AGRICULTURAL ASSESSMENT

CONSTRUCTION AND OPERATION

of the proposed

MORTLAKE SOLAR FARM

Prepared by

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March 2024

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1. Introduction

1.1 Project Brief

Ag-Challenge Consulting Pty Ltd has been instructed by Urbis Pty Ltd, to investigate the agricultural impacts of a proposed solar farm and battery storage complex on approximately 251 hectares of farming land at Mortlake in the Moyne Shire.

This investigation describes the existing agricultural use in both a local and regional context. The investigation is to consider the impact of the development of a renewable energy facility on the existing uses of the land, identify any potential impacts on adjacent properties and determine whether the proposal is likely to have any adverse impacts on surrounding land uses and the regional agricultural economy.

The combined area of land in which the solar panels are to be installed, will hereinafter be referred to as the Project Site. The separate parcels that comprise the Property and specifically which are included in the Project Site are listed in Table 1. An aerial photomap of the Project Site is shown in Figure 1.

Table 1. Title specifications of Total Property and subject area "Project site".

Property Designation on Figure 1	**Parcel Identification**	**Included in Part of the Subject Area (Yes/No)**
A	2\PS409088	Yes
B & C	2 & 3\LP76419	Yes
D	10~2\PP2425	No
E	9~2\PP2425	Yes
F	2\PP2425	Yes
G and H	1 & 2\PS636473	Yes
I	2\PS347828	No
J	2\LP121574	Yes
K	8~2\PP2425	Yes
L	4B~2\PP2754	Yes
M	3\PS342923	Yes
N	2\TP11005	Yes
O	3\TP11005	Yes
P	1\TP12057	Yes
Q & R	2 & 1 \PS342923	No
S	3~1\PP2754	No
T	2~6\PP2754	No
U	1\TP11005	No
V	1~10\PP2425	Yes

Figure 1. Aerial Image of Property – property outline in white, approximate Project Site shaded yellow and letters depicting parcels.

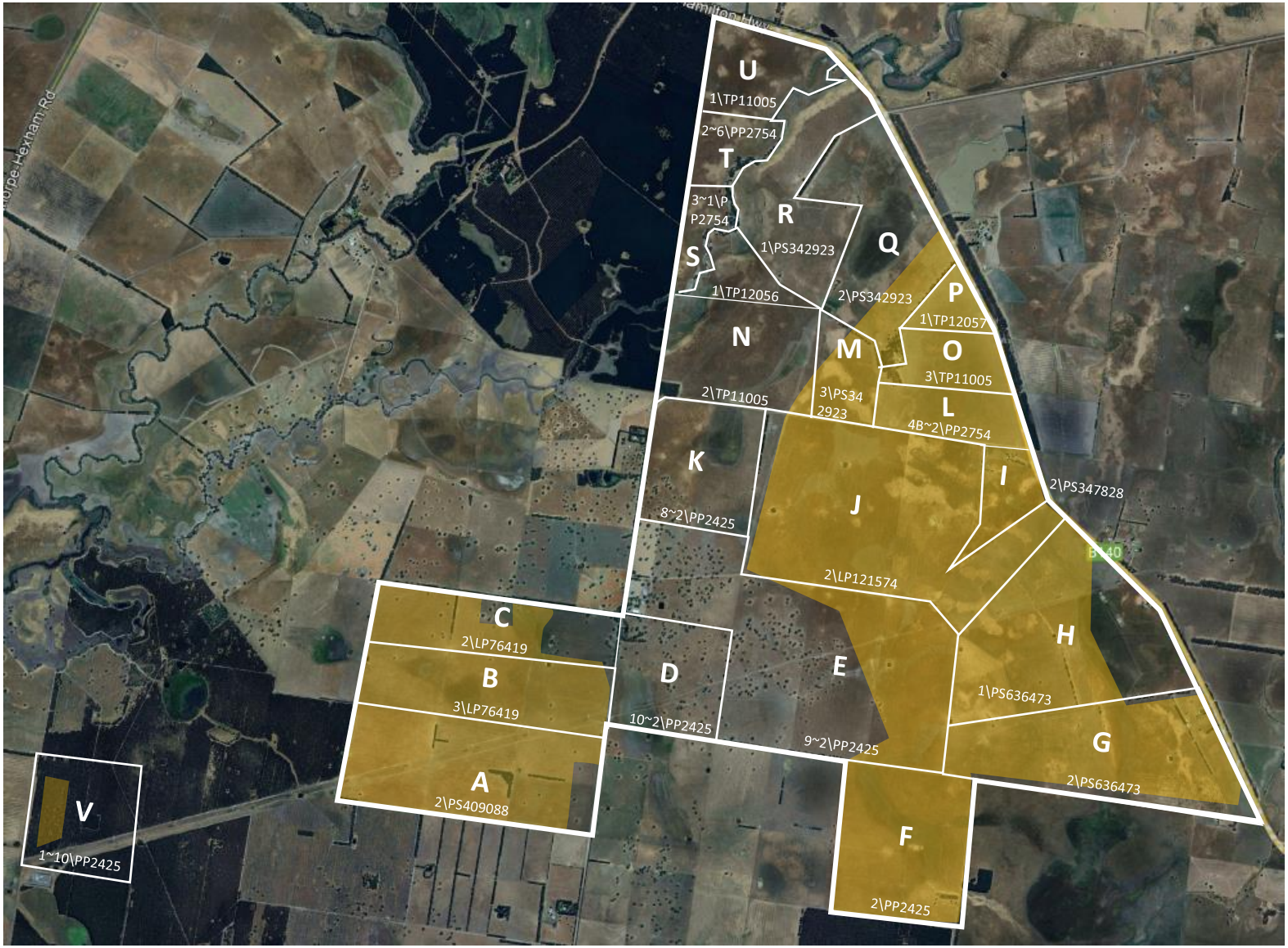
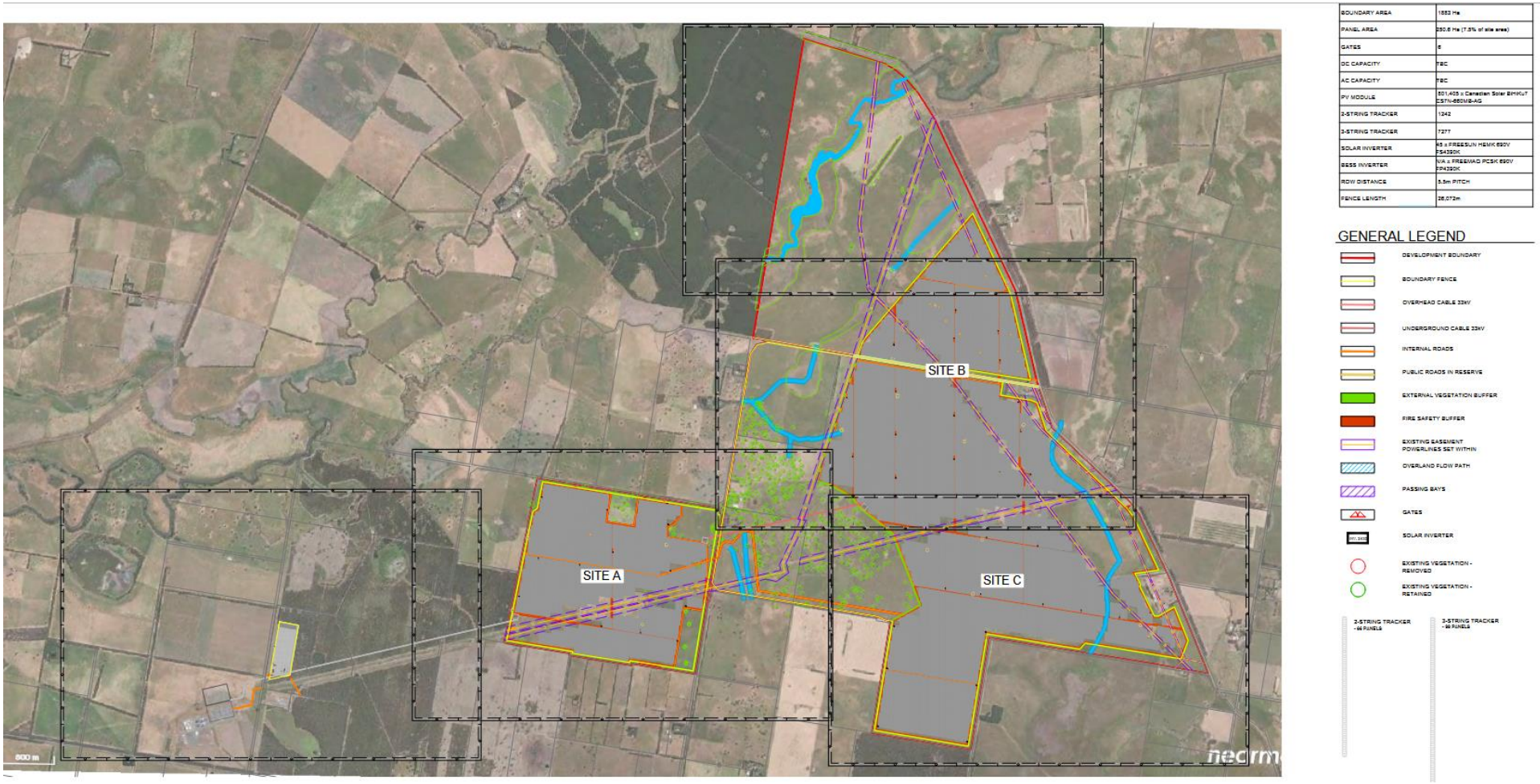
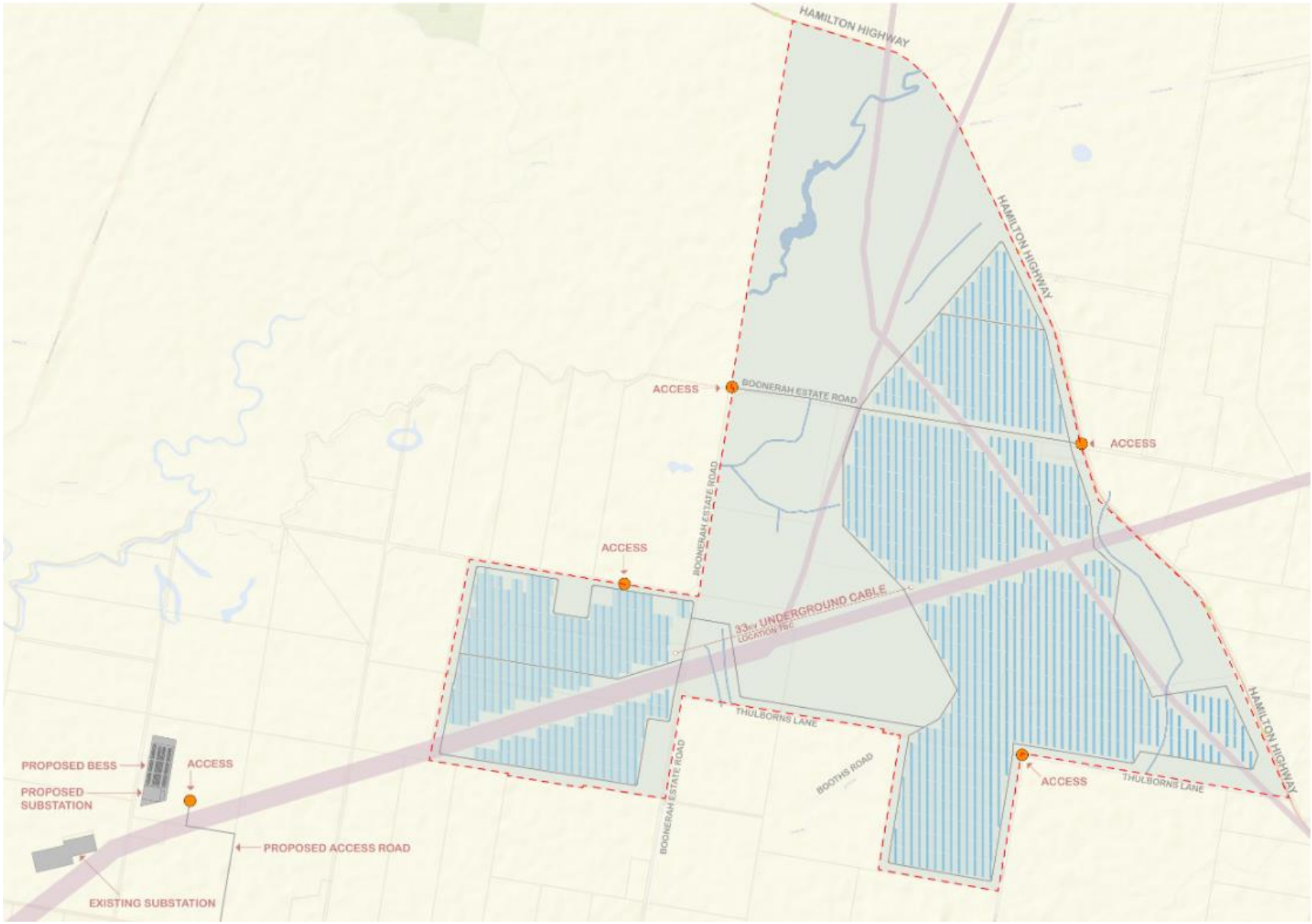


Figure 2. Project site layout



BOUNDARY AREA	1553 Ha
PANEL AREA	250.6 Ha (7.5% of site area)
GATES	6
DC CAPACITY	TBC
AC CAPACITY	TBC
PV MODULE	501,405 x Canadian Solar BiHiKuT CS7N-660MB-AG
2-STRING TRACKER	1242
3-STRING TRACKER	7277
SOLAR INVERTER	95 x FREESUN HEMK 690V FS4350K
BESS INVERTER	NA x FREEMAQ PCSK 690V FP4350K
ROW DISTANCE	5.5m PITCH
FENCE LENGTH	26,072m


HAMILTON HIGHWAY
HAMILTON HIGHWAY
ACCESS
BOONERAH ESTATE ROAD
ACCESS
ACCESS
BOONERAH ESTATE ROAD
33kV UNDERGROUND CABLE
LOCATION TBC
THULBORNS LANE
BOOTHS ROAD
BOONERAH ESTATE ROAD
ACCESS
THULBORNS LANE
HAMILTON HIGHWAY
PROPOSED BESS
ACCESS
PROPOSED SUBSTATION
PROPOSED ACCESS ROAD
EXISTING SUBSTATION

1.2 Experience and Capability of Ag-Challenge Consulting

Ag-Challenge Consulting is an agricultural consultancy company servicing the dairy, beef, and potato industries as well as other high rainfall and irrigated agriculture industries of Western, Southern and Northern Victoria. The company is based in Warragul and the principals of the company have been providing independent farm consultancy advice since 1988 from this location. There are four active consultants within the company that service approximately 200 individual farmer clients with consultancy services from Ag-Challenge Consulting, as well as industry associations, financial institutions, and government. The company is active in vocational training, running focus farms and discussion groups and undertaking farm design work. The recycled water industry is a significant user of Ag-Challenge Consulting for the design and monitoring of recycled water projects. The renewable energy industry has collectively been a significant client of Ag-Challenge Consulting, using the company services for site selection and design, liaison with adjacent farm businesses, agricultural impact assessments, and assistance in satisfying the provisions of planning schemes.

2. Regional Context

2.1 Planning Provisions

The Project Site is all within the Farming Zone of the Moyne Planning Scheme. The objectives of the farming Zone are:

- *To implement the Municipal Planning Strategy and the Planning Policy Framework.*
- *To provide for the use of land for agriculture.*
- *To encourage the retention of productive agricultural land.*
- *To ensure that non-agricultural uses, including dwellings, do not adversely affect the use of land for agriculture.*
- *To encourage the retention of employment and population to support rural communities.*
- *To encourage use and development of land based on comprehensive and sustainable land management practices and infrastructure provision.*
- *To provide for the use and development of land for the specific purposes identified in a schedule to this zone.*

A planning permit is required for the development and use of a Renewable Energy Facility within the Farming Zone, and the Planning Scheme states that a condition of approval is that the facility must meet the provisions of Clause 59.13 of the Planning Scheme. Among other provisions, Clause 59.13 states that the applicant must undertake a site and context analysis including a description of the site and surrounding area and examine the impact of the proposal on strategically important agricultural land.

This agricultural assessment forms part of the response to the provisions of Clause 59.13.

The Solar Energy Facilities Design and Development Guideline (October 2022) specifies a number of factors that also need to be considered during the site selection and decision making process in order that agricultural production is not unduly detrimentally affected. These factors include:

- Protecting strategically important agricultural and primary production land from incompatible land use.
- Protecting productive agricultural land that is of strategic significance to a local area or in a regional context.

- Avoiding the loss of productive agricultural land without considering the impact of the loss on the agricultural sector and its consequential effect on other sectors.

The agricultural values of the land will be assessed in accordance with these guidelines and the Moyne Shire Council Plan, to ensure protection of valuable agricultural land.[1]

2.2 Climate

Climate records from the Bureau of Meteorology weather station at Mortlake Racecourse (Site number 090176) are presented in Table 2 below. This climate station is some 5 km east of the Project Site at the closest point and is considered representative of the prevailing climate for the Project Site. Average annual rainfall from these records is 590 mm per annum and the rainfall is fairly evenly distributed throughout the year.

Table 2. Monthly average rainfall (mm) for Mortlake (BOM Station: 090176).

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Mortlake (mm)	36	32	33	44	58	55	61	65	58	57	50	39	590

The rainfall data for Mortlake (BOM Data) has been entered into a water budget spreadsheet that can be used to predict seasonal surpluses and deficits (Appendix II). Allowing for a 50 mm carry forward of soil moisture from the slightly wetter months into the drier period of the year, and a pasture crop factor ranging from 0.6 in mid-winter through to 1.0 in summer, the growing season for pasture is predicted to be for about 6 months each year, with soil moisture being a significant restriction to growth from September through to May.

Table 3. Climatic Averages from Bureau of Meteorology at Mortlake Racecourse

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Highest monthly Rainfall (mm)	134	87	63	117	132	101	128	167	120	147	96	129
Lowest Monthly Rainfall (mm)	2	1	9	12	7	1	23	23	23	13	20	6
Mean Number of Days of Rain	8	7	11	14	18	18	20	19	19	17	13	11
Highest Daily Rainfall (mm)	60	49	31	37	47	25	52	43	34	50	39	67

The BOM meteorology station records daily maximum and minimum temperatures as well as humidity and wind speed. A summary of the temperature data are provided in Appendix III. Frost is likely to have occurred if the screen temperature at the meteorology station falls to 2°C or less and a severe frost is likely to have occurred if screen temperature drops to 0°C or less. Frost will restrict the growth of pasture and crops, increase risk of livestock mortality (especially in young or susceptible stock), and out of season frosts have the potential to damage pastures and crops at sensitive growth stages. The data in Appendix III identifies frosts commonly occur throughout winter and October with 4-6 frosts expected per month. Importantly severe frosts do occur throughout winter with up to two severe frosts expected

[1] Moyne Shire Council Plan 2021 – 2025, p. 28

per month, and out of season frosts occasionally occur during April and November. Summer temperatures are variable with some summers having no days above 35°C, but other summers having one or more clusters of extreme temperatures with several days above 44°C. The hottest day on record was 46°C on 7th February 2009.

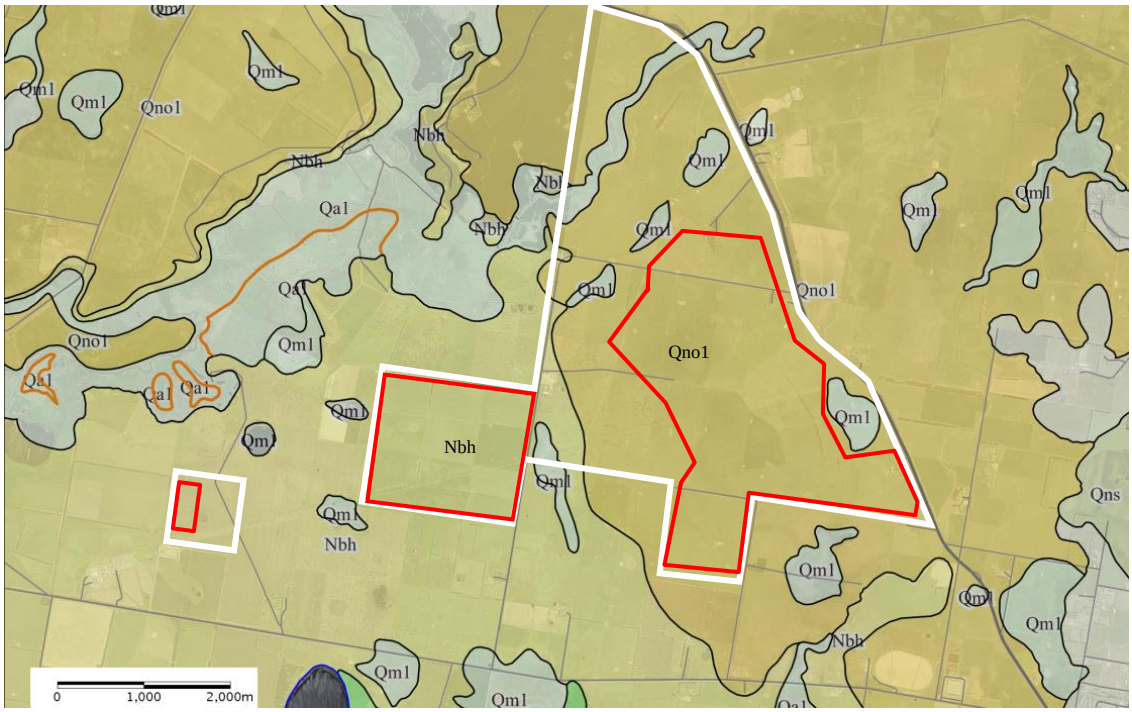
Daily rainfall data in Table 3 shows occasional very heavy falls of rainfall up to 60 mm or more in a 24 hour period. The highest fall on record was 67 mm on the 13th December, 2008 and the second highest fall was 60 mm on the 12th January 2011. Heavy falls are more common in the summer and late winter period than during the autumn and spring months.

2.3 Regional Land Form

The Project Site has been described by Maher and Martin (1987)[2] as a large plain system, with gentle slopes greater than 1% and by Glenelg CaLPB (1997) as the Western District Plain System above flood level.[3]

The landscape is best understood in terms of the processes that formed it (Figure 3). The landscape is predominantly a basaltic plain, formed during the Quaternary to Neogene period, from igneous extrusive lava flows of olivine basalt (Qno1). The south western part of the property, including the agroforestry area has been predominantly influenced by Sedimentary fluvial marine deposits of quartz, sand, clayey sand and gravel (Nbh). While small pockets across the site have been influenced by Quaternary age swamp and lake deposits of Sedimentary clay, sand, silt, peat and calcareous deposits (Qm1).[4] The soils tend to have poorly developed drainage, ranging from sodic to non-sodic texture contrast soils and minor gradational, Gilgai shrink-swelling clay soils.[5]

Figure 3. Geology – with property outline in white, approximate project site in red – Accessed from Geovic



[2] Maher and Martin (1987), Soil and Landforms of South Western Victoria, Department of Agriculture and Rural Affairs, Victoria.
[3] https://vro.agriculture.vic.gov.au/dpi/vro/glenregn.nsf/pages/glenelg_landform
[4] https://gsv.vic.gov.au/sd_weave/registered.htm
[5] https://vro.agriculture.vic.gov.au/dpi/vro/vrosite.nsf/pages/landform_geomorphological_framework_6.1.3

2.4 Regional Land Use

Land use within the Moyne Shire is a mix of agriculture, seafood, industrial, tourism and urban. Agriculture is the dominant land use by area, but forestry and manufacturing has been a key wealth generation land use for the region.[6] Within the agricultural sector, grazing of sheep is the dominant form of land use and other major agricultural uses include cattle grazing, dairy, cereal cropping, oilseed cropping, and fodder cropping. There is a diversity of other minor land uses. There is minor pressure on rural land for rural lifestyle blocks and small lot subdivisions around the Mortlake area, but within the Moyne Shire there is significant pressure around the major urban and tourism centres of Warrnambool and Port Fairy.

3 Site Characteristics

3.1 Description of the Land

The Project site resides within the Western Plain system and are comprised of undulating rises and extensive plateaus. The property has convex slopes of 1-3% from east to west, with the steeper areas located along the northern margin of the project area.

Overflows from farm dams forming ephemeral tributaries to Hopkins River, flow from north to south and west to east, concentrated on the western side of the property.

3.2 Soils

The soils of the Project Site, classified as map unit 144 were described by Maher and Martin (1987) as mostly mottled-yellow duplex soils, ranging from neutral to acidic on gently undulating plains[7]. With minor occurrences of mottled brown duplex soils with no bleaching in the subsurface horizons. The Glenelg-Hopkins Catchment Management Authority has also published soil maps which shows a previously recorded soil pit within the Project site as SWSL382, described as Shallow Black Chromosols and Vertosols, with many surface stones.[8]

In descriptive terms, these classifications mean that the soils have a sharply contrasting texture between the surface soil (usually a sandy clay loam) and the subsoil (light to medium clay). The surface soil normally has a poorly structured, apedal A1 horizon to a depth of about 15 cm over a blocky structured B1 horizon. Where these soils are on the lower slopes and plains, they are generally poorly drained, and sodic at depth. In some areas buckshot was prevalent at a depth of 15 – 45 cm below the occasionally bleached A2 horizon which indicates periodic waterlogging, reflecting the nature of the poorly drained potentially sodic subsoils.
In other areas, the surface soil was quite deep, without buckshot and the texture a sandy loam, reflecting variation in the underlying deposits.

The soil profile was examined at eight locations within the Project Site, with the locations and descriptions included in Appendix 1. The profiles were consistent with the descriptions and the high variability outlined above.

[6] Moyne Shire Council Annual Report 2021-22

[7] Maher & Martin, 1987, Soil and Landforms of South-Western Victoria Part 1. Inventory of soils and their associated landscapes.

[8] Baxter, N & Robinson, N, 2001. Land Resource Assessment for the Glenelg Hopkins Region, Agriculture Victoria. https://vro.agriculture.vic.gov.au/dpi/vro/glenregn.nsf/pages/glenelg_swsl382

3.3 Vegetation

Ground cover at the Project site is mostly improved pasture species, of ryegrass and clover. Chickweed, scotch thistle, capeweed and milk thistle were the prevalent weeds throughout most of the paddocks, while Yorkshire fog grass and barley grass dominated the drains bordering the paddocks.

Remnant vegetation in the form of various eucalypt species were scattered across the Project site but are mostly concentrated centrally around the shearing shed dispersing out eastwards. The most western paddocks have Cyprus tree windbreaks in addition to south of the shearing shed.

A Forestry Plantation of Eucalyptus Blue Gums is located across the most south western point of the project site, with little to no understory vegetation.

3.4 Water Supply

Stock water is supplied from small rainfed farm dams that are located in most paddocks, or from the bore, using water tanks and windmills to pump to stock troughs. The Project site is not located within an irrigation district. There is no private irrigation development or other irrigation infrastructure on the Project Site or on any of the surrounding farms to the Project Site. The potential for the groundwater resource for agricultural irrigation use has been investigated in Appendix III.

3.5 Farm Infrastructure

The Project site has a network of access tracks that permit movement around the east of the property in most weather conditions. In prolonged wet periods some of the crossings would become impassable due to flood flows over culverts. An all-weather gravel access track connects Coonewarren Lane to the proposed Battery Storage and substation area.

There are no buildings within the Project site, with the stockyards and shearing shed located outside of the Project site. One open shed is located to the east of the shearing shed. There are no other buildings or farm structures located within the Project site.

3.6 Current Land Use

The current land use in the eastern parcels of the Project site is a combination of grazing with sheep and cattle. At the time of field inspection approximately ~700-800 angus cows, calves and steers and ~10,000- 15,000 sheep were grazing the 1,883 ha property. The large range in stock numbers is due to the stock moving between multiple properties. This equates to a stocking rate of 10-12 dse[9]/ha and equates to the 251 ha Project Site carrying a total of 93-107 angus cows and calves and 1,331-1,966 sheep. The property has never been used for cropping due to the prevalence of surface rocks. Shearing facilities are present, and located on Boonerah Estate Road, which will remain available during and after construction of the solar panels.

The current land use in the south western most parcel is Blue Gum Agroforestry. The total plantation on the north of Coonewarren Lane covers approximately 580 ha, while the project site covers approximately 9 ha of the plantation. Blue gum is predominantly grown for the purpose of durable timber in heavy construction, flooring and as a pulpwood species.[10]

[9] dse or dry sheep equivalent is a measure of carrying capacity and is defined as the amount of energy required to maintain the liveweight of a 40 kg wether.

[10] Farm Forestry Series – Eucalypts No. 1 Overview – Version 3, June 2020

4 Land Capability and Agricultural Production Potential Assessment

4.1 Agricultural Land Capability Classification

Land Capability Rating systems for a series of land uses, including agricultural land uses were developed by Rowe, Howe and Alley[11]. This Land Capability Rating system adopts the highest assessed value across a range of relevant risk factors to determine the overall land capability rating for a particular site and land use.

The Project Site consists predominantly of a single land type with some variation in surface soil depth and the prevalence of a buckshot layer. For the purpose of the land capability assessment the land can be considered to be of the one type. Land capability assessment is instructive in identifying whether there are severe constraints and serious risk factors impacting on a particular land use.

The land capability rating for grazing use in areas with annual rainfall between 500 - 625 mm is provided in Table 3 below. An additional land capability rating for agroforestry has not been considered as a requirement, given only ~9 ha of the 251 ha Project Site, or 4%, is used for the production of Blue Gum trees.

For each land feature to be assessed, the appropriate attribute is highlighted in the table. The overall land capability is determined by the highest assessed numerical value, which gives an overall rating of 3. There are some areas where surface rocks would require an altered assessment to 4 but these areas are localised in extent and an overall rating of 3 is appropriate. A rating of 3 means that the land is suitable for grazing use and the risk factors are minor and can be managed. The risk factors associated with a rating of 3 on the site are soil pugging, limitations to cultivation and low productivity due to waterlogging from impeded subsoil drainage.

Table 3. Land Capability for Grazing in low to moderate rainfall areas (500-265 mm per annum)[6].

	Land Capability Class[6]				
Land Feature	**1**	**2**	**3**	**4**	**5**
Slope	Less than 10%	10% to 20%	20% to 30%	30% to 45%	More than 45%
Aspect	E. SE	S, SW, NE	N, NW, W		
Soil Group (northcote)	Gradational soils, Um soils	Duplex soils with A horizon of 25 to 40 cm thickness	Other duplex soils; Ur, Ug soils	Uc soils	
Average soil depth	More than 1.0 m	0.6 m to 1.0 m	0.3 m to 0.6 m	0.15 m to 0.3 m	More than 0.15 m
Surface rock	Less than 2%	2% to 15%	15% to 25%	25% to 40%	More than 40%
Nominal DSE/ha rating	5	3 ½	2	½	Exclude from Grazing

A Land Capability rating of 1 or 2 means that the land is suitable for these uses and the hazards associated with such use are low to very low. It means that this is a sustainable form of land for grazing from an environmental risk perspective. A Land Capability rating of 3 indicates that there is a minor hazard and risk of land degradation hazard associated with this use, which can usually be corrected with appropriate prudent management. A Land Capability Rating of 4 indicates that significant land degradation risks are associated with the particular land use, while a rating of 5 indicates that risks are severe and that the land may not be suitable for such use without very significant and potentially expensive intervention.

[11] Rowe, Howe and Alley, 1981, *Guidelines for Land Capability Assessment in Victoria*, Soil Conservation Authority.

The Land Capability rating for grazing is presented in Table 4, with the highlighted boxes being the assessed rating for the Project Site for each parameter. The combined land parcel is determined to have a Land Capability rating of 3 for grazing with the limiting attributes being the duplex soils with shallow A horizons and widespread surface rock. In the most western grazing areas where surface rock is not a limitation to cultivation, the poor aggregate stability becomes the limitation, as the soil would not be able to withstand regular cultivation.

4.2 Land Quality & Strategically Important Agricultural Land

Agricultural land may be considered to be high value and strategically important due to a combination of features such as high quality or niche soils, good rainfall, access to irrigation, resilience to climate change, existing infrastructure investment and/or its special role within a specific industry. None of this land fits within these criteria. In particular, the soils are not high quality or niche soils, the rainfall is moderate and variable with a pronounced dry season each year, and there is no specific farm or public infrastructure within the Project Site which makes the land inherently productive or special from an agricultural perspective.

Table 5. Assessment of the agricultural values of the Combined parcel land.

Attribute groups adapted from Solar Energy Facilities – Design and Development Guideline (2022).

Attribute Group	Assessment Criteria	Assessment	Comments
Soils and Landscape	Inherent Soil Quality Niche Soil Inherent Soil Versatility	Fair quality soils No Limited versatility	These soils are poor to moderately well drained, have intermittent bleached A2 horizons and buckshot layers, with likely sodic subsoils. They are not highly productive and have some management constraints with apedal surface horizons, poor aggregate stability and surface rocks preventing cultivation and cropping.
Water and Climate	Access to modern irrigation infrastructure	No access	Subject land is entirely dependent on natural rainfall. Annual rainfall of the area is 590 mm which is adequate to support a growing season of around 6 months.
Impact of fragmentation	Impact on local and regional productivity	Low	The impact on local and regional productivity is estimated to be a loss of 0.1% of the sheep grazing land and 0.5% loss of cattle grazing land within the region.
Impact of change of land use	Recent reform to update and modernize production or create industry clusters	No	No recent changes to these properties or within the general area.
Specific planning protection for agricultural values	Land set aside or defined for agricultural use and development in a planning scheme or other strategic document	No	The land has no special protection for agricultural values outside of the schedule to the farming zone (FZ).
Government Investment	Government investment to support productivity from the site or the area	No	There is no specific government investment relevant to the agricultural use of this property or this area.
Co-location of solar energy facility with agriculture	Opportunity to co-locate the solar energy facility with agricultural production to diversify farm income without reducing productivity	Yes	The solar farm design will enable the grazing of sheep under the panels, thus mitigating some of the potential loss of agricultural production.

The agricultural attributes of land that identify whether a particular parcel may be strategically important land or strategically significant are presented in Table 5, together with an assessment of how the subject land performs with respect to these attributes. The combined parcel of land can be described as fair quality land for grazing and agroforestry but it has no special values. The combined parcel of land is not significant agricultural land, in that it is not unique, not highly productive, not highly versatile for a multiple range of uses, and not located within an irrigation district.

The combined parcel of land is productive farmland and agroforestry. The proposed change of primary land use to solar energy production will mean that the current agricultural versatility (sheep & cattle grazing) in addition to agroforestry will be compromised in favour of the alternative primary use for energy production. The design of the solar farm will however enable sheep to be grazed underneath the solar panels, thus retaining a reasonable level of agricultural productivity. Agricultural versatility and productivity will potentially be reduced, although significant options also exist in the future design and management of the farming operations of this property to enhance agricultural productivity. These options can be incorporated into the solar farm design.

5. Environmental Risks

5.1 Fuel Load and Fire Risk

Fire risk management will be the subject of a separate investigation. However, management of the fuel load from pasture growth beneath the panels requires some mention within an agricultural context. Much of the incident rainfall at the Project Site will be directed by the panels to the soil surface directly below the panel rim. The ground cover will need to be controlled with planned management. If unplanned, the growth could become a fire hazard.

The growth will be controlled by grazing sheep under the panels. The grazing will enable management of the fuel load from the pasture, preferably to a defined maximum for the duration of the fire risk period, while at the same time also maintaining a soil cover to protect the soil surface from rainfall impact during storm events. These objectives should take precedent over any secondary objectives to optimise liveweight gain in ewes and lambs. The farming objectives can be quite different from the decisions for fire risk mitigation. The solar arrays will be arranged into fenced paddocks that will enable controlled grazing to manage the fire risk, and the paddock shapes and alignments will be arranged so that under panel mustering can be achieved efficiently.

Additionally, the battery storage and substation area should be carefully monitored, and the immediate surrounding groundcover minimised, given the risk of fire spreading into the surrounding Blue Gum plantation, and potential impacts on the ~580 ha of plantation north of Coonewarren Lane.

5.2 Weeds

Scotch thistle (*Onorpdum acanthium*) is widespread across the property with substantial areas of moderate to high density weed infestation particularly concentrated around remnant eucalyptus trees and the north central paddocks. There are some sporadic infestations elsewhere. This is a regionally controlled weed whereby landholders are required to undertake mitigation measures to restrict and suppress the weed activity. However, they are common throughout the region and not of significant concern.

No other regionally controlled or restricted weeds were observed on the property at the time of inspection. A weed management plan will be prepared as part of the Project design. The weed management plan will aim to suppress the growth of weeds and ensure that any regionally controlled weeds of concern are suppressed as far as practical.

6. Agricultural Impacts of the Proposal

6.1 Impact of Solar Farm on Neighbouring Farms.

All properties adjoining the Project site are operated and used by the landowners of the Project Site and support low intensity beef cattle and sheep grazing. Within the general vicinity of the Project site to the East is extensive Forestry and the Mortlake Power Station, while to the West is the Mortlake Racecourse and a small forestry plot. There is no perceived detrimental impact on the continued agricultural use of these properties for grazing operations as a consequence of the development of the Project Site for a solar energy facility.

6.2 The Agricultural Amenity of the Region.

The Australian Bureau of Statistics (ABS) collects and publishes data for agriculture and agricultural production at Statistical Area Level 4 (SA4). SA4 are geographical areas with defined boundaries and broadly similar production systems. The SA4 regions are the largest sub-State regions in the Main Structure of the Australian Statistical Geography Standard and have been designed for the output of a variety of regional data. They are generally representative of regional labour markets, but also tend to represent agricultural groupings as well. The Moyne Shire sits within the SA4 South West Victoria region which includes the shires of Colac, Corangamite, Warrnambool, Glenelg and Southern Grampians and forms a geographical bundle of land in the south western part of Victoria.

The 2021 ABS data for the Moyne Shire region lists the following:

Number of beef cattle	633,439
Number of sheep	4,442,764
Plantation Forests	2,631 ha

In the regional context the Project Site provides grazing for 0.04% of the regional sheep flock and less than 0.02% of the regional beef herd. Sheep grazing will continue with development of the solar energy facility with sheep grazing beneath the panels, but the beef cattle grazing will no longer be possible and will only occur on the properties outside of the project area.

Carrying capacity of the Project Site has been estimated to be around 10-12 dse/ha. When developed, grazing of sheep under the panels will be part of the on-going management of the facility. Thus, while the grazing from the site is a contributor to regional productivity, it is not a significant contributor to the agricultural production of the region. Additionally, the Project site comprises 0.3 % of regional Plantation Forestry area. The removal of ~9 ha of the Blue Gum plantations for the battery and substation, will remove Agricultural productivity after the harvest period as additional plantings will not be able to occur. Although this will decrease the agricultural productivity of the area, it is considered generally as a small decrease.

Overall, agricultural productivity at the Project Site is unlikely to significantly decrease, with the exception of cattle grazing and ~9 ha of Blue Gum plantations, as a consequence of the Solar Farm development.

7. Conclusions and Summary

- The Project Site comprises approximately 251 hectares of agricultural land in the Moyne Shire. The land is currently utilised for grazing and minor agroforestry.
- There are no inherently unique features about the Project Site that distinguish it from neighbouring farms in the area.
- The climate of the area has a moderate annual rainfall of 590 mm average, cool to cold winters with a significant frost incidence from May to October, and a growing season of about 6 months.
- The landform is a flat to gently undulating plain, part of the extensive western plain system.
- The soil types present are noted for their duplex profiles (contrasting texture between surface soils and subsoils), poor soil structure in the A1 horizon, incidences of a buckshot layer and medium to heavy clay subsoils.
- The dominant agricultural use of the land is grazing with sheep and cattle. The land is not considered suitable for cropping, given the prevalence of surface rock, limiting cultivation and poor surface soil structure.
- The land is neither highly productive nor highly versatile. It is not considered to be significant land or strategically important land from an agricultural perspective.
- The development of a solar energy facility on the combined property will alter the nature of the farm. Grazing of cattle will no longer be practical. ~9 ha of Blue Gum Forestry will be removed form production. With appropriate design of the panels and management of weeds, sheep will be able to graze beneath the panels.
- Heightened wildfire risk may occur if attention is not given to fuel load management. Flexible fuel load management needs to be considered as part of the Project design. Under panel grazing with sheep is to be part of that management. Control of ground cover surrounding the substation and battery storage is pertinent, given the area is surrounded by ~580 ha of Blue Gum Plantations.
- There are no perceived detrimental impacts of the development of the solar energy facility to the surrounding farm businesses. The impacts to the agricultural amenity of the Region are not significant.

Appendix I – Soil Profile Descriptions

<u>Site 1: In most western paddock, ~500m east of property boundary.</u> Gentle 1% convex slope, predominantly ryegrass and clover, with some chickweed. – *Similar to Site 5 & 6 in the most north-eastern and south-eastern paddocks.*

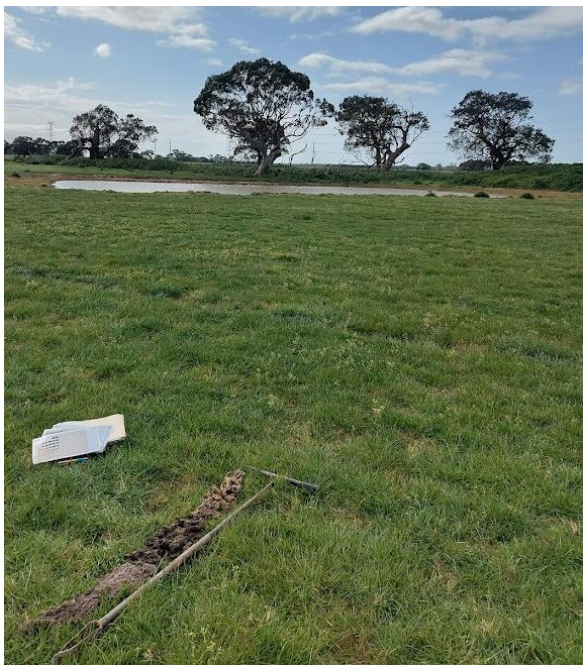
Depth (cm)	Horizon	Description
0 – 15	A1	Brown 2.5 YR 5/2 **Sandy Loam** Poor Structure *Distinct transition to:*
15 – 30	A2	Light Brown 7.5 YR 6/3 Bleached Layer **Sandy Loam** Poor structure *Abrupt transition to:*
30 – 60		Light brown, minor yellow-brown, grey mottles **Buckshot** Weakly cemented *Abrupt transition to:*
60 – 100	B1	Brown 2.5 YR 5/2, with strong reddish yellow and reddish-brown mottles **Medium Clay** Moderate Structure *No auger refusal. Hole termination at 100 cm.*

<u>Site 2: Approximately centre of the western most paddocks.</u> Plateau consisting of perennial ryegrass, minor clover, chickweed and scotch thistle.

Depth (cm)	Horizon	Description
0 – 10	A1	Brown 7.5 YR 5/3, with minor reddish mottles **Sandy Loam** Poor Structure *Abrupt transition to:*
10 – 25	A2	Brown 7.5 YR 4/4, with minor reddish-yellow mottles **Light Clay** Poor structure *Abrupt transition to:*
25 – 85	B1	Yellowish Brown 10 YR 5/4 **Medium Clay** Moderate Structure *Abrupt transition to:*
85 – 100	B2	Light Yellowish Brown 10 YR 6/4 **Light Clay** Moderate Structure *No auger refusal. Hole termination at 100 cm.*

<u>Site 3: In western paddock, near farm dam.</u> Predominantly ryegrass and clover, minor chickweed and winter grass.

Depth (cm)	Horizon	Description
0 – 20	A1	Brown 7.5 YR 5/3 **Sandy Loam** Moderate to Poor Structure *Diffuse transition to:*
20 – 30	A2	Pinkish Gray 7.5 YR 6/2 Bleached Layer **Sandy Loam** Poor structure *Abrupt transition to:*
30 – 60	B1	Dark Brown 7.5 YR 3/2, with strong reddish yellow and yellow brown mottles **Silty Clay Loam** Moderate Structure *Abrupt transition to:*
60 – 100	B2	Light Yellowish Brown 10 YR 6/4, strong yellow brown mottles. **Light Clay** Moderate Structure *No auger refusal. Hole termination at 100 cm.*

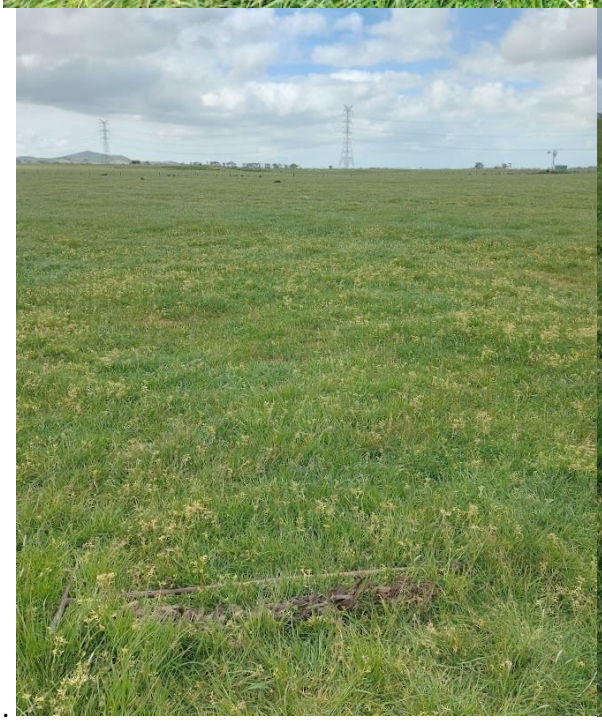


<u>Site 4: In north eastern paddock, near powerlines.</u> Predominantly ryegrass and clover, minor chickweed and capeweed.

Depth (cm)	Horizon	Description
0 – 20	A1	Reddish Brown 5 YR 4/3 **Sandy Loam** Moderate to Poor Structure *Abrupt transition to:*
10 – 40	A2	Minor red-brown mottles **Buckshot** Weakly cemented *Abrupt transition to:*
40 – 85	B1	Yellowish Brown 10 YR 5/4, with strong reddish yellow and yellow brown mottles **Medium Clay** Moderate Structure *Abrupt transition to:*
85 – 100	BC	Light Yellowish Brown 10 YR 6/4, strong yellow brown and reddish yellow mottles, with calcium carbonate. **Unconsolidated Parent Material** *No auger refusal. Hole termination at 100 cm.*

<u>Site 7: In north central paddock.</u> Predominantly ryegrass and clover, chickweed, paspalum and capeweed.

Depth (cm)	Horizon	Description
0 – 10	A1	Reddish Brown 5 YR 4/3 **Sandy Loam** Poor Structure *Abrupt transition to:*
10 – 25	A2	Dark Brown 7.5 YR 3/2, with minor reddish-yellow mottles **Light Clay** Poor structure *Abrupt transition to:*
25 – 100	B1	Brown 7.5 YR 5/3, with minor reddish brown mottles. **Medium Clay** Moderate Structure *No auger refusal. Hole termination at 100 cm.*



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<u>Site 8: In north central paddock south of site 7.</u> Predominantly ryegrass and clover, chickweed, and scotch thistle.

Depth (cm)	Horizon	Description
0 – 10	A1	Reddish Brown 5 YR 4/3 **Sandy Loam** Moderate to Poor Structure *Abrupt transition to:*
10 – 65	A2	**Buckshot** Yellowish Brown, Reddish Brown, *Auger refusal. Hole termination at 65 cm.*

Appendix II – Water Balance

Table 6 Water balance for the Project Site based on rainfall records from BOM Station* 090176 *and evaporation records from SILO Long Paddock – Latitude 38.05, Longitude 142.65

Mean Rainfall													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
BOM DATA	36	32	33	44	58	55	61	65	58	57	50	39	590

Evaporation data	January	February	March	April	May	June	July	August	September	October	November	December	
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	
Mean Evaporation	204.6	165.7	138.4	82.7	50.5	35.4	40.2	56.8	78.6	115.2	142.7	184.5	**1295**

Water Balance for Pasture	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Ave Rainfall	36	32	33	44	58	55	61	65	58	57	50	39	590
Evaporation	205	166	138	83	51	35	40	57	79	115	143	184	1295
Crop factor	1.0	1.0	1.0	0.8	0.7	0.6	0.6	0.6	0.7	0.8	1.0	1.0	
Evapotransporation	205	166	138	66	35	21	24	34	55	92	143	184	
Water deficit/excess	-169	-134	-105	-22	23	34	37	31	3	-35	-93	-145	
Growing season with 50 mm soil water	No	No	No	No	Yes	Yes	Yes	Yes	Yes	No	No	No	

Appendix III – Groundwater

The development for irrigation is regulated by Southern Rural Water (SRW) in this part of Victoria and the Project Site lies within the South West Limestone groundwater management area (GMA) see Figure 4.[12] Each GMA is generally associated with a specific aquifer or group of aquifers. Among other things, the GMA allows groundwater licence holders the ability to trade the use of the groundwater resource between different users, either permanently or by way or an annual lease. The total volume of groundwater that can be extracted across all users in the GMA is capped.

Figure 4. Southern Rural Water – Interactive Map of Groundwater Management Areas – project site indicated by arrow.

To provide an indication of the water quality in the existing bore, and if irrigation is a viable option for the property, Table 4 has been provided below to summarise the water quality in nearby monitored bores in relation to salinity levels.

Table 4. Quality of Water Measured in Bores surrounding the property[13]

Bore Number	Conductivity (mS/cm)	Total Dissolved Solids (TDS) (mg/L)	Chloride (mg/L)
56447	16,164	*10,345*	5,360
56462	13,400	*8,576*	4,350
56461	11,530	*7,379*	3,300
56457	7,100	3788	2,000
56456	9,000	*5,760*	2,714
Median	**11,530**	**7,379**	**3,300**
Salinity Risk Assessment Category[14]	**Extreme**	**Extreme**	**Extreme**

Italicised Values calculated from Conductivity – Approximately 1000 uS/cm = TDS 640 mg/L[15]

[12] Accessed from Southern Rural Water - https://www.srw.com.au/water-and-storage/groundwater-and-bores/groundwater/groundwater-management-area-supporting-documentation#gma22

[13] Accessed from Visualising Victorias Groundwater - https://www.vvg.org.au/vvg_map.php?agreement=Agree+and+Continue#

[14] EPA Doc 168.3, Figure 6-1 Recycled Water Salinity Risk Assessment, p. 54

[15] EPA Document 168.3, p. 53

The median salinity measures of the bore water in the surrounding areas, classifies the groundwater as saline and if used for irrigation presents an extreme risk to the salinity levels in the soil and at risk to the soil sodicity. As the median chloride concentrations are significantly above the threshold of 400 mg/L where damage to foliage may occur at times of high evaporation, there is the potential for leaf burn and scold of pastures if used for irrigation. Ultimately the use of groundwater for irrigation, for horticultural crops or pasture is not considered as a viable option. This could be verified with groundwater quality sampling of the existing bore.

This review of the groundwater potential for the Project Site should not be relied upon as being definitive and a hydrogeologist should be engaged if a further and more definitive investigation is deemed necessary.