Appendix N

Agricultural Impact Assessments

AGRICULTURAL IMPACTS

of the

INSTALLATION OF SOLAR PANELS AND CONSTRUCTION OF

the

WEST MOKOAN SOLAR FARM

For

892 Yarrawonga Development Pty Ltd

Prepared by

C.J. de Kok
&
A.J. Pitt

Ag-CHALLENGE CONSULTING pty. ltd.

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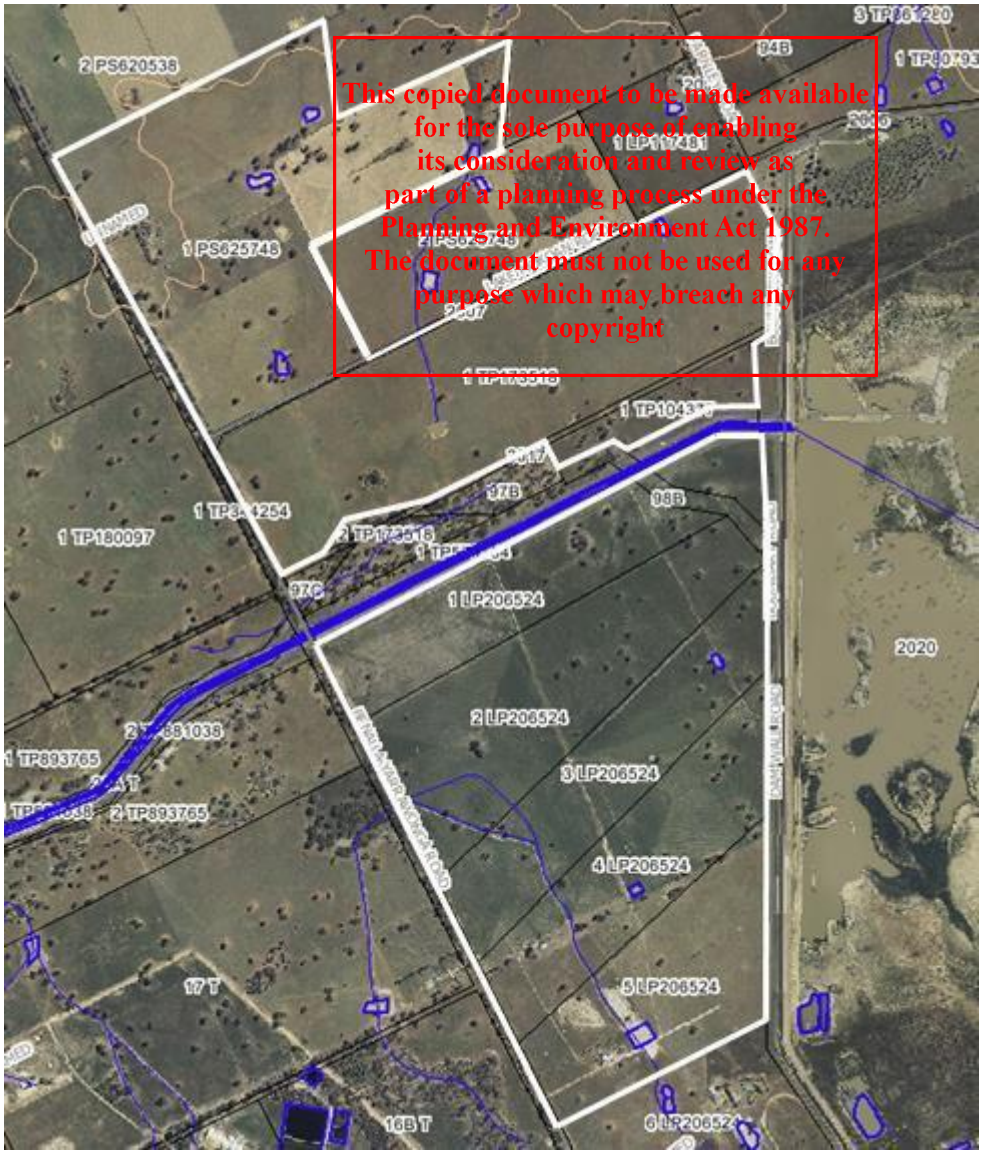
1. Introduction

1.1 Project Brief

Ag Challenge Consulting has been instructed by South Energy on behalf of 892 Yarrawonga Development Pty Ltd to investigate the agricultural impacts of a proposed construction of a solar farm on approximately 430 hectares of farmland on the western side of the Winton Wetlands at Benalla in northern Victoria. The investigation is to describe the existing agricultural use in both a local and regional context and to consider the impact of the solar development 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.

The 430 hectares of farmland is comprised of five separate parcels, each of which consists of just one or several separate titles. An aerial photomap of the proposed site is provided in Figure 1.

Figure 1. Aerial of the Combined land parcels



The five separate parcels can be described as follows:

- Lot 1 PS625748, known as 892 Benalla Yarrawonga Road, approximate area 102 hectares,
- Lot 1 TP173518, approximate area 95 hectares,
- Lot 1 TP104377, approximate area 13 hectares,
- A crown land parcel of 3.1 hectares being Crown Allotment 98B Parish of Goorambat, and
- Lot 1, Lot 2, Lot 3, Lot 4 and Lot 5 of LP206524, collectively known as 616 Benalla-Yarrawonga Road, approximate area 217 hectares.

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 Southern Victoria and Northern Victoria. The company is based at 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 undertakes farm design work. The recycled water industry is a significant user of Ag-Challenge Consulting for the design and monitoring of recycled water projects.

2. Regional Context

2.1 Property Zoning

The land is located within the Benalla plain and the majority of lots are currently zoned as Farming Zone within the Benalla Planning Scheme. This is denoted as such by the acronym FZ on the Planning Scheme Map. The purpose of the Farming Zone is:

> *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.*[1]

A planning permit is required for the development and use of a Renewable Energy Facility and Utility Installation within the Farming Zone, and the Planning Scheme states that a condition of approval is that the facility must meet the provisions of Clause 53.13 of the Planning Scheme. Among other provisions, Clause 53.13 states that the applicant must undertake a site and context analysis including a description of the site and surrounding area. This

[1] Victorian Planning Provisions – DELWP - http://planning-schemes.delwp.vic.gov.au/schemes/vpps/35_07.pdf

assessment of agricultural impacts forms part of the response to the provisions of Clause 53.13.

There are no planning overlays that apply to the properties.

The Solar Energy Facilities Design and Development Guideline (August 2019) specifies a number of factors that 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, including an assessment of the agricultural significance of the land and the location of agriculturally significant land within the Shire and the region.

The various titles are all within a Designated Bushfire Prone Area. The Designated Bushfire Prone Area identifies land at high risk of bushfires occurring within the area. The purpose of this designation is to ensure that any development within the area meets bushfire construction requirements.

An area of Aboriginal Cultural Heritage Sensitivity lies along the drainage corridor between the south boundary of Lot 1 TP1735128 and the north boundary of Lot 2 LP206524, and extends into the north east corner of Lot 2 LP206524. Culturally Sensitive Areas normally require a management plan to be prepared prior to any development or change of land use. The management plan is to identify the nature of sensitive area and specify how development may proceed without impacting on the sensitivity. A Cultural Heritage Management Plan is currently being prepared for this project.

2.2 Climate

The climate of the Benalla Plain is defined by low annual rainfall and hot summers. The region experiences hot summers with an average daily maximum temperature of 31 °C. Thunderstorms during summer are not uncommon and lead to an increased risk of fire and floods. Winters are mild, with frosts a common occurrence[2]. The average annual rainfall of the area is 500 mm; the mean rainfall for Benalla is 617 mm per annum[2]. Since 1950 the annual average temperature in this area has increased by as much as 1.2 °C and rainfall decreasing by as much 200 mm per annum[3]. The weather of the lower slopes and plains of the Benalla Plain is conducive to broadacre cropping together with low density grazing such as sheep and cattle.

[2] Climate-Ready Victoria, Hume – Victorian State Government - https://www.climatechange.vic.gov.au/__data/assets/pdf_file/0022/60745/Hume.pdf
[3] Climate-Ready Victoria, Hume – Victorian State Government - https://www.climatechange.vic.gov.au/_data/assets/pdf_file/0022/60745/Hume.pdf

2.3 Regional Landform

The Benalla Plain has been formed from the outwash and flood deposits from the north flowing rivers in this section of the Murray Darling Basin. The King, Broken and Ovens rivers emerge from the Victorian highlands as fast flowing streams and rapidly slow as they enter this extensive geological feature. Over many hundreds of centuries these streams have deposited sediments across a broad plain. The deposits are very extensive and often very deep, and the flood plain is characterized by numerous terraces at different levels, prior streams, existing flood plains, swamps and billabongs. The landforms and their associated soils in this particular section of the Benalla Plain were described in some detail by Rundle and Rowe (1974)[4].

Rundle and Rowe describe four separate land types (land systems) within this section of the Benalla Plain which are all low lying and lacking in topographical relief. They are the Benalla system, the Samaria system, the Warrenbayne – Tatong system and the Mokoan system. They differ in soils and drainage as well as minor differences in climate. The Mokoan system encompasses all the land which is the subject of this impact study and is described *as a flat plain which contains swamps and areas of internal drainage…. The topography is very subdued and consists of outwash slopes at the foot of the hills, and swampy plains which terminate in swamps… The area is developed on alluvium and dark coloured stream sediments derived from both granitic and sedimentary rock. The land system occupies 247 square kilometres.*

The other three land systems within the Benalla Plain are described as having better drainage and better soils for a diversity of agricultural uses. The Mokoan land system has limited versatility for agriculture because of the soil types and regional drainage restriction.

2.4 Regional Land Use

The intensity and type of agricultural production varies across the Benalla Plain. Grazing on both improved and unimproved pasture is common in the southern areas, where low hills and outwash slopes are interspersed with broad flood plains and old river terraces. There is substantial viticulture in the southern areas where soils and climate are suitable. The northern parts of the Benalla Plain can be conveniently separated from a land use perspective into eastern and western areas. The western area has well drained soils and is a highly productive agricultural region. In this area intensive agriculture is based around Shepparton. Fruit crops, vegetable crops, dairying and fodder production for intensive animal industries are all undertaken using irrigation water from the Goulburn system. The eastern area does not possess the same extensive areas of well drained soils and plant growth is often restricted in winter due to waterlogging. The eastern area is used for more extensive forms of agriculture such as grazing of beef and sheep cattle and some broad acre cropping. These properties are located within this eastern area.

[4] Rundle and Rowe (1974) A Study of the Land in the Catchment of the Broken River, TC 9, Soil Conservation Authority Victoria

3 Site Characteristics

3.1 Description of the Land

This land is located within a flat depositional landscape with nearby swamps and internal drainage basins. The Winton Wetlands (formerly Lake Mokoan) is a large internal drainage basin located to the east of the subject property. Stockyard Creek is the natural overflow from this wetland and is a partly man made drain that carries water from the Wetlands to the Broken River and lies along the corridor between the north and south parcels of the subject land. Surface water drains towards this channel and then towards the Broken River. The topography is very subdued.

The underlying geology is alluvial deposits, partly derived from both granitic and sedimentary sources upstream in the catchment of the Broken River, and partly derived from lacustrine deposits from a former lakebed in this area. There may be prior streams embedded within the strata.

3.2 Soils

The soils of the properties were assessed by Glenn Marriott and Cameron de Kok of Ag-Challenge Consulting during the site visit on November 27, 2018. The soils were similar over most of the landscape and can be described as a yellow duplex soil that has a tendency towards poor internal drainage and winter waterlogging. These soils are described regionally as being duplex, poorly drained, calcareous at depth and usually gilgaied. No gilgai were observed during the site visit but surface working of the soil is likely to have masked this soil property. A soil profile description from the field investigation of November 27, 2018 is included below.

Table 1 Soil Profile Description, 892 Benalla Yarrawonga Road, Goorambat:

Depth (cm)	Horizon	Description
0 – 15	A1	Dark Yellowish Brown (10YR 5/4) **Fine Sandy loam**. Moderate Structure Abrupt *to:*
15 – 25	A2	Light Yellowish Brown (10YR 6/4) **Clay Loam** Weak structure Some minor gravel to 3mm *Clear transition to:*
25 –	B2	Brownish Yellow (10YR 6/6) with mottles of yellow, light red and white **Light Clay** Well Structured Hole terminated at 1100 mm

These soils are limited in the diversity of potential uses. The B2 horizon has low porosity and appears to be only slowly permeable, thus restricting vertical movement of water through the soil profile. The three northern parcels have no recent broad acre cropping and presence of swamps in the immediate area is indicative of poorly drained soils and susceptibility to winter

waterlogging. The southern parcel appears to be slightly better drained and has been regularly cropped to oilseed crops and forage crops.

3.3 Native Vegetation and Riparian Zone

Stockyard Creek is a partly natural and partly man-made waterway that follows the corridor between the north and south parts of the combined land parcel. The riparian zone of this waterway is heavily timbered. The species have not been formally identified but are likely to be Red Gum and possibly some Grey Box. This riparian zone is not part of the proposed area for solar development, and is entirely contained within other land titles.

Elsewhere there are scattered remnants of the former open woodland vegetation that would have once grown across this landscape. The remnants are mostly confined to the margins of the dams but there are also a number of trees scattered elsewhere, including a slightly denser stand in the north east corner of the combined land parcel. Refer to the Flora and Fauna Assessment Report prepared by AECOM for further details on native vegetation on the site.

Despite the poor ability for these soils to drain, there was no evidence during the site inspection of uncontained water ponding. Surface run-off is currently captured in farm dams or makes its way to the water channel of Stockyard Creek.

3.4 Water Supply

Within the boundaries of the combined land parcel are 13 dams, the largest of which has a capacity of around 15 ML. These dams are well sited to collect surface water run-off from surplus rainfall. All stock water is sourced from surface runoff into the farm dams and also from stock having access to surface water within the waterway along the southern boundary. Water security for stock water appears to be adequate.

3.5 Current Land Use

The northern parcel on the north side of Lake Mokoan Road (Lot 1 PS625748) is used for fattening cattle. The current system being used by the owner of the northern property (892 Benalla- Yarrawonga Road) is to purchase weaned Fresian cross heifers, join them to an Angusbull and sell them as vealer mothers at the point of calving.

The central parcel of land (Lot 1 TP173518) is part of a larger farm enterprise which runs sheep. This parcel is used as a turn out paddock to compliment the sheep enterprise. Depending on seasonal conditions, it can also be used for grazing cattle.

The southern parcel (Lot 1 to 5 of LP206524) is mainly used for grain and oilseed cropping and fodder crop production. It has one large dam that has been used in the past to irrigate summer fodder crops and pasture, but the current landowner has not used this dam for irrigation for several years. The current landowner possesses a 15 Megalitre irrigation licence that can be used in association with this dam to irrigate crops, but chooses not to do so.

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[5] The Land Capability Rating system for low rainfall grazing use has been applied to the combined land parcel and determined to have a value of 2 using the highest determined value method across a range of potentially limiting parameters (Table 2). A rating value of 1 or 2 means that the land is suitable for this use and the hazards associated with such use are low to very low. It indicates that this is a sustainable form of land use. No other land capability ratings for other agricultural land uses have been examined due to the restrictions from the soils and soil drainage.

Table 2 Land Capability for Grazing[6] in low rainfall areas (500 mm to 625 mm per annum)

	Land Capability Classes[6]					**Selected Capability Rating**
Land Feature	1	2	3	4	5	
Slope	Less than 10%	10% to 20%	20% to 30%	30% to 40%	More than 40%	**1**
Aspect	E. SE	S. SW, NE	N, NW, W			**1**
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		**2**
Average soil depth	More than 1.0 m	0.6 m to 1.0 m	0.3 m to 0.6 m	0.15m to 0.3 m	Less than 0.15 m	**1**
Surface rock	Less than 2%	2% to 15%	15% to 25%	25% to 40%	More than 40%	**1**
Nominal DSE rating	More than 5	3.5 to 5	2 to 3	0.5 to 2	Less than 0.5	**1**

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 soils, good rainfall, access to irrigation, resilience to climate change, existing infrastructure investment and/or its special role within a specific industry. These criteria have been considered and the assessment is presented in Table 3. None of this land fits with these criteria. In particular, the soils are not high quality, the rainfall is only moderate and quite variable from year to year, and there is no specific farm or public infrastructure which makes the land inherently productive or special. The southern parcel (Lots 1 to 5 of LP206524) does have a dam that can be used to irrigate part of the property as a private irrigation system.

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

Table 3 Assessment of the agricultural values of the Combined parcel land

Attribute Group	Assessment Criteria	Project Land Assessment	Comments
Soils and Landscape	Inherent Soil Quality Niche Soil Inherent Soil Versatility	Fair quality soils No Low versatility	These soils are poorly drained and not inherently productive or well suited to cropping use. They do have good water holding capacity and are naturally stable, but not highly productive.
Water and Climate	Access to modern irrigation infrastructure	15 Megalitre irrigation licence	The southern parcel possesses irrigation infrastructure and a 15 Megalitre irrigation licence. As such a small parcel of land (10 to 15 hectares) could be irrigated. The greater balance of the land (395 hectares) is entirely dependent on natural rainfall.
Impact of fragmentation	Impact on local and regional productivity	Yes	The impact on local and regional productivity is minor
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	Other than inclusion within the Farming Zone, the land has no special protection for agricultural values
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	Limited	There are opportunities for sheep grazing to continue beneath the panels, although the carrying capacity will be reduced. In areas where solar panels are not installed, existing grazing can continue.

The agricultural values of the subject land that may identify the combined site as being strategically important land or strategically significant have been outlined in Table 3. The combined parcel of land can be described as fair quality land for grazing and for broad acre cropping, but it has no special values. The combined parcel 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. It is currently part of the extensive land resource that supports the grazing and broad acre cropping districts of Benalla.

The combined parcel of land is productive farmland. The proposed change of land use to solar energy production will mean that much of the current agricultural productivity will be lost in favour of the alternative use for energy production.

4.3 Potential Agricultural Productivity of the Site

With improved pastures and appropriate inputs of fertilizer and management, the potential carrying capacity for grazing on these farms has been estimated to be around 10 dse[7]/ha for a total of 4300 dse for the combined land parcel.

Alternatively the southern parcel of 216 hectares can be removed from this calculation as it has been used in recent years for cropping. At a regional level canola yields for 2017/18 averaged 2.1 tonne/ha (ABS data). As such the combined potential production is 2140 dse for the existing grazing land and 350 tonnes to 400 tonnes of canola with some variation depending on the specific crop chosen and seasonal conditions.

The current carrying capacities for the grazing enterprises are considerably lower than these figures as pastures are generally dominated by unimproved species and the fertility appears to be in need of some enhancement.

4.4 Indicative Gross Margins

A gross margin for the production of beef vealers from first cross cows (Fresian/Angus cross) has been prepared and is presented in Table 4. This is based on the description of the production system used by the operator of the parcel on the north side of Lake Mokoan road (Lot 2 PS625478). It shows a 25 cow production unit grazed on 40 hectares of improved pasture and with a carrying capacity of around 10 dse per hectare. Further details of the carrying capacity and livestock reconciliation are in Appendix I.

Each cow and calf unit from this production system would require around 1.6 hectares of improved pasture, and the gross margin from this production unit of 25 vealer mothers can be extrapolated to match the available grazing area. That is, if 80 hectares of improved pasture are available, two units or 50 first cross cows can be grazed. Alternatively if the land is unimproved and carrying capacity is only 5 dse/ha, the 80 hectares would be required for just one production unit of 25 first cross cows. It is assumed that peak production period is cycled to match the seasonal nature of pasture growth in the spring.

The gross margins for other production systems in use on these land parcels have not been modelled. They will all provide broadly similar gross margins and differences between the calculated values will depend more upon assumptions made than upon innate differences between profitability of different production systems. The cropping gross margins in

[7] dse or dry sheep equivalent is a measure of stock fodder requirements and is defined as the amount of feed required to maintain the bodyweight of a 2 year old 45 kg merino wether.

particular will be highly dependant on the assumptions made on machinery use and maintenance as well as yields and seasonal conditions.

Table 4 Indicative Gross Margin for First Cross Vealer Mothers on 40 Hectares

Income	Per ha	Unit	Price/unit	Cash Income
			$/unit	$
Sale of Weaners	25	head	3.10	23250
Sale of Cull Cows	4	head	2.10	4620
Sale of Cull Bull	1	head	2100.00	2100
Total Income				**29970**
Expenditure	**Quantity**	**Units**	**Price**	**Cash Costs**
			$/unit	$
Purchase of Heifers	4	head	650.00	2600
Purchase of Bulls	1	head	3500.00	3500
Cartage costs	5	from point of purchase	25.00	125
Cartage costs	29	to point of sale	25.00	725
Saleyard fees	29	head	8.00	232
Agents commision	4.5	percentage of sale revenue	0.045	1349
Fodder vconservation	25	Rolls of hay	26.000	650
Fertilser (Pasture Booster)	0.1	tonne/ha	750.00	3000
Fertiliser (urea)	0.1	tonne/ha	650.00	2600
Drenches and vacines	178	head	10.00	3560
Total Costs				**18341**
Gross Margin				**11629**

The analysis in Table 4 shows a potential gross margin of around $11,629 per annum from 40 hectares of improved pasture. Extrapolating this to the total area of approximately 430 hectares would give a gross margin of around $125,000 if all the land was being gazed on improved pastures. If the existing cropping land is excluded from this calculation, the remaining 214 hectares (430-216) would have a potential combined gross margin of $62,000.

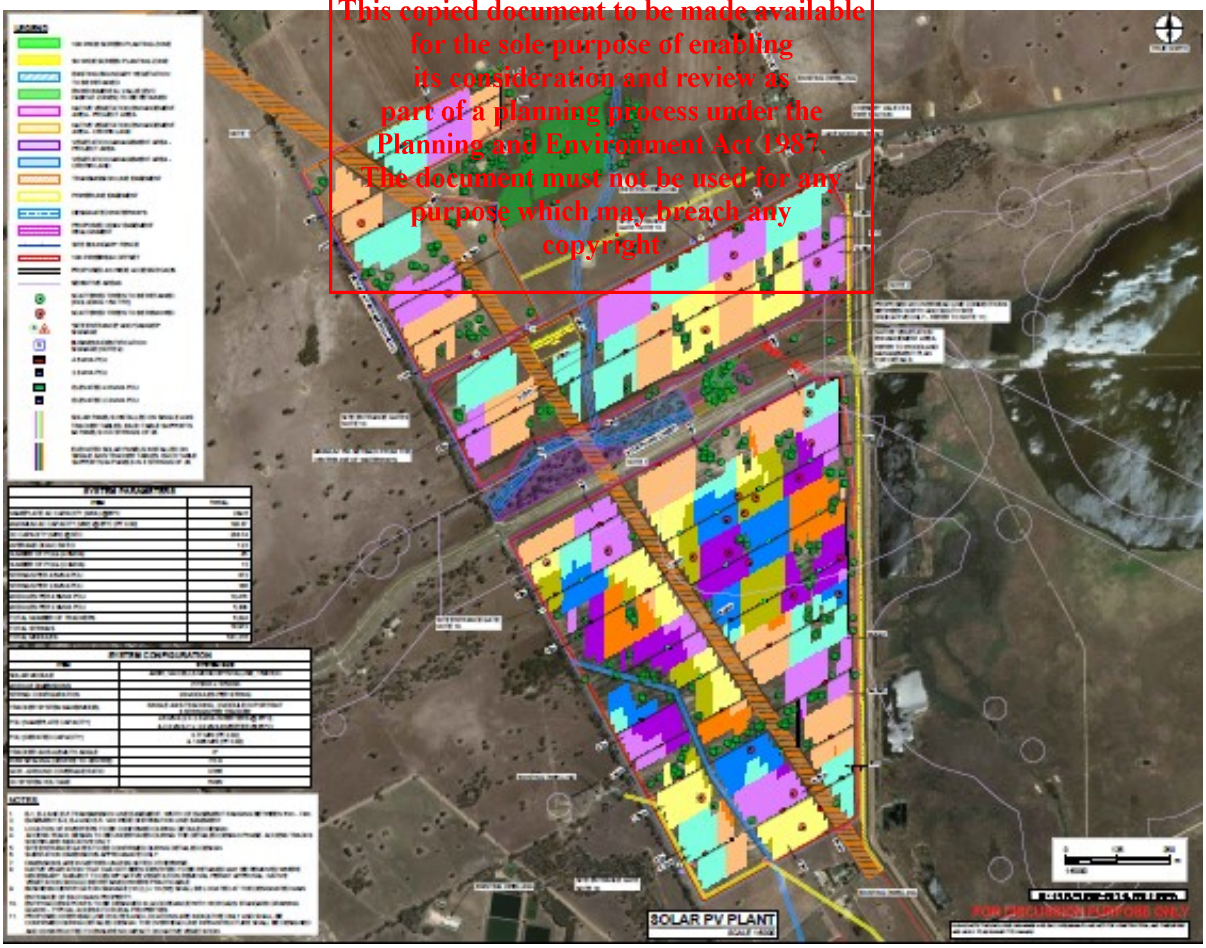
5 Potential Impacts of The Solar Farm development for Agriculture

5.1 Livestock, Crop Production and the Solar Farm

The proposed concept design of the solar arrays together with utility areas, areas to be retained with existing native vegetation, areas planted to shelter belts and other proposed uses is provided in Figure 2. Detailed design is yet to be fully resolved. The proposed design provides a significant area of land for development for solar panels, but also a considerable area is proposed to be retained with no solar array development. This latter will presumably continue to be available for grazing use.

The installation of the solar panels will see physical changes to the farm. Existing internal fencing will mostly be removed. A large number of the dams are to be filled in to create extra space for the installation of the solar panels, although some of the larger dams are being retained and will provide security for stock and for fire fighting purposes and for reticulation to defined watering points if stock are to be grazed beneath the panels.

Figure 2 West Mokoan Solar Farm Proposed Solar Development



Sheep may be able to be grazed beneath and between the solar panels. The carrying capacity of the farm will be much lower than the current capacity. The reduced carrying capacity is as

a result of the restriction on plant growth due to the presence of the solar panels. Solar panels are installed for the purpose of capturing sunlight and converting it to power. This competes directly with photosynthesis of grasses and other plants, which is the process by which plants convert sunlight into energy for the purpose of growth. With solar panels installed above pastures, there will be a reduction in the quantity of light which gets through, reducing the potential growth of the plants.

There is also an impact on soil moisture as affected by rainfall. The solar panels will not reduce the amount of rain but will change where the moisture will accumulate. Instead of rain falling evenly over all of the land, around half of the incident rainfall will fall on the panels, generating runoff which will be directed onto the area of land just below the panels. Although the uneven spread in rainfall may further reduce the growth of pasture overall, it is likely to stimulate plant growth in the area where rainfall is directed.

Should stock be used to control grass sward length on the farm, sheep would be preferable to cattle as they would be less likely to damage solar panel infrastructure. The current farm infrastructure will need to be updated to do so. In particular, a stock water reticulation system would be desirable. Subdivisional fencing will need to be sheep proof.

5.2 Weeds

Weeds as a result of the development of the solar farm are likely to be largely dependent on the management of the pastures after the solar farm has been established. It is probable that weeds will establish in disturbed soils from the installation of powerlines and solar panels. It is unlikely that the solar panels will directly cause a weed problem, but weeds may invade pastured areas because of the soil disturbance involved during panel installation. Weeds will grow in and around pastures as is the case on the farm in its present state. A weed management plan will be required to minimise the growth of weeds.

5.3 Impact of Solar Farm on Neighbouring Farms.

There is no clearly identifiable agricultural impact from the installation of solar panels on any of the surrounding farming businesses. The removal of this 430 hectares from grazing and cropping use should not result in any discernible negative impacts on the other grazing businesses in the immediate area. It should not unduly affect market competition. It should not affect the ability of the adjacent farms to operate efficiently. It should not affect productivity of any of the adjacent properties.

5.4 The Agricultural Amenity of the Region.

The Australian Bureau of Statistics (ABS) compiles and publishes agricultural commodity data for nine separate agricultural regions in Victoria, referred to as Statistical Areas Level 4. The subject land for this impact analysis all lies within the Hume Region. ABS data for the Hume Region shows a significant and stable beef industry with around 470,000 head. The regional beef herd is complemented by 1,000,000 head of sheep and cull animals from the dairy industry. The gross value of meat production from the region is around $340m. Wheat dominates crop production for the region (25,000 ha), followed by canola (15,000 ha) and another 29,000 ha is used each year for fodder production (mainly pasture based hay).

The proposed solar development will potentially remove around 200 hectares of grazing land from beef production (although it could still be partially used for sheep) and 216 hectares from crop production. On current carrying capacity estimates this would be a loss of grazing area for 130 head which is just 0.03% of the regional beef herd. This should have no noticeable effect on beef supply or market competition. The loss of 216 hectares of cropping land equates to 0.4% of the cropping land within the region. Again this should have no noticeable effect on supply or competition within the region.

The loss of this land for grazing of cattle should not affect the ability of the adjacent farms to operate efficiently. The adjacent farms appear to have unrelated production systems. It should not affect productivity of any of the adjacent properties.

If all the land were at a productive optimum, the estimated gross margin from a vealer mother beef herd for this land is around $284 per hectare per annum. The total gross margin from the productive grazing land could be as high as $62,000. This is not sufficient farm income to support one labour unit. It is likely that other income sources would be required for any of the grazing enterprises to remain as an economically viable entity.

While substantial farm income would no longer be available from agricultural use of the land, this loss of income is offset by the income from the renewable energy facility. Similarly, loss of agricultural employment is fully offset by the employment of operation and maintenance staff to manage the renewable energy facility. There would be additional employment of contractors during the construction phase.

5.5 Cumulative Effect of Solar farms on Agriculture in the Region.

There are currently seven known solar farms within the regional area of the subject site that have been approved for development and operation. The electricity generation capacities range from 70 MW to 250 MW and development footprints from 30 hectares to 600 hectares (Table 5). Six of these farms are located within the Rural City of Benalla, and one is within the Rural City of Wangaratta. The Winton Solar Farm and the Glenrowan West Solar Farm are currently under construction and expected to be operational by early 2021.

Table 5 Solar Farms in Proximity to West Mokoan Solar Farm

	Distance from Project	Generation Capacity	Development Footprint
Winton Solar Farm	11 kilometres south-east	85 MW	250 hectares
Mokoan Solar Farm	10 kilometres south-east	15 MW	30 hectares
Glenrowan West Solar Farm	14 kilometres south-east	125 MW	320 hectares
Glenrowan Solar Farm	16 kilometres south-east	140 MW	245 hectares
Goorambat Solar Farm	8 kilometres north	70 MW	130 hectares
Goorambat East Solar Farm	8.5 kilometres north	250 MW	600 hectares
Kennedys Creek Solar Farm	5.2 kilometres south	125 MW	290 hectares

6 Environmental Risks

6.1 Soil Erosion

The nature of the landscape in which this farm resides means that there is a low overall risk of erosion from the development of the Project. As a result of a predominately flat landscape the only area that is at medium risk of erosion is the natural waterway crossing through the south western corner of the property. While this waterway currently shows good structural integrity, the solar array will require a spatial separation from the embankments. With careful design and management of runoff as discussed in the paragraph below, it should be possible to achieve an outcome whereby there are no heightened flows from runoff into the drain and thus no higher risk erosion within this waterway than with the current agricultural enterprise.

The design and management of the surface water requires special consideration. In the first instance, the runoff of water from the panels may result in degradation of the soil below the panels where the water falls. The panel will tend to concentrate runoff as both an impact and an increased flow into a relatively small area. The degree of concentration will depend on the size of the panels, with smaller panels providing a lower level of risk than larger panels. These soils are not considered to be excessively prone to impact damage or dispersion. However, it would be prudent to consider placing crushed rock below each panel where water falls to absorb the impact energy of the rain splash, and also to help disperse the runoff across the soil surface rather than allowing concentrated flows within a small area. With impact damage minimized, it will also be prudent to introduce measures that will retard surface runoff and increase infiltration. The total area of panels is substantial and the runoff from storm events will be concentrated by hard surfaces. It is undesirable to allow the higher flows to move directly into the drain in the south western corner of the property as the waterway may not be able to cope with higher erosivity of the flood flow. The surface runoff needs to be dispersed and retarded as far as is practically possible around the property so that no higher storm runoff occurs within any natural or manmade waterway.

While the design of the Project needs to consider soil erosion risks and mitigate against this appropriately, it would also be prudent to incorporate a soil loss and land degradation review into the monitoring program. Other measures to prevent soil loss can be introduced if the design needs modification. An annual review for the first five years of operation would be appropriate.

6.2 Wildfire

The location of the property within a dry arid climate gives it an inherent risk of fire damage. Bush fires are a common occurrence during Australian summers and occur more easily in dry areas where fuel (dry plant matter) for a fire is readily available. Summer thunderstorms are also common within Goulburn Broken region and as such further increase the risk of bushfires.

The key to fire management is to manage fuel loads, so that if fire does occur it is of low intensity and controllable. It will be important to consider how this is done and a number of options are available. One option would be to graze under the panels with sheep, ensuring that the sheep are unable to damage the panels as part of the initial design. This may mean preserving some of the existing farm infrastructure so that stock water can be reticulated

around the property. Another option would be to use chemical weed control to suppress vegetation within and around the panel areas. A third option would be to mulch the soil with rock or some other substances that will suppress or severely limit plant growth beneath the panels. The increased electrical infrastructure may result in higher risk of ignition, but the fuel load management is critical to how a fire, once started, is controlled.

It is anticipated that general bushfire management measures will be addressed in the Project's detailed Environmental Management Plan. The Bushfire Management Plan will be prepared in consultation with the Country Fire Authority (CFA) to ensure that appropriate fire risk assessments are undertaken and measures are implemented during development and operation, to minimise the risk to life and property from fire.

7 Conclusions and Summary

- The subject land comprises an area of approximately 430 hectares of agricultural land on Benalla-Yarrawonga Road, Benalla in five separate parcels. The land is currently utilised for grazing and cropping.
- There are no inherently unique features about the subject land that distinguish it from neighbouring farms in the area.
- The climate of the area is notable for dry and hot summers, summer thunderstorms, moderately low annual rainfall, and significant frost incidence in winter.
- Much of the native vegetation within the four properties has been removed over the years. Some mature eucalypts remain on farm dams and in the north east corner of the combined parcels. Remnant vegetation also occurs along the drainage corridor between the north and south groups of land parcels.
- The landform is a flat plain and is part of the extensive landscape of the Benalla Plain.
- The soil types present are noted for low permeability and there is a regional problem in this area with impeded drainage.
- The land is neither highly productive nor particularly versatile. It is not considered to be significant land from an agricultural perspective
- The development of a solar energy facility on the combined property will alter the nature of the farms. Grazing with cattle may no longer be possible except within areas where no panels are to be located. Cropping will no longer be practical as residual areas with no panels are either timbered or too small to be used for broad acre crops. With appropriate design of the panels and introduction of stock water, sheep may be able to be grazed between the panels. The carrying capacity of the farm will be reduced.
- 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.
- The concentration of runoff from the panels onto the soil surface may initiate soil erosion and streambank erosion. Consideration needs to be given to minimizing this risk in the design stage.
- Heightened wildfire risk will occur if attention is not given to how fuel loads on the

farm are managed. Fuel load management needs to be considered as part of the project design.

Appendix I

Model for 25 First Cross Cows for Vealer Production

Opening			**Closing**	
Cows	25		Cows	25
Heifers (joined)	5		Heifers	5
Bulls	1		Bulls	1
Purchases			**Sales**	
Heifers	5		Weaners	25
Bulls	1		Bulls	1
Birth	25		Cull Cows	4
			Deaths and provisions	1
Total	**62**		**Total**	**62**

Annual Feed Requirements				
Type of Stock	DES rating	Portion of the year		DSE
Cows (weaner mothers)	14	12	months	350
Heifers	9	12	months	45
Bull	14	12	months	14
			Total DSE	409
Area required at	**10**	**DSE/ha**	**41**	**hectares**

Cull cow price	2.1	$/kg		
Weaner sale price	3.1	$/kg		
Cull cow sale weight	550	Kg		
Income	**Per ha**	**Unit**	**Price/unit**	**Cash Income**
			$/unit	**$**
Sale of Weaners	25	head	3.10	23250
Sale of Cull Cows	4	head	2.10	4620
Sale of Cull Bull	1	head	2100.00	2100
Total Income				**29970**
Expenditure	**Quantity**	**Units**	**Price**	**Cash Costs**
			$/unit	**$**
Purchase of Heifers	4	head	650.00	2600
Purchase of Bulls	1	head	3500.00	3500
Cartage costs	5	from point of purchase	25.00	125
Cartage costs	29	to point of sale	25.00	725
Saleyard fees	29	head	8.00	232
Agents commision	4.5	percentage of sale revenue	0.045	1349
Fodder vconservation	25	Rolls of hay	26.000	650
Fertilser (Pasture Booster)	0.1	tonne/ha	750.00	3000
Fertiliser (urea)	0.1	tonne/ha	650.00	2600
Drenches and vacines	178	head	10.00	3560
Total Costs				**18341**
Gross Margin				**11629**
Gross Margin/DSE				**45**
Gross Margin/ha				**284**

Prepared for
433 Link Development Pty Ltd
ABN: 30 626 633 369

Project Amendment Addendum

Agricultural Impact Assessment

22-Feb-2023
Kennedys Creek Solar Farm

Project Amendment Addendum

Agricultural Impact Assessment

Client: 433 Link Development Pty Ltd

ABN: 30 626 633 369

Prepared by

AECOM Australia Pty Ltd
Wurundjeri and Bunurong Country, Tower 2, Level 10, 727 Collins Street, Melbourne VIC 3008, Australia
T +61 3 8670 6800 www.aecom.com
ABN 20 093 846 925

22-Feb-2023

Job No.: 60597829

AECOM in Australia and New Zealand is certified to ISO9001, ISO14001 and ISO45001.

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1.0 Introduction

1.1 Purpose

The purpose of this addendum report is to determine whether technical assessments attached to the approved permit for Kennedys Creek Solar Farm (the Project) will require further consideration and assessment following amendments to the solar farm layout and inclusion of a new transmission line.

This is an addendum report to *Agricultural Impacts of the Installation of Solar Panels and Construction of the Kennedys Creek Solar Farm* (Ag-Challenge Consulting, 2019) (the Report).

1.2 Background to Planning Permit Application

AECOM Australia Pty Ltd (AECOM) continues to act on behalf of the Project Applicant, 433 Link Development Pty Ltd, in relation to Planning Permit Application PA1900684 (the Permit) for the Kennedys Creek Solar Farm (the Project). It is noted that AECOM previously acted on behalf of South Energy, the former owner of the Project Applicant. On 22 September 2021, ownership of the Project Applicant was transferred from South Energy to Lightsource bp. South Energy retain ownership of the subject site and therefore an interest in the Project.

The Permit was granted on 30 November 2020 and amended on 5 February 2021 in accordance with Section 71 of the *Planning and Environment Act 1987* (P&E Act), to correct a clerical error at condition 73. The Application is for the **use and development of a solar energy facility, utility installation and associated buildings and works, native vegetation removal, creation of access to a Road Zone Category 1, business identification signage, and remove, vary and create easements**.

The Project site is at the following addresses:

- Murray Road, Benalla (Lot 3 and 4 PS318659S)
- 51 Nelson Road, Benalla (Lot 6 PS627741K)
- 67 Nelson Road, Benalla (Lot 7 PS627741K)
- 127 Nelson Road, Benalla (Lot 2 PS803108)
- 284 Benalla-Yarrawonga Road, Benalla (Lot 3 PS715932M).

1.3 Project Amendments

Following changes to the concept design, an application under Section 72 of the P&E Act is being sought to amend PA1900684 (the amendment). The amendment seeks to:

- Rearrange the layout of Kennedys Creek Solar Farm to:
  - Relocate the Substation and Operations and Maintenance Facility area to the north-east of the site and connection to new transmission infrastructure
  - Make minor updates as a result of the above.
- Include a new transmission line from the Kennedys Creek Solar Farm to the network connection point at West Mokoan Solar Farm.

The new transmission line will further affect the following parcels of land:

- Lake Mokoan Road, Winton North (Allotment 2020 Parish of Winton PP3843)
- 368 Benalla-Yarrawonga Road, Benalla (Lot 2 PS627741)
- 370 Benalla-Yarrawonga Road, Benalla (Lot 1 PS627741)
- 82 Snowy Lane, Benalla (Lot 2 LP123365)
- Benalla-Yarrawonga Road, Benalla (Lot 1 PS717978)

- 524 Benalla-Yarrawonga Road, Benalla (Lot 6 LP206524)
- 572-616 Benalla-Yarrawonga Road, Benalla (Lot 5 LP206524; Lot 4 LP206524 Lot 3 LP206524)
- Allotment 2019 Parish of Goorambat PP2704
- Snowy Lane, Benalla road reserve.

2.0 Assessment

Ag-Challenge Consulting investigated the impacts of the construction the Project on agricultural uses in the local and regional context. The Report considers the impact of the solar development on the existing uses within the project area, identifies any potential impacts to adjacent properties, and determines the likelihood of adverse impacts to surrounding land.

The report concludes that there are no detrimental impacts to the surrounding farm businesses and that the impacts to the agricultural amenity of the Region are not significant. The Report recommends further consideration of potential erosion caused by the solar panel runoff, bushfire fuel load management, and design of panels to allow for sheep grazing.

2.1 Relocated substation to north-east boundary

The result of the substation being relocated to the north-east boundary is that solar panels are now proposed along the southern boundary where the substation was previously located, and solar panels removed where the substation is now located in the north-east.

The agricultural impacts of the Project are not affected by the specific internal layout of solar panels. Rather, the Project is assessed as a whole. Therefore, the amendments to layout configuration do not alter the recommendations and conclusions of the Report.

2.2 New transmission line and associated minor changes

The proposed transmission line will run along parcel boundaries and in parallel to existing overhead lines. Transmission poles are proposed to be located within the road reserve or along the boundary of private property, with minimal impact on agricultural uses and operations. It is anticipated that there will be minimal construction during construction, however any potential impacts can be mitigated through the Construction Environmental Management Plan that is required by Condition 10 of the Permit.

3.0 Conclusion

The proposed amendments to the concept design and additional transmission line do not warrant further assessment for agricultural impacts. The conclusions and recommendations outlined in *Agricultural Impacts of the Installation of Solar Panels and Construction of the Kennedys Creek Solar Farm* (Ag-Challenge Consulting, 2019) remain relevant to the amended proposal.

AGRICULTURAL IMPACTS

of the

INSTALLATION OF SOLAR PANELS AND CONSTRUCTION OF

The

KENNEDYS CREEK SOLAR FARM

For

433 Link Development Pty Ltd

Prepared by

C.J. de Kok
&
A.J.Pitt

Ag-CHALLENGE CONSULTING pty. ltd.

September, 2019

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1. Introduction

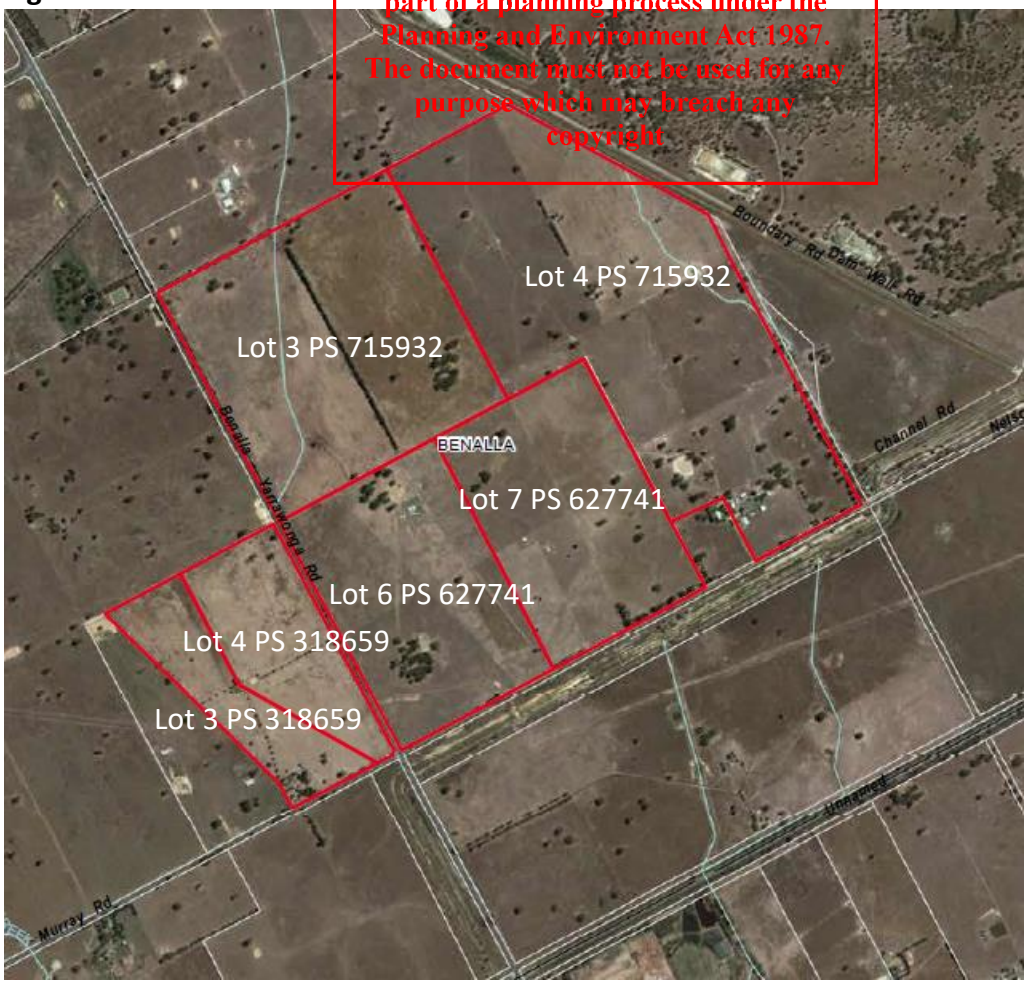
1.1 Project Brief

Ag-Challenge Consulting has been instructed by South Energy on behalf of 433 Link Development Pty Ltd to investigate the agricultural impacts of a proposed construction of a Solar Farm on approximately 283 hectares of farmland at Benalla in northern Victoria. The investigation is to describe the existing agricultural use in both a local and regional context and to consider the impact of the solar development on the existing use of the property, identify any potential impacts on adjacent properties and determine whether the proposal is likely to have any adverse impacts on surrounding land uses.

The 283 hectares of farmland is a single contiguous area comprised of five individual properties in six separate titles. The separate properties are delineated in Figure 1. The six titles and their street addresses are:

Lot 3 PS 715932	284 Benalla Yarrawonga Road, Benalla	Approx. 65 ha
Lot 7 PS 627741	67 Nelson Road, Benalla	Approx. 43 ha
Lot 6 PS 627741	51 Nelson Road, Benalla	Approx. 44 ha
Lot 3 PS 318659	Murray Road, Benalla	Part 36 ha
Lot 4 PS 318659	Murray Road, Benalla	Part 36 ha
Lot 4 PS 715932	125 Nelson Road, Benalla	Approx. 95 ha

Figure 1. Aerial of the Combined land parcels



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 Southern Victoria and Northern Victoria. The company is based at 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 undertakes farm design work. The recycled water industry is a significant user of Ag-Challenge Consulting for the design and monitoring of recycled water projects.

2. Regional Context

2.1 Property Zoning

The subject land is located within the Rural City of Benalla. The Benalla Yarrawonga Road property and the three Nelson Road properties are currently zoned as Farming Zone (Benalla Planning Scheme). The Murray Road property is zoned as Industrial 1 (Benalla Planning Scheme).

The purpose of the Farming Zone is:

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.[1]

A planning permit is required for the construction of a Renewable Energy Facility and Utility Installation within the Farming Zone, and the Planning Scheme states that a condition of approval is that the facility must meet the provisions of Clause 53.13 of the Planning Scheme. Among other provisions, Clause 53.13 states that the applicant must undertake a site and context analysis including a description of the site and surrounding area. This assessment of agricultural impacts forms part of the response to the provisions of Clause 53.13.

The planning scheme states that the purpose of the Industrial Zone 1 land is:
To provide for manufacturing industry, the storage and distribution of goods and associated uses in a manner that does not affect the safety and amenity of local communities.

[1] Victorian Planning Provisions – DELWP - http://planning-schemes.delwp.vic.gov.au/schemes/vpps/35_07.pdf

Agricultural use for grazing does not require a permit within an Industrial Zone, although more intensive agricultural uses are subject to permits. Within the Industrial Zone 1, a Renewable Energy Facility and Utility Installation are Section 2 uses (permit required)

There are no planning overlays that apply to the properties.

The *Solar Energy Facilities – Design and Development Guidelines* were developed by the Victorian Government to support the siting, design and assessment of large-scale solar energy facilities. The Guidelines were finalised in July 2019 and will come into effect by a future Planning Scheme Amendment (Amendment VC161). The main aims of the guidelines are to ensure new solar energy facilities are sited in locations with sufficient access to the electricity transmission network, and to avoid or minimise impacts on the local environment, productive agricultural land, irrigated areas and sensitive land uses. Site selection criteria to be considered are:

- Policy context, zones and overlays
- Agricultural values including irrigation infrastructure impacts
- Heritage and Aboriginal cultural values
- Landscape and visual amenity values
- Biodiversity and native vegetation
- Access to the Victorian Electricity Grid
- Other infrastructure requirements
- Cumulative effect of solar energy facilities in the area

The agricultural values of the land will be assessed in accordance with these guidelines, including an assessment of the agricultural significance of the land and the location of agriculturally significant land within the area and the region.

2.2 Climate

The climate of the Benalla Plain is defined by low annual rainfall and hot summers. The region experiences hot summers with an average daily maximum temperature of 31 °C. Thunderstorms during summer are not uncommon and lead to an increased risk of fire and floods. Winters are mild, with frosts a common occurrence[2]. The average annual rainfall of the area is 500 mm; the mean rainfall for Benalla is 617 mm per annum[2]. Since 1950 the annual average temperature in this area has increased by as much as 1.2 °C and rainfall decreasing by as much 200 mm per annum[3]. The weather of the lower slopes and plains of the Benalla Plain is conducive to broadacre cropping together with low density grazing such as sheep and cattle.

2.3 Regional Land Form

The Benalla Plain has been formed from the outwash and flood deposits from the north flowing rivers in this section of the Murray Darling Basin. The King, Broken and Ovens rivers emerge from the Victorian highlands as fast flowing streams and rapidly slow as they enter

[2] Climate-Ready Victoria, Hume – Victorian State Government - https://www.climatechange.vic.gov.au/__data/assets/pdf_file/0022/60745/Hume.pdf
[3] Climate-Ready Victoria, Hume – Victorian State Government - https://www.climatechange.vic.gov.au/__data/assets/pdf_file/0022/60745/Hume.pdf

this extensive geological feature. Over many hundreds of centuries these streams have deposited sediments across a broad plain. The deposits are very extensive and often very deep, and the flood plain is characterized by numerous terraces at different levels, prior streams, existing flood plains, swamps and billabongs. The landforms and their associated soils in this particular section of the Benalla Plain were described in some detail by Rundle and Rowe (1974)[4].

Rundle and Rowe describe four separate land types (land systems) within this section of the Benalla Plain which are all low lying and lacking in topographical relief. They are the Benalla system, the Samaria system, the Warrenbayne – Tatong system and the Mokoan system. They differ in soils and drainage as well as minor differences in climate. The Mokoan system encompasses all the land that comprises the proposed Kennedys Creek Solar Farm. It is described by Rowe and Rundle as a flat plain which contains swamps and areas of internal drainage. The topography is very subdued and the swampy plains are often internal drainage basins and terminate in swamps. The landscape has developed on alluvium and dark coloured stream sediments derived from both granitic and sedimentary rock. The Mokoan land system occupies 247 square kilometres within the Broken River catchment.

2.4 Regional Land Use

The intensity and type of agricultural production varies across the Benalla Plain. Grazing on both improved and unimproved pasture is common in the southern areas, where low hills and outwash slopes are interspersed with broad flood plains and old river terraces. There is some substantial viticulture in the southern areas where soils are suitable. The northern parts of the Benalla Plain can be conveniently separated from a land use perspective into eastern and western areas. The western area has well drained soils and is a highly productive agricultural region. In this area intensive agriculture is based around Shepparton. Fruit crops, vegetable crops, dairying and fodder production for intensive animal industries are all undertaken using irrigation from the Goulburn system. The eastern area does not possess the same extensive areas of well drained soils and plant growth is often restricted in winter due to waterlogging. The eastern area is used for more extensive forms of agriculture such as grazing of beef and sheep cattle and some broad acre cropping. This subject land is all located within this eastern area.

3 Site Characteristics

3.1 Description of the Land

The subject land is located within a flat depositional landscape with nearby swamps and internal drainage basins. Kennedys Creek lies to the west of the subject land and drains to the north, resulting in a slightly better drained landscape for the Murray Road property. The eastern side (east of the Benalla Yarrawonga Road) slopes very gently to the north, but natural waterways are absent and the east side is not well drained. The Winton Wetlands (formerly Lake Mokoan) is a large internal drainage basin to the north east and there are other smaller

[4] Rundle and Rowe (1974) A Study of the Land in the Catchment of the Broken River, TC 9, Soil Conservation Authority Victoria

swamps and internal drainage basins nearby. There are some artificial drains along roads and across adjacent farm land that assist in removing surplus water when major rain events occur.

The underlying geology is Quaternary alluvium, partly derived from both granitic and sedimentary sources upstream in the catchment of the Broken Rover, and partly derived from lacustrine deposits from a former lakebed in this area. There are likely to be prior streams embedded within the strata and these may provide a local sink for drainage waters in an internal drainage basin.

3.2 Soils

The soils of the property were assessed by Glenn Marriott and Cameron de Kok of Ag-Challenge Consulting during the site visit on November 27 2018. The soils were similar over most of the 283 hectares and can be described as yellow brown gradational soils that have a tendency towards poor internal drainage and winter waterlogging. These soils are described regionally as being duplex, poorly drained, calcareous at depth and usually gilgaied. At this location, gradational soil profiles rather than duplex soils were encountered and no gilgais were observed. Recent surface working of the soil is likely to have masked the surface feature of gilgais. Two soil profile descriptions from the field investigation of November 27, 2018 are included below.

Table 1 Soil Profile Description, 284 Benalla Yarrawonga Road, Benalla:

Depth (cm)	Horizon	Description
0 – 20	A1	Dark Yellowish Brown (10YR 5/3) **Fine Sandy loam**. Moderate Structure *Clear Transition to:*
20 – 50	A2	Light Yellowish Brown (10YR 5/8) **Fine Sandy Clay Loam** Weak structure Some minor gravel to 3mm *Gradational to:*
50 –	B2	Brownish Yellow (10YR 6/6) with mottles of yellow, light red and white **Light Clay** Well Structured Hole terminated at 1100 mm

Table 2 Soil profile Description, 51 Nelson Road, Benalla

Depth (cm)	Horizon	Description
0 – 30	A1	Dark Yellowish Brown (10YR 5/3) **Fine Sandy loam**. Moderate Structure Root oxidation from seasonal waterlogging *Clear Transition to:*
30 – 75	A2	Light Yellowish Brown (10YR 6/4) **Clay Loam** Weak structure *Gradational to:*
75 –	B2	Brownish Yellow (10YR 6/6) with mottles of yellow, light red and white **Light Clay/Medium Clay** Well Structured Hole terminated at 1100 mm

These soils are limited in the diversity of potential uses. The B2 horizon has low porosity and appears to be only slowly permeable, thus restricting vertical movement of water through the soil profile. The presence of swamps in the immediate area is indicative of poorly drained soils and susceptibility to winter waterlogging.

3.3 Native Vegetation and Riparian Zone

Remnants of the former open woodland vegetation that would have once grown across this landscape are present on all five properties. The species have not been formally identified but are likely to be Red Gum and Grey Box.

The remnant vegetation on the east side of the Benalla Yarrawonga Road is sparse over most of the area and is mainly confined to the margins of farm dams. 284 Benalla Yarrawonga Road has two substantial shelter belts, one oriented in a north south direction and the along the north boundary with an east west orientation.

An Ecological Assessment is currently being prepared for the Project to assess the ecological values of the site.

3.4 Water Supply

A number of farm dams are located within the boundaries of each separate property, but none of the properties could be considered to have good water security overall. There are 2 small dams located within the boundary of the Murray Road property, neither of which would appear to be a secure water source for a prolonged dry period. The properties on the east side of the Benalla Yarrawonga road have water reticulation systems supplying water troughs in each paddock. However, the capacity of the dams on each title appears to be quite small and they are likely to become dry after an extensive period with no rainfall. The 125 Nelson Road property has the largest dam of these properties, but does still not appear to be a secure

water source for a prolonged dry period. The properties making up the proposed Kennedys Creek Solar farm do not have good water security.

4 Land Capability and Agricultural Production Potential Assessment

4.1 Agricultural Land Capability Classification

The Land Capability Rating[5] for low rainfall grazing use has been determined to have a value of 1 using the highest determined value method for a range of potentially limiting parameters (Table 3). A rating value of 1 or 2 means that the land is suitable for this use and the hazards associated with such use are low to very low. It means that this is a sustainable form of land use. No other land capability ratings for other agricultural land uses have been examined due to the restrictions from the soils and soil drainage.

Table 3 Land Capability for Grazing[6] in low rainfall areas (500 mm to 625 mm per annum)

	Land Capability Classes					**Selected Capability Rating**
Land Feature	1	2	3	4	5	
Slope	Less than 10%	10% to 20%	20% to 30%	30% to 40%	More than 40%	**1**
Aspect	E. SE	S, SW, NE	N, NW, W			**1**
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		**1**
Average soil depth	More than 1.0 m	0.6 m to 1.0 m	0.3 m to 0.6 m	0.15m to 0.3 m	Less than 0.15 m	**1**
Surface rock	Less than 2%	2% to 15%	15% to 25%	25% to 40%	More than 40%	**1**
Nominal DSE rating	More than 5	3.5 to 5	2 to 3	0.5 to 2	Less than 0.5	**1**

4.2 Land Quality

The land to be occupied for the Kennedys Creek Solar Farm (the combined parcel) can be described as fair quality grazing land but is not significant agricultural land. This opinion is based on the presence of soils with good water holding capacity but poor drainage, a flat depositional landform, an acceptable rainfall, and location within an agricultural district with appropriate support services and infrastructure. The combined parcel 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. It is currently part of the extensive land resource that supports the grazing districts of Benalla.

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

The combined parcel has been assessed against the key attributes that are used to identify strategically significant agricultural land (Table 4). The list of attributes in Table 4 has been adopted from the Draft Solar Energy Facilities Design and Development Guidelines (2018). Productive farmland that is of strategic significance represents the most productive farmland in the state. The analysis in Table 4 supports the opinion of the authors that this land is not of strategic significance for agriculture, due to the fair quality soils with poor drainage and low versatility of the combined parcel.

Table 4 Assessment of the Agricultural Values of the Combined Parcel

Attribute Group	Assessment Criteria	Project Land Assessment	Comments
Soils and Landscape	Inherent Soil Quality Niche Soil Inherent Soil Versatility	Fair quality soils No Low versatility	These soils are poorly drained and not inherently productive or well suited to cropping use. They have good water holding capacity and are naturally stable
Water and Climate	Access to modern irrigation infrastructure Resilience and Adaptability	No No	There is no irrigation infrastructure and no irrigation appears to be available. The agriculture here is entirely dependent on natural rainfall.
Structural	Favourable Subdivision Post Farm Gate Processing and Value Adding Industry Clusters Access	Yes Possible but no development No Yes	The farm size and paddock sizes are suitable for this type of agriculture. The farm is a commercially viable entity. There is good market access to abattoirs and sale yards.
Economic	Government Investment Market trends	No Limited	There is no specific government investment relevant to this property or this industry. The market for beef is mature and stable.

The authors are of the opinion that there is no significant agricultural land within The Rural City of Benalla. Within the broader Benalla region, significant agricultural land can be found to the west towards Shepparton in the Goulburn-Murray Irrigation District and also in other directions for the viticultural land in the King Valley, Milawa and Rutherglen areas.

4.3 Potential Agricultural Productivity of the Site

The 283 hectares of farmland is not located within proximity to any irrigation district and does not have the potential for irrigation development. It is dry farming land, dependant on natural rainfall for the maintenance pasture. The soils are limiting because of their poor drainage and the rainfall is limiting due to significant moisture deficits in summer and autumn. With improved pastures and appropriate inputs of fertiliser and management, the potential carrying capacity for grazing animals has been estimated to be around 10 dse/ha {(500 mm rainfall – 250)/25} for a total of 2830 dse for the entire property. The current carrying capacity is lower than this figure as pastures are generally dominated by unimproved species and the fertility appears to be in need of some enhancement.

The land at Murray Road, 67 Nelsons Road and 125 Nelsons Road is used for the fattening of cattle. Pastures are unimproved and water security is not good, and these two factors restrict the productivity to well below the estimated potential of 10 dse/ha. Cattle are taken onto the property on an agistment basis when adequate feed and water are available, and then the property is destocked again when seasonal conditions deteriorate. The property at 284 Benalla Yarrawonga Road is used for producing beef weaners. In some seasons the young cattle may get to slaughter weights but mostly they would be sold onto feedlots for further fattening. The property at 51 Nelson Road operates with cattle agistment and rearing of Alpacas.

4.4 Indicative Gross Margins

Each of the farms that run cattle have different operating systems, from trading in steers and heifers through to rearing weaners. In order to examine the potential income from beef cattle it is necessary to define a specific production system. For this purpose, the production system that rears weaner calves from beef mothers will be used. Our experience shows that the net return from different extensive beef grazing operations are all broadly similar.

A gross margin for the production of 8 to 9 months old weaners suitable for growing on in a feedlot or in a pasture based refattening operation has been prepared and is presented in Table 5. This type of system is being deployed on at least one of the properties. There are many variations to the general model presented in table 5 and table 6. The stock reconciliation that underpins this budget is provided in Table 6. The gross margin shows a production unit based on 49 hectares of land with a carrying capacity of around 10 dse per hectare. There are no hay making inputs in the production system, but annual fertilizer applications are undertaken. It is assumed that the peak feed requirement for the herd is cycled to match the seasonal nature of peak pasture growth in the spring. The production model can be treated as a production unit and multiples of the units and part units can be used to estimate income potential from grazing use of the land.

Table 5 Gross Margin for Beef weaners (stores)

Area required	49	hectares		
Purchase prices, bulls	2000	$/head		
Purchase prices, heifers	500	$/head		
Vealer weights at sale	300	kg		
Cull cow price	2.1	$/kg		
Vealer sale price	2.9	$/kg		
Cull cow sale weight	550	Kg		
Income	Per ha	unit	Price/unit	Cash Income
Sales vealers	30	head	2.90	26100
Sales cull cows	6	head	2.10	6930
Sale of cull bull	1	head	1600.00	1600
Total Income				**33030**
Expenditure	Quantity	Units	Price	Cash cost
			$/unit	$
Purcahse, heifers	6	head	500.00	3000
Purchases, bulls	1	head	2000.00	2000
Cartage costs	1	from point of purcahse	$25	25
Cartage costs	37	To Benalla	$25	925
Saleyard fees	37	head	$8	296
Agents commission	4.5	percentgage of sale revenue	0.045	1486
Fertiliser (DAP)	0.150	tonne/ha	$750	5490
Fertiliser (urea)	0.16	tonne/ha	$560	4372
Drenches and vaccines	67	head	$10	670
Total Costs				**18265**
Gross margin				**14765**
Gross margin/dse				**30**
Gross margin/ha				303

The analysis in Table 5 shows a gross margin of around $15,000 per annum or $300 per hectare. Costs of fertilizer are included in the gross margin but no allowance has been made for fodder conservation. The gross margin represents the net income form the herd of 30 cows and calves, 1 bull and 6 replacement heifers, 67 head in total.

This gross margin is indicative of what could be expected from this land if operated with good management and strategic use of fertilizer. The gross margin for other types of beef cattle grazing operations are similar. The gross margin can be extrapolated from the model production unit of 49 hectares and 67 head to the whole of the 283 hectares. Just under 6 production units (5.8) of 30 cows, 1 bull, and 6 heifers would be required for the 283 hectares. This gives a potential gross margin from the total of the five properties of around $85,000 per annum. The actual farming profit from the combined area may be considerably less than this figure because of the productivity constraints of unimproved pastures and poor water security.

Table 6 Stock Reconciliation for Beef Weaners

Opening			**Closing**		
Cows	30		Cows		29
Heifers (joined)	6		Heifers		6
Bulls	1		Bulls		1
Purchases			**Sales**		
Heifer weaners	6		Vealers		30
Bulls	1		Bulls		1
Births	30		Cull cows		6
			Deaths and provisions		1
Total	74		Total		74
Annual Feed Requirements					
Type of Stock	DSE rating		Portion of t	DSE	
Cows (vealer mothers)	14	12	months	420	DSE
Heifers	9	12	months	54	DSE
Bull	14	12	months	14	DSE
			TOTAL	488	DSE
Area Required at 10 DSE/ha		10 dse/ha		**48.8**	**hectares**

5 Potential Impacts of The Solar Farm development for Agriculture

5.1 Livestock, Crop Production and the Solar Farm

The installation of solar panels is likely to significantly impact the current agricultural uses of the land.

It is understood that solar panels are proposed for installation over most of the subject land. The installation of solar panels will see physical changes to the farm. Existing internal fencing will mostly be removed. Most of the dams are likely to be filled in to create extra space for the installation of the solar panels, although it may be prudent to retain one or two of the larger dams for fire fighting purposes and for reticulation to defined watering points if stock are to be grazed beneath the panels.

The presence of solar panels will reduce the incident sunlight available for plants growing beneath.

Sheep may be able to be grazed beneath and in between the solar panels. The carrying capacity of the farm will be much lower than the current capacity. The reduced carrying capacity is as a result of the restriction on plant growth due to the presence of the solar panels. Solar panels are installed for the purpose of capturing sunlight and converting it to power. This competes directly with photosynthesis of grasses and other plants, which is the process by which plants convert sunlight into energy for the purpose of growth. With solar

panels installed above pastures, there will be a reduction in the quantity of light which gets through, reducing the potential growth of pasture plants.

There is also an impact on soil moisture as affected by rainfall. The solar panels will not reduce the amount of rain but will redirect where the moisture will accumulate. Instead of rain falling evenly over all of the land, around half of the incident rainfall will fall on the panels, generating a runoff which will be directed onto the area of land just below the panels. Although the uneven spread in rainfall may further reduce the growth of pasture overall, it is likely to stimulate pasture growth in the area where rainfall is directed, particularly in the late summer and autumn periods when rainfall limits growth.

Should stock be used to control grass sward length on the farm, sheep would be preferable to cattle as they would be less likely to damage solar panel infrastructure. The current farm infrastructure will need to be updated to do so. Boundary fences will need to be made stockproof for sheep and considerable redesign and improvements to the stock water system would be required.

5.2 Weeds

Weeds as a result of the development of the solar farm are likely to be largely dependent on the management of the pasture after the solar farm has been established. It is probable that weeds will establish in disturbed soils from the installation of powerlines and solar panels. It is unlikely that the solar panels will directly cause a weed problem, but weeds may invade pastured areas because of the soil disturbance involved during panel installation. Weeds will grow in and around pastures as is the case on the farm in its present state. A weed management plan will be required to minimise the growth of weeds.

5.3 Impact of Solar Farm on Neighbouring Farms.

There is no clearly identifiable impact from the installation of solar panels on any of the surrounding farming businesses. The removal of this 283 hectares from grazing use should not result in any discernible negative impacts on the other grazing businesses in the immediate area. It should not affect market competition. It should not affect the ability of the adjacent farms to operate efficiently. It should not affect productivity of any of the adjacent properties.

While the installation of the solar panels is not expected to have any agricultural impact on the neighbouring farms it is possible that they may have a visual impact. A landscape plan is being prepared to designate plantings of trees to screen the panels from roadways, nearby dwellings and amenity areas. Vegetation screening will be provided along sensitive interfaces (such as residential properties and along Benalla-Yarrawonga Road).

5.4 The Agricultural Amenity of the Region.

The Australian Bureau of Statistics data for the Hume Region shows a significant and stable beef industry with around 470,000 head. The regional beef herd is complemented by

1,000,000 head of sheep and cull animals from the dairy industry, giving a gross value of meat production from the region of around $340m.

The Project will remove 283 hectares from beef production (although it could still be partially used for sheep). On potential carrying capacity estimates and using the production models from tables 5 and 6, this would be a potential loss of grazing for around 390 head of beef (5.8 production units x 67 head) which is just 0.08% of the regional beef herd. This should not affect beef supply or market competition.

The loss of this land for grazing of cattle should not affect the ability of the adjacent farms to operate efficiently. The adjacent farms appear to have unrelated production systems. It should not affect productivity of any of the adjacent properties.

If all the land were at a productive optimum, the estimated gross margin from a vealer mother beef herd for this land is around $300 per hectare per annum. The total gross margin could be as high as $85,000. This is insufficient farm income to support one labour unit. Other income sources would be required for the farm remain as an economically viable entity. While this income would no longer be available from The Project, this loss of income is offset by the income from the renewable energy facility and by the employment of operation and maintenance staff to manage the facility. There would be additional employment of contractors during the construction phase.

5.5 Cumulative Effect of Solar farms on Agriculture in the Region.

There is a total of three solar farms near the subject site that have been approved. Two of these are located within the shire of Benalla. The Winton solar farm located south of the Winton Wetlands received approval in January 2018 with construction to begin late 2018. Once completed the Winton Solar farm will cover an area of 250 ha and generate 210,000 MWh/year. The second solar farm within the shire of is the Mokoan Solar Farm, which received approval in 2018. The project is to be located at 116 Lee Road, Winton and cover an area of 28 ha, with a generation capacity of 15 MW. The third is located within the greater region surrounding Benalla, it is located 2 km south west of Glenrowan. The Glenrowan Solar farm will cover an area of 245 ha and has a generation capacity of 140 MW.

6 Environmental Risks

6.1 Soil Erosion

The nature of the landscape in which this farm resides means that there is a low overall risk of erosion from the development of The Project. As a result of a predominately flat landscape the only area that is at medium risk of erosion is the natural waterway crossing through the north western corner of the property. While this waterway currently shows good structural integrity, the solar array will require a spatial separation from the embankments. With careful design and management of runoff as discussed in the paragraph below, it should be possible to achieve an outcome whereby there are no heightened flows from runoff into the drain and thus no higher risk erosion within this waterway than with the current agricultural enterprise.

The design and management of the surface water requires special consideration. In the first instance, the runoff of water from the panels may result in degradation of the soil below the panels where the water falls. The panel will tend to concentrate runoff as both an impact and an increased flow into a relatively small area. The degree of concentration will depend on the size of the panels, with smaller panels providing a lower level of risk than larger panels. These soils are not considered to be excessively prone to impact damage or dispersion. However, it would be prudent to consider placing crushed rock below each panel where water falls to absorb the impact energy of the rain splash, and also to help disperse the runoff across the soil surface rather than allowing concentrated flows within a small area. With impact damage minimized, it will also be prudent to introduce measures that will retard surface runoff and increase infiltration. The total area of panels is substantial and the runoff from storm events will be concentrated by hard surfaces. It is undesirable to allow the higher flows to move directly into the drain in the north western corner of the property as the waterway may not be able to cope with higher erosivity of the flood flow. The surface runoff needs to be dispersed and retarded as far as is practically possible around the property so that no higher storm runoff occurs within any natural or manmade waterway.

While the design of The Project needs to consider soil erosion risks and mitigate against this appropriately, it would also be prudent to incorporate a soil loss and land degradation review into the monitoring program. Other measures to prevent soil loss can be introduced if the design needs modification. An annual review for the first five years of operation would be appropriate.

A Surface Water Assessment is being prepared for the Project and will identify potential mitigation measures to reduce any impacts of runoff from the solar panels.

6.2 WildFire

The location of the property within a dry arid climate gives it an inherent risk of fire damage. Bush fires are a common occurrence during Australian summers and occur more easily in dry areas where fuel (dry plant matter) for a fire is readily available. Summer thunderstorms are also common within Goulburn Broken region and as such further increase the risk of bushfires.

The key to fire management is to manage fuel loads, so that if fire does occur it is of low intensity and controllable. It will be important to consider how this is done and a number of options are available. One option would be to graze under the panels with sheep, ensuring that the sheep are unable to damage the panels as part of the initial design. This may mean preserving some of the existing farm infrastructure so that stock water can be reticulated around the farm. Another option would be to use chemical weed control to suppress vegetation within and around the panel areas. A third option would be to mulch the soil with rock or some other substances that will suppress or severely limit plant growth beneath the panels. The increased electrical infrastructure may result in higher risk of ignition, but the fuel load management is critical to how a fire, once started, is controlled.

It is anticipated that general bushfire management measures will be addressed in the Project's detailed Environmental Management Plan. The Bushfire Management Plan will be prepared in consultation with the Country Fire Authority (CFA) to ensure that appropriate fire risk assessments are undertaken and measures are implemented during development and operation, to minimise the risk to life and property from fire.

6 Conclusions and Summary

- The subject land comprises a contiguous area of 283 hectares of farm land at Benalla and is currently utilised for grazing.
- There are no inherently unique features about the subject land that distinguish it from neighbouring farms in the area.
- The climate of the area is notable for dry and hot summers, summer thunderstorms, moderately low annual rainfall, and significant frost incidence in winter.
- Considerable remnant native vegetation remains on the combined area of subject land. The separate titles do however have significant areas with no trees.
- The landform is a flat plain and is part of the extensive landscape of the Benalla Plain.
- The soil types present are noted for low permeability and there is a regional problem in this area with impeded drainage.
- The land is fair quality grazing land but is limited in diversity for other agricultural uses. It is not significant agricultural land.
- The development of a solar farm on the property will alter the nature of the farm. Grazing with cattle may no longer be possible. With appropriate design of the panels and improvements and redesign of the stock water system, sheep may be able to graze the land. The carrying capacity of the farm will be reduced.
- There are no detrimental impacts of the development of the solar farm to the surrounding farm businesses. The impacts to the agricultural amenity of the Region are not significant.
- The concentration of runoff from the panels onto the soil surface may initiate soil erosion and streambank erosion. Consideration needs to be given to minimizing this risk in the design stage.

- Heightened wildfire risk will occur if attention is not given to how fuel loads on the farm are managed. Fuel load management needs to be considered as part of the project design.