

Flood Impact and Risk Assessment

Alterations and Additions to Newington College Senior Campus, Stanmore

Prepared for Council of Newington College c/o AJC / 8 May 2026

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2	13/11/2025	RC/MK	MK	For SSDA
3	1/12/2025	RC/MK	MK	For SSDA – Masterplan Staging Plan Update
4	21/04/2026	RC/MK	MK	For SSDA – ToA Comments Update
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Executive Summary

This Flood Impact and Risk Assessment has been prepared by TTW to accompany a State Significant Development Application for the alterations and additions to the Newington College Senior Campus located at 200-244 and 221-235 Stanmore Road, Stanmore NSW 2048 (the Site).

This report has been prepared to address flooding related items of the SEARs (Secretary's Environmental Assessment Requirements) issued for the project (SSD-78268465).

The flood assessment has been carried out based on the TUFLOW model developed by Cardno in 2017 as part of the Marrickville Valley Floodplain Risk Management Study, as provided by Inner West Council. Majority of the modelling parameters adopted in the original Council model have been retained in this assessment to maintain the consistency of modelling approach, however minor changes were carried out to suit the site and proposed development conditions better in the assessment. This is discussed further in Section 4. It is worth noting that all AEP (Annual Exceedance Probability) design events available within the Council's TUFLOW model provided, have been assessed as part of this assessment which spread across the more frequent 39% AEP event to the most severe PMF event, as discussed in Section 4.1.

Two development scenarios have been considered in this assessment, namely the proposed Stage 1 and ultimate Masterplan development scenarios. This is discussed in detail in Section 4.1.

The effects of climate change have been considered in the assessment, for both the current and future (at 2090) conditions, as discussed in Section 4.2.5 and 5.5 respectively.

To achieve acceptable flooding outcome for the school areas, mitigation measures have been adopted in the modelling. In particular, the crest to the basement car parking area of the proposed Sevington building has been set at 28.95mAHD which will prevent floodwater from entering the basement areas for all events assessment, including the PMF event. Further, minimum height of 700mm of flood gates/barriers are proposed at the Sevington pedestrian entrance areas to prevent floodwater from Stanmore Road from inundating the proposed Sevington podium and connected building areas. The above mitigation measures are discussed further in Section 4.2.3. Similarly, to protect the basement car parking area of the Concordia building against PMF flood inundation the crest of the entrance area has been raised and set at 37.20mAHD. In addition, additional mitigation measures are also required in the proposed College Lane development area (i.e. as part of the ultimate Masterplan development scenario), as discussed in Section 4.2.4.

Detail modelling results are discussed in Section 5 for each scenario assessed. Flood impact assessment is discussed in detail in Section 5.4 while Section 5.5 discusses the effects of climate change on the subject site in the future (at year 2090).

In general, the assessment concludes that the proposed alterations and additions to the Senior Campus (i.e. together with the implementation of the proposed mitigation measures adopted in the modelling) are suitable and can be supported, will not result in unacceptable impact, and warrants approval. In particular, the modelling demonstrates that:

- The proposed basement car parking area of the Sevington building will be protected to the PMF event assessed, including the PMF event in the future 2090 conditions, with the crest level to the basement areas being set with sufficient freeboard.
- The proposed Sevington podium and connected building areas will also be protected to the year 2090 PMF event assessed, against overtopping floodwater from Stanmore Road (i.e. with the installation of flood gates/barriers at the Sevington pedestrian entrance area).
- The proposed development has no significant impact on flood behaviour or flood hazard in any modelled event. The exception is that notable flood level increases are observed in the PMF event assessed for the Masterplan development scenario at College Lane area. This is mainly due to the fact that the mitigation measures adopted (as discussed in Section 4.2.4) for the College Lane development have been sized to mitigate impacts up to the 1% AEP event assessed only and of high-level concept at this stage, to demonstrate that with appropriate mitigation measures development at the College Lane area can be supported as part of the ultimate Masterplan development. Nonetheless, additional further detailed assessment will be required for the College Lane area, especially when more detailed design information is available (i.e. for the College Lane development), to confirm and ensure that acceptable flooding outcome can be achieved for the College Lane area (i.e. up to the PMF event).
- The basement car parking area of the proposed Concordia building will be protected to the PMF event assessed, including the PMF event in the future 2090 conditions.

While modelling results show that generally acceptable flooding outcome can be achieved with the adopted mitigation measures for the proposed site development works, these are considered of concept nature and additional assessments will need to be carried out in the detailed design phase (especially for the subsequent masterplan developments) to test and confirm the final adopted civil design for the site will result in no adverse impacts to the surrounding properties.

1.0 Introduction

TTW has been commissioned by the Council of Newington College (the Applicant) to prepare this report in accordance with the technical requirements of the Secretary's Environmental Assessment Requirements (SEARs), and in support of the State Significant Development Application (SSD-78268465) for alterations and additions to the Newington College Senior Campus in Stanmore.

This Flood Impact and Risk Assessment (FIRA) report has been prepared to address the SEARs issued on 28 October 2025 for the project. Specifically, this report has been prepared to respond to the flooding related Item 14 (for concept proposal) and Item 19 (for Stage 1 upgrade works) of the SEARs. It is worth noting that both of these items have identical SEARs as outlined in Table 1, together with responses to each requirement.

The purpose of this FIRA is to outline the existing constraints of flooding at the site, alongside an assessment into the likely impacts of the proposed development in post-construction conditions. The details of this report are based on currently available information and correspondence undertaken at the time of writing.

Table 1: SEARS Flooding Item 14 (Masterplan Upgrade Concept Proposal) and Item 19 (Stage 1 Upgrade Works)

Issue and Assessment Requirements	Response
Flooding Risk	
Where the concept development could alter flood behaviour, affect flood risk to the existing community or expose its users to flood risk provide a flood impact and risk assessment (FIRA) prepared in accordance with the <i>Flood Impact and Risk Assessment – Flood Risk Management Guide LU01</i> , the <i>Flood Risk Management Manual 2023</i> , and <i>Support for Emergency Management Planning</i> . The scope of the FIRA should be confirmed with the Department prior to undertaking the assessment and be informed by: - Conservation Programs, Heritage and Regulation (CPHR) division of DCCEE's project specific advice and Standard DCCEE Flood Requirements. - NSW State Emergency Services project specific advice. - Council's project specific advice.	This FIRA has been prepared to determine the flooding behaviour, risks and likely impacts that the proposed development will have to the surrounding areas. The modelling methodology adopted for the assessment is discussed in Section 4. Flooding characteristics surrounding the school site for the pre-development, proposed Stage 1 development and proposed Masterplan development scenarios are discussed in Section 5.1, 5.2 and 5.3 respectively. The likely impacts of the proposed development for the Stage 1 and Masterplan development scenarios are discussed in Section 5.4.1 and 5.4.2 respectively. The impacts of climate change are discussed in Section 5.5.
Where a Flood Emergency Management Plan is required, it must be prepared in accordance with the <i>Flood Risk Management Manual 2023</i> and supporting guidelines, including the <i>Support for Emergency Management Planning</i> and the <i>Shelter in place guideline for flash flooding</i> (if applicable). The Flood Risk Assessment must be prepared in consultation with the NSW State Emergency Service, CPHR and Council where required.	A Flood Emergency Response Plan (FERP) has been prepared by TTW and submitted together with this FIRA to support the SSDA.
Detail design solutions and operational procedures to mitigate flood risk, where required.	The crest to the proposed basement car parking area of the Sevington building has been set to above the PMF flood level to provide PMF flood immunity. Similarly, flood gates/barriers have been proposed at the Sevington entrance area to prevent floodwater on Stanmore Road from inundating the Sevington podium area. The above is discussed further in Section 4.2.3.

The site was previously submitted for SSDA approval, and this report also addresses the response to submissions received from the relevant authorities for the proposed development.

Table 2 summarises the flood related comments raised by CPHR and SES, and how these have been addressed in this report.

Table 2: Agency Comments to Initial SSDA and TTW Responses

Agency	Request for Information	TTW Response
CPHR	Future development must: - Identify any flood risk on-site having regard to adopted flood studies and flood models (previous flood study models and recently developed flood models for flood risk management planning by council) and the potential effects of climate change, and any relevant provisions of the <i>NSW Flood Risk Management Manual (2023)</i> and the <i>guidance on climate change considerations from ARR2019 Version 4.2 (August 2024)</i>. - Assess the impacts of the development, including any changes to flood risk on-site or off-site during construction and operational stages, and develop appropriate flood risk mitigation measures, where required. - Identify (and interpret) flood behaviour, flood constraints and risks on the site and its surrounding including the potential impacts of climate change for the full range of events i.e., up to and including the probable maximum flood (PMF) event based on completed studies and its flood models. - Proposed management measures required to minimise the impacts of flooding on the development, including an Emergency Management Plan, if appropriate, considering access to and from the site, and evacuation issues during significant flood events including the PMF Event.	This FIRA has been prepared to determine the flooding behaviour, risks and likely impacts that the proposed development will have to the surrounding areas. All available AEP design events within Council's flood model have been adopted and modelled as part of the assessment for the development. A Flood Emergency Response Plan (FERP) has been prepared by TTW and submitted together with this FIRA to support the SSDA.
SES	Recommend a site specific flood assessment is undertaken in accordance with the NSW Government Guidelines including: - An assessment of the flood risk up to and including the PMF on site and surrounding access/egress routes. - Climate change considerations.	As above, time to onset and duration of inundation are discussed in greater detail in the FERP submitted together with this FIRA. The effects of climate change have been considered in the assessment for both the current conditions (refer to Section 4.2.5) as well as at the year 2090 (refer to Section 5.5).

	• Time to onset, duration of inundation. • Depth, velocity and hydraulic hazard of any flooding. • An assessment of the impact of the proposed development on flood behaviour.	
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1.1 Guidance Documents

The following documents have been reviewed and referenced in preparing this report:

- Australian Institute of Disaster Resilience (AIDR) Guideline 7-3: Flood Hazard (2017);
- Australian Rainfall and Runoff (ARR) 2019;
- Inner West Council (IWC) Marrickville Development Control Plan (DCP), 2011;
- Inner West Council (IWC) Local Environmental Plan (LEP), 2022;
- Department of Planning and Environment (2021) Considering Flooding in Land Use Planning Guideline;
- Department of Planning and Environment (2023) Flood Impact and Risk Assessment – Flood Risk Management Guide LU01;
- Department of Planning and Environment (2023) Support for Emergency Management Planning – Flood Risk Management Guideline EM01;
- Department of Planning, Housing and Infrastructure – Planning Circular PS 24-001, Update on addressing flood risk in planning decisions, 1st March 2024;
- NSW Department of Planning and Environment (2023) Flood Risk Management Manual <https://www.environment.nsw.gov.au/topics/water/floodplains/floodplain-manual>; and
- NSW Planning Portal Spatial Viewer ([Spatial Collaboration Portal - Map Viewers \(nsw.gov.au\)](#)).

1.2 Site Description

The Newington College Senior Campus is located at 200-244 Stanmore Road, Stanmore and is bordered by Stanmore Road to the north, Newington Road to the south and College Lane to the west. The College boundary also includes the Concordia building to the north at 221-235 Stanmore Road. The main campus is legally described as Lot 8 in DP710369 and the Concordia site is legally described as Lot A in DP109269, Lot 1 in DP49, Lot B in DP330028, and Lot 1 in DP526319.

Key features of the site include:

- The main campus site is a regular shaped allotment with an area of 8.7ha. The Concordia site (and access handle to Cavendish Street), immediately north of the main campus is irregular in shape and is 2,903sqm in area.
- The topography of the main campus is a defining characteristic, particularly the grassed slope from the historic Founders Building down to Johnson Oval. The site has an overall fall of approximately 18m from the north-west corner to south-east corner.
- The at-grade car park adjacent to the Concordia building sits approximately 2.8m above the Stanmore Road street level, and is accessed via Cavendish Street (to the rear).
- The existing school buildings are largely located along the College Lane and Newington Road edges of the site. Existing buildings generally range from 2-4 storeys in scale. The balance of the site comprises at-grade car parking and sporting facilities, including sporting ovals and tennis courts.
- The Concordia building across Stanmore Road is a two-storey building with basement and car parking accessed from Stanmore Road. An at-grade car park is located within the eastern portion of this site, with vehicular access from a driveway to Cavendish Street (to the north).
- The site has a primary frontage to Stanmore Road (which accommodates both vehicular and pedestrian access to the site) and a secondary frontage to Newington Road, which is generally limited to pedestrian access and service vehicles.

- The area surrounding the site is predominantly zoned R2 Low Density Residential and includes a combination of single dwellings and residential flat building ranging from 1-3 storeys in height. Stanmore Train Station is located approximately 220m to the north. An existing pedestrian bridge and signalised traffic lights provide pedestrian access over Stanmore Road to Stanmore Trains Station, further north.

The site is identified in Figure 1.



Figure 1: Aerial photograph of existing site (Source: Urbis 2024)

1.3 Proposed Development Description

This SSDA seeks consent for staged alterations and additions to the Newington College Senior Campus, comprising:

Concept Proposal for the provision of new and upgraded facilities, including:

- Building envelope for the redevelopment of Sevington Courts to accommodate recreational facilities and teaching spaces (refer to detailed Stage 1 Works below).
- Building envelope for alterations and additions to Centenary Hall and development of an adjoining, four storey teaching and learning facility (College Lane building). This development will accommodate a cafeteria and dining hall, lecture theatre, multi-purpose teaching spaces and additional pastoral spaces.
- Building envelope for the redevelopment of the Concordia building to accommodate a performance theatre, multi-purpose gallery and exam centre, new teaching spaces and basement car parking. The Concordia redevelopment includes a new pedestrian bridge across Stanmore Road to the main campus.
- Landscaping design strategy across the campus.
- Car parking provision and circulation arrangements.
- Increase of 368 students and 45 full-time equivalent (FTE) staff.

Detailed Stage 1 works, including:

- Earthworks and the associated demolition of Sevington Courts.
- Construction, fit-out and operation of 3 storey building comprising multi-purpose indoor and rooftop courts, fitness centre, multi-purpose teaching spaces, amenities and basement car parking.
- Construction, fit-out and operation of 4 storey building comprising multi-purpose teaching spaces, administrative functions and amenities.
- Alterations to the existing driveway within the site to facilitate vehicle access to the new basement car park.
- Temporary car park during construction phase of Stage 1 Works.
- The removal and new landscaping adjacent to the Stage 1 development site.
- Increase of 368 students and 45 FTE staff.

Figure 2 provides an aerial image of the site in its current form and shows the location of each proposed building area. Figure 3 shows the proposed masterplan of the college development.



Figure 2: Proposed site development plan

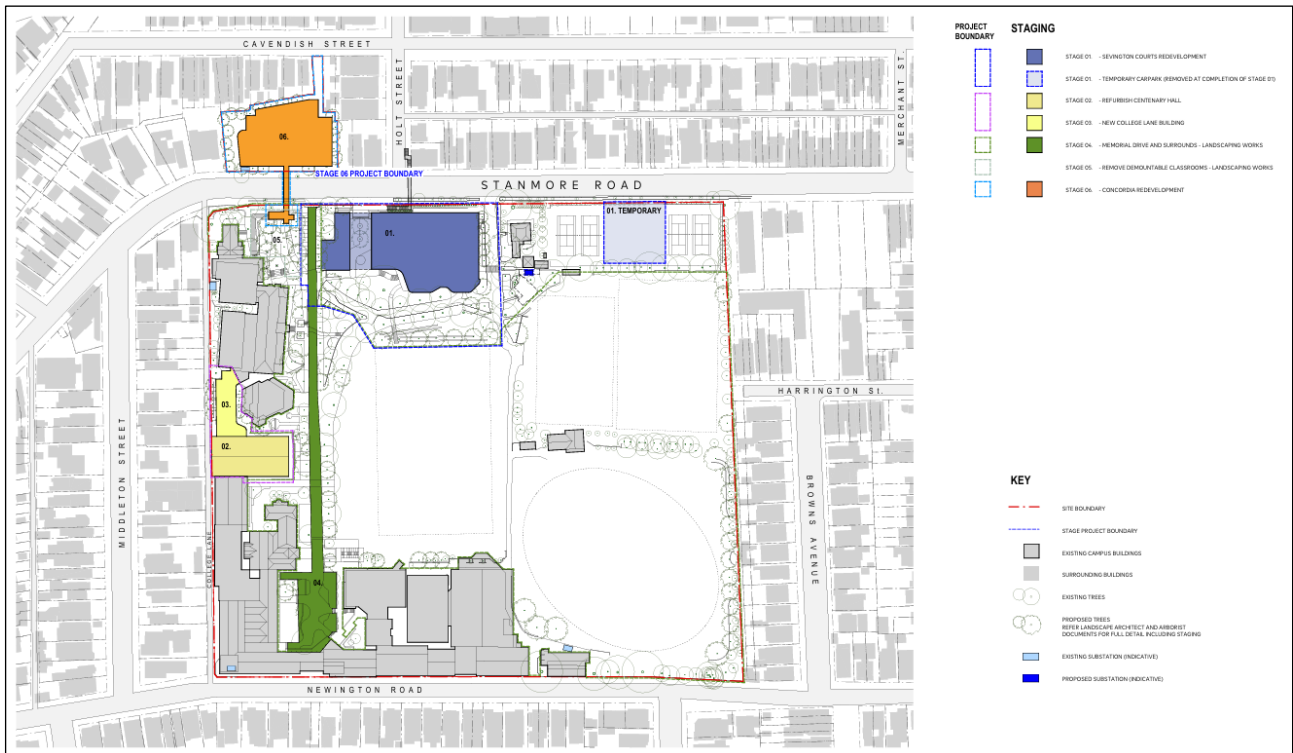


Figure 3: Proposed site development masterplan (Source: AJC Architects, dated 17 April 2026-Rev6)

The proposed upgrades aim to ultimately increase the existing college student population of 1,492 to 1,850 (i.e. a 358 increase in students).

2.0 Site Characteristics

2.1 Catchment Information

The site is situated near the ridgeline of the Marrickville Valley catchment which ultimately drains into the Cooks River, approximately 2.7km south-west of the site (refer to Figure 4). The entire Marrickville Valley catchment is approximately 7.9km² in size and predominantly urban in nature. As such, excess stormwater runoff is conveyed either by underground stormwater network system or as overland flow via existing roadways, dedicated open channels or drains.



Figure 4: Location of site in relation to Cooks River

2.2 Site Topography

To assess the topography of wider area, the latest available elevation data (2020) was obtained from the NSW Spatial Services, Elevation Information System (ELVIS), with a spatial resolution of 1m. As presented in the Digital Elevation Model (DEM) in Figure 5, the Concordia Building area is located on the ridgeline and is generally higher than the Senior Campus area. The Senior Campus area predominantly slopes from north-west to south-east towards the south-eastern corner of the property boundary. Ground level within the Senior Campus peaks at approximately 38.1m AHD in the north-west lot boundary, with a notable drop to approximately 17.0m AHD in the south-east corner (i.e. equivalent to an average gradient of 5%). It is worth noting that significant drops (i.e. more than 2m) over a short distance are observed around the three existing sporting fields. The existing sporting field at the south-eastern corner is surrounded by a bund around the field's south-east corner and this provides some form of flow detention and attenuation to stormwater runoff.

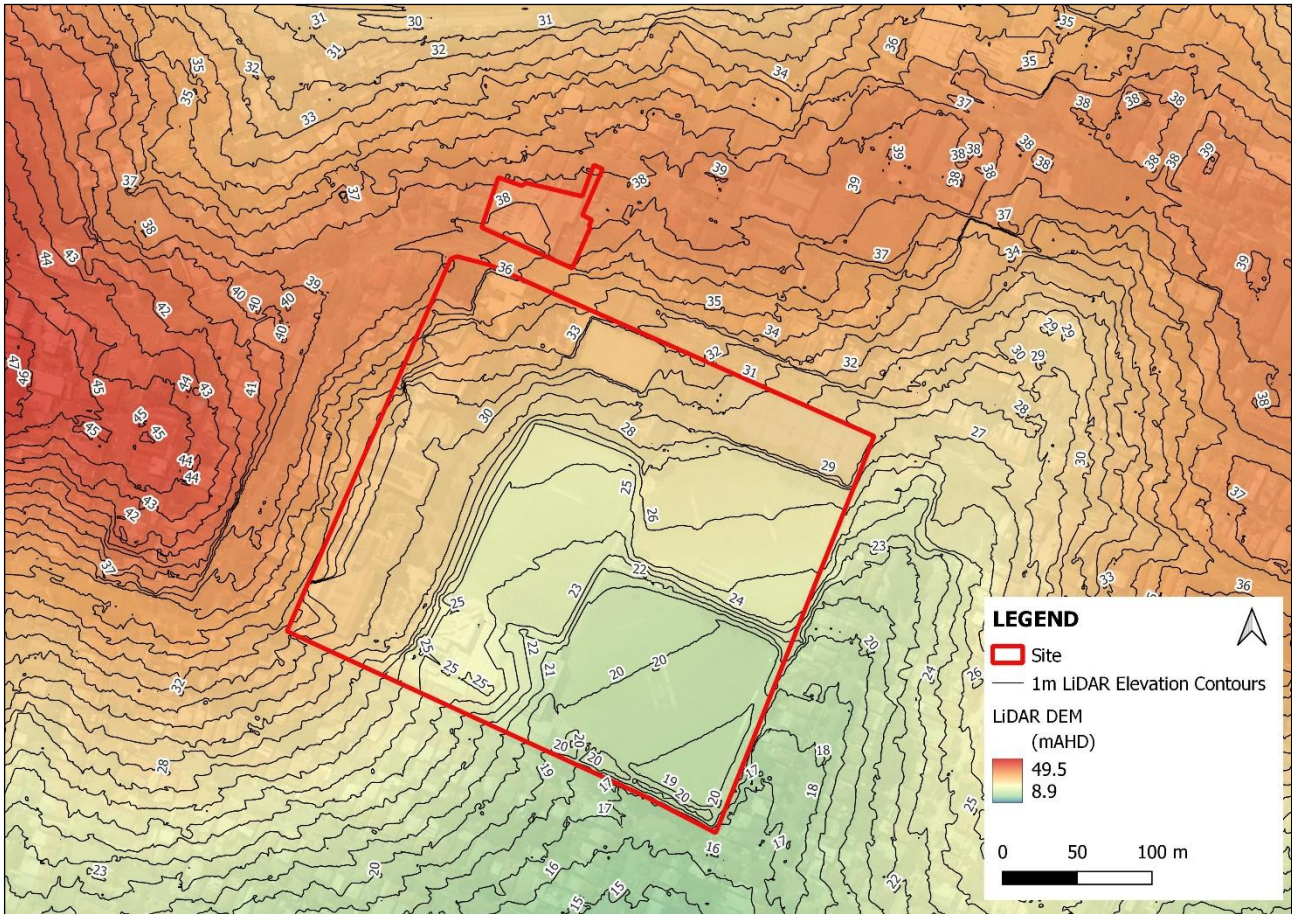


Figure 5: Topography of the site and its surrounding area based on 2020 LiDAR data (Source: ELVIS)

3.0 Existing Flood Information

3.1 Inner West Council Flood Planning Maps

The current Inner West Council's flood planning mapping shows that the site is located outside the Flood Planning Area and Flood Liable Land, as shown in Figure 6 and Figure 7 respectively. Based on the current 2011 Marrickville Development Control Plan (DCP), Flood Planning Area has the following definition:

- Cooks River Flooding – land likely to be affected by the 1% AEP (Annual Exceedance Probability) flood, factoring in a rise in sea level of 400mm to the year 2050, (plus 500mm freeboard) of the Cooks River; and
- Overland Flow Flooding – land (in accordance with Council's Flood Tagging Policy) likely to be affected by the 1% AEP flood associated with various locations affected by local overland flooding.

Similarly, Flood Liable Land is defined by the 2011 Marrickville DCP as:

- Land within a flood planning area, and land likely to be affected by the probable maximum flood (PMF) of the Cooks River. This means that the map identifies some land as being within the Cooks River PMF area, but not within the Cooks River 100-year flood (plus 500mm freeboard) area.

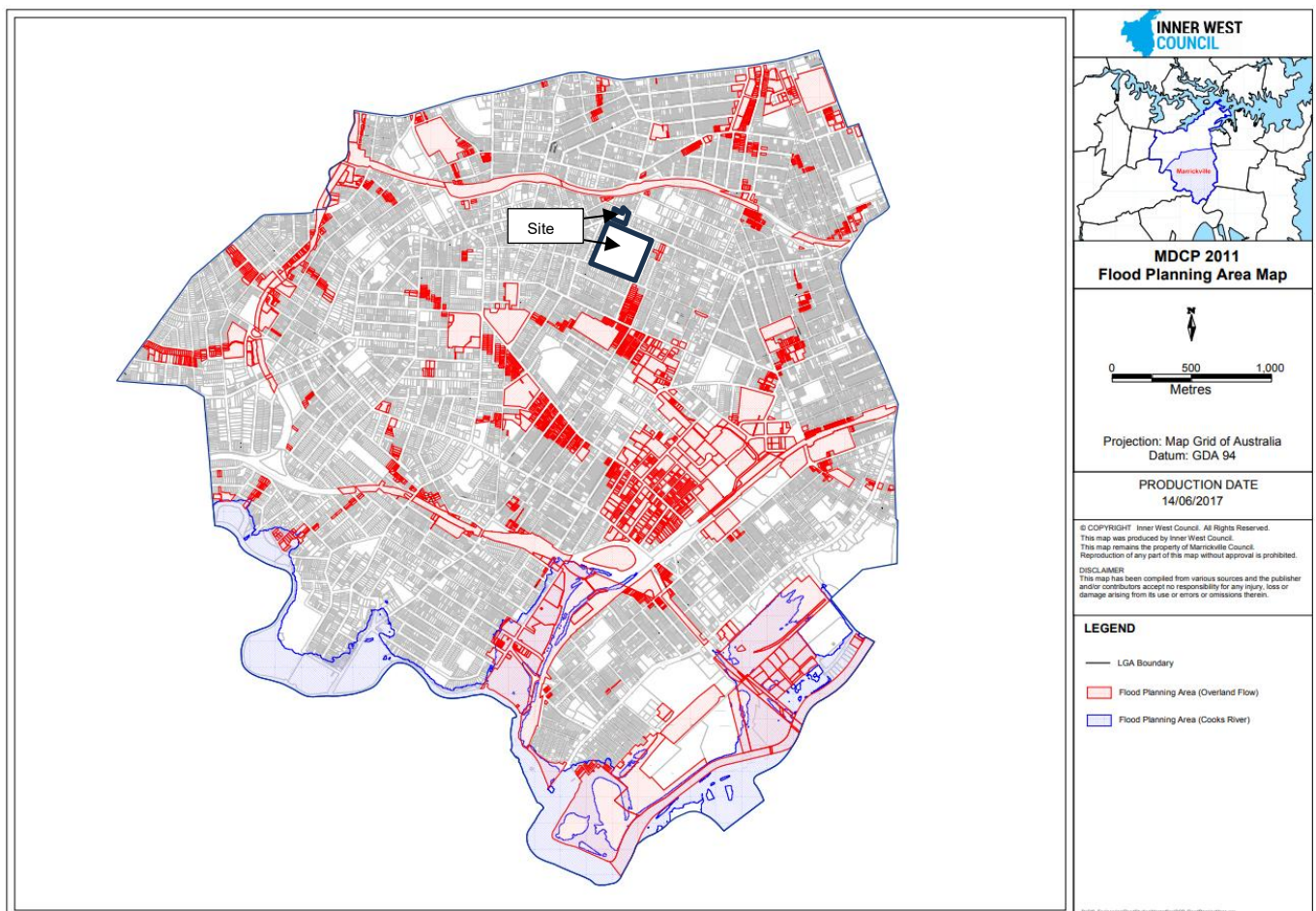


Figure 6: Inner West Council Flood Planning Area Mapping (Source: Inner West Council DCP 2011)

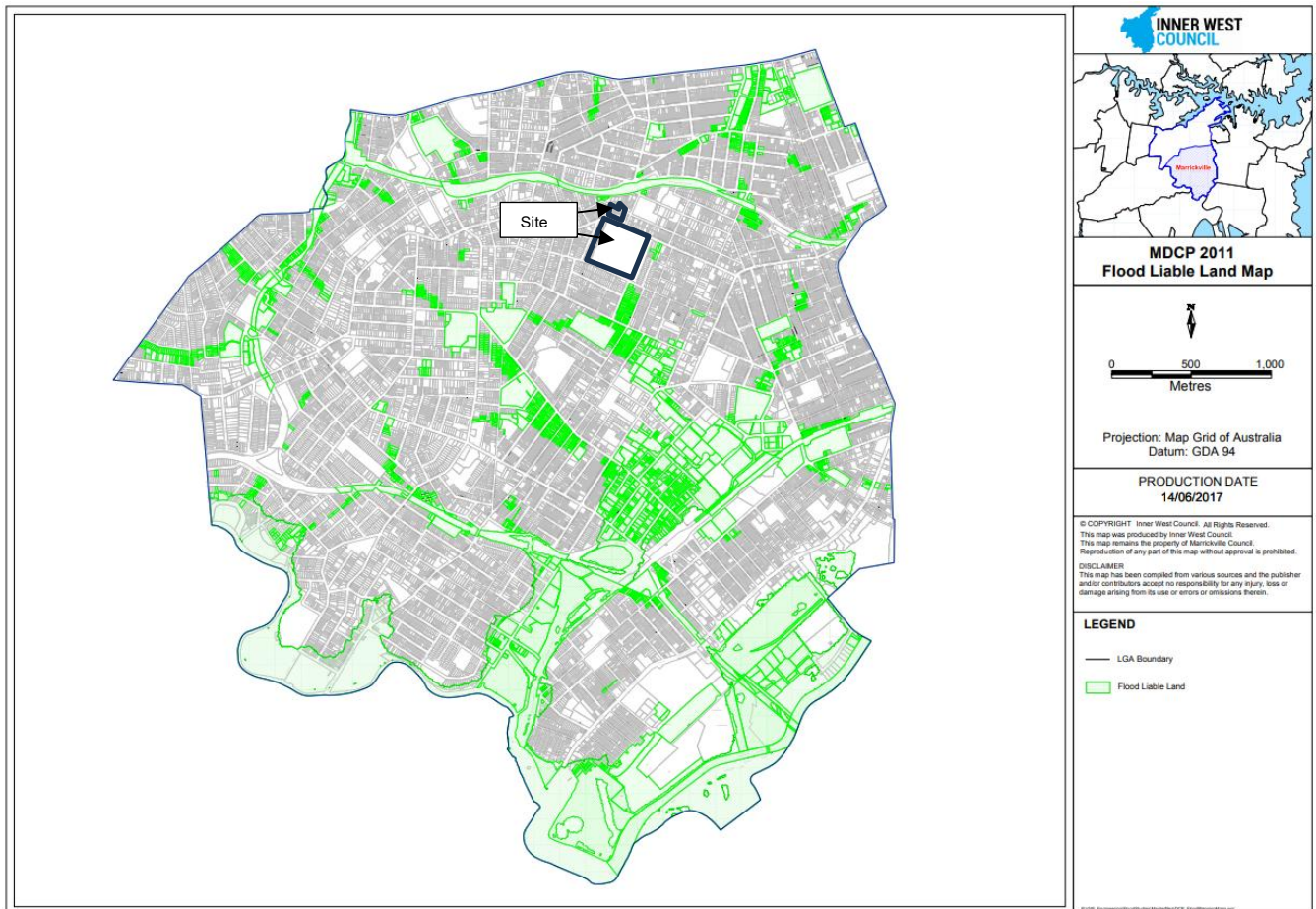


Figure 7: Inner West Council Flood Liable Land Mapping (Source: Inner West Council DCP 2011)

3.2 Marrickville Valley Floodplain Risk Management Study

Inner West Council commissioned Cardno to conduct a Floodplain Risk Management Study for the Marrickville Valley catchment in 2017 to assist Council with the future management of flood prone lands within the study catchment and to allow the community to better understand the flood risks. The study shows that the Senior Campus site is impacted by overland flow flooding as frequently as the 39% AEP event. However, the Concordia site is not shown to be impacted by flooding (i.e. up to the PMF event) in the study. The study shows that flooding across the Senior Campus site area is mostly shallow with depths generally less than 100mm.

Flood depths and extent estimated from the 2017 Marrickville Valley Floodplain Risk Management Study, for the 39% AEP, 1% AEP and PMF events are shown in Figure 8, Figure 9 and Figure 10, respectively.

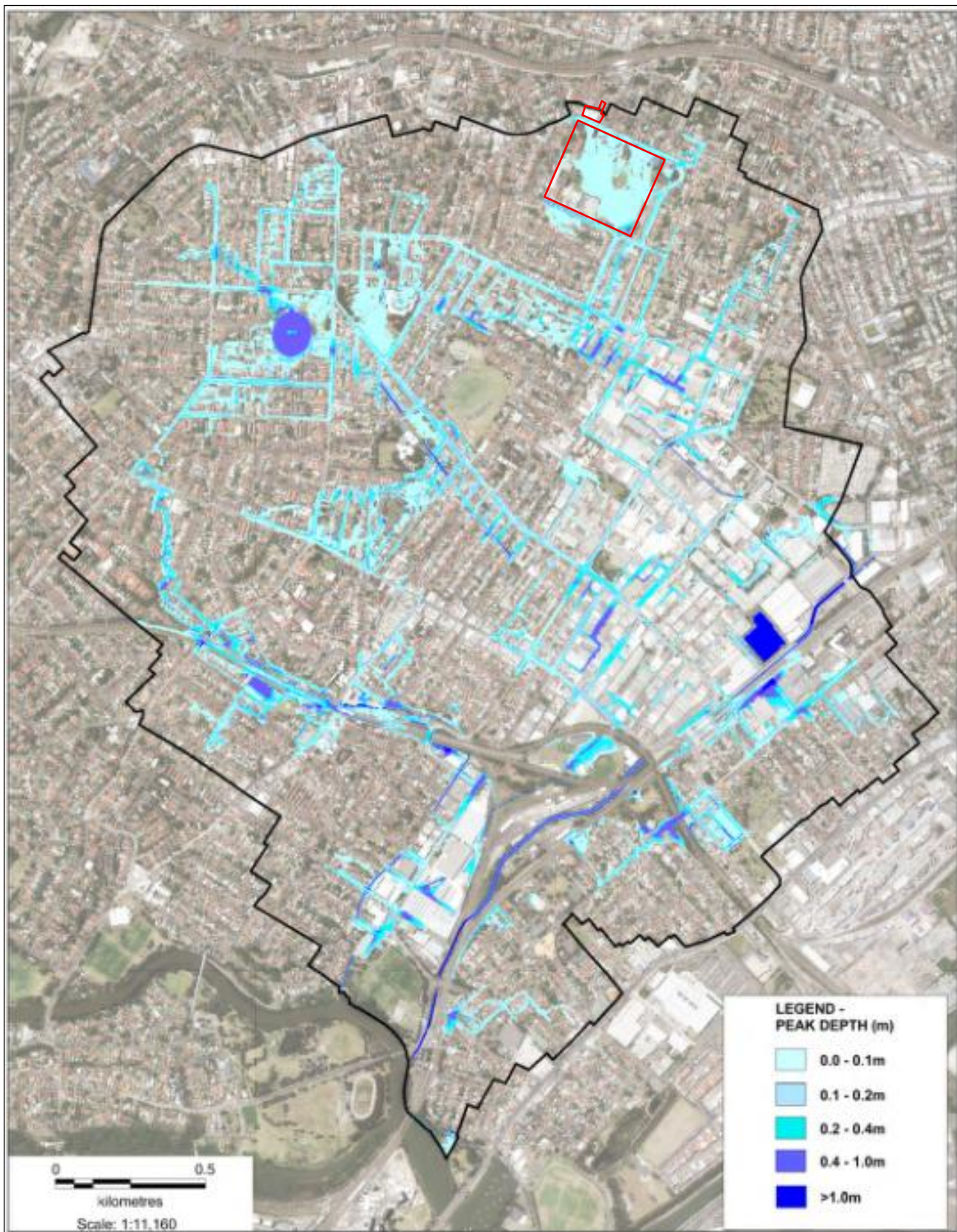


Figure 8: Flood depths in the 39% AEP event (Source: Cardno's Marrickville Valley Floodplain Risk Management Study, 2017)

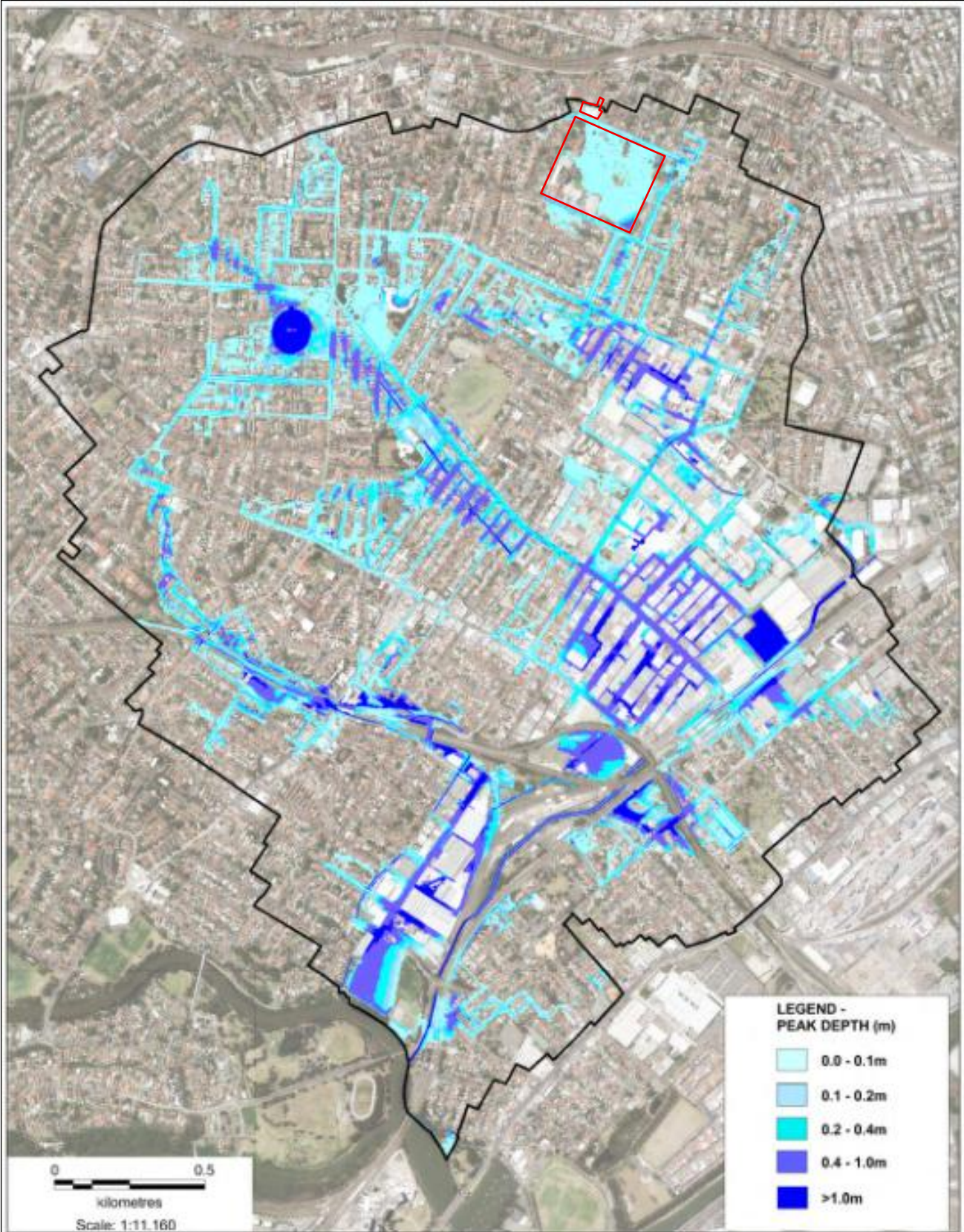


Figure 9: Flood depths in the 1% AEP event (Source: Cardno's Marrickville Valley Floodplain Risk Management Study, 2017)

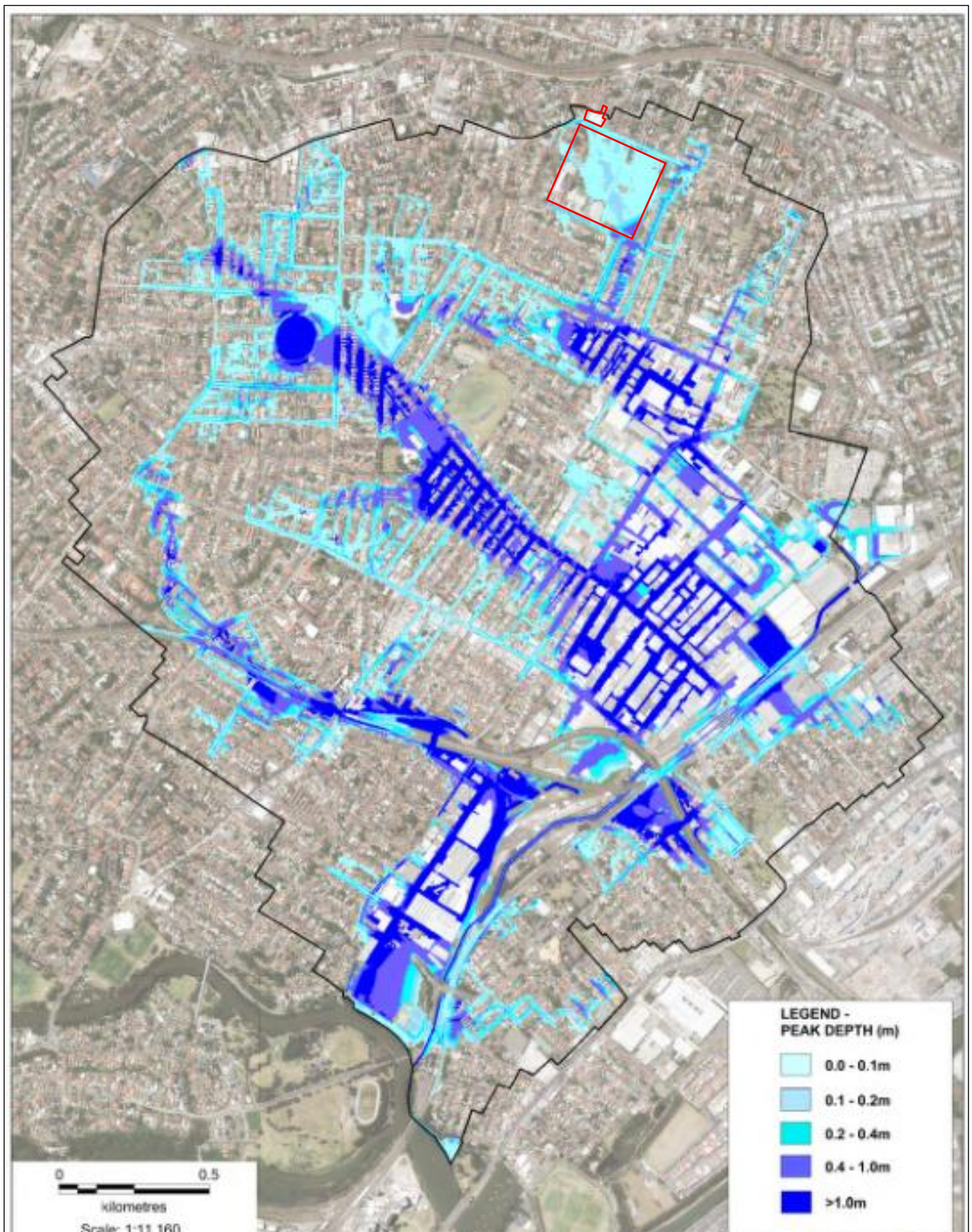


Figure 10: Flood depths in the PMF event (Source: Cardno's Marrickville Valley Floodplain Risk Management Study, 2017)

4.0 Hydraulic Modelling and Assessment Methodology

Council have provided TTW with the Marrickville Valley Floodplain Risk Management Study TUFLOW model, prepared by Cardno as part of the study in 2017. This has been confirmed by Council as suitable to use for this proposed college development and has therefore been used as the basis of the flood modelling completed as part of this assessment. The model boundary extends from the catchment ridges near and along Stanmore Road and Enmore Road at the north to the Cooks River at the south, as shown in Figure 11. The TUFLOW model covers approximately 7.9km² of area.

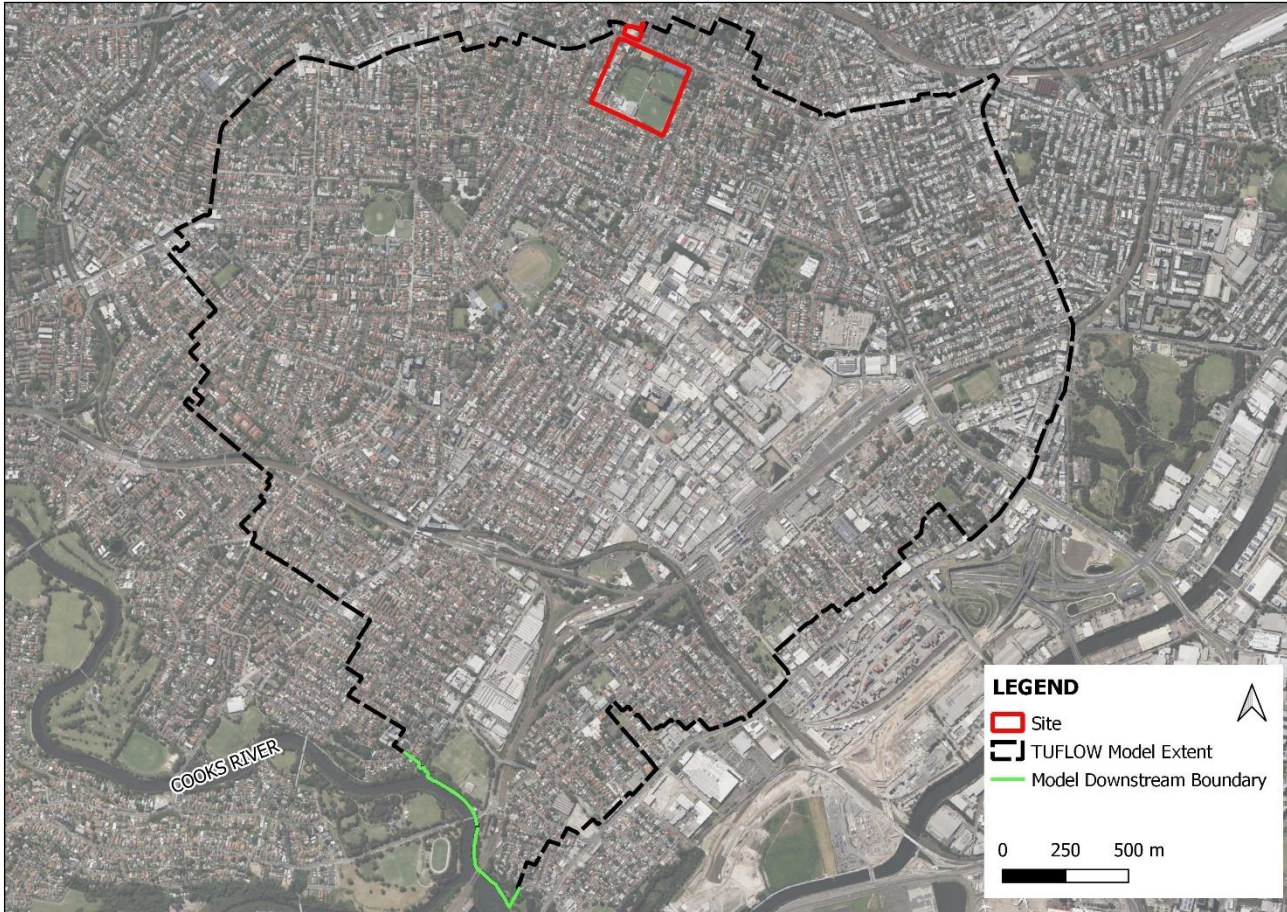


Figure 11: TUFLOW Hydraulic model boundary

The key modelling methodology adopted by Cardno in the 2017 Marrickville Valley Floodplains Risk Management Study is summarised in Table 3.

Table 3: Key features of original Council’s TUFLOW modelling

Model domain	Dynamic 1D (pipe network) and 2D (floodplain)
Hydraulic model software	TUFLOW version 2013-12-AE-iSP
Solver	Classic
Grid size	3m cell
Model inflows	DRAINS hydrographs incorporated as Source Area (SA) boundaries to apply flow directly onto the 2D domain, based on 1987 ARR Design Rainfall Methodology
Design Storms Assessed	39% AEP 2hr storm, 18% AEP 2hr storm, 10% AEP 2hr storm, 1% AEP 2hr storm, PMF 15min storm & PMF 1hr storm

4.1 Modelling Scenarios and Storm Events

Three modelling scenarios have been carried out as part of this assessment, namely:

- Pre-Development Scenario (i.e. base case), where the site remains as is at the time of the assessment.
- Post-Development Stage 1 Scenario, where the proposed Stage 1 Sevington development (i.e. refer to Section 1.3) is assumed to be developed.
- Post-Development Masterplan Scenario, where all proposed future developments (i.e. refer to Section 1.3) are assumed to be developed.

The above modelling scenarios have been simulated for all the critical design storm events adopted in the original Council's model, as summarised in Table 3. It is worth noting that the design storm events of 39% AEP, 18% AEP, 10% AEP, 1% AEP and PMF events adopted for this assessment (as summarised in Table 3) are all design storms assessed and available within the 2017 Marrickville Valley Floodplains Risk Management Study TUFLOW model provided. These adopted AEP events are considered appropriate and meet the purpose of the assessment as they represent a range of design AEP events that spread across the more frequent 39% AEP event to the most severe PMF event. These adopted AEP events are considered to be standard ARR's AEP events adopted in typical flood assessments in Australia.

Modelling assumptions adopted to each modelling scenario above as well as changes made to original Council's model are discussed further in the following section.

4.2 TTW Model Updates

Although some minor amendments have been made to the original Council's model provided for this assessment, majority of the model parameters remained similar to those adopted in the original Council's model. Changes made to the original Council's model for each scenario assessed are discussed in the following sections.

4.2.1 Model Stability and Sensitivity

Initial simulation of the original Council's model indicated that the model had instability issues (i.e. high mass balance error) and did not complete the simulation for the 10% AEP and PMF events. The instabilities of the 10% AEP event are found to be caused by the 1D channel between Petersham Road and Centennial Street in Marrickville, approximately 800m south-west of the site. Instabilities of the PMF event are found to be caused by the 1D channel between Fitzroy Street and Smith Street in Marrickville, approximately 950m south-east of the site.

Few iterations of modelling were carried out and a 20% increase in the 1D channel node storage of these 1D channels was found to be able to reduce the mass balance error to within acceptable range and also allow the simulation of the 10% AEP and PMF events to be fully completed. As such, this minor amendment has been adopted in the subsequent modelling carried out as part of this assessment for the 10% AEP and PMF events. Checks have been carried out and the increase in 1D channel node storage does not have any effects on the modelling results at the subject site area, given that these channels are located some distance away and downstream.

The modelling results also show that the model is sensitive and results tend to change slightly with each iteration of simulation, especially at the 1D-2D interface areas. It is worth noting that the main purpose of this assessment is to estimate and determine the flooding regime as well as likely flood impacts that the proposed college development will have on the surrounding areas. Fully resolving the underlying model stability and sensitivity issues are not part of the objectives of the assessment.

4.2.2 Pre-Development Scenario

In the Pre-Development Scenario, the following changes have been made to the original Council's model for the assessment (i.e. base case model for the assessment):

- Survey data collected by Colliers for the subject site for the project has been incorporated into the model to provide a better surface elevation representation for the subject site area. The survey elevation data adopted in the model is shown in Figure 12.

- Existing fences and stone walls along the Senior Campus's northern property boundary (i.e. as shown in Figure 13) have been added to the model to prevent floodwater from entering the site. These stone walls have been modelled as 0.5m high while other fences have been modelled as 1.5m high. This provides a better representation of flooding conditions in the area. The exact location and extent of these additional obstructions adopted in the model are shown in Figure 12.
- The detention system outlet at the south-east sporting field has been added to the model to provide more realistic flooding conditions for the college (i.e. by allowing otherwise trapped flow to be discharged to the downstream stormwater network). The outlet system of this detention system has been modelled as a 900mmx900mm pit set at the lowest point near the south-east corner of the sporting field and a 375mm diameter pipe connecting to the existing stormwater network on Newington Road to the south. Refer to Figure 12 for exact location.

It is also worth noting that all existing buildings within the college site and immediate surrounding areas have been modelled as full obstruction whereby no water can flow through these buildings. This approach has been retained in this assessment.

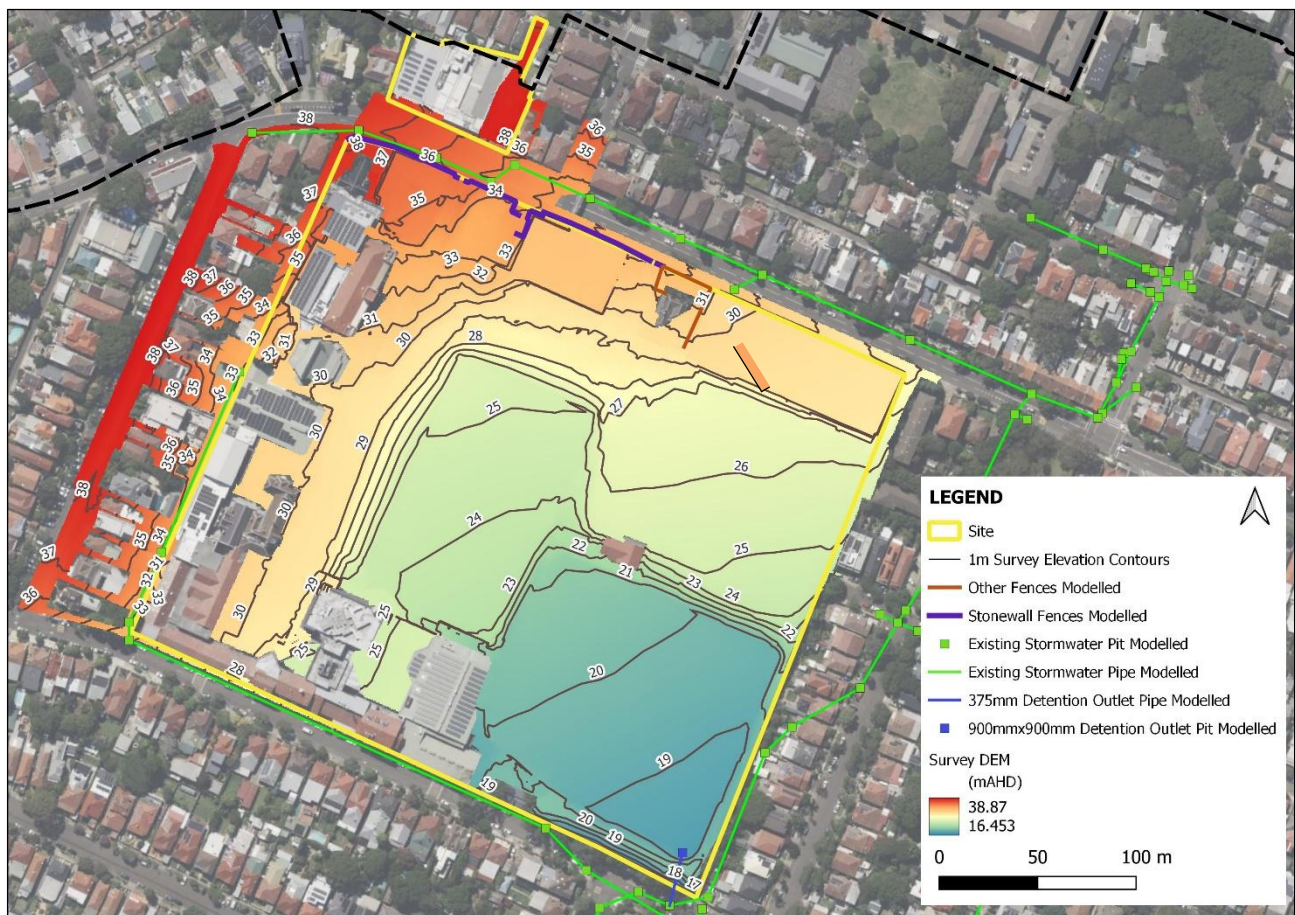


Figure 12: Key features amended for Pre-Development model



Figure 13: Existing fences and stone walls along Stanmore Road (Source: Google Street View)

4.2.3 Post-Development Stage 1 Scenario

In the Post-Development Stage 1 Scenario, the following changes have been made to the Pre-Development Scenario model for the assessment:

- The proposed Sevington building footprint has been incorporated into the model to fully block floodwater from flowing across.
- The civil design DEM for the driveway to the entrance of basement car parking area of the proposed Sevington building has been incorporated into the model. The crest to the basement car parking area has been set at 28.95mAHD.
- Existing stonewall fences facing Stanmore Road have been cut back to allow for the proposed Sevington building, near the existing pedestrian bridge. A 12m of opening at the entrance to Sevington building has been assumed and adopted in the model for this assessment. Initial modelling showed that overland flows from Stanmore Road will overtop the road kerbs and flow downstream across this proposed entrance even in the 39% AEP event assessed. To prevent Stanmore Road overland flows from entering the proposed Sevington podium area (i.e. at the bottom of the Sevington entrance stairs) and to provide PMF immunity to the Sevington buildings at the podium, flood gates/barriers have been proposed along the Sevington entrance (i.e. including entrance to disable ramp to the podium area). The location and extent of the proposed flood gates/barriers are shown in TTW's civil design drawing 241840-TTW-00-DR-CI-04101-E, attached to Appendix B of this report. The flood gates/barriers will be at least 700mm high (i.e. minimum top of gates at 35mAHD) and will only engage when floodwater starts to overtop Stanmore Road kerbs at the Sevington entrance. In the modelling, no floodwater is allowed to flow downstream across the Sevington entrance area.
- Existing vehicular entrance from Stanmore Road has been assumed to be 6m wide (i.e. 2 x 3m model grids of opening) in the model for this assessment.

The surface elevations of the proposed temporary car parking area during the Stage 1 construction phase (i.e. at the existing tennis court area near the north-east corner of the Senior Campus) are anticipated to remain at existing ground levels. The above adopted changes made for the Stage 1 Scenario model are summarised in Figure 14.



Figure 14: Key features adopted for Post-Development Stage 1 model

4.2.4 Post-Development Masterplan Scenario

In the Post-Development Masterplan Scenario, the following changes have been added to the Post-Development Stage 1 Scenario model for the assessment:

- The proposed College Lane building footprint has been incorporated into the model to fully block floodwater from flowing across, while the obstruction due to the existing demountable building west of the proposed Sevington building has been removed from the model.
- Existing stonewall fences facing Stanmore Road have been cut to allow for the proposed pedestrian bridge connecting Concordia building, and a 6m opening (i.e. 2 x 3m model grids of opening) has been assumed and adopted in the model for this assessment.
- 3m long (i.e. 0.15m high) side entry pit and 2x600mm diameter pipe system have been adopted at College Lane in the model. This stormwater system is assumed to be discharged to the southern side of Johnson Oval. This stormwater system has been adopted in the modelling to compensate for the loss of the existing overland flow path as a result of the currently proposed College Lane building. It is worth noting that this stormwater system has been conceptually sized to convey the 1% AEP event flows of the area in the modelling, to ensure that flooding along College Lane will not be exacerbated by the proposed College Lane building development for events up to the 1% AEP event. Flood impacts are anticipated for events more severe than the 1% AEP event when the capacity of this proposed pit and pipe system is exceeded. As such, further assessment should be carried out in the subsequent detailed design phase of the College Lane building development when additional design information of the development is available.
- Although this is not obvious in the modelling results given the modelling methodology adopted for the building areas (i.e. full obstruction and ignored in the TUFLOW model), the crest to the entrance of the basement car parking area of the Concordia building has been raised and set at 37.20mAHD.

The above adopted changes made to the Post-Development Stage 1 Scenario model for the Masterplan Scenario model are summarised in Figure 15.

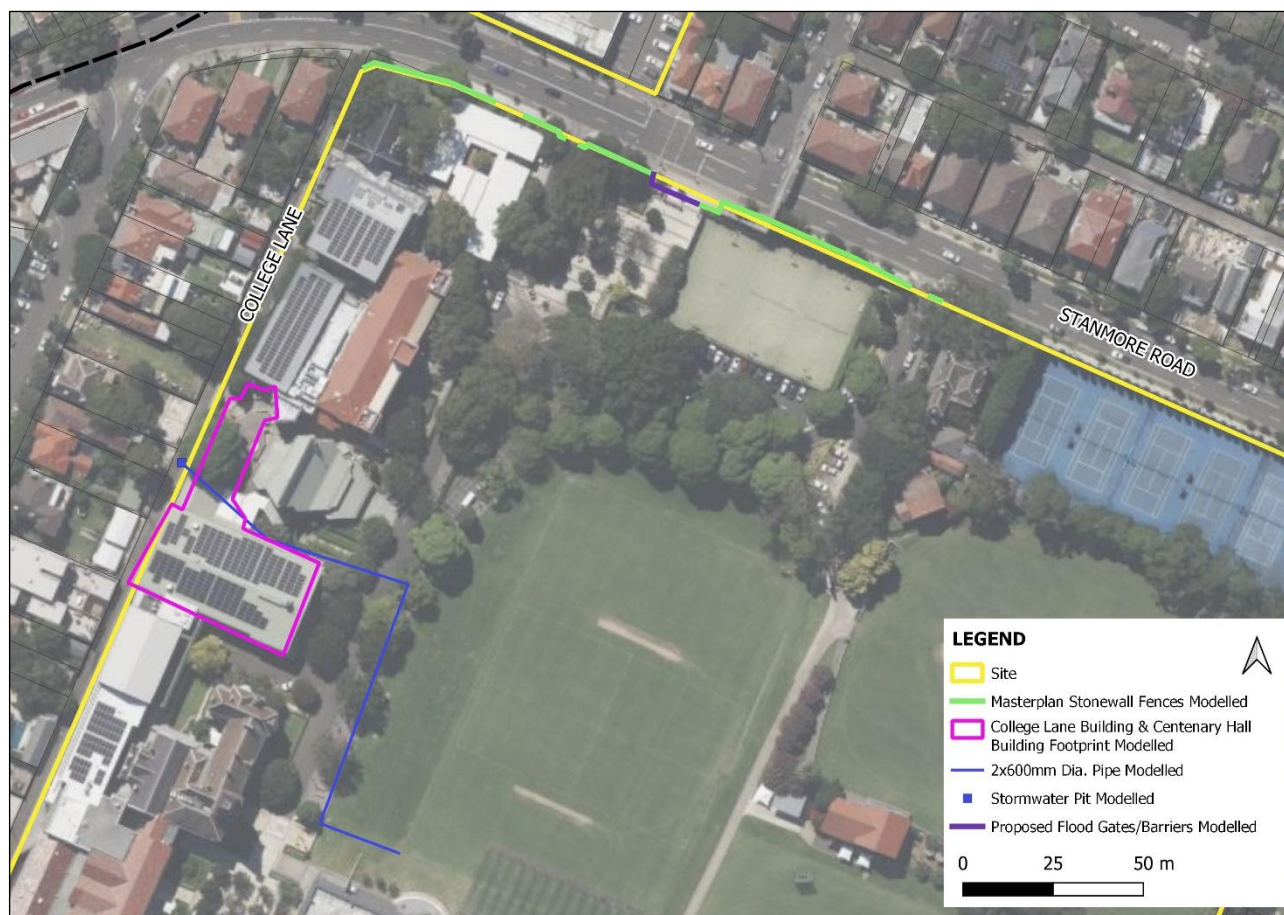


Figure 15: Key features adopted for Post-Development Masterplan model

4.2.5 Climate Change Consideration

As outlined in the new ARR2019 Climate Change Considerations chapter (i.e. Book 1 Chapter 6), the effects of climate change that has occurred since the development of the adopted design rainfall IFDs (Intensity-Frequency-Duration data) should be considered and accounted for in the assessment of present time flooding conditions (i.e. the year of 2025 at the time of assessment). For this assessment, all model inflows adopted have been upscaled to the year 2025 based on the Shared Socioeconomic Pathway (SSP) 2-4.5 Scenario, which represents the intermediate Greenhouse Gas Emissions Scenario. The upscale factors for various design storm durations, as extracted from the ARR Data Hub for the site area, and adopted in this assessment are summarised in Table 4. These factors have been applied to the original Council's TUFLOW model hydrological data for all scenarios of modelling outlined above.

Table 4: Upscale factors adopted for Year 2025

Climate Change Scenario	Climate Change Increase Factor Adopted for Various Design Storm Durations							
	<1hr	1.5hrs	2hrs	3hrs	4.5hrs	6hrs	9hrs	12hrs
SSP2-4.5 – Year 2025	1.18	1.17	1.16	1.14	1.13	1.12	1.12	1.11

4.3 Flood Hazard Categories

The relative vulnerability of the site to flood hazard has been assessed by using the flood hazard vulnerability curves set out in 'Handbook 7 – Managing the Floodplain: A Guide to Best Practice in Flood Risk Management in Australia' of the Australian Disaster Resilience Handbook Collection (2017).

These curves assess the vulnerability of people, vehicles and buildings to flooding based on the velocity and depth of flood flows. The flood hazard categories are outlined in Figure 16, ranging from a level of H1 (generally safe for people, vehicles and buildings) to H6 (unsafe for vehicles and people, with all buildings considered vulnerable to failure). Table 5 outlines the threshold limits for each hazard category.

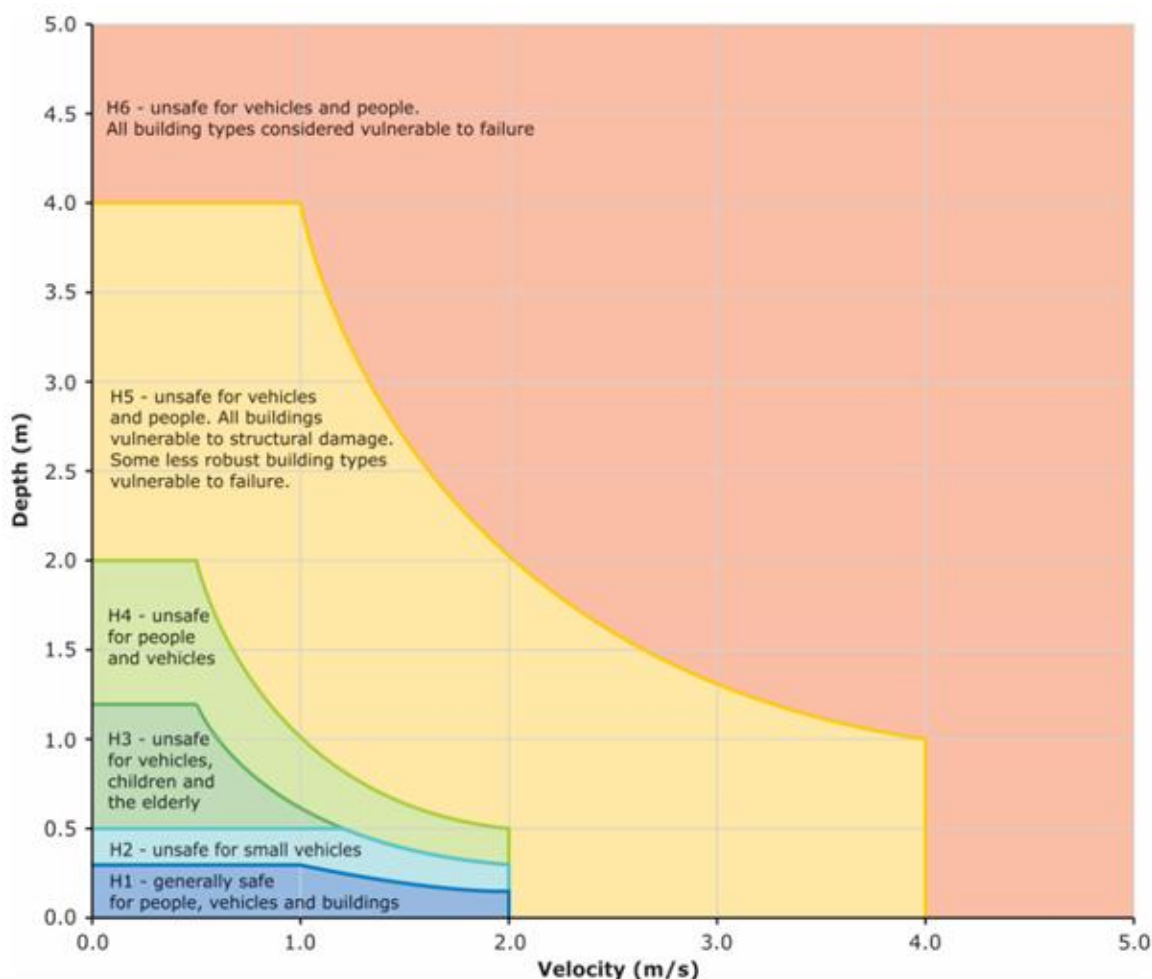


Figure 16: Flood hazard vulnerability curve (Source: Flood Risk Management Guide FB03 - Flood Hazard, NSW Department of Planning and Environment, 2022)

Table 5: Hazard vulnerability threshold limits

Hazard	Description	Classification Limit (m ² /s)	Limiting still water depth (D) (m)	Limiting velocity (V) (m/s)
H1	Generally safe for people, vehicles and buildings	$D \times V \leq 0.3$	0.3	2.0
H2	Unsafe for small vehicles	$D \times V \leq 0.6$	0.5	2.0
H3	Unsafe for vehicles, children and the elderly	$D \times V \leq 0.6$	1.2	2.0
H4	Unsafe for people and vehicles	$D \times V \leq 1.0$	2.0	2.0
H5	Unsafe for people and vehicles. All buildings vulnerable to structural damage.	$D \times V \leq 4.0$	4.0	4.0
H6	Unsafe for people and vehicles. All building types considered vulnerable to failure.	$D \times V > 4.0$	No Limit	No Limit

5.0 Flood Modelling Results

All modelling scenarios discussed above have been simulated with the critical design storms adopted in original Council's model, as summarised in Table 3. As the PMF event is simulated for 2 storm durations, post-processing has been carried out to produce the maximum flooding results for the PMF event from the two set of storm durations assessed. The PMF results discussed in the following sections are based on the 'maxmax' (i.e. maximum of all individual storm maximum results) flooding results derived for the PMF event.

Section 5.1 below discussed the Pre-Development Scenario results for the 39% AEP, 1% AEP and PMF events while Section 5.2 discussed the Post-Development Stage 1 Scenario results. Modelling results for the Post-Development Masterplan Scenario are discussed in Section 5.3. Results for the remaining 18% AEP and 10% AEP events are contained within Appendix A. The flood impact assessment is discussed in Section 5.4 while consideration of future climate change effects is presented in Section 5.5.

5.1 Pre-Development Scenario Flood Behaviour

5.1.1 39% AEP Event

The peak flood levels and depths during the 39% AEP event for the Pre-Development Scenario are shown in Figure 17, while the peak flood velocity and flood hazard are depicted in Figure 18 and Figure 19, respectively. Under the existing conditions, overland flows on Stanmore Road overtop the road and flow across the Senior Campus site, inundating part of the proposed Sevington building area, the driveway at entrance to college, the tennis courts area (where the proposed temporary car parking area is proposed during the Stage 1 construction phase) and the three sporting fields further south. While majority of the overland flows accumulate at the south-east corner of the Senior Campus site within the sporting field, there are some overland flows flowing directly east onto existing residential properties on Browns Avenue and Harrington Street. The existing basement car parking area of the Concordia building (i.e. access via Stanmore Road) is not inundated in this event assessed as the crest to the car parking area is surveyed at 37.00mAHD, while the flood level is estimated to be 36.86mAHD.

The flood depths on site are shallow and generally less than 40mm, including the proposed temporary car parking area during the Stage 1 construction phase (i.e. within the existing tennis court area adjacent and south of Stanmore Road). The results also show that the existing underground stormwater system on College Lane is exceeded in this event, resulting in some overland flows onto the Senior Campus site north of the existing Centenary Hall area. The overland flows continue east onto the Johnson Oval, joining the overland flows from Stanmore Road. Flood depths in excess of 1.5m are observed around the existing building north of the Centenary Hall, but flooding in this area is considered not real as the modelling has not considered detailed local stormwater system in the area, hence resulting in floodwater being permanently trapped at this location.

The results show that no existing buildings onsite will be affected by flooding in this event assessed. Flow velocities are generally less than 0.5m/s within the Senior Campus site, but higher flow velocities are observed on the steep drop areas around the sporting fields. Hazards both within the site and within the vicinity are similarly low at mostly H1 (generally safe for people, vehicles and buildings), with small patches of H5 and H6 around the steep drop areas around the edge of sporting fields due to the anticipated high flow velocities. Hence, these steep drop areas within the site should be avoided during a storm event.

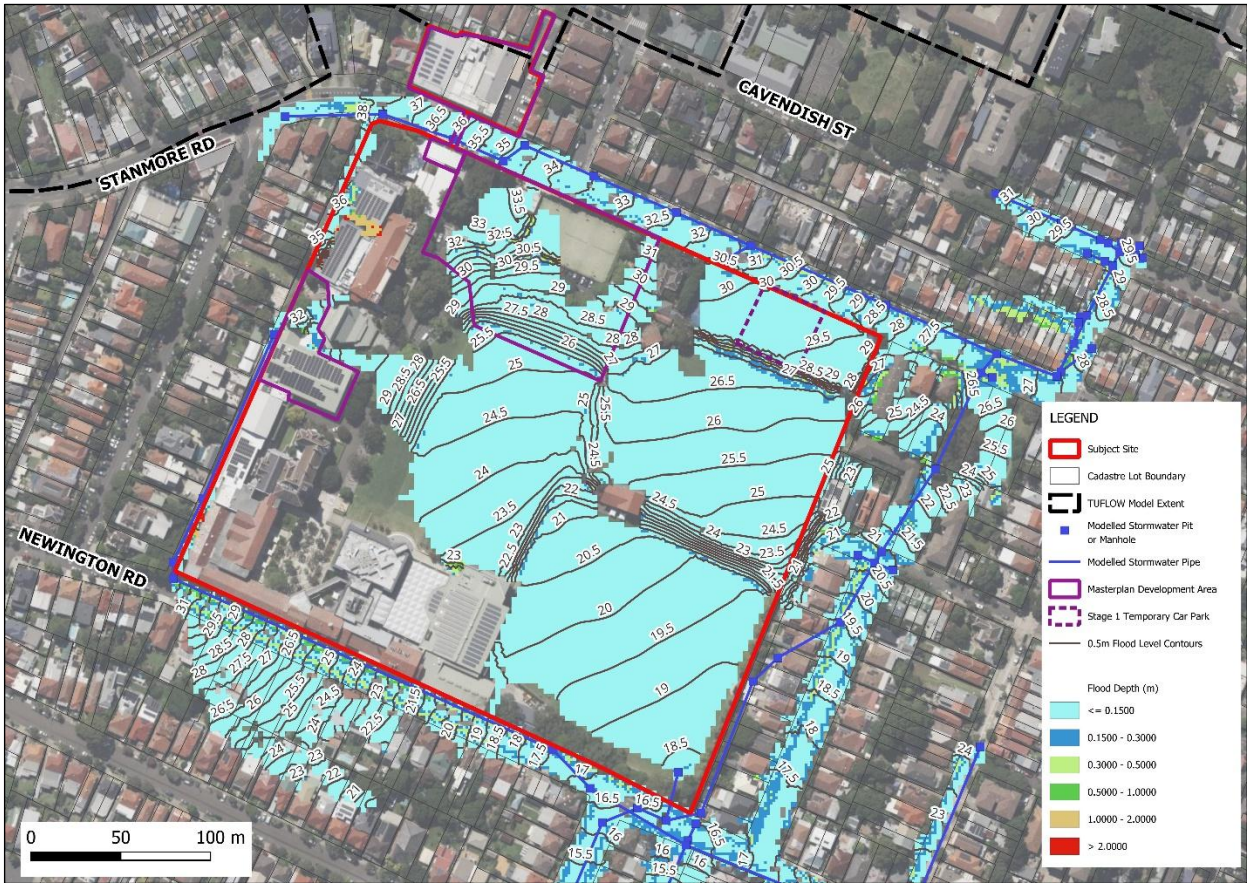


Figure 17: Existing scenario - peak flood levels and depths at the site in the 39% AEP event

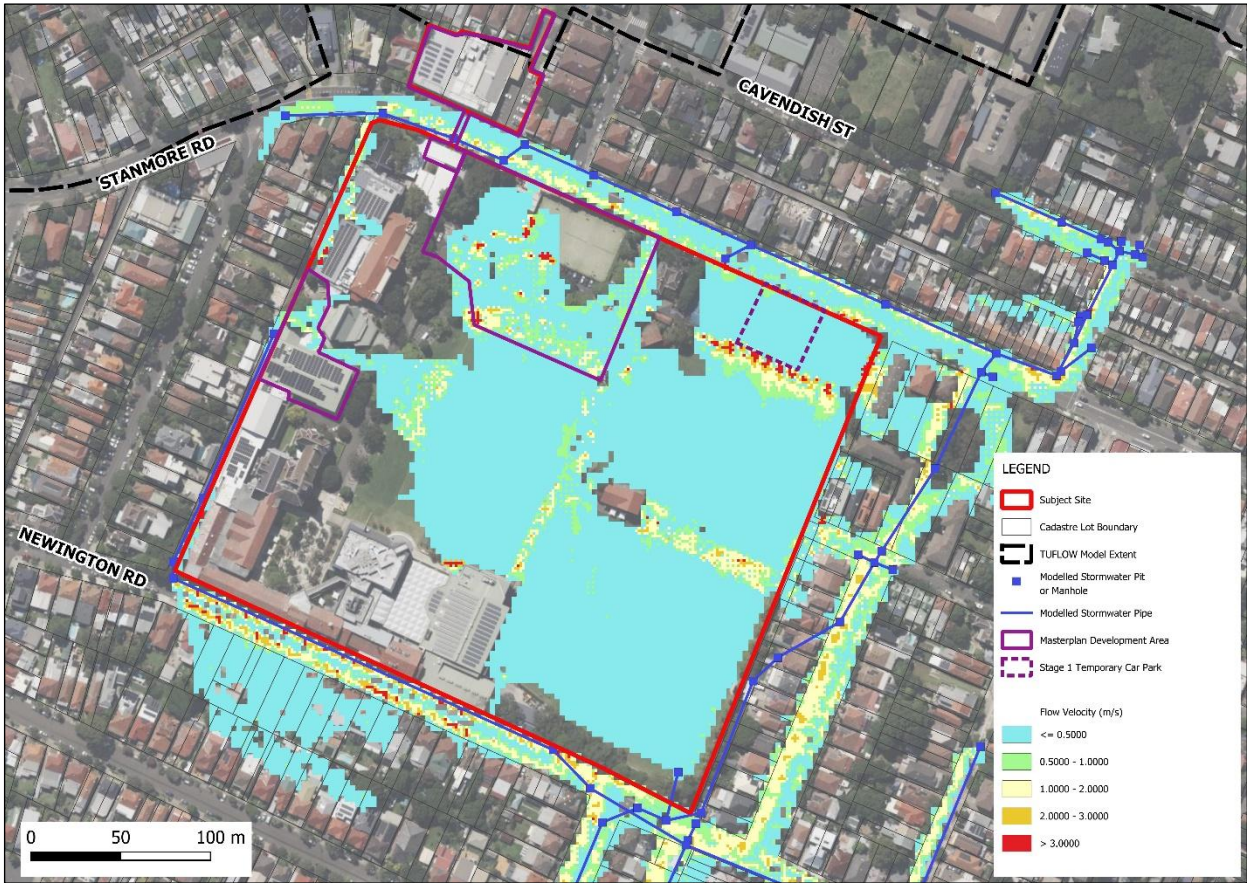


Figure 18: Existing scenario - peak flood velocity at the site in the 39% AEP event

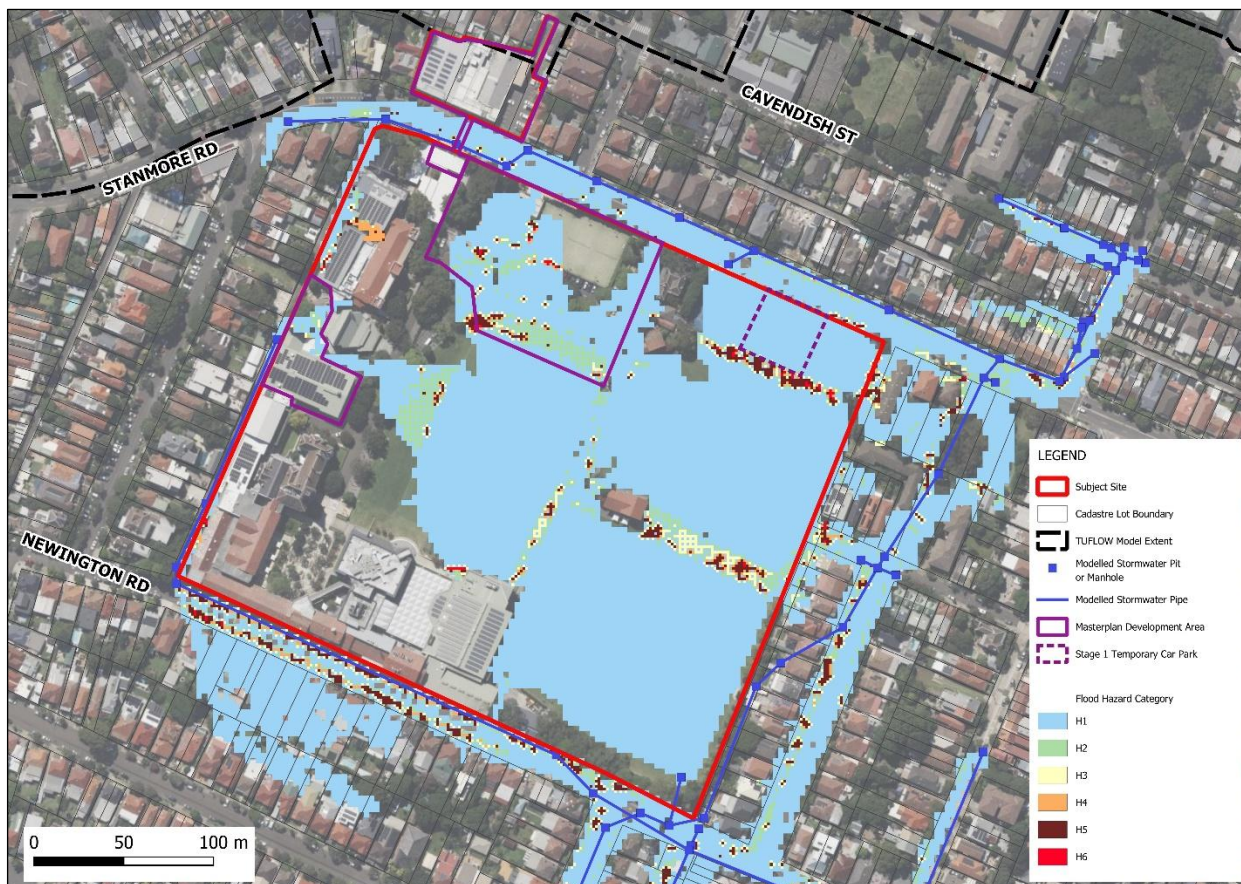


Figure 19: Existing scenario - peak flood hazard at the site in the 39% AEP event

5.1.2 1% AEP Event

The peak flood levels and depths during the 1% AEP event for the Pre-Development Scenario are shown in Figure 20, while the peak flood velocity and flood hazard are depicted in Figure 21 and Figure 22, respectively. Flooding results are generally similar to the 39% AEP event but with larger flood extent observed (i.e. more areas estimated to be impacted by flooding).

Similarly, the flood depths on site are shallow and generally less than 60mm. Maximum flood depth in the detention system at the south-east corner sporting field is approximately 0.75m, suggesting that additional floodwater being detained and attenuated at this location. Flood depths at the proposed temporary car parking area (i.e. proposed during the Stage 1 construction phase) are generally less than 90mm in this event. Similar to the 39% AEP event, flood depths in excess of 2m are observed around the existing building north of the Centenary Hall, but flooding in this area is considered not real as the modelling has not considered detailed local stormwater system in the area, hence resulting in floodwater being permanently trapped at this location. The existing basement car parking area of the Concordia building (i.e. access via Stanmore Road) will be inundated by floodwaters from Stanmore Road in this event, as the flood level in the car park entrance area is estimated to be approximately 37.006mAHD (i.e. the crest to the car parking area is surveyed at 37.00mAHD).

The results show that no existing buildings onsite will be affected by flooding in this event assessed. Flow velocities are generally less than 0.5m/s within the Senior Campus site, but higher flow velocities are observed on the steep drop areas around the sporting fields. Similarly, flow velocities within the proposed temporary car parking area (i.e. proposed during the Stage 1 construction phase) are estimated to be lower than 0.5m/s in this event. Hazards within the site remain low at mostly H1 (generally safe for people, vehicles and buildings), with small patches of H5 and H6 around the steep drop areas around the edge of sporting fields due to the anticipated high flow velocities. Hence, these steep drop areas within the site should be avoided during a storm event. H5 hazards are observed on part of Stanmore Road, Newington Road and Browns Avenue, making these road areas unsafe for traffic. H3 hazards are also observed on the south-east corner where floodwater is detained, making this area not safe for children and elderly.

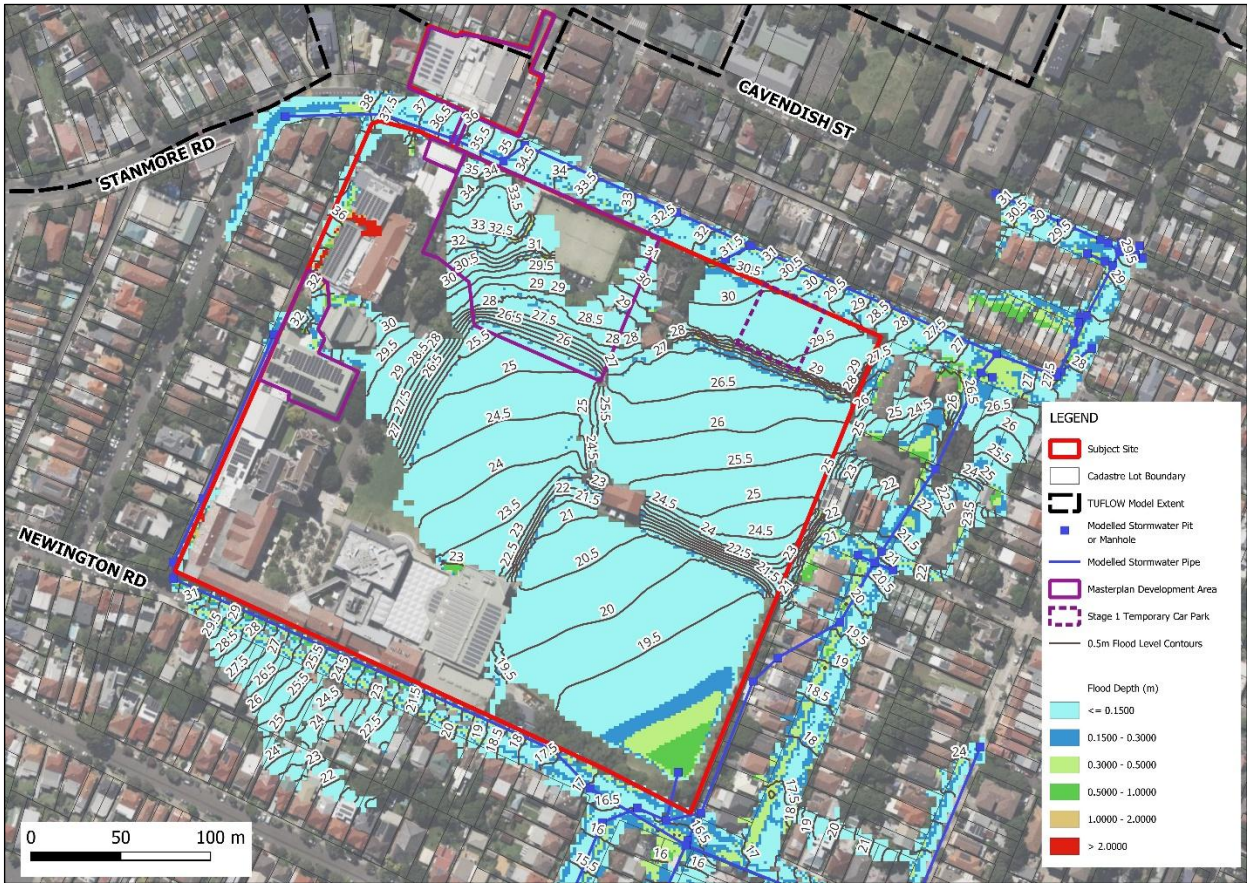


Figure 20: Existing scenario - peak flood levels and depths at the site in the 1% AEP event

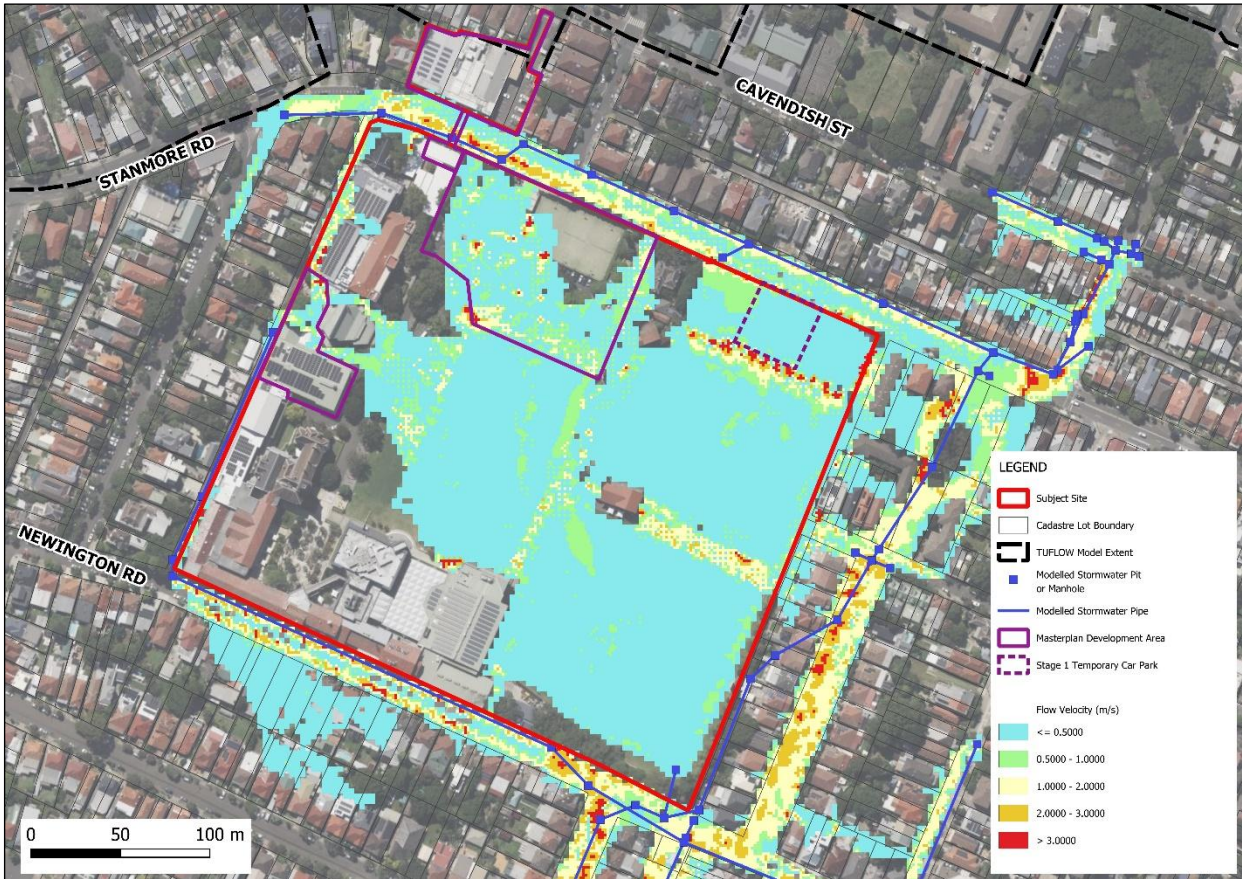


Figure 21: Existing scenario - peak flood velocity at the site in the 1% AEP event

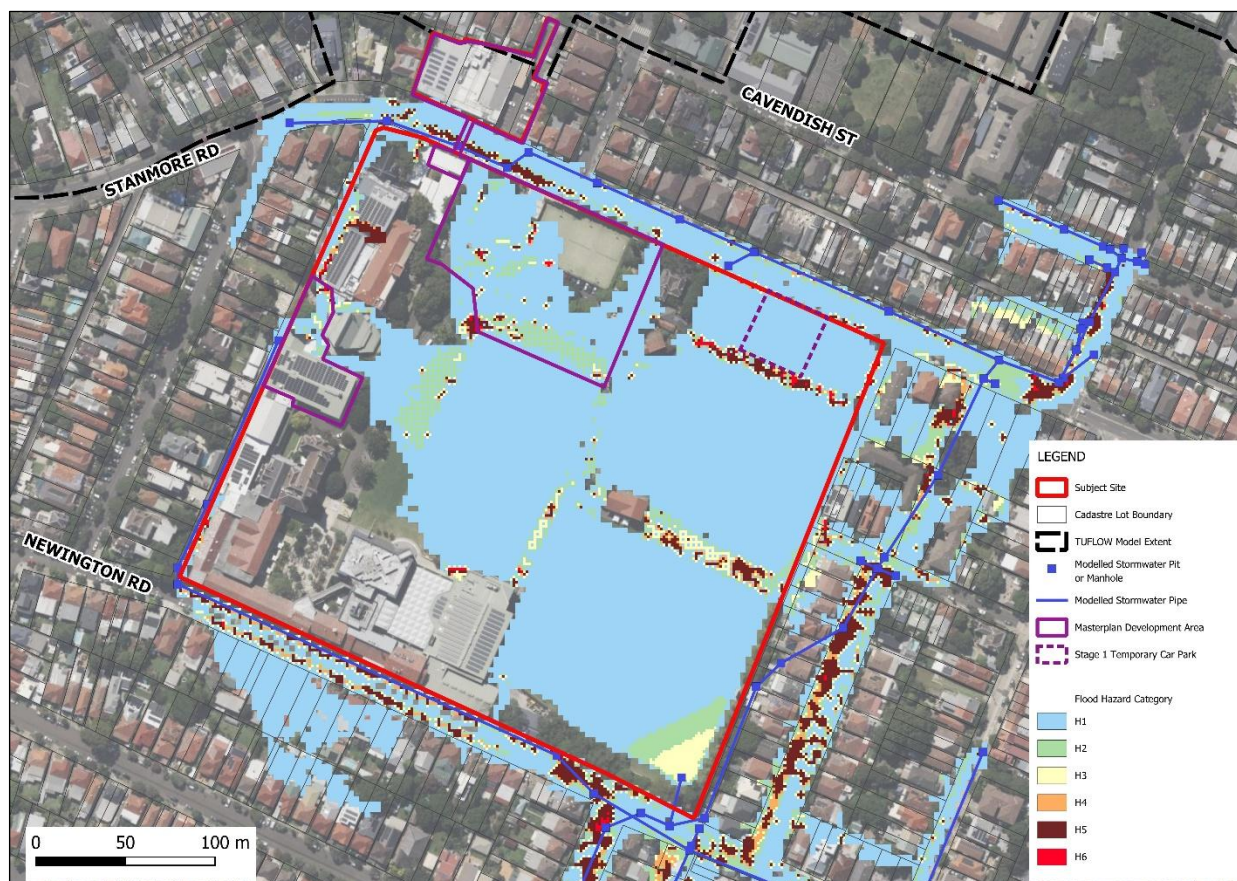


Figure 22: Existing scenario - peak flood hazard at the site in the 1% AEP event

5.1.3 PMF Event

The peak flood levels and depths during the PMF event for the Pre-Development Scenario are shown in Figure 23, while the peak flood velocity and flood hazard are depicted in Figure 24 and Figure 25, respectively. Wider spread of flooding is estimated in the PMF event when compared to the 1% AEP event. The existing basement car parking area of the Concordia building (i.e. access via Stanmore Road) will be inundated by floodwaters from Stanmore Road in this event, as the flood level in the car park entrance area is estimated to be approximately 37.046m AHD (i.e. the crest to the car parking area is surveyed at 37.00m AHD). The modelling results show that flood levels at the entrance to the basement car parking area of the Concordia building do not change significantly between the PMF and 1% AEP events assessed (i.e. only an increase of 40mm).

Flood depths across the Senior Campus site are generally less than 100mm. Maximum flood depth in the detention system at the south-east corner sporting field is approximately 1.6m. Floodwater in the detention area overtops the detention bund and inundate existing residential properties on the east in this event. Similar to the 39% AEP and 1% AEP events, flood depths in excess of 2.5m are observed around the existing building north of the Centenary Hall, but flooding in this area is considered not real as the modelling has not considered detailed local stormwater system in the area, hence resulting in floodwater being permanently trapped at this location.

The results show that no existing buildings onsite will be affected by flooding in this event assessed. Flow velocities are generally less than 0.8m/s within the Senior Campus site, but higher flow velocities are observed on the steep drop areas around the sporting fields. Hazards within the site remain low at mostly H1 (generally safe for people, vehicles and buildings), with small patches of H5 and H6 around the steep drop areas around the edge of sporting fields due to the anticipated high flow velocities. Hence, these steep drop areas within the site should be avoided during a storm event. The detention area at the site's south-east corner will experience hazards as high as H4 in the PMF event (i.e. due to the depth of the detained floodwater), hence this area should also be avoided in the PMF event. Larger extents of H5 and H6 hazards are observed (i.e. when compared to the 1% AEP results) on part of Stanmore Road, Newington Road and Browns Avenue, making these road areas unsafe for traffic.

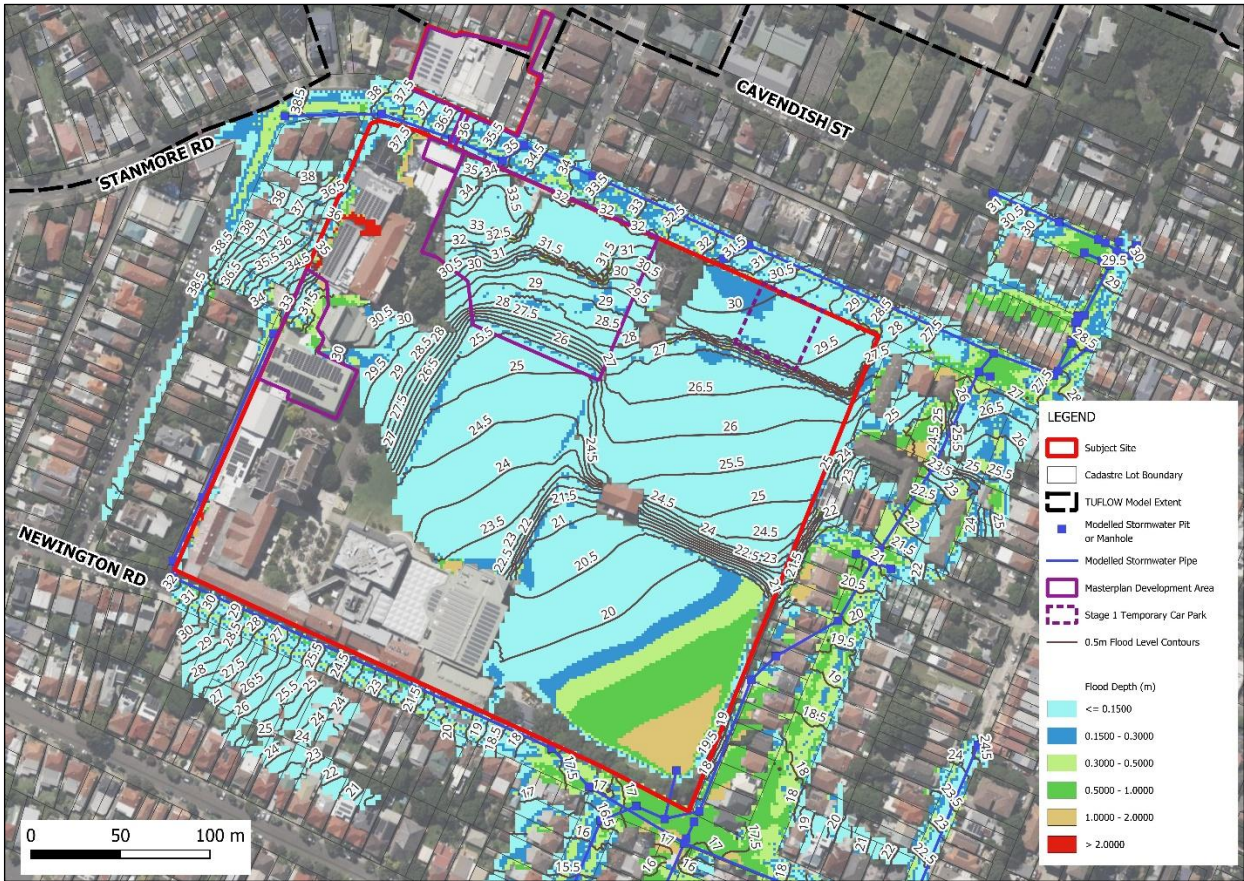


Figure 23: Existing scenario - peak flood levels and depths at the site in the PMF event

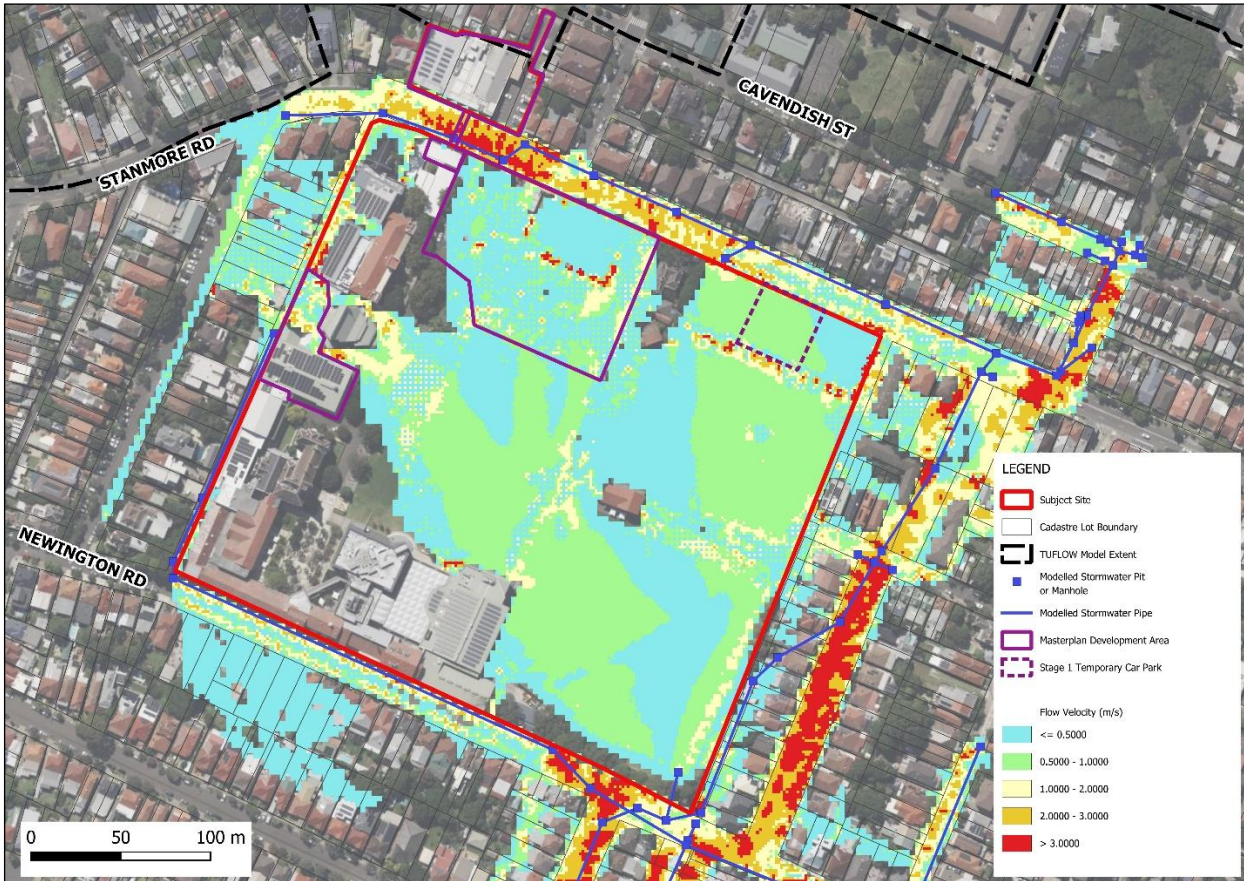


Figure 24: Existing scenario - peak flood velocity at the site in the PMF event

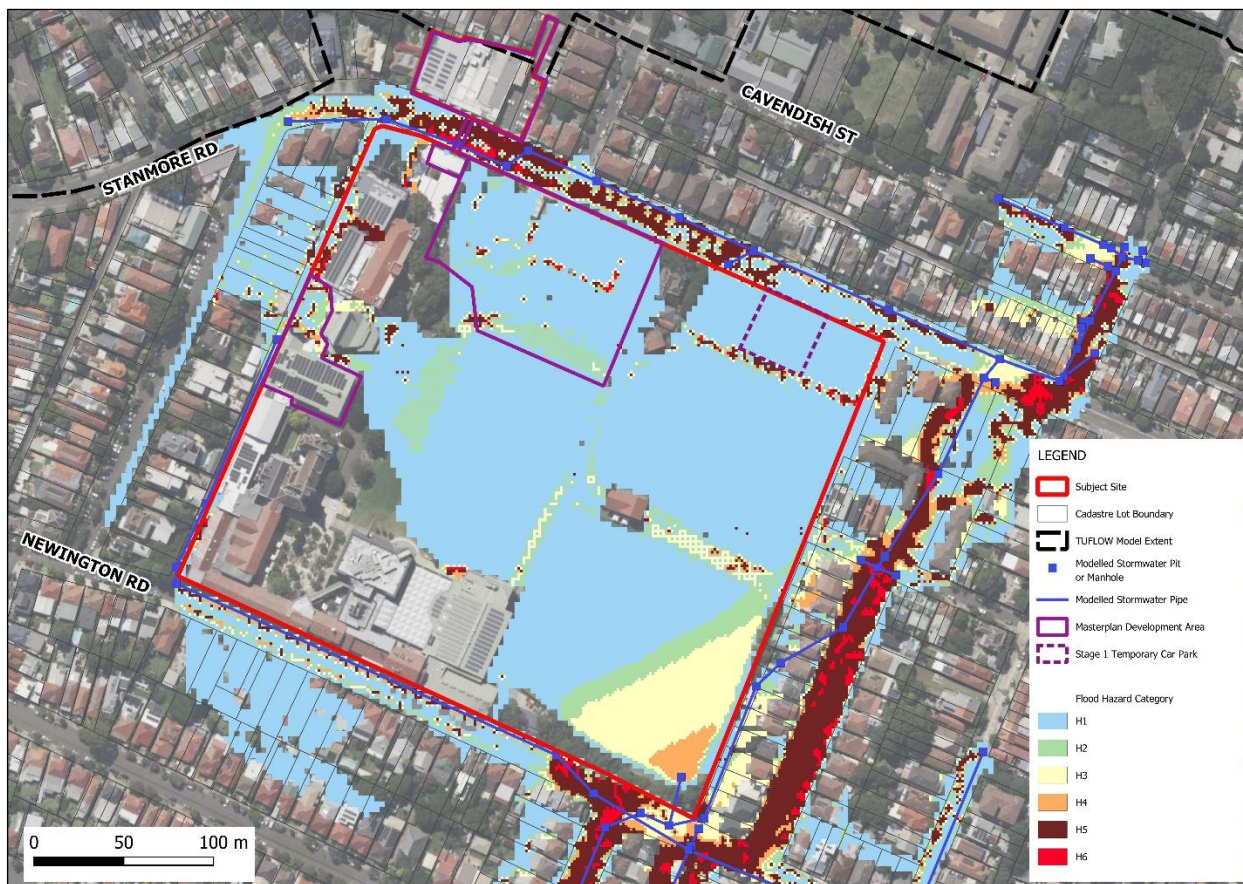


Figure 25: Existing scenario - peak flood hazard at the site in the PMF event

5.2 Post-Development Stage 1 Scenario Flood Behaviour

5.2.1 39% AEP Event

The peak flood levels and depths during the 39% AEP event for the Post-Development Stage 1 Scenario are shown in Figure 26, while the peak flood velocity and flood hazard are depicted in Figure 27 and Figure 28, respectively. Under the Stage 1 development conditions, flood inundation of the Senior Campus site and its immediate surrounding areas remained generally similar to that of the Pre-Development Scenario, except the extent of overland flow flood inundation on the proposed Sevington building area has been reduced and restricted to the east and south-east of this new building. Results show that the proposed Sevington entrance stair and podium areas are not impacted by flooding from Stanmore Road. The existing basement car parking area of the Concordia building (i.e. access via Stanmore Road) will not be impacted by floodwaters from Stanmore Road in this event, as the flood level in the car park entrance area is estimated to be approximately 36.86mAHD while the crest to the car parking area is surveyed at 37.00mAHD.

The flood depths on site are shallow and generally less than 40mm (i.e. including the temporary car parking area proposed during Stage 1 construction phase). The results also show that the existing underground stormwater system on College Lane is exceeded in this event, resulting in some overland flows onto the Senior Campus site north of the existing Centenary Hall area. The overland flows continue east onto the Johnson Oval, joining the overland flows from Stanmore Road. Flood depths in excess of 1.5m are observed around the existing building north of the Centenary Hall, but flooding in this area is considered not real as the modelling has not considered detailed local stormwater system in the area, hence resulting in floodwater being permanently trapped at this location.

The results show that no buildings onsite will be affected by flooding in this event assessed. Flow velocities are generally less than 0.5m/s within the Senior Campus site, but higher flow velocities are observed on the steep drop areas around the sporting fields. Flow velocities within the temporary car parking area proposed during the Stage 1 construction phase are low and generally at 0.3m/s or lower across the car parking area, with only two minor spot areas with flow velocities as high as 0.8m/s along the northern boundary of the car parking area. Hazards within the site are low at mostly H1 (generally safe for people, vehicles and buildings), with small patches of H5 and H6 around the steep drop areas around the edge of sporting fields due to the anticipated high flow velocities. Hence, these steep drop areas within the site should be avoided during a storm event. Hazards within the proposed temporary car parking area (i.e. proposed during the Stage 1 construction phase) are generally low at H1 in this event assessed.

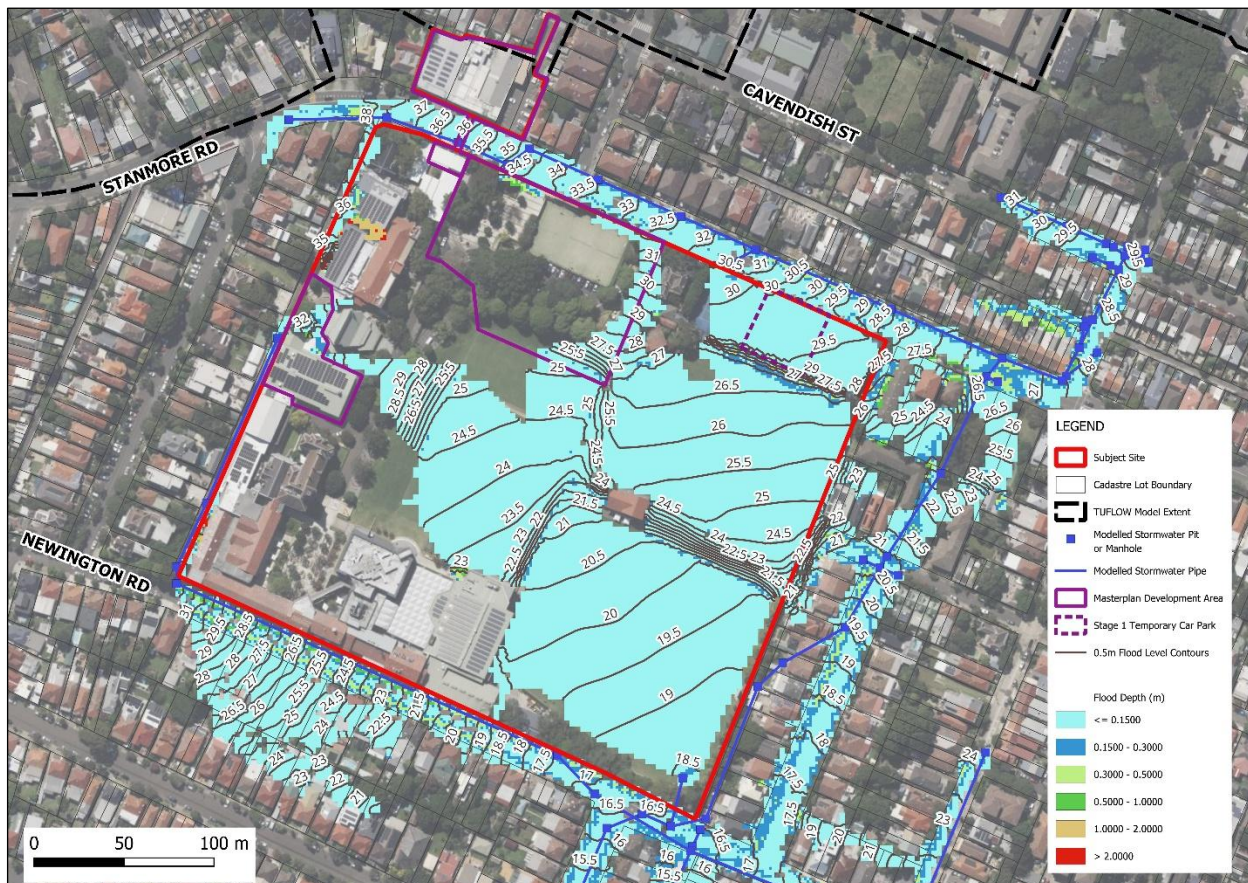


Figure 26: Post-Development Stage 1 scenario - peak flood levels and depths at the site in the 39% AEP event

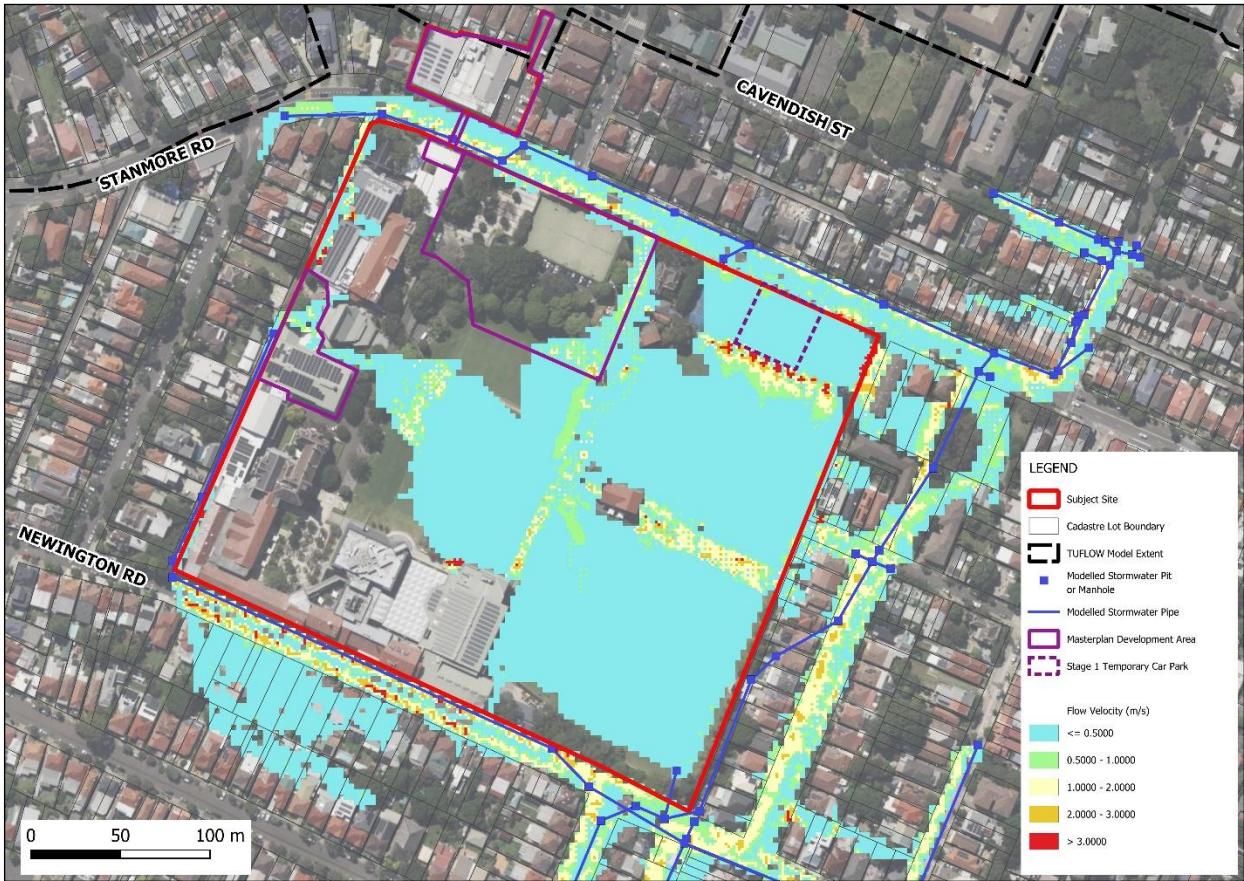


Figure 27: Post-Development Stage 1 scenario - peak flood velocity at the site in the 39% AEP event

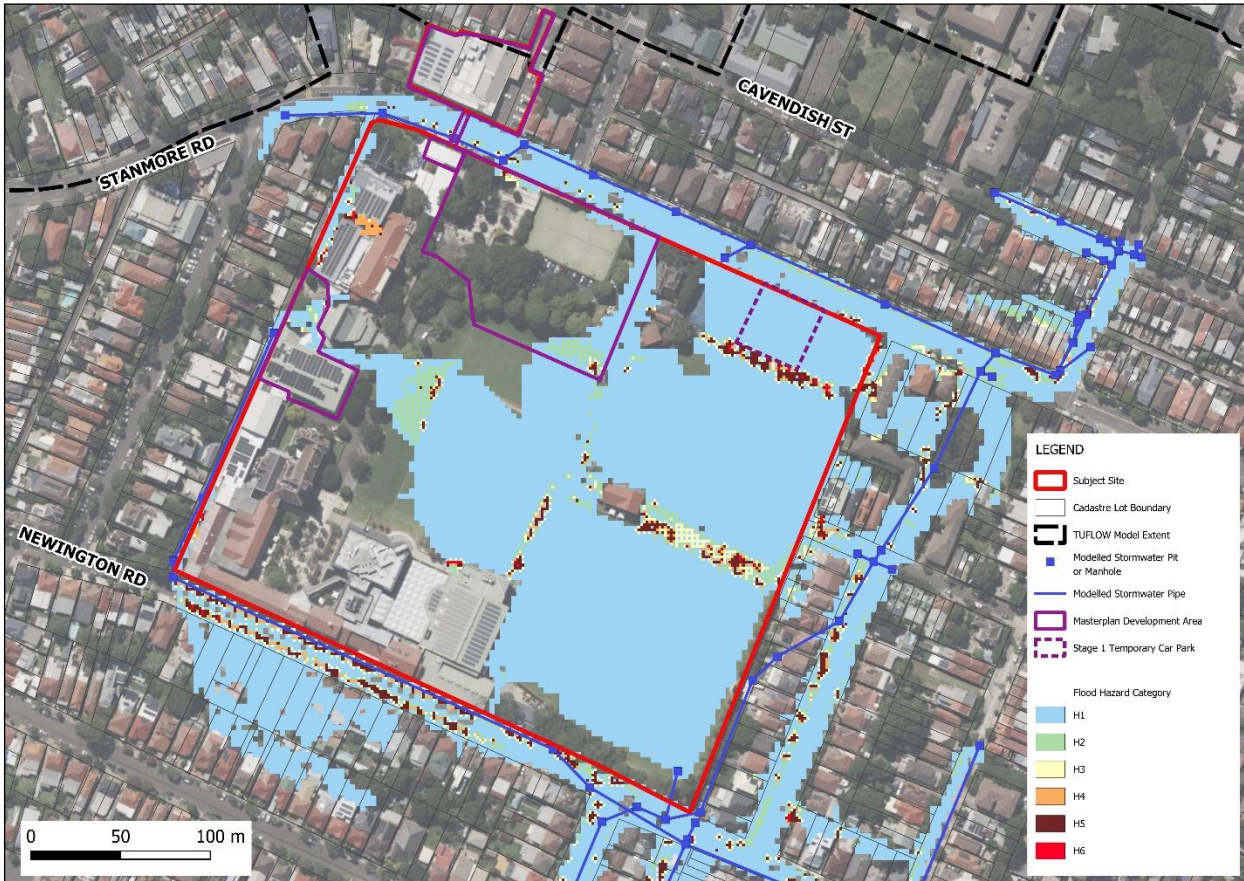


Figure 28: Post-Development Stage 1 scenario - peak flood hazard at the site in the 39% AEP event

5.2.2 1% AEP Event

The peak flood levels and depths during the 1% AEP event for the Post-Development Stage 1 Scenario are shown in Figure 29, while the peak flood velocity and flood hazard are depicted in Figure 30 and Figure 31, respectively. Flooding results are generally similar to the 39% AEP event but with larger flood extent observed (i.e. more areas estimated to be impacted by flooding). Additional flooding and inundation are observed on the driveway exit to Stanmore Road and western side of the proposed Sevington building when compared to the 39% AEP event. The flood level at the entrance to the proposed basement car parking area of Sevington building is 28.633mAHD. The flood level at the proposed Sevington entrance area is 34.42mAHD.

The existing basement car parking area of the Concordia building (i.e. access via Stanmore Road) will be inundated by floodwaters from Stanmore Road in this event, as the flood level in the car park entrance area is estimated to be approximately 37.006mAHD (i.e. the crest to the car parking area is surveyed at 37.00mAHD).

Similarly, the flood depths on site are shallow and generally less than 60mm. Similar to the pre-development scenario, flood depths at the proposed temporary car parking area (i.e. proposed during the Stage 1 construction phase) are generally less than 90mm in this event. Maximum flood depth in the detention system at the south-east corner sporting field is approximately 0.85m, which is 100mm higher than the Pre-Development Scenario, suggesting that additional floodwater being detained and attenuated at this location. Similar to the 39% AEP event, flood depths in excess of 2m are observed around the existing building north of the Centenary Hall, but flooding in this area is considered not real as the modelling has not considered detailed local stormwater system in the area, hence resulting in floodwater being permanently trapped at this location.

The results show that no buildings onsite will be affected by flooding in this event assessed. Flow velocities are generally less than 0.5m/s within the Senior Campus site, but higher flow velocities are observed on the steep drop areas around the sporting fields. Flow velocities within the proposed temporary car parking area (i.e. proposed during the Stage 1 construction phase) are estimated to be lower than 0.5m/s in this event, generally similar to that of the pre-development scenario. Hazards within the site remain low at mostly H1 (generally safe for people, vehicles and buildings), with small patches of H5 and H6 around the steep drop areas around the edge of sporting fields due to the anticipated high flow velocities. Hence, these steep drop areas within the site should be avoided during a storm event. H5 hazards are observed on part of the road areas on Stanmore Road, Newington Road and Browns Avenue, making these road areas unsafe for traffic. H3 hazards are also observed on the south-east corner where floodwater is detained, making this area not safe for children and elderly. Hazards within the proposed temporary car parking area (i.e. proposed during the Stage 1 construction phase) remained low at H1, hence the temporary car parking area remain safe for traffic in the 1% AEP event.

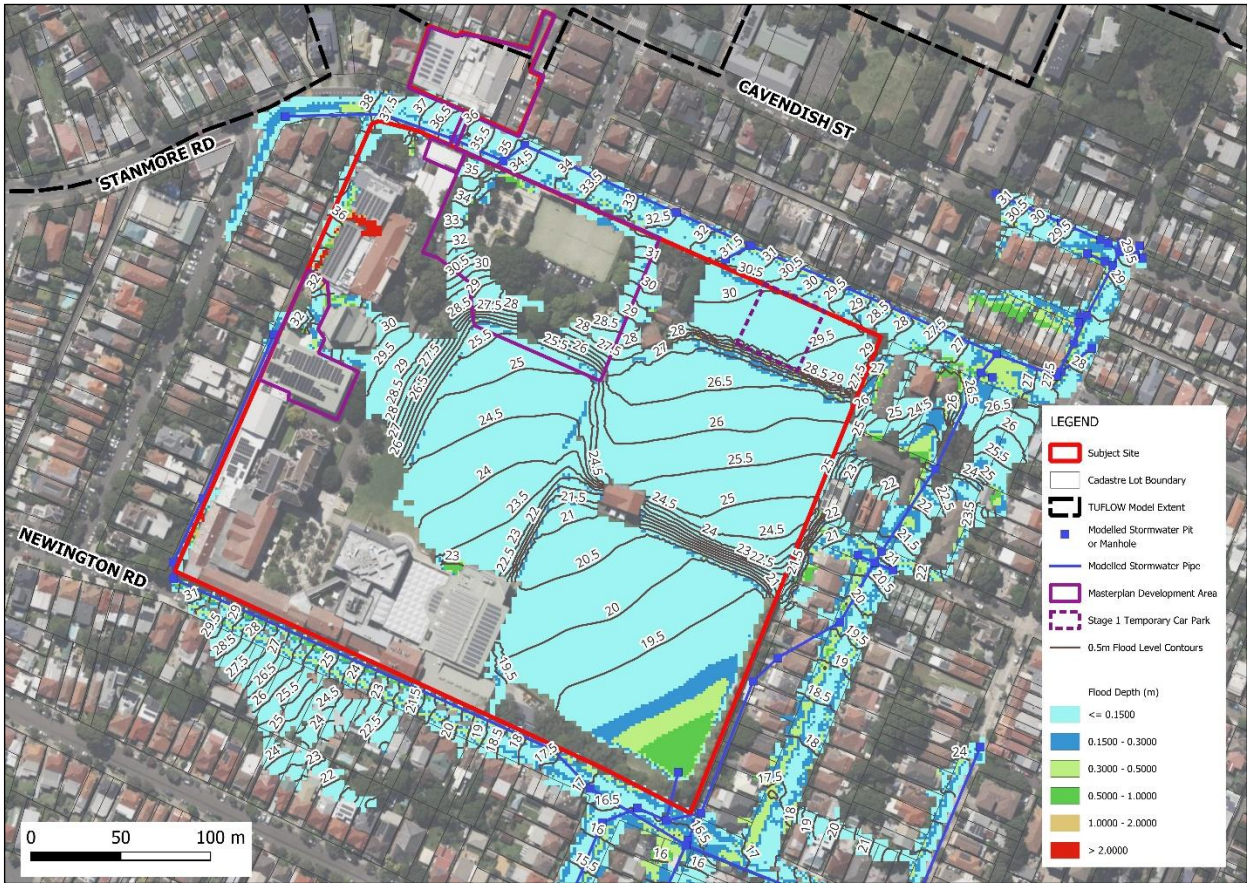


Figure 29: Post-Development Stage 1 scenario - peak flood levels and depth at the site in the 1% AEP event

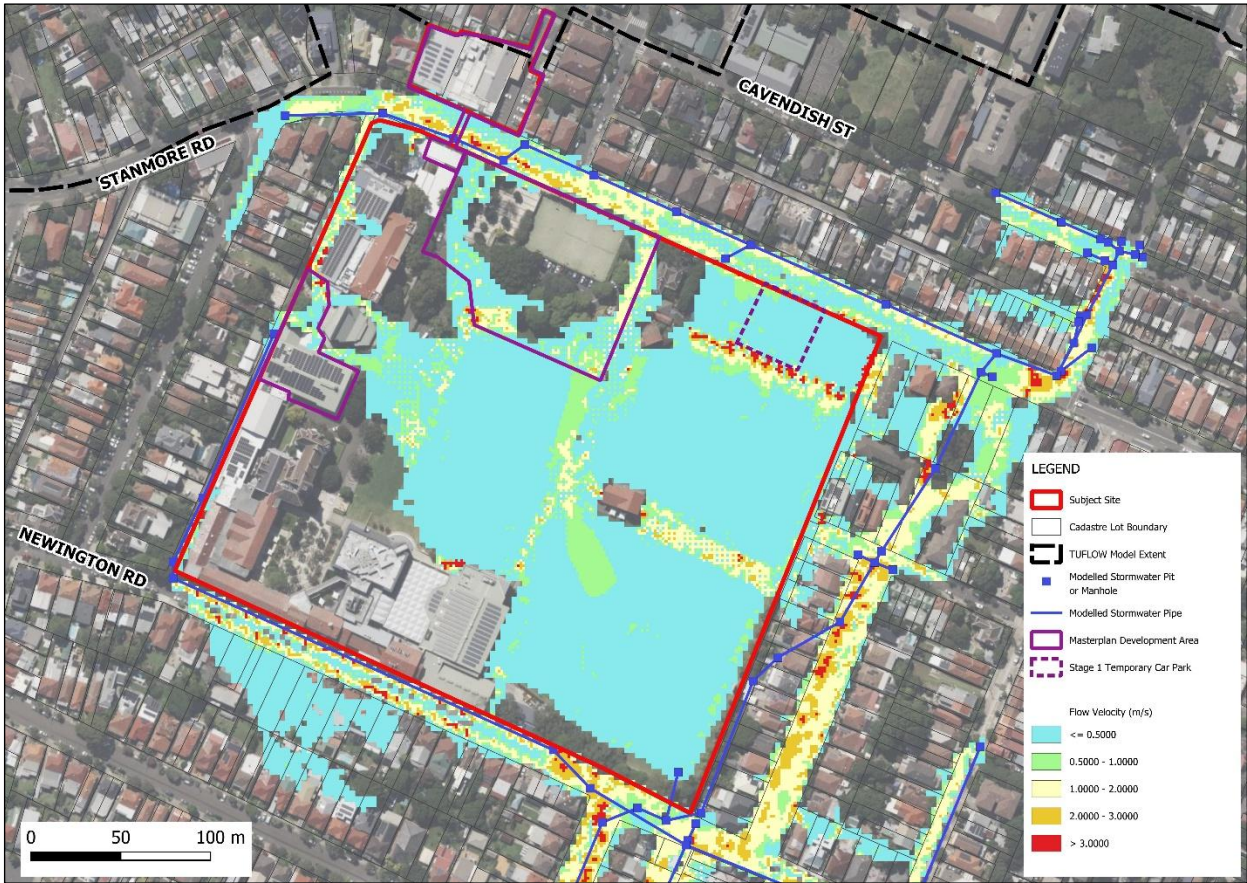


Figure 30: Post-Development Stage 1 scenario - peak flood velocity at the site in the 1% AEP event

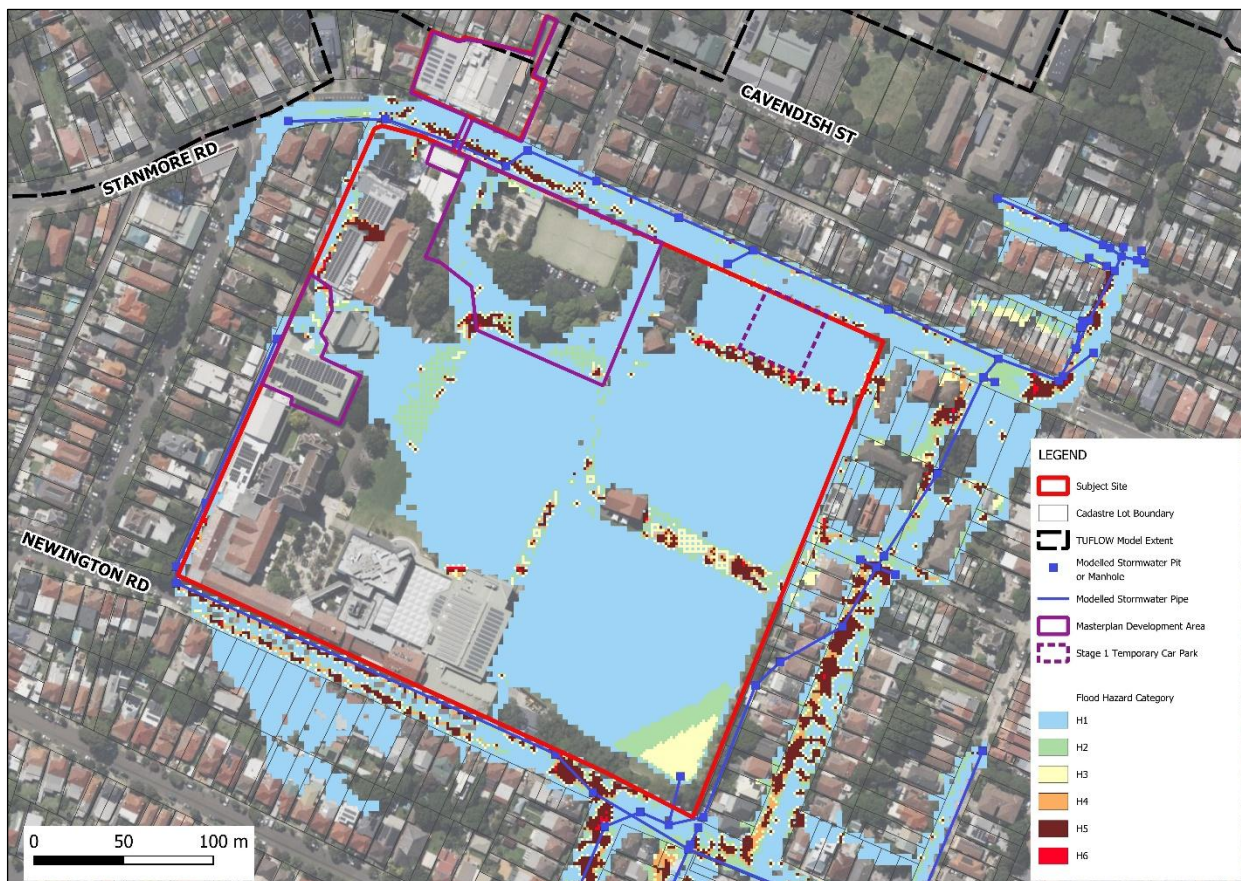


Figure 31: Post-Development Stage 1 scenario - peak flood hazard at the site in the 1% AEP event

5.2.3 PMF Event

The peak flood levels and depths during the PMF event for the Post-Development Stage 1 Scenario are shown in Figure 32, while the peak flood velocity and flood hazard are depicted in Figure 33 and Figure 34, respectively. Wider spread of flooding is estimated in the PMF event when compared to the 1% AEP event. The flood level at the entrance to the proposed basement car parking area of Sevington building is 28.636mAHd (i.e. only 3mm higher than the 1% AEP event). The flood level at the proposed Sevington entrance area is 34.50mAHd in the PMF event assessed. The existing basement car parking area of the Concordia building (i.e. access via Stanmore Road) will be inundated by floodwaters from Stanmore Road in this event, as the flood level in the car park entrance area is estimated to be approximately 37.046mAHd (i.e. the crest to the car parking area is surveyed at 37.00mAHd). Similar to the pre-development scenario, the modelling results show that flood level only increased by approximately 40mm between the PMF and 1% AEP events assessed, at this car park entrance area.

Flood depths across the Senior Campus site are generally less than 100mm. Flood depths within the proposed temporary car parking area (i.e. proposed during the Stage 1 construction phase) are lower than 160mm, with lower flood depths estimated towards the south of the car parking area, generally similar to that of the pre-development scenario. Maximum flood depth in the detention system at the south-east corner sporting field is approximately 1.6m. Floodwater in the detention area overtops the detention bund and inundate existing residential properties on the east in this event. Similar to the 39% AEP and 1% AEP events, flood depths in excess of 2.5m are observed around the existing building north of the Centenary Hall, but flooding in this area is considered not real as the modelling has not considered detailed local stormwater system in the area, hence resulting in floodwater being permanently trapped at this location.

The results show that no buildings onsite will be affected by flooding in this event assessed. Flow velocities are generally less than 0.8m/s within the Senior Campus site, but higher flow velocities are observed on the steep drop areas around the sporting fields. Flow velocities within the proposed temporary car parking area (i.e. proposed during the Stage 1 construction phase) are generally less than 0.7m/s, however flow velocities as high as 0.85m/s are estimated over small area near the north-west corner of the car parking area. These are generally similar to those of the pre-development scenario.

Hazards within the site remain low at mostly H1 (generally safe for people, vehicles and buildings), with small patches of H5 and H6 around the steep drop areas around the edge of sporting fields due to the anticipated high flow velocities. Hence, these steep drop areas within the site should be avoided during a storm event. Further, the detention area at the site's south-east corner will experience hazards as high as H4 in the PMF event (i.e. due to the depth of the detained floodwater), hence this area should also be avoided in the PMF event. Larger extents of H5 and H6 hazards are observed (i.e. when compared to the 1% AEP results) on Stanmore Road, Newington Road and Browns Avenue, making these roads unsafe for traffic. Nonetheless, hazards within the proposed temporary car parking area (i.e. proposed during the Stage 1 construction phase) are generally low at H1 in the PMF event assessed, hence considered safe for traffic.

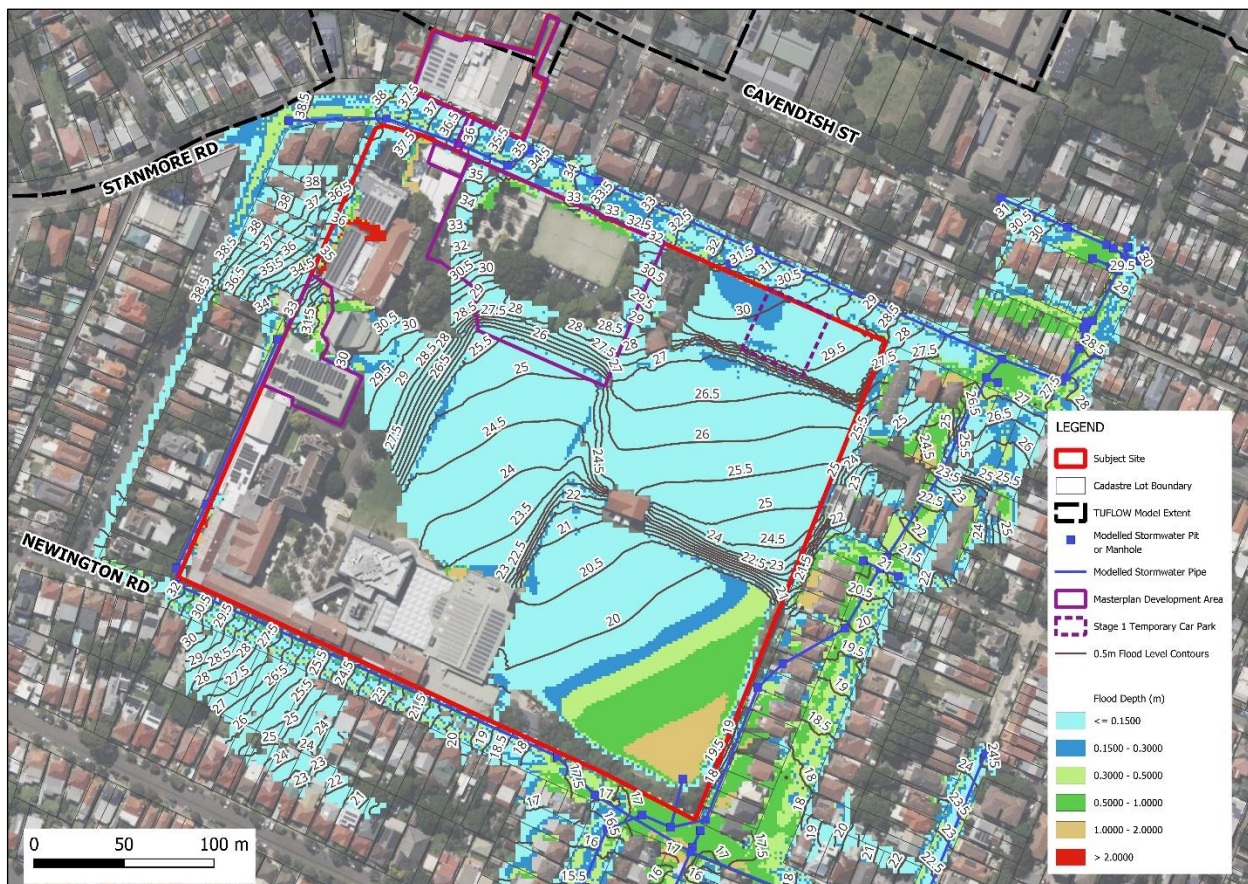


Figure 32: Post-Development Stage 1 scenario - peak flood levels and depths at the site in the PMF event

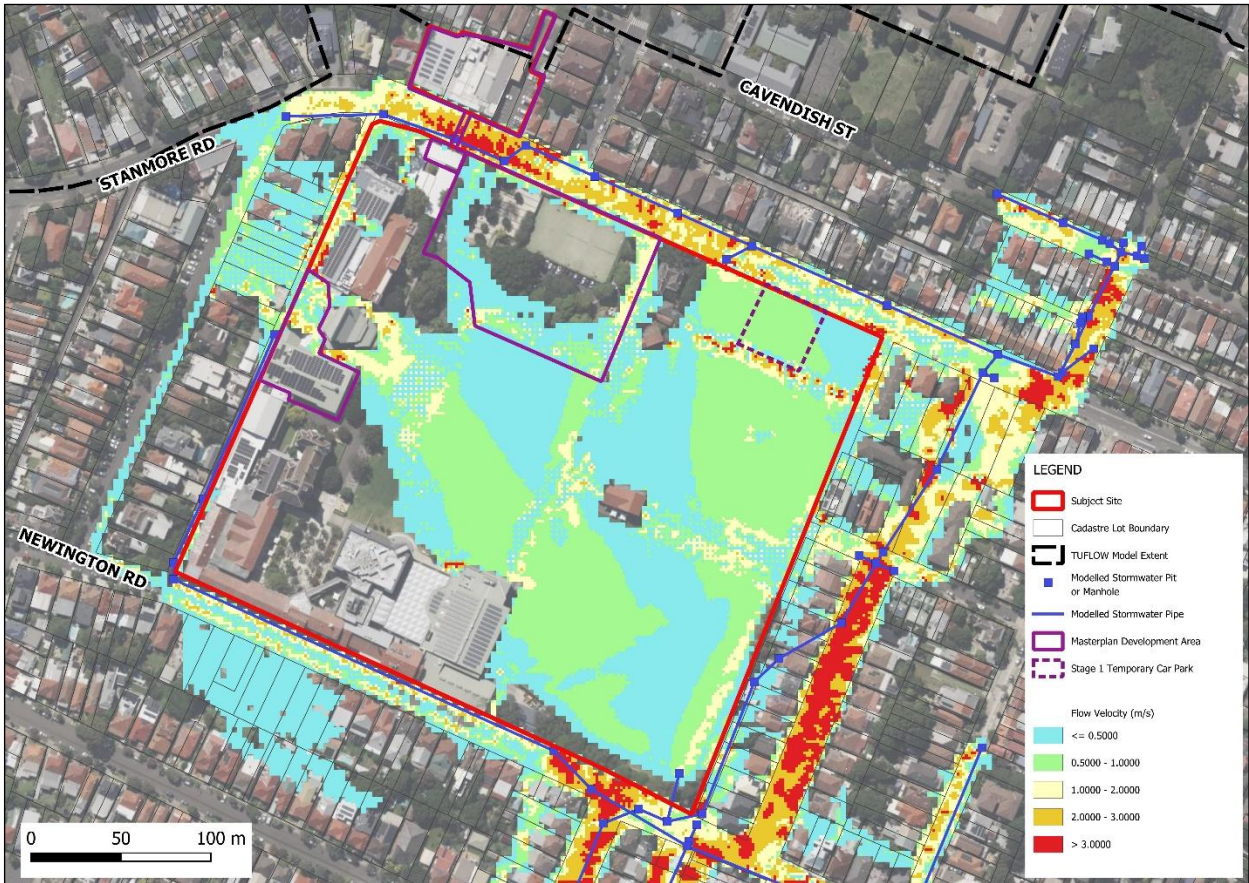


Figure 33: Post-Development Stage 1 scenario - peak flood velocity at the site in the PMF event

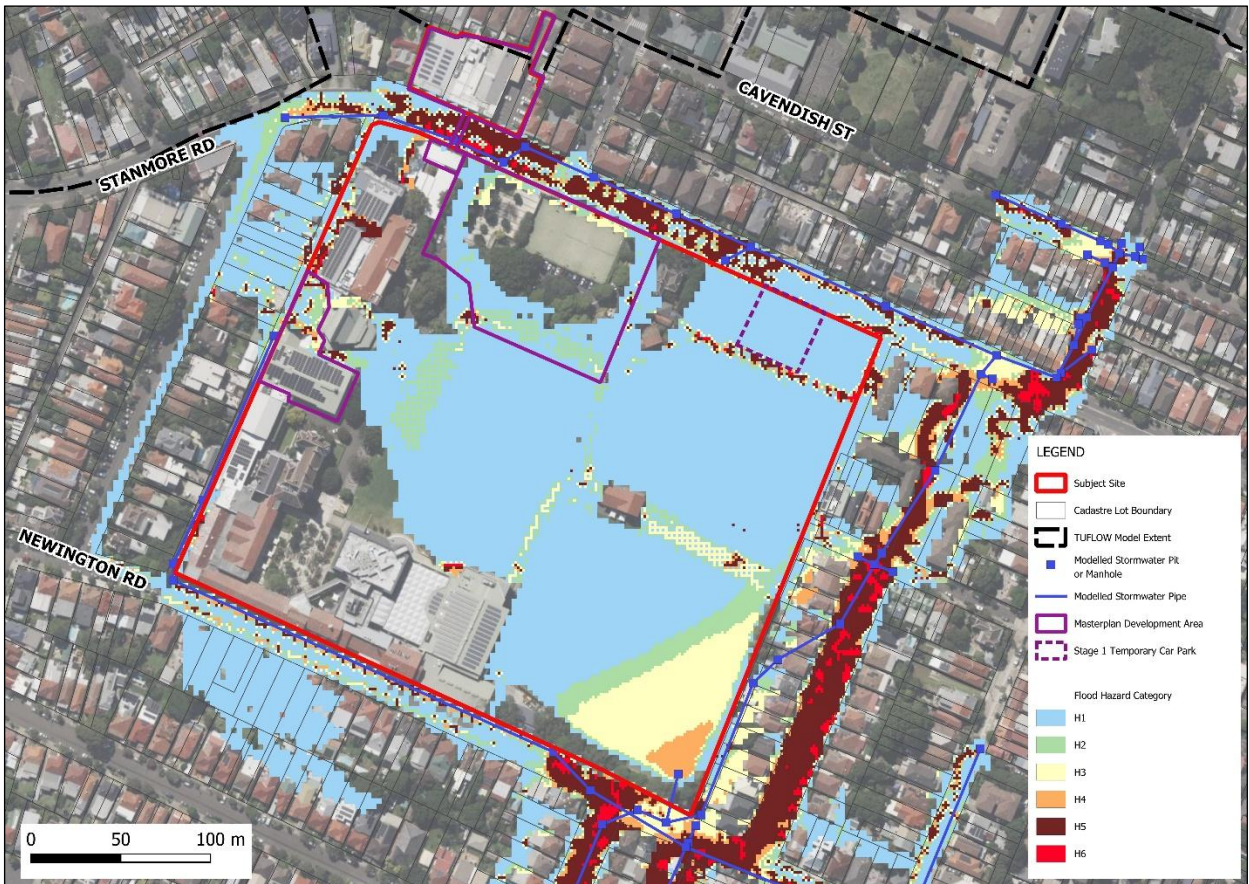


Figure 34: Post-Development Stage 1 scenario - peak flood hazard at the site in the PMF event

5.3 Post-Development Masterplan Scenario Flood Behaviour

5.3.1 39% AEP Event

The peak flood levels and depths during the 39% AEP event for the Post-Development Masterplan Scenario are shown in Figure 35, while the peak flood velocity and flood hazard are depicted in Figure 36 and Figure 37, respectively. Under the ultimate Masterplan development conditions, flood inundation of the Senior Campus site and its immediate surrounding areas remained generally similar to that of the Pre-Development Scenario, except the extent of overland flow flood inundation on the proposed Sevington building area has been reduced and restricted to the east and south-east of this new building (i.e. when compared to the Pre-Development Scenario). Additional overland flow from Stanmore Road is also observed across the existing demountable building area (i.e. proposed to be removed as part of the Masterplan) via the adopted 6m opening to accommodate the new bridge crossing from Concordia building.

The flood depths on site are shallow and generally less than 40mm, including the temporary car parking area proposed during Stage 1 construction phase. The results also show that the overland flow that runs east across the north of Centenary Hall area towards the Johnson Oval is no longer occurring, as the overland flow is now being fully captured and conveyed by the adopted stormwater pit and pipe system on College Lane. Similar to the Pre-Development Scenario modelling, flood depths in excess of 1.5m are observed around the existing building north of the Centenary Hall, but flooding in this area is considered not real as the modelling has not considered detailed local stormwater system in the area, hence resulting in floodwater being permanently trapped at this location.

The results show that no buildings onsite will be affected by flooding in this event assessed. Flow velocities are generally less than 0.5m/s within the Senior Campus site, but higher flow velocities are observed on the steep drop areas around the sporting fields. Flow velocities within the temporary car parking area proposed during the Stage 1 construction phase are low and generally at 0.3m/s or lower across the car parking area, with only two minor spot areas with flow velocities as high as 0.8m/s along the northern boundary of the car parking area. Hazards within the site are low at mostly H1 (generally safe for people, vehicles and buildings), with small patches of H5 and H6 around the steep drop areas around the edge of sporting fields due to the anticipated high flow velocities. Hence, these steep drop areas within the site should be avoided during a storm event. Similar to the Stage 1 scenario, hazards within the proposed temporary car parking area (i.e. proposed during the Stage 1 construction phase) are generally low at H1 in this event assessed, hence is safe for traffic.

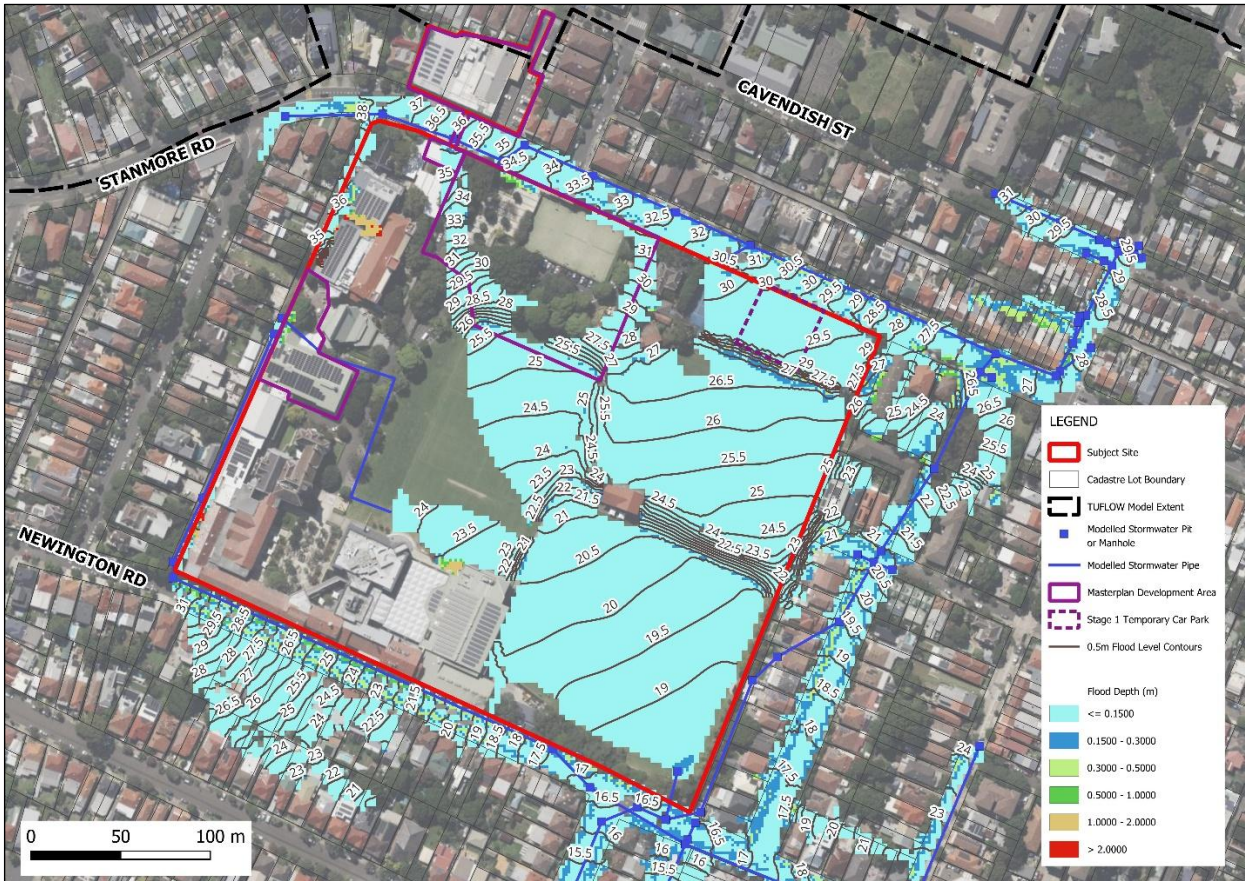


Figure 35: Post-Development Masterplan scenario - peak flood levels and depths at the site in the 39% AEP event

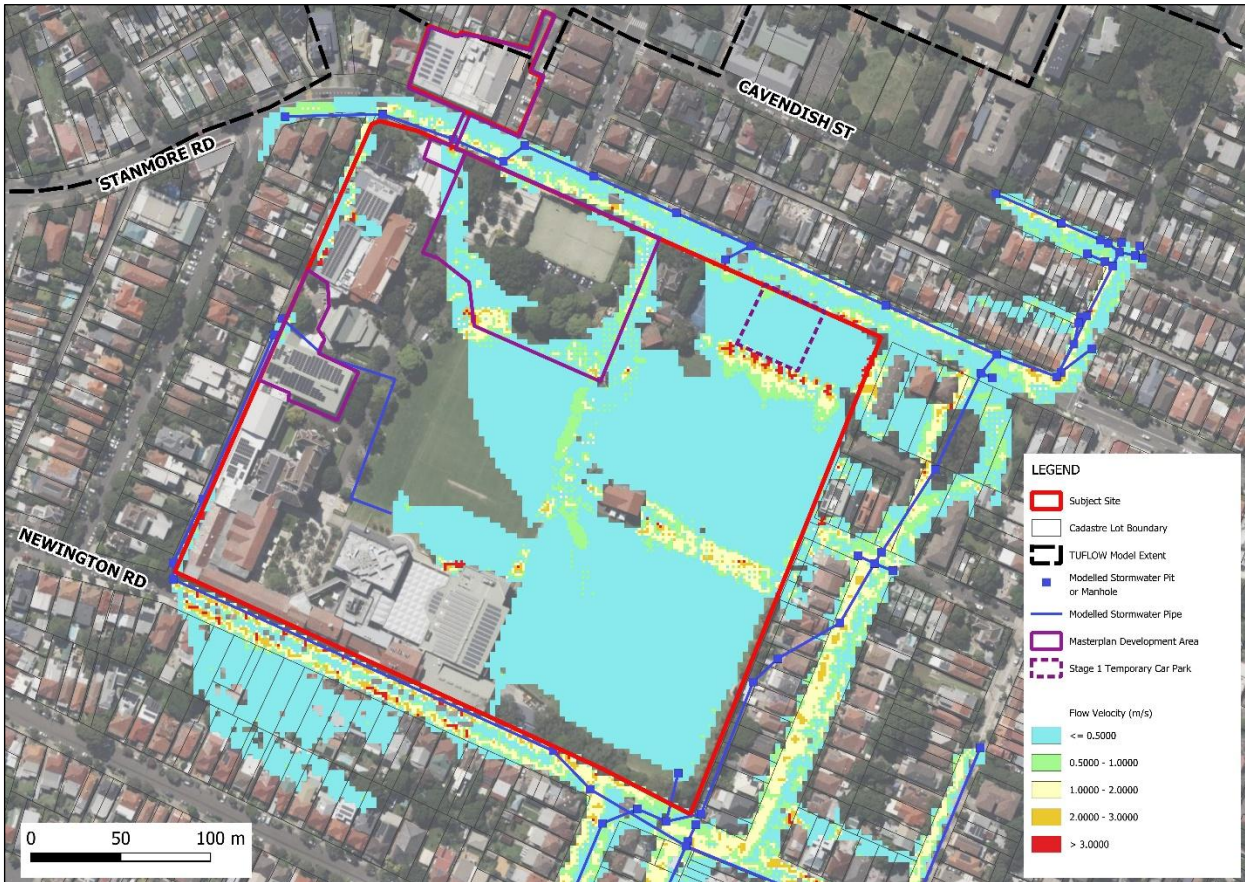


Figure 36: Post-Development Masterplan scenario - peak flood velocity at the site in the 39% AEP event

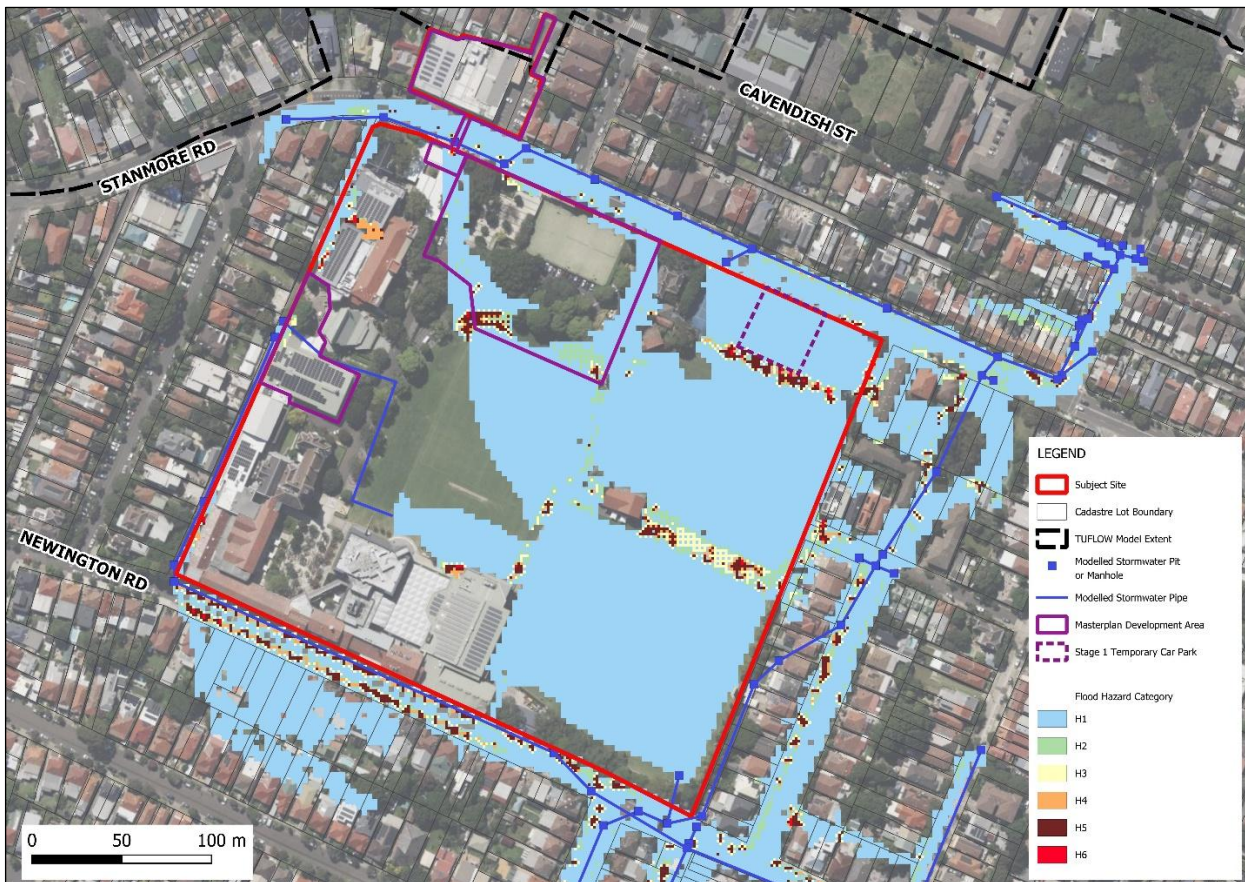


Figure 37: Post-Development Masterplan scenario - peak flood hazard at the site in the 39% AEP event

5.3.2 1% AEP Event

The peak flood levels and depths during the 1% AEP event for the Post-Development Masterplan Scenario are shown in Figure 38, while the peak flood velocity and flood hazard are depicted in Figure 39 and Figure 40, respectively. Flooding results are generally similar to the 39% AEP event but with larger flood extent observed (i.e. more areas estimated to be impacted by flooding). In particular, additional flooding and inundation are observed on the driveway exit to Stanmore Road and north-west corner of Johnson Oval when compared to the 39% AEP event. The flood level at the entrance to the proposed basement car parking area of Sevington building is 28.633mAHD. The flood level at the proposed Sevington entrance area is 34.42mAHD.

The existing basement car parking area of the Concordia building (i.e. access via Stanmore Road) will not be inundated by floodwaters from Stanmore Road in this event, as the flood level in the car park entrance area is estimated to be approximately 37.006mAHD (i.e. the crest to the car parking area has been set at 37.20mAHD).

Similarly, the flood depths on site are shallow and generally less than 60mm. Flood depths at the proposed temporary car parking area (i.e. proposed during the Stage 1 construction phase) are generally less than 90mm in this event. Maximum flood depth in the detention system at the south-east corner sporting field is approximately 0.85m, which is 100mm higher than the Pre-Development Scenario, suggesting that additional floodwater being detained and attenuated at this location. Similar to the 39% AEP event, flood depths in excess of 2m are observed around the existing building north of the Centenary Hall, but flooding in this area is considered not real as the modelling has not considered detailed local stormwater system in the area, hence resulting in floodwater being permanently trapped at this location.

The results show that no buildings onsite will be affected by flooding in this event assessed. Flow velocities are generally less than 0.5m/s within the Senior Campus site, but higher flow velocities are observed on the steep drop areas around the sporting fields. Flow velocities within the proposed temporary car parking area (i.e. proposed during the Stage 1 construction phase) are estimated to be lower than 0.5m/s in this event, and generally similar to that of the pre-development scenario. Hazards within the site remain low at mostly H1 (generally safe for people, vehicles and buildings), with small patches of H5 and H6 around the steep drop areas around the edge of sporting fields due to the anticipated high flow velocities. Hence, these steep drop areas within the site should be avoided during a storm event. H5 hazards are observed on part of Stanmore Road, Newington Road and Browns Avenue, making these road areas unsafe for traffic. H3 hazards are also observed on the south-east corner where floodwater is detained, making this area not safe for children and elderly. Hazards within the proposed temporary car parking area (i.e. proposed during the Stage 1 construction phase) remained low at H1, hence the temporary car parking is considered safe for traffic in the 1% AEP event.

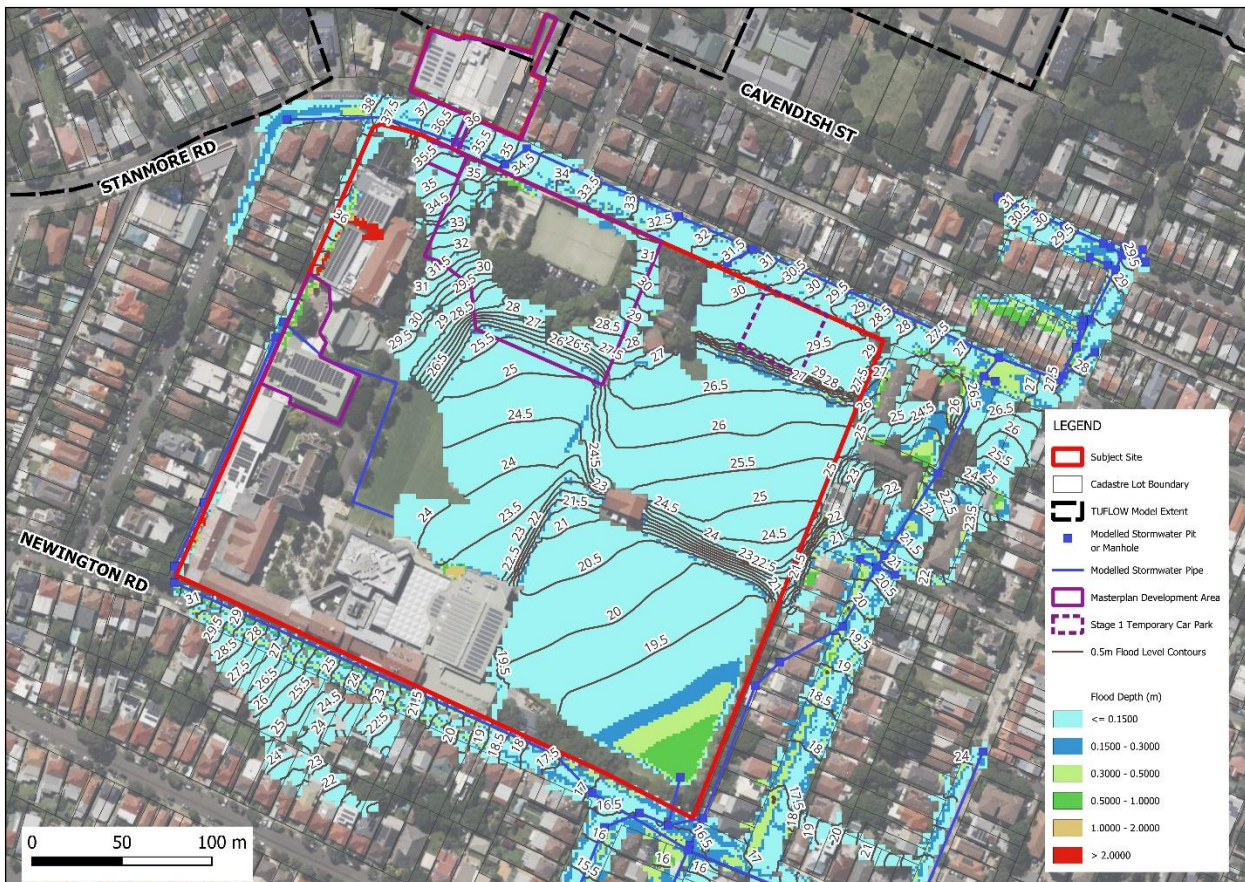


Figure 38: Post-Development Masterplan scenario - peak flood levels and depth at the site in the 1% AEP event

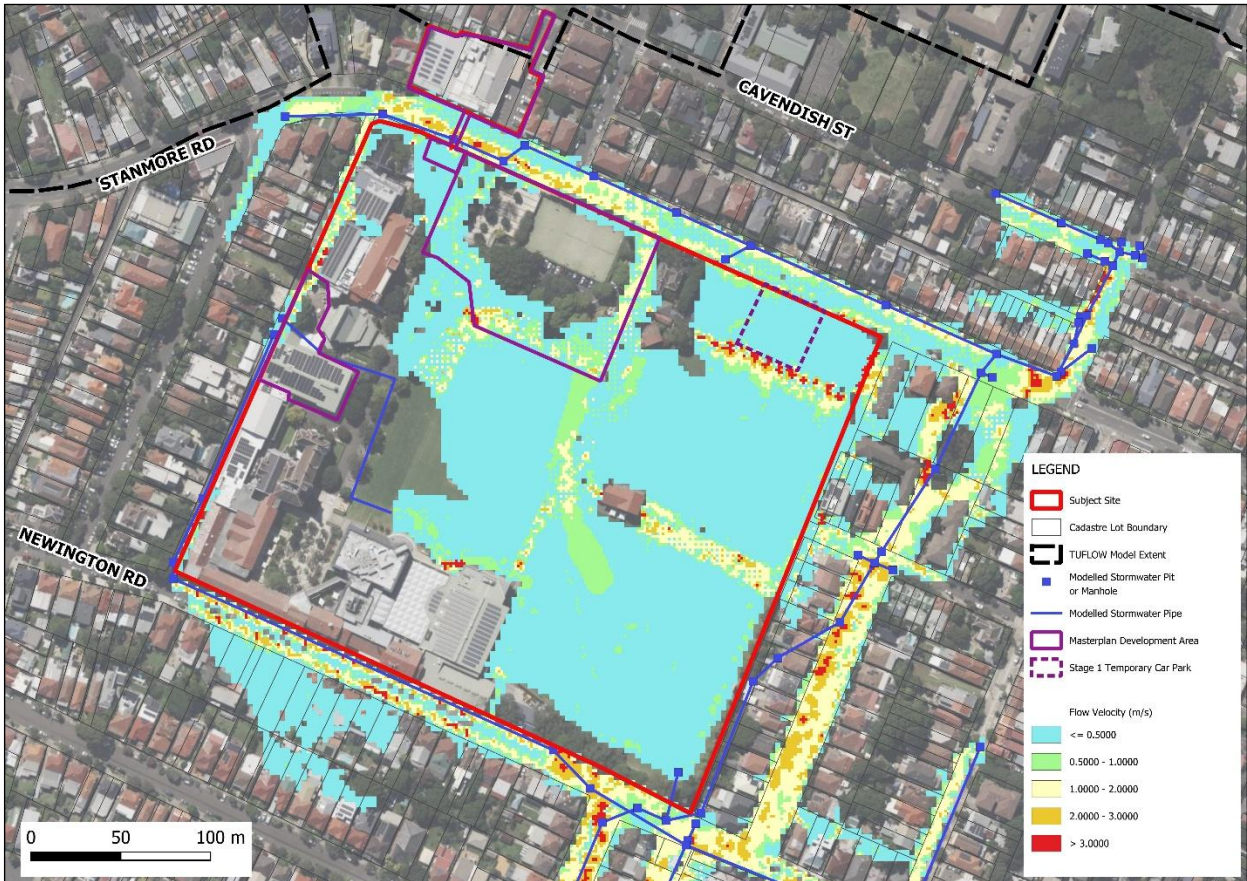


Figure 39: Post-Development Masterplan scenario - peak flood velocity at the site in the 1% AEP event

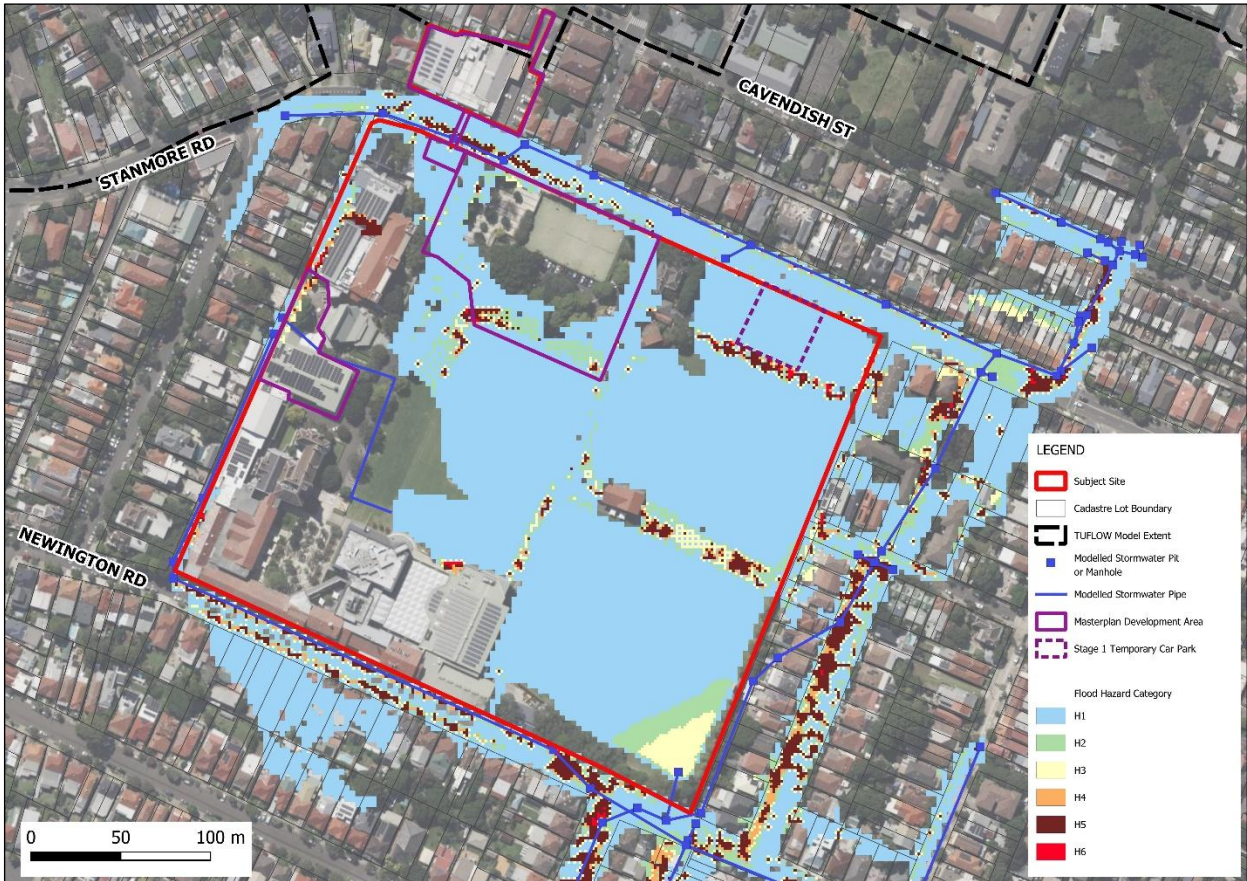


Figure 40: Post-Development Masterplan scenario - peak flood hazard at the site in the 1% AEP event

5.3.3 PMF Event

The peak flood levels and depths during the PMF event for the Post-Development Masterplan Scenario are shown in Figure 41, while the peak flood velocity and flood hazard are depicted in Figure 42 and Figure 43, respectively. Wider spread of flooding is estimated in the PMF event when compared to the 1% AEP event. The flood level at the entrance to the proposed basement car parking area of Sevington building is 28.636mAHd (i.e. 3mm higher than the 1% AEP event). The flood level at the proposed Sevington entrance area is 34.5mAHd in the PMF event assessed. The basement car parking area of the Concordia building (i.e. access via Stanmore Road) will not be impacted by floodwaters from Stanmore Road in this event, as the flood level in the car park entrance area is estimated to be approximately 37.046mAHd (i.e. the crest to the car parking area has been set at 37.20mAHd).

Flood depths across the Senior Campus site are generally less than 100mm. Flood depths within the proposed temporary car parking area (i.e. proposed during the Stage 1 construction phase) are lower than 160mm, with lower flood depths estimated towards the south of the car parking area, generally similar to that of the pre-development scenario. Maximum flood depth in the detention system at the south-east corner sporting field is approximately 1.6m. Floodwater in the detention area overtops the detention bund and inundate existing residential properties on the east in this event. Similar to the 39% AEP and 1% AEP events, flood depths in excess of 2.5m are observed around the existing building north of the Centenary Hall, but flooding in this area is considered not real as the modelling has not considered detailed local stormwater system in the area, hence resulting in floodwater being permanently trapped at this location.

The results show that no buildings onsite will be affected by flooding in this event assessed. Flow velocities are generally less than 0.8m/s within the Senior Campus site, but higher flow velocities are observed on the steep drop areas around the sporting fields. Flow velocities within the proposed temporary car parking area (i.e. proposed during the Stage 1 construction phase) are generally less than 0.7m/s, however flow velocities as high as 0.85m/s are estimated over small area near the north-west corner of the car parking area. Hazards within the site remain low at mostly H1 (generally safe for people, vehicles and buildings), with small patches of H5 and H6 around the steep drop areas around the edge of sporting fields due to the anticipated high flow velocities. Hence, these steep drop areas within the site should be avoided during a storm event. Further, the detention area at the site's south-east corner will experience hazards as high as H4 in the PMF event (i.e. due to the depth of the detained floodwater), hence this area should also be avoided in the PMF event. Larger extents of H5 and H6 hazards are observed (i.e. when compared to the 1% AEP results) on Stanmore Road, Newington Road and Browns Avenue, making these road areas unsafe for traffic. Nonetheless, hazards within the proposed temporary car parking area (i.e. proposed during the Stage 1 construction phase) are generally low at H1 in the PMF event assessed, hence considered safe for traffic.

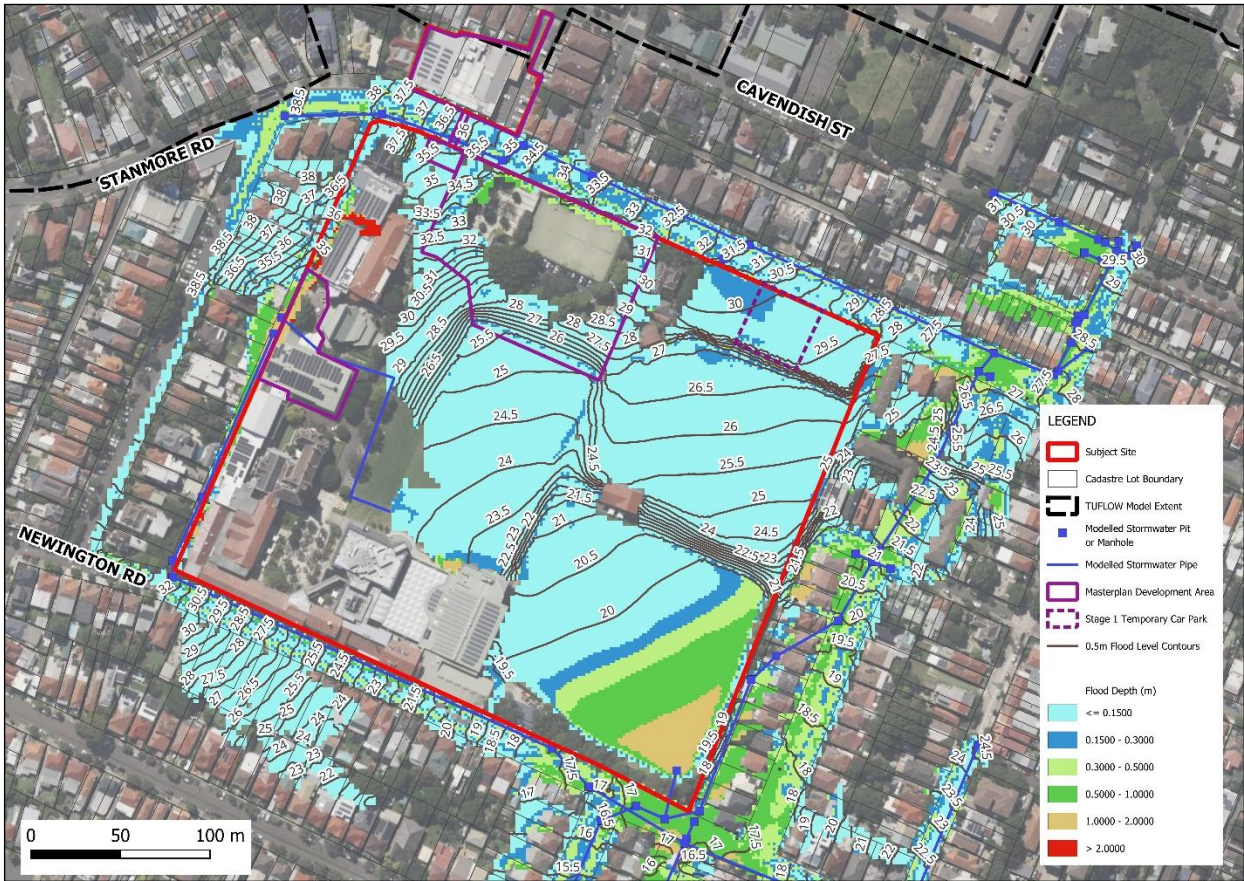


Figure 41: Post-Development Masterplan scenario - peak flood levels and depths at the site in the PMF event

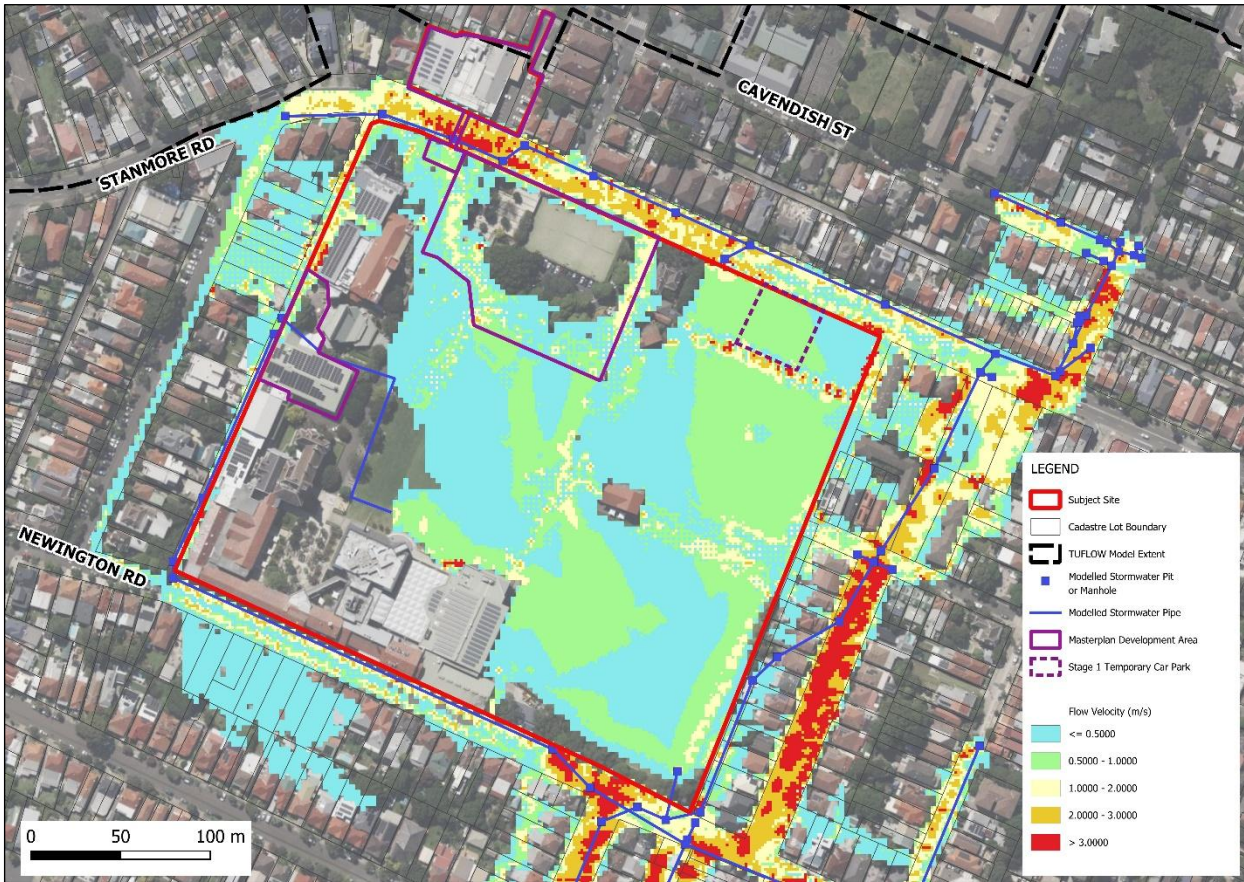


Figure 42: Post-Development Masterplan scenario - peak flood velocity at the site in the PMF event

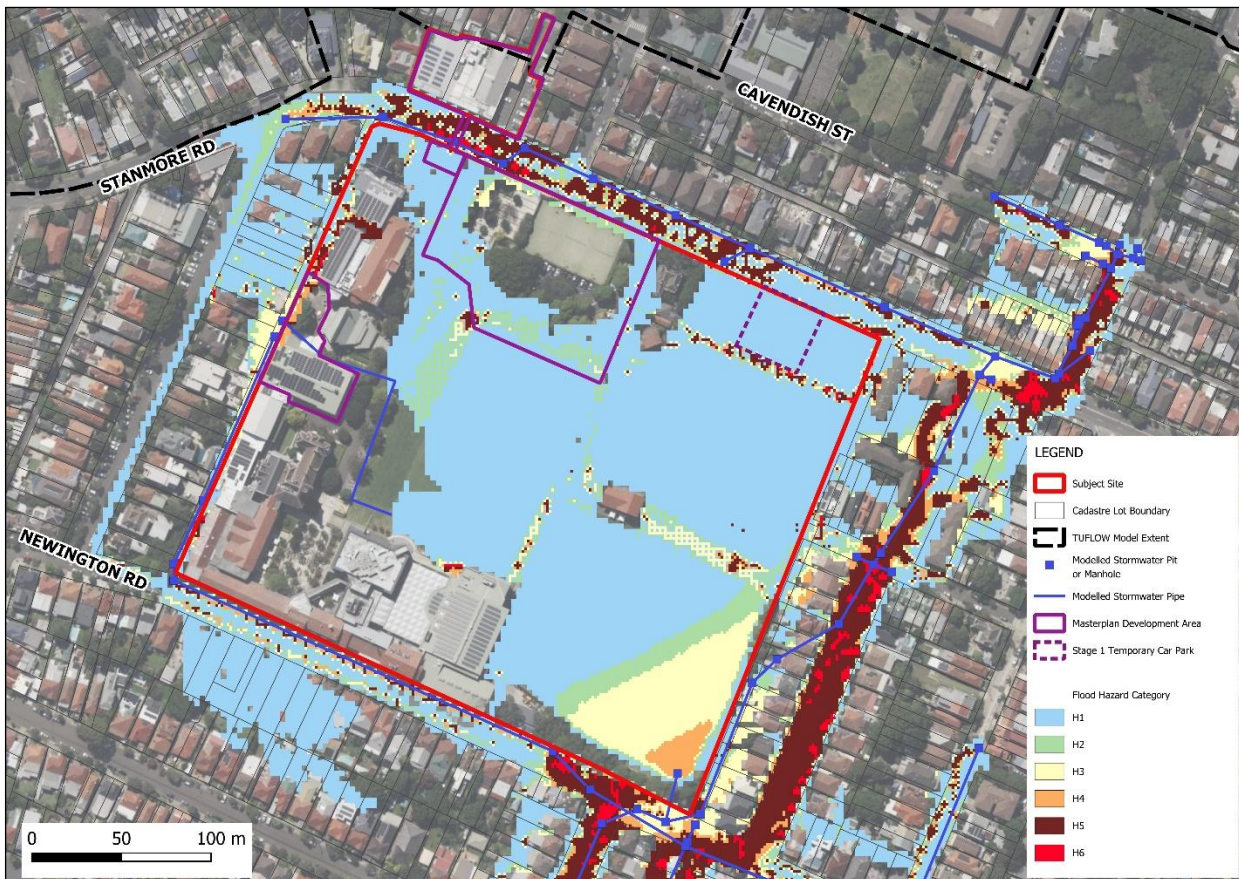


Figure 43: Post-Development Masterplan scenario - peak flood hazard at the site in the PMF event

5.4 Impact of Development

A flood impact assessment has been undertaken to ensure the proposed development would not result in either an unacceptable flood level increase or worsening of the flood conditions over neighbouring properties, for both the proposed Stage 1 and Masterplan developments. The flood impact assessment for the proposed Stage 1 development scenario is discussed in Section 5.4.1 while Section 5.4.2 discusses the flood impact assessment for the proposed Masterplan development scenario.

5.4.1 Stage 1 Development Scenario

39% AEP Event

Figure 44 presents the estimated flood level affluxes for the site and its surrounding area in the 39% AEP event assessed. The flood impact assessment shows that there are some changes in flood level within the site due to proposed Stage 1 development works. However, these changes are generally limited to within 20mm with isolated spots of higher increase observed. Flood inundation on the west and south of the proposed Sevington building no longer occur in this event (i.e. was inundated in the Pre-Development Scenario). The modelling results show that flooding on Stanmore Road north of the site generally remains unchanged, with isolated spots of flood level increases but these are generally limited to within 20mm adjacent to the Senior Campus' northern property boundary. Hence, no properties are expected to be impacted. No changes of estimated flood levels of more than 10mm are observed on the temporary car parking area proposed during the Stage 1 construction phase.

Further, flood level increases of higher than 20mm are observed over a small area adjacent to the existing tennis courts area near the north-east corner of the Senior Campus property boundary and over a small area on the southern end of Browns Avenue (i.e. this area includes some residential properties which are not impacted in the Pre-Development Scenario that are observed to be impacted under the Stage 1 Development Scenario). However, further interrogation of the modelling results show that these two isolated impacted areas are surrounded by no increase or decrease in flood levels and that no model inflows are introduced in the immediate surrounding of these two impacted areas. Estimated flood levels on the reporting points surrounding these impacted areas are summarised in Table 6, while Figure 45 shows the exact location of these reporting points. Based on the above, these two isolated impacted areas are considered “noise” of the modelling due to the sensitivity and stability of the model, as discussed in Section 4.2.1. Further, the flood impacts near the southern end of Browns Avenue are not observed in the more severe events, as discussed in the following.

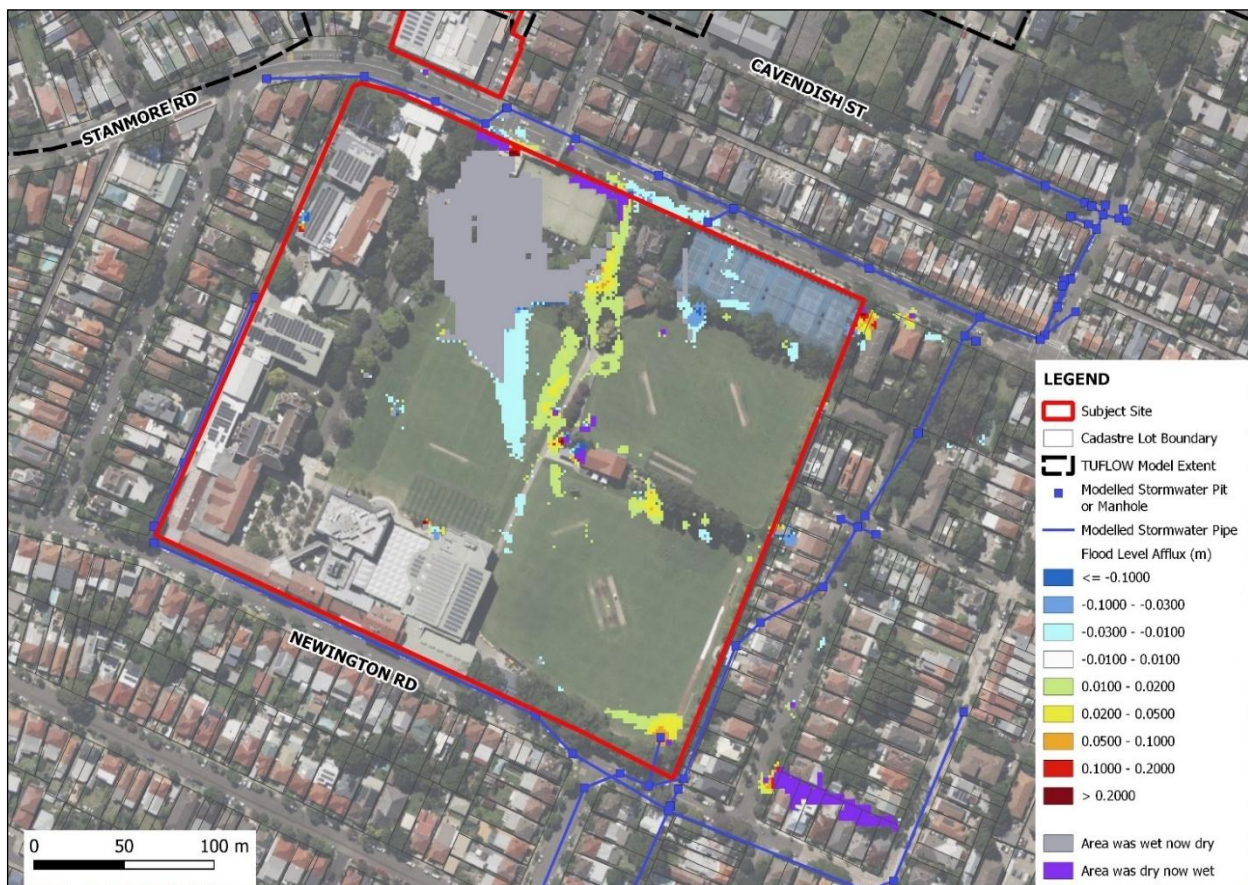


Figure 44: Stage 1 Development vs Pre-Development flood level afflux in the 39% AEP event



Figure 45: Flood level affluxes reporting point – 39% AEP Event

Table 6: Estimated flood levels and affluxes at reporting points for the 39% AEP Event

Reporting Point*	Estimated Flood Level – Pre-Development (mAHD)	Estimated Flood Level – Post-Development Stage 1 (mAHD)	Flood Level Afflux (m)
RP1	26.395	26.391	-0.004
RP2	27.539	27.539	0.000
RP3	27.784	27.784	0.000
RP4	29.421	29.421	0.000
RP5	29.275	29.275	0.000
RP6	26.847	26.830	-0.017
RP7	N/A	N/A	N/A
RP8	17.477	17.477	0.000
RP9	17.223	17.222	-0.001
RP10	22.256	22.256	0.000

* refer to Figure 45 for exact location

18% AEP Event

Figure 46 presents the estimated flood level affluxes for the site and its surrounding area in the 18% AEP event assessed. The flood impact assessment shows that there are some changes in flood level within the site due to proposed Stage 1 development works. However, these changes are generally limited to within 20mm with isolated spots of higher increase observed. In particular, flood level increases as high as 79mm are observed in the detention area near the Senior Campus' south-east corner. However, no adverse impacts are observed downstream of the detention area. Flood inundation on the west and south of the proposed Sevington building no longer occur in this event (i.e. was inundated in the Pre-Development Scenario). The modelling results show that flooding on Stanmore Road north of the site generally remains similar to the Pre-Development Scenario, with isolated spots of flood level increases but these are generally limited to within 20mm adjacent to the Senior Campus' northern property boundary. Flood level increases as high as 30mm are observed over a small area on the northern verge of Stanmore Road, north of the proposed Sevington building. Such increases are isolated and on Stanmore Road, hence no adverse impacts are anticipated on surrounding properties. Similarly, no changes of estimated flood levels are observed on the temporary car parking area proposed during the Stage 1 construction phase in this event assessed.

Further, flood level increases of higher than 20mm are observed over a small area adjacent to the existing tennis courts area near the north-east corner of the Senior Campus property boundary. However, further interrogation of the modelling results show that these isolated impacted areas are surrounded by no increase or decrease in flood levels and that no model inflows are introduced in the immediate surrounding of these impacted areas. Estimated flood levels on the reporting points surrounding these impacted areas are summarised in Table 7, while Figure 47 shows the exact location of the reporting points. Based on the above, these two isolated impacted areas are considered "noise" of the modelling due to the sensitivity and stability of the model, as discussed in Section 4.2.1.

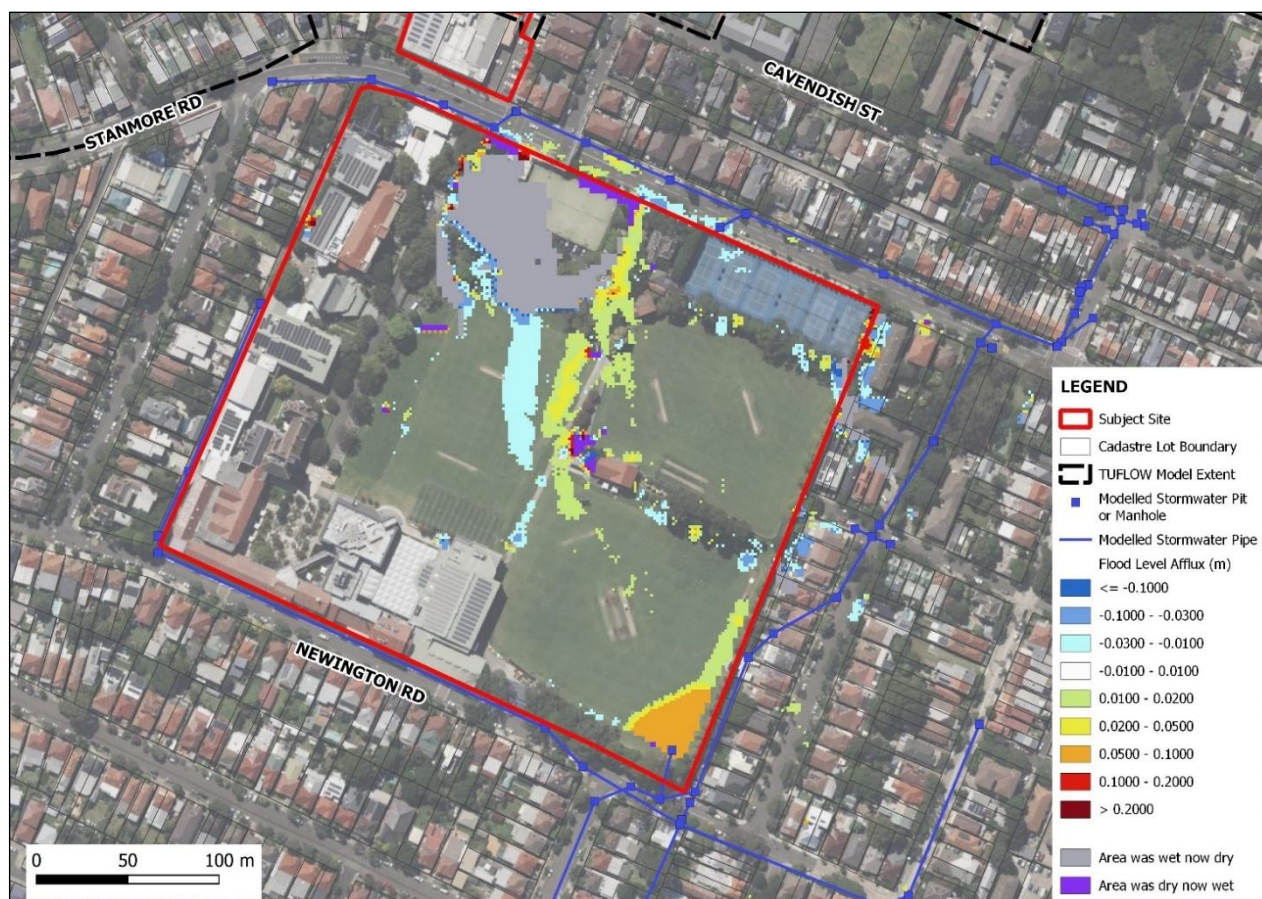


Figure 46: Stage 1 Development vs Pre-Development flood level afflux in the 18% AEP event

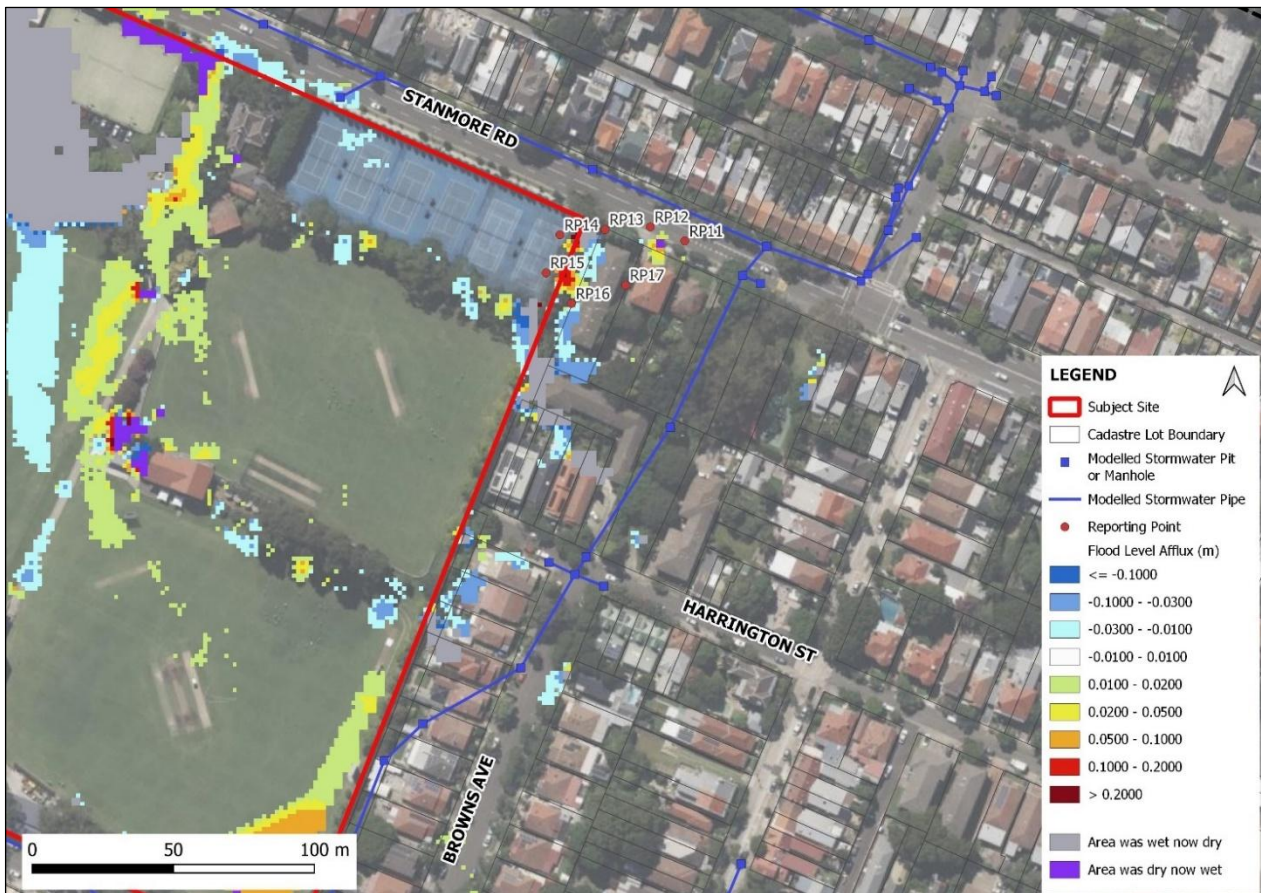


Figure 47: Flood level affluxes reporting point – 18% AEP Event

Table 7: Estimated flood levels and affluxes at reporting points for the 18% AEP Event

Reporting Point*	Estimated Flood Level – Pre-Development (mAHD)	Estimated Flood Level – Post-Development Stage 1 (mAHD)	Flood Level Afflux (m)
RP11	27.255	27.255	0.000
RP12	27.598	27.598	0.000
RP13	27.878	27.878	0.000
RP14	29.422	29.421	-0.001
RP15	29.275	29.275	0.000
RP16	26.500	26.493	-0.007
RP17	26.146	26.145	-0.001

* refer to Figure 47 for exact location

10% AEP Event

Figure 48 presents the estimated flood level affluxes for the site and its surrounding area in the 10% AEP event assessed. The flood impact assessment shows that there are some changes in flood level within the site due to proposed Stage 1 development works. However, these changes are generally limited to within 25mm with isolated spots of higher increase observed. In particular, flood level increases as high as 64mm are observed in the detention area near the Senior Campus' south-east corner. However, no adverse impacts are observed downstream of the detention area. The modelling results show that flooding on the southern verge of Stanmore Road north of the site has generally remained similar to the Pre-Development Scenario, but flood level increases as high as 30mm are observed over a small area on the southern verge of Stanmore Road, north of the proposed Sevington building. Such increases are isolated and contained within Stanmore Road, hence no adverse impacts are anticipated on surrounding properties. The modelling results also show that flood levels estimated across the temporary car parking area proposed during the Stage 1 construction phase will remain similar to that of the pre-development levels.

Further, flood level increases higher than 20mm are observed over some small areas adjacent to the existing tennis courts area near the north-east corner of the Senior Campus property boundary. However, further interrogation of the modelling results show that these isolated impacted areas are surrounded by no increase or decrease in flood levels and that no model inflows are introduced in the immediate surrounding of these impacted areas. Estimated flood levels on the reporting points surrounding these impacted areas are summarised in Table 8, while Figure 49 shows the exact location of the reporting points. Based on the above, these two isolated impacted areas are considered “noise” of the modelling due to the sensitivity and stability of the model, as discussed in Section 4.2.1.

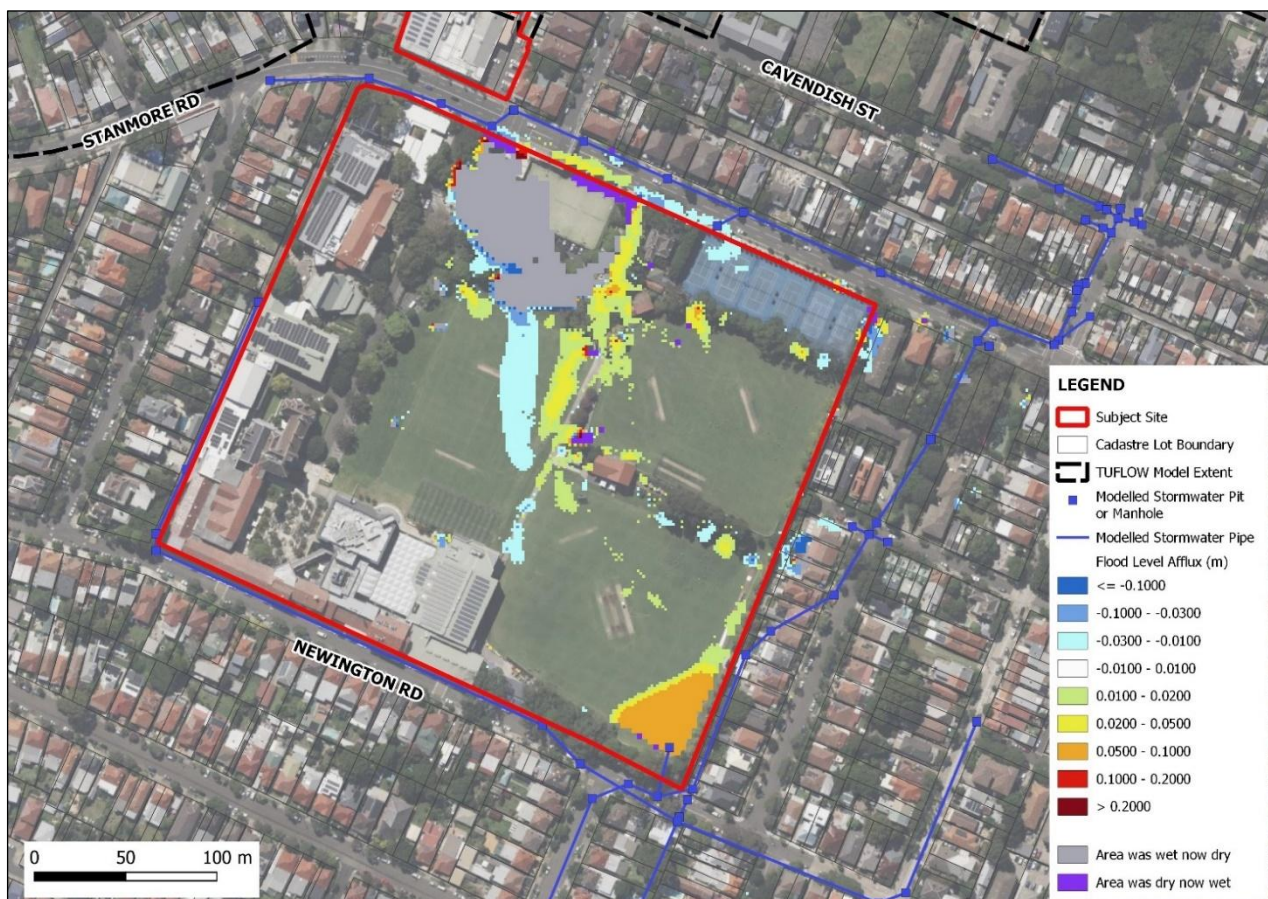


Figure 48: Stage 1 Development vs Pre-Development flood level afflux in the 10% AEP event



Figure 49: Flood level affluxes reporting point – 10% AEP Event

Table 8: Estimated flood levels and affluxes at reporting points for the 10% AEP Event

Reporting Point*	Estimated Flood Level – Pre-Development (mAHD)	Estimated Flood Level – Post-Development Stage 1 (mAHD)	Flood Level Afflux (m)
RP21	27.228	27.228	0.000
RP22	27.599	27.599	0.000
RP23	29.619	29.618	-0.001
RP24	28.949	28.948	-0.001
RP25	29.435	29.435	0.000
RP26	28.763	28.759	-0.004
RP27	26.147	26.146	-0.001

* refer to Figure 49 for exact location

1% AEP Event

Figure 50 presents the estimated flood level affluxes for the site and its surrounding area in the 1% AEP event assessed. The flood impact assessment shows that there are some changes in flood level within the site due to the proposed Stage 1 development works. However, these changes are generally limited to within 30mm with isolated spots of higher increase observed. In particular, flood level increases as high as 70mm are observed in the detention area near the Senior Campus' south-east corner. However, no adverse impacts are observed downstream of the detention area. The modelling results show that flood level increases of more than 20mm are observed over some small areas on Stanmore Road, near intersection with Holt Street north of the proposed Sevington building. Given that such increases are isolated and contained within Stanmore Road, no adverse impacts are anticipated on surrounding properties. Further the existing properties along the northern end of Stanmore Road are elevated approximately 1m above the kerb level, as shown in Figure 51. The modelling results show that allowing additional flows from Stanmore Road onto the Senior Campus in the 1% AEP event will likely result in unacceptable impacts on properties downstream of the detention area. Some slight reductions in estimated flood levels are observed on the temporary car parking area proposed during the Stage 1 construction phase in this event assessed.

Further, flood level increases of higher than 20mm are observed over some small areas adjacent to the existing tennis courts area near the north-east corner of the Senior Campus property boundary and over a small area near the southern end of Browns Avenue. However, further interrogation of the modelling results show that these isolated impacted areas are surrounded by no increase or decrease in flood levels and that no model inflows are introduced in the immediate surrounding of these impacted areas. Estimated flood levels on the reporting points surrounding these impacted areas are summarised in Table 9, while Figure 52 shows the exact location of the reporting points. Based on the above, these isolated impacted areas are considered "noise" of the modelling due to the sensitivity and stability of the model, as discussed in Section 4.2.1.

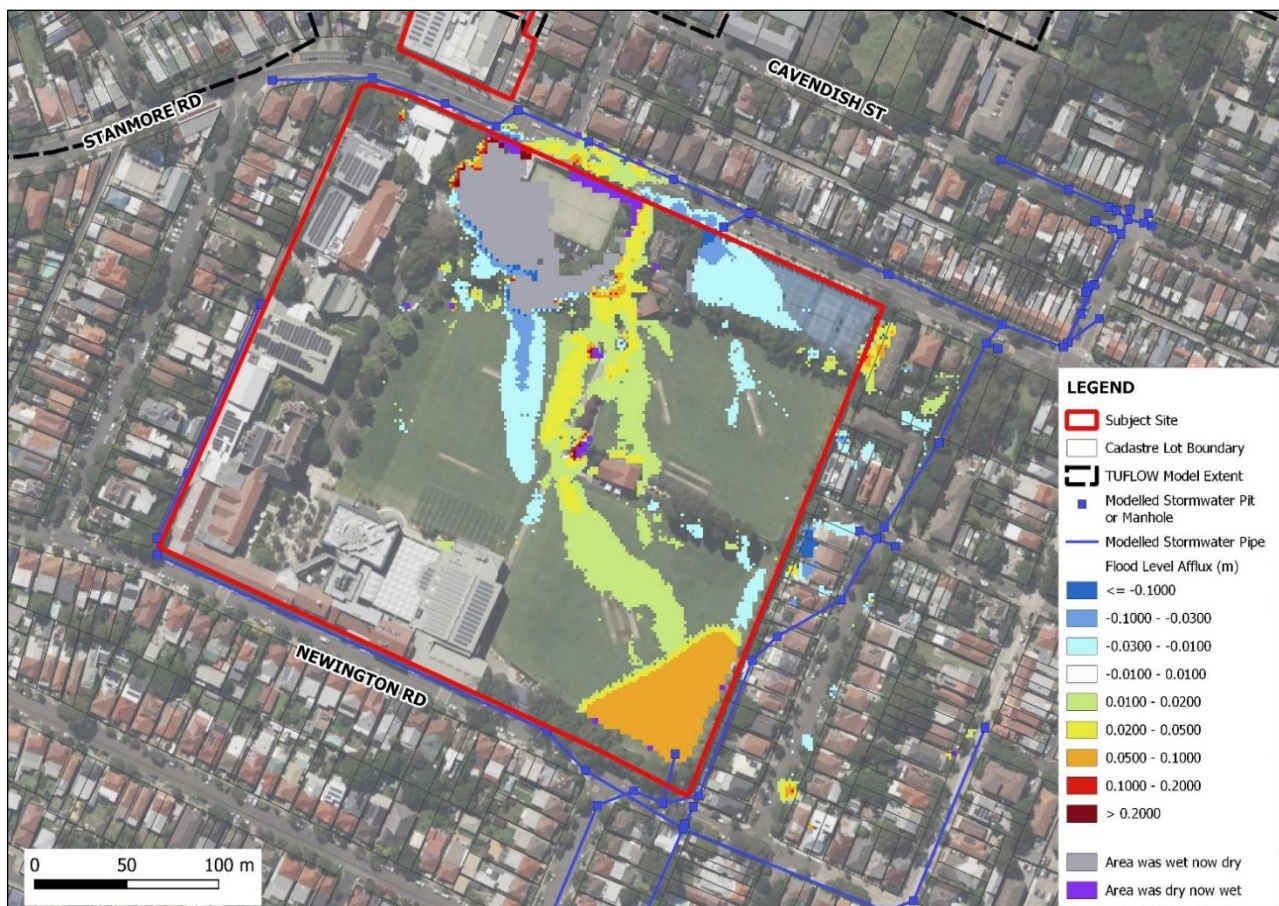


Figure 50: Stage 1 Development vs Pre-Development flood level afflux in the 1% AEP event



Figure 51: Existing elevated residential properties along northern end of Stanmore Road (Source: Google Street View)



Figure 52: Flood level affluxes reporting point – 1% AEP Event

Table 9: Estimated flood levels and affluxes at reporting points for the 1% AEP Event

Reporting Point*	Estimated Flood Level – Pre-Development (mAHD)	Estimated Flood Level – Post-Development Stage 1 (mAHD)	Flood Level Afflux (m)
RP31	26.616	26.616	0.000
RP32	24.155	24.155	0.000
RP33	23.831	23.830	-0.001
RP34	27.882	27.879	-0.003
RP35	29.435	29.435	0.000
RP36	29.222	29.219	-0.003
RP37	26.000	25.996	-0.004
RP38	24.928	24.924	-0.004
RP39	17.249	17.249	0.000
RP40	17.692	17.684	-0.008

* refer to Figure 52 for exact location

PMF Event

Figure 53 presents the estimated flood level affluxes for the site and its surrounding area in the PMF event assessed. It is important to note that flood level affluxes mapping in the PMF event is to assist in understanding and preparing for the likely additional risks that the proposed Stage 1 development will have on its surrounding areas in extreme events. It is not intended for SSDA approval consideration.

The flood impact assessment shows that there are some changes in flood level within the site due to proposed Stage 1 development works. However, these changes are generally limited to within 30mm with isolated spots of higher increase observed. The modelling results show that estimated flood levels across the temporary car parking area proposed during the Stage 1 construction phase have generally remained similar to that of the pre-development levels (i.e. no adverse affluxes). The modelling results show that flood level increases of more than 10mm are observed over some small spot areas on Stanmore Road, back of existing residential properties east of the Senior Campus property boundary and near the intersection between College Lane and Newington Road. However, flood level increases in these spot areas are generally limited to within 35mm and this has no impact on the existing flood emergency planning arrangements for the area as the flood hazards remained generally similar in the PMF event. Given that the PMF event is the most extreme event that will ever occur in an area where significant inundation would have already occurred, therefore such minor increases in flood levels are considered acceptable.

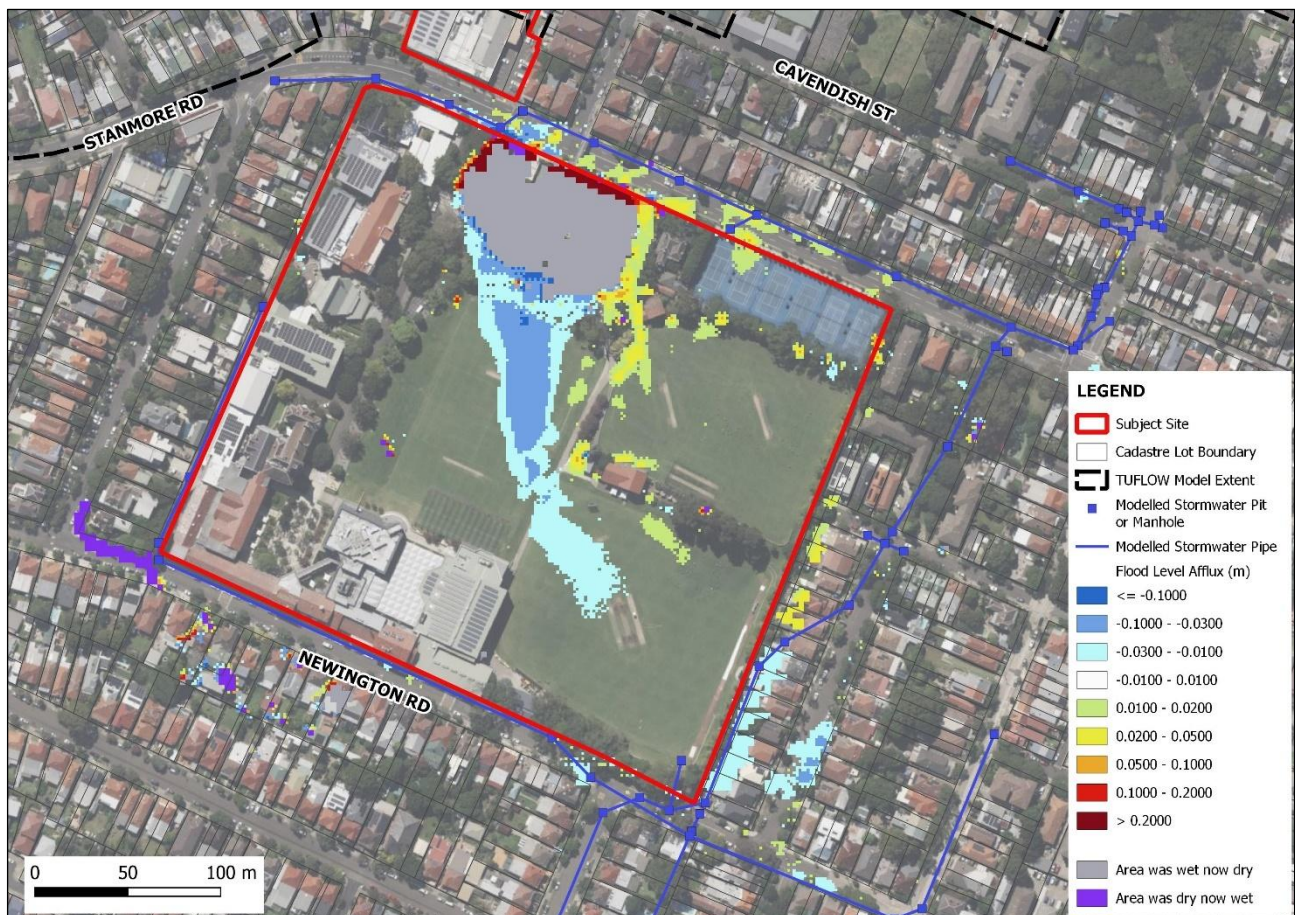


Figure 53: Stage 1 Development vs Pre-Development flood level afflux in the PMF event

5.4.2 Masterplan Development Scenario

39% AEP Event

Figure 54 presents the estimated flood level affluxes for the site and its surrounding area in the 39% AEP event assessed. The flood impact assessment shows that there are some changes in flood level within the site due to the proposed Masterplan development works. However, these changes are generally limited to within 20mm with isolated spots of higher increase observed. The modelling results show that the estimated flood levels within the temporary car parking area proposed during the Stage 1 construction phase have generally remained similar to those of the pre-development levels (i.e. no adverse affluxes observed). Flood inundation on the west and south of the proposed Sevington building no longer occur in this event (i.e. was inundated in the Pre-Development Scenario). However, new inundation area downstream of the adopted 6m new opening at the proposed new pedestrian bridge are observed. The modelling results show that flooding on the southern verge of Stanmore Road, north of the site is generally improved by 10mm to 20mm.

Flood level increases of higher than 20mm are observed over a small area adjacent to the existing tennis courts area near the north-east corner of the Senior Campus property boundary and over some small areas near the southern end of Browns Avenue (i.e. this area includes some residential properties which are not impacted in the Pre-Development Scenario that are observed to be impacted under the Stage 1 Development Scenario). However, further interrogation of the modelling results show that these isolated impacted areas are surrounded by no increase or decrease in flood levels and that no model inflows are introduced in the immediate surrounding of these two impacted areas. Estimated flood levels on the reporting points surrounding these impacted areas are summarised in Table 10, while Figure 55 shows the exact location of the reporting points. Based on the above, these two isolated impacted areas are considered “noise” of the modelling due to the sensitivity and stability of the model, as discussed in Section 4.2.1. Further, the flood impacts near the southern end of Browns Avenue are not observed in the more severe events, as discussed in the following.

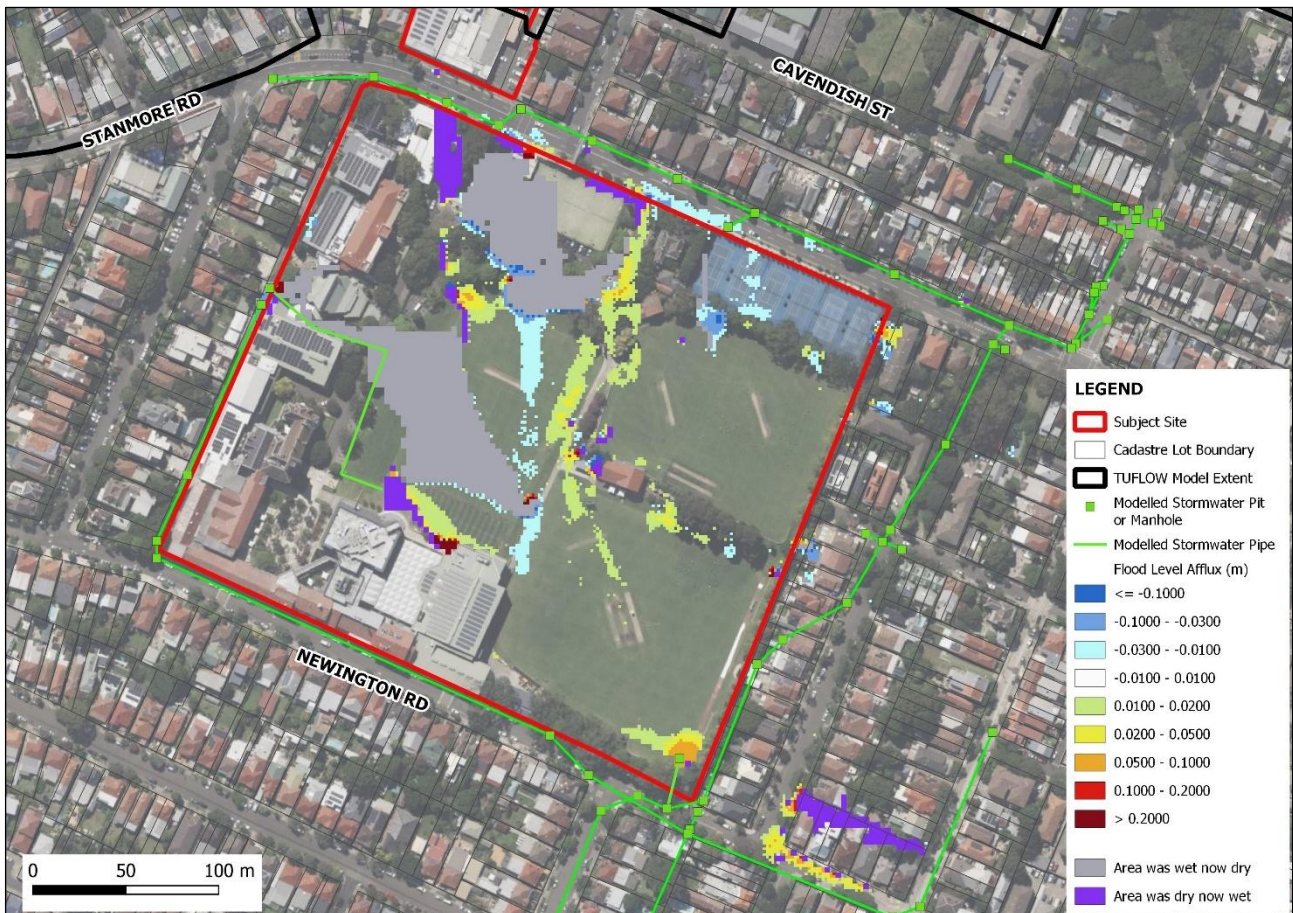


Figure 54: Masterplan Development vs Pre-Development flood level afflux in the 39% AEP event



Figure 55: Flood level affluxes reporting point – 39% AEP Event

Table 10: Estimated flood levels and affluxes at reporting points for the 39% AEP Event

Reporting Point*	Estimated Flood Level – Pre-Development (mAHD)	Estimated Flood Level – Post-Development Stage 1 (mAHD)	Flood Level Afflux (m)
RP101	26.354	26.354	0.000
RP102	25.981	25.981	0.000
RP103	27.784	27.784	0.000
RP104	29.421	29.421	0.000
RP105	29.293	29.293	0.000
RP106	21.332	21.332	0.000
RP107	16.956	16.956	0.000
RP108	17.477	17.477	0.000
RP109	17.188	17.186	-0.002
RP110	22.256	22.256	0.000

* refer to Figure 55 for exact location

18% AEP Event

Figure 56 presents the estimated flood level affluxes for the site and its surrounding area in the 18% AEP event assessed. The modelling results show that the estimated flood levels within the temporary car parking area proposed during the Stage 1 construction phase have generally remained similar to those of the pre-development levels. However, the flood impact assessment shows that there are some changes in flood level within the site due to the proposed Masterplan development works. Nonetheless, these changes are generally limited to within 20mm with isolated spots of higher increase observed, especially at the detention area near the south-east corner of the Senior Campus site where flood level increases as high as 52mm are observed. The modelling results however, show that the additional floodwater being detained will not have any adverse impacts on the downstream properties in this event assessed.

New inundation area downstream of the adopted 6m new opening at the proposed new pedestrian bridge are observed. The modelling results show that flooding on the southern verge of Stanmore Road, north of the site is generally improved by 10mm to 20mm, but increases in flood levels as high as 22mm are observed over some areas on Stanmore Road north of the proposed Sevington building. These are small isolated areas and located within Stanmore Road itself, and given that the flood hazards in these impacted areas generally remained similar to that of the Pre-Development conditions, such increases are considered not to result in adverse impacts to surrounding properties.

Flood level increases of higher than 20mm are observed over a small area adjacent to the existing tennis courts area near the north-east corner of the Senior Campus property boundary. However, further interrogation of the modelling results show that these isolated impacted areas are surrounded by no increase or decrease in flood levels and that no model inflows are introduced in the immediate surrounding of the impacted area. Estimated flood levels on the reporting points surrounding the impacted area are summarised in Table 11, while Figure 57 shows the exact location of the reporting points. Based on the above, the isolated impacted area is considered “noise” of the modelling due to the sensitivity and stability of the model, as discussed in Section 4.2.1.

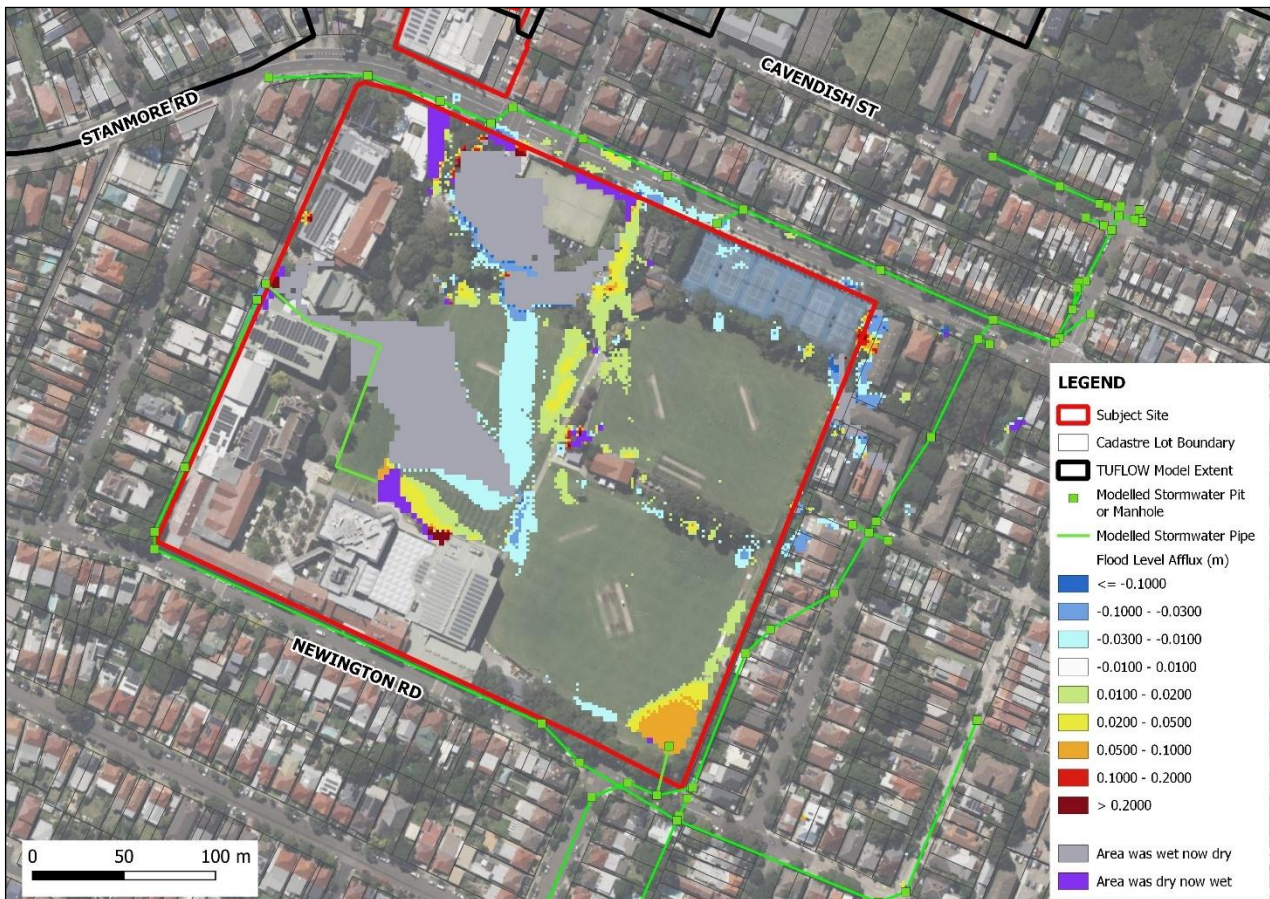


Figure 56: Masterplan Development vs Pre-Development flood level afflux in the 18% AEP event



Figure 57: Flood level affluxes reporting point – 18% AEP Event

Table 11: Estimated flood levels and affluxes at reporting points for the 18% AEP Event

Reporting Point*	Estimated Flood Level – Pre-Development (mAHD)	Estimated Flood Level – Post-Development Stage 1 (mAHD)	Flood Level Afflux (m)
RP201	26.376	26.358	-0.018
RP202	25.980	25.980	0.000
RP203	27.988	27.988	0.000
RP204	29.422	29.421	-0.001
RP205	29.294	29.294	0.000

* refer to Figure 57 for exact location

10% AEP Event

Figure 58 presents the estimated flood level affluxes for the site and its surrounding area in the 10% AEP event assessed. The flood impact assessment shows that there are some changes in flood level within the site due to proposed Masterplan development works. However, these changes are generally limited to within 20mm with isolated spots of higher increase observed, especially at the detention area near the south-east corner of the Senior Campus site where flood level increases as high as 38mm are observed. The modelling results however, show that the additional floodwater being detained will not have any adverse impacts on the downstream properties in this event assessed. No changes of estimated flood levels are observed on the temporary car parking area proposed during the Stage 1 construction phase. New inundation area downstream of the adopted 6m new opening at the proposed new pedestrian bridge are observed. The modelling results show that flooding on the southern verge of Stanmore Road, north of the site is generally improved by 10mm to 25mm, and increases in flood levels over some small spot areas on the southern verge of Stanmore Road (i.e. near the north of the proposed Sevington building) are observed but these increases are limited to 19mm.

Flood level increases of higher than 20mm are observed over a small area adjacent to the existing tennis courts area near the north-east corner of the Senior Campus property boundary. However, further interrogation of the modelling results show that these isolated impacted areas are surrounded by no increase or decrease in flood levels and that no model inflows are introduced in the immediate surrounding of the impacted area. Estimated flood levels on the reporting points surrounding the impacted area are summarised in Table 12, while Figure 59 shows the exact location of the reporting points. Based on the above, the isolated impacted area is considered “noise” of the modelling due to the sensitivity and stability of the model, as discussed in Section 4.2.1.

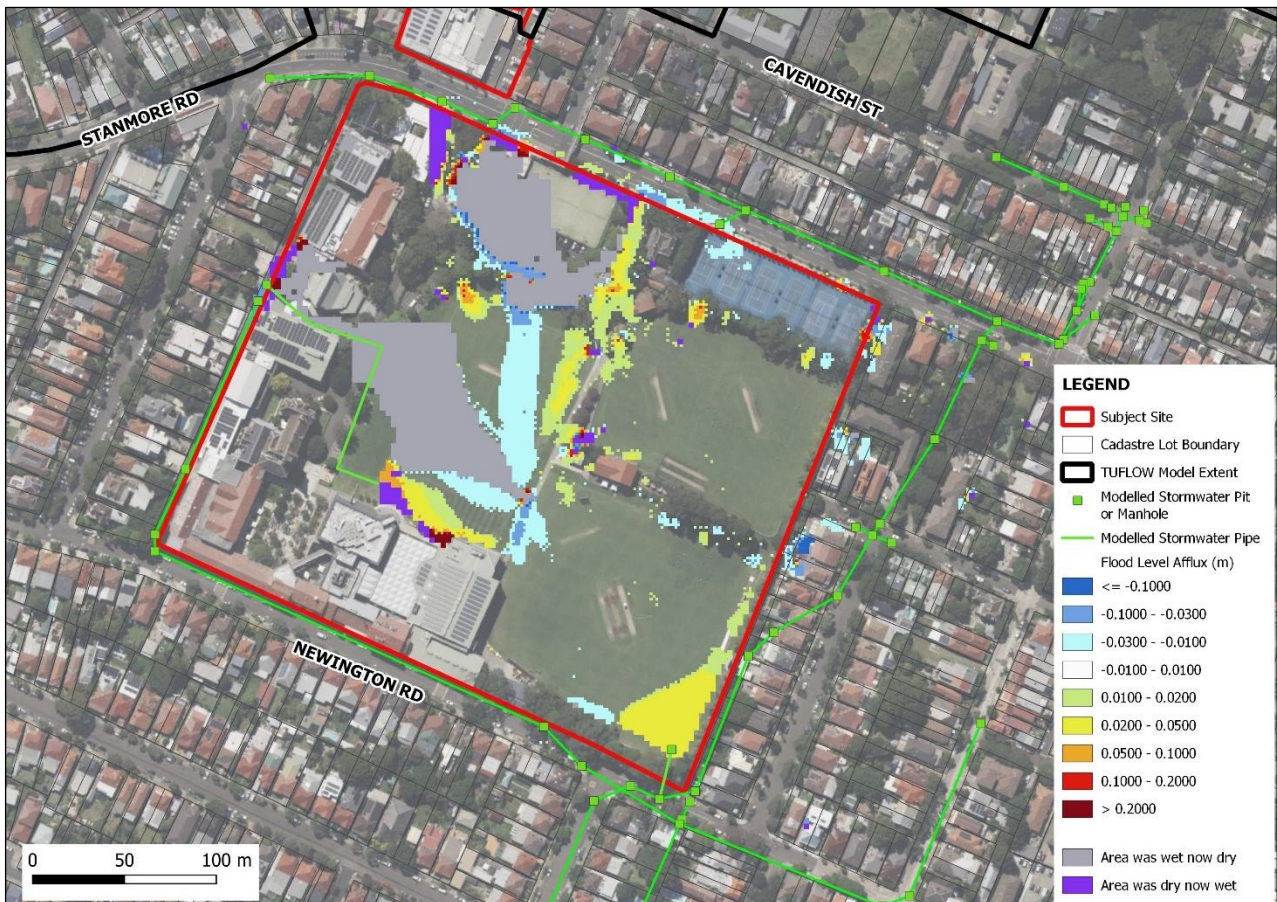


Figure 58: Masterplan Development vs Pre-Development flood level afflux in the 10% AEP event



Figure 59: Flood level affluxes reporting point – 10% AEP Event

Table 12: Estimated flood levels and affluxes at reporting points for the 10% AEP Event

Reporting Point*	Estimated Flood Level – Pre-Development (mAHD)	Estimated Flood Level – Post-Development Stage 1 (mAHD)	Flood Level Afflux (m)
RP301	26.377	26.367	-0.010
RP302	25.981	25.981	0.000
RP303	28.060	28.059	-0.001
RP304	29.438	29.438	0.000
RP305	29.289	29.288	-0.001

* refer to Figure 59 for exact location

1% AEP Event

Figure 60 presents the estimated flood level affluxes for the site and its surrounding area in the 1% AEP event assessed. The flood impact assessment shows that there are some changes in flood level within the site due to the proposed Masterplan development works. However, these changes are generally limited to within 20mm with isolated spots of higher increase observed, especially at the detention area near the south-east corner of the Senior Campus site where flood level increases as high as 79mm are observed. The modelling results however, show that the additional floodwater being detained will not have any adverse impacts on the downstream properties in this event assessed. Slight reductions in estimated flood levels across the temporary car parking area proposed during the Stage 1 construction phase are observed in this event assessed.

New inundation area downstream of the adopted 6m new opening at the proposed new pedestrian bridge are observed. The modelling results show that flooding on the southern verge of Stanmore Road, north of the site is generally improved by 10mm to 35mm. Increases in flood levels over some small spot areas on the southern verge of Stanmore Road (i.e. near the north of the proposed Sevington building) are observed, however such increases are generally limited to 20mm with only a small area near the intersection with Holt Street observed increases as high as 28mm. These are isolated areas and the modelling results show that the hazards in these areas generally remain similar to that of the Pre-Development conditions, hence are considered not to increase flood risks or result in adverse impacts to surrounding properties.

Similar to other events assessed above, flood level increases of higher than 20mm are observed over a small area adjacent to the existing tennis courts area near the north-east corner of the Senior Campus property boundary. However, further interrogation of the modelling results show that these isolated impacted areas are surrounded by no increase or decrease in flood levels and that no model inflows are introduced in the immediate surrounding of the impacted area. Estimated flood levels on the reporting points surrounding the impacted area are summarised in Table 13, while Figure 61 shows the exact location of the reporting points. Based on the above, the isolated impacted area is considered “noise” of the modelling due to the sensitivity and stability of the model, as discussed in Section 4.2.1.

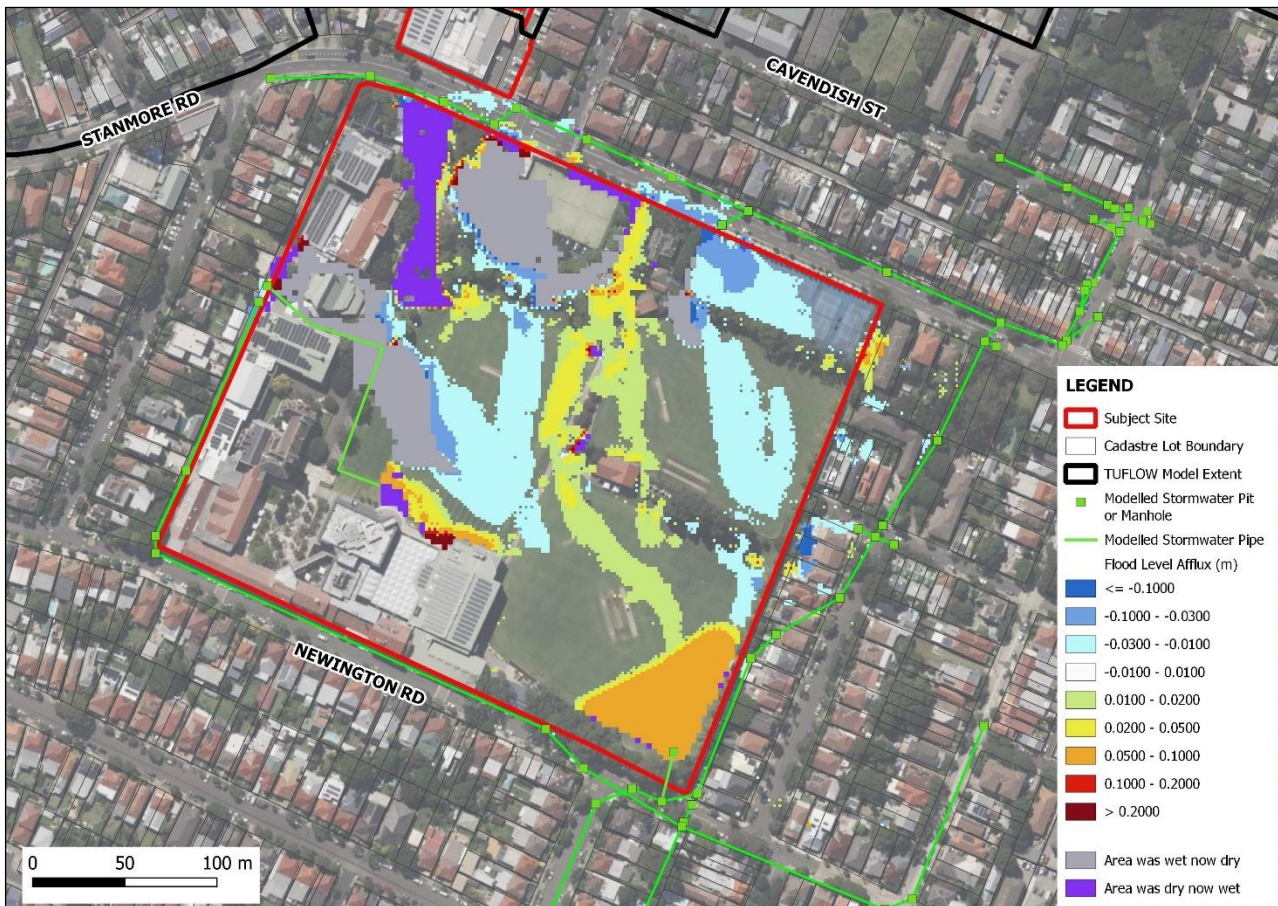


Figure 60: Masterplan Development vs Pre-Development flood level afflux in the 1% AEP event

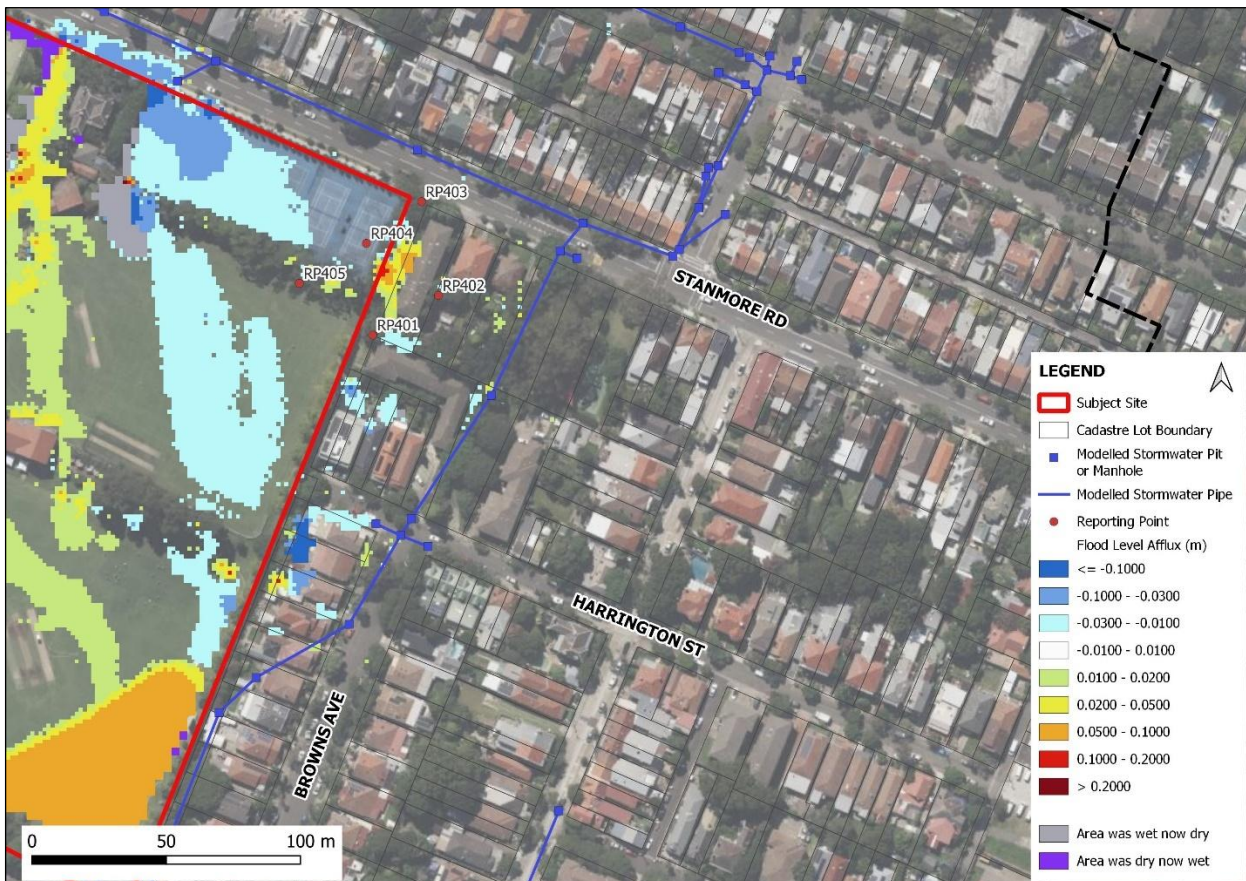


Figure 61: Flood level affluxes reporting point – 1% AEP Event

Table 13: Estimated flood levels and affluxes at reporting points for the 1% AEP Event

Reporting Point*	Estimated Flood Level – Pre-Development (mAHD)	Estimated Flood Level – Post-Development Stage 1 (mAHD)	Flood Level Afflux (m)
RP401	25.740	25.739	-0.001
RP402	25.412	25.410	-0.002
RP403	28.063	28.063	0.000
RP404	29.321	29.320	-0.001
RP405	26.392	26.391	-0.001

* refer to Figure 61 for exact location

PMF Event

Figure 62 presents the estimated flood level affluxes for the site and its surrounding area in the PMF event assessed. It is important to note that flood level affluxes mapping in the PMF event is to assist in understanding and preparing for the likely additional risks that the proposed Masterplan development will have on its surrounding areas in extreme events. It is not intended for SSDA approval consideration.

The flood impact assessment shows that there are some changes in flood level within the site due to the proposed Masterplan development works. However, these changes are generally limited to within 30mm with isolated spots of higher increase observed. No changes of estimated flood levels are observed on the temporary car parking area proposed during the Stage 1 construction phase. The modelling results show that flood level increases of more than 10mm are observed over some small spot areas on the back of existing residential properties south-east of the Senior Campus property boundary, on College Lane and Newington Road. Flood level increases on the back of existing residential properties are generally limited to within 18mm. However, the flood level increases on College Lane are more than 400mm and this is anticipated given that the proposed stormwater system incorporated into the model has been conceptually sized to convey flows up to the 1% AEP event, as discussed in Section 4.2.4. The loss of overland flow path onto the Senior Campus north of the Centenary Hall has caused floodwater to pool above the proposed stormwater system, resulting in increases in flood levels on College Lane. Given that the design of the mitigation stormwater system and the proposed College Lane building are of concept nature and likely to change in the subsequent design iterations, the impacts observed on College Lane are therefore considered not real at this stage. Nonetheless, further assessment will need to be carried out to confirm the actual impacts (if any) in the subsequent design phases of the College Lane development, to ensure that appropriate mitigation measures are considered and acceptable flooding outcome can be achieved.

As such, apart from the impacts on College Lane all other remaining impacts are considered to have no impact on the existing flood emergency planning arrangements for the area as the flood hazards remained generally similar to the Pre-Development conditions in the PMF event.

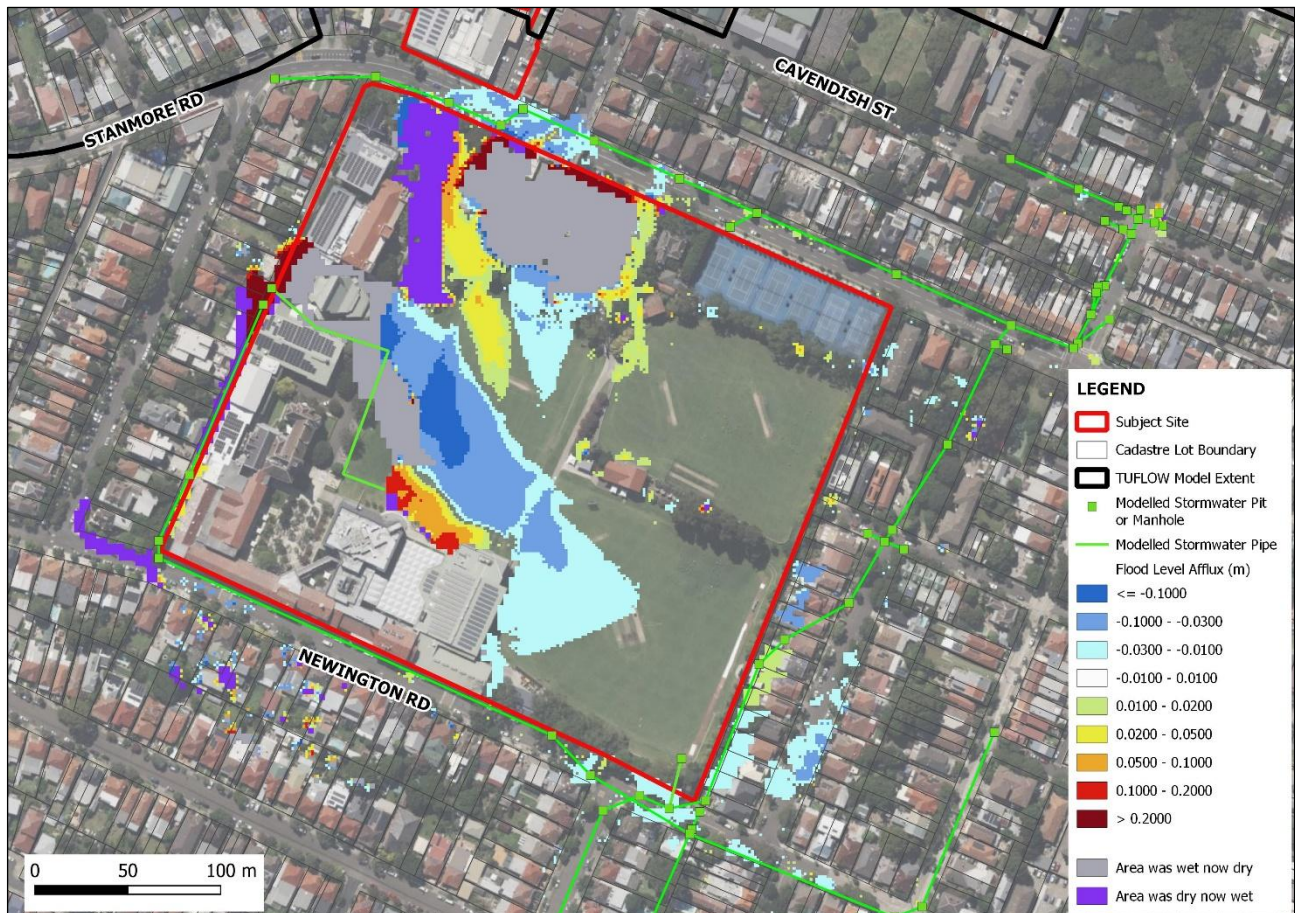


Figure 62: Masterplan Development vs Pre-Development flood level afflux in the PMF event

5.5 Impact of Future Climate Change Consideration and Assessment

Climate change is expected to have an adverse impact on rainfall intensities, which has the potential to have a significant impact on flood behaviour. For this assessment, a sensitivity analysis has been carried out to determine the impact of climate change on local flood conditions under the Shared Socioeconomic Pathway (SSP) 2-4.5 Scenario, which represents the intermediate Greenhouse Gas Emissions Scenario. Specifically, this study adopted the long term (at year 2090) SSP2-4.5 climate change factors in the modelling, whereby rainfall intensities are estimated to be increased by 40% in 2090 (i.e. when compared to the base design rainfall) for the 1hr or shorter storms. The increase in rainfall intensity factors for various design storm durations, as extracted from the ARR Data Hub for the site area, and adopted in this assessment are summarised in Table 14. These upscale factors have been applied to the original Council's TUFLOW model hydrological data for the Stage 1 Development and Masterplan Development Scenarios in the 1% AEP and PMF events.

Table 14: Adopted increases in climate change factors for the assessment

Climate Change Scenario	Climate Change Increase Factor Adopted for Various Design Storm Durations							
	<1hr	1.5hrs	2hrs	3hrs	4.5hrs	6hrs	9hrs	12hrs
SSP2-4.5 – Long Term (Year 2090)	1.4	1.36	1.34	1.31	1.28	1.26	1.24	1.23

Given that the school site is located at the upper end of catchment, although increases in flood levels due to climate change effects are anticipated, the modelling results show that increases within the school site (i.e. Senior Campus in particular) are generally minimal. The effects of climate change in the 1% AEP and PMF events, for both the Stage 1 Development and Masterplan Development Scenarios are discussed further in Section 5.5.1 and Section 5.5.2, respectively.

5.5.1 Stage 1 Development Scenario

The modelling results show that the effects of climate change will result in some increases in estimated flood levels in both the 1% AEP and PMF events assessed (i.e. when compared to the without climate change consideration).

In the 1% AEP event assessed, flood level increases are estimated for the Senior Campus site and its surrounding areas. However, such increases in estimated flood levels are largely limited to 40mm with the highest increase observed at the detention area on the south-east sporting fields where increases as high as 145mm is estimated in the 1% AEP event assessed. Further, increases in flood levels across the temporary car parking area proposed during Stage 1 construction phase are generally limited to less than 10mm in the 1% AEP event assessed.

In the PMF event assessed, majority of the flood level increases within the Senior Campus site are limited to 40mm, including the detention area on the south-east sporting fields. Higher increases in flood levels are estimated for areas external to the Senior Campus, especially areas on the east and on Newington Road near the south-east corner.

The 1% AEP and PMF flood levels at the entrance to the proposed basement car parking area of Sevington building are 28.636m AHD (i.e. a 3mm increase from the 1% AEP event) and 28.648m AHD (i.e. a 12mm increase from the PMF event) respectively. These levels are lower than the crest to the basement car parking area (i.e. at 28.95m AHD), hence making the basement car parking area of the Sevington building to remain flood free. The PMF with climate change consideration flood level at the proposed Sevington entrance area is 34.55m AHD, which is approximately 50mm higher than the PMF event assessed.

The respective estimated increases in flood levels due to climate change effects in the year 2090, for the 1% AEP and PMF events assessed are shown in

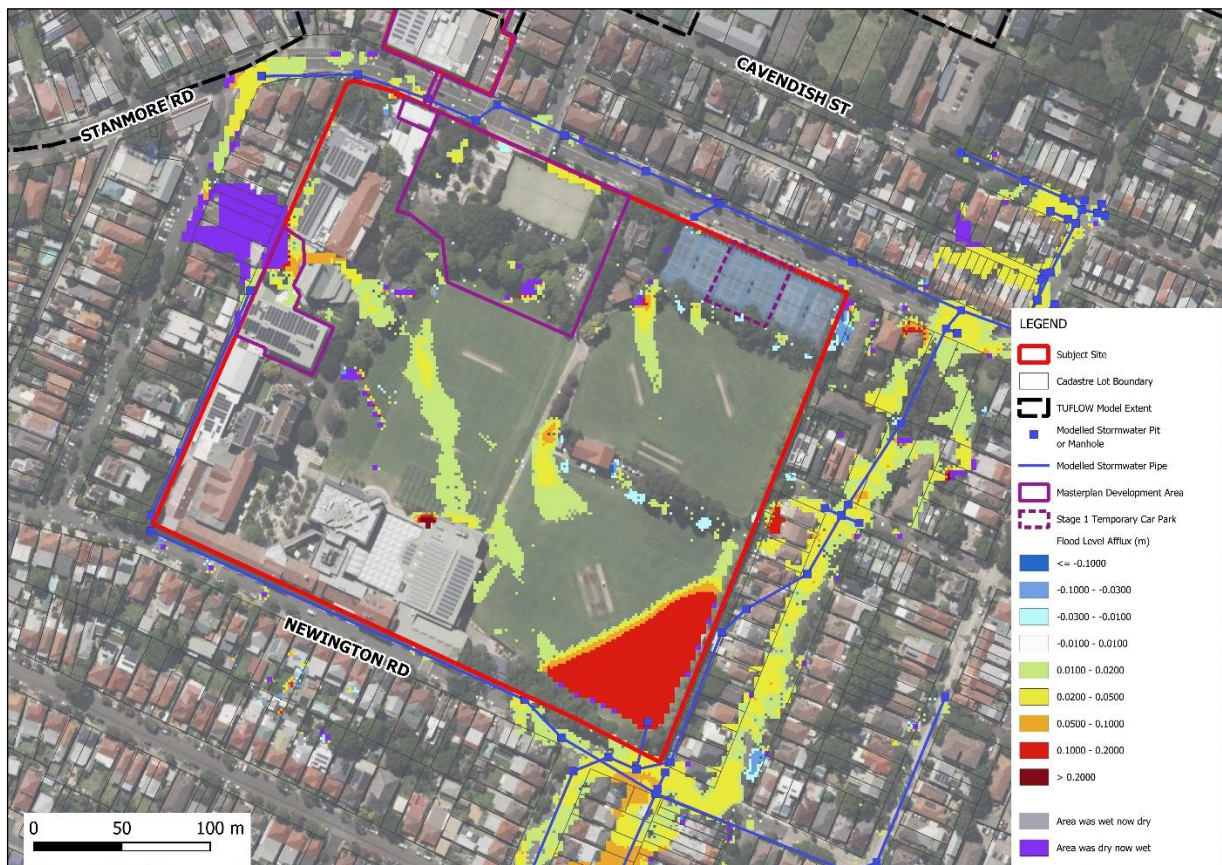


Figure 63 and Figure 64, respectively.

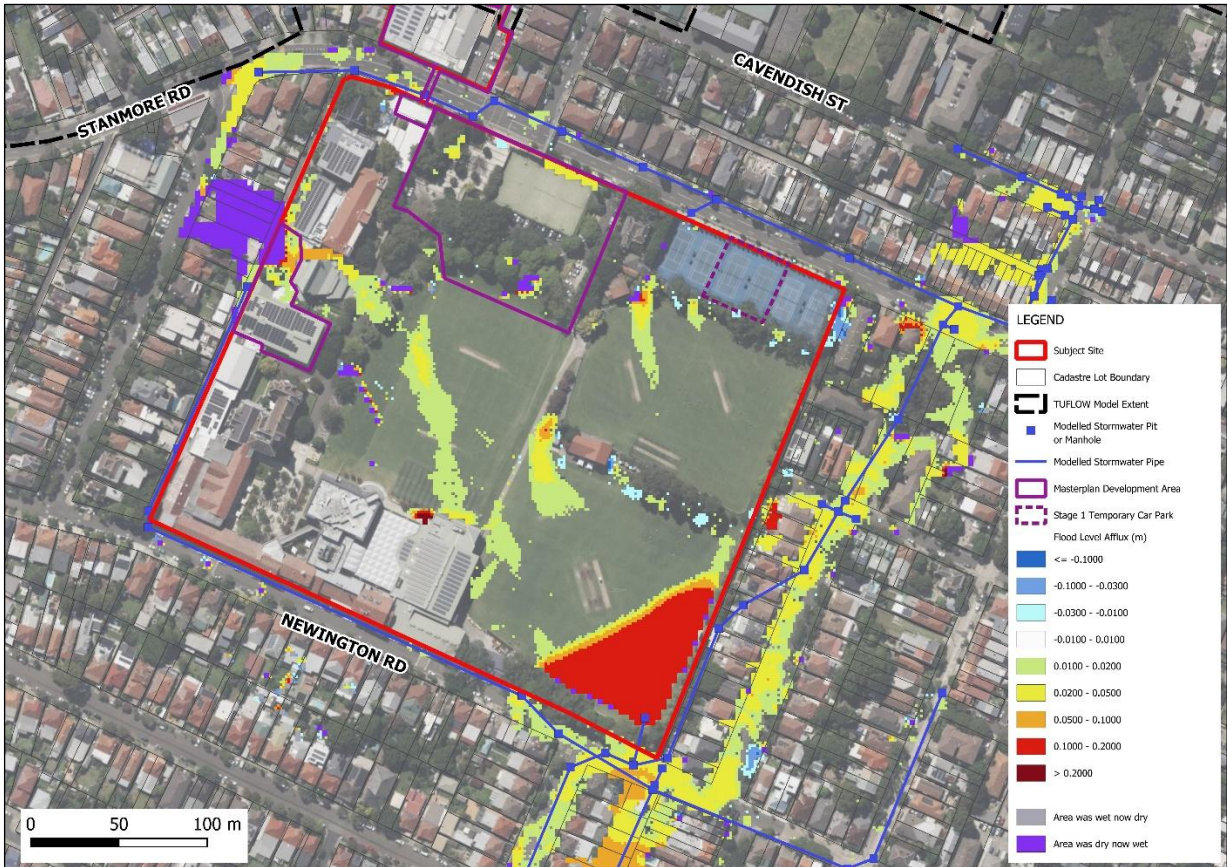


Figure 63: Flood level increase at and around the site due to climate change in the 1% AEP event – Stage 1 Development scenario

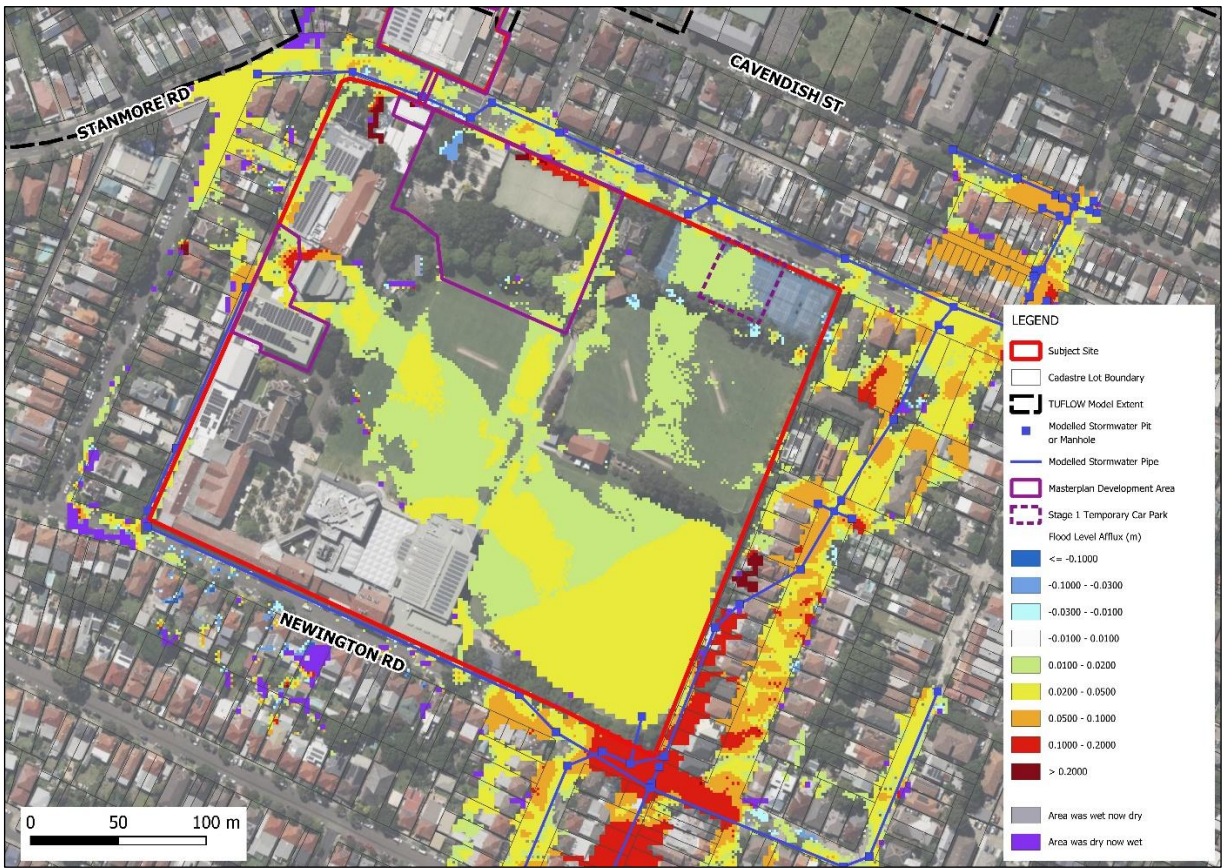


Figure 64: Flood level increase at and around the site due to climate change in the PMF event – Stage 1 Development scenario

5.5.2 Masterplan Development Scenario

Similar to the Stage 1 Development Scenario, the modelling results show that the effects of climate change will result in some increases in estimated flood levels in both the 1% AEP and PMF events assessed (i.e. when compared to the without climate change consideration).

In the 1% AEP event assessed, flood level increases are estimated for the Senior Campus site and its surrounding areas. However, such increases in estimated flood levels are largely limited to 40mm with the highest increase observed at the detention area on the south-east sporting fields where increases as high as 140mm is estimated in the 1% AEP event assessed. Further, increases in flood levels across the temporary car parking area proposed during Stage 1 construction phase are generally limited to less than 10mm in the 1% AEP event assessed.

In the PMF event assessed, majority of the flood level increases within the Senior Campus site are limited to 40mm, including the detention area on the south-east sporting fields. Higher increases in flood levels are estimated for areas external to the Senior Campus, especially areas on the east and on Newington Road near the south-east corner.

The 1% AEP and PMF flood levels at the entrance to the proposed basement car parking area of Sevington building are 28.636mAHD (i.e. a 3mm increase from the 1% AEP event) and 28.648mAHD (i.e. a 12mm increase from the PMF event) respectively. These levels are lower than the crest to the basement car parking area (i.e. at 28.95mAHD), hence making the basement car parking area of the Sevington building to remain flood free. The PMF with climate change consideration flood level at the proposed Sevington entrance area is 34.55mAHD, which is approximately 50mm higher than the PMF event assessed.

Similarly, 1% AEP and PMF flood levels at the entrance to the basement car parking area of Concordia building are 37.009mAHD (i.e. a 3mm increase from the 1% AEP event) and 37.050mAHD (i.e. a 4mm increase from the PMF event) respectively. These levels are lower than the crest level of 37.20mAHD adopted. A minimum crest level of 37.20mAHD will provide at least 150mm of freeboard from the future PMF level estimated for the area. If regrading is a constraint for the Concordia building redevelopment, then flood gate/barrier can be adopted at the underground car park entrance to prevent floodwaters on Stanmore Road from entering.

The respective estimated increases in flood levels due to climate change effects in the year 2090, for the 1% AEP and PMF events assessed are shown in Figure 65 and Figure 66, respectively.

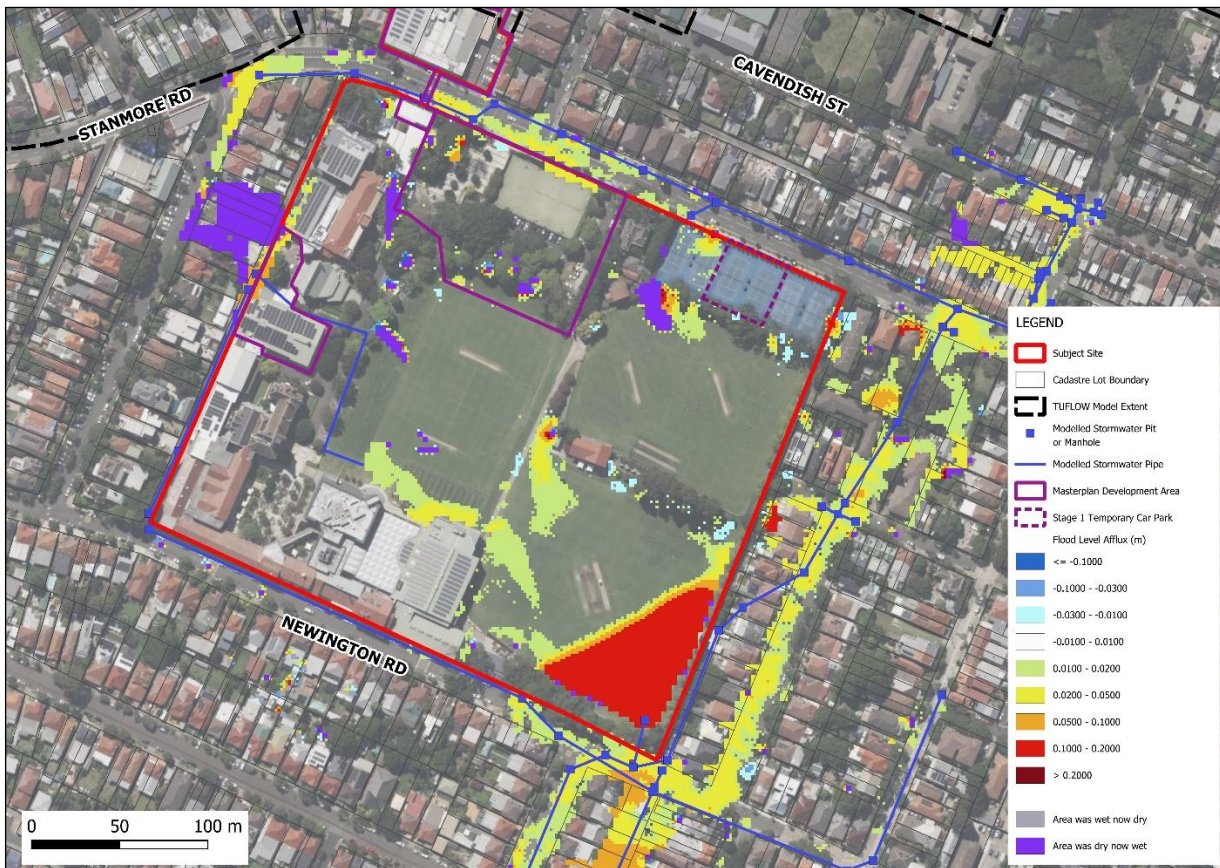


Figure 65: Flood level increase at and around the site due to climate change in the 1% AEP event – Masterplan Development scenario

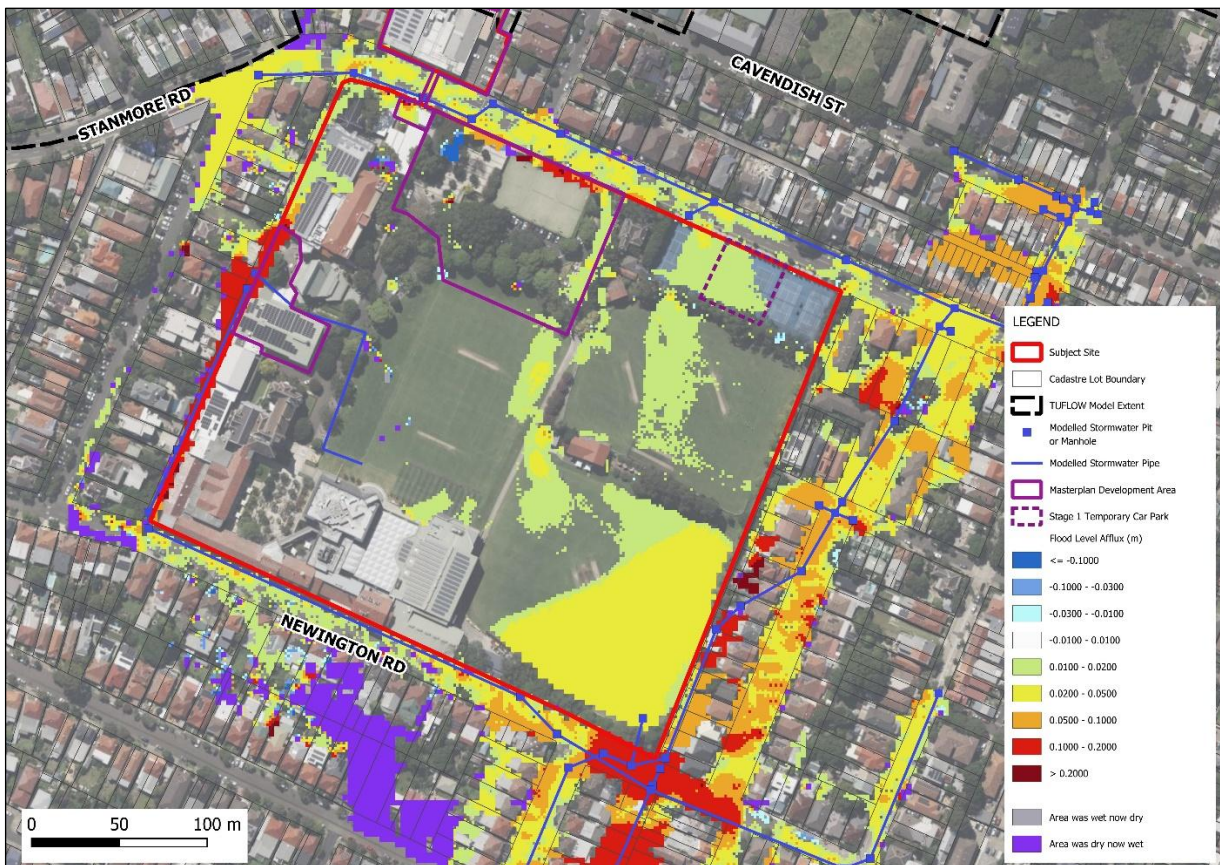


Figure 66: Flood level increase at and around the site due to climate change in the PMF event – Masterplan Development scenario

6.0 Flood Planning Requirements

The current Development Control Plan (DCP) in place for the site is the Inner West Council's Marrickville DCP (2011) which provides detailed planning and design guidelines to support the planning controls set out in the Inner West Council Local Environmental Plan (LEP) 2022.

As discussed and demonstrated in Section 3.1, the entire Newington College site is located outside of the Flood Planning Area and Flood Liable Area. Therefore, the flood management controls of the Marrickville DCP do not apply to the entire Newington College site.

The New South Wales State Government flood prone land policy is to reduce the impact of flooding and flood liability on individual owners and occupiers of flood prone property, and to reduce private and public losses resulting from floods, utilising ecologically positive methods wherever possible.

The Marrickville DCP defines the Standard/Design Flood as the 1% AEP flood event, and the Design Flood Level as the level of that event. The DCP specifies a Flood Planning Level or Design Floor Level to be 500mm above the design flood level for residential and non-residential buildings. For areas of minor overland flow (a depth of 300mm or less or overland flow of 2m³/s or less), a lower freeboard of 300mm may be considered on its merits. However, the DCP does not specify any flood controls specific to schools or educational facilities.

For basement car parking, the DCP specifies the below (as extracted from the DCP):

- "On properties with a low flood hazard classification, basement (below natural ground level) car parking must have all access and potential water entry points above the Flood Planning Level, and a clearly signposted flood free pedestrian evacuation route provided from the basement area separate to the vehicular access ramps. For basement car parking in properties affected by High Hazard flooding further considerations will apply."

Despite not required to meet the DCP requirements, the crest to the basement of the Sevington building has been set at 28.95mAHD, which is higher than the PMF and PMF with climate change consideration flood levels of 28.636mAHD and 28.648mAHD respectively (i.e. approximately 300mm of freeboard to the PMF with climate change consideration flood level). Hence, protecting the proposed basement car parking area from any flood inundation into the future. Further, the proposed flood gates/barriers will be set at a minimum height of 35mAHD, which is 700mm above the Sevington entrance area (i.e. proposed to be set at 34.3mAHD). The PMF and PMF with climate change consideration flood levels at the Sevington entrance area are estimated to be approximately 34.5mAHD and 34.55mAHD respectively. Based on this, the flood gates/barriers at the Sevington entrance area will have at least 450mm of freeboard which is sufficient to protect the Sevington podium area from overflows on Stanmore Road. All openings that lead to the Sevington basement car parking area will also be set at least 500mm above the surrounding ground levels to prevent floodwater from entering.

Similarly, the entrance area to the basement car parking area of the Concordia building is proposed to be regraded with crest set at 37.20mAHD to provide approximately 150mm of freeboard to the estimated year 2090 PMF flood level, as part of the future Concordia building redevelopment. A flood gate/barrier can be adopted at this car park entrance should regrading of this area is not possible due to development constraints.

7.0 Conclusions

A flood impact and risk assessment has been carried out to support the SSDA (SSD-78268465) for the proposed upgrades and extension works to the existing Newington College. As discussed in Section 4, modelling has been carried out, based on the TUFLOW model developed by Cardno in 2017 as part of the Marrickville Valley Floodplain Risk Management Study, as provided by Inner West Council.

Modelling has been carried out for both the proposed Stage 1 and ultimate Masterplan development scenarios, as discussed further in Section 4.1. The results show that with the proposed mitigation measures adopted in the modelling (i.e. as discussed in Section 4.2.3 and 4.2.4), the proposed school developments (i.e. both Stage 1 and ultimate Masterplan developments) will not result in any real damages or increased flood risks to neighbouring properties, for all the AEP events assessed up to and including the PMF event. The exception is that notable flood level increases are still observed in the PMF event assessed for the Masterplan development scenario at College Lane area. This is mainly due to the fact that the mitigation measures adopted (as discussed in Section 4.2.4) for the College Lane development have been sized to mitigate impacts up to the 1% AEP event assessed only and of high-level concept at this stage. As the development at College Lane area is in its early masterplan stage, therefore additional further detailed assessment should be carried out for the College Lane area, especially when more detailed design information is available for the College Lane development, to confirm and ensure that acceptable flooding outcome can be achieved for the College Lane area (i.e. up to the PMF event).

For Stage 1 Sevington development, flood gates/barriers with minimum height of 700mm will be required at the pedestrian entrance to the proposed Sevington building areas to provide PMF flood immunity to these proposed buildings. Similarly, the entrance to the basement car parking area of the proposed Sevington building has been set at 28.95mAHD to prevent floodwaters from entering in the PMF event. These mitigation measures are discussed in more detail in Section 4.2.3.

Based on the assessment carried out for the site and discussed in this report, both the proposed Stage 1 and ultimate Masterplan developments can be supported as it will not cause adverse impacts to the surrounding properties. It should however be noted that mitigation measures adopted in the modelling have mainly been manually manipulated in the TUFLOW model, to demonstrate that the development will not result in any adverse flooding impacts to neighbouring properties and can be supported, provided that appropriate mitigation measures are implemented. Therefore, these are considered of concept nature and additional assessments will need to be carried out (i.e. especially for the subsequent masterplan developments) in the detailed design phase to test and confirm the final adopted civil design for the site will result in no adverse impacts to the surrounding properties.

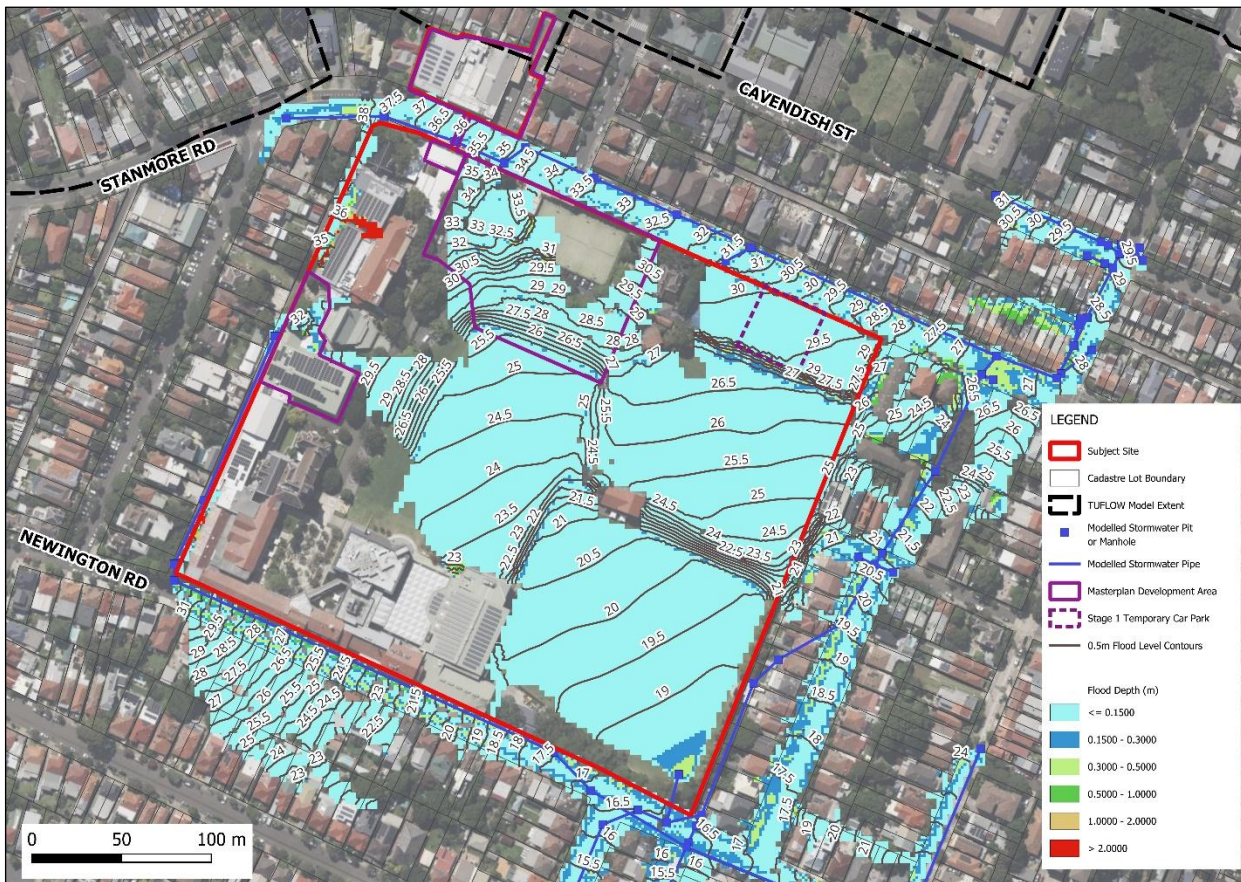
Updated & Authorised by
TTW (NSW) PTY LTD



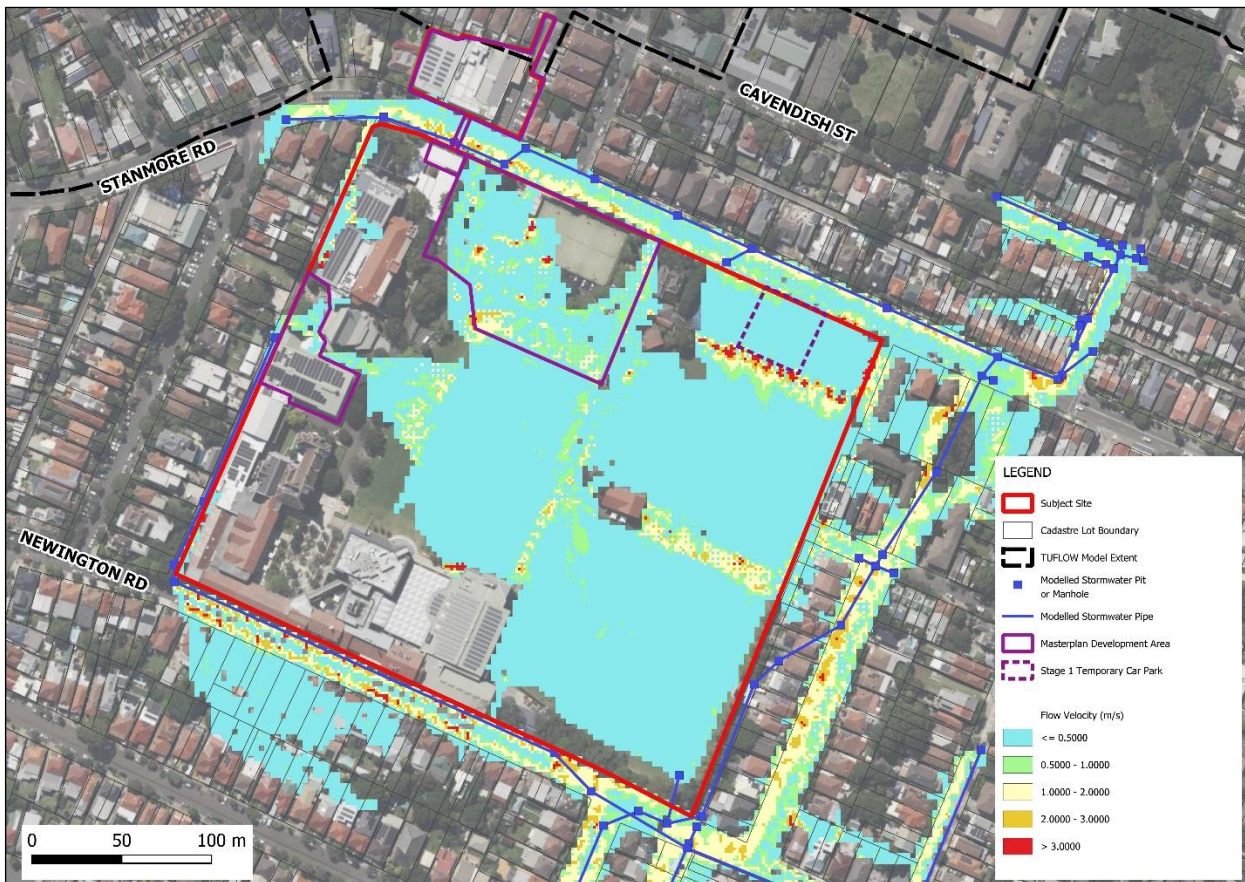
MICHAEL KOI
Associate (Flood)

Appendix A – Modelling Results for Remaining AEP Events

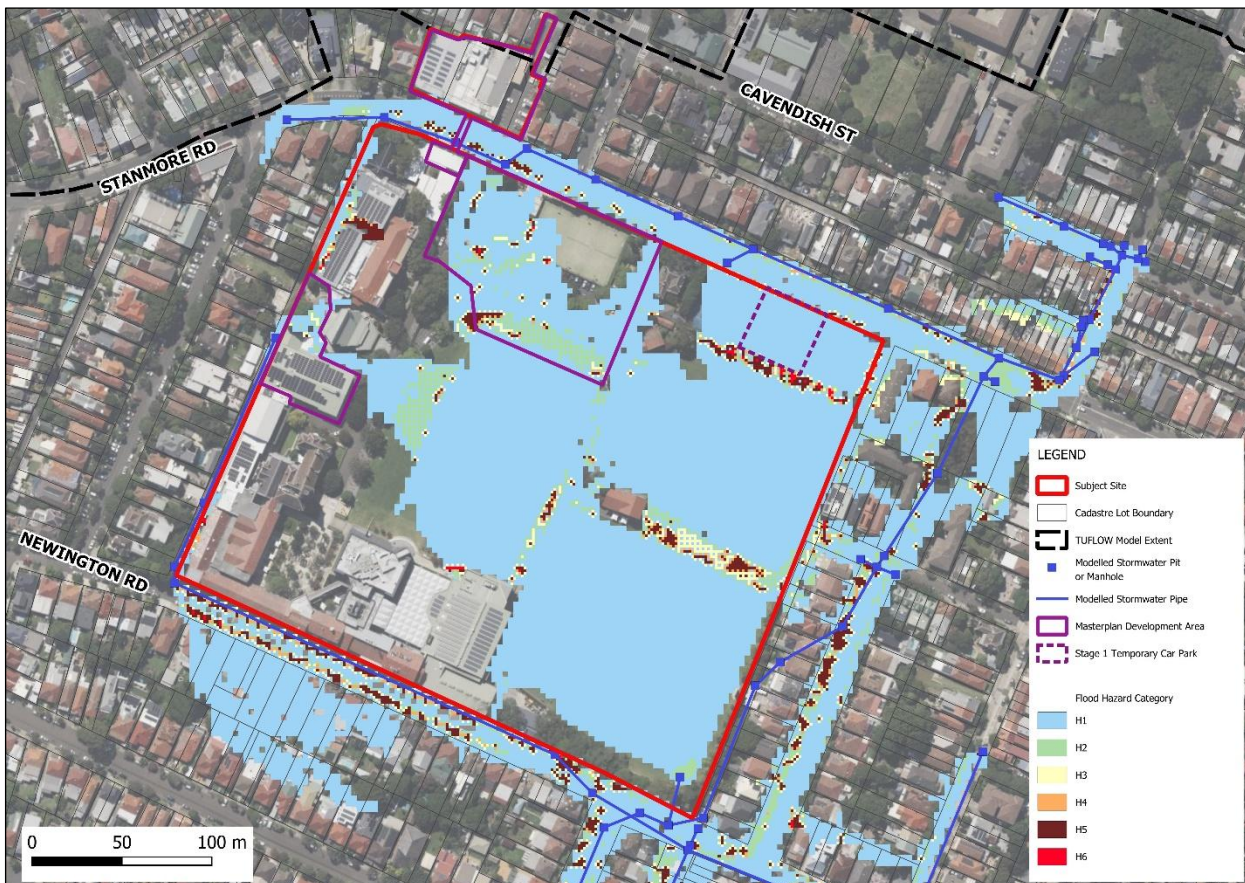
Existing Scenario



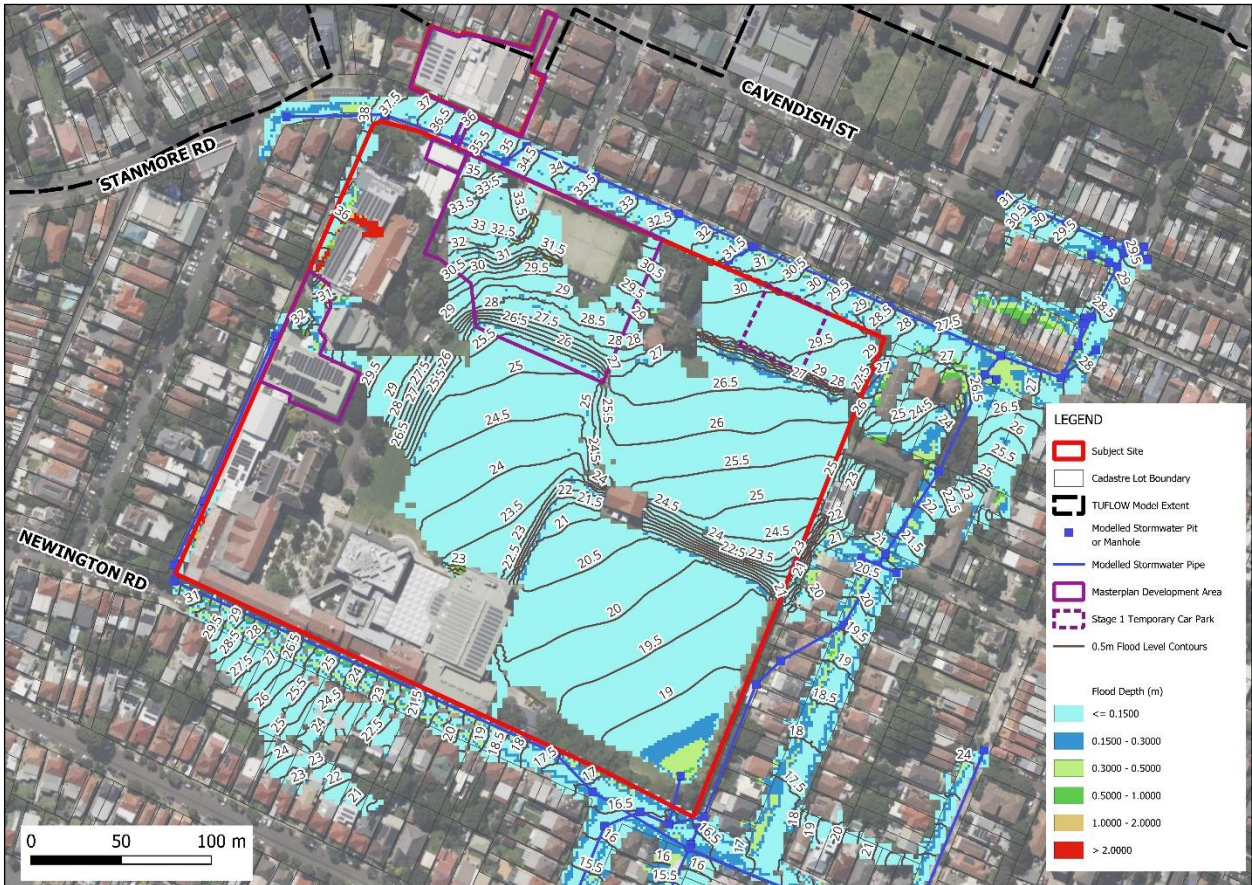
Existing scenario - peak flood levels and depths at the site in the 18% AEP event



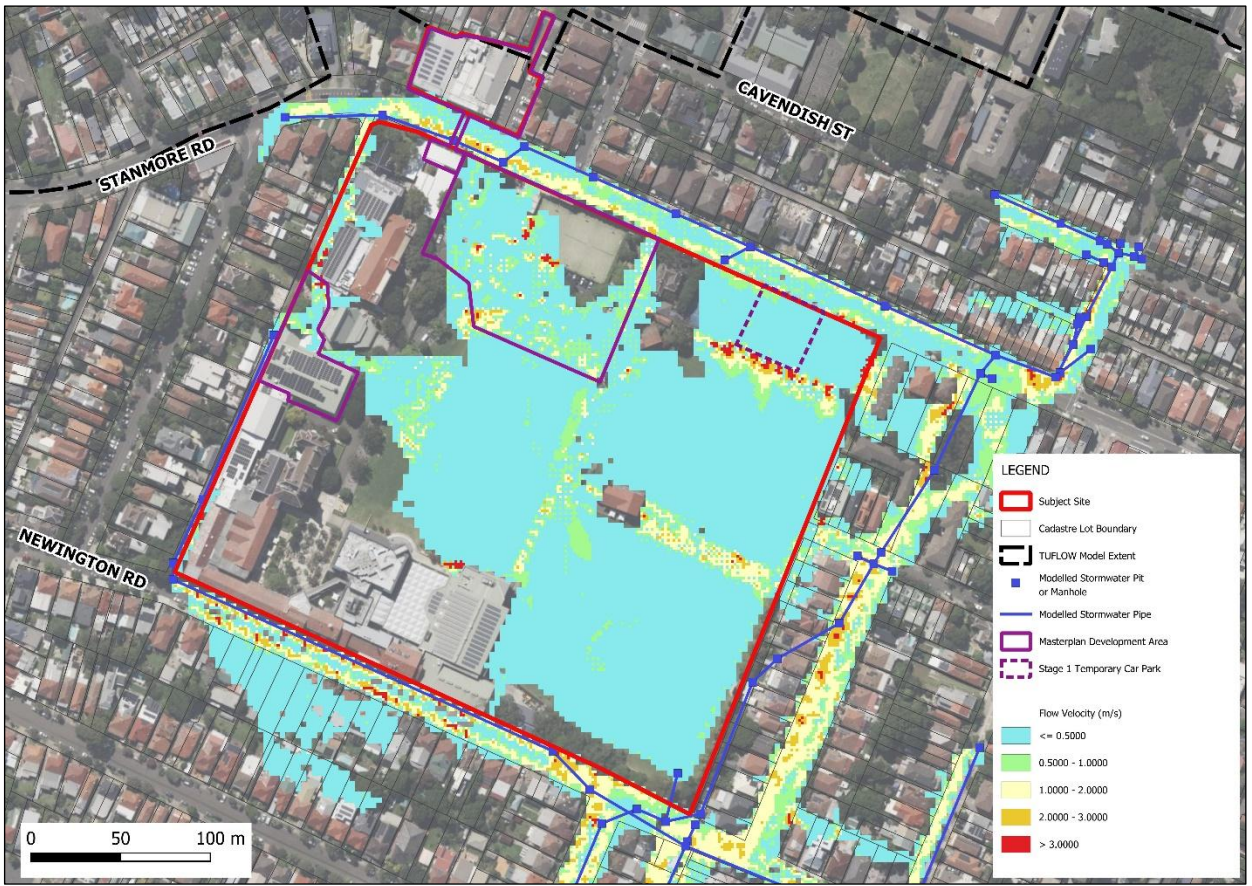
Existing scenario - peak flood velocity at the site in the 18% AEP event



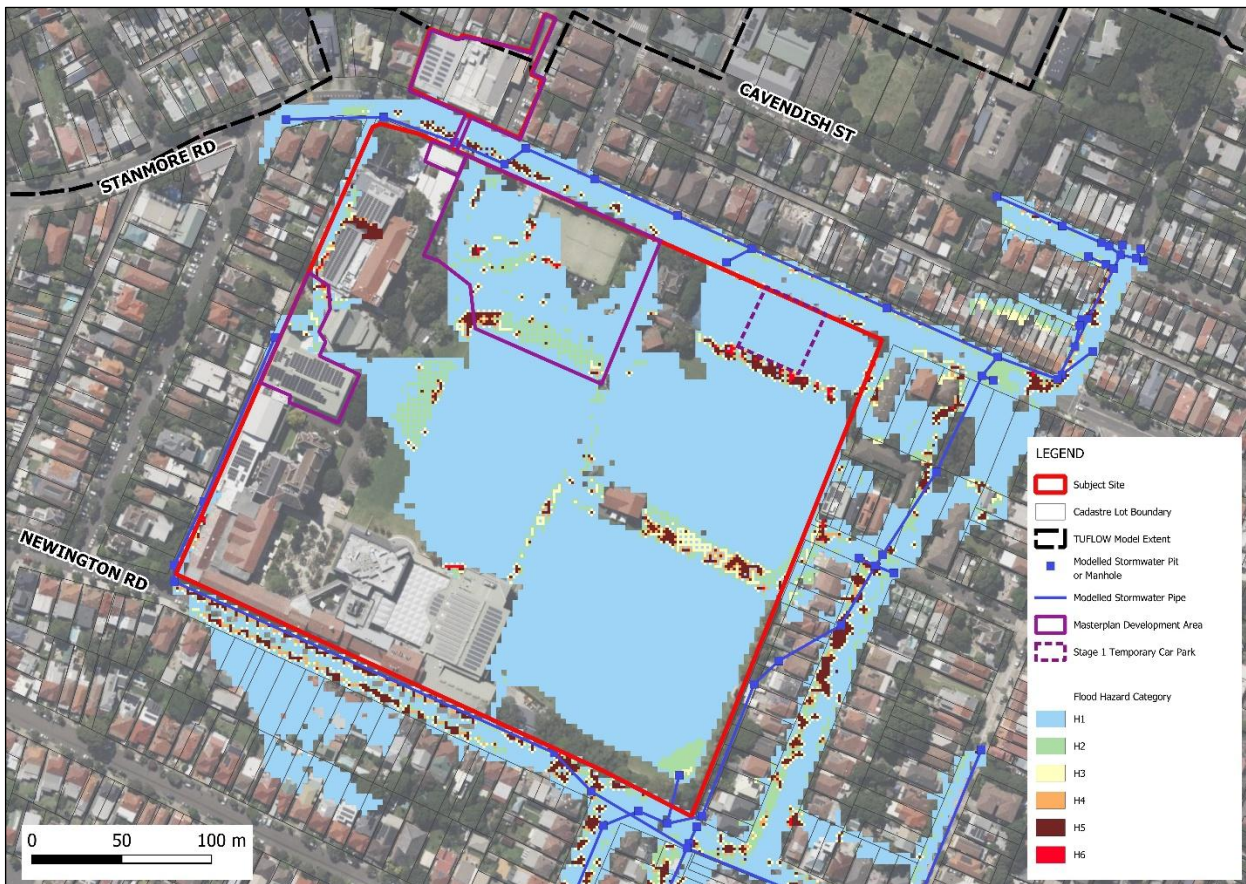
Existing scenario - peak flood hazard at the site in the 18% AEP event



Existing scenario - peak flood levels and depths at the site in the 10% AEP event

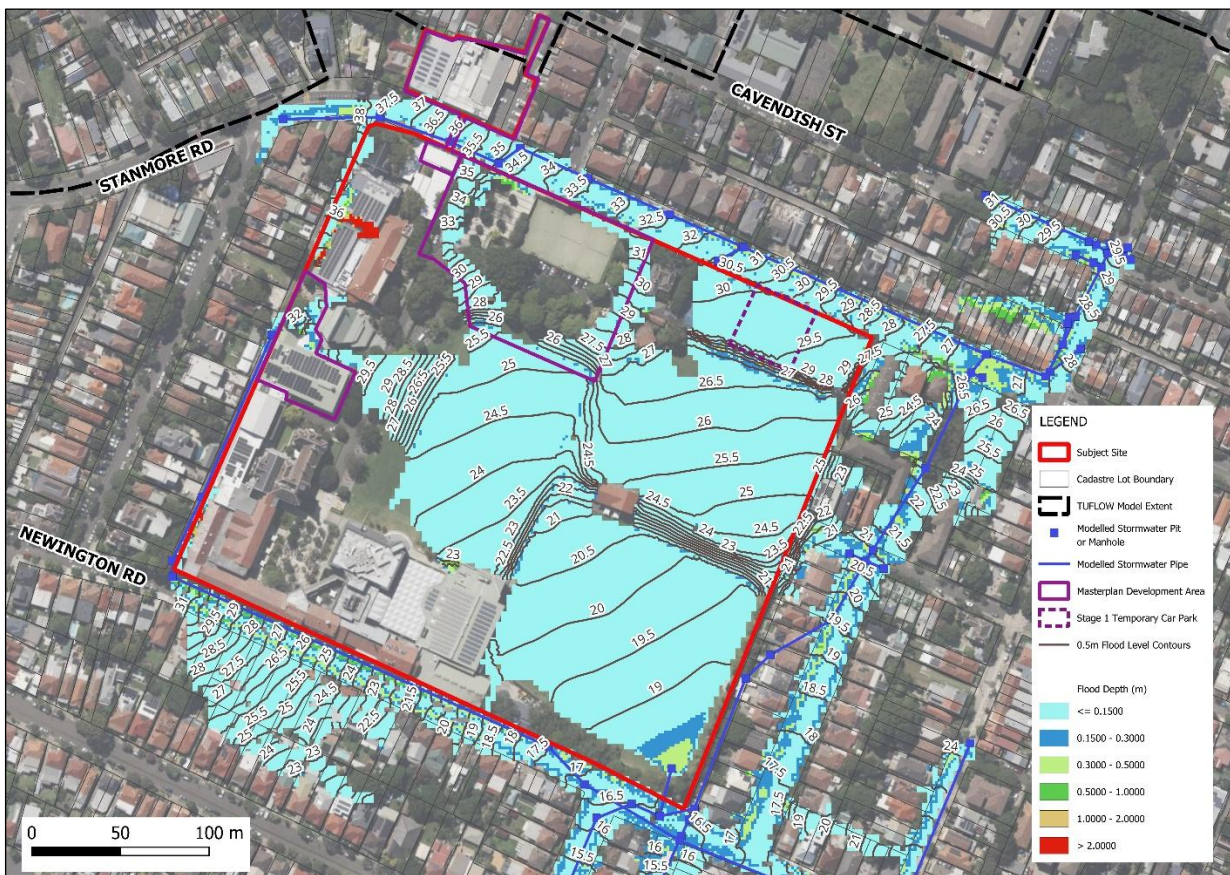


Existing scenario - peak flood velocity at the site in the 10% AEP event

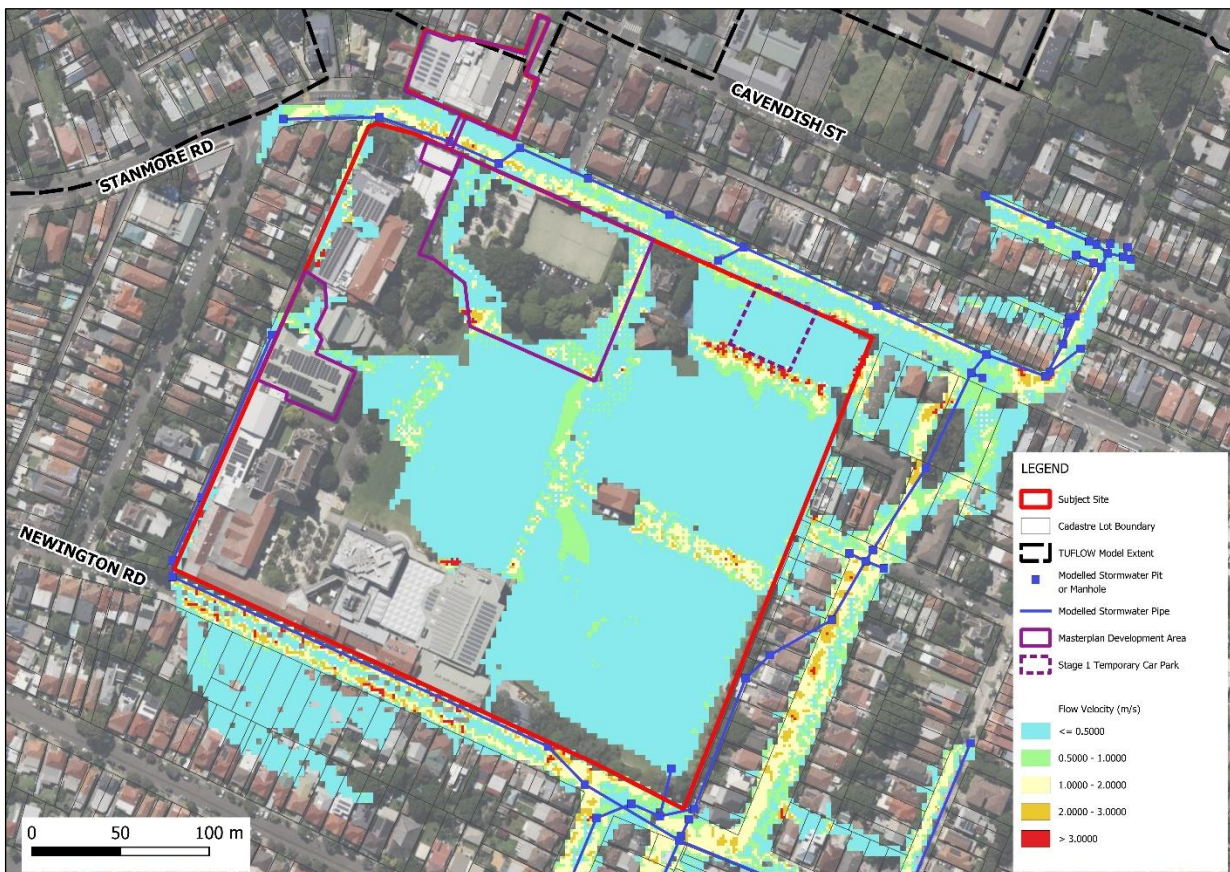


Existing scenario - peak flood hazard at the site in the 10% AEP event

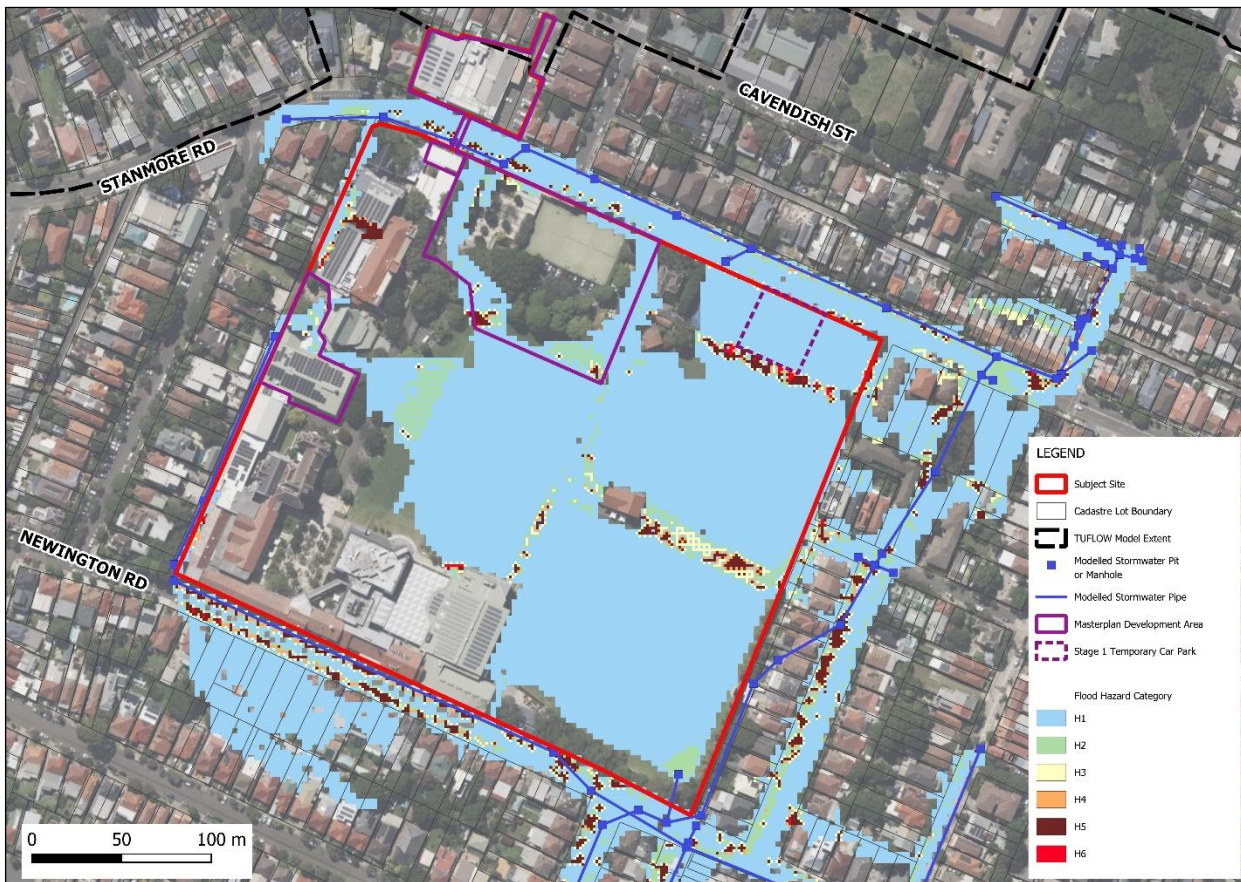
Post-Development Stage 1 Scenario



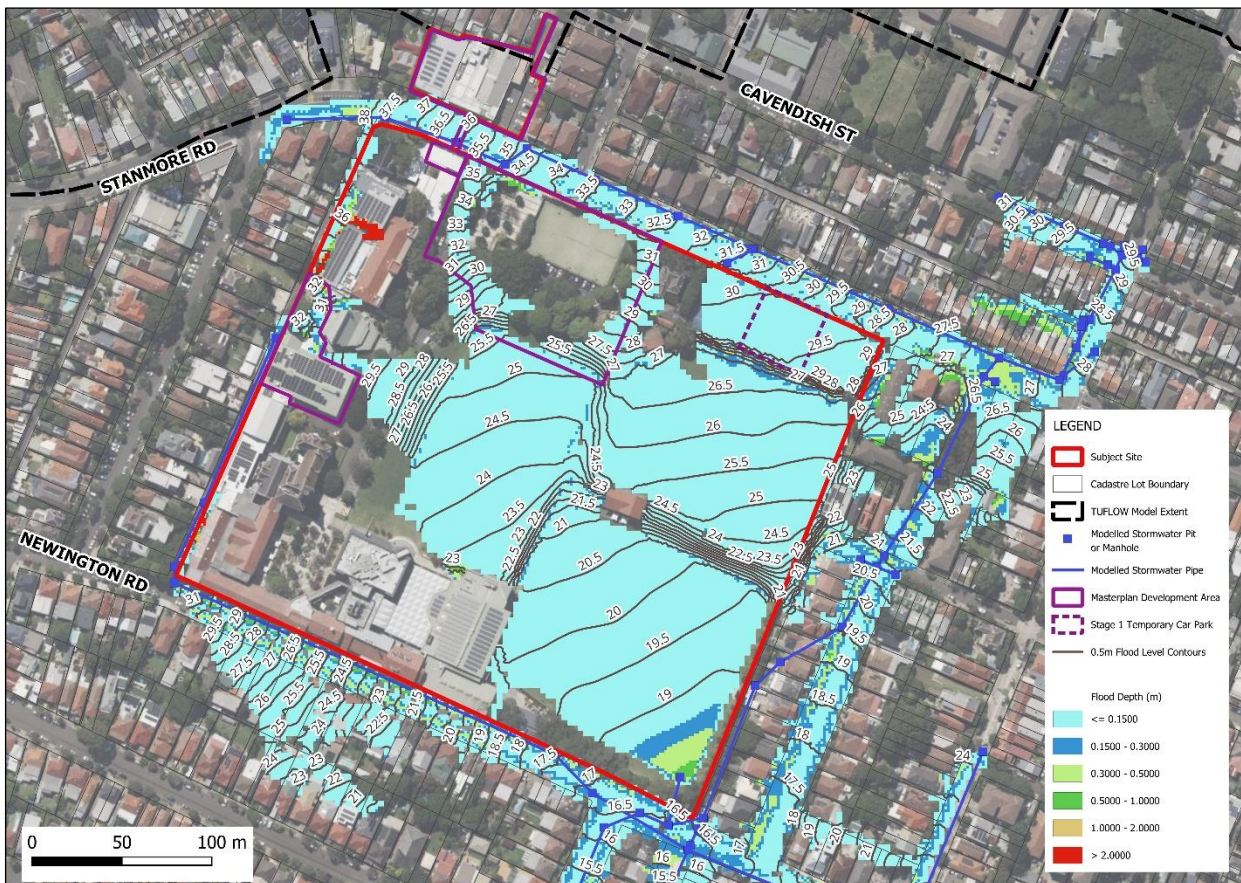
Post-Development Stage 1 scenario - peak flood levels and depths at the site in the 18% AEP event



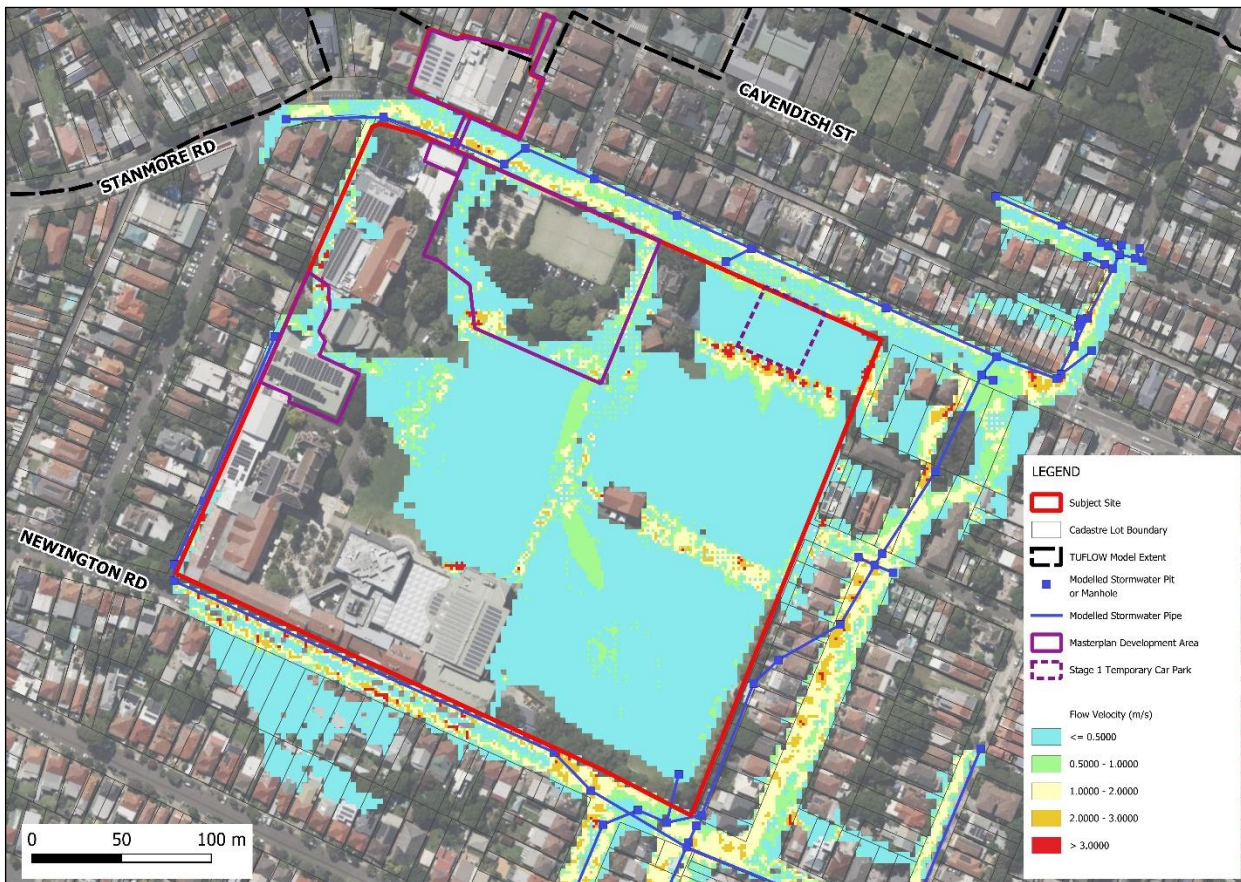
Post-Development Stage 1 scenario - peak flood velocity at the site in the 18% AEP event



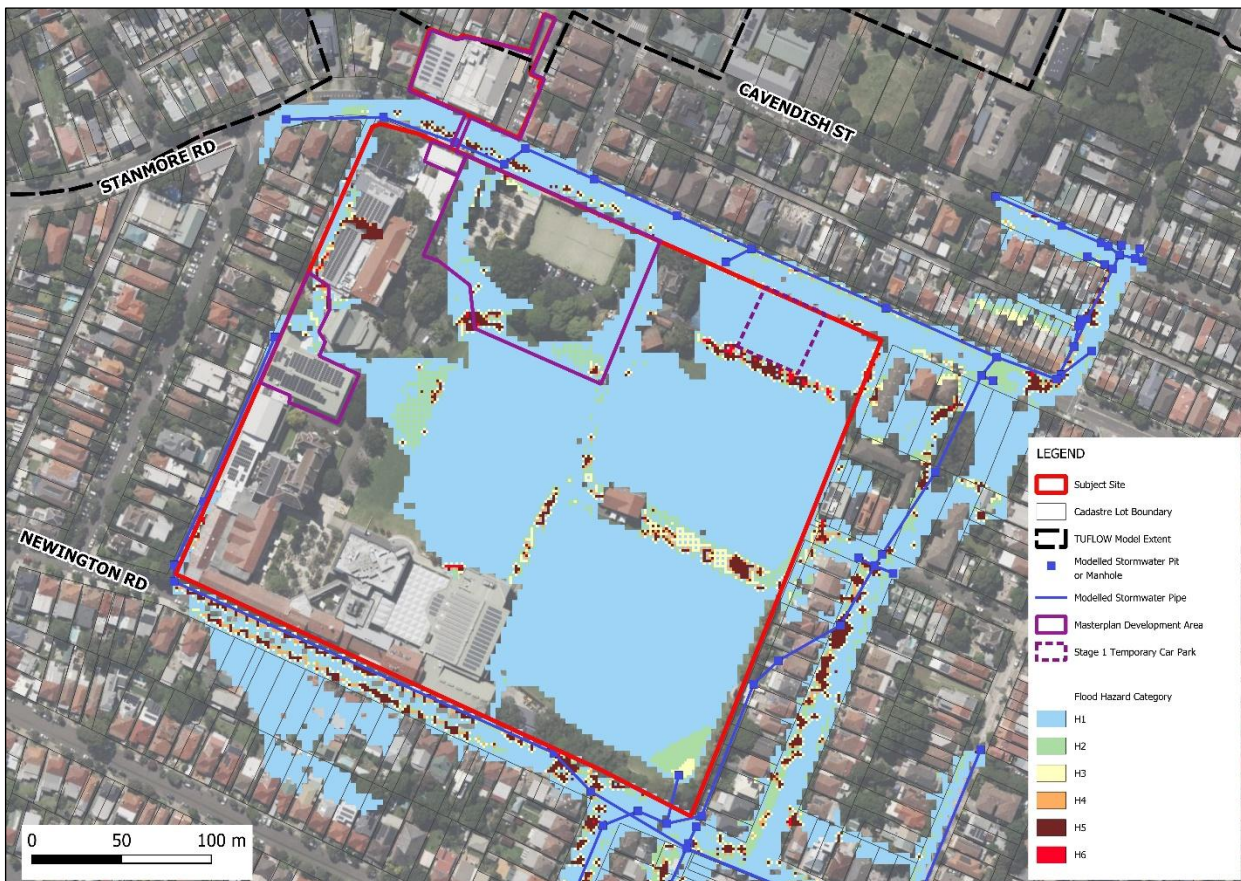
Post-Development Stage 1 scenario - peak flood hazard at the site in the 18% AEP event



Post-Development Stage 1 scenario - peak flood levels and depths at the site in the 10% AEP event

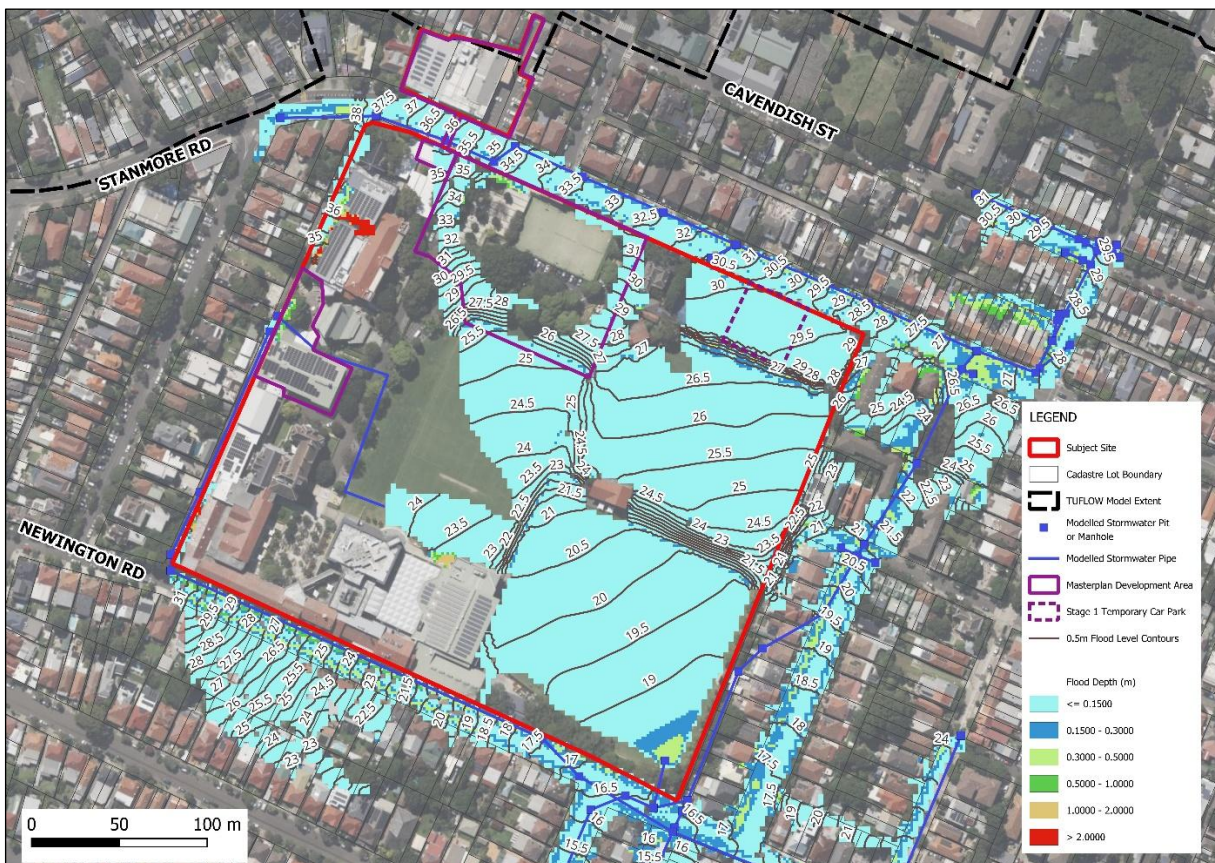


Post-Development Stage 1 scenario - peak flood velocity at the site in the 10% AEP event

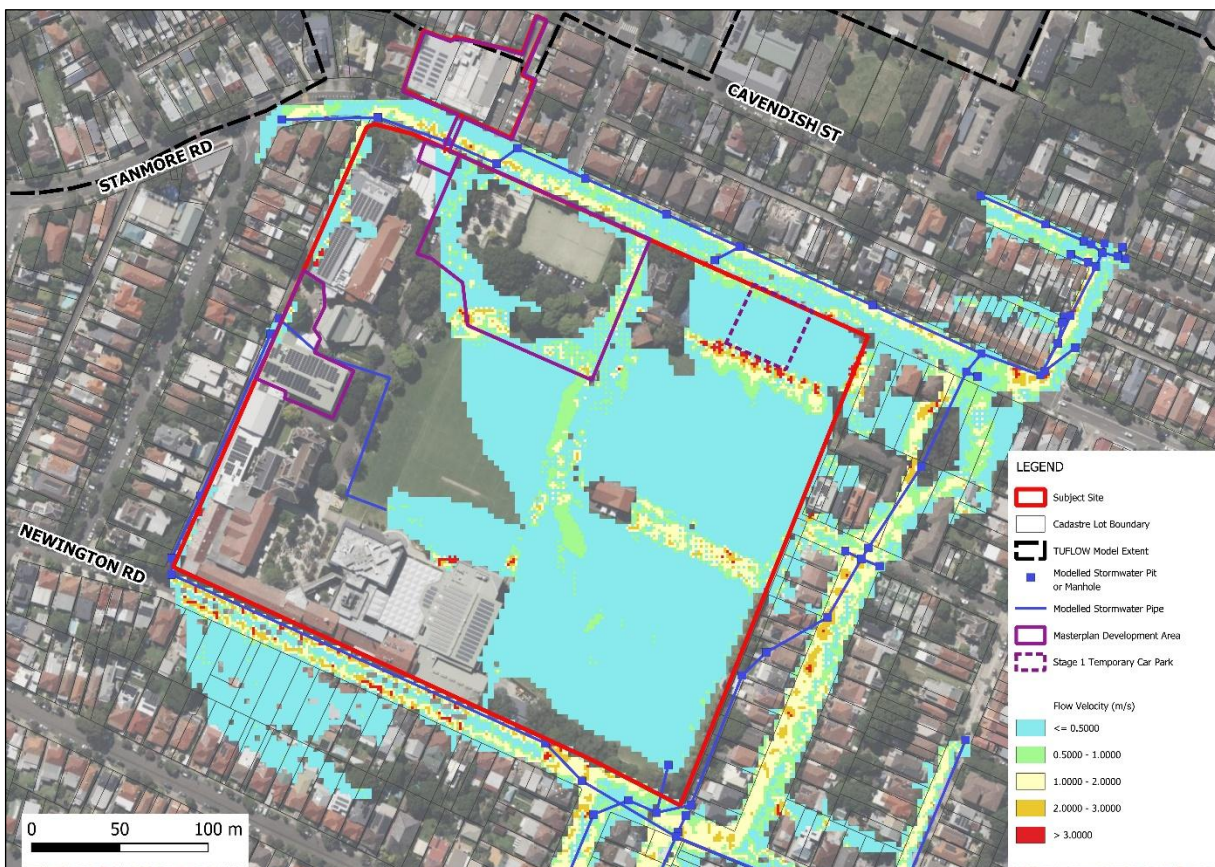


Post-Development Stage 1 scenario - peak flood hazard at the site in the 10% AEP event

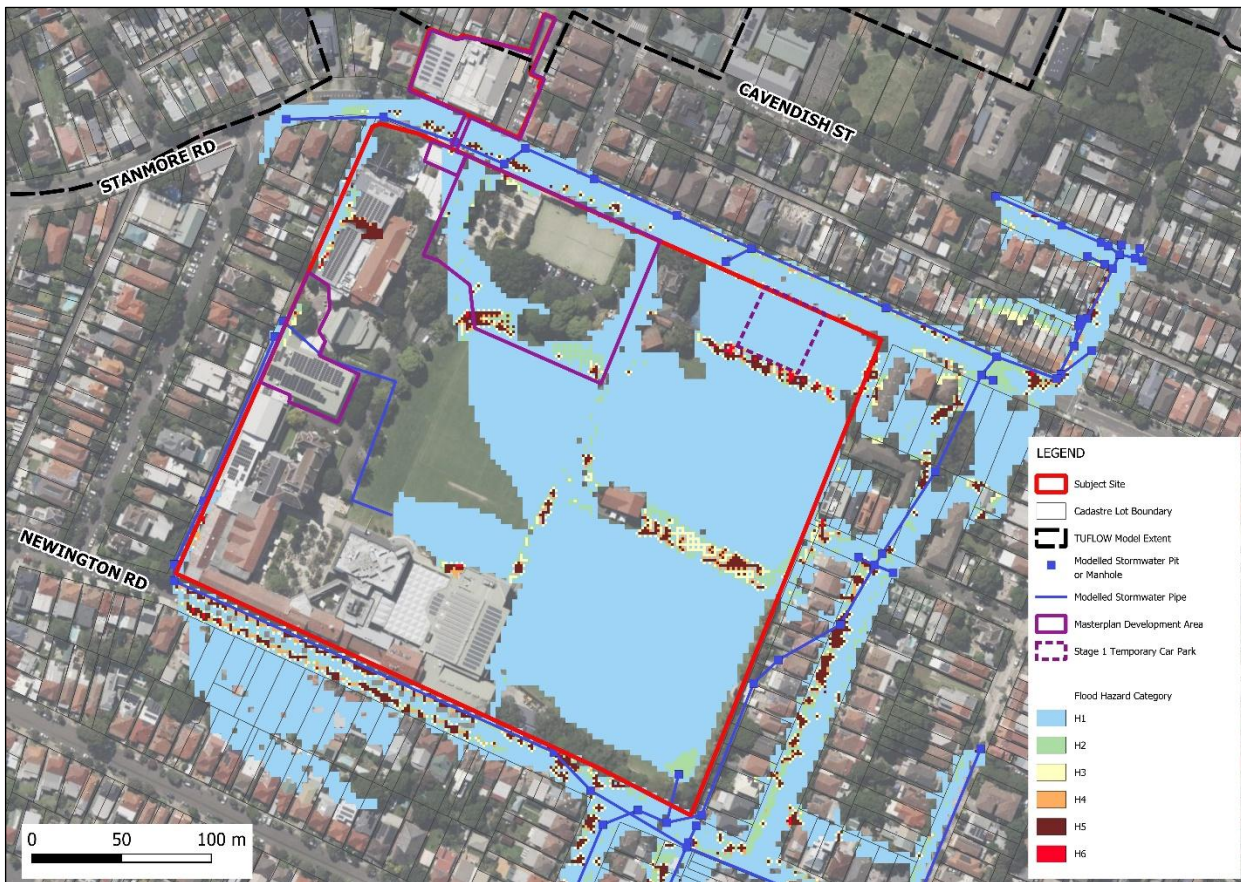
Post-Development Masterplan Scenario



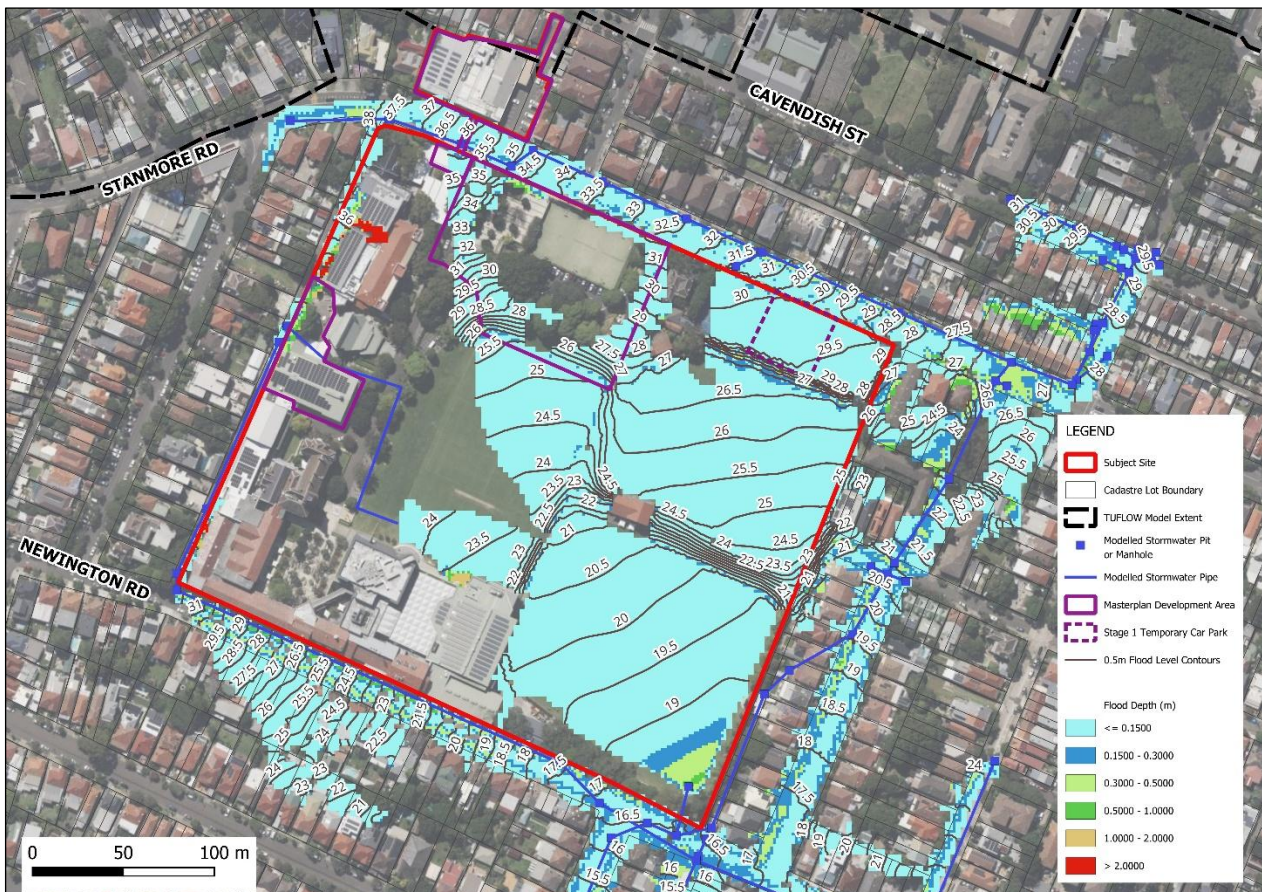
Post-Development Masterplan scenario - peak flood levels and depths at the site in the 18% AEP event



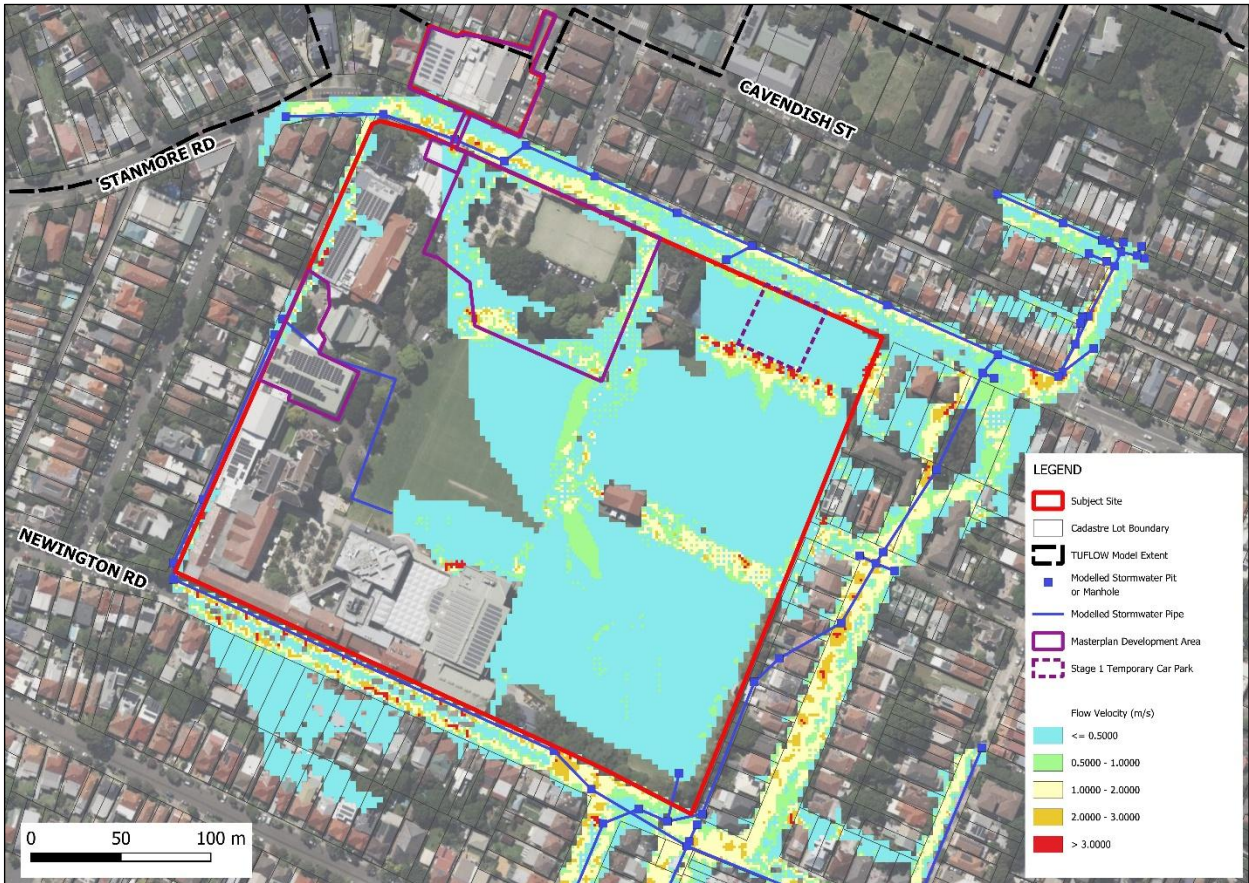
Post-Development Masterplan scenario - peak flood velocity at the site in the 18% AEP event



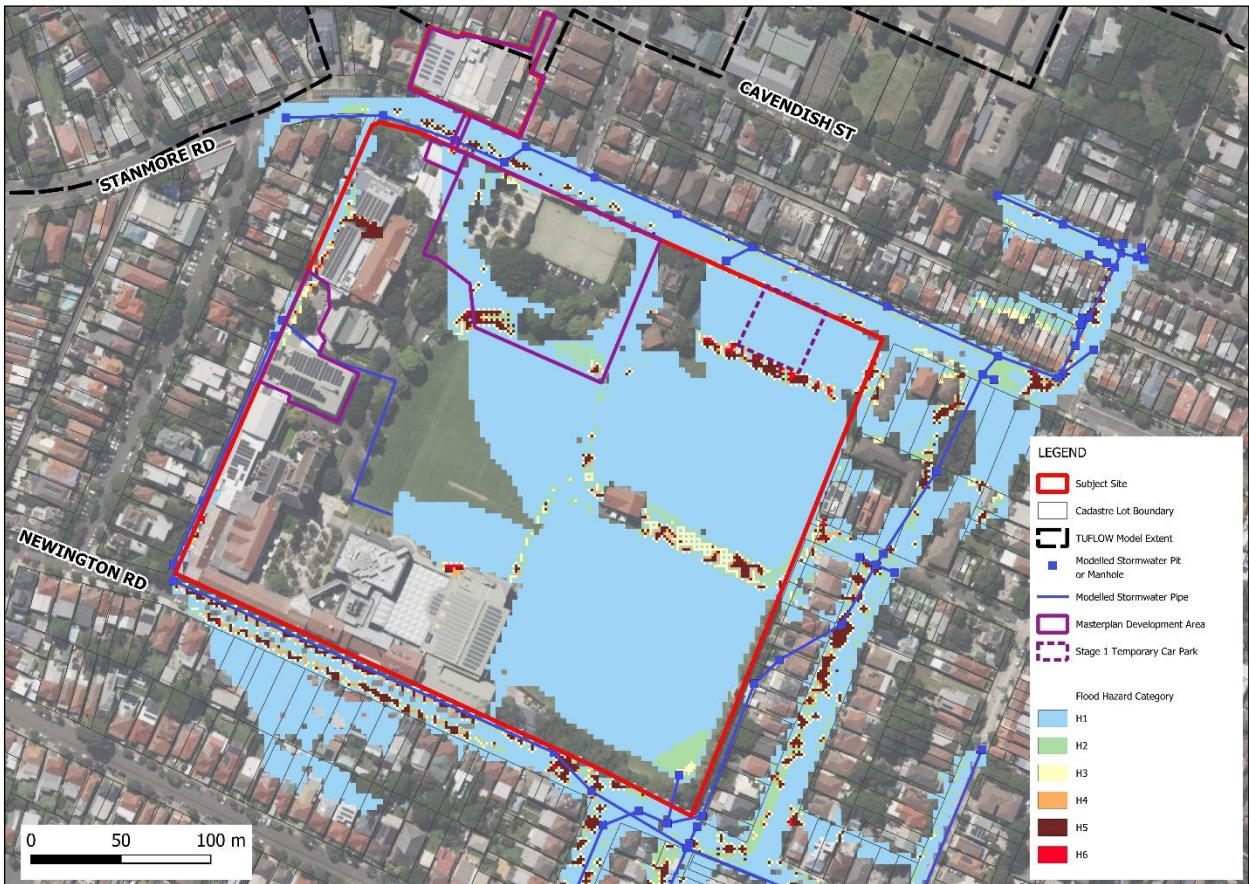
Post-Development Masterplan scenario - peak flood hazard at the site in the 18% AEP event



Post-Development Masterplan scenario - peak flood levels and depths at the site in the 10% AEP event



Post-Development Masterplan scenario - peak flood velocity at the site in the 10% AEP event



Post-Development Masterplan scenario - peak flood hazard at the site in the 10% AEP event

Appendix B

TTW Design Drawings

- 241840-TTW-00-DR-CI-04101-E

- FLOOD BARRIER (MIN. HEIGHT OF 700mm WITH MIN. TOP OF BARRIER AT 35.0m AHD) TO BE LOCATED AT TOP OF STAIRS AND RAMP AS PER FLOOD REPORT.

PROPOSED SWALE —

PODIUM DRAINAGE TO
HYDRAULIC SPEC

ALL BUILDING DRAINAGE TO DISCHARGE TO
OSD TANK - REFER HYDRAULIC PLANS
CONNECTION IL 28.60

PROPOSED OSD TANK
EFFECTIVE VOLUME = 60m³
INVERT OF TANK 26.80
TOP WATER LEVEL 28.60
15x690mm 'PSORB' STORMPIPE
TO BE LOCATED INTERNAL

PROPOSED STORMWATER PIPE RUNNING OVER
EXISTING SEWER - APPROX SEWER IL 25.1 TO BE
CONFIRMED IN DETAILED DESIGN

PROPOSED KERB INLET PIT
AT SAG POINT - 1.8m LINTEL

EXISTING WATER MAIN LEVEL TO BE CONFIRMED
IN DETAILED DESIGN

— PIPE TO BE UNDERBORED

RECONFIGURE EXISTING PIT TO GRATED SURFACE INLET PIT.
TREATMENT AND LEVELS TO BE DETERMINED AND GUIDED BY
THE PROJECT CONSULTING ARBORIST DURING CONSTRUCTION.
SURFACE DISTURBANCES AND REGRADING TO BE MINIMISED.
TREE ROOTS GREATER THAN 50mm TO BE RETAINED AND
PROTECTED FROM DAMAGE.

Scale at A1	Drawn	Designed	Approved			
1:200	JUT	SF	SF			
Project No	Originator	Zone	Type	Role	Sheet No.	Re
241840-TTW-00-DR-CI-04101-E						
10.04.2026 2:30 PM						

Rev	Description	Eng	Draft	Date	Rev	Description	Eng	Draft	Date
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Rev	Description	Eng	Draft	Date	Rev	Description	Eng	Draft	Date	Rev	Description	Eng	Draft	Date
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Newington College



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Drawing Title:
STORMWATER
AND SUBSOIL DRAINAGE
PLAN

Scale at A1	Drawn	Designed	Approved			
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