Preliminary Hydrogeological Assessment

Macorna Wind Farm

Atmos MWV Pty Ltd.

Level 9, 123 Pitt Street, Sydney NSW 2000

Prepared by:

SLR Consulting Australia Pty Ltd

SLR Project No.: 640.031876.00006

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Revision Record

Revision	Date	Prepared By	Checked By	Authorised By
1.0	03/02/2026	E Quartero	S Hulbert	DRAFT
2.0	20/03/2026	E Quartero	S Hulbert	FINAL
3.0	20/04/2026	E Quartero/S Hulbert	S Hulbert	FINAL (minor updates)
4.0	24/04/2026	E Quartero/S Hulbert	S Hulbert	FINAL (minor updates)

Basis of Report

This report has been prepared by Select SLR entity (SLR) with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with Atmos Renewables (the Client). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

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SLR disclaims any responsibility to the Client and others in respect of any matters outside the agreed scope of the work.

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Acronyms and Abbreviations

BOM	Bureau of Meteorology
Cth	Commonwealth of Australia
EES	Environment Effects Statement
EMP	Environmental Management Plan
EPA	Environment Protection Authority
GED	General Environmental Duty (under the *Environment Protection Act 2017*)
GDE	Groundwater Dependent Ecosystem
REZ	Renewable Energy Zone
VVG	Visualising Victoria's Groundwater (2022)
WTG	Wind Turbine Generator

1.0 Introduction

This report presents a Preliminary Hydrogeological Assessment prepared to support the early-stage design and approvals process for the proposed Macorna Wind Farm in northern Victoria. The assessment has been undertaken to characterise the local and regional hydrogeological setting, with specific consideration of aquifer conditions, groundwater quality, flow dynamics, and the presence of sensitive receptors, including licensed groundwater users and potential groundwater dependent ecosystems (GDEs). The findings are intended to inform a self-assessment under the Environment Effects Act 1978 (Vic), support referral decision-making under the Environment Protection and Biodiversity Conservation Act 1999 (Cth), guide relevant statutory approvals under the Water Act 1989 (Vic) and Environment Protection Act 2017 (Vic), and future planning permit applications where applicable.

The assessment is based on a desktop review of publicly available datasets and previous investigations and includes a qualitative risk evaluation of potential groundwater-related impacts associated with the construction and operation of wind energy infrastructure. Where potential risks are identified, preliminary recommendations are provided for monitoring and management. This report forms part of a broader suite of technical studies being undertaken to support the development of the Macorna Wind Farm.

2.0 Project Description

2.1 Project Overview

The Macorna Wind Farm (MAWF) is a proposed approximately 820.8 megawatt (MW) wind farm comprised of up to 114 wind turbine generators (WTGs) (the Project). The turbines are proposed to be the Vestas V172 7.2 MW with a hub height of up to 166 metres (m).

Atmos Renewables (Atmos) on behalf of the Macorna SPV – Atmos MWV Pty Ltd as trustee for the Atmos MHV Trust (Proponent) is the Project's implementing organisation.

The Project is proposed to be located within and surrounding the locality of Macorna in the Gannawarra Shire and Loddon local government areas, within Victoria's Loddon Mallee Region. The Project comprises 26 landholdings. The Project Area is approximately 23,000 hectares (ha), with an expected development or construction footprint of approximately 749.75 ha.

Development of the Project is expected to involve:

- Foundations, crane hardstand, crane boom laydown blade laydown and a rotor assembly area
- Access tracks, including:
    - new and upgraded tracks within Project Area generally comprising a nominal 6.5 m wide access track for light vehicles
    - 30-40 m wide corridor for oversize overmass (OSOM) vehicles within the Project Area
- Upgrades to the proposed transport access route, as required
- Underground cabling (low voltage (LV) and medium voltage (MV)) and overhead transmission lines (MV and high voltage (HV)) within the Project Area
- Up to four collector substations, with associated battery energy storage systems (BESS) (size and duration to be determined)

- Connection to the grid via the adjacent proposed Victoria to New South Wales Interconnector (VNI) West Tragowel terminal station
- Electrical switching station (noting that the switching station infrastructure will be constructed, owned and operated by the electricity provider, rather than the Proponent)
- Up to seven permanent meteorological masts
- Construction compounds and laydown areas
- Concrete batching plants
- Operational and maintenance facilities
- Potential construction workers accommodation facility
- Potential communications towers
- Native vegetation removal and vegetation screening as required and identified by technical assessments
- Fencing, gates and signage.

Construction is expected to commence in 2029 (subject to planning and environmental approvals). The construction phase is expected to be completed over 3.5 years, with initial energisation/operations expected to occur from late 2030. The Project may be delivered in stages. It is also noted that the Projects schedule is currently aligned to the delivery of the VNI West project, which provides the proposed connection point for the Project.

2.2 Site Location

The proposed location of the Project at Faulkner Road, Tragowel 3579, is within and surrounding the locality of Macorna in the Gannawarra Shire and Loddon local government areas (LGAs). The Project is located in Victoria's Loddon Mallee Region.

The Project comprises approximately 26 landowner groups, within the localities of Macorna, Macorna North, Loddon Vale, Tragowel, Mincha West and Macorna North. The Project Area is approximately 23,000 hectares (ha), with an expected development or construction footprint of 912 ha.

Figure 1 presents a Project Area Plan, outlining the various features of the Project Area including:

- The Study Area – Approximately 26,000 ha – the broad area investigated for the Project
- The Project Area – Approximately 23,000 ha – the properties investigated for inclusion in the Project
- Temporary construction footprint – 749.75 ha – the land proposed to be disturbed for the purposes of construction of the Project

Of the temporary construction footprint, an estimated 40% of this area will remain as the development footprint for use during operation of the Project.

The majority of land within the Project Area would be undeveloped and used exclusively for existing agricultural and farming practices during the construction and operations phases of the Project.

The Project is proximate to the Kerang Ramsar wetland group, with the Johnson Swamp and Hird Swamp adjacent to the northeast boundary of the Project Area. Tragowel Swamp is found to the west of the site, whilst Two Mile Swamp and two other identified potential GDEs can be found to the east. Several drainage channels and creeks, including the Nine Mile Creek, intersect the Project Area. Pyramid Creek is located along the eastern boundary of the Project Area.

2.3 Project Phases

2.3.1 Construction Phase

Construction is expected to commence in 2029 (subject to planning and environmental approvals). The construction phase is expected to be completed over 3.5 years, with initial energisation/operations expected to occur from late 2030. The project may be delivered in stages. It is also noted that the Projects schedule is currently aligned to the delivery of the VNI West project, which provides the proposed connection point for the Project.

The construction phase is expected to employ a workforce of 375 full-time employees (FTE), across the construction, transport, professional and technical services, and administrative and support services industries.

The Project is expected to require the following pre-construction and construction activities:

- Site establishment works, including temporary site fencing, hoarding, erection of site offices and vehicle parking areas
- Site clearance and levelling
- Construction of temporary access roads, diversion roads and vehicle parking areas
- Construction, protection, modification, removal or relocation of utility services
- Establishing environmental and traffic controls, including designation of ‘no-go’ zones
- Establishing erosion and sediment control measures
- Clear and remove vegetation as required
- Earthworks, including for construction of internal roads, drainage, laydown areas, wind turbine foundations and assembly areas
- Pavement construction, including for internal roads, drainage, laydown areas and wind turbine assembly areas
- Drainage for the construction for roads, waterways and site flood mitigation
- Delivery of WTG components to site
- Construction, assembly and erection of WTG
- Construction of electrical reticulation from WTG to substation, including trenching and directional drilling for underground cabling
- Construction of O&M facility and site office
- Construction of the BESS, and ancillary infrastructure, including all earthworks, benching, pavement, drainage, concrete foundations, steel structures and all electrical equipment installation
- Construction of overhead transmission infrastructure, including concrete foundations, steel towers and overhead lines
- Installation of meteorological masts

- Site investigation, and quality assurance inspections and testing activities, including geotechnical testing, permanent works materials sampling and testing
- Commissioning and energisation activities
- Removal of temporary works and construction facilities
- Reinstatement of temporarily disturbed land

2.3.2 Operational Phase

The Project's operational life is expected to be between 30 and 35 years.

The Project is expected to employ 18 FTE staff during the operations and maintenance phase, covering electricity generation, professional and technical services, and administrative and support services industries.

During this period, operation, maintenance and monitoring of the wind farm would include the following activities:

- Service of the wind turbines and associated infrastructure
- Ongoing maintenance of on-site facilities, internal access tracks and electrical infrastructure
- Administrative tasks
- Use and maintenance of buildings and plant, including the O&M facility
- Ongoing environmental monitoring in accordance with operational requirements and relevant approval conditions.

A Supervisory Control and Data Acquisition (SCADA) system and other site equipment, including the meteorological masts, would enable remote monitoring and control of the Project's electricity generation.

Underground assets, including cables and joints, are not expected to require maintenance.

Regular monitoring would be undertaken by the Proponent remotely.

2.3.3 Decommissioning Phase

The WTGs have a typical life of 30 to 35 years. At the end of its wind farm's operational life, there are three main options available:

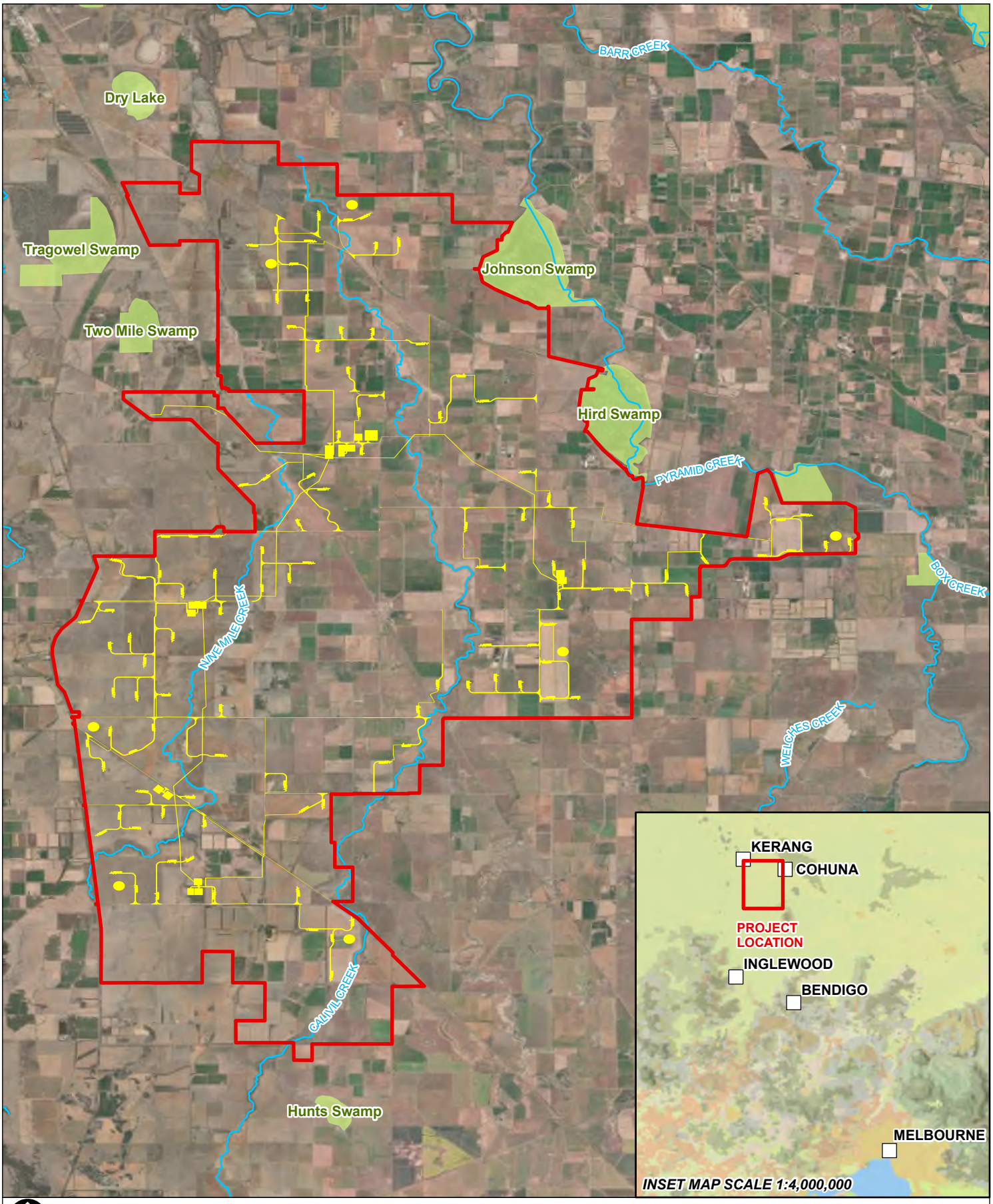
- Repair or replace any required main components and continue to use the existing WTGs
- Replace the WTGs with new technology at that time and continue the wind farm use (which would be subject to new planning permit applications)
- Decommission the wind farm and remove the WTGs and infrastructure in accordance with the provisions of the landowner agreement.

Decommissioning activities will adopt a similar method to those utilised in the construction phase of the Project. When decommissioning occurs:

- Key stakeholders, landholders and community members will be consulted
- All above ground structures not required for the ongoing agricultural use of the land will be removed and the land rehabilitated to ensure it can be returned to agricultural use

- Access tracks and hardstands that are not required or requested by the landowners to be retained will be removed and land rehabilitated and returned to a suitable condition for agricultural use
- Associated below ground infrastructure, including cabling and WTG foundations, would be left in place below a certain depth and appropriately managed to avoid further disturbance, and minimise clearing of revegetated areas
- Rehabilitated areas will be adequately graded to reflect the slope of the surrounding area and mitigate risk of soil erosion
- All materials removed will be sorted for reuse and/or recycling where possible or adequately disposed of in accordance with applicable policy and regulations.

The Project will comply with any relevant requirements for decommissioning under the planning approval and / or any permit or licence that may be required. The decommissioning process will be carried out in line with the Project's decommissioning and rehabilitation plan, that will be prepared in accordance with relevant regulatory requirements and the best practice methods available at the time of decommissioning.



0 2.5 5 km

Coordinate System:	GDA2020
Scale:	1:160,000 at A4
Project Number:	640.031876.00001
Date Drawn:	20-Mar-2026
Drawn by:	AS

LEGEND

- Watercourse
- Project Boundary
- Construction Footprint
- GDE (Groundwater Dependant Ecosystem)

MACORNA WIND FARM

SITE LOCATION

SLR

FIGURE 1

Path: \\au.slr.local\Corporate\Projects-SLR\640-MEL\640-MEL\640.031876.00001 Macorna Wind Farm\06 SLR Data\01 GIS\GIS\640031876_Macorna_Wind_Farm\640031876_Macorna_Wind_Farm.aprx\640031876_GW_F01_Site Location

3.0 Legislative and Policy Framework

The proposed Macorna Wind Farm is subject to a range of Commonwealth and State legislation, policies, and guidelines that govern groundwater protection, management, and use in Victoria. These frameworks are relevant due to the potential for construction activities to intersect with shallow aquifers, and the proximity of environmentally sensitive receptors, including wetlands and potential groundwater-dependent ecosystems.

Table 1 summaries relevant high level regulatory policy to inform the assessment of groundwater-related impacts associated with the project and establishes the statutory context within which potential risks must be evaluated and managed.

Table 1 Legislative, policy, guidelines and standards relevant to the project

Legislative Framework	Summary	Relevance to Project
Water Act 1989 (Vic)	Provides the legal framework for the management, allocation, and use of Victoria's surface water and groundwater resources. License or Works Approval required for: • Water extraction or groundwater take • Any works or infrastructure that interfere with waterway or aquifer This applies to all groundwater users	Any potential groundwater or surface water take related to the project is subject to the Act
Environment Protection Act 2017 (Vic)	The *Environment Protection Act 2017* (EP Act) provides a legislative framework to protect the environment and human health in Victoria, including the protection of air, land and water from pollution and waste. The EP Act introduces: • A general environmental duty (GED), which requires everyone, including businesses and individuals, conducting activities that pose a risk to human health or the environment from pollution or waste to understand those risks and take reasonably practicable steps to eliminate or minimise them. • A duty to notify, which requires a person in management or control of land to notify EPA as soon as practicable if the contamination or pollution incident may pose a risk to human health or the environment.	Any Potential risks to Groundwater, related to the project, are subject to the act. In determining whether it is reasonably practicable to minimise risks of harm to human health and the environment, the following matters are relevant: • The likelihood of the risk eventuating • The degree of harm that would result if the risk eventuated • What the person knows, or ought reasonably to know about the harm or risks of harm and ways of eliminating or reducing those risks • The availability and suitability of ways to eliminate or reduce the risk • The cost of eliminating or reducing the risk.

Legislative Framework	Summary	Relevance to Project
Environment Effects Act 1978 (Vic)	Assessment of the Potential Environmental impacts or effects of a proposed development may be required. The Act Outlines specific Environmental Effects Statement (EES) requirements	Potential effects to Groundwater Dependant Ecosystems (GDE) may indicate whether a EES is required If an Environmental Effects Statement (EES) is required the project proponent is responsible for preparing the EES and undertaking the necessary investigations
Groundwater Management Areas (GMAs)	GMAs are defined by hydrogeological boundaries and identify aquifer-specific restrictions and water allocation limits. The purpose of GMAs is to sustainably manage groundwater resources.	If the site falls under Victorian Groundwater Area, any restrictions or permissible extraction limits that must be respected.
Water for Victoria (2016)	Provides strategic plan for groundwater. Water for Victoria is a plan for a future with less water as Victoria responds to the impact of climate change and a growing population	Several Water for Victoria Actions are relevant to groundwater: • Action 2.1 – Achieve net-zero emissions in the water sector; • Action 2.3 – Leading climate change adaptation across Victoria's water system; • Action 3.2 – Stronger catchment management and long-term investment in waterway health; • Action 8.2 – Investigating increased flexibility and choice for licence-holders; • Action 8.5 – Improving rural water supply planning; • Action 8.10 – Provide clear information about water resources to the community; • Action 8.11 – Improve water resource information to support planning and decisions; • Action 9.6 – Improve trading rules in northern Victoria; and • Action 9.7 – Develop trading rules in other water systems.

Consideration of relevant legislative and policy frameworks is beneficial to review that the proposed development complies with legislated obligations, protects groundwater resources, and avoids adverse effects to environmental receptors. These provide the regulatory framework for assessing groundwater-related risks, decision-making, and informing any approvals, licensing, or mitigation measures that may be required.

4.0 Hydrogeological Characterisation

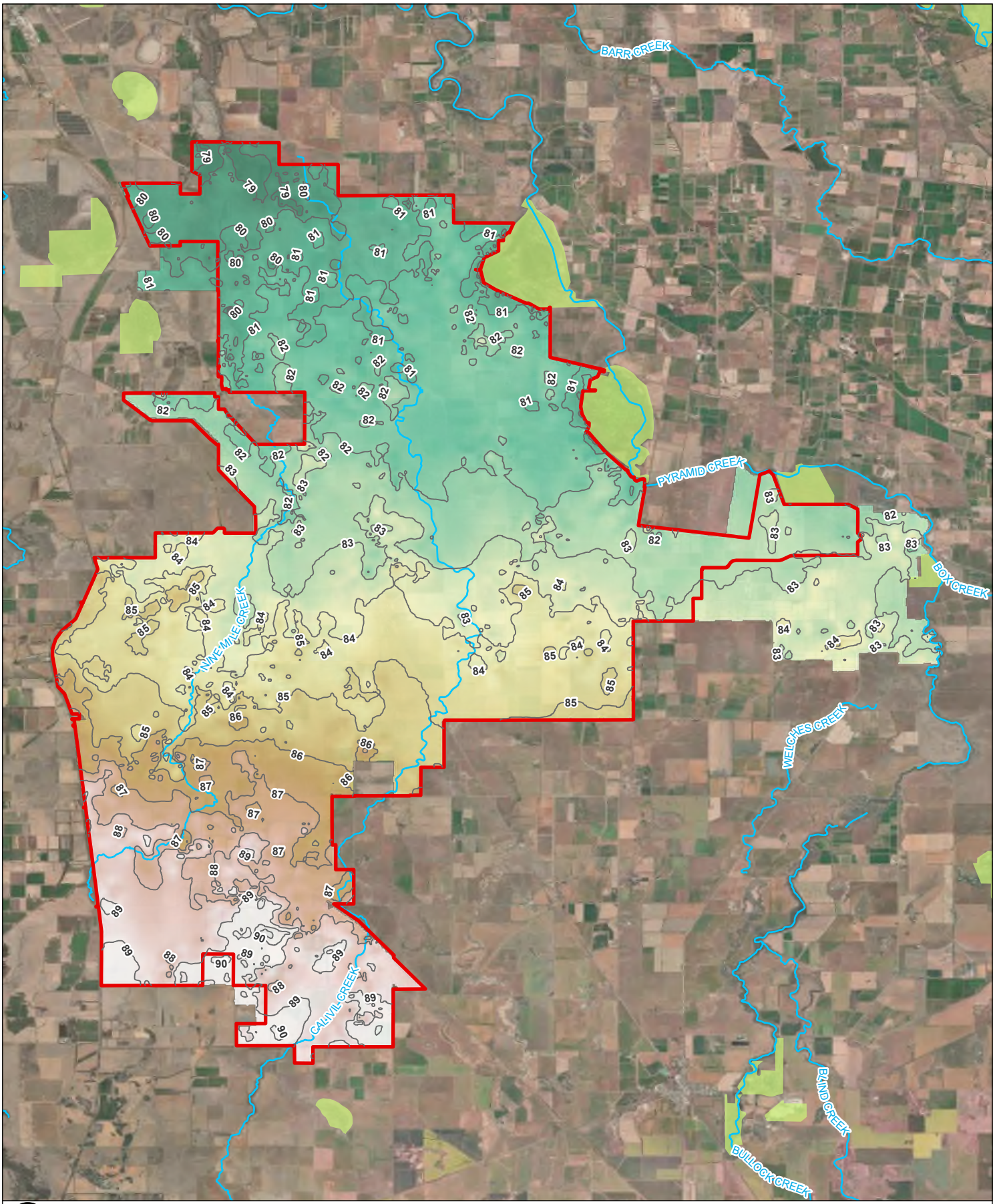
4.1 Topography and Drainage

The topography of the area surrounding and including the Project is generally flat to gently undulating. The proposed Project site encompasses 30,000 hectares ranging from 90 mAHD at the southern end of the site boundary to 80 mAHD to the north, indicating a gentle slope towards Pyramid Creek (**Figure 2**).

The site is located in the Loddon River basin with Bannagher Creek flowing south to north to the west of the site, and Pyramid Creek to the north-east also flowing south to north. Few permanent water course features appear to intersect the Project site boundaries. However, Calivil Creek and Nine Mile Creek bisect the Project area, carrying surface water flow south to the north, as well, numerous drainage features such as low-lying depressions, constructed ditches and ephemeral creeks, are present.

Pyramid Creek is classified as a “very poor”, according to the 2010 Index of Stream Condition (ISC) assessment (“*Monitoring waterways”*, cited January 2026).

The site is located near several wildlife nature conservation areas identified as potential Groundwater Dependant Ecosystems (GDEs). Two Mile Swamp and Tragowel Swamp Nature Conservation Reserve are located to the northwest margin of the Project site boundary and receives surface water flow from Bannagher Creek. To the northeastern site boundary, Johnson Swamp and Hird Swamp Wildlife Reserve connect to the surface flow of Pyramid Creek swamp roughly three (3) km downstream of Hird Swamp. Other GDE areas (Dry Lake, and Hunts Swamp) do not appear to contribute to the site drainage.



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Coordinate System:	GDA2020
Scale:	1:160,000 at A4
Project Number:	640.031876.00001
Date Drawn:	21-Apr-2026
Drawn by:	AS

LEGEND

- Watercourse
- Project Boundary
- GDE (Groundwater Dependant Ecosystem)
- Topographic Contour (mAHD)

Topography (mAHD)

91

77

MACORNA WIND FARM

SITE TOPOGRAPHY

SLR

FIGURE 2

Path: H:\Projects-SLR\640-MEL\640-MEL\640.031876.00001 Macorna Wind Farm\06 SLR Data\01 GIS\GIS\640031876_Macorna_Wind_Farm\640031876_Macorna_Wind_Farm_v2.aprx\640031876_GW_F02_Site Topography

4.2 Geology

4.2.1 Surface Geology

The creek beds of Cavil Creek and Nine Mile Creek are interpreted to correspond with 5-10 metres (m) of Quaternary alluvium (Geo Vic Online). The alluvium consists of re-worked and deposited sediments by the respective flowing creeks. The remainder of the site is dominated by the Shepparton Formation. This is a Late Pliocene-Quaternary sedimentary unit is also fluvial in nature, comprising predominantly gravel, sand, silt, clay, and limestone. The Shepparton Formation is highly heterogenous alternating between fluvio-lacustrine clay and sand and gravel lenses. The average thickness of this unit is approximately 30 m and represents the most recent phase fluvial lacustrine deposition of the Murray basin (WMC, 1999). The surficial geology is shown on **Figure 3.**

4.2.2 Bedrock Geology

Underlying the unconsolidated outcropping sediments is the Late Miocene to Pliocene Parilla Sand. This is a marine sequence which covers much of the Murray basin. The Parilla Sand is anticipated to be roughly 50 m in thickness near the Macorna area. Underlying this is the Cavil and Onley Formations, which are dated to Eocene to Pliocene. Whilst the Calivil Formation is fluvial in origin, the Onley Formation has more marine influence with fine grained carbonaceous silt and clay with brown coal. The combined Formation thickness is expected to be approximately 20 to 30 m (WMC, 1999).

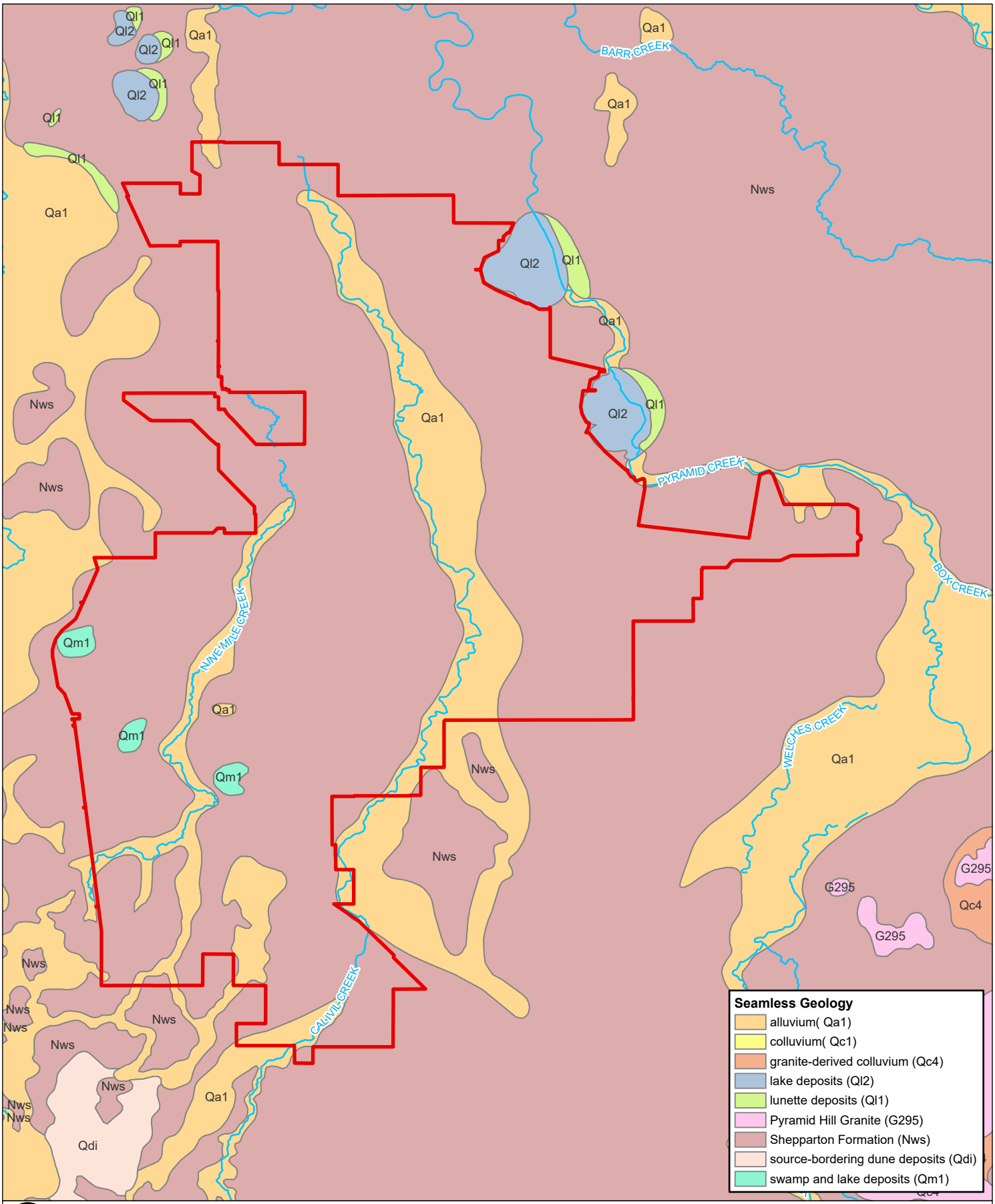
4.2.3 Basement

The Basement bedrock is composed of Devonian granite and Ordovician turbidites. Basement units are considered to define the vertical hydrogeological boundary. Groundwater flow from the overlying sedimentary units is expected to be negligible when considering the project sites groundwater flow regime.

A summary of the stratigraphy from youngest to oldest (surface to basement) in presented in Table 2 below.

Table 2 Site geology profile (WMC, 1999)

Age	Geological Unit	Lithology
Late Pliocene- Quaternary	Alluvium, Shepparton Fm	Surface Alluvium
Eocene to Pliocene	Parilla Sand, Calivil, and Onley Formations	Marine and non-marine Sandstone/Mudstone
Devonian to Ordovician	Basement	Granite and Turbidites



0 2.5 5 km

LEGEND

Project Boundary

Watercourse

Coordinate System:	GDA2020
Scale:	1:160,000 at A4
Project Number:	640.031876.00001
Date Drawn:	20-Mar-2026
Drawn by:	AS

MACORNA WIND FARM

SEAMLESS GEOLOGY

SLR

FIGURE 3

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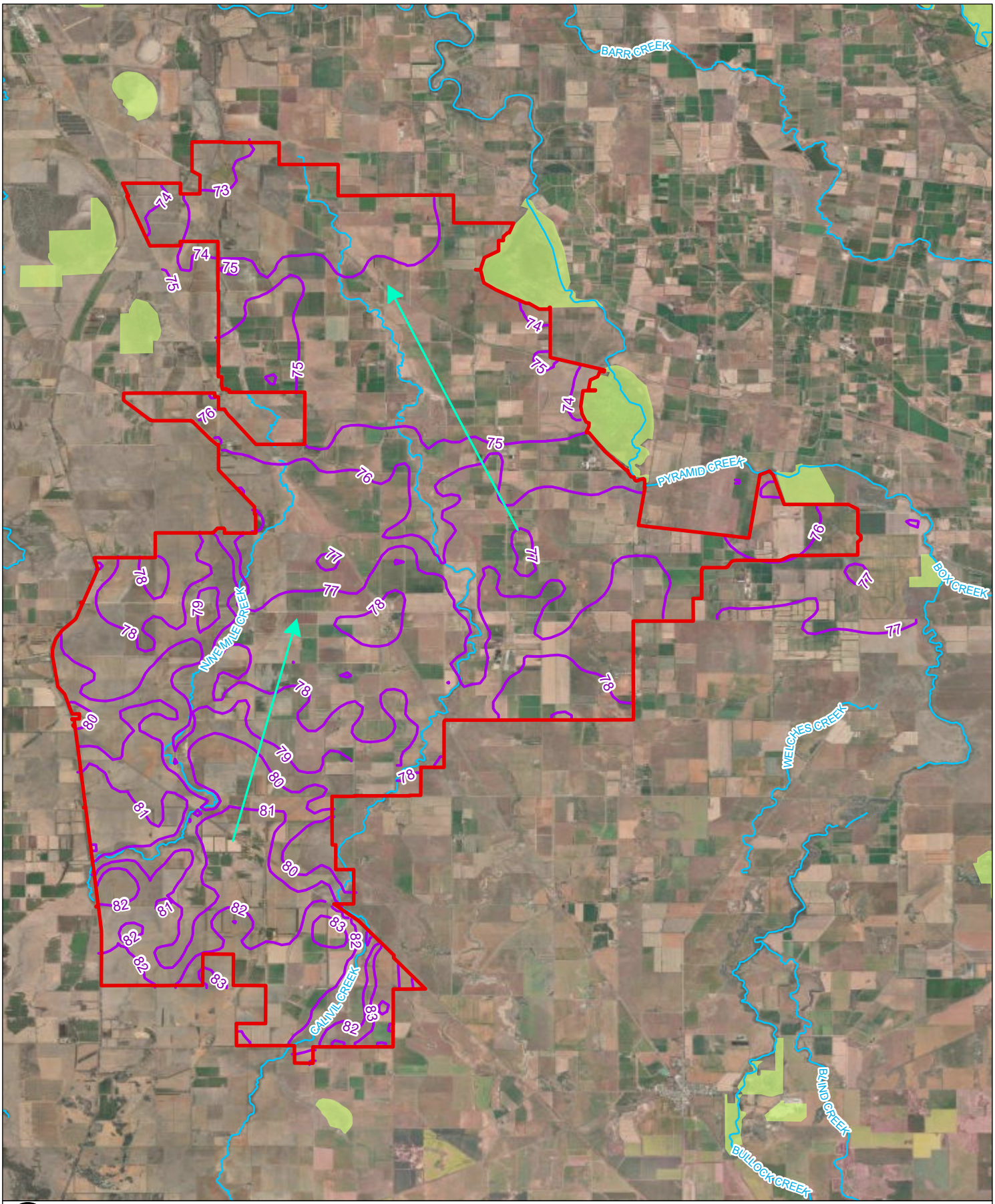
4.3 Hydrogeology

The shallow groundwater table occurs within the alluvium and unconsolidated Shepparton formation with average water levels 2.5 m below ground level (mbgl). The aquifer is unconfined with groundwater flow and hydraulic conductivity primarily controlled by the intergranular porosity. Alluvial and fluvial sediments with high degree of heterogeneity will result in spatial changes in the hydraulic properties within the aquifer, with areas of higher clay and silt content correlation with decreased hydraulic conductivity as the finer-grained material decrease the available interconnected pores space.

4.3.1 Groundwater Levels and Flow

Groundwater flow is dominated primarily by topography in the project area. Visualising Victoria's Groundwater (VVG) provides groundwater elevation maps based on the publicly available Water Measurement Information System (WMIS) database. **Figure 4** shows the water table elevation map within the project area. Groundwater elevations vary from 85 m AHD to 70 m AHD with high elevation levels concentrated to the south end of the project area. Regionally groundwater would flow from south to north with a regional gradient of 0.0006 m/m, local topography and drainage would result in spatial variations both in direction and gradient, however groundwater travel times are expected to be slow, beneficial for spill response and remediation, if necessary.



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Date Drawn:	20-Mar-2026
Drawn by:	AS

LEGEND

- Direction of Flow
- Groundwater Table Contours (VVG)
- Watercourse
- Project Boundary
- GDE (Groundwater Dependant Ecosystem)

MACORNA WIND FARM

GROUNDWATER TABLE CONTOURS (VVG)

SLR

FIGURE 4

Path: \\au.slr.local\Corporate\Projects-SLR\640-MEL\640-MEL\640.031876.00001 Macorna Wind Farm\06 SLR Data\01 GIS\GIS\640031876_Macorna_Wind_Farm\640031876_Macorna_Wind_Farm.aprx\640031876_GW_F03_Groundwater Table Contours (VVG)

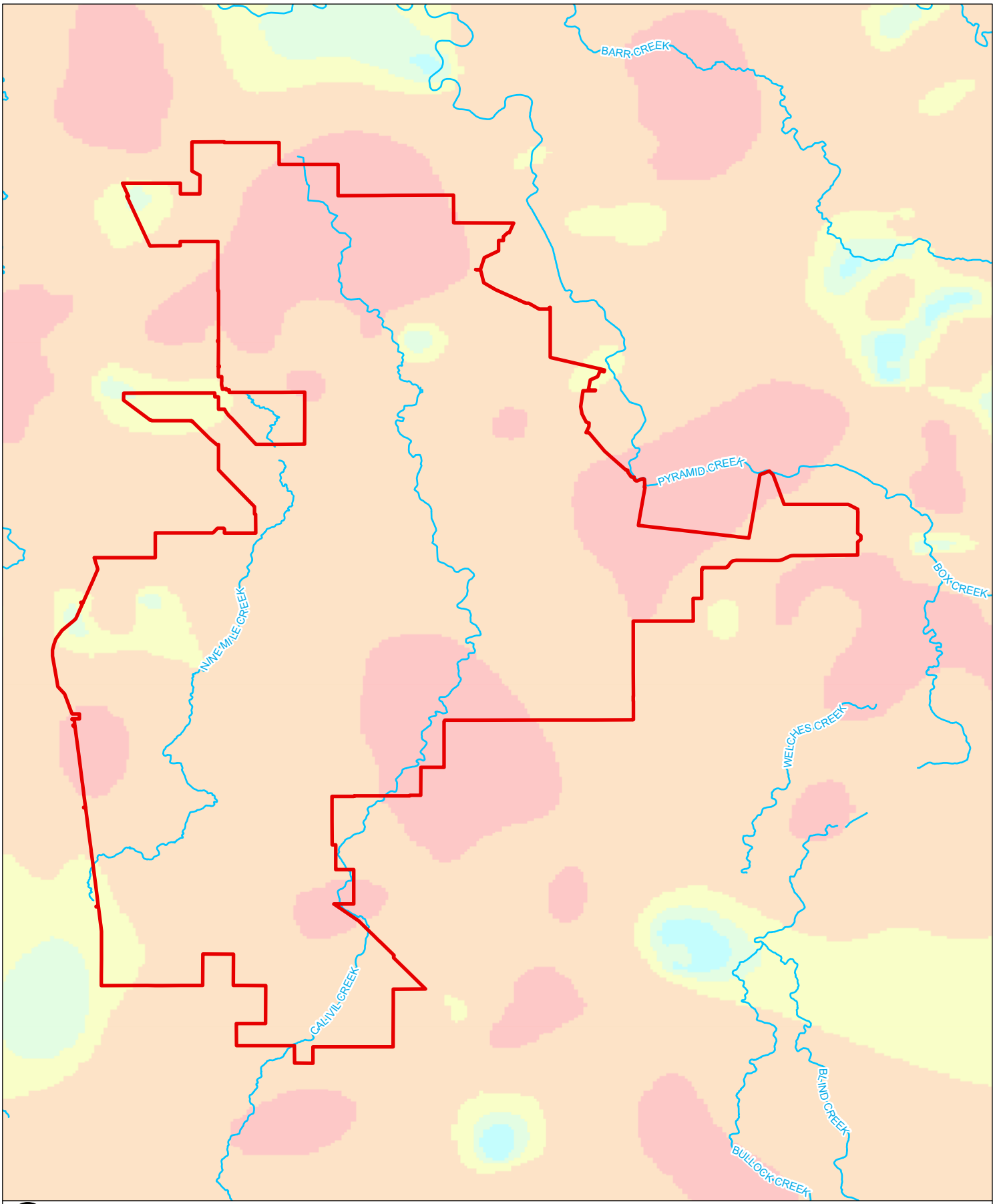
4.3.2 Groundwater Recharge and Discharge

No hydrometric data is publicly available for the project area, and a site water balance is not presented here. Conceptually, the shallow groundwater system primarily received recharge via direct infiltration from precipitation in high land areas as well as directly above the site. Groundwater flows from higher elevations from the south to the north. Groundwater discharges the site to the north.

4.3.3 Groundwater Quality

Publicly available groundwater quality data was reviewed for the project area. Mapped salinity, as measured by conductivity, is presented in **Figure 5**. Groundwater at the site is predominantly classified as segment F, according to the Environmental Reference Standard (ERS) groundwater segment guideline, with TDS exceeding 10,001 mg/L (Victorian Government, 2021).

No in-situ groundwater quality data were available, some data from nearby bores is available from WMIS, generally the high TDS corresponds to high amounts of inorganics, such as sodium, calcium, iron, and bicarbonate. Chloride levels in several bores indicate concentrations of 3,000 to 20,000 mg/l, indicated high chloride water type.



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Project Number:	640.031876.00001
Date Drawn:	20-Mar-2026
Drawn by:	AS

LEGEND

- Watercourse
- Project Boundary

Salinity (mg/l)

< 500	500 - 1,000	1,000 - 3,500	3,500 - 7,000	7,000 - 13,000	13,000 - 35,000	> 35,000

MACORNA WIND FARM

VVG GROUNDWATER SALINITY

SLR

FIGURE 5

Path: \\au.slr.local\Corporate\Projects-SLR\640-MEL\640-MEL\640.031876.00001 Macorna Wind Farm\06 SLR Data\01 GIS\GIS\640031876_Macorna_Wind_Farm\640031876_Macorna_Wind_Farm.aprx\640031876_GW_F04_VVG Groundwater Salinity

5.0 Receptors

A groundwater receptor can be defined as any characteristic that may be impacted via a change in the hydrogeological conditions. These may be environmental or anthropogenic in nature, including the baseline groundwater environment (i.e. groundwater levels or quality), existing users, or ecosystems dependent on groundwater

5.1 Environmental Receptors

5.1.1 Groundwater Environmental Values

According to the Environmental Reference Standard (ERS), issued under the Environmental Protection Act, 2017 (Victorian Government) the site generally hosts Segment F water, with groundwater Total Dissolved Solids (TDS) exceeding 10,001 mg/L across the site.

Each groundwater segment has associated environmental values, in accordance with **Table 3**.

Table 3 Protected Environmental Values of the segments

Environmental Value	Segment (TDS mg/L)						
	A1 (0 to 600)	A2 (601 to 1,200)	B (1,201 to 3,100)	C (3,101 to 5,400)	D (5,401 to 7,100)	E (7,101 to 10,000)	F (>10,000)
Water dependent ecosystems and species	✓	✓	✓	✓	✓	✓	✓
Potable Water Supply (desirable)	✓						
Potable Water Supply (acceptable)		✓					
Potable Mineral Water Supply	✓	✓	✓	✓			
Agriculture and irrigation (irrigation)	✓	✓	✓				
Agriculture and irrigation (stock watering)	✓	✓	✓	✓	✓	✓	
Industrial and commercial	✓	✓	✓	✓	✓		
Water-based recreation (primary contact recreation)	✓	✓	✓	✓	✓	✓	✓
Traditional Owner cultural values	✓	✓	✓	✓	✓	✓	✓
Cultural and spiritual values	✓	✓	✓	✓	✓	✓	✓
Buildings and structures	✓	✓	✓	✓	✓	✓	✓
Geothermal properties	✓	✓	✓	✓	✓	✓	✓

The following relevant environmental values that would be protected under the ERR (2021) are:

- Water dependant ecosystems and species
- Water-based recreation
- Traditional Owner cultural values
- Buildings and structures
- Geothermal properties

The documented Environmental values, and their preservation via maintenance of the existing groundwater conditions (i.e. no degradation or change) can be considered a receptor of the project

5.1.2 Groundwater Dependant Ecosystems

Ecosystems that rely on groundwater to maintain their structure and function are classified as Groundwater Dependent Ecosystems (GDEs). The GDE Atlas developed by the Bureau of Meteorology (BOM) provides high level mapping for surface and sub-surface GDEs, based on national-scale analysis and regional studies. The GDE Atlas (BOM, 2025) contains information about three types of ecosystems:

- Aquatic ecosystems are ecosystems that rely on the surface expression of groundwater. This includes surface water ecosystems which may have a groundwater component, such as rivers, wetlands, and springs. Marine and estuarine ecosystems can also be groundwater dependent, but these are not mapped in the Atlas.
- Terrestrial ecosystems are ecosystems that rely on the subsurface presence of groundwater – this includes all vegetation ecosystems.
- Subterranean ecosystems, includes cave and aquifer ecosystems (stygofauna). The first two categories may overlap in riparian zones where vegetation may access groundwater in the subsurface but also via its surface expression during overbank flooding of streamflow sourced from baseflow.

The first two categories may overlap in riparian zones where vegetation may access groundwater in the subsurface but also via its surface expression during overbank flooding of streamflow sourced from baseflow.

The GDE mapping is based on two broad sources, being:

- National assessment – national-scale analysis based on a set of rules that describe potential for the groundwater/ecosystem interaction and available GIS data.
- Regional Studies – more detailed analysis undertaken by various State and regional agencies using a range of different approaches including field work, analysis of satellite imagery and application of rules/conceptual models.

The GDE Atlas national dataset identified several unnamed “Meadow Wetlands” with moderate potential aquatic ecosystems within the site (BOM, 2025). The following lists potential GDE occurring within 2 km set back from the site boundary (BOW, 2025):

- Tragowel Swamp – moderate potential GDE wetland
- Two Mile Swamp – moderate potential GDE wetland
- Johnson Swamp – moderate potential GDE wetland
- Hird Swamp – moderate potential GDE wetland

- Pyramid Creek – moderate potential GDE wetland
- Hunts Swamp – moderate potential GDE wetland
- Dry Lake – low potential GDE wetland

All named GDEs fall outside the project area, with only several unnamed "Meadow Wetlands" with moderate potential aquatic ecosystems within the site. None of these intersect the construction footprint.

Figure 6 shows the mapped GDEs within 2 km of the site boundary, note several small unnamed "meadow wetlands" within the site boundary as well as the 2 km setback.

It is important to note that the following identified GDEs, also form part of the Kerang Wetlands Ramsar Site:

- Tragowel Swamp
- Two Mile Swamp
- Johnson Swamp
- Hird Swamp

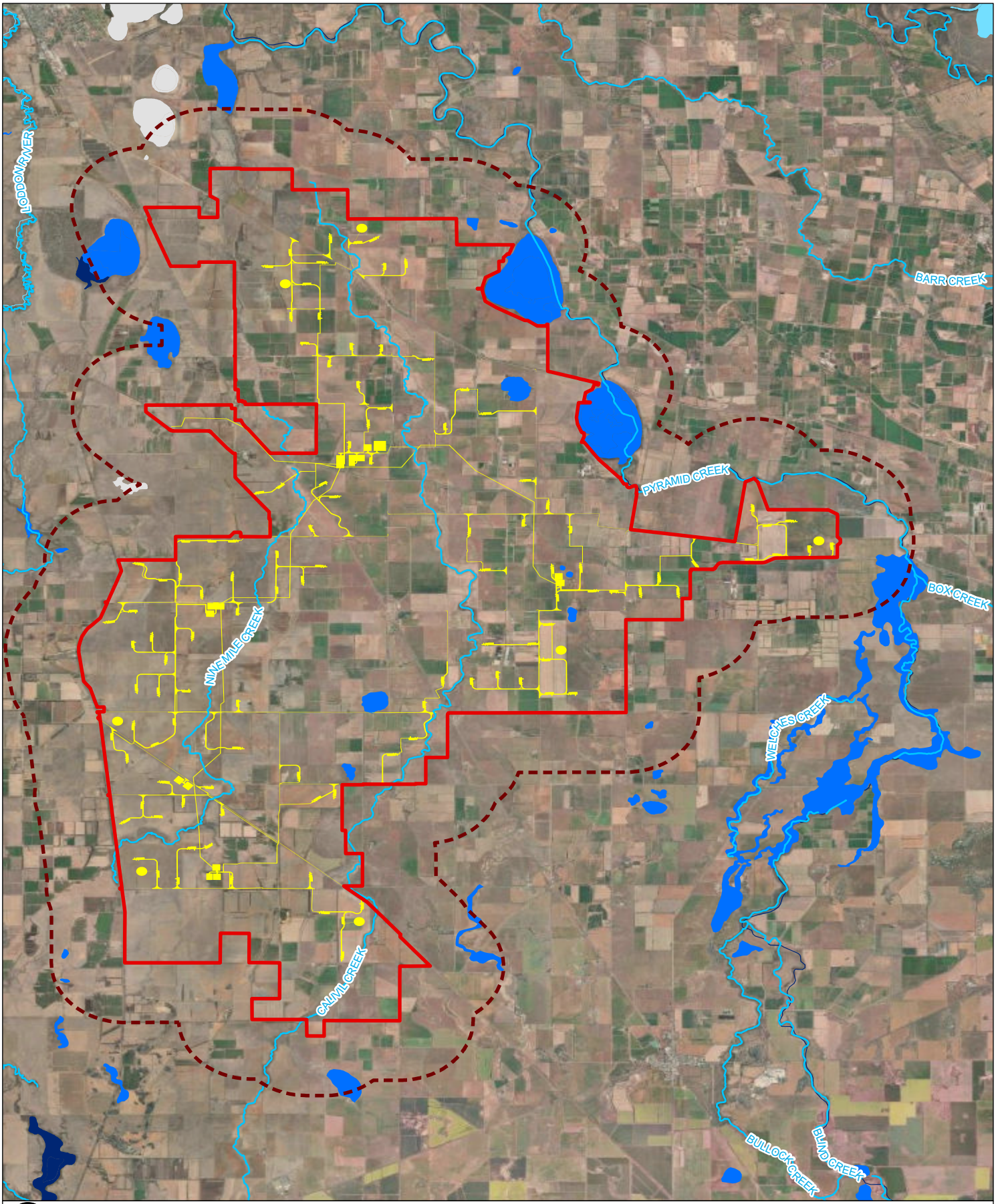
A 2 km buffer has been allowed between all Ramsar sites and wind turbine locations, creating an exclusion zone in which no turbine will be placed within a 2km radius of the identified Ramsar wetlands.

5.2 Anthropogenic Receptors (existing groundwater users)

Interrogation of the VVG identified 650 registered groundwater bores within the study area and 2km buffer area. The locations of the registered bores is shown on **Figure 7**. Almost all are registered as investigation, observation or non-groundwater bores, and thus have no associated groundwater use. Nine bores, as per **Table 4** and shown on **Figure 8**, had registered users indicating the take of groundwater. Only one of these, WRK091707 falls within the project area.

Table 4 Registered groundwater users

Bore ID	Easting	Northing	Construction Date	Depth	Bore Use
41680	238613	6020884	14/03/1994	105.00	Domestic. Investigation, Observation
64029	232676	6034534	29/05/1967	89.92	Dewatering
115175	247648	6021850	31/05/1993	30.00	Dewatering, Investigation
115176	247794	6021662	18/05/1993	30.00	Dewatering, Investigation
WRK009679	247540	6021665	22/07/2003	20.00	Commercial, Dewatering
WRK069165	247376	6021783	1/01/2012	30.00	Dewatering
WRK069166	247903	6020876	1/01/2012	55.00	Dewatering
WRK091707	228830	6025442	19/01/2016	n/a	Domestic and Stock
WRK952775	247376.	6021783	n/a	40.00	Commercial



0 2.5 5 km

Coordinate System:	GDA2020
Scale:	1:170,000 at A4
Project Number:	640.031876.00001
Date Drawn:	20-Mar-2026
Drawn by:	AS

LEGEND

- Watercourse
- Project Boundary
- Project Boundary 2km Buffer
- Construction Footprint

Groundwater Dependent Ecosystem (GDE)

- High potential for GW interaction
- Moderate potential for GW interaction
- Low potential for GW interaction
- Identified in previous study

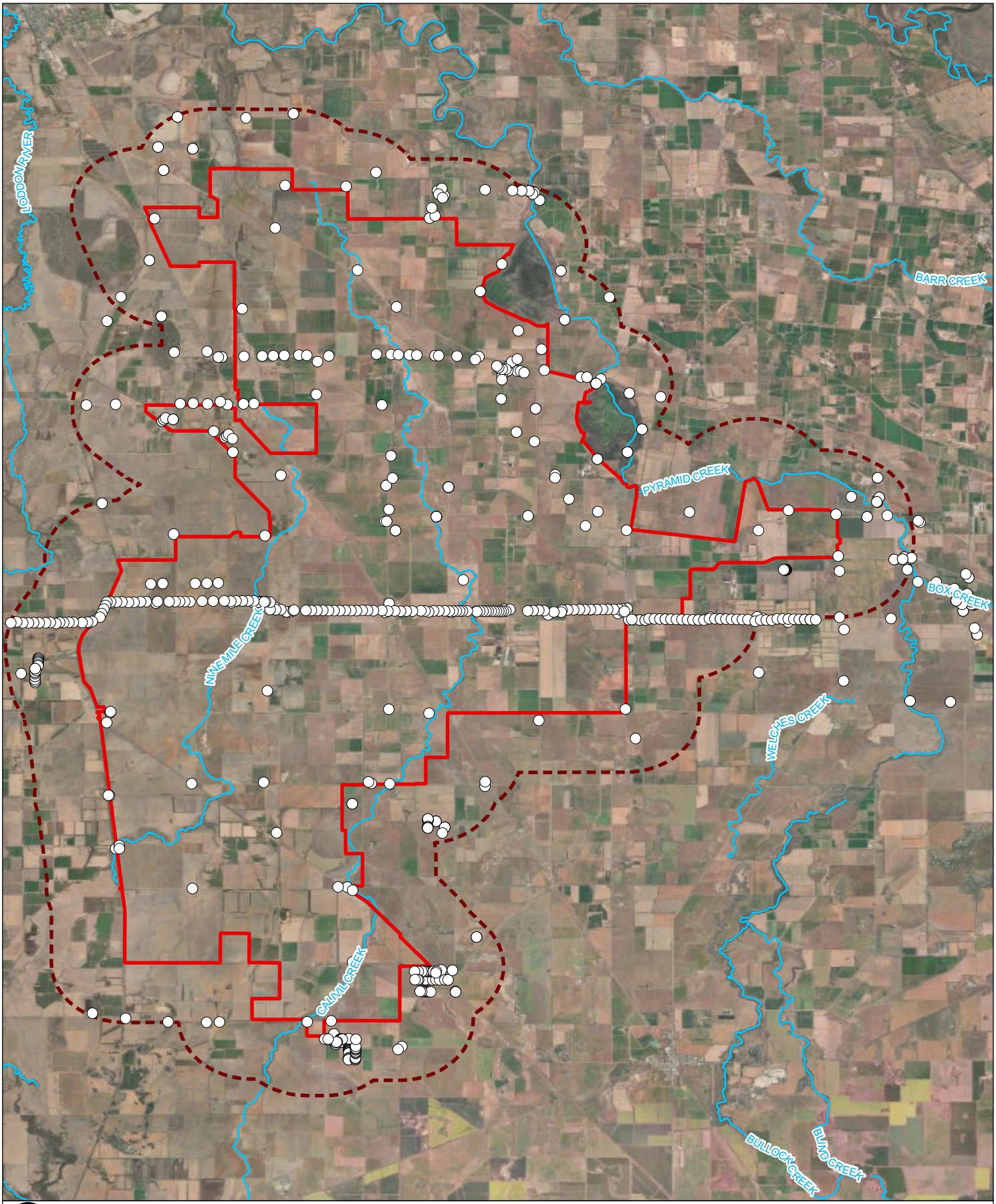
MACORNA WIND FARM

GROUNDWATER DEPENDENT ECOSYSTEM

SLR

FIGURE 6

Path: \\au.slr.local\Corporate\Projects-SLR\640-MEL\640-MEL\640.031876.00001 Macorna Wind Farm\06 SLR Data\01 GIS\GIS\640031876_Macorna_Wind_Farm\640031876_Macorna_Wind_Farm.aprx\640031876_GW_F05_Groundwater Dependent Ecosystem



0 2.5 5 km

Coordinate System:	GDA2020
Scale:	1:170,000 at A4
Project Number:	640.031876.00001
Date Drawn:	20-Mar-2026
Drawn by:	AS

LEGEND

- Grounwater Bore
- Project Boundary 2km Buffer
- Project Boundary
- Watercourse

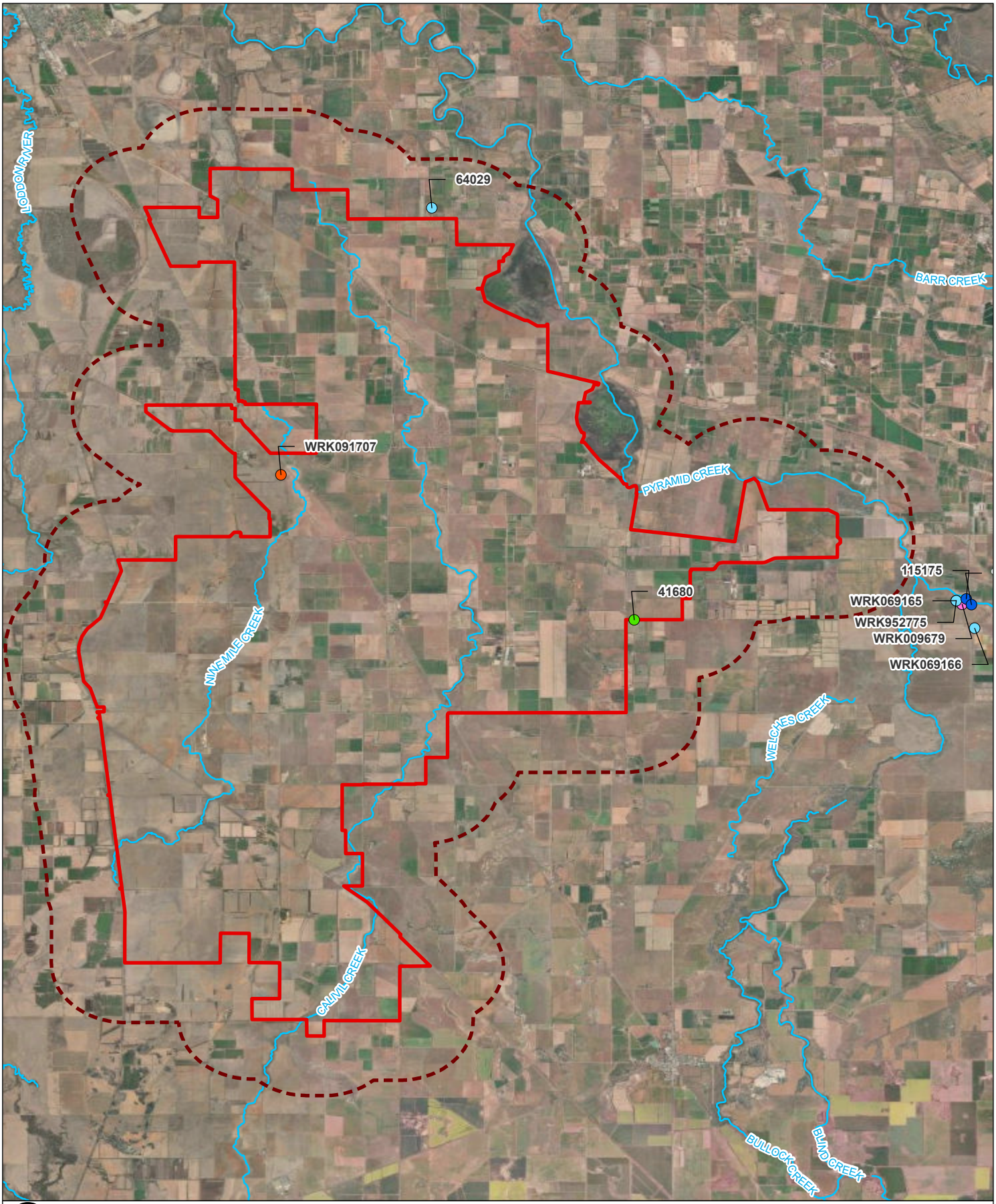
MACORNA WIND FARM

REGISTERED BORES

SLR

FIGURE 7

Path: \\au.slr.local\Corporate\Projects-SLR\640-MEL\640-MEL\640.031876.00001 Macorna Wind Farm\06 SLR Data\01 GIS\GIS\640031876_Macorna_Wind_Farm\640031876_Macorna_Wind_Farm.aprx\640031876_GW_F06_Registered Bores



0 2.5 5 km

Coordinate System:	GDA2020
Scale:	1:170,000 at A4
Project Number:	640.031876.00001
Date Drawn:	20-Mar-2026
Drawn by:	AS

LEGEND

Potential Groundwater Users

- Commercial
- Commercial & Dewatering
- Dewatering
- Dewatering & Investigation
- Domestic & Stock
- Domestic, Investigation & Observation

- Watercourse
- Project Boundary 2km Buffer
- Project Boundary

MACORNA WIND FARM

POTENTIAL GROUNDWATER USERS

SLR

FIGURE 8

Path: \\au.slr.local\Corporate\Projects-SLR\640-MEL\640-MEL\640.031876.00001 Macorna Wind Farm\06 SLR Data\01 GIS\GIS\640031876_Macorna_Wind_Farm\640031876_Macorna_Wind_Farm.aprx\640031876_GW_F07_Potential Groundwater Users

6.0 Preliminary Impacts Assessment

A preliminary impacts assessment examines the potential impact of the project on the groundwater environment and by extension the groundwater receptors classified in Section 5.0. The preliminary impacts assessment is segmented into two phases, being the construction phase and operational phase of the project.

6.1 Impacts Classification

A risk assessment matrix has been developed to summarise the potential risks on key receptors arising from the Project's groundwater impacts discussed in the previous report sections. For each of the key groundwater related risks identified, the following were considered and recorded as part of the risk assessment:

- Brief description of the risk.
- Likely cause.
- Potential consequence.
- Potential likelihood.
- Risk rating and rank.

To undertake the risk assessment, it is useful to define (in a descriptive sense) the various levels of consequence of a particular event and the likelihood of such an event occurring. Descriptions of the categories that were used to rank the consequence and the likelihood of a risk are provided in

Table 5 and **Table 6** respectively.

The level of risk for each potential impact was determined by combining consequences defined in

Table 5 with likelihood as defined in **Table 6**. The resulting impact analysis matrix (combining consequence and likelihood) is presented in **Table 7**.

Table 5 Consequence (magnitude of impact) classification

Classification		Impact
1	Negligible	Change to integrity of attribute not detectable or inconsequential.
2	Minor	Measurable decrease in the integrity of an attribute, limited to short term duration (<1 year)
3	Moderate	Measurable decrease in the integrity of an attribute, limited to medium term duration (<2 year)
4	High	Measurable decrease in the integrity of an attribute, extended to long-term (2 to 10 years)
5	Major	Loss of an attribute and/or large measurable decrease in integrity of attribute in the long term (permanent; >10 years)

Table 6 Likelihood Assessment

Likelihood	Probability	Basis of Rating
A	Highly Likely	Expected to occur
B	Likely	More likely to occur than not to occur
C	Possible	As likely to occur as not to occur
D	Unlikely	More likely to not occur than to occur
E	Highly Unlikely	Very unlikely to occur

Table 7 Impact assessment matrix

		Likelihood				
		E	D	C	B	A
Consequence	5	Negligible	Low	High	High	High
	4	Negligible	Low	Moderate	High	High
	3	Negligible	Low	Moderate	Moderate	Moderate
	2	Negligible	Low	Low	Low	Low
	1	Negligible	Negligible	Negligible	Negligible	Negligible

6.2 Impacts Assessment

6.2.1 Receptor value classification

Prior to conducting the impact assessment, it is useful to consider the value of the identified receptors. The receptor values are classified in three broad categories, being:

- High Value/Sensitivity: Threatened species/habitats (e.g., RAMSAR sites), high-priority groundwater bores, or drinking water supplies.
- Medium Value/Sensitivity: Functional ecosystems, recreational water areas, or commercial land uses.
- Low Value/Sensitivity: Heavily degraded areas, industrial areas, or species with low conservation status.

The receptors, as described in Section 5.0 that have the potential to be impacted by the shallow groundwater system are:

- The Quaternary alluvium and Shepparton Formation Aquifer,
- Groundwater Dependant Ecosystems, and
- Existing users.

The receptor value classification is summarised in **Table 8**.

Table 8 Receptor Value classification

Receptor	Type	Discussion	Receptor value
Alluvial/Shepparton Aquifer	Aquifer	Low quality groundwater (Segment F) supporting only minor environmental values.	Low to Medium
Tragowel Swamp	GDE, Ramsar Wetland	Outside Project area (included as located within 2km buffer of project area, however noting a 2km exclusion zone has been applied between any turbine and Ramsar wetland)). Moderate potential for groundwater interaction based on regional studies (BoM, 2025).	High
Two Mile Swamp	GDE, Ramsar Wetland	Outside Project area (included as located within 2km buffer of project area, however noting a 2km exclusion zone has been applied between any turbine and Ramsar wetland)). Moderate potential for groundwater interaction based on regional studies (BoM, 2025).	High
Johnson Swamp	GDE, Ramsar Wetland	Outside Project area (included as located within 2km buffer of project area, however noting a 2km exclusion zone has been applied between any turbine and Ramsar wetland)). Moderate potential for groundwater interaction based on regional studies (BoM, 2025).	High
Hird Swamp	GDE, Ramsar Wetland	Outside Project area (included as located within 2km buffer of project area, however noting a 2km exclusion zone has been applied between any turbine and Ramsar wetland)). Moderate potential for	High

		groundwater interaction based on regional studies (BoM, 2025).	
Pyramid Creek	Aquatic GDE	Outside Project area (within 2km buffer of Project Boundary). Moderate potential for groundwater interaction based on regional studies (BoM, 2025).	Moderate
Hunts Swamp	GDE	Outside Project area (within 2km buffer of Project boundary). Moderate potential for groundwater interaction based on regional studies (BoM, 2025).	Moderate
Dry Lake	GDE	Outside Project area (halfway within 2km buffer of project boundary, halfway outside). Recognised dependence on groundwater.	Moderate
Minor unnamed meadow wetlands	GDE	Inside project area, minor meadow swamps with moderate potential for groundwater interaction based on national studies (BoM, 2025).	Moderate
Existing users	Anthropogenic	One existing domestic user identified within project area.	Moderate

6.2.2 Impacts Classification

The potential impacts from each phase are discussed separately in the subsequent sections.

6.2.2.1 Construction Phase

During the construction phase, shallow groundwater has the potential to be intercepted by footings or piles depending on the construction methodology employed.

Preliminary footing designs, drafted by icubed consulting (2026), were reviewed for consideration of potential level of interaction with groundwater. Three design concepts were supplied and are summarised in **Table 9**.

Table 9 Summary of footing concept design

Aspect	Type A	Type B	Type C
Excavation depth	~3.5 m	~3.5 m	~3.5 m
Footing thickness	4.0 m	4.0 m	4.5 m
Plan size (Df)	24.6 m	25.6 m	28.8 m
Groundwater assumption	None in founding zone	1 m above founding level	~0.3 m above ground surface

Type B and Type C, both assume an interaction with groundwater and therefore the potential requirement for dewatering is assumed where employed. The location and number of these footings is not available at the time of reporting.

If temporary and localised dewatering is required for installation of the Type B and Type C footings, the nature of such dewatering is considered to result in negligible impact on the groundwater environment. Dewatering has the potential to create local drawdown in the aquifer, temporarily reducing the groundwater level. However, the highly temporary nature of any dewatering activity, associated with the very shallow nature of the footings (maximum of 3.5 metres below ground surface) suggests minimal potential for propagation of drawdown beyond the very local environment. Further, the drawdown would be highly limited in nature, given the shallow nature of the footings (i.e. at a maximum drawdown would be to 3.5 metres below surface at the site of the footing). Coupled with the notable buffer distance between any identified receptors and construction zones (i.e. all receptors are outside the project area), indicates that the risk of impact to identified receptors is negligible.

Any collection, treatment, storage, discharge or off-site disposal of water generated during these activities would be required to be undertaken in accordance with all applicable statutory requirements, approvals, licences and local regulatory requirements. The detailed design and management of any such dewatering discharge or disposal arrangements is outside the scope of this report.

Potential for contamination to shallow groundwater via spills or interaction of the groundwater with construction materials is a potential impact.

Construction Phase Mitigation

Consideration was given to whether any additional management, mitigation or monitoring measures are required if localised dewatering were to occur. Given the small scale, short duration and temporary nature of any anticipated dewatering, further hydrogeological investigation is unlikely to materially alter either the assessed level of risk or prompt any specific management response.

Further, the Project has enforced a 2 km buffer, or exclusion zone, from any Turbine to the Ramsar wetlands, resulting in highly limited potential pathway (i.e. drawdown propagation) to reach these sites.

Risks via contamination would be mitigated using standard operating procedures (SOPs) for management of potential contaminates.

The magnitude of impact to the groundwater system during construction phase is expected to be “Negligible”.

6.2.2.2 Operational Phase

Since disturbance of the groundwater table, if required, is temporary and limited to the footprint of the turbine foundations during construction, no impacts are identified at this time that may affect the groundwater table during the operational phase of the project. In areas where dewatering may have occurred, water levels are expected to recover quickly and maintain regional groundwater levels, quality, and regional flow dynamics throughout operation.

The magnitude of impact to the groundwater system during operational phase is expected to be “Negligible”.

6.2.3 Assessment

Based on the impact assessment matric (Table 7), the final risk rating has been assessed and summarised in **Table 10** below.

Table 10 Impact Assessment

Potential Receptor	Potential Impact Description	Phase	Likely cause	Potential Impact	Consequence Assessment	Likelihood	Risk Rating
Existing groundwater users (private bores).	Loss of supply (yield) from private bores.	Construction	Drawdown of groundwater levels in the bore source aquifer.	Reduction in, or complete loss of, supply (yield) from third party bores.	*Negligible* Drawdown and therefore reduction or loss of bore yield not expected to occur	Highly Unlikely (E). Bores are significantly removed from construction footprint, with no pathway for any minor & temporary drawdown associated with minor dewatering to impact.	Negligible
Existing groundwater users (private bores).	Reduction in water quality at private bores.	Construction	Spills or release of contaminants to the groundwater system. .	Bore water quality no longer suitable for the intended use.	*Negligible* Local groundwater quality is relatively poor, no expected use of toxic materials.	Highly Unlikely (E). Bores are significantly removed from construction footprint, with no pathway for contaminants to reach bores. Standard Operating Procedures (SoPs) would manage spills risks.	Negligible
Aquatic GDEs.	Reduction in flow in surface water systems.	Construction	Drawdown of groundwater levels in the shallow groundwater system either reduces baseflow to the surface water system or increases leakage out of	Impact to environmental receptors reliant on flow in surface water systems.	*Negligible* Low expected level of groundwater dependence, reduction of groundwater levels beyond localised temporary occurrence not expected.	Highly Unlikely (E). Groundwater dependence of surface water features expected to be low, and any potential drawdown resultant from minor & temporary drawdown would not propagate to surface water features.	Negligible

Potential Receptor	Potential Impact Description	Phase	Likely cause	Potential Impact	Consequence Assessment	Likelihood	Risk Rating
			the surface water system.				
Surface water systems.	Reduction in water quality in surface water systems.	Construction	Release of contaminants to the groundwater system that then enter the surface water systems.	Surface water quality no longer suitable for environmental users.	*Negligible* Local groundwater quality is relatively poor, no expected use of toxic materials.	Highly Unlikely (E). Low expectation of groundwater dependence of local watercourses, and Standard Operating Procedures (SoPs) would manage spills risks.	Negligible
GDEs, Ramsar Wetlands	Loss of groundwater availability to GDEs.	Construction	Drawdown of groundwater levels in the groundwater system utilised by GDEs/Ramsar wetalnds.	Decline in health of GDEs.	*Negligible* Reduction of groundwater levels beyond localised temporary occurrence not expected	Highly Unlikely (E). 2km buffer/exclusion zone between turbines and Ramsar wetlands, no potential for localised and temporary drawdown to propagate to wetlands.	Negligible
GDEs, Ramsar Wetlands	Reduction in water quality used by GDEs.	Construction	Release of contaminants to the groundwater system that then enter the groundwater system utilised by TGDEs.	Decline in health of GDEs.	*Negligible* Change is shallow groundwater on which GDEs may be dependent would impact health of receptor, not expected to occur.	Highly Unlikely (E). 2km buffer/exclsuion zone between turbines and Ramsar wetlands limits pathway for interaction. Standard Operating Procedures (SoPs) would manage spills risks	Negligible

7.0 Referral Criteria for Environmental Effects Statement

Based on the above impact assessment, the proposed Macorna Wind Farm is not expected to result in extensive or long-term changes to regional groundwater resources, groundwater-dependent ecosystems, or the environmental values of nearby wetlands.

The project footprint is underlain by a shallow unconfined aquifer of low beneficial use value, with only one registered groundwater users within the site and potential for only very limited and temporary groundwater interaction anticipated during construction.

Given the naturally highly saline nature of groundwater (Segment F), the negligible and highly localised and temporary predicted change in groundwater levels or flow regimes (only if and where minor dewatering activity is required), the project implemented 2 km buffer zone between Ramsar wetlands and turbines, the potential for long-term alteration to the ecological character of nearby wetlands, including those listed in nationally important wetlands directories, is considered negligible.

The proposed construction footprint does not directly intersect any defined potential receptors. Appropriate mitigation measures including standard construction environmental management, localised dewatering controls (if required) will allow for any residual impacts to remain negligible. Overall, the findings indicate that the project does not trigger the thresholds for an Environment Effects Statement (EES) under the Ministerial Guidelines, and potential impacts can be effectively managed through routine approvals and environmental controls.

8.0 Conclusion

This Preliminary Hydrogeological Assessment has characterised the groundwater setting of the Macorna Wind Farm project area and evaluated potential risks associated with the proposed wind farm construction and operation. The site is underlain by Quaternary alluvium and the Shepparton Formation, with groundwater generally occurring at shallow depths 2-5 metres below ground) in an unconfined aquifer system. Groundwater quality is classified as high salinity (Segment F from Victoria Government), limiting its use as a groundwater resource. The Groundwater in the area is still associated with recognised environmental and cultural values, although all of which fall outside the project area. One registered groundwater user is located within the project footprint, and potential receptors are considered to be limited to regional GDEs.

The assessment indicates that the risk of significant impacts to groundwater resources or receptors is negligible, provided that standard environmental management practices are implemented during construction and operation. The impacts assessment indicates that the project does not trigger the threshold for EES under ministerial guidelines with respect to impacts associated with groundwater. Future investigations and approvals should focus on confirming whether project activities will require groundwater take or dewatering and ensuring compliance with relevant statutory obligations under the Water Act 1989 (Vic), Environment Protection Act 2017 (Vic), and related policies.

9.0 References

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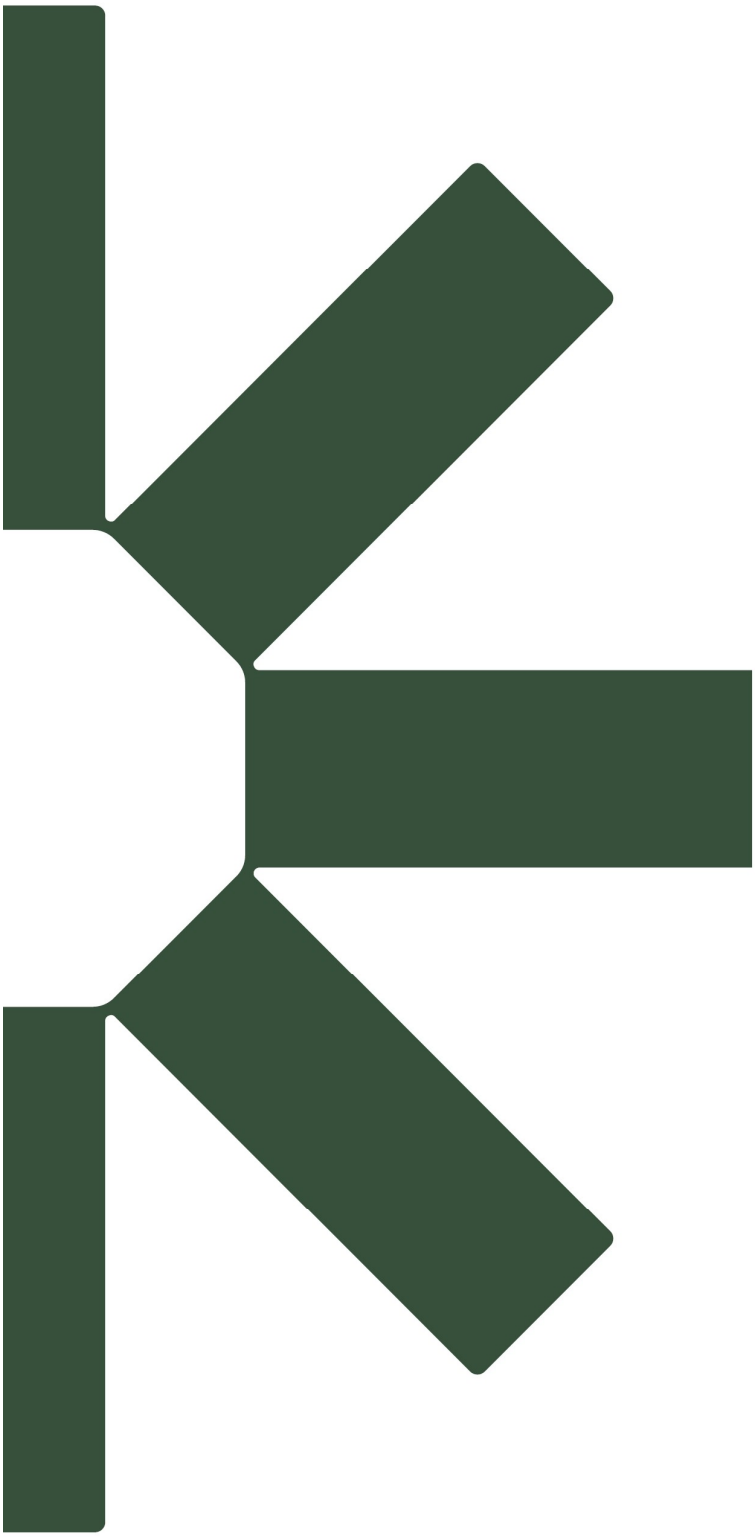

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