GREENWICH HOSPITAL FLOOD ASSESSMENT

APRIL 2022

PREPARED FOR

HammondCare

FOREWORD

This Greenwich Hospital Flood Assessment is submitted to the Department of Planning, Industry and Environment (DPIE) in support of a State Significant Development Application (SSD-13619238) for the redevelopment of Greenwich Hospital into an integrated hospital and seniors living facility on land identified as 97-115 River Road, Greenwich (the site). The extent of the site is shown below.

The subject proposal is for the detailed design and construction of the facility following its concept approval under SSD-8699. Specifically, SSD-13619238 seeks approval for the following:

- Demolition of the existing hospital building and associated facilities at the site;
- Construction of a new hospital facility and integrated healthcare campus comprising of hospital, residential aged care, seniors housing, overnight respite, across:
    - A new main hospital building up to RL 80.0;
    - Two new seniors living buildings, Northern building up to RL 56.36, and Southern building up to RL 60.65;
    - A new respite care building up to RL 56.9;
- Construction of associated site facilities and services, including pedestrian and vehicular access and basement parking;
- Site landscaping and infrastructure works; and
- Preservation of Pallister House which will continue to host dementia care and administrative functions.

This flood assessment has assessed the flood risk to the site and the potential floodings impacts of the proposed development. In accordance with section 4.39 of the Environmental Planning & Assessment Act 1979 (EP&A Act), the Secretary's Environmental Assessment Requirements (SEARs) for SSD-13619238 were issued on 24 February, 2021. This report has been prepared to respond to the following SEARs:

SEAR	Relevant section of report
Concept Instrument of Consent **(SSD-8699)** Item B25: All future development applications for new built form must be accompanied by a Stormwater Management Plan detailing an assessment of any flood risk on Site and consideration of any relevant provisions of the NSW Floodplain Development Manual 2005, stormwater and drainage infrastructure, and details demonstrating that water sensitive urban design measures have been incorporated into the development.	Flood Risk on site – Section 5 Assessment has been undertaken in accordance with the principles of the NSW Floodplain Development Manual 2005
Detailed Design Sears **(SSD-13619238)** Item 16 part 1: Identify any flood risk on-site in consultation with Council and having regard to the most recent flood studies for the development area and the potential effects of climate change, sea level rise and an increase in rainfall intensity.	Flood Risk on site – Section 5
Detailed Design Sears **(SSD-13619238)** Item 16 part 2: Assess the impacts of the development, including any changes to flood risk onsite or off-site, and detail design solutions to mitigate flood risk where required.	Flood Impact Assessment – Section 5.5

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LIST OF ABBREVIATIONS

AEP	Annual Exceedance Probability
ARR	Australian Rainfall and Runoff
DCP	Development Control Plan
DEM	Digital Elevation Model
LEP	Local Environmental Plan
LiDAR	Light Detection and Ranging
PMF	Probable Maximum Flood
PMP	Probable Maximum Precipitation
TIN	Triangulated Integrated Network
WMS	Water Modelling Solutions

1 INTRODUCTION

Water Modelling Solutions (WMS) was engaged by HammondCare to provide a flood assessment for the proposed redevelopment of Greenwich Hospital. This report outlines the assessment process, defines flood behaviour for pre-development (current conditions) and post-development scenarios, and ensures the proposed development is compliant with relevant flood related planning requirements.

1.1 BACKGROUND

HammondCare (the proponent) owns and operates Greenwich Hospital (referred to as “the site”) at 95-115 River Road, located within the Lane Cove Local Government Area (LGA). HammondCare is preparing a State Significant Development (SSD) Application involving the demolition of the existing Greenwich Hospital and the construction of a new health campus, with integrated serviced Seniors Living buildings and a respite care facility.

As part of the SSD process, the development must demonstrate compliance with the below:

- Concept Instrument of Consent (SSD-8699) Item B25: All future development applications for new built form must be accompanied by a Stormwater Management Plan detailing an assessment of any flood risk on Site and consideration of any relevant provisions of the NSW Floodplain Development Manual 2005, stormwater and drainage infrastructure, and details demonstrating that water sensitive urban design measures have been incorporated into the development;
- Detailed Design Sears (SSD-13619238) Item 16 part 1: Identify any flood risk on-site in consultation with Council and having regard to the most recent flood studies for the development area and the potential effects of climate change, sea level rise and an increase in rainfall intensity;
- Detailed Design Sears (SSD-13619238) Item 16 part 2: Assess the impacts of the development, including any changes to flood risk onsite or off-site, and detail design solutions to mitigate flood risk where required.

1.2 OBJECTIVES

TSA has engaged WMS to undertake a flood assessment to inform the planning and design of the proposed works and to assist TSA and HammondCare with the preparation of the SSDA.

As such, WMS has prepared a flood assessment of the Site to:

- Confirm network representation based on information received from council and a site visit;
- Advise TSA on the flood risk at the site under existing conditions for the 1% AEP and PMF event;
- Provide advice to the design team regarding site layout, design considerations and minimum driveway and floor levels and inputs for the Stormwater Management Plan; and
- Determine if the proposed works adversely impact the local overland flood behaviour outside the site boundary and, if so, provide the design team with suggestions on minimising that impact.

2 SITE CHARACTERISTICS

2.1 STUDY AREA

The site (Lot 3 DP584287 and Lot 4 DP584287) is located at 95-115 River Road in Greenwich in the Lane Cove Municipal Council LGA and is shown in Figure 2-1. The site covers an area of approximately 3.4 Ha and has an upstream contributing catchment area of approximately 20 Ha. The site is around 400 m southwest of the Pacific Highway and 30 m northeast of Gore Creek.

Figure 2-1 Site Locatity Plan

2.2 EXISTING TOPOGRAPHY

Elevations across the site range from 53.3 mAHD to 13.5 mAHD and slope from northeast to southwest. Given the steep topography, the site is not expected to be subject to inundation from Gore Creek (the site is located some 30 m above the creek). The elevation of Pacific Highway is around 95 m AHD, which has indicated the site may be impacted by the local stormwater runoff and overland flow.

The existing topography was represented in the modelling using Digital Elevation Model (DEM), developed using a combination of the 1 m LiDAR DEM obtained from ELVIS (Geosciences Australia) - Elevation and Depth - Foundation Spatial Data (See Appendix B) from 2020 and detailed site survey provided by LTS Lockley received on the 9th of February 2022.

The LiDAR was obtained as a series of ASCII tiles and all that was required for the DEM development was to determine the relevant tiles for the catchment and join them into one FLT (floating point binary file). The floating-point file is typically a much smaller file size and provides modelling run time efficiencies.

The existing site survey was provided to WMS as a .dwg file. WMS converted this to an .asc file which is a file format that is accessible by TUFLOW.

The site area DEM is illustrated in Figure 2-2, and illustrates a high point in the eastern portion of the site, sloping down to each of the boundaries. The slope down towards the southwest corner is the steepest and drops down into a gully before meeting Gore Creek outside of the site boundary.

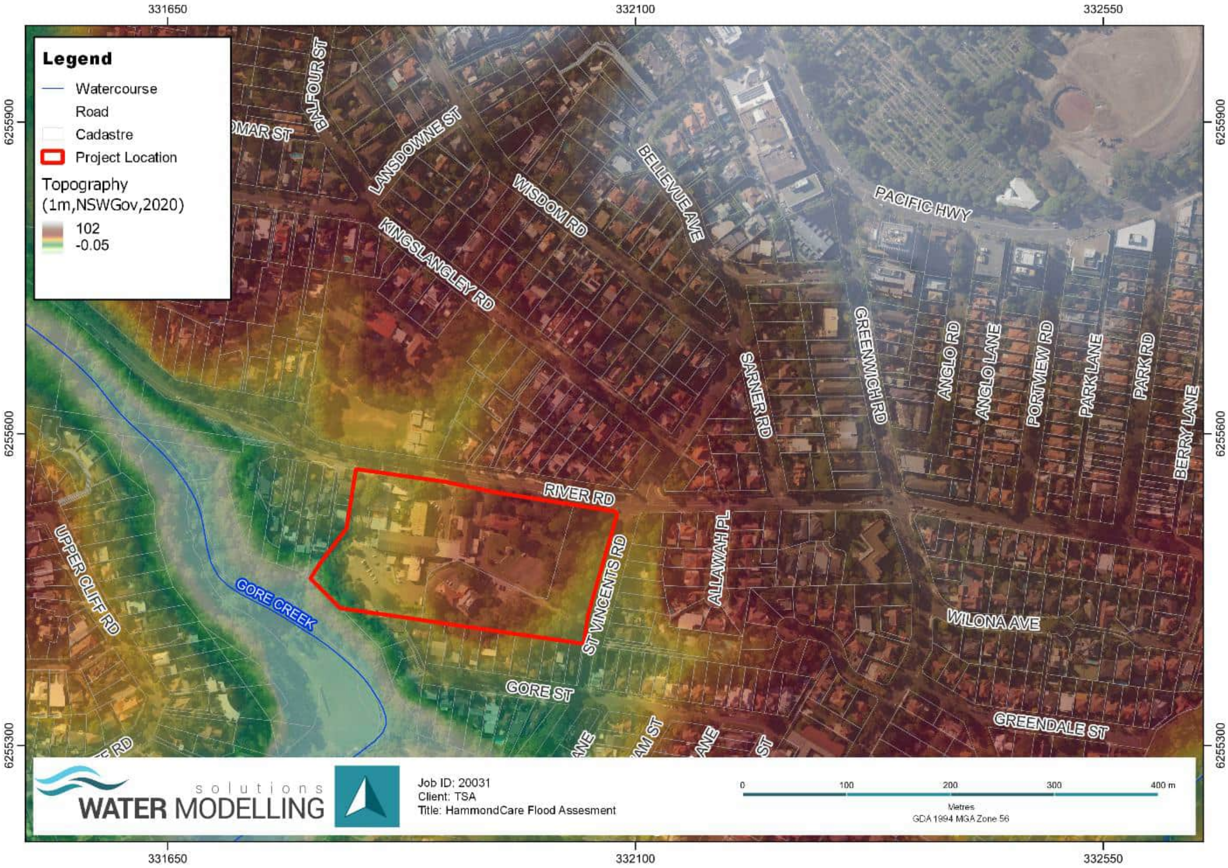


Figure 2-2 Site Area DEM

2.3 EXISTING STORMWATER NETWORK

Flows from the upstream (northern) part of the catchment travel downstream towards the site via a series of culverts and open channels. As noted in our site visit, there are two culverts located in the upstream end of the catchment beneath Wisdom Road and Kingslangley Road. More details on these two culverts can be found in Appendix C. Flow travels through these culverts and then into an open channel through Greenwich Public School, located immediately north of the site. An existing council culvert runs from within Greenwich Public School, under River Road and under the north-western corner of the site before discharge into the gully leading down to Gore Creek, this network was confirmed by inspection on our site visit and on the existing stormwater network plan provided to Van der Meer consulting by Lane Cove Municipal Council. Stormwater infrastructure in the vicinity of the site can be seen in Figure 2-3.

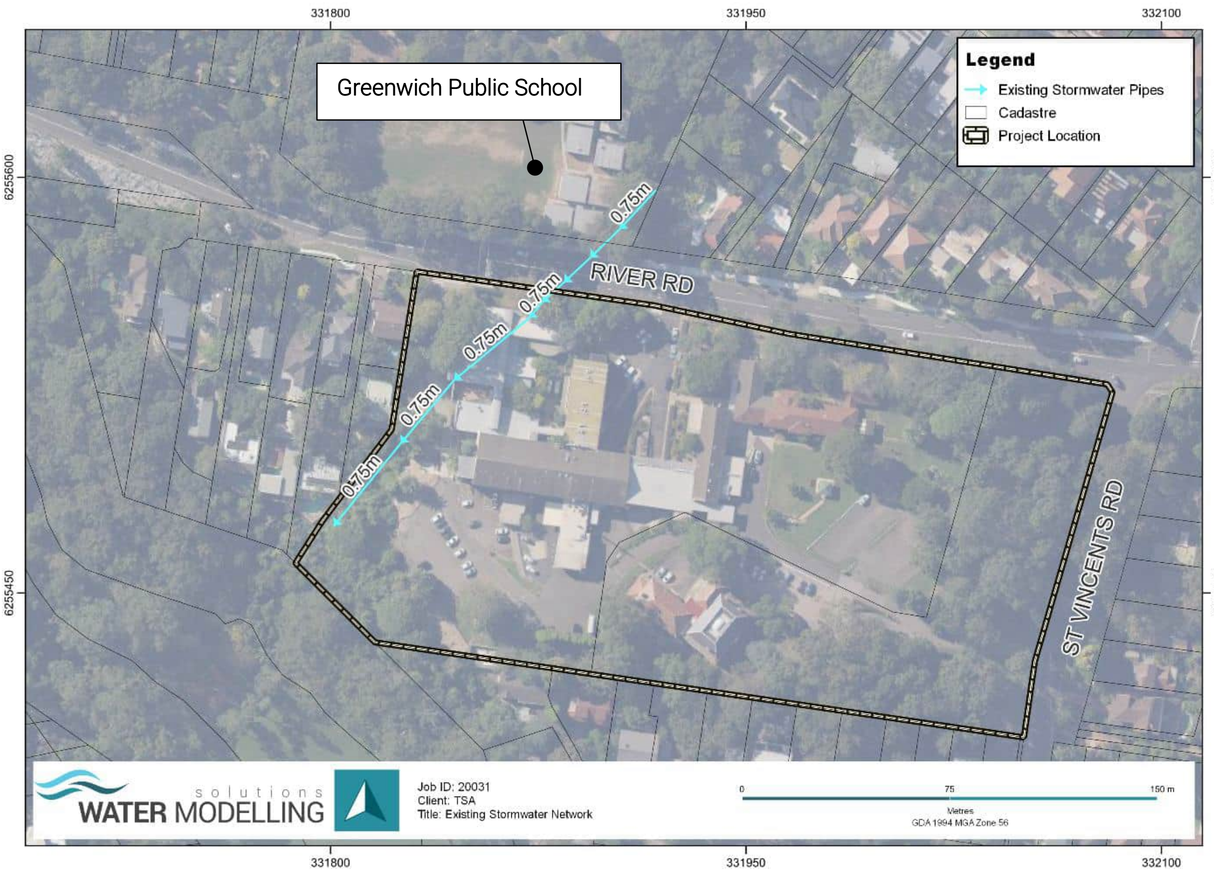


Figure 2-3 Existing Stormwater Network

3 PROPOSED DEVELOPMENT

3.1 PROPOSED DEVELOPMENT

The redevelopment of the hospital is proposed to include:

- Demolition of the existing hospital building and associated facilities at the site;
- Construction of a new hospital facility and integrated healthcare uses and services;
- Construction of associated site facilities and services, including pedestrian and vehicular access and basement parking; and
- Site landscaping and infrastructure works.

It is noted that Pallister House will be retained and is to host dementia care and administrative functions under the proposed redevelopment.

The proposed development is divided into four stages, and the Staging Plan is provided in Appendix A. For the purposes of this study only the final development staging has been modelled and the impacts on flooding have been assessed.

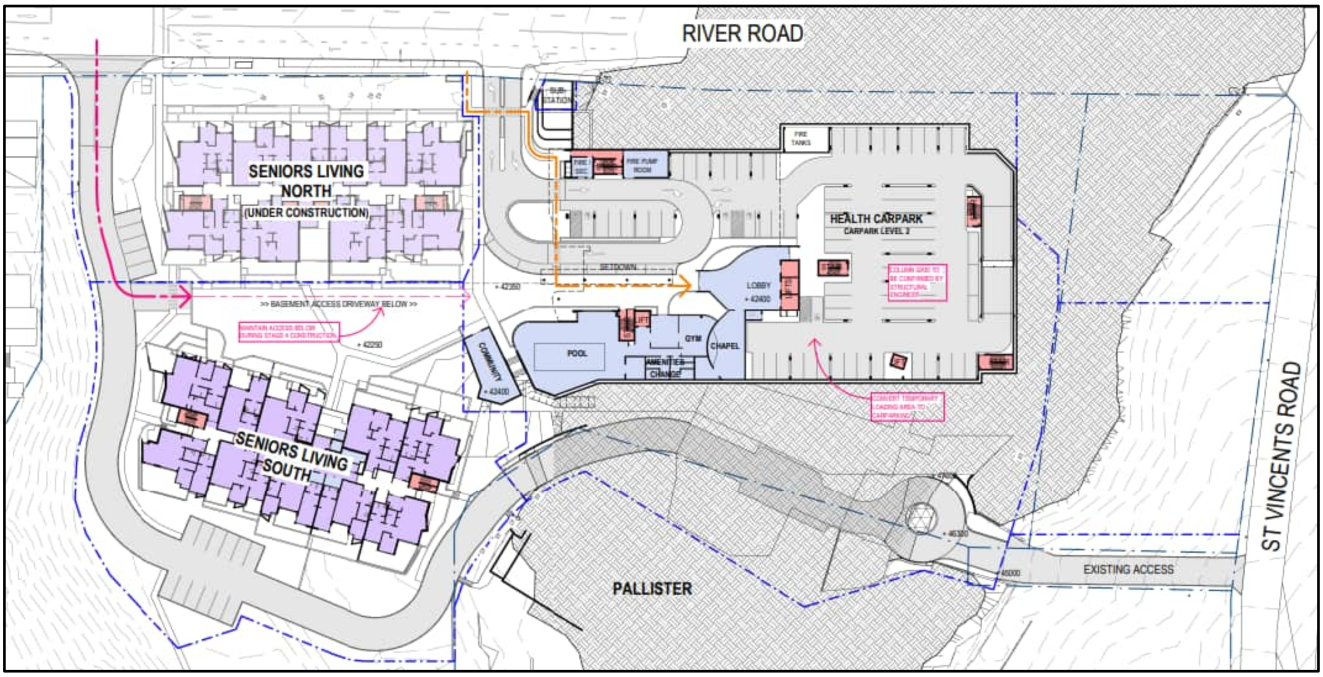


Figure 3-1 Proposed Site Plan

4 HYDROLOGIC AND HYDRAULIC MODELLING

4.1 SELECTION OF MODEL

Information is not publicly available on the nature of flooding within the Gore Creek catchment from Lane Cove Council. As such, WMS were required to establish a flood model for the purpose of this site-specific flooding assessment.

A review of the study area topography was conducted prior to commencement of the model build to identify the catchment area (3.4 Ha) that was likely to contribute to overland flow at the Site.

Due to the small area of the upstream catchment and the urban nature of the study area, a 'direct rainfall' 1D/2D TUFLOW model was considered adequate to model both hydrologic and hydraulic behaviours and was therefore selected for this study. TUFLOW is used widely in Australia for flooding and drainage studies and offers a suite of advanced 1D/2D/3D computer simulation software for flooding, urban drainage, coastal hydraulics, and many other applications. TUFLOW is also internationally recognised as the industry leader for hydraulic modelling accuracy, speed and workflow efficiency.

4.2 DIGITAL ELEVATION MODEL

The Digital Elevation Model (DEM) for the 'existing conditions' scenario was developed using the 1 m LiDAR DEM obtained from Geosciences Australia (ELVIS), supplemented with the detailed site survey provided by LTS Lockley received on the 9th of February 2022. A grid cell size of 3 m was chosen to strike a balance between model resolution and run times. This spatial resolution was deemed appropriate based on the size of the area to be modelled and considering the key hydraulic features that needed to be represented.

Additional modifications to the topographic information, in the existing scenario included:

- Terrain modifier removing artificial depressions in the DEM;
- Terrain modifier defining kerbs and footpaths throughout the site picked up by survey; and
- Terrain modifiers creating building pads to represent the building footprints on site.

The Proposed Scenario DEM was developed from the Existing DEM and incorporates a design TIN of the proposed surface and building floor levels supplied. Several terrain modifications were required to ensure the proposed design was being appropriately represented in the model due to the complex nature of the proposed design and the steep slopes within the site.

The Seniors Living buildings, depicted in Figure 3-1, on the western side of the site are multi-level buildings with a courtyard joining the two. Key features of the proposed development to be incorporated into the modelling are listed below:

- Ground level matches the existing surface levels for the southern building and the surface level matches Level 2 on the northern building;
- Courtyard connecting the two buildings is on Level 2 and it is proposed that culverts or an alternate drainage system will allow overland flow path from the courtyard on Level 2 down to the surface level at the southern end of the site; and
- The main entrance road and western buildings sit 2 floors above the surface level and will utilise the same drainage system to allow overland flow to continue through the site.

Additional modifications to the DEM were made to appropriately represent the proposed development, including

- Building footprints and courtyard areas;
- Retaining walls and bunds;
- Roadways and landscaping;
- Removal of artificial depressions in the LiDAR data (confirmed with detailed survey and site inspection).

4.3 HYDRAULIC ROUGHNESS

The hydraulic roughness (Manning's 'n') values used in the model are in line with ranges outlined in Book 6 of the ARR 2019. The spatial distribution of roughness values was delineated based on inspection of aerial imagery, Google Street view and site visit observations, and land use data. For more details on hydraulic roughness refer Section C.2.2 of Appendix C.

4.4 HYDRAULIC STRUCTURES

The drainage network within the study was represented in the model as a 1D network. The location and size of pipes and pits were provided by Lane Cove Municipal Council and confirmed on a site visit.

The proposed scenario incorporates a new drainage network within the site to drain the overland flow from the Level 2 driveway and courtyard areas to the ground level at the south of the site. This proposed drainage network as well as the hydraulic structures in the existing scenario are detailed in Section C.2.3 of Appendix C.

4.5 BOUNDARY CONDITIONS

Given the steep drop (30 m) from the site to Gore Creek, overland flow is likely to drain freely from the site, following the existing topography. The downstream model boundary was applied as a slope boundary along Gore Creek, which is 140 m south of the site boundary. The boundary is located a sufficient distance away from and below the site to ensure flood behaviour in the area of interested was not affected by localised boundary conditions.

In addition, a 1D boundary condition was applied at the downstream end of the pit and pipe network to allow flow within the pipes to exit the study area. A 'constant water level' boundary was used to simulate the more conservative scenario that the downstream network is full.

For more details on boundary conditions refer Section C.2.1 of Appendix C.

4.6 DESIGN RAINFALL

The Bureau of Meteorology's (BOM) Design Rainfall Data System (2016) was used to extract the Intensity Frequency Duration (IFD) Table which was used as input for the TUFLOW model. The adopted IFD table is provided in Section C-2 of Appendix C.

Probable Maximum Precipitation (PMP) is not available through the ARR Data Hub. To calculate PMP, the Generalised Short-Duration Method (GSDM) was used. This method is based on an analysis of convective thunderstorms and is appropriate for durations up to 6 hours. The GSDM PMP rainfall calculation procedure has been undertaken in accordance with 'The Estimation of Probable Maximum Precipitation in Australia: Generalised Short-Duration Method' (BoM, 2003). The PMP rainfall totals adopted in the modelling are listed in Table 4-1.

Table 4-1 PMP Design Rainfall

Duration (hours)	Rounded PMP Estimated Depth (mm) (nearest 10 mm)
0.25	170
0.50	250
0.75	310
1.0	360
1.5	400
2.0	450
2.5	520
3.0	550
4.0	610
5.0	670
6.0	700

4.7 RAINFALL LOSSES

Design rainfall initial loss (IL) and continuing loss (CL) parameters for the study area were extracted from the ARR Data Hub. The ARR Data Hub IL and CL were 33 mm and 1.8 mm/h, respectively.

The rainfall initial loss and continuing loss values were applied to the pervious areas within the hydrologic models. An initial loss value of 33.0 mm was adopted within the hydrologic models (Storm Initial Loss – Preburst Depth). As the catchment is within NSW the Continuing Loss has been factored by a value of 0.4, a continuing loss value of 0.72 mm/hr (1.8 mm/hr * 0.4) was also adopted.

For PMP, the IL and CL were 1 mm and 0 mm/h, respectively.

4.8 CRITICAL DURATION ASSESSMENT

The modelling included the assessment of the 1% AEP and PMF events for durations from 15 mins to 3 hours. For each duration, all 10 temporal patterns were simulated. The results were then processed to extract the median flow values from the ten temporal patterns and the maximum flows values from all the durations.

The assessment of maximum values indicated that the critical duration for both the 1% AEP and PMF events was the 15 min duration and the temporal pattern which produce the median flow for the 15 minutes duration was temporal pattern 1.

5 DESIGN FLOOD BEHAVIOUR

Mapping for key flood metrics for the 1% AEP and PMF events are provided in Appendix E, including peak flood depths, water surface level, velocity and hazard classification for the site and surrounding areas in the 1% AEP and PMF events.

5.1 EXISTING CONDITIONS

The key features of the flood behaviour in the existing scenario are depicted in Figure 1 for the 1% AEP event and Figure 4 for the PMF event of Appendix E and are as follows:

- Overland flow in the upper reaches of the catchments travel from north to south through the catchment, making its way to Gore Creek via two main flowpaths: In a westerly direction along River Road, south along St Vincents Road (along the eastern boundary of the site). When the capacity of the gutter system along River Road is exceeded a shallow flow path enters the site through the western driveway, and continues to the southwest.
- Aside from this western flowpath, there is limited flood risk in the site, with shallow runoff generated only by local rainfall falling within the site.
- The existing site has a high point located on the eastern side and grades down to each of the southern and western boundaries with the largest drop being down towards the southwestern corner. Rain falling on the high point creates shallow flow paths in several directions all discharging to different points of the site, generally travelling in a southern direction, before discharging from the site along each of the boundaries; and
- Flooding across most of the site is classified as H1 or No Restrictions in the 1% AEP and PMF events. There are small, isolated areas surrounding some of the buildings in the north-western corner with areas of *H2* classification or *unsafe for small vehicles* in the 1% AEP event; and small areas reaching up to *H4 Unsafe for People and Vehicles* along the eastern driveway from St Vincents Road and the western driveway entrance from River Road in the PMF event. The PMF event also has areas of up to H6 Not Suitable for People, Vehicles or Buildings along (and predominantly outside) the western boundary in the vicinity of the steep slopes down into Gore Creek.

5.2 PROPOSED CONDITIONS

The key features of the flood behaviour in the proposed scenario are depicted in Figure 7 for the 1% AEP event and Figure 10 for the PMF event of Appendix E and are as follows:

- Overland flow behaviour upstream (north) of the site is largely unchanged by the proposed development. There is a minor reduction of peak flood levels on River Road immediately adjacent to the driveway entry, likely due to the slight regrading proposed at the driveway;
- In the 1% AEP event runoff within the site is generally limited to low hazard (H1), shallow sheet flow with depths typically less than 0.15 m;
- In the PMF event, the flowpath from River Road through the western driveway entry becomes more pronounced. Flood risk from this flow path will need to be managed for the Seniors Living North building. Additionally, runoff from the courtyard due to internal rainfall creates a flowpath between the two Seniors Living Buildings. This is proposed to be managed through the stormwater management drainage design;
- The overland flow characteristics upstream of the site remain as with the existing scenario, the proposed conditions alter the flow regime within the site and flows leaving the site;
- The majority of the site is classified as H1 or No Restrictions in the 1% AEP and PMF events. There are small, isolated areas surrounding some of the buildings in the north-western corner with areas of H2 classification or unsafe for small vehicles in the 1% AEP event; and small areas reaching up to H4 Unsafe for People and Vehicles along the eastern driveway from St Vincents Road and the western driveway entrance from River Road in the PMF event. The PMF event also has areas of up to H6 Not Suitable for People, Vehicles or Buildings along the western boundary in the vicinity of the steep slopes down into Gore Creek.

5.3 FLOOD PLANNING LEVELS

The Flood Planning Levels have been established based on the top water levels of the PMF. The PMF has been selected for the basis of Flood Planning Levels based on best practice floodplain risk management in NSW, and acknowledges the vulnerable nature of the aged care occupancy of the proposed development. It is therefore considered appropriate to manage both the risk of flood damage to buildings and risk to life to the PMF level. It is noted further that given the shallow, overland flow nature of flood behaviour within the site, the PMF levels are generally consistent with the 1% AEP event, and application of the PMF level is not considered overly conservative, and is able to be achieved whilst meeting accessibility requirements of the Disability Discrimination Act (DDA).

It is noted that unless otherwise specified building entrance floor levels are to be 150 mm above the adjacent ground level nearest to the entrance point.

The resulting Flood Planning Levels have been depicted in Appendix F and summarised in Table 5-1 below.

Table 5-1 Flood Planning Levels

Location	Flood Risk	Flood Planning Level (mAHD) (based on adjacent PMF level)	Proposed Floor Level (mAHD)	Compliant (tick/cross)
SL CP - Seniors Living Carpark Entrance	Carpark entrance location not subject to overland flow	37.50	37.95	✓
SLN1 - Seniors Living North north-western corner	Building entrance location not subject to overland flow	150mm above adjacent ground level	38.30	✓
SLN2 - Seniors Living North western side	Building entrance location subject to overland flow, FPL set at the PMF level	38.25	38.30	✓
SLN3 - Seniors Living North western side	Building entrance location subject to overland flow, FPL set at the PMF level	38.20	38.30	✓

5.4 EVACUATION CONSIDERATIONS

Lane Cove LEP 2009 (Clause 5.21) require the proponent and assessor to consider whether the development incorporates measures to minimise the risk to life and ensure the safe evacuation of people in the event of a flood.

The site is subject to limited flood risk, with the key area of risk associated with the overland flow path that traverses the north western corner of the site. Flood risk is managed here with a retaining wall that prevents overland flow from entering the courtyards on the northern side of the Seniors Living North building, and by ensuring entries along the western face of the building are above the adjacent PMF level.

With all proposed finished floor levels above the adjacent PMF levels around the site, occupants would be able to safely shelter in place during a flood event. Furthermore, flooding in this area is likely to be 'flashy' in nature, that is, rising and falling quickly in response to local rainfall, and external evacuation would pose a greater risk to occupants and staff than sheltering in place.

It is noted however that risks external to the site (such as storm damage to power, telephone or water supply) may impact the site indirectly. These risks, as well as shelter-in-place procedures, are to be captured and addressed in a Flood Emergency Response Plan for the site prior to occupation. The FERP should be prepared by a suitably qualified engineer, and be consistent with the relevant NSW SES "Floodsafe" Guides, and address the following specific actions:

- Preparing for a flood;
- Responding when a flood is likely, including evacuation routes and when to leave;
- Responding during a flood, including what to do if isolated; and
- Recovery after a flood.

The Flood Emergency Response Plan should be prepared in collaboration with the occupants and NSW SES for both the construction phase and operational phase to ensure it is fit for purpose and meets the needs of the occupants for each building/ facility within the complex.

5.5 FLOOD IMPACT ASSESSMENT

The key features of the change in flood behaviour as a result of the proposed development depicted in Figure 13 for the 1% AEP event of Appendix E are as follows:

- Outside of the site boundary there is a minor reduction in flood levels on River Road (0.02-0.05 m) as a result of slight changes to the grading of the western driveway;
- Properties immediately south of the site are no longer flooded in the 1% AEP event due to a proposed landscaping bund along the southern boundary. These dwellings had previously been subject to very shallow runoff (less than 0.15 m depths) travelling from north to south towards Gore Creek;
- Within the site, there is a localised redistribution of runoff as a direct result of the changes in building footprints and ground levels around the site, however no material changes to flood risk occur, nor creation/removal of flow paths as a result of the proposed development.

6 FLOOD RELATED DEVELOPMENT CONTROLS

In November 2020, the Independent Planning Commission approved a State Significant Development Application (SSD-8699) for a Concept Plan for the redevelopment of Greenwich Hospital. The consent included a number of future assessment requirements for the subsequent detailed design SSD. Schedule 2, Part B25 contains requirements pertaining to flooding and floodplain risk management as follows.

Schedule 2, Part B25 (SSD-8699) contains requirements pertaining to flooding and floodplain risk management as follows:

"All future development applications for new built form must be accompanied by a Stormwater Management Plan detailing an assessment of any flood risk on site and consideration of any relevant provisions of the NSW Floodplain Development Manual 2005, stormwater and drainage infrastructure, and details demonstrating that water sensitive urban design measures have been incorporated into the development."

WMS has reviewed the planning requirements set out in the Lane Cove LEP 2009 and the Lane Cove DCP 2009 in order to assess the compliance of the proposed development with applicable flood related development controls.

6.1 LANE COVE LOCAL ENVIRONMENTAL PLAN (LEP) 2009, CLAUSE 5.21: FLOOD PLANNING

The objectives of Clause 5.21 – Flood Planning are as follows:

a) To minimise the flood risk to life and property associated with the use of land;

b) to allow development on land that is compatible with the flood function and behaviour on the land, taking into account projected changes as a result of climate change,

c) to avoid adverse or cumulative impacts on flood behaviour and the environment,

d) to enable the safe occupation and efficient evacuation of people in the event of a flood.

The objectives of the LEP are supported by the Lane Cove Development Control Plan (DCP) 2009, which set out specific requirements to ensure proposed developments meet the above outcomes. The planning requirements set out in the LEP are detailed and addressed regarding the proposed development in Table 6-1.

Table 6-1 Lane Cove LEP, Section 5.21, Flood Planning – Requirements

Planning Requirements	Comment	Compliant (tick/cross)
(1) Objectives, see list above.	*n/a*	n/a
(2) Development consent must not be granted to development on land the consent authority considers to be within the flood planning area unless the consent authority is satisfied the development	*The proposed development is not within a flood precinct planning area defined by Lane Cove Council and satisfies the planning requirements as outlined below.*	✓
(a) is compatible with the flood function and behaviour on the land, and	*The site is not subject to flood risk from Gore Creek or Lane Cove River.* *The Flood Assessment indicates the site is subject to overland flow flood risk, shallow in nature (generally less than 0.15 m deep), with a low hazard classification (H1: Safe for people, vehicles and buildings) in the 1% AEP event and PMF event.* *As such, the proposed development is considered compatible with the existing flood function and behaviour and will further minimise risk to occupants through minimum floor level controls and emergency response procedures.*	✓
(b) will not adversely affect flood behaviour in a way that results in detrimental increases in the potential flood affectation of other development or properties, and	*A flood impact assessment (Section 5.3) has demonstrated the proposed development does not adversely affect flood behaviour on other developments.*	✓

Planning Requirements	Comment	Compliant (tick/cross)
(c) will not adversely affect the safe occupation and efficient evacuation of people or exceed the capacity of existing evacuation routes for the surrounding area in the event of a flood, and	*Finished floor levels in the proposed development are to be at or above the PMF level, enabling occupants to safely shelter in place during flood events (Section 5.4).*	✓
(d) incorporates appropriate measures to manage risk to life in the event of a flood, and	*The proposed development is designed to be flood free in events up to and including the PMF event and occupants are expected to be able to safely shelter in place during flood events with the support of a Flood Emergency Response Plan (Section 5.4).*	✓
(e) will not adversely affect the environment or cause avoidable erosion, siltation, destruction of riparian vegetation or a reduction in the stability of river banks or watercourses.	*The proposed development is wholly contained within the existing site and will not encroach on riparian corridors or water courses.*	✓
(3) In deciding whether to grant development consent on land to which this clause applies, the consent authority must consider the following matters		
(a) the impact of the development on projected changes to flood behaviour as a result of climate change,	*An increase in rainfall intensity associated with climate change could be expected to increase overland flow depths and durations, however given that the site is subject to shallow overland flow under current conditions, the proposed development is not likely to impact on flood behaviour under a future climate change scenario.*	✓
(b) the intended design and scale of buildings resulting from the development,	*The proposed development is wholly contained within the site, in keeping with the current scale of development within the site.*	✓
(c) whether the development incorporates measures to minimise the risk to life and ensure the safe evacuation of people in the event of a flood,	*The proposed development is designed to be flood free in events up to and including the PMF event and occupants are expected to be able to safely shelter in place during flood events with the support of a Flood Emergency Response Plan (Section 5.4).*	✓
(d) the potential to modify, relocate or remove buildings resulting from development if the surrounding area is impacted by flooding or coastal erosion.	*The site is not affected by riverine flooding or coastal erosion, and removal or relocation of buildings is unlikely to be necessary due to overland flow.*	✓

6.2 LANE COVE DEVELOPMENT CONTROL PLAN 2009

The Lane Cove DCP, Part O contains controls relating to stormwater management and overland flow.

WMS has reviewed the proposed plans in relation to Council's requirements and provided an assessment of the development's compliance with each control in Table 6-2.

Table 6-2 Lane Cove DCP Section O – Stormwater Management

ID	Control Description		WMS Comment	Compliant (tick/cross)
O.10 (a)	Where overland flow enters a property due consideration must be given to the effects of stormwater discharges upon neighbouring properties.		*Landscaping along the southern boundary results in a reduction in flood risk to dwellings immediately south of the Site. No adverse impacts outside the site are caused by the proposed development.*	✓
(b)	In situations where there is a known flooding problem, or there is a risk of stormwater inundation, a flood study of the catchment containing the development site will be required. The flood study shall be in accordance with current practice as outlined in Australian Rainfall & Runoff, and subject to the satisfaction of Council's Engineer.		*This flood study has been undertaken in accordance with ARR2019 methodologies utilising all available council documentation.*	✓
(c)	Development Applications to undertake any property improvements on land that is subject to overland flow, must give due consideration to the manner in which the proposed work will affect the free passage of overland flow through the property. The development is not to create or aggravate hazardous overland flow conditions.		*A flood impact assessment has been undertaken for the proposed development (refer to Section 5.5). The hazard classifications of overland flow paths will not be aggravated as a result of the proposed development.*	✓
10.1	Adverse Impacts upon Adjoining Properties	Proposed Developments must not increase the quantity of flow through an adjoining property, concentrate, redirect, create or aggravate overland flow characteristics on adjoining properties.	*See above and Section 5.5.*	✓
10.2	Adverse Effects upon Proposed Improvements	All work must be compatible with the existing constraints of the site, including the overland flow. Site improvements must be designed to ensure there will be no significant damage caused by stormwater runoff within the property	*Stormwater runoff within the property will maintain existing flows paths where the site remains unchanged and where development occurs the flow paths will replicate the existing characteristics as close as possible.*	✓
10.3	Safety	People, particularly children, must not be placed at risk of being swept away by overland flow. Any development proposal must not modify the way in which overland flow is conveyed through a property in a way that makes it hazardous, or promote the increased use of a property (or part of a property) that has an existing stormwater inundation safety hazard. Refer to Section 9.2.2 – Depth Velocity Product	*The hazard classifications of overland flow paths will not be aggravated as a result of the proposed development. Areas with increased hazard classifications are restricted to areas not expected to be used by people or vehicles.*	✓
10.4	New Development	Due regard is to be given to the location and shape of proposed buildings on the land so as to remove obstruction to overland flow or to remove potential to damage structures as a consequence of flow or may cause	*Overland flow paths have been maintained as closely as possible (Section 5.5).*	✓

ID	Control Description		WMS Comment	Compliant (tick/cross)
		hazard to occupants. Building over a flowpath will not be permitted due to the potential for blockage. Areas under buildings are not to be included when calculating impacts on adjoining properties, post developed flood depths, velocities or the like		
10.5	Freeboard	Floor levels of dwellings, including garages, should be at a level that will ensure they are not subject to stormwater inundation or nuisance flooding. • To prevent stormwater from entering buildings the finished floor levels must be set at least 150mm above the adjacent ground levels. • The entire outside perimeter of all buildings must have overland escape routes which will protect all finished floor levels from flooding in the event of the complete blockage of the surrounding drainage system. • Where it is proposed to build in an area known to be affected by overland flow, all spaces are to have a minimum freeboard of 300mm (except parking and storage areas which are to have a freeboard of 150mm), above the calculated top water level for the 1 in 100 year ARI storm event. • Freeboard may need to be increased to 500mm or greater where there are high flowrates, high flow depths or low confidence in the accuracy of the flood model.	*Flood levels have been established based on the top water levels of the PMF storm event due to the nature of the aged care occupancy of the proposed development.* *The site is subject to shallow overland flow and the adoption of top water levels from the PMF event complies with the 1% AEP event plus freeboard requirements without creating unnecessarily high floor levels, (Section 5.3).*	✓
10.6	Additions & Alterations to Existing Buildings	Additions to existing buildings on properties affected by overland flow will be assessed using the same criteria as for new buildings. Council may not approve an application that involves significant capital expenditure improving an existing building that does not meet current minimum standards with regard to overland stormwater management.	*All buildings as part of this development are new buildings and no additions or alterations to existing buildings are proposed.*	n/a
10.7	Vehicle Parking Areas	The maximum depth of flow through designated car parking spaces or open carports is to be 150mm.	*Basement carpark entrances crest levels have been designed to the top water levels of the PMF storm event, (Section 5.3).*	✓
10.8	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 to Council that it is possible to provide a development on the newly created lot that realises the full Floor Space Ratio (FSR) potential of the lot and provides suitable private open space while meeting the overland flow management criteria outlined in this document.	*This proposed development does not involve subdivision of lots.*	n/a
10.9	Overland Flow inspection by Consultant	In instances where the development was approved following the submission of a flood study, the consulting engineer that prepared the flood	*WMS (or other suitably qualified consultant) will attend the site following*	tbc

ID	Control Description		WMS Comment	Compliant (tick/cross)
		study must inspect the property following completion of all work, and certify that the development has been completed in a manner that is fully consistent with the approved overland flow management strategy.	*completion of construction and review Works as Executed survey to approve the development complies with the approved overland flow management strategy.*	
10.10	Safety Fencing	Safety fencing necessary to restrict access to areas affected by hazardous flows shall meet the minimum standards outlined in AS 1926.1-1993 Fencing for Swimming Pools. The fenced off area will not be considered as open space for the purposes of calculating minimum private open space requirements as outlined in the relevant planning codes. Where the property is to be a strata subdivision or community title subdivision, any fenced off area of land should be nominated as common property and access should only be available from common property.	*Hazardous flows (H4 and above) are generally located outside of the western site boundary within the existing gully. This is considered a sufficient distance from the proposed development to not pose a risk to pedestrians and occupants requiring fencing.*	✓
10.11	Fences	Boundary and internal fences should not obstruct the natural path of overland flow. Impermeable boundary fences where used shall be constructed in a manner so as to provide a clearance of at least 50mm between the ground and the bottom of the fence. All fences located within an overland flowpath shall be permeable in nature to at least 300mm above the calculated top water level in order to allow water to freely pass through them. In most instances, only the lower portions of the fence will need to be permeable. No permanent structures are to be built over Council drainage easements, watercourses or pipelines over which Council has an interest. This includes brick and other fences of masonry construction.	*The retaining wall along the northern boundary of Seniors Living North, see Section 5.4, does not obstruct the overland flow path.* *Additional retaining walls are proposed as part of the landscaping within the internal courtyards however these will not obstruct any overland flow paths.*	✓
10.12	In-Ground Swimming Pools	The coping level of the pool is to be at or above the top water level of the 1 in 20 year ARI storm event. The impact of the pool structure and any associated structures on the flow characteristics will also need to be considered for overland flows up to the 1 in 100 year and 1 in 20 year ARI storm events.	*No in-ground swimming pools are proposed as part of the development.*	n/a

7 SUMMARY AND CONCLUSIONS

HammondCare owns and operates Greenwich Hospital located at 95-115 River Road, within the Lane Cove Local Government Area (LGA) and is preparing a State Significant Development (SSD) Application. The proposed development involves the demolition of the existing Greenwich Hospital and the construction of a new health campus, with integrated serviced Seniors Living buildings and a respite care facility.

The site is located within the Gore Creek catchment and is subject to flood risk from overland flow, defined by a site-specific TUFLOW model established by WMS for the purposes of the SSD Application. The flood assessment presented in this report has confirmed that the proposed development satisfies the below requirements of the SSD:

- *Concept Instrument of Consent (SSD-8699) Item B25:* All future development applications for new built form must be accompanied by a Stormwater Management Plan detailing an assessment of any flood risk on Site and consideration of any relevant provisions of the NSW Floodplain Development Manual 2005, stormwater and drainage infrastructure, and details demonstrating that water sensitive urban design measures have been incorporated into the development;
- *Detailed Design Sears (SSD-13619238) Item 16 part 1*: Identify any flood risk on-site in consultation with Council and having regard to the most recent flood studies for the development area and the potential effects of climate change, sea level rise and an increase in rainfall intensity;
- *Detailed Design Sears (SSD-13619238) Item 16 part 2:* Assess the impacts of the development, including any changes to flood risk onsite or off-site, and detail design solutions to mitigate flood risk where required.

The following points summarise the assessment and its outcomes:

- A TUFLOW rain-on-grid flood model has been established for the site using the best available data and undertaken in accordance with ARR2019 methodologies;
- The site is subject to limited flood risk from overland flow as runoff makes its way through the site towards Gore Creek. The greatest flood risk exists at the north western corner, where runoff enters from River Road in rare events. Other than this area, flood risk within the site is generated by direct rainfall only, and can be managed using suitable stormwater drainage design;
- The finished floor levels of the proposed development will be at or above the PMF level adjacent to each entry, meaning that occupants can safely shelter in place during a flood event with the support of a Flood Emergency Response Plan to be prepared prior to occupation;
- The proposed development, which involves changes to building footprints, ground levels and landscaping, does not adversely affect flood behaviour outside the site. In fact, proposed landscaping bunding along the southern boundary reduces flood risk to neighbouring properties to the south, which had previously been subject to shallow overland flow (less than 0.15 m deep).

WMS is satisfied that the proposed development meets the requirements of both the SSD and local flood related planning controls set out in the Lane Cove LEP 2009 and Lane Cove DCP 2009.

8 REFERENCES

Ball J, Babister M, Nathan R, Weeks W, Weinmann E, Retallick M, Testoni I, (Editors) (2019). Australian Rainfall and Runoff: A Guide to Flood Estimation, Commonwealth of Australia.

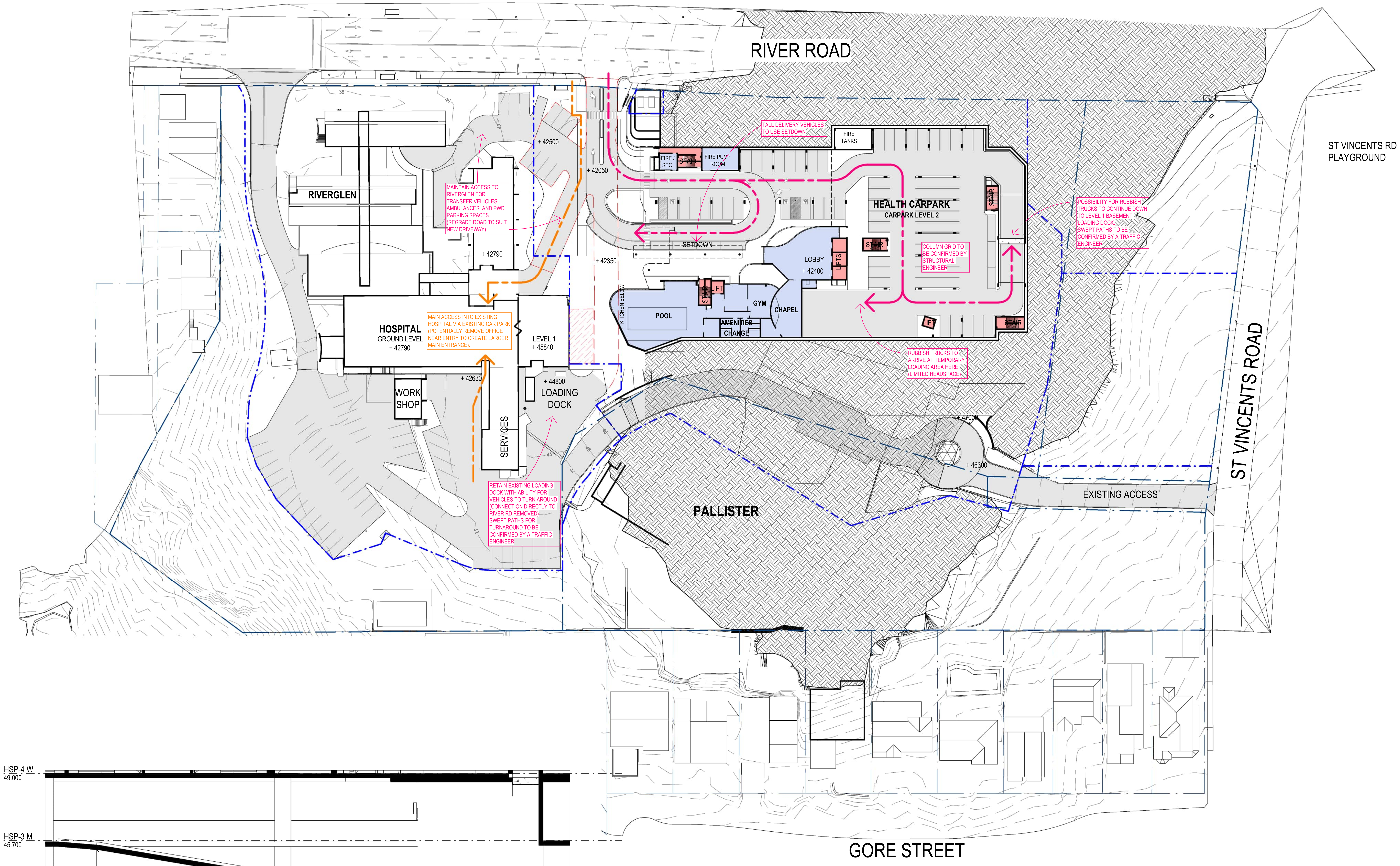
BOM (2003). The Estimation of Probable Maximum Precipitation in Australia: Generalised Short-Duration Method

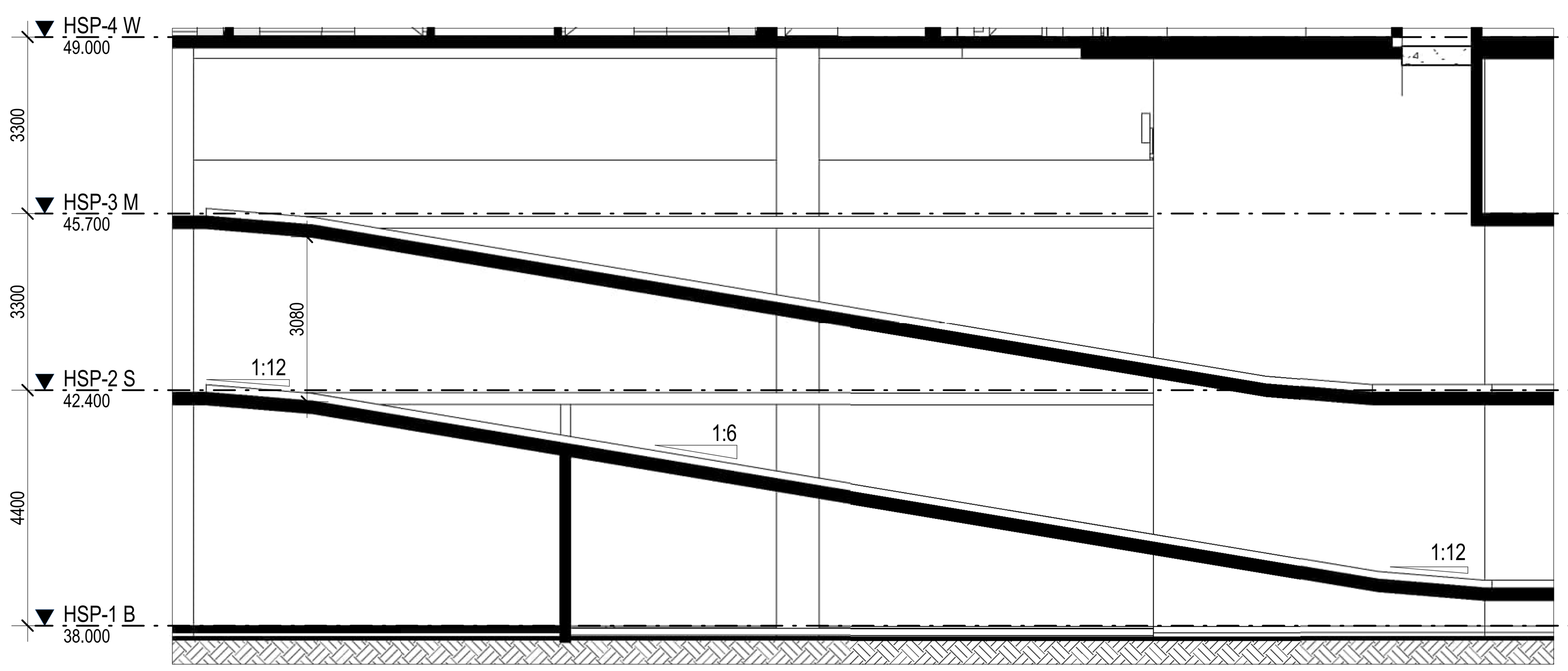
Lane Cove Council (2009) Lane Cove Local Development Control Plan, Part O, Lane Cove Council, Lane Cove, NSW.

Lane Cove Council (2009) Lane Cove Local environmental Plan, Lane Cove Council, Lane Cove, NSW.

APPENDIX A

DESIGN DRAWINGS





CARPARK RAMP SECTION
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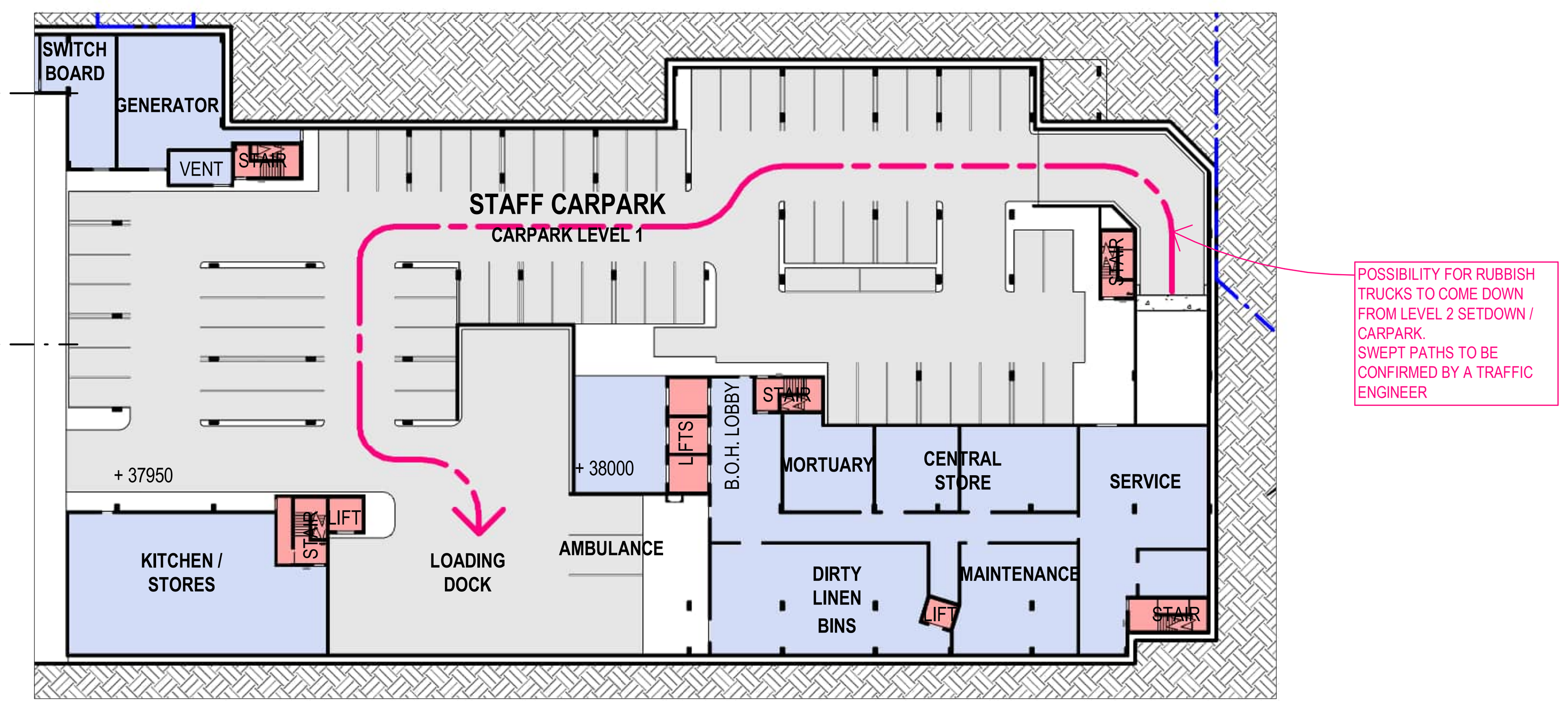

BASEMENT LEVEL PLAN
1 : 500

LEGEND

- SITE BOUNDARY
- STAGING LINE
- DELIVERY VEHICLE ACCESS
- PEDESTRIAN ACCESS

STAGE 1/2

NORTH

SYDNEY
(02) 9261 8333
STUDIO 3, LEVEL 3
35 BUCKINGHAM STREET
SURRY HILLS 2010, NSW
www.bickertonmasters.com.au

CLIENT: HAMMONDCARE

PROJECT: 01605
GREENWICH HOSPITAL REDEVELOPMENT
RIVER RD, GREENWICH

DRAWING TITLE: DELIVERIES STAGING - PREFERRED OPTION - STAGE 1/2

DATE: 02/07/22 **SCALE:** As indicated @ A1

CHECKED: Checker **DRAWING:** **REVISION:**

DRAWN: NAH SK.220218.01

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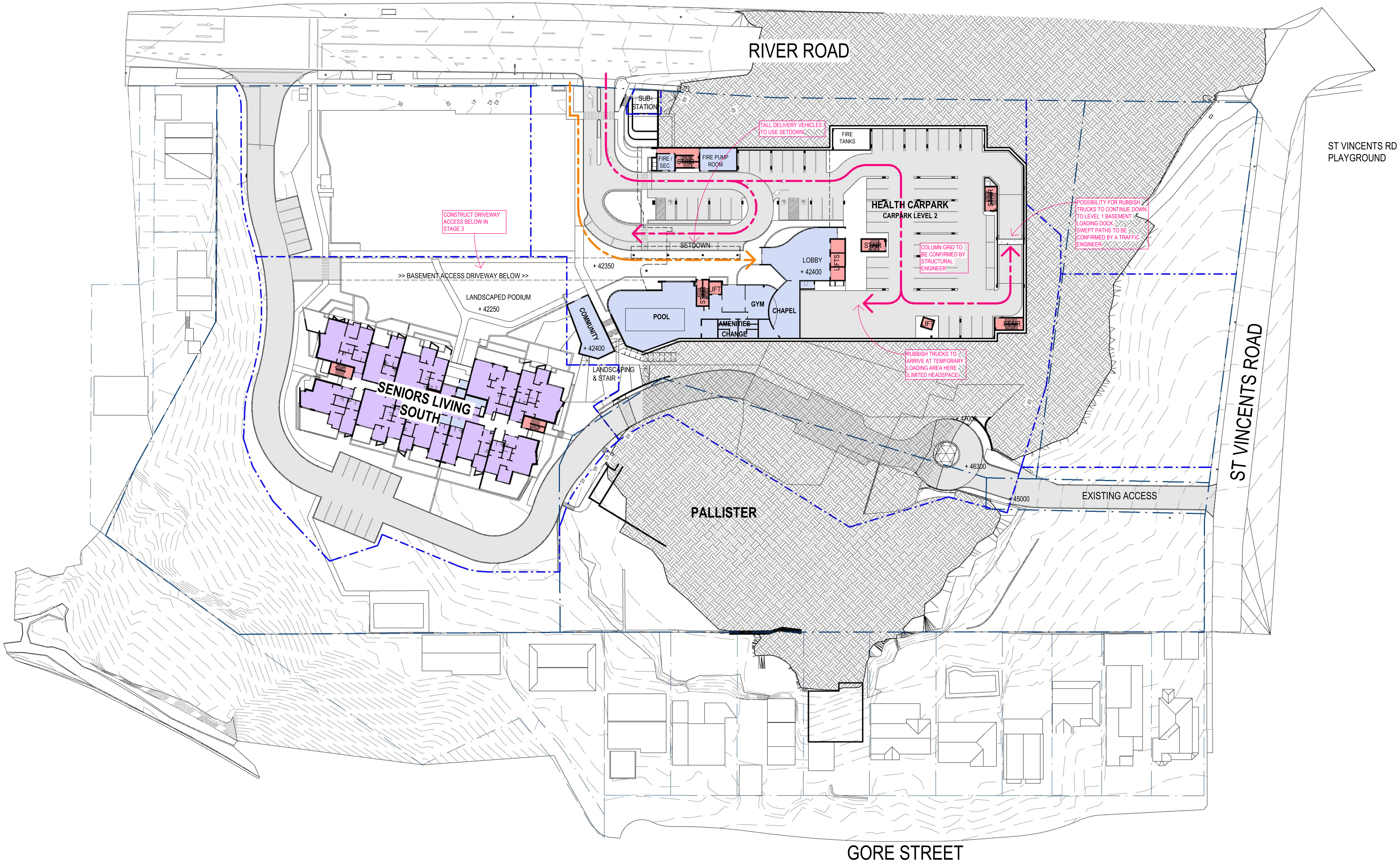

STAGE 3

NORTH

LEGEND

- SITE BOUNDARY
- STAGING LINE
- DELIVERY VEHICLE ACCESS
- PEDESTRIAN ACCESS

SYDNEY
(02) 9261 8333
STUDIO 3, LEVEL 3
35 BUCKINGHAM STREET
SURRY HILLS 2010, NSW
www.bickertonmasters.com.au

CLIENT: HAMMONDCARE

PROJECT: 01605
GREENWICH HOSPITAL REDEVELOPMENT
RIVER RD, GREENWICH

DRAWING TITLE: DELIVERIES STAGING - PREFERRED OPTION - STAGE 3

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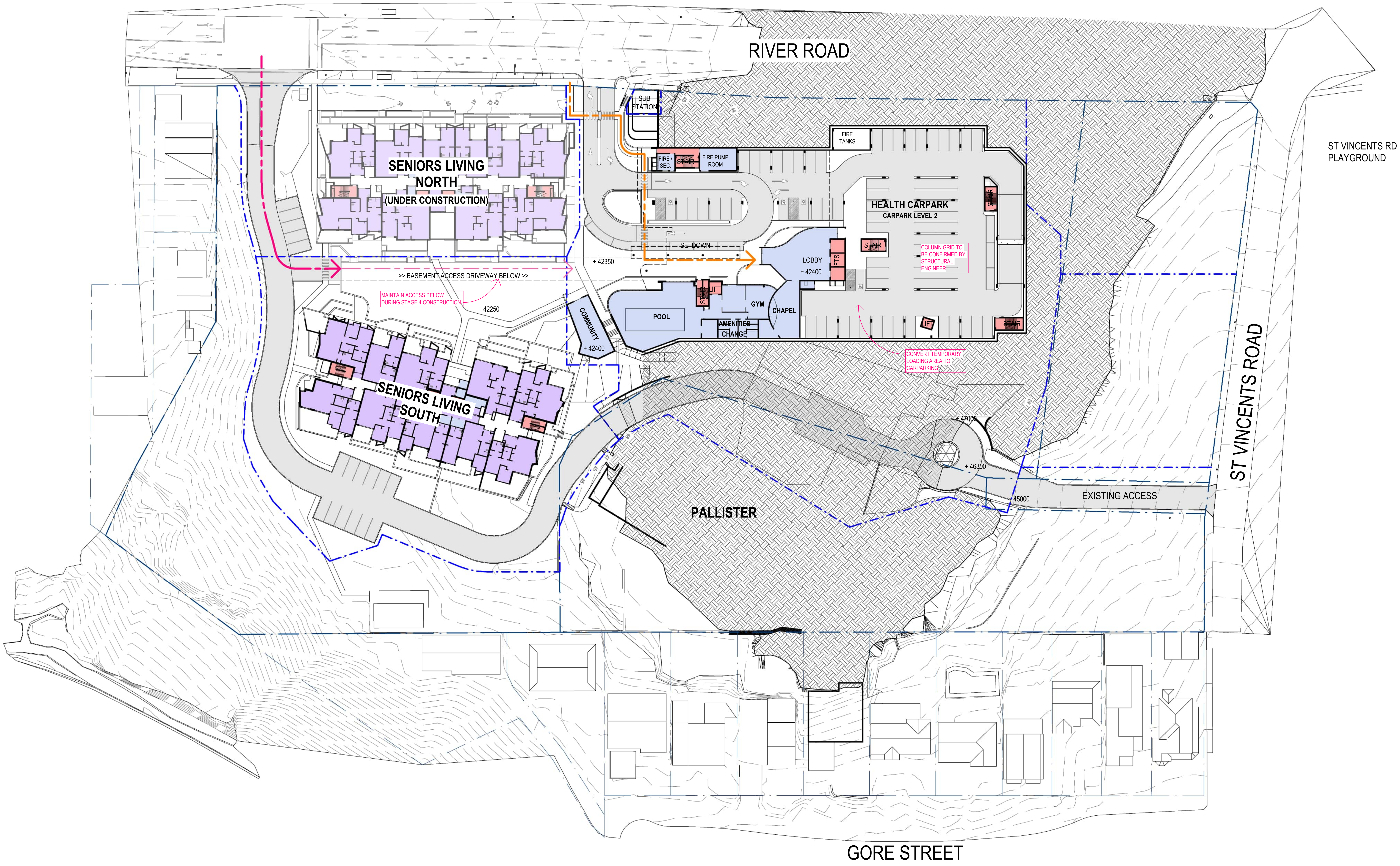
CHECKED: Checker **DRAWING:** **REVISION:**

DRAWN: NAH SK.220218.02



STAGE 4

NORTH

LEGEND

- SITE BOUNDARY
- STAGING LINE
- DELIVERY VEHICLE ACCESS
- PEDESTRIAN ACCESS

SYDNEY
(02) 9261 8333
STUDIO 3, LEVEL 3
35 BUCKINGHAM STREET
SURRY HILLS 2010, NSW
www.bickertonmasters.com.au

CLIENT: HAMMONDCARE

PROJECT: 01605
GREENWICH HOSPITAL REDEVELOPMENT
RIVER RD, GREENWICH

DRAWING TITLE: DELIVERIES STAGING - PREFERRED OPTION - STAGE 4

DATE: 02/07/22 **SCALE:** 1 : 500 @ A1

CHECKED: Checker **DRAWING:** **REVISION:**

DRAWN: NAH SK.220218.03

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APPENDIX B

TUFLOW MODEL INPUTS

B.1 TUFLOW MODEL PARAMETERS

Table B-1 TUFLOW Model Parameters

Model Parameter	Value	Comments
TUFLOW Version	2020-10-AC-TUFLOW_iSP-w64	Utilising Sub Grid Sampling to Capture details in the channels
Guidelines	ARR2019 Lane Cove Development Control Plan	
LiDAR	1m Resolution	The coverage of this dataset is over the Lane Cove region. The 1m metre Digital Elevation Model (DEM) is produced using TIN (Triangular Irregular Network) method of averaging ground heights to formulate a regular grid. This data set contains ground surface model in ASCII grid format derived from C3 LiDAR (Light Detection and Ranging) from an ALS50ii (Airborne Laser Scanner). The model is not hydrologically enforced. Standard Airbourne Laser Sensor (ALS) products are processed to ICSM standards level C3. This data has an accuracy of 0.3m (95% Confidence Interval) vertical and 0.8m (95% Confidence Interval) horizontal with a minimum point density of UNK laser return per square metre measured at nadir. For more information on the data's accuracy, please refer to the lineage provided in the data history.
Hydrology	Losses IL = 33.0mm CL = 0.72mm/hr	
Cell Size	3m	
2D Starting Time Step	Adaptive time stepping used	Adaptive time stepping used
1D Starting Time Step	Adaptive time stepping used	Adaptive time stepping used
Projection	GDA2020 Z56	
Inflows	Rain-On-Grid	Hyetographs Obtained from the ARR2019 Data Hub
Mannings Roughness Values	Outlined in Appendix C.2.2	
Drainage Network	Outlined in Appendix C.2.3	
Events	1% AEP Durations: 15m (Critical to site),20m, 25m, 30m, 45m, 60m, 90m, 120m.	

APPENDIX C

MODEL DEVELOPMENT

C.1 HYDROLOGIC INPUT

C.1.1 Design Rainfall

The centroid of the contributing catchment's latitude and longitude were used as inputs to the BOM's Design Rainfall Data System (2016) to extract the Intensity Frequency Duration (IFD) Table which was used within the TUFLOW model.

The adopted IFD table is provided in Table C-1.

Table C-1 IFD Intensity Frequency Depths (mm) Table (BOM)

Duration	Annual Exceedance Probability (AEP)						
	63.20%	50%	20%	10%	5%	2%	1%
1 min	2.39	2.68	3.59	4.21	4.82	5.64	6.27
2 min	3.96	4.4	5.8	6.75	7.7	9.02	10.1
3 min	5.5	6.12	8.08	9.43	10.8	12.6	14.1
4 min	6.89	7.68	10.2	11.9	13.6	16	17.8
5 min	8.14	9.1	12.1	14.2	16.3	19	21.2
10 min	12.9	14.5	19.4	22.8	26.2	30.6	34
15 min	16.1	18.1	24.3	28.6	32.8	38.3	42.5
20 min	18.5	20.8	27.9	32.8	37.6	43.9	48.8
25 min	20.4	22.9	30.7	36.1	41.3	48.3	53.7
30 min	22	24.7	33	38.8	44.4	51.9	57.7
45 min	25.7	28.7	38.3	44.9	51.4	60.2	67
1 hour	28.5	31.8	42.3	49.5	56.7	66.5	74.1
1.5 hour	32.8	36.5	48.4	56.7	64.9	76.3	85.3
2 hour	36.2	40.3	53.3	62.5	71.7	84.5	94.6
3 hour	41.9	46.5	61.7	72.4	83.4	98.5	111
4.5 hour	48.8	54.3	72.2	85.1	98.4	117	131
6 hour	54.8	61	81.5	96.3	112	133	150
9 hour	64.9	72.4	97.6	116	135	161	183
12 hour	73.4	82.2	112	133	156	186	211
18 hour	87.6	98.6	135	162	190	229	259
24 hour	99	112	155	186	219	263	298

C.1.2 Temporal Patterns

ARR 2019 temporal patterns have been adopted for the analysis.

The temporal patterns adopted within the hydraulic models were taken from Chapter 5 of Book 2 of ARR 2019. The site is situated in the East Coast South region of Figure C-1.

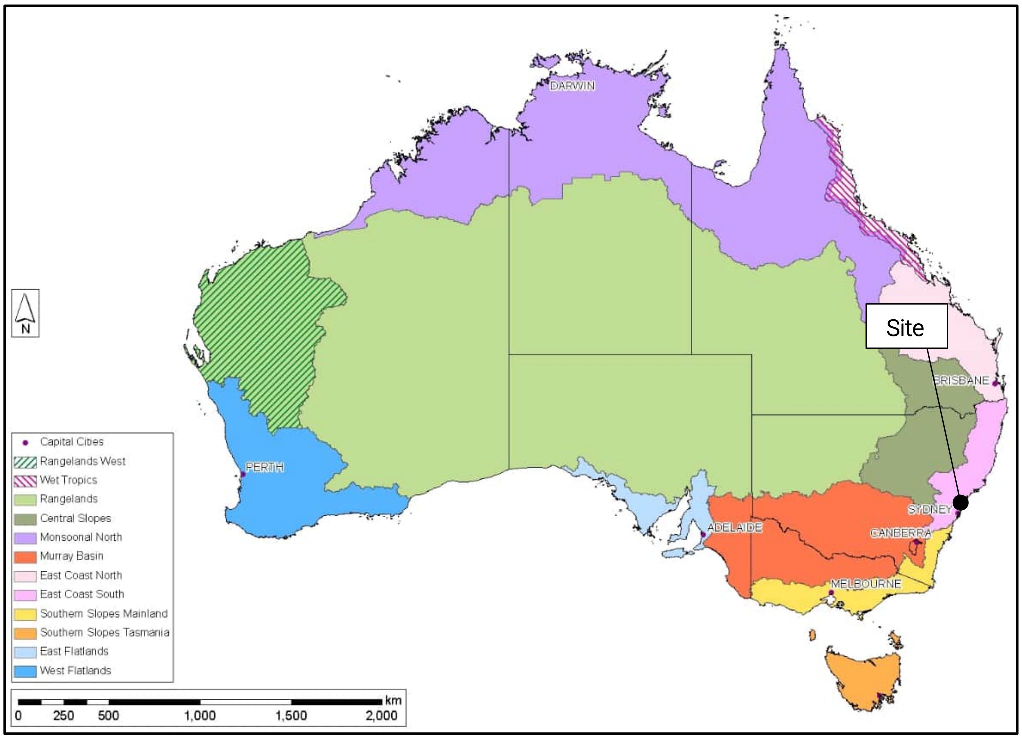


Figure C-1 Temporal pattern regions (ARR 2019)

C.1.3 Rainfall Losses

Storm losses and median pre-burst rainfall depths were extracted from the ARR Data Hub to determine the rainfall initial loss and continuing loss parameters adopted within the model. The latitude and longitude inputs used within the ARR Data Hub are shown in Figure C-2.

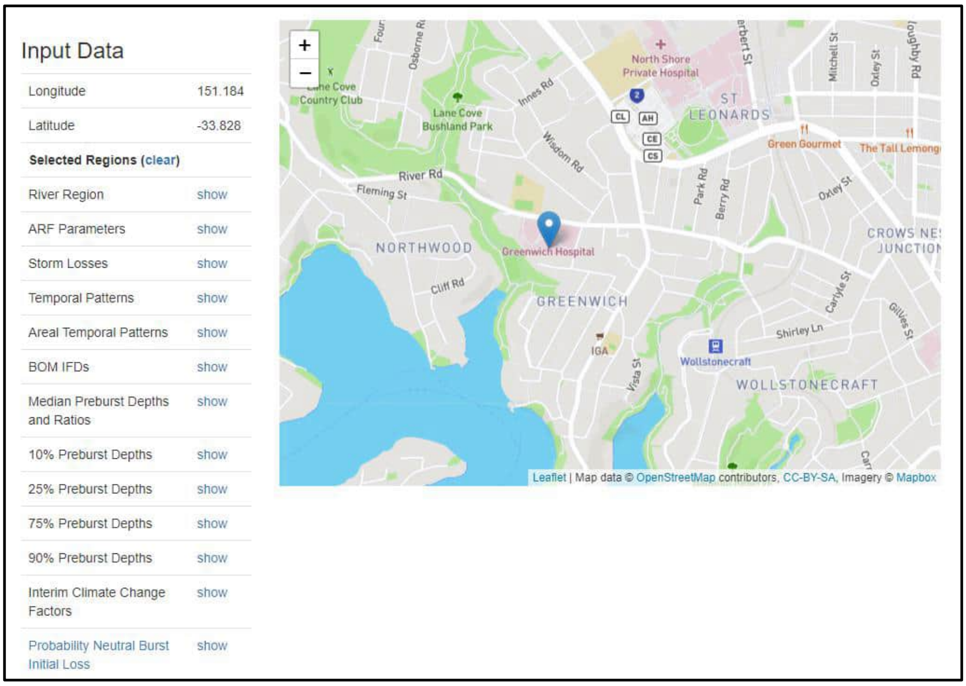


Figure C-2 ARR Data Hub Location Inputs

The storm losses from the ARR datahub are shown in Figure C-3. and the median pre-burst rainfall depths for the 60 minute event are shown in Figure C-4

Storm Initial Losses (mm)	33.0
Storm Continuing Losses (mm/h)	1.8

Figure C-3 ARR Data Hub Storm Losses

Median Preburst Depths and Ratios

Values are of the format depth (ratio) with depth in mm

min (h)\AEP(%)	50	20	10	5	2	1
60 (1.0)	11.0 (0.345)	7.7 (0.182)	5.6 (0.112)	3.5 (0.062)	2.1 (0.031)	1.0 (0.013)

Figure C-4 ARR Data Hub Pre-burst Depths

The rainfall initial loss and continuing loss values were applied to the pervious areas within the hydrologic models. An initial loss value of 33.0 mm was adopted within the hydrologic models (Storm Initial Loss – Preburst Depth). As the catchment is within NSW the Continuing Loss has been factored by a value of 0.4, a continuing loss value of 0.72 mm/hr (1.8 mm/hr * 0.4) was also adopted.

C.2 HYDRAULIC MODEL SETUP

A 2D hydraulic model was developed using TUFLOW version 2020-10-AC. The latest versions of TUFLOW incorporate the HPC (Heavily Parallelised Compute) model run engine. TUFLOW HPC is an explicit solver for the full 2D Shallow Water Equations (SWE), including a sub-grid scale eddy viscosity model. HPC can be used in GPU (Graphics Processing Unit) mode to improve simulation speed. TUFLOW HPC GPU was used for this assessment.

C.2.1 Model Extent and Topography

A spatial resolution of 3m was chosen as a compromise between model resolution and run times. This spatial resolution was deemed appropriate based on the size of the area to be modelled and considering the key hydraulic structures that needed to be represented. The TUFLOW model topography is illustrated below in Figure C-5.

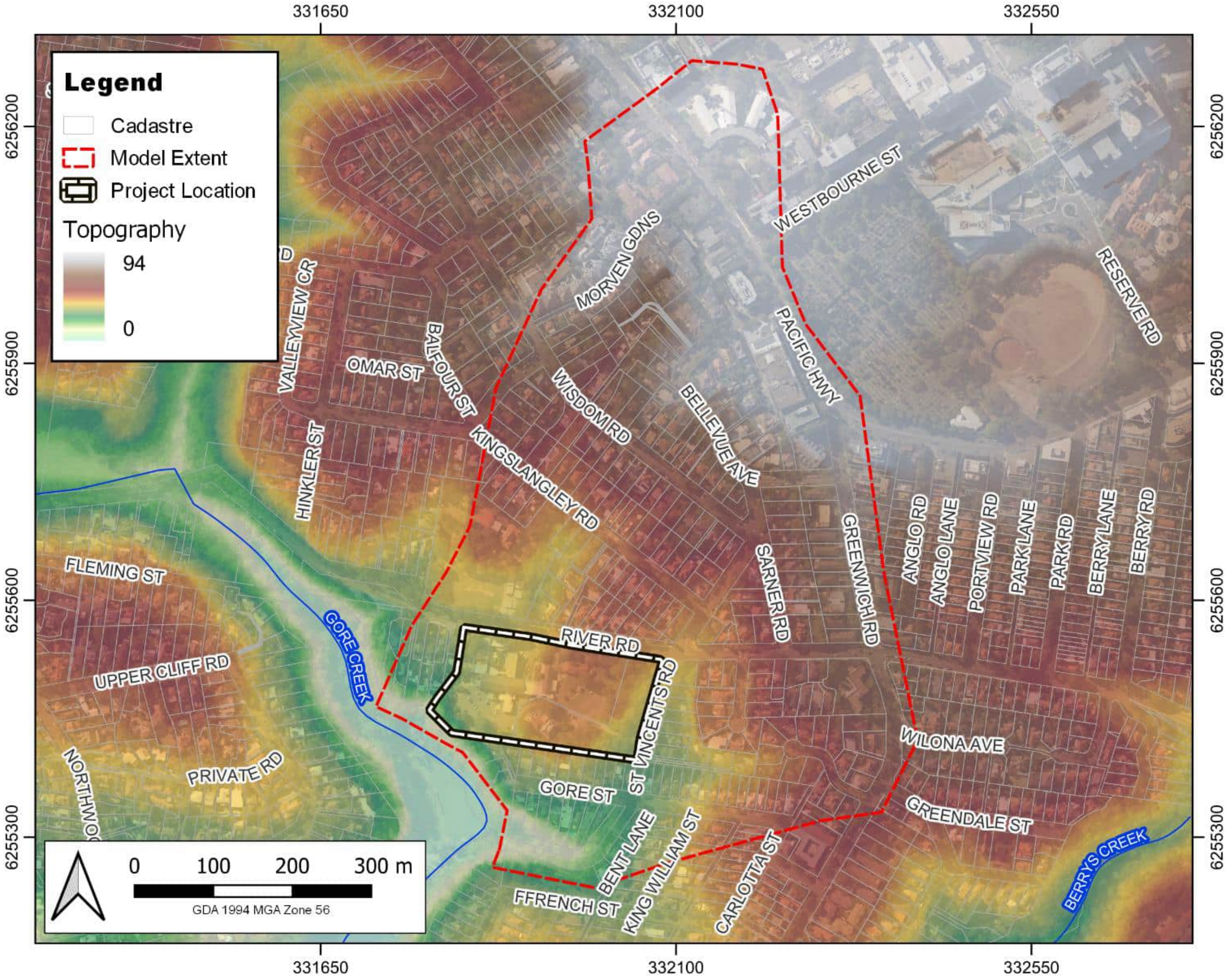


Figure C-5 TUFLOW Model Extent and Topography

C.2.2 Hydraulic Roughness

The adopted hydraulic roughness (Manning's 'n') values for each land use are listed in Table C-2. The spatial distribution of roughness is shown in Figure C-6 for the existing scenario and Figure C-7 for the proposed scenario. The spatial distribution of roughness values was delineated based on inspection of aerial imagery, Google Street view and site visit observations, and land use data.

Table C-2 Adopted Hydraulic Roughness Values

Land Use	Adopted Manning's 'n'
Building Footprints	0.4
Roads and Car Parks	0.025
Grass	0.045
Open Spaces	0.1

Figure C-6 TUFLOW Model Materials – Existing Scenario

Figure C-7 TUFLOW Model Materials – Proposed Scenario

C.2.3 Drainage Network

As mentioned in Section 4.4, the area's drainage network was included in the model provided by Lane Cove Municipal Council.

Pipes were modelled as concrete circular culverts with a Manning's 'n' value of 0.014. Entrance and exit losses and contraction coefficient were adopted based on recommendations in the TUFLOW Manual.

The model 1D network is illustrated in Figure C-8 for the existing scenario and Figure C-9 for the proposed scenario.

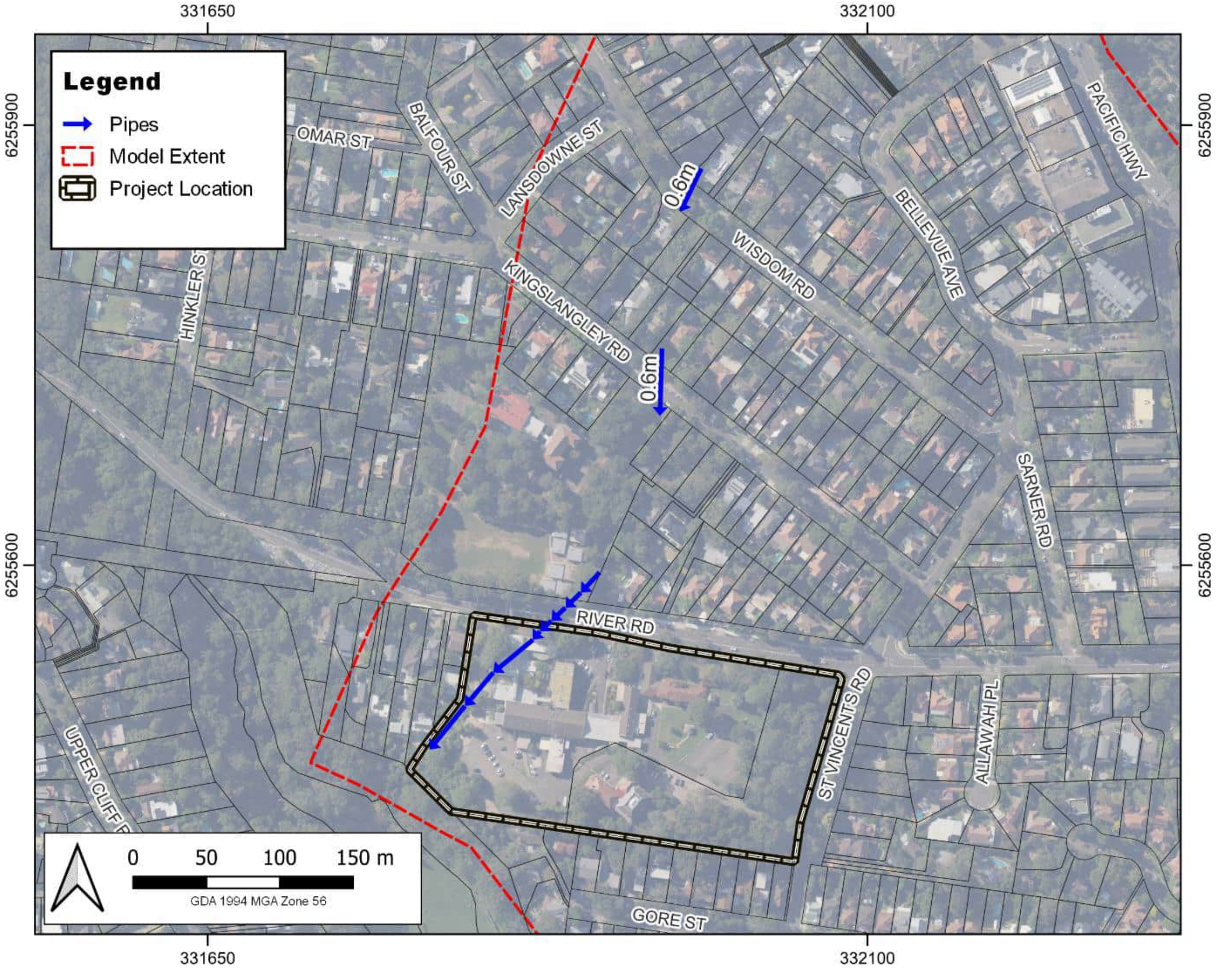


Figure C-8 TUFLOW Model 1D Network – Existing Scenario

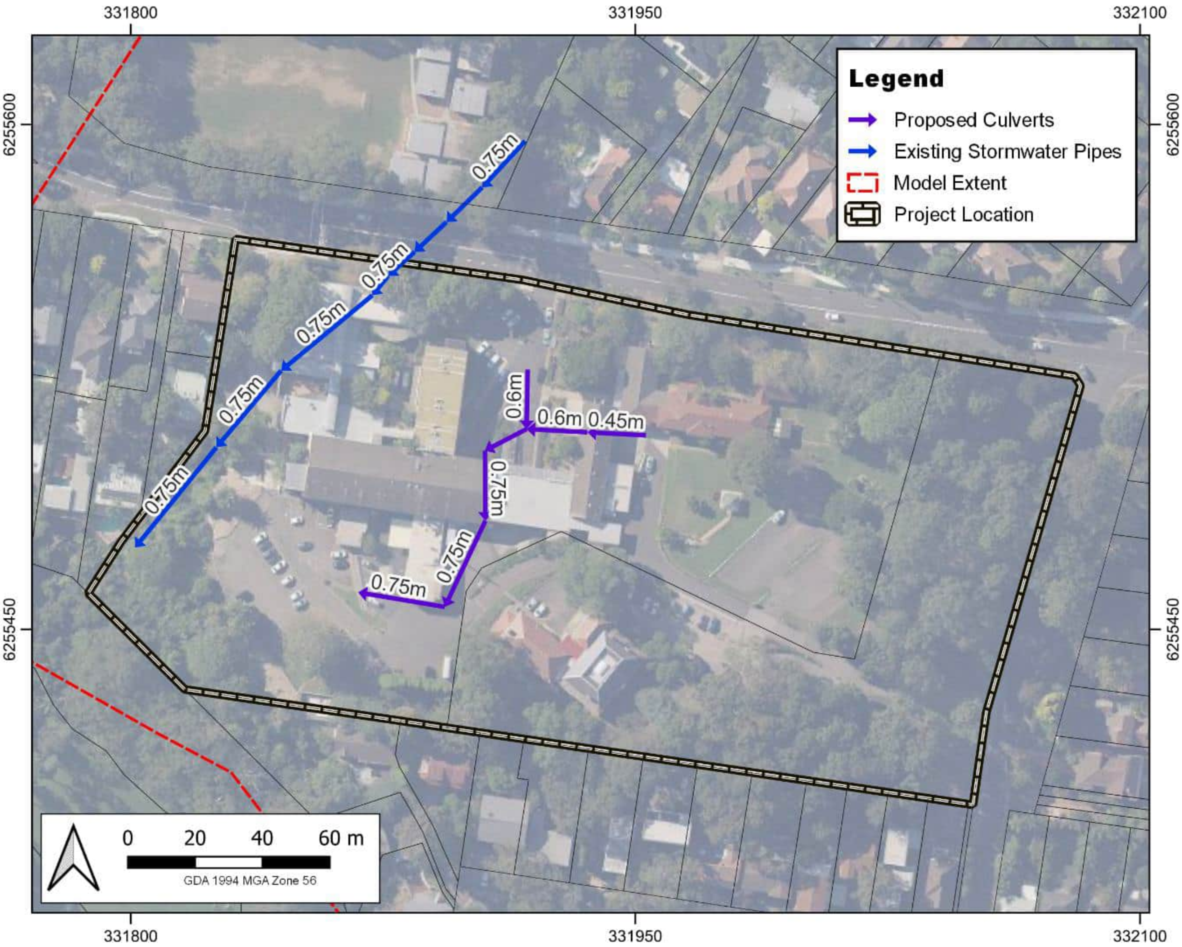


Figure C-9 TUFLOW Model 1D Network – Proposed Scenario

APPENDIX D

SITE VISIT

Figure D-1 Looking South towards Existing Driveway

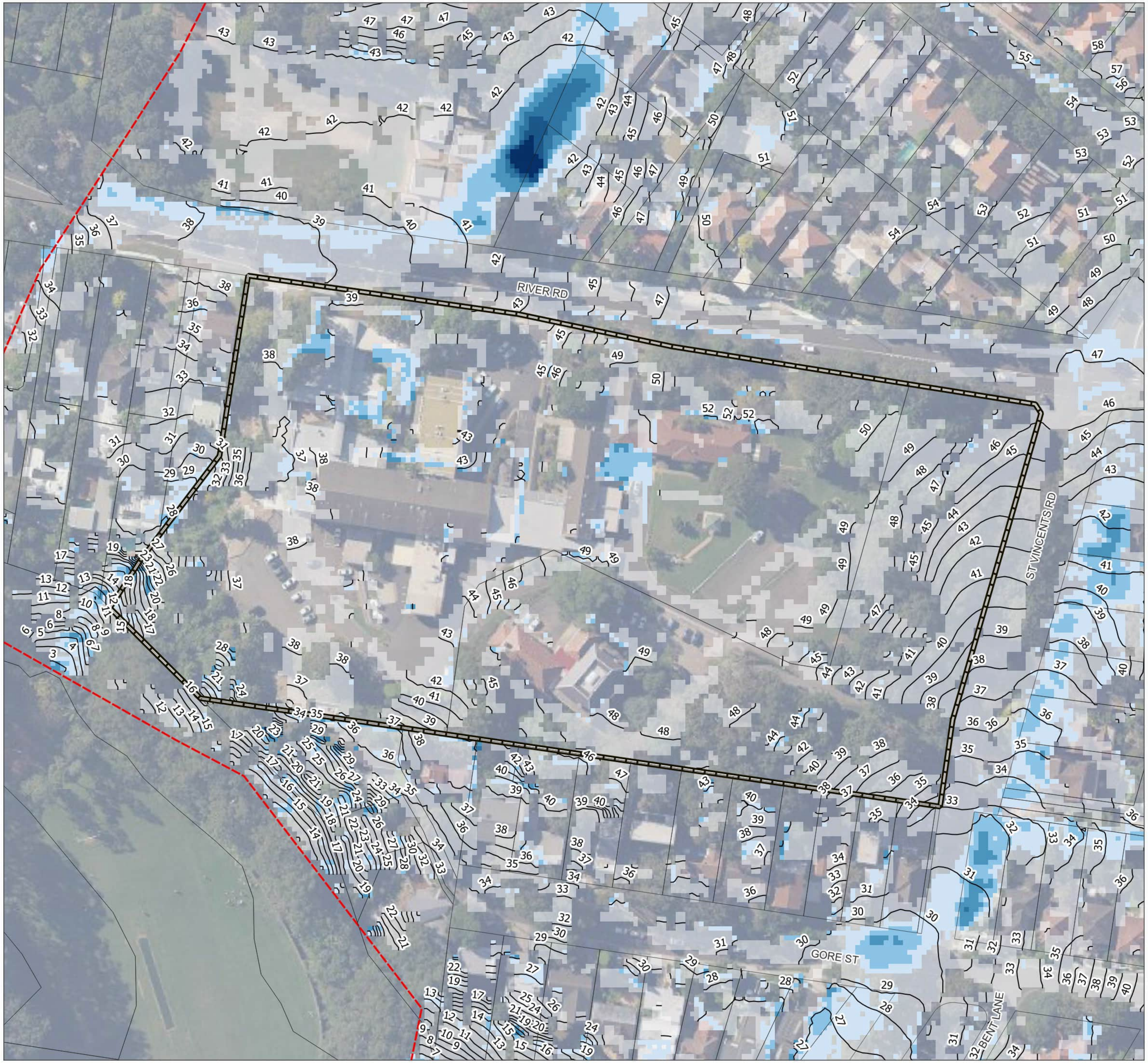
Figure D-2 Existing Western Carpark Entry

Figure D-3 Stormwater Inlet Pit along River Road

Figure D-4 Upstream Culvert on Wisdom Road

APPENDIX E

FLOOD RESULTS



WATER MODELLING solutions

Appendix E - 1

Existing 1% AEP Peak Depth

LEGEND

- Contours
- Cadastre
- Model Extent
- Project Location

Existing 1% AEP Peak Depth (m)

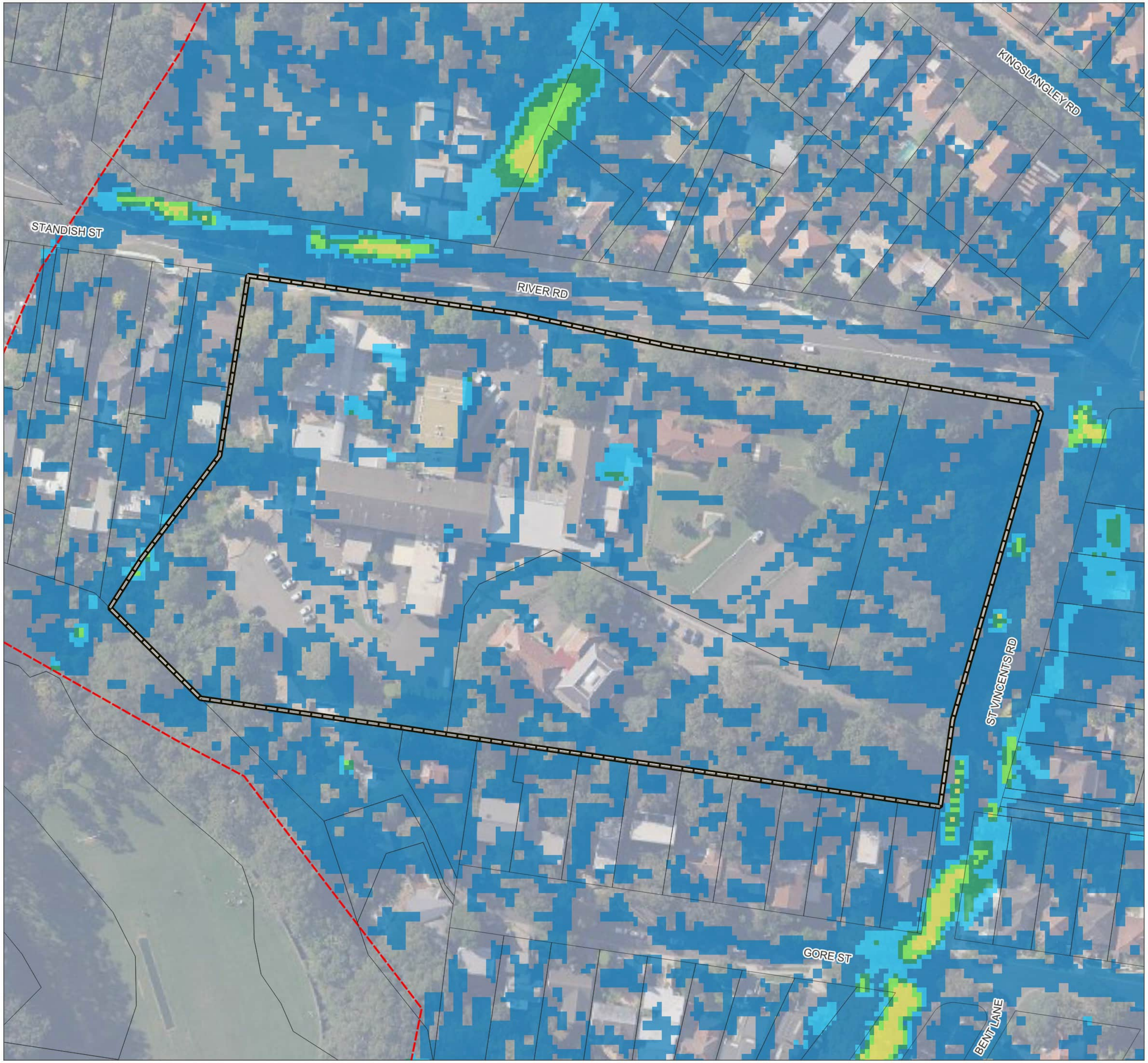
- <= 0.15
- 0.15 - 0.30
- 0.30 - 0.50
- 0.50 - 1.00
- 1.00 - 1.50
- 1.50 - 2.00
- > 2.00

Greenwich Flood Impact Assessment

A3 Scale: 1:1,200
GDA 2020 / MGA Zone 56

0 25 50 75 m

Job No: 20031
Date: 04/04/2022



WATER MODELLING solutions

Appendix E - 2
Existing 1% AEP Peak Hazard

LEGEND

- Cadastre
- Model Extent
- Project Location

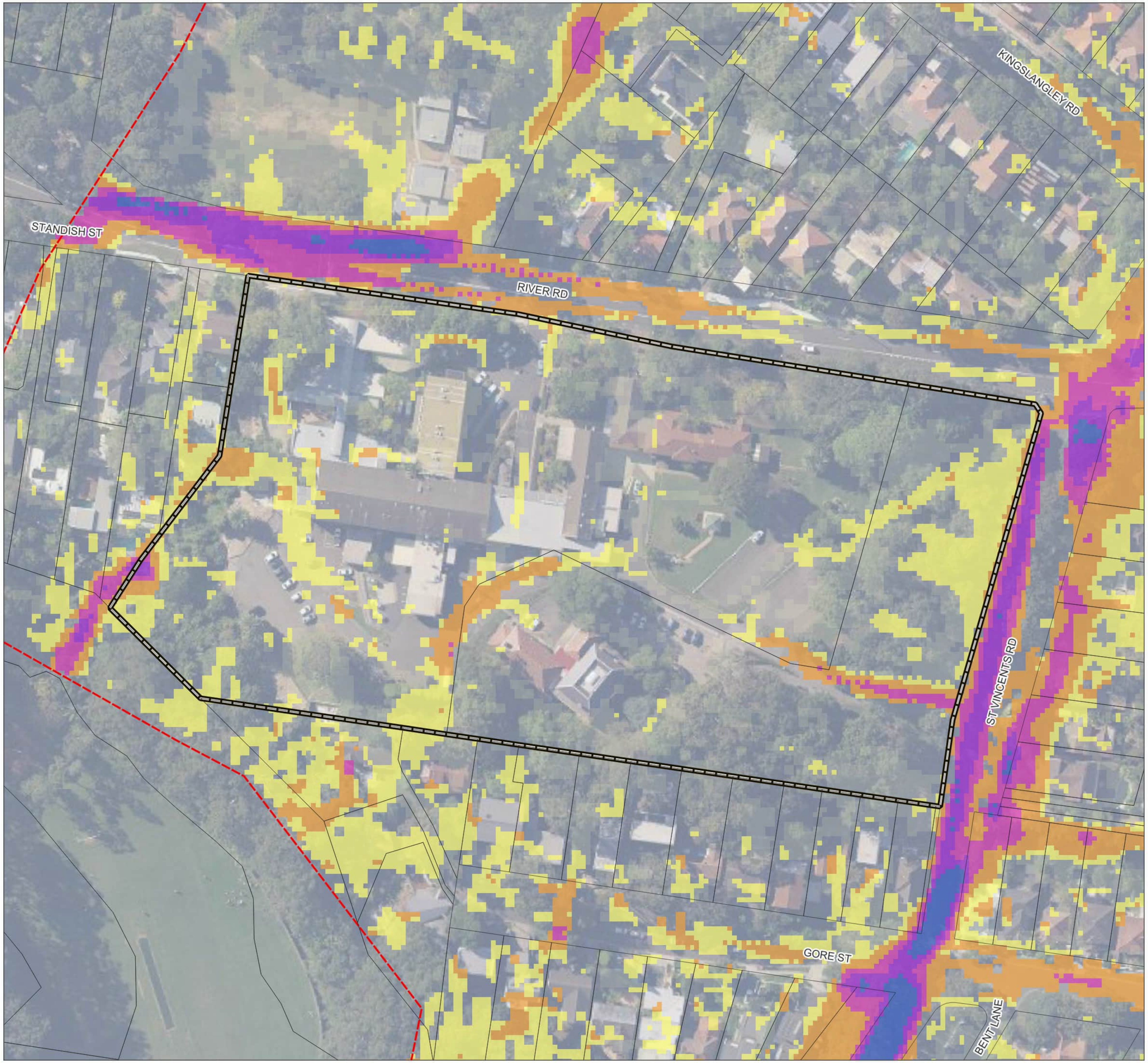
Existing 1% AEP Peak Hazard

- H1 - No Restrictions
- H2 - Unsafe for Small Vehicles
- H3 - Unsafe for Vehicles, Children & Elderly
- H4 - Unsafe for People and Vehicles
- H5 - Unsafe for People or Vehicles. (Buildings Require Special Engineering Design and Construction)
- H6 - Not Suitable for People, Vehicles or Buildings

Greenwich Flood Impact Assessment

A3 Scale: 1:1,200
GDA 2020 / MGA Zone 56
0 25 50 75 m

Job No: 20031
Date: 04/04/2022



solutions
WATER MODELLING

Appendix E - 3
Existing 1% AEP Peak Velocity

LEGEND

- Cadastre
- Model Extent
- Project Location

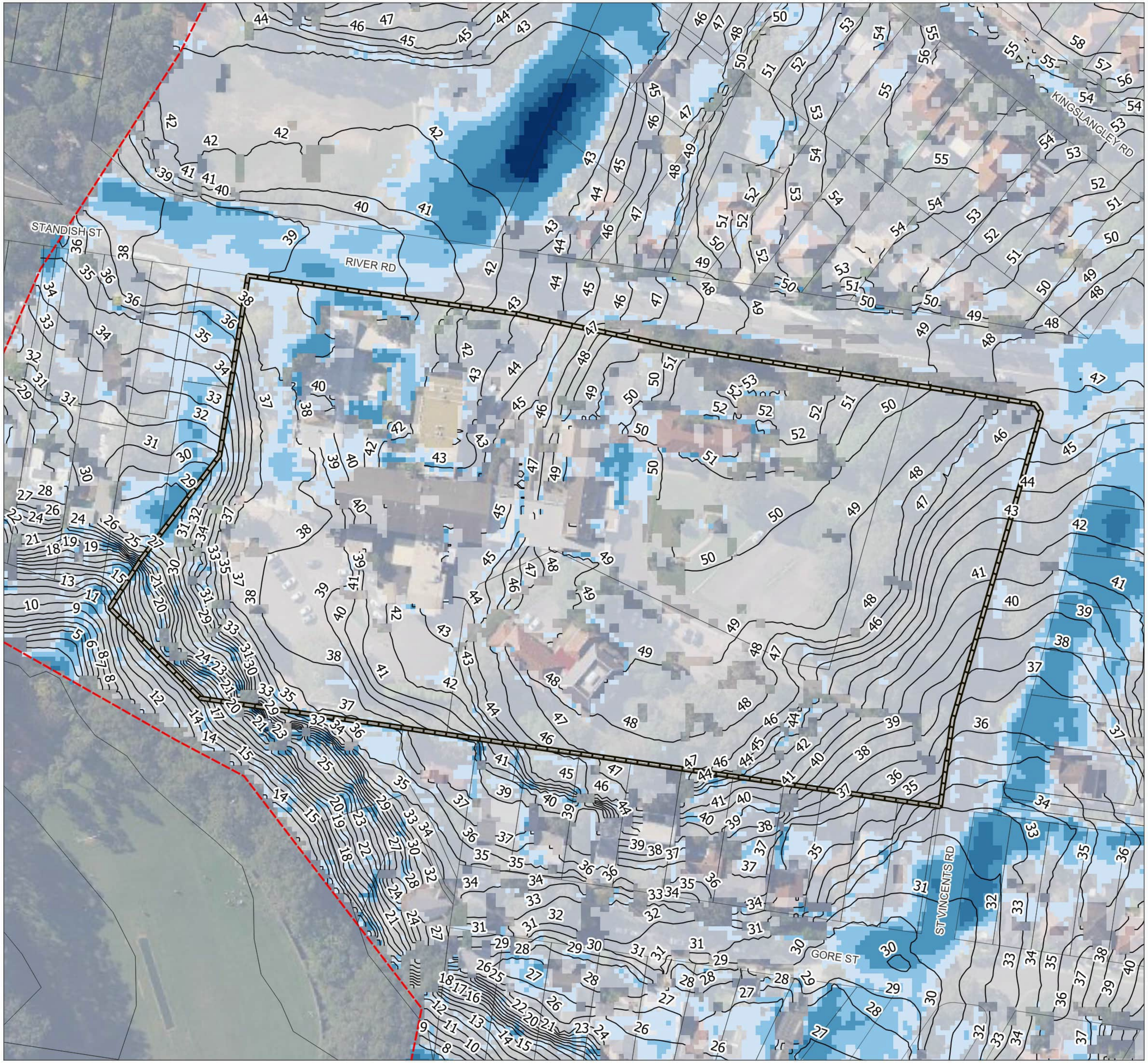
Existing 1% AEP Peak Velocity (m2/s)

- <= 0.25
- 0.25 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.0
- > 2.0

Greenwich Flood Impact Assessment

A3 Scale: 1:1,200
GDA 2020 / MGA Zone 56
0 25 50 75 m

Job No: 20031
Date: 04/04/2022



solutions
WATER MODELLING

Appendix E - 4

Existing PMF Peak Depth

LEGEND

- Contours
- Cadastre
- Model Extent
- Project Location

Existing PMF Peak Depth (m)

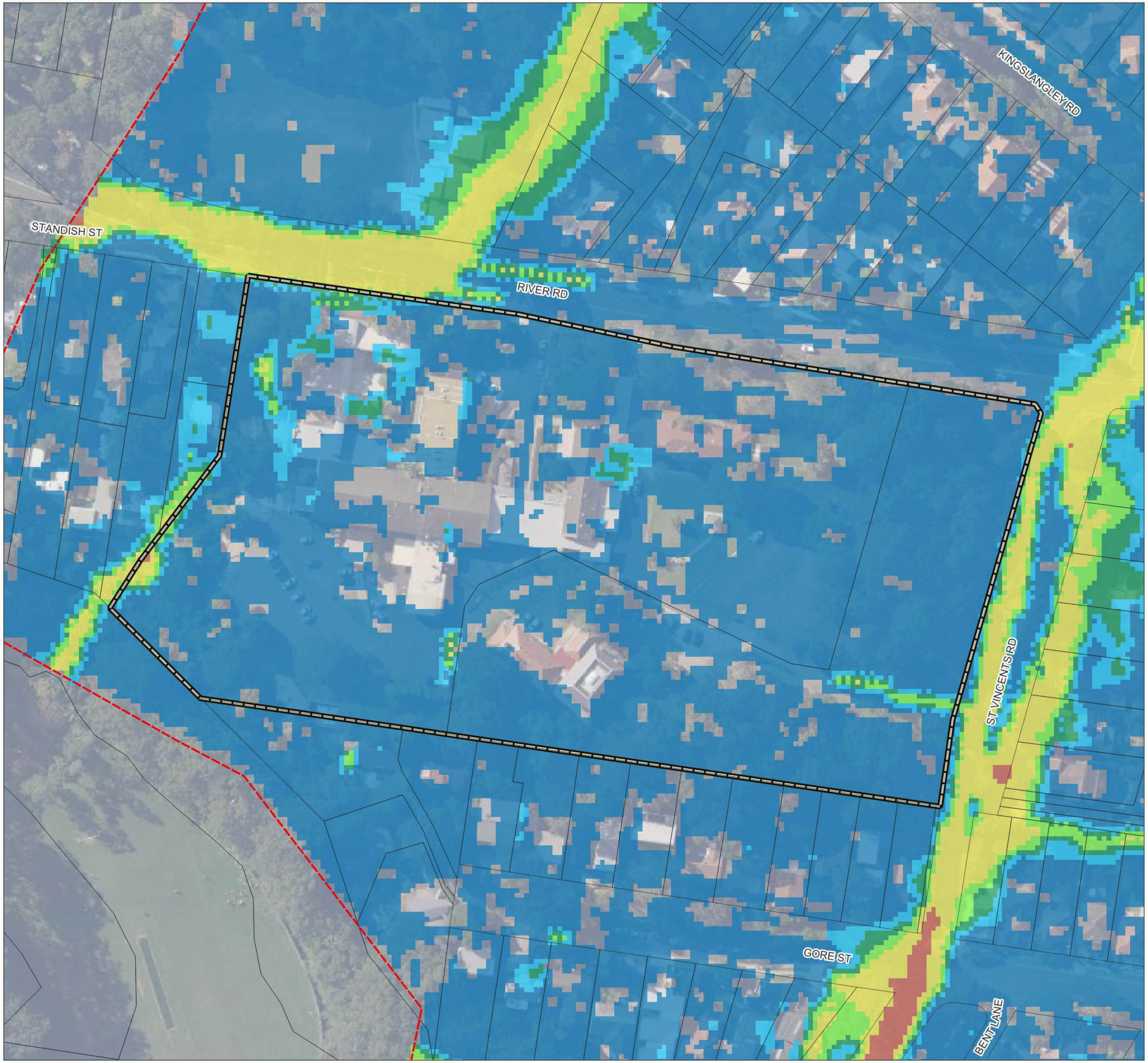
- <= 0.15
- 0.15 - 0.30
- 0.30 - 0.50
- 0.50 - 1.00
- 1.00 - 1.50
- 1.50 - 2.00
- > 2.00

Greenwich Flood Impact Assessment

A3 Scale: 1:1,200
GDA 2020 / MGA Zone 56

Job No: 20031
Date: 04/04/2022

0 25 50 75 m



solutions
WATER MODELLING

Appendix E - 5

Existing PMF Peak Hazard

LEGEND

- Cadastre
- Model Extent
- Project Location

Existing PMF Peak Hazard

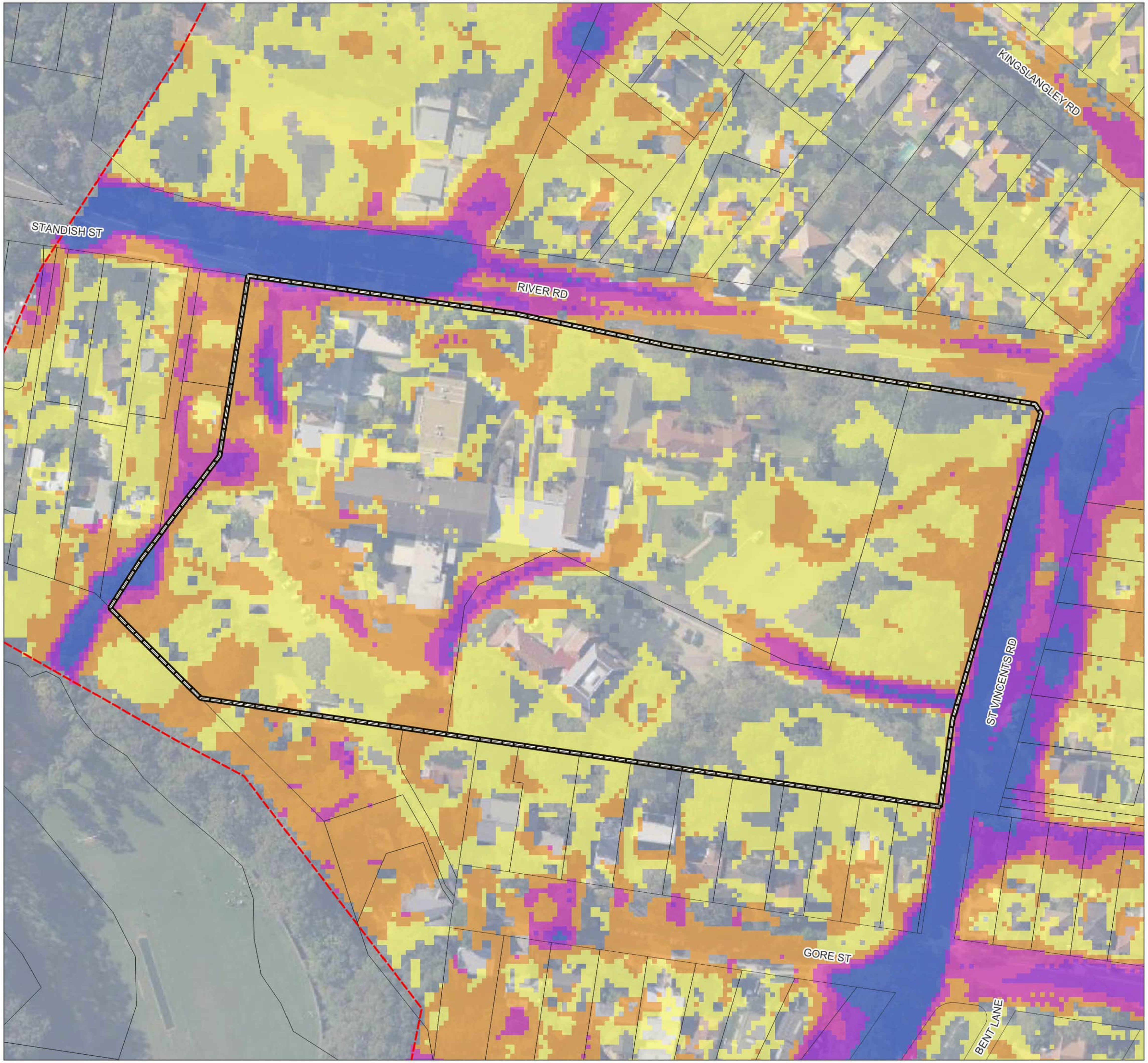
- H1 - No Restrictions
- H2 - Unsafe for Small Vehicles
- H3 - Unsafe for Vehicles, Children & Elderly
- H4 - Unsafe for People and Vehicles
- H5 - Unsafe for People or Vehicles. (Buildings Require Special Engineering Design and Construction)
- H6 - Not Suitable for People, Vehicles or Buildings

Greenwich Flood Impact Assessment

A3 Scale: 1:1,200
GDA 2020 / MGA Zone 56

0 25 50 75 m

Job No: 20031
Date: 04/04/2022



solutions
WATER MODELLING

Appendix E - 6
Existing PMF Peak Velocity

LEGEND

- Cadastre
- Model Extent
- Project Location

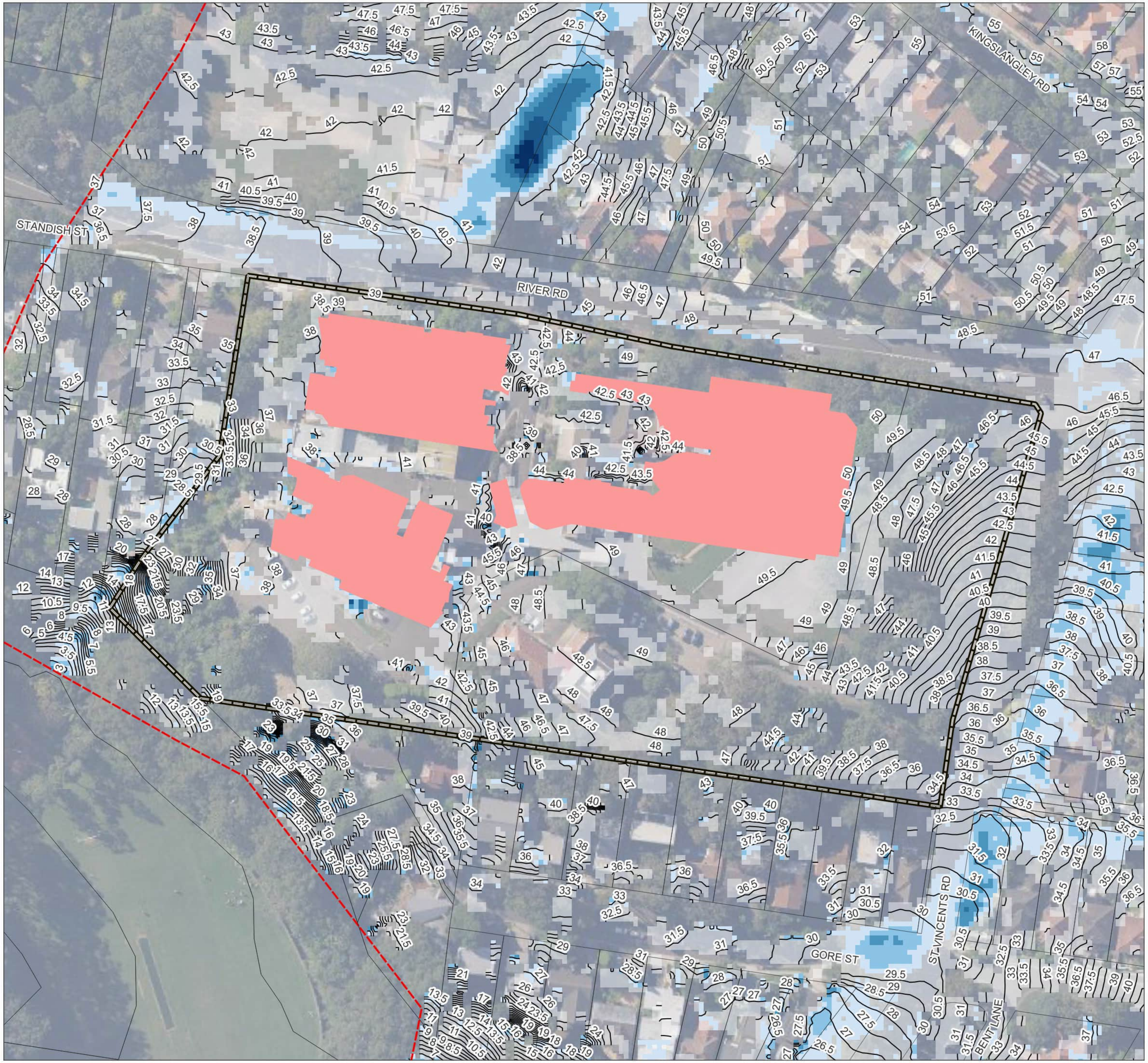
Existing PMF Peak Velocity (m2/s)

- <= 0.25
- 0.25 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.0
- > 2.0

Greenwich Flood Impact Assessment

A3 Scale: 1:1,200
GDA 2020 / MGA Zone 56
0 25 50 75 m

Job No: 20031
Date: 04/04/2022



solutions
WATER MODELLING

Appendix E - 7
Proposed 1% AEP Peak Depth

LEGEND

- Contours
- Cadastre
- Model Extent
- Proposed Building
- Project Location

Proposed 1% AEP Peak Depth (m)

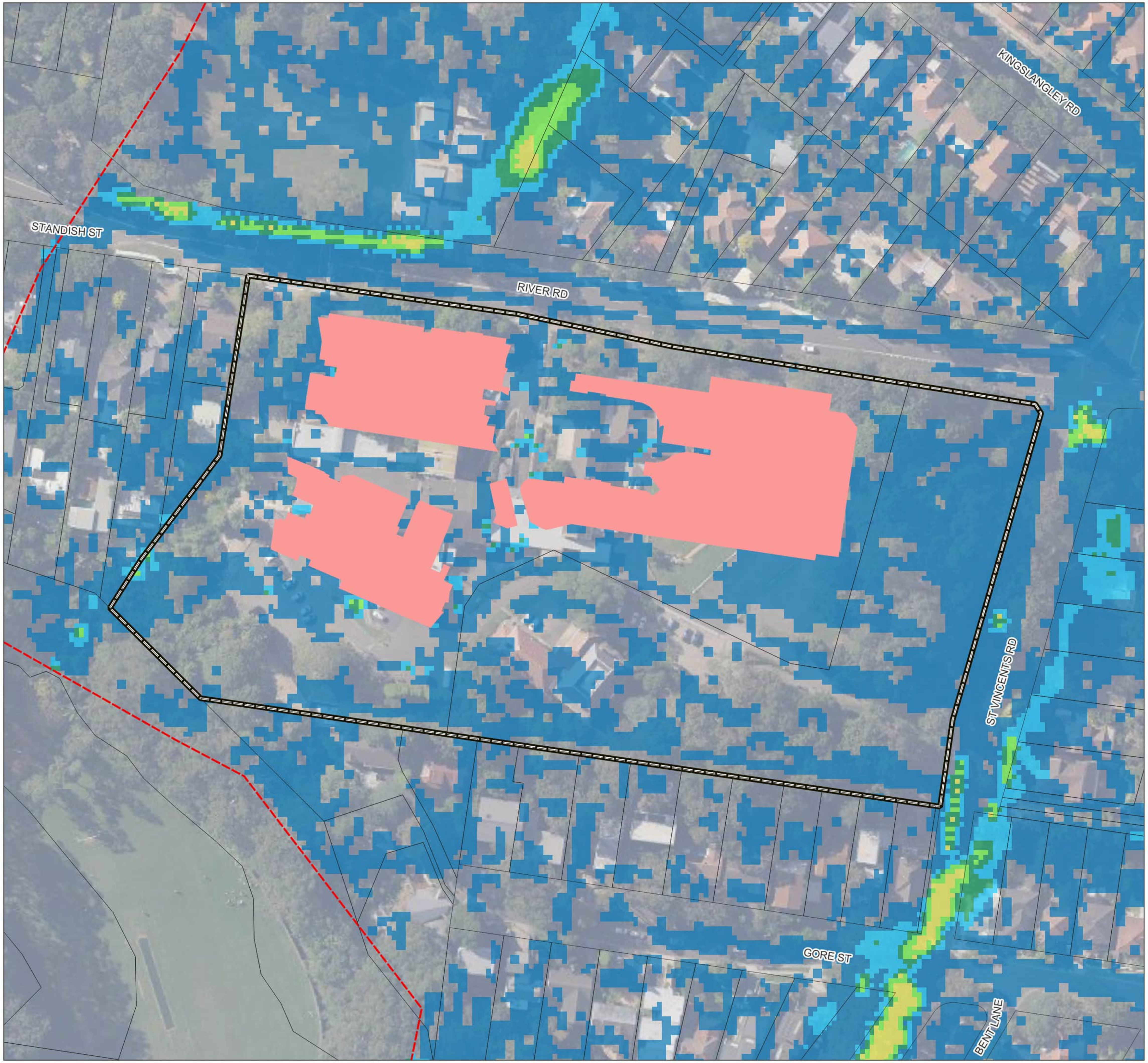
- <= 0.15
- 0.15 - 0.30
- 0.30 - 0.50
- 0.50 - 1.00
- 1.00 - 1.50
- 1.50 - 2.00
- > 2.00

Greenwich Flood Impact Assessment

A3 Scale: 1:1,200
GDA 2020 / MGA Zone 56

Job No: 20031
Date: 04/04/2022

0 25 50 75 m



WATER MODELLING solutions

Appendix E - 8
Proposed 1% AEP Peak Hazard

LEGEND

- Cadastre
- Model Extent
- Proposed Building
- Project Location

Proposed 1% AEP Peak Hazard

- H1 - No Restrictions
- H2 - Unsafe for Small Vehicles
- H3 - Unsafe for Vehicles, Children & Elderly
- H4 - Unsafe for People and Vehicles
- H5 - Unsafe for People or Vehicles. (Buildings Require Special Engineering Design and Construction)
- H6 - Not Suitable for People, Vehicles or Buildings

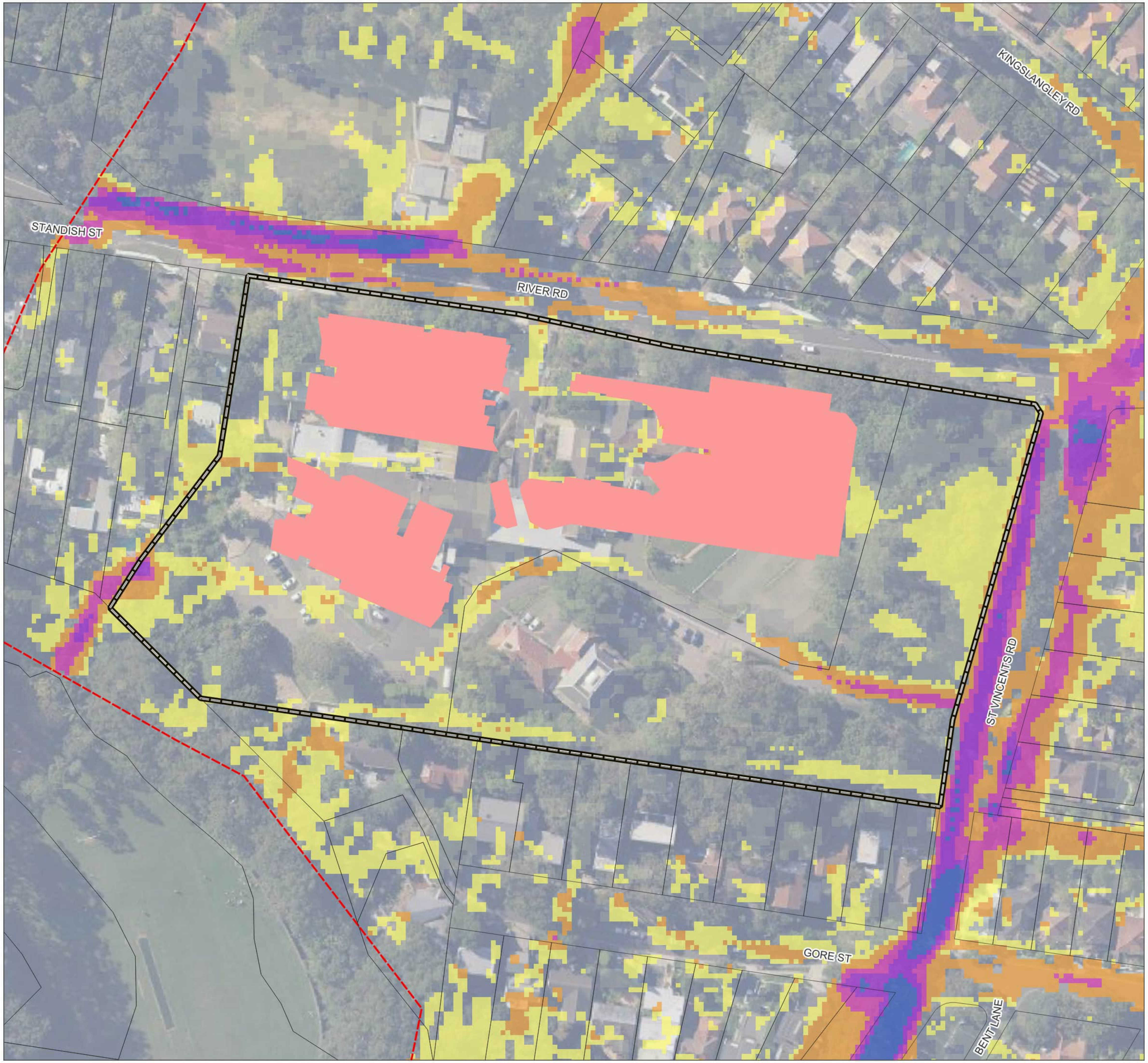
Greenwich Flood Impact Assessment

A3 Scale: 1:1,200
GDA 2020 / MGA Zone 56
0 25 50 75 m

Job No: 20031
Date: 04/04/2022

solutions
WATER MODELLING

Appendix E - 9
Proposed 1% AEP Peak Velocity



LEGEND

- Cadastre
- Model Extent
- Proposed Building
- Project Location

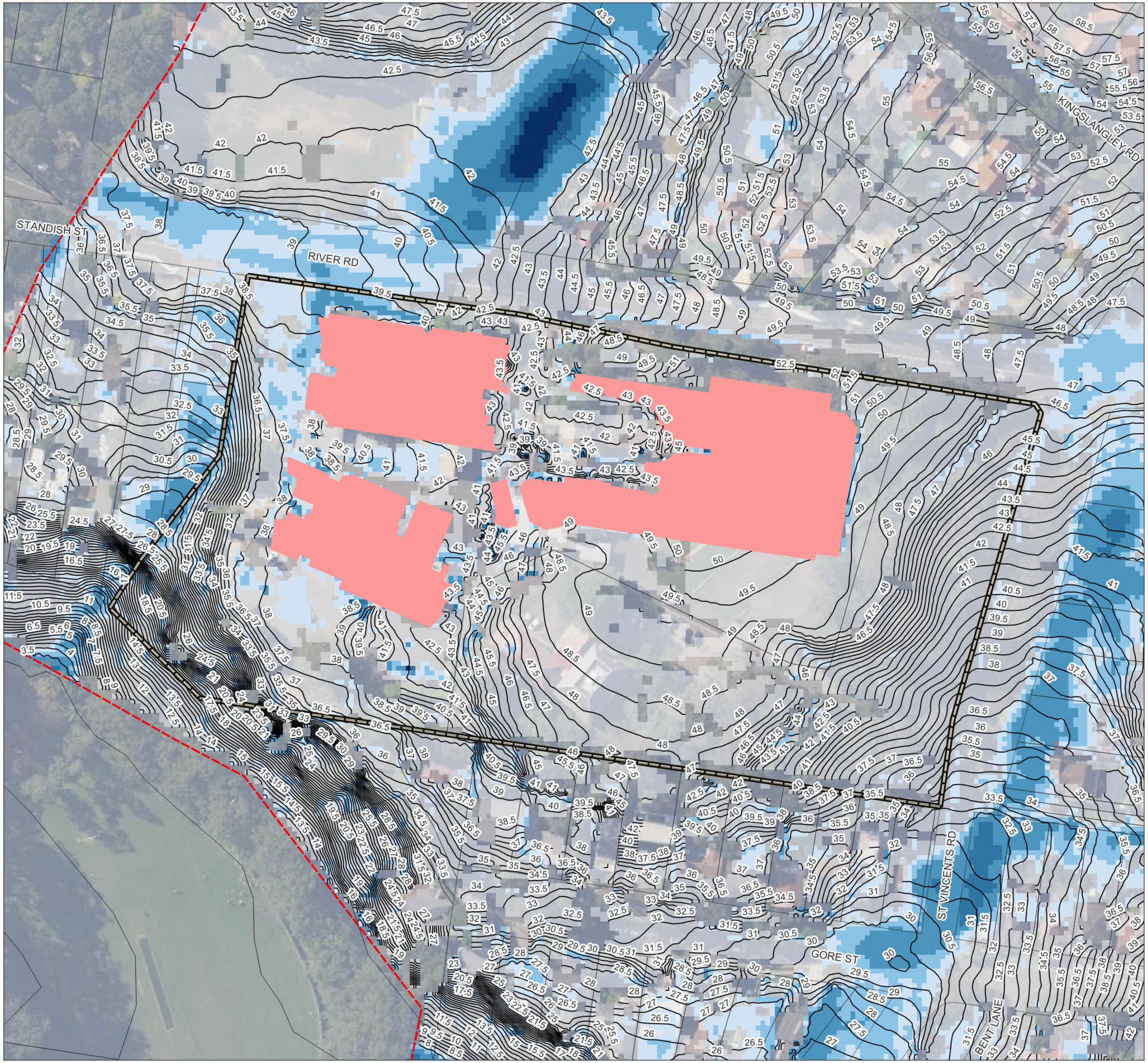
Proposed 1%AEP Peak Velocity (m2/s)

- <= 0.25
- 0.25 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.0
- > 2.0

Greenwich Flood Impact Assessment

A3 Scale: 1:1,200
GDA 2020 / MGA Zone 56
0 25 50 75 m

Job No: 20031
Date: 04/04/2022



WATER MODELLING solutions

Appendix E - 10

Proposed PMF Peak Depth

LEGEND

- Contours
- Cadastre
- Model Extent
- Proposed Building
- Project Location

Proposed PMF Peak Depth (m)

- <= 0.15
- 0.15 - 0.30
- 0.30 - 0.50
- 0.50 - 1.00
- 1.00 - 1.50
- 1.50 - 2.00
- > 2.00

Greenwich Flood Impact Assessment

A3 Scale: 1:1,200
GDA 2020 / MGA Zone 56

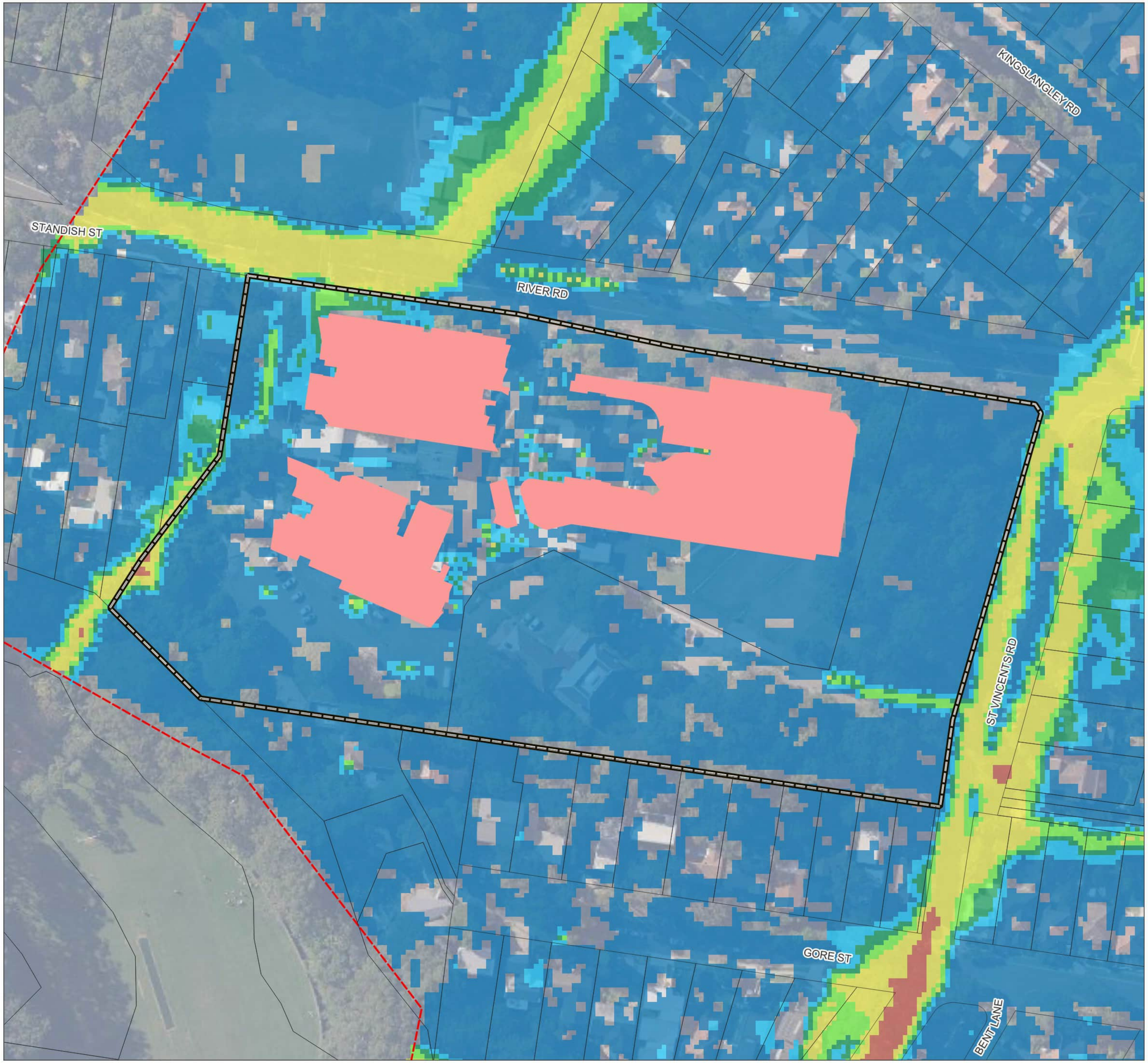
Job No: 20031
Date: 04/04/2022

0 25 50 75 m

solutions
WATER MODELLING

Appendix E - 11

Proposed PMF Peak Hazard



LEGEND

- Cadastre
- Model Extent
- Proposed Building
- Project Location

Proposed PMF Peak Hazard

- H1 - No Restrictions
- H2 - Unsafe for Small Vehicles
- H3 - Unsafe for Vehicles, Children & Elderly
- H4 - Unsafe for People and Vehicles
- H5 - Unsafe for People or Vehicles. (Buildings Require Special Engineering Design and Construction)
- H6 - Not Suitable for People, Vehicles or Buildings

Greenwich Flood Impact Assessment

A3 Scale: 1:1,200
GDA 2020 / MGA Zone 56

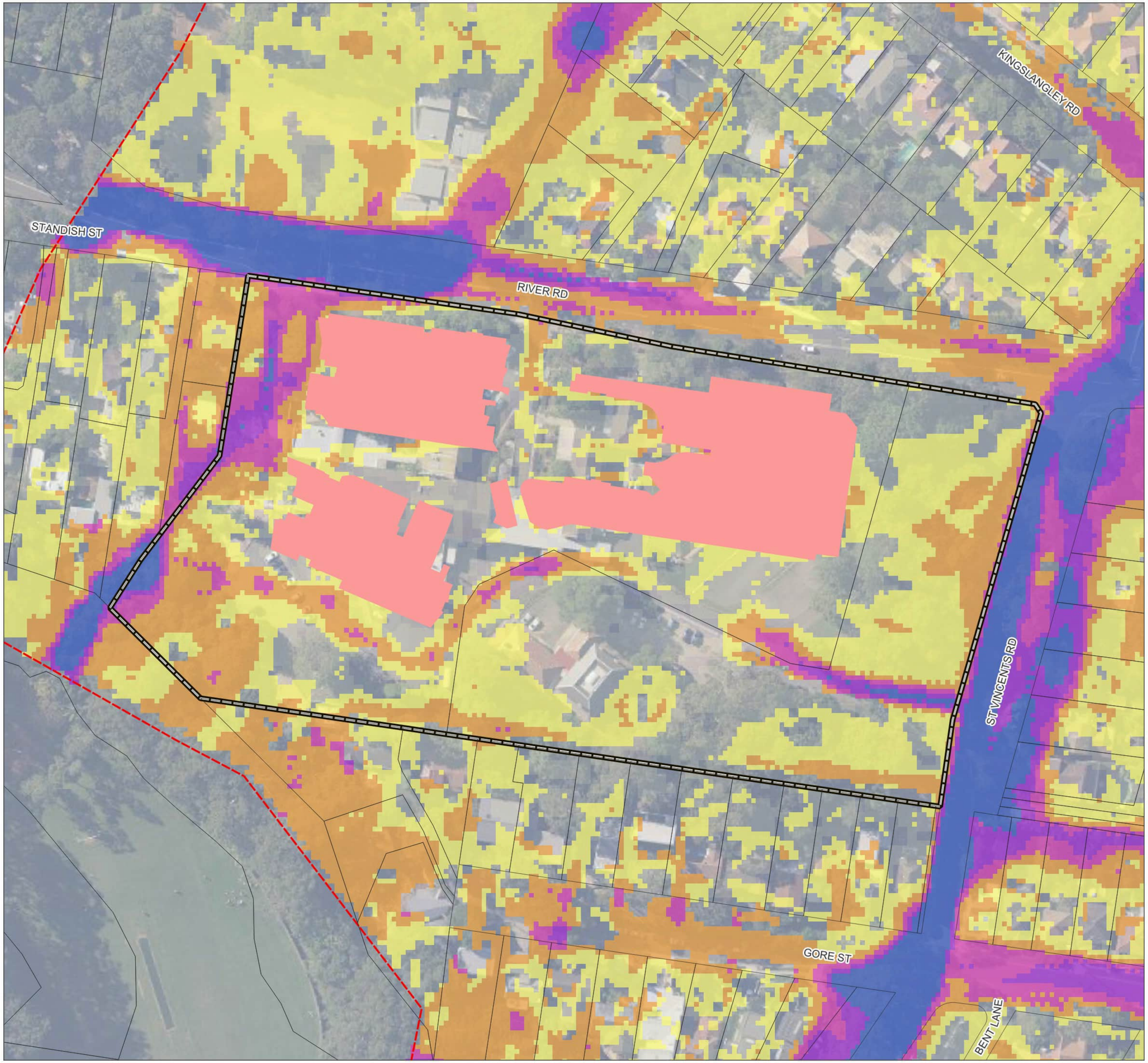
0 25 50 75 m

Job No: 20031
Date: 04/04/2022

WATER MODELLING solutions

Appendix E - 12

Proposed PMF Peak Velocity



LEGEND

- Cadastre
- Model Extent
- Proposed Building
- Project Location

Proposed PMF Peak Velocity (m2/s)

- <= 0.25
- 0.25 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.0
- > 2.0

Greenwich Flood Impact Assessment

A3 Scale: 1:1,200
GDA 2020 / MGA Zone 56
0 25 50 75 m

Job No: 20031
Date: 04/04/2022

solutions
WATER MODELLING

Appendix E - 13

1% Flood Impact Assessment

LEGEND

Cadastre
Model Extent
Project Location

Afflux

- <= -0.4
- -0.4 - -0.2
- -0.2 - -0.1
- -0.1 - -0.05
- -0.05 - -0.02
- -0.02 - 0.02
- 0.02 - 0.05
- 0.05 - 0.1
- 0.1 - 0.2
- 0.2 - 0.4
- > 0.4
- Was Wet Now Dry
- Was Dry Now Wet

Greenwich Flood Impact Assessment

A3 Scale: 1:1,200
GDA 2020 / MGA Zone 56

0 25 50 75 m

Job No: 20031
Date: 04/04/2022

APPENDIX F

FLOOD PLANNING LEVELS

SLN - Seniors Living North
SLN CP - Seniors Living Carpark
FPL - Flood Planning Level

SLN1 - Overland flow path runs south along the driveway west of the building, building entrance not subject to flooding, 150mm stormwater requirement to be met

SLN2 - Entrance subject to overland flow, FPL has been set at the PMF level to ensure building remains flood free, FPL above or at 38.25 mAHD
Proposed Level: 38.3 mAHD
SATISFIED

SLN3 - Entrance subject to overland flow, FPL has been set at the PMF level to ensure building remains flood free, FPL above or at 38.2 mAHD
Proposed Level: 38.3 mAHD
SATISFIED

SL CP - Overland flow path runs south along the driveway west of the building, carpark entrance grades up at 1:29 from ground level (37.35 mAHD) and is not subject to flooding, current design is suitable
Proposed Level: 37.95 mAHD
SATISFIED

Unless specified, building entrances are not subject to overland flow, rather local runoff within the site are to be managed by internal stormwater drainage.

Council requires floor levels to be 150mm above the adjacent ground level. Aprons to be designed at entrances sloping away from the building that achieve this requirement are appropriate.

LEGEND - PLAN

SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
GA.##	(Glazing Assembly).(Glazing Assembly Number) - Refer to Glazing Assembly Elevations for details.	ROOM NAME / 000 / XXX	Room Name (or abbreviation) / Room Number / Floor Finish
W.R.##	(Window).(Room Number).(Window Number) - Refer Elevations & Schedules.	000 / 00000 SIM	Detail Number of Section / Elevation / Sheet Number of Section / Elevation
D.R.##	(Door).(Room Number).(Door Number) - Refer Elevations & Schedules.		

PRELIMINARY ISSUE
NOT FOR CONSTRUCTION

SYDNEY
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35 BUCKINGHAM STREET
SURRY HILLS 2010, NSW
www.bickertonmasters.com.au

CLIENT: HammondCare
PROJECT: 01605
GREENWICH HOSPITAL REDEVELOPMENT
RIVER RD, GREENWICH

REVISION: P8
DATE:
DRAWING No: DD-SLN-0200
DRAWING TITLE: SLN - GENERAL ARRANGEMENT PLAN - L1
DRAWN: NAH, MLL CHECKED: SP SCALE: 1 : 100 @A1
NSW NOMINATED ARCHITECT: ANDREW MASTERS (8037)
30/03/2022 3:25:10 PM