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MZ: et

Date: 30/07/2025

Landcom

Level 14 / 60 Station St E

Parramatta, NSW 2150

Attention:	**Tim Chee**
Subject:	**MGN Affordable Housing (R3) – Flood Compliance Letter**

Hi Tim Chee

This **flood compliance letter** has been prepared by J. Wyndham Prince (**JWP**) on behalf of Landcom (**the Applicant**) to accompany a State Significant Development Application (SSDA) for an affordable housing development within the Macarthur Gardens North precinct (MGN) in the Campbelltown Local Government Area (LGA). The MGN precinct is identified as Lot 1097 in DP1182558.

1. INTRODUCTION

The SSDA seeks development consent for a 100% affordable housing development on site R3 of the MGN Precinct, specifically for:

- Construction of two 3 to 9-storey residential flat buildings
- 130 dwellings, all of which are affordable housing
- One basement level for car parking
- Landscaping
- Communal open space area

The purpose of the project is to facilitate the delivery of high-quality, affordable housing on a strategically located site consistent with the vision for MGN.

This letter has been prepared to address the Secretary's Environmental Assessment Requirements (SEARs) issued for the project (SSD-80482713) on 16 July 2025. Specifically, it addresses section 19 of the SEARs as outlined in Table 1-1.

Table 1-1: Secretary's Environmental Assessment Requirements (SEARs)

Item	Description of requirement	Reference

19. Flood Risk	• Identify the flood planning area and level as set out in the relevant EPI and other supporting documents to determine.
	  ○ The flood extent and velocity up to the Probable Maximum Flood and risk on-site, having regard to adopted flood studies, floodplain risk management studies and plans
	  ○ The site access and egress routes
	  ○ The potential effects of climate change,
	  ○ any relevant provisions of the NSW Flood Risk Management Manual, and any other relevant guidelines
		Section 5 and Appendix A – Section 5

	• Where the development is occurring on flood-prone land, a flood impact and risk assessment (FIRA) must be prepared, having regard to the Flood Impact and Risk Assessment – Flood Risk Management Guide LU01. When determining the scope and category of the FIRA, the requirements outlined in the FIRA guide must be taken into account.	Section 5 and Appendix A – Section 5
	• Detail any flood risk management measures that are to be incorporated as part of the development, having regard to relevant guidelines (including any design solutions, flood modification measures, property modification measures, operational procedures or Flood Emergency Response Plan).	Appendix A – Section 3

2. BACKGROUND

On 14 December 2022, the Sydney Western City Planning Panel approved 3944/2021/DA-SW, which comprised:

- A concept masterplan for mixed-use development within MGN (Plate 2-1)
- Stage 1 works (parks, civil works, landscaping and subdivision of the site into super lots)

The masterplan sets the planning context for MGN. Importantly, the use and building envelopes for the site are subject to this SSDA, outlined in red below.

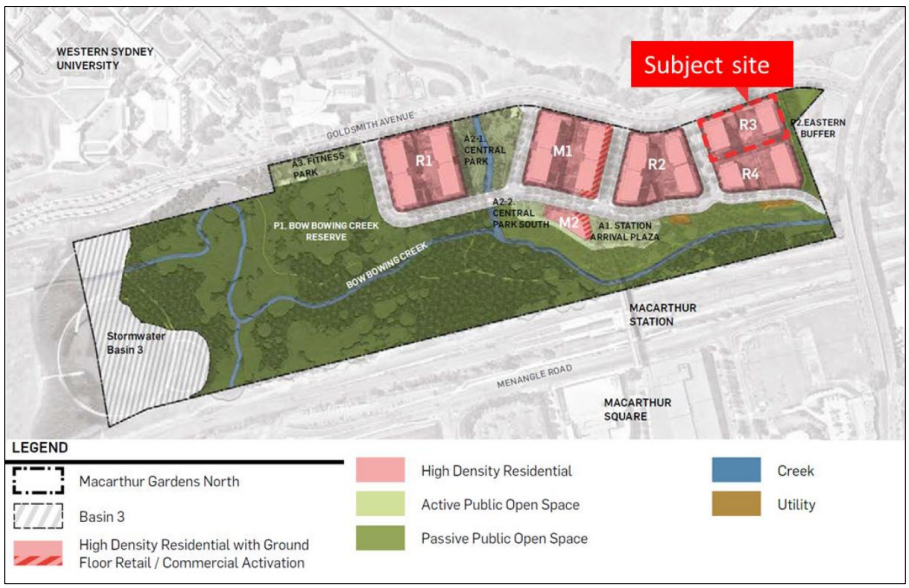

Plate 2-1- R3 Site Location

3. SITE DESCRIPTION

The site is located in the MGN precinct within the Campbelltown LGA. The MGN Precinct is legally described as Lot 1097 in DP1182558.

As shown in Plate 3-1 below, the site is situated in the northeastern corner of MGN and is rectangular in shape. The site has an area of 4,895 m² and is currently bounded by Goldsmith Avenue to the north, vacant land (known as Site R3 within the 3944/2021/DA-SW concept masterplan) to the south, and a pedestrian link and road, which are under construction, to the east and west, respectively.

The site is zoned R4 High Density Residential pursuant to the Campbelltown Local Environmental Plan 2015 and is currently vacant land which has been excavated in accordance with Stage 1 of the 3944/2021/DA-SW approval.

Plate 3-1-The site (Source: Nearmaps)

The site is also strategically located within the Glenfield to Macarthur Urban Renewal Corridor, which is identified by the Department of Planning, Housing and Infrastructure as a corridor to accelerate housing and jobs.

Surrounding context

The vision for MGN is a mixed-use development precinct. Once developed, the site will be immediately bounded by high-density residential areas, roads, and landscape buffers. Outside of the MGN precinct, the broader site context is characterised by educational establishments to the north and northwest (Western Sydney University and TAFE), vacant undeveloped land to the west, Macarthur Train Station, railway lines, commercial premises (including Macarthur Square Shopping Centre) and low density residential to the south and a recreation area known as Gilchrist Oval to the east.

The site is also located approximately 43 kilometres southwest of the Sydney CBD, and 20km southwest of Liverpool.

4. RELEVANT GUIDELINES

The following control documents have been used to inform this assessment:

- The Secretary's Environmental Assessment Requirements (SEARs) dated 16 July 2025
- Campbelltown City Council – Engineering Design for Development

As per the council's Engineering Design guidelines:

- Section 4.5: Fill and Floor Levels:
  - The council sets fill levels for properties at the controlling 100-year flood level. Floor levels are then set at the fill level plus appropriate freeboard. Additionally, the finished floor levels for habitable areas are required to be a minimum of 150 mm above the surrounding finished ground levels (requirement of AS 2870 Cl. 5.2.2). This allowance is to accommodate minor overland flow that may affect any property in the event of an extreme storm event. Council recommends that this value be increased to 300 mm.
  - The flooding and associated freeboard that reaches the highest level on a particular site will be used to determine the required floor level.
- Section 4.13.8: underground car park facilities:
  - Must demonstrate that access and entry points are not affected by the 100-year ARI (1% AEP) flood
  - The lip of the driveway must be located at or above the 100-year ARI flood level
  - Any ramp down to an underground car park must be covered to minimise rainwater intrusion.

5. COMPLIANCE ASSESSMENT

J. Wyndham Prince (JWP) has undertaken a Flood Impact Assessment (FIA) in March 2023 for MGN in March 2023 to support DA. The FIA 2023 concluded that the MGN development would not have an adverse impact on either upstream or downstream areas from the site during the 1% AEP storm event.

Since the amendment to the Current Concept approval (3944/2021/DA-SW/A) does not propose alterations to the proposed design surface or MGN masterplan, including the proposed building footprint and road layout, the FIA 2023 remains valid to support the DA amendment of MGN, and updated TUFLOW modelling is not deemed necessary.

5.1. Floor Level Compliance

The proposed underground parking entrance (ID1), along with the entry points for both the western and eastern buildings (IDs 2 to 5), are shown in Plate 5-1. Each of these buildings has two access points, with floor levels of 78.65 m AHD and 77.95 m AHD for the western and eastern towers, respectively. A comparison of the proposed floor level compliance for these points against the relevant requirements is provided in Table 5-1.

Plate 5-1 - MGN R3 Entry Locations

Table 5-1– Floor Level Compliance Assessment

ID	Location	1% AEP Flood Level (m AHD)	PMF Flood Level (m AHD)	Compliance Level (m AHD)	Proposed Floor Level (m AHD)	Compliance
1	GL Car Park Entrance	76.67	Not Relevant	76.67	76.67	Yes
2	Western Building GL Lobby (Western Access)	77.87	77.93	78.17	78.65	Yes
3	Eastern Building GL Lobby (Northeastern Access)	77.16	77.17	77.46	77.95	Yes
4	Western Building GL Lobby (Goldsmith Ave)	Dry*	Dry*	N/A	78.65	Yes
5	Eastern Building GL Lobby (Goldsmith Ave)	Dry*	Dry*	N/A	77.95	Yes

* Dry: Flood depths less than 100 mm are excluded from this assessment, as it was considered shallow overland flow that the street stormwater network would manage.

5.2. Climate change

The entrance points of the proposed buildings are flood-free during the PMF event (See Table 5-1). Considering that the flood level of the PMF event is generally higher than 1% AEP with climate change, the proposed floor levels are not sensitive to the climate change impact.

5.3. Flood Hazard

The PMF hazard level in the vicinity of the site was H1 (generally safe for people and vehicles) in the developed case flood modelling results; therefore, the proposed development is deemed safe.

5.4. Evacuation Route

The site vicinity is subject to shallow overland flow with no significant flood hazard during the PMF event, and Goldsmith Avenue can be used as a flood evacuation route by a future resident of the MGN Precinct.

6. CONCLUSION

This assessment compares the proposed plan against the council's Engineering Design for Development and Secretary's Environmental Assessment Requirements (SEARs). The results of this assessment confirm that the proposed development is compliant with the relevant council's Engineering Design for Development and SEARs.

Yours faithfully

MEHDI ZOMORODIAN

Mehdi Zomorodian

Principal Water Resources Engineer

APPENDIX A – JWP FLOOD IMPACT ASSESSMENT

Flood Impact Assessment

LANDCOM

Macarthur Garden North Master Plan

March 2023

J. WYNDHAM PRINCE
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Version control

Issue	Author	Reviewer	Approver	Date approved
A – For DA1	Sabina Lohani	David Crompton	David Crompton	01/05/2020
B – First Issue	Sabina Lohani	David Crompton	David Crompton	06/05/2020
C – For DA Submission	Sabina Lohani	David Crompton	David Crompton	19/08/2020
D – Updated Masterplan	Sabina Lohani	David Crompton	David Crompton	21/02/2022
E – Updated Masterplan	Sabina Lohani	Sabina Lohani	Sabina Lohani	16/05/2022
F – Updated Design	Sabina Lohani	Sabina Lohani	Sabina Lohani 	10/03/2023

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PLATES

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1. EXECUTIVE SUMMARY

This Flood Impact Assessment Report has been prepared by J. Wyndham Prince on behalf of Landcom to support the preparation of the Development Application (DA) for the Macarthur Garden North (MGN) master plan and to understand the impact of flooding on the neighbouring properties during the design flood events.

The MGN is on a greenfield site within the Western Sydney University Campbelltown development site. The site borders Goldsmith Avenue to the North and Gilchrist Drive to the east. The development comprises towered high-density residential development.

The flood modelling is undertaken within TUFLOW to determine flood extents, levels and flows for a range of storm events, with comparisons made between the “developed” landform and “existing” site conditions.

The results from a 1% AEP storm event assessment indicates that the development extent is generally well clear of the 1% AEP flood extents and the flood levels downstream of the site (at Gilchrist Basin) are not increased as a result of the development of the MGN site. There is also no reportable increase in flood level external to the MGN site.

In conclusion, the results of this Flood Impact Assessment demonstrated that the MGN development, will not have an adverse impact upstream and downstream from the site in the 1% AEP storm event.

Furthermore, critical DCF failure scenario (Fail Basin 1, 2 & 3 west of the site) assessment was also undertaken and concluded that flood inundation along the road is generally safe H1 Hazard flow within the proposed MGN development except at road sags on north-west portion of the site is H3 hazard. It also concluded that the proposed floor level of all the buildings within the Macarthur Garden North would be at or above the flood level of the critical DCF failure scenario (Fail Basin 1, 2 & 3) of 74.0 m AHD to avoid dam failure flood risk demonstrating compliance with Council requirement.

J. Wyndham Prince, therefore, supports the master plan submission for the MGN development and hereby include mapping of the 1% AEP and PMF together with DCF failure scenario (Fail Basin 1, 2 & 3) results for Council consideration.

2. BACKGROUND

2.1. Subject Site

The Macarthur Garden North (MGN) site is located in the suburb of Campbelltown within the Western Sydney University (WSU) development. The overall WSU Campbelltown development site is bounded by the Southern railway line, the Hume Highway, Narellan Road and Macarthur Railway Station.

The MGN site is situated at the confluence of Bow Bowing Creek and tributaries of Bow Bowing Creek and is bounded by Goldsmith Avenue to the north, southern railway line to the south, Basin 3 to the west and Gilchrist Drive to the east. The Bow Bowing Creek traverses the MGN Precinct running from west to east. The MGN is located on a greenfield site of approximately 18.52 ha. The site terrain is at a low level and is relatively flat. The site locality is provided in **Plate 2-1**.

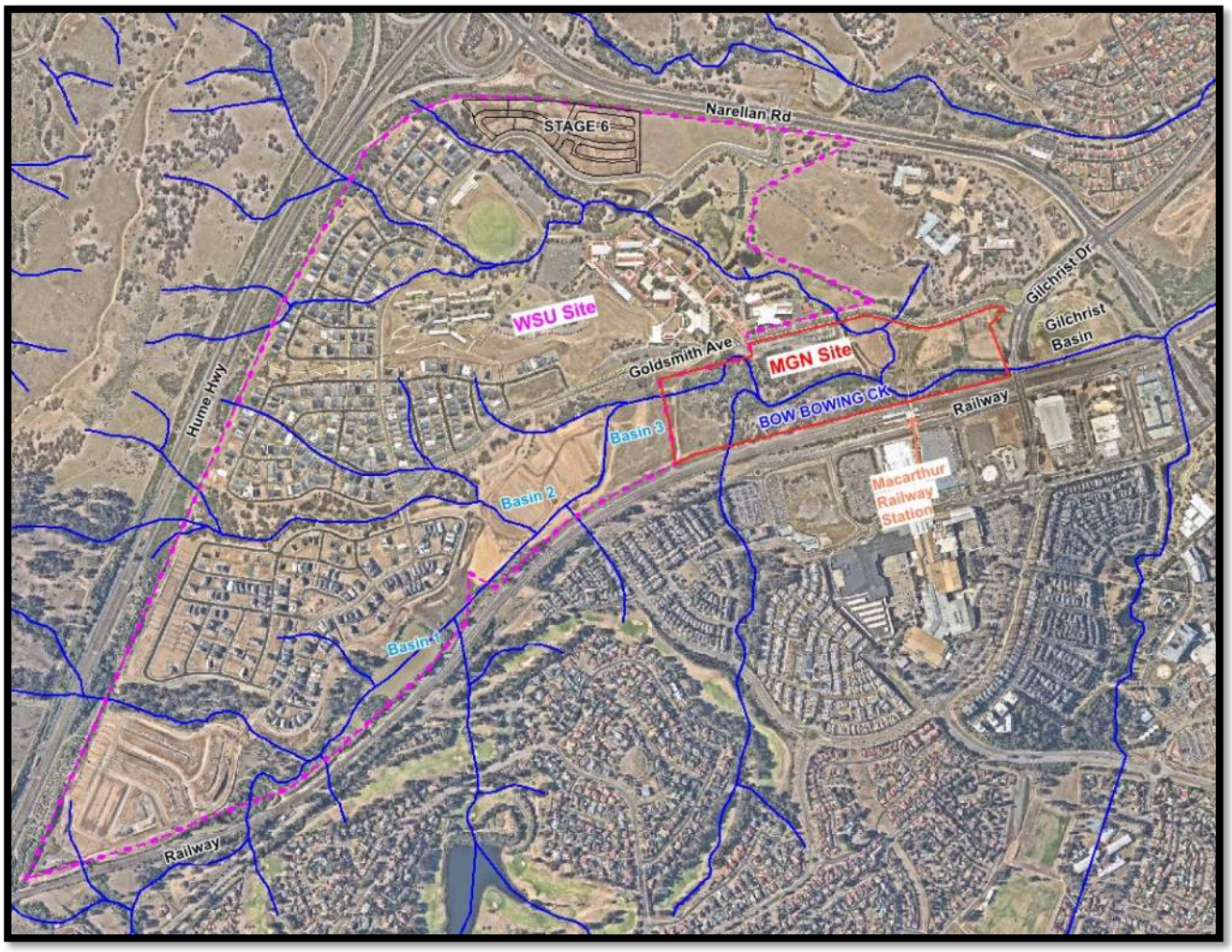


Plate 2-1 – Locality Plan

Three (3) existing cascading detention basins are located towards the west of the MGN site. The existing outlet from Basin 3 is situated on the north-east corner of the basin which discharge to the existing meandering Bow Bowing Creek inverts. These basins discharge to Bow Bowing Creek towards / alongside the MGN site and ultimately into Gilchrist Basin approximately 80 m downstream of MGN.

2.2. Proposed Development

We understand that Landcom is planning to develop a residential density with multiple towered buildings which includes apartment units and strata development. In addition, the proposed development layout includes roads, recreational open space / water body and drainage corridor.

The total development footprint in MGN is 6.6 ha. The site consists of Existing Ecological Endangered Communities (EEC) and Riverflat Eucalyptus vegetation communities which are proposed to be retained as part of this development application.

The master plan of the proposed MGN development is provided in **Plate 2-2** and in **Appendix A**.

Plate 2-2 – Macarthur Garden North Precinct Master Plan

2.3. Objective

The objective of this assessment is to support the preparation of the Development Application (DA) for the MGN master plan by reviewing existing reports and undertake an assessment of flooding within and near the subject site. The report will also assess the compliance or otherwise of the planned development with the Council's Development Control Plan (DCP) and other relevant flood policies.

3. PREVIOUS STUDIES

3.1. Upper Bow Bowing Creek TUFLOW Modelling (Campbelltown City Council, 2013)

In 2014, Campbelltown City Council (through its consultant – Catchment Simulation Solutions) prepared TUFLOW modelling of the WSU site and surrounding catchments. This modelling included the three (3) regional detention basins within WSU Campbelltown along with all undeveloped areas of WSU, Macarthur Gardens North (MGN) and surrounding areas.

The TUFLOW Models were provided to J. Wyndham Prince on an external hard drive on the 6th May 2014. Upon review, J. Wyndham Prince provided a detailed "Issues Paper" including several recommendations for further refinement of the modelling to better reflect "existing" conditions (JWP, 2014).

Through liaison with Campbelltown City Council, refinements were agreed to and undertaken within the models and have subsequently been adopted as the "base case" (i.e. existing conditions) as presented in Section 6 of the WSU Campbelltown & Macarthur Gardens North Residential Development Revised Basin Strategy & Flood Modelling Report – J. Wyndham Prince (JWP, 2017).

The most significant modification was that in the Council model, the residential development of WSU Campbelltown was considered to have occurred and was included in the base case (i.e. existing conditions). It was agreed that to test the potential impact of the WSU Campbelltown development, the "existing conditions" should exclude the proposed development works at WSU Campbelltown.

3.2. WSU Campbelltown & Macarthur Gardens North Residential Development Revised Basin Strategy & Flood Modelling Report – J. Wyndham Prince (JWP, 2017)

In 2017, J. Wyndham Prince was commissioned by Urban Growth NSW to further revise the basin strategy for WSU and demonstrate the overall basin performance within TUFLOW and in addition, create an "Ultimate" development scenario. This "Ultimate" Scenario was to represent all of the latest development proposals across both WSU and MGN within one (1) combined model. Importantly, Council can then use the model results to approve all current DA / CC applications and to provide a base case for the approval of future applications (providing no significant changes).

The amended basin strategy included a reconstruction of Basin 2 and 3 to be consistent with the Sports field DA plans including a low flow channel / riparian corridor, playing fields, elevated platform between Basin 2 and 3, Macarthur Trail, elevated raingarden, staged basin outlets and reformed basin embankments.

The findings of this report are summarised as follows:

- Results from XP-RAFTS modelling confirmed that the "Ultimate" Scenario will manage developed flows within the proposed basins whilst ensuring that downstream areas are not adversely affected. The strategy will deliver an improved outcome from existing conditions with a reduction in downstream regional flows benefiting local communities.
- Flood Mapping and Flood Difference Mapping indicated that:
  - By implementing the proposed basin works, flood levels at Gilchrist Basin and downstream from Basin 3 are generally lower than under existing conditions (improvement)
  - No flood differences at Basin 1 (Harrison's Dam)
  - Some isolated increases in flood levels within the bounds of the WSU site which can be accommodated within the riparian corridors and drainage reserves and by the additional filling of the urban areas within the development.
- Results, therefore, demonstrated that the amended basin strategy under "Ultimate" Conditions strategy will manage flows from the proposed WSU development within the proposed basins whilst ensuring that downstream levels and adjacent properties are not adversely impacted. These results were shown to be relatively consistent with XP-RAFTS modelling.

3.3. Western Sydney University Campbelltown, Basin 3 Construction Certificate Flood Assessment (JWP, 2021)

The Basin 3 Construction Certificate Flood Assessment was undertaken by J. Wyndham Prince in January 2021 to support the Construction Certificate design of regional detention Basin 3 at Western Sydney University (WSU) Campbelltown. The proposed works included a modification to the eastern embankment of Basin 3 and the inclusion of a low flow pipe to drain this area, together with earthworks and outlet modifications to Basin 2.

The XP-RAFTS hydrologic and TUFLOW hydraulic models described in the 2017 Revised Basin Strategy report (JWP, 2017) have been updated to reflect the proposed works in this assessment. Updated flood mapping presented as a part of Basin 3 assessment confirmed that there were no adverse flood impacts external to the site.

3.4. Western Sydney University Campbelltown, Stage 6 Development Application Flood Assessment (JWP, 2021)

J. Wyndham Prince undertook the flood assessment in September 2021 to support the Development Application of the Stage 6 subdivision development at Western Sydney University (WSU) Campbelltown.

WSU Stage 6 assessment (JWP 2021), updated the 2017 WSU Campbelltown ultimate conditions flood assessment to reflect the WSU Stage 6 development. The flood assessment confirmed that there were no adverse flood impacts external to the WSU site. Flood differences within the site were consistent with those accepted as part of the 2017 assessment.

4. FLOOD MODELLING ASSESSMENT

4.1. Available data

The following data was used to inform the hydrologic and hydraulic assessment of this study:

- WSU Campbelltown and Macarthur Gardens North Residential Development Revised Basin Strategy hydrologic and hydraulic model (JWP, 2017);
- Western Sydney University Campbelltown, Basin 3 Construction Certificate Flood Assessment hydrologic and hydraulic model (JWP, 2021);
- Western Sydney University Campbelltown, Stage 6 Development Application Flood Assessment (JWP, 2021)
- MGN development 3D surface DWG file (received on 13 February 2023).
- MGN master plan prepared by URBIS (dated 14 December 2021)

4.2. Modelling approach

In order to assess the flood behaviour of the site, the existing XPRAFTS hydrology and TUFLOW 1D/2D floodplain model used extensively for the past 6 years in support of both the WSU and MGN development. This has been used as the basis of this assessment. All parameters have been adopted from 2017 ultimate basin strategy modelling have been adopted unless otherwise specified.

The ‘existing’ conditions and ‘developed’ conditions model have been assessed to consider the existing and future conditions of the MGN precinct.

The “existing” conditions assessment considers the existing topography of the MGN site with the full development of stages 1 – 6, with WSU complete.

The ‘developed’ conditions assessment considers the proposed development landform within MGN.

4.2.1 Hydrology Model Update

The 2017 developed conditions hydrologic model for the broader WSU is adopted as a base hydrology model to develop the existing condition model for the MGN Precinct assessment. The existing condition hydrology model for the MGN assessment includes full development of stages 1 – 6 within WSU with the following updates to the 2017 developed conditions XPRAFTS model:

- The recently approved and constructed Basin 3 and 2 outlets (JWP, 2021);
- The proposed WSU Stage 6 development (JWP, 2021); and
- Existing landform within MGN Precinct.

It is noted from aerial imagery that the majority of the WUS is developed as such the developed condition model has been adopted and updated with existing site conditions within MGN to reflect the current catchment conditions in this assessment.

The developed condition hydrology model for the MGN site includes amendments to the existing condition model based on the proposed master plan for the Precinct from URBIS. The road including verge and building pads are assumed to have 90% and 100% impervious respectively while the remaining area is assumed to be 10% Impervious in order to assess the developed condition flow from the precinct. The existing and developed sub-catchments is provided in **Figure 4-1** and **4-2** respectively in **Appendix B**.

4.2.2 Model Domain Extent

The model domain for this study is kept consistent with the 2017 assessments. A map showing the main features in the TUFLOW model is illustrated in **Figure 4-1**.

4.2.3 Model Version

The 2017 assessment was completed using the 2013 TUFLOW build. The latest TUFLOW build includes improvements in modelling calculation as such, the 2017 assessment has been updated to the latest 2020 TUFLOW Heavily Parallelised Compute (HPC) for this study.

TUFLOW HPC is an explicit solver which has the capability to provide reduced run times per assessment and allows a more efficient modelling process, particularly when testing mitigation options. There may be a slight difference in flood behaviour due to the alternative way the HPC solves the shallow water equation based on the depth rather than levels and use of adaptive time-stepping which allows the model to solve equations with less chance of instabilities. The flood level changes are influenced by the improvement in the way and channel flows are calculated in TUFLOW and will improve the definition of flood behaviour within this catchment.

4.2.4 Terrain

The underlying Digital Terrain Model (DTM) as part of the 2017 study has been used as the base for this assessment. The surface representing upgraded Goldsmith Avenue and the culvert crossing (twin 3.3 m x 1.2 m RCBC) at the north-south tributary crossing is overlaid on the 'existing' condition terrain to be consistent with the current catchment condition along the northern boundary of the site. In addition, an updated design surface for the Basin 2 and Basin 3 area with the storage amendments, together with an amended development pad at RL 80.0 in between the basins (JWP, 2021) is used in the TUFLOW model. It is also noted that the Bow Bowing creek downstream of Basin 3 within the MGN site has now been modelled in the 2d domain. Detailed survey information from the 2017 assessment is utilised to inform the landform in this area. The existing condition terrain is provided in **Figure 4-3** in **Appendix B**.

4.2.5 Flows and Boundary conditions

Flow hydrographs extracted from the hydrological model have been applied to represent developed flows for Bow Bowing Creek and the north-south tributary entering the MGN site. Please refer to **Figure 4-1** in **Appendix B** for the inflow location.

It is noted from aerial imagery, the majority of the WUS is developed as such the developed flow has been applied within WSU, upstream of the MGN site to reflect the current upstream catchment conditions for this assessment. The flow hydrographs were applied as a 'source area' (SA) input consistent with the previous assessments.

4.2.6 Downstream Control

The downstream boundary control conditions remain consistent with Council's supplied model and include discharge controls being located downstream of the Gilchrist Basin.

This boundary control was kept consistent for both the 'existing' and 'developed' conditions.

4.2.7 Developed Scenario

The developed condition model for the MGN site is developed amending the existing condition model. Amendments to the existing condition model for the developed condition MGN site are presented in **Figure 4-2** are summarised below:

- The existing condition XPRAFTS hydrology model developed for this study was updated to reflect the MGN development.
- The developed flows were extracted for 1% and PMF event for developed catchments within MGN and are applied in TUFLOW hydraulic model.
- Revised land uses consistent with the MGN masterplan layout (Urbis, 14 December 2021) have been used and applied in accordance with Council's adopted materials roughness for the Upper Bow Bowing Creek model.
- Under 'developed' conditions, the terrain was updated with the design surface for MGN received on 13 February 2023 and is provided in **Figure 4-4** in **Appendix B**.
- A twin culvert of size 3.3 m (w) x 1.2 m (H) is provided to allow conveyance of north-south tributary through the proposed central park of the MGN development with no blockage applied.

5. FLOOD MODELLING RESULTS

J. Wyndham Prince has assessed the flood behaviour for the 1% AEP and PMF storm events under existing and developed conditions. The flood depth, level and hazard mapping for existing and developed conditions are shown in **Figures 5-1** to **5-8** in **Appendix B**.

5.1. Existing Condition Flood behaviour

During the 1% AEP event, mainstream flows breach the banks of the Bow Bowing Creek at its confluence with the north-south tributary adjoining and towards the eastern side of the MGN site. The flood level on Goldsmith Avenue is 73 m AHD at the north-south tributary crossing and 77 m AHD at Goldsmith Avenue near Gilchrist Drive intersection. The peak flows from Goldsmith Avenue is then conveyed through the MGN site (see **Figure 5-1** for details). In the 1% AEP event the overland flow is conveyed in a southerly direction from Goldsmith Avenue through the site to Bow Bowing Creek.

The flood levels range from 77 m AHD near Goldsmith Avenue to 69 m AHD at the Bow Bowing Creek at the eastern boundary of the site. During the PMF storm event the majority of the MGN site is inundated.

The 1% AEP and PMF storm event existing condition flood level, extent and depth are shown in **Figures 5-1** to **5-4** in **Appendix B**.

5.2. Developed Condition Flood behaviour

The 1% AEP storm event result for the developed condition shows that the peak flood level at the Bow Bowing Creek is 69 m AHD at the eastern boundary of the site and the flood level on Goldsmith Avenue is 73 m AHD at the north-south tributary crossing. It is noticed that the MGN development is not affected by mainstream flooding in 1% AEP storm events. However, the overland flow from Goldsmith Avenue enters the development site through the proposed road network with a very shallow flood depth of less than 0.1 m in a 1% AEP event. This minor flow will be managed by the future internal street drainage system which is not included in the TUFLOW model. It is noted that the proposed road along the north-western boundary of the site is inundated during the PMF storm event. The developed condition 1% AEP and PMF storm events flood level, depth and hazard are shown in **Figure 5-5** to **5-8** in **Appendix B**.

The hazard result indicates that the proposed MGN development is generally limited to low H1 hazard across proposed roads and lots including Goldsmith Avenue for the 1% AEP storm event. The high H5 hazard, which is unsafe for vehicles and people is seen along the Bow Bowing Creek and proposed central park along the north-south tributary which is evident within the main channel.

PMF result in developed condition suggests high H5 hazard along the proposed road surrounding the north-western tower building of the site, which is unsafe for vehicles and people. However, all the proposed roads and lots to the east of the proposed central park are generally limited to low H1 hazard in PMF events. It is noted that all finished floor levels will be above the minimum of 1% AEP plus freeboard.

The safe evacuation of people from the western towers during a PMF event is recognised as a key design consideration for the MGN development. Flood evacuation routes are to be identified ensuring a “continuous rising grade” can be maintained to a level above the PMF for all evacuees, with connections to the designated regional evacuation routes.

It is important to note that Goldsmith Avenue has been constructed to a higher level (above the 1% AEP) in order to provide a flood evacuation route for residential development areas in Stages 1 – 5 within WSU. As such Goldsmith Avenue can be used as a flood evacuation route by a future resident of the MGN Precinct.

5.3. Impact assessment

The impact of the proposed development at MGN on flooding was assessed by comparing the peak flood levels under existing and developed conditions. The assessed peak flood level differences under the 1% AEP event is shown in **Figure 5-9** in **Appendix B**. As a result of the MGN development, a localised increase in flood levels of up to 0.10 m occurs along the Bow Bowing Creek during the 1% AEP event.

However, the 1% AEP flood impact demonstrated that there are no adverse flood level impacts to the neighbouring properties and at Gilchrist Basin as a result of the MGN development.

6. IMPACT OF CRITICAL DAM BREAK ON MACARTHUR GARDEN NORTH

The Dam Break Assessment Report have been prepared by J. Wyndham Prince on 16 February 2022 on behalf of Landcom to support the preparation of the Development Application (DA) for Macarthur Garden North (MGN) master plan. This study assessed the flooding impact and potential hazard that a “Dam Failure” of three (3) online cascading regional detention basins situated adjacent to the Macarthur Heights Estate may have on the future MGN development.

The Dam Break Assessment was undertaken in TUFLOW for these three (3) regional detentions basins. The assessment showed that failure of Basin 3 together with basin 1 and 2 has the most significant impact on the future MGN development with producing the highest peak flow of approximately 199m3/s which travel past the MGN.

The assessment of the Population at Risk (PAR), estimation of the severity of damage and environment impact has concluded that Basin 3 would be categorised as a ‘Very Low’ consequence category. A dam information form has been submitted to Dam Safety NSW as a part of this study for their review and advice regarding any further prescription.

The 2022 study concluded that flood inundation along the road is generally safe H1 Hazard flow within the proposed MGN development except at road sags on north-west portion of the site is H3 hazard. It also concluded that the proposed floor level of all the buildings within the Macarthur Garden North would be at or above the flood level of the critical DCF failure scenario (Fail Basin 1, 2 & 3) of 74.0 m AHD to avoid dam failure flood risk demonstrating compliance with Council requirement.

However, due to the update on the design surface, the critical DCF failure scenario (Fail Basin 1, 2 & 3) was reassessed as a part of this study. The results indicate that the peak flows under the critical dam break scenario (Fail Basin 1, 2 & 3) are generally conveyed by the existing creek profile. The result showed that flood levels downstream of Basin 3 encroach upon the proposed MGN masterplan development at the northwest corner of the development near Goldsmith Avenue with flood level reaching up to 74.0 m AHD, consistent with 2022 Assessment, and is presented in **Figure 6-1** in **Appendix B** and P**late 6-1**. The flood hazard map for the critical basin failure scenario is provided in **Figure 6-2** in **Appendix B**.

It is understood that the proposed floor level of all the buildings within the Macarthur Garden North is to be at or above the flood level of the critical DCF failure scenario (Fail Basin 1, 2 & 3) of 74.0 m AHD to avoid future flood risk from the worst-case dam failure scenario. These development floor levels are significantly higher than Campbelltown City Council flood planning level (FPL) (i.e. 100% AEP plus 0.5 m freeboard). To explain further, 1% AEP AEP flood level surrounding the western building is 73 m AHD (refer to **Figure 5-5** in **Appendix B**). Hence, demonstrating compliance with the Council requirement, the FPL for the western building would be approximately 73.5 m AHD, however, it is proposed to have a floor level of 74m AHD for the development suggesting the freeboard of 1m, considering critical basin failure scenario (i.e 4000y ARI).

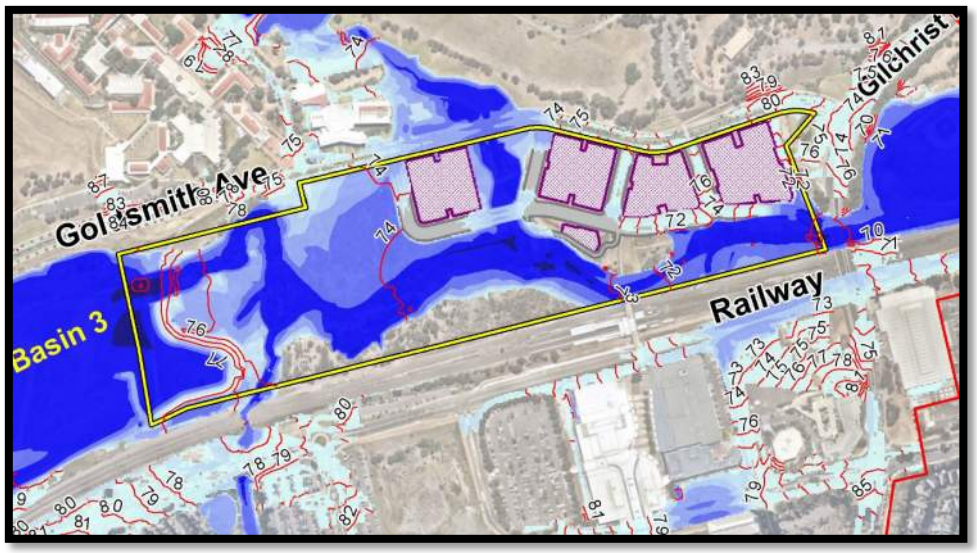


Plate 6-1 – Critical DCF Failure Scenario (4000y ARI) Flood Depth and Levels

7. GLOSSARY

Term	Definition
Airborne Laser Survey (ALS)	Is a technique for obtaining a definition of the surface elevation (ground, buildings, power lines, trees, etc.) by pulsing a laser beam at the ground from an airborne vehicle (generally a plane) and measuring the time taken for the laser beam to return to a scanning device fixed to the plane. The time taken is a measure of the distance which, when ground-truthed, is generally accurate to ± 150mm.
Annual Exceedance Probability (AEP)	The chance or probability of a natural hazard event (usually a rainfall or flooding event) occurring annually. Normally expressed as a percentage.
Australian Rainfall and Runoff (AR&R)	Refers to the current edition of Australian Rainfall and Runoff published by the Institution of Engineers, Australia.
Dam Crest Flood (DCF)	The flood event where a dam embankment is first overtopped.
Dam Safety Committee (DSC)	A NSW statutory body aligned with Department of Primary Industries. Its function is to ensure the safety of dams within NSW.
Digital Terrain Model (DTM)	Is a spatially referenced three-dimensional (3D) representation of the ground surface represented as discrete point elevations where each cell in the grid represents an elevation above an established datum.
Exceedances per Year (EY)	The number of times a year that statistically a storm flow is exceeded.
Floodplain Planning Level (FPL)	The FPL is a height used to set floor levels for property development in flood-prone areas. It is generally defined as the 1% AEP flood level plus 0.5m freeboard.
Floodplain Development Manual (FDM) and Guidelines (April 2005)	The FDM is a document issued by the Department of Environment Climate Change and Water (DECCW) that provides a strategic approach to floodplain management. The guidelines have been issued by the NSW Department of Planning (DoP) to clarify issues regarding the setting of FPL's. This document is also the framework for the development of Floodplain Risk Management Studies and Plans.
Floodplain Storage Areas	Parts of a floodplain that are important for the temporary storage of floodwaters during the passage of a flood. Loss of flood storage can increase the severity of flood impacts by reducing natural flood attenuation.
Floodway	The areas of the floodplain where a significant discharge of water occurs during floods. They are often aligned with naturally defined channels. Floodways are areas that even if only partially blocked, would cause a significant redistribution of flood flow, or a significant increase in flood levels.
Hyetograph	The distribution of rainfall over time.
Hydrograph	Is a graph that shows how the stormwater discharge changes with time at any particular location.

Term	Definition
Hydrology	The term given to the study of the rainfall and runoff process as it relates to the derivation of hydrographs for given floods.
J. Wyndham Prince Pty Ltd (JWP)	Consulting Civil Infrastructure Engineers and Project Managers undertaking these investigations
MUSIC	A modelling package designed to help urban stormwater professionals visualise possible strategies to tackle urban stormwater hydrology and pollution impacts. MUSIC stands for Model for Urban Stormwater Improvement Conceptualisation and has been developed by the Cooperative Research Centre (CRC),
Peak Discharge	Is the maximum stormwater runoff that occurs during a flood event
Potential Loss of Life (PLL)	Potential Loss of Life assessment
Population at Risk (PAR)	Population at risk assessment
Probable Maximum Flood (PMF)	The greatest depth of precipitation for a given duration meteorologically possible for a given size storm area at a particular location at a particular time of the year, with no allowance made for long-term climatic trends.
Triangular Irregular Network (TIN)	A technique used in the created DTM by developing a mass of interconnected triangles. For each triangle, the ground level is defined at each of the three vertices, thereby defining a plane surface over the area of the triangle
TUFLOW	A computer program that provides two-dimensional (2D) and one dimensional (1D) solutions of the free surface flow equations to simulate flood and tidal wave propagation. It is specifically beneficial where the hydrodynamic behaviour, estuaries, rivers, floodplains and urban drainage environments have complex 2D flow patterns that would be awkward to represent using traditional 1D network models.
XP-RAFTS	Is a runoff routing model that uses the Laurenson non-linear runoff routing procedure to develop a sub catchment stormwater runoff hydrograph from either an actual event (recorded rainfall time series) or a design storm utilising Intensity-Frequency-Duration data together with dimensionless storm temporal patterns as well as standard AR&R 1987 data.

8. REFERENCES

1. Campbelltown City Council (2008) University of Western Sydney Campbelltown – Development Control Plan (dated October 2008).
2. Campbelltown City– Development Control Plan 2015.
3. Campbelltown City Council (2014) TUFLOW Models files (received 6 May 2014)
4. J. Wyndham Prince (2014) "*TUFLOW Modelling Issues Paper – Campbelltown City Council Upper Bow Bowing Creek Model*" – Issues paper e-mailed to Council dated 19 May 2014
5. J. Wyndham Prince (2017) "*WSU Campbelltown and Macarthur Garden North Residential Development – Revised Basin Strategy and Flood Modelling Report*" dated 18 February 2015
6. J. Wyndham Prince (2015) "*Macarthur Gardens North – Flood Impact Assessment*" dated 9 December 2015
7. J. Wyndham Prince (2022) "WSU Campbelltown & Macarthur Garden North Ultimate Development" dated 16 May 2022

APPENDIX A – MGN MASTER PLAN

URBIS

MACARTHUR GARDENS NORTH
MASTER PLAN

DISCLAIMER:

This plan is conceptual and is for discussion purposes only and is subject to further detail study, Council approval, engineering input, and survey. Cadastral boundaries, areas and dimensions are approximate only. Written figured dimensions shall take preference to scaled dimensions.

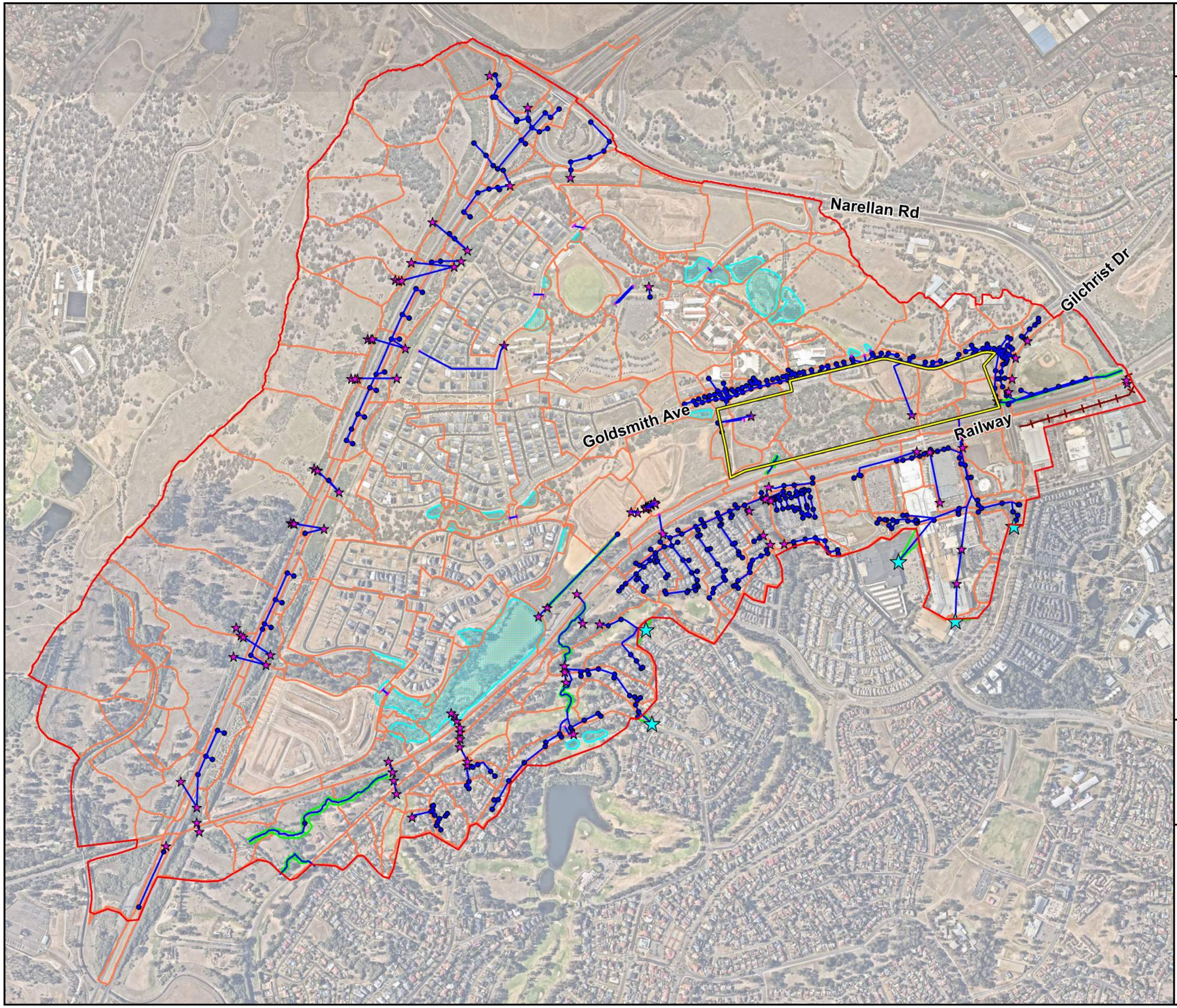
1:2,500 @ A3

0 20 40 60 80 100 120

DATE: 14 DEC 2021

REV: B

APPENDIX B – FIGURES



J. WYNDHAM PRINCE
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LEGEND

- MGN Site Boundary
- TUFLOW Model Boundary
- SA Catchment Inflow Boundary
- Initial Water Level
- HQ Slope Boundary
- Connection Line (CN)
- 1d NWK Culvert
- 2D HX Connection (Line)
- 2D SX Connection (Line)
- 2D SX Connection (Point)
- 1D BC Boundary (Point)
- 1d NWK Pit

N

0 440

metres
Scale 1:11,000 @ A3

Projection: GDA 1994 MGA Zone 56

Figure 4-1

Macarthur Garden North Flood Impact Assessment

Existing Conditions
TUFLOW Model Elements

Date: 16/02/2022 Issue: B

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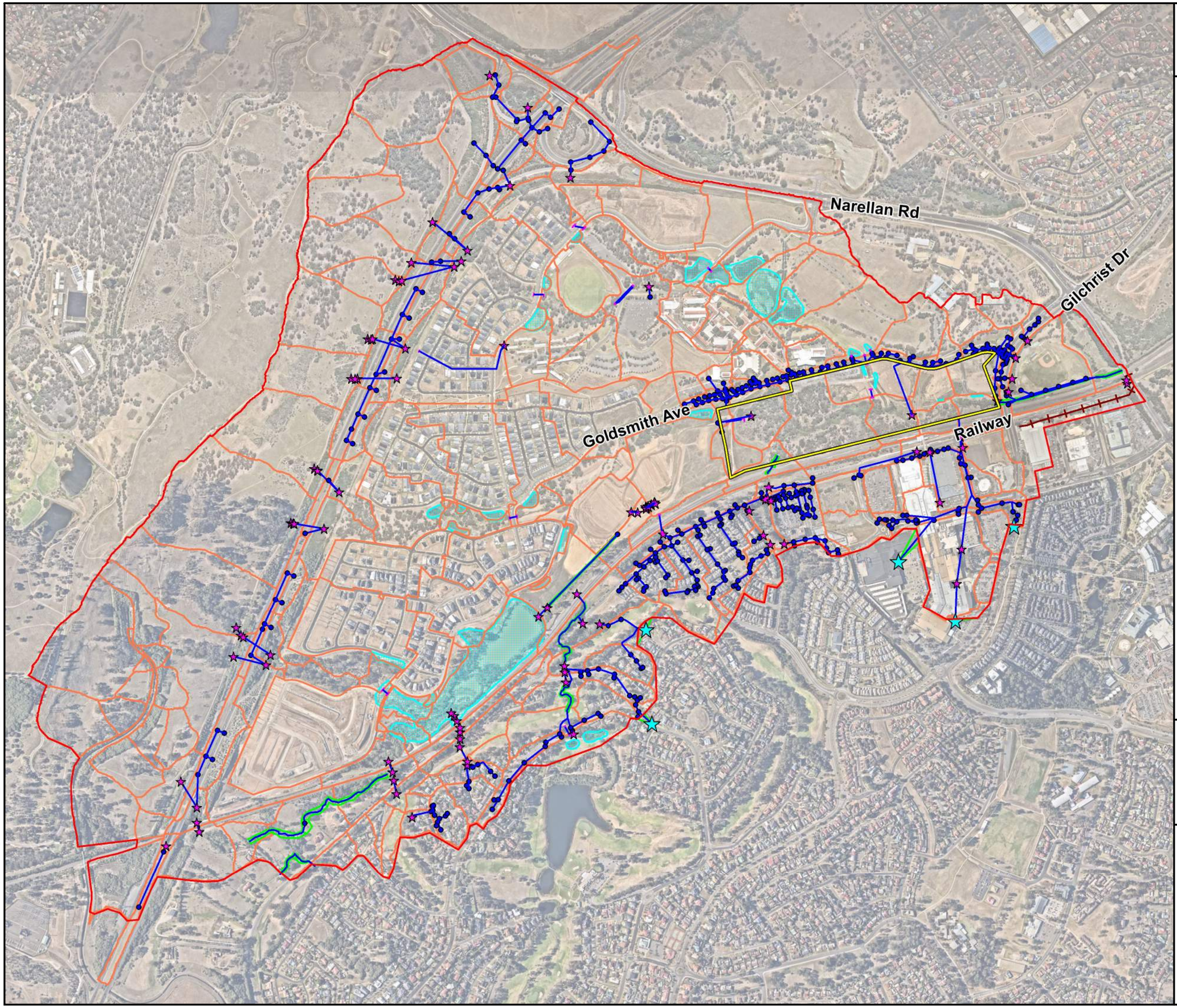

J. WYNDHAM PRINCE
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LEGEND

- MGN Site Boundary
- TUFLOW Model Boundary
- SA Catchment Inflow Boundary
- Initial Water Level
- HQ Slope Boundary
- Connection Line (CN)
- 1d NWK Culvert
- 2D HX Connection (Line)
- 2D SX Connection (Line)
- 2D SX Connection (Point)
- 1D BC Boundary (Point)
- 1d NWK Pit

N

0 440
metres
Scale 1:11,000 @ A3

Projection: GDA 1994 MGA Zone 56

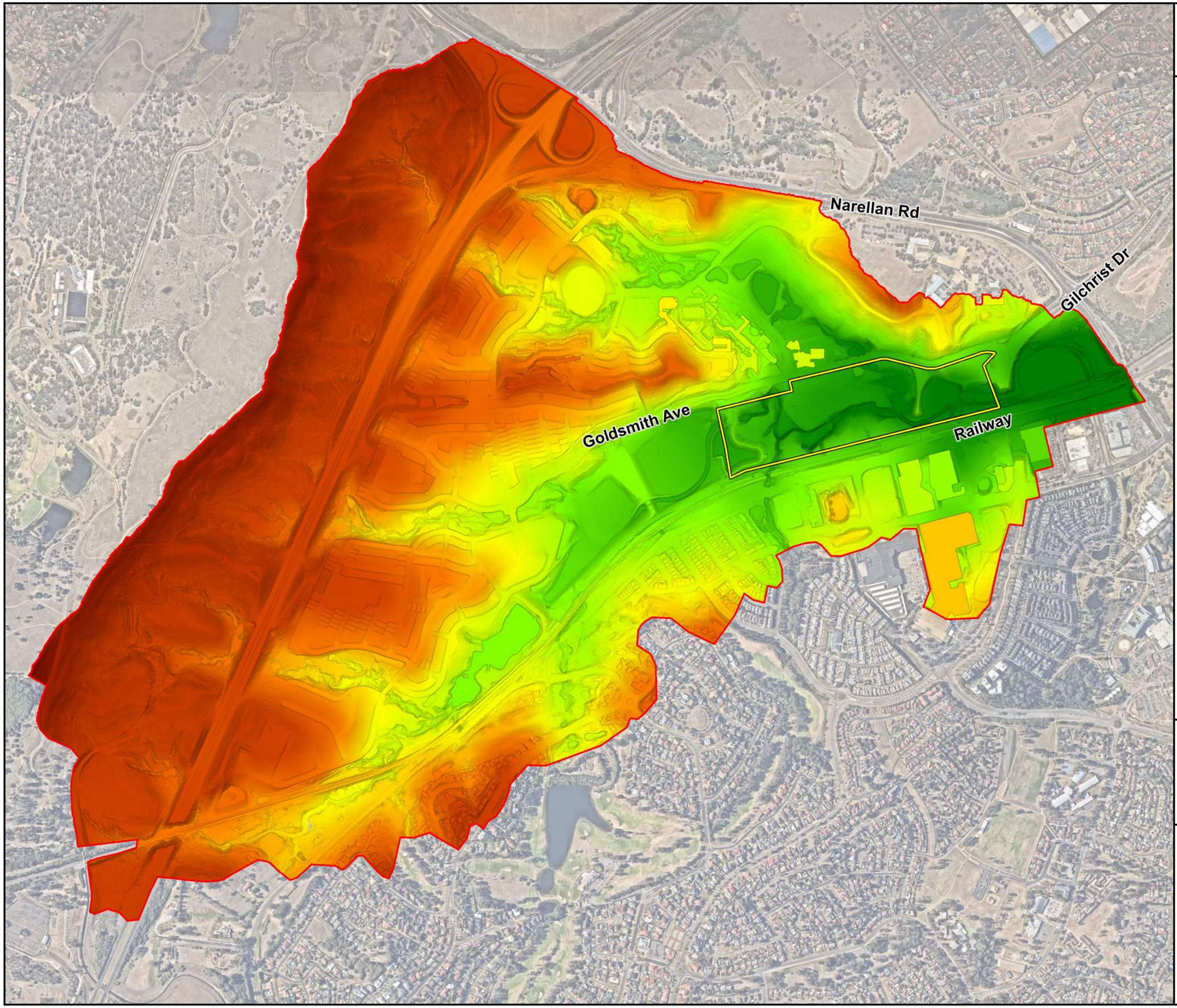
Figure 4-2

Macarthur Garden North Flood Impact Assessment

Developed Conditions
TUFLOW Model Elements

Date: 16/02/2022 Issue: B

Filename: J:\9562W\MapInfo\Figures\DA1_DA2\109562_Fig4-2_DEV01_TUFLOW_A.wor



J. WYNDHAM PRINCE
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& PROJECT MANAGERS

LEGEND

Terrain Level (m AHD)

- 60.0 to 70.0
- 70.0 to 80.0
- 80.0 to 90.0
- 90.0 to 100.0
- 100.0 to 110.0
- 110.0+
- MGN Site Boundary
- TUFLOW Model Boundary

N

0 440

metres

Scale 1:11,000 @ A3

Projection: GDA 1994 MGA Zone 56

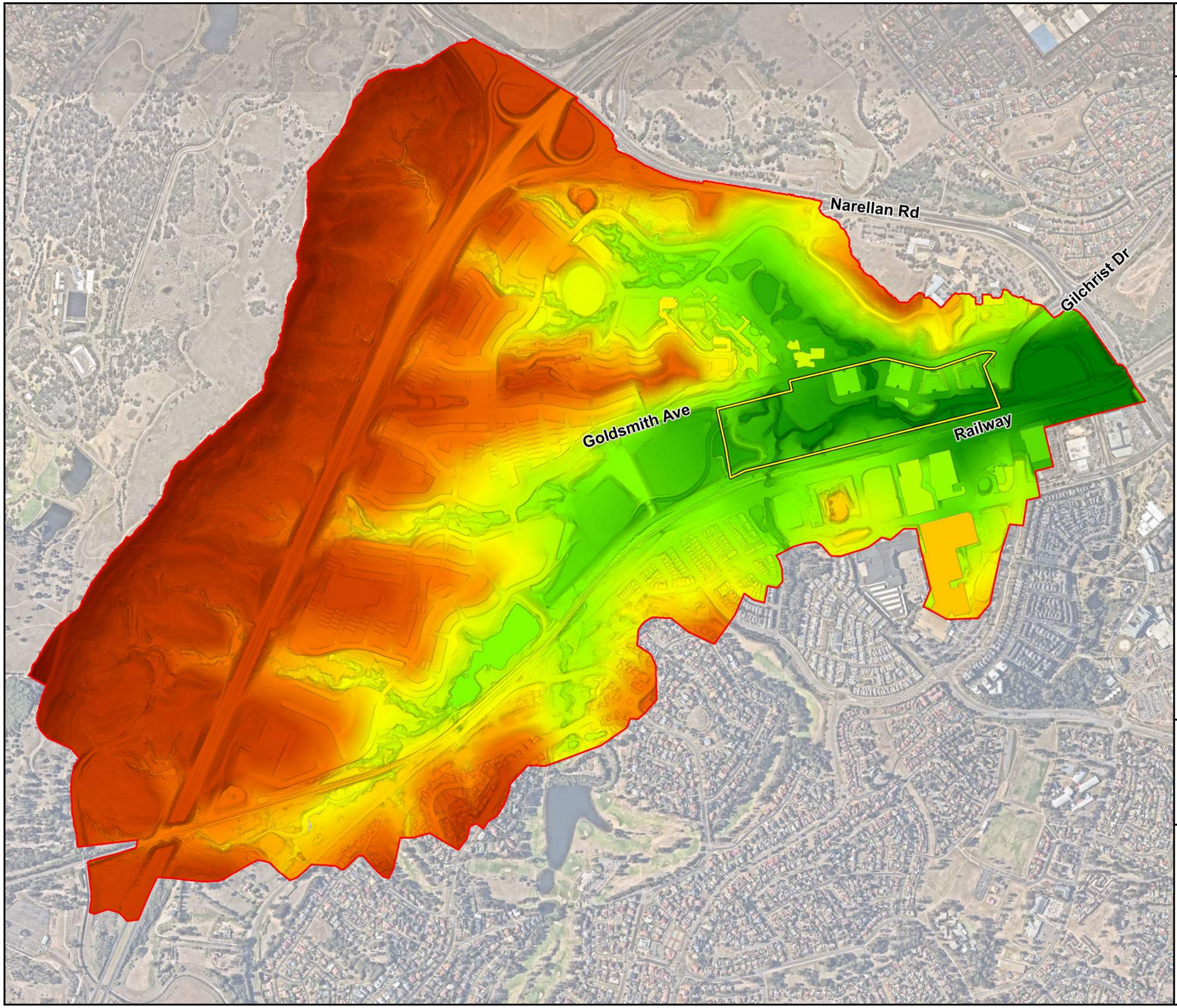
Figure 4-3

Macarthur Garden North Flood Impact Assessment

Existing Conditions
TUFLOW Model Terrain

Date: 16/02/2022 Issue: B

Filename: J:\9562W\MapInfo\Figures\Rpt_2022\109562_Fig4-3_EX01_TUFLOW_B.wor



J. WYNDHAM PRINCE
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& PROJECT MANAGERS

LEGEND

Terrain Level (m AHD)

- 60.0 to 70.0
- 70.0 to 80.0
- 80.0 to 90.0
- 90.0 to 100.0
- 100.0 to 110.0
- 110.0+
- MGN Site Boundary
- TUFLOW Model Boundary

N

0 440

metres

Scale 1:11,000 @ A3

Projection: GDA 1994 MGA Zone 56

Figure 4-4

Macarthur Garden North Flood Impact Assessment

Developed Conditions
TUFLOW Model Terrain

Date: 2/03/2023 Issue: C

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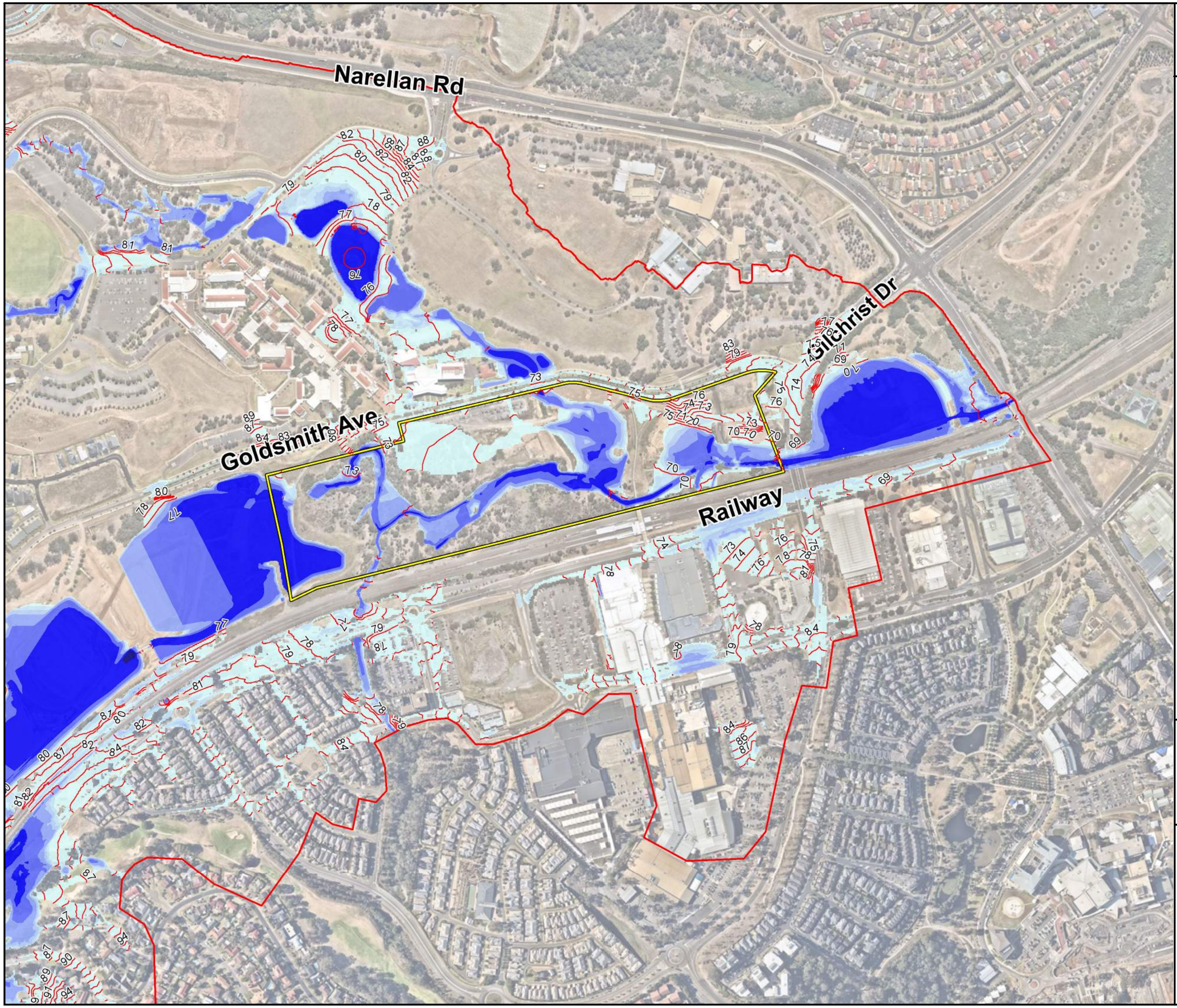

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LEGEND

FLOOD DEPTH (m)

- 0.0 to 0.1
- 0.1 to 0.3
- 0.3 to 0.5
- 0.5 to 1.0
- 1.0 to 2.0
- 2.0 to 5.0
- 5.0 to 10.0
- 10.0 +

35.0 — 1 m Flood Contours

MGN Site Boundary

TUFLOW Model Boundary

N

0 240

metres
Scale 1:6,000 @ A3

Projection: GDA 1994 MGA Zone 56

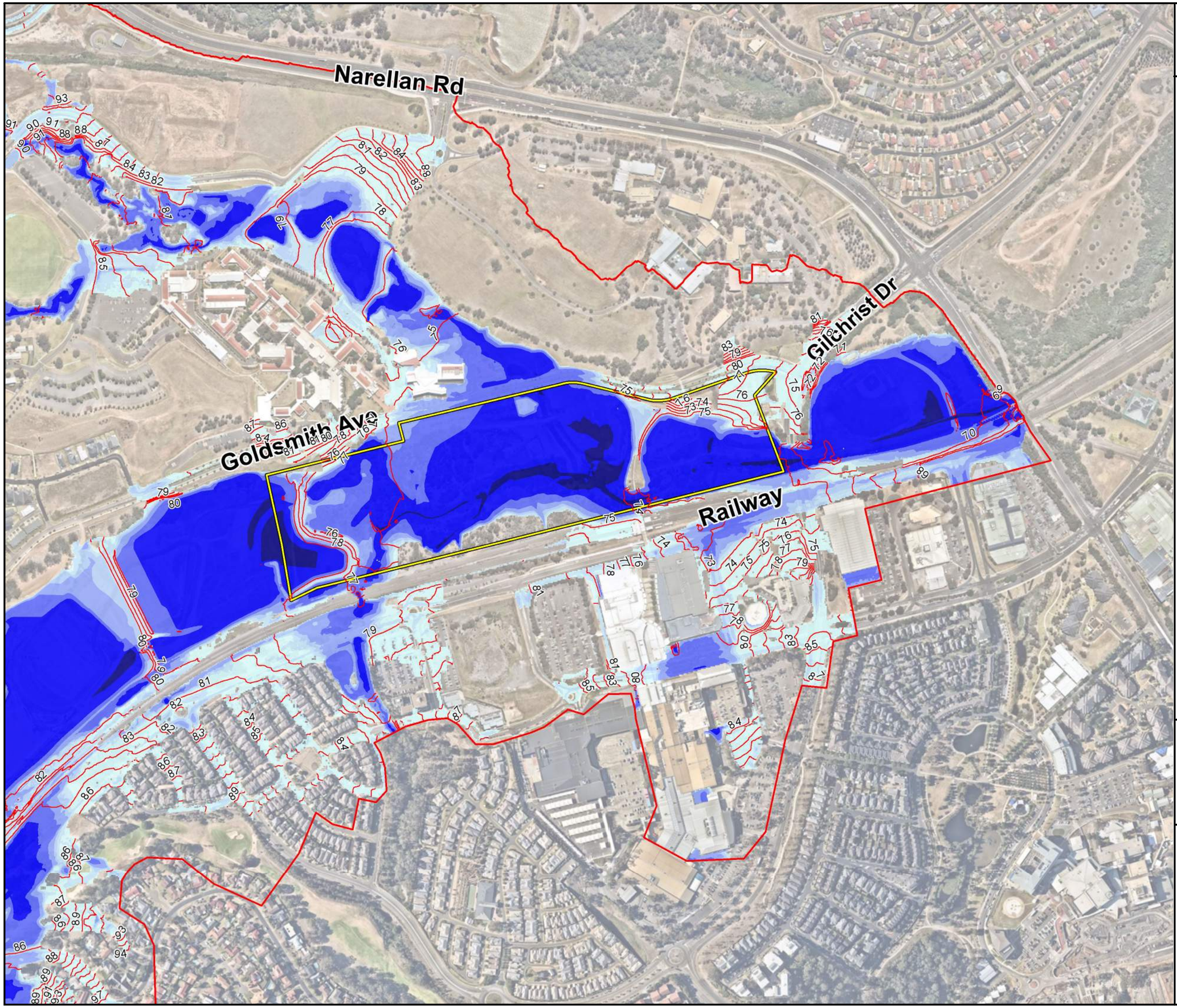
Figure 5-1

Macarthur Garden North Flood Impact Assessment

1% AEP
Existing Conditions
Flood Depths and Levels

Date: 16/02/2022 Issue: B

Filename: J:\9562W\MapInfo\Figures\RPT_20221109562_Fig5-1_EX01_1AEP_DEP_B.wor



J. WYNDHAM PRINCE
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LEGEND

FLOOD DEPTH (m)

- 0.0 to 0.1
- 0.1 to 0.3
- 0.3 to 0.5
- 0.5 to 1.0
- 1.0 to 2.0
- 2.0 to 5.0
- 5.0 to 10.0
- 10.0 +

35.0 1 m Flood Contours

MGN Site Boundary

TUFLOW Model Boundary

N

0 240

metres
Scale 1:6,000 @ A3

Projection: GDA 1994 MGA Zone 56

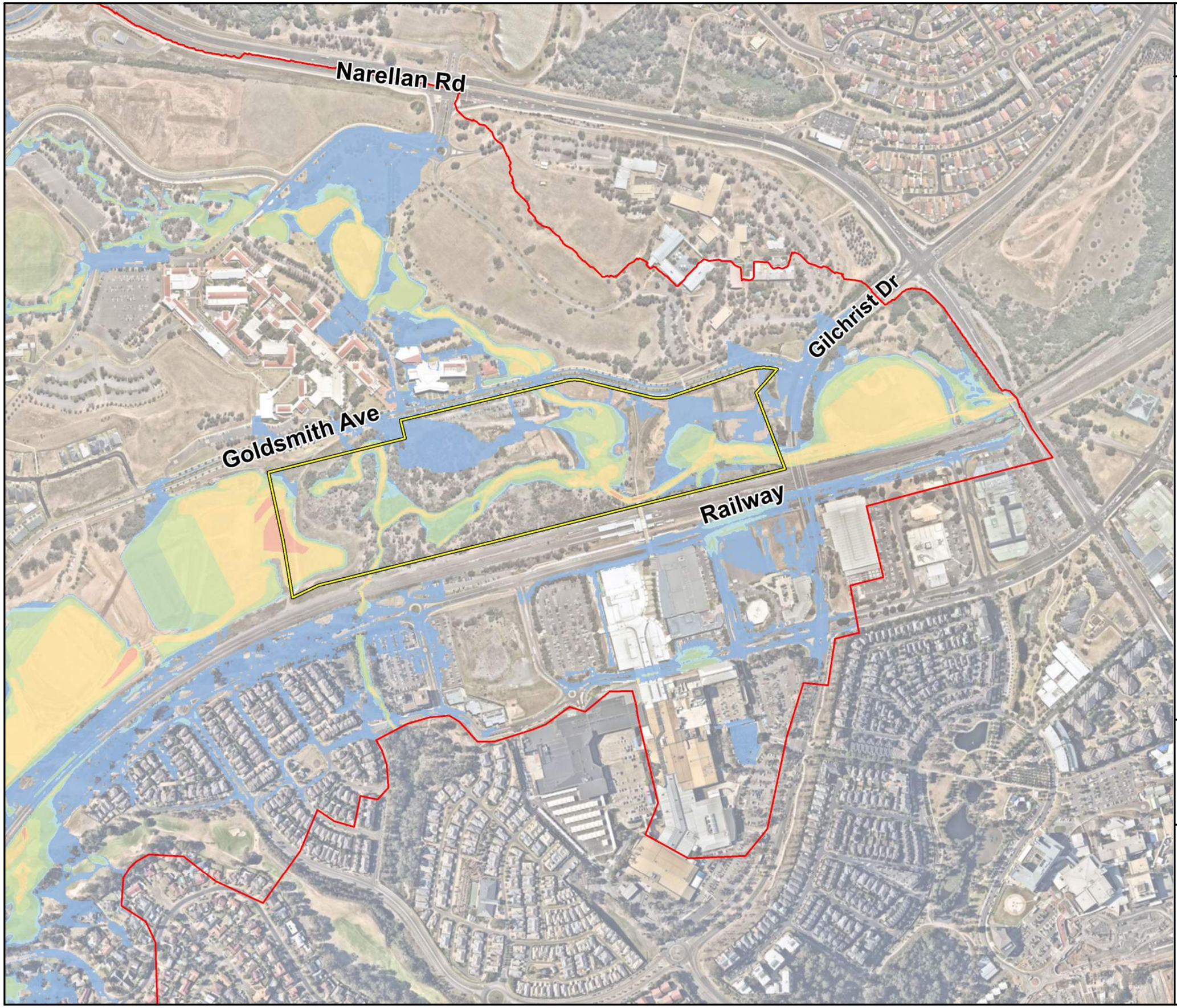
Figure 5-2

Macarthur Garden North Flood Impact Assessment

PMF
Existing Conditions
Flood Depths and Levels

Date: 16/02/2022 Issue: B

Filename: J:\9562W\MapInfo\Figures\RPT_2022\109562_Fig5-2_EX01_PMF_DEP_B.wor



J. WYNDHAM PRINCE
CONSULTING CIVIL INFRASTRUCTURE ENGINEERS & PROJECT MANAGERS

LEGEND

FLOOD HAZARD

- H1 - Generally safe.
- H2 - Unsafe for small vehicles.
- H3 - Unsafe for vehicles, children and the elderly.
- H4- Unsafe for people and vehicles.
- H5 - Unsafe for vehicles and people. All buildings vulnerable to structural damage.
- H6 - Unsafe for vehicles and people. All buildings vulnerable to failure.
- MGN Site Boundary
- TUFLOW Model Boundary

N

0 240
metres
Scale 1:6,000 @ A3

Projection: GDA 1994 MGA Zone 56

Figure 5-3

Macarthur Garden North Flood Impact Assessment

1% AEP
Existing Conditions
Flood Hazard

Date: 16/02/2022 Issue: B

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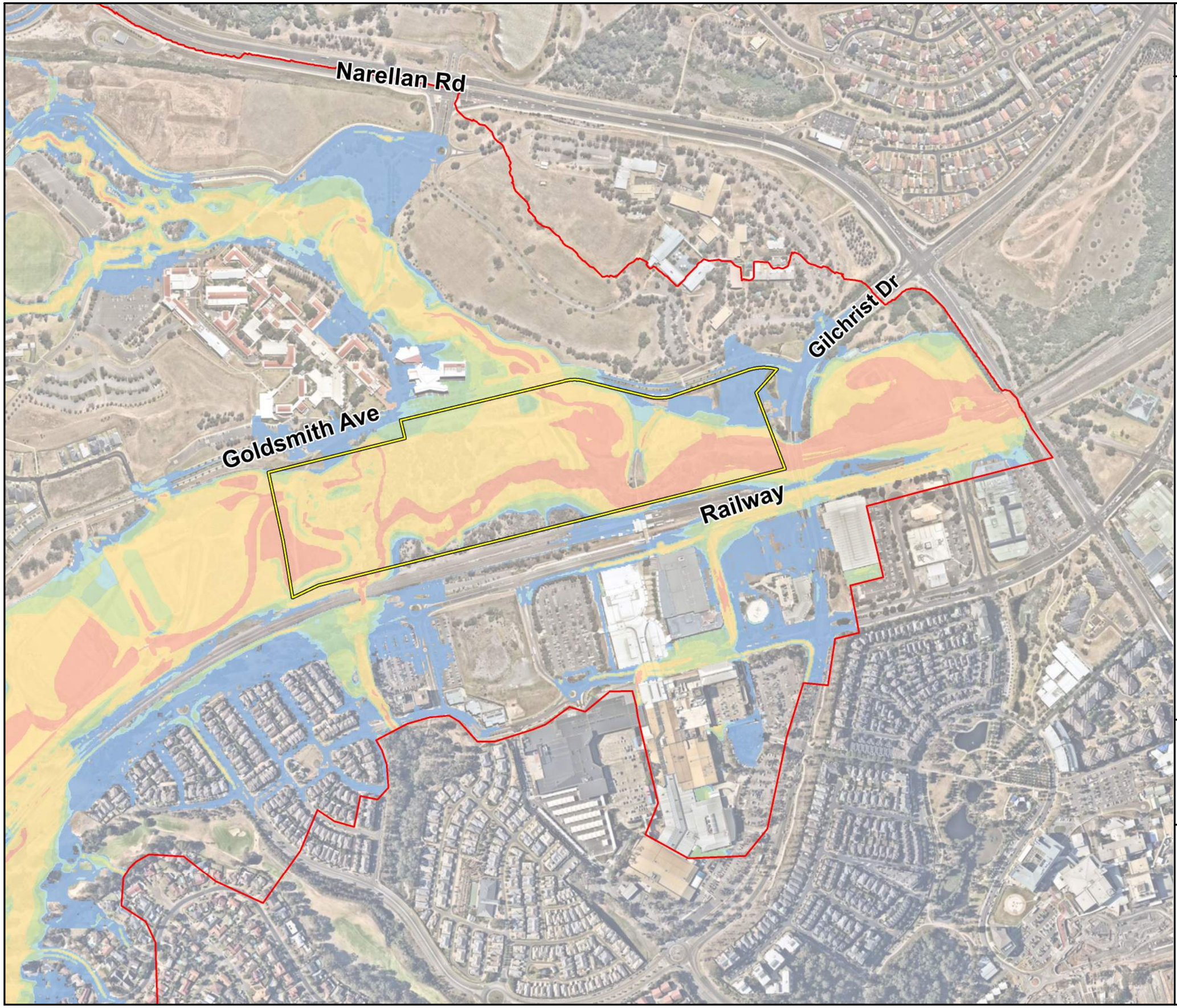

J. WYNDHAM PRINCE
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LEGEND

FLOOD HAZARD

- H1 - Generally safe.
- H2 - Unsafe for small vehicles.
- H3 - Unsafe for vehicles, children and the elderly.
- H4- Unsafe for people and vehicles.
- H5 - Unsafe for vehicles and people. All buildings vulnerable to structural damage.
- H6 - Unsafe for vehicles and people. All buildings vulnerable to failure.
- MGN Site Boundary
- TUFLOW Model Boundary

N

0 240

metres
Scale 1:6,000 @ A3

Projection: GDA 1994 MGA Zone 56

Figure 5-4

Macarthur Garden North Flood Impact Assessment

PMF
Existing Conditions
Flood Hazard

Date: 16/02/2022 Issue: B

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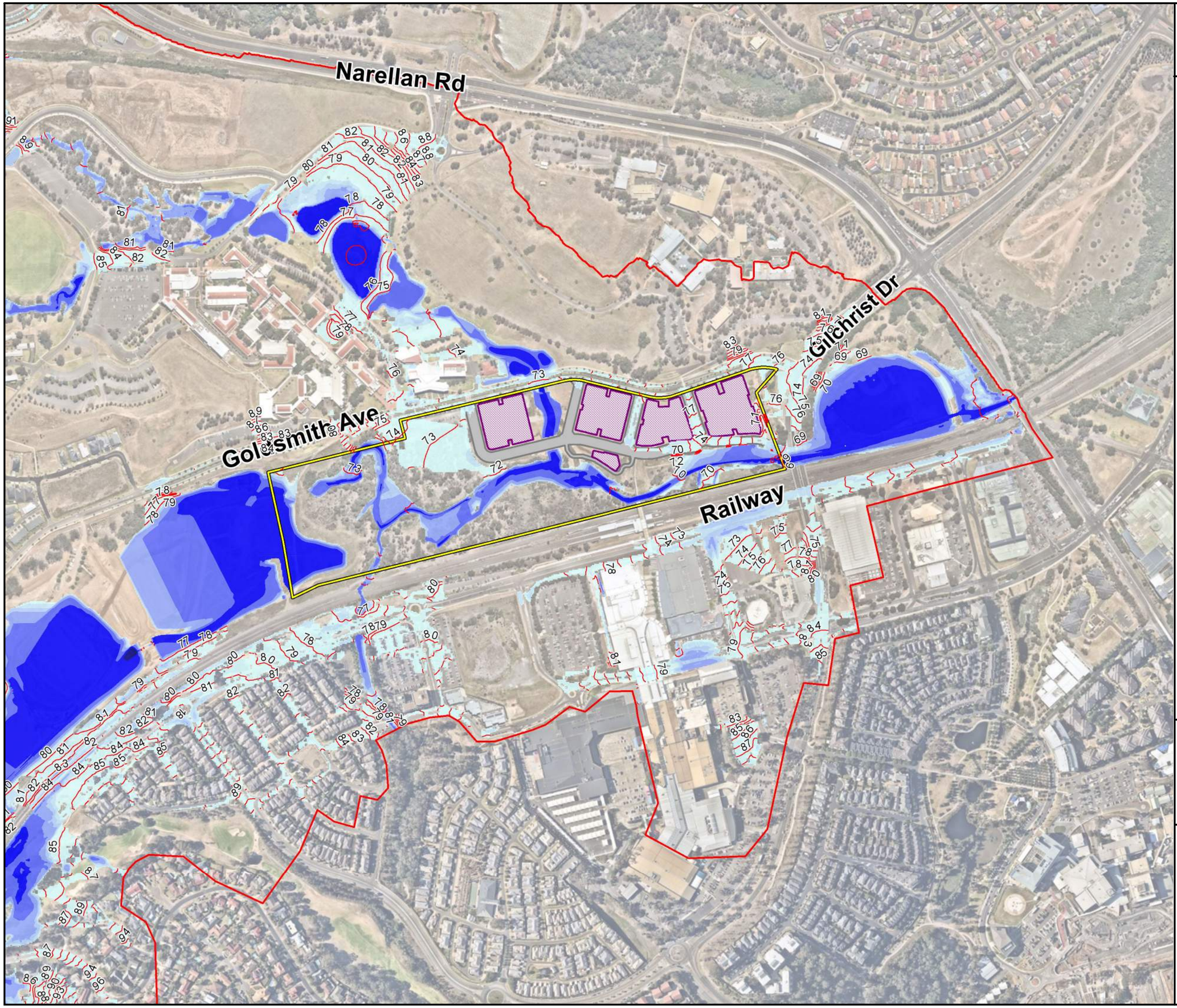

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LEGEND

FLOOD DEPTH (m)

- 0.0 to 0.1
- 0.1 to 0.3
- 0.3 to 0.5
- 0.5 to 1.0
- 1.0 to 2.0
- 2.0 to 5.0
- 5.0 to 10.0
- 10.0 +

35.0 — 1 m Flood Contours

MGN Site Boundary

TUFLOW Model Boundary

Road

Building

N

0 240

metres

Scale 1:6,000 @ A3

Projection: GDA 1994 MGA Zone 56

Figure 5-5

Macarthur Garden North Flood Impact Assessment

1% AEP
Developed Conditions
Flood Depths and Levels

Date: 2/03/2023 Issue: C

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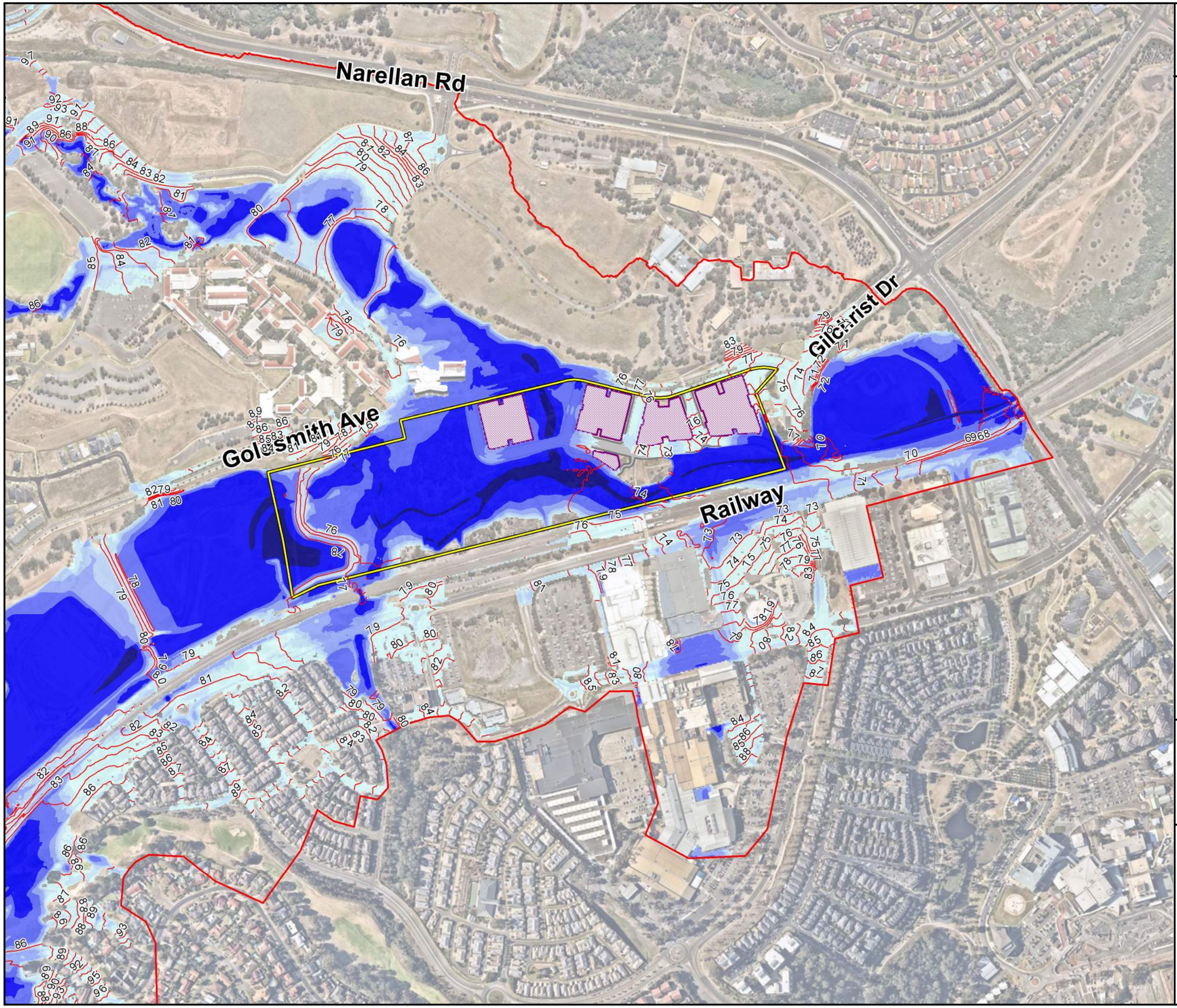

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LEGEND

FLOOD DEPTH (m)

- 0.0 to 0.1
- 0.1 to 0.3
- 0.3 to 0.5
- 0.5 to 1.0
- 1.0 to 2.0
- 2.0 to 5.0
- 5.0 to 10.0
- 10.0 +

35.0 — 1 m Flood Contours

MGN Site Boundary

TUFLOW Model Boundary

Road

Building

N

0 240

metres

Scale 1:6,000 @ A3

Projection: GDA 1994 MGA Zone 56

Figure 5-6

Macarthur Garden North Flood Impact Assessment

PMF
Developed Conditions
Flood Depths and Levels

Date: 2/03/2023 Issue: C

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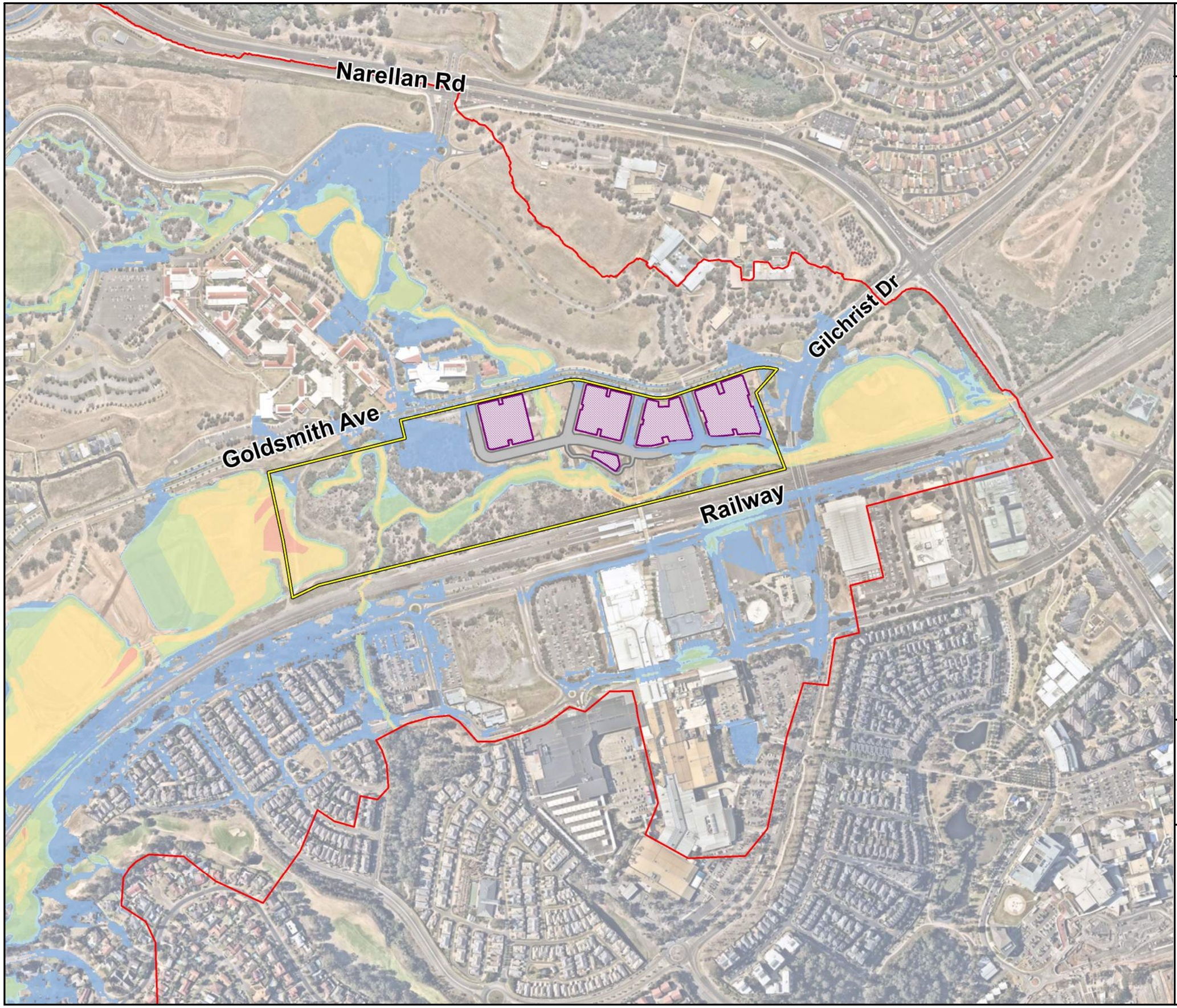

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LEGEND

FLOOD HAZARD

- H1 - Generally safe.
- H2 - Unsafe for small vehicles.
- H3 - Unsafe for vehicles, children and the elderly.
- H4- Unsafe for people and vehicles.
- H5 - Unsafe for vehicles and people. All buildings vulnerable to structural damage.
- H6 - Unsafe for vehicles and people. All buildings vulnerable to failure.
- MGN Site Boundary
- TUFLOW Model Boundary
- Road
- Building

N

0 240

metres
Scale 1:6,000 @ A3

Projection: GDA 1994 MGA Zone 56

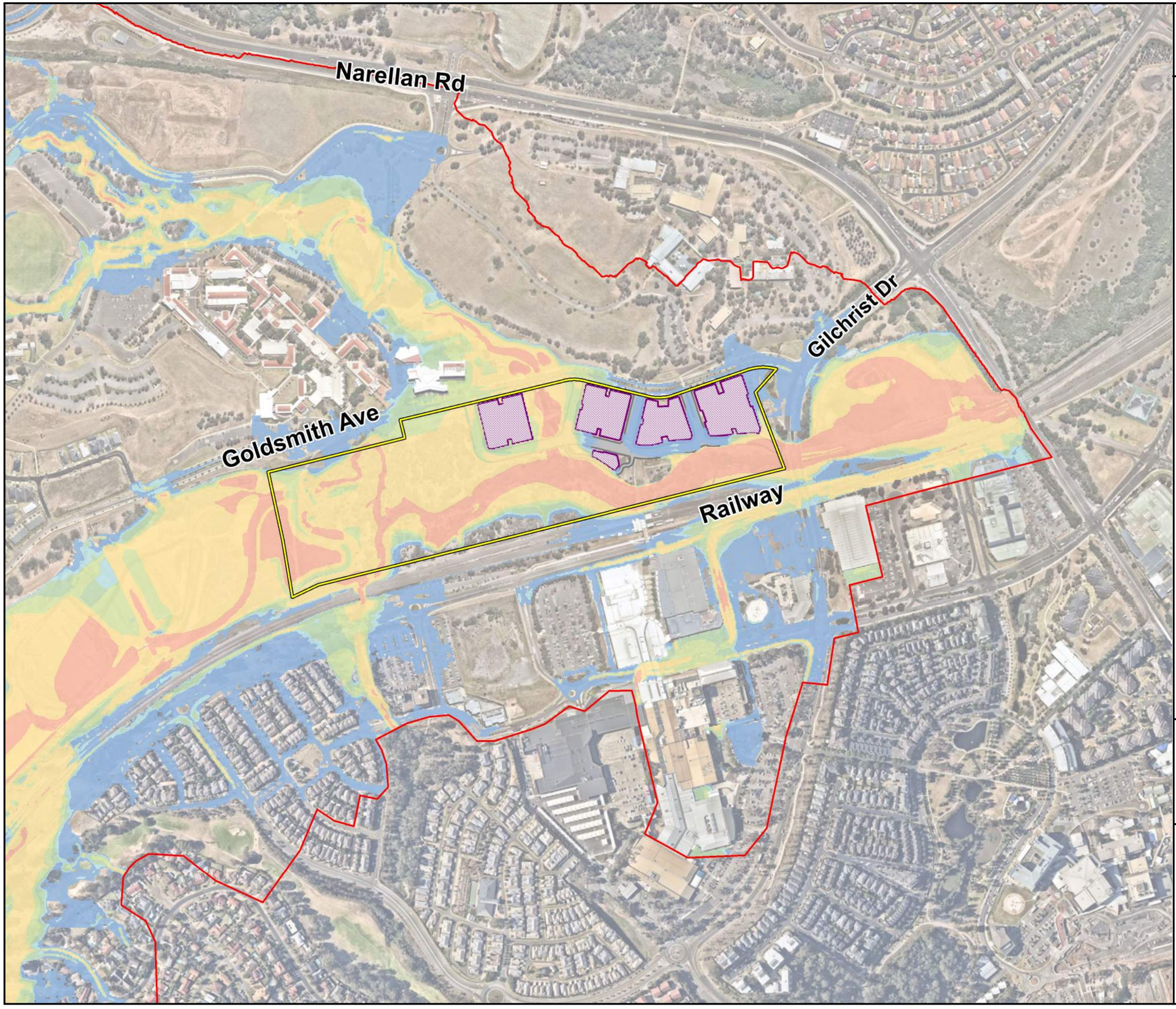
Figure 5-7

Macarthur Garden North Flood Impact Assessment

1% AEP
Developed Conditions
Flood Hazard

Date: 2/03/2023 Issue: C

Filename: J:\9562W\MapInfo\Figures\FIA_2023\109562_Fig5-7_DEV02_1AEP_HZD_C.wor



J. WYNDHAM PRINCE
CONSULTING CIVIL INFRASTRUCTURE ENGINEERS & PROJECT MANAGERS

LEGEND

FLOOD HAZARD

- H1 - Generally safe.
- H2 - Unsafe for small vehicles.
- H3 - Unsafe for vehicles, children and the elderly.
- H4- Unsafe for people and vehicles.
- H5 - Unsafe for vehicles and people. All buildings vulnerable to structural damage.
- H6 - Unsafe for vehicles and people. All buildings vulnerable to failure.
- MGN Site Boundary
- TUFLOW Model Boundary
- Road
- Building

N

0 240

metres
Scale 1:6,000 @ A3

Projection: GDA 1994 MGA Zone 56

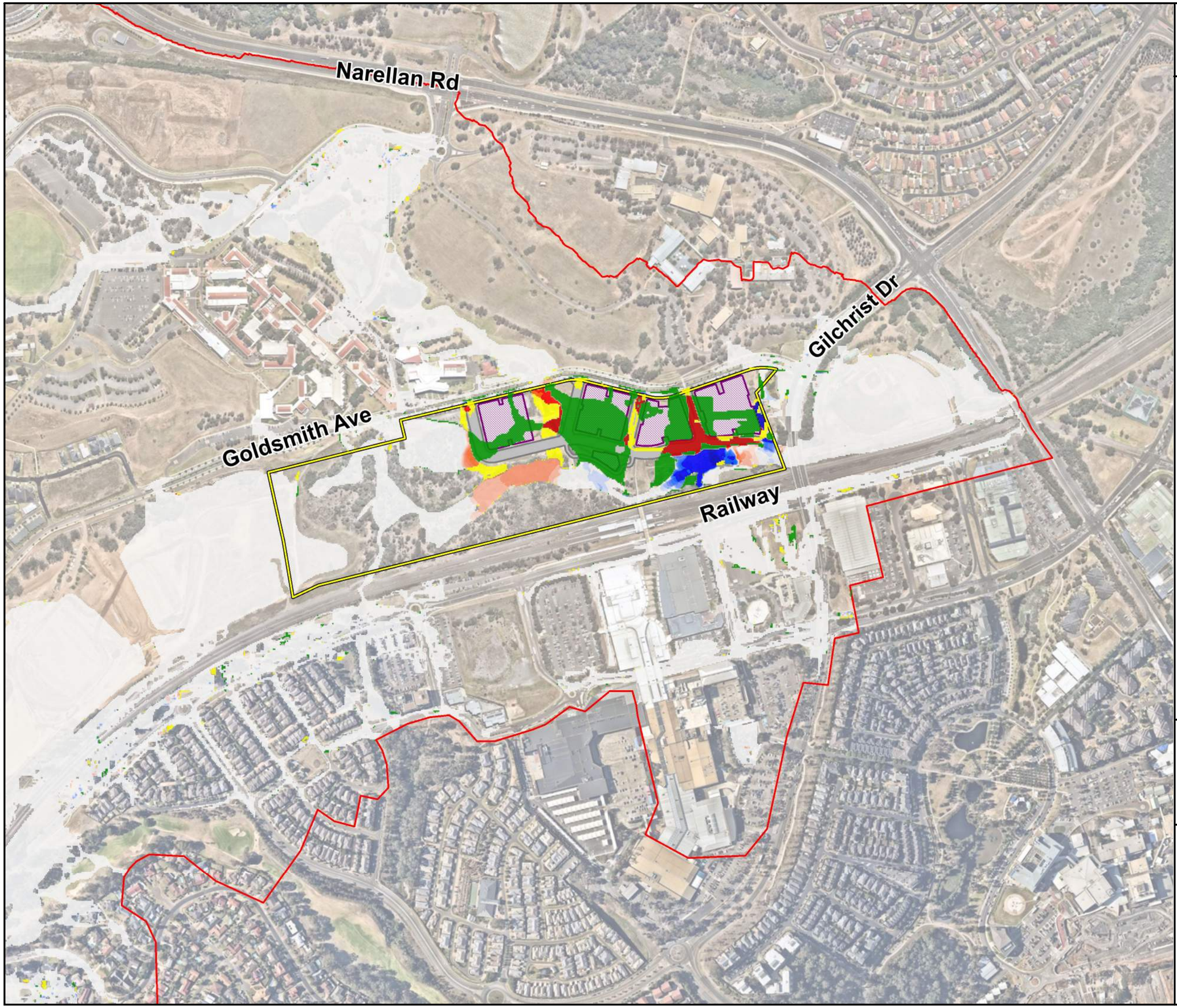
Figure 5-8

Macarthur Garden North Flood Impact Assessment

PMF
Developed Conditions
Flood Hazard

Date: 2/03/2023 Issue: C

Filename: J:\9562W\MapInfo\Figures\FIA_2023\109562_Fig5-8_DEV02_PMF_HZD_C.wor



J. WYNDHAM PRINCE
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LEGEND

FLOOD DIFFERENCE (m)

- 0.5 +
- -0.10 to 0.5
- -0.08 to 0.10
- -0.06 to 0.08
- -0.04 to 0.06
- -0.02 to 0.04
- -0.02 to 0.02
- 0.02 to 0.04
- 0.04 to 0.06
- 0.06 to 0.08
- 0.08 to 0.10
- 0.1 to 0.5
- 0.5 +
- Areas that were flood affected and are now flood free in modelled event
- Areas that were flood free and are now flood affected in modelled event
- Study Area
- TUFLOW Model Boundary
- Road
- Building

N

0 240

metres

Scale 1:6,000 @ A3

Projection: GDA 1994 MGA Zone 56

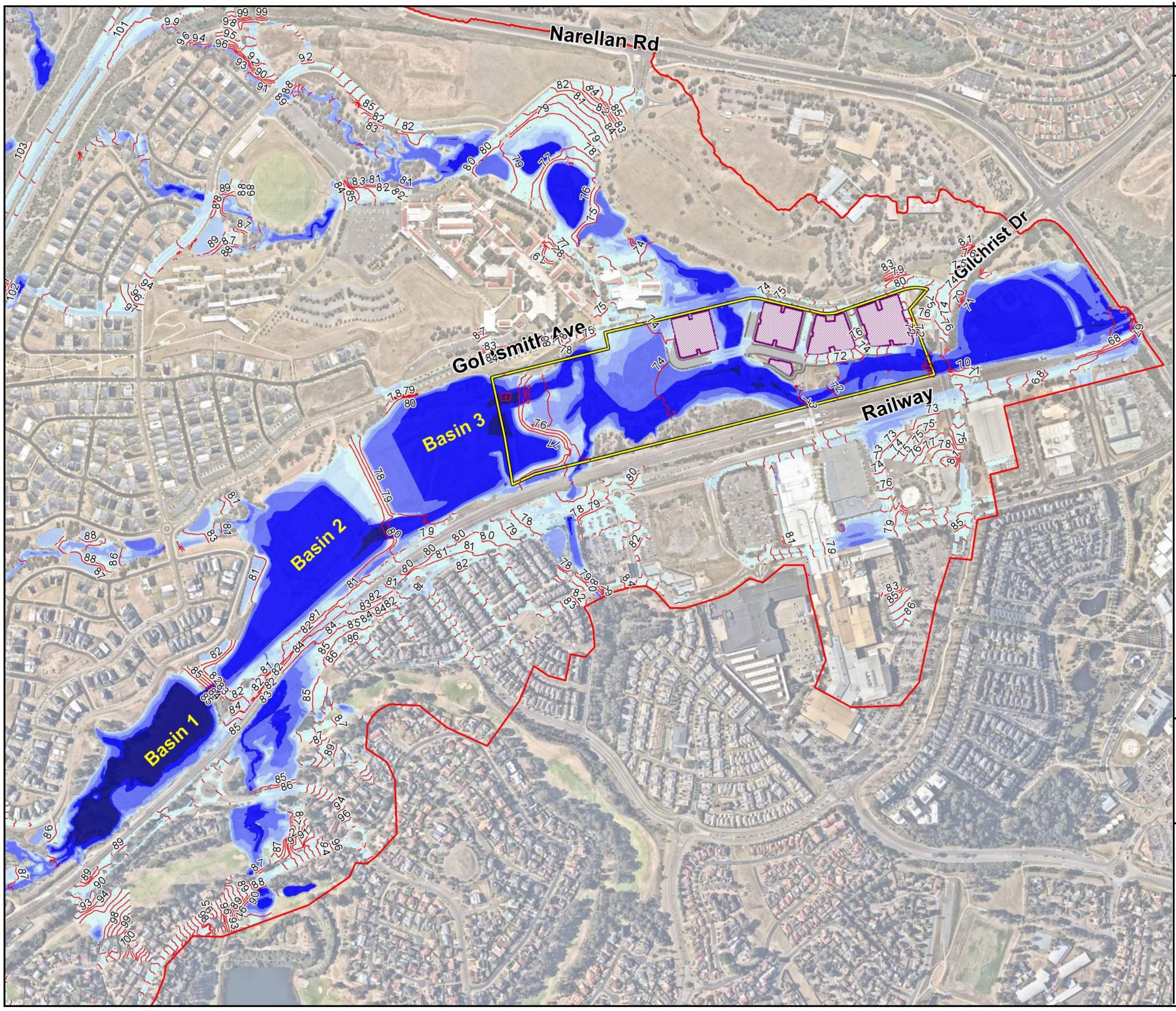
Figure 5-9

Macarthur Garden North Flood Impact Assessment

1% AEP
Flood Level Difference
Developed Minus Existing Conditions

Date: 2/03/2023 Issue: C

Filename: J:\9562W\MapInfo\Figures\FIA_2023\109562_Fig5-9_DEV02-EX01_1AEP_DIF_C.wor



J. WYNDHAM PRINCE
CONSULTING CIVIL INFRASTRUCTURE ENGINEERS & PROJECT MANAGERS

LEGEND

FLOOD DEPTH (m)

- 0.0 to 0.1
- 0.1 to 0.3
- 0.3 to 0.5
- 0.5 to 1.0
- 1.0 to 2.0
- 2.0 to 5.0
- 5.0 to 10.0
- 10.0 +

35.0 — 1 m Flood Contours

MGN Site Boundary

TUFLOW Model Boundary

Road

Building

N

0 280

metres

Scale 1:7,000 @ A3

Projection: GDA 1994 MGA Zone 56

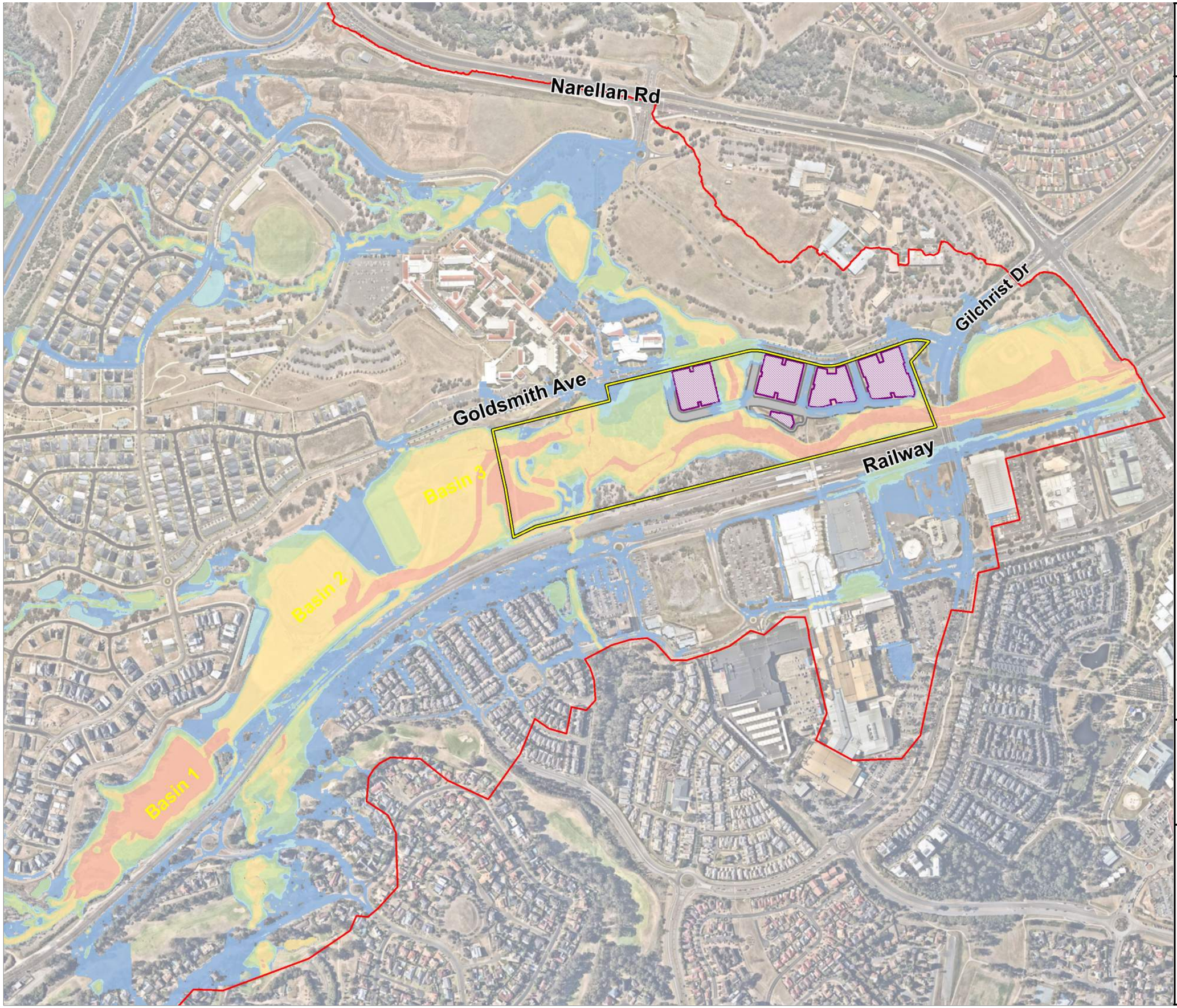
Figure 6-1

WSU Campebelltown & Macarthur Garden North Ultimate Development

DCF Dam Break Basin 1, 2 & 3 Ultimate Conditions Flood Depths and Levels

Date: 3/03/2023 Issue: C

Filename: J:\9562WMapInfo\Figures\DB_2023\109562_Fig5-6_DEV02_DB Basin123_4000yARI_DEP_C.wor



J. WYNDHAM PRINCE
CONSULTING CIVIL INFRASTRUCTURE ENGINEERS & PROJECT MANAGERS

LEGEND

FLOOD HAZARD

- H1 - Generally safe.
- H2 - Unsafe for small vehicles.
- H3 - Unsafe for vehicles, children and the elderly.
- H4- Unsafe for people and vehicles.
- H5 - Unsafe for vehicles and people. All buildings vulnerable to structural damage.
- H6 - Unsafe for vehicles and people. All buildings vulnerable to failure.
- MGN Site Boundary
- TUFLOW Model Boundary
- Road
- Building

N

0 280

metres
Scale 1:7,000 @ A3

Projection: GDA 1994 MGA Zone 56

Figure 6-2

WSU Campebelltown & Macarthur Garden North Ultimate Development

DCF Dam Break Basin 1, 2 & 3
Ultimate Conditions
Flood Hazard

Date: 3/03/2023 Issue: C

Filename: J:\9562W\MapInfo\Figures\DB_2023\109562_Fig5-7_DEV02_DB Basin123_4000yARI_HZD_C.wor