

Western Sydney University Indigenous Centre of Excellence Flood Impact Assessment

Western Sydney University

August 2024

Rev D

Western Sydney University Indigenous Centre of Excellence Flood Impact Assessment

Project	Western Sydney University, Indigenous Centre of Excellence – Flood Impact Assessment
Report Includes:	Flood Impact Assessment Flood Emergency Response Plan Riparian Zone Management Assessment
Client	Western Sydney University
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Introduction

The Western Sydney University South Parramatta Campus is located at 171 Victoria Road, Parramatta.

The site comprises one (1) singular allotment, which is legally described as Lot 100 in DP 816829. The project site is known as the P1 Car Park in the northern portion of the wider site campus. The project site is approximately 12,150m² in size and is broadly rectangular in shape. It currently comprises of a hardstand area that accommodates approximately 284 car parking spaces. There is an existing single storey Central Energy Plant to the west of the development area which serves the wider campus; it remains outside of the scope of this SSDA.

The site is strategically positioned to the northern boundary of the Western Sydney University (University) South Parramatta Campus, fronting Victoria Road (the A40). The wider campus comprises a significant landholding size of approximately 20ha containing a series of buildings of differing heights and massing forms which are used for educational purposes. The buildings contained within the wider campus site are dissected by a series of open, at grade car parks, internal roads, pathways, and landscaped areas. The Campus sits to the north of the Parramatta River.

The site is located approximately 3km east of the Parramatta CBD, which is an area undergoing a process of significant transformation. It is also located approximately 500m to the Parramatta Light Rail Corridor, with the construction of new Yallamundi Light Rail now completed and awaiting operation by TfNSW.

The site location is identified in Figure 1.

Figure 1: Western Sydney University Parramatta South Campus locational context



Source: Nearmap/Ethos Urban

Project Description

The Applicant seeks development consent for the construction of a new state-of-the-art Indigenous Centre of Excellence as a new tertiary education facility on campus. The Indigenous Centre of Excellence project is funded by the NSW Government's Western Sydney Infrastructure Grants Program in association with Western Sydney University. The new Indigenous Centre of Excellence will be an important asset for both the University and local community alike, providing a space for the commitment to advancing Indigenous education, leadership, and reconciliation. The Indigenous Centre of Excellence will stand as a symbol of recognition of Indigenous land and the University's relationship with Indigenous communities. The Indigenous Centre of Excellence will represent a celebration of tens of thousands of years of Indigenous knowledges and histories, a legacy that the University is honoured to nurture and promote through further education opportunities for students and communities.

Through the Indigenous Centre of Excellence, the University will aim to drive positive change, increase Indigenous participation in higher education, and contribute to the preservation and sharing of Indigenous cultures.

This State Significant Development Application (SSDA) specifically seeks detailed approval for the following works:

- Site preparation including demolition of the existing car park, tree removal and installation of inground utility infrastructure services.
- Construction of a four-storey Indigenous Centre of Excellence encompassing:
 - Ground level facilities, including but not limited to; a dedicated arrival area, outdoor amphitheatre, cinema and lecture theatre, performance space, artist studios and exhibition space. Associated workspaces, meeting areas, lounge areas and other amenities are to be provided throughout the ground floor.
 - First floor level upwards comprising dedicated educational facilities including library facilities, learning areas and teaching spaces.
 - Second floor level comprising staff / student foyer, offices, meeting rooms and collaboration spaces.
 - Third level comprising a multi-functional recreational sports court, with associated ancillary amenities, alongside an astronomy garden.
 - Roof level plant and services.
- Landscaping works to provide outdoor educational and recreational spaces.

This report responds to the SSD-64916225 Secretary's Environmental Assessment Requirement (SEARs) identified below. These SEARs were issued by the Department of Planning, Housing and Infrastructure on 21st November 2023.

Flood Risk Assessment	15. Flooding Risk
	<ul style="list-style-type: none"> • Identify any flood risk on-site having regard to adopted flood studies, the potential effects of climate change, and any relevant provisions of the NSW Floodplain Development Manual. • Assess the impacts of the development, including any changes to flood risk on-site or off-site, and detail design solutions and operational procedures to mitigate flood risk where required.

Riparian Zone Management Assessment

Riparian Zone Management

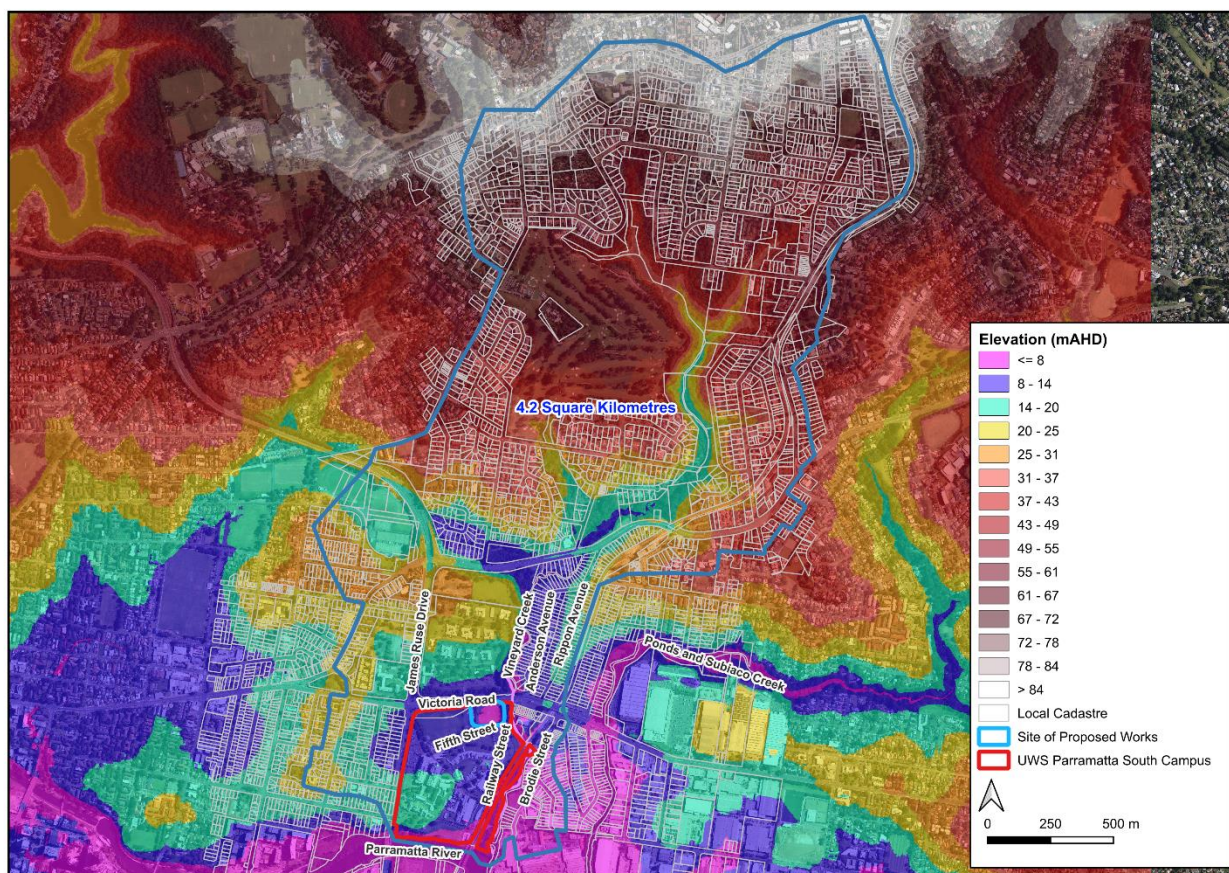
- Where applicable, provide a Riparian Zone Management Assessment prepared by a suitably qualified professional, to determine the presence of mapped and potential unmapped waterways across the site and where relevant to map the top of bank of waterways to determine appropriate Vegetated Riparian Zones (VRZ) and riparian zone management as required by NSW Water Management Act 2000.

Topographic Context

The proposed development is to be situated in the north-western corner of the site where an open-air, on ground car park is currently situated (as documented in Figure 1 above).

The site is situated north of the Parramatta River and immediately west of Vineyard Creek, a tributary of the Parramatta River that drains a catchment of approximately 4.2 km². The site is located towards the bottom of this catchment.

Figure 2: Vineyard Creek Catchment



The site is identified by Council as flood-labile and as such, a Flood Impact Assessment (FIA), a Riparian Zone Management Assessment (RZMA) and Flood Emergency Response Plan (FERP) is required to be submitted as part of the State Significant Development Application to confirm the proposed development has been designed to accommodate the local flooding regime and is compliant with flood-related controls and guidance outlined in Council and State planning instruments. These include Local Environmental Plans (LEP), Development Control Plans (DCP) and any Secretary's Environmental Assessment Requirements (SEARs) issued for the site by the NSW Department of Planning, Housing and Infrastructure (DPHI).

Project Scope

GRC Hydro (GRC) has been engaged to prepare the FIA and FERP for this proposed development. These items are presented herein.

The work undertaken to complete this report includes:

- Engaging with the City of Parramatta (Council) to confirm the Council-endorsed flood levels and extents for the site in its existing case;
- Developing a best practice hydrological and hydraulic model to derive local flood depths, flood levels, hazards and velocities for the following events (20%, 2%, 1%, 0.2% and PMF) in the existing and post-developed case;
- Assess the site's flood affectation in a future climate change scenario in accordance with the NSW Department of Planning and Environment's (DPE) Flood Risk Management Guideline FB01. This has been conducted through the modelling of a 1% AEP + RCP 4.5 2050 and 1% AEP + RCP 4.5 2090 event in both an existing and post-developed scenario;
- Assess the proposed development and modelled flood affectation relative to planning instruments applicable for the site, such as:
 - The Parramatta Local Environmental Plan 2023 (PLEP 2023);
 - The Parramatta Development Control Plan 2023 (PDCP 2023);
 - The SEARs issued for the site by NSW DPHI.
- Assess the proposed development's opportunities for safe shelter and/or evacuation in the event of a flood emergency; and
- Summarise the above in a FIA, RZMA and FERP.

This assessment has been informed by the NSW DPE's *Flood Risk Management Manual (2023)* (FRMM 2023). Reference to how this report has addressed the FRMM 2023 is outlined in detail in Appendix C.

The Site's Flood Liability

The site is flood liable when Vineyard Creek flow overtops its banks at Victoria Road, enters Victoria Road and then flows into the site. This flood liability has been documented in the City of Parramatta's (Council's) provided flood certificate. This flood certificate summarises Council's adopted flood levels in the vicinity of the site and has been attached to this report in Appendix A.

Figure 3: Flood Extents at the Site (Council)



Rather than specify a fixed flood level for the site, the flood certificate sets out 5% AEP, 1% AEP and PMF flood levels in the vicinity of the site, on a map.

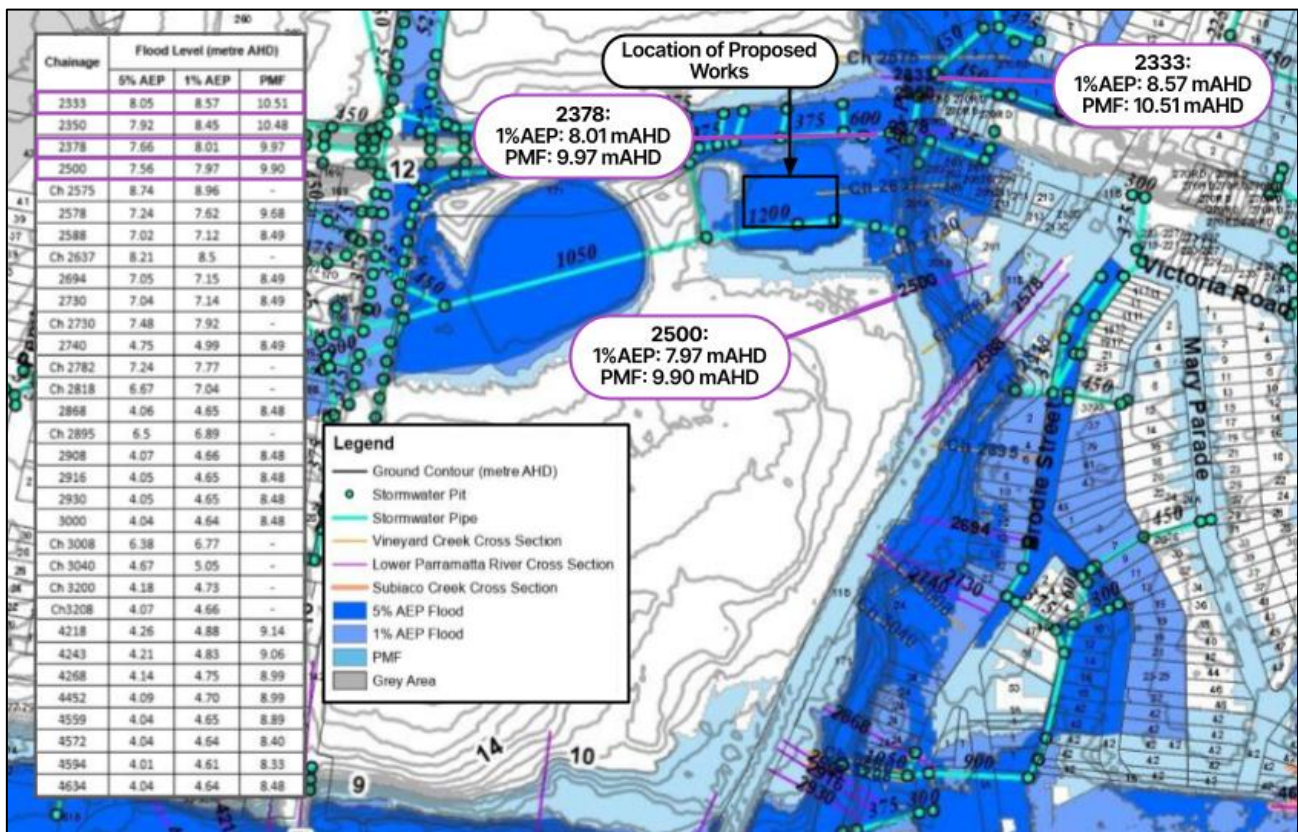
The map documents flood levels along Vineyard Creek that have been sourced from two Council-endorsed flood studies. These are:

- Vineyard Creek Sub-Catchment Management Plan, 2004 (SMEC); and
- Lower Parramatta River Floodplain Risk Management Plan – Flood Study Review, 2005 (SKM)

The *Lower Parramatta River Floodplain Risk Management Plan – Flood Study Review* (referred henceforth as “SKM 2005”) is the most recent of these studies and the flood mapping documents a 1% AEP and PMF flood level at each chainage location.

Analysis of the SKM 2005 flood levels documented in the vicinity of the site show the site is flooded to a level of approximately 8.0 mAHD in a 1% AEP event. With site ground levels around 7.5 mAHD, this equates to depths of around 0.5 m across the site.

Figure 4: Council Provided Flood Levels for Vineyard Creek



A third study was reviewed that provided information on flooding in the catchment; the *Rydalmere Development Precinct Watercycle & Flood Management Strategy Report* (J. Wyndham Prince, 2016). This study established a hydrologic model (XP-RAFTS) and hydraulic modelling (TUFLOW) in aid of assessing a planning proposal in the catchment. The model parameters, specifically the rainfall losses, being the default values as per the 1987 Australian Rainfall and Runoff were adopted for the current study (see Hydrological Model section).

Flood Modelling

Flood modelling of the proposed development was required in order to determine how the proposed development may impact the local flooding regime.

GRC's preferred method is always to use the endorsed Council flood model for the catchment in which a development is proposed.

GRC emailed and phoned Council flooding staff in February 2024 to seek the endorsed model for the Vineyard Creek catchment but received no response from Council.

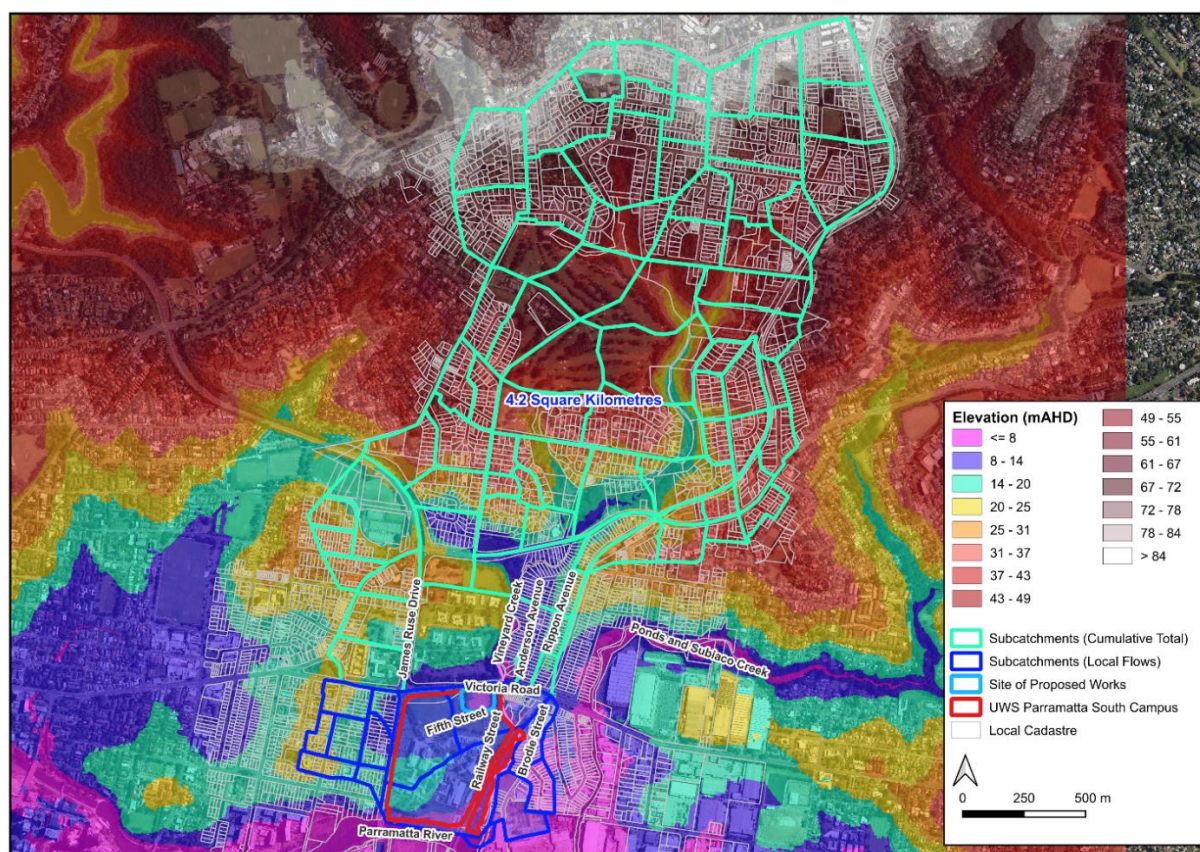
This resulted in GRC needing to develop a model to better understand the local flooding regime and potential impacts of the proposed development.

For reference purposes, in the course of building this model, GRC has reviewed reports outlining modelling previously conducted for this catchment including the Draft Parramatta River Flood Study (Stantec, 2023).

Hydrological Model

A hydrological model for Vineyard Creek catchment to Parramatta River in the downstream, covering an area of approximately 4.2 km², was set up using the Watershed Bounded Network Model (WBNM). The main flow from the catchment – conveyed through Vineyard Creek – runs along the eastern boundary of the site under investigation. The catchment was sub-divided into 90 sub-catchments, taking into consideration both natural topographic characteristics of the catchment as well as urban features within that have the potential of altering flow paths between the delineated sub-catchments (Figure 5). The advantage of the WBNM model is it has been built to produce probability equivalent flows in South-East Australia as well as its requirement for relatively few parameters in order to produce a reasonable hydrological representation of a modelled area. Those parameters of interest are summarised below.

Figure 5: Hydrological Sub-catchments



Rainfall Losses

In the absence of calibration data for the catchment, storm Initial Losses (IL) and Continuing Losses (CL) have been adopted from the 2016 catchment study (Rydalme Development Precinct Watercycle & Flood Management Strategy Report, Initial Investigation, J. Wyndham Prince). Noting that these loss values were also the default losses for use in NSW as per the 1987 edition of ARR. The resulting design flood levels were then compared to the flood levels provided on Council’s flood certificate. Table 1 summarises the losses used in this study.

Table 1: Losses adopted in the hydrological model

Event	Initial Loss (IL) [mm]		Continuing Loss (CL) [mm/hr]
	Impervious	Pervious	
20, 5, 1 % AEP	1	15	2.5
PMF	0	0	1

Lag Parameter

As recommended by WBNM documentation, a lag parameter of 1.6 was adopted. Nevertheless, other values were tested in order to have a sense on how adjusting this parameter would affect the catchment response; in addition to seeing whether that would improve the convergence between the results from the current study and suggested results from former reports.

Imperviousness

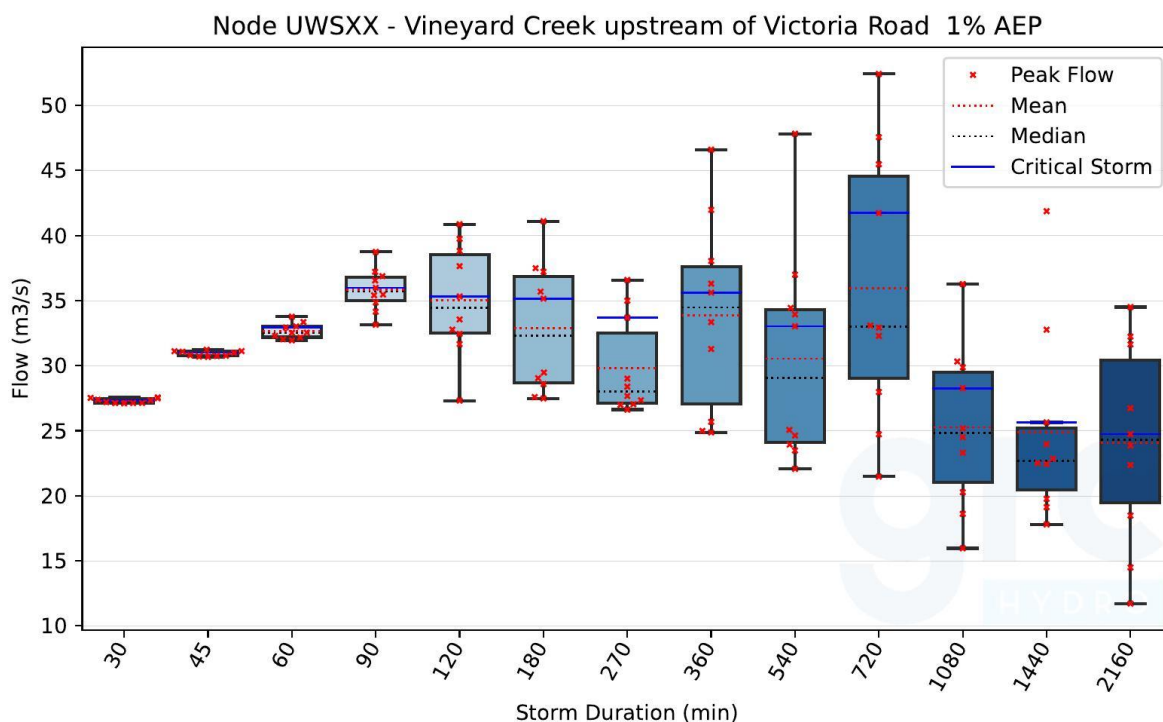
An impervious parameter was set for each model subcatchment, based on the land use in that area. In order to estimate imperviousness within the study area, the ESA Land Use and Land Cover product was used, which shows the 'Built Area' class within each catchment, which was treated as 100% impervious, and then averaged with the pervious areas, for each catchment, to get the percentage impervious.

Temporal Patterns and Critical Duration Assessment

Rainfall temporal patterns are used to describe how rainfall is distributed over time. The recommended ARR2019 ensemble approach to applying temporal patterns has been utilised in the current study. The ensemble approach to flood modelling applies a suite of 10 different temporal patterns for each duration. Temporal patterns were obtained from ARR2019 for the 'East Coast South' region from the ARR Data Hub. Point temporal patterns were used as the catchment area is smaller than 75 km².

The critical duration assessment is shown in Figure 3 below, for the 1% AEP event. As shown, durations of 60 minutes up to 720 minutes (12 hours) all produce a critical storm peak flow of between around 33 to 42 m³/s. The critical duration is 720 minutes/12 hours, which produces the highest peak flow of the critical storms (~42 m³/s). It is noteworthy that 720 min temporal patterns were assessed and TP01, TP05 and TP09 were all found to contain embedded bursts which exceed 1% AEP rainfall. As such it is apparent that the 1% AEP flow estimate derived herein is expected to be conservative (presuming neutral or conservative estimates elsewhere).

Figure 6: 1% AEP Hydrology - Duration and Temporal Pattern Distribution Box and Whisker Plot



Unit Flow Rate Comparison

In addition to that verification, the hydrologic model results were compared to unit flow rates in the Sydney basin, in the absence of other calibration data. Regional Flood Frequency Estimate was not considered for the catchment as the closest available catchments were around 25-100 km², much larger than the site's catchment.

The unit flow rate is calculated as the 1% AEP peak flow, divided by the catchment size, to give a flow rate per hectare.

$$\textit{Unit Flow Rate} = \frac{\textit{1\% AEP Peak Flow}}{\textit{Catchment Size (ha)}}$$

GRC Hydro have estimated unit flow rates for many catchments across Sydney and find that values are consistently in the 0.1-0.4 m³/s per hectare range, for urbanised overland flow catchments. Given the site's catchment is large (around 360 ha to Victoria Road) with large areas of native bush and including areas that hold water, its unit flow rate would be expected to be towards the lower end of the typical range.

At the subject site, the peak flow of 42 m³/s (calculated for the 3.6 km² catchment (360 ha) upstream of Victoria Road) gives a unit flow rate of 0.12 m³/s per hectare. This value falls within the expected range and indicates the hydrologic model estimates are on face value reliable.

Hydraulics

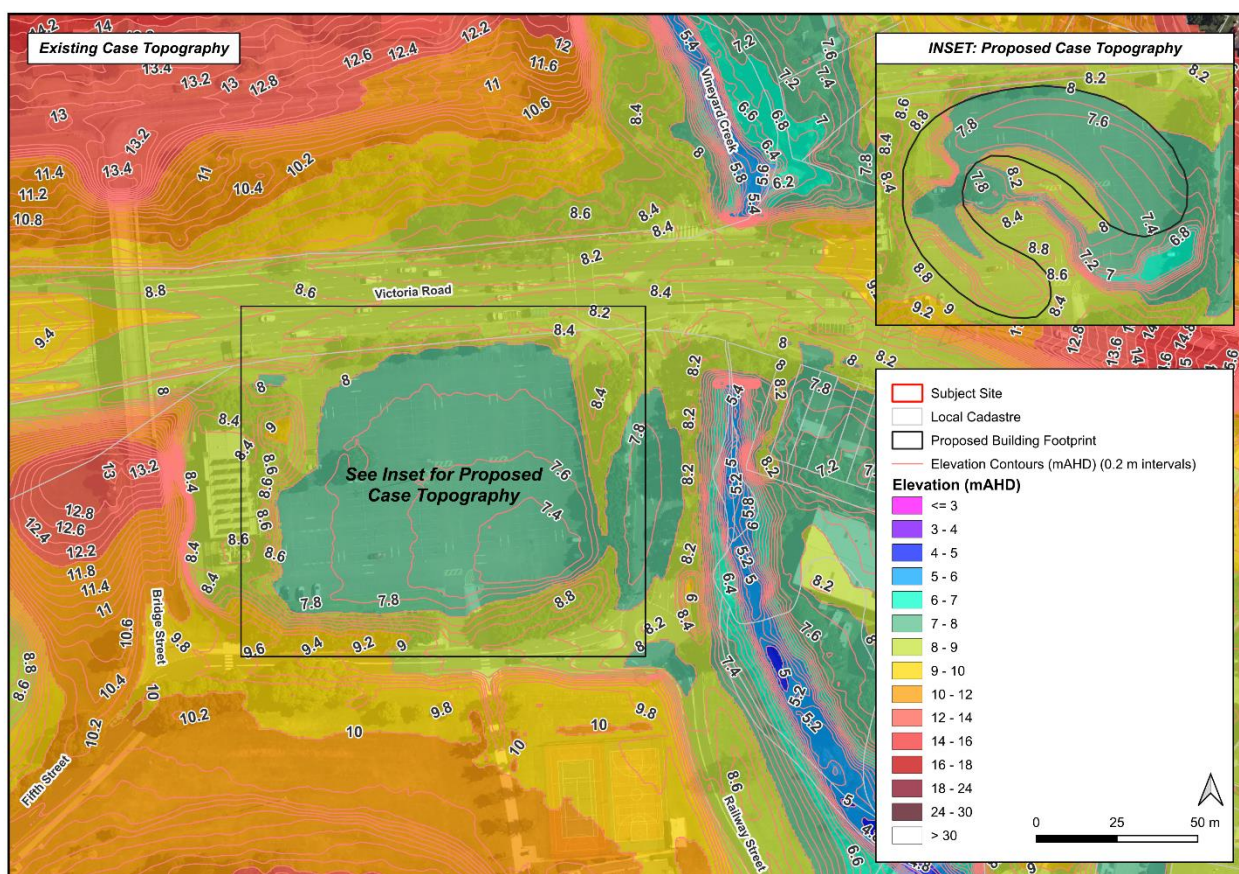
Topography

The topography within the model domain is represented by LiDAR sourced from [NSW Spatial Services](#). This LiDAR surface was the most up-to-date available at the time of modelling and is representative of the local terrain as of June 2019.

GRC undertook a desktop review of this LiDAR for locations where structures may have been lacking accuracy due to local vegetation obscuring the aerial survey. GRC made some edits upstream and downstream of the Victoria Road culvert based on analysis of Lidar and our site inspections.

Where topographic changes are to be made as part of the proposed development, these have been represented in the model by a grid developed from a tinned surface supplied to GRC on 03/05/2024 by Taylor Thomson Whitting (TTW) via WSU.

Figure 7: Site Topography and Proposed Changes



Material Roughness

Aerial imagery of the model domain was inspected and polygons representing the nature of the varied surface material were developed. These polygons are used in the hydraulic model to represent the different types of surfaces water will travel across in the course of flooding. A different roughness coefficient is applied to each surface type. The roughness coefficient adopted for each surface type in the model is documented below in Table 2. Where appropriate, GRC has adopted the same roughness coefficients as have been used in the Draft Parramatta River Flood Study (DPRFS).

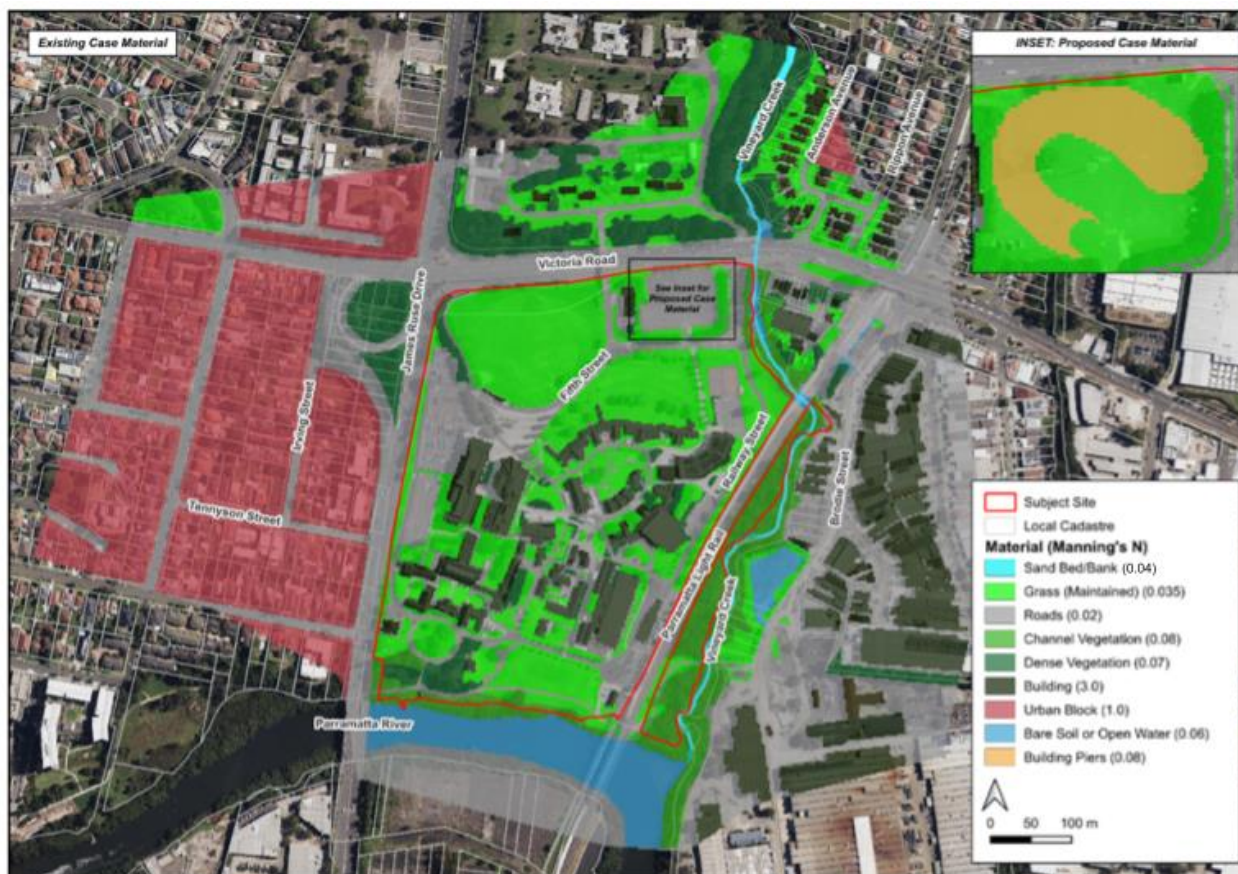
Table 2: Material Roughness Coefficients

Surface ID	Materials Roughness	Surface Type
1	0.04	Sand bed/bank
2	0.07	Grassy channels
3	0.035	Grass (maintained)- Value from DPRFS
4	0.05	Pasture
5	0.02	Roads- Value from DPRFS
6	0.013	Concrete Storage Areas
7	0.08	Channel Banks (Dense Riparian Vegetation)- Value from DPRFS
8	0.07	Dense Vegetation- Value from DPRFS
9	0.04	Creek Bed (middle of creek) mainly lower reaches
10	3	Building
11	1	Urban Block
12	0.02	Concrete in channel
13	0.06	Dams, open water, bare soil
17	0.12	Array of Building Piers

Buildings in the vicinity of the subject site have been modelled using a roughness coefficient of 3.

Mapping documenting the surfaces and roughness coefficients applied throughout this model is shown in Figure 8 below.

Figure 8: Material Roughness (Manning's N)



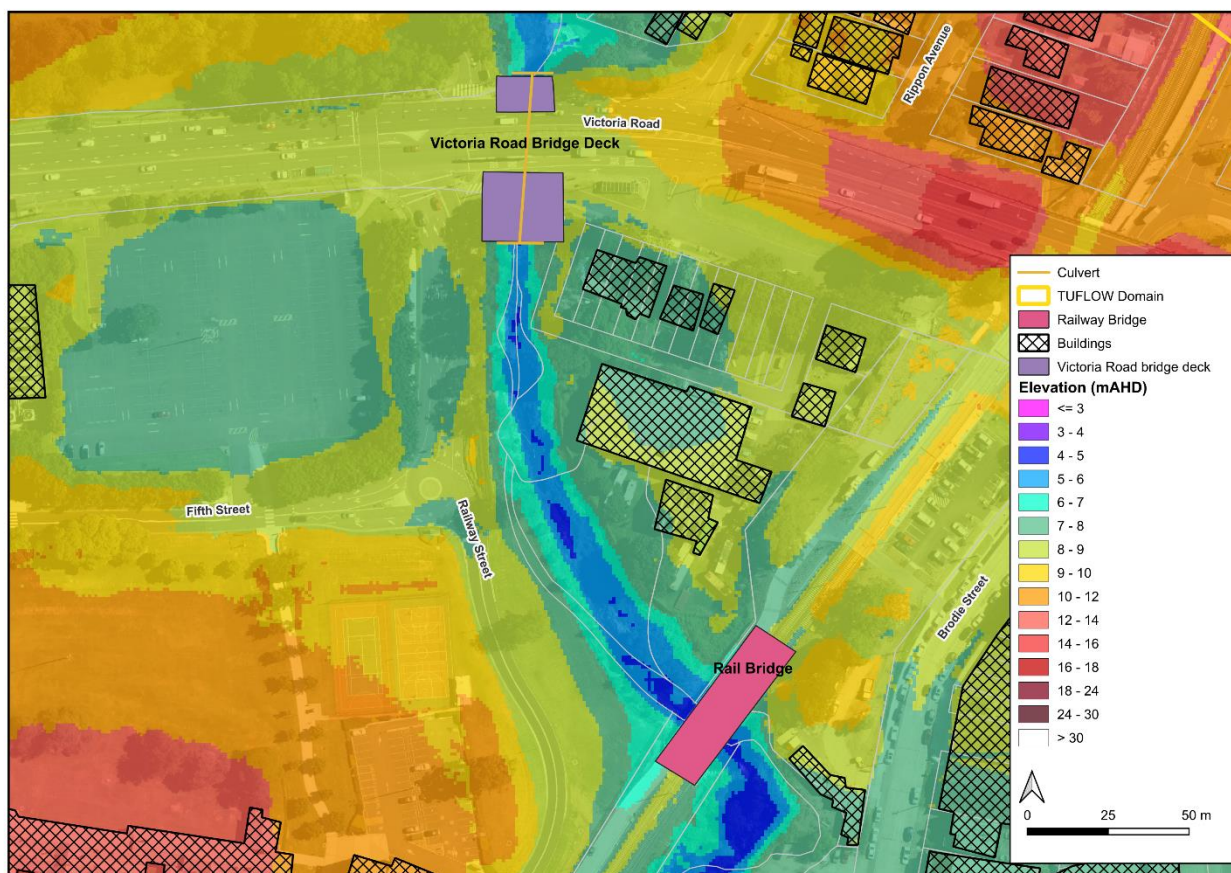
Structures

Vineyard Creek passes underneath two structures as it passes southward through the model domain. These include:

- Victoria Road crossing of Vineyard Creek. The structure is shown in Image 1. The dimensions were measured as part of a site visit. The structure is modelled in TUFLOW as a box culvert, with a 1% AEP design blockage of 15%, based on a ARR2019 Blockage Assessment; and
- A bridge deck and piers where a railway corridor passes above Vineyard Creek. This structure is shown in Image 2. A flow loss calculation was conducted for this structure, as was an ARR2019 Blockage Assessment. A 15% design blockage was adopted as a result.

These structures are identified in Figure 9 below.

Figure 9: Vineyard Creek Structures



Victoria Road Bridge Deck

Vineyard Creek passes beneath a bridge deck where Victoria Road crosses the creek. Victoria Rd is situated at the subject site’s northern boundary.

GRC undertook a site visit to better understand the geometry of this structure.

The upstream side of this structure is pictured in Image 1.

The dimensions of the void beneath this structure were measured by GRC and were found to be approximately 9.8 m wide and 2.5 m high from the bridge soffit to the creek’s invert at this location.

Given the rectangular nature of this structure, it has been represented in the TUFLOW model as a box culvert.

An ARR 2019 Blockage Assessment has been undertaken for this structure and as such, a blockage factor of 15% has been applied at this structure in GRC’s modelling.

Image 1: Victoria Road Bridge Deck and approximate dimensions (Upstream side)



Parramatta Light Rail Bridge

Vineyard Creek passes beneath the Parramatta Light Rail alignment downstream of the site. At this point a bridge deck, supported by a row of cylindrical piers, allows the track to pass across the top of Vineyard Creek.

GRC undertook a site visit to better understand the geometry of this structure.

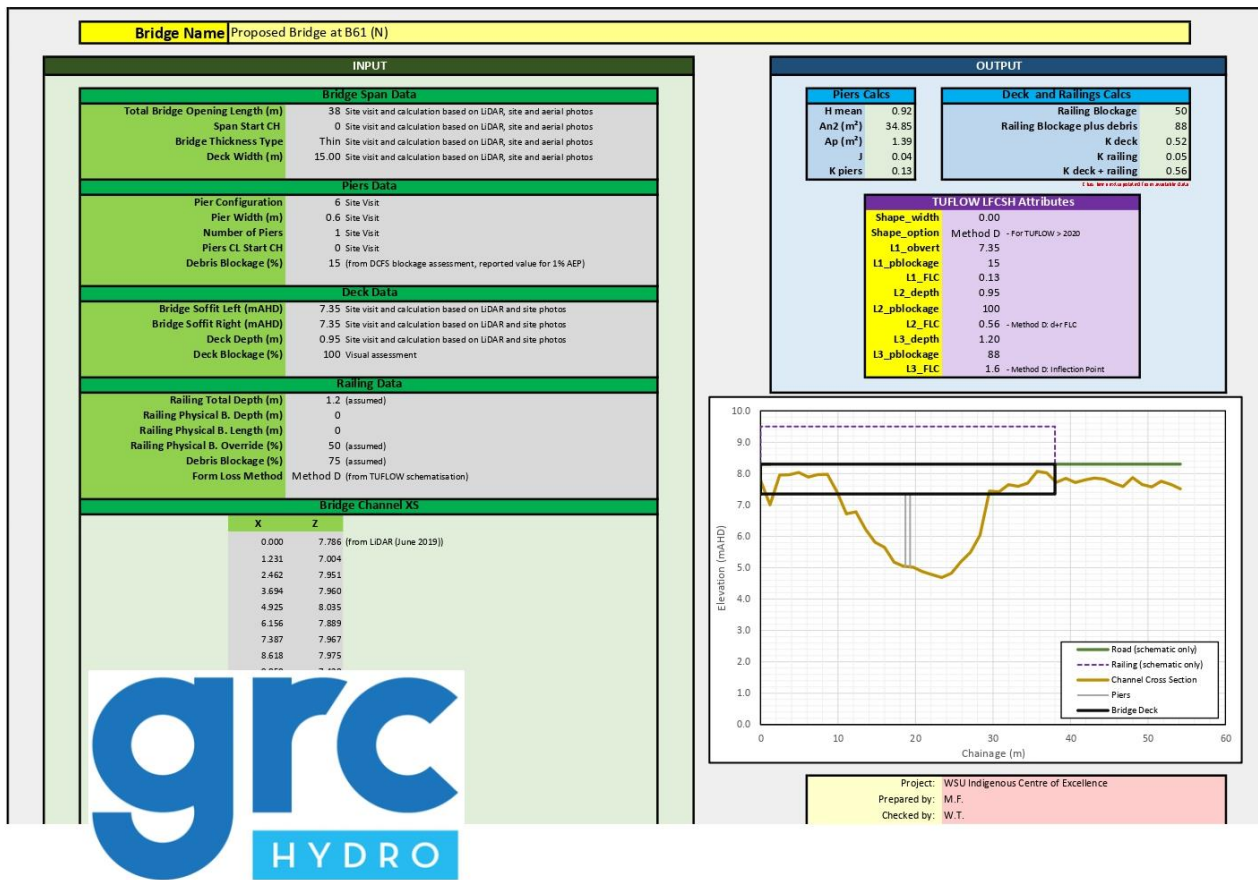
The upstream side of this structure is pictured in Image 2.

Image 2: Parramatta Light Rail Bridge (Upstream side)



A form loss calculation was undertaken for this structure in order to determine the appropriate parameters to represent this crossing in the TUFLOW model.

Figure 10: Form Loss Calculations (Parramatta Light Rail Bridge Crossing)



An ARR 2019 Blockage Assessment was undertaken for this structure and as a result of this assessment, a blockage factor of 15% has been applied at this structure in GRC’s modelling.

Stormwater Network

The whole of catchment local stormwater network has not been incorporated into this model. The 0.7 m pipe that drains the subject site to Vineyard Creek has been included in the existing case. The diameter of this pipe was confirmed in a site visit. This approach has been adopted as the site is subject to mainstream flooding and this is the critical issue for the site vis a vis flooding.

Upstream Flow Boundary

The WBNM generated flows for the 90 Vineyard Creek sub-catchments identified in Figure 5 have been applied in this model as follows:

- All sub-catchments north of Victoria Road lead to Vineyard Creek north of Victoria Road. As such, the accumulated flows for these sub-catchments have been applied to an upstream boundary north of the Victoria Road culvert; and
- All sub-catchments south of Victoria Road were applied as local inflows.

Tailwater

Two tailwater scenarios have been examined for this modelling in order to account for potential coincident flooding between Vineyard Creek and Parramatta River flooding. These tailwater levels are:

- A mean sea level tailwater of 0 mAHD; and

- A 5% AEP tailwater that adopts the 5% AEP flood level for the model’s downstream boundary from the Lower Parramatta River Flood Study (SKM, 2005).

Climate Change

Two climate change scenarios have been included as part of this modelling:

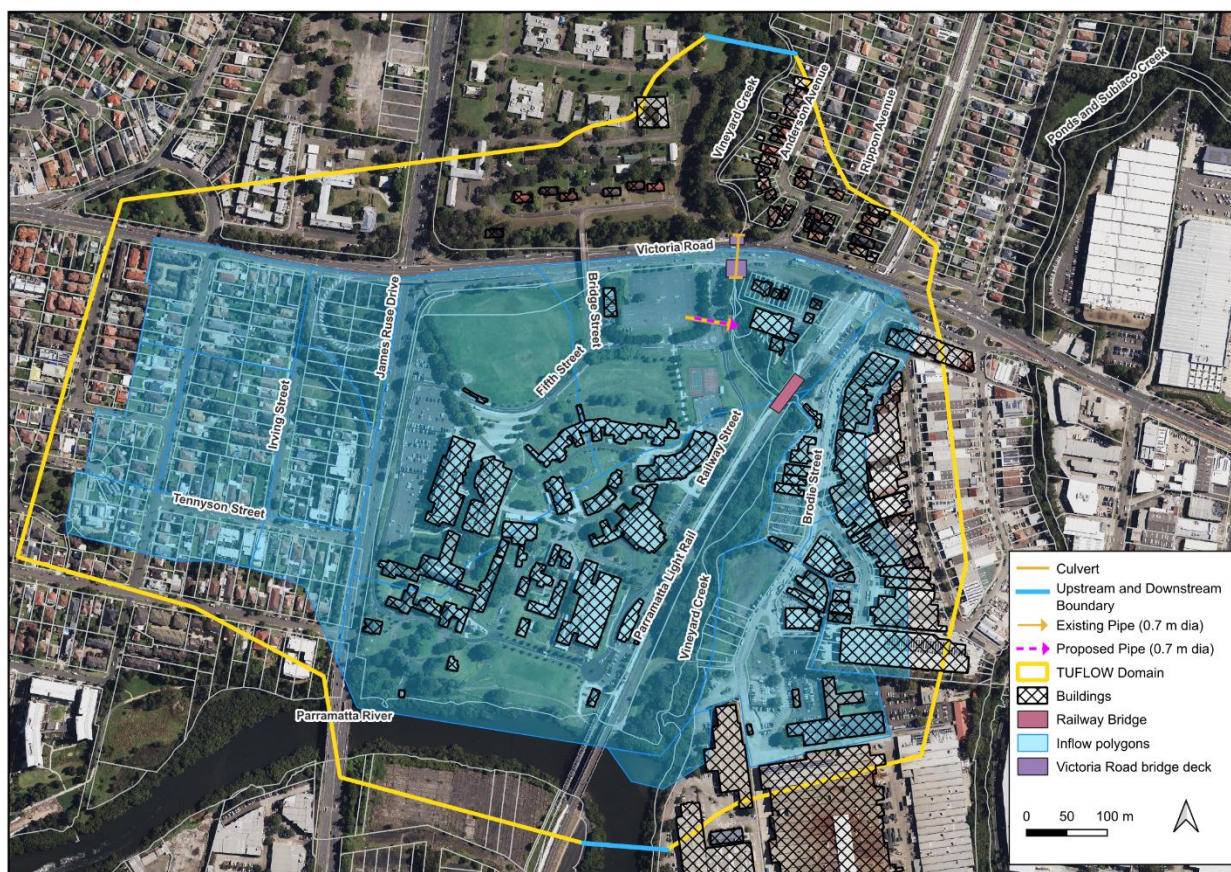
- RCP 4.5 – 2050
- RCP 4.5 – 2090

The tailwater increases for these scenarios have been adopted from Table 5 in the NSW DPE’s *Understanding and Managing Flood Risk - Flood Risk Management Guideline FB01*.

TUFLOW Model Setup

The TUFLOW Model Setup for this project is documented in Figure 11.

Figure 11: TUFLOW Model Setup



Model Results and Verification

A full series of hydrological events – with varying storm durations and temporal patterns – were modelled in GRC’s 2D hydraulic model (Existing Condition scenario) to determine the critical 1% AEP event for the site.

These events were as follows:

Durations: 60 minutes, 90 minutes, 120 minutes, 360 minutes, 540 minutes and 720 minutes

Temporal Pattern: TP01, TP02, TP03, TP04, TP05, TP06, TP07, TP08, TP09 and TP10

The critical duration selected for the 1% AEP event was 720 minutes (12 hours) with the TP06 temporal pattern.

The critical durations selected for all design events were as follows:

20% AEP	120 minutes (2 hours)- TP05	Flow: 18 m ³ /s
1% AEP	720 minutes (12 hours)- TP06	Flow: 42 m ³ /s
1% AEP + RCP 4.5 2050*	720 minutes (12 hours)- TP06	Flow: 46.8 m ³ /s
1% AEP + RCP 4.5 2090*	720 minutes (12 hours)- TP06	Flow: 48.6 m ³ /s
0.2% AEP	90 minutes (1.5 hours) – TP05	Flow: 47 m ³ /s
PMF	45 minutes – TP01	Flow: 373 m ³ /s

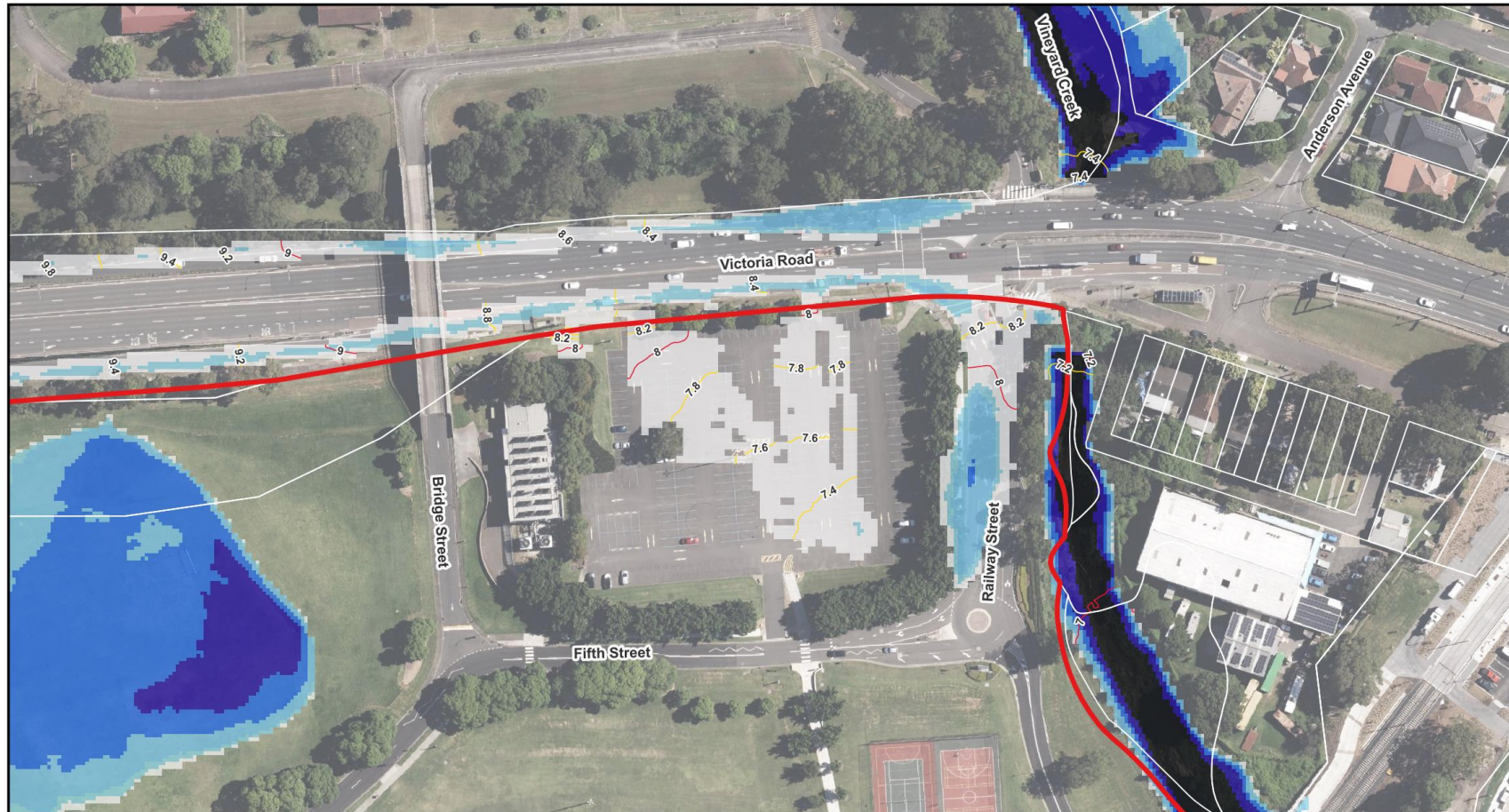
** These Climate Change scenarios have incorporated rainfall increases as per Table 4 of the NSW DPE’s Understanding and Managing Flood Risk - Flood Risk Management Guideline FB01.*

Existing Condition

Modelling results for the Existing Condition for the 20% AEP, 1% AEP, 0.2% AEP and PMF design events are documented below from Figure 12 to Figure 23.

20% AEP	<p><i>Flood Levels:</i> ranging from 7.3 mAHD to 8.2 mAHD along the northern boundary of the car park.</p> <p><i>Flood Depths:</i> predominantly less than 0.1 m deep with a small portion up to 0.3 m.</p> <p><i>Flood Hazard:</i> Max of H1 (low hazard).</p>
1% AEP	<p><i>Flood Levels:</i> ranging from 8.2 mAHD in the south-western corner of the car park to 8.3 mAHD along the northern boundary of the car park</p> <p><i>Flood Depths:</i> from 0.3 m up to 1.0 m deep</p> <p><i>Flood Hazard:</i> Max of H3 (low to medium hazard).</p>
1% AEP + RCP 4.5 2050	<p><i>Flood Levels:</i> plateaued at 8.3 mAHD.</p> <p><i>Flood Depths:</i> from 0.3 m up to 1.0 m deep</p> <p><i>Flood Hazard:</i> Max of H3 (low to medium hazard).</p>
1% AEP + RCP 4.5 2090	<p><i>Flood Levels:</i> ranging from 8.3 mAHD in the south-western corner of the car park to 8.4 mAHD along the northern boundary of the car park</p> <p><i>Flood Depths:</i> from 0.3 m up to 1.0 m deep</p> <p><i>Flood Hazard:</i> Max of H3 (low to medium hazard).</p>
0.2% AEP	<p><i>Flood Levels:</i> plateaued at 8.3 mAHD.</p> <p><i>Flood Depths:</i> from 0.3 m up to 1.0 m deep</p> <p><i>Flood Hazard:</i> Max of H3 (low to medium hazard).</p>
PMF	<p><i>Flood Levels:</i> 10.4 mAHD</p> <p><i>Flood Depths:</i> from 1.0 m up to 3.1 m deep</p> <p><i>Flood Hazard:</i> Max of H5 (high hazard)</p>

Figure 12: Peak Flood Levels and Depths – 20% AEP – Existing Condition



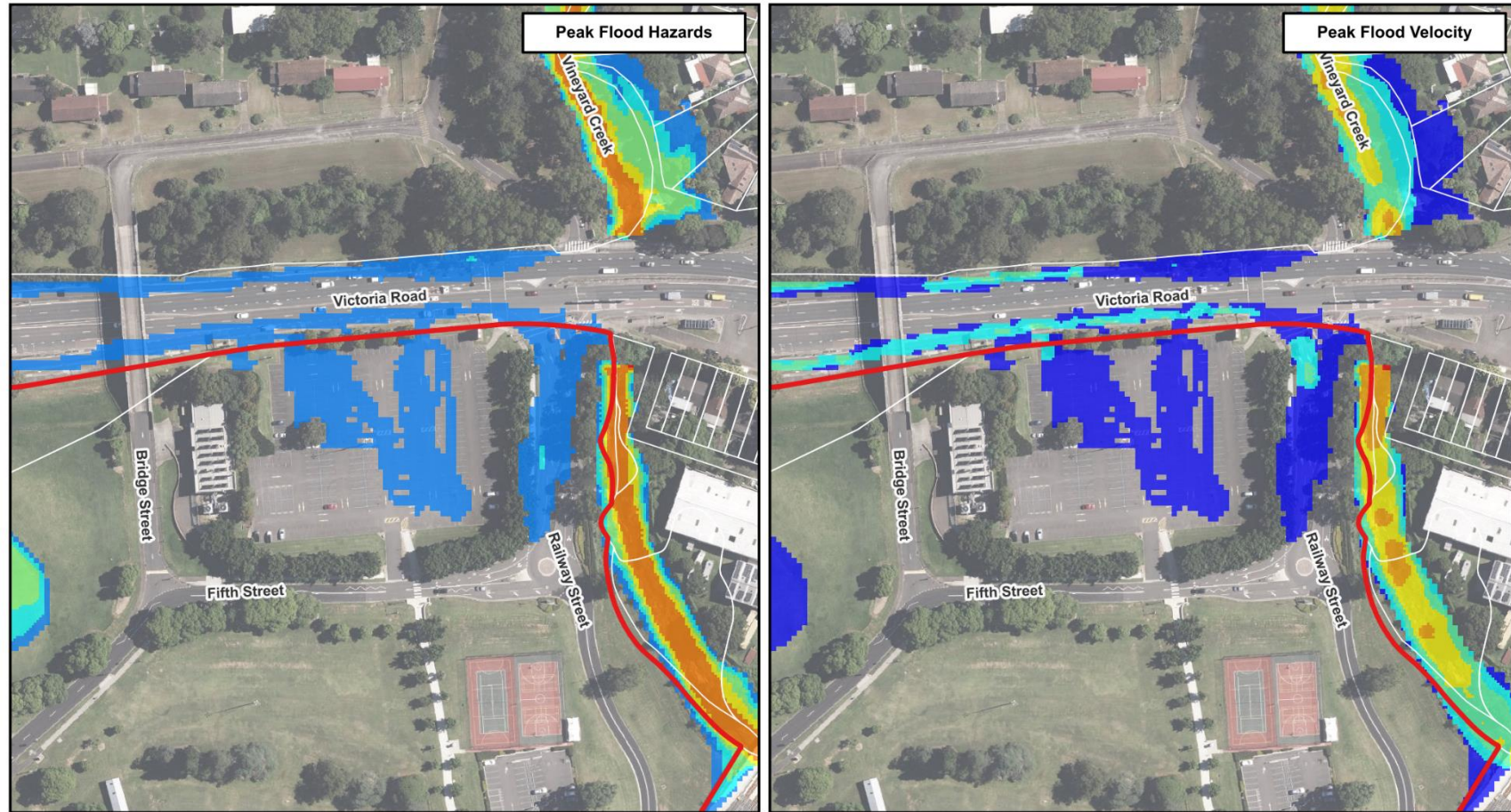
Event: 20% AEP (120 minute TP05)
 Title: Peak Flood Levels and Depths
 Scenario: Existing Condition

- Subject Site
- Local Cadastre
- Flood Level Contours (mAHD - 1.0 m intervals)
- Flood Level Contours (mAHD - 0.2 m intervals)

- Flood Depth (m)**
- <= 0.05
 - 0.05 - 0.10
 - 0.10 - 0.30
 - 0.30 - 0.50
 - 0.50 - 1.00
 - > 1.00



Figure 13: Flood Velocity and Hazard – 20% AEP – Existing Condition



Event: 20% AEP (120 minute TP05)
 Title: Flood Velocity and Hazard
 Scenario: Existing Condition

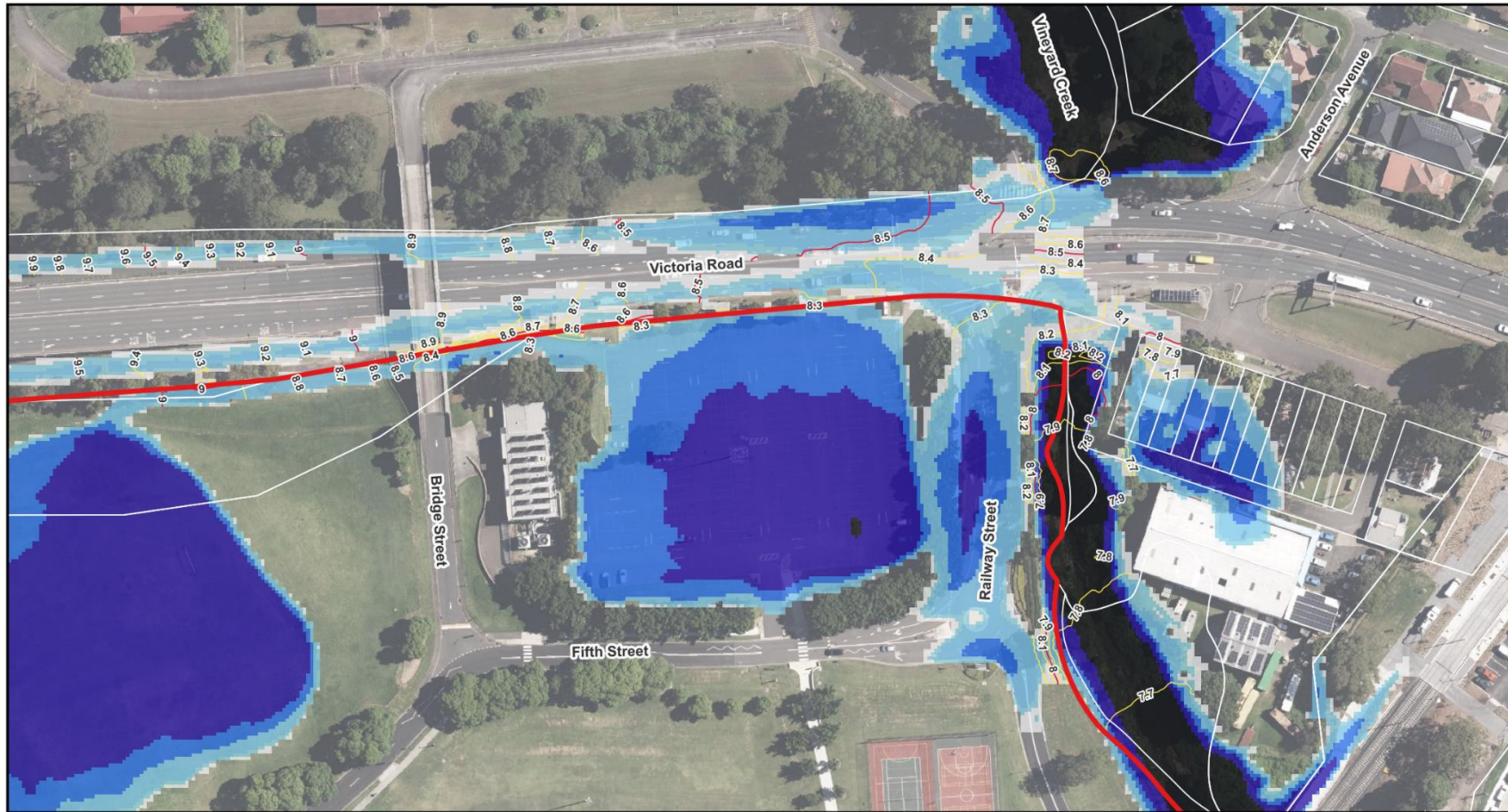
Subject Site
 Local Cadastre



0 50 100 m

Hazard	Velocity
H1	<math>< 0.25</math>
H2	0.25 to 0.50
H3	0.50 to 0.75
H4	0.75 to 1.00
H5	1.00 to 2.00
H6	> 2.00

Figure 14: Peak Flood Levels and Depths – 1% AEP – Existing Condition



Event:	1% AEP (720 minute TP06)
Title:	Peak Flood Levels and Depths
Scenario:	Existing Condition

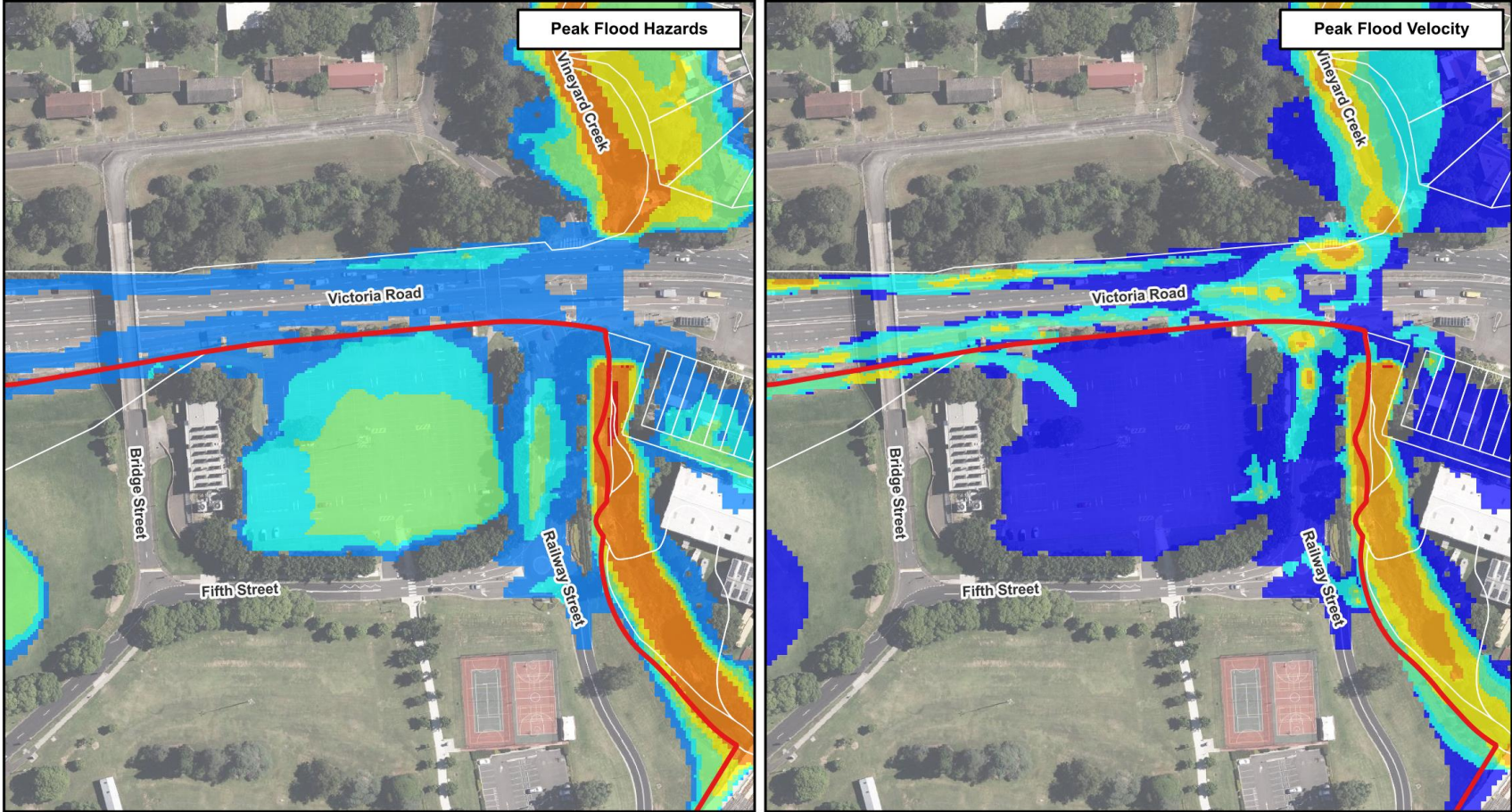
- Subject Site
- Local Cadastre
- Flood Level Contours (mAHD - 0.5 m intervals)
- Flood Level Contours (mAHD - 0.1 m intervals)

Flood Depth (m)

- <= 0.05
- 0.05 - 0.10
- 0.10 - 0.30
- 0.30 - 0.50
- 0.50 - 1.00
- > 1.00

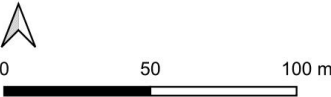


Figure 15: Flood Velocity and Hazard – 1% AEP – Existing Condition



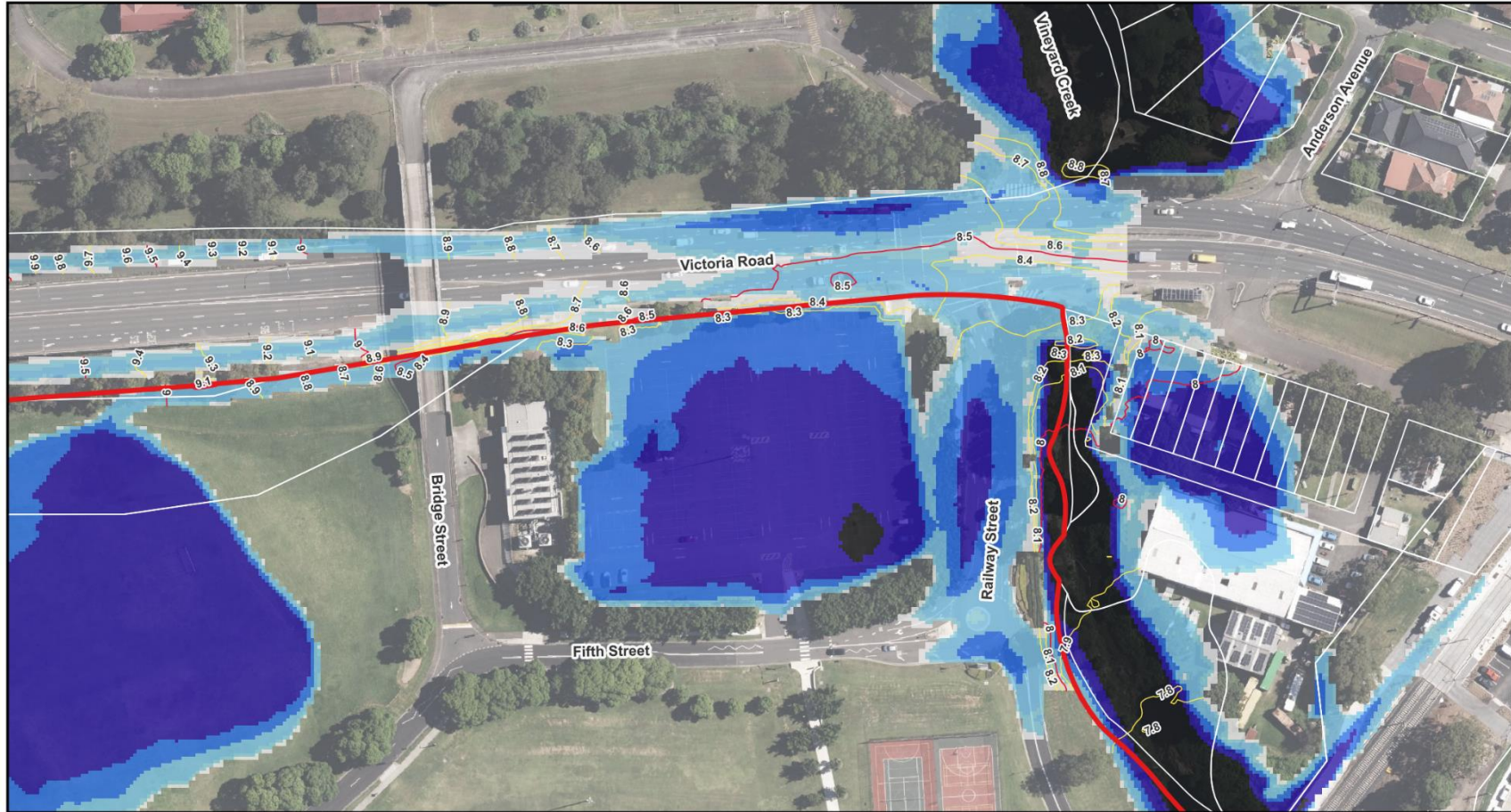
Event: 1% AEP (720 minute TP06)
 Title: Flood Velocity and Hazard
 Scenario: Existing Condition

Subject Site
 Local Cadastre



Hazard	Velocity
H1	< 0.25
H2	0.25 to 0.50
H3	0.50 to 0.75
H4	0.75 to 1.00
H5	1.00 to 2.00
H6	> 2.00

Figure 16: Peak Flood Levels and Depths – 1% AEP with Climate Change (RCP 4.5 2050) – Existing Condition



Event: 1% AEP (720 minute TP06) RCP4.5 2050
 Title: Peak Flood Levels and Depths
 Scenario: Existing Condition

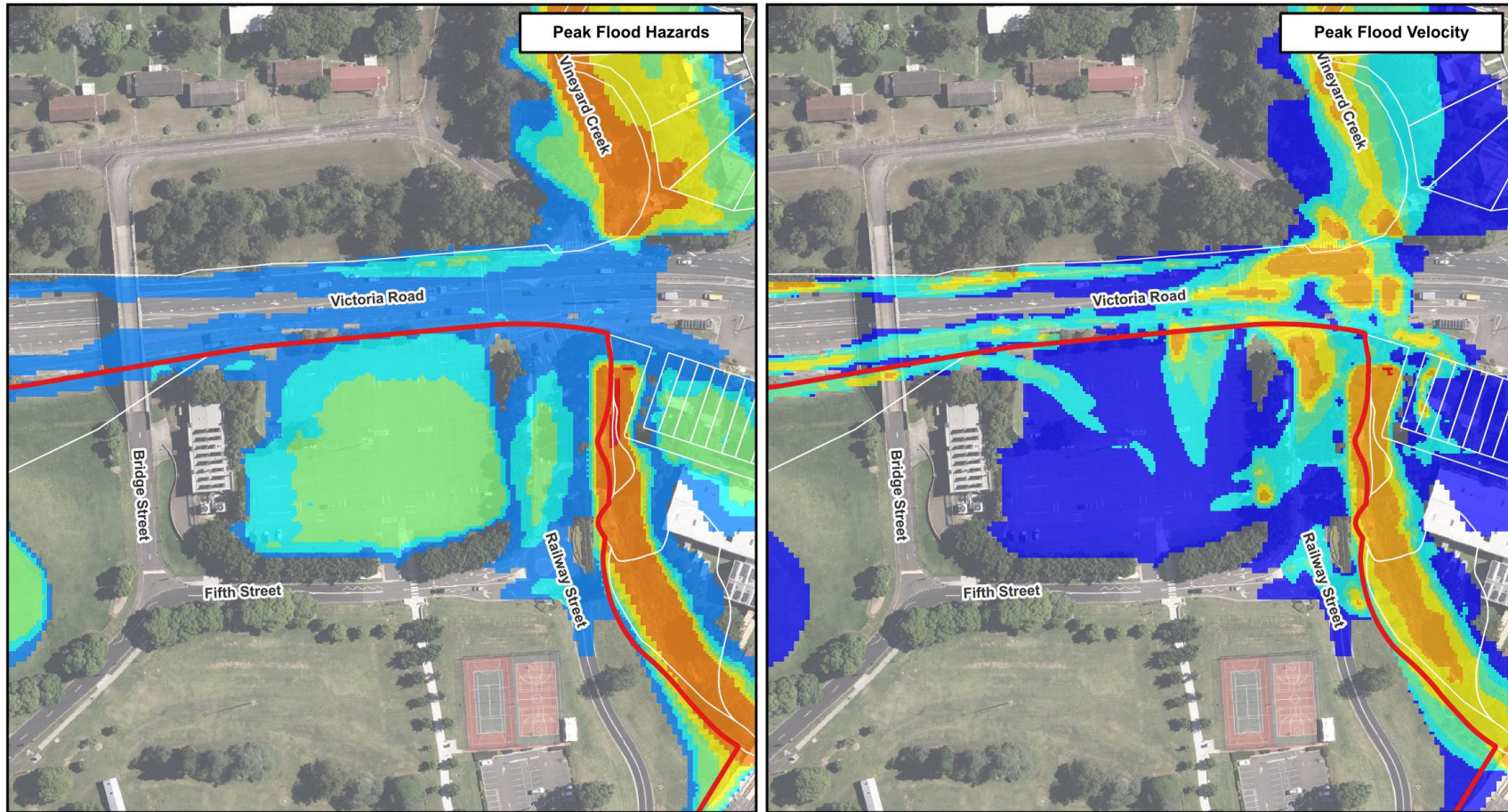
- Subject Site
- Local Cadastre
- Flood Level Contours (mAHD - 0.5 m intervals)
- Flood Level Contours (mAHD - 0.1 m intervals)

Flood Depth (m)

- <= 0.05
- 0.05 - 0.10
- 0.10 - 0.30
- 0.30 - 0.50
- 0.50 - 1.00
- > 1.00



Figure 17: Flood Velocity and Hazard – 1% AEP with Climate Change (RCP 4.5 2050) – Existing Condition



Event:	1% AEP (720 minute TP06) RCP4.5 2050
Title:	Flood Velocity and Hazard
Scenario:	Existing Condition

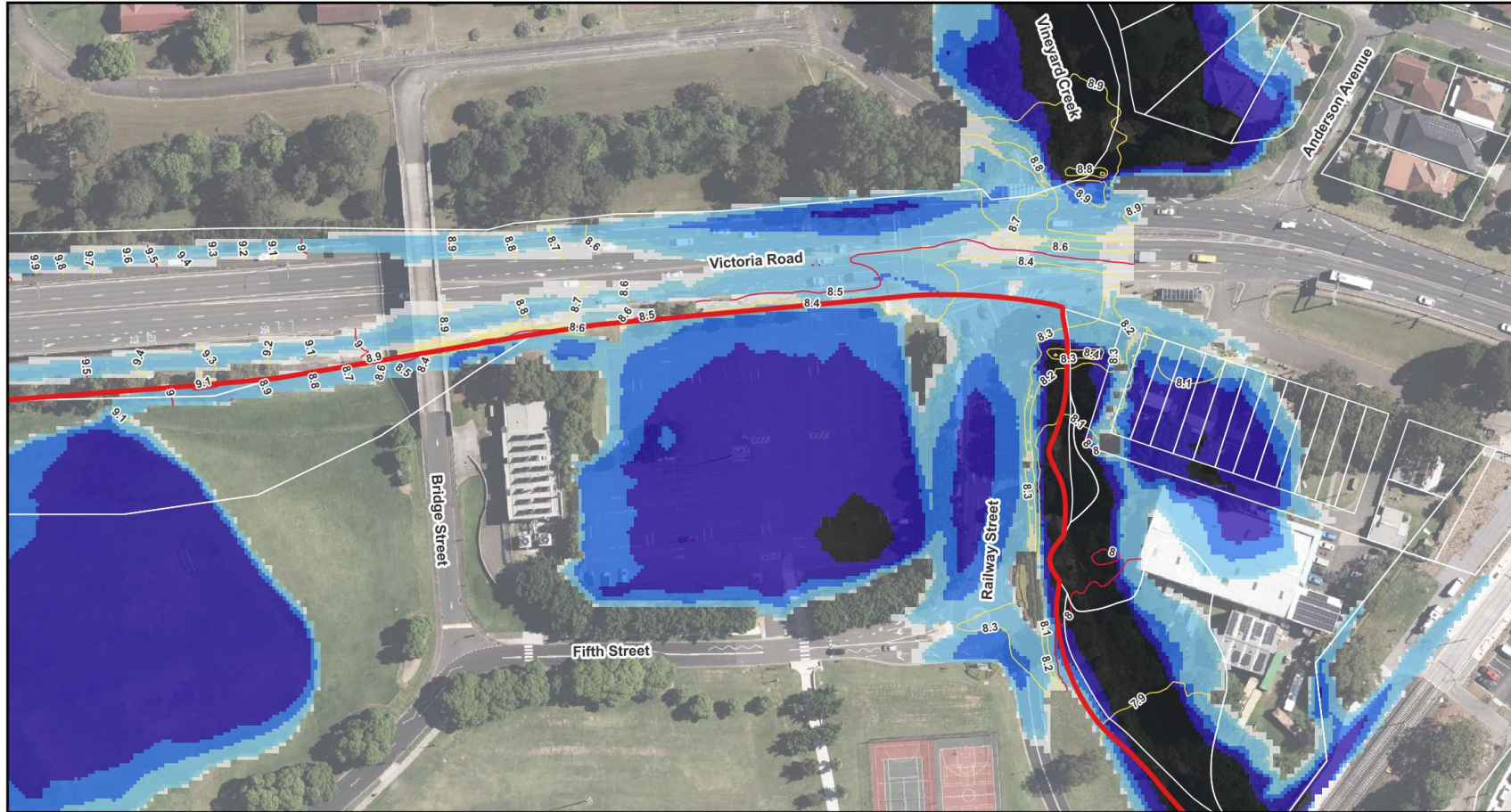
Subject Site
 Local Cadastre



0 50 100 m

Hazard	Velocity
H1	< 0.25
H2	0.25 to 0.50
H3	0.50 to 0.75
H4	0.75 to 1.00
H5	1.00 to 2.00
H6	> 2.00

Figure 18: Peak Flood Levels and Depths – 1% AEP with Climate Change (RCP 4.5 2090) – Existing Condition



Event: 1% AEP (720 minute TP06) RCP4.5 2090
 Title: Peak Flood Levels and Depths
 Scenario: Existing Condition

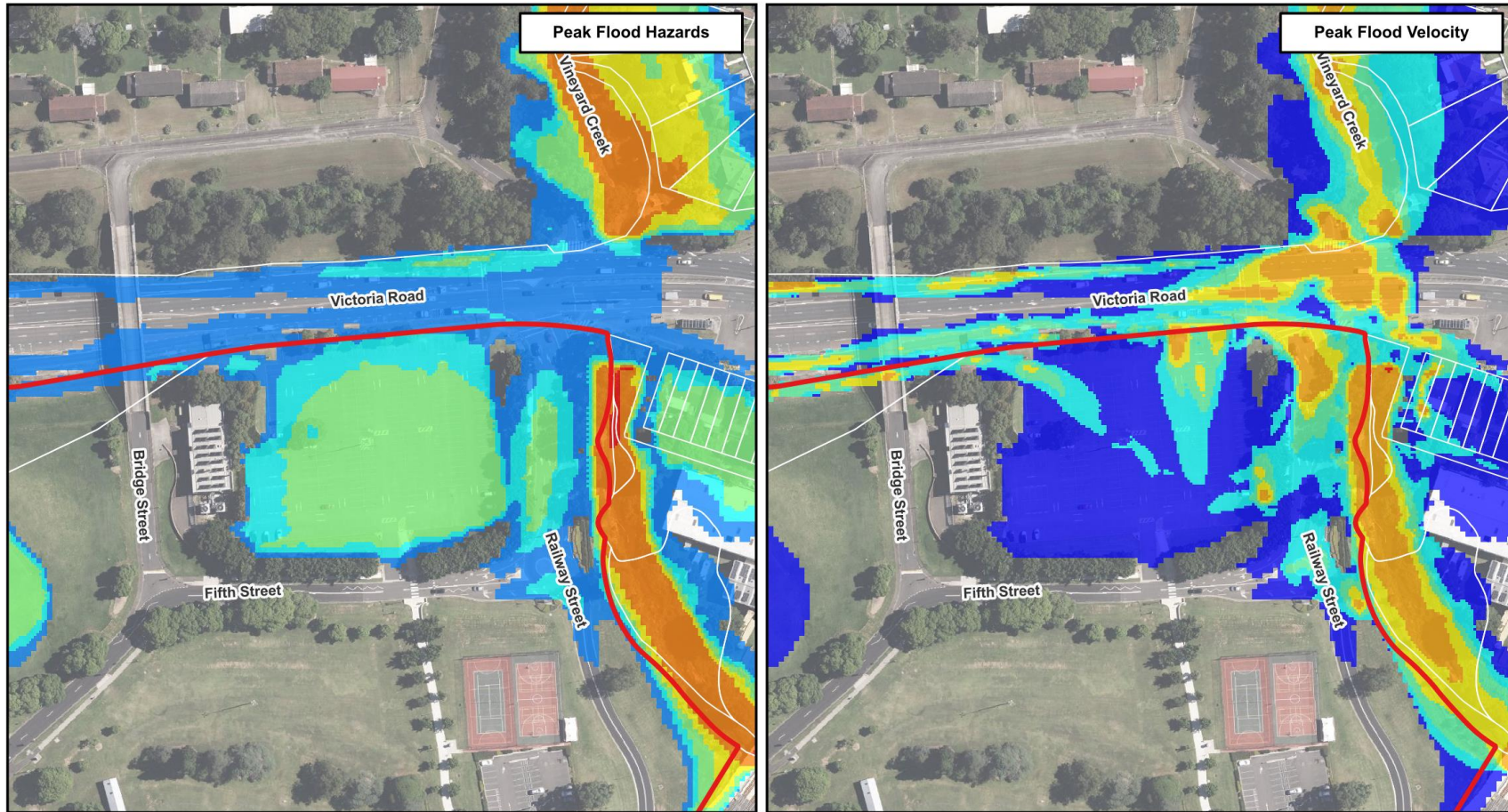
- Subject Site
- Local Cadastre
- Flood Level Contours (mAHD - 0.5 m intervals)
- Flood Level Contours (mAHD - 0.1 m intervals)

Flood Depth (m)

- <= 0.05
- 0.05 - 0.10
- 0.10 - 0.30
- 0.30 - 0.50
- 0.50 - 1.00
- > 1.00



Figure 19: Flood Velocity and Hazard – 1% AEP with Climate Change (RCP 4.5 2090) – Existing Condition



Event:	1% AEP (720 minute TP06) RCP4.5 2090
Title:	Flood Velocity and Hazard
Scenario:	Existing Condition

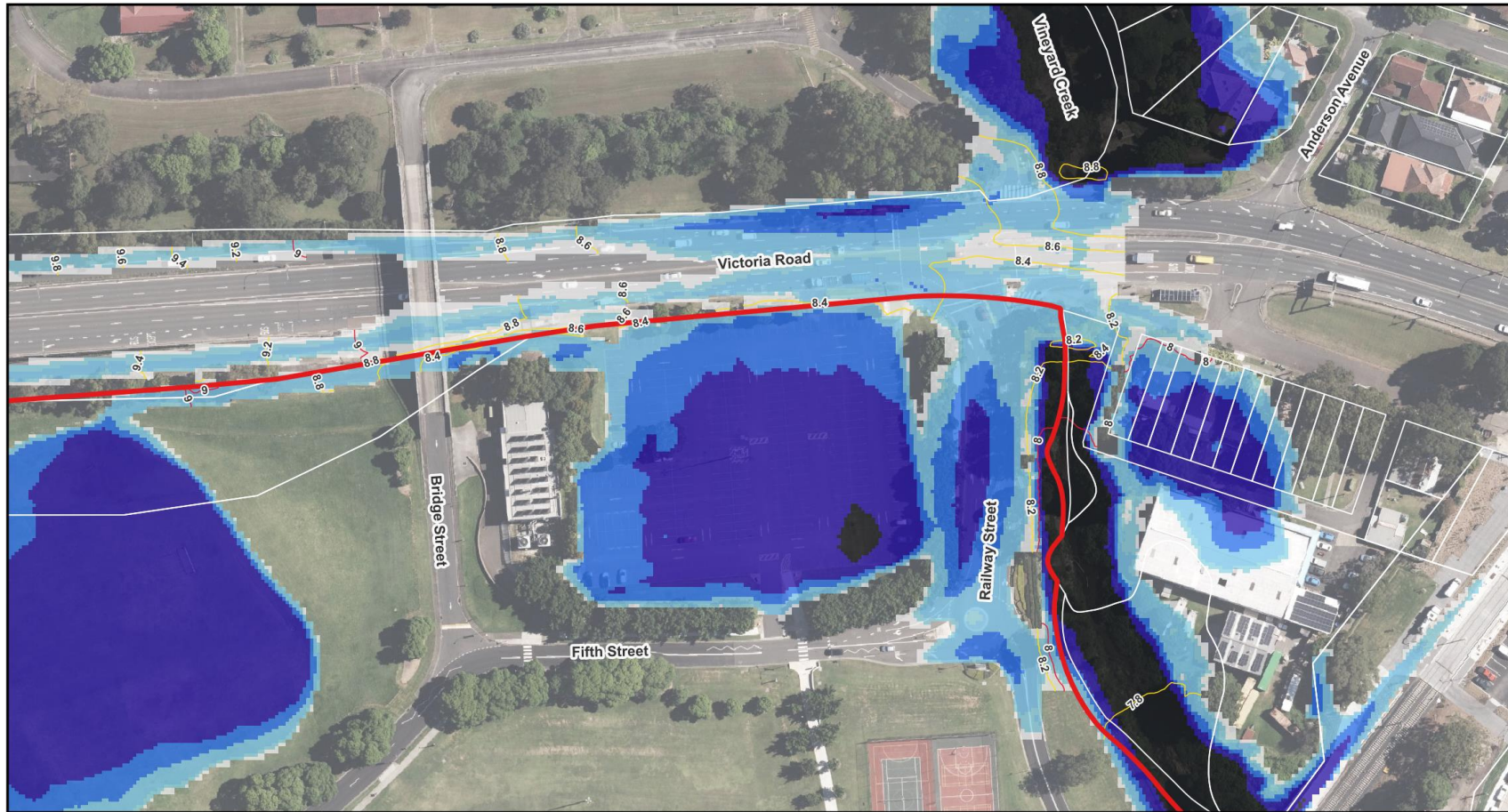
Subject Site
 Local Cadastre



0 50 100 m

Hazard	Velocity
H1	< 0.25
H2	0.25 to 0.50
H3	0.50 to 0.75
H4	0.75 to 1.00
H5	1.00 to 2.00
H6	> 2.00

Figure 20: Peak Flood Levels and Depths – 0.2% AEP – Existing Condition



Event: **0.2% AEP (90 minute TP05)**
 Title: **Peak Flood Levels and Depths**
 Scenario: **Existing Condition**

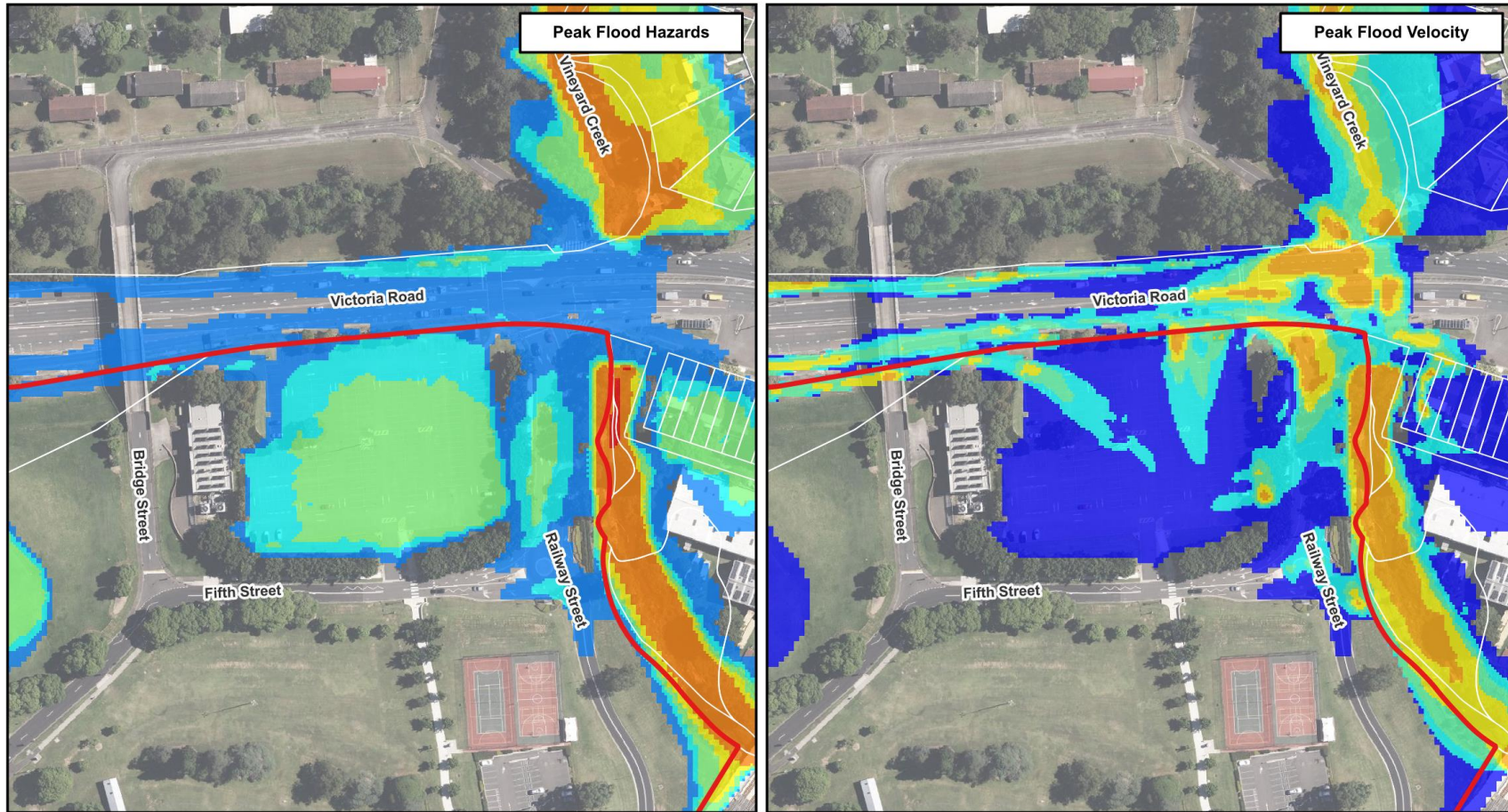
- Subject Site
- Local Cadastre
- Flood Level Contours (mAHD - 1.0 m intervals)
- Flood Level Contours (mAHD - 0.2 m intervals)

Flood Depth (m)

- <= 0.05
- 0.05 - 0.10
- 0.10 - 0.30
- 0.30 - 0.50
- 0.50 - 1.00
- > 1.00

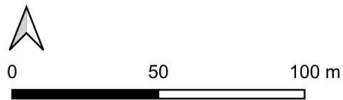


Figure 21: Flood Velocity and Hazard – 0.2% AEP – Existing Condition



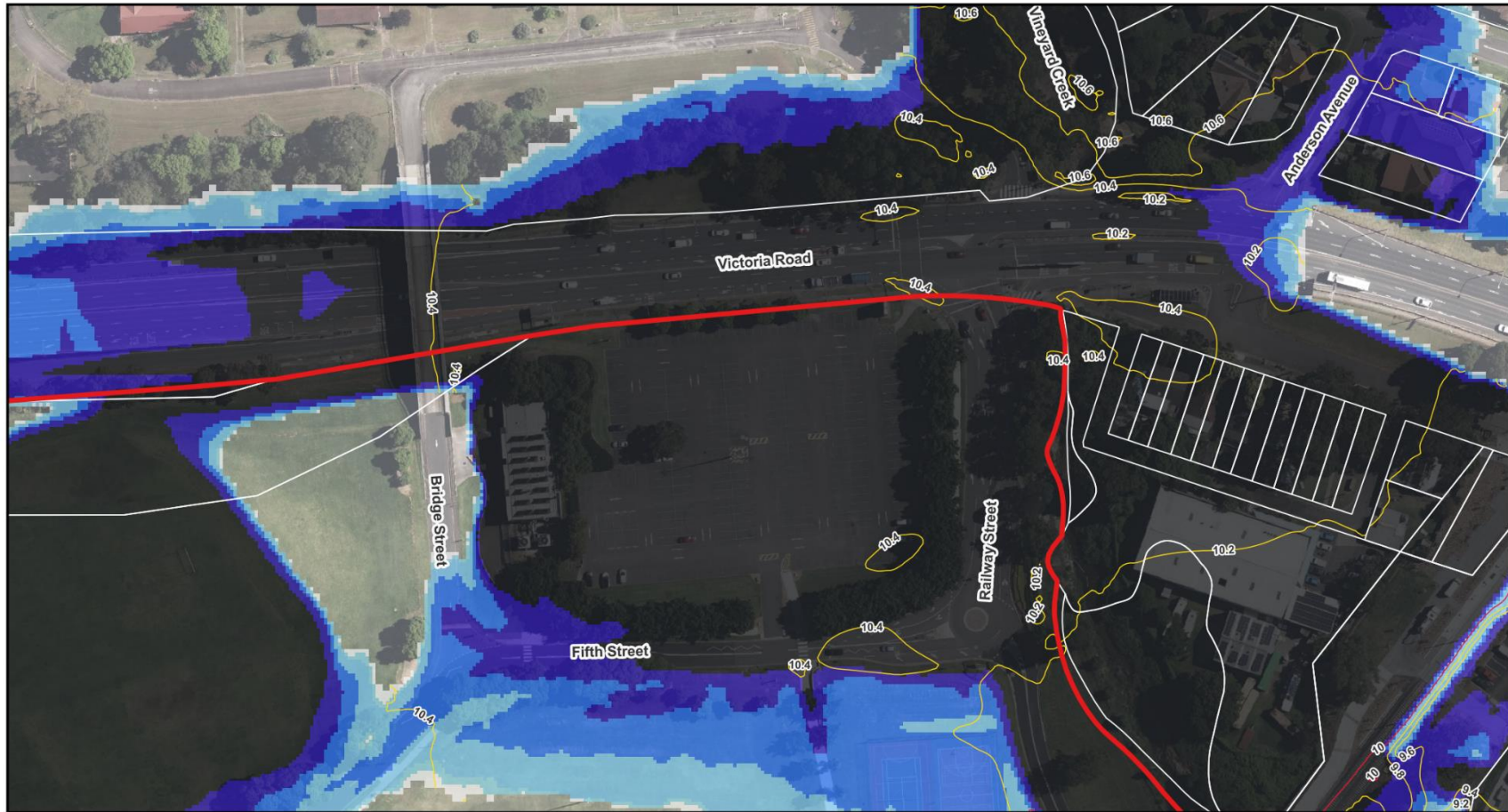
Event: 0.2% AEP (90 minute TP05)
 Title: Flood Velocity and Hazard
 Scenario: Existing Condition

Subject Site
 Local Cadastre



Hazard	Velocity
H1	< 0.25
H2	0.25 to 0.50
H3	0.50 to 0.75
H4	0.75 to 1.00
H5	1.00 to 2.00
H6	> 2.00

Figure 22: Peak Flood Levels and Depths – PMF – Existing Condition



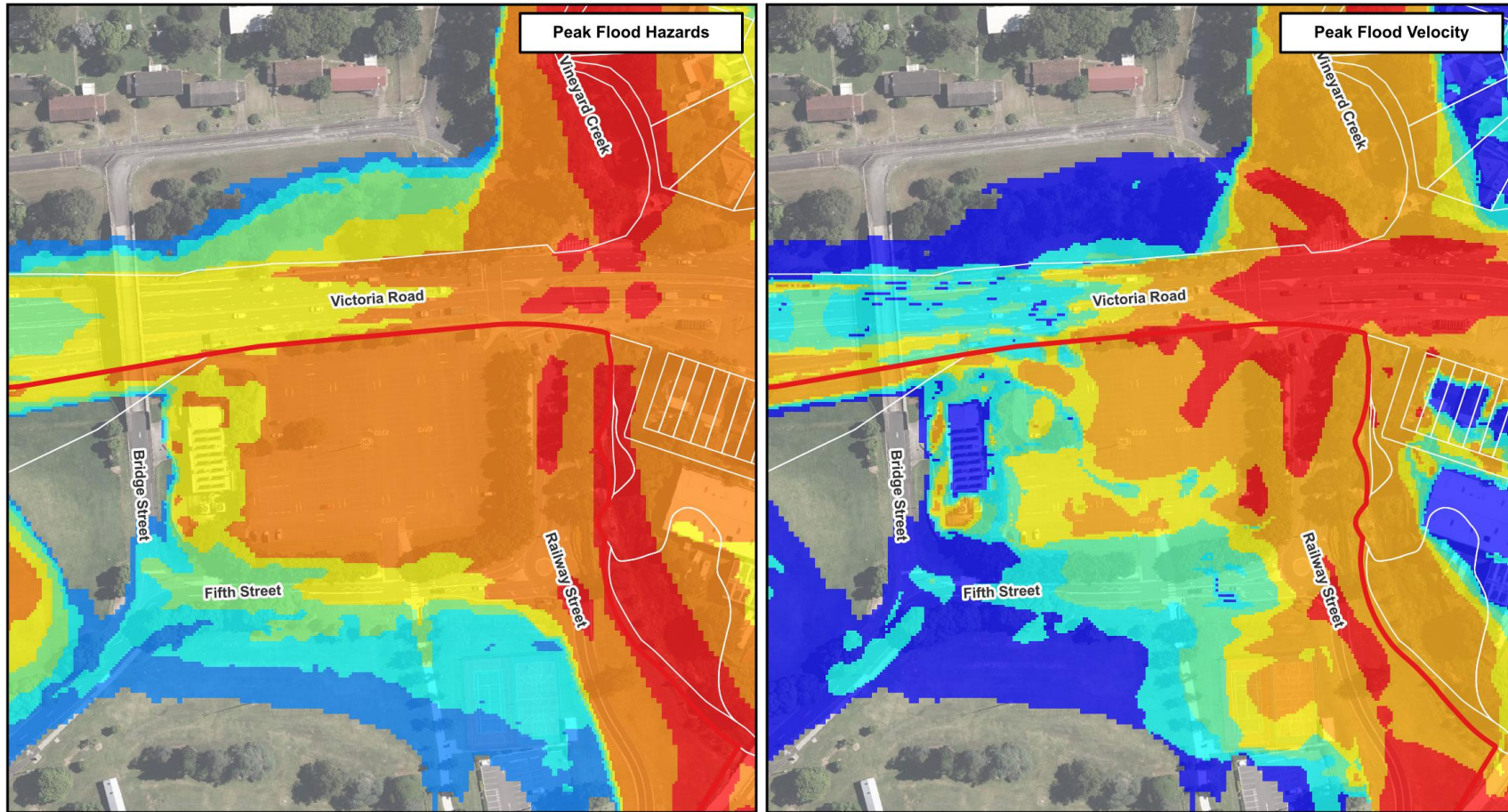
Event:	PMF (45 minute TP01)
Title:	Peak Flood Levels and Depths
Scenario:	Existing Condition

- Proposed Building Footprint
- Subject Site
- Local Cadastre
- Flood Level Contours (mAHD - 1.0 m intervals)
- Flood Level Contours (mAHD - 0.2 m intervals)

- Flood Depth (m)**
- <= 0.05
 - 0.05 - 0.10
 - 0.10 - 0.30
 - 0.30 - 0.50
 - 0.50 - 1.00
 - > 1.00



Figure 23: Flood Velocity and Hazard – PMF – Existing Condition



Event: **PMF (45 minute TP01)**
 Title: **Flood Velocity and Hazard**
 Scenario: **Existing Condition**

Subject Site
 Local Cadastre



0 50 100 m

Hazard	Velocity
H1	< 0.25
H2	0.25 to 0.50
H3	0.50 to 0.75
H4	0.75 to 1.00
H5	1.00 to 2.00
H6	> 2.00

Comparison of Modelled Existing Levels to Council Flood Levels

The modelled flood level at the site in the 1% AEP event is 8.3 mAHD (see Figure 14). The flood certificate does not provide a comparable level at the subject site, however the Vineyard Creek flood levels documented on the Council-provided flood map (see Figure 4) appear to be a good match with GRC's 1% AEP estimate (see Figure 14) in that:

- in both sets of results the site is flooded in the 1% AEP;
- in the SKM 2005 results, the level upstream of Victoria Road is 8.6 mAHD which is similar to GRC's modelled level of 8.5 mAHD; and
- in the creek immediately downstream of Victoria Road, the SKM 2005 levels of 8.0 mAHD are approximately matched by GRC's modelling with slightly higher values of approximately 8.1 mAHD in this location (see Figure 14).

SMEC 2004 flood level estimates are higher than GRC's estimates. SMEC 2004 flood level estimates are 9.0 mAHD upstream of Victoria Road and approximately 8.5 mAHD in the downstream reach of Vineyard Creek. GRC were unable to determine how the SMEC 2004 estimates came to be and given they exceed the ARR2019 0.2% AEP design level estimates at the site, we conclude they may constitute an exaggeration. It is speculation but given the 2004 estimate was done in Mike-11 (a modelling package), the extreme levels could be the result of limited cross-section width meaning that the entire floodplain was not available for flow and storage.

GRC's modelling is deemed to be acceptable for use on the following basis:

- Best practice has been followed- Given that the modelling tools available in 2024 have progressed since the SKM and SMEC studies were originally conducted, and as the hydrological and hydraulic modelling conducted for this study represents current best practice, GRC believe that the 1% AEP flood level of 8.3 mAHD is a reliable estimate;
- GRC's work uses a 12 hour critical duration in the 1% AEP and this is conservative as in truth the 12 hour event temporal patterns contain embedded bursts which mean rainfall is rarer than the 1% AEP;
- GRC's modelled 1% AEP flood levels are a reasonable match with the latest design levels Council's flood certificate refers to (SKM, 2005);
- Flood level sensitivity is not high as the 0.2% AEP design flood estimate has levels only slightly higher than the 1% AEP design flood estimate;
- The use of a 500 mm freeboard at the subject site implies a high level of protection from flooding and as per the Manual incorporates a suitable factor of safety. This is particularly the case when we look at the over bank conditions for Vineyard Creek at Victoria Road (wide and flat overbank will tend to mean minimal increases in flood level relative to flow increase); and finally
- In adopting a FFL of 9.0 mAHD (whereas arguably 8.8 mAHD only is required), and a design that is flood compatible (allows through flow and doesn't seek to block site), the proposed works reduce the flood risk impact of site inundation.

Flood Planning Level

The Flood Planning Level (FPL) for this development equates to the 1% AEP flood level with an additional 0.5 m on top for freeboard. The appropriate FPL for this site is 8.8 mAHD. The proposed development has a finished floor level of 9.0 mAHD. As such there is an additional 0.2 m of freeboard being applied. As such the proposed FFL is compliant and conservative and this is a key risk mitigation measure for the proposed development.

Proposed Development

The proposed development consists of:

- The regrading of the existing car park to facilitate seamless on-ground transition into a new, raised building (as per the surface provided by TTW on 3 May 2024: 234338 BS-TIN_240503.dwg);
- The development of a culturally-significant educational facility (the Indigenous Centre of Excellence) (as per Drawings DA1-102 to DA1-106 provided to GRC by Jackson Clements Burrows Architects on 08/05/2024 – see Appendix B); and
- The development of a local water feature at south-east with piped drainage (0.7 m diameter) to Vineyard Creek (as is currently present with some relocation of the pit at the site to better align with the regraded landscape).

Proposed Condition

Modelling results for the proposed condition for the 20% AEP, 1% AEP, 0.2% AEP and PMF design events are documented below from Figure 24 to Figure 36.

20% AEP	<p><i>Flood Levels:</i> ranging from 7.3 mAHD to 8.2 mAHD along the northern boundary of the car park.</p> <p><i>Flood Depths:</i> predominantly less than 0.1 m deep with a small portion up to 0.3 m. The newly introduced pond at the south-eastern corner experiences depths up to 1 m.</p> <p><i>Flood Hazard:</i> Predominantly H1 with a small pocket of H2 in the new pond (low hazard).</p>
1% AEP	<p><i>Flood Levels:</i> 8.3 mAHD across the building footprint</p> <p><i>Flood Depths:</i> from 0.3 m up to 1.7 m deep in the pond area.</p> <p><i>Flood Hazard:</i> H3 (low to medium hazard) at the building footprint with a max of H4 at the pond.</p>
1% AEP + RCP 4.5 2050	<p><i>Flood Levels:</i> 8.4 mAHD in the north-west corner of the proposed footprint to 8.3 mAHD in the south-eastern corner.</p> <p><i>Flood Depths:</i> from 0.3 m up to 1.8 m deep in the pond area.</p> <p><i>Flood Hazard:</i> H3 (low to medium hazard) at the building footprint with a max of H4 at the pond.</p>
1% AEP + RCP 4.5 2090	<p><i>Flood Levels:</i> 8.5 mAHD in the north-west corner of the proposed footprint to 8.3 mAHD in the south-eastern corner.</p> <p><i>Flood Depths:</i> from 0.3 m up to 1.8 m deep in the pond area.</p> <p><i>Flood Hazard:</i> H3 (low to medium hazard) at the building footprint with a max of H4 at the pond.</p>
0.2% AEP	<p><i>Flood Levels:</i> 8.4 mAHD in the north-west corner of the proposed footprint to 8.3 mAHD in the south-eastern corner.</p> <p><i>Flood Depths:</i> from 0.3 m up to 1.8 m deep in the pond area.</p> <p><i>Flood Hazard:</i> H3 (low to medium hazard) at the building footprint with a max of H4 at the pond.</p>
PMF	<p><i>Flood Levels:</i> 10.4 mAHD</p> <p><i>Flood Depths:</i> from 1.0 m up to 3.9 m deep in the pond area.</p> <p><i>Flood Hazard:</i> Max of H5 (high hazard)</p>

Flood Level Impact

The modelled flood level impact is documented in Figure 27. The proposed design modifies the land in a way that aggregates flood waters into a smaller footprint than in the existing case. This is the result of the introduction of water sensitive landscaping (excavation and reforming) in the south-eastern portion of the site and the use of piers and underfloor voids that allow floodwaters to flow through the site rather than be obstructed by a solid building.

The adverse flood level impact of this development is restricted to the subject site and does not cause flood impacts for surrounding properties.

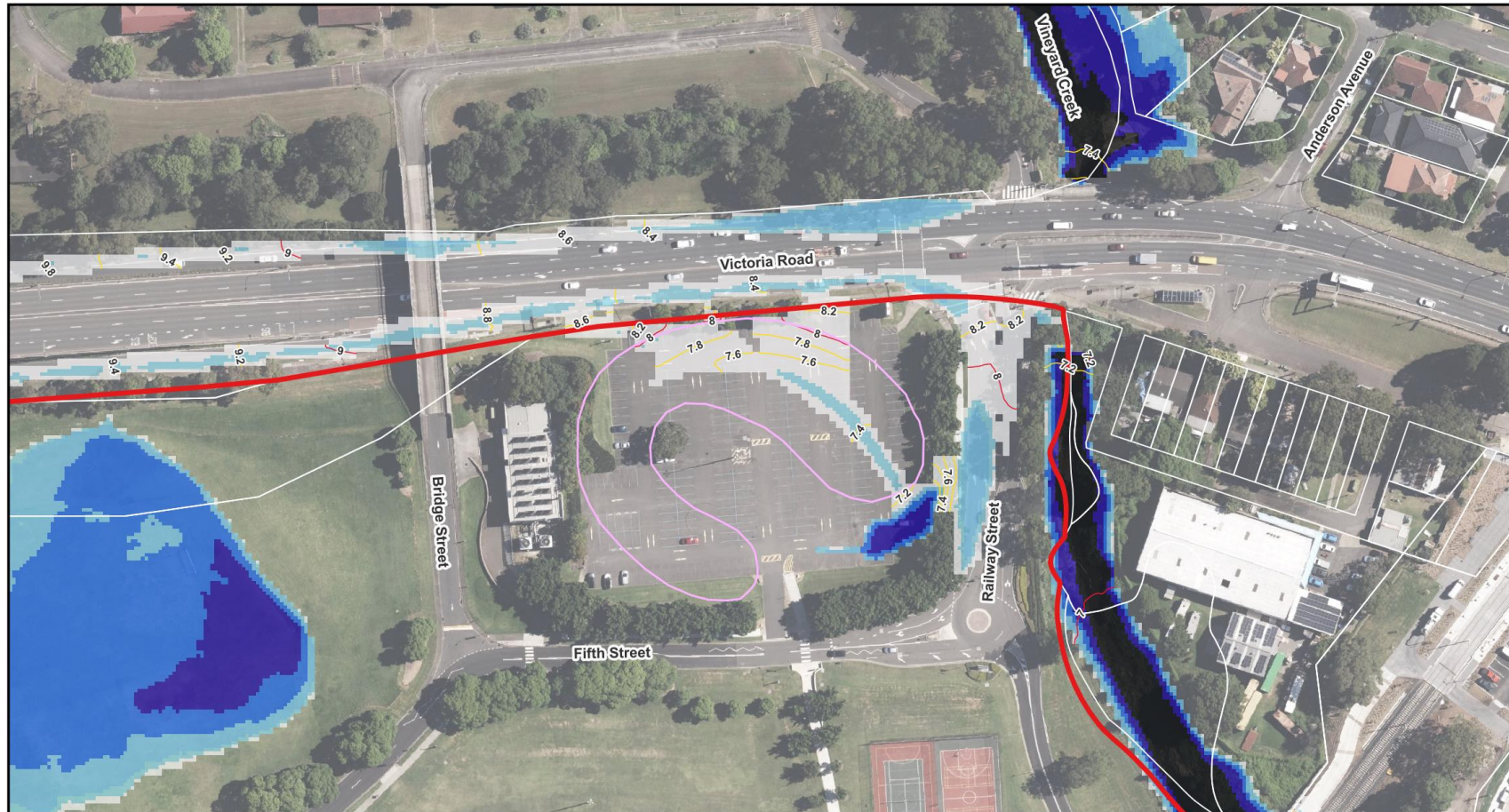
Broadly what we see is that the proposed works make it easier for flow to move across Victoria Road (i.e. water that does not continue to flow downstream in Vineyard Creek) and into the site. As such we see reductions in 1% AEP flood levels on Victoria Road at the subject site's northern boundary.

Reductions in flood levels in the middle of the site correspond to the site's regrading (excavation with some relocation of fill) and relocation of the existing pit to a more concentrated low point which has the potential to improve drainage at this site. These impacts make sense and are consistent with what could be expected based on the proposed design. Proposed works on the subject site do then not impede design flows from entering the subject site and hence the proposed works are compatible with their location.

We do note in the impact mapping an impact on flood levels to the east of the creek in the area immediately downstream of Victoria Road. This has been amended in the Figure as GRC are of the opinion that such impact is not an accurate indication of the impact of proposed works on the 1% AEP design event. GRC's reasoning for this is as follows:

- The area being immediately downstream of the Victoria Road culvert may be subject to some localised model instability at times – 2D dynamic models can suffer minor instabilities in model runs which otherwise produce coherent result sets;
- No changes are proposed in the model in this area and there are no impacts for flow paths leading to the location and as such the impacts don't align with what would be expected. This is in stark contrast to the other impacts shown on the Figure as discussed above;
- In inspecting the area GRC noted a number of informal earthen levees adjacent to the creek and the impounded water appears consistent with the location of these; and
- GRC are of the opinion that sub-grid features would allow the drainage of this water in the event of flooding rather than impounding the water as our model shows however the inclusion of such features is not germane to the work at hand.

Figure 24: Peak Flood Levels and Depths – 20% AEP – Developed Condition



Event: 20% AEP (120 minute TP05)
 Title: Peak Flood Levels and Depths
 Scenario: Proposed Condition

- Proposed Building Footprint
- Subject Site
- Local Cadastre
- Flood Level Contours (mAHD - 1.0 m intervals)
- Flood Level Contours (mAHD - 0.2 m intervals)

- Flood Depth (m)**
- <= 0.05
 - 0.05 - 0.10
 - 0.10 - 0.30
 - 0.30 - 0.50
 - 0.50 - 1.00
 - > 1.00



Figure 25: Flood Velocity and Hazard – 20% AEP – Developed Condition

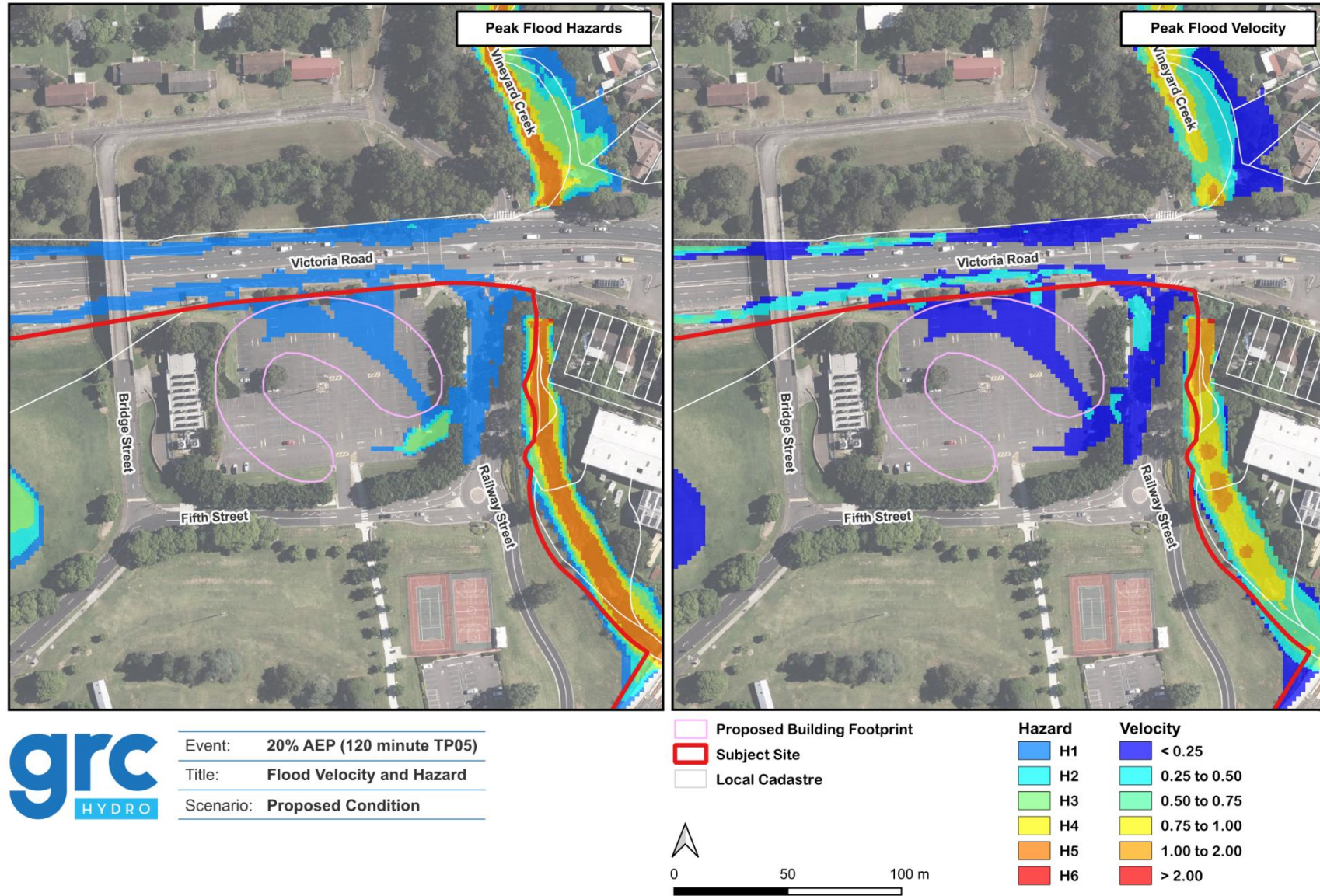
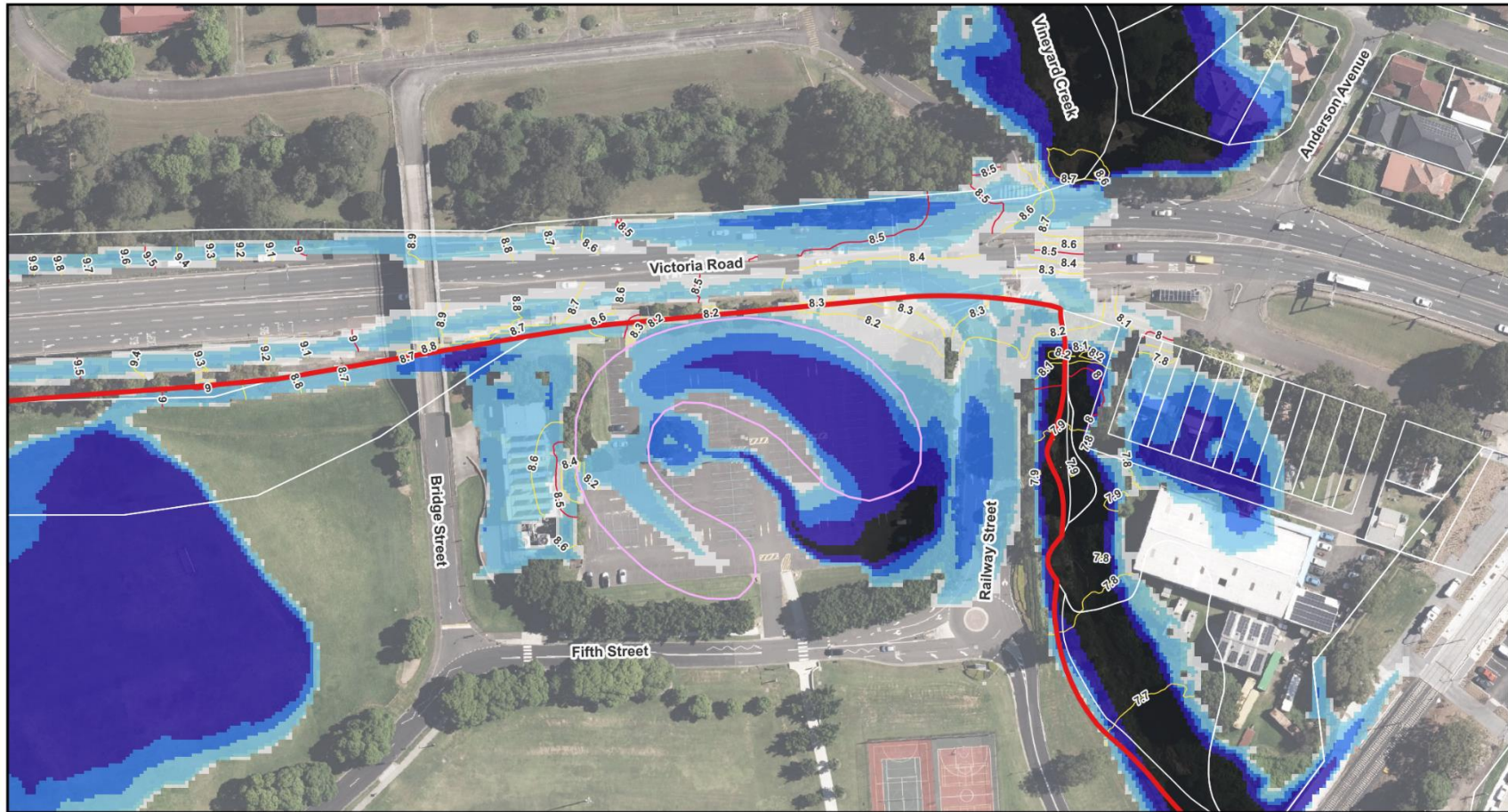


Figure 26: Peak Flood Levels and Depths – 1% AEP – Developed Condition



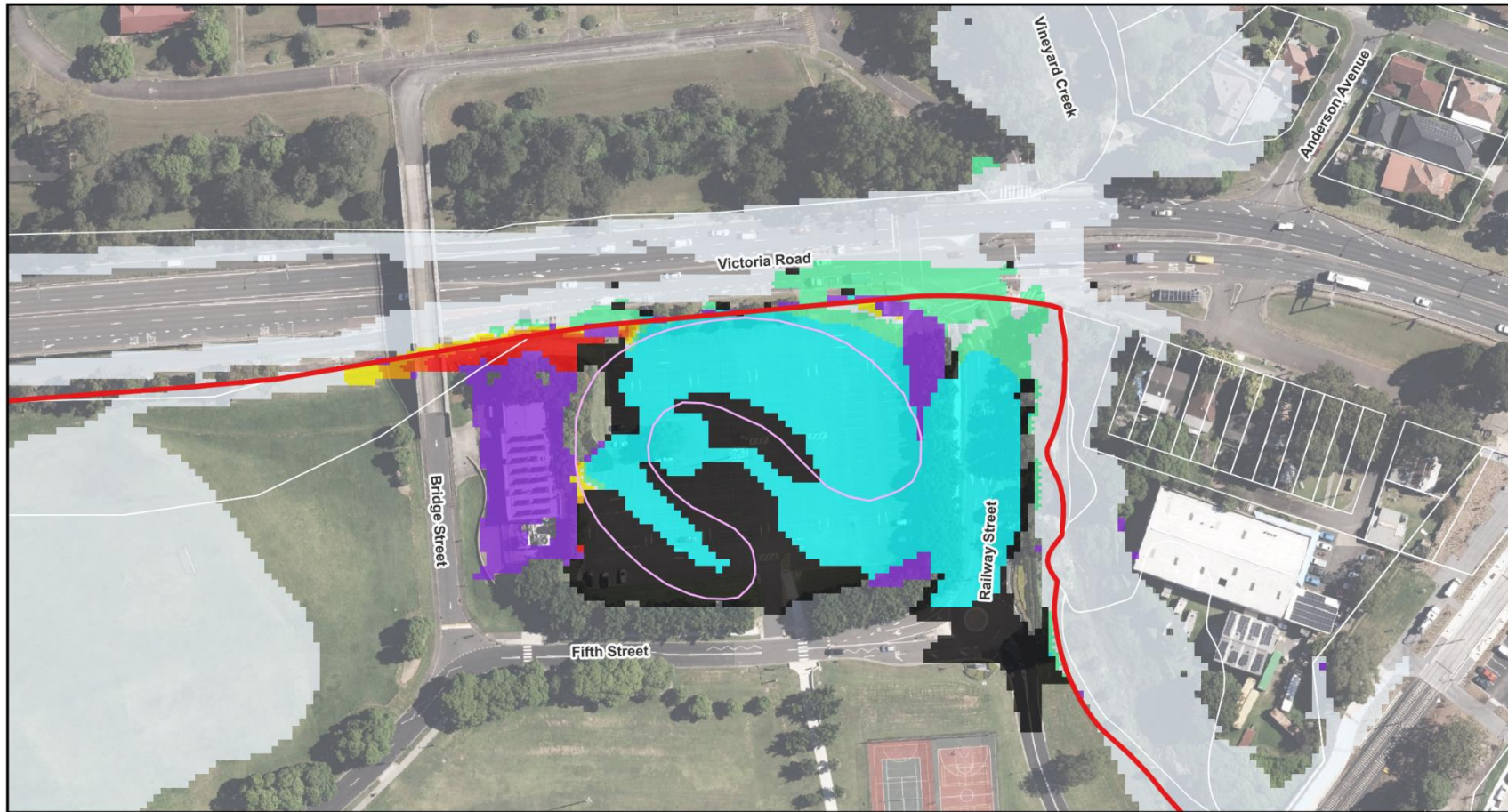
Event:	1% AEP (720 minute TP06)
Title:	Peak Flood Levels and Depths
Scenario:	Proposed Condition

- Proposed Building Footprint
- Subject Site
- Local Cadastre
- Flood Level Contours (mAHD - 0.5 m intervals)
- Flood Level Contours (mAHD - 0.1 m intervals)

- Flood Depth (m)**
- <= 0.05
 - 0.05 - 0.10
 - 0.10 - 0.30
 - 0.30 - 0.50
 - 0.50 - 1.00
 - > 1.00



Figure 27: Flood Level Impact – 1% AEP – Developed Condition

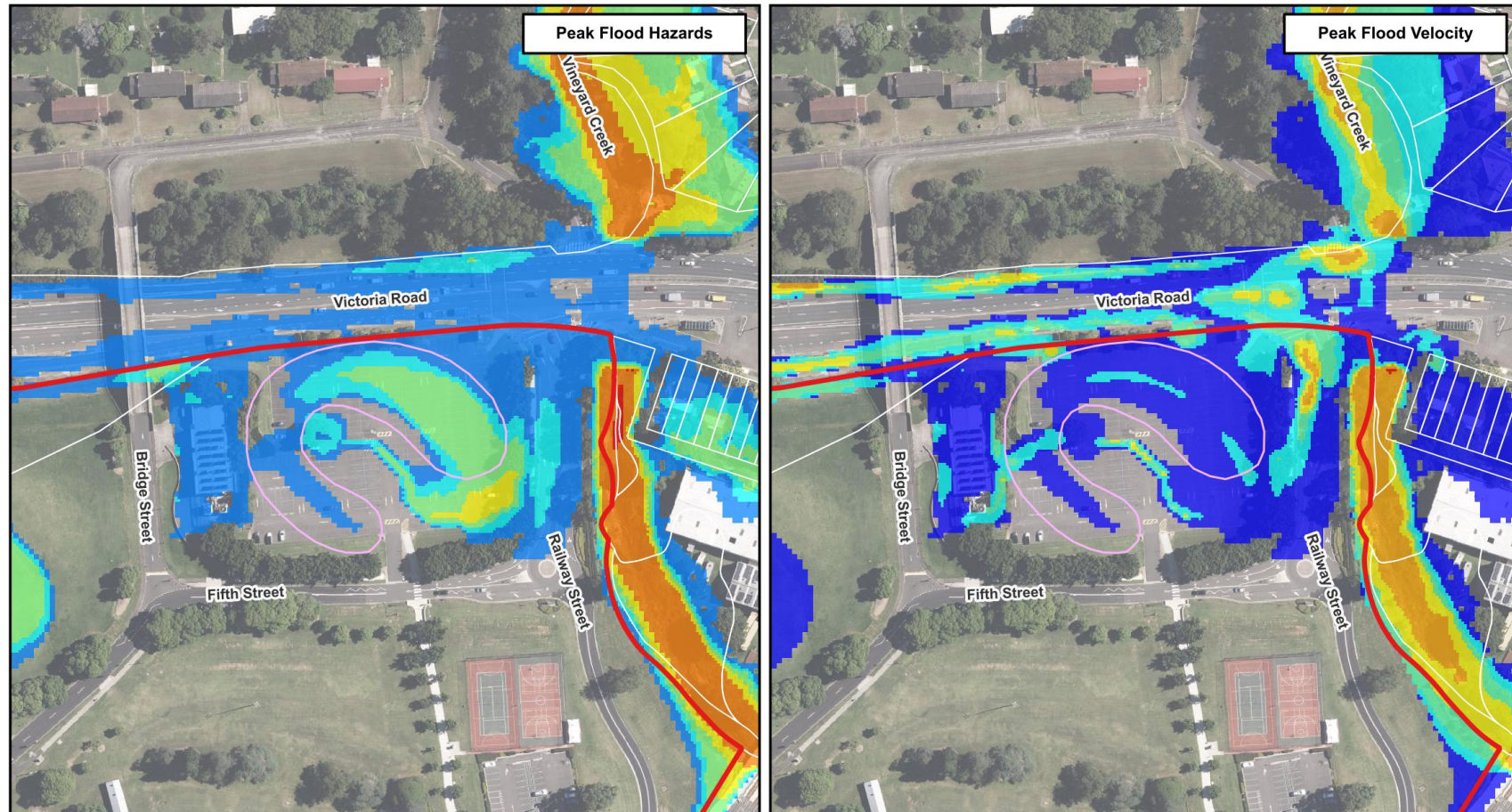


Event:	1% AEP (720 minute TP06)
Title:	Flood Level Impact
Scenario:	Development Minus Existing Conditions

- | | | |
|-----------------------------|-------------------------------|-------------------|
| Local Cadastre | Flood Level Impact (m) | 0.01 to 0.1 |
| Subject Site | < -0.3 | 0.1 to 0.2 |
| Proposed Building Footprint | -0.3 to -0.2 | 0.2 to 0.3 |
| | -0.2 to -0.1 | No Longer Flooded |
| | -0.1 to -0.01 | Newly Flooded |
| | No Impact | |



Figure 28: Flood Velocity and Hazard – 1% AEP – Developed Condition



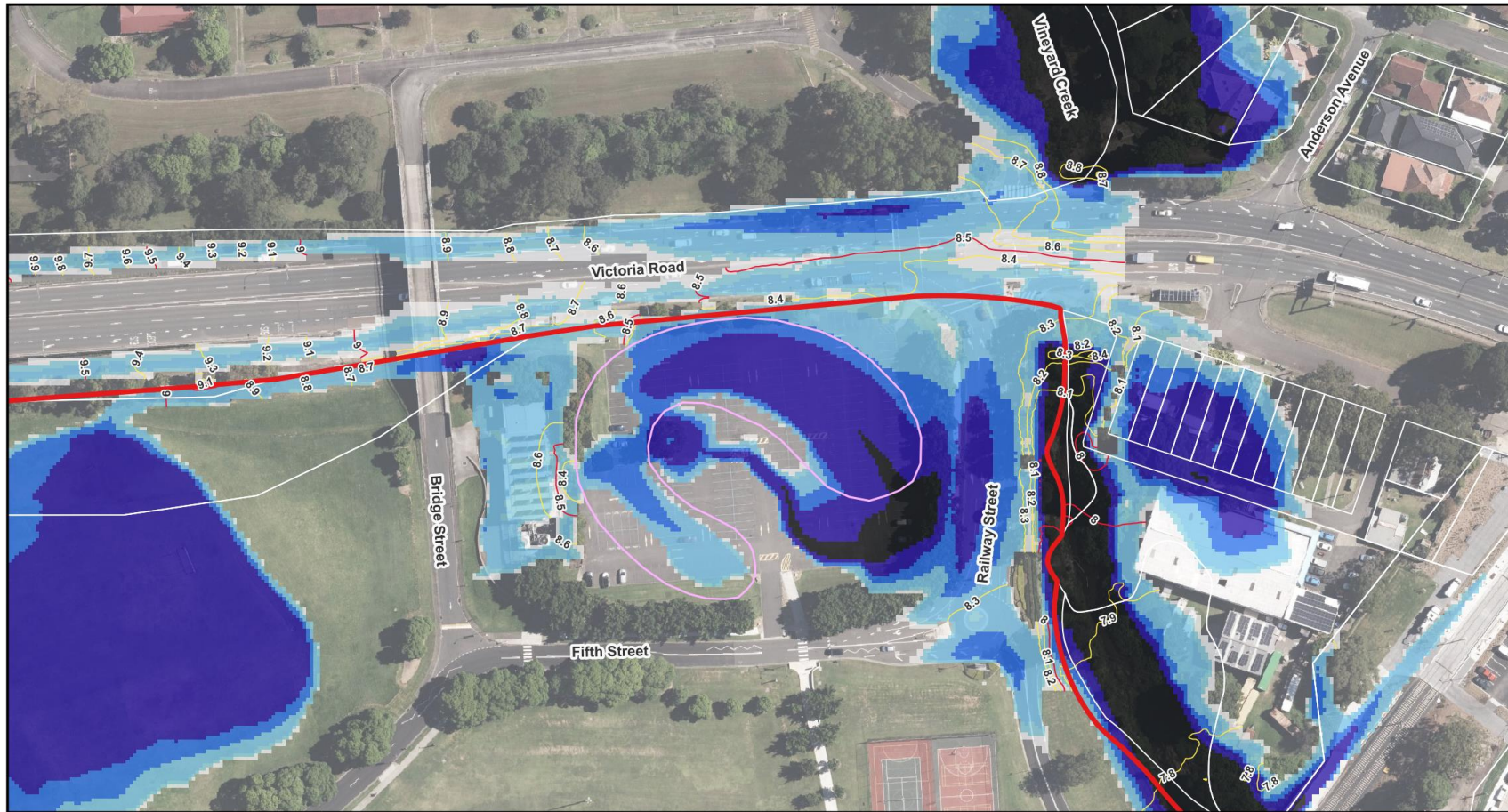
Event: 1% AEP (720 minute TP06)
 Title: Flood Velocity and Hazard
 Scenario: Proposed Condition

- Proposed Building Footprint
- Subject Site
- Local Cadastre

Hazard	Velocity
H1	< 0.25
H2	0.25 to 0.50
H3	0.50 to 0.75
H4	0.75 to 1.00
H5	1.00 to 2.00
H6	> 2.00



Figure 29: Peak Flood Levels and Depths – 1% AEP with Climate Change (RCP 4.5 2050) – Developed Condition



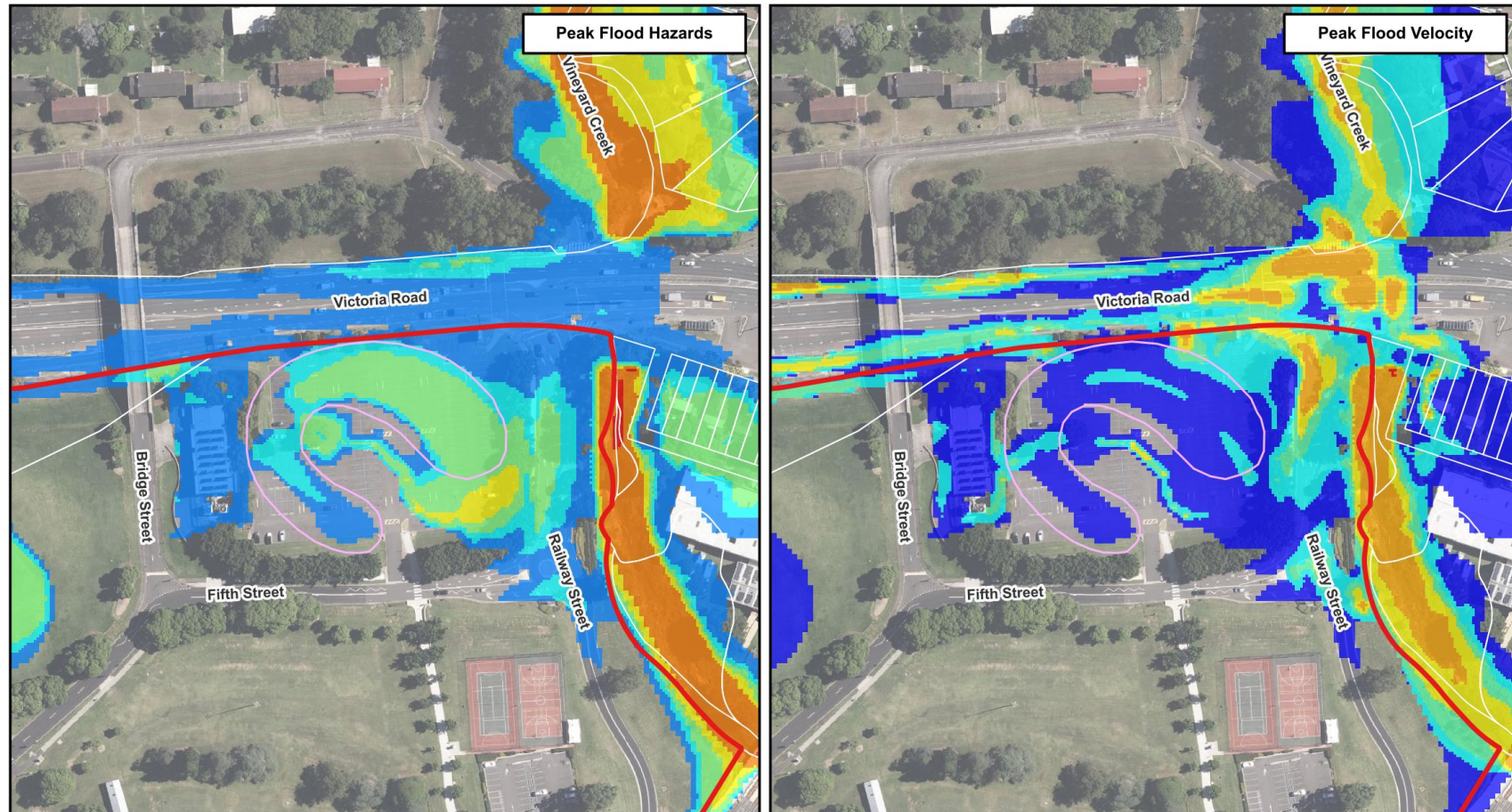
Event:	1% AEP (720 minute TP06) RCP4.5 2050
Title:	Peak Flood Levels and Depths
Scenario:	Proposed Condition

- Proposed Building Footprint
- Subject Site
- Local Cadastre
- Flood Level Contours (mAHD - 0.5 m intervals)
- Flood Level Contours (mAHD - 0.1 m intervals)

- Flood Depth (m)**
- <= 0.05
 - 0.05 - 0.10
 - 0.10 - 0.30
 - 0.30 - 0.50
 - 0.50 - 1.00
 - > 1.00



Figure 30: Flood Velocity and Hazard – 1% AEP with Climate Change (RCP 4.5 2050) – Developed Condition



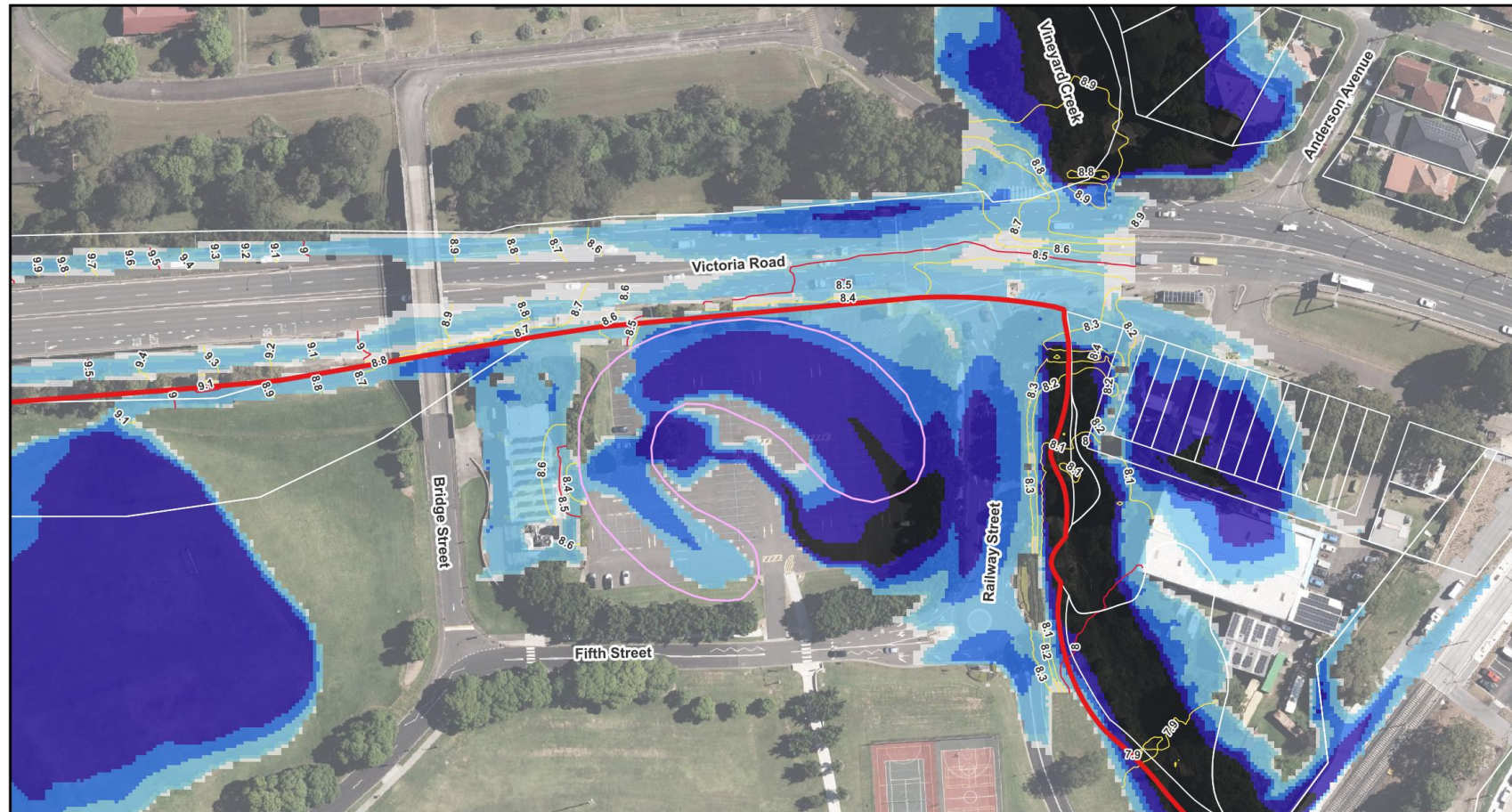
Event:	1% AEP (720 minute TP06) RCP4.5 2050
Title:	Flood Velocity and Hazard
Scenario:	Proposed Condition

- Proposed Building Footprint
- Subject Site
- Local Cadastre

- | Hazard | Velocity |
|--------|--------------|
| H1 | < 0.25 |
| H2 | 0.25 to 0.50 |
| H3 | 0.50 to 0.75 |
| H4 | 0.75 to 1.00 |
| H5 | 1.00 to 2.00 |
| H6 | > 2.00 |



Figure 31: Peak Flood Levels and Depths – 1% AEP with Climate Change (RCP 4.5 2090) – Developed Condition



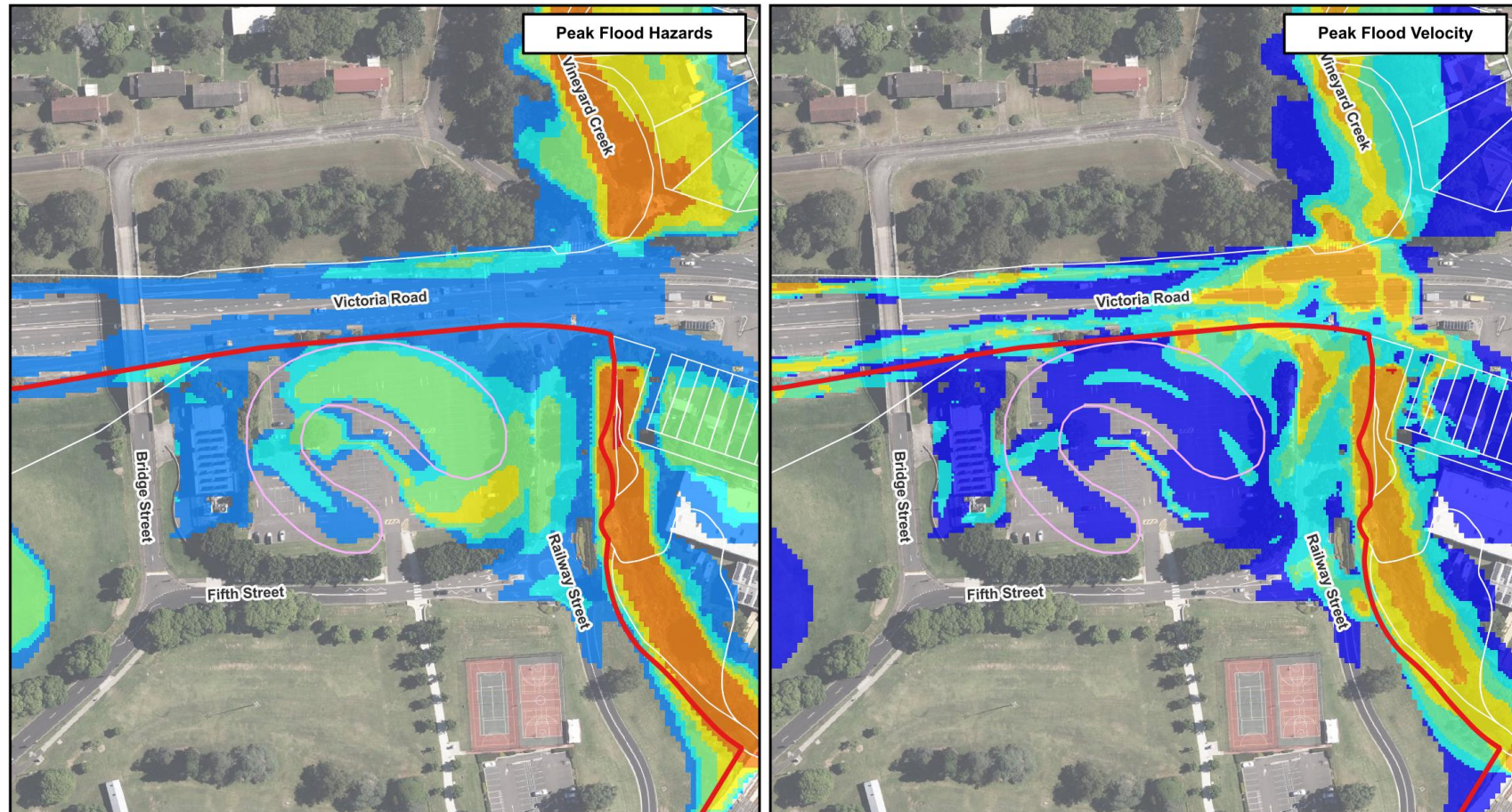
Event:	1% AEP (720 minute TP06) RCP4.5 2090
Title:	Peak Flood Levels and Depths
Scenario:	Proposed Condition

- Proposed Building Footprint
- Subject Site
- Local Cadastre
- Flood Level Contours (mAHD - 0.5 m intervals)
- Flood Level Contours (mAHD - 0.1 m intervals)

- Flood Depth (m)**
- <= 0.05
 - 0.05 - 0.10
 - 0.10 - 0.30
 - 0.30 - 0.50
 - 0.50 - 1.00
 - > 1.00



Figure 32: Flood Velocity and Hazard – 1% AEP with Climate Change (RCP 4.5 2090) – Developed Condition



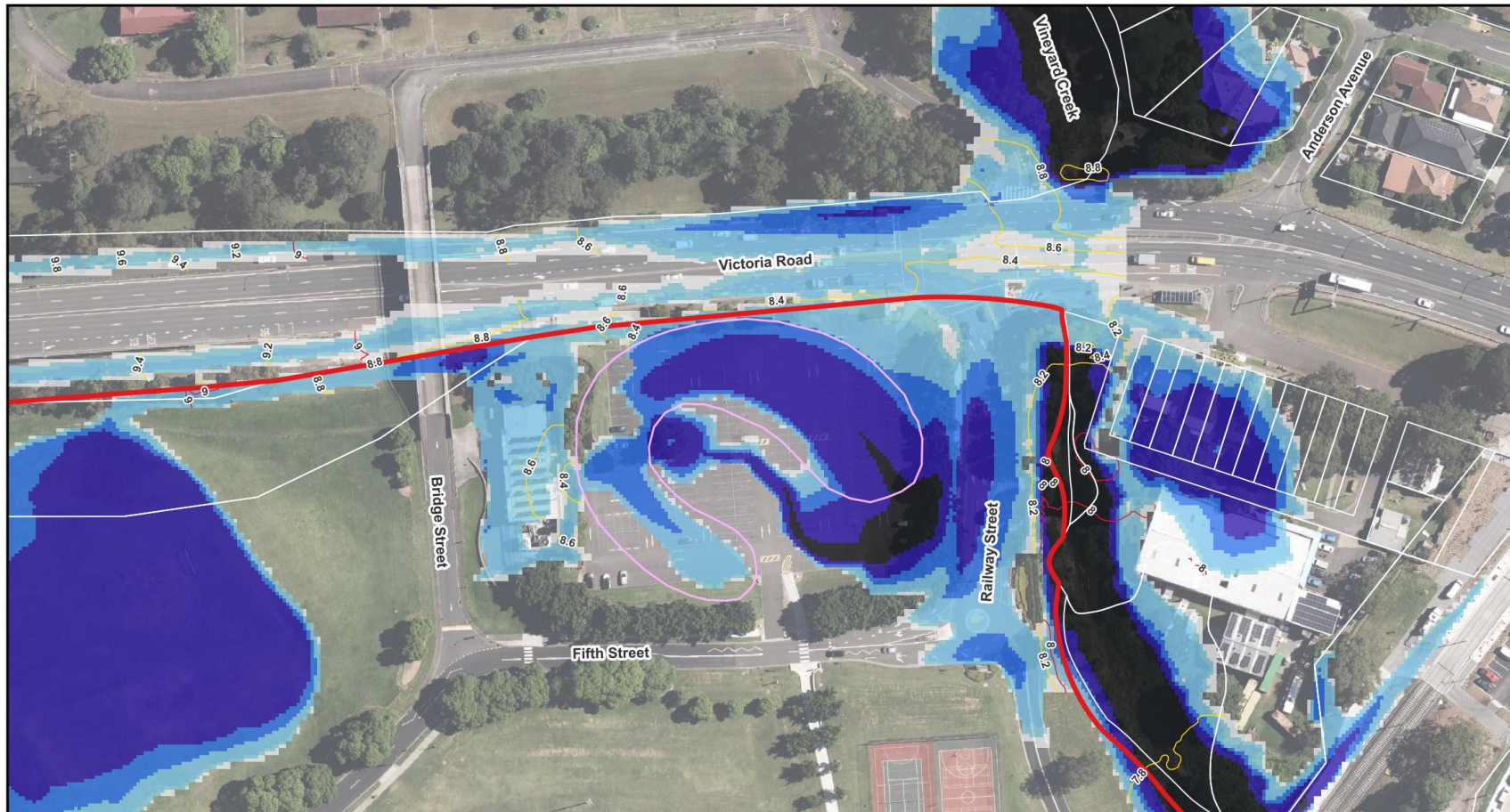
Event:	1% AEP (720 minute TP06) RCP4.5 2090
Title:	Flood Velocity and Hazard
Scenario:	Proposed Condition

- Proposed Building Footprint
- Subject Site
- Local Cadastre

- | Hazard | Velocity |
|--------|--------------|
| H1 | < 0.25 |
| H2 | 0.25 to 0.50 |
| H3 | 0.50 to 0.75 |
| H4 | 0.75 to 1.00 |
| H5 | 1.00 to 2.00 |
| H6 | > 2.00 |



Figure 33: Peak Flood Levels and Depths – 0.2% AEP – Developed Condition



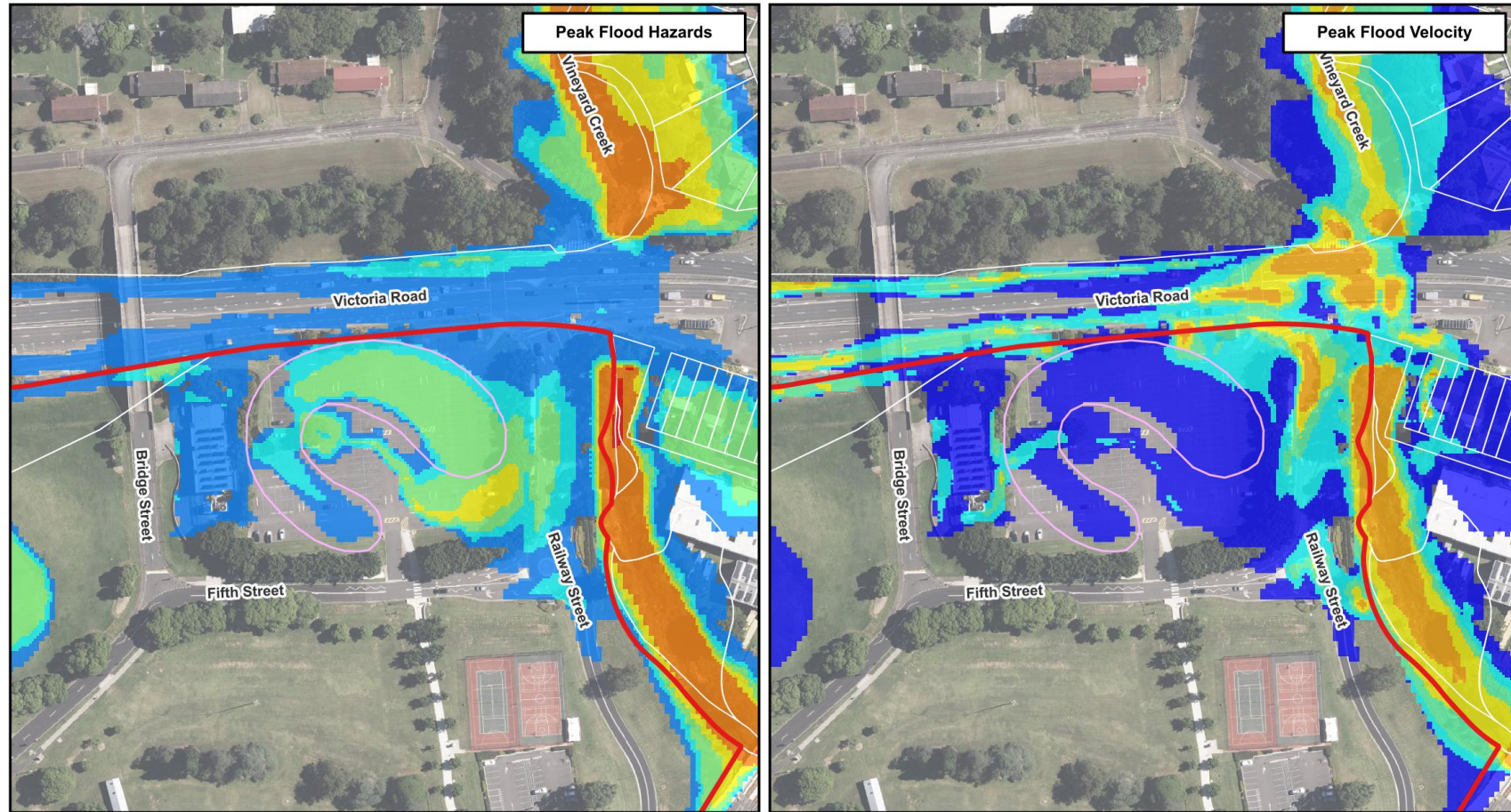
Event:	0.2% AEP (90 minute TP05)
Title:	Peak Flood Levels and Depths
Scenario:	Proposed Condition

- Proposed Building Footprint
- Subject Site
- Local Cadastre
- Flood Level Contours (mAHD - 1.0 m intervals)
- Flood Level Contours (mAHD - 0.2 m intervals)

- Flood Depth (m)**
- <= 0.05
 - 0.05 - 0.10
 - 0.10 - 0.30
 - 0.30 - 0.50
 - 0.50 - 1.00
 - > 1.00



Figure 34: Flood Velocity and Hazard – 0.2% AEP – Developed Condition



Event: 0.2% AEP (90 minute TP05)
 Title: Flood Velocity and Hazard
 Scenario: Proposed Condition

- Proposed Building Footprint
- Subject Site
- Local Cadastre

Hazard	Velocity
H1	< 0.25
H2	0.25 to 0.50
H3	0.50 to 0.75
H4	0.75 to 1.00
H5	1.00 to 2.00
H6	> 2.00

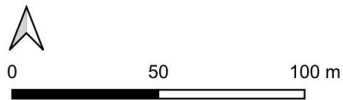
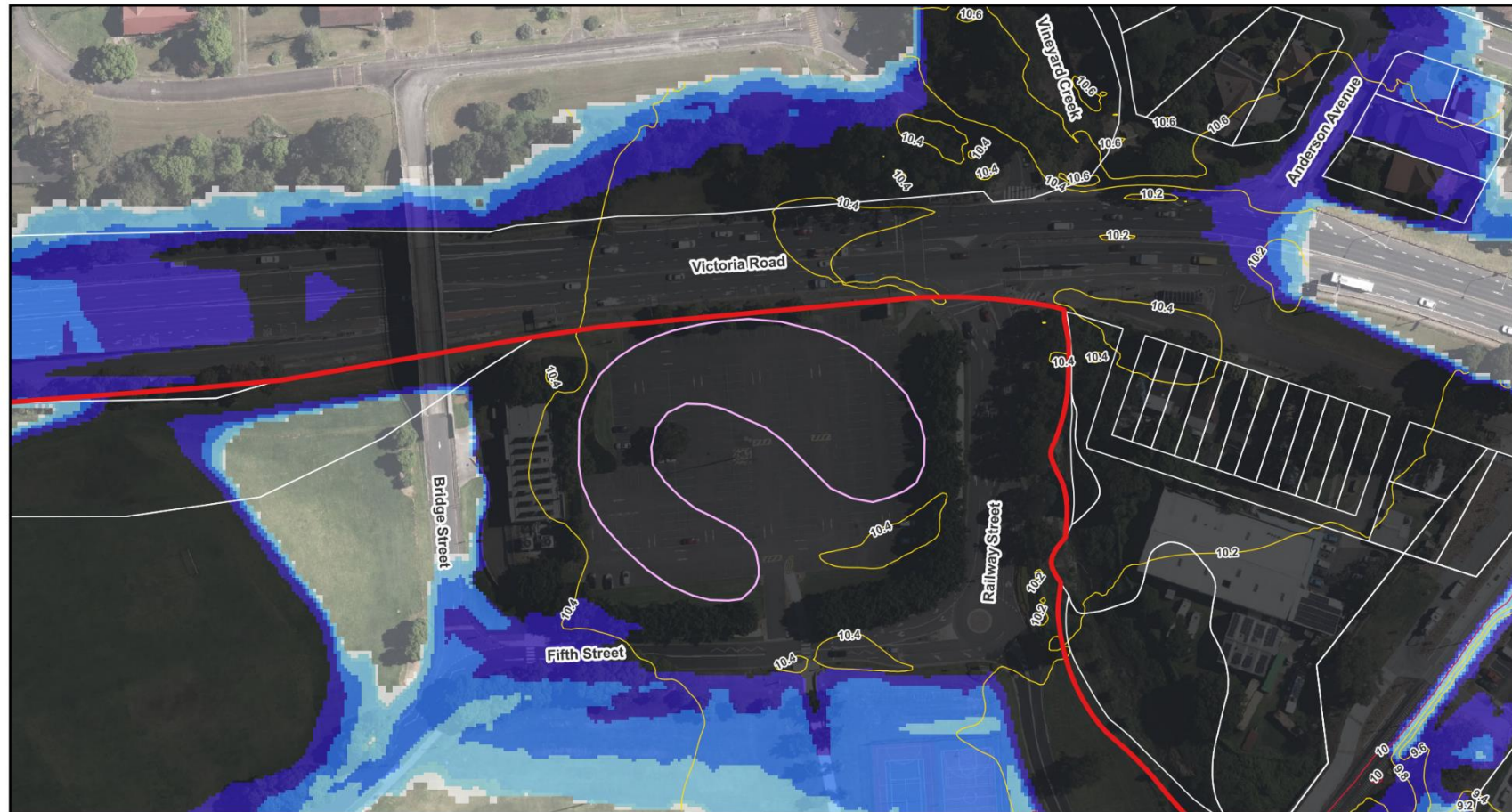


Figure 35: Peak Flood Levels and Depths – PMF – Developed Condition



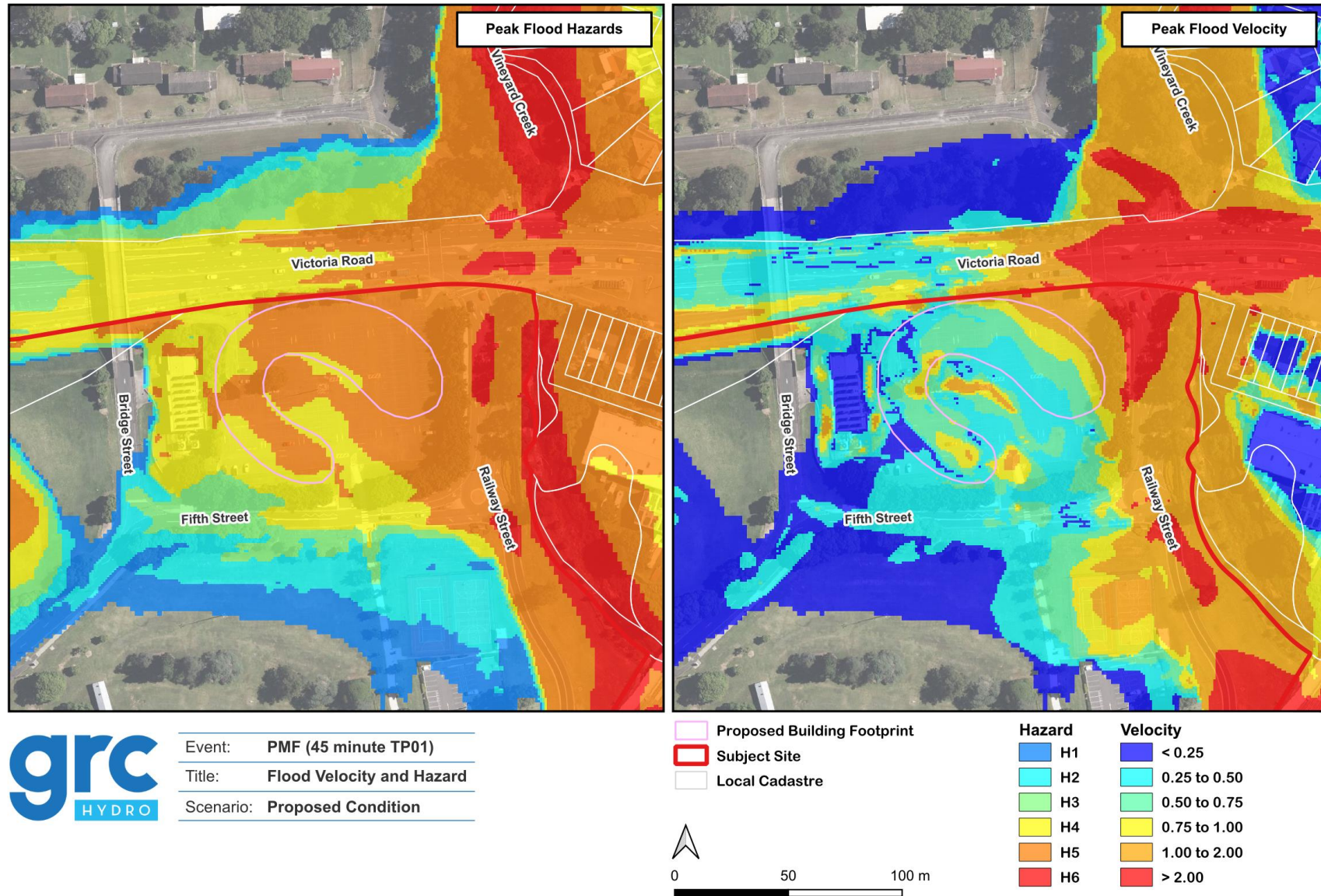
Event:	PMF (45 minute TP01)
Title:	Peak Flood Levels and Depths
Scenario:	Proposed Condition

- Proposed Building Footprint
- Subject Site
- Local Cadastre
- Flood Level Contours (mAHD - 1.0 m intervals)
- Flood Level Contours (mAHD - 0.2 m intervals)

- Flood Depth (m)**
- <= 0.05
 - 0.05 - 0.10
 - 0.10 - 0.30
 - 0.30 - 0.50
 - 0.50 - 1.00
 - > 1.00



Figure 36: Flood Velocity and Hazard – PMF – Developed Condition



Event: PMF (45 minute TP01)
 Title: Flood Velocity and Hazard
 Scenario: Proposed Condition

Flood Emergency Response Plan

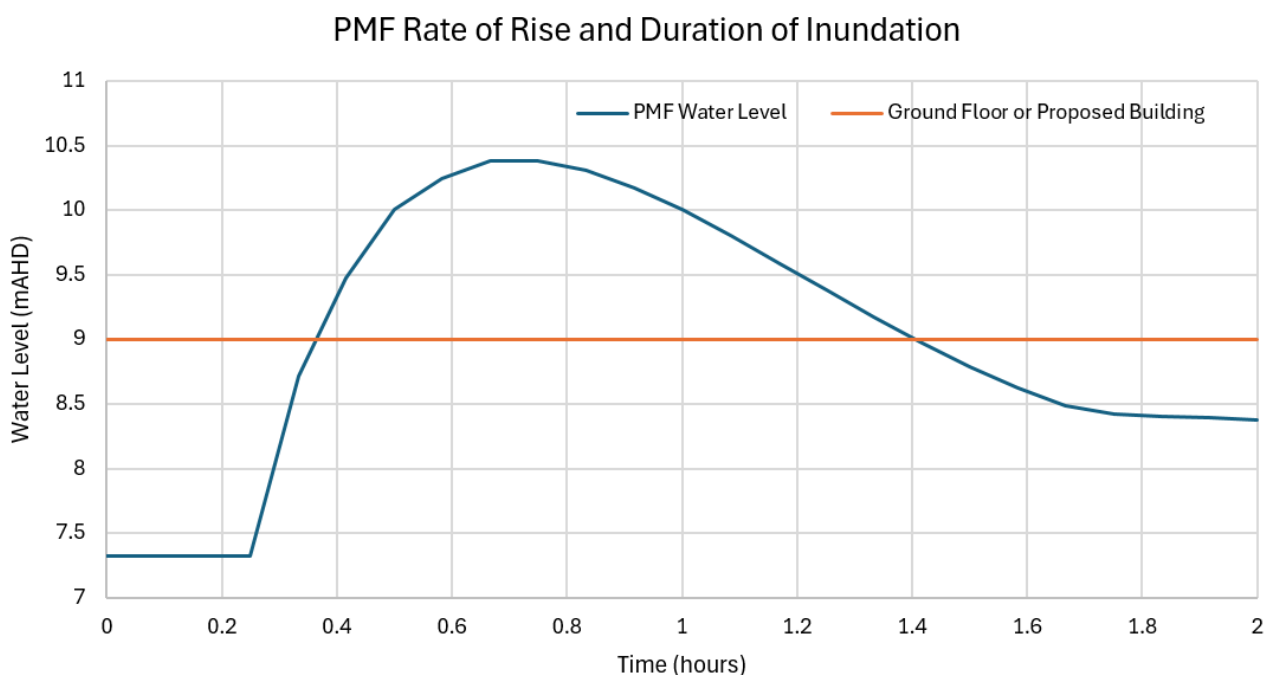
Flood Emergency Context

The proposed building will have a finished floor level of 9.0 mAHD. This is approximately 0.7 m higher than the 1% AEP event at this site.

In a 1% AEP design flood event, the southern entrance to the building (at 9.0 mAHD) remains well above the flood level and an accessible (on foot and by wheelchair) connection remains to the south of the building which remains flood free in this design event.

However, in the course of an event occurring, flood wardens won't easily estimate what magnitude of event is occurring (5% AEP, 1% AEP, 0.2% AEP etc.). In a PMF design flood event, the rate of rise of flood waters is relatively quick (only ~35 minutes for waters to rise above the finished floor level – see Chart 1) so little warning time is available to safely administer an evacuation process. Therefore, a *shelter-in-place strategy is strongly recommended* so that occupants are not exposed to the risk of being caught in floodwaters. This is a flood emergency response that is commonplace for developments in the City of Parramatta LGA.

Chart 1: PMF Rate of Rise and Duration of Inundation



The duration of inundation in this extreme event is less than 2 hours. This is a manageable period in which all occupants can safely and calmly evacuate in place. Backup power and water supply and emergency supplies can sustain this building and its occupants for this duration.

Flood Emergency Response Preparation

Responsibility of WSU Management

WSU Management shall appoint a senior member of ICoE staff to be responsible for flooding issues. This member of staff will advocate for emergency flood measures and WSU Management's responsibility in this

relationship is to liaise with this ICoE flooding advocate and provide adequate funds and support to maintain flood emergency systems, measures and provisions.

Responsibility for Coordination

A senior flood warden needs to be appointed to manage and maintain flood emergency preparation measures. This can be a member of staff and ideally would be the responsibility of the building manager.

The flood warden would be responsible for the following:

- **Briefing and deputising other senior members of staff** to act as flood wardens to help communicate flood emergency procedures and issues to other staff and occupants. These flood wardens may be relied upon to help coordinate flood emergency response measures if the senior flood warden is not on site at the time of flooding.
- **Liaising with local SES staff** to ensure that the building's flood emergency response plan aligns with their preferences for local flood emergency management.
- **Undertaking quarterly checks of emergency systems** such as:
 - the backup power and water provision,
 - the flood warning system (an alarm and public announcement system);
 - emergency provision of suitable food,
 - personal washing facilities,
 - medical equipment including a first aid kit, and
 - a battery-powered radio and relevant communications equipment.
- **Undertake annual Evacuation Management Drills** (as outlined below)
- **Check signage** and make sure that it is correctly posted throughout the ICoE.
- **Register with the City of Parramatta's FloodSmart Service** by going to the website below: <https://www1.ewn.com.au/parramatta/register.aspx>. This is something that all flood wardens should do.
- **Liaise with Plumbers and Electricians** to undertake post-flooding checks of building systems.
- **Maintain and improve the Flood Emergency Response Plan** as required.

Warning Systems

Flood Markers

Two flood markers should be installed in the proposed water sensitive landscaped area. These should be discreet but should be easily visible from ICoE management offices. These markers should indicate depths and flood levels so that occupants can easily understand the depth of flood waters and that flood wardens can immediately see the flood level in order to trigger evacuation actions.

Alarm and Public Announcement System

The proposed building will have an alert system to inform occupants of the actions they are required to take in the event of flooding.

This will take the form of an alarm and a voiceover (with additional public announcement system for backup) to relay specific instructions on where occupants should move to evacuate or shelter.

A recorded message that follows an alarm should clearly and specifically direct occupants that:

- Evacuation to Level 1 or above is required.
- It is to be done immediately.

- It is to be on-foot or with assistance from other occupants or staff if needed.
- Occupants are not to leave the site on foot. They are not to use vehicles and attempt to leave the site as floodwaters may pose a threat to life.
- Evacuees will be informed when it is safe to return to the ground floor and/or leave the building.

Shelter-in-Place Refuge Area

The proposed building is a public education facility with generous provision of indoor space for congregation. Floors 1 to 3 will all be elevated above the PMF level. Evidence of this is attached in the architectural plans attached in Appendix B.

The facilities available to occupants sheltering on these floors during an emergency are as follows:

- emergency electricity supply, and lighting,
- clean water for drinking, washing and toilet flushing,
- working bathroom and toilets,
- suitable food,
- personal washing facilities,
- medical equipment including a first aid kit,
- a battery-powered radio and relevant communications equipment, and
- a comfortable, safe, indoor, sheltered environment.

Signage

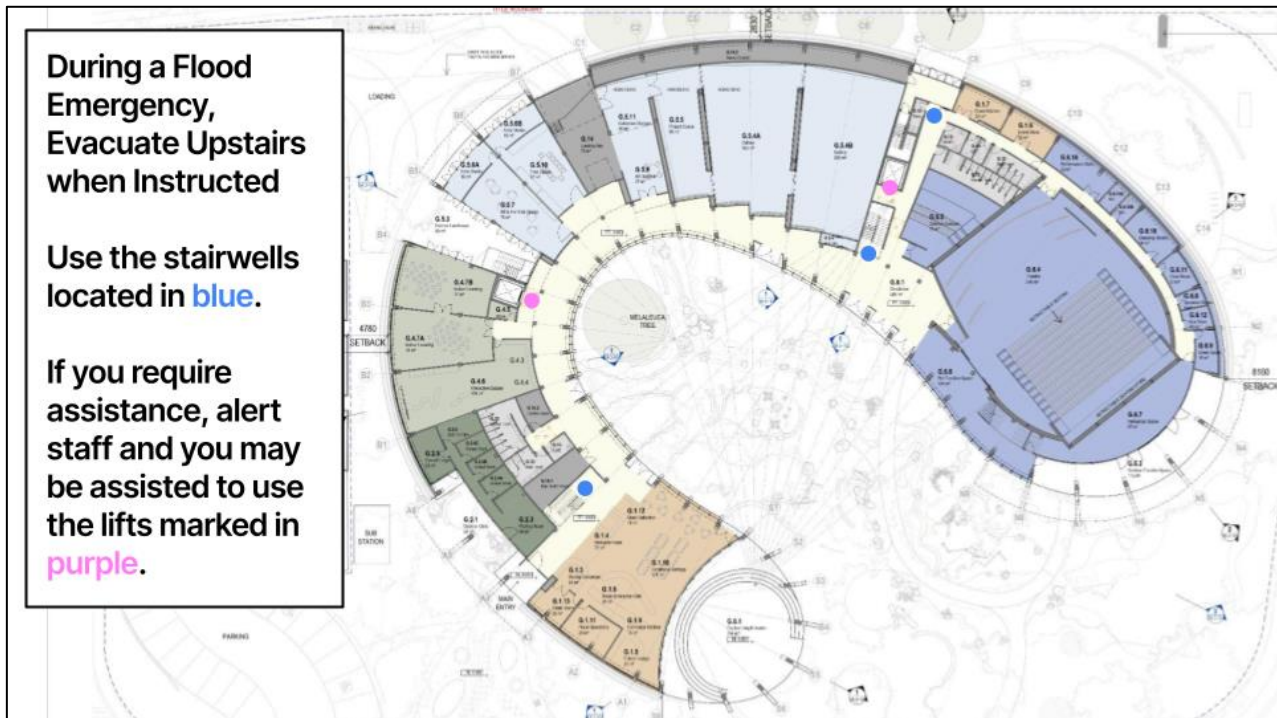
Signage will be positioned throughout the building, most notably the ground floor, that communicates that:

- The building is flood liable and that occupants shall follow instructions in the event of flooding; and
- In the event of a flood emergency, occupants are able to follow the routes identified on an accompanying map to safely shelter on Floors 1 to 3.

Evacuation Routes and Information

Building management shall create a map identifying vertical evacuation routes to be used in the event of a flood emergency. A suggested example of such a map is below. This map shall feature clear guidance to users on how they should evacuate when instructed.

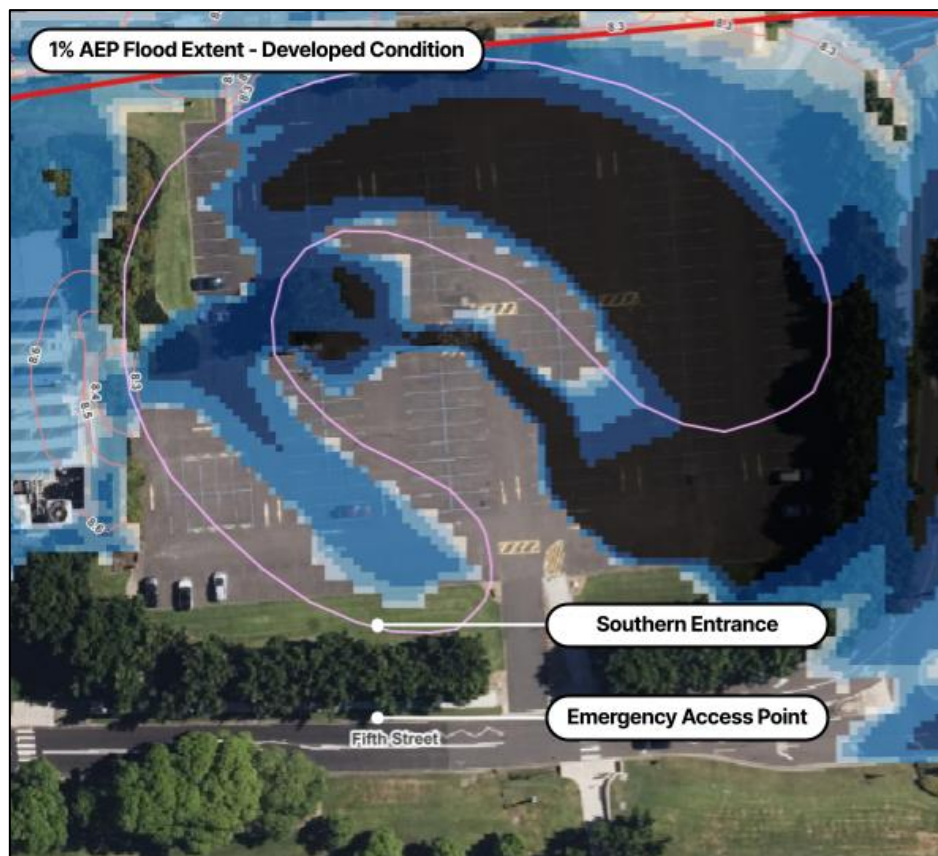
Figure 37: Example Flood Evacuation Route Map



Emergency Access Point

An emergency access point above the 1% AEP flood level is located immediately south of the proposed building's southern entrance. This location is identified in Figure 38 below.

Figure 38: Emergency Access Point (above the 1% AEP Flood Level)



Flood Emergency Drills

Annual Flood Emergency Drills should be conducted. This will allow for the alarm system to be tested and conduct a drill of a shelter-in-place procedure as follows:

- *Step 1:* An alarm and warning will sound to direct all occupants to make their way to Level 1 or above immediately. All occupants on Level 1 and above can remain in place and await further instructions.
- *Step 2:* Flood wardens shall check the ground floor to make sure it has been fully vacated. This may be done via CCTV if the system is able to cover all areas of the ground floor.
- *Step 3:* Sound a message over the PA system that all staff and occupants that the drill has concluded may safely return to the building.

Emergency Procedure

GRC suggest the following Flood Emergency Response Procedure for the ICoE.

1. **Keep Abreast of Weather Forecasts:** The most senior flood warden on site each day should keep abreast of local weather forecasts so that wardens are ready to take further actions should heavy rainfall occur that day.
2. **Consult Local Warnings:** If heavy rainfall is predicted for Sydney, flood wardens should refer to the Bureau of Meteorology's (BOM) Warnings for NSW at the following website: http://www.bom.gov.au/products/warn_nsw.shtml. Staff should specifically look for warnings related to Parramatta River.
3. **Stay alert to FloodSmart Warnings:** Flood wardens will be signed up to the City of Parramatta's FloodSmart service. This service will send flood alerts and advice for predicted flood behaviour that may affect the user's catchment. This is based on the address used when signing up (171 Victoria Road, Parramatta, NSW 2116). FloodSmart will send users text messages and/or emails with links to guidance on predicted flood behaviour and how local occupants should respond.
4. **Observe On-Site Flood Markers:** Once local flooding is determined to be likely (based on local warnings as above) Flood wardens will observe the on-site flood markers at very regular intervals.
5. **Initiate Shelter-in-Place Alert Procedure**
 - **When the flood markers indicate a level of 7.8 mAHD** a voiceover alert should sound to inform occupants that: *"This building is observing a flood alert. Please do not vacate the building at this time. People on the ground floor, please await further instructions and be ready to evacuate to the first floor or above if instructed. If you require assistance, please ask a fellow occupant or member of staff to be ready to help you move to Level One if evacuation is required. People on floors one and above can remain in place."*

Whilst stairways are the encouraged vertical evacuation route, , elevators can continue to be used to vertically evacuate persons requiring assistance to the first level as the ground floor will be 1.2 mAHD above the flood level at this point.

The senior flood warden should call the local SES liaison to advise them that a flood emergency procedure is being initiated. This is an opportunity to receive advice and more information on real-time flood behaviour in this catchment. Verbal information is valuable in this catchment as no real-time water level gauges are active on Vineyard Creek.

- **If flood markers rise to indicate a level of 8.0 mAHD** a voiceover alert should sound to inform occupants that: *"This building's ground floor may soon become flooded. People on the ground floor, please make your way to the first floor. Please assist others who may need help to proceed to the first floor. People on floors one and above can remain in place."*

Flood wardens should survey the ground floor to help occupants make their way to floor one and should conduct a check to make sure all occupants have vacated the ground floor.

Whilst stairways are the encouraged vertical evacuation route, elevators can continue to be used to vertically evacuate persons requiring assistance to the first level as the ground floor will be 1.2 mAHD above the flood level at this point.


- **Observe the flood markers to guide continued measures.** If the flood waters continue to rise, occupants are to remain sheltering in place until further notice. When flood waters start to subside, flood wardens should continue to observe and wait to see 20 minutes of consistent falling of the flood level before allowing occupants to move back to the ground level.
 - **If flood waters continue to recede** flood wardens can inform occupants that it is safe to exit the site via the southern, ground floor entrance.
6. **Survey Post-Flood Damage:** Following a flood emergency event, flood wardens should survey the ground floor and landscaping to identify any damage or issues that may have resulted due to flooding.
 7. **Initiate a Building Check** by asking the building's plumbing and electrical contractor to do a check of the building to ensure that the building's systems are not damaged and are in working order.
 8. **Flood Warden Debrief:** the senior flood warden should convene a meeting of all wardens present to share observations about the flood emergency event and highlight improvements that can be made to the procedure(s).






Engagement with the State Emergency Service

GRC has contacted the NSW State Emergency Service to gain feedback on this Flood Emergency Response Plan and begin a collaboration process to align the site's plan with that of the local SES unit.

At the time of writing, GRC's contact with the SES has been as follows:

- 17/06/2024 – 12:11pm: Called SES on 132 500 in order to reach the Parramatta branch. Was advised to lodge a request via the SES website.
- 18/06/2024 – 12:30pm: Lodged a request via the SES website to find out the process through which we could discuss the FERP for our proposed development with the appropriate local Parramatta branch representative.
- 18/06/2024 – 12:33pm: Received email confirmation that the SES had received the enquiry and had passed it on to the relevant team.

 Visitors <visitors@ses.nsw.gov.au>
To Matthew Faint

 Reply  Reply All  Forward   Tue 18/06/2024 12:33 PM

Good afternoon Mat

Thank you for your enquiry to the NSW SES.

I have forwarded your requests to the relevant team for their action.

Kind Regards



Chontell Asserian
Receptionist |
NSW State Emergency Service - SHQ
P 0242516499 E visitors@ses.nsw.gov.au
93-99 Burrell Street Wollongong NSW 2500
PO Box 6126 Wollongong NSW 2500
www.ses.nsw.gov.au



- 18/06/2024 – 1:56pm: Received a request from the SES for more information.

RE: New enquiry from SES website

NSW SES Risk Reduction <rra@ses.nsw.g...
 To: Matthew Faint
 Cc: NSW SES Risk Reduction; Visitors
 Tue 18/06/2024 1:56 PM

Good afternoon Matthew

Thank you for your email.

Please reply to this email address with FERP and any other additional documentation for consideration.

Please note for any future referrals, please email this address: rra@ses.nsw.gov.au

Kind regards,
Daniela

Daniela Mitreski
 Program Support Officer | Emergency Risk Assessment Branch |
 Emergency Management Directorate
 NSW State Emergency Service – State Headquarters
 E rra@ses.nsw.gov.au

- 19/06/2024 – 5:41pm: FIA and FERP emailed to the SES.

Flood Emergency Response Plans for a Proposed Indigenous Centre of Excellence at WSU's Parra...

Matthew Faint
 To: 'rra@ses.nsw.gov.au'
 Cc: Steven Botterill; Stephen Gray; Thomas Klobucar
 Wed 19/06/2024 5:41 PM

L240516_WSUICOE_FloodImpactAssessment.pdf
 16 MB

Hi Daniela,

Please find attached the flood impact assessment and flood emergency response plan for a proposed educational facility at Western Sydney University's Parramatta South campus.

It would be great to get a discussion going to get your feedback on the flood emergency response component.

Thanks

Mat Faint
 Engineer

GRC Hydro Pty Ltd
 e: matthew@grchydro.com.au | t: +61 434 724 459
 a: Level 20, 66 Goulburn Street, Sydney 2000
 w: grchydro.com.au

- 20/06/2024 – 9:50am: Confirmation that the SES has received the provided FIA and FERP.

ACK ID2520 RE: Flood Emergency Response Plans for a Proposed Indigenous Centre of Excellence ...

NSW SES Risk Reduction <rra@ses.nsw.g...
 To: Matthew Faint
 Cc: Steven Botterill; Stephen Gray; Thomas Klobucar; NSW SES Risk Reduction
 Thu 20/06/2024 9:50 AM

Good morning Mat

Thank you for the above referral which has been registered as ID 2520. Please quote this ID on any related future correspondence.

The referral will be assessed and if deemed applicable, a response will be forthcoming in due course. Please note we aim to provide a response within 21-28 days of receipt.

Please also note that staff may be involved in NSW SES Operations which could result in a delay in response times.

We will reach out if we need further information.

Kindly note the above email address for all future referrals.

Kind regards,
Daniela

Daniela Mitreski
 Program Support Officer | Emergency Risk Assessment Branch |
 Emergency Management Directorate
 NSW State Emergency Service – State Headquarters
 E rra@ses.nsw.gov.au

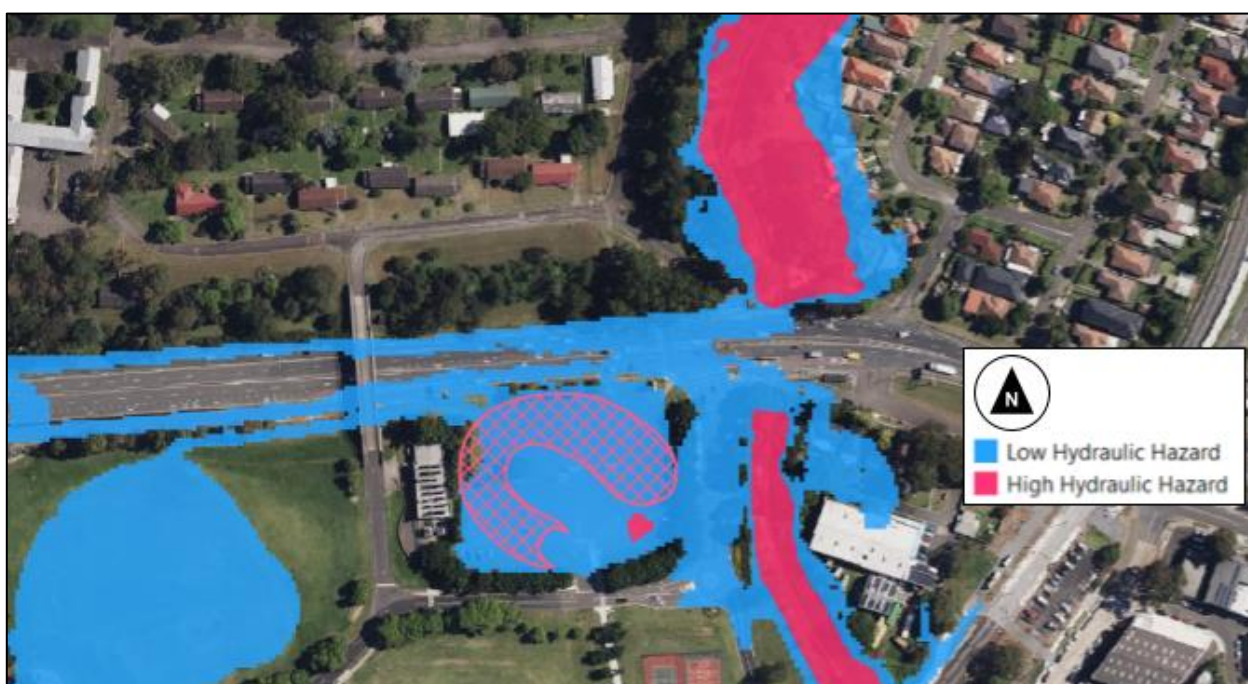
Compliance with Flood-Related Planning Controls

The relevant design standards that apply to the proposed development are determined in accordance with the following planning controls:

- The Parramatta Development Control Plan (DCP) (2023); and
- The Parramatta Local Environment Plan (LEP) (2023).

The hazard map (Figure C2) that Council provided for the site excludes Vineyard Creek (see Appendix A). As such, GRC has derived a flood hazard for the site by modelling the hydraulic hazard at the site as per the method outlined in Appendix L of the Floodplain Development Manual. In the 1% AEP event, the site is primarily subject to low hydraulic hazard with a small pocket of high hazard in the south-eastern corner, as documented in Figure 39 below. As such, GRC has conservatively classified the subject site as medium flood hazard.

Figure 39: Hydraulic Hazard (calculated in accordance with Floodplain Development Manual, Appendix L)



Compliance Requirements

The primary flood-related planning requirements for the site are outlined in the following planning instruments:

- The Parramatta Development Control Plan (2023) as it applies to University (Commercial) development; and
- The Parramatta Local Environmental Plan 5.21 and 7.11 as it applies to University (Commercial) development.

These flood-related controls (PDCP 2023, Section 5.1.1 and LEP) are outlined below in addition to comments to summarise how the proposed development addresses each control.

Guidance on which flood-related controls are relevant to each individual development is outlined under Section 5.1.1- C.24.

GRC has outlined the flood-related controls relevant to this site and the proposed land use in the following tables.

Table 3: Land Use Category Definitions (Table 5.1.1.1 from the PDCP, 2023)

Table 5.1.1.1 – Land Use Category Definitions

Land Use Categories	Identifies Land Uses	Open space or Non-urban uses	Subdivisions	Filling of flood prone land	Concessional Development
Sensitive uses and facilities	<ul style="list-style-type: none"> Community facilities or Public administration buildings which may provide an important contribution to the notification and evacuation of the community during flood events; Early education and care facilities; Hospitals; Residential care facilities; Seniors housing; Educational establishments; Emergency services facilities. 	<ul style="list-style-type: none"> Animal boarding and training establishments; Boat launching ramps; Boat repair facilities; Boat sheds; Cemetery; Charter and tourism boating facilities; Environmental facilities; Environmental protection works; Helipad; Jetty; Marinas; Mooring; Port facilities; Water recreation structures; Recreation areas and minor ancillary structures (e.g. Toilet blocks or kiosks); Recreation facilities (outdoor) 	Subdivision of land which involves the creation of additional allotments.	<p>The net importation of fill material onto a flood prone site is not permitted, except where:</p> <ol style="list-style-type: none"> final surface levels are raised by no more than 100mm over no more than 50% of the site; or filling is to be no more than 800mm thick beneath a concrete building slab, provided this does not significantly affect the floodway conveyance or flood storage. 	Concessional development is any development or redevelopment that would normally not be permitted under this Plan, but may be permitted as a concession provided it: <ol style="list-style-type: none"> is kept clear of any floodway; and involves an acceptably small (see below for limits) addition or alteration to an existing development that will not cause a significant increase in potential flood losses, risks or have an adverse impact on adjoining properties; or redevelopment for the purposes of substantially reducing the extent of flood affectation to the existing building; provided that such redevelopments incorporate to the fullest extent practical, design features and measures to substantially reduce the existing potential for flood losses and personal risks, and avoid any adverse impacts
Critical uses and facilities	<ul style="list-style-type: none"> Hazardous industries; Heavy industrial storage establishments; Offensive industries; Public utility undertakings which may cause pollution of waterways during flooding, are essential to evacuation during periods of flood or if affected during flood events would unreasonably affect the ability of the community to return to normal activities after flood events; Telecommunication facilities; Waste management facilities. 				
Residential	<ul style="list-style-type: none"> Attached dwellings; Backpackers accommodation; Bed and breakfast establishments; Boarding houses; Camping grounds; Caravan parks; Community facilities (other than sensitive uses/facilities); Dual occupancies; Dwelling houses; Group homes; Health consulting rooms; Home based child care; Home businesses; Home industries; Home occupations; Hostels; Multi dwelling housing; Neighbourhood shops; Residential flat buildings; Secondary dwellings; Semi-detached dwellings; Serviced apartments; Public utility undertakings (other than critical uses and facilities). 				
Commercial or Industrial	<ul style="list-style-type: none"> Advertising structures; Agriculture; Amusement centres; Business Premises; Car parks; Correctional centres; Crematorium; Depots; Entertainment facilities; Food and drink premises; Freight transport facilities; Funeral homes; Function centres; Hardware and building supplies; Health consulting rooms; Heavy industries; Hotel accommodation; Industries; Information and education facilities; Industrial retail outlets; Kiosks; Landscape and garden supplies; Light industries; Markets; Materials recycling or recovery centres; Medical centres; Mixed-use development; Mortuaries; Office premises; Passenger transport facilities; Places of public worship; Public administration buildings (other than essential uses and facilities); Pubs; Recreation facilities (indoor); Recreation facilities (major); Registered clubs; Restricted premises; Retail Premises; Service stations; Sex services premises; Shop top housing; Signage; Specialised retail premises; Storage premises; Transport depot; Truck depot; Tourist and visitor accommodation; Vehicle body repair workshops; Vehicle repair stations; Vehicle showrooms; Veterinary hospitals; Warehouse or distribution centres; Waste or resource management facilities; Wholesale supplies. 				

The proposed development is classed as an “Information and education facility,” therefore it is categorised as a Commercial or Industrial land use.

As outlined above, GRC has assessed the site can be classified as a Medium Flood Risk area.

The Floodplain Matrix in Section 5.1.1 – C.24 of the PDCP (2023) (included as Table 4 below) stipulates which development controls are relevant to a development with this land use and flood risk.

Table 4: Flood-related controls and requirements (Table 5.1.1.2 from the PDCP, 2023)

Table 5.1.1.2 – Floodplain Matrix Planning and Development Controls

Flood Risk Precincts (FRPs)	Planning Consideration	Floor Level	Building Components	Structural Soundness	Flood Affection	Car Parking & Driveway Access	Evacuation	Management & Design
High Flood Risk	Sensitive Uses & Facilities	X	X	X	X	X	X	X
	Critical Uses & Facilities	X	X	X	X	X	X	X
	Residential*	X	X	X	X	X	X	X
	Commercial & Industrial	X	X	X	X	X	X	X
	Open Space & Non-Urban	1	1	1	1	2, 4, 6, 7	1, 4	2, 3, 4
	Subdivision	X	X	X	X	X	X	X
	Filling	X	X	X	X	X	X	X
	Concessional Development	4	1	1	1	1, 5	3, 4, 6	2, 3, 4
Medium Flood Risk	Sensitive Uses & Facilities	X	X	X	X	X	X	X
	Critical Uses & Facilities	X	X	X	X	X	X	X
	Residential*	2	1	1	1	1, 3, 5, 6, 7	3, 4, 6	2, 3, 4
	Commercial & Industrial	2	1	1	1	1, 3, 5, 6, 7	3, 4, 6	2, 3, 4
	Open Space & Non-Urban	1	1	1	2	2, 4, 6, 7	1, 4	2, 3, 4
	Subdivision				1		3, 4, 5	1
	Filling	X	X	X	X	X	X	X
	Concessional Development	4	1	1	1	1, 5	2, 5	2, 3, 4
Low Flood Risk	Sensitive Uses & Facilities	X	X	X	X	X	X	X
	Critical Uses & Facilities	3	2	2	2	1, 3, 5, 6	2, 4, 6	2, 3, 4
	Residential*	2			2	1, 3, 5, 6	3, 4	
	Commercial & Industrial	2			2	1, 3, 5, 6	4	
	Open Space & Non-Urban					2, 4, 6, 7		
	Subdivision				2		5	1
	Filling				1			
	Concessional Development							

*For redevelopment of existing dwellings refer also to 'Concessional Development' provisions.

Legend		Not relevant	X	Unsuitable Land Use
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- i. Freeboard equals an additional height of 500mm.
- ii. The flood level is usually the higher of that level adopted by Council for fluvial flooding (from rising rivers, creeks, tributaries) for a 1% Annual Exceedance Probability event (1% AEP), or the modelled overland flow flood level (from rainfall in the local catchment) for an event with the same probability (1% AEP). The Flood Planning Level is usually the 1% AEP Flood Level plus a 500mm freeboard safety factor.
- iii. The Parramatta LEP 2023 identifies development permissible with consent in various zones. Notwithstanding, constraints specific to individual sites may preclude Council granting consent for certain forms of development on all or part of a site. The above matrix identifies where flood risks are likely to determine where certain development types will be considered "unsuitable" due to flood related risks.
- iv. Filling of the site, where acceptable to Council, may change the FRP considered to determine the controls applied in the circumstances of individual applications.
- v. Any fencing that forms part of a proposed development is subject to the relevant Flood Effects and Structural Soundness planning considerations of the applicable land use category.
- vi. Development within the floodplain may be subject to Clause 6.7 Foreshore Building Line in the Parramatta LEP 2023.
- vii. Additional controls apply to basement carparking within the floodplain, please see Car Park Basements associated controls above.
- viii. Where a flood warning and emergency response plan is required, requirements set out below under 'Flood Warning and Emergency Response Planning' must be achieved.

For a development with:

- Land use: Commercial and Industrial; and
- Flood Risk: Medium

The following flood-related controls (documented in Table 5) apply according to guidance outlined in the matrix tables 5.1.1.2 and 5.1.1.3 in Section 5.1.1 of the PDCP 2023.

Where relevant, GRC has added comment to assist with how to consider these controls during the design process.

Table 5: Flood-Related Controls Relevant to the Proposed Development

Reference	Control	GRC Comment
PDCP 2023 Control (From Table 5.1.1.3)		
Floor Level		
2	All habitable floor levels to be equal to or greater than the 1% AEP (100 year ARI) flood level plus 0.5 metre freeboard.	All habitable finished floor levels are above 8.8 mAHD (8.3 mAHD + 0.5m freeboard) with a proposed finished floor level of 9.0 mAHD.
Building Components and Method		
1	All structures to have flood compatible building components and construction below the 1% AEP (100 year ARI) flood level plus freeboard.	Separate to this report, a structural engineer will provide guidance on the structural soundness of the proposed concept design.
Structural Soundness		
1	Unless otherwise approved by Council, a structural engineer's report is required to certify that the structure can withstand the forces of floodwater, debris and buoyancy up to and including a 1% AEP (100 year ARI) flood level plus freeboard.	Separate to this report, a structural engineer will provide guidance on the structural soundness of the proposed concept design.
Flood Affection		
1	A hydraulic engineer's report is required to certify that the development will not increase flood affection elsewhere, having regard to: (i) loss of flood storage; (ii) changes in flood levels, flows and velocities caused by alterations to flood flows; and (iii) the cumulative impact of multiple potential developments in the vicinity.	<p>This report certifies that the development:</p> <ul style="list-style-type: none"> (i) Doesn't contribute to a net loss of storage as the development's impacts are restricted to the site and the development purposefully seeks to ensure no loss of flood storage by being built up on piers and by not broadly filling the grounds surrounding; (ii) Flows and velocities remain largely unchanged relative to the existing case; (iii) GRC can't attest to the impact of developments other than this proposed building as the

Reference	Control	GRC Comment
		development is relatively unique and unlikely to be replicated in the catchment. We can say however that this development's impacts are relatively minor and restricted to the subject site.
Car Parking and Driveway Access		
1	The minimum surface level of unenclosed parking spaces or carports shall be as high as practical, but no lower than 0.1 metres below the 1% AEP (100 year ARI) flood level. In the case of garages and other enclosed parking areas for less than 3 motor vehicles, the minimum surface level shall be as high as practical, but no lower than the 1% AEP (100 year ARI) flood level, plus 0.15 metres freeboard.	13 unenclosed parking spaces are proposed to the south-west of the proposed building. This area is largely unaffected by flooding in the 1% AEP event. 11 of the 13 spaces lie south of the 1% AEP flood extent and the remaining 2 spaces are predicted to have an approximate flood depth ranging from 0.1 to 0.3 m however this area has a low flood hazard of H1 in this and the 0.2% AEP event.
3	Garages, and other enclosed car parking areas, capable of accommodating more than 3 motor vehicles, must be protected from inundation by floods equal to or greater than the 1% AEP (100 year ARI) flood. Ramp levels to be no lower than 0.5m above the 100 year ARI flood level. Where below ground car parking is proposed additional measures must achieve protection up to the PMF.	No garages or enclosed parking is proposed as part of this development.
5	Unless otherwise approved by Council and provided this does not obstruct or displace floodwaters, the level of the driveway providing access between the road and parking spaces shall be no lower than 0.2 metres below the 1% AEP (100 year ARI) flood level.	The driveway provides rising egress from the site above the 1% AEP level.
6	Enclosed car parking, and car parking areas accommodating more than 3 motor vehicles, with a floor below the 1% AEP (100 year ARI) flood level, shall have adequate warning systems, signage, exits and evacuation routes. Refer to Flood Warning and emergency Response Planning section of the Parramatta DCP for requirements.	No enclosed parking is proposed as part of this development.
7	Restraints or vehicle barriers to be provided to prevent floating vehicles leaving a site during a 1% AEP (100 year ARI flood.)	No parking is proposed as part of this development.

Evacuation

Reference	Control	GRC Comment
3	Reliable access for pedestrians required from the site to an area of refuge (including shelter in place) above the PMF level, on site (e.g. second storey) or off site.	Provision has been made to allow pedestrians to travel up to the first level (elevated at 13.2 mAHD, higher than the PMF level of 10.4 mAHD) and safely congregate there as part of a shelter-in-place strategy. Back up electricity and water provision will be included in the event of an emergency.
4	Applicant is to demonstrate the development is consistent with any relevant flood emergency response plan, flood risk management plan or similar plan.	The proposed development. A flood emergency response plan has been developed and documented in this report above.
6	Adequate flood warning is to be available to allow safe and orderly evacuation without increased reliance upon SES or other authorised emergency services personnel.	The proposed development will include a flood warning system to alert occupants when to evacuate to higher ground elsewhere on the campus or shelter in place on Level 1.

Management and Design

2	Flood emergency response plan required where the site is affected by the 1% AEP (100 year ARI) flood level. Plan is to detail procedures that would be in place for an emergency (such as warning systems, signage and evacuation emergency drills) and should consider the following aspects: (i) preparing for a flood, (ii) responding when a flood is likely, (iii) responding during a flood, and (iv) recovery after a flood. Must be consistent with Flood Warning and Emergency Response Planning requirements outlined in DCP.	This plan has been outlined previously in this report
3	Applicant is to demonstrate that sufficient area is available to store goods above the 1% AEP (100 year ARI) flood level plus 0.5 metre freeboard.	The building's ground floor is proposed above the 1% AEP (100 year ARI) flood level plus 0.5 metre freeboard. Therefore all storage space will be above this level.
4	No storage of materials below the Flood Planning Level (1% AEP flood plus 0.5 metre freeboard) which may cause pollution or be potentially hazardous during any flood.	The building's ground floor is proposed above the 1% AEP (100 year ARI) flood level plus 0.5 metre freeboard. Therefore all storage space will be above this level.

Parramatta LEP 2023 – 7.11

(3)	Development consent must not be granted to the erection of a building on the land unless the consent authority is satisfied the building— (a) contains an area that is— (i) located above the probable maximum flood level, and	An emergency access point connecting the building above the 1% AEP flood level (8.3 mAHD) is located near to the south-eastern entrance of the proposed development. The proposed design includes provision to be connected to an emergency electricity and
-----	---	--

Reference	Control	GRC Comment
	<p>(ii) connected to an emergency electricity and water supply, and</p> <p>(iii) of sufficient size to provide refuge for all occupants of the building, including residents, workers and visitors, and</p> <p>(b) has an emergency access point to land above the 1% annual exceedance probability event, and</p> <p>(c) is able to withstand the forces of floodwaters, debris and buoyancy resulting from a probable maximum flood event.</p>	<p>water supply and has sufficient space on level 1 and above to allow all occupants of the building to safely shelter above the PMF level (10.4 mAHD) in the event of an emergency. There are three publicly accessible levels proposed above the PMF level so ample space will be available to allow all occupants to comfortably shelter in place.</p> <p>Separate to this report, a structural engineer will provide guidance on the structural capacity of the proposed concept design to withstand the forces of floodwaters, debris and buoyancy resulting from a PMF event.</p>
(4)	<p>Subclause (3)(a) does not apply if—</p> <p>(a) there is pedestrian access located between the building and land above the probable maximum flood level, and</p> <p>(b) the pedestrian access is located above the probable maximum flood level.</p>	<p>Subclause (3)(a) does apply.</p>

Riparian Zone Management Assessment

NSW Government guidelines set out objectives for development in the vicinity of a creek or other watercourse. The guidance is presented in the NSW Department of Planning and Environment Fact Sheet “Controlled Activities – Guidelines for Riparian Corridors on Waterfront Land” (2022) and is based on the relevant legislation (Water Management Act 2000).

The subject site is in the vicinity of Vineyard Creek. The riparian corridor of the creek is defined as the channel itself including its banks, plus the Vegetated Riparian Zone (VRZ) on either side of the channel. The VRZ is of constant width and is based on the channel’s Strahler Stream Order. NSW GIS data available online on the ‘NSW Map’ website indicates a Strahler Stream Order of 2, however, given the significant upstream catchment and the site’s location near the creek outlet, the creek’s Strahler Stream Order is assessed to be 4 (the maximum), for which the VRZ width is 40 m on either side of the channel. Based on this categorization, the riparian corridor is shown below. The total width is approximately 85 m.

Figure 40: Riparian Corridor



The creek in the vicinity of the site consists of a narrow channel of around 3-5 m width, with sloped banks on either side occupying a total width of ~20m. In this corridor the creek has been fully disturbed from its natural state, and now has a mix of cleared areas, native and non-native vegetation. Examples are shown in Image 3 below. Outside of this corridor on the western side of the creek (i.e. towards the subject site) there is no remnants of the original riparian vegetated zone, and is now a mix of fences, grass, bitumen roads, concrete footpath and trees adjacent to the car park that were planted in approximately 2011.

Image 3: Riparian Investigation Photos



Once the RVZ is identified and mapped, the guideline requires that development:

- maintain or rehabilitate a RC/VRZ with fully structured native vegetation in accordance with Table 1 Controlled activities – Guidelines for riparian corridors on waterfront land Department of Planning and Environment 4
- minimise disturbance and harm to the recommended RC/VRZ
- minimise the number of creek crossings and provide perimeter road separating development from the RC/VRZ
- locate services and infrastructure outside of the RC/VRZ. Within the RC/VRZ provide multiple service easements and/or utilise road crossings where possible
- treat stormwater run-off before discharging into the RC/VRZ.

Given the location of the subject site in what is currently a sealed car park, and no creek crossings are proposed, it is recommended to incorporate the following measures in the design and construction of the proposed building:

1. Minimise disturbance and harm to the area via use of a sediment control and erosion plan, for the construction phase of the project.
2. Include stormwater treatment in the design of the site's drainage

Summary

The proposed development has been designed to be compatible with the existing flood regime at the subject site. Key features are:

- Elevated FFL at 9.0 mAHD versus 1% AEP level of 8.3 mAHD;
- Open undercroft beneath with building on piers;
- Landscaping sympathetic to inflow and avoiding filling of subject site;
- Means of egress to flood free areas external to the building in 1% AEP; and
- Facilitation of shelter in place for the worst possible flood the PMF.

The impact of this development on flood affectation at the site has been modelled and any adverse flood level impacts predicted as a result of this development are contained within the site.

In addition to a Flood Impact Assessment, this report contains a Flood Emergency Response Plan for the proposed development and a Riparian Zone Management Assessment.

The proposed development has been assessed relative to its flood affectation and the flood-related controls outlined in the Parramatta LEP and DCP and have been found to be compliant with these controls.

Appendix A: Council Flood Certificate



Our Reference: FL/205/2023
 Contact: Peter Sirianni
 Telephone: 02 9806 8250
 Fax: 02 9806 5906

GRC Hydro
 Level 20/66 Goulburn St
 SYDNEY NSW 2000

12 October 2023

FLOOD ENQUIRY APPLICATION

Property Details

Address	171 Victoria Road, PARRAMATTA NSW 2150
	<i>This form applies for up to three adjoining sites relating to the same development. A separate Flood Enquiry form and fee will be required for more than 3 or separate lots.</i>

Delivery Preference

matthew@grchydro.com.au

Reason for Enquiry

--

Property Type

**** GST not applicable from 1 July 2013****

Flooding Application – Commercial	\$599.00
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Disclaimer: Flood levels and flood extent lines are based on current information held by Council. Council does not accept responsibility for the accuracy of this information. Any pipe sizes and location of pits and pipe lines should be confirmed by site investigation. The flood levels shown on the back of this form are only an approximate guide and have been derived using the current computer simulated model.

The information provided in this document is presented in good faith to assist the public in understanding Council's drainage requirements that apply within the Parramatta Local Government Area. It is the responsibility of each individual using this information to undertake their own checks and confirm this information prior to its use.

City of Parramatta Council, its agents and employees are not liable (whether by reason of negligence, lack of care or otherwise) to any person for any damage or loss whatsoever which has occurred or may occur in relation to that person taking or not taking (as the case may be) action in respect of any representation, statement, or advice referred to above.

Refer to back of this form for level information issued



Flood Enquiry Information Issued - 12 October 2023

Mainstream Flooding

Is this property affected by mainstream flooding? 171 Victoria Road, PARRAMATTA		<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Flood Levels	Closest Cross Sections: <i>(Please refer to Flood Study):</i> Refer to Flood Map	
5% AEP	Refer to Flood Map	Comments: See Note on Flood/Hazard Map
1% AEP		
PMF		
<input checked="" type="checkbox"/> Refer to flood maps provided for detailed flood levels.		
Flood information is obtained from the following flood study report: 1. Lower Parramatta River Floodplain Risk Management Study – Flood Study Review, 2005 (SKM) 2. Vineyard Creek Sub-Catchment Management Plan, 2004 (SMEC)		

Note: Flood inundation can be verified by detail survey to AHD undertaken by a Registered Surveyor.

Local Flooding

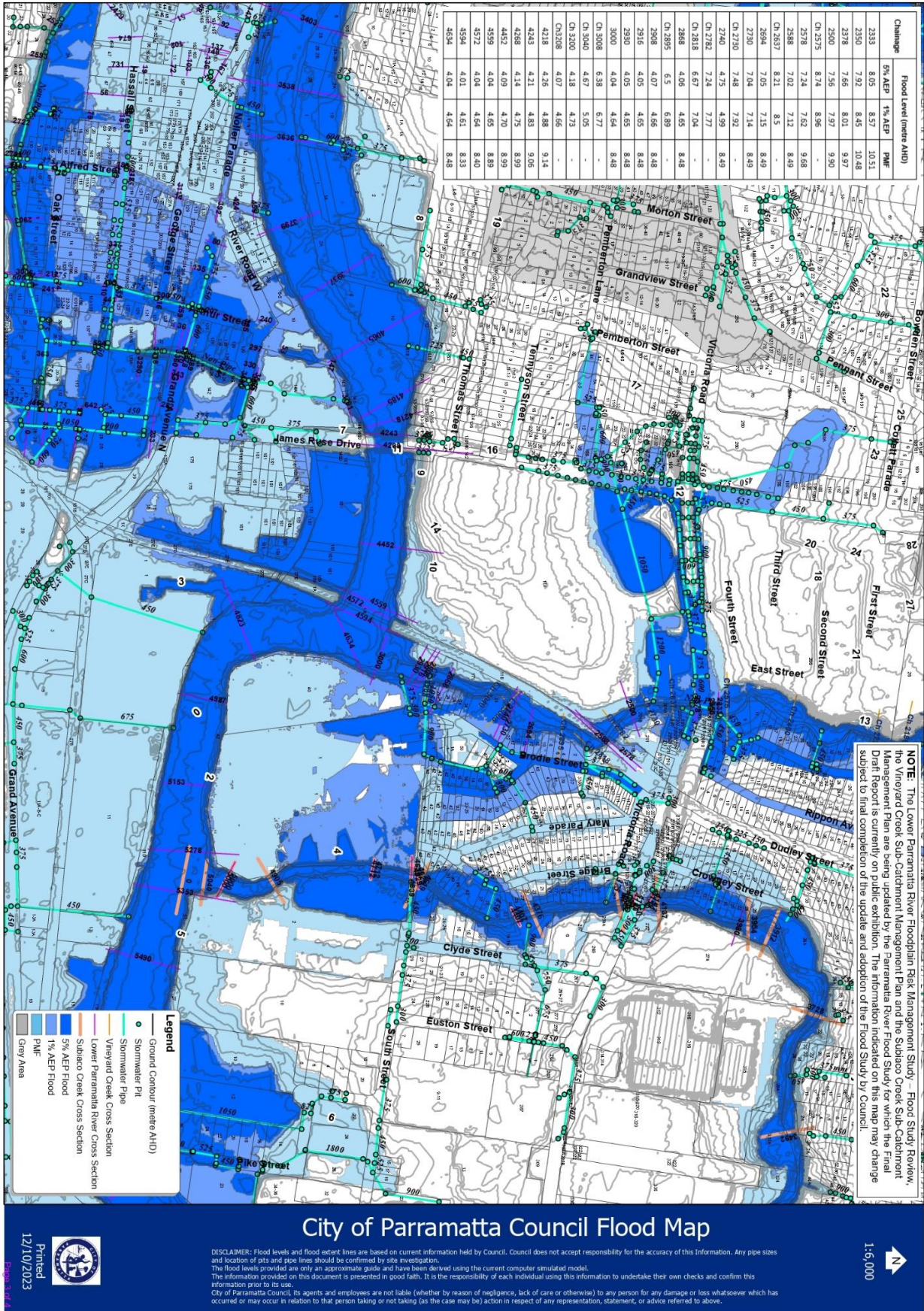
Is the property located within a Hatched Grey Area? <i>Properties located within a Hatched Grey Area are subjected to flooding from the local catchment.</i>	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Is the property located within a Grey Area? <i>Properties located within a Grey Area are subjected to additional site drainage controls to manage flooding in the local catchment.</i>	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Is the property likely to be affected by overland stormwater run-off from the local catchment?	<input checked="" type="checkbox"/> Subject to Detailed Investigation
Note: You are required to contact Council's Development Service Engineer for any details and requirements relating to development that is affected by local flooding.	

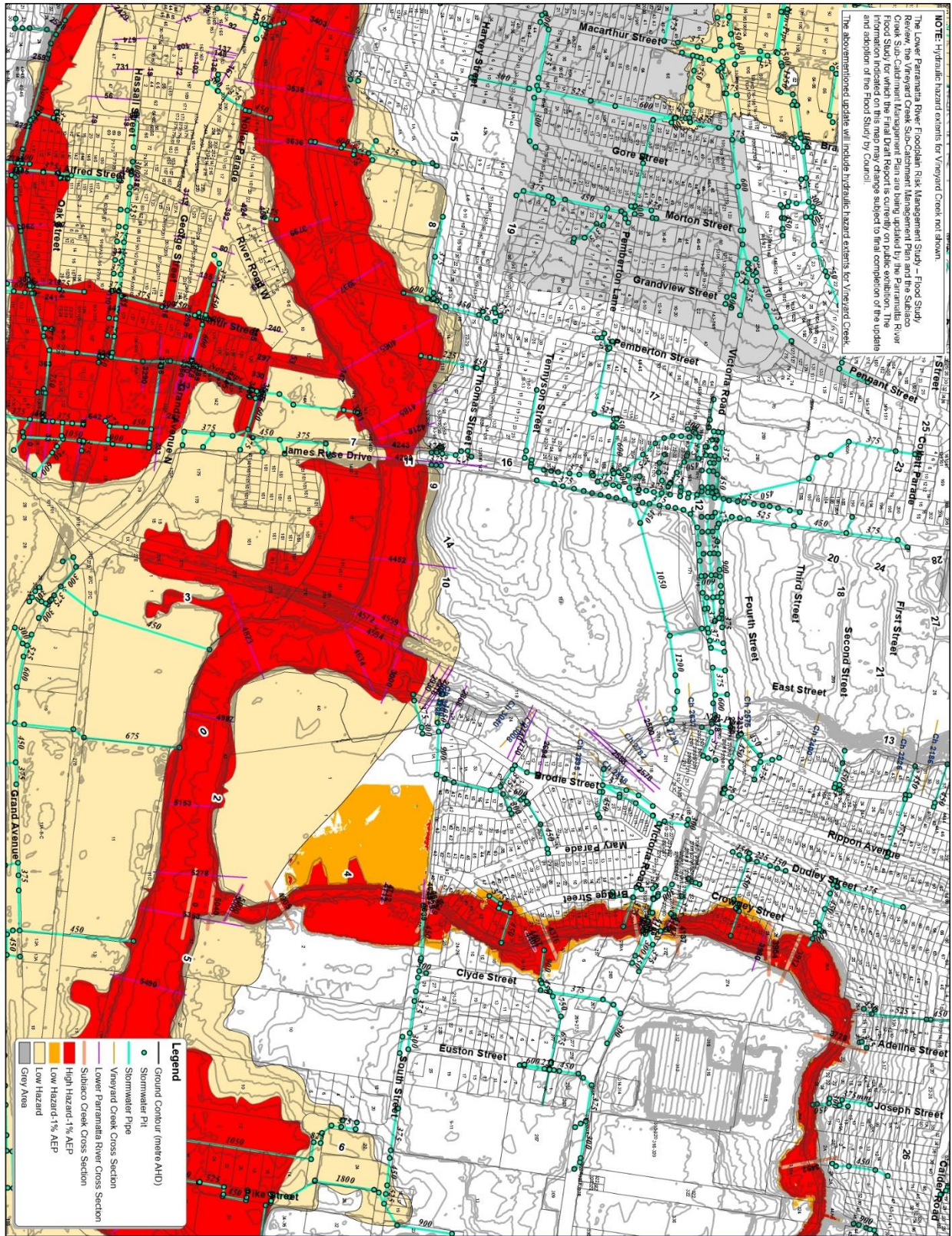
Additional Recommended Actions

<input checked="" type="checkbox"/>	The Applicant needs to discuss the proposal to re-develop this site with Council's Town Planner and Development Services Engineer.
<input checked="" type="checkbox"/>	The Applicant needs to contact Council's Town Planner and organise a pre-lodgement meeting to discuss any proposal to redevelop this property.
<input checked="" type="checkbox"/>	The Applicant needs to refer to Council's Local Floodplain Risk Management policy for details relating to developing a land affected by flooding.

Definitions: (As per NSW Floodplain Development Manual dated April 2005)

- AHD** – a common national surface level datum approximately corresponding to mean sea level.
- ARI** – the long term average number of years between the occurrences of a flood as big as or larger than, the selected event.
- PMF** – is the largest flood that could conceivably occur at a particular location, usually estimated from probable maximum precipitation.
- AEP** – Annual Exceedance Probability is the chance of a flood of a given or larger size occurring in any one year, usually expressed as a percentage.





NOTE: Hydraulic hazard extents for Vineyard Creek not shown.
The Lower Parramatta River Floodplain Risk Management Study - Flood Study Review, the Vineyard Creek Sub-catchment Management Plan and the Salween Creek Sub-catchment Management Plan are being updated by the Parramatta River Flood Study for which the Final Draft Report is currently on public exhibition. The information indicated on this map may change subject to final completion of the update and adoption of the Flood Study by Council.
The aforementioned update will include hydraulic hazard extents for Vineyard Creek.

Legend

- Ground Contour (metre AHD)
- Stormwater Pit
- Vineyard Creek Cross Section
- Lower Parramatta River Cross Section
- Subsido Creek Cross Section
- High Hazard - 1% AEP
- Low Hazard - 1% AEP
- Low Hazard - 10% AEP
- GDIY Area

City of Parramatta Council Hydraulic Hazard Map

DISCLAIMER: Flood levels and flood extent lines are based on current information held by Council. Council does not accept responsibility for the accuracy of this information. Any pipe sizes and location of pits and pipe lines should be confirmed by site investigation. The flood levels provided are only an approximate guide and have been derived using the current computer simulated model. The information provided in this document is presented in good faith. It is the responsibility of each individual using this information to undertake their own checks and confirm this information prior to its use. City of Parramatta Council, its agents and employees are not liable (whether by reason of negligence, lack of care or otherwise) to any person for any damage or loss whatsoever which has occurred or may occur in relation to that person taking or not taking (as the case may be) action in respect of any representation, statement, or advice referred to above.



Printed
12/10/2023

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Appendix B: ICoE Architectural Drawings

PROPOSED FLOOR PLAN LEVEL 01

WESTERN SYDNEY UNIVERSITY
INDIGENOUS CENTRE OF EXCELLENCE
VICTORIA RD, RYDALMERE NSW 2116
DARUG NARRARA

DATE: 23/03/22
SCALE: 1:200
PROJECT: DA-1-103
REVISION: 2

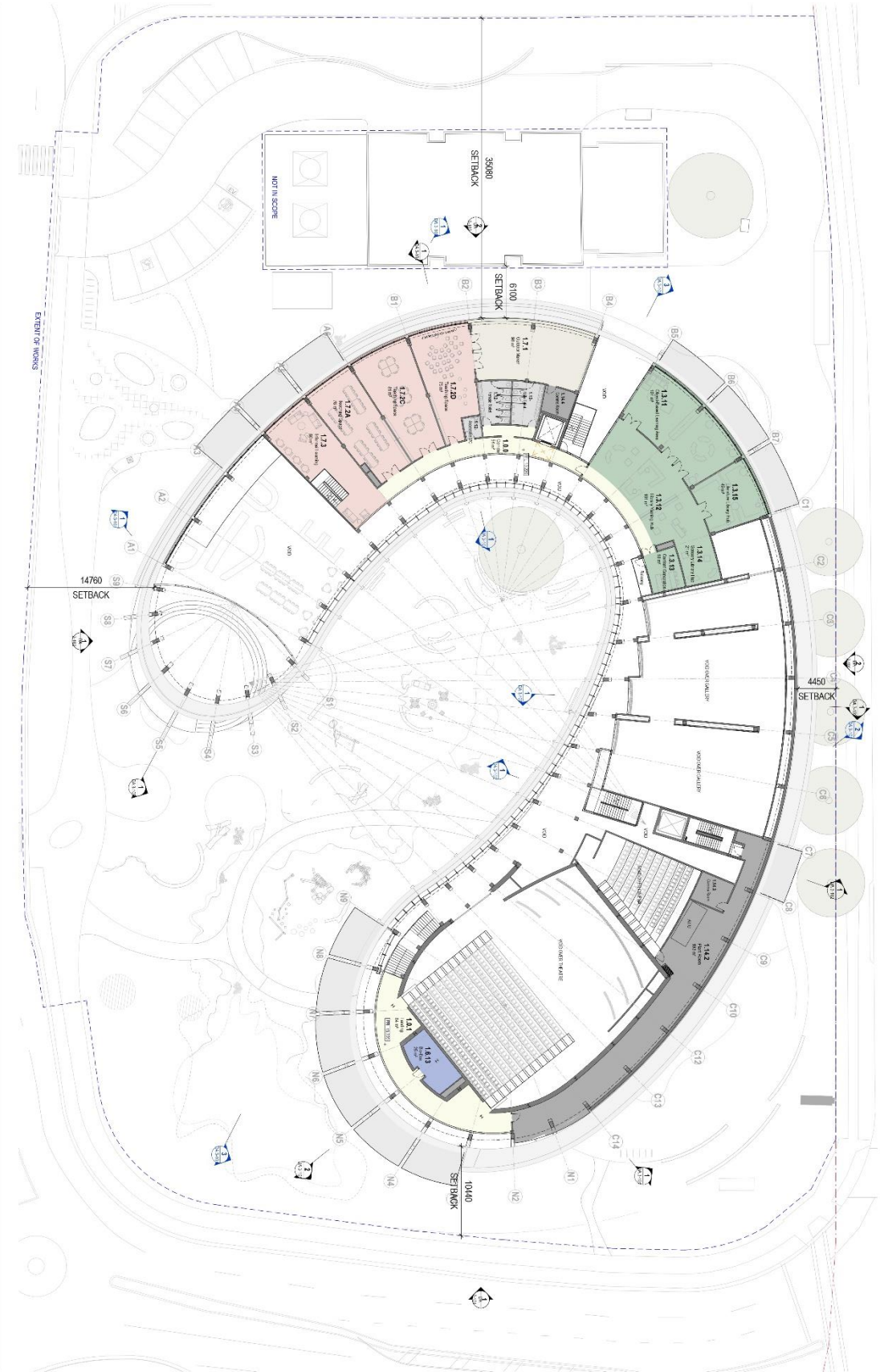
DESIGNER: JACKSON BUCKROU ARCHITECTS
23/03/22
35/55 SMITH STREET RYDALMERE NSW 2116
T: +61 2 9518 8222 WWW.JBA.COM.AU

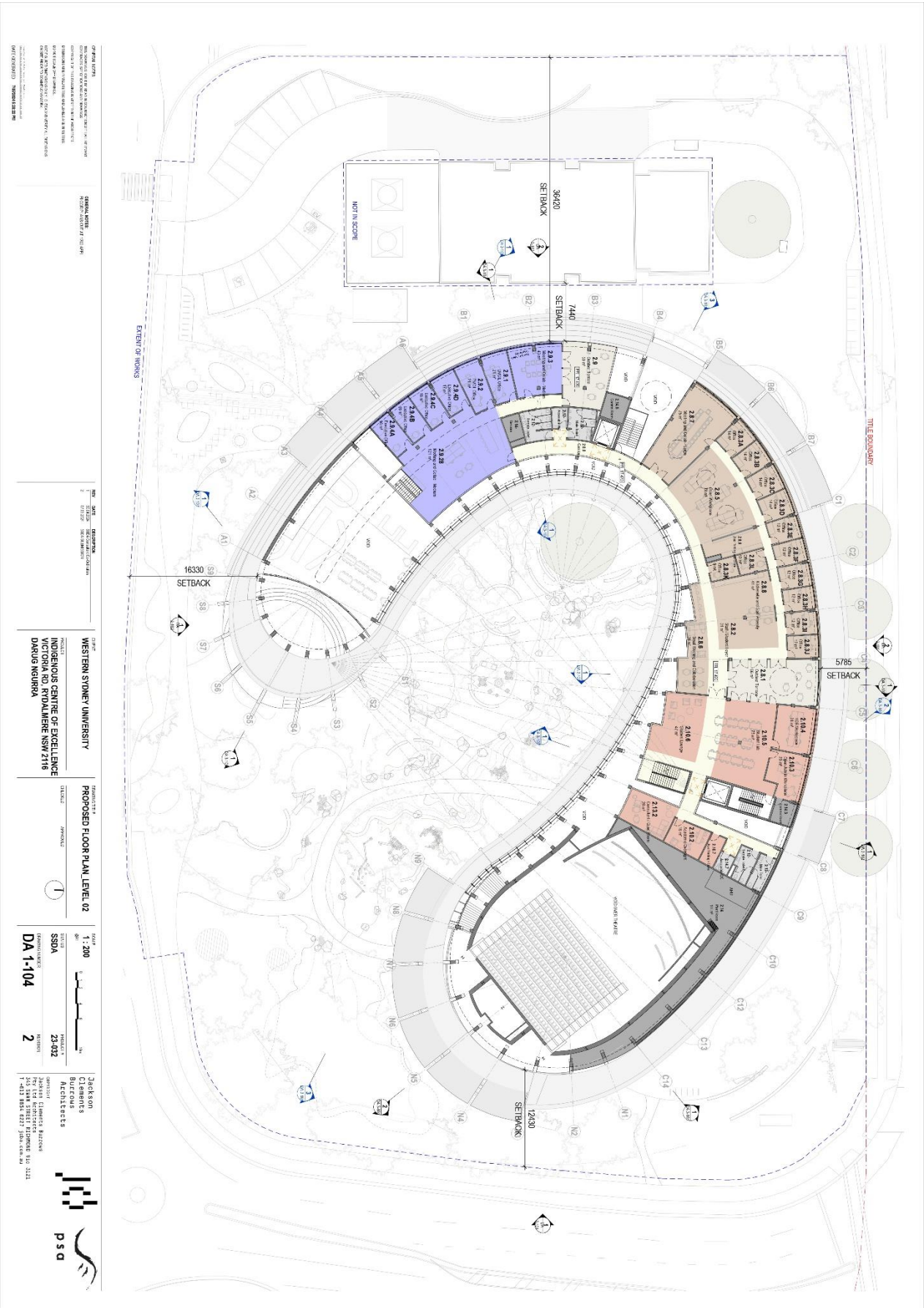
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INDIGENOUS CENTRE OF EXCELLENCE
VICTORIA RD, RYDALMERE NSW 2116
DARUG NARRARA

DATE: 23/03/22
SCALE: 1:200
PROJECT: DA-1-103
REVISION: 2

DESIGNER: JACKSON BUCKROU ARCHITECTS
23/03/22
35/55 SMITH STREET RYDALMERE NSW 2116
T: +61 2 9518 8222 WWW.JBA.COM.AU

CLIENT: WESTERN SYDNEY UNIVERSITY
INDIGENOUS CENTRE OF EXCELLENCE
VICTORIA RD, RYDALMERE NSW 2116
DARUG NARRARA





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REVISIONS:
 NO. DATE DESCRIPTION
 1 23/03/22 23-0322

PROJECT:
 WESTERN SYDNEY UNIVERSITY
 INDIGENOUS CENTRE OF EXCELLENCE
 VICTORIA RD, ROYALME NSW 2116
 DARUG NARRA

PROPOSED FLOOR PLAN LEVEL 02

SCALE:
 1:200

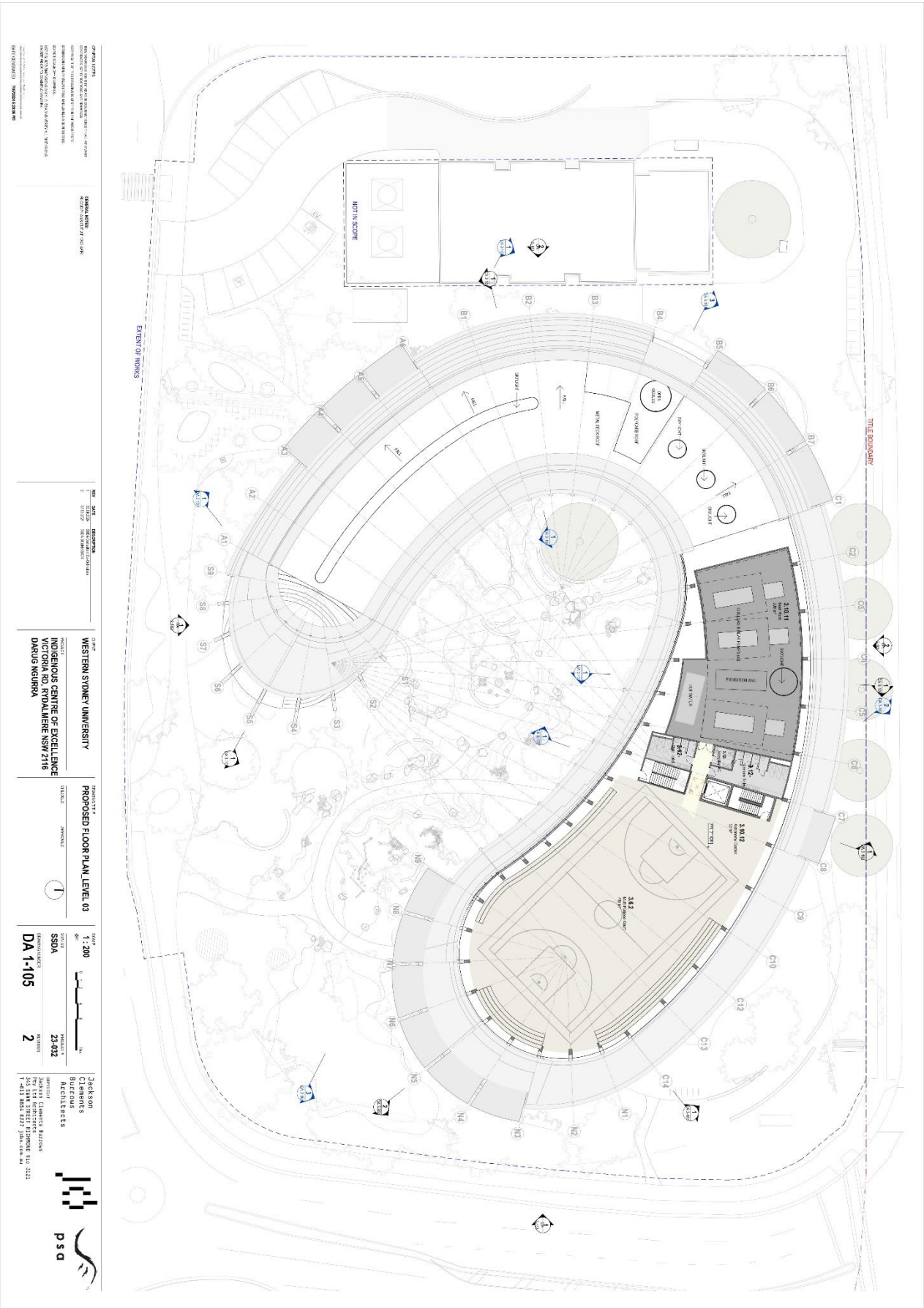
DATE:
 23/03/22

PROJECT NO.:
 DA-1-104

PROJECT NO.:
 2

ARCHITECT:
 JACKSON BUCHHEIT ARCHITECTS
 JACKSON BUCHHEIT ARCHITECTS
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 T: +61 2 9251 8222 JBA@jba.com.au

ENGINEER:
 P30



PROPOSED FLOOR PLAN LEVEL 03

WESTERN SYDNEY UNIVERSITY
INDIGENOUS CENTRE OF EXCELLENCE
VICTORIA RD, ROSALINDIE NSW 2116
DARUG NONGARNA

DATE: 23/03/22
SCALE: 1:200
PROJECT: DA-1-105
REVISION: 2

DESIGNER: JACKSON BUCKROU ARCHITECTS
CLIENT: JACKSON SIMPSON ARCHITECTS
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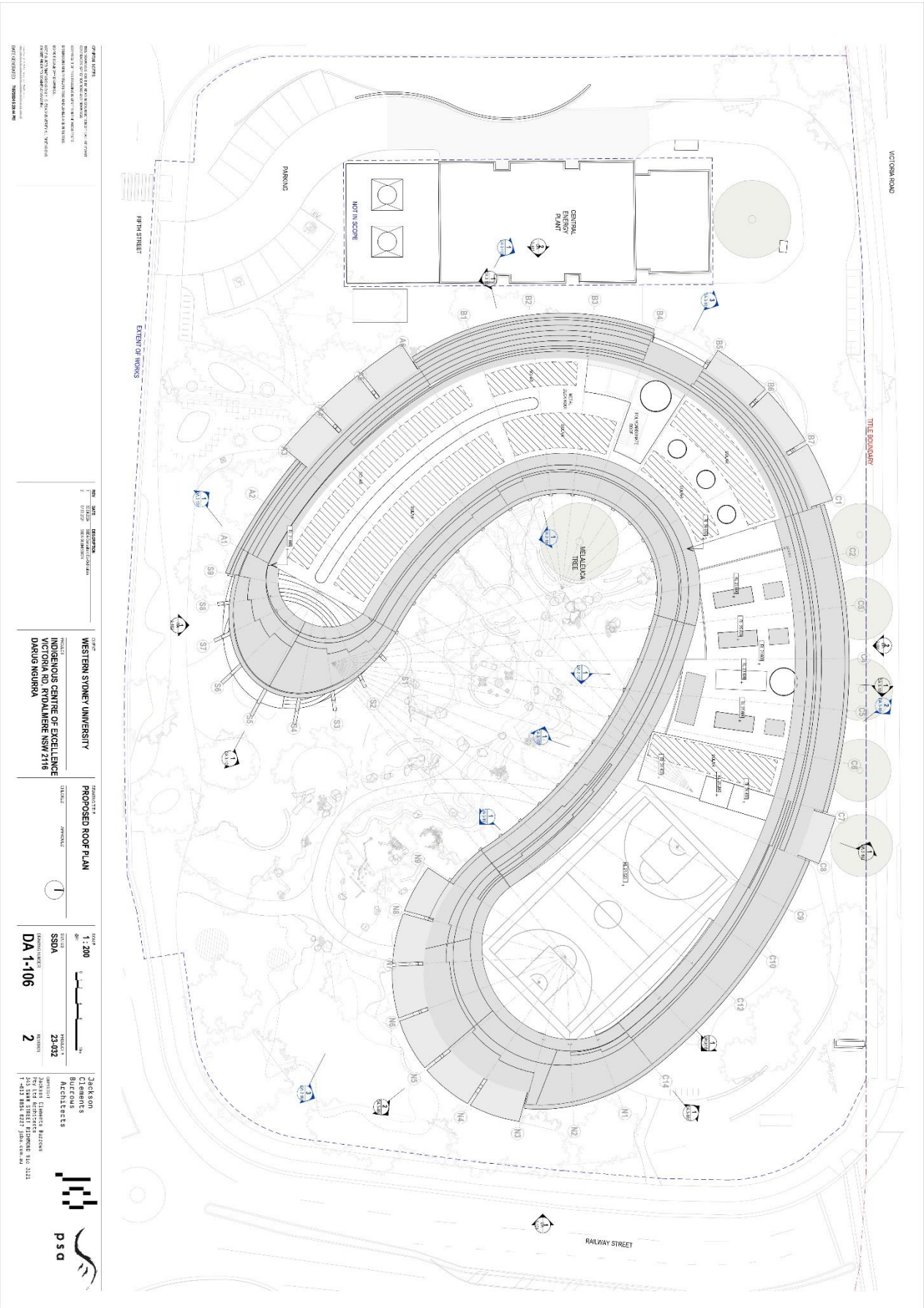
SCALE: 1:200
DATE: 23/03/22
PROJECT: DA-1-105
REVISION: 2

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DATE 23/03/22
SCALE 1:200
PROJECT WESTERN SYDNEY UNIVERSITY
INDIGENOUS CENTRE OF EXCELLENCE
 VICTORIA RD, ROYALME NSW 2116
 DARUG NIGURRA

PROPOSED ROOF PLAN
 SHEET 2 OF 2

SCALE 1:200
SSDA 23/03/22
DA-1-106 2

JACKSON BUCHHEIT ARCHITECTS
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Appendix C: Consideration of the Flood Risk Management Manual (2023)

Responding to the Flood Risk Management Manual 2023

The Department of Planning, Housing and Infrastructure has requested that GRC reference and address the relevant provisions of the Flood Risk Management Manual 2023 for this development.

This manual is primarily targeted at the government and policy development level. As identified in Section 1.2 of the manual:

“The manual does not outline the requirements for the development of flood prone land. These requirements are provided by the relevant planning legislation and policies, however, in managing development of flood prone land, planning proposal and development consent authorities are to consider the principles of this manual and the advice provided by it and the supporting toolkit.”

GRC has attempted to extract criteria and provisions that may be relevant to this individual development. These provisions, and GRC’s response to them, are documented in the table below.

Section	Criteria	GRC Response
2 Principle 1	Establish sustainable governance arrangements	This principle is directed at the government level and is not relevant to this standalone development.
2 Principle 2	Think and plan strategically	This principle is directed at the government level. GRC has modelled flood behaviour at the site in the existing and post-development case in accordance with best practice.
2 Principle 3	Be consultative	This principle is directed at the government level. GRC has reached out for coordination with the City of Parramatta regarding flooding throughout this project.
2 Principle 4	Make flood information available	GRC was unable to obtain a flood model from Council throughout this study. As such, GRC developed a flood model for the site. The flood information that has resulted from this work has been documented in this report.
2 Principle 5	Understand flood behaviour and constraints.	Modelling has been undertaken to develop an understanding of the existing flood affectation at the site.
2 Principle 6	Understand flood risk and how it may change	Flood affectation has been modelled under a variety of design events (including climate change specific scenarios) and development scenarios.
2 Principle 7	Consider variability and uncertainty	A variety of design events of increasing magnitudes and probabilities (including climate change specific scenarios) have been modelled in a existing and post-developed case in order to understand how flooding at the site can vary when subjected to different events.
2 Principle 8	Maintain natural flood functions	The impact of the proposed development has been assessed and amended throughout the course of this project in order to preserve the existing flood function as far as is practicable. The natural flood functions have been maintained.
2 Principle 9	Manage flood risk effectively	A flood emergency response plan has been developed for the site which documents a suite of recommendations and processes so that occupants and staff can safely prepare and act in the event of flooding at the site.

Section	Criteria	GRC Response
2 Principle 10	Continually improve management of flood risk	A Flood Emergency Response Plan has been created for the proposed development. This plan will improve the management of flood risk at this site.
3	Flood Risk	GRC has conducted flood modelling at this site for the existing and post-development scenario and has assessed the potential flood hazard surrounding the development. A Flood Emergency Response Plan (FERP) has been developed to help the future occupants manage flood risks and coordinate with the SES to prepare for, and act in accordance with during flood events. This FERP has devised a process for dealing with potential flood risks given the local flooding context and the available warning mechanisms in the local catchment.
4	Managing of Flood Risk	GRC has conducted flood modelling at this site for the existing and post-development scenario and has assessed the potential flood hazard surrounding the development. A Flood Emergency Response Plan (FERP) has been developed to help the future occupants manage flood risks and coordinate with the SES to prepare for, and act in accordance with during flood events. This FERP has devised a process for dealing with potential flood risks given the local flooding context and the available warning mechanisms in the local catchment.
5	<p>Roles and Responsibilities</p> <p>5.4.13 Developers <i>Development proponents may be required by consent authorities to provide information and prepare reports on the impacts of the development on flood behaviour and the existing community, as well as the risks associated with the development and its use. These reports should identify management measures needed to address these risks. Proposed management measures to offset impacts may require development approval and may be subject to additional approval requirements. Developers may also be required to contribute to the costs of management measures required to limit the effects of their development on others.</i></p>	<p>GRC has prepared this report for the proponent regarding this development.</p> <p>The report includes:</p> <ul style="list-style-type: none"> the impacts of the development on flood behaviour and the existing community, as well as the risks associated with the development and its use (see FERP). The design of the development has been informed by flood modelling and an iterative process has been undertaken to preserve existing flood behaviour and limit the exposure of occupants to potential flood risks. A Flood Emergency Response Plan has been developed to guide management measures for flood preparation and procedures to be enacted during flood events.