GANNAWARRA SOLAR FARM:
ENVIRONMENTAL MANAGEMENT PLAN

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Our ref: A563_EMP
Date: 8/07/2016

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Document Status

	Issue Date	Purpose of Document
Revision A	18 September 2015	Draft for internal review
Revision B	13 October 2015	Final incorporating client comments
Revision 0	8 July 2016	Final for submission

	Name	Position	Signature	Date
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Reviewer	Chris Alderton	Senior Environmental Consultant		8 July 2016

Disclaimer

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1. EMERGENCY CONTACTS

Table 1.1 provides contact details for personnel who will be contacted should and emergency occur on site.

Table 1.1: Emergency Contact Listing

Position / Company / Authority	Name	Phone	Mobile
Project Management Contacts			
Project Manager	TBA		TBA
Project Engineer	TBA		TBA
Site Environmental Representative	TBA		TBA
Contractors Contacts			
Contractor	TBA		TBA
Environmental Officer	TBA		TBA
First Aid Officer	TBA		TBA
Emergency Services / Authorities			
Fire Brigade / Police / Ambulance		000	
EPA	General Enquires	(03) 9695 2777	
Gannawarra Shire Council	General Enquires	(03) 5450 9333	
	After Hours	TBA	
Department of Environment, Land, Water & Planning	General Enquires	13 61 86	
Poisons Information Centre		13 1126	

2. INTRODUCTION

Solar Choice Pty Ltd (Solar Choice) plans to develop a solar farm, known as the Gannawarra Solar Farm. Planning approval has already been obtained for the 350 megawatt (MW) Gannawarra Solar Farm along Lalbert-Kerang Road in northern Victoria.

This Environmental Management Plan (EMP) for the Gannawarra Solar Farm has been developed to meet the requirements of **Condition 10** in the Gannawarra Shire Council Planning Permit number P13.055 (condition #10). Table 2.1 summarises the requirements of **Condition 10** of the planning permit and advises which section of the EMP addresses these requirements.

Table 2.1: Scope of the EMP and corresponding report section numbers

Condition 10 requirements	Relevant EMP sections
Site maintenance	8.1-8.12, 9.1.2 & 9.4.1
Weed and pest management	8.6 & 8.12
Soil management	8.6
Stormwater management	8.7
Fire management	8.11
Traffic management	8.1
Procedures to ensure no significant adverse environmental impacts	5.3 & 8.12
Impact of the proposal on any species listed under the *FFG Act 1988*, *the EPBC Act 1999* or nearby Ramsar sites	5.3 & 8.12
Decommissioning of the facility	3.4 & 8.1-8.12

This plan must be reviewed annually and any consequential changes to the plan should be submitted to and approved by Gannawarra Shire Council.

2.1 PURPOSE

The purpose of this EMP is to:

- Identify key environmental issues associated with the construction, operation and decommissioning of the Gannawarra Solar Farm development.
- Minimise impacts to the environment during construction.
- Achieve environmental compliance with regards to relevant regulatory requirements.
- Identify environmental management procedures to achieve the above.
- Provide a document for briefing construction team.

3. PROJECT OVERVIEW

3.1 LOCATION

The site is located approximately 12.5km west of the township of Kerang (see Appendix A for location map). Access is from the turn off on the Murray Valley Highway at Kerang along the Kerang-Quambatook Road, which in turn leads to the Lalbert-Kerang Road. The project site consists of three adjoining cropping paddocks totaling 535 hectares (1,323 acres).

3.2 CONSTRUCTION AND OPERATIONAL ACTIVITIES

In most cases the solar photovoltaic and site offices will be built off-site and transported to the site in modulated sections. The Traffic Management Plan will identify the on-site and on road routes to be used for the construction and operation phase of the project. On site construction will conform to the following Australian Standards:

- AS/NZS 3000:2007 Electrical installations (known as the Australian/New Zealand Wiring Rules).
- AS/NZS 3017:2007 Electrical installations - Verification guidelines.
- AS/NZS 3000:2007/Amdt 1:2009 Electrical installations (known as the Australian/New Zealand Wiring Rules).
- AS 1428.1-2009/Amdt 1-2010 Design for access and mobility - General requirements for access - New building work.
- AS/NZS 1170.2:2011 Structural design actions - Wind actions.
- AS/NZS 3000:2007/Amdt 2:2012 Electrical installations (known as the Australian/New Zealand Wiring Rules).

Construction on-site will be limited the unloading and joining together of the modulated sections, trenching electrical and control cabling to the electricity grid and control room. The proposed project will consist of installing the following components:

- An array of solar photovoltaic (PV) modules arranged in a series of long rows (85m) no higher than 2.1m above the ground and supported by a steel and/or aluminium mounting structure including framing, pylons which are either screwed or driven into the ground.
- A series of inverters and kiosk transformers distributed throughout the solar array.
- Electrical connections between PV array, associated monitoring and protection equipment and central inverters via underground or frame secured cabling.
- A tracker actuation system.
- Network interconnection facilities to connect the project to either or both of the 220KV and 66KV distribution system via a new terminal or an overhead transmission line to Kerang substation, including a main power transformer, switchgear, protection, metering and communications equipment.
- Site office and operations and maintenance facilities.
- Site entry road, internal access tracks and car park.
- Site fencing and associated security equipment.

Activities to occur at each stage of the works are described in Table 3.1.

Table 3.1: Proposed activities

Stage	Activities	Time frame
Pre mobilisation	Site fencing	3 weeks
	Removal of any vegetation (if required)	1 week
	Laydown of temporary offices and facilities	2 weeks
Construction	Pile driving or screwing mounting pylons	4 months
	Trenching or underground cabling connecting PV	2 months
	Mounting pre constructed PV modules	12 months
	Network interconnection	1 week
	Establishing revegetation as screening	1-2 years
Commissioning	Testing of PV system prior to connection to network	1 month
Decommissioning	Removal of temporary offices and facilities	2 weeks
	Removal of PV modules	4 months
	Removal of mounting pylons	2 months

3.3 TIMING

Construction is estimated to take place over a 12 month period and expected to commence mid 2016.

3.4 DECOMMISSIONING

The operational timeframe for the project is between 25 and 50 years. Decommissioning will include the removal or all on-ground and below ground infrastructure.

3.5 STRATEGIC JUSTIFICATION

The solar farm will form an important part of the Gannawarra Shire Council's vision to create a regional hub of large-scale solar generation, and will significantly augment the proportion of Victoria's electricity supplied from renewable energy generation.

The proposed works would:

- Reduce greenhouse gas emissions contributing to climate change. A 350MW solar farm near Kerang can be expected to produce an approx. average of 638,750 MWhrs of clean energy per annum, abating approx. 638,750 tonnes of greenhouse gas emissions annually.
- Contribute to meeting Commonwealth and Victorian Government policy objectives to enhance the contribution made by renewable energy sources to meeting energy demand.
- Contribute to the development of the utility scale renewable energy industry in Victoria and Australia.
- Connect up to 350MW of solar photovoltaic renewable energy generation to the Victorian grid.
- Demonstrate the provision of large scale solar photovoltaic energy generation within Victoria.
- Work with the relevant utilities to provide safe connection and reliable supply of renewable electricity generation to the Victorian electricity network.
- Deliver valuable power to the National Electricity Market in peak consumption periods of morning and late afternoon through the use of either single or dual axis tracking.
- Work with the Council to develop appropriate knowledge, experience and processes for large scale solar farms in the region.
- Provide a local and regional economic stimulus through jobs and training.

The Commonwealth Government's Mandatory Renewable Energy Target (MRET) scheme is designed to encourage additional generation of renewable energy. The Renewable Energy Target (RET) is an expansion of the MRET and requires an additional 20% of Australia's total electricity supply to be sourced from renewable projects by 2020, assuring that national greenhouse gas emissions are reduced to meet Commonwealth Government targets.

4. LEGISLATIVE FRAMEWORK

All activities at the site need to be undertaken in consideration of relevant legislation.

4.1 PROJECT APPROVALS

This section outlines legislative requirements for the project and the environmental and planning approval status.

Table 4.1: Environmental planning approval status

Jurisdiction	Legislation	Details
Commonwealth	*Environmental Protection and Biodiversity Conservation Act 1999*	From a preliminary meeting between the Proponent and the Council on 24 May 2013 it was understood that there are no threatened flora or flora issues relevant to the Proposed Site.
Victorian	*Aboriginal Heritage Act 2006*	From a preliminary meeting between the Proponent and the Council on 24 May 2013 it was understood that there are no archaeological or Aboriginal heritage issues relevant to the Proposed Site, particularly as the only areas to be used for the solar farm are those that have been subject to wheat farming and heavy machinery for many decades.
Victorian	*Flora and Fauna Guarantee Act 1988*	From a preliminary meeting between the Proponent and the Council on 24 May 2013 it was understood that there are no threatened flora or flora issues relevant to the Proposed Site.
Victorian	*Planning and Environment Act 1987*	Gannawarra Shire Council Planning Permit has been granted with conditions. A permit to remove, lop or destroy native vegetation has may be required should paddock trees be removed.

4.2 ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION ACT 1999

The *Environment Protection and Biodiversity Conservation Act* 1999 (EBPC Act) is the Commonwealth's key piece of environmental legislation providing for the protection and management of Matters of National Significance (MNES). The act aims to provide environmental protection while promoting ecologically sustainable development through the conservation and sustainable use of natural resources.

The nine matters of national environmental significance (MNES) defined in the Act are:

1. World heritage properties.
2. National heritage places.
3. Wetlands of international importance (often called 'Ramsar' wetlands after the international treaty under which such wetlands are listed).
4. Nationally threatened species and ecological communities.
5. Migratory species.
6. Commonwealth marine areas.
7. The Great Barrier Reef Marine Park.
8. Nuclear actions (including uranium mining).

9. A water resource, in relation to coal seam gas development and large coal mining development.

A person must not take an action that has, will have, or is likely to have, a significant impact on a MNES, without approval from the Minister (Department of the Environment, 2013).

4.3 ENVIRONMENTAL EFFECTS ACT 1978

In Victoria environmental assessment of a proposed development may be required under the *Environmental Effects Act* (EE Act).

4.4 FLORA AND FAUNA GUARANTEE ACT 1988

The *Flora and Fauna Guarantee Act* (FFG Act) is the key piece of Victorian legislation for the conservation of threatened species and communities and for the management of potentially threatening processes. The flora and fauna conservation and management objectives, as outlined under the FFG Act are:

- To guarantee that all taxa of Victoria's flora and fauna ….. can survive, flourish and retain their potential for evolutionary development in the wild.
- To conserve Victoria's communities of flora and fauna.
- To manage potentially threatening processes.
- To ensure that any use of flora or fauna by humans is sustainable.
- To ensure that the genetic diversity of flora and fauna is maintained.
- To provide programs:
  - Of community education in the conservation of flora and fauna.
  - To encourage co-operative management of flora and fauna through, amongst other things, the entering into of land management co-operative agreements under the *Conservation, Forests and Lands Act 1987*.
  - Of assisting and giving incentives to people, including landholders, to enable flora and fauna to be conserved.
  - To encourage the conserving of flora and fauna through co-operative community endeavours.

Permits are required under the FFG Act for collecting or destroying native flora on public land, as well as for handling or relocating native fish.

4.5 CATCHMENT AND LAND PROTECTION ACT 1994

The *Catchment and Land Protection Act* (CaLP Act) is the main article of legislation governing the management of invasive plants and animals in Victoria. Under the CaLP Act species of plants and animals can be declared as noxious weeds or pest animals. The CaLP Act prohibits the movement and sale of noxious weeds in Victoria, and covers weed seeds occurring as contaminants in seed lots, plant products or on vehicles, machinery or animals. The CaLP Act also regulates the importation, keeping, selling and releasing of declared pest animals.

Permits may be required to:

- Bring into Victoria, keep, sell or release declared pest animals for specific purposes and under particular conditions.
- Sell or hire, or offer for hire, a substance or machinery that is used or intended to be used in primary production and which contains the seeds or any other part of a noxious weed that is capable of growing.

4.6 WILDLIFE ACT 1975

All native wildlife is protected under the *Wildlife Act*. It is an offence to harm native wildlife or move them from where they are found.

The purposes of this Act are:

a) to establish procedures in order to promote:

   i) the protection and conservation of wildlife; and

   ii) the prevention of taxa of wildlife from becoming extinct; and

   iii) the sustainable use of and access to wildlife; and

b) to prohibit and regulate the conduct of persons engaged in activities concerning or related to wildlife.

Permits or licenses may be issued under the *Wildlife Act* to:

- Take or destroy wildlife.
- Buy, sell, acquire, receive, dispose of, keep, possess, control, breed, process or display wildlife.

4.7 PLANNING AND ENVIRONMENT ACT 1987

The *Planning and Environment Act* (PE Act) provides the legal framework for the operation of Victoria's planning system. It sets the objectives, rules and principles for planning in Victoria. The main parts of the planning system established by the Act include:

- The system of planning schemes that sets out how land may be used and developed.
- The Victoria Planning Provisions that sets out the template for the construction and layout of planning schemes.
- The procedures for preparing and amending the Victoria planning provisions and planning schemes.
- The procedures for settling disputes, enforcing compliance with planning schemes, and other administrative procedures.

4.8 NATIVE VEGETATION FRAMEWORK

The Permitted clearing of native vegetation – Biodiversity assessment guidelines (DEPI 2013a) are incorporated into the Victoria Planning Provisions and all planning schemes in Victoria. These Guidelines replace Victoria's Native Vegetation – A Framework for Action (DNRE 2002).

The biodiversity impacts from the removal of native vegetation are considered primarily through the following provisions within all Victorian planning schemes:

- Clause 52.16 Native Vegetation Precinct Plan.
- Clause 52.17 Native Vegetation.

The objective for permitted clearing of native vegetation in Victoria is "no net loss in the contribution made by native vegetation to Victoria's biodiversity" (DEPI 2013a). Therefore, a site-based planning permit is required to remove, destroy or lop native vegetation.

4.9 VICTORIAN HERITAGE ACT 1995

The *Victorian Heritage Act* is administered by Heritage Victoria. It is the Victorian Government's key cultural heritage legislation.

The Act identifies and protects heritage places and objects that are of significance to Victoria, including:

- Historic archaeological sites and artefacts.
- Historic buildings, structures and precincts.
- Gardens, trees and cemeteries.
- Cultural landscapes.
- Shipwrecks and relics.
- Significant objects.

The Act establishes the Victorian Heritage Register, the Heritage Inventory and the Heritage Council of Victoria. A Permit may be needed to alter a Heritage Place or Object.

4.10 ABORIGINAL HERITAGE ACT 2006

The *Aboriginal Heritage Act* links the protection of Aboriginal cultural heritage in Victoria with planning and land development processes.

The Act and associated regulations require the preparation of a Cultural Heritage Management Plan (CHMP) for activities which are defined as High Impact Activities (activities which cause significant ground disturbance) and are within an area of Cultural Heritage Sensitivity. Under Section 49 of the AH Act a CHMP must be prepared prior to commencing works for a project for which an EES has been required.

4.11 CIVIL AVIATION ACT AND REGULATIONS 1988

The main purpose of the *Civil Aviation Act* is to establish a regulatory framework for maintaining, enhancing and promoting the safety of civil aviation, with particular emphasis on preventing aviation accidents and incidents. Under this Act, and the accompanying Civil Aviation Regulations, any glare or glint arising from objects or the use of lighting which may distract or confuse pilots may be ordered to be removed or modified by the Civil Aviation Authority.

4.12 REGIONAL AND LOCAL POLICIES

Regional and local management plans and strategies are relevant to this project include:

- North Central Native Vegetation Plan 2005.
- North Central Regional Catchment Strategy 2013-2019.
- North Central Invasive Plants and Animals Strategy 2010-15.
- North Central River Health Strategy 2005.
- The Gannawarra Shire Council Planning Scheme.
- Industrial waste management policy (Prescribed Industrial Waste).
- State environment protection policy (Air Quality Management).
- State environment protection policy (Groundwater of Victoria).
- State Environment Protection Policy (Prevention and Management of Contamination of Land).
- Permitted clearing of native vegetation: Biodiversity Assessment Guidelines (DEPI, 2013).

5. EXISTING ENVIRONMENT

The site sits within the Gannawarra Shire Council and North Central Catchment Management Authority boundaries.

5.1 LANDFORM AND SOIL

The site consists of slightly undulating cleared land and sits primarily in the 'Mallee Dunefield low calcareous dunes' geomorphic landsystem characterised by calcareous clays and earth with moderate to rapidly drained soils, low water erosion and high wind erosion (Rowan *et al.* 2000). It is situated above 1 in 100 year flood levels and the soil is predominantly free of the clay topsoil typical of the floodplain that commences 2km to the east of the site.

5.2 SURFACE DRAINAGE AND WATER QUALITY

The site is located partly in the Avoca River Basin and partly in the Loddon River Basin. The Avoca River is situated approximately 4.5km to the west of the site, with Lake Bael Bael sitting approximately 1km north. There are no creeks or waterways existing on the site, however, there are two small dams which will be retained.

5.3 ENVIRONMENT, FLORA AND FAUNA

The site sits on predominantly cleared land which has been farmed for over a century and is almost exclusively cropped. It sits within the Murray Mallee bioregion and the following Ecological Vegetation Classes (EVCs) are mapped as occurring at the site:

- EVC 96: Ridged Plains Mallee (Endangered bioregion conservation status).
- EVC 824: Woorinen Mallee (Vulnerable bioregion conservation status).

Two reports were generated using the Protected Matters Search Tool (Department of the Environment, 2015) identified the following potential Matters of National Environmental Significance (MNES) under the *Environment Protection and Biodiversity Conservation Act* (Table 5.1).

Table 5.1: Potential Matters of National Environmental Significance under the EPBC Act which may occur within 5km of the site

MNES	Within 5km buffer of the site	Within the site boundary
Ramsar site	1 (Kerang Wetlands)	0
Threatened Ecological Communities	4	4
Threatened fauna species	12	11
Threatened flora species	4	4
Migratory species	15	6

The site is situated approximately 1km south of Lake Bael Bael which is a Ramsar site of international importance and a wetland of national importance under the Directory of Important Wetlands of Australia (DIWA). This wetland was listed as a Ramsar site as part of a larger wetland complex (Kerang Wetlands) and the following Ramsar criteria applied to the Lake Bael Bael section of the wetland at the time of listing (Kellogg, Brown & Root Pty Ltd 2011):

- 1a: regularly supports 10 000 ducks, geese and swans, or 10 000 coots or 20 000 waders.
- 2b: is of special value for maintaining the genetic and ecological diversity of a region because of the quality and peculiarities of its flora and fauna.
- 3: is a particularly good example of a specific type of wetland characteristic of its region.

The Ecological Character Description for the Ramsar site estimates that Lake Bael Bael received some water in early 2000 and was then recorded as continuously dry until 2010. In February 2011, Lake Bael Bael was inundated by flood water. There have only been two recorded colonial nesting waterbird breeding events at this Ramsar site between 1980 and 2003 (Kellogg, Brown & Root Pty Ltd, 2011). Direct impacts on the Ramsar wetland are not expected due to the type of activity occurring at the site and its proximity to the wetland.

There is currently very little vegetation at the solar farm site however there is a wide strip of roadside vegetation along Lalbert-Kerang Road and a patch of remnant vegetation (approximately 4 ha) along the northern site boundary which will be retained. There are also a number of scattered paddock trees within the site boundaries.

5.4 HERITAGE

No Aboriginal heritage issues have been identified within the site, particularly as the land has been subject to clearing, farming and heavy machinery for decades. The areas north and west of the site (beginning at Lake Bael Bael and following the Avoca River) have applicable Aboriginal Heritage Overlays, however these are at least a kilometer away from the site and no works will be undertaken in these areas.

There is a historic school sign located at the entrance to the existing site identifying the Korangie school site which must be retained and maintained to the satisfaction of the Council.

5.5 COMMUNITY

The project site sits 12.5km west of the township of Kerang, which at the time of the 2011 census had a population of 3,872 (Australian Bureau of Statistics 2013). The proposed project has been through a consultation process for the planning permit application, community raised issues have built into the project.

6. SUMMARY OF KEY ENVIRONMENTAL ISSUES

Table 6.1 summarises the key environmental issues for the construction of the Gannawarra solar farm.

Table 6.1: The key environmental issues for the construction of the Gannawarra solar farm

Issue	Potential impact/Aspect
Increased traffic movements	Road congestion
	Vehicle collision
	Animal strike
	Disturbance of residents
	Introduction of weeds
Air quality and dust	Impact on local amenity
	Impact on health of flora, fauna and ecosystems
Noise/vibration	Impact on local amenity
Solar panel glare and external lighting	Distraction of local traffic
	Impact on local amenity
	Distraction of pilots (air traffic)
	Attraction of birds, bats and insects
Overhead electrical infrastructure	Collision of birds
Land and soil management	Erosion of soil from site
	Spread of weeds
	Compaction of soil
Stormwater management	Altered runoff from site
	Transport of chemicals and sediment from site
	Inundation of site
Waste	Waste generation
	Impact on local amenity
	Wildlife accessing waste
Spills (chemical, fuel etc.)	Surface water pollution
	Soil contamination
	Groundwater contamination
Heritage impacts	Disturbance of or damage to significant Aboriginal heritage sites
	Damage to the historic Korangie school sign
Fire	Increased fire hazards
Power supply	Interruptions to local power supply
Flora and fauna management	Grasses under solar panels overgrown
	Disturbance of migratory waterbirds
	Loss of habitat for local fauna

7. RISK ASSESSMENT

A high-level environmental risk assessment of the proposed activities has been undertaken. This assessment is provided in Table 7.1 with the process outlined in Appendix C. Management measures for each of the identified environmental risks are provided below.

Table 7.1: Risk Assessment

Issue	Potential impact	Environmental aspect	L/C	Risk Level	Mitigation measures link	Revised L/C	Residual Risk
Increased traffic movements	Road congestion	Community	4/Mi	Moderate	8.1.2	5/N	Low
	Vehicle collision	Community	5/Se	High	8.1.2	6/Me	Moderate
	Animal strike	Flora and Fauna	4/Mi	Moderate	8.1.2	5/N	Low
	Disturbance of residents	Community	4/Mi	Moderate	8.1.2	5/N	Low
	Introduction of weeds	Flora and Fauna	4/Me	Major	8.6.2	5/Mi	Moderate
	Impact on local amenity	Community	4/Mi	Moderate	8.1.2	5/N	Low
Air quality and dust	Impact on local amenity	Community	4/Mi	Moderate	8.1.2	6/Mi	Low
	Impact on health of flora, fauna and ecosystems	Community	4/Mi	Moderate	8.13.2	6/Mi	Low
Noise/vibration	Impact on local amenity	Community	4/Mi	Moderate	8.1.2	5/Mi	Moderate
Solar panel glare and external lighting	Distraction of local traffic	Community	4/Mi	Moderate	8.1.2	6/Mi	Low
	Impact on local amenity	Community	4/Mi	Moderate	8.1.2	6/Mi	Low
	Distraction of pilots (air traffic)	Other	4/Mi	Moderate	8.4.2	6/Mi	Low
	Attraction of birds, bats and insects	Flora and Fauna	4/Me	Major	8.13.2	5/Me	Moderate
Overhead electrical infrastructure	Collision of birds	Flora and Fauna	4/Ne	Low	8.5.2	4/Ne	Low
Land and soil management	Erosion of soil from site	Landform and soil	4/Mi	Moderate	8.6.2	5/Mi	Moderate
	Spread of weeds	Flora and Fauna	4/Mi	Moderate	8.6.2	6/Mi	Low
	Compaction of soil	Landform and soil	4/Mi	Moderate	8.6.2	5/Ne	Low
Stormwater management	Altered runoff from site	Surface water and drainage	4/Mi	Moderate	8.7.2	5/Mi	Moderate
	Transport of chemicals and sediment from site	Surface water and drainage	4/Mi	Moderate	8.7.2	6/Mi	Low

	Inundation of site	Surface water and drainage	5/Se	High	8.7.2	7/Me	Low
Waste	Waste generation	Community	3/Mi	Major	8.8.2	4/Mi	Moderate
	Impact on local amenity	Community	4/Mi	Moderate	8.1.2	5/Ne	Low
	Wildlife accessing waste	Flora and Fauna	4/Mi	Moderate	8.8.2	5/Ne	Low
Spills (chemical, fuel etc.)	Surface water pollution	Surface water and drainage	5/Mi	Moderate	8.7.2	6/Mi	Low
	Soil contamination	Landform and soil	5/Mi	Moderate	8.9.2	6/Mi	Low
	Groundwater contamination	Surface water and drainage	5/Mi	Low	8.9.2	6/Mi	Low
Heritage impacts	Disturbance of or damage to significant Aboriginal heritage sites	Heritage	5/Se	High	8.10.2	7/M	Low
	Damage to the historic Korangie school sign	Heritage	7/Se	Moderate	8.10.2	7/Me	Low
Fire	Increased fire hazard	Other	4/se	High	8.11.2	5/Me	Moderate
Flora and fauna management	Grasses under solar panels overgrown	Flora and fauna	3/Me	Major	8.12.2	5/Mi	Moderate
	Disturbance of migratory waterbirds	Flora and fauna	4/Me	Major	8.12.2	5/Me	Moderate
	Loss of habitat for local fauna	Flora and fauna	4/Me	Major	8.12.2	5/Ne	Low

8. ENVIRONMENTAL MANAGEMENT AND MITIGATION MEASURES

8.1 INCREASED TRAFFIC MOVEMENT

8.1.1 Potential Impacts

Increased traffic to the project site has the potential to cause the following impacts:

- Road congestion.
- Vehicle collision.
- Animal strike.
- Impact on local amenity.
- Disturbance of residents.
- Introduction of weeds.

8.1.2 Management Measures

Adherence to the Traffic Management Plan for the project.

8.2 AIR QUALITY AND DUST

8.2.1 Potential Impacts

Dust generation due to construction activities has the potential to impact:

- Local amenity.
- Health of flora, fauna and ecosystems.

8.2.2 Management Measures

The management measures outlined in Table 8.1 will be implemented during construction and operation of the solar farm to reduce the potential impacts of dust.

Table 8.1: Management measures relating to air quality and dust

AIR QUALITY AND DUST		
OBJECTIVES	To construct and operate the solar farm with minimal impacts to air quality to: • Maintain the aesthetics and amenity of the local environment • Protect the health of surrounding ecosystems and species • Protect human health and wellbeing	
TARGETS	• The State Environment Protection Policy (Air Quality) (No. S240) specifies that the limit for total particulate matter (nuisance dust) is **0.5 g/m^3** No complaints received.	
ISSUE	**MITIGATION MEASURE**	**TIMING**
Dust	Use dust suppression measures (e.g. water trucks) during construction	As required
	Rehabilitate exposed surfaces as rapidly as practicable.	As required

8.3 NOISE AND VIBRATION

8.3.1 Potential Impacts

Noise and vibration due to construction activities has the potential to impact local amenity.

8.3.2 Management Measures

The management measures outlined in Table 8.2 will be implemented during construction and operation of the solar farm to reduce the potential impacts of noise and vibration.

Table 8.2: Management measures relating to noise and vibration

NOISE AND VIBRATION		
OBJECTIVES	To construct and operate the solar farm with minimal noise and vibration to: • Maintain the aesthetics and amenity of the local environment	
TARGETS	In accordance with the *Environment Protection Act 1970* and the '*Noise from industry in regional Victoria (NIRV)' guidelines* the limits on noise levels for the construction site and surrounding areas are: • Day: 46 dB • Evening: 41 dB • Night: 36 dB	
ISSUE	**MITIGATION MEASURE**	**TIMING**
Noise	• Undertake construction activities in accordance with the *Environment Protection Act 1970* and the 'Noise from industry in regional Victoria (NIRV)' guidelines	Throughout project
	Liaise with/notify residents of work and intended construction times and the potential for increased noise levels during the works.	Throughout project
	• Select appropriate equipment.	As required
	• Fit and maintain appropriate mufflers on earth-moving equipment and other vehicles on the site.	As required
	• If undertaking drilling, use drilling equipment with noise ratings suitable for use on public roads.	As required
	• Schedule noisy operations for periods which are less likely to result in noise nuisance, in accordance with statutory noise limitations.	As required
	• Maintain a complaints register and respond to any complaints received.	As required

8.4 SOLAR PANEL GLARE AND EXTERNAL LIGHTING

8.4.1 Potential Impacts

Glare and glint from solar panels has the potential to cause the following impacts:

- Distraction of local motorists.
- Impact on local amenity.
- Distraction of air traffic (pilots).
- Attraction of wildlife (e.g. birds, bats, insects).

8.4.2 Management Measures

The management measures outlined in Table 8.3 will be implemented during construction and operation of the solar farm to reduce the potential impacts of solar panel glare.

Table 8.3: Management measures relating to solar panel glare and external lighting

SOLAR PANEL GLARE AND EXTERNAL LIGHTING		
OBJECTIVES	To minimise solar panel glare from PV solar modules in order to: • Maintain the aesthetics and amenity of the local environment • Protect the health of fauna	
TARGETS	The Civil Aviation Safety Authority (CASA) has the power through regulation 94 of the Civil Aviation Regulations 1988 (CAR 1988), to require lights which may cause confusion, distraction or glare to pilots in the air, to be extinguished or modified.	
ISSUE	**MITIGATION MEASURE**	**TIMING**
Glare	• Solar panels will be made of non-reflective glass to minimise the amount of glare.	Solar farm design
	Any glare or external lighting identified as hazardous to be modified if requested by the Civil Aviation Authority.	As required
	Vegetation to be planted in accordance with the site Landscape Plan to provide adequate screening	Pre-mobilisation and construction

8.5 OVERHEAD ELECTRICAL INFRASTRUCTURE

8.5.1 Potential Impacts

The presence of overhead electrical infrastructure has the potential to cause bird collisions.

8.5.2 Management Measures

The management measures outlined in Table 8.4 will be implemented during construction and operation of the solar farm to reduce the impact of overhead electrical infrastructure.

Table 8.4: Management measures relating to overhead electrical infrastructure

OVERHEAD ELECTRICAL INFRASTRUCTURE		
OBJECTIVES	To minimise the collision of birds (especially migratory birds) with overhead electrical infrastructure.	
TARGETS	If more than five incidents occur in a calendar year, an investigation is launched and additional mitigation measures developed.	
ISSUE	**MITIGATION MEASURE**	**TIMING**
Collision of birds	• Overhead infrastructure to be minimised, underground cables to be used wherever possible.	Project design

8.6 LAND AND SOIL MANAGEMENT

8.6.1 Potential Impacts

Potential impacts relating to land and soil management are:

- Erosion of soil from the site.
- Spread of weeds.
- Compaction of soil.

8.6.2 Management Measures

The land and soil management measures outlined in Table 8.5 will be implemented during construction and operation of the solar farm.

Table 8.5: Management measures relating to land and soil management

LAND AND SOIL MANAGEMENT		
OBJECTIVES	To minimise the impact to land and soil from construction activities, specifically: • Erosion. • Compaction. • Spreading of weeds through use of imported or existing soils.	
TARGETS	Groundcover percentage maintained at or above 80% across all seasons during operations. No outbreaks of high threat environmental weeds recorded.	
ISSUE	**MITIGATION MEASURE**	**TIMING**
Erosion and sedimentation	• Limit ground disturbance and vegetation clearing to the minimum extent necessary for safe construction of solar modules.	Pre-mobilisation and construction
	• Minimise the amount of material exposed to potential erosion (e.g. exposed ground, stockpiles).	Pre-mobilisation and construction
	• Store stockpiles or excavated material in appropriate locations (e.g. on level ground, away from stormwater drainage).	Pre-mobilisation and construction
	• Install and maintain erosion and sediment control structures where necessary.	Pre-mobilisation and construction
	• Backfill and compact any trenches or other excavations to a level consistent with surrounding soils.	Pre-mobilisation, construction and decommission
	• In the event of rain and wet soils, movement of vehicles and equipment will be minimised or avoided.	Pre-mobilisation, construction and decommission
Soil Compaction	• Restriction of construction activities to defined areas.	Pre-mobilisation and construction
	• Do not stockpile materials or park on vegetated nature strips and verges.	Pre-mobilisation and construction
	• Ripping any areas of compacted soil as part of reinstatement works, to 500mm deep and 300mm centres.	Decommission
Spread of weeds	• Cleaning and inspection procedures will ensure that machinery and vehicles are free of soil and vegetation before entering or leaving the project area, to prevent the introduction or spread of weeds and disease.	As required
	• Materials (e.g. gravel and sand) brought on to site will be obtained from weed-free sources.	As required

8.7 STORMWATER MANAGEMENT

8.7.1 Potential Impacts

Potential impacts relating to stormwater management are:

- Altered runoff from site
- Transport of chemicals from site
- Inundation of swales.

8.7.2 Management Measures

The stormwater management measures outlined in Table 8.6 will be implemented during construction and operation of the solar farm.

Table 8.6: Management measures relating to stormwater management

STORMWATER MANAGEMENT		
OBJECTIVES	To minimise the impact of stormwater, specifically: • Changes in the volume or path of runoff. • Inundation of the site with floodwaters or stormwater.	
TARGETS	To ensure all stormwater is retained on site. Should swales become inundated, water is removed within 7 days to retain groundcover.	
ISSUE	**MITIGATION MEASURE**	**TIMING**
Altered runoff from site	• Ensure appropriate vegetation is planted in and around the site to promote infiltration of runoff (see project Landscape Plan).	Pre-mobilisation and construction
	• Backfill and compact any trenches or other excavations to a level consistent with surrounding soils.	Pre-mobilisation and construction
	• Avoid creating any new access tracks where possible.	Pre-mobilisation and construction
	• Treat compacted soil (**Table 8.5**) appropriately and quickly to promote infiltration of stormwater.	As appropriate
Transport of chemicals from site	• Ensure spill response equipment is present on the site and implement clean-up procedures if a spill occurs.	Throughout project
	• Ensure that all personnel have received appropriate training in spill prevention, response and cleanup, including refuelling techniques and chemical storage and handling requirements.	Throughout project
	• Ensure the construction area is kept free of rubbish and construction generated waste.	Throughout project
Inundation of site	• Pump water from swales within 7 days to following a localised flooding event.	Throughout project

8.8 WASTE

8.8.1 Potential Impacts

Potential impacts relating to waste management at the site are:

- Waste generation.
- Impact on local amenity.
- Wildlife accessing waste.

8.8.2 Management Measures

The waste management measures outlined in **Table 8.7** will be implemented during construction and operation of the solar farm.

Table 8.7: Management measures relating to waste management

WASTE MANAGEMENT		
OBJECTIVES	To minimise the amount of waste generated at the project site and ensure proper waste disposal both on-site and off-site.	
TARGETS	No non-conformances received during the audit process.	
ISSUE	**MITIGATION MEASURE**	**TIMING**
Waste generation	• Segregate waste for recycling where possible.	Throughout project
	• Manage hazardous wastes, such as solvents, rust proofing agents and primer, in accordance with the requirements of relevant legislation and industry standards.	Throughout project

WASTE MANAGEMENT		
	• Place a high emphasis on housekeeping and cleanliness at the site. All work areas will be maintained in a neat and orderly manner. Redundant equipment must be removed from site.	Throughout project
Impact on local amenity	• Ensure all bins at the site are covered to prevent spread of rubbish by wind.	Throughout project
	• Promptly remove waste from site for recycling or disposal at a licensed facility.	Throughout project
	• Cover all loads when leaving the construction site to minimise dust emissions and loss of loose objects.	As required
Wildlife accessing waste	• Ensure all bins and litter-receptacles at the site are bird/animal proof.	Throughout project

8.9 SPILLS

8.9.1 Potential Impacts

Potential impacts relating to spill management (chemicals, fuels etc.) at the site are:

- Surface water pollution.
- Soil contamination.
- Groundwater contamination.

8.9.2 Management Measures

The spill management measures outlined in Table 8.8 will be implemented during construction and operation of the solar farm.

Table 8.8: Management measures relating to spill management

SPILL MANAGEMENT		
OBJECTIVES	To minimise the impacts of chemical or fuel spills on and around the project site and ensure timely and appropriate response to any spills that occur.	
TARGETS	To adhere to requirements of the: • *Environment Protection Act 1970.* • State Environment Protection Policies (SEPPs). • Environment Protection (Industrial Waste Resource) Regulations 2009. • Dangerous Goods Act 1985.	
ISSUE	**MITIGATION MEASURE**	**TIMING**
Hazardous substance (handling and storage)	• Minimise the quantities of hazardous substances, fuel, oil and chemicals stored on site.	Throughout project
	• Material Safety Data Sheets be obtained and made available on site to all persons using hazardous substances or dangerous goods.	Throughout project
	• Hazardous material will be securely stored and handled to ensure it cannot drain onto the ground or to waterways.	Throughout project
	• Appropriate storage (as per regulatory guidelines such as EPA guidelines) of all fuels and hazardous materials used on-site.	Throughout project
	• Any bulk chemicals to be transported using an appropriately licensed and experienced operator.	As appropriate
	• Ensure spill response equipment is present on the site.	Throughout project
	• Ensure that all personnel have received appropriate training in spill prevention, response and cleanup, including refuelling techniques and chemical storage and handling requirements.	Throughout project

Spill prevention	• Regularly inspect machinery for fuel and oil leaks and maintain in good working order.	Throughout project
	• Refuelling should be undertaken off-site as far as practicable and minimised on site. Where refueling occurs use drip trays and spill mats during any on-site refuelling operations.	When required
	• Use spill mats and spill containment equipment onsite if pumps are required on the site.	When required
Spill response	• Implement cleanup procedures if a spill occurs.	When required

8.10 HERITAGE

8.10.1 Potential Impacts

The potential impact relating to Aboriginal and built heritage is the disturbance of or damage to significant sites or to the historic Korangie school sign.

8.10.2 Management Measures

The management measures outlined in Table 8.8 will be implemented during construction and operation of the solar farm to minimise impacts to Aboriginal and built heritage.

Table 8.9: Management measures relating to heritage impacts

HERITAGE IMPACTS		
OBJECTIVES	To avoid impacts to built and Aboriginal heritage in and around the project site.	
TARGETS	• To adhere to the *Aboriginal Heritage Act* and associated regulations activities in which activities defined as High Impact (activities which cause significant ground disturbance) and are within an area of Cultural Heritage Sensitivity require the preparation of a Cultural Heritage Management Plan (CHMP). • No damage to built heritage places within and around the site.	
ISSUE	**MITIGATION MEASURES**	**TIMING**
Aboriginal heritage	• If any previously unidentified cultural heritage material is discovered all works will cease within 20m and the project manager will be notified, and appropriate authorities contacted.	Pre-mobilisation, construction and decommission
Built heritage	• Work, traffic and lay down areas to avoid the historic Korangie school sign.	Pre-mobilisation, construction and decommission

8.11 FIRE

8.11.1 Potential Impacts

Increased fire risk is a potential impact of the proposed solar farm construction and operation.

8.11.2 Management Measures

Adherence to the Emergency Management Plan for the project.

8.12 FLORA AND FAUNA MANAGEMENT

8.12.1 Potential Impacts

Potential impacts to flora and fauna as a result of solar farm construction and operation include:

- Grasses under solar panels overgrown.
- Disturbance of migratory waterbirds.
- Loss of habitat for local fauna.
- Introduction and spread of weeds.
- Introduction and spread of vermin.

8.12.2 Management Measures

The management measures outlined in Table 8.10 will be implemented during construction and operation of the solar farm to minimise impacts to flora and fauna.

Table 8.10: Management measures relating to flora and fauna

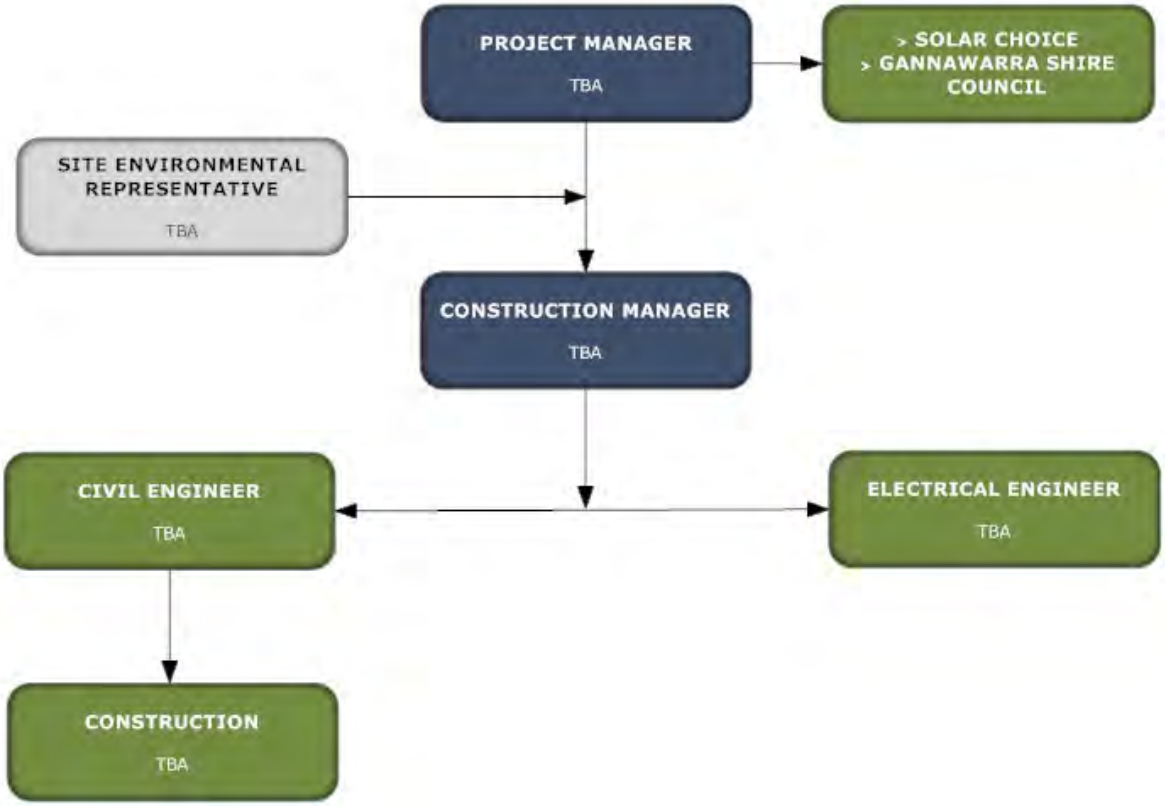
FLORA AND FAUNA MANAGEMENT		
OBJECTIVES	To minimise impacts of solar farm construction and operation on flora and fauna, particularly migratory species.	
TARGETS	Under the EPBC Act there should be no significant impacts to threatened ecological communities, threatened species, or migratory species.	
ISSUE	**MITIGATION MEASURE**	**TIMING**
Grass control under solar panels	• Implement strategic grazing of stock or mechanical control as required.	As required
Disturbance of migratory waterbirds	• Ensure all bins and litter-receptacles at the site are bird/animal proof.	Throughout project
	• Collect and dispose of litter daily, especially plastic bags and other hazardous materials.	Throughout project
	• Note the presence and location of any nests and take care not to disturb or damage them.	Throughout project
	• Undertake construction (wherever possible) outside of key breeding times for migratory species.	Pre-mobilisation, construction and decommission
	• Be aware of the presence of large numbers of migratory waterbirds at the site, and if possible pause work until the birds have moved on.	Throughout project
Loss of habitat	• Removal and disturbance of vegetation will be avoided wherever possible.	Pre-mobilisation, construction and decommission
	• Any native vegetation removed will be offset through the appropriate authority.	Pre-mobilisation, construction and decommission
	• Restrict disturbance (including vehicle access) to the existing tracks and designated work areas.	Pre-mobilisation, construction and decommission
	• Avoid parking machinery or locating stockpiles under trees. Erect protective flagging / fencing where necessary.	Pre-mobilisation, construction and decommission
	• Avoid damaging planted 'nature strip' vegetation or storing material on the road side where possible.	Pre-mobilisation, construction and decommission
	• Select locations for lay-down areas, stockpiles etc. that avoid vegetation disturbance where possible.	Pre-mobilisation, construction and decommission

Introduction and spread of weeds	• Inspect all vehicles and plant to ensure that they are weed free prior to their initial commencement of works, and conduct washdowns where required.	Pre-mobilisation, construction and decommission
	• Any imported fill must be free of weeds and foreign material.	As required
	• Regular site inspections undertaken to assess and record areas of weed infestation	Throughout project
	• Any recorded weed areas shall be managed in accordance with the Ganawarra Shire Council's guidelines.	Throughout project
	• Solar Choice shall consult with the landowner/s to determine if there are any specific weed management plans or requirements in place for the site that need to be complied with and incorporate these in the project Environmental Management Plan (EMP).	Pre-mobilisation
Introduction and spread of vermin	• Ensure all bins are covered and waste is removed from site in a timely manner.	Throughout project
	• Ensure site offices and other fixtures are rodent-proof as far as practicable.	Pre-mobilisation
	• Regular site inspections undertaken to assess the presence of vermin on site	Throughout project
	• Any pest control work on site will be carried out by a professional pest control organisation, either from the local authority environmental health department, or from a pest control company which is a member of a recognised trade body.	As required

9. PROJECT ROLES AND RESPONSIBILITIES

The project team is shown in Figure 1 below. Table 9.1 lists the responsibilities each team member has in relation to environmental management on the project.

Figure 1: Project Roles



9.1 TRAINING, AWARENESS AND COMPETENCY

Project personnel will be trained and competent to undertake project works in accordance with environmental requirements outlined within this plan. Project staff training, awareness and competency needs are determined and implemented as required.

Minimum training required for project personnel before undertaking site works include:

- Completion of Construction Induction.
- Completion of Relevant Project Induction(s).
- Proof of Competency.

9.1.1 Induction

Project personnel, subcontractors and visitors (including stakeholders) will be inducted into the project before being able to undertake works. Those who are required to spend time on site unaccompanied are required to undertake a full induction.

The full site induction provides an overview of environmental management requirements for the project, including:

- A briefing by the project manager.
- The purpose and objectives of the EMP.
- Due diligence and duty of care requirements.

- Statutory obligations including conditions of environmental licences, permits and approvals.
- Reporting process for environmental harm/incidents.

Visitor inductions are for delivery drivers and stakeholders who are accompanied at all times by an inducted person. The visitor induction is a shortened version which is site specific and tailored to the specific activity the visitor will be undertaking.

9.1.2 Monitoring

An environmental monitoring program has been developed for the project to:

- Determine whether environmental management objectives are achieved.
- Measure critical environmental indicators.

The monitoring program is outlined in Appendix B and includes weekly monitoring activities.

9.1.3 Complaints

Public complaints and enquiries related to work under the contract will be directed to developments Project Manager and managed as follows:

- Enquiries will be documented and kept as a project record
- Complaints regarding environmental issues on the project will be investigated and managed by the Project Manager.

9.2 AUDITS

Project performance will be audited in accordance with the Project Audit Program (Appendix B). The program includes both site based and system level audits to review compliance with legislative conditions and conformance to environmental controls.

9.3 REPORTING

Regular reporting on the environmental performance of the project will be provided. As a minimum this will include a fortnightly report to the Project Manager outlining the following:

- Site inspection and audit results.
- Non-conformances and incidents.
- Risk mitigation progress.
- Close out of actions raised.

This report will be prepared by the Site Environmental Representative and available for distribution to project stakeholders as required.

9.4 DOCUMENTATION

9.4.1 Site records

Environmental records will be accessible at site for the following:

- Completed site inspections.
- Non-conformances, incidents and complaints.
- Current contacts list.
- Completed waste tracking records.
- Toolbox or other relevant meeting or correspondence records.
- Compliance monitoring and reporting.

9.4.2 Process for amendment to the EMP

The EMP and associated documents are 'live' documents and will be reviewed and updated as required during the construction and operation period to ensure they are current and relevant (eg. Reflecting changes in construction methodology or risk reviews). Any changes will be made in agreement with the Responsible Authority.

Table 9.1: Role Responsibilities

RASCI* Matrix					
Responsibility	**Role**				
	Project Manager	Construction Manager	Civil Engineer	Site Enviro Representative	Construction Personnel
Public enquiries and complaints	**R**				
Identify project environmental requirements	**A**			**R**	
Establish project risk assessment	**A**			**R**	
Establish this plan and associated project controls	**A**	**S**		**R**	
Induct and train project personnel into this plan and associated project controls.		**A**		**R**	
Adhere to the requirements of this plan and associated controls.	**A**	**A**	**R**	**R**	**R**
Monitor and report on environmental performance	**A**	**S**	**S**	**S**	**S**
Adequately resource (personnel and equipment) the project to meet quality requirements.	**A**	**R**	**S**		
Key: * R – Responsible, A – Accountable, S – Supportive, C – Consulted, I – Informed, HSEQ = Health, Safety, Environment and Quality,					

10. REFERENCES

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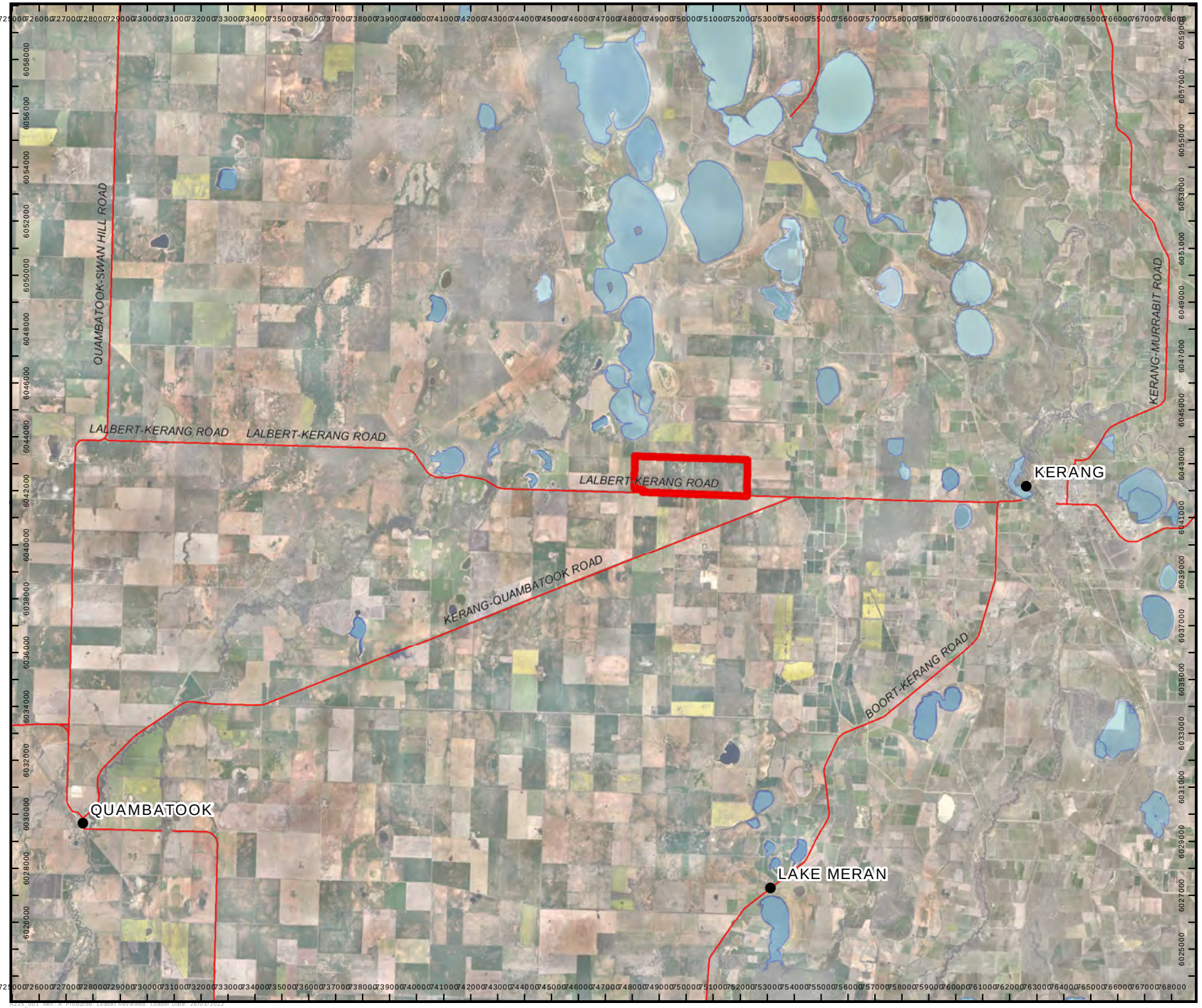
APPENDIX A:
MAP SERIES



LEGEND

- Site Boundary
- Surface Water Area
- Roads

N

1,000 0 1,000 2,000 3,000

Meters

APPROX SCALE 1:200,000 @ A4

GDA 1994 MGA Zone 54

DATA SOURCES

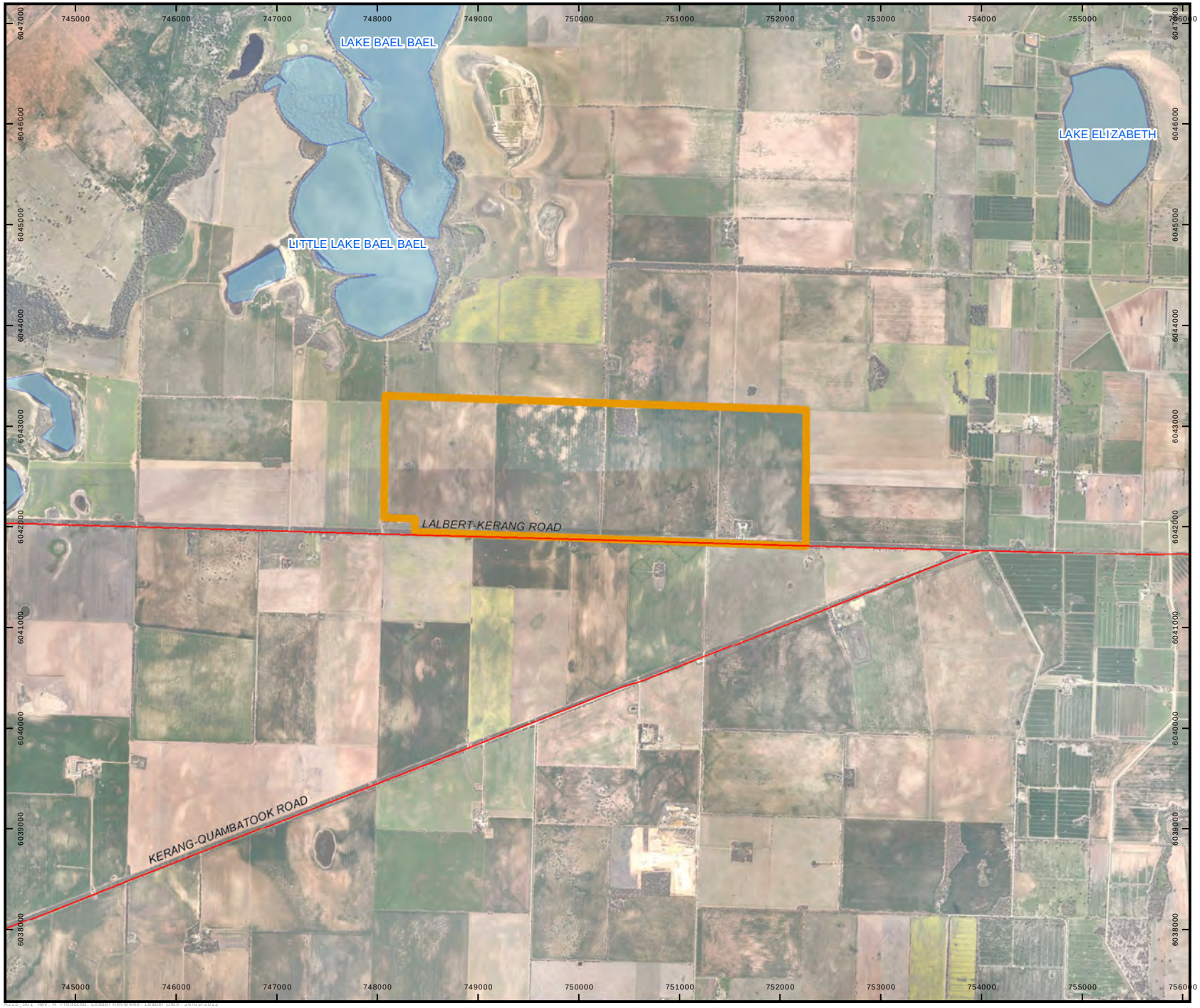
WCMA
Geoscience Australia

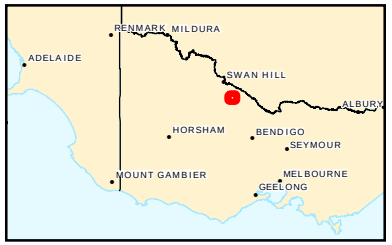
Disclaimer: While all reasonable care has been taken to ensure the information contained on this map is up to date and accurate, no guarantee is given that the information portrayed is free from error or omission. Please verify the accuracy of all information prior to use.

RPS

FIGURE 1

Gannawarra Solar Farm
Location





LEGEND

- Site Boundary
- Surface Water Area
- Roads

N

500 0 500 1,000

Meters

APPROX SCALE 1:53,532 @ A4

GDA 1994 MGA Zone 54

DATA SOURCES

WCMA
Geoscience Australia

RPS

FIGURE 2

Gannawarra Solar Farm
Site Map

R225_001 Rev. A Produced: Leader Reviewed: Leader Date: 26/04/2012

SITE CONCEPT DESIGN

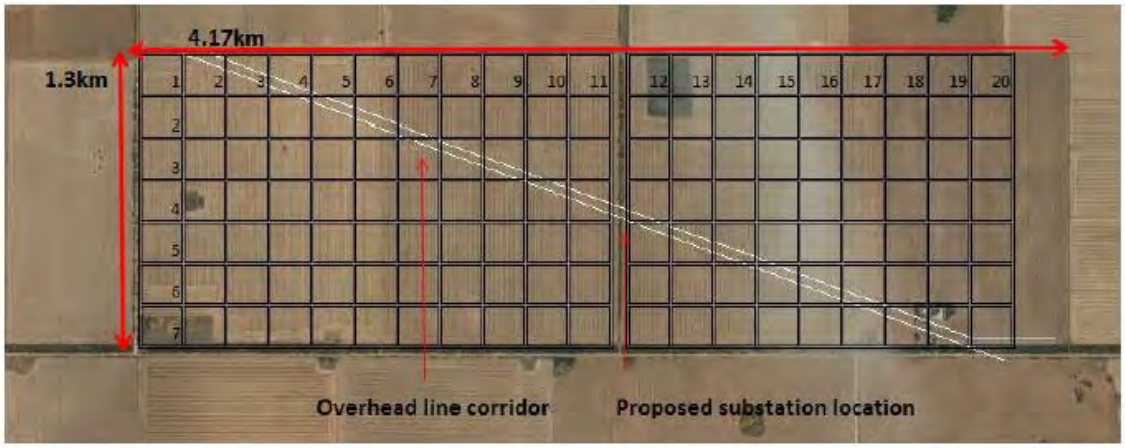


Figure 1: Draft design reflecting the site lands

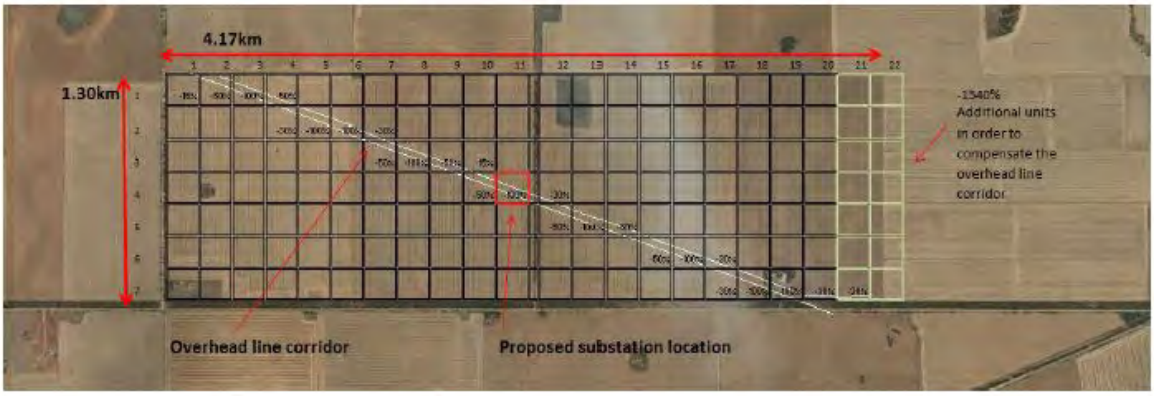


Figure 2: Proposed solar farm layout

Figure 3: Detailed solar farm configuration

Source: DIgSILENT (2015) Gannawarra Solar Farm System Study. Prepared for Solar Choice by DIgSILENT, Melbourne, Victoria.

APPENDIX B:
AUDIT PROGRAM

Action	Who	Timing
Environmental Monitoring		
Internal reviews and inspections	SER	Weekly
Weekly 'checklist' inspections to ensure environmental management measures are in place and appropriately maintained , based on EMP requirements	SER	Weekly
Reporting of the status of the corrective action in the monthly project reports provided to the Gannawarra Shire Council. Corrective actions will be identified based on the outcome of the daily inspections	Project Manager	Monthly
Following completion of each inspection, results of inspection to be recorded on a checklist, detailing the date and time of inspections as well as any comments on non-compliance. Non compliances will be managed and addressed via a non-compliance report detailing actions for resolution	SER	As required
Plant and equipment testing		
Serviceability checks for all mobile plant and equipment with results documented in the plant maintenance log book.	Construction personnel	Daily
A random sample of plant and equipment inspection logs will be checked during the environmental inspections	SER	During audit
Site Environmental Representative Inspections		
Undertake periodical inspections of the project	Gannawarra Shire representative	As Required
Provide written report of non-conformances with the EMP to SER	Gannawarra Shire representative	As Required
Where control measure is found to be inadequate or a potential incident is likely, remedial work to be undertaken at the request of the SER.	Project Manager	As Required
Compliance tracking program		
Compliance status reports	Project Manager	Monthly
Reporting on the EMP		
Formal health, safety and environmental project audits.	SER	3 Monthly
Incidents and response management		
Construction incident/Corrective Action Reporting form to be filed out in the event of an incident	Project Manager	As Required
Reporting of an incident to Solar Choice	Project Manger	Within 24 hours of incident
Full written details of the incident to be provided to Solar Choice	Project Manager	Within 5 Days of incident
Reporting of any incident with actual or significant off-site impacts on people or the biophysical environment to the appropriate authority	Gannawarra Shire representative	Initial reporting within 24 hours of incident Full written details within 7 days
Documentation and management of records		
Environmental monitoring records to be provided to the Gannawarra Shire, and/or any other regulatory or authorised officer	Project Manager	Upon request
Identify standards, codes and regulations that must be adhered to throughout the construction works. Ensure that these are acquired and maintained for the works	Project Manager	Prior to commencement of the project. Updates will be included throughout the project.
Review and continuous improvement		
Review and update CEMP and the associated sub plans and procedures during the construction period	SER	3 Monthly or as required if deficiencies are identified
Review of amendments to the CEMP	GMW/SHRCC	As Required

APPENDIX C:
RISK ASSESSMENT PROCESS

Table 1: Environmental Consequence Severity Table

Consequence Severity	Negligible	Minor	Medium	Serious	Severe	Catastrophic
Environment Impact	Impacts to the biological or physical environment that cause no indigenous species damage; and/or impair natural ecosystem function or commercial productivity of land across 1 hectare; and/or are short term (<3 months); and/or do not impair resources.	Impacts to the biological or physical environment that cause single indigenous species damage; and/or result in damage or loss of species and/or habitat of local significance; and/or impair natural ecosystem function or commercial productivity of land across >1 to 100 hectares; and/or are short to medium term (<1 year); and/or temporarily affect resources.	Impacts to the biological or physical environment that cause multiple indigenous species damage within a local area; and/or cause damage or loss of species, habitat and/or cultural heritage items of local significance, and/or impair natural ecosystem function or commercial productivity of land across >100 to 1000 hectares; and/or are medium term (1 to 10 years) and/or there is loss of resource but sustainability unaffected.	Impacts to the biological or physical environment that cause multiple indigenous species damage across a regional area and/or cause damage or loss of species, habitat of National significance, and/or impair natural ecosystem function or commercial productivity of land across >10,000 to 50,000 hectares; and/or are longer term (>10 years); and/or loss of sustainability of selected resources is caused.	Impacts to the biological or physical environment that cause multiple indigenous species damage across a regional area and/or cause damage or loss of species, habitat of National significance, and/or impair natural ecosystem function or commercial productivity of land across >10,000 to 50,000 hectares; and/or are longer term (>10 years); and/or loss of sustainability of selected resources is caused.	Impacts to the biological or physical environment that cause indigenous species extinction; and/or irretrievable loss of habitat of State/National/International significant; and/or impair natural ecosystem function or commercial productivity of land across >50,000 hectares; and/or long term (>100 years); and/or loss of sustainability of most resources is caused.
Notes:						
Environment	Surroundings in which construction is occurring, including air, water, land, natural resources, flora, fauna, humans, and their interrelation.					
Significance	Relates to formal significance under relevant legislation or policy. For example International – Ramsar wetlands, National – National Heritage places, State – Threatened species or ecological communities under legislation, Local – Significant roadside vegetation under local council plans					
Species	Refers to both flora and fauna					

Table 2: Guide for Determining Likelihood Levels

Likelihood	Description
1. Certain	Expected to occur
2. Expected	Will occur in most circumstances
3. Likely	Likely to occur in most circumstances
4. Possible	Could occur at some time
5. Unlikely	Unlikely to occur at some time
6. Improbable	May have occurred in the past
7. Exceptional	Occurs only in exceptional circumstances
8. Remote	Published information exists, but in a different context
9. Rare	No published information on a similar case

N.B. that the likelihood selected must be related to the consequence of severity not the likelihood of the activity. Each type of consequence i.e. environment, asset, credibility etc may have a different likelihood.

Table 3: Guide for Determining Risk Level

Consequence / Likelihood	Negligible	Minor	Medium	Serious	Severe	Catastrophic
1. Certain	MO	M	M	H	E	E
2. Expected	MO	M	M	H	E	E
3. Likely	MO	M	M	H	E	E
4. Possible	L	MO	M	H	E	E
5. Unlikely	L	MO	MO	H	E	E
6. Improbable	L	L	MO	M	H	H
7. Exceptional	I	L	L	MO	M	M
8. Remote	I	I	L	L	MO	MO
9. Rare	I	I	I	L	L	L

I – Insignificant; **L** – Low; **Mo** – Moderate; **M** – Major; **H** – High risk; **E** – Extreme risk

APPENDIX D:
TRAFFIC MANAGEMENT PLAN

GANNAWARRA SOLAR FARM: LANDSCAPE MANAGEMENT PLAN

GANNAWARRA SOLAR FARM: LANDSCAPE MANAGEMENT PLAN

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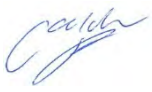
Document Status

	Issue Date	Purpose of Document
Revision A	15 September 2015	Draft for internal review

	Name	Position	Signature	Date
Author	Sarah Imgraben	Environmental Consultant		15/9/2015
Reviewer	Chris Alderton	Senior Environmental Consultant		15/9/2015

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1. INTRODUCTION

1.1 SCOPE OF THIS PLAN

This Landscape Management Plan (LMP) for the Gannawarra Solar Farm has been prepared to meet requirements Gannawarra Shire Council Planning Permit number P13.055 (condition #7). As outlined in the Planning Permit conditions this LMP must address the following details:

- plantings within the site that will provide screening for neighbours
- additional in-fill planting within the site along road reserve boundaries to fill any gaps
- planting schedule, including botanical names, common names, size at maturity and quantities.

1.2 LANDSCAPE PLANTING OBJECTIVES

The objective of the landscape planting detailed within the LMP is to minimise the visual impact of the solar farm development particularly viewed from the surrounding roads (public places) and neighbouring properties.

The Planning Permit specifies that landscaping works must occur before the use/occupation of the development, or by such later date as approved by the Council.

The plantings are designed for long term visual impact mitigation and will not provide an immediate screening of the development. Construction activities will continue to be visible in any gaps until the in-fill landscape plantings have matured. In the semi-arid environment, vegetative growth is highly dependent on rainfall, which is obviously affect growth rates of the revegetation and screening effect.

In addition to the proposed planting, existing remnant native vegetation within the site will be retained. All other vegetation, including paddock trees are protected under the Gannawarra Planning Scheme.

1.3 LANDSCAPE PLANTING PRINCIPLES

The principles are broadly to:

- use Indigenous species that are suited to the local environment
- use species that produce colour through flowers and foliage
- use species that will provide a suitably dense and high foliage cover to effectively screen development infrastructure.

2. SPECIES PROPOSED FOR SCREENING

The development site sits within the Murray Mallee bioregion and the following Ecological Vegetation Classes (EVCs) are mapped as occurring at the site:

- EVC 96: Ridged Plains Mallee
- EVC 824: Woorinen Mallee

The Murray Mallee Bioregion, located in the north west of the state, is typified by calcareous material in the form of broad undulating sandy plains that is often associated with linear, east-west aligned, low sand dunes with intervening heavier textured swales developed from Cainozoic deposits of alluvial, aeolian and swampy deposits. The vegetation is dominated by East/West-Dune Mallee with some Chenopod Mallee and Shallow-Sand Mallee[1].

The plains, drainage lines and groundwater discharge landscapes are dispersed with salt lakes and gypsum flats with lunettes developed on the eastern margins of the lakes. The Cainozoic deposits give rise to calcareous earths (Calcarosols), cracking clays (Vertosols), red sands (Rudosols). The vegetation is dominated by Gypseous Plains Shrubland, Saline Shrubland (Raak), Plains Grassland and Drainage-line Grassy Woodland[1].

Ecological Vegetation Classes (EVC) are the standard unit for classifying vegetation types in Victoria, EVCs are described through a combination of floristics, lifeforms and ecological characteristics, and through an inferred fidelity to particular environmental attributes. Each EVC includes a collection of floristic communities (i.e. lower level in the classification) that occur across a biogeographic range, and although differing in species, have similar habitat and ecological processes operating[1].

Trees and shrubs recommended below are all characteristic of these EVCs and are well suited to the local environment.

[1] DELWP (2015) *EVC Benchmarks.* Department of Environment, Land, Water and Planning, Victoria. [online] available from: http://www.depi.vic.gov.au/environment-and-wildlife/biodiversity/evc-benchmarks

2.1 TREES PROPOSED BASED ON EVC

The following tables outlines the benchmarks for the overstory species that are Indigenous to the area and EVC, including their size at maturity, the density per hectare (ha) and the percentage of area the canopy covers.

Table 2.1: Tree species to be used for planting at the Gannawarra solar farm development

Botanical name	Common name	Size at maturity	DBH(cm)	#/ha	% canopy cover
Allocasuarina luehmannii	Buloke	Up to 10 m	40	15	10
Eucalyptus behriana	Bull Mallee	Up to 10 m	30	15	10
Eucalyptus calycogona	Red Mallee	Up to 12 m	15	30	25
Eucalyptus cyanophylla	Blue-leaved Mallee	Up to 12 m	15	30	25
Eucalyptus dumosa	Dumosa Mallee	Up to 10 m	15-30	15-30	10
Eucalyptus gracilis	Yorrell	Up to 12 m	15	30	25
Eucalyptus oleosa ssp. *oleosa*	Oil Mallee	Up to 12 m	15	30	25
Eucalyptus porosa	Black Mallee-box	Up to 10 m	30	15	10
Eucalyptus socialis	Grey Mallee	Up to 12 m	15	30	25

2.2 SHRUBS PROPOSED BASED ON EVC

The following tables outlines the benchmarks for the understory species that are Indigenous to the area and EVC, including the density per hectare (ha) and the percentage of area the canopy covers.

Table 2.2: Shrub species to be used for planting at the Gannawarra solar farm development

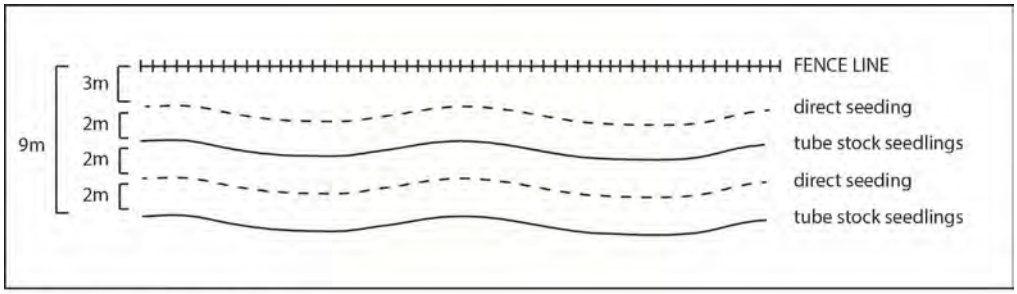
Botanical name	Common name	Size at maturity	#/ha	% cover
Acacia melvillei	Myall	Up to 10 m	3	5
Acacia oswaldii	Umbrella Wattle	Up to 6 m	3	5
Chenopodium curvispicatum	Cottony Goosefoot	Up to 1 m	6	20
Enchylaena tomentosa var. *tomentosa*	Ruby saltbush	Up to 1 m	6	20
Eremophila glabra	Common Emu-bush	Up to 1.5 m	6	10
Eremophila longifolia	Berrigan	Up to 8 m	6	20
Exocarpus aphyllus	Leafless Ballart	Up to 5 m	6	10
Maireana brevifolia	Short-leaf Bluebush	Up to 1 m	3	10
Maireana pentatropis	Erect Bluebush	Up to 1.5 m	6	20
Olearia muelleri	Mueller Daisy-bush	Up to 1.5 m	6	20
Rhagodia spinescens	Hedge Saltbush	Up to 1.5 m	3	10
Santalum acuminatum	Sweet Quandong	Up to 6 m	6	10

3. PLANTING LOCATIONS AND DENSITIES

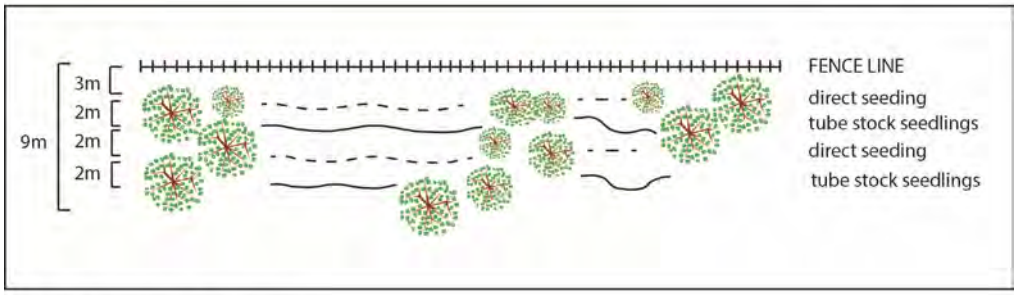
The proposed development site has been divided into Section A (south), B (west), C (north) and D (east), refer to Appendix A. Some Sections (A and B) require random infill planting in the gaps while Sections C and D require a significant revegetation effort to gain the required affect. Figure 1 presents the planting concept for infill planting and new plantings or revegetation.

To calculate the number of species required the following assumptions have been made:

- A three metre offset along the fence line to allow for fence maintenance and bushfire control
- Four rows of revegetation two metres apart, consisting of alternate rows of planted seedlings and direct seeding
- Rows to be slightly wavy and not straight
- To achieve the appropriate density of the species to allow for mortality and a visual screening affect, a rate of 120% of the benchmark has been used.



a) example layout for new plantings



b) example layout for in-fill planting

Figure 1: Planting concepts

The requirements to achieve 120% of the benchmark EVC for each section are shown in Tables 3.1 to 3.4, which are to be made up through a mixture of planting seedlings and direct seeding.

Table 3.1: Section A species and densities required to be achieved

Botanical name	Common name	Density to be achieved (0.65ha)
Allocasuarina luehmannii	Buloke	12
Eucalyptus behriana	Bull Mallee	12
Eucalyptus dumosa	Dumosa Mallee	12
Eucalyptus gracilis	Yorrell	23
Eucalyptus oleosa ssp. *oleosa*	Oil Mallee	23
Eucalyptus socialis	Grey Mallee	23

Botanical name	Common name	Density to be achieved (0.65ha)
Acacia melvillei	Myall	2
Acacia oswaldii	Umbrella Wattle	2
Chenopodium curvispicatum	Cottony Goosefoot	5
Eremophila glabra	Common Emu-bush	5
Eremophila longifolia	Berrigan	5
Exocarpus aphyllus	Leafless Ballart	5
Maireana brevifolia	Short-leaf Bluebush	2
Maireana pentatropis	Erect Bluebush	5
Olearia muelleri	Mueller Daisy-bush	5
Rhagodia spinescens	Hedge Saltbush	2
Santalum acuminatum	Sweet Quandong	5

Table 3.2: Section B species and densities required to be achieved

Botanical name	Common name	Density to be achieved (0.12ha)
Allocasuarina luehmannii	Buloke	2
Eucalyptus behriana	Bull Mallee	2
Eucalyptus dumosa	Dumosa Mallee	2
Eucalyptus gracilis	Yorrell	4
Eucalyptus oleosa ssp. *oleosa*	Oil Mallee	4
Eucalyptus socialis	Grey Mallee	4
Acacia melvillei	Myall	1
Acacia oswaldii	Umbrella Wattle	1
Chenopodium curvispicatum	Cottony Goosefoot	1
Eremophila glabra	Common Emu-bush	1
Eremophila longifolia	Berrigan	1
Exocarpus aphyllus	Leafless Ballart	1
Maireana brevifolia	Short-leaf Bluebush	1
Maireana pentatropis	Erect Bluebush	1
Olearia muelleri	Mueller Daisy-bush	1
Rhagodia spinescens	Hedge Saltbush	1
Santalum acuminatum	Sweet Quandong	1

Table 3.3: Section C species and densities required to be achieved

Botanical name	Common name	Density to be achieved (2.4ha)
Allocasuarina luehmannii	Buloke	43
Eucalyptus behriana	Bull Mallee	43
Eucalyptus dumosa	Dumosa Mallee	43
Eucalyptus gracilis	Yorrell	86
Eucalyptus oleosa ssp. *oleosa*	Oil Mallee	86

Botanical name	Common name	Density to be achieved (2.4ha)
Eucalyptus socialis	Grey Mallee	43
Acacia melvillei	Myall	9
Acacia oswaldii	Umbrella Wattle	9
Chenopodium curvispicatum	Cottony Goosefoot	17
Eremophila glabra	Common Emu-bush	17
Eremophila longifolia	Berrigan	17
Exocarpus aphyllus	Leafless Ballart	17
Maireana brevifolia	Short-leaf Bluebush	9
Maireana pentatropis	Erect Bluebush	17
Olearia muelleri	Mueller Daisy-bush	17
Rhagodia spinescens	Hedge Saltbush	9
Santalum acuminatum	Sweet Quandong	17

Table 3.4: Section D species and densities required to be achieved

Botanical name	Common name	Density to be achieved (0.84ha)
Allocasuarina luehmannii	Buloke	15
Eucalyptus behriana	Bull Mallee	15
Eucalyptus dumosa	Dumosa Mallee	15
Eucalyptus gracilis	Yorrell	30
Eucalyptus oleosa ssp. *oleosa*	Oil Mallee	30
Eucalyptus socialis	Grey Mallee	30
Acacia melvillei	Myall	3
Acacia oswaldii	Umbrella Wattle	3
Chenopodium curvispicatum	Cottony Goosefoot	6
Eremophila glabra	Common Emu-bush	6
Eremophila longifolia	Berrigan	6
Exocarpus aphyllus	Leafless Ballart	6
Maireana brevifolia	Short-leaf Bluebush	3
Maireana pentatropis	Erect Bluebush	6
Olearia muelleri	Mueller Daisy-bush	6
Rhagodia spinescens	Hedge Saltbush	3
Santalum acuminatum	Sweet Quandong	6

4. IMPLEMENTATION AND MANAGEMENT

4.1 PLANTING METHODS

4.1.1 Preparation

Herbicide should be sprayed in one metre strips six months prior to planting. If seeds are to be collected locally this should commence twelve months prior to planting to ensure that seed is available and ready to be planted.

The use of tube stock seedlings is recommended for *Eucalyptus* spp. whilst direct seeding is recommended for *Acacia* spp. and other shrubs. Seeds should be collected in November to December for *Acacia* spp. Alternatively seeds can be purchased from the Swan Hill Regional Seed Bank.

To assist *Acacia* seed germination, half of the seed to be planted should be pre-treated by covering the seeds with boiling water and allowing them to soak for 24 hours.

4.1.2 Methods

Planting of seedlings may occur by machine or hand, depending on the specific conditions on site. Seeds can be directly drilled by machine. The use of tree guards or rabbit-proof fencing should be investigated to protect seedlings and young trees.

4.2 PLANTING DISTANCES AND RATIOS

Alternative rows of tube stock and seed should be planted approximately two metres apart. Refer to Section 3 for information about numbers of plants at each planting location.

4.3 WATERING

The plant species, in accordance with the principles outlined in Section 1.3, have been selected as they are Indigenous and suited to the specific climatic conditions in this area. Tube stock should be watered at planting and again two weeks later. Follow up watering would be utilised only if extreme adverse weather conditions occur that threaten survival of the seedlings. Additional watering should not be needed if adequate weed control, correct planting and average rainfall occur.

4.4 MAINTANANCE

Maintenance activities may include:

- Checks of tree guards to ensure they are correctly in place and /or undamaged. Tree guards should be removed when plants are well established and at a stage where the viability of the plant will not be compromised by pest animal activity.
- If necessary young plants should be watered if it becomes very dry. However, as specified in Section 4.3 this should not be necessary.
- Checks for weed competition, however the need for weed spraying will be minimised as far as practicable with pre-planting site preparation as described in Section 4.1.1.
- Checks for evidence of browsing by wildlife such as rabbits and kangaroos. Additional measures to prevent browsing should be employed, such as fencing to ensure wildlife cannot access seedlings.
- In accordance with Planning Permit requirements, any dead, diseased or damaged plants must be replaced within twelve months.

APPENDIX A:
LANDSCAPE PLAN

LEGEND

- Site Boundary
- New planting
- In-fill planting
- Remnant vegetation

N

200 0 200 400

Metres

APPROX SCALE 1:22,500 @ A4

GDA 1994 MGA Zone 54

DATA SOURCES
WCMA
Geoscience Australia

Disclaimer: While all reasonable care has been taken to ensure the information contained on this map is up to date and accurate, no guarantee is given that the information portrayed is free from error or omission. Please verify the accuracy of all information prior to use.

RPS

FIGURE 1

Gannawarra Solar Farm
Landscape Plan

A225_001 Rev: A Produced: Leader Reviewed: Leader Date: 26/03/2012