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Bison Energy Australia Pty Ltd

Agricultural Impact Assessment

Cosgrove Solar Farm

September 2020

Executive summary

GHD Pty Ltd was engaged by BE Group Pty Ltd (BE Group) to undertake an Agricultural Impact Assessment of the proposed 5 megawatt solar renewable energy facility at Cosgrove, as part of a planning permit application.

The land that is the subject of the planning proposal has an area of 15.8 hectares and is situated approximately 20km east of Shepparton and 7km south-west of Dookie in the Greater Shepparton Council Local Government Area (Lot 40A in PP3396). The project site is zoned as Farming Zone (FZ) under the Greater Shepparton Planning Scheme.

A desktop study was undertaken to examine the land, soils, landform and existing land use of the subject site and the broader region, as well as the gross value of agricultural production. The operation of a solar renewable energy facility is an activity that differs from the agricultural activities on surrounding properties, therefore a land use conflict risk assessment (LUCRA) was undertaken to understand and identify measures to avoid and minimise impacts on the neighbouring properties and their ability to undertake ongoing agricultural production.

The Victorian Geomorphology Framework (VGF) incorporates information from geomorphology, pedology and ecology fields, and provides an assessment of both soil and vegetation distribution. The VGF was used to analyse the soils within the subject site and to compare them against the Greater Shepparton LGA. The subject site is located on plains without leveed channels and the topography associated with these landforms is very gentle to almost level and very often treeless.

As expected based on the soils and landform information, land use at the subject site is exclusively 'irrigated cereals,' representing 0.13% of all irrigated cereals land use (11,484.5 ha) or approximately 0.01% of all agricultural related land uses within the Greater Shepparton LGA. The subject site is not located within a designated irrigation district (namely the G-MW Shepparton Irrigation Area) and the soils and landform are classed as plains without leveed channels. The topography of land to the east of the subject site changes from hills to low-hills and therefore could be subject to erosion management so is unlikely to be classified as strategic agricultural land now or in the future.

It is estimated that the project site generates 0.000007% of the total value of agricultural production within the Greater Shepparton LGA. The removal of the land from agricultural production would have minimal impact on the relevant agricultural industries within the region and the subject site would need to amalgamate with other adjoining holdings if it was to become a profitable enterprise.

It is expected that there would be limited and short-term earthworks associated with construction and operation of the site and therefore the majority of the soil surfaces would not be impacted by the development of the project site.

The site was selected for a solar farm due to the proximity to an existing 22kV power transmission line, which extends through the northern part of the property (Cosgrove-Caniambo Road). Connection to this transmission line via a substation located on the property is possible and no offsite connection or infrastructure is required. This would minimise the need for additional infrastructure and associated impacts.

The analysis of the potential for land use conflict to arise should the solar farm be developed indicates that the likelihood of potential conflict is considered low, and current land uses on surrounding land could continue with minimal impact. No significant changes to existing site access points are required and the development is not expected to impact on the current access arrangements of adjoining properties.

The project is anticipated to have an operational life of 30 years. If at some time in the future, the solar farm ceases to operate, infrastructure can be removed and the project site can be rehabilitated to enable agricultural production to resume.

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1. Introduction

BE Pro B Pty Ltd (Bison Energy) is proposing to develop a 5 megawatt solar renewable energy facility at 290 Cosgrove-Caniambo Road, Cosgrove, Victoria. As part of the project planning, GHD Pty Ltd was engaged by Bison Energy to consider the elements of the sites agricultural land status and the issues surrounding conversion to a solar renewable energy facility. This assessment considers the sites agricultural capability, the regional implications of removing agricultural land use from the site and provides commentary on whether the proposed facility can co-locate with other agricultural activities.

1.1 Project site and project development

The 15.8 hectare (ha) site for the proposed solar renewable energy facility is located in northern Victoria approximately 20km east of Shepparton and 7km south-west of Dookie. The site is located on private freehold property and fronts the Cosgrove-Caniambo Road to the east and the Shepparton-Dookie College Road to the south. The site has a history of cropping activities and consists of a single parcel of land (Lot 40A in PP3396). The subject site adjoins other freehold agricultural land to the north and west.

The subject site is located in the Greater Shepparton Council Local Government Area (LGA), North East Catchment Management Area and the Victorian Riverina Bioregion. Following an extensive search, the site was selected for a solar renewable energy facility due to the proximity of a 22kV power transmission line which extends through the northern part of the property. GHD understands that direct connection to this transmission line via a substation located on the property is possible, therefore no offsite connection or infrastructure is required. This would minimise the need for additional infrastructure and associated impacts.

In this report, there is reference to both the subject site and the study area. The subject site refers to the entire property, shown in Figure 1. The study area refers to the Greater Shepparton Council LGA.

1.2 Methodology

GHD was engaged to assess the suitability of the land for the proposed solar renewable energy facility and to conduct an agricultural impact assessment.

This report has been compiled based on information obtained following desktop investigations and photos of the subject site and surrounding land. The desktop study has used a range of reports, statistical and mapping data obtained from a number of sources. Knowledge of the site and the broader planning context has also informed the study. GHD has reviewed and referenced a number of State and local government planning reports and guidelines to inform this assessment. These include:

- *Solar Energy facilities – Design and Development Guidelines*, Department of Environment, Land, Water and Planning (DELWP) (August 2019)
- *Hume Regional Growth Plan* (May 2014)
- *Greater Shepparton Planning Scheme*

1.3 Scope and limitations

This report: has been prepared as a desktop study by GHD for BE Group and may only be used and relied on by BE Group for the purpose agreed between GHD and the BE Group as set out in section one of this report.

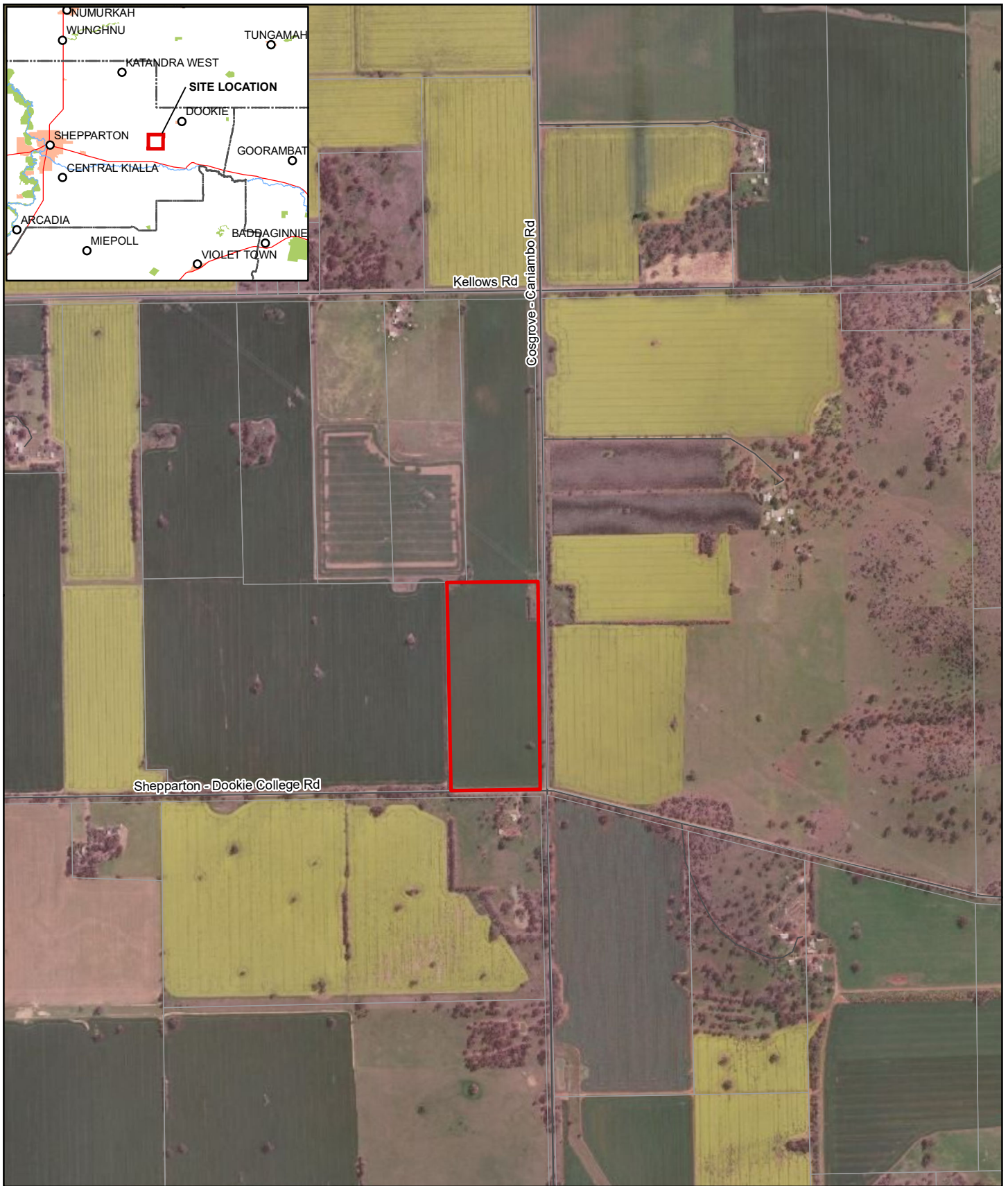
GHD otherwise disclaims responsibility to any person other than BE Group arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

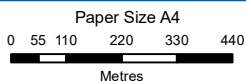
The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report (refer section one of this report). GHD disclaims liability arising from any of the assumptions being incorrect.

GHD has prepared this report on the basis of information provided by BE Group and others who provided information to GHD (including Government authorities), which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

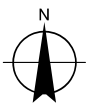


LEGEND

- Cosgrove Site Boundary
- Parcel



Horizontal Datum: GDA 1994
Grid: GCS GDA 1994



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Agricultural Impact Assessment

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Revision | B
Date | 29/07/2020

Cosgrove
Site Location

Figure 1

2. Land zoning

The subject site comprises of a single allotment (Lot 40A in PP3396) of 15.8 ha and is zoned as Farming Zone (FZ) under the Greater Shepparton Planning Scheme (clause 35.07). The stated purpose and table of uses for land zoned as FZ is shown in Table 1.

As noted below, under clause 53.13 of the Greater Shepparton Planning Scheme, an application is required to use or develop land for a renewable energy facility (other than a wind energy facility) and must meet the requirements of that clause.

Table 1 Farming Zone – Greater Shepparton Planning Scheme

Farming Zone	
Purpose	<p>To implement the Municipal Planning Strategy and the Planning Policy Framework.</p> <p>To provide for the use of land for agriculture.</p> <p>To encourage the retention of productive agricultural land.</p> <p>To ensure that non-agricultural uses, including dwellings, do not adversely affect the use of land for agriculture.</p> <p>To encourage the retention of employment and population to support rural communities.</p> <p>To encourage use and development of land based on comprehensive and sustainable land management practices and infrastructure provision.</p> <p>To provide for the use and development of land for the specific purposes identified in a schedule to this zone.</p>
Permit not required (section 1)	<p>Agriculture (other than Animal keeping, Animal production, Apiculture, Racing dog training, Rice growing and Timber production), Animal keeping (other than Animal boarding), Bed and breakfast, Cattle feedlot, Dependent person's unit, Dwelling (other than Bed and breakfast), Grazing animal production, Home based business, Informal outdoor recreation, Poultry farm, Primary produce sales, Racing dog training, Railway, Rural industry (other than Abattoir and Sawmills), Rural store, Timber production, Tramway, Any use listed in Clause 62.01.</p>
Permit required (section 2)	<p>Abattoir, Animal boarding, Animal production (other than Broiler farm, Cattle feedlot and Grazing animal production), Broiler farm - if the Section 1 condition to Poultry farm is not met, Camping and caravan park, Car park, Cattle feedlot – if the Section 1 condition is not met, Dependent person's unit – if the Section 1 condition is not met, Dwelling (other than Bed and breakfast) – if the Section 1 condition is not met, Emergency services facility, Freeway service centre, Group accommodation, Host farm, Industry (other than Rural industry), Landscape gardening supplies, Leisure and recreation (other than Informal outdoor recreation), Manufacturing sales, Market, Place of assembly (other than Amusement parlour, Night club, Carnival and Circus), Primary school, Racing dog keeping – if the Section 1 condition to Animal keeping is not met, Racing dog training – if the Section 1 condition is not met, Renewable energy facility (other than Wind energy facility), Residential hotel, Restaurant, Rice growing, Sawmill, Secondary school, Timber production – if the Section 1 condition is not met, Trade supplies, Utility installation (other than Minor utility installation and Telecommunications facility), Warehouse (other than Rural store), Wind energy facility, Winery, Any other use not in Section 1 or 3.</p>
Prohibited (section 3)	<p>Accommodation (other than Bed and breakfast, Camping and caravan park, Dependent person's unit, Dwelling, Group accommodation, Host farm and Residential hotel), Amusement parlour, Brothel, Child care centre, Cinema based entertainment facility, Education centre (other than Primary school and Secondary school), Nightclub, Office, Retail premises (other than Market, Landscape gardening supplies, Manufacturing sales, Primary produce sales, Restaurant and Trade supplies)</p>

3. Land capability and existing land use

This section has been compiled based on information and data obtained from:

- Photos of the site and surrounding area
- Public sources
- Aerial photographs of the study area and its surrounds, and
- General information regarding the study area known by GHD

This section specifically addresses:

- The agricultural quality of the proposed subject site for the proposed solar renewable energy facility
- The amount of strategically significant agricultural land in the Council area and the region
- The potential impact of removing this land from agricultural production

3.1 Land use at the project site

The subject site has an area of 15.8 ha and is currently used for agricultural purposes with the dominant activity being cropping (see photographs 1 and 2) and is fenced to a stock-proof standard. The site contains an older set of livestock handling yards (condition not assessed) and a windmill and water tank for pumping water (photograph 3). There is a small farm dam located on the north-western corner of the subject site for stock watering purposes. The storage capacity and condition of these assets were not assessed.

Topographically, the site is low lying with very minor elevation change (<3m) from south to north with a drainage line along the western boundary and therefore the proposal would avoid the need for unnecessary or excessive earthworks and not result in a change to the natural landscape. The subject site is largely cleared of vegetation with the exception of a large paddock tree (photograph 1) in the south-east corner and a clump of small planted trees in the north-east corner and some other trees adjoining the small farm dam on the northern boundary (photograph 2). Access is via a double set of gates on the Cosgrove-Caniambo Road (photograph 3). Adjoining properties appear to be similar in land use to the subject site and predominately used for cropping activities. Further to the east (~500m), the topography changes from flat cropping land to undulating grazing land. The site is also located close to the electricity grid network and therefore minimises the need for additional infrastructure and associated impacts to connect to the power network.

3.1.1 Future agricultural land use

In addition to the proposed solar renewable energy facility, the proponent would maintain the option to undertake opportunistic grazing of sheep on the subject site once the solar renewable energy facility is established. Such Grazing could be used to maintain the height of ground cover and will allow agriculture to continue on the site, although at reduced capacity. The site is considered suitable for sheep grazing as it is already well fenced, has the availability of stock water (via the windmill and small farm dam) and a sheep yards (though may require maintenance to bring up to standard). This additional grazing area might be of interest to an adjoining landholder who could selectively graze the site as required. Sheep grazing activities also occur throughout the Greater Shepparton LGA (refer Table 5).

Given the relatively small area, GHD believe that opportunistic rather than continuous grazing of the site would be preferable, as this would allow stocking rates to be strategically and regularly adjusted to manage pasture biomass, maintain groundcover, reduce fuel loads/fire risk, allow

desirable plants to set seed and germinate, and reduce weed impacts. This type of grazing strategy would be best achieved if the site was managed by an adjoining landholder and incorporated into an existing grazing rotation.

To date, there have not been any formal studies conducted to quantify the productivity benefits or costs associated with grazing sheep within solar renewable energy facility sites. While it would be expected that shading would reduce overall pasture growth, anecdotal evidence from a trial in northern NSW found that panels retained more soil moisture during summer months, therefore generating more pasture production during these periods. The panels also had an extra benefit of sheltering lambing ewes from eagles and ravens¹.

3.2 Soils and landform

Most agricultural enterprises depend on the local natural resource base that determines the suitability of a location for a specific enterprise. There are a range of natural resources that need to be considered including soil type, topography, climate and water availability.

The Victorian Geomorphology Framework (VGF) is a three tier hierarchical system of land unit descriptions. This framework describes and defines details of Victoria's landscapes and provides a hierarchy to align past and future soil and land information. The system incorporates information from geomorphology, pedology and ecology fields, and provides an assessment of both soil and vegetation distribution. The VGF was used to analyse the soils for subject site and to compare them against the Greater Shepparton LGA (see Table 2). The majority of soils across the Greater Shepparton LGA are classed as Northern Riverine Plains.

The Northern Riverine Plain is an extensive and complex alluvial plain associated with the River Murray and its tributaries which developed following the retreat of the Neogene (Pliocene) sea from the Murray Basin. The Riverine plain consists essentially of two geological formations. The most extensive and older is the older alluvial plains (GMU 4.2) which represents 63% of the Greater Shepparton LGA. These older alluvial plains are not normally subject to flooding and the soils on these plains are collectively known as the Shepparton Formation.

Majority of land use across the LGA can be classed as plains with leveed channels (GMU 4.2.1) and are formed on sediments derived from earlier prior streams associated with the former courses of the Murray and Goulburn Rivers and these landforms are largely irrigated, with lighter textured soils supporting high value horticultural crops.

The second type of unit are plains without leveed channels (GMU 4.2.2) which account for 12% of soils and landforms across the LGA and encompass the entirety of the subject site. The topography associated with these landforms is very gentle to almost level and are very often treeless. The dominant soils are grey Vertosols and red and brown Sodosols, mostly used for cropping and pasture production. The major problems associated with the Sodosols are their hardsetting surfaces and all soils tend to have high sodicity in the deep subsoil.

Alluvial fans and aprons (GMU 4.3) accounts for 20% of soil and landforms across the LGA and occur along the edge of the uplands and are generally higher in the landscape than the older alluvial plains.

¹ Solar farm offers dual purpose land (The Land) 20 March 2018 [Online] <https://www.theland.com.au/story/5256360/can-a-solar-farm-be-a-lambing-paddock/>

Table 2 Soils and land information – Victorian Geomorphological Framework

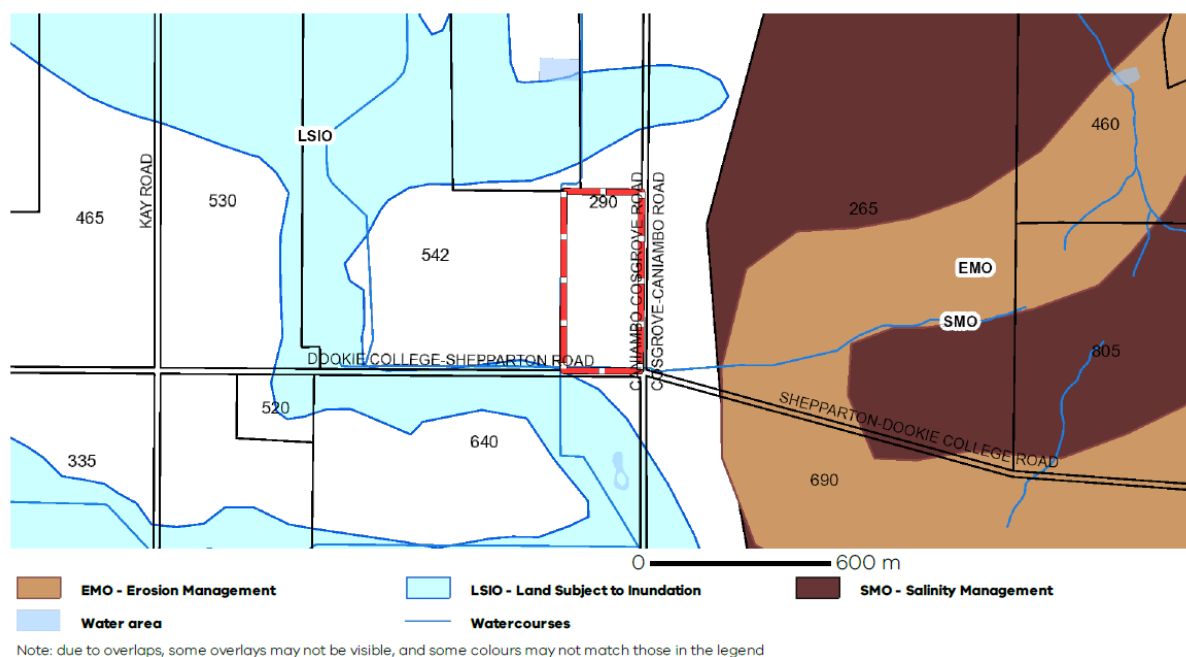
Geomorphological Unit	Subject Site		Greater Shepparton LGA	
	Area (ha)	Percent	Area (ha)	Percent
1.4.6 – Outlying ridges and hills			4,566	2%
2.1.2 - Hills, valley slopes and plains on non-granitic Palaeozoic rocks			8,396	3%
4.1.1 - Meander belt below plain level, sometimes source-bordering dunes			14,643	6%
4.1.2 - Areas of inundation away from modern channels			2,523	1%
4.2.1 - Plains with leveed channels, sometimes source-bordering dunes			123,213	51%
4.2.2 - Plains without leveed channels	15.4	100%	29,950	12%
4.3 – Alluvial fans and aprons			47,399	20%
4.4 – Hills and low hills			11,438	5%
Total	15.4	100%	242,127	100%

Source: Victorian Geomorphological Framework (VGF) (2007) Available [Online]:

http://vro.agriculture.vic.gov.au/dpi/vro/vrosite.nsf/pages/landform_geomorphological_framework

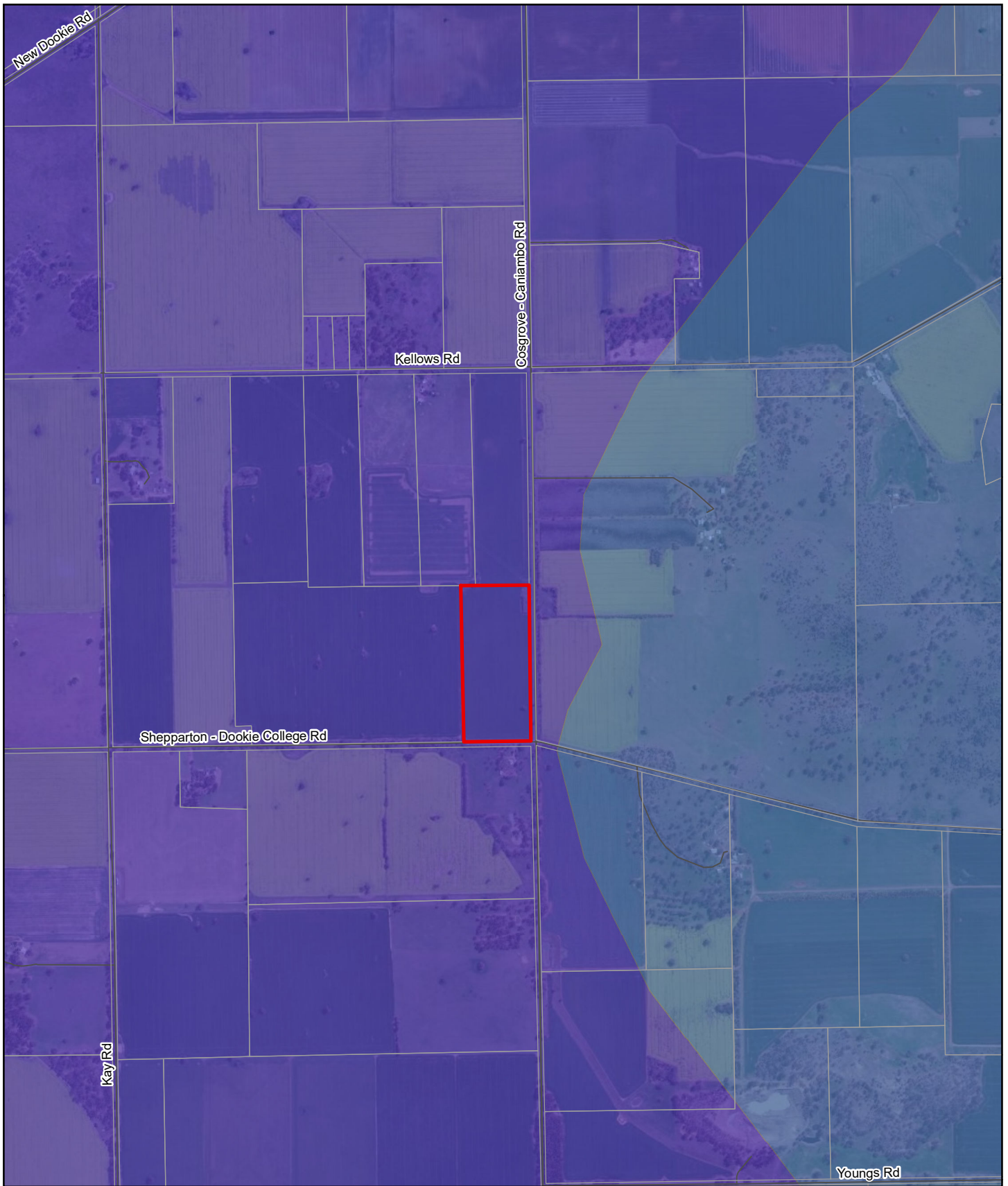
3.3 Flooding and drainage constraints

As outlined above in section 3.2, the VGF classifies the site as plains without leveed channels (GMU 4.2.2) and are not the landforms that are subjected to routine irrigation (GMU 4.2.1). As per Figure 2, the land further to the east is subject to erosion and salinity management and the subject site is not on land subject to inundation. Therefore, It is unlikely that the solar panels on the site would be subject to sheet erosion.



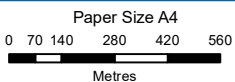
Source: Victoria DELWP – Planning Property Report

Figure 2 Planning overlay

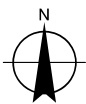


LEGEND

- Cosgrove Site Boundary **GMU**
- Parcel
- 4.2.2 - Plains without leveed channels
- 4.4 - Hills and low hills



Horizontal Datum: GDA 1994
Grid: GCS GDA 1994



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Revision | B
Date | 29/07/2020

**Cosgrove
Soil**

Figure 2

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3.4 Strategically significant agricultural land

The Hume Regional Growth Plan (2014) provides broad direction for land use and development in the Hume Region. Through the region, a number of areas have been defined as strategic agricultural areas because they have versatility in production, are of significant scale, are located in proximity to value-adding processing and have access to secure water supplies.

The high scale of the map in the Plan (Figure 4) makes it difficult to ascertain if the site is located within the boundary of strategic agricultural land of national, state, regional or sub-regional significance. As outlined in sections 3.2 and 3.3, the subject site is not located within a designated irrigation district (namely the G-MW Shepparton Irrigation Area) and the soils and landform are classed as plains without leveed channels. The topography of land to the east of the subject site changes from hills to low-hills and could be subject to erosion management (DELWP Planning Property Report) so GHD consider the land is unlikely to be classified as strategic agricultural land.

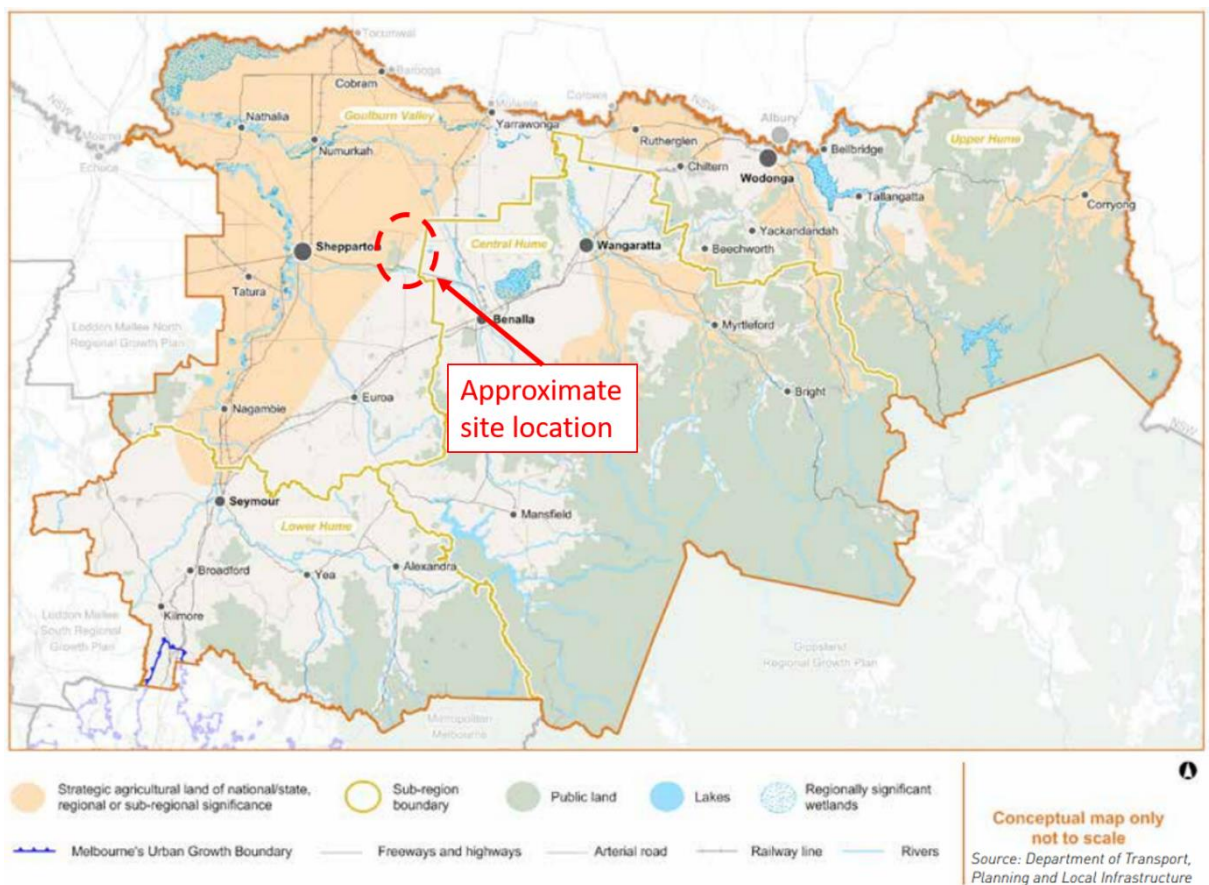


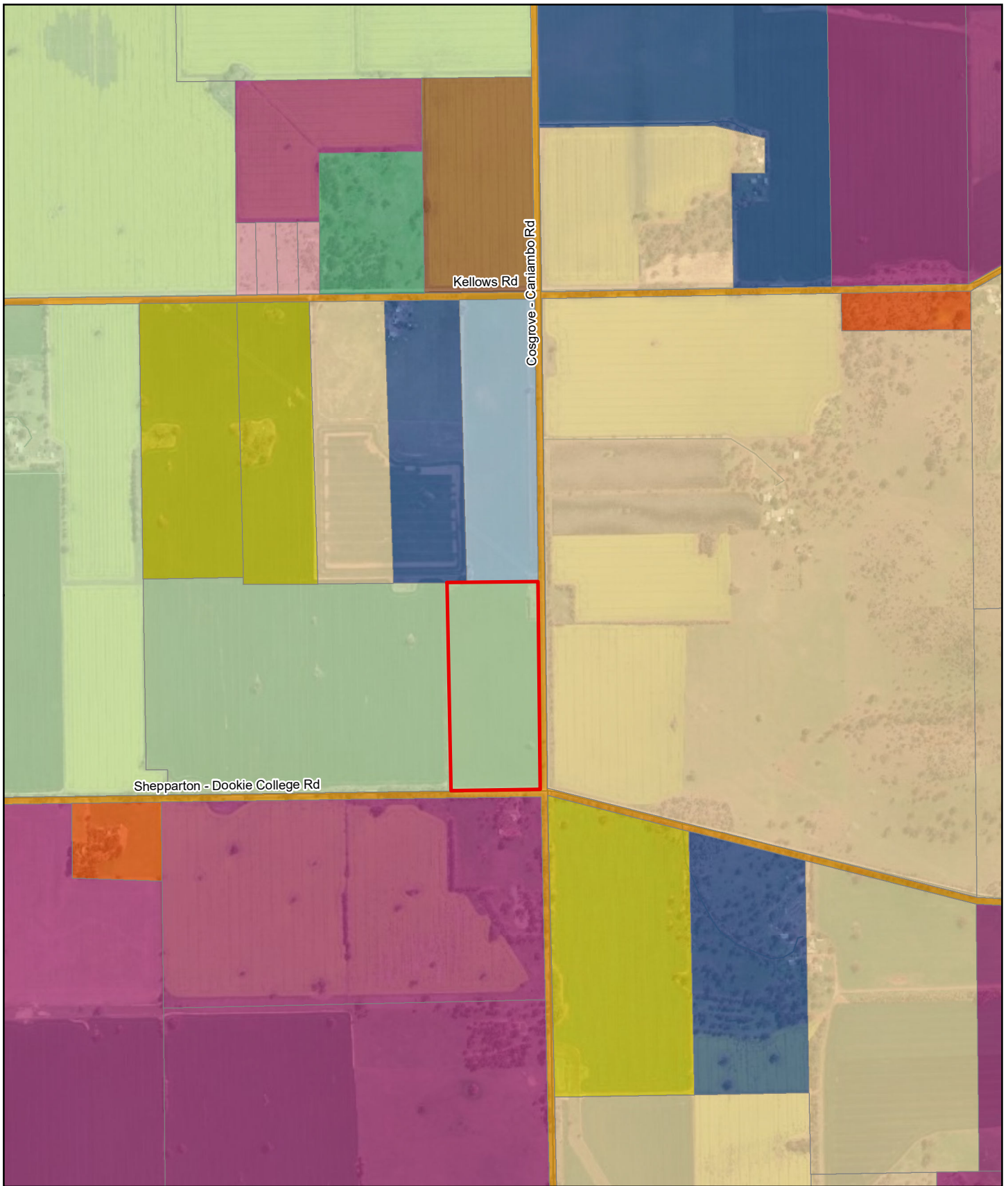
Figure 4 Hume Regional Growth Plan

3.5 Land use in the study area



Table 3 and Figure 5 below show the land use for the Greater Shepparton LGA and at the subject site respectively, as sourced from the Victoria Department of Environment, Land, Water and Planning. As expected based on the soils and landform information (outlined in section 3.2), land use at the subject site is exclusively 'irrigated cereals.' The area of the subject site (15.4 ha) represents 0.13% of all irrigated cereals land use (11,484.5 ha) or approximately 0.01% of all agricultural related land uses within the Greater Shepparton LGA.

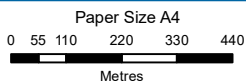
Table 3 Land use – Greater Shepparton LGA

Land use	Area (ha)	Percent	Land use (cont.)	Area (ha)	Percent
Airports/aerodromes	57.0	0.0%	Natural feature protection	2,858.1	1%
Bulk grain storage	17.9	0.0%	Navigation & communication	230.3	0.1%
Cereals	18,988.3	8%	No defined use	343.6	0.1%
Channel/aqueduct	2,368.5	1%	No defined use - irrigation	8.8	0.0%
Commercial services	407.8	0.2%	Oilseeds	4,855.6	2%
Cropping	2,423.5	1%	Other conserved area	3,599.4	1%
Dairy sheds and yards	124.8	0.1%	Other minimal use	305.2	0.1%
Drainage channel/aqueduct	7.7	0.0%	Perennial horticulture	479.8	0.2%
Electricity substations and transmission	4.6	0.0%	Piggeries	718.2	0.3%
Evaporation basin	1.2	0.0%	Plantation forests	57.9	0.0%
Food processing factory	6.9	0.0%	Poultry farms	167.8	0.1%
Gas treatment, storage and transmission	0.1	0.0%	Production native forests	180.1	0.1%
General purpose factory	137.0	0.1%	Production nurseries	11.9	0.0%
Grapes	149.7	0.1%	Protected landscape	65.0	0.0%
Grazing irrigated modified pastures	97,574.0	40%	Public services	790.8	0.3%
Grazing modified pastures	51,856.3	21%	Pulses	294.4	0.1%
Grazing native vegetation	359.3	0.1%	Quarries	298.6	0.1%
Horse studs	1,563.7	1%	Railways	333.0	0.1%
Irrigated cereals	11,484.5	5%	Recreation and culture	559.8	0.2%
Irrigated citrus	71.9	0.0%	Research facilities	93.4	0.0%
Irrigated cropping	843.4	0.3%	Reservoir	11.1	0.0%
Irrigated environmental forest plantation	136.4	0.1%	Residential and farm infrastructure	198.1	0.1%
Irrigated grapes	25.9	0.0%	River	58.2	0.0%
Irrigated land in transition	150.2	0.1%	River - conservation	1,526.8	1%
Irrigated oilseeds	2,625.8	1%	Roads	7,715.5	3%
Irrigated olives	65.3	0.0%	Rural residential with agriculture	3,790.4	2%
Irrigated perennial horticulture	3,753.1	2%	Rural residential without agriculture	1,754.1	1%
Irrigated plantation forests	16.3	0.0%	Saleyards/stockyards	0.9	0.0%
Irrigated seasonal horticulture	515.8	0.2%	Services	52.2	0.0%
Irrigated seasonal vegetables & herbs	15.7	0.0%	Sewage/sewerage	320.2	0.1%
Irrigated tree fruits	6,536.0	3%	Softwood plantation forestry	50.3	0.0%
Irrigated tree nuts	37.4	0.0%	Stormwater	11.2	0.0%
Irrigated vine fruits	126.6	0.1%	Strict nature reserves	885.6	0.4%
Lake	1.0	0.0%	Supply channel/aqueduct	337.7	0.1%
Lake - conservation	2.0	0.0%	Transport and communication	1.2	0.0%
Land in transition	87.9	0.0%	Tree nuts	52.8	0.0%
Landfill	47.3	0.0%	Urban residential	2,841.0	1%
Major industrial complex	16.2	0.0%	Utilities	72.4	0.0%
Manufacturing and industrial	290.6	0.1%	Waste treatment & disposal	9.7	0.0%
Mining	1.6	0.0%	Water extraction & transmission	6.1	0.0%
National park	4,305.7	2%	Water storage - intensive use/farm dams	170.3	0.1%
Total Greater Shepparton LGA 243,322 ha					

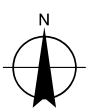


LEGEND

- | | | | |
|------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------|
|  Cosgrove Site Boundary |  Grazing modified pastures |  Oilseeds |  Strict nature reserves |
| Landuse Description |  Irrigated cereals |  Roads |  Parcel |
|  Cereals |  Irrigated cropping |  Rural residential with agriculture | |
|  Grazing irrigated modified pastures |  Irrigated oilseeds |  Rural residential without agriculture | |



Horizontal Datum: GDA 1994
Grid: GCS GDA 1994



Bison Engery Australia
Agricultural Impact Assessment

Job Number | 12434338
Revision | B
Date | 29/07/2020

**Cosgrove
Land Use**

Figure 3

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Data source: DELWP, VicMap, 2020; GHD, 2020; Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community Created by: kgardner

Photograph 1: View looking south along Cosgrove-Caniambo Road towards Shepparton-Dookie College Road. This is the eastern boundary of the subject site and as per the Victorian Geomorphology Framework plains without leaved channels are very often treeless.



Photograph 2: Looking north-west from the eastern boundary of the subject site along Cosgrove-Caniambo Road. The site is currently used for cropping activities. A small farm dam is located in the north-west corner of the subject site.



Photograph 3: Looking west from Cosgrove-Caniambo Road with windmill and water tank for pumping water. The livestock handling yards are just out of view near the clump of trees. The transmission lines intersects the northern boundary of the subject site. Access to the site during construction and operation will be via this existing accesses located on Cosgrove-Caniambo Road.



Photograph 4: Looking west across the subject site with the western boundary of the subject site visible. Paddock trees located on adjoining landholding and demonstrates the small parcel size (~270m between eastern and western boundary).



Photograph 5: Photo taken from Kellows Road looking towards the south-east across non-irrigated cropping land adjacent to the subject site.



Photograph 6: Looking south-west from the intersection of Cosgrove-Caniambo Road and Shepparton-Dookie College Road showing rural-residential and other uses on surrounding land. Appropriate buffer zones between the subject site and surrounding land uses currently exist.



3.6 Value of agricultural production

The importance of agriculture in the region can be demonstrated by considering data for the Greater Shepparton LGA as shown in Table 4. The gross value of agricultural production in the Greater Shepparton LGA was approximately \$596 million in 2015-16. The majority of the value of production was from fruits and nuts (apples, pears, peaches and plus), followed by dairy production, with lesser contributions from livestock slaughterings (mainly cattle), vegetables, and hay production. More detail on livestock production is provided in section 3.6.1 and Table 5.

Table 4 Gross value of agricultural production Greater Shepparton LGA

Commodity	Greater Shepparton LGA
Broadacre crops	\$27,948,076
Hay	\$26,307,120
Nurseries, cut flowers, or cultivated turf	\$5,456,413
Fruit and nuts	\$220,422,157
Grapes (incl. wine production)	\$680,657
Vegetables	\$32,476,867
Livestock products - wool	\$6,750,714
Livestock products - milk	\$146,285,140
Livestock products - eggs	\$45,744
Livestock slaughterings - cattle	\$68,412,189
Livestock slaughterings – sheep and lambs	\$10,685,270
Livestock slaughterings - other	\$20,122,595
Total (\$)	\$595,592,942

Source: ABS (2018) Agricultural Commodities Produced, Australia, 2015-16, Cat. No. 7503.0 (Table 3)

3.6.1 Agricultural production – livestock

Livestock enterprises are an important component of the regional agricultural economy. The dairy industry is very dominant throughout the LGA with almost 93,000 head of cattle intensively grazed across 277 establishments and there are smaller number of beef cattle (17,731 head) run more extensively across 215 establishments and traded for meat production and restockers. Sheep and lamb production also account for 117,408 head with merinos being bred for wool production and prime lamb production is focused mainly for meat production.

Table 5 Livestock numbers Greater Shepparton LGA

	Total Numbers	No. of Establishments
Dairy cattle	92,816	277
Beef cattle	17,731	215
Sheep and lambs	117,408	128
Poultry - layers	880	7
Poultry – meat chickens	200,000	1
Pigs	26,801	12

Source: ABS (2018) Agricultural Commodities Produced, Australia, 2015-16, Cat. No. 7503.0 (Table 3)

3.6.2 Value of agricultural production at the project site

In order to provide an indicative value of agriculture at the site, an estimate of the value of production was derived using publically available data from the recent *Profitable Integration of Cropping and Livestock in Southern Australia* project undertaken by Meat & Livestock Australia (2020). This project provides benchmark data for mixed farming systems in Northern Victoria which GHD consider to be representative of the subject site. The publication notes that this region is characterised by lower rainfall, warmer climate and lighter soils. Table 6 outlines the indicative cropping and livestock gross margin performance for Northern Victoria.

Table 6 Northern Victoria Gross Margin Performance

Enterprise	Gross Margin
Cropping	\$253 per hectare
Livestock	\$50 per DSE

Source: Profitable Integration of Cropping and Livestock MLA (2020)

Key assumptions relating to subject property:

1. Area 15.4 ha
2. Production Cropping
3. Alternative Not considered owing to capital cost of development

The gross margin for the subject site is estimated to be \$4,000 (\$253 x 15.4 ha), using the above information on gross margin per hectare and applying this to the land use areas (refer to Table 3). This is considered a best case given the scale but even so represents 0.000007% of the total value of agriculture in the Greater Shepparton LGA as described in Table 4. This is based on a long-term seasonal conditions and it is assumed the project site is being run as a commercial agricultural entity with full efficiencies of production to reach the long term gross margin figures.

It should be noted that gross income from agricultural activities is not a measure of farm profitability as it does not include capital (machinery, land, buildings etc.) or fixed or variable costs (insurance, rates, taxes, variable costs incurred in agricultural enterprises).

The Australian Bureau of Agricultural Economics (ABARES) publishes Farm Financial Performance (2020) which provides an estimate of total farm performance and is also broken down into sectors. This average is across a broader sample set, however these figures have not been incorporated into this project analysis as the subject area is considered below the average farm size for the survey sample. The localised and current results from Meat and Livestock Australia are considered in this instance to be a reliable indication of mixed farming enterprises in Northern Victoria for the purpose of this analysis.

The ABARES (2020) report outlines that for wheat and other crops industry farms are expected to record a large increase in average farm cash income in 2019-20 (refer to Figure 5). This large increase follows a 25% fall in 2018-19 and is due to substantial increases in receipts from cropping as a result of increased production.

average per farm

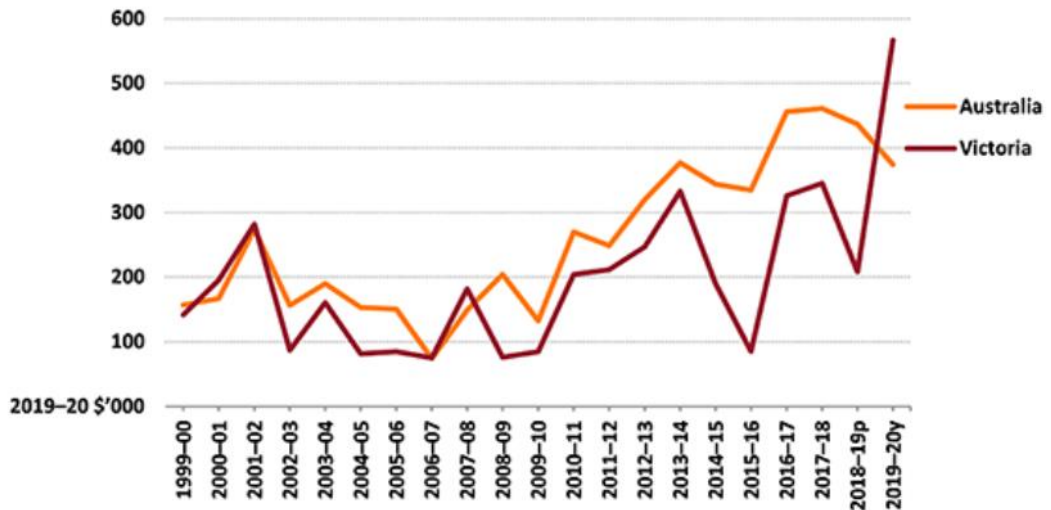


Figure 6 Farm cash income, wheat and other crops industry 1999-2020

Source: ABARES (2020) Farm Financial Performance - Victoria

While development of the site would represent a continuing annual reduction in agricultural income over the life of the project, it is expected that this will be offset by the value of future solar energy sales. In addition, the project is expected to have a light impact on land capability such that when it is at the end of its operational life (estimated to be 30 years), the site could be rehabilitated to a state that would allow resumption of agricultural production similar to its current status. The installation of solar farms on rural properties can also assist in diversifying sources of income for the agricultural sector, allowing financial resilience for farmers and communities. As outlined in section 3.1.1, there is also the option for strategic grazing of sheep in and around the solar panels to manage pasture biomass and reduce the fuel load which would generate some agricultural activity and additional economic return from the subject site.

3.7 Agricultural employment

Table 7 below analyses employment for the Greater Shepparton LGA. Employment within the Greater Shepparton LGA is diversified with health care and social assistance being the largest employer (16%), followed by retail trade (11%) and manufacturing (9%). Agriculture, forestry and fishing is the fifth largest employer (8%) employing 2,150 people in the LGA.

Table 7 Employees by industry of occupation (2016)

	Greater Shepparton LGA	% of total
Agriculture, Forestry and Fishing	2,150	8%
Mining	31	0.1%
Manufacturing	2,618	9%
Electricity, Gas, Water and Waste Services	883	3%
Construction	1,920	7%
Wholesale Trade	651	2%
Retail Trade	3,201	11%
Accommodation and Food Services	1,527	5%
Transport, Postal and Warehousing	1,141	4%
Information Media and Telecommunications	280	1%
Financial and Insurance Services	453	2%
Rental, Hiring and Real Estate Services	304	1%
Professional, Scientific and Technical Services	1,105	4%
Administrative and Support Services	752	3%
Public Administration and Safety	1,347	5%
Education and Training	2,364	8%
Health Care and Social Assistance	4,587	16%
Arts and Recreation Services	271	1%
Other Services	1,240	4%
Inadequately described/Not stated	1,198	4%
Total	28,025	100%

Source Australian Bureau of Statistics (2020) Census 2016, Industry of employment by occupation Greater Shepparton (C)

3.8 Biosecurity Impacts

The productivity and profitability of agricultural production depends in part on the management of pests and diseases, including the prevention of incursion of pests and diseases onto properties. Biosecurity is a term that is commonly used for such management and the set of measures adopted to protect a property from the entry and spread of pests, diseases and weeds.

Farm biosecurity plans are often prepared for farm businesses based on industry guidelines such as those available on the website: www.farmbiosecurity.com.au. The guidelines include risk assessments and mitigation options to avoid / minimise impacts. The key biosecurity risks from this project relate to the movement of people, vehicles and machinery, with the risks occurring at both construction and operation phases. Table 8 outlines the potential biosecurity risks and potential measures that may mitigate the risks.

Access to the site during construction and operation will be via existing accesses located on Cosgrove-Caniambo Road and should have minimal impact on the continuation of agricultural activities on adjoining properties. There will be an increase in traffic numbers, particularly during construction, however increased traffic volumes are not expected to have a significant impact on local roads. During operation, there is not expected to be any change in traffic numbers that would impact upon routine agricultural operations.

Recommended mitigation and monitoring measures will be captured in a project specific Construction EMP.

Table 8 Biosecurity risks and mitigation measures

Biosecurity risk	Potential mitigation measures
Incursion of foreign weeds, pests and diseases during construction	<ul style="list-style-type: none"> • Limit the number of entry and exit points (one is preferable) • All construction vehicles, equipment and boots should be cleaned upon entering the property in a wash-down bay • Where possible destock the site during production. • Limit worker contact with livestock, crops or plant materials as much as possible and eliminate any unnecessary contact altogether • Maintain vehicle register • Clearly sign and lock restricted access areas • Ensure construction vehicles remain on designated tracks • Record, monitor and manage any chemical use during construction, avoiding any chemicals which may impact or contaminate soil, plants or livestock. • Ensure a complete and thorough clean-up of construction materials on the site
Incursion of foreign weeds, pests and diseases during operation	<p>Most of the biosecurity practices listed above are relevant and should be continued into the operational phase of the project. In addition the following practices should be considered:</p> <ul style="list-style-type: none"> • Monitor and control any existing or new incursions of pest plants and animals, e.g. through grazing, spraying or baiting. • Establish signage and protocols to ensure gates are closed when vehicles enter and exit the facility. • Maintain good livestock proof fencing.

Source: Adapted from www.farmbiosecurity.com.au website (accessed July 2020)

4. Land use conflict risk assessment

As the operation of the project is an activity that differs from the agricultural activities on surrounding properties, it is important that the solar renewable energy facility does not impact on the continuing ability of neighbouring properties to pursue agricultural production. A land use conflict risk assessment (LUCRA) is a tool that can be used to assess the potential of any negative impacts on surrounding land use and provide options for mitigation of potential impacts.

As Victoria does not have formal guidelines on how to assess land use conflict affecting existing agricultural developments, GHD has undertaken a preliminary review of potential sources of land use conflict, assessed the risk and where possible suggested management strategies to reduce possible conflicts.

Table 9 Land use conflict risk assessment

Issue	Risk of land use conflict	Discussion and mitigation measures
Catchment management and drainage	Low	As per section 3.3, the site is not on land subject to inundation and is not located on a watercourse. The site is also not mapped as being in either a salinity or erosion management area.
Dust	Low	While initial construction is expected to generate low levels of dust, once construction is completed there will be minimal dust generation as a result of vehicles accessing the site for maintenance / operational purposes. Post construction dust generation is expected to be similar to that occurring on adjacent agricultural land for routine agricultural activities. A buffer / setback from the site boundary is proposed and landscaping measures to be located on site would potentially reduce dust moving beyond the site boundary.
Fencing	Low	Fences with adjoining agricultural land will be maintained in a condition to minimise the possibility of livestock straying onto the site from adjoining properties. The maintenance of shared boundary fencing is the responsibility of all land owners. The maintenance of the boundary fence adjoining roads is the sole responsibility of the proponent.
Lights	Low	Construction of the project would be limited to standard construction hours and therefore it is not proposed that any lighting would be required. During operation there would not be any lighting required on site.
Noise	Low	Construction noise may be audible from adjoining sensitive receivers but is not expected to have significant impacts on adjacent land use. Construction activities would be limited to standard working hours as outlined in the CEMP. No significant operational noise is anticipated.
Odour	N/A	No odour impacts are anticipated.
Pesticides	Low	Pesticide use within the project site will be limited to activities such as weed control to ensure the land can be continue to be utilised for grazing and returned to agricultural use upon decommissioning. Where possible, the proponent could also explore opportunities for the grazing of sheep on the site in order to control pasture growth on site. Accredited and licensed contractors would be used, and any products used would be approved for the proposed use. Herbicides to be used are likely to be similar to those used by surrounding landholders. The distance from neighbouring properties means that potential conflict is assessed as low.
Roads and traffic	Low	Existing access points would be used during construction and operation with access off Cosgrove-Caniambo Road. No new access is required. No impacts on access arrangements for adjoining properties are expected. There will be a temporary increase in traffic volume during construction, however no significant impact on local roads is

		<p>anticipated. Construction traffic and access is addressed elsewhere in the planning application.</p> <p>Operational traffic volume for maintenance and supervision of the site is expected to be similar to that currently experienced at the site.</p>
Straying livestock	N/A	<p>Livestock will be removed from the site during construction.</p> <p>During the operation phase, protocols and signage will be established to ensure gates are closed and stock-proof fences will be maintained (see Fencing above).</p>
Visual amenity	Low-moderate	<p>The project site has frontage to two public roads. A variety of visual impact mitigation measures are proposed in accordance with the LVIA assessment prepared as part of the planning application. Refer to Land Visual Impact Assessment undertaken as part of this planning permit.</p>
Weed and pest management	Low	<p>Weed and pest control, including for noxious weed and pests, will be subject to ongoing routine monitoring and management and is the responsibility of the proponent. See also biosecurity (section 3.8).</p>

5. Rehabilitation and decommissioning

The proposed solar renewable energy facility is anticipated to have a lifespan of 30 years (plus a one-year construction period and six months for decommissioning). At the end of its operational life, the project site would be either reconditioned or decommissioned. This development has a reversible nature, so once the solar farm is decommissioned the land can be returned to its former agricultural use.

5.1 Decommissioning

The Decommissioning EMMPs (DEMMP) will focus on site rehabilitation and traffic management. Given that best practice methodologies associated with decommissioning cannot be reasonably foreseen in advance of project construction, it is proposed that the DEMMP will only be prepared towards the end of the solar farm's operational life, though would include the removal of all the solar facilities equipment above and below ground and the site rehabilitated as close to pre-construction as possible.

To return the site to agricultural production the site is likely to require tillage, application of fertiliser/soil ameliorants followed by sowing of a pasture/crop. Soil testing should be undertaken and advice from a qualified agronomist sought to develop an appropriate plan for agricultural rehabilitation.

6. Conclusion

The proposed conversion of 15.4 ha of agricultural land to a solar renewable energy facility has been assessed for its impact to adjoining agricultural land and the Greater Shepparton LGA. This assessment has considered the agricultural land, soils, landform and existing land use of the subject site and addresses the strategic site selection assessment criteria outlined in the Solar Energy Facilities, Design and Development Guidelines (DELWP 2019).

The assessment has used a variety of information sources including current land use, Victorian geomorphology framework, gross value of agricultural production and employment statistics. The impact of removal of this parcel of land on the broader agricultural economy within the Greater Shepparton LGA has also been assessed.

Having regard to the information available, including the general knowledge of agriculture in the area by the consultant, it is estimated that the project site represents 0.01% of all agricultural related land uses and generates 0.000007% of the total value of agricultural production within the Greater Shepparton LGA. Removal of the land from agricultural production is considered to have minimal impact on relevant industries and employment within the region.

The Hume Regional Growth Plan outlines areas that have been defined as strategic agricultural areas because they have versatility in production, are of significant scale, are located in proximity to value-adding processing and have access to secure water supplies. Given the changes in soils and land use adjacent to the subject site, it is unlikely to be classified as strategic agricultural land. The subject site has also been selected as it not located within a designated irrigation district.

An analysis of the potential for land use conflicts to arise from the solar renewable energy facility has been undertaken. The likelihood of significant conflict is considered low, and current land use on surrounding land could continue with minimal impact. No significant changes to existing site access points are required and the development is not expected to impact on the current access arrangements of adjoining properties. A range of impact mitigation measures have been identified.

Construction impacts are expected to be short term in nature. The limited earthworks associated with construction and operation of the site mean that the majority of the soil surfaces would not be impacted by the development.

The project is anticipated to have an operational life of 30 years. If at some time in the future, the solar renewable energy facility ceases to operate, the project site can be rehabilitated to enable agricultural production to resume.

7. References

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