Appendix H

Hydraulic impact assessment

Green Square to Ashmore Connector (GS2AC) Hydraulic Impact Assessment

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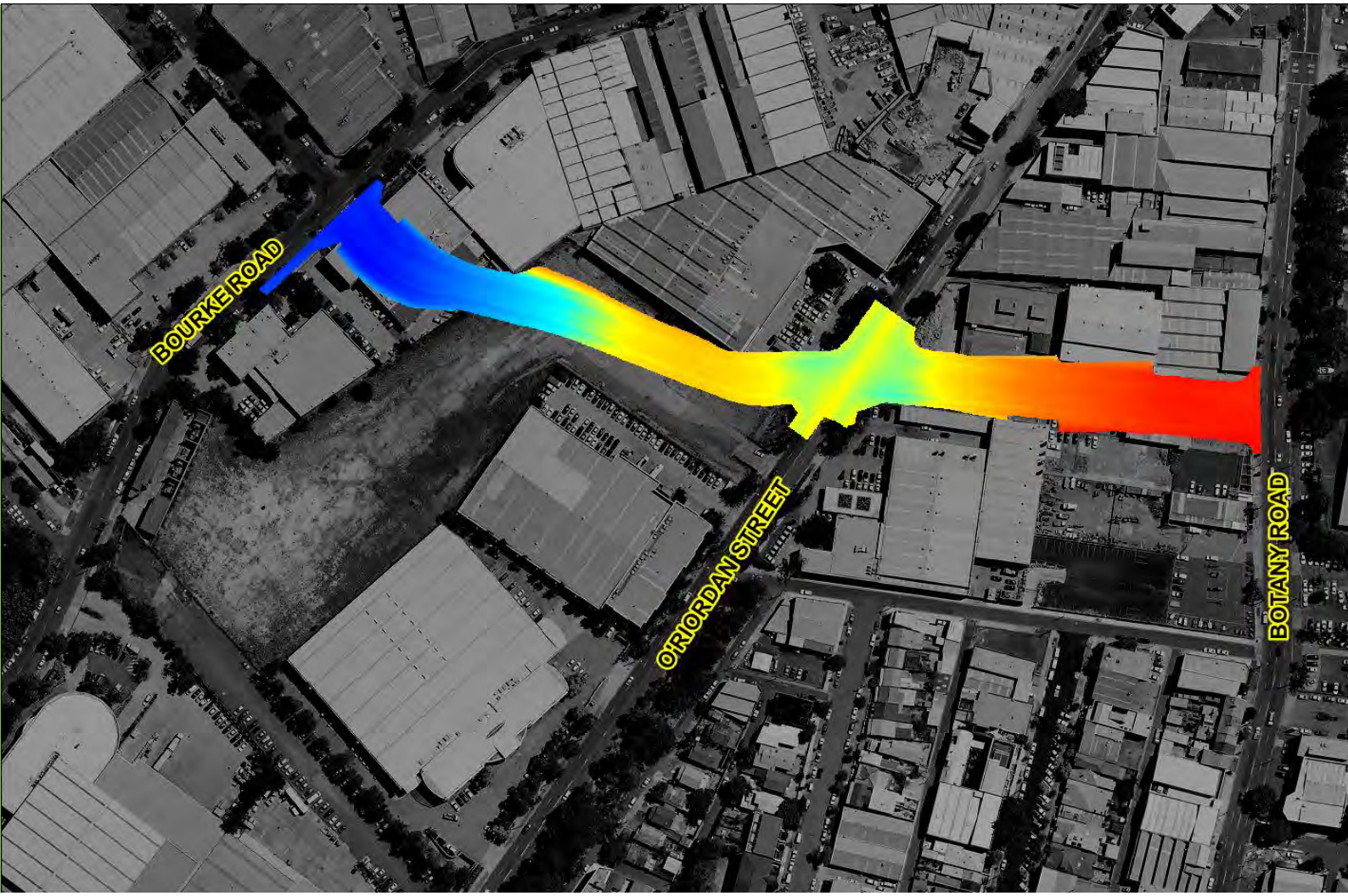

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Issue Details

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1	9/10/17	H Rehman		Draft	For AECOM/CITO Comment
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1 Introduction

The development of Green Square Town Centre (GSTC) is currently underway. The provision of a transport corridor running in an east-west direction has been identified to assist with connectivity and permeability between the Green Square Town Centre and the Ashmore Precinct. This new access corridor is required in the next 5 years to ensure the timely provision of transport services to support the parallel development of the GSTC and the Ashmore Precinct.

The Green Square to Ashmore Connector (GS2AC) was originally investigated in the Green Square Structural Master Plan 1997 and further investigated in the Green Square Transport Accessibility Plan (Masson Wilson and Twinney, 2001) where a preliminary route alignment was suggested. In 2008, the Green Square Transport Management and Accessibility Plan (TMAP) further identified the GS2AC as the transport strategy to improve access to the Green Square Town Centre. The City of Sydney is currently in the process of acquiring land for the proposed GS2AC based on a preliminary concept plan outlined by AECOM.

The proposed road's intersection with O'Riordan Street is at a sag point along O'Riordan which floods to a depth of approximately 1m in a 100 yr flood event.

The GS2AC site is generally flood prone and any development within the site needs to address the flood risk associated with the development. Additionally, the proposed development should not have an adverse impact on the surrounding environment.

This report has been prepared to present the results of hydraulic modelling, which was undertaken to assess the impact of GS2AC on existing flood behaviour. The report also presents the basic hydraulic parameters relevant to the development, in order to manage the flood risk to the development.

It is noted that the impact assessment is for GS2AC only. It has been assumed that the GSTC has been developed to Stage4 (Option2) and the proposed Sydney Water Trunk Drain is also operational before the commencement of GS2AC.

2 GS2AC Details

The GS2AC is proposed to be located in the suburb of Alexandria, extending Bowden Street, at the intersection with Bourke Road, in an easterly direction to the Green Square Town Centre. The route will create a new intersection with O'Riordan Street, prior to connecting to the new intersection of Geddes Avenue and Botany Road (currently under construction as part of the Green Square Town Centre Essential Infrastructure and Public Domain works).

The GS2AC design has been undertaken by AECOM and the complete terrain was provided for modeling purposes. Figure 1 shows the terrain. The current land use where the GS2AC will pass is light industrial. The terrain provided for modelling also includes two developments along GS2AC west of Botany Road.

The detailed drainage design for GS2AC would be completed as per the Council requirements and the standard AR&R minor/major system design philosophy. The infrastructure development application is required to incorporate street drainage catering

for a 20 year ARI event and the road network to act as an overland flow path for flood greater than the 20 year ARI event.

3 Hydraulic Modelling

3.1 Existing Conditions

Development of GS2AC would follow completion of Stage 4 development in the GSTC. In addition, the proposed Sydney Water Trunk Drain is also under construction and would be completed before the GS2AC works commence. The existing conditions for the assessment of GS2AC include completed Stage 4 and the Sydney Water Trunk Drain.

The Stage 4 terrain has been used as the base case to assess the impact of GS2AC development.

It is noted that two options for Stage 4 were considered previously. The base case used for the current study is based on Option 2 of Stage 4.

3.2 Hydraulic Model Development

The SOBEK hydraulic model developed for the draft Alexandra Canal Catchment Flood Study has been adopted for the assessment of GS2AC. This model is based on a 4 m grid and utilises the direct rainfall method for hydrological modelling. The model grid is derived from the Lidar data acquired by Council in 2009.

The proposed terrain for GS2AC was provided by AECOM. This terrain is based on the surveyed ground levels and where the existing levels have been retained, some differences with the Lidar data are likely. This implies that the model grid generated from the two sets of data would have some discrepancies, which can possibly impact the modelled flood levels.

The terrain data was processed to develop a 4m grid for the site. The lots allocated for development purposes were blocked out in the grid such that flow does not occur through these lots.

The elevation grid for GS2AC is shown in Figure 2 and the difference with the base case grid is shown in Figure 3.

The GS2AC grid was incorporated in the existing model such that it replaced the existing features within the development site boundary. The terrain for GS2AC was simply stamped on to the Alexandra Canal Catchment Flood Study grid. No refinement at the boundary of the two grids was undertaken since data was not available to rectify any discrepancies at the boundary of the two grids.

3.3 Design Flood Modelling

Modelling was undertaken for the existing and developed conditions (with GS2AC) for the 20 year and 100 year ARI events together with the Probable Maximum Flood (PMF). A two hour duration was adopted for the 20 year and the 100 year flood events and 45 minutes for the PMF. These durations are generally considered to be critical for the Alexandra Canal Catchment.

4 Impact Assessment

The modelling results for the base case and GS2AC development conditions were processed and the difference in flood levels for the two conditions were mapped. Although the results showed an improvement at the O'Riordan Street intersection with GS2AC, a significant adverse impact was created in the area near the Bourke Road intersection with GS2AC. This was due to additional flows travelling west down GS2AC from O'Riordan Street sag.

A number of options were considered to remove this impact, including raising the crest of GS2AC west of O'Riordan Street intersection and provision of drainage in the GS2AC sag west of O'Riordan Street. The street drainage was assumed to discharge directly into the Sydney Water Trunk at that location.

It is noted that a secondary consideration was to reduce the existing high flood hazard at the O'Riordan Street sag.

After a few iterations of the GS2AC terrain, a suitable outcome was achieved, as confirmed through modeling. The drainage from the GS2AC sag west of O'Riordan was also limited to 2.3 m3/s to minimise downstream impacts.

The 20 year difference in flood levels is shown in Figure 4 whereas the 100 year difference is shown in Figure 5. Flood level differences greater than 0.01m are shown in these figures.

The 100 year results for the adopted GS2AC terrain show that the flood levels at O'Riordan Street would drop by 0.35 m as compared to the existing conditions..

At a few locations, the impact is due to the blockage of local overland flow or runoff from the developed lots to the surrounding areas. This impact can be mitigated by providing appropriate internal drainage in the future lot developments or improve the local street drainage or a combination of the two. Other relevant flood risk management measures should also be provided for the proposed development as per the Council DCP.

The impact at the head of Alexandra canal has been assumed to be addressed in the design of Sydney Water Trunk Drain.

The impact of 20 year event is also minor and similar to the 100 year event and can be managed by the provision of local drainage and other appropriate risk management measures.

Figure 6 shows the 100 year flood depth and Figure 7 shows the PMF flood depth for the GS2AC development. The flood depths in these figures is shown as gradation of different colours and should be read with caution.

The proposed design results in significant reduction in flood depths for a 100 year event at O'Riordan Street. However, a significant increase in flood depth occurs near the Bowden Street intersection. Although this depth does not result in high hazard, it is desirable that this depth be further reduced by raising the road levels at the detailed design stage.

The flood depths presented in Figure 6 and Figure 7 are based on the modelled terrain. Since the modelled terrain is based on a 4m grid, the gutter and spill levels at critical low points within the local drainage system are not well defined. As such the flood depth data is approximate and this should be taken into account while using this data. It should also be noted that the local drainage has not been taken into account in

undertaking the flood modelling for the GS2AC development. Provision of local drainage is likely to reduce the flood depths along GS2AC.

Figure 8 shows the 100 year ARI provisional flood hazard for existing conditions and Figure 9 shows the hazard with GS2AC development. The flood hazard has been estimated based on the peak flood depth and peak velocity as obtained in each grid cell of the model.

The proposed GS2AC has a small area of high flood hazard near the intersection with O'Riordan Street. This high hazard is primarily caused by the local high velocities due to the proposed design at that location. A more detailed analysis was undertaken to determine the timing of the peak depth and velocity at the high hazard location. The analysis shows that the provisional hazard remains low during the course of the event due to staggered peaks for the flood depth and velocity.

The GS2AC becomes a major overland flow path in a PMF event, carrying runoff to O'Riordan Street and further west to Bowden Street. This is an important consideration in future planning for critical infrastructure and evacuation planning of the flood prone areas within the catchment.

5 Impact Management

The impact of the proposed GS2AC development can be managed by

- implementing the appropriate GS2AC design as established in this study
- connecting street drainage to the Sydney Water Trunk with a maximum discharge of 2.3 m3/s from the street to the trunk drain.

Other local impacts can be managed by providing either:

- local drainage near the area of impact; or
- provision of an appropriate overland flow path; or
- a combination of the above two options.

As the local impacts relate to the future potential building works, development applications for any development adjacent to the GS2AC will be required to further investigate the impact and determine appropriate management measures.

6 Conclusion

The hydraulic impact of constructing the proposed GS2AC development has been assessed utilising the available hydraulic model from the Alexandra Canal Floodplain Risk Management Study. The assessment is based on the assumption that GSTC work up to Stage 4 (Option 2) would be completed along with the Sydney Water Trunk Drain, before the start of GS2AC works.

This assessment shows that there will be no significant adverse impact of the proposed GS2AC development if the modelled terrain is adopted for the final design. Any local impacts will need to be addressed as part of the future detailed design including the local street drainage for GS2AC. Flood depths and hazard for the GS2AC development for various design flood events have been provided to assist with the flood risk management for the development.

7 Qualifications

The modelling results for the GS2AC are based on the Sydney Water Trunk design, as used in the Stage4 (option2) modelling. Any modifications to this design is likely to change the outcome of this study. Further modelling may be required for any revision in the Trunk design.

Figure 1: Proposed Layout for GS2AC

Figure 2: Terrain for GS2AC

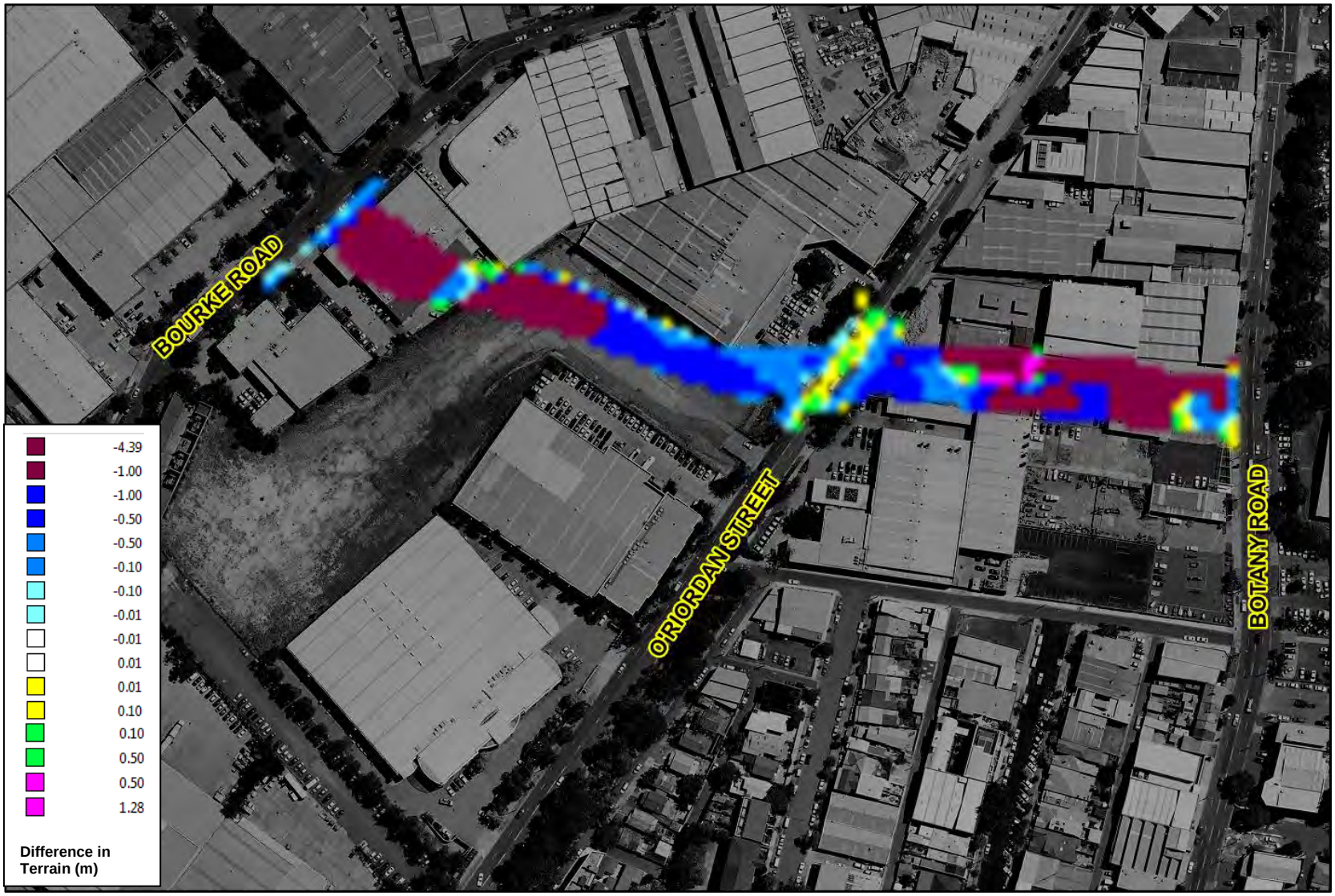

Figure 3: Difference between the GS2AC and Stage 4-Option2 Terrain

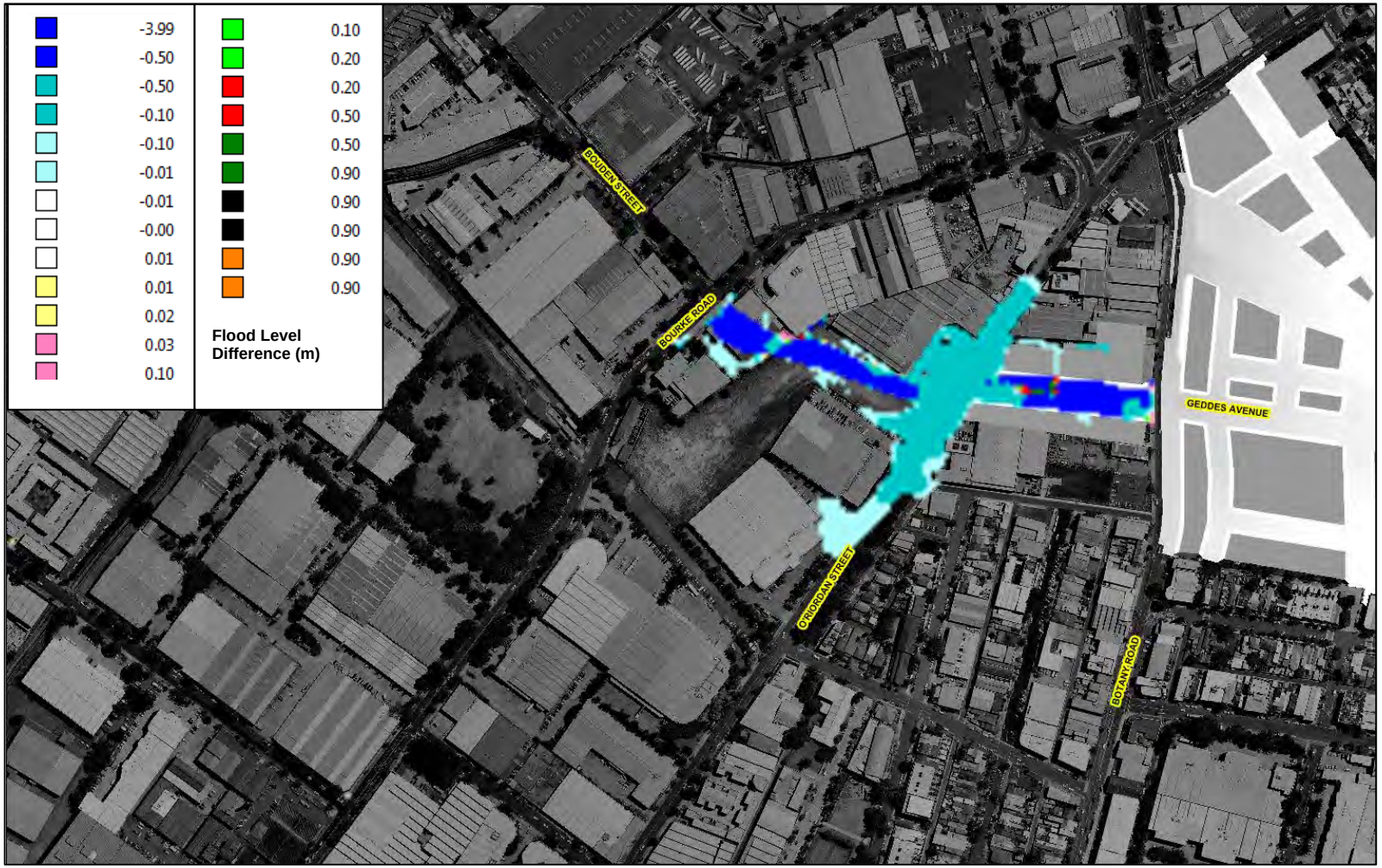

Figure 4: Impact of GS2AC in a 20 year Event - Difference in Flood Level between GS2AC and Stage4-Option2 Conditions (m)

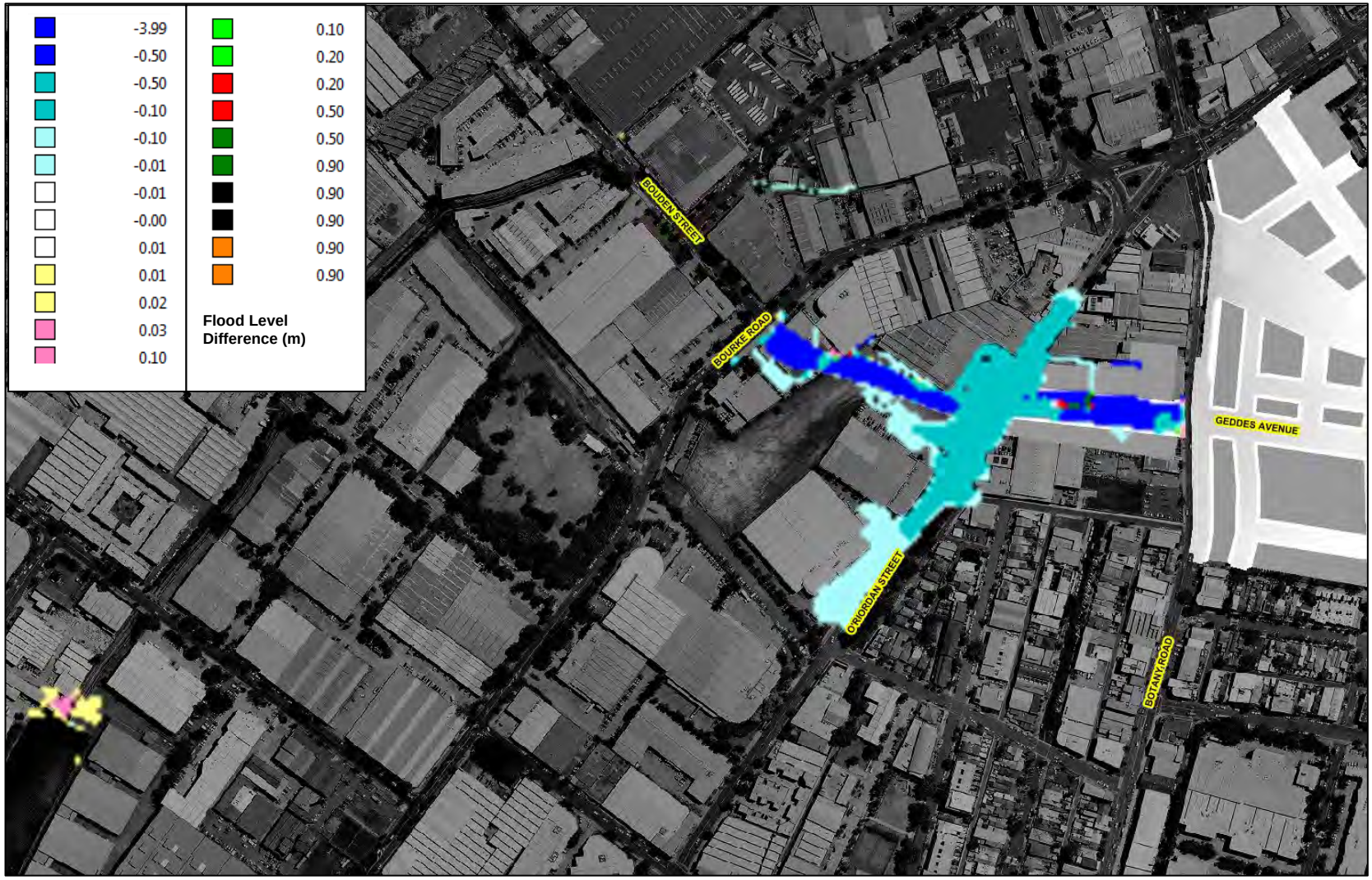

Figure 5: Impact of GS2AC in a 100 year Event - Difference in Flood Level between GS2AC and Stage4-Option2 Conditions (m)

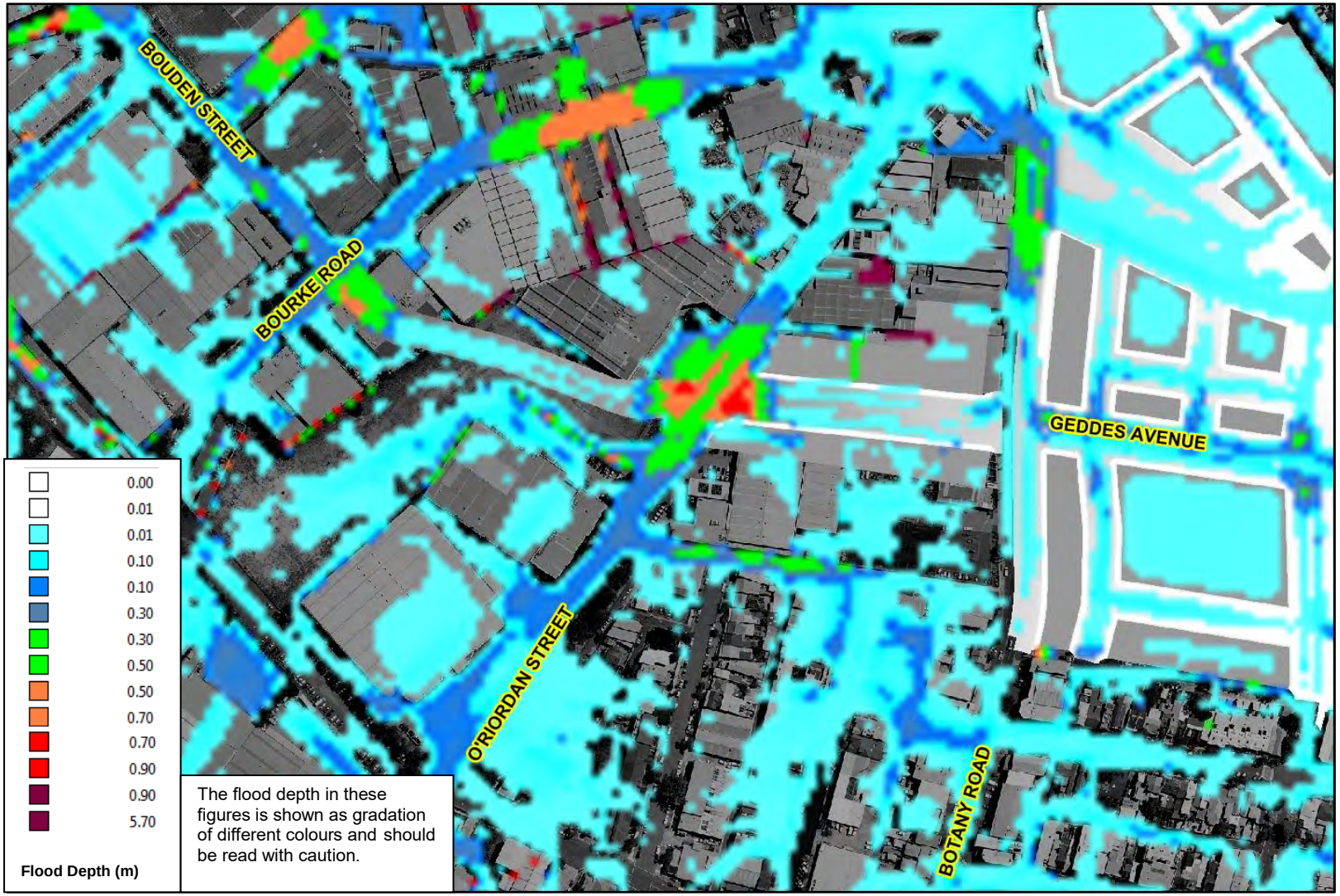

Figure 6: 100 year Flood Depth - GS2AC

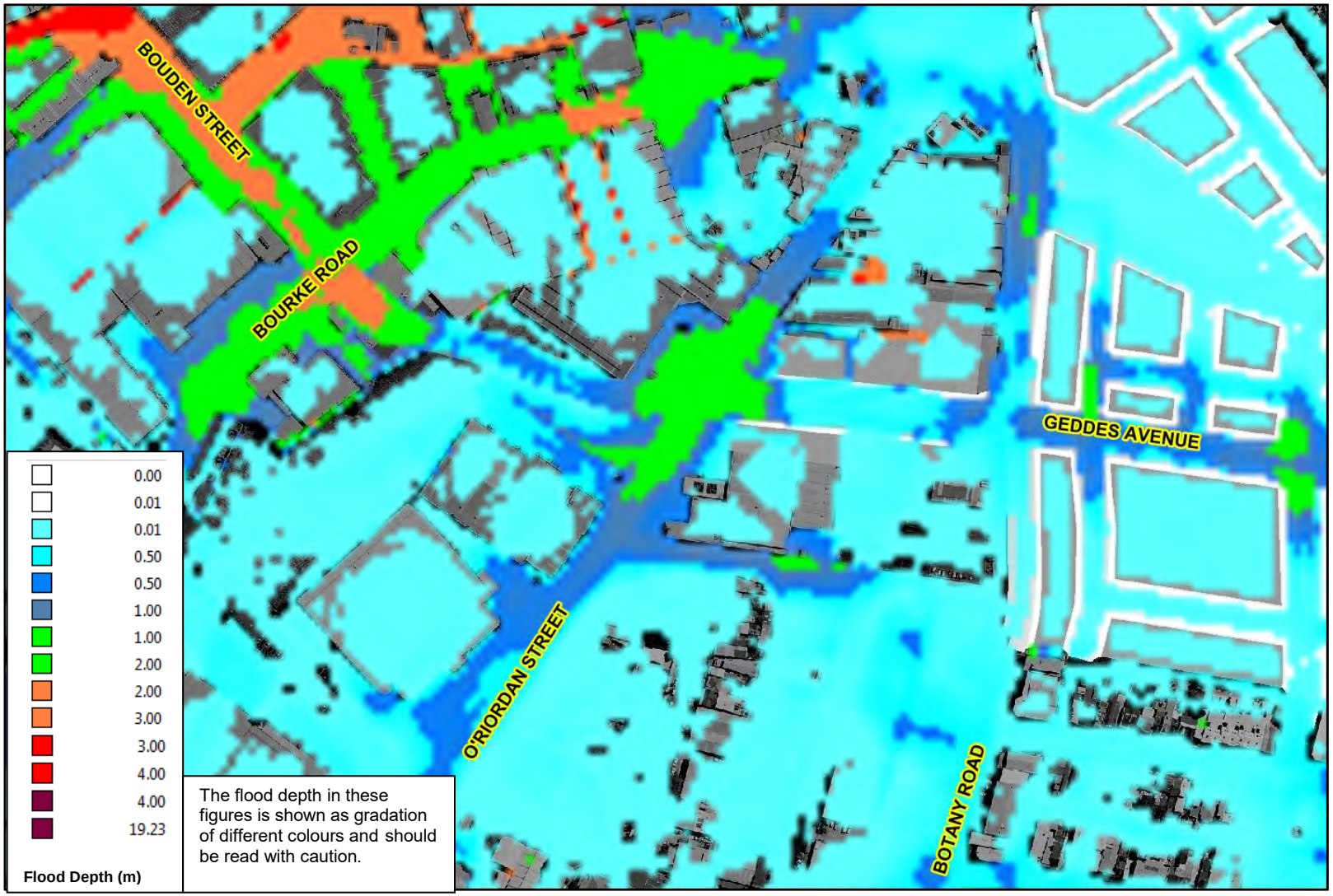

Figure 7: PMF Flood Depth - GS2AC

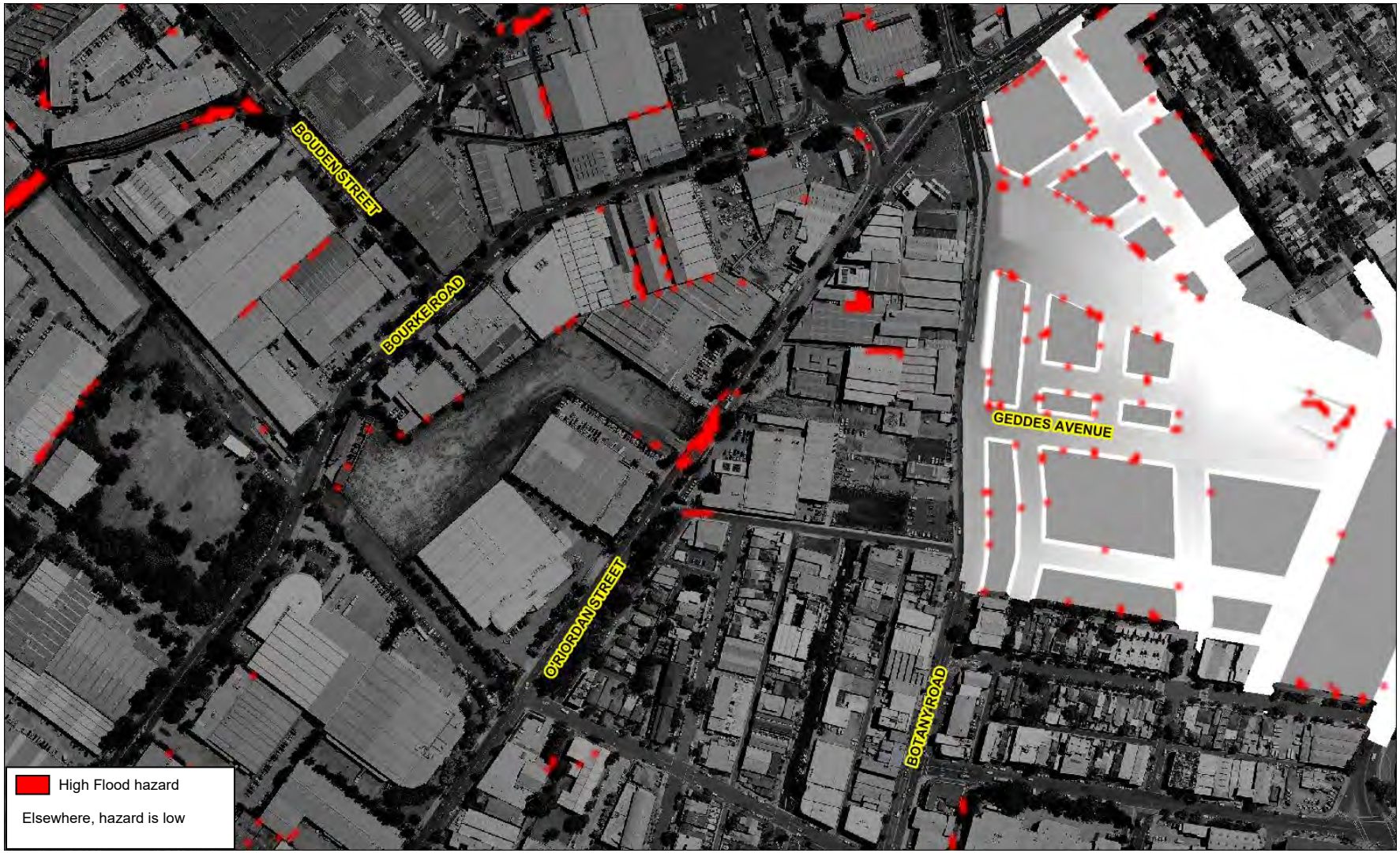

Figure 8: 100 year Provisional High Flood Hazard for Stage 4 (Option 2) - Existing Conditions

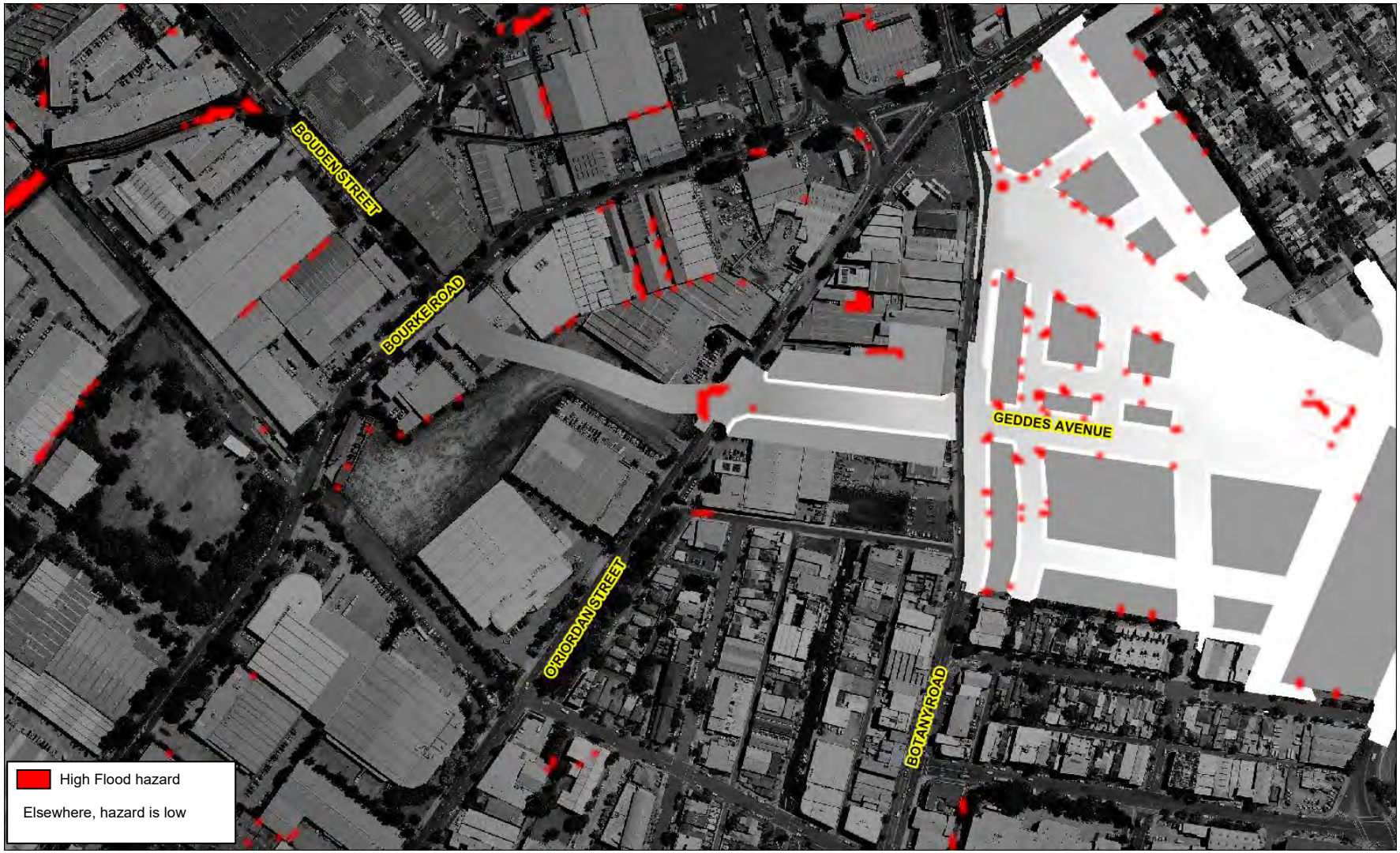

Figure 9: 100 year Provisional High Flood Hazard for GS2AC