

# MEMORANDUM

**To** Ronan Murphy / Greater Shepparton City Council  
**From** Water Technology  
**Date** 05 December 2016  
**Subject** Potential Flood Risk of planning applications at 215 Mitchell Road

Please find the below memo regarding the potential flood risk at 215 Mitchell Road, Kialla and the flood risk associated with proposed development on the site in regards to two planning applications put forward to the Greater Shepparton City Council. The report includes details on the following topics.

- Floodplain Management in Victoria
- Summary of the subject site
- Review of previous flood modelling and existing planning controls
- Updated flood mapping as part of the Shepparton – Mooroopna Flood Intelligence project and the Investigation Area 1 project undertaken for the Greater Shepparton City Council
- Proposed development and associated flood risk (flood hazard, egress)
- Discussion and Summary

## 1 VICTORIAN FLOODPLAIN MANAGEMENT

In 2016, the Department of Environment, Land, Water and Planning (DELWP) released the Victorian Floodplain Management Strategy. This document aims to set the direction for floodplain management in Victoria.

*The Victorian Floodplain Management Strategy sets out a systematic approach to evaluating Victoria's flood risks. It also provides a systematic approach to sharing information between the individuals, communities, government agencies and other organisations responsible for managing the various aspects of flood risk. Most importantly, it clarifies which agency is accountable for each aspect of floodplain management.*

Relevant to the following memo regarding the potential flood risk at 215 Mitchell Road, Kialla are the following sections:

- **Policy 13a** The 1% Annual Exceedance Probability flood will remain the design flood event for the land use planning and building systems in Victoria.
- **Policy 13b** The strategic planning framework must give due consideration to flooding and its impacts on land use potential.
- **Policy 13c** LGAs with areas at risk of a 1% Annual Exceedance Probability flood must ensure that their Planning Scheme contains:
  - the objectives and strategies for managing the risk in the Municipal Strategic Statement
  - the appropriate zone and overlays.



- **Accountability 13a** LGAs are accountable for ensuring that their Planning Schemes correctly identify the areas at risk of a 1% Annual Exceedance Probability flood, and contain the appropriate objectives and strategies to guide decisions in exercising land use controls in regard to flooding.
- **Action 13b** The CMAs and Melbourne Water will work with LGAs to ensure that Planning Schemes use the planning controls that align with their flood risks.

Existing planning controls for the site have been based on flood modelling undertaken in 2002 (Shepparton – Mooroopna Floodplain Management Study – SKM). The current planning controls show the site is subject to flooding during a 1% AEP (or 1 in 100 year ARI flood event). The flood related planning controls are based on the modelled flood risk, with deep and/or fast flowing water associated with a higher flood risk, and classified as Floodway Overlay or Urban Floodway Zone. Flooding up to a depth of 0.50 m was generally assigned a Land Subject to Inundation Overlay classification, however significant research and current industry advice may see this depth threshold reduced to 0.30 m. This reduction of the depth threshold for hazardous flood depths, would see the area classified as Floodway Overlay potentially increasing.

## 2 SUBJECT SITE

The subject site at 215 Mitchell Road, Kialla, is approximately 104 ha, the site currently has 74.64 ha zoned as Farming (FZ2) and the remaining 29.03 ha is zoned as Urban Floodway Zone (UFZ). The Seven Creeks watercourse runs from the middle of the site at Mitchell Road through to the west of the site on the Goulburn Valley Highway. The site slopes gradually from the south east (115.32 m AHD) to the north west where the lowest elevation (out of the Seven Creeks channel) is 114.20 m AHD. The south west corner of the site also has several lower areas with the elevation between 114.20-114.30 m AHD. Several irrigation channels cross through the site, with a channel running parallel either side of Seven Creeks. All waterways (including channels and drains) within the VicMAP database are shown in Figure 2-1. The Local Government Authority for the site is the Greater Shepparton City Council (GSCC) and the Goulburn Broken Catchment Management Authority (GBCMA) are the statutory referral agency for floodplain management under the Water Act (1989).

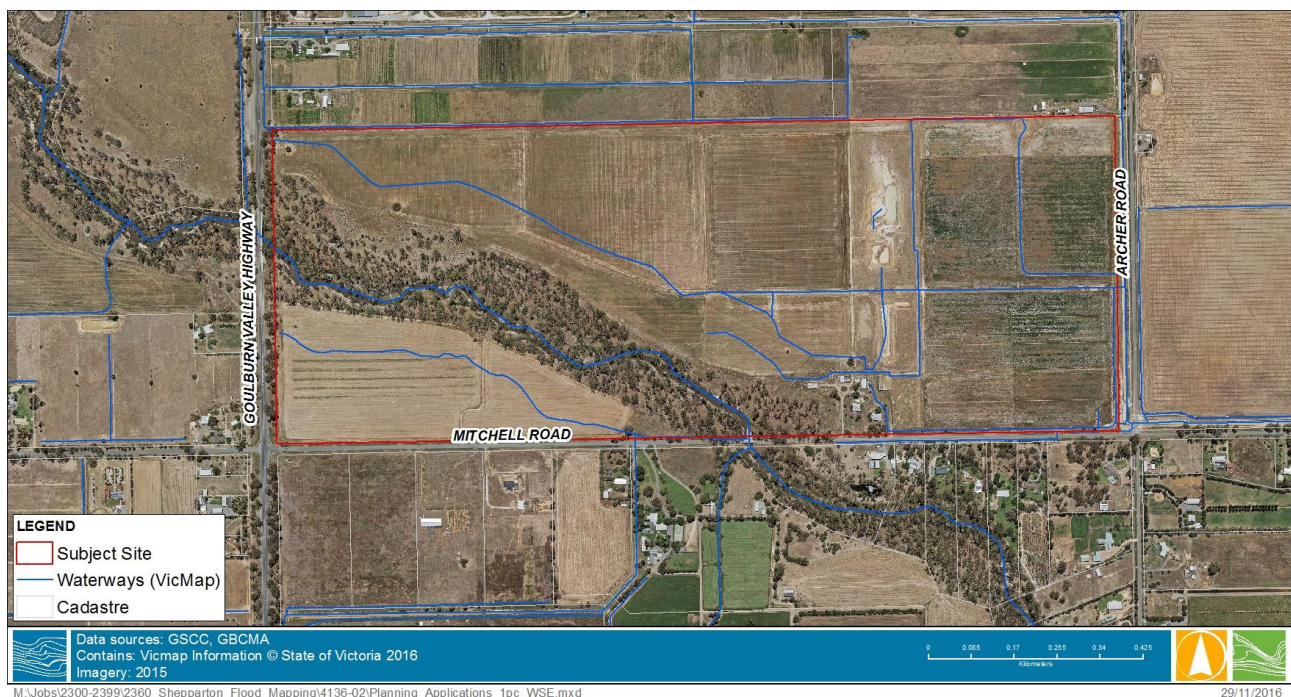
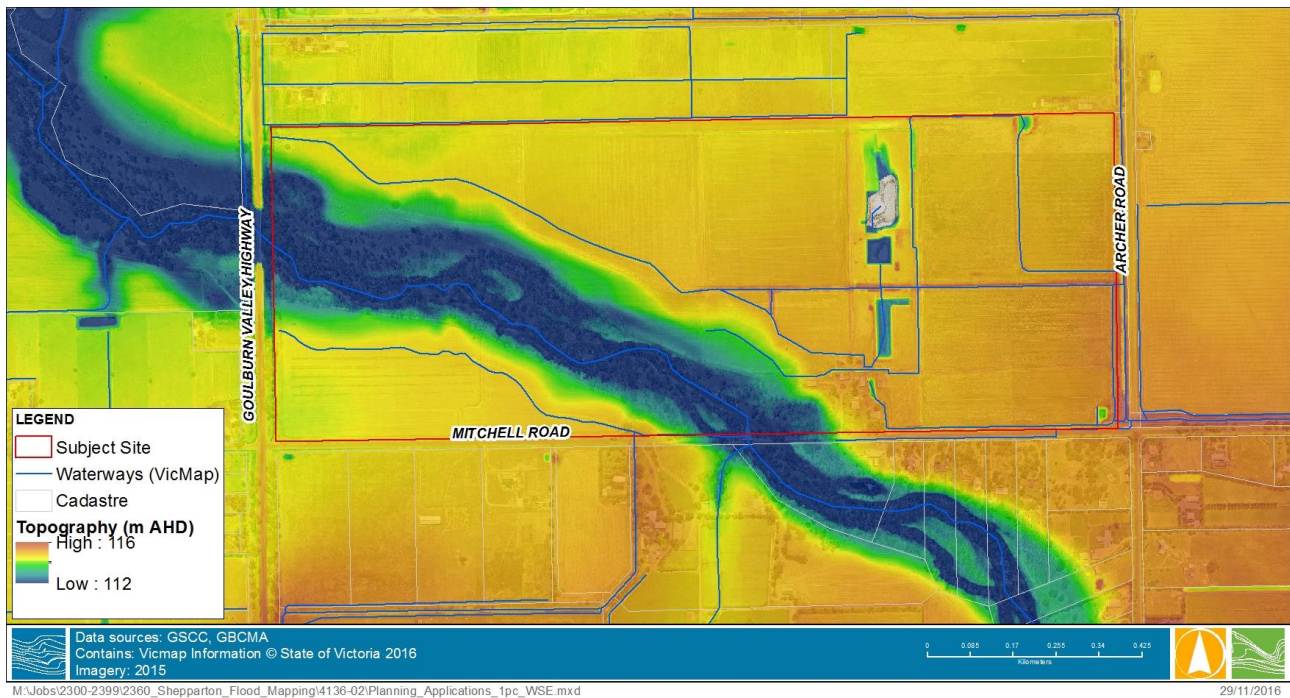


Figure 2-1 Subject Site





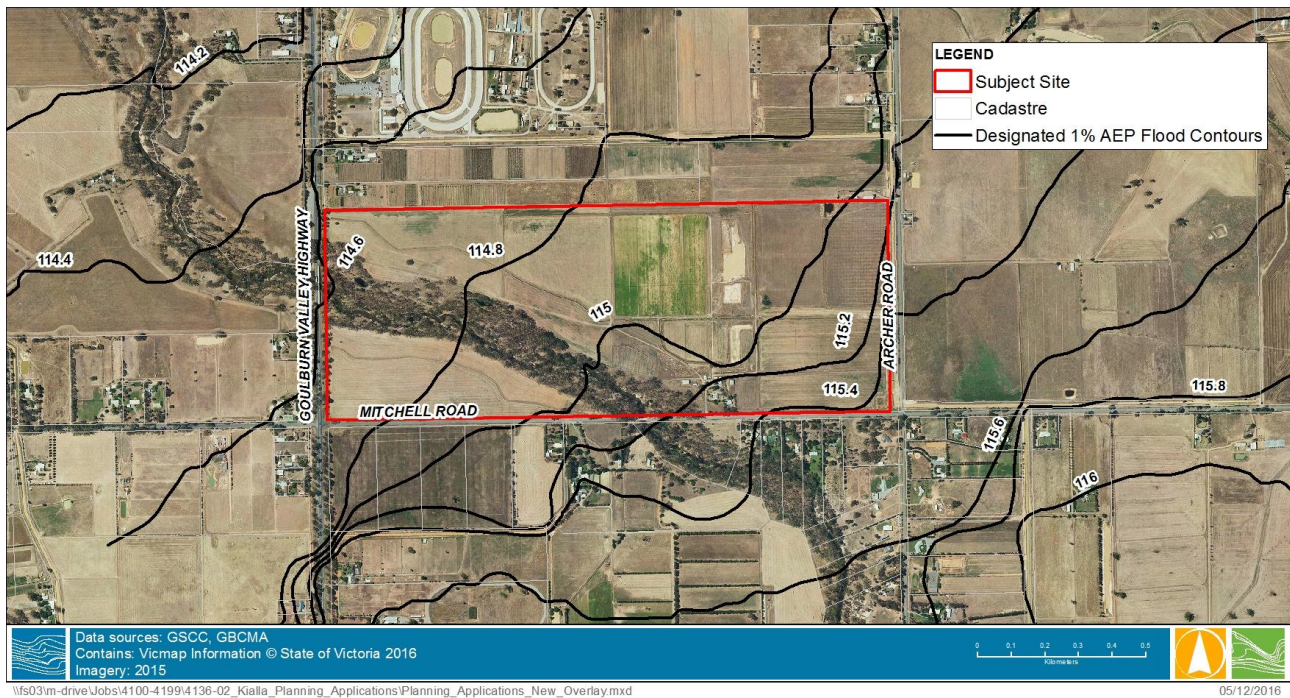
**Figure 2-2 Subject Site Topography (sourced from LiDAR)**

## 2.1 Existing Flooding Conditions

### 2.1.1 Shepparton – Mooroopna Floodplain Management Study (2002)

The Shepparton Mooroopna Floodplain Management Study was undertaken in 2002 by Sinclair Knight Merz in conjunction with Lawson and Treloar Pty Ltd. This study used computational floodplain modelling using MIKE 21 to calibrate the flood events of 1974 and 1993 to within +/- 500 mm. A model topography utilised photogrammetry flown in September 1999 and a model grid resolution of 12.5 m for the 'inner area' and a 25 m grid resolution in the 'outer area'. The subject site is in the 'outer area'.

The modelling undertaken in the 2002 flood study formed the basis for the current planning scheme. The existing 1% AEP flood level for the subject site ranges from 115.4 m AHD at the south east of the property to 114.6 m AHD at the north west of the property (Figure 2-3).



**Figure 2-3 Designated Flood Contours (Shepparton – Mooroopna Floodplain Management Study 2002)**

### 2.1.2 Shepparton-Mooroopna Flood Intelligence Project (Ongoing)

Water Technology are currently undertaking the Shepparton-Mooroopna Flood Mapping and Intelligence Study. The revised modelling will be used to update the existing planning controls within the site. The modelling undertaken recently for Council's Investigation Area 1 replicated the modelling being undertaken for the ongoing Shepparton-Mooroopna Flood Mapping and Intelligence Study. This involved utilising the same model parameters as used in the Shepparton-Mooroopna Flood Mapping and Intelligence Study and ensuring existing conditions flood levels matched the ongoing flood study results. The modelling for the Shepparton – Mooroopna Flood Mapping and Intelligence Study used high resolution Light Detection and Ranging (LiDAR) survey, resampled to a 10 x 10 m grid resolution. The model was calibrated using a number of surveyed flood height marks from the 1974 and 1993 floods and further validated using aerial imagery from these events. Calibration of water levels for these events was aimed at within +/- 200 mm. The use of aerial imagery for validation was taken with some caution as the timing of the photography covering the area does not coincide with the peak of the flood event and was taken some two days after the peak. Additionally, local rainfall during the event can cause flooding in areas which may not be represented within the riverine floodplain studies.

Figure 2-4, Figure 2-5 and Figure 2-6, show the maximum depth, water surface and velocity for the site in a 1% AEP flood event on the Seven Creeks system. The south west corner of the site is almost entirely flooded at a depth of greater than 0.40 m, while most of the area is inundated at depths great than 0.50 m. The area to the east of Seven Creeks in the location of the farm stay application also has depths greater than 0.50 m. The flood depths are slightly lower where the existing farm buildings are located. The water surface elevation plot (Figure 2-5), shows the most water surface elevation contours range from 114.8 m AHD – 115.6 m AHD.



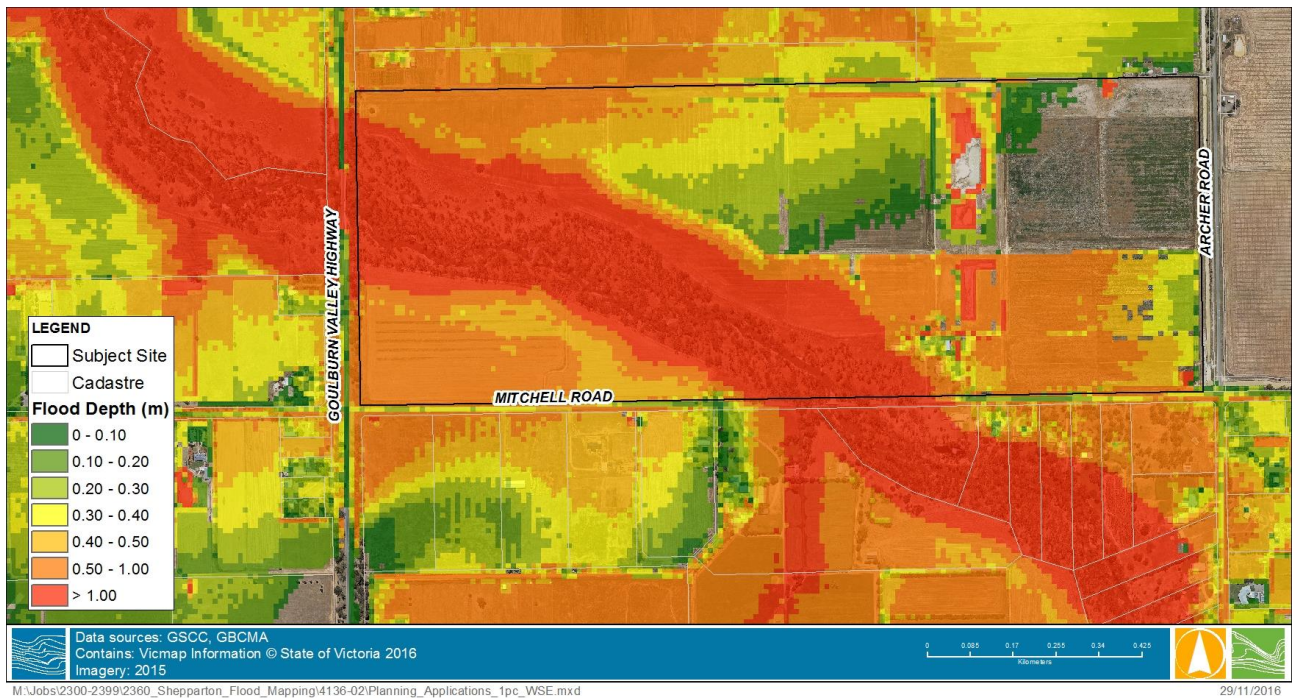


Figure 2-4 1% AEP Flood Depth (m)

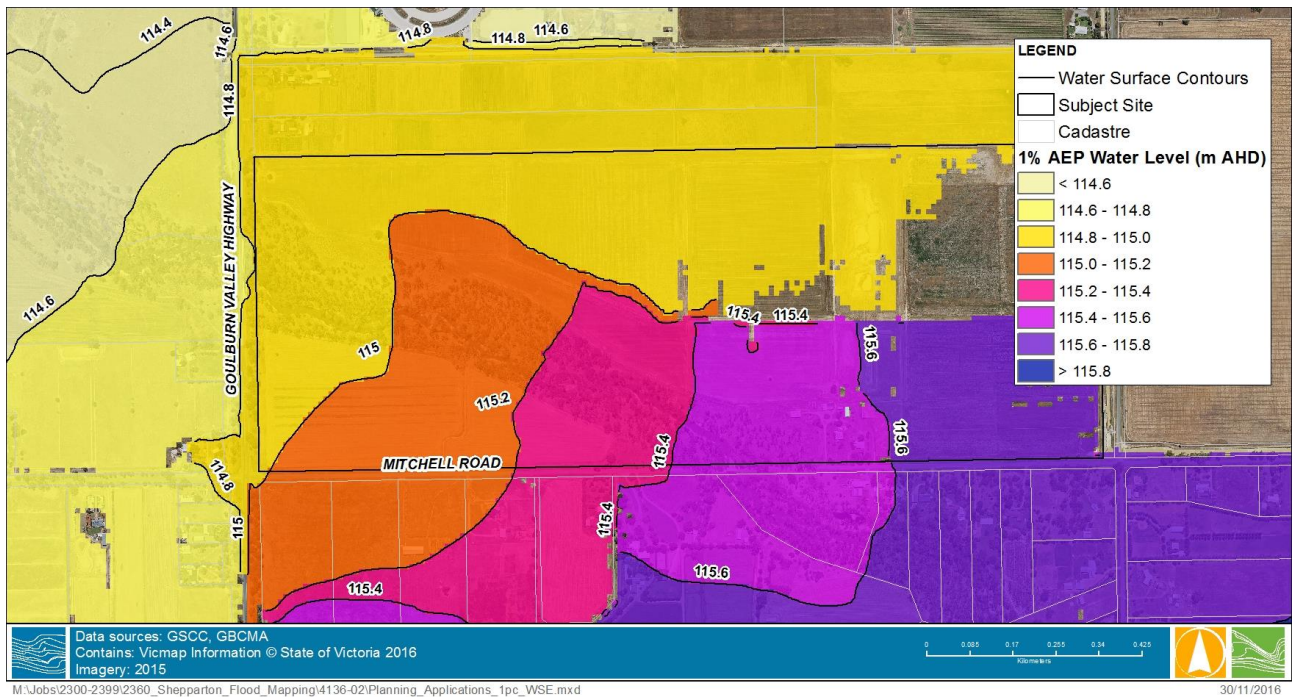
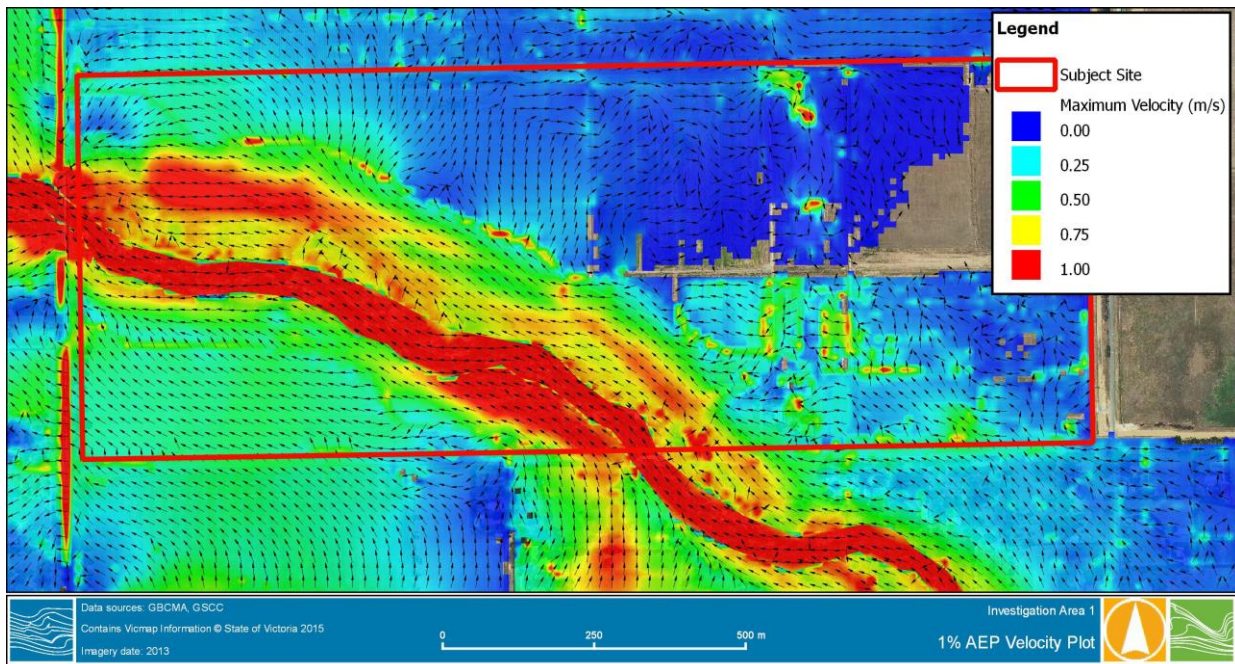


Figure 2-5 1% AEP Water Surface Elevation



**Figure 2-6 1% AEP Flood Velocity Vectors**





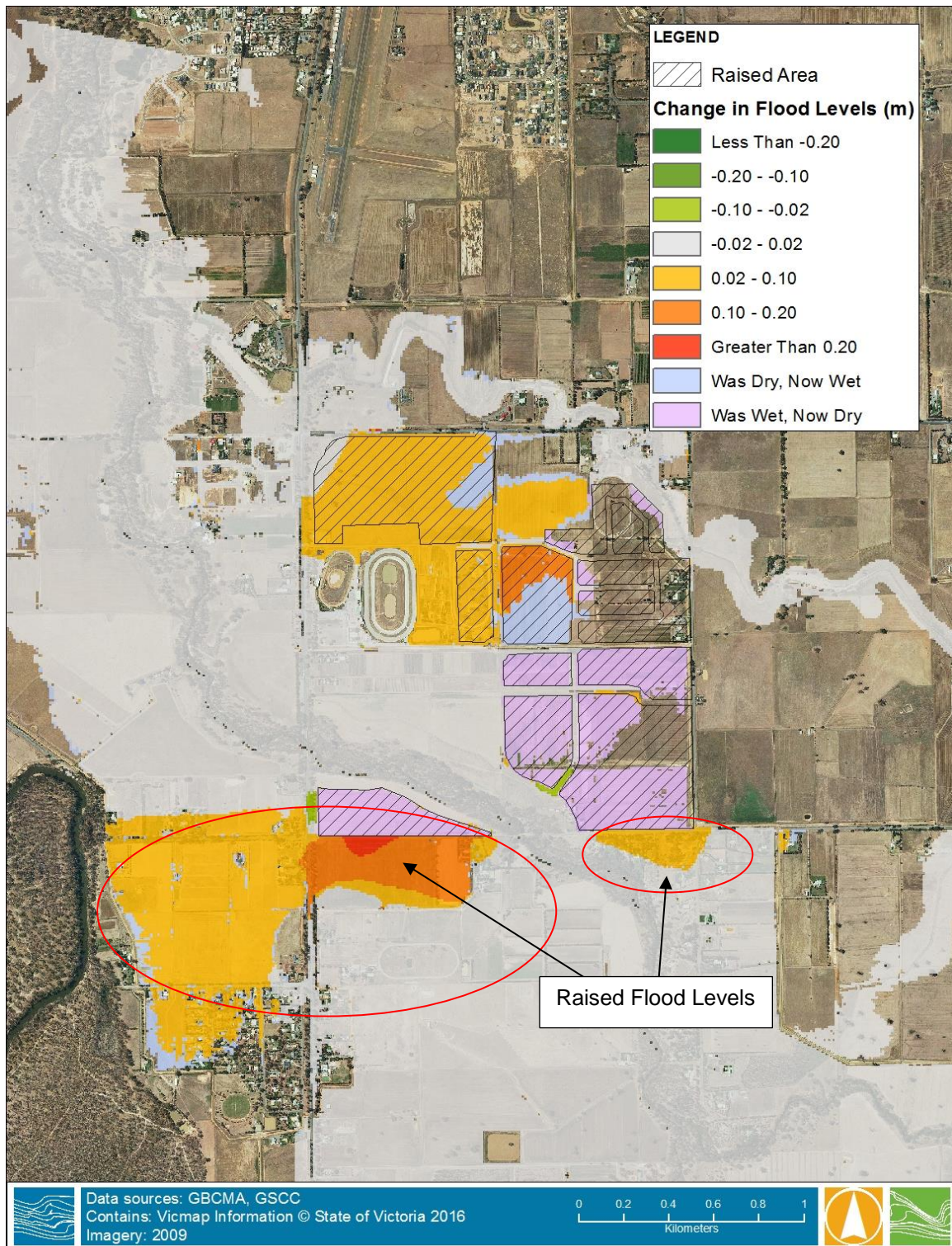
### 2.1.3 Investigation Area 1

Water Technology was engaged by the Greater Shepparton City Council to undertake a model of flood behaviour for an area of land at Kialla known as Investigation Area 1. The study area which includes the subject site (215 Mitchell Road Kialla) is proposed for future development. Investigation Area 1 contains a number of properties surrounding the Kialla Paceway, which incorporates the Shepparton Greyhound Racing Club, The Shepparton Harness Racing Club and the Shepparton Pony Club.

Water Technology investigated the existing conditions flood behaviour for a 1% AEP flood event. This was compared to the proposed development conditions from a master plan developed by Urban Enterprise. The flood modelling showed that if this masterplan was implemented that it would result in unacceptable increases in flood levels in areas upstream and downstream of Investigation Area 1. A number of elements of the masterplan were found to be located in areas critical to floodplain function, and recommendations were made to change the masterplan to better accommodate the flood risk.

A number of iterations of the layout were undertaken, one which included much of the subject site raised above the flood level including the south west corner of the site. The results of this were then compared with existing conditions and found that the parcel raised above the flood levels resulted an increase in flood levels outside of the site as shown in Figure 2-7. In terms of floodplain management, this arrangement would not be suitable as it impacted negatively on adjacent properties.

A revised masterplan was developed which addressed not only flooding issues, but acoustic and existing service infrastructure issues. The revised masterplan demonstrated through flood modelling an acceptable outcome with regards to managing flood risk was achievable. The revised masterplan seeks to strike a balance between the level of development and managing the flood risk for the safety of the community and appropriate development for the associated flood risk. The revised masterplan is shown in Figure 2-8.



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**Figure 2-7 Masterplan Layout (with parcel raised above flood level) – Difference Plot**



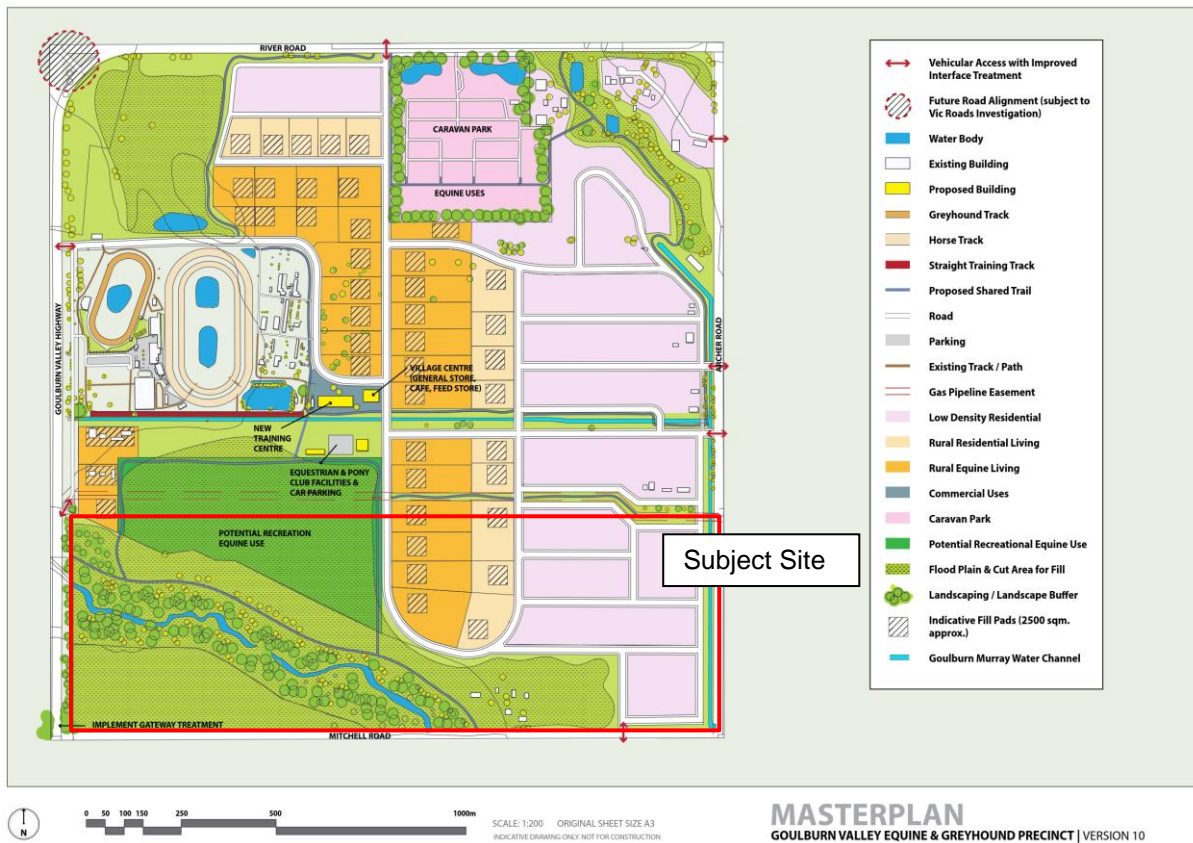


Figure 2-8 Final Masterplan Layout for Investigation Area 1

## 2.2 Proposed Development

The planning application in question for 215 Mitchell Road, Kialla proposes to include a variety of uses. Two planning applications have been lodged with the Greater Shepparton City Council. A layout of the developments is shown in Figure 2-9. The application for the area in the south west corner of the site is for a caravan park/resort which includes permanent accommodation, a restaurant and local produce store. To accommodate these facilities, the site would be expected to be flood free given the nature of the proposed development. The remainder of the site includes landscaped open space and gardens incorporating walking and bike paths and a market garden. The area immediately to the east of Seven Creeks has an application for a host farm. This is to include accommodation (permanent pods and caravan sites), a farm store and a restaurant. The accommodation areas, farm store and restaurant would be expected to be flood free. Safe egress to both sites would also be required, this is covered further in 3.2.3.

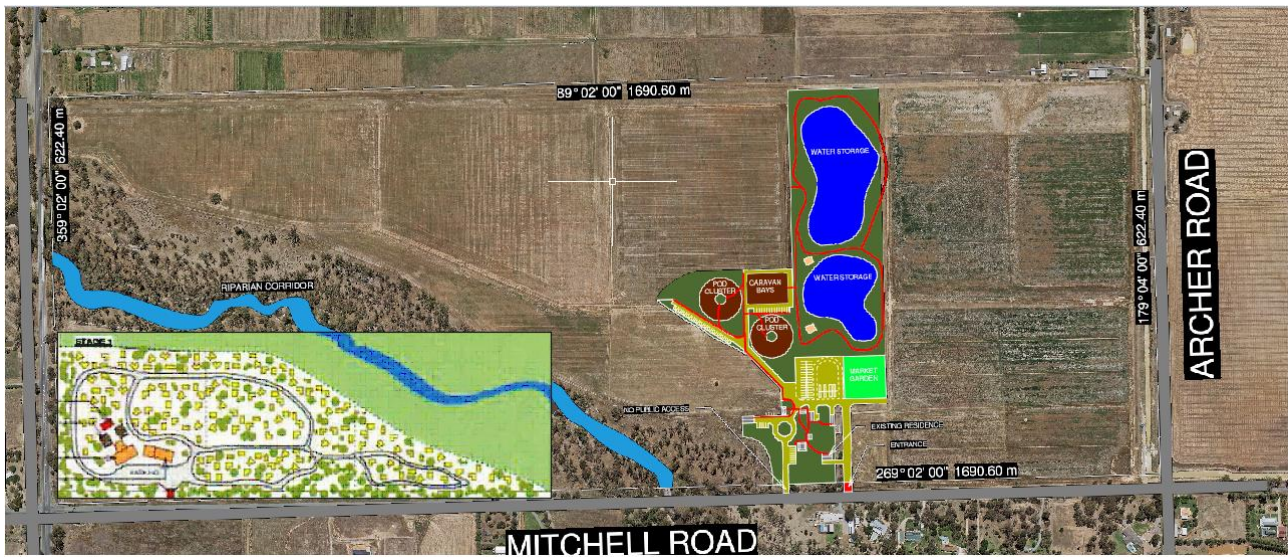


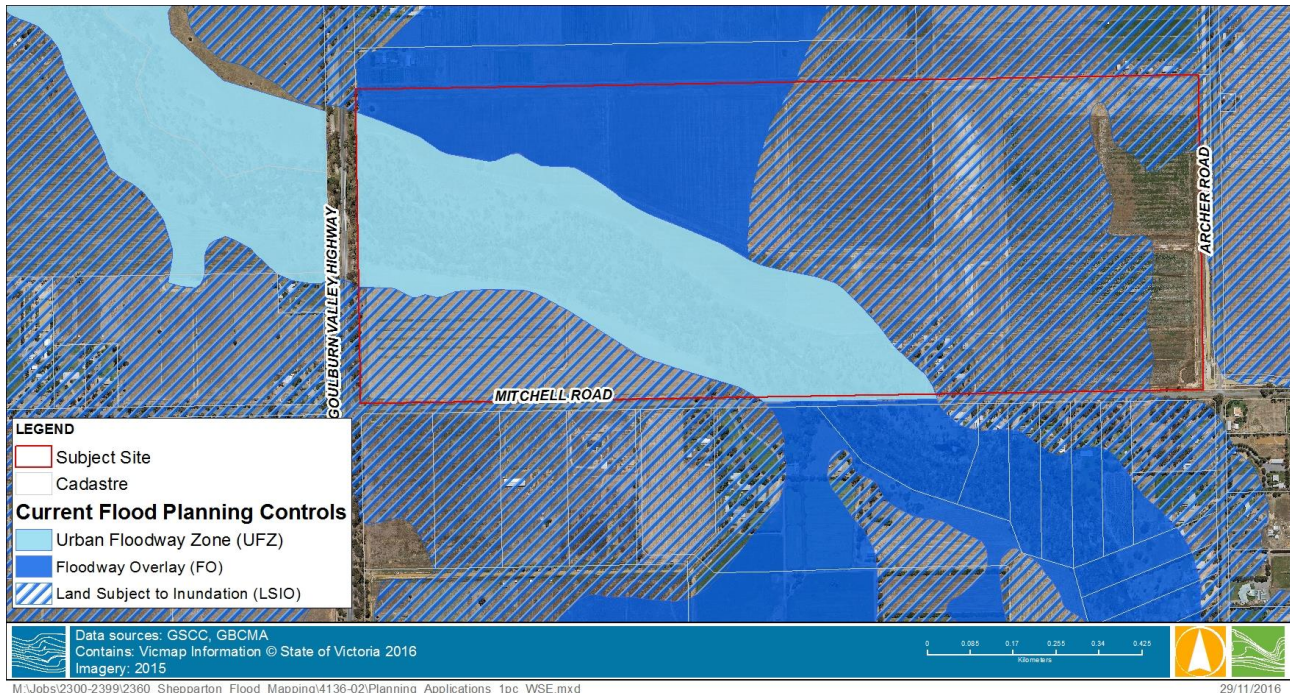
Figure 2-9 Two proposed development sites (Source: GSCC)



## 3 FLOOD RISK

### 3.1 Planning Framework

The existing flood planning controls are shown in Figure 3-1, these are based on the 2002 modelling.



**Figure 3-1 Existing Flooding Planning Controls**

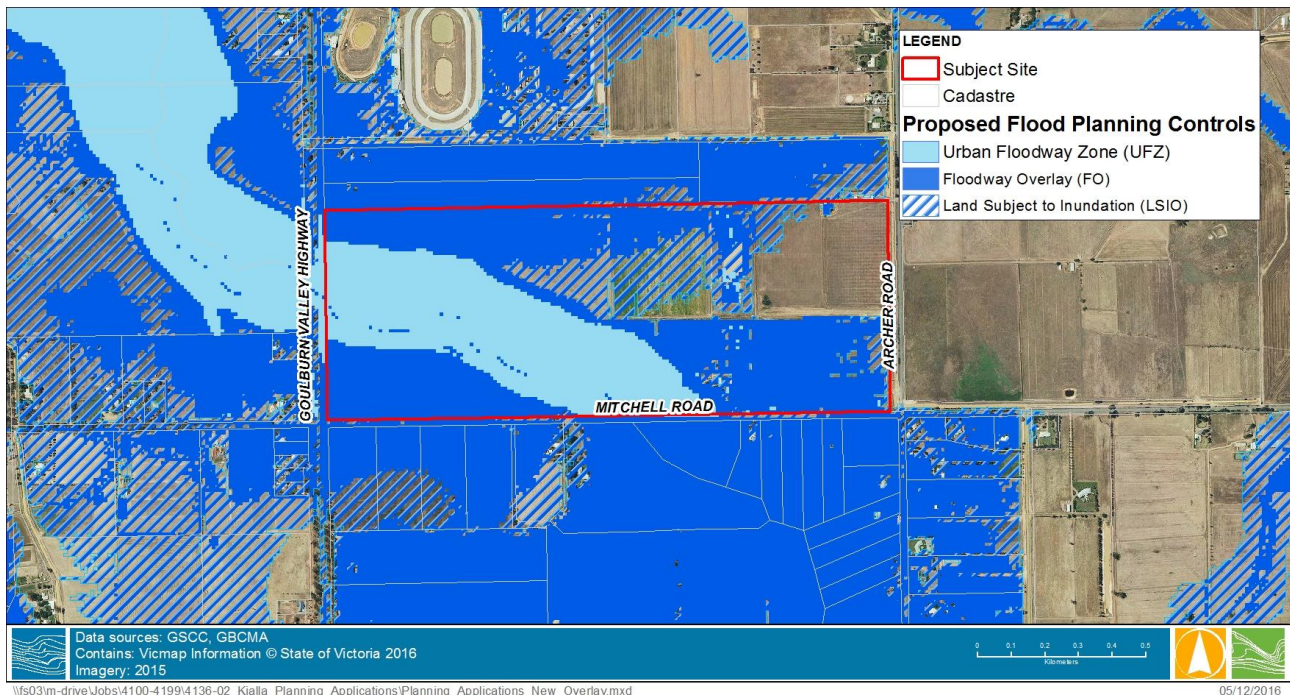
The updated modelling results as part of the Shepparton – Mooroopna Flood Mapping and Intelligence Study, along with a change in industry standards will likely result in changes to the planning scheme in the future. The Australian Rainfall and Runoff guidelines provide guidance to engineers, planners and agencies for how to undertake a flood investigation, with the Victorian Floodplain Management Strategy providing guidance for making policy decisions.

Project 10 'Appropriate Safety Criteria for People' within the Australian Rainfall and Runoff guidelines provides a method to identify hazardous areas of flooding. Significant research has been undertaken to define a criterion for delineating hazardous areas of flooding in consideration to both vehicle stability and people safety, and are as follows, based on the 1% AEP flood:

- Depth > 0.30 m
- Velocity > 1.50 m/s
- Depth x velocity > 0.30 m<sup>2</sup>/s.

The above thresholds are consistent with hazard criteria that the Goulburn Broken CMA and other CMAs across Victoria are adopting to provide advice on safety requirements associated with new development within a floodplain. Adopting these hazard criteria for defining future Floodway Overlay means that consistency will be in place across Victoria.

The Land Subject to Inundation Overlay includes the area outside of Floodway Overlay and bounded by the 1% AEP flood extent. An example overlay plot based on the above criterion is shown in Figure 3-2 with the Urban Floodway Zone defined by the major flood path and high hazard areas in an urban area. The previous planning controls applied Urban Floodway Zone for the parcels north of Mitchell Road. In this example, the Depth, Velocity and Depth x Velocity thresholds mentioned were used.



**Figure 3-2 Proposed Flood Planning Controls (based on ARR Chapter 10 Criterion)**

## 3.2 Potential Flood Risk

The following section utilises the updated flood mapping based on the Shepparton – Mooroopna Flood Mapping and Intelligence Study and the Investigation Area 1 Project.

### 3.2.1 Risk Factors

The risk factors associated with development on the site were assessed for a 1% AEP flood event.

- **Warning Time** - Four streamflow gauges are located upstream of the subject site at Euroa and further upstream in the Strathbogie Ranges. While there is sufficient warning time to predict a flood at the subject site, the proposed land use is likely to see tourists and visitors to the site who may have little knowledge of the local area.
- **Flood depths** up to 6 metres were found within the Seven Creeks channel during a 1% AEP flood event. Outside of the channel, flood depths across the site vary from a flood free area on the east of the site, through to depths up to 0.70 metres on the south west and north west areas of the site. Flood depths to the east of Seven Creeks also reach close to 0.70 metres. These depths are significant and do pose a flood risk to people and vehicles.
- **Flood Velocities** outside of the Seven Creeks channel are relatively low due to the relatively flat gradient, with velocities not hazardous. The combination of flood depth and velocity is assessed in Flood Hazard (below).

### 3.2.2 Site Egress

During a 1% AEP flood event, Mitchell Road is inundated at the Seven Creeks crossing. This road way is overtopped at much lower magnitude flood events on Seven Creeks. In 2016, the road was closed to traffic on a number of occasions when the Kialla West streamflow gauge reached moderate flood level. A Moderate flood level is a gauge depth of 5.00 m which is less than a 20% AEP (1 in 5 year ARI). The Goulburn Valley





Highway is overtopped in a 1% AEP flood event, however not flooded at depths greater than 0.30 metres. The area to the east of Seven Creeks within the subject site has suitable egress via Archer Road, allowing access into Shepparton via Doyles Road. Existing conditions modelling shows isolated flood depths up to 0.50 metres along Mitchell Road between the existing driveway and Archer Road.

### 3.2.3 Flood Hazard

Flood Risk is the product of the likelihood of a certain event and the consequence of that event occurring. To assess the flood risk the hydraulic modelling design outputs (depth, velocity and flood hazard mapping) can be used to identify both the likelihood of the event happening (in terms of annual exceedance probability) and the consequence of such an event happening. Depth maps are useful in showing the areas impacted by the flooding, while the velocity and flood hazard mapping provides more detail for the areas which pose a higher consequence. The flood hazard plot below Figure 3-3, is based on a criteria including depth, velocity and depth x velocity and is based on the ARR recommendations mentioned earlier.



**Figure 3-3 1% AEP Hazard Map – based on ARR Chapter 10 Recommendations**

## 3.3 Flood Conveyance and Storage

Much of the subject site is within the flood extent and accounts for flood storage in a 1% AEP flood event. The whole site (including the Seven Creeks channel has over 1.1 million cubic metres of floodplain storage.

The parcel of land in the south west of the site is around 11 hectares in size and contains 72,864 m<sup>3</sup> of floodplain storage volume during a 1% AEP flood event.

The proposed development to the east of Seven Creeks contains approximately 5 hectares of development that would be required to be raised above the 1% AEP flood level (restaurant, accommodation, store and driveway access). This removes approximately 30,000 m<sup>3</sup> of floodplain storage volume during a 1% AEP flood event.

A GBCMA condition of building within the floodplain states any filling of the floodplain must be balanced by providing 130% cut volume to offset any lose in floodplain storage.



## 4 SUMMARY

Under existing conditions, the flood modelling to date has shown the area in the south west of the site is inundated at depths greater than 0.50 metres in a 1% AEP flood event. Access to the subject site is also restricted to the Goulburn Valley Highway during a 1% AEP flood event, with Mitchell Road inundated and closed at much lower magnitude flood events.

The proposed development to the east of Seven Creeks is inundated at depths greater than 0.50 and is part of the main flow path of Seven Creeks. Flood depths around the existing buildings in this area range from 0.05 to 0.50 metres.

The flood modelling undertaken during Investigation Area 1 found that if the entire south west parcel of land was raised, the flow path conveyance was reduced and resulted in an increase in flood levels on adjacent properties. This would suggest the proposed development in the south west of the site is not an appropriate land use given the flood risks identified.

The proposed development on the east area of the site also does not appear to be an appropriate land use given the associated flood risks identified. The parcel of land has more appropriate areas for development with a lower flood risk in the eastern edge of the site. Flood depths in this area are between 0.30 – 0.50 m, with some areas flood free. The eastern area of the site also has sufficient access to the site during a 1% AEP flood event via Archer Road.

Based on the information reported above, the planning applications put forward do not appear to be appropriate land use given the flood risks identified.