Woolacotts.
CONSULTING ENGINEERS

School Infrastructure NSW

New Primary School in Mulgoa Rise

Flood Impact Assessment

20-306 / 12 August 2021 / SSDA Submission

Contents

Document control

Rev	Date	Revision details	Approved	Verified	Prepared
A	06.05.21	SSDA Submission	KEC	JC	AP
B	10.08.21	Draft SSDA Submission			AP
C	12.08.21	SSDA Submission			AP

1.0 Introduction

The proposed primary school at Mulgoa Rise / Glenmore Park is a new school on a brownfield site, the site is a former quarry that has been filled to the current surface levels.

The new primary school in Mulgoa Rise /Glenmore Park is to be designed and built to significantly improve educational outcomes and address the capacity shortfall across the area for an approximate 414 students initially, with the potential expansion to 1000 as demand grows.

Refer Figure 1 below for the proposed site plan.

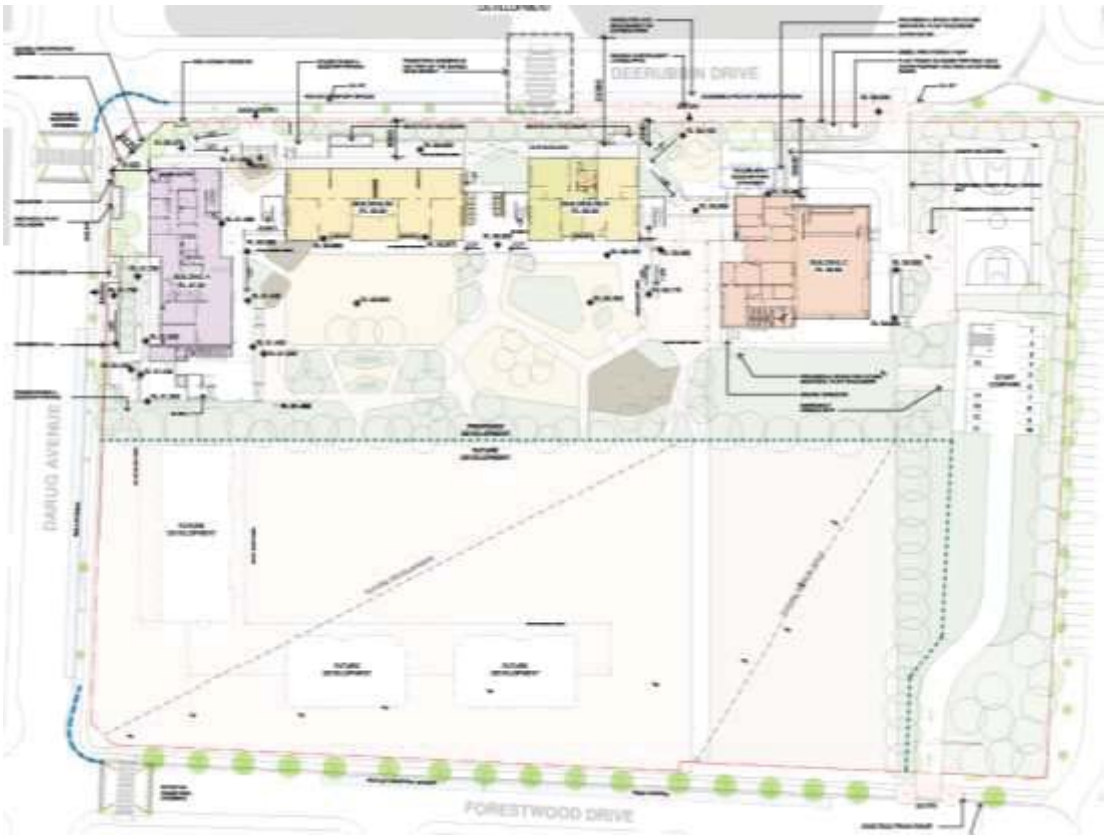

Figure 1 Site Plan

The purpose of this report is to detail the following:

- Flood risk on-site taking into account the effects of climate change, sea level rise and an increase in rainfall intensity.
- Assess the impacts of the development, including any changes to flood risk onsite or off-site, and propose design solutions to mitigate flood risk where required.
- Two-dimensional flood modelling

2.0 Existing Conditions

The proposed primary school site (“The Site”) is a brownfield site. The subject site is bounded to the north by Deerubbin Drive, to the south by Forestwood Drive, to the west by Darug Avenue and to the east by the existing Mulgoa Rise Sports Fields and on-grade carpark. The site is located within a parent subdivision, consisting of predominately low-density residential dwellings. The subject site is shown in Figure 2 below:

Figure 2 New Primary School in Mulgoa Rise Site – Aerial Image. Source: Sixmaps (2021)

The total existing site area is approximately 3 hectares based on the surveyed site boundaries. The site grades gently from a high point in the south-west corner, to a low point in the north east corner. An existing grassed batter (approximately 1V:10H) is located along the southern site boundary. Remaining gradients within the site, from the toe of the batter to the north west corner of the site, varies between 1% to 4%.

3.0 Proposed Development

The new primary school in Mulgoa Rise /Glenmore Park is to be designed and built to significantly improve educational outcomes and address the capacity shortfall across the area for an approximate 414 students initially, with the potential expansion to 1000 as demand grows.

This proposal will facilitate a Core 21 school with 18 learning spaces (also known as Home bases) + 2 support classes, with the selected core facilities at Core 35, for the Hall, Library, Staff facilities and Admin.

The current proposal includes the following buildings:

Building A	Administration and Library
Buildings B2	Home bases learning
Building B3.S	Home bases learning and Support Unit Hub
Building C	Hall and ancillary facilities

4.0 Flood Behaviour

4.1 Flood Investigation

Preliminary investigations have indicated that The Site is potentially affected by two sources of flooding: riverine flooding from the Nepean River (including its tributaries) and local overland flow flooding.

Riverine flooding occurs when heavy rainfall causes the water levels in a river to rise and escape the main channel. Local overland flow flooding is run-off that travels over the land during heavy rainfall events, affected by urban features such as stormwater infrastructure, roads, fences, walls and other structures.

4.2 Riverine Flooding

Correspondence with Penrith City Council has revealed that The Site is not flood affected by riverine flooding by the 1% Annual Exceedance Probability (AEP) design storm event. Refer to Appendix B – Council Flood Advice for further information.

4.3 Overland Flow Flooding

Preliminary site investigations indicated that a large external catchment area was directed towards The Site. Due to the sizeable frontage of The Site, in combination with the limited channel capacity of the surrounding roadways, the investigations indicated that there was potential for overland flow flooding to be directed through The Site.

Based on the above investigations, Woolacotts engaged GRC Hydro to undertake two-dimensional overland flow flood modelling of the proposed development using Tuflow analysis software. A summary of the results of this modelling is provided below:

- The Tuflow modelling has shown that The Site is subjected to overland flow flooding during the 1% Annual Exceedance Probability (AEP) storm event and Probable Maximum Flood (PMF) event. Refer Figures 3 and 4 below.
- During the 1% AEP storm event, existing overland flow flooding occurs in the north-western corner and eastern portion of The Site. This flooding is shallow (less than 300mm) and has a hazard classification of H1, which is the lowest level of hazard and is generally safe for people, vehicles, and buildings.
- The 1% AEP rainfall intensity was increased by 10% (in accordance with ARR2019) to account for climate change. Refer to Section 3.2 in Appendix A for further clarification. This resulted in an increase of peak water levels by 0.1 m. Based on this assessment it is concluded that the climate change scenario does not have any significant effect on flood risk at the site.

- The 1% AEP flood level impact that compares the changes in flood levels between existing and the proposed conditions is currently being undertaken by GRC Hydro for the revised site layout. The previous impact is shown in Figure 5 below, however this Figure will be revised once modelling of the proposed site layout is complete. It is anticipated that the revised flood modelling will produce similar results to the previous proposed development.

[This section will be updated once flood modelling of the proposed development is completed. This is estimated to be completed by the first week of September 2021.]

Refer to Appendix A for the previous *Overland Flow Flood Study* by GRC Hydro dated 29th April 2021 for further information on overland flow flooding, noting that report will be updated with the revised flood modelling.

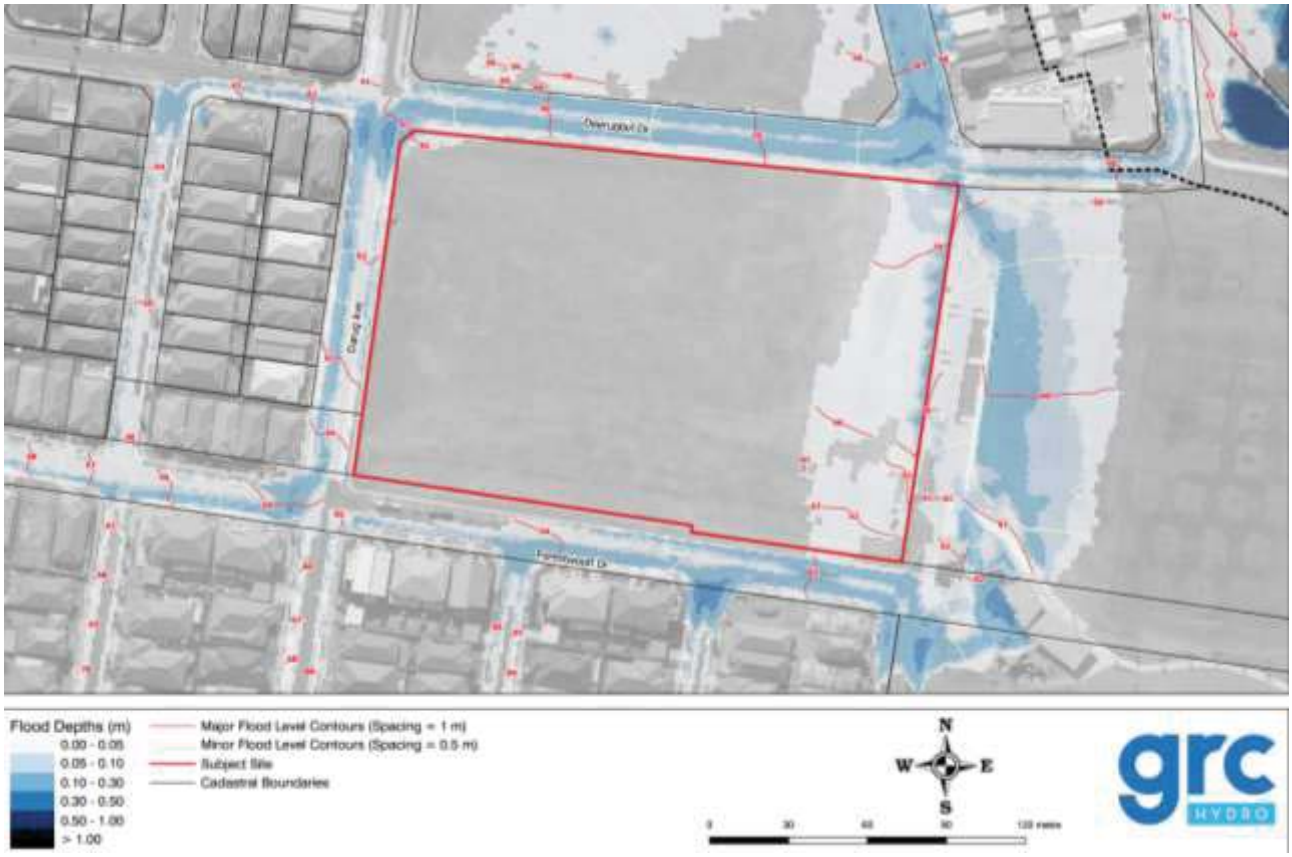

Figure 3 – 1% Pre-developed flood mapping (extract from *Overland Flow Flood Study)*

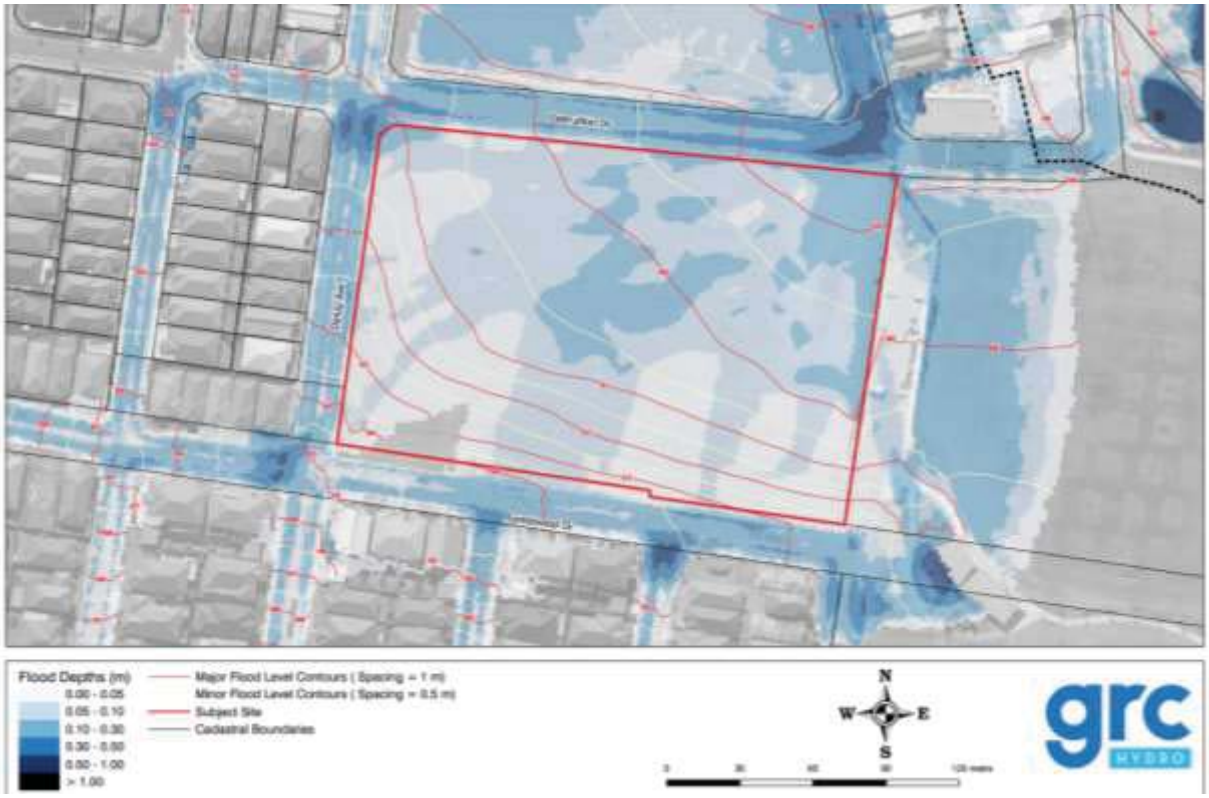

Figure 4 – PMF Pre-developed flood mapping (extract from *Overland Flow Flood Study)*

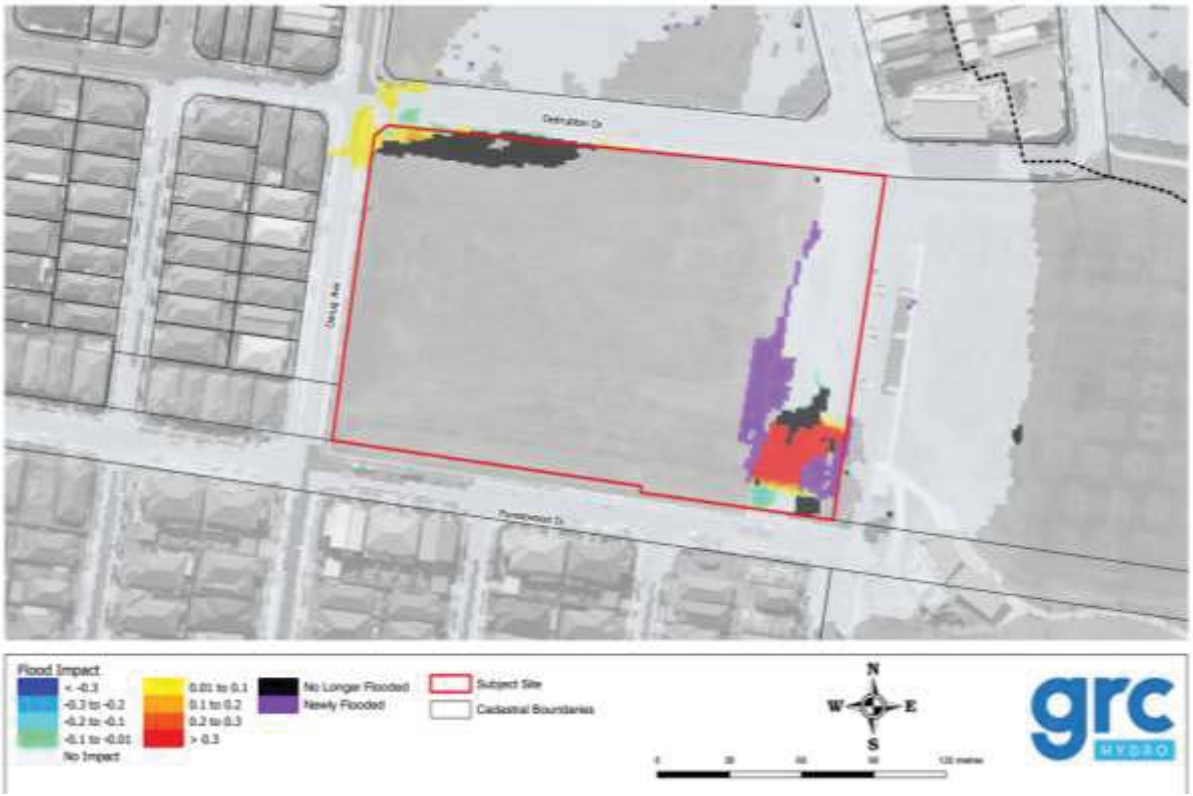

Figure 5 – 1% Post-developed flood mapping (extract from *Overland Flow Flood Study)* for previous flood modelling. [This image will be updated for the proposed development once the flood modelling has been completed]

5.0 Flood management and impacts

5.1 Minimum Floor Levels

According to Council requirements, the Finished Floor Levels (FFL) must be located 500mm above the 1% AEP flood level.

The overland flow flooding along Darug Avenue and Deerubbin Drive governs the FFL of Buildings (1% AEP flood level plus 500mm freeboard).

For Deerubbin Drive, the flood contours (along the northern site boundary) vary from 61.0m to 59.5m AHD. This results in a minimum FFL of 61.5m AHD for Building A, 60.9m AHD for Buildings B2 and B3, and 60.10m AHD for Building C. This is summarised in Table 1 below.

Table 1 - Minimum Floor Level Information

Building	**A**	**B2**	**B3.S**	**C**
Design flood level (1% AEP)	61.0m AHD*	60.4m AHD	59.9m AHD	59.5m AHD
Freeboard	0.5m	0.5m	0.5m	0.5m
Flood Planning Level (FPL)	61.5m AHD (1% AEP + 0.5m Freeboard)	61.9m AHD (1% AEP + 0.5m Freeboard)	60.4m AHD (1% AEP + 0.5m Freeboard)	60.0m AHD (1% AEP + 0.5m Freeboard)

*Note: The 1% AEP Design Flood Level for Building A shown in Table 1 above, is along Deerubbin Drive. For Darug Avenue, the flood contours (along the western site boundary) vary from 64.5m to 61.0m AHD. To maintain an FFL of 61.5m AHD for Building A, a diversion wall is required along the northern half of the western boundary, along with a diversion embankment south of Building. Refer to the *Civil Engineering Schematic Design Report* by Woolacotts, Revision B, dated 10th August 2021 for further information.

5.2 Proposed raised thresholds / blisters

The proposed development will include a pedestrian crossings on Darug Avenue and Forestwood Drive adjacent the north-western corner of The Site.

The provision of raised thresholds / blisters along Darug Avenue, Deerubbin Drive and Forestwood Drive will result in additional depth of flooding entering The Site and neighbouring properties and will impact the required building FFLs.

Refer to the *Civil Engineering SSDA Report* by Woolacotts, Revision B, dated 10th August 2021 for further information.

5.3 Flood Response

The two main responses to a flood emergency include evacuation or Shelter in Place. Evacuation involves moving to an area that is outside the reach of floodwaters, while Shelter in Place refers to staying within the building until floodwaters have receded and it is safe to leave.

The appropriate flood response is typically provided in a Flood Emergency Response Plan. A Flood Emergency Response Plan will be undertaken by the project team prior to the completion of construction.

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Appendix A

Overland Flow Flood Study

[This study will be updated once flood modelling of the proposed development is completed]

Woolacotts.
CONSULTING ENGINEERS

MULGOA RISE PUBLIC SCHOOL
OVERLAND FLOW FLOOD STUDY

APRIL 2021

grc HYDRO

Mulgoa Rise Public School Overland Flow Flood Study

Project Number:	210009
Client:	Woolacotts Consulting Engineers
Client Contact:	Justin Chirillo
Report Author:	Felix Taaffe and Christine Chang
Date:	29 April 2021
Verified By:	Stephen Gray

Date	Version	Description
23 April 2021	1	Draft
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Figures

EXECUTIVE SUMMARY

An overland flow flood study has been undertaken for the proposed Mulgoa Rise Public School. Small sections of the subject site are subject to shallow overland flow flooding, which passes through the north-west corner and east portion of the site.

The site's upstream catchment consists of residential blocks to the south. A hydraulic model has been developed based on TUFLOW software as well as a DRAINS hydrologic model. Flood characteristics for 1% AEP and PMF events have been assessed, as well as a climate change scenario. Peak flood depths, levels and velocities and hazard has been mapped for the site. In most flood events, the large majority of overland flow is contained in the kerb-gutter system and poses minimal risk to the site. 1% AEP flooding has H1 hazard and is not sensitive to increased rainfall intensity due to climate change. In the PMF there is shallow sheet flow across the site, also of H1 hazard.

The proposed development will raise and re-grade a portion of the site and place a car park near the site's south-east corner. The development will not significantly impact on existing flooding, with only a localised increase in two areas that does not correspond to any increase in flood risk. Based on this assessment the development is considered suitable for the site and in accordance with the SEARs requirements.

1. INTRODUCTION

This report has been prepared by GRC Hydro Pty Ltd on behalf of Woolacotts Consulting Engineers. Development of a grassed area in a new residential area of Mulgoa is proposed. The development is for the construction of Mulgoa Rise Public School and will include school buildings in the north-west corner of the site, a large open space and a car park in the south-east corner. This report assesses flooding at the site in accordance with the Secretary's Environmental Assessment Requirements (SEARs). The subject site can be affected by both riverine flooding from the Nepean River and local overland flow flooding. The current assessment only addresses overland flow flooding.

2. PROPOSED DEVELOPMENT

2.1 Site Description

The subject site is located in Mulgoa, NSW around 6 km south of Penrith. The subject site is approximately 2.9 ha and is bounded by Deerubbin Drive to the north, Forestwood Drive to the south, and Darug Avenue to the west. A carpark and grassed area is located to the east and a second grassed area is located to the north. The site is located within an area of medium density residential development.

The site slopes down from south west to east north, with an elevation range of around 64.2 mAHD at the corner of Darug Avenue and Forestwood Drive, to 58.5 mAHD at east end of Deerubbin Drive.

The site's upstream catchment has been determined as part of a hydrologic assessment and is shown on Figure 1, which shows the study area and digital elevation model (DEM). The catchment area is approximately 29 ha.

2.2 Proposed Development

The proposed school includes construction of school buildings, carparks and assembly areas, sport courts, and landscaped areas. Buildings will be located in the north-west portion of the site. The proposed development includes raising and re-grading parts of the existing site. The proposed ground surface has been provided for the purpose of this flooding assessment.

2.3 SEARs SSDA Requirements

This flood study addresses the relevant Standard Secretary's Environmental Assessment Requirements (SEARs) for the proposed development, which include the assessment of hydrologic flows, potential flooding impacts and flood hazard considerations. Peak flood level, depth, extent and flood hazard have been produced for the 1% AEP and PMF events. The current study is for the purpose of addressing SEARs requirements pertaining to overland flow only.

3. FLOODING ASSESSMENT

3.1 Model Setup

The site was previously excluded from overland flow modelling undertaken by Penrith City Council's Overland Flow Flood Overview Study (Cardno, 2006) where it was identified as being within the 1% AEP Nepean River and South Creek flood extent. However, as per the current study's brief, correspondence with Penrith City Council has revealed that the site is not flood affected by riverine flooding by the 1% AEP design storm event. A hydrologic model (DRAINS) and hydraulic model (TUFLOW) have been established by the current study to assess overland flow flooding. This software is widely used and is considered best practice under the NSW Floodplain Risk Management Program.

3.1.1 Hydrologic Model

The hydrologic model (DRAINS) consists of 38 subcatchments, delineated based on LiDAR data. The subject site including the topography are shown in Figure 1 while the subcatchments are shown in Image 1 below. The imperviousness percentage of each subcatchment was estimated from aerial imagery. The DRAINS model was then run for the 1% AEP and Probable Maximum Flood (PMF) using the ARR2019, including rainfall losses.

Image 1: DRAINS subcatchments

Critical Duration Analysis

The critical storm duration for flooding at the site was determined to be 20 minutes. As per ARR2019, ten temporal patterns per storm duration were run to determine the median and mean flow value for each duration. The results are shown in Image 2 below, which shows the critical duration (20 minutes) and temporal pattern (no. 4).

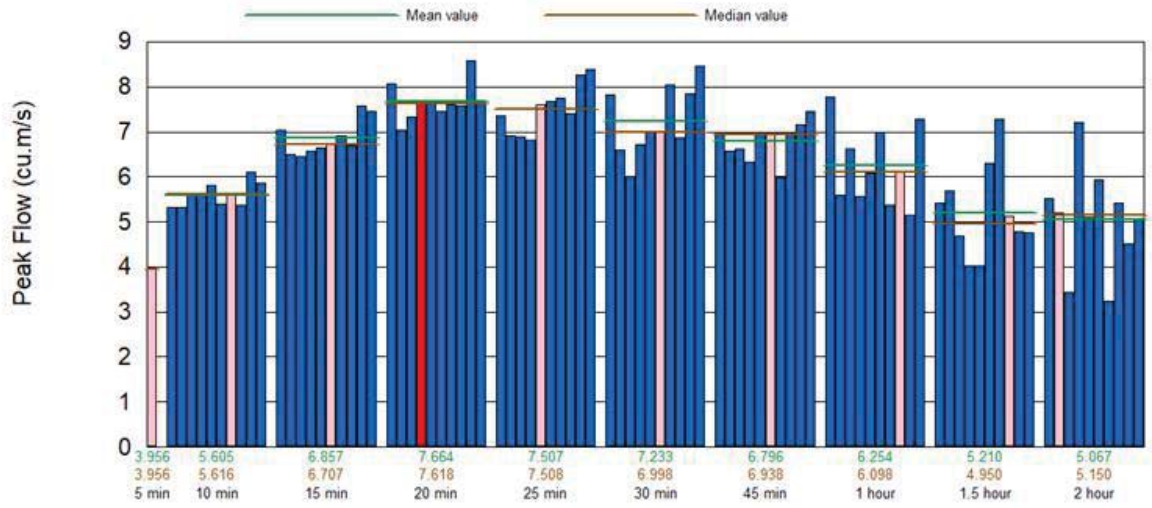


Image 2: Critical Duration Analysis Results

3.1.2 Hydraulic Model

The hydraulic model was based on TUFLOW software. The model extent and input layers are shown on Figure 2. The model input data and parameters are as follows:

- Topographic data: LiDAR data has been supplied by the Department of Education and also compared to data downloaded from the NSW LPI website (date: 2019). LiDAR was then used to develop a 1 m x 1 m DEM.
- Hydraulic roughness (Manning's 'n') based on surface types, including:
    - Grassed areas: 0.04
    - Roads and urban areas: 0.025
- Model inflows: Inflows hydrographs from DRAINS were applied on the downstream corner of each urban block
- Downstream boundary: fixed tailwater downstream boundary approximately 200 m downstream of the site
- Buildings have been modelled as impermeable obstructions.
- Kerb and gutter system and road crests were included as breaklines in the model, based on LiDAR data and the estimated gutter depth.

Model Validation

In the absence of calibration data for the site's catchment, the hydraulic model results were validated based on a review of the unit flow rate for the 1% AEP event. The unit flow rate is calculated as the 1% AEP peak flow, divided by the catchment size, to give a flow rate per hectare. GRC Hydro have

estimated unit flow rates for many catchments across Sydney and find that values are consistently in the 0.1-0.4 m^3/s per hectare range, for overland flow catchments.

The model results gave a peak 1% AEP flow of 6.75 m^3/s from a 29 ha catchment, or a unit flow rate of 0.23 m^3/s per hectare. This values fall within the expected range and give a strong indication that the hydrologic and hydraulic model results are accurate and reliable.

3.2 Existing Flood Behaviour

Hydraulic model results are presented in the following section, which include the assessment of hydrologic flows, potential flooding impacts and flood hazard considerations. Peak flood level, depth, extent and flood hazard have been produced for the 1% AEP and PMF events.

These are presented in Figure 3 to Figure 8, as follows:

- Figure 3: Existing Flood Depths and Levels- 1% AEP;
- Figure 4: Existing Flood Velocity- 1% AEP;
- Figure 5: Existing Flood Hazard- 1% AEP;
- Figure 6: Existing Flood Depths and Levels- PMF;
- Figure 7: Existing Flood Velocity- PMF;
- Figure 8: Existing Flood Hazard- PMF;

Flood hazard mapping has been developed through application of ARR2019 and Australian Emergency Management Institute (AEMI) flood hazard guidelines. The guidelines consider the threat to people, vehicles and buildings based on flood depth and velocity at a specific location. The AEMI flood hazard mapping can be used to assess the flood hazard for site occupants and proposed site usage, as well as for the community surrounding the site. The hazard categories are shown in Chart 1 below.

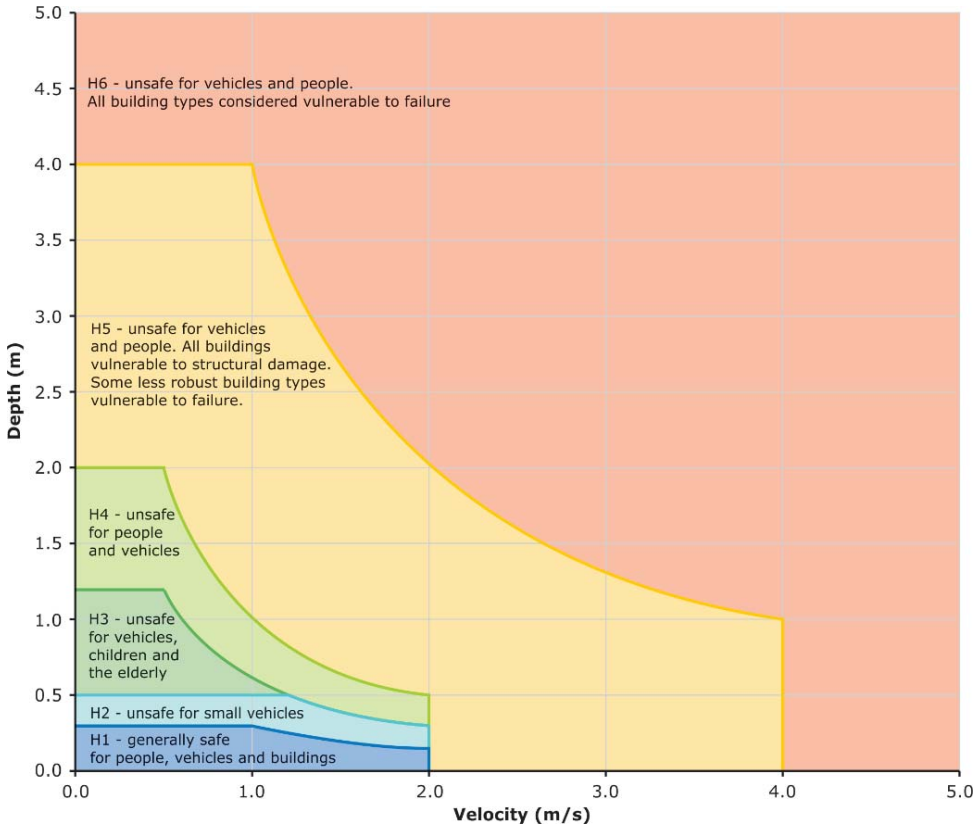


Chart 1: Flood Hazard Curves (Australian Emergency Management Handbook 7)

The results show there are two shallow overland flowpaths that affect the subject site in the 1% AEP event. These are:

1. Overland flow that arrives at the corner of Darug Avenue and Forestwood Drive then continues north down Darug Avenue. The flow is largely contained in the roadway with depths of less then 0.1 m across most of the road, and flow of 0.1-0.3 m in the gutter. After it turns east onto Deerubbin Drive there is a depth of less than 0.1 m that extends onto the corner of the subject site.
2. Overland flow that arrives at Forestwood Drive south of the site flows east and is mostly contained in the kerb-gutter system, preventing flow onto the site, until a shallow flow of less than 0.1 m spills onto the south-east corner of the site and flows north.

The large majority of the site is not flood-affected by overland flow flooding in a 1% AEP event. There is a corresponding low level of hazard with only H1 hazard on the site in the 1% AEP event.

In the PMF the entire site is flood-affected with broad sheet flow of around 0.1 m depth (some areas are slightly deeper at 0.1-0.3 m). The PMF hazard is H1 across the site.

Climate Change Assessment

The 1% AEP rainfall intensity was increased by 10% to account for potential increases in rainfall intensity associated with climate change. The procedures outlined in Book 1, Chapter 6 of ARR2019 were applied with the following parameters/assumptions; East Coast South Cluster, medium consequence risk rating, RCP4.5, 2090 planning horizon.

The augmented inflows to the hydraulic model (TUFLOW) translate to a general increase of peak water levels by 0.01 m or less. Based on this assessment it is concluded that the small size of the site's catchment means the climate change scenario does not have any significant effect on flood risk at the site.

3.3 Assessment of Proposed Development

The proposed development is located in an area that is largely unaffected in most flood events but experiences shallow overland flooding on the east boundary and the north-west corner. To assess the suitability of the development with regard to overland flow, the proposed design was schematised in the hydraulic model as a 'proposed' case. This was then used to assess flood risk to the site itself, and secondly, impact on the existing flood behaviour established in the previous section.

The model 'proposed' case was based on the design drawings and 3D TIN provided by Woolacotts and shown in Image 3. The proposed case in the hydraulic model consisted of incorporation of the proposed landform into the TUFLOW model grid. No stormwater drainage for overland flow is proposed as part of the development.

Image 3: Overview of modified area of the site

The 1% AEP flood level impact that compared the changes in flood levels between existing and proposed conditions. Figure 9 shows the 1% AEP depth and level under the proposed case while Figure 10 shows the flood impact. As can be seen on the impact figure, the following impacts occur as a result of the development:

- The raised area near the north-west corner results in marginally higher flooding at the intersection of Deerubbin Drive and Darug Avenue. The impact is less than 0.1 m and there is no impact on private property. There is no increase in flood risk associated with the slight increase in peak level.

- The raised area for the car park in the south-east corner results in a localised increase in flood level. The car park itself raises the flood level (i.e. the flood depths are not higher) by 0.3 m and slightly redistributes the overland flow path. This results in a newly flooded area. Given it is very shallow (<0.05 m) and located away from any buildings, there is no increase in flood risk.

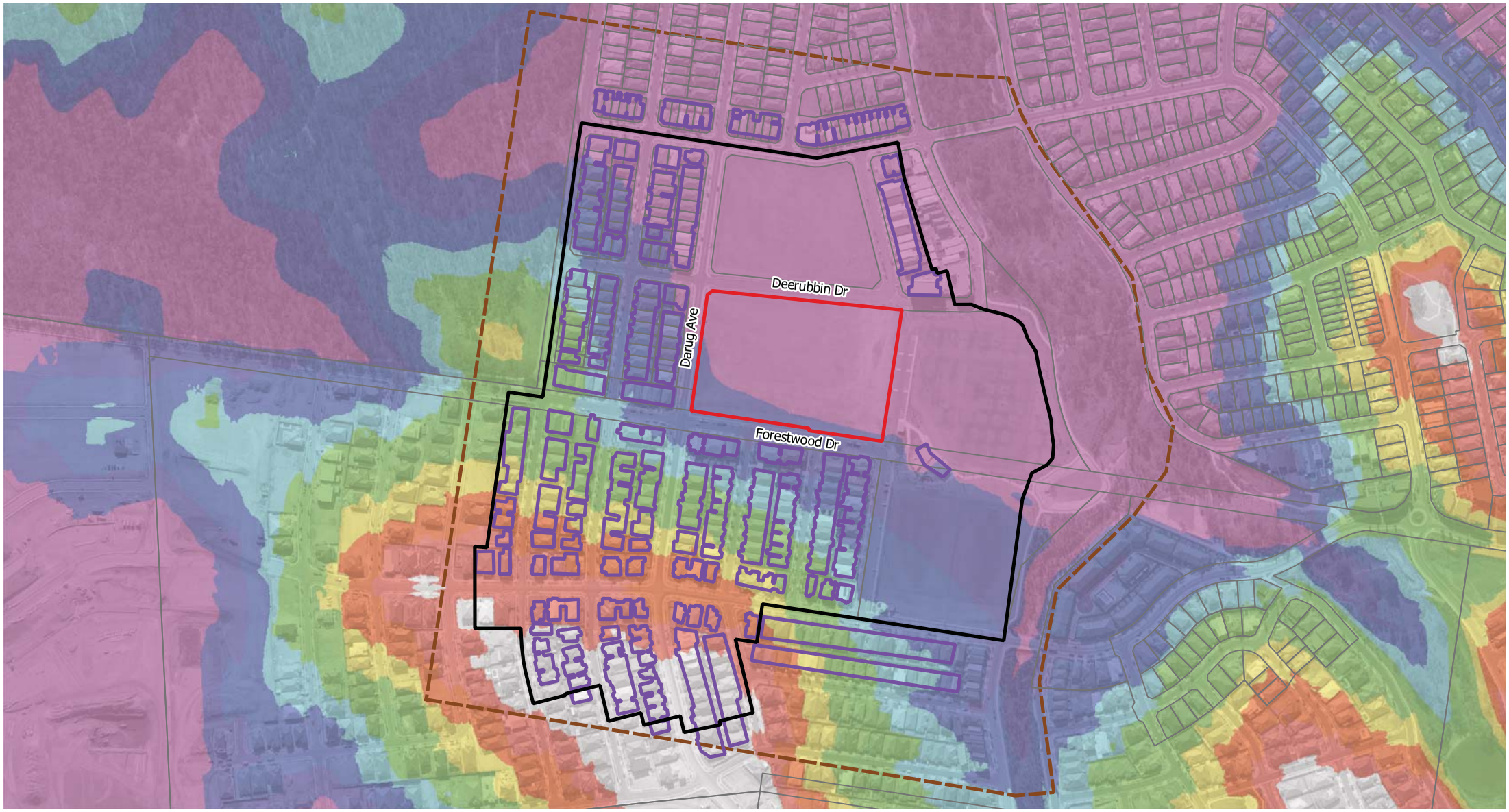
Overall, the proposed development will have no significant adverse impacts on the existing 1% AEP flood behaviour, which consists of shallow overland flowpaths of H1 hazard.

4. CONCLUSIONS

An overland flow flood study has been undertaken for the proposed Mulgoa Rise Public School. Small sections of the subject site are subject to shallow overland flow flooding, which passes through the north-west corner and east portion of the site.

The site's upstream catchment consists of residential blocks to the south. A hydraulic model has been developed based on TUFLOW software as well as a DRAINS hydrologic model. Flood characteristics for 1% AEP and PMF events have been assessed, as well as a climate change scenario. Peak flood depths, levels and velocities and hazard has been mapped for the site. In most flood events, the large majority of overland flow is contained in the kerb-gutter system and poses minimal risk to the site. 1% AEP flooding has H1 hazard and is not sensitive to increased rainfall intensity due to climate change. In the PMF there is shallow sheet flow across the site, also of H1 hazard.

The proposed development will raise and re-grade a portion of the site and place a car park near the site's south-east corner. The development will not significantly impact on existing flooding, with only a localised increase in two areas that does not correspond to any increase in flood risk. Based on this assessment the development is considered suitable for the site and in accordance with the SEARs requirements.



Ground Levels (mAHD)

<= 62	72 - 74
62 - 64	74 - 76
64 - 66	76 - 78
66 - 68	> 78
68 - 70	
70 - 72	

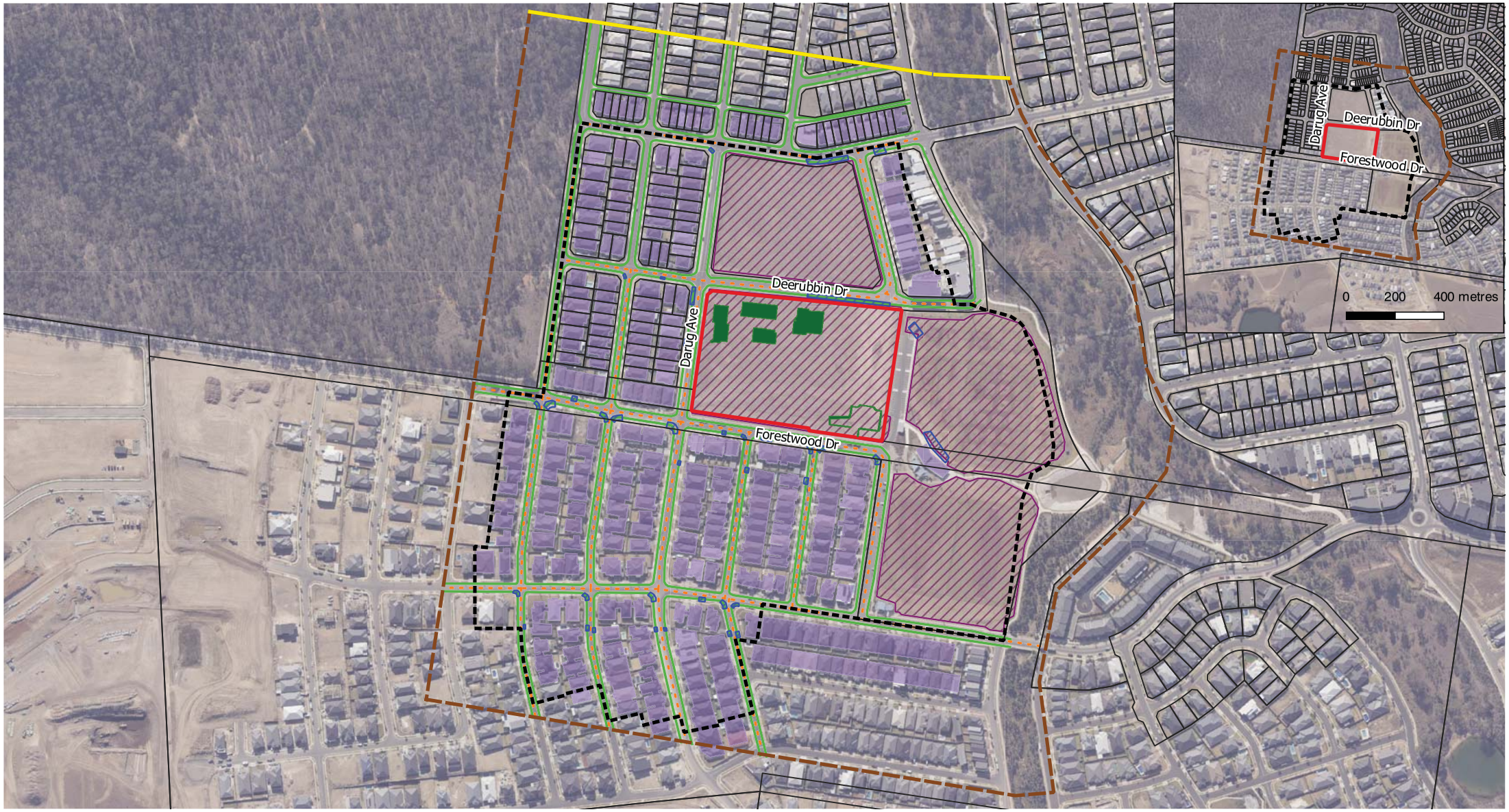
- Subject Site
- Existing Buildings
- Model Extent
- Catchment
- Cadastral Boundaries

N
W E
S

0 100 200 300 400 metres

grc HYDRO

TITLE: **Study Area and DEM**	PROJECT: **Mulgoa Rise Public School**	PROJECT No. **210009**	DATE: **04-2021**	SCALE: **1:4000**	FIGURE No. **01**



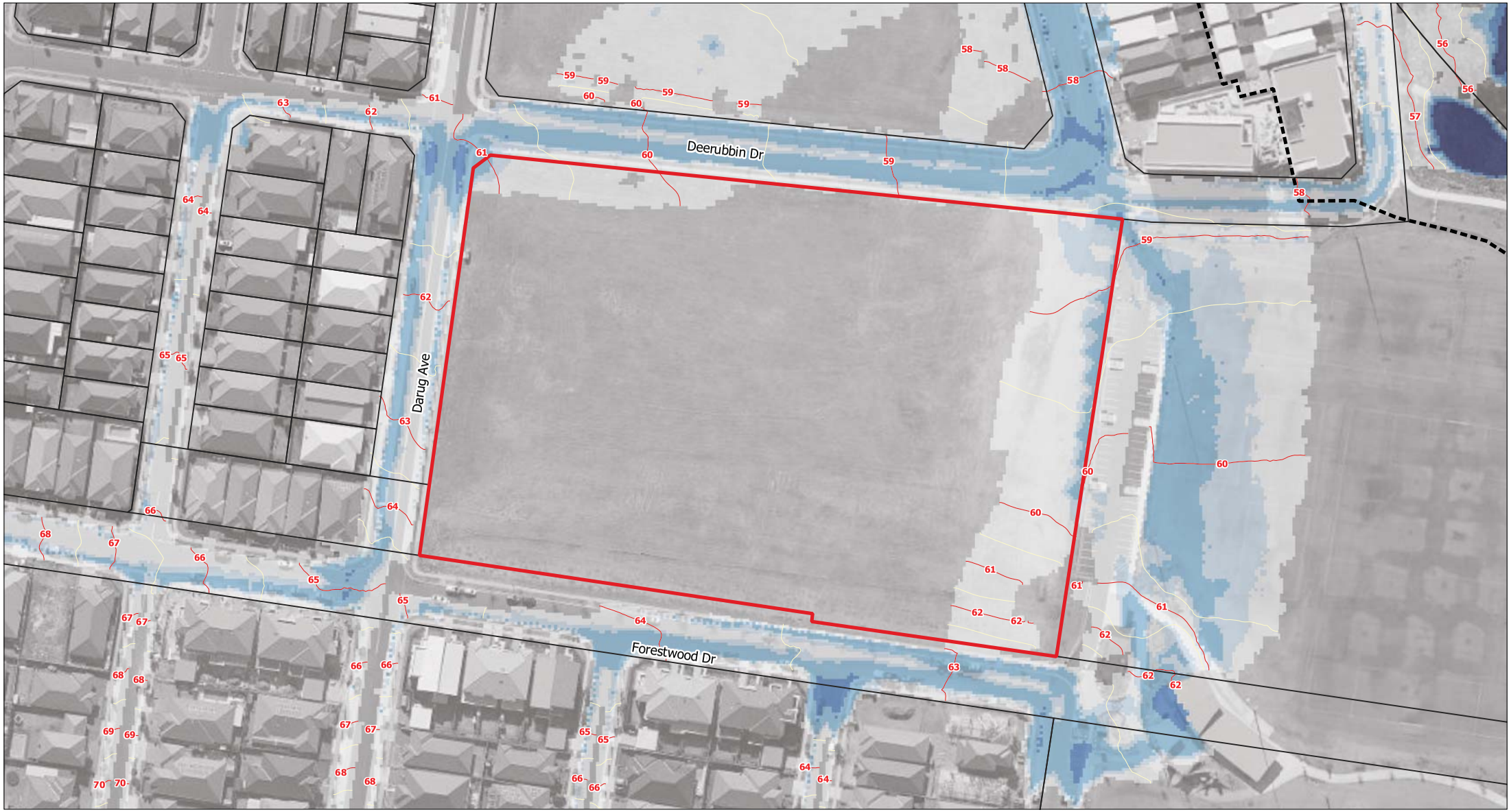
Inflow Locations
Rural (Mannings Value = 0.04)
Existing Buildings
Proposed New Structures
Subject Site
Model Extent
Catchment
Cadastral Boundaries
Downstream Boundary
Road Crests
Road kerbs

N
W
E
S

0 100 200 300 400 metres

grc HYDRO

TITLE: **Hydraulic Model Inputs- Existing Conditions**	PROJECT: **Mulgoa Rise Public School Flood Study**	PROJECT No. **210009**	DATE: **04-2021**	SCALE: **1:4000**	FIGURE No. **02**



Flood Depths (m)
- 0.00 - 0.05
- 0.05 - 0.10
- 0.10 - 0.30
- 0.30 - 0.50
- 0.50 - 1.00
- > 1.00

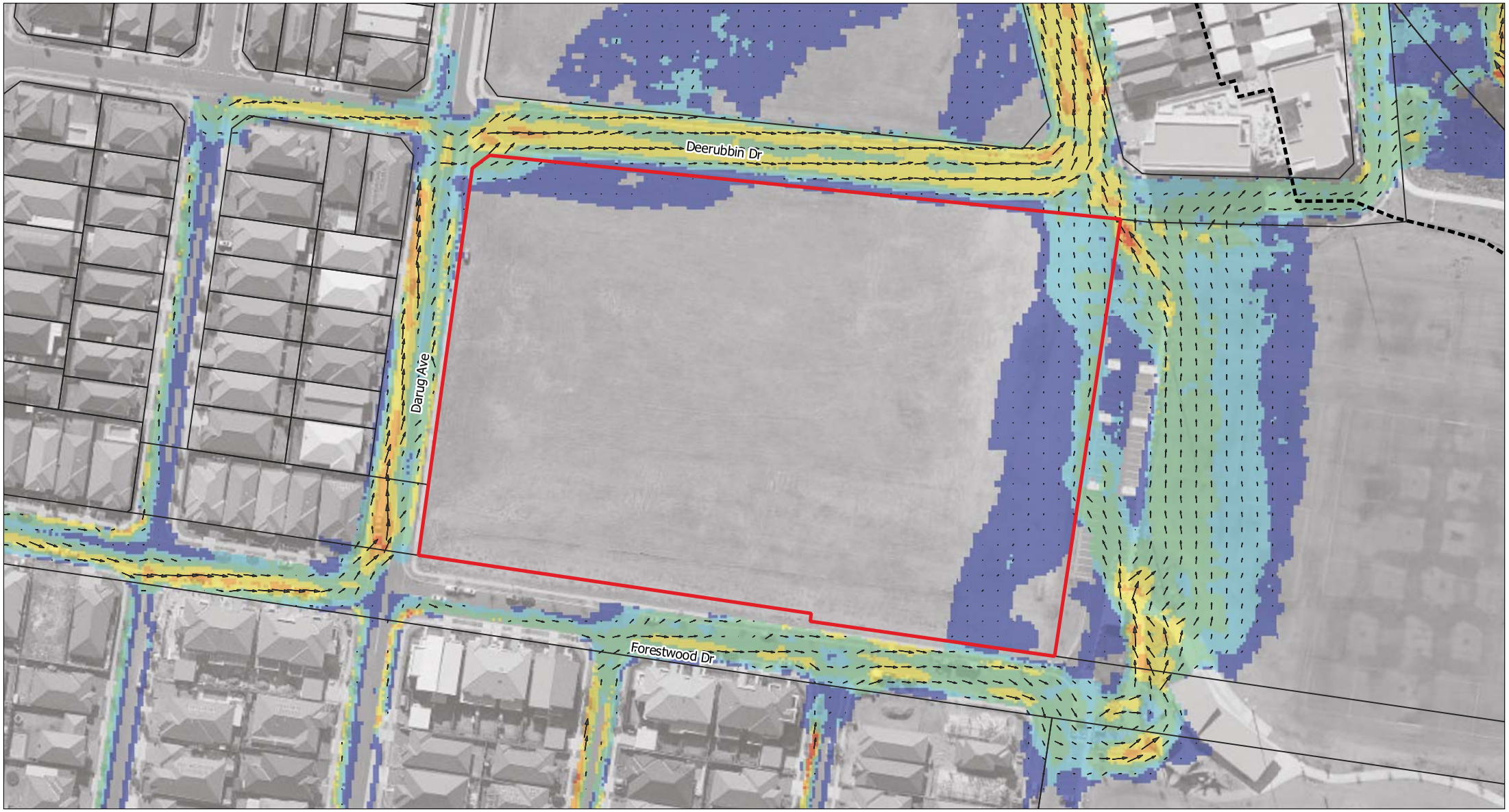
Major Flood Level Contours (Spacing = 1 m)
Minor Flood Level Contours (Spacing = 0.5 m)
Subject Site
Cadastral Boundaries

N
W E
S

0 30 60 90 120 metre

grc HYDRO

TITLE: **Existing - Flood Depths and Levels - 1% AEP**	PROJECT: **Mulgoa Rise Public School Flood Study**	PROJECT No. **210010**	DATE: **04-2021**	SCALE: **1:1200**	FIGURE No. **03**



Flood Velocity (m/s)
- < -0.25
- 0.25 to 0.50
- 0.50 to 1.00
- 1.00 to 1.50
- 1.50 to 2.00
- > 2.00

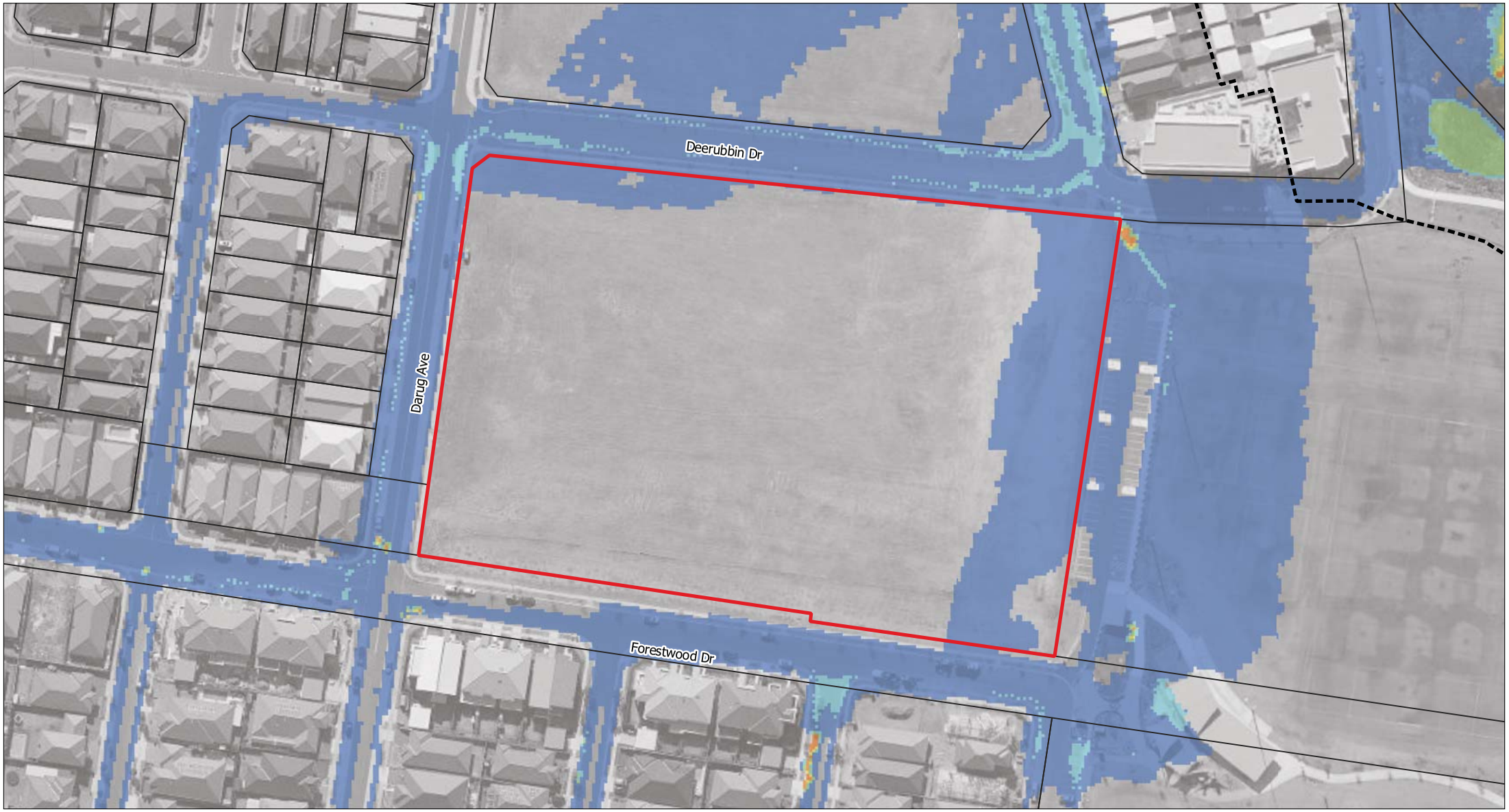
Subject Site
Cadastral Boundaries
Flood Levels (Spacing = 0.5 m)
Velocity Arrows

N
W E
S

0 30 60 90 120 metre

grc HYDRO

TITLE: **Existing Flood Velocity - 1% AEP**	PROJECT: **Mulgoa Rise Public School Flood Study**	PROJECT No. **210010**	DATE: **04-2021**	SCALE: **1:1200**	FIGURE No. **04**



Flood Hazard (ZAEM1)
- H1
- H2
- H3
- H4
- H5
- H6

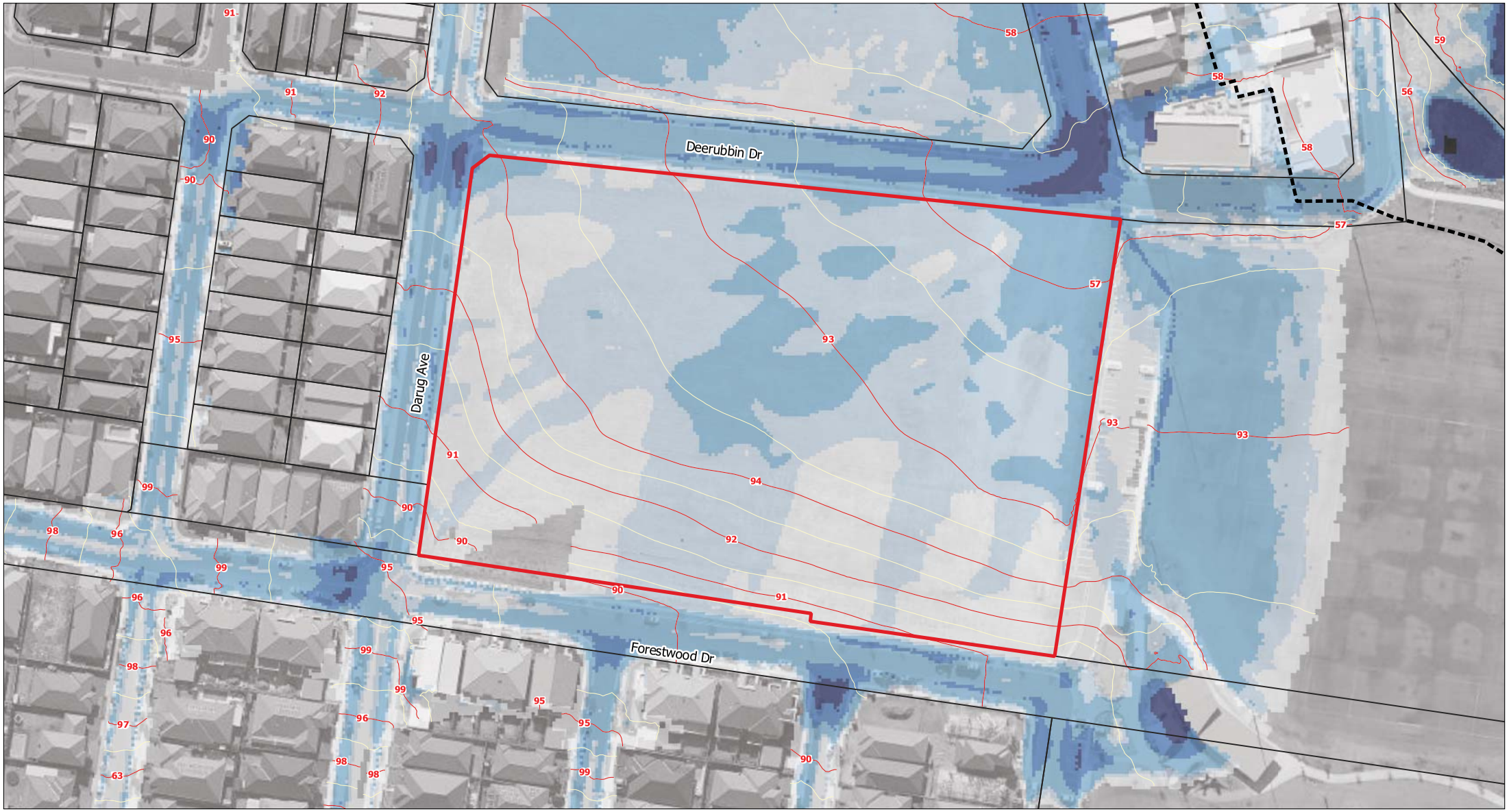
Subject Site
Cadastral Boundaries

N
W E
S

0 30 60 90 120 metre

grc HYDRO

TITLE: **Existing Flood Hazard - 1% AEP**	PROJECT: **Mulgoa Rise Public School Flood Study**	PROJECT No. **210010**	DATE: **04-2021**	SCALE: **1:1200**	FIGURE No. **05**



Flood Depths (m)
- 0.00 - 0.05
- 0.05 - 0.10
- 0.10 - 0.30
- 0.30 - 0.50
- 0.50 - 1.00
- > 1.00

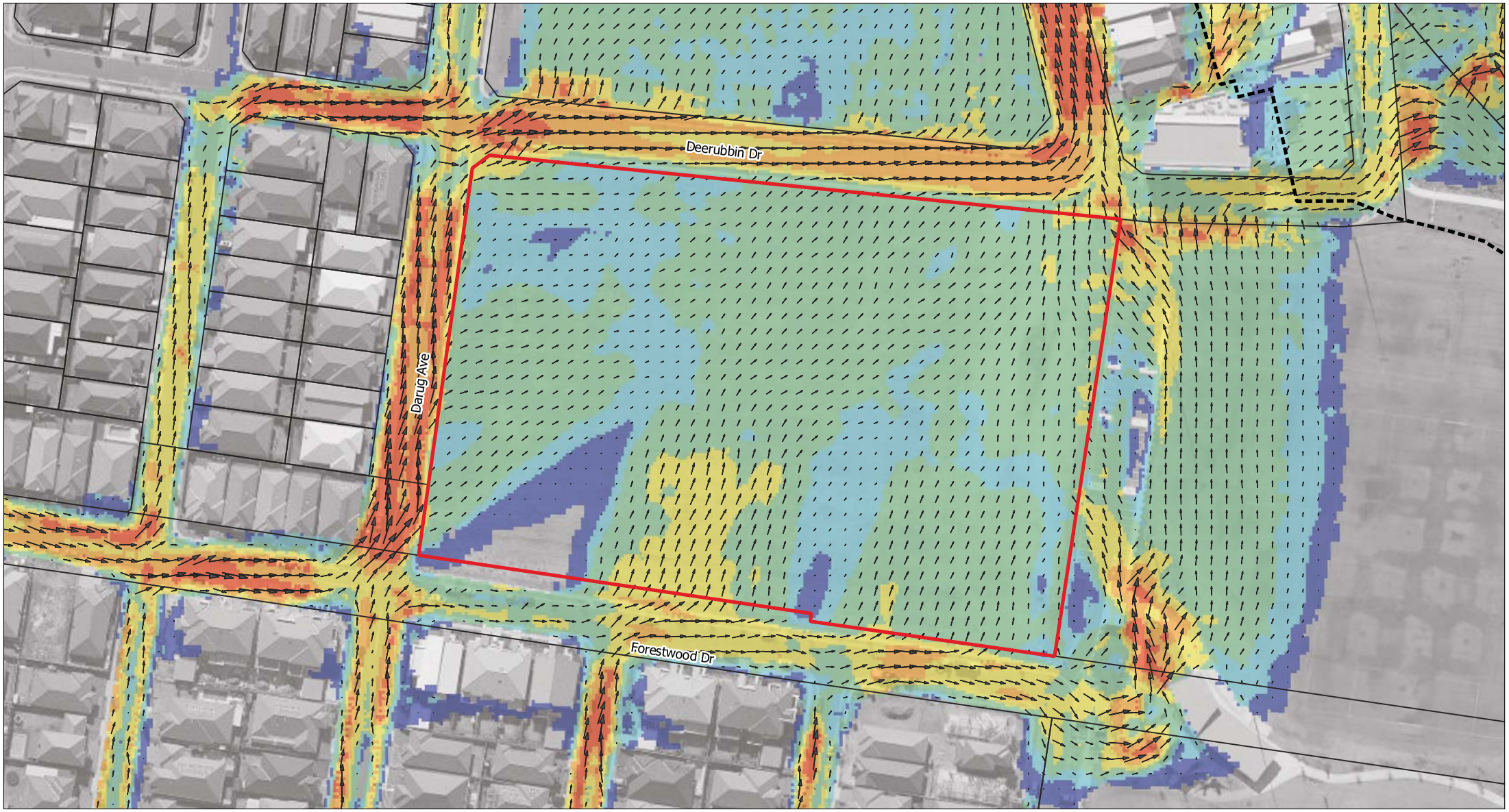
Major Flood Level Contours (Spacing = 1 m)
Minor Flood Level Contours (Spacing = 0.5 m)
Subject Site
Cadastral Boundaries

N
W E
S

0 30 60 90 120 metre

grc HYDRO

TITLE: **Existing - Flood Depths and Levels - PMF**	PROJECT: **Mulgoa Rise Public School Flood Study**	PROJECT No. **210010**	DATE: **04-2021**	SCALE: **1:1200**	FIGURE No. **06**



Flood Velocity (m/s)
- < -0.25
- 0.25 to 0.50
- 0.50 to 1.00
- 1.00 to 1.50
- 1.50 to 2.00
- > 2.00

Subject Site
Cadastral Boundaries
Velocity Arrows

N
W E
S

0 30 60 90 120 metre

grc HYDRO

TITLE: **Existing Flood Velocity - PMF**	PROJECT: **Mulgoa Rise Public School Flood Study**	PROJECT No. **210010**	DATE: **04-2021**	SCALE: **1:1200**	FIGURE No. **07**

Flood Hazard (ZAEM1)
- H1
- H2
- H3
- H4
- H5
- H6

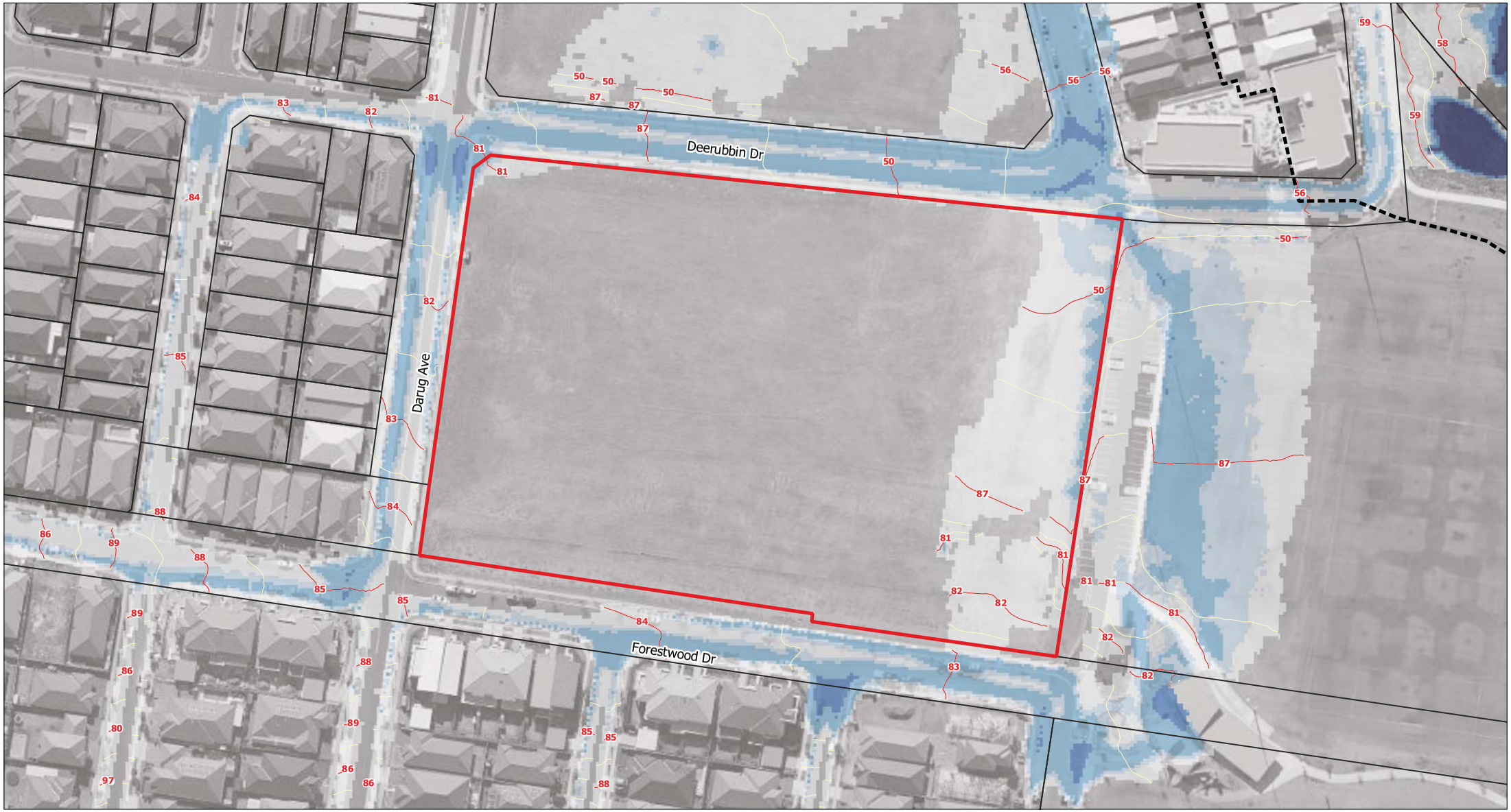
Subject Site
Cadastral Boundaries

N
W E
S

0 30 60 90 120 metre

grc HYDRO

TITLE: **Existing Flood Hazard - PMF**	PROJECT: **Mulgoa Rise Public School Flood Study**	PROJECT No. **210010**	DATE: **04-2021**	SCALE: **1:1208**	FIGURE No. **08**



Flood Depths (m)
- 0.00 - 0.05
- 0.05 - 0.10
- 0.10 - 0.30
- 0.30 - 0.50
- 0.50 - 1.00
- > 1.00

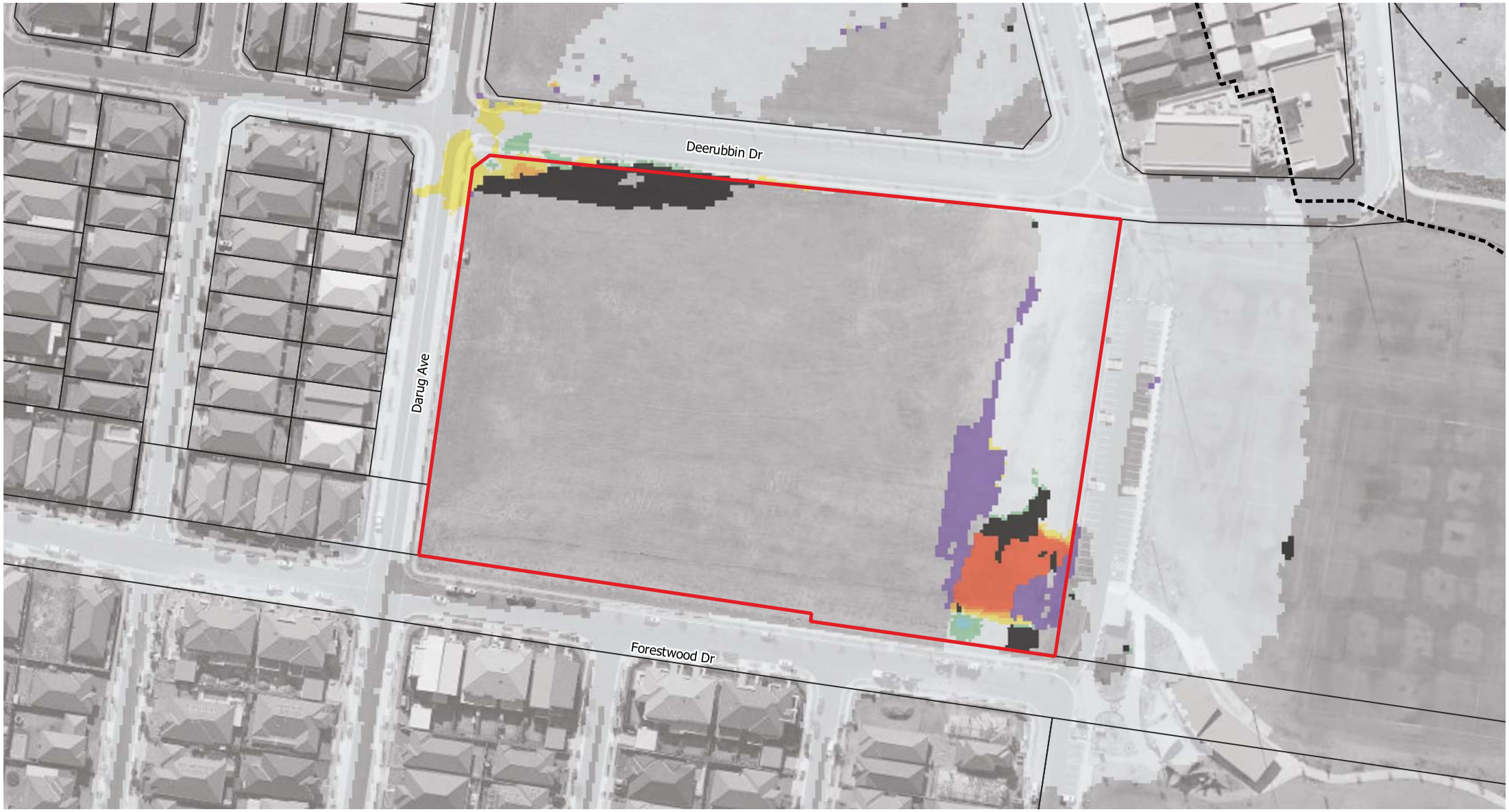
Major Flood Level Contours (Spacing = 1 m)
Minor Flood Level Contours (Spacing = 0.5 m)
Subject Site
Cadastral Boundaries

N
W E
S

0 30 60 90 120 metre

grc HYDRO

TITLE: **Proposed - Flood Depths and Levels - 1% AEP**	PROJECT: **Mulgoa Rise Public School Flood Study**	PROJECT No. **210010**	DATE: **04-2021**	SCALE: **1:1200**	FIGURE No. **09**



Flood Impact

- < -0.3
- -0.3 to -0.2
- -0.2 to -0.1
- -0.1 to -0.01
- No Impact
- 0.01 to 0.1
- 0.1 to 0.2
- 0.2 to 0.3
- > 0.3
- No Longer Flooded
- Newly Flooded
- Subject Site
- Cadastral Boundaries

N W E S

0 30 60 90 120 metres

grc HYDRO

TITLE: **Flood Impact - 1% AEP**	PROJECT: **Mulgoa Rise Public School**	PROJECT No. **210009**	DATE: **04-2021**	SCALE: **1:1200**	FIGURE No. **10**

Appendix B

Council Flood Advice

Alexander Phillips

From: Caleb O'Reilly <Caleb.O'Reilly@penrith.city>
Sent: Thursday, 21 January 2021 12:11 PM
To: Alexander Phillips
Cc: Justin Chirillo
Subject: Engineering Advice - 1-23 Forestwood Drive, Glenmore Park (Lot 1663 DP 1166869) - Flood Advice
Attachments: Penrith_Overland_Flow_Overview_Study Exclusion.pdf

Hi Alex,

As discussed over the phone, 1-23 Forestwood Drive, Glenmore Park (Lot 1663 DP 1166869) is not currently identified as flood effected by the 1% AEP design storm event. This information is based on data available to Council on the date of this email and may change in the future if new information becomes available.

If you have any further questions feel free to contact me.

Kind Regards,

Caleb O'Reilly
Trainee Engineer

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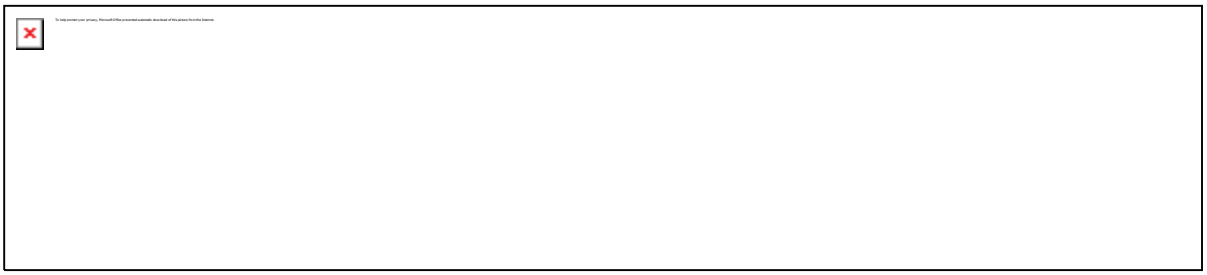

From: Alexander Phillips <aphillips@woolacotts.com.au>
Sent: Thursday, 21 January 2021 9:40 AM
To: Caleb O'Reilly <Caleb.O'Reilly@penrith.city>
Cc: Justin Chirillo <JChirillo@woolacotts.com.au>
Subject: 1-23 Forestwood Dr, Glenmore Park - Flood Query

Hi Caleb,

I am currently working on the civil concept design for a Department of Education development at 1-23 Forestwood Drive, Glenmore Park and had a question regarding flooding.

Woolacotts have been unable to locate a Flood Study which includes The Site area. Has a separate flood study been prepared for the southern end of Glenmore Park where The Site is located?

The Site area is currently excluded from the Penrith Overland Flow Study by Cardno (2006), as seen in the attached extract. Additionally, further investigation has shown that The Site area has also not been covered by the following flood studies:

- Nepean River Flood Study – Final Report by Advisian, dated November 2018
- South Creek Floodplain Risk Management Study by Advisian, dated August 2019 (Exhibition Draft)
- Peach Tree and Lower Surveyors Creek Flood Study - Final Report by Catchment Simulation Solutions, dated April 2019
    - Although the Site area is included in the catchment map

Please advise if you have any additional information that may assist, thanks.

Regards,

Alexander Phillips | Associate Structural & Civil Engineer

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