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Construction Flood Emergency Management Sub-Plan (CFEMSP)

**PROPOSED HIGH SCHOOL
ALLAMBIE HEIGHTS, NSW**

**Revision 01
October 2023**

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Preface

This Construction Flood Emergency Management Sub-Plan (CFEMSP) has been prepared for Schools Infrastructure NSW (SINSW) to supplement the State Significant Development Application (SSD-26876801) for the proposed Forest High School.

The CFEMSP has been prepared to address the management of flooding during the construction phases of the proposed school site and detail the strategies of employees and contractors working at the construction site.

The appropriate responses following commissioning of the school are addressed in the Civil Engineering SSDA Report (ECESSDAR) prepared by Enstruct (referenced below) submitted as part of the Planning Approval process. The responses between the two plans (FMP & CFEMSP) differ greatly due to the vulnerable nature of the patrons of the school when compared to those employed/working at the construction site. During the school construction the nature of the occupants of the construction site is more similar to that of a commercial development and as such a different response strategy is proposed and detailed in the report following.

This CFEMSP has been written in consideration of the Floodplain Risk Management Guidelines (FRMG) which include reference to the following applicable guidelines:

- SES Requirements from the FRM Process (2007) by the Department of Environment & Climate Change.
- Flood Emergency Response Planning Classification of Communities by the Department of Environment & Climate Change.
- Business Flood Safe Toolkit and Plan prepared by State Emergency Service.

Also reviewed in the creation of the CFEMSP are several reports discussing flooding around the construction site, and the greater region in general. These will be periodically introduced and addressed throughout the report where necessary. The main reports relating to the flooding for the development and the wider catchment are listed below:

- (ECESSDAR) Enstruct Civil Engineering SSDR Report (received: 1 September 2023).
- (NBCWMD) Northern Beaches Council Water Management for Developments Policy (28 February 2021).



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Compliance Table

The table below provides an overview of the Conditions of Consent addressed under this CFEMSP. Refer detailed responses in Chapter 9 'Responses to State Significant Development (SSD) Consent Conditions' on page 17 for further information.

Condition	Description	Relevant Report Section
B21. (a)	(a) be prepared by a suitably qualified and experienced person(s)	Chapter 9, Appendix H
B21. (b)	(b) address the provisions of the Floodplain Risk Management Guidelines (EHG);	Chapter 3.2, Chapter 9.
B21. (c.i)	(c) include details of: i) the flood emergency responses for the construction phases of the development.	Chapter 4, Chapter 5.
B21. (c.ii)	(ii) predicted flood levels;	Chapter 3.1.
B21. (c.iii)	iii) flood warning time and flood notification;	Chapter 3.4, Chapter 6.1
B21. (c.iv)	iv) assembly points and evacuation routes;	Chapter 2, Chapter 5.3.1.
B21. (c.v)	v) evacuation and refuge protocols; and	Chapters 5, Chapter 6.
B21. (c.vi)	(vi) awareness training for employees and contractors, and users/visitors.	Chapter 8

Table 1: Compliance table



1 Introduction

This Construction Flood Emergency Management Sub-Plan (the Plan) has been prepared for Schools Infrastructure NSW (SINSW) to supplement the State Significant Development Application (SSD-26876801) for the proposed Forest High School. The site comprises an area of 4.50 Ha for the construction of 8 proposed buildings as well as necessary carparking and ancillary infrastructure, playing fields, and landscaping. The topography of the undeveloped site can be described as generally falling to the south-west with grades that range around 3-5%. Architectural Concept Plan is provided by Architectus dated August 2023 refer Appendix C for full size.

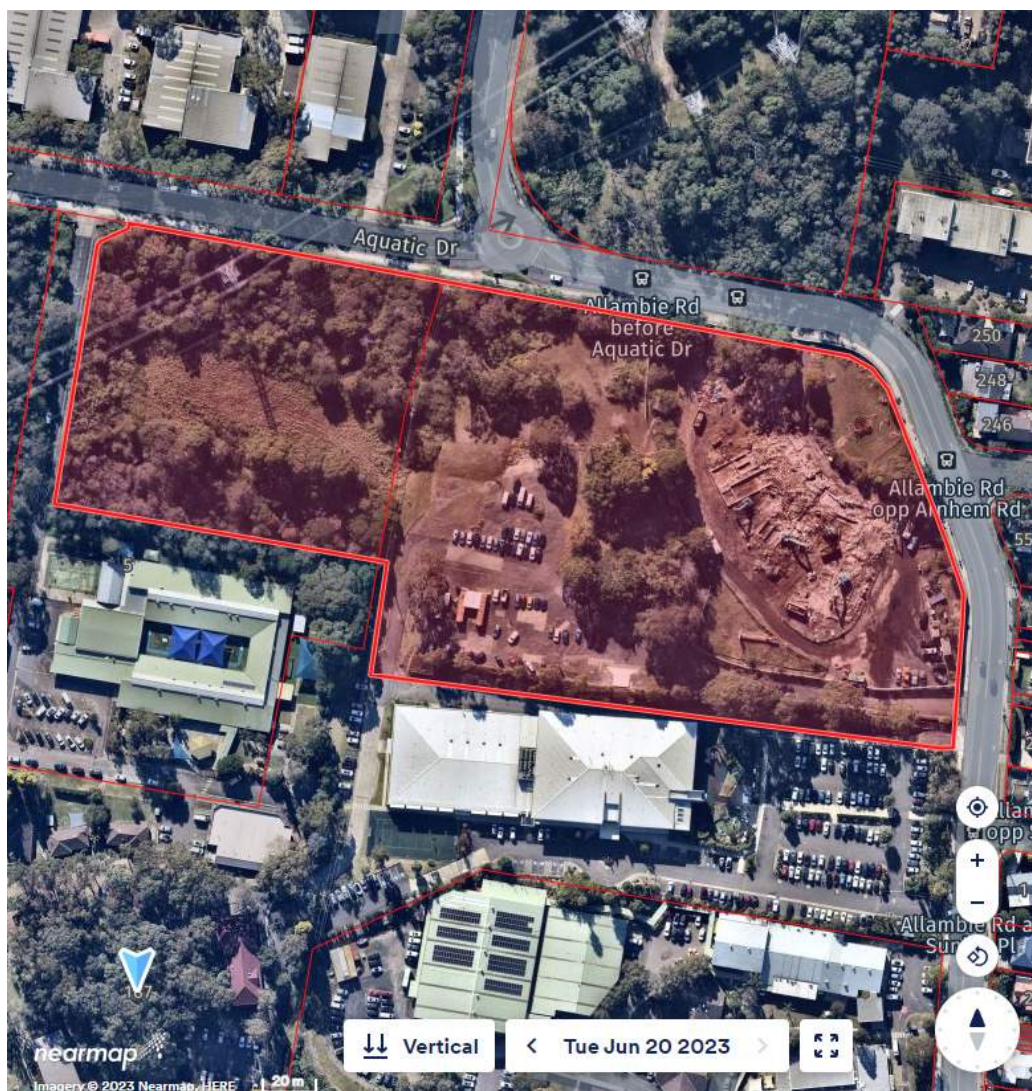


Figure 1: Proposed Development Site (Near Map, 20 June 2023)

As part of due diligence investigations for the proposed development, it was identified through the use of the Northern Beaches Council Water Management for Developments Policy (NBCWMD) that the area of construction works is not at risk of low, medium or high-risk flooding during construction (refer Figure 2 and 4 showing excerpt of the NBCWMD 1% AEP flood extent and level model and Appendix E for a full-size copy). However, the NBC Manly Lagoon Floodplain Risk Management Study and Plan indicates some minor flooding zones in the 20% and 1% AEP flood extents.

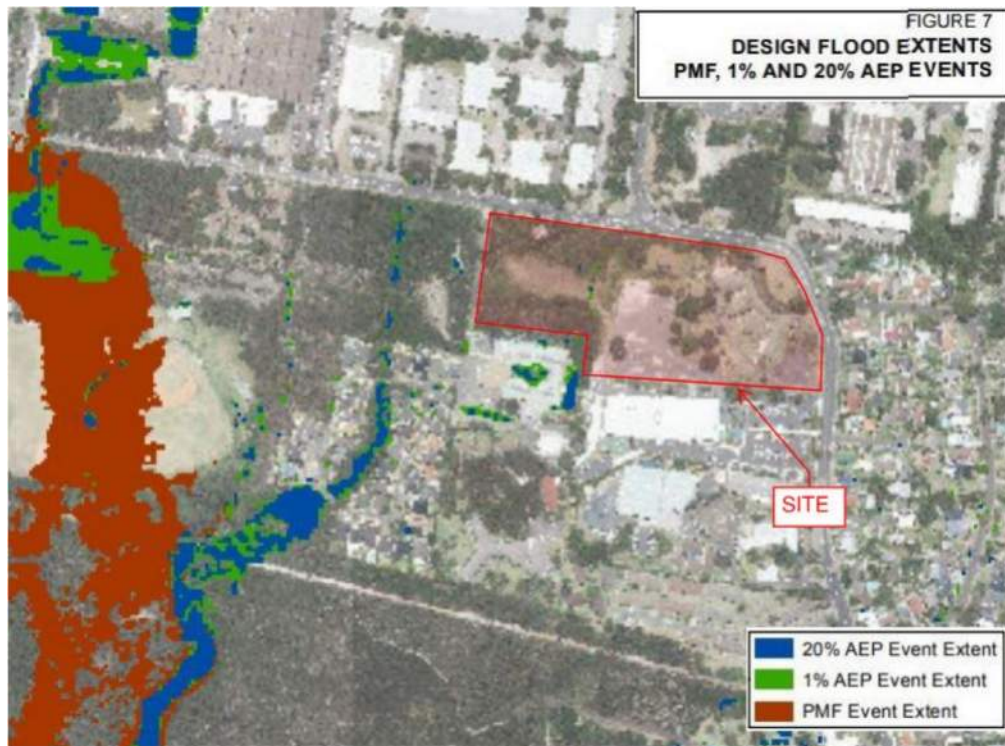


Figure 2: Excerpt of NBC's flood extent model

2 Construction Overview

A Site Management Plan showing the proposed layout of the construction site during these stages is shown in Figure 3, a full-size drawing is provided in Appendix B.

Work hours (including delivery of materials to and from the site) are noted in the conditions of consent and are limited to:

- between 7am and 6pm, Mondays to Fridays inclusive; and
- between 8am and 5pm, Saturdays.
- No work may be carried out on Sundays or public holidays.

A flood emergency assembly point is proposed in the northeast corner of the site, refer Figure 3.

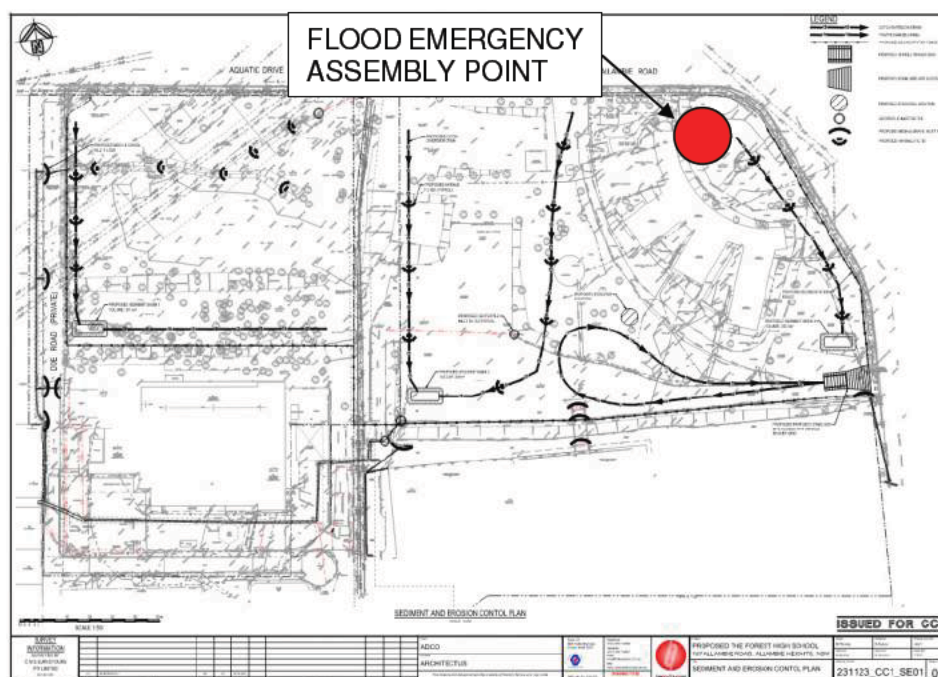


Figure 3: Site Management plan during construction

3 Flood Context

The site is located towards the top of the Manly Lagoon catchment. As such, the site is generally not susceptible to medium or high-risk flooding. However, from Item 14 Flood Risk Assessment of the SSD-26876801 SEARs Matrix:

“Council has a flood study which indicates that there is some flood affectation on the site. The report indicates that the private road through Lot 11 and the entrance to the underground car park are affected by the 1% AEP flood event.”

This localised flooding is due to unoptimized overland flow paths through the existing site and surrounding developments. Therefore, it will be a primary concern both during and post construction that internal and external overland flows are thoroughly considered in the design.

3.1 Flood Mapping, Levels and Data

As the site is subject to flooding from the Manly Lagoon Catchment, relevant flood studies, such as the NBCWMD was reviewed during the planning approval stage. Based on the relevant flood studies, Enstruct provided a flood study (the ECESSDAR) specific to the development site to ascertain key information regarding the flood inundation. The ECESSDAR flood study forms the basis of flood data assessed in this report as it represents the most ‘up to date’ and high-resolution data.

The lowest corner portion at the southwestern corner of the site currently sits at 147.71 m AHD. The high point in the northeastern corner of the site has a level of approximately 156.00 m AHD. That results in a level difference of 15m. From a review of ECESSDAR, it was determined that the lower reaches of the site are slightly encroached on in storms greater than 1% AEP flood event (refer below Figure 4 and Figure 5, and mapping in Appendix E). Further review of the ECESSDAR determined that the main region of construction and the main school building structure remains mainstream flood immune in all storms up to and including the PMF. Refer Figure 5.

In the critical location at the corner of the private internal road the 1% AEP flood level is 147.40 m



(AHD) and the PMF flood level is 147.60 m AHD, according to the ECESSDAR. Similarly, the north fronting side of the site off Aquatic Drive, the 1% AEP flood level is 151.60 m (AHD) and the PMF flood level is 151.80 m AHD. As such the flood extent mapping showing the maximum flood levels and velocities are presented below in Figure 4 and Figure 5.



Figure 4: 1% AEP existing condition flood extent and maximum flood levels. (ECESSDAR)

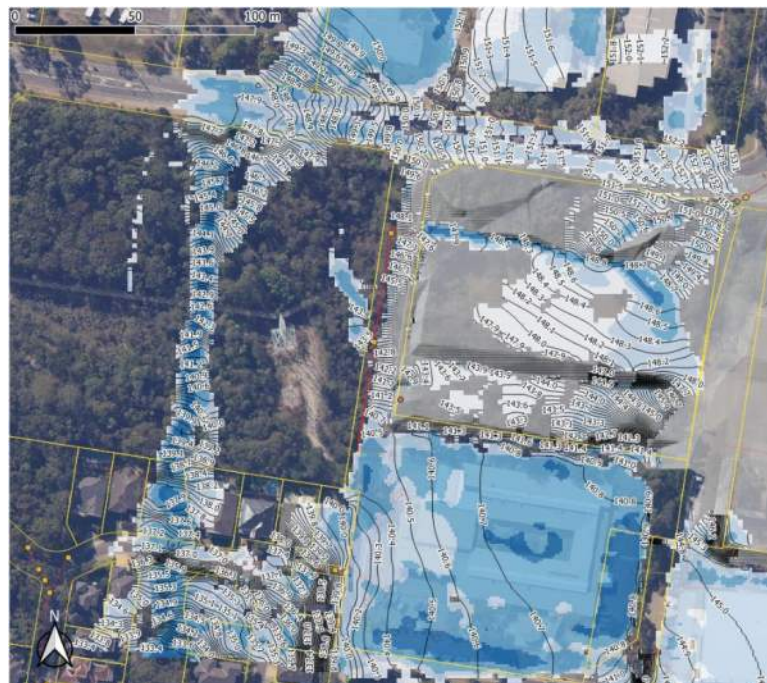


Figure 5: PMF existing condition flood extent and maximum flood levels. (ECESSDAR)



3.2 Flood classification

In line with the recommendations of the Flood Emergency Response Planning Classification of Communities as part of the Floodplain Risk Management Guidelines, the emergency response planning classification was reviewed for the PMF and 20-year and 100-year average recurrence interval (ARI) events.

During the PMF storm event, from review of the preliminary flow chart of emergency response classification from the Flood Emergency Response Planning Classification of Communities as part of the Floodplain Risk Management Guideline the emergency response classification was assessed as:

Partially flood effected – Rising Access Area.

During the 20-year and 100-year ARI storm event, from review of the preliminary flow chart of emergency response classification from the Flood Emergency Response Planning Classification of Communities as part of the Floodplain Risk Management Guideline the emergency response classification was assessed as:

Partially flood effected – Rising Access Area.

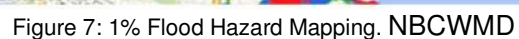
3.3 Potential Hazard

Flood hazard represents the impact that flooding would have on people, vehicles and buildings and is usually represented by a combination of depth and velocity of the floodwaters. Based on flood hazard mapping presented in ECESSDAR the following comments are made based on flood hazard:

- 1% AEP – localised areas within the development that are unsafe to occupy.
- PMF – localised areas within the development that are unsafe to occupy.

Under the technical flood risk management guideline, the flood hazard in the critical PMF event is H5. H5 is described as: generally unsafe for vehicles and people.

Flood classification and hazard mapping from ECESSDAR for the critical storm durations is shown below in Figure 6 and 7.





Review of Flood Hazard mapping for the 1% AEP and PMF confirms the velocity is greater than 2.0 m/s. Under the technical flood risk management guideline, the flood hazard in the critical PMF event is flood is H5 (generally unsafe for vehicles and people).

3.4 Rate of Rise and Duration

Insufficient technical information is available to provide detailed information on the rate and rise and duration of the critical flood event at this exact location.

However, based on the development's flood classification detailed in Chapter 3.2, the flood hazard detailed in Chapter 3.3 and the proposed Emergency Response Philosophy in Chapter 4 a detailed understanding of the rate of rise and flood duration is not required for the proposed an adequate and safe flood response. The development is classified 'partially flood effected – Rising Access Area' in both the 1% AEP and PMF storm event. In the very unlikely worst-case scenario where a PMF storm event occurs and persons are still at the construction site, persons can walk at a continually rising grade to the emergency assembly area. From review of rate of rise and flood duration data for downstream data points and in consideration of the nature of flooding at the subject location it is considered that persons can traffic the gentle continually rising grade at rate in excess of the rate of rise of the PMF storm event.

3.5 Emergency Response Philosophy

This CFEMSP recognises that protection of life is of critical and utmost importance. In order of importance, the protection of all lives takes priority, with the comfort of employees and contractors second and the protection of the property is third.

Under the Flood Emergency Response Planning Classification of Communities (part of the Floodplain Risk Management Guidelines) the emergency response planning (ERP) classification for each relevant flood event was classified as follows:

- 20-year and 100-year ARI storm event – **Partially flood effected – Rising Access Area**
- During the PMF storm event - **Partially flood effected – Rising Access Area**

As the requirement to evacuate as described in the Flood Emergency Response Planning Classification of Communities document is inexplicit, it is proposed that a core concept of the emergency response philosophy is to provide a tiered response which matches the constraint of the construction site and surroundings whilst responding to nature of flooding in region. The responses are shown in order of preferability starting from 1 (most preferred) to 3 (least preferred):

1. Pre-emptive closure of the site (day before): Ensure the employees and contractors working at the school are not present during major flood events in excess of the 1 in 100-year ARI flood event.
2. Early Closure of site (day of): Facilitate the early closure of site in the unlikely event major flood events occur without satisfactory notification to allow for closure of the site the day before.
3. Emergency evacuation: Ensure evacuation routes are available and assessable in the very unlikely event:
 - The construction site has not been closed during a sudden and unexpected flood event and employees are still working on-site.
 - The portions of the site which are located above the PMF flood level (the majority of the site) is considered dangerous and not suitable for refuge.
 - Medical emergency (or similar) may occur, and persons need to be evacuated.



4 Response

The response section of the report aims to present a response strategy for the employees and contractors of the proposed construction site that adheres to the governing local and regional flood plans and responds to unique flooding characteristics of the flood area. The response section will detail the three main responses strategies: pre-emptive closure of site, early closure of site and emergency evacuation.

4.1 Pre-emptive Closure of Site (Day Before)

The primary response strategy, site closure, is simply to close the site when the instance of major flooding is likely. Employees and contractors working at the construction site will remain at home. If evacuation orders are provided by the SES, the employees, and contractors, with their families will be evacuated as per the procedures outlined in their regional and local flood plan.

The key to the site closure strategy is the timing of the dissemination of flooding information. If notification is received well advance of site operating hours or within sufficient time to disseminate information to its employees and contractors prior to leaving for work the strategy completely mitigates the scenario of evacuating persons during major flood events.

Considering the attention provided to a major flooding event of magnitude in excess of the 1 in 100-year ARI event it is understood the school site closure scenario could easily be implemented in nearly every major flood case. Additionally, due to the proceeding extreme rainfall and extreme winds brought by storm events in excess of the 1 in 100-year ARI storm event it is very likely the site would not safely proceed with construction activities and would be closed regardless.

4.2 Early Closure of Site (Day of)

In the unlikely event the Pre-emptive Closure of Site response strategy cannot be facilitated the Early Closure of Site response strategy will be enabled. The Early Closure of Site strategy, in summary, is dismissal of employees and contractors from the site in an orderly manner via predetermined evacuation routes that may or not be active at the time of closure. Similarly, with the Pre-emptive Closure of Site response the employees will be returned home and evacuated with their families, if required.

Given the regional stage of the response and to the discretion of the SES regional commander employees and contractors will be allowed to return home (or beyond the floodplain) via their vehicles, pedestrian route, and access public transport. However, given the likely disruption to the transportation network due to earlier flood impacts, it is likely the route from the Allambie Heights region will be closely monitored by the SES. As employees and contractors leave the site, they will be cross referenced against the sign in' register to confirm no employees or contractors remain on- site. The Flood Warden (discussed in subsequent chapters) should remain onsite until all employees and contractors present have been dismissed.

4.3 Emergency Evacuation

The following response strategy, emergency evacuation, is very unlikely and is proposed under the assumption:

1. Adequate response time was not provided to pre-emptively close the site.
2. Adequate response time was not provided to close the site and safely dismiss employees and contractors on the day of the flood event.
3. The construction site has not been closed during a sudden and unexpected flood event and employees are still working on-site.



4. The portions of the site which are located above the PMF flood level (the majority of the site) is considered dangerous and not suitable for refuge.
5. Medical emergency (or similar) may occur, and persons need to be evacuated.

The emergency evacuation strategy will consider possible routes of evacuation for pedestrians to local high ground within site and outside the extent of PMF flood plain.

The preferable mode evacuation strategy will need to consider up-to-date reporting on local conditions and constraints as well as available resources at the time of event. This decision and preference of evacuation strategy is further discussed below.

4.3.1 Evacuation to Local High ground

It is generally understood that flood management plans cannot wholly rely on the provision of transport from the SES or other authorities during extreme events. Additionally, the evacuation plan cannot wholly rely on the provision and use of transportation vehicles that will be required to traverse floodwaters to access the development. If necessary, and failing the implementation of earlier preferred strategies, evacuees can follow an evacuation route to a proposed refuge point.

Under the direction of the SES (or other emergency authorities), employees and contractors will assemble in the emergency assembly zone. Ideally the assembly zone will be located with a continually rising grade from the areas of the site affected by flooding in the PMF flood event. A suggested assembly zone is located in the location of the future Block A at the corner of Allambie Road refer figure 3. At this location employees and contractors present will be cross-referenced against the 'sign-in' register to ensure all are present. Following confirmation everyone is accounted for, employees and contractors will walk the short evacuation route to the proposed evacuation center/shelter (or neighboring evacuation shelter) as determined by SES). Once the evacuation strategy is activated it will likely be very late into the flood event, and as such employees and contracts should not try and drive home as floodwaters may be encountered.

The proposed evacuation route for the development considering its location within the Manly Lagoon is to the east. Since mainstream flooding is encroaching on the site from the north, and is travelling south to Manly Dam, the evacuation route will take occupants and employees generally in a north-easterly direction to the nearest accessible area with sufficient space to cater to the number of pedestrians that is outside of the PMF flood extent. The evacuation/ refuge location is determined by the SES subject to flooding conditions and available resources, however as a fall back, a local public space beyond the PMF extent should be considered.

5 Decision on Response Strategy

Under regional and local state plans the decision on and implementation of the response strategy (excluding evacuation) will be managed by Adco project management team (Flood Warden) in consultation with and at the discretion of the State Emergency Service.

The preferable mode response strategy will need to consider up-to-date reporting on local conditions and constraints as well as available resources at the time of event. The information required to determine the route and method of the evacuation is readily accessible to the SES, as such having the SES coordinate the response strategy is supported. Understanding the decision on the preferred strategy will be controlled by the SES, the following section presents recommendations on the decision to evacuate based on the context of flooding in the area and in the response of the nature and needs of the employees and contractors of the school construction site.



As previously proposed the hierarchy of response strategies is a tiered response which increases in reactive effort and mobilisation as the imposing risk of the flood increases. The responses are shown in order of preferability starting from 1 (most preferred) to 3 (least preferred):

1. Pre-emptive Closure of Site (day before): Ensure the employees and contractors working at the school are not present during major flood events in excess of the 1 in 100-year ARI flood event.
2. Early Closure of site (day of): Facilitate the early closure of site in the unlikely event major flood events occur without satisfactory notification to allow for closure of the site the day before.
3. Emergency evacuation: Ensure evacuation routes are available and assessable in the very unlikely event the construction site has not been closed during a sudden and unexpected flood event and employees are still working on-site.

The preferred strategies listed above can now be evaluated in terms of reaction time from the conservative estimate:

1. Pre-emptive Closure of Site (day before): It is generally accepted upon activation of the datum time and emergency plans that sufficient information/forecasting is available to determine the magnitude and duration of the storm (especially larger storm events discussed in this flood report). Given the intensity of the storm event it is highly probable in most instances the site can be temporary closed from 'day-before' storm forecasting. Based on the information provided to the SES and available for Adco management team a decision can be made to close the site or not. Refer Chapter 8 for Dissemination of flood and storm warnings.
2. Early Closure of site (day of): Assuming forecasting on the severity of the storm have been updated and the construction site was not initially closed by the SES or Adco management the team may move to begin the early closure of the site. This is most likely to occur if start times and plan activation occurs during site construction hours or immediately preceding the start of work. Refer Chapter 8 for Dissemination of flood and storm warnings.
3. Emergency evacuation: Response times in relation to emergency evacuation, especially vehicular evacuation from the Upper South Creek Catchment is dependent on possible routes and different time scenarios. Given the site provides a continually rising grade to the proposed assembly area and later to potential refuge locations 100m to the west (Champagnat Park) suitable emergency evacuation routes beyond floodwaters are considered available and trafficable given flood times and durations.

5.1 Evacuation Warning & Order Delivery

The SES will advise the community of the requirements to evacuate. The SES will issue an Evacuation Warning when the intent of an SES Operations Controller is to warn the community of the need to prepare for a possible evacuation.

During the period where an evacuation warning has been issued, the Adco management team (Flood Warden) is to coordinate with the SES to prepare the employees and contractors to evacuate. The SES will issue an Evacuation Order when the intent of the SES Operations Controller is to instruct a community to immediately evacuate in response to an imminent threat.

Evacuation warnings will be disseminated via a wide variety of mediums including television and radio broadcasting, fax, internet, public announcements as well as warnings and updated distributed to media outlets and emergency services. Of particular interest to the development is the early warning network, which when subscribed will send alerts to mobile devices and door knocking teams.

Regarding door knocking teams, Sector Command Centres, where established, will distribute Evacuation Warnings and Orders via Emergency Service personnel in doorknock teams to areas under threat of inundation. Field teams conducting doorknocks will record and report back the following information to their Sector Commander: Addresses and locations of houses doorknocked and/or



evacuated, the number of occupants: details of support required (such as transport, medical evacuation).

5.2 Rescue

Flood rescue of people and domestic animals will generally be performed by NSW SES. NSW SES may request other supporting accredited/authorized emergency services to undertake flood rescues on behalf of the NSW SES. This will be completed upon completion of a risk assessment which has verified acceptable risk to rescuers. Flood rescue operations will be conducted in accordance with the State Rescue Board Land Rescue Policy and the NSW State Rescue Board Flood Rescue Policy which sets out the framework, governance, responsibilities, and requirements for the management and conduct of flood rescue in NSW. Given the benign nature of flooding at the subject site, and the tiered response proposed, potential rescue is highly unlikely.

5.3 Return

Once it is considered safe to do so, the SES Local Controller will authorise the return of evacuees to their normal or alternative place of residence. The decision will be made in consultation with the Health Services Functional Area.

If the construction site is damaged by the flood and the building is unable to be worked in, employees and contractors are to remain off-site. The final decision to return to the construction site will be at the discretion of the Adco management team and will consider the following.

- Access to facility is to be confirmed.
- Sewerage systems and sanitation systems are functional.
- Suitable contamination testing is performed and confirmed safe.
- Plumbing, electrical and gas services are functional.

Cleaning and repairs are to be conducted as required depending on the extent of flood damage.

7 Dissemination Orders for SES flood information and warning

The Flood Warden (a designated member of the Adco management team) is required to monitor the Bureau of Meteorology for severe weather forecasts. Also, the State Emergency services, Northern Beaches Council and local radio should also be monitored and contacted if required.

The Flood Warden is required to subscribe to, or be aware of, the following warning products:

- Northern Beaches Emergency Sub Plan (April 2021)
- Severe Thunderstorm Warnings
- Regional Severe Thunderstorm Warnings
- Flood Watches
- Flood Warnings
- Local Flood Advice
- Flood Bulletins
- NSW SES Evacuation Warnings
- NSW SES Evacuation Orders



8 Awareness Training for Employees and Contractors

In order to coordinate the response to a flood event, a Flood Warden should be on duty at all times. The selection of these is at the discretion of management, however in the interest of interfacing emergency response plans, it would be ideal if the role of fire warden and flood wardens were undertaken by the same people. Two phases need to be undertaken to ensure the effective training of staff:

- Induction training
- Ongoing training/drills

Induction Training of All employees and contractors.

As part of work site induction training, awareness of the risk of flooding and control measures is essential. All employees and contractors should be aware of the following:

- Role of Flood Wardens as outlined in the Construction Flood Emergency Management Sub-Plan (CFEMSP).
- How to visually identify a dangerous water level onsite (or approaching the site) from the site office (which has a sight line to the lower reaches of the neighbouring drainage channel).
- Location of the assembly area and evacuation location.
- Their responsibilities in a flood situation.
- Emergency supplies required to be kept onsite in the assembly area at all times.

Induction Training of Flood Wardens

In addition to the general employee induction, the nominated flood wardens need training in the following areas.

- Emergency management policies in the Northern Beaches Council LGA
- Knowledge of flood warning products (listed above).
- Safe operation procedure of evacuation.

Ongoing Training of All employees

- The Flood Warden is to brief the project team yearly on the flood emergency procedures.
- Half Yearly Flood Response procedure review to be completed by project team.
- Updates to flood levels as they become available.
- Safety observations to be raised as part of monthly OH & S review.

Ongoing Training of Flood Warden

Formal training / refreshers for Wardens shall be undertaken at least once per year.

- Updates of emergency management policies in Northern Beaches Council LGA as they become available.
- Knowledge of flood warning products (listed above).
- Safe operation procedure of the evacuation.
- Discussion of safety observations that are raised as part of monthly OH & S review.

9 Responses to State Significant Development Consent Conditions

This section of the report has been provided to demonstrate how the Construction Flood Emergency Management Sub-Plan demonstrates adherence with the development consent conditions provided by Minister for Planning and Public Spaces (ref. SSD 26876801). Relevant condition, condition B21, is provided below in black with responses provided by the Author of the report in blue:

The Construction Flood Emergency Management Sub-Plan (CFEMSP) must address, but not be limited to, the following:



(a) be prepared by a suitably qualified and experienced person(s)

The Construction Flood Emergency Management Sub-Plan has been prepared by Matthew Mishevski, a civil engineer for Henry & Hymas nearly 3 years of experience in the industry specifically including the preparation of Construction Flood Emergency Management Sub-Plan (CFEMSP) for previous SSDA developments (e.g., SSD 41306367). The plan has been reviewed and approved by Andrew Francis, Director of the Civil department within Henry & Hymas with over 25 years industry experience. Team CVs are included in Appendix F.

(b) address the provisions of the *Floodplain Risk Management Guidelines* (EHG);

Following the recommendations of Flood Emergency Response Planning Classification Of Communities document (a part of the Floodplain Risk Management Guideline) an assessment of emergency response planning (ERP) classification for the development in the 20-year, 100-year and PMF ARI storm events was undertaken. The assessment found the site during each of the flood events listed below held the following flood ERP Classifications:

20-year ARI and 100-year ARI storm event – **Partially flood effected – Rising Access Area**

During the PMF storm event - **Partially flood effected – Rising Access Area**

Based on the flood ERP Classifications provided by the of Flood Emergency Response Planning Classification Of communities document and recommendations of other Floodplain Risk Management Guidelines the Flood Emergency Response Sub-Plan was formed and is presented.

Classifications are made in Chapter 3.2.

(c) include details of:

i) the flood emergency responses for the construction phases of the development.

Flood emergency responses for the construction phases of the development are provided in Chapter 4 & 5.

ii) predicted flood levels;

Predicted flood levels for all relevant storm events are presented in Chapter 3.1.

iii) flood warning time and flood notification;

Flood warning times and flood notification are presented in Chapters 3, 7 & 8.

iv) assembly points and evacuation routes;

Details of assembly points and evacuation routes are provided in Chapters 2 & 5.3.1.

v) evacuation and refuge protocols; and

Details of evacuation and refuge protocols are provided in Chapters 5, 6 and 7.

vi) awareness training for employees and contractors and users/visitors.

Details of awareness training for employees and contractors are provided in Chapter 9.



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10 List of Appendices

- Appendix A – Northern Beaches Council Water Management for Developments Policy – Flood Mapping
- Appendix B – Construction Site Management Plans
- Appendix C – Architectural site plan dated, December 2022, Prepared by Architectus
- Appendix D – Site plans 231123_CC_C101 - 231123_CC_C104, dated September 2023 prepared by Henry & Hymas Engineers.
- Appendix E – Relevant Mapping from Enstruct: Civil Engineering SSDA Report
- Appendix F - CV – Andrew Francis and Matthew Mishevski



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**Appendix A – Northern Beaches Council Water Management for Developments
Policy – Flood Mapping**

10.0 Flood Risk Management

Council manages flood prone land in accordance with the Flood Risk Management Process as outlined in the NSW Government Floodplain Development Manual, 2005 with the aim of producing Floodplain Risk Management Plans for the Northern Beaches LGA.

Through strategic and operational outcomes, Council aims to reduce the impact of flooding and reduce private and public losses resulting from floods.

10.1 Flood risk Management Objectives

The specific flood risk management objectives of this Policy are:

- a) To increase public awareness of the hazard and extent of land affected by all potential floods, including floods greater than the 1% AEP flood
- b) To ensure the flood risk associated with development is minimised
- c) To manage the risk to life, damage to property and impacts on the natural environment caused by flooding and inundation by controlling development on flood prone land
- d) To ensure the development is compatible with the flood risk through the application of risk-based controls that take into account social, economic, ecological and design considerations
- e) To ensure that proposed development does not expose existing development to increased risks associated with flooding
- f) To ensure that effective development controls apply so that development is carried out in accordance with these objectives and the requirements of this policy
- g) To ensure that the preparation of flood related information required to be lodged is carried out by suitably qualified professionals with appropriate expertise in the applicable areas of engineering.

10.2 Strategic Flood Risk Management Activities

Council undertakes both strategic and operational actions in the management of the floodplain. At the strategic level, Council undertakes the following actions.

10.2.1 Risk Assessment and Management

Council will identify, map and manage flood prone land in accordance with the Flood Risk Management Process. This involves undertaking Flood Studies, Floodplain Risk Management Studies and Floodplain Risk Management Plans with the aim of adopting and implementing plans for the entire LGA. Recommended floodplain management options will be investigated in detail and implemented in a priority order in accordance with available resources.

10.2.2 Land Use Planning

Council will maintain a framework of Local Environmental Plans and Development Control Plans to provide appropriate flood risk protection measures. The flood related development controls will contain provisions to manage the flood risk to both life and property. Planning proposals seeking to rezone land will be assessed in accordance with the NSW State Government's Ministerial Direction 9.1 – 4.3 Flood Prone Land and must demonstrate that the flood risk to future occupants and structures can be appropriately managed through the available legislative framework.

10.2.3 Combat Agencies

Communication and relationships with relevant combat agencies will be fostered and strengthened through the sharing of flood intelligence, establishment of partnership projects and informing the development of Local Flood Plans and other emergency incident management plans. Strategies for

improvement in incident response and shared incident response methodologies will be implemented where relevant.

10.2.4 Climate Change

The Northern Beaches is expected to be particularly affected by the impacts of climate change. Council recognises the importance of climate change adaptation and will investigate the impacts of climate change in flood risk projects in accordance with the best available data, science and policy. Changes to climate change policy or practice will be implemented on an iterative basis to reflect the current best advice/information.

10.2.5 Community Engagement

Council recognises the importance of community engagement in achieving good governance and well understood and accepted outcomes. Engagement on flood risk projects will be undertaken in accordance with the Northern Beaches Council Community Engagement Policy and Matrix. Public exhibitions of flood studies will be accompanied by opportunities to meet with staff on a personal level to discuss issues. Flood risk awareness through engagement is recognised as a strategic priority.

10.2.6 Flood Monitoring Program

Effective flood warning and response can reduce the impacts of flooding. Council operates a series of flood monitoring stations and a publicly accessible flood warning webpage known as the Northern Beaches Flood Information Network. Council proactively monitors weather and potential flooding conditions. Council will continue to investigate and implement improvements to the flood warning system to better prepare for and respond to flood events.

10.3 Operational Flood Risk Management Activities

At the strategic level, Council undertakes the following actions:

10.3.1 Risk Response

Council undertakes a number of risk response measures to reduce the impacts of flooding. This includes mechanically opening the entrances of Manly, Curl Curl, Dee Why and Narrabeen Lagoons at defined trigger levels. Council also maintains the water level of Manly Dam at 34.1m AHD to provide flood storage during severe storms.

10.3.2 Education

Council in conjunction with the NSW SES will prepare and implement education strategies to build community resilience to flood and coastal storms. Such strategies will improve the capacity of the Northern Beaches community to prepare, respond and recover from major flood and storm events and learn from their experiences to improve future preparedness.

10.3.3 Mitigation Works

Floodplain Risk Management Plans will investigate a range of floodplain management options to reduce the impacts of flooding in individual catchments. This may include property modification options such as development controls, voluntary purchase or voluntary house raising however often a Plan may recommend the delivery of flood mitigation works. Council will investigate and implement mitigation works in accordance with the Floodplain Risk Management Process and priority rankings. Council undertakes the Narrabeen Lagoon Entrance Clearance Works on a 3-5 year schedule to promote an increase in the duration in which Narrabeen Lagoon is open and to reduce the severity of flooding impacts.

10.3.4 Development Applications

Applications for development on flood prone land will be assessed according to the legislative framework of Local Environment Plans, Development Control Plans and any supporting

documentation including policies. Appropriate controls will be applied to ensure that future occupants of the floodplain are not subject to an unacceptable level of flood risk.

10.3.5 Planning Certificates

Question 7A of a Planning Certificate identifies whether flood related development controls apply to individual properties. Following the release of publicly available flood information, the answer to Question 7A will be amended to reflect whether flood related development controls now apply to subject properties. Part (5) Planning Certificates will be amended to reflect when flood studies are in progress but not yet adopted by Council.

10.3.6 Provision of Data to the Public

- a) A Flood Information Report is available from Council (refer Council's fees and charges).
- b) Council will provide the 1% AEP, FPL and PMF levels for a specific property where available.
- c) Flood level information may be subject to change in the future.
- d) For large-scale developments or developments in key flood areas, applicants may be requested to use Council's hydraulic model to assess the impacts. This would be applicable only for a development that is likely to cause a change in the flood regime or requires confirmation that it will create no impact on flooding for neighbouring properties. Hydraulic models are available from Council (refer Council's fees and charges) and recipients will be required to complete the appropriate Data Use Agreement.

11.0 Overland Flow Flooding

Overland flow differs from mainstream flooding from creeks or lagoons as they are usually generated from surface run off and overflows from kerbs and smaller pipes, to more serious overland flows involving exceedance in the capacity of major trunk drainage systems.

11.1 Identifying Overland Flows

To determine if the subject property is affected by overland flow, a Civil Engineer who is currently registered on the National Engineering Register (NER), should be engaged to investigate and verify whether the subject property is affected by overland flows during a 1% AEP even. [Council's Stormwater Planning Maps](#) may assist identifying Council drainage in the vicinity of the property.

11.2 Development on Land Subject to Overland Flows

- a) For development on properties subject to overland flow that has not been identified as being flood affected must comply with flood related development controls in the relevant planning instruments.
- b) Overland flow paths designed to contain a 1% AEP storm flow are to be provided over all pipelines that are not designed to cater for this flow. The design of the overland flow path must consider the velocity-depth hazard.
- c) An overland flow path shall be defined, and not impeded, even where the 1% AEP storm flows can be maintained within the underground-piped drainage system.
- d) Overland flow paths are to be kept free of obstruction and must not be landscaped with loose material that could be removed during a storm event, such as wood chip or pine bark.

11.3 Subdivisions on Lots Affected by Overland Flow

Proposed land subdivisions of lots affected by overland flow will not be approved unless the applicant can demonstrate that future development can comply with the requirements of the relevant planning instruments.

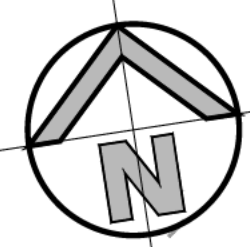
11.4 Piping Overland Flows

Developments proposing the collection and piping of overland flow through the subject property will generally not be permitted. Where an existing Council pipeline is to be diverted and/or upgraded, the design is to be in accordance with Section 6 of this Policy.

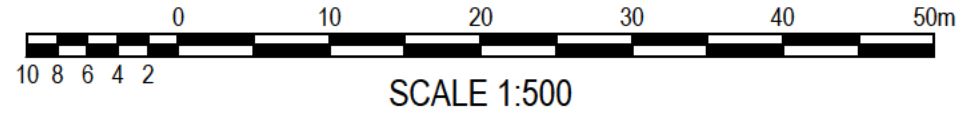
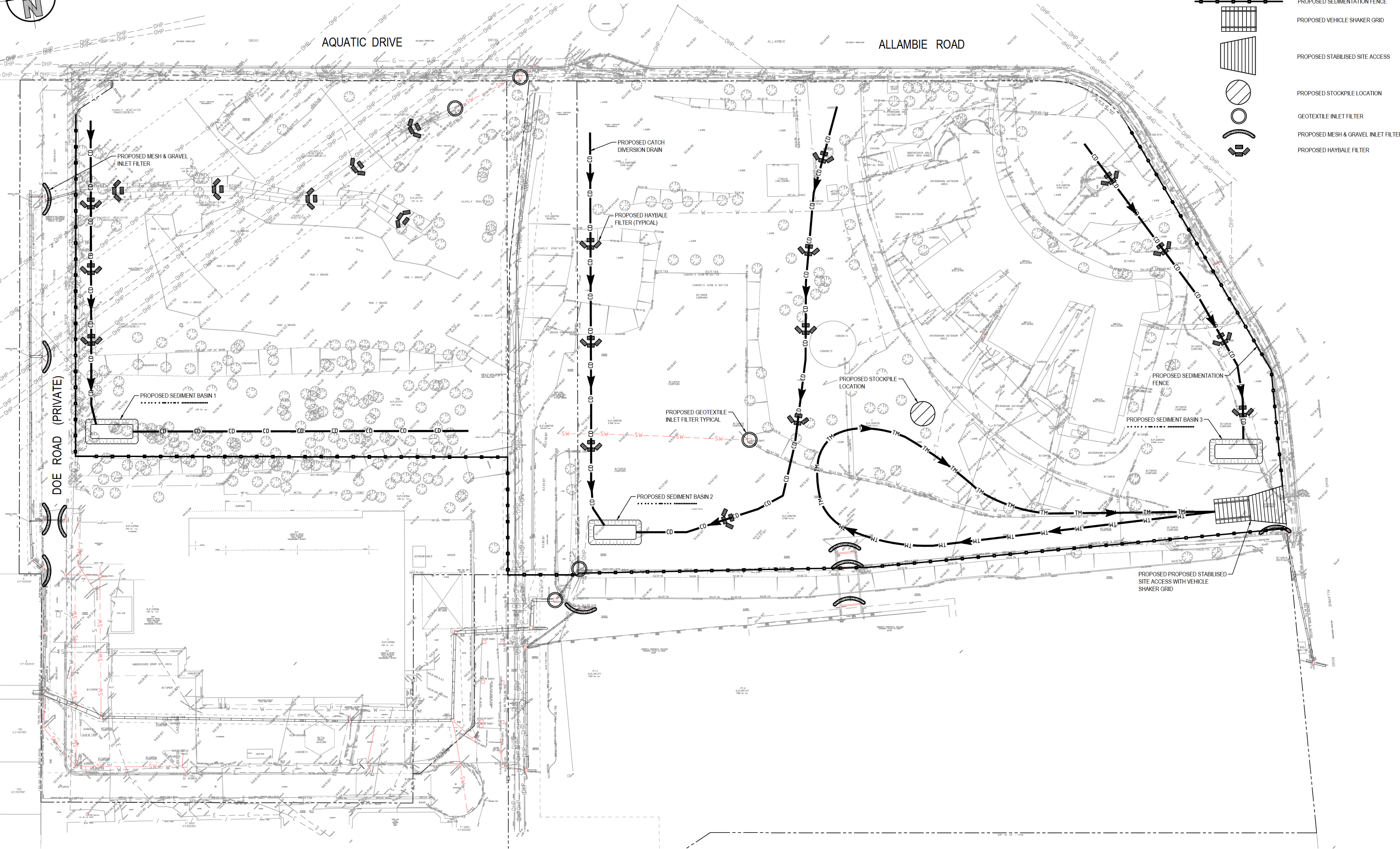


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Appendix B – Construction Site Management Plans





- LEGEND**
- CD → CATCH DIVERSION DRAIN
 - TM → TRAFFIC MANOEUVRING
 - PROPOSED SEDIMENTATION FENCE
 - PROPOSED VEHICLE SHAKER GRID
 - PROPOSED STABILISED SITE ACCESS
 - PROPOSED STOCKPILE LOCATION
 - GEOTEXTILE INLET FILTER
 - PROPOSED MESH & GRAVEL INLET FILTER
 - PROPOSED HAYBALE FILTER



SEDIMENT AND EROSION CONTOL PLAN
SCALE: 1:500

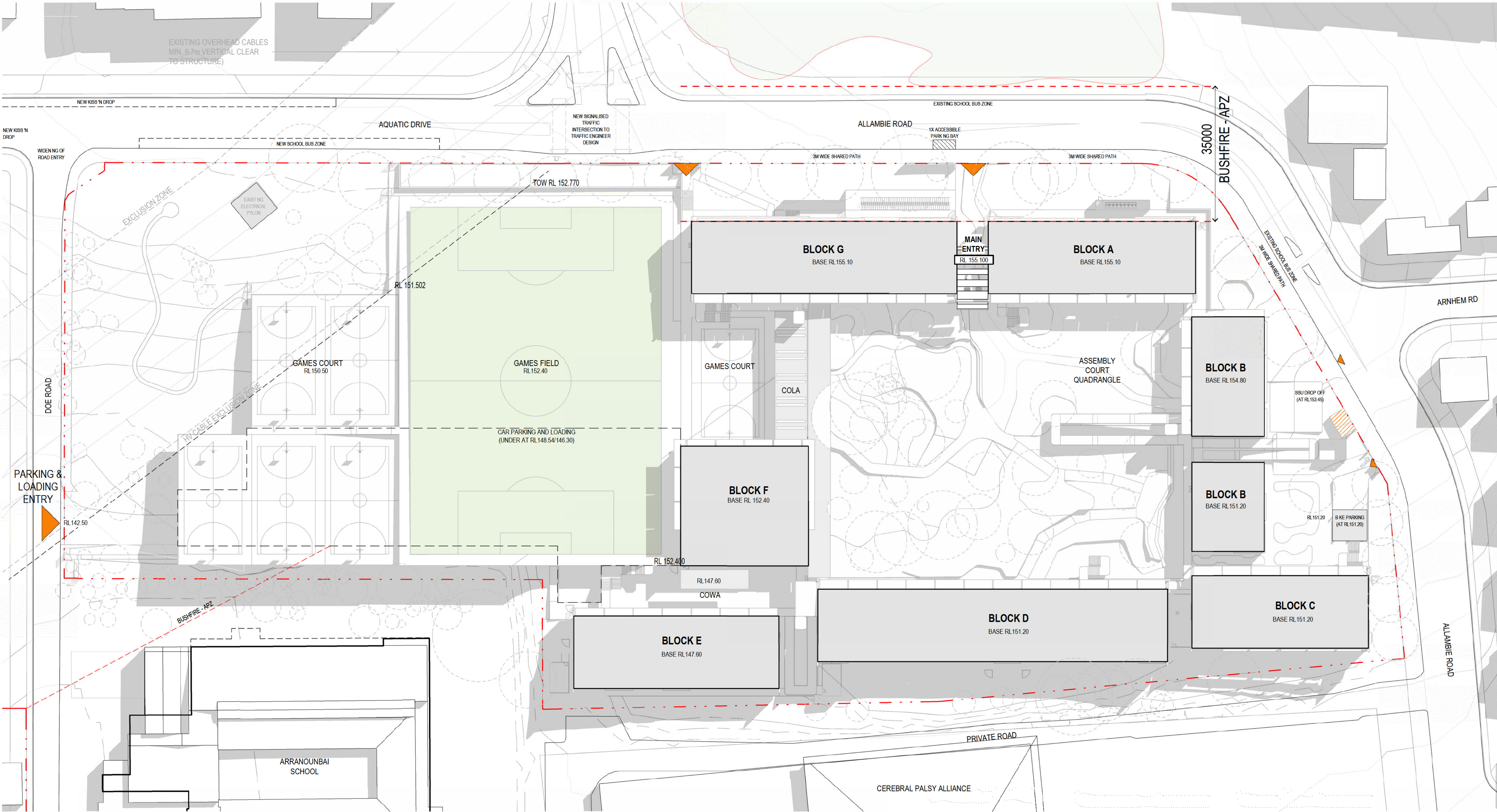
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Appendix C – Architectural site plan dated, December 2022, Prepared by Architectus



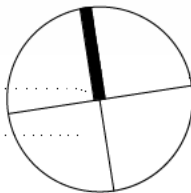
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Nominated Architect
Ray Brown, NSWARB 6359

Do not scale drawings. Verify all dimensions on site

issue	amendment	date
F	FOR INFORMATION	10/06/2022
G	FOR INFORMATION	17/06/2022
H	50% SCHEMATIC DESIGN ISSUE	01/07/2022
I	FOR INFORMATION	08/07/2022
J	60% SCHEMATIC DESIGN ISSUE	08/07/2022
K	70% SCHEMATIC DESIGN	15/07/2022
L	100% SCHEMATIC DESIGN	22/07/2022
M	FOR INFORMATION	26/07/2022
N	100% SCHEMATIC DESIGN - CONSULTANT COORDINATION ISSUE	29/07/2022
O	100% SCHEMATIC DESIGN - CONEXT PLANS	01/08/2022
P	100% SCHEMATIC DESIGN - REISSUE	05/08/2022
Q	SCHEMATIC DESIGN - ISSUE FOR TENDER	09/09/2022
R	SCHEMATIC DESIGN - ISSUE FOR TENDER - REVISION	13/09/2022



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checked SW scale 1 : 500@A1
drawn KG JL IT RW SW project no 200420.01

project THE FOREST HIGH SCHOOL

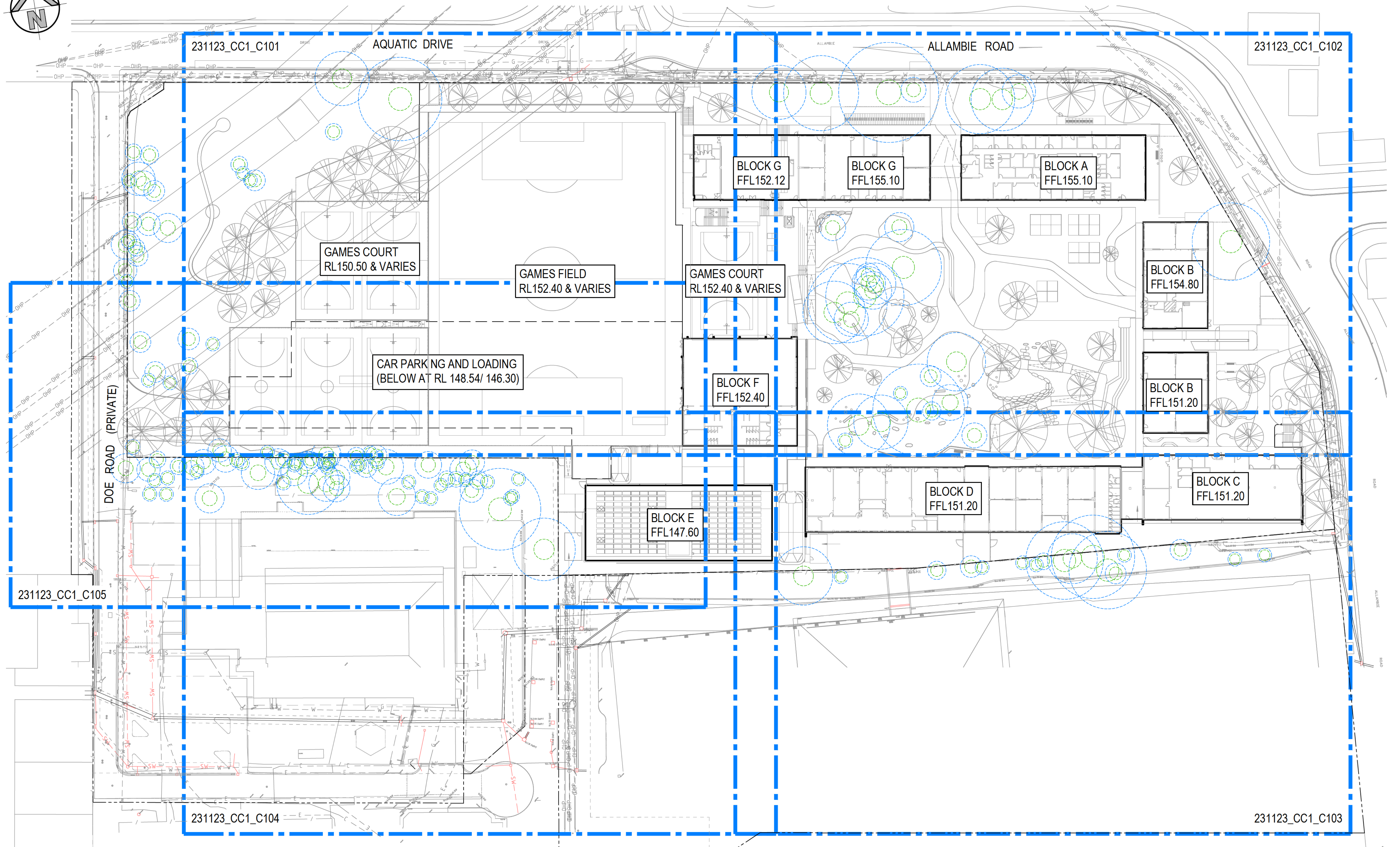
drawing CONTEXT PLAN - SITE PLAN

drawing no. SD-1001 issue R

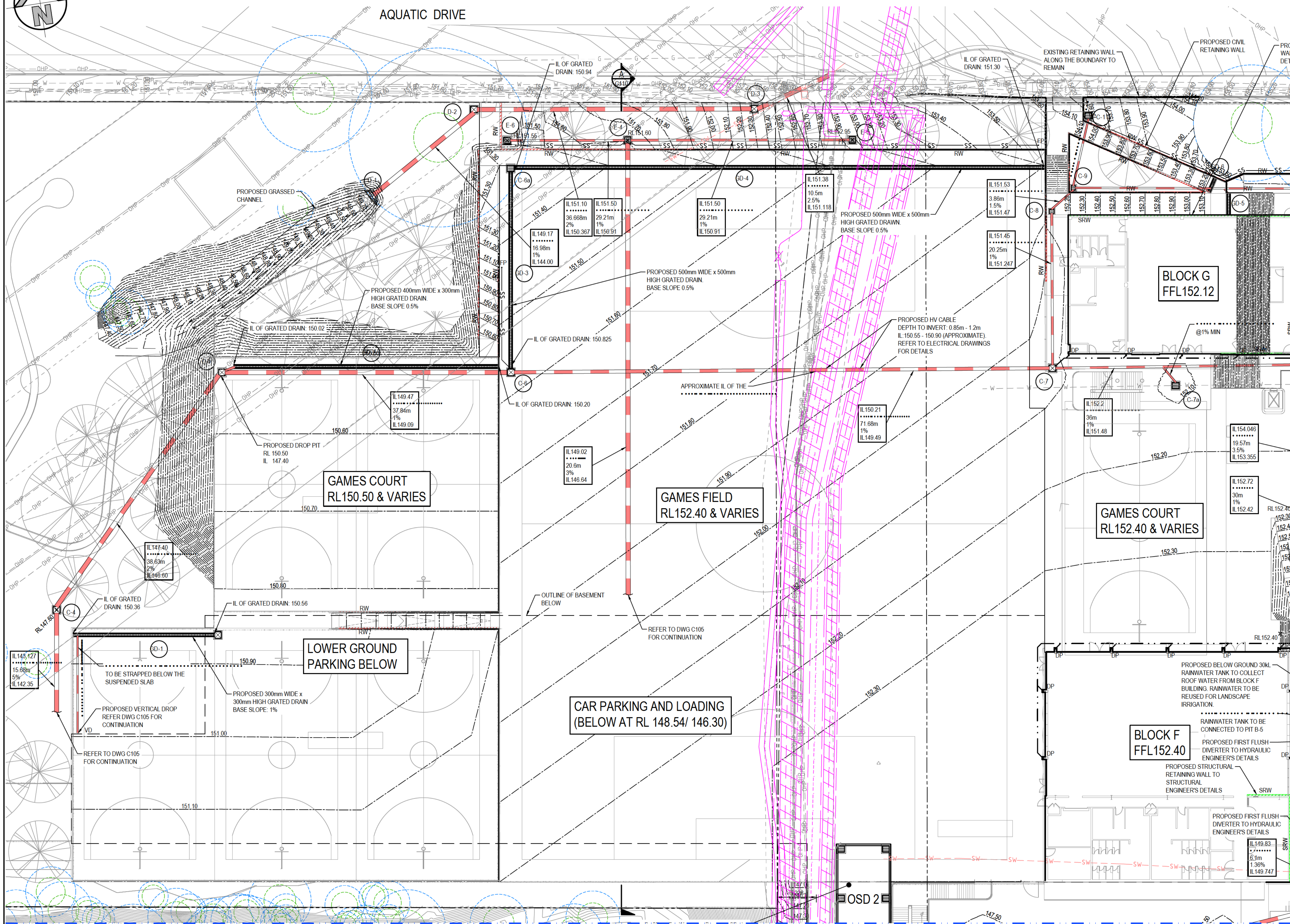


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Appendix D – Site plans 231123_CC_C101 - 231123_CC_C104, dated September 2023 prepared by Henry & Hymas Engineers.

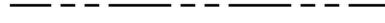




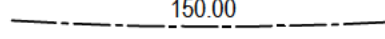
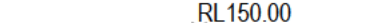


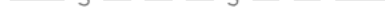






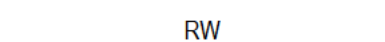
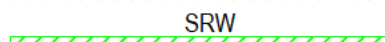










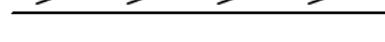



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DETAIL PLAN
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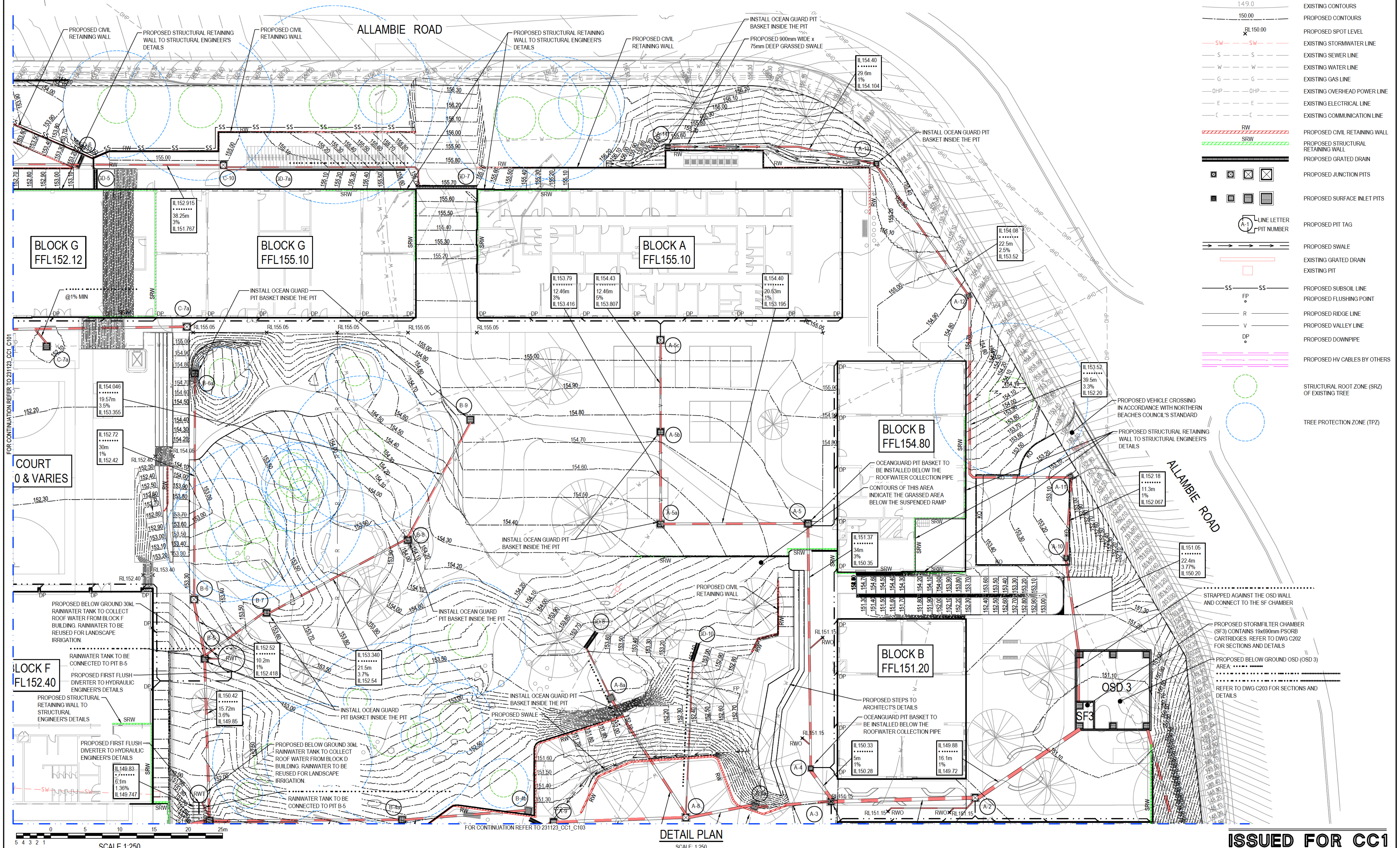
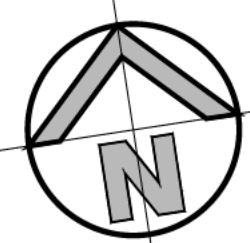
TO 231123_CC1_C104

	EXISTING BOUNDARY
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	EXISTING STORMWATER PIPE
	EXISTING CONTOURS
	PROPOSED CONTOURS
	PROPOSED SPOT LEVEL
	EXISTING STORMWATER LINE
	EXISTING SEWER LINE
	EXISTING WATER LINE
	EXISTING GAS LINE
	EXISTING OVERHEAD POWER LINE
	EXISTING ELECTRICAL LINE
	EXISTING COMMUNICATION LINE
	PROPOSED CIVIL RETAINING WALL
	PROPOSED STRUCTURAL RETAINING WALL
	PROPOSED GRATED DRAIN
	PROPOSED JUNCTION PITS
	PROPOSED SURFACE INLET PITS
	PROPOSED PIT TAG
	PROPOSED SWALE
	EXISTING GRATED DRAIN
	EXISTING PIT
	PROPOSED SUBSOIL LINE
	PROPOSED FLUSHING POINT
	PROPOSED RIDGE LINE
	PROPOSED VALLEY LINE
	PROPOSED DOWNPIPE
	PROPOSED HV CABLES BY OTHERS
	STRUCTURAL ROOT ZONE (SRZ) OF EXISTING TREE
	TREE PROTECTION ZONE (TPZ)

- SUBSOIL DRAINAGE PIPES BELOW THE GAMES FIELD TO BE CONNECTED TO THE NEAREST STORMWATER PIT.
- REFER TO HYDRAULIC DRAWINGS FOR DETAILS OF ROOF DRAINAGE AND DOWNPIPE RETICULATIONS.

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Drawing number	Revision
231123_CC1_C101	01



LEGEND

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- PROPOSED STORMWATER PIPE
- EXISTING STORMWATER PIPE
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- EXISTING CONTOURS
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- PROPOSED CONTOURS
- PROPOSED SPOT LEVEL
- EXISTING STORMWATER LINE
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- EXISTING GAS LINE
- EXISTING OVERHEAD POWER LINE
- EXISTING ELECTRICAL LINE
- EXISTING COMMUNICATION LINE
- PROPOSED CIVIL RETAINING WALL
- PROPOSED STRUCTURAL RETAINING WALL
- PROPOSED GRATED DRAIN
- PROPOSED JUNCTION PITS
- PROPOSED SURFACE INLET PITS
- PROPOSED PIT TAG
- PROPOSED SWALE
- EXISTING GRATED DRAIN
- EXISTING PIT
- PROPOSED SUBSOIL LINE
- PROPOSED FLUSHING POINT
- PROPOSED RIDGE LINE
- PROPOSED VALLEY LINE
- PROPOSED DOWNPIPE
- PROPOSED HV CABLES BY OTHERS
- STRUCTURAL ROOT ZONE (SRZ) OF EXISTING TREE
- TREE PROTECTION ZONE (TPZ)

ISSUED FOR CC1

SURVEY INFORMATION

SURVEYED BY
C.M.S. SURVEYORS
PTY LIMITED

DATUM: AHD

ORIGIN OF LEVELS: SSN 9185, RL 127 659

REVISION	AMENDMENT	DRAWN	DESIGNED	DATE	REVISION	AMENDMENT	DRAWN	DESIGNED	DATE
01	ISSUED FOR CC1	MP	FZ	06.10.2023					

Client
ADCO

Architect
ARCHITECTUS

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PRINTED IN COLOUR**



Project
**PROPOSED THE FOREST HIGH SCHOOL
187 ALLAMBIE ROAD, ALLAMBIE HEIGHTS, NSW**

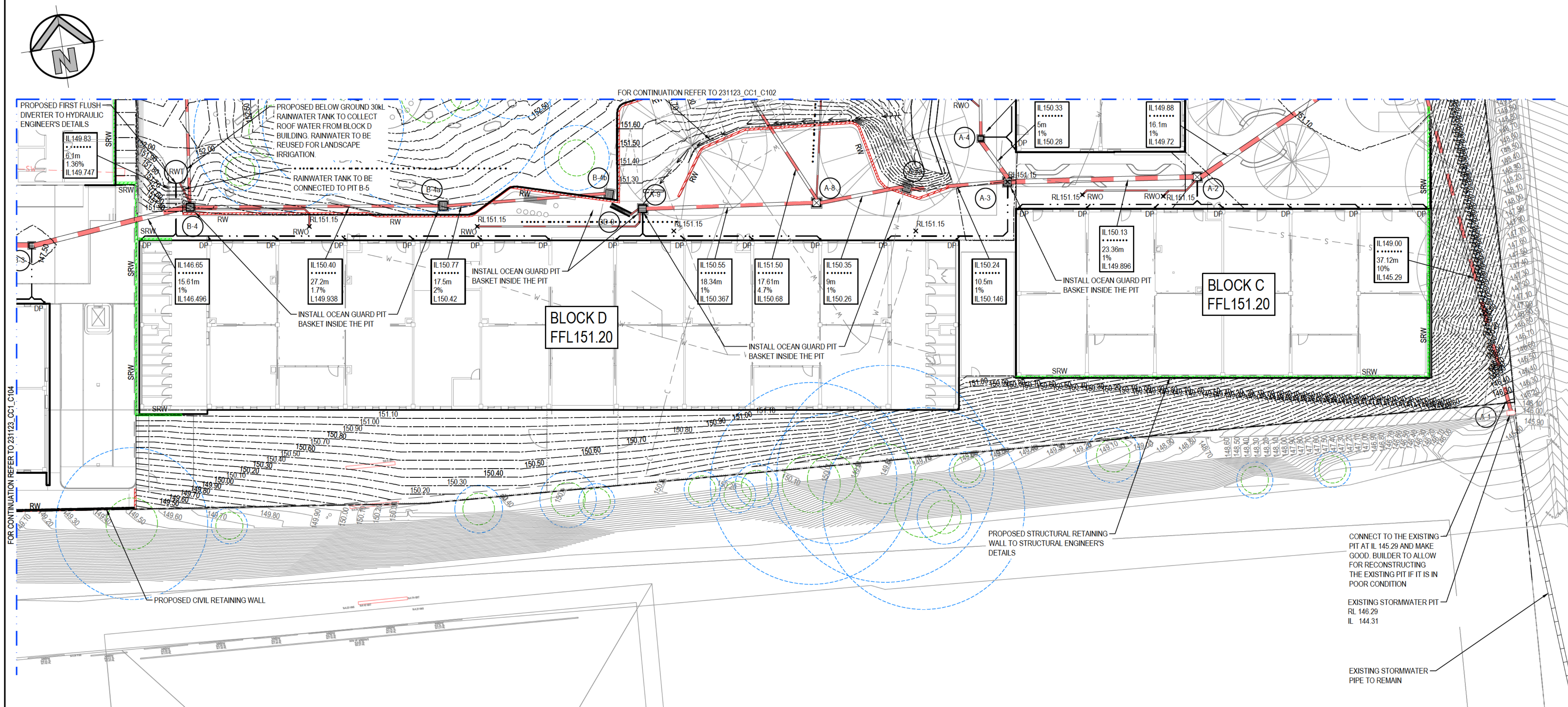
Title
DETAIL PLAN - SHEET 2 OF 4

Drawn M. Pereira	Designed B. Seizov	Original issue date JULY
Checked B. Seizov	Approved A. Francis	Scale @A1 1:250

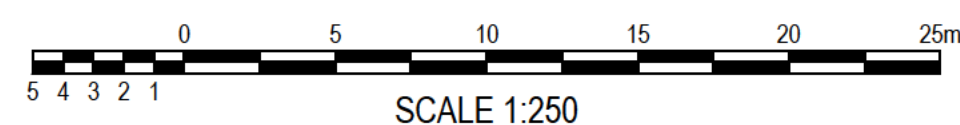
Drawing number
231123_CC1_C102

Revision
01

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	EXISTING CONTOURS
	PROPOSED CONTOURS
	PROPOSED SPOT LEVEL
	EXISTING STORMWATER LINE
	EXISTING SEWER LINE
	EXISTING WATER LINE
	EXISTING GAS LINE
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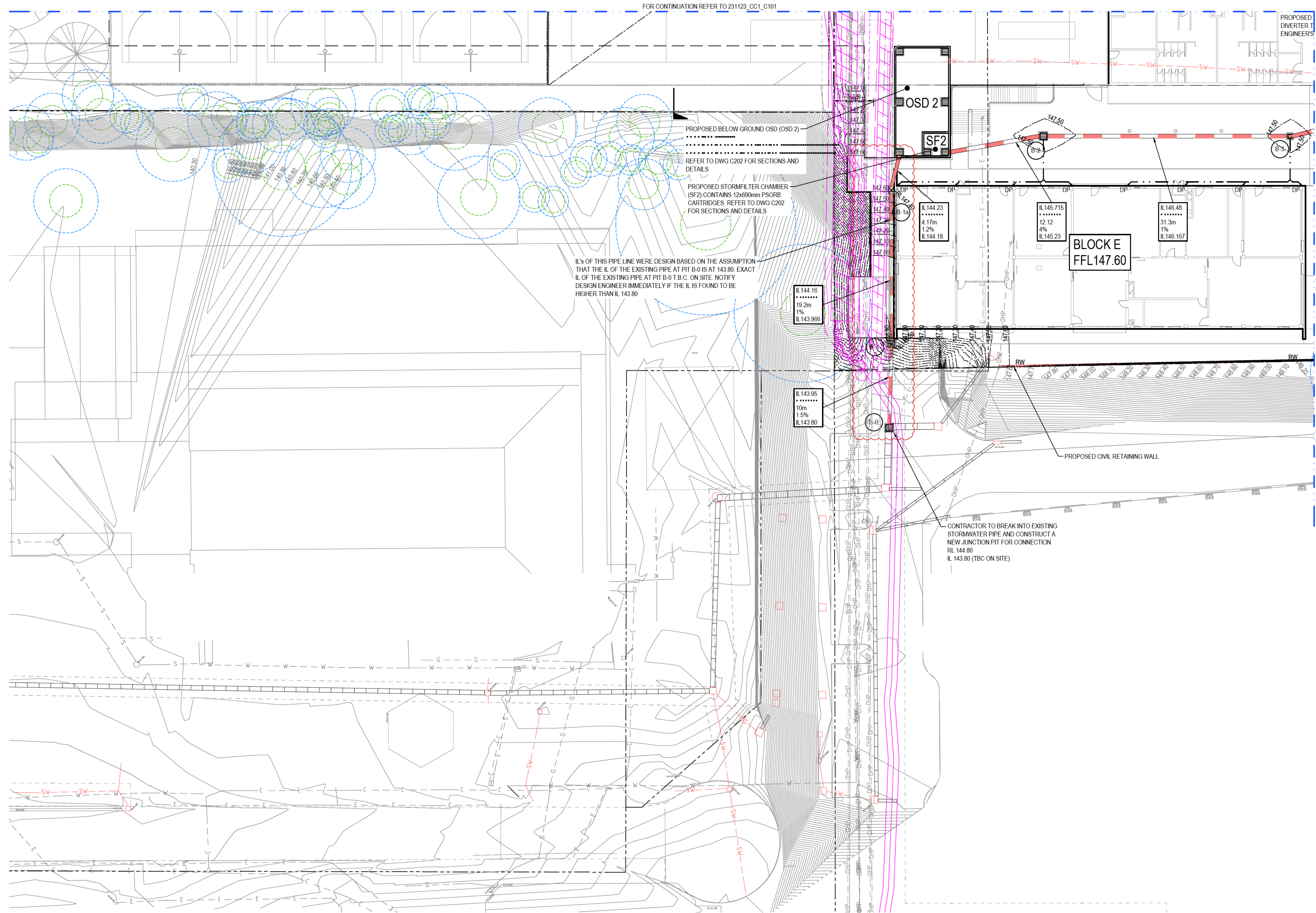
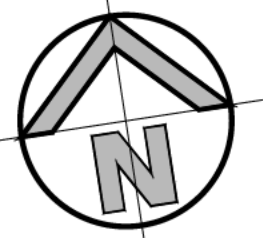


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 - EXISTING CONTOURS
 - PROPOSED CONTOURS
 - PROPOSED SPOT LEVEL
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 - PROPOSED HV CABLES BY OTHERS
 - STRUCTURAL ROOT ZONE (SRZ) OF EXISTING TREE
 - TREE PROTECTION ZONE (TPZ)

DETAIL PLAN
SCALE: 1:250

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SURVEY INFORMATION SURVEYED BY C.M.S. SURVEYOURS PTY LIMITED DATUM: AHD ORIGIN OF LEVELS: SSM 9185, RL 127.659				Client ADCO Architect ARCHITECTUS This drawing and design remains the property of Henry & Hymas and may not be copied in whole or in part without the prior written approval of Henry & Hymas.				Telephone +61 2 9417 8400 Facsimile +61 2 9417 8337 Email email@hbconsult.com.au Web www.henryandhymas.com.au DRAWING TO BE PRINTED IN COLOUR		Project PROPOSED THE FOREST HIGH SCHOOL 187 ALLAMBIE ROAD, ALLAMBIE HEIGHTS, NSW Title DETAIL PLAN - SHEET 4 OF 4	Drawn M.Pereira Checked B.Seizov Design B.Seizov Approved A.Francis Original issue date JULY Scale @A1 1:250	Revision 01
01	ISSUED FOR CC1	MP	FZ	06.10.2023				H&H Job No: 231123			231123_CC1_C104	
REVISION	AMENDMENT	DRAWN	DESIGNED	DATE	REVISION	AMENDMENT	DRAWN	DESIGNED	DATE			



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Appendix E – Relevant Mapping from Enstruct: Civil Engineering SSDA Report

4.6 Erosion and Sediment Control

During construction and while the site is disturbed, erosion prevention and sediment control measures are required. The erosion and sediment control plan has been designed to maintain the required performance standard defined by the project ecologist to guarantee the protection of the site downstream environment with specific attention to the Manly Creek downstream.

Erosion prevention generally involves managing stormwater by diverting overland flow around construction areas as well as collecting stormwater within the construction zone and directing to sediment control devices. Devices incorporated into the site erosion and sediment control design are silt removal fences, hay bales, catch drains, and water flow dissipation and discharge control devices such as sandbags, pollution mattresses, geotextile pit filters, and basins.

Erosion prevention and sediment removal strategies need to be inspected regularly during construction works, cleaned and maintained after storm events, and modified to suit construction work progress, decanting and demolition.

The erosion and sediment controls are designed in accordance with Managing Urban Stormwater: Soils and construction - Volume 1 and are to be maintained until the site is fully stabilised to prevent pollution of the receiving environment. The erosion and sediment control plan can be referred in **Appendix C**.

5 Flooding

In reference to *Item 14. Flood Risk Assessment* of the SSD-26876801 SEARs Matrix, and Northern Beaches Council advice being:

“Council has a flood study which indicates that there is some flood affectation on the site. The report indicates that the private road through Lot 11 and the entrance to the underground car park are affected by the 1% AEP flood event. Basement carparks need to be protected up to the Flood Planning Level (FPL) determined by the 1% AEP flood height, which generally means having the crest of entrances at or above the FPL. The main entrance is at the south-west corner, with overland flow coming from the north / north-east. Flood engineer shall do a flood investigation to ensure that the carpark is protected up to the FPL, and that building floor levels are at or above the PMF level as a school is Vulnerable Development.” the civil engineering design has been undertaken following review of existing flood studies, consideration of climate change impacts on the site, and the relevant provisions of the NSW Floodplain Development Manual.

The existing site currently has one disused two storey building in the north-eastern portion of the site, greenfield land to the west and north, and a hardstand carpark area to the south. A crib-lock and concrete retaining wall up to approximately 6m in height follows the southern boundary of the site.

An open channel traverses the north-western portion of the site (**Figure 4**) and connects to a stormwater pipe crossing the private road in Lot 11. The pipe crossing is connected to a trunk drainage line on the western side of the roadway in Lot11.

There are two embankments stepping down the site of approximately 3m in height each running parallel to Aquatic Drive in the western greenfield portion of the site.

In regard to the whole Manly Lagoon Catchment, the site is located towards the top of the catchment and grades from the north-eastern corner to the south-western corner. There is a level difference across the site from RL156.00 to RL141.00.

The NBC Water Management for Developments Policy does not identify the site as being flood prone due to the inland location of the campus (**Figure 15**). The school site is not within a Low, Medium or High Flood Risk Planning Precinct (**Figure 16**). The Medium Flood Risk Planning area represents the extent of the 1% AEP flood and hence, the site is not expected to be affected by any flooding in the 1% AEP storm event. However, minor flooding spots of 1% and 20% AEP flood extents can be seen in NBC Manly Lagoon Floodplain Risk Management Study and Plan (**Figure 17**).

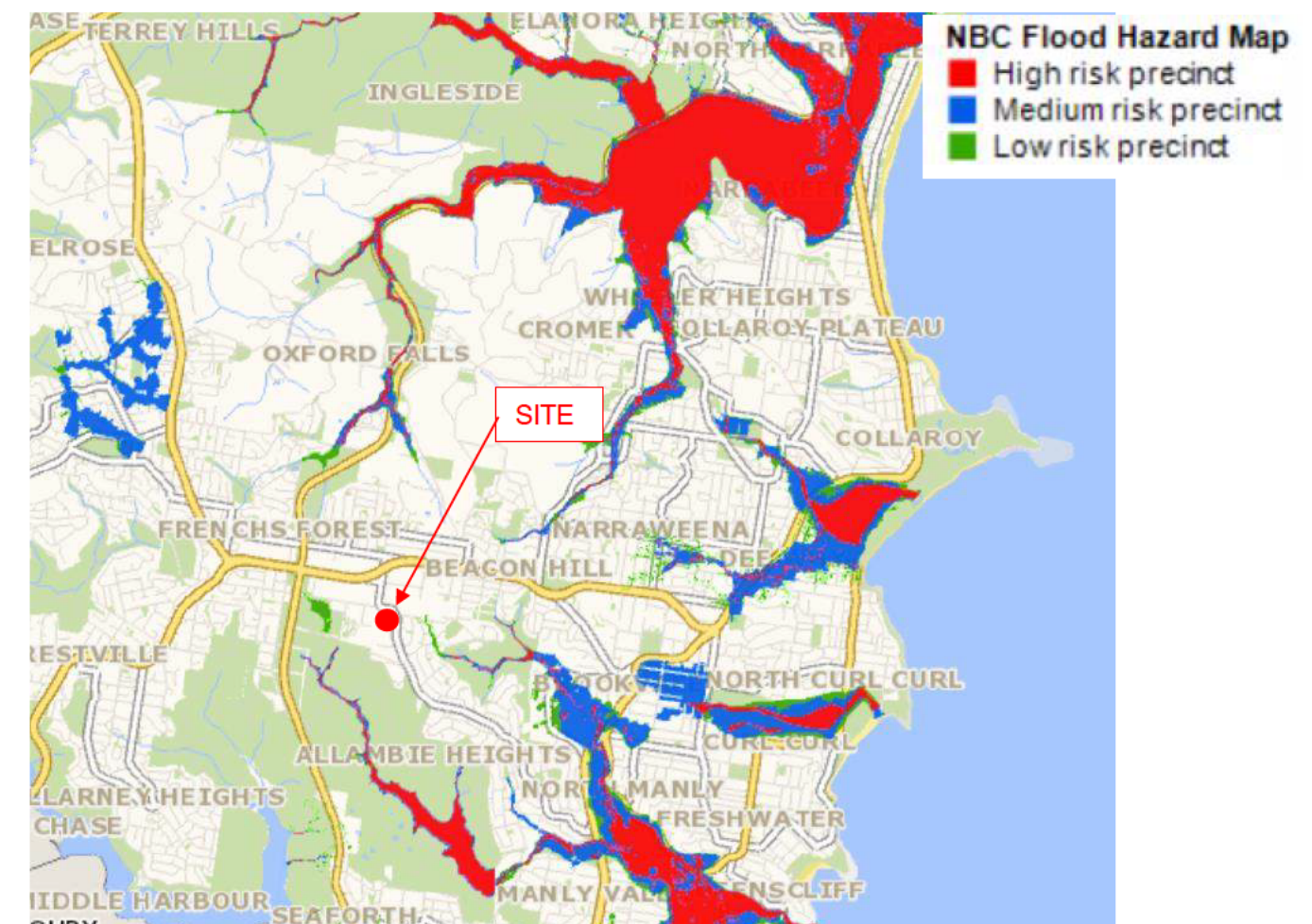


Figure 15: NBC Flood Hazard Map (Source: NBC Water Management for Developments Policy)

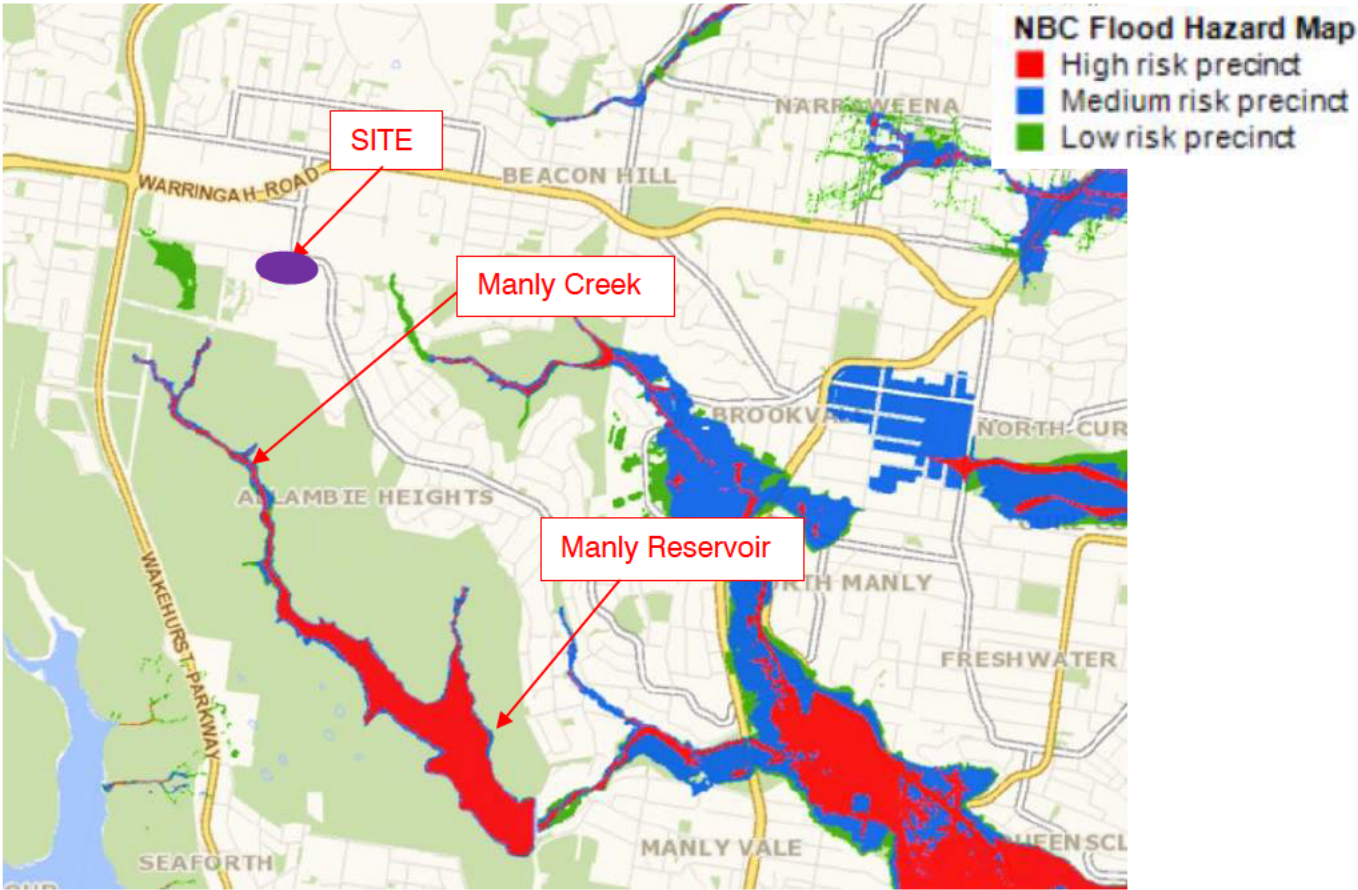


Figure 16: NBC Flood Hazard Map (Source: NBC Water Management for Developments Policy)

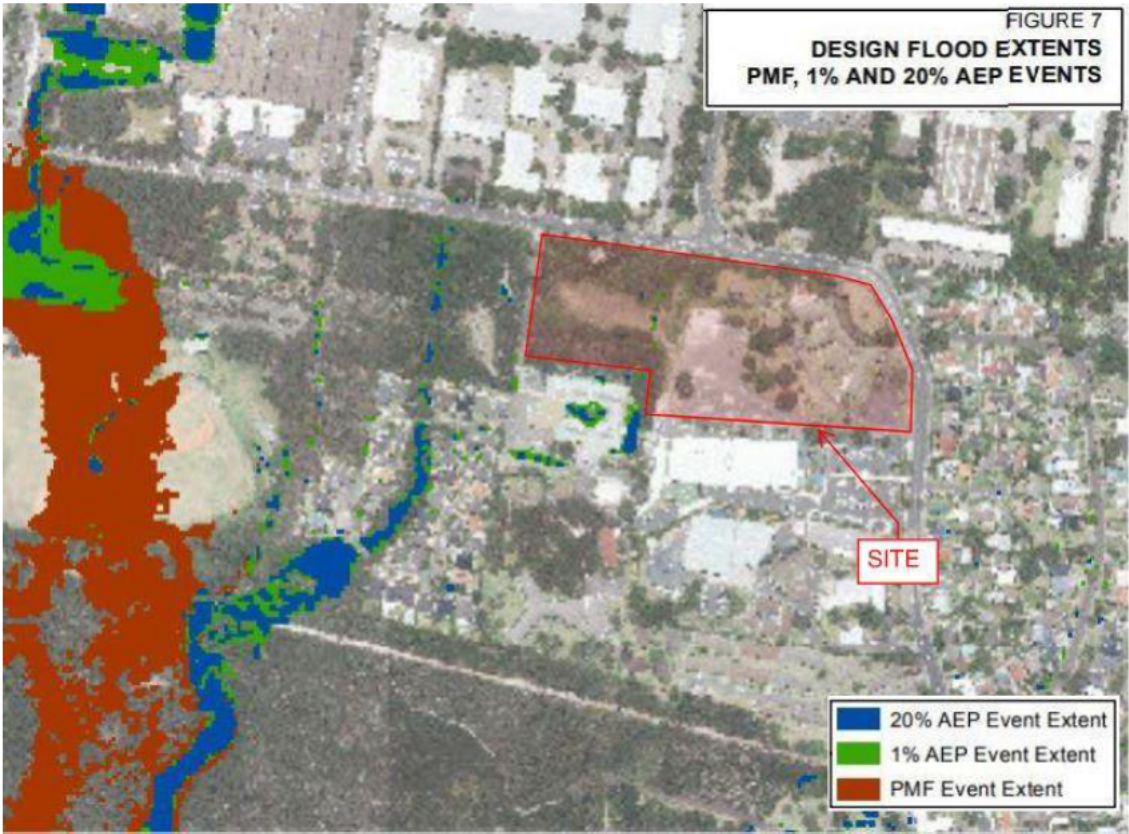


Figure 17: Extract from NBC Manly Lagoon Floodplain Risk Management Study and Plan

5.1 Flood Planning Levels

The NBC Water Management for Developments Policy requires any new development to provide suitable freeboard to habitable floor levels. The Council’s standard freeboard for habitable floor levels is 500mm above the 1% AEP storm event flood level. However, upon revision of Council’s DCP Section E11 Flood Prone Land, Table 1: Land Use Groups the school is a vulnerable development, where the building floor levels are the be set at or above the Probable Maximum Flood (PMF) flood level.

Table 6 provides the Flood Planning Levels, PMF and 1% AEP

Location	1% AEP	PMF	Proposed Building Level
A – WITHIN GAMES FIELD	RL 151.60	RL 151.80	BLOCK G – FFL 152.12
B – ADJACENT TO OPEN CHANNEL	RL 148.00	RL 149.40	GAMES COURT RL 150.50
C – ADJACENT TO DRIVEWAY ENTRY	RL 140.40	RL 143.40	CAR PARKING AT RL143.80
D – SITE OVERLAND FLOW ADJACENT TO BLOCK E	RL 147.40	RL 147.60	BLOCK E - FFL 147.60

Table 6 – Flood Planning Levels

From Table 6, the building floor levels are set at or above the PMF levels.

Refer to Sketch drawing SK-350 in **Appendix C** for the locations of the 1% AEP and PMF flood levels.

Following advice, during the Response to Submission (RtS) meeting, that Council has an unpublished Flood Management report indicating that overland flow from Council’s open channel flows into the site and eventually floods the downstream properties, enstruct undertook a flooding assessment. The flooding assessment was to ensure that the site does not cause a flooding impact to the downstream properties, such as Arranounbai School and along Madison Way. NBC’s DCP states that a flood impact is considered if the flood level is increased by more than 20mm in the 1% AEP and 50mm in the PMF. In order to undertake the flood assessment, enstruct obtained the NBC’s current Tuflow flood model (**Figure 18**), however, Council’s model covers a very large area, extending through the Manly Dam and down to the Manly Lagoon approximately 6km downstream of the site.

5.1.1 Tuflow Model Changes:

For enstruct to accurately model the existing and proposed flooding conditions at the site, the following alterations and additions were made to Council’s model:

- The model was trimmed to shorten run times to only cover the upper reach in which the proposed school is located,
- The surface model from the TUFLOW model was updated to include the field survey undertaken as part of this project,
- The model hydrology was re-worked to provide a more accurate understanding of pipe and overland flows in the catchment. The council model, while suitable for the larger

catchment area, did not apply model inflows in a manner that can accurately show local overland flow routes,

- The kerb along the Arranounbai School driveway is not represented well due the limitation of using a 2m model grid. This kerb was added to the model as a 150mm high barrier,
- Pipe network south of Arranounbai School, through the carpark, was added to the model (previously not in the model), and
- The proposed surface model was added to the proposed conditions surface model.



Figure 18: Existing Conditions Flood Map – Original Council Tuflow Model Output

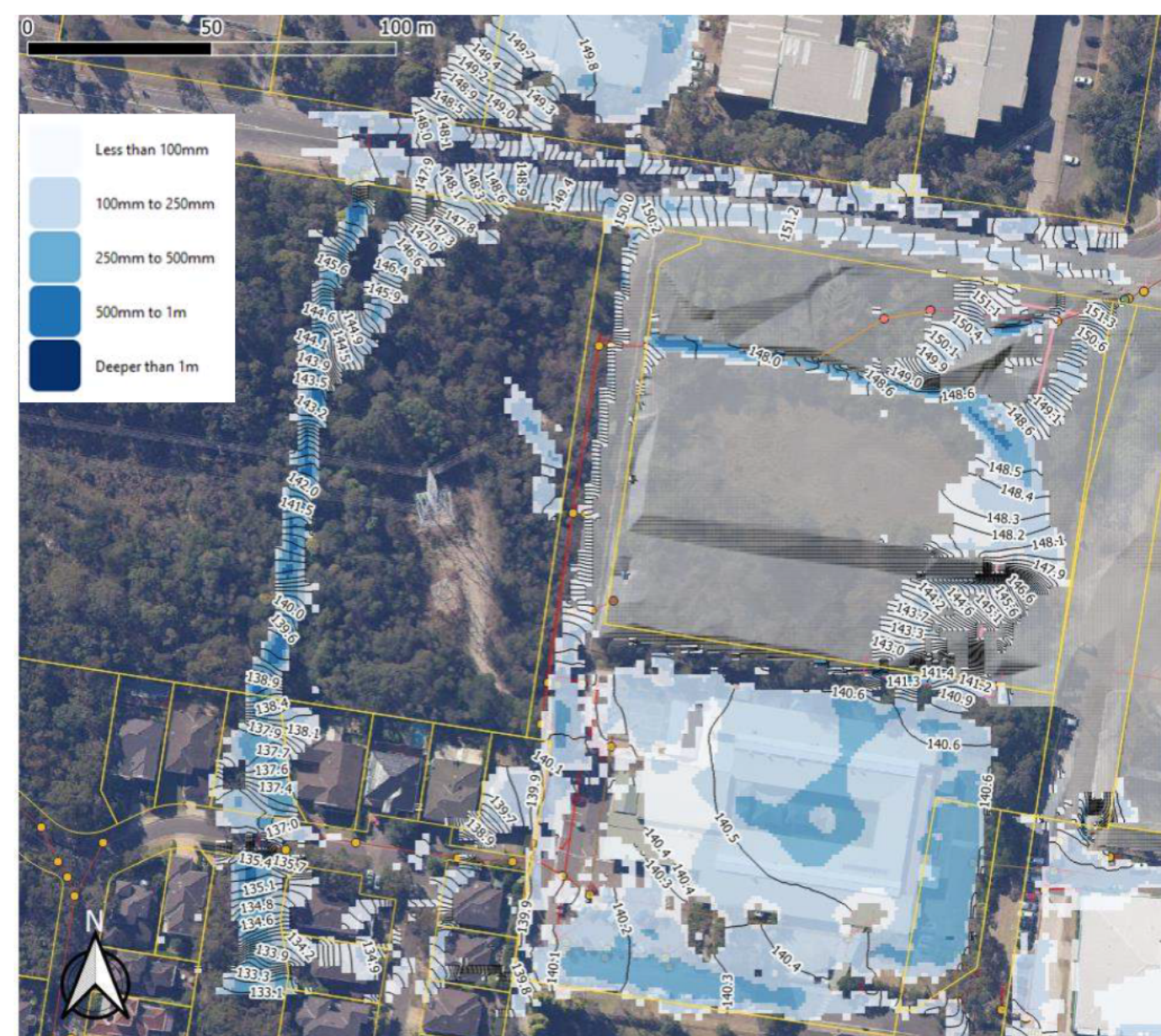


Figure 19: Existing Conditions 1% AEP Flood Map – With Revised Council Tuflow Model Output

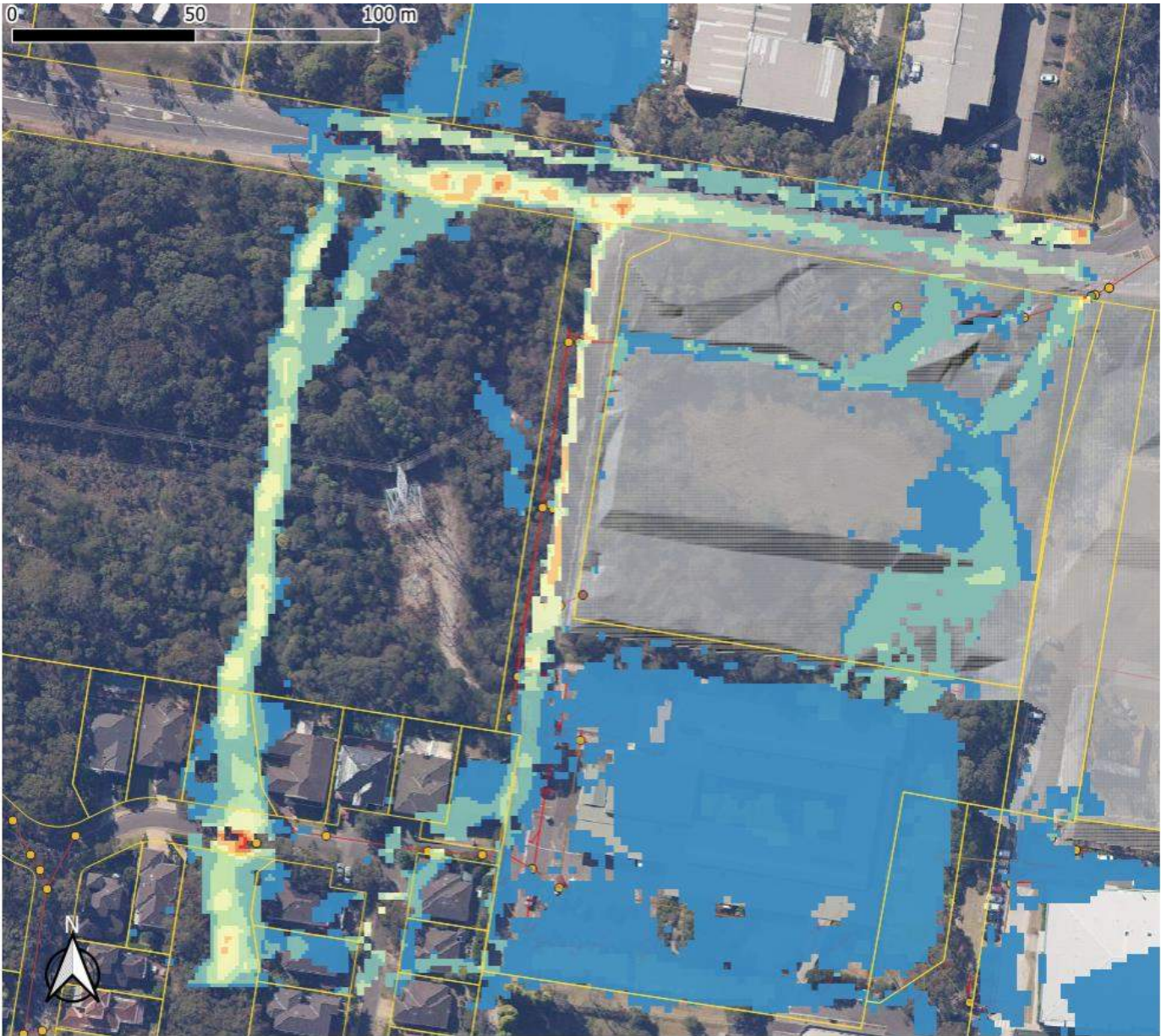
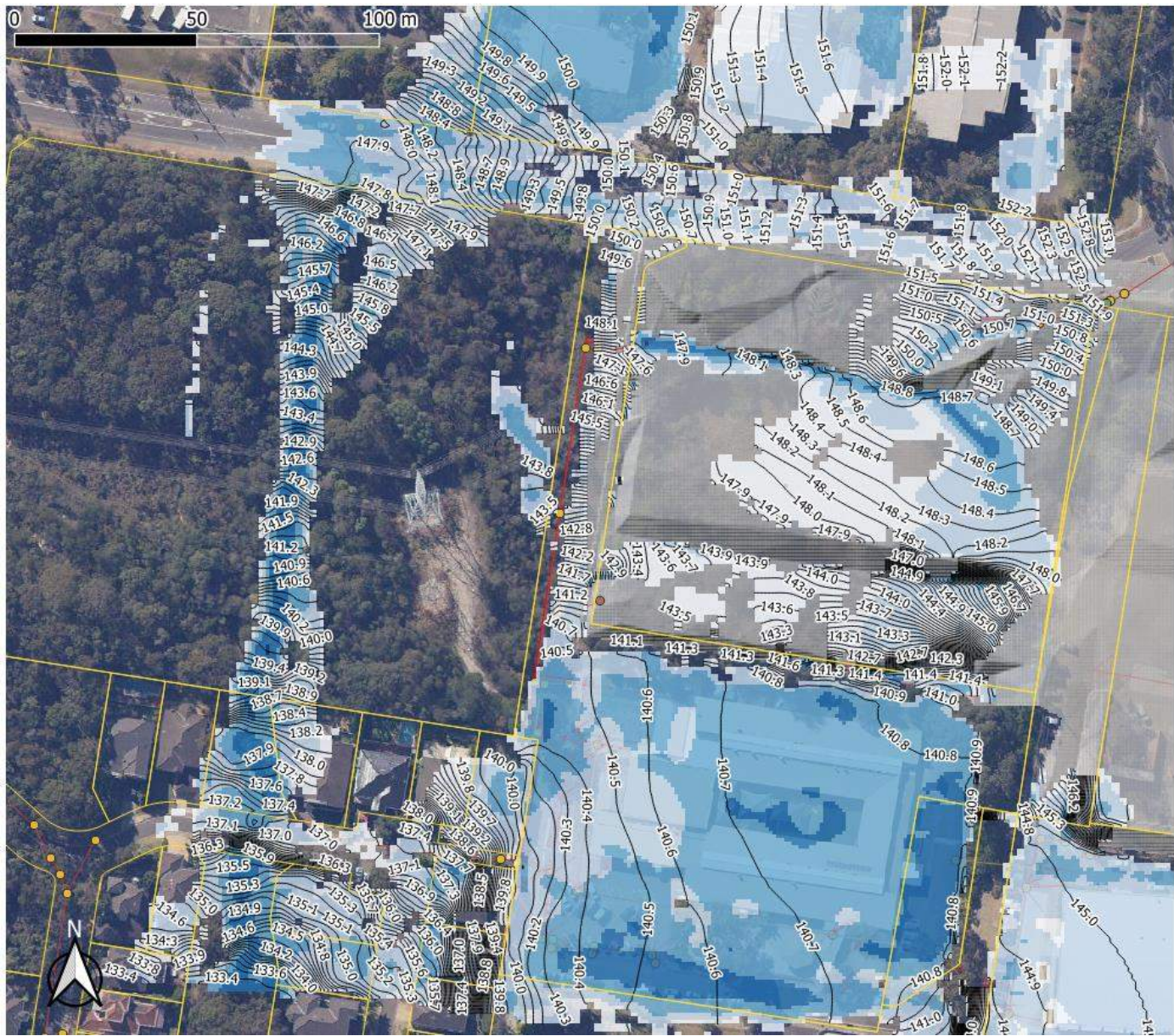


Figure 20: Existing Conditions PMF Flood Map – With Revised Council TufLOW Model Output

Figure 21: Existing Conditions 1% AEP Velocity Map – With Revised Council TufLOW Model Output

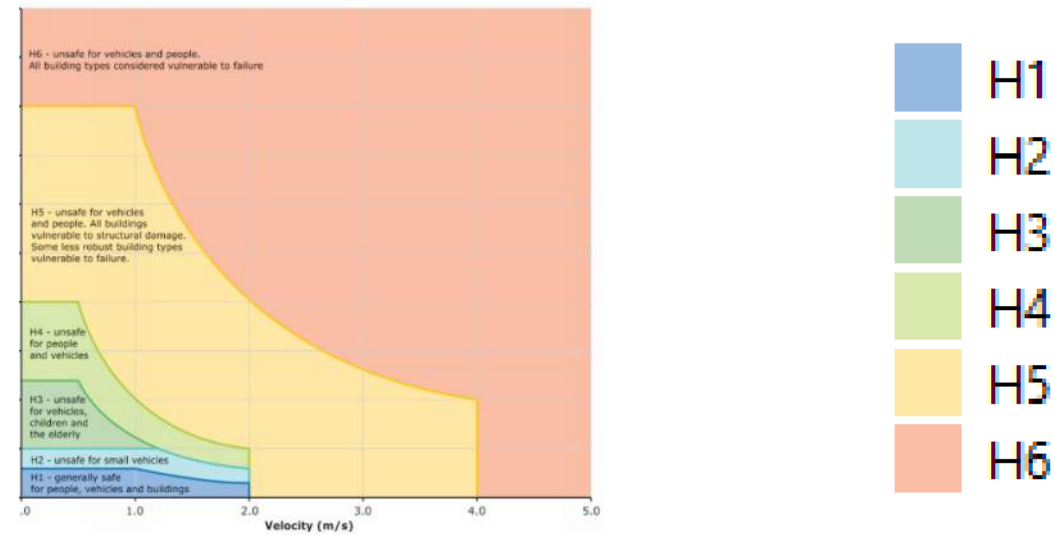
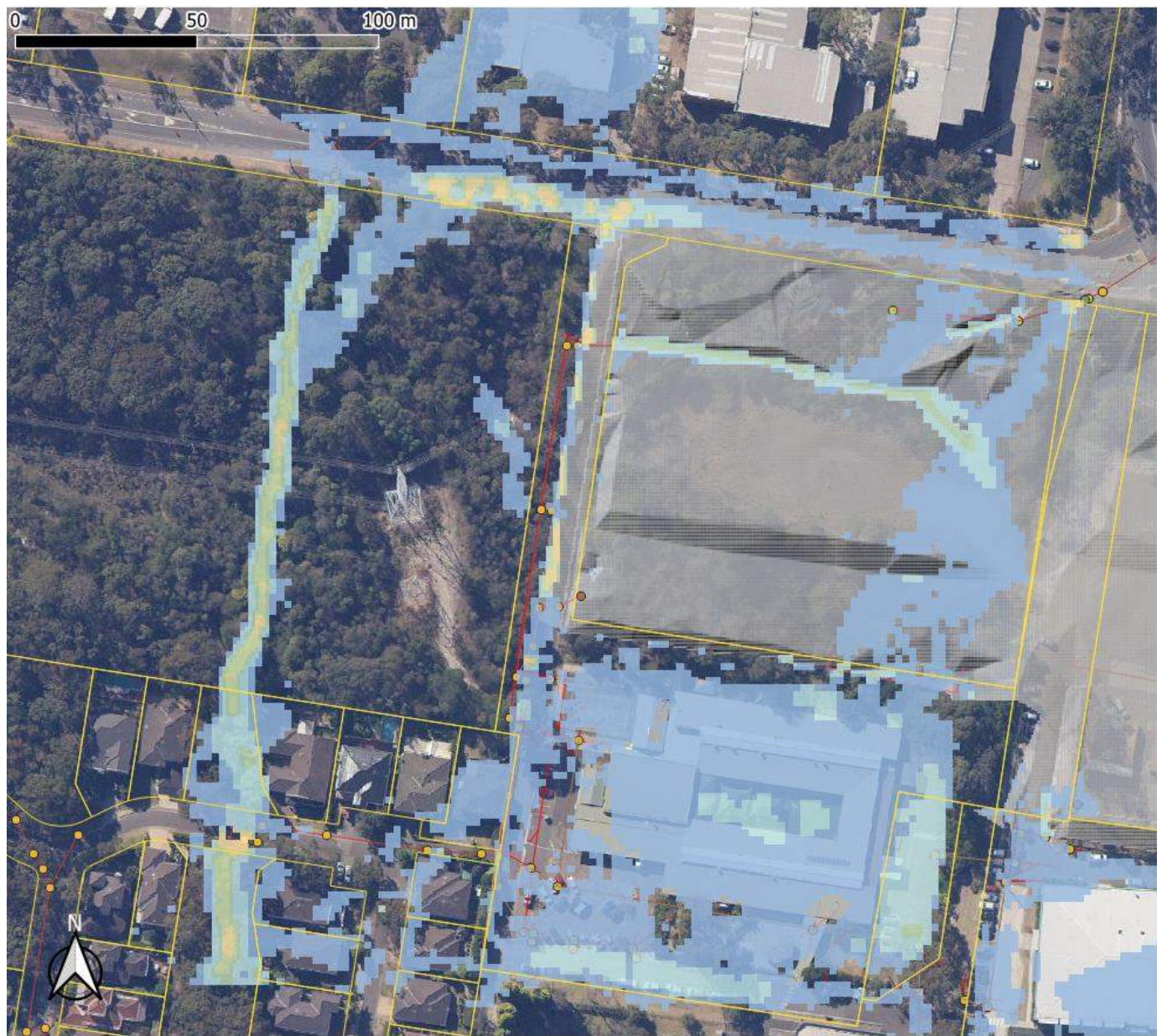


Figure 22: Existing Conditions 1% AEP Hazard Map – With Revised Council TufLOW Model Output

From the results of the existing conditions, it can be seen that the properties downstream of the site, including the Arranounbai School and Nos 29, 30, 32, 35, 37 and 39 Madison Way. The flooding of Arranounbai School is from overland flow from the site and based on NBC's DCP, the building floor levels should be set at or above the Probable Maximum Flood (PMF) flood level. For this to be accepted, it is assumed Arranounbai School has an Emergency Flood Evacuation Management Plan.

Property Nos 35, 37 and 39 Madison Way are impacted during the 1% AEP and PMF events due to overland flow from the Arranounbai School and entering their properties. Where properties Nos 29, 30 and 32 Madison Way are impacted during the 1% AEP and PMF events due to floodwater overtopping Council's Drainage Reserve and entering their properties. However, for residential properties, the FPL for the habitable rooms is 500mm above the 1% AEP and no requirement for PMF, therefore provided the FPL is met, Council has accepted flooding within the Madison Way properties.

In regard to Hazard Classification surrounding the development, Arranounbai School and Madison Way, the overland flow is travelling in places greater than 2.0m/s on Aquatic Drive and Arranounbai School Driveway. These conditions show that Aquatic Drive at the entrance to Arranounbai School and its driveway have a H5 classification, meaning it is unsafe for vehicles and people to pass through these waters. This would result in the new school needing an Emergency Flood Evacuation Management Plan to advise on how the staff and students are managed in the flood events.

5.1.2 Flood Mitigations

To demonstrate there is no flooding impact on the surrounding private properties, several flood mitigation measures were applied to the proposed TufLOW model and have been reflected in the adjusted design. These measures include:

- The 450mm diameter Aquatic Drive discharge pipe is extended and then routed through a new channel around the proposed school courts.
- The OSD basins for the proposed development were modelled in DRAINS, and the resultant outlet hydrographs included in the flood model to represent to post-development conditions.
- The level of the entry to the school driveway was raised by 100mm.
- Three grated inlet pits were introduced to capture any overland flow at the northern boundary when the Aquatic Drive discharge pipe is at capacity. The additional pits are linked to a new 600mm diameter pipe running south through the school to convey run-off in excess of Aquatic Drive pipe system's capacity. A level spreader weir is proposed at the pipe outlet set back from the boundary of the Arranounbai School to reduce the risks associated with a concentrated discharge point, such as erosion and localised ponding. The level spreader weir is fenced off from both Arranounbai School and proposed access way.
- The pipe network on the Arranounbai school driveway was increased from a 450mm diameter pipe to a 600mm diameter pipe. Like the discharge pipe from Aquatic Drive, this reduces the likelihood of pits surcharging.

- The proposed measures to control the flooding within the site provide an increase in safety to both the Arranounbai School with lower flood levels and residents in Madison Way

The measures above have been identified as part of the post RtS modelling and are illustrated in Figure 23.

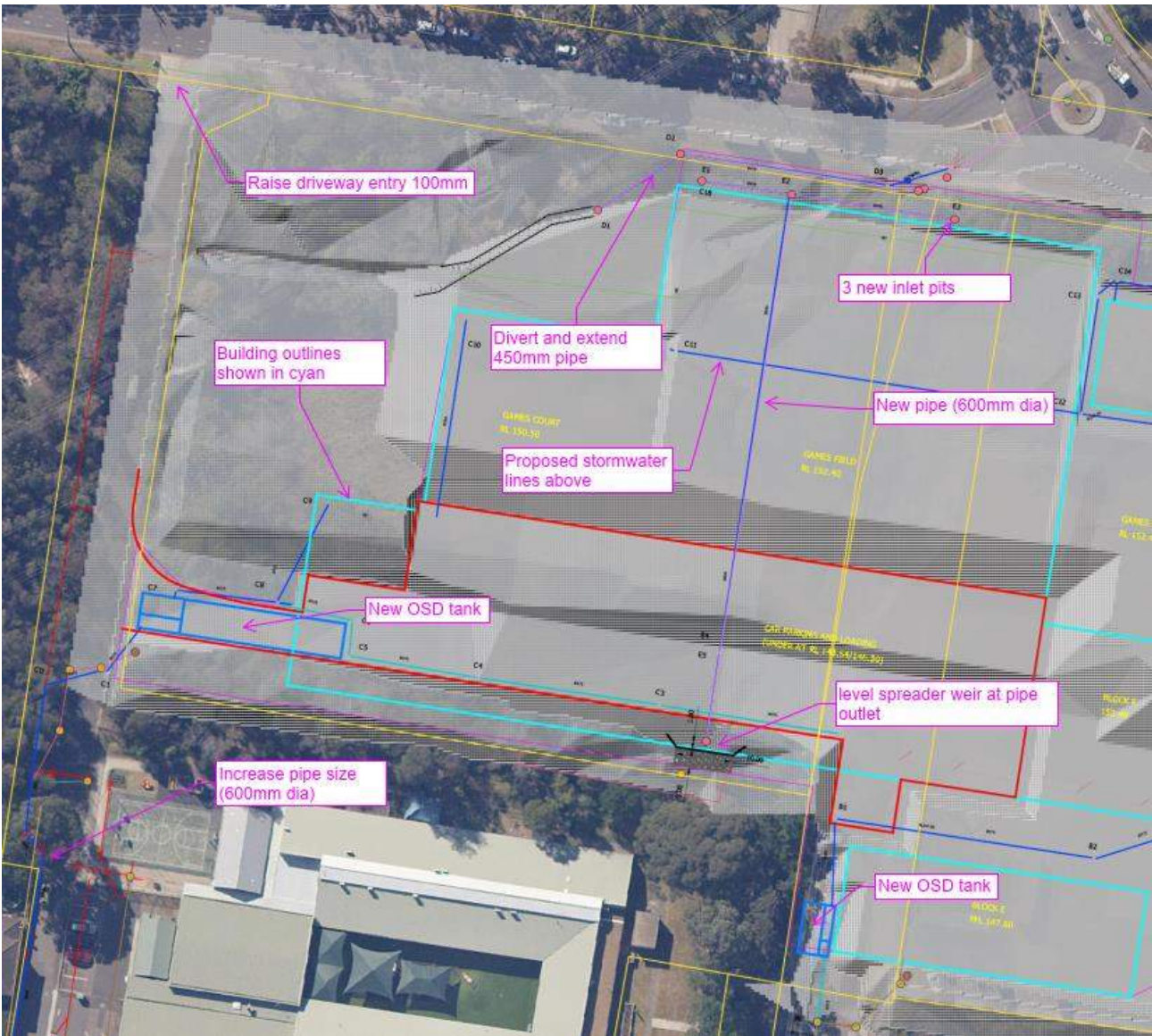


Figure 23: Flood Mitigation Measure Plan

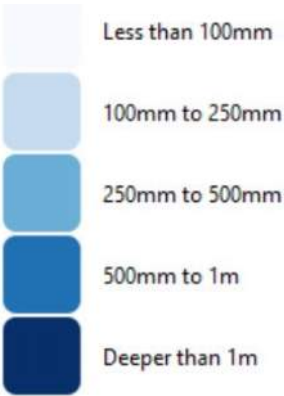
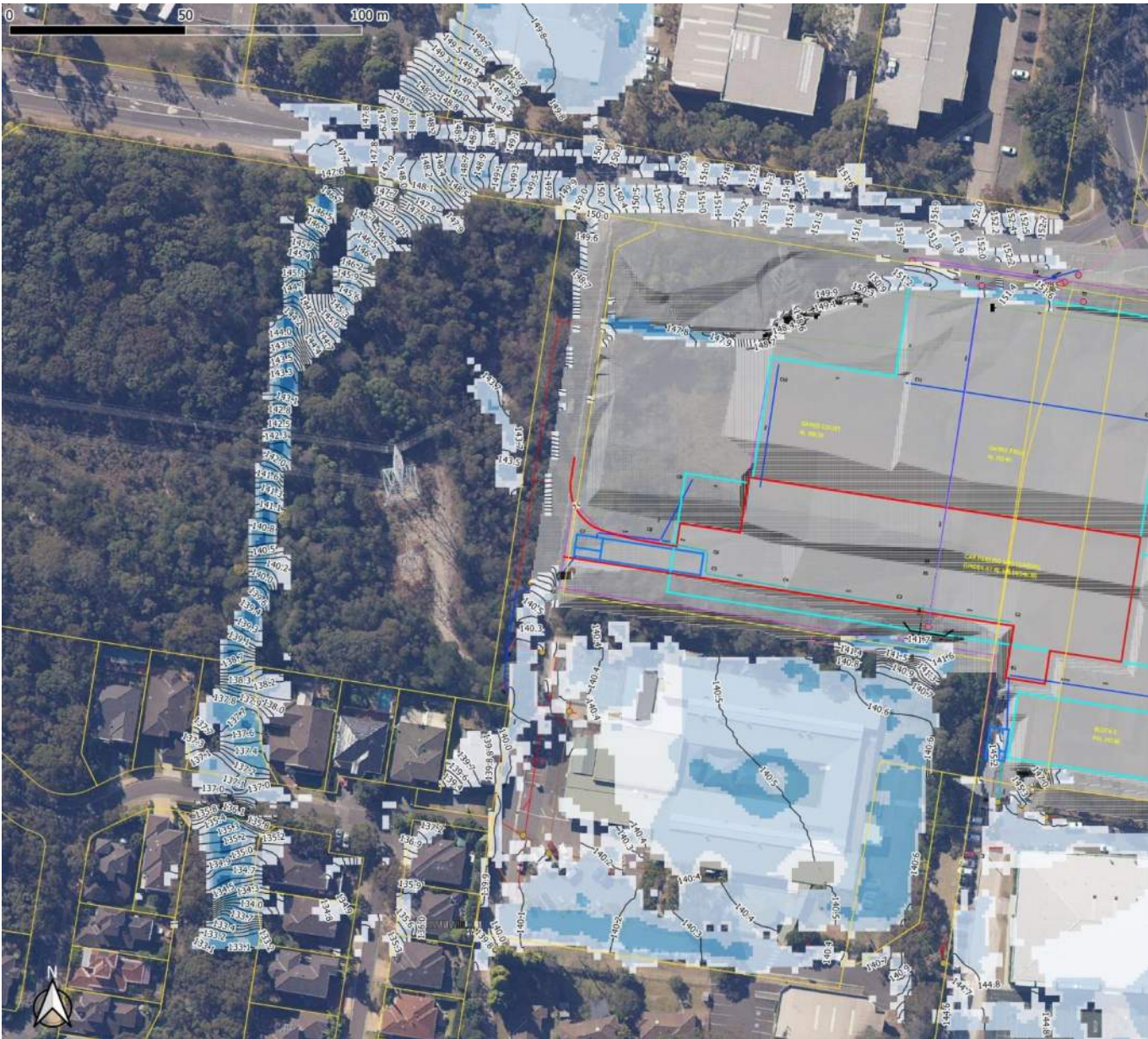


Figure 24: Proposed Design 1% AEP Flood Map – With Revised Council Tuflow Model Output

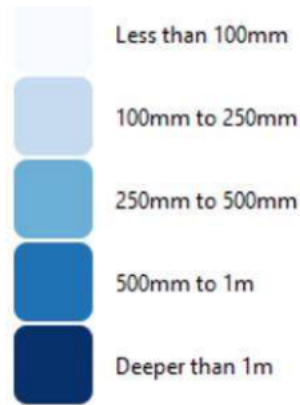
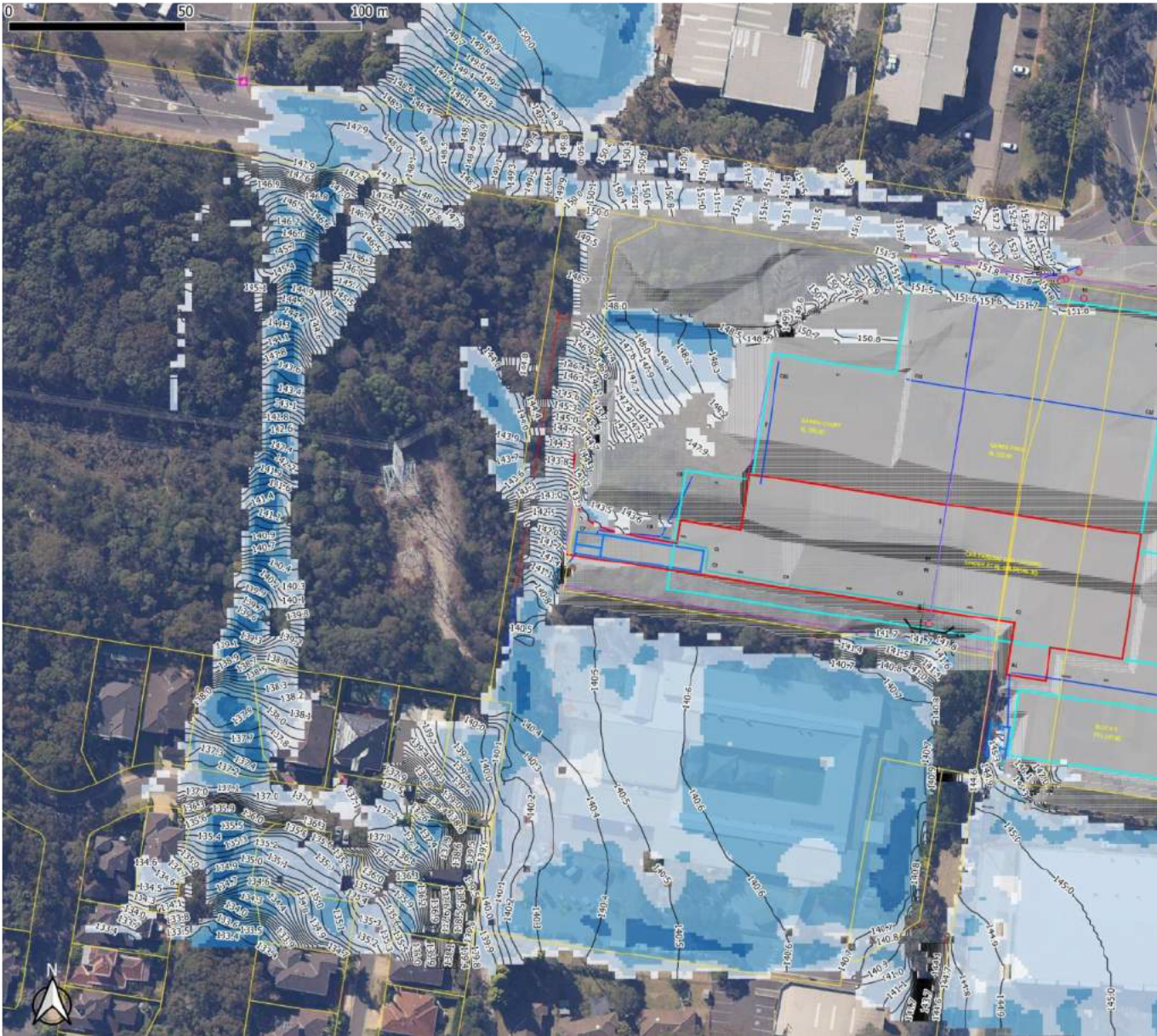


Figure 25: Proposed Design PMF Flood Map – With Revised Council TufLOW Model Output

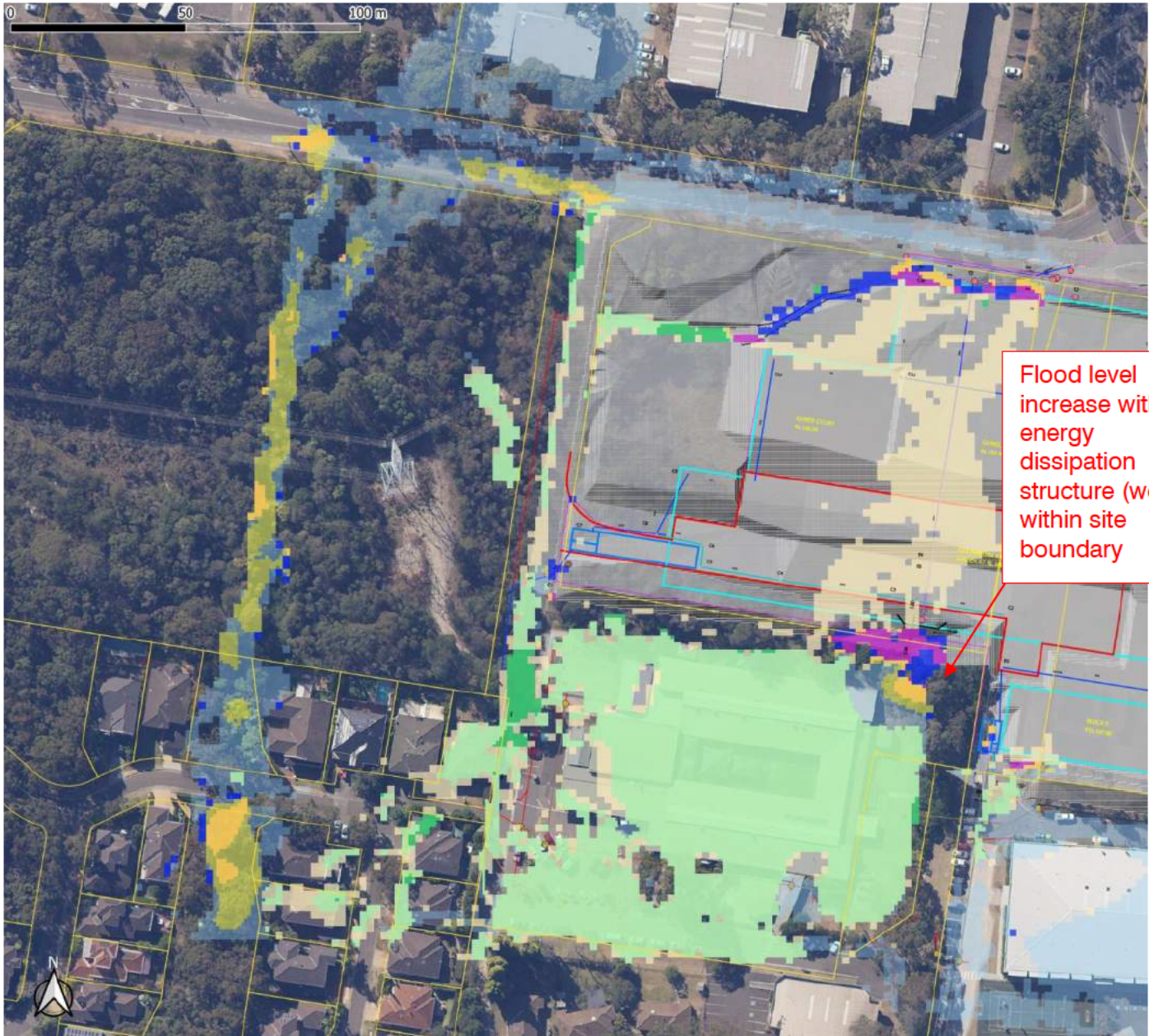


Figure 26: Flood Impact Map – 1% AEP – With Revised Council TufLOW Model Output

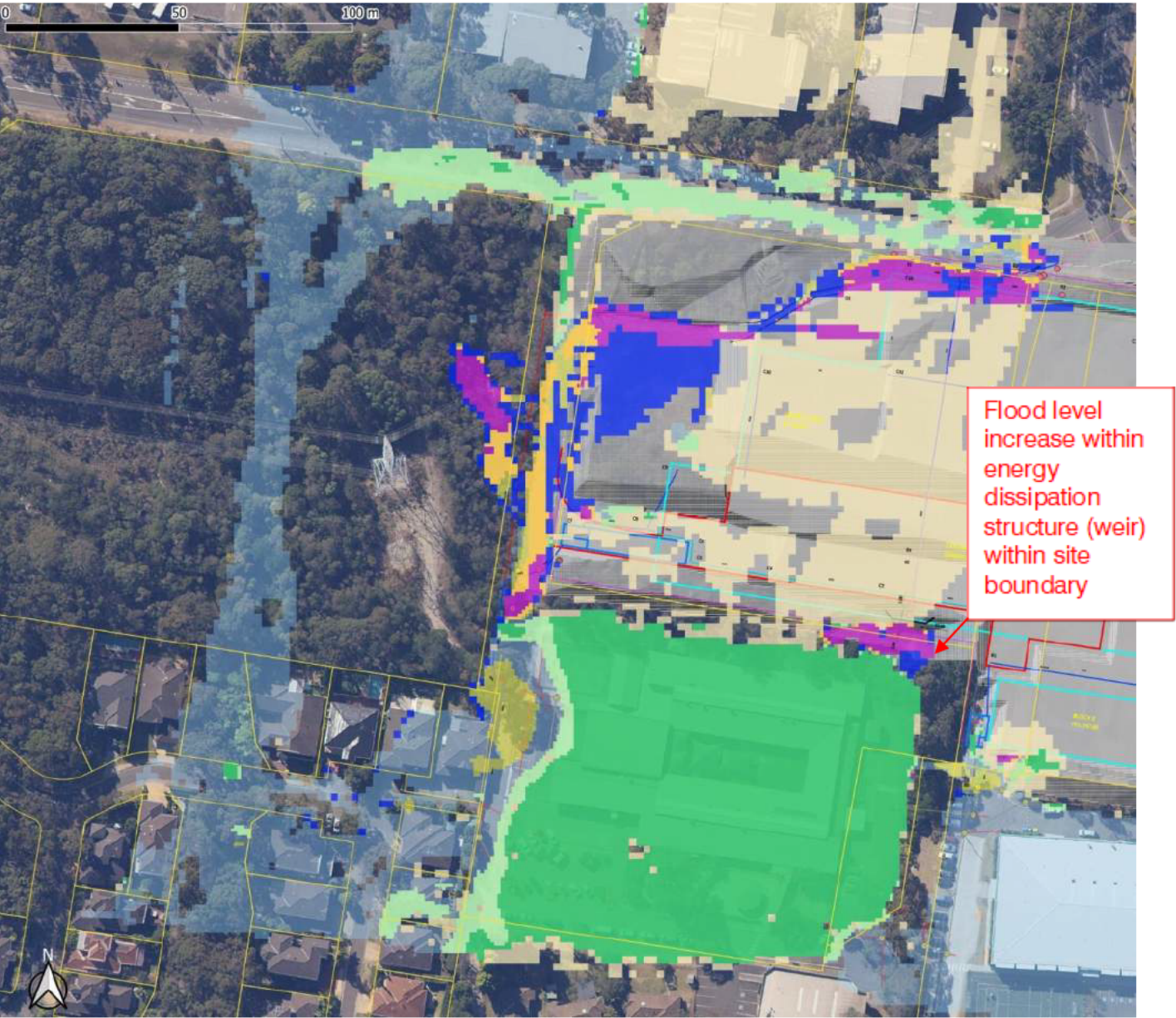


Figure 27: Proposed Impact Map – PMF – With Revised Council Tuflow Model Output

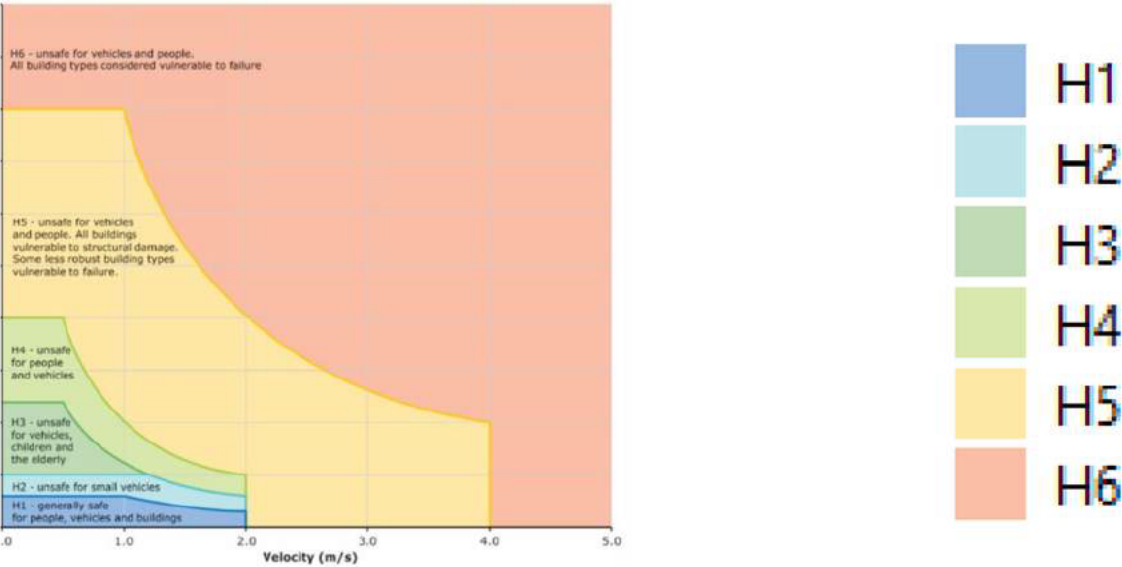
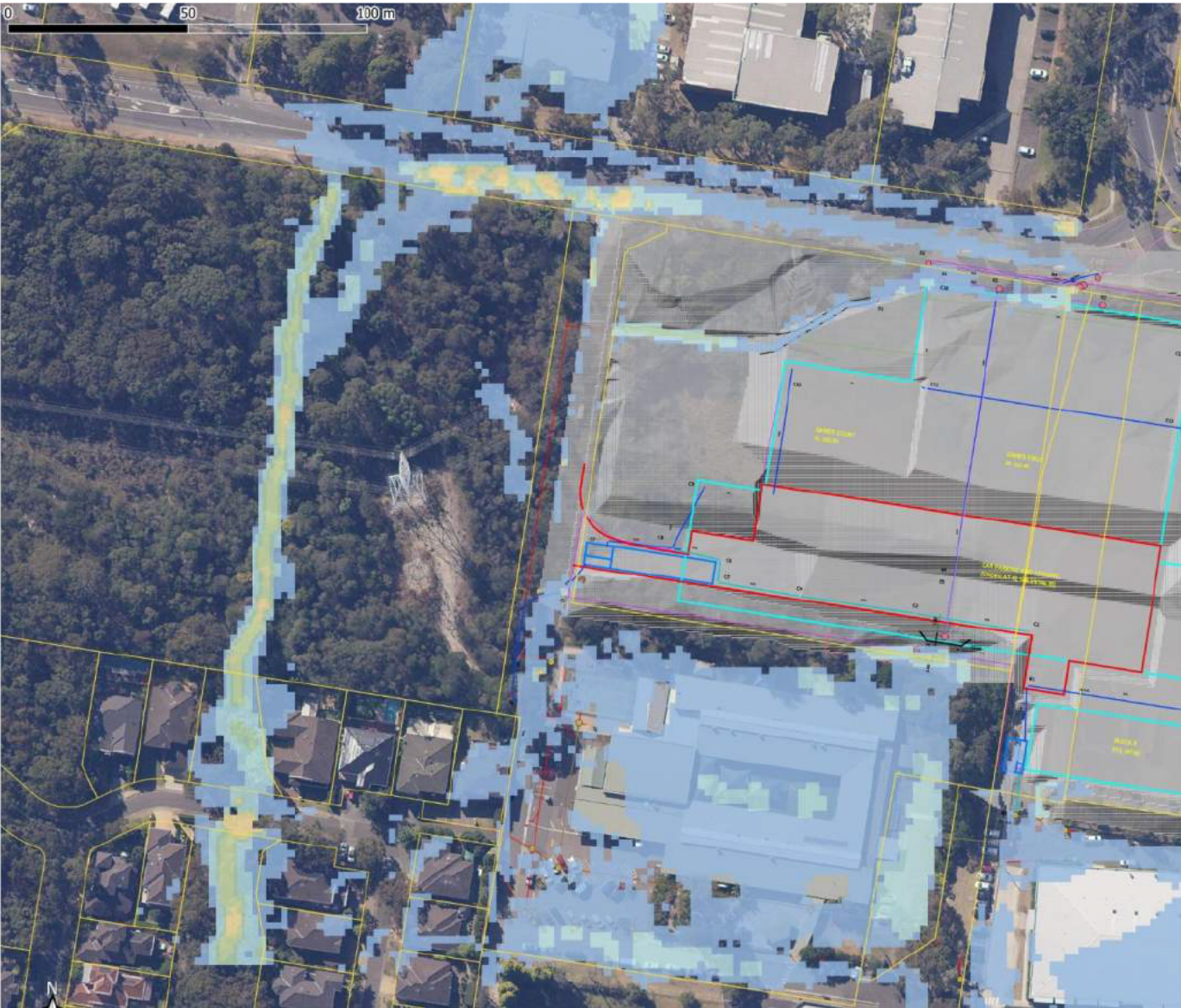


Figure 28: Proposed Conditions 1% AEP Hazard Map – With Revised Council Tuflow Model Output

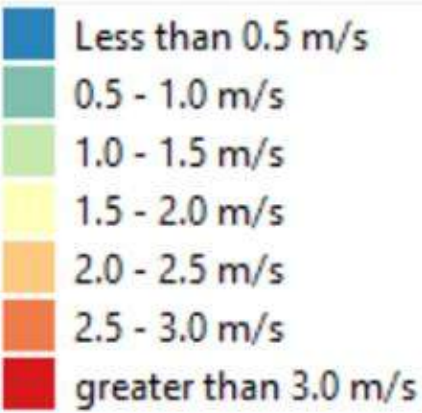
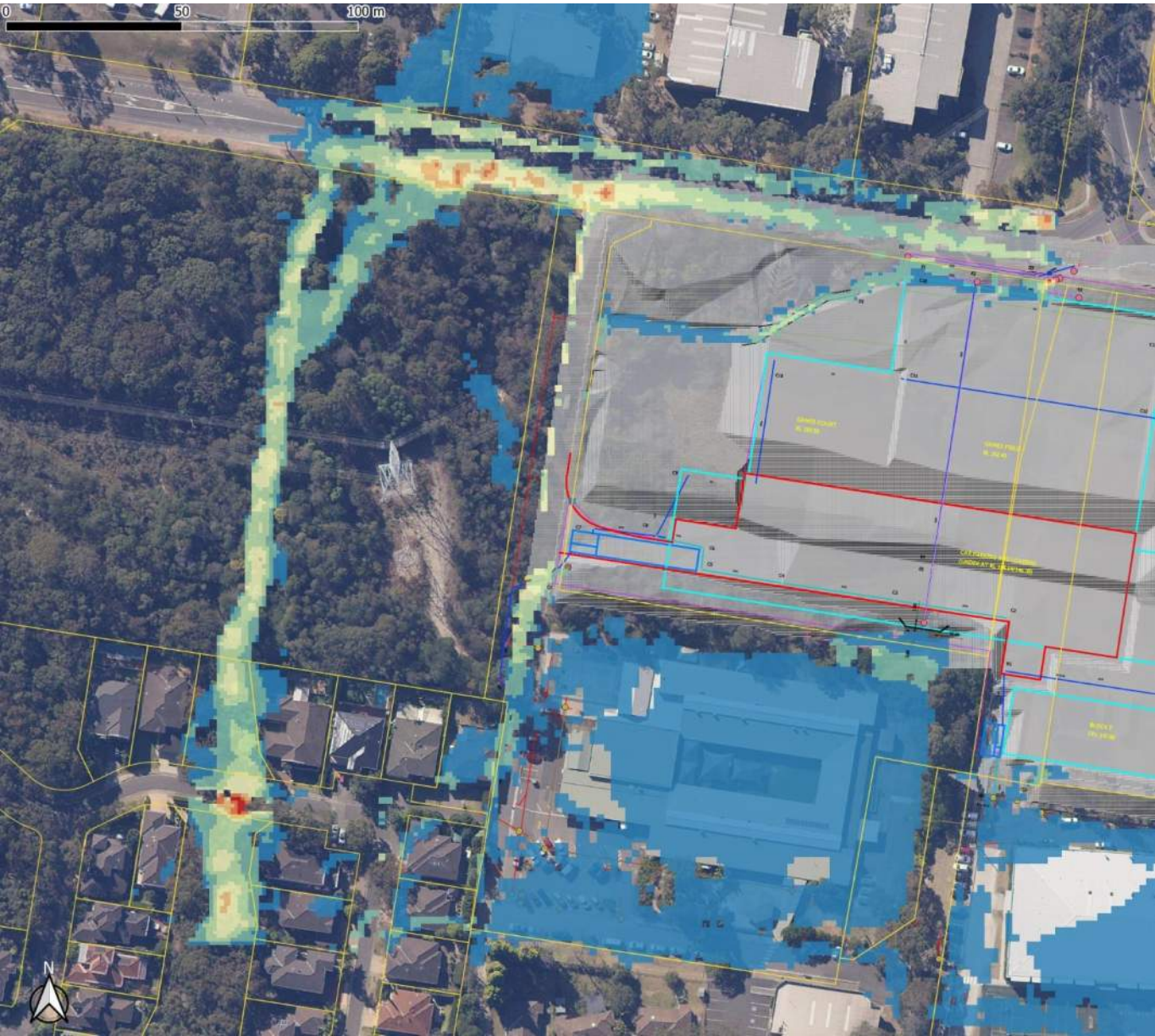


Figure 29: Proposed Conditions Velocity Map – With Revised Council Tuflow Model Output

5.2 Flooding Impacts

To address Item 14.2 of the SEARs Matrix, the impact of the development on the flood risk on and off the site has been assessed. Based on Council’s available stormwater data, the site is not considered within a flood risk precinct. However, following the revision of the Council’s TuFlow model, the site is considered to be within a flood risk precinct.

The Tuflow model simulating the proposed conditions post-development shows the decrease in flood affectation to neighbouring properties as a result of the flood mitigation measures proposed in the civil design, as discussed in **Section 5.1.2**.

The impacts to neighbouring properties show the following:

- A decrease in flood depth for the Arranounbai School building of more than 10mm in the 1% AEP event and by more than 50mm in the PMF event. Therefore, an increase in safety to the school.
- A reduction in flood depths across several properties in Madison Way, especially Nos 29, 30, 32, 35, 37 and 39 Madison Way. The impact is so significant, there are some areas which were wet are now dry in the 1% AEP.
- No change has occurred to the Aquatic Drive discharge pipes, hence, there is no impact on the upstream properties.
- The 100mm driveway threshold at Arranounbai School has redirected the overland flow in Aquatic Drive to Council’s drainage reserve and therefore reducing the overland flow within the driveway and in turn reducing the velocity of the overland flow within the Arranounbai School and passing through No 35 Madison Way.
- The reduction in the amount of water within the Arranounbai School driveway has led to the Hazard Classification on the Arranounbai School driveway being reduced to H2, however Hazard Classification at Aquatic Drive remains H5 at the driveway entry. This is an improvement in safety within both school sites.

A visual representation of the flood impacts created by the proposed design is available in **Figure 26** and **27**.

In response to Council’s advice regarding the flood affectation of Lot 11 and the entrance to the new under cover car park, the flooding maps show some minor isolated flooding along the Arranounbai driveway, but the flooding is overland flow down the driveway and not to the main overland flow path, as shown in **Figure 19**. The proposed driveway entrance road to the car park at Lot 11 is at RL142.5, with the entrance to the undercover carpark being at RL143.80 and grades up to RL146.3 which is 5.0m above the existing ground. Therefore, the undercover car park or covered carpark is above the FPL and will not be impacted by any flooding.



henry&hymas

Appendix F – CV – Andrew Francis and Matthew Mishevski



henry&hymas

ANDREW FRANCIS

Managing Director –
Civil Manager
BE Civil UNSW,
MIEAust.

afrancis@hhconsult.com.au



Professional Profile

Andrew is a director of *henry&hymas* and responsible for management and integration of the civil engineering department. Andrew's deep understanding of engineering is matched by his enthusiasm for his staff making the civil department a great success.

Andrew started with *henry&hymas* in 2005 and has extensive experience in the development industry including civil design, project management, and documentation and construction supervision of numerous urban development projects. He has an excellent reputation in the industry delivering complaint cost effective and quality engineering outcomes.

Andrew enjoys managing his team of talented civil engineers capable of delivering the full spectrum of civil engineering services needed for the urban development industry.

Qualifications

Bachelor of Civil Engineering at the University of NSW

Technical Skills

- Experienced in design of pavements, road design, Water Sensitive Urban Design, stormwater and site works for numerous industrial sites and subdivisions, aged care, retail, health and education facilities.
- Extensive experience DRIANS/ILSAX, Circly, RAT-HGL, RAFTS, HEC-RAS
- Expertise in Australian Standards, AUSTROADS
- Management and Business Development
- Human Resources

Major Project Experience

- Narellan Shopping Centre, Narellan
- Woolworths Prestons – Shopping centre
- Woolworth Bulli –Shopping centre
- Anglicare The Ponds – 14Ha retirement village (ILUs and RACF)
- OPAL Aged Care - Bathurst –Multi storey RACF
- Erskine Park Estate, Erskine Park – 50Ha industrial subdivision
- M7 business Hub, Eastern Creek – 160Ha industrial subdivision
- ECQ, Rooty Hills Road South, Eastern Creek - Industrial subdivision
- St.Benedicts and St.Justins, Oran Park (Catholic Education Office Wollongong)
- North Kellyville Public School, North Kellyville (NSW Department of Education)



Matthew [REDACTED] Mishevski

Personal Profile

Currently employed as a civil engineer at Henry & Hymas Consulting Engineers (H&H). Originally, my employment contract was a 3-month internship, however, after 4 weeks of performance, H&H offered full time employment as a civil engineer. This professional experience has expanded my proficiency in all general aspects of civil engineering including stormwater modelling, pavement design, flood modelling, reporting, and earthworks. Additionally, this role has developed my skills with all essential stormwater software including Drains, MUSIC, S3QM and Cosmos. During my 2 years at H&H I have collaborated with many architects, construction companies, project managers and other engineering consultants. My tertiary study, at the University of Sydney and Lunds Tekniska Högskola culminated in an honours thesis on aeroacoustics which received a high distinction. At the completion of my study, the university awarded me 1st class honours and I graduated 5th in my cohort.

Experience

Civil Engineer, Henry & Hymas, Gordon (January 2021 – present)

- Worked on \$200M+ worth of developments primarily in NSW and QLD over a multitude of commercial, industrial, and residential projects.
- Work on these projects included:
 - Modeling and design of stormwater networks and water quality treatment trains
 - Design of pavement and jointing plans
 - Completion of flood analysis and reporting
 - Collaboration with many councils in the Greater Sydney area (including Blacktown, the City of Sydney, Parramatta, etc.)

Manager, Oporto Taren Point and Circular Quay (January 2014 – December 2020)

- Hired and trained new employees, demonstrating the best methods for serving clients and guests.
- Supervised a team of 4+ FOH employees and helped to resolve issues arising during shifts.
- Handled guest complaints and offered complementary services to maintain high guest satisfaction.

Education

The University of Sydney - Bachelor of Civil Engineering (Honours) (Graduated 2020)

- Graduated with 1st class honours (ranked 5th in cohort)
- Awarded with a high distinction for honours thesis

Lunds Tekniska Högskola (Sweden) - Bachelor of Civil Engineering (Honours) (June 2019 – November 2019)

- 6-month exchange course where I expanded my collaborative skills with other engineering students from a variety of cultural backgrounds
- Overcame language barriers and developed communication skills with specific focus towards collaborating on complex problems using clear language

Computing skills

- Drains (stormwater/hydraulic network modelling and design)
- MUSIC (stormwater quality treatment train design)
- S3QM
- Cosmos
- Coding: MATLAB (Python)

Extra-Curricular Activities/Achievements

- Brazilian Jiu Jitsu (2 years)
- Amateur Weight Training/Coaching

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