# Western Sydney University Indigenous Centre of Excellence Flood Impact Risk Assessment

## Compilation of Reports

**Item A**
ICoE Flood Impact Risk Assessment

**Item B**
Car Park Flood Assessment

**Item C**
RtS Response Letter

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# Item A
# ICoE Flood Impact Risk Assessment

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# Western Sydney University Indigenous Centre of Excellence Flood Impact Risk Assessment

Western Sydney University

July 2025

Rev I

# Western Sydney University
# Indigenous Centre of Excellence
# Flood Impact Risk Assessment

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| Project | Western Sydney University, Indigenous Centre of Excellence – Flood Impact Assessment |
| Report Includes: | Flood Impact Risk Assessment<br>Flood Emergency Response Plan<br>Riparian Zone Management Assessment |
| Client | Western Sydney University |
| Job No. | 230076 |


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# 2. Executive Summary

An Indigenous Centre of Excellence (ICoE) is proposed to be developed in the north-eastern corner of Western Sydney University's (WSU) Parramatta South campus.

A flood impact risk assessment (FIRA) has been undertaken for the site and the proposed development. The flood behaviour has been modelled – according to Australian Rainfall and Runoff guidance – in both this existing and proposed scenario and compliance has been demonstrated with local planning guidance including the Parramatta Local Environmental Plan (LEP) (2023), the Parramatta Development Control Plan (DCP) (2023).

GRC Hydro's (GRC) initial report was reviewed by a variety of agencies who then offered comment. GRC has responded to these comments and have updated this report accordingly.

This updated report documents modelling for an updated on-slab design that replaces the previously proposed on-pier design. This updated design remains consistent, and compliant with the flood-related controls and objectives of local planning instruments.

Additionally, GRC has accepted agency guidance on the preference for evacuation and has amended the Flood Emergency Response Plan (FERP) to include provision for an early evacuation trigger based on FloodSmart warnings. FloodSmart warnings will also trigger an email/text request that would-be occupants (students, staff or guests) should stay away from the site if flooding is predicted. Shelter-in-Place has been retained as a residual safety measure in the event that occupants are unable to evacuate prior to Victoria Road becomes inundated.

## 2.1 Response to Request for Information

Previous Development Application (DA) supporting documents have been reviewed by the following agencies:

- The City of Parramatta (Council)
- Transport for NSW (TfNSW)
- NSW State Emergency Service (SES)
- NSW Department of Climate Change, Energy, the Environment and Water (DECCEEW)
- Sydney Water (SW)
- NSW Biodiversity, Conservation and Science (BCS)

The flood-related requests have been collated in the table below along with GRC's responses.

*Table 1: Responses to Agency Comments*

| Agency Ref. | Request | GRC Response |
|---|---|---|
| City of Parramatta Council | The following recommended civil design changes are reiterated:<br>• Suspended slabs are not supported for overland flow flood mitigation.<br>• Building over the existing Council Stormwater pipe is not supported as this does not allow access for maintenance in the future. This pipe must be relocated by the applicant with a set of civil and design drawings of the relocated pipe submitted as part of this application. It should be shown on architectural and landscape plans to ensure that there is no future conflict.<br>• Unobstructed overland flow paths must be provided for the 1% AEP flow event. Council recommends that a further meeting is held with us to discuss these requirements prior to the submission any Response to Submissions report. | The proposed design has been amended so that water can no longer pass beneath the building. The revised proposal is for a slab on ground foundation.<br><br>Regarding stormwater pipe issues, please refer to Civil response.<br><br>The only overland flow path passing through the site comes via a swale that carries water from the oval, beneath the Bridge Rd overpass and into the north-western corner of the existing car park. This flowpath experiences a minor flow of 0.4 $m^3/s$ in a 1% AEP event. The proposed design results in only minor impacts to this flow behaviour and these impacts are limited to the site of proposed works and are predicted to result in no adverse impacts to the oval nor the flowpath upstream of the site. |
| City of Parramatta Council | As the subject site is highly impacted by flooding, overland flow paths need to be identified and quantified to ensure appropriate flooding and overland flow path management. Overland flow paths should be safe and adequate up to 1% AEP (with climate change and rainfall calibration), however adequacy for conveyance should be available for higher storm events up to PMF. | The only overland flow path passing through the site comes via a swale that carries water from the oval, beneath the Bridge Rd overpass and into the north-western corner of the existing car park. This flowpath experiences a minor flow of 0.4 $m^3/s$ in a 1% AEP event. The proposed design results in only minor impacts to this flow behaviour and these impacts are limited to the site of proposed works and are predicted to result in no adverse impacts to the oval nor the flowpath upstream of the site. |
| City of Parramatta Council | A detailed 1D-2D TUFLOW model needs to be developed for the site area for both pre-development condition and post development condition to demonstrate that there will be no impact due to the proposed development and flooding & overland flow paths are safely managed. Council can provide a copy of its flood model for this location to assist the applicant's consultant set up of their pre-developed hydraulic model for this location. A formal request will need to be submitted to Council and a processing fee for this information will be charged in accordance with Council's Fees and Charges. | A detailed 1D-2D TUFLOW model has been developed for the site.<br><br>GRC Hydro acquired Council's model and found errors during the review process. These errors were communicated to Council and Council acknowledged these errors and has accepted GRC's model instead.<br><br>Council has reviewed this model and during a meeting on 12/12/2024, deemed it the most appropriate available model to use to determine flood affectation and developmental impacts at this site. |
| City of Parramatta Council | Currently, the subject site is also functioning as flood storage. Loss of existing flood storage needs to be incorporated in the design. | Proposed reshaping of the site has sought to compensate for the loss of storage posed by amending the design to a slab on ground foundation. Whilst the resulting cut and fill balance results in a 400 $m^3$ loss of flood volume in a 1% AEP event, the design has facilitated improved flow conveyance which has been modelling to have no adverse impact to surrounding (off-site) flood levels in a 1% AEP event. |
| City of Parramatta Council | Climate change scenario with sea level rise should be included in accordance with the latest industry guidelines, especially Australian Rainfall & Runoff. | Two climate change scenarios with sea level rise have been included in the modelling for this project and are included in this report's figure suite. |
| City of Parramatta Council | As part of Parramatta River Flood Study, it was identified that ARR2024 rainfall and methodology is providing lower flowrates than experienced and calibration of the model to match with the Flood Frequency Analysis was required. A separate advice will be provided in relation to the calibration methodology. This should be included while undertaking flood impact assessments. | A 1% AEP design scenario with an additional 19% rainfall loading has been modelled and the results of this modelling have been included in this report's figure suite. |
| City of Parramatta Council | Afflux Maps (Post-Development Scenario minus Pre-Development Scenarios) need to be prepared, and no impact should be demonstrated considering 1%, 5%, 10% & 20% and PMF storm events. | Flood level impacts (afflux) for the 1% AEP event have been shown to demonstrate compliance. The 1% AEP event is the event nominated for compliance. |

| Agency Ref. | Request | GRC Response |
|---|---|---|
| City of Parramatta Council | Hazard Maps as per ARR2019 should be included. | As per previous reporting, these have been included. |
| City of Parramatta Council | Velocity Maps should be included. | As per previous reporting, these have been included. |
| City of Parramatta Council | Sensitivity Analysis<br>a. Blockage 100%, 50% & design blockage for stormwater pipes<br>b. Climate Change (ARR2024)<br>c. Downstream Boundary Condition<br>d. Loss Parameters<br>e. Others parameter as required. | This sensitivity analysis has been done. Blockage and climate change scenarios have been included in the figure set. Downstream boundary conditions were altered in GRC's modelling with no impact at the subject site. |
| City of Parramatta Council | An electronic copy of TUFLOW Model with all relevant files with a brief report outlining model inputs, boundary conditions, assumptions, impact analysis, pre-development and post-development comparison flows & levels at relevant locations, overland flow paths and flood storage changes, results, and recommendations must be provided. | This will be provided in addition to this report. |
| City of Parramatta Council | Investigate and incorporate design to alleviate flooding issues at Victoria Road adjacent to the subject site and drainage adequate to the current standard as mentioned in item 2 below. | The revised proposed design has improved conveyance along the north of the site to alleviate flooding issues along Victoria Road. |
| City of Parramatta Council | Climate change for 2070 has been adopted however climate change in reference to the design/service life of the development should be adopted. Guidance on design/service life is available in ARR2024. | A 2090 climate change scenario has been included. The service life of this building is expected to be within the 50 to 100 year range using the nearest applicable design/service life guidance. |
| City of Parramatta Council | The recently adopted PRFS 2024, advises flood planning area and flood planning level. Flood Planning Level adopted is 1% AEP + 2150 Climate Change with RCP 8.5 + Rainfall Calibration + 0.5m Free Board.<br>Any changes in adopted flood planning level will not be supported. A formal flood enquiry application needs to be submitted to Council to receive flood information. A separate request needs to be submitted for electronic copy of model set-up files. Note that there will be charges for flood enquiry application and for model set-up files. | Council has accepted there are several errors in the adopted PRFS 2024 modelling and as such it does not demonstrate an accurate indication of flood affectation at the subject site. During a meeting on 12/12/2024, Council flood staff deemed GRC's modelling as the most appropriate model to use to determine flood affectation and developmental impacts at this site. Council's 2023 Parramatta DCP defines the flood planning level at 1% AEP plus 0.5 m freeboard. |
| City of Parramatta Council | Provide an adequate Flood Emergency Management Plan that is consistent with SES Flood Emergency Plan and with local emergency plans. | A preliminary flood emergency response plan has been included in this report and this has been done with the intent to align with SES and local emergency plans. Site specific plans may need to differ from broader regional plans in order to adequately address specific risks that each site may experience.<br><br>A more detailed FERP can be developed prior to construction in collaboration with more stakeholders. |
| City of Parramatta Council | Council will not accept underfloor flow paths and buildings must be solid to the ground.<br>Flow paths may contain Water Sensitive Design features, provided they are adequately designed for both low and high flow functions. | The design has been revised to adopt a slab on ground foundation and consequently, no underfloor flow paths exist in the revised design. |
| NSW State Emergency Service | Note the study referred to throughout the Flood Risk Assessment as "Draft Parramatta River Flood Study" was adopted by Parramatta Council in June 2024 should be viewed as the most up to date flood information for the site. | Reference to the PRFS has been updated in GRC's reporting. As noted above, Council has agreed to adopt GRC's modelling as the most appropriate model for the site given the acknowledged errors in the adopted PRFS modelling. |
| NSW State Emergency Service | Note the site is significantly flood affected becoming inundated as frequently as a 20% Annual Exceedance Probability (AEP) event and reaches depths in excess of 3 metres during a Probable Maximum Flood (PMF) event. | These flood depths were the result of an erroneous model. GRC's modelling, which has been accepted by Council as the most reliable model to assess flooding at this site indicates the magnitude of flooding in the noted events (20% AEP and PMF) to be less than as modelled in the PRFS. The flood affectation in these events is documented in the suite of figures. |

| Agency Ref. | Request | GRC Response |
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| NSW State Emergency Service | Recommend seeking further information incorporating from the adopted Parramatta River Flood Study as well as time to overtopping of both the site and adjacent roads. | According to GRC's modelling (which as been approved by Council to supersede a presently erroneous PRFS model) in a 20% AEP event, Vineyard Creek does not overtop and as a consequence, Victoria Road does not become inundated. In a 1% AEP event, the time to overtop Victoria Road and the site itself becomes inundated after 1 hour and 15 minutes. |
| NSW State Emergency Service | Emphasise that NSW SES does not support shelter in place as a strategy for new development or the imposition of development consent conditions requiring private flood evacuation plans rather than the application of sound land use planning and flood risk management. | GRC has addressed the recently adopted Shelter-in-Place Guideline for Flash Flooding in Section 8.2. |
| NSW State Emergency Service | Recommend closing the facility or sections that are at known risk of flooding or isolation prior to the onset of flooding and when there is an indication that flooding is likely. | When there is an indication that flooding is likely, WSU staff will instruct occupants on the ground floor to ready themselves for vertical evacuation up to levels one and above. As the likelihood of flooding increases, WSU flood wardens will instigate vertical evacuation as part of a shelter in place strategy and temporarily close off the ground floor of the building until flooding subsides. |
| NSW State Emergency Service | Request that the emergency procedures contained in the Flood Emergency Response Plan are rewritten to reflect current NSW SES terminology and procedures. Please see Attachment A for further specific details. However, we reinforce that a FERP is not a failsafe way of managing an underlying flood risk. | GRC understand that a FERP in and of itself is not a failsafe and design iteration has been undertaken to significantly mitigate the exposure of the current site to flood affectation. For example, the site currently exposes dozens of cars to floodwaters whereas the proposed design will reduce the potential damages due to flooding by raising the usable area well above the 1% AEP flood level in a flood-safe structure.<br><br>SES terminology and deference to the SES as the combat agency as per the Parramatta EMPLAN have been reflected in the updated preliminary FERP (see section 7). |
| NSW State Emergency Service | Recommend pursuing, if relevant, site design and stormwater management that reduces the impact of flooding and minimises any risk to the community. Any improvements that can be made to reduce flood risk will benefit the community. | An amended proposed design has resulted in a reduction of potential flood levels at and surrounding the site. The proposed development will reduce the potential damage due to flooding by replacing a flood-exposed car park with a flood-safe building raised well above the 1% AEP flood level. Therefore the potential for damage is reduced as is the direct exposure of people to flooding. |
| NSW State Emergency Service | Any proposed Emergency Management strategy for an area should be compatible with the evacuation strategies identified in the relevant local or state flood plan or by the NSW SES. As per the NSW State Flood Plan4 and the Parramatta LGA Flood Emergency Sub Plan, evacuation is the primary emergency management strategy for people impacted by flooding5. | The FERP component of this study has been amended to address agency concerns and also address DPHI's recently-issued Shelter in Place guidelines. |

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| NSW State Emergency Service | We request that the emergency procedures contained in the Flood Emergency Response Plan are rewritten to reflect current NSW SES terminology and procedures, and provide the following additional recommendations:<br>• Recommend reducing the reliance on flood wardens and human behaviour to initiate emergency procedures. The FERP currently states "Flood wardens will observe the on-site flood markers at very regular intervals" and that emergency procedures will commence when markers reach 7.8 mAHD, however as the PMF rate of rise shows flooding reaches flood level in a matter of minutes this is not a reliable trigger.<br>• Recommend references to "the 1% AEP design flood event" and other modelled storm events are removed from the emergency management plan and replaced with clear and actionable triggers which align with warnings issued by the Bureau of Meteorology and NSW SES, rather than AEP events. Warnings will not list the expected AEP extent as this is not known until after the peak of the flood event. Further, as the site is affected by flash flooding it is not subject to flood warnings. As such, Severe Weather Warnings and Thunderstorm Warnings will be the most likely form of advice about the potential for flood producing storms and rainfall.<br>• Recommend 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. This is particularly challenging and likely to result in many "false alarms" as there are no formal warning systems for flooding at the site. However, the strategy of isolation or sheltering in buildings surrounded by flood water are not equivalent, in risk management terms, to evacuation.<br>• Recommend careful consideration to the use of lifts in any vertical evacuation strategy. While the FERP states "Whilst stairways are the encouraged vertical evacuation route, elevators can continue to be used to vertically evacuate persons requiring assistance to the first level, during a PMF event flood water is modelled to reach 1.4 metres above floor level. | The FERP has been amended to prioritise a very early warning trigger that encourages evacuation and for would-be occupants to stay away in the first place.<br><br>It also makes clear that the SES are the combat agency for flood response as per the Parramatta EMPLAN and that their evacuation orders are to be deferred to.<br><br>Shelter-in-Place provision is retained as a last resort in the event that some occupants aren't able to evacuate prior to Victoria Rd (the major access road) becomes inundated and unsafe to pass through.<br><br>The FERP component of this study has been amended to address agency concerns and also address DPHI's recently-issued Shelter in Place guidelines. |
| NSW State Emergency Service | The Parramatta River Flood Study adopted by Parramatta Council in June 2024 shows the site, in its current condition, as significantly more flood affected than stated in the Flood Impact Assessment. The Parramatta River Flood Study shows the site is entirely inundated as frequently as a 20% AEP event reaching hazard level 4 (H4). During a PMF event flooding exceeds 1.5 metres depth across the entire site and is mapped as H5 across the site. This level of hazard is unsafe for all people and vehicles with buildings requiring special engineering design and construction.<br><br>The Flood Impact Assessment, however, states that during a 20% AEP event "Flood Depths: predominantly less than 0.1 m deep with a small portion up to 0.3 m. Flood Hazard: Max of H1 (low hazard)". Further, figures 12 to 23 show significantly less flooding across the site than the adopted flood study showing the site as only partially inundated during a 20% AEP event and reaching only H3 under existing conditions.<br><br>Further information should be sought, particularly with reference to the adopted 2024 Parramatta River Flood Study to accurately determine the flood risk on the site.<br><br>NSW SES has previously responded to flooding incidents in the area of the university campus including road inundation. As the site and Victoria Road access are inundated during the 20% AEP flood, isolating the site, further modelling should be undertaken to demonstrate the time to overtopping of roads and the site itself. | Council has accepted there are several errors in the adopted PRFS 2024 modelling and as such it does not demonstrate an accurate indication of flood affectation at the subject site. During a meeting on 12/12/2024, Council flood staff deemed GRC's modelling as the most appropriate model to use to determine flood affectation and developmental impacts at this site.<br><br>In a 20% AEP event, Vineyard Creek does not overtop and as a consequence, Victoria Road does not become inundated. In a 1% AEP event, the time to overtop Victoria Road and the site itself becomes inundated after 1 hour and 15 minutes. |

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| NSW State Emergency Service | The ability of the existing community to effectively respond (including self-evacuating) within the available timeframe on available infrastructure is to be maintained. It is not to be impacted on by the cumulative impact of new development.<br>Risk assessment should have regard to flood warning and evacuation demand on existing and future access/egress routes. Consideration should also be given to the impacts of localised flooding on evacuation routes. Evacuation must not require people to drive or walk through flood water.<br>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. | An early flood evacuation trigger has been adopted based on FloodSmart warnings.<br><br>In the event that some occupants aren't able to safely evacuate in time, an adequate shelter above the PMF with ample space and provisions is retained for their safety.<br><br>The proposed design provides ample refuge above the PMF level and is situated within a university campus that has plenty of ground and enclosed shelter that lies outside the PMF extent. |
| NSW State Emergency Service | Managing flood risks associated with Low Flood Islands requires careful consideration of development type, likely users, and their ability respond to minimise their risks. This includes consideration of:<br>• 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.<br>• 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.<br>• 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 site is situated on the fringe of a trapped high perimeter area (according to the PRFS) with ample land and enclosed refuge areas situated both above the PMF level and outside of the PMF extent.<br><br>In the event of a secondary risk, emergency vehicles can access the site even in an extremely rare PMF event by entering and exiting the site via Bridge St overpass that connects the site with the housing facility on the northern side of Victoria Road which then connects to James Ruse Drive. |
| NSW State Emergency Service | Any Emergency Management strategy needs to consider people visiting the area or using a development. | The FERP component of the report has been updated to clarify this consideration.<br><br>The adoption of a residual (after early warning and evacuation has been conducted) shelter in place strategy addresses the potential naivety and/or confusion of visitors with regard to safe evacuation options during a flood event. Visitors to the site (even those who might be familiar with the local area) are unlikely to be familiar with which roads are likely to be inundated in a flash flooding event. This makes attempting to evacuate by road very unsafe. A strategy that encourages occupants and visitors to remain on-site – where ample refuge above the PMF is available – is a more reliable harm minimisation strategy than relying on the uncertainty of multiple parties attempting to evacuate and expose themselves to floodwaters in a stressful emergency situation. |
| NSW State Emergency Service | 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 rate of rise of flood waters is relatively quick (only ~35 minutes for waters to rise above the finished floor level" during the PMF event, little to no warning time is likely to be available following the commencement of rainfall that would provide the community an opportunity to respond. | An early warning system has been adopted to encourage evacuation early based on FloodSmart warnings.<br><br>These warnings will be clearly communicated to occupants and would-be users of the site via a range of electronic and aural means both on-site and off-site (to discourage people trying to travel to the site). |
| NSW State Emergency Service | Development in a floodplain will increase the need for NSW SES to undertake continuous community awareness, preparedness, and response operations.<br>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.<br>However, it is important to note that the NSW SES is opposed to the imposition of development consent conditions requiring private flood evacuation plans rather than the application of sound land use planning and flood risk management. | The proposed development, being commercial in nature and operated by a single entity with staff who are on-site every day, allows for efficient and effective communication of flood risks and carry out training and evacuation preparedness.<br><br>The proposed development is situated within a broader area (off site) that is developed and also flood liable. The proposed site has connection and rising access to surrounding ground and facilities which are flood free in a 1% AEP event and a PMF event. |

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| Biodiversity, Conservation and Science | The site is affected by local overland flow and mainstream flooding from Vineyard Creek. Flooding from the Parramatta River would also affect the site, although this may only be during larger events.The Parramatta River Flood Study (PRFS, Stantec, 2024) was exhibited in draft form in 2023 and adopted on 11 June 2024, which is acknowledged in the EIS. It should be noted that the PRFS was calibrated through an extensive process. The PRFS shows substantially different levels and hazard to the FIA, which the EIS suggests would be investigated at the "post-lodgement stage". The site is mapped as including floodway and flood storage from the 20% AEP event. The FIA has not considered flood function. The FIA therefore requires substantial revision to comply with the SEARs.BCS notes considerable residual risks are associated with this development as proposed, particularly in relation to lack of access and isolation. | Council has accepted there are several errors in the adopted PRFS 2024 modelling and as such it does not demonstrate an accurate indication of flood affectation at the subject site. During a meeting on 12/12/2024, Council flood staff deemed GRC's modelling as the most appropriate model to use to determine flood affectation and developmental impacts at this site.<br><br>Floodway modelling has been undertaken and has now been added to this report. The proposed development is not located in a floodway. |
| Biodiversity, Conservation and Science | The PRFS indicates that significant flooding of the development site would occur from at least the 20% AEP event. In the PMF, floodwater would inundate the ground floor to a depth in the order of 1.5 m, which is considered high hazard. High hazard floodwater would also be present on evacuation routes.<br>The PRFS indicates that access to the site would be lost from at least the 20% AEP event. More frequent events are not available in the published study. However, more frequent events were modelled for the PRFS and should be available in the Council flood model.<br>Recommendation: The FIA is updated to include more frequent events as outlined in above comment. | Council has accepted there are several errors in the adopted PRFS 2024 modelling and as such it does not demonstrate an accurate indication of flood affectation at the subject site. During a meeting on 12/12/2024, Council flood staff deemed GRC's modelling as the most appropriate model to use to determine flood affectation and developmental impacts at this site.<br><br>GRC's modelling includes a wide spectrum of design events. The 5% AEP event has been added. The 20% AEP modelling at the site indicates that the site is not materially flood affected. |
| Biodiversity, Conservation and Science | The newly adopted PRFS shows different levels and different hazard in some areas compared to the FIA. The PRFS, being calibrated, is expected to have higher flows than the FIA model. Further, the FIA does not appear to have modelled building blockages as the PRFS has per the below image. The PRFS has modelled Council's drainage network in full. The FIA states that a 700 mm pipe was modelled, which is inconsistent with the drainage system diagram shown in Figure 2 of the Stormwater SSD Report. There would be further differences between the models. Recommendation: The FIA is revised in line with the new PRFS and then the EIS should be revised accordingly. BCS recommends that the Council flood study model is used to revise the FIA due to the significant discrepancies between the two sets of results. | Council has accepted there are several errors in the adopted PRFS 2024 modelling and as such it does not demonstrate an accurate indication of flood affectation at the subject site. During a meeting on 12/12/2024, Council flood staff deemed GRC's modelling as the most appropriate model to use to determine flood affectation and developmental impacts at this site.<br><br>The City of Parramatta provided GRC with the PRFS model and GRC updated its model to include the local pits and pipes data.<br><br>For the proposed case modelling, a pipe proposed to connect the site with Vineyard Creek downstream has been modelled as 100% blocked so as to provide a conservative representation of flood behaviour at the subject site. |

| Agency Ref. | Request | GRC Response |
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| **Biodiversity, Conservation and Science** | Given the mapping of floodway and flood storage for the site, potential flood impact requires detailed consideration. BCS raises the following concerns regarding the flood impact assessment.<br>The civil drawings indicate a design surface has been prepared for below the building and show excavation of 0.15 – 0.5 m over a large area below the northern arm of the building. It appears the intent is to create an overland flow path beneath the building by regrading the existing surface to mitigate flood impacts. The FIA should be updated to explain the design here, including the principles and criteria. It should be noted that Parramatta City Council no longer permits flow paths beneath buildings due to poor urban design outcomes, the accumulation of rubbish, unsightly appearance, and difficulties with maintenance and vermin. The Parramatta Development Control Plan 2023 under Section 5.1.1 Flooding control C.15 states "In general, Council will not support proposals for flood flow-through or flood storage chambers within or beneath a new building, and alternate design solutions will be required." BCS considers that the introduction of an underfloor void introduces considerable risks which would preferably be avoided through an alternate design.<br>With no details presented in the FIA, BCS raises concerns with the flow path design. The architectural drawings indicate locations with insufficient height available for water to pass beneath the building, which could lead to blockage. The proposed surface beneath the building has not been stated. Blockage, maintenance access, and obstruction by vegetation have not been considered. Figure 19 Concept Design Development Render of the EIS shows considerable vegetation in front of the entry to the flow path, which does not appear to have been included in the flood model. The flood figures, architectural, civil and landscaping drawings do not designate the overland flow path.<br>BCS is further concerned that the FIA has not modelled any obstructions for the proposed building. As a minimum, the entry points shown on architectural drawings need to be included in the model.<br>The FIA notes that an impact on flood levels to the east of the creek in the area immediately downstream of Victoria Road has been edited from the mapping. BCS requests that all mapping be provided without such editing, notwithstanding that the justification for the impact does not appear unreasonable.<br>Recommendation: The FIA is updated to address the above flood impact assessment concerns. | The underfloor flow path has been eliminated in the revised design which instead adopts a slab on ground foundation. |
| **Biodiversity, Conservation and Science** | The PRFS indicates that access to the site would be lost from at least a 20% AEP event, which is very frequent. For context, drainage for this development would be typically designed to convey the 5% AEP event. This frequency of inundation and isolation increases the risk of several adverse outcomes such as people driving or walking through floodwater and requiring rescue; coincident medical or other emergencies such as fire; and loss of services such as power and water.Recommendation: BCS recommends further consideration is given to improving the frequency with which access is lost. | Council has accepted there are several errors in the adopted PRFS 2024 modelling and as such it does not demonstrate an accurate indication of flood affectation at the subject site. During a meeting on 12/12/2024, Council flood staff deemed GRC's modelling as the most appropriate model to use to determine flood affectation and developmental impacts at this site.<br><br>GRC's modelling indicates that the inundation in the 20% AEP event is less significant than that modelled in the PRFS and that access to the site is not lost in even the 1% AEP event. In the 1% AEP event, flood free connection remains between the ground floor entrance and the street frontage. |

| Agency Ref. | Request | GRC Response |
|---|---|---|
| **Biodiversity, Conservation and Science** | The FIA should be updated to a Flood Impact and Risk Assessment (FIRA) in accordance with the NSW Flood Risk Management Manual 2023 and its supporting toolkit. In particular, the revised report should consider the provisions of Flood Risk Management Guidelines FB01 Understanding and managing flood risk, EM01 Support for Emergency Management Planning, and LU01 Flood Impact and Risk Assessment. In addition to the issues raised elsewhere in this advice, the following is required:<br>• A new flood certificate based on the current flood study should be sought from Council.<br>• Consideration of the flood function of the land.<br>• Consideration of flood impacts for the full range of flood events. The building footprint and ground conditions require further detailed consideration to accurately determine the flood impact as explained above. The developed conditions figures should show relevant architectural details such as entries and other obstructions.<br>• Consideration of flooding from the Parramatta River in extreme events. The PMF level in Parramatta River appears to be in the order of 9 m, which approximately corresponds to a 2% AEP event in Vineyard Creek at the site. This would also isolate the site.<br>• Consideration of the time to onset of flooding and duration of isolation. This requires consideration of a range of storm durations and consideration of flooding from the Parramatta River.<br>• Recommendation: The FIA is updated to a Flood Impact and Risk Assessment (FIRA) in accordance with the NSW Flood Risk Management Manual 2023 and its supporting toolkit and address all matters raised in above comment. | The FIA has been updated to a FIRA which considers provisions in the following:<br>• FB01 Understanding and managing flood risk,<br>• EM01 Support for Emergency Management Planning, and<br>• LU01 Flood Impact and Risk Assessment<br><br>An updated flood certificate was requested and provided, however the advice on the certificate was based on PRFS 2024 results which have been demonstrated to be unreliable given a suite of errors that have been acknowledged by Council.<br><br>Flood function and impacts have been modelled and included in this report. The site lies outside of the floodway which remains in-bank along Vineyard Creek.<br><br>Flood level impacts have been modelled for a variety of events. Afflux in the 1% AEP event remains the event upon which compliance is determined.<br><br>Whilst the Parramatta River PMF exhibits connectivity with Vineyard Creek flooding at the site, the site remains connected to land, sheltered facilities and levels one and above which are all free of inundation in a PMF event.<br><br>In a 20% AEP event, Vineyard Creek does not overtop and as a consequence, Victoria Road does not become inundated. In a 1% AEP event, the time to overtop Victoria Road and the site itself becomes inundated after 1 hour and 15 minutes.<br><br>The report has been upgraded to a FIRA, |
| **Biodiversity, Conservation and Science** | Flood Risk Management Guideline EM01 Support for Emergency Management Planning provides guidance on emergency management.<br><br>The principles of the guideline should be fully considered and responded to in a FIRA. Under Part D, Figure 21 presents a decision-making process for development that is compatible with existing zoning.<br><br>Recommendation: Further investigation of the relevant elements of the flowchart in Figure 21 of the Flood Risk Management Guideline EM01 and as detailed elsewhere in this letter is required. This includes time of isolation, safety of occupants during isolation and residual risks. | A response to EM01 Support for Emergency Management Planning is included in Section 8.2. |

| Agency Ref. | Request | GRC Response |
|---|---|---|
| **Biodiversity, Conservation and Science** | The FIA has recommended a shelter in place (SIP) strategy, due to the fast rate of rise of floodwater in the PMF. Where provisions are made to SIP, particular consideration must be given to isolation, secondary risks and human behaviour. Suitable utilities and provisions must be provided. The building itself would require sufficient space and amenities to cater to the itinerant population. These issues have not been duly considered in the FIA. SIP is not considered suitable in areas of high hazard flooding. The building is surrounded by high hazard flooding in a PMF event.<br>Further, SIP is not considered suitable when the duration of isolation is not short. The duration of isolation has not been adequately addressed in the FIA because Parramatta River flooding was not considered. The duration of isolation should be suitably checked, including by modelling long duration PMF events. It is unreasonable to make conclusions on the duration of isolation solely based on the critical duration for flood levels. When long duration PMF events are considered, much longer durations of isolation can be identified.<br>Utility services such as power and water may be unavailable at the same time as lack of access and egress due to flooding. Further detail around back up services may be needed for example generators and water storage, including their location (preferably above the PMF).<br>Recommendation: The above comments in relation to the proposed shelter in place strategy need to be addressed. | The preliminary FERP included in this document recommends early evacuation, defers to SES evacuation orders as a priority but also retains a shelter-in-place capacity in the event that flash flooding occurs so quickly that FloodSmart, BoM or SES warnings allow for safe evacuation.<br><br>Shelter in place offers the safest flood emergency response given the broader catchment is subject to flash flooding and this poses unacceptable risk to would-be evacuees. Evacuation increases the risk of drivers being caught up in unsafe flood waters.<br><br>Backup power and water supply will be afforded in the development's final design and operation.<br><br>The site has been modelled to be isolated for less than two hours and the Parramatta River PMF (9 mAHD according to the PRFS 2024) will also recede steadily after reaching this peak. |

| Agency Ref. | Request | GRC Response |
|---|---|---|
| Biodiversity, Conservation and Science | BCS does not consider that private FERPs are a substitute for sound land use planning. Issues pertaining to flood emergency management should be co-ordinated with the SES and adequately resolved prior to planning approval to ensure that the development is compatible with the flood function and behaviour of the land. Guideline EM01 recommends that any emergency response strategy is consistent with SES local flood plans. Section A2.4 states that site-specific flood response plans are not considered by the SES to be an effective measure to strategically and effectively manage EM risks to the community during flooding. It is further stated that they are prone to failure, particularly where they do not consider important EM planning factors, do not have formalised and practised EM arrangements or access to important information.A FERP has been included as part of the FIA. BCS raises several issues with the FERP:• The FERP refers to "back up power and water provision", but no detail has been provided on these. Further, details of food storage have not been provided.• The FERP provides no details on the proposed shelter in place location, nor its capacity or suitability.• The FERP suggests that lifts may be used during a flood. The use of lifts should be avoided during a flood.• The nominated emergency access point immediately south of the proposed building's southern entrance would not provide emergency access as the area is isolated from the 20% AEP flood.• The FERP suggests that "staff should specifically look for warnings related to Parramatta River" on the Bureau of Meteorology (BoM) warnings page. However, BoM does not issue flood warnings for the Parramatta River. Nevertheless, flood watches are issued by BoM for the Parramatta River and may provide advance notice of flooding. It should be noted that flood watches issued by BoM are for large areas and that no indication of event magnitude (for example minor, moderate or major) is provided for the Parramatta River. A reference to severe weather warnings issued by BoM may also be beneficial for the FERP.• The FERP notes that the flood warden should monitor water levels to trigger moving to higher elevations. BCS is concerned that reliance on this method may not lead to the outcome of safe relocation to SIP. The FIA (page 52) indicates that a very short time is available and has not demonstrated that the time available would be sufficient to initiate and execute relocation of occupants present on the ground floor and the floodplain surrounding the building.Recommendation: The FERP is revised following reassessment of risk based on the current version of the PRFS and then referred to the SES for consideration. | A site-specific flood emergency response plan (FERP) is requested as per the Parramatta DCP 2023 and GRC has provided this.<br><br>The FERP has been revised based on agency feedback to adopt an early warning, early evacuation approach.<br><br>Shelter-in-Place has been retained for residual risks following evacuation so if some people are unable to safely evacuate due to rising waters overtopping Victoria Road, ample and sufficient shelter above the PMF remains so that they can wait for the flash flooding to subside (within 2 hours as modelling suggests).<br><br>The FERP outlines the following:<br>• Backup power and water provision will be detailed in the detailed design phase;<br>• The whole of floors 1, 2 and 3 can safely function as refuge above the PMF level. These floors will be populated by architecturally designed lecture halls and classrooms and will offer comfortable refuge.<br>• Emergency supplies and food storage will be facilitated in kitchen areas on each floor.<br>• The building's southern entrance is not isolated in a 20% AEP flood. BCS's assessment of isolation in a 20% AEP event is based on the PRFS modelling which Council has acknowledged as erroneous with GRC's modelling to be preferred for this study. The southern entrance remains accessible in a 1% AEP event.<br>• Stairwells allow for vertical evacuation from the ground floor to the first floor.<br>Whilst GRC understands there is a preference not to rely on visual assessment at the site, the triggers adopted are conservative (i.e. the levels of the trigger are 1 m below the ground level and the evacuation process only involves walking up a few steps to get a few metres above the ground floor level which will likely only take a few seconds to a few minutes.) |
| Biodiversity, Conservation and Science | The development is inconsistent with the flood provisions in Part 5.1.1 of Parramatta DCP 2023. In particular:<br>• new development is only permitted where reliable access is available (Control C.07). It has not been demonstrated that the development is consistent with the Parramatta LGA Flood Emergency Sub Plan as required under the matrix control number 4 for evacuation. Excavation below the flood planning level is generally not permissible without a flood impact and risk assessment (FIRA); and<br>• 'Educational establishments', listed under 'Sensitive Uses and Facilities' in Table 5.1.1.1 are not permitted on land subject to flooding in a PMF (Control C.16). 'Educational establishment' is defined the Parramatta LEP 2023 as a building or place used for education (including teaching) – b) tertiary institution, including a university or a TAFE establishment, that provides formal education and is constituted by or under an Act.<br>Recommendation: Parramatta DCP 2023 flood provisions C.07 and C.16 should be addressed. | The Indigenous Centre of Excellence will function as a special use building and will operate differently to a traditional university building.<br><br>In essence, it functions as a commercial space which predominantly serves adults (not children or elderly people) who would have the capacity to evacuate or seek shelter in the event of an emergency. |
| Biodiversity, Conservation and Science | The proposed building nor the water feature should encroach into the riparian zone. Recommendation: Figure 40 of the FIA is updated to include the proposed conditions, and the landscape and civil drawings should include the riparian zone boundary in order to confirm the nature of proposed works within the riparian corridor. | Figure 57 indicates that the proposed building and landscaping zone does not encroach on the riparian zone. |

# 3. Introduction

## 3.1 Site Location and Description

The Western Sydney University South Parramatta Campus is located within the City of Parramatta Local Government Area (LGA).

The site is legally described as Lot 100 and 101 in DP 816829 and largely comprises the P1 Car Park and grassed embankments along Fifth Street in the northern portion of the wider site campus. The site location and project boundary is identified in Figure 1.

*Figure 1: Western Sydney University Parramatta South Campus locational context*

Source: Nearmap/Ethos Urban

The site is located approximately 3km east of the Parramatta CBD and is also located adjacent to the recently completed Parramatta Light Rail Corridor, with direct access to the Yallamundi Light Rail stop.

# 4 Project Description

The Applicant seeks development consent for the construction of a new state-of-the-art Indigenous Centre of Excellence as a new tertiary education facility on campus. The Indigenous Centre of Excellence project is funded by the NSW Government's Western Sydney Infrastructure Grants Program in association with Western Sydney University. The new Indigenous Centre of Excellence will be an important asset for both the

University and local community alike, providing a space for the commitment to advancing Indigenous education, leadership, and reconciliation.

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

- Site preparation including demolition of the existing car park, tree removal and installation of inground utility infrastructure services.
- Construction of a four-storey Indigenous Centre of Excellence encompassing the following facilities:
  - Outdoor amphitheatre,
  - Cinema and lecture theatre,
  - Artist studios and gallery exhibition space.
  - Teaching workspaces and general study areas,
  - Library and other educational research spaces,
  - Multi-functional recreational sports court, with ancillary amenities, and
  - Astronomy garden.
- Construction of hardstand paving and line marking to accommodate new parking areas, including:
  - 13 spaces on the existing P1 car park site, adjacent to the new dedicated arrival zone to the proposed ICoE,
  - 107 spaces proposed in new western car park to the west of Bridge Street, adjacent to the existing oval, and
  - 181 spaces proposed in new eastern car park on the southern side of Fifth Street, adjacent to the new ICoE.
- Landscaping works to provide outdoor educational and recreational spaces.

This report responds to the relevant SSD-64916225 Secretary's Environmental Assessment Requirement (SEARs), as well as addresses updated Amending SSD cumulative impacts associated with the revised car park scope.

| | |
|---|---|
| Flood Risk Assessment | 15. Flooding Risk<br>• 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.<br>• Assess the impacts of the development, including any changes to flood risk on-site or off-site, and detail design solutions and operational procedures to mitigate flood risk where required. |

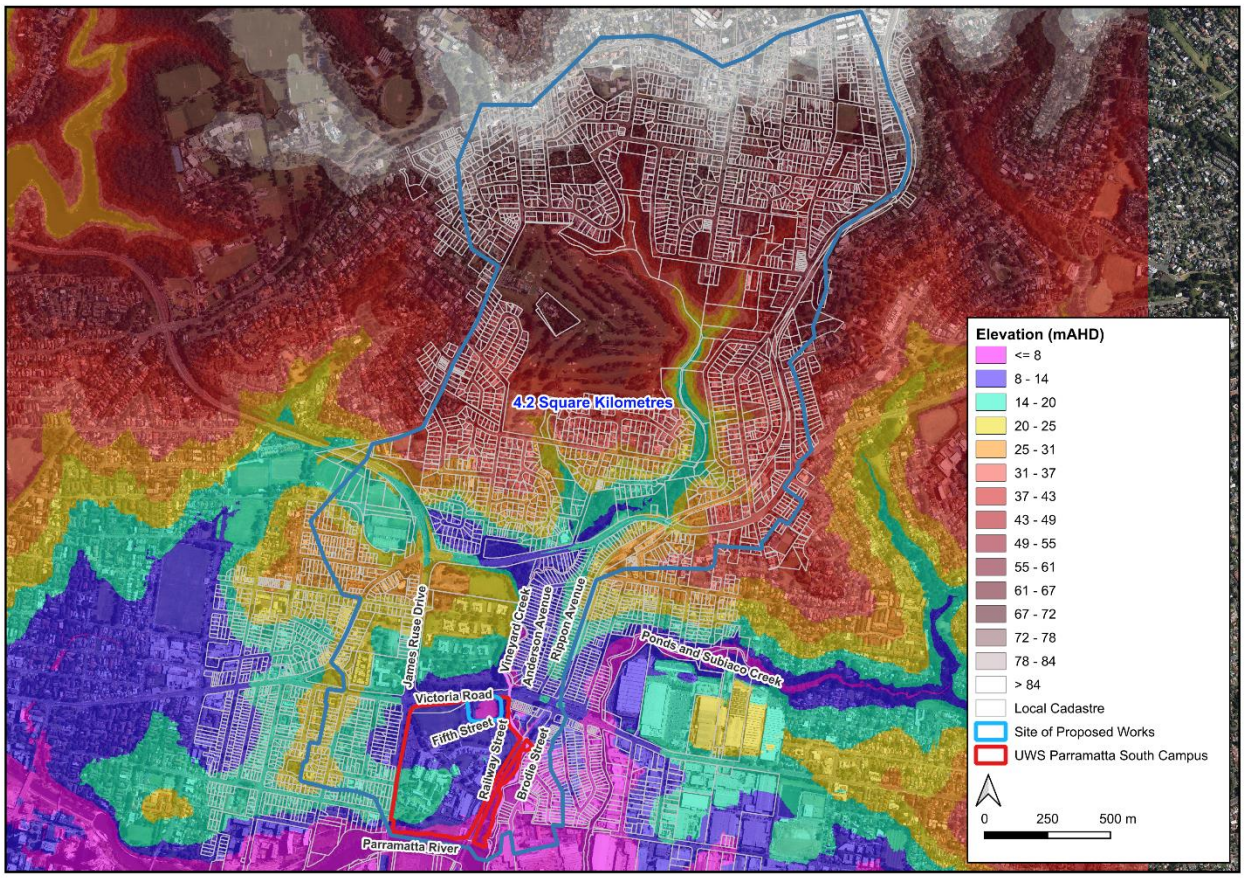
| | |
|---|---|
| Riparian Zone Management Assessment | Riparian Zone Management<br>• Where applicable, provide a Riparian Zone Management Assessment prepared by a suitably qualified professional, to determine the presence of mapped and potential unmapped waterways across the site and where relevant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

## 4.1 Topographic Context

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

The site is situated north of the Parramatta River and immediately west of Vineyard Creek, a tributary of the Parramatta River that drains a catchment of approximately 4.2 km$^2$. The site is located towards the bottom of this catchment.

*Figure 2: Vineyard Creek Catchment*




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

Requirements (SEARs) issued for the site by the NSW Department of Planning, Housing and Infrastructure (DPHI).

## 4.2 Project Scope

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

The work undertaken to complete this report includes:

- Engaging with the City of Parramatta (Council) to confirm the Council-endorsed flood levels and extents for the site in its existing case;
- Developing a best practice hydrological and hydraulic model to derive local flood depths, flood levels, hazards and velocities for the following events (20%, 5%, 1%, 0.2% and PMF) in the existing and post-developed case;
- Assess the site's flood affectation in a future climate change scenario in accordance with the NSW Department of Planning and Environment's (DPE) Flood Risk Management Guideline FB01. This has been conducted through the modelling of a 1% AEP + RCP 4.5 2050 and 1% AEP + RCP 4.5 2090 event in both an existing and post-developed scenario;
- Assess the proposed development and modelled flood affectation relative to planning instruments applicable for the site, such as:
    - The Parramatta Local Environmental Plan 2023 (PLEP 2023);
    - The Parramatta Development Control Plan 2023 (PDCP 2023);
    - The SEARs issued for the site by NSW DPHI.
- Assess the proposed development's opportunities for safe shelter and/or evacuation in the event of a flood emergency; and
- Summarise the above in a FIRA, RZMA and FERP.

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

# 5 The Site's Flood Liability

The site is flood liable when Vineyard Creek flow overtops its banks at Victoria Road, enters Victoria Road and then flows into the site.

The site is bordered to the west by an oval which is elevated slightly higher (8.4 mAHD) than the existing car park site (7.5 mAHD) and the oval drains toward the existing car park via a swale which travels eastward from the north-east corner of the oval, beneath Bridge Street's overpass and connects with the north-western corner of the car park.

This flood liability has been documented in the City of Parramatta's (Council's) provided flood certificate. This flood certificate summarises Council's adopted flood levels in the vicinity of the site and has been attached to this report in Appendix A.

*Figure 3: Flood Extents at the Site (Council)*

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

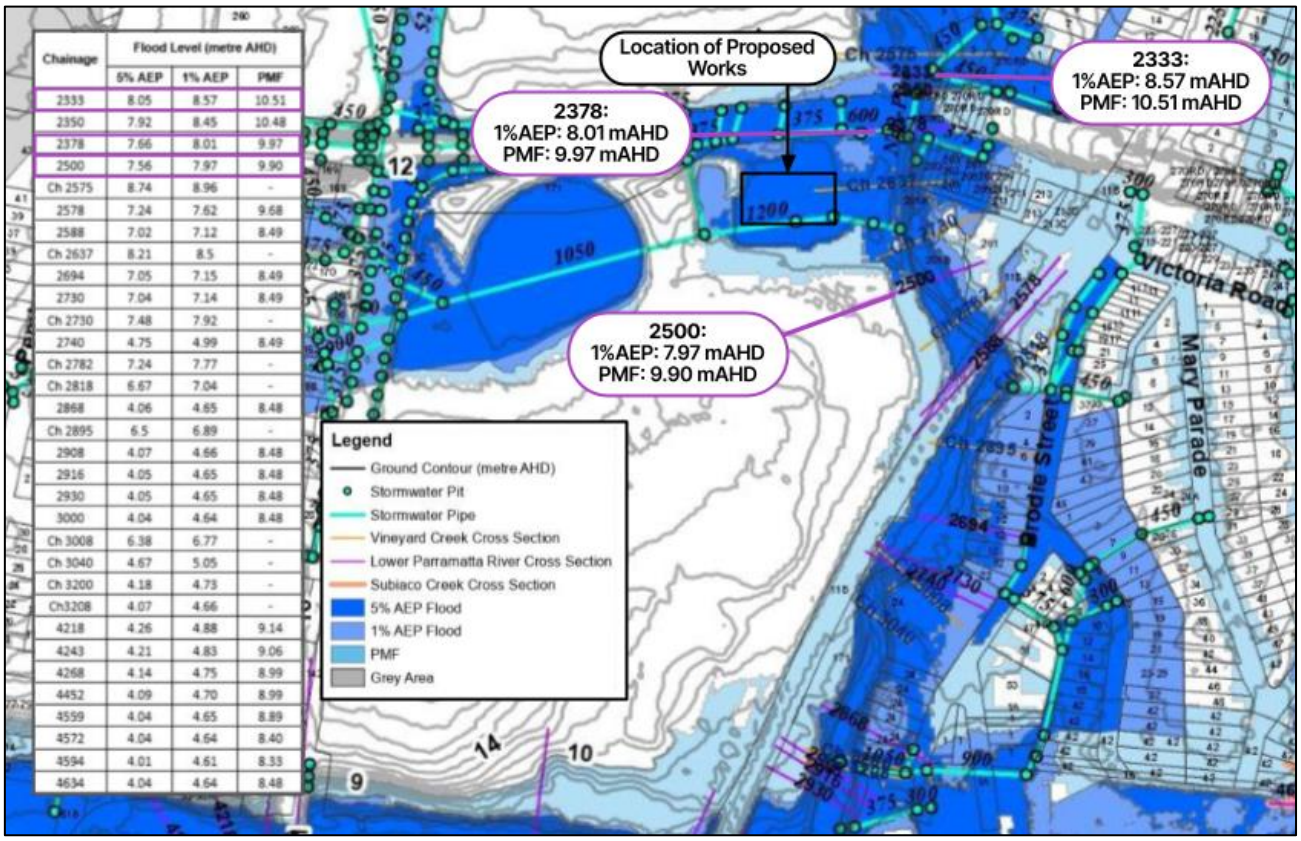
The map documents flood levels along Vineyard Creek that have been sourced from two Council-endorsed flood studies. These are:

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

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

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

*Figure 4: Council Provided Flood Levels for Vineyard Creek*




| Chainage | Flood Level (metre AHD) | | |
|---|---|---|---|
| | 5% AEP | 1% AEP | PMF |
| 2333 | 8.05 | 8.57 | 10.51 |
| 2350 | 7.92 | 8.45 | 10.48 |
| 2378 | 7.66 | 8.01 | 9.97 |
| 2500 | 7.56 | 7.97 | 9.90 |
| Ch 2575 | 8.74 | 8.96 | - |
| 2578 | 7.24 | 7.62 | 9.68 |
| 2588 | 7.02 | 7.12 | 8.49 |
| Ch 2637 | 8.21 | 8.5 | - |
| 2694 | 7.05 | 7.15 | 8.49 |
| 2730 | 7.04 | 7.14 | 8.49 |
| Ch 2730 | 7.48 | 7.92 | - |
| 2740 | 4.75 | 4.99 | 8.49 |
| Ch 2782 | 7.24 | 7.77 | - |
| Ch 2818 | 6.67 | 7.04 | - |
| 2868 | 4.06 | 4.65 | 8.48 |
| Ch 2895 | 6.5 | 6.89 | - |
| 2908 | 4.07 | 4.66 | 8.48 |
| 2916 | 4.05 | 4.65 | 8.48 |
| 2930 | 4.05 | 4.65 | 8.48 |
| 3000 | 4.04 | 4.64 | 8.48 |
| Ch 3008 | 6.38 | 6.77 | - |
| Ch 3040 | 4.67 | 5.05 | - |
| Ch 3200 | 4.18 | 4.73 | - |
| Ch3208 | 4.07 | 4.66 | - |
| 4218 | 4.26 | 4.88 | 9.14 |
| 4243 | 4.21 | 4.83 | 9.06 |
| 4268 | 4.14 | 4.75 | 8.99 |
| 4452 | 4.09 | 4.70 | 8.99 |
| 4559 | 4.04 | 4.65 | 8.89 |
| 4572 | 4.04 | 4.64 | 8.40 |
| 4594 | 4.01 | 4.61 | 8.33 |
| 4634 | 4.04 | 4.64 | 8.48 |

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

# 6 Flood Modelling

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

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

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

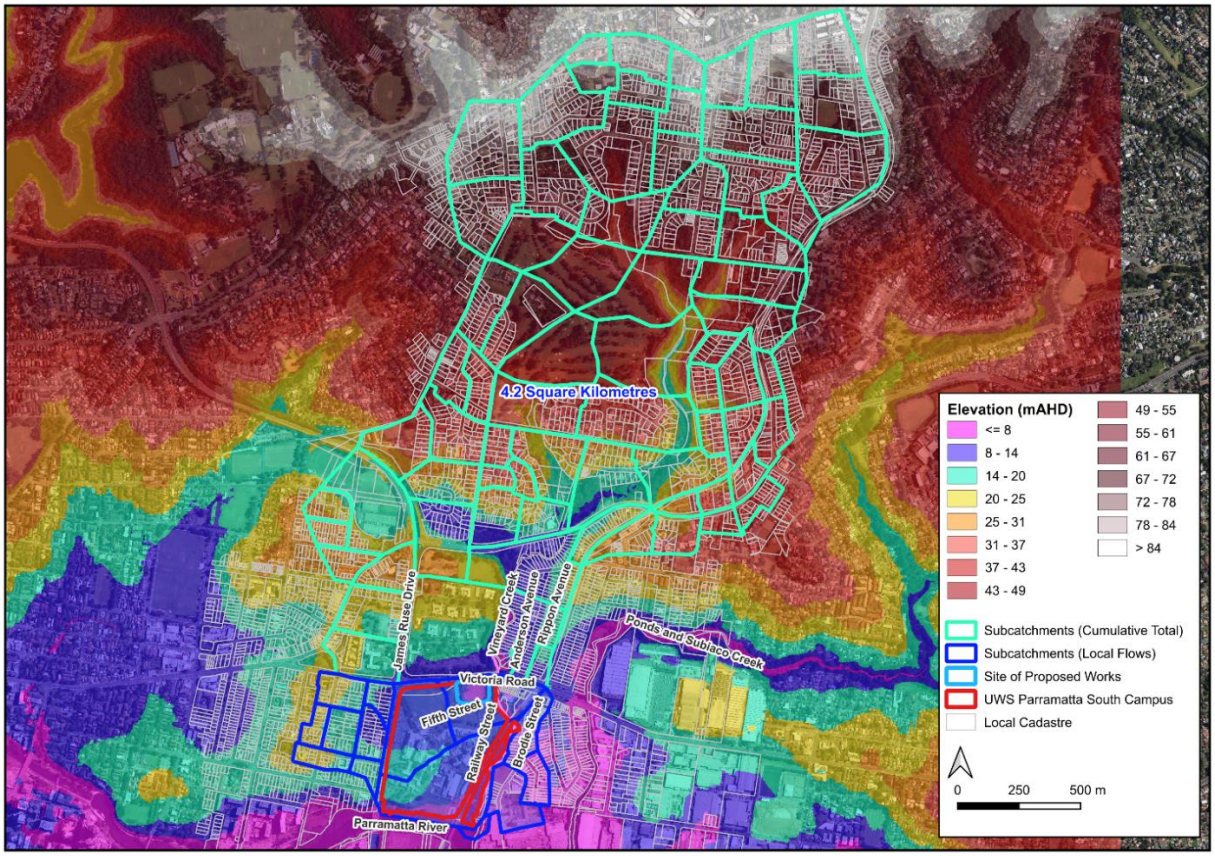
This resulted in GRC needing to develop a model to better understand the local flooding regime and potential impacts of the proposed development.

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

## 6.1 Hydrological Model

A hydrological model for Vineyard Creek catchment to Parramatta River in the downstream, covering an area of approximately 4.2 $km^2$, was set up using the Watershed Bounded Network Model (WBNM). The main flow from the catchment – conveyed through Vineyard Creek – runs along the eastern boundary of the site under investigation. The catchment was sub-divided into 90 sub-catchments, taking into consideration both natural topographic characteristics of the catchment as well as urban features within that have the potential of altering flow paths between the delineated sub-catchments (Figure 5). The advantage of the WBNM model is it has been built to produce probability equivalent flows in South-East Australia as well as its requirement for relatively few parameters in order to produce a reasonable hydrological representation of a modelled area.  Those parameters of interest are summarised below.

*Figure 5: Hydrological Sub-catchments*




### 6.1.1 Rainfall Losses

In the absence of calibration data for the catchment, storm Initial Losses (IL) and Continuing Losses (CL) have been adopted from the 2016 catchment study (Rydalmere Development Precinct Watercycle & Flood Management Strategy Report, Initial Investigation, J. Wyndham Prince). Noting that these loss values were also the default loses for use in NSW as per the 1987 edition of ARR. The resulting design flood levels were then compared to the flood levels provided on Council's flood certificate. Table 2 summarises the losses used in this study.

*Table 2: Losses adopted in the hydrological model*

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

### 6.1.2 Lag Parameter

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

### 6.1.3 Imperviousness

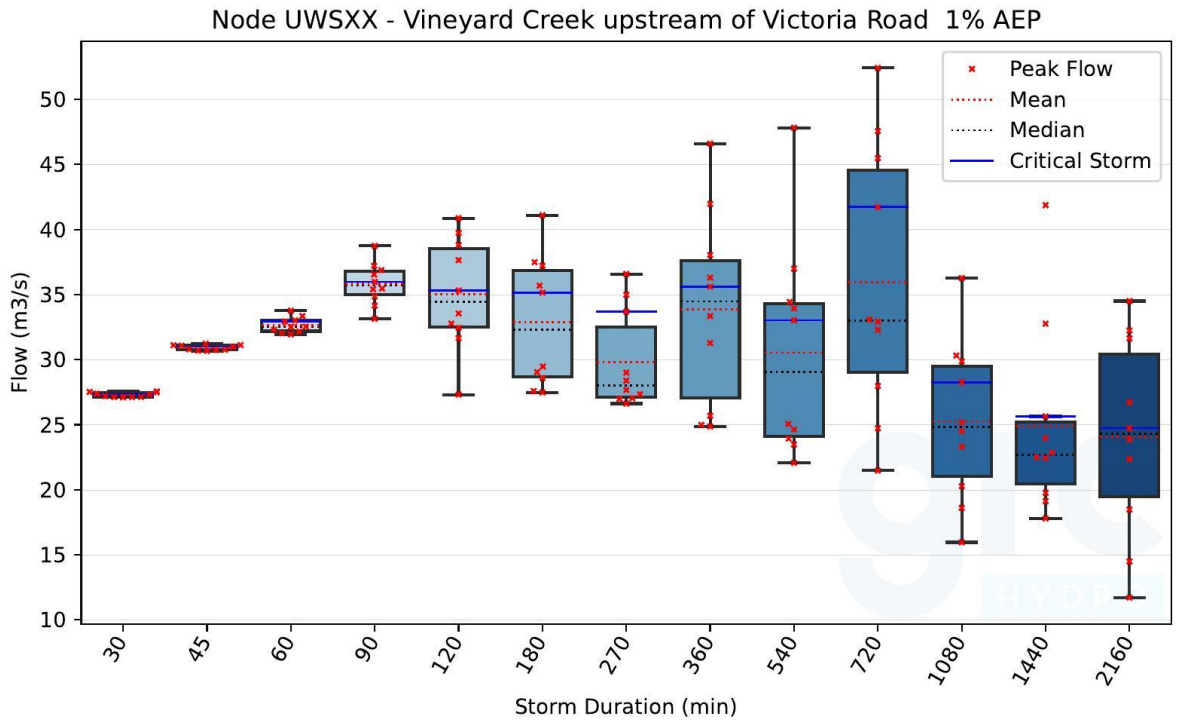
An impervious parameter was set for each model subcatchment, based on the land use in that area. In order to estimate imperviousness within the study area, the ESA Land Use and Land Cover product was used, which shows the 'Built Area' class within each catchment, which was treated as 100% impervious,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

### 6.1.4 Temporal Patterns and Critical Duration Assessment

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

The critical duration assessment is shown in Figure 6 below, for the 1% AEP event. As shown, durations of 60 minutes up to 720 minutes (12 hours) all produce a critical storm peak flow of between around 33 to 42 $m^3/s$. The critical duration is 720 minutes/12 hours, which produces the highest peak flow of the critical storms (~42 $m^3/s$). It is noteworthy that 720 min temporal patterns were assessed and TP01, TP05 and TP09 were all found to contain embedded bursts which exceed 1% AEP rainfall. As such it is apparent that the 1% AEP flow estimate derived herein is expected to be conservative (presuming neutral or conservative estimates elsewhere).

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




### 6.1.5 Unit Flow Rate Comparison

In addition to that verification, the hydrologic model results were compared to unit flow rates in the Sydney basin, in the absence of other calibration data. Regional Flood Frequency Estimate was not considered for

the catchment as the closest available catchments were around 25-100 $km^2$, much larger than the site's catchment.

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

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

GRC Hydro have estimated unit flow rates for many catchments across Sydney and find that values are consistently in the 0.1-0.4 $m^3/s$ per hectare range, for urbanised overland flow catchments. Given the site's catchment is large (around 360 ha to Victoria Road) with large areas of native bush and including areas that hold water, its unit flow rate would be expected to be towards the lower end of the typical range.

At the subject site, the peak flow of 42 $m^3/s$ (calculated for the 3.6 $km^2$ catchment (360 ha) upstream of Victoria Road) gives a unit flow rate of 0.12 $m^3/s$ per hectare. This value falls within the expected range and indicates the hydrologic model estimates are on face value reliable.

## 6.2 Hydraulics

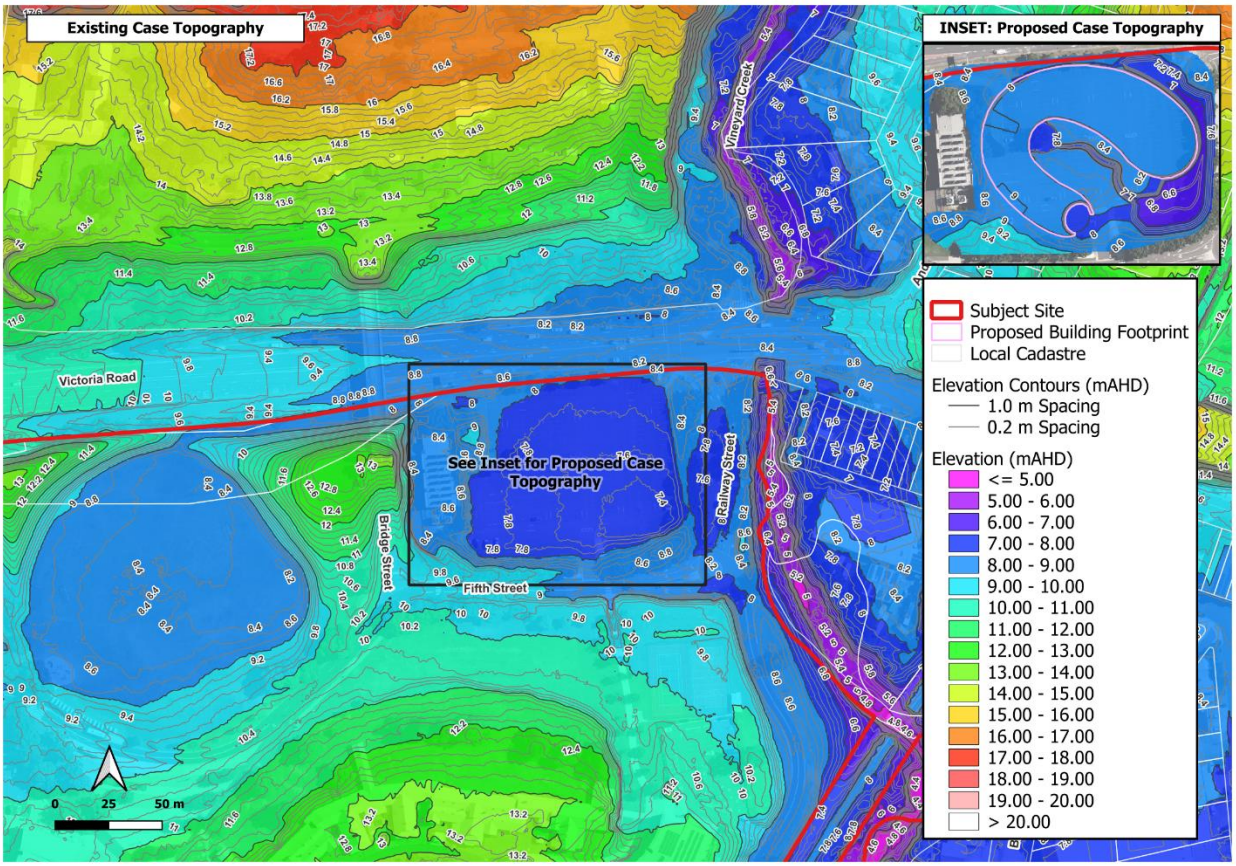
### 6.2.1 Topography

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

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

Where topographic changes are to be made as part of the proposed development, these have been represented in the model by a grid developed from a tinned surface supplied to GRC on 03/03/2025 by Taylor Thomson Whitting (TTW) via WSU.

*Figure 7: Site Topography and Proposed Changes*




### 6.2.2 Material Roughness

Aerial imagery of the model domain was inspected and polygons representing the nature of the varied surface material were developed. These polygons are used in the hydraulic model to represent the different types of surfaces water will travel across in the course of flooding. A different roughness coefficient is applied to each surface type. The roughness coefficient adopted for each surface type in the model is

documented below in Table 3. Where appropriate, GRC has adopted the same roughness coefficients as have been used in the Draft Parramatta River Flood Study (DPRFS).

*Table 3: Material Roughness Coefficients*

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

The proposed building has been blocked out. Buildings in the vicinity of the subject site have been modelled using a roughness coefficient of 3.

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

*Figure 8: Material Roughness (Manning's N)*

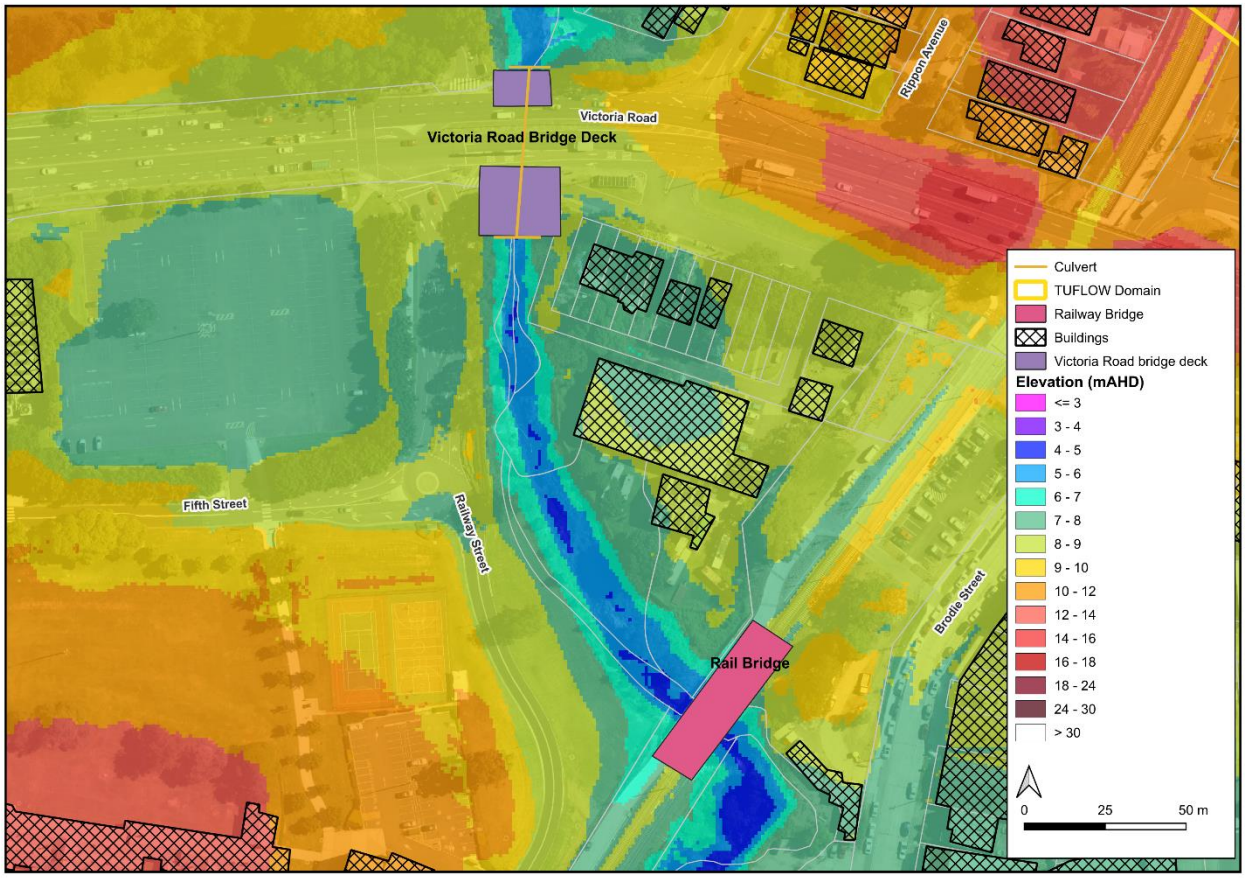
## 6.2.3 Structures

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

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

These structures are identified in Figure 9 below.

*Figure 9: Vineyard Creek Structures*




### 6.2.4 Victoria Road Bridge Deck

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

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

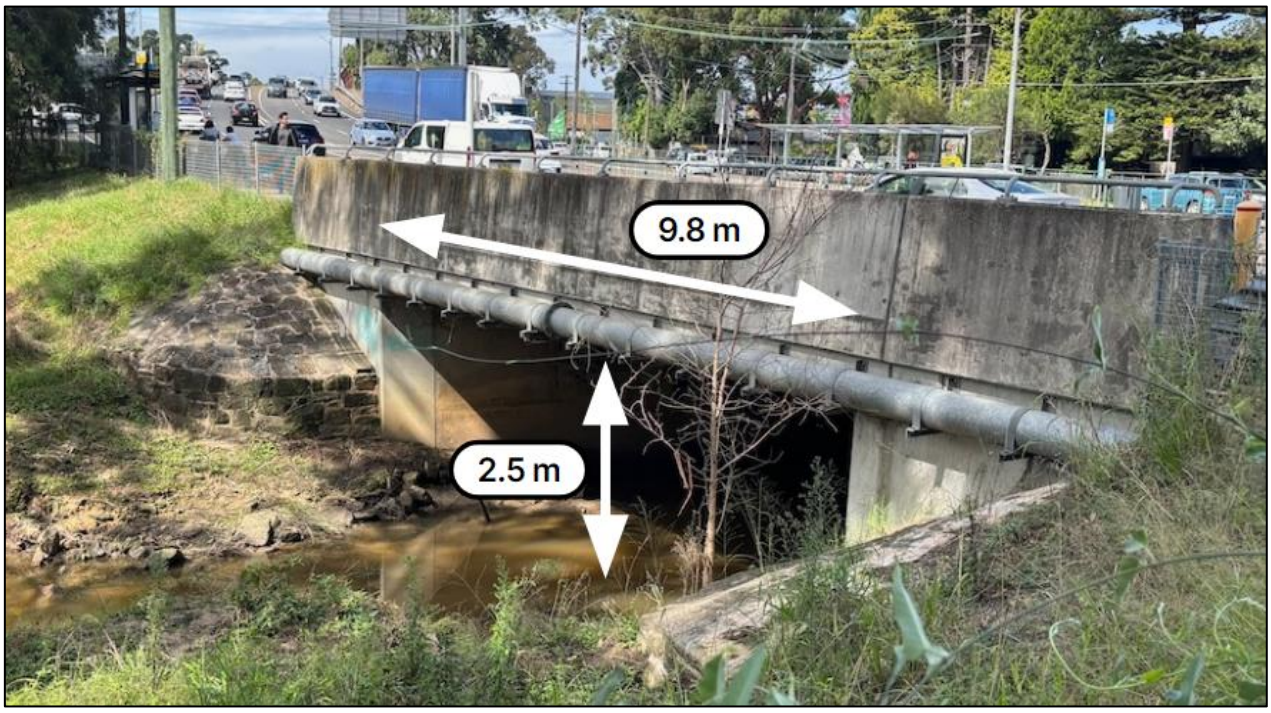
The upstream side of this structure is pictured in Image 1.

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

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

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

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




### *6.2.5* Parramatta Light Rail Bridge

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

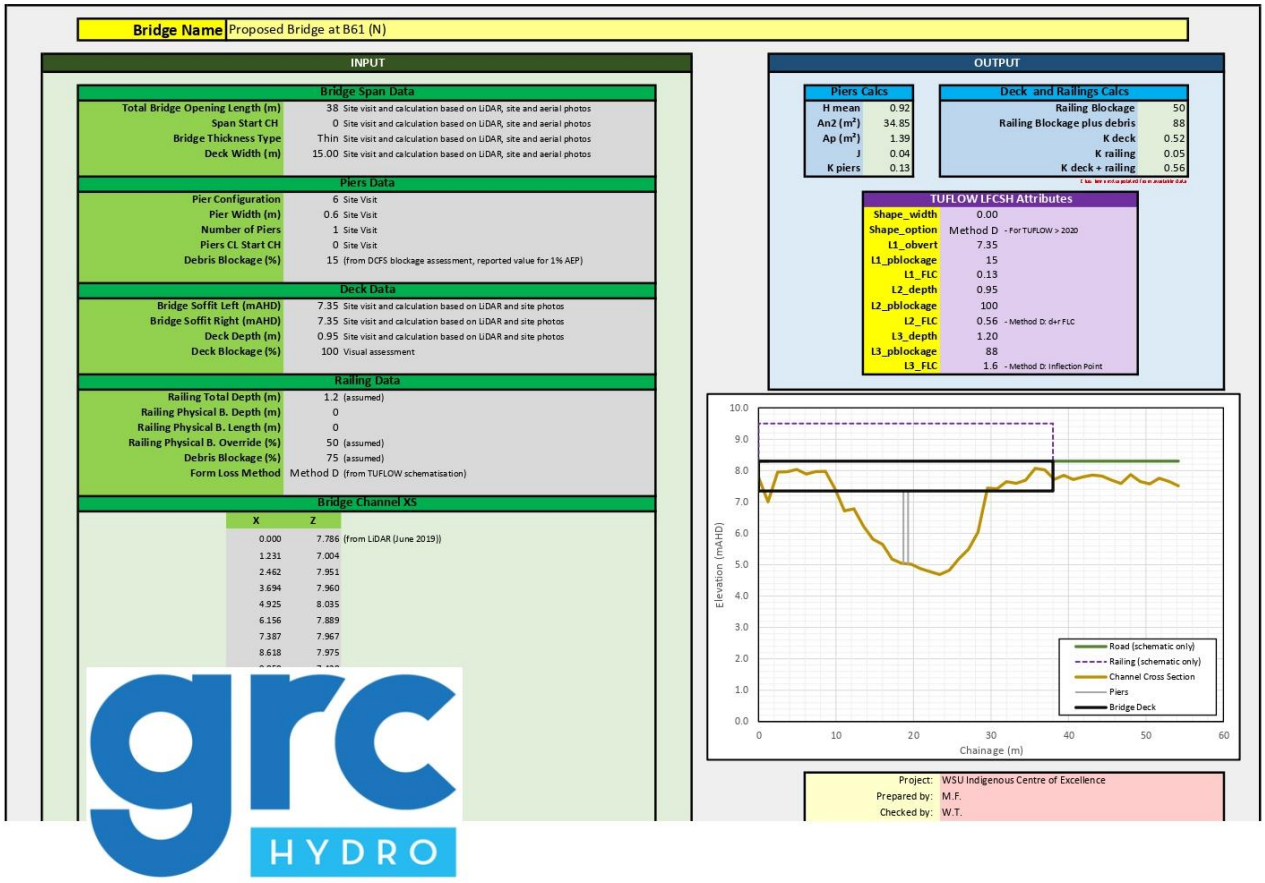
GRC undertook a site visit to better understand the geometry of this structure.

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

*Image 2: Parramatta Light Rail Bridge (Upstream side)*

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

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




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

### 6.2.6 Stormwater Network

Council provided its stormwater network data to GRC as part of its handover of the Parramatta River Flood Study 2024 model. GRC has incorporated this provided stormwater network in this revised modelling.

### 6.2.7 Upstream Flow Boundary

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

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

### 6.2.8 Tailwater

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

- A mean sea level tailwater of 0 mAHD; and
- A 5% AEP tailwater that adopts the 5% AEP flood level for the model's downstream boundary from the Lower Parramatta River Flood Study (SKM, 2005).

### 6.2.9 Climate Change

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

- RCP 4.5 – 2050
- RCP 4.5 – 2090

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

*Table 4: NSW Mean Sea Level Projections*

**Table 5** **IPCC *Sixth assessment report* (AR6) New South Wales mean sea level (MSL) projections to 2150 (in millimetres)**

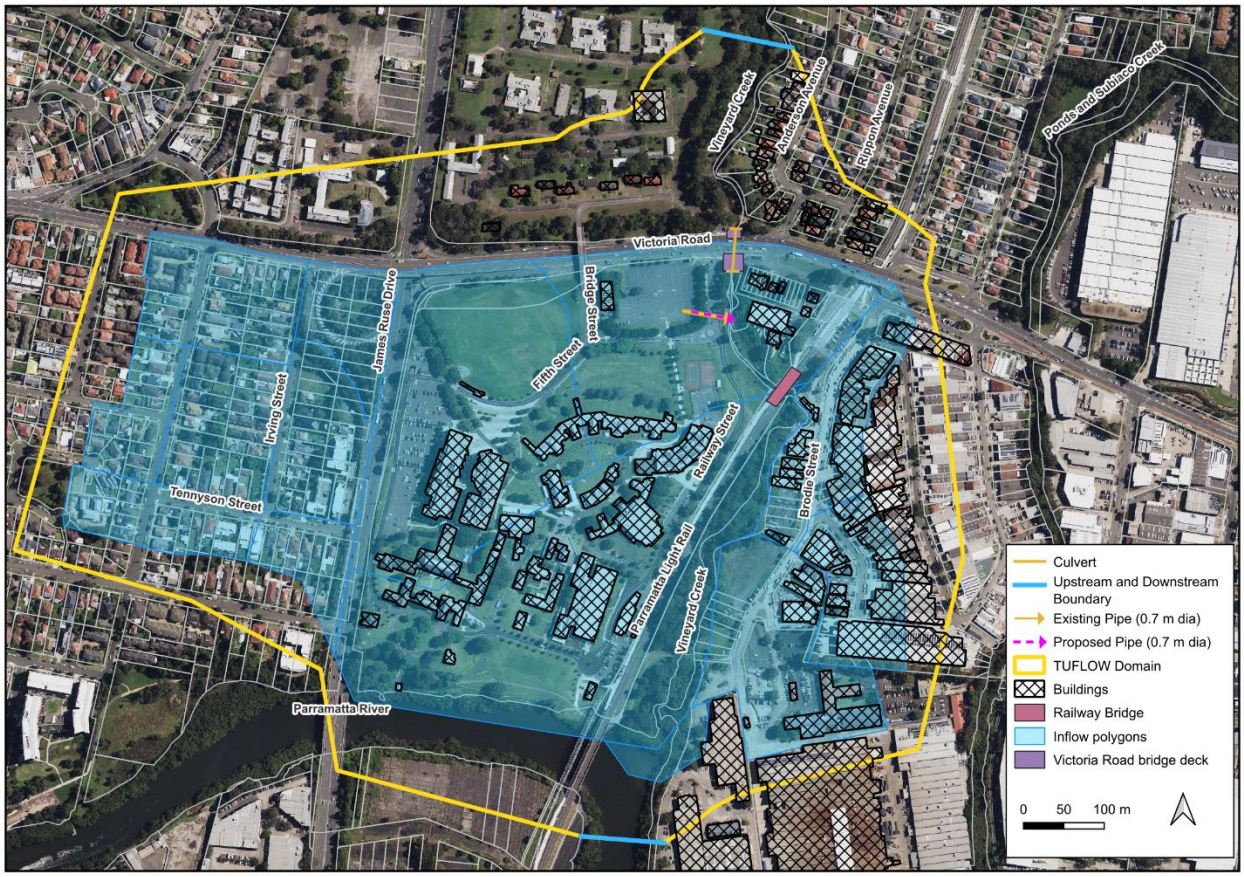
| | SSP2–4.5 | | SSP5–8.5 | |
|---|---|---|---|---|
| Year | Median | **Likely** range [5% - 95%] | Median | **Likely** range [5% - 95%] |
| 2020 | 54 | [–1–114] | 57 | [5–113] |
| 2030 | 100 | [37–176] | 108 | [43–187] |
| 2040 | 148 | [74–250] | 168 | [92–274] |
| 2050 | 212 | [114–353] | 247 | [149–394] |
| 2060 | 270 | [148–456] | 329 | [199–533] |
| 2070 | 341 | [196–577] | 430 | [266–701] |
| 2080 | 416 | [244–707] | 545 | [346–888] |
| 2090 | 486 | [284–835] | 678 | [438–1,111] |
| 2100 | 564 | [331–983] | 814 | [523–1,342] |
| 2110 | 645 | [353–1,136] | 920 | [528–1,578] |
| 2120 | 722 | [392–1,281] | 1,052 | [605–1,811] |
| 2130 | 797 | [430–1,425] | 1,178 | [680–2,039] |
| 2140 | 872 | [466– 1,567] | 1,297 | [749– 2,263] |
| 2150 | 945 | [502–1,708] | 1,408 | [812–2,481] |

Source: IPCC AR6 (Garner et al. 2021).

## 6.2.10 TUFLOW Model Setup

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

*Figure 11: TUFLOW Model Setup*



## 6.3 Model Results and Verification

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

These events were as follows:

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

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

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

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

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

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

### 6.3.1 Existing Condition

Modelling results for the Existing Condition for the 20% AEP, 1% AEP, 0.2% AEP and PMF design events are documented below in Figures 12 to 30 below.

| | |
|---|---|
| **20% AEP** | *Flood Levels:* Not flooded.<br>*Flood Depths:* Not flooded.<br>*Flood Hazard:* Not flooded. |
| **5% AEP** | *Flood Depths:* A small portion up to 0.3 m. The newly introduced pond at the south-eastern corner experiences depths up to 1 m.<br>*Flood Hazard:* Predominantly H1 with a small pocket of H2 in the new pond (low hazard). |
| **1% AEP** | *Flood Levels:* ranging from 8.2 mAHD in the south-western corner of the car park to 8.3 mAHD along the northern boundary of the car park<br>*Flood Depths:* from 0.3 m up to 1.0 m deep<br>*Flood Hazard:* Max of H3 (low to medium hazard). |
| **1% AEP (plus 19% rainfall loading)** | *Flood Levels:* 8.4 mAHD<br>*Flood Depths:* from 0.3 m up to 1.8 m deep in the pond area.<br>*Flood Hazard:* H3 (low to medium hazard). |
| **1% AEP + RCP 4.5 2050** | *Flood Levels:* plateaued at 8.3 mAHD.<br>*Flood Depths:* from 0.3 m up to 1.0 m deep<br>*Flood Hazard:* Max of H3 (low to medium hazard). |
| **1% AEP + RCP 4.5 2090** | *Flood Levels:* ranging from 8.3 mAHD in the south-western corner of the car park to 8.4 mAHD along the northern boundary of the car park<br>*Flood Depths:* from 0.3 m up to 1.0 m deep<br>*Flood Hazard:* Max of H3 (low to medium hazard). |
| **0.2% AEP** | *Flood Levels:* plateaued at 8.2 mAHD.<br>*Flood Depths:* from 0.3 m up to 1.0 m deep<br>*Flood Hazard:* Max of H3 (low to medium hazard). |
| **PMF** | *Flood Levels:* 10.3 mAHD<br>*Flood Depths:* from 1.0 m up to 3.1 m deep<br>*Flood Hazard:* Max of H5 (high hazard) |

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

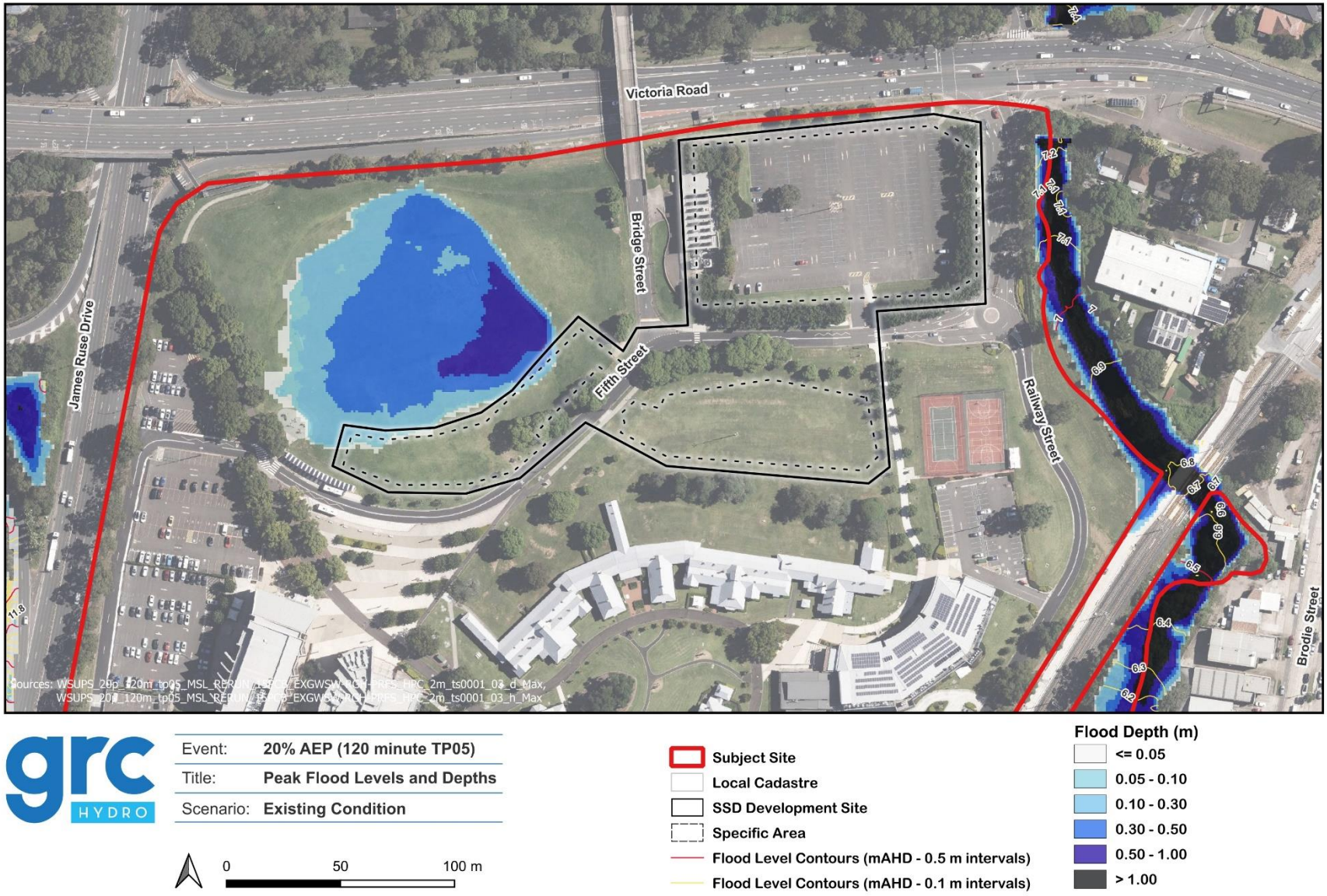


*Figure 13: Flood Velocity and Hazard – 20% AEP – Existing Condition*

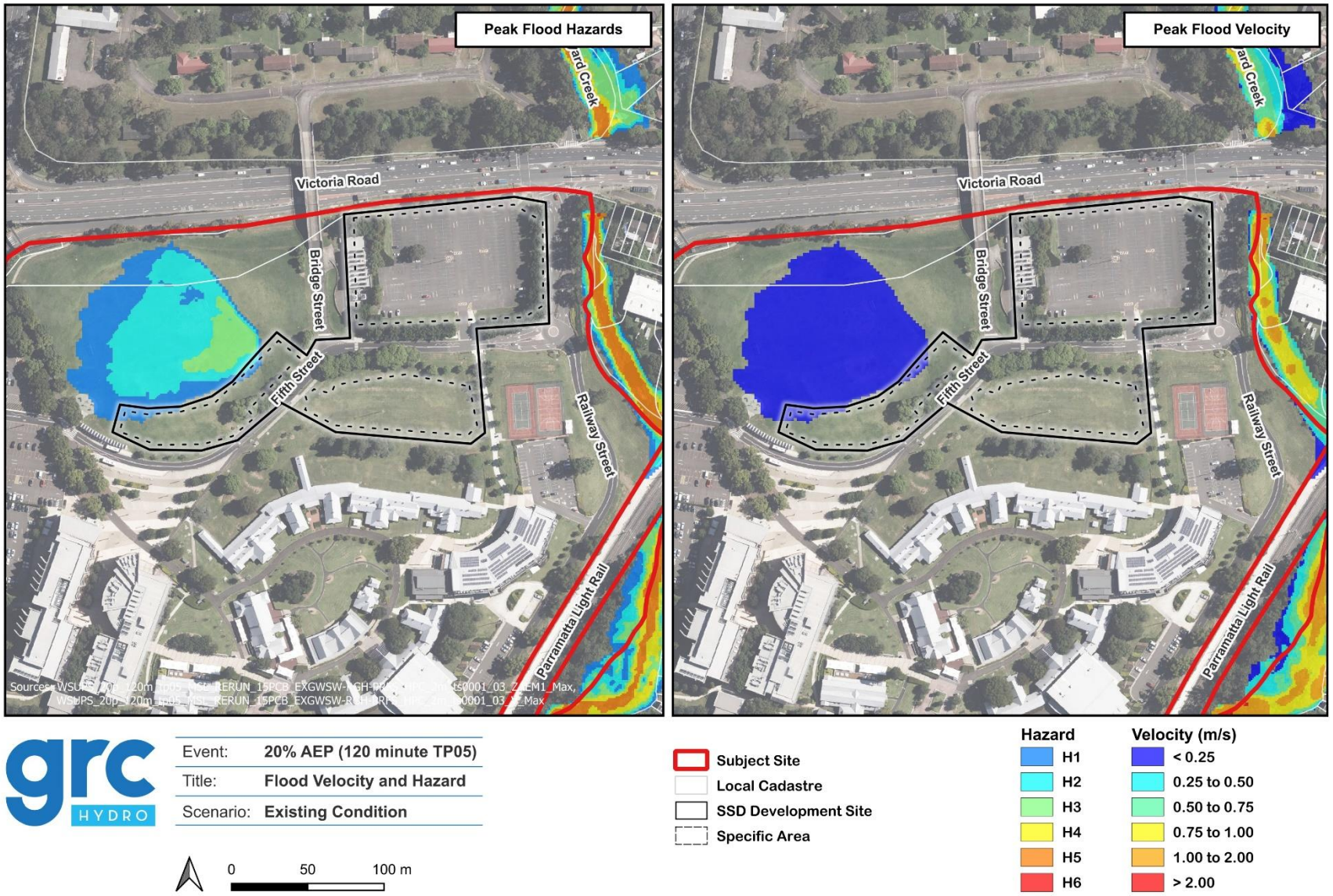


*Figure 14: Peak Flood Levels and Depths – 5% AEP – Existing Condition*

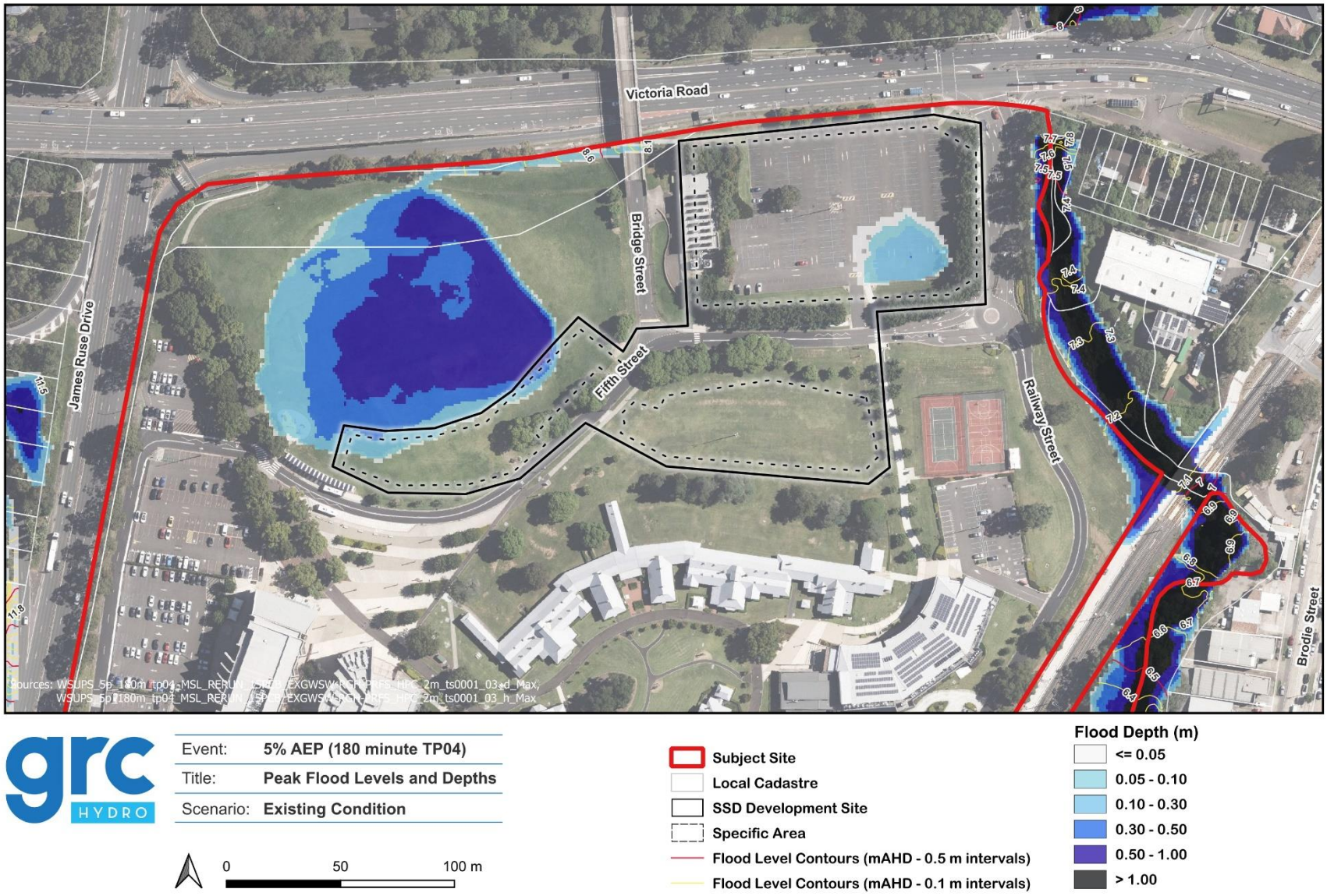


*Figure 15: Flood Velocity and Hazard – 5% AEP – Existing Condition*

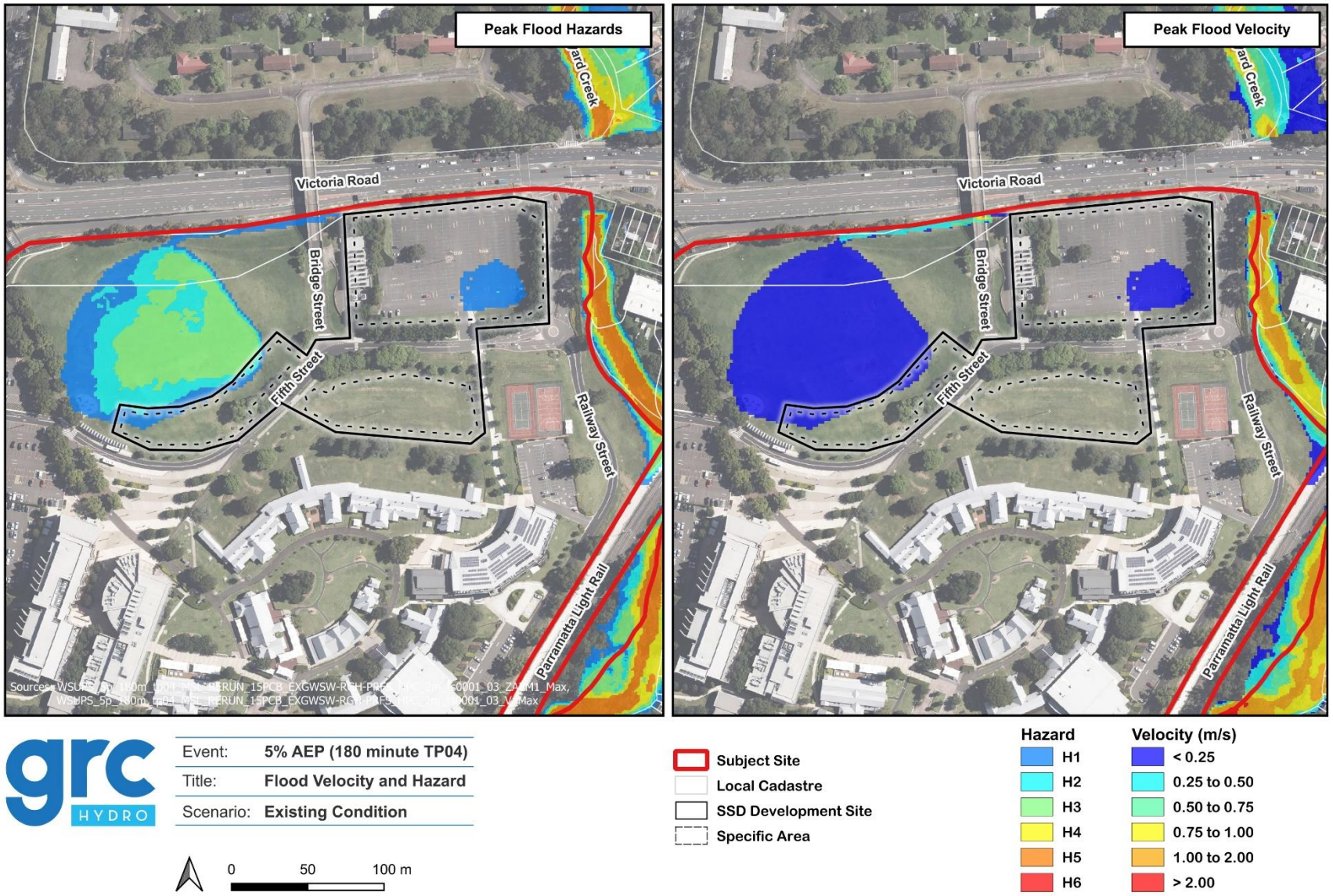


*Figure 16: Peak Flood Levels and Depths – 1% AEP – Existing Condition*

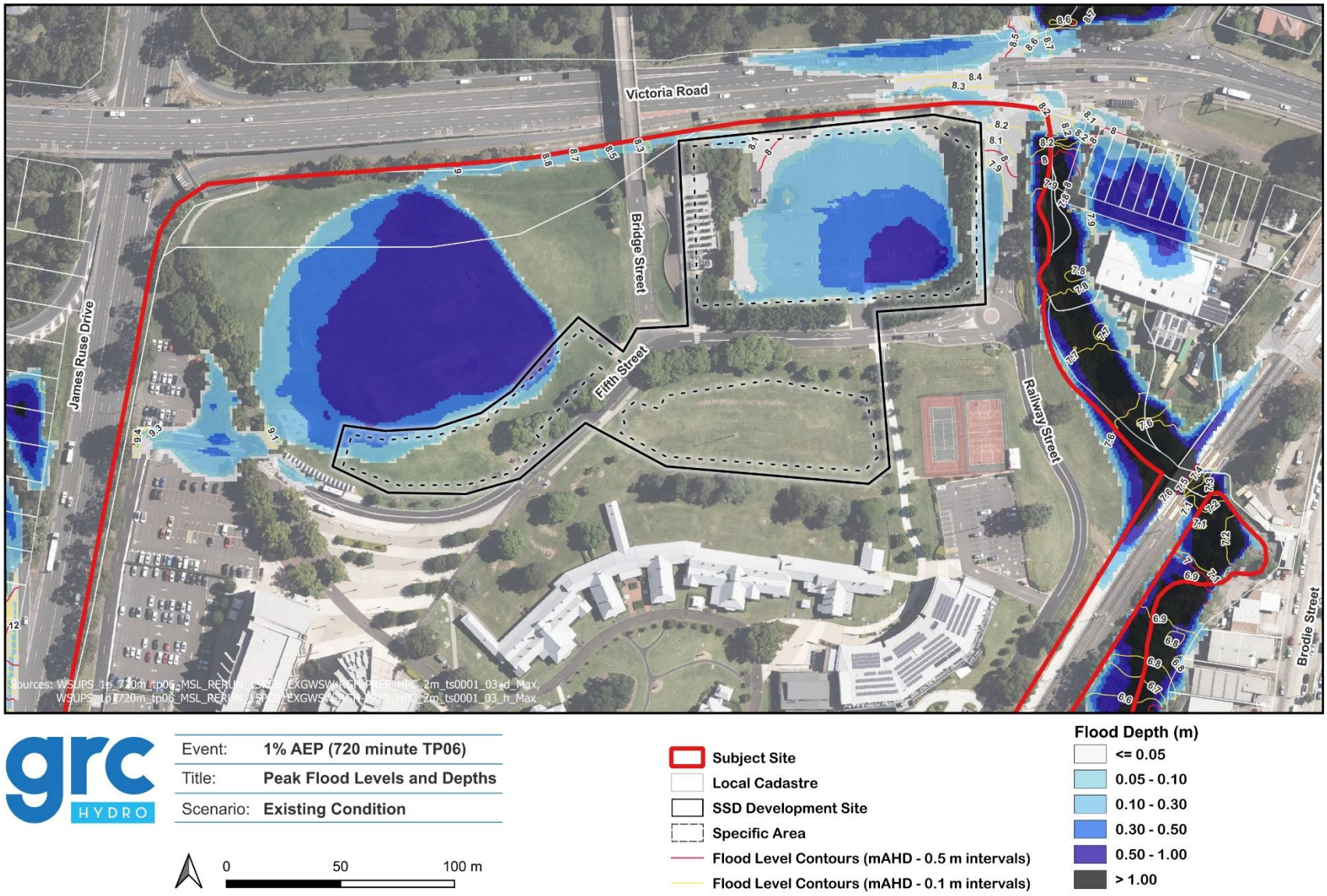


*Figure 17: Flood Velocity and Hazard – 1% AEP – Existing Condition*

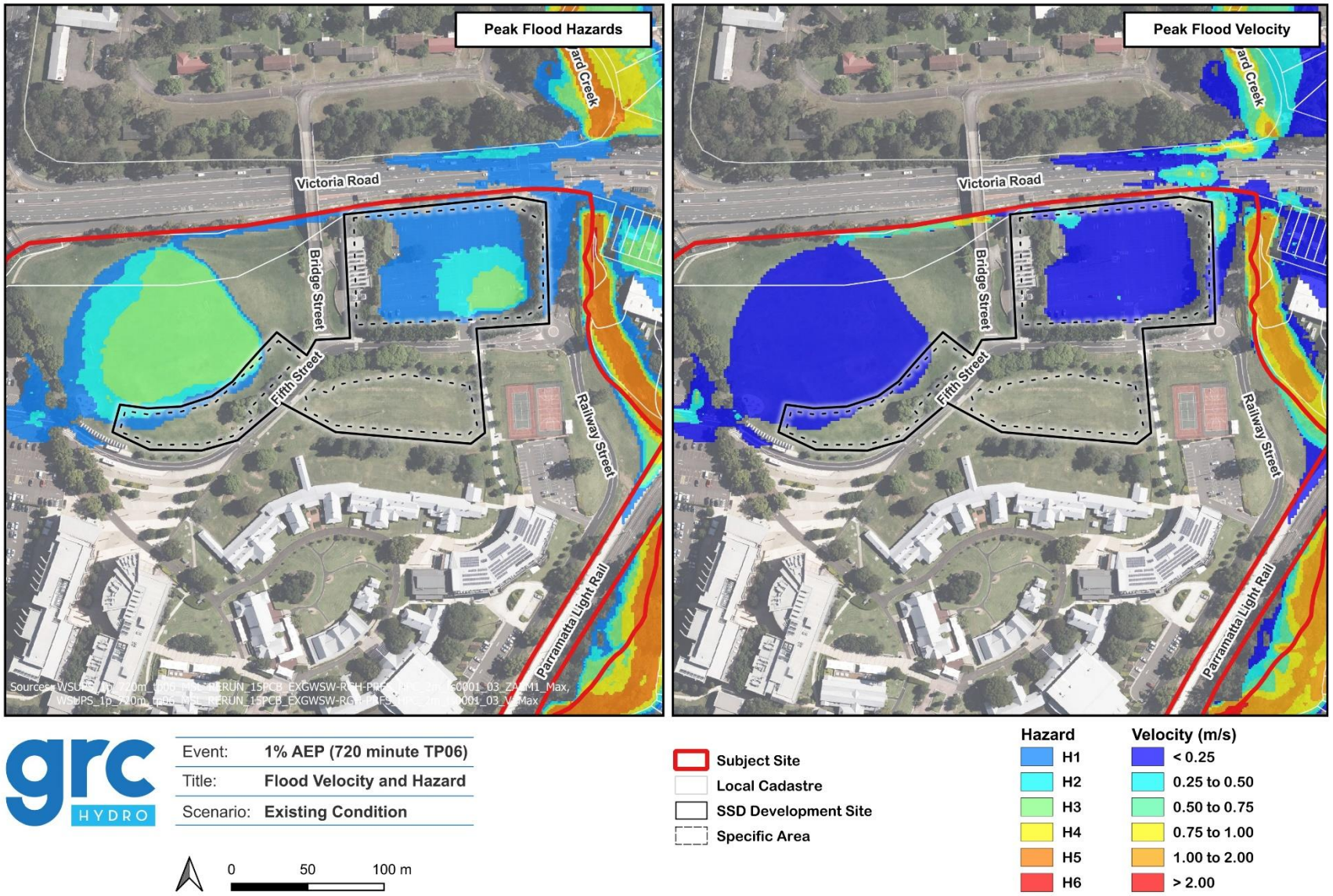


*Figure 18: Flood Function – 1% AEP – Existing Condition*

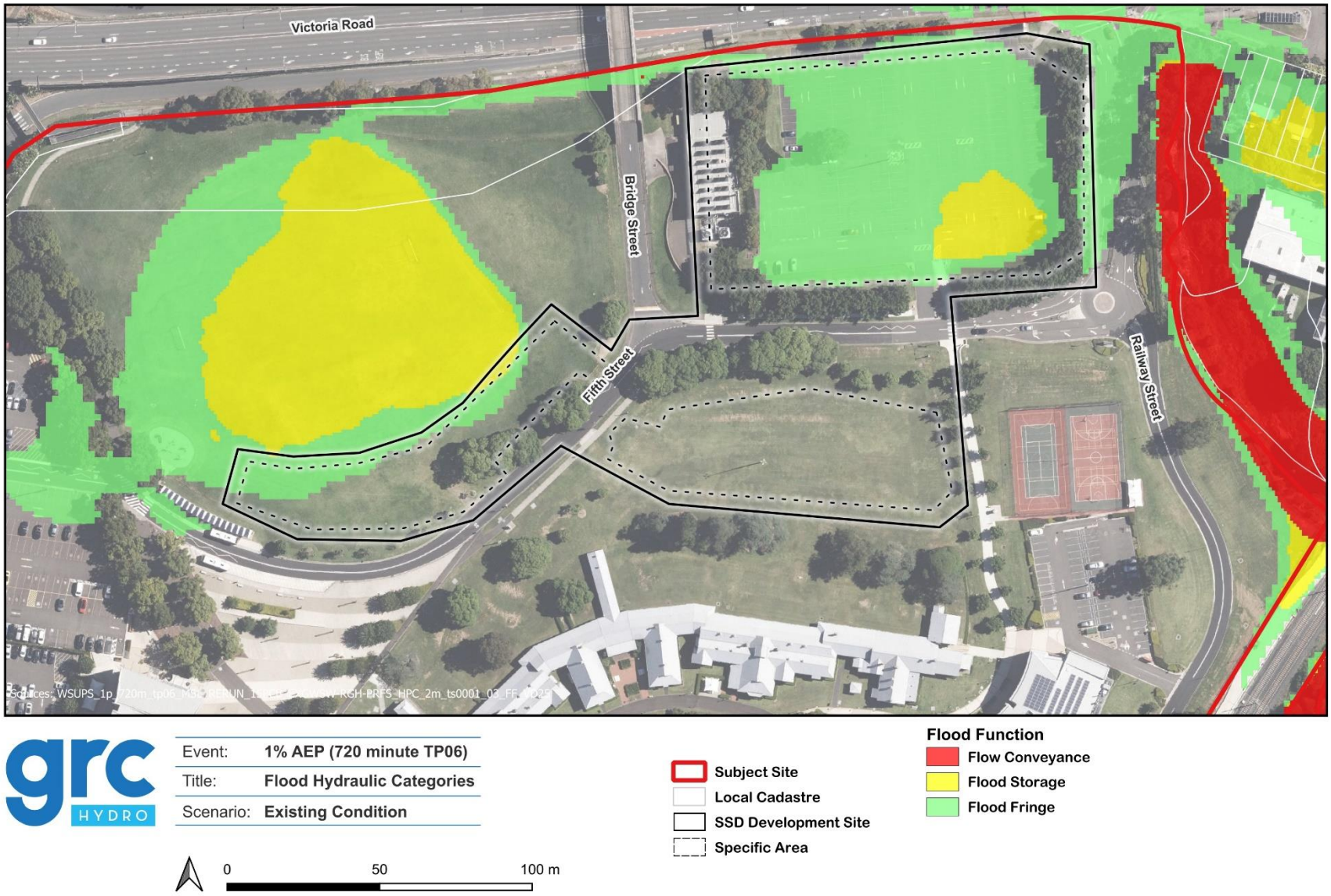


*Figure 19: Flood Level Impact Sensitivity Analysis – 1% AEP – Existing Condition (50% Blockage minus No Blockage)*

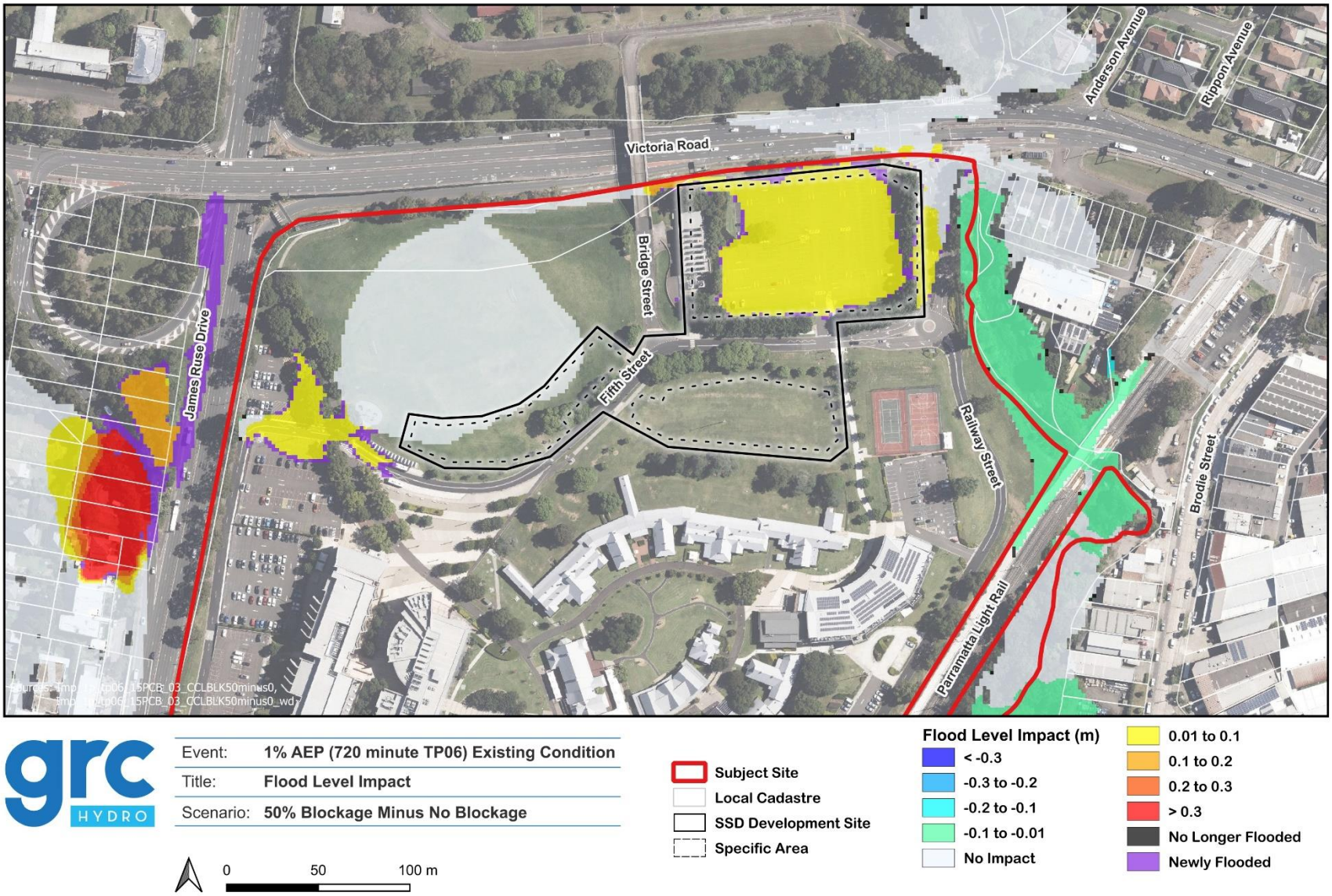


*Figure 20: Flood Level Impact Sensitivity Analysis – 1% AEP – Existing Condition (100% Blockage minus No Blockage)*

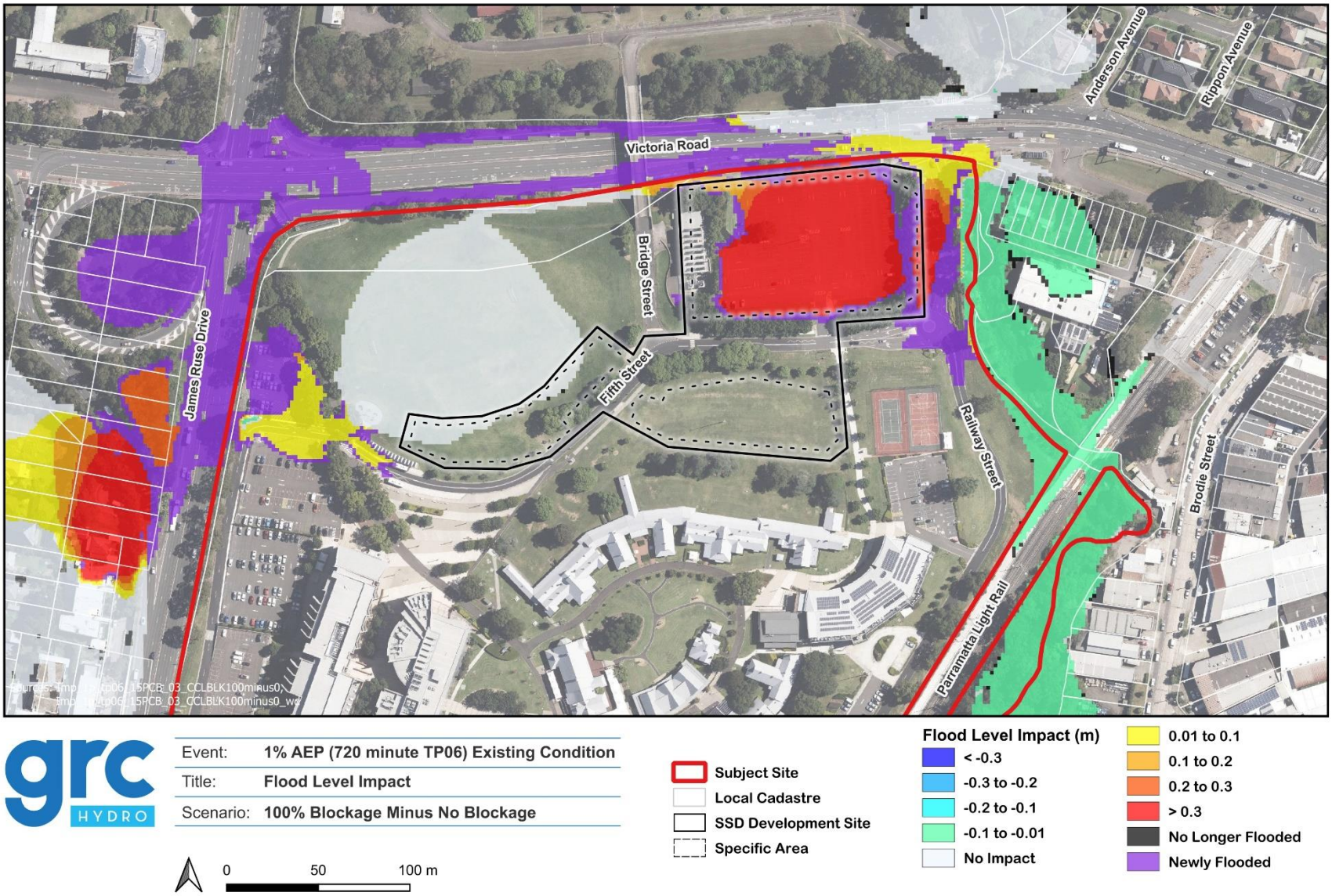


*Figure 21: Peak Flood Levels and Depths – 1% AEP (with additional 19% rainfall loading) – Existing Condition*

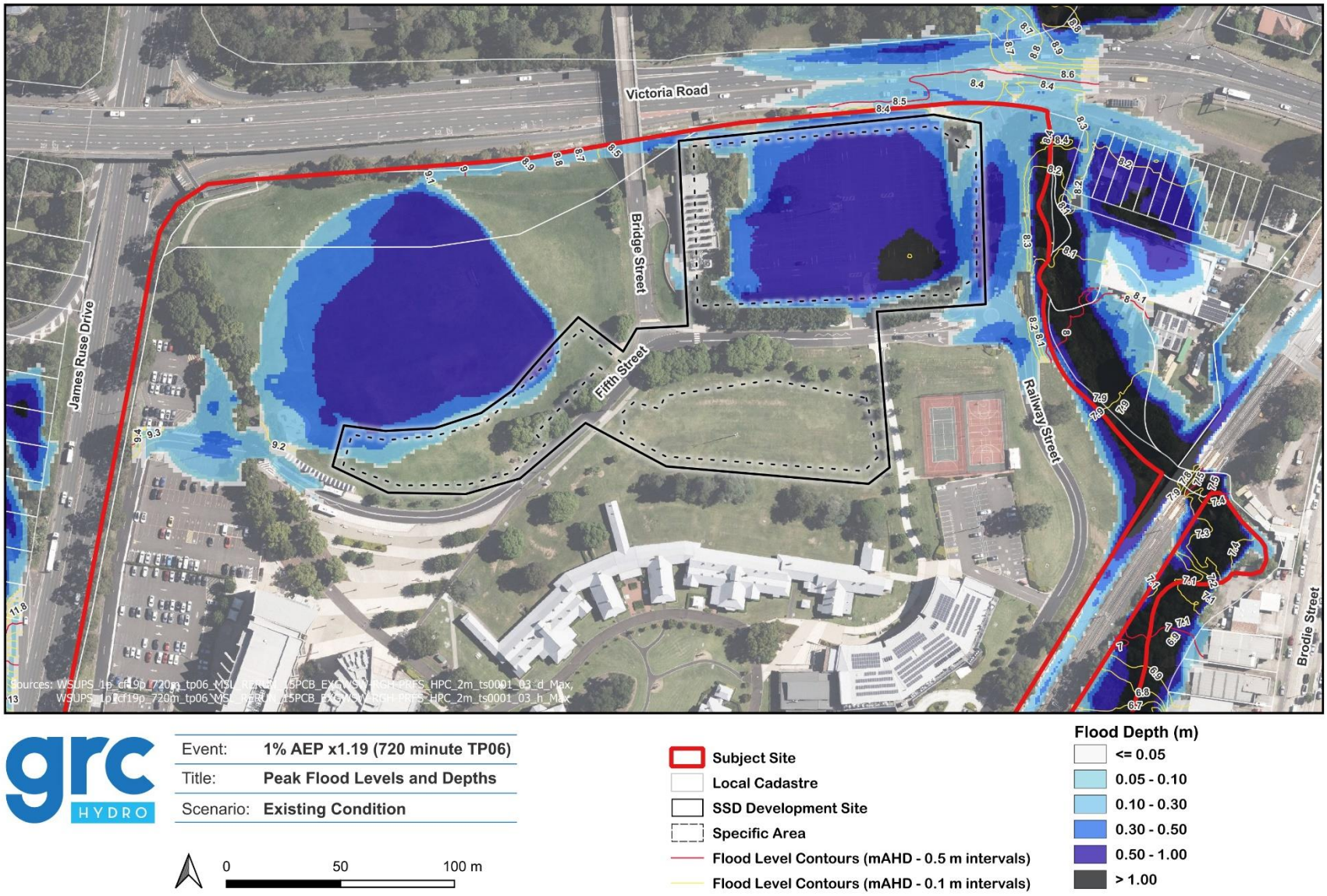


*Figure 22: Flood Velocity and Hazard – 1% AEP (with additional 19% rainfall loading) – Existing Condition*

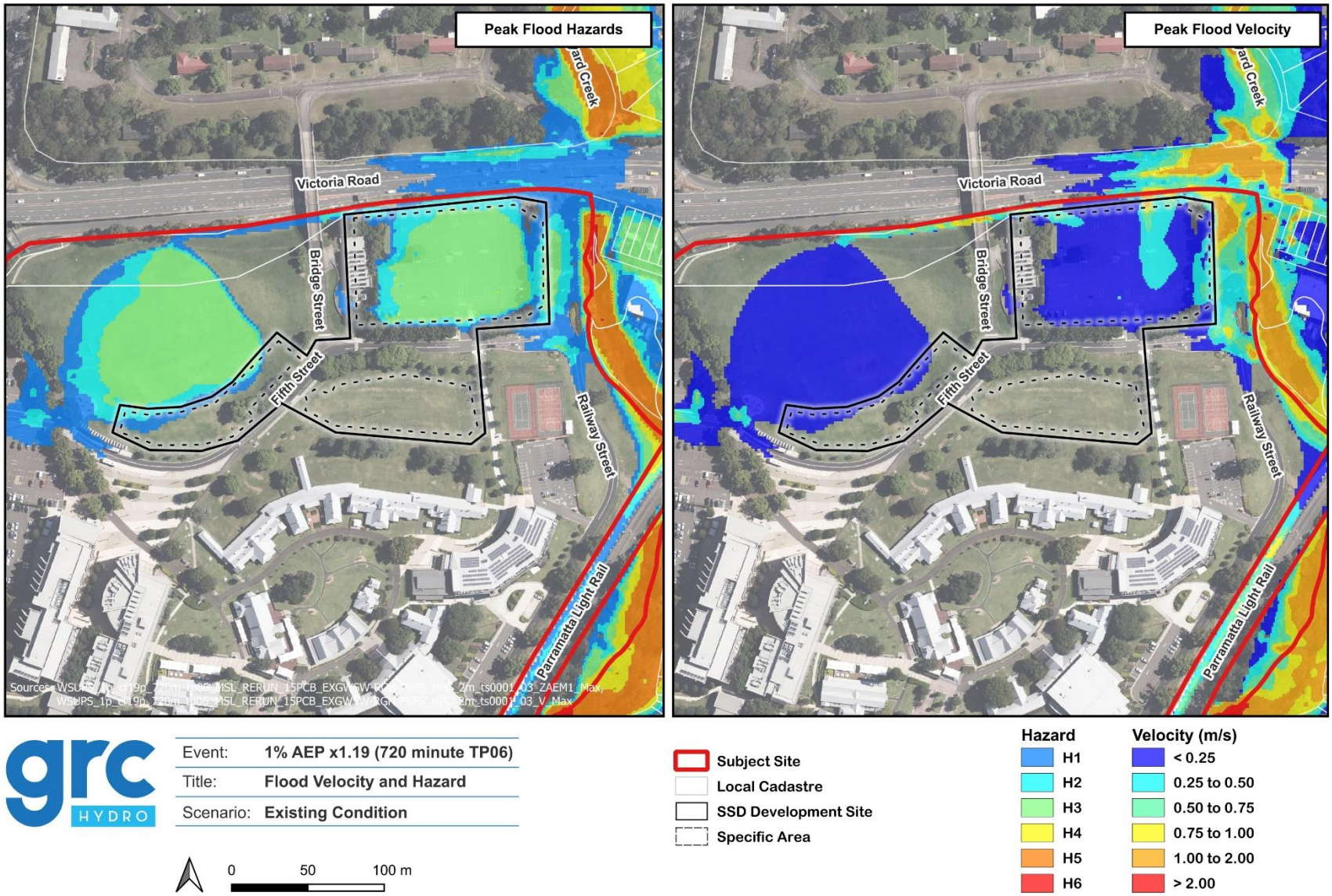


*Figure 23: Peak Flood Levels and Depths – 1% AEP with Climate Change (RCP 4.5 2050) – Existing Condition*

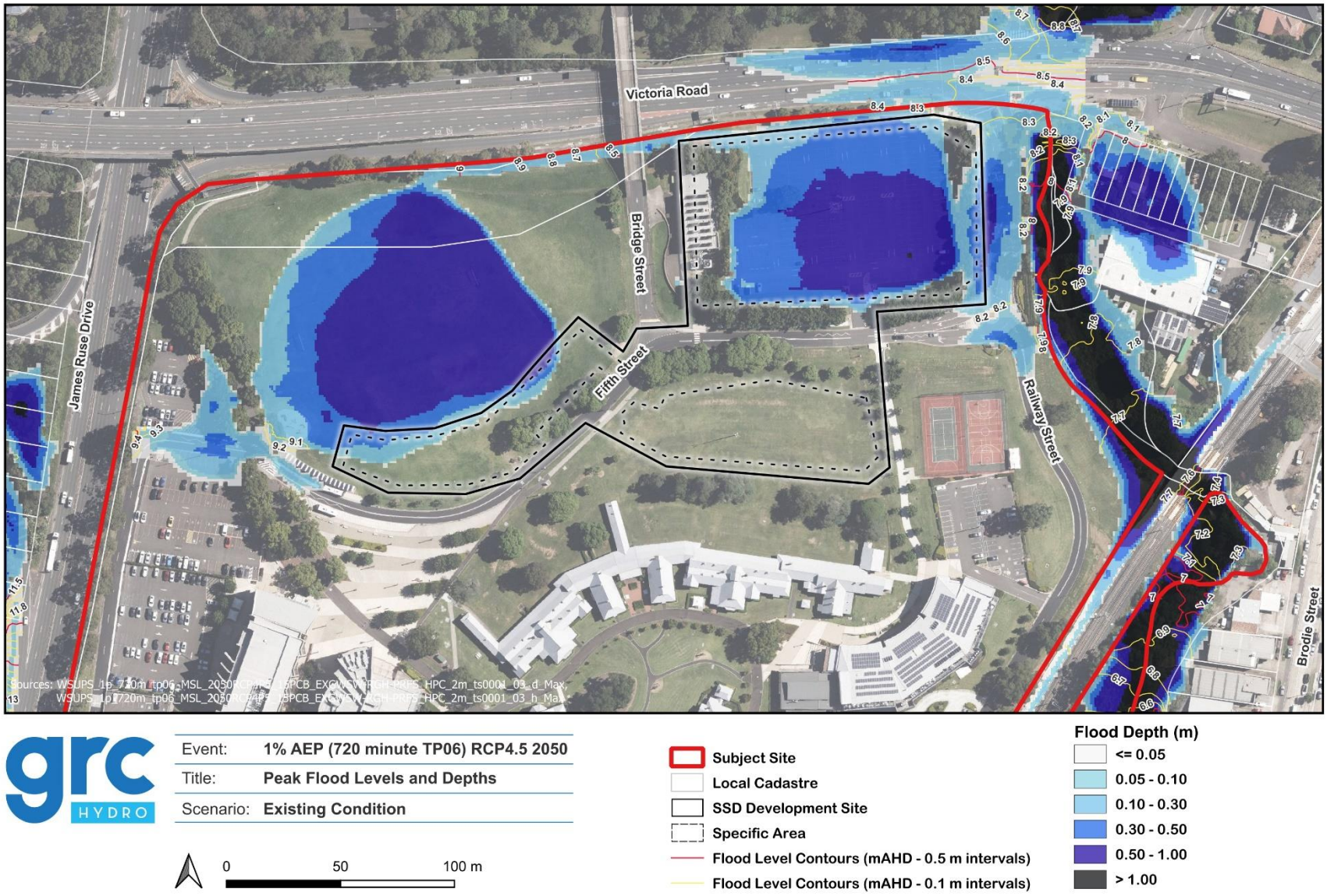


*Figure 24: Flood Velocity and Hazard – 1% AEP with Climate Change (RCP 4.5 2050) – Existing Condition*

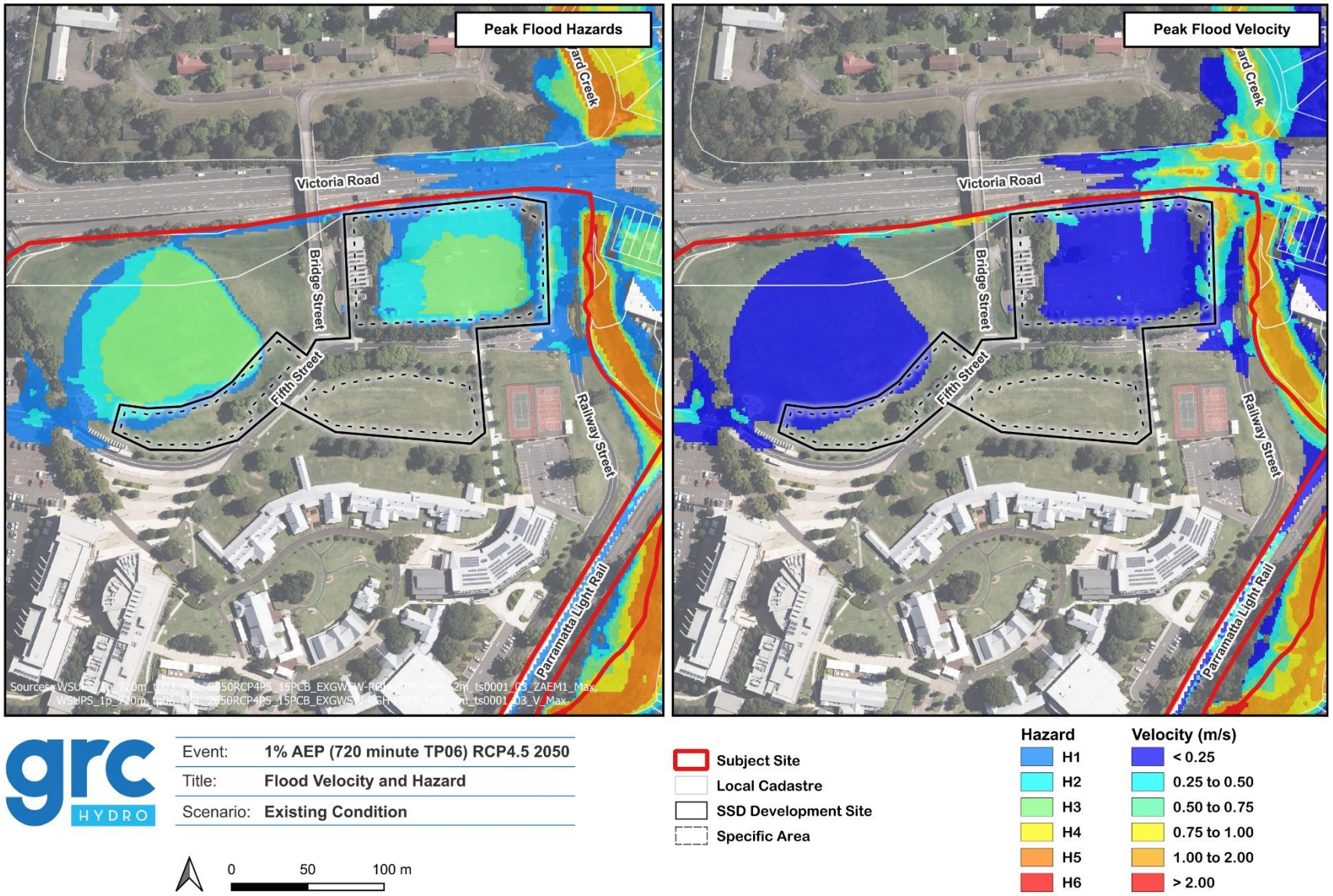


*Figure 25: Peak Flood Levels and Depths – 1% AEP with Climate Change (RCP 4.5 2090) – Existing Condition*

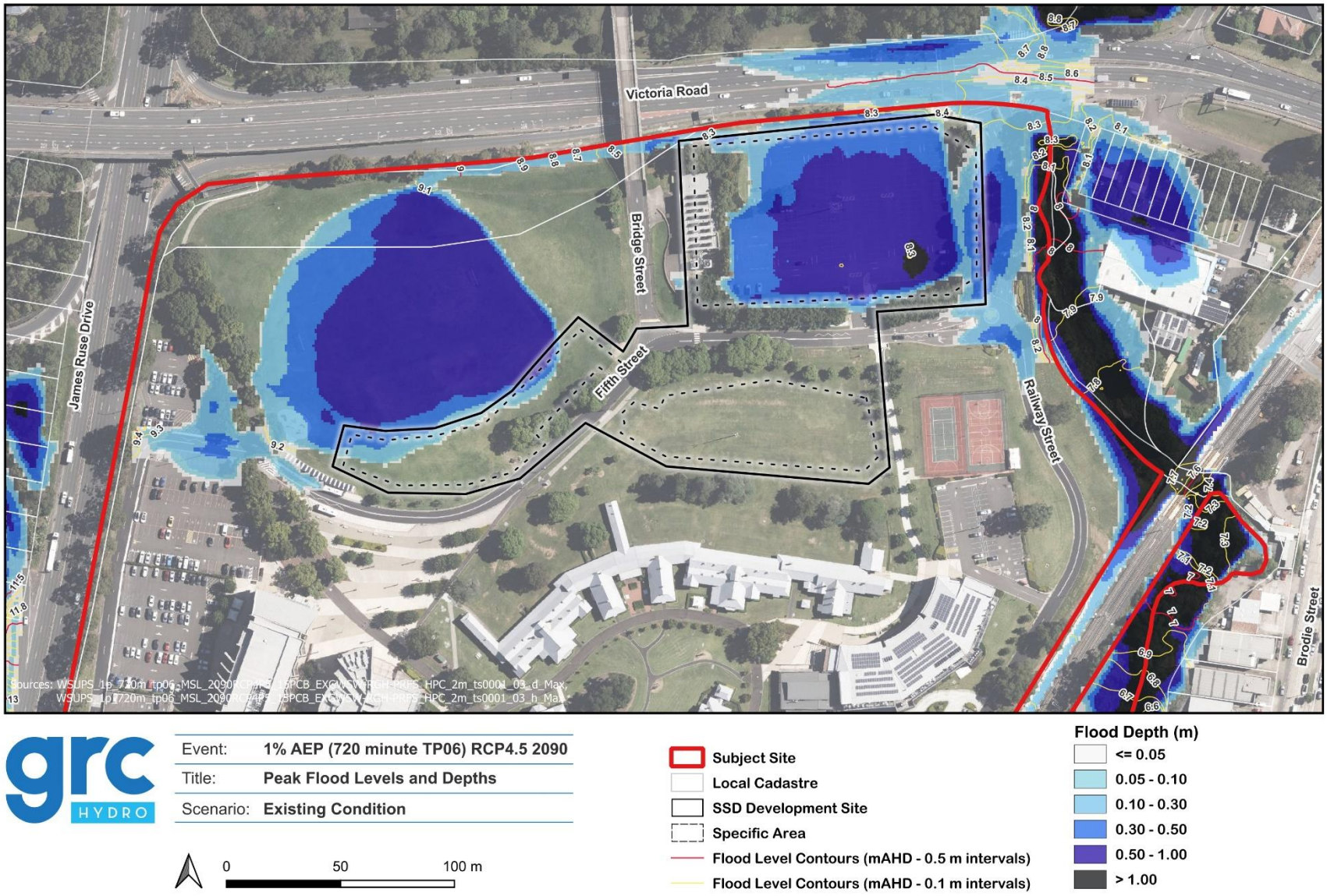


*Figure 26: Flood Velocity and Hazard – 1% AEP with Climate Change (RCP 4.5 2090) – Existing Condition*

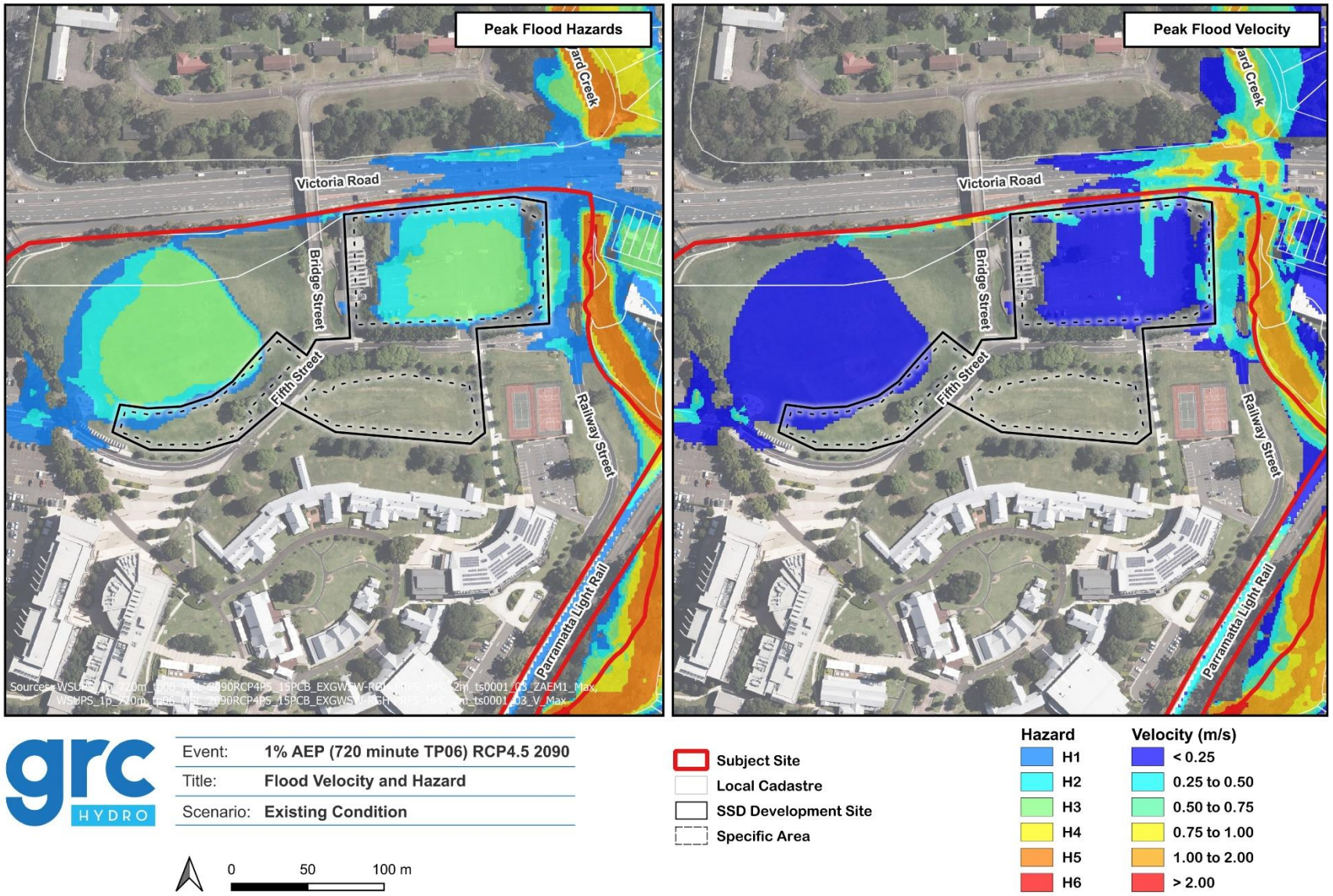


*Figure 27: Peak Flood Levels and Depths – 0.2% AEP – Existing Condition*

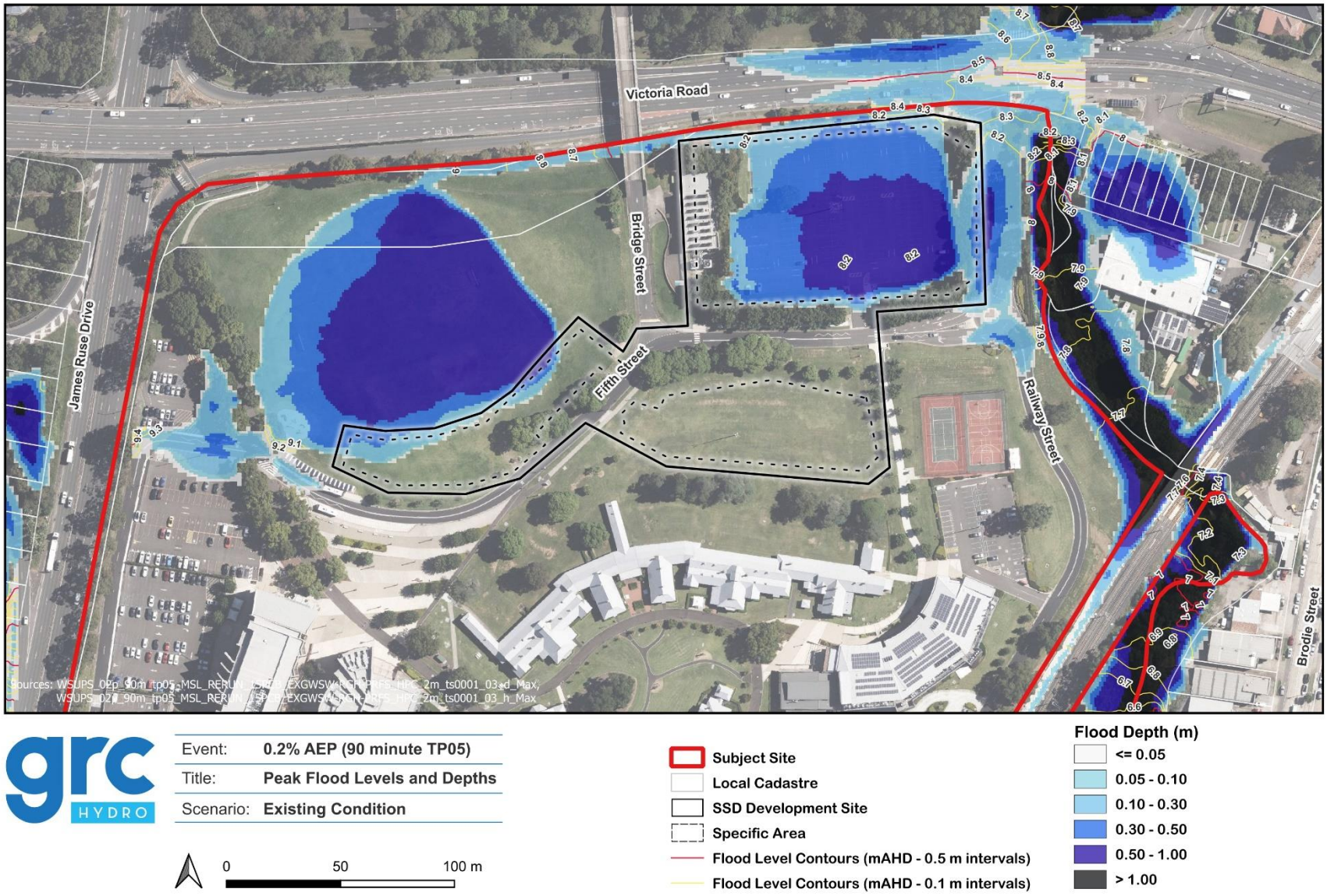


*Figure 28: Flood Velocity and Hazard – 0.2% AEP – Existing Condition*

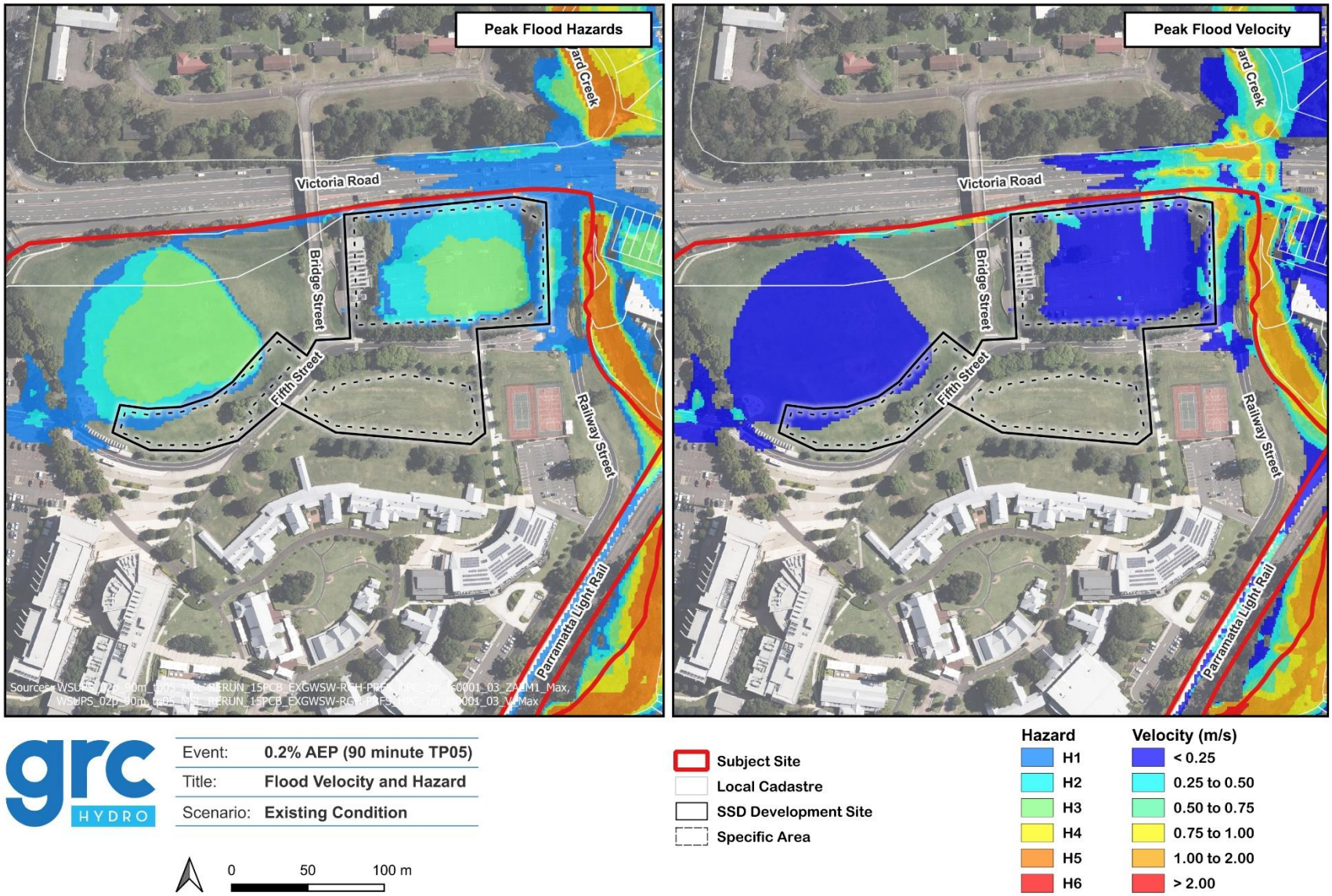
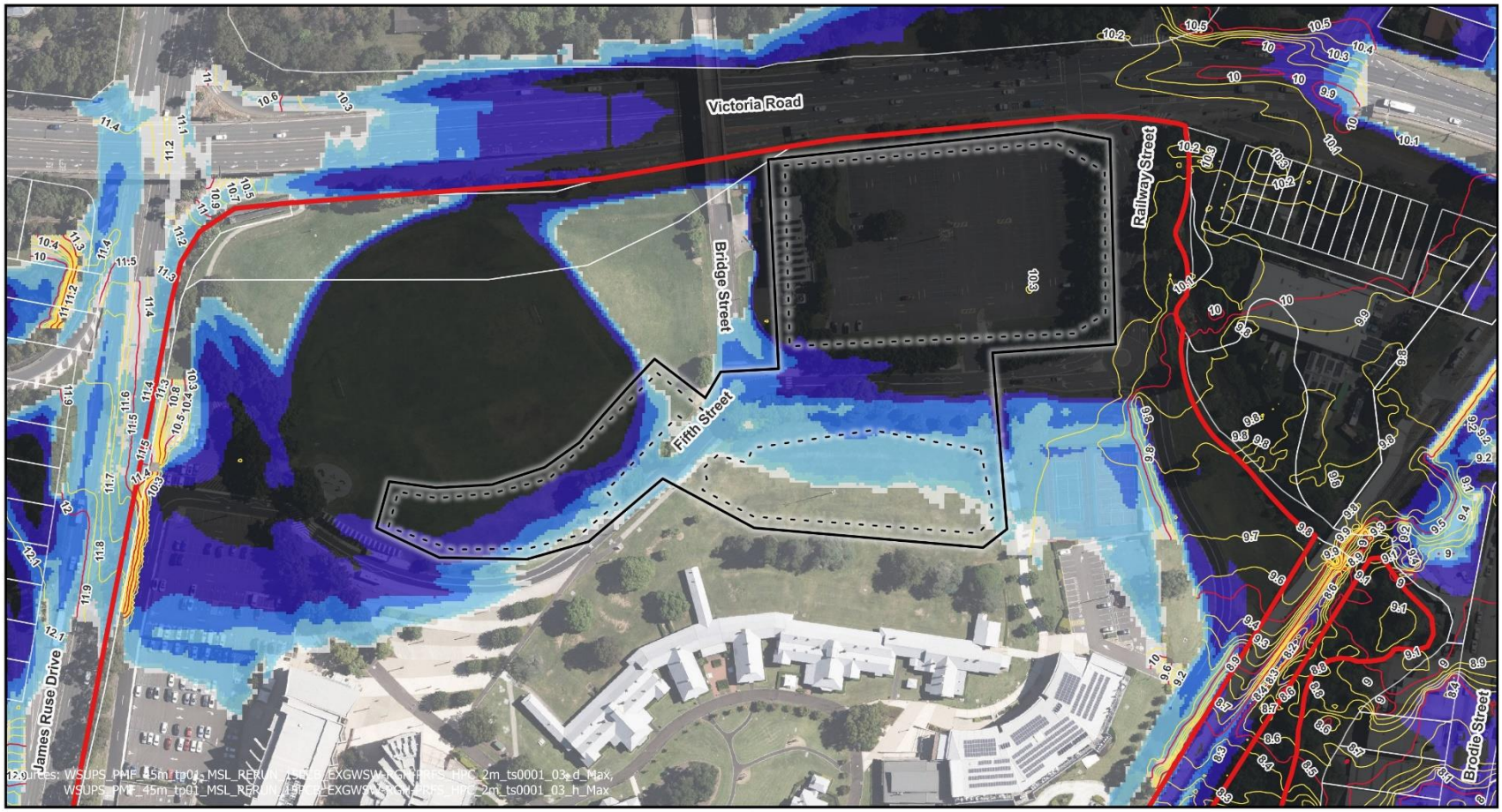


*Figure 29: Peak Flood Levels and Depths – PMF – Existing Condition*




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

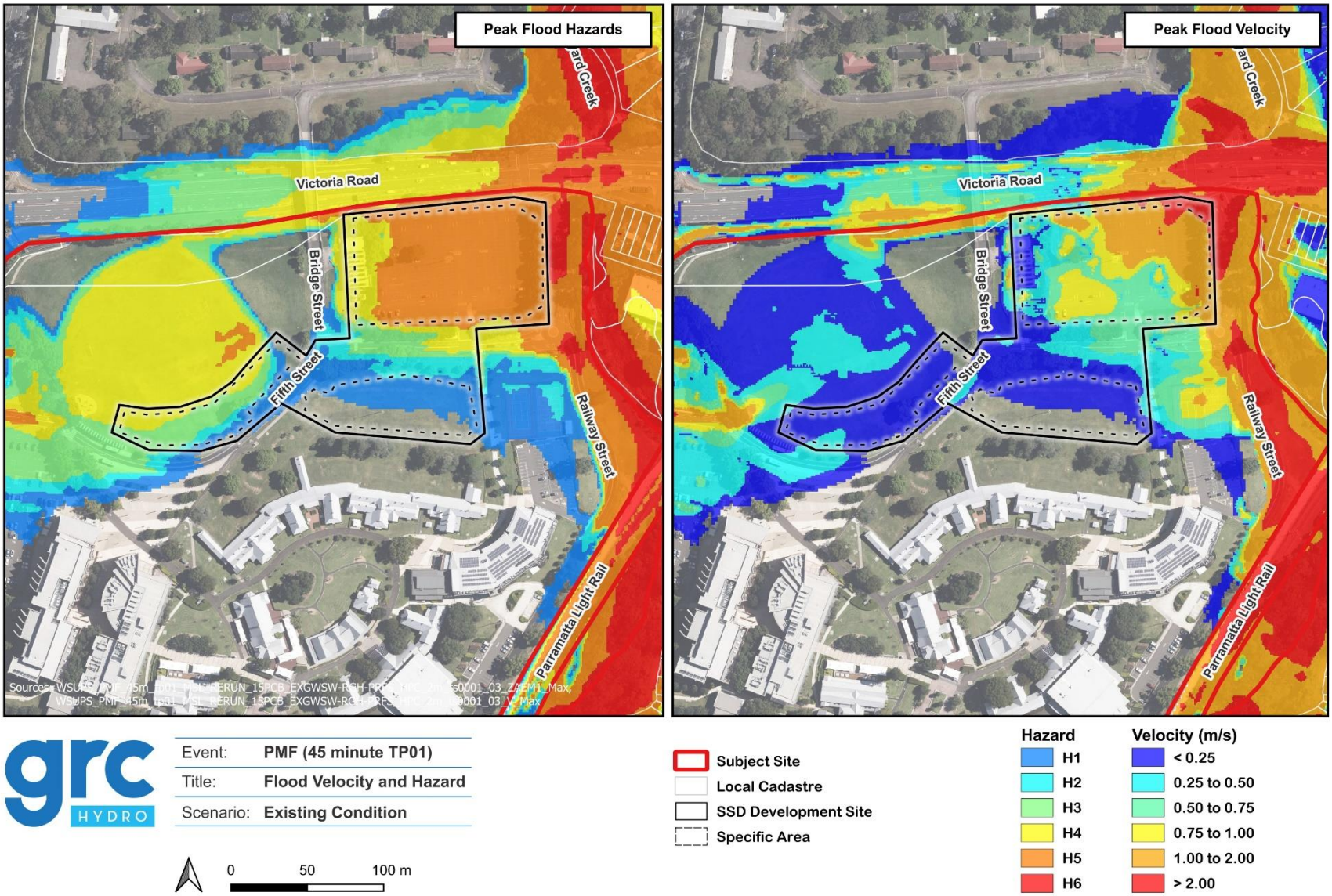
0 50 100 m

- Subject Site
- Local Cadastre
- SSD Development Site
- Specific Area
- Flood Level Contours (mAHD - 0.5 m intervals)
- Flood Level Contours (mAHD - 0.1 m intervals)

**Flood Depth (m)**

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

*Figure 30: Flood Velocity and Hazard – PMF – Existing Condition*



### 6.3.2 Comparison of Modelled Existing Levels to Council Flood Levels

The modelled flood level at the site in the 1% AEP event is 8.3 mAHD (see Figure 16). The flood certificate does not provide a comparable level at the subject site, however the Vineyard Creek flood levels documented on the Council-provided flood map (see Figure 4) appear to be a good match with GRC's 1% AEP estimate (see Figure 16) in that:

- in both sets of results the site is flooded in the 1% AEP;
- in the SKM 2005 results, the level upstream of Victoria Road is 8.6 mAHD which is similar to GRC's modelled level of 8.5 mAHD; and
- in the creek immediately downstream of Victoria Road, the SKM 2005 levels of 8.0 mAHD are approximately matched by GRC's modelling with slightly higher values of approximately 8.1 mAHD in this location (see Figure 16).

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

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

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

### 6.3.3 Flood Planning Level

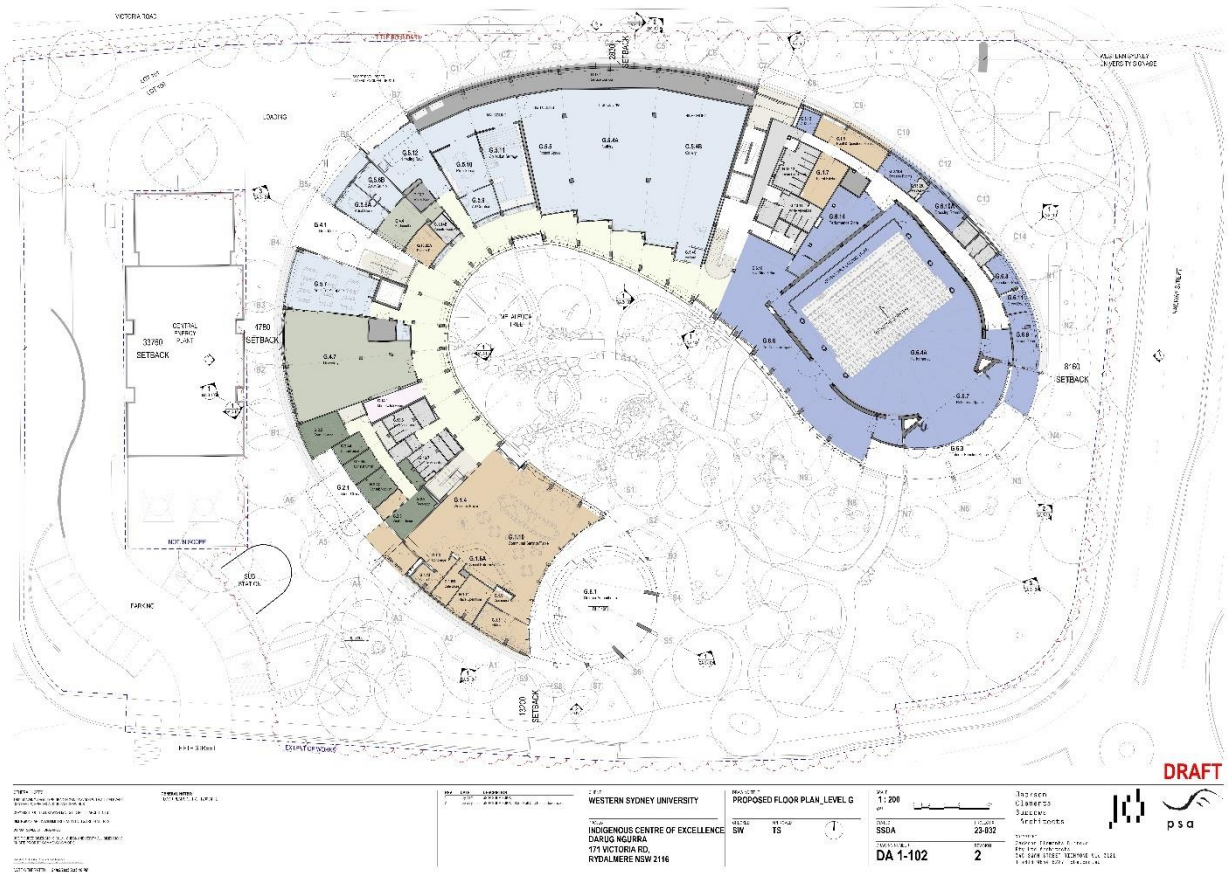
The Flood Planning Level (FPL) for this development equates to the 1% AEP flood level with an additional 0.5 m on top for freeboard. The appropriate FPL for this site is 8.8 mAHD. The proposed development has a finished floor level of 9.0 mAHD. As such there is an additional 0.2 m of freeboard being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

the proposed FFL is compliant and conservative and this is a key risk mitigation measure for the proposed development.

### 6.3.4 Proposed Development

The proposed development consists of:

- The regrading of the existing car park to facilitate landscaping and the proposed development (as per the surface provided by TTW on 3 March 2025: TIN SURFACE_250228.dwg);
- The development of a culturally-significant educational facility (the Indigenous Centre of Excellence) (as per Drawings DA1-102 to DA1-106 provided to GRC by Jackson Clements Burrows Architects on 24/02/2025 – see figure below and also Appendix B); and
- The development of a local water feature at south-east with piped drainage (0.7 m diameter) to Vineyard Creek (as is currently present with some relocation of the pit at the site to better align with the regraded landscape). This pipe has been represented as 100% blocked in GRC's modelling to result in a conservative estimate at the subject site.



### 6.3.5 Proposed Condition

Modelling results for the proposed condition for the 20% AEP, 1% AEP, 0.2% AEP and PMF design events are documented below from Figures 31 to 50.

| | |
|---|---|
| **20% AEP** | *Flood Levels:* Not flooded.<br>*Flood Depths:* Not flooded.<br>*Flood Hazard:* Not flooded. |
| **5% AEP** | *Flood Levels:* Not flooded.<br>*Flood Depths:* Not flooded.<br>*Flood Hazard:* Not flooded. |
| **1% AEP** | *Flood Levels:* 8.3 mAHD along the northern and western fringe of the site<br>*Flood Depths:* from 0.3 m up to 1.7 m deep in the pond area.<br>*Flood Hazard:* H3 (low to medium hazard) at the building footprint with a max of H4 at the pond. |
| **1% AEP (plus 19% rainfall loading)** | *Flood Levels:* 8.5 mAHD across the western fringe<br>*Flood Depths:* from 0.3 m up to 1.8 m deep in the pond area.<br>*Flood Hazard:* H3 (low to medium hazard) at the building footprint with a max of H4 at the pond. |
| **1% AEP + RCP 4.5 2050** | *Flood Levels:* 8.4 mAHD in the north-west corner of the proposed footprint to 8.3 mAHD in the south-eastern corner.<br>*Flood Depths:* from 0.3 m up to 1.8 m deep in the pond area.<br>*Flood Hazard:* H3 (low to medium hazard) at the building footprint with a max of H4 at the pond. |
| **1% AEP + RCP 4.5 2090** | *Flood Levels:* 8.5 mAHD in the north-west corner of the proposed footprint to 8.3 mAHD in the south-eastern corner.<br>*Flood Depths:* from 0.3 m up to 1.8 m deep in the pond area.<br>*Flood Hazard:* H3 (low to medium hazard) at the building footprint with a max of H4 at the pond. |
| **0.2% AEP** | *Flood Levels:* 8.4 mAHD in the north-west corner of the proposed footprint to 8.3 mAHD in the south-eastern corner.<br>*Flood Depths:* from 0.3 m up to 1.8 m deep in the pond area.<br>*Flood Hazard:* H3 (low to medium hazard) at the building footprint with a max of H4 at the pond. |
| **PMF** | *Flood Levels:* 10.3 mAHD<br>*Flood Depths:* from 1.0 m up to 3.8 m deep in the pond area.<br>*Flood Hazard:* Max of H5 (high hazard) |

### 6.3.6 Flood Level Impact

The modelled flood level impact is documented in Figure 36. The proposed design modifies the land in a way that aggregates flood waters into a smaller footprint than in the existing case. This is the result of the introduction of water sensitive landscaping (excavation and reforming) in the eastern and south-eastern portion of the site.

The proposed development and regrading results in a generally positive flood level impact. Any minor adverse impacts are restricted to the subject site and does not cause flood impacts for surrounding properties and some adjacent areas are predicted to experience less flooding.

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

### 6.3.7 Cumulative Impact Associated with Car Park Development

GRC conducted a flood assessment for the proposed car park to the south of the proposed ICoE. This development is to be constructed largely on grade, with limited change to the existing elevations. The proposed car park footprint also has limited overlap with the flood extent (PRFS 2024).

The proposed car park is to consist of a combination of bitumen access roads and parking spaces with a turf cell surface so the potential impact of introducing hardstand to this area upstream of the ICoE is limited.

The car park flood assessment was developed on the basis that the car park was to be constructed of bitumen but the recent amendment to construct car spaces using turf cells poses no material difference to the assessment and the ICoE site.

*Figure 31: Peak Flood Levels and Depths – 20% AEP – Developed Condition*

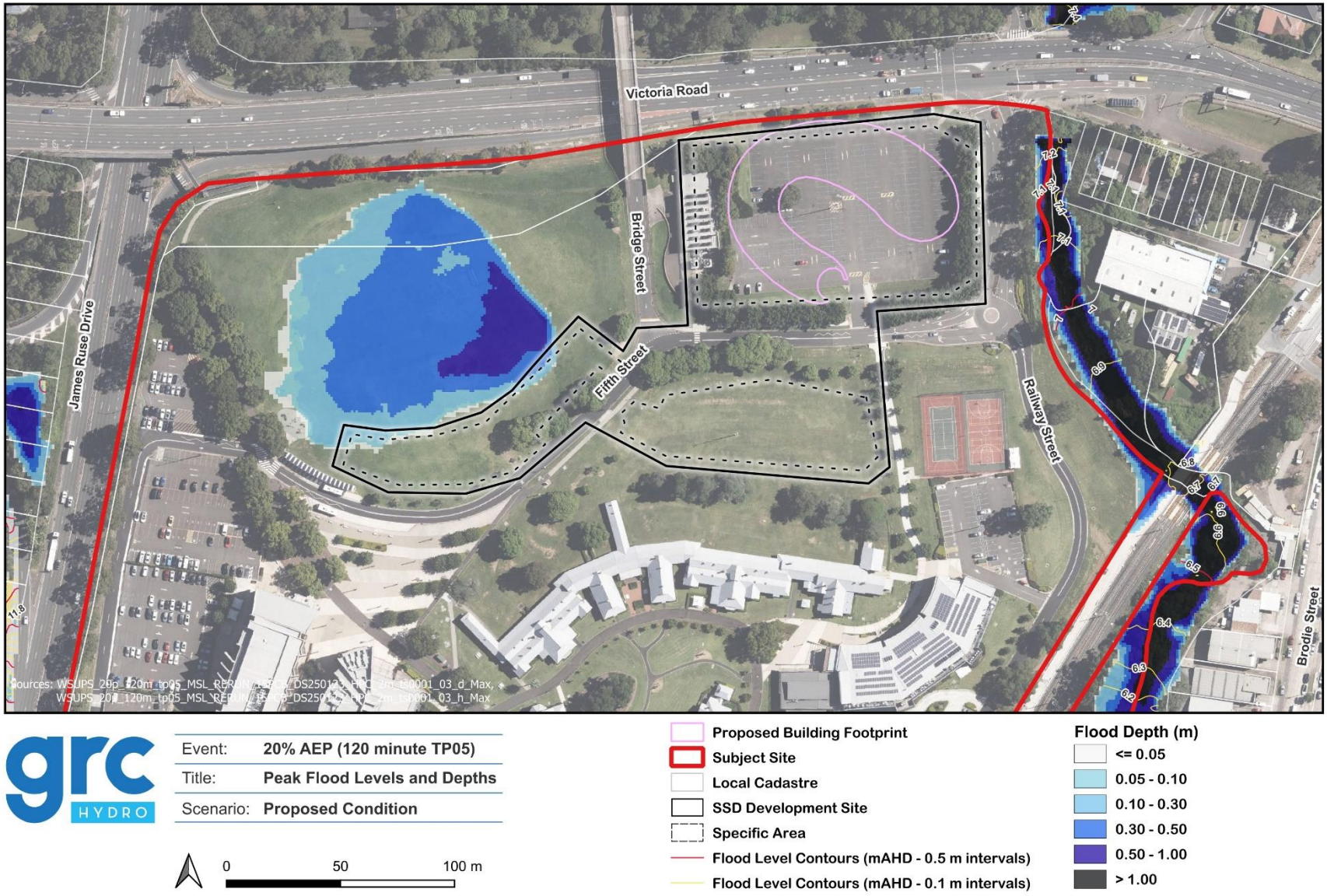


*Figure 32: Flood Velocity and Hazard – 20% AEP – Developed Condition*

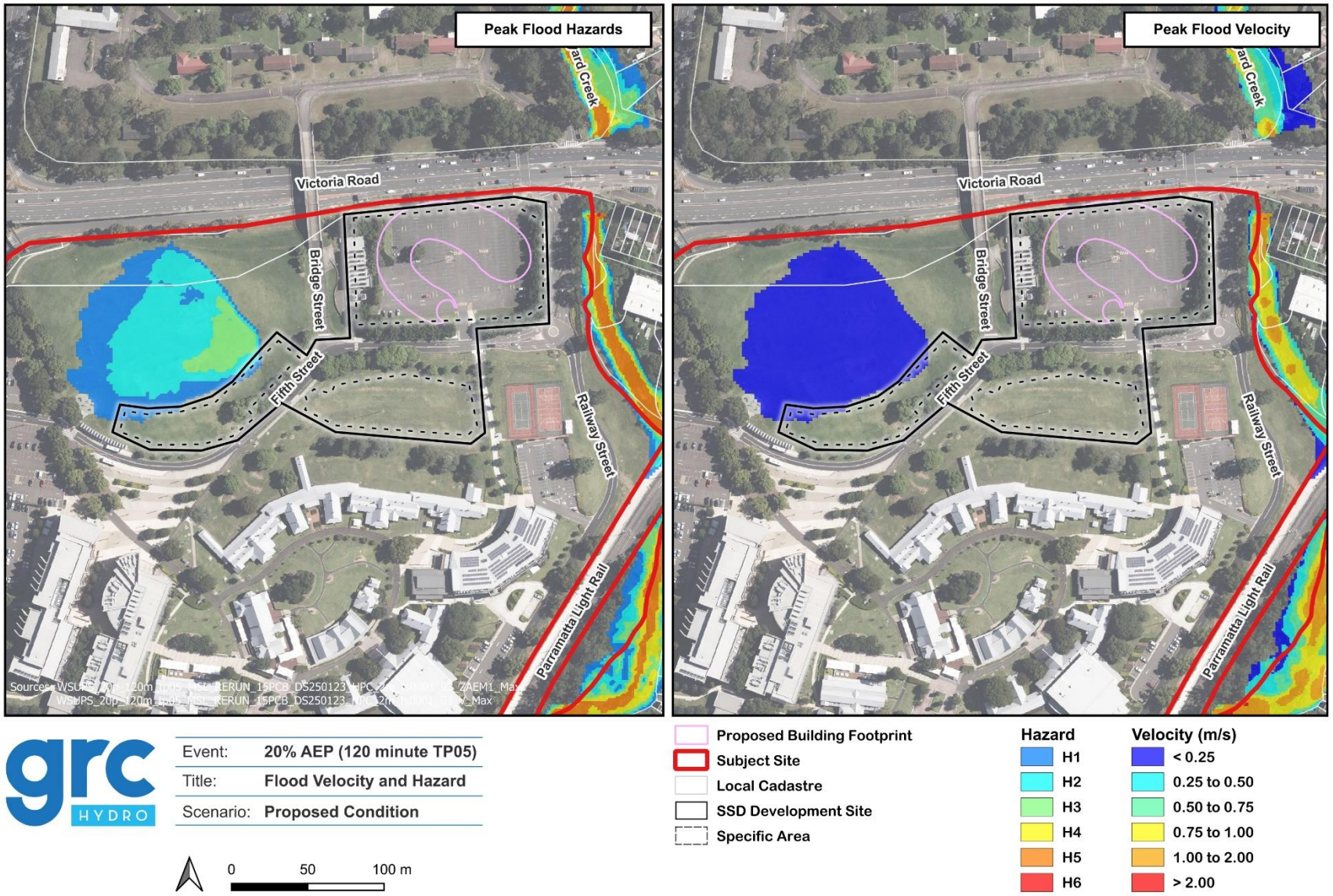


*Figure 33: Peak Flood Levels and Depths – 5% AEP – Developed Condition*

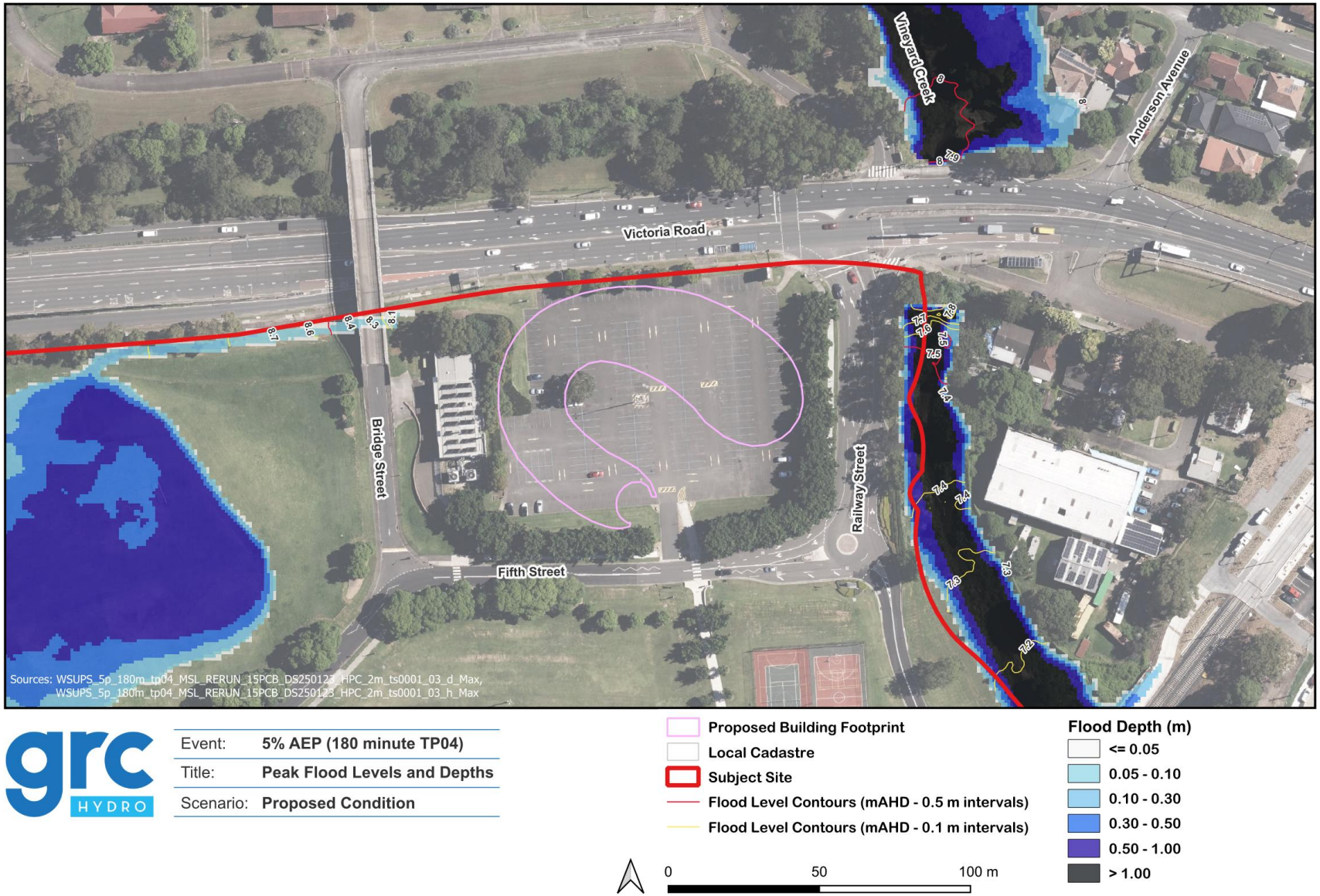


*Figure 34: Flood Velocity and Hazard – 5% AEP – Developed Condition*

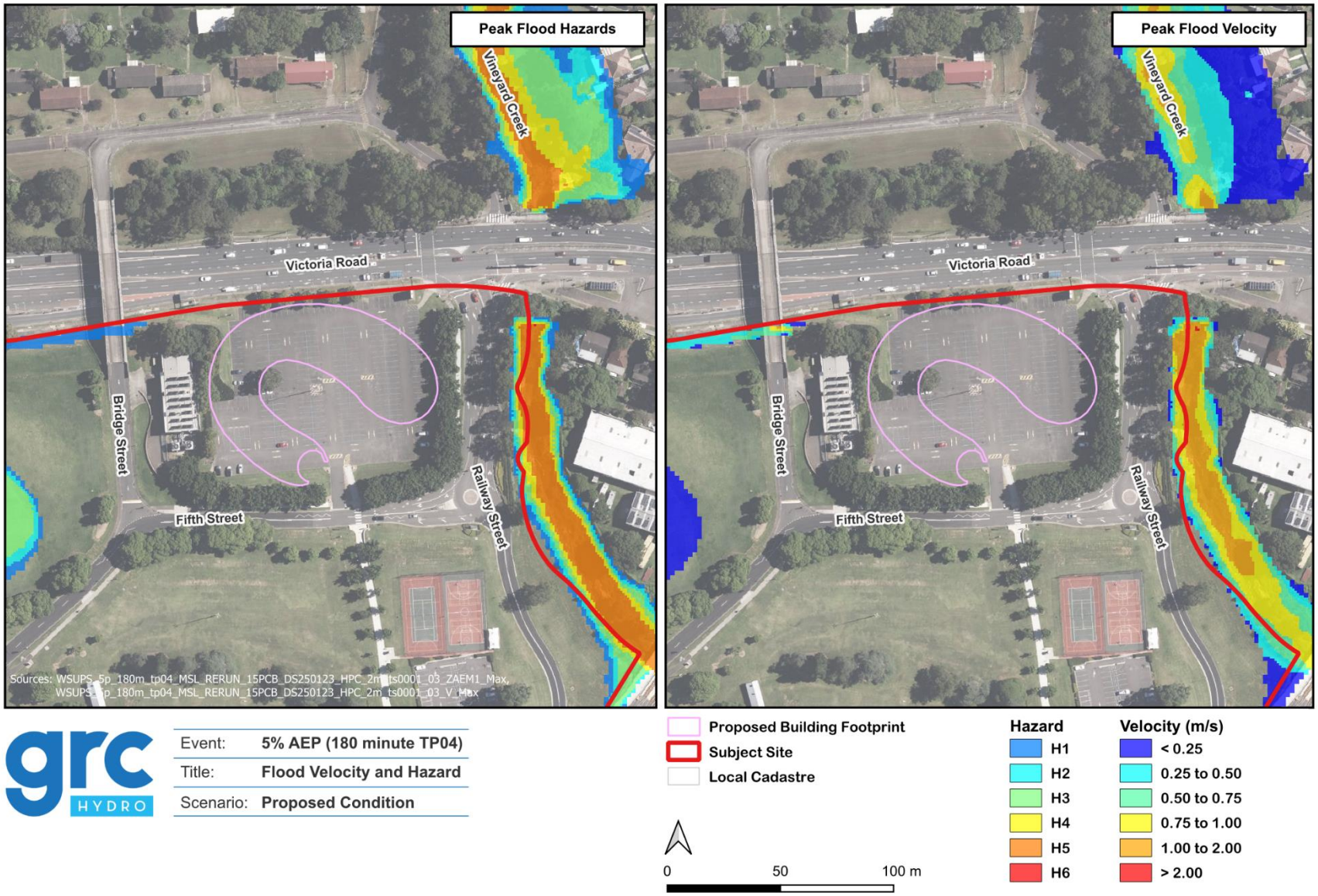


*Figure 35: Peak Flood Levels and Depths – 1% AEP – Developed Condition*

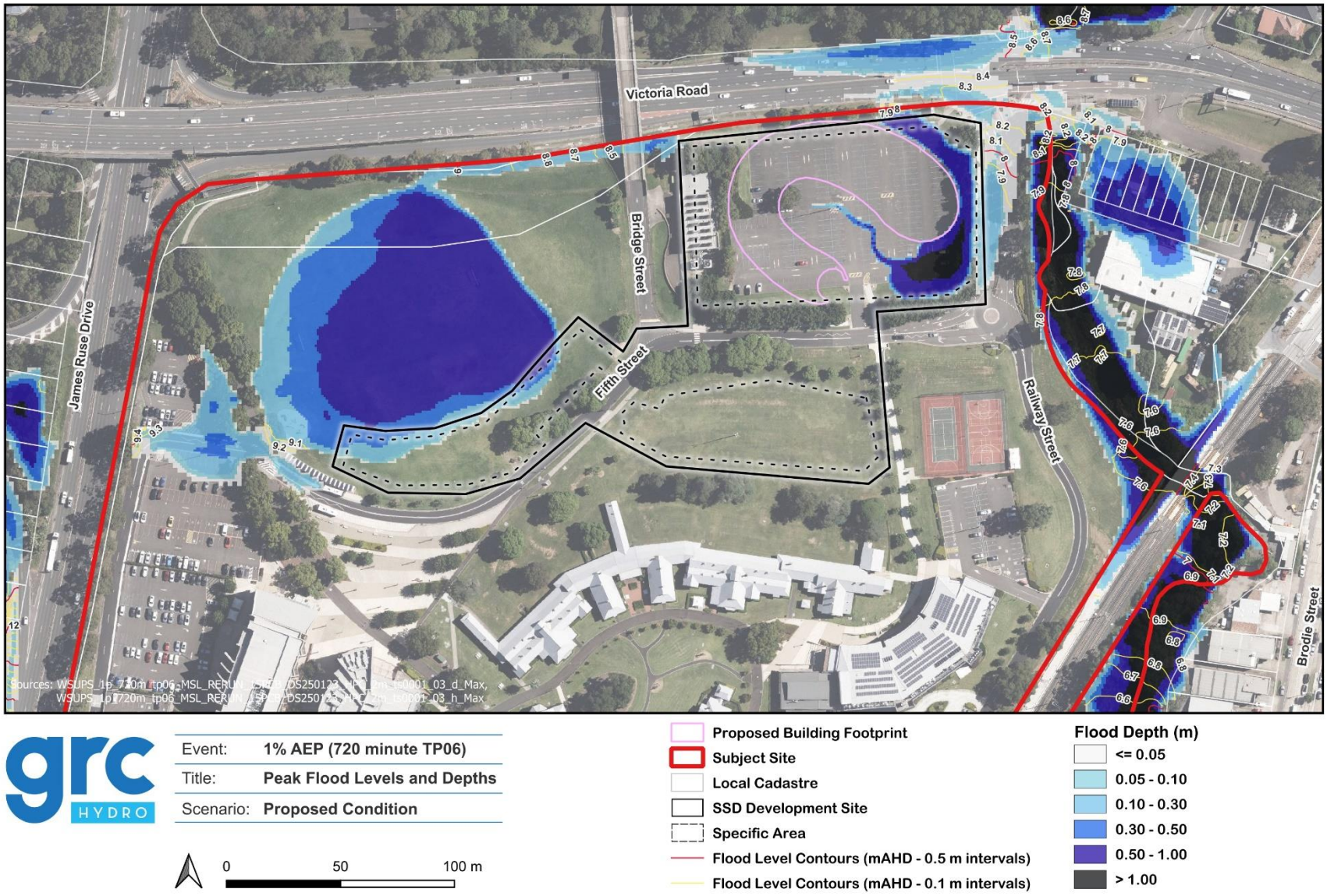


*Figure 36: Flood Level Impact – 1% AEP – Developed Condition Minus Existing Condition*

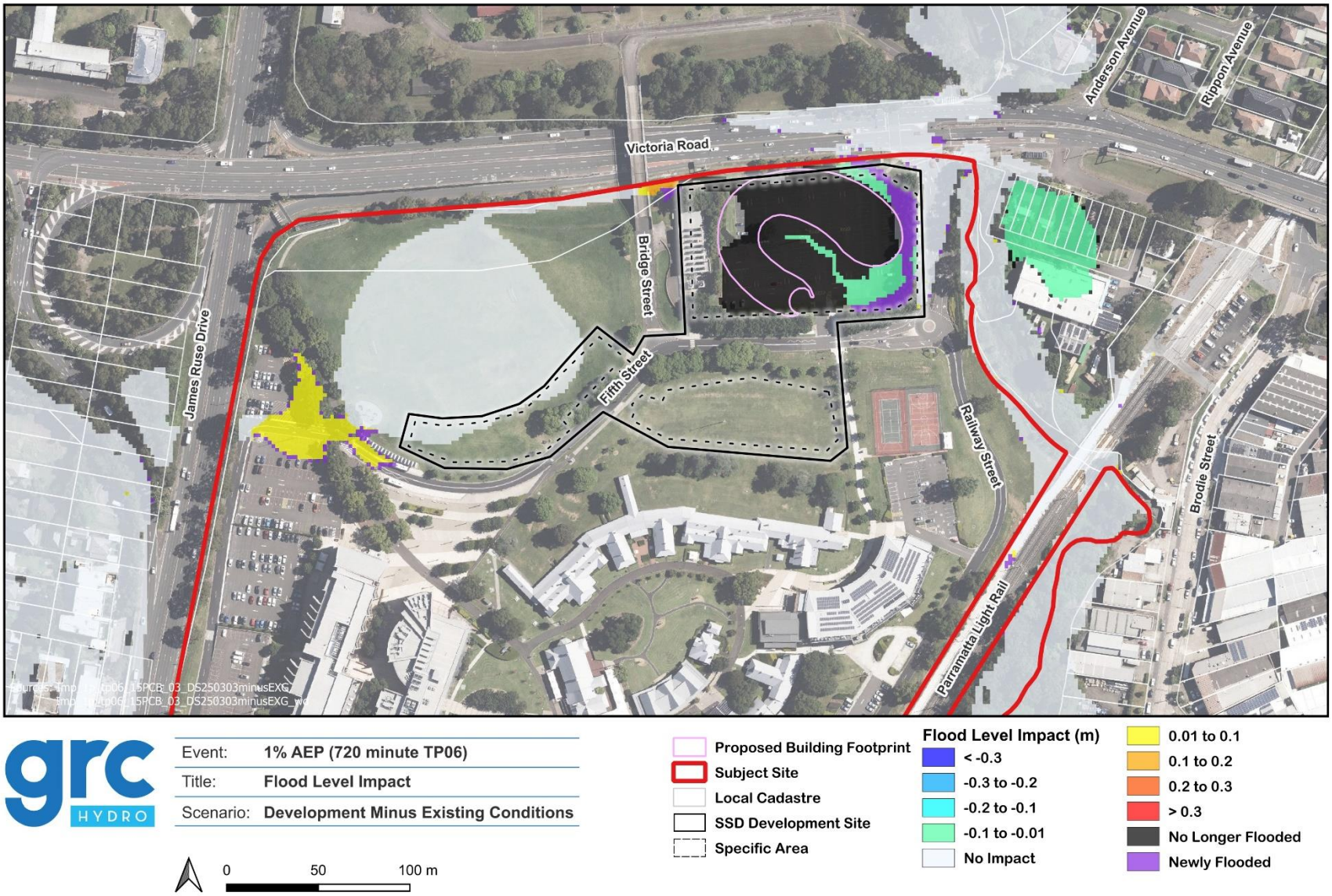


*Figure 37: Flood Velocity and Hazard – 1% AEP – Developed Condition*

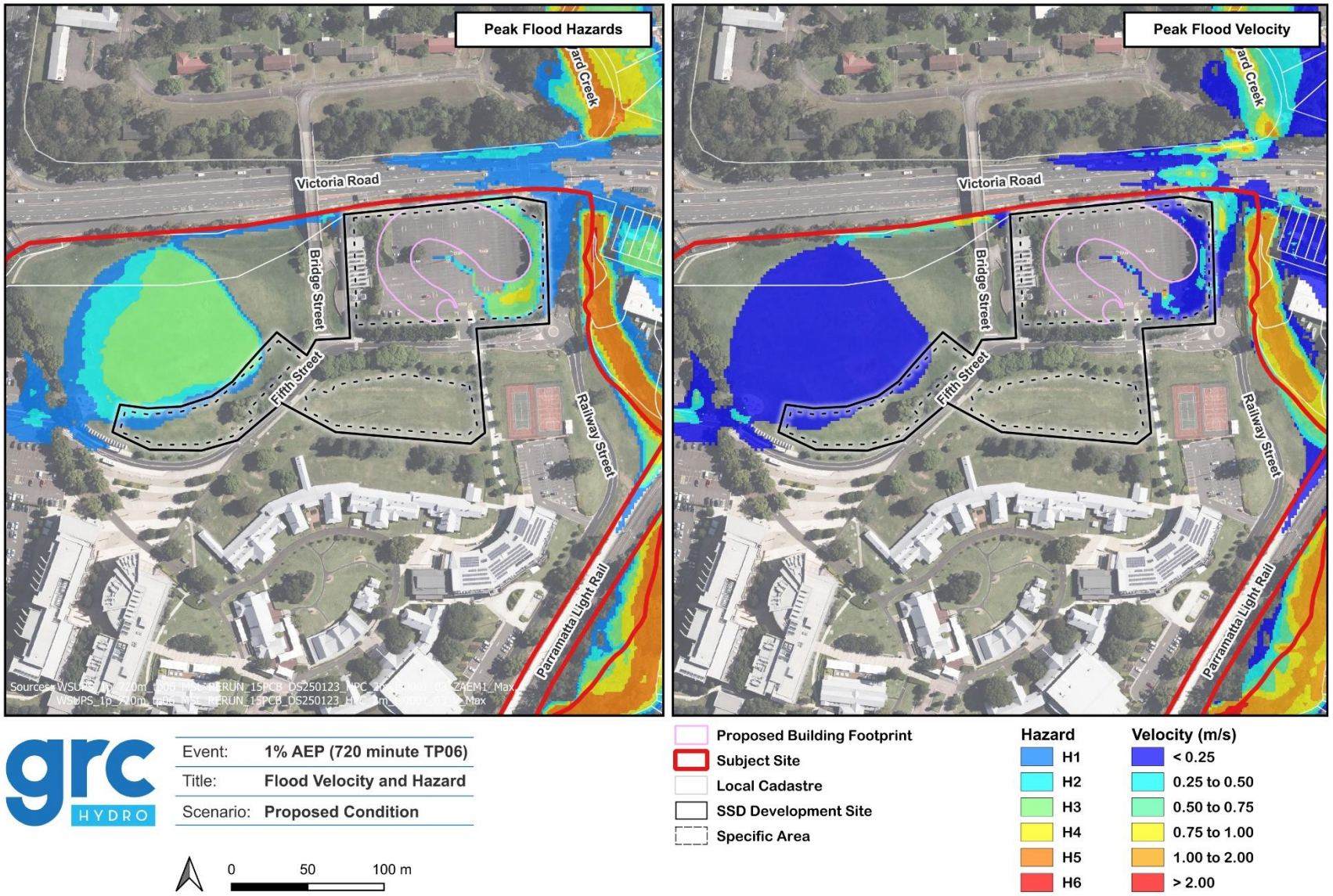


*Figure 38: Flood Function – 1% AEP – Developed Condition*

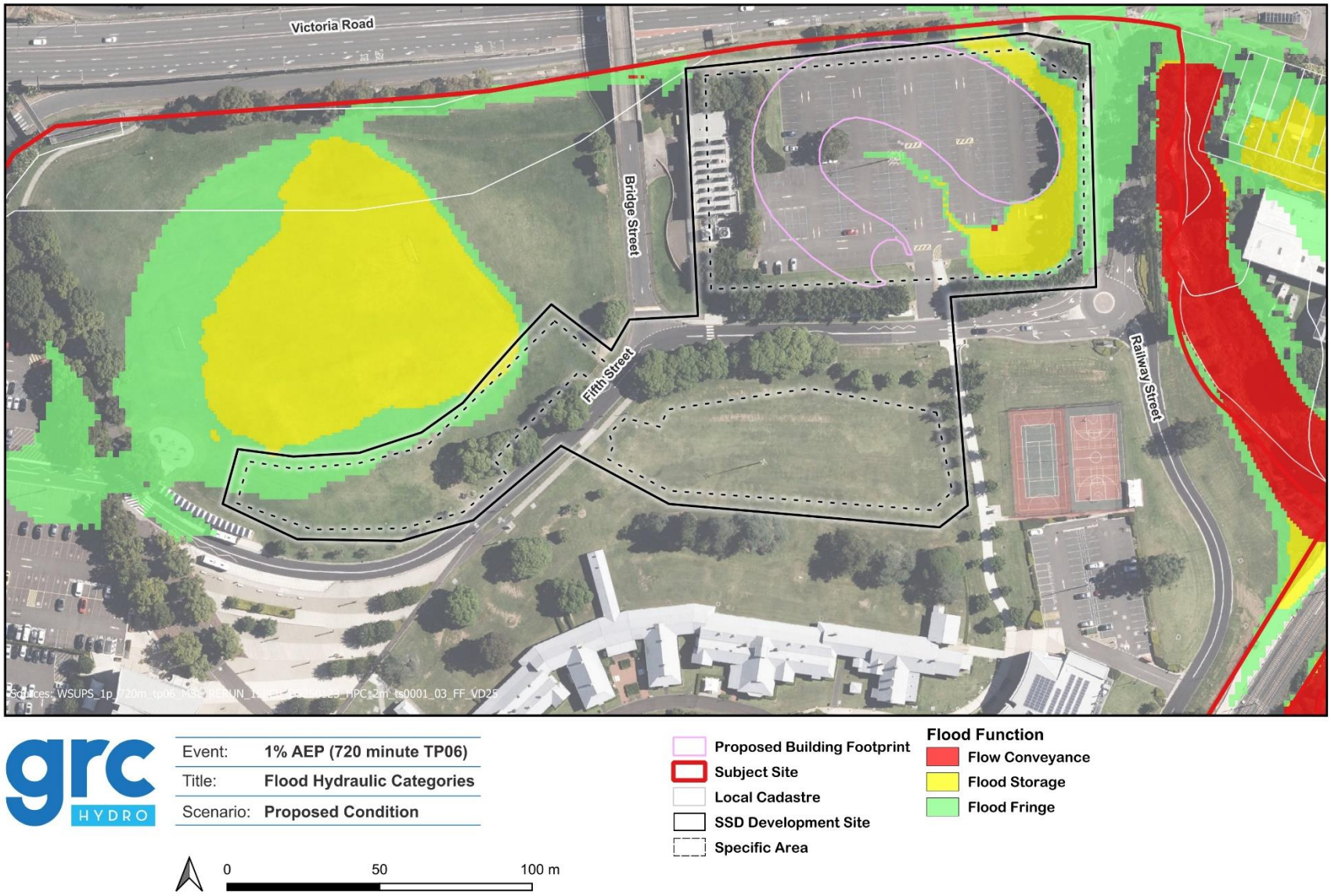


*Figure 39: Flood Level Impact Sensitivity Analysis – 1% AEP – Developed Condition (50% Blockage minus No Blockage)*

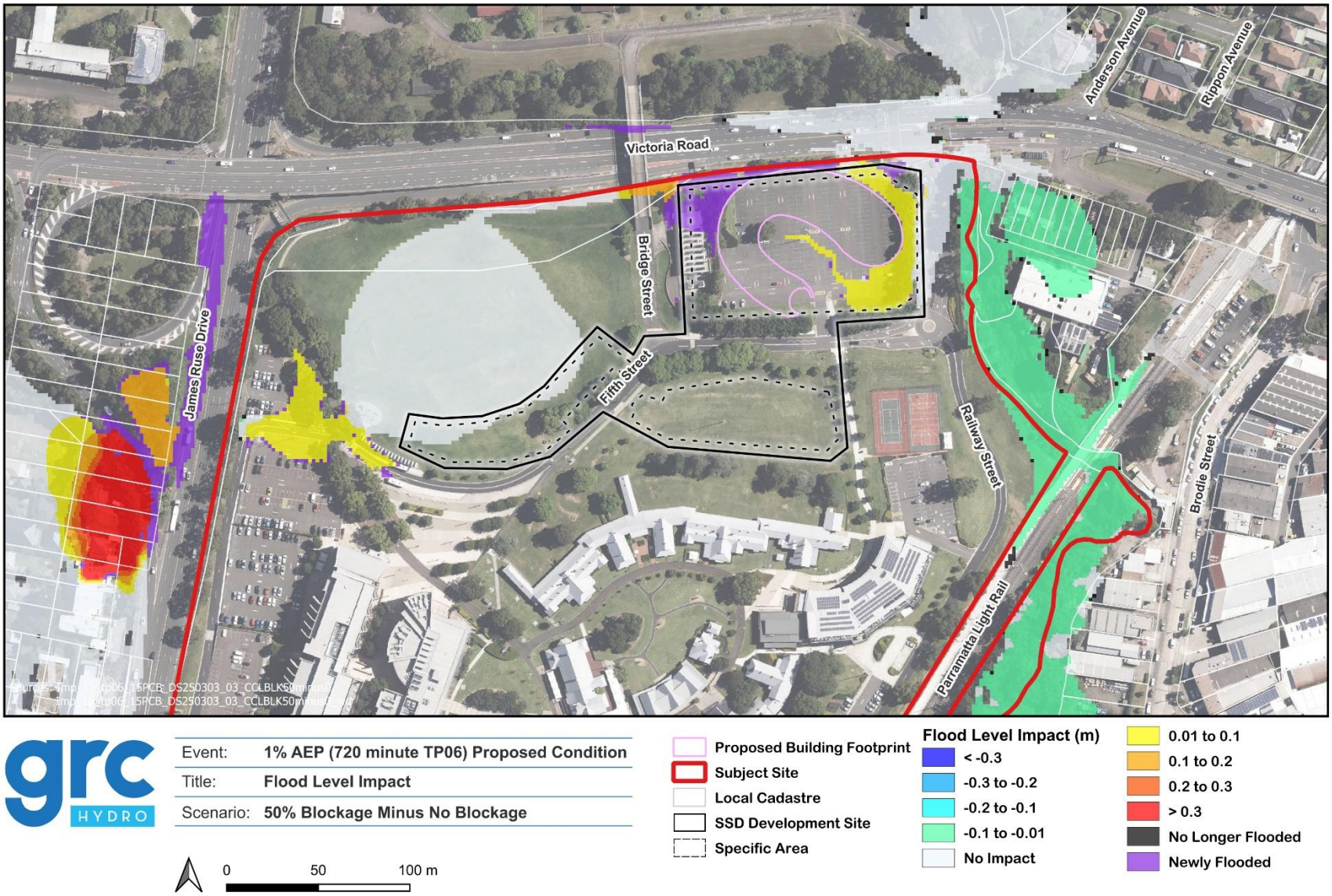


*Figure 40: Flood Level Impact Sensitivity Analysis – 1% AEP – Developed Condition (100% Blockage minus No Blockage)*

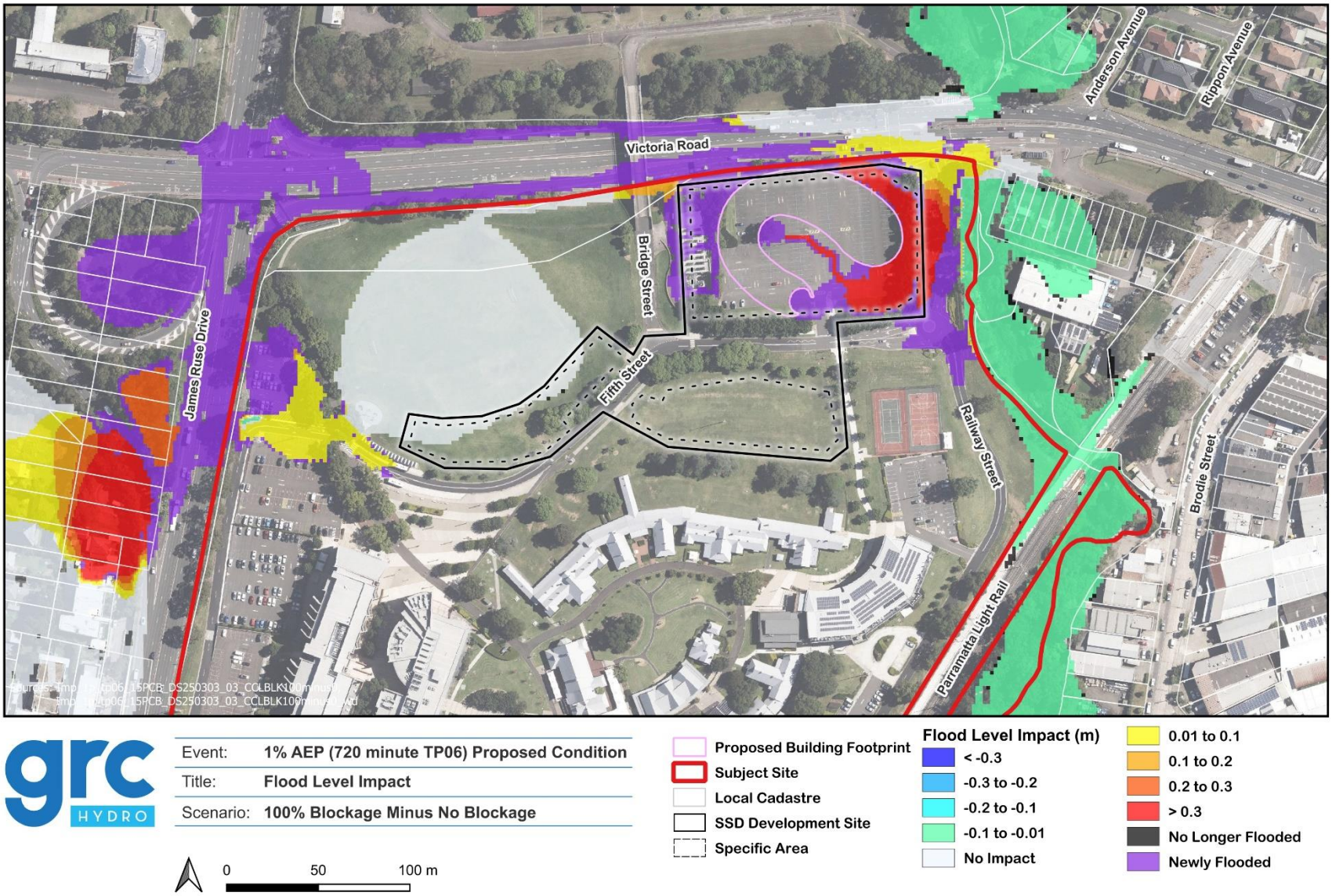


*Figure 41: Peak Flood Levels and Depths – 1% AEP (with additional 19% rainfall loading)– Developed Condition*

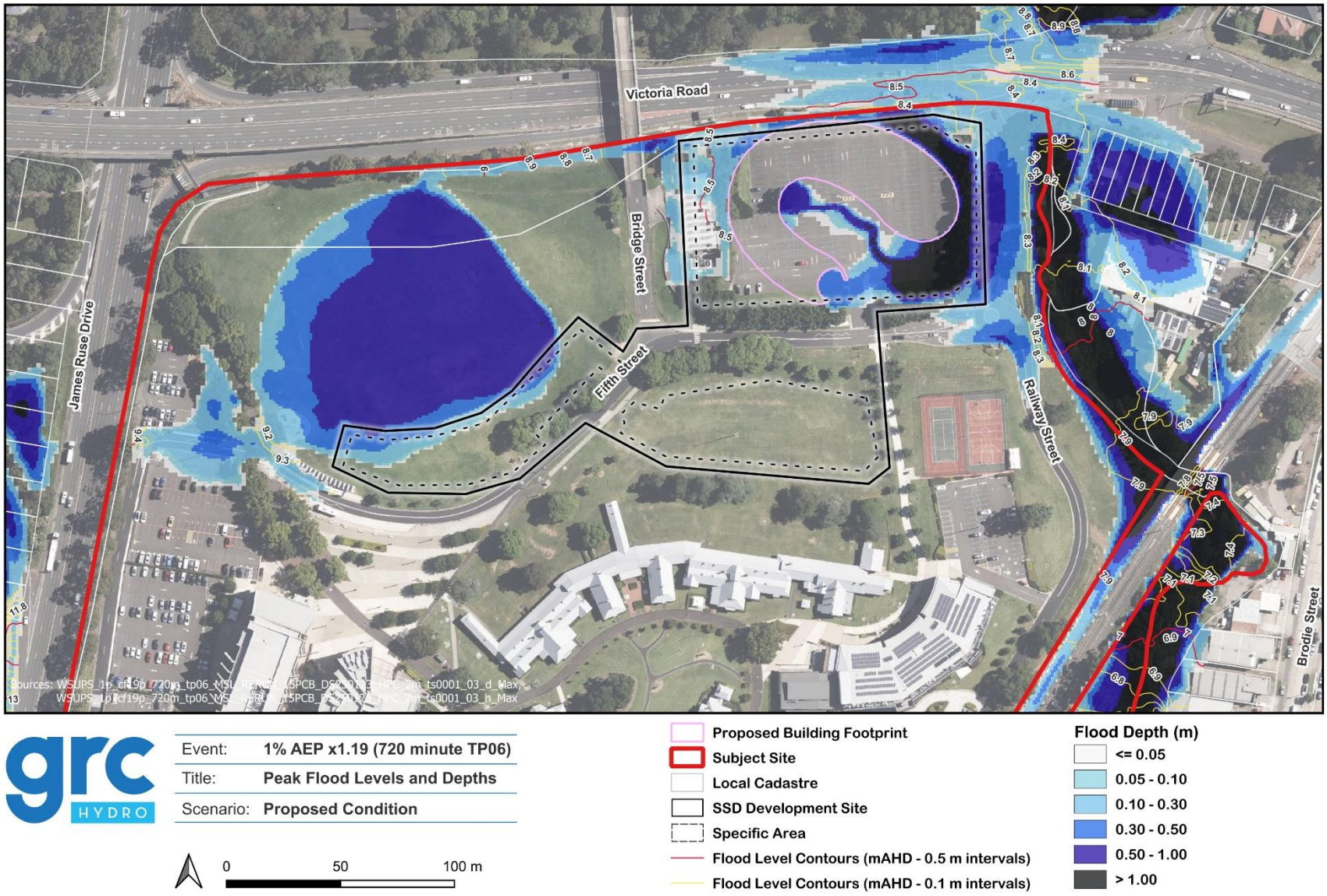


*Figure 42: Flood Velocity and Hazard – 1% AEP (with additional 19% rainfall loading) – Developed Condition*

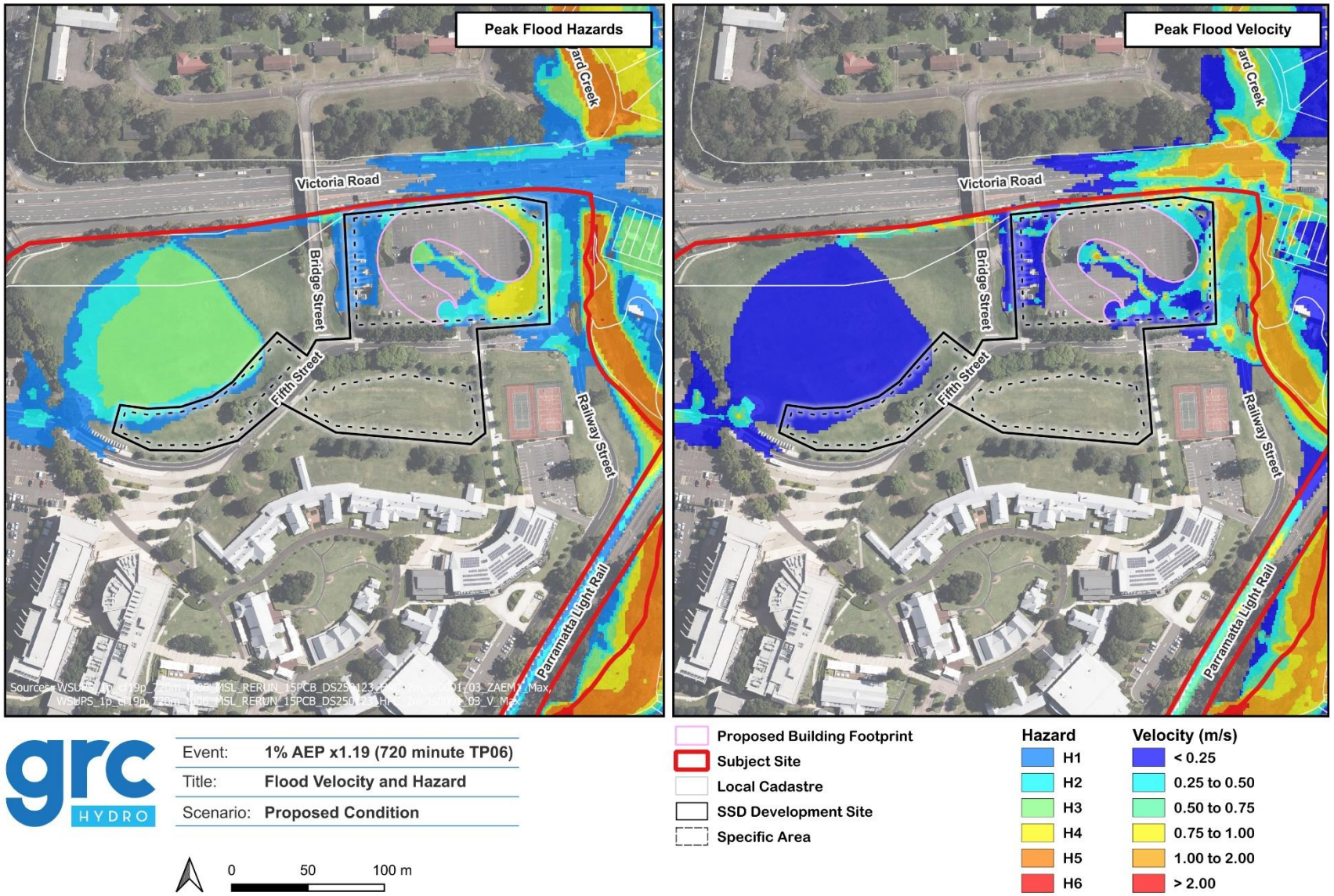


*Figure 43: Peak Flood Levels and Depths – 1% AEP with Climate Change (RCP 4.5 2050) – Developed Condition*

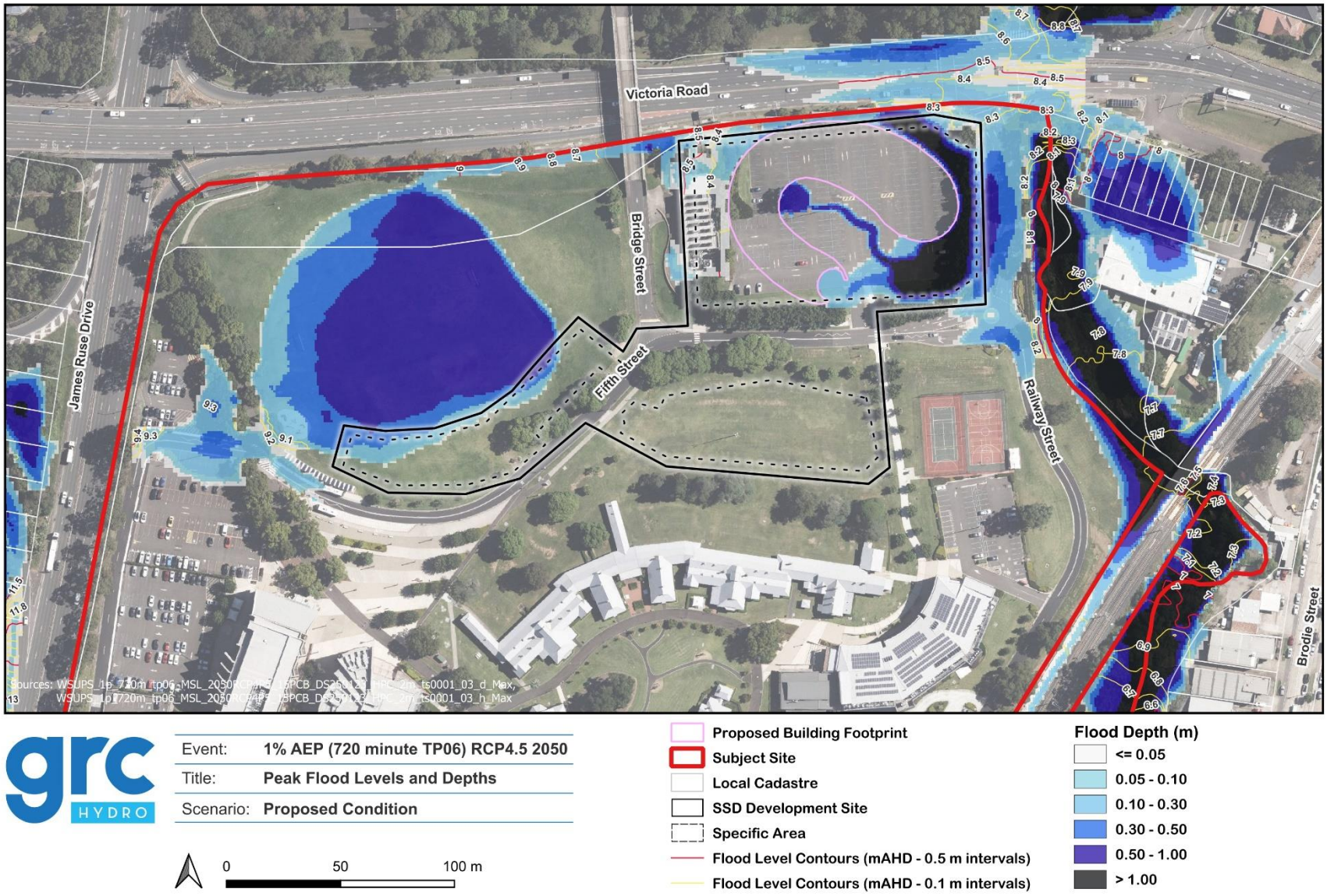


*Figure 44: Flood Velocity and Hazard – 1% AEP with Climate Change (RCP 4.5 2050) – Developed Condition*

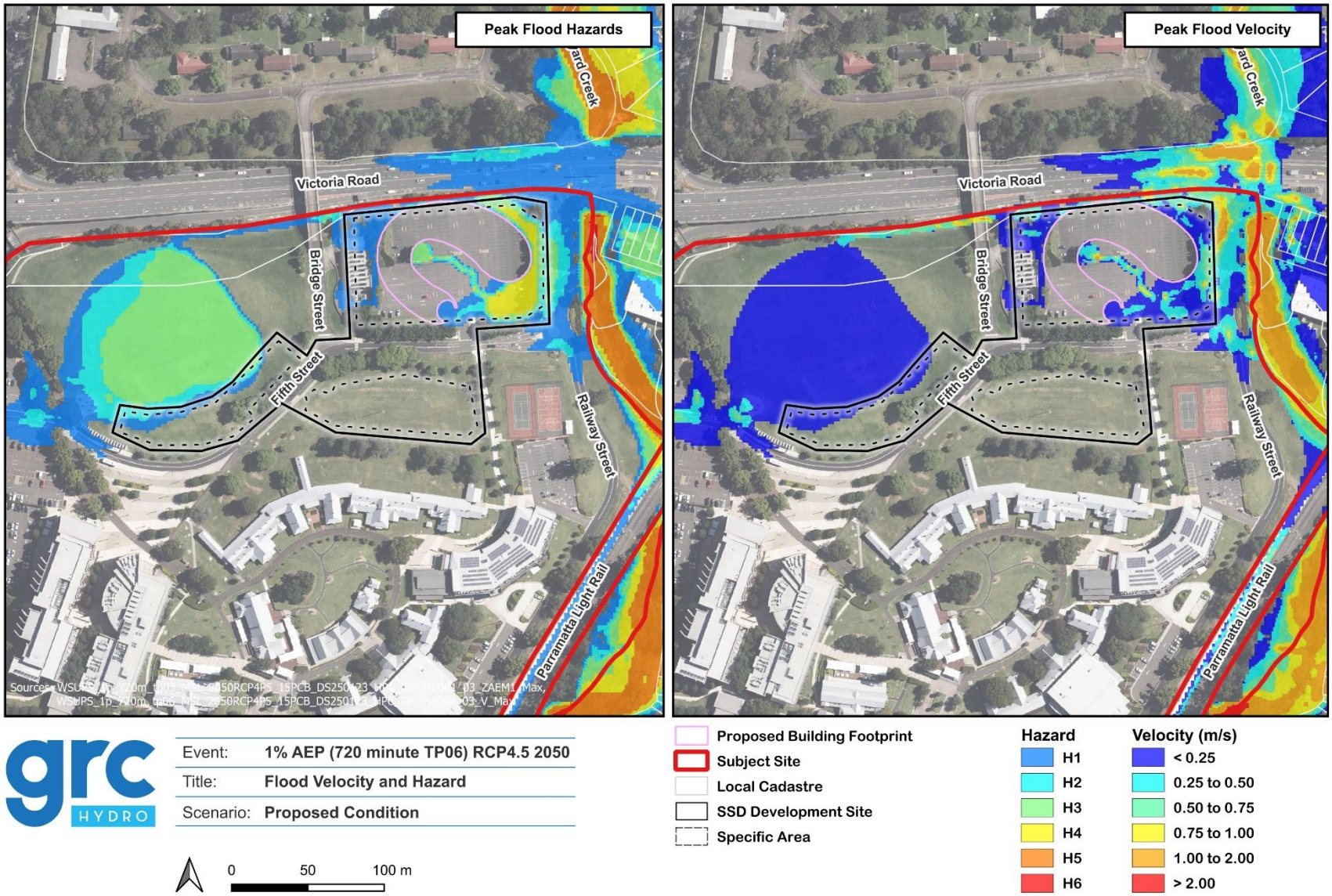


*Figure 45: Peak Flood Levels and Depths – 1% AEP with Climate Change (RCP 4.5 2090) – Developed Condition*

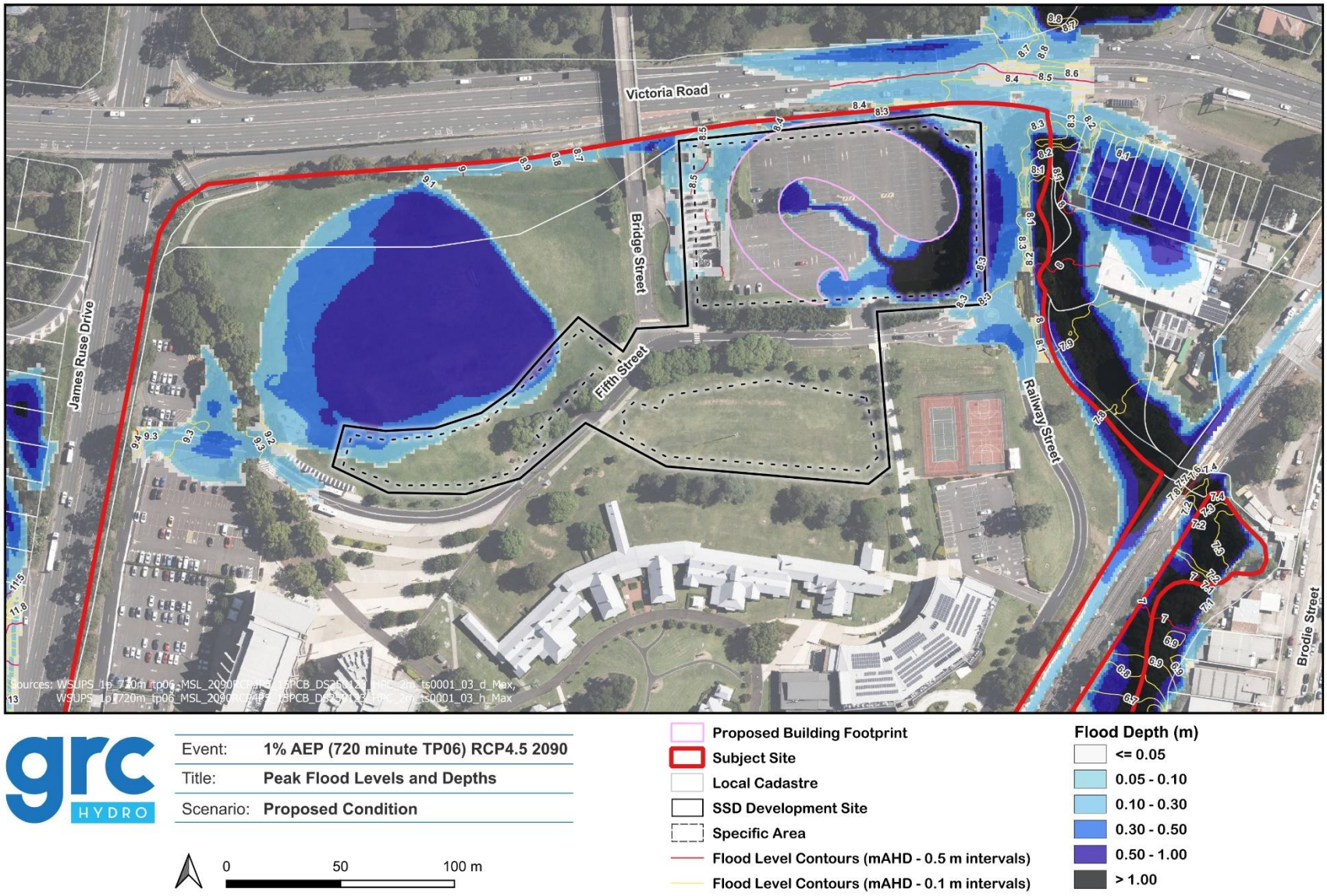


*Figure 46: Flood Velocity and Hazard – 1% AEP with Climate Change (RCP 4.5 2090) – Developed Condition*

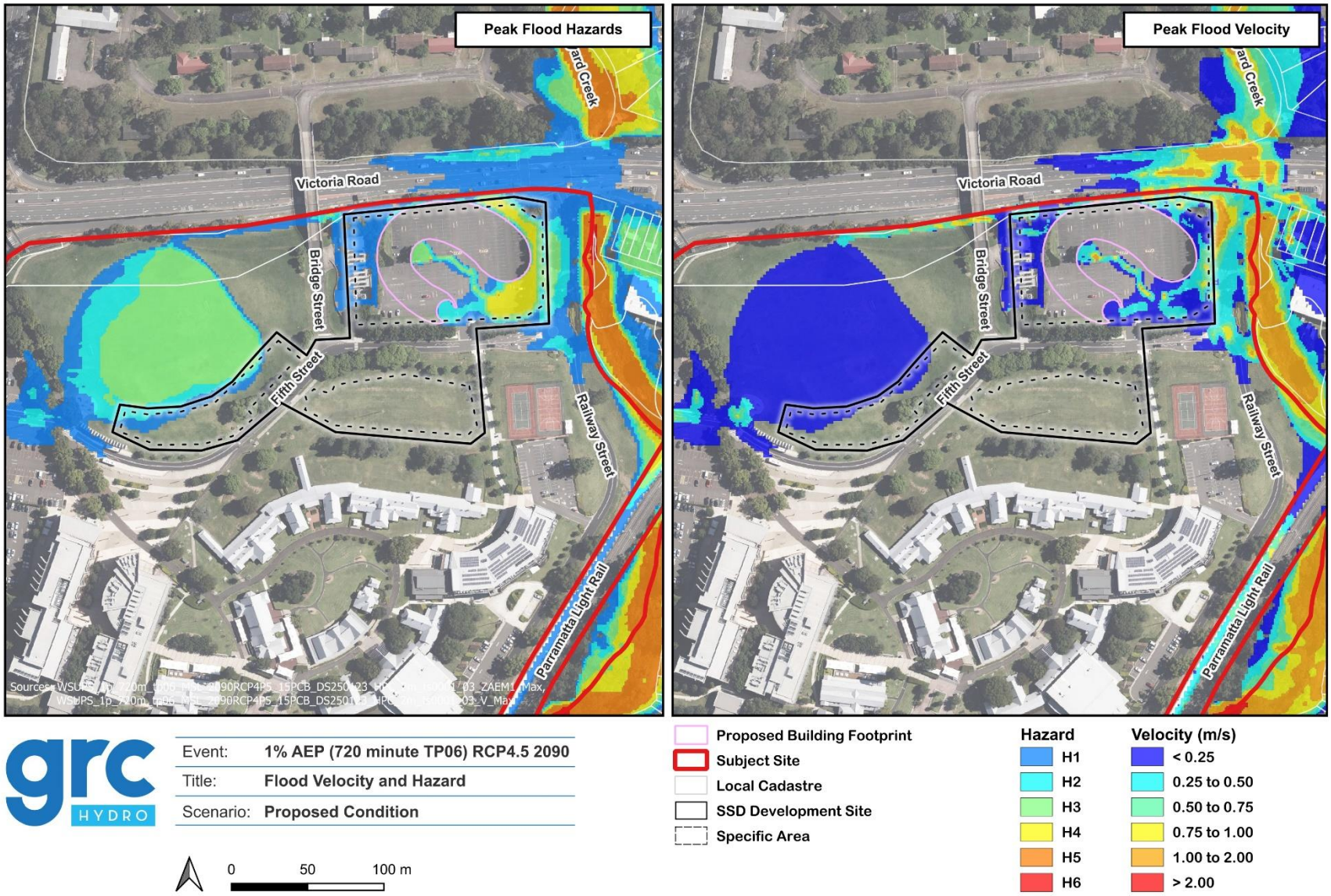


*Figure 47: Peak Flood Levels and Depths – 0.2% AEP – Developed Condition*

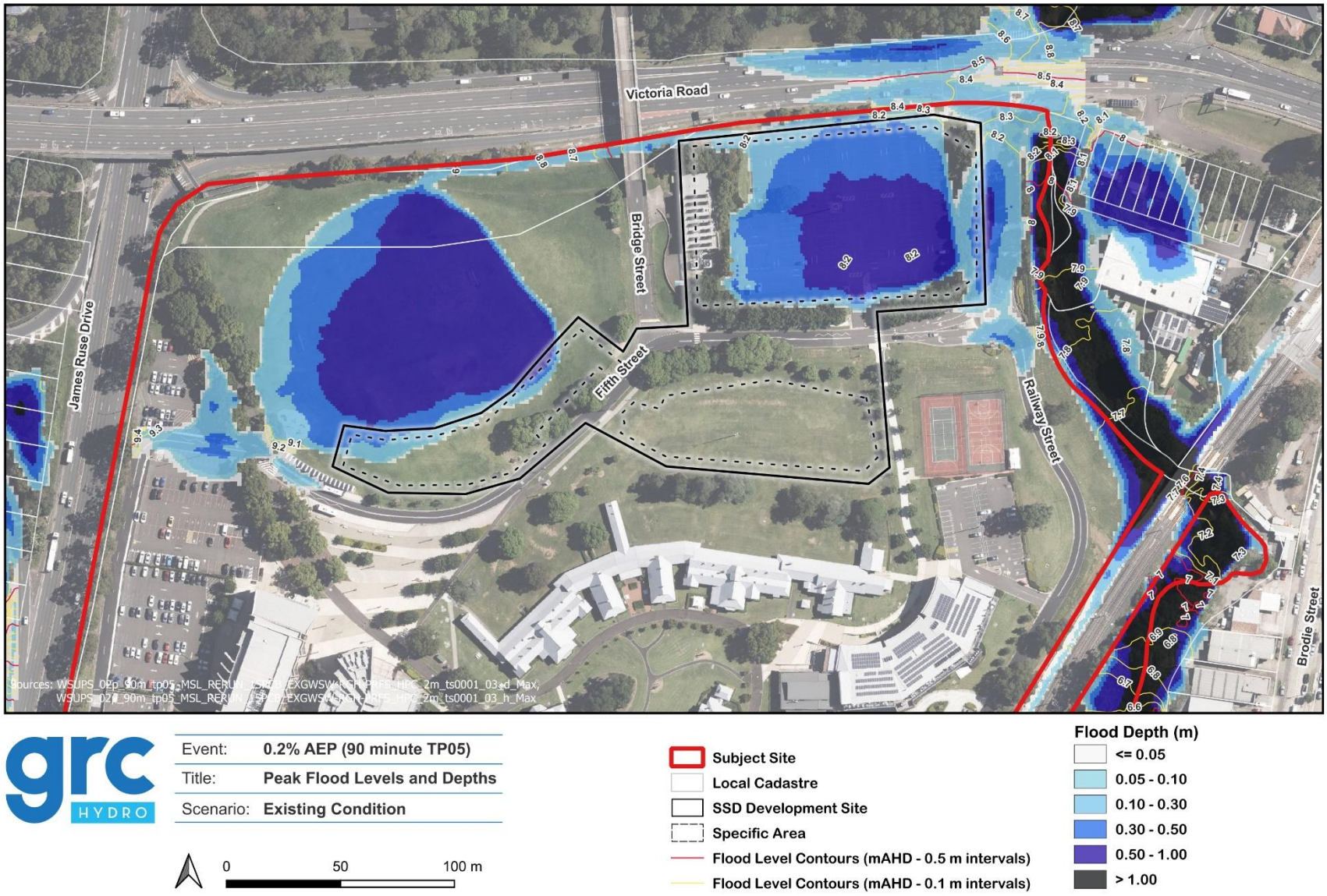


*Figure 48: Flood Velocity and Hazard – 0.2% AEP – Developed Condition*

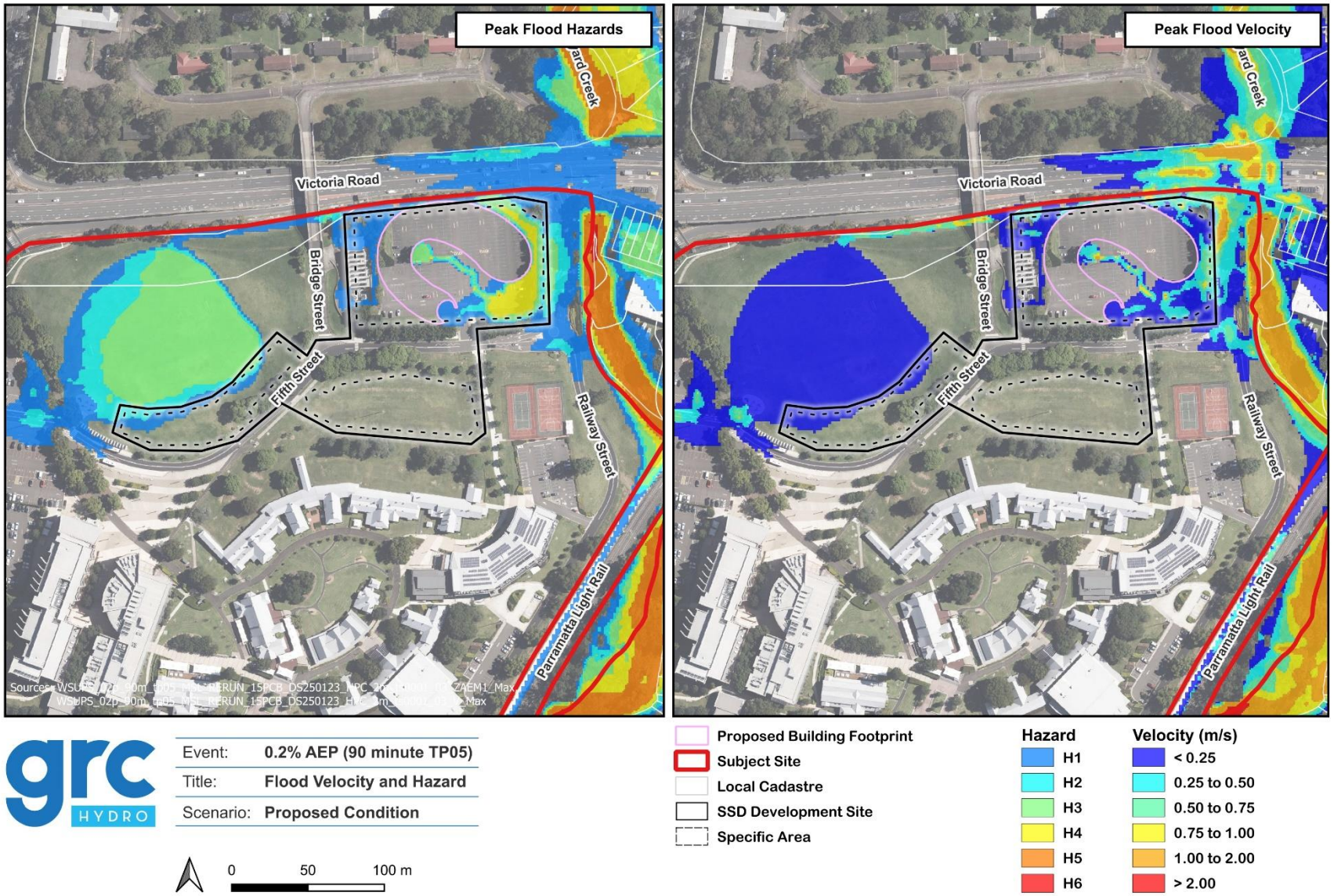


*Figure 49: Peak Flood Levels and Depths – PMF – Developed Condition*

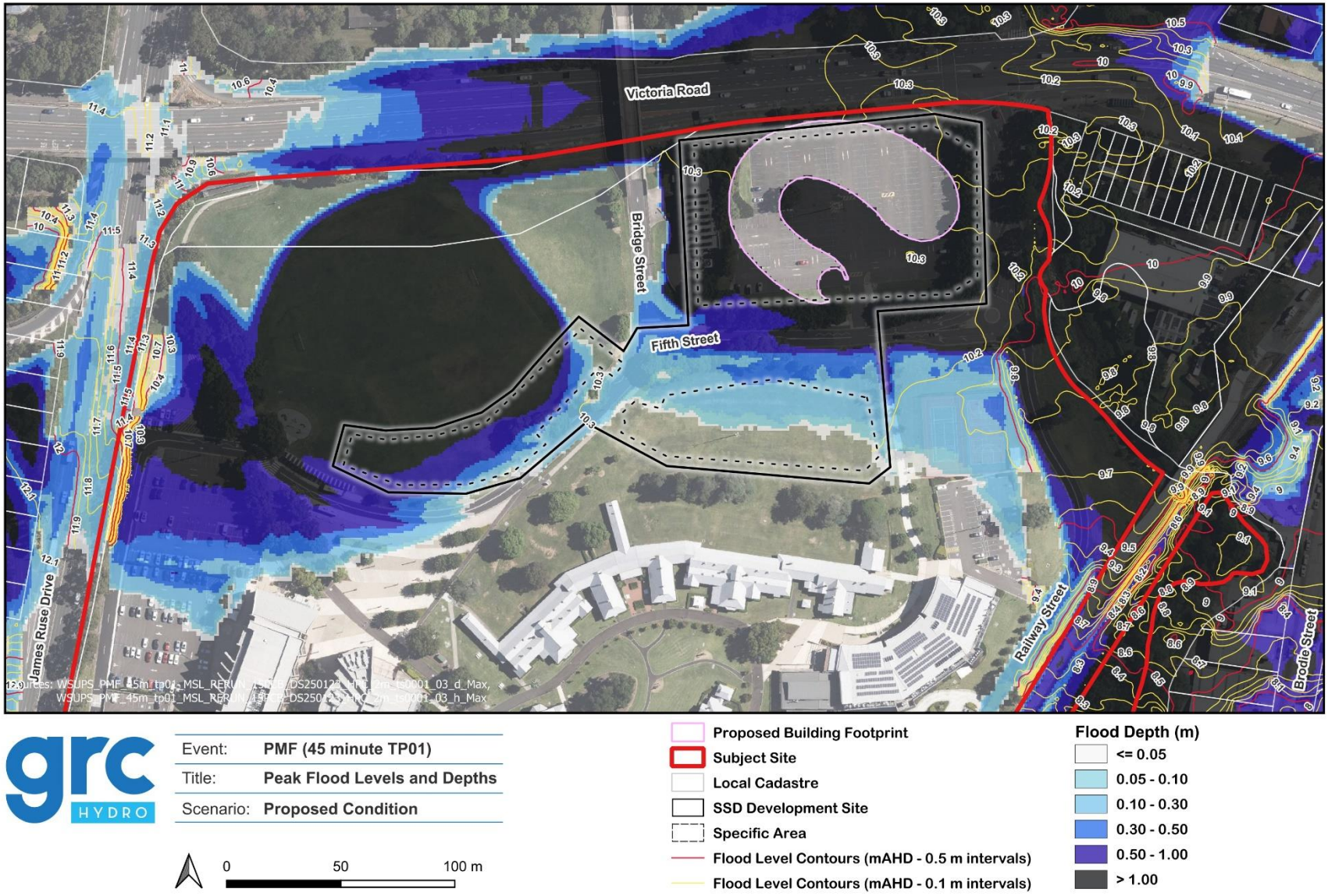
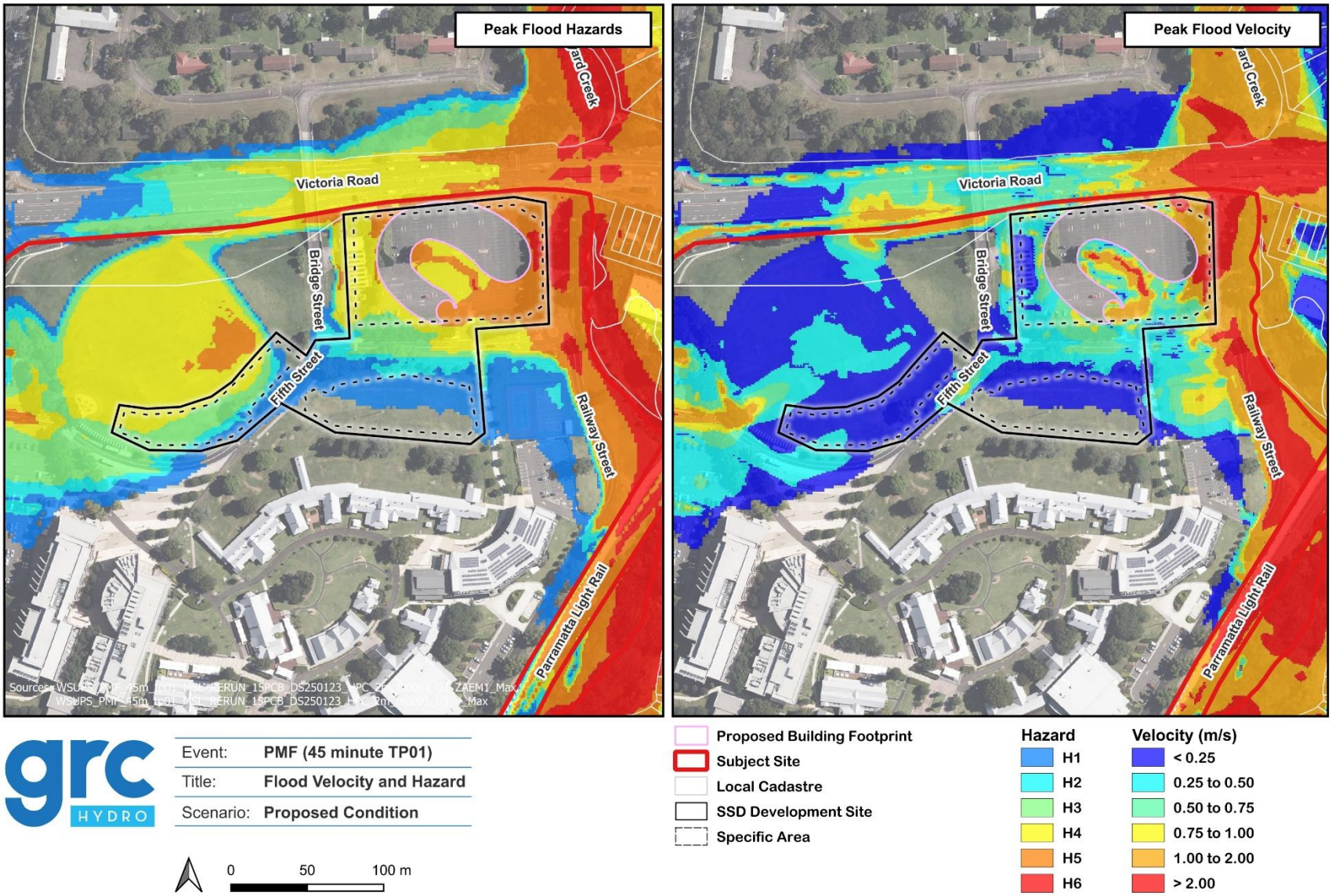


*Figure 50: Flood Velocity and Hazard – PMF – Developed Condition*



# 7 Flood Emergency Response Plan

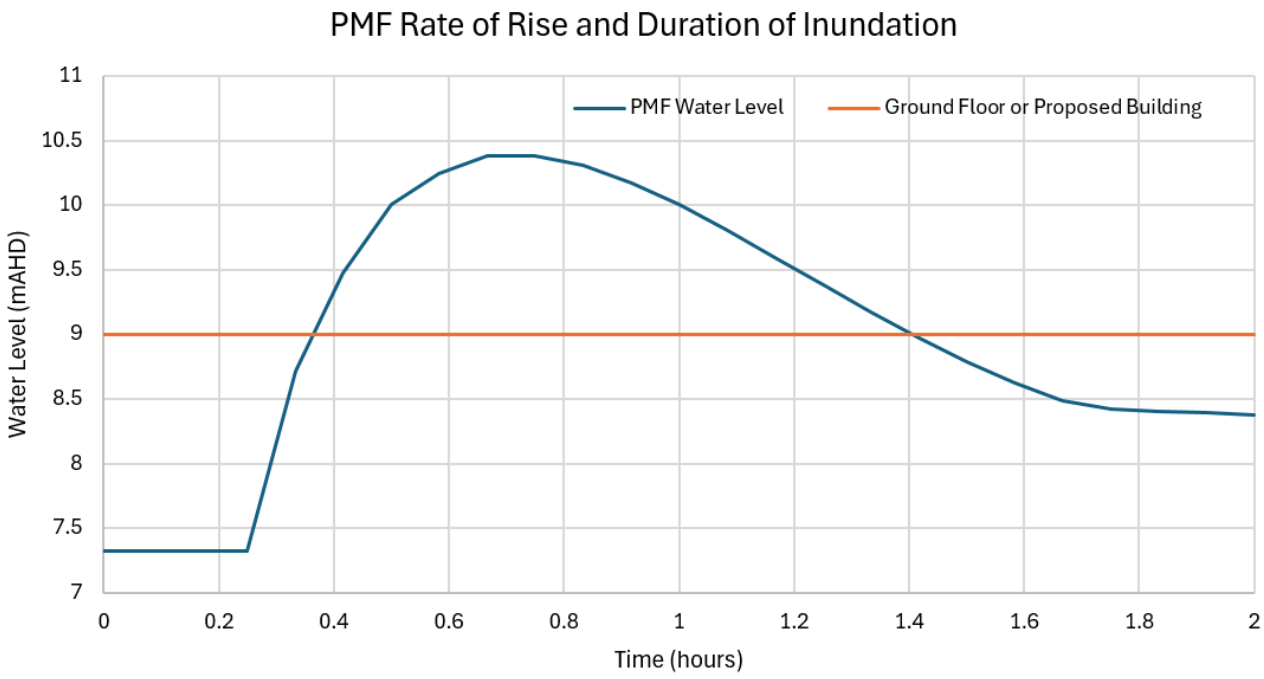
## 7.1 Flood Emergency Context

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

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

However, in the course of an event occurring, flood wardens won't easily estimate what magnitude of event is occurring (5% AEP, 1% AEP, 0.2% AEP etc.). In a PMF design flood event, the rate of rise of flood waters is relatively quick (only ~21 minutes for waters to rise above the finished floor level – see Chart 1) so little warning time is available to safely administer an evacuation process. Therefore, a *shelter-in-place strategy is strongly recommended* so that occupants are not exposed to the risk of being caught in floodwaters. This is a flood emergency response that is commonplace for developments in the City of Parramatta LGA.

*Chart 1: PMF Rate of Rise and Duration of Inundation*




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

## 7.2 Riverine Flooding

The proposed building will have a finished floor level of 9 mAHD. This remains well above the PRFS 2024 riverine flood level (~3.3 mAHD) in a 1% AEP flood event. GRC did not model riverine Parramatta River flooding as part of this study so GRC have deferred to the PRFS 2024 results.

The modelling conducted for this work did not evaluate a riverine PMF so in aid of determining the site's duration of inundation in a PMF event, along with the predicted rate of rise, a PMF hydrograph has been generated using the following as a basis:

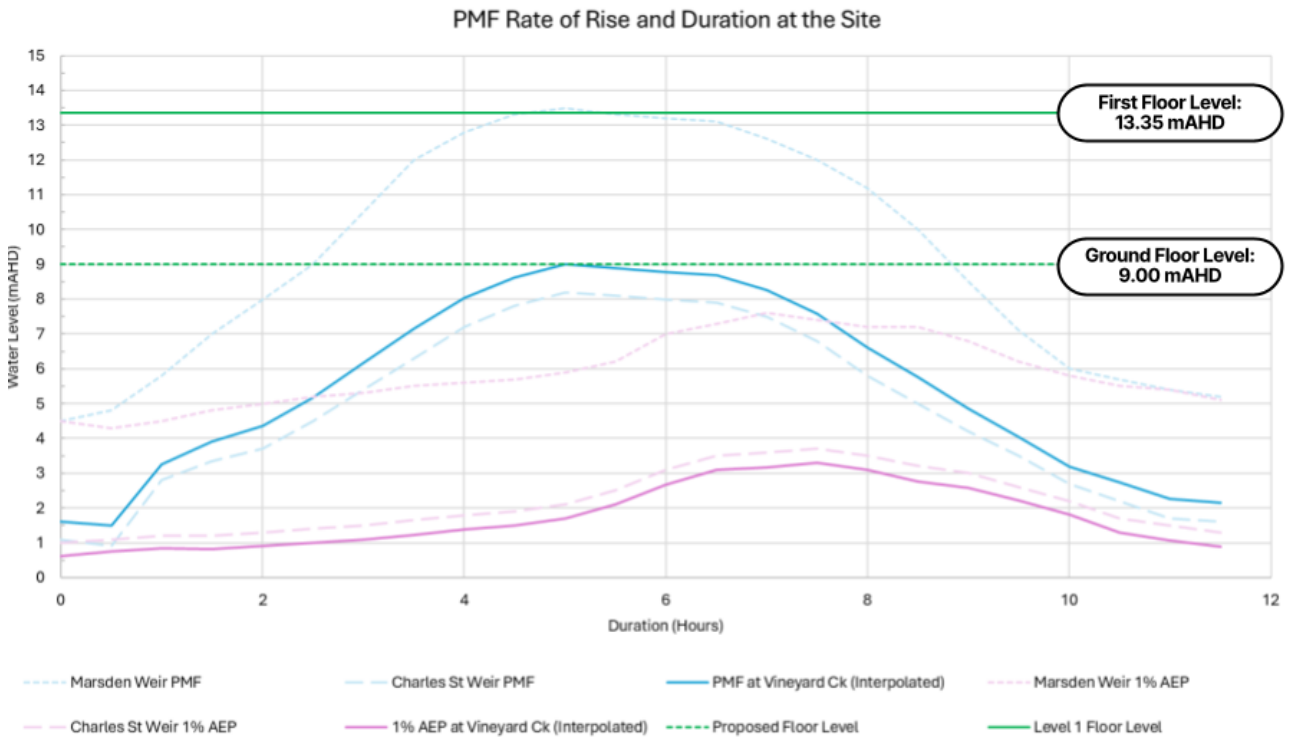
- Two PMF hydrographs provided for Parramatta River at Marsden Weir and Charles St Weir in the *Update of Parramatta Floodplain Risk Management Plans* (Molino Stewart, October 2021); and
- the PRFS 2024 modelled riverine PMF flood level at Vineyard Creek.

The hydrograph in Chart 2 below documents predicted PMF behaviour at the site, most notably that:

- During a riverine PMF event the site is likely to only match the proposed ground level momentarily (not taking into account the modelled PMF as shown above); and
- The rate of rise in a PMF event is in the order of 1.5 m per hour with it taking approximately 5 hours from when flooding starts before the ground floor would become inundated during a PMF event.

Additionally, the riverine PMF peak (5 hours from commencement) does not coincide with the modelled PMF peak at the site (less than 2 hours from commencement).

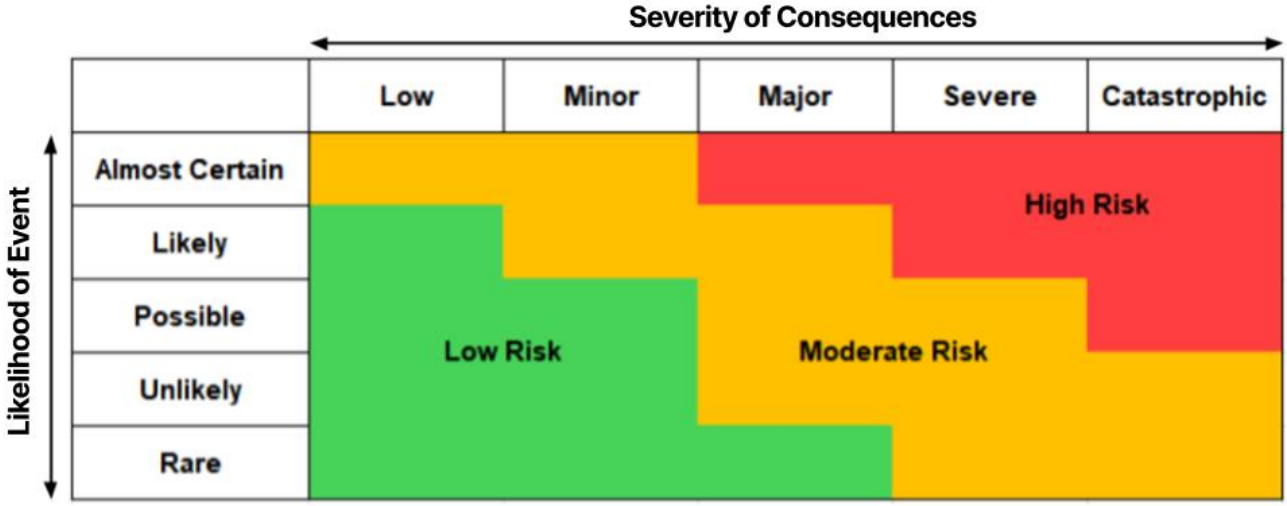
*Chart 2: Parramatta River PMF Rate of Rise and Duration of Inundation*




## 7.3 Flood Risk Assessment

GRC has assessed the risks posed by flooding on property, life and the environment. This assessment outlines the potential consequences posed by flooding events of varying likelihoods. The risk is a product of the likelihood and the severity of consequences and the relationship between risk, likelihood (probability) and consequences is outlined in the following diagram.

*Figure 51: Relationship between Likelihood, Severity of Consequences and Risk:*




The resulting risk matrix is documented below.

*Table 5: Risk Matrix – Risks to Property, Life and Environment*

| Factor | Likelihood (Probability) | | Consequences | | Risk |
|---|---|---|---|---|---|
| Property Damage | Likely | 20% AEP flood event | Low | In a 20% AEP event, the flood affectation is minor and is unlikely to have any impact on the physical building. A small amount of scour may occur in this event but the damages incurred are likely to be insignificant. | Low Risk |
| | Unlikely | 1% AEP flood event | Minor | The 1% AEP flood level remains lower than the finished floor level of the proposed development. The proposed development is to be constructed from flood safe materials in a manner to withstand 1% AEP flood forces. The landscaping may be affected by flooding and this could incur damages. | Low Risk |
| | Rare | PMF flood event | Major | No damage to the structure itself expected but internal equipment (computers, electrical equipment, carpets and glass panels) may need replacing. The landscaping is likely to be damaged as a result of very rare PMF flooding. | Low Risk |

| Factor | Likelihood (Probability) | | Consequences | | Risk |
|---|---|---|---|---|---|
| Risk to Life | Likely | 20% AEP flood event | Low | In a 20% AEP event, flooding at the site will be low, not reach the ground level and will remain concentrated in non-pedestrian areas. Unlikely that harm to life will occur at this site. Low flood hazards are predicted along Victoria Road during flooding of this magnitude however roads elsewhere may experience greater hazards so remaining at the site and waiting for flooding to subside is recommended to limit risk. | Low Risk |
| | Unlikely | 1% AEP flood event | Minor | In a 1% AEP event, flooding at the site will be major however it will not reach the ground level and will largely remain concentrated in non-pedestrian areas. It's unlikely that harm to life will occur at this site as occupants on site will be directed to seek refuge inside on the ground floor at a level well above the 1% AEP flood level. Moderate flood hazards are predicted along Victoria Road during flooding of this magnitude and roads elsewhere may experience greater hazards so remaining at the site and waiting for flooding to subside is recommended to limit risk. | Low Risk |
| | Rare | PMF flood event | Minor | In a PMF event, the consequences of flooding could be significant however occupants will be directed to shelter on levels one and higher, which all lie above the predicted PMF level. Warning to vertically evacuate to Level One will be triggered when floodwaters are well below the ground floor so as to provide ample time to seek safe refuge in a flood-safe structure. This mitigation (in addition to an early evacuation trigger) downgrades otherwise catastrophic consequences to minor consequences to human life by forcing occupants out of harm's way early. | Low Risk |

| Factor | Likelihood (Probability) | | Consequences | | Risk |
|---|---|---|---|---|---|
| Environmental Harm | Likely | 20% AEP flood event | Low | The site is proposed at an existing hardstand site that is topographically disconnected from Vineyard Creek's riparian corridor. Flooding at the site, especially in small events, is unlikely to result in environment damage and the potential for environmental damage is certainly not exacerbated by the introduction of the new development. Any hazardous goods stored at the site will be well above the 1% AEP level plus 0.5 m freeboard. | Low Risk |
| | Unlikely | 1% AEP flood event | Low | The site is proposed at an existing hardstand site that is topographically disconnected from Vineyard Creek's riparian corridor. Flooding at the site, especially in small events, is unlikely to result in environment damage and the potential for environmental damage is certainly not exacerbated by the introduction of the new development. Any hazardous goods stored at the site will be well above the 1% AEP level plus 0.5 m freeboard. | Low Risk |
| | Rare | PMF flood event | Minor | The site is proposed at an existing hardstand site that is topographically disconnected from Vineyard Creek's riparian corridor. Flooding at the site, especially in small events, is unlikely to result in environment damage and the potential for environmental damage is certainly not exacerbated by the introduction of the new development. Any hazardous goods stored at the site will be well above the 1% AEP level plus 0.5 m freeboard. Whilst these could be impacted in a PMF event, the volume of hazardous goods present on the site as the proposed development will not have any labs so the need for a large volume of chemicals is low. | Low Risk |

Whilst the site is flood liable, the proposed development has been designed to limit risk to life and as such the residual risk remains low or moderate for the reasons explained in the table above.

## 7.4 Emergency Management Approach

A summary of the proposed flood emergency management approach is as follows:

- Preparation – To be undertaken at regular intervals, making sure that staff are aware of flooding issues and emergency procedures as well as making sure that the requisite emergency supplies are stocked and that emergency backup systems are working properly. During these preparation sessions, staff will be reminded that the SES are the combat agency responsible for flood emergency response (as per the Parramatta Local Emergency Management Plan) and they can be contacted via the following:
    - For non-emergency or general enquiries, call 138 737.
    - For emergency assistance during a flood, storm or tsunami, call NSW SES on 132 500
- Warning Systems – At regular intervals (i.e. outside of flood emergency periods) staff should familiarise themselves with the available local flood warning systems such as FloodSmart. They should also become aware with on-site flood markers and the procedure by which alarms and warnings can be sounded at the site in the event of a flood emergency.
- Evacuation and Dissuasion – The site is subject to flash flooding. When this occurs the site and its primary vehicle access road (Victoria Road) can become inundated without warning in a 1% AEP event or rarer. Practically speaking, when a flood event is in process, it is difficult to accurately predict its magnitude and there isn't much time to safely evacuate once a storm event is in process. WSU can take advantage of the City of Parramatta's FloodSmart warning system and issue Evacuation/Dissuasion notices when a FloodSmart warning is triggered for the local catchment. These notices shall be distributed to all staff, students and stakeholders to:
    - *Evacuate* if their presence at the University is non-essential (i.e. if lectures, tutorials and functions can be conducted remotely); and
    - *Stay away* from the campus if their presence at the University is non-essential (i.e. if lectures, tutorials and functions can be conducted remotely).
- Emergency Access for Secondary Medical Events – Evacuation in a medical emergency is possible for this site even in a PMF event as a flood free access route is available via Bridge St. Given the flood liability of the broader Parramatta River area, evacuation should be reserved for emergency services drivers with the experience to manage the situation appropriately.
- Shelter-in-Place – If staff, students and stakeholders haven't evacuated in time and floodwaters are overtopping (or nearing to overtop) Victoria Road, flood wardens will direct remaining occupants to vertically evacuate to level one. The proposed development has been designed to be flood-resilient and to safely accommodate occupants well above the design flood level in all events. Emergency supplies and services (power and water) will be assured by design and through operation and maintenance. The proposed development is a good candidate for sheltering in place as the new building has been designed to withstand flood forces, ample space is provided and level 1 lies more than 2.9 m higher than the modelled PMF level.
- Continuous Improvement – Following a flood emergency, however small, responsible staff will review the event and the effectiveness of the actions taken to assure safety. A record of the event should be made which includes the flood depth, time of peak and local rainfall record. Improvements should be made, where appropriate, to improve the effectiveness of the emergency procedures.

### 7.4.1 Preparation

#### 7.4.1.1 Responsibility of WSU Management

WSU Management shall appoint a senior member of ICoE staff to be responsible for flooding issues. This member of staff will advocate for emergency flood measures and WSU Management's responsibility in this relationship is to liaise with this ICoE flooding advocate and provide adequate funds and support to maintain flood emergency systems, measures and provisions.

#### 7.4.1.2 Responsibility for Coordination

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

- Briefing and deputising other senior members of staff to act as flood wardens to help communicate flood emergency procedures and issues to other staff and occupants. These flood wardens may be relied upon to help coordinate flood emergency response measures if the senior flood warden is not on site at the time of flooding.
- Liaising with local SES staff to ensure that the building's flood emergency response plan aligns with their preferences for local flood emergency management. Staff will be reminded that the SES are the combat agency responsible for flood emergency response (as per the Parramatta Local Emergency Management Plan) and WSU staff should act in conjunction with SES evacuation orders in the event of an emergency. The SES can be contacted via the following:
    - For non-emergency or general enquiries, call 138 737.
    - For emergency assistance during a flood, storm or tsunami, call NSW SES on 132 500
- Undertaking quarterly checks of emergency systems such as:
    - the backup power and water provision,
    - the flood warning system (an alarm and public announcement system);
    - emergency provision of suitable food,
    - personal washing facilities,
    - medical equipment including a first aid kit, and
    - a battery-powered radio and relevant communications equipment.
- Undertake annual Evacuation Management Drills (as outlined below)
- Check signage and make sure that it is correctly posted throughout the ICoE.
- Register with the City of Parramatta's FloodSmart Service by going to the website below: https://www1.ewn.com.au/parramatta/register.aspx. This is something that all flood wardens should do.
- Oversee development of an Email and Text Alert System that will be deployed to communicate FloodSmart warnings to inform staff and students that:
    - They should evacuate if their presence at the University is non-essential (i.e. if lectures, tutorials and functions can be conducted remotely); and
    - They should stay away from the campus if their presence at the University is non-essential (i.e. if lectures, tutorials and functions can be conducted remotely).
- Liaise with Plumbers and Electricians to undertake post-flooding checks of building systems.
- Maintain and improve the Flood Emergency Response Plan as required.

#### 7.4.1.3 Signage

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

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

Specific signage will be provided in more detail at the detailed design phase.

#### 7.4.1.4 Emergency Supplies and Provisions

The development's operation and management procedures shall ensure the following emergency supplies and back-up systems are stocked (on level one or higher, above the PMF level) and/or functioning correctly.

- Emergency electricity supply, and lighting,
- Clean water for drinking, washing and toilet flushing,
- Working bathroom and toilets,
- A stock of suitable food which may include:
    - Canned vegetables (e.g., green beans, carrots)
    - Canned fruits (e.g., peaches, mandarin oranges)
    - Canned proteins (e.g., tuna, salmon, chicken, beans)
    - Canned soups or stews
    - Shelf-stable milk (powdered or cartons)
    - Instant oats
    - Whole-grain crackers
    - Pre-cooked rice packets or instant rice
    - Pasta or couscous (quick-cooking varieties)
    - Nut butter (e.g., peanut butter, sunflower seed butter; single-serving packets if nut-free)
    - Granola bars or protein bars
    - Dried fruits (e.g., raisins, apricots)
    - Trail mix (nut-free if needed)
    - Dark chocolate (for energy and comfort)
    - Bottled water (at least 2 litres per person per day)
    - Electrolyte drinks or powder mixes
    - Instant noodles or cups of soup
    - Comfort snacks (e.g., cookies, biscuits)
    - Manual can opener
- Personal washing facilities,
- Medical equipment including a first aid kit,
- A battery-powered radio and relevant communications equipment, and
- A comfortable, safe, indoor, sheltered environment.

### 7.4.2 Warning Systems

#### 7.4.2.1 FloodSmart

The City of Parramatta's FloodSmart warning system will function as an early warning trigger for the site.

FloodSmart warnings can however take place multiple times per year and repeated warnings that result in a non-event may cause ambivalence to this early-warning approach. That is why a residual shelter-in-place strategy is so important as a contingency measure.

#### 7.4.2.2 Email and Text System

WSU will take advantage of the City of Parramatta's FloodSmart warning system. If a FloodSmart warning is issued and automated email and text will go out to all relevant ICoE staff, students and stakeholders to encourage them to either evacuate or stay away from the campus if their presence is non-essential and any planned activities (lectures, meeting etc) can be instead organised to be conducted remotely.

- Evacuate if their presence at the University is non-essential (i.e. if lectures, tutorials and functions can be conducted remotely); and
- Stay away from the campus if their presence at the University is non-essential (i.e. if lectures, tutorials and functions can be conducted remotely).

#### 7.4.2.3 Alarm and Public Announcement Systems

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

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

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

- Evacuation to Level 1 or above is required.
- It is to be done immediately.
- It is to be on-foot or with assistance from other occupants or staff if needed.
- Occupants are not to leave the site on foot. They are not to use vehicles and attempt to leave the site as floodwaters may pose a threat to life.
- Evacuees will be informed when it is safe to return to the ground floor and/or leave the building.

### 7.4.3 Evacuation and Dissuasion

The site is subject to flash flooding where the site and its primary vehicle access road (Victoria Road) can become inundated without warning in a 1% AEP event or rarer. Practically speaking, when a flood event is in process, it is difficult to accurately predict its magnitude and there isn't much time to safely evacuate once a storm event is in process. WSU can take advantage of the City of Parramatta's FloodSmart warning system and issue Evacuation/Dissuasion notices when a FloodSmart warning is triggered for the local catchment. These notices shall be distributed to all staff, students and stakeholders to:

- Evacuate if their presence at the University is non-essential (i.e. if lectures, tutorials and functions can be conducted remotely); and

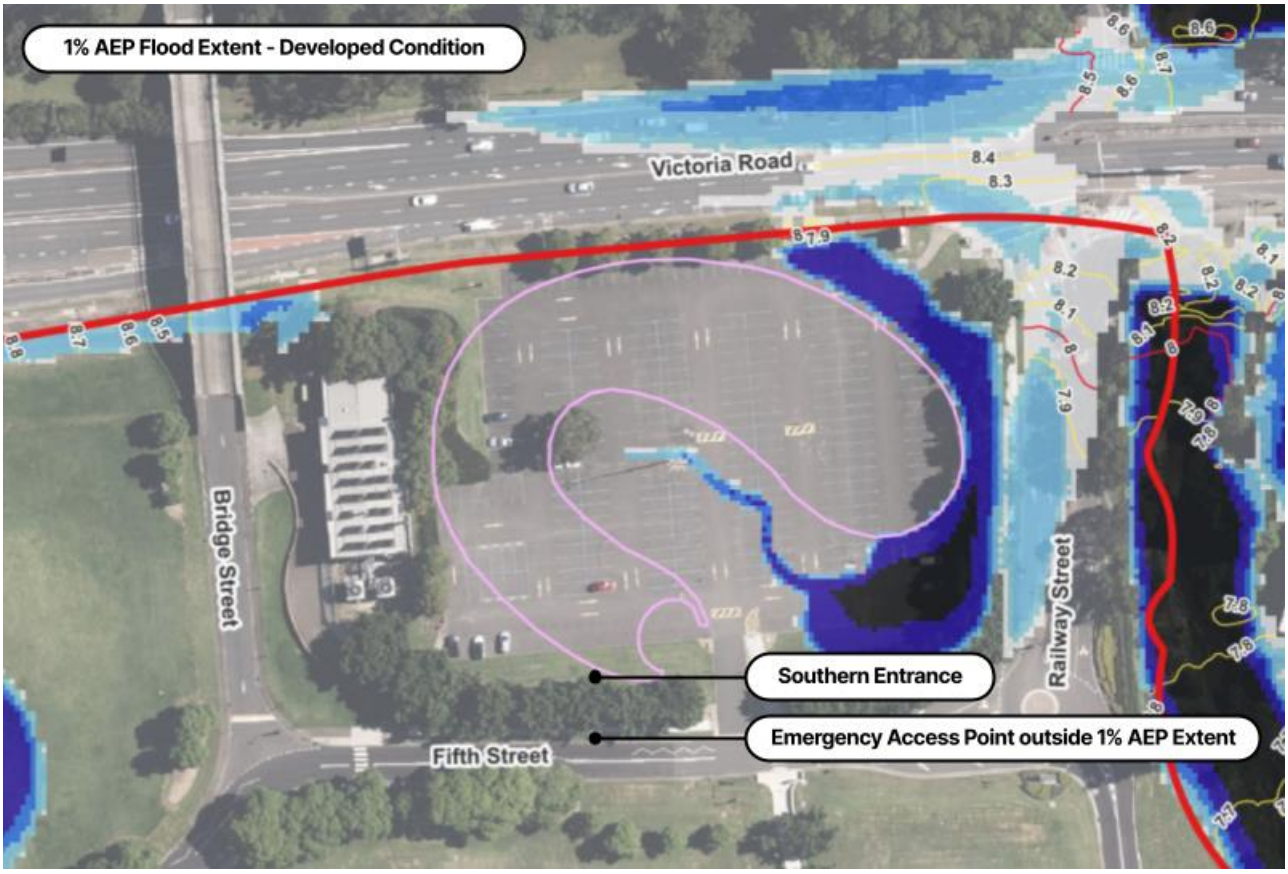
- Stay away from the campus if their presence at the University is non-essential (i.e. if lectures, tutorials and functions can be conducted remotely).

### 7.4.4 Emergency Access for Secondary Medical Events

Evacuation in a medical emergency is possible for this site even in a PMF event as a flood free access route is available via Bridge St. Given the flood liability of the broader Parramatta River area, evacuation should be reserved for emergency services drivers with the experience to manage the situation appropriately.

An emergency access point above the 1% AEP flood level is located immediately south of the proposed building's southern entrance. This location is identified in Figure 52 below.

*Figure 52: Emergency Access Point (above the 1% AEP Flood Level)*




Even in a PMF event, emergency access to and from the site can be achieved via the Bridge St overpass.

*Figure 53: Emergency Access Route (PRFS PMF flood mapping has been used here to include potential flooding outside the GRC study area)*

## 7.4.5 Shelter-in-Place

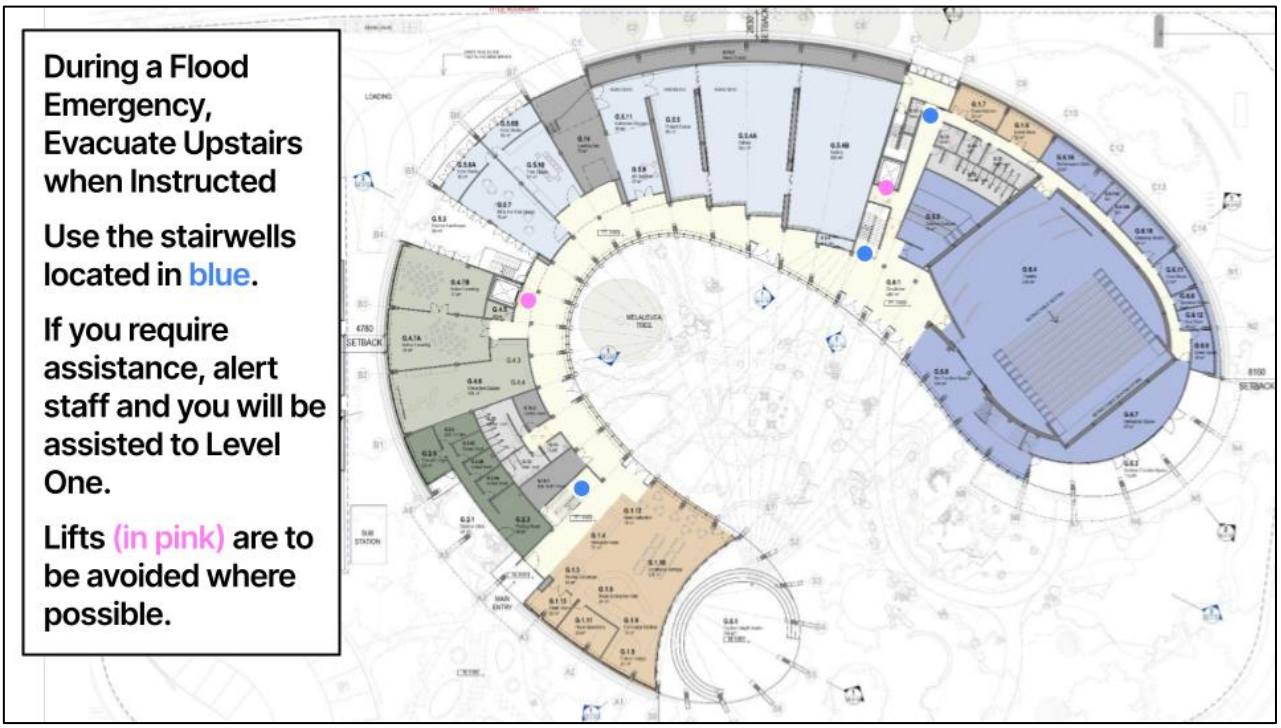
### 7.4.5.1 Shelter-in-Place Refuge Area

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

### 7.4.5.2 Vertical Evacuation Route to Shelter-in-Place Refuge Area

Building management shall create a map identifying vertical evacuation routes to be used in the event of a flood emergency. A suggested example of such a map is below. This map shall feature clear guidance to users on how they should evacuate when instructed. Stairwells are to be the primary route for vertical evacuation. Lifts are to be avoided during vertical evacuation. Occupants with mobility issues should be assisted up the stairs in the event of an emergency. For context, the likelihood of the ground floor being overtopped by hazardous flood waters is significantly rarer than 1 in 500 years.

*Figure 54: Example Flood Evacuation Route Map*




### 7.4.6 Continuous Improvement

Following a flood emergency, however small, responsible staff will review the event and the effectiveness of the actions taken to assure safety. A record of the event should be made which includes the flood depth, time of peak and local rainfall record. Improvements should be made, where appropriate, to improve the effectiveness of the emergency procedures.

## 7.5 Emergency Procedure

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

1. Keep Abreast of Weather Forecasts: The most senior flood warden on site each day should keep abreast of local weather forecasts so that wardens are ready to take further actions should heavy rainfall occur that day.
2. Consult Local Warnings: If heavy rainfall is predicted for Sydney, flood wardens should refer to the Bureau of Meteorology's (BOM) Warnings for NSW at the following website: http://www.bom.gov.au/products/warn_nsw.shtml. Staff should specifically look for warnings related to Parramatta River.
3. Stay alert to FloodSmart Warnings: Flood wardens will be signed up to the City of Parramatta's FloodSmart service. This service will send flood alerts and advice for predicted flood behaviour that may affect the user's catchment. This is based on the address used when signing up (171 Victoria Road, Parramatta, NSW 2116). FloodSmart will send users text messages and/or emails with links to guidance on predicted flood behaviour and how local occupants should respond.
4. Issue an Automated Email/Text Alert when triggered by a FloodSmart Warning that encourages staff, students and guests to leave the site, or not go to the site, if their presence is optional or could be replaced with a remote option. This will greatly lessen the number of people on site in the event of flash flooding.

- Stay alert to SES Orders: The SES are the combat agency responsible for flood emergency response (as per the Parramatta Local Emergency Management Plan) and WSU staff should act in conjunction with SES evacuation orders in the event of an emergency. If the local situation at the site appears unsafe for evacuation (if staff can see fast and deep water flowing over Victoria Road, staff should exercise judgement and rely upon shelter-in-place. The SES can be contacted via the following:
    - For non-emergency or general enquiries, call 138 737.
    - For emergency assistance during a flood, storm or tsunami, call NSW SES on 132 500

5. Issue an Email/Text Alert and Alarm when triggered by a SES Evacuation Order. If the SES issue an order and on-site staff can see that Vineyard Creek is not flooding Victoria Road (or is not close to flooding Victoria Road), an email/text and on-site alarm (with directions) should be immediately issued that encourages staff, students and guests to leave the site immediately. This will greatly lessen the number of people on site in the event of flash flooding.

   Observe Flooding: For those remaining at the site unable to evacuate prior to Victoria Road becoming inundated, the proposed development has a clear view of the outside area so a visual assessment can be undertaken by wardens to determine appropriate actions.

6. Initiate Shelter-in-Place Alert Procedure
    - If flooding has risen to approximately 1 m below the ground floor level a voiceover alert should sound to inform occupants that: "*This building's ground floor may soon become flooded. People on the ground floor, please make your way to the first floor. Please assist others who may need help to proceed to the first floor. People on floors one and above can remain in place*."

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

Stairways are the encouraged vertical evacuation route.

- **Observe flooding outside to guide continued measures.** If the flood waters continue to rise, occupants are to remain sheltering in place until further notice. When flood waters start to subside, flood wardens should continue to observe and wait to see 20 minutes of consistent falling of the flood level before allowing occupants to move back to the ground level.
- **If flood waters continue to recede** flood wardens can inform occupants that it is safe to exit the site via the southern, ground floor entrance.

7. **Survey Post-Flood Damage**: Following a flood emergency event, flood wardens should survey the ground floor and landscaping to identify any damage or issues that may have resulted due to flooding.
8. **Initiate a Building Check** by asking the building's plumbing and electrical contractor to do a check of the building to ensure that the building's systems are not damaged and are in working order.
9. **Flood Warden Debrief**: the senior flood warden should convene a meeting of all wardens present to share observations about the flood emergency event and highlight improvements that can be made to the procedure(s).

## 7.6 Flood Emergency Drills

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

- *Step 1*: Issue a test email, text and alarm to ensure that the email/text warning system is working and will work when triggered by a FloodSmart alert or if manually triggered in the event of a SES evacuation order.
- *Step 2*: Emulate the checking of floodwaters at Victoria Road and surrounding the building. Pretend that waters are close to breaking the banks along Vineyard Creek. Trigger the alarm. An alarm and warning will sound to direct all occupants to make their way to Level 1 or above immediately. All occupants on Level 1 and above can remain in place and await further instructions.
- *Step 3*: Flood wardens shall check the ground floor to make sure it has been fully vacated. This may be done via CCTV if the system is able to cover all areas of the ground floor.
- *Step 4*: Sound a message over the PA system that all staff and occupants that the drill has concluded may safely return to the building.

## 7.7 Engagement with the State Emergency Service

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

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

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

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

Reply | Reply All | Forward

Tue 18/06/2024 12:33 PM

Good afternoon Mat

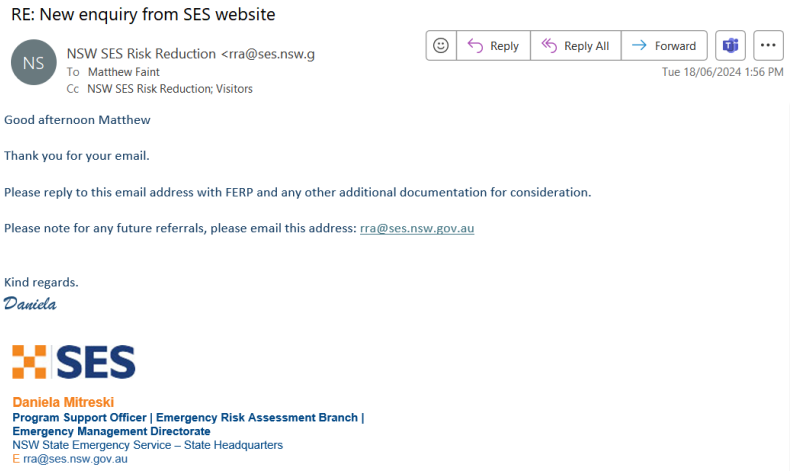
Thank you for your enquiry to the NSW SES.

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

Kind Regards

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

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



RE: New enquiry from SES website

NS NSW SES Risk Reduction <rra@ses.nsw.g

To Matthew Faint

Cc NSW SES Risk Reduction; Visitors

Reply | Reply All | Forward

Tue 18/06/2024 1:56 PM

Good afternoon Matthew

Thank you for your email.

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

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

Kind regards.

*Daniela*

SES

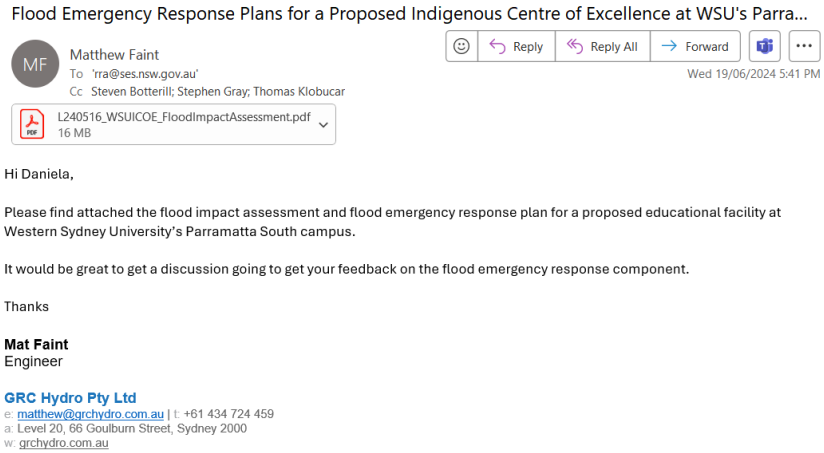
**Daniela Mitreski**

**Program Support Officer | Emergency Risk Assessment Branch | Emergency Management Directorate**

NSW State Emergency Service – State Headquarters

E rra@ses.nsw.gov.au

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



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

MF Matthew Faint

To 'rra@ses.nsw.gov.au'

Cc Steven Botterill; Stephen Gray; Thomas Klobucar

Reply | Reply All | Forward

Wed 19/06/2024 5:41 PM

L240516_WSUICOE_FloodImpactAssessment.pdf 16 MB

Hi Daniela,

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

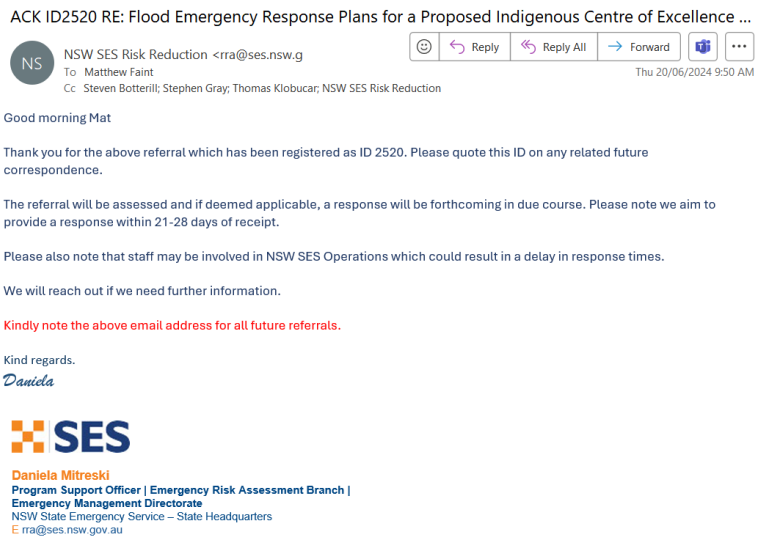
It would be great to get a discussion going to get your feedback on the flood emergency response component.

Thanks

**Mat Faint**
Engineer

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

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



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

NS NSW SES Risk Reduction <rra@ses.nsw.g

To Matthew Faint

Cc Steven Botterill; Stephen Gray; Thomas Klobucar; NSW SES Risk Reduction

Reply | Reply All | Forward

Thu 20/06/2024 9:50 AM

Good morning Mat

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

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

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

We will reach out if we need further information.

Kindly note the above email address for all future referrals.

Kind regards.

*Daniela*

SES

**Daniela Mitreski**

**Program Support Officer | Emergency Risk Assessment Branch | Emergency Management Directorate**

NSW State Emergency Service – State Headquarters

E rra@ses.nsw.gov.au

## 7.8 Emergency Response – Car Park

The emergency response for the car park is the same as the procedures for the ICoE building.

Signage should be placed in the car park that makes visitors aware that the site is flood liable and direct them to seek refuge in the campus buildings to the south of the car park should rising floodwaters be present.

If early evacuation is triggered at the site, occupants will be able to drive their cars off the site.

If occupants witness floodwaters surrounding the ICoE building, they should not attempt to drive off site. Instead, they should walk uphill to the south and seek temporary cover in one of the campus buildings south of the carpark – all of which are elevated higher than the PMF level.

*Image 3: Carpark overlap with 0.2% AEP Flood Hazard*

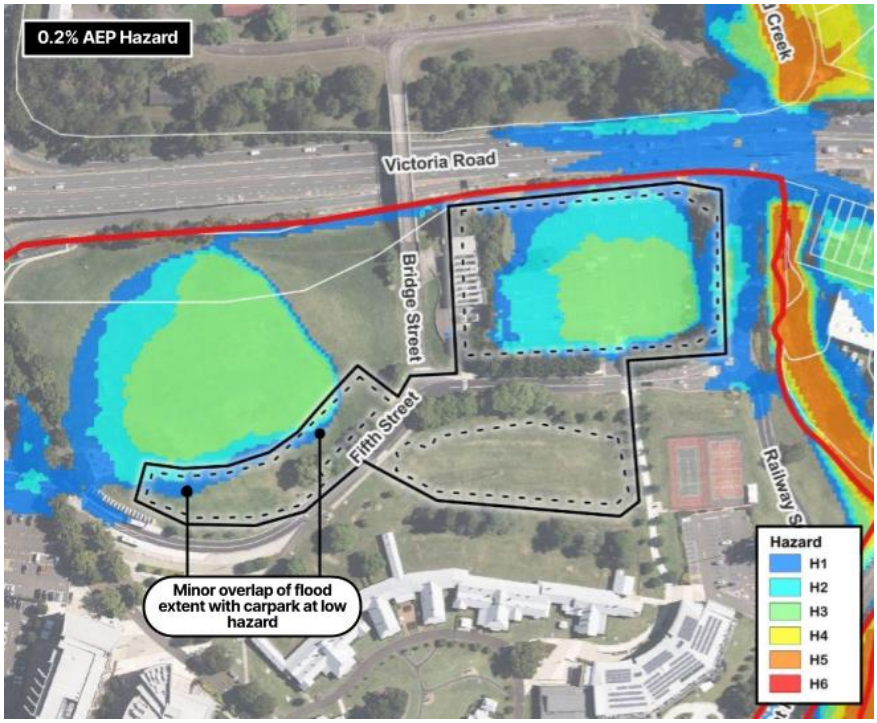
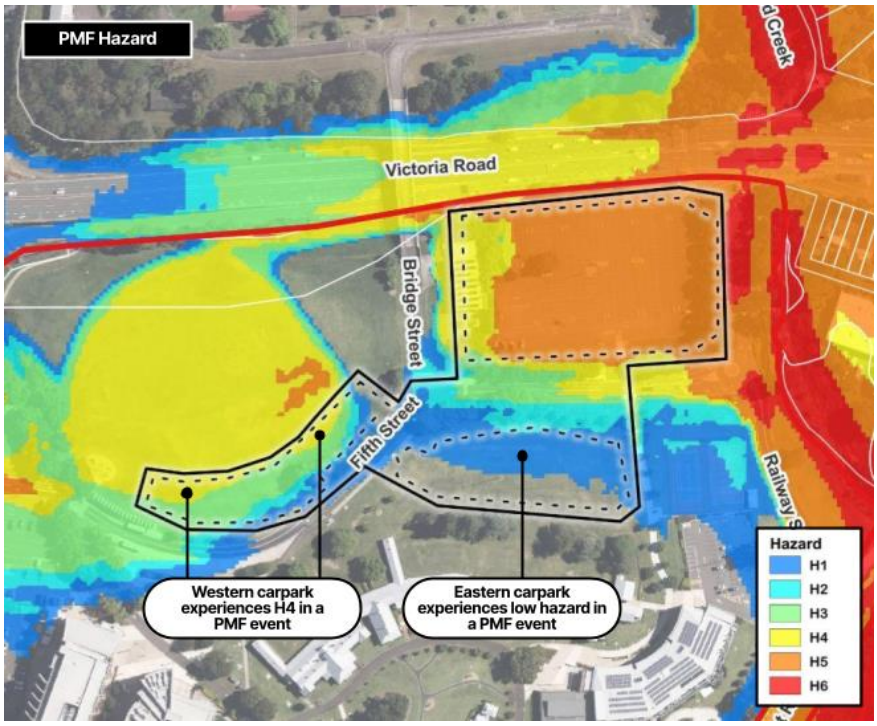


*Image 4: Carpark overlap with PMF Flood Hazard*



# 8 Compliance with Flood-Related Planning Controls

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

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

The hazard map (Figure C2) that Council provided for the site excludes Vineyard Creek (see Appendix A). As such, GRC has derived a flood hazard for the site by modelling the hydraulic hazard at the site as per the method outlined in Appendix L of the Floodplain Development Manual. In the 1% AEP event, the site is primarily subject to low hydraulic hazard with a small pocket of high hazard in the south-eastern corner, as documented in Figure 55 below. As such, GRC has conservatively classified the subject site as medium flood hazard.

*Figure 55: Hydraulic Hazard (calculated in accordance with Floodplain Development Manual, Appendix L)*

## 8.1 Planning Control Compliance Requirements

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

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

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

### 8.1.1 Parramatta Development Control Plan (2023)

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

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

*Table 6: Land Use Category Definitions (Table 5.1.1.1 from the PDCP, 2023)*

Table 5.1.1.1 – Land Use Category Definitions

| Land Use Categories | Identifies Land Uses |
|---|---|
| Sensitive uses and facilities | • Community facilities or Public administration buildings which may provide an important contribution to the notification and evacuation of the community during flood events;<br>• Early education and care facilities;<br>• Hospitals;<br>• Residential care facilities;<br>• Seniors housing;<br>• Educational establishments,<br>• Emergency services facilities. |
| Critical uses and facilities | • Hazardous industries;<br>• Heavy industrial storage establishments;<br>• Offensive industries;<br>• Public utility undertakings which may cause pollution of waterways during flooding, are essential to evacuation during periods of flood or if affected during flood events would unreasonably affect the ability of the community to return to normal activities after flood events;<br>• Telecommunication facilities;<br>• Waste management facilities. |
| Residential | • Attached dwellings;<br>• Backpackers accommodation;<br>• Bed and breakfast establishments;<br>• Boarding houses;<br>• Camping grounds;<br>• Caravan parks;<br>• Community facilities (other than sensitive uses/facilities);<br>• Dual occupancies;<br>• Dwelling houses;<br>• Group homes;<br>• Health consulting rooms;<br>• Home based child care;<br>• Home businesses;<br>• Home industries;<br>• Home occupations;<br>• Hostels;<br>• Multi dwelling housing;<br>• Neighbourhood shops;<br>• Residential flat buildings;<br>• Secondary dwellings;<br>• Semi-detached dwellings;<br>• Serviced apartments;<br>• Public utility undertakings (other than critical uses and facilities). |
| Commercial or Industrial | • Advertising structures;<br>• Agriculture;<br>• Amusement centres;<br>• Business Premises;<br>• Car parks;<br>• Correctional centres;<br>• Crematorium;<br>• Depots;<br>• Entertainment facilities;<br>• Food and drink premises;<br>• Freight transport facilities;<br>• Funeral homes;<br>• Function centres;<br>• Hardware and building supplies;<br>• Health consulting rooms;<br>• Heavy industries;<br>• Hotel accommodation;<br>• Industries;<br>• Information and education facilities;<br>• Industrial retail outlets;<br>• Kiosks;<br>• Landscape and garden supplies;<br>• Light industries;<br>• Markets;<br>• Materials recycling or recovery centres;<br>• Medical centres;<br>• Mixed-use development;<br>• Mortuaries;<br>• Office premises;<br>• Passenger transport facilities;<br>• Places of public worship;<br>• Public administration buildings (other than essential uses and facilities);<br>• Pubs;<br>• Recreation facilities (indoor);<br>• Recreation facilities (major);<br>• Registered clubs;<br>• Restricted premises;<br>• Retail Premises;<br>• Service stations;<br>• Sex services premises;<br>• Shop top housing; Signage;<br>Specialised retail premises;<br>• Storage premises;<br>• Transport depot;<br>• Truck depot;<br>• Tourist and visitor accommodation;<br>• Vehicle body repair workshops;<br>• Vehicle repair stations;<br>• Vehicle showrooms;<br>• Veterinary hospitals;<br>• Warehouse or distribution centres;<br>• Waste or resource management facilities;<br>• Wholesale supplies. |
| Open space or Non-urban uses | • Animal boarding and training establishments;<br>• Boat launching ramps;<br>• Boat repair facilities;<br>• Boat sheds; Cemetery;<br>• Charter and tourism boating facilities;<br>• Environmental facilities;<br>• Environmental protection works;<br>• Helipad;<br>• Jetty;<br>• Marinas;<br>• Mooring;<br>• Port facilities;<br>• Water recreation structures;<br>• Recreation areas and minor ancillary structures (e.g. Toilet blocks or kiosks);<br>• Recreation facilities (outdoor) |
| Subdivisions | Subdivision of land which involves the creation of additional allotments. |
| Filling of flood prone land | The net importation of fill material onto a flood prone site is not permitted, except where:<br>i) final surface levels are raised by no more than 100mm over no more than 50% of the site; or<br>ii) filling is to be no more than 800mm thick beneath a concrete building slab, provided this does not significantly affect the floodway conveyance or flood storage. |
| Concessional Development | Concessional development is any development or redevelopment that would normally not be permitted under this Plan, but may be permitted as a concession provided it:<br>i) is kept clear of any floodway; and<br>ii) involves an acceptably small (see below for limits) addition or alteration to an existing development that will not cause a significant increase in potential flood losses, risks or have an adverse impact on adjoining properties; or<br>iii) redevelopment for the purposes of substantially reducing the extent of flood affectation to the existing building; provided that such redevelopments incorporate to the fullest extent practical, design features and measures to substantially reduce the existing potential for flood losses and personal risks, and avoid any adverse impacts |

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

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

The Floodplain Matrix in Section 5.1.1 – C.24 of the PDCP (2023) (included as Table 7 below) stipulates which development controls are relevant to a development with this land use and flood risk.

*Table 7: Flood-related controls and requirements (Table 5.1.1.2 from the PDCP, 2023)*

Table 5.1.1.2 – Floodplain Matrix Planning and Development Controls

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

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

**Legend** | | Not relevant | X | Unsuitable Land Use

i. Freeboard equals an additional height of 500mm.

ii. The flood level is usually the higher of that level adopted by Council for fluvial flooding (from rising rivers, creeks, tributaries) for a 1% Annual Exceedance Probability event (1% AEP), or the modelled overland flow flood level (from rainfall in the local catchment) for an event with the same probability (1% AEP). The Flood Planning Level is usually the 1% AEP Flood Level plus a 500mm freeboard safety factor.

iii. The *Parramatta LEP 2023* identifies development permissible with consent in various zones. Notwithstanding, constraints specific to individual sites may preclude Council granting consent for certain forms of development on all or part of a site. The above matrix identifies where flood risks are likely to determine where certain development types will be considered "unsuitable" due to flood related risks.

iv. Filling of the site, where acceptable to Council, may change the FRP considered to determine the controls applied in the circumstances of individual applications.

v. Any fencing that forms part of a proposed development is subject to the relevant Flood Effects and Structural Soundness planning considerations of the applicable land use category.

vi. Development within the floodplain may be subject to Clause 6.7 Foreshore Building Line in the *Parramatta LEP 2023*.

vii. Additional controls apply to basement carparking within the floodplain, please see Car Park Basements associated controls above.

viii. Where a flood warning and emergency response plan is required, requirements set out below under *'Flood Warning and Emergency Response Planning'* must be achieved.

For a development with:

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

The following flood-related controls (documented in Table 8) apply according to guidance outlined in the matrix tables 5.1.1.2 and 5.1.1.3 in Section 5.1.1 of the PDCP 2023.

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

*Table 8: Flood-Related DCP Controls Relevant to the Proposed Development*

| Reference | Control | GRC Comment |
|---|---|---|
| **PDCP 2023 Control (From Table 5.1.1.3)** | | |
| **Floor Level** | | |
| 2 | All habitable floor levels to be equal to or greater than the 1% AEP (100 year ARI) flood level plus 0.5 metre freeboard. | All habitable finished floor levels are above 8.8 mAHD (8.3 mAHD + 0.5m freeboard) with a proposed finished floor level of 9.0 mAHD. |
| **Building Components and Method** | | |
| 1 | All structures to have flood compatible building components and construction below the 1% AEP (100 year ARI) flood level plus freeboard. | Separate to this report, a structural engineer will provide guidance on the structural soundness of the proposed concept design. |
| **Structural Soundness** | | |
| 1 | Unless otherwise approved by Council, a structural engineer's report is required to certify that the structure can withstand the forces of floodwater, debris and buoyancy up to and including a 1% AEP (100 year ARI) flood level plus freeboard. | Separate to this report, a structural engineer will provide guidance on the structural soundness of the proposed concept design. |
| **Flood Affectation** | | |
| 1 | A hydraulic engineer's report is required to certify that the development will not increase flood affectation elsewhere, having regard to: (i) loss of flood storage; (ii) changes in flood levels, flows and velocities caused by alterations to flood flows; and (iii) the cumulative impact of multiple potential developments in the vicinity. | This report certifies that the development:<br>(i) Flood storage is preserved by offering excavation along the eastern portion of the site to compensate for lost volume owing to the establishment of the building.<br>(ii) Flows and velocities remain largely unchanged relative to the existing case;<br>(iii) GRC can't attest to the impact of developments other than this proposed building as the development is relatively unique and unlikely to be replicated in the catchment. We can say |

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

| Reference | Control | GRC Comment |
|---|---|---|
| | shelter in place) above the PMF level, on site (e.g. second storey) or off site. | 13.35 mAHD, higher than the PMF level of 10.4 mAHD) and safely congregate there as part of a shelter-in-place strategy. Back up electricity and water provision will be included in the event of an emergency. |
| 4 | Applicant is to demonstrate the development is consistent with any relevant flood emergency response plan, flood risk management plan or similar plan. | A flood emergency response plan has been developed and documented in this report above which encourages early evacuation based on FloodSmart and BoM warnings and also makes clear that the SES is the combat agency and their evacuation orders are to be deferred to in the event of an emergency as per the Parramatta EMPLAN. |
| 6 | Adequate flood warning is to be available to allow safe and orderly evacuation without increased reliance upon SES or other authorised emergency services personnel. | The proposed development will include a flood warning system to alert occupants when to evacuate to higher ground elsewhere on the campus or shelter in place on Level 1. |
| Management and Design | | |
| 2 | Flood emergency response plan required where the site is affected by the 1% AEP (100 year ARI) flood level. Plan is to detail procedures that would be in place for an emergency (such as warning systems, signage and evacuation emergency drills) and should consider the following aspects: (i) preparing for a flood, (ii) responding when a flood is likely, (iii) responding during a flood, and (iv) recovery after a flood. Must be consistent with Flood Warning and Emergency Response Planning requirements outlined in DCP. | This plan has been outlined previously in this report |
| 3 | Applicant is to demonstrate that sufficient area is available to store goods above the 1% AEP (100 year ARI) flood level plus 0.5 metre freeboard. | The building's ground floor is proposed above the 1% AEP (100 year ARI) flood level plus 0.5 metre freeboard. Therefore all storage space will be above this level. |
| 4 | No storage of materials below the Flood Planning Level (1% AEP flood plus 0.5 metre freeboard) which may cause pollution or be potentially hazardous during any flood. | The building's ground floor is proposed above the 1% AEP (100 year ARI) flood level plus 0.5 metre freeboard. Therefore all storage space will be above this level. |

### 8.1.2 Parramatta Local Environmental Plan (2023)

The proposed development aligns with the flood-related controls in the LEP as outlined in the table below.

*Table 9: Flood-Related LEP Controls Relevant to the Proposed Development*

| Reference | Control | GRC Comment |
|---|---|---|
| | **Parramatta LEP 2023 – 7.11** | |
| (3) | Development consent must not be granted to the erection of a building on the land unless the consent authority is satisfied the building—<br>(a) contains an area that is—<br>(i) located above the probable maximum flood level, and<br>(ii) connected to an emergency electricity and water supply, and<br>(iii) of sufficient size to provide refuge for all occupants of the building, including residents, workers and visitors, and<br>(b) has an emergency access point to land above the 1% annual exceedance probability event, and<br>(c) is able to withstand the forces of floodwaters, debris and buoyancy resulting from a probable maximum flood event. | An emergency access point connecting the building above the 1% AEP flood level (8.3 mAHD) is located near to the south-eastern entrance of the proposed development.<br><br>The proposed design includes provision to be connected to an emergency electricity and water supply and has sufficient space on level 1 and above to allow all occupants of the building to safely shelter above the PMF level (10.4 mAHD) in the event of an emergency. There are three publicly accessible levels proposed above the PMF level so ample space will be available to allow all occupants to comfortably shelter in place.<br><br>Separate to this report, a structural engineer will provide guidance on the structural capacity of the proposed concept design to withstand the forces of floodwaters, debris and buoyancy resulting from a PMF event. |
| (4) | Subclause (3)(a) does not apply if—<br>(a) there is pedestrian access located between the building and land above the probable maximum flood level, and<br>(b) the pedestrian access is located above the probable maximum flood level. | Subclause (3)(a) does apply. |

## 8.2 Addressing Government Guidance

In the course of developing this flood impact risk assessment, GRC has done so according to the following guidelines:

- Shelter-in-Place Guidelines for Flash Flooding;
- Understanding and Managing Flood Risk (FB01); and
- Support for Emergency Management Planning (EM01)

### 8.2.1 Shelter-in-Place Guidelines for Flash Flooding

The NSW Department of Planning, Housing and Infrastructure finalised its updated *Shelter-in-Place Guidelines for Flash Flooding* in January of 2025. This document provides guidance for developments in flood-prone areas to ensure the safety of occupants during flash flood events. Below is a summary of the key criteria that a proposed development or site must meet to satisfy the guidelines for sheltering in place during a flood event:

1. does shelter-in-place align with existing emergency management strategies for the area, as determined through the flood risk management process and by the NSW SES.

   GRC has developed a preliminary flood emergency response plan (FERP) that seeks to adopt and respond to elements of the NSW State Emergency Management Plan (EMPLAN) and the Sydney Metropolitan Region Emergency Management Plan.

   GRC has suggested the proposed development adopt FloodSmart warnings as a trigger to encourage early evacuation and to dissuade would-be occupants to stay away from the site.

   Shelter-in-Place has been reserved as a residual safety measure in the event that flooding occurs quicker than people can evacuate.

   Shelter in Place strategies have been used for developments throughout the City of Parramatta LGA. GRC Hydro understands that the SES has a preference for evacuation, however GRC is of the view that sheltering in place is a safer strategy at this site for the following reasons:

   - this site can be subject to flash flooding, a phenomenon where flooding can occur with little warning for on-site occupants;
   - surrounding roads throughout Rydalmere and Parramatta (a large affected area) can become inundated and unsafe for evacuees in cars and on foot; and
   - evacuees are unlikely to be aware which road routes might be safe for them to use throughout the broader flood-affected area.

2. has evacuation off-site (the primary emergency management strategy) been investigated and determined to be unachievable

   GRC has suggested the proposed development adopt FloodSmart warnings as a trigger to encourage early evacuation and to dissuade would-be occupants to stay away from the site.

   Shelter-in-Place has been reserved as a residual safety measure in the event that flooding occurs quicker than people can evacuate.

3. does the development include medical centres, emergency service and community facilities, and sensitive and hazardous land uses, some of which may not be suitable for shelter-in-place.
   No. The site does not include medical centres, emergency service and community facilities, and sensitive and hazardous land uses. The site will be predominantly occupied by adults (students and faculty staff) ranging in age from 17 to 65. Refuge space above the PMF level will be readily accessible to any occupants with mobility restrictions.

4. shelter-in-place for greenfield development is not supported
   The site is not greenfield. The development is situated on a currently operating university campus with the demolition of an existing car park required to facilitate its construction.

5. whether there is existing government developed flood warning systems that give advanced detailed forecasts of flash flooding to allow sufficient time to evacuate to the proposed refuge locations
   A City of Parramatta operated FloodSmart warning system provides forecasts that inform residents on the potential for flash flooding in different areas within the broader Parramatta River catchment.

   Whilst they are not detailed, they appear to be generally advanced. GRC has suggested the proposed development adopt FloodSmart warnings as a trigger to encourage early evacuation and to dissuade would-be occupants to stay away from the site.

   Shelter-in-Place has been reserved as a residual safety measure in the event that flooding occurs quicker than people can evacuate.

6. can the community effectively be informed of the risks associated with the emergency management strategy

   An on-site shelter in place strategy can be put into action relatively quickly. The majority of the site's floor space lies well above the PMF and occupants on the ground floor can quickly move to floor one and above in the event of a flood emergency. Even moving up a few steps (1.5 m) from the ground floor would result in occupants being above the PMF level. This can be done in a very short period of time.

   The ground floor's finished floor level is more than 0.5 m above the 1% AEP design flood level. The proposed design will allow occupants to have a near-uninterrupted view of flood waters ponding in the site's watercourse area so visual warning will be available to all parties.

   Even in a 0.2% AEP event (1 in 500 year event), the finished floor level will remain flood free. However, in advance of floodwaters nearing the finished floor level, alarms, instructions and warden-led assistance (via deputised staff) will guide occupants to progress to the upper floors well above the PMF level.

Following satisfactory consideration of the above issues, the Flood Impact and Risk Assessment (FIRA) being undertaken for the site must provide advice for the consent authority to consider the suitability of the site for shelter-in-place. The FIRA should include:

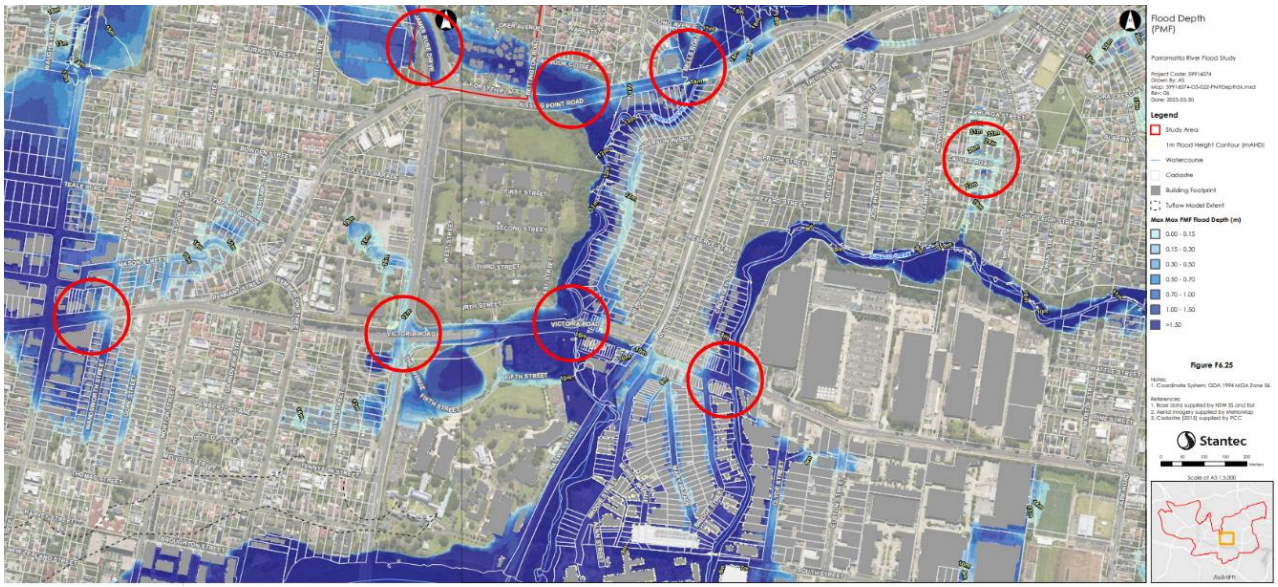
7. detailed assessment of evacuation off-site (the primary emergency management strategy) to determine that evacuation off-site is not achievable.

   GRC has suggested the proposed development adopt FloodSmart warnings as a trigger to encourage early evacuation and to dissuade would-be occupants to stay away from the site. If

evacuation is not triggered early, the complex nature of flooding in the local area could confuse drivers and place them at harm.

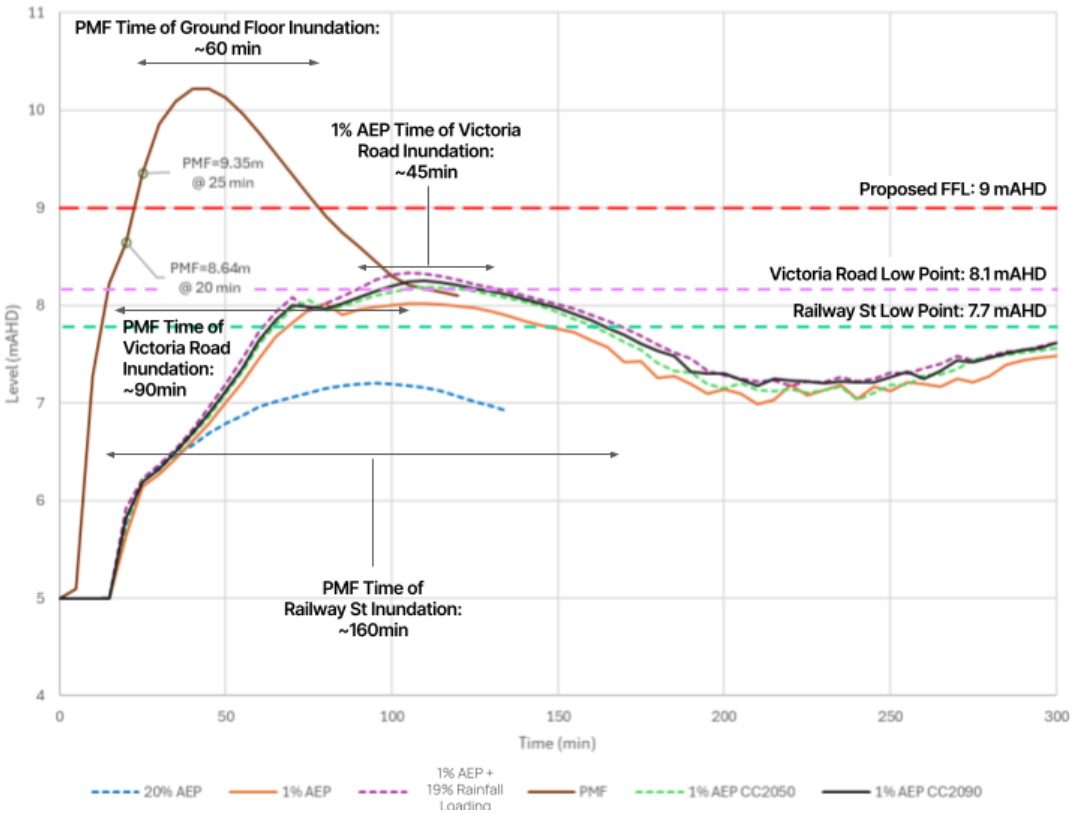
Shelter-in-Place has been reserved as a residual safety measure in the event that flooding occurs quicker than people can evacuate. The low point of Victoria Road (where it crosses Vineyard Ck) will be monitored as a trigger to halt evacuation if that location is nearing inundation. The site provides ample shelter space above the PMF and the flash flooding is predicted to subside within 2 hours so the site and proposed development are well suited to this residual strategy.

*Figure 56: Road Network Inundation Locations in a PMF Event*




8. the flood behaviour at the site, with consideration of climate change and assessment of the potential maximum duration of isolation up to and including the PMF to identify that:
    a. flash flooding is the only flood risk present at the site, whether it be from overland flooding, local creek or riverine flooding, and
    The site is subject to three mechanisms:
        - Overland flow coming from the west of the site. This is only minor.
        - Mainstream flooding that overtops Vineyard Creek upstream of Victoria Road and then flows into the site from the north-east; and
        - In a PMF event only, the Parramatta River level becomes similar to the modelled flood level at the site. In more common events, the flood affectation at the site exhibits no sensitivity to Parramatta River levels.
    b. the 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, and
    The modelled local inundation at the site and at the Victoria Road crossing above Vineyard Creek is documented in the hydrograph below. In all events, the modelling suggests that the site's isolation will have ended within 2 and a half hours following the commencement of rainfall.

*Chart 3: Hydrograph of Inundation at Site (Downstream of Victoria Road Culvert)*




The site can be evacuated via Bridge St to the north which connects to Victoria Road. The critical low point for this route is Victoria Road which is isolated for approximately 90 minutes in a PMF event.

c. the development is not subject to high hazard flooding (e.g. floodways, high hazard H5 or H6 areas) or surrounding roadways are not subject to high hazard flooding.
In the 1% AEP event, the site is subject to a maximum hazard of H3. In this event, flood-free emergency access to and from the site is available via the Bridge St overpass.

Following consideration of items 1 to 7, and if items 8a, b and c are met, and the consent authority considers shelter-in-place is an appropriate emergency response strategy the following items must also be considered through a FIRA:

9. how shelter-in-place will be:
    a. used as part of the site's emergency management response, including actions before, during and after sheltering-in-place, and

Shelter in Place is to be used as a last resort and only when it is deemed too late to safely evacuate the site. Occupants will be given approval to safely leave the site once flood wardens decide that the floodwaters have receded and are confident that they are continuing to recede. This is explained in more detail in the preliminary FERP procedures.

    b. communicated to occupants and visitors of the building and how this communication will be maintained for the life of the development.

In ordinary times, occupants will be made aware of the site's flood liability and evacuation procedure via posters shown throughout the campus and communicated to new students and staff as a part of an induction process. This will remain a fundamental part of the campus's introduction of the site to new students, faculty and guests.

During emergency periods, emails will be distributed to all staff and students to alert them of possible flood risks (and evacuation/stay away directions) when a local FloodSmart warning is issued by the City of Parramatta. Additionally, alerts (sirens and PA instructions), information posters, evacuation/shelter mapping and in-person direction will all be used to communicate the procedure by which safe shelter should be sought in an emergency.

10. an understanding of the secondary risks and how the proponent proposes they will be managed is outlined in the FIRA. Secondary risks include medical emergencies, building fire, health and wellbeing.

    During secondary emergencies, the site can be reached via the southern entrance in a 0.2% AEP event. Even when Victoria Rd is inundated, occupants can evacuate overland to other parts of the campus which can offer shelter and are higher than the PMF. In a PMF event, stranded sheltering occupants will likely only be isolated from emergency services for 60 minutes or less.

The consent authority should reflect the following design criteria (I to III) in relevant conditions of consent:

I. the floor level of the shelter-in-place part of the development be above the PMF, and

   The shelter-in-place area on levels one and above is higher than the PMF level

II. structural soundness for conditions in a PMF event, considering flood and debris forces, be verified by a suitably qualified structural engineer, and

   The structural soundness of the proposed development is to be verified by a suitably qualified structural engineer.

III. area and access to the area does not rely on access to electricity, is self-directing, and have clearly marked internal access for all people on site, including consideration of access for potential occupants and/or visitors.

   The area and access to the area will not rely on access to electricity (accessible via stairs and no accreditation or security keys will be required to access this publicly accessible area) and will be clearly marked and accessible to all occupants or visitors. Backup power will also be provided.

The consent authority may also consider the following design criteria (IV to X) when setting relevant conditions of consent depending on the scale and type of development: IV. protection from weather and appropriate heating and cooling

IV. access to personal hygiene facilities such as a toilet
   Toilets are located on level one and above.

V. a minimum floor space of 2 $m^2$ per person.
   The proposed building is a campus with ample public space. The building has been designed to be spacious during everyday use – more so than a regular commercial building – and this space will be

more pronounced in an emergency situation where the number of occupants is much lower than normal as the result of filtering process that includes:

- dissuading occupants to come to the facility in the first place; and then
- encouraging timely and early evacuation

VI. items for self-sufficiency that are stored, maintained and are regularly updated in an accessible location above the PMF, including sufficient drinking water and food for occupants, fire extinguishers, radios and torches with spare batteries, and a first aid kit with an automated external defibrillator (AED)
A checklist of these items has been mandated and outlined in the preliminary FERP in this report.

VII. centralised communal shelters may be considered but must be freely accessible internally at all times and externally accessible during events
The proposed shelter areas are freely accessible internally at all times. Sheltering occupants will be able to access external areas with fresh air situated well above the PMF level.

VIII. access is provided to onsite systems that generate power of the shelter-in-place location during and after the event for a full range of flood events up to the PMF. Detail how these requirements will be maintained and enforced for the life of the development.
Backup power and water supply will be provided. Further details specific to these backup systems will be provided during the detailed design phase.

### 8.2.2 Flood Risk Management: Understanding Flood Behaviour (FB01)

GRC has reviewed DPHI's "Understanding and Managing Flood Risk- Flood Risk Management Guideline FB01" in the course of developing this flood assessment and response plan. Whilst this guideline doesn't stipulate a range of specific, defined criteria for developments, GRC has addressed the how the proposed development and this FIRA has addressed the general topics discussed in this guideline below.

#### Understanding Flood Behaviour

- The development must assess the flood behaviour of the area, including flood sources, pathways, and potential impacts.
- **GRC Response**: GRC has assessed the flood behaviour of the site for a variety of design storm events, in both the existing and proposed condition, and have modelled the potential flood level impacts.

#### Flood Risk Assessment

- A detailed flood risk assessment must be conducted to evaluate the likelihood and consequences of flooding, including the potential for property damage, loss of life, and environmental harm.
- **GRC Response**: GRC has undertaken a risk assessment for the site and proposed development and this is included in Section 7.3.

### Flood Planning Levels (FPLs)

- The development must comply with designated Flood Planning Levels (FPLs), which define the height and extent of flooding that the development must be designed to withstand.
- **GRC Response**: GRC has adopted the Parramatta DCP's (2023) Flood Planning Level criteria of the 1% AEP flood level + 0.5 m freeboard. The proposed development's compliance with the DCP defined FPL is demonstrated in Section 8.1.

### Design and Construction Standards

- The development must adhere to design and construction standards that mitigate flood risks, such as elevating structures, using flood-resistant materials, and incorporating flood-compatible land uses.
- **GRC Response**: The proposed development will be constructed using flood-safe materials and methods. This will be verified in separate reporting by structural engineers associated with the project.

### Emergency Response Planning

- The development must include an emergency response plan that addresses evacuation routes, flood warnings, and community preparedness.
- **GRC Response**: GRC has developed a Flood Emergency Response Plan (FERP) in Section 7. This FERP addresses evacuation routes, flood warnings, and community preparedness.

### Environmental Considerations

- The development must consider the environmental impacts of flooding, including the potential for erosion, sedimentation, and damage to ecosystems.
- **GRC Response**: The site is an existing hard-stand car park. The proposed development will introduce native landscape and ephemeral watercourse features. The site is disconnected from the Vineyard Creek riparian corridor so there is very little potential for the proposed development to contribute to erosion, sedimentation and damage to ecosystems.

### Community and Stakeholder Engagement

- The development must involve community and stakeholder engagement to ensure that flood risks are understood and that the proposed measures are socially acceptable.
- **GRC Response**: WSU will engage with its student cohort, faculty and any other relevant stakeholders to build upon and strengthen the development's preliminary FERP.

### Compliance with Local and State Regulations

- The development must comply with all relevant local and state regulations, including floodplain management plans and development controls.
- **GRC Response**: Compliance with the intent and controls of the local LEP, DCP and state guidance has been demonstrated in Section 8.1.

### Climate Change Considerations

- The development must account for the potential impacts of climate change, such as increased rainfall intensity and sea level rise, on flood risk.
- GRC Response: The potential impacts of climate change have been incorporated into GRCs modelling. Potential climate change scenarios have been modelled in GRC's flood impact risk assessment.

### Monitoring and Maintenance

- The development must include plans for ongoing monitoring and maintenance of flood mitigation measures to ensure their effectiveness over time.
- GRC Response: Ongoing monitoring and maintenance of flood risk management measures is incorporated in the FERP guidance.

## 8.2.3 Support for Emergency Management Planning Support (EM01)

GRC has reviewed DPHI's "*Support for Emergency Management Planning*" (EM01) in the course of developing this flood assessment and response plan. Whilst this guideline doesn't stipulate a range of specific, defined criteria for developments, GRC has addressed the how the proposed development and this FIRA has addressed the general topics discussed in this guideline below.

### Flood Risk Assessment and Mapping

- Criteria: The development must be based on a comprehensive flood risk assessment, including flood mapping that identifies flood extents, depths, velocities, and hazards.
- GRC Response: This flood impact risk assessment has involved the modelling of a variety of design flood events and the result of this has been a suite of mapping that documents flood extents, depths, velocities, and hazards at the site in both the existing and proposed scenarios.

### Emergency Response Planning

- Criteria: The development must include a robust emergency response plan that addresses evacuation routes, flood warnings, and community preparedness.
- GRC Response: The FERP component of this report addresses evacuation routes, flood warnings, and community preparedness.

### Flood Warning Systems

- Criteria: The development must incorporate or align with existing flood warning systems to ensure timely and accurate information is available to residents and emergency services.
- GRC Response: The FERP component of this report discusses that the site lies within an area that has a broad flood warning system called FloodSmart and observance and response to FloodSmart is incorporated into the flood emergency response plan. FloodSmart warnings will be communicated to all potential on-site stakeholders with additional directions specific to the site.

### Community Engagement and Education

- **Criteria**: The development should involve community engagement and education programs to ensure residents understand flood risks and know how to respond during a flood event.
- **GRC Response**: WSU will engage with its student cohort, faculty and any other relevant stakeholders to build upon and strengthen the development's preliminary FERP.

### Flood-Compatible Design and Construction

- **Criteria**: The development must adhere to flood-compatible design and construction standards, such as elevating structures, using flood-resistant materials, and avoiding high-risk areas.
- **GRC Response**: WSU will engage with its student cohort, faculty and any other relevant stakeholders to build upon and strengthen the development's preliminary FERP.

### Evacuation Planning

- **Criteria**: The development must include clear and safe evacuation routes and plans, ensuring that residents can evacuate quickly and safely during a flood.
- **GRC Response**: Evacuation planning has been documented in the preliminary FERP above.

### Integration with Local and Regional Plans

- **Criteria**: The development must align with local and regional floodplain management plans, emergency management plans, and other relevant strategies.
- **GRC Response**: The proposed development's preliminary FERP has been developed so as to align with state and Sydney metropolitan EMPLANS.

### Resilience and Adaptation Measures

- **Criteria**: The development must incorporate resilience and adaptation measures to address future flood risks, including those exacerbated by climate change.
- **GRC Response**: The proposed design is to be constructed using flood resilient materials and its ground flood finished floor level is elevated well above the 1% AEP flood level.

### Monitoring and Maintenance of Flood Mitigation Measures

- **Criteria**: The development must include plans for ongoing monitoring and maintenance of flood mitigation measures to ensure their long-term effectiveness.
- **GRC Response**: The proposed design is to be constructed using flood resilient materials and its ground flood finished floor level is elevated well above the 1% AEP flood level.

### Compliance with Regulatory Requirements

- **Criteria**: The development must comply with all relevant local, state, and national regulations, including floodplain development controls and emergency management standards.

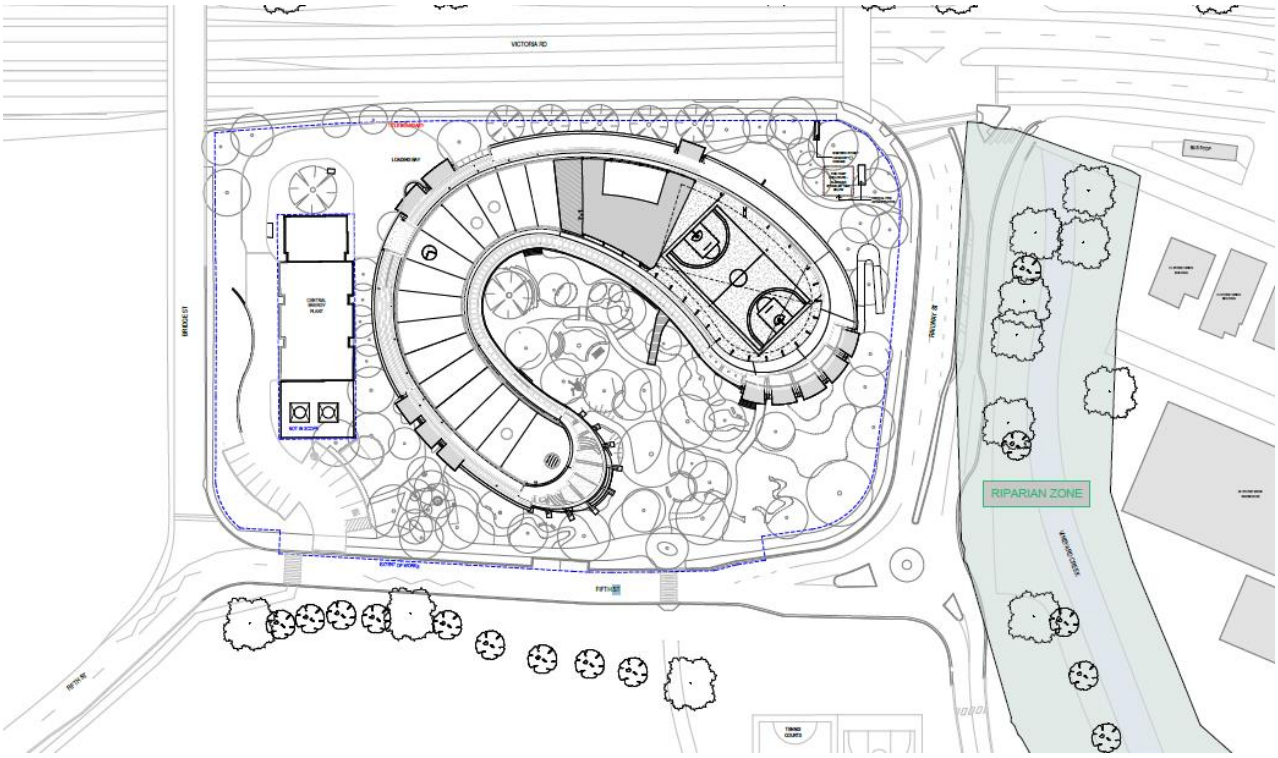
- GRC Response: Compliance with the intent and controls of the local LEP, DCP and state guidance has been demonstrated in Section 8.1.

# 9 Riparian Zone Management Assessment

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

The subject site is in the vicinity of Vineyard Creek. The riparian corridor of the creek is defined as the channel itself including its banks, plus the Vegetated Riparian Zone (VRZ) on either side of the channel. The VRZ is of constant width and is based on the channel's Strahler Stream Order. NSW GIS data available online on the 'NSW Map' website indicates a Strahler Stream Order of 2. This does not encroach on the site.

*Figure 57: Riparian Corridor*




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

*Image 5: Riparian Investigation Photos*

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

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

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

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

# 10 Summary

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

- Elevated FFL at 9.0 mAHD versus 1% AEP level of 8.3 mAHD;
- Building to be constructed on slab;
- Landscaping sympathetic to inflow and avoiding filling of subject site;
- Means of egress to flood free areas external to the building in 1% AEP;
- Adoption of early evacuation, deference to the SES as the combat agency in an emergency; and
- Facilitation of residual shelter in place (at 13.35 mAHD or above) for the worst possible flood, the PMF event (10.4 mAHD), which has a potential isolation period of less than 2 hours.

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

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

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

# Appendix A: Council Flood Certificate

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

GRC Hydro
Level 20/66 Goulburn St
SYDNEY NSW 2000

12 October 2023

# FLOOD ENQUIRY APPLICATION

## Property Details

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

## Delivery Preference

matthew@grchydro.com.au

## Reason for Enquiry

## Property Type

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

| | |
|---|---|
| Flooding Application – Commercial | $599.00 |

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

**Refer to back of this form for level information issued**

## Flood Enquiry Information Issued - 12 October 2023

**Mainstream Flooding**

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

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

**Local Flooding**

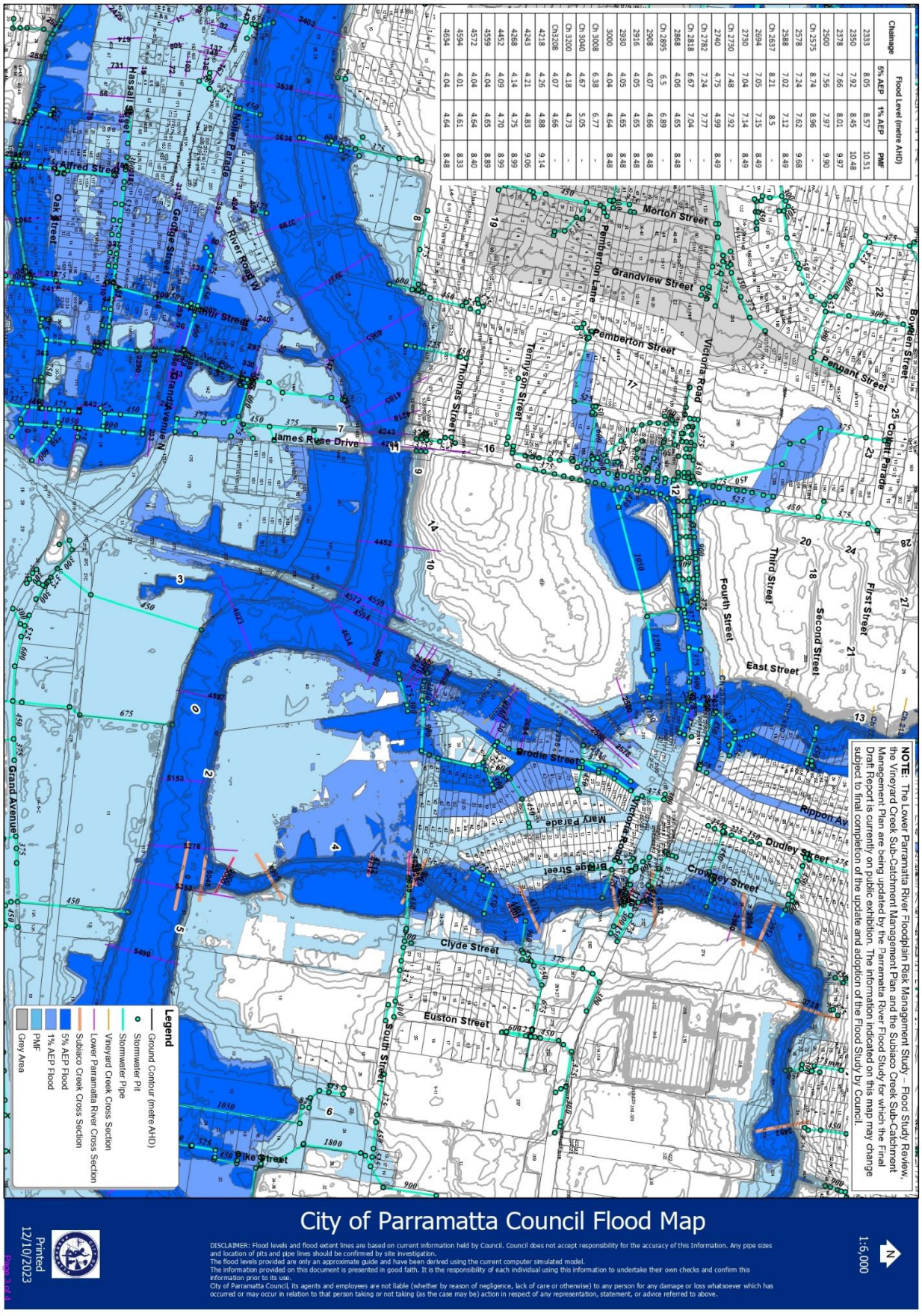
| | |
|---|---|
| Is the property located within a Hatched Grey Area?<br>*Properties located within a **Hatched Grey Area** are subjected to flooding from the local catchment.* | ☐ Yes<br>☒ No |
| Is the property located within a Grey Area?<br>*Properties located within a **Grey Area** are subjected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

**Additional Recommended Actions**

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

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

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


Flood Level (metre AHD)
Chainage
5% AEP
1% AEP
PMF
2333 8.05 8.57 10.51
2350 7.92 8.45 10.48
2378 7.66 8.01 9.97
2500 7.56 7.97 9.90
Ch 2575 8.74 8.96 -
2578 7.24 7.62 9.68
2588 7.02 7.12 8.49
Ch 2637 8.21 8.5 -
2694 7.05 7.15 8.49
2790 7.04 7.14 8.49
Ch 2790 7.48 7.92 -
2740 4.75 4.99 8.49
Ch 2782 7.24 7.77 -
Ch 2818 6.67 7.04 -
2868 4.06 4.65 8.48
Ch 2895 6.5 6.89 -
2908 4.07 4.66 8.48
2916 4.05 4.65 8.48
2930 4.05 4.65 8.48
3000 4.04 4.64 8.48
Ch 3008 6.38 6.77 -
Ch 3040 4.67 5.05 -
Ch 3200 4.18 4.73 -
Ch3208 4.07 4.66 -
4218 4.26 4.88 9.14
4243 4.21 4.83 9.06
4268 4.14 4.75 8.99
4452 4.09 4.70 8.99
4559 4.04 4.65 8.89
4572 4.04 4.64 8.40
4594 4.01 4.61 8.33
4634 4.04 4.64 8.48
Legend
Ground Contour (metre AHD)
Stormwater Pit
Stormwater Pipe
Vineyard Creek Cross Section
Lower Parramatta River Cross Section
Subiaco Creek Cross Section
5% AEP Flood
1% AEP Flood
PMF
Grey Area
NOTE: The Lower Parramatta River Floodplain Risk Management Study - Flood Study Review, the Vineyard Creek Sub-Catchment Management Plan and the Subiaco Creek Sub-Catchment Management Plan are being updated by the Parramatta River Flood Study for which the Final Draft Report is currently on public exhibition. The information indicated on this map may change subject to final completion of the update and adoption of the Flood Study by Council.
City of Parramatta Council Flood Map
DISCLAIMER: Flood levels and flood extent lines are based on current information held by Council. Council does not accept responsibility for the accuracy of this Information. Any pipe sizes and location of pits and pipe lines should be confirmed by site investigation.
The flood levels provided are only an approximate guide and have been derived using the current computer simulated model.
The information provided on this document is presented in good faith. It is the responsibility of each individual using this information to undertake their own checks and confirm this information prior to its use.
City of Parramatta Council, its agents and employees are not liable (whether by reason of negligence, lack of care or otherwise) to any person for any damage or loss whatsoever which has occurred or may occur in relation to that person taking or not taking (as the case may be) action in respect of any representation, statement, or advice referred to above.
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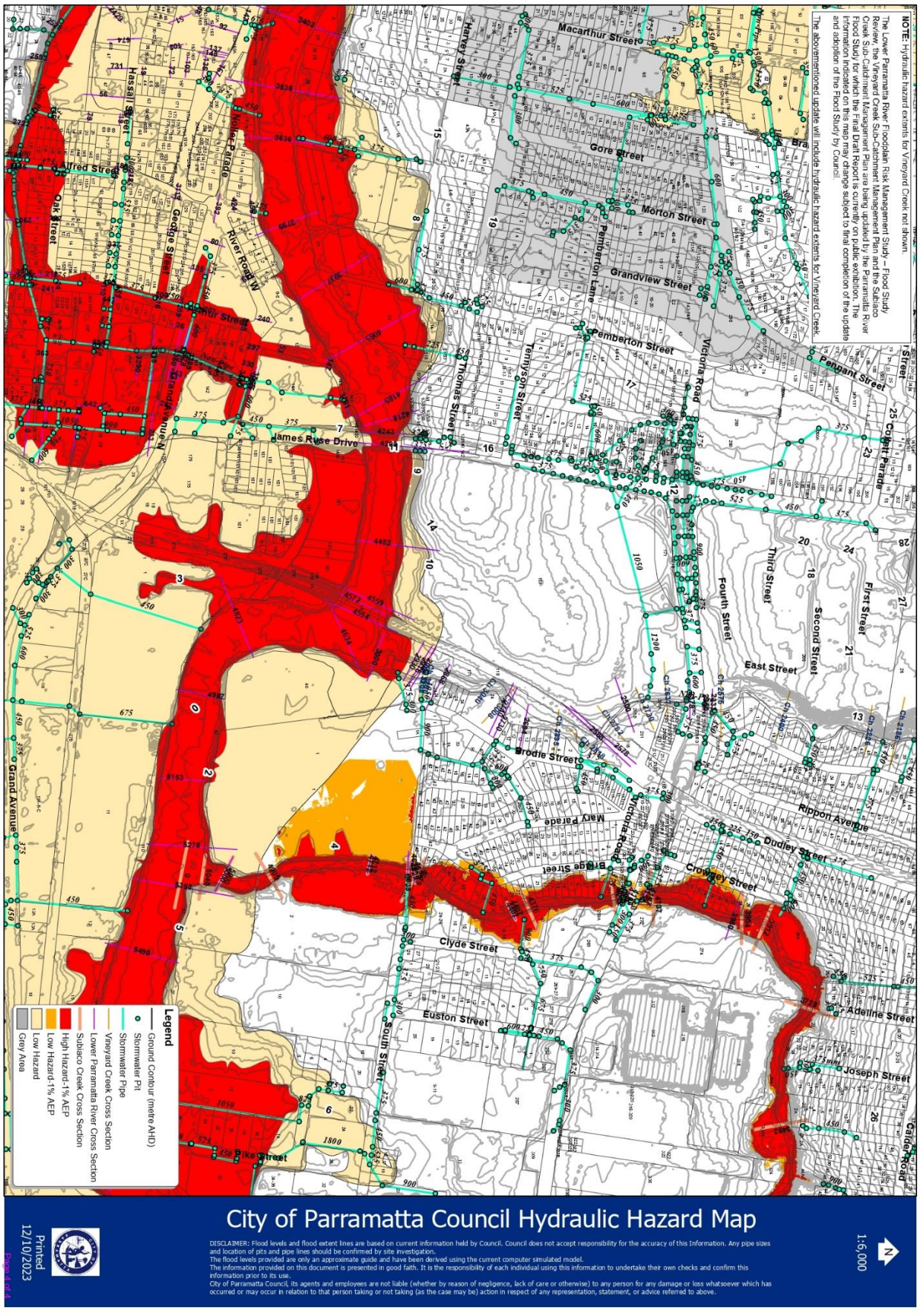
Page 3 of 4


NOTE: Hydraulic hazard extents for Vineyard Creek not shown.
The Lower Parramatta River Floodplain Risk Management Study – Flood Study Review, the Vineyard Creek Sub-Catchment Management Plan and the Subiaco Creek Sub-Catchment Management Plan are being updated by the Parramatta River Flood Study for which the Final Draft Report is currently on public exhibition. The information indicated on this map may change subject to final completion of the update and adoption of the Flood Study by Council.
The abovementioned update will include hydraulic hazard extents for Vineyard Creek.
Legend
Ground Contour (metre AHD)
Stormwater Pit
Stormwater Pipe
Vineyard Creek Cross Section
Lower Parramatta River Cross Section
Subiaco Creek Cross Section
High Hazard-1% AEP
Low Hazard-1% AEP
Low Hazard
Grey Area
Macarthur Street
Gore Street
Morton Street
Grandview Street
Pemberton Street
Pemberton Lane
Victoria Road
Pennant Street
Cobett Parade
Harley Street
Alfred Street
Oak Street
George Street
River Road W
Hassall Street
Thomas Street
Tennyson Street
James Ruse Drive
Grand Avenue
Third Street
Fourth Street
Second Street
First Street
East Street
Brodie Street
Mary Parade
Bridge Street
Rippon Avenue
Dudley Street
Crowley Street
Clyde Street
Euston Street
South Street
Adeline Street
Joseph Street
Calder Road
City of Parramatta Council Hydraulic Hazard Map
DISCLAIMER: Flood levels and flood extent lines are based on current information held by Council. Council does not accept responsibility for the accuracy of this Information. Any pipe sizes and location of pits and pipe lines should be confirmed by site investigation.
The flood levels provided are only an approximate guide and have been derived using the current computer simulated model.
The information provided on this document is presented in good faith. It is the responsibility of each individual using this information to undertake their own checks and confirm this information prior to its use.
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# Appendix B: ICoE Architectural Drawings

VICTORIA ROAD
LOT 101
LOT 100
PARKING
NOT IN SCOPE
SUB STATION
3780 SETBACK
4780 SETBACK
LOADING
EXTENT OF WORKS
MELALEUCA TREE
13200 SETBACK
2830 SETBACK
8160 SETBACK
RAILWAY STREET
WESTERN SYDNEY UNIVERSITY SIGNAGE
DRAFT
WESTERN SYDNEY UNIVERSITY
PROPOSED FLOOR PLAN_LEVEL G
INDIGENOUS CENTRE OF EXCELLENCE
DARUG NGURRA
171 VICTORIA RD
RYDALMERE NSW 2116
SW
TS
SSDA
DA 1-102
1:200
22-032
2
Jackson Clements Burrows Architects
psa

DRAFT
psa
Jackson Clements Burrows Architects
PROPOSED FLOOR PLAN_LEVEL 01
WESTERN SYDNEY UNIVERSITY
INDIGENOUS CENTRE OF EXCELLENCE
DARUG NGURRA
1/14 VICTORIA RD.
RYDALMERE NSW 2116
DA 1-103
SSDA
1:200
23-032
2
SW
TS
GENERAL NOTES
DESCRIPTION
DATE
REV
14760
SETBACK
6100
SETBACK
36080
SETBACK
NOT IN SCOPE
EXTENT OF WORKS
4450
SETBACK
10440
SETBACK

DRAFT
psa
Jackson Clemenes Burrows Architects
PROPOSED FLOOR PLAN_LEVEL 02
WESTERN SYDNEY UNIVERSITY
INDIGENOUS CENTRE OF EXCELLENCE
DARUG NGURRA
171 VICTORIA RD.
RYDALMERE NSW 2116
SW
TS
1:200
SSDA
DA 1-104
23-032
2
16330
SETBACK
7440
SETBACK
38420
SETBACK
NOT IN SCOPE
EXTENT OF WORKS
TITLE BOUNDARY
5785
SETBACK
12430
SETBACK

NOT IN SCOPE
EXTENT OF WORKS
TITLE BOUNDARY
DRAFT
PROPOSED FLOOR PLAN_LEVEL 03
WESTERN SYDNEY UNIVERSITY
INDIGENOUS CENTRE OF EXCELLENCE
DARUG NGURRA
171 VICTORIA RD.
RYDALMERE NSW 2116
DA 1-105
SSDA
1:200
23-032
2
Jackson Clements Burrows Architects
psa

DRAFT
PROPOSED ROOF PLAN
WESTERN SYDNEY UNIVERSITY
INDIGENOUS CENTRE OF EXCELLENCE
DARUG NGURRA
174 VICTORIA RD.
RYDALMERE NSW 2116
DA 1-106
SSDA
1:200
23-032
2
Jackson Clemenes Burrows Architects
VICTORIA ROAD
FIFTH STREET
RAILWAY STREET
PARKING
NOT IN SCOPE
CENTRAL ENERGY PLANT
EXTENT OF WORKS
LOT 101
LOT 100
TITLE BOUNDARY

1 DA SECTION 1
1 : 200
2 DA SECTION 2
1 : 200
3 DA SECTION 3
1 : 200
VICTORIA ROAD
RAILWAY STREET
RAILWAY STREET
G.5.40
G.5.5A
G.4.1
G.6.1
G.6.3
G.6.7
WESTERN SYDNEY UNIVERSITY
SECTIONS
INDIGENOUS CENTRE OF EXCELLENCE
DARUG NGURRA
171 VICTORIA RD,
RYDALMERE NSW 2116
SW
TS
SSDA
DA 3-101
1 : 200
23-032
2
Jackson Clements Burrows Architects
DRAFT
psq

# Appendix C: Consideration of the Flood Risk Management Manual (2023)

# Responding to the Flood Risk Management Manual 2023

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

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

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

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

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

| Section | Criteria | GRC Response |
|---|---|---|
| 2<br>Principle 10 | Continually improve management of flood risk | A Flood Emergency Response Plan has been created for the proposed development. This plan will improve the management of flood risk at this site. |
| 3 | Flood Risk | GRC has conducted flood modelling at this site for the existing and post-development scenario and has assessed the potential flood hazard surrounding the development. A Flood Emergency Response Plan (FERP) has been developed to help the future occupants manage flood risks and coordinate with the SES to prepare for, and act in accordance with during flood events. This FERP has devised a process for dealing with potential flood risks given the local flooding context and the available warning mechanisms in the local catchment. |
| 4 | Managing of Flood Risk | GRC has conducted flood modelling at this site for the existing and post-development scenario and has assessed the potential flood hazard surrounding the development. A Flood Emergency Response Plan (FERP) has been developed to help the future occupants manage flood risks and coordinate with the SES to prepare for, and act in accordance with during flood events. This FERP has devised a process for dealing with potential flood risks given the local flooding context and the available warning mechanisms in the local catchment. |
| 5 | Roles and Responsibilities<br><br>5.4.13 Developers<br>*Development proponents may be required by consent authorities to provide information and prepare reports on the impacts of the development on flood behaviour and the existing community, as well as the risks associated with the development and its use. These reports should identify management measures needed to address these risks. Proposed management measures to offset impacts may require development approval and may be subject to additional approval requirements. Developers may also be required to contribute to the costs of management measures required to limit the effects of their development on others.* | GRC has prepared this report for the proponent regarding this development.<br><br>The report includes:<br>• the impacts of the development on flood behaviour and the existing community, as well as the risks associated with the development and its use (see FERP).<br>• The design of the development has been informed by flood modelling and an iterative process has been undertaken to preserve existing flood behaviour and limit the exposure of occupants to potential flood risks.<br>• A Flood Emergency Response Plan has been developed to guide management measures for flood preparation and procedures to be enacted during flood events. |

# Item B
# Car Park Flood Assessment

grc HYDRO

Job Number: 230076
Date: 24 July 2025

GRC Hydro
Level 20, 66 Goulburn Street
Sydney NSW 2000

Tel: +61 413 631 447
www.grchydro.com.au

Stuart Pullens
Division Infrastructure and Commercial
Western Sydney University
171 Victoria Road
Parramatta NSW 2116

Dear Stuart,

# Flood Assessment – Western Sydney University Parramatta South Campus Temporary Car Park Relocation

## Introduction

This flood assessment has been prepared on behalf of the Western Sydney University (WSU) (the Proponent) by GRC Hydro (GRC). This report has been prepared for WSU to assess a proposed development involving the construction of relocated car parking facilities located at Fifth Street, within the Western Sydney University, Parramatta South Campus (the site).

The proposed works consist of site establishment, tree removal, civil, stormwater and earthworks, pavement works to comprise relocated car parking areas for 288 cars.

This report assesses how the proposed development relates to the local flood regime and how it complies with local flood-related planning controls as outlined in:

- The Parramatta Local Environmental Plan 2023 (PLEP 2023); and
- The Parramatta Development Control Plan 2023 (PDCP 2023).

## Site Context

The site is situated on Darug Ngurra land, also known as 171 Victoria Road, Rydalmere, located within the City of Parramatta Local Government Area (LGA).

The site comprises the Western Sydney University Parramatta South Campus and is bounded by Victoria Road (north), James Ruse Drive (west), the Parramatta River foreshore walk (south) and Railway Street (east) and the future Parramatta light rail line Stage 1. The site is located approximately 1.2km north-east from the Parramatta City Centre and the Parramatta Ferry Wharf (approximately a 20-minute walk).

## Site Description

The site is legally described as Lot 100 in DP 816829 and the wider campus comprises a significant land holding size of approximately 20ha. The specific development area relative to the proposed car parking relocation is within the northern portion of the campus. Refer to Figure 1 which provides an approximate

outline of the proposed works zone. The subject land comprises landscaped vegetation consisting predominantly of mowed lawn with mature tree planting at its perimeter and is also located adjacent to the sports oval.

*Figure 1: Site Location (Source: Nearmaps, edited by Ethos Urban)*

# Proposed Development

The specific works to relocate the Cark Park P1 at the Parramatta South Campus involves the following:

- Site establishment works (laybacks and temporary fencing);
- Tree removal;
- Earthworks, stormwater and civil activities;
- Pavement works and minor landscaping works;
- Hard stand paving for roadways and turf cell car spaces with line marking for 288 cars; and
- Signage and lighting.

The proposed works are depicted on drawings prepared by TTW which are attached in Appendix A.

# Flood Affectation

The site is located east of Vineyard Creek which drains southward to the Parramatta River. The broader WSU campus is flood liable and this was documented in the Parramatta River Flood Study (Stantec, 2024) which was recently adopted by the City of Parramatta (Council).

The proposed car park footprint has a small overlap with the 1% AEP flood extent (PRFS, Stantec, 2024) as is documented in Figure 2 below. The proposed car park has been designed to have a surface similar to the existing grade albeit with some minor regrading.

The cutting and filling volumes required to achieve the proposed design surface are as follows:

- Eastern Car Park: Cut: 940 $m^3$ Fill: 110 $m^3$
- Western Car Park: Cut: 310 $m^3$ Fill: 190 $m^3$
- Total: Cut: 1250 $m^3$ Fill: 300 $m^3$
- Net Change: Cut: 950 $m^3$

The proposed regrading, much of which is situated in the flood free Eastern Car Park, is unlikely to have an adverse impact to flood affectation at the site. Furthermore, the proposed design surface along north-western boundary of the Western Car Park – where flooding is predicted to occur according to the PRFS – is only subject to very minor changes so no increase in the footprint's flood affectation is expected.

*Figure 2: 1% AEP Flood Extent relative to the proposed car park footprint*

# Compliance with Flood-Related Planning Controls

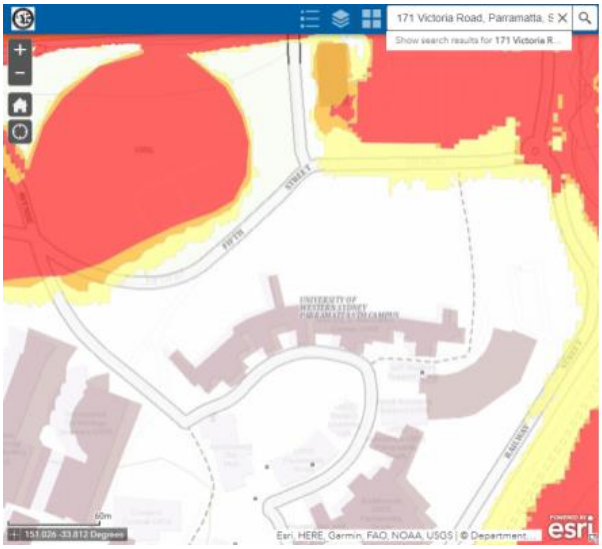
The relevant design standards that apply to the proposed development are determined in accordance with the following planning controls:

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

The flood risk at the footprint of the proposed works is defined by Council's online "Know Your Flood Risk" mapping. Whilst the northern section of the lot is defined as experiencing High Flood Risk, the proposed works are to be situated in a part of the lot predominantly experiencing low, no or medium flood risk.

Whilst most of the footprint has no flood risk, GRC has adopted planning controls on the basis of medium flood risk given there is some cross-over in the medium flood risk area.

*Figure 3: Hydraulic Hazard (calculated in accordance with Floodplain Development Manual, Appendix L)*




| Risk area | Common description | Technical description |
|---|---|---|
| High risk area | • Frequent flooding is common<br>• Near the main river and creeks where water flows during a flood, including overflow from drainage<br>• This area will see the fastest flowing and deepest water and cause a significant risk to life | High hazard flood area within the 1% annual exceedance probability (AEP) (1:100) |
| Medium risk area | • Frequent flooding will be rare<br>• Where the flood water goes once the creek/river areas overflow<br>• In rare floods these areas have the potential for deep and fast flowing water | Medium and low hazard area in the 1% AEP (1:100) |
| Low risk area | • Flooding is extremely rare<br>• Generally, away from the river or creek and higher up<br>• If a flood affects these areas it will cover a large area with dangerous water in many places | Area from the 1% AEP (1:100) up to the Probable Maximum Flood |
| Everywhere else | Not expected to flood but there still could be local incidents water running off the land and of street drainage not coping with rainfall amounts. | Area outside the Probable Maximum Flood. There may still be isolated impacts from local overland flow. |

## Compliance Requirements

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

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

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

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

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

*Table 1: Land Use Category Definitions (Table 5.1.1.1 from the PDCP, 2023)*

Table 5.1.1.1 – Land Use Category Definitions

| Land Use Categories | Identifies Land Uses |
|---|---|
| Sensitive uses and facilities | • Community facilities or Public administration buildings which may provide an important contribution to the notification and evacuation of the community during flood events;<br>• Early education and care facilities;<br>• Hospitals;<br>• Residential care facilities;<br>• Seniors housing;<br>• Educational establishments,<br>• Emergency services facilities. |
| Critical uses and facilities | • Hazardous industries;<br>• Heavy industrial storage establishments;<br>• Offensive industries;<br>• Public utility undertakings which may cause pollution of waterways during flooding, are essential to evacuation during periods of flood or if affected during flood events would unreasonably affect the ability of the community to return to normal activities after flood events;<br>• Telecommunication facilities;<br>• Waste management facilities. |
| Residential | • Attached dwellings;<br>• Backpackers accommodation;<br>• Bed and breakfast establishments;<br>• Boarding houses;<br>• Camping grounds;<br>• Caravan parks;<br>• Community facilities (other than sensitive uses/facilities);<br>• Dual occupancies;<br>• Dwelling houses;<br>• Group homes;<br>• Health consulting rooms;<br>• Home based child care;<br>• Home businesses;<br>• Home industries;<br>• Home occupations;<br>• Hostels;<br>• Multi dwelling housing;<br>• Neighbourhood shops;<br>• Residential flat buildings;<br>• Secondary dwellings;<br>• Semi-detached dwellings;<br>• Serviced apartments;<br>• Public utility undertakings (other than critical uses and facilities). |
| Commercial or Industrial | • Advertising structures;<br>• Agriculture;<br>• Amusement centres;<br>• Business Premises;<br>• Car parks;<br>• Correctional centres;<br>• Crematorium;<br>• Depots;<br>• Entertainment facilities;<br>• Food and drink premises;<br>• Freight transport facilities;<br>• Funeral homes;<br>• Function centres;<br>• Hardware and building supplies;<br>• Health consulting rooms;<br>• Heavy industries;<br>• Hotel accommodation;<br>• Industries;<br>• Information and education facilities;<br>• Industrial retail outlets;<br>• Kiosks;<br>• Landscape and garden supplies;<br>• Light industries;<br>• Markets;<br>• Materials recycling or recovery centres;<br>• Medical centres;<br>• Mixed-use development;<br>• Mortuaries;<br>• Office premises;<br>• Passenger transport facilities;<br>• Places of public worship;<br>• Public administration buildings (other than essential uses and facilities);<br>• Pubs;<br>• Recreation facilities (indoor);<br>• Recreation facilities (major);<br>• Registered clubs;<br>• Restricted premises;<br>• Retail Premises;<br>• Service stations;<br>• Sex services premises;<br>• Shop top housing; Signage;<br>Specialised retail premises;<br>• Storage premises;<br>• Transport depot;<br>• Truck depot;<br>• Tourist and visitor accommodation;<br>• Vehicle body repair workshops;<br>• Vehicle repair stations;<br>• Vehicle showrooms;<br>• Veterinary hospitals;<br>• Warehouse or distribution centres;<br>• Waste or resource management facilities;<br>• Wholesale supplies. |
| Open space or Non-urban uses | • Animal boarding and training establishments;<br>• Boat launching ramps;<br>• Boat repair facilities;<br>• Boat sheds; Cemetery;<br>• Charter and tourism boating facilities;<br>• Environmental facilities;<br>• Environmental protection works;<br>• Helipad;<br>• Jetty;<br>• Marinas;<br>• Mooring;<br>• Port facilities;<br>• Water recreation structures;<br>• Recreation areas and minor ancillary structures (e.g. Toilet blocks or kiosks);<br>• Recreation facilities (outdoor) |
| Subdivisions | Subdivision of land which involves the creation of additional allotments. |
| Filling of flood prone land | The net importation of fill material onto a flood prone site is not permitted, except where:<br>i) final surface levels are raised by no more than 100mm over no more than 50% of the site; or<br>ii) filling is to be no more than 800mm thick beneath a concrete building slab, provided this does not significantly affect the floodway conveyance or flood storage. |
| Concessional Development | Concessional development is any development or redevelopment that would normally not be permitted under this Plan, but may be permitted as a concession provided it:<br>i) is kept clear of any floodway; and<br>ii) involves an acceptably small (see below for limits) addition or alteration to an existing development that will not cause a significant increase in potential flood losses, risks or have an adverse impact on adjoining properties; or<br>iii) redevelopment for the purposes of substantially reducing the extent of flood affectation to the existing building; provided that such redevelopments incorporate to the fullest extent practical, design features and measures to substantially reduce the existing potential for flood losses and personal risks, and avoid any adverse impacts |

The proposed development is classed as a "Car Park," therefore it is categorised as a Commercial or Industrial land use.

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

The Floodplain Matrix in Section 5.1.1 – C.24 of the PDCP (2023) (included as Table 2 below) stipulates which development controls are relevant to a development with this land use and flood risk.

*Table 2: Flood-related controls and requirements (Table 5.1.1.2 from the PDCP, 2023)*

Table 5.1.1.2 – Floodplain Matrix Planning and Development Controls

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

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

**Legend** | | Not relevant | X | Unsuitable Land Use

i. Freeboard equals an additional height of 500mm.

ii. The flood level is usually the higher of that level adopted by Council for fluvial flooding (from rising rivers, creeks, tributaries) for a 1% Annual Exceedance Probability event (1% AEP), or the modelled overland flow flood level (from rainfall in the local catchment) for an event with the same probability (1% AEP). The Flood Planning Level is usually the 1% AEP Flood Level plus a 500mm freeboard safety factor.

iii. The *Parramatta LEP 2023* identifies development permissible with consent in various zones. Notwithstanding, constraints specific to individual sites may preclude Council granting consent for certain forms of development on all or part of a site. The above matrix identifies where flood risks are likely to determine where certain development types will be considered "unsuitable" due to flood related risks.

iv. Filling of the site, where acceptable to Council, may change the FRP considered to determine the controls applied in the circumstances of individual applications.

v. Any fencing that forms part of a proposed development is subject to the relevant Flood Effects and Structural Soundness planning considerations of the applicable land use category.

vi. Development within the floodplain may be subject to Clause 6.7 Foreshore Building Line in the *Parramatta LEP 2023*.

vii. Additional controls apply to basement carparking within the floodplain, please see Car Park Basements associated controls above.

viii. Where a flood warning and emergency response plan is required, requirements set out below under *'Flood Warning and Emergency Response Planning'* must be achieved.

For a development with:

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

The following flood-related controls (documented in Table 3) apply according to guidance outlined in the matrix tables 5.1.1.2 and 5.1.1.3 in Section 5.1.1 of the PDCP 2023.

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

*Table 3: Flood-Related Controls Relevant to the Proposed Development*

| Reference | Control | GRC Comment |
|---|---|---|
| **PDCP 2023 Control (From Table 5.1.1.3)** | | |
| **Car Parking and Driveway Access** | | |
| 1 | The minimum surface level of unenclosed parking spaces or carports shall be as high as practical, but no lower than 0.1 metres below the 1% AEP (100 year ARI) flood level. In the case of garages and other enclosed parking areas for less than 3 motor vehicles, the minimum surface level shall be as high as practical, but no lower than the 1% AEP (100 year ARI) flood level, plus 0.15 metres freeboard. | 288 unenclosed car parking spaces are proposed as part of this temporary facility. 66 of these (all along the north-western border) are predicted to be inundated in a 1% AEP event according to the Parramatta River Flood Study (Stantec, 2024). These spaces have rising egress above the 1% AEP level to the car park driveway entrance to Fifth St.<br><br>The proposed development is temporary in nature and the spaces that lie along the flood fringe have clear access to land above the 1% AEP in the event of potential flooding. |
| 3 | Garages, and other enclosed car parking areas, capable of accommodating more than 3 motor vehicles, must be protected from inundation by floods equal to or greater than the 1% AEP (100 year ARI) flood. Ramp levels to be no lower than 0.5m above the 100 year ARI flood level. Where below ground car parking is proposed additional measures must achieve protection up to the PMF. | No garages or enclosed parking is proposed as part of this temporary development. |
| 5 | Unless otherwise approved by Council and provided this does not obstruct or displace floodwaters, the level of the driveway providing access between the road and parking spaces shall be no lower than 0.2 metres below the 1% AEP (100 year ARI) flood level. | The driveway provides rising egress from the site above the 1% AEP level, outside the 1% AEP flood extent. |
| 6 | Enclosed car parking, and car parking areas accommodating more than 3 motor vehicles, with a floor below the 1% AEP (100 | No enclosed parking is proposed as part of this temporary development. |

| Reference | Control | GRC Comment |
|---|---|---|
| | year ARI) flood level, shall have adequate warning systems, signage, exits and evacuation routes. Refer to Flood Warning and emergency Response Planning section of the Parramatta DCP for requirements. | |
| 7 | Restraints or vehicle barriers to be provided to prevent floating vehicles leaving a site during a 1% AEP (100 year ARI flood.) | No fencing is proposed as this proposed development is temporary only.<br><br>Furthermore, the flood affected component of the proposed temporary development is flood fringe in nature only and will not likely exhibit the forces required to dislodge vehicles from their stationary positions. |
| **Parramatta LEP 2023 – 7.11** | | |
| (3) | Development consent must not be granted to the erection of a building on the land unless the consent authority is satisfied the building—<br>(a) contains an area that is—<br>(i) located above the probable maximum flood level, and<br>(ii) connected to an emergency electricity and water supply, and<br>(iii) of sufficient size to provide refuge for all occupants of the building, including residents, workers and visitors, and<br>(b) has an emergency access point to land above the 1% annual exceedance probability event, and<br>(c) is able to withstand the forces of floodwaters, debris and buoyancy resulting from a probable maximum flood event. | The majority of the proposed temporary development lies outside the 1% AEP flood extent. Emergency access can be facilitated to the proposed car park via Fifth St.<br><br>The proposed design is not an active place of business or an area designed for people to congregate. The vast majority of the footprint lies outside of the 1% AEP extent and just like all other open space on the campus, if indoor refuge from rain and flooding is sought, visitors can make their way south to the campus's covered buildings which lie above the 1% AEP and PMF levels, as does the path to get to them.<br><br>If required, separate to this report, a structural engineer will provide confirmation on the structural capacity of the proposed concept design to withstand the forces of floodwaters, debris and buoyancy resulting from a PMF event. |
| (4) | Subclause (3)(a) does not apply if—<br>(a) there is pedestrian access located between the building and land above the probable maximum flood level, and<br>(b) the pedestrian access is located above the probable maximum flood level. | Subclause (3)(a) does apply. |

# Conclusion

The proposed temporary car park poses very little change to the existing terrain. As such it is likely to have little to no adverse impact to the existing flood affectation at this site.

The proposed temporary development is largely compliant with the planning instruments applicable to this site and nature of development.

Yours Sincerely,

Steve Gray
Director

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

# Appendix A

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# WSU - CARPARK RELOCATION PROJECT

## CIVIL DRAWINGS

## DRAWING INDEX


| | |
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| 234338-TTW-01-DR-CI-00001 | GENERAL COVER SHEET, DRAWING INDEX AND LOCALITY PLAN |
| 234338-TTW-01-DR-CI-00002 | GENERAL NOTES AND LEGEND SHEET 1 |
| 234338-TTW-01-DR-CI-00003 | GENERAL NOTES AND LEGEND SHEET 2 |
| 234338-TTW-01-DR-CI-00011 | GENERAL ARRANGEMENT PLAN |
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| **TRAFFIC** | |
| 234338-TTW-01-DR-CI-07011 | TRAFFIC CONTROL SIGNAGE AND LINEMARKING SHEET 1 |
| 234338-TTW-01-DR-CI-07012 | TRAFFIC CONTROL SIGNAGE AND LINEMARKING SHEET 2 |


## CITY OF PARRAMATTA STANDARD DRAWINGS

| STANDARD | DRAWING DESCRIPTION |
|---|---|
| DS1 | KERBS AND LAYBACKS |
| DS8 | VEHICULAR CROSSING |
| DS19 | STEP IRONS |
| DS21 | KERB INLET PIT (ON GRADE) |
| DS25 | SURFACE INLET PIT GENERAL PURPOSE |
| DS29 | SURFACE INLET PIT FOR DRIVEWAYS |
| DS33 | SUBSOIL DRAINAGE DETAILS |
| DS37 | INSTALLATION OF PIPELINES AND RESTORATION OF TRENCHES |
| DS43 | TREE PROTECTION TIMBER HOARDING |
| DS47 | TYPICAL SECTIONS ROAD PAVEMENTS |

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THE LOCATION OF UNDERGROUND SERVICES ARE APPROXIMATE ONLY AND THEIR EXACT POSITION SHOULD BE PROVEN ON SITE. NO GUARANTEE IS GIVEN THAT ALL EXISTING SERVICES ARE SHOWN

NOT FOR CONSTRUCTION

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| Rev | Description | Eng Draft | Date |
|---|---|---|---|
| T4 | TENDER ADDENDUM ISSUE | RP KN | 02.05.2025 |
| T3 | TENDER ADDENDUM ISSUE | RP KN | 19.12.2024 |
| T2 | TENDER ISSUE | RP JLE | 08.10.2024 |
| T1 | TENDER ISSUE | RP JLE | 03.10.2024 |
| P2 | PRELIMINARY ISSUE | RP JLE | 23.09.2024 |
| P1 | PRELIMINARY ISSUE | RP PB | 13.09.2024 |

Client: WESTERN SYDNEY UNIVERSITY

Engineer: TTW www.ttwengineers.com

Project: WSU CARPARK RELOCATION PROJECT

Drawing Title: GENERAL COVER SHEET DRAWING INDEX AND LOCALITY PLAN

| Scale at A1 | Drawn | Designed | Approved |
|---|---|---|---|
| | KN | JLE | RP |

| Project No | Originator | Zone | Type | Role | Sheet No. | Rev |
|---|---|---|---|---|---|---|
| 234338 | TTW | | 01 | DR | CI-00001 | T4 |

02.05.2025 11:40 AM

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## GENERAL NOTES

1. THESE DRAWINGS SHALL BE READ IN CONJUNCTION WITH ALL OTHER ENGINEERING AND ARCHITECTURAL DRAWINGS.
2. ANY OBSERVED DISCREPANCY IS TO BE REFERRED TO THE SUPERINTENDENT PRIOR TO COMMENCING WORKS.
3. THESE DRAWINGS SHALL ALSO BE READ IN CONJUNCTION WITH THE CIVIL SPECIFICATION.
4. DO NOT SCALE FROM THE DRAWINGS.
5. ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE NOTED.
6. ALL LEVELS ARE EXPRESSED TO THE AUSTRALIAN HEIGHT DATUM (AHD).
7. THE CONTRACTOR SHALL SEEK APPROVAL FROM THE SUPERINTENDENT FOR ANY SUBSTITUTIONS OF PRODUCTS AND MATERIALS NOTED IN THE DRAWINGS.

## SURVEY AND SERVICES INFORMATION

SURVEY

ORIGIN OF LEVELS : CONTACT THE SURVEYOR

DATUM OF LEVELS: CONTACT THE SURVEYOR

COORDINATE SYSTEM: MGA 2020

SURVEY PREPARED BY : LTS

SETOUT POINTS: CONTACT THE SURVEYOR

TTW DOES NOT GUARANTEE THAT THE SURVEY INFORMATION SHOWN ON THESE DRAWINGS IS ACCURATE AND WILL ACCEPT NO LIABILITY FOR ANY INACCURACIES IN THE SURVEY INFORMATION PROVIDED TO US FROM ANY CAUSE WHATSOEVER.

THE CONTRACTOR IS TO GET APPROVAL FROM THE RELEVANT STATE SURVEY DEPARTMENT, TO REMOVE/ADJUST ANY SURVEY MARK. THIS INCLUDES BUT IS NOT LIMITED TO; STATE SURVEY MARKS (SSM), PERMANENT MARKS (PM), CADASTRAL REFERENCE MARKS OR ANY OTHER SURVEY MARK WHICH IS TO BE REMOVED OR ADJUSTED IN ANY WAY.

TTW PLANS DO NOT INDICATE THE PRESENCE OF ANY SURVEY MARK. THE CONTRACTOR IS TO UNDERTAKE THEIR OWN SEARCH.

UNDERGROUND SERVICES - WARNING

THE LOCATIONS OF UNDERGROUND SERVICES SHOWN ON TTW'S DRAWINGS HAVE BEEN PLOTTED FROM DIAGRAMS PROVIDED BY SERVICE AUTHORITIES. THIS INFORMATION HAS BEEN PREPARED SOLELY FOR THE AUTHORITIES OWN USE AND MAY NOT NECESSARILY BE UPDATED OR ACCURATE.

THE POSITION OF SERVICES AS RECORDED BY THE AUTHORITY AT THE TIME OF INSTALLATION MAY NOT REFLECT CHANGES IN THE PHYSICAL ENVIRONMENT SUBSEQUENT TO INSTALLATION.

TTW DOES NOT GUARANTEE THAT THE SERVICES INFORMATION SHOWN ON THESE DRAWINGS SHOWS MORE THAN THE PRESENCE OR ABSENCE OF SERVICES, AND WILL ACCEPT NO LIABILITY FOR INACCURACIES IN THE SERVICES INFORMATION SHOWN FROM ANY CAUSE WHATSOEVER.

THE CONTRACTOR MUST CONFIRM THE EXACT LOCATION AND EXTENT OF SERVICES PRIOR TO CONSTRUCTION AND NOTIFY ANY CONFLICT WITH THE DRAWINGS IMMEDIATELY TO THE ENGINEER/SUPERINTENDENT.

THE CONTRACTOR SHALL NOTIFY THE RELEVANT SERVICE AUTHORITY FOR ANY REQUIRED MODIFICATION WORKS TO THEIR ASSETS. ALL SERVICE MODIFICATION WORKS SHALL BE UNDERTAKEN IN STRICT ACCORDANCE WITH THE REQUIREMENTS OF THE RELEVANT SERVICE AUTHORITY.THE CONTRACTOR SHALL PROVIDE ALL NECESSARY PROTECTION MEASURES TO EXISTING SERVICES THAT ARE TO BE RETAINED. THE CONTRACTOR IS LIABLE FOR RECTIFICATION/REINSTATEMENT COSTS FOR DAMAGE TO EXISTING SERVICES.

## BOUNDARY AND EASEMENT NOTE

THE PROPERTY BOUNDARY AND EASEMENT LOCATIONS SHOWN ON TTW'S DRAWINGS HAVE BEEN BASED FROM INFORMATION RECEIVED FROM : LTS

TTW MAKES NO GUARANTEES THAT THE BOUNDARY OR EASEMENTINFORMATION SHOWN IS CORRECT. TTW WILL ACCEPT NO LIABILITIES FOR BOUNDARY INACCURACIES. THE CONTRACTOR/BUILDER IS ADVISED TO CHECK/CONFIRM ALL BOUNDARIES IN RELATION TO ALL PROPOSED WORK PRIOR TO THE COMMENCEMENT OF CONSTRUCTION. BOUNDARY INACCURACIES FOUND ARE TO BE REPORTED TO THE SUPERINTENDENT PRIOR TO CONSTRUCTION STARTING.

## KERBING NOTES

INCLUDES ALL KERBS, CHANNELS, SPOON DRAINS, CROSSINGS AND EDGES.

1. CONCRETE KERBS SHALL BE CONSTRUCTED USING GRADE 32MPA CONCRETE U.N.O.
2. ALL KERBS, CHANNELS, SPOON DRAINS AND CROSSINGS TO BE CONSTRUCTED ON MINIMUM 75MM GRANULAR BASECOURSE COMPACTED TO MINIMUM 98% MODIFIED MAXIMUM DRY DENSITY IN ACCORDANCE WITH AS 1289 5.2.1.
3. EXPANSION JOINTS (EJ) TO BE FORMED FROM 10MM COMPRESSIBLE FILLER BOARD FOR THE FULL DEPTH OF THE SECTION AND CUT TO PROFILE.
EXPANSION JOINTS TO BE LOCATED AT DRAINAGE PITS, ON TANGENT POINTS OF CURVES AND ELSEWHERE AT 12M CENTRES EXCEPT FOR INTEGRAL KERBS WHERE THE EXPANSION JOINTS ARE TO MATCH THE JOINT LOCATIONS IN SLABS.
4. SAW CUT JOINTS TO BE MIN 3MM WIDE AND LOCATED AT 3M CENTRES EXCEPT FOR INTEGRAL KERBS WHERE WEAKENED PLANE JOINTS ARE TO MATCH THE JOINT LOCATIONS IN SLABS.
5. BROOM FINISHED TO ALL RAMPED AND VEHICULAR CROSSINGS, ALL OTHER KERBING OR DISH DRAINS TO BE STEEL FLOAT FINISHED.
6. IN THE REPLACEMENT OF KERBS - EXISTING ROAD PAVEMENT IS TO BE SAWCUT 350MM FROM LIP OF UPON COMPLETION OF NEW KERBS, NEW BASECOURSE AND SURFACE IS TO BE LAID 350MM WIDE TO MATCH EXISTING MATERIALS AND THICKNESSES. EXISTING ALLOTMENT DRAINAGE PIPES ARE TO BE BUILT INTO THE NEW KERB WITH A 100MM DIA HOLE. EXISTING KERBS ARE TO BE COMPLETELY REMOVED WHERE NEW KERBS ARE SHOWN.

## STORMWATER DRAINAGE NOTES

1. ALL NEW DRAINAGE PIPES EQUAL TO OR GREATER THAN 450Ø TO BE RUBBER RING JOINTED RCP UNLESS NOTED OTHERWISE IN DRAWINGS
   1.1. RCP PIPES SUBJECT TO PEDESTRIAN LOADING ONLY TO BE CLASS 3 UNLESS NOTED OTHERWISE.
   1.2. RCP PIPES SUBJECT TO TRAFFIC LOADING TO BE MIN. CLASS 4 UNLESS NOTED OTHERWISE
2. PIPES UP TO 375Ø SHALL BE HDPE OR SEWER GRADE UPVC WITH SOLVENT WELDED JOINTS UNLESS NOTED OTHERWISE IN DRAWINGS. SOME OF OUR PIPES ARE CPP. IN AREAS OF EXPANSIVE SOILS, UPVC PIPES MUST BE RUBBER RING JOINTED.
3. EQUIVALENT STRENGTH VCP OR FRP PIPES MAY BE USED SUBJECT TO APPROVAL.
4. PRECAST PITS MAY BE USED EXTERNAL TO THE BUILDING SUBJECT TO APPROVAL BY THE SUPERINTENDENT.
5. ENLARGERS, CONNECTIONS AND JUNCTIONS TO BE MANUFACTURED FITTINGS WHERE PIPES ARE LESS THAN 300 DIA.
6. SUBSOIL DRAINS TO BE SLOTTED FLEXIBLE 100DIA UPVC U.N.O.
7. WHERE SUBSOIL DRAINS ARE SHOWN AS UNSLOTTED, UNSLOTTED 100DIA UPVC SEWER GRADE PIPE IS TO BE USED.
8. SUBSOIL DRAINS TO BE LOCATED BEHIND ALL RETAINING WALLS AND NEW KERBING SHALL BE CONNECTED TO NEAREST STORMWATER PIT.
9. GRATES AND COVERS SHALL CONFORM WITH AS 3996-2006, AND AS 1428.1 FOR ACCESS REQUIREMENTS. ALL PITS WITHIN FOOT TRAFFIABLE AREA TO HAVE MINIMUM SLIP RESISTANCE OF R10 OR R11.
10. CONCRETE PIPES ARE TO BE INSTALLED IN ACCORDANCE WITH AS 3725. ALL BEDDING TO BE TYPE H2 U.N.O.
11. CARE IS TO BE TAKEN WITH LEVELS OF STORMWATER LINES. GRADES SHOWN ARE NOT TO BE REDUCED WITHOUT APPROVAL.
12. ALL STORMWATER PIPES TO BE 150 DIA AT 1 IN 100 MIN FALL U.N.O.
13. ADOPT INVERT LEVELS FOR PIPE INSTALLATION (GRADES SHOWN ARE ONLY NOMINAL).
14. ALL DRAINS AND OTHER SERVICE INFRASTRUCTURE TRENCHES BENEATH ROAD PAVEMENTS, DRIVEWAYS, FOOTPATHS OR CONCRETE STRUCTURES SLABS, OR WITHIN 1.0M OF CONCRETE STRUCTURES OR OTHER COUNCIL ASSETS, INCLUDING KERB, FOOTPATH, DRAINS, ETC MUST BE BACKFILLED WITH CLASS 2 FCR, COMPACTED AND TESTED TO THE SATISFACTION OF THE SUPERINTENDENT.
15. LITTER TRAPS TO BE INSTALLED IN ALL NEW GRATED PITS WITHIN LANDSCAPE AREAS.
16. ALL GRATED PITS WITHIN PAVED PEDESTRIAN AREAS TO BE HEEL GUARD BOLT DOWN COVER UNLESS SPECIFIED OTHERWISE ON PLANS.
17. ALL DOWNPIPES TO BE CONNECTED TO ADJACENT INGROUND STORMWATER DRAINAGE INFRASTRUCTURE. REFER TO HYDRAULIC DRAWINGS FOR DOWN PIPE LOCATION IF NOT DETAILED ON CIVIL PLANS.
18. ALL EXISTING ACTIVE DOWNPIPES, WHERE INGROUND STORMWATER HAS BEEN ABANDONED, TO BE CONNECTED TO NEW INGROUND STORMWATER DRAINAGE NETWORK.
19. PRIOR TO COMMENCING ANY STORMWATER DRAINAGE WORKS ON SITE THE CONTRACTOR MUST CONFIRM THE CONNECTION TO THE LEGAL POINT OF DISCHARGE AUTHORITY DRAIN AS DOCUMENTED BY:
    19.1. VERIFICATION OF THE EXISTING INVERT LEVEL OF THE LEGAL POINT OF DISCHARGE TO COUNCIL DRAIN.
    19.2. VERIFICATION THAT THE PROPOSED STORMWATER DRAIN INVERT LEVELS CAN ACHIEVE THE COUNCIL STANDARD CONNECTION DETAIL IN ACCORDANCE WITH COUNCIL STANDARDS
    19.3. VERIFICATION THAT THE ROUTE IS CLEAR OF ALL OBSTRUCTIONS AND EXISTING SERVICES.

    THE CONTRACTOR SHALL NOTIFY THE SUPERINTENDENT IF ANY OF THE ABOVE CANNOT BE ACHIEVED PRIOR TO COMMENCING WORKS ON SITE.
20. THE INTERNAL BASE OF ALL DRAINAGE PITS SHALL BE BENCHED AND SHAPED TO ALLOW FREE FLOW OF WATER THROUGH TO THE PIT OUTLET PIPE.
21. PITS DEEPER THAN 1.0M SHALL BE FITTED WITH STEP IRONS.

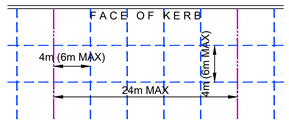
## CONCRETE FINISHING NOTES

1. ALL EXPOSED CONCRETE PAVEMENTS ARE TO BE BROOMED FINISHED U.N.O REFER ARCHITECTURAL / LANDSCAPE DRAWINGS FOR PAVEMENT FINISHES.
2. ALL EDGES OF THE CONCRETE PAVEMENT INCLUDING KEYED AND DOWELLED JOINTS ARE TO BE FINISHED WITH AN EDGING TOOL.
3. CONCRETE PAVEMENTS WITH GRADES GREATER THAN 1:10 SHALL BE HEAVILY BROOM FINISHED.
4. CARBORUNDUM TO BE ADDED TO ALL STAIR TREADS AND RAMPED CROSSINGS U.N.O.

## JOINTING NOTES

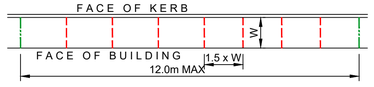
VEHICULAR PAVEMENT JOINTING

1. ALL VEHICULAR PAVEMENTS TO BE JOINTED AS SHOWN ON DRAWINGS.
2. SAW CUT JOINTS SHOULD GENERALLY BE LOCATED AT A MAXIMUM OF 6.0M CENTRES OR 1.5 X THE SPACING OF KEYED JOINTS, WHERE KEY JOINT SPACING IS LESS THAN 4.0M, WITH DOWELLED EXPANSION JOINTS AT MAXIMUM OF 24M CENTRES.
3. PROVIDE 10MM WIDE FULL DEPTH ISOLATION JOINTS BETWEEN BUILDINGS, STRUCTURES AND KERBS.
4. THE TIMING OF THE SAW CUT IS TO BE CONFIRMED BY THE CONTRACTOR ON SITE. SITE CONDITIONS WILL DETERMINE HOW MANY HOURS AFTER THE CONCRETE POUR BEFORE THE SAW CUTS ARE COMMENCED. REFER TO THE SPECIFICATION FOR WEATHER CONDITIONS AND TEMPERATURES REQUIRED.
5. INDICATIVE VEHICULAR PAVEMENT JOINTING AS FOLLOWS.




PEDESTRIAN FOOTPATH JOINTING

1. SAWCUT JOINTS ARE TO BE LOCATED WHERE POSSIBLE AT TANGENT POINTS OF CURVES AND ELSEWHERE.
2. SAW CUT JOINTS ARE TO BE LOCATED AT A MAX 1.5 X WIDTH OF THE PAVEMENT.
3. WHERE POSSIBLE JOINTS SHOULD BE LOCATED TO MATCH KERBING AND / OR ADJACENT PAVEMENT JOINTS.
4. ALL PEDESTRIAN FOOTPATH JOINTINGS AS FOLLOWS (U.N.O).
5. JOINTS SPACING ARE INDICATIVE ONLY AND THE CONTRACTOR TO REFER LANDSCAPE ARCHITECTURAL PLAN FOR FINAL LOCATION.




| Design base thickness, D (mm) | Dowel diameter (mm) |
|---|---|
| 150 < D ≤ 175 | 24 |
| 175 < D ≤ 200 | 28 |
| 200 < D ≤ 260 | 32 |
| D > 260 | 36 |

## BULK EARTHWORKS NOTES

1. CONTRACTOR TO REFERENCE GEOTECHNICAL REPORT BY DOUGLAS PARTNERS 227191.00.R.001Rev0 DATED 15 NOVEMBER 2024 FOR SUBGRADE PREPARATION REQUIREMENTS.
2. ALL BATTERS AT A MAXIMUM SLOPE TO BE CONFIRMED AND SUBJECT TO GEOTECHNICAL ENGINEER ADVICE. REFER TO GEOTECHNICAL REPORT BY DOUGLAS PARTNERS 227191.00.R.001Rev0 DATED 15 NOVEMBER 2024.
3. EXCAVATED MATERIAL MAY BE USED AS STRUCTURAL FILL PROVIDED,
   3.1. IT COMPLIES WITH THE SPECIFICATION REQUIREMENTS FOR FILL MATERIAL,
   3.2. THE PLACEMENT MOISTURE CONTENT COMPLIES WITH THE GEOTECHNICAL CONSULTANTS REQUIREMENTS, AND ALLOWS FILLING TO BE PLACED AND PROOF-ROLLED IN ACCORDANCE WITH THE SPECIFICATION. WHERE NECESSARY THE CONTRACTOR MUST MOISTURE CONDITION THE EXCAVATED MATERIAL TO MEET THESE REQUIREMENTS.

| 4. COMPACT FILL AREAS AND SUBGRADE TO NOT LESS THAN: | | |
|---|---|---|
| LOCATION | STANDARD DRY DENSITY (AS 1289 5.1.1) | OPTIMUM MOISTURE CONTENT (OMC) |
| UNDER BUILDING SLABS ON GROUND | 98% | ±2% |
| UNDER ROADS AND CARPARKS | 98% | ±2% |
| LANDSCAPE AREAS: | 95% | ±2% |

5. BEFORE PLACING FILL, PROOF ROLL EXPOSED SUBGRADE WITH A 10 TONNE MINIMUM ROLLER TO TEST SUBGRADE AND THEN REMOVE SOFT SPOTS (AREAS WITH MORE THAN 3MM MOVEMENT UNDER ROLLER). SOFT SPOTS TO BE REPLACED WITH GRANULAR FILL UNLESS NOTED OTHERWISE.
6. CONTRACTOR SHALL PLACE SAFETY BARRIERS AROUND EXCAVATIONS IN ACCORDANCE WITH RELEVANT SAFETY REGULATIONS.
7. BULK EARTHWORKS DRAWINGS ARE NOT TO BE USED FOR DETAILED EXCAVATION IN LANDSCAPE ZONES. CONTRACTOR TO MAKE ALLOWANCE FOR ADDITIONAL FILL OR CUT THROUGH LANDSCAPE ZONES.
8. CONTRACTOR TO REVIEW LANDSCAPE DRAWINGS TO CONFIRM SOFTSCAPE PROFILE DEPTHS.
9. STRIP ALL TOPSOIL FROM THE CONSTRUCTION AREA. ALL STRIPPED TOPSOIL SHALL BE DISPOSED OF OFFSITE UNLESS DIRECTED OTHERWISE.
10. MAKE SMOOTH CONNECTION WITH ALL EXISTING WORKS
11. COMPACT SUBGRADE UNDER BUILDINGS AND PAVEMENTS TO MINIMUM 98% STANDARD MAXIMUM DRY DENSITY IN ACCORDANCE WITH AS1289.5.1.1. COMPACTION UNDER BUILDINGS TO EXTEND 2.0M MINIMUM BEYOND BUILDING FOOTPRINT.
12. TEMPORARY STORMWATER CONTROL AND CONNECTIONS TO BE MANAGED ONSITE BY THE BUILDER/CONTRACTOR.
13. SITE TO BE FREE DRAINING AND SUBGRADE TO BE PROTECTED FROM MOISTURE INGRESS.
14. DEWATERING TO BE MANAGED BY CONTRACTOR AT ALL TIMES.
15. QUANTITIES TO UNDERLYING GEOLOGY SUCH AS ROCK OR NATURAL CLAY ARE INDICATIVE ONLY AND BASED ON THE GEOTECHNICAL INFORMATION AVAILABLE AT THE TIME OF ISSUE. UNDERLYING NATURAL CLAY AND ROCK LEVELS CAN BE HIGHLY VARIABLE BETWEEN GEOTECH SAMPLE LOCATIONS.
16. ALL EARTHWORKS ACTIVITIES SHALL BE UNDERTAKEN WITH LEVEL 1 SUPERVISION IN ACCORDANCE WITH AS3798 (2007) BY A SUITABLY QUALIFIED GEOTECHINICAL INSPECTION AND TESTING AUTHORITY (GITA) ENGAGED BY THE CONTRACTOR. AS A MINIMUM, THE FREQUENCY AND LOCATION OF TESTING SHALL BE IN ACCORDANCE WITH TABLE 8.1 OF AS3798 (2007). THE GITA IS TO MAINTAIN DAILY SITE RECORD SHEETS AS SET OUT IN AS3798 (2007).

## EROSION AND SEDIMENT CONTROL

THESE DRAWINGS SHALL BE READ IN CONJUNCTION WITH ALL OTHER ENGINEERING AND ARCHITECTURAL DRAWINGS.

1. ALL WORK SHALL BE GENERALLY CARRIED OUT IN ACCORDANCE WITH:
   1.1. LOCAL AUTHORITY REQUIREMENTS
   1.2. EPA - POLLUTION CONTROL MANUAL FOR URBAN STORMWATER,
2. EROSION AND SEDIMENT CONTROL ARE TO BE PROVIDED FOR THE WHOLE OF THE WORKS BY THE CONTRACTOR. SHOULD THE CONTRACTOR STAGE THESE WORKS THEN THE DESIGN MAY BE REQUIRED TO BE MODIFIED. VARIATION TO THESE DETAILS MAY REQUIRE APPROVAL BY THE RELEVANT AUTHORITIES. THE EROSION AND SEDIMENT CONTROL SHALL BE IMPLEMENTED AND ADOPTED TO MEET RELEVANT EPA AND/OR AUTHORITY GUIDELINES
3. MAINTAIN ALL EROSION AND SEDIMENT CONTROL DEVICES TO THE SATISFACTION OF THE SUPERINTENDENT AND THE LOCAL AUTHORITY.
4. WHEN STORMWATER PITS ARE CONSTRUCTED PREVENT SITE RUNOFF ENTERING THE PITS UNLESS SILT FENCES ARE ERECTED AROUND PITS.
5. MINIMISE THE AREA OF SITE BEING DISTURBED AT ANY ONE TIME.
6. PROTECT ALL STOCKPILES OF MATERIALS FROM SCOUR AND EROSION. DO NOT STOCKPILE LOOSE MATERIAL IN ROADWAYS, NEAR DRAINAGE PITS OR IN WATERCOURSES.
7. ALL SOIL AND WATER CONTROL MEASURES ARE TO BE PUT BACK IN PLACE AT THE END OF EACH WORKING DAY, AND MODIFIED TO BEST SUIT SITE CONDITIONS.
8. CONTROL WATER FROM UPSTREAM OF THE SITE SUCH THAT IT DOES NOT ENTER THE DISTURBED SITE.
9. ALL CONSTRUCTION VEHICLES SHALL ENTER AND EXIT THE SITE VIA THE TEMPORARY CONSTRUCTION ENTRY/EXIT.
10. ALL VEHICLES LEAVING THE SITE SHALL BE CLEANED AND INSPECTED BEFORE LEAVING.
11. MAINTAIN ALL STORMWATER PIPES AND PITS CLEAR OF DEBRIS AND SEDIMENT. INSPECT STORMWATER SYSTEM AND CLEAN OUT AFTER EACH STORM EVENT.
12. CLEAN OUT ALL EROSION AND SEDIMENT CONTROL DEVICES AFTER EACH STORM EVENT.

SEQUENCE OF WORKS

1. PRIOR TO COMMENCEMENT OF EXCAVATION THE FOLLOWING SOIL MANAGEMENT DEVICES MUST BE INSTALLED.
   1.1. CONSTRUCT SILT FENCES BELOW THE SITE AND ACROSS ALL POTENTIAL RUNOFF SITES.
   1.2. CONSTRUCT TEMPORARY CONSTRUCTION ENTRY/EXIT AND DIVERT RUNOFF TO SUITABLE CONTROL SYSTEMS.
   1.3. CONSTRUCT MEASURES TO DIVERT UPSTREAM FLOWS INTO EXISTING STORMWATER SYSTEM.
   1.4. CONSTRUCT SEDIMENTATION TRAPS/BASIN INCLUDING OUTLET CONTROL AND OVERFLOW.
   1.5. CONSTRUCT TURF LINED SWALES.
   1.6. PROVIDE SANDBAG SEDIMENT TRAPS UPSTREAM OF EXISTING PITS.
2. CONSTRUCT GEOTEXTILE FILTER PIT SURROUND AROUND ALL PROPOSED PITS AS THEY ARE CONSTRUCTED.
3. ON COMPLETION OF PAVEMENT PROVIDE SAND BAG KERB INLET SEDIMENT TRAPS AROUND PITS.
4. PROVIDE AND MAINTAIN A STRIP OF TURF ON BOTH SIDES OF ALL ROADS AFTER THE CONSTRUCTION OF KERBS.

## SERVICE TRENCHES

EXCAVATION

1. BEFORE EXCAVATING TRENCHES THROUGH EXISTING PAVEMENT, SAW-CUT EXISTING CONCRETE AND BITUMINOUS SURFACES ON EACH SIDE OF THE TRENCH TO PROVIDE A STRAIGHT EVEN JOINT. LIFT AND STORE UNIT PAVING FOR LATER REINSTATEMENT.

2. EXCAVATE FOR UNDERGROUND SERVICES, TO REQUIRED LINES, LEVELS AND GRADES. GENERALLY MAKE THE TRENCHES STRAIGHT BETWEEN MANHOLES, INSPECTION POINTS AND JUNCTIONS, WITH VERTICAL SIDES AND UNIFORM GRADES. EXCAVATION OF SERVICE TRENCHES SHALL BE COMPLETED PRIOR TO LIME STABILIZATION OF THE SUBGRADE. NOTIFY THE CONTRACT ADMINISTRATOR IF ANY TRENCHES ARE BE TO EXCAVATED IN STABILISED GROUND. ANY TRENCHES IN STABILISED GROUND TO BE BACKFILLED AS SPECIFIED IN THE "BACKFILLING" NOTES.

3. KEEP TRENCH WIDTHS TO THE MINIMUM CONSISTENT WITH THE LAYING AND BEDDING OF THE RELEVANT SERVICE AND CONSTRUCTION OF PERSONNEL ACCESS WAYS AND PITS.

4. EXCAVATE TRENCHES IN SECTIONS OF SUITABLE LENGTH.

5. TRENCH DEPTHS TO BE CONSTRUCTED AS REQUIRED BY THE RELEVANT SERVICE AND ITS BEDDING METHOD.

6. IF EXCAVATION IS NECESSARY BELOW THE LEVEL OF ADJACENT FOOTINGS, GIVE NOTICE, AND PROVIDE NECESSARY SUPPORT FOR THE FOOTINGS.

7. CLEAR TRENCHES OF SHARP PROJECTIONS. CUT BACK ROOTS ENCOUNTERED IN TRENCHES TO AT LEAST 600MM CLEAR OF SERVICES. REMOVE OTHER OBSTRUCTIONS INCLUDING STUMPS AND BOULDERS WHICH MAY INTERFERE WITH SERVICES OR BEDDING.

8. KEEP TRENCHES FREE OF WATER. PLACE BEDDING MATERIAL, SERVICES AND BACKFILLING ON FIRM GROUND FREE OF SURFACE WATER.

9. IF TRENCH EXCAVATION EXCEEDS THE CORRECT DEPTH, REINSTATE TO THE CORRECT DEPTH AND BEARING VALUE USING COMPACTED BEDDING MATERIAL OR GRADE 20MPA CONCRETE.

BACKFILLING

THESE REQUIREMENTS APPLY TO BACKFILL TO STORMWATER DRAINAGE TRENCHES AND SERVICE ACCESS POINTS. BEDDING AND OVERLAY TO A MINIMUM DEPTH OF 200MM ABOVE THE SERVICE SHALL BE PIPE BEDDING AS SPECIFIED BELOW UNLESS SPECIFIED OTHERWISE IN RELEVANT SERVICE SPECIFICATION. TRENCH BACKFILL ABOVE THIS LEVEL SHALL BE BACKFILL MATERIAL AS SPECIFIED BELOW. BEDDING, OVERLAY AND TRENCH BACKFILL TO BE COMPACTED IN ACCORDANCE WITH THE COMPACTION SCHEDULE. PLACE FILLING IN LAYERS NOT EXCEEDING 200MM COMPACTED LAYER THICKNESS.

PIPE BEDDING

UNLESS NOTED OTHERWISE IN "STORMWATER DRAINAGE" NOTES, PIPE BEDDING TO BE GRANULAR MATERIAL (CLEAN SHARP WASHED RIVER SAND OR CLEAN UNWEATHERED HARD BASALTIC OR SEDIMENTARY CRUSHED ROCK, FREE OF SALT, CLAY OR ORGANIC CONTAMINANTS) OR CEMENTITIOUS MATERIAL (MORTAR OR CONCRETE) AS SPECIFIED.

CRUSHED ROCK:

| SLEVE APERTURE (mm) TO AS 1152 | PERCENTAGE PASSING (BY MASS) |
|---|---|
| 9.50 | 98 TO 100 |
| 6.70 | 50 TO 100 |
| 4.75 | 15 TO 75 |
| 2.36 | 0 TO 40 |
| 1.16 | 0 TO 5 |

CEMENT MORTAR BEDDING: 1 PORTLAND CEMENT: 4 SAND.
CONCRETE BEDDING: NOT LESS THAN 20 MPA.

BACKFILL MATERIAL

GENERAL: GENERAL FILL EXCEPT WITH NO STONES GREATER THAN 25 MM OCCURRING WITHIN 150 MM OF THE SERVICE, OR OTHER MATERIALS AS REQUIRED FOR PARTICULAR SERVICES OR LOCATIONS. WELL GRADED, INORGANIC, NON-PERISHABLE MATERIAL, MAXIMUM SIZE 75 MM, PLASTICITY INDEX * 55% AND CLASSIFIED AS CLASS A OR CLASS S MATERIAL IN TABLE 2.1 OF AS 2870. FILL MATERIAL TO HAVE A MINIMUM 4 DAY SOAKED CBR OF 4% IN ACCORDANCE WITH AS 1239.6.1.1 UNLESS NOTED OTHERWISE ON DRAWINGS. MATERIAL TO BE NON-DISPERSIVE (A RATING OF NIL AS DEFINED BY THE DISPERSION TEST AS 1239.3.8.1).

UNDER ROADS AND PAVED AREAS: COARSE SAND, FINE CRUSHED ROCK, OR 3% CEMENT STABILISED SAND.

IN TOPSOIL AREAS: COMPLETE THE BACKFILLING WITH TOPSOIL FOR AT LEAST THE TOP 50 MM.

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| Rev | Description | Eng Draft | Date |
|---|---|---|---|
| T4 | TENDER ADDENDUM ISSUE | RP | KN 02.05.2025 |
| T3 | TENDER ADDENDUM ISSUE | RP | KN 19.12.2024 |
| T2 | TENDER ISSUE | RP | JLE 08.10.2024 |
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| P2 | PRELIMINARY ISSUE | RP | JLE 23.09.2024 |
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Client: WESTERN SYDNEY UNIVERSITY

Engineer: TTW www.ttwengineers.com

Project: WSU CARPARK RELOCATION PROJECT

Drawing Title: GENERAL NOTES AND LEGENDS SHEET 1

| Scale at A1 | Drawn | Designed | Approved |
|---|---|---|---|
| | KN | JLE | RP |

| Project No | Originator | Zone | Type | Role | Sheet No. | Rev |
|---|---|---|---|---|---|---|
| 234338 | TTW | 01 | DR | CI | 00002 | T4 |

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| AREA | COMPACTION RATIO % OF MAXIMUM DRY DENSITY OR DENSITY INDEX (DI) | MOISTURE % FROM OPTIMUM* |
|---|---|---|
| LANDSCAPE AREA | | |
| BEDDING AND OVERLAY | 70 (DI) | ±2 |
| TRENCH BACKFILL | 70 (DI) OR 95% STANDARD | ±2 |
| UNDER OR WITHIN LINE OF INFLUENCE OF PAVEMENTS, STRUCTURES OR BUILDING SLABS | | |
| BEDDING AND OVERLAY | 80 (DI) | ±2 |
| TRENCH BACKFILL | 80 (DI) OR 98% STANDARD | ±2 |
| PAVEMENT ZONE | 98% MODIFIED | ±2 |

## SIGNS AND LINE MARKING

1. PAVEMENT MARKING AND SIGN POSTING ON PUBLIC ROADS SHALL BE IN ACCORDANCE WITH THE REQUIREMENTS OF THE RELEVANT ROAD AUTHORITY. THE CONTRACTOR SHALL OBTAIN THESE REQUIREMENTS FROM THE ROAD AUTHORITY.
2. PAVEMENT MARKING AND SIGN POSTING TO BE IN ACCORDANCE WITH R.T.A. 'INTERIM GUIDE TO SIGNS AND MARKINGS'.
3. CONTRACTOR IS TO PROVIDE GUIDE POSTS, SPACED IN ACCORDANCE WITH AS1742.2. THEY ARE TO BE LOCATED NEAR ALL HEAD WALLS AND PIPE OUTLETS.
4. RAISED PAVEMENT MARKERS TO BE IN ACCORDANCE WITH AS1742.2
5. WHERE EXISTING PAVEMENT MARKING CONFLICTS WITH PROPOSED, IT IS TO BE REMOVED.
6. LANE WIDTHS DO NOT INCLUDE WIDTH OF GUTTER.
7. LINE MARKING PLAN DOES NOT DEFINE BOUNDARIES.
8. ERECT TEMPORARY SIGN 'CHANGED TRAFFIC CONDITIONS AHEAD' 120M AHEAD OF NEW WORK IN BOTH DIRECTIONS.
9. ESTABLISH THE LOCATION OF EXISTING UTILITY SERVICES AND LOCATE NEW SIGNS CLEAR OF THESE INSTALLATIONS.
10. THE SLOPED FACE OF THE SF MEDIAN KERBS WHICH ADJOIN THROUGH LANES, ARE TO BE PAINTED WHITE IN LIEU OF AN E3 EDGE LINE. THE REFLECTIVE PAVEMENT MARKERS NORMALLY ASSOCIATED WITH AN E3 EDGE LINE ARE TO BE LOCATED ON THE PAVEMENT ADJACENT TO THE SF KERB.
11. BICYCLE PAVEMENT MARKINGS AND SIGN POSTING TO BE IN ACCORDANCE WITH AUSTROADS STANDARDS.
12. THE DESIGN OF MAJOR DIRECTIONAL SIGN POSTING TO BE PREPARED AND ASSESSED BY THE RELAVENT ROAD AUTHORITY

## SAFETY IN DESIGN

EXISTING SERVICES
BEFORE EXCAVATING TRENCHES THROUGH EXISTING PAVEMENT, SAW-CUT EXISTING CONCRETE AND BITUMINOUS SURFACES ON EACH SIDE OF THE TRENCH TO PROVIDE A STRAIGHT EVEN JOINT. LIFT AND STORE UNIT PAVING FOR LATER REINSTATEMENT.

EXISTING STRUCTURES
CONTRACTOR TO BE AWARE EXISTING STRUCTURES MAY EXIST WITHIN THE SITE. TO PREVENT DAMAGE TO EXISTING STRUCTURE(S) AND/OR PERSONNEL, SITE WORKS TO BE CARRIED OUT AS FAR AS PRACTICABLY POSSIBLE FROM EXISTING STRUCTURE(S).

EXISTING TREES
CONTRACTOR TO BE AWARE EXISTING TREES EXIST WITHIN THE SITE WHICH NEED TO BE PROTECTED. TO PREVENT DAMAGE TO TREES AND/OR PERSONNEL, SITE WORKS TO BE CARRIED OUT AS FAR AS PRACTICABLY POSSIBLE FROM EXISTING TREES. ADVICE NEEDS TO BE SOUGHT FROM ARBORIST AND/OR LANDSCAPE ARCHITECT ON MEASURES REQUIRED TO PROTECT TREES.

GROUNDWATER
CONTRACTOR TO BE AWARE OF GROUNDWATER LEVELS CLOSE TO EXISTING SURFACE LEVEL. TEMPORARY DE-WATERING MAY BE REQUIRED DURING CONSTRUCTION WORKS.

EXCAVATIONS
DEEP EXCAVATIONS DUE TO STORMWATER DRAINAGE WORKS IS REQUIRED. CONTRACTOR TO ENSURE SAFE WORKING PROCEDURES ARE IN PLACE FOR WORKS. ALL EXCAVATIONS TO BE FENCED OFF AND BATTERS ADEQUATELY SUPPORTED TO APPROVAL OF GEOTECHNICAL ENGINEER.

GROUND CONDITIONS
CONTRACTOR TO BE AWARE OF THE SITE GEOTECHNICAL CONDITIONS. REFER TO THE GEOTECHNICAL REPORT FOR FURTHER INFORMATION.

HAZARDOUS MATERIALS
EXISTING ASBESTOS PRODUCTS & CONTAMINATED MATERIAL MAY BE PRESENT ON SITE. CONTRACTOR TO ENSURE ALL HAZARDOUS MATERIALS ARE IDENTIFIED PRIOR TO COMMENCING WORKS. SAFE WORKING PRACTISES AS PER RELEVANT AUTHORITY TO BE ADOPTED AND APPROPRIATE PPE TO BE USED WHEN HANDLING ALL HAZARDOUS MATERIALS. REFER TO GEOTECHNICAL REPORT FOR FURTHER INFORMATION.

CONFINED SPACES
CONTRACTOR TO BE AWARE OF POTENTIAL HAZARDS DUE TO WORKING IN CONFINED SPACES SUCH AS STORMWATER PITS, TRENCHES AND/OR TANKS. CONTRACTOR TO PROVIDE SAFE WORKING METHODS AND USE APPROPRIATE PPE WHEN ENTERING CONFINED SPACES.

MANUAL HANDLING
CONTRACTOR TO BE AWARE MANUAL HANDLING MAY BE REQUIRED DURING CONSTRUCTION. CONTRACTOR TO TAKE APPROPRIATE MEASURES TO ENSURE MANUAL HANDLING PROCEDURES AND ASSESSMENTS ARE IN PLACE PRIOR TO COMMENCING WORKS.

WATER POLLUTION
CONTRACTOR TO ENSURE APPROPRIATE MEASURES ARE TAKEN TO PREVENT POLLUTANTS FROM CONSTRUCTION WORKS CONTAMINATING THE SURROUNDING ENVIRONMENT, INCLUDING COUNCIL STORMWATER DRAINAGE SYSTEM.

SITE ACCESS/EGRESS
CONTRACTOR TO BE AWARE SITE WORKS OCCUR IN CLOSE PROXIMITY TO FOOTPATHS AND ROADWAYS. CONTRACTOR TO ERECT APPROPRIATE BARRIERS AND SIGNAGE TO PROTECT SITE PERSONNEL AND PUBLIC.

VEHICLE MOVEMENT
CONTRACTOR TO SUPPLY AND COMPLY WITH TRAFFIC MANAGEMENT PLAN AND PROVIDE ADEQUATE SITE TRAFFIC CONTROL INCLUDING A CERTIFIED TRAFFIC MARSHALL TO SUPERVISE VEHICLE MOVEMENTS WHERE NECESSARY.

## ABBREVIATIONS

| | | | |
|---|---|---|---|
| TOK | TOP OF KERB | EX | EXISTING LEVEL |
| IOK | INVERT OF KERB | FL | FINISHED LEVEL |
| BOK | BACK OF KERB | F* | FUTURE LEVEL |
| RCL | ROAD CENTRE LINE | | |
| BDY | BOUNDARY | FFL | FINISHED FLOOR LEVEL |
| | | SSL | STRUCTURAL SLAB LEVEL |
| TOW | TOP OF WALL | | |
| BOW | BOTTOM OF WALL | | |

CL COVER LEVEL
IL INVERT LEVEL

SITEWORKS LEGEND

- × F22.20 — Finished surface level
- 22.00 — Finished major contour
- 22.10 — Finished minor contour
- Property Boundary
- KG — Kerb & Gutter
- KO — Kerb Only
- ES — Edge Strip
- DD — Dish Drain
- Vehicular Crossing
- Pedestrian Kerb Ramp
- IL 10.20 — Stormwater pit and drain
- GT — Grated Trench
- AG — Ag Drain
- GI — Grated Inlet / Floor Waste
- Concrete Endwall
- IO — Inspection Opening with subsoil drainage line (100 dia) to be provided at the start of all AG
- FP — Flushout point with subsoil drainage line (100 dia)
- Concrete encased stormwater line
- Overland Flowpath
- Wheelstop
- RW — Retaining wall
- Batter
- Tool Joint
- Expansion Joint
- Dowelled Tool Joint
- Dowelled Expansion Joint
- Grass Swale
- Guard Rail
- Fence
- TPZ — Tree Protection Zone
- SRZ — Structural Root Zone
- Low Priority for Retention (TPZ)
- Medium Priority for Retention (TPZ)
- High Priority for Retention (TPZ)
- Tree to be Demolished
- Indicative 1% AEP Flood Extent

EXISTING SERVICES LEGEND

- bCOMM — TELECOMS
- bG — GAS
- bE — ELECTRICAL
- bHV — ELECTRICAL (OVERHEAD)
- bW — WATER
- bSW — STORMWATER
- bS — SEWER

DRAWINGS TO BE PRINTED IN COLOUR
Y M C R G B K

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| Rev | Description | Eng Draft | Date |
|---|---|---|---|
| T4 | TENDER ADDENDUM ISSUE | RP | KN 02.05.2025 |
| T3 | TENDER ADDENDUM ISSUE | RP | KN 19.12.2024 |
| T2 | TENDER ISSUE | RP | JLE 08.10.2024 |
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Client: WESTERN SYDNEY UNIVERSITY

Engineer: TTW www.ttwengineers.com

Project: WSU CARPARK RELOCATION PROJECT

Drawing Title: GENERAL NOTES AND LEGENDS SHEET 2

| Scale at A1 | Drawn | Designed | Approved |
|---|---|---|---|
| | KN | JLE | RP |

| Project No | Originator | Zone | Type | Role | Sheet No. | Rev |
|---|---|---|---|---|---|---|
| 234338 | TTW | | 01 | DR | CI-00003 | T4 |

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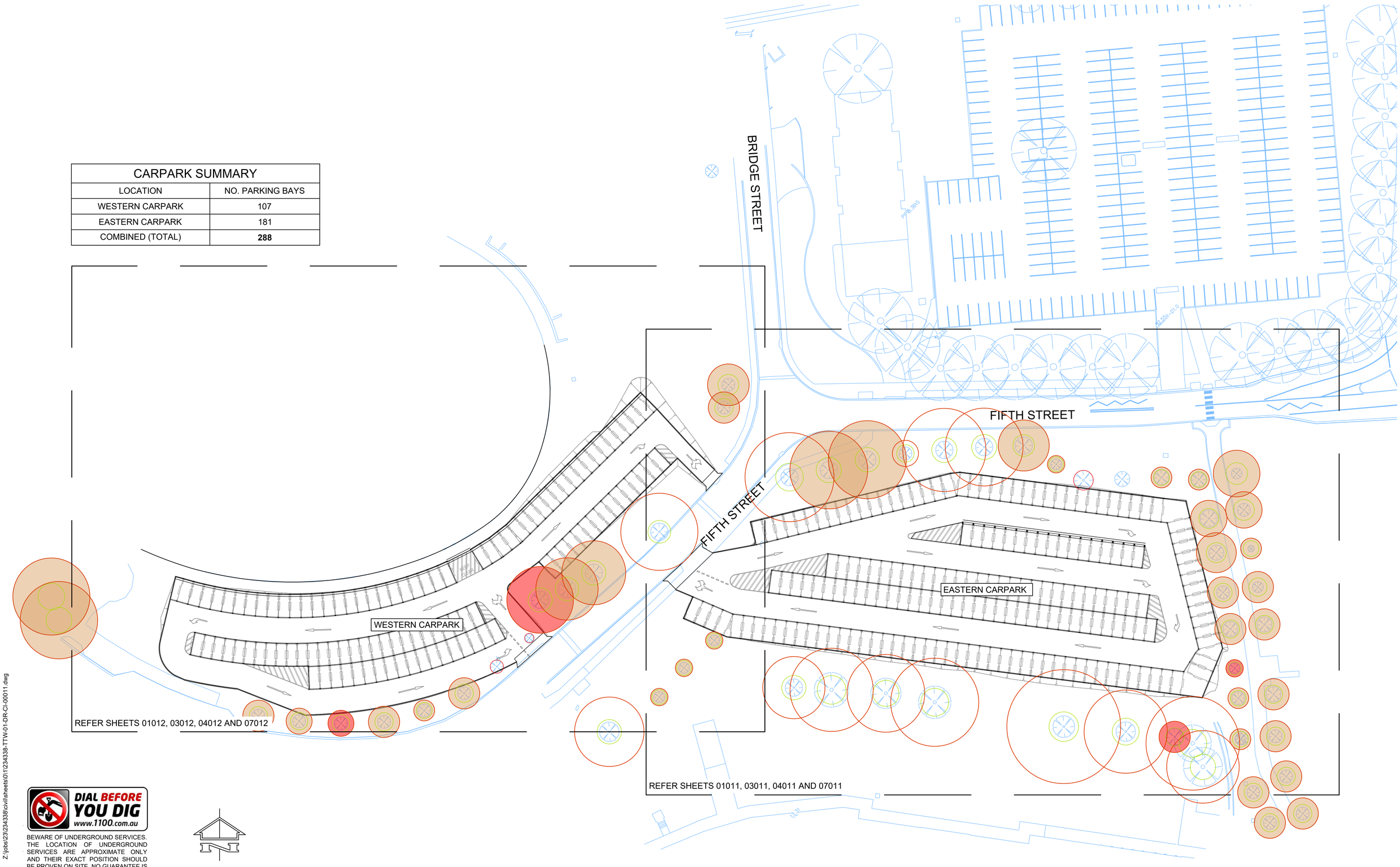
| CARPARK SUMMARY | |
|---|---|
| LOCATION | NO. PARKING BAYS |
| WESTERN CARPARK | 107 |
| EASTERN CARPARK | 181 |
| COMBINED (TOTAL) | **288** |

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DIAL BEFORE YOU DIG www.1100.com.au

BEWARE OF UNDERGROUND SERVICES. THE LOCATION OF UNDERGROUND SERVICES ARE APPROXIMATE ONLY AND THEIR EXACT POSITION SHOULD BE PROVEN ON SITE. NO GUARANTEE IS GIVEN THAT ALL EXISTING SERVICES ARE SHOWN

0.0 8.0 16.0 24.0 32.0m
1:400 A1 1:800 A3

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| Rev | Description | Eng Draft | Date |
|---|---|---|---|
| T4 | TENDER ADDENDUM ISSUE | RP KN | 02.05.2025 |
| T3 | TENDER ADDENDUM ISSUE | RP KN | 19.12.2024 |
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Client: WESTERN SYDNEY UNIVERSITY

Engineer: TTW www.ttwengineers.com

Project: WSU CARPARK RELOCATION PROJECT

Drawing Title: GENERAL ARRANGEMENT PLAN

| Scale at A1 | Drawn | Designed | Approved |
|---|---|---|---|
| 1:400 | KN | JLE | RP |

| Project No | Originator | Zone | Type | Role | Sheet No. | Rev |
|---|---|---|---|---|---|---|
| 234338 | TTW | | 01 | DR | CI-00011 | T4 |

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KEEP CLEAR LINEMARKING FOR ACCESS TO OVAL

ALLOW FOR 9 FIXED AND 3 REMOVABLE BOLLARDS IN HATCH AREAS OF THE WESTERN CARPARK TO PREVENT PARKING. LOCATIONS TO BE CONFIRMED IN CONSTRUCTION DOCUMENTATION

ALL PARKING BAYS TO BE 5.4m LONG x 2.5m WIDE

LINEMARK KERB AT START AND END OF PARKING BAY TO DELINEATE INDIVIDUAL BAYS. (TYPICAL) INTERMITTENT AT KERB/EDGE STRIP ONLY

5.4

2.5

KEEP CLEAR

ONE WAY

R2-17(A)

ONE WAY

R2-17(A)

GIVE WAY

R1-2

ONLY

R2-14(A)L

FIFTH STREET

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BEWARE OF UNDERGROUND SERVICES. THE LOCATION OF UNDERGROUND SERVICES ARE APPROXIMATE ONLY AND THEIR EXACT POSITION SHOULD BE PROVEN ON SITE. NO GUARANTEE IS GIVEN THAT ALL EXISTING SERVICES ARE SHOWN

0.0 4.0 8.0 12.0 16.0m

1:200 A1 1:400 A3

NOT FOR CONSTRUCTION

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| Rev | Description | Eng Draft | Date |
|---|---|---|---|
| T4 | TENDER ADDENDUM ISSUE | RP KN | 02.05.2025 |
| T3 | TENDER ADDENDUM ISSUE | RP KN | 19.12.2024 |
| T2 | TENDER ISSUE | RP JLE | 08.10.2024 |
| T1 | TENDER ISSUE | RP AE | 03.10.2024 |

Client: WESTERN SYDNEY UNIVERSITY

Engineer: TTW www.ttwengineers.com

Project: WSU CARPARK RELOCATION PROJECT

Drawing Title: TRAFFIC CONTROL SIGNAGE AND LINEMARKING SHEET 2

| Scale at A1 | Drawn | Designed | Approved |
|---|---|---|---|
| 1:200 | KN | JLE | RP |

| Project No | Originator | Zone | Type | Role | Sheet No. | Rev |
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| 234338 | TTW | 01 | DR | CI | 07012 | T4 |

02.05.2025 4:43 PM

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FIFTH STREET

FIFTH STREET

ALL PARKING BAYS TO BE 5.4m LONG x 2.5m WIDE

LINEMARK KERB AT START AND END OF PARKING BAY TO DELINEATE INDIVIDUAL BAYS (TYPICAL). INTERMITTENT AT KERB/EDGE STRIP ONLY

ALLOW FOR 14 FIXED BOLLARDS IN HATCH AREAS OF THE EASTERN CARPARK TO PREVENT PARKING. LOCATIONS TO BE CONFIRMED IN CONSTRUCTION DOCUMENTATION

5.4

2.5

ONE WAY R2-17(A)

ONE WAY R2-17(A)

R2-17(A)

ONLY R2-14(A)R

R4-14(A)

R4-1(A)

10

10

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| T2 | TENDER ISSUE | RP JLE | 08.10.2024 |
| T1 | TENDER ISSUE | RP AE | 03.10.2024 |

Client: WESTERN SYDNEY UNIVERSITY

Engineer: TTW www.ttwengineers.com

Project: WSU CARPARK RELOCATION PROJECT

Drawing Title: TRAFFIC CONTROL SIGNAGE AND LINEMARKING SHEET 1

| Scale at A1 | Drawn | Designed | Approved |
|---|---|---|---|
| 1:200 | KN | JLE | RP |

| Project No | Originator | Zone | Type | Role | Sheet No. | Rev |
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| 234338 | TTW | 01 | DR | CI | 07011 | T4 |

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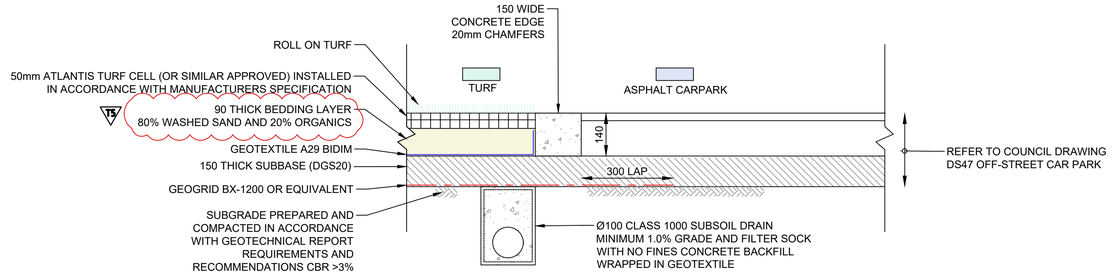
## PAVEMENT LEGEND

**P1** — VEHICULAR ASPHALT PAVEMENT
REFER TO CITY OF PARRAMATTA COUNCIL STANDARD DRAWING DS47 PAVEMENT FOR OFF-STREET CAR PARK.
PROVIDE BIDIM A29 GEOTEXTILE.

**P2** — VEHICULAR CONCRETE PAVEMENT
REFER TO CITY OF PARRAMATTA COUNCIL STANDARD DRAWING DS8

**P3** — ATLANTIS TURF CELL (OR SIMILAR APPROVED)
REFER TO PRODUCT SPECIFICATIONS

NOTES:
1. ANY UNCONTROLLED / SOFT SPOT TO BE REMOVED AND BACKFILL WITH ENGINEERING FILL / PROOF ROLL AND COMPACTED IN ACCORDANCE WITH GEOTECHNICAL ENGINEER'S RECOMMENDATION.




## PAVEMENT EDGE DETAIL
## ASPHALT VEHICULAR AND ATLANTIS TURF CELL INTERFACE
SCALE N.T.S

NOTE: WORKS WITHIN CLOSE PROXIMITY TO EXISTING RETAINED TREES TO BE SUPERVISED BY A SUITABLY QUALIFIED ARBORIST. REFER TO PRELIMINARY TREE ASSESSMENT (PTA) DATED 25/08/24 BY TREE SURVEY FOR INFORMATION ON EXISTING TREES. IMPLEMENT APPROPRIATE TREE PROTECTION MEASURES IN ACCORDANCE WITH ARBORIST REQUIREMENTS. MAXIMUM 10% ENCROACHMENT INTO TPZ FOR TREES TO BE RETAINED.

REFER TO PAVEMENT EDGE DETAIL ABOVE FOR INTERFACE DETAIL

KEEP CLEAR

FIFTH STREET

P1 P2 P3

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| T4 | TENDER ADDENDUM ISSUE | RP KN | 02.05.2025 |
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| T2 | TENDER ISSUE | RP JLE | 08.10.2024 |
| T1 | TENDER ISSUE | RP JLE | 03.10.2024 |
| P2 | PRELIMINARY ISSUE | RP JLE | 23.09.2024 |
| P1 | PRELIMINARY ISSUE | RP PB | 13.09.2024 |
| T5 | TENDER ADDENDUM ISSUE | RP SFU | 06.05.2025 |

Client: WESTERN SYDNEY UNIVERSITY

Engineer: TTW www.ttwengineers.com

Project: WSU CARPARK RELOCATION PROJECT

Drawing Title: PAVEMENT AND JOINTING PLAN SHEET2

| Scale at A1 | Drawn | Designed | Approved |
|---|---|---|---|
| 1:200 | KN | JLE | RP |

| Project No | Originator | Zone | Type | Role | Sheet No. | Rev |
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| 234338 | TTW | 01 | DR | CI | 03012 | T5 |

06.05.2025 11:35 AM

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## PAVEMENT LEGEND

**P1** — VEHICULAR ASPHALT PAVEMENT
REFER TO CITY OF PARRAMATTA COUNCIL STANDARD DRAWING DS47 PAVEMENT FOR OFF-STREET CAR PARK.
PROVIDE BIDIM A29 GEOTEXTILE.

**P2** — VEHICULAR CONCRETE PAVEMENT
REFER TO CITY OF PARRAMATTA COUNCIL STANDARD DRAWING DS8

**P3** — ATLANTIS TURF CELL (OR SIMILAR APPROVED)
REFER TO PRODUCT SPECIFICATIONS

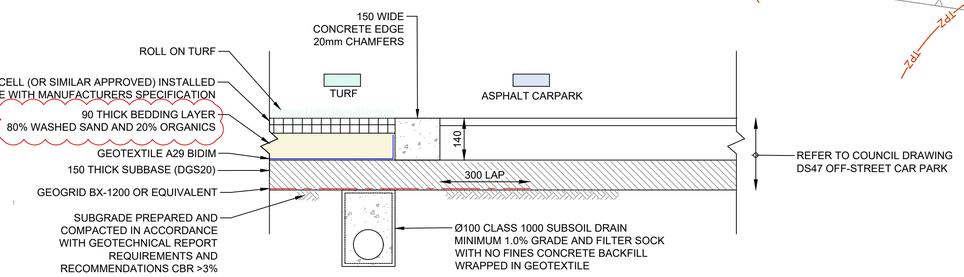
NOTES:
1. ANY UNCONTROLLED / SOFT SPOT TO BE REMOVED AND BACKFILL WITH ENGINEERING FILL / PROOF ROLL AND COMPACTED IN ACCORDANCE WITH GEOTECHNICAL ENGINEER'S RECOMMENDATION.

FIFTH STREET

FIFTH STREET

REFER TO PAVEMENT EDGE DETAIL BELOW FOR INTERFACE DETAIL

NOTE: WORKS WITHIN CLOSE PROXIMITY TO EXISTING RETAINED TREES TO BE SUPERVISED BY A SUITABLY QUALIFIED ARBORIST. REFER TO PRELIMINARY TREE ASSESSMENT (PTA) DATED 25/08/24 BY TREE SURVEY FOR INFORMATION ON EXISTING TREES. IMPLEMENT APPROPRIATE TREE PROTECTION MEASURES IN ACCORDANCE WITH ARBORIST REQUIREMENTS. MAXIMUM 10% ENCROACHMENT INTO TPZ FOR TREES TO BE RETAINED.




## PAVEMENT EDGE DETAIL
## ASPHALT VEHICULAR AND ATLANTIS TURF CELL INTERFACE
SCALE N.T.S

0.0 4.0 8.0 12.0 16.0m
1:200 A1 1:400 A3

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| T2 | TENDER ISSUE | RP | JLE | 08.10.2024 |
| T1 | TENDER ISSUE | RP | JLE | 03.10.2024 |
| P2 | PRELIMINARY ISSUE | RP | JLE | 23.09.2024 |
| P1 | PRELIMINARY ISSUE | RP | PB | 13.09.2024 |
| T5 | TENDER ADDENDUM ISSUE | RP | SFU | 06.05.2025 |

Client: WESTERN SYDNEY UNIVERSITY
Engineer: TTW www.ttwengineers.com
Project: WSU CARPARK RELOCATION PROJECT
Drawing Title: PAVEMENT AND JOINTING PLAN SHEET 1

| Scale at A1 | Drawn | Designed | Approved |
|---|---|---|---|
| 1:200 | KN | JLE | RP |

| Project No | Originator | Zone | Type | Role | Sheet No. | Rev |
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| 234338 | TTW | | | | 03011 | T5 |

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## CUT AND FILL VOLUME ESTIMATES

EASTERN CARPARK
CUT 940 $m^3$
FILL 110 $m^3$

WESTERN CARPARK
CUT 310 $m^3$
FILL 190 $m^3$

FX.XX DENOTES CUT AND FILL DEPTH FROM THE NATURAL SURFACE TO THE DESIGN FINISHED SURFACE

NOTES:
1. NO BULKING FACTOR APPLIED.
2. CUT AND FILL VOLUME ESTIMATES CALCULATED FROM THE NATURAL SURFACE TO THE DESIGNED FINISHED SURFACE.
3. NO VOLUME ALLOWANCE HAS BEEN MADE FOR EXCAVATIONS REQUIRED FOR TRENCHINGS, THICKENINGS ETC.
4. CONTRACTOR TO BE AWARE OF ASBESTOS CONTAMINATED MATERIALS (ACM) PRESENT ON SITE AS PER ENVIRONMENTAL INVESTIGATIONS BY DOUGLAS PARTNERS. CONTRACTOR TO MAKE ALLOWANCE FOR DISPOSAL OF SITE WON MATERIAL.
5. FOR RE-USE OF SITE WON MATERIAL, REFERENCE SHOULD BE MADE TO THE GEOTECHNICAL REPORT. THE CONTRACTOR IS TO MAKE ALLOWANCE FOR SORTING/TESTING AND HANDLING OF ANY FILL MATERIAL PROPOSED FOR RE-USE.
6. REFER TO GEOTECHNICAL REPORT PREPARED BY DOUGLAS PARTNERS 227191.00.R.001.REV0 DATED 15 NOVEMBER 2024 FOR SUBGRADE PREPARATION.
7. WORKS WITHIN CLOSE PROXIMITY TO EXISTING RETAINED TREES TO BE SUPERVISED BY A SUITABLY QUALIFIED ARBORIST.
8. THE CONTRACTOR SHALL UNDERTAKE A DILAPIDATION SURVEY OF EXISTING PAVEMENTS AROUND THE EXTENT OF WORKS PRIOR TO COMMENCING WORKS. DAMAGE TO EXISTING PAVEMENTS OUTSIDE THE LIMIT OF WORKS SHALL BE REMEDIATED AND MADE GOOD AT THE CONTRACTOR'S EXPENSE. CONTRACTOR TO OBTAIN ALL NECESSARY AUTHORITY PERMITS & APPROVALS.

### LEVELS TABLE

| No. | FROM LEVEL (m) | TO LEVEL (m) | COLOUR |
|---|---|---|---|
| 1 | -2.00 | -1.50 | |
| 2 | -1.50 | -1.00 | |
| 3 | -1.00 | -0.50 | |
| 4 | -0.50 | 0.00 | |
| 5 | 0.00 | 0.50 | |
| 6 | 0.50 | 1.00 | |

NOTE: WORKS WITHIN CLOSE PROXIMITY TO EXISTING RETAINED TREES TO BE SUPERVISED BY A SUITABLY QUALIFIED ARBORIST. REFER TO PRELIMINARY TREE ASSESSMENT (PTA) DATED 25/08/24 BY TREE SURVEY FOR INFORMATION ON EXISTING TREES. IMPLEMENT APPROPRIATE TREE PROTECTION MEASURES IN ACCORDANCE WITH ARBORIST REQUIREMENTS. MAXIMUM 10% ENCROACHMENT INTO TPZ FOR TREES TO BE RETAINED.

ASBESTOS CONTAMINATED MATERIALS (ACM) PRESENT ON SITE. REFER NOTE 4

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0.0 8.0 16.0 24.0 32.0m
1:400 A1 1:800 A3

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| Rev | Description | Eng | Draft | Date |
|---|---|---|---|---|
| T3 | TENDER ADDENDUM ISSUE | RP | KN | 02.05.2025 |
| T2 | TENDER ADDENDUM ISSUE | RP | KN | 19.12.2024 |
| T1 | TENDER ISSUE | RP | JLE | 08.10.2024 |

Client: WESTERN SYDNEY UNIVERSITY
Engineer: TTW www.ttwengineers.com
Project: WSU CARPARK RELOCATION PROJECT
Drawing Title: EARTHWORKS CUT AND FILL VOLUMES PLANS

| Scale at A1 | Drawn | Designed | Approved |
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| 1:400 | KN | JLE | RP |

| Project No | Originator | Zone | Type | Role | Sheet No. | Rev |
|---|---|---|---|---|---|---|
| 234338 | TTW | 01 | DR | CI | 02011 | T3 |

02.05.2025 4:39 PM

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# Item C
# RtS Response Letter

grc HYDRO

Job Number: 230076
Date: 8 April 2025

GRC Hydro
Level 20, 66 Goulburn Street
Sydney NSW 2000

Tel: +61 432 477 036
www.grchydro.com.au

Steven Botterill | Design Manager
Division Infrastructure and Commercial
Western Sydney University
171 Victoria Road
Parramatta NSW 2116

Dear Steven,

# Re: Western Sydney University – Indigenous Centre of Excellence Response to Remaining RtS Issues- Flooding

## Introduction

GRC Hydro Pty Ltd (GRC) undertook a Flood Impact Risk Assessment (FIRA) and developed a Flood Emergency Response Plan (FERP) for a proposed Indigenous Centre of Excellence (ICoE) at Western Sydney University's (WSU) Parramatta South campus at 171 Victoria Road, Parramatta NSW 2116.

GRC has made various amendments to these reports in response to agency feedback as part of a Response to Submissions (RtS) process. The few remaining flood-related issues have been further addressed below.

## GRC Response to RtS Issues

The following table identifies some remnant flood-specific issues requiring GRC's response. GRC's response has been outlined below. Where applicable, changes to the FIA and FERP have been made and this updated reporting has been attached to this letter.

*Table 1: GRC Response to RtS Issues*

| RtS Comment | GRC Response |
|---|---|
| *As per BCS' flood advice, the use of lifts should be avoided during a flood event. Clarify the alternative access available for evacuation to upper levels for occupants with restricted mobility during a flood event.* | The FERP was previously amended to recommend that stairwells are the correct vertical evacuation route in a flood emergency. Lifts are not to be used in a flood emergency.<br><br>The ground floor's finished floor level is proposed at 9 mAHD, which is 0.7 m higher than the 1% AEP (1 in 100 year) flood level of 8.3 mAHD. The 0.2% AEP (1 in 500 year) modelling suggests a flood level in that event to be approximately 8.4 mAHD, 0.6 m lower than the proposed ground floor level.<br><br>In the event of an extremely rare scenario where flood waters inundate the ground floor at 9 mAHD, stairwells are the vertical evacuation route and able bodied people will be able to physically assist occupants with restricted mobility up these stairs to adequate shelter on Level 1. |
| *Evidence from a certified engineer is required to confirm that the building can maintain structural integrity during a PMF event. Consideration must be given to the flood resilience of all building components.*<br><br>*Appendix N of the RtS report, which states that 'the primary structure has sufficient robustness to avoid disproportionate collapse during the PMF event,' does not adequately address the concerns. Please confirm that the building structures will be designed to withstand the combined loads from occupants and staff, as well as any forces that may arise from flood water and debris during a PMF event, as per the finalised Shelter in Place Guideline for Flash Flooding.*<br><br>*If damage to any part of the building structures is anticipated, please discuss the potential risks to property, life, and the environment in the revised FERP, as well as recovery strategies from flooding that would minimise damage and disruption.*<br><br>*Based on Chart 1: PMF Rate of Rise and Duration of Inundation in the revised Flood Emergency Response Plan (FERP), flood water reaches the ground finished floor level at 9m AHD within approximately 0.35 hours, which is about 21mins. Please clarify the statement in the plan indicating that it takes about 35mins for water to rise above the finished floor level.* | GRC note that structural engineers TTW have reviewed the flood forces in a PMF event and have deemed that the proposed structure will be able to withstand the combined loads from occupants and staff, as well as any forces that may arise from flood water and debris during this event, as per the finalised Shelter in Place Guideline for Flash Flooding. This will be verified in separate reporting from TTW.<br><br>TTW have also responded to concerns regarding the risk of flood damage to the structure and have determined that no damage will occur to the timber superstructure in the 1% AEP event. In an extremely rare PMF event, potential material damage sustained (as a result of water inundation's impact on wooden structures) will pose no structural issues during or immediately after the event and these issues can be rectified following a PMF event.<br><br>TTW's addressing of these issues has been attached to this letter as Attachment B.<br><br>Regarding PMF overtopping time, GRC has amended the incorrect value in the report and the overtopping time is now shown as 21 minutes. |
| *Discuss the local inundation and low points (Chart 3) on Fifth Street and Railway Street to determine the accurate duration of site isolation, considering that vehicles will access Fifth Street and Railway Street to exit the site after a flood event.* | The Railway Street low-point has been added to Chart 3. Fifth Street is elevated higher than Railway Street so the Railway Street low-point is more critical.<br><br>The site can be evacuated via Bridge St to the north which connects to Victoria Road. (This means that there is no |

| RtS Comment | GRC Response |
|---|---|
| | need to rely on Railway Street for evacuation.) The critical low point for this route is Victoria Road (8.1 mAHD) which is isolated for approximately 90 minutes in a PMF event. |
| *Confirm whether the flood model accounts for the additional runoff resulting from the new hardstand surfaces within the reinstated P1 Car Park, which will be completed prior to the construction of the SSD development.* | GRC has not included the proposed (not yet constructed) car park in the modelling of the proposed ICoE concept. The proposed car park is largely on-grade and therefore does not imply any loss of flood storage.<br><br>The car park is a small area relative to the broader three square kilometre catchment and the preponderance of flow that impacts the site comes from Vineyard Creek, not from the WSU campus itself. All of the above suggests that the proposed car park will not have any impact on flood behaviour at the subject site. |
| *Include the safety measures for the proposed lifts listed in Appendix F of the RtS in the Flood Impact Risk Assessment.* | The FERP was previously updated to discourage the use of lifts. This has been reinforced with additional text added to the FERP.<br><br>JCBa has confirmed the inclusion of safety features for proposed lifts to ensure that floodwater does not enter the lift and ensure that people do not exit the lift car into flooded areas<br><br>This includes a flood switch that will be provided in the pit to park the lift car on a safe upper level above the flooding.<br><br>Full water proofing of the lift shaft shall also be provided. This includes:<br>• drains at landing sills;<br>• protection of lobbies from water; and<br>• emergency and inspection panels. |

Yours Sincerely,

Steve Gray
Director

Email: gray@grchydro.com.au

Tel: +61 413 631 447

# Attachment B

## TTW Structural Assessment – SSDA – Structural Integrity During a PMF Event

07/04/2025 234338 SAAA

Jackson Clements Burrows Architects
345 Swan Street
Richmond VIC 3121

Attention: Tom Sharp

## WSU Indigenous Centre of Excellence

**SSDA – Structural Integrity During a PMF Event**

Dear Tom

TTW have reviewed the comments from the NSW Planning Department regarding the SSDA for WSU ICOE and have provided responses below. The original comments are shown in blue

*Evidence from a certified engineer is required to confirm that the building can maintain structural integrity during a PMF event. Consideration must be given to the flood resilience of all building components.*

- *Please confirm that the building structures will be designed to withstand the combined loads from occupants and staff, as well as any forces that may arise from flood water and debris during a PMF event, as per the finalised Shelter in Place Guideline for Flash Flooding.*

The flood modelling indicates that during a PMF event, the maximum water velocity will be 2.5m/s and will reach a point approximately 1.5m above the ground floor partially inundating the building for a period of approximately 1 hour. This equates to a horizontal load on the column base of approximately 42kN. This is noted as being below the 5% robustness load the column connections have been designed to as per AS1170.0 CL 6.2.3.

Furthermore, the force generated by the flood water on the ground floor is approximately 30% of the seismic loads the building has been designed for. As such, the building superstructure can be seen as sufficient to resist the forces generated by this water flow onto the superstructure while simultaneously carrying the load of the building occupants sheltering on the upper floors.

This means there is sufficient strength to maintain structural integrity during and immediately after the PMF event allowing for occupants to shelter during the event and evacuate safety once the flood water has subsided. Minimal debris is expected to impact the structure considering the numerous culverts, bunds and roads that provide an obstacle to potential debris.

- *If damage to any part of the building structures is anticipated, please discuss the potential risks to property, life, and the environment in the revised FERP, as well as recovery strategies from flooding that would minimise damage and disruption.*

In terms of anticipated damage during the PMF, it is noted that due to the inundation, it is expected there would be some damage to the building façade and its contents present on the ground floor. The steel superstructure used on the eastern half of the building near the theatre would not be expected to sustain long term damage due to inundation as steel is considered a flood compatible material. The timber columns that make up the superstructure on the western portion of the building may become partially damaged during the inundation period due to the uptake of water into the timber. This will not affect their structural integrity during or immediately after the PMF event but may present a risk to their long-term durability which will need to be assessed after the PMF event via an appropriate engineering investigation.

Damaged portions of timber superstructure may be treated or replaced as required to maintain the building function. As such, it is expected that there is only a risk of property damage and not any risk to life during the PMF. The return period of this PMF event is considered beyond 1 in 10,000 years and this building does not perform any post-disaster function.

It should be noted that the damage to the timber superstructure will only occur during a PMF event. During a 1% AEP event, the flood water does not reach the ground floor slab and all the structure below ground floor is constructed using flood compatible materials i.e. reinforced concrete and masonry.

Should you require anything further please contact the undersigned

Yours faithfully,
**TTW (VIC) PTY LTD**

**SAMEED KHAN**
**Associate (Structural)**

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