

Appendix J

Agricultural Assessment

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GOORAMBAT EAST SOLAR FARM

Neoen Australia Pty Ltd

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1.0 INTRODUCTION

Neoen Australia is proposing to develop a renewable energy facility (solar) with an installed capacity of approximately 250 megawatts (MW) and located within the district of Goorambat, 12 kilometres to the north of Benalla, Victoria. The Project involves five land holdings with a combined area of approximately 630 hectares (ha).

This report considers the agricultural value of the site investigation area particularly in relation to the objectives and strategies for the protection of agricultural land within Clause 14.01 of the Benalla Planning Scheme. The report addresses the following:

- The agricultural quality and productivity of the farmland;
- The strategic significance of the land in the local, state and regional context;
- The economic importance of the land for the agricultural production and processing sectors within the Benalla district.

2.0 NATURAL FEATURES DESCRIPTION

2.1 Description of region

The site investigation area (study area) lies north of Benalla within the district of Goorambat. The Broken River serves as a major physiographic feature and forms the southern boundary of the investigation area. Climate, soils and topography are the important components in establishing land capability and therefore, the type of farming to which the district is most suited. The following is a brief description of each of these natural features.

2.2 Climate

The annual average rainfall for the district is 550-600 millimetres. Its distribution is predominantly over the April to October period at around 50-55 millimetres per month, while for the late spring-summer period it falls to 35-40 millimetres per month. The highest temperatures are recorded in the January-February period at a mean of 28-30°C. Because of these summer temperatures, the district is subject to high evaporation rates. The interaction of rainfall, temperature and evaporation provides a growing season under dryland conditions that commences with the autumn break, normally mid to late April and continues through until mid to late October. These climatic features conditions suit winter cropping, annual pastures and perennial pastures where suitable species have been established.

2.3 Soils and topography

The Broken River is the southern boundary of the investigation area, with accompanying river plains. Extending northwards, the terrain forms slopes and hilly rises, that are usually linked to soil type changes. Mount Major is a significant landform to the west and north where it forms a steep hill rising to 377 metres. Major Creek and Broken Creek rise from the local catchments and have Broken River as their outfall.

Most of the landform in the study area is flat to gentle and moderate slopes. The arable land has been cleared for cropping while the steeper country remains open vegetation and used for either grazing or conservation.

The many soils within the study area can be grouped into three associations that are differentiated by landform, location and soil type:

- Broken River alluvial plains; These soils are silty clay loams that become yellowish-brown mottled clay at 20-35 centimetres. They are suited to crop production but require careful soil management to maintain soil structure. The lack of soil profile drainage can be a constraint under wet conditions.
- Goorambat Plains: Brown, fine sandy clay loam, hard setting, few quartz gravel, stronger colour with depth, higher clay proportion, overlying a yellow-brown mottled medium to heavy clay. Rising country has greater gravel content. Suited to cropping using direct drill techniques.
- Other soil associations are skeletal in nature and constrained by topography and soil profile characteristics (shallow, gravelly, low fertility). They are usually under native vegetation and their use intermittent grazing or conservation. Productivity levels are low.

2.4 Vegetation

The original native vegetation pattern was open woodland and depending on landform, included Grey Box, Yellow Box, White Box, Red Gum and Casuarina species (Buloke, Sheoak) with an understorey of native grasses. Farming development has cleared most of the arable land for crop production and replaced native grasses with introduced species for livestock production. The poorer country is retained under its original cover.

2.5 Water and Drainage

The study area is outside of the irrigation district and possesses no irrigation capability other than the irrigation licenses from Broken River. A significant proportion of these were sold through the Environmental Water Buyback Scheme, first administered in 2015.

Stock and domestic water supply is catchment based or diversions from local streams. Some holdings have town water supply.

The main streams in the study area are Major Creek and Broken Creek. Surface drainage is based on slope and some low lying areas are subject to waterlogging under extended or high rainfall events. Soil permeability is moderate to low which aggravates drainage effectiveness on low lying areas.

2.6 Land capability

Table 1 provides an assessment of how the natural features can be considered on a land quality class basis. The table was originally developed by the Soil Conservation Authority to measure environmental hazard but has been modified to incorporate land capability. Land capability is measured on a 5-point scale where 1 is best and 5 worst.

The study area has three soil associations that form distinct land classes and are significant in determining land capability. They include the Alluvial Plains, Goorambat fine sandy clay loams and skeletal hills. Table 1 provides an assessment for the Goorambat fine sandy clay loam soil profile as the most frequently occurring soil association in the study area.

Table 1: Criteria and Performance Levels to Measure Agricultural Land Quality

Rating	1	2	3	4	5	
Feature	Very High	High	Average	Poor	Very poor	Goorambat clay loam
Length of growing season (months)	11 – 12	9 – 11	8 – 9	7 – 8	<7	8-9
Availability of supplementary water	Yes	Yes	No	No	No	No
Slope %	0 – 5	3 – 6	6 – 12	12 – 20	20 – 30	3-6
Drainage	Good	Moderate - easily drained	Moderate - not easily drained	Poor	Very poor	Moderate
Soil	Friable loams	Friable loams	Clay Loams	Sands & clay	Sands & clay	Fine Sandy Clay Loam
Profile permeability	High	Moderate	Mod/low	Low	Low	Low
Depth of friable soil	50 cm	20 - 30cm	10 - 25cm	5-10cm	< 5 cm	10-15cm
Soil fertility	High	Mod/high	Moderate	Low	Low	Moderate
Depth to rock	1 m	1 - 0.5 m	0.5 m	0.5-0.1m	< 0.1 m	0.5 m
Erosion	Low	Low	Moderate	High	Very high	Moderate
Flooding frequency (years)	None	1 in 15	1 in 10	Annual	Annual	1 in 15
Arability	Excellent	Good	Moderate	Poor	Nil	Moderate
Overall land capability						3

Agricultural quality

The Goorambat Soil Association is classed as 3 or “Average”. The A horizon is a fine sandy clay loam with an increasing clay content with depth. Soil pH is acid, fertility levels moderate and the subsoils sodic, requiring gypsum applications to reduce dispersibility. Surface drainage is moderate due to a slightly undulating landform but soil permeability remains low because of soil profile characteristics. There is no irrigation supply and because of soil profile characteristics, the land is generally unsuited to irrigation.

The associated rising country has a higher gravel content in the A horizon, of lower fertility and has a greater susceptibility to gully and tunnel erosion because of the highly dispersible A2 horizon.

Broadacre cropping is the major land use using direct drilling techniques to avoid deterioration in soil structure, retain soil fertility levels and avoid erosion risk. Continuous cropping is possible alternating between cereals and oilseeds. Under this system, livestock are only used as a management tool for stubble grazing.

On a regional basis better quality agricultural land lies within the Goulburn Murray Irrigation District (GMID) that commences approximately 25km west of the site in the Dookie-Shepparton region and extends west to Tongala. The soils are well suited to irrigation but vary in their textural qualities and therefore preferred land use. Land quality is high to moderate depending on soil type and use, from horticulture to intensive grazing and cropping.

Summary

The agricultural quality of the Goorambat soil association is classed as average (Class 3) because of its soil profile characteristics, lack of irrigation capability and therefore limitation to broadacre cropping as its best and most productive use.

Other soils in the region, particularly those within the GMID are more productive because of their soil profile characteristics, suitability to irrigation and capacity to support horticultural and intensive grazing farming systems. These soils vary between Class 1 and Class 3 (as per Table 1).

2.8 Land use

Cropping

The cropping enterprise within the district is broadacre based where cereals and oilseeds are the major crops. Legumes (lupins, faba beans, chickpeas) are more experimental crops to extend the cropping rotation through providing an additional disease break and building up soil fertility levels. Hay is also an important enterprise through baling crop stubble or in adverse seasons, directing crops to hay rather than grain.

Table 2¹ provides indicative gross margins² for the two crops commonly grown on a continuous crop rotation cycle. Overhead costs such as operator labour, rates, farm repairs, financing etc are not included and need to be deducted if calculating net farm income.

Table 2: Indicative gross margins: Dryland

		Wheat	Canola
Yield	t/ha	4.25	2.25
Net price	\$/t	250	500
Gross income	\$/ha	1063	1125
Variable costs	\$/ha	431	590
Gross margin	\$/ha	632	535

¹ Data source is from Agriculture Victoria templates using local physical and financial values

² Gross margin is gross income less variable costs including seed, fertiliser, sprays, cultivation, harvest etc.

Price and yield are the most significant variables when estimating crop performance, with farmer consensus that a gross margin of \$500/ha is a reasonable expectation under dryland cropping. Crop yield for wheat can range between 3.5-5.0 t/ha whereas for canola the range is 1.5-3.0 t/ha.

Grazing

The main enterprise in the study area is wool production, followed by beef and prime lamb. The latter two enterprises require better feeding levels to turn off prime stock which is more difficult where farming systems have a cropping specialty and crop stubble is the main feed available.

Table 3 provides livestock performance data extracted from the Livestock Monitor Project³ (Northern Victoria) for the 2016-17 season. They represent average values rather than the top 20% (which are also published.)

Table 3: Livestock gross margins (2017)

		Wool	lamb	Beef
Stocking rate	dse/ha	9.1	9.6	11
Gross margin	\$/dse	42	53	47
Gross margin	\$/ha	382	509	517
Enterprise mix	%	36	18	34

The gross margins for livestock as a complementary enterprise to cropping specialists is likely to be in the range of \$350/ha-\$400/ha with a bias towards wool production.

3.0 PROJECT CHARACTERISTICS

3.1 Solar farm description

The renewable energy facility is planned to have an installed capacity of 250 megawatts (MW). Some of the design specifications that can affect agriculture include:

- Panel structures to be 45.1 metres in length and 3.9 metres in width with a pitch of 5.5 metres to 13 metres depending on the arrangement of modules chosen at the detailed design phase;
- Support pole length from ground foundation to pivot beam 1.5m with maximum height tracker at 60°, 3.9 metres. The minimum opposing clearance tracker at 60°, height 0.5 metres;
- Panel density is site dependent through account being taken of wetlands, water courses, vegetation, easements and buffer distances to road reserves. Because of these constraints, the site is estimated to have a site density of 50%.

The design features are influential in the manner under which agriculture could still be practiced on the land area following construction. Current design specifications are to maximise solar energy efficiency rather than co-locate with agriculture.

³ Livestock Monitor Project is an annual survey conducted by Agriculture Victoria to measure farm and livestock performance

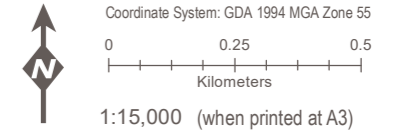
3.2 Landholding description

The Project is to be located across one site, which lies to the north-east of the Benalla-Tocumwal Road and between the Goorambat-Thoona Road and Peck Road in the south. It comprises five separate landholdings with a combined area of approximately 630 hectares. The land holdings are contiguous with the exception of one tenement which lies to the north of Spinks Lane and east of the Goorambat-Cheney Road. It has recently been granted a solar farm permit⁴.

All of the project land holdings are representative of the Goorambat Plains soil association. The farming systems practised are cropping dominant with livestock production (wool) a minor enterprise. The land rises to the north and east becoming more strongly vegetated through soil type changes. Land use changes from cropping to grazing. To the south contour falls and flattens with a greater cropping intensity.

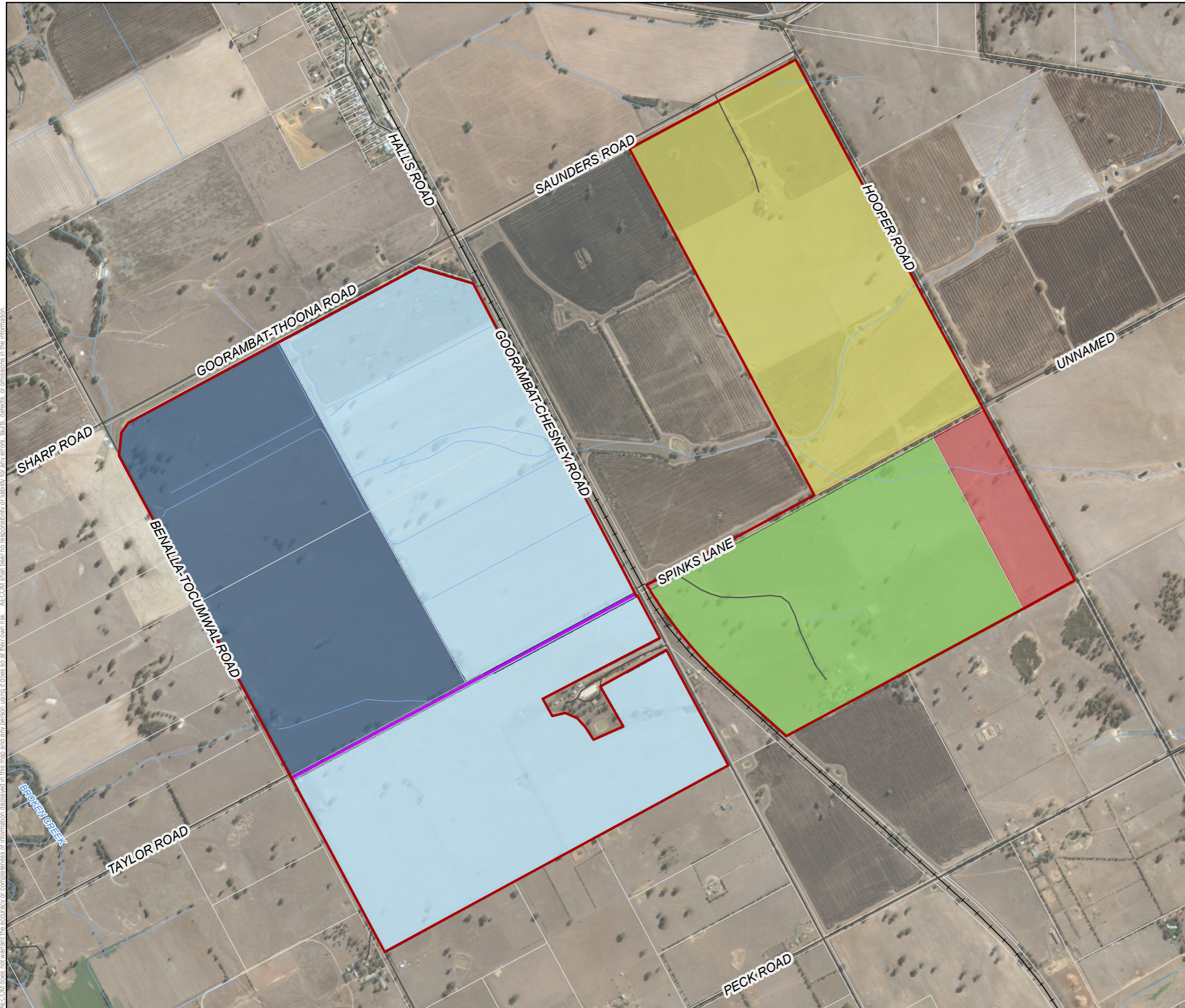
Figure 1 shows the land holdings by tenement and location while the series of three photos show the land use patterns across the properties.

⁴ 3725-Sharp Development Pty Ltd C/-South Energy 2018



Legend

- Site Investigation Area
- Roads
- Unused Government Road
- Railway
- Watercourses
- Cadastre
- Allotment 39B Parish of Goorambat
- Allotment 59A Parish of Goorambat
- Lot 1 and 2 TP399580
Allotment 41 Parish of Goorambat
- Lot 1 TP161528
- Lot 1 and 2 TP179662



Data Sources:
Locality, Railway, Drainage Line, Streets, Features © VICMAP - 2018

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Victoria State Government - Environment, Land, Water and Planning © (VICMAP) 2018
Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Goorambat East Solar Farm

LAND HOLDING

PROJECT #:	60591336
CREATED BY:	JB
LAST MODIFIED:	brierej; 16/08/2019
VERSION:	1

Figure 1

AECOM does not warrant the accuracy or completeness of information displayed in this map and any person using it does so at their own risk. AECOM shall bear no responsibility or liability for any errors, faults, defects, or omissions in the information.

Photos 1-3 show landform and land use patterns for the site. Photo 1 shows canola stubble in the foreground and cultivated wheat stubble in the background. The country rises to the north. Photo 2 shows cereal stubble following harvest. This paddock will be direct seeded to canola as the second rotation.

Photo 1: Canola stubble and undulating landform



Photo 2: Cereal stubble following harvest



Photo 3 shows merino ewes stubble grazing. Livestock facilities are now redundant with the change to intensive broadacre cropping.

Photo 3: Merino sheep stubble grazing



Summary of site characteristics

The site comprises the Goorambat Plains soil association. It is well suited to broadacre crop production providing minimum till practises are followed. The soil A horizon is subject to soil structure decline under over cultivation and the A2 horizon is a dispersive clay which is susceptible to waterlogging and requires regular gypsum input. Direct drilling with the necessary fertiliser and gypsum requirement can sustain continuous cropping and is considered Best Management Practice.

Under this regime there is no pasture ley phase which restricts the size of any livestock enterprise to stubble grazing and the occasional paddock that is rested from the cropping cycle. Wool sheep are favoured over beef and lambs.

4.0 PLANNING CONSIDERATIONS

4.1 Agriculture

The Benalla Planning Scheme, Clause 14.01, Protection of Agricultural land, has as its strategies:

- The agricultural quality and productivity of the farmland.
- The strategic significance of the land in the local, state and regional context.
- The economic importance of the land for the agricultural production and processing sectors within the Benalla district.

These strategies are addressed in Chapters 2 and 5 of this report.

Natural Resource Management, Clause 21.05-1 notes that agricultural land is a significant income generating asset. In defining Council's strategic position, it identifies four objectives that need to be met to ensure the productive capacity of the land is maintained. The objectives are:

- 1 To protect agricultural areas from inappropriate and unsustainable housing development.
- 2 To protect agricultural areas from inappropriate subdivision.
- 3 To protect agricultural areas from inappropriate and unsustainable development.
- 4 To consider amenity impacts that might arise from intensifying agricultural practices.

The first two objectives are specific to housing and subdivision and so have no relevance to the proposal. The fourth objective relates to the location of intensive animal industries such as feedlots, piggeries and poultry farms, so again have no relevance to the proposal.

Objective 3 lists four strategies to protect agricultural areas from inappropriate and unsustainable development:

- Protect productive agricultural land from uses and developments that will reduce its potential for agricultural production;
- Encourage and support viable and diversified alternative agricultural pursuits;
- Only consider proposals for non-agricultural uses in rural areas when they are compatible with surrounding agricultural use and when they can be justified in terms of broader community benefit;
- Encourage agricultural practices that are not detrimental to the environment and maintain native vegetation as far as practical.

The third strategy is the one which has relevance to the proposal and is addressed in Chapter 5 of this report.

4.2 Farming Zone

Clause 35.07 of the planning scheme defines the purpose of the Farming Zone. However, it is the Decision Guidelines, Clause 35.07-6 that are more specific in identifying agricultural issues and the impacts from non-agricultural uses. Most of the issues raised have some relevance to the proposal with the significant ones being:

- Whether the use or development will support and enhance agricultural production;
- Whether the use or development will adversely affect soil quality or permanently remove land from agricultural production;

- The capacity of the site to sustain the agricultural use;
- The agricultural qualities of the land, such as soil quality, access to water and access to rural infrastructure;
- Any integrated land management plan prepared for the site.

These issues are addressed in Chapters 2 and 5 of this report.

4.3 Design and development guidelines

DELWP⁵ have recently published draft guidelines on the appropriate location of solar energy facilities and require permit applications to address the following items and provide a design response:

- The agricultural quality of the proposed site.
- The strategic significance of the agricultural land.
- The potential impact of removing land from agricultural production.

The guidelines identify other requirements to be considered and include:

- The co-location and dual use with agriculture.
- Planning for future agricultural use.
- Decommissioning requirement of the facility.

These requirements are described and addressed in Chapters 2 and 5 of this report.

4.4 Planning precedent

The Benalla Rural City Council recently granted a planning permit to develop a solar farm within the study area. The property is located between Saunders Road and Spinks Lane, Goorambat, 130 hectares in size and adjoins three of the four landholdings involved in this current application. The planning application was for the use and development of a Renewable Energy Facility (solar).

There is strong commonality between the two applications:

- The natural feature characteristics are the same. Climate, soils, vegetation patterns, water, drainage and therefore land capability are identical.
- The farming system characteristics are the same, namely broadacre crop production being operated on a minimum till and continuous basis.
- The planning conditions of the Benalla Planning Scheme, Farming Zone and the more recent Design and Development Guidelines have equal application to the two proposals.

The only difference is one of scale. The Saunders Road proposal is 75MW capacity located on 130 hectares while the Goorambat East proposal is 250MW over 630 hectares. The lower density of the proposal is due to site characteristics rather than any other factor.

⁵ Department of Environment, Land, Water and Planning

5.0 STRATEGIC SIGNIFICANCE OF LAND

5.1 Industry significance of local agriculture

Grain

The current and future farming practice on the proposed project land holdings is to service the grains market, both cereals and oilseeds. The major marketing channel is GrainCorp Limited. The company's core business is the receipt and storage of grain and is listed on the Australian Stock exchange. Its operations extend throughout Australia and into North America and Europe with the closest receipt depot being Dookie.

There are a number of privately owned stock feed companies in the region that serve as alternative market outlets.

Grain is a readily transportable commodity and is not dependent on location for its handling and processing. However, a local receipt facilities lowers the cost of transport from farm gate to depot.

Livestock

Livestock numbers are unlikely to exceed 1,400 dry sheep equivalents as they play a minor role under continuous cropping regimes. At this level of numbers, any loss is unlikely to have an impact on the viability of livestock operations across the district.

5.2 Land removal impact

A critical feature of the proposal is what impact the removal of the site land will have on regional agriculture. There are three relevant issues to consider:

- 1 The natural resource characteristics of the Project site favour broadacre cropping and grazing activities. The quality of the land involved is considered "Moderate". While quite productive under a minimum till, continuous cropping regimes, care needs to be taken in soil management to avoid soil structure decline and susceptibility to waterlogging. This requires high standards of management which may not be available to all land holders, particularly when approaching retirement.
- 2 The loss of land to the solar farm represents a small proportion of the total available land to dryland agriculture within the Benalla region and unlikely to have any strategic effect. The loss of agricultural income is more than offset by the value of the proposal.
- 3 Land holders contributing some or all of their land to the proposal see it as a means of increasing per hectare income and a reduction in risk to their rural business enterprise. Most land holders are contributing only part of their total land holding to the proposal and see it as a means of income diversification. There are some however, nearing retirement age that view it as a better income alternative to renting or share-farming their holding, while still retaining ownership.

5.3 Co-location and dual use with agriculture

There is a potential opportunity of continuing to use the land for agriculture while operating as a solar farm. A recent international review on the interaction between agriculture and alternative

energy sources was recently conducted by Dr Cassandra Scheffe⁶ to identify any mutual benefits that might be realised between agriculture and solar farms.

The review concluded that crop productivity gains could be realised under solar panels but was strongly dependent on crop type, degree of shading and water availability.

There is a lack of similar work in Australia. A trial at Parkes Solar Farm in 2017 successfully used a mob of sheep to reduce herbage bulk under the panels over a three week period, but this work needs to be extended to a longer term to be confident of the outcomes that can be realised.

The review highlighted several issues:

- Co-location and dual use between agriculture and solar farms need to be considered before the commencement of a project to enable the incorporation of any necessary design features for each activity;
- The management requirements for agriculture and solar farms are quite different. The skills for each need to be included in the project team. Agriculture is environmentally and biologically based whereas solar farming is largely engineering based. An Integrated Land Management Plan is likely to be an essential planning requirement to soften the interface between agriculture and engineering;
- The project life is estimated to be 25-30 years. The manner of decommissioning is an important element in managing the return of land to agriculture without loss of productive capacity.

5.4 Economic importance of land

The Project land, under Best Management Practice would be directed to broadacre cropping with a complementary livestock enterprise for stubble and vegetation control. An average gross margin of \$500/ha is considered reasonable for crop production. For livestock, the gross margin is lower at \$350/ha. However, on a whole farm basis, when allowance is made for unproductive land, areas unsuited to crop production and the occasional crop failure, the average yearly gross margin is reduced to \$400/ha.

For the total land area contributing to the project, this represents a total gross margin (before overheads) of \$252,000.

The value adding effect of broadacre cropping is relatively low involving transport, segregation, storage and processing. The multipliers used are generally in the range of 2.0-2.5 of farm gate value.

⁶ Review of current published knowledge-solar and agriculture, Dr Cassandra Scheffe, May 2019

6.0 CONCLUSION

The Goorambat Soil Association is classed as 3 or “Average”. The A horizon is a fine sandy clay loam with an increasing clay content with depth. Soil pH is acid, fertility levels moderate with a soil profile that exhibits low permeability and is subject to waterlogging. There is no irrigation supply and because of soil profile characteristics, the land is generally unsuited to irrigation.

The loss of land to the solar farm represents a small proportion of the total available land to dryland agriculture within the Benalla region and is unlikely to have any strategic effect. There is no productive farmland of strategic significance on the site.

Other soils in the region, particularly those within the GMID are more productive because of their soil profile characteristics, suitability to irrigation and capacity to support horticultural and intensive grazing farming systems. These soils vary between Class 1 and Class 3 (as per Table 1).

Broadacre cropping is the major land use using direct drilling techniques to avoid deterioration in soil structure, retain soil fertility levels and avoid erosion risk. Continuous cropping is possible alternating between cereals and oilseeds. Under this system, livestock are only used as a management tool for stubble grazing.

The Project land, under Best Management Practice would be directed to broadacre cropping with a complementary livestock enterprise for stubble and vegetation control. An average gross margin for crop and stock is estimated to be \$400/ha. For the total land area contributing to the project, this represents a total gross margin of \$252,000.

Land holders contributing to the proposal see it as a means of increasing per hectare income, providing income diversification and reducing agricultural risk. There are some land holders are nearing retirement age who view the proposal as a better income alternative to renting or share-farming while still retaining ownership of their land holding.



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