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Surface and Groundwater Impact Assessment

Eileen O'Connor Catholic School

84 Gavenlock Road, Mardi

NSW, 2259

March 2025

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Report Distribution

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Revision	Date	Created by	Short Description of Changes
1	28th May 2024	Tiago Guedes	Final Version
2	19th March 2025	Gonzalo Serna Diaz	Addressing client's comments
3	1st July 2025	Gonzalo Serna Diaz	Changed client name

Executive Summary

Raw Earth were engaged to conduct a Surface and Groundwater Impact Assessment (SGIA) at the property located at 84 Gavenlock Road, Mardi, NSW 2259. The site is described as Lot 9 Section 4 DP 3368 and comprises an approximate total area of 133,500 m². The investigation area is located on the north-west portion of the site and comprises an approximate total area of 10,000 m².

Desktop assessment indicated that the site is located within a highly urbanised catchment area with risk of flooding. The site investigation area is relatively flat, sloping slightly downhill from southwest towards northeast direction. The surface elevation ranges from 14m to 12m AHD.

Information provided by the client indicated that the dam present on site will be dewatered and infilled as part of the development. If the dam is not dewatered and infilled prior to the commencement of construction/earthworks, mitigation and control measures will be implemented to safeguard the dam against potential impacts.

Based on previous investigations and information provided by the client, regarding depth of excavation during construction works, groundwater is not expected to be encountered during the development and therefore no direct impacts are expected to be caused to groundwater. There are no aquatic or terrestrial GDE registered on site, therefore no GDE's will be impacted during construction works.

The main potential impacts identified to surrounding surface and groundwater during construction phase of the project are related to earth/works and stockpiles (erosion and release of sediments), and construction leaks and spills. Mitigation measures will be employed to minimise the risks of the potential impacts, including implementation of sediment control devices and spill management protocols.

The stormwater runoff (quality and quantity) is the main source of potential impact to surrounding surface water, during the operation phase of the project. The Stormwater Management Plan for the Eileen O'Connor Catholic School includes stormwater quantity and quality control devices to comply with CCC site discharge requirements. An underground on-site stormwater detention (OSD) system will be implemented to control stormwater quantity and limit site discharge. A stormwater treatment system will be implemented to reduce pollutants load, including a primary treatment to reduce gross pollutants and suspended solids, and tertiary treatment to reduce nutrients (nitrogen and phosphorus) and achieve the minimum pollutant removal performance targets (ARQ, 2006).

No residual impacts for surface or groundwater surrounding the site are expected after the implementation of mitigation measures presented in this report.

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Appendices

1 Introduction

1.1 Background

Raw Earth Environmental Pty Ltd (Raw Earth) have been engaged to conduct a Surface and Groundwater Impact Assessment (SGIA) to address the Planning Secretary's Environmental Assessment Requirements (SEARs) for the Development Application (DA) for upgrades to Eileen O'Connor Catholic School, located at 84 Gavenlock Road, Mardi, NSW 2259 (herein referred to as 'the site'). The site is described as Lot 9 Section 4 DP 3368 and comprises an approximate total area of 133,500 m². The proposed development area is located on the north-west portion of the site and comprises an approximate total area of 10,000 m².

The Site Location Plan is shown in Figure 1, in the **Appendix A**. The site is located approximately 15.5 km north-east of Gosford Central Business District (CBD), within the Local Government Area of Central Coast Council (CCC).

Raw Earth understands that the proposed school development at the site includes the construction of an additional three (3) two-storey school buildings on the north-west portion of the site. Information provided to Raw Earth by the client indicates that as part of the project, most of excavation works will occur to shallow depths (around 0.5 m below ground level - bgl) and only the southwest portion of the development area (highest portion) will have excavation occurring to maximum depth of 1.8 m bgl.

1.2 Objectives

The objectives of this Surface and Groundwater Impact Assessment were as follows:

- Assess the potential impacts on surface and groundwater resources (quality and quantity), including related infrastructure, hydrology, dependent ecosystems, drainage lines, downstream assets, and watercourses.
- Provide management and mitigation measures to minimise impacts on surface and groundwater during construction and operation phases of the project.

2 Scope of Works

To complete the SGIA, Raw Earth undertook the following scope of works:

- A desktop review of the following sources:
  - Published geology and soil landscape maps.
  - Real NSW Bore reports.
  - Local council GIS layers including lot description, land zoning and council flood mapping.
  - NSW ePlanning Spatial Viewing GIS layers including hydrology and Acid Sulfate Soil Risk Mapping.
  - NSW River Styles Map
  - Bureau of Meteorology (Rainfall historical data and Groundwater dependent ecosystems).
  - Protected Matters Search Tool (Department of Climate Change, Energy, the Environment and Water).
  - Council Local Environmental Plan (LEP) and Development Control Plan (DCP).
- A review of previous investigations conducted at the site.
- Site inspection, detailing current site conditions.
- Preparation of this Surface and Groundwater Impact Assessment, documenting the findings of the desktop study.

3 Regulatory Framework

This SGIA was undertaken in accordance with the following regulatory framework and guidelines:

- Australian Department of Agriculture, Water and the Environment, Environment Protection and Biodiversity Conservation Act, 1999.
- Australian and New Zealand Environment and Conservation Council (ANZEC), National Water Quality Management Strategy, 2017.
- Australian and New Zealand Guidelines for Fresh and Marine Water Quality, 2018.
- Central Coast Council, Local Environmental Plan, 2022.
- Central Coast Council, Development Control Plan, 2022.
- National Environment Protection (Assessment of Site Contamination) Measure as varied 2011, Schedule B1 – Guideline on Investigation Levels for Soil and Groundwater, 2013.
- NSW Environmental Planning and Assessment Act, 1979.
- NSW Department of Environment and Conservation, Guidelines for the Assessment and Management of Groundwater Contamination, 2007.
- NSW Environmental Protection Authority, Contaminated Land Management, Guidelines for the NSW Site Auditor Scheme (3rd Edition), 2017.
- NSW Groundwater Quality Protection Policy, 1998.
- NSW Groundwater Quantity Management Protection Policy, 1998.
- NSW Groundwater Dependent Ecosystems Policy, 2002.
- NSW Water Quality and River Flow Objectives

4 Previous Investigations

Previous investigations were conducted on site and those related to the Surface and Groundwater Impact Assessment are described below.

4.1 Raw Earth Environmental: *Acid Sulfate Soils Investigation, 2023.*

Raw Earth Environmental has conducted an Acid Sulfate Soil (ASS) Investigation at the site to assess the subsurface soil conditions and the presence of ASS. The investigation included the advancement of 6 boreholes to a maximum depth of 2.5m, soil characterisation, sampling, and analysis. The key findings are described below:

- Groundwater was intercepted within boreholes HA04, HA05 and HA06 (Refer to Figure 6, **Appendix A**), all located on the north portion of the development area.
- The soil analytical results indicate presence of ASS within soils greater than 2.0 m mark.

4.2 Raw Earth Environmental: *Preliminary Site Investigation, 2024.*

Raw Earth Environmental has conducted a Preliminary Site Investigation (PSI) at the site to assess the presence of potential contamination from former or current land use. The investigation included site inspection and desktop assessment (review of land zoning, historical aerial photographs, geology, hydrogeology, contaminated land register, etc). The key findings are described below:

- The desktop assessment indicated that the site has remained as a private school since 1983.
- The PSI concluded that the use of potential uncontrolled fill was the main potential source of contamination and environmental concern for the site.

4.3 Raw Earth Environmental: *Salinity and Aggressivity Assessment, 2024.*

Raw Earth Environmental has conducted a Salinity and Aggressivity Assessment at the site to assess the in-situ soil for salinity and aggressivity. The investigation included the advancement of 15 boreholes to a maximum depth of 1.8m, soil sampling, and analysis. The key findings are described below:

- The site soil conditions were classified as non-saline.
- The pH analyses indicated acidic soil conditions, ranging from 3.7 to 5.7.
- Site soils were found to be non-aggressive to mildly aggressive to steel and non-aggressive to severely aggressive to concrete according to AS 2159-2009 - *Piling – Design and Installation* criteria.

5 Site Condition and Environmental Setting

5.1 Site Description

A site location plan is shown in Figure 1, with a site layout plan shown in Figure 2, **Appendix A**. A summary of the site details is shown below in **Table 1.**

Table 1: Site Details	
Site Address	84 Gavenlock Road, Mardi, NSW 2259
Lot Description	Lot 9 Section 4 DP 3368
Site Location Map	Figure 1, **Appendix A**
Site Layout Plan	Figure 2, **Appendix A**
Area of Site (m²)	133,500
Development Area (m²)	10,000
Local Government Council	Central Coast Council

5.2 Site Inspection

Raw Earth undertook a site inspection at the site on 22nd April 2024. Key observations noted during the inspection are summarised in **Table 2** below.

Table 2: Site Layout and Current Use	
Site Layout and Use	**Details**
Current use	The site is an independent school, and it is being used as such.
Surface cover type and condition	The site investigation area is predominantly covered by grass and vegetation.
Building construction	There are 3 single-storey buildings (sheds) built on concrete slab, with steel frame structure and corrugated metal walls and roofing.
Water runoff flow direction and drain/ pit location	The site investigation area slopes downhill from southwest to northeast of the property, water runoff will follow this direction travelling across the site.
Depth, size and flow of any water features which may include creeks, rivers, lakes, ponds and lagoons	There is a dam in the centre portion of the site, with an approximate area of 2000 m². Information provided by the client indicated that the dam will be dewatered and infilled.
Waste/ rubble	No waste/rubble was present on-site.
Areas of restricted access	No areas of restricted access.

5.3 Surrounding Land use

A summary of surrounding features and/or land uses noted during a review of desktop information and the site inspected is provided in **Table 3** below.

Table 3: Surrounding Land Use	
North	Residential properties zoned as R1, and vacant bushland zoned as RE2 and C2 located adjacent and beyond.
East	Commercial properties zoned as E4 and E3 located across Gavenlock Road.

South	Residential properties zoned as R1, and vacant bushland zoned as C2 located adjacent and beyond.
West	Residential properties zoned as R1 adjacent, with vacant bushland zoned as C2.

Abbreviations (NSW Department of Planning and Environment):
R1: General Residential
C2: Environmental Conservation and Environmental Management
E4: General Industrial
E3: Productivity Support
RE2: Private Recreation

5.4 Climate

5.4.1 Rainfall historical records

A search of the Bureau of Meteorology conducted on 15th May 2024 indicated that the site's region has summer average temperatures around 20 – 22° C, with maximum temperatures ranging from 26 – 28° C, and winter average temperatures range from 12 – 14° C, with minimum temperatures ranging from 6 – 8° C. The region has experienced considerable rainfall variability with intermittent periods of drier and wetter conditions, but generally summer is the wettest season. The region presents an average annual rainfall of approximately 1,100 mm. **Table 4** shows the rainfall historical data from 1995 to 2023.

Table 4: Rainfall historical data

Statistic	Jan	Fev	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean (mm)	102.2	140.4	150.3	85.2	43.8	86.0	46.9	44.4	42.3	72.1	91.6	85.0
Lowest (mm)	16.0	16.0	20.0	4.0	3.0	3.0	0.0	1.0	1.0	7.0	32.0	20.0
Highest	319.0	296.0	535.0	366.0	142.0	408.0	426.0	182.0	135.0	204.0	198.0	188.0

5.5 Geology

The Geological Map of Gosford-Lake Macquarie (Geological Series Sheet 9131, 1st Edition, Scale 1:100,000, D.J. Jones, D.C. Uren, and R.R. Hughes, 2015) published by the NSW Geological Survey, indicates the site is underlain by Quaternary gravel and sand as well as Triassic Patonga Claystone consisting of red-brown claystone and siltstone and light green-grey fine-grained sandstone.

A search of the NSW Central Resource for Sharing and Enabling Environmental Data (SEED) was conducted and indicated that the site is underlain by Alluvial floodplain deposits (Holocene) consisting of silt, very fine to medium-grained lithic to quartz-rich sand and clay, as well as Patonga Claystone (Early Triassic) consisting of red-brown claystone and siltstone and light green-grey fine-grained sandstone (Vega, M. Patonga Claystone stratigraphic unit description, 2021. Published via MinView). Geology Map is presented in Figure 3, **Appendix A**.

5.6 Local Soils

5.6.1 Soil Landscapes

The development area is part of Woodbury's Bridge (wo) and Wyong Soil Landscapes (wy), according to information extracted from Soil Landscape of Central and Eastern NSW (SEED – Central Resource for Sharing and Enabling Environmental Data in NSW).

Woodbury's Bridge soil landscape is characterised by gentle undulating rises to rolling low hills on Patonga Claystone. Local relief 40 to 80 m and slope gradients up to 20%. Predominant soil material within this soil landscape includes:

- **Dark brown pedal fine sandy loam (wo1)**: Dark brown fine sandy loam with weak to moderate sub-angular blocky structure and rough ped fabric. It occurs as topsoil (A1 horizon). Occasionally medium textured sand grains are present. Textures range from sandy loam to loam fine sandy. Colour, which is commonly dark brown, ranges from brownish black to dull yellowish brown. The pH is moderately acid (pH 5.0–pH 5.5).
- **Hardsetting dull yellowish brown sandy clay loam (wo2):** Dull yellowish brown light sandy clay loam, sandy clay loam or fine sandy clay loam with massive structure and earthy fabric. It occurs as shallow subsoil (A2 horizon). This material is often hardsetting when dry. Colour ranges from brown to a more common dull yellowish brown or dull yellow orange. This material is occasionally bleached when dry. The pH ranges from strongly acid (pH 4.5) to moderately acid (pH 5.5). Roots are common. Few to common fine sandstone, ironstone, mudstone, and charcoal fragments are often present.
- **Reddish brown slaking pedal clay (wo3):** Reddish brown light medium to medium clay with a strong angular blocky or prismatic structure and smooth ped fabric. When dry, very large (50–200 mm) prismatic and lenticular shaped peds are often present. The material readily slakes when wetted to a fine polyhedral structure. Occasionally 20–50 mm lenticular shaped peds with slickensides occur. Colours vary according to the colour of the parent mudstone material. Usually they are reddish brown, but they can range from brown to dark olive brown. At depth brownish grey often occurs. Red-yellow or grey mottles are often present especially at depth. The pH ranges from strongly acid (pH 4.0) to slightly acid (pH 6.0). Roots are common to few. Ironstone and mudstone rock fragments are few, and charcoal fragments absent.
- **Yellowish brown pedal sandy clay (wo4):** Yellowish brown sandy clay loam to medium clay with moderate to strong angular blocky structure and rough ped fabric. It occurs as subsoil (B horizon) on sandstone bedrock. Medium-sized sand grains are present. Faunal mixing is common at the top of this material. Common colours include orange (7.5YR 6/8, 7.5YR 7/6), yellowish brown and bright yellowish brown. Grey or orange mottles are occasionally present. The pH ranges from moderately acid (pH 5.0) to slightly acid (pH 6.0). Sandstone rock fragments are present, but roots are few and charcoal fragments are absent.

Wyong soil landscape is characterised by broad poorly drained deltaic floodplains and alluvial flats of Quaternary sediments. Local relief >10 m and slope gradients up to 3%. Meander scrolls, oxbows and swamps are common. Predominant soil material within this soil landscape includes:

- **Brownish black pedal loam (wy1):** Brownish black loam to silty clay loam with moderate sub-angular structure and a rough ped fabric. It occurs as topsoil (A horizon) This material usually has a friable surface condition and is occasionally hardsetting when dry. Colour ranges from a common brownish black when organic matter is abundant to greyish yellow brown. The pH ranges from strongly acid to slightly acid (pH 6.0). Roots are common, but charcoal and rock fragments are absent.

- **Mottled brownish grey plastic clay (wy2):** Brownish silty to heavy clay with massive structure when wet and strong angular blocky structure when dry. It occurs as subsoil (B horizon). This material is often plastic and silty. It is often permanently waterlogged at depth with strong anaerobic odour. Colour ranges from brownish grey to yellowish brown. Orange- and straw-coloured mottles are often present along root channels. The pH ranges from strongly acid (pH 4.0) to slightly acid (pH 6.0). Roots are rare and charcoal and rock fragments are absent.

5.6.2 Soil Site Characteristics

Raw Earth Environmental has previously conducted an ASS investigation through advancement of boreholes to a maximum depth of 2.5m on site and the local soils were characterized. The soil characteristics are presented in **Table 5**.

Table 5: Soil Characterisation	
Depth range (m)	**Material Description**
0.0 – 0.15	Topsoil: Gravely sand. Dark brown, dry, loose, fine to medium grained sand with angular to subangular gravels.
0.15 – 0.75	Natural: Gravely sandy clay. Pale grey, moist, loose, fine to medium grained sand.
0.75 -1.5	Natural: Clay. Pale brown and pale grey, moist, hard, low plasticity.
1.5 – 2.5	Natural: Sandy silty clay. Pale brown and pale grey, moist, soft, fine to medium grained sand, low to medium plasticity.

5.6.3 Acid Sulfate Soils

A search of the Central Coast Council - Local Environmental Plan (LEP) 2022 was undertaken to identify if Acid Sulfate Soils (ASS) are a risk at the site.

The investigation area is categorised as Class 4 and Class 5. The central and northern portions of the investigation area are categorised as Class 4, and the southern portion of the investigation area is categorised as Class 5. ASS within Class 4 areas is typically found below two (2) meters of the natural ground surface. The site's location in relation to nearby Class 1, 2, 3 and 4 ASS is presented in Figure 4, **Appendix A.**

Raw Earth Environmental has carried out an Acid Sulfate Soils Investigation in the investigation area in October 2023. Soil sampling and laboratory analysis indicated that Potential Acid Sulfate Soils (PASS) and Actual Acid Sulfate Soils (AASS) are likely to be present on site within soils greater than 2.0m bgl.

5.7 Topography

The region where the site is located is characterized by gently undulating rises to rolling low hills (slope gradient <20%) in conjunction with deltaic floodplains and alluvial flats (slope gradient <3%).

A review of Australia Topographic Map undertaken on the 7th of May 2024, indicates the topography of the site is sloping downhill from southwest towards north and east direction, with a surface elevation range from 24 to 4 m AHD (slope gradient 3%). The investigation area is predominantly flat, sloping slightly downhill from southwest towards northeast direction. The surface elevation ranges from 14m to 12m AHD (slope gradient <2%).

5.8 Site Vegetation

The site investigation area is covered mainly by grass. Vegetation, including shrubs and trees were found surrounding the dam in the centre of the site and along the fences in the southern and eastern boundaries.

5.9 Land Contamination

A Preliminary Site Investigation (PSI) was conducted by Raw Earth Environmental in March 2024 to assess the potential contamination at the site from former or actual land use. The investigation included site inspection and desktop assessment. No clear signs of land contamination were found, and the key findings are described below:

- The desktop assessment indicated that the site has remained as a private school since 1983.
- The PSI concluded that the use of potential uncontrolled fill was the main potential source of contamination and environmental concern for the site.
- Further investigation in form of a Detailed Site Investigation (DSI) was recommended prior to earth works or soil excavation occurring.

5.10 Hydrogeology

5.10.1 Groundwater characteristics

A search of the WaterNSW Portal was conducted on 10th May 2024, which identified 13 registered groundwater bore within 1.6 km radius around the site. Details and information about groundwater bores within the region of the site are presented in **Table 6.** Refer to Figure 5, **Appendix A** for groundwater bore details within proximity to site.

Table 6: Groundwater Bore Information

Bore ID	Bore Location	Total Depth (m)	Lithology	Standing Water Level (m)	Purpose
GW054807	680 m south	11.50	Sand and clay	-	Domestic/General use
GW200520	1,050 m southeast	61.0	Clay, Sandstone and Shale	4.0	Irrigation/Test
GW049427	1,100 m southeast	36.6	Clay, Sandstone and Shale	10.0	Irrigation
GW066326	1,170 m southwest	39.5	-	14.0	Stock/Domestic
GW066297	1,230 m southwest	41.0	-	18.0	Domestic
GW078358	1,340 m southwest	61.0	Clay, Sandstone and Mudstone	15.0	Domestic/Farm
GW200566	1,030 m west	150.0	Sand, Clay and Shale	19.0	Test
GW202635	1,400 m northeast	6.0	Gravel, Sand and Clay	3.0	Monitoring
GW202636	1,410 m northeast	6.0	Gravel, Clay and Sand	3.25	Monitoring

The site topography and regional landscape suggests that the groundwater flows from west to east. Analysing Table 6 revels a pattern related to the standing water levels (SWL) of the boreholes. The SWL of the boreholes located to the west of the site (uphill) were deeper, ranging from 14.0 to 19.0 m bgl, compared to the boreholes located to the east of the site (towards the coast) ranging from 3.0 to 10.0 m bgl.

Raw Earth has advanced boreholes to a maximum depth of 2.5 m bgl for an ASS investigation at the site. Groundwater was encountered at 2.0 m bgl only around the lower ground levels (centre/northern portion) of the site. Groundwater was not encountered until 2.5 m bgl within the boreholes around the higher ground levels (southwestern portion) of the site (Refer to Figure 6, **Appendix A**). Information provided by the client indicates that the excavations within the centre/northern portion of the site will be shallow (around 0.5 m bgl) and groundwater is not expected to be encountered.

5.10.2 Groundwater dependent ecosystems

A search of the Bureau of Meteorology's Groundwater dependent ecosystem atlas indicated that there are no registered aquatic groundwater dependent ecosystems (GDE) in the vicinity of the site. The closest GDE identified were within the Wyong River and Tuggerah Lake, located 1.5 km and 3.0 km from the site respectively. No terrestrial GDE were identified within the site, although were found in the surrounding area. The development is not considered to impact terrestrial GDE since groundwater is not expected to be encountered during development works.

5.11 Hydrology

5.11.1 Regional catchment and surface water

The site is located within the Wyong River Catchment area, which occupies a total area of 440 km² and is drained by a network of rivers and creeks, including Wyong River, Cedar Bush Creek, Jilliby Jilliby Creek, Ports Creek, Mardi Creek and Deep Creek. Ultimately the Wyong River Catchment area drain into the Tuggerah Lake, the largest of three interconnected coastal lakes that discharge to the Pacific Ocean via a single outlet at the Entrance.

The upper parts of the catchment area include forested areas, rural farms and the villages of Yarramalong, Cedar Bush Creek and Dooralong. East of the Pacific Motorway the catchment is more developed and includes the major township of Wyong as well as Tuggerah, Mardi, and Tacoma.

The lower sections of the catchment, where the site is located at, contain a range of residential, commercial and industrial land uses including the Tuggerah Straight industrial area.

A search of NSW River Styles (SEED) was undertaken on 7th May 2024, the closest off-site surface water receptors are tributaries to Wyong River, which is located approximately 1.5 km northeast (Figure 7, **Appendix A**).

There is a dam located in the centre of the investigation area. Information provided by the client indicates that the dam will be dewatered and infilled as part of the proposed development.

5.11.2 Surface Water Quality

Wyong River and tributaries fall under the Lake Macquarie and Tuggerah Lakes Water Quality and River Flow Objectives. The water quality objectives (WQOs) that apply to Wyong River and tributaries (streams affected by urban development) are:

- Aquatic ecosystems.

- Visual amenity.
- Secondary contact recreation.

The majority of the Tuggerah industrial area drains into Mardi Creek and then into Tuggerah Creek and further down into Wyong River, indicating that their surface water quality is likely to be impacted by urban stormwater runoff.
Urban stormwater runoff is typically characterised by elevated levels of total suspended solids, nutrients, heavy metals and oil and grease.

5.11.3 Surface Water Hydrology

The River Flow Objectives (RFOs) that apply to Wyong River and tributaries (streams affected by urban development) include:

- Maintain wetland and floodplain inundation.
- Mimic natural drying in temporary waterways.
- Maintain natural flow variability.
- Maintain natural rates of change in water levels.
- Minimise effects of weirs and other structures.

5.11.4 Flooding Risk

Central Coast Council and Catchment Simulation Solutions conducted The Wyong River Catchment Floodplain Risk Management Study and Plan, which was used as reference for this section of the report.

The headwaters of the Wyong River are located at the foot of the Watagan Mountains. The river generally flows in a south and then south-easterly direction. The upper sections of the catchment are characterised by extensive forested areas. Downstream of the confluence of the Wyong River and Jilliby Jilliby Creek the topography flattens appreciably, and the floodplain becomes more expansive. Several major transportation routes are located across this section of the catchment including M1 Pacific Motorway, Pacific Highway and Main Northern Railway. Urban development is more prominent across the downstream sections of the catchment. This includes the major township of Wyong as well as Mardi, Tuggerah and Tacoma/South Tacoma. Land use across each of these urban centres includes a mix of residential, industrial and commercial as well as open space.

The Tuggerah straight industrial area is also located immediately south of the Wyong River within the lower catchment. The majority of the industrial area drains into Mardi Creek and then into Tuggerah Creek which forms another tributary of the Wyong River. Mardi Dam, a water supply dam for Central Coast Council, is located within the headwaters of the Mardi Creek catchment. This dam does not currently function as a flood storage basin (i.e., its purpose is water supply).

The Wyong River catchment has a significant history of flooding although records for areas outside of the main township of Wyong are scant. Significant rainfall and flood events have occurred in the Wyong River catchment in June 1905, 1927, 1949, 1964, 1977, 1989, 1990, 2017 and 2015.

The available historic flood information indicates that most significant floods tend to occur around June. Significant rainfall at this time of year is generally associated with east coast lows which produce significant rainfall over multiple days in conjunction with elevated ocean water levels. Consequently, the most significant flooding typically occurs as a result of extended periods of rainfall.

The region where the site is located, Tuggerah Straight industrial area, is subject to inundation during relatively frequent events. Although the depths of inundation are generally not as significant as other areas of the floodplain, the highly populated nature of this area, the "flashy" nature of the Mardi Creek catchment and the lower floor level requirements relative to other areas across the area does result in a significant flooding problem.

The site has been flood affected in a number of events and it is predicted to be flooded in the 20% Annual Exceedance Probability (AEP).

5.11.5 Sensitive receiving environments

The surface water sensitive receiving environments related to the development at the site are the downstream watercourses Wyong River and tributaries, which are located within Industrial/Urban areas and receive runoff from that land use. Central Coast Waterways Report (2021) indicated that the Wyong River water quality was graded from fair to good, however turbidity and chlorophyl-a has often exceeded the trigger value.

A search on the Protected Matters Search Tool was conducted on 15th May 2024 and the EPBC Act Protected Matters Report (Refer to **Appendix B**) outlined a number of threatened species in the vicinity of the site. Most of threatened species are birds and trees, which are not expected to be impacted by potential changes to surface water resulting from the development of the site.

The impact of the site development on surface water sensitive receiving environments will be minimized by the adoption of mitigation measures described in **Section 8**.

Information provided by the client indicates that the dam will be dewatered and infilled as part of the development. If the dam is not dewatered and infilled prior to the commencement of construction/earthworks, mitigation and control measures will be implemented to safeguard the dam against potential impacts.

5.12 Stormwater Management

Stormwater runoff is one of the main sources of potential impacts on surrounding surface water during the construction and operation phase of the project. Therefore, the stormwater management plays a crucial role in preventing and minimizing the environmental impacts on surface water throughout the project.

The Stormwater Management Plan for the Eileen O'Connor Catholic School is being undertaken and includes stormwater quantity and quality control devices to comply with CCC site discharge requirements.

For stormwater quantity control, a 245m³ underground on-site stormwater detention (OSD) with an orifice plate will be implemented to limit site discharge and comply with CCC Development Control Plan (DCP) 2022 requirements. This includes limiting post development flows to be less than or equal to pre-development flows for the 1% AEP storm event.

For stormwater quality control, a stormwater treatment system will be implemented to reduce pollutant load and comply with CCC DCP 2022 requirements. The stormwater treatment system will include primary treatment to reduce gross pollutants and suspended solids, and tertiary treatment to reduce nutrients (nitrogen and phosphorus) and achieve the minimum pollutant removal performance targets (ARQ, 2006), described in **Table 7**.

Table 7: Minimum Pollutant Removal Performance Targets	
Pollutants	**Performance Requirements (Targets)**
Gross Pollutants (greater than 5mm in diameter)	90% reduction in the post-development mean annual load
Total Suspended Solids (TSS)	80% reduction in the post-development mean annual
Total Nitrogen (TN)	45% reduction in the post-development mean annual
Total Phosphorus (TP)	45% reduction in the post-development mean annual

6 Environmental Impact Assessment

The purpose of the environmental impact assessment (EIA) is to ensure that decision-makers consider the environmental impacts related to a project.

The EIA involves 3 steps:

- Identify the potential related to the project.
- Assess the risk of the potential impacts.
- Implement impact mitigation/control measures.

6.1 Potential Impacts Identification

The first step of the environmental impact assessment is identifying the potential impacts related to the project. A formal evaluation of the activities that could potentially impact surface and/or groundwater during both construction and operational phases of the project was conducted to identify the main potential impacts.

6.2 Impact Risk Assessment

Once the potential impacts were identified, they were assessed in terms of risk. The risk assessment evaluates the likelihood of the impact occurring, and the consequence if it does occur. **Table 8** describes the risk assessment.

Table 8: Risk Assessment	
Step A – Likelihood of the impact to happen.	
Likelihood	**Description**
Almost certain	Expected in most circumstances.
Likely	Will probably occurs in most circumstances.
Possible	Could occur at some time.
Unlikely	Not expected to occur.
Rare	Exceptional circumstances only.
Step B – Consequences if the impact happens.	
Consequence	**Description**
Severe	Significant impact or serious harm to the environment resulting in irreversible damage
Major	Significant impact or material harm to the environment or a notifiable incident to an environmental protection authority (EPA).
Moderate	Moderate impact to the environment or a notifiable incident to an EPA.
Minor	Minor impact on the environment (quickly rectified).
Insignificant	Negligible environmental impact (no rectification necessary).

After evaluating the likelihood and consequence for each potential impact, the risks were classified through the risk assessment matrix described in **Table 9.**

		Table 9: Risk Assessment Matrix				
		Consequence				
		Insignificant	Minor	Moderate	Major	Significant
Likelihood	Almost certain	Medium	High	Very High	Very High	Very High
	Likely	Medium	Medium	High	Very High	Very High
	Possible	Low	Medium	Medium	High	Very High
	Unlikely	Low	Low	Medium	Medium	High
	Rare	Low	Low	Low	Medium	Medium

6.3 Impact Risk Control

Based on the risk assessment, potential impacts must be eliminated or, where that is not reasonably practicable, minimized. For each potential impact a mitigation/control measure must be recommended and implemented.

7 Surface and Groundwater Impact Assessment

7.1 Potential Impacts and Risk Assessment – Construction phase

The construction phase of the project is more likely to cause potential impacts on surface and groundwater compared to the operation phase. During the construction phase of the project, excavation/earthworks and stockpiling will occur. If they are not managed properly, sediments can migrate into the stormwater systema and eventually reach downstream water courses.

7.1.1 Surface Water

The site will potentially discharge the local stormwater into the highly vegetated lot owned by Council, located to the north of the site, that eventually overflows into Wyong River. The main activities and/or source of potential impact on surrounding surface water bodies are described below.

- Earthworks: Earthworks within the site could potentially lead to erosion of exposed soils and mobilisation of sediment via local runoff to the stormwater system or by overland flow to tributaries to Wyong River while these soils are exposed. The risk of mobilisation of exposed soils is higher given the site is subjected to flooding.
- Stockpiles: Stockpile sites would be used to temporarily store raw materials, excess spoil and wastes before their use or reuse on-site or disposal off-site. Sediment management measures should be used on the stockpile sites to minimise the potential for sediment laden runoff to be discharged offsite and lead to sedimentation impacts to the receiving waterways of the stormwater system and overland flow to downstream watercourses.
- Leaks and spills: Potentially harmful chemicals and substances could accidentally be released to the soil during construction spills or as result of maintenance works, refuelling and inappropriate storage or handling. This could potentially lead to contamination of exposed soils and/or mobilisation of contaminated soils and liquids into local watercourses which could result in water quality impacts.

Information provided by the client indicated that the dam present on site will be dewatered and infilled as part of the development. If the dam is not dewatered and infilled prior to the commencement of construction/earthworks, mitigation and control measures will be implemented to safeguard the dam against potential impacts.

The aspects and main potential impacts on surface watercourses during construction phase of the project are summarised in **Table 10**. Mitigation and control measures for the potential impacts are described in **Section 8**.

Table 10: Aspects, Potential Impacts and Risk Assessment – Surface Water				
Aspects	**Potential Impacts**	**Likelihood**	**Consequence**	**Risk**
Earthworks/ Excavation works	Erosion of exposed soils and mobilization of sediments via local runoff, degrading downstream surface water environments	Possible	Moderate	Medium
Stockpiles	Mobilization of sediments via local runoff, degrading downstream surface water bodies	Possible	Moderate	Medium
Concrete Washout	Contamination of downstream surface watercourses via local runoff	Unlikely	Moderate	Medium
	Impact on vegetation and aquatic wildlife	Unlikely	Moderate	Medium
Flooding of Worksite	Contamination of floodwaters by sewage, fuels, and/or chemicals onsite	Possible	Moderate	Medium
Leaks or spillage of fuels, oils or grease from construction plant and equipment	Contamination of soil, stormwater system and downstream watercourses	Possible	Moderate	Medium
Inappropriate management/storage of hazardous substances	Contamination of soil, stormwater system and downstream watercourses	Unlikely	Moderate	Medium

7.1.2 Groundwater

Raw earth Environmental conducted an ASS investigation at the site, which included the advancement of 6 boreholes to maximum depth of 2.5 m bgl, across the area of the proposed development. Groundwater was intercepted in three (3) boreholes - HA04, HA05 and HA06 during drilling at depths of 2.4 m, 2.1 m and 2.0 m bgl respectively.

It is noted that the before-mentioned boreholes are located within the lower ground levels (centre/north portion) of the site. Information provided by the client indicates that the maximum depth of excavation will be 1.8m bgl, only around the upper ground levels (southwest portion) and around the lower ground levels (centre/north/northeast) of the site the depth of excavation will be around 0.5 m bgl.

Based on previous investigations conducted at the site, groundwater is not expected to be intercepted during construction/excavation works. However, potential impacts to groundwater must be considered. **Table 11** summarises the aspects, potential impacts and risk assessment to groundwater during the construction phase of the project.

There are no aquatic or terrestrial GDE registered on site, therefore no GDE's will be impacted during construction works.

Table 11: Aspects, Potential Impacts and Risk Assessment –Groundwater				
Aspects	**Potential Impacts**	**Likelihood**	**Consequence**	**Risk**
Earthworks/ Excavation works	Interception of groundwater and exposure to contamination	Unlikely	Minor	Medium
Concrete Washout	Contamination of groundwater	Possible	Minor	Medium

Leaks or spillage of fuels, oils or grease from construction plant and equipment	Contamination of groundwater	Unlikely	Minor	Medium
Inappropriate management/storage of hazardous substances	Contamination of groundwater	Unlikely	Moderate	Medium

7.2 Potential Impacts and Risk Assessment – Operation phase

7.2.1 Surface Water

The main potential impacts on surrounding surface water during the operation phase of the project are related to the stormwater runoff, flooding risk and accidental spills. The aspects of the potential impacts are explained below.

- Stormwater runoff: The proposed development has the potential to increase the volume of stormwater runoff and consequently the pollutant load being released into downstream watercourses. The pollutants expected to be present within the stormwater runoff include sediments, heavy metals, oil, and grease washed off pavement surface.
- Flooding risk: The site is already susceptible to flooding and with the increase of impervious surface areas, the flooding risk at the site will increase.
- Accidental spill: Accidental spills of oils or other chemicals used for maintenance activities has the potential to contaminate stormwater system and downstream watercourses.

The aspects, potential impacts, and risk assessment to surface water during the operation phase of the project is summarised in **Table 12**.

Table 12: Aspects, Potential Impacts and Risk Assessment – Water (Operation)

Aspects	Potential Impacts	Likelihood	Consequence	Risk
Increase of impervious surfaces	Increase of stormwater runoff (pollutant load) and degrading water quality of downstream watercourses	Unlikely	Minor	Medium
	Increasing of flooding risk	Possible	Minor	Medium
Leaks or spillage of fuels, oils or grease from vehicles and equipment	Contamination of downstream watercourses	Unlikely	Moderate	Medium

7.2.2 Groundwater

The groundwater is unlikely to be impacted during the operation phase of the project. The proposed development is a school and as such its daily activities are not expected to impact groundwater. The potential impacts to groundwater during operation phase is summarised in **Table 13**.

Table 13: Aspects, Potential Impacts and Risk Assessment – Groundwater (Operation)				
Aspects	**Potential Impacts**	**Likelihood**	**Consequence**	**Risk**
Leaks or spillage of fuels, oils or grease from vehicles and equipment	Contamination of groundwater	Unlikely	Moderate	Medium

8 Mitigation and Control Measures

8.1 Construction phase

The construction phase of the project can lead to the most potential impacts on the surrounding surface and groundwater environments. The mitigation/control measures recommended to be implemented on site during the construction stage will minimise the potential impact of the development on both surface and groundwater surrounding environment. **Table 14** presents the mitigation/control measures to be implemented on site.

Information provided by the client indicated that the dam present on site will be dewatered and infilled as part of the development. If the dam is not dewatered and infilled prior to the commencement of construction/earthworks, mitigation and control measures will be implemented to safeguard the dam against potential impacts.

Table 14: Aspects, Potential Impacts and Mitigation/Control Measures – Surface and Ground water (Construction)

Aspects	Potential Impacts	Mitigation/Control Measures
Earthworks/ Excavation works	Erosion of exposed soils and mobilization of sediments via local runoff, degrading downstream surface water environments	• Stabilise ground surfaces progressively upon completion rather until the end of all works. • Installation of sediment fences around the downstream boundary of the construction site and around the dam (if still present). • Use of scour protection and energy dissipation around discharge points to reduce erosion where necessary.
Stockpiles	Mobilization of sediments via local runoff, degrading downstream surface water bodies	• Stockpiles must not exceed 2 metres in height. • Utilise temporary ground covers (e.g., hydraulic soil stabilizers, geotextile fabrics) for stabilizing stockpiles. • Stockpiling and storage of materials to occur outside of potential runoff/flood areas.
Concrete Washout	• Contamination of downstream surface watercourses via local runoff. • Contamination of groundwater.	• All concrete washouts are to occur offsite.
Flooding of Worksite	Contamination of floodwaters by sewage, fuels, and/or chemicals onsite	• Monitoring of weather forecasts and rainfall events. • Stockpiling and storage of materials to occur outside potential runoff/flood areas.
Leaks or spillage of fuels, oils or grease from construction plant and equipment	• Contamination of downstream surface watercourses via local runoff. • Contamination of groundwater.	• Vehicles and machinery will be properly maintained to minimise risk of fuel/oil leaks. • All spills on site must be cleaned up immediately to minimise pollution of stormwater. • Emergency spill kits shall always be available on-site. All staff must be made aware of the location of the spill kit and be trained in its use.

8.1.1 Sediment Control Measures

Sediment Control Measures must be employed to minimise sediments leaving the site construction premises into stormwater system and/or downstream watercourses. Sediment control devices recommended to implemented on site are described below.

1. **Stockpiles**
    - All stockpile and building materials are to be located behind sediment controls and must be protected from run-on water through a combination of up-slope water diversion banks and down-slope sediment control structures.
    - All stockpiles onsite must be at least 2 metres, preferably 5 metres, away from all particular areas of concentrated or high velocity water flows such as waterways, paved areas, kerb inlet pits and driveways.
    - All stockpiles onsite must have a height less than 2 metres.
    - The incorrect storage of stockpiles can result in significant stormwater pollution.
    - Diagram of stockpile establishment is provided in Figure 9, **Appendix A**.
2. **Sediment Fencing**
    - Sediment fences are most effective in retaining suspended solids coarser than 0.02mm.
    - All sediment fences are to be trenched vertically, in at least 150mm and buried into the soil, in order for the water to flow through and not underneath the barrier.
    - They are generally not designed to filter concentrated flows and thus must be placed following the contours at all possible instances.
    - Sediment fences last up to six months and require weekly maintenance checks, as their performance is significantly diminished when crushed by building material delivery.
    - Soil must be compacted on both sides of fence to avoid any and all seepage under the barrier.
    - When the sediment fence is installed incorrectly, water will flow through points of least resistance and will require immediate correction.
    - All sediment fences will require immediate maintenance checks following any and all storm events to minimise seepage.
    - A layout of the sediment fencing to be installed at the site construction is provided in Figure 8, **Appendix A**.
    - Diagram of sediment fencing installation and establishment is provided in Figure 10, **Appendix A**.

8.2 Operation phase

The potential impacts on surface and groundwater during the operation phase of the project are mainly consequence of the increase of impervious surfaces and accidental spills. The mitigation/control measures are presented in **Table 15**.

Table 15: Aspects, Potential Impacts and Mitigation/Control Measures – Surface and Groundwater (Operation)		
Aspects	**Potential Impacts**	**Mitigation/Control Measures**
Increase of impervious surfaces	Increase of stormwater runoff (pollutant load) and degrading water quality of downstream watercourses	• Installation of an on-site stormwater detention (OSD) and stormwater treatment system.
	Increasing of flooding risk	
Leaks or spillage of fuels, oils or grease from vehicles and equipment	• Contamination of downstream watercourses • Contamination of groundwater	• All spills on site must be cleaned up immediately to minimise pollution of stormwater and groundwater. • Emergency spill kits shall always be available on-site. All staff must be made aware of the location of the spill kit and be trained in its use.

8.3 Residual Impacts

No residual impacts for surface or groundwater surrounding the site are expected after the implementation of the mitigation measures presented in the previous sections of this report.

8.4 Monitoring

No monitoring procedures is proposed for the construction phase of the development. However, during the operation phase stormwater quality shall be monitored to ensure that the minimum pollutant removal performance targets have been achieved.

9 Conclusions and Recommendations

Raw Earth were engaged to conduct a Surface and Groundwater Impact Assessment (SGIA) at the property located at 84 Gavenlock Road, Mardi, NSW 2259. The site is described as Lot 9 Section 4 DP 3368 and comprises an approximate total area of 133,500 m². The investigation area is located on the north-west portion of the site and comprises an approximate total area of 10,000 m².

Desktop assessment indicated that the site is located within a highly urbanised catchment area with risk of flooding. The site investigation area is relatively flat, sloping slightly downhill from southwest towards northeast direction. The surface elevation ranges from 14m to 12m AHD.

Information provided by the client indicated that the dam present on site will be dewatered and infilled as part of the development. If the dam is not dewatered and infilled prior to the commencement of construction/earthworks, mitigation and control measures will be implemented to safeguard the dam against potential impacts.

Based on previous investigations and information provided by the client, regarding depth of excavation during construction works, groundwater is not expected to be encountered during the development and therefore no direct impacts are expected to be caused to groundwater. There are no aquatic or terrestrial GDE registered on site, therefore no GDE's will be impacted during construction works.

The main potential impacts identified to surrounding surface and groundwater during construction phase of the project are related to earth/works and stockpiles (erosion and release of sediments), and construction leaks and spills. Mitigation measures will be employed to minimise the risks of the potential impacts, including implementation of sediment control devices and spill management protocols.

The stormwater runoff (quality and quantity) is the main source of potential impact to surrounding surface water, during the operation phase of the project. The Stormwater Management Plan for the Eileen O'Connor Catholic School includes stormwater quantity and quality control devices to comply with CCC site discharge requirements. An underground on-site stormwater detention (OSD) system will be implemented to control stormwater quantity and limit site discharge. A stormwater treatment system will be implemented to reduce pollutants load, including a primary treatment to reduce gross pollutants and suspended solids, and tertiary treatment to reduce nutrients (nitrogen and phosphorus) and achieve the minimum pollutant removal performance targets (ARQ, 2006).

No residual impacts for surface or groundwater surrounding the site are expected after the implementation of mitigation measures presented in this report.

10 Limitations

Raw Earth Environmental Pty Ltd (Raw Earth) understands to the best of our knowledge, the information within this report is accurate at the date of issue. However, due to the irregularity and dynamic nature of subsurface conditions, soil and groundwater characteristics are capable of change over a short period of time. No warranties, expressed or implied, are made. The contents of this report must be read in full.

Raw Earth performed the services in a manner consistent with the normal level of care and expertise exercised by members of the environmental consulting profession. Regulatory criteria are subject to change, where concentrations of a particular contaminant currently considered low, could be subject to review and fall under different regulatory standards and criteria and may require remediation in the future.

The results of this assessment are based on a desktop review of available information and regulatory criteria identified at the time of the site inspection. Raw Earth will not be liable to revise the report to account for any changes in site characteristics, regulatory requirements, assessment criteria or the availability of additional information, subsequent to the issue date of this report. The scope and period of Raw Earths' services are subject to restrictions and limitations. Raw Earth did not perform a complete assessment of all possible conditions that may exist at the site.

Raw Earth takes no responsibility or liability for errors in any data obtained from scientific laboratories, regulatory agencies, statements from sources outside of Raw Earth, or developments resulting from situations outside the scope of this project.

All conclusions and recommendations regarding the site are the opinion of Raw Earth. Opinions are judgements, which are based on our understanding and interpretation of current regulatory standards and should not be construed as legal opinions.

We trust the information contained within this document meets your requirements. Should you have any queries, please do not hesitate to contact the Raw Earth.

11 References

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12 Abbreviations

Abbreviation	Full Description
AEP	Annual Exceedance Probability
ARQ	Australian Runoff Quality
ASS	Acid Sulfate Soils
BGL	Below Ground Level
CBD	Central Business District
CCC	Central Coast Council
DCP	Development Control Plan
EIA	Environmental Impact Assessment
GDE	Groundwater Dependent Ecosystems
EPA	Environment Protection Agency
OSD	On-site Stormwater Detention
PSI	Preliminary Site Investigation
RFO	River Flow Objectives
SEARs	Secretary's Environmental Assessment Requirements
SGIA	Surface and Groundwater Impact Assessment
SSDA	State Significant Development Application/Approval
TN	Total Nitrogen
TP	Total Phosphorus
TSS	Total Suspended Solids
WQO	Water Quality Objectives

Appendix A: Figures

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Figure 1:
Site Location Plan

Project:
Surface and Groundwater Impact Assessment.
84 Gavenlock Road, Mardi, NSW 2259.

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Site Boundary

Site Investigation Area

Figure 2:
Site Layout Plan

Project:
Surface and Groundwater Impact Assessment.
84 Gavenlock Road, Mardi, NSW 2259.

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N

Site Boundary

Site Investigation Area

Figure 3:
Geology Map

Project:
Surface and Groundwater Impact Assessment.
84 Gavenlock Road, Mardi, NSW 2259.

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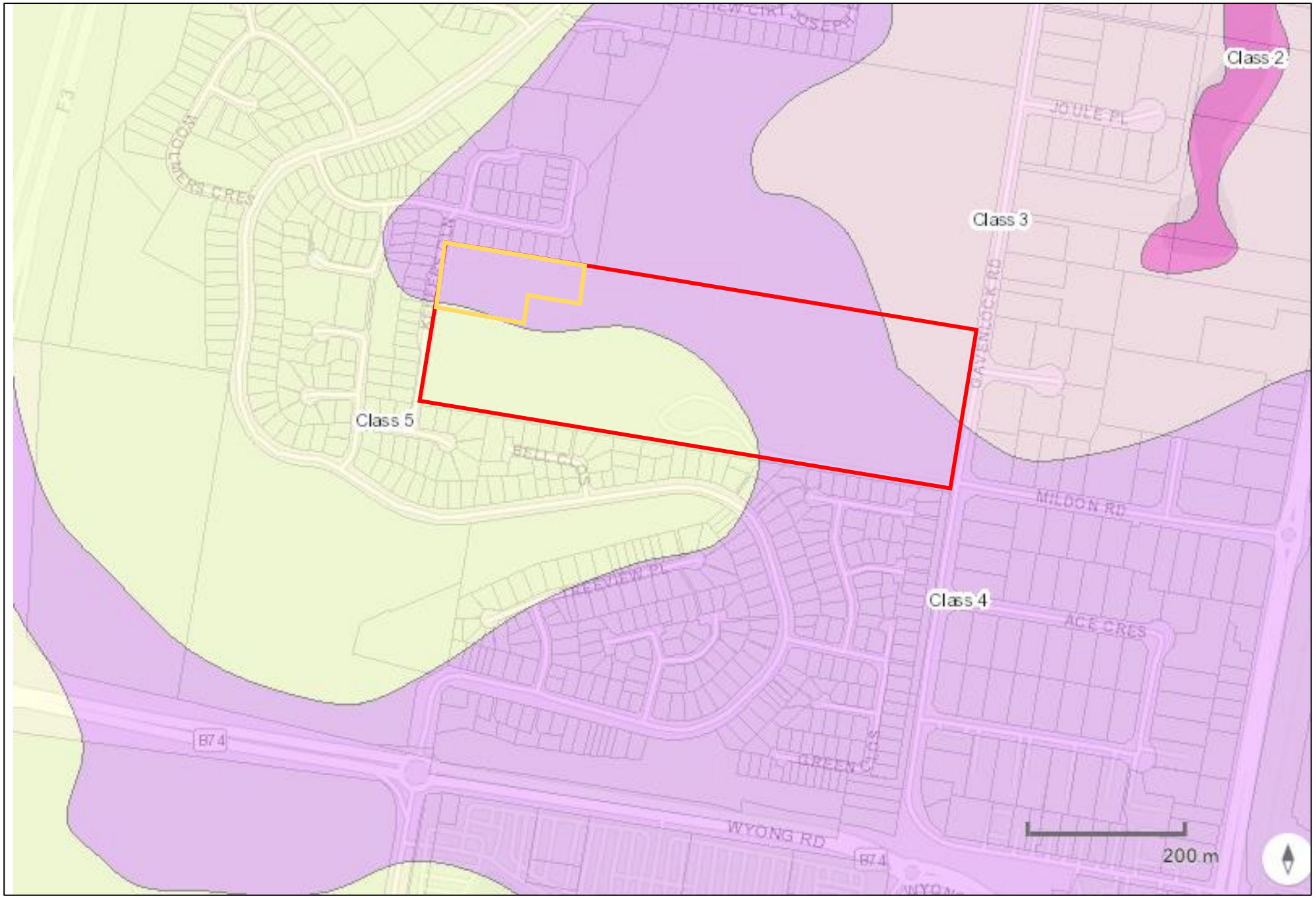

Figure 4:
Acid Sulfate Soils Map

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Surface and Groundwater Impact Assessment.
84 Gavenlock Road, Mardi, , NSW 2259.

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Site Boundary

Groundwater Bore (GW)

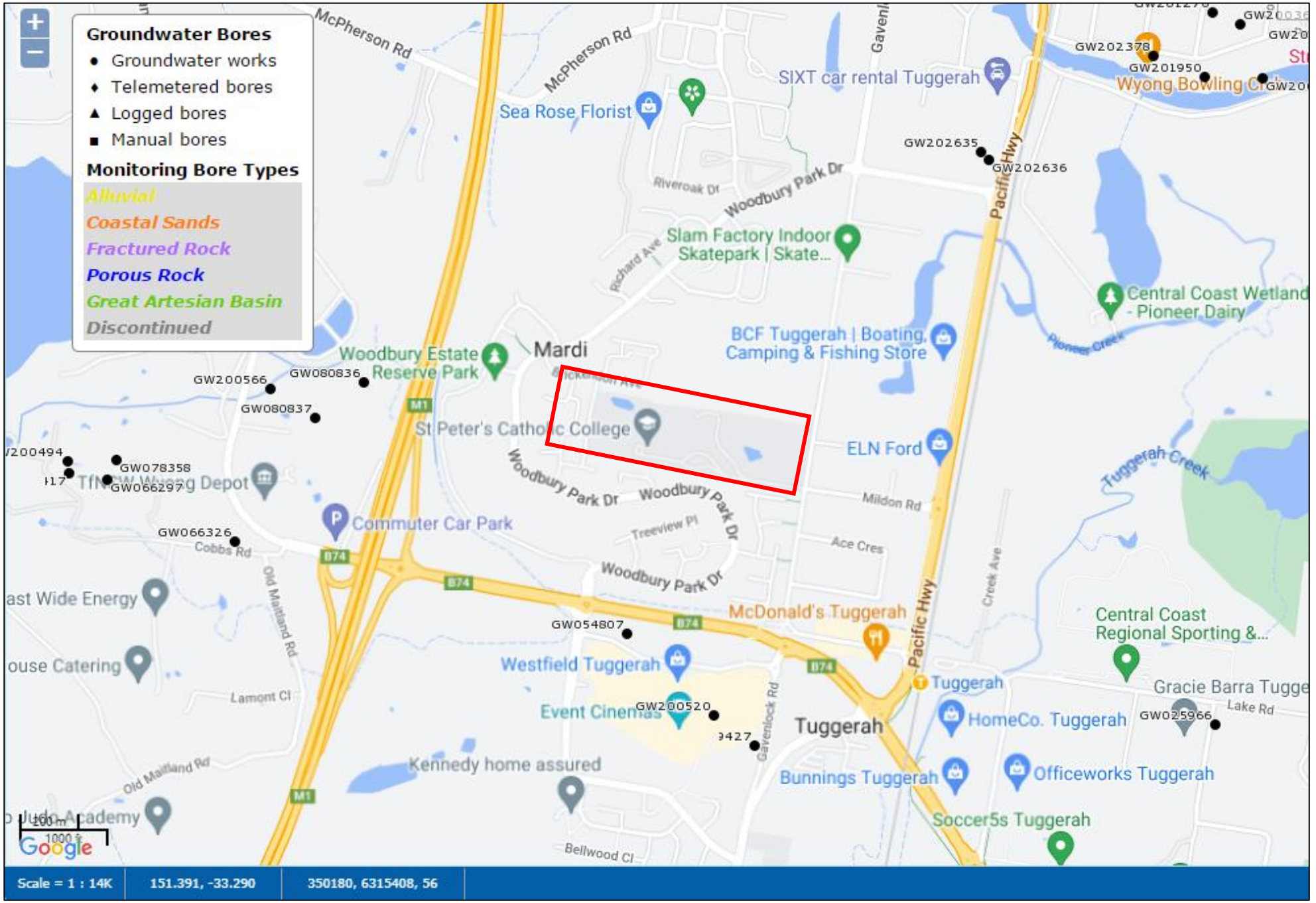

Figure 5:
Groundwater Bore Map

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Surface and Groundwater Impact Assessment.
84 Gavenlock Road, Mardi, NSW 2259.

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Site Boundary

Site Investigation Area

Borehole Location

Figure 6:
Sampling Plan (ASS Investigation)

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Surface and Groundwater Impact Assessment.
84 Gavenlock Road, Mardi, NSW 2259.

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Site Boundary

Site Investigation Area

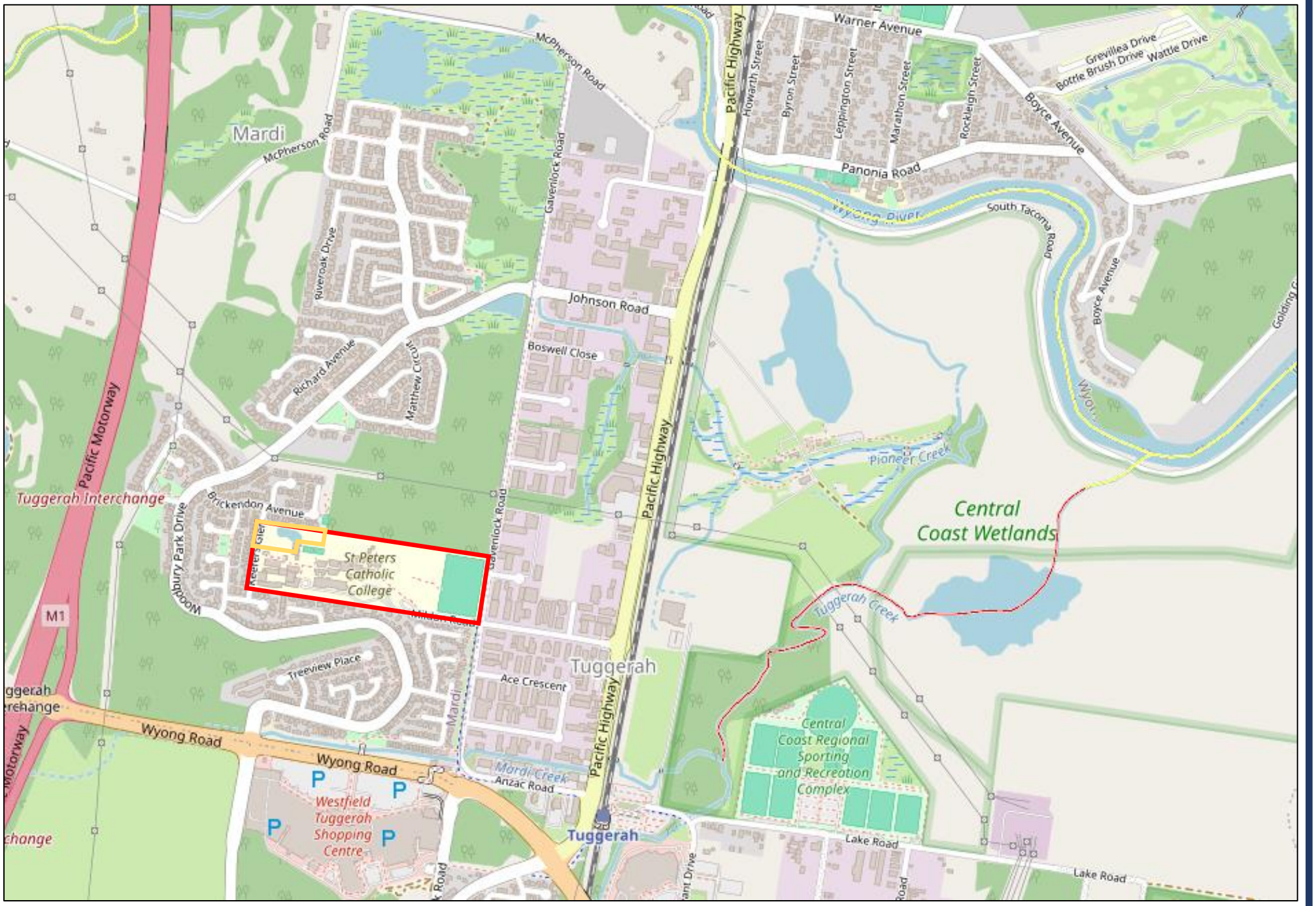

Figure 7:
Hydrology Map

Project:
Surface and Groundwater Impact Assessment.
84 Gavenlock Road, Mardi, NSW 2259.

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Site Investigation Area

Sediment Fencing

Figure 8:
Site Sediment Control Layout

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Surface and Groundwater Impact Assessment.
84 Gavenlock Road, Mardi, NSW 2259.

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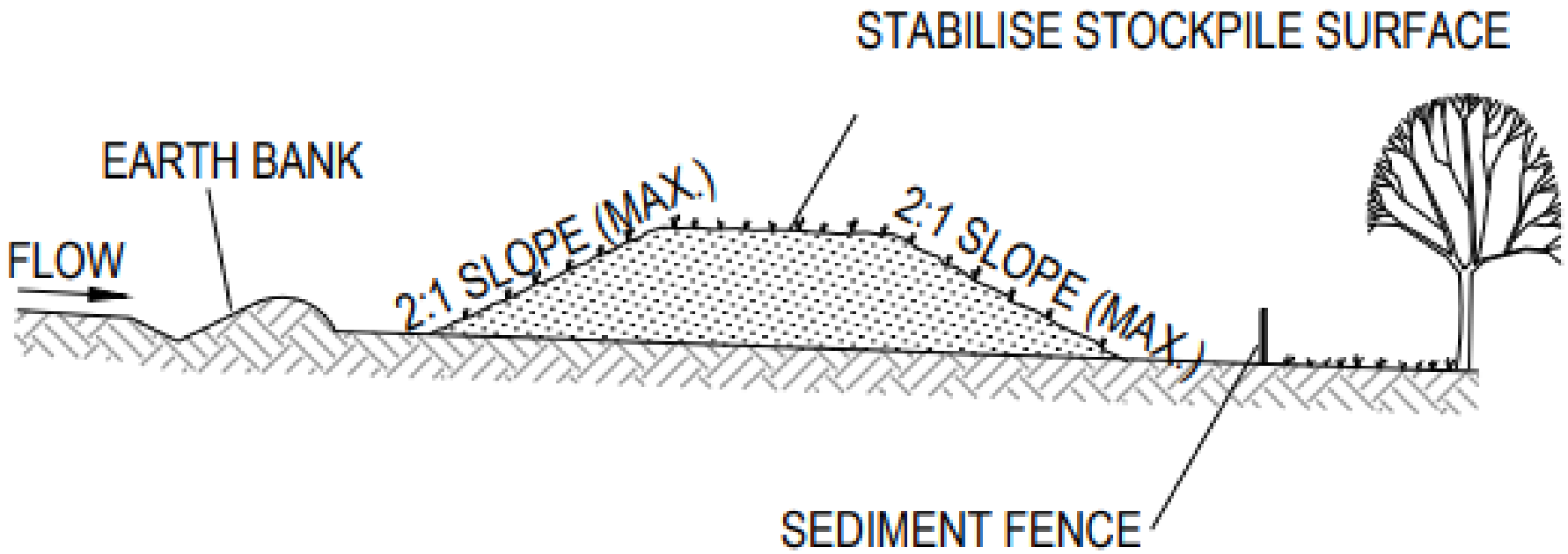

Figure 9:
Diagram of onsite stockpile establishment

Project:
Surface and Groundwater Impact Assessment.
84 Gavenlock Road, Mardi, NSW 2259.

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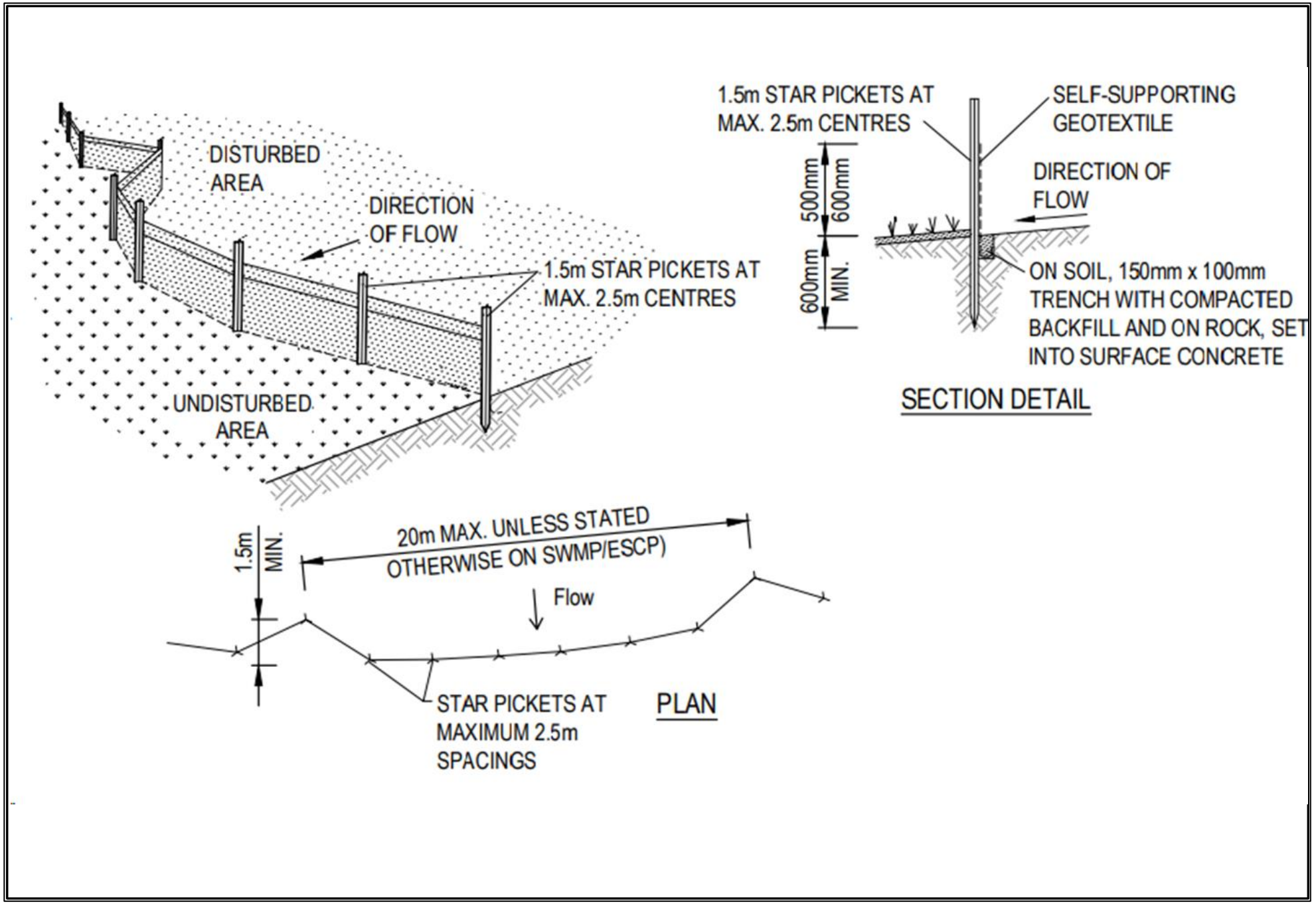

Figure 10:
Diagram of appropriate sediment fencing

Project:
Surface and Groundwater Impact Assessment.
84 Gavenlock Road, Mardi, NSW 2259.

Appendix B: EPBC Act Protected Matters Report

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected. Please see the caveat for interpretation of information provided here.

Report created: 15-May-2024

Summary

Matters of National Environment Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance (Ramsar	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	3
Listed Threatened Species:	58
Listed Migratory Species:	19

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at https://www.dcceew.gov.au/parks-heritage/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Lands:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	27
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None
Habitat Critical to the Survival of Marine Turtles:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have

State and Territory Reserves:	None
Regional Forest Agreements:	1
Nationally Important Wetlands:	None
EPBC Act Referrals:	3
Key Ecological Features (Marine):	None
Biologically Important Areas:	None
Bioregional Assessments:	1
Geological and Bioregional Assessments:	None

Details

Matters of National Environmental Significance

Listed Threatened Ecological Communities [Resource Information]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.
Status of Vulnerable, Disallowed and Ineligible are not MNES under the EPBC Act.

Community Name	Threatened Category	Presence Text
Coastal Swamp Oak (Casuarina glauca) Forest of New South Wales and South East Queensland ecological community	Endangered	Community likely to occur within area
Coastal Swamp Sclerophyll Forest of New South Wales and South East Queensland	Endangered	Community may occur within area
River-flat eucalypt forest on coastal floodplains of southern New South Wales and eastern Victoria	Critically Endangered	Community likely to occur within area

Listed Threatened Species [Resource Information]

Status of Conservation Dependent and Extinct are not MNES under the EPBC Act.
Number is the current name ID.

Scientific Name	Threatened Category	Presence Text
BIRD		
Anthochaera phrygia Regent Honeyeater [82338]	Critically Endangered	Species or species habitat known to occur within area
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat may occur within area
Calidris canutus Red Knot, Knot [855]	Vulnerable	Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Callocephalon fimbriatum Gang-gang Cockatoo [768]	Endangered	Species or species habitat known to occur within area
Calyptorhynchus lathami lathami South-eastern Glossy Black-Cockatoo [67036]	Vulnerable	Species or species habitat known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat likely to occur within area
Climacteris picumnus victoriae Brown Treecreeper (south-eastern) [67062]	Vulnerable	Species or species habitat likely to occur within area
Erythrotriorchis radiatus Red Goshawk [942]	Endangered	Species or species habitat may occur within area
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat may occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]	Vulnerable	Species or species habitat known to occur within area
Grantiella picta Painted Honeyeater [470]	Vulnerable	Species or species habitat likely to occur within area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
Melanodryas cucullata cucullata		
South-eastern Hooded Robin, Hooded Robin (south-eastern) [67093]	Endangered	Species or species habitat may occur within area
Neophema chrysostoma		
Blue-winged Parrot [726]	Vulnerable	Species or species habitat may occur within area
Numenius madagascariensis		
Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pachyptila turtur subantarctica		
Fairy Prion (southern) [64445]	Vulnerable	Species or species habitat likely to occur within area
Pycnoptilus floccosus		
Pilotbird [525]	Vulnerable	Species or species habitat may occur within area
Rostratula australis		
Australian Painted Snipe [77037]	Endangered	Species or species habitat known to occur within area
Stagonopleura guttata		
Diamond Firetail [59398]	Vulnerable	Species or species habitat known to occur within area
Sternula nereis nereis		
Australian Fairy Tern [82950]	Vulnerable	Species or species habitat may occur within area
Tringa nebularia		
Common Greenshank, Greenshank [832]	Endangered	Species or species habitat likely to occur within area
FROG		
Heleioporus australiacus		
Giant Burrowing Frog [1973]	Vulnerable	Species or species habitat likely to occur within area
Litoria aurea		
Green and Golden Bell Frog [1870]	Vulnerable	Species or species habitat likely to occur within area

Scientific Name	Threatened Category	Presence Text
Mixophyes balbus		
Stuttering Frog, Southern Barred Frog (in Victoria) [1942]	Vulnerable	Species or species habitat likely to occur within area
MAMMAL		
Chalinolobus dwyeri		
Large-eared Pied Bat, Large Pied Bat [183]	Endangered	Species or species habitat likely to occur within area
Dasyurus maculatus maculatus (SE mainland population)		
Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population) [75184]	Endangered	Species or species habitat known to occur within area
Notamacropus parma		
Parma Wallaby [89289]	Vulnerable	Species or species habitat likely to occur within area
Petauroides volans		
Greater Glider (southern and central) [254]	Endangered	Species or species habitat likely to occur within area
Petaurus australis australis		
Yellow-bellied Glider (south-eastern) [87600]	Vulnerable	Species or species habitat known to occur within area
Petrogale penicillata		
Brush-tailed Rock-wallaby [225]	Vulnerable	Species or species habitat may occur within area
Phascolarctos cinereus (combined populations of Qld, NSW and the ACT)		
Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	Endangered	Species or species habitat known to occur within area
Potorous tridactylus tridactylus		
Long-nosed Potoroo (northern) [66645]	Vulnerable	Species or species habitat likely to occur within area
Pseudomys novaehollandiae		
New Holland Mouse, Pookila [96]	Vulnerable	Species or species habitat likely to occur within area
Pteropus poliocephalus		
Grey-headed Flying-fox [186]	Vulnerable	Foraging, feeding or related behaviour known to occur within area

Scientific Name	Threatened Category	Presence Text
PLANT		
Acacia bynoeana Bynoe's Wattle, Tiny Wattle [8575]	Vulnerable	Species or species habitat may occur within area
Angophora inopina Charmhaven Apple [64832]	Vulnerable	Species or species habitat may occur within area
Caladenia tessellata Thick-lipped Spider-orchid, Daddy Long-legs [2119]	Vulnerable	Species or species habitat likely to occur within area
Cryptostylis hunteriana Leafless Tongue-orchid [19533]	Vulnerable	Species or species habitat likely to occur within area
Cynanchum elegans White-flowered Wax Plant [12533]	Endangered	Species or species habitat likely to occur within area
Diuris praecox Newcastle Doubletail [55086]	Vulnerable	Species or species habitat likely to occur within area
Eucalyptus camfieldii Camfield's Stringybark [15460]	Vulnerable	Species or species habitat may occur within area
Euphrasia arguta [4325]	Critically Endangered	Species or species habitat may occur within area
Genoplesium baueri Yellow Gnat-orchid, Bauer's Midge Orchid, Brittle Midge Orchid [7528]	Endangered	Species or species habitat may occur within area
Grevillea parviflora subsp. parviflora Small-flower Grevillea [64910]	Vulnerable	Species or species habitat likely to occur within area
Melaleuca biconvexa Biconvex Paperbark [5583]	Vulnerable	Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
Persicaria elatior Knotweed, Tall Knotweed [5831]	Vulnerable	Species or species habitat may occur within area
Rhizanthella slateri Eastern Underground Orchid [11768]	Endangered	Species or species habitat may occur within area
Rhodamnia rubescens Scrub Turpentine, Brown Malletwood [15763]	Critically Endangered	Species or species habitat known to occur within area
Rhodomyrtus psidioides Native Guava [19162]	Critically Endangered	Species or species habitat likely to occur within area
Rutidosis heterogama Heath Wrinklewort [13132]	Vulnerable	Species or species habitat likely to occur within area
Syzygium paniculatum Magenta Lilly Pilly, Magenta Cherry, Daguba, Scrub Cherry, Creek Lilly Pilly, Brush Cherry [20307]	Vulnerable	Species or species habitat known to occur within area
Tetratheca juncea Black-eyed Susan [21407]	Vulnerable	Species or species habitat likely to occur within area
Thelymitra adorata Wyong Sun Orchid [84724]	Critically Endangered	Species or species habitat likely to occur within area
Thesium australe Austral Toadflax, Toadflax [15202]	Vulnerable	Species or species habitat likely to occur within area
REPTILE		
Hoplocephalus bungaroides Broad-headed Snake [1182]	Endangered	Species or species habitat may occur within area

Listed Migratory Species		[Resource Information]
Scientific Name	Threatened Category	Presence Text
Migratory Marine Birds		

Scientific Name	Threatened Category	Presence Text
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat known to occur within area
Migratory Terrestrial Species		
Cuculus optatus Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat may occur within area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat likely to occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area
Symposiachrus trivirgatus as Monarcha trivirgatus Spectacled Monarch [83946]		Species or species habitat may occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Calidris canutus		
Red Knot, Knot [855]	Vulnerable	Species or species habitat may occur within area
Calidris ferruginea		
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos		
Pectoral Sandpiper [858]		Species or species habitat may occur within area
Charadrius leschenaultii		
Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat likely to occur within area
Gallinago hardwickii		
Latham's Snipe, Japanese Snipe [863]	Vulnerable	Species or species habitat known to occur within area
Numenius madagascariensis		
Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus		
Osprey [952]		Breeding known to occur within area
Tringa nebularia		
Common Greenshank, Greenshank [832]	Endangered	Species or species habitat likely to occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species		[Resource Information]
Scientific Name	Threatened Category	Presence Text
Bird		
Actitis hypoleucos		
Common Sandpiper [59309]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area overfly marine area
Bubulcus ibis as Ardea ibis Cattle Egret [66521]		Species or species habitat may occur within area overfly marine area
Calidris acuminata Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat may occur within area
Calidris canutus Red Knot, Knot [855]	Vulnerable	Species or species habitat may occur within area overfly marine area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area overfly marine area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area overfly marine area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat likely to occur within area
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat known to occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]	Vulnerable	Species or species habitat known to occur within area overfly marine area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area overfly marine area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat known to occur within area overfly marine area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area overfly marine area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area overfly marine area
Motacilla flava Yellow Wagtail [644]		Species or species habitat likely to occur within area overfly marine area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area overfly marine area
Neophema chrysostoma Blue-winged Parrot [726]	Vulnerable	Species or species habitat may occur within area overfly marine area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pachyptila turtur Fairy Prion [1066]		Species or species habitat likely to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area

Scientific Name	Threatened Category	Presence Text
Pterodroma cervicalis White-necked Petrel [59642]		Species or species habitat may occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area overfly marine area
Rostratula australis as Rostratula benghalensis (sensu lato) Australian Painted Snipe [77037]	Endangered	Species or species habitat known to occur within area overfly marine area
Sterna striata White-fronted Tern [799]		Migration route may occur within area
Symposiachrus trivirgatus as Monarcha trivirgatus Spectacled Monarch [83946]		Species or species habitat may occur within area overfly marine area
Tringa nebularia Common Greenshank, Greenshank [832]	Endangered	Species or species habitat likely to occur within area overfly marine area

Extra Information

Regional Forest Agreements [Resource Information]

Note that all areas with completed RFAs have been included. Please see the associated resource information for specific caveats and use limitations associated with RFA boundary information.

RFA Name	State
North East NSW RFA	New South Wales

EPBC Act Referrals [Resource Information]

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action			
Development of Westfield Limited land holdings at Tuggerah	2010/5562	Not Controlled Action	Completed
Improving rabbit biocontrol: releasing another strain of RHDV, sthrn two thirds of Australia	2015/7522	Not Controlled Action	Completed

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action			
Not controlled action (particular manner)			
330kV Transmission Line	2002/863	Not Controlled Action (Particular Manner)	Post-Approval

Bioregional Assessments [Resource Information]

SubRegion	BioRegion	Website
Hunter	Northern Sydney Basin	BA website

Caveat

1 PURPOSE

This report is designed to assist in identifying the location of matters of national environmental significance (MNES) and other matters protected by the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) which may be relevant in determining obligations and requirements under the EPBC Act.

The report contains the mapped locations of:

- World and National Heritage properties;
- Wetlands of International and National Importance;
- Commonwealth and State/Territory reserves;
- distribution of listed threatened, migratory and marine species;
- listed threatened ecological communities; and
- other information that may be useful as an indicator of potential habitat value.

2 DISCLAIMER

This report is not intended to be exhaustive and should only be relied upon as a general guide as mapped data is not available for all species or ecological communities listed under the EPBC Act (see below). Persons seeking to use the information contained in this report to inform the referral of a proposed action under the EPBC Act should consider the limitations noted below and whether additional information is required to determine the existence and location of MNES and other protected matters.

Where data are available to inform the mapping of protected species, the presence type (e.g. known, likely or may occur) that can be determined from the data is indicated in general terms. It is the responsibility of any person using or relying on the information in this report to ensure that it is suitable for the circumstances of any proposed use. The Commonwealth cannot accept responsibility for the consequences of any use of the report or any part thereof. To the maximum extent allowed under governing law, the Commonwealth will not be liable for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance

3 DATA SOURCES

Threatened ecological communities

For threatened ecological communities where the distribution is well known, maps are generated based on information contained in recovery plans, State vegetation maps and remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species

Threatened, migratory and marine species distributions have been discerned through a variety of methods. Where distributions are well known and if time permits, distributions are inferred from either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc.) together with point locations and described habitat; or modelled (MAXENT or BIOCLIM habitat modelling) using

Where little information is available for a species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc.).

In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More detailed distribution mapping methods are used to update these distributions

4 LIMITATIONS

The following species and ecological communities have not been mapped and do not appear in this report:

- threatened species listed as extinct or considered vagrants;
- some recently listed species and ecological communities;
- some listed migratory and listed marine species, which are not listed as threatened species; and
- migratory species that are very widespread, vagrant, or only occur in Australia in small numbers.

The following groups have been mapped, but may not cover the complete distribution of the species:

- listed migratory and/or listed marine seabirds, which are not listed as threatened, have only been mapped for recorded
- seals which have only been mapped for breeding sites near the Australian continent

The breeding sites may be important for the protection of the Commonwealth Marine environment.

Refer to the metadata for the feature group (using the Resource Information link) for the currency of the information.

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact us page.

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