
Biodiversity Management Plan

Beryl Solar Farm

Prepared for Downer Group | 6 August 2018

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Biodiversity Management Plan

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Date **6 August 2018**

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1 Introduction

1.1 Background

Downer Group plans to construct the Beryl Solar Farm (the project). The project is located 6 km west of Gulgong and 80 km east of Dubbo, within the locality of Beryl and the Mid Western Local Government Area (LGA) (Figure 1.1).

The project includes the installation of an array of photovoltaic panels with an upper capacity of 95 Megawatts (MW) once fully operational. The following works will be completed during the construction stage of the project:

- site establishment and preparation for construction (fencing, ground preparation, preliminary civil works and drainage);
- installation of steel post and rail foundation system for the solar panels;
- installation of underground cabling (trenching) and installation of inverter stations;
- modifications of existing Beryl Substation, including civil and electrical works;
- construction of the 66kV overhead transmission line, onsite substation and equipment, and interconnection to the existing Beryl substation;
- removal of temporary construction facilities and rehabilitation of disturbed areas;
- the installation of the piles supporting the solar panels, which would be driven or screwed into the ground to a depth of approximately 1.5m;
- construction of internal access tracks and associated drainage;
- substation bench preparation;
- concrete or steel pile foundations for the inverter stations, onsite substation and maintenance building;
- trenches up to 1000mm deep for the installation of cables;
- construction of footings for the transmission line to the existing Beryl substation;
- establishment of temporary staff amenities and offices for construction;
- construction of perimeter security fencing; and
- native vegetation screening, where required, to provide a buffer around the site and screening of infrastructure from surrounding residences.

1.2 Project biodiversity values and impacts

The Beryl Solar Farm Biodiversity Assessment Report (BAR) (ngh Environmental 2017) identified the biodiversity values and impacts of the project. The biodiversity values were considered to be impacted by the Beryl Solar project in ngh Environmental (2017) comprise:

- 0.99 ha of PCT 281 Rough-barked Apple – Red Gum – Yellow Box Woodland on alluvial clay to loam soils on valley flats in Moderate/good condition (Zone 2 in ngh Environmental 2017);
- 12.6 ha of PCT 281 Rough-barked Apple – Red Gum – Yellow Box Woodland on alluvial clay to loam soils on valley flats in Low condition (Zone 3 in ngh Environmental 2017);
- 64.3 ha of PCT 281 Rough-barked Apple – Red Gum – Yellow Box Woodland on alluvial clay to loam soils on valley flats in Low (derived grassland) condition (Zone 4 in ngh Environmental 2017); and
- 63 ha of non -assessed sown pasture.

Zones 2 and 3 (see above and Figure 1.1) represent the endangered ecological community (EEC) White Box-Yellow Box-Blakely's Red Gum Woodland listed under the NSW *Biodiversity Conservation Act 2016* (BC Act). Areas of the community which meet the listing criteria for the critically endangered ecological community (CEEC) White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) are located outside of the development footprint. No impacts to the EPBC Act listed CEEC will occur.

Consideration has been given to avoiding and minimising impacts to biodiversity. The layout has been revised three times and now excludes impacts on higher value EPBC Act listed Box-Gum Woodland CEEC on the project site' western corner and most of the higher value EEC associated with the site's central laneway north-south. Areas of derived ephemeral wetland in the north-east section of the site are also now avoided. Residual impacts are mostly in low condition EEC. The low condition EEC has limited potential for regeneration after a long history of grazing; only one tree species is present in low abundance and this is not dominant species of the EEC. Groundcover vegetation is highly modified with a low percentage of native species.

As a result of these measures to avoid and minimise impacts, residual impacts requiring offsets have been limited to 0.99 ha of 16.14 ha of PCT 281 in Moderate/good condition and 16.14 ha of PCT 281 in Low condition. Impacts to 95.04 ha of PCT 281 in Low (derived grassland) condition do not require offsets due to their site value score. The total credit requirement for the project is 684 credits.

Also as a result of the measures to avoid and minimise impacts, significant areas of native vegetation will be retained. Areas of retained native vegetation contain potential habitat for a number of threatened species.

Biodiversity constraints data, shown in Figure 1.1, will be provided to all contractors, included in drawings and outlined in inductions packages (see Section 3.2.1).

Figure 1.1 **The project, biodiversity values and impacts**

2 Management zones and objectives

2.1 Management zones

The following management zones (Figure 2.1) have been designated in the project area:

1. groundcover re-establishment zone – the solar farm footprint;
2. retained vegetation zone – areas of retained vegetation; and
3. vegetation screen.

2.2 Management zone objectives

The groundcover re-establishment zone is the area that will be cleared for installation of the solar array, and adjacent construction areas, and which will be re-established following construction. The management objectives of the groundcover re-establishment zone are to:

- ensure sensitive removal of native vegetation, minimising clearing and impacts to native fauna;
- restore ground cover in the solar farm footprint to prevent erosion as soon as practicable and within 12 months following the completion of construction, using suitable species; and
- maintain the restored groundcover and keep it free of weeds.

The retained vegetation zone includes all areas of retained vegetation, outside of the solar array, which will be retained. The management objectives of the retained vegetation zone are to:

- manage and protect remnant vegetation and fauna habitat;
- minimise vegetation and habitat clearing and disturbance; and
- control weeds.

The vegetation screen at selective locations around the site (Figure 2.1) will provide a buffer around the site and screening of infrastructure from surrounding residences. The management objectives of the vegetation screen are to:

- provide effective screening of the solar panels and ancillary infrastructure from surrounding residences;
- use species representative of PCT 281; and
- re-use salvaged vegetation and soil from any development.

Figure 2.1 Management zones



3 Management measures and implementation

3.1 Management measures

This chapter provides the management measures to be implemented, comprising:

- a vegetation screen;
- minimisation of vegetation clearing and disturbance;
- minimisation of fauna impacts;
- restoration and maintenance of groundcover; salvage and re-use of vegetation and soil resources;
- management of remnant vegetation and fauna habitat; and
- control of weeds and feral pests.

The following sections describe these management measures and provide a schedule for their implementation.

3.1.1 Vegetation screen

A vegetation screen will be planted on the northern and north-western boundaries of Beryl Solar Farm (Figure 2.1).

The vegetation screen will be comprised of species representative of PCT 281 Rough-barked Apple – Red Gum – Yellow Box Woodland on alluvial clay to loam soils. A species list for PCT 281 is provided in Table 3.1.

Table 3.1 Species list for PCT 281

Stratum	Species
Overstorey species	<i>Eucalyptus floribunda</i> <i>Eucalyptus blakelyi</i> <i>Eucalyptus melliodora</i> <i>Callitris endlicheri</i> <i>Callitris glaucophylla</i>
Midstorey species	<i>Acacia implexa</i> <i>Acacia pennivervis</i> var. <i>pennivervis</i> <i>Bursaria spinosa</i> subsp. <i>spinosa</i> <i>Acacia gladiiformis</i> <i>Acacia uncinata</i> <i>Acacia leiocalyx</i> <i>Acacia decora</i> <i>Cassinia quinquefaria</i> <i>Notalaea macrocarpa</i> var. <i>microcarpa</i> <i>Geijera parviflora</i>

Table 3.1 Species list for PCT 281

Stratum	Species
	<i>Exocarpos cupressiformis</i>

A Landscape Management Plan has been prepared by Geolyse (2018) to address conditions 10 and 11 of the project approval. As per this plan, plants selected for the vegetation screen will be selected from Table 3.1 to provide a visual screen within 3 years and provide a diversity of growth characteristics. Screen plantings will be undertaken in four areas, and will collectively provide for 3.035 km of vegetative screening.

Site preparation will be conducted in accordance with the Landscaping Plan (Appendix A). Salvaged topsoil and any mulched vegetation will be stored in the groundcover restoration zone and utilised during groundcover restoration efforts.

Detailed information on the vegetation screen, including planting and spacing densities, preparation and planting and management, is provided in the Landscaping Plan (Appendix A). Once established, the vegetation screen will be properly maintained and kept free of weeds. Further information on weed control in the vegetation screen is provided in Section 3.1.8 and the Landscape Management Plan (Appendix A).

3.1.2 Minimisation of vegetation clearing and disturbance

The predicted biodiversity impacts of the Beryl Solar Farm, outlined in the BAR by ngh Environmental (2017), comprised the removal of 12 ha of PCT 281 Rough-barked Apple – Red Gum – Yellow Box Woodland on alluvial clay to loam soils on valley flats moderate to low condition.

The layout for the Beryl Solar Farm has been revised three times and now excludes impacts on higher value Box-Gum Woodland EEC on the project site's western corner (Figure 2.1). Areas of derived ephemeral wetland in the north-east section of the site are also now avoided. Following detailed design, the actual impacts include the development of the solar footprint on:

- 0.99 ha of PCT 281 Rough-barked Apple – Red Gum – Yellow Box Woodland on alluvial clay to loam soils on valley flats in Moderate/good condition (Zone 2 in ngh Environmental 2017);
- 12.6 ha of PCT 281 Rough-barked Apple – Red Gum – Yellow Box Woodland on alluvial clay to loam soils on valley flats in Low condition (Zone 3 in ngh Environmental 2017);
- 64.4 ha of PCT 281 Rough-barked Apple – Red Gum – Yellow Box Woodland on alluvial clay to loam soils on valley flats in Low (derived grassland) condition (Zone 4 in ngh Environmental 2017); and
- 63 ha of non -assessed sown pasture.

As a part of the site preparation works, a perimeter fence will be constructed around the solar array. This fence is primarily to provide security for the solar farm, but will also delineate the extent of works. The fence will be constructed to be visible to fauna, and will allow unrestricted movement around the solar arrays. Non barbed wire fencing will be used where possible. The perimeter fence is expected to take several months to construct, but once complete will clearly delineate the extent of works. No clearing of vegetation along the southern boundary of the site will be undertaken prior to the completion of the perimeter fence or the entire southern boundary has been clearly marked as 'no-go' zones prior to clearing and fenced off, using parawebbing, flagging or similar.

Areas of retained vegetation within the perimeter fence, may be subject to minor disturbance during construction, for the purposes of laydowns or other areas, as well as minor vehicle access. However, these areas will not require significant disturbance. A small section of PCT 281 in moderate/good condition, associated with the site's central north-south laneway will be included within the perimeter security fence. These areas will be clearly marked as 'no-go' zones prior to clearing and fenced off, using parawebbing, flagging or similar. Avoidance of impacts to this retained vegetation will be included in project inductions.

Retained vegetation outside of the perimeter fence will not be directly impacted, although they may be susceptible to edge effects and weed invasion following clearing and development. Management of remnant vegetation and fauna habitat is outlined in Section 3.1.7. In areas where the perimeter fence cannot be completed prior to commencement of construction, the extent of clearing will be clearly delineated using parawebbing, flagging or similar and will be clearly marked as 'no-go' zones prior to clearing, with a minimum of 250 m in advance of proposed clearing.

A number of mature trees will be retained within the perimeter fence. Tree protection zones (TPZs) will be set up around all trees retained within and adjacent to the disturbance footprint. TPZs will be established in accordance with the Australian Standard AS 4970-2009 Protection of trees on development sites (Standards Australia 2009):

$$TPZ = DBH \times 12$$

The TPZ will be fenced and clearly marked as 'no-go' zones prior to clearing.

3.1.3 Minimisation of fauna impacts

Clearing of hollow-bearing trees within the development site will be commenced in August; clearing between June and January cannot be avoided (as recommended in ngh Environmental 2017).

As clearing will be undertaken during this period pre-clearing surveys will be undertaken. Pre-clearing surveys will be undertaken by appropriately qualified ecologist and will:

- check for the evidence of presence of fauna species, particularly those outlined above;
- flag key habitat features, including (but not limited to) nests, hollow bearing trees or large logs;
- identify nearby habitat suitable for the release of any that may be encountered during clearing works; and
- contact a wildlife carer or veterinarian to inform them of vegetation clearing works upcoming.

Following pre-clearing surveys, vegetation clearing works are to follow a two-staged process, as outlined below:

- Stage 1 will include the removal of all non-habitat vegetation (eg shrubs, regrowth, ground cover and non-habitat trees). The groundcover will be scalped to topsoil where appropriate. A minimum of 24 hours will be allowed between Stage 1 and Stage 2.
- Stage 2 will include the removal of all habitat vegetation:

- nests and on-ground logs will be carefully inspected by an ecologist. Logs should be carefully rolled and inspection beneath the log undertaken;
- habitat trees (trees with hollows or nests) will be carefully lowered to the ground with minimal impact and nests and hollows inspected by the ecologist; and
- any fauna species are to be relocated to habitat identified during the pre-clearing process or, if injured, transported to a veterinarian or wildlife carer.

No other fauna habitat features that require management during construction were identified in the Beryl Solar Farm Biodiversity Assessment (ngb 2017) and therefore no further measures are recommended.

3.1.4 Ground disturbance approval process

Prior to undertaking any ground disturbance, the following checklist should be approved by the on-site contractor (Downer):

- Is the area proposed for clearing within the approved disturbance boundary?
- Has a general check of biodiversity constraints been undertaken, ensuring impacts are aligned with the EIS?
- Have clearing limits been established, using perimeter fencing and/or parawebbing or similar, for a minimum of 250 m ahead of proposed clearing?
- Have TPZs been established around all trees proposed for retention?
- Is clearing of trees required? If yes, assess all trees and mark hollow-bearing trees for two-staged clearing. Undertake two-staged clearing process.

This should be completed and signed by the on-site representative prior to any ground disturbance.

3.1.5 Restoration and maintenance of groundcover

i Soils in the project area

Results from Macquarie Geotech's (2017) 'Desk study and Preliminary Soil Survey for Beryl Solar Farm' (Appendix H, Beryl Solar Farm EIS), state that the main geotechnical properties of the underlying soils on site are as follows;

- site soils fell predominantly into the Home Rule Soil Group and consisted of silty sands underlain by clays;
- the emerson crumb results ranged between 1 to 2 and indicated that the site soils are dispersive;
- the erosion risk of the area is high, based especially in areas with no or minimal ground cover. It is noted that the majority of the site investigated is protected from erosion by existing groundcover;
- erosion on site can be managed and controlled by implementation of erosion and sedimentation management plans; and
- the probability of acid sulphate soils in the area is generally low.

Construction works will involve stripping of topsoil in limited area for the purposes of road construction and to flatten the site prior to installation of the solar array and associated infrastructure. Across the majority of the site, steel piles will be installed using a tracked piling machine, avoiding the need for removal of existing groundcover or stripping of topsoil.

Following completion of construction activities, groundcover will be re-established in areas where stripping has been required. Soil preparation and groundcover re-establishment for these areas is outlined below.

ii Technical stabilisation and rehabilitation notes

a. Topsoil preparation and seeding

Given the sites soils consist of silty sands underlain by clays, topsoils should be prepared and improved by spreading a mix of organic matter (i.e. compost, decayed sawdust, wood shavings) and fertiliser as evenly as possible through the topsoil layer, avoiding compaction. This will increase and strengthen soil structure, promote plant growth and thus minimise the risk of erosion. Shallow ripping should be undertaken from 50 to 100 mm in depth. Multiple passes may be required depending on the equipment being used.

The final surface should be presented in a roughened state to reduce runoff and provide furrows for seeds to wash into, and then be covered by soil, this will provide the soil-seed contact required for germination. Given silty topsoils, overwatering should be avoided.

iii Seed broadcasting

Seeds can be broadcast or applied with hydromulch at 4 tonnes per hectare. Recommended seeds include a mix of native grasses comprising Speargrass (*Austrostipa* spp.), Redgrass (*Bothriochloa macra*), Windmill Grass (*Chloris ventricosa*), Weeping Grass (*Microlaena stipoides*), Wallaby Grasses (*Rytidosperma* spp.) and Kangaroo Grass (*Themeda australis*). The groundcover will be maintained and kept free of weeds by implementing the measures described in Section 3.1.7.

In areas where no groundcover has been removed no groundcover restoration is required. On the occasion of extended periods of drought, topsoil preparation and seed broadcasting will not commence until conditions are more seasonally favourable.

3.1.6 Salvage and re-use of vegetation and soil resources

Where appropriate, salvaged topsoil and any mulched vegetation will be stored in the vegetated screen and utilised during groundcover restoration efforts to stabilise bare ground and prevent erosion. Non-hollow bearing salvaged vegetation will be mulched and stockpiled for later re-use.

Where possible, fallen timber with hollows is to be collected and placed into adjacent suitable habitats outside the development footprint, such as the vegetation screen management zone or retained vegetation zone.

3.1.7 Management of remnant vegetation and fauna habitat

The following measures will be implemented for the protection of the retained vegetation zone:

- erection of the perimeter fence, for long term protection of retained vegetation outside the fence;

- temporary erection of ‘environmental protection zone’ signage at the boundary of retained vegetation zone. Fence to be removed once groundcover has re-established; and
- restriction of entry to the retained vegetation zone (ie. only for the purposes of environmental monitoring and weed management).

Weed inspections will be conducted in this area to identify any priority and/or invasive weeds and conduct weed control as appropriate. Control of introduced species is outlined further in Section 3.1.8.

Staged removal of hollow-bearing trees and other habitat features such as fallen logs with attendance by an ecologist. Where possible, fallen timber with hollows is to be collected and placed into adjacent suitable habitats outside the development footprint.

Areas of retained vegetation were identified in the biodiversity offset strategy (ngh Environmental 2017c) as being suitable to offset the impacts of the Beryl Solar Farm, generating 723 ecosystem credits for PCT 281. Condition 14 of the project approval excludes the use of areas zoned R5 – Large Lot Residential in the north-east of the site being used as an offset. This reduces the number of credits available.

In line with condition 13, First Solar has two years from commencement of the development to meet their credit requirements. First Solar is currently investigating the use of these areas of retained vegetation as an offset, as well as other measures such as retirement of suitable credits from an off-site BioBank site, payment into the Biodiversity Conservation Fund (BCF) or supplementary measures.

Until this matter is resolved, in consultation with the Office of Environment and Heritage (OEH) and Department of Planning and Environment (DPE), areas of retained vegetation will be fenced off and passively managed.

3.1.8 Control of introduced species

i Introduced flora species

A total of 74 exotic and non-indigenous flora species were identified by ngh Environmental (2017) as occurring within the Beryl Solar Farm project area (Appendix B). None of these species are identified as priority weeds in the Central Tablelands Regional Strategic Weed Management Plan (LLS 2017).

Quarterly weed monitoring will be undertaken during the first year following completion of construction. This will be followed by biannual monitoring each year during operation. This will comprise of traverses across vegetation screens and groundcover re-establishment zones, as well as opportunistic observations. If significant weed outbreaks, defined as a greater than 20% cover of priority weeds (LLS 2017) in any strata, are identified, controls will be undertaken following best practise methods by a qualified bush regeneration contractor.

As outlined above, the retained vegetation zone will be passively managed. No weed monitoring is proposed in this area.

ii Introduced fauna species

A total of five introduced vertebrate pest species were identified by ngh Environmental (2017) as occurring within the Beryl Solar Farm site. These include the Common Starling (*Sturnus vulgaris*), Rock Dove (*Columba livia*), Hare (*Lepus europaeus*), European Rabbit (*Oryctolagus cuniculus*) and the European Red Fox (*Vulpes vulpes*).

No significant pest species occurrences or issues are identified in the BAR (ng Environmental 2017). As such, significant control is not required. Quarterly feral species monitoring will be undertaken within the solar farm and in retained vegetation zone during the first year following completion of construction, and biannually each year during operation. Monitoring will consist of visual inspections for signs of introduced fauna species, focusing on the Hare and European Rabbit. If significant introduced fauna species outbreaks are identified, controls will be undertaken. Best practise methods include the biannual inspection, ripping and rehabilitation of rabbit and hare warrens as detected.

3.2 Implementation of management measures

Table 3.2 lists the management measures, their relevant objectives, monitoring requirements, performance criteria and corrective actions and a timeframe for their implementation.

Table 3.2 Management measures and their implementation

Management measure	Management objective/s	Monitoring	Performance criteria and corrective actions	Management zone	Implementation timeframe
Establishment of vegetation screen (Section 3.1.1)	Provide effective screening of the solar panels and ancillary infrastructure from surrounding residences.	Monitor seedlings for mortality during establishment. Four inspections will be undertaken in the first 12 months of planting, dropping to three inspections each year for the following two years.	Vegetation screen will be effective at screening views of the solar panels and ancillary infrastructure on site from surrounding residences within 3 years of the commencement of construction. Mortalities greater than 10% or gaps greater than 5 m will be replaced within the first 3 years.	Vegetation screen	Site preparation during construction period. Seed application 12 months following site preparation
	Provide species representative of PCT 281.	Records will be kept of the species used. This data will be audited against Table 3.1.	Species listed in Table 3.1 are used in the vegetation screen. No corrective actions required.	Vegetation screen	Seed application 12 months following site preparation
	Manage weed outbreaks.	Quarterly weed monitoring during the first year following completion of construction followed by bi-annual monitoring each year during operation.	Exotic plant cover does not exceed pre-construction weed cover of 90% (as derived from nph Environmental 2017). Weed control conducted as necessary.	Vegetated screen	Construction and operation
Minimisation of vegetation clearing and disturbance	Minimise vegetation and habitat clearing and disturbance.	Regular monitoring of fencing and environmental protection zone signage.	Survey and clear delineated prior to clearing. Temporary fences and	Retained native vegetation	Prior to and during construction

Table 3.2 Management measures and their implementation

Management measure	Management objective/s	Monitoring	Performance criteria and corrective actions	Management zone	Implementation timeframe
(Section 3.1.2)			<p>signage are in good working order, with any damage observed during inspections repaired.</p> <p>No access to environmental protection zone (except for environmental monitoring and weed management).</p> <p>Ground disturbance approvals process implemented.</p>		
Minimisation of fauna impacts (Section 3.1.3)	Manage and protect remnant vegetation and fauna habitat.	Biannual fencing inspections for the first 6 years during project operation.	Permanent fence is in good working order with any damage observed during inspections repaired.	Retained native vegetation	Permanent fencing installed within 12 months of the completion of construction
	Control weed outbreaks.	Quarterly weed monitoring during the first year following completion of construction followed by biannual monitoring each year during operation. Monitoring will comprise traverses across the management zone and removal of identified weeds as per best practice methods.	<p>Exotic plant cover does not exceed pre-construction weed cover of 40% (Zone 1), 82% (Zone 2) or 48% (Zone 5) (as derived from ngh Environmental 2017).</p> <p>Weed control conducted as necessary.</p>	Retained native vegetation	Construction and operation
	Minimise vegetation and habitat clearing and disturbance.	Regular monitoring of temporary fencing and environmental protection zone signage.	Temporary fences and signage are in good working order, with any damage observed during inspections repaired.	Retained native vegetation	Prior to and during construction

Table 3.2 Management measures and their implementation

Management measure	Management objective/s	Monitoring	Performance criteria and corrective actions	Management zone	Implementation timeframe
			Ground disturbance approvals process implemented.		
Restoration and maintenance of groundcover (Section 3.1.4)	Prepare soil for restoration.	Assess soil conditions prior to seedling establishment.	Soil conditions meet the criteria listed in Section 3.1.2 with additional amelioration where required.	Groundcover re-establishment	12 months prior to seed application
	Restore ground cover in the solar farm footprint as soon as practicable and within 12 months following the completion of construction, using suitable species.	Monitor grass for mortality during establishment in 20 m x 50 m nested plots in accordance with Appendix C. Monitoring will be undertaken quarterly during the first twelve months following seed application. Monitoring frequency for the second year will be defined based on results of assessment of performance criteria at the end of the first year (see Section 4.3).	Re-establishment a predominantly native, groundcover. Overall groundcover post restoration should target 60% to limit and prevent erosion (25% native groundcover, based on values from ngh Environmental 2017). This should be achieved within two years or two growing seasons (whichever is greater) of groundcover restoration being completed. Measures to ensure success may include supplementary watering, if below average rainfall occurs. As a contingency measure, if	Groundcover re-establishment	Within 12 months of the completion of construction

Table 3.2 Management measures and their implementation

Management measure	Management objective/s	Monitoring	Performance criteria and corrective actions	Management zone	Implementation timeframe
	Maintain the restored groundcover and keep it free of weed outbreaks.	Quarterly weed monitoring during the first year following completion of construction followed by bi-annual monitoring each year during operation.	required, a sterile non-native crop will be used to establish groundcover and overplanted by native seed mix. Exotic plant cover does not exceed pre-construction weed cover of 90% (as derived from ngh Environmental 2017). Weed control conducted as necessary.	Groundcover re-establishment	Construction and operation
Salvage and re-use of vegetation and soil resources (Section 3.1.5)	Maximise the salvage of vegetation and soil resources for use in the groundcover reestablishment areas.	Records are kept regarding stockpiling and re-use of salvaged vegetation and soil.	Salvaged soil and mulched vegetation is used in groundcover reestablishment areas.	Groundcover reestablishment areas.	Prior to seed application
Management of remnant vegetation and fauna habitat (Section 3.1.6)	Manage and protect remnant vegetation and fauna habitat.	Biannual fencing inspections for the first 6 years during project operation.	Permanent fence is in good working order with any damage observed during inspections repaired.	Retained native vegetation	Permanent fencing installed prior to the completion of construction
	Control weed outbreaks.	Quarterly weed monitoring during the first year following completion of construction followed by biannual monitoring each year during operation. Monitoring will comprise traverses across the management zone and removal of identified weeds as per best practice methods.	Exotic plant cover does not exceed pre-construction weed cover of 40% (Zone 1), 82% (Zone 2) or 48% (Zone 5) (as derived from ngh Environmental 2017). Weed control conducted as necessary.	Retained native vegetation	Construction and operation

Table 3.2 Management measures and their implementation

Management measure	Management objective/s	Monitoring	Performance criteria and corrective actions	Management zone	Implementation timeframe
Protection of vegetation and fauna habitat outside the approved disturbance areas	Manage and protect remnant vegetation and fauna habitat.	Biannual fencing inspections for the first 6 years during project operation	Permanent fence is in good working order with any damage observed during inspections repaired.	Retained native vegetation	Permanent fencing installed within 12 months of the completion of construction
	Control weed outbreaks.	Quarterly weed monitoring during the first year following completion of construction followed by biannual monitoring each year during operation. Monitoring will comprise traverses across the management zone and removal of identified weeds as per best practice methods.	Area is free of all weed outbreaks with weed control conducted as necessary.	Retained native vegetation	Construction and operation
	Minimise vegetation and habitat clearing and disturbance.	Regular monitoring of temporary fencing and environmental protection zone signage.	Temporary fences and signage are in good working order, with any damage observed during inspections repaired.	Retained native vegetation	Prior to and during construction
Control of introduced species (Section 3.1.7)	Control weed outbreaks.	Quarterly weed monitoring during the first year following completion of construction followed by biannual monitoring each year during operation. Monitoring will comprise traverses across the management zone and removal of identified weeds as per best practice methods. Opportunistic observations of weeds.	Exotic plant cover does not exceed pre-construction weed cover of 40% (Zone 1), 82% (Zone 2), 90% (Zone 4) or 48% (Zone 5) (as derived from ngh Environmental 2017). Priority weed species (LLS 2017) do not exceed 20% in any strata of the native vegetation communities.	Groundcover re-establishment Retained native vegetation	Construction and operation

Table 3.2 Management measures and their implementation

Management measure	Management objective/s	Monitoring	Performance criteria and corrective actions	Management zone	Implementation timeframe
			Weed control conducted as necessary.		
	Control introduced fauna species	Quarterly introduced fauna species monitoring during the first year following completion of construction followed by biannual monitoring each year during operation. Monitoring will consist of visual inspections for signs of introduced fauna species, focusing on the Hare and European Rabbit. If significant introduced fauna species outbreaks are identified, best practise controls will be undertaken	.Introduced fauna species do not reach outbreak levels within any zones in or surrounding construction and operation.	Groundcover re-establishment Retained native vegetation	Construction and operation

3.2.1 Project inductions

Key elements of this BMP should be communicated to all on-site personnel during the site induction process. In particular, the following key elements should be communicated:

- management zones and objectives;
- key measures to minimise vegetation clearing and disturbance, as per Section 3.1.2;
- vegetation clearing protocols, as per Section 3.1.3; and
- ground disturbance approvals process, as per Section 3.1.4.

Environmental constraints data, including Figures 1.1 and 1.2 will be provided to all on-site personnel during the site induction process. Records of site inductions should be maintained by Downer and First Solar.

4 Responsibilities, monitoring, reporting and review

4.1 Responsibilities

First Solar (Australia) Pty Ltd is the owner of Beryl Solar Farm. First Solar (Australia) Pty Ltd has engaged Downer as the engineering-procurement-construction (EPC) contractor for the Beryl Solar Farm. Downer will be responsible for monitoring, reviewing and implementing the BMP for the term of their engagement. This will include all actions outlined in Table 3.2 up to and including construction.

After this time, responsibility for operational activities and monitoring will rest with First Solar (Australia) Pty Ltd.

4.2 Monitoring

Performance criteria have been set for each management measure to determine if these have been satisfactorily achieved (Table 3.2). The monitoring measures described in Table 3.2 will be implemented and reported annually (Section 4.3).

4.3 Reporting

Records will be kept to document the dates, methods and outcomes of the management measures to be implemented relevant to the BMP. A report will be submitted to the Department of Planning and Environment and Office of Environment and Heritage 12 months following the completion of construction. This report will assess the efficacy of the management measures implemented against the relevant performance criteria in Table 3.2.

A second report will be submitted 24 months following the completion of construction. If performance criteria have been achieved, no further reporting will be undertaken.

4.4 Review

This plan will be reviewed following the resolution of the biodiversity offsets for the project.

A further review will be undertaken concurrent with the first report (Section 4.3), 12 months following the completion of construction. The efficacy of implemented management measures will be reviewed against the relevant performance criteria. If the performance criteria are not being satisfactorily achieved within this timeframe, the management measures will be amended accordingly.

References

ng 2017, *Beryl Solar Farm Biodiversity Assessment*, report to First Solar (Australia) Pty Ltd

DPI 2014, *Noxious and environmental weed control handbook – A guide to weed control in non-crop, aquatic and bushland situations*. Sixth edition (November 2014), NSW Department of Primary Industries

DPI 2018, *Ecology and management of vertebrate pests in NSW*, Second edition, NSW Department of Primary Industries

DPI 2018, *Vertebrate Pesticide Manual*, tenth edition, NSW Department of Primary Industries

OED 2014, *Framework for Biodiversity Assessment*, NSW Office of Environment and Heritage

NSW Local Land Services (Central Tablelands) 2017, *Central Tablelands Regional Strategic Weed Management Plan 2017 - 2022*

Appendix A

Landscape Management Plan

Appendix B

Introduced species

ng Environmental conduct a site visit in 2017, recording all introduced flora and fauna sighted – these species are presented in the table below.

Table i **Introduced flora species identified on site**

Scientific name	Common name
<i>Acetosella vulgaris</i>	Sheep Sorrel
<i>Aira elegantissima</i>	Delicate Hairgrass
<i>Anagallis arvensis</i>	Scarlet Pimpernel
<i>Arctotheca calendula</i>	Capeweed
<i>Arenaria leptoclados</i>	Lesser Thyme-leaved Sandwort
<i>Bidens subalternans</i>	Greater Beggar's Ticks
<i>Briza maxima</i>	Giant Shivery Grass
<i>Briza minor</i>	Small Shivery Grass
<i>Bromus diandrus</i>	Great Brome
<i>Bromus hordeaceus</i>	Soft Brome
<i>Bromus molliformis</i>	Soft Brome
<i>Capsella bursa-pastoris</i>	Shepherd's Purse
<i>Carduus pycnocephalus</i>	Slender Thistle
<i>Carthamus lanatus</i>	Saffron Thistle
<i>Centaurea melitensis</i>	Maltese Cocksup
<i>Centaurium erythraea</i>	Common Centaury
<i>Cerastium glomeratum</i>	Mouse-ear Chickweed
<i>Chondrilla juncea</i>	Skeleton Weed
<i>Cirsium vulgare</i>	Spear Thistle
<i>Conyza bonariensis</i>	Flaxleaf Fleabane
<i>Echium plantagineum</i>	Paterson's Curse
<i>Erodium cicutarium</i>	Common Storksbill
<i>Gamochaeta americana</i>	Cudweed
<i>Hedypnois rhagadioloides</i> subsp. <i>cretica</i>	Cretan Weed
<i>Hordeum leporinum</i>	Barley Grass
<i>Hypericum perforatum</i>	St. Johns Wort
<i>Hypochaeris glabra</i>	Smooth Catsear
<i>Hypochaeris microcephala</i> var. <i>albiflora</i>	White Flatweed
<i>Hypochaeris radicata</i>	Flatweed
<i>Juncus capitatus</i>	A Rush

Table i **Introduced flora species identified on site**

Scientific name	Common name
<i>Lactuca serriola</i>	Prickly Lettuce
<i>Lepidium bonariense</i>	-
<i>Linaria pelisseriana</i>	Pelisser's Toadflax
<i>Lolium perenne</i>	Perennial Ryegrass
<i>Lolium rigidum</i>	Wimmera Ryegrass
<i>Malva parviflora</i>	Small-flowered Mallow
<i>Marrubium vulgare</i>	White Horehound
<i>Medicago minima</i>	Woolly Burr Medic
<i>Medicago truncatula</i>	Barrel Medic
<i>Modiola caroliniana</i>	Red-flowered Mallow
<i>Paronychia brasiliiana</i>	Brazilian Whitlow
<i>Paspalum dilatatum</i>	Paspalum
<i>Petrorhagia nanteuilii</i>	-
<i>Plantago lanceolata</i>	Lamb's Tongues
<i>Poa bulbosa</i>	Bulbosa Poa
<i>Polycarpon tetraphyllum</i>	Four-leaved Allseed
<i>Polygonum aviculare</i>	Wireweed
<i>Romulea minutiflora</i>	Small-flowered Onion Grass
<i>Romulea rosea</i>	Onion Grass
<i>Salvia verbenaca</i>	Vervain
<i>Silene gallica</i>	French Catchfly
<i>Silybum marianum</i>	Variegated Thistle
<i>Sisyrinchium rosulatum</i>	Scourweed
<i>Solanum nigrum</i>	Black-berry Nightshade
<i>Soliva sessilis</i>	Bindyi
<i>Sonchus asper</i>	Prickly Sowthistle
<i>Sonchus oleraceus</i>	Common Sowthistle
<i>Spergularia rubra</i>	Sandspurry
<i>Stachys arvensis</i>	Stagger Weed
<i>Taraxacum officinale</i>	Dandelion
<i>Tolpis barbata</i>	Yellow Hawkweed
<i>Trifolium angustifolium</i>	Narrow-leaved Clover
<i>Trifolium arvense</i>	Haresfoot Clover
<i>Trifolium campestre</i>	Hop Clover
<i>Trifolium cernuum</i>	-
<i>Trifolium dubium</i>	Yellow Suckling Clover
<i>Trifolium glomeratum</i>	Clustered Clover
<i>Trifolium striatum</i>	Knotted Clover
<i>Trifolium subterraneum</i>	Subterranean Clover
<i>Trifolium tomentosum</i>	Woolly Clover
<i>Urtica urens</i>	Small Nettle
<i>Vulpia bromoides</i>	Squirrel Tail Fescue
<i>Vulpia muralis</i>	-

Table i **Introduced flora species identified on site**

Scientific name	Common name
<i>Vulpia myuros</i>	Rat's Tail Fescue

Table ii. **Introduced fauna species identified on site**

Scientific name	Common name
<i>Lepus europaeus</i>	Hare
<i>Oryctolagus cuniculus</i>	European Rabbit
<i>Vulpes</i>	European Red Fox
<i>Columba livia</i>	Rock Dove
<i>Sturnus vulgaris</i>	Common starling

Appendix C

Groundcover monitoring

The groundcover monitoring method follows Section 5.3.2 of the Framework for Biodiversity Assessment. Plots will be undertaken during each monitoring event in the groundcover re-establishment zone. The location and number of plots will be determined based on areas requiring clearing and removal of topsoil, and resultant requirements for restoration of groundcover. The plots will record the percent cover of native and exotic vegetation.

The plots are 50 m x 20 m. A 20 m x 20 m quadrat is positioned within this larger plot (Plate 1). Marker pegs will be positioned at the top-middle of the plot to establish a permanent plot position. GPS coordinates will be recorded to ensure monitoring plots can be relocated over time.

The 20 m x 20 m quadrat will record details of the groundcover structure including composition and percent cover of native/exotic species. The 50 m transect will assess the projected cover of the grasses at 50 points (ie each 1 m).

Suggested transect/plot layout:

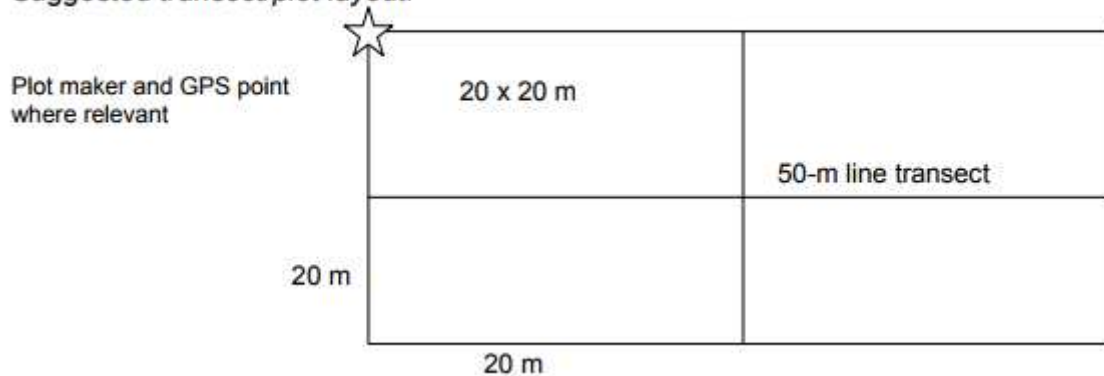


Plate 4.1 Plot/transect layout