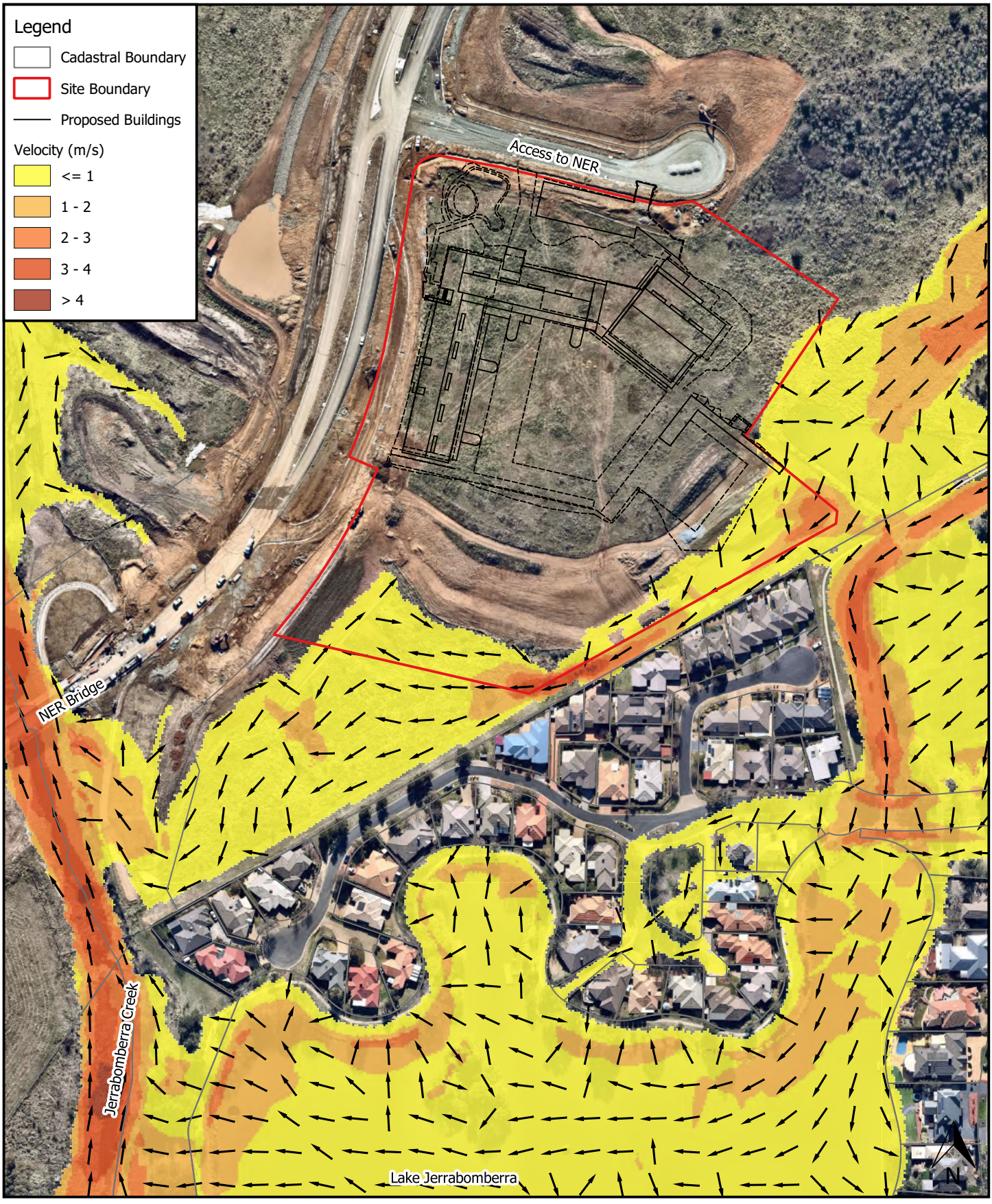

0 20 40 60 80 100 m

1:2500 @ A4

Viewport Results

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

Map Title / Figure:

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

FL14	Map
Lot 1, DP1263364	Site
New High School in Jerrabomberra	Project
Flooding Assessment	Sub-Project
Department of Education	Client
22/09/2021	Date

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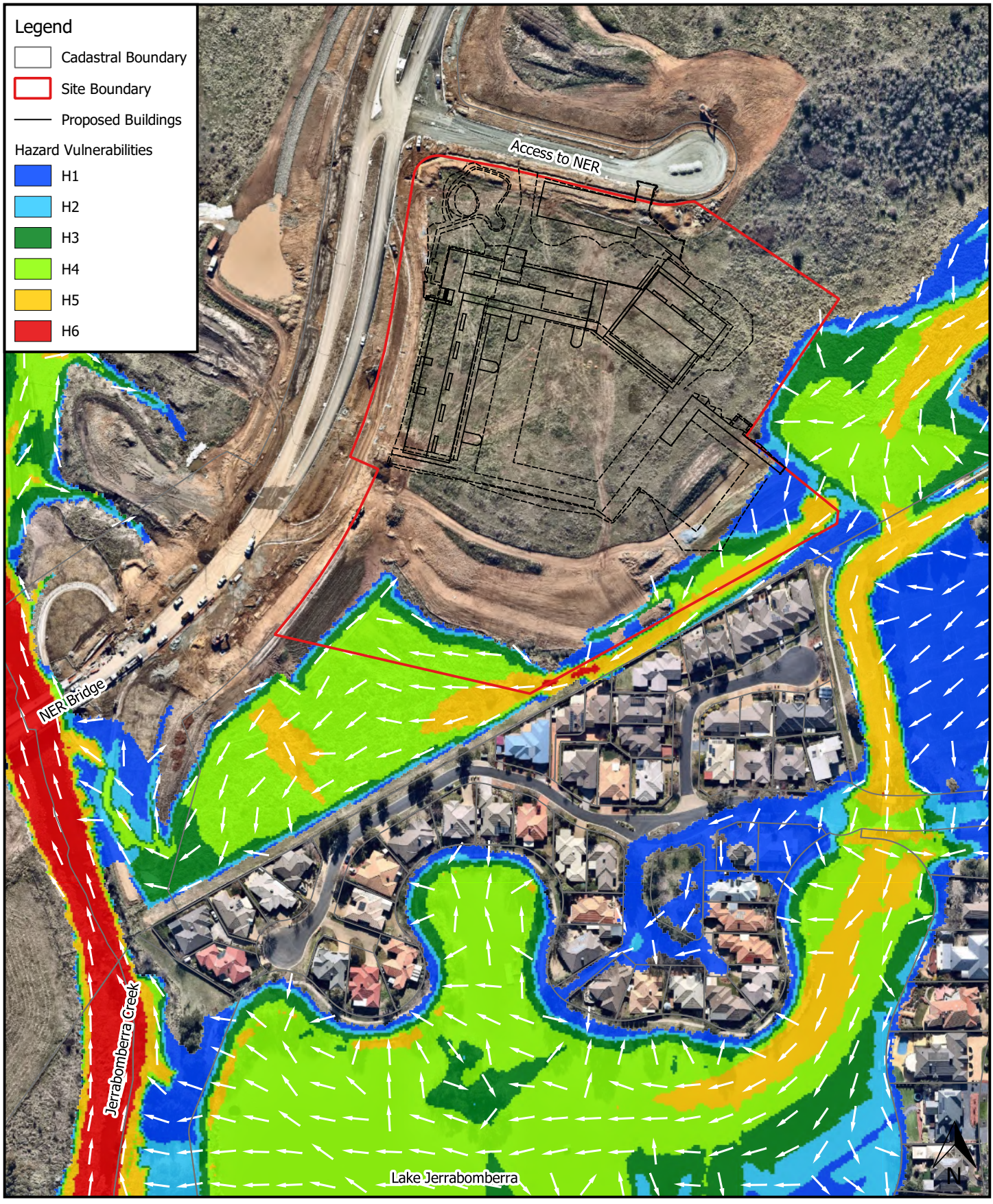
Project No: P2108170 Map Set: MS01-R03 EPSG: 28355



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).
Flood Hazard Vulnerabilities based on ARR 2019 Combined flood hazard curves.

Map Title / Figure:

1% AEP - Developed Conditions Flood Hazard Vulnerabilities

FL15	Map
Lot 1, DP1263364	Site
New High School in Jerrabomberra	Project
Flooding Assessment	Sub-Project
Department of Education	Client
22/09/2021	Date

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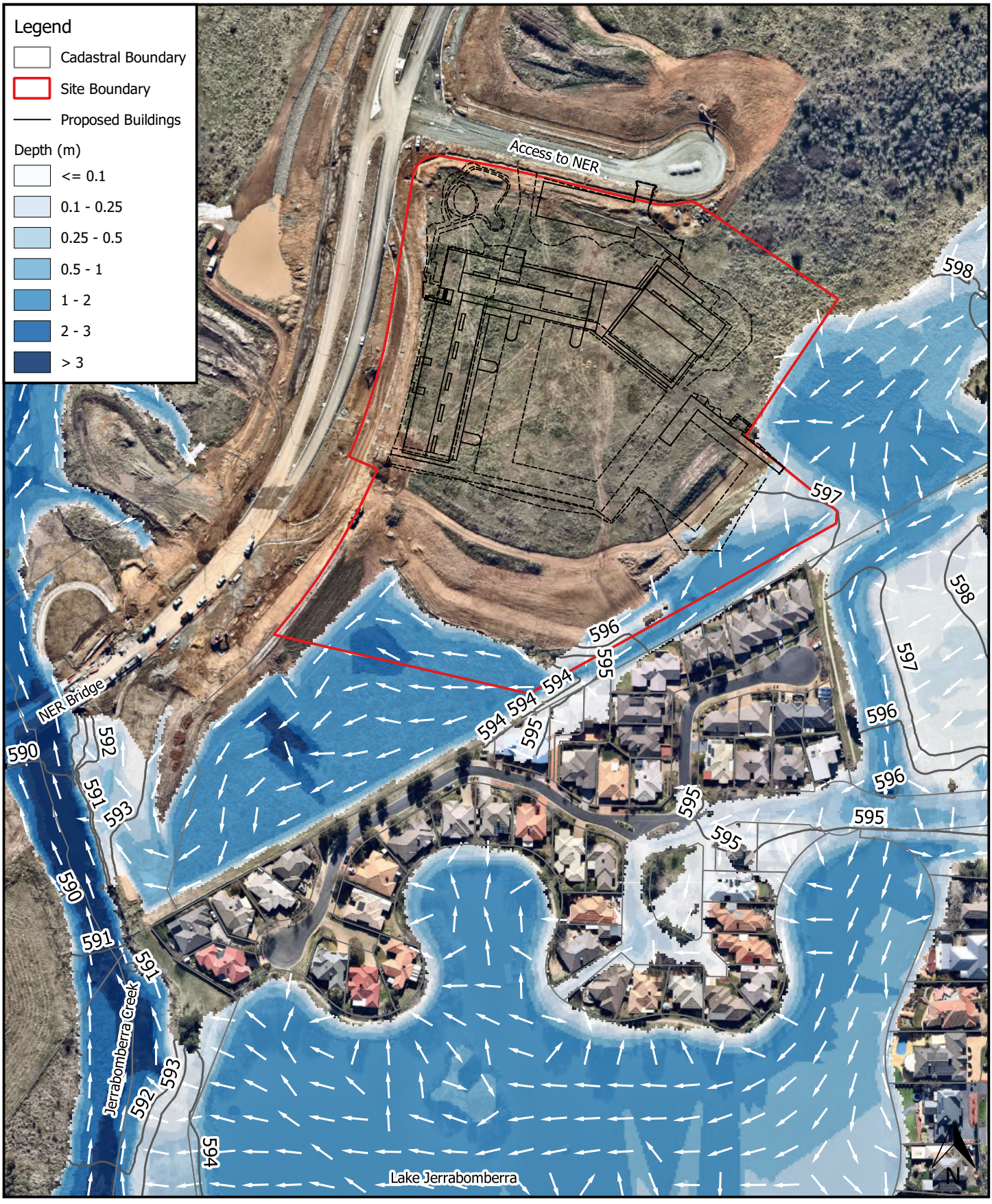
Project No: P2108170 Map Set: MS01-R03 EPSG: 28355



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Viewport Results

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

Map Title / Figure:

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

FL16	Map
Lot 1, DP1263364	Site
New High School in Jerrabomberra	Project
Flooding Assessment	Sub-Project
Department of Education	Client
22/09/2021	Date

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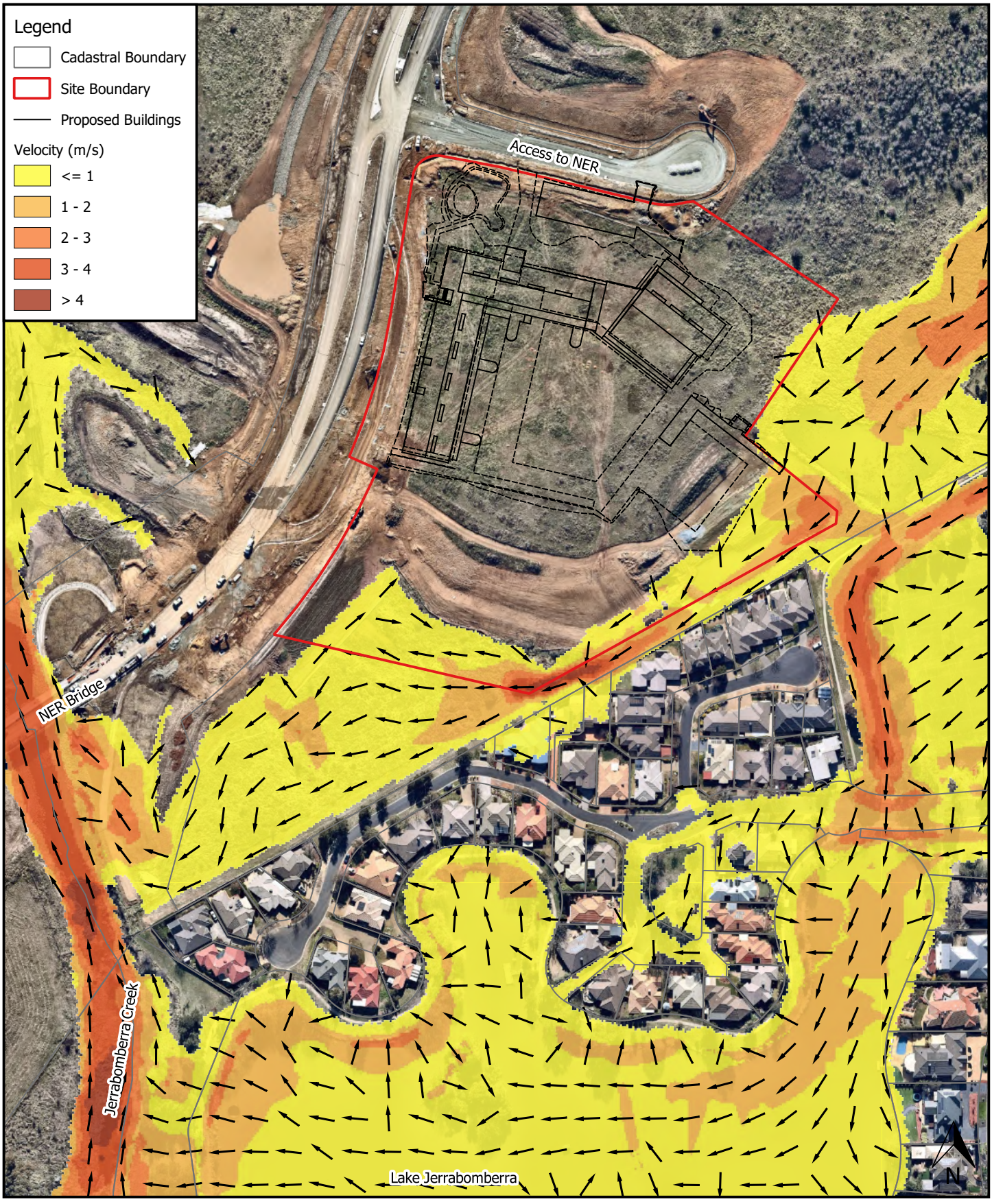
Project No: P2108170 Map Set: MS01-R03 EPSG: 28355



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Viewport Results

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

Map Title / Figure:

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

FL17	Map
Lot 1, DP1263364	Site
New High School in Jerrabomberra	Project
Flooding Assessment	Sub-Project
Department of Education	Client
22/09/2021	Date

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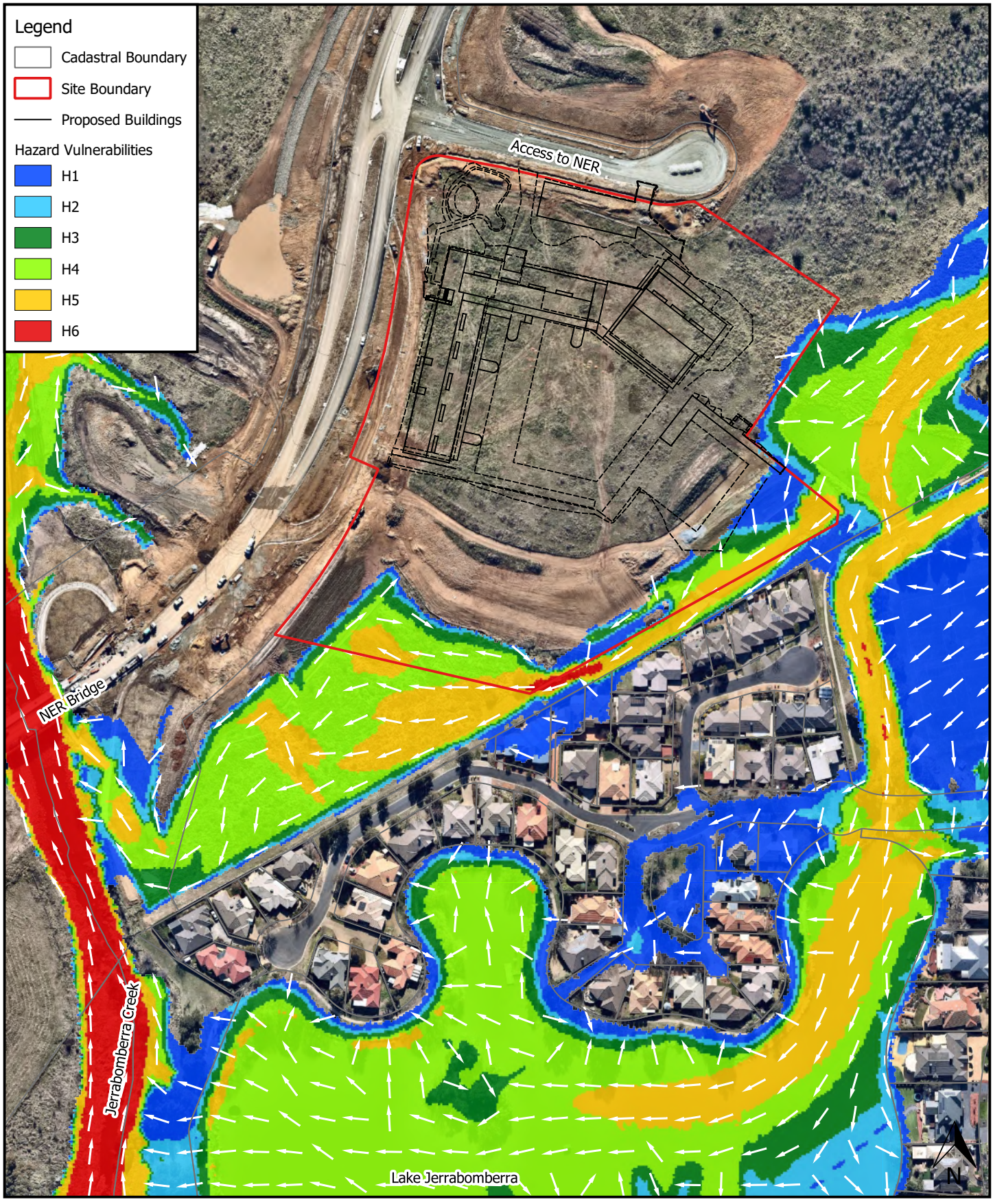
Project No: P2108170 Map Set: MS01-R03 EPSG: 28355



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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.

Map Title / Figure:

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

FL18	Map
Lot 1, DP1263364	Site
New High School in Jerrabomberra	Project
Flooding Assessment	Sub-Project
Department of Education	Client
22/09/2021	Date

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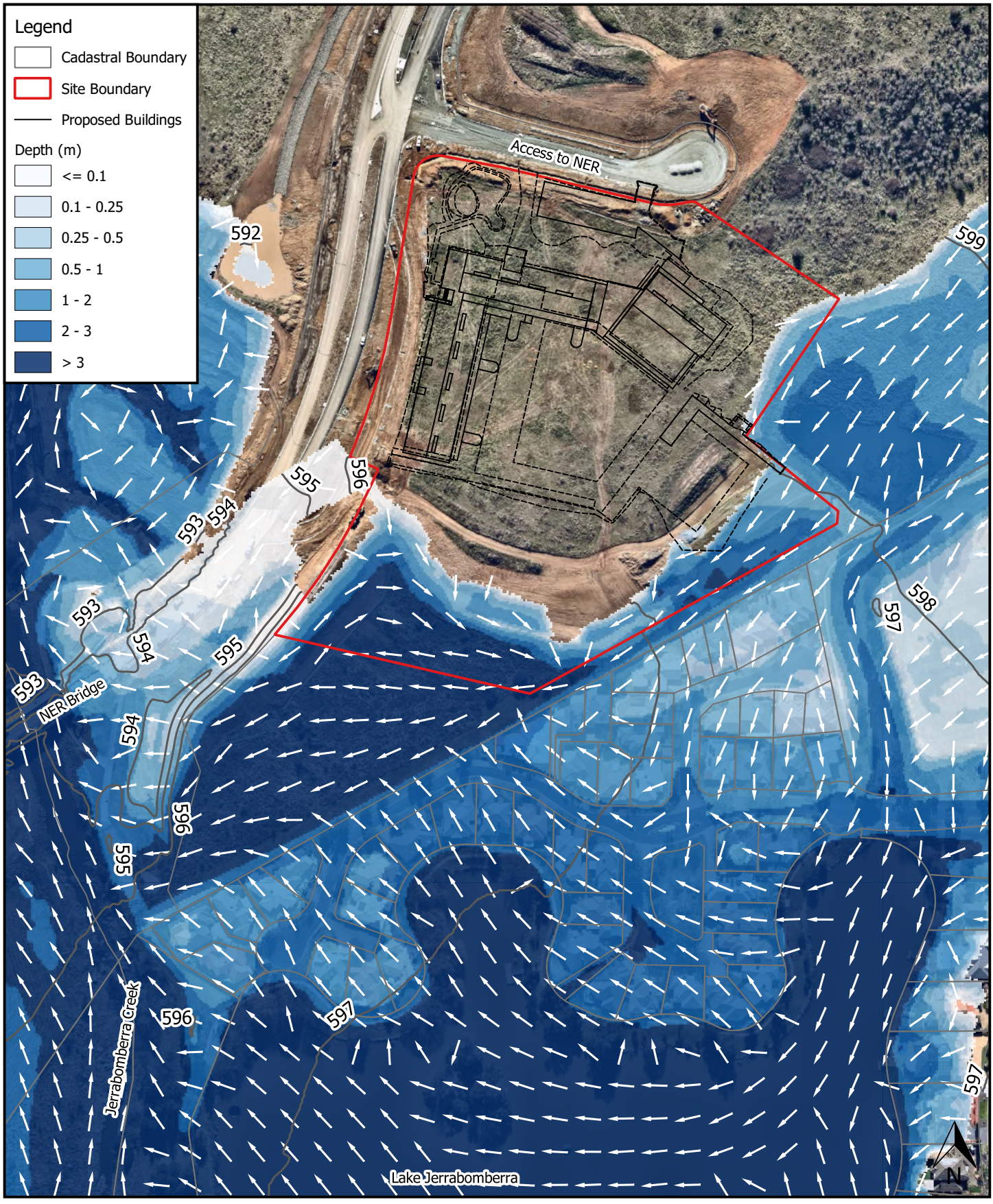
Project No: P2108170 Map Set: MS01-R03 EPSG: 28355



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Viewport Results

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

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

Map Title / Figure:

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

FL19	Map
Lot 1, DP1263364	Site
New High School in Jerrabomberra	Project
Flooding Assessment	Sub-Project
Department of Education	Client
22/09/2021	Date

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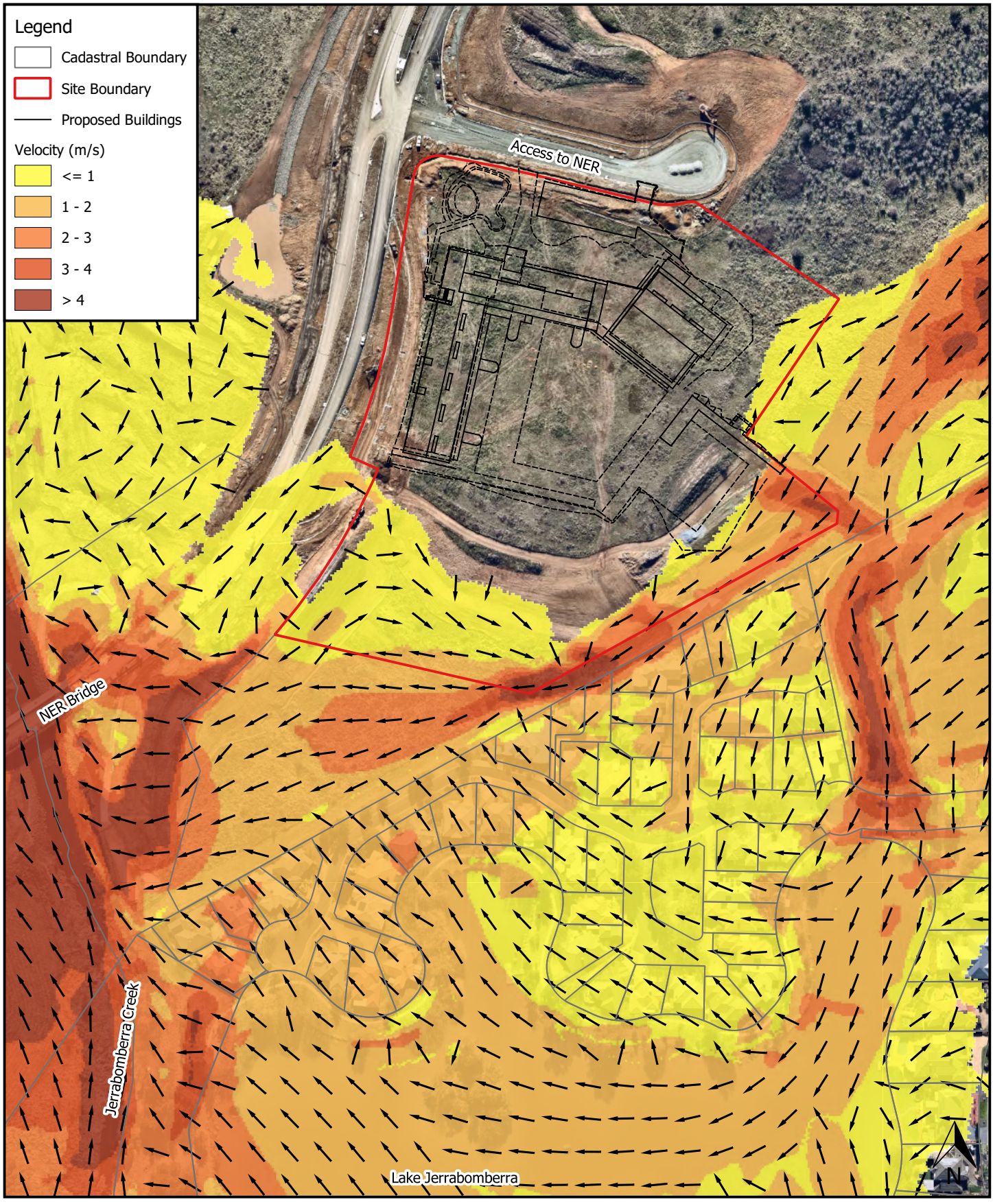

0 20 40 60 80 100 m

1:2500 @ A4

Viewport Results

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

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

Map Title / Figure:

PMF - Developed Conditions Water Velocity (m/s)

FL20	Map
Lot 1, DP1263364	Site
New High School in Jerrabomberra	Project
Flooding Assessment	Sub-Project
Department of Education	Client
22/09/2021	Date

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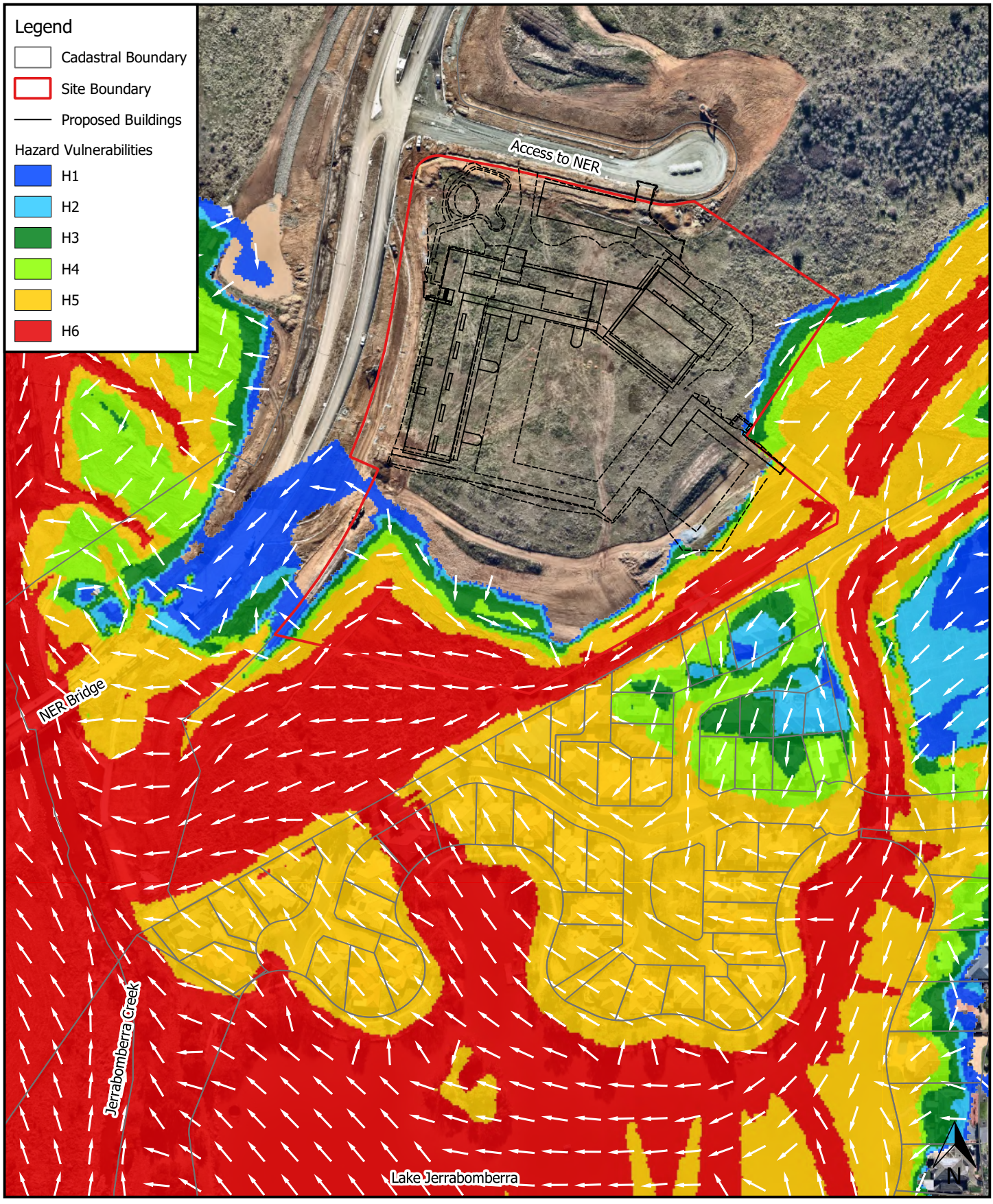

0 20 40 60 80 100 m

1:2500 @ A4

Viewport Results

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

Map Title / Figure:

PMF - Developed Conditions Flood Hazard Vulnerabilities

FL21	Map
Lot 1, DP1263364	Site
New High School in Jerrabomberra	Project
Flooding Assessment	Sub-Project
Department of Education	Client
22/09/2021	Date

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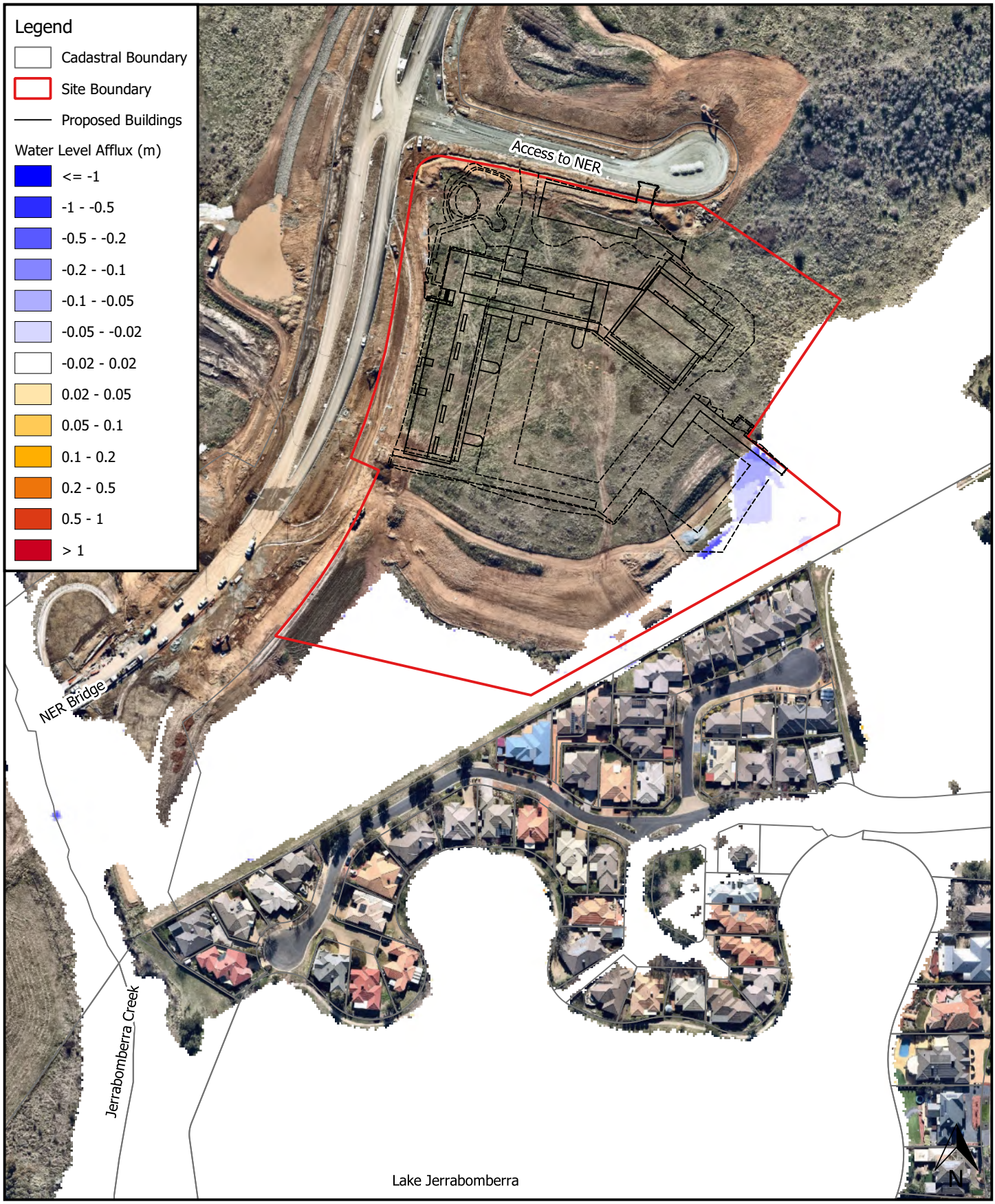
Project No: P2108170 Map Set: MS01-R03 EPSG: 28355



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

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).
Areas coloured white represent negligible change.
Areas coloured blue represent water level reduction.
Areas coloured yellow / red represent water level increase.

Map Title / Figure:

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

FL22	Map
Lot 1, DP1263364	Site
New High School in Jerrabomberra	Project
Flooding Assessment	Sub-Project
Department of Education	Client
22/09/2021	Date

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9 Attachment D: Emergency Contact List

When to call the NSW SES

NSW STATE EMERGENCY SERVICE

132 500

For emergency help in flood, storm and tsunami

IN LIFE-THREATENING EMERGENCIES

CALL TRIPLE ZERO (000)

Due to flood or storm is anyone trapped or injured?

YES → Call **Triple Zero (000)**.

NO

Has a fallen tree blocked access? (i.e. front door/driveway/road)

OR

Is a tree threatening to fall on your property or driveway?

OR

Is your property flooded or in danger of flooding?

OR

Is your roof damaged or leaking?

OR

Is there damage to your property that you cannot fix yourself?

NO

Contact your insurance company or a private contractor to assess and complete the job, or repair it yourself if safe to do so.

YES

Call the NSW SES on 132 500

Your request for assistance will be logged by our operations centre who will give you a reference number. Your request will then be forwarded onto the nearest SES unit for action.

NSW SES Volunteers undertake temporary emergency measures to make your home and the situation safe. It is important that you contact either your insurance company or a private contractor to make permanent repairs to damage resulting from a flood or storm or to remove any remaining debris.

When to call the NSW SES

NSW STATE EMERGENCY SERVICE

132 500

For emergency help in flood, storm and tsunami

IN LIFE-THREATENING EMERGENCIES

CALL TRIPLE ZERO (000)

The ***NSW SES*** experiences many calls during floods and storms.

Assisting people in our communities who are overwhelmed by damage and impacts of natural disasters as quickly as possible is important to all ***NSW SES*** volunteers.

What to do after logging a call with us:

- Make sure you keep your phone close by so we can easily contact you about your request for assistance.
- Stay away from any fallen trees and/or power lines that may have been brought down in the storm.
- Follow any safety recommendations you are given by the ***NSW SES***.
- ***NSW SES*** attends to request for assistance in a priority based order. A life threatening emergency will always be given immediate priority.
- If you no longer require emergency assistance, call us on **132 500** quoting your reference number to cancel the request. This helps free up our emergency crews if you no longer need us.

For great tips on how you can Get Ready this Storm Season, or to find out more information about the *NSW SES*, head to our website at www.ses.nsw.gov.au

NSW Emergency Contact Numbers

NORTHERN SETTLEMENT SERVICES LIMITED

Services	Disaster	Service Name	Telephone Number	Details	Social Media	App	Website
000 EMERGENCY	All Emergencies	Emergency	TRIPLE ZERO (000)	All life threatening emergencies			www.triplezero.gov.au
	All Emergencies	NSW Police Force	TRIPLE ZERO (000)	Police Assistance Line - 131 444, Crime Stoppers - 1800 333 000 **Report crimes that are not in progress**		–	www.police.nsw.gov.au
		NSW Fire & Rescue	TRIPLE ZERO (000)	Helps the community during building fires, car accidents, rescues & accidents involving hazardous material			www.fire.nsw.gov.au
		NSW Rural Fire Service - RFS	TRIPLE ZERO (000)	Info Line - 1800 679 737 Help the community during bush, grass & building fires, as well as car accidents		NSW RFS	www.rfs.nsw.gov.au
SES NSW STATE EMERGENCY SERVICE		NSW Emergency Service - SES	132 500	For general help in a flood or storm			www.ses.nsw.gov.au
TIS TRANSLATING AND INTERPRETING SERVICE	–	Translating Interpreting Service - TIS	13 14 50	If you do not speak English well, you can call TIS (not an emergency service)	–	–	www.tisnational.gov.au

Updates During and After an Emergency

	All Emergencies	Emergency NSW	–	Alerts and Updates	–	–	www.emergency.nsw.gov.au
ABC Local Radio Your Emergency Broadcaster Be prepared. Stay informed.	All Emergencies	ABC Local Radio ABC Emergency	–	Emergency Broadcasts Updates			www.abc.net.au/news/emergency/
NSW Emergency New South Wales	All Disasters	State Disaster Welfare Services	1800 018 444	Disaster Relief Grants	–	–	www.emergency.nsw.gov.au

Developed by Northern Settlement Services Ltd. Natural Disaster Awareness Program in partnership with NSW State Emergency Service and NSW Rural Fire Service. Project funded by the Commonwealth and NSW Governments under the Community Resilience Innovation Program. Resource funded by Westpac Natural Disaster Recovery Fund. **www.nsservices.com.au**

10 Attachment E: Company Profile and Engineer CVs

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capability statement

world class sustainable engineering solutions

Environment | Water | Wastewater | Geotechnics | Civil

martens consulting engineers

contents

About us

ENGINEERING SOLUTIONS

Martens & Associates are an Australian engineering consultancy wholly owned by employees specialising in the fields of environment, water, wastewater, geotechnical and civil engineering.

With 25+ years of national and international industry experience, we bring cutting edge knowledge, technology and innovative design to meet your engineering needs. Martens have undertaken more than 6000 projects involving environmental engineering design, documentation, construction, management, auditing and reporting throughout the Australia, New Zealand and South Pacific region. You can rely on our advice being:

- Practical
- Cost and budget effective
- Informed and experienced
- Industry best practice
- Committed to excellence

OUR HISTORY

The company was founded by Dr Daniel Martens and has grown rapidly into a multi-disciplinary team of highly skilled engineers, designers, scientists, hydrogeologists, technicians and support staff.

PROJECT LIFE CYCLE MANAGEMENT

Martens & Associates Pty Ltd provide comprehensive expertise for all stages of your engineering project lifecycle from concept development through to planning, detailed design, construction and operation.

WORKING WITH YOUR DEADLINES

Your design and / or construct project is just as important to us as it is to you. When you enlist our services, you are ensuring that your project is going to be well managed. We provide:

- On-time project delivery
- Strict project time lines
- Experienced staff

Sustainable Engineering Solutions

OUR GOAL

To deliver water and energy efficient engineering solutions that can be readily and cost effectively integrated into your project.

BEST PRACTICE ENVIRONMENTAL STANDARDS

Our firm specializes in delivering sustainable engineering solutions which meet and exceed best practice environmental standards. You can rely on our advice achieving:

- Re-use of resources
- Minimising of waste products
- Energy efficient designs
- Water conservation
- Recycling of waste products
- Minimising of environmental impact

CORE ENGINEERING BUSINESS AREAS

Our core business areas are:

- Environmental Engineering
- Water Engineering
- Wastewater Engineering
- Geotechnical Engineering
- Civil Engineering

SPECIALIST SERVICES

Specialist areas where sustainable solutions are offered include:

- Stormwater collection, treatment and re-use systems
- Effluent re-use and irrigation systems
- Water sensitive urban design
- Groundwater recharge applications
- Beneficial biosolids re-use and soil conditioning
- Waste minimisation programs
- Water reclamation

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Environmental Engineering

KEY AREAS

For 15 years we have provided environmental management services to private, corporate and government needs in locations throughout Australia, New Zealand and the South Pacific. Our expertise in environmental management and engineering has been widely used to assist with developments, provide site remediation and develop suitable environmental controls. These services are applied on projects as diverse as:

- Urban, commercial and industrial development
- Residential sub-divisions
- River and water-course management and engineering
- Mining and extraction industries

STAYING IN FRONT OF THE OTHERS

Our engineers and scientists place emphasis on maintaining up-to-date knowledge about current best practice, legislation, regulations and emerging issues. We add value by helping ensure that our clients meet current and emerging best practice performance criteria in the most cost-ffective manner.

CORE CAPABILITIES

Our services cover a range of environmental management and engineering disciplines, including:

- Environmental Impact Statements (EIS)
- Review of environmental factors (REF)
- Geomorphological survey
- Floodplain management plans
- River management and engineering
- Investigation of groundwater resources
- Legislation and environmental compliance
- Environmental auditing
- Water quality
- Environmental monitoring programs
- Air and noise impact assessment

"serving the environmental management needs of industry"

Water Engineering

MULTI-DISCIPLINARY SERVICES

For 15 years now, Martens & Associates Pty Ltd have provided industry with benchmarking expertise in water engineering. We offer comprehensive services for all aspects of the water cycle and scales of projects ranging from feasibility studies, through to the design and construction. Our key water engineering disciplines are:

- Water supply
- Stormwater
- Treatment
- Environment

RISK AND COST MANAGEMENT

Our experienced engineers will add value to your project by helping to manage and reduce your risk exposure whilst dealing with challenging water management issues in a cost-effective and innovative manner.

CORE CAPABILITIES

Our services cover a range of technical disciplines, including:

- Water supply, storage and resource allocation
- Stormwater engineering and urban drainage
- Flood hydrology and hydraulics
- Water quality control
- Sediment and erosion control
- Water balance
- Irrigation systems
- Coastal Processes
- Environmental monitoring
- Management

"comprehensive services for all aspects of the water cycle"

Wastewater Engineering

KEY CAPABILITIES

Martens & Associates maintain expertise in a wide array of wastewater engineering disciplines ranging from collection and treatment through to land application and beneficial re-use of treated effluent. We have undertaken more than 500 wastewater engineering projects including process design and / or construction sewage treatment plants and effluent re-use schemes. We maintain extensive in-house expertise in a wide range of traditional and innovative wastewater management practices which we readily apply to your unique project. Our wastewater engineering services cover:

- Feasibility assessment and option evaluation
- Concept designs
- Detailed designs
- Approvals
- Project management
- Construction and monitoring

TYPICAL APPLICATIONS

Martens & Associates involvement in the planning, investigation, design and construction of sewage management infrastructure has extended to many types of developments. Our services are by no means restricted to only these items, with our design engineers ready to solve new wastewater collection, transport, treatment and management problems in an innovative manner using conventional, new or hybrid technologies.

- Individual on-site systems
- Resort complexes
- Shopping centres
- Restaurants
- Hotels / motels
- Schools
- Trade waste applications
- Piggery wastes
- Landfill leachate
- Food processing
- Villages
- Contaminated stormwater

"traditional & innovative designs to achieve sustainable solutions"

Geotechincal Engineering

KEY AREAS

For over 10 years our engineers have been working with clients to help them develop creative designs and solutions to their geotechnical problems. Our geotechnical expertise is used in a wide range of markets to investigate sub-surface conditions and develop designs for site development, structures and excavations. These services are applied on projects as diverse as:

- Single story buildings to multi-story developments
- Urban developments
- Water supply and earth dams
- Excavations for buildings, pipelines and utilities
- Road, rail and urban transit systems
- Tunnels and underground storage facilities

ADDING VALUE

Our engineers and scientists provide specialist technical services directly to clients which permit efficiencies in our work and in our clients' management requirements. We add value by helping our clients manage their risk exposure, and deal with challenging issues in a cost effective and innovative manner.

CORE CAPABILITIES

Our services cover a range of technical disciplines:

- Foundation engineering
- Soil and rock mechanics
- Engineering geology
- Terrain and natural hazard evaluations
- Hydrogeology
- Contamination assessment and remediation
- Risk management
- Pavement and materials engineering
- Mining
- Geophysics
- Soft-ground engineering

"developing creative designs & solutions to geotechnical problems"

Civil Engineering

OUR EXPERIENCE

Martens & Associates have for 10 years provided successful civil engineering solutions to the full range of development types including:

- Residential housing developments
- Rural and rural-residential sub-divisions
- Agricultural infrastructure
- Commercial developments
- Industrial developments and estates

Our specific areas of expertise include:

- Road design
- Earthworks and excavations
- Pavement design
- Sub-divisions
- Carparking design and solutions
- Marinas and seawalls

PROJECT MANAGEMENT

Depending on your requirements, Martens & Associates can provide a range of project management services. Our services cover the full development cycle

- Project feasibility and options investigations
- Planning advice
- Development Application (DA) management
- Construction certificate (CC)
- Tender documentation and expressions of interest (EOI)
- Contractor engagement
- Construction management
- Auditing and compliance

"building for a better future"

Contact

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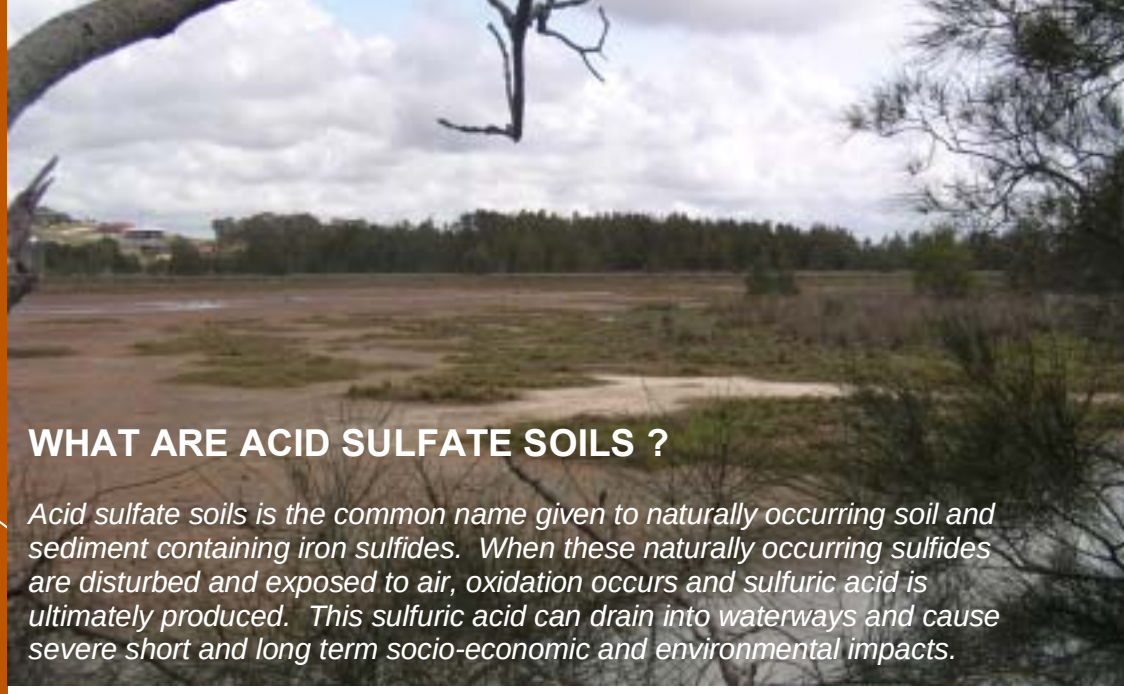
Acid Sulfate Soils

Capability Sheet CS1



WHAT ARE ACID SULFATE SOILS ?

Acid sulfate soils is the common name given to naturally occurring soil and sediment containing iron sulfides. When these naturally occurring sulfides are disturbed and exposed to air, oxidation occurs and sulfuric acid is ultimately produced. This sulfuric acid can drain into waterways and cause severe short and long term socio-economic and environmental impacts.

WHAT CAUSES ACID SULFATE SOILS ?

Many activities and industries can lead to acid drainage such as grazing, cropping, development and aquaculture. The most common activities that disturb acid sulfate soils are:

- Agricultural activities that involve land drainage
- Agricultural activities that lower groundwater (eg. cropping)
- Extractive industries and channel / floodplain mining
- Groundwater abstraction or flow modification
- Infrastructure works such as flood management
- Urban and tourism development
- Works that prevent tidal and flood inundation

The impacts of acid sulfate disturbance constitute the most acute water based environmental problem in coastal areas of Australia. The problem is comparable to the environmental impacts of salinity in inland waters. Acid drainage can cause fish kills, fish disease, oyster damage and mortality, adverse effects on aquatic ecosystems, release heavy metals from contaminated sediments, human and animal health impacts from polluted water, adverse impacts on soil structure and arability and damage to built structures such as bridges and buildings.

TECHNICAL SERVICES

Martens and Associates Pty Ltd provide comprehensive environmental and geotechnical services for investigating, controlling and managing acid sulfate soils.

- Stage 1 preliminary investigation (geomorphogical)
- Stage 2 comprehensive acid sulphate soil survey
- Acid sulphate soil management plans
- Construction management protocols
- Groundwater well (Piezometer) installation and monitoring
- Impact assessment where leaching has occurred
- Soil remediation strategies and site supervision

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Biosolids Management

Capability Sheet CS2

BIOSOLIDS RE-USE TECHNICAL SERVICES

Dewatered and stabilised sludges and other organic waste bi-products represent valuable biosolids products available to a range of re-use applications. Martens & Associates Pty Ltd have expertise in a range of biosoilds activities. We have delivered state-of-the-art solutions to biosolids management and re-use projects throughout Australia and New Zealand.

Our services include:

- Sludge processing and dewatering
- Sludge management
- Organic waste recycling
- Development applications
- Site assessment for Biosolids application
- Design of Biosolids application schemes
- Composting programs

APPLICATIONS

Biosolids are today regarded as a valuable agricultural resource. Sludge products typically contain very high organic matter levels and can be suitable, depending on stabilization grade, for a range of applications:

- Soil conditioning
- Agricultural fertilizer
- Sub-soil drainage
- Crop management

ON-GOING MONITORING OF RE-USE PROGRAMS

Biosolids re-use programs frequently involve considerable monitoring in order that any risks to public health and the environment are suitably managed and maintained within acceptable limits. The level of monitoring will depend on the type and strength of sludge applied to the soil profile.

Our monitoring services include:

- Sludge quality and compliance
- Soil condition and chemistry
- Surface water quality
- Microbiological activity
- Groundwater quality
- Air quality

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Coastal Engineering

Capability Sheet CS4

OUR EXPERIENCE

Martens & Associates have experience in a wide range of projects in coastal engineering involving open ocean, estuarine, lagoon and coastal river system environments.

We undertake investigations and provide engineering design solutions for coastal developments at varying scales ranging from 'home-owner' level including pontoons, slipways, boat sheds, jetties, retaining walls, through to larger scale investigations such as estuary management, coastal flooding and inlet management schemes.

KEY PROJECT AREAS

Key project areas include:

- Coastal erosion and hazard definition
- Environmental risk and impact assessment
- Coastal flooding and inundation modelling
- Coastal sedimentation and process investigations
- Coastal management
- Coastal geotechnical investigations
- Field investigations of tides and sediment transport
- Computer modelling

INVESTIGATION & DESIGN OF COASTAL WORKS

Martens & Associates scientists and engineers provide a range of investigation and engineering design services for the coastal environment including:

- Seawalls
- Marinas
- Revetments
- Groynes
- Breakwaters
- Training walls
- Beach nourishment
- Dune reconstruction
- Configuration dredging

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Constructed Wetands

Capability Sheet CS5

WHY CONSTRUCTED WETLANDS ?

Constructed wetlands are one of a suite of new science technologies used in Water Sensitive Urban Design (WSUD) to mitigate water flow, velocities and pollutant loads to receiving waters . Developments can utilise constructed wetlands in the water treatment train to aid in stormwater or wastewater processing and reclamation, thus protecting and enhancing water quality in downstream creeks, rivers and bays. Well maintained, aesthetically constructed wetlands provide multi-factor benefits and generate premium prices for adjacent allotments.

WHAT IS A CONSTRUCTED WETLAND ?

Constructed wetlands are either built as surface or sub-surface flow systems, depending on application and site specific needs. Surface flow wetlands are typically used for stormwater management and are generally shallow (< 2 m deep), acting as an interface between permanent water bodies and the terrestrial environment. Sub-surface flow systems, where inflows are more uniform than in surface flow systems, are frequently used for wastewater treatment, precluding access to open water and improve the quality of treatment. Wetlands are characterised by the presence of emergent macrophytes (large aquatic plants proturding above the waterline) and epiphytes (algae growing on the surface of macrophytes).

INVESTIGATION, DESIGN & CONSTRUCTION SERVICES

Martens provide comprehensive industry services including concept and detailed designs, water balance, development approvals, construction certificate plans, and construction.

- Preliminary planning and feasibility, concept design and approvals
- Multi-purpose designs -stormwater treatment, flood mitigation, WSUD, stormwater re-use
- Wastewater treatment wetlands and effluent polishing
- Detailed civil, structural and hydraulic design
- Complete construction services including site preparation, earthworks, engineering ‘fit-out’ and planting and establishment
- On-going management, environmental monitoring, weed control, watering systems, risk management and mosquito control

RECENT PROJECTS

Some recent major constructed wetlands projects that we have worked on include:

- Twin Creeks Golf Course Residential Estate, Luddenham, NSW - Investigation, design and construction documentation for 17 constructed wetlands for stormwater quality control, runoff capture and re-use, flood mitigation and irrigation water storage.
- South Bowenfels Seniors Living Estate, Lithgow, NSW - Design of stormwater treatment wetland for water quality control and integration with a range of site WSUD management practices.
- Cessnock Airport and Visitor Centre, Cessnock, NSW - Design and construction of wetland for tertiary effluent polishing of secondary effluent for irrigation reclamation.
- Buttondery Waste Depot, Wyong, NSW - Design and construction of wetland for treatment of primary wastewater prior to effluent re-use.

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Contaminated Land Studies & Remediation

Capability Sheet CS6

OVERVIEW

Contaminated lands may occur in any number of urban residential, commercial, industrial and rural environments. More commonly, it is not possible to identify the occurrence and / or extent of contamination without some evaluation of former land-use and soil / groundwater testing.

In many situations, Local Council's now require a contaminated land assessment to be provided with a development application in order that a 'clean bill of health' can be provided for the development site. In situations where a site is contaminated, the contaminated land assessment provides the applicant with an indication of the likely costs and measures required for remediation.

OUR EXPERIENCE

For some 10 years, our environmental engineers have conducted contaminated land assessments for a range of developments and project scales. Martens & Associates have provided land contamination investigations and remediation advice for all stages of development and are frequently called upon to provide expert witness evidence on matters relating to soil sampling, analysis, contamination levels and site remediation.

WORKING ENVIRONMENTS

Martens & Associates scientists and engineers have undertaken works in a wide range of environments:

- Residential lands
- Commercial and industrial estates
- Rural and agricultural industries

KEY PROJECT TYPES

Key project areas include:

- Site history and risk evaluations
- Preliminary site assessments (Stage 1 investigations)
- Detailed site assessments (Stage 2 investigations)
- Preparation of site remediation plans
- Remediation plan implementation and site works
- Monitoring and environmental reporting
- Review and auditing of other investigations
- Monitoring bore-fields and groundwater sampling

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Effluent Re-use Schemes

Capability Sheet CS7

'WASTE' WATER OR A VALUABLE RESOURCE ?

In the past decade, environmental planning and management at local, state and national government levels has shifted towards the recognition that wastewater in a treated form presents a valuable resource not a costly waste. In particular, effluent or 'reclaimed water' re-use schemes provide a means of beneficially re-using wastewater for a range of commercial uses.

OUR EXPERIENCE

Martens & Associates Pty Ltd have 15 years experience with the siting, design, installation, operation and management of numerous effluent re-use schemes throughout Australia. Our team of environmental engineers will ensure that practical, cost effective, low impact and sustainable solutions to your project are delivered.

RE-USE APPLICATIONS

Our firm is actively involved in the concept design, documentation, development and implementation of re-use schemes for a wide range of applications including for example:

- Agricultural re-use such as vineyards, turf farms and pasture
- Golf course irrigation
- Groundwater injection
- Industrial re-use opportunities
- Landfill irrigation and injection
- Non-potable residential re-use ie. third pipe solutions
- Stream flow rehabilitation

TECHNICAL DESIGN SERVICES

In all of the activity types, our engineering services encompass the full suite of technical design services including:

- Site soil and geotechnical assessment
- Land capability assessment for re-use scheme
- Approvals and licensing
- Financial modelling
- Water budgeting and water balance modelling
- Nutrient and contaminant accumulation, transport & impact modelling
- Irrigation scheme design, construction and management
- Reclaimed water detention facilities
- Land application schemes
- Crop selection and crop management
- Salinity modelling, monitoring and control

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Flood Studies

Capability Sheet CS9

Martens provides expertise in numerical flood modelling, conceptualising physical processes and communicating the outcomes of detailed flooding analyses to a range of audiences. We are accustomed to working with problems that require integrated solutions satisfying the requirements of clients, environment and the community and are dedicated to ensuring that the outcomes of all investigations are practical and sustainable.

CAPABILITIES

Martens engineers have extensive experience in urban and river hydrodynamics, estuaries, water resource management, geomorphology and community consultation. Our flood management plans are aimed at containing existing and future flood risk in both urban and rural environments and can include a detailed analysis of current flooding conditions, economic and social impacts, and recommended mitigation measures to reduce flood risk. Key services that we provide in relation to flood assessments include:

- Catchment management studies
- Dam failure impact assessment
- Flood impact assessment and development feasibility
- Flood mitigation option investigations
- Flood warning systems
- Floodplain risk management studies – damage and safety analysis
- Historical flood analysis and stream gauging
- Hydrographic survey
- Sizing major hydraulic structures such as bridges and culverts
- Stormwater analysis for urban infrastructure
- Urban and rural catchment flood investigations

MODELLING TOOLS

Martens maintain a range of sophisticated numerical modelling tools that allow for detailed investigation, prediction and representation of flood behaviour:

- Hydraulic modelling software eg. HEC RAS
- Catchment hydrologic modelling eg. DRAINS, RAFTS
- Geographical Information Systems (GIS) for regional mapping
- CAD – various packages such as AutoCAD and TurboCAD

RECENT PROJECTS

Some of our recent investigations include:

- South Creek and Cosgroves Creek – Inundation risk assessment– rural-residential sub-division and 18 hole golf course
- Kemps Creek – Undertake mapping floodplain risk categories
- Narrabeen Lagoon – Quantification of flow velocity hazard and detailed tributary flow assessment
- Brunswick River – 100 year and PMF flood modelling for village of Main Arm
- Stony Creek – Inundation risk assessment for 282 ha 152 lot rural-residential land release

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Groundwater / Hydrogeology

Capability Sheet CS10

OVERVIEW

The terrestrial water cycle is closely linked to groundwater and in many areas of Australia, groundwater forms a fundamental water resource for agriculture, sensitive ecosystems, potable water supply and environmental amenity.

Hydrogeology represents the discipline of understanding groundwater dynamics. Martens & Associates have 10 years experience with a wide range of hydrogeological investigations including resource assessment, resource maintenance, water quality assessment, impact assessment and groundwater modelling. Martens maintain all the necessary in-house geotechnical skills to undertake the complete range of hydrogeological investigations.

RESOURCE INVESTIGATION

We provide the full range of resource investigation services including initial resource feasibility assessment through to on-going resource monitoring and maintenance. Typical investigations that we undertake include:

- Groundwater contamination assessment
- Long-term instrumented monitoring bores (level and quality)
- Single and multi-bore (ie. bore-field) pump tests
- Water quality (short and long term monitoring)
- Yield determination and recharge assessment

IMPACT ASSESSMENT

In many areas of Australia, groundwater is under varying degrees of threat or risk. Risks come about by way of resource depletion or water quality impacts and may be the result of industry, agriculture, extraction and land-use change.

Martens & Associates have undertaken groundwater impact assessments for a range of development types including:

- Dip sites
- Industrial parks
- Intensive agricultural activities
- Landfill sites
- Mining and groundwater dewatering
- Petrol stations
- Sewage treatment and re-use facilities
- Stormwater recharge systems

GROUNDWATER MODELLING

Martens & Associates are capable of undertaking a full range of groundwater modelling investigations. These are often required where environmental impact and potential fate of contaminants need to be investigated

- Flow nets
- 1D, 2D and 3D modelling
- Pollutant plume analysis
- Risk analysis and assessment

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On-site Wastewater Management

Capability Sheet CS11

OVERVIEW OF ON-SITE WASTEWATER MANAGEMENT

For the past 15 years, Martens & Associates Pty Ltd have provided comprehensive national and international investigation, design and construction services in the field of on-site wastewater management (OSWM).

Martens are familiar with relevant management issues, understand current best practice and can provide innovative technological solutions to OSWM. Our in-depth knowledge of OSWM means that we will provide your project with the most efficient and cost effective treatment and disposal / beneficial re-use solution.

MANAGEMENT CAPABILITIES

We have extensive expertise in on-site domestic wastewater management:

- Site assessment for single allotments
- Sub-division planning
- Land capability mapping
- Minimum sustainable allotment size
- Re-use of resources
- Monitoring and evaluation
- Site feasibility assessment
- Geotechnical inspection
- Treatment and disposal options studies
- Impact assessment
- Common effluent schemes

Treatment Options

- Septic tanks
- Anaerobic reactors
- Aerobic sand filtration
- Recirculating filtration
- Aerated treatment plants
- Composting toilets
- Constructed wetlands
- Grey-water treatment
- Communal systems

Disposal / Re-use Options

- Absorption trenches
- Surface irrigation
- Sub-surface irrigation
- Evapotranspiration beds
- Mound application
- Groundwater recharge
- Stream flow rehabilitation

TREATMENT AND RE-USE OPTIONS

Domestic wastewater commonly contains elevated concentrations of nutrients, organic matter and pathogens, particularly bacteria. Martens & Associates can provide extensive investigation, design and construction services for the full range of on-site sewage treatment options.

Following treatment, many options are available for effluent disposal or beneficial re-use. These depend on site and legislative constraints. Martens & Associates provide comprehensive investigation, design and installation services for most effluent disposal and re-use systems.

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River Management

Capability Sheet CS13

Martens & Associates Pty Ltd are recognised as national river management experts. Our in-house river engineers, geomorphologists and environmental scientist have provided specialist services to government bodies, and other consulting firms on all aspects of watercourse management.

CAPABILITIES

Our capabilities cover a broad range of river management aspects including river protection, impact assessment, modification, characterisation and remediation. Specific areas of expertise where we have provided services in the past 15 years include the following:

- Bed and bank stabilisation and rehabilitation
- Bedload characterisation and load assessment
- Channel change and risk assessment
- Historical aerial photograph interpretation (API)
- Hydraulic geometry and flood behaviour
- Impact assessment and mitigation
- Riparian management plans
- River health assessment and stream classification
- River regulation and flow regime analysis
- River restoration and remediation strategies
- Watercourse crossing risk assessment and designs

PROJECTS ACROSS THE COUNTRY

Some recent major river projects that we have worked on:

- Gwydir River, Moree -
  Assessment of the impacts of river regulation on bank stability and channel migration and bed sedimentation.
- Clarence River, NSW North Coast -
  Documentation of historical channel changes in response to anthropogenically induced catchment changes.
- Hawkesbury-Nepean River System, NSW -
  Review of the Hawkesbury-Nepean River basin geomorphology, channel changes, geological controls and bio-geomorphology.
- Shannon Creek, Grafton -
  Impact assessment and channel protection strategy downstream of the Grafton – Coffs Harbour water supply reservoir
- South Creek, Sydney -
  Right bank tributary realignment and channel reconstruction to modified hydraulic regime.

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Sediment & Erosion Control

Capability Sheet CS15

WHAT IS THE ISSUE ?

Sediment control practices are used on building sites to prevent sand, soil and other building materials from reaching waterways. Even small amounts of site pollution can cause significant environmental damage by killing aquatic life, silting up streams and blocking stormwater pipes. Sediment control or soil and water management plans are typically submitted to Council for approval prior to work commencing. These address the location, design, scheduling and maintenance of sediment control measures and details of site rehabilitation.

THE NEED

The need for and design of sediment control structures is influenced by a range of factors including:

- Catchment characteristics
- Climate and season when works are undertaken
- Extent, nature and duration of soil disturbance
- Size and location of the site
- Slope and runoff characteristics
- Soil type and potential for erosion

CONTROL STRUCTURES

Martens provides strategic advice, detailed design and documentation, and implementation services for a range of control structures such as:

- Diversion drainage and kerbside drain protection
- Revegetation and rehabilitation
- Sediment detention basins and stockpile management
- Sediment filter fences and vegetated buffers
- Stabilisation drains and banks
- Stabilised site access and washdown bays

MARTENS SERVICES

Martens provides comprehensive services in relation to site soil and water management so that erosion and sedimentation are controlled to relevant local, state and national standards. Our services include:

- Design of structures and detailed documentation
- Preparation of erosion and sediment control plans
- Preparation of soil and water management plans
- Site inspections and geotechnical investigations
- Soil survey and testing

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Sewage Treatment Plants

Capability Sheet CS16

THE CONCEPT

Through our use of in-house designs and engineering skills, the best available treatment technologies are combined to produce a highly efficient sewage treatment system built to suit the full range of field applications. Treated effluent from our sewage treatment plants can be readily used for water recycling projects in any areas where treated sewage waters are required or can be re-used.

THE PROCESS

Martens design flexibility allows natural processes to be specifically tailored to the clients requirements of space, water quality and budget. We utilise a variety of processes to optimise each installation:

- Inlet screens and structures
- Anaerobic sludge lagoons
- Outlet structures
- PS Primary Sedimentation
- ATF Aerobic Trickling Filtration
- CFAS Continuous Flow Activated Sludge
- IDEA Intermittent Decant Extended Aeration
- IDEAL Intermittent Decant Extended Aeration Lagoon
- TTS Tertiary Treatment Systems
- MF Micro and Membrane Filtration

TREATMENT SOLUTIONS

Martens sewage treatment plant solutions have been installed in many development situations.

- Airports
- Camping grounds & caravan parks
- Commercial developments
- Hospitals
- Industrial estates
- Motels & hotel complexes
- Residential subdivisions
- Resorts and golf courses
- Rest stops & comfort stations
- Schools and universities
- Shopping centres
- Swimming centres

- Concept development
- Research & development
- Planning
- Conceptual design
- Detailed design
- Design & build
- Operate & maintain
- Asset management
- Monitoring & reporting

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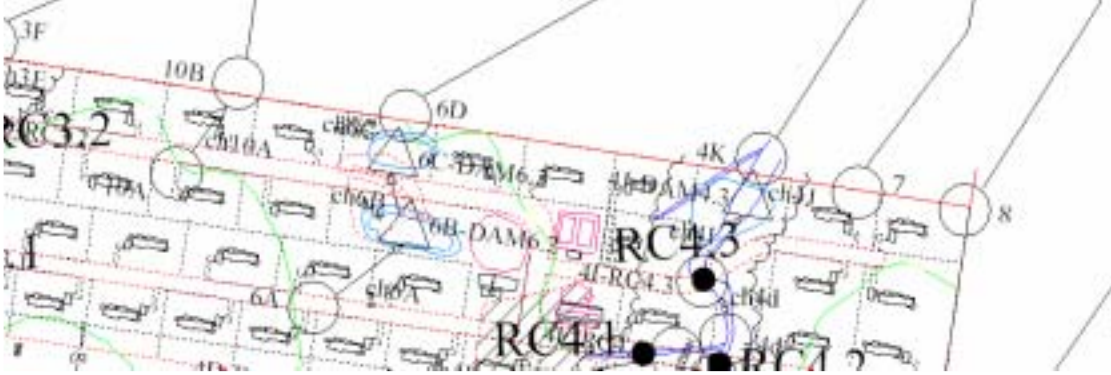
Stormwater Drainage

Capability Sheet CS17



KEY AREAS OF EXPERTISE

Our urban stormwater and drainage engineering expertise is wide ranging and encompasses natural systems, urban systems and construction activities. What ever your design requirements, we will be able to provide you with tailor-made environmentally beneficial solutions and designs meeting your site and project specific constraints.

Our engineering services in stormwater and drainage design are as diverse as:

- Residential sub-divisions
- Road and pavement drainage
- Industrial estates and commercial centres
- Creek and river works
- Wetland and lake systems

HOLISTIC INTEGRATED DESIGNS

Martens & Associates engineers and scientists ensure that our stormwater and drainage designs are well integrated into your project. Our designs are holistic and consider the drainage network as a key part of the entire development project.

We ensure minimum visual impact, sustainable development practice, integration between constructed and natural systems, and cost effective solutions.

CORE CAPABILITIES

Our services cover a range of core technical disciplines:

- Stormwater drainage and reticulation
- Stormwater detention
- Stormwater treatment systems
- Stormwater re-use and irrigation
- Constructed wetlands for water quality control
- Open channel hydraulics
- Flooding and risk assessment
- Floodplain flood dynamics
- Floodway mapping

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Telecommunications Towers & Monopoles

Capability Sheet CS18

EXPERIENCE

Martens & Associates has undertaken several hundred investigations for the approval, design and construction of telecommunications infrastructure for a range of private and public organisations. Structures for which services have been provided include:

- Lattice towers
- Monopoles
- Power supply facilities
- Service buildings
- Service trenching

PROBLEM SOLVING AND INNOVATION

Our design and field engineers are capable of delivering a range of investigations and services in order that local environmental conditions and constraints can be managed in a practical and cost-effective way. Examples of specific services include:

- Contaminated soil investigations
- Foundations investigation
- Groundwater monitoring
- Hazardous gas management
- Rock engineering
- Site supervision
- Slope stability assessment and management
- Soil reinforcement
- Stormwater control
- Water quality and groundwater chemistry

DIFFICULT ENVIRONMENTS

Martens have delivered practical design information for numerous difficult footing environments. Examples include:

- Acid sulphate soils
- Contaminated soil
- High and corrosive groundwater conditions
- Landfill and uncontrolled fill sites
- Low bearing pressure soils
- Soft deep alluvial sediments
- Steep unstable sites

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