

Department of Education

Flood Assessment: New High School in Jerrabomberra



ENVIRONMENTAL



WATER



WASTEWATER



GEOTECHNICAL



CIVIL



PROJECT
MANAGEMENT



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Head Office
Suite 201, 20 George Street
Hornsby, NSW 2077, Australia
ACN 070 240 890 ABN 85 070 240 890
Phone: +61-2-9476-9999
Fax: +61-2-9476-8767
Email: mail@martens.com.au
Web: www.martens.com.au

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Calvin Li		Sina Arbabzadeh		Terry Harvey			
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All enquiries regarding this project are to be directed to the Project Manager.

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1 Overview

1.1 Introduction

This flood assessment and preliminary flood emergency response plan (FERP) accompanies an Environmental Impact Statement (EIS) pursuant to Part 4 of the Environmental Planning and Assessment Act 1979 (EP&A Act) in support of an application for a State Significant Development (SSD No 24461956). The SSDA is for a new high school located at Jerrabomberra.

This report addresses the Secretary's Environmental Assessment Requirements (SEARs), notably:

Table 1: Flooding related SEARs for the proposed development.

SEARs Requirement	Response
16. Flooding 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.	MA have consulted Queanbeyan-Palerang Regional Council regarding the available flood studies and identified the most recent assessment for the Jerrabomberra Creek catchment (refer Section 2.4). Potential increase in rainfall intensity as a result of climate change has been included in the flood assessment.
Assess the impacts of the development, including any changes to flood risk on- site or off- site, and detail design solutions to mitigate flood risk where required.	Impacts of the development have been assessed and presented in the report, refer Section 3.2, Section 4.6 and Mapset.
Relevant Policies and Guidelines: <ul style="list-style-type: none">• NSW Floodplain Development Manual (DIPNR, 2005).	This flood assessment has been prepared in accordance with NSW Floodplain Development Manual.

1.2 Proposal

The proposed development is for the construction of a new high school in Jerrabomberra. The proposal will meet community demand and to ensure new learning facilities are co-located near existing open space infrastructure. The proposal generally includes the following works:

- Site preparation;
- Construction of a series of buildings up to three storeys including administration/staff areas, library, hall and general learning spaces;
- Construction of new walkways, central plaza and outdoor games courts;

- Construction of a new at-grade car park;
- Associated site landscaping and open space.

The proposal has been designed to accommodate approximately 500 students with Stream 3 teaching spaces, however the core facilities will be future proofed to a Stream 5 to enable possible future expansion to meet projected demand.

The proposal will include site preparation works, such as clearing and levelling to accommodate the proposed buildings and play areas. The proposal will involve the construction of a series of buildings housing general learning spaces, administration and staff wings, outdoor learning areas, a library and assembly hall.

The proposal will include construction of a new driveway and hardstand with access proposed off the northern stub road east of Envrona Drive. Pedestrian access is proposed off Envrona Drive and the northern stub road.

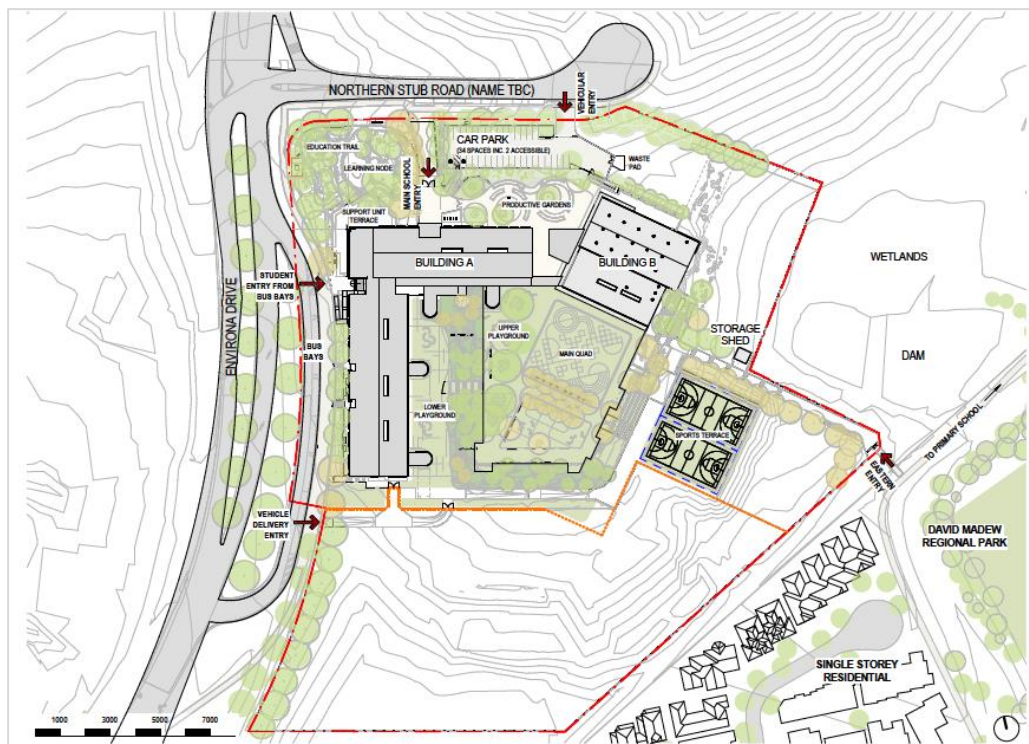


Figure 1: Proposed site plan. Source: TKD Architects

1.3 Site Description

The proposed development is located within the South Jerrabomberra Innovation Precinct, also referred as the Poplars Innovation Hub, in the local government area of Queanbeyan-Palerang Regional Council.

The school site- is part of an existing lot (Lot 1 in DP 1263364), which is approximately 65.49ha in area and will be characterised by a mix of business park and open space uses and a new north-south connector road named Environa Drive.

Delivery of the Precinct is underway with Environa Drive currently under construction. Most of the-lot, however, remains undeveloped.

The school site is subject to a proposed lot (Lot 2 in DP 1263364), which was approved by Council under DA332-2015 on 10 March 2021 but is not yet registered. The approved lot is irregular in shape, is largely cleared and is approximately 4.5ha in area. A small dam is located adjacent to the south eastern boundary of the site, which forms part of a broader wetland.

The site is located in excellent proximity to existing open space facilities. It adjoins David Madew Regional Park to the south east and is located 100m east of an existing recreational field associated with Jerrabomberra Public School.

A description of the site is provided in the table below.

Table 2: New High School in Jerrabomberra Site Description.

ITEM	DESCRIPTION
Site Address	School address yet to be determined however, it is located within the Jerrabomberra Innovation Precinct at 300 Lanyon Drive, Jerrabomberra.
Legal Description	Lot 1 in DP 1263364 (existing) Lot 2 in DP 1263364 (proposed, but not registered)
Total Area	Lot 1 – 65.49ha Lot 2 – 4.5ha
Frontages	The site provides frontage to Environa Drive and the northern stub road, both currently under construction.
Existing Use	The site is undeveloped and contains a series of small vegetation clusters scattered across the site.
Existing Access	Existing access is via an informal unsealed driveway off Tomsitt Drive along the northern boundary of the existing lot. The site will be accessed via Environa Drive and a secondary access road (North Road), which is currently under construction.

ITEM	DESCRIPTION
Context	<p>Land to the south is primarily residential in nature.</p> <p>Jerrabomberra Public School and David Madew Regional Park are located to the east/south-east, while land to the west is undeveloped and features Jerrabomberra Creek.</p> <p>The site is located within the South Jerrabomberra Innovation Precinct, which is currently under construction.</p> <p>The areas north and west of the site are currently undeveloped but the site is currently undergoing a transition from rural to business park uses.</p> <p>Development further north on the opposite side of Tomsitt Drive and along Edwin Land Parkway includes retail and commercial uses.</p> <p>Development immediately to the south includes existing low density residential development. Land in the south west has been identified for future low density residential, light industrial and business park uses.</p>



Figure 2: Site aerial depicting the land subject to the proposed High School. Source: TKD Architects

1.4 Project Scope and Objectives

Project scope and objectives are:

1. Prepare a hydrologic model (RAFTS) for the site to determine the peak flow of the 1% annual exceedance probability (AEP) flood (with and without climate change) and probable maximum flood (PMF) events.
2. Prepare a hydraulic model (TUFLOW) for the site under existing and proposed conditions and calibrate to available flood data.

3. Prepare relevant flood maps including flood extents, depths, levels, velocities, hazards and impacts.
4. Comment on flood characteristics and model outcomes in existing and proposed conditions.
5. Comment on flood emergency responses for the developed site.

The objective of this flood assessment is to address the following considerations for planned development of the site:

1. To ensure the development is compatible with the flood hazard of the land.
2. To ensure no significant adverse impacts on flood behaviour.
3. To ensure appropriate measures to manage risk to life from flood.

1.5 Executive Summary of Findings

This report documents the procedures and findings of hydrologic and hydraulic modelling of the site in existing and proposed conditions.

The assessment concluded that:

1. Proposed flood characteristics are largely consistent with existing conditions, and differences due to the proposed development are negligible.
2. Flooding on the school site is limited to lower areas for the 1% AEP and PMF events. All school building finished floor levels are above the PMF levels.
3. The proposed buildings are outside of flood extent in the 1% AEP (with and without climate change) and PMF events. All building finished floor levels are above the FPL and PMF levels.

Whilst the proposed development area is not affected by flood hazards during all floods up to and including the PMF event, we recommend the school management subscribe to the relevant flood warning systems and maintain communication with SES and local police at all times with respect to flood emergency response.

1.6 Relevant Guidelines

This report has been prepared in accordance with the following guidelines and policies:

1. Commonwealth of Australia (Geoscience Australia) (2016), *Australian Rainfall and Runoff – A Guide to Flood Estimation*.
2. NSW Department of Infrastructure, Planning and Natural Resources (2005), *Floodplain Development Manual*.
3. Queanbeyan-Palerang Regional Council (2013), *Queanbeyan Local Environmental Plan (West Jerrabomberra) (LEP)*.
4. Queanbeyan-Palerang Regional Council (2012), *Queanbeyan Development Control Plan (DCP)*.

1.7 Definitions

AEP	Annual exceedance probability: the probability of a flood event occurring within a year. A 1% AEP flood has a 1% chance of occurring in any given year.
AHD	Australian Height Datum
ARI	Average recurrence interval: the average time between flood events occurring. A 100 year ARI flood occurs on average once every 100 years.
ARR	Australian Rainfall & Runoff
BOM	Bureau of Meteorology
Council	Queanbeyan-Palerang Regional Council (QPRC)
SSDA	State Significant Development application
FERP	Flood emergency response plan
FFL	Finished floor level
FPL	Flood planning level
IFD	Intensity frequency duration – design rainfall data for frequent and infrequent storm events.
MA	Martens & Associates Pty Ltd
NER	South Tralee Northern Entry Road

PMF

Probable maximum flood – the most extreme flood event possible for a certain location, with an approximate ARI of 100,000 to 10,000,000 years.

2 Background Flooding Data

2.1 Catchment Description

We note the following regarding the catchment upstream of the site:

- The site is located within the Jerrabomberra Creek catchment. The Jerrabomberra Creek catchment has a total area of approximately 75 km² upstream of NER bridge and drains northwest to the Lake Burley Griffin. Extent of the catchments is shown in Attachment C Map FL 01.
- The site local upstream catchment area is 295.3 ha, which includes urban residential areas of Jerrabomberra and undulating bushland. A plan of local catchments is shown in Attachment C Map FL 02.
- A number of detention basins and water bodies are located within the vicinity of the site. These include a stormwater detention basin upstream of the site and Lake Jerrabomberra, an artificial lake downstream in the local catchment.
- The stormwater detention basin is located directly upstream of the site. The outlet structure discharges flow into the sports field in the neighbouring catchment. Under major events, floodwater may overtop the spillway of the detention basin and discharge into the site.

2.2 Site Flood and Overland Flow Mechanisms

Jerrabomberra Creek runs from the southeast to the northwest approximately 150 m to the west of the site. A drainage depression runs from north-east to south-west along the southeastern boundary and discharges to Jerrabomberra Creek. A sediment control basin is located within the southern area of the site.

The site is likely affected by the following flood mechanisms:

- Overland flows from the site itself and the local upstream catchment (refer Section 2.1).
- We understand that, under extreme events, constriction due to the NER bridge and road embankments may cause floodwaters to back up onto the site.

2.3 Previous Flood Studies

A review of previous flood investigations was undertaken to assess likely local flood behaviour and characteristics for the site and the Jerrabomberra Creek catchment. In addition to reviewing previous documents available to the public, MA also consulted QPRC for the access to the most recent flood study in the area. Review identified three previous flood studies which would be relevant to this assessment.

2.3.1 *Brown (2010) Flood Study and Riparian Corridor Assessment, Jerrabomberra Creek*

Brown Consulting conducted a flood assessment for Tralee North and The Poplars development areas, and summarised the assessment in the report *Flood Study and Riparian Corridor Assessment, Jerrabomberra Creek (2010)*, hereafter referred to as the Brown flood study. As part of their study, Brown used RAFTS for hydrologic modelling and SOBEK for hydraulic modelling of the reach of Jerrabomberra Creek between Lake Jerrabomberra and Lanyon Drive. Assessed flood behaviour in the Brown flood study includes the 1% AEP and as PMF events. MA noted that the proposed school site is not included in the hydraulics model.

2.3.2 *Calibre (2016) North Tralee – Jerrabomberra Creek Flood Study – Update to 2010 Flooding*

The letter report prepared by Calibre (hereafter referred to as the Calibre flood study) updates the Brown flood study to assist with the rezoning application for the North Tralee site. In the Calibre flood study, the flow rate of Jerrabomberra Creek remains the same as the Brown flood study. For the hydraulics, Calibre adopted a 1 m topographic grid for TUFLOW modelling.

In a peer review by WMAwater (2016), this model is regarded as 'unsuitable for determining finished floor levels for residential properties and other outputs that are required as part of a Flood Study performed under the NSW Floodplain Management Program'. WMAwater also recommended a coarser topographic grid size to provide accurate modelling of deep floodwater in the creek. However, WMAwater acknowledged that 'assumptions and modelling methods applied have been determined to be generally conservative'.

MA noted that the proposed school site is not included in the domain of the hydraulics model.

2.3.3 *Lyall & Associates (2020) Jerrabomberra Creek and Queanbeyan-Palerang Regional Sports Complex Flooding and Drainage Investigation*

Lyall & Associates conducted a flood assessment on behalf of QPRC and summarised the assessment in the report *Jerrabomberra Creek and Queanbeyan-Palerang Regional Sports Complex Flooding and Drainage Investigation*, hereafter referred to as the Lyall flood study. MA obtained this report from Council officer Derek Tooth on 30 April 2021.

Lyall used RAFTS for hydrologic modelling and TUFLOW for hydraulic modelling. The TUFLOW model adopted a 2 m topographic grid. MA have relied upon the Lyall flood study for hydrologic / hydraulic validation and comparison purposes.

We noted that although the proposed school site is included in the domain of the hydraulics model, runoff from the local catchment was amalgamated into mainstream hydrographs and does not appropriately represent the site flood affectation. Moreover, details of the NER2 bridge crossing of Jerrabomberra Creek and the section of road to its north were not included in the assessment.

3 Hydrology Modelling

3.1 Overview

The DRAINS software package (version 2020.061 – 22 December, 2020) was used with the RAFTS hydrological engine to assess the 1% AEP flood (with and without climate change) and probable maximum flood (PMF) peak flow rates for a range of storm durations between 10 minutes and 6 hours.

3.2 Model Setup

Parameters used in the model are provided in Table 3. Model inputs are as follows:

1. Sub-catchment delineation, flow paths and slopes were developed using LIDAR data provided by ACT Government - Environment and Planning Directorate (2015). Refer to Attachment C Map FL2 for details.
2. Sub-catchment impervious areas were adopted based on recent catchment aerals obtained from Nearmap (2021).
3. Roughness coefficients were determined using a weighted average based on the XP-RAFTS (1996) *User's Manual* and each sub-catchment's land use as per recent site aerals obtained from Nearmap (2021).
4. Intensity Frequency Duration (IFD) data and rainfall temporal patterns were based on the Bureau of Meteorology (BOM 2017) *Rainfall IFD Data System* and the Australian Rainfall & Runoff (ARR 2019) *Data Hub*.
5. 1% AEP rainfall intensities were increased by 20.2% for the 2090 RCP 8.5 climate change scenario based on the ARR 2019 *Data Hub*.
6. Probable Maximum Precipitation (PMP) intensities and temporal distributions were determined using the BOM (2003) Generalised Short-Duration Method.
7. RAFTS initial and continue loss parameters are based on Storm Losses in the ARR 2019 *Data Hub*.

Table 3: Details of sub-catchments used in RAFTS modelling.

Sub-catchment ¹	Area (ha) ¹	Catchment Slope (%) ¹	Impervious (%) ²	PERN Roughness Coefficient ³
Catchment N	295	2.5	23	0.058
Catchment M	183	3.5	20	0.064
Jerrabomberra Creek (exclude local catchments)	7073	3	4.5	0.063
Jerrabomberra Creek	7528	3	5	0.06

Notes

1. Obtained based on aerial survey data provided by ACT Government - Environment and Planning Directorate (2015). Refer to Attachment C Map FL1 and FL2 for site catchment plan.
2. Adopted based on recent catchment aerals obtained from Nearmap (2021).
3. Obtained from the weighted average land use based on recent catchment aerial photographs obtained from Nearmap (2021) and the XP-RAFTS User Manual (1996).

3.3 Results

3.3.1 Hydrology Results

Results of peak flow rates for catchments arriving at the site for the critical duration 1% AEP flood event with and without climate change and PMF events are summarised in Table 4.

The critical storm duration for the site was determined to be 1 hour for the 1% AEP flood event with and without climate change. For validation purpose, a 6 hours 1% AEP flood is modelled for the critical storm duration in the Jerrabomberra Creek upstream of NER bridge. Given the site is affected by the mainstream flooding during the PMF event, the critical storm duration of 3 hours for the Jerrabomberra Creek is adopted.

Table 4: Peak 1% AEP with and without climate change and PMF flow rates for critical duration storms estimated by DRAINS modelling for sub-catchments.

Flood Event	Critical Storm Duration (hrs)	Peak Catchment Flow Rates (m ³ /s)			
		Catchment N	Catchment M	Jerrabomberra Creek (ex. local catchments) ¹	Jerrabomberra Creek ²
1% AEP (Jerrabomberra Creek) ³	6	20	13	268	293
1% AEP	1	38	25	159	181
1% AEP CC ⁴	1	47	30	212	240
PMF (Jerrabomberra Creek) ¹	3	205	128	2565	2854

Notes

1. Flow rate used for hydraulic modelling.
2. Flow rate used for validation only.
3. The critical storm duration is adopted at the NER bridge for Jerrabomberra Creek upstream.
4. Based on 20.2% increased rainfall intensity for the 2090 RCP 8.5 climate change scenario.

3.3.2 Validation

Comparisons between the Lyall flood study and MA peak flow rates of Jerrabomberra Creek for 1% AEP and PMF events are given in Table 5. The comparison shows flow rates for 1% AEP event modelled by MA agree well with Lyall modelling, and differences are less than 1%. We noted the PMF flow rate modelled by MA is 4.8% higher. This is likely due to the difference in the interpretation and implementation of BOM (2003) Generalised Short-Duration Method and RAFTS model setup. The MA model therefore is slightly more conservative for the extreme event and is considered acceptable for the purposes of detailed site modelling.

Table 5: Catchment peak flow rate comparison for various flood events.

Flood Event	Lyall (m ³ /s) ¹	MA (m ³ /s)	Difference (%)
1% AEP	294	293	- 0.3
PMF	2724	2854	+4.8

Notes

1. From the Lyall flood study, Table 4.1.

4 Hydraulic Modelling

4.1 Overview

The TUFLOW hydraulic model was used to determine flood characteristics including flood extents, levels, depths, velocities and hydraulic hazard for the critical 1% AEP flood (with and without climate change) and probable maximum flood (PMF) events for existing and proposed conditions.

4.2 Scenarios

The hydraulic model was set up to represent the following flood condition scenarios:

1. Existing condition: the catchment and site in their current state as described in Sections 2.1 and 2.2.
2. Proposed condition: the catchment in its current state and the site in [its proposed state as described in Section 1.2.

The hydraulic model was used to assess flooding for the following events:

1. 1% AEP 6 hours (critical duration for Jerrabomberra Creek) event for validation purpose (existing condition only).
2. 1% AEP 1 hour (critical duration) event.
3. 1% AEP with climate change (20.2% increased rainfall intensity) 1 hour (critical duration) event.
4. PMF 3 hours (critical duration for Jerrabomberra Creek) event.

In summary, a total of 7 scenarios were modelled as part of this assessment (2 flood condition scenarios and 3 flood events each plus a validation event).

4.3 Terrain Data

The following geospatial information was utilised to create a 3D surface for the existing conditions site and the local floodplain environment used in the TUFLOW model.

- o LIDAR data provided by ACT Government - Environment and Planning Directorate (2015)

- Site survey conducted by Project Surveyors (March 2021)
- A 2016 survey supplied by Hindmarsh, which covers the area between Tomsitt Drive and Jerrabomberra Creek.
- The partially constructed NER stage 1 area to the north of Jerrabomberra Creek is also incorporated into the 3D surface based on the finished surface provided by Council officer Eli Ramsland on 11 May 2021.

4.4 Model Setup

4.4.1 Existing Conditions

TUFLOW model construction for existing conditions consisted of:

1. A 2.0 m topographic grid based on the topographic surface described in Section 4.3,
2. The model domain was defined as the reach of Jerrabomberra Creek from 200 m upstream of the Lake Jerrabomberra to Territory Parade. Local upslope catchments starting from Firethorn Place and Jerrabomberra Parkway are also incorporated into the model.
3. Inflow boundary conditions based on the critical duration 1% AEP (with and without climate change) and PMF hydrographs from DRAINS for each sub-catchment discharging to the study area.
4. Computed water slope for downstream model extent boundary condition is adopted with a 0.1% hydraulic slope.
5. Manning's zones based on Nearmap (2021) aerial photography of the study area with roughness coefficients adopted as per Table 6.
6. The road embankments of the partially constructed NER were modelled as z-line modifications to ensure inclusion in the existing model surface. Levels of embankments were adopted based on long section plots of NER stage 2 and stage 3 construction drawings supplied by QPRC and Hindmarsh.
7. The bridge over Jerrabomberra Creek was modelled as layered flow constrictions. Levels and structural blockages were adopted based on NER stage 1 construction drawings supplied by Council Officer Andrew Palmer on 6 May 2021. Debris blockages were adopted based on the assessment procedure in Australian Rainfall and Runoff (Weeks & Rigby, 2016), being 10% and 20% for 1% AEP and PMF respectively.

8. All culverts, pits and pipes in the study area have conservatively been assumed to be 100% blocked.

Table 6: Manning's roughness values for TUFLOW modelling.

Catchment Material Type	Manning's Roughness Coefficient ¹
Bushland	0.080
Grassland	0.045
Riparian Area	0.065
Residential / Urban Areas ²	0.080
NER Road embankment	0.020
Open Water Body	0.030

Notes

1. Based on typical values from similar catchments.
2. Based on the weighted average land use of a representative urban lot area and the adopted roughness coefficients for pervious / impervious areas.

4.4.2 Proposed Conditions

The existing conditions model was modified to include bulk earthworks for the proposed school site with z-line and z-polygon modifications to ensure inclusion in the proposed model surface based on Meinhardt Bonacci (March 2021).

All other model construction elements remained consistent with the existing conditions model.

4.5 Results

4.5.1 Flood Results

Flood mapping results (flood levels, depths, velocities and hazard categories) for the critical duration 1% AEP flood event with and without climate change and PMF events in existing and proposed conditions are provided in Attachment C, with mapping references summarised in Table 7.

Table 7: Flood mapping references in Attachment C (MA mapset P2108170MS01).

Flood Condition Scenario	Critical Duration Flood Event	Water Level & Depth	Water Velocity	Flood Hazard Vulnerabilities ¹	Water Level Afflux
Existing Conditions	1% AEP	FL 04	FL 05	FL 06	–
	1% AEP (CC ²)	FL 07	FL 08	FL 09	–
	PMF	FL 10	FL 11	FL 12	–
Proposed Conditions	1% AEP	FL 13	FL 14	FL 14	FL 22
	1% AEP (CC ²)	FL 16	FL 17	FL 18	–
	PMF	FL 19	FL 20	FL 21	–

Notes

1. Hazard vulnerabilities based on ARR 2019 Flood Hazard Curves and are shown in Figure 3.
2. Climate change based on 20.2% increased rainfall intensity for the 2090 RCP 8.5 scenario.

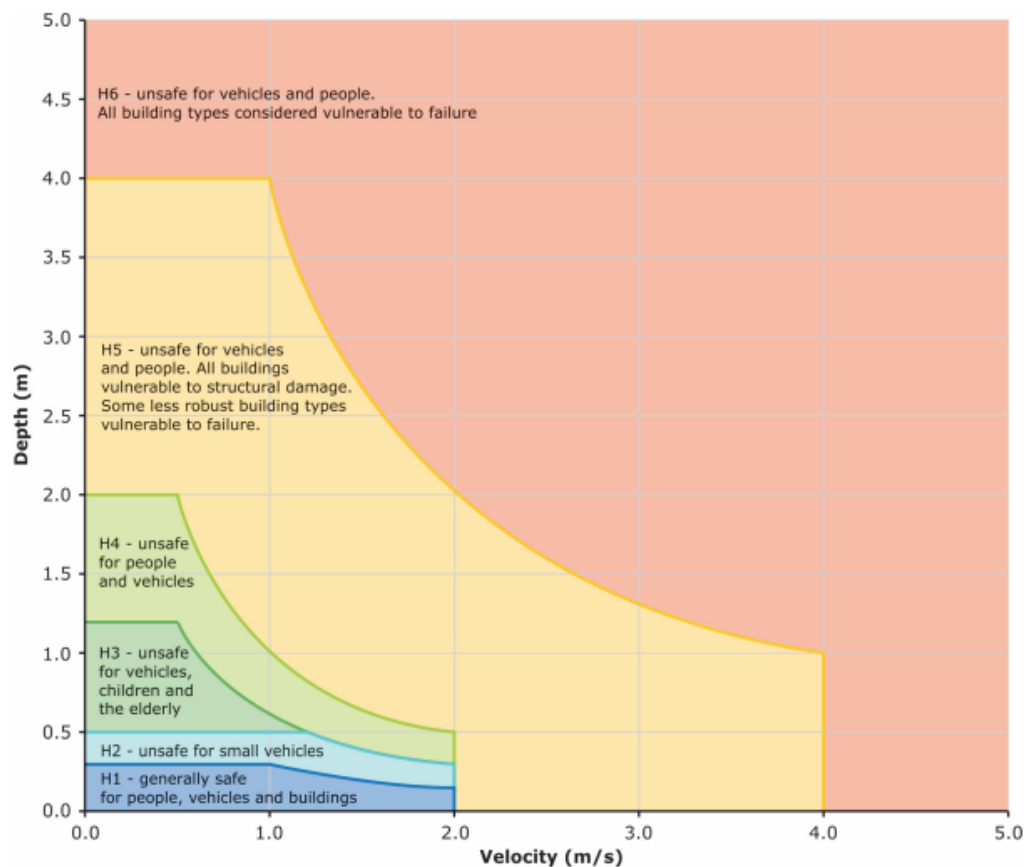


Figure 3: Flood Hazard Curves (Geoscience Australia, 2019).

4.5.2 Validation

Comparison between the Lyall flood study and MA peak flood levels of in Jerrabomberra Creek for 1% AEP 6 hours (critical duration for Jerrabomberra Creek) is given in Table 8. Comparison is made for the peak flood levels at the three locations shown in Attachment C Map FL 03.

The comparison shows flood levels as modelled by MA generally agree with Lyall modelling. The differences between modelled flood levels are likely due to the different model setup and the inclusion of NER bridge and embankments. These changes serve to increase the accuracy of the modelled flood levels at the site.

Table 8: Comparison between Lyall and MA modelled peak water levels.

Locations ¹	Peak Site Flood Level (mAHD)		Difference	
	Lyall ²	MA	(m)	(%)
Point A	589.0	588.99	-0.01	-0.002%
Point B	590.0	590.09	0.09	0.015%
Point C	591.0	591.04	0.04	0.007%

Notes

1. Comparison locations shown in Attachment C Map FL 03.
2. Peak creek flood level from Lyall (2020) Figure 4.6.

4.6 Discussion

We note the following regarding modelled flood behaviour:

4.6.1 Existing Conditions

1. The primary source of site flooding is overland flows from the unnamed drainage lines northeast of the site. Under extreme events, the site flood affectation is dominated by the overbank flow of Jerrabomberra Creek.
2. Floodwaters primarily flow across the site from northeast to southwest along the existing depression.
3. 1% AEP flood levels range from 593 mAHD to 597 mAHD over the approximately 300 m width of the site.
4. Under PMF events, floodwaters in Jerrabomberra Creek back up behind the NER bridge and overtopping the embankment. This causes the water to flood the southern portion of the site.
5. Other than in the existing depression, hydraulic hazards on-site are generally low.

4.6.2 Proposed Conditions

1. Flooding on the school site is limited to lower areas for the 1% AEP and PMF events.
2. Proposed flooding conditions are largely unchanged from existing conditions, and the proposed fill pad does not materially affect local flood characteristics.

3. 1% AEP flood and PMF levels for the sports courts fill pad are 597.4 mAHD and 598.2 mAHD respectively. The fill pad is at least 2.8 m above the PMF level.
4. According to Queanbeyan DCP 2012, flood planning level (FPL) is the 1% AEP flood level plus 0.5 metre freeboard. All proposed building finished floor levels are above the FPL and PMF levels.

4.6.3 Offsite Flood Impacts

1. The proposed development has no offsite impacts on the floodplain environment in the 1% AEP event.
2. The proposed development does not cause any lots to become flood affected in the 1% AEP event.
3. The hydraulic hazard is generally unchanged in the 1% AEP flood event between existing and proposed conditions.

5 Preliminary Flood Emergency Response Considerations

Whilst the proposed buildings are not directly affected by flooding, part of the site is inundated and likely experiences high flood hazards. We note the following with respect to the preliminary flood emergency response:

1. The proposed buildings are not affected by the 1% AEP flood event.
2. The high flood risk area is located in the depression along the southeastern boundary, including the proposed eastern entry. Access to these areas should be restricted on wet days. Appropriate signages are required along the footpath to provide warning of the associated flood risk.
3. Access to flood free land above the PMF on the site is available. Both evacuation and shelter-in-place are recommended as emergency response strategies for the site.
4. Rising flood egress along future NER is available for both pedestrians and vehicles, and evacuation can occur in all stages of a flood event up to and including the PMF.
5. Proposed vehicle access points are outside the PMF extents and hence reliable vehicular access is available.
6. If school management receives flood emergency response orders, they should undertake immediate action.
7. School management will be subscribed to the following systems and may be alerted to flood warnings via the following mechanisms:
 - SES emergency alert telephone warning system.
 - BOM alerts and press releases.
 - Weather apps (e.g. 'Early Warning Network').
 - Media warnings (TV, radio, internet etc.).
 - Police and / or SES door knocking.

6 Summary and Recommendations

A hydrologic and hydraulic model has been developed for the site consistent with previous flood assessments for the Jerrabomberra Creek catchment to assess local flood characteristics. The model was used to determine the existing and proposed flood conditions in the 1% AEP flood (with and without climate change) and PMF events. Modelling concluded that:

1. Proposed flood characteristics are largely consistent with existing conditions, and differences due to the proposed development are negligible.
2. Flooding on the school site is limited to lower areas for the 1% AEP and PMF events. All school building finished floor levels are above the PMF levels.
3. The proposed buildings are outside of flood extent in the 1% AEP (with and without climate change) and PMF events. All building finished floor levels are above the FPL and PMF levels.

Whilst the proposed development is not affected by flood hazards during all floods up to and including the PMF event, we recommend the school management to subscribe to the relevant flood warning systems and maintain communication with SES and local police at all times with respect to flood emergency response.

Brown (2010), *Flood Study and Riparian Corridor Assessment, Jerrabomberra Creek*

Bureau of Meteorology (2003), *The Estimation of Probable Maximum Precipitation in Australia: Generalised Short-Duration Method*.

Bureau of Meteorology (2017), *Rainfall IFD Data System*, <http://www.bom.gov.au/water/designRainfalls/revised-ifd/>.

Calibre (2016), *North Tralee – Jerrabomberra Creek Flood Study – Update to 2010 Flooding*.

Commonwealth of Australia (Geoscience Australia) (2019), *Australian Rainfall and Runoff – A Guide to Flood Estimation*.

DRAINS (2016), *DRAINS Content Menu*.

Lyll & Associates (2020), *Jerrabomberra Creek and Queanbeyan-Palerang Regional Sports Complex Flooding and Drainage Investigation*.

Meinhardt Bonacci (2021), *Civil & Stormwater 12785-02c - New High School in Jerrabomberra Environs Drive, Jerrabomberra NSW 2619*.

NSW Department of Infrastructure, Planning and Natural Resources (2005), *Floodplain Development Manual*.

Queanbeyan-Palerang Regional Council (2013), *Queanbeyan Local Environmental Plan (West Jerrabomberra) (LEP)*.

Queanbeyan-Palerang Regional Council (2012), *Queanbeyan Development Control Plan (DCP)*.

Tanner Kibble Denton Architects (2021), *High School in Jerrabomberra*.

Weeks, W and Rigby, T (2016), *Blockage of Hydraulic Structures*, Chapter 6 of Book 6 in *Australian Rainfall and Runoff – A Guide to Flood Estimation*.

XP-RAFTS (1996), *User's Manual*.

**8 Attachment A: Proposed Earthworks Plan (Meinhardt
Bonacci, 2021)**

BULK EARTHWORKS DEPTH RANGE				
Lower_value	Upper_value	Colour		
-10.5	to -10	2		
-10	to -9.5	2		
-9.5	to -9	2		
-9	to -8.5	2		
-8.5	to -8	2		
-8	to -7.5	2		
-7.5	to -7	2		
-7	to -6.5	2		
-6.5	to -6	2		
-6	to -5.5	2		
-5.5	to -5.0	2		
-5.0	to -4.5	2		
-4.5	to -4.0	2		
-4.0	to -3.5	2		
-3.5	to -3.0	2		
-3.0	to -2.5	2		
-2.5	to -2.0	2		
-2.0	to -1.5	2		
-1.5	to -1.0	2		
-1.0	to -0.5	2		
-0.5	to 0	2		
0	to 0.5	2		
0.5	to 1.0	2		
1.0	to 1.5	2		
1.5	to 2.0	2		
2.0	to 2.5	2		
2.5	to 3.0	2		
3.0	to 3.5	2		
3.5	to 4.0	2		
4.0	to 4.5	2		
4.5	to 5.0	2		
5.0	to 5.5	2		
5.5	to 6	2		
6	to 6.5	2		
6.5	to 7	2		
7.5	to 8	2		

SURVEY LEGEND

---	SITE BOUNDARY
---	EX SURFACE LEVEL
---	EX SURFACE CONTOUR
---	LEGEND
---	BULK EARTHWORKS MINOR SURFACE CONTOUR
---	BULK EARTHWORKS MAJOR SURFACE CONTOUR

EXCAVATION NOTES

- E1 VOLUMES ARE APPROXIMATE ONLY AND DO NOT INCORPORATE BULKING FACTORS AND OVER EXCAVATION. VOLUMES HAVE BEEN CALCULATED BETWEEN 150mm STRIPPED SURFACE LEVELS AND BULK EARTHWORKS SURFACE OR AS NOTED IN GEOTECHNICAL REPORT.
- E2 GROUND WATER SEEPAGE MAY OCCUR IN EXCAVATED AREAS. DE-WATERING MAY BE REQUIRED IN THIS INSTANCE.
- E3 THIS DRAWING ONLY DETAILS EXCAVATION ASSOCIATED WITH THE BUILDING SLAB INCLUDING STRUCTURAL FOOTINGS, BEAMS AND COLUMNS. IN ADDITION TO MAKING NO ALLOWANCE FOR TRENCH BACKFILL, TREE ROOTBALLS OR DETAILED EXCAVATION.
- E4 PROVIDE TEMPORARY MAXIMUM 1 IN 1 BATTERS UNLESS GEOTECH TO CONFIRM BATTER ACCEPTABILITY DURING CONSTRUCTION.
- E5 THE EXCAVATED MATERIAL IS TO BE TEMPORARILY STOCKPILED WITHIN THE LANDSCAPED AREAS (TO BE CONFIRMED ON-SITE) AND RE-USED USING VALIDATED MATERIALS AS LANDSCAPING SOIL BUILD-UP/BACKFILL IN ACCORDANCE WITH LANDSCAPE ARCHITECTS SPECIFICATIONS.
- E6 REFER TO ARBORIST REPORT FOR TREE PROTECTION MEASURES IF REQUIRED.
- E7 500mm ZONE OFFSET FROM BUILDING HAS BEEN ALLOWED FOR FORM WORK.
- E8 SITE SURVEY SUPPLIED BY PROJECT SURVEYORS' PTY LTD JOB REFERENCE No. B04-901 DRAWING No. B04-901-JPS-1 DATED 16/03/21

BULK EARTHWORKS QUANTITIES SUMMARY (IN-PLACE)

150mm STRIPPED SURFACE = 4,885m³
(ASSUMED TO BE REMOVED OFF-SITE)

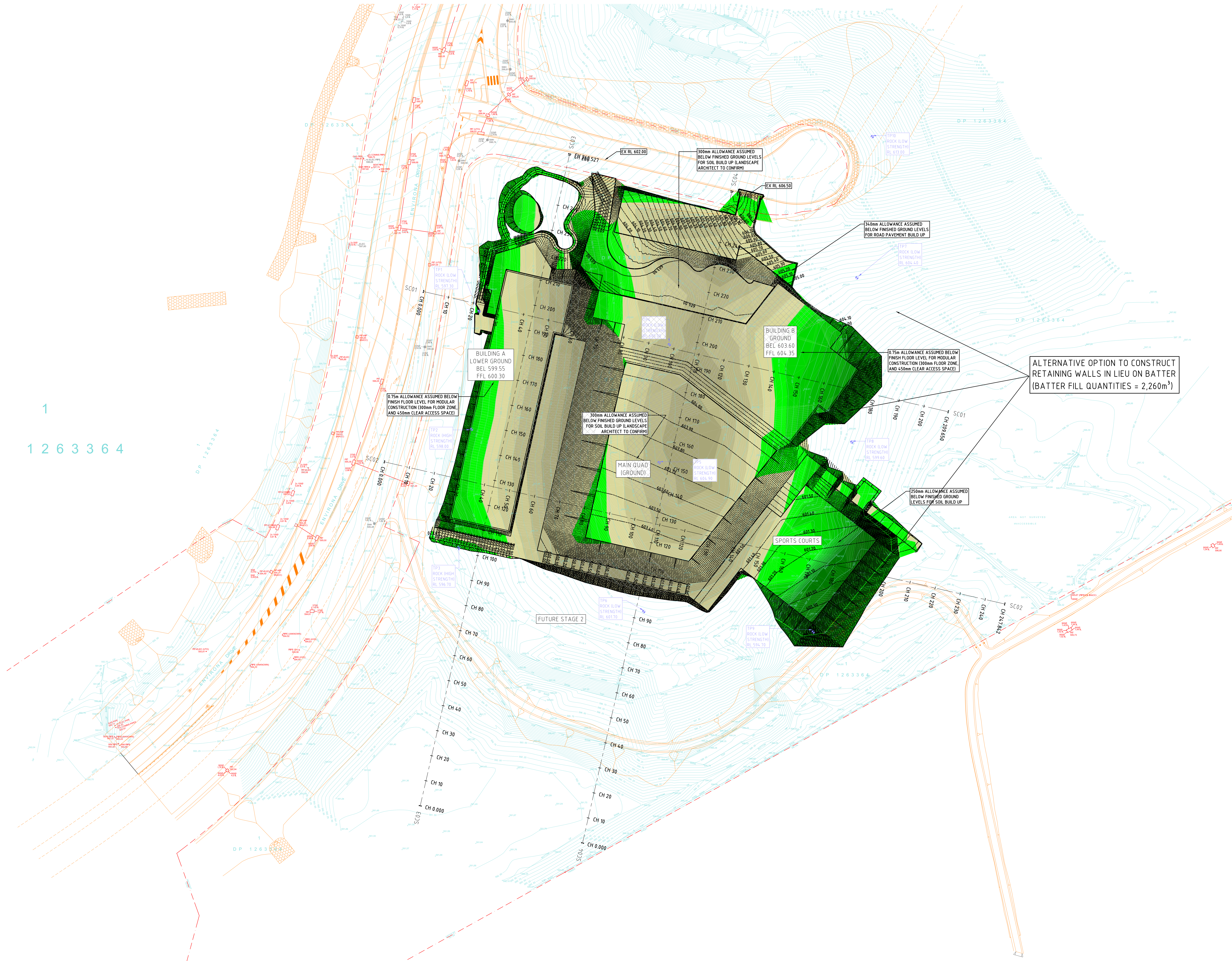
TOTAL CUT VOLUME = 14,720m³

VOLUME INCLUDES THE FOLLOWING:
• EXCAVATION INTO ROCK = 3,770m³
SHOWN THIS

TOTAL FILL VOLUME = 8,600m³

TOTAL EXCESS CUT VOLUME = 6,120m³
(FILL VOLUME BASED ON 100% REUSABLE EXCAVATED MATERIAL)

1 2 6 3 3 6 4



ALTERNATIVE OPTION TO CONSTRUCT RETAINING WALLS IN LIEU ON BATTER (BATTER FILL QUANTITIES = 2,260m³)

NOT FOR CONSTRUCTION

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DESIGN PDF FILES GENERATED FROM THIS DIGITAL FILE HAVE BEEN CONFIGURED FOR PRINTING IN COLOUR ONLY. IT IS THE RESPONSIBILITY OF THE END USER TO HAVE PLANS PRINTED IN COLOUR FORMAT SO THAT THE DESIGN INFORMATION CAN BE INTERPRETED CORRECTLY.



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School Infrastructure

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1/2 St Marks Street
North Sydney NSW 1585
www.mgconsulting.com.au

MEINARDT
BONACCI

Level 4, 60 Clarence Street
Sydney NSW 2000
Australia
Tel: +61 2 9555 3038
F: +61 2 9555 3755
info@meinhardtbonacci.com.au
www.meinhardtbonacci.com.au

Project Name
**NEW HIGH SCHOOL IS
JERRABOMBERRA**

Drawing Title
BULK EARTHWORKS PLAN

SCHEMATIC DESIGN

Designed	CK	Approved		Date	
Drawn	HM				
Scale	1:500				
Date	MAR 2021				
Sheet	A0				

Project Ref
20095 CE-SD-HS-2009 F

Drawing No
20095 CE-SD-HS-2009 F

Rev

9 **Attachment B: Consultation Evidences**

Calvin Li

From: Calvin Li
Sent: Monday, 29 March 2021 3:33 PM
To: Derek Tooth
Cc: Stefan Szczew; Sina Arbabzadeh
Subject: RE: 8170 Flood information for high school site, Jerrabomberra

Hi Derek,

Thanks for your update. It would be great if we could have access to the flood study for the regional sport complex.

With regards,

Calvin Li | Civil Engineer

BEng (Hons1), MPhil (Civil & Env Eng), MIEAust

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Suite 201, 20 George Street, Hornsby, NSW 2077



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From: Derek Tooth
Sent: Monday, 29 March 2021 3:16 PM
To: Calvin Li
Cc: Stefan Szczew ; Sina Arbabzadeh
Subject: RE: 8170 Flood information for high school site, Jerrabomberra

Hi Calvin

I'm yet to hear back from my consultant if he is happy for me to pass on his report noting that it covers the school site but was primarily done for the regional sport centre further down stream.

Derek

From: Calvin Li <cli@martens.com.au>
Sent: Monday, 29 March 2021 2:48 PM
To: Derek Tooth <Derek.Tooth@qprc.nsw.gov.au>
Cc: Stefan Szczew <Stefan.Szczew@hindmarsh.com.au>; Sina Arbabzadeh <sarbabzadeh@martens.com.au>
Subject: RE: 8170 Flood information for high school site, Jerrabomberra

[EXTERNAL] This email originated from outside of the organisation. Please do not click links or open attachments unless you recognise the sender and know that the content is safe.

Hi Derek,

I tired contact you earlier and have left you a message at the switchboard.

I would like to check the progress of my request on flooding information. If possible, I would like to obtain your permission to contact Lyall & Associates directly.

With regards,

Calvin Li | Civil Engineer

BEng (Hons1), MPhil (Civil & Env Eng), MIEAust

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Please consider the environment before printing this email.

From: Calvin Li

Sent: Thursday, 25 March 2021 12:24 PM

To: 'derek.tooth@qprc.nsw.gov.au' <derek.tooth@qprc.nsw.gov.au>

Cc: 'Stefan Szyzew' <Stefan.Szyzew@hindmarsh.com.au>; Sina Arbabzadeh <sarbabzadeh@martens.com.au>

Subject: RE: 8170 Flood information for high school site, Jerrabomberra

Hi Derek,

I was trying to contact you earlier while you were not available. I would like to check the progress of my request on flooding information.

Could you please give me a call on 9476 9999 at your convenience?

With regards,

Calvin Li | Civil Engineer

BEng (Hons1), MPhil (Civil & Env Eng), MIEAust

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Please consider the environment before printing this email.

From: Calvin Li

Sent: Wednesday, 24 March 2021 12:52 PM

To: 'derek.tooth@qprc.nsw.gov.au' <derek.tooth@qprc.nsw.gov.au>

Cc: 'Stefan Szyzew' <Stefan.Szyzew@hindmarsh.com.au>; Sina Arbabzadeh <sarbabzadeh@martens.com.au>

Subject: FW: 8170 Flood information for high school site, Jerrabomberra

Hi Derek,

Thank you for discuss with me over the phone last week regarding my request for flood information at Jerrabomberra.

Since we are subjected to a tight project schedule, I would like to follow up on the progress of my request.

Would you mind giving me the permission and contact details to directly liaise with Lyall & Associates?

With regards,

Calvin Li | Civil Engineer

BEng (Hons1), MPhil (Civil & Env Eng), MIEAust

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Please consider the environment before printing this email.

From: Calvin Li

Sent: Tuesday, 16 March 2021 1:12 PM

To: 'derek.tooth@qprc.nsw.gov.au' <derek.tooth@qprc.nsw.gov.au>

Cc: Sina Arbabzadeh <sarbabzadeh@martens.com.au>

Subject: 8170 Flood information for high school site, Jerrabomberra

Hi Derek,

We are working on the Flood Risk Assessment for the proposed high school in Jerrabomberra. I would like to obtain site flood level and related information for the surrounding area.

We noted the Calibre 2016 flood study (<https://yourvoice.qprc.nsw.gov.au/west-jerrabomberra-planning-proposal/widgets/232591/documents>)

does not cover the site nor the recently constructed Environa Dr bridge. I understand Council have recently conducted a flood study, which may be relevant to the school site. Could you provide us with access to this flood study, please?

Based on our preliminary study, the school site is in the vicinity of two local drainage lines from the northeast of Lake in Jerrabomberra. The upstream catchment was fitted with several detention structures. To understand the flood affectation at the school site, we need to know details of these structures, or the adopted flow rates from those catchments.

Thank you for your help.

With regards,

Calvin Li | Civil Engineer

BEng (Hons1), MPhil (Civil & Env Eng), MIEAust

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Calvin Li

From: Calvin Li
Sent: Monday, 3 May 2021 10:41 AM
To: Derek Tooth
Cc: 'Stefan Szyzew'; Sina Arbabzadeh
Subject: RE: Generated batch document - Jerrabomberra High School
Attachments: FW: 8007 / 8170 Bungendore and Jerrabomberra High School - Concept Drainage Design - Council Feedback

Hi Derek,

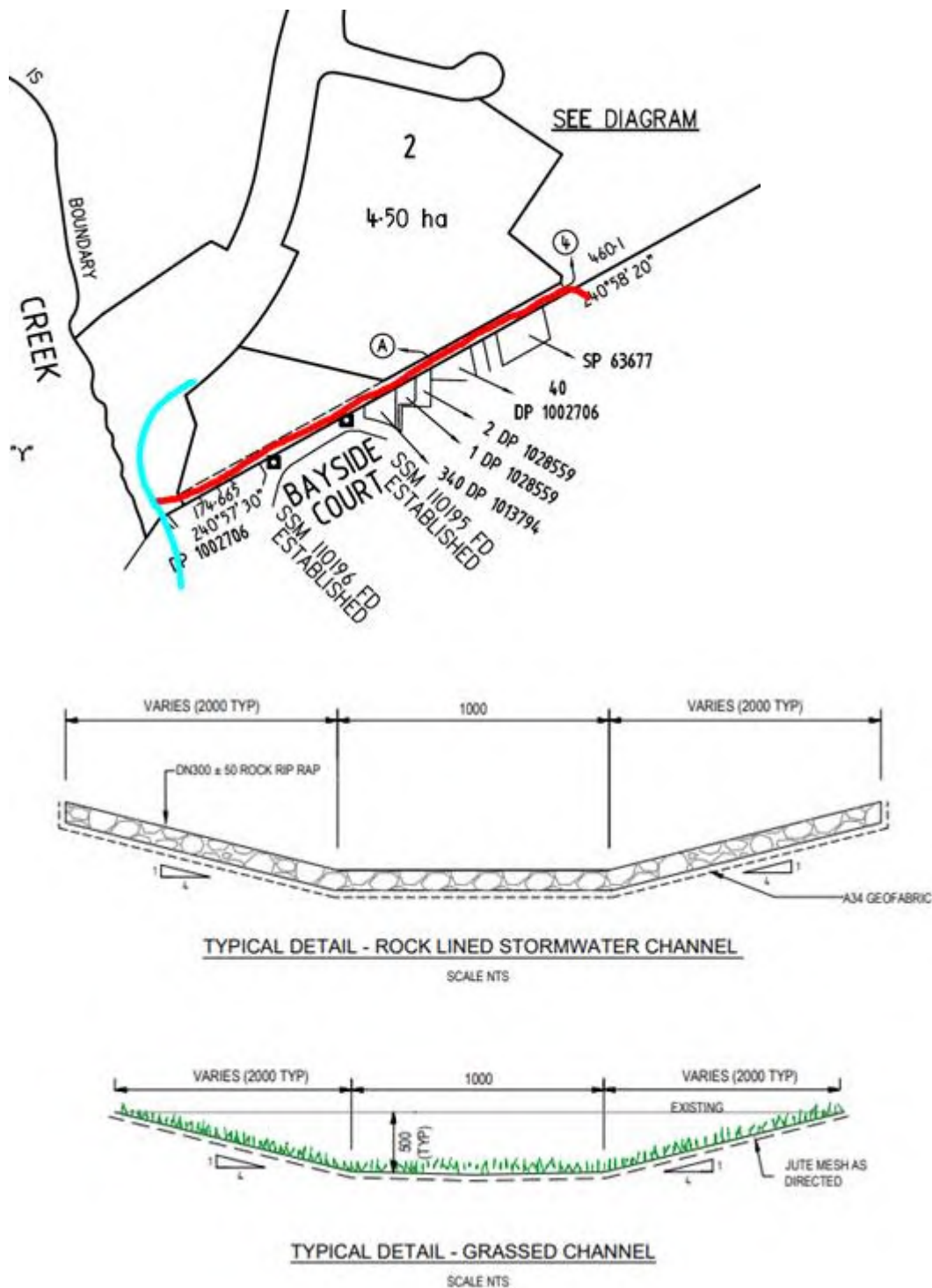
Thank you for your previous email. I have downloaded the flood reports.

After a brief review, I understand the flood study does not assess the local drainage structures under 1% AEP flood around Jerrabomberra Lake. Therefore I still need to confirm some details of the drainage concept near the school site.

1. I understand from local news (image below) that South Jerrabomberra Innovation Precinct include an education precinct. Does any master plan/precinct plan include any drainage considerations in the vicinity of the school site?



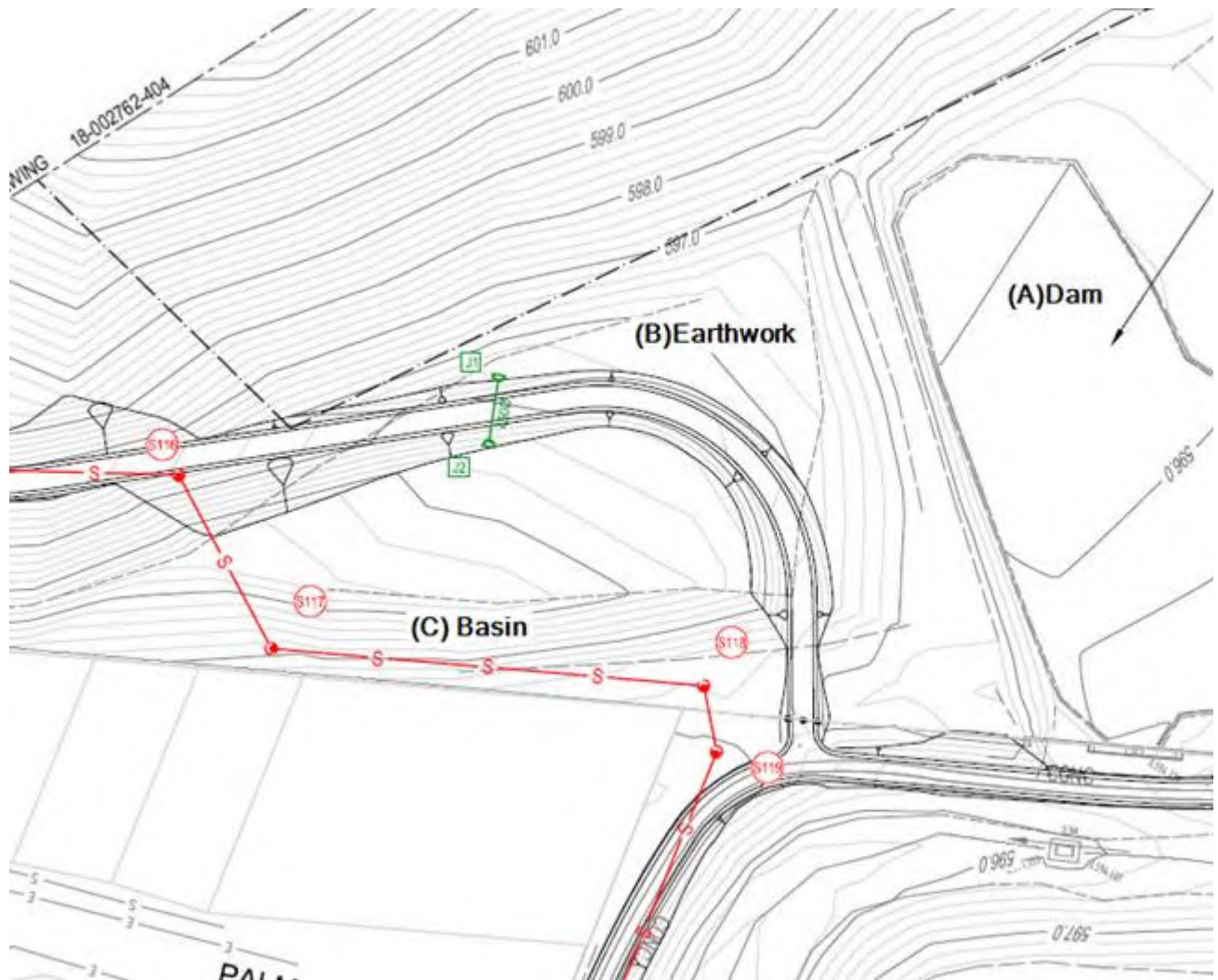
2. In case of larger events (for example, 1% AEP or PMF), would Council assume flood water to be directed along the drainage depression, as shown in the QPRC markup? QPRC markups were extracted from email by Andrew Palmer to TSA and NSW Education on 2 March 2021, with the original email attached.



3. We understand that the catchment upslope of the school site drains into the dam (A), then to Lake Jerrabomberra (shown as red arrows). Under major event, however, flood would overtop the dam and discharge into the school site (shown as green arrows). Is there any design report or drainage study available to confirm the functionalities of the dam and lake when they were constructed back in 1990s?
4. Prior to the construction of NER, floodwater would follow two old drainage depression and discharge into Jerrabomberra Creek (shown as blue arrows). Does the council aware of any flood study associated with the NER section north of Jerrabomberra Creek?



5. Aerial imagery indicates there are extensive earthworks (B). Our survey shows the fill depth ranges between 0.5-1 m. Does Council aware of such earthwork being permanent or temporary? We note (based on the available NER construction drawing dated 13/7/2020, reproduced below) such earthwork is not in the area of proposed sewer. Similar work also includes a basin at (C), which seems to be a sedimentation basin for construction.



I look forward to hearing from you at your earliest convenience. I will follow up this afternoon.

Thank you for your help.

With regards,

Calvin Li | Civil Engineer

BEng (Hons1), MPhil (Civil & Env Eng), MIEAust

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Please consider the environment before printing this email.

From: Derek Tooth

Sent: Friday, 30 April 2021 2:48 PM

To: Calvin Li

Subject: Generated batch document

Hi Calvin

Let me know if this doesn't work

Derek

Derek Tooth

Service Manager Contracts & Projects

Queanbeyan-Palerang Regional Council

Mob: 0408 430 739

Web: www.qprc.nsw.gov.au

Mail: PO Box 90 Queanbeyan NSW 2620



Click on the link to access the generated batch document.

<https://onecouncil.qprc.nsw.gov.au/T1Prod/CiAnywhere/Web/PROD/ECMCore/BulkAction/Get/73b74f3c-4f7e-464b-9779-000662f2528e>

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This link will expire on 29 July 2021, 2:41 PM.


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Calvin Li

From: Andrew Palmer <andrew.palmer@qprc.nsw.gov.au>
Sent: Thursday, 6 May 2021 9:51 AM
To: Calvin Li
Subject: FW: [8170] Jerrabomberra High School - Flooding

Hi Calvin,

Please let me know if there is a problem with this link.

 https://queanbeyan-my.sharepoint.com/:b:/g/personal/andrew_palmer_qprc_nsw_gov_au/ETIHyoPyjJImjU1Fp9DKPQBV1Fjj-KikFmegSYQPN9ug?email=cli%40martens.com.au&e=80DEcL

Regards

Andrew Palmer

Team Leader Subdivisions – Development Engineering
Queanbeyan-Palerang Regional Council



Phone: (02) 6238 8125
Mobile: (0437) 320 468
Mail: PO Box 90, Queanbeyan NSW 2620
Email: andrew.palmer@qprc.nsw.gov.au
Web: www.qprc.nsw.gov.au

From: Andrew Palmer
Sent: Thursday, 6 May 2021 9:47 AM
To: Calvin Li
Subject: RE: [8170] Jerrabomberra High School - Flooding

Hi Calvin,

Attached are the Jerrabomberra Creek bridge plans for the NER project. The road plans are quite large, subsequently I'll send a link separately.

Regards

Andrew Palmer

Team Leader Subdivisions – Development Engineering
Queanbeyan-Palerang Regional Council



Phone: (02) 6238 8125
Mobile: (0437) 320 468
Mail: PO Box 90, Queanbeyan NSW 2620
Email: andrew.palmer@qprc.nsw.gov.au
Web: www.qprc.nsw.gov.au

From: Calvin Li <cli@martens.com.au>
Sent: Monday, 3 May 2021 1:13 PM
To: Andrew Palmer <andrew.palmer@qprc.nsw.gov.au>
Cc: Derek Tooth <Derek.Tooth@qprc.nsw.gov.au>; 'Stefan Szyzew' <Stefan.Szyzew@hindmarsh.com.au>; Sina Arbabzadeh <sarbabzadeh@martens.com.au>
Subject: [8170] Jerrabomberra High School - Flooding

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Hi Andrew,

Thank you for speaking with us over the phone last Friday on the NER design surface near Jerrabomberra.

As discussed with Sina, could you please provide the road design surface for the section south of the Jerrabomberra creek?

With regards,

Calvin Li | Civil Engineer

BEng (Hons1), MPhil (Civil & Env Eng), MIEAust

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Calvin Li

Subject: CL SA 8170 Jerra High School - Drainage MR1
Location: <https://zoom.us/j/99209829489?pwd=WGpLQUUzUkgrL1NJdWlyUlc4eEZjUT09>
Start: Thu 6/05/2021 3:00 PM
End: Thu 6/05/2021 3:30 PM
Recurrence: (none)
Meeting Status: Not yet responded
Organizer: Derek Tooth

Derek Tooth is inviting you to a scheduled Zoom meeting.

Join Zoom Meeting

<https://zoom.us/j/99209829489?pwd=WGpLQUUzUkgrL1NJdWlyUlc4eEZjUT09>

Meeting ID: 992 0982 9489

Passcode: 718553

One tap mobile

+61370182005,,99209829489#,,,,*718553# Australia

+61731853730,,99209829489#,,,,*718553# Australia

Dial by your location

+61 3 7018 2005 Australia

+61 7 3185 3730 Australia

+61 8 6119 3900 Australia

+61 8 7150 1149 Australia

+61 2 8015 6011 Australia

Meeting ID: 992 0982 9489

Passcode: 718553

Find your local number: <https://zoom.us/u/adOQ4DqQpg>

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PROJECT NO.

8/70

Author:

CL

Subject:

Meeting w QPRC re drainage
and site earthwork conditions.
Andrew Palmer, Derek Tooth

Event Details:

Date:

06/05/21

Time:

3:00

am/pm

Duration:

45

hrs/mins

☐ Phone call

☐ Team meeting

☐ Conference

☐ Site inspection

☒ Video call

☐ General note

Notes: Attendees, discussions, sketches, agreements, instructions. Attach if needed any marked-up maps, diagrams, photos etc.

Page No:

1 of 1

El: Ramsland, CL, SA

- work as exc. plans is requested

- Area next to the site has no master plan
regarding drainage / flooding

- Utilising drainage reserve is still at high level
planning stage

- AP, DT has no knowledge of the functions of
U/S dam or drainage design

- Benchmark on site relates to Sewer. Design
will be provided.

- Design works or survey after construction for
NGR Stage 1 area will be provided.

- All earthworks on-site are final and are
not of temporary nature, inc. sed. basin

- Benchmark on site is finished. U/S exists
surface as per flood model.

To follow with El: Ramsland

Calvin Li

From: Eli Ramsland <Eli.Ramsland@qprc.nsw.gov.au>
Sent: Tuesday, 11 May 2021 4:31 PM
To: Sina Arbabzadeh; Stefan Szyzew; Calvin Li; Derek Tooth; Terry Harvey
Cc: Andrew Palmer; Daniel Dhiacou; Leigh Woodley; Doug Woods; Mark Price
Subject: RE: [8170] Jerra High School - Drainage meeting
Attachments: FINISHED SURFACE NER 1.dwg

Hi Sina,

Please find attached details for the extended noise mound near the creek.

As discussed with Calvin during our meeting last week, Council does not propose to touch the dam wall. What we are currently doing is installing the sewer mains behind Bayside Court properties so we can connect the main to the pump station on Bayside Court. As this work is still underway there are no as built information to provide on surfaces. My understanding is that the dam currently spills towards the Oval but that your modelling work could recommend an additional spillway on the dam wall for larger flows. If your work finds that a spillway is required through the current dam wall and you have design surfaces for us to work with, we could possibly accommodate this when we make the area good, if the information comes to us in time.

Unfortunately at this stage, we cannot find any further information on the dam or stormwater flows to the dam.

Regards,
Eli

From: Sina Arbabzadeh
Sent: Monday, 10 May 2021 5:10 PM
To: Eli Ramsland ; Stefan Szyzew ; Calvin Li ; Derek Tooth ; Terry Harvey
Cc: Andrew Palmer ; Daniel Dhiacou ; Leigh Woodley ; Doug Woods ; Mark Price
Subject: RE: [8170] Jerra High School - Drainage meeting

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Eli and Derek,

Thanks for quick turnaround; however, this plan doesn't show any information related to surface changes through the exiting dam's spillway.

Please note that we don't have information regarding with noise/deflection mound near the creek, so still require those information if available.

Regards,

Sina Arbabzadeh | Senior Engineer & Technical Team Leader

Meng (civil), BEng (civil)

T 02 9476 9999 | F 02 9476 8767 | W www.martens.com.au

Suite 201, 20 George Street, Hornsby, NSW 2077



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From: Eli Ramsland <Eli.Ramsland@qprc.nsw.gov.au>

Sent: Monday, 10 May 2021 4:28 PM

To: Stefan Szyzew <Stefan.Szyzew@hindmarsh.com.au>; Calvin Li <cli@martens.com.au>; Derek Tooth <Derek.Tooth@qprc.nsw.gov.au>; Sina Arbabzadeh <sarbabzadeh@martens.com.au>; Terry Harvey <THarvey@martens.com.au>

Cc: Andrew Palmer <andrew.palmer@qprc.nsw.gov.au>; Daniel Dhiacou <DDhiacou@martens.com.au>; Leigh Woodley <Leigh.Woodley@hindmarsh.com.au>; Doug Woods <Doug.Woods@hindmarsh.com.au>; Mark Price <Mark.Price@hindmarsh.com.au>

Subject: RE: [8170] Jerra High School - Drainage meeting

Hi Stefan/Calvin,

Please find attached the design for the sewer line behind Bayside Court which will go through the school lot in a 4m easement. Please disregard the path that is shown running parallel to the sewer in this design, this path is no longer going to get built.

We have asked our internal staff to search for wae or any studies covering the dam area but have had no response to date.

I note that you have stated that Martens have information on the noise/deflection mound near the creek and that Derek and I no longer need to provide any information on this.

Regards,
Eli

From: Stefan Szyzew <Stefan.Szyzew@hindmarsh.com.au>

Sent: Monday, 10 May 2021 3:55 PM

To: Calvin Li <cli@martens.com.au>; Derek Tooth <Derek.Tooth@qprc.nsw.gov.au>; Sina Arbabzadeh <sarbabzadeh@martens.com.au>; Terry Harvey <THarvey@martens.com.au>

Cc: Andrew Palmer <andrew.palmer@qprc.nsw.gov.au>; Eli Ramsland <Eli.Ramsland@qprc.nsw.gov.au>; Daniel Dhiacou <DDhiacou@martens.com.au>; Leigh Woodley <Leigh.Woodley@hindmarsh.com.au>; Doug Woods <Doug.Woods@hindmarsh.com.au>; Mark Price <Mark.Price@hindmarsh.com.au>

Subject: RE: [8170] Jerra High School - Drainage meeting

[EXTERNAL] This email originated from outside of the organisation. Please do not click links or open attachments unless you recognise the sender and know that the content is safe.

Hi All,

Following discussions with Sina just now and in relation to correspondence requesting further information from Council issued on the 6/5/21 (below).

We're wanting to expedite transfer of information as available from Council, refer below correspondence with comments in red). Alternatively if this information is not available please advise such immediately to allow Martens to progress studies.

For your information, the projects, being both Jerrabomberra and Bungendore High Schools are planned to have SSD applications finalised for submission by the end of this month. This therefore means flood study information is overdue for consideration of the wider consultant team.

We need to have studies wrapped up no later than this week please.

Thanks, Stefan

From: Calvin Li <cli@martens.com.au>

Sent: 6 May 2021 4:04 PM

To: Derek Tooth <Derek.Tooth@qprc.nsw.gov.au>

Cc: Andrew Palmer <andrew.palmer@qprc.nsw.gov.au>; eli.ramsland@qprc.nsw.gov.au; Stefan Szyzew <Stefan.Szyzew@hindmarsh.com.au>; Sina Arbabzadeh <sarbabzadeh@martens.com.au>

Subject: [8170] Jerra High School - Drainage meeting

Hi Derek,

Thank you for organising the meeting today. It was really helpful to see you and talk about the drainage issues near Jerrabomberra High School.

As discussed, we would like to request the following information

1. Design / work as executed drawings for the sewer line downslope of the dam within the proposed school site. **Eli and Derek have advise design is available for sewer design and will issue**
2. Design / work as executed drawings in NER Stage 1 area. These include the deflection mound next to the Jerrabomberra Creek and civil works in the vicinity of the bridge. **Martens have this information, no further action required**
3. If available, the original drainage scheme for the dam upslope of the school site when it was constructed back in the 1990s. **Eli and Derek have advised this information may be available and will provide (if available)**

I look forward to hearing from you at your earliest convenience. Thanks for your help.

Calvin Li | Civil Engineer

BEng (Hons1), MPhil (Civil & Env Eng), MIEAust

T 02 9476 9999 | **F** 02 9476 8767 | **W** www.martens.com.au

Suite 201, 20 George Street, Hornsby, NSW 2077



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10 **Attachment C: Mapset**



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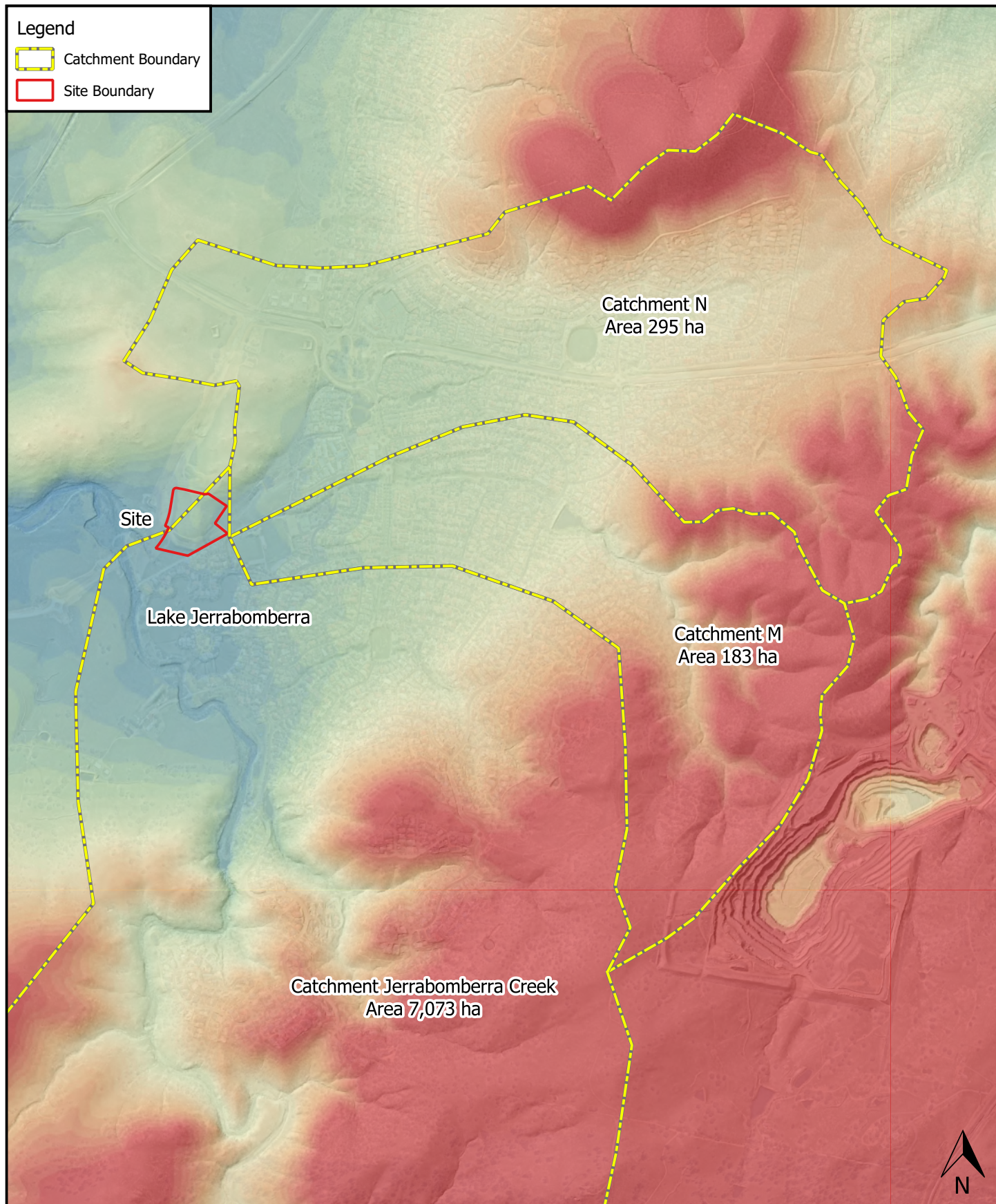
Map Title / Figure:

Catchment Plan - Jerrabomberra Creek

1:90000 @ A4

Viewport CatCreek

Aerial image from Nearmap (2021).



1:20000 @ A4

Viewport CatLocal

Aerial image from Nearmap (2021).
Digital Elevation Model by LiDAR data from ACT Government - Environment and Planning Directorate (2015).



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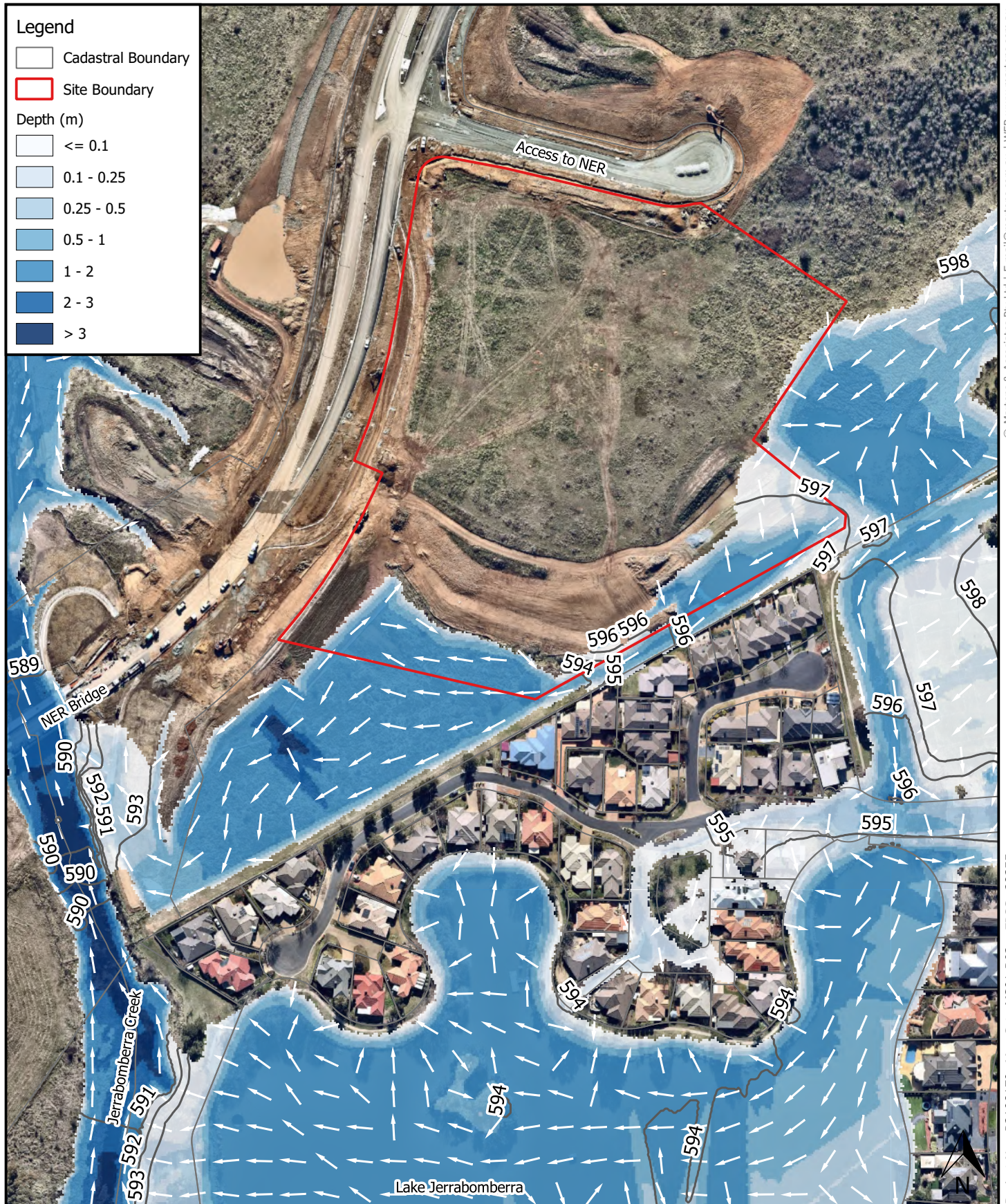
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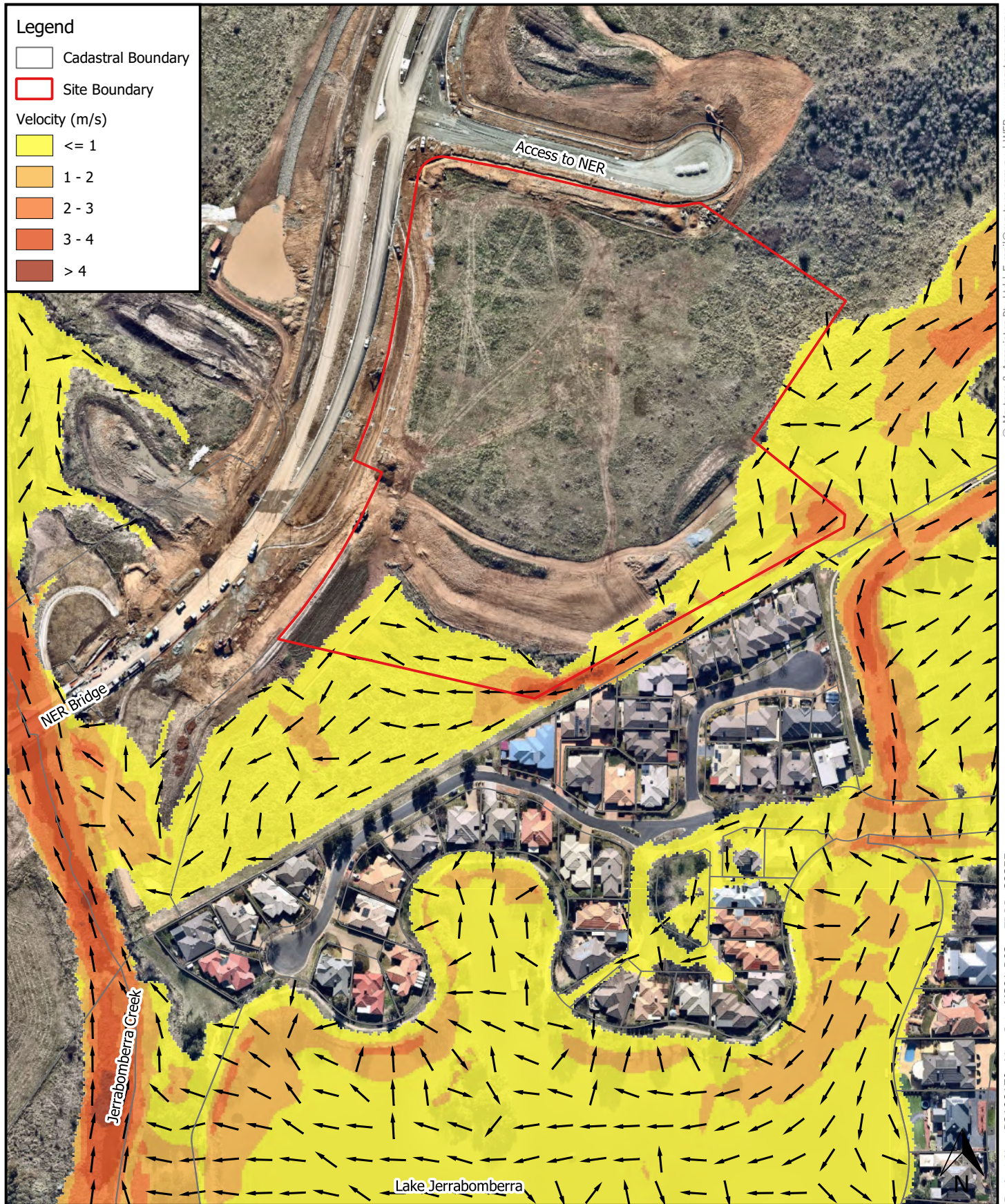
Viewport Validation

Aerial Image from Nearmap (2021).

Map Title / Figure:

Validation Locations



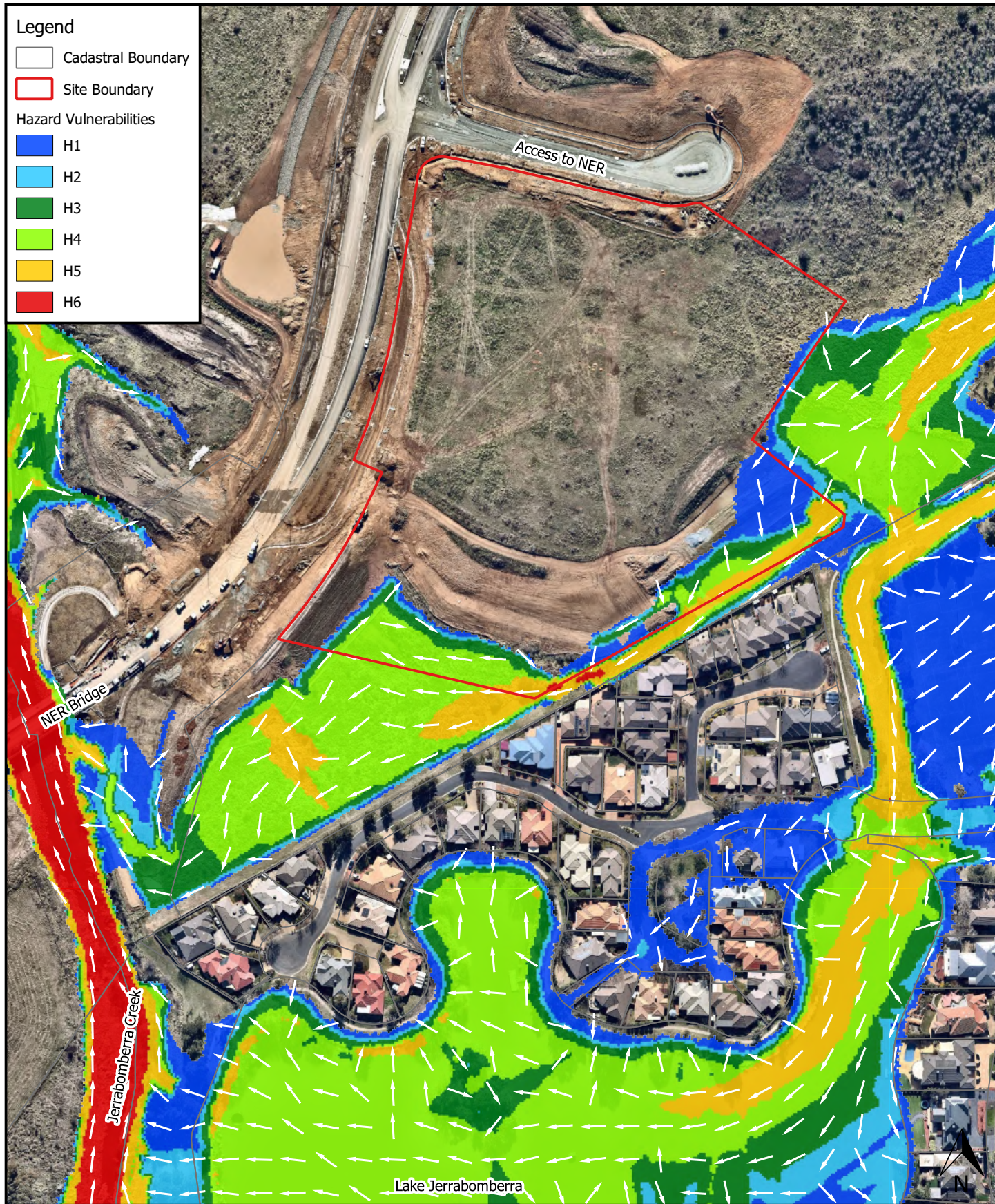


1% AEP - Existing Conditions Water Velocity (m/s)

1:2500 @ A4

Viewport Results

Aerial Image from Nearmap (2021).
Cadastre sourced from SIX Maps Clip & Ship (2021).



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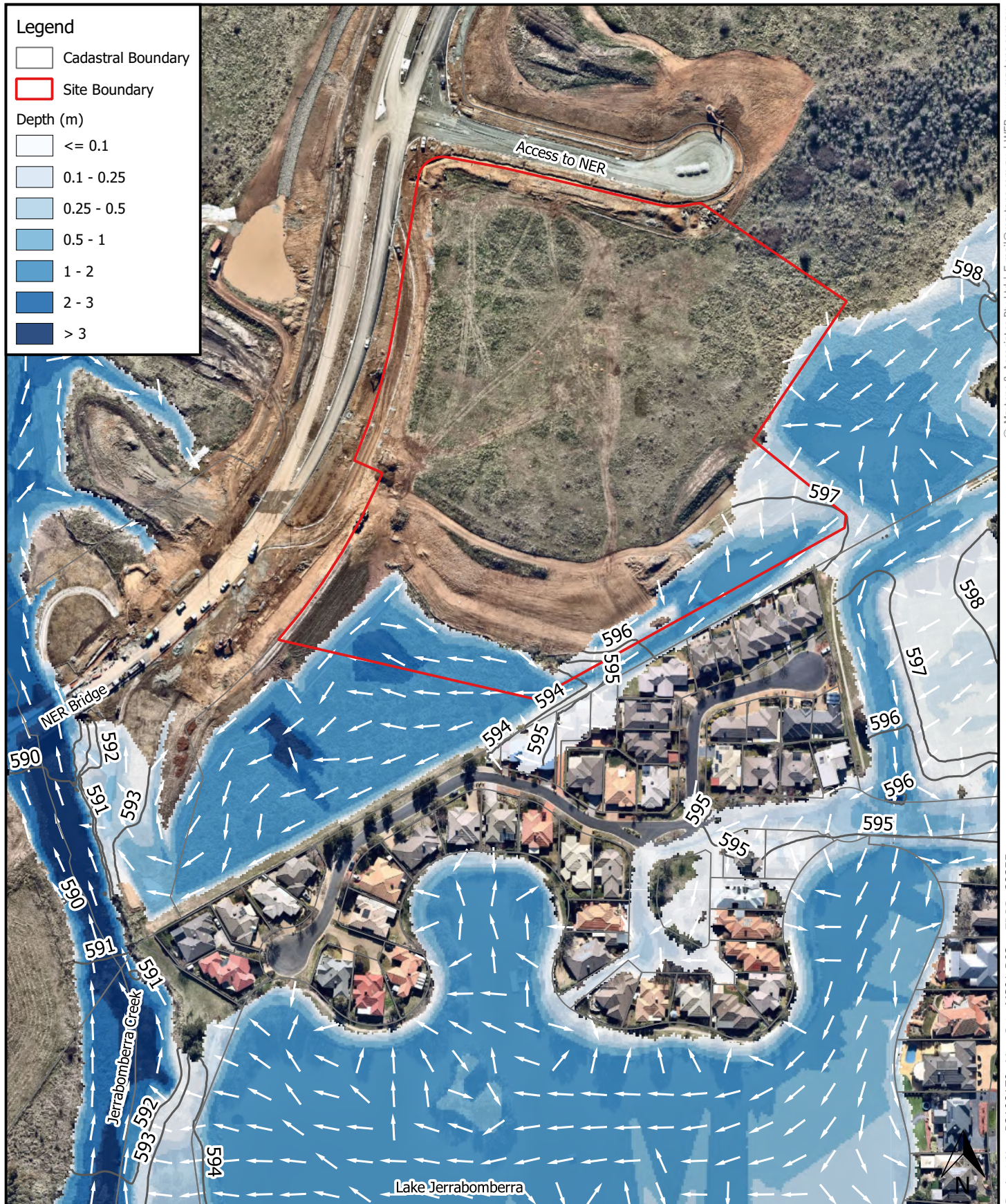
Map Title / Figure:

1% AEP - Existing Conditions Flood Hazard Vulnerabilities

1:2500 @ A4

Viewport Results

Aerial Image from Nearmap (2021).
Cadastre sourced from SIX Maps Clip & Ship (2021).
Flood Hazard Vulnerabilities based on ARR 2019 Combined flood hazard curves.

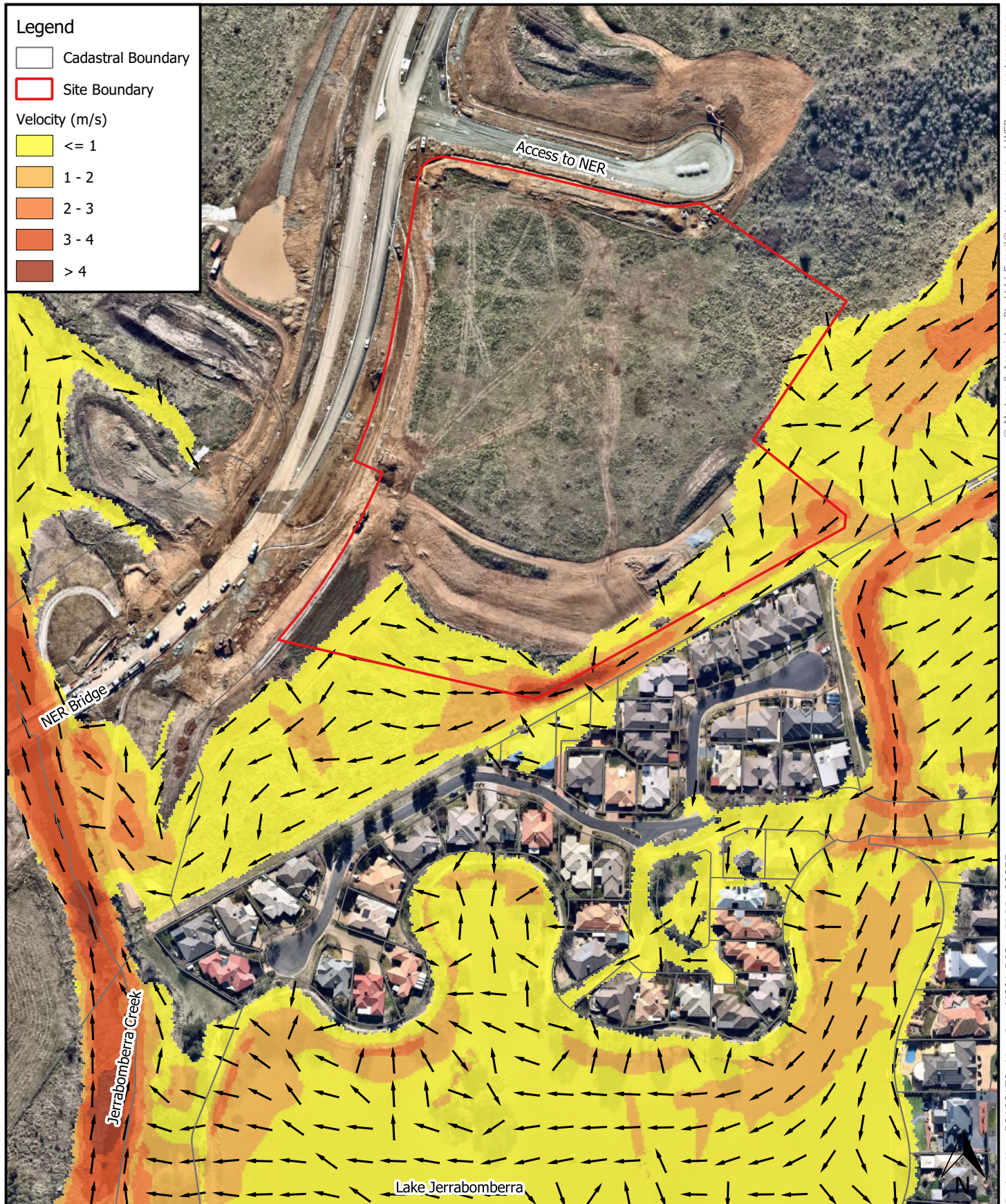


1% AEP with Climate Change - Existing Conditions Water Level (mAHD) & Water Depth (m)

1:2500 @ A4

Viewport Results

Aerial Image from Nearmap (2021).
Cadastre sourced from SIX Maps Clip & Ship (2021).



0 20 40 60 80 100 m

1:2500 @ A4

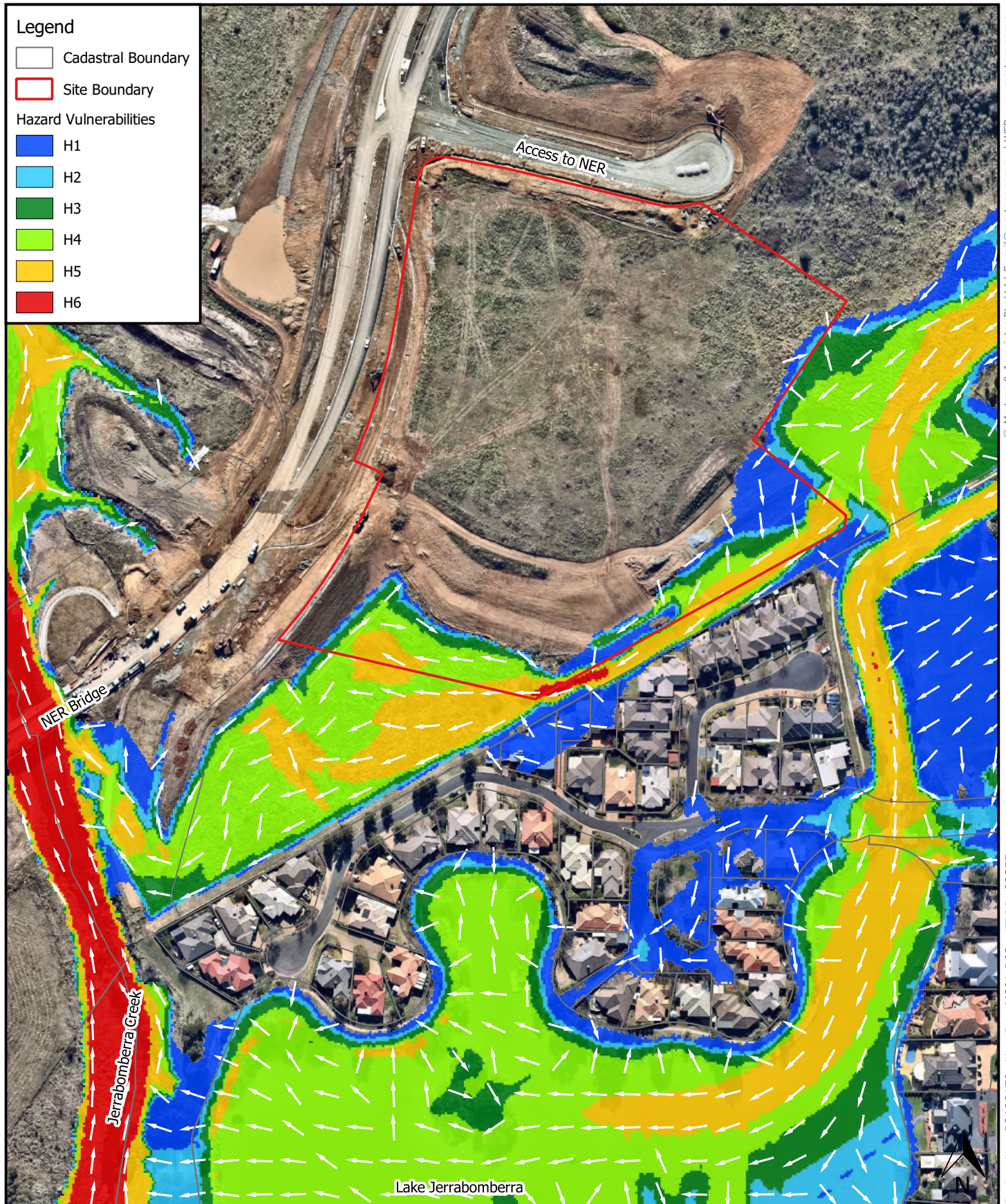
Viewport Results

Aerial Image from Nearmap (2021).
Cadastre sourced from SIX Maps Clip & Ship (2021).

1% AEP with Climate Change - Existing Conditions Water Velocity (m/s)

Map Title / Figure:

FL08	Map
Lot 1, DP1263364	Site
New High School in Jerrabomberra	Project
Flooding Assessment	Sub-Project
Department of Education	Client
22/09/2021	Date

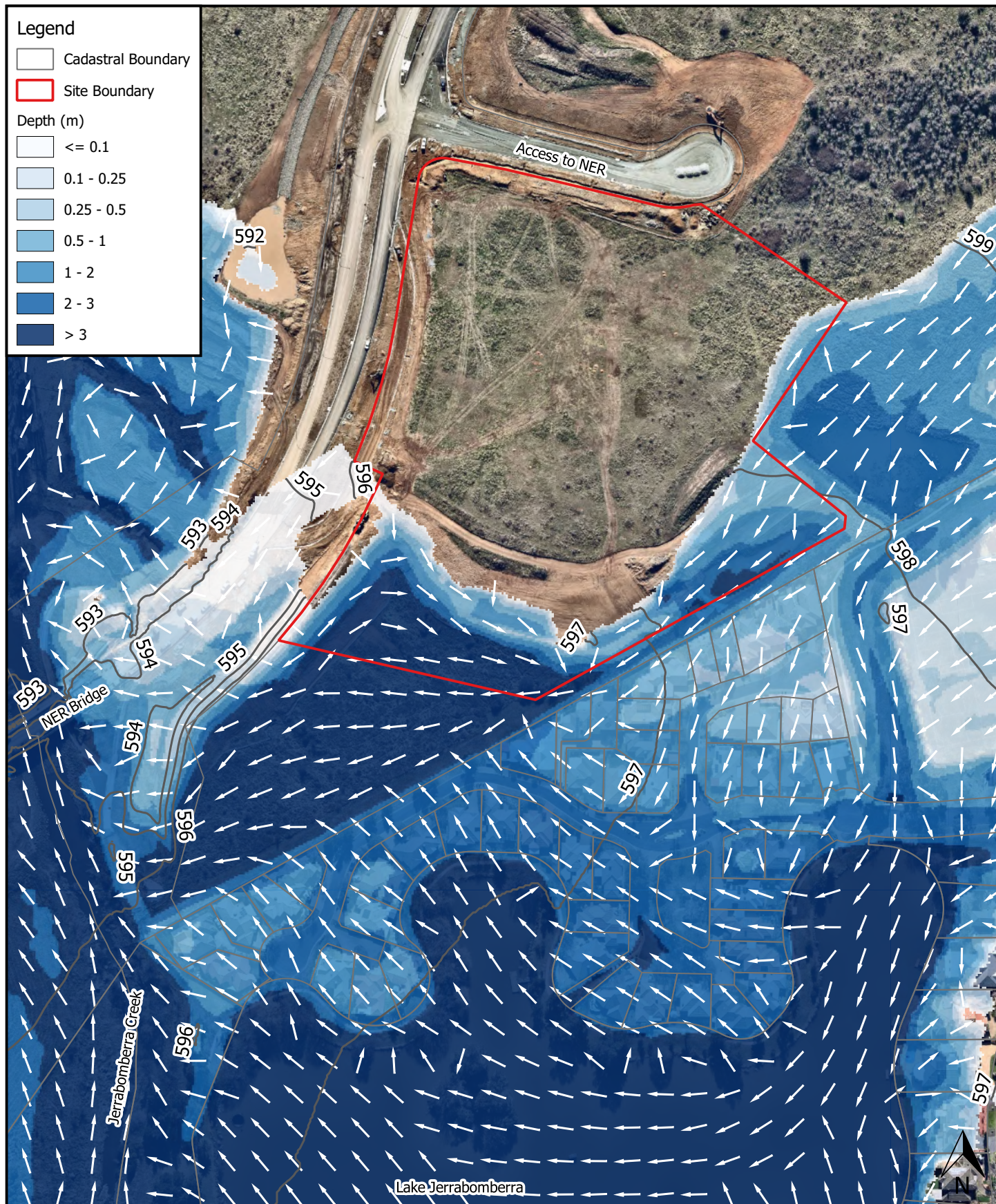


1% AEP with Climate Change - Existing Conditions Flood Hazard Vulnerabilities

1:2500 @ A4

Viewport Results

Aerial Image from Nearmap (2021).
 Cadastre sourced from SIX Maps Clip & Ship (2021).
 Flood Hazard Vulnerabilities based on ARR 2019 Combined flood hazard curves.



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Project No: P2108170 Map Set: MS01-R03 EPSG: 28355

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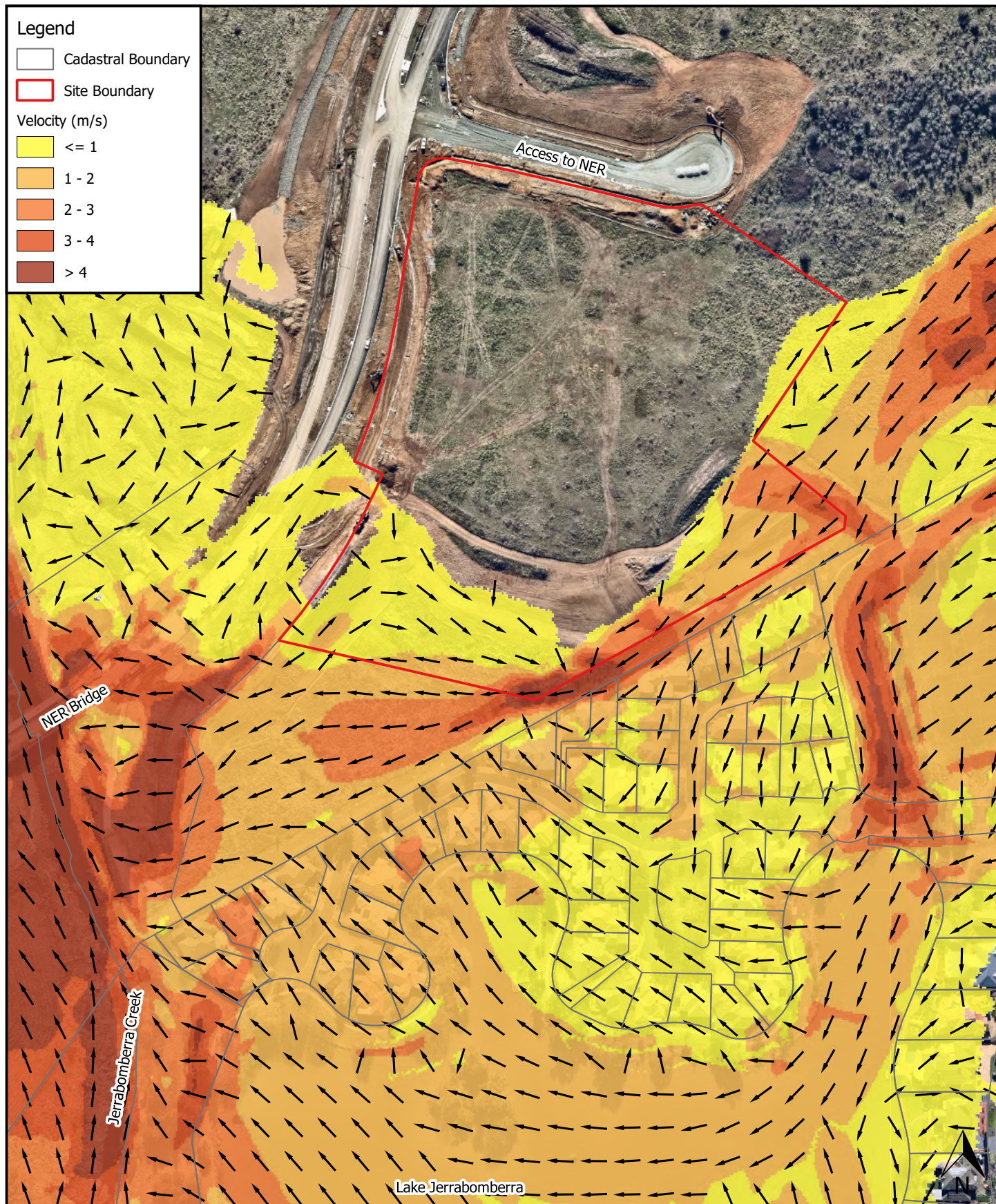
Map Title / Figure:

PMF - Existing Conditions Water Level (mAHD) & Water Depth (m)

1:2500 @ A4

Viewport Results

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Cadastre sourced from SIX Maps Clip & Ship (2021).

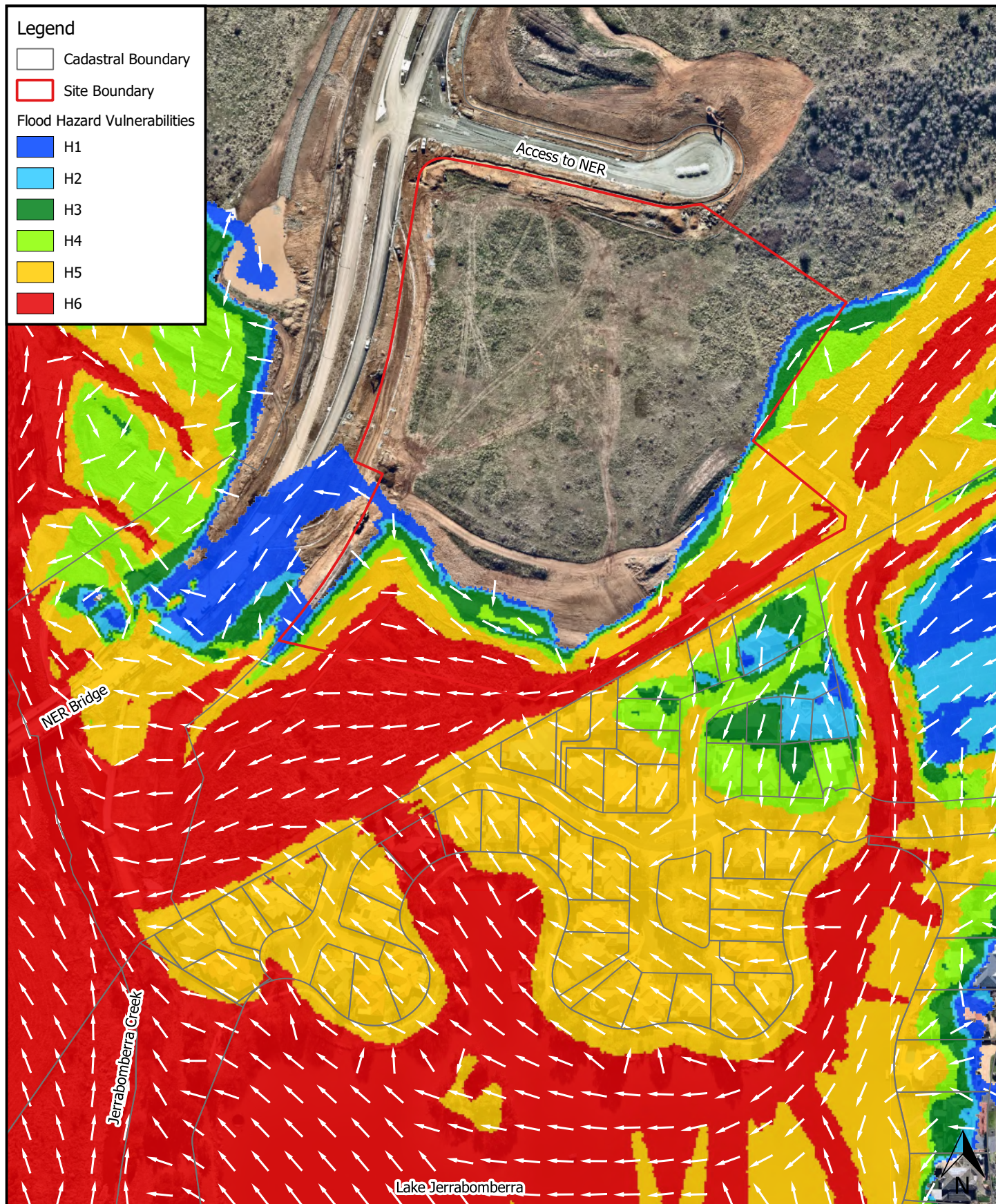


PMF - Existing Conditions Water Velocity (m/s)

1:2500 @ A4

Viewport Results

Aerial Image from Nearmap (2021).
Cadastre sourced from SIX Maps Clip & Ship (2021).

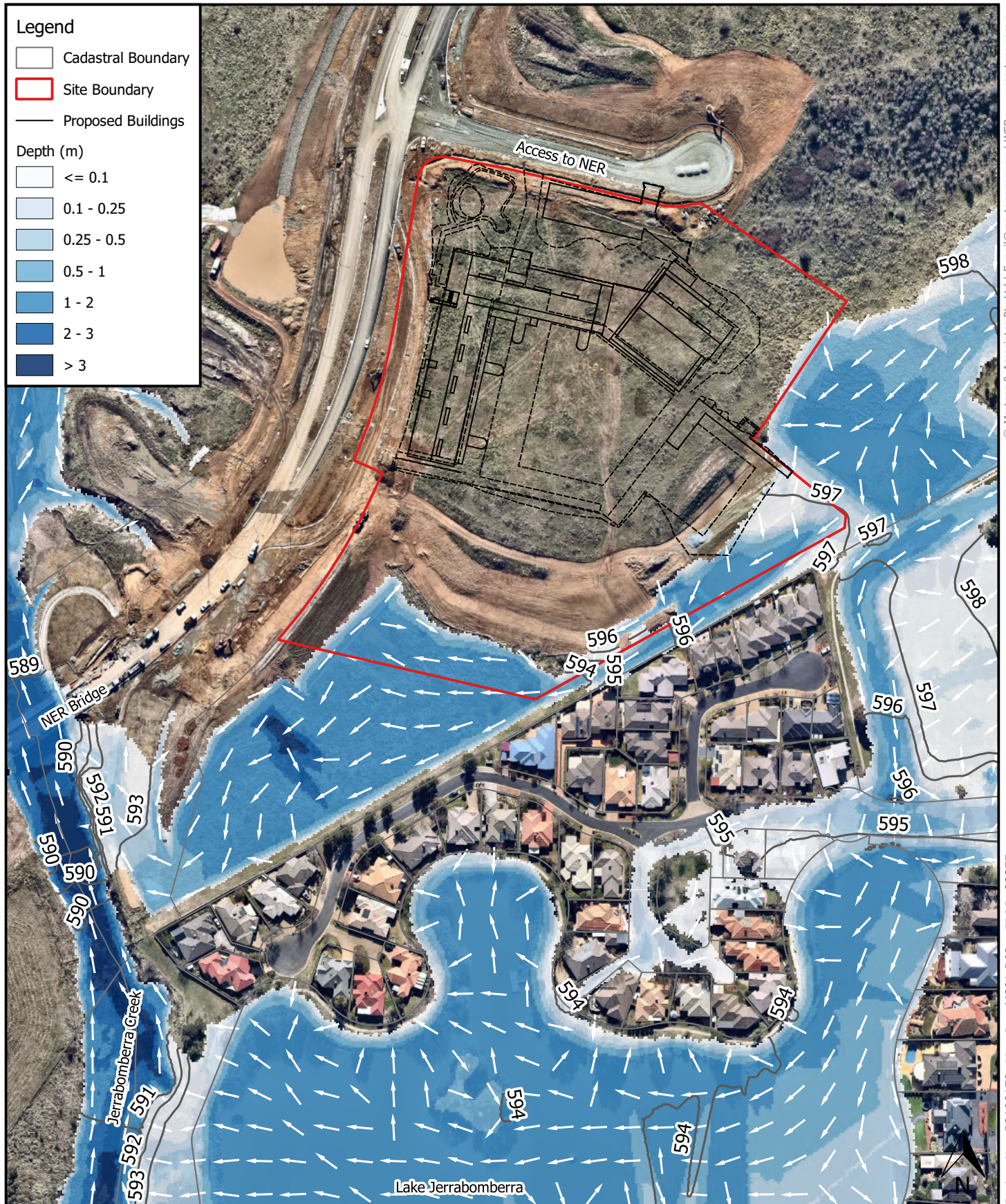


PMF - Existing Conditions Flood Hazard Vulnerabilities

1:2500 @ A4

Viewport Results

Aerial Image from Nearmap (2021).
 Cadastre sourced from SIX Maps Clip & Ship (2021).
 Flood Hazard Vulnerabilities based on ARR 2019 Combined flood hazard curves.



0 20 40 60 80 100 m

1:2500 @ A4

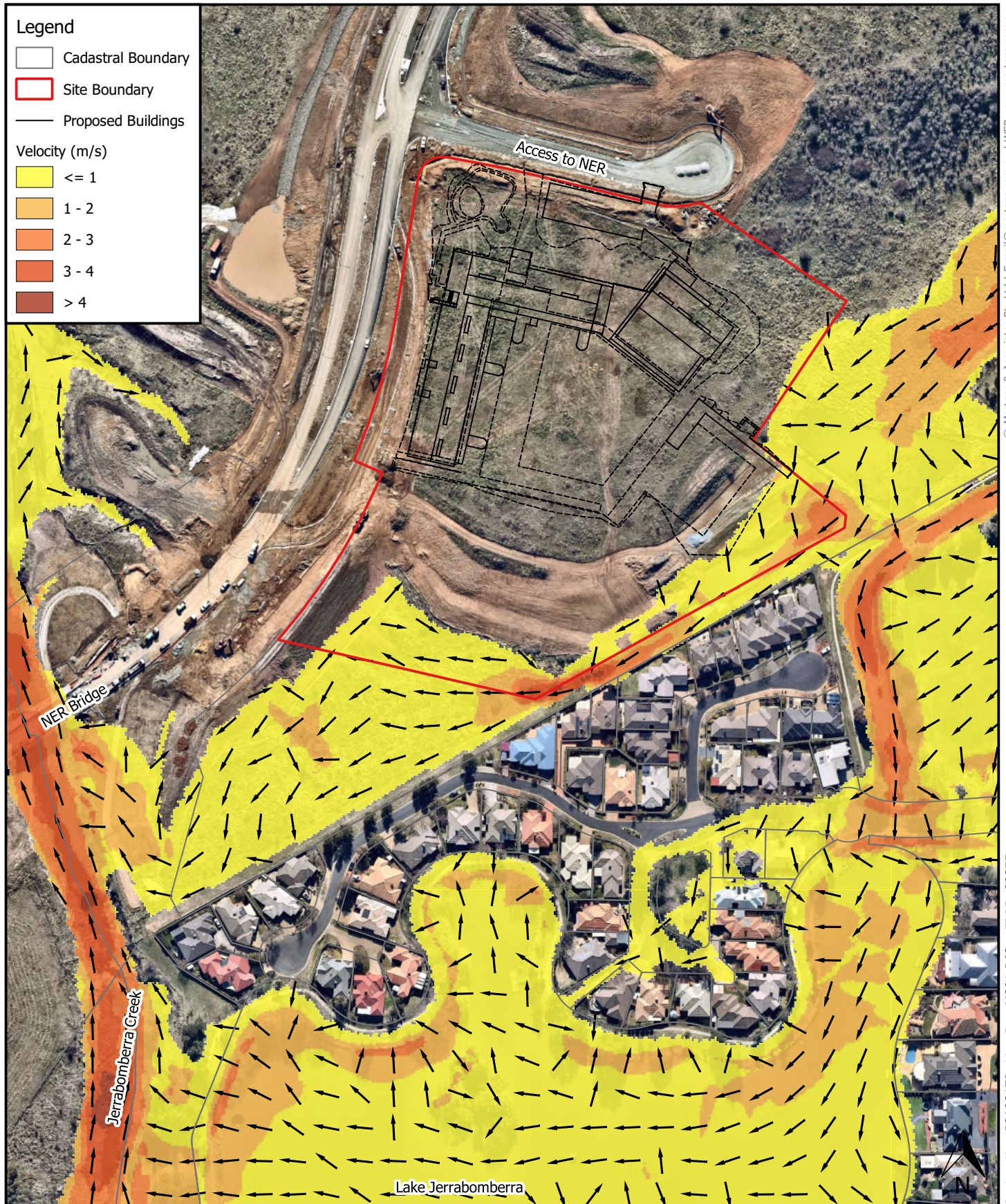
Viewport Results

Aerial Image from Nearmap (2021).
Cadastre sourced from SIX Maps Clip & Ship (2021).

1% AEP - Developed Conditions Water Level (mAHD) & Water Depth (m)

FL13
Lot 1, DP1263364
New High School in Jerrabomberra
Flooding Assessment
Department of Education
22/09/2021

Map
Site
Project
Sub-Project
Client
Date



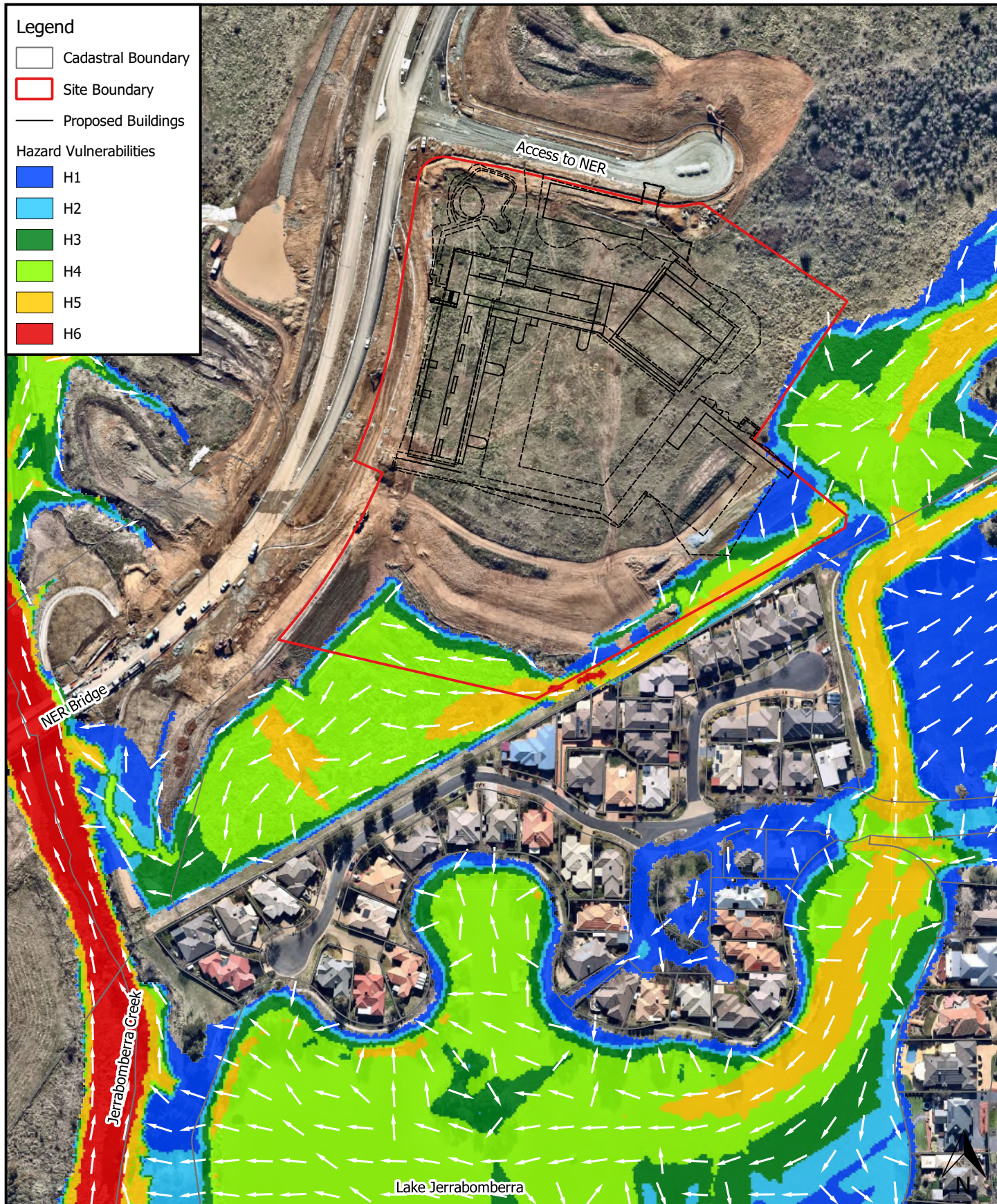
Map Title / Figure:

1% AEP - Developed Conditions Water Velocity (m/s)

1:2500 @ A4

Viewport Results

Aerial Image from Nearmap (2021).
Cadastre sourced from SIX Maps Clip & Ship (2021).



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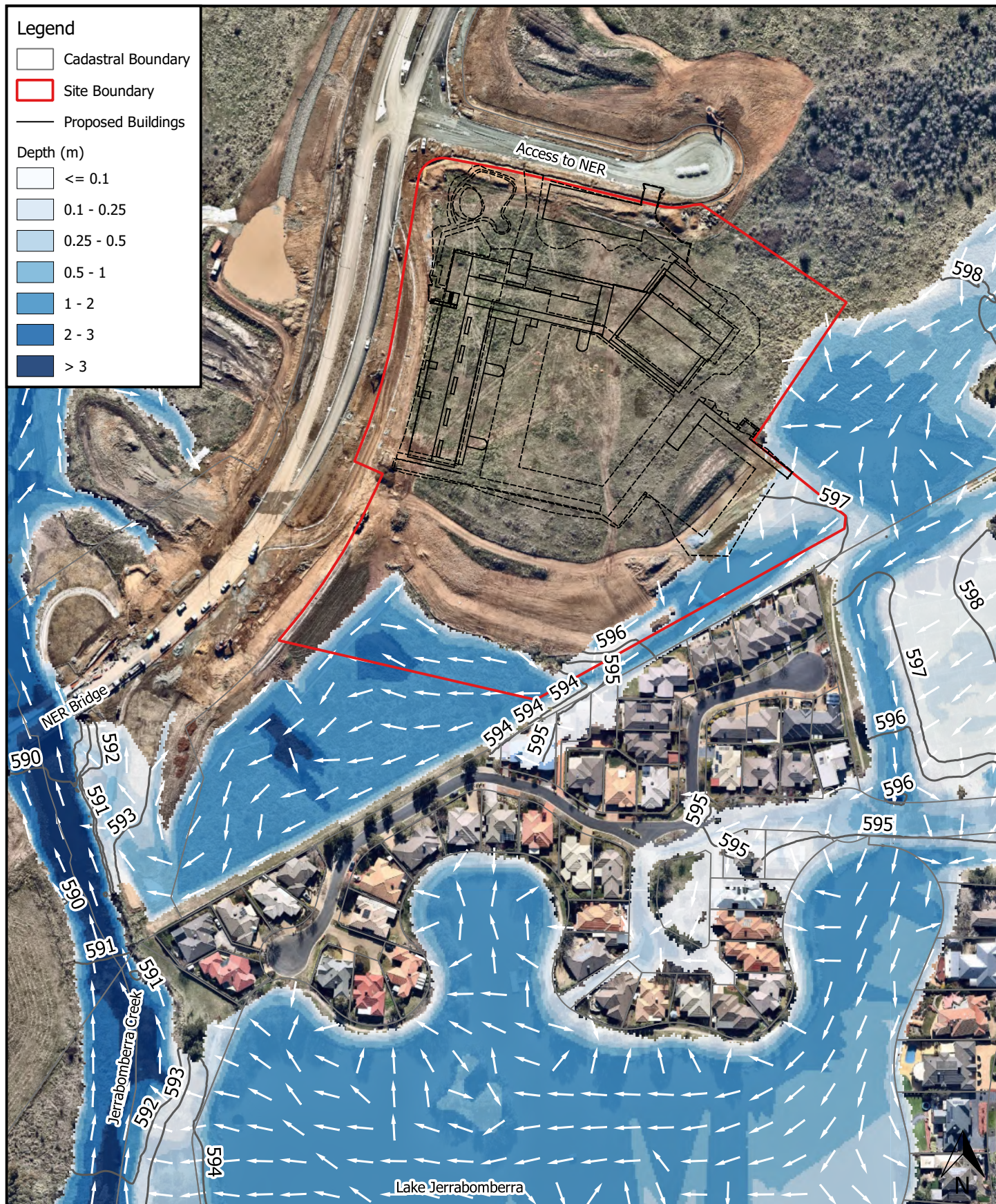
Map Title / Figure:

1% AEP - Developed Conditions Flood Hazard Vulnerabilities

1:2500 @ A4

Viewport Results

Aerial Image from Nearmap (2021).
Cadastre sourced from SIX Maps Clip & Ship (2021).
Flood Hazard Vulnerabilities based on ARR 2019 Combined flood hazard curves.



1:2500 @ A4

Viewport Results

Aerial Image from Nearmap (2021).
Cadastre sourced from SIX Maps Clip & Ship (2021).

1% AEP with Climate Change - Developed Conditions Water Level (mAHD) & Water Depth (m)

Map Title / Figure:

FL16

Lot 1, DP1263364

New High School in Jerrabomberra

Flooding Assessment

Department of Education

22/09/2021

Map

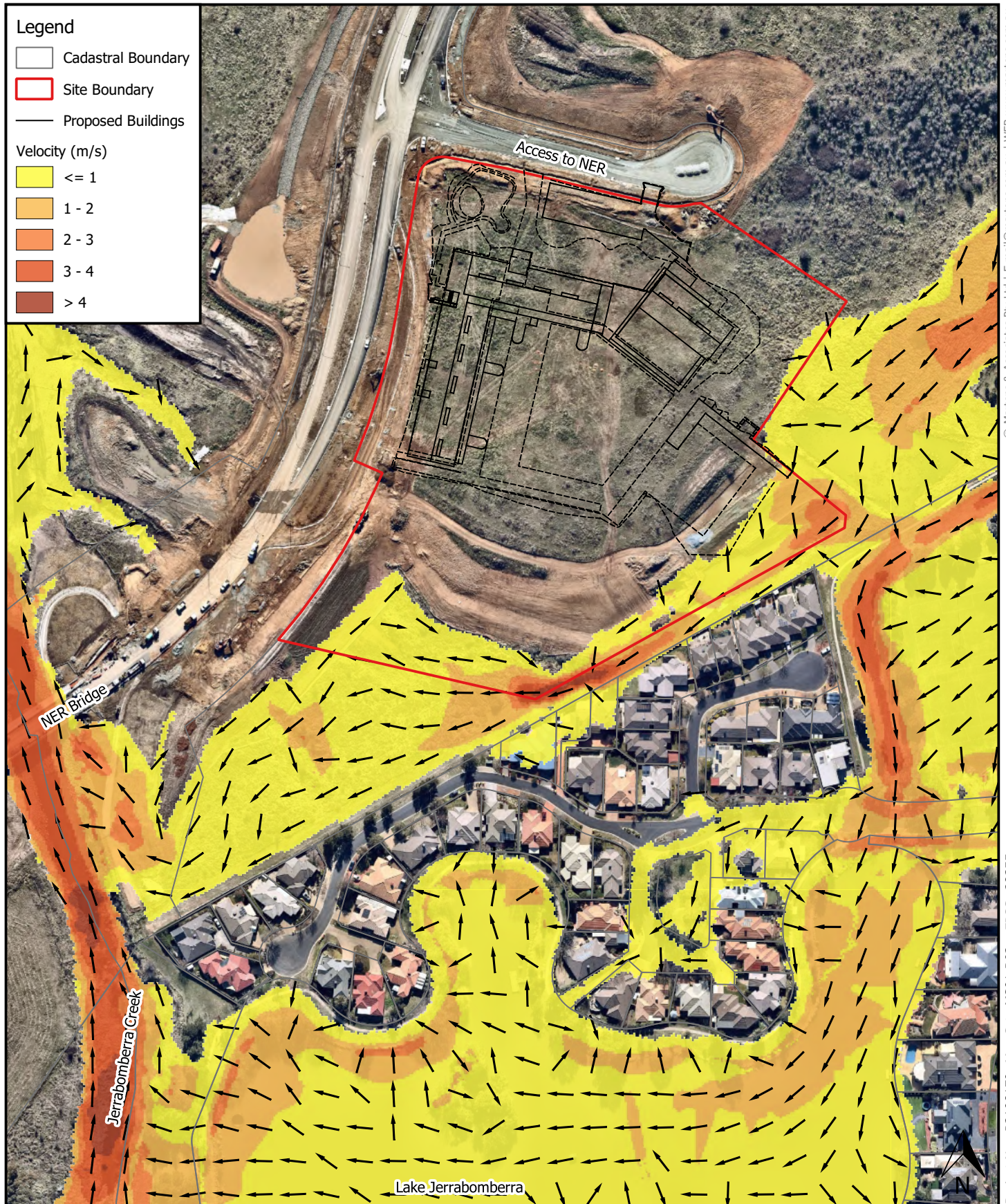
Site

Project

Sub-Project

Client

Date



0 20 40 60 80 100 m

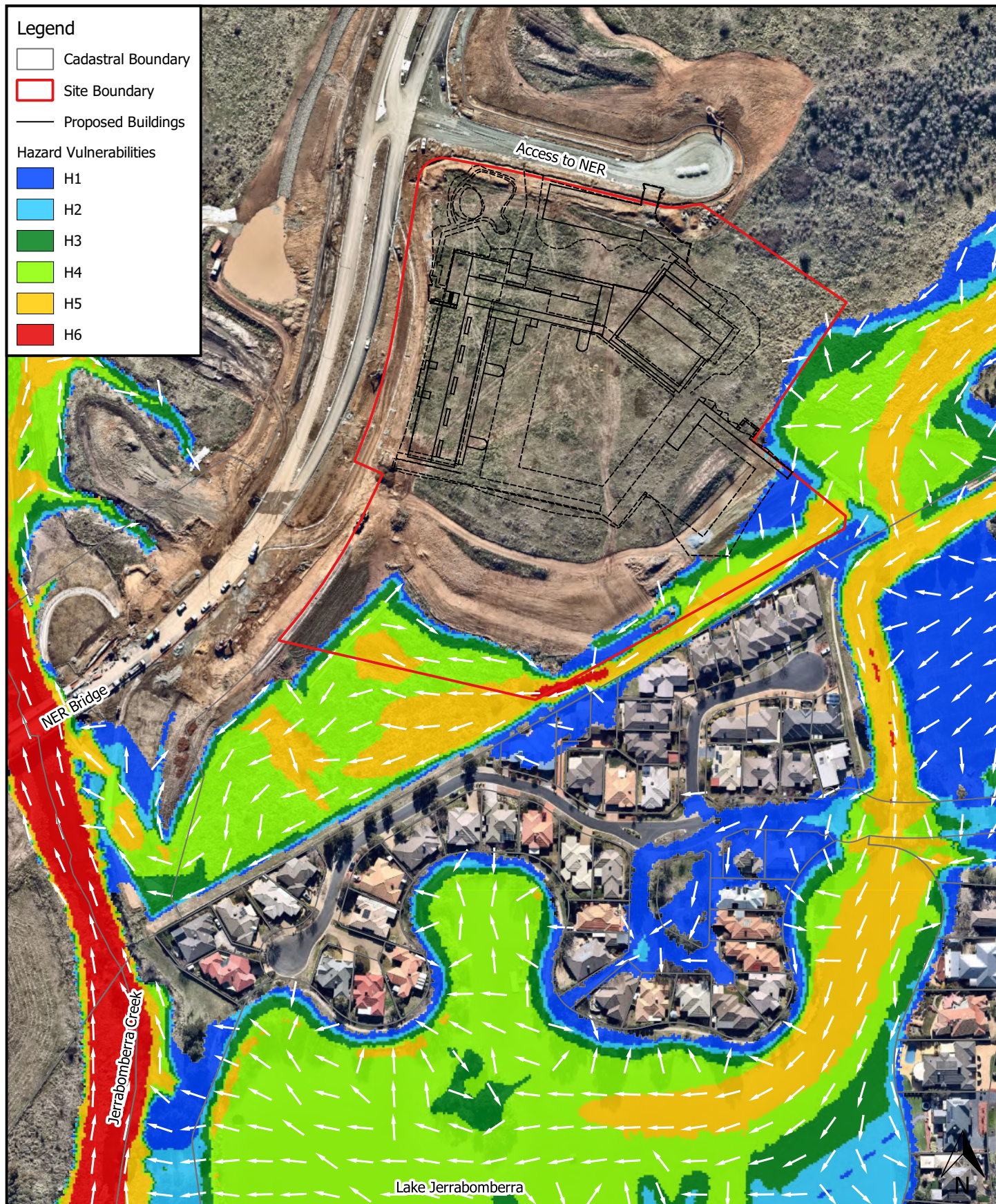
Map Title / Figure:

1% AEP with Climate Change - Developed Conditions Water Velocity (m/s)

1:2500 @ A4

Viewport Results

Aerial Image from Nearmap (2021).
Cadastre sourced from SIX Maps Clip & Ship (2021).

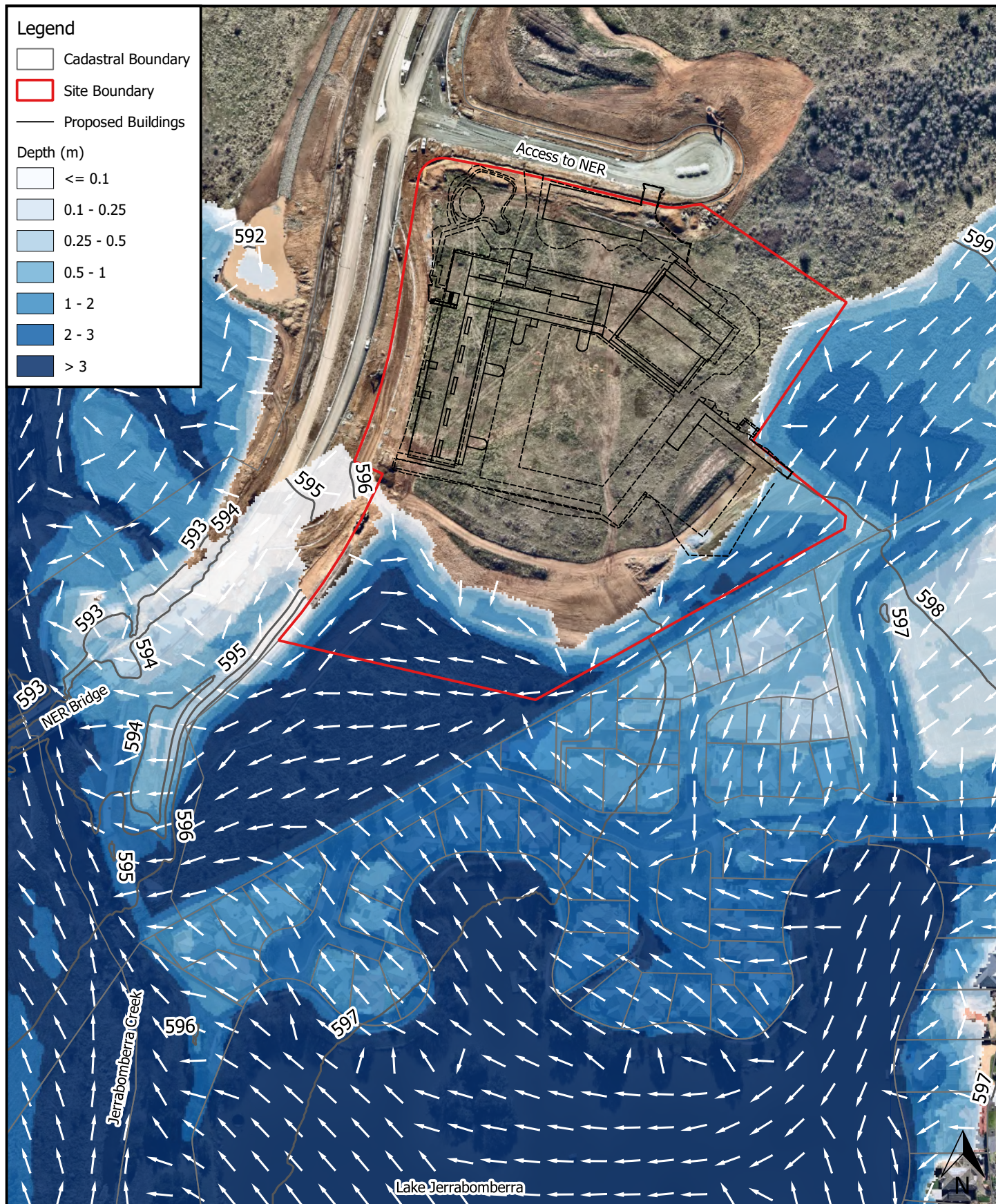


1% AEP with Climate Change - Developed Conditions Flood Hazard Vulnerabilities

1:2500 @ A4

Viewport Results

Aerial Image from Nearmap (2021).
 Cadastre sourced from SIX Maps Clip & Ship (2021).
 Flood Hazard Vulnerabilities based on ARR 2019 Combined flood hazard curves.



0 20 40 60 80 100 m

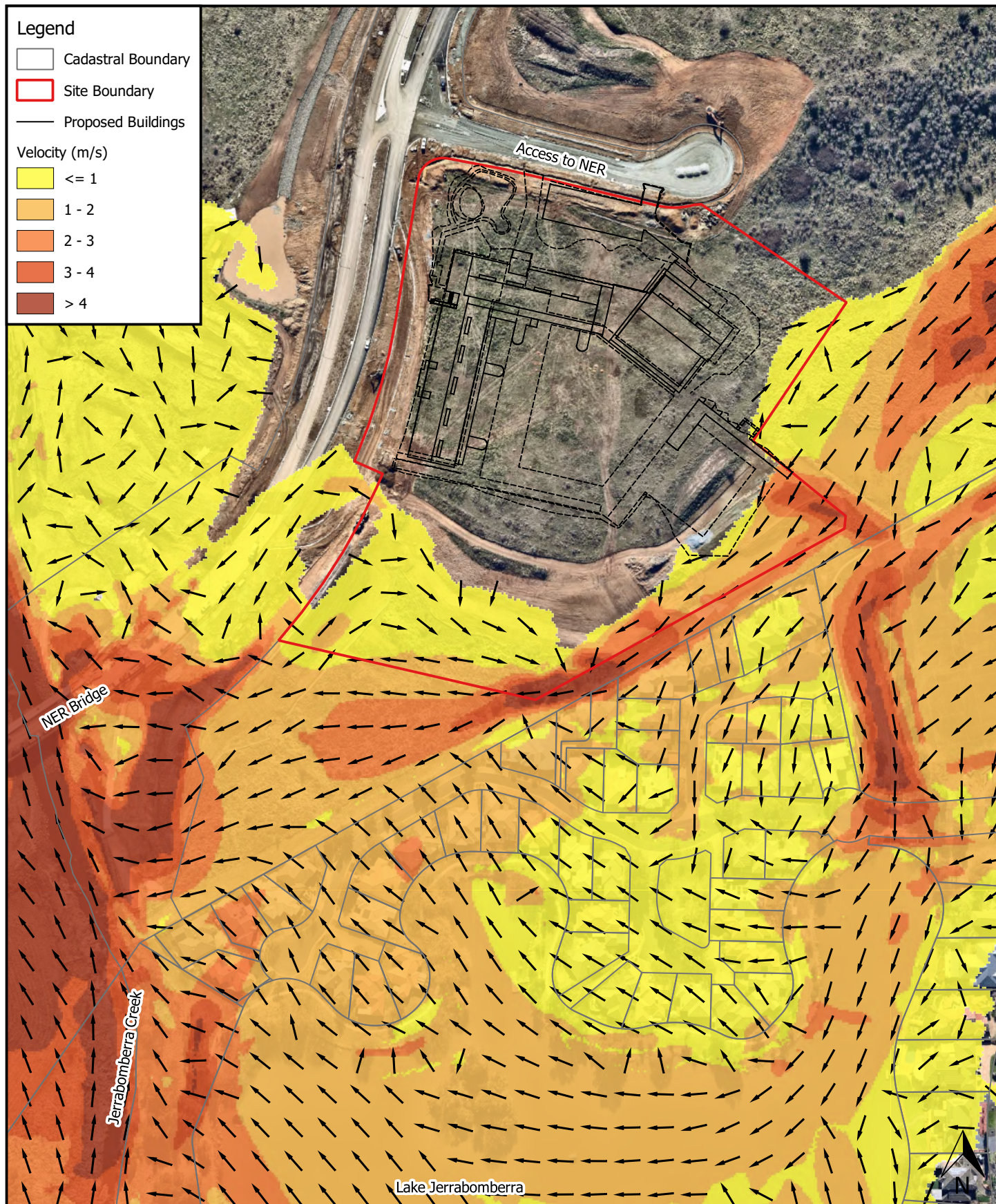
1:2500 @ A4

Viewport Results

Aerial Image from Nearmap (2021).
Cadastre sourced from SIX Maps Clip & Ship (2021).

PMF - Developed Conditions Water Level (mAHD) & Water Depth (m)

Map Title / Figure:



0 20 40 60 80 100 m

1:2500 @ A4

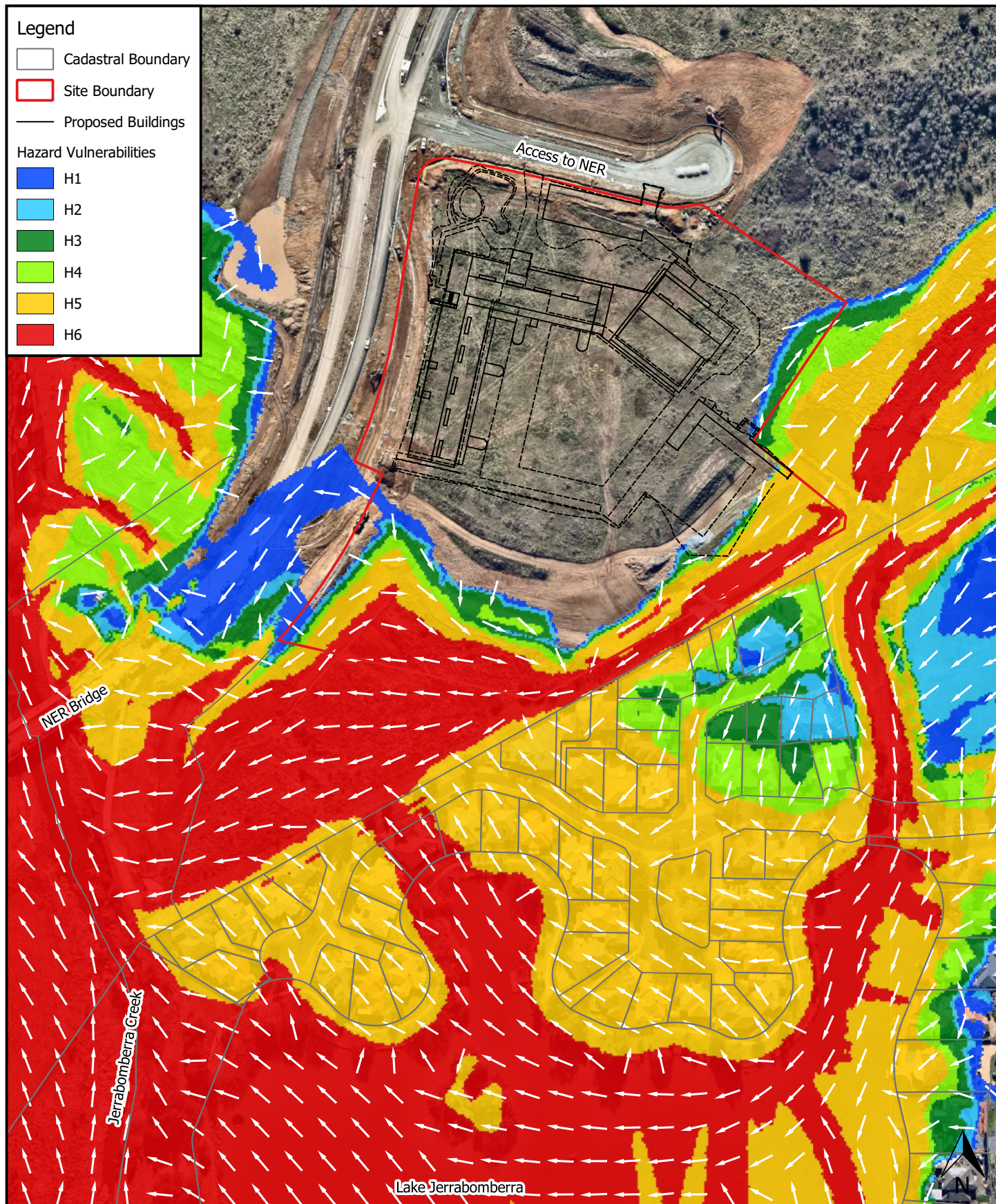
Viewport Results

Aerial Image from Nearmap (2021).
Cadastre sourced from SIX Maps Clip & Ship (2021).

PMF - Developed Conditions Water Velocity (m/s)

FL20
Lot 1, DP1263364
New High School in Jerrabomberra
Flooding Assessment
Department of Education
22/09/2021

Map
Site
Project
Sub-Project
Client
Date

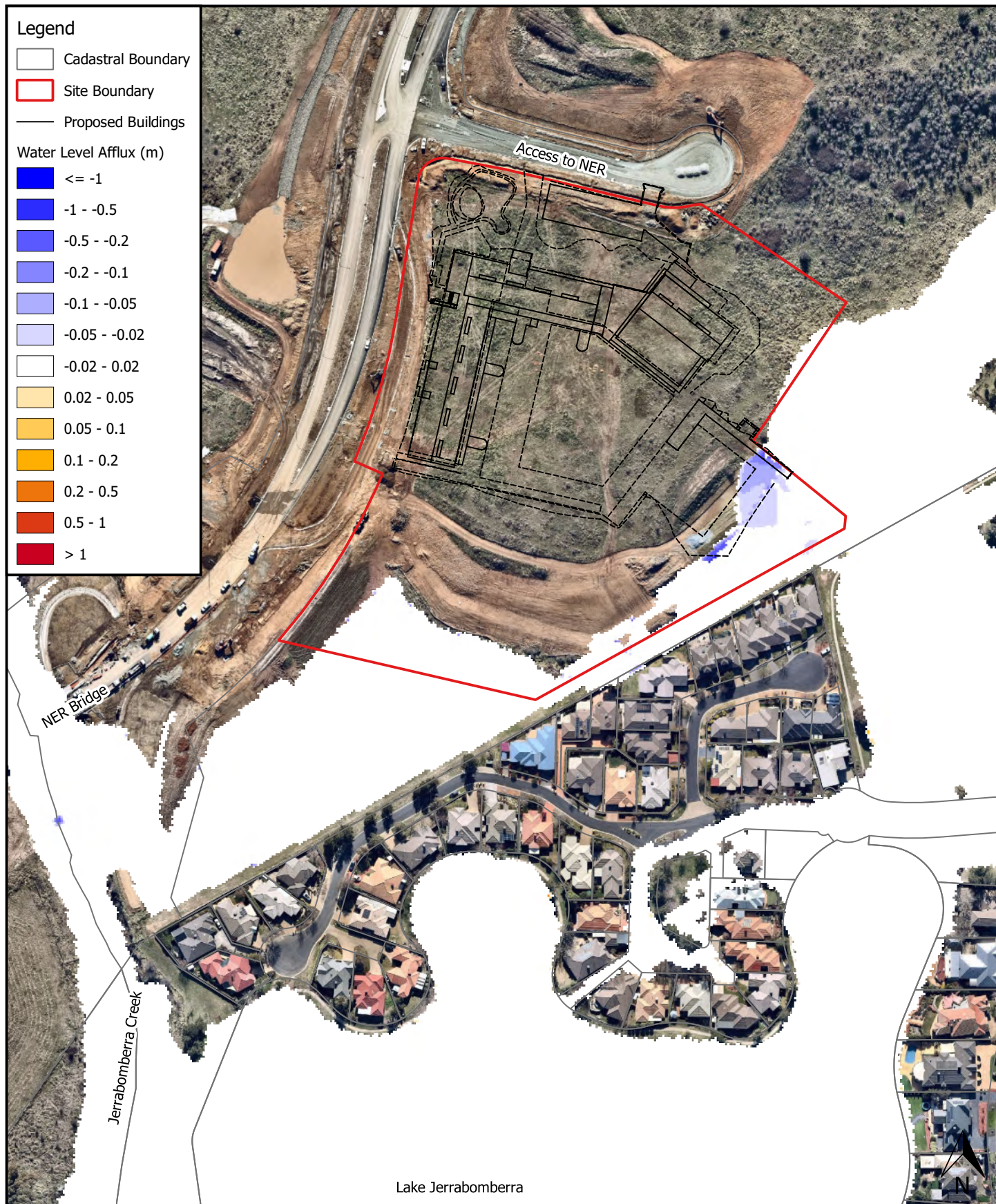


PMF - Developed Conditions Flood Hazard Vulnerabilities

1:2500 @ A4

Viewport Results

Aerial Image from Nearmap (2021).
Cadastral sourced from SIX Maps Clip & Ship (2021).
Flood Hazard Vulnerabilities based on ARR 2019 Combined flood hazard curves.



1% AEP - Developed Conditions Water Level Afflux (m)

1:2500 @ A4

Viewport Results

Aerial Image from Nearmap (2021).
 Cadastre sourced from SIX Maps Clip & Ship (2021).
 Areas coloured white represent negligible change.
 Areas coloured blue represent water level reduction.
 Areas coloured yellow / red represent water level increase.