The bridge consists of a 950mm deep slab which currently has a deck level of 261.12 m AHD, and so raised to 262.12m AHD in this scenario. As with the previous scenario the approaches to the bridge were modified to produce a constant grade from existing surface levels over a distance of approximately 16 metres either side of the bridge with three culverts of varying sizes (600mm, 450mm and 300mm) on either side, as shown in Figure 4-1.

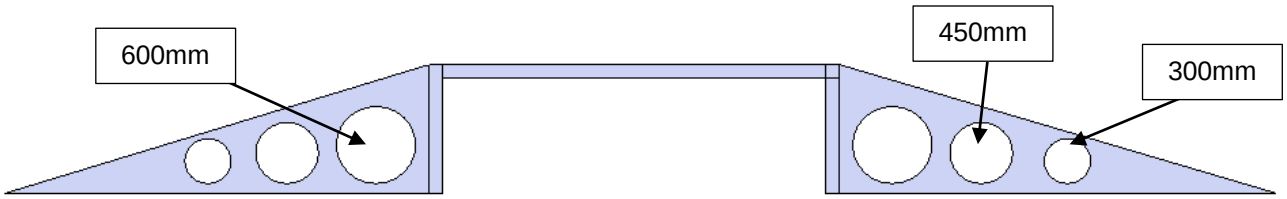

Figure 4-1 Bridge Example (600mm, 450mm, 300mm culverts)

The scenario was modelled for the 1%, 0.5% AEP and historic January 2016 events and the results shown below in Figure 4-2 through to Figure 4-7.

4.2 Scenario Results

The results of the modelling are presented in difference plots (Figure 4-2, Figure 4-3 and Figure 4-4) and depth plots (Figure 4-5, Figure 4-6 and Figure 4-7) below. The difference plots shown the impact on flood levels compared to current conditions. The results show that:

- By raising the bridge to 1000 mm above original height a net decrease in 1% AEP floodwater levels is achieved improving access along Main Street considerably. 1% AEP flood levels are up to 300mm lower than under current conditions.
- As with the 500mm and 750mm previous model outputs the flood extents are reduced upstream with water levels in the riparian region greater than 500mm lower.
- Under 0.5% AEP conditions the extents have also decreased significantly along Main Street with reductions in flood level of up to 200mm.
- Under January 2016 conditions the extents have decreased marginally along Main Street with reductions in flood levels of up to 150mm (slightly less than the 0.5% AEP event reductions)
- The results shown no adverse impacts to properties in the vicinity of the bridge in either the 1%, 0.5% or modelled historic January 2016 AEP event.

Overall the results show that raising the bridge by 1000mm and including culverts under the bridge approaches on both sides achieves a greater benefit in the 1%/0.5% AEP/January 2016 events compared to raising by 500mm and 750 mm.

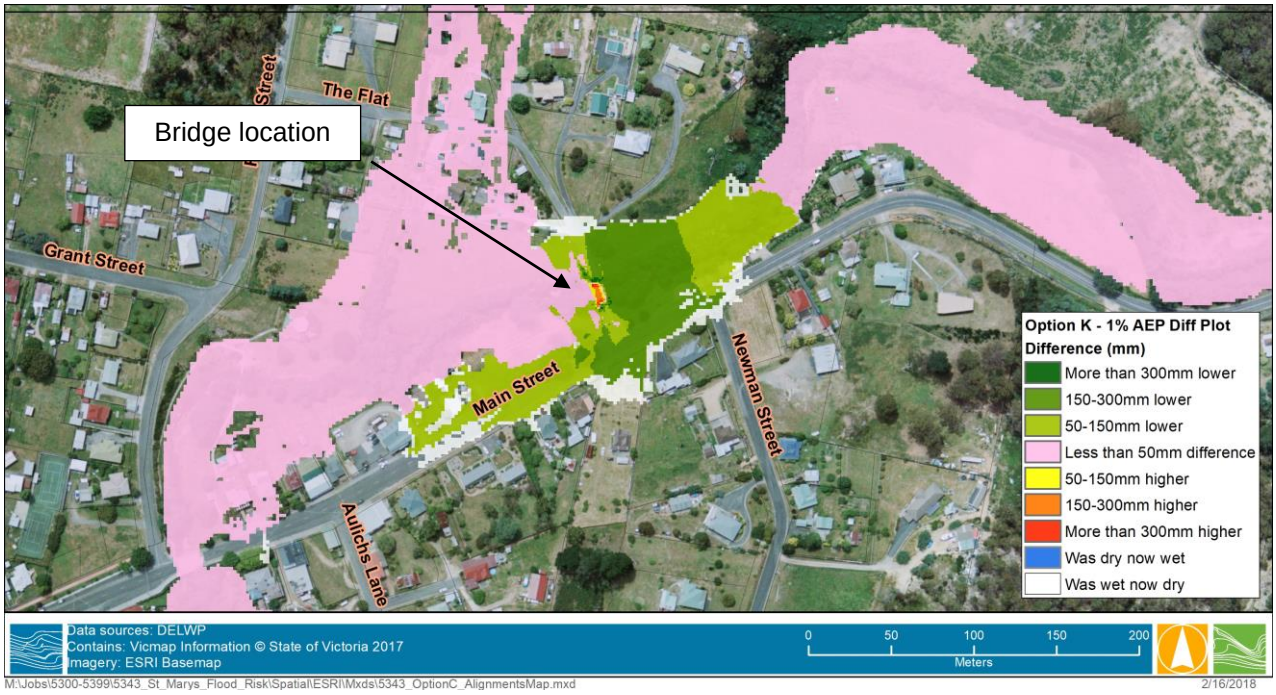

Figure 4-2 Option K (1000mm raised bridge + culverts), 1% AEP Difference Plot

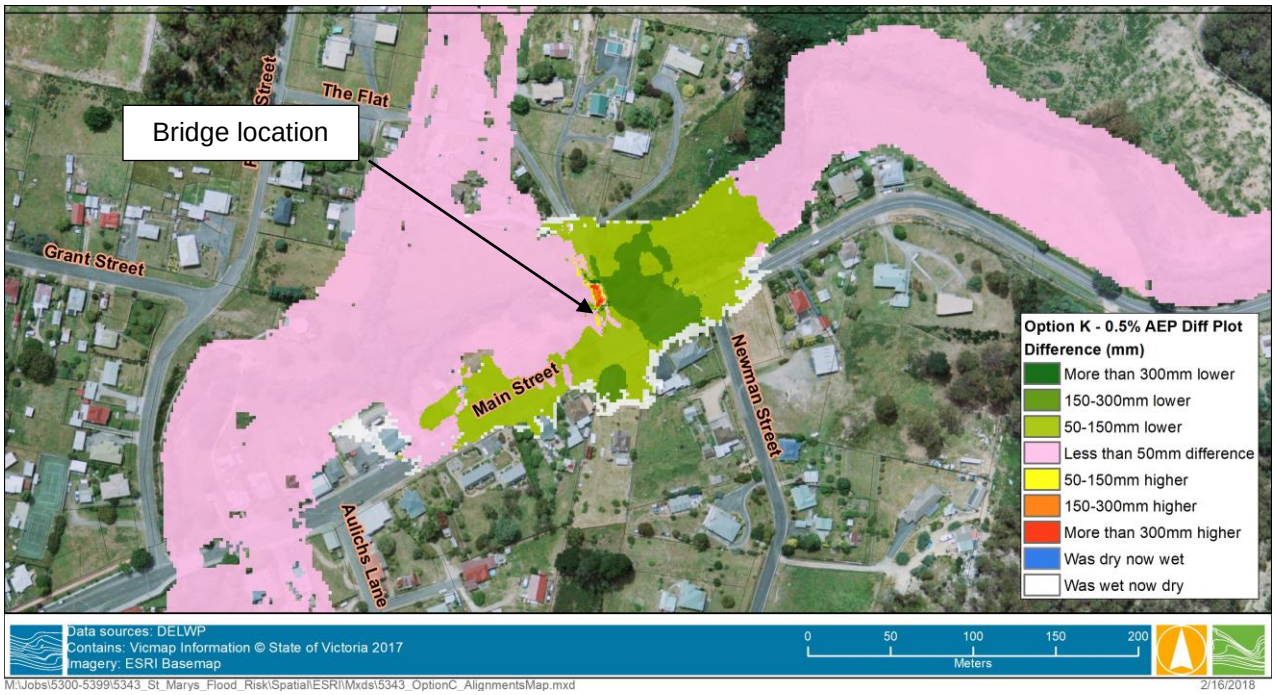

Figure 4-3 Option K (1000mm raised bridge + culverts), 0.5% AEP Difference Plot

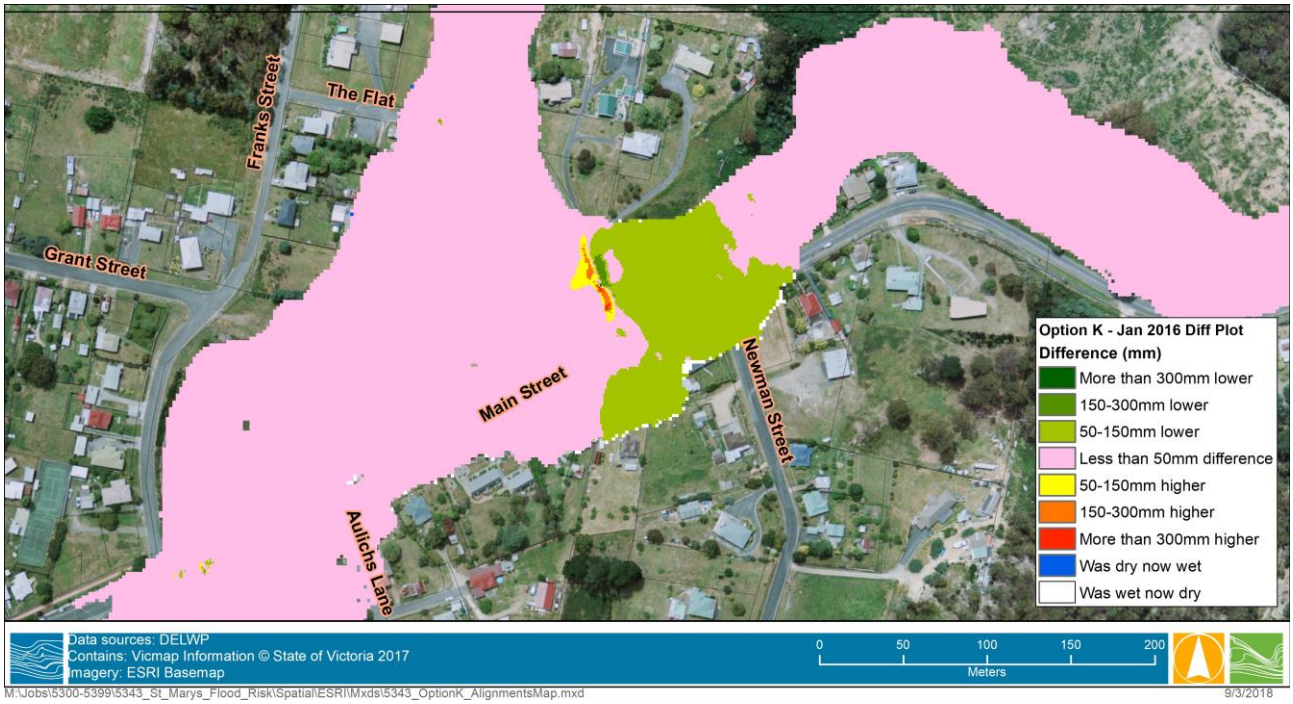

Figure 4-4 Option K (1000mm raised bridge + culverts), Jan 2016 Event Difference Plot

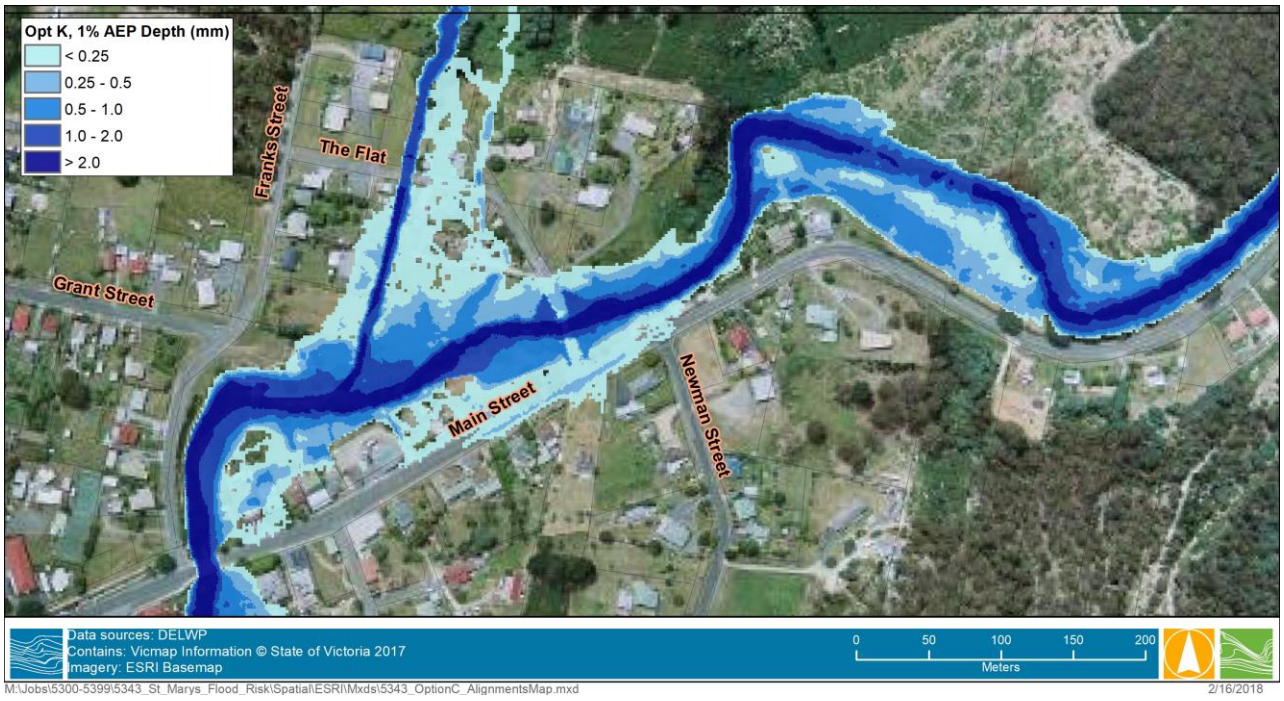

Figure 4-5 Option K (1000mm raised bridge and culverts), 1% AEP Depth Map

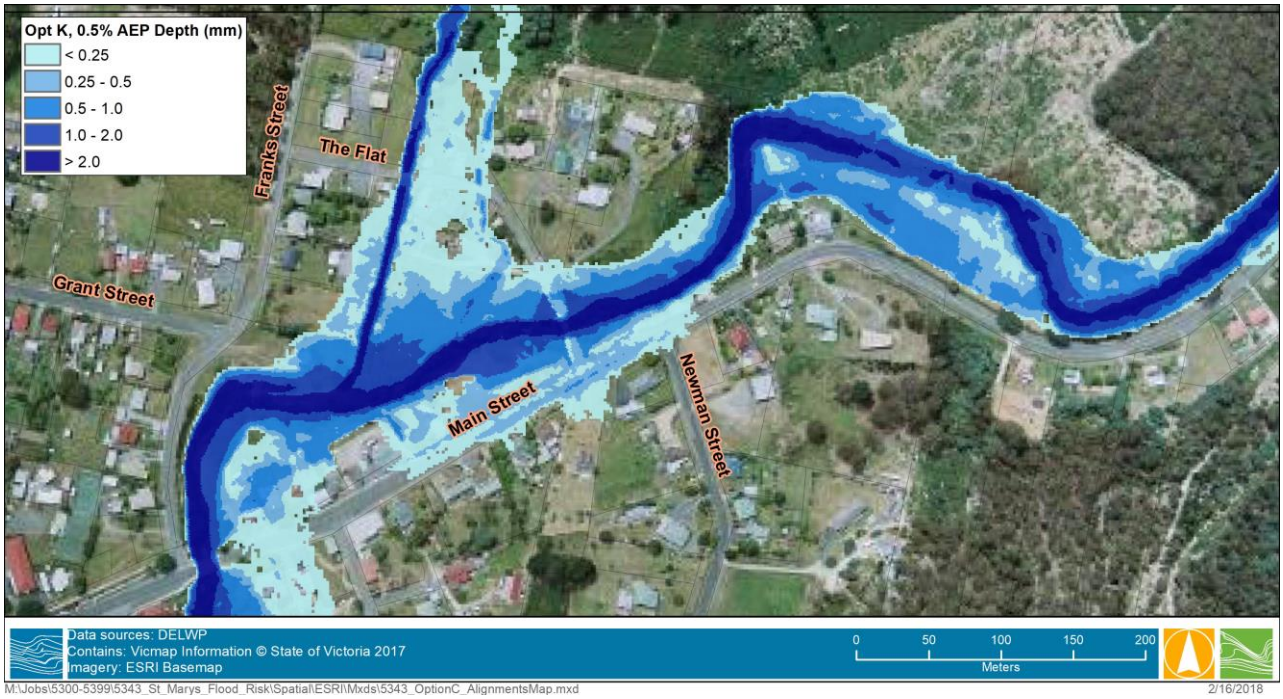

Figure 4-6 Option K (1000mm raised bridge and culverts), 0.5% AEP Depth Map

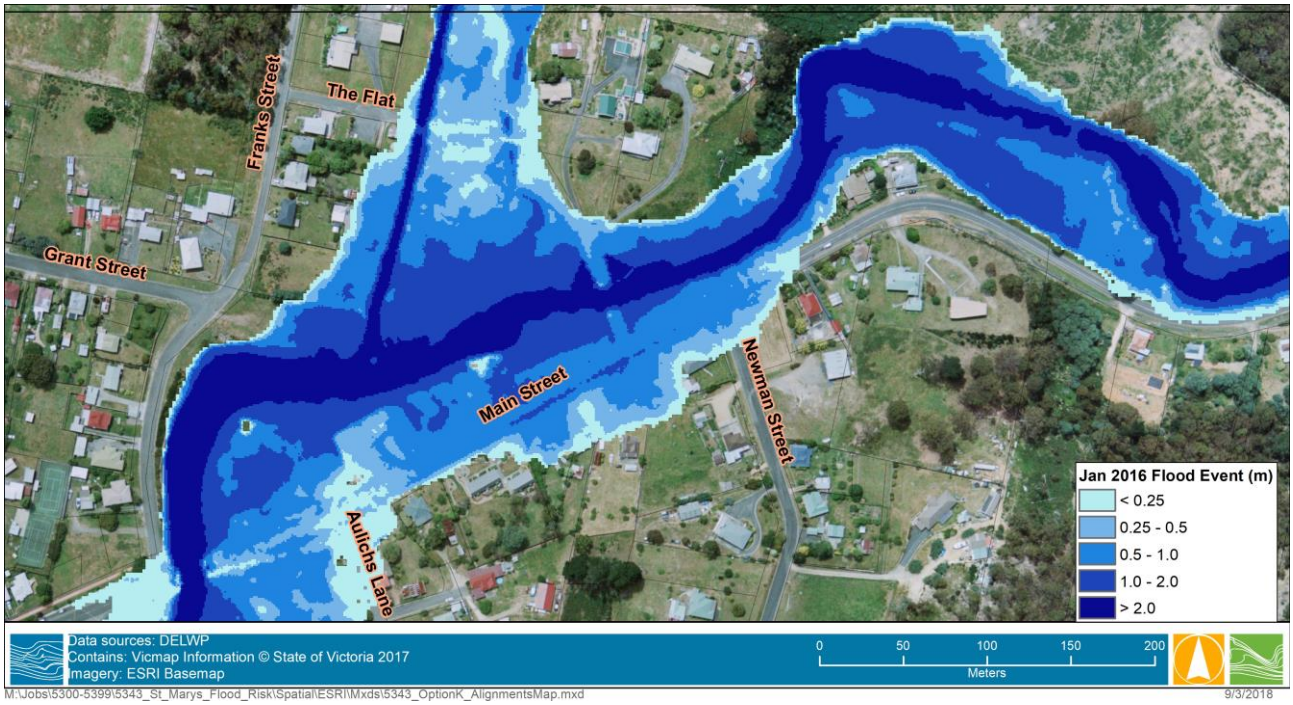

Figure 4-7 Option K (1000mm raised bridge and culverts), Jan 2016 Flood Event Depth Map

5 SUMMARY

This memo has presented the results of additional mitigation scenarios to improve flood risk at St Marys. The scenarios have involved raising The Flat Road Bridge by 500mm, 750mm and 1000mmto test the impact on flood behaviour in the area. The results show that the 500 and 750mm scenarios provide good benefit in the more frequent 10% AEP event whilst providing less benefit in the 1% AEP event and greater.

In the 1% AEP event the 1000mm bridge raise offers significantly greater benefit than the 500mm and 750mm bridge raise scenarios. Main Street remains overtopped in the 1000mm raise scenario but to much shallower depths.

The results show that overall the 1000mm raise provides the most benefit of the three scenarios and is therefore recommended as the best option from a flood risk perspective. This recommendation does not consider the cost or feasibility of these options, but we understand this is being assessed by Break O'Day Council.

It is recommended that this memorandum be reviewed, and feedback provided to Water Technology regarding next steps.