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Project:	<i>Ross Street T&L Centre, Flood Assessment</i>
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Date:	<i>22nd July 2025</i>
To:	<i>Nora Babik, University of Sydney</i>
Subject:	<i>Ross Street T&L Hub, Flood Assessment</i>
Version:	<i>Version 6 (Update for SSDA response to submissions)</i>
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1. Introduction

This Flood Impact and Risk Assessment has been prepared by GRC Hydro on behalf of the University of Sydney (the applicant) in support of a State Significant Development Application (SSDA) submitted to the Minister of Planning under Part 4 of the Environmental Planning and Assessment Act 1979 (EP&A Act).

The SSDA seeks development consent for the detailed design and construction of a new building, referred to as the A01 Ross Street Teaching and Learning Hub, on the south-eastern corner of Ross Street and Parramatta Road, Camperdown (the site – refer Image 1).

The site is legally described as Lot 1 in Deposited Plan 1171804 and currently contains demountable buildings.

The project has been declared as a State Significant Development (SSD) pursuant to Section 4.36(2) of the EP&A Act. In accordance with Schedule 1, Clause 15 of the State Environmental Planning Policy (Planning Systems) 2021 (Planning Systems SEPP), the project is declared SSD as it is development for the purpose of a tertiary institution with a capital investment value (CIV) of more than \$50 million.

The project falls within the University's Campus Improvement Program (referred to as the "CIP"). The CIP forms a Concept Approval determined by the Minister for Planning on 16 February 2015 (SSD-6123). The CIP is the University's concept development implementation program for future campus precincts with accompanying building envelopes. The Ross Street Teaching and Learning Hub development is fully compliant with the approved concept plan.

The project is designed to maximise the accommodation of large flat floor teaching spaces and provide a learning hub for students in more flexible, collaborative, and larger scale spaces. Key features of the project include:

- Relocation of existing demountable buildings
- New 5 storey building comprising approximately 6,200m² GFA
- General Teaching Spaces (GTS) comprising 60 and 120 person flat floor teaching spaces as well as informal learning spaces
- 5 star Greenstar building
- Significantly enhanced public domain, including outdoor seating areas, new landscaping and increased tree canopy
- Food and beverage offering directly fronting the new public domain.

This Flood Impact and Risk Assessment addresses the specific project requirements provided in the Secretary's Environmental Assessment Requirements (SEARs) issued by the Department of Planning

and Environment (DPE) on 1 May 2023 (DPE reference: SSD- 57838709). Where relevant, this reports also addresses relevant conditions of consent contained in the CIP Concept Approval (SSD-6123).

Version 6 of this FIRA contains updated text to address the response to submissions from SSD-57838709 received April 2025. Responses were received from NSW State Emergency Services (SES) and the Conservation Programs, Heritage and Regulation Group (CPHR) with comments addressed as noted in Section 1.4 of this report.

Volume 1 contains the report text which presents flooding results for both 'Existing Conditions' and 'Proposed Conditions', quantifies the impacts on flood behaviour for both the site and wider community, presents a detailed risk assessment and details the compliance of the proposed development against relevant planning policies.

Volume 2 contains mapping of flood behaviour for a wide range of events. The mapping is guided by the 'Flood Risk Management Toolkit' (DPE 2023), in particular the 'Flood Risk Management Manual' (DPE 2023) and 'Flood Impact and Risk Assessment LU01' (DPE 2023).

Volume 3 presents a preliminary Emergency Management Plan (EMP or EM Plan) based on the current development, with a recommended approach for minimising risk to life in the event of a flood. This early preparation of an EMP demonstrates the proposed development can safely manage flood risk and includes updates based on consultation with the NSW State Emergency Service (SES) for a final EMP during future development stages.

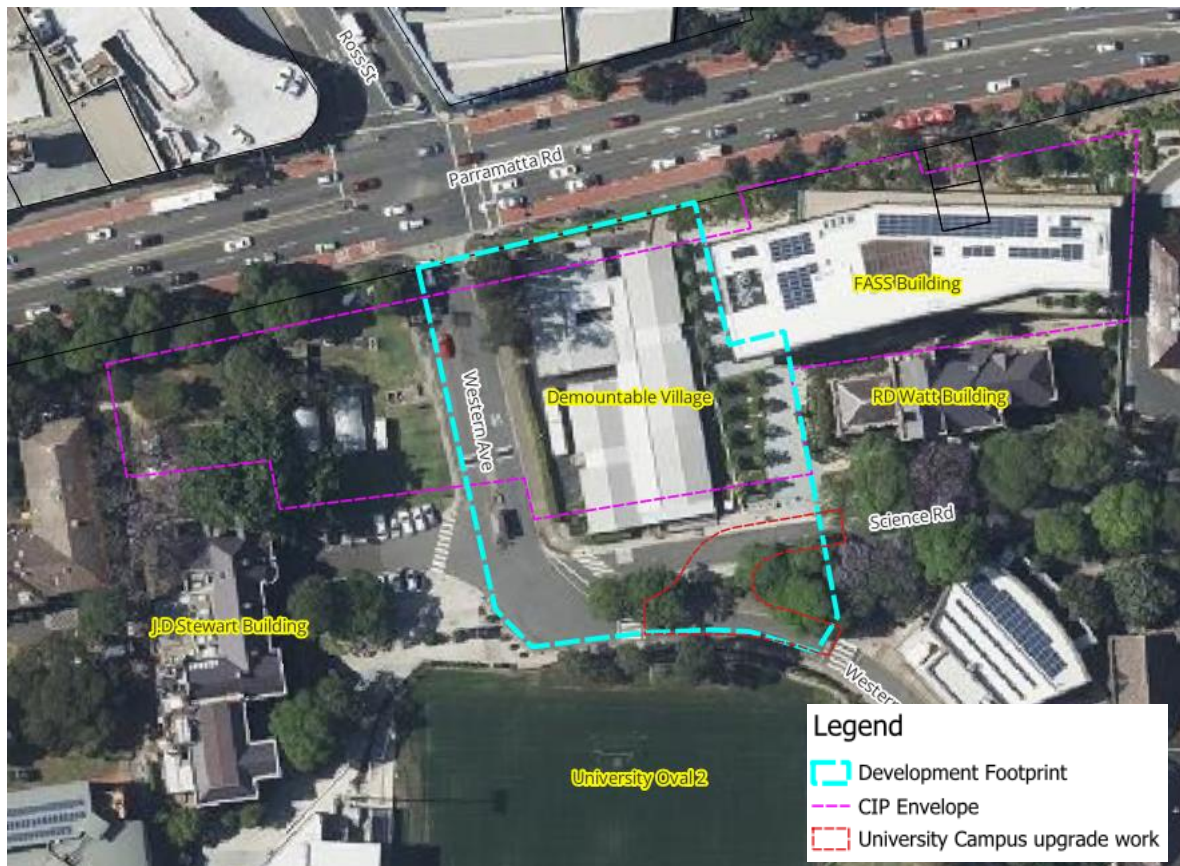
This Flood Risk Assessment has been prepared with reference to architectural plans prepared by BVN (June 2024) and landscaping plans by OCULUS (June 2024). Specific references provided throughout the report.

1.1 The Site

The site is located between Parramatta Rd, Western Ave and Science Rd with the extent of proposed works extending to include updates to Western Avenue. An aerial photograph of the Site detailing the approximate development footprint is provided in Image 1. The Site currently consists of the Demountable Village (USYD Bld. A06) which is a set of raised temporary buildings. To the east of the Site is the Faculty of Arts and Social Sciences building (FASS building, USYD Bld. A02) and RD Watt Building (USYD Bld. A04). To the south is Science Rd, Western Ave (sometimes referred to as Regimental Cr) and University Oval 2. Parramatta Rd and Western Avenue bound the Site on the north and west. The development is precluded by University Campus upgrade work on Science Rd within the area indicated in Image 1.

The terrain slopes in a general southwest direction, with Science Rd steeply sloping to the west and Western Ave sloping south with a comparatively gentler slope. The terrain on the site has generally been maintained to its natural slope, with the existing Demountable Village foundation using raised piers to level the building, rather than a solid slab.

Image 1: The Site

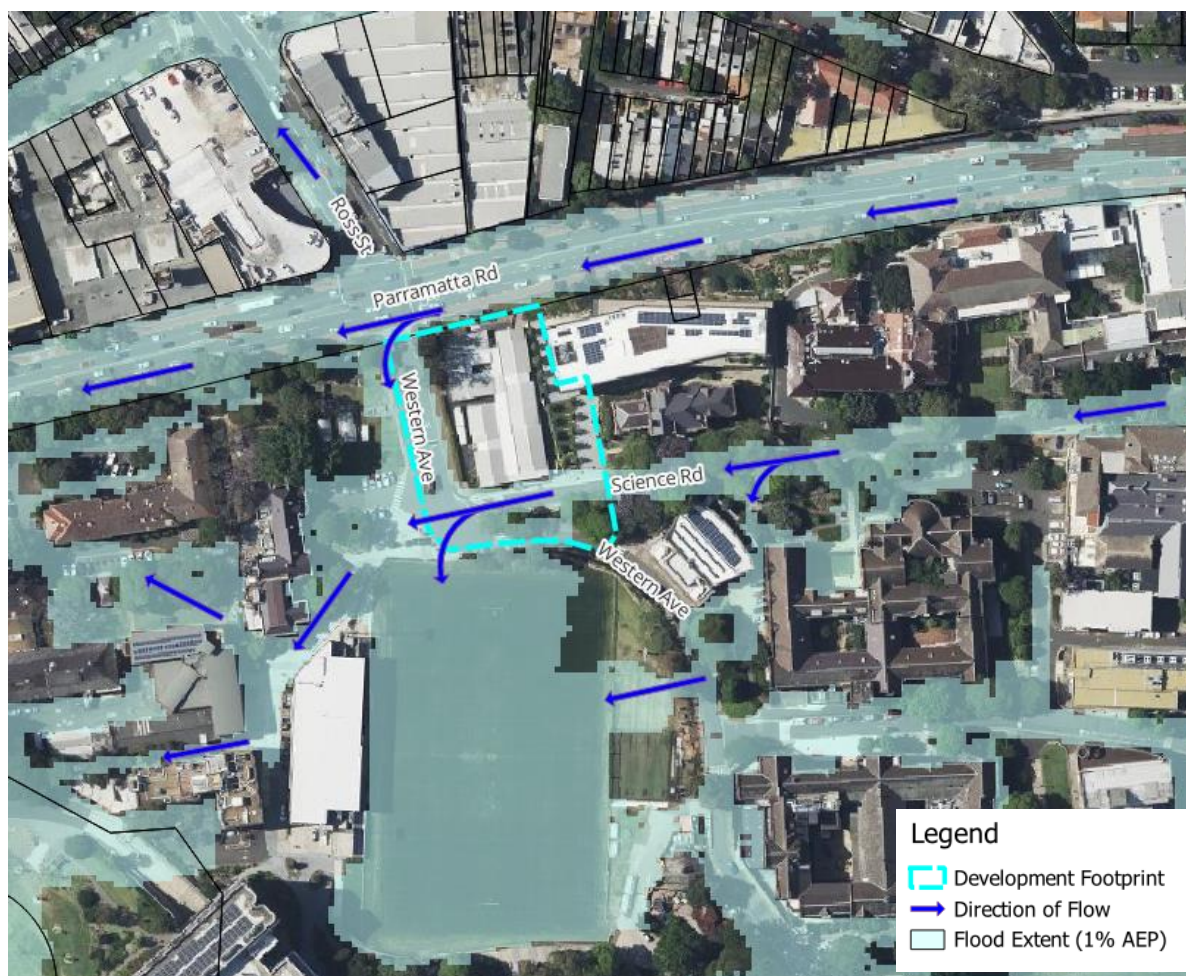


1.2 Flood Behaviour

The site is located in the Johnstons Creek catchment. The creek proper is well downstream of the university campus and areas of flooding within the university are categorised as overland flow flooding. Flood behaviour in the area has been established by a 2D flood model setup as part of the City of Sydney's Johnstons Creek Flood Study (WMAwater 2015).

The Site is located within a small sub-catchment near the east of the Johnsons Creek catchment. The building site is outside of mainstream flooding, as defined by the City of Sydney Interim Floodplain Management Policy (2014), with overland flow contained to Parramatta Rd and Science Rd. University Oval 2 acts as a basin and is the closest source of rising floodwater to the Site. An overview of the flow paths is presented in Image 2.

Image 2: Overview of flow paths



1.3 University campus upgrade work in Science Rd

The proposed development considered for this SSD are precluded by University campus upgrade work conducted in Science Rd to realign its intersection with Western Avenue. These campus upgrades are subject to a separate application process and not within the scope considered for the proposed works as part of the SSDA detailed within this flood risk assessment.

The flood risk assessment needs to consider the cumulative impact of multiple developments which could influence the flood behaviour for the site. As such, the University campus upgrade work is included in this assessment as part of the proposed conditions for the site.

1.4 Project History

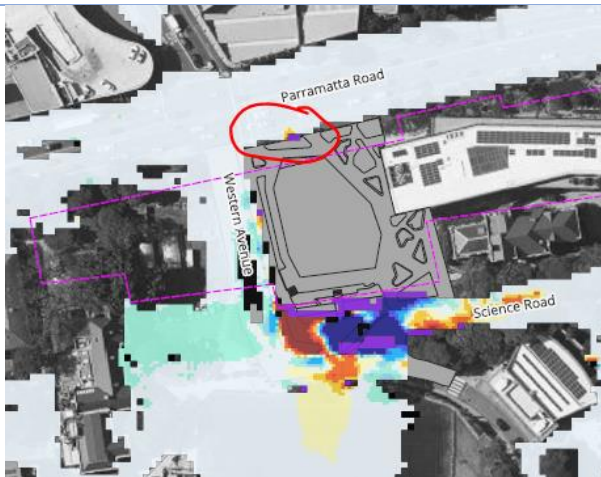
Comments were received after the submission of SSD-57838709 in April 2025. Responses were received from NSW State Emergency Services (SES) and the Conservation Programs, Heritage and Regulation Group (CPHR). These comments have been addressed as detailed in the tables below, with section references provided.

Table i: Response to submissions received from CPHR

Summary of Agency Comment	GRC Hydro Response	Updates from Version 5 to Version 6 of this FIRA
Recommendations 1 to 5	Under consultation in Flood Response Statement issued to CPHR 14 th July 2025	None
Recommendation 6: Review and correct any inconsistencies in the reported velocity values	Table 12 and the velocities have been reviewed. Table 12 is reporting the maximum velocities over all of Science Rd. However, the C05, C06 and C07 figures are mapping the difference in velocities at the peak of the flood. So C05, C06 and C07 can show velocities increasing >0.4m/s for a particular location along Science Rd, however the maximum velocity when considering the whole road is decreasing in the proposed case in the FIRA. For example, a cell goes from 0.8m/s to 1.4m/s in the 1% AEP which is showing as an increase in velocity in figure C06 at that location in Science Rd. However, the maximum of ALL values in Science Rd drops from 3.0m/s to 2.3m/s as shown in Table 12.	Reworded “The deviation also reduces the velocities...” to “The deviation also reduces the maximum velocities...” regarding velocities in Table 12, to make it clearer.
Recommendations 7 to 12	Under consultation in Flood Response Statement issued to CPHR 14 th July 2025	None
Recommendation 13: Demonstrate how floodwater is prevented from entering the basement in all events up to and including the PMF event	Whilst Level 01 of the proposed building is at 21.0 mAHD and has a larger footprint than the Level 02 footprint shown in the FIRA: (1) almost all of it is underground, (2) as noted in the FIRA the only access is internal stairs from Level 02, and (3) Level 01 lies under the 25.5 mAHD high, flood free, footprint of the site. The ventilation is located on or above 25.5 mAHD and is flood free. Section 3.4 has been updated to make this clearer. The only component of Level 01 that interacts with an area below 25.5 mAHD is a window located on the path near the south-western stairs towards Ross St/Western Ave. As this lies within the 1% AEP + 500mm area it will have to be made of flood compatible materials and has been designed to be flood proof. The PMF has a 24.04 mAHD level which is well below the 25.5 mAHD entrances to the site as discussed in Section 3.4. As such the proposed building is designed to prevent inundation of the basement, for all events upto and including the PMF.	Section 3.4: Added sentence on ventilation being flood free in the PMF. Image 11: Updated to include point #10 for ventilation Table 10: Added point #10 for ventilation and details showing it is compliant with FPL Section 3.4, Table 14, and Section 6: Where flood compatible materials are discussed, specific reference to the window on Level 01 has been included.
Recommendation 14 to 16 regarding Emergency Management	NSW SES were consulted on the emergency management during the SSDA submission and their recommendations have been incorporated into the Emergency Management Plan in Volume 3	Volume 3 updated to Version 6

Table ii: Response to submissions received from SES

Agency Comment	GRC Hydro Response
Any proposed Emergency Management strategy for an area should be compatible with the evacuation strategies identified in the NSW State Flood Plan and the City of Sydney Council Flood Emergency Sub Plan, where evacuation is the preferred emergency management strategy for people impacted by flooding.	The EM Plan in Volume 3 has been updated to make it clear that evacuation from the site is the primary Emergency Management strategy, to maintain consistency with the NSW State Flood Plan and City of Sydney Council Flood Emergency Sub Plan.
Implementing early triggers in the Flood Emergency Response Plan (FERP), such as monitoring Severe Weather Warnings and consider closing the site down ahead of the start of the university day, particularly considering the flash flooding risk in the area.	Monitoring Bureau of Meteorology Severe Weather Warnings and Severe Thunderstorm Warnings has been added to the emergency responses, with specific actions to undertake when receiving the warning. These include closing the site down ahead of the university day, in order to minimise attendees to the site when risk of flash flooding is high.
Ensuring the Emergency Management Plan contains clear actions to be undertaken and triggers which align with Australian Warning System warning levels, Bureau of Meteorology warnings or other specific flood information.	Actions have been aligned with Bureau of Meteorology warnings, as well as warnings issued by the NSW SES
Ensuring any emergency management strategy considered for the site aligns with the Flood Risk Management Manual, including guideline EM01 Support for Emergency Management Planning, Ministerial Direction 4.1 and the Shelter-in-place Guideline for Flash Flooding, where applicable.	Strategies have been aligned with the Flood Risk Management Manual, EM01, Ministerial Direction 4.1 and Shelter-in-place Guidelines for Flash flooding. The documents considered when developing the EM Plan have been included in Volume 3.
Decisions relating to future development should be risk-based and ensure Emergency Management risks to the community of the full range of floods are effectively understood and managed. Climate change should also be considered.	Decisions have been based on the FIRA which considers floods from the 20% AEP to the PMF, which covers the full range of floods, and the FIRA provides a detailed assessment for use in the risk-based approach to the EM Plan. Climate Change is considered. Decisions are primarily based off of the PMF.
NSW SES has responded to flood related requests along Parramatta Road, including responding to cars in floodwater in the area identified as “H09 Parramatta Rd - Sag Point”. This location is identified as being impacted by “very minor increases flood levels and flows in Parramatta Rd”, while the Flood	To clarify, the “H09 Parramatta Rd – Sag Point” is NOT impacted by minor increases in flood levels and flows in Parramatta Rd, but rather there are reductions in levels and flows at this location. Refer to Table 8, H09 and Table 9, Q06, Q07 and Q08. The “very minor increases flood levels and flows in Parramatta Rd” we refer the reader to Section 4.1.1 and 4.1.2 where the increases are for single cells in the hydraulic model (a cell being a 2m square area). The area being discussed is circled in red in the 1% AEP impacts below:

Impact and Risk Assessment (FIRA) suggests these increases are likely to be minor we recommend aiming to reduce any increases in either flood depth or velocity in this area.	
Development strategies relying on an assumption that mass rescue may be possible where evacuation either fails or is not implemented are not acceptable to the NSW SES.	Agreed. The proposal does not use mass rescue as a means for managing flood risk, but rather prioritises strategies to minimise personal onsite when flood risk is high and has prepared the site to implement a shelter-in-place strategy as a tertiary means to manage flood risk for the site.
Isolation – There is no known safe period of isolation in a flood, the longer the period of isolation the greater the risk to occupants who are isolated.	Whilst there is no known safe period of isolation in a flood, the site minimises risks associated with isolation given the use of shelter-in-place as a tertiary flood response, and as the site has a very small local catchment flooding is expected to subside quickly (2 hours or less) after the end of causative rainfall.
Secondary risks – This includes fire and medical emergencies that can impact on the safety of people isolated by floodwater. The potential risk to occupants needs to be considered and managed in decision-making.	Secondary risks have been considered and made clearer in the EM Plan. Evacuation to the FASS building, or any of the buildings to the east of the site is possible on foot from the site in the event of a fire risk.
Consideration of human behaviour – The behaviour of individuals such as choosing not to remain isolated from their family or social network in a building on a floor above the PMF for an extended flood duration or attempting to return to a building during a flood, needs to be considered.	The priority has been to minimise personal onsite when there is risk of flash flooding. This minimises the risks associated with human behaviour. The shelter-in-place is a final tertiary means to manage flood risk for the site and the EM Plan has made it clear to communicate to people sheltering that the sheltering period will be short and to not leave the site due to the potential hazardous flooding surrounding the site.
Any Emergency Management strategy needs to consider people visiting the area or using a development.	The EM Plan has made it clearer that visitors to the site have been considered when developing the EM Plan.
An effective flood warning strategy with clear and concise messaging understood by the community is key to providing the community an opportunity to respond to a flood threat in an appropriate and timely manner. As the site is affected by flash	Actions have been linked to the regional weather warnings issued by the BoM and actions prioritised to minimise people on the site well before flash flooding is expected to occur. Tertiary strategies have been developed to manage situations where personal are still present on the site during a flood.

flooding little to no warning time is likely to be available with Severe Weather Warnings and Severe Thunderstorm Warnings from the BOM the only warnings currently available.	
The flood risk at the site and actions taken to reduce risk to life should be communicated to all site users (includes increasing risk awareness, community connections, preparedness actions, appropriate signage and emergency drills) during and after the construction phase.	The EM Plan has included recommendations for the communication of flood risk for the site considering the users of the site. Emergency drills are recommended every teaching semester to align with the use of the site.

2. Flood Modelling Approach

The TUFLOW model setup as part of the City of Sydney's Johnstons Creek Flood Study (WMAwater 2015) forms the basis for this assessment, henceforth referred to as the 'Council TUFLOW model'. It is estimated the Council TUFLOW model represents catchment conditions as they were in the year 2012. Several inclusions to the Council TUFLOW model have been made prior to this assessment, including:

- The Charles Perkins Building (development finished 2013)
- The Nanoscience Building (development finished 2014/2015)
- The Susan Wakil Health Building (development finished 2022)

Notably the following University of Sydney Campus updates are missing from the list of amendments to the Council TUFLOW model:

- The Michael Spence Building,
- The Physics Road Learning Hub,
- Updates to St Pauls Oval,
- Updates to St John's Oval,
- Additions to St John's College and nearby carpark,
- The Demountable Village,
- The new Social Sciences Building,
- The grandstand in University Oval 2 and associated upgrades, and,
- Various updates to Hockey Square and University Oval 1.

Due to several of the missing developments being pertinent to the Ross St T&L Hub catchment area, the amended Council TUFLOW model was updated to 'Existing Conditions' which represents 2023/early 2024 catchment conditions as part of this assessment.

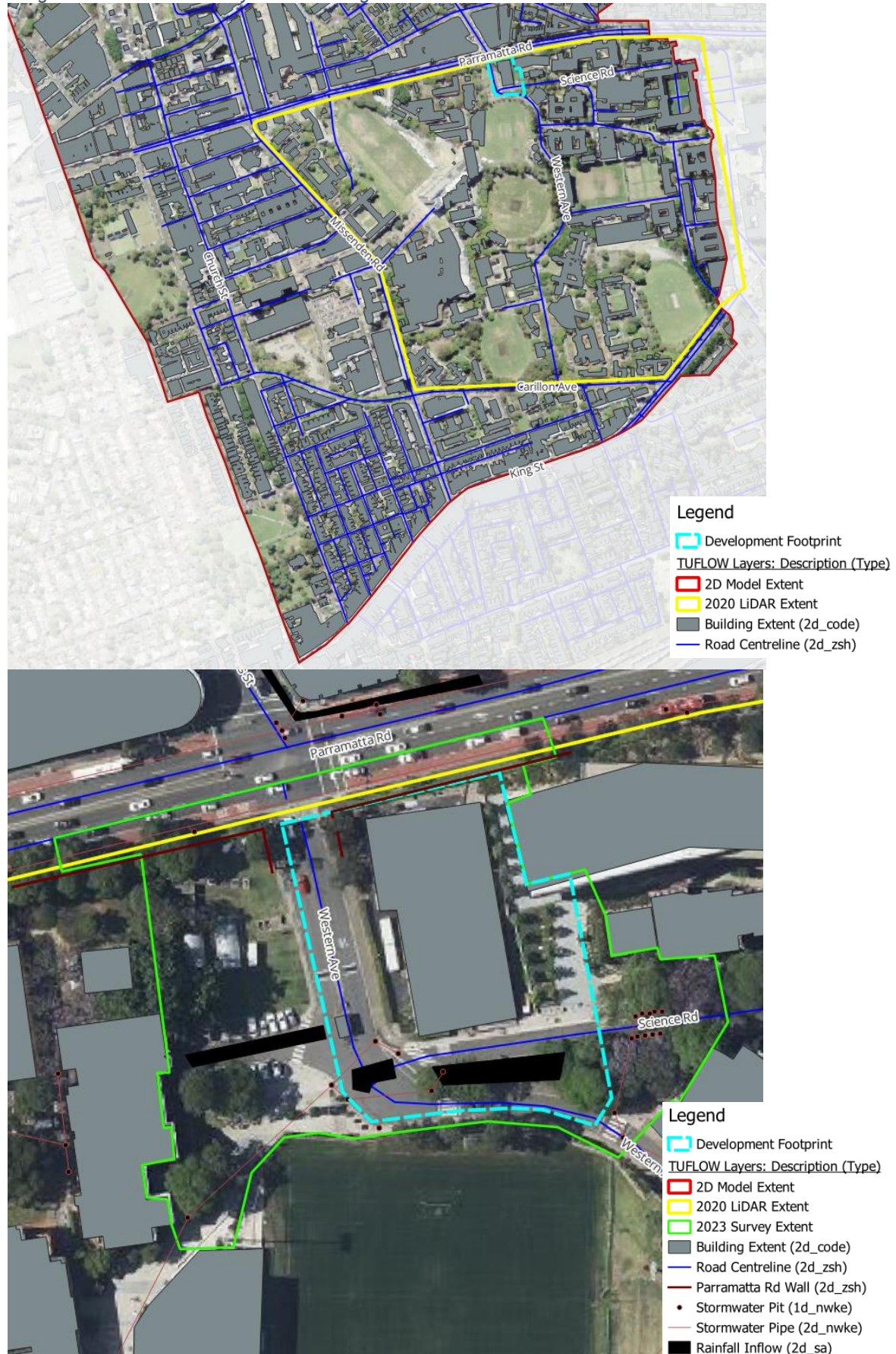
2.1 Existing Conditions Model

The amended Council TUFLOW model was refined within the University of Sydney campus to produce the 'Existing Conditions TUFLOW model' to better define pre-development conditions. Details of the amendments made to produce the Existing Conditions TUFLOW model are described below. Image 3 presents an overview of the amendments.

Technical Updates

- TUFLOW version '2023-03-AB' was used with implementation of the 'Classic' solver and set to use 'Pre 2012' settings. The 'Pre 2012' setting allows TUFLOW to maintain compatibility with versions before 2012, but also allows utilising the advantages of more modern versions. The Council TUFLOW model and all previous projects have utilised the '2011-09-AF' TUFLOW versions with 'Classic' solver.

Image 3: TUFLOW Model Layout for Existing Conditions.



Bulk Updates to the Campus Area

- 2020 LiDAR was downloaded from the Elvis – Elevation and Depth – Foundation Spatial Data website on the 10/11/2023 and added to the Council TUFLOW model for the University of Sydney campus area (as shown in Image 3). This captures terrain updates for all the missing campus developments and fully represents the changes to the ovals.
- Road centrelines and kerbs were rebuilt within the campus area based on the 2020 LiDAR. This included removing several roads and carparks from the model that do not exist anymore. These assume a minimum 150mm kerb depth, consistent with approaches for implementing kerbs when only LiDAR information is available.
- Building extents were updating to reflect current catchment conditions based on available aerial imagery. Building extents are represented using a '2d_code' layer, which is consistent with the approach used in the Council TUFLOW model.

Specific Site Updates

- Survey (Realserve, 'Plan Showing Select Features & Levels, Part of Lot 1 in DP 1171804', Revision 02, 17/10/2023) covering the site and surrounds (see Image 3 for extent) was compared to the 2020 LiDAR and show a strong match for the site (within +/-0.15m). Elevations from the survey were used to detail pertinent hydraulic features around the site, including the top and toe of the kerbs, road centrelines, wall heights and building floor levels.
- Routed inflow locations for the Council TUFLOW model use '2d_sa' type layers to apply sub catchment flows. These were manually placed at the most downstream location within each sub catchment during the development of the Council TUFLOW model. The site and FASS building routed inflow locations were updated from applying the routed flow to Paramatta Rd, to applying the routed flow to Science Rd, as this best reflects the direction of overland flow given the south-westerly sloping terrain.
- Design inflows are calculated by TUFLOW based on a rainfall depth and loss model. This model uses impervious and pervious percentages to determine the applied rainfall. As the Council TUFLOW Model uses a generalised approach to determine the impervious percentages, impervious percentages for two catchments relevant to the site were updated based on a detailed assessment of the distribution of impervious and pervious surfaces. Values are shown in Table 1.

Table 1: Impervious and pervious percentages for Existing Conditions

Parameter	Council TUFLOW model (WMA 2015)		Existing Conditions Model (GRC Hydro 2023)	
	Pervious Surfaces	Impervious Surfaces	Pervious Surfaces	Impervious Surfaces
Subcatchment 1	80%	20%	22%	78%
Subcatchment 2	80%	20%	32%	68%

- The stormwater upgrade in Science Rd was added to the model based on as-built plans (Durkin and PND Civil Ground, 'Science Rd: AS-BUILT STORMWATER PLAN', CA2.01, Issue 2, 1/6/2016). These stormwater upgrades were part of the list of mitigation works proposed in the Campus Improvement Program (2015) which is discussed in further detail in Section 3.5. Conduit attributes and pit blockage factors were consistent with the Council TUFLOW model by using the following parameters:
 - Conduit Manning's n was applied as 0.013.
 - Blockage to inlet structures has been applied based off City of Sydney blockage values for 'Kerb inlet > 1.0' in Table 2.

Table 2: Design structure blockage factors reproduced from the City of Sydney: Sydney Streets Technical Specifications (2023)

Type	On grade blockage factor	Sag blockage factor
Kerb inlet ≤ 1.0	50%	70%
Kerb inlet > 1.0	20%	50%
V grate or Grate only	90%	90%
Strip drain or Other	95%	95%

- The additional pit inlet ratings were applied using 'Q' type inlets with rating characteristics developed using the 'Anstab Pty Ltd Generic Pit Inlet Capacity Calculator (2015). Pit dimensions/characteristics were extracted from the as-built plans.
- The fenceline located between the campus and Parramatta Rd has a solid base raised at a minimum 150mm from the sidewalk, based on measures taken by the author. This was added as a '2d_zsh' feature for the wall extent 60m east and west of the Western Avenue entrance onto Parramatta Rd. The gate and sandstone pillars on this road access were also included, but the gates were assumed open and not an impediment to flow for the purposes of this assessment as a conservative assumption.

Parameters retained from the Council TUFLOW Model

- The 2-metre model grid resolution and 2D model extent were retained.
- Surface roughness values for the Manning's 'n' were retained.
- Rainfall inflows use the Council TUFLOW Model rainfall, which is based on Australian Rainfall and Runoff (ARR) Guidelines 1987.
- 0.2% AEP rainfall depths were based on a growth factor of the 1% AEP event of 1.344 as per ARR 2019 guidelines (Book 8, Chapter 3, Section 3.6.3)
- Critical durations were reviewed at the site which resulted in the durations from the Council TUFLOW model being retained. All critical durations are the 120minute storm, as shown in Table 3.

Table 3: Critical durations

Event	Critical Storm Duration
20% AEP	120 minute
1% AEP	120 minute
0.2% AEP	120 minute
PMF	120 minute

- Loss values have been retained from the Council model as per Table 4.

Table 4: Losses

Parameter	Losses	
	Pervious	Impervious
Initial Loss	10mm	1.5mm
Continuing Loss	2.5mm/hr	0mm/hr

- All other 1D stormwater networks pits and pipes have been retained as per the Council TUFLOW Model, but some updates from the Council TUFLOW model have been made during previous work. These include the Susan Wakil Health Building stormwater network, and upgrades conducted as part of the Charles Perkins Building development.

- All other sub catchment inflow parameters and locations besides the two sub catchments covering the Site have been maintained as per the Council TUFLOW Model.

Section 3.1 presents the results of the Existing Conditions model.

2.2 Proposed Conditions Model

The Existing Conditions model was updated to Proposed Conditions by incorporating the design elements in the landscaping plans by OCULUS (Dated 4/6/2024) and architectural drawings prepared by BVN (Dated 11/6/2024). The design elements pertinent to this assessment are:

- The new five-storey building
- Terrain updates including:
 - Walkways surrounding the building at the Level 02 RL of 25.5m AHD.
 - Staircases south and west onto terrain which slopes in a south-westerly direction.
 - Providing access north onto Parramatta Rd.
 - Changes to impervious and pervious surfaces due to gardening and landscaping changes.
- The Science Rd University campus upgrade work being implemented prior to this SSDA. These involve the realignment of Science Rd to adjoin Western Avenue to the south.

As the project design is still approaching the 40% design stage, full details on the surrounding landscaping were unavailable. Representative terrain was developed by GRC Hydro for the Proposed Conditions TUFLOW Model in consultation with Robert Bird Group and OCULUS for these locations. Image 4 gives an overview of locations where assumptions were required and also indicates the extent of the Science Rd University campus upgrade work which are outside of the SSDA project scope but are included as part of the cumulative development of the area as presented in Section 1.3.

Image 4: Overview of assumed terrain within the development area.



The Proposed Conditions scenario model schematisation, including assumptions made, is detailed below:

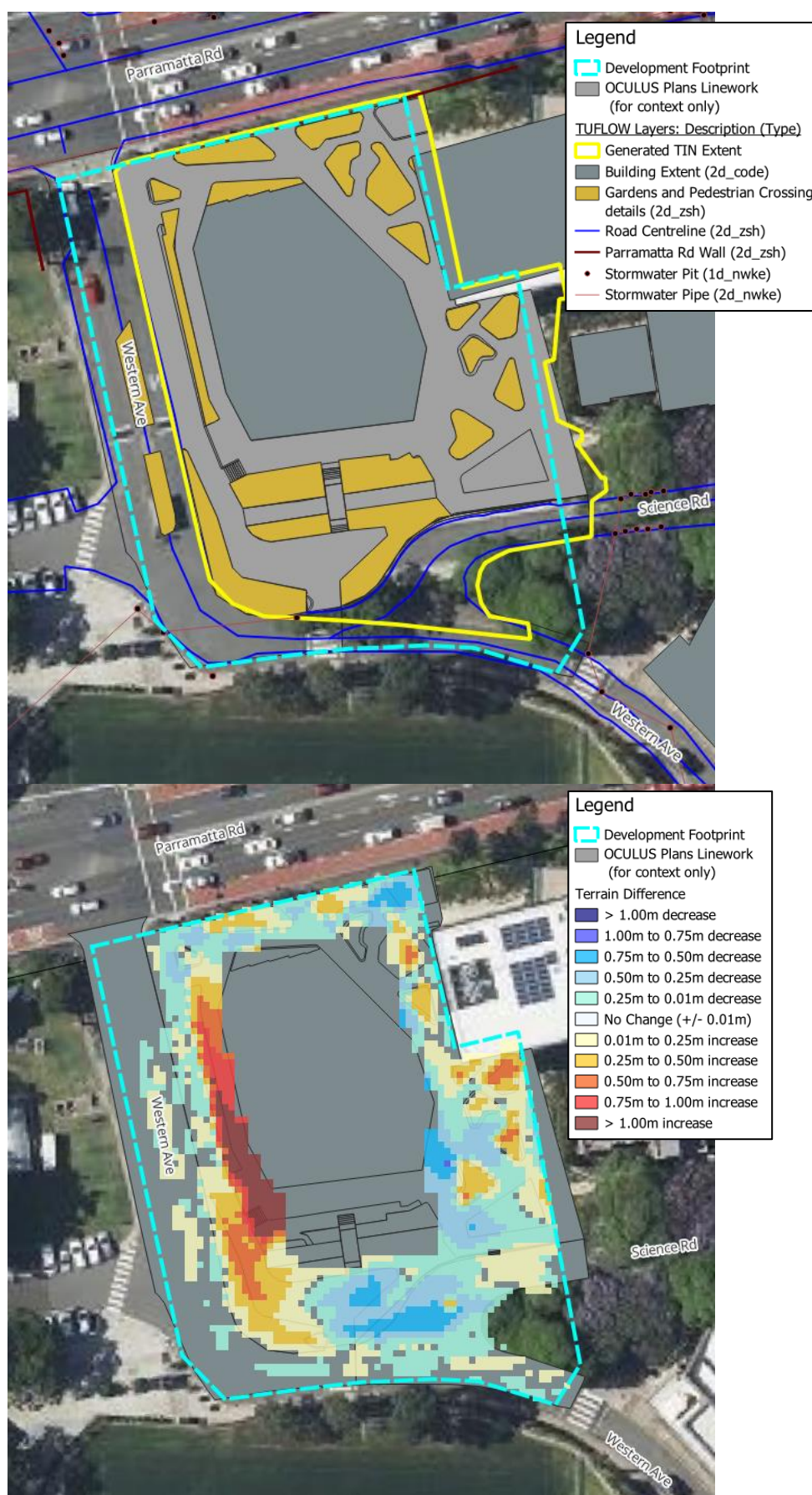
- The proposed building extent based on Level 2 of the architectural plans was 'coded out' of the model using a '2d_code' layer to form an impermeable flow obstruction. Level 2 was chosen as it represents the above-ground building extent that could potentially impede overland flow and acts as the main entrance to the building.
- A ground surface TIN developed by GRC Hydro (Using values from OCULUS, 'Levels Plan Level 02, Issue 3, 4/6/2024') was incorporated into the model to inform Proposed Conditions terrain elevations. The extent of the generated terrain is in Image 5, as well as the relative difference to Existing Conditions elevations.
 - This TIN includes a representation of the University campus upgrade work for the Science Rd deviation based on plans provided by Robert Bird Group ('Stormwater Plan', Version SK02, 14/6/2024) and OCULUS ('General Arrangement Plan', S60/REF, Issue 2, 7/6/2024).
 - Western Avenue to the west of the proposed development was assumed to maintain Existing Conditions elevations, but the kerbs were moved to match the Oculus drawings ('Levels Plan Level 02, Issue 3, 4/6/2024'), and a minimum 150mm kerb height used before matching into the surrounding pedestrian paths.
- Raised flat terrain, such as the proposed garden beds, were included as a separate '2d_zsh' layer to enforce the terrain elevations on top of the surface TIN.
- The fenceline located between the campus and Parramatta Rd was modified to reflect the OCULUS plans by removing the section adjacent to the Site.
- The impervious percentages of the two catchments relevant to the Site were updated based on an assessment of the materials presented by OCULUS ('Surface Finishes Level 02, Issue 3, 4/6/2024'). Changes from Existing Conditions are shown in Table 5.

Table 5: Impervious and pervious percentages for Proposed Conditions

Parameter	Proposed Conditions Model (GRC Hydro 2023)		Change from Existing Conditions Model	
	Pervious Surfaces	Impervious Surfaces	Pervious Surfaces	Impervious Surfaces
Subcatchment 1	16%	84%	-6%	+6%
Subcatchment 2	25%	75%	-7%	+7%

- Critical durations from the Existing Conditions model were retained for the Proposed Conditions model.
- Pits and pipes in Western Ave were removed to reflect the Science Rd's change into a pedestrian area. No additional stormwater pits or pipes were added as the proposed stormwater design is being developed in later project stages.

Image 5: Updates to the TUFLOW Model Layout for Proposed Conditions (top) and changes to terrain (bottom)



3. Flood Model Results

3.1 Existing Conditions Results

3.1.1: Depths, Levels and Velocities

The model results for Existing Conditions are presented in:

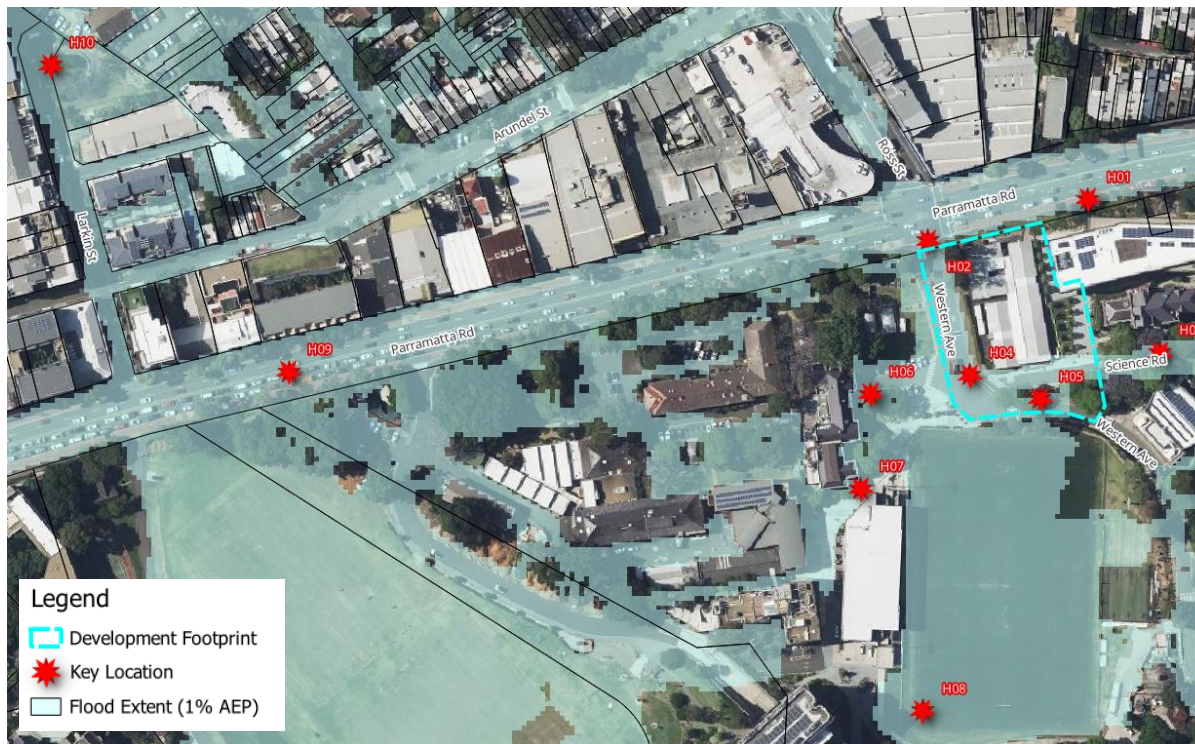
- Figure A01: Existing Conditions - 20% AEP event, depths and levels
- Figure A02: Existing Conditions - 1% AEP event, depths and levels
- Figure A03: Existing Conditions - 0.2% AEP event, depths and levels
- Figure A04: Existing Conditions - PMF event, depths and levels

Tabulated water levels at key locations are presented in Table 6, with the locations mapped in Image 6.

Table 6: Water levels at key locations for Existing Conditions

		Water Level (m AHD)			
ID	Location	20% AEP	1% AEP	0.2% AEP	PMF
Locations near the Site					
H01	Parramatta Rd – East of the Site	27.11	27.15	27.16	27.17
H02	Junction of Parramatta Rd and Western Ave	24.71	24.75	24.76	24.79
H03	Science Rd – East of the Site	28.04	28.09	28.12	28.15
H04	Junction of Science Rd and Western Ave (before deviation of Science Rd)	23.32	23.33	23.35	24.03
H05	Junction of Science Rd and Western Ave (when Science Rd has been deviated)	24.16	24.19	24.19	24.21
H06	Outside J.D. Stewart Building	23.18	23.22	23.24	24.03
H07	Near Grandstand	22.90	22.93	22.95	23.64
H08	University Oval 2	22.85	23.02	23.13	24.04
Locations in the greater Johnsons Creek catchment					
H09	Parramatta Rd - Sag Point	19.86	20.10	20.25	21.11
H10	Larkin St	11.17	12.29	13.07	16.47

Image 6: Key locations for recording water level



3.1.2: Velocities and Flows

The model results for Existing Conditions are presented in:

- Figure A05: Existing Conditions - 20% AEP event, velocities and flows
- Figure A06: Existing Conditions - 1% AEP event, velocities and flows
- Figure A07: Existing Conditions 0.2% AEP event, velocities and flows
- Figure A08: Existing Conditions PMF event, velocities and flows

Flows at key locations are summarised in Table 7, with the locations mapped in Image7. These recorded flow values represent the total flows along the entire floodplain width (i.e. 'Parramatta Rd – East of the Site' is the total flow of floodwater along the entire road width travelling west).

Image 7: Key locations for recording flow



Table 7: Flows at key locations for Existing Conditions

ID	Location	Flow (m³/s)			PMF
		20% AEP	1% AEP	0.2% AEP	
Locations near the Site					
Q01	Parramatta Rd – East of the Site	0.71	1.19	1.67	2.15
Q02	Parramatta Rd – West of the Site	0.58	0.99	1.30	1.84
Q03	Western Avenue	0.18	0.30	0.45	0.60
Q04	Science Rd – East of the Site	0.55	0.92	1.19	1.57
Q05	Near Grandstand	0.81	1.45	1.92	16.53
University of Sydney Campus Outlet					
Q06	Combined University of Sydney campus overland flow exiting campus via Parramatta Rd	0.96	3.42	5.59	24.05
Q07	University of Sydney stormwater asset - 1400mm x 1170mm rectangular culvert	2.47	2.65	2.65	2.65
Q08	University of Sydney stormwater asset - 1350mm circular culvert	0.03	0.04	0.05	0.78

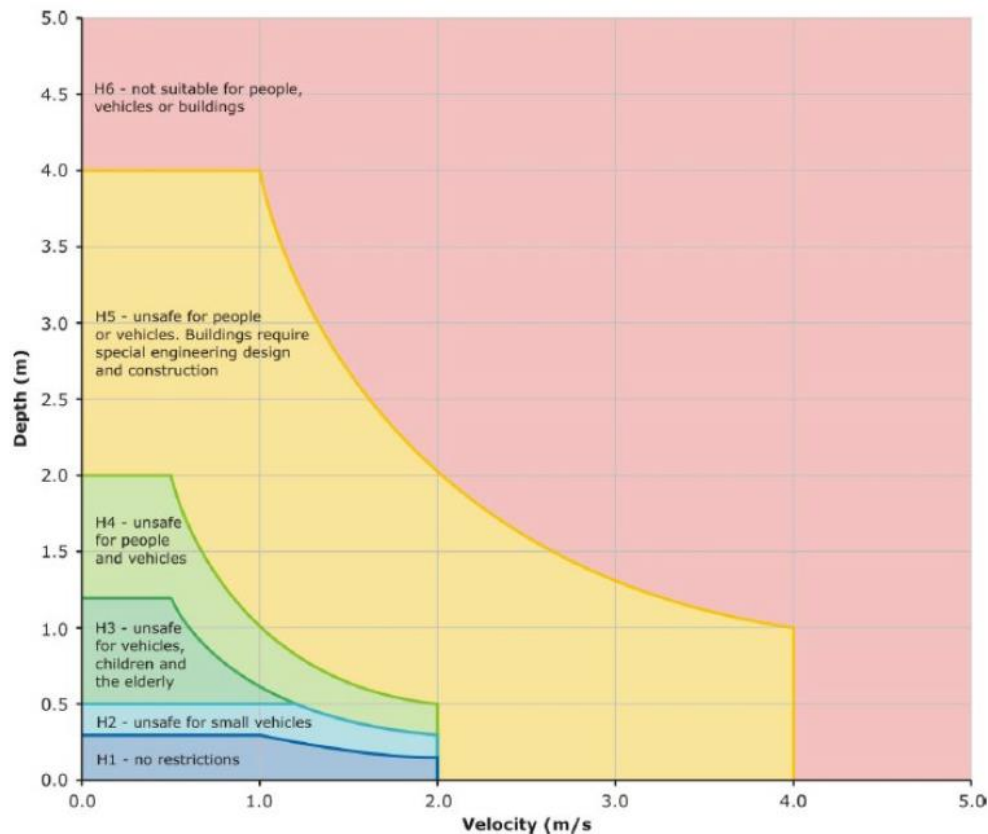
3.1.3: Flood hazards

The model results for Existing Conditions are presented in:

- Figure A09: Existing Conditions 20% AEP event, hazards
- Figure A10: Existing Conditions 1% AEP event, hazards
- Figure A11: Existing Conditions 0.2% AEP event, hazards
- Figure A12: Existing Conditions PMF event, hazards

Flood hazard values were derived using the approach outlined in ARR2019 which recommends using the hazard definitions from the Australian Disaster Resilience Handbook Collection ('Guideline 7-3: Flood Hazard', Australian Institute for Disaster Resilience, 2017). The advantages of this approach is the hazards consider flow hydraulic characteristics of velocity and depth, as presented in Image 8, to determine flood hazard for various floodplain uses. These hazards are usefully equated to vulnerability groups, which is also detailed in Image 8.

Image 8: ARR2019 flood hazard – depth and velocity characteristics based on the Australian Disaster Resilience Handbook Collection Guideline 7-3.



3.1.4: Flood Function

Flood Function (also referred to as 'Hydraulic Categories') refers to the classification of floodwaters into three categories: floodway/flow conveyance, flood storage and flood fringe. These categories help to describe the nature of flooding across the floodplain and aid planning when assessing developable areas. The definitions from the Floodplain Risk Management manual 2023 are provided below, which haven't changed significantly since the 2005 definitions:

- Floodway – Areas of the floodplain which generally convey a significant discharge of water during floods and are sensitive to changes that impact flow conveyance. They often align with naturally defined channels or form elsewhere in the floodplain.
- Flood storage – Areas of the floodplain that are outside floodways which generally provide for temporary storage of floodwaters during the passage of a flood and where flood behaviour is sensitive to changes that impact on temporary storage of water during a flood; and,
- Flood fringe – The part of the flood extents for the event remaining after the flood function areas of floodway and flood storage areas have been defined.

To maintain consistency with the established Council study, the methodology to define the hydraulic categories for the site have used the definitions from the Johnstons Creek Catchment Floodplain Risk Management Study (WMA Water 2015) below:

- Floodway: Velocity x Depth > 0.25m²/s AND Velocity > 0.25m/s
 - OR Velocity > 1m/s
- Flood Storage: Land outside the floodway where depth > 0.2m
- Flood Fringe: Land outside the floodway where depth < 0.2m

The model results for Existing Conditions are presented in:

- Figure A13: Existing Conditions 20% AEP event, flood function
- Figure A14: Existing Conditions 1% AEP event, flood function
- Figure A15: Existing Conditions 0.2% AEP event, flood function
- Figure A16: Existing Conditions PMF event, flood function

3.2 Proposed Conditions Results

3.2.1: Depths and Levels

The model results for Proposed Conditions are presented in:

- Figure B01: Proposed Conditions 20% AEP event, depths and levels
- Figure B02: Proposed Conditions 1% AEP event, depths and levels
- Figure B03: Proposed Conditions 0.2% AEP event, depths and levels
- Figure B04: Proposed Conditions PMF event, depths and levels

Tabulated results for all events are provided in Table 8. Refer to Image 6 in Section 3.1.1 for the mapped locations. Discussion on the relevance of any changes is discussed in Section 3.5 and Section 4.1, noting that impacts outside of the University of Sydney Campus are of most relevance for compliance.

Table 8: Water levels at key locations for Proposed Conditions as well as change from Existing Conditions

ID	Location	Water Level (m AHD)			
		20% AEP		1% AEP	
		Proposed	Change	Proposed	Change
Locations near the Site					
H01	Parramatta Rd – East of the Site	27.11	0	27.15	0
H02	Junction of Parramatta Rd and Western Ave	24.71	0	24.75	0
H03	Science Rd – East of the Site	28.04	0	28.09	0
H04	Junction of Science Rd and Western Ave (before deviation of Science Rd)	23.33	+0.01	23.34	+0.01
H05	Junction of Science Rd and Western Ave (when Science Rd has been deviated)	24.17	+0.01	24.20	+0.01
H06	Outside J.D. Stewart Building	23.17	-0.01	23.20	-0.02
H07	Near Grandstand	22.90	0	22.93	0
H08	University Oval 2	22.85	0	23.03	+0.01
Locations in the greater Johnsons Creek catchment					
H09	Parramatta Rd - Sag Point	19.86	0	20.09	-0.01
H10	Larkin St	11.17	0	12.29	0

		Water Level (m AHD)			
ID	Location	0.2% AEP		PMF	
		Proposed	Change	Proposed	Change
Locations near the Site					
H01	Parramatta Rd – East of the Site	27.16	0	27.17	0
H02	Junction of Parramatta Rd and Western Ave	24.75	-0.01	24.79	0
H03	Science Rd – East of the Site	28.12	0	28.15	0
H04	Junction of Science Rd and Western Ave (before deviation of Science Rd)	23.26	-0.09	24.03	0
H05	Junction of Science Rd and Western Ave (when Science Rd has been deviated)	24.19	0	24.20	-0.01
H06	Outside J.D. Stewart Building	23.25	+0.01	24.03	0
H07	Near Grandstand	22.95	0	23.64	0
H08	University Oval 2	23.14	+0.01	24.04	0
Locations in the greater Johnsons Creek catchment					
H09	Parramatta Rd - Sag Point	20.25	0	21.11	0
H10	Larkin St	13.07	0	16.47	0

3.2.2: Velocities and Flows

The model results for Proposed Conditions are presented in:

- Figure B05: Proposed Conditions 20% AEP event, velocities and flow
- Figure B06: Proposed Conditions 1% AEP event, velocities and flow
- Figure B07: Proposed Conditions 0.2% AEP event, velocities and flow
- Figure B08: Proposed Conditions PMF event, velocities and flow

Flows at key locations are summarised in Table 9. Refer to Image 7 in Section 3.1.2 for the mapped locations.

Table 9: Flows at key locations for Proposed Conditions as well as change from Existing Conditions

ID	Location	Flow (m ³ /s)			
		20% AEP		1% AEP	
		Proposed	Change	Proposed	Change
Locations near the Site					
Q01	Parramatta Rd – East of the Site	0.71	0	1.19	0
Q02	Parramatta Rd – West of the Site	0.57	-0.01	1.00	+0.01
Q03	Western Avenue	0.18	0	0.30	0
Q04	Science Rd – East of the Site	0.55	0	0.92	0
Q05	Near Grandstand	0.79	-0.02	1.38	-0.07
University of Sydney Campus Outlet					
Q06	Combined University of Sydney campus overland flow exiting campus via Parramatta Rd	0.95	-0.01	3.4	-0.02
Q07	University of Sydney stormwater asset - 1400mm x 1170mm rectangular culvert	2.47	0	2.65	0
Q08	University of Sydney stormwater asset - 1350mm circular culvert	0.03	0	0.04	0

ID	Location	Flow (m ³ /s)			
		0.2% AEP		PMF	
		Proposed	Change	Proposed	Change
Locations near the Site					
Q01	Parramatta Rd – East of the Site	1.67	0	2.15	0
Q02	Parramatta Rd – West of the Site	1.28	-0.02	1.85	+0.01
Q03	Western Avenue	0.45	0	0.59	-0.01
Q04	Science Rd – East of the Site	1.18	-0.01	1.55	-0.02
Q05	Near Grandstand	1.83	-0.09	16.54	+0.01
University of Sydney Campus Outlet					
Q06	Combined University of Sydney campus overland flow exiting campus via Parramatta Rd	5.58	-0.01	24.05	0
Q07	University of Sydney stormwater asset - 1400mm x 1170mm rectangular culvert	2.59	-0.06	2.55	-0.10
Q08	University of Sydney stormwater asset - 1350mm circular culvert	0.05	0	0.78	0

3.2.3: Flood hazards

The model results for Proposed Conditions are presented in:

- Figure B09: Proposed Conditions 20% AEP event, hazards
- Figure B10: Proposed Conditions 1% AEP event, hazards
- Figure B11: Proposed Conditions 0.2% AEP event, hazards
- Figure B12: Proposed Conditions PMF event, hazards

See Section 3.1.3 for the definition of flood hazard used in this assessment.

3.2.4: Flood Function

The model results for Proposed Conditions are presented in:

- Figure B13: Proposed Conditions 20% AEP event, flood function
- Figure B14: Proposed Conditions 1% AEP event, flood function
- Figure B15: Proposed Conditions 0.2% AEP event, flood function
- Figure B16: Proposed Conditions PMF event, flood function

See Section 3.1.4 for the definition of flood function used in this assessment.

3.3 Flood Impact Analysis

3.3.1: Flood Level

A flood impact map that compares Existing and Proposed Conditions peak flood levels for the design events are presented in:

- Figure C01: Flood level impact map – 20% AEP event
- Figure C02: Flood level impact map – 1% AEP event
- Figure C03: Flood level impact map – 0.2% AEP event
- Figure C04: Flood level impact map – PMF AEP event

3.3.2: Velocities and Flows

Comparison of Existing and Proposed Conditions peak flow velocities are presented in:

- Figure C05: Flood velocity impact map – 20% AEP event
- Figure C06: Flood velocity impact map – 1% AEP event
- Figure C07: Flood velocity impact map – 0.2% AEP event
- Figure C08: Flood velocity impact map – PMF AEP event

3.3.3: Flood Hazards

Comparison of Existing and Proposed Conditions hazard changes are presented in:

- Figure C09: Flood hazard impact map – 20% AEP event
- Figure C10: Flood hazard impact map – 1% AEP event
- Figure C11: Flood hazard impact map – 0.2% AEP event
- Figure C12: Flood hazard impact map – PMF event

3.3.4: Flood Function

The change in Existing to Proposed Conditions flood functions are presented in:

- Figure C13: Flood function impact map – 20% AEP event
- Figure C14: Flood function impact map – 1% AEP event
- Figure C15: Flood function impact map – 0.2% AEP event
- Figure C16: Flood function impact map – PMF event

Further discussion of changes in flood levels, velocities, flows, hazards and flood function is presented in Section 3.5 and Section 4.1.

3.3.5: Duration of Inundation and Warning Time

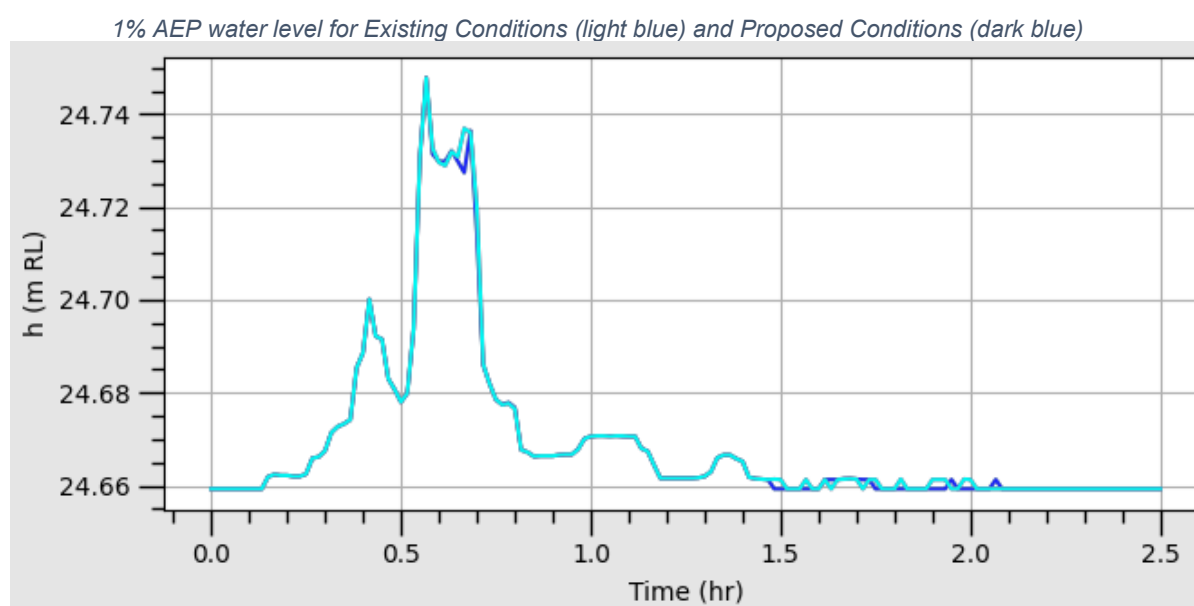
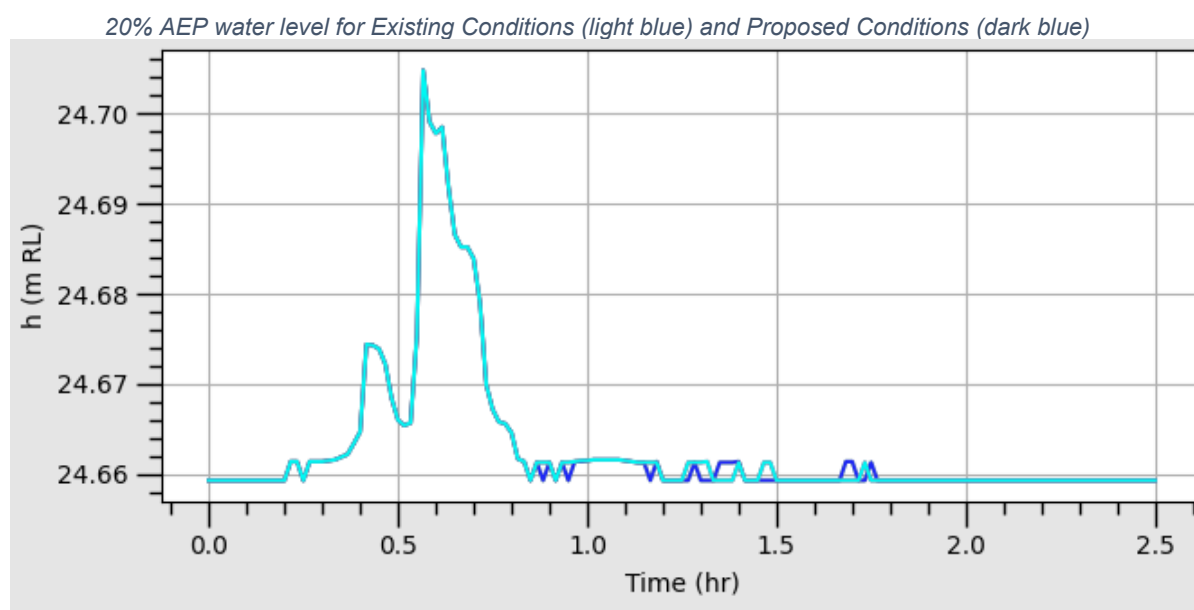
Water levels over time provide estimates of duration of inundation and warning time. Two locations have been selected:

- The Junction of Western Ave and Parramatta Rd in Image 9
- Western Ave at the low point near University Oval 2 in Image 10

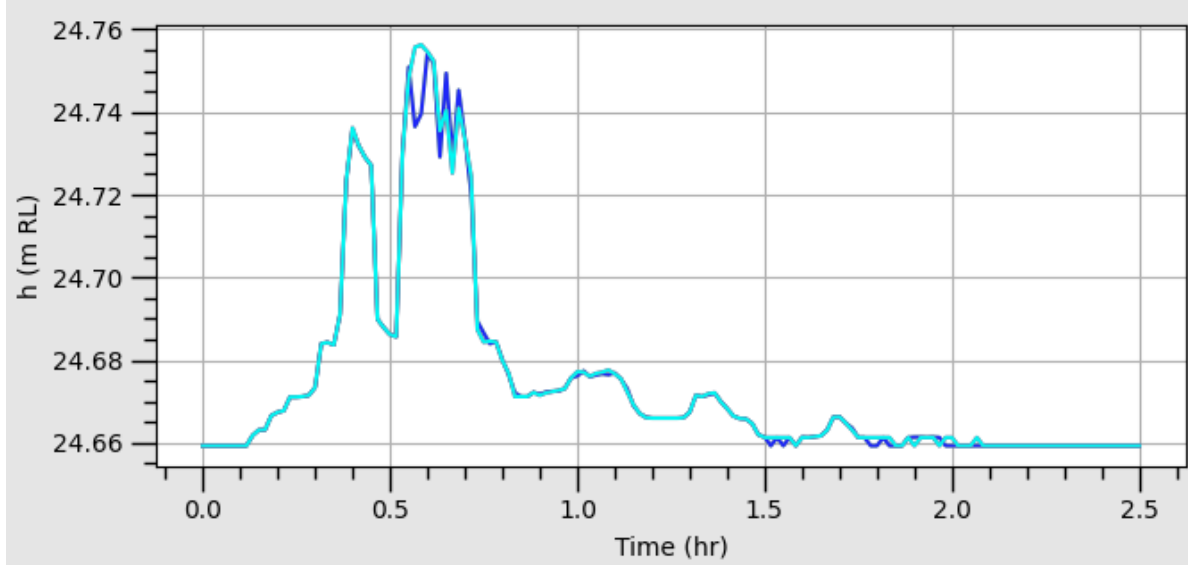
The results indicate that duration of inundation does not change significantly between Existing Conditions and Proposed Conditions for all events. Both locations indicate an approximate duration of inundation of less than 1 hour after the end of the storm (end of storm at timestep 2.0(hr)).

Results also show that the warning time is typically < 30 minutes for both locations from the onset of the storm (onset of storm at timestep 0.0(hr)).

Image 9: Water levels at the Junction of Western Ave and Parramatta Rd



0.2% AEP water level for Existing Conditions (light blue) and Proposed Conditions (dark blue)



PMF water level for Existing Conditions (light blue) and Proposed Conditions (dark blue)

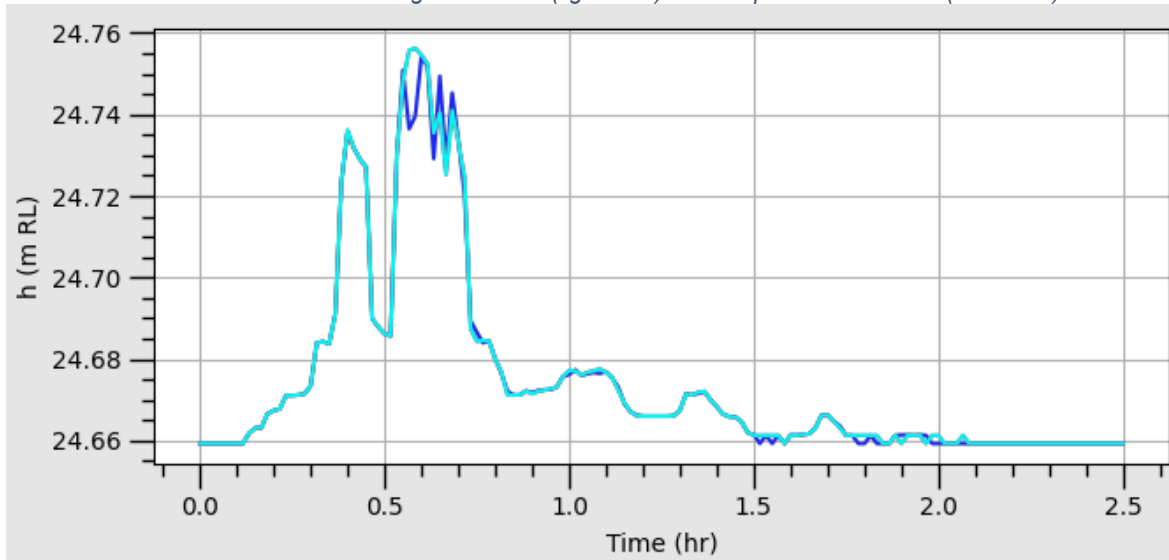
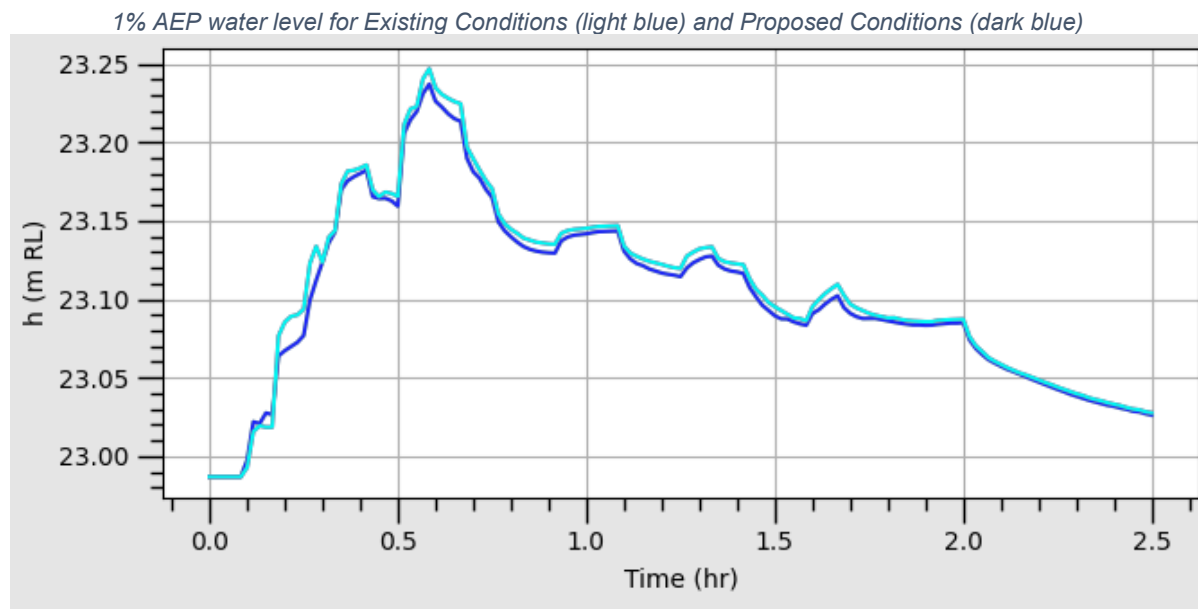
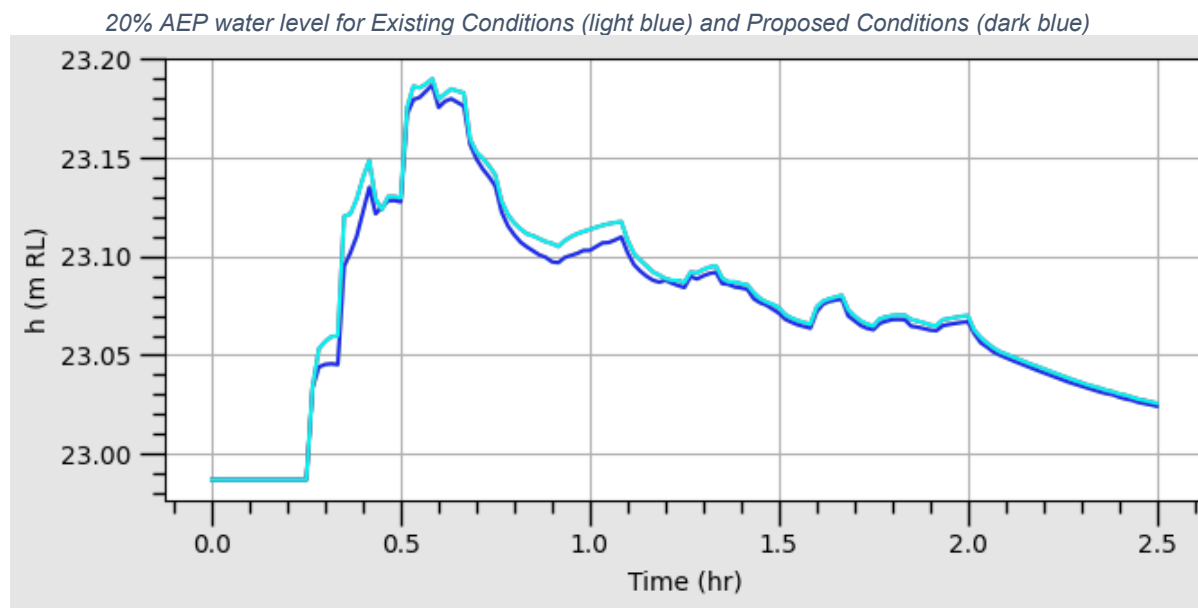
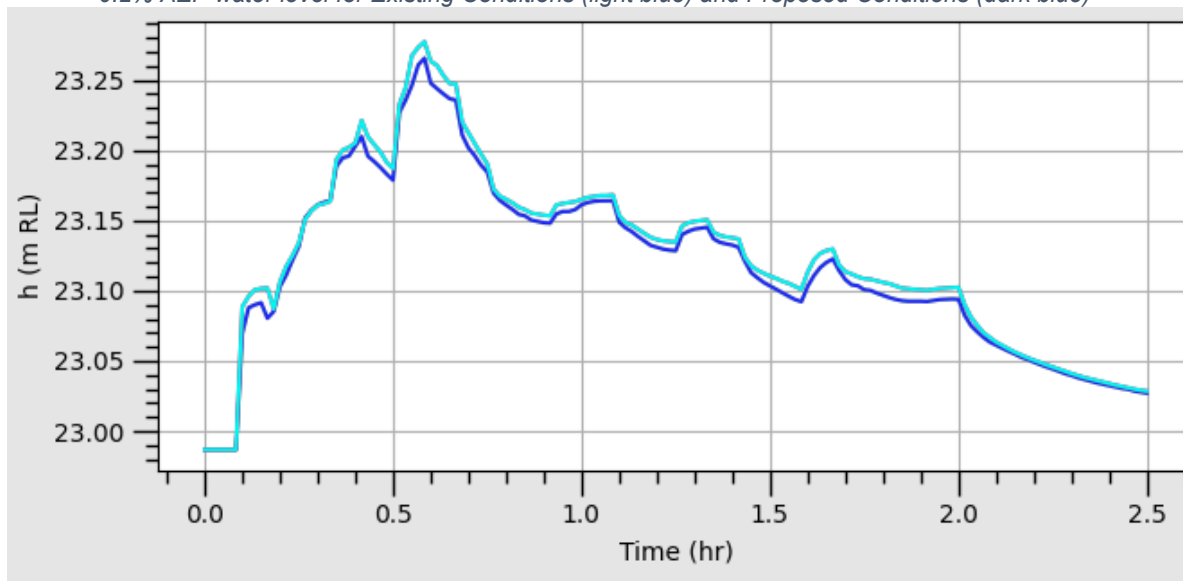


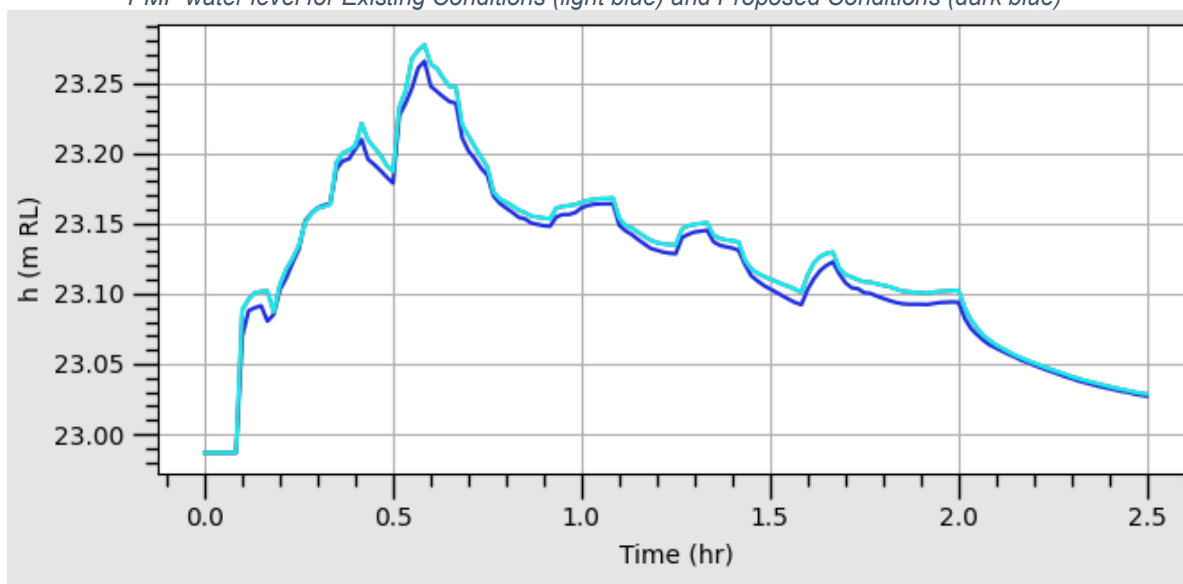
Image 10: Water levels in Western Ave at the low point near University Oval 2



0.2% AEP water level for Existing Conditions (light blue) and Proposed Conditions (dark blue)



PMF water level for Existing Conditions (light blue) and Proposed Conditions (dark blue)



3.4 Flood Planning Levels

The City of Sydney Interim Floodplain Management Policy (2014), Section 5 requires that floor levels are set at the required Flood Planning Level (FPL). Using the land uses in the FPL Section 5, the proposed building is an 'Industrial or Commercial: Schools' development with a flood planning level based on a 'Merits approach presented by the applicant with a minimum of the 1% AEP flood level + 0.5m'.

Level 2 of the proposed development has nine entrances, as shown in Image 11. All access locations to Level 1 are via internal staircases from Level 2. As Level 2 represents the first floor in which floodwater could potentially inundate the building, the FPL has been assessed against the proposed Level 2 floor level of 25.50m AHD. Each entrance has been individually assessed for compliance with the FPL with Table 10 summarising their protection from floodwater for both the 1% AEP design flood and PMF. This assessment considers all entrances to be compliant dependant on the endorsement of a merit-based approach which would include the following:

- Should a location not have a 500mm freeboard from the nearest 1% AEP level as per City of Sydney requirements that:

- The location is not flooded in the PMF event, and
- 1% AEP and PMF results are shallow overland flow, rather than rising floodwater.

Entrances 1, 2 and 3 are located in the courtyard area between the proposed building and Parramatta Rd. Floodwater in Parramatta Rd remains within the road extent and does not enter the site for all events, including the PMF. Extra precautions have been taken in the design to ensure that should floodwater enter this courtyard area (which has not occurred in any flood model result), the proposed landscaping terrain slopes away from all the entrances to further minimise the chances of them becoming avenues of building inundation. Similarly entrances 4 and 5 are facing a courtyard area that is flood free in all events with terrain that slopes away from the buildings 25.5m AHD plate towards Science Rd at 25.27m AHD. The walkway set at 25.5m AHD around the building is flood free in all events, which is where entrances 6, 7, 8 and 9 are located. These entrances all have over 500mm of freeboard from 1% AEP levels as the 1% AEP does not reach levels at risk of inundating above the surrounding wall due to it being shallow overland flow. Ventilation from Level 01 is located outside of the flood extent and located at or above the 25.5m AHD plate ensuring the building is protected up to and including the PMF event.

Image 11: Proposed entrances (BVN, 'General Arrangement Plan – Level 02', Issue 10, 11/6/2024)

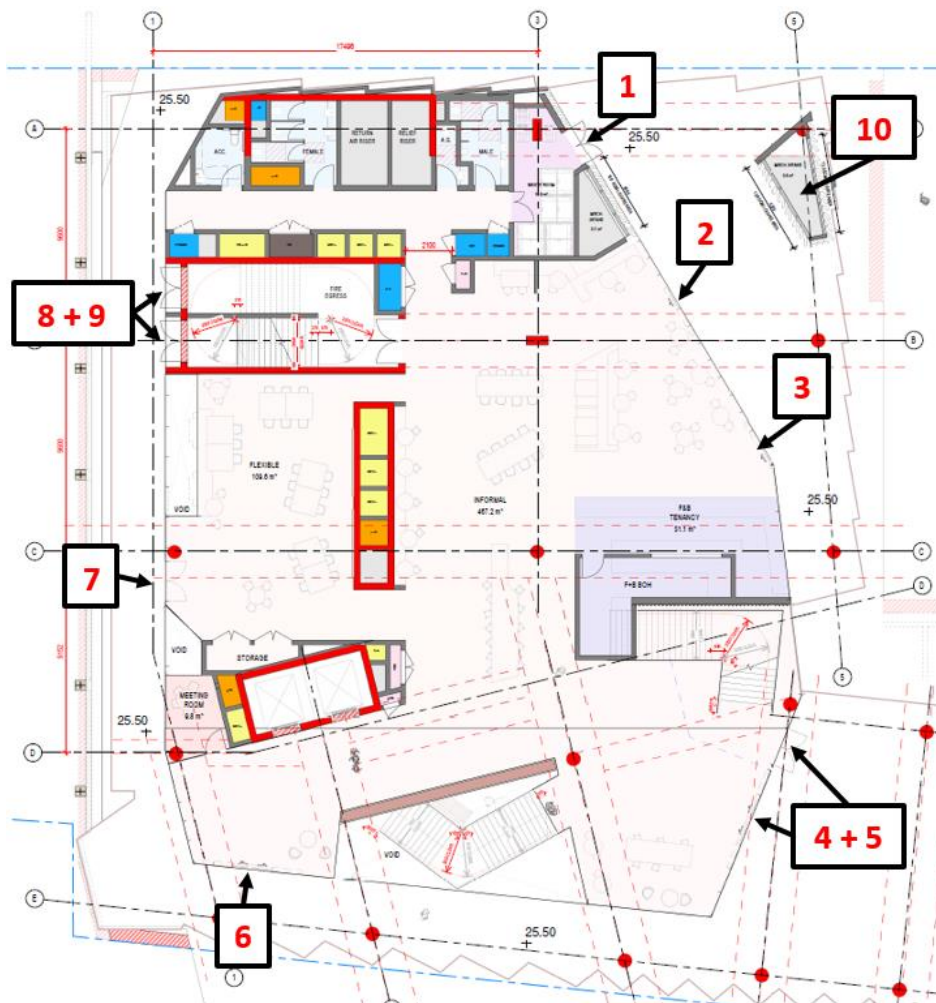


Table 10: Flood Planning Level (FPL) assessment against consent authority requirements

Location #	Location Description (Direction)	FFL (m AHD)	1% AEP Results		PMF Results	Justification for compliance
			Floodwater at entrance?	Nearest Flood Level (m AHD)	Floodwater at entrance?	
1	Wastroom entrance (north-east)	25.5	Not flooded	-	Not flooded	Flood free in all events, including the PMF. Nearest floodwater is shallow overland flow 15m away in Parramatta Rd which is <0.15m deep in a PMF event and fully contained within the road extent below the kerb.
2 + 3	Two sliding doors towards Parramatta Rd (north-east)	25.5	Not flooded	-	Not flooded	Flood free in all events, including the PMF. Nearest floodwater is PMF shallow overland flow approx. 21m away in Parramatta Rd which is <0.15m deep in a PMF event and fully contained within the road extent below the kerb. Proposed terrain slopes away from entrances 2 and 3 towards Science Rd.
4 + 5	Sliding and swinging doors towards Science Rd (south-east)	25.5	Not flooded	25.3	Not flooded	Flood free in all events, including the PMF. Nearest PMF floodwater is shallow overland flow approx. 10m away which is <0.13m deep. Proposed terrain slopes away from the entrance towards Science Rd helping to provide immunity. 0.2m freeboard to the 1% AEP event.
6	Sliding door towards Western Ave (south)	25.5	Not flooded	24.8	Not flooded	Flood free in all events, including the PMF. Proposed terrain slopes away from the entrance towards Western Ave. Nearby 1% AEP levels remain below FFL with 0.7m of freeboard.
7	Swinging door towards Western Ave (west)	25.5	Not flooded	23.8	Not flooded	Flood free in all events, including the PMF. Proposed terrain slopes away from the entrance towards Western Ave. Nearby 1% AEP levels remain below FFL with 1.7m of freeboard.
8 + 9	Stairwell entrances towards Western Ave (west)	25.5	Not flooded	24.4	Not flooded	Flood free in all events, including the PMF. Proposed terrain slopes away from the entrance towards Western Ave. Nearby 1% AEP levels remain below FFL with 1.1m of freeboard.
10	Ventilation/ Void Space	25.5 or above	Not flooded	-	Not flooded	Ventilation/void space to Level 01 in the through-link near the FASS building is flood free in all events, including the PMF. Surrounded by garden walls removes any risk from surface flow.

3.5 The Campus Improvement Program (CIP)

The University of Sydney had the Campus Improvement Program (SSD-6123) for their Camperdown campus approved by the Minister of Planning in 2015. This detailed the future development of the campus, by planning for the upgrade of several precincts and implementing campus wide mitigation measures towards offsetting the proposed works. The Ross St T&L Hub is part of the Life Sciences Precinct of the Campus Improvement Program.

In preparation for management of the flood risk the Campus Improvement Program could pose, Warren Smith & Partners (now Warren Smith Consulting Engineers) were contracted to prepare the 'University of Sydney Camperdown Campus – Stormwater Concept Design Report' (2015). This document recommended several mitigation works be completed in the campus to offset flood impacts, and an agreement was made with the consent authorities Sydney Water and City of Sydney Council. This agreement meant the campus could act as a communal entity when assessing OSD and flooding, subject to requesting approval from the relevant consent authority during future developments.

The agreement was based on the following mitigation works being completed:

- Increasing floodwater storage in Hockey Square,
- Managing the flood paths through the Health Precinct,
- Formalizing University Oval 2 as a detention basin in conjunction with the development of the Grandstand, and
- Works to divert overland flows from Science Rd to University Oval 2.

Of these mitigation measures, the last two are relevant to the Ross St T&L Hub development. The University Oval 2 was formalised as a detention basin during the Grandstand development during 2015 and 2016. Science Rd then had stormwater upgrades in 2016 which divert overland flows into University Oval 2. These two mitigation measures in conjunction were assessed during the Stormwater Concept Design Report to have a beneficial impact in Larkin St, with an estimated 0.08m reduction in flood levels. The reason Larkin St is chosen as a measure of offsite impacts for the whole campus is because all overland floodwater from the University of Sydney campus goes through Larkin St, and as a result it is sensitive to changes in flood behaviour within the campus.

Rather than each campus development requiring OSD, permission can be sought from Sydney Water to utilise the communal OSD. The Proposed Conditions in this assessment has implemented no OSD as part of the Ross St T&L Hub development through assumptions that all rainfall over the site (including on roof space) is converted into overland flow for the TUFLOW model after losses are accounted for.

Results shown in Table 8 and Table 9 demonstrate there are no changes to flood levels in Larkin St for all events, and the total outflow from the campus for the 20% AEP to the 0.2% AEP is reduced. These results support OSD not being required for the Ross St T&L Hub, subject to approval from Sydney Water.

The development in conjunction with the Science Rd realignment as part of a separate set of work as part of campus upgrades increase overland and stormwater flow into University Oval 2, as intended in the Stormwater Concept Design Report (WSCE 2015). This is a large contributing factor to achieving the mitigated flood levels and outflow at Larkin St with any impacts due to the proposed development located locally within the University of Sydney grounds at Science Rd and within the University Oval 2 detention basin, as shown in the impact maps in Figures C01 to C16.

4. Risk Assessment

This section collates the information and results from this report to provide a framework to review flood risk to the development with the aim of identifying any residual risk to the community, to the development and to the users of the proposed development. These residual risks are to be managed through the emergency management plan (EMP).

- Section 4.1 provides an overview of the risk to the community, primarily focussing on discussing impacts presented in Section 3.3.
- Section 4.2 quantifies the risks to the proposed development property and infrastructure over the full range of flood events.
- Section 4.3 discusses risks to the users of the proposed development, which includes discussion on flood warning, evacuation strategies and a recommended approach for occupants to respond in an emergency.
- Section 4.4 summarises any residual risks based on Sections 4.1 to 4.3.
- Section 4.5 presents any risk to the development due to future potential climate change conditions.

The following guidelines and reports are referenced and used in the preparation of the risk assessment:

- Flood Risk Management Toolkit (DPE, June 2023), in particular:
 - Support for emergency management planning: EM01 (DPE, June 2023)
 - Understanding and managing flood risk: FB01 (DPE, June 2023)
 - Flood impact and risk assessment: LU01 (DPE, June 2023)
 - Flood risk management manual: FRMM (DPE, June 2023)
- Johnstons Creek Catchment Flood Study: Flood Study (WMAwater, Sep 2015)
- Johnstons Creek Catchment Floodplain Risk Management Study: FPRMS (WMAwater, Sep 2015)
- Sydney Metropolitan EMPLAN: EMPLAN (NSW Gov, Jan 2022)

4.1 – Risk to Community

Section 5 details the compliance of the proposed development with City of Sydney Policy, demonstrating compliance on all items relevant to the current design phase. The policies focus on the 1% AEP design event and PMF, whilst this section will focus on assessing whether there is any residual risk to the community based on the impact results presented in Section 3.3 over the full range of design events (20% AEP to PMF). Impacts to the community are defined as ‘impacts outside the University of Sydney Camperdown campus’, based on the Campus Improvement Program discussed in Section 3.5. Table 11 summarises the impacts relevant to the cumulative impact considerations from FB01 (DPE, 2023) to assist with consideration of the full range of design floods for a wide range of flood characteristics and help identify any residual risks to the community.

Table 11: Impacts relevant to the cumulative impact of developments on the community. (overpage)

Impact	No Change (range of floods)	Potential Change (range of floods)	Risk Assessment Summary	Results Reference
Flood Levels	20% AEP to PMF	Very minor. Discussed further in 4.1.1	Very Low to No Risk. See Section 4.1.1	Impacts: Section 3.3.1 Figures: C01 to C04 Discussed further in 4.1.1
Duration of Inundation	20% AEP to PMF	None	No risk to community as no offsite change.	See Section 3.3.5 for duration of inundation graphs for the Site
Flow	20% AEP to PMF	Very minor. Discussed in Section 4.1.2	Very Low to No risk. See Section 4.1.2	Impacts: Section 3.3.2 Table 9. Discussed further in 4.1.2
Flood Extent	20% AEP to 0.2% AEP	PMF	Very Low to No risk. See Section 4.1.1.	Impacts: Section 3.3.1 Figures: C01 to C04 Discussed further in 4.1.1
Warning and Evacuation Time	20% AEP to PMF	None	The small catchment means there is a warning and evacuation time of less than 30 minutes from the onset of a storm. The development does not change this.	See Section 3.3.5 for estimated warning times for the Site. Discussed further in 4.3.2, 4.3.3 and 4.3.4
Flood Function	20% AEP to PMF	None	No risk as no consistent changes in flood function and any consistent changes are on campus. See Section 4.1.2	Impacts: Section 3.3.4 Figures: C15 to C20
Hazard	20% AEP to PMF	None	No risk as no consistent changes in hazard categories and any consistent changes are on campus. See Section 4.1.2	Impacts: Section 3.3.3 Figures: C09 to C14

As shown in Table 11 the cumulative effect of the proposed development and the University campus upgrade work in Science Rd do not add any additional risk to the community for most flood characteristics. The flood level and flow risks are considered 'Very Low' to 'No Risk' and discussed in Sections 4.1.1 and 4.1.2. These very minor water level and flow increases in Parramatta Rd do suggest flood behaviour can be sensitive to changes in Western Ave and on the development boundaries. Future development phases should consider this during the design of Western Ave in particular, as the implementation of stormwater infrastructure could remove these impacts.

4.1.1: Flood Level Risk Assessment

For the 1% AEP, 0.2% AEP and PMF events, there are some scattered increases in flood levels within Parramatta Rd, just adjacent to the development site of one or two cells. The cause is uncertain; however, the impacts are local and could be attributed to the resolution of the flood model causing a single cell to be higher at the proposed garden bed. These impacts don't produce a change in hazard or flood function, and as such have been assessed as a Very Low to No Risk to the community, should they even be an actual impact.

In addition, there is a slight increase in the PMF flood extent on the corner of Western Avenue and Parramatta Rd. This floodwater is very shallow overland flow that does not pose any additional risk to people, infrastructure or buildings and only occurs during the rarest of floods. As such it is considered at most a Very Low risk to the community, with it likely posing no risk.

4.1.2: Flow Risk Assessment

Similar to the flood level risk assessment in Section 4.1.1, there are increases in flows in Parramatta Rd downstream of the site with the minor increases in the 1% AEP (+0.01m³/s) and PMF (+0.01 m³/s). Decreases of similar magnitude occur in the 20% AEP and 0.2% AEP. The increases are at most a 1% increase in flows down Parramatta Rd.

These impacts don't produce a change in hazard or flood function for all events for Parramatta Rd. In addition, the flows down Parramatta Rd combine with the University of Sydney overland flow at Larkin St, where there is no change or beneficial impacts (reductions in flow) for all events (see Table 9 Q06, Q07 and Q08). These indicate the very minor increases in Parramatta Rd flows are at most a 'Very Low' risk to the community, with evidence supporting they pose almost no risk.

4.2 – Risk to Property and Infrastructure

As per Council requirement 'Section 2 (d)' the building will be built with flood compatible materials below the FPL (1% AEP + 500mm) including the Level 01 window on the south-west corner of the site. A suitably qualified civil engineer will be required to provide a supporting assessment of the structural soundness of the site during a flood in later development phases. As hazards are at most H1 near the development for all events, the development is not expected to require specialist building design to withstand floodwater.

All detrimental impacts within the campus area are contained to Science Rd and University Oval 2. Water level impacts for events between the 1% AEP to PMF in University Oval 2 are at most 0.02m and the increases to water levels are only within a portion of University Oval 2. This indicates there is minimal risk of impact on the lifespan of the basin due to the development. Similar conclusions of the risk to University Oval 2 can be made for all other flood behaviour.

The impacts on Science Rd are mainly due to the changes to terrain elevations due to the University campus upgrade work for the realignment. A review of the velocities and hazards in Table 12 indicate that the deviated portion of Science Rd under Proposed Conditions isn't subject to any values higher

than during Existing Conditions. The deviation also reduces the maximum velocities expected within the road for events between the 20% AEP and 0.2% AEP. The proposed development is unlikely to subject road infrastructure to any additional flood risk relative to Existing Conditions.

Table 12: Comparison of flood behaviour on Science Rd

Parameter	Existing Conditions (Science Rd unmodified)				Proposed Conditions (Science Rd deviated)			
	20% AEP	1% AEP	0.2% AEP	PMF	20% AEP	1% AEP	0.2% AEP	PMF
Velocity	2.6	3.0	3.6	3.0	1.7	2.3	2.7	3.0
Hazard	H5	H5	H5	H6	H5	H5	H5	H6

4.3 – Risk to People

4.3.1: Expected Occupants

The expected occupants can be summarised as follows:

- The use as a university teaching facility means it will mostly contain adults.
- There may be visitors who are children.
- There may be people who require access to accessibility provisions due to limited mobility or in the event of an emergency be subject to some injuries that limit their mobility.
- It is unlikely that vulnerable people such as the elderly or those in need of significant medical care will be present in any regularity.

Based on the above the proposed facility is to mostly contain able bodied adults, but when considering items of risk there should be consideration for children, the need for accessibility provisions and people vulnerable in a flood such as the elderly should be included.

4.3.2 Overview of the type of flooding

Flash flooding can be defined as flooding occurring ‘... within 6 hours of the precipitating weather event, and often involves rapid water level changes and flood water velocity. This definition excludes flooding caused by dam failure, storm surge or tsunami although similar emergency management principles may apply to these events’ (AFAC 2018) and extracted from EM01.

Both critical durations for the proposed development site are for storm durations less than 6 hours (Section 2.1) and involve rapid water level changes for all events regardless of the duration of storm (Warning and Evacuation Time, Section 4.1, Table 11). As such flash flooding is the best description for the type of flood behaviour most likely to provide a risk to the safety of users of the proposed development.

4.3.3 Flood warning and rate of rise

As noted in EM01, for flash flood catchments the time to flooding and flood duration are typically very short with minimal warning time. It also notes that emergency services (or emergency combat authorities such as the NSW State Emergency Service (SES)) will have little ability to warn individuals of the onset of flooding to the site.

Because of the above, warnings in flash flooding areas, such as the proposed development site, are limited to severe weather warnings or flood watches for the area. For the proposed development the

recommended sources for information are the Bureau of Meteorology weather alerts, but it is also noted on the “City of Sydney Emergency advice: Floods” website page to listen to the local ABC radio station for more local information.

The total warning time, that is the time from the potential flood inducing storm hitting the catchment and flooding to be experienced at the site, is shown by the water level hydrographs in Section 3.3.5 Images 9 and 10. These indicate the total warning time is less than 30 minutes, as the onset of the storm begins at timestep 0.0(hr) for all events.

4.3.4 Evacuation potential

As summarised in the EM01, the preferred emergency response approach is evacuation, but should only be the appropriate strategy where it has been demonstrated that there is sufficient:

- Warning time to evacuate before hazardous floodwater cuts evacuation.
- Where there is evacuation capacity on the roads proposed for the strategy.
- Capability to evacuate along the proposed routes.

The proposed site is within a flash flood catchment and as quoted in EM01 ‘attempting to evacuate may be worse than not evacuating given the dangers inherent in moving through flood waters, particularly fast-moving flash floodwaters. The timescale over which flash floods occur may limit the feasibility of evacuation as a response measure’ (AFAC, 2018). As discussed in Section 4.3.3, the total warning time is less than 30 minutes from the onset of the storm, which already limits the use of evacuation as an effective risk management approach.

For events between the 1% AEP and PMF the evacuation potential is hazardous if using any of the nearby roads including when exiting onto Science Rd, or Parramatta Rd, whether by vehicle or on foot. This is demonstrated in Figures C10 to C14, which show hazards at H5 which are ‘unsafe for people or vehicles’ (see Image 8 for hazard vulnerability definitions). As water levels do not exceed 0.30m for most events around the site, the hazardous nature of the floodwater can be attributed to the high velocities. The time to peak hazard is less than 30 minutes for these events.

For the 20% AEP the hazards remain at H1, which is safe for everyone. In addition, water levels aren’t expected to exceed 0.30m near the site during this event.

In all events there is a flood free pedestrian evacuation to the Parramatta Rd Footbridge. As this extends beyond the Johnsons Creek catchment, it is uncertain the flood conditions in the neighbouring catchments. There seems to be minimal benefit for this evacuation route as the site is already flood free in all events, and there seems to be no additional facilities such as medical access located over the footbridge. There is some potential use if emergency providers require access to the site, and can safely reach the Parramatta Rd footbridge, it could provide a means for providing emergency medical care should the site be surrounded by floodwater.

The alternative strategy is to shelter in place, preferably at an emergency evacuation centre. This is discussed in Section 4.3.5. Ideally people would not be present on the site and will have heeded weather warnings or warnings given by emergency combat authorities to not enter the area, however there is always a risk that people are present on the site during a flood and it is a residual risk that needs to be managed. The emergency management plan presented in Volume 3 details the preferred strategy.

4.3.5 Shelter in Place and Duration of inundation

The duration of inundation is an important measure of the potential risk to people isolated during a flood. The longer the duration of flooding, the higher the potential for people who are isolated from the community to be subject to risks such as, lack of medical access, isolation anxiety should

communications channels be down, potable water and food, and exposure to secondary risks such as fire without emergency services to deal with them (FB01). Longer periods of isolation can also lead to decisions to venture into floodwater at significant potential risk to the persons involved (FB01).

The duration of inundation for the proposed site is estimated as storm length + 1 hour for all events (Section 3.3.5). This means the surrounding area is estimated to become safe for evacuation within an hour of the storm ending. The proposed building also has flood free access to several other campus buildings, which reduces risks associated with exposure to secondary risks such as a fire, and there is pedestrian access to the Parramatta Rd Footbridge, which can be explored as a potential source of emergency medical care.

4.4 – Overview of Residual Risks

The residual risks identified in Sections 4.1 to 4.3 and from the results presented in Section 3 are the following:

- Catchment is subject to flash flooding with minimal warning time once the storm starts. (Section 4.3.2 and 4.3.3)
- Evacuation from the site is dependent on receiving and communicating risks to users of the proposed development. These warnings would be from regional storm warnings from the BoM or local radio. (Section 4.3.3)
- The Sydney Metropolitan EMPLAN may require the evacuation of the Central Business District. This is likely to reduce the evacuation capacity of the main evacuation routes from the site – these being Parramatta Rd and King Street.
- Any residents who remain at the site or are caught unaware by the onset of a flood inducing storm, are unlikely to find a safe vehicle evacuation route from the site with dangers of being caught in hazardous floodwater. (Section 4.3.4)
- Residents who shelter at the site are safe from floodwater in most events, however are subject to the risks associated with isolating. These risks are minimised by flood free access to other flood free buildings and pedestrian access to the Parramatta Rd Footbridge. (Section 4.3.5)
- People are likely to want to evacuate in a flood, if not told of the risks associated with doing so. (EM01)
- Even if told of the risk, people may still attempt to evacuate if they do not accept the risk (EM01)

Based on the residual risks to the site the Emergency Management Plan focuses on:

- Establishing a chain of command to distribute warnings of the potential onset of flood inducing storms to prioritise the evacuation of the site well before the onset of the storm itself.
- Educating visitors and permanent users of the site of the flood protocols and procedures.
- Setup the preferred management strategy for people isolated by floodwater. The recommended approach is for a shelter in place strategy.

The Emergency Management Plan is presented in Volume 3 of this report.

4.5 Risks due to Climate Change

Climate change is expected to worsen flood risk over time as higher greenhouse gas concentrations lead to increases in high intensity rainfall and sea levels. There are four greenhouse gas concentration projections named RCP 2.5, 4.5, 6.0 and 8.5, with RCP 2.5 being the most optimistic (emissions plateau and then decline) and 8.5 the least optimistic (emissions continue to grow). For the RCP4.5 and 8.5 scenarios, the precipitation intensity for the site was obtained from the ARR Data Hub and shown in Table 13 for 2050 and 2090 projections.

Table 13: Climate change factors – Percentage increase in Rainfall Intensity

Year	Increase in Rainfall Intensity	
	RCP 4.5	RCP 8.5
2050	+6.4%	+9.0%
2090	+9.5%	+19.7%

As the 0.2% AEP event is a 1.344 multiplier of the 1% AEP event (i.e. equivalent to a 34.4% increase in rainfall intensity), it was used as a proxy to assess the risks associated with climate change for this assessment. This is based on the 34.4% increase in rainfall greatly exceeding even the least optimistic projections for 2090 conditions.

Given the site is flood free in the 0.2% AEP event, we can conclude then that the development will continue to remain flood free under climate change conditions. The increases in flood levels between the 0.2% AEP and 1% AEP around the site are quite minor. At most an estimated +10mm increase in flood levels on the Science Rd side of the development, and +20mm increase in Parramatta Rd levels. This indicates that the development should be able to maintain a 500mm freeboard for most entrances or continue to be within the merit approach presented in the assessment in Section 3.4.

As the 0.2% AEP greatly exceeds the projected climate rainfall intensity increases, the risk that increases in rainfall intensity due to climate change pose are at most a 'Very Low' risk to the development. During future development stages results for the 2090 RCP 8.5 can be produced, which would confirm whether there is a 'Very Low' or 'No Risk' due to climate change.

Sea level rise is not expected to impact levels at the site. This is due to modelling conducted as part of the FS (WMAwater 2015) showing that all impacts due to a projected 0.9 m increase in sea level by 2100 would only impact levels immediately in and adjacent to Johnstons Creek itself. As the site is located well above these influences, no further testing has been conducted as part of this risk assessment.

5. Compliance with relevant policy

5.1 City of Sydney (CoS) Policy

The City of Sydney Interim Floodplain Management Policy (2014), henceforth FMP, facilitates the best practice approach for the management of flood risk within the Council local government area. The Council requirements are detailed in FMP Section 2. These requirements have been detailed in Table 14 along with how they apply to this report.

Table 14: City of Sydney Interim Floodplain Management Policy (2014) Section 2: Requirements

Required Information		Location of Information
a)	Development applications affected by this Policy shall be accompanied by a survey plan showing: i) The position of the existing building/s or proposed building/s; ii) The existing ground levels and features to Australian Height Datum around the perimeter of the site and contours of the site; and iii) The existing or proposed flood levels to Australian Height Datum	Survey was conducted by Realserve titled 'Plan Showing Select Features & Levels, Part of Lot 1 in DP 1171804'. Revision 02 is dated 17/10/2023. This contains all the required information.
b)	Applications for earthworks, filling of land, infrastructure and subdivision shall be accompanied by a survey plan (with minimum contour interval of 0.25m) showing relative levels to Australian Height Datum	Architectural and civil design will be finalised in future development phases. OCULUS has provided proposed terrain spot levels for this development phase.
c)	For large scale developments, or developments that in the opinion of the City are in critical situations, where an existing catchment based flood study is not available, a flood assessment report prepared by a suitably qualified engineer using a hydrology and hydraulic dynamic one or two dimensional computer model.	This report updates the existing catchment-based flood study information (WMA 2015) utilising the previous TUFLOW model updated to current conditions
d)	Where the controls for a particular development proposal require an assessment of structural soundness during potential floods, the following impacts must be addressed: i) Hydrostatic pressure; ii) Hydrodynamic pressure; iii) Impact of debris; and iv) Buoyancy forces	The development will utilise flood compatible materials within the 1% AEP + 500mm including the Level 01 window on the south-west corner of the site. A suitably qualified civil engineer will be required to provide design information on the structural soundness during a flood in later stages of the development. The low hazard for all events at the site indicate structural soundness can be achieved without specialist building design.

FMP Section 3 details the development provisions and performance criteria requirements. Table 15 details the performance criteria from FMP Section 3.1 and the Ross St T&L Hub compliance with the associated criterion. The remainder of FMP Section 3, that is FMP Sections 3.2 (Concessional Development – Minor Additions) and FMP 3.3 (Heritage Considerations), do not apply to this development.

Table 15: City of Sydney Interim Floodplain Management Policy (2014) Section 3.1: Performance Criteria (overpage)

Criteria			Compliance
a)		The development is compatible with the established flood hazard of the land. In areas where flood hazard has not been established through previous studies or reports, the flood hazard must be established in accordance with the Floodplain Development Manual considering the following:	
	i)	Impact of flooding and flood liability is to be managed ensuring the development does not divert floodwaters or interfere with flood storage or the natural function of the waterway;	The proposed development has demonstrated in Section 4.1 and associated results from Section 3 that impacts have been managed, the development does not divert floodwater or interfere with the flood function of the catchment.
	ii)	Flood behaviour (for example, flood depths reached, flood flow velocities, flood hazard, rate or rise of floodwater)	Results provided in Section 3.1 to establish Existing flood behaviour, and Section 3.2 to establish Proposed flood behaviour
	iii)	Duration of flooding for a full range of events;	Results from the 20% AEP to the PMF have been provided. Discussion on duration of flooding and its effect on safety and evacuation in Section 4.3.5
	iv)	Appropriate flood mitigation works;	A recommended flood mitigation work is provided in Sections 3.2 and 3.5 to inform later development stages.
	v)	Freeboard;	The appropriate freeboard of 0.5m as per Section 5 of the CoS Interim Floodplain Management Policy (2014) has been adopted. Two entrances require a merit based approach for compliance as presented in Section 3.4.
	vi)	Council's duty of care – Proposals to address or limit; and	No increase in Council maintained assets
	vii)	Depth and velocity of flood waters for relevant flood events.	Depth and velocity have been provided for the design event, see Sections 3.1 and 3.2
b)		Will not significantly adversely affect flood behaviour resulting in detrimental increases in the potential flood affectation of other development or properties;	Compliant. Section 3.3 provides flood impact mapping for both levels, velocities, hazards and on flood function. Section 4.1 shows impacts are considered Very Low to No Risk in their potential offsite impact.
c)		Incorporates appropriate measures to manage risk to life from flood considering the followings:	
	i)	The proposed development should not result in any increased risk to human life	Compliant. The development is flood free for events up to the PMF event (Section 3.2), evacuation and safety in the event of a flood up to the PMF has been addressed (Section 4)
	ii)	Controls for risk to life for floods up to the Flood Planning Level	See above
	iii)	Controls for risk to life for floods greater than the Flood Planning Level	See above

	iv)	Existing flood levels of development in relation to the Flood Planning Level and floods greater than the Flood Planning level	See above
	v)	Councils' duty of care – Proposals to address and limit	The suitability of the site as a shelter in place facility limits any additional increases to Council's duty of care
	vi)	What level of flooding should apply to the development e.g. 1 in 100 year, etc	The development utilises the 1% AEP as the design event. All results provided in this report reference this as the design event. Consideration has been given for all events between the 20% AEP to PMF to demonstrate resilience of the design.
	vii)	Effective flood access and evacuation issues	Risks associated with flood access and evacuation are discussed in Sections 4.3.3 and 4.3.4.
	viii)	Flood readiness – Methods to ensure relative flood information is available to current and future occupants and visitors.	A preliminary emergency management plan is provided in Volume 3. Future development phases will expand on the plan, including continued consulting with the SES and incorporating the plan with University of Sydney Emergency Response Strategies.
d)		Will not significantly adversely affect the environment or cause avoidable erosion, siltation, destruction of riparian vegetation or a reduction in the stability of creek or channel banks or watercourse;	Development is not located within or near a riparian corridor or creek with the closest being Johnsons Creek located 450m downstream. This report has shown no downstream effects in the design event for this development.
e)		Is not likely to result in unsustainable social and economic costs to the community as a consequence of flooding;	Demonstrated level of protection for all events demonstrate a low likelihood to result in social and economic costs to the community as a consequence of flooding. Section 4.1 discusses risks to the community, with all risks either 'Very Low' or 'No Risk'
f)		Is consistent with the principles of Ecologically Sustainable Development; and	Outside the scope of this assessment
g)		Adequately considers the impact of climate change	Climate change has been discussed in Section 4.5. No expected risks due to climate change.

In addition, the General Requirements from FMP Section 4 are detailed in Table 16. FMP Section 5 is discussed in this report (see Section 3.4) and FMP Section 6 provides a list of flood compatible materials allowed below the FPL which are recommended to be referenced during the final design stage of the Ross St T&L Hub project.

Table 16: City of Sydney Interim Floodplain Management Policy (2014) Section 4: General Requirements

Development Type/Aspect	Requirement	Compliance
Fencing	Fencing is to be designed and constructed in such a manner that it will not modify the flow of floodwaters and cause damage to surrounding land.	No fencing proposed within the existing flood corridors at this design phase.
Industrial and Commercial Properties	- The CoS may consider merits-based approaches presented by the applicant. The proposed industrial or commercial buildings must meet the Flood Planning Level Requirements detailed in Section 5; and - The proposed industrial or commercial development should not increase the likelihood of flooding on other developments, properties or infrastructure.	Demonstrated compliance with Flood Planning Level Requirements detailed in Section 3.4. The design shows no increase in flooding on other developments as per results in Section 3.3
Car Parking	- To minimise the damage to motor vehicles from flooding; - To ensure that motor vehicles do not become moving debris during floods which threaten the integrity or blockage of structures or the safety of people, or damage other property; and - To minimise risk to human life from the inundation of basement and other car park or driveway areas.	No parking proposed as part of this development at this design phase.
Filling of Flood Prone Lane	Unless a floodplain risk management plan for the catchment has been adopted, which allows filling to occur, filling for any purpose, including the raising of a building platform in flood-prone areas is not permitted without Council Approval. Application for any filling must be supported by a flood assessment report from a suitably qualified engineer which certifies that the filling will not increase flood affectation elsewhere.	Any fill is not on flood prone land. Any fill has been incorporated into the design flood modelling with results in Sections 3.3 and 3.4 demonstrating the compliance.
Storage of Hazardous Substances	The storage of products which, in the opinion of the City, may be hazardous or pollute floodwaters, must be placed above the 1% AEP flood level or placed within an area protected by bunds or levels such that no flood waters can enter the bunded area and must comply with the Flood Planning Level requirement for such a facility.	No hazardous material storage proposed at this design phase.
Consideration of the Impact of Climate Change	- For those developments which have a lifespan of more than fifty years the impact due to sea level rise and impacts due to increased rainfall intensities shall be considered. - Meet the allowances for sea level rise as recommended in the NSW Government Coastal Planning Guideline Adopting Sea Level Rise 2010 (recently withdrawn from publication). Specifically, this shall include an allowance of 40cm by 2050 and a 90cm by 2100 from the 2009 Mean Sea Level - Where in the opinion of the CoS the proposed development is of reasonable impact to regional or catchment trunk drainage, the drainage system design shall allow for a minimum of 10% increased rainfall.	Climate change has been assessed in Section 4.5 demonstrating no risks due to increased rainfall intensities. No risks due to sea level rise are demonstrated by the flood study (WMAwater 2015) which concluded that sea level rise will have no impact on the University campus.

5.2 Campus Improvement Program Conditions of Consent

As discussed in Section 3.5, the Ross St T&L Hub falls under the Campus Improvement Program. Table 17 details the development compliance with relevant conditions.

Table 17: Relevant conditions from the Campus Improvement Program conditions of Consent

Item	Requirement	Compliance
B29	Future development applications for new built form shall be accompanied by a stormwater management plan detailing as assessment of any flood risk on site and consideration of any relevant provisions of the NSW Floodplain Development Manual (2005), stormwater and drainage infrastructure, and details demonstrating that water sensitive urban design measures have been incorporated into the development.	This report details the assessment of flood risk on the site in Section 4.2 and Section 4.3, assessment of flood risk to the community in Section 4.1. The risk assessment has been made with reference to the Flood Risk Management Toolkit (DPE, June 2023) which includes the updated Flood risk management manual (DPE, June 2023). Stormwater and drainage infrastructure, and details demonstrating that WSUD measures have been incorporated are beyond the scope of this assessment.

5.3 Project SEARS

This assessment addresses the SEARs for SSD-57938709 as demonstrated in Table 18. Compliance on all items is shown, with references to relevant figures and report sections.

Table 18: Compliance with project SEARS

SEAR	Compliance
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.	This report details the assessment of flood risk on the site in Sections 4.1 to Section 4.5. This risk assessment has been made in reference to: - Flood Risk Management Toolkit (DPE, June 2023), in particular: - Support for emergency management planning: EM01 (DPE, June 2023) - Understanding and managing flood risk: FB01 (DPE, June 2023) - Flood impact and risk assessment: LU01 (DPE, June 2023) - Flood risk management manual (DPE, June 2023) - Johnstons Creek Catchment Flood Study (WMAwater, Sep 2015) - Johnstons Creek Catchment Floodplain Risk Management Study (WMAwater, Sep 2015) - Sydney Metropolitan EMPLAN (NSW Gov, Jan 2022) - University of Sydney Camperdown Campus – Stormwater Concept Design Report (WS&P, 2015)
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.	Impacts have been assessed for the full range of events (20% AEP to PMF) in Section 3.3. Discussion of the risk, both on-site or off-site is presented in Sections 4.1 to 4.5. An emergency management plan is provided in Volume 3 detailing operational procedures to mitigate flood risk.
Provide a flood impact and risk assessment prepared in accordance with the NSW Floodplain Development Manual, and existing Council and Government studies and guidance.	This report details a detailed flood impact and risk assessment based on the guidelines from Flood impact and risk assessment: LU01 (DPE, June 2023). The assessment has been prepared in accordance with relevant studies and guidance (see above)
Identify flood behaviour, flood constraints and risks on the site and its surrounding including the potential impacts of climate change for the full range of events (i.e. up to and including the probable maximum flood (PMF) event).	Flood behaviour, constraints and risks have been identified including depths, levels, velocities, hazard, hydraulic categories and duration of inundation in Section 3. Climate change is discussed in Section 4.5. This has been done using the full range of events from the 20% AEP to the PMF.
Assess the impacts of the development, including any changes to flood behaviour and risk, impacts of flooding on the development and its future community and on existing community for the full range of events.	Impact results are in Section 3.3 for all flood behaviour items over the full range of events from the 20% AEP to the PMF. Sections 4.1 to 4.3 discuss the impact of flooding on the development, its future community and existing community using the results presented in Section 3.
Propose management measures required to minimise the impacts of flooding on the development and minimise flood risk to the community, including an Emergency Management Plan considering access to and from the site, and evacuation issues during significant flood events including the PMF, from both local catchments and/or regional catchments.	The site is showing no offsite flood impacts that require management measures. An Emergency Management Plan is provided in Volume 3, which details preparation and planning recommendations and an emergency response strategy. The emergency strategy is discussed in Section 4.3. The EMP considers the full range of events from the 20% AEP to the PMF

6. Conclusion and Recommendations

The Ross St T&L Centre Flood Impact and Risk Assessment presented herein, demonstrates compliance to the City of Sydney Policies, Campus Improvement Program Conditions of Consent and the SSD project SEARs. The main building area is flood free in all events, facilitates a 25.5m AHD FFL and results in no impacts on adjacent private property. In addition, measures to increase the flow of floodwater into University Oval 2 means there is better utilisation of existing flood mitigation measures present on the University of Sydney campus.

It is recommended that future design phases:

- Continue to consult with the SES regarding the proposed Emergency Management Plan in Volume 3,
- Any future proposed fencing, carparking, or storage of hazardous substances adheres to Section 4 of the CoS Interim Floodplain Management Policy (2014),
- Create a survey plan of the proposed development terrain (with minimal 0.25m intervals) to meet the Section 2 requirement of the CoS Interim Floodplain Management Policy (2014),
- Use suitable flood compatible materials within the 1% AEP + 500mm extent including the Level 01 window on the south-west corner of the site, and,
- Have a suitably qualified civil engineer assess the structural soundness of the development during a flood.

Yours Sincerely

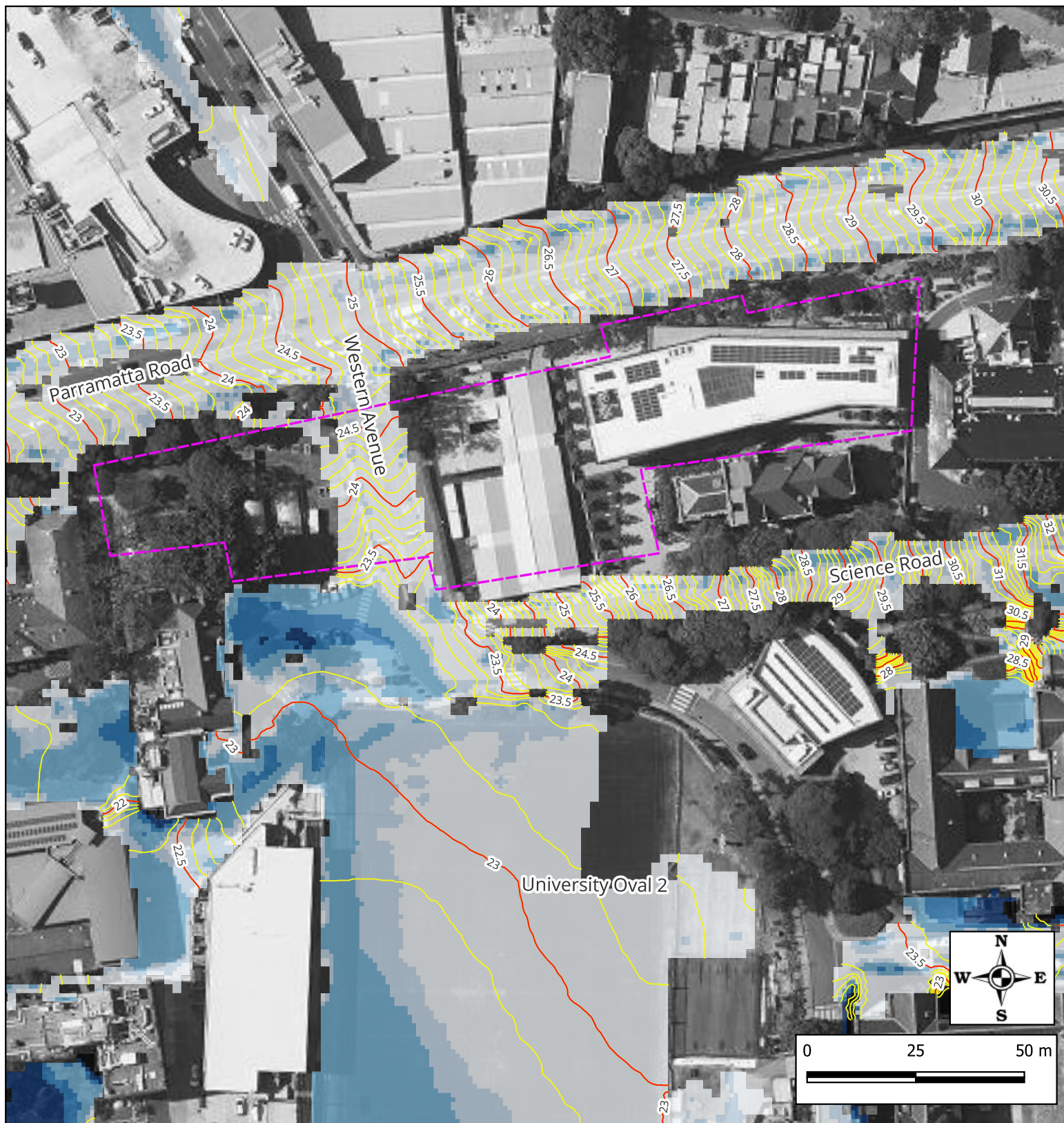


Steve Gray

Director

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Tel: +61 413 631 447



Legend

Depth(m)

< 0.05

0.30 - 0.50

--- CIP Envelope

0.05 - 0.10

0.50 - 1.00

--- Minor Level Contours (spacing = 0.5m)

0.10 - 0.30

> 1.00

--- Minor Level Contours (spacing = 0.1m)

TITLE: **Existing Conditions - 20% AEP event, depths and levels**

PROJECT: **A01 Ross St T&L Hub - Flood Risk Assessment**

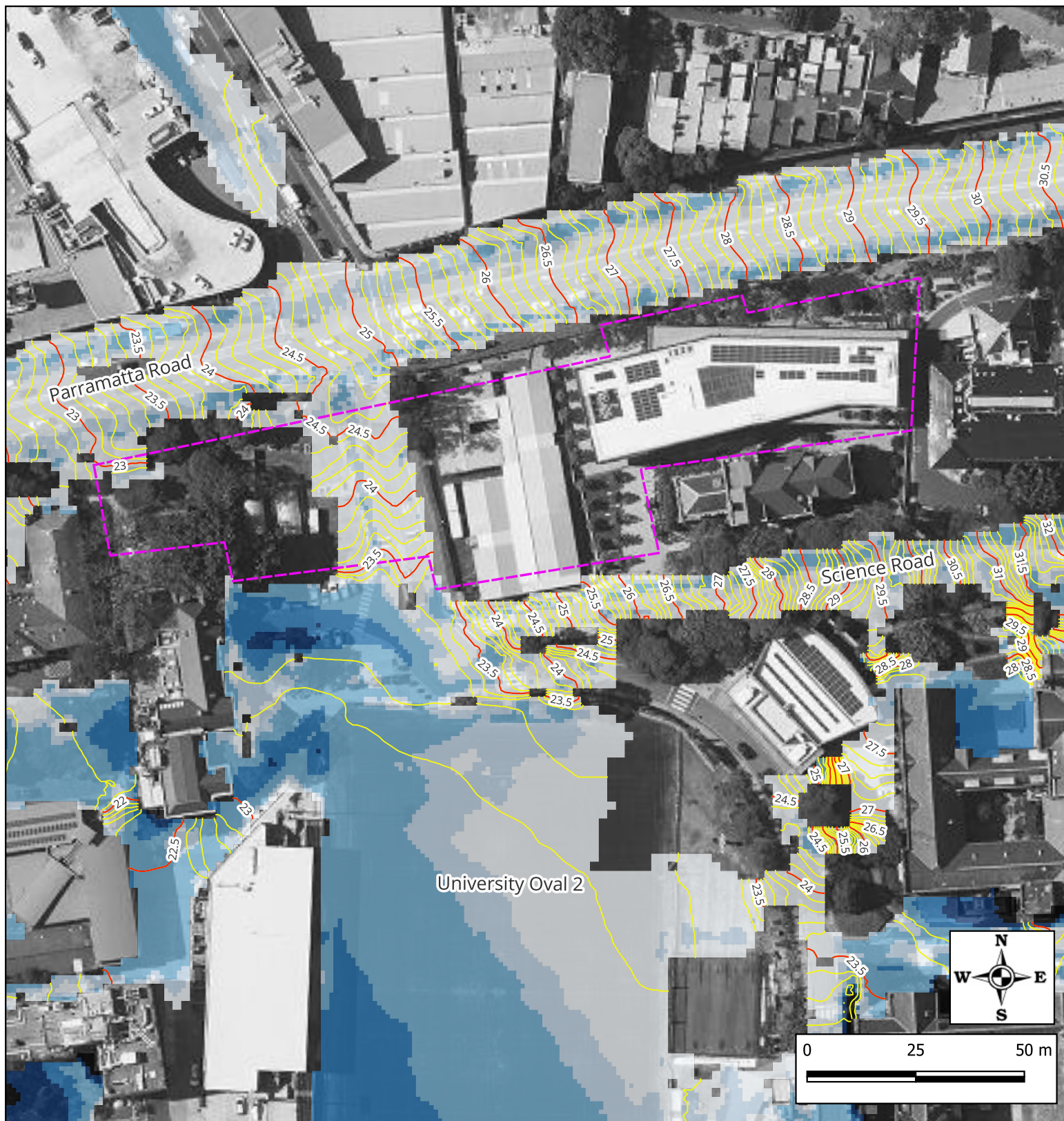
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DATE: **07-2024**

SCALE: **1:1,200**

FIGURE No. **A01**

grc
HYDRO



Legend

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0.30 - 0.50

CIP Envelope

0.05 - 0.10

0.50 - 1.00

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0.10 - 0.30

> 1.00

Minor Level Contours (spacing = 0.1m)

TITLE: **Existing Conditions - 1% AEP event, depths and levels**

PROJECT: **A01 Ross St T&L Hub - Flood Risk Assessment**

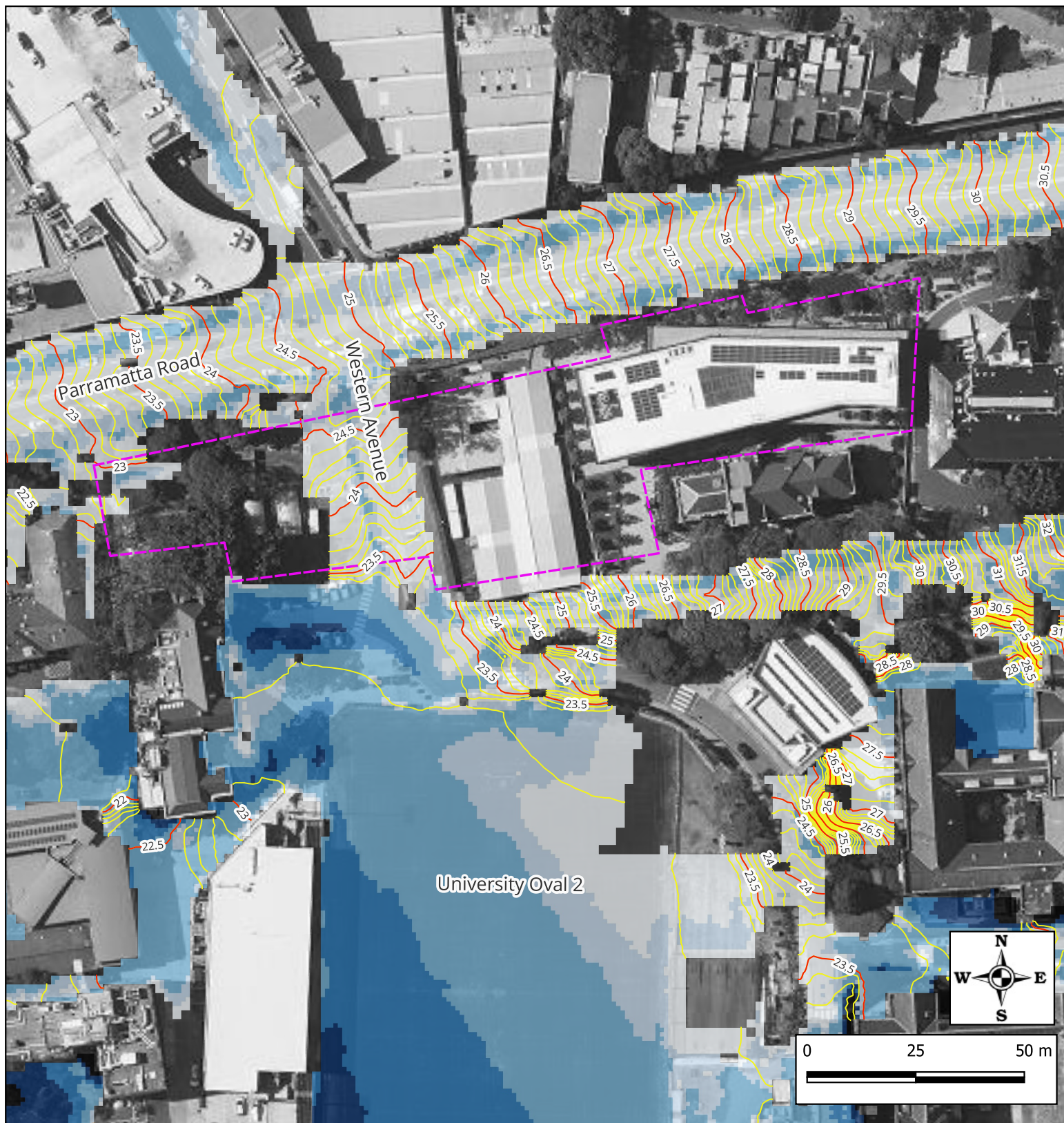
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DATE: **07-2024**

SCALE: **1:1,200**

FIGURE No. **A02**





Legend

Depth(m)

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0.30 - 0.50

CIP Envelope

0.05 - 0.10

0.50 - 1.00

Minor Level Contours (spacing = 0.5m)

0.10 - 0.30

> 1.00

Minor Level Contours (spacing = 0.1m)

TITLE: **Existing Conditions - 0.2% AEP event, depths and levels**

PROJECT: **A01 Ross St T&L Hub - Flood Risk Assessment**

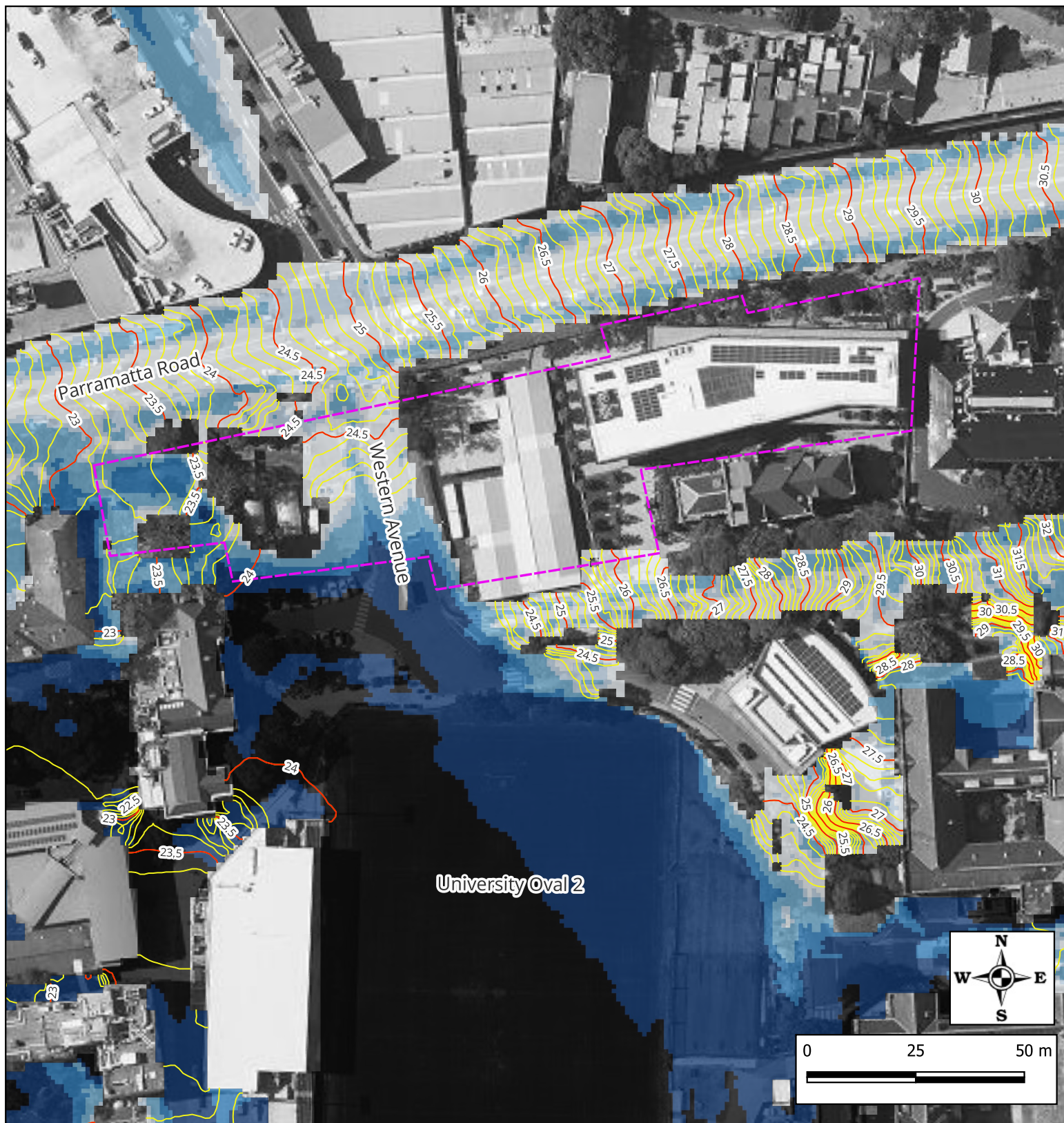
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DATE: **07-2024**

SCALE: **1:1,200**

FIGURE No. **A03**





Legend

Depth(m)

< 0.05

0.30 - 0.50

CIP Envelope

0.05 - 0.10

0.50 - 1.00

Minor Level Contours (spacing = 0.5m)

0.10 - 0.30

> 1.00

Minor Level Contours (spacing = 0.1m)

TITLE: **Existing Conditions - PMF event, depths and levels**

PROJECT: **A01 Ross St T&L Hub - Flood Risk Assessment**

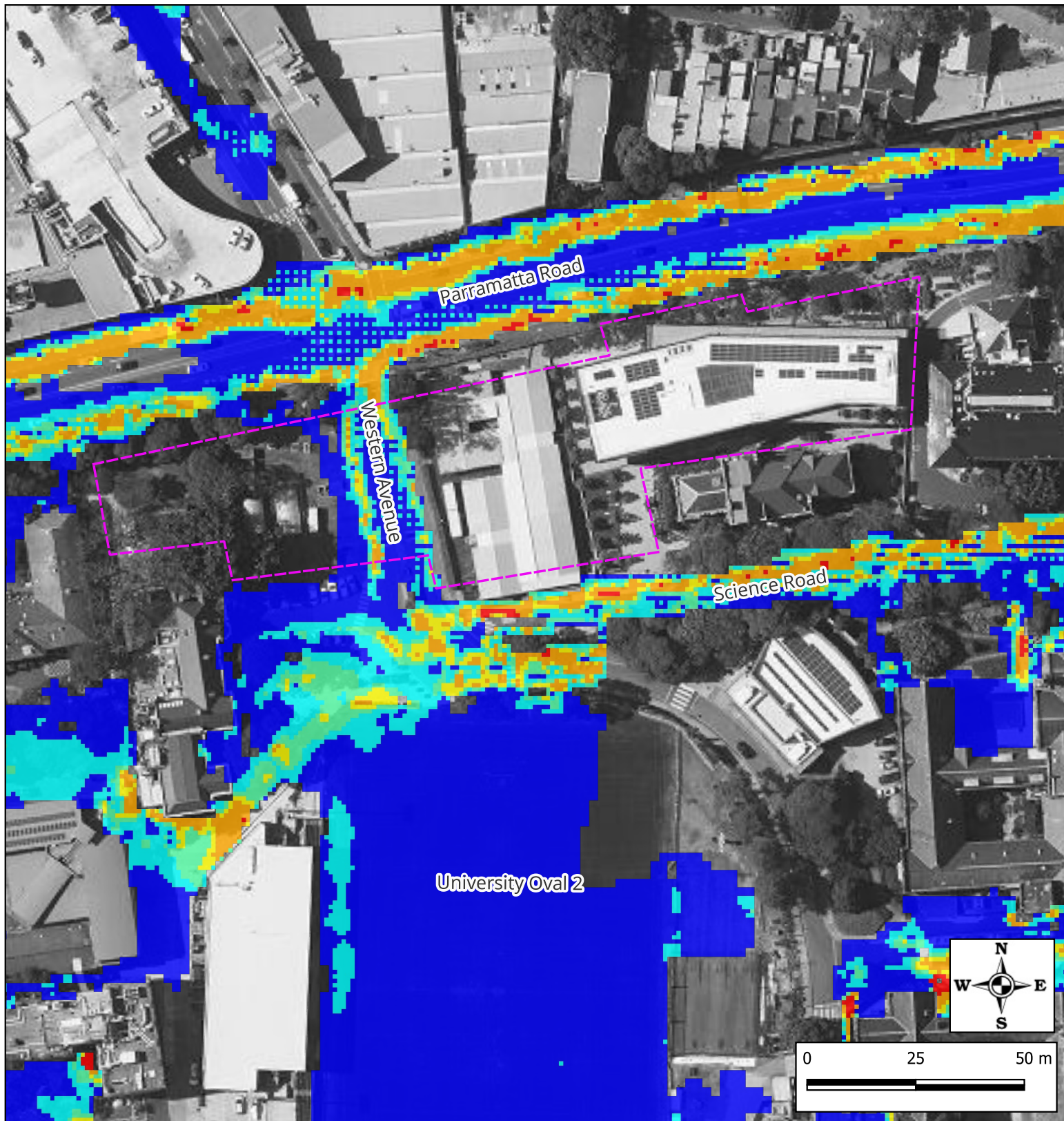
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DATE: **07-2024**

SCALE: **1:1,200**

FIGURE No. **A04**





Legend

Velocity(m/s)

< 0.25

0.25 to 0.50

0.50 to 0.75

0.75 to 1.00

1.00 to 2.00

> 2.00

CIP Envelope

TITLE: **Existing Conditions - 20% AEP event, velocities and flows**

PROJECT:

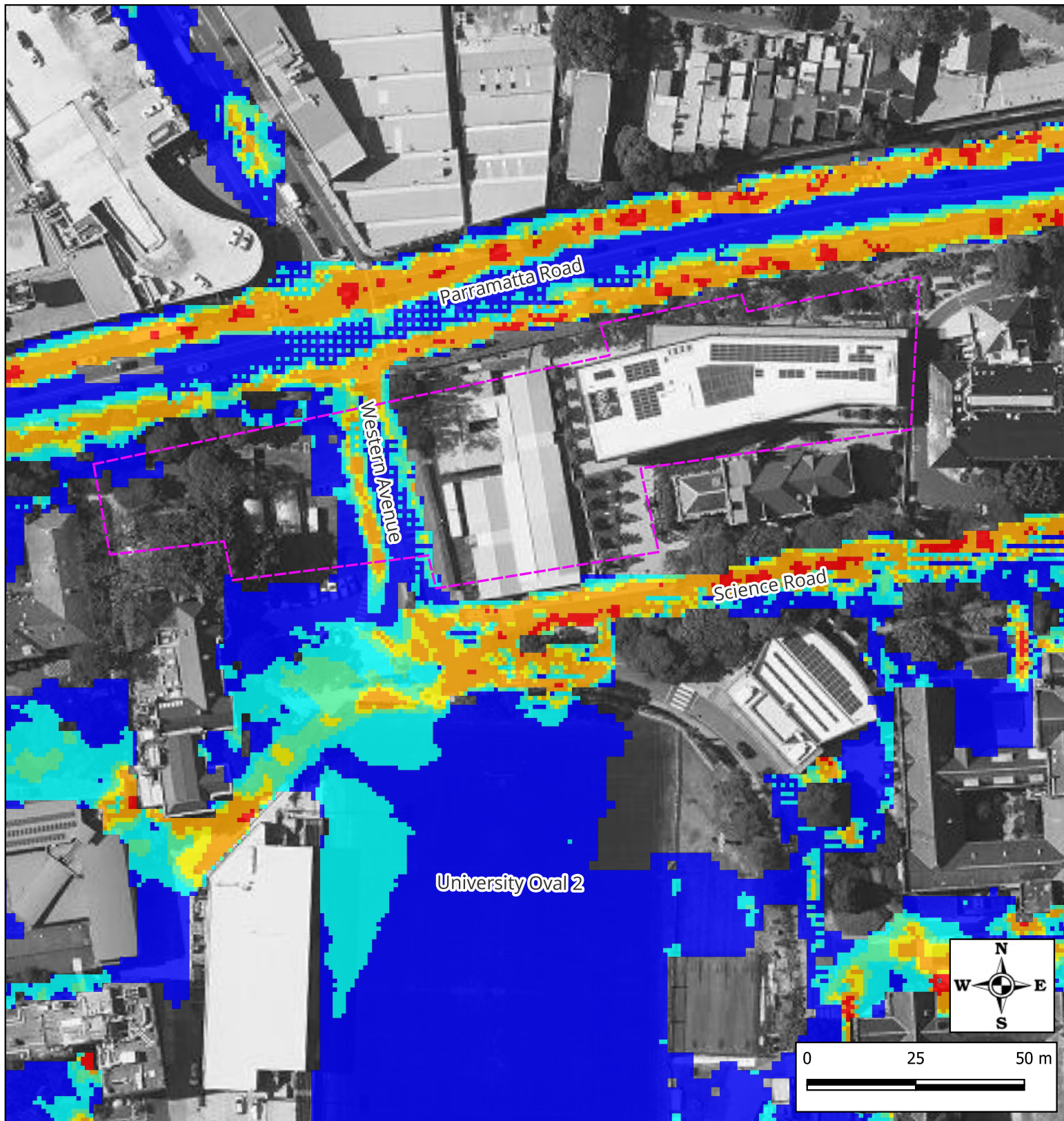
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DATE: **07-2024**

SCALE: **1:1,200**

FIGURE No. **A05**

grc
HYDRO



Legend

Velocity(m/s)

< 0.25

0.25 to 0.50

0.50 to 0.75

0.75 to 1.00

1.00 to 2.00

> 2.00

CIP Envelope

TITLE: **Existing Conditions - 1% AEP event, velocities and flows**

PROJECT:

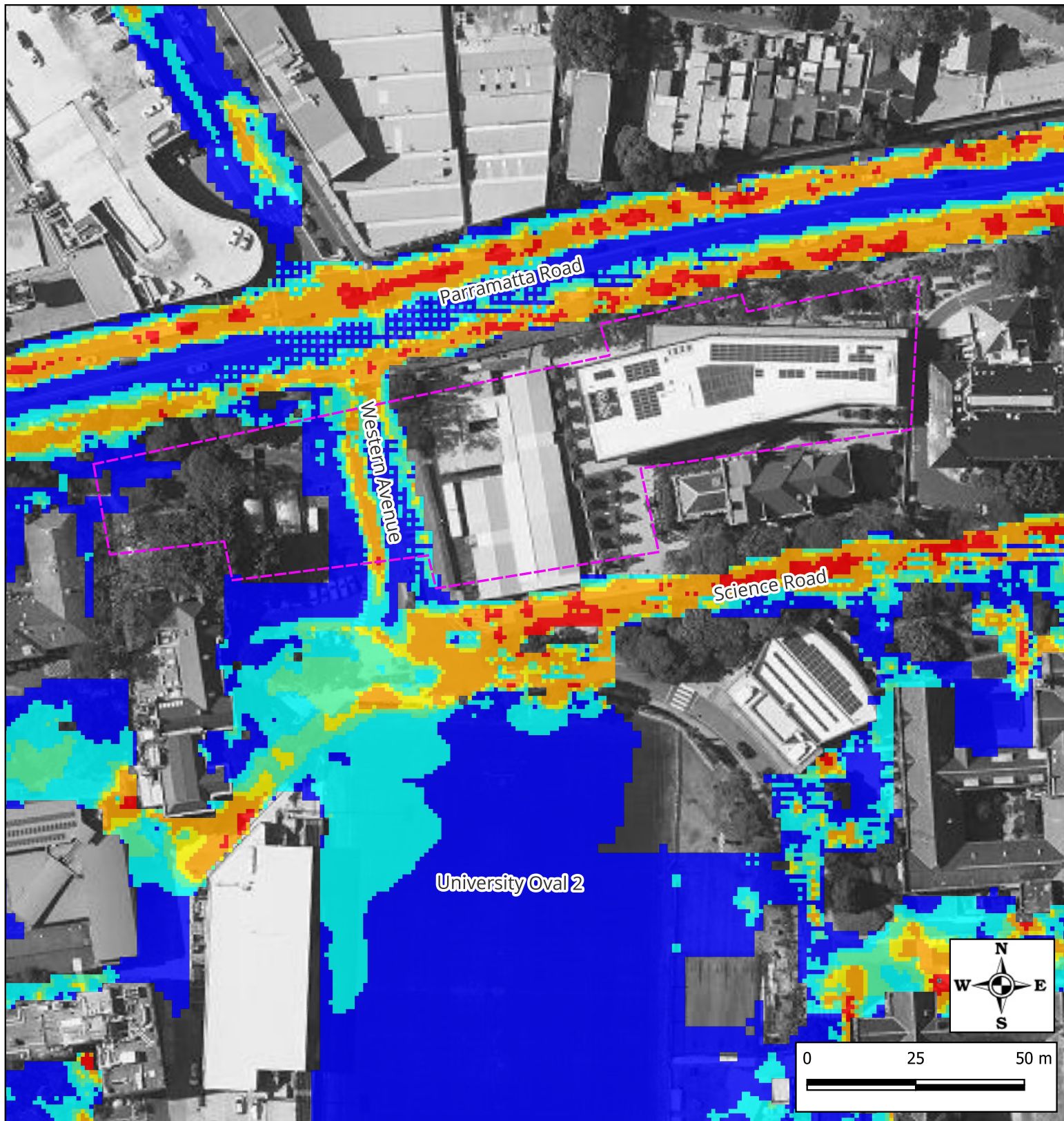
PROJECT No. **230077**

DATE: **07-2024**

SCALE: **1:1,200**

FIGURE No. **A06**

grc
HYDRO



Legend

Velocity(m/s)

 < 0.25

 0.25 to 0.50

 0.50 to 0.75

 0.75 to 1.00

 1.00 to 2.00

 > 2.00

 CIP Envelope

TITLE: **Existing Conditions - 0.2% AEP event, velocities and flows**

PROJECT:

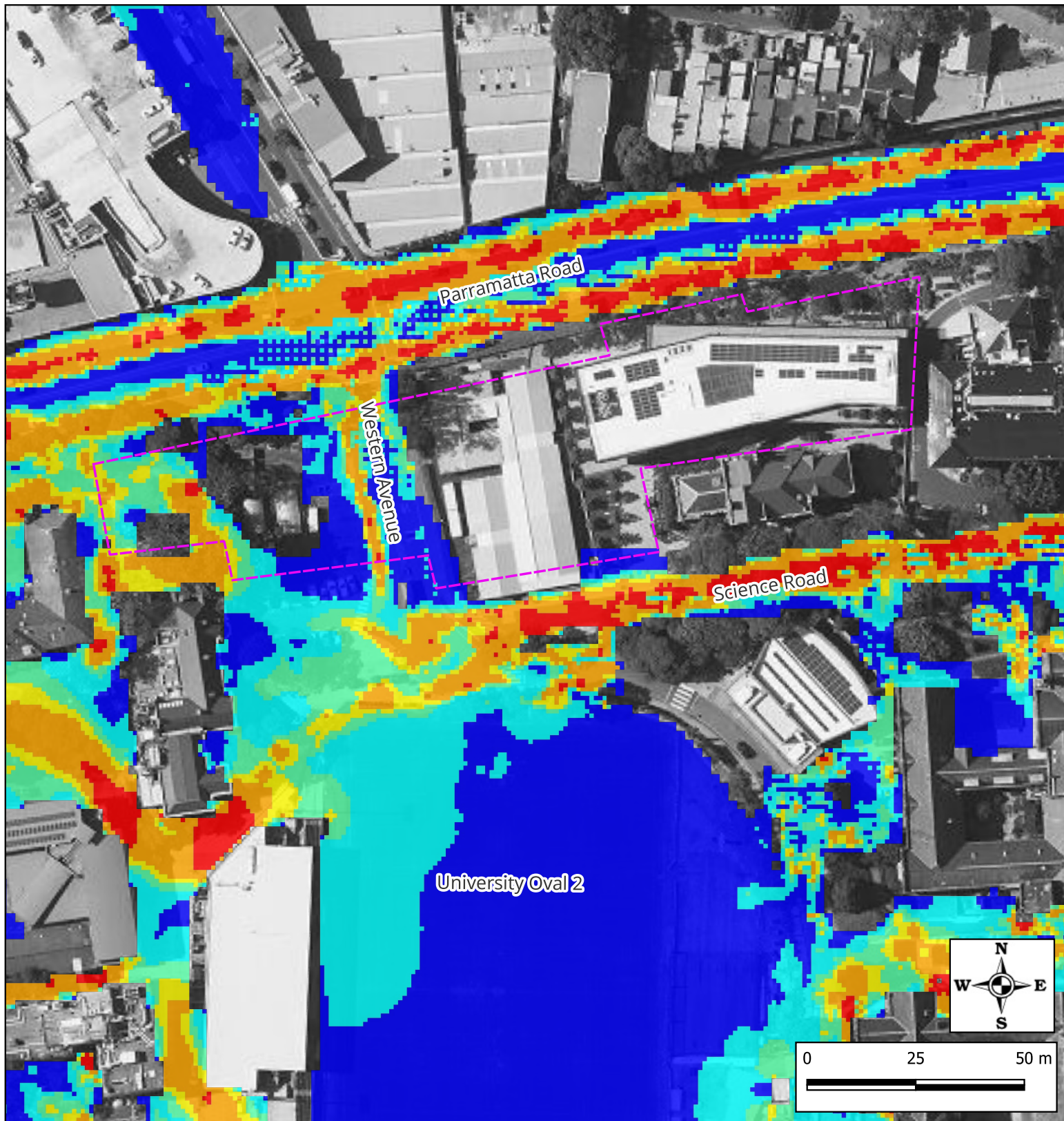
PROJECT No. **230077**

DATE: **07-2024**

SCALE: **1:1,200**

FIGURE No. **A07**

grc
HYDRO



Legend

Velocity(m/s)

< 0.25

0.25 to 0.50

0.50 to 0.75

0.75 to 1.00

1.00 to 2.00

> 2.00

CIP Envelope

TITLE: **Existing Conditions - PMF event, velocities and flows**

PROJECT:

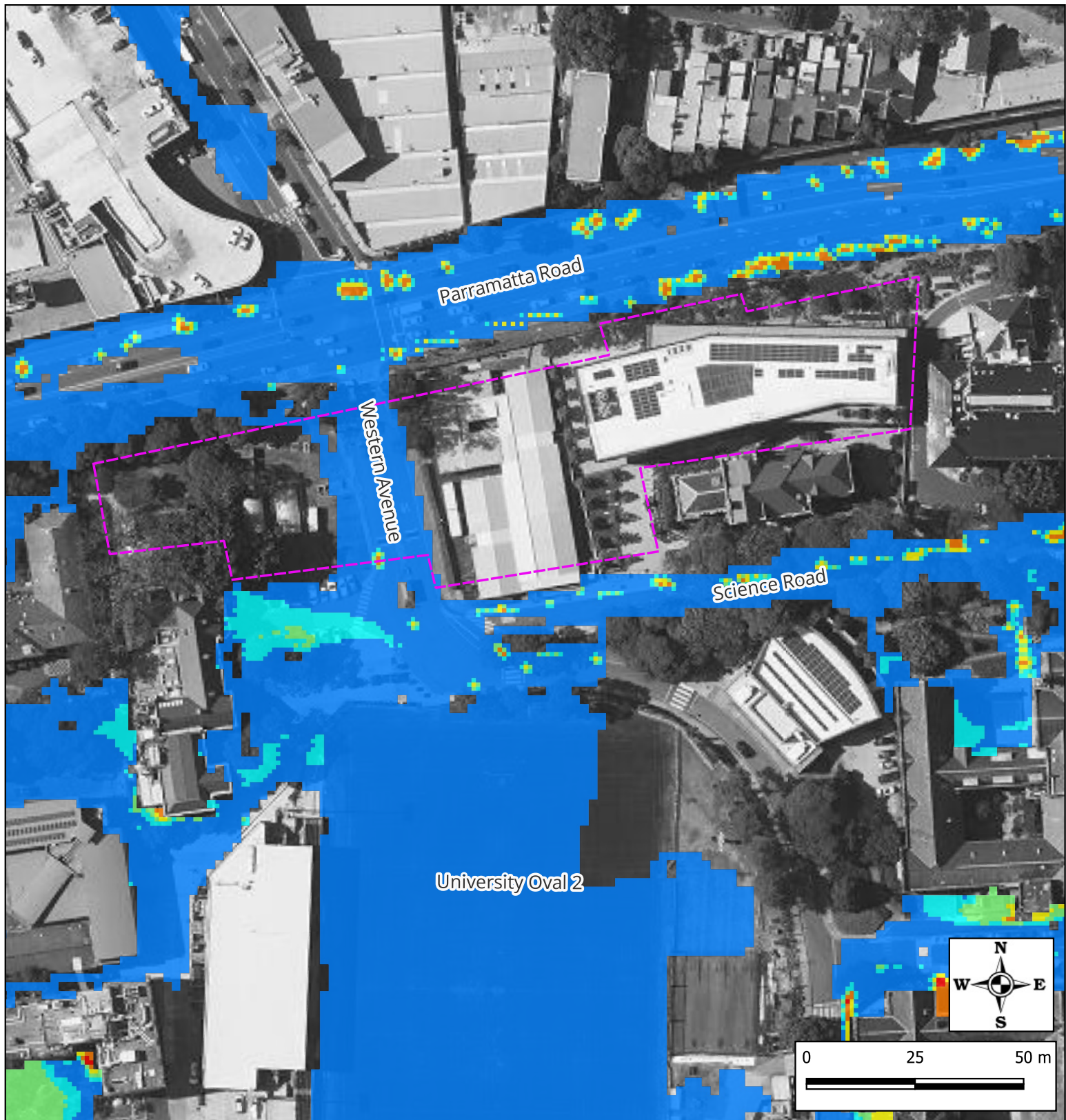
PROJECT No. **230077**

DATE: **07-2024**

SCALE: **1:1,200**

FIGURE No. **A08**

grc
HYDRO



Legend

Hazard Category

H1	H4
H2	H5
H3	H6

--- CIP Envelop

TITLE: **Existing Conditions - 20% AEP event, hazards**

PROJECT: **A01 Ross St T&L Hub - Flood Risk Assessment**

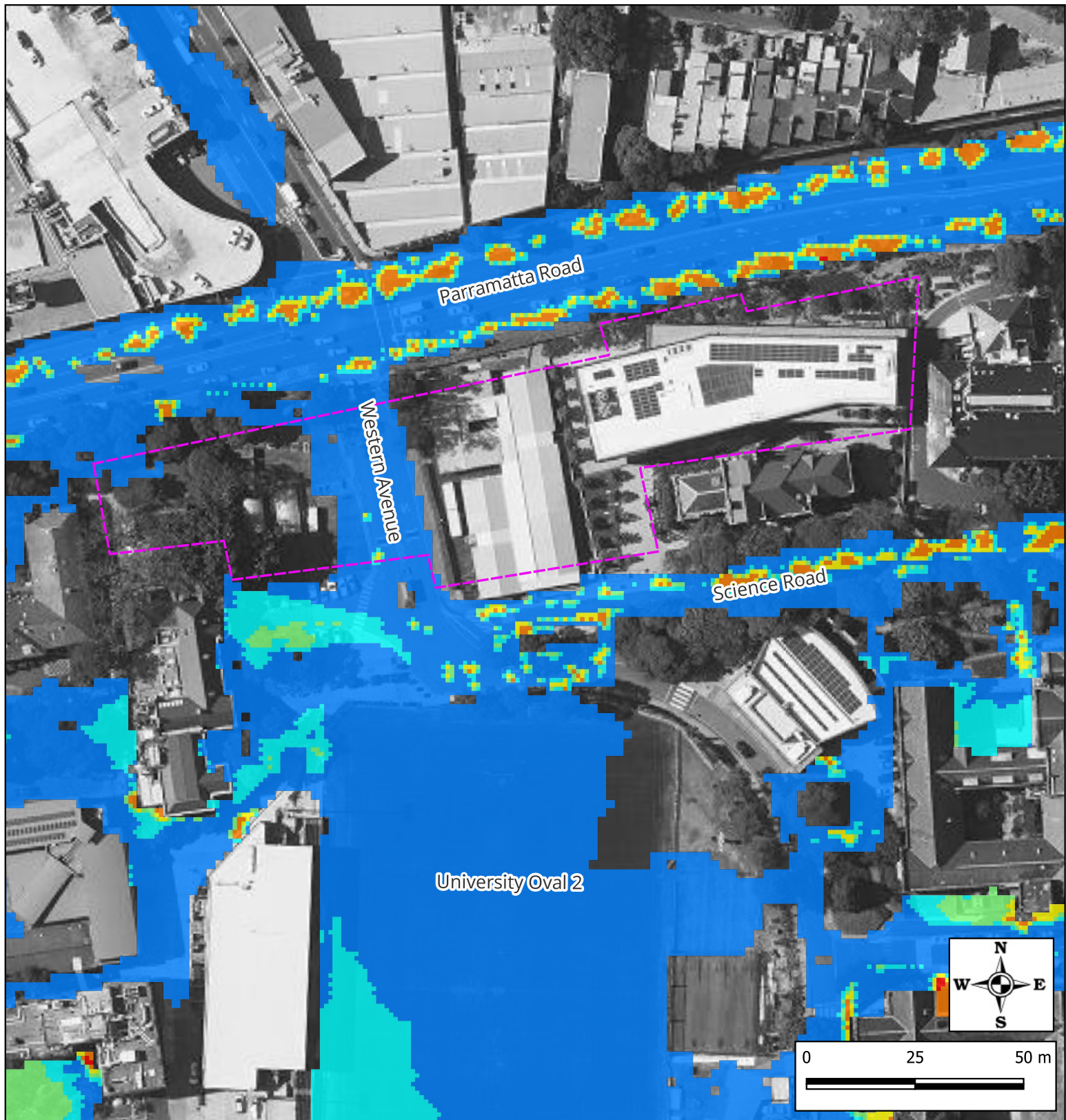
PROJECT No. **230077**

DATE: **07-2024**

SCALE: **1:1,200**

FIGURE No. **A09**





Legend

Hazard Category

H1	H4
H2	H5
H3	H6

--- CIP Envelop

TITLE: **Existing Conditions - 1% AEP event, hazards**

PROJECT: **A01 Ross St T&L Hub - Flood Risk Assessment**

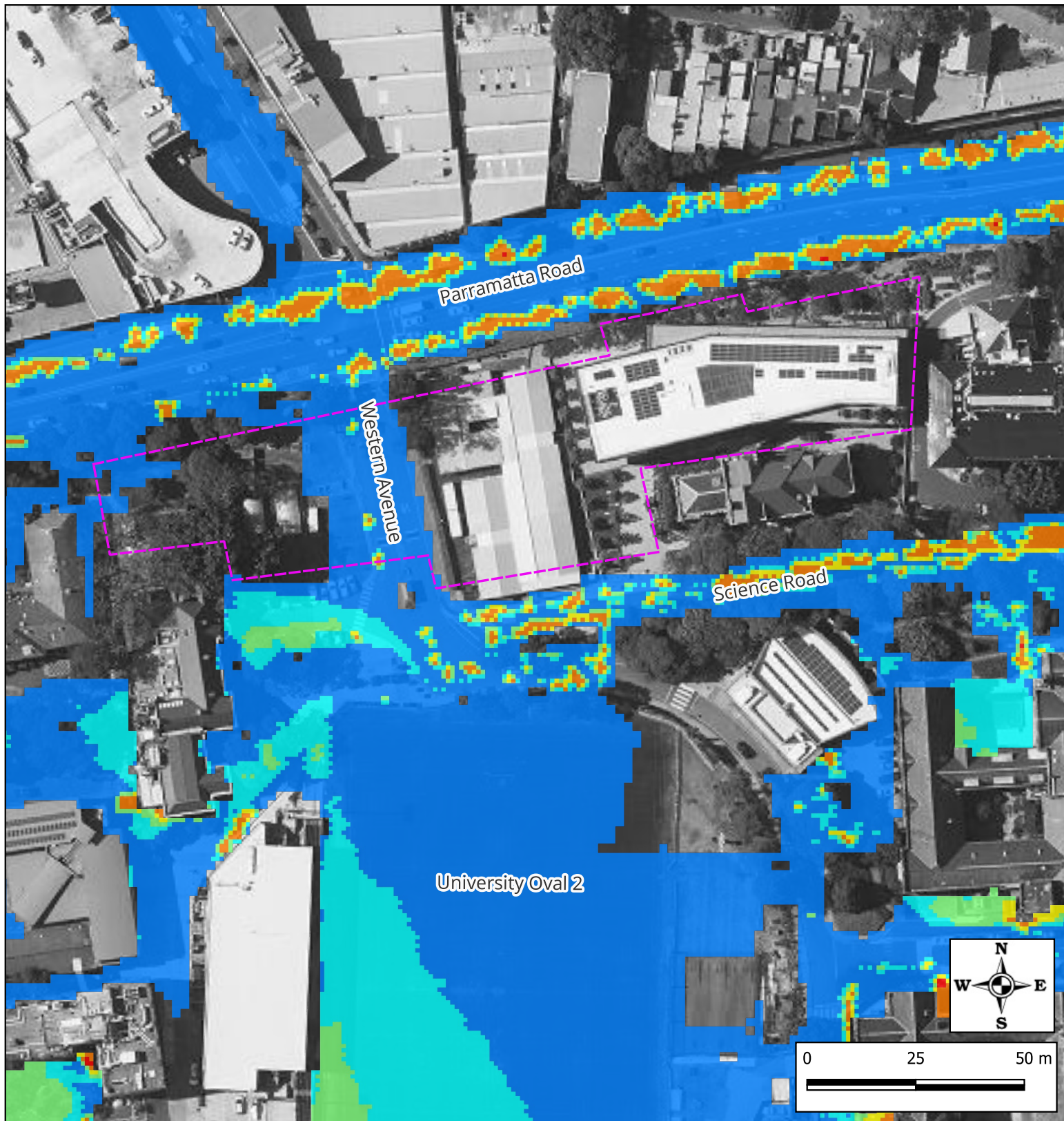
PROJECT No. **230077**

DATE: **07-2024**

SCALE: **1:1,200**

FIGURE No. **A10**

grc
HYDRO



Legend

Hazard Category

 H1	 H4
 H2	 H5
 H3	 H6

 CIP Envelop

TITLE: **Existing Conditions - 0.2% AEP event, hazards**

PROJECT: **A01 Ross St T&L Hub - Flood Risk Assessment**

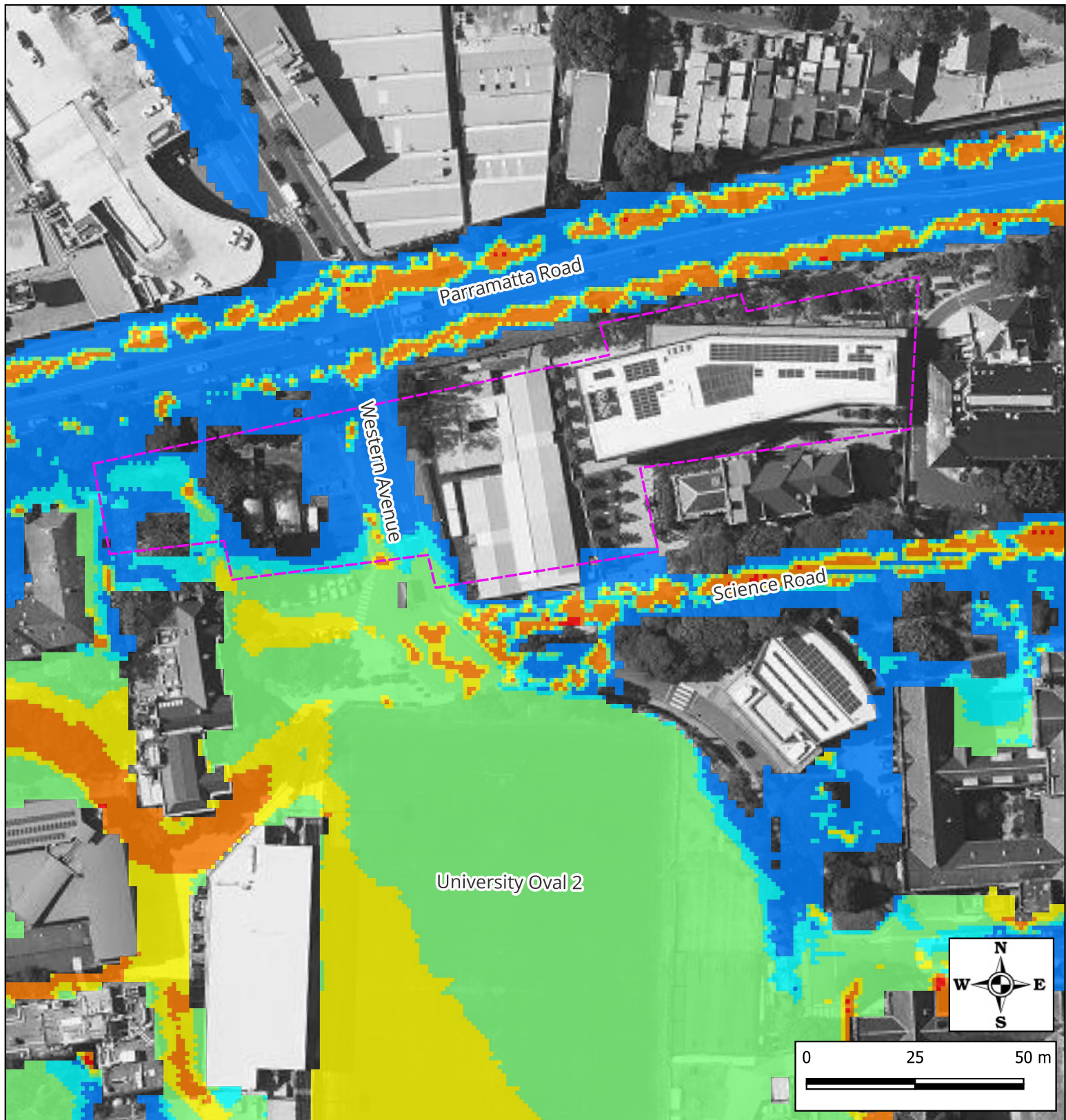
PROJECT No. **230077**

DATE: **07-2024**

SCALE: **1:1,200**

FIGURE No. **A11**





Legend

Hazard Category

■ H1	■ H4
■ H2	■ H5
■ H3	■ H6

--- CIP Envelop

TITLE: **Existing Conditions - PMF event, hazards**

PROJECT: **A01 Ross St T&L Hub - Flood Risk Assessment**

PROJECT No. **230077**

DATE: **07-2024**

SCALE: **1:1,200**

FIGURE No. **A12**





Legend

Flood Function

- Flow Conveyance
- Flood Storage
- Flood Fringe

--- CIP Envelop

TITLE: **Existing Conditions - 20% AEP event, flood function**

PROJECT: **A01 Ross St T&L Hub - Flood Risk Assessment**

PROJECT No. **230077**

DATE: **07-2024**

SCALE: **1:1,200**

FIGURE No. **A13**





Legend

Flood Function

- Flow Conveyance
- Flood Storage
- Flood Fringe

---- CIP Envelop

TITLE: **Existing Conditions - 1% AEP event, flood function**

PROJECT: **A01 Ross St T&L Hub - Flood Risk Assessment**

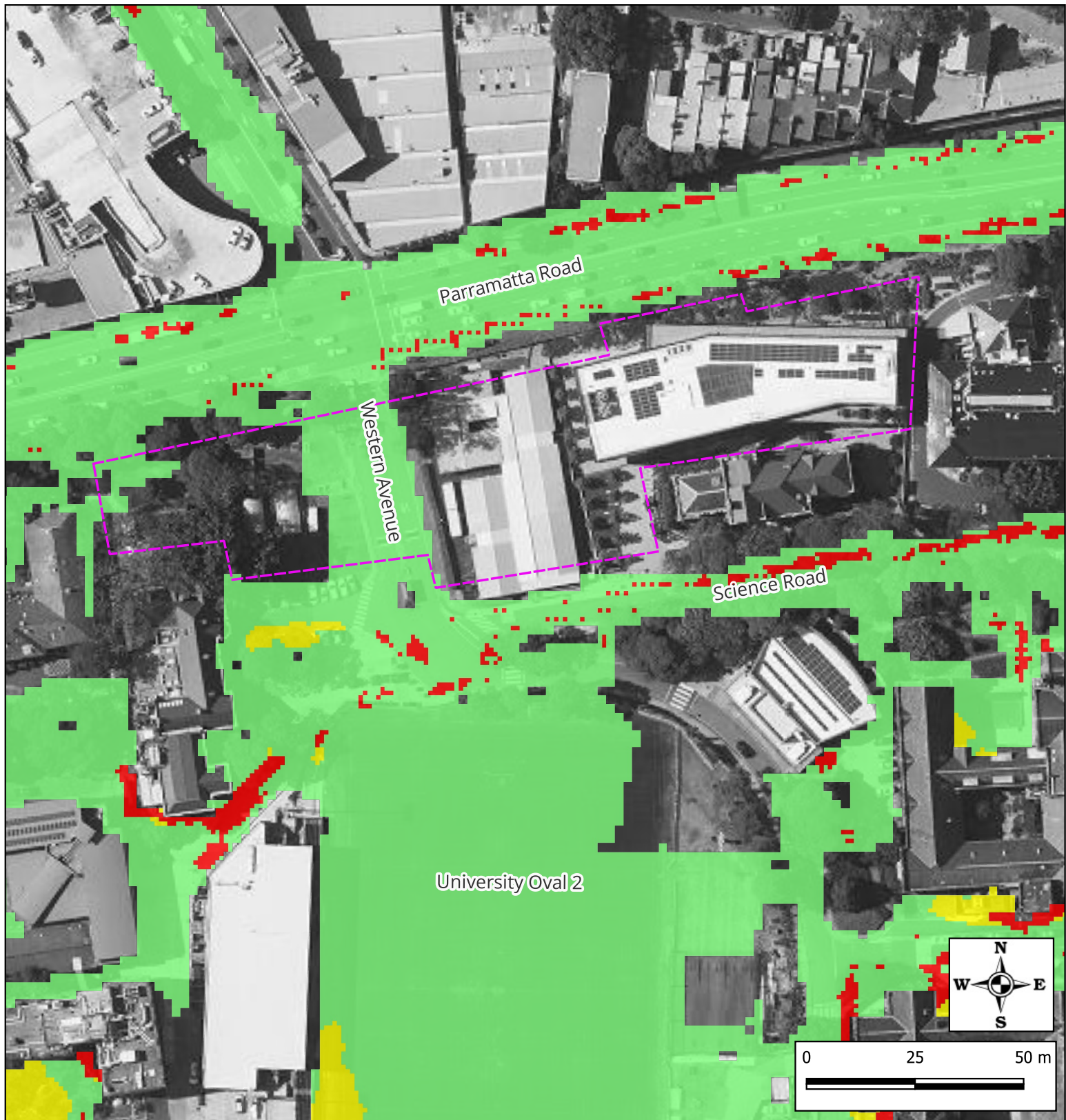
PROJECT No. **230077**

DATE: **07-2024**

SCALE: **1:1,200**

FIGURE No. **A14**





Legend

Flood Function

- Flow Conveyance
- Flood Storage
- Flood Fringe

--- CIP Envelop

TITLE: **Existing Conditions - 0.2% AEP event, flood function**

PROJECT: **A01 Ross St T&L Hub - Flood Risk Assessment**

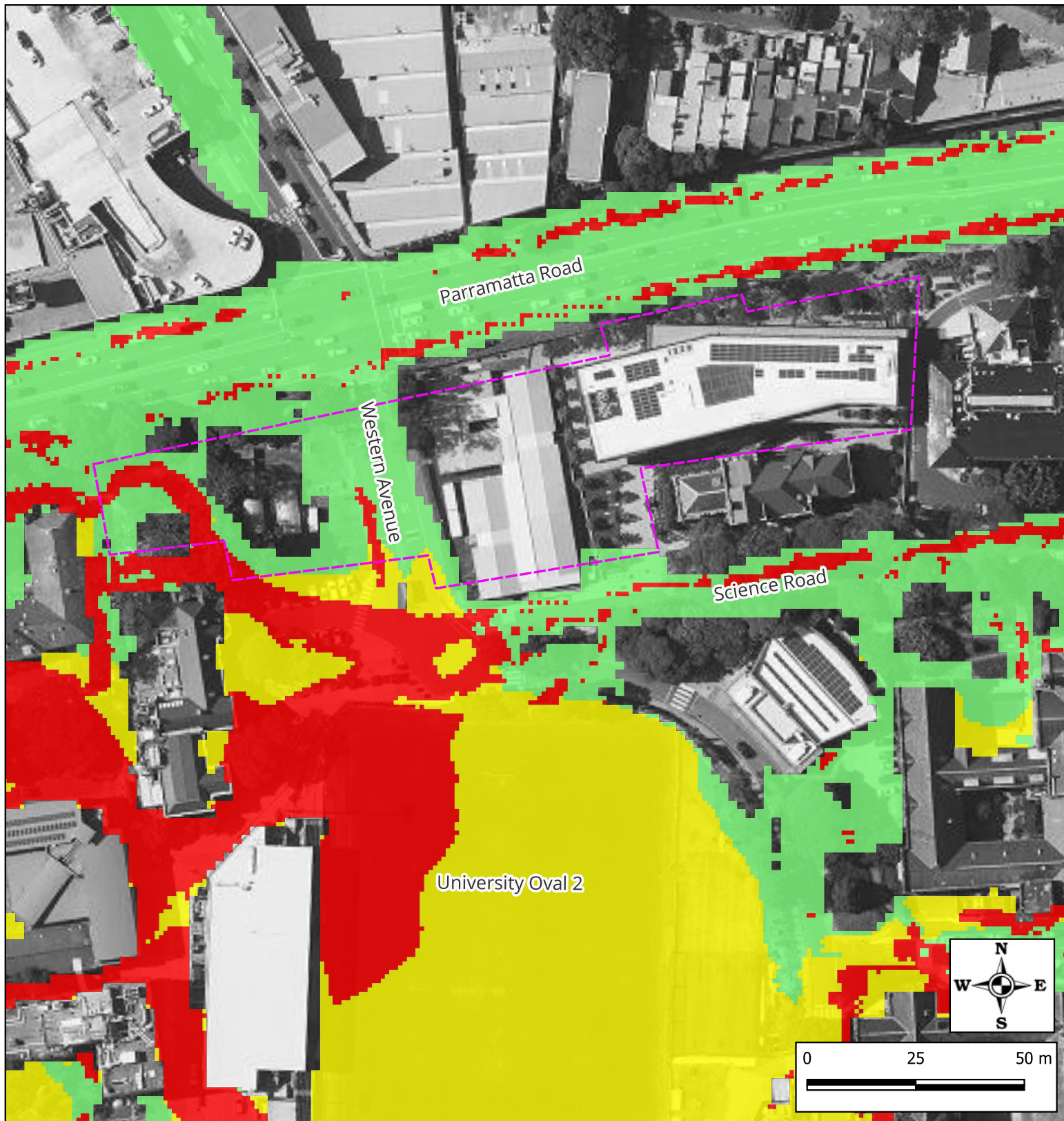
PROJECT No. **230077**

DATE: **07-2024**

SCALE: **1:1,200**

FIGURE No. **A15**





Legend

Flood Function

- Flow Conveyance
- Flood Storage
- Flood Fringe

--- CIP Envelop

TITLE: **Existing Conditions - PMF event, flood function**

PROJECT: **A01 Ross St T&L Hub - Flood Risk Assessment**

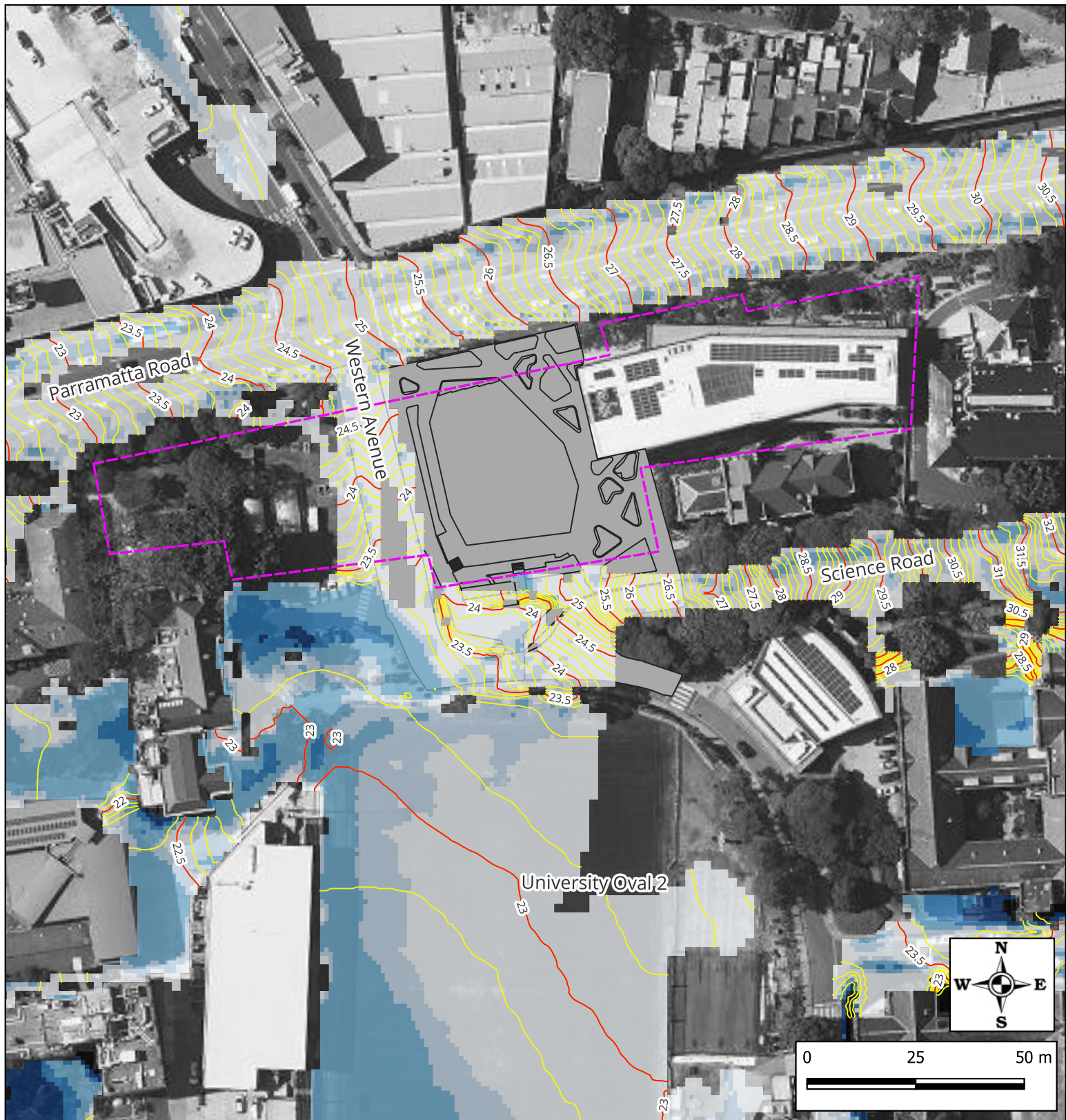
PROJECT No. **230077**

DATE: **07-2024**

SCALE: **1:1,200**

FIGURE No. **A16**





Legend

Depth(m)

< 0.05

0.30 - 0.50

CIP Envelop

0.05 - 0.10

0.50 - 1.00

Minor Level Contours (spacing = 0.5m)

0.10 - 0.30

> 1.00

Minor Level Contours (spacing = 0.1m)

Proposed Layout

TITLE: **Proposed Conditions - 20% AEP event, depths and levels**

PROJECT: **A01 Ross St T&L Hub - Flood Risk Assessment**

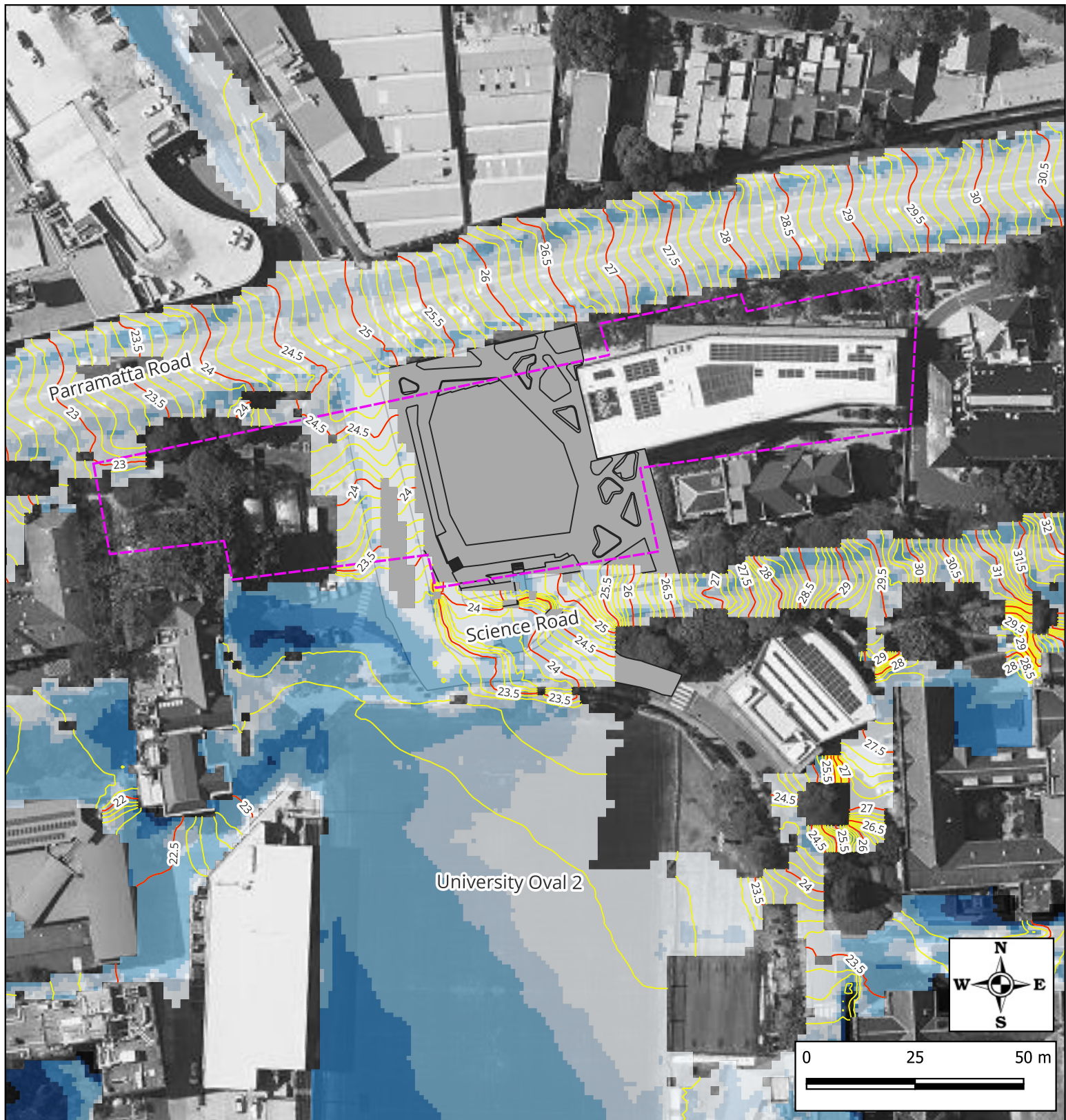
PROJECT No. **230077**

DATE: **07-2024**

SCALE: **1:1,200**

FIGURE No. **B01**

grc
HYDRO



Legend

Depth(m)

< 0.05

0.30 - 0.50

0.05 - 0.10

0.50 - 1.00

0.10 - 0.30

> 1.00

CIP Envelop

Minor Level Contours (spacing = 0.5m)

Minor Level Contours (spacing = 0.1m)

Proposed Layout

TITLE: **Proposed Conditions - 1% AEP event, depths and levels**

PROJECT: **A01 Ross St T&L Hub - Flood Risk Assessment**

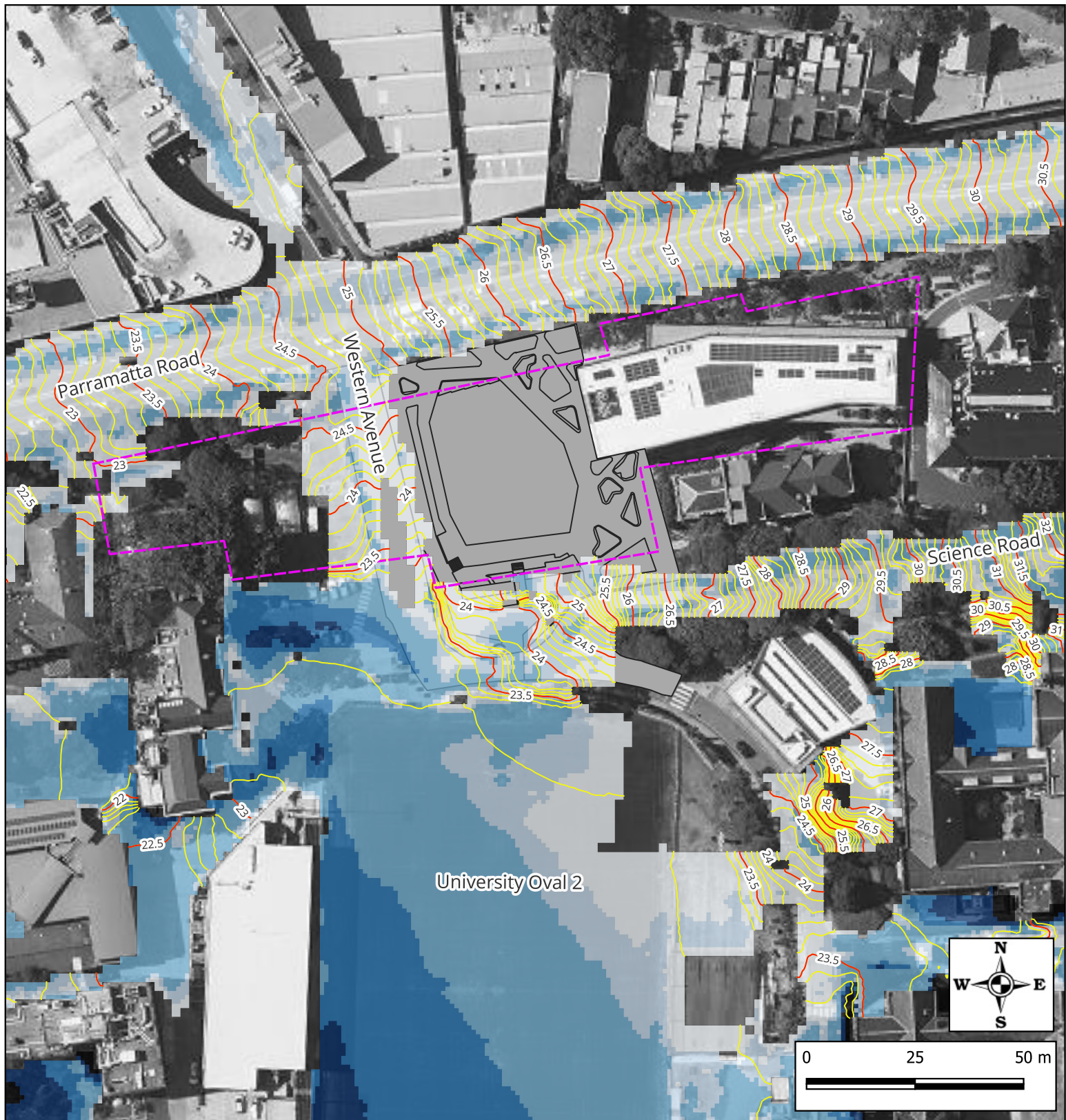
PROJECT No. **230077**

DATE: **07-2024**

SCALE: **1:1,200**

FIGURE No. **B02**

grc
HYDRO



Legend

Depth(m)

< 0.05

0.30 - 0.50

0.05 - 0.10

0.50 - 1.00

0.10 - 0.30

> 1.00

CIP Envelop

Minor Level Contours (spacing = 0.5m)

Minor Level Contours (spacing = 0.1m)

Proposed Layout

TITLE: **Proposed Conditions - 0.2% AEP event, depths and levels**

PROJECT: **A01 Ross St T&L Hub - Flood Risk Assessment**

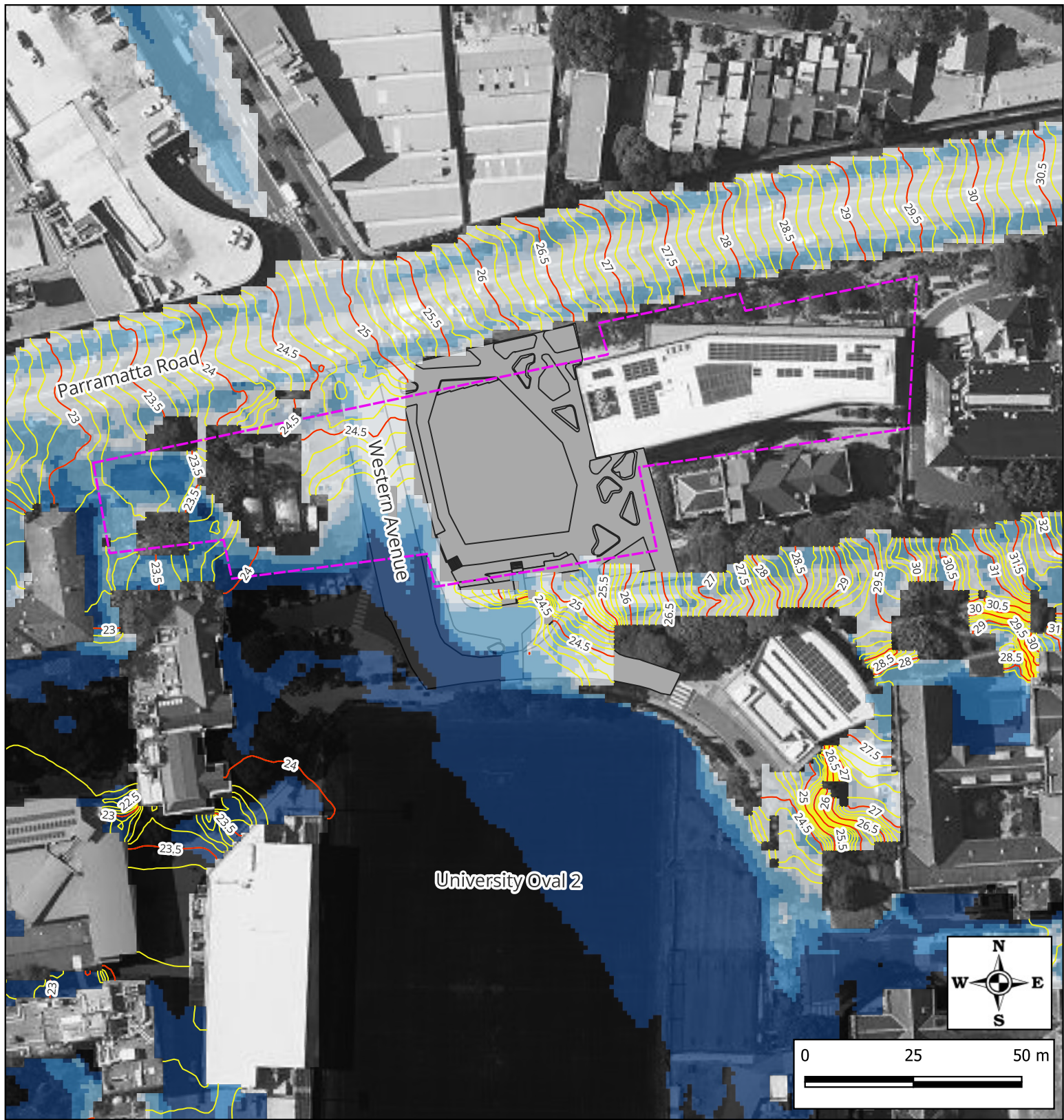
PROJECT No. **230077**

DATE: **07-2024**

SCALE: **1:1,200**

FIGURE No. **B03**

grc
HYDRO



Legend

Depth(m)

< 0.05

0.30 - 0.50

0.05 - 0.10

0.50 - 1.00

0.10 - 0.30

> 1.00

CIP Envelop

Minor Level Contours (spacing = 0.5m)

Minor Level Contours (spacing = 0.1m)

Proposed Layout

TITLE: **Proposed Conditions - PMF event, depths and levels**

PROJECT: **A01 Ross St T&L Hub - Flood Risk Assessment**

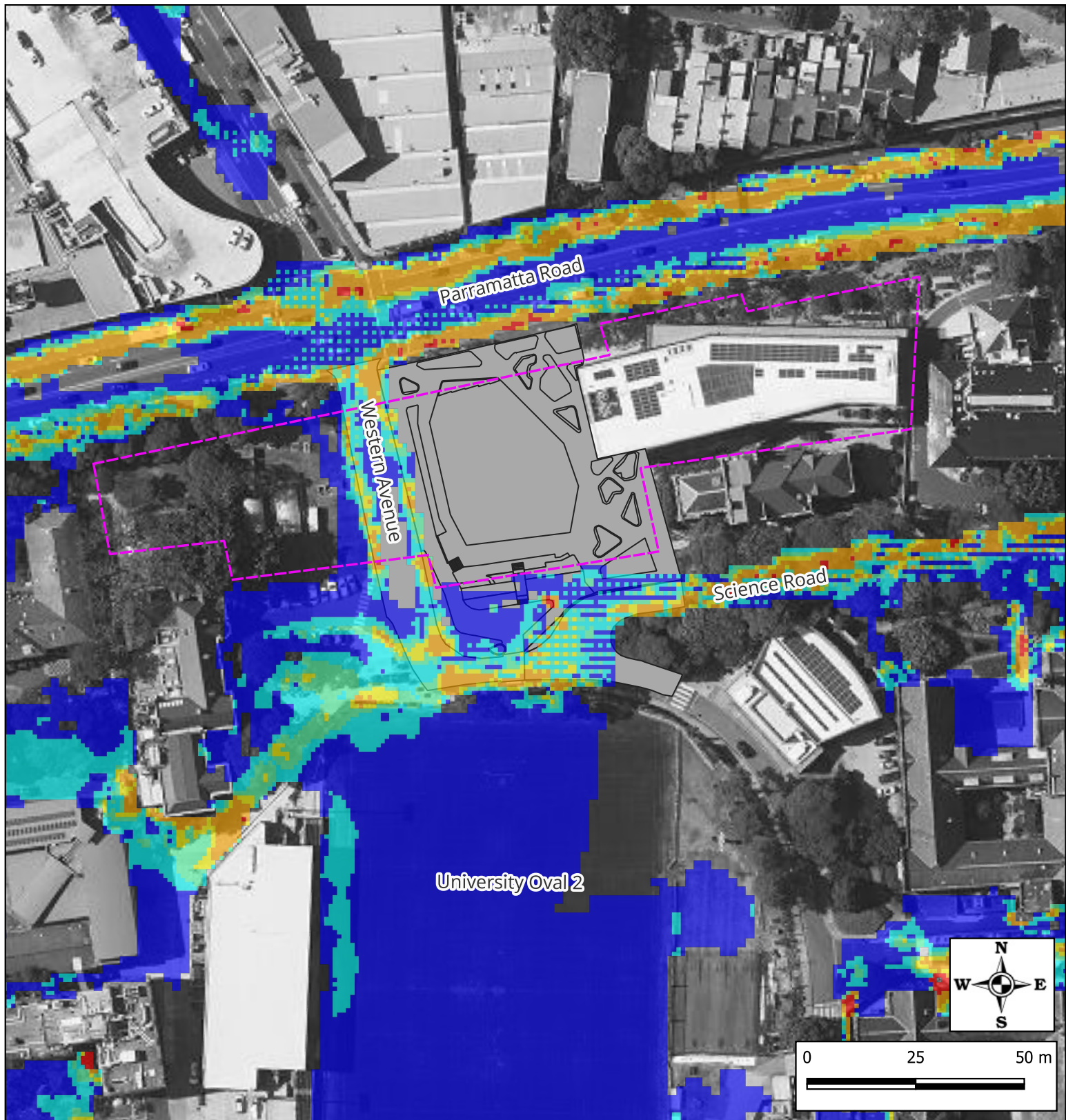
PROJECT No. **230077**

DATE: **07-2024**

SCALE: **1:1,200**

FIGURE No. **B04**





Legend

Velocity(m/s)

< 0.25

0.25 to 0.50

0.50 to 0.75

0.75 to 1.00

1.00 to 2.00

> 2.00

CIP Envelop

Proposed Layout

TITLE: **Proposed Conditions - 20% AEP event, velocities and flows**

PROJECT: **A01 Ross St T&L Hub - Flood Risk Assessment**

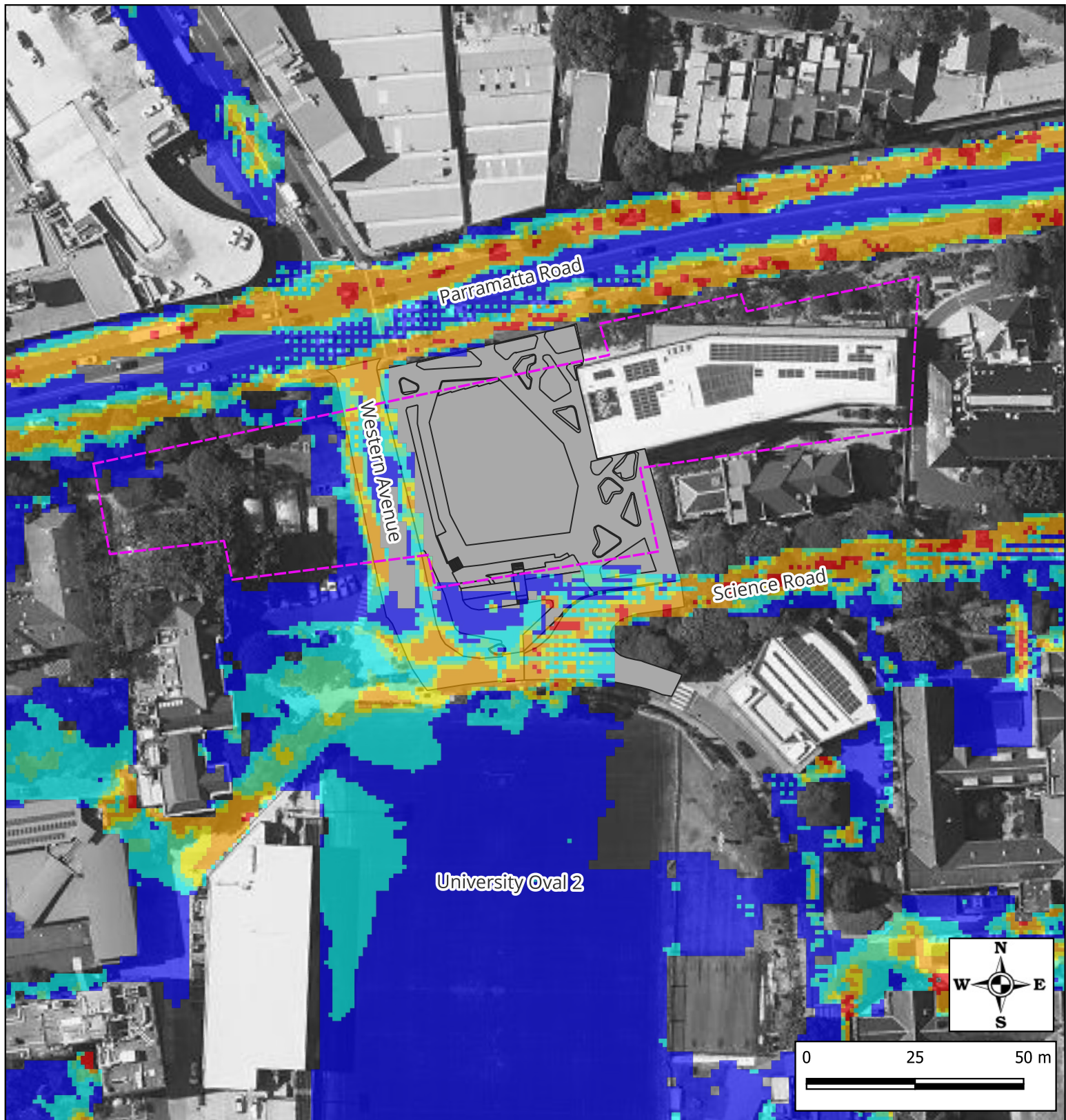
PROJECT No. **230077**

DATE: **07-2024**

SCALE: **1:1,200**

FIGURE No. **B05**

grc
HYDRO



Legend

Velocity(m/s)

< 0.25

0.25 to 0.50

0.50 to 0.75

0.75 to 1.00

1.00 to 2.00

> 2.00

CIP Envelop

Proposed Layout

TITLE: **Proposed Conditions - 1% AEP event, velocities and flows**

PROJECT: **A01 Ross St T&L Hub - Flood Risk Assessment**

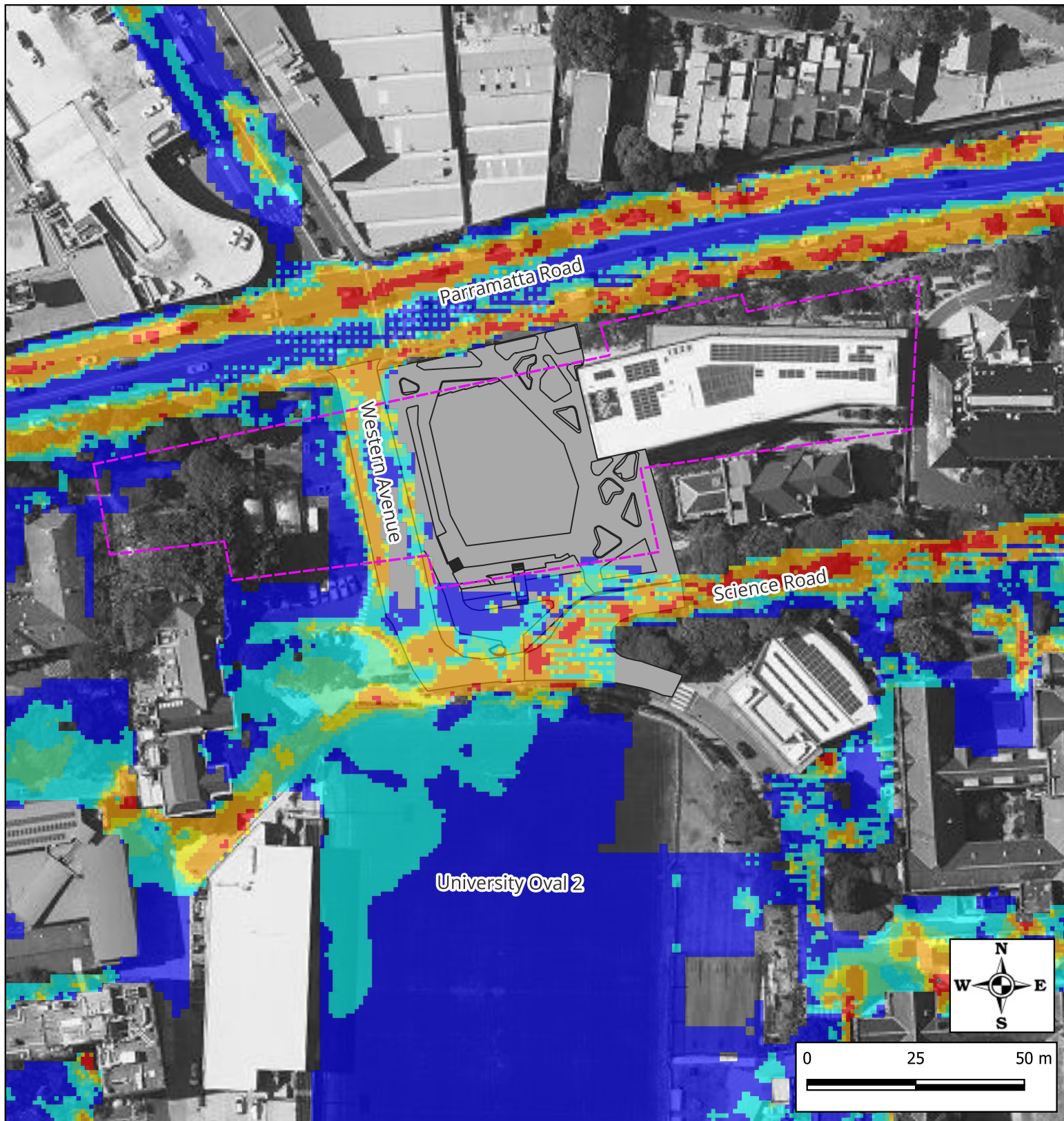
DATE: **07-2024**

SCALE: **1:1,200**

PROJECT No. **230077**

FIGURE No. **B06**

grc
HYDRO



Legend

Velocity(m/s)

< 0.25

0.75 to 1.00

--- CIP Envelop

0.25 to 0.50

1.00 to 2.00

■ Proposed Layout

0.50 to 0.75

> 2.00

TITLE: **Proposed Conditions - 0.2% AEP event, velocities and flows**

PROJECT: **A01 Ross St T&L Hub - Flood Risk Assessment**

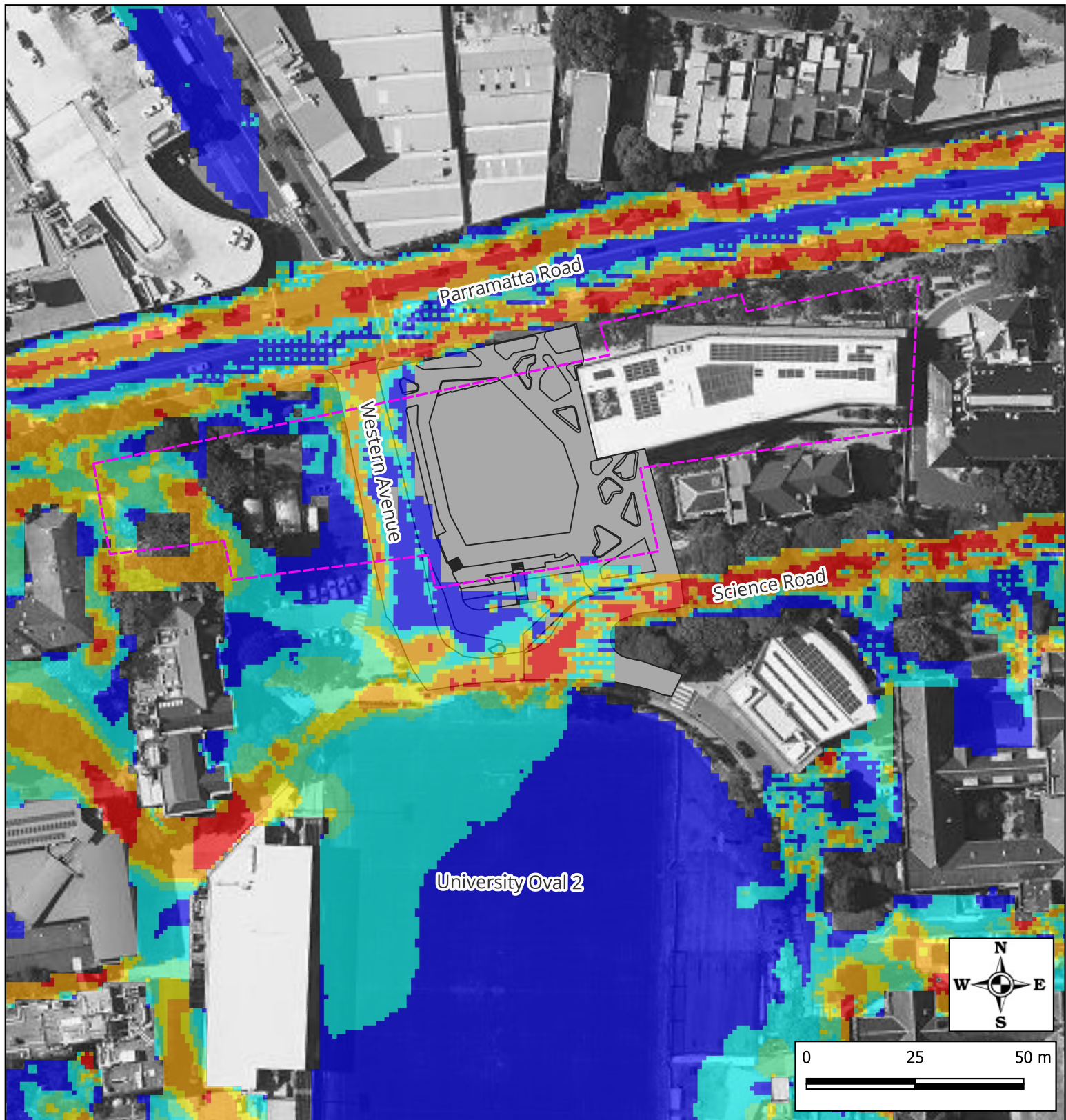
PROJECT No. **230077**

DATE: **07-2024**

SCALE: **1:1,200**

FIGURE No. **B07**

grc
HYDRO



Legend

Velocity(m/s)

< 0.25

0.25 to 0.50

0.50 to 0.75

0.75 to 1.00

1.00 to 2.00

> 2.00

CIP Envelop

Proposed Layout

TITLE: **Proposed Conditions - PMF event, velocities and flows**

PROJECT: **A01 Ross St T&L Hub - Flood Risk Assessment**

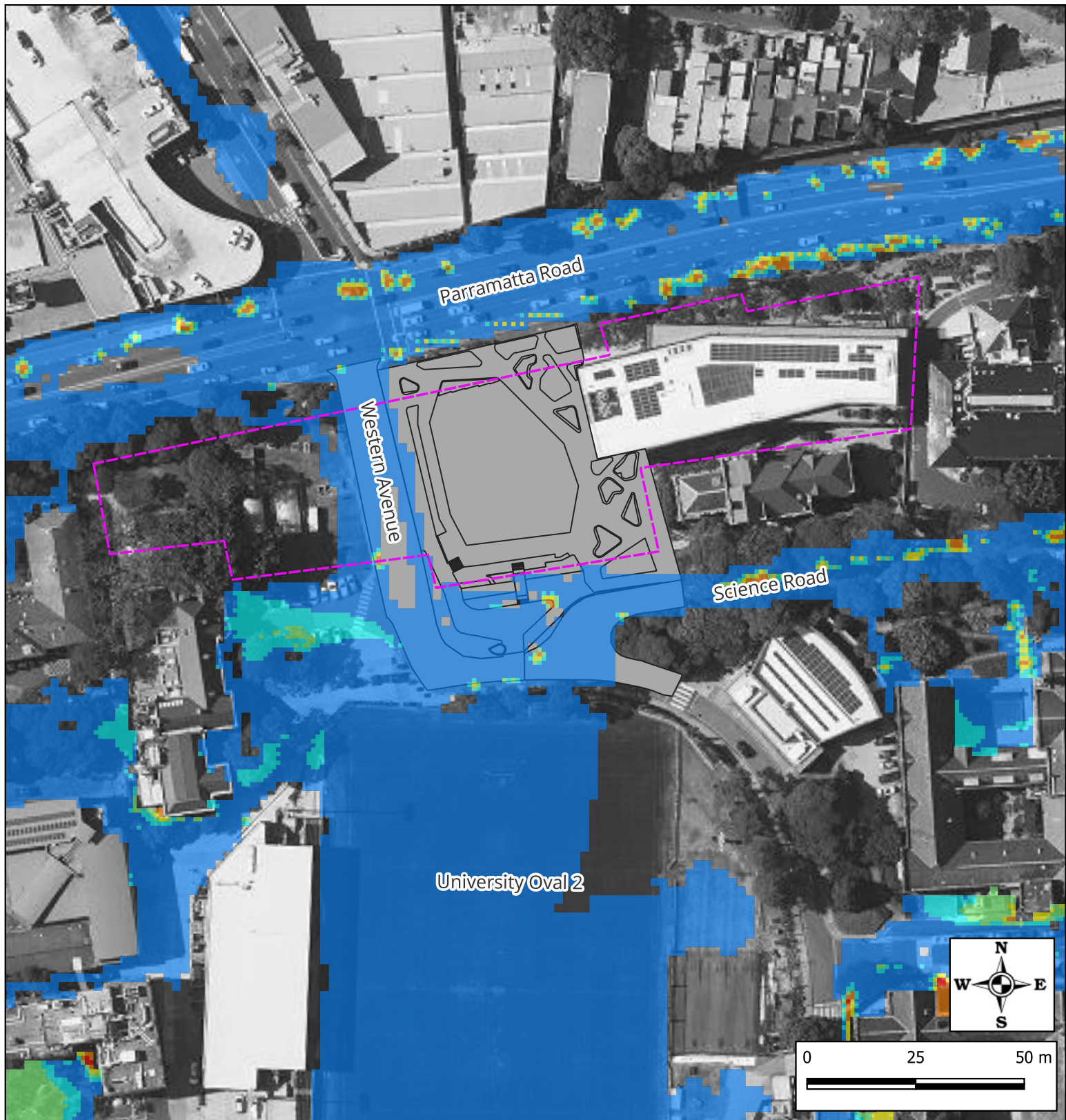
DATE: **07-2024**

PROJECT No. **230077**

SCALE: **1:1,200**

FIGURE No. **B08**

grc
HYDRO



Legend

Hazard Category

■ H1	■ H4
■ H2	■ H5
■ H3	■ H6

--- CIP Envelope

Proposed Layout

TITLE: **Proposed Conditions - 20% AEP event, hazards**

PROJECT: **A01 Ross St T&L Hub - Flood Risk Assessment**

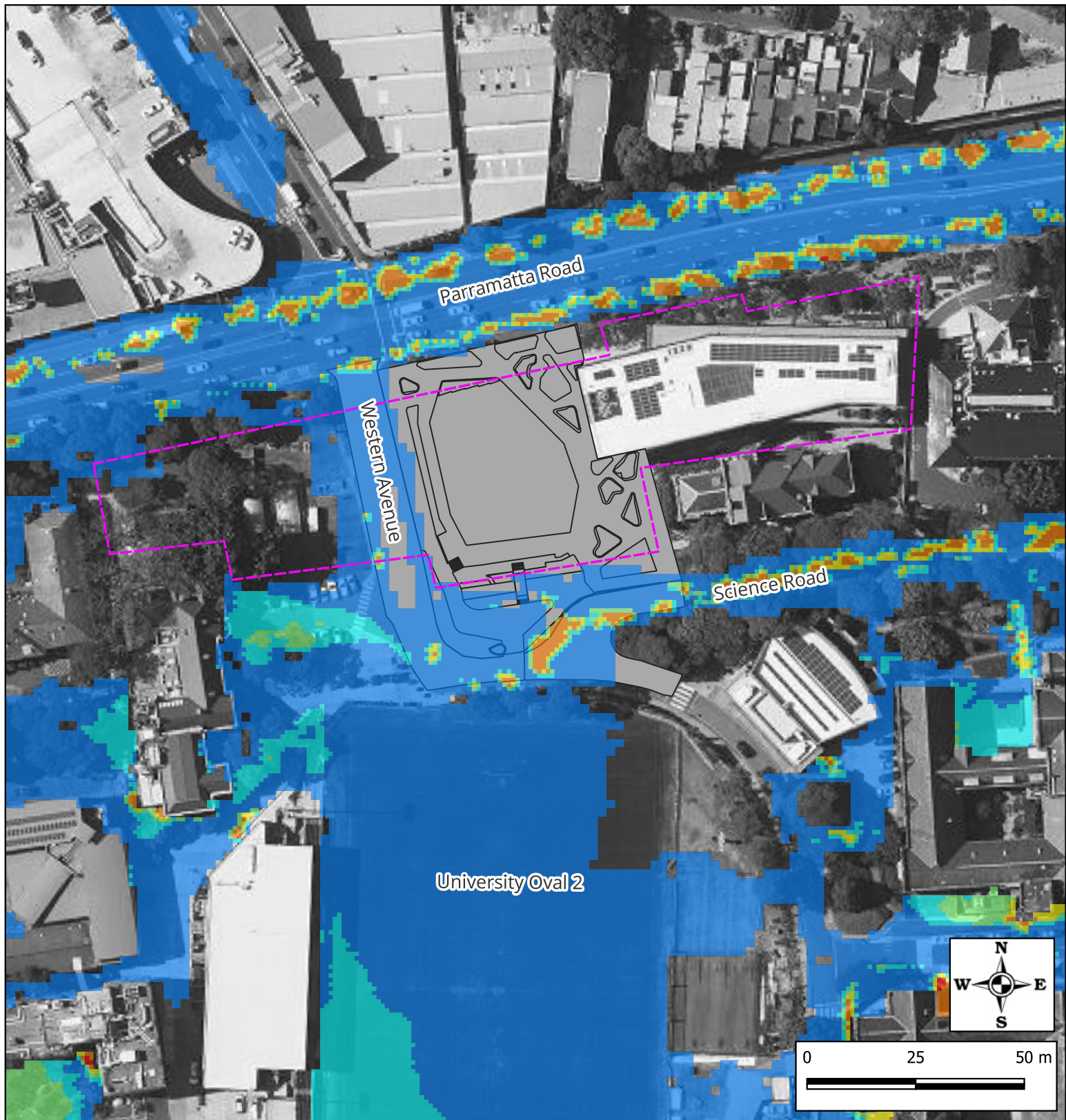
PROJECT No. **230077**

DATE: **07-2024**

SCALE: **1:1,200**

FIGURE No. **B09**





Legend

Hazard Category

■ H1	■ H4
■ H2	■ H5
■ H3	■ H6

--- CIP Envelope

Proposed Layout

TITLE: **Proposed Conditions - 1% AEP event, hazards**

PROJECT: **A01 Ross St T&L Hub - Flood Risk Assessment**

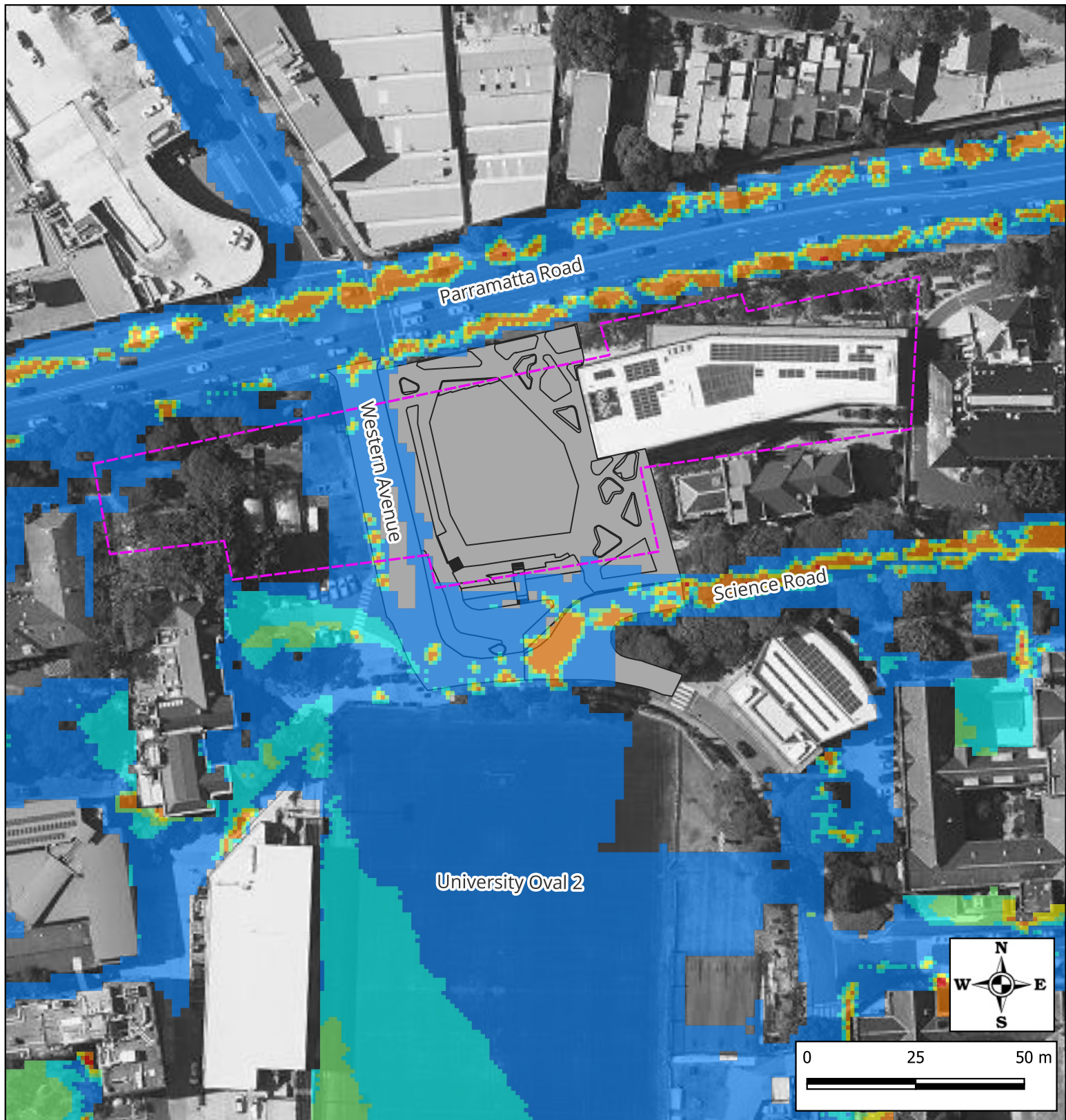
PROJECT No. **230077**

DATE: **07-2024**

SCALE: **1:1,200**

FIGURE No. **B10**





Legend

Hazard Category

■ H1	■ H4
■ H2	■ H5
■ H3	■ H6

--- CIP Envelope

Proposed Layout

TITLE: **Proposed Conditions - 0.2% AEP event, hazards**

PROJECT: **A01 Ross St T&L Hub - Flood Risk Assessment**

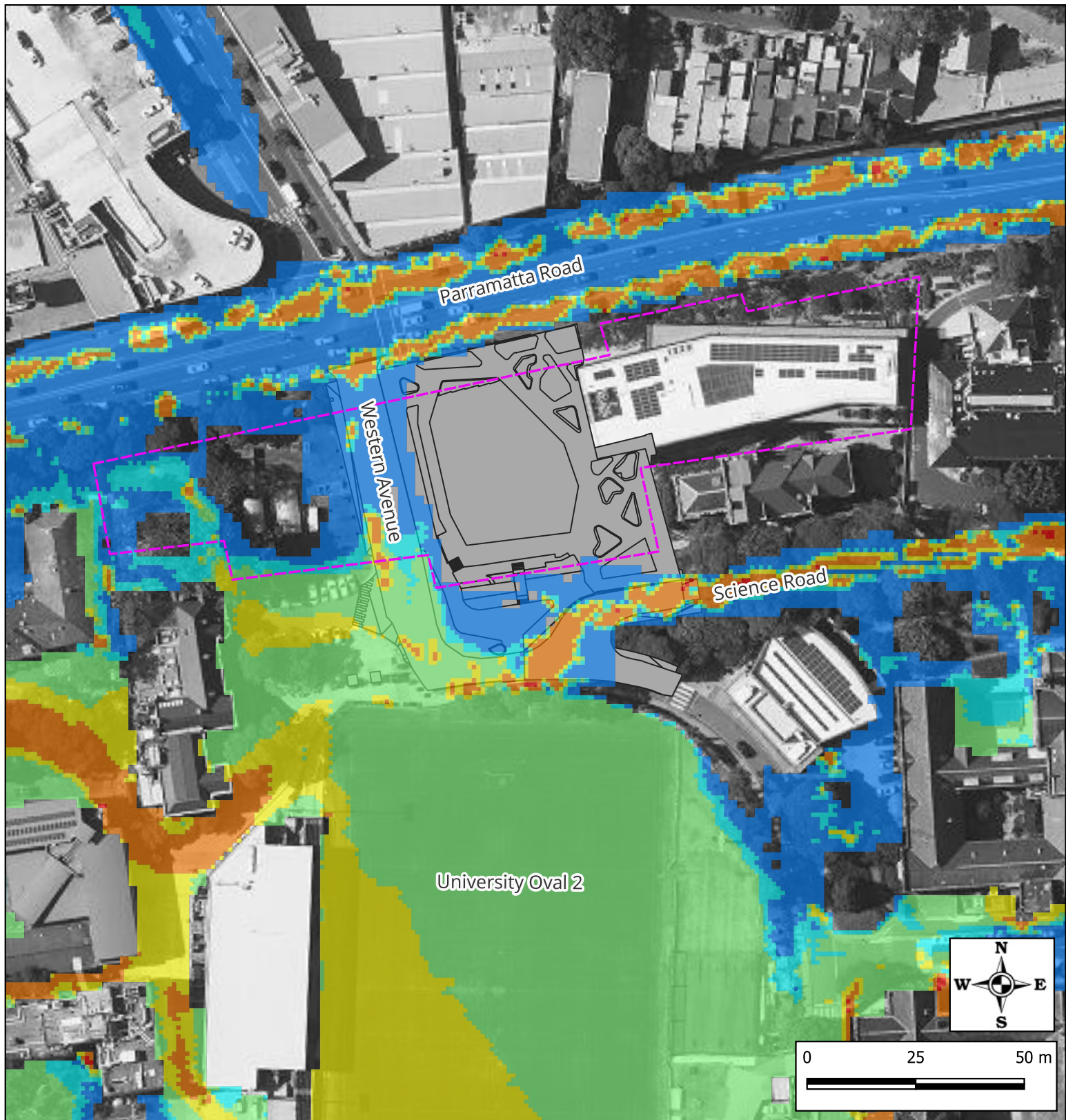
PROJECT No. **230077**

DATE: **07-2024**

SCALE: **1:1,200**

FIGURE No. **B11**





Legend

Hazard Category

■ H1	■ H4
■ H2	■ H5
■ H3	■ H6

--- CIP Envelope

■ Proposed Layout

TITLE: **Proposed Conditions - PMF event, hazards**

PROJECT: **A01 Ross St T&L Hub - Flood Risk Assessment**

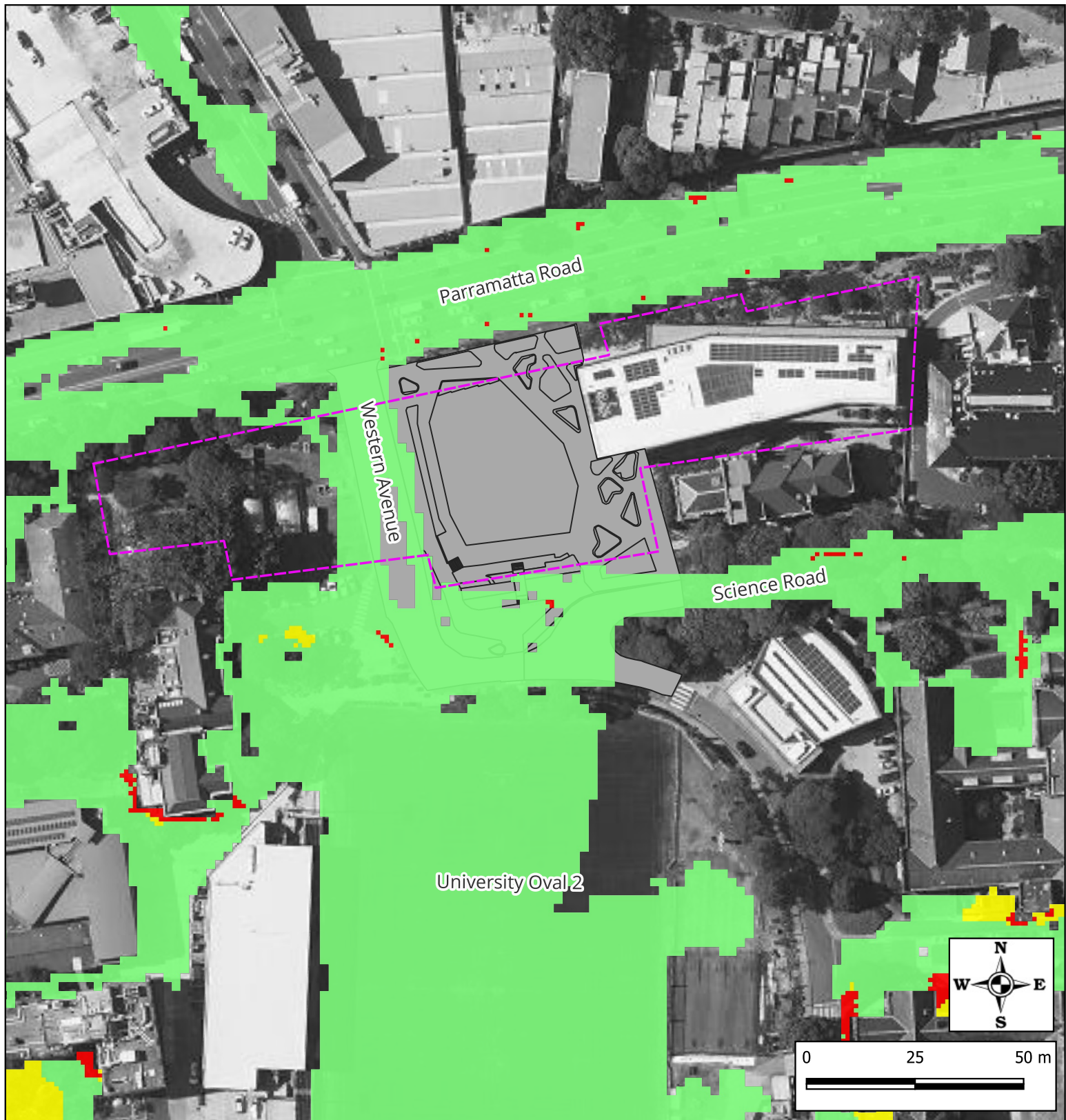
PROJECT No. **230077**

DATE: **07-2024**

SCALE: **1:1,200**

FIGURE No. **B12**





Legend

Flood Function

- Flow Conveyance
- Flood Storage
- Flood Fringe

--- CIP Envelop

■ Proposed Layout

TITLE: **Proposed Conditions - 20% AEP event, flood function**

PROJECT: **A01 Ross St T&L Hub - Flood Risk Assessment**

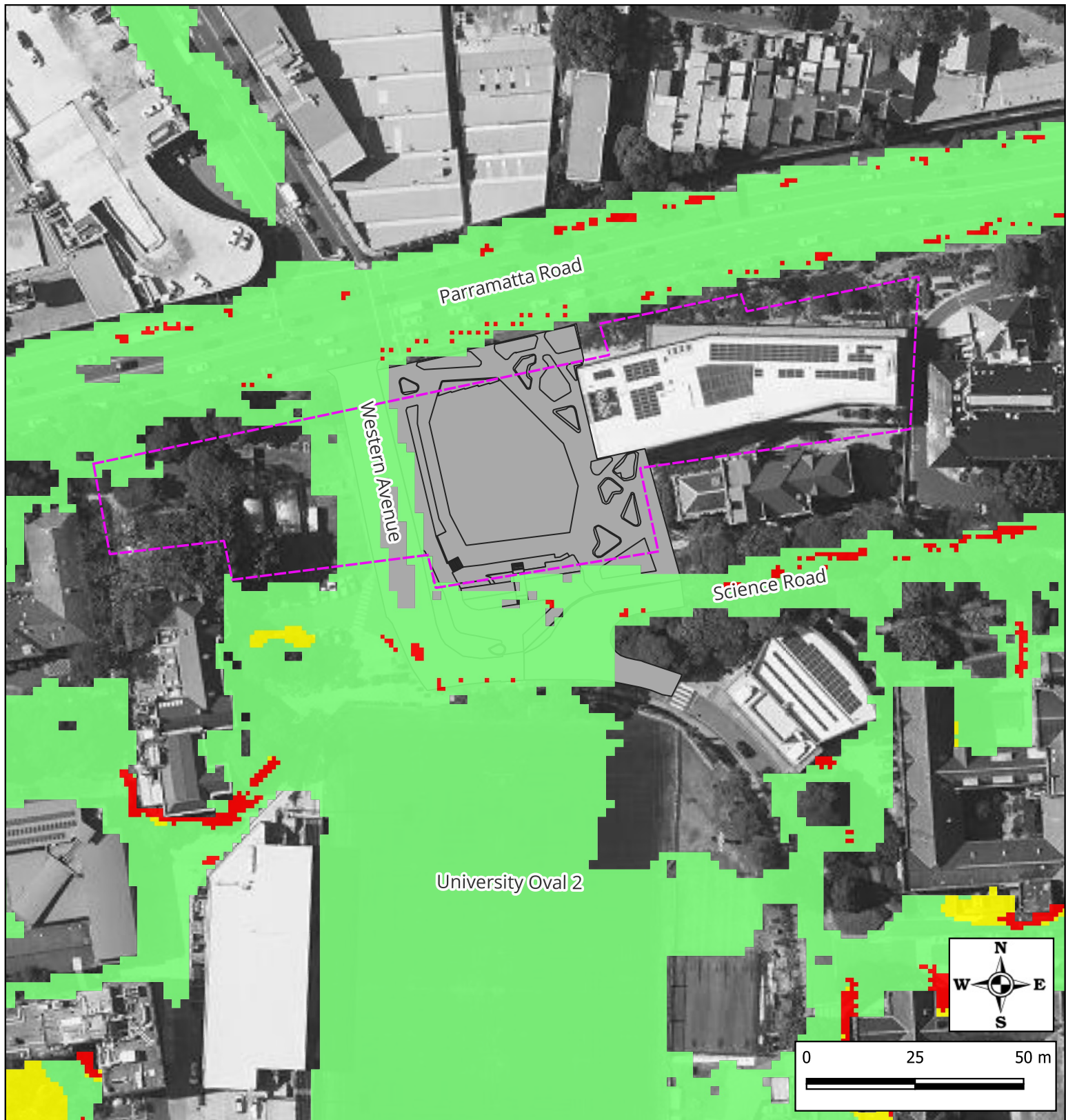
PROJECT No. **230077**

DATE: **07-2024**

SCALE: **1:1,200**

FIGURE No. **B13**





Legend

Flood Function

- Flow Conveyance
- Flood Storage
- Flood Fringe

--- CIP Envelop

■ Proposed Layout

TITLE: **Proposed Conditions - 1% AEP event, flood function**

PROJECT: **A01 Ross St T&L Hub - Flood Risk Assessment**

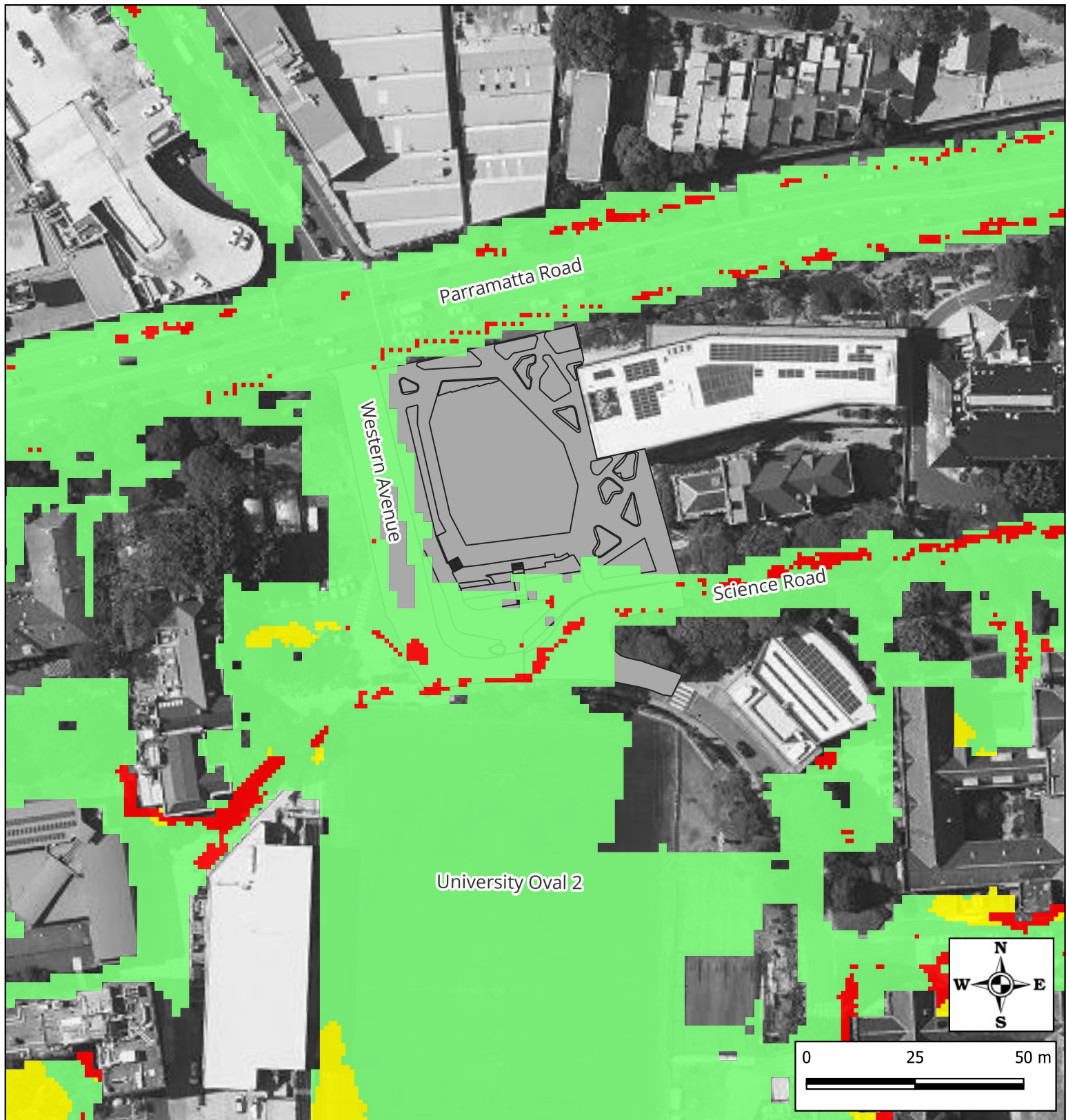
PROJECT No. **230077**

DATE: **07-2024**

SCALE: **1:1,200**

FIGURE No. **B14**





Legend

Flood Function

- Flow Conveyance
- Flood Storage
- Flood Fringe

CIP Envelop

Proposed Layout

TITLE: **Proposed Conditions - 0.2% AEP event, flood function**

PROJECT: **A01 Ross St T&L Hub - Flood Risk Assessment**

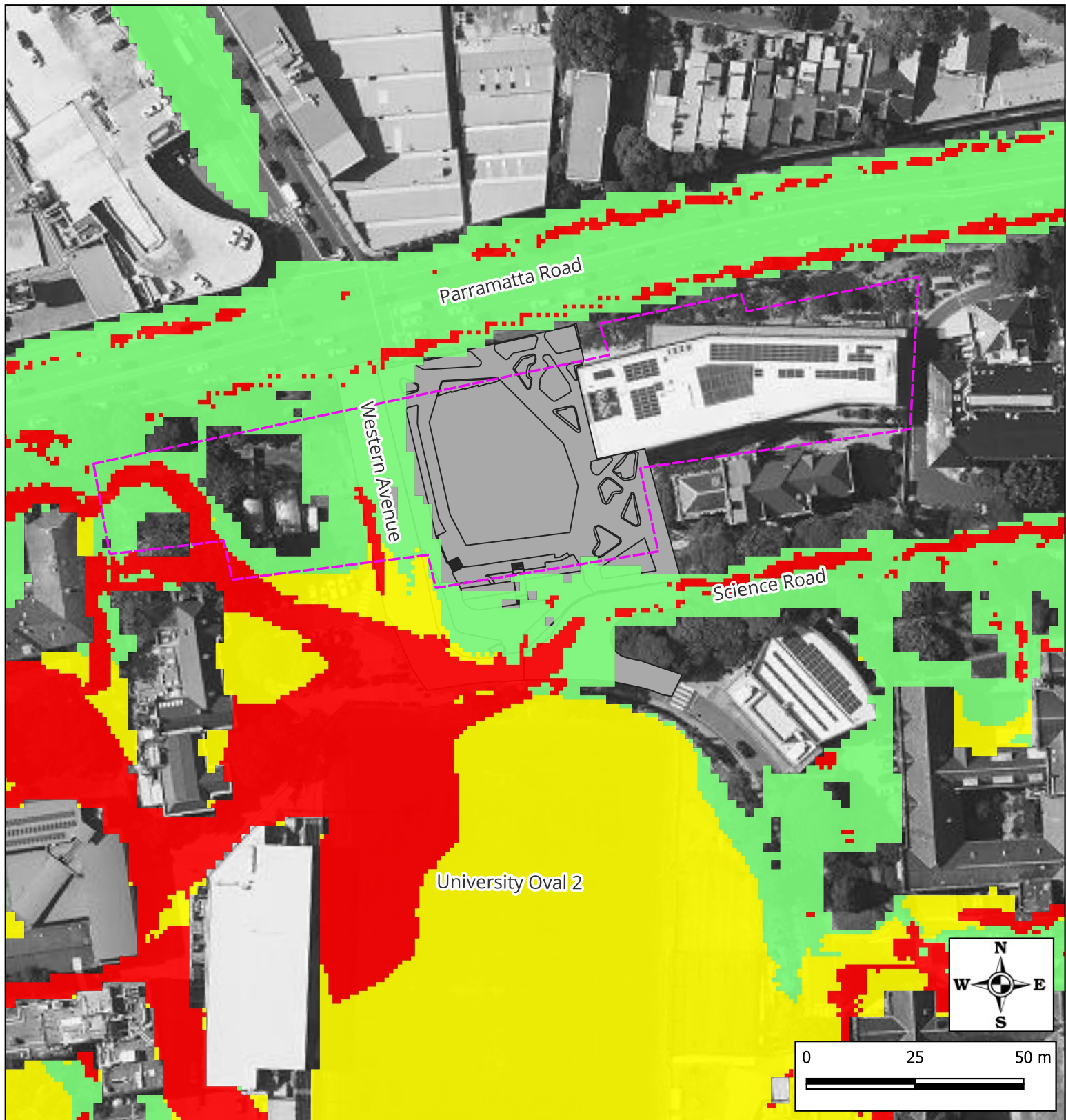
PROJECT No. **230077**

DATE: **07-2024**

SCALE: **1:1,200**

FIGURE No. **B15**





Legend

Flood Function

- Flow Conveyance
- Flood Storage
- Flood Fringe

CIP Envelop

Proposed Layout

TITLE: **Proposed Conditions - PMF event, flood function**

PROJECT: **A01 Ross St T&L Hub - Flood Risk Assessment**

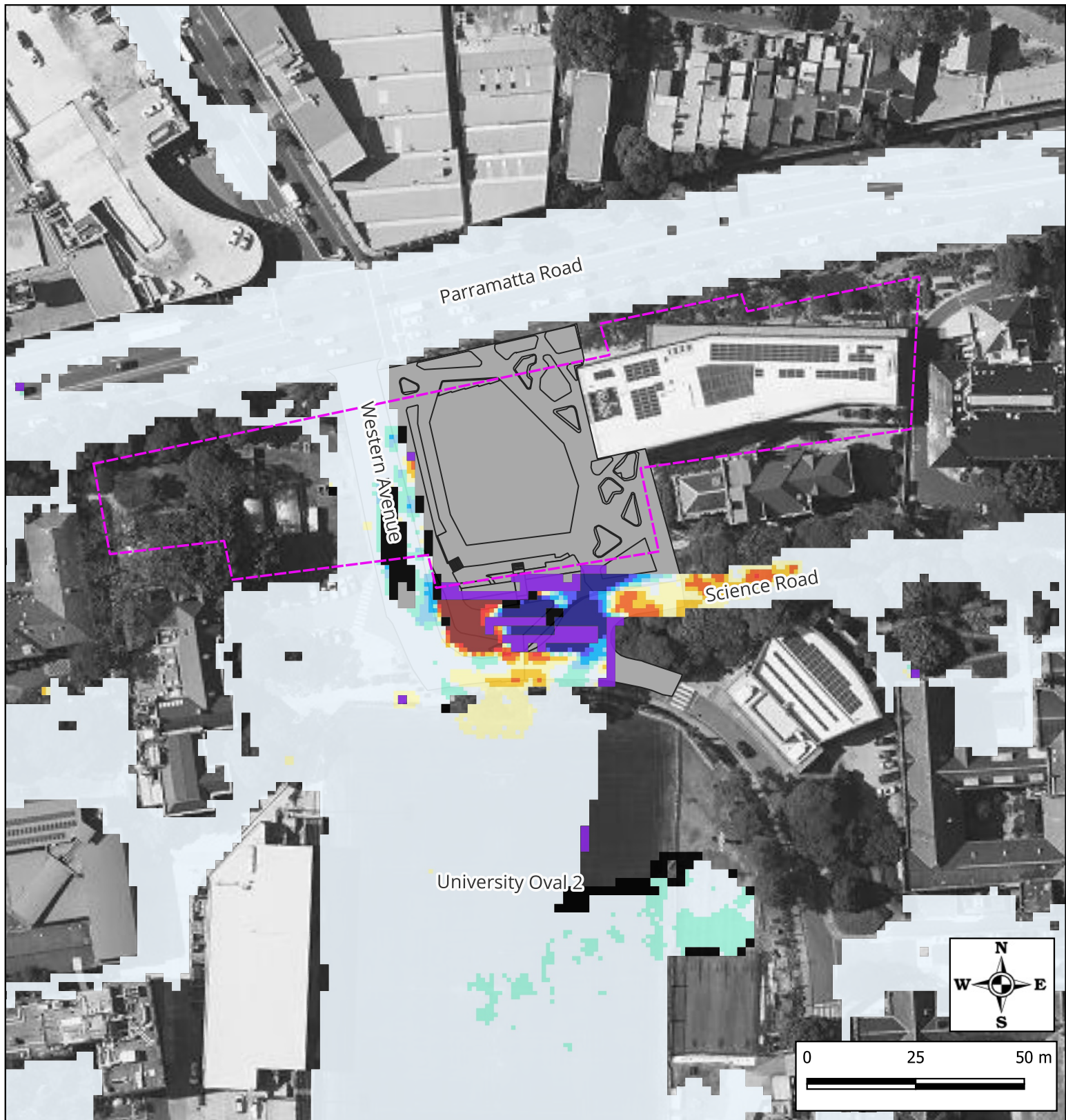
PROJECT No. **230077**

DATE: **07-2024**

SCALE: **1:1,200**

FIGURE No. **B16**





Level Impact

Was wet - now dry	50mm to 30mm decrease	30mm to 50mm increase	Was dry - now wet
> 150mm decrease	30mm to 10mm decrease	50mm to 100mm increase	CIP_Envelop
150mm to 100mm decrease	No Change (+/- 10mm)	100mm to 150mm increase	Proposed Layout
100mm to 50mm decrease	10mm to 30mm increase	> 150mm increase	

TITLE: **Flood level impact map – 20% AEP event**

PROJECT: **A01 Ross St T&L Hub - Flood Risk Assessment**

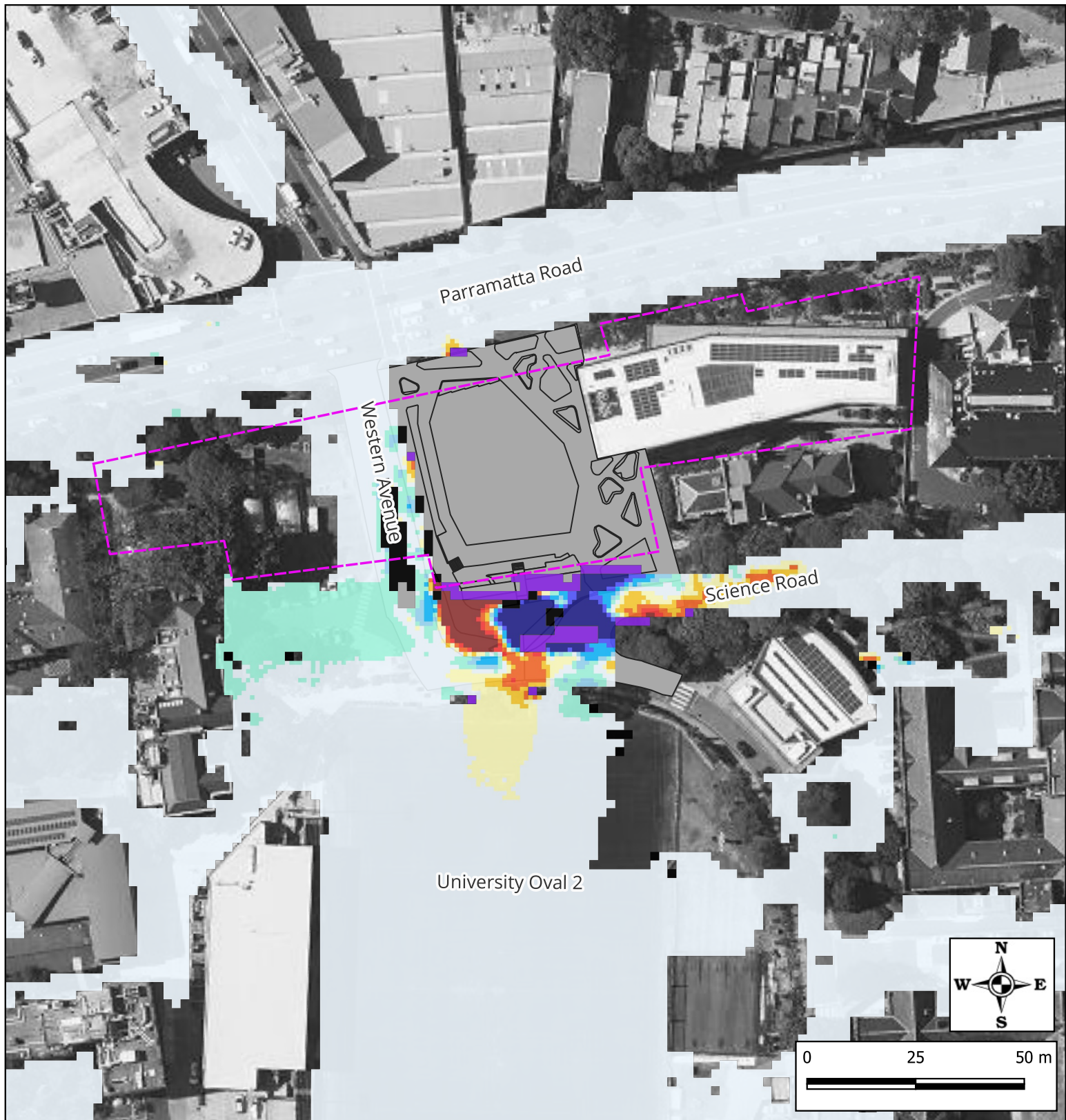
PROJECT No. **230077**

DATE: **07-2024**

SCALE: **1:1,200**

FIGURE No. **C01**





Level Impact

Was wet - now dry	50mm to 30mm decrease	30mm to 50mm increase	Was dry - now wet
> 150mm decrease	30mm to 10mm decrease	50mm to 100mm increase	CIP_Envelop
150mm to 100mm decrease	No Change (+/- 10mm)	100mm to 150mm increase	Proposed Layout
100mm to 50mm decrease	10mm to 30mm increase	> 150mm increase	

TITLE: **Flood level impact map – 1% AEP event**

PROJECT: **A01 Ross St T&L Hub - Flood Risk Assessment**

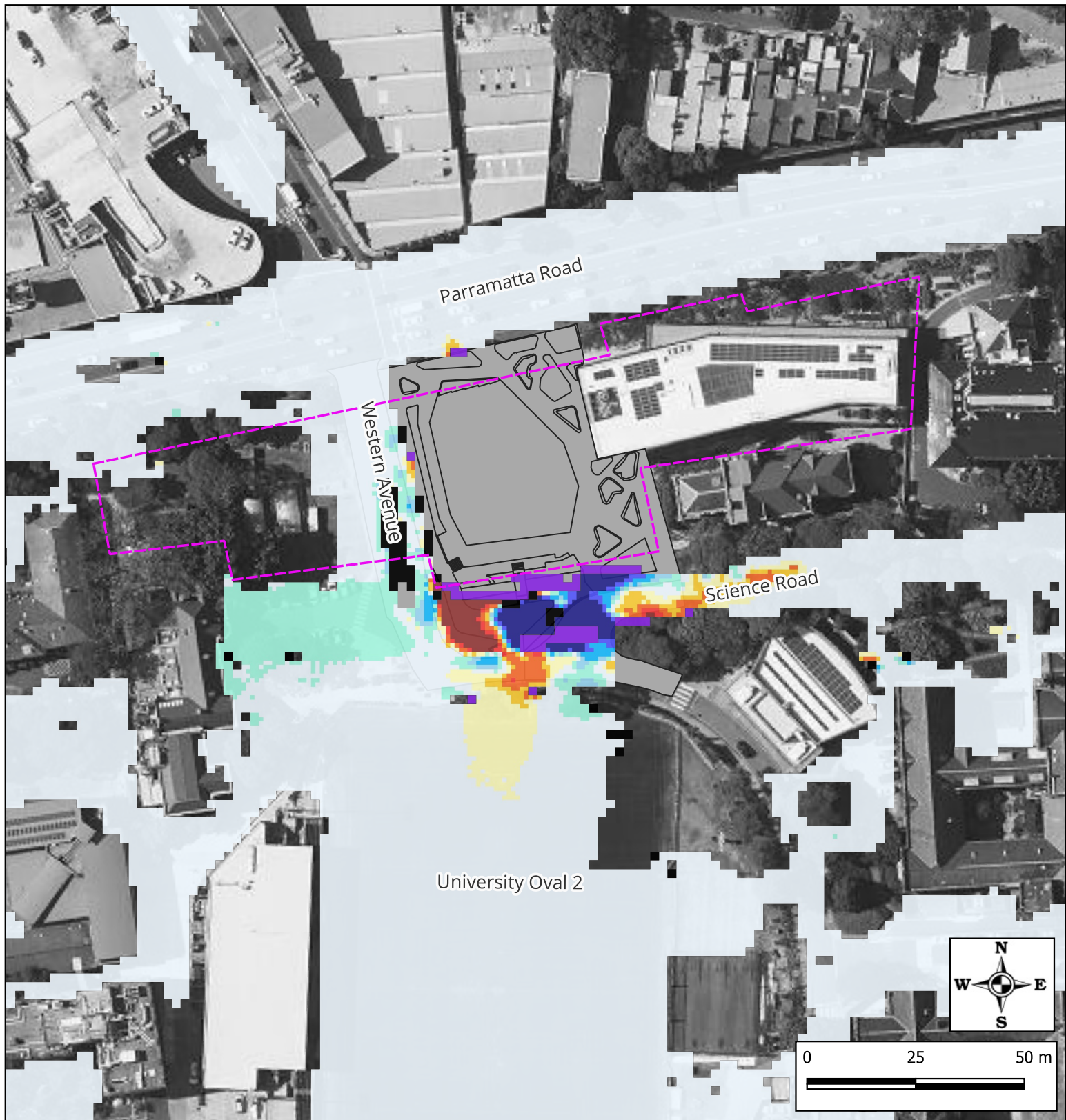
PROJECT No. **230077**

DATE: **07-2024**

SCALE: **1:1,200**

FIGURE No. **C02**





Level Impact

Was wet - now dry	50mm to 30mm decrease	30mm to 50mm increase	Was dry - now wet
> 150mm decrease	30mm to 10mm decrease	50mm to 100mm increase	CIP_Envelop
150mm to 100mm decrease	No Change (+/- 10mm)	100mm to 150mm increase	Proposed Layout
100mm to 50mm decrease	10mm to 30mm increase	> 150mm increase	

TITLE: **Flood level impact map – 0.2% AEP event**

PROJECT: **A01 Ross St T&L Hub - Flood Risk Assessment**

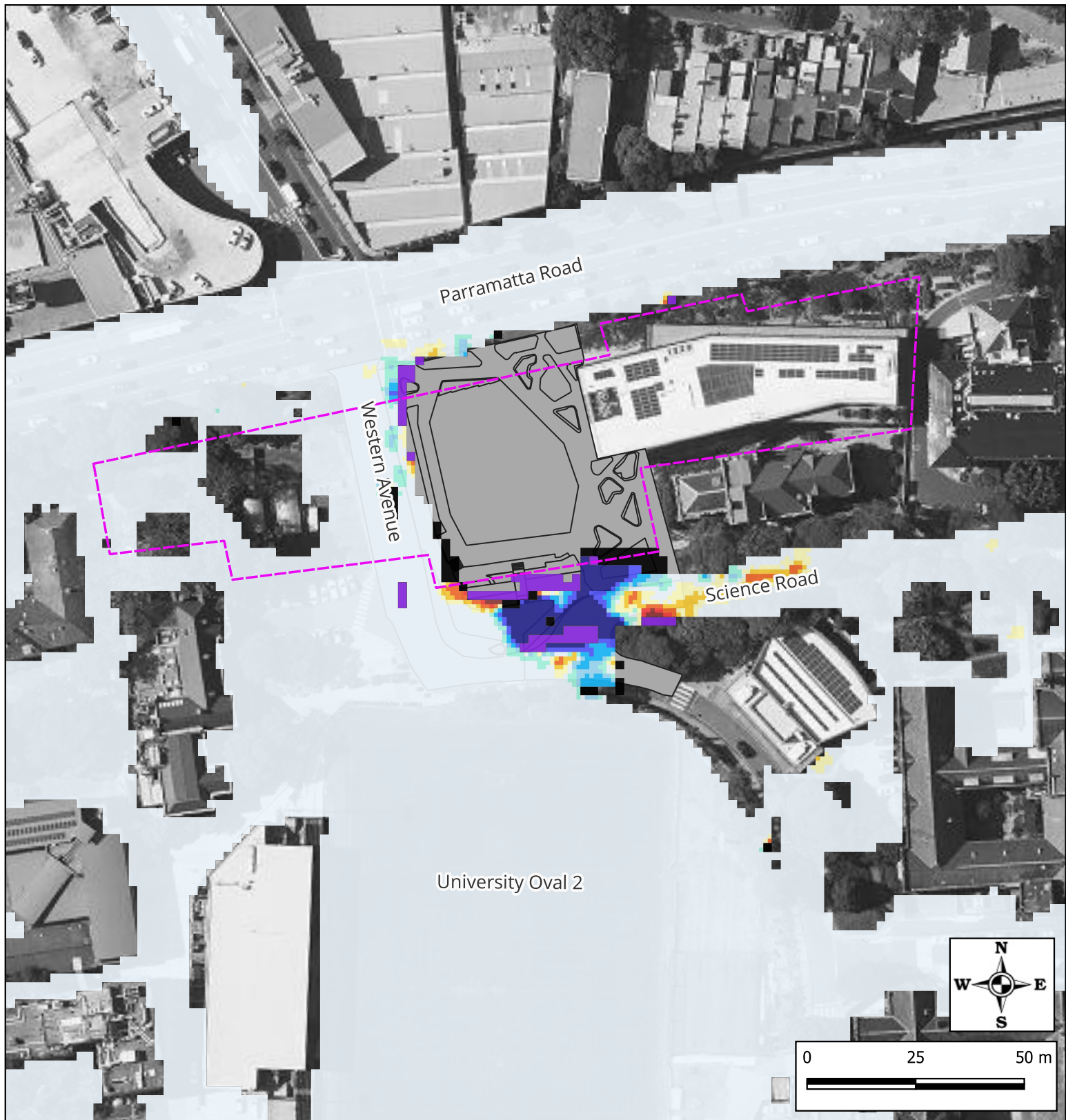
PROJECT No. **230077**

DATE: **07-2024**

SCALE: **1:1,200**

FIGURE No. **C03**





Level Impact

Was wet - now dry	50mm to 30mm decrease	30mm to 50mm increase	Was dry - now wet
> 150mm decrease	30mm to 10mm decrease	50mm to 100mm increase	CIP_Envelop
150mm to 100mm decrease	No Change (+/- 10mm)	100mm to 150mm increase	Proposed Layout
100mm to 50mm decrease	10mm to 30mm increase	> 150mm increase	

TITLE: **Flood level impact map – PMF AEP event**

PROJECT: **A01 Ross St T&L Hub - Flood Risk Assessment**

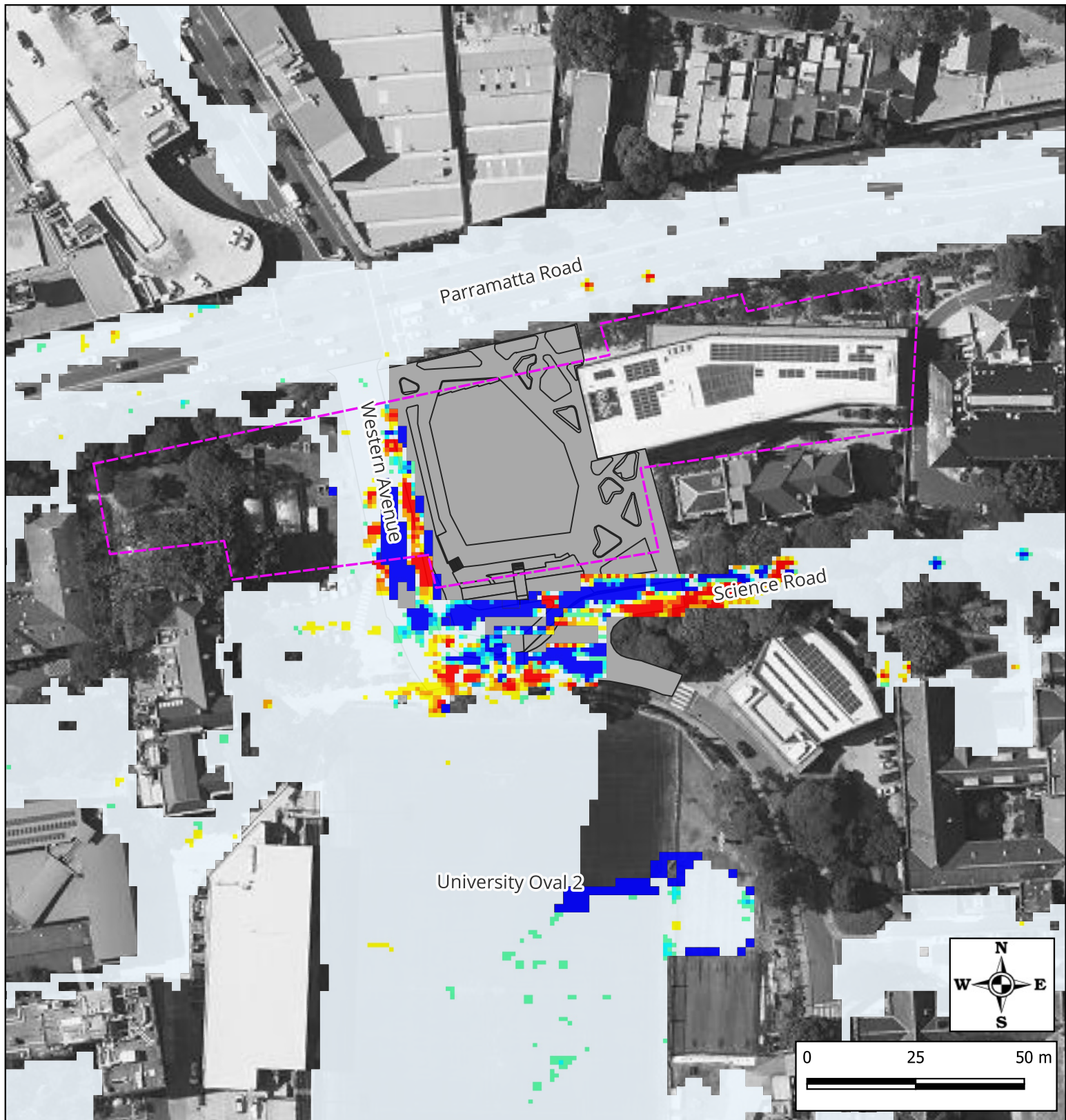
PROJECT No. **230077**

DATE: **07-2024**

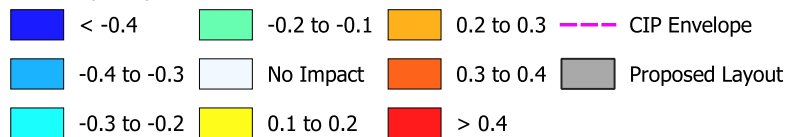
SCALE: **1:1,200**

FIGURE No. **C04**





Velocity Impact



TITLE: **Flood velocity impact map – 20% AEP event**

PROJECT: **A01 Ross St T&L Hub - Flood Risk Assessment**

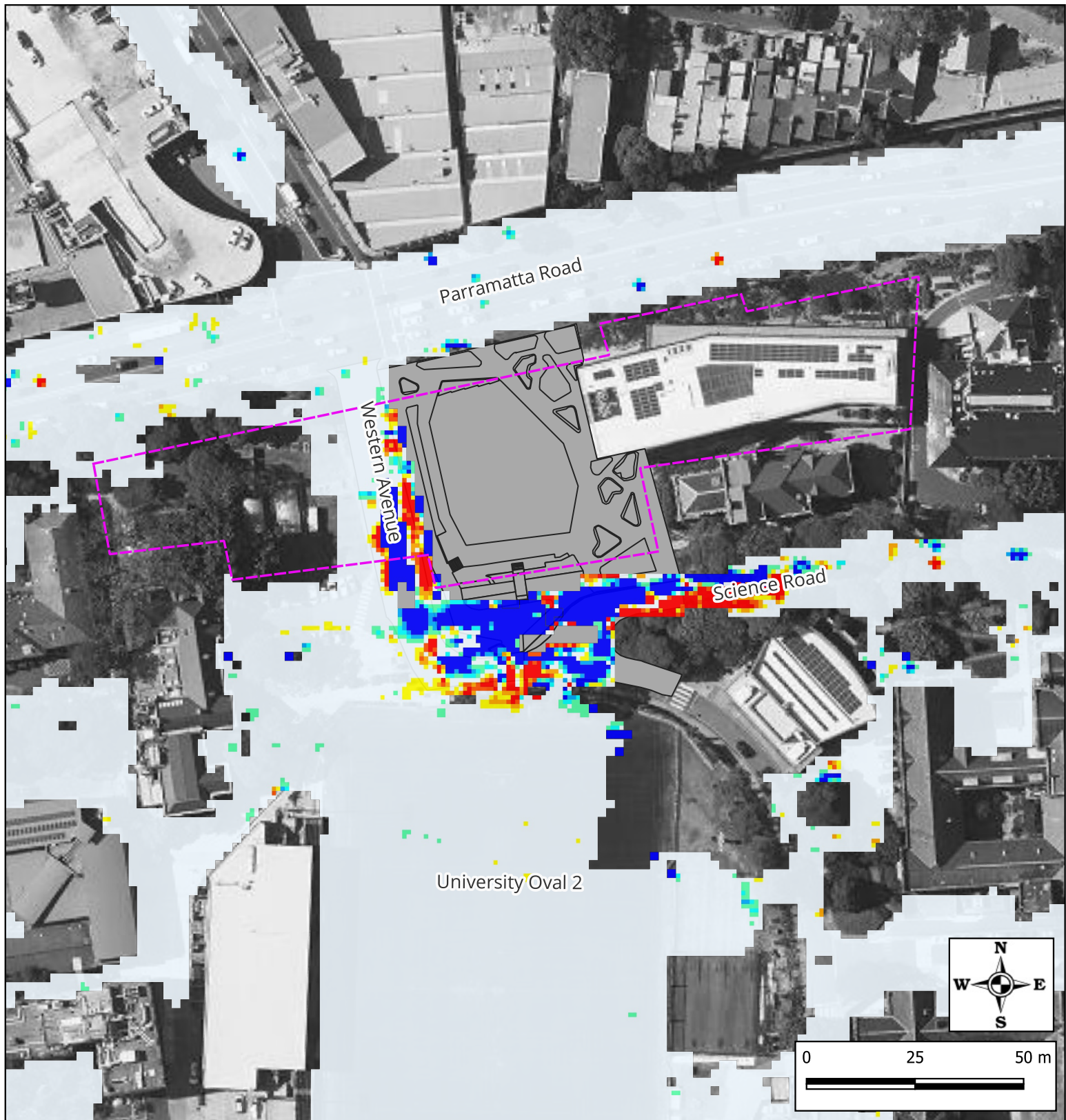
PROJECT No. **230077**

DATE: **07-2024**

SCALE: **1:1,200**

FIGURE No. **C05**





Velocity Impact

< -0.4	-0.2 to -0.1	0.2 to 0.3	CIP Envelope
-0.4 to -0.3	No Impact	0.3 to 0.4	Proposed Layout
-0.3 to -0.2	0.1 to 0.2	> 0.4	

TITLE: **Flood velocity impact map – 1% AEP event**

PROJECT: **A01 Ross St T&L Hub - Flood Risk Assessment**

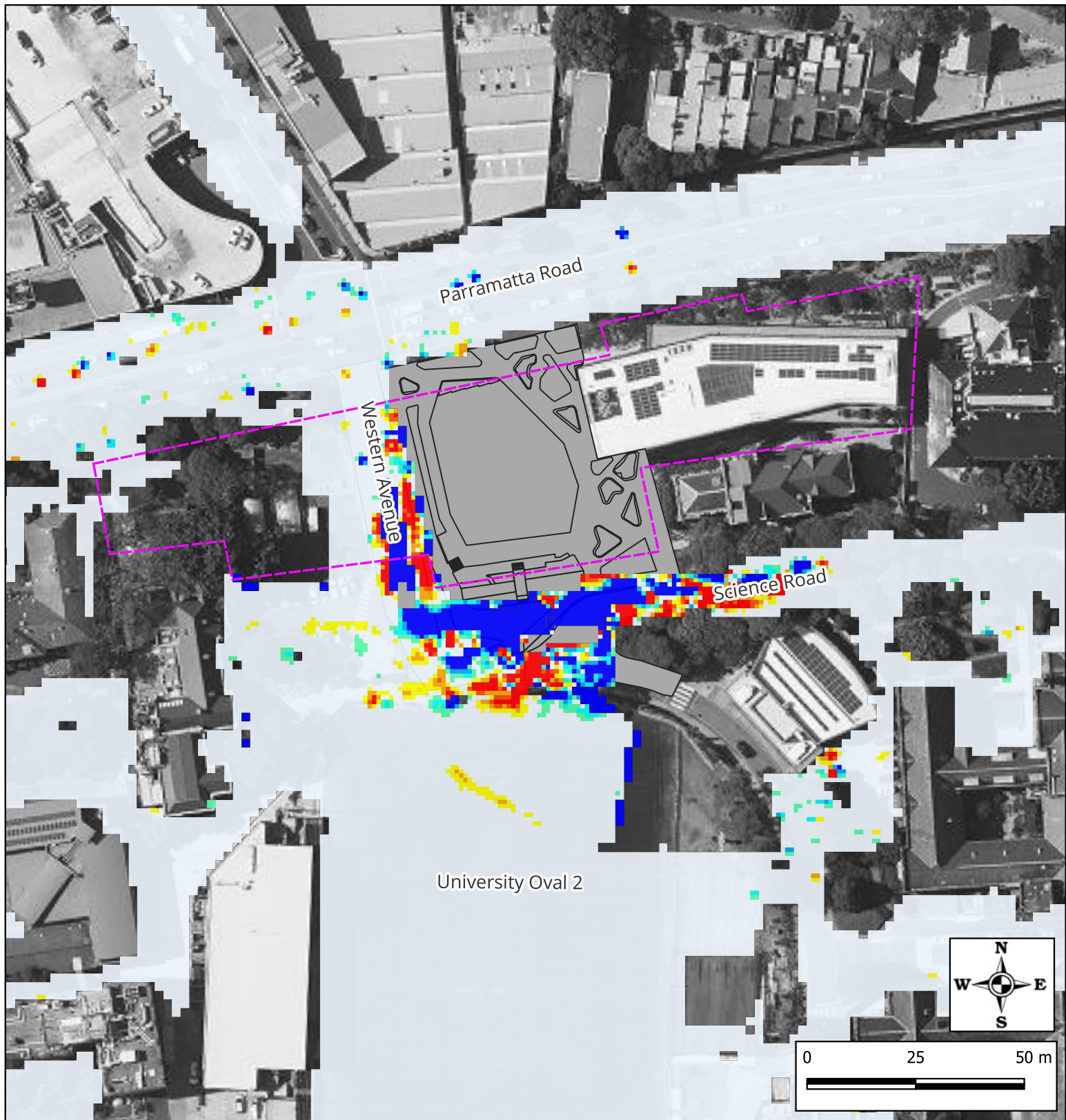
PROJECT No. **230077**

DATE: **07-2024**

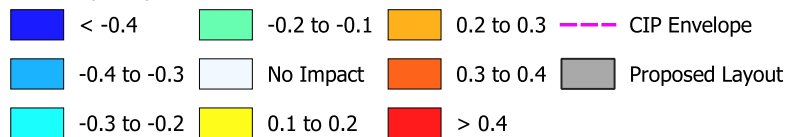
SCALE: **1:1,200**

FIGURE No. **C06**





Velocity Impact



TITLE: **Flood velocity impact map – 0.2% AEP event**

PROJECT: **A01 Ross St T&L Hub - Flood Risk Assessment**

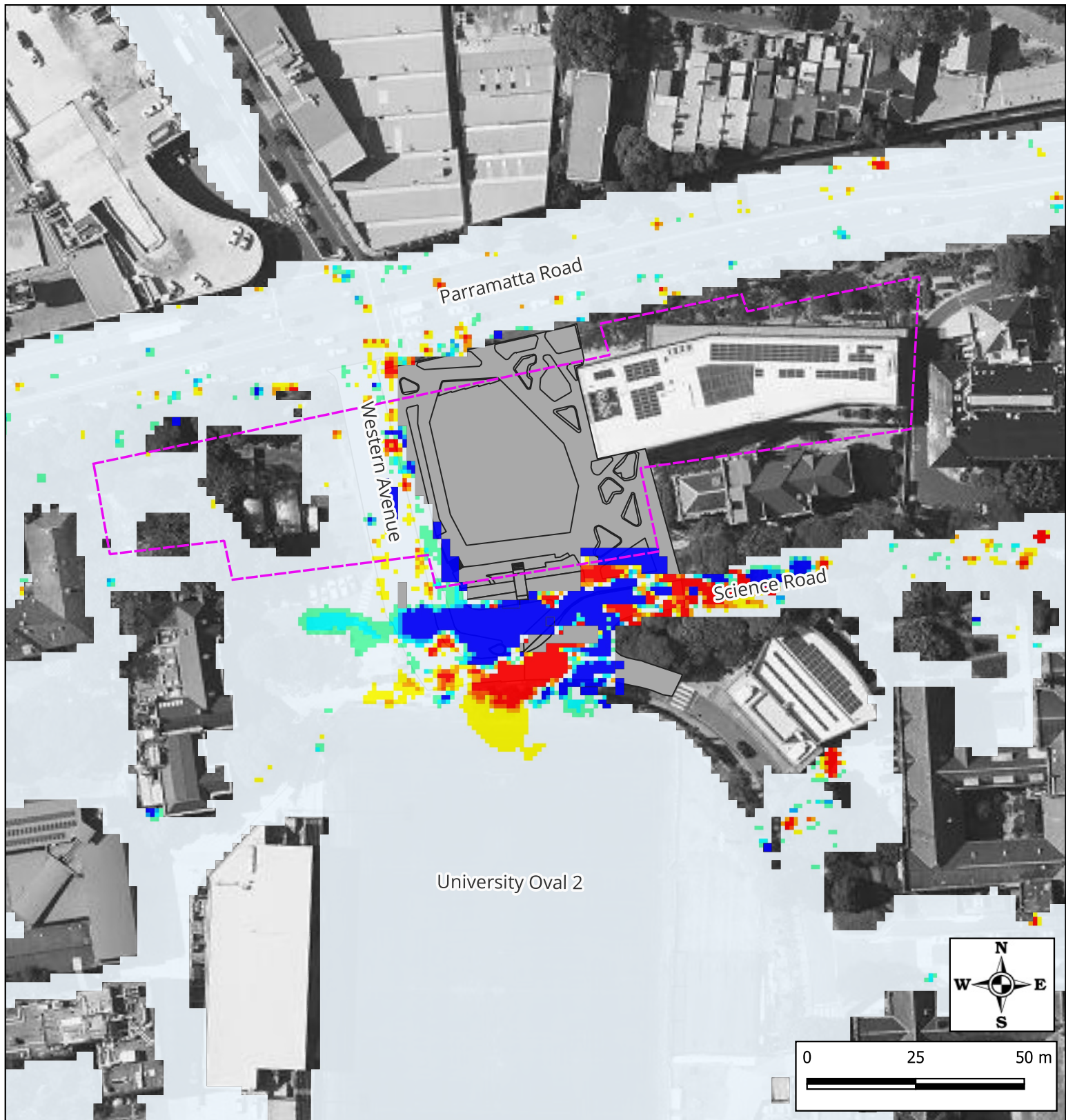
PROJECT No. **230077**

DATE: **07-2024**

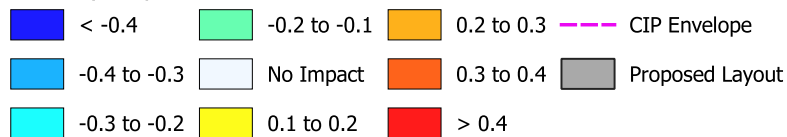
SCALE: **1:1,200**

FIGURE No. **C07**





Velocity Impact



TITLE: **Flood velocity impact map – PMF AEP event**

PROJECT: **A01 Ross St T&L Hub - Flood Risk Assessment**

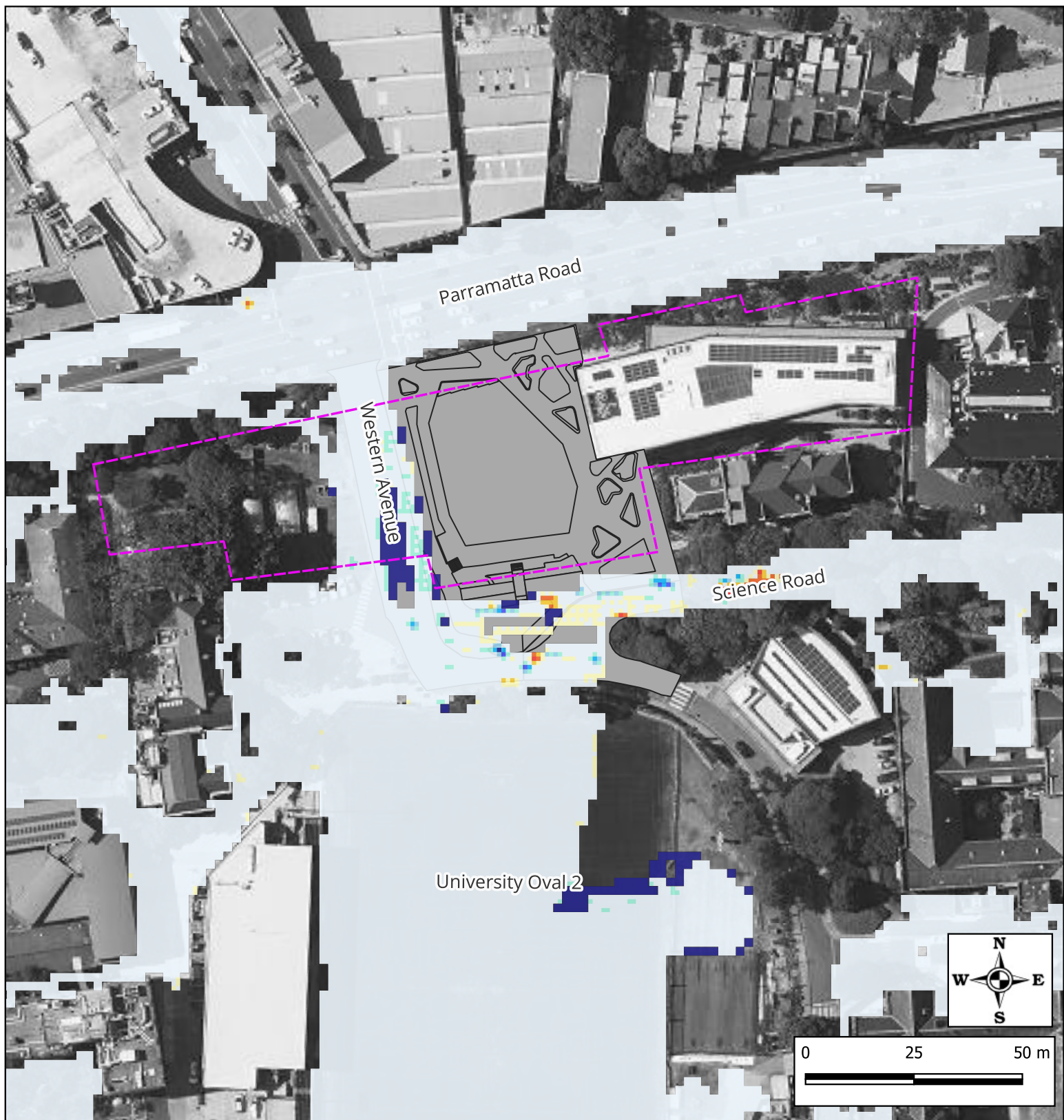
PROJECT No. **230077**

DATE: **07-2024**

SCALE: **1:1,200**

FIGURE No. **C08**





Hazard Impact

5 categories better (H6 to H1)	No change	5 categories worse (H1 to H6)
4 categories better	1 category worse	CIP Envelope
3 categories better	2 categories worse	Proposed Layout
2 categories better	3 categories worse	

TITLE: **Flood hazard impact map – 20% AEP event**

PROJECT: **A01 Ross St T&L Hub - Flood Risk Assessment**

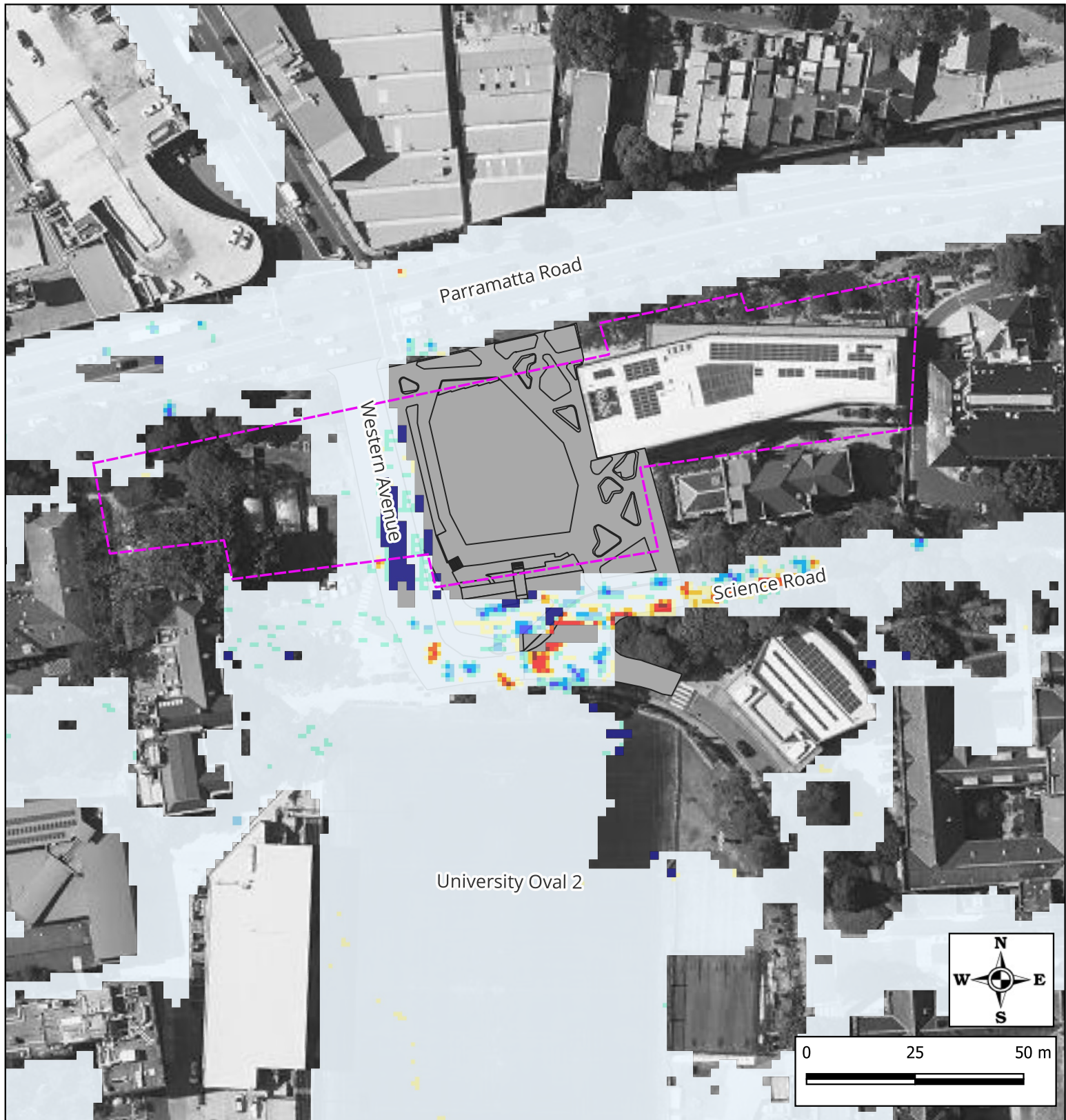
PROJECT No. **230077**

DATE: **07-2024**

SCALE: **1:1,200**

FIGURE No. **C09**





Hazard Impact

5 categories better (H6 to H1)	No change	5 categories worse (H1 to H6)
4 categories better	1 category worse	CIP Envelope
3 categories better	2 categories worse	Proposed Layout
2 categories better	3 categories worse	

TITLE: **Flood hazard impact map – 1% AEP event**

PROJECT: **A01 Ross St T&L Hub - Flood Risk Assessment**

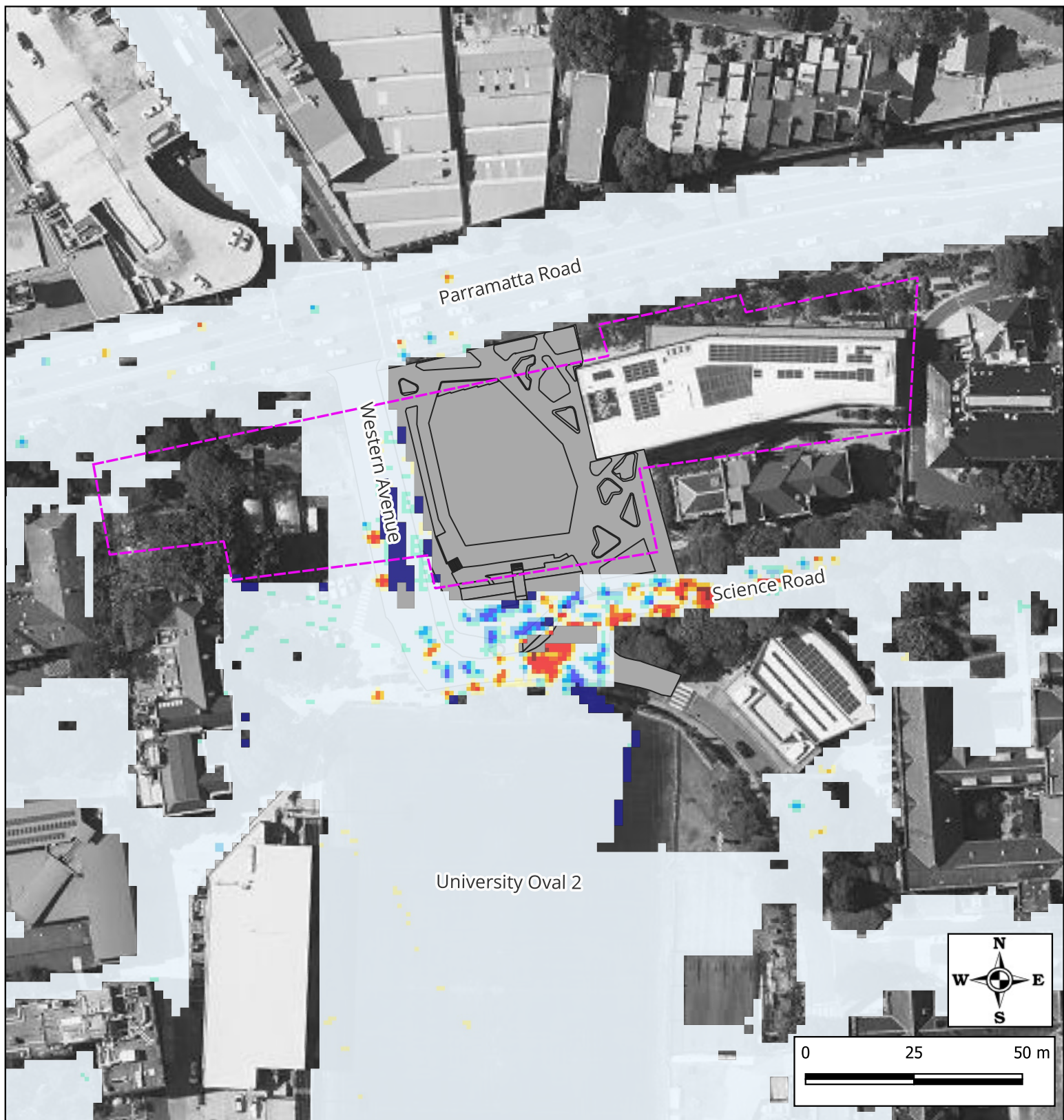
PROJECT No. **230077**

DATE: **07-2024**

SCALE: **1:1,200**

FIGURE No. **C11**





Hazard Impact

- | | | |
|--------------------------------|--------------------|-------------------------------|
| 5 categories better (H6 to H1) | No change | 5 categories worse (H1 to H6) |
| 4 categories better | 1 category worse | CIP Envelope |
| 3 categories better | 2 categories worse | Proposed Layout |
| 2 categories better | 3 categories worse | |

TITLE: **Flood hazard impact map – 0.2% AEP event**

PROJECT: **A01 Ross St T&L Hub - Flood Risk Assessment**

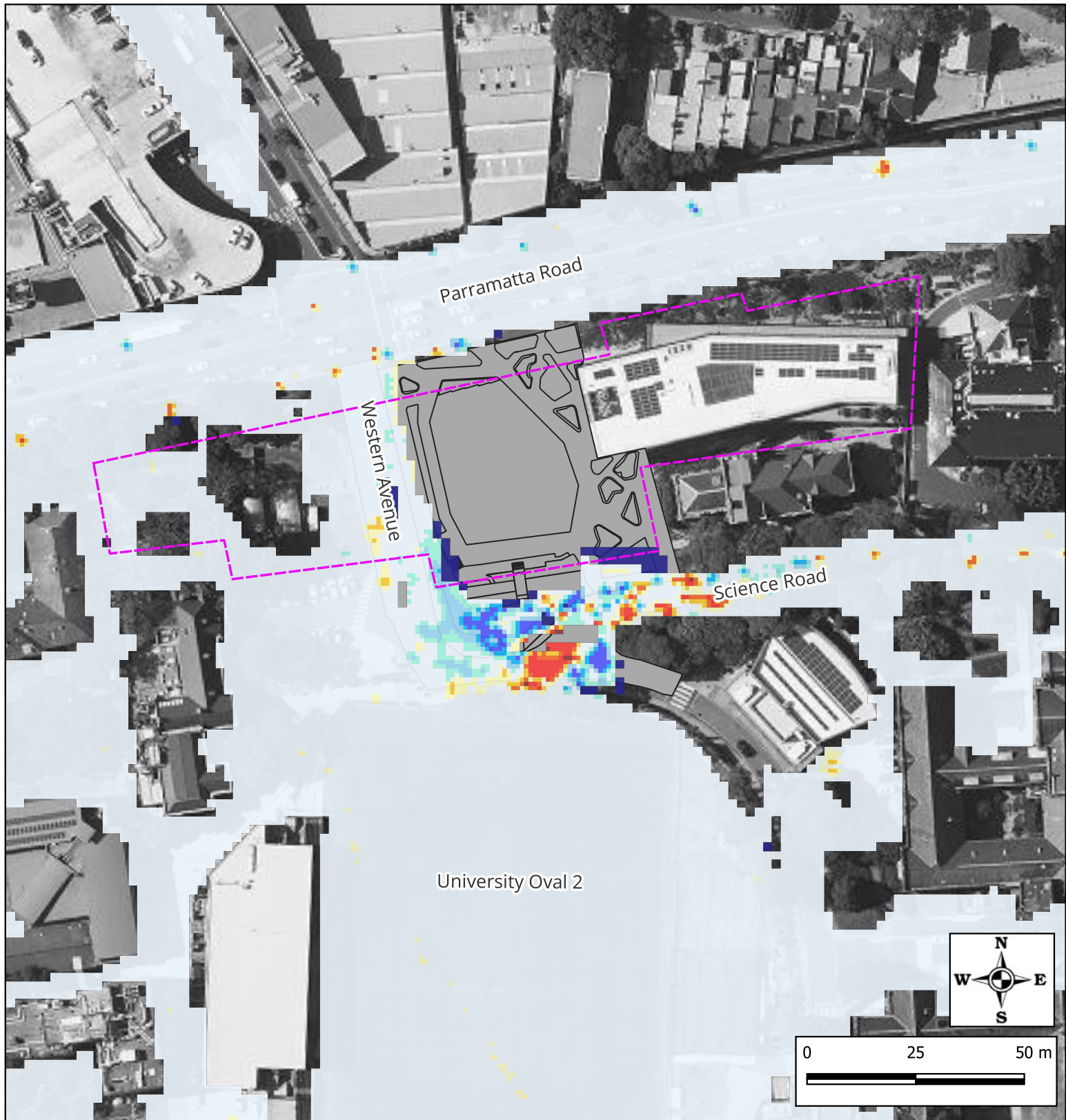
PROJECT No. **230077**

DATE: **07-2024**

SCALE: **1:1,200**

FIGURE No. **C13**





Hazard Impact

5 categories better (H6 to H1)	No change	5 categories worse (H1 to H6)
4 categories better	1 category worse	CIP Envelope
3 categories better	2 categories worse	Proposed Layout
2 categories better	3 categories worse	

TITLE: **Flood hazard impact map – PMF AEP event**

PROJECT: **A01 Ross St T&L Hub - Flood Risk Assessment**

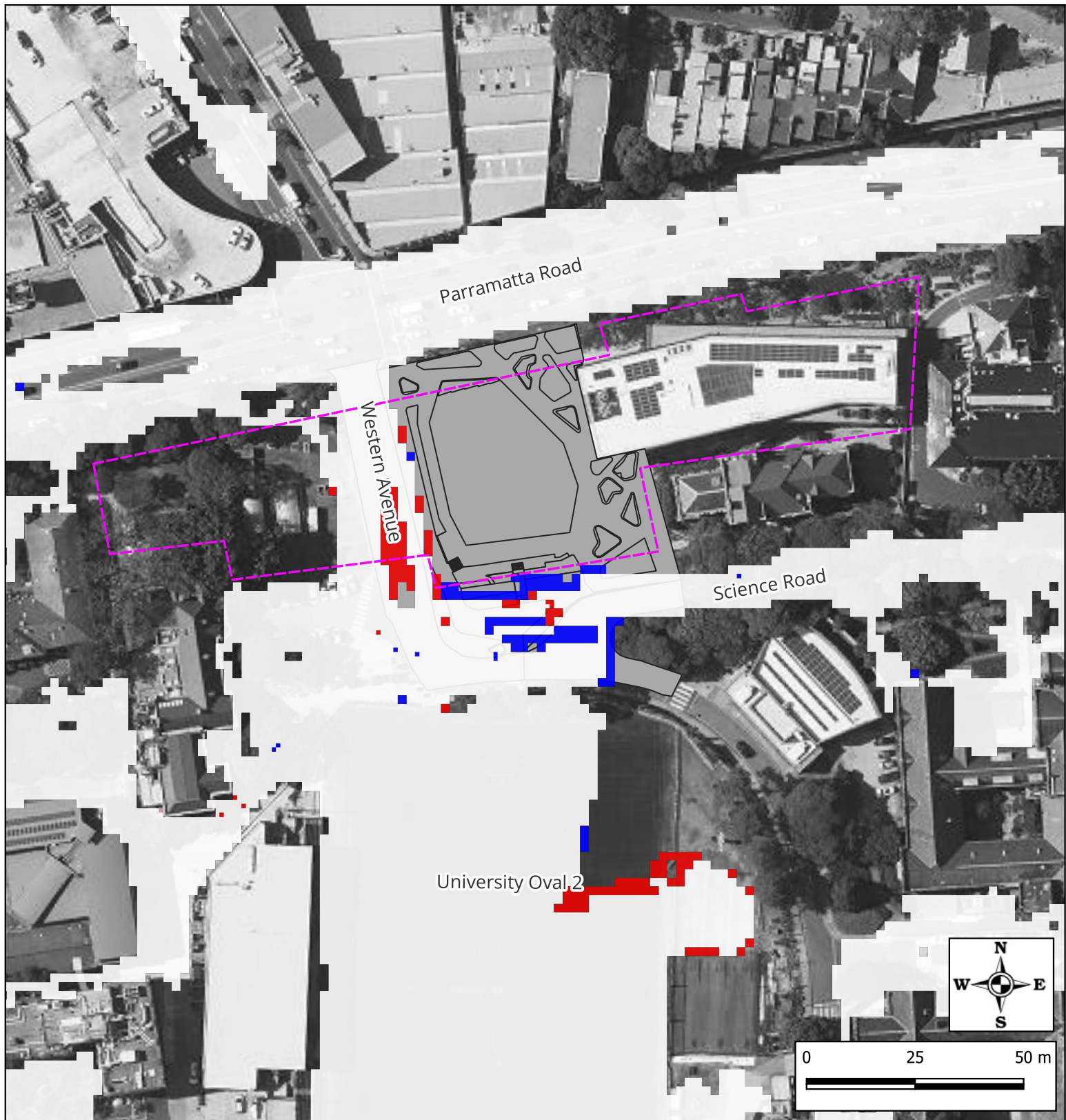
PROJECT No. **230077**

DATE: **07-2024**

SCALE: **1:1,200**

FIGURE No. **C14**





Flood Function Impact

- | | |
|--|--|
| ■ Flood Fringe to Floodway | ■ Floodway to Flood Fringe |
| ■ Flood Storage to Floodway or Flood Fringe to Flood Storage | --- CIP_Envelop |
| ■ No Change | ■ Proposed Layout |
| ■ Floodway to Flood Storage or Flood Storage to Flood Fringe | |

TITLE: **Flood function impact map – 20% AEP event**

PROJECT: **A01 Ross St T&L Hub - Flood Risk Assessment**

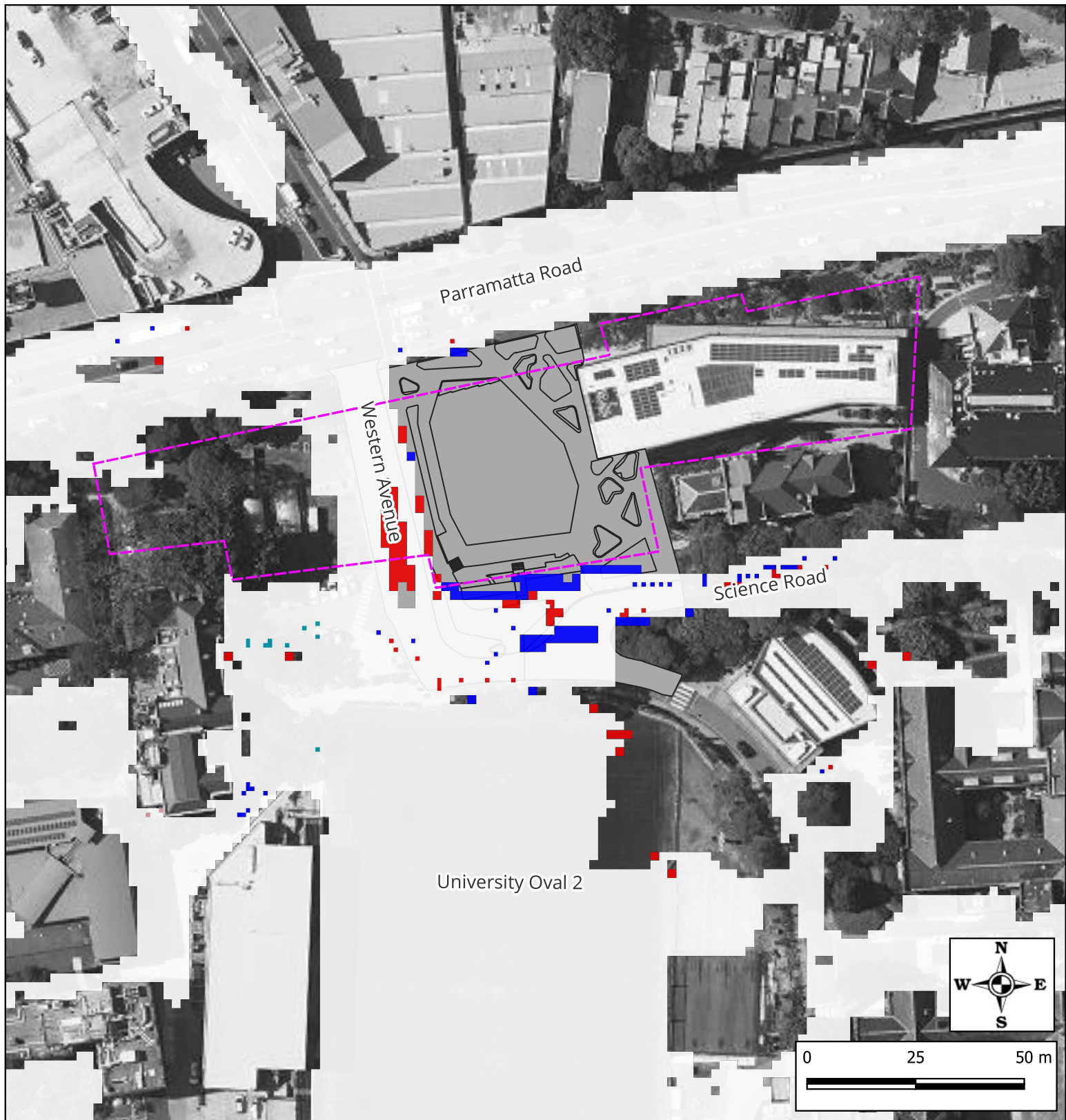
PROJECT No. **230077**

DATE: **07-2024**

SCALE: **1:1,200**

FIGURE No. **C15**





Flood Function Impact

- Flood Fringe to Floodway
- Floodway to Flood Fringe
- Flood Storage to Floodway or Flood Fringe to Flood Storage
- CIP_Envelop
- No Change
- Proposed Layout
- Floodway to Flood Storage or Flood Storage to Flood Fringe

TITLE: **Flood function impact map – 1% AEP event**

PROJECT: **A01 Ross St T&L Hub - Flood Risk Assessment**

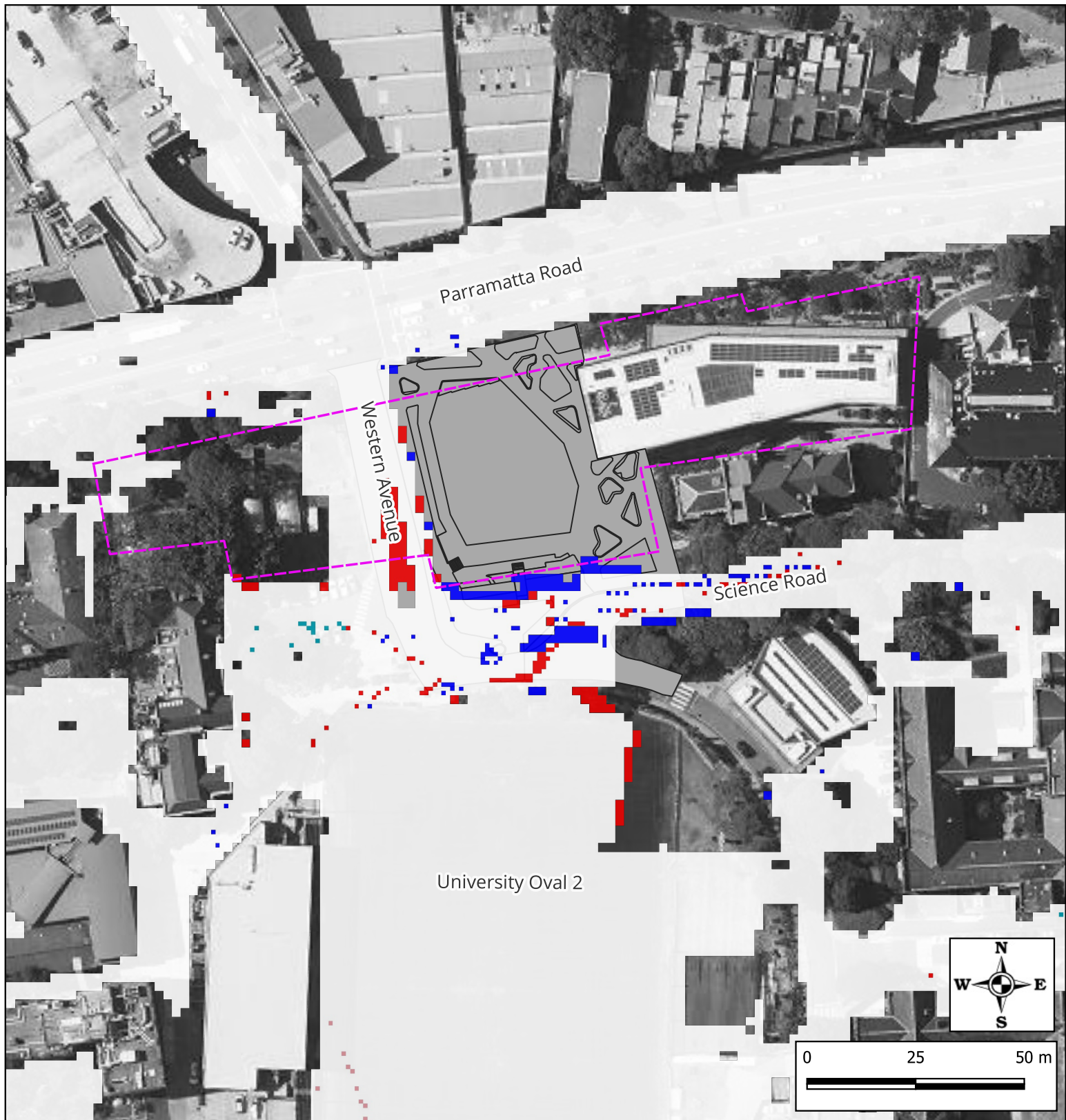
PROJECT No. **230077**

DATE: **07-2024**

SCALE: **1:1,200**

FIGURE No. **C17**





Flood Function Impact

- | | |
|--|--|
| ■ Flood Fringe to Floodway | ■ Floodway to Flood Fringe |
| ■ Flood Storage to Floodway or Flood Fringe to Flood Storage | --- CIP_Envelop |
| ■ No Change | ■ Proposed Layout |
| ■ Floodway to Flood Storage or Flood Storage to Flood Fringe | |

TITLE: **Flood function impact map – 0.2% AEP event**

PROJECT: **A01 Ross St T&L Hub - Flood Risk Assessment**

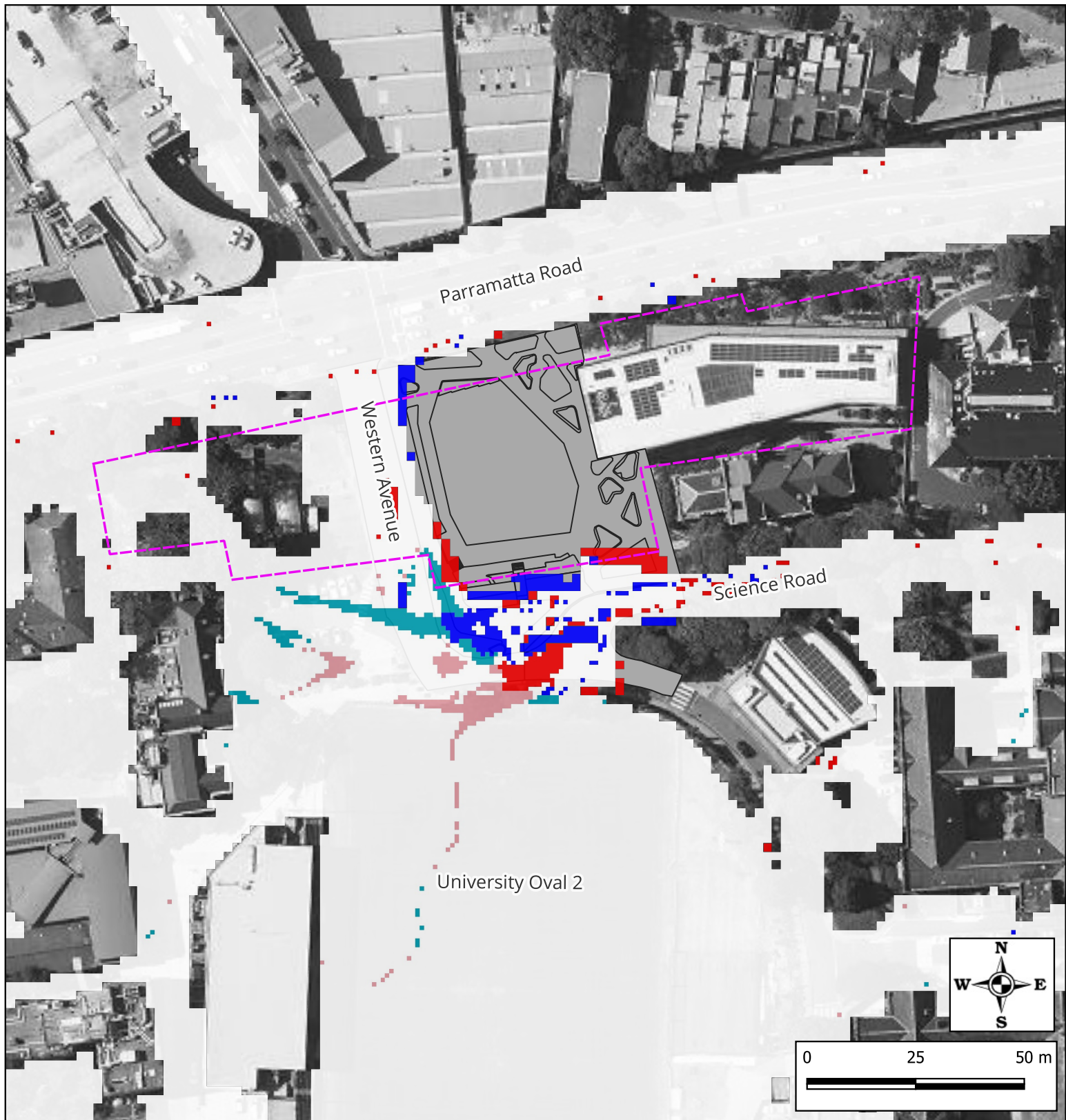
PROJECT No. **230077**

DATE: **07-2024**

SCALE: **1:1,200**

FIGURE No. **C19**





Flood Function Impact

- | | |
|---|---|
| Flood Fringe to Floodway | Floodway to Flood Fringe |
| Flood Storage to Floodway or Flood Fringe to Flood Storage | CIP_Envelop |
| No Change | Proposed Layout |
| Floodway to Flood Storage or Flood Storage to Flood Fringe | |

TITLE: **Flood function impact map – PMF AEP event**

PROJECT: **A01 Ross St T&L Hub - Flood Risk Assessment**

PROJECT No. **230077**

DATE: **07-2024**

SCALE: **1:1,200**

FIGURE No. **C20**





GRC Hydro
Level 20,66 Goulburn Street
Sydney NSW 2000

Tel: +61 2 9030 0342
www.grchydro.com.au

Project:	<i>Ross Street T&L Centre, Flood Assessment</i>
Project ID:	<i>230077</i>
Date:	<i>22nd July 2025</i>
To:	<i>Nora Babik, University of Sydney</i>
Subject:	<i>Ross Street T&L Hub, EMP</i>
Version:	<i>Version 6 (Update for SSDA response to submissions)</i>
Author:	<i>Tomas Steele</i>
Reviewer:	<i>Stephen Gray</i>
Authorised by:	<i>Stephen Gray</i>

RE: Emergency Management Plan for the Ross Street Teaching and Learning Hub SSDA Flood Assessment

An Emergency Management Plan (EM Plan or EMP) has been prepared for the proposed Ross Street Teaching and Learning Hub (Ross St T&L Hub) on behalf of the University of Sydney in support of SSDA application SSD-57938709. The EM Plan is based on the flood impact and risk assessment (FIRA) in the main report (GRC Hydro, 'Ross Street T&L Hub, Flood Assessment', 22/07/2025). Where relevant flood levels, finished floor levels, duration of inundation and flood warning time have been drawn from the FIRA.

The EM Plan contains the recommended strategies and procedures to help manage the residual risks identified in Section 4 – Risk Assessment from the main report. Version 6 of the EM Plan has been updated to include the recommendations from NSW State Emergency Services (SES) on the EM Plan, as they are the state agency responsible for dealing with floods, storms and tsunamis in NSW.

Yours Sincerely

A handwritten signature in blue ink, appearing to read 'Steve Gray', with a stylized flourish at the end.

Steve Gray

Director

Email: gray@grchydro.com.au
Tel: +61 413 631 447

1. Overview of Flood Risk Assessment

The Flood Impact and Risk Assessment (FIRA) for the site (GRC Hydro, 'Ross Street T&L Hub, Flood Assessment', 22/07/2025) used the design results of the presented in the FIRA to conduct a flood risk assessment for the proposed development in Section 4 of the main report. The risk assessment showed that the site is a low flood risk given:

- the proposed building is above the PMF level
- no flow paths through the site, with floodwater contained to the roadways surrounding the site
- no risk from rising floodwater as the site lies above the PMF
- the local catchment is small at less than 5.6 ha

The flood behaviour can be described as:

- Flash flooding behaviour with durations much less than 6 hours. The critical durations for the FIRA were 2 hour storms.
- Shallow overland flow moving west down Parramatta Rd and Science Rd, and south down Western Ave. This surrounds the site on the north, west and southern sides. In a PMF this is mostly less than 0.05m, but can reach between 0.10m to 0.30m in the road gutters.
- The roadways have a high slope, which results in the shallow overland flow reaching high velocities in the road corridors and can exceed 2m/s in a PMF. The velocities are between 1m/s and 2m/s and mostly contained to the road gutters during a 20% AEP.
- There is rising floodwater in University Oval 2 that reaches 24.04 mAHD high. The proposed building and most of the site lies above 25.5 mAHD high.

The risk assessment showed that whilst the development itself is protected from flooding for all events up to and including the Probable Maximum Flood (PMF) there are residual risks remaining that cannot be addressed with flood mitigation measures for the site. This Emergency Management Plan (EM Plan or EMP) provides recommended actions in order to minimise these residual risks. The residual risks include:

- Residual Risks
 - There is minimal warning time for floodwater impacting the streets around the site
 - Evacuation from the site from state agencies is likely to occur too late to manage risks associated with flash flooding
 - Evacuation on foot or via vehicle risks evacuees being caught in hazardous flood conditions surrounding the site, if insufficient notice to evacuate is received
 - People are likely to want to evacuate in a flood, if not told the risks associated with doing so.
 - Even if told of the risk, people may still attempt to evacuate if they do not accept the risk.
- When conducting the risk assessment, the following was considered that needs to be considered in the EM Plan:
 - Whilst the site is mostly going to contain able bodied adults, consideration needs to be given for those with impaired movement, injuries, and higher risk groups such as children and the elderly
 - The site may include visitors that are unfamiliar with the site and the site has relatively public access so there are not opportunities to inform them of emergency procedures

2. Emergency Management Plan

The EMP presents recommended actions to take for the management of emergency flood situations that cannot be managed through other aspects of the proposed development. Primarily the intent is to minimise the risk to users of the site during an emergency flood event when guidance from emergency combat authorities is not available, which is an inherent risk associated with the flash flooding nature of the surrounding catchment. It is immediately superseded by advice from emergency combat

authorities, which include the NSW Police force and NSW State Emergency Service. This plan is a preliminary emergency response plan, which is to be incorporated with existing emergency plans for the University of Sydney.

Relevant flood levels due to rising floodwater, ground levels and floor levels for the Ross St T&L Hub site are:

- 1% AEP Flood Level (University Oval 2) = 23.0m AHD
- Probable Maximum Flood Level (University Oval 2) = 24.0m AHD
- Finished Floor Level = 25.5m AHD
- Shallow overland flow is found in Parramatta Rd, Western Ave and Science Rd for all events at levels higher than University Oval 2, but not at risk of inundating the site due to be fully contained to the road corridors.

The above levels give an indication of how the various floods will impact this site and what level of protection is provided. Finished floor levels are designed to be a minimum of 0.5m above the 1% AEP Flood Level. The building is flood free for all flood events up to and including the Probable Maximum Flood (PMF), which is the largest event which can occur at this location.

In addition to the above, the predicted warning time and duration of inundation from the, 'Ross Street T&L Hub, Flood Assessment' (GRC Hydro 19/02/2025) have been provided below:

- Predicted flood warning time = < 30 minutes from the onset of the storm
- Duration of inundation = < 1 hours for all events up to and including the PMF

2.1 Guidance

The following legal and regulatory guidance has been referred to in the development of this FEMP:

- NSW SES FloodSafe Guidelines;
- NSW Emergency Management Act 2002;
- Support for Emergency Management Guidelines (EM01, DPE 2023)
- Understanding and Managing Flood Risk Guideline (FB01, DPE 2023)
- DPHI Disaster Risk Reduction Framework; and the
- DPHI Shelter-in-Place Guideline for Flash Flooding (2025)

2.2 Agency Liaison

2.2.1 NSW State Emergency Service

As designated by the State Emergency Service Act of 1989 and in the NSW State Emergency Management Plan (EMPLAN) the NSW State Emergency Service (SES) are the 'combat agency' in the event of a flood to coordinate the evacuation and welfare of affected communities. As the combat agency, they are designated responsibility for the emergency management efforts related to that emergency and will be the primary authority on what communities should do. The local unit for the site is the NSW SES Parramatta Unit, however during an emergency a site to manage the evacuation efforts will be established.

The SES website has information regarding flooding, including any current warnings. They will also disseminate warning information via the 'Hazards Near Me App', their social media and geolocated text messages.

NSW SES can be contacted by:

- For general enquires on 138 737 / 138 SES
- During a flood emergency on 132 500

During a life-threatening emergency contact emergency services on Triple-Zero (000)

2.2.2 City of Sydney Council

The site lies within the LGA of the City of Sydney Council. As the local Council, they have responsibilities for the preparation of flood information for their LGA and for the management of development in flood prone areas. Information regarding flood risk in their LGA can be found on their website, with the site within the Johnsons Creek catchment area.

2.2.3 Bureau of Meteorology

The Bureau of Meteorology (BoM) is the nation's weather, climate and water agency. Weather information, including forecasts, historical and current are available on their website. They also issue weather warnings that provide some degree of potential flooding. These warnings can include:

- Severe weather warnings. These relate to either 'Damaging Winds' or 'Rain', with a severe weather warning for rainfall potentially leading to flash flooding. Warnings can be anywhere from an hour to 36 hours in advance.
- Severe thunderstorm warning. These specifically relate to thunderstorms that are severe or very dangerous and beside the thunder can cause hail, damaging winds or heavy rainfall that can cause flash flooding.
- Flood Warnings. These usually relate to a specific river or catchment area that has potentially dangerous floodwater.

Warnings are available via the BoM website, their app and the local news channels/radio.

2.3 Preparation and Planning

The preferred response is to follow advice from the SES and evacuate away from the site should an evacuation order be issued, as per the local and state EMPLANS. As the site is at risk of flash flooding, which it is difficult for the SES to issue warnings for, the site needs to be prepared to limit flood risk. It is preferred to issue strategies that minimise the number of people onsite, but the site also needs to be prepared to enact a shelter-in-place strategy for situations where people are onsite during a flood. The preparation and planning cover all three of these approaches.

It is recommended that a designated member of the University of Sydney sign up to monitor both BoM and SES flood warnings. The SES website has information regarding flooding, including any current warnings. They will also disseminate warning information via the 'Hazards Near Me App', their social media and geolocated text messages. BoM warnings are available via the BoM website, their app and the local news channels/radio. Actions to take when receiving warnings are covered in Section 2.4 below. It is preferred that a permanent building or site manager has this responsibility, however it is expected that the building will have rotating staff, and a more permanent facilities manager in charge of several buildings around the campus would be better suited for this responsibility. The methods to communicate warnings from a facilities manager to the site should be established before a flood during the preparation and planning stages when finalising the EM Plan.

Education of both visitors and staff of flood risk and the emergency procedures in the event of a flood is a powerful tool for managing flood risk. However, some limitations need to be considered given the intended use of the site, including:

- The site is likely to not have permanent staff, with teachers using classes for a semester or on a temporary basis
- Similarly, students and visitors are likely to be temporary users of the site
- No site induction for the users of the site

As such, efforts to educate and disseminate information on flood risk and the emergency procedures should be made where there are opportunities, but there needs to be ways for temporary users of the site to be informed. The recommendations are:

- Staff with classes in the building to be informed of the flood risk and emergency procedures before the commencement of classes for the semester
- Information be readily available throughout the building on the flood risk and emergency procedures similar to the fire evacuation plans
- Plan for announcements that can be issued in the event of a flood
- Clear signage to assist people when making decisions during an emergency
- Regular drills, preferably each teaching semester. Drills can include both evacuation drills and/or testing of announcements to ensure the emergency procedures are checked regularly.

As the emergency procedures include preparing the site for shelter-in-place, emergency kits should be available on all floors of the proposed building. The contents are usually standardized and used for all emergency situations but typically include:

- Bottled water
- Non-perishable food and energy bars
- First aid kit
- Light sources (preferably flashlights) with batteries
- Dust mask
- Emergency contact numbers

Ideally access to a radio and the recommended frequencies to tune into for more information from emergency combat authorities should also be part of this kit. The emergency kits need to be maintained and checked regularly and should be reviewed during the regular evacuation drills.

Clearly deciding on responsibilities before a flood is critical to minimise issues during an emergency. These responsibilities are likely to include:

- Signing up for BoM and SES warnings
- Disseminating information to evacuate during a flood
- Issuing announcements before or during a flood
- Preparation and regular checking of emergency kits
- Regular evacuation drills

2.4 Emergency response strategy

The preferred response is to follow advice from the SES and evacuate away from the site should an evacuation order be issued. Warning information from SES is issued via the 'Hazards Near Me App', their social media and geolocated text messages. It would likely also be issued via news reports and radio. These evacuation orders target large areas, such as multiple suburbs, and won't be specific to the site. These evacuation orders are to be heeded as a priority and immediately supersede any recommendations in this EMP.

Upon receiving an evacuation order, the site is to immediately see to closing down all operations and follow the evacuation order.

Evacuation orders from the SES are unlikely to be issued for flash flooding situations that the site is at risk at. As such the emergency response strategy needs to allow for the management of flash flooding. The recommended triggers for enacting actions to manage flash flooding is to sign up for weather warnings from the BoM. Regional weather warnings such as a 'Severe Weather Warning' or 'Severe Thunderstorm Warning' for the suburb from the BoM indicates there is a high risk of flash flooding occurring around the site. These warnings begin as a generalised forecast of flood inducing rainfall but the actual flooding at the site could occur both before and after the warning as local

conditions can vary. Quite often these warnings will result in no flooding for the site, but there is no way to accurately predict that from the available information, and flooding should be planned for every time a warning is issued. Given the following:

- No formal warning for flooding occurring around the site, and flooding can occur around the site within 30 minutes of high intensity rainfall impacting the local area
- There is safe refuge at the site, but the roads surrounding the site can become hazardous
- Flooding around the site will likely last less than 6 hours, with several indicators it the roads surrounding the site could return to normal conditions less than an hour after the flood inducing rainfall has occurred

The recommendations for managing flash flooding in order of priority are:

- Actions and responsibilities that minimise the number of people attending the site
- Enacting a shelter-in-place strategy for a short period of time.

These strategies should be implemented depending on the situations below:

If a regional weather warning is received before the working day commences, it is recommended all non-essential work should be cancelled for the site and it communicated to everyone to not attend the site. The priority is to minimise the number of people located on the site as all attendees are either at risk of being on the roads when they become hazardous, or at risk of being isolated on the site should flooding occur without warning. Any people who are necessary to be onsite should be prepared to shelter at the site if necessary.

If a regional weather warning is received during the working day, it is recommended to prepare the site for closure. The specific actions depend on the amount of warning time received.

More than 6 hours warning. Actions should be taken to postpone or cancel any activities that would cause more people to attend the site, such as visitors. The warnings need to be continuously monitored as they can change suddenly, and the severe weather can occur before the predicted time. It should be planned to close the site with sufficient time to allow all attendees to return safely home a few hours before the Severe Weather Warning is predicted to occur.

Less than 6 hours warning. This situation should be avoided as much as reasonable possible as it puts evacuees at risk of needing to drive through or traverse floodwater. Should it occur, actions should be taken to immediately start the closure of the site and evacuation of attendees on the site. The priority should be to allow attendees onsite to travel home and be a home a few hours before the Severe Weather Warning is predicted to start. Should there be insufficient time for people onsite to get home, or to a safe place, then the site should prepare for a shelter-in-place strategy and notify the emergency combat authorities at the NSW SES on 132 500 for further advice. Under no circumstances should floodwater be driven through.

Should people be isolated at the building due to the onset of a flood inducing storm or be unsure of how safe it is to evacuate, the recommended strategy is to adopt a shelter-in-place strategy. The site is suitable for a shelter-in-place strategy given the criteria in the DPHI Shelter-in-Place Guideline for Flash Flooding (2025) in that:

- Evacuation off-site (the primary emergency management strategy) is no longer achievable and all efforts to ensure evacuation off-site have been adhered to
- The site itself isn't subject to any flooding, and flash flooding is the only flood risk present at the site
- Flooding occurs within less than 6 hours from the commencement of causative rain and the duration of shelter-in-place due to isolation by floodwaters is less than 12 hours from the commencement of rainfall.
- The development is not subject to high hazard flooding. High hazards can occur in the gutters of the surrounding roadways, however the shelter in place is a last resort for managing flood risk for attendees isolated at the site. As such attendees aren't expected to use the surrounding roadways when seeking isolation during a flood.
- The floor level of the development where people are to shelter is above the PMF level
- The building is expected to be structurally sound for the PMF, by adhering to requirements for flood compatible materials upto the 1% AEP + 500mm and given the low flood liability from the PMF
- Site is protected from the weather and has heating and cooling
- Access to personal hygiene facilities including toilets
- A minimum floor space of 2m² per person, including visitors
- Emergency kits to help ensure self-sufficiency are recommended to be located on every floor
- Surrounding flood conditions return to trafficable levels with an hour of the end of causative rainfall meaning the time for shelter-in-place is likely to be much lower than the 12 hour minimum.

It is recommended that it be made clear to people seeking refuge in the building that the local floodwater is expected to be too hazardous to evacuate in for both small and large vehicles, to leave any possessions in their cars as most exits from the building to cars are likely to be subject to high hazard flooding and meet at the emergency assembly point. It is too early to designate the recommended location for the emergency assembly point, however it should be located at or above Level 2.

When assembling it is recommended to not use elevators unless the building has an emergency power supply. Allowances in the proposed assembly approach should include procedures for assisting people with limited mobility or who might be injured to the assembly location. If it is safe to do so, emergency kits should also be collected.

Once assembled it should be made clear to not leave the building until permission has been granted by the local combat authority. Based on the expected duration of inundation, this is going to be within a 6-hour timeframe. Should a secondary risk such as a fire occur, orderly evacuation to the FASS building should be organised, as there is flood free access to all buildings between the Parramatta Rd Footbridge and the proposed Ross St T&L Hub. This emergency evacuation should avoid using Science Rd and Parramatta Rd.

Notify the NSW SES that people are sheltering-in-place on 132 500. Only end the shelter-in-place upon recommendation from NSW SES. Note that when ending the evacuation that Parramatta Rd about 400m to the west of the site, portions of Western Avenue within the campus and Carillon Ave at the south of the campus could be subject to deep floodwater for longer periods than roads in the immediate vicinity of the site.

In summary:

1. Evacuate the site when an evacuation order is issued by NSW SES as a priority.

2. For flash flooding, when official warnings may be issued too late, the priority is to minimise the number of personal attending the site. This is achieved by:
 - a. When a regional Severe Weather or Severe Thunderstorm warning is issued by the BoM. Actions when:
 - i. The regional warning is received before the working day:
 1. cancel all non-essential work at the site and notify all potential attendees that the site is closed until further notice
 - ii. The regional warning is received during a working day with 6 hours or more warning:
 1. Plan to close the site with sufficient time to allow attendees to return home. This should be atleast a few hours before the severe weather is expected to occur
 2. Cancel any activities that would have more attendees on the site.
 3. Continue to monitor the warnings as they can change rapidly.
 - iii. The regional warning is received during a working with less than 6 hours or more warning:
 1. Immediately plan to close the site and cancel all events or activities that would encourage more attendees to the site.
 2. Assess whether there is sufficient time for attendees to return home safely. Plan for a few hours before the severe weather is expected to occur.
 3. Send all attendees home that can return home safely.
 4. For those who cannot return home safely, plan for a shelter-in-place strategy onsite or plan to move them to a friend's place or shelter until the severe weather has passed.
 - iv. In circumstances when people are isolated at the site by the sudden onset of flash flooding, to enact a shelter in place strategy. This includes:
 1. Clearly communicate the order for assembly at the emergency assembly point through all possible channels
 2. Collect the nearest emergency evacuation kit, if safe to do so.
 3. Have an authorised staff member liaison with the local SES unit to notify them of the decision to shelter in place, so that they can provide additional advice.
 4. Listen to the local radio station for updates on the severe weather warning.
 5. Call emergency services immediately for life threatening emergencies.
 6. Evacuate on foot to the FASS building should it be too dangerous to remain on site.
 7. Only end the shelter-in-place as advised by NSW SES.

Flood Management Plan

Ross Street Teaching and Learning Hub
University of Sydney, Camperdown Campus

Preparedness

- A designated member of the campus staff to sign up for warnings from the NSW SES and BoM to be used as triggers for actions in the event of an emergency.
- Education of staff using the site for the semester of the emergency procedures in the event of a flood should be made available before the teaching semester.
- The final Emergency Management Plan should be easily available for attendees on the site.
- Signage of the emergency procedures during a flood should be readily available, similar to the fire evacuation plans.
- Emergency kits should be available on all floors of the proposed building and clearly signed.
- The emergency kits to be maintained and checked regularly.
- Clearly decide on staff responsibilities before an emergency.
- Test and reinforce the plan through regular evacuation drills, at a minimum frequency of every 12 months but recommend at every teaching semester

Response

1. Evacuate the site when an evacuation order is issued by NSW SES as a priority.
2. For flash flooding, when official warnings may be issued too late, the priority is to minimise the number of personal attending the site. This is achieved by:
 - a. When a regional Severe Weather or Severe Thunderstorm warning is issued by the BoM. Actions when:
 - i. The regional warning is received before the working day:
 1. cancel all non-essential work at the site and notify all potential attendees that the site is closed until further notice
 - ii. The regional warning is received during a working day with 6 hours or more warning:
 1. Plan to close the site with sufficient time to allow attendees to return home. This should be atleast a few hours before the severe weather is expected to occur
 2. Cancel any activities that would have more attendees on the site.
 3. Continue to monitor the warnings as they can change rapidly.
 - iii. The regional warning is received during a working with less than 6 hours or more warning:
 1. Immediately plan to close the site and cancel all events or activities that would encourage more attendees to the site.
 2. Assess whether there is sufficient time for attendees to return home safely. Plan for a few hours before the severe weather is expected to occur.
 3. Send all attendees home that can return home safely.

4. For those who cannot return home safely, plan for a shelter-in-place strategy onsite or plan to move them to a friend's place or shelter until the severe weather has passed.
- iv. In circumstances when people are isolated at the site by the sudden onset of flash flooding, to enact a shelter in place strategy. This includes:
 1. Clearly communicate the order for assembly at the emergency assembly point through all possible channels

It must be made clear to people seeking refuge in the building that the local floodwater is expected to be too hazardous to evacuate in for both small and large vehicles, to leave any possessions in their cars as most exits from the building to cars are likely to be subject to high hazard flooding and meet at the emergency assembly point.

2. Collect the nearest emergency evacuation kit, if safe to do so.
3. Have an authorised staff member liaison with the local SES unit to notify them of the decision to shelter in place, so that they can provide additional advice.
4. Listen to the local radio station for updates on the severe weather warning.
5. Call emergency services immediately for life threatening emergencies.
6. Evacuate on foot to the FASS building should it be too dangerous to remain on site due to a fire.
7. Only end the shelter-in-place as advised by NSW SES.

Recovery

Listen and follow recommended procedures once floodwaters subside. If electrical or gas services have been inundated do not turn these appliances on until they have been checked by a qualified electrician or gas fitter.

Important phone numbers		
NSW State Emergency Service:	Emergency – 132 500	General enquiries – p: 4251 6111
Police, Fire, Ambulance	Emergency – 000	
USYD Campus Security		p: 9351 3333
Bureau of Meteorology	Website: http://www.bom.gov.au/nsw/warnings/ , p: 1300 659 218	

