Flood Impact and Risk Assessment

New High School for Schofields and Tallawong

Prepared for NSW Department of Education c/o TSA Riley / 28 January 2025

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1.0 Introduction

This Flood Impact and Risk Assessment (FIRA) has been prepared to support a Review of Environmental Factors (REF) for the Department of Education (DoE) for the construction and operation of a new high school for Schofields and Tallawong (the activity).

The purpose of the REF is to assess the potential environmental impacts of the activity prescribed by *State Environmental Planning Policy (Transport and Infrastructure) 2021* (T&I SEPP) as “development permitted without consent” on land carried out by or on behalf of a public authority under Part 5 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). The activity is to be undertaken pursuant to Chapter 3, Part 3.4, Section 3.37A of the T&I SEPP.

This document has been prepared in accordance with the *Guidelines for Division 5.1 assessments* (the Guidelines) by the Department of Planning, Housing and Infrastructure (DPHI). The purpose of this report is to outline the existing constraints of flooding at the site, alongside an assessment into the likely impacts of the proposed activity in post-construction conditions. The details of this report are based on currently available information and correspondence undertaken at the time of writing.

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);
- Bathla Groups (2024) 151 & 161 Tallawong Road Rouse Hill NSW 2155 Subdivision Works Certificate – Stage 1.
- Blacktown City Council (BCC) Development Control Plan (DCP), 2015;
- Blacktown City Council (BCC) Water Sensitive Urban Design (WSUD) Developer Handbook MUSIC Modelling and Design Guide, 2020;
- Blacktown City Council (BCC) Engineering Guide for Development (EGD), 2005;
- 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, Housing and Infrastructure – Planning Circular PS 24-001, Update on addressing flood risk in planning decisions, 1st March 2024;
- NSW Floodplain Development Manual, June 2023;
- NSW Planning Portal Spatial Viewer (Spatial Collaboration Portal - Map Viewers (nsw.gov.au)); and
- School Infrastructure New South Wales (SINSW) Guidelines for School Site Selection and Master Planning, 2023.

1.2 Site Description

The site is known as 201 Guntawong Road, Tallawong, NSW, 2762 (the site), and is legally described as part of Lot 1 in Deposited Plan 1283186. The site is located at the corner of Guntawong Road and Clarke Street, Tallawong and is approximately 4 hectares in area. The site has an approximately 100-metre-long frontage to Guntawong Road along its northern boundary. Nirmal Street provides a partial frontage along the eastern boundary of the site with plans to extend Nirmal Street to provide a future connection to Guntawong Road.

The site is predominantly cleared land and consists of grassland with several patches of remnant native vegetation particularly within the northern portion of the site. As a result of precinct wide rezonings, the surrounding locality is currently transitioning from a semi-rural residential area to a highly urbanised area with new low to medium density residential development with supporting services. The site is located approximately 1.5km to the northwest of Tallawong Metro Station and is also serviced by an existing bus stop along Guntawong Road.

Figure 1 below provides an aerial image of the site.

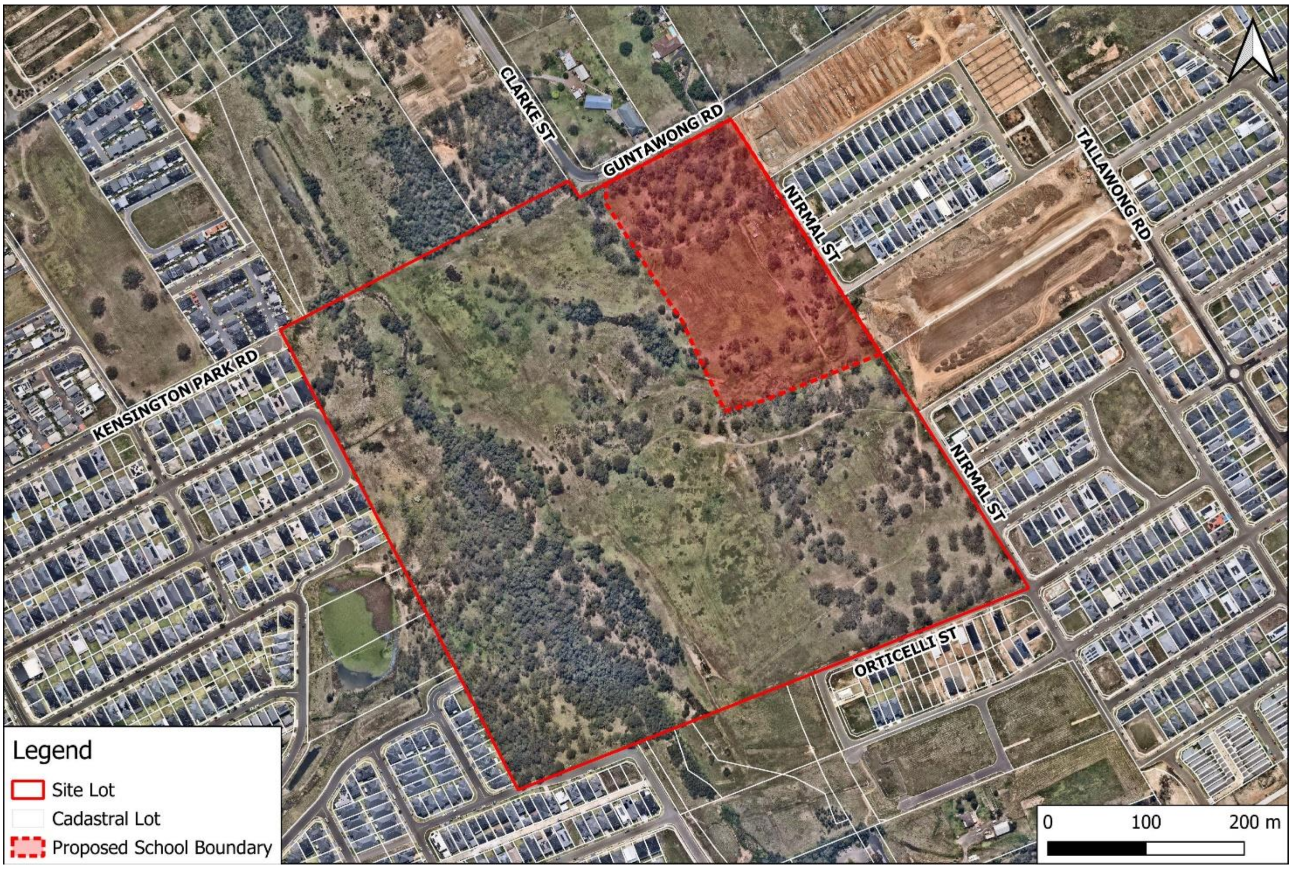

Figure 1: Aerial photograph of site (Source: Nearmap, dated 27th October 2024).

1.3 Proposed Activity Description

The proposed activity is for the construction and operation of a new high school known as Schofields - Tallawong High School. The new high school will accommodate up to 1,000 students. The school will provide 49 permanent teaching spaces (PTS), and 3 support teaching spaces (STS) across three buildings.

The buildings will be three-storey in height and will include teaching spaces, specialist learning hubs, a library, administrative areas and a staff hub. Additional core facilities are also proposed including a standalone school hall, a carpark, a pick-up and drop off zone along Nirmal Street, two sports courts and a sports field.

Specifically, the proposal involves the following:

- Three learning hubs (three-storeys in height) accommodating 49 general teaching spaces and 3 support learning units (SLUs).
- Other core facilities including amenities, library, staff hub and administrative areas.
- Standalone school hall.
- Separate carpark with 72 spaces.
- Kiss and drop zone along Nirmal Street.
- Open play space including sports courts and sports field.
- Public domain works including extension of Nirmal Street.

The proposed site access arrangements are as follows:

- Main pedestrian entrance to be located off Nirmal Street.

- Kiss and drop zone proposed along Nirmal Street.
- Onsite parking access via Nirmal Street.

Figure 2 provides an extract of the proposed site plan.

Figure 2: Proposed site plan (Source: DJRD Architects, 20th January 2025).

2.0 Site Characteristics

2.1 Future Development and Zoning

It is important to acknowledge that there is notable upcoming and proposed development within the Schofields and Tallawong area. The land use zoning of the site and surrounding area is shown in Figure 3 and gives an indication of the future development in the area. The site is currently zoned as R3 – Medium Density Residential to the north and R2 – Low Density Residential to the south. As an educational facility, the proposal is permissible with consent in the R3 and R2 zone and meets the zone objectives.

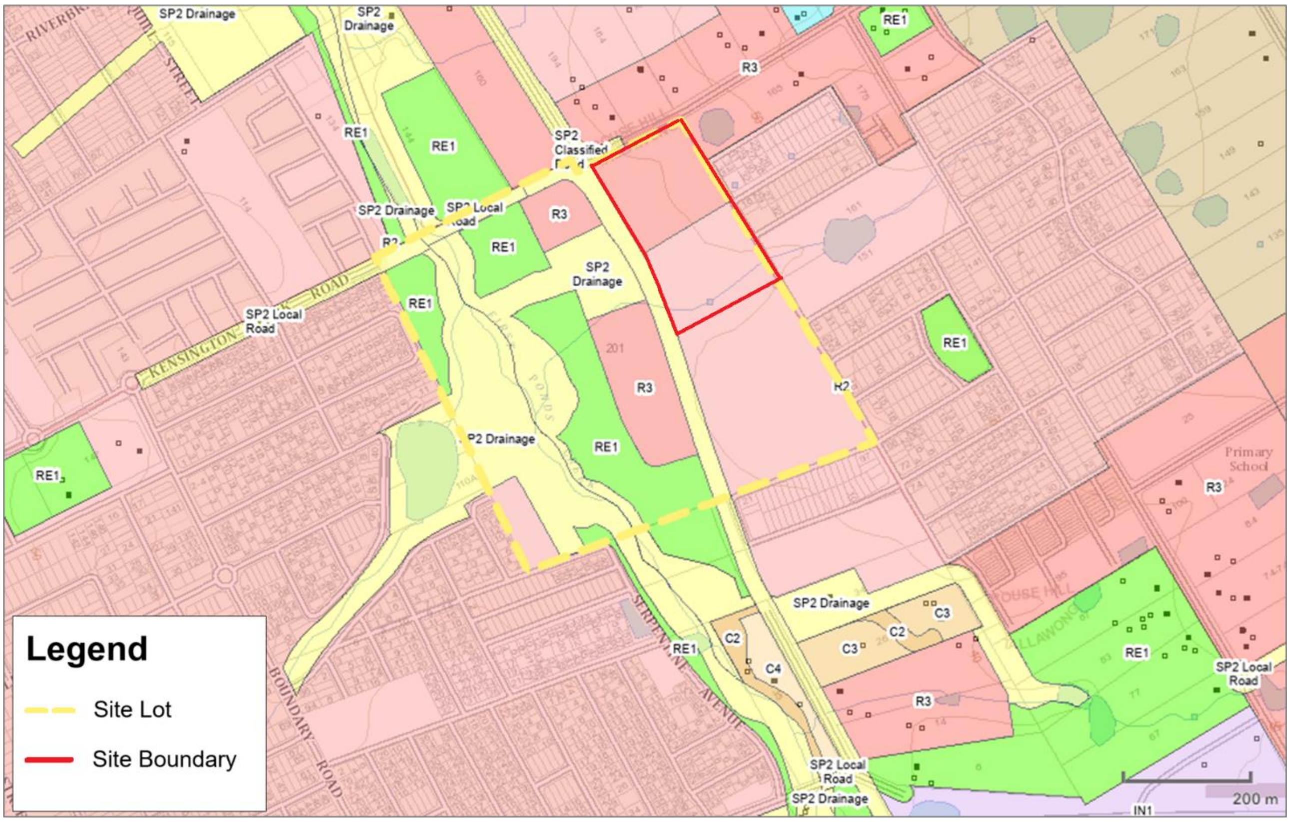

Figure 3: Land use zoning for the site and surrounding area. Source: NSW Planning Portal Spatial Viewer, 2024.

2.2 Catchment Information

The site is situated within the First Ponds Creek sub-catchment of Wianamatta-South Creek Catchment. Wianamatta South Creek is a tributary of the Hawkesbury-Nepean River that drains a 640 km^2 catchment in Western Sydney. The catchment extends from its headwaters near Narellan in the south, to its confluence with the Hawkesbury River near Windsor. Approximately 65% (414 km^2) of the catchment is situated upstream of the Richmond Road crossing at Marsden Park.

The First Ponds sub-catchment lies between the Eastern Creek catchment to the west, and the Seconds Pond Creek catchment to the east, as indicated in Figure 4. This region is currently undergoing significant development, including new residential subdivisions and new/upgraded roadways to support the increasing population. These developments have the potential to alter catchment runoff characteristics and flood behaviour along the Creek.

The site is located within close proximity to the third-order First Ponds Creek, which travels through the site lot from south to north, approximately 240m west of the proposed school boundary. A first order creek which drains into the First Ponds Creek intersects the south of the proposed school boundary.

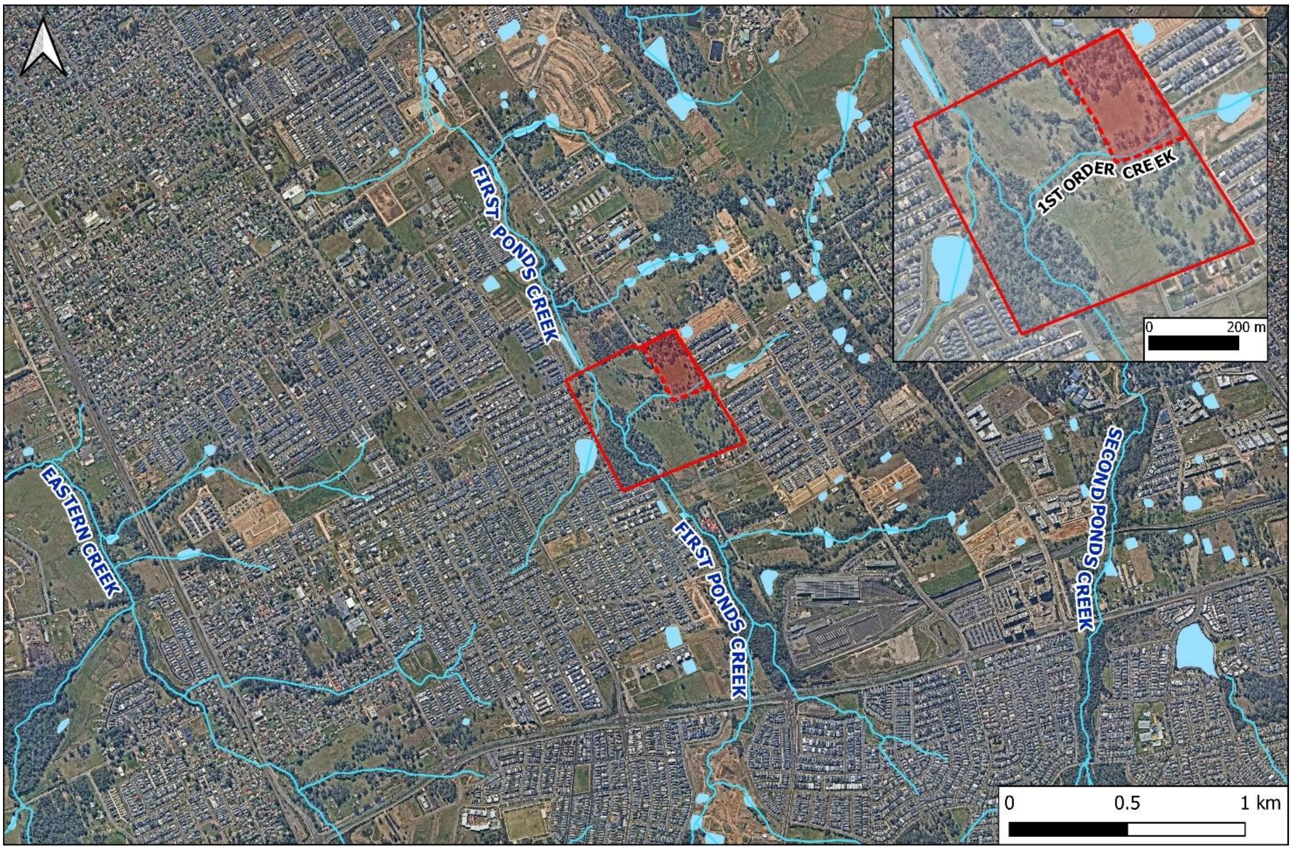

Figure 4: Location of site in relation to surrounding creeks.

2.3 Site Topography

To assess the topography of wider area, the latest available elevation data (2019) was obtained from the NSW Spatial Services, Elevation Information System (ELVIS), with a spatial resolution of 1 metre. As presented in the Digital Elevation Model (DEM) in Figure 5, the site predominantly slopes from east to west towards First Ponds Creek. Ground level peaks in the northeast of the proposed school boundary at approximately 46.5m AHD, with a notable drop to approximately 36.9m AHD at the first order creek to the southwest corner (with an approximate gradient of 3.5%). A cross-sectional profile of this slope is presented in Figure 6.

Across the wider area, higher elevations are found to the east of the site (peaking at approximately 68.0m AHD along Guntawong Road), while elevation falls to around 32.0m AHD along First Ponds Creek to the west.

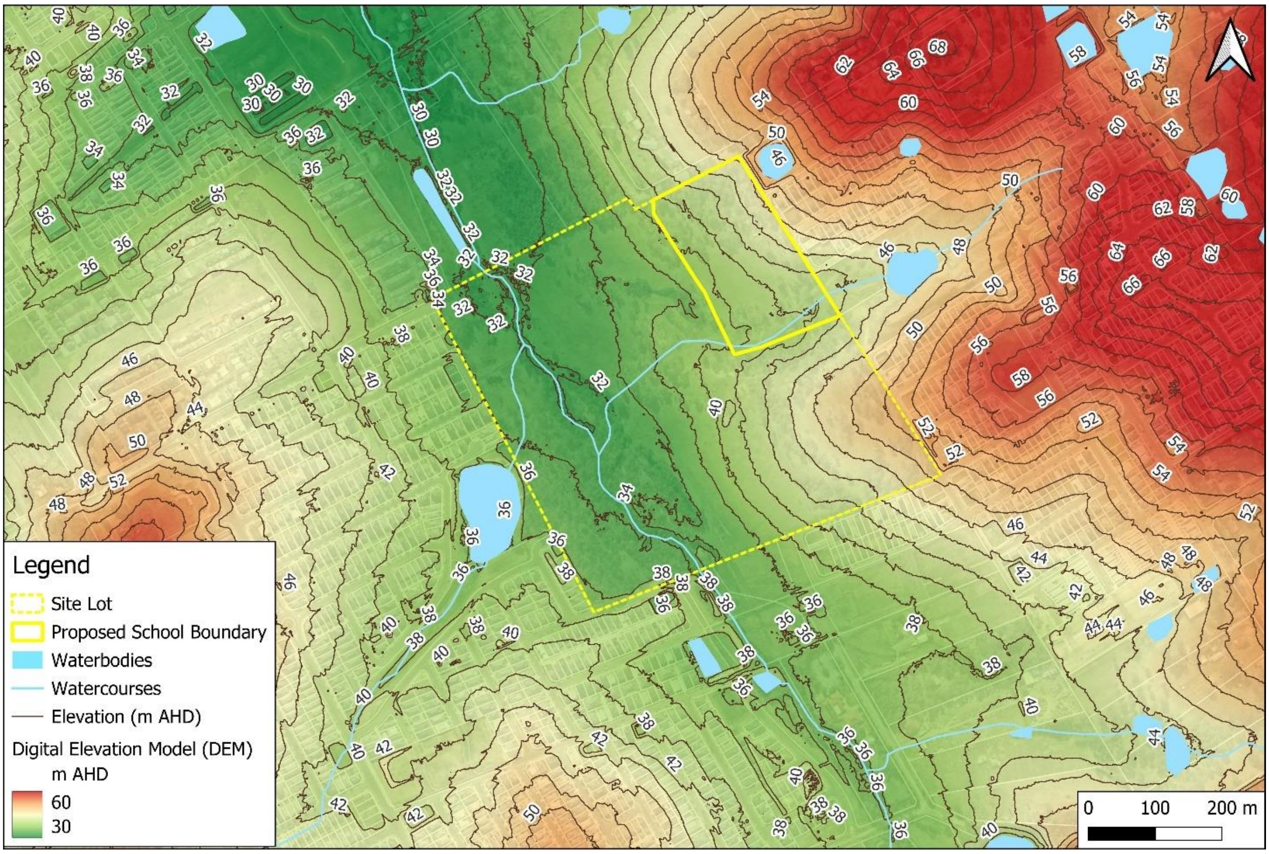

Figure 5: Topography of the site and its surrounding area based on 2019 LiDAR data (Source: ELVIS).

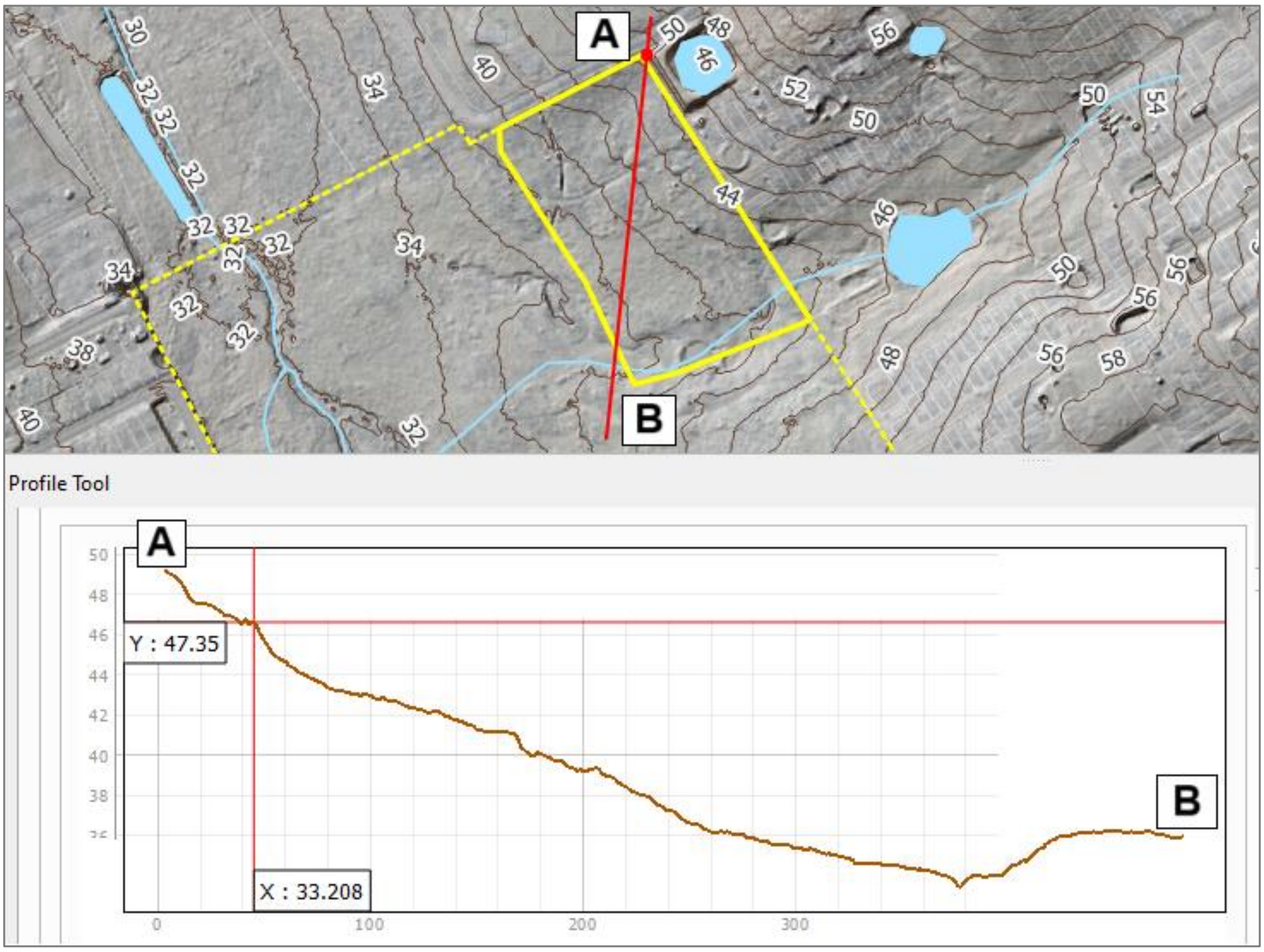

Figure 6: Elevation profile through the site from northeast to southwest.

3.0 Existing Flood Information

3.1 Blacktown City Council Flood Maps

Flood mapping available on Blacktown City Council's website indicates that the southern portion of the proposed school boundary is situated within the "SEPP Flood" zone. The SEPP (State Environmental Planning Policy) maps indicate the extent of flood prone land based on existing conditions at the time of preparing the precinct planning, and do not include changes resulting from subsequent development or infrastructure works.

The site is within close proximity to the area of Riverine Medium Flood Risk Precinct, which occupies the western portion of the wider site lot. This precinct is equivalent to the flood planning area, i.e. land impacted by the 1% AEP flood level plus 500mm freeboard. However, the proposed school site is mostly located outside any flood risk precincts with only the southern end of the site being mapped within the "SEPP Flood" zone. This affected southern area is generally receiving stormwater runoff from the upstream area to the east and the flow accumulated within the first order creek, which cuts through the southern area of the proposed school site.

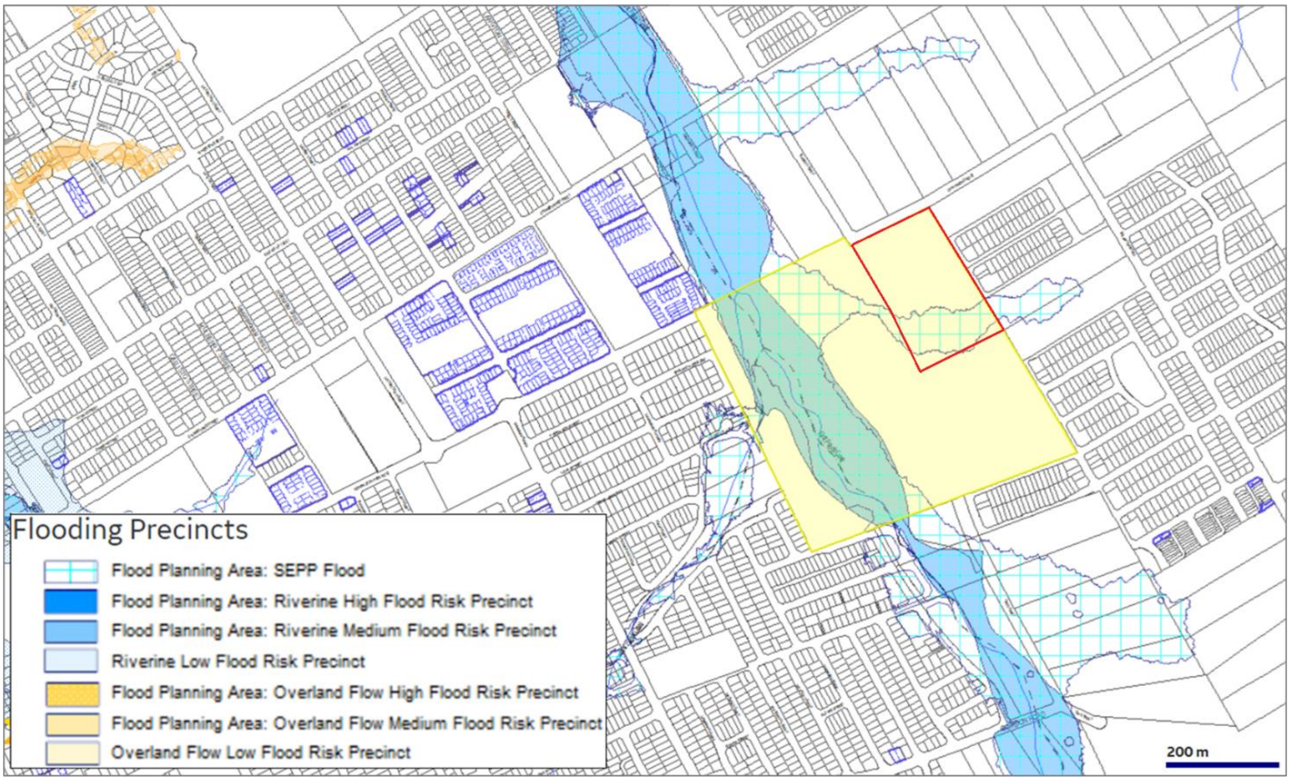

Figure 7: Flooding precinct at and around the site. Source: Blacktown City Council Interactive Maps, 2024.

3.2 First Ponds Creek Flood Assessment

Blacktown City Council commissioned Catchment Simulations Solutions (CSS) to conduct a Flood Assessment for First Ponds Creek (FPC) in 2021 to determine whether development of the catchment may have adverse impacts on flood behaviour. The project includes an assessment of the following:

- 'Pre-Development' conditions based on 2010 topographic and catchment development information.
- 'Ultimate Catchment Development' conditions, that assumes full development across the FPC catchment, incorporating proposed changed in land use (i.e. increasing impervious surfaces to reflect the projected increase in development), water management infrastructure (i.e. addition of proposed flood detention basins based on design terrain plus outlet details provided by Council), terrain modifications and hydraulic structure upgrades.

Flood depths and levels surrounding the site in the PMF event under 'pre-development' (2010) conditions is presented in Figure 8, while Figure 9 shows the flood behaviour under the ultimate catchment development scenario. At the site, the ultimate catchment development scenario incorporates two new roads surrounding the site, including an extension of Guntawong Road (that marks the site's northern boundary), alongside a new road along the site's western boundary. In this scenario, the flood extent at the site appears to have reduced slightly compared with the pre-development model, with flooding restricted to the west of the new road, reaching a maximum level of approximately 37.0m AHD in the PMF. Depths exceed 1 metre along one proposed road further west of the site and exceed 2 metres within the main channel. Clarke Street and Guntawong Road are not affected.

The modelling within CSS' flood assessment uses LiDAR survey with limited representation of specific site details. Further modelling of the site with higher resolution survey data for the site is necessary to confirm the flood risk to the site in both existing and post-development conditions.

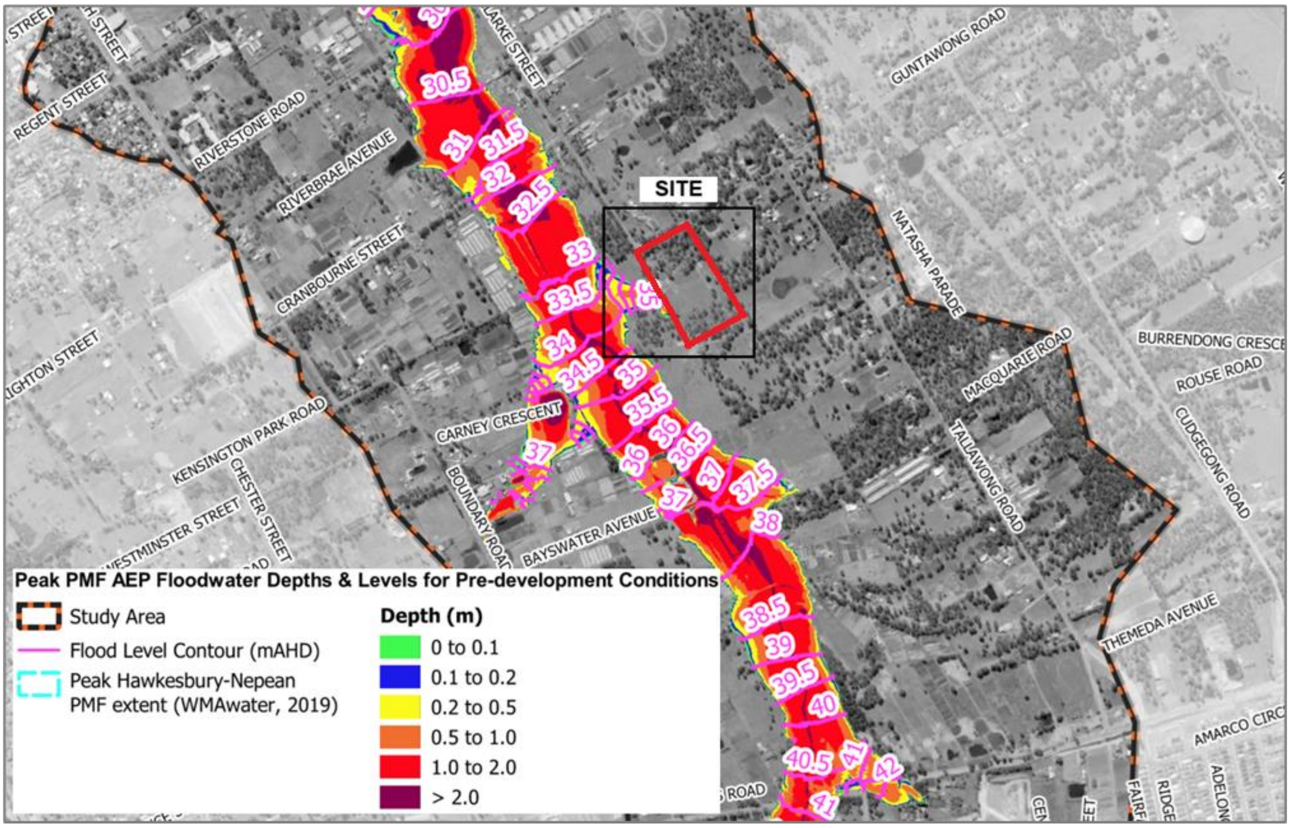

Figure 8: Flood depths and levels in the PMF event – Pre-development conditions (2010) (Source: taken from the First Ponds Creek Flood Assessment, 2021)

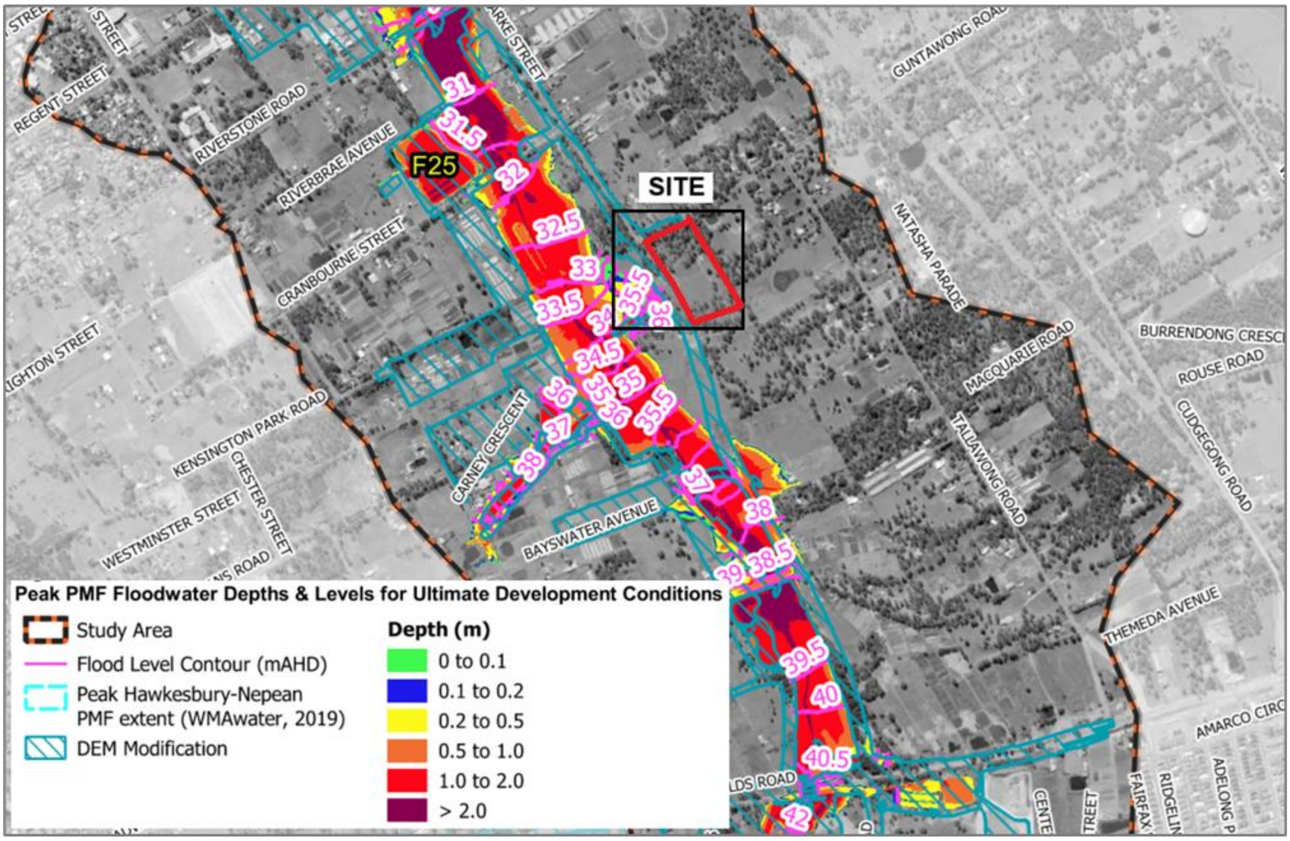

Figure 9: Flood depths and levels in the PMF event – Ultimate catchment development scenario (Source: taken from the First Ponds Creek Flood Assessment, 2021)

4.0 Methodology

4.1 First Ponds Creek TUFLOW Model

Council have provided TTW with the First Ponds Creek Flood Study and model (CSS, 2021). This has been confirmed by Council as suitable to use for this proposed activity and has therefore been used as the basis of the flood modelling completed as part of this assessment. The model boundary extends from upstream of Schofields Road to downstream of Windsor Road, as shown against the site location in Figure 10.

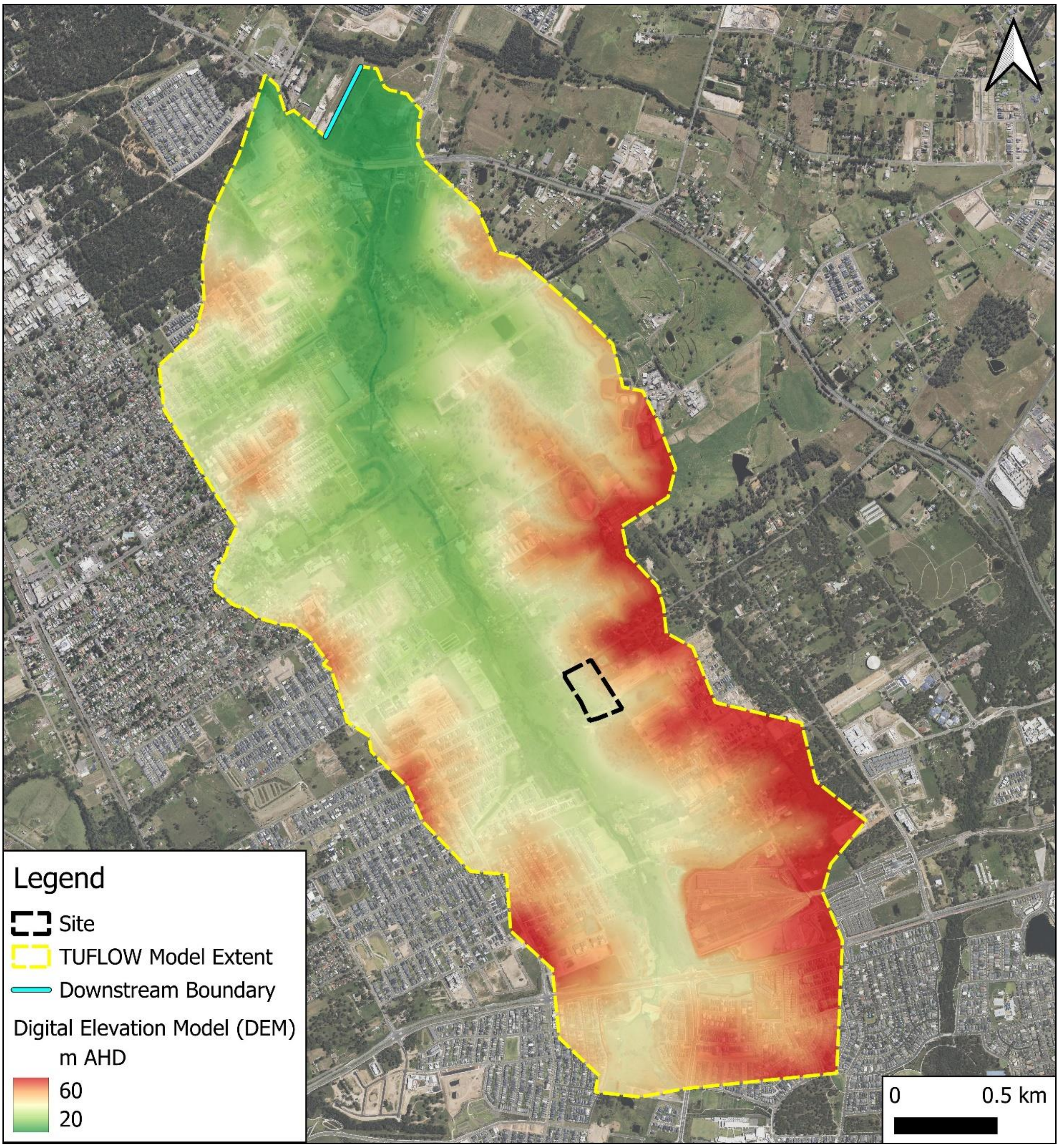

Figure 10: TUFLOW Hydraulic model boundary

The modelling methodology used by CSS can be summarised as follows:

Model domain	Dynamic 1D (pipe network) and 2D (floodplain)
Hydrologic model	An XP-RAFTS hydrologic model of the catchment was used to simulate rainfall runoff processes for the complete suite of design storms, based on the 2019 Australian Rainfall and Runoff methodology. This included application of multiple temporal patterns for each design storm frequency and duration (i.e., from 10 minutes up to 96 hours).
Hydraulic model software	TUFLOW HPC software
Solver	2020-01-AB
Grid size	2m cell with sub grid sampling (1m sampling interval)
Model inflows	XP-RAFTS hydrographs incorporated as Source Area (SA) boundaries to apply flow directly onto the 2D domain.

As noted in Section 3.2, two scenarios were modelled as part of the FPC flood assessment; a 'Pre-Development' conditions based on 2010 topographic and development information, and the 'Ultimate Catchment Development' conditions, which assumes full development across the FPC catchment.

4.2 TTW Model Updates

4.2.1 Combination of Council's Scenarios

As part of this flood assessment, TTW adopted Council's 'Pre-Development' model as a base, and updated it with relevant aspects of the 'Ultimate Developed' model, as outlined below:

- The 2019 LiDAR used in Council's 'Ultimate Developed' model was incorporated into the Digital Elevation Model (DEM).
- Road, drainage and subdivision information from the 'Ultimate Developed' model was incorporated into the DEM for areas that have already been developed and which were not already represented in the 2019 LiDAR, including Riverstone Road, Shuttle Parade, Ken Birdsey Park, Gwyneth Parade, and Serpentine Avenue.
- Development that has not yet occurred was excluded from the assessment, though it should be acknowledged that there are proposed works in the area surrounding the site but the timing of these works cannot be confirmed at the time of preparing this report. Most significantly, future development includes the Hambledon Road extension to the west of the site, and the remaining portion of Nirmal Street to the site's east.

This model responds to Planning Circular PS-24-001, by facilitating the analysis of potential impacts of cut and fill of other building works on flood behaviour and how the flooding might impact surrounding properties.

4.2.2 Topography

In addition to incorporating 2019 LiDAR, the DEM was updated to include topographical survey data of the wider site lot collected by Project Surveyors in June 2022, alongside more recent detailed survey of the proposed site by SDG Pty Ltd in October 2024. In addition to covering the site and wider site lot, the survey captures the Guntawong Road frontage and a portion of Clarke Street to the north, in addition to sections of Nirmal Street.

For the creek, it was determined that the detailed survey of the creek channel included within Council's model provided a more accurate depiction of levels, and this was therefore retained.

Aerial imagery obtained from Nearmap indicates there has been significant construction work in the lots to the east of the site (Lots 43 and 42 DP30186). While the lots were shown to be undeveloped with a dam in imagery collected on 28th August 2024, more recent imagery obtained on 27th October indicates that the dam has been filled, changing the existing flow regime in this area. It is understood that the existing flow path is to be culverted under the future Nirmal Street at this location, discharging to the downstream side of Nirmal Street onto the site (i.e. near the site's southeast corner). To capture the changing topography east of the site, the DEM has been adjusted at Lots 43 and 42 DP30186 and at a section of Nirmal Street (soon to be constructed), raising the level here to 42.6m AHD. This is based on design drawings indicating the future level of Nirmal Street at this location.

The survey data is depicted in Figure 11 alongside the FPC survey contained within Council's model, and the area in which levels were raised to 42.6m AHD (shown in orange).

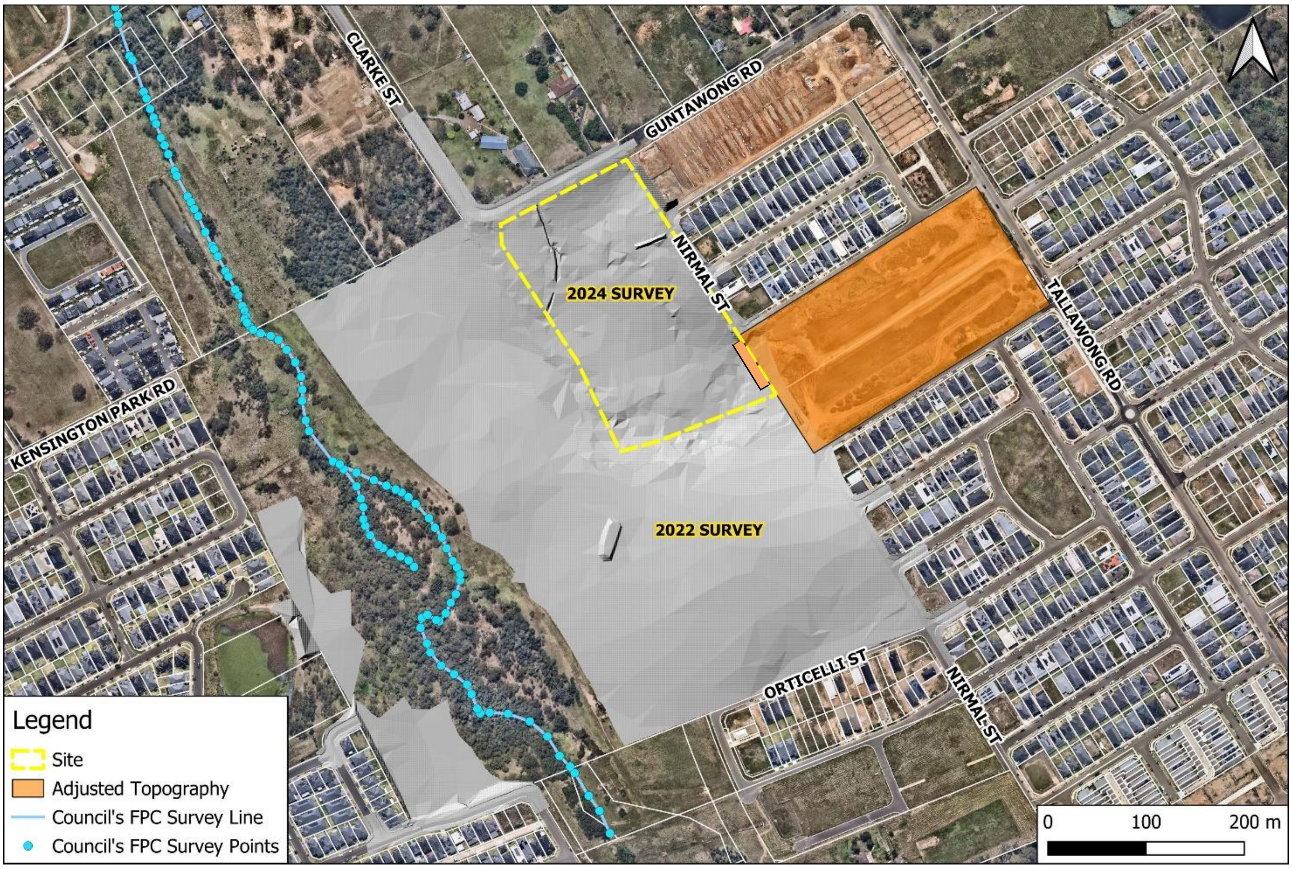

Figure 11: Survey data incorporated into the model

4.2.3 Model Inflows

TTW obtained Council's XP-RAFTS hydrographs in addition to the catchment delineation completed as part of the FPC Flood Study. In Council's model, the total inflow from the upstream catchment east of the site was applied downstream of the site as a total flow. This masks the actual flow path which cuts through the site, falsely indicating that the site is unaffected by flooding in the PMF event (refer to Figure 8 for Council's FPC Flood Study results).

In order to understand the actual flooding regime and extent at the southern portion of the site, the inflow hydrographs (i.e. from the contributing catchment areas upstream of Nirmal Street southeast of the school development area) were incorporated as Source Areas (SAs) and applied as local model inflows in the TUFLOW model. Figure 12 shows the model inflows applied close to the site for this study. One inflow was placed directly upstream of the site to replicate the future flow conditions at the site and to capture the changing topography east of the site, as discussed in Section 4.2.2.

Figure 12: TTW Model inflows close to the site shown against the First Ponds Creek catchment delineation provided by Council.

4.2.4 Sub-grid sampling (SGS)

As noted in Section 4.1, sub-grid sampling was utilised in Council's FPC model. Sub-grid sampling improves the accuracy of hydraulic modelling by refining the spatial resolution within a given grid cell without significantly increasing the simulation time. TUFLOW ordinarily samples the digital terrain model (DTM) by taking a singular value at the centroid of each grid cell, which can often mis-represent the topography and potential variation within each cell especially when the adopted grid cell size is not sufficiently fine.

With sub-grid sampling, the underlying DTM cell elevations are used to determine a water surface elevation vs volume relationship for each grid cell. This is also performed along the cell faces, using the full topography across the cell face to represent fluxes between adjacent cells. The full array of information in the DTM is therefore being utilised within the 2D hydraulic modelling even where grid resolution is lower, improving the accuracy of simulated results in terms of storages available for each model cell (i.e. note that the improvement of accuracy achieved is dependent on the resolution of the sub-grid sampling distance and the underlying Lidar/survey data used).

Given that the 2020 version of TUFLOW has been adopted for the First Ponds Creek model, post-processing (i.e. using the asc_to_asc TUFLOW utility) of the modelling maximum result grids against a finer 1m model surface elevation data was required, to provide a better maximum result grid representation of the actual flooding extent and depths.

4.2.5 Post-construction scenario

To allow for flood assessment of the site in post-construction conditions, the flood model was modified to include:

- The proposed buildings and associated works.
- Proposed filling, grading, and external levels of the buildings, and surrounding areas including footpath and public domain. This includes a 3m wide and approximately 80m long tail out channel to the south of the site

as per Nirmal Street stormwater design documents by Bathla (2024). An extract of the tail out plan is shown in Figure 13. Within the hydraulic model, the upstream end of this channel has been cut by more than 2m to 39.12m AHD to match the invert level of the outlet pipe under Nirmal Street proposed by Bathla and match back to the existing surface elevation of 38.81m AHD at the downstream end of the channel.

- An arbitrary retaining wall was incorporated into the model along the school construction boundary and set at an arbitrary high value to provide flood immunity to the PMF event for the proposed school carpark area at the south. The extent and location of the retaining wall adopted in the model is shown in Figure 14.

All other parameters of the flood model have remained unchanged.

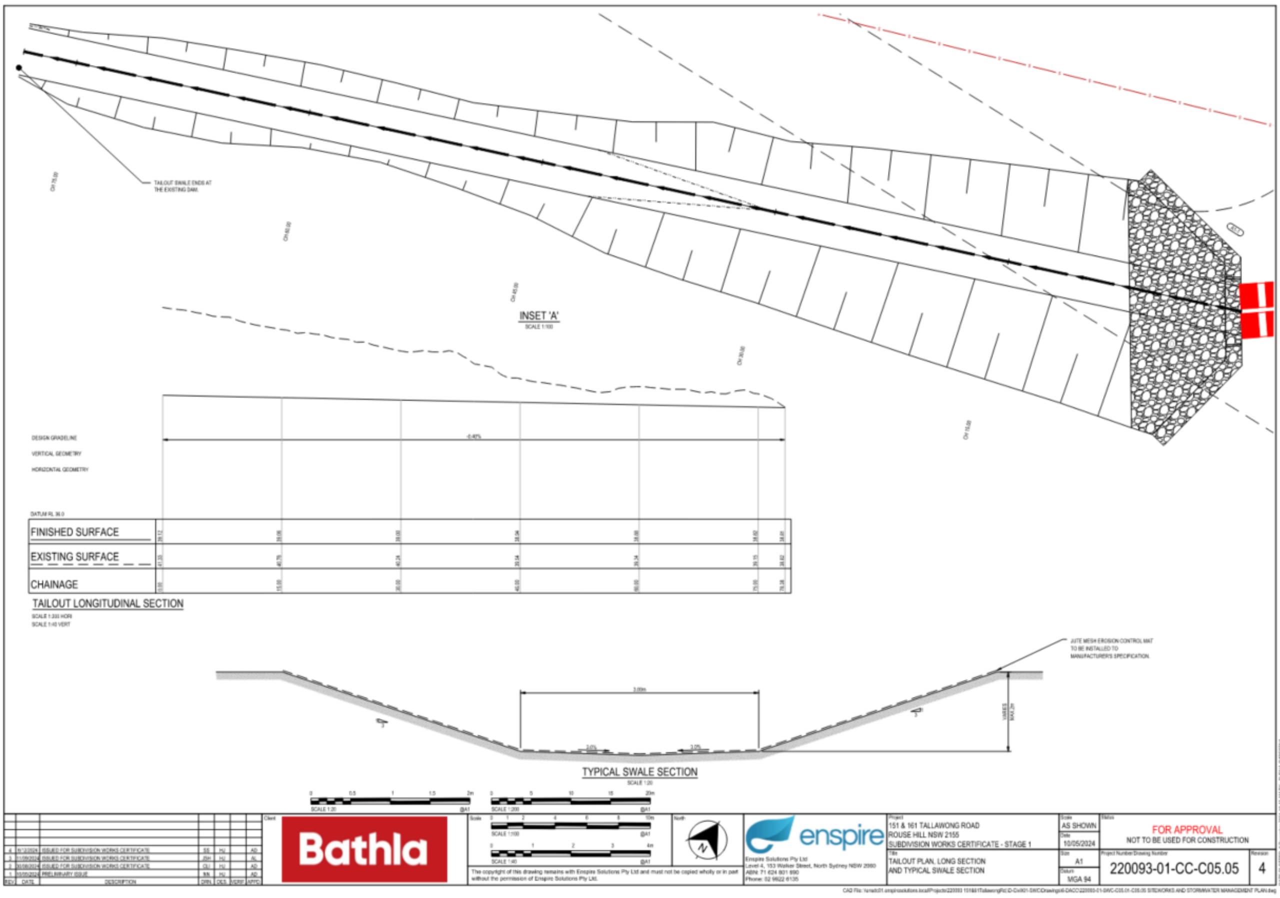

Figure 13: Details of the tail out channel plan provided in Bathla Subdivision Works Certificate (2024).

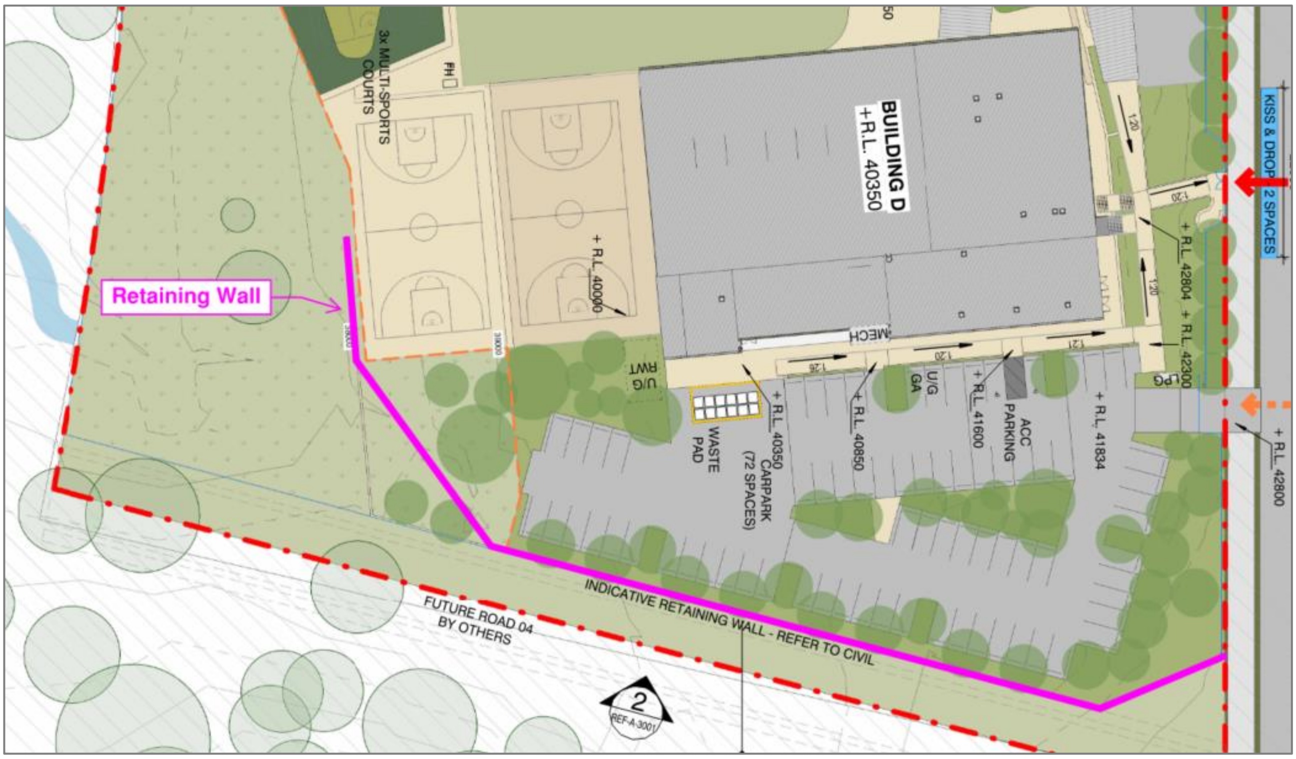

Figure 14: Location of retaining wall, close to the southern boundary of the site.

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 15, 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 1 outlines the threshold limits for each hazard category.

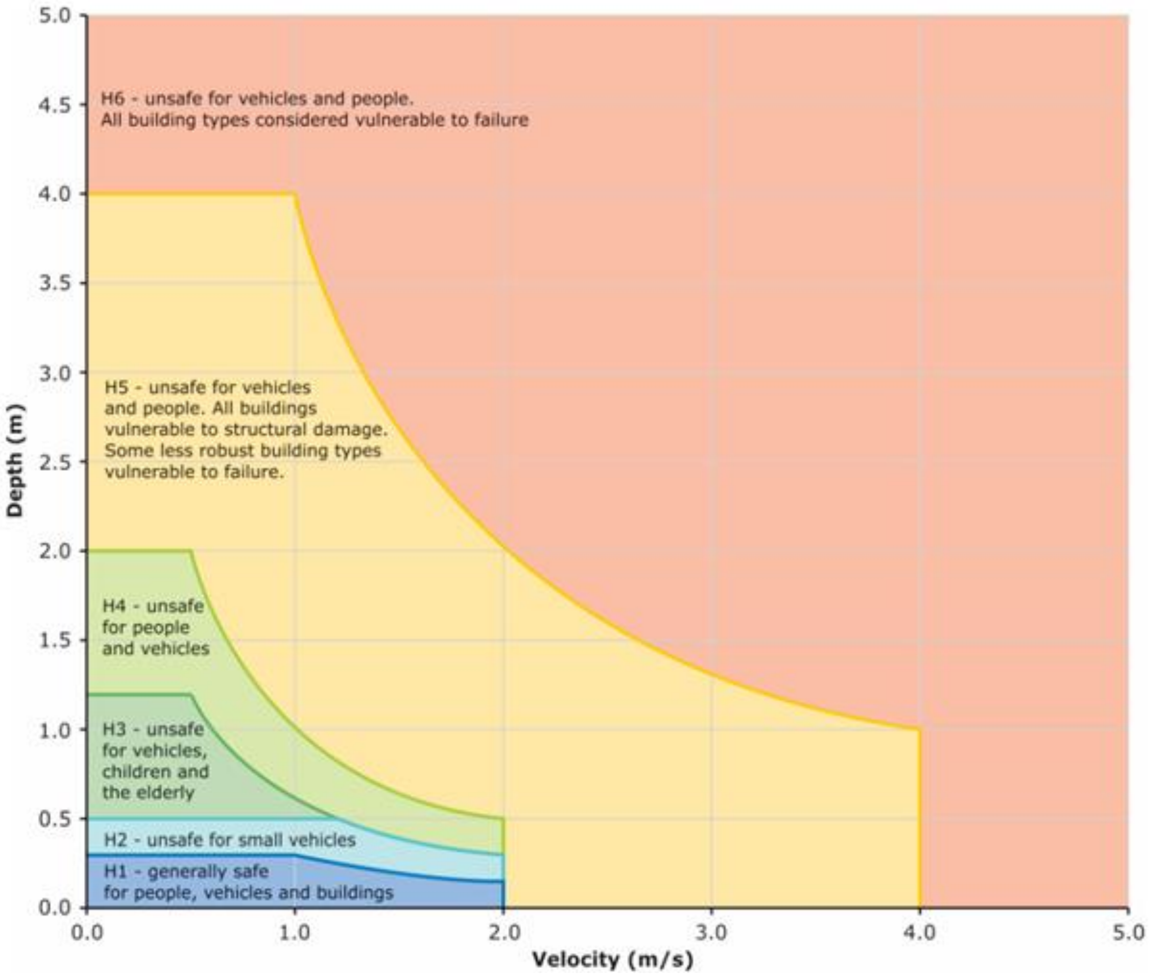

Figure 15: Flood hazard vulnerability curve (Source: Flood Risk Management Guide FB03 - Flood Hazard, NSW Department of Planning and Environment, 2022)

Table 1: Hazard vulnerability threshold limits

Hazard	Description	Classification Limit (m2/s)	Limiting still water depth (D) (m)	Limiting velocity (V) (m/s)
H1	Generally safe for people, vehicles and buildings	D x V ≤ 0.3	0.3	2.0
H2	Unsafe for small vehicles	D x V ≤ 0.6	0.5	2.0
H3	Unsafe for vehicles, children and the elderly	D x V ≤ 0.6	1.2	2.0
H4	Unsafe for people and vehicles	D x V ≤ 1.0	2.0	2.0
H5	Unsafe for people and vehicles. All buildings vulnerable to structural damage.	D x V ≤ 4.0	4.0	4.0
H6	Unsafe for people and vehicles. All building types considered vulnerable to failure.	D x V > 4.0	No Limit	No Limit

5.0 Results

The existing and post-construction flood conditions on-site during the critical 20%, 1% AEP, and PMF events are summarised and discussed in the following sections. Results for the existing 10%, 2%, 0.2% AEP events and the 1% AEP with climate change are attached in Appendix A, while the post-construction results for the 10%, 2%, and 0.2% AEP events and the 1% AEP with climate change are attached in Appendix B.

5.1 Existing Scenario

5.1.1 20% AEP Event

The peak flood levels and depths during the 20% AEP event are shown in Figure 16, while the peak flood velocity and flood hazard are depicted in Figure 17 and Figure 18, respectively. Under the existing conditions, floodwaters are present along the first-order creek to the southern frontage of the site. Depths on site peak at approximately 0.7m, while flood level reaches a peak of approximately 41.3m AHD to the east, where elevations are highest. The flow entering the site from the east peaks at approximately 1.3 m^3/s, approximately 1 hour 25 minutes after the onset of the critical 20% AEP storm assessed.

Flood velocities are generally less than 0.5m/s, with small areas of slightly increased velocity, peaking at approximately 0.9m/s at the southwestern corner of the site boundary. 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 H2 (unsafe for small vehicles) and H3 to the southwest of the site boundary (unsafe for vehicles, children and the elderly). These estimated H2 and H3 areas are isolated patches within the existing waterway corridor.

Figure 16: Existing scenario - peak flood levels and depths at the site in the 20% AEP event

Figure 17: Existing scenario - peak flood velocity at the site in the 20% AEP event

Figure 18: Existing scenario - peak flood hazard at the site in the 20% AEP event

5.1.2 1% AEP Event

The peak flood levels and depths during the 1% AEP event are shown in Figure 19, while the peak flood velocity and flood hazard are depicted in Figure 20 and Figure 21, respectively.

The extent of floodwaters along the first-order creek have increased slightly from the 20% AEP event, though are still confined to the southern end of the site. Peak depths on site increase to approximately 0.8m, while flood level reaches a peak of approximately 41.4m AHD to the east. The flow entering the site from the east peaks at approximately 3.4m^3/s, approximately one hour after the onset of the critical 1% AEP storm assessed.

Flood velocities have increased slightly from the 20% AEP but are still mostly less than 1.0 m/s, with small areas of increased velocity, peaking at about 1.2m/s at the southwestern corner of the site boundary. Hazards both within the site and within the vicinity are still low at mostly H1, with slightly larger patches of H2 and H3 to the south of the site and to the west of the site boundary. Similarly, these flood-affected areas of H2 and H3 are located within the existing waterway corridor.

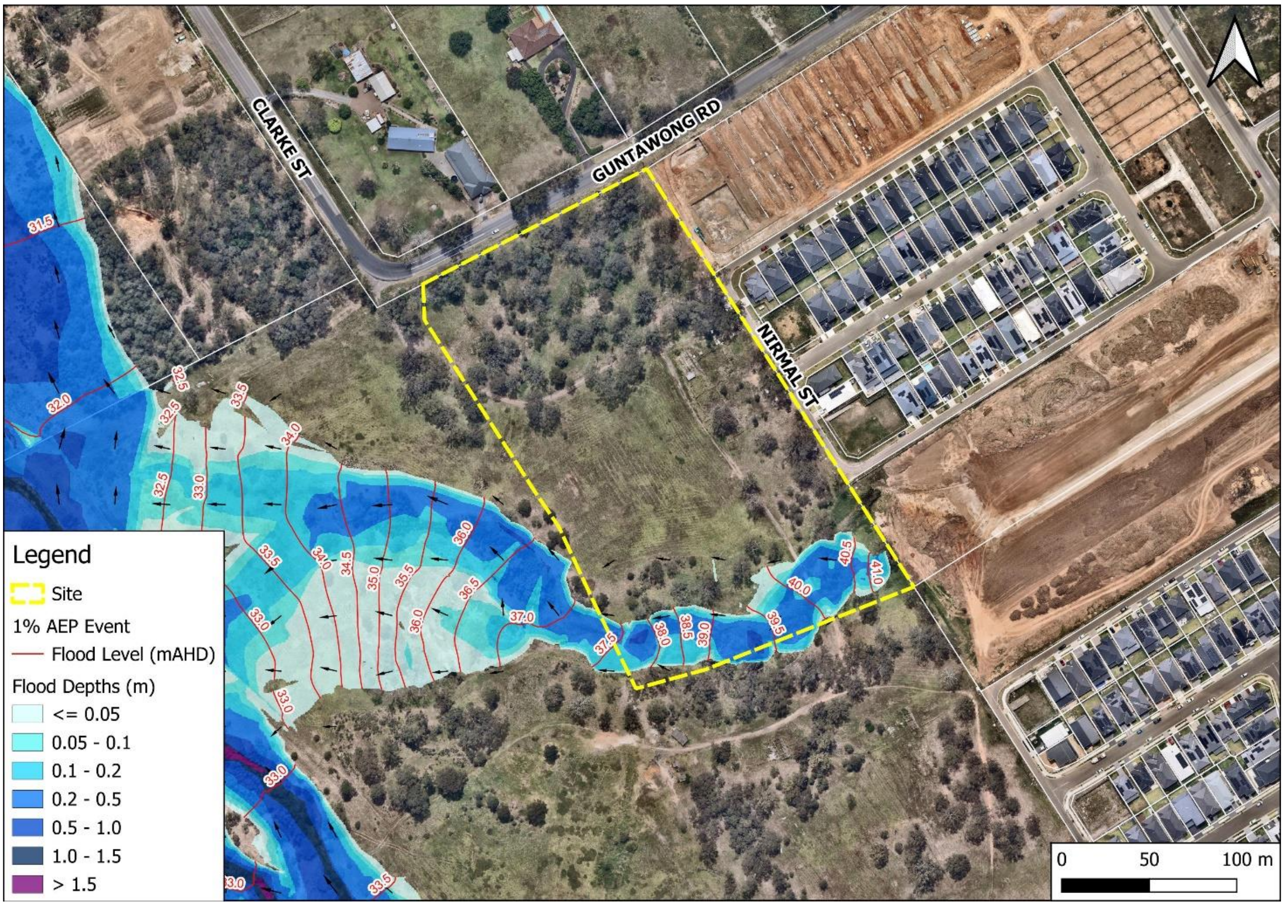

Figure 19: Existing scenario - peak flood levels and depths at the site in the 1% AEP event

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

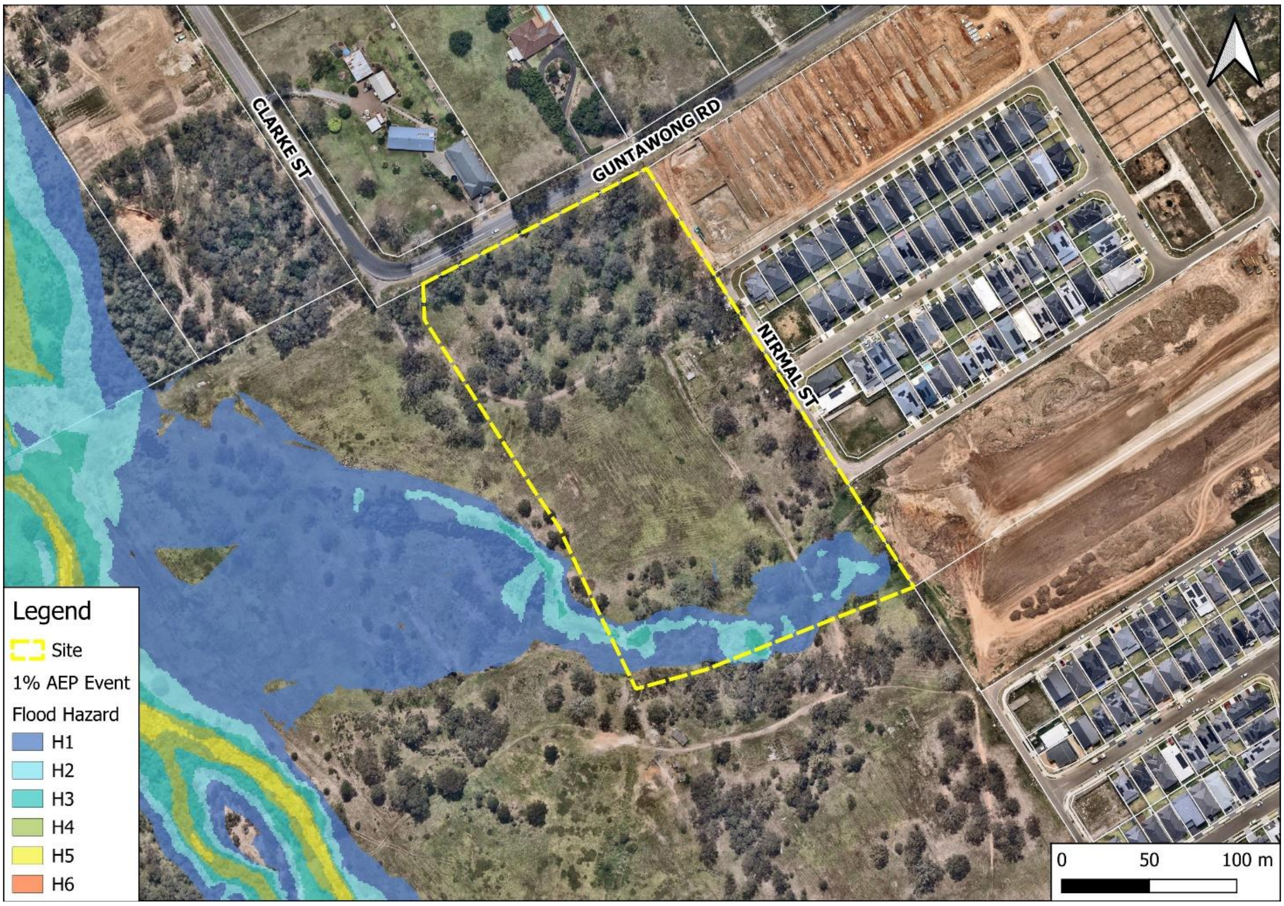

Figure 21: Existing scenario - peak flood hazard at the site in the 1% AEP event

5.1.3 PMF Event

The peak flood levels and depths during the PMF event are shown in Figure 22, while the peak flood velocity and flood hazard are depicted in Figure 23 and Figure 24, respectively.

Under the existing conditions at the site, the PMF extent occupies the southern third of the site, with peak depths increasing to approximately 1.2m to the southwest, while flood level reaches a peak of approximately 41.8m AHD to the southeast. The flow entering the site from the east peaks at around 20m^3/s, approximately 30 minutes after the onset of the critical PMF storm assessed.

Flood velocities have also notably increased, peaking at approximately 2.0m/s at the southeastern corner of the site boundary. Flood hazard has similarly risen both within the site and within the vicinity, with H4 hazard (unsafe for people and vehicles) along the creek, peaking at H5 at both the southeast and southwestern corners (unsafe for vehicles and people. All buildings vulnerable to structural damage. Some less robust building types vulnerable to fail). These flood-affected H4 and H5 areas are generally located within the main flow path of the existing waterway corridor.

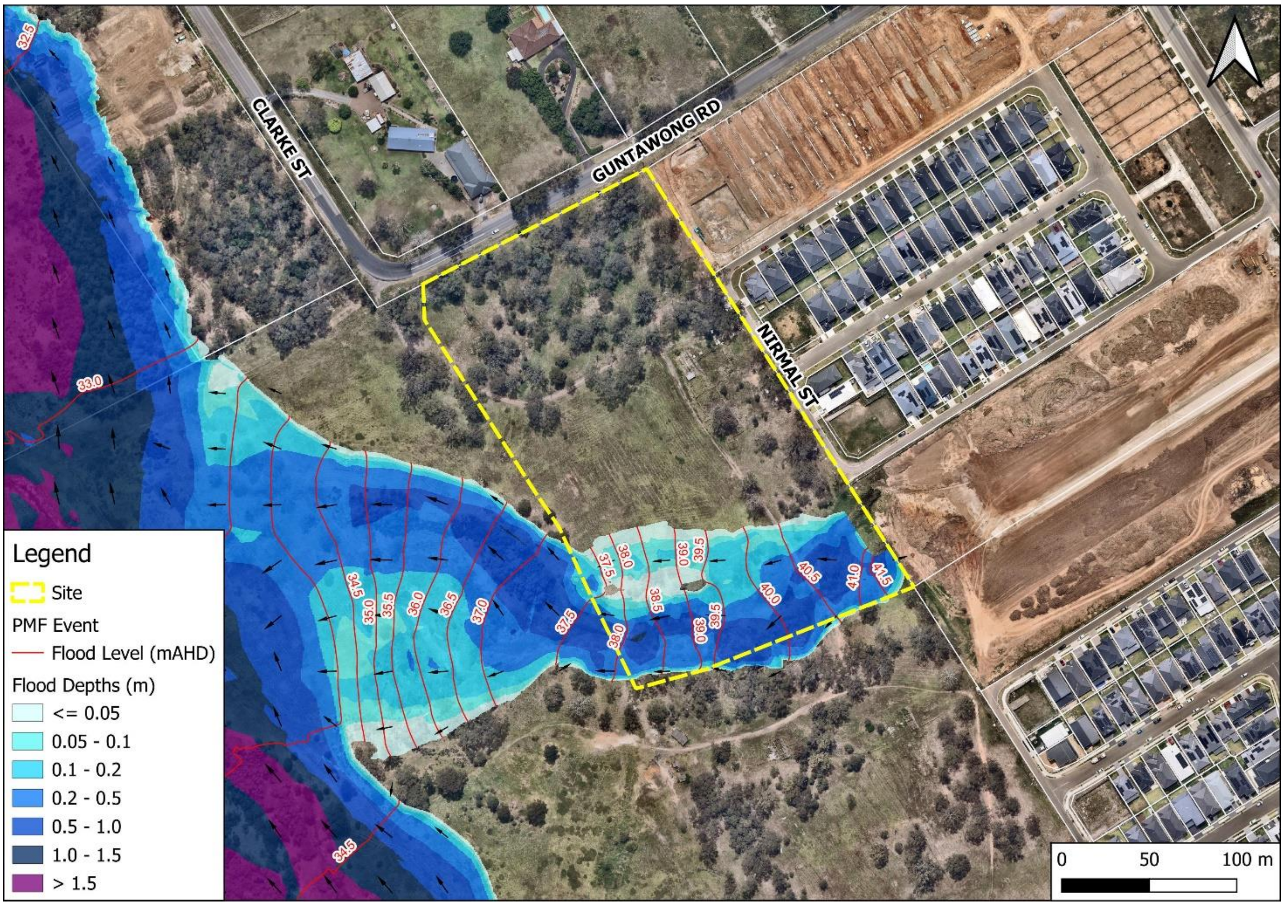

Figure 22: Existing scenario - peak flood levels and depths at the site in the PMF event

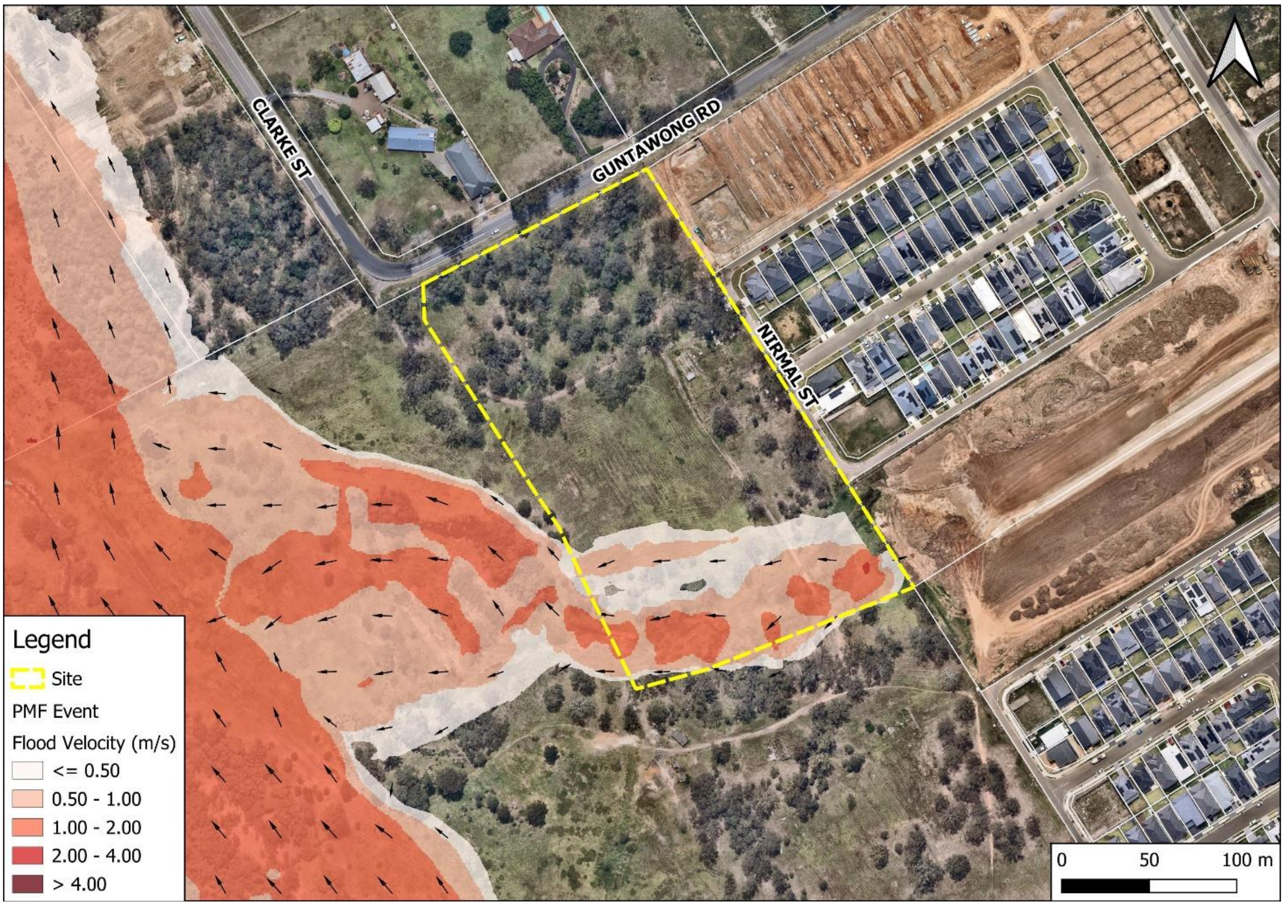

Figure 23: Existing scenario - peak flood velocity at the site in the PMF event

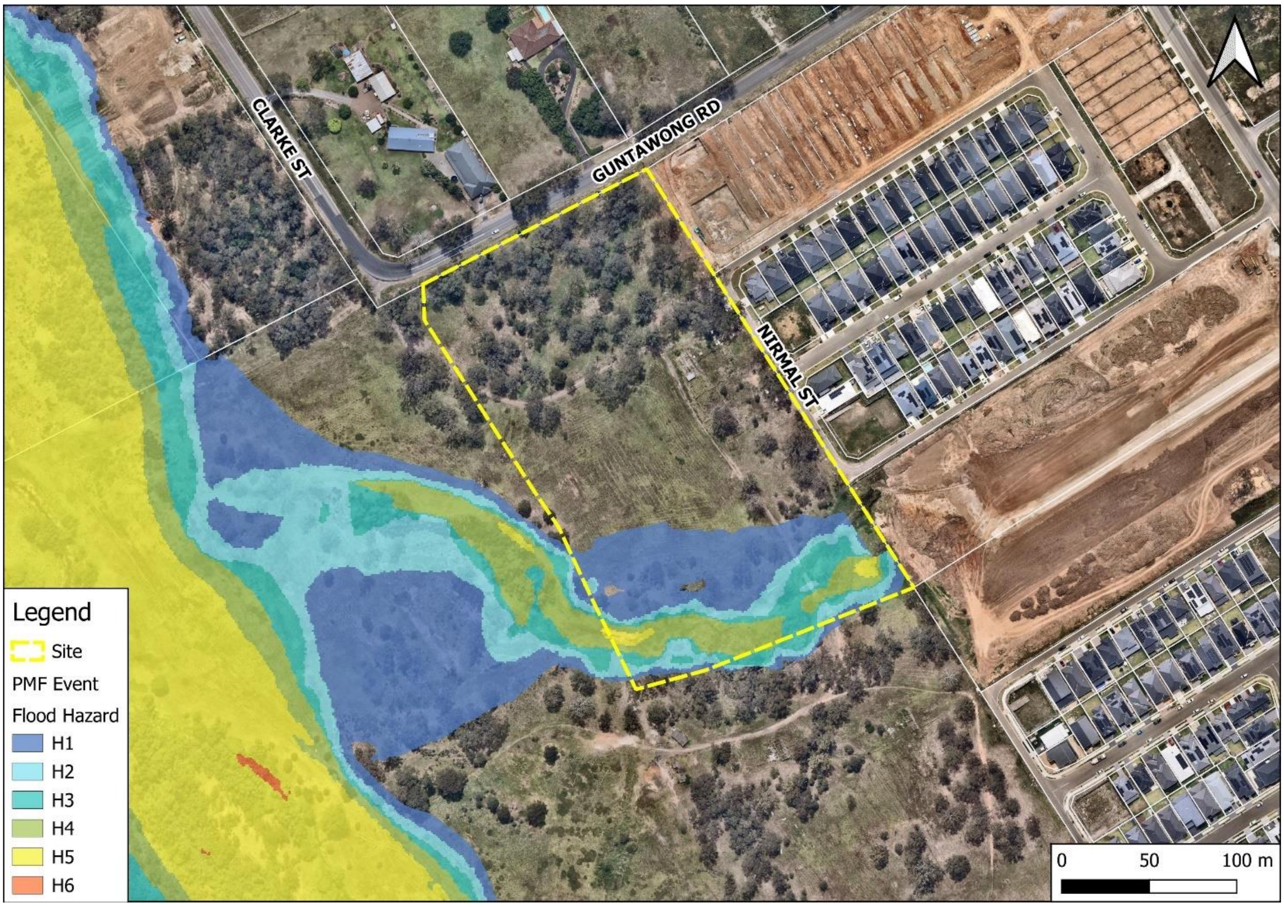

Figure 24: Existing scenario - peak flood hazard at the site in the PMF event

5.2 Post-Construction Scenario

5.2.1 20% AEP Event

The peak flood levels and depths during the post-construction 20% AEP event are shown in Figure 25, while the peak flood velocity and flood hazard are depicted in Figure 26 and Figure 27, respectively. Under the post-construction conditions, creek discharge is largely contained within the tail out channel to the south, occupying a considerably smaller portion of the site. Depths here are generally around 0.3–0.4m, peaking at the southeast (i.e. upstream end of the channel) at approximately 0.6m. Flood level reaches a peak of approximately 40.0m AHD at the eastern frontage, down from the 41.3m AHD in the existing scenario. The reduction in estimated peak flood level at this upstream location is mainly due to the lowering of the invert of the southern channel. The flow entering the site from the east peaks at around 1.3 m^3/s approximately one hour after the onset of the critical 20% AEP storm.

Flood velocities have notably increased in the post-construction scenario, with velocities generally peaking around 0.8m/s along the length of the channel, increasing to around 1.0m/s at the southwest. Flood hazard has similarly increased to H2 ((unsafe for small vehicles) and H3 (unsafe for vehicles, children and the elderly) within the channel to the southeast, falling to H1 at the west.

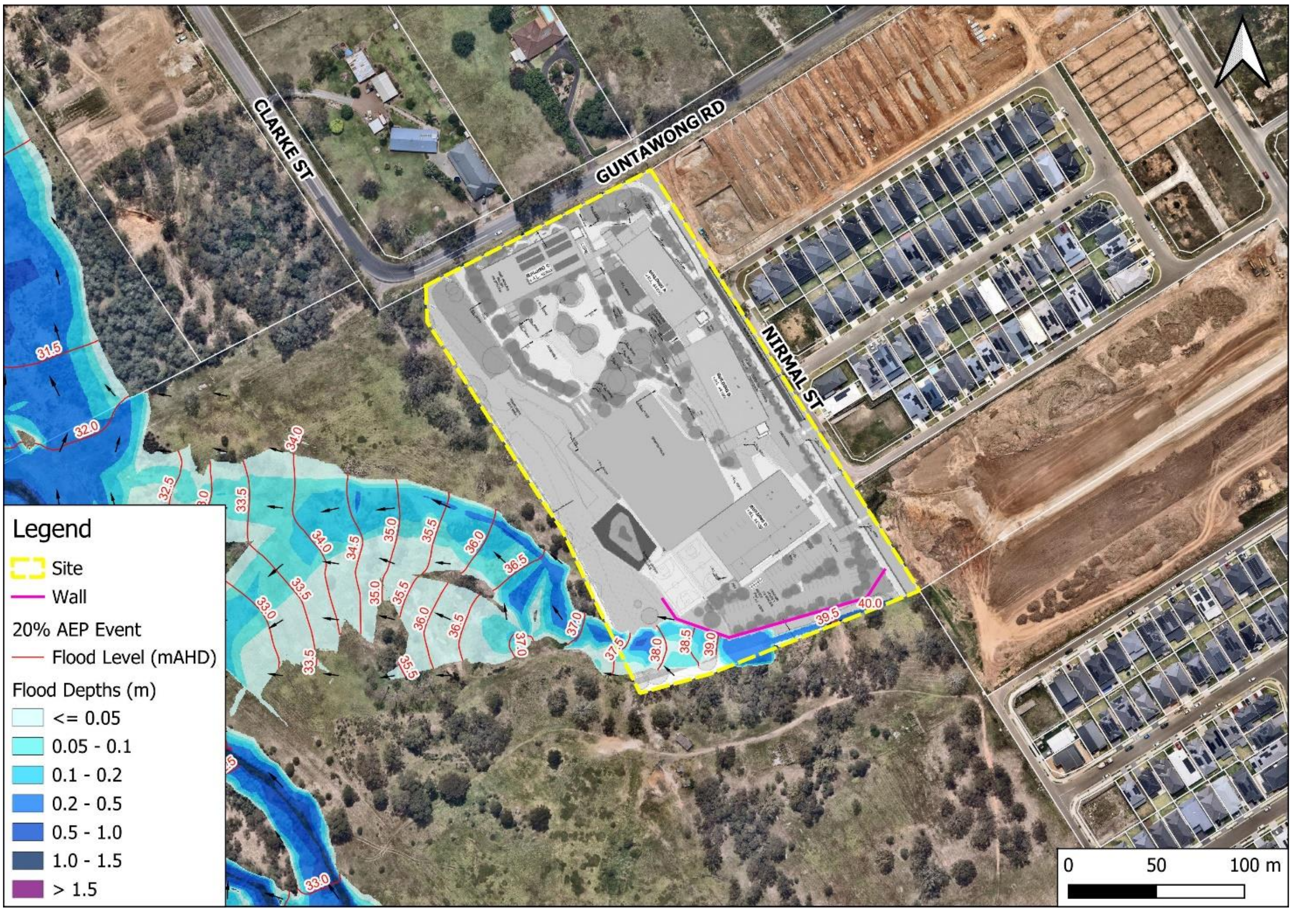

Figure 25: Post scenario - peak flood levels and depths at the site in the 20% AEP event

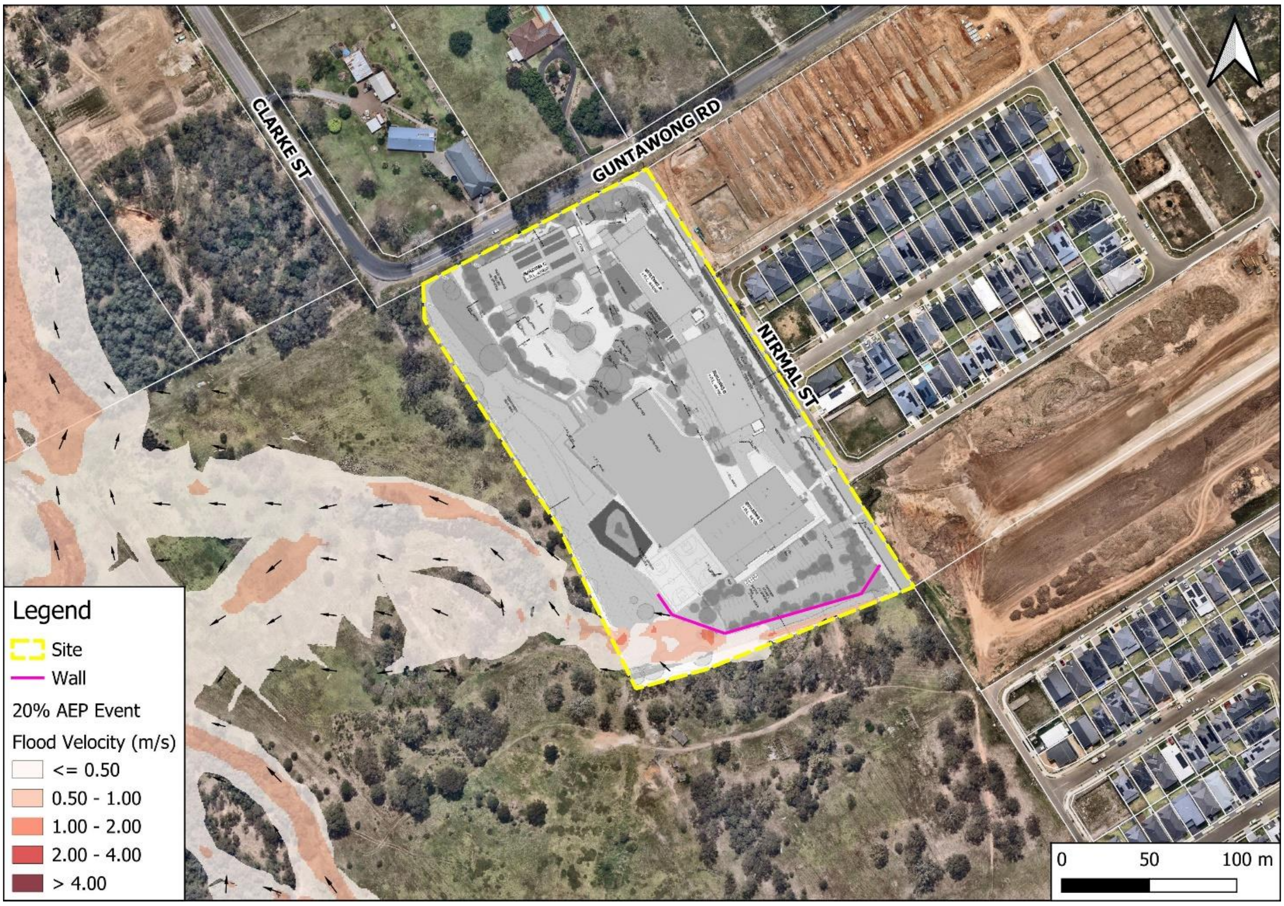

Figure 26: Post scenario - peak flood velocity at the site in the 20% AEP event

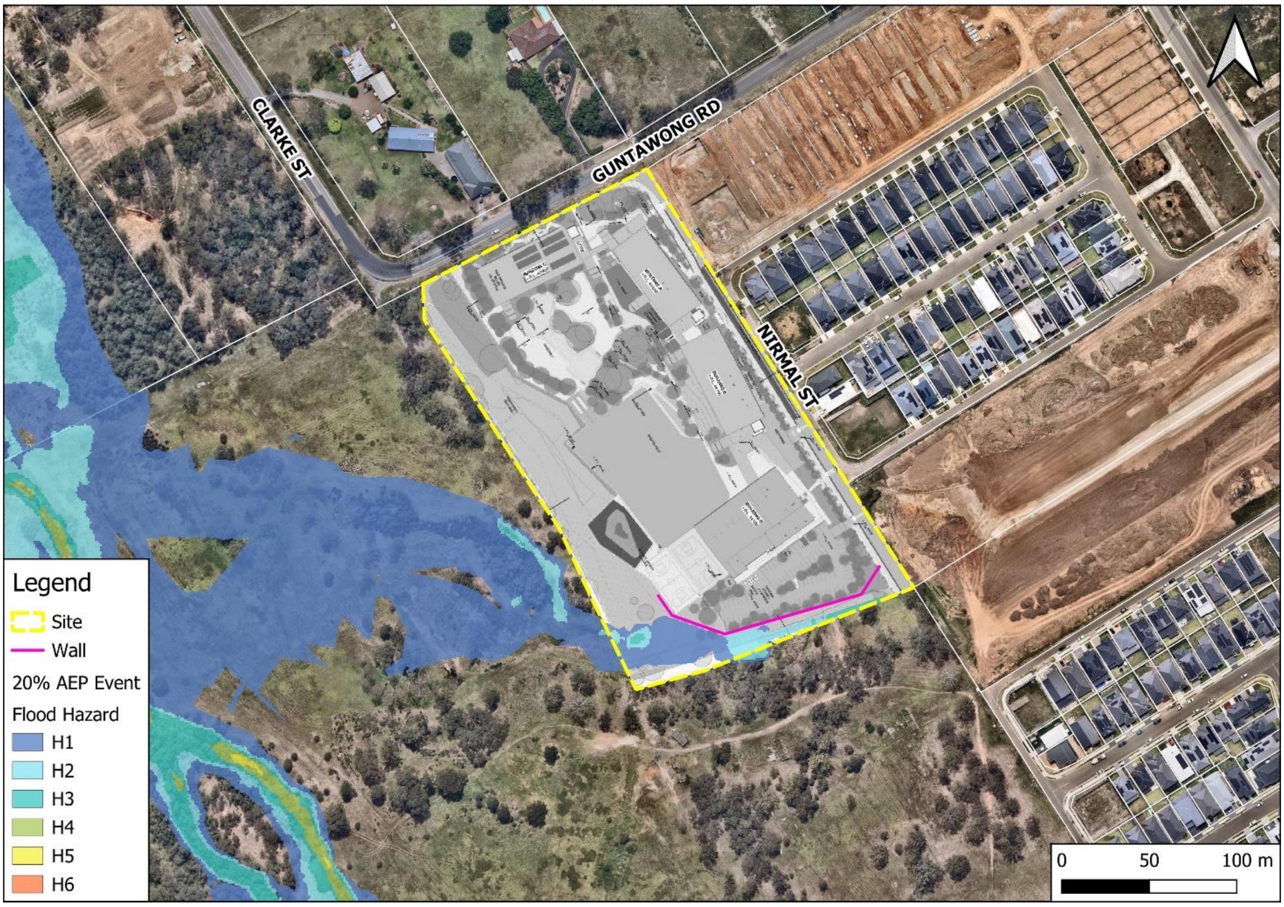

Figure 27: Post scenario - peak flood hazard at the site in the 20% AEP event

5.2.2 1% AEP Event

The peak flood levels and depths during the 1% AEP event are shown in Figure 28, while the peak flood velocity and flood hazard are depicted in Figure 29 and Figure 30, respectively.

Similar to the 20% AEP, floodwaters in the post-construction 1% AEP event are still contained to the south of the site, with some increase in flood extent south of the car park. Peak depth reaches approximately 1.0m at the southeast within the tail out channel (up from 0.6m in the 20% AEP). Flood levels also peak here at approximately 40.13m AHD at the southeastern corner. The flow entering the site from the east peaks at around 3.1m^3/s, approximately 25 minutes after the onset of the critical 1% AEP storm.

Flood velocities have increased slightly from the 20% AEP peaking at around 1.6m/s within the southern channel. Hazards within the site have similarly increased, with the channel area classified as H4 (unsafe for people and vehicles) and H5 hazard (unsafe for people and vehicles. All buildings vulnerable to structural damage), up from H3 in the 20% AEP.

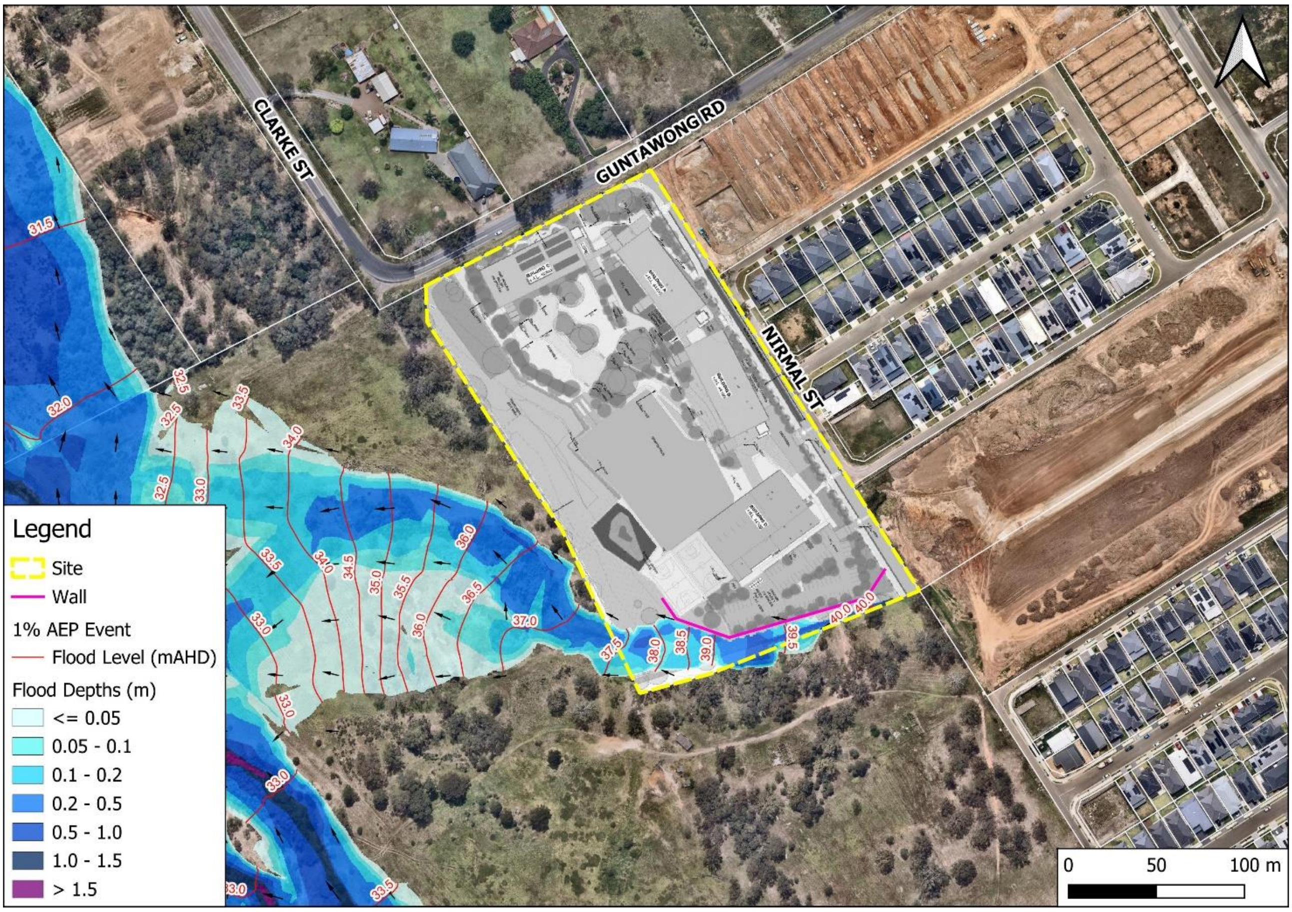

Figure 28: Post scenario - peak flood levels and depth at the site in the 1% AEP event

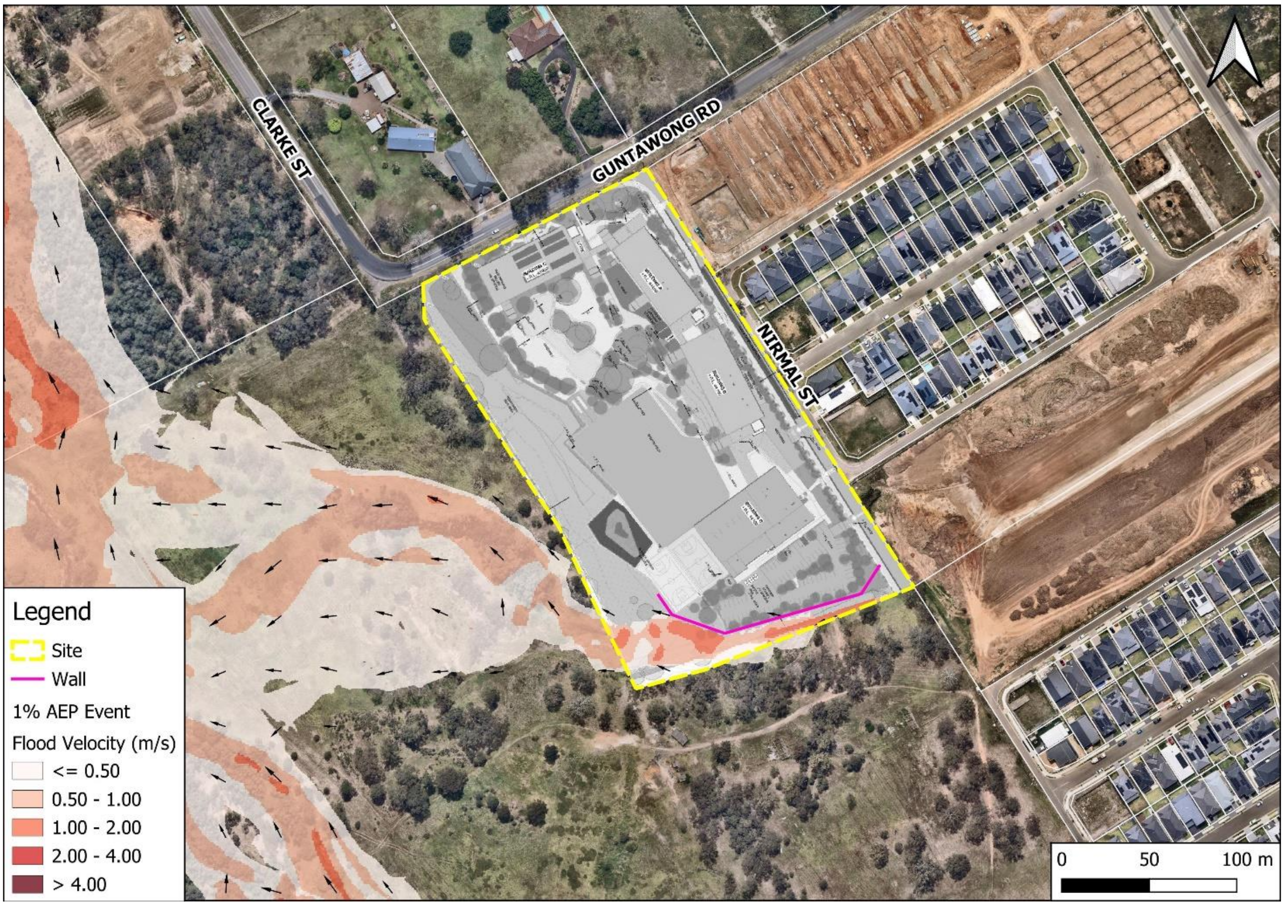

Figure 29: Post scenario - peak flood velocity at the site in the 1% AEP event

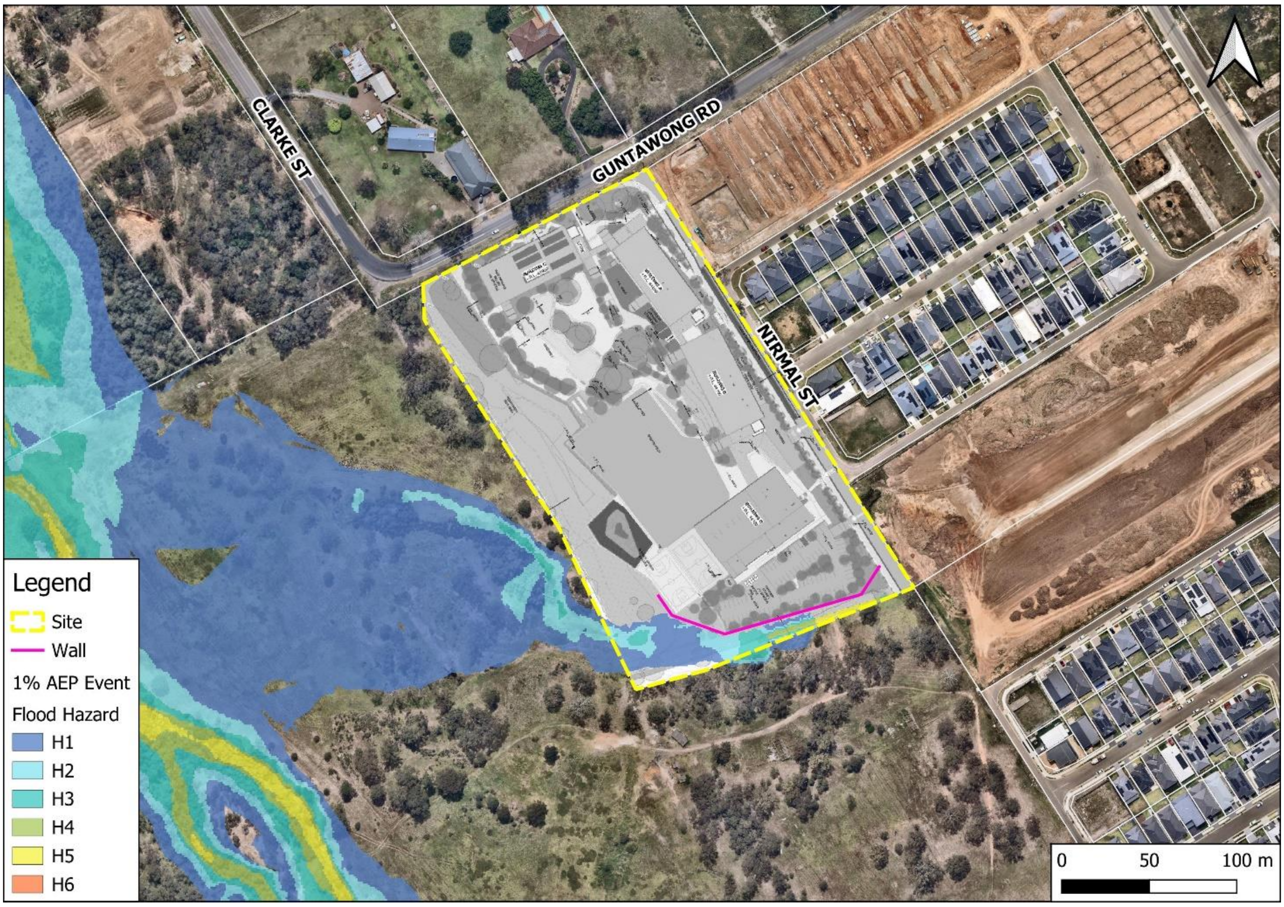

Figure 30: Post scenario - peak flood hazard at the site in the 1% AEP event

5.2.3 PMF Event

The peak flood levels and depths during the PMF event are shown in Figure 31, while the peak flood velocity and flood hazard are depicted in Figure 32 and Figure 33, respectively.

Under the post-construction conditions, the PMF extent breaches the tail out channel and reaches the retaining wall south of the carpark. Peak depths within the site are at the southeastern channel, at 2.5m depth, while depths at the southwestern boundary of the carpark reach 1.0m. Peak flood levels increase to approximately 41.6m AHD. The flow entering the site from the east peaks at around 20m^3/s, approximately 20 minutes after the onset of the critical PMF storm.

Flood velocities have also notably increased, peaking at around 2.2–2.5 m/s, reaching a high of 3.0m/s within the channel area. Flood hazard within the channel reaches H6 along a 30m distance (unsafe for vehicles and people. All buildings vulnerable to structural damage. Some less robust building types vulnerable to fail) within the upstream channel area.

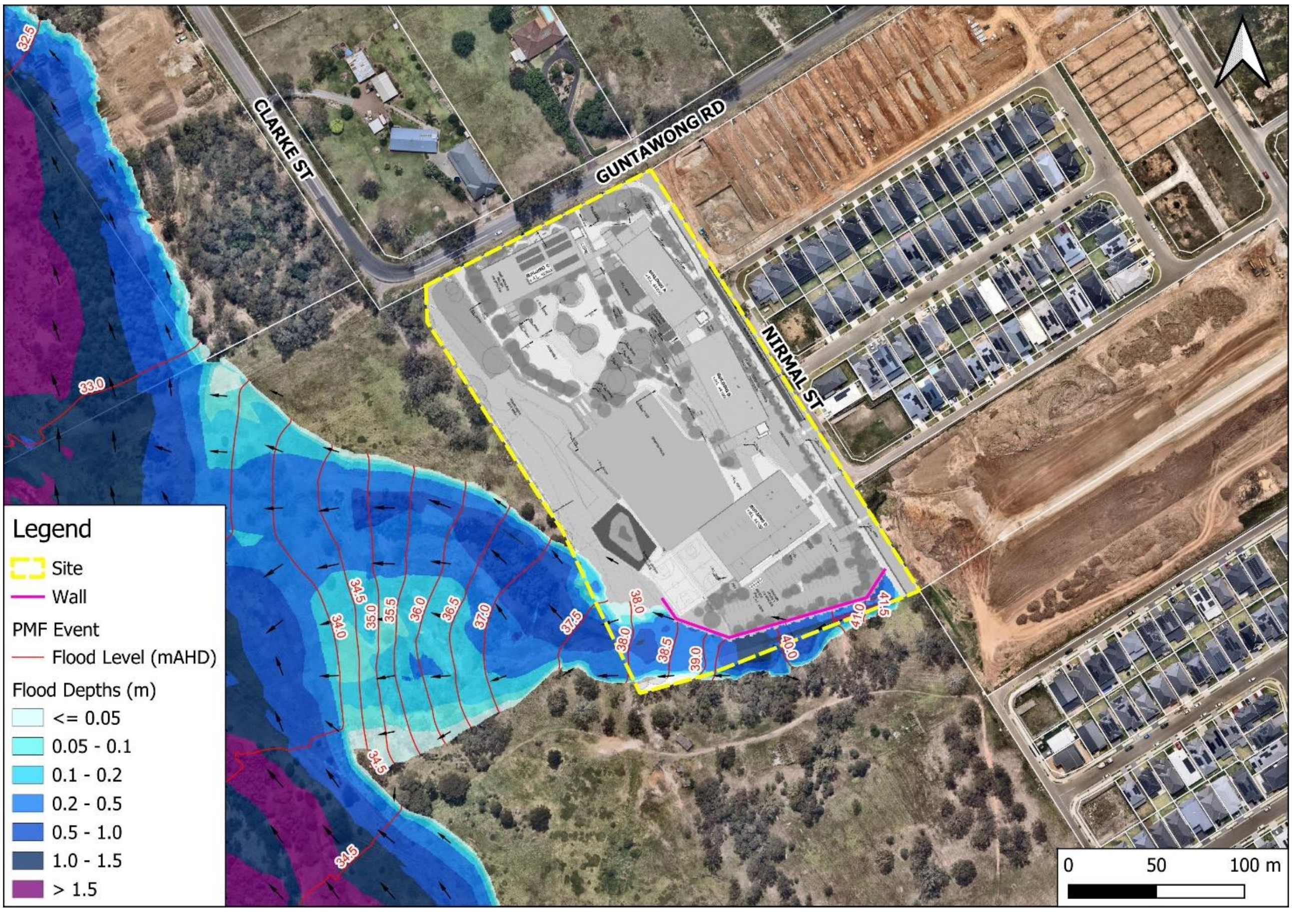

Figure 31: Post scenario - peak flood levels and depths at the site in the PMF event

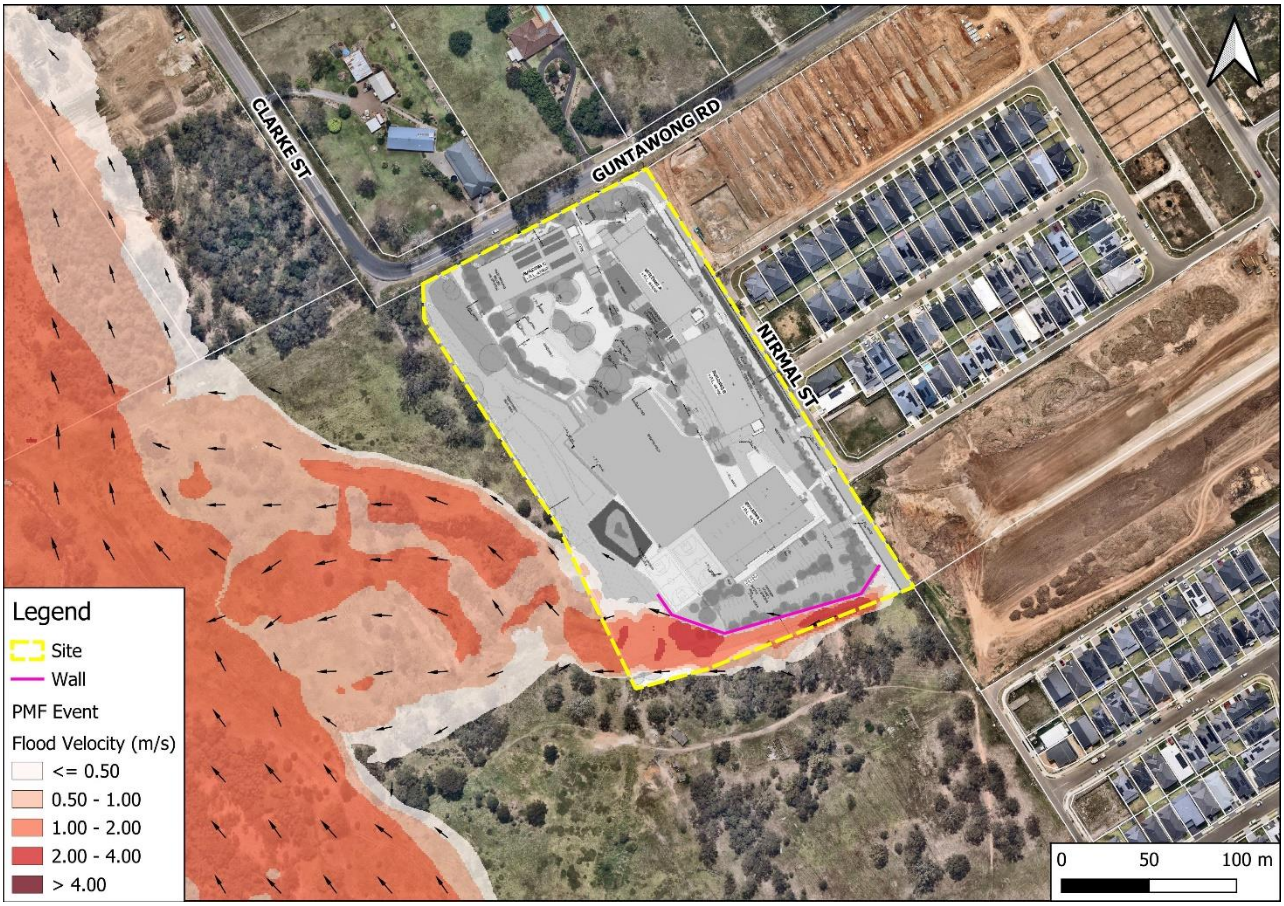

Figure 32: Post scenario - peak flood velocity at the site in the PMF event

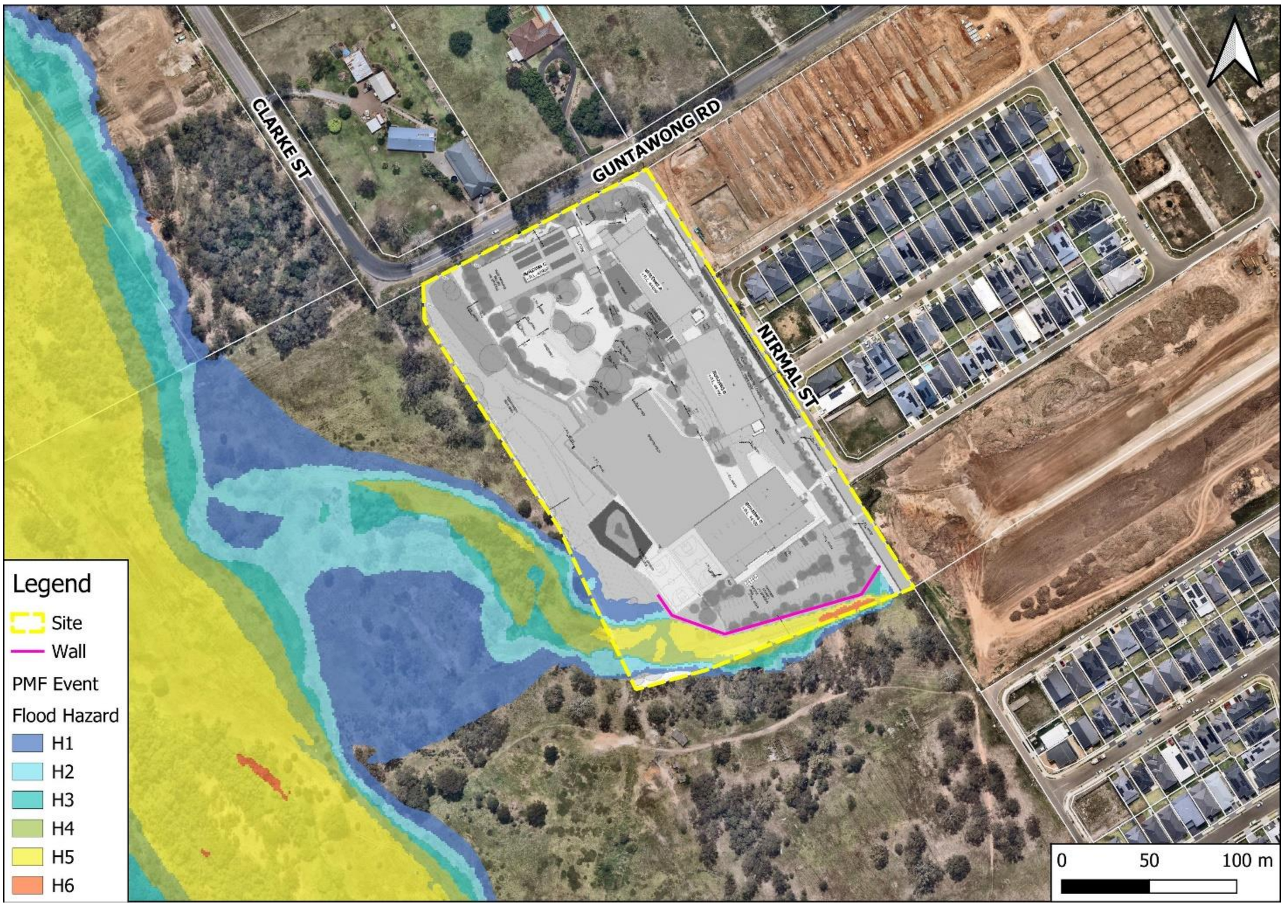

Figure 33: Post scenario - peak flood hazard at the site in the PMF event

Figure 32 compares the PMF level along the south of the site with the design levels. This indicates that the carpark and sports pitches are set well above the estimated PMF level, which peaks at 41.62m AHD at the southeast.

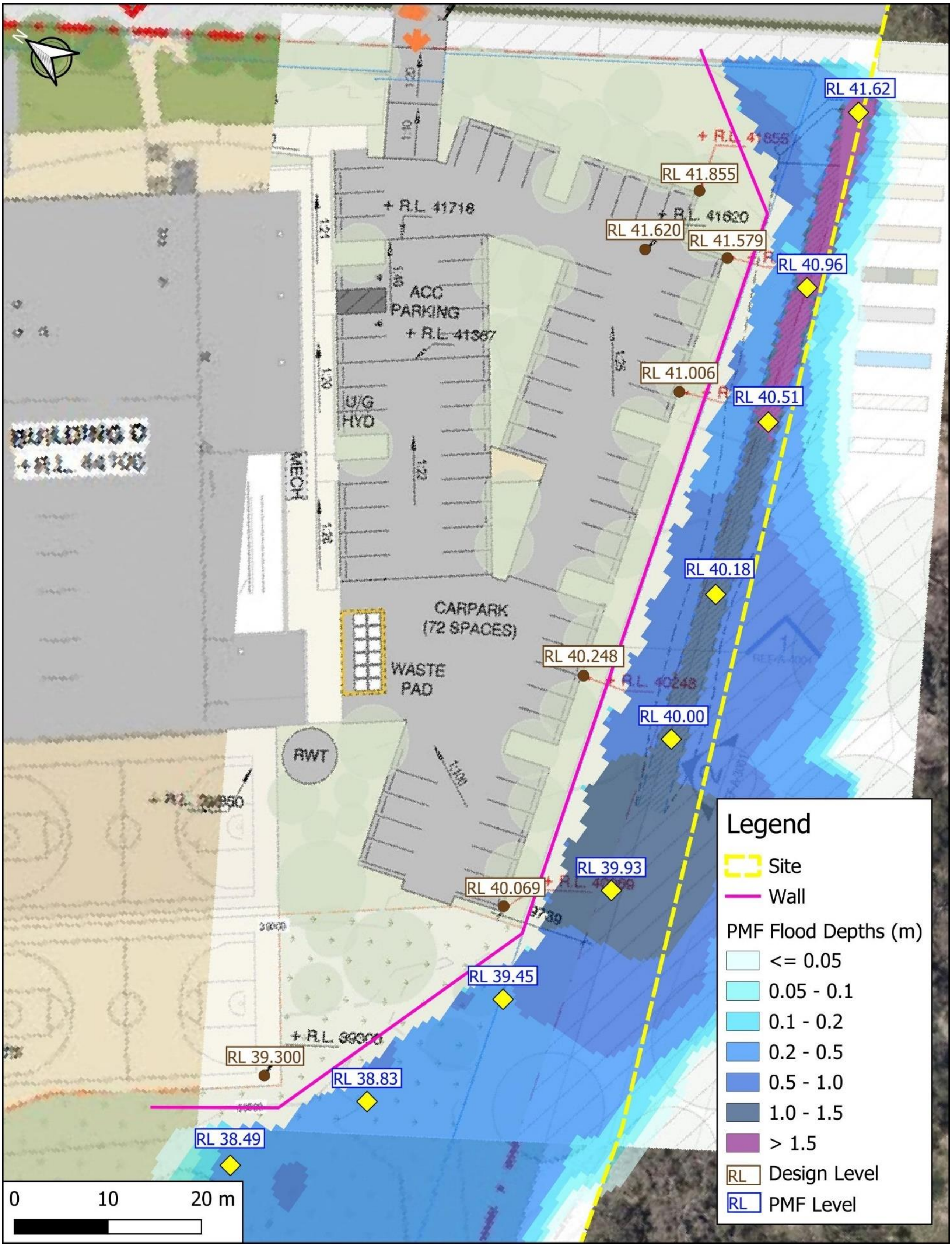

Figure 34: PMF levels compared against design ground levels

6.0 Flood Planning Requirements

6.1 Blacktown Development Control Plan

The current Development Control Plan (DCP) in place for the site is the Blacktown DCP (2015) which provides detailed planning and design guidelines to support the planning controls set out in the City of Blacktown Local Environmental Plan (LEP) 2015.

Under Section 4.15 of the Environmental Planning and Assessment Act 1979, the consent authority is required to take into consideration the relevant provisions of the DCP. Part A, Chapters 9 and 10 of the Blacktown DCP provides a risk-based approach to planning in the flood prone lands of the City of Blacktown LGA. 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 Blacktown City Council DCP defines the Design Flood as the 1% AEP flood event, and the Design Flood Level as the level of that event. The DCP specifies a Design Floor Level to be 500mm above the designated flood level for residential buildings, and 300mm above the designated flood level for commercial and industrial buildings.

However, the DCP does not specify any flood controls specific to schools or educational facilities.

6.2 Blacktown Water Sensitive Urban Design (WSUD)

Section 15.3.1 of the Water Sensitive Urban Design (WSUD) developer handbook (2020) provides guidance on design standards for Flood Planning Levels (FPLs).

The document identifies schools as **sensitive activities** that require a **higher standard of flood protection due to the age of and potential risk to the occupants**. For these activities, “sufficient area above the PMF” may need to be demonstrated for all occupants to shelter-in-place, and emergency back-up generators (if provided) must be installed above the PMF.

This documents also notes “where shelter-in-place is specified as a flood management strategy then a structural engineer, registered on NER, is to certify that the structure is safe to the PMF level.”

Therefore, based on Blacktown Council’s Water Sensitive Urban Design guide, a school site must have **sufficient area above the PMF**. Modelling of the post-construction conditions onsite indicate that this provision has been suitably met. Figure 34 compares the design levels with PMF levels and demonstrates that the site is set well above the PMF. While flood level peaks at approximately 41.62m AHD at the southeastern corner of the site, the proposed buildings are set between 43.9m AHD (Building C) – 44.4m AHD (Building A). This includes Building D to the south, which has a proposed Finished Floor Level (FFL) of 44.1m AHD. The carpark and sports pitches are similarly elevated above the PMF level.

6.3 Flood Risk Management Manual

The ‘Support for Emergency Management Planning’ (EM01) Flood Risk Management Manual (FRMM) document states that ‘*new secondary school classrooms should also be located above the PMF level. However, at a minimum there should be access to adequate space above the PMF within a school building for school students, staff and visitors where the facility is not intended to be evacuated outside the floodplain’*.

As noted above, all proposed buildings are set well above the maximum post-construction PMF level of 41.62m AHD.

7.0 Consultation

TTW met with NSW SES on 31st October 2024 to discuss the impact of the proposed site activity and considerations for the flood emergency management of the site. The meeting minutes are attached in Appendix C. NSW SES noted that due to the area's susceptibility to flash flooding, it may be challenging to relocate offsite, with little warning time before peak flooding occurs.

While the hydraulic model provided by Council is adequate in assessing flood risk and impact within the immediate site area, they do not provide an indication of the flood risk in the surrounding access roads which are mainly subjected to overland flow flooding. It is therefore recommended that a small site-specific hydraulic model is developed to assess the overland flooding of these surrounding access routes alongside a Flood Emergency Response Plan (FERP) in order to adequately prepare the site in the event of a major flood. This assessment has been carried out and produced by TTW, and is contained within the Flood Risk Emergency Assessment (TTW, January 2025) submitted alongside this report.

8.0 Impact Assessment

8.1 Impact of Activity

A flood impact assessment has been undertaken to ensure the proposed activity would result in either an unacceptable flood level increase or worsening of the flood conditions over neighbouring properties. The flood level impact map for the proposed activity in the 1% AEP event is shown in Figure 35, while Figure 36 depicts the impact of the activity in the 1% AEP event with climate change. The impact of the activity in the PMF event is shown in Figure 37. For the 1% AEP event with climate change, a 20% increase in rainfall has been adopted for this assessment (refer to Section 8.2 for further discussion).

The flood impact assessment shows that there are some local changes in flood level within the site due to modification to the ground level. Levels at the south and southwest have mostly reduced in the post-construction scenario, with an afflux of approximately -40mm to -500mm in both the 1% AEP event and the 1% AEP event with climate change. The reduction is mainly due to the lowering of the tail out channel inverts from existing surface levels.

In the PMF event, post-construction flood levels to the south of the site show an increase ranging from 20mm to 200mm, due to the significant reduction in flood extent from the existing conditions. It is important to note that flood level afflux in the PMF event is to assist in understanding the additional risks of the construction in extreme events such as the PMF and is not intended for DA approval consideration. While there are increases in the PMF flood level, this would have no impact on the existing flood emergency planning arrangements.

Offsite, there is largely no change to flood level, although there is a small portion west of the site boundary with a minor increase of approximately 25mm in the 1% AEP event, the 1% AEP event with climate change and the PMF event. This localised increase is not considered significant as it does not affect adjacent properties, and it is mainly located within the existing waterway corridor immediately downstream of the site, in which future development would not be permitted. Further, the results show that the estimated flood hazard for the areas immediately downstream of the site in the 1% AEP event assessed remained generally unchanged (refer to Figure 21 and Figure 30 for the 1% AEP event flood hazard mapping of the existing and post scenarios, respectively).

The flood impact assessment for both the 1% AEP and PMF events confirm that there are no significant changes to offsite flood levels or flood behaviour and there is no impact to adjacent properties. Therefore, the proposed activity is not considered to cause any offsite flood impacts and is in accordance with Council's DCP requirements. Floodwaters do not reach the proposed school buildings in the PMF, with a peak flood level of approximately 41.62m AHD at the southeastern corner of the site. With the proposed buildings set between 43.9m AHD (Building C) – 44.4m AHD (Building A), the proposed site buildings are well protected against the PMF. This includes Building D to the south, which has a proposed Finished Floor Level (FFL) of 44.1m AHD.

Figure 35: Impact of activity: existing vs post-construction flood level afflux in the 1% AEP event

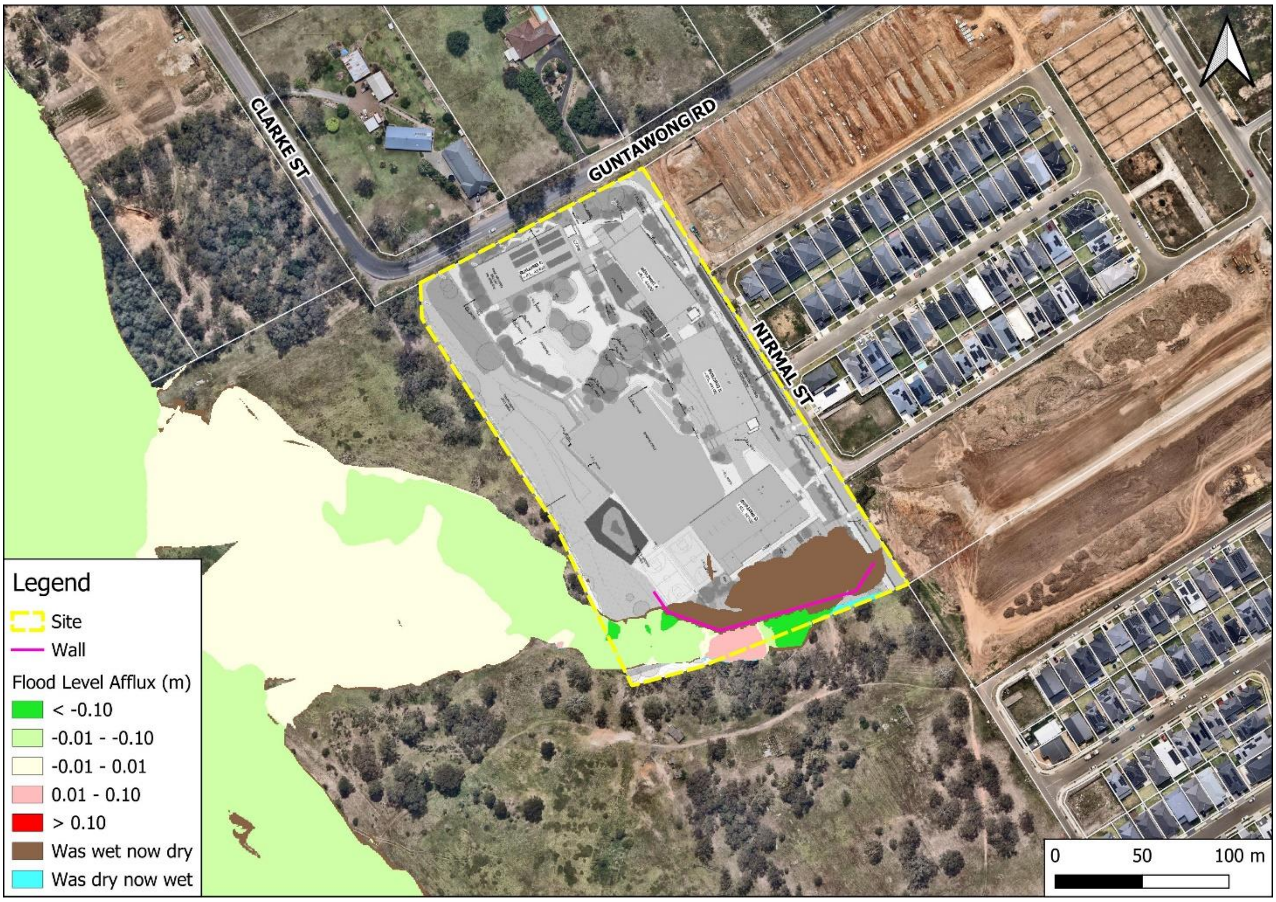

Figure 36: Impact of activity: existing vs post-construction flood level afflux in the 1% AEP event with climate change

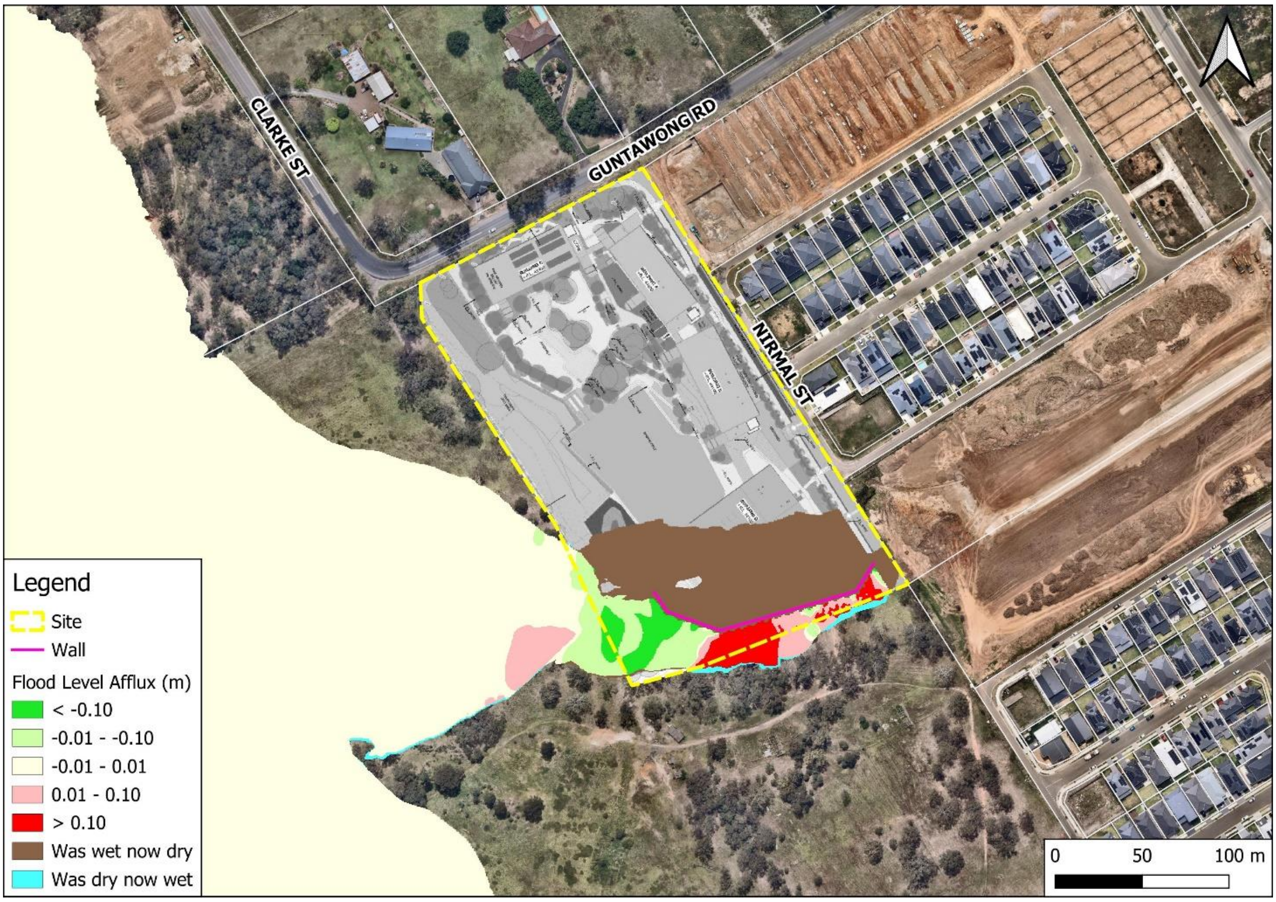

Figure 37: Impact of activity: existing vs post-construction flood level afflux in the PMF event

8.2 Impact of Climate Change

Climate change is expected to have an adverse impact on rainfall intensities, which has the potential to produce significant impacts on flood behaviour at specific locations.

For this study, a sensitivity analysis has been carried out to determine the impact of climate change on local flood conditions. The ARR2019 Interim Climate Change Factor for the site in the 2090 RCP8.5 scenario equates to a 19.7% increase in rainfall intensity. To adopt a more conservative approach, the impact of a 20% uplift in rainfall intensity has been adopted and assessed in this study.

Figure 38 presents the increase in 1% AEP flood depths and levels around the site with the consideration of climate change. Within the tail out channel, there is generally an uplift of around 40-60mm, with a very slight increase in flood extent west of the site. The results also show that flows are generally contained within the tail out channel in the 1% AEP with climate change consideration scenario assessed, and hazards within the channel have not increased as a result of climate change. While the site shows some sensitivity to climate change, the increased flood levels associated with climate change are still well below the proposed building floor level thresholds for the school, and are still less than the PMF levels and extent.

The flood levels and depths, flood velocities and flood hazards for the 1% AEP event with climate change are shown in Appendix A (existing scenario) and Appendix B (post-construction scenario).

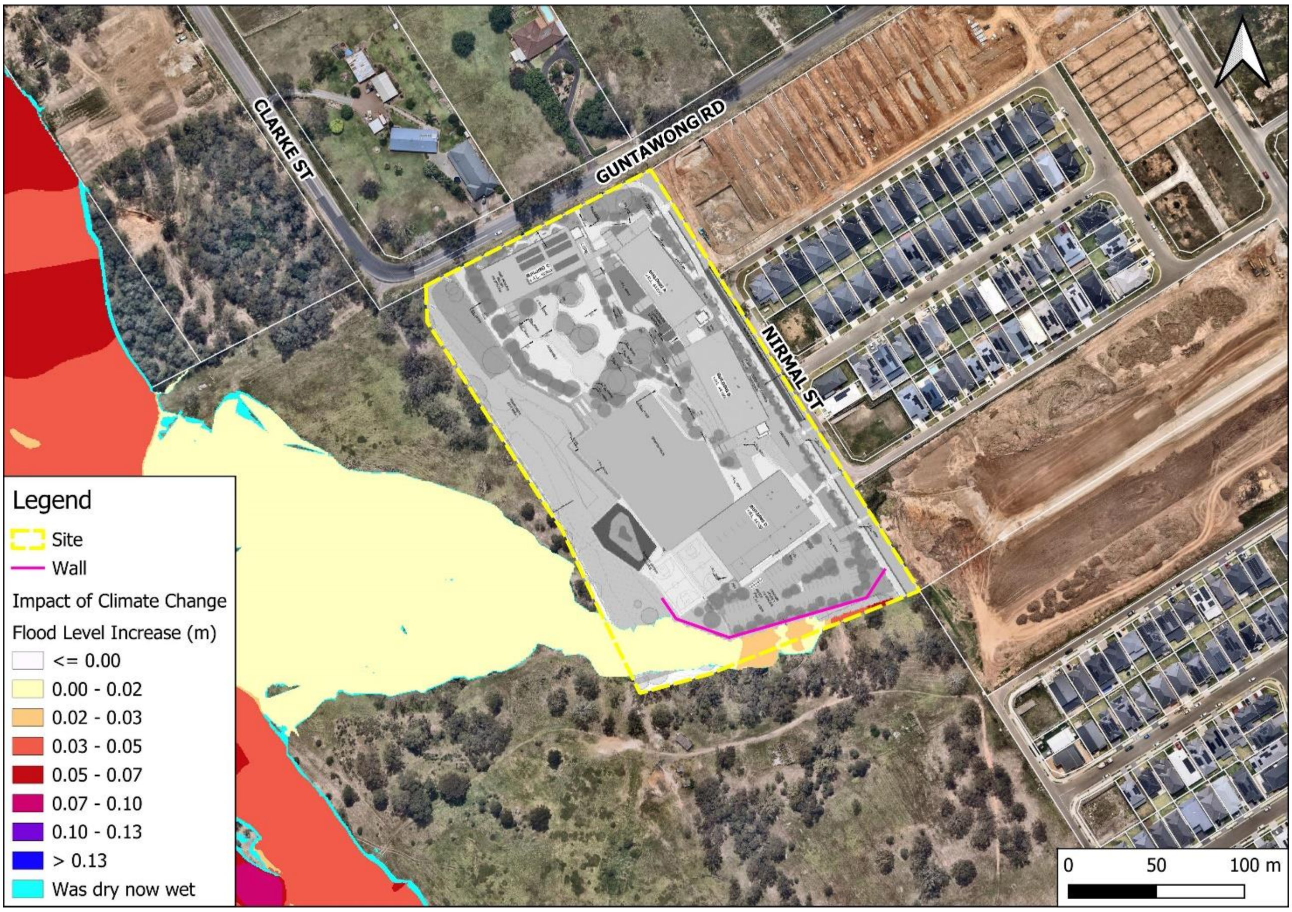

Figure 38: Flood level increase at and around the site as a result of climate change in the 1% AEP event

9.0 Conclusions

An analysis of the existing conditions at the proposed site for the new high school for Schofields and Tallawong has found that the southern portion of the site is flood-affected in events as frequent as the 20% AEP event. This is due to the presence of a first-order creek which conveys overland flow towards the nearby First Ponds Creek.

Modelling of the post-construction scenario, including mitigation measures in the form of a tail out channel and a retaining wall, indicates that the site is only partially impacted by overland flow at its southern boundary, with the open channel directing flow towards the western First Ponds Creek and away from the site. Floodwaters do not reach either the carpark or the proposed school buildings in the PMF, with a peak flood level of 41.62m AHD at the southeastern corner of the site. With the proposed buildings set between 43.9m AHD – 44.4m AHD, the site is therefore well protected against the PMF.

The flood impact assessment for the 1% AEP event, the 1% AEP with climate change and the PMF event confirms that changes to offsite flood levels are generally less than +/- 10mm, and therefore the proposed activity is considered to result in negligible offsite impacts and will not have significant adverse effects on the locality, community and the environment.

Potential impacts can be appropriately mitigated or managed to ensure that there is minimal effect on the locality, community through recommended measures, as outlined in the following section.

Mitigation Measures

Mitigation measures identified as necessary are outlined in Table 2.

Table 2: Mitigation Measures

Mitigation Number/Name	Aspect/ Section	Mitigation Measure	Reason for Mitigation Measure
Tail out channel	Channel to be constructed by developer	Incorporation of an open tail out channel to the south of the site as part of associated works for the adjacent residential development and Nirmal Street stormwater design. This is by Bathla as part of a separate DA, outside of this site. Flows will be conveyed across the site via an open channel along the southern boundary of the site.	To manage incoming flows from the upstream catchment. When the future road to the south of the site is constructed, the channel is to be removed, and upstream flows will be captured and conveyed via concrete culverts below the proposed road along the southern boundary. This flood risk assessment report analyses the post-construction flood behaviour prior to culverting of the flow path, and thereby incorporates the tail out channel as per civil design drawings.
PMF immunity	Design	Protection of site (proposed buildings, carpark) above the PMF level either through elevation of the site / retaining wall.	To provide flood free access and egress from the site, and to provide suitable shelter in the event of a flood. Reduces the flood risk to people on site.
Flood Emergency Response Plan	Prior to construction	Prepare a construction Flood Emergency Response Plan (FERP).	To reduce flood risks to people on site during a flood event. A preliminary Flood Emergency

	Prior to commence of operation	Prepare a final operational FERP.	Response Plan has been produced within the Flood Risk Emergency Assessment (TTW, 2025) submitted alongside this report.

Evaluation of Environmental Impacts

Based on the identification of potential issues, and an assessment of the nature and extent of the impacts of the proposed activity, it is determined that:

- The flood impact assessment for the 1% AEP event and the 1% AEP with climate change event confirms that changes to offsite flood levels are generally within +/- 10mm, and while there are some higher than 10mm of flood level increases estimated for the PMF event, these impacted areas are generally located within existing waterway corridor. Therefore, the proposed activity is considered to result in negligible offsite impacts and will not have significant adverse effects on the locality, community and the environment.
- Potential flood risks and impacts can be appropriately mitigated or managed to ensure that there is minimal effect on the locality, community through recommended measures as outlined above.
- The activity is not considered to produce a significant impact.

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RACHEL CALDWELL
Civil Flood Modeller

Authorised by
TTW (NSW) PTY LTD

MICHAEL KOI
Associate (Flood)

Appendix A

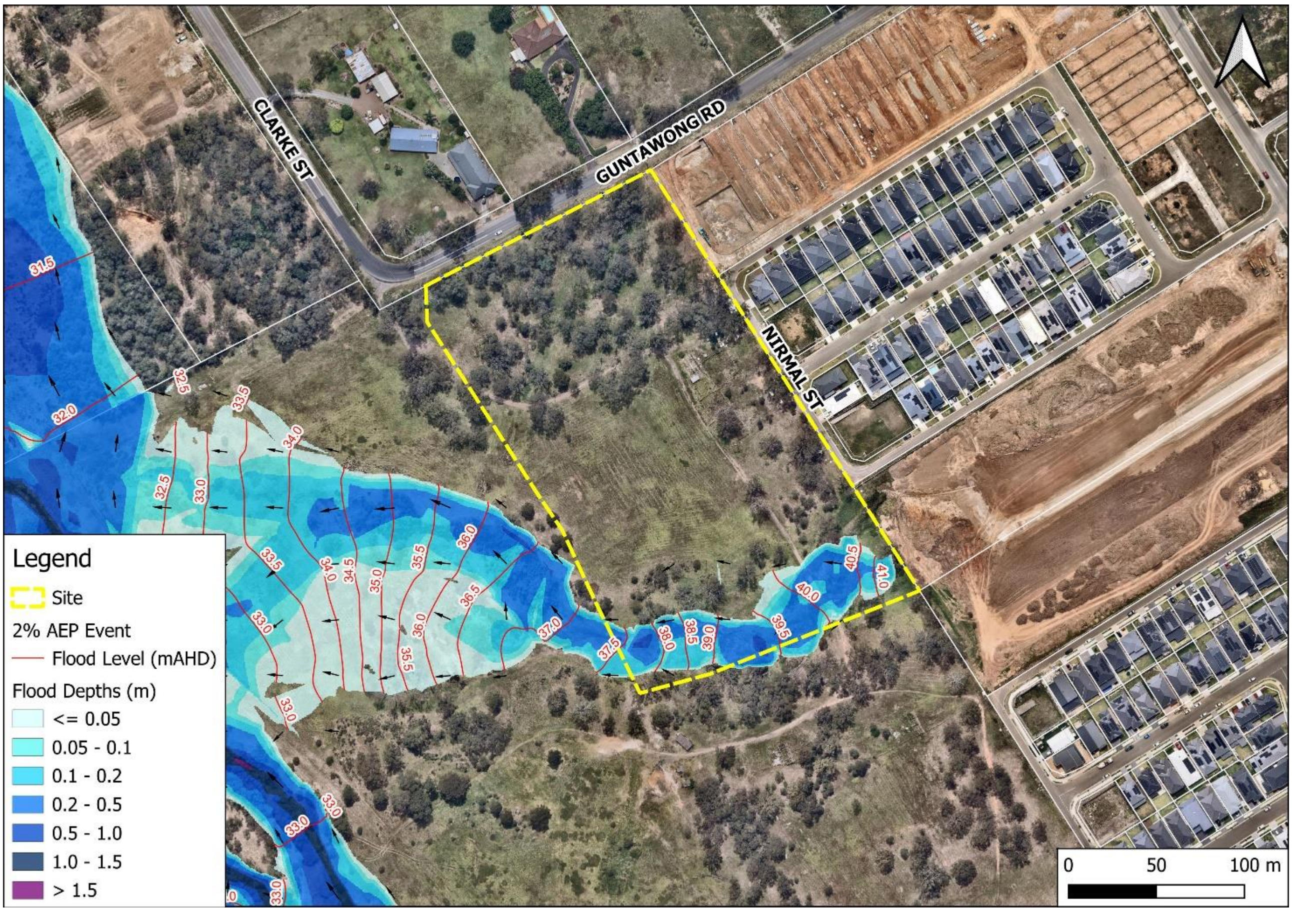
10% AEP Event – Existing Scenario

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

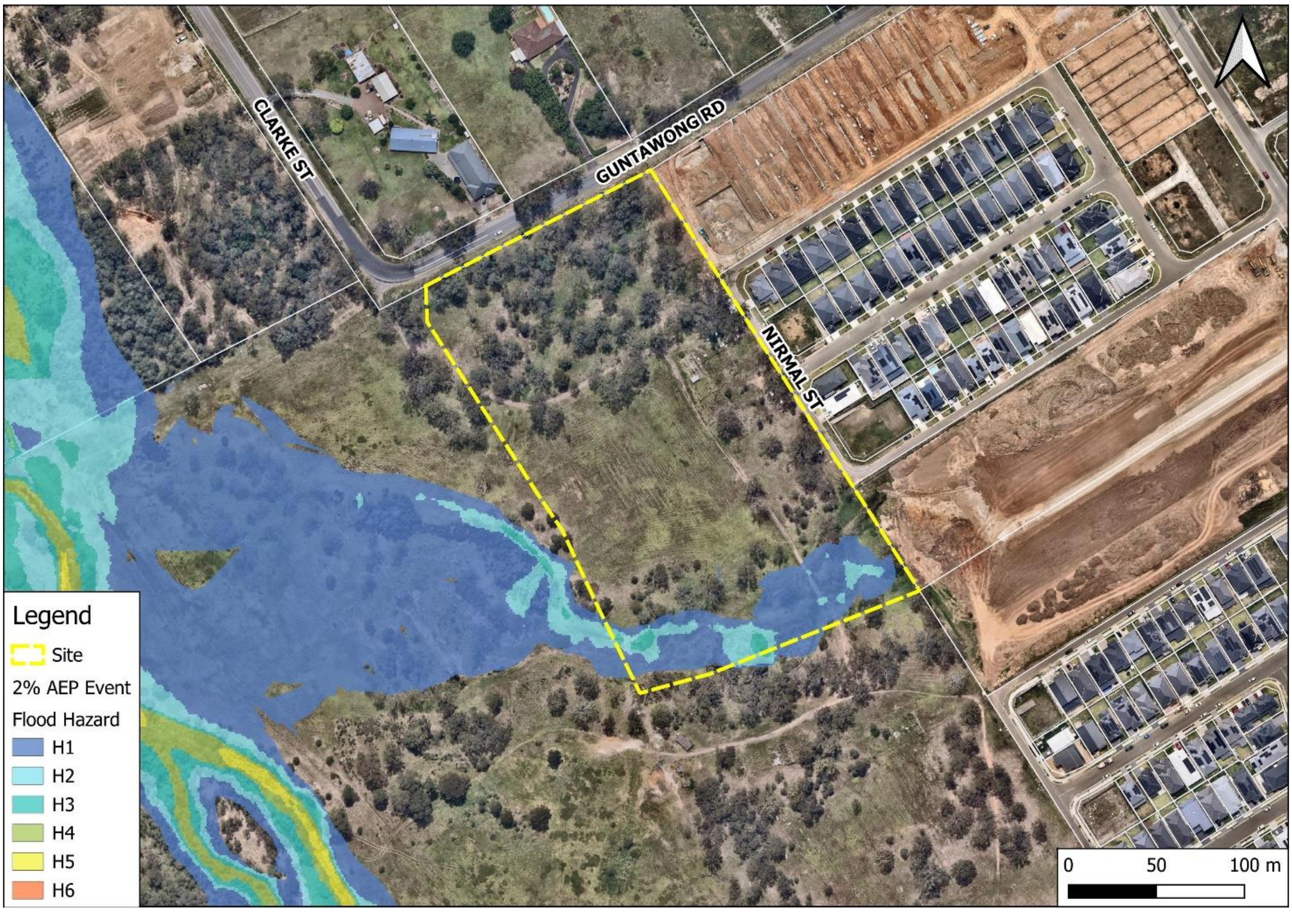
Existing scenario - peak flood hazard at the site in the 10% AEP event

2% AEP Event – Existing Scenario



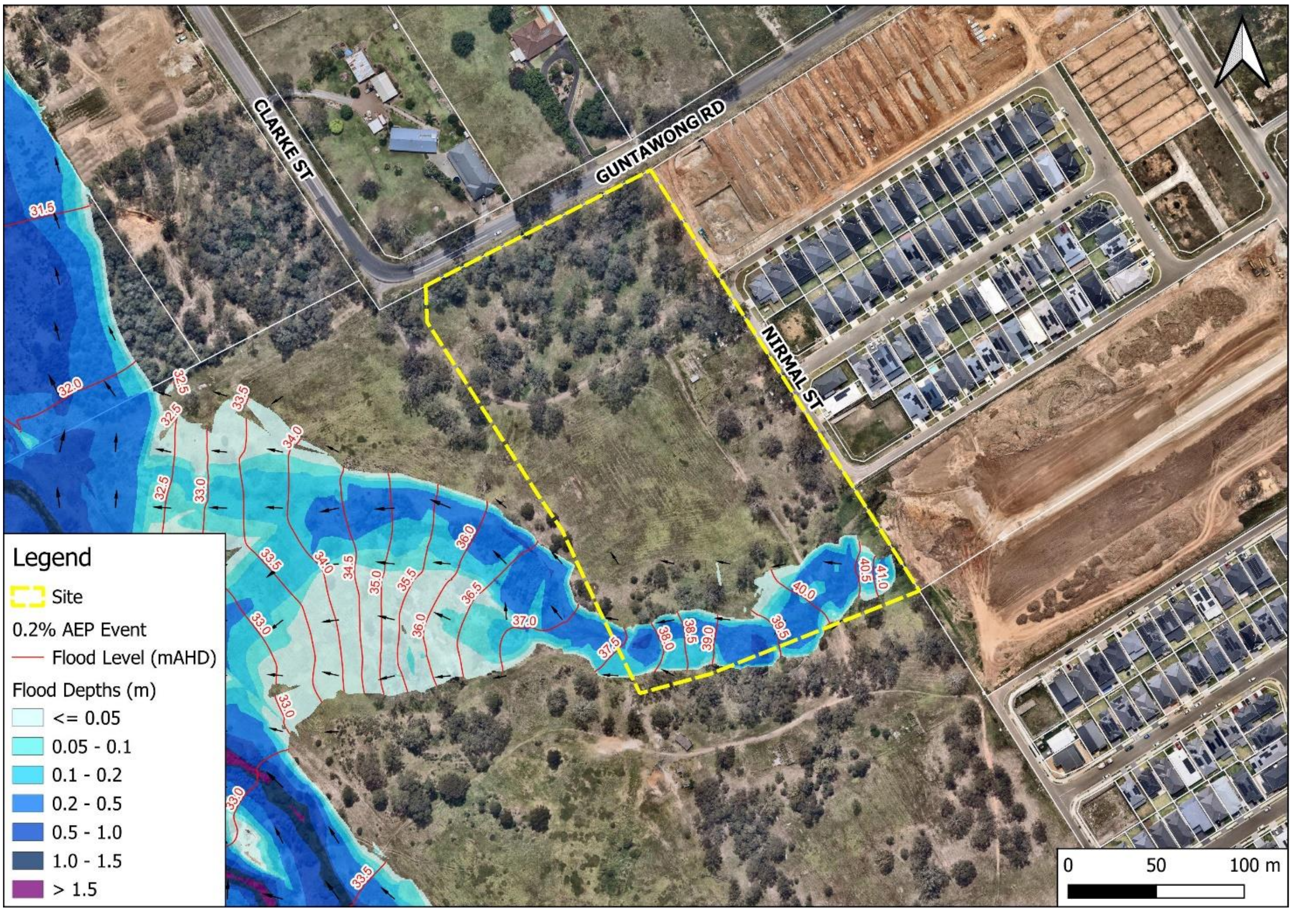
Existing scenario - peak flood levels and depths at the site in the 2% AEP event

Existing scenario - peak flood velocity at the site in the 2% AEP event



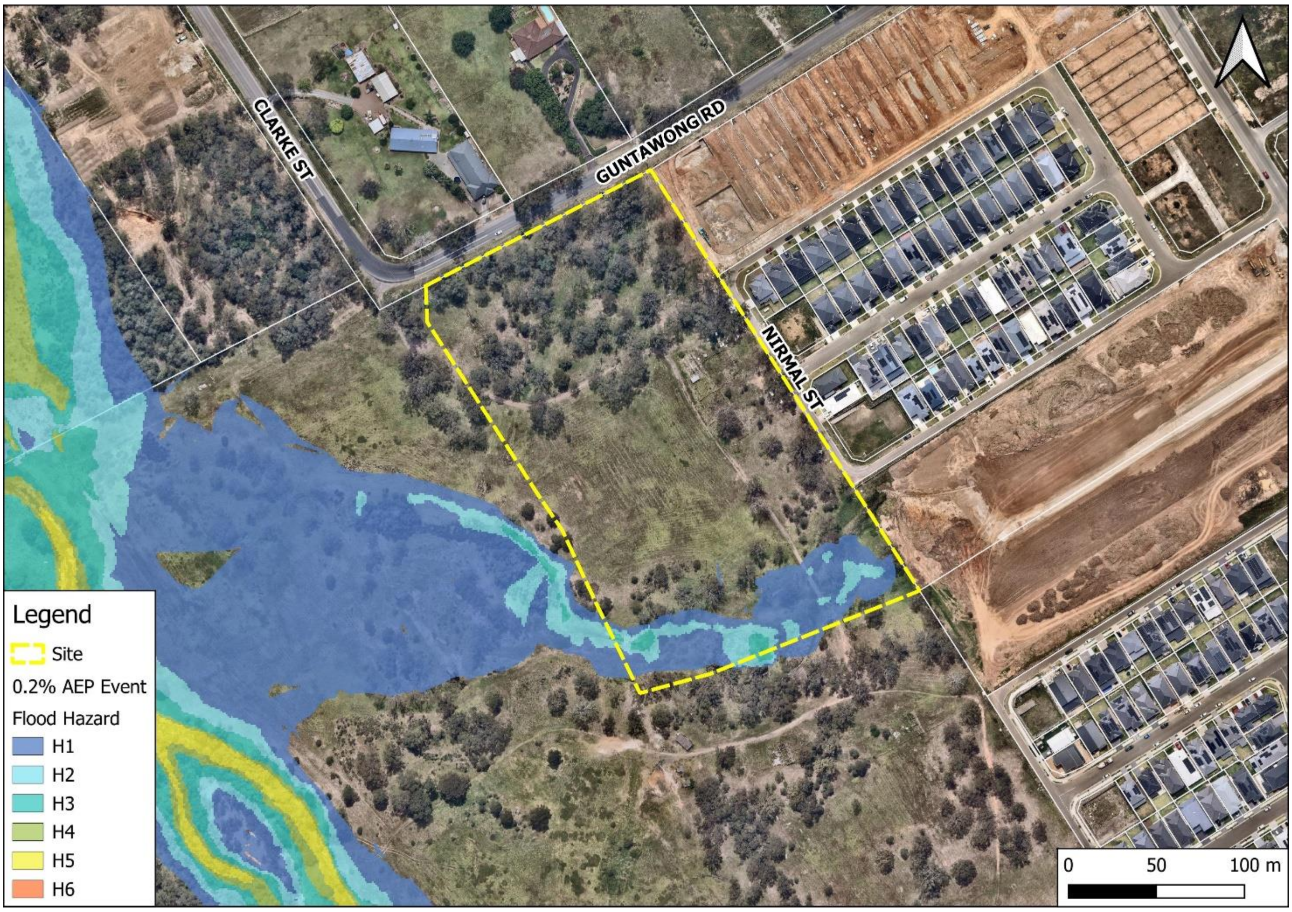
Existing scenario - peak flood hazard at the site in the 2% AEP event

0.2% AEP Event – Existing Scenario



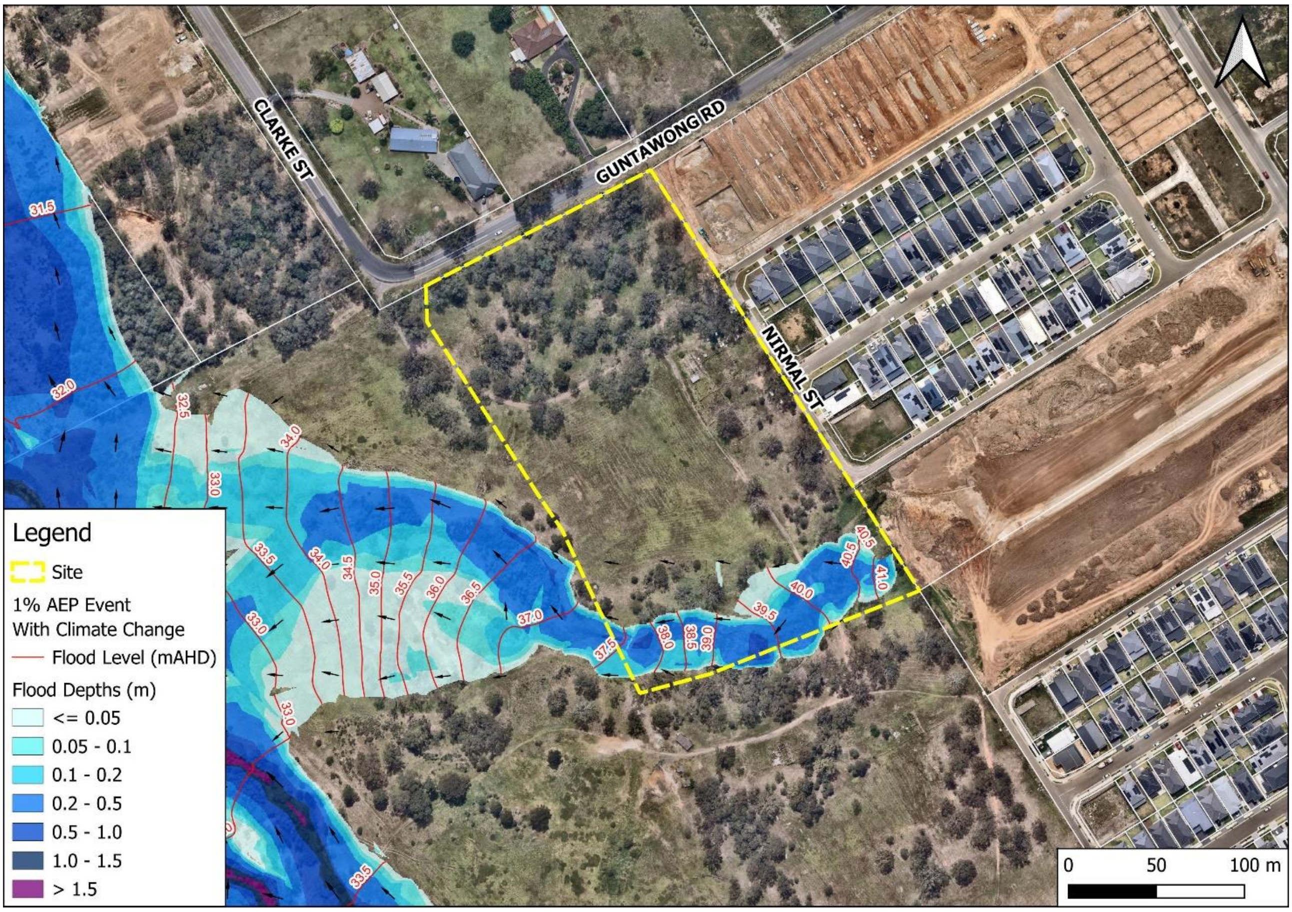
Existing scenario - peak flood levels and depths at the site in the 0.2% AEP event

Existing scenario - peak flood velocity at the site in the 0.2% AEP event



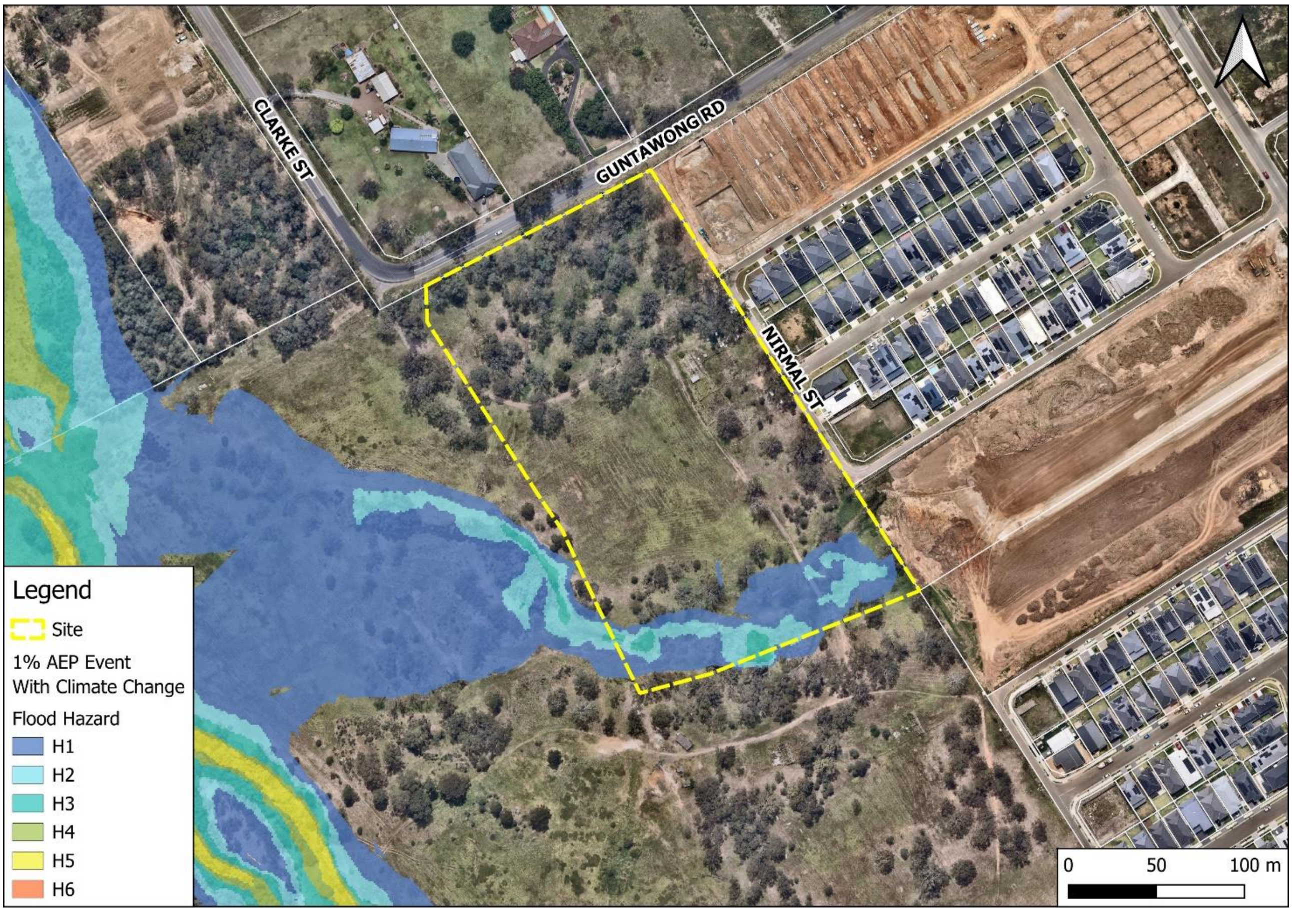
Existing scenario - peak flood hazard at the site in the 0.2% AEP event

1% AEP Event with Climate Change – Existing Scenario



Existing scenario - peak flood levels and depths at the site in the 1% AEP event with climate change

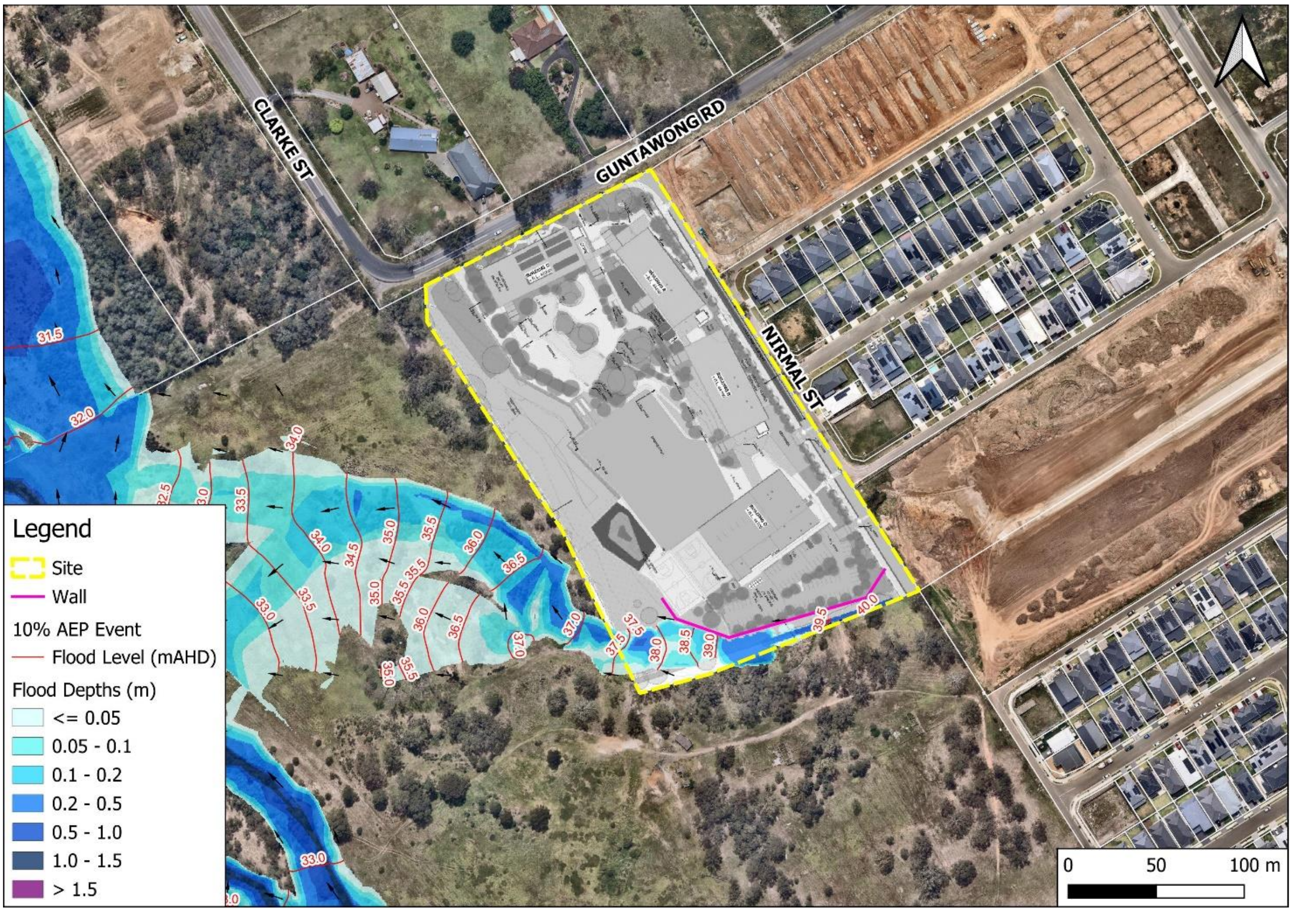
Existing scenario - peak flood velocity at the site in the 1% AEP event with climate change



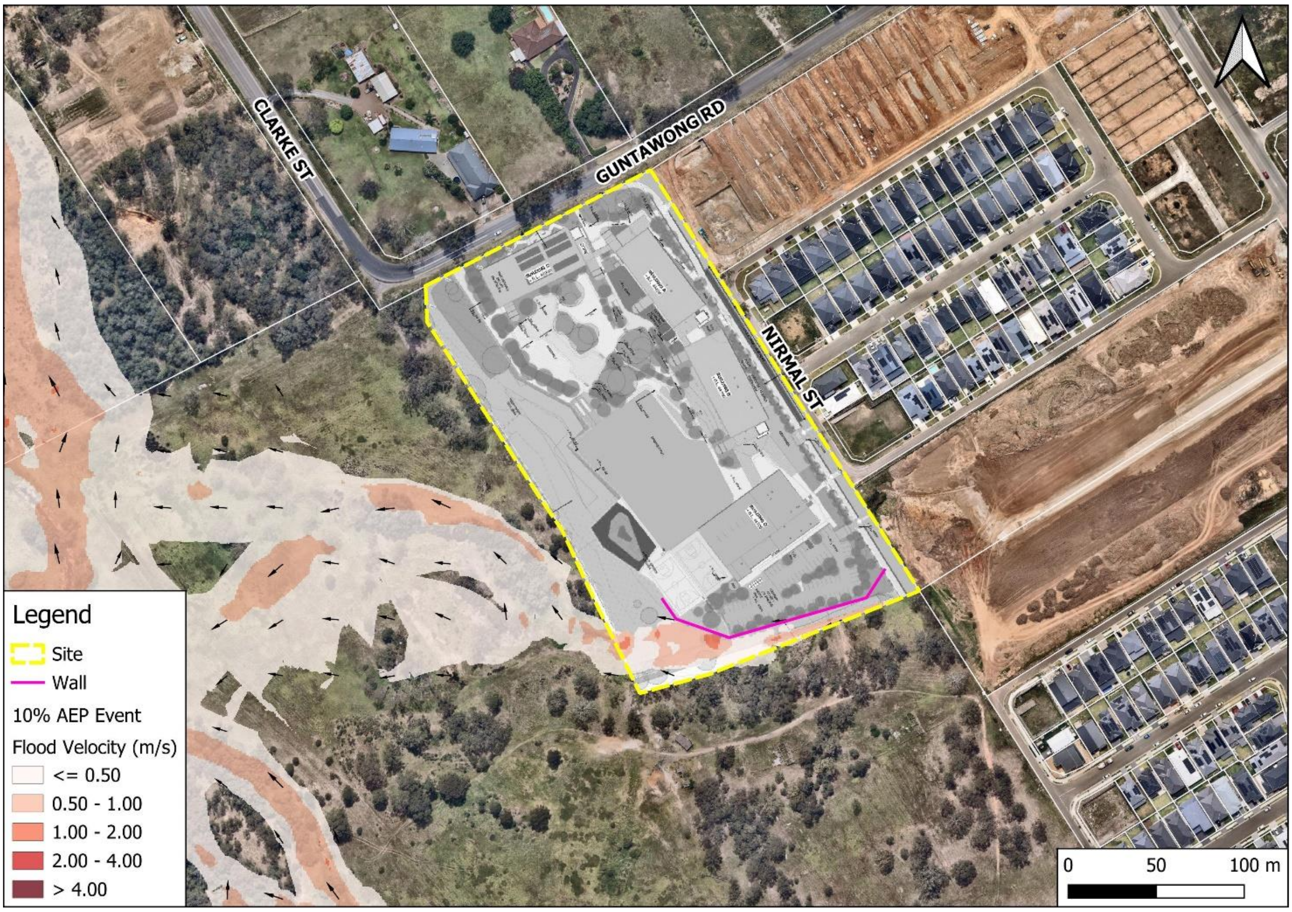
Existing scenario - peak flood hazard at the site in the 1% AEP event with climate change

Appendix B

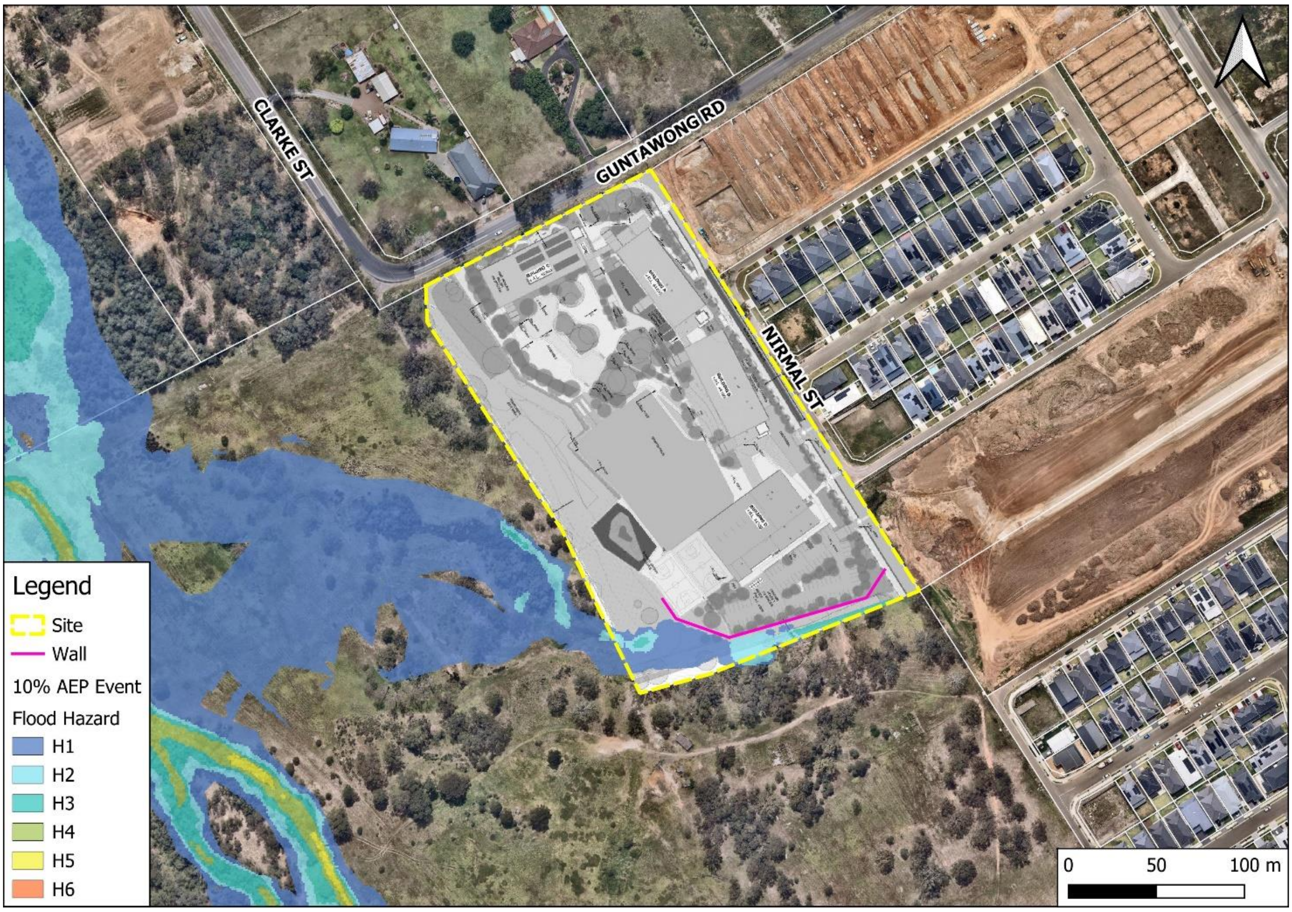
10% AEP Event – Post-Construction Scenario



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

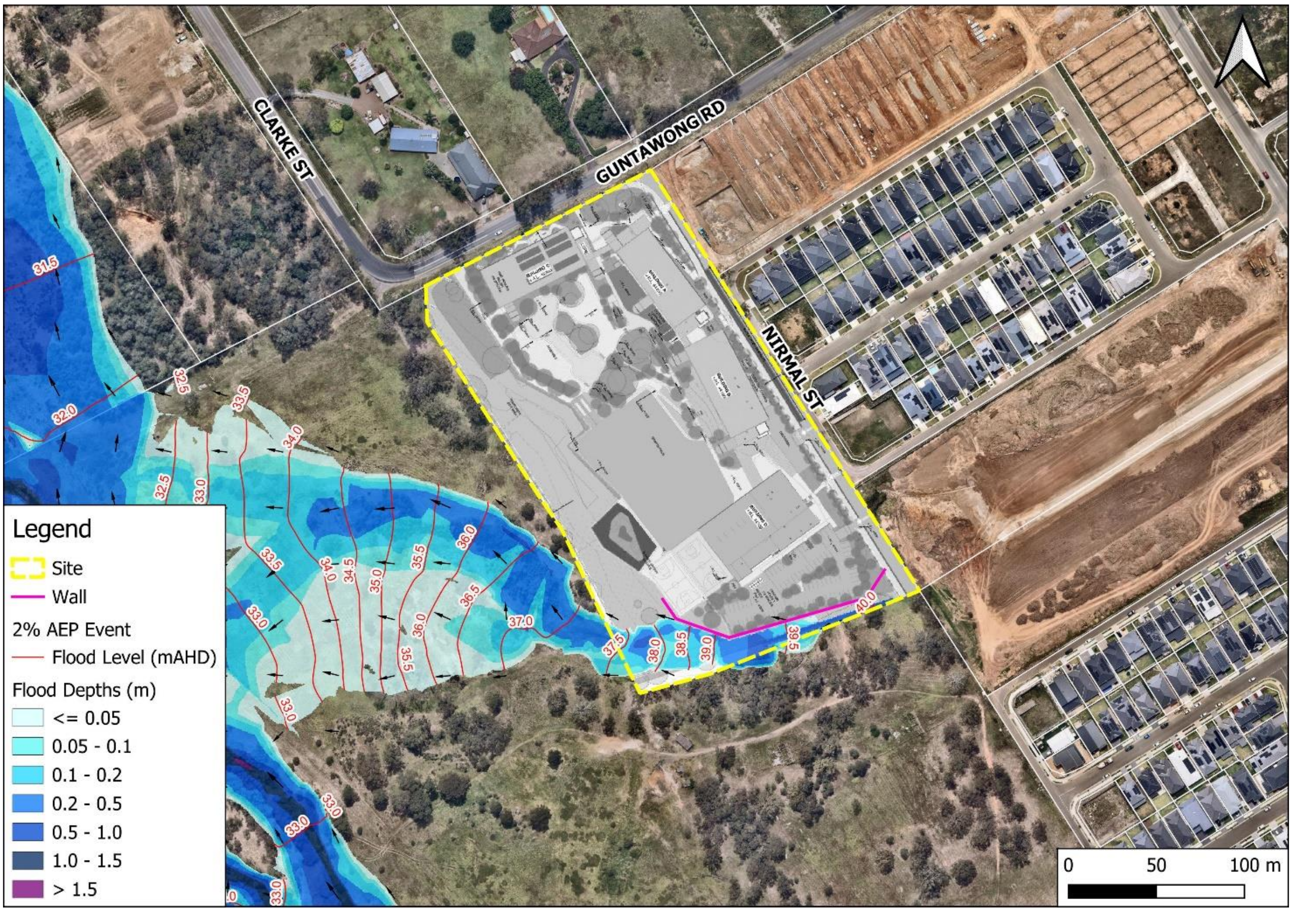


Post-construction scenario - peak flood velocity at the site in the 10% AEP event

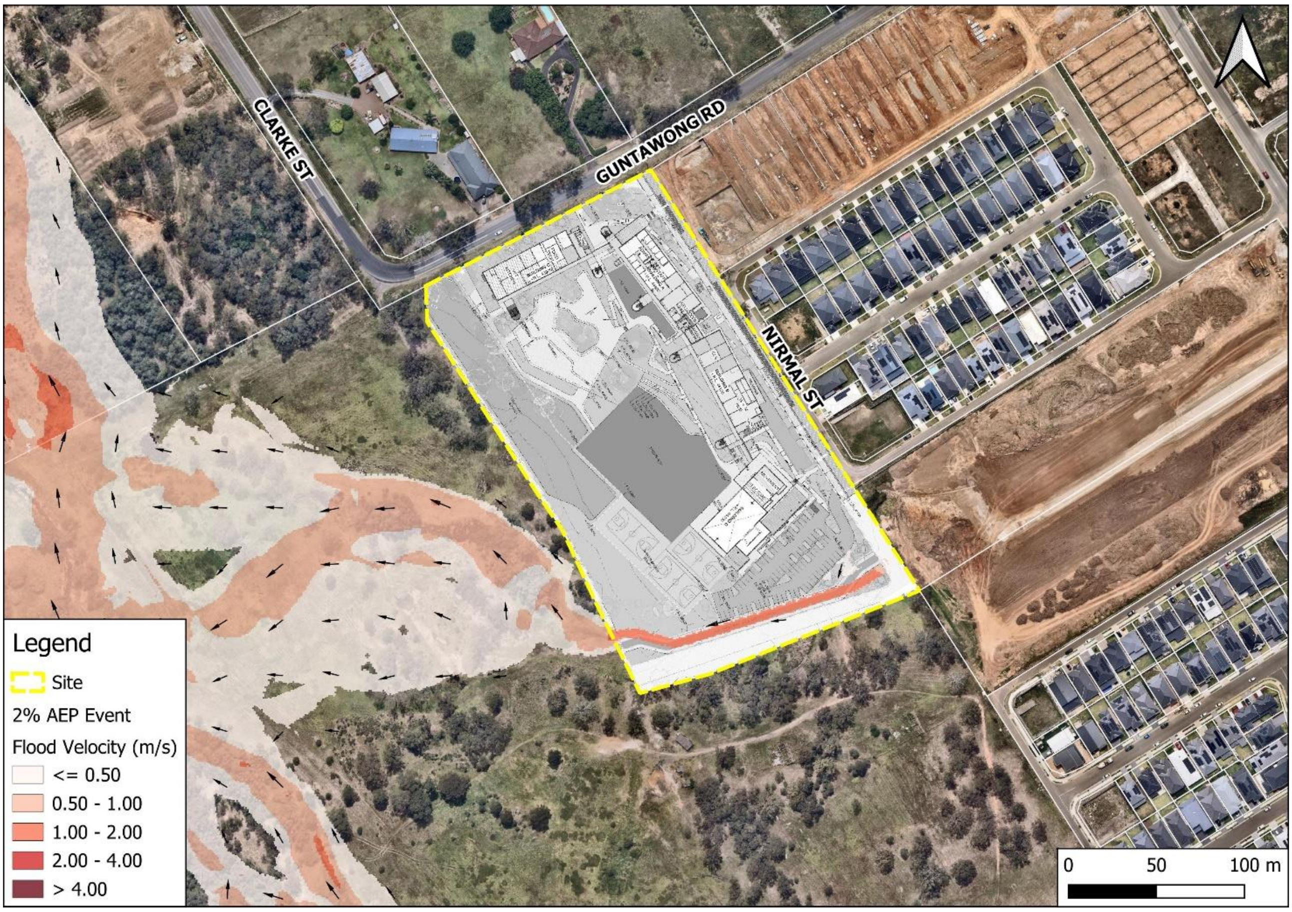


Post-construction scenario - peak flood hazard at the site in the 10% AEP event

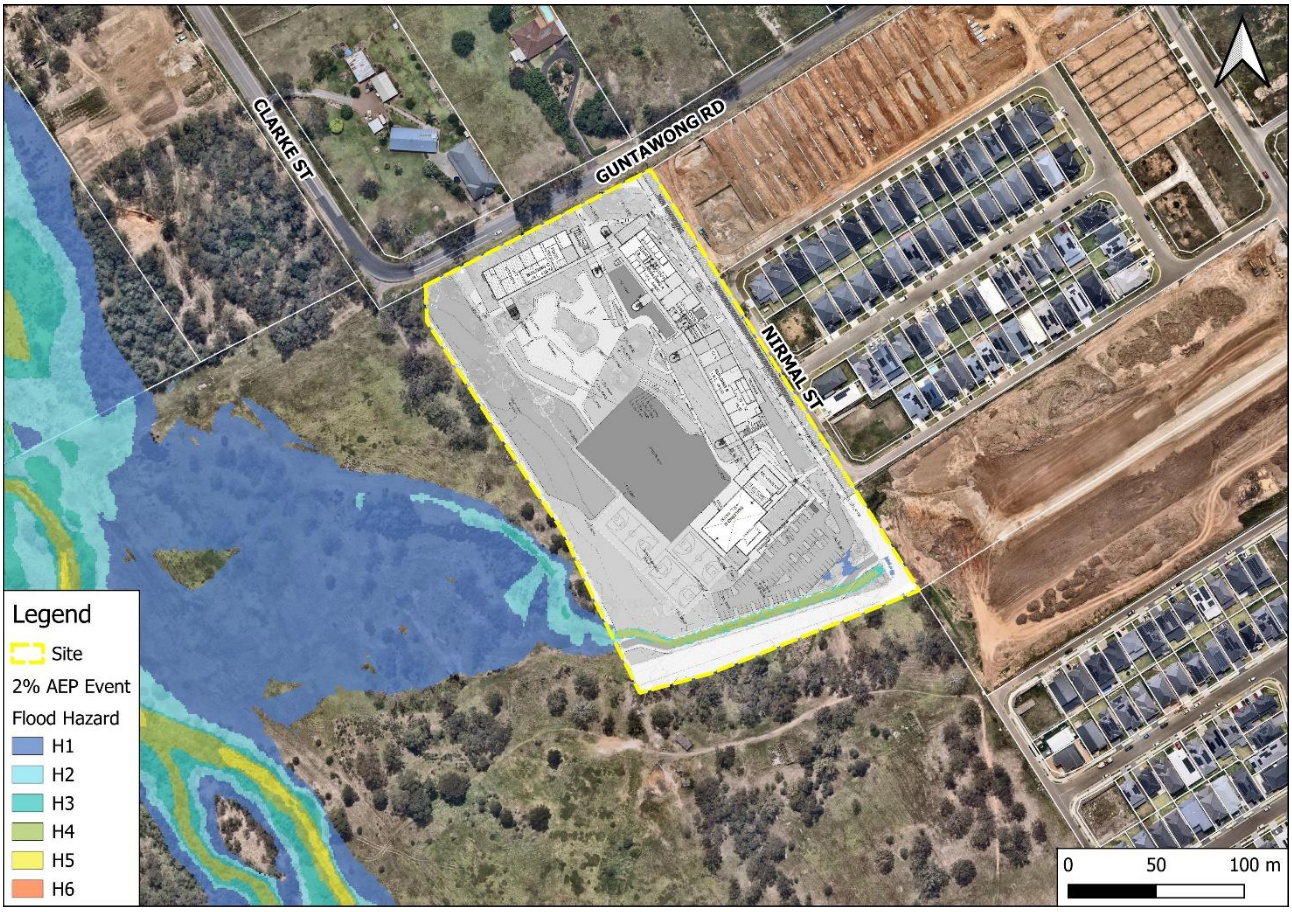
2% AEP Event – Post-Construction Scenario



Post-construction scenario - peak flood levels and depths at the site in the 2% AEP event

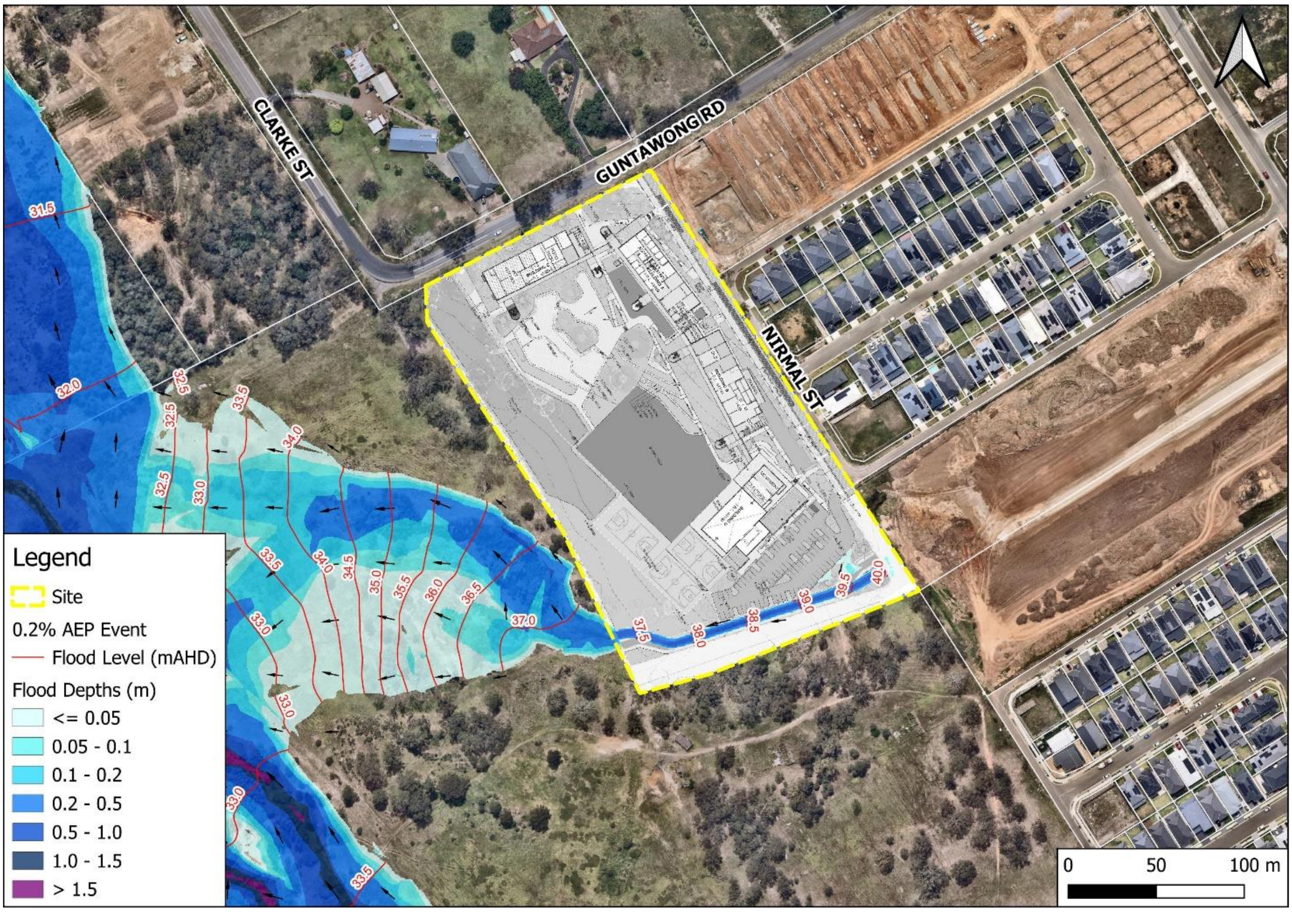


Post-construction scenario - peak flood velocity at the site in the 2% AEP event

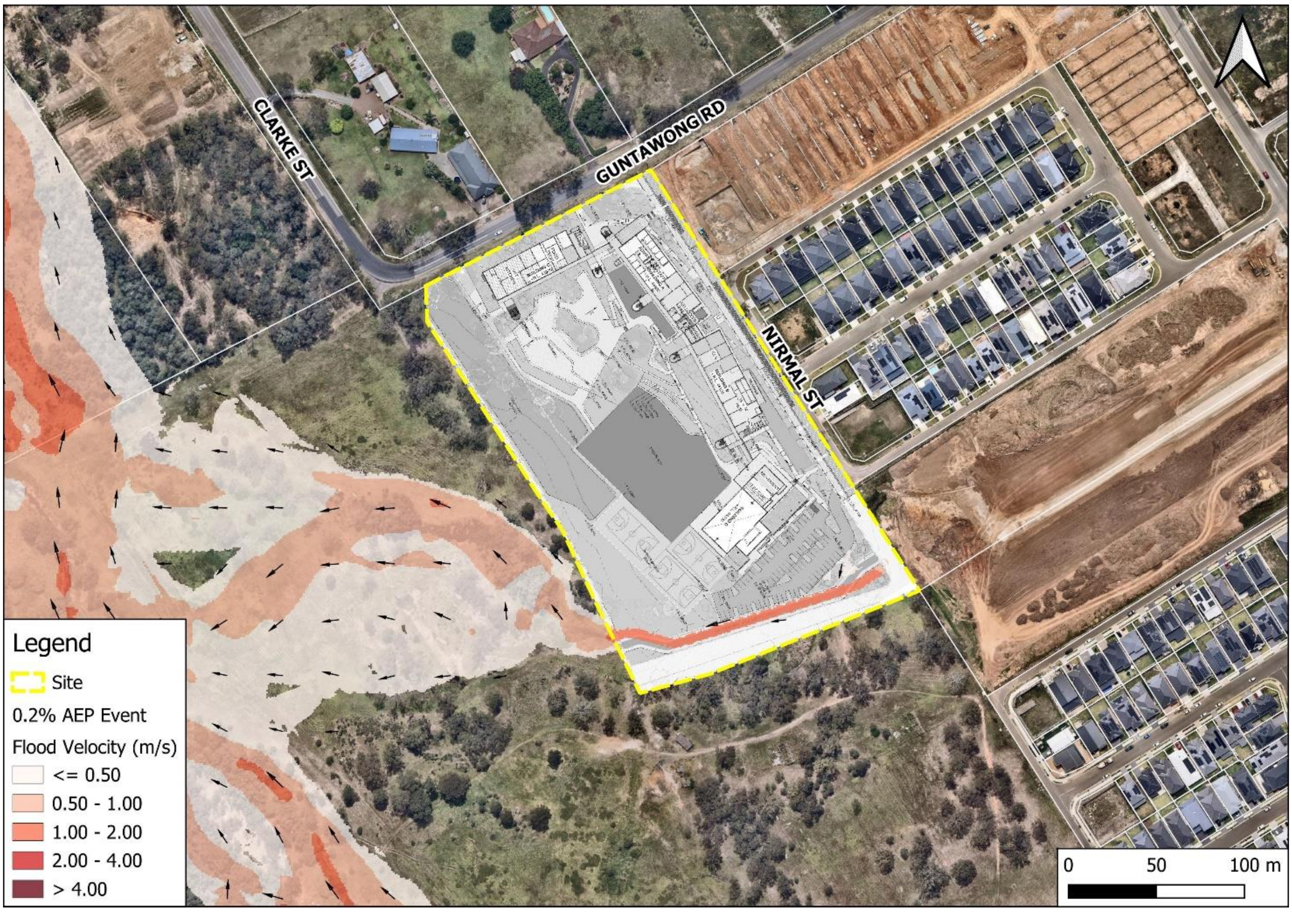


Post-construction scenario - peak flood hazard at the site in the 2% AEP event

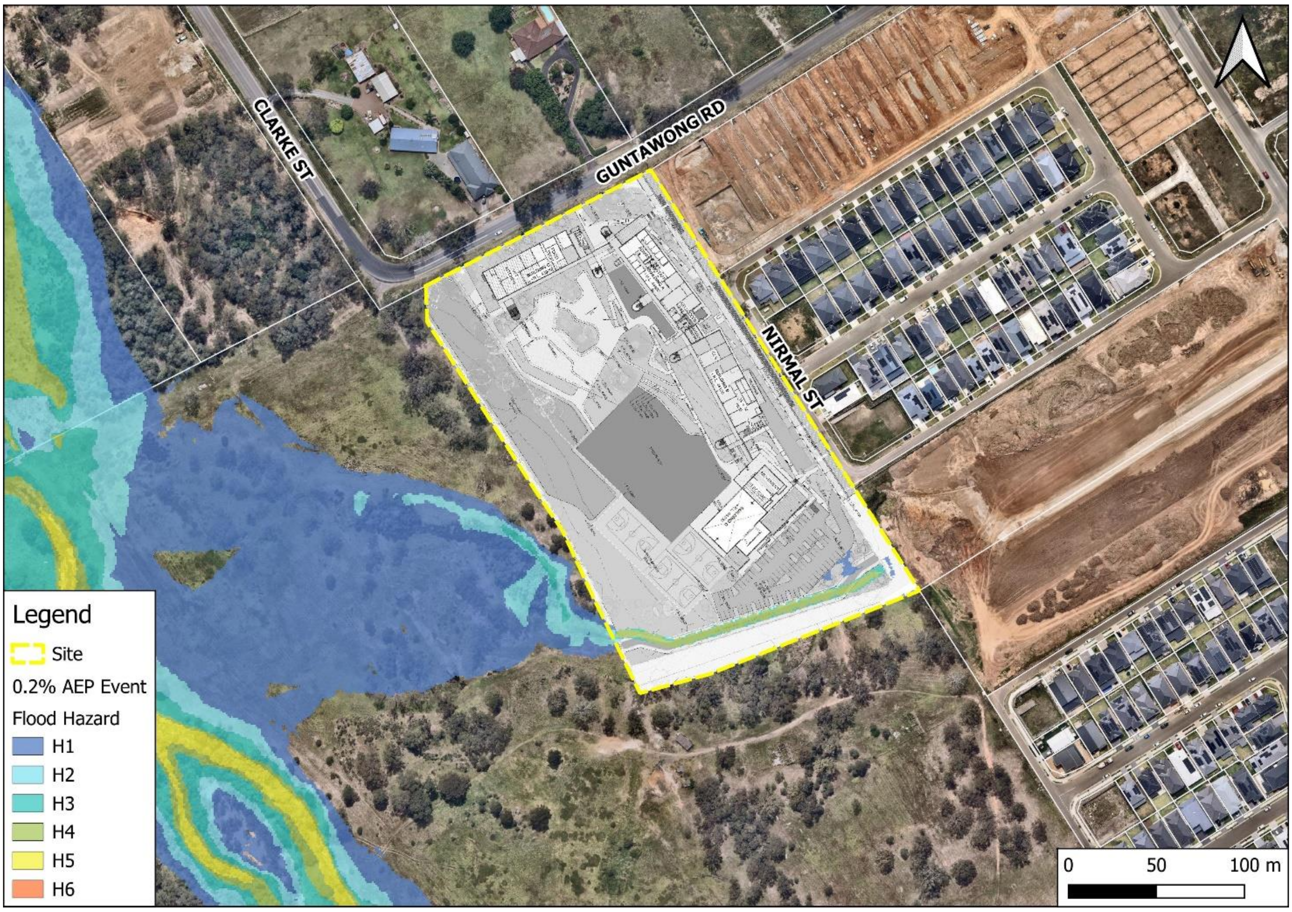
0.2% AEP Event – Post-Construction Scenario



Post-construction scenario - peak flood levels and depths at the site in the 0.2% AEP event

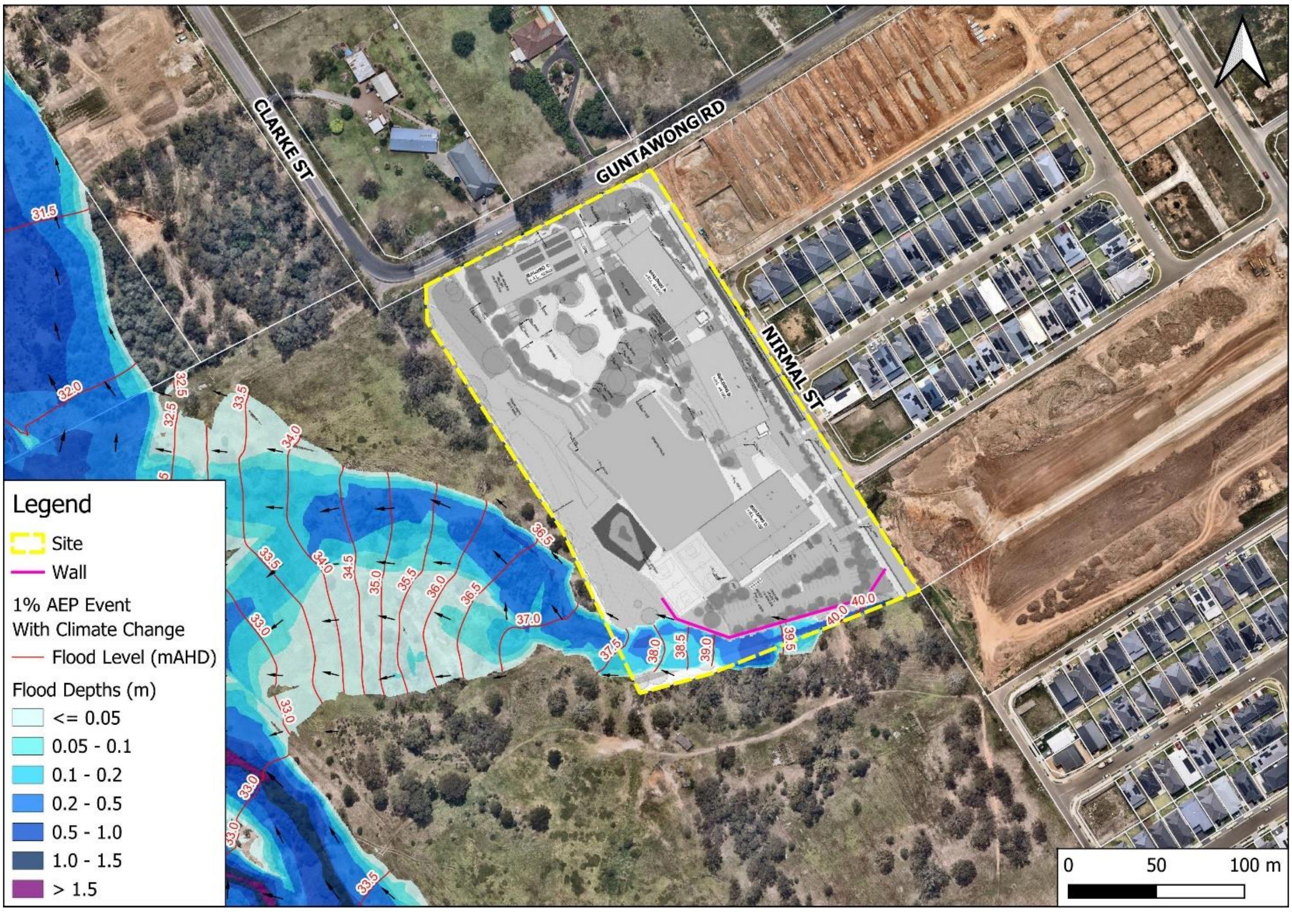


Post-construction scenario - peak flood velocity at the site in the 0.2% AEP event

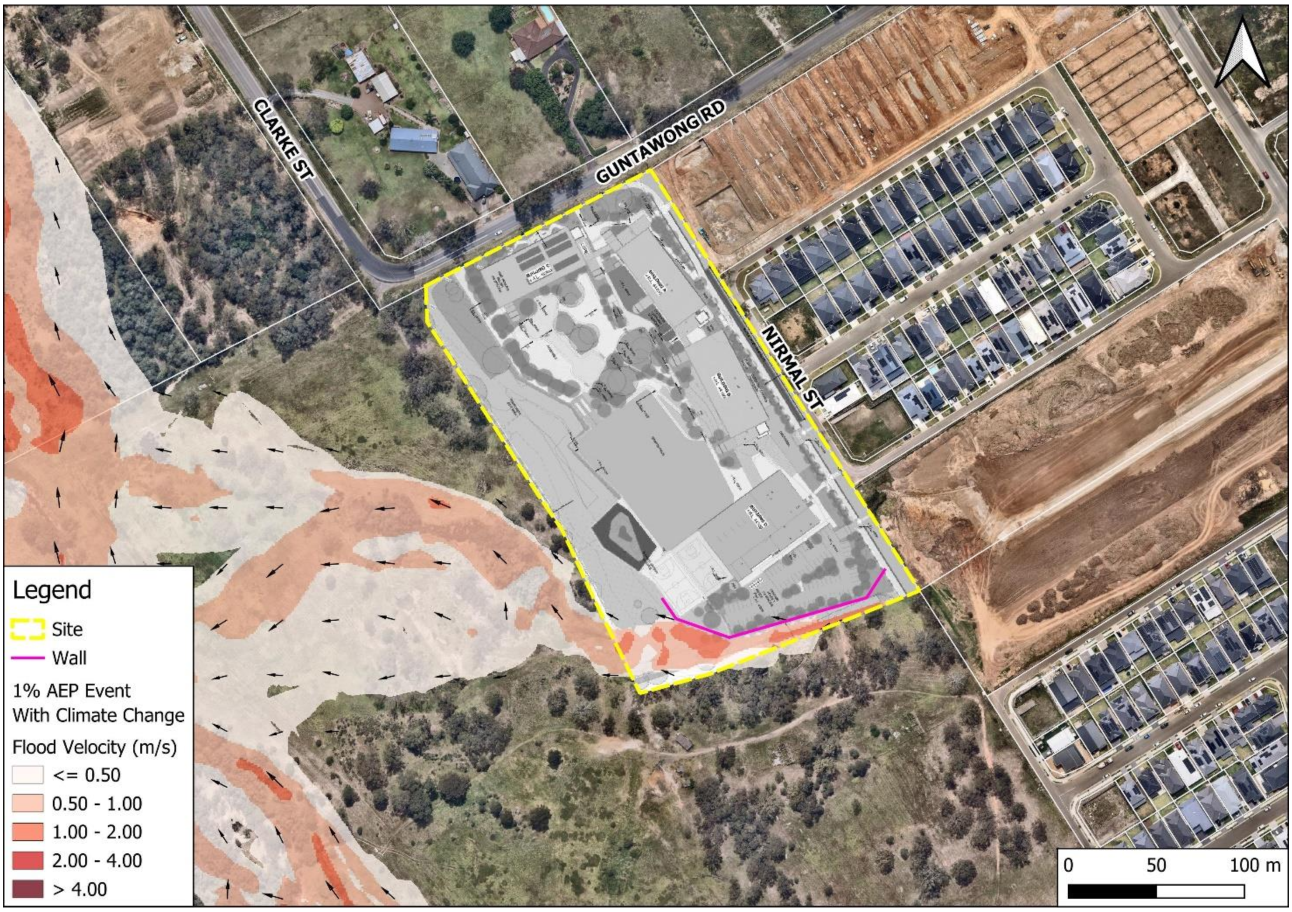


Post-construction scenario - peak flood hazard at the site in the 0.2% AEP event

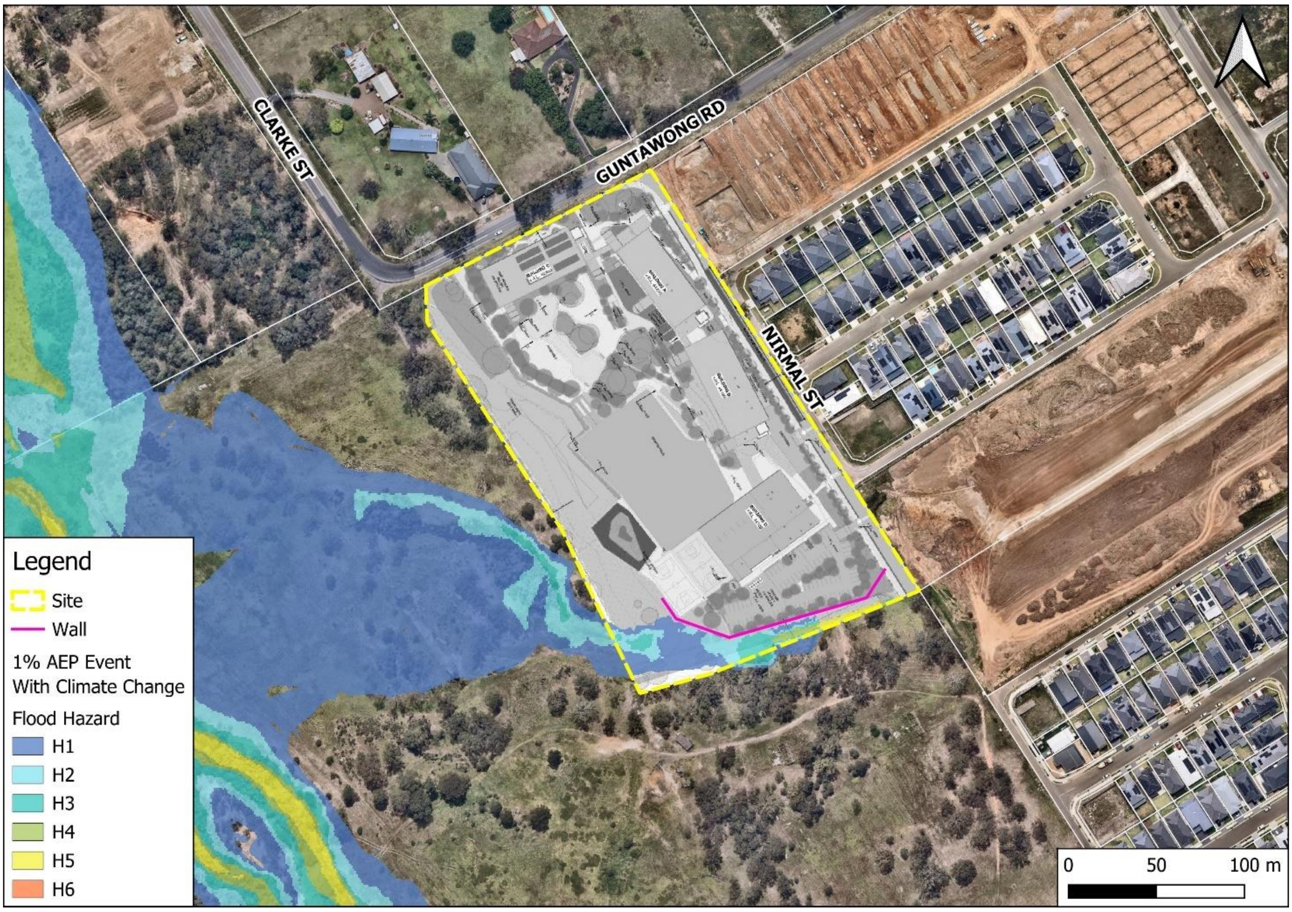
1% AEP Event with Climate Change – Post-Construction Scenario



Post-construction scenario - peak flood levels and depths at the site in the 1% AEP event with climate change



Post-construction scenario - peak flood velocity at the site in the 1% AEP event with climate change



Post-construction scenario - peak flood hazard at the site in the 1% AEP event with climate change

Appendix C

NSW SES Meeting Minutes – 31st October 2024