Solar Reserve

Aurora Solar Energy Project
Development Application
Specialist Reports

October 2017

Specialist Reports

Report 1 – Landscape and Visual Impact Assessment

Report 2 – Flora and Fauna Assessment

Report 2a – Native Vegetation Clearance Application

Report 3 – Traffic Impact Assessment

Report 4 – Aviation Impact Assessment

Report 5 – Cultural Heritage Assessment

Report 1

Landscape and Visual Impact Assessment

SolarReserve Australia Pty Ltd

Aurora Solar Project - DA & Enviro Studies

Landscape and Visual Impact Assessment

September 2017

Executive summary

SolarReserve LLC proposes to construct the Aurora Solar Energy Project (the Project), which is a 110 MW Concentrating Solar Power (CSP) facility with the capacity to store 880 MWh of energy in the form of molten salt. The facility would be the first of its kind within Australia and would be located approximately 30 km to the north west of Port Augusta, South Australia.

The purpose of this LVIA report is to assess the potential impact of the Project on the visual amenity of the site and surrounding area with a particular focus on key landscape values and viewpoints. An assessment of glare impact has also been provided as well as recommendations on the mitigation of impacts. This report has been primarily based on site observations and photography with desktop research to support the findings as appropriate.

The landscape within the study area contains a number of features of significance to landscape and visual amenity. They are predominantly located toward the east, near Port Augusta and immediate surrounds, away from the project. These include Flinders Ranges, Red Cliff, Eyre Peninsula Coastline, Australian Arid Lands Botanic Garden and Yorkeys Crossing. Some features, such as Ranges View Rest Area, Uro Bluff and Tent Hills are located closer to the site.

The history and character of Port Augusta, together with the presence of existing power stations and a renewable energy facility suggests that the addition of a new solar energy facility would not be out of character within the existing landscape.

The visual impact of the project would be highest at those locations closest to the site, where a medium visual impact rating has been assigned. Given that the project does not impact on the key landscape values identified, the impact is not high at any of the viewpoints. Elsewhere the effect of distance and intervening terrain and atmospheric haze would result in a low impact.

The calculations and site observations show that the glare that is likely to be emitted from the receiver tower would not be substantial in comparison to day-to-day effects. As the surrounding landscape is relatively flat, glare impacts from the heliostats would be restricted to locations at a higher elevation such as Flinders Ranges. Given the distance away however, the effect is likely to be inconsequential. Glare would reduce in overcast conditions.

Given these reasons, the project is well sited to minimise impacts to key landscape and visual resources within the region as is consistent with the planning legislation.

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Abbreviations and definitions

Abbreviations	
AHD	Australian Height Datum
km	Kilometres
LVIA	Landscape and Visual Impact Assessment
MW	Mega Watts
MWh	Mega Watt hours
m	Meters
VP	Viewpoint

Definitions	
Glare	A continuous source of brightness
Glint	A momentary source of brightness
Photomontage	A computer generated image showing a proposed development as it would appear on the existing landscape
Visual amenity	Visually attractive or pleasant environment
Visual impact	A dramatic change to the visual quality of a view

1. Introduction

1.1 Project background

SolarReserve LLC proposes to construct the Aurora Solar Energy Project (the Project), which is a 110 MW Concentrating Solar Power (CSP) facility with the capacity to store 880 MWh of energy in the form of molten salt. The facility would be the first of its kind within Australia and would be located approximately 30 km to the north west of Port Augusta, South Australia.

GHD has been engaged by SolarReserve to assist with the approvals process for the Project. This landscape and visual impact assessment (LVIA) will form part of that process.

1.2 Purpose of the report

The purpose of this LVIA report is to assess the potential impact of the Project on the visual amenity of the site and surrounding area with a particular focus on key landscape values and viewpoints. An assessment of glare impact has also been provided as well as recommendations on the mitigation of impacts. This report has been primarily based on site observations and photography with desktop research to support the findings as appropriate.

1.3 Report structure

This report is organised under the following general headings:

- *Methodology.* Providing an outline of the way in which the assessment has been undertaken.
- *Project Description*. Providing an outline of the key visually prominent components of the project.
- *Study Area*. Delineating the area of investigation.
- *Legislation and policy.* As relevant to landscape and visual amenity.
- *Existing Landscape.* Outlining the general conditions of the landscape, key landscape values and sensitivities and other key features.
- *Visual Impact Assessment*. Assessment of visual impact of the project from a range of publicly accessible locations.
- *Assessment of Glare*. An assessment of glare impact of the project.
- *Tourism*. Opportunities for potential tourism related values of the project.
- *Mitigation measures*. Recommended mitigation measures for minimisation of visual impact.
- *Conclusion*.

2. Methodology

The methodology for carrying out this LVIA was drawn from and is generally in accordance of The Landscape Institute and Institute for Environmental Management and Assessment LIIEMA, (2013), *Guidelines for Landscape and Visual Impact Assessment*, Routledge 3rd Edition (GLVIA). The methodology has been adapted from GLVIA to address the scoping requirements and to relate to the particular issues of the project.

The methodology and report structure is graphically illustrated in Figure 2-1. Sections 2.1 to 2.6 provide further details of the individual tasks that were undertaken.

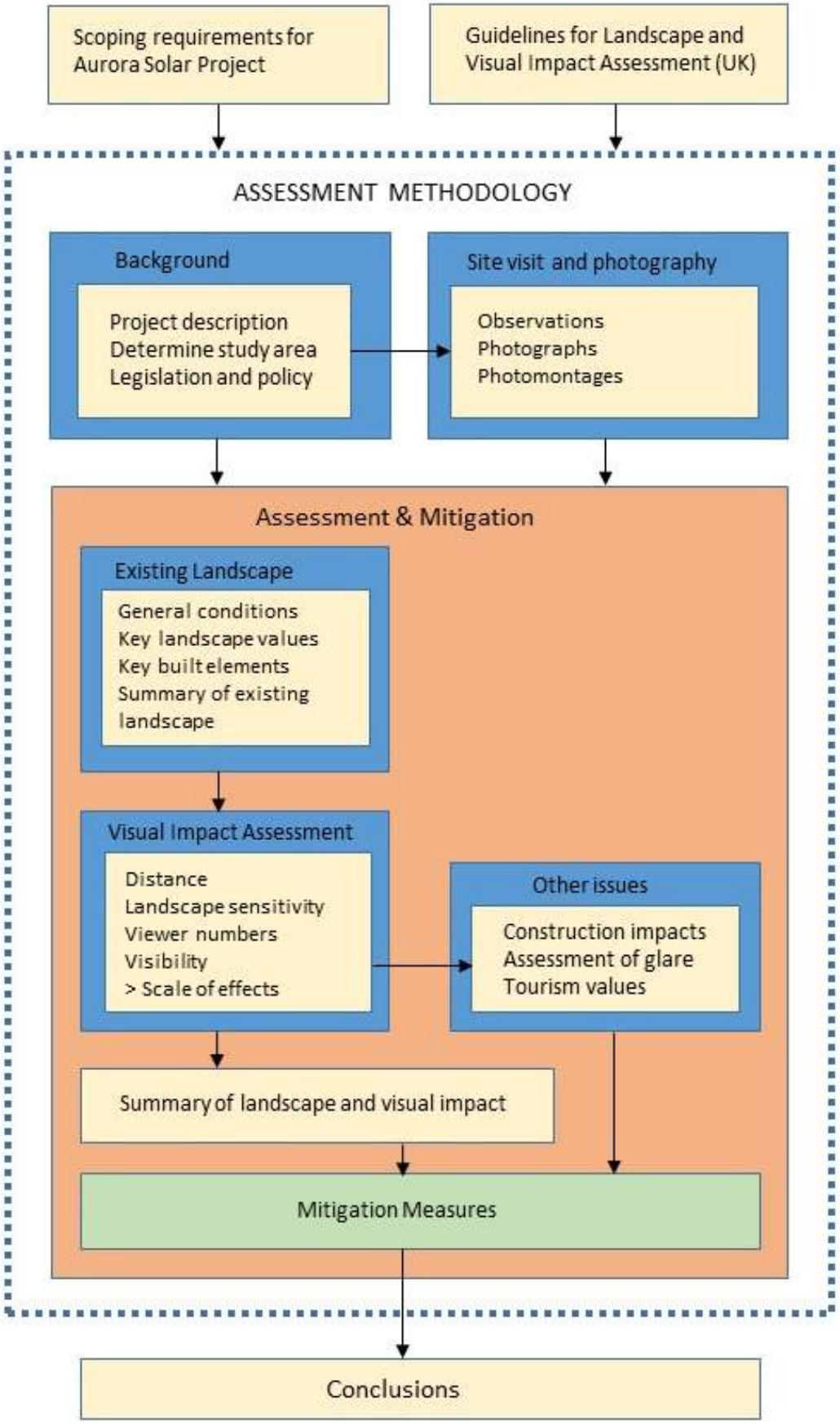


Figure 2-1 LVIA methodology for Aurora Solar Project

2.1 Background

Background studies were undertaken to inform the site visit and assessment process. These are described in the following sections.

2.1.1 Project description

The major visually prominent components of the project which are likely to have an effect on landscape and visual amenity have been identified and described.

2.1.2 Determining the study area

The determination of the study area has been based on the limit of discernibility of the most visually prominent project elements identified in section 2.1.1. Beyond this limit, the project is not likely to be discernible therefore the impact is most likely nil or negligible, hence this defines the study area.

2.1.3 Legislation and policy within the study area

A desktop investigation was undertaken to identify the relevant legislation and policies relating to landscape and visual amenity within the study area to inform the assessment.

2.2 Site visit and photography

A site visit was undertaken on the 7th to 9th August, 2017 to establish a first-hand account of the existing landscape conditions within the study area as well as to verify the information gathered at desktop level. The observations, notes and photographs from the site visit were used to inform the assessment.

2.2.1 Photography

A Canon EOS 6D digital camera was used together with a 70 mm lens which has a picture angle of 26.5° and a horizontal angle of view of approximately 21.3°. In some cases, a 50 mm lens was used to capture more of the surrounding context.

The camera was held at eye level, approximately 1.8 m above ground level to take the photographs. GPS coordinates were also recorded on a separate hand held GPS at the locations from which the photographs were taken and these locations were marked on a digital map.

Panoramas and photomontages are generally composed of four individual photos.

2.2.2 Photomontages

Photomontages have been used to assist in the assessment by illustrating the scale and location of the project over base photographs.

Topographical data as well as the project are modelled within a computer program (3D Max). A virtual camera is set up in the 3D model at the GPS coordinates where the photograph was taken. Using reference markers, terrain and other spatial information, a computer rendered image can be overlain and incorporated within the photograph to produce a spatially accurate, visual representation of the project.

2.3 Existing landscape

The existing landscape was analysed with respect to the following considerations.

2.3.1 General conditions

The existing landscape has been analysed in terms of topography and vegetation to determine the capacity of the landscape to visually absorb the project.

2.3.2 Key landscape values

A summary of key high quality landscape features has been compiled to gain an understanding of how the project may have an impact those values. These have been gathered from desktop studies and site observations.

2.3.3 Key built elements

A summary of the key built elements has been provided to gain an understanding of the degree of landscape modification within the study area.

2.3.4 Summary of existing landscape

A summary of the existing landscape conditions has been provided to determine the sensitivity of the landscape to accommodate the visual changes that may be brought about by the project.

2.4 Visual impact assessment

The assessment of visual impact follows a process of sampling a range of publicly accessible locations with a potential view of the project. By assessing a representative range of viewpoints that are at different distances and directions from the project and from a range of landscapes, one can evaluate the visual impact of the project on the broader landscape as a whole.

Each viewpoint is assessed for the change in the view that the project would bring about. The effect of the change in the view, or visual impact, is dependent on four factors, namely distance, landscape sensitivity, viewer numbers and visibility of the project. These are described in further detail in the following sections.

2.4.1 Distance

The distance that a viewer is away from an object affects its visual prominence. The further an observer is from an object, its apparent size is reduced and it would take up less of a person's field of vision. At the limits of discernibility, an object would be 'visually absorbed' into the landscape. Section 4 Study Area provides further detail about the effect of distance on the visual prominence of this particular project.

2.4.2 Landscape sensitivity

The landscape context that an object is viewed against also has an effect on its visual prominence. A landscape which already contains numerous elements similar to the project is more capable of visually absorbing it than a landscape where the new element seems 'out of place'. Also, a landscape which is highly valued for its visual amenity would be more sensitive to visual changes than a highly degraded landscape. Section 6 provides further details about landscapes within the study area and their associated sensitivity to visual changes.

2.4.3 Viewer numbers

The level of visual impact is also influenced by the number of viewers that may experience the change in the view. Generally, a visual change to the landscape is likely to have an impact on more people where there are many people to observe the change. Conversely, a visual change to the landscape is likely to have an impact on less people where there are fewer people to observe the change.

2.4.4 Visibility

Where the project would be partially visible or not visible due to intervening topography, vegetation, buildings, structures or atmospheric haze, visual impact would be reduced as a result.

2.4.5 Scale of effects

Each of the criteria of distance, landscape sensitivity, viewer numbers and visibility are given a rating of either low, medium or high. The scale of effects provides a rating for the overall visual impact from each viewpoint as an average of the individual ratings. Where there is one overriding factor that negates all others (e.g. the project is not visible), this is captured in the supporting comments.

The scale of effects ranges from no impact (**nil**) to a potentially **positive** visual impact. Negative visual impacts are graded from **negligible** to **high**. These ratings are described in more detail below.

Nil – there is no visual change as a result of the project.

Positive – is a visual change that improves the outlook or view.

Negligible – minute level of effect that is barely discernible over ordinary day-to-day effects. The assessment of a “negligible” level of visual impact is usually based on distance and or visibility. That is, the project would be at such a distance that it would be a minute element in the view. Alternately it may be predominantly screened by intervening topography and vegetation.

Low – visual effects that are noticeable but that will not cause any significant adverse impacts. The assessment of a “low” level of visual impact can be derived if the rating of most of the four criteria is assessed as low.

Medium – a medium visual impact occurs when the project would result in a moderately detrimental visual change to the landscape.

High – extensive adverse effects that cannot be avoided, remedied or mitigated. The assessment of a high impact from a publicly accessible viewpoint requires the assessment of most of all four factors to be high. For example, a highly sensitive landscape, viewed by many people, with the project in close proximity and largely visible would lead to an assessment of a high adverse effect.

Figure 2-2 shows the relationship between the four individual criteria and the scale of effects at each viewpoint location.

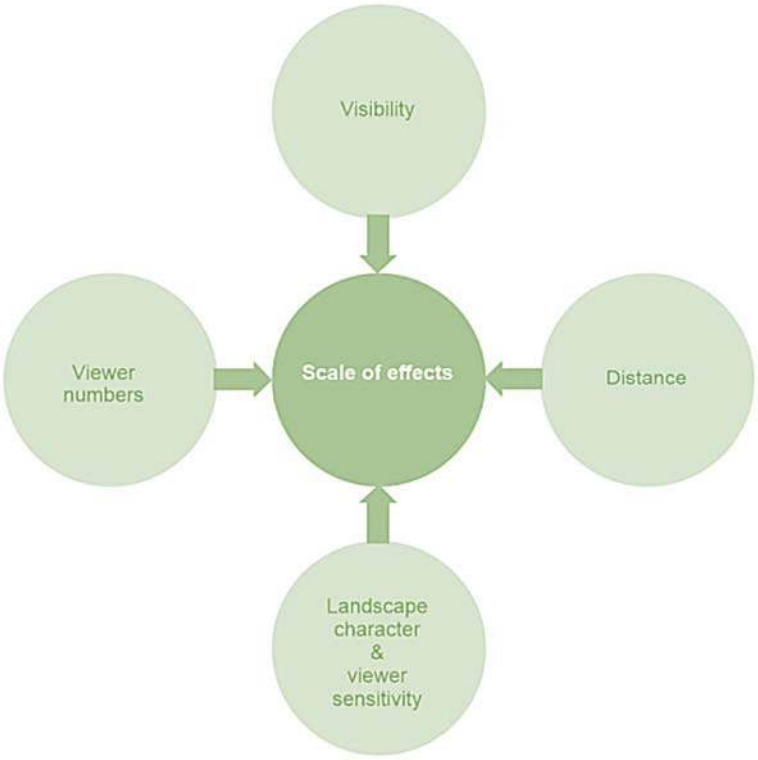


Figure 2-2 Scale of effects

2.5 Other issues

Other issues which have been included in this LVIA include the following.

2.5.1 Construction impacts

Due to the temporary nature of construction activities, visual impact from construction has been assessed in a qualitative manner.

2.5.2 Assessment of Glare

The assessment of glare impacts has been undertaken based on information provided by SolarReserve. Observations of a similar solar power facility in the region has also been used to inform the study.

2.5.3 Tourism values

Information regarding the value of large solar installations as a tourist attraction has been included to illustrate the positive benefits that the project may also have on landscape and visual amenity.

2.6 Mitigation measures

Mitigation measures to minimise impacts to landscape and visual amenity has been considered in section 10.

3. Project description

The following sections provide an overview of the major visually prominent components of the project which may have an effect on landscape and visual amenity.

3.1 Site location

The project is located approximately 17 km to the north west of Port Augusta, South Australia. It is in close proximity to Stuart Highway, a major road connecting South Australia to Northern Territory. Figure 3-1 shows the location of the site.

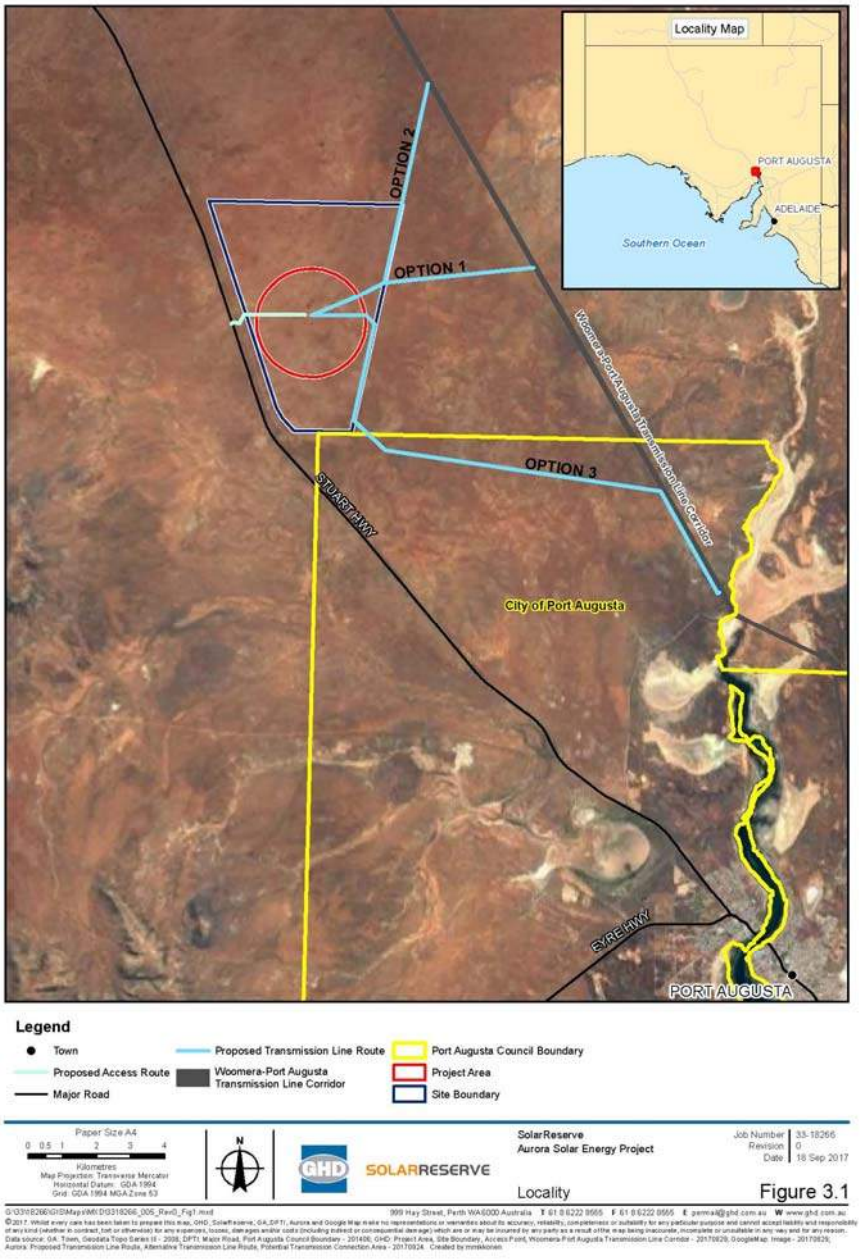


Figure 3-1 Site location

3.2 Project components

The project consists of a central core of equipment measuring approximately 267 m diameter. Located centrally within the core would be a receiver tower measuring 250 m above ground level at its peak. Surrounding the tower would be an array of ancillary equipment such as salt storage tanks, a steam generator, heat exchangers, an air cooled condenser, water treatment plant and a range of other ancillary, control and storage facilities.

Positioned around the core would be a 3.1 km diameter field of daylight tracking heliostats (mirrors) which would direct and concentrate sunlight onto the receiver at the top of the tower. Each heliostat would be mounted on a single pedestal and footing.

The project would also include a transmission line connecting to an existing line, which is to the east of the site and a water pipeline connecting to an existing pipe to the west of the site. Administration buildings and an evaporation pond are also proposed at the periphery of the heliostat field. Figure 3-2 and Figure 3-3 show the central core and heliostat field, respectively. Figure 3-4, Figure 3-5, Figure 3-6 and Figure 3-7 show views of an existing project in the USA, similar to the one being proposed.

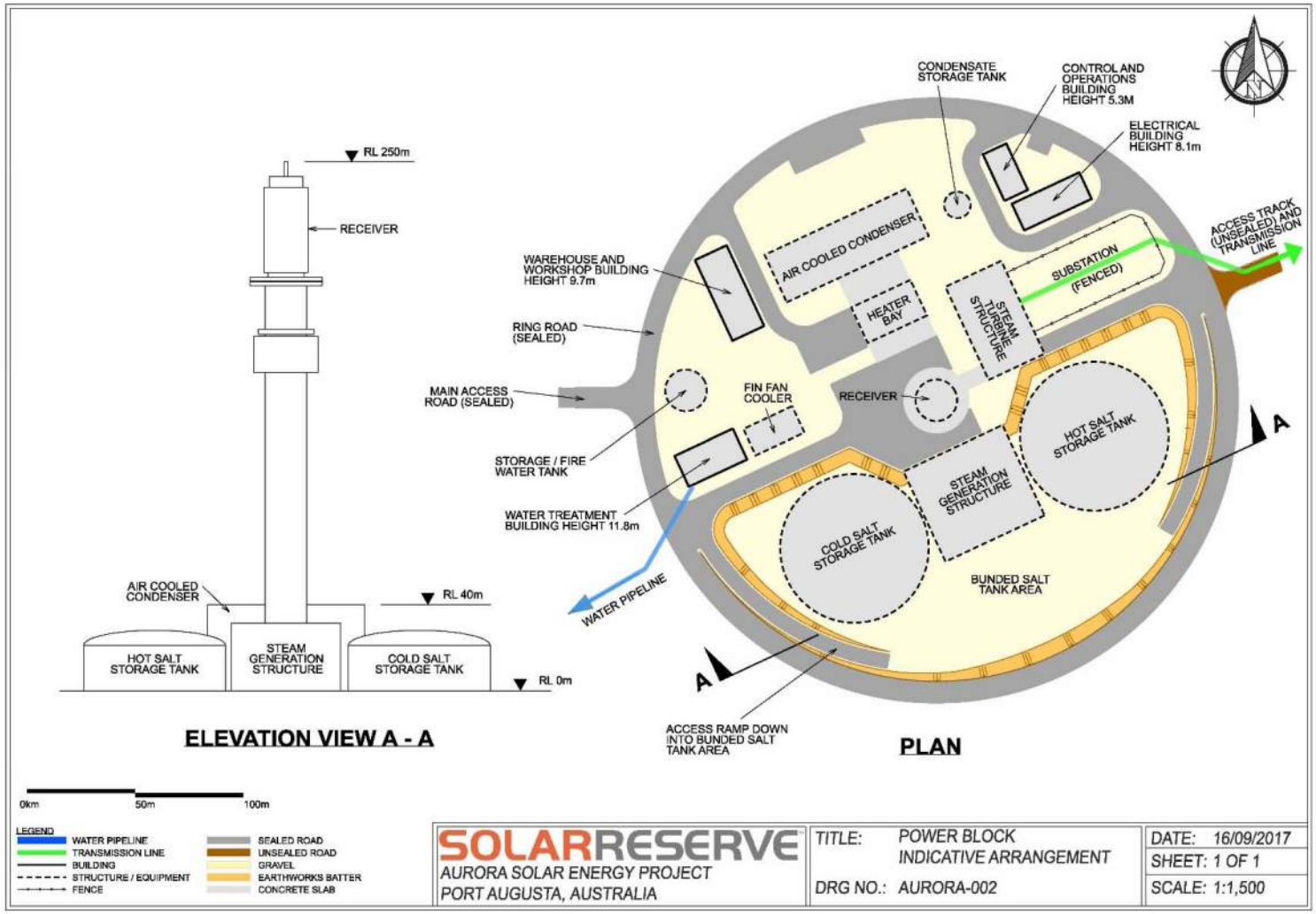


Figure 3-2 Indicative arrangement of central core (source: SolarReserve)

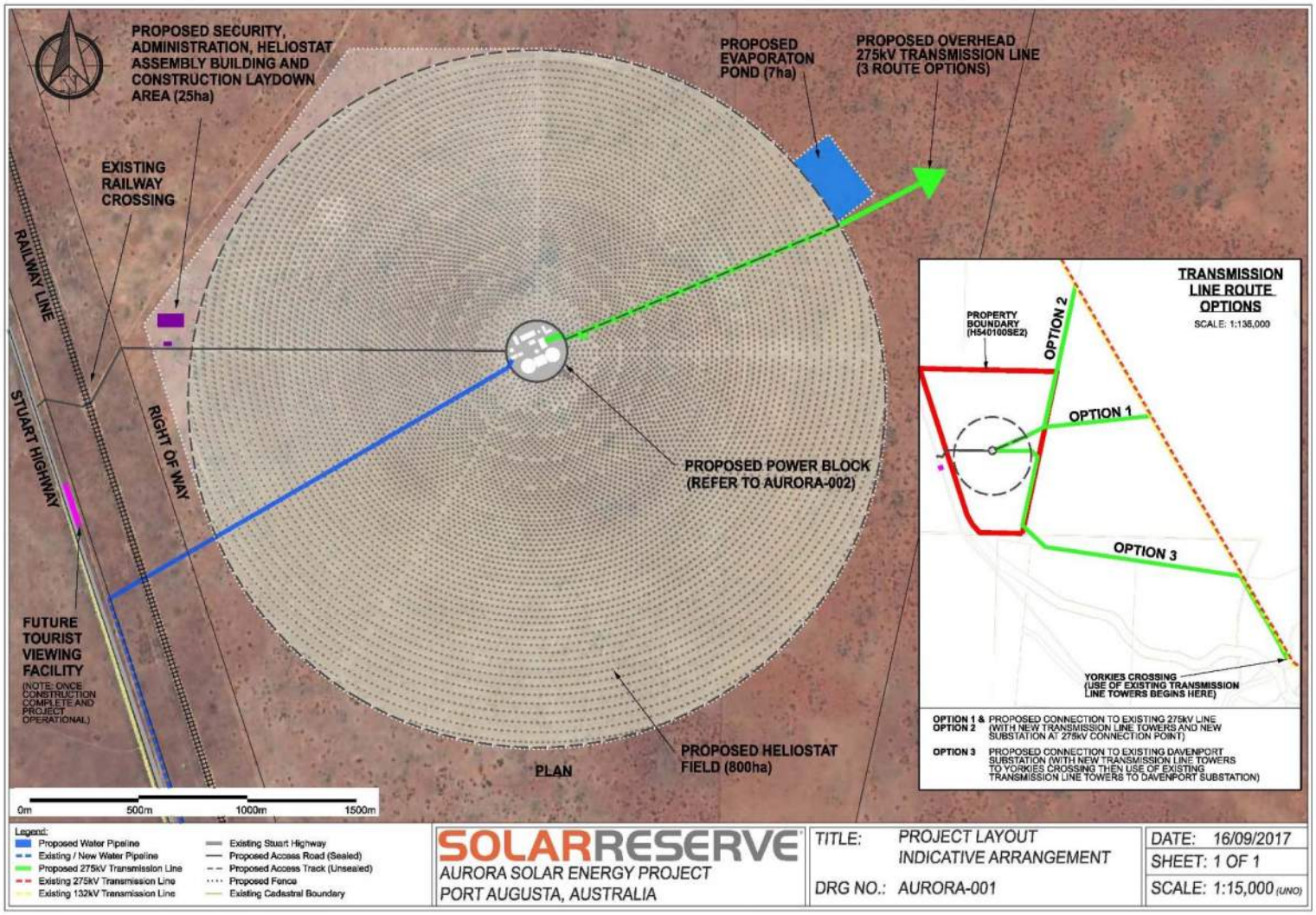


Figure 3-3 Indicative arrangement of project layout (source: SolarReserve)

Figure 3-4 Crescent Dunes Solar Energy Project, Nevada - Molten salt receiver tower

Figure 3-5 Crescent Dunes Solar Energy Project, Nevada – Heliostat array

Figure 3-6 Crescent Dunes Solar Energy Project, Nevada – Tower,plant and Heliostats

Figure 3-7 Crescent Dunes Solar Energy Project, Nevada – Heliostat mirror

3.3 Key project components to be assessed

The key project components that have been considered for assessment of visual impact include the receiver tower, heliostats, transmission line, administration buildings and ancillary equipment. As the receiver tower would be by far the most visually prominent element at 250 m tall, the study area has been based on the physical dimensions of the tower. Other key project components have been considered in the assessment where they are likely to be visible.

4. Study Area

A study area of 25 km has been selected based on SolarReserve recommendations, which are in turn based on existing solar projects of similar physical dimensions in the USA. A desktop review has revealed that most key viewing locations around the site would be covered within this radius. Viewing locations such as Ranges View Rest Area and Dutchman's Stern Conservation Park are located outside of this radius, but have been included in the assessment for completeness as they are key viewpoints. Refer to sections 7.1 and 7.15 for further information.

4.1 Zones of visual influence

Within the study area, different zones of visual influence have been determined based upon the distance of the viewpoint from the receiver tower. For example, the visual prominence of the tower seen from 25 km away would be far less than when seen from 5 km away. This is because the apparent size of the object would be much greater when viewed up close.

Northern Power Station is located approximately 3 km to the south east of Port Augusta township. A key component of the power station is a chimney, which has been established to be 200 m tall via desktop research. Observations of the visual prominence of the chimney from different distances away provides a reasonably sound basis for estimating the zones of visual influence of the receiver tower. The fact that the receiver tower would be 50 m taller than the chimney has been taken into consideration in the estimations. Also considered is that the power station incorporates other elements at its base that also contributes to its visual prominence.

Figure 4-1, Figure 4-2 and Figure 4-3 show views of Northern Power Station and its chimney from 4 km, 7 km and 17 km away respectively. It must be remembered that objects typically look larger when viewed first hand as compared to being presented as a figure within this report.

Figure 4-1 Northern Power Station seen from 4 km away (visually prominent)

Figure 4-2 Northern Power Station seen from 7 km away (moderately prominent)

Figure 4-3 Northern Power Station seen from 17 km away (at the right of the image. noticeable but not visually prominent)

Based on site observations of Northern Power Station chimney, the following zones of visual influence of the receiver tower have been adopted for this assessment.

Distance	Value for visual impact assessment purposes
0 – 5 km	High
5.1 – 10 km	Medium
10.1 – 25+ km	Low

Figure 4-4 shows the zones of visual influence that have been adopted for this study.

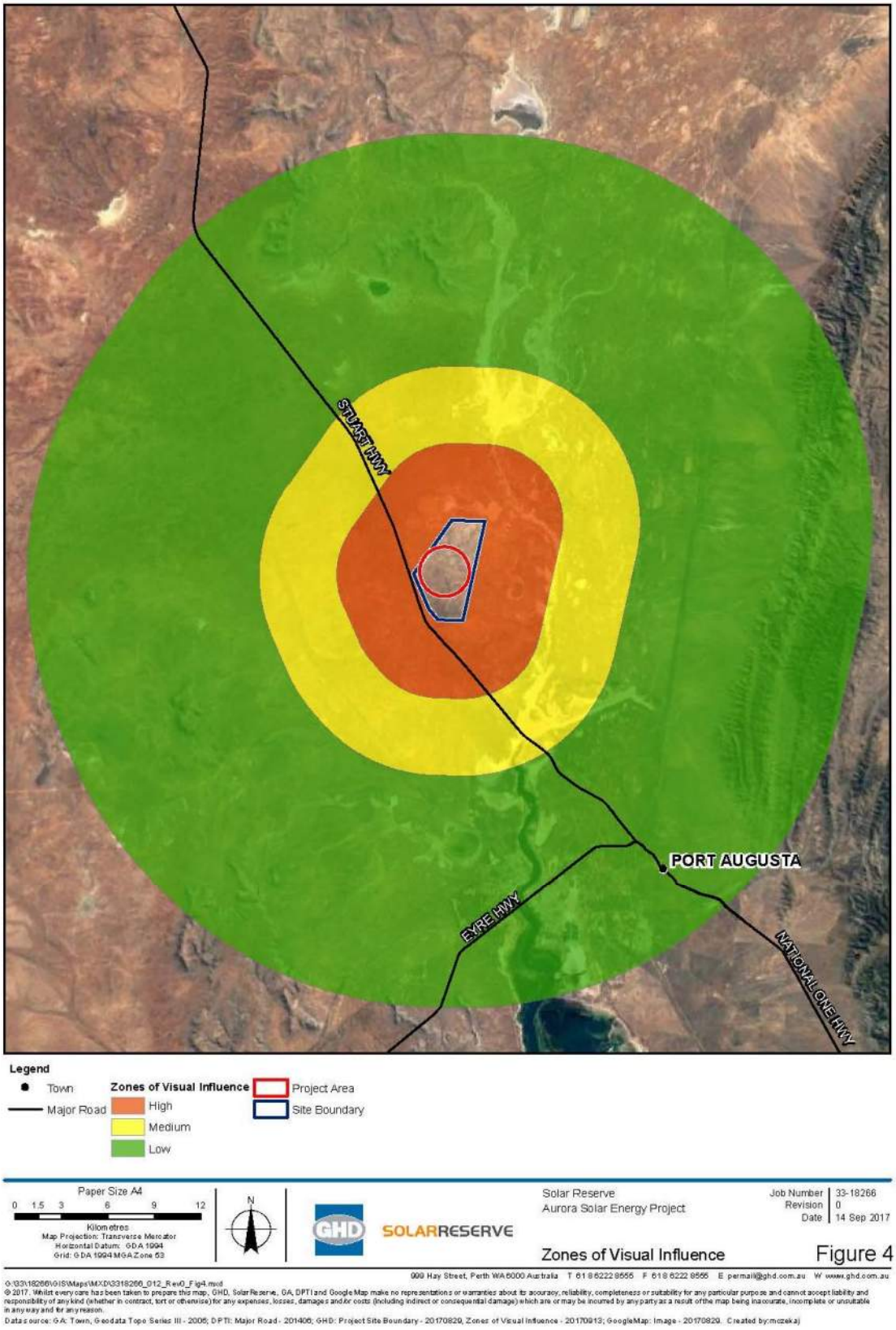


Figure 4-4 Zones of visual influence

5. Legislation and policy

Legislation and policy relating to landscape and visual amenity is contained in the *Planning, Development and Infrastructure Act 2016* (the Act). The following are specific relevant policies and standards.

- AS 4282: Control of obtrusive effects of outdoor lighting

The SolarReserve site is within the SA Government's Land not within a Council Area (Flinders) Development Plan defined area. There are five other development plans which cover the surrounding areas and are also relevant to the infrastructure of the solar farm:

- Port Augusta Development Plan
- Flinders Ranges Development Plan
- Land Not Within a Council Area (Coastal Waters)
- Land Not Within a Council Area (Eyre)
- Land Not Within a Council Area (Far North)

Each Development Plan has a broad range of policies relevant to the design and appearance of the SolarReserve farm and associated infrastructure. In particular, Development Plans support visual amenity through:

- Preservation of areas of high landscape and amenity value including stands of vegetation, exposed cliffs, headlands, islands and hill tops, and areas which form an **attractive background** to urban and tourist developments.
- Conserving environmental quality, in particular water quality, and other aspects of the coastal environment including sea floor health, **visual qualities**, wilderness, ecosystems, and biodiversity.
- **Minimising of adverse impact on the visual amenity of the coastal environment, and unspoilt views adjacent to the coast.**
- Minimising adverse impacts areas valued for their beauty or amenity.
- Appearance of land, buildings and objects not impairing the amenity of the locality in which they are situated.
- Wherever practicable, incorporate the retention of existing trees and the planting of new trees, preferably native species endemic to the area.
- Designed and located electricity infrastructure to minimise its visual and environmental impacts.
- Building facades facing a non-industrial zone, public road, or public open space should contain materials of low reflectivity.
- Minimisation of significant adverse impact on adjoining uses due to hours of operation, traffic, noise, fumes, smell, dust, paint or other chemical over-spray, vibration**, glare or light spill**, electronic interference, ash or other harmful or nuisance-creating impacts.
- Fencing should be set back behind a landscaped area that softens its visual impact.
- Avoiding or minimising impacts of shadowing, flickering, reflection or glint on nearby property owners/occupiers, road users and wildlife.

5.1 Implications of legislation and policy

The review of planning and policy has indicated that the project should avoid visual impact to areas of high landscape and visual amenity. Such areas may include prominent ridgelines, cliffs and other distinctive geographical features, coastlines and vegetated areas.

The planning and policy also makes provisions for the minimisation of visual impact from electricity infrastructure as well as minimising impacts from glint, glare and light spill.

This assessment has considered how the project would meet these objectives and has informed the study by considering impacts to key landscape values within the region. Further details of how the project performs against these objectives is provided in the conclusion.

6. Existing landscape

The following sections discuss the existing landscape within the study area and region in terms of general conditions, key landscape values and key built elements. A summary of the existing landscape is also provided as well as landscape sensitivity ratings. The landscape sensitivity ratings have been used to assess the visual impact of the project in the visual impact assessment, under section 7.

6.1 General conditions

The site and surrounding landscape is predominantly used for pastoral activities, particularly sheep grazing, and is subdivided into privately operated lots. It is a semi arid landscape with numerous unsealed roads, with Stuart Highway being the only sealed road within 20 km of the site. There is also an existing water pipeline, rail line and transmission line within close proximity.

The following sections discuss topography and vegetation with a particular emphasis on the ability of the landscape to visually absorb the Project.

6.1.1 Topography

The topography of the site and surrounding area is flat to gently undulating with a number of prominent geological formations rising sharply above the plain. Uro Bluff is a ridgeline that is located approximately 20 km to the north west of the site. Tent Hills is a series of plateaus located approximately 10 km to the south west of the site. There are two major formations, one larger than the other, and have the appearance of a tent, hence the name. Flinders Ranges is a major mountain range and a regionally significant geographical feature that is located approximately 30 km to the east of the site. Figure 6-1, Figure 6-2 and Figure 6-3 shows views of Uro Bluff, Tent Hills and Flinders Ranges, respectively. These features are also described in further detail in section 6.2.

Figure 6-1 View of Uro Bluff from Ranges View Rest Area

Figure 6-2 View of Tent Hills from the site

Figure 6-3 View east toward Flinders Ranges from the site

Other key topographical features include Barney Basin and the northern extent of Spencer Gulf, with its associated tributaries, salt lakes, swamps and lagoons, which are located at a lower elevation approximately 12 km to the east of the site. Spencer Gulf extends from Port Augusta to the Great Australian Bight, which is located approximately 350 km to the south west.

Given that the landscape within the vicinity of the site is relatively flat, any sizeable elements introduced onto the landscape is likely to be visible from a considerable distance away.

6.1.2 Vegetation

The vegetation within the site and surrounding area primarily consists of low growing saltbush and native grasses, with scattered trees and shrubs. Taller roadside vegetation is more common along Stuart Highway to the north west of the site. The capacity of the existing vegetation to visually absorb the project is limited in most areas, especially considering the height of the receiving tower. Figure 6-4 shows a view of vegetation growing near the site. Figure 6-5 shows a view of taller roadside vegetation along Stuart Highway to the north west of the site.

Figure 6-4 Vegetation near the site, low growing saltbush with scattered trees

Figure 6-5 Taller roadside vegetation along Stuart Highway to the north west of the site.

6.2 Key landscape values

The key landscape values within the study area and region have been identified and described in the following sections. This has been carried out to gain an understanding of whether the project is sensitively sited to minimise impact on those values. Specific views toward the site from some of these locations have been assessed in Section 7 Visual impact assessment. shows a map of the key landscape values identified. Figure 6-6 shows the key landscape values within the study area.

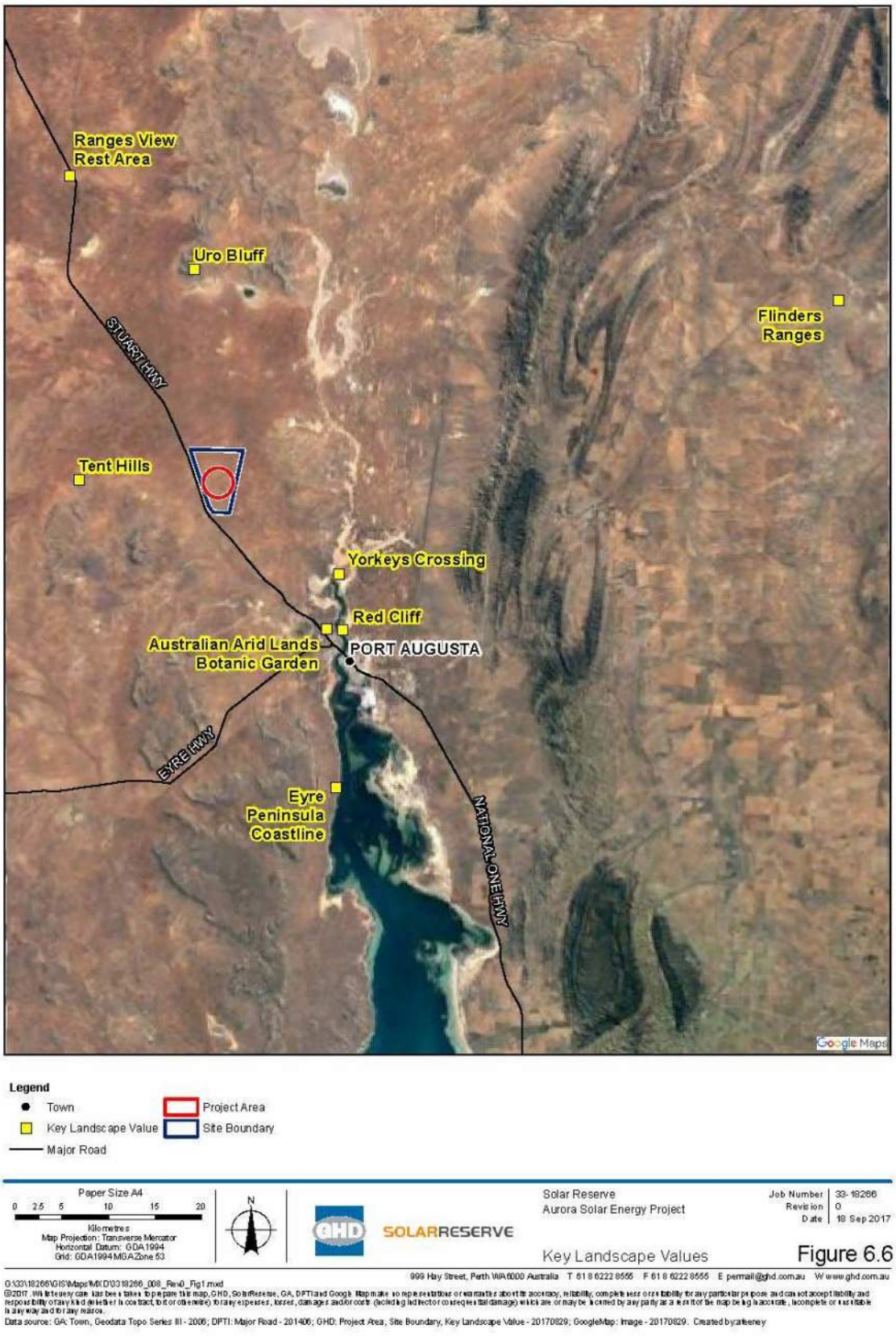


Figure 6-6 Key landscape values

6.2.1 Flinders Ranges

The Flinders Ranges are the largest mountain range in South Australia, which starts about 200 km north of Adelaide and continue to the east of Port Augusta and further north. The discontinuous ranges stretch for over 430 km from Port Pirie to Lake Callabonna. It is highly visible from a number of locations within the study area including tourist destinations, hiking trails and lookouts and is of high scenic, ecological, recreational and cultural value. The summit at Dutchmans Stern, at 820 m above sea level offers expansive views of the surrounding ranges, Spencer Gulf and Willochra Plain. Figure 6-7 shows a view from Dutchman's Stern Conservation Park.

Figure 6-7 Flinders Ranges from Dutchman's Stern Conservation Park

6.2.1 Red Cliff

Red Cliff and Matthew Flinders Red Cliff Lookout are located at the northern periphery of Port August Township and approximately 16 km to the south east of the site. The lookout incorporates a cliff top walking track, which features views of Flinders Ranges and Red Cliff, a striking cliff formation that flanks the upper reaches of Spencer Gulf. It is a locally and regionally important geographical feature. Figure 6-8 shows a view of Red Cliff and Flinders Ranges from Matthew Flinders Red Cliff Lookout walking trail.

Figure 6-8 View of Red Cliff and Flinders Ranges from walking trail

6.2.2 Ranges View Rest Area

Ranges View Rest Area is located adjacent to Stuart Highway in Kootaberra, approximately 35 km north-west of the site. It incorporates a lookout, interpretive signage, toilets, sheltered picnic tables and power facilities suitable for an overnight stay with a caravan or campervan. Aptly named for its view of the Flinders Ranges, there are expansive views of the surrounding landscape and most if not all of the most prominent geographical features within the region. Figure 6-9 shows a view of Ranges View Rest Area.

Figure 6-9 Ranges View Rest Area.

6.2.3 Eyre Peninsula Coastline

The eastern coastline of Eyre Peninsula, particularly between Port Augusta and Blanche Harbour is an area of high scenic, ecological and recreational value. The coastline is accessible via Shack Road, which services approximately 300 beachfront shacks and holiday accommodation. Views east over Spencer Gulf are of a dramatic landscape with intertidal mangroves and sandflats in the foreground and outstanding views of Flinders Ranges in the distance. Figure 6-10 shows a view from Blanche Harbour looking north east over Spencer Gulf. Flinders Ranges are visible in the distance.

Figure 6-10 Blanche Harbour looking north-east

6.2.4 Australian Arid Lands Botanic Garden

Australian Arid Lands Botanic Garden is located adjacent to Stuart Highway at the northern periphery of Port August Township. The botanic gardens is set within an arid coastal landscape and attracts many visitors, including ecotourists and hikers. The grounds comprise a native garden and a visitor centre with dining, carpark and toilet facilities. Walking trails provide a connection between the gardens, a bird hide and Matthew Flinders Red Cliff Lookout. A lookout located to the south west of the botanic gardens takes in views of the gardens in the foreground and Flinders Ranges in the distance. Figure 6-11 shows a view of Australian Arid Lands Botanic Garden.

Figure 6-11 Australian Arid Lands Botanic Garden

6.2.1 Yorkeys Crossing

Yorkeys Crossing is located approximately 7.5 km north of Port Augusta Township. Yorkeys Crossing Road incorporates a causeway that crosses the upper reaches of Spencer Gulf. It is an area of local significance where the northern most part of the Gulf flattens out into alluvial plains. There is also a rail crossing approximately 1 km to the south of the causeway and high voltage transmission towers are located within close proximity to the north. Figure 6-12 shows a view of Yorkeys Crossing from the west, with high voltage transmission towers visible in the foreground and Flinders Ranges visible in the distance.

Figure 6-12 Approach to Yorkeys Crossing from the west

6.2.2 Uro Bluff and Tent Hills

Uro Bluff and Tent Hills are prominent geological formations that are visible from Stuart Highway near the site and in other locations. Both were found to be inaccessible during the site visit and appear to be located within private land. Views from the top of these features were not assessed as a result. Figure 6-1and Figure 6-2 in section 6.1.1 show views of Uro Bluff and Tent Hills respectively.

6.3 Key built elements

The key built elements within the study area and region have been identified and described in the following sections. This has been carried out to gain an understanding of the level of modification of the existing landscape and whether it is able to accommodate further changes. Figure 6-13 shows a view of the key built elements within the study area.

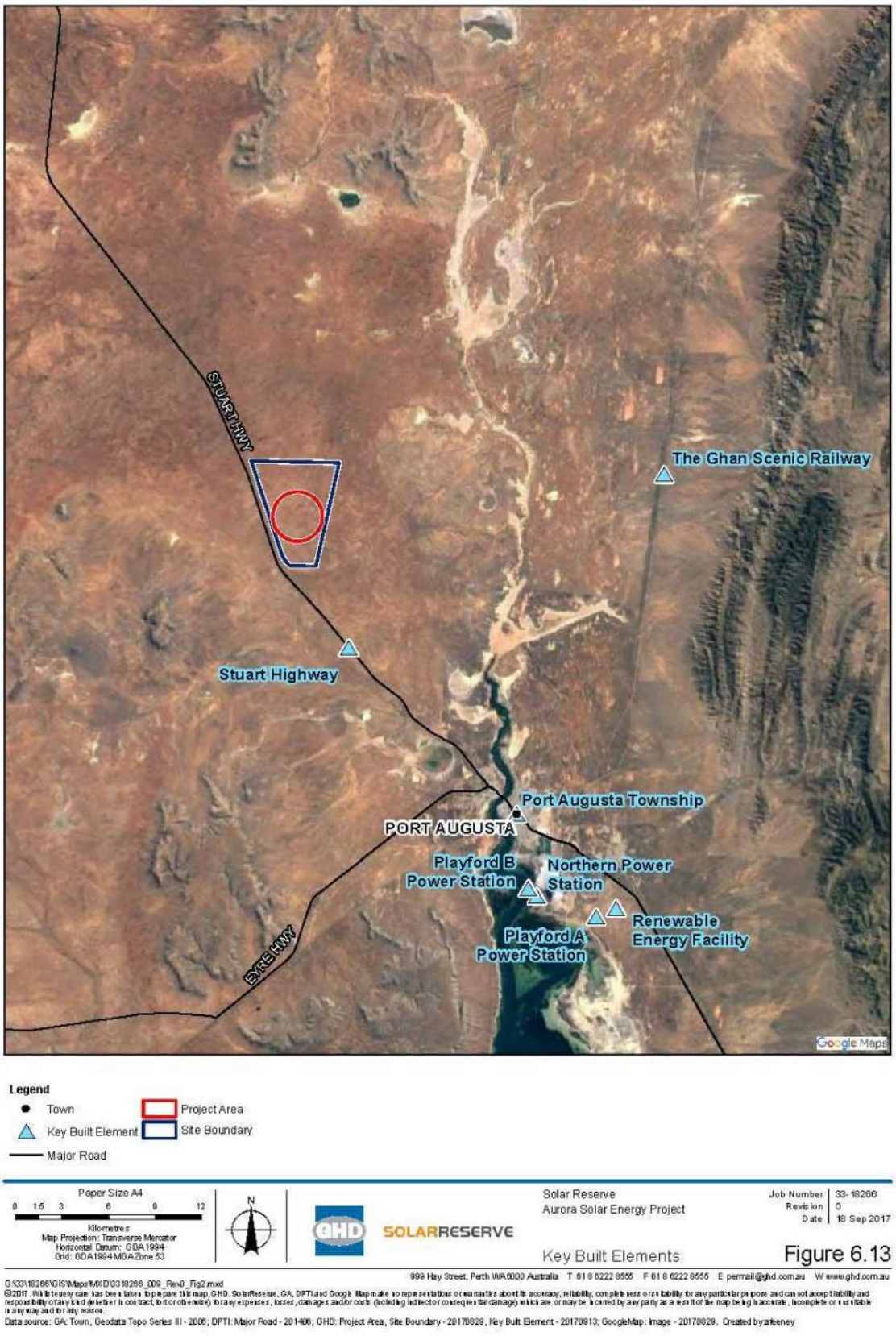


Figure 6-13 Key built elements

6.3.1 Port Augusta Township

The township of Port Augusta is located approximately 17 km to the south east of the site and straddles head of Spencer Gulf. It has a population of approximately 15,000 people. Formerly a seaport, it is now a road and rail freight junction city. It is also serves as a gateway for tourists travelling between Northern Territory and South Australia. Other major industries included, up until mid-2010s, electricity generation. Supply of coal for the power station was via a rail line connecting it to the Leigh Creek Coal Mine.

Given the town's history in industry and power generation, the addition of new power infrastructure is unlikely to be wholly inconsistent with its character. Figure 6-14 shows a view of Port Augusta. There are power stations are visible to the right in the image.

Figure 6-14 View east over Spencer Gulf towards Port Augusta

6.3.2 Power stations

There are three coal fired power stations in Port Augusta, the Playford A, Playford B and Northern Power Stations which are located on the eastern shores of the upper Spencer Gulf. The first power station was commissioned in 1943 when commercial coal was mined in Leigh Creek and transported to Port Augusta via a 250 km rail line. Over time, they expanded to accommodate the 240MW Playford B Power Station, which was commissioned in 1963. However, due to the increase in renewable energy demand, they have been decommissioned. All three power stations are no longer in use.

The power stations are a prominent visual element that can be seen from Port Augusta and much of the surrounding landscape. The introduction of new power infrastructure within the region of a comparable size and scale would not be inconsistent with the appearance of the existing power stations. Figure 6-15 shows a view of the power stations from south of Port Augusta.

Figure 6-15 Power stations visible from south of Port Augusta

6.3.1 Renewable energy facility

Sundrop Farms Renewable Energy and Greenhouse Growing Facility is located approximately 6 km south east of Port Augusta Township. It comprises a 115 m tall receiving tower, 23,000 solar panels and desalination plant. The receiving tower is a prominent visual element that can be seen from Port Augusta and much of the surrounding landscape. The introduction of a new solar power facility within the region of a comparable appearance would not be inconsistent with the appearance of the existing solar farm. Figure 6-16 shows a view of Sundrop Farms Renewable Energy facility from Princes Highway.

Figure 6-16 Sundrop Farms Renewable Energy facility from Princes Highway

6.3.1 Stuart Highway

The Stuart Highway is a major Australian highway which generally runs in a north / south direction from Darwin through Alice Springs in Northern Territory to Port Augusta in South Australia. It runs for 2,834 km through the centre of Australia through what is likely to be a flat and featureless landscape over much of its length.

The appearance of the receiver tower on approach to Port Augusta along Stuart Highway from the west may serve as a gateway element, marking one's arrival into town. There are examples of infrastructure used specifically for this purpose in other Australian towns.

6.3.1 The Ghan Scenic Railway

The Ghan Scenic Railway runs through the study area and is a major tourist attraction. From Port Augusta to Kootaberra, the railway runs parallel to Stuart Highway on its eastern side. The railway line is also shared by freight trains. Passengers of The Ghan may appreciate a close up view of the Project on approach to Port Augusta as a point of interest after travelling through a vast and relatively featureless landscape. Figure 6-17 shows a view of the railway line used by The Ghan.

Figure 6-17 Railway line used by The Ghan adjacent to site boundary

6.4 Summary of existing landscape

The landscape within the study area contains a number of features of significance to landscape and visual amenity. They are predominantly located toward the east, near Port Augusta and immediate surrounds, away from the project. These include Flinders Ranges, Red Cliff, Eyre Peninsula Coastline, Australian Arid Lands Botanic Garden and Yorkeys Crossing. Some features, such as Ranges View Rest Area, Uro Bluff and Tent Hills are located closer to the site.

The history and character of Port Augusta, together with the presence of existing power stations and a renewable energy facility suggests that the addition of a new solar energy facility would not be out of character within the existing landscape.

Although the terrain and vegetation would have a limited capacity to conceal views of the receiving tower from most locations, its presence may potentially be viewed positively in breaking up the journey for passengers on the Ghan and motorists approaching Port Augusta from the west.

Table 1 summarises the key landscape features within the study area and their sensitivity to visual changes.

Table 1 Summary of Landscape sensitivities

Landscape type	Description	Sensitivity to change
Flat and gently undulating pastoral	The most prevalent landscape within the study area. Flat and gently undulating pastoral consists of broadacre agricultural land predominately covered by scrub-like vegetation, interspersed by medium to large canopy trees. This landscape is used for grazing livestock (mostly sheep).	Low
Hills and mountains	Areas of high scenic value including Flinders Ranges, Uro Bluff, Tent Hills and other prominent geographical features. May include recreational parks and reserves with hiking trails and scenic lookouts. This landscape attracts relatively higher visitation than the pastoral landscape.	Medium to High
Township	Comprising of areas of settlement with a relatively high number of viewers. Typically sensitive to changes in the surroundings, however the existence of energy infrastructure (power station and Renewable Farm) in and around the Port Augusta township make the landscape less sensitive to change (more familiar to large energy infrastructure)	Medium
Coastal and riverine	Comprising tracts of the land along the northern part of the Spencer Gulf where the ocean, mangroves, coastal plains, sand flats and intertidal creeks are a prominent element of the view. A dynamic landscape which is typically valued for its visual amenity and attracts higher levels of visitation.	High

7. Visual impact assessment

This section assesses the visual impact of the project from a range of publicly accessible locations with a potential view of the project. This has been undertaken to evaluate the visual impact of the project as a whole. The criteria used to assess visual impact are distance, landscape sensitivity, viewer numbers and visibility of the project. Figure 7-1 shows the viewpoint locations.

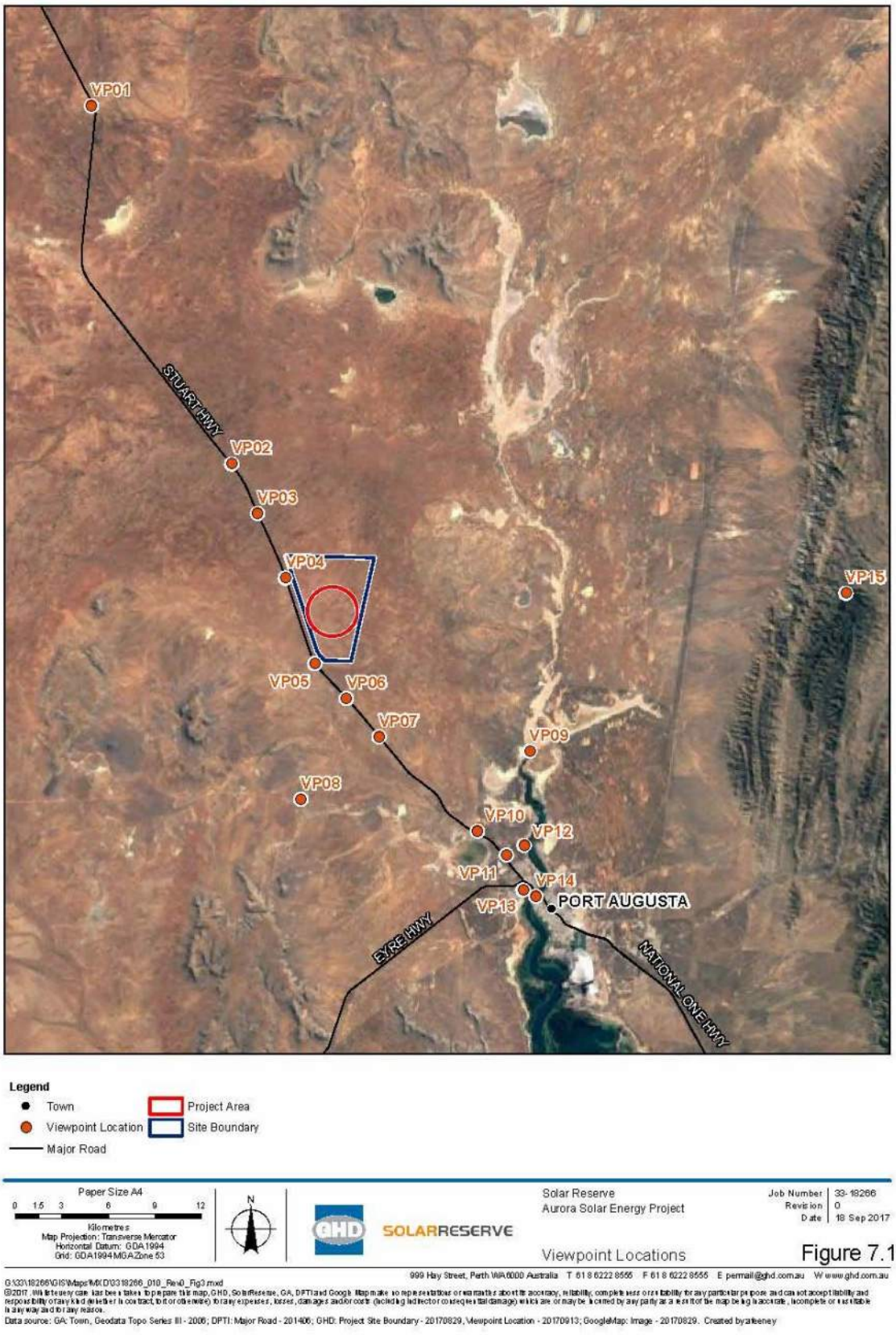
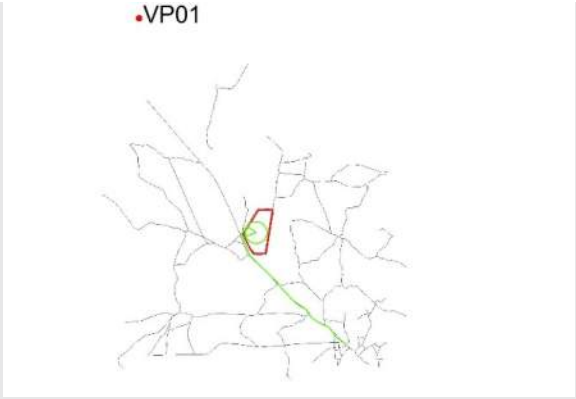


Figure 7-1 Viewpoint locations

7.1 Viewpoint 1 – Stuart Highway #1 (Ranges View rest area)

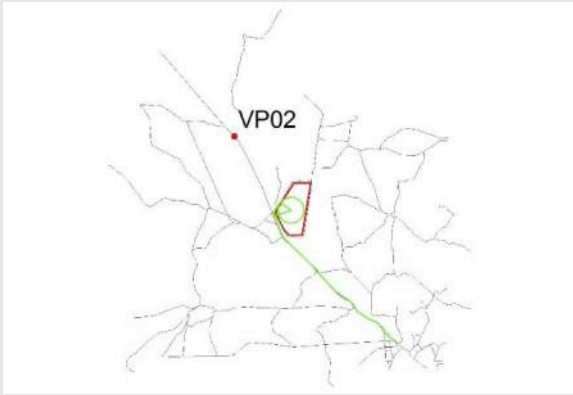
Location details	
Location description	Ranges View rest area, approximately 36.2 km from the receiver tower.
Coordinates	164 177, 6 450 155 (GDA 1994 MGA Zone 54)
View direction	South east. Project would be approximately at the centre of the view.
Description of view	
Description of viewpoint	Ranges view rest area is located adjacent to Stuart Highway on a natural high point. Expansive and high quality views are available south east toward Port Augusta. Several rocky escarpments are visible in the middle distance and Flinders Ranges are visible in the far distance.
Description of visual change	The receiving tower may be just visible at the centre of the image on a clear day however it is unlikely to easily discernible. The other project elements are unlikely to be visible due to the distance away.



Assessment of Impact	**Value**	**Supporting Comments**
Distance from project	Low	The project would be barely discernible from this distance.
Landscape sensitivity	High	High quality expansive views of a topographically dynamic landscape.
Viewer numbers	Medium	A stop off point that is frequented by a moderate number of visitors.
Visibility	Low	Visibility of the project would be inhibited by distance and intervening vegetation and terrain.
Overall Visual Impact	**Low**	Although it is a high quality viewing location, the project would not significantly alter this view.

7.2 Viewpoint 2 – Stuart Highway #2

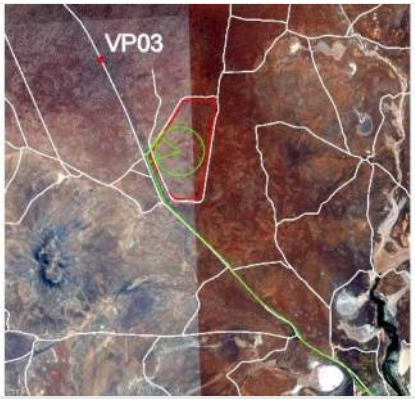
Location details	
Location description	Unnamed rest area approximately 11.6 km from the receiver tower.
Coordinates	174 505, 6 427 559 (GDA 1994 MGA Zone 54)
View direction	South east. Project would be approximately at the centre of the view.
Description of view	
Description of viewpoint	Views from this location are of a flat to gently undulating landscape with low growing scrubland vegetation interspersed with moderately tall shrubs and trees. Views of rocky escarpments and Flinders Ranges are generally inhibited by vegetation.
Description of visual change	Views of the project are likely to be constrained to the receiving tower only. Views of the other project elements would generally be inhibited by vegetation. The receiving tower would be a noticeable addition.



Assessment of Impact	Value	Supporting Comments
Distance from project	Low	The receiving tower may be discernible but not visually prominent.
Landscape sensitivity	Low	Views such as this are common and not distinguishable by prominent topographical features.
Viewer numbers	Medium	A stop off point that is frequented by a moderate number of visitors.
Visibility	Low	Visibility of the project would be inhibited by distance and intervening vegetation.
Overall Visual Impact	**Low**	Given the low landscape sensitivity and presence of intervening vegetation.

7.3 Viewpoint 3 – Stuart Highway #3

Location details	
Location description	Stuart Highway, approximately 8.0 km from the receiver tower.
Coordinates	176 374, 6 424 445 (GDA 1994 MGA Zone 54)
View direction	South east. Project would be approximately at the centre of the view.
Description of view	
Description of viewpoint	Views from this location are of a flat to gently undulating landscape with low growing scrubland vegetation interspersed with moderately tall shrubs and trees. Views of rocky escarpments and Flinders Ranges are generally inhibited by vegetation.
Description of visual change	Views of the project are likely to be constrained to the top of the receiving tower only. Views of the other project elements would generally be inhibited by vegetation. The receiving tower may be a moderately noticeable addition.



Assessment of Impact	Value	Supporting Comments
Distance from project	Medium	The receiving tower may be a moderately noticeable addition but not visually dominant.
Landscape sensitivity	Low	Views such as this are common and not particularly distinguishable by prominent topographical features.
Viewer numbers	High	The Stuart Highway is a major road which connects to the capital cities of Alice Springs and Darwin.
Visibility	Low	Visibility of the project would be partially inhibited by intervening vegetation.
Overall Visual Impact	**Low**	Given the low landscape sensitivity and presence of intervening vegetation.

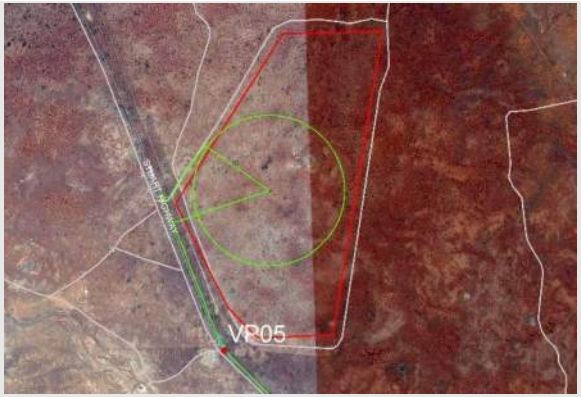
7.4 Viewpoint 4 – Stuart Highway #4

Location details	
Location description	Stuart Highway, approximately 3.7 km from the receiver tower.
Coordinates	178 397, 6 420 377 (GDA 1994 MGA Zone 54)
View direction	South east. Project would be approximately at the centre of the view.
Description of view (refer to the photomontage included in the appendix)	
Description of viewpoint	Views from this location are of a flat to gently undulating landscape with low growing scrubland vegetation with occasional shrubs and trees. Flinders Ranges are just visible above the vegetation. An existing pipeline runs parallel to Stuart Highway and can be seen to the left.
Description of visual change	Views of the project would mainly consist of the receiving tower only however the tops of some elements such as the transmission line may be visible.

Assessment of Impact	Value	Supporting Comments
Distance from project	High	The project would be visible at a relatively close range.
Landscape sensitivity	Low	Views such as this are common. Flinders Ranges are partially visible but mostly concealed by vegetation.
Viewer numbers	High	The Stuart Highway is a major road which connects to the capital cities of Alice Springs and Darwin.
Visibility	Low	Visibility of the project would be partially inhibited by intervening vegetation.
Overall Visual Impact	**Medium**	The receiver may be a visually prominent addition to the landscape but given low sensitivity and visibility, the overall visual impact is medium.

7.5 Viewpoint 5 – Stuart Highway #5

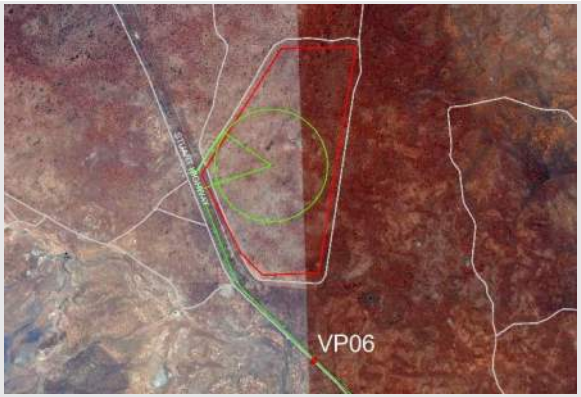
Location details	
Location description	Stuart Highway, approximately 3.5 km from the receiver tower.
Coordinates	180 605, 6 414 980 (GDA 1994 MGA Zone 54)
View direction	North east. Project would be approximately at the centre of the view.
Description of view (refer to the photomontage included in the appendix)	
Description of viewpoint	Views from this location are of a flat to gently undulating landscape with low growing vegetation. An existing pipeline runs parallel to Stuart Highway and can be seen to the right. The landscape is generally devoid of distinguishing topographical features except for some rocky escarpments which are visible in the far distance.
Description of visual change	The receiving tower would be a visually prominent addition to the view. Other project elements such as the heliostats, transmission line and central core buildings are also likely to be visible.



Assessment of Impact	Value	Supporting Comments
Distance from project	High	The project would be visible at a relatively close range.
Landscape sensitivity	Low	Views such as this are common, apart from the rocky escarpments which are visible in the far distance.
Viewer numbers	High	The Stuart Highway is a major road which connects to the capital cities of Alice Springs and Darwin.
Visibility	Medium	Some elements such as heliostats are likely to be concealed by foreground vegetation and terrain.
Overall Visual Impact	**Medium**	The receiver would be a visually prominent addition to the landscape but given its low sensitivity, the overall visual impact is medium.

7.6 Viewpoint 6 – Stuart Highway #6

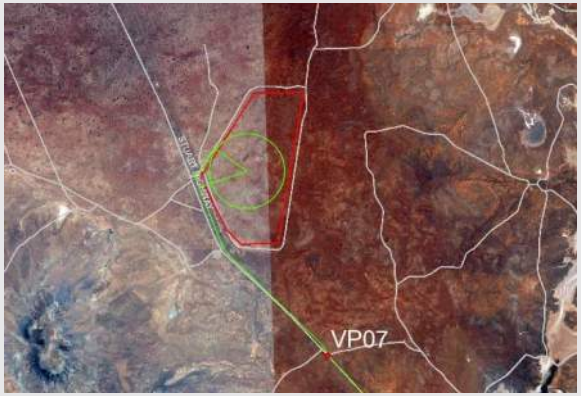
Location details	
Location description	Stuart Highway, approximately 5.7 km from the receiver tower.
Coordinates	182 773, 6 412 834 (GDA 1994 MGA Zone 54)
View direction	North west. Project would be approximately at the centre of the view.
Description of view	
Description of viewpoint	Views from this location are of a flat to gently undulating landscape with low growing vegetation and occasional tree cover. An existing pipeline runs parallel to Stuart Highway and can be seen to the right. The landscape is generally devoid of distinguishing topographical features except for some rocky escarpments which are visible in the far distance.
Description of visual change	The receiving tower would be a moderately prominent addition to the view. Other project elements such as the heliostats, transmission line and administration buildings may be partially visible.



Assessment of Impact	Value	Supporting Comments
Distance from project	Medium	The receiving tower would be a moderately noticeable addition but not visually dominant.
Landscape sensitivity	Low	Views such as this are common, apart from the rocky escarpments which are visible in the far distance.
Viewer numbers	High	The Stuart Highway is a major road which connects to the capital cities of Alice Springs and Darwin.
Visibility	Medium	The heliostats are likely to be concealed by vegetation.
Overall Visual Impact	**Medium**	The receiver would be a visually prominent addition to the landscape but given its low sensitivity, the overall visual impact is medium.

7.7 Viewpoint 7 – Stuart Highway #7

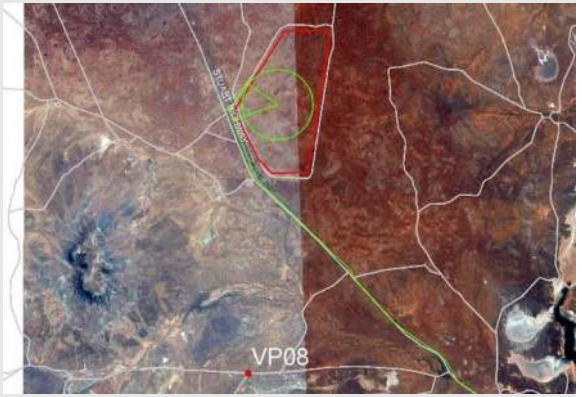
Location details	
Location description	Stuart Highway, approximately 8.6 km from the receiver tower.
Coordinates	184 998, 6 410 488 (GDA 1994 MGA Zone 54)
View direction	North west. Project would be slightly left of centre in the view.
Description of view	
Description of viewpoint	Views from this location are of a flat to gently undulating landscape with low growing vegetation and occasional tree cover. An existing pipeline runs parallel to Stuart Highway and can be seen to the right. The landscape is generally devoid of distinguishing topographical features except for some rocky escarpments which are visible in the far distance and Flinders Ranges which are just visible to the right.
Description of visual change	Views of the project would mainly consist of the receiving tower only. Other elements such as the heliostats, transmission line and administration buildings are likely to be partially or wholly concealed.



Assessment of Impact	Value	Supporting Comments
Distance from project	Medium	The receiving tower would be a moderately noticeable addition but not visually dominant.
Landscape sensitivity	Low	Views such as this are common, apart from the hills which are visible in the far distance.
Viewer numbers	High	The Stuart Highway is a major road which connects to the capital cities of Alice Springs and Darwin.
Visibility	Low	Visibility of the project would be partially inhibited by intervening terrain and vegetation.
Overall Visual Impact	**Low**	Given the low landscape sensitivity and presence of intervening vegetation.

7.8 Viewpoint 8 – Carriewerloo Road

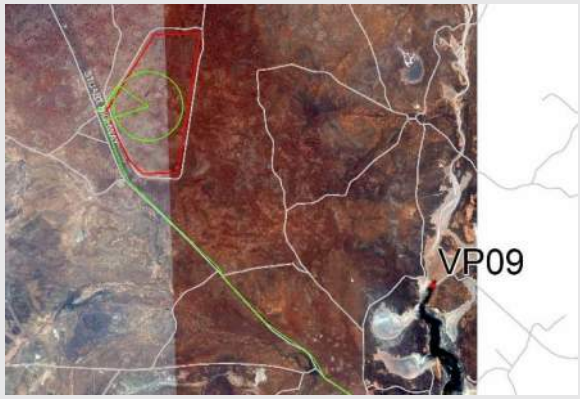
Location details	
Location description	Carriewerloo Road, approximately 12.3 km from the receiver tower.
Coordinates	180 216, 6 406 162 (GDA 1994 MGA Zone 54)
View direction	North west. Project would be approximately at the centre of the view.
Description of view	
Description of viewpoint	Views from this location are of a flat to gently undulating landscape with low growing vegetation and occasional shrubs. A rocky escarpment is visible to the left in the middle distance. There are also other rocky escarpments visible in the far distance and Flinders Ranges are visible to the right.
Description of visual change	The main project element that would be visible from this location would be the receiving tower, however it would not be a dominant visual element given the distance away.



Assessment of Impact	Value	Supporting Comments
Distance from project	Low	The receiving tower would be a noticeable element but not visually dominant.
Landscape sensitivity	Low	The project would not be visible in front of the major geological formations.
Viewer numbers	Low	Carriewerloo Road is a dirt road that carries relatively low volumes of traffic.
Visibility	Low	Visibility of the project would be partially inhibited by intervening terrain and vegetation.
Overall Visual Impact	**Low**	Given that all criteria have been rated as low.

7.9 Viewpoint 9 – Yorkeys Crossing Road #1

Location details	
Location description	Yorkeys Crossing Road, approximately 15.6 km from the receiver tower.
Coordinates	194 761, 6 410 091 (GDA 1994 MGA Zone 54)
View direction	North west. Project would be approximately at the centre of the view.
Description of view	
Description of viewpoint	This view looks out across a causeway that spans the upper portion of Spencer Gulf toward a gently undulating landscape with low growing vegetation. An existing transmission line is visible to the right in the image.
Description of visual change	The main project element that would be visible from this location would be the receiving tower, however it would not be a dominant visual element given the distance away.



Assessment of Impact	Value	Supporting Comments
Distance from project	Low	The receiving tower would be a noticeable element but not visually dominant.
Landscape sensitivity	Medium	Given the area may seasonally fill with water and would be more sensitive to visual changes.
Viewer numbers	Low	Yorkeys Crossing Road is a dirt road that carries relatively low volumes of traffic.
Visibility	Low	Visibility of the project would be partially inhibited by intervening terrain.
Overall Visual Impact	**Low**	Given that most of the criteria have been rated as low.

7.10 Viewpoint 10 – Yorkeys Crossing Road #2

Location details	
Location description	Yorkeys Crossing Road, approximately 17.0 km from the receiver tower.
Coordinates	191 692, 6 404 761 (GDA 1994 MGA Zone 54)
View direction	North west. Project would be approximately at the centre of the view.
Description of view	
Description of viewpoint	Views from this location are of a flat to gently undulating landscape with low growing vegetation with occasional shrubs and trees. The major geological formations in the area are mostly hidden from view. A residential dwelling is visible toward the left in the image.
Description of visual change	The main project element that would be visible from this location would be the receiving tower, however it would not be a dominant visual element given the distance away.

Assessment of Impact	**Value**	**Supporting Comments**
Distance from project	Low	The receiving tower would be a noticeable element but not visually dominant.
Landscape sensitivity	Low	The project would not be visible in front of the major geological formations.
Viewer numbers	Low	Yorkeys Crossing Road is a dirt road that carries relatively low volumes of traffic.
Visibility	Low	Visibility of the project would be partially inhibited by intervening terrain and vegetation.
Overall Visual Impact	**Low**	Given that all criteria have been rated as low.

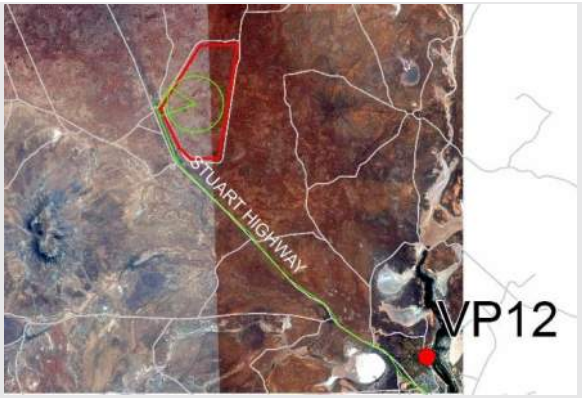
7.11 Viewpoint 11 – Australian Arid Lands Botanic Garden Lookout

Location details	
Location description	Adjacent to Stuart Highway, approximately 19.3 km from the receiver tower.
Coordinates	193 638, 6 403 309 (GDA 1994 MGA Zone 54)
View direction	North west. Project would be approximately at the centre of the view.
Description of view	
Description of viewpoint	This lookout is located at the south western edge of the botanic gardens. Views toward the project are of a flat to gently undulating landscape with low growing vegetation. Geological formations are visible to the far left and to the far right.
Description of visual change	The main project element that would be visible from this location would be the receiving tower, however it would not be a dominant visual element given the distance away.

Assessment of Impact	Value	Supporting Comments
Distance from project	Low	The receiving tower would be a noticeable element but not visually dominant.
Landscape sensitivity	Low	The project would not be visible in front of the major geological formations.
Viewer numbers	High	The lookout is well signposted from Stuart Highway.
Visibility	Low	Visibility of the project would be partially inhibited by intervening terrain and vegetation.
Overall Visual Impact	**Low**	Given that most of the criteria have been rated as low.

7.12 Viewpoint 12 – Matthew Flinders Red Cliff Lookout

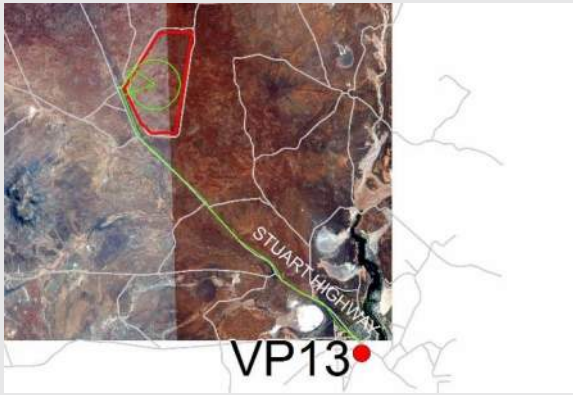
Location details	
Location description	On the banks of Spencer Gulf, approximately 19.5 km from the receiver tower.
Coordinates	194 739, 6 404 017 (GDA 1994 MGA Zone 54)
View direction	North west. Project would be approximately at the centre of the view.
Description of view	
Description of viewpoint	This lookout is located along a trail that runs adjacent to Red Banks and Spencer Gulf. Views north west toward the project are of a flat to gently undulating landscape with low growing vegetation. Geological formations are visible to the far left and to the far right.
Description of visual change	The main project element that would be visible from this location would be the receiving tower, however it would not be a dominant visual element given the distance away.



Assessment of Impact	Value	Supporting Comments
Distance from project	Low	The receiving tower would be a noticeable element but not visually dominant.
Landscape sensitivity	Low	The project would not be visible in front of the major geological formations.
Viewer numbers	High	The lookout is well signposted from Stuart Highway and an important tourist destination.
Visibility	Low	Visibility of the project would be partially inhibited by intervening terrain and vegetation.
Overall Visual Impact	**Low**	Given that most of the criteria have been rated as low.

7.13 Viewpoint 13 – Water Tower Lookout

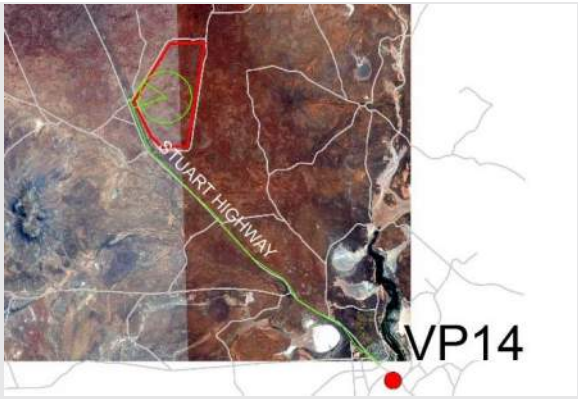
Location details	
Location description	Within Port Augusta township, approximately 21.8 km from the receiver.
Coordinates	194 839, 6 401 132 (GDA 1994 MGA Zone 54)
View direction	North west. Project would be approximately at the centre of the view.
Description of view	
Description of viewpoint	This view is from halfway up the tower given that a wire mesh covers the view from the top of the tower. Views toward the project are over a modified environment with residential dwellings, power lines, antennae and other structures within the view. There are also established trees along most of the streets.
Description of visual change	The main project element that would be visible from this location would be the receiving tower, however it would not be a dominant visual element given the distance away.



Assessment of Impact	Value	Supporting Comments
Distance from project	Low	The receiving tower would be a noticeable element but not visually dominant.
Landscape sensitivity	Low	Given the presence of manmade modifications to the landscape.
Viewer numbers	High	This location is a tourist attraction.
Visibility	Low	Visibility of the project would be partially inhibited by intervening terrain and vegetation.
Overall Visual Impact	**Low**	Given that most of the criteria have been rated as low.

7.14 Viewpoint 14 – Eastside Foreshore Reserve

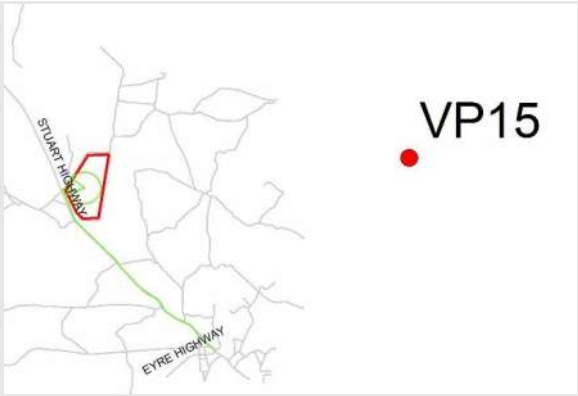
Location details	
Location description	Port Augusta Harbour, approximately 22.6 km from the receiver tower.
Coordinates	195 681, 6 400 766 (GDA 1994 MGA Zone 54)
View direction	North west. Project would be approximately at the centre of the view.
Description of view	
Description of viewpoint	Eastside foreshore reserve is located at the western end of Port Augusta town centre along Port Augusta Harbour. Views toward the project are of a flat to gently undulating modified harbour and coastal landscape with numerous structures, residential dwellings, boats and a bridge visible in the view.
Description of visual change	The main project element that would be visible from this location may be the receiving tower, however it would not be a dominant visual element given the distance away, if it is even visible at all.



Assessment of Impact	Value	Supporting Comments
Distance from project	Low	The receiving tower may be a noticeable element but not visually dominant.
Landscape sensitivity	Medium	The harbour has many modifications, but it would still be valued for its scenic amenity.
Viewer numbers	High	This location is likely to be an important landscape feature of Port Augusta.
Visibility	Low	Visibility of the project would be partially or completely inhibited by intervening terrain and vegetation.
Overall Visual Impact	**Low**	The project is not likely to be discernible if it is visible at all.

7.15 Viewpoint 15 – Dutchman's Stern Conservation Park

Location details	
Location description	Summit viewpoint, approximately 33.2 km from the receiver tower.
Coordinates	214 586, 6 421 434 (GDA 1994 MGA Zone 54)
View direction	South west. Project would be approximately at the centre of the view.
Description of view	
Description of viewpoint	The Summit viewpoint is accessible via a hiking trail in Dutchman's Stern Conservation Park. There are expansive views available with the foothills of Finders Ranges visible in the foreground and a flat to gently undulating arid landscape incorporating a number of prominent geological features visible in the middle and far distance.
Description of visual change	As this is an elevated view, the project is likely to be visible in its entirety, including receiving tower, heliostats, transmission line and other supporting infrastructure. It would not be a discernible change to the landscape however, given the distance away.



Assessment of Impact	Value	Supporting Comments
Distance from project	Low	The project may be a noticeable element but not visually dominant or discernible.
Landscape sensitivity	High	This viewpoint is a tourist attraction and of high scenic amenity
Viewer numbers	Medium	Access is via a one hour hiking trail, however it is a visitor attraction.
Visibility	Low	The project would be visible in its entirety however it would be difficult to discern.
Overall Visual Impact	**Low**	Distance is an overriding factor, the project would not be a visually dominant element.

7.16 Summary of visual impact assessment

The following table provides a summary of visual impact from the assessed viewpoints.

Viewpoint	Overall Visual Impact
Viewpoint 1 – Stuart Highway #1 (Ranges View rest area)	Low
Viewpoint 2 – Stuart Highway #2	Low
Viewpoint 3 – Stuart Highway #3	Low
Viewpoint 4 – Stuart Highway #4	Medium
Viewpoint 5 – Stuart Highway #5	Medium
Viewpoint 6 – Stuart Highway #6	Medium
Viewpoint 7 – Stuart Highway #7	Low
Viewpoint 8 – Carriewerloo Road	Low
Viewpoint 9 – Yorkeys Crossing Road #1	Low
Viewpoint 10 – Yorkeys Crossing Road #2	Low
Viewpoint 11 – Australian Arid Lands Botanic Garden Lookout	Low
Viewpoint 12 – Matthew Flinders Red Cliff Lookout	Low
Viewpoint 13 – Water Tower Lookout	Low
Viewpoint 14 – Eastside Foreshore Reserve	Low
Viewpoint 15 – Dutchman's Stern Conservation Park	Low

The visual impact of the project would be highest at those locations closest to the site, where a medium visual impact rating has been assigned. Given that the project does not impact on the key landscape values identified, the impact is not high at any of the viewpoints. Elsewhere the effect of distance and intervening terrain and atmospheric haze would result in a low impact. The project is well sited to minimise impacts to key landscape and visual resources within the region.

8. Assessment of Glare

Glare is a continuous source of brightness whereas glint is momentary. The following sections focus on an assessment of the potential glare impact of the project. It is based on a review of information provided by SolarReserve, site observations of a solar project in the vicinity and calculations. Ocular safety, or risk of injury to the eyes, has not been considered as it a safety issue, not a visual impact issue.

8.1 Central tower receiver glint/glare (SolarReserve)

The following is a summary of information provided by SolarReserve on the potential glare effects of the receiver and heliostats.

8.1.1 Receiver

The receiver surface consists of many metal tubes coated with matte black paint and are designed to absorb rather than reflect light. Hence, the less light that is reflected, the greater the efficiency of capturing sunlight for conversion to heat and electricity. The uneven and textured surface causes unabsorbed light to scatter and diffuse, rather than to reflect from the receiver, thus further reducing its apparent brightness. Nevertheless some light is reflected which is approximately 6% of the total amount of light absorbed.

The amount of reflected light observed would dissipate at greater distances from the receiver. Figure 8-1 illustrates this concept.

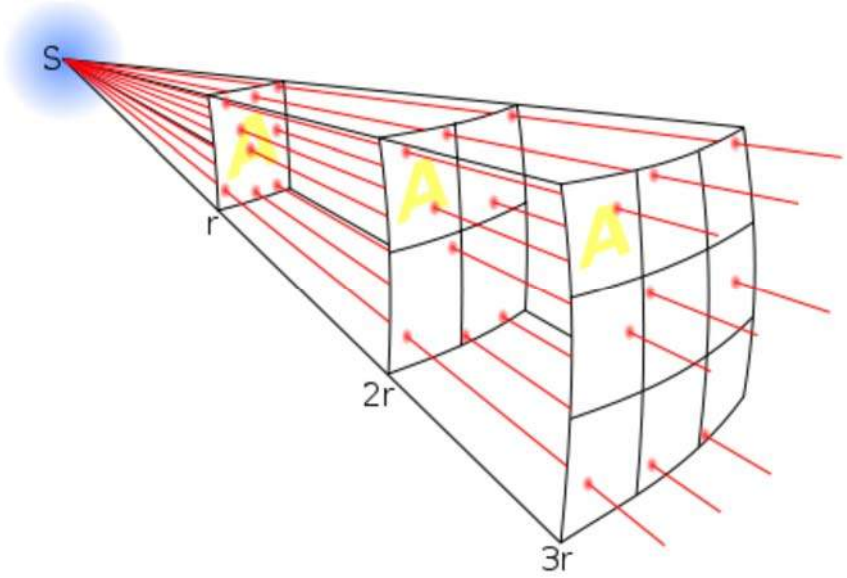


Figure 8-1 Brightness diminishing with distance from light source (SolarReserve)

At a distance of 1,200 metres away from the receiver, the brightness is comparable to looking at a 60 W incandescent light bulb at a distance of two feet away. Figure 8-2 shows an example of glare from the receiver and heliostat field during normal operation.

Figure 8-2 An example of glare from the receiver and heliostat field (SolarReserve)

8.1.2 Heliostats

From an elevated view point as shown in Figure 8-2, a wedge shaped section of the heliostat field will exhibit glare. The area and intensity of the bright area will appear less the further away one is from the heliostat field. The rest of the heliostats will typically appear blue or dark blue showing reflection of the sky, as would a body of water or glass windows.

Under normal plant operations, the sun's rays reflected from the heliostat field will be directed at the receiver. In general, unless an observer is at the receiver location, no beam from any mirror will be directed at observers. On occasion when heliostats are in a stow position or transitioning to an operational position, glint or glare from certain angles may be possible.

From ground level, observers outside the heliostat field perimeter will only see the back of the heliostats. The outer rows of heliostats will shield the inner rows of heliostats as well as heliostats from the opposing field. If by some remote opportunity that a line of sight is exposed to a heliostat on the opposing side, the potentially reflected beam would not be visible from the observer at ground level, since it would be angled upwards.

8.2 Site observations of existing solar facility

A nearby existing solar facility of a similar design provided a reasonable basis to qualitatively gauge the level of glare that is likely to be emitted from the project. Sundrop Farms Renewable Energy was viewed under clear, sunny conditions from a variety of distances and directions. In all cases, the level of glare was not overwhelming. It was not observed to be substantially greater than sunlight reflecting off a shiny surface such as a water body or building. Figure 8-3

shows a view of Sundrops renewable energy facility from close range. Figure 8-4 shows a view of Sundrops renewable energy facility from approximately 4 km away (at the centre of the image). The glare emitted from the receiver from this location was at its most apparent, yet not substantial. The glare from the heliostats was not observable.

Figure 8-3 Sundrop Farms Renewable Energy facility

Figure 8-4 Sundrop Farms Renewable Energy facility from approximately 4 km away

8.3 Glare calculations

Calculations have been undertaken to estimate a quantifiable measure of glare. Calculations have been based on the methodology from the Solar reserve Report 'Central Tower Receiver Glint/Glare – SolarReserve CSP Power Tower Plant'.

Tower receiver reflectance of 6% has been assumed as per typical values noted in the above referenced report. Local climatic data has been analysed to understand potential peak direct solar radiation levels during solar noon, which has been taken as 1,200 W/m^2 at solar noon on a peak day occurrence.

Without considering viewing distance from the tower, the reflected irradiance from the receiver will be most intense from the South (at solar noon). However, the visual impact at any point is reduced by a factor of the distance squared from the receiver, meaning that the quantum of glare is significantly more impacted by viewing distance rather than the orientation from which the tower is being viewed from. Therefore, the 'worst case' viewing point will generally be the point closest to the tower irrespective of whether the tower is being viewed from north, south, east or west.

A number of scenarios have been assessed for potential viewers along the Stuart Highway, with the worst case scenario being a viewer located to the southwest of the solar field, approximately 18 degrees south of the due-west as highlighted in Figure 8-5.

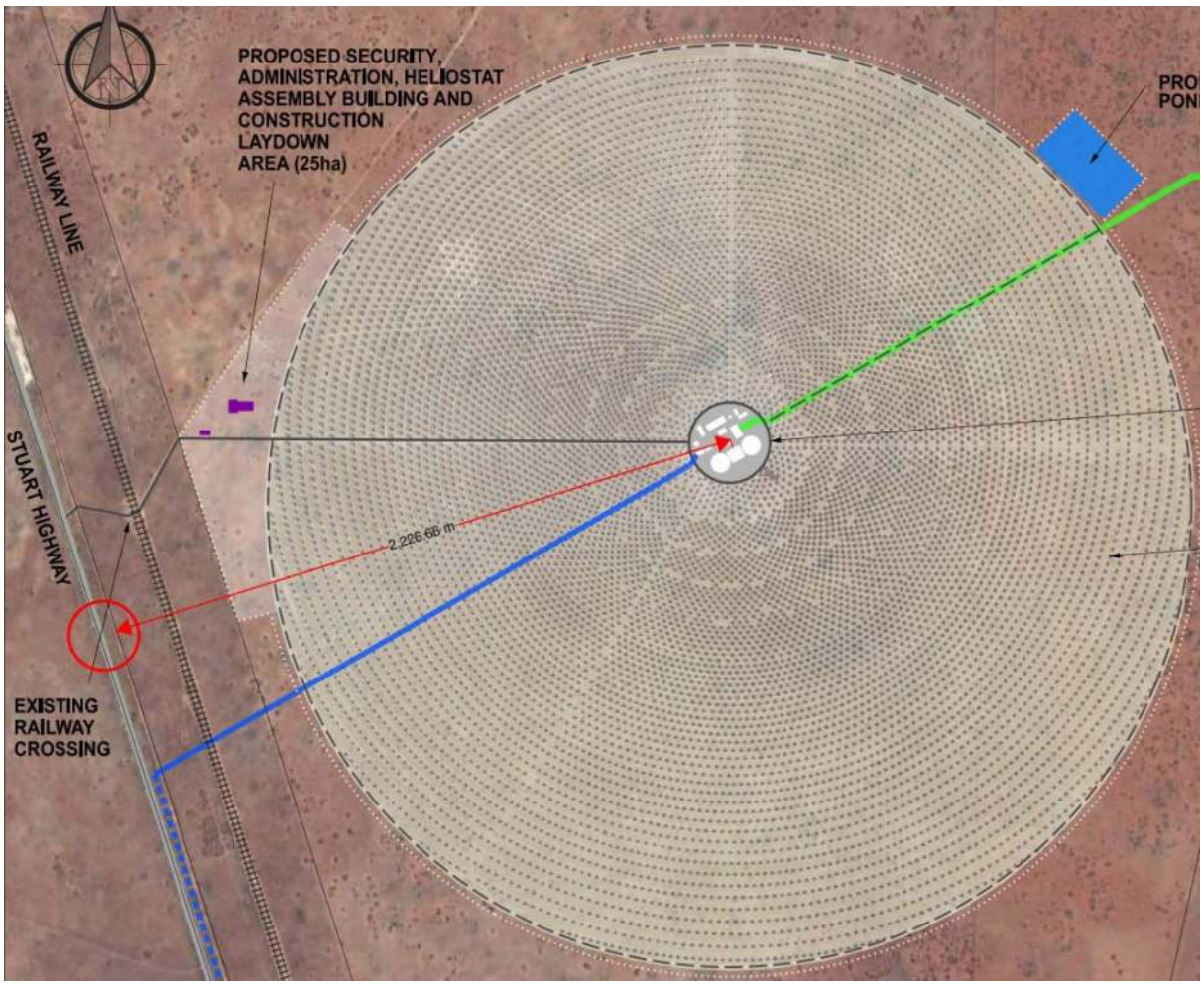


Figure 8-5 Viewer location for glare calculations

Based on the inputs noted above and the calculations undertaken, it is estimated that the maximum receiver luminance for an observer at this point is approximately 264 Lux. For purpose of comparison this equates to an observer viewing a standard 60W incandescent light bulb (with luminous power of 860 lumens) from a distance of 0.51 metres.

As a secondary level of comparison to these figures, Australian & New Zealand Standards for indoor lighting design (AS/NZS 1680) require a minimum level of 320 lux on the working plane in office environment.

An observer point from the railway line has also been assessed. This point was adjacent to the Stuart Highway observer point but slightly closer to the tower. The estimated maximum illuminance for this location is 313 Lux, which equate to viewing a 60W incandescent light bulb from a distance of approximately 0.47 meters.

8.4 Summary of glare assessment

The calculations presented in section 8.3 show that the glare that is likely to be emitted from the receiver tower would not be substantial in comparison to day-to-day effects. Table 2 shows the relative strengths of various light sources.

Table 2 Relative strengths of various light sources

Illuminance (lux or lumens/m2)	Example
0.01	Quarter moon
0.27	Full moon on a clear night
50	Family living room
100	Very dark overcast day
320–500	Office lighting
400	Sunrise or sunset on a clear day.
1,000	Overcast day; typical TV studio lighting
10,000–25,000	Full daylight (not direct sun)
32,000–130,000	Direct sunlight

As the surrounding landscape is relatively flat, glare impacts from the heliostats would be restricted to locations at a higher elevation such as Flinders Ranges. Given the distance away however, the effect is likely to be inconsequential. Glare would reduce in overcast conditions.

9. Tourism

The visual impact of the project may be mitigated by the potential for tourism, as visitors could benefit from observing new technology utilized for renewable energy generation. It may also assist with reinforcing a positive message of sustainability. The addition of the solar project could also add to the diversity of visual experiences in the region, whilst interpretive signage with viewing areas could be used to capitalise on its educational value. Figure 9-1 shows a sheltered information board located adjacent to the Windorah Solar project in Queensland, which was built in October 2009.

Figure 9-1 Interpretive sign: Windorah Solar Project Queensland (Source: www.penbroke-graphics.com)

10. Mitigation measures

The following extract from SolarReserve guidelines helps to gain an understanding of the best way to approach mitigation:

The height of the tower, and its associated visual impact, is not possible to mitigate. SolarReserve development teams should generally be forthcoming and upfront with the visual impact that this will cause. Because nothing can be done – the tower cannot be lowered or made less bright – the best policy is to help guide the community to an accurate understanding of the situation.

Informally, it is often helpful to discuss with individuals how a 200-meter tower appears large when you are close to it, but from far away it becomes a small feature on the horizon. It is often the case that observers cannot easily (or would not typically) get close enough to our facilities for them to be more than a small object on the horizon. Outside observers cannot approach within ~1.5 km of the tower without trespassing on our site.

12. Conclusion

The visual impact of the project would be highest at those locations closest to the site, where a medium visual impact rating has been assigned. Given that the project does not impact on the key landscape values identified, the impact is not high at any of the viewpoints. Elsewhere the effect of distance and intervening terrain and atmospheric haze would result in a low impact.

Mitigation of visual impact is not feasible due to the physical size of the receiver tower. The heliostats are unlikely to be highly visible from the surrounding landscape given the flat terrain and presence of intervening vegetation at some locations. At higher elevations, they may be visible but such high points are either too far away or relatively inaccessible for visual impact of the heliostats to be high.

There may be a potential for the project to add to the visual experience of motorists and rail passengers through tourism opportunities.

The impact of glare from the project is unlikely to be high, based on an understanding of the nature of glare, observations of solar project of a similar design in the region and calculations which show that the glare emitted would not be greater than day to day effects.

Given these reasons, the project is well sited to minimise impacts to key landscape and visual resources within the region as is consistent with the planning legislation.

13. References

Guidelines for Landscape and Visual Impact Assessment, Routledge 3rd Edition (GLVIA). The Landscape Institute and Institute for Environmental Management and Assessment LIIEMA, (2013)

Environmental Impact Assessment Practice Note: Guideline for landscape character and visual impact assessment EIA-NO4

http://flinderspower.com.au (Accessed 15/08/2017)

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https://www.adelaide.edu.au/press/titles/coast-sa/coast-sa-ebook.pdf

SolarReserve blue book Visual Impact Analysis Guidance

SolarReserve blue book Power Tower Glint-Glare

https://en.wikipedia.org/wiki/List_of_tallest_structures_in_Australia

14. Limitations

This report: has been prepared by GHD for SolarReserve Australia Pty Ltd and *may only be used and relied on by SolarReserve Australia Pty Ltd for the purpose agreed between GHD and the SolarReserve Australia Pty Ltd as set out in this report.*

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

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

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

Appendices

Appendix A – Photomontages

Photomontage Viewpoint 4: Stuart Highway #4

Existing view looking south east from Stuart Highway.

Photomontage of project (note: only top of receiver tower and top of some transmission towers visbile due to intervening vegetation).

Location:	Stuart Highway, approximately 3.7 km from the receiver tower.
Coordinates:	178 397, 6 420 377 (GDA 1994 MGA Zone 54)
View direction:	South east.
Lens size:	70 mm.
Date of Photography:	8th August, 2017.
Date of Photomontage:	15th September, 2017.

Aurora Solar Project

Viewpoint Location Map

Photomontage Viewpoint 5: Stuart Highway #5

Existing view looking north from Stuart Highway.

Photomontage of project (note: southern option of transmission line shown).

Location:	Stuart Highway, approximately 3.5 km from the receiver tower.
Coordinates:	180 605, 6 414 980 (GDA 1994 MGA Zone 54).
View direction:	North east.
Lens size:	70 mm.
Date of Photography:	8th August, 2017.
Date of Photomontage:	15th September, 2017.

Aurora Solar Project

Viewpoint Location Map

Photomontage Viewpoint 15: Dutchman's Stern Conservation Park

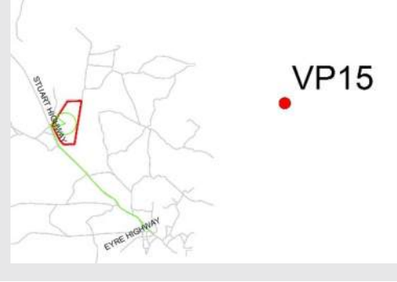
Existing view looking west from Summit Viewpoint, Dutchman's Stern Conservation park

Photomontage of project (Note: project has been artificially contrasted to make it more visible)

Location:	Summit viewpoint, approximately 33.2 km from the receiver tower.
Coordinates:	214 586, 6 421 434 (GDA 1994 MGA Zone 54).
View direction:	West.
Lens size:	70 mm.
Date of Photography:	8th August, 2017.
Date of Photomontage:	27th September, 2017.

Aurora Solar Project

Viewpoint Location Map



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Document Status

Revision	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date

www.ghd.com

Report 2

Flora and Fauna Assessment

ebs ecology

Aurora Solar Energy Project

Flora and Fauna Assessment

Aurora Solar Energy Project Flora and Fauna Assessment

14 September 2017

FINAL (updated)

Prepared by EBS Ecology for GHD

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Cover photograph: Looking to Tent Hill from the Project area.

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GLOSSARY AND ABBREVIATION OF TERMS

CEMP	Construction Environment Management Plan
BDBSA	Biological Database of South Australia (managed by DEWNR)
DEWNR	Department of Environment, Water and Natural Resources
DOE	Australian Government Department of the Environment
DotEE	Australian Government Department of the Environment and Energy (previously DoE)
EPBC Act	*Environment Protection and Biodiversity Conservation Act, 1999*
LGA	Local Government Area
NES	National Environmental Significance
NPW Act	*National Parks and Wildlife Act, 1972*
NRM Act	*Natural Resources Management Act 2004*
NVC	Native Vegetation Council
SEB	Significant Environmental Benefit
IBRA	Interim Biogeographical Regionalisation of Australia
Ha	Hectare

COVER LETTER

EBS Ecology was contracted by GHD, on behalf of SolarReserve, to conduct an ecological assessment for the Aurora Solar Energy Project. The information contained within this report is based upon desktop and field assessments in spring 2015 and winter 2017, which sought to determine the presence of national and state threatened species, and map vegetation communities and their condition over the project area.

The project area covered by EBS included the proposed 806 hectare (ha) Heliostat collector field centering on a molten salt tower, associated access tracks, water pipeline, substation, public viewing platform, and one of the options for an overhead transmission line. It is understood that there are a number of options for the location of the transmission line, which are subject to a range of technical, land ownership and impact considerations. An ecological assessment, comprised of desktop and field surveys, will be required for each of the proposed transmission line options.

EBS lodged a Native Vegetation Clearance Application (on behalf of SolarReserve) on 30 June 2017; however, once the project footprint is finalised, the NVC application will be updated.

The desktop and field survey results have determined that there are no species listed under the *Environment Protect Biodiversity Conservation Act 1999*, which would trigger an EPBC referral, within the areas surveyed. Desktop and field surveys are required to determine whether other proposed transmission line options may impact on matters of national significance.

EXECUTIVE SUMMARY

EBS Ecology was contracted by GHD to undertake an ecological assessment for the Aurora Solar Energy Project, located 20 km north east of Port Augusta along the Stuart Highway, South Australia. The ecological assessment comprised of a desktop assessment and two flora and fauna field surveys to determine how matters of federal and state significance may be impacted upon by the proposed development. In addition to this, a Significant Environmental Benefit (SEB) offset was determined for the proposed clearance of native vegetation within the Project area.

The desktop ecological assessment utilised data from the Protected Matters Search Tool and Biological Database of South Australia (BDBSA), to determine the potential presence of species listed as threatened and or migratory under the *Environment Protection and Biodiversity Conservation* (EPBC) *Act* and *National Parks and Wildlife* (NPW) *Act*. The likelihood of occurrence within the Project area for each EPBC Act and NPW Act listed species identified on the database was then deliberated based on habitat availability in the Project area, date of last record and the conspicuousness of the species. Prior to field surveys, the fauna desktop assessment determined that one threatened fauna species and one migratory species listed under the EPBC Act had potential to occur, while a further two fauna species listed under the NPW Act also had potential to occur. The flora desktop assessment determined that one flora species listed under the EPBC Act and a further two species listed under the NPW Act had potential to occur.

Vegetation and flora field assessments were conducted over two trips; 21 - 23 October 2015 (spring 2015) and 16 - 18 August 2017 (winter 2017). In spring 2015, the vegetation associations and condition were mapped over the Project area. In addition to this, all flora species observed were recorded and a targeted search of the threatened flora species identified in the desktop assessment was conducted. In winter 2017, a targeted search for threatened flora species was again conducted with greater search effort.

The vegetation assessment determined that four Vegetation Associations were present over the Project area:

- *Acacia papyrocarpa* (Western Myall) open woodland +/- *Myoporum platycarpum* ssp. *platycarpum* (False Sandalwood) +/- *Alectryon oleifolius* ssp. *canescens* (Bullock Bush) over *Maireana pyramidata* (Black Bluebush) / *Maireana sedifolia* (Bluebush);
- *Maireana pyramidata* (Black Bluebush) / *Maireana sedifolia* (Bluebush) *shrubland;*
- *Atriplex vesicaria* (Bladder Saltbush) / *Maireana astrotricha* (Low Bluebush) / *Maireana pyramidata* (Black Bluebush) / *Tecticornia medullosa* mixed low shrubland; and
- *Acacia aneura* (Mulga) open woodland.

The condition of the vegetation varied from 4:1 (poor) to 8:1 (good) over the Project area. Vegetation in poor condition was associated with greater weed invasion and high grazing intensity from domestic sheep and feral goats.

A total of 812.93 ha of native vegetation to be cleared, will require approval under the *Native Vegetation Act 1991*. The Significant Environmental Benefit (SEB) offset was calculated to be 5743.5 ha, with a land value of $20/ha, this totaled $765,215.64. The SEB offset was based upon the project footprint shown in Figure 1.

The flora survey in spring 2015 recorded 92 flora species, including 13 exotic species. No flora species of National or State conservation significance were recorded. Three of the 13 exotic species were classified as declared under the *Natural Resources Management Act 2004* (NRM Act). The winter 2017 survey targeted the presence of the three threatened plant species, considered to potentially occur within the Project area. The plant species targeted were:

- *Frankenia plicata* (Braided Sea-heath) (EPBC: Endangered, SA: Vulnerable) – Perennial forb.
- *Calandrinia sphaerophylla* (Bead Purslane) (SA: Rare) – Annual or short lived perennial forb.
- *Citrus glauca* (Desert Lime) (SA: Vulnerable) – Perennial large shrub or small tree.

No threatened plant species were observed and their likelihood of presence in the Project area is now considered to be unlikely.

Fauna field assessments were conducted in spring 2015 and winter 2017. The fauna assessment targeted birds; however, all fauna taxa observed within the Project area were opportunistically recorded. The potential for threatened fauna species to occur was further assessed by examining the habitats available within the Project area.

The fauna survey recorded 48 bird species in spring 2015 and 42 bird species in winter 2017. There were nine species not previously observed in spring 2015, while a further 33 species had previously been observed during the spring 2015 survey. Differences in the suite of birds present between surveys were primarily due to the presence and/or absence of transient and nomadic species. The only bird species recorded of conservation significance was the Blue-winged Parrot (*Neophema chrysostoma*), which is listed under the NPW Act as vulnerable. This species was observed during both the spring 2015 and winter 2017 surveys.

In addition to birds, the fauna surveys recorded seven mammal species, of which four were introduced species, and four reptile species. None of the mammals and reptiles recorded during the field survey or identified during the desktop assessment were listed under the EPBC Act or the NPW Act.

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1 INTRODUCTION

GHD are undertaking feasibility studies for a proposed solar farm, located approximately 20 km north east of Port Augusta along the Stuart Highway, South Australia. The proposed development includes an 806 hectare (ha) Heliostat collector field centering on a molten salt tower, associated access tracks, water pipeline, over-head transmission line, substation and a public viewing platform.

EBS Ecology was engaged by GHD to undertake an assessment of the potential ecological impacts of the proposed Aurora Solar Energy Project in October 2015 and August 2017. Where potential impacts were identified, mitigation measures were recommended. The ecological assessments are intended to support State and Federal project approval documents such as the Development Application, EPBC Referral and Native Vegetation Clearance Application.

1.1 Objectives

The specific objectives of the assessment were to:

- identify and map vegetation communities;
- identify and map the extent and significance of fauna habitat;
- identify species of national or state conservation significance known or likely to occur in the area and details on possible impacts;
- identify areas of conservation value, including areas of high biodiversity value;
- identify pest plants and animals;
- assess the likely level of impact from an ecological perspective;
- identify sensitive/exclusion areas; and
- recommend measures to mitigate potential ecological impacts, including avoidance and management of sensitive areas.

2 COMPLIANCE AND LEGISLATIVE SUMMARY

2.1 Environment Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places – defined in the Act as 'matters of national environmental significance'. The eight matters of national environmental significance protected under the Act are:

- World Heritage properties
- National Heritage places
- wetlands of international importance (listed under the Ramsar Convention)
- listed threatened species and ecological communities
- migratory species protected under international agreements
- Commonwealth marine areas
- the Great Barrier Reef Marine Park
- nuclear actions (including uranium mines).

Any action that has, will have, or is likely to have a significant impact on matters of national environmental significance requires referral under the EPBC Act. Substantial penalties apply for undertaking an action that has, will have or is likely to have significant impact on a matter of national environmental significance without approval.

The EPBC Act Significant Impact Guidelines provide overarching guidance on determining whether an action is likely to have a significant impact on a matter of national environmental significance. In terms of nationally threatened species, the guidelines define an action as likely to have a significant impact if there is a real chance or possibility that it will:

- lead to a long term decrease in the population
- reduce the area of occupancy of the species
- fragment an existing population
- adversely affect critical habitat
- disrupt breeding cycles
- modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline
- result in the establishment of invasive species that are harmful to the species
- introduce disease that may cause the species to decline
- interfere with the recovery of the species.

2.2 Native Vegetation Act 1991

The project site is situated in the District Council of Yorke Peninsula which is currently subject to the *Native Vegetation Act 1991* and *Regulations 2003*. An assessment against the Native Vegetation Clearance Principles is not required as the clearance is considered to comply with *Exemption 5 (1)(d) Building or provision of infrastructure including infrastructure in the public interest.*

Regulation

5(1)(d) Building or provision of infrastructure, including infrastructure in the Public Interest

Pursuant to Section 27(1)(b) of the Act, native vegetation may, subject to any other Act or law to the contrary, be cleared if—

(i) - (A) the clearance is incidental to the construction or expansion of a building or infrastructure and the Minister has, by instrument in writing, declared that he or she is satisfied that the clearance is in the public interest;

or

(B) the clearance is required in connection with the provision of infrastructure or services to a building or proposed building, or to any place; and

(ii) any development authorisation required by or under the Development Act 1993 has been obtained; and

(iii) the Council is satisfied (on the basis of information provided to the Council by the person seeking the benefit of this paragraph and such other information as the Council thinks fit) that, after taking into account the need to preserve biological diversity and the nature and purposes of any proposed building or infrastructure that is yet to be constructed, the proposed site of the building or infrastructure is the most suitable that is available; and

(iv) the Council is satisfied (on the basis of information provided to the Council by the person seeking the benefit of this paragraph and such other information as the Council thinks fit) that there is no other practicable alternative that would involve no clearance or the clearance of less vegetation or the clearance of vegetation that is less significant or (if relevant) the clearance of vegetation that has been degraded to a greater extent than the vegetation proposed to be cleared; and

(v) the clearance is undertaken in accordance with a standard operating procedure determined or approved by the Council for the purposes of this provision or a management plan that has been approved by the Council, and either—

(A) there will be a significant environmental benefit on the property where the clearance is being undertaken or within the same region of the State; or

(B) either—

- *the owner of the land (or a person acting on his or her behalf); or*
- *a person connected with the construction or expansion of the building or infrastructure, or the provision of the infrastructure or services (as the case requires),has, on application to the Council to proceed with clearing the vegetation in accordance with this provision, made a payment into the Fund of an amount considered by the Council to be sufficient to achieve a significant environmental benefit in the manner contemplated by section 21(6) of the Act.*

2.3 National Parks and Wildlife Act 1972

The South Australian *National Parks and Wildlife Act 1972* covers the protection of native plants within reserves and native animals throughout the State. Threatened plant and animal species are listed in Schedules 7 (endangered species), 8 (vulnerable species) and 9 (rare species). Persons must not:

- take a native plant on a reserve, wilderness protection area, wilderness protection zone, land reserved for public purposes, a forest reserve or any other Crown land
- take a native plant of a prescribed species on private land
- take a native plant on private land without the consent of the owner (such plants may also be covered by the *Native Vegetation Act 1991*)
- take a protected animal or the eggs of a protected animal without approval
- keep protected animals unless authorised to do so.
- use poison to kill a protected animal without approval.

Persons must comply with the conditions imposed upon permits and approvals.

2.4 Natural Resources Management Act 2004

Under the *Natural Resources Management Act 2004* (NRM Act), landholders have a legal responsibility to manage declared pest plants and animals and prevent land and water degradation.

This Act will have relevance in relation to the control of pest plant and animal species during construction and site remediation. The project area falls within the Northern and Yorke NRM region.

3 BACKGROUND INFORMATION

3.1 Project details

The proposed Aurora Solar Energy Project is located approximately 20 km north-west of Port Augusta, on the eastern side of the Stuart Highway (Figure 1). The Project area occurs on Carriewerloo pastoral station with a proposed transmission line and sub-station, which would merge into the existing Electranet or BHP transmission line, located on Mount Arden pastoral station. An existing water pipeline and Trans Australian Railway line runs south-north, parallel to the Stuart Highway. Both pastoral properties currently graze sheep.

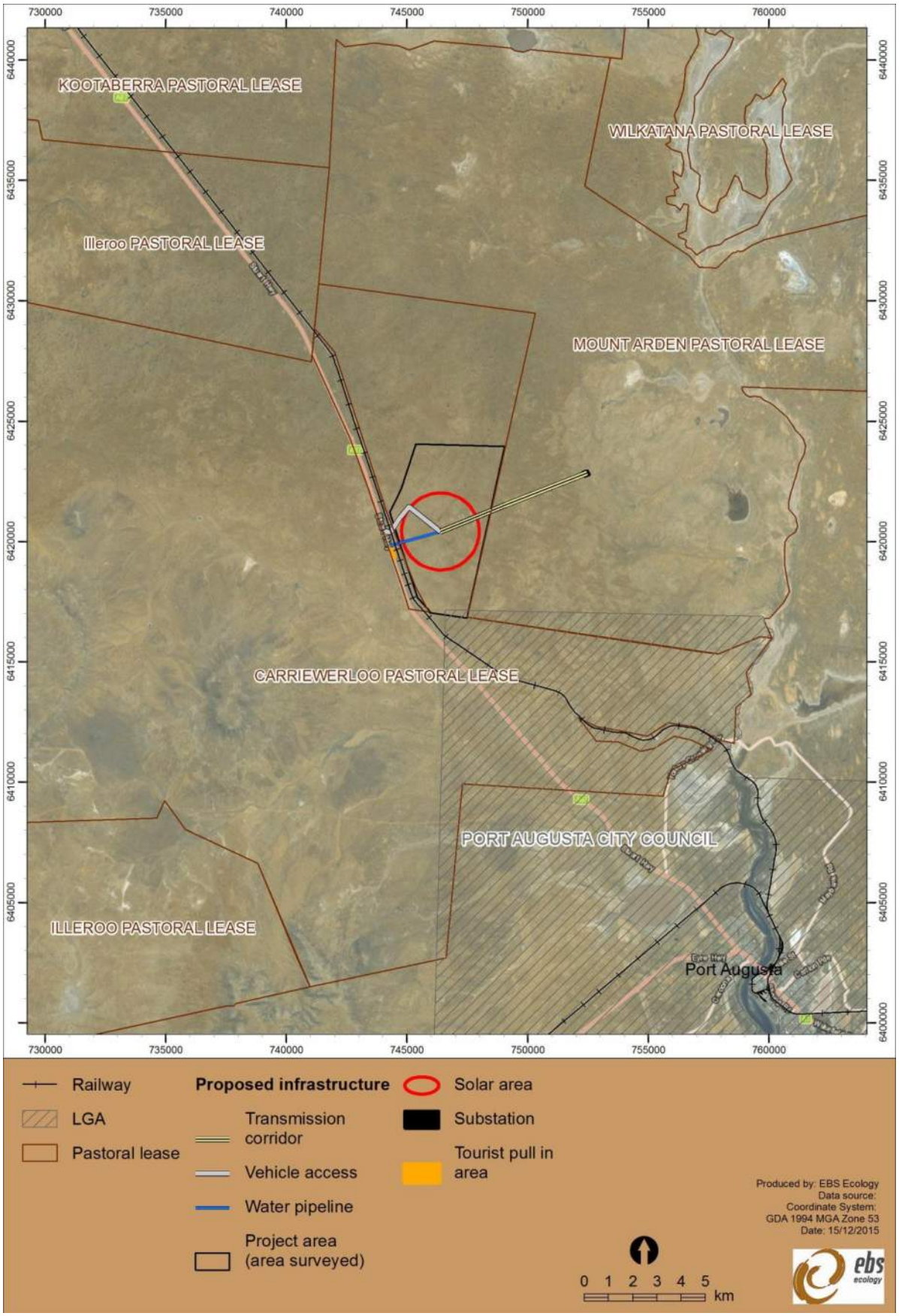


Figure 1. Location of the proposed Aurora Solar Energy Project, area surveyed and associated infrastructure.

3.2 Environmental setting

3.2.1 IBRA

Interim Biogeographical Regionalisation of Australia (IBRA) is a landscape based approach to classifying the land surface across a range of environmental attributes, which is used to assess and plan for the protection of biodiversity (DoE 2012). Land is classified into bioregions, which is further divided into subregions, and then environmental associations.

Table 1. IBRA bioregion, subregion, and environmental association environmental landscape summary.

Gawler IBRA bioregion	
Semi arid to arid, flat topped to broadly rounded hills of the Gawler Range Volcanics and Proterozoic sediments, low plateaux on sandstone and quartzite with an undulating surface of aeolian sand or gibbers and rocky quartzite hills with colluvial footslopes, erosional and depositional plains and salt encrusted lake beds, with black oak (belah) and myall low open woodlands, open mallee scrub, bluebush/saltbush open chenopod shrublands and tall mulga shrublands on shallow loams, calcareous earths and hard red duplex soils.	
Gawler Lakes IBRA subregion	
An undulating upland plain underlain by quartzite and sandstone, with shallow loamy soils. Encompasses the Woomera plateau, which is characterised by the absence of trees and tall shrubs, except on floodplains, where mulga (Acacia aneura), bullock bush (Alectryon oleifolius ssp. canescens), occasional red gums (Eucalyptus camaldulensis) and other species may be found. The gibber-covered areas are either bare or carry a scattered growth of samphire (Halosarcia sp.) and bindyi (Sclerolaena sp.). The depositional plains to the south and south-west of the plateau are covered with deep calcareous earths characteristically carrying an open myall (Acacia papyrocarpa) woodland with a bluebush (Maireana sedifolia) understorey, or red aeolian sand sheets and dunes with open mulga shrubland or a low woodland of Casuarina pauper or Callitris glaucophylla.	
Remnant vegetation	Approximately 62% (1271089 ha) of the subregion is mapped as remnant native vegetation, of which 2% (30615ha) is formally conserved
Landform	Undulating plains overlain with sand sheets and dunes, with occasional silcrete capped rises
Geology	Alluvium, colluvium (sand silt clay & gravels). Silcrete cappings & Ti-rich skins. Dune sand & residual sand mantles. Evaporites (gypsum & halite). Bleached Cretaceous shales. Silicified rhizomorphs & nodular silcrete (Tertiary)
Soil	Brown calcareous earths, Crusty loamy soils with red clayey subsoils, Sand soils, brown and red, Shallow dense loams
Vegetation	Assumed native vegetation cover
Conservation significance	39 species of threatened fauna, 33 species of threatened flora. 2 wetlands of national significance.
Hesso IBRA environmental association	
Remnant vegetation	Approximately 97% (431791 ha) of the association is mapped as remnant native vegetation, of which 0.1% (433ha) is formally conserved
Landform	Gently undulating sandy plain with isolated silcrete-capped rises and salt lakes.
Geology	Sand, silcrete and alluvium.
Soil	Red calcareous earths, crusty red duplex soils and reddish sands.
Vegetation	Low open woodland of myall, bluebush and black oak, tall shrubland of mulga, turpentine mulga

	and horse mulga, chenopod shrubland of saltbush and plover daisy, or samphire, tall shrubland of horse mulga and woodland of native pine.
Climate	Semi-arid climate that is too dry to support field crops. Soil moisture tends to be greatest in winter.
Conservation significance	3 species of threatened fauna

3.2.2 Administrative boundaries

The majority of the Project area does not fall within Local Government Area (LGA) boundaries However, a small section falls inside the LGA of Port Augusta and within the zone of South Australian Arid Lands and the Hundred of Coastline.

3.2.3 Climate

The Port Augusta region experiences cool winters and hot summers. Average annual rainfall is 218.7 mm with the majority during winter and the highest falls in June (average 24.7 mm). Summer rains are also high with December averaging 23.9 mm. The mean minimum temperature ranges from 4.7°C (July) to 19.4°C (January) and the mean maximum temperature ranges from 17.7°C (July) to 34.3°C (January) (Figure 2).

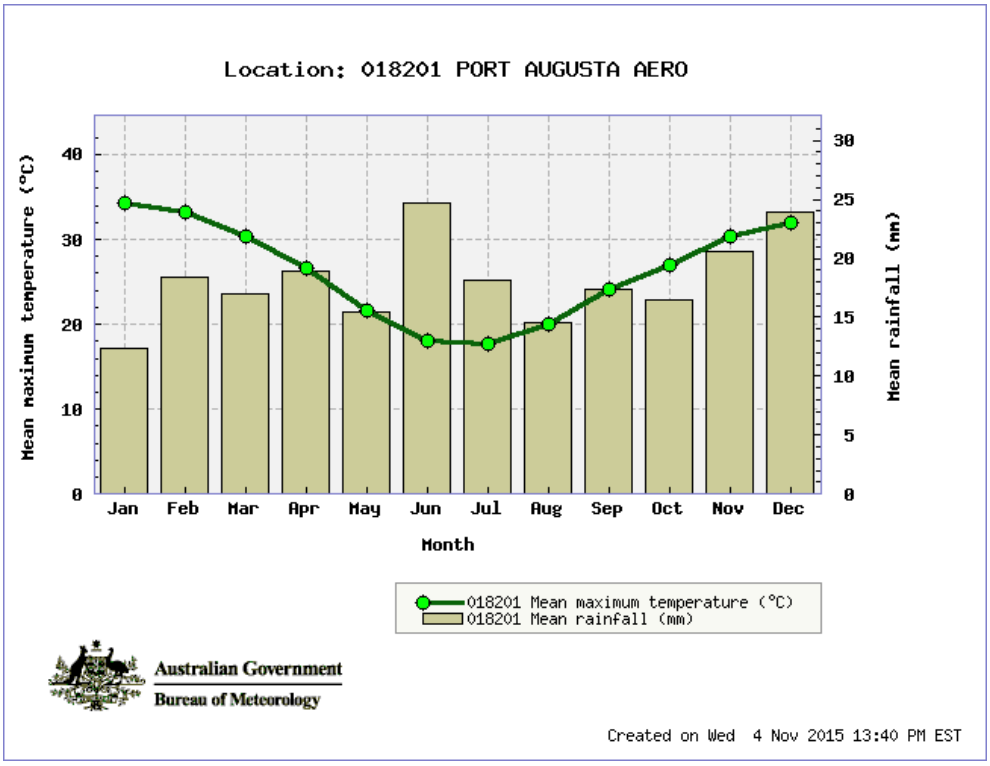


Figure 2. Average monthly rainfall and temperature for Port Augusta.

4 METHODS

4.1 Desktop assessment

4.1.1 Database searches

A Protected Matters Report was generated on 27/10/2015 to identify matters of national environmental significance under the EPBC Act that may occur or may have suitable habitat occurring within the project area. A buffer of 10 km was applied for this search (DotEE 2015).

A Biological Database of South Australia (BDBSA) search was obtained from the Department of Environment Water and Natural Resources (DEWNR) on 09/09/2015, to identify flora and fauna species previously recorded within and around the project area (10 km buffer) (DEWNR 2017). The BDBSA is comprised of an integrated collection of corporate databases which meet DEWNR standards for data quality, integrity and maintenance. In addition to DEWNR biological data, the BDBSA also includes data from partner organisations (Birds Australia, Birds SA, Australasian Wader Study Group, SA Museum, and other State Government Agencies). This data is included under agreement with the partner organisation for ease of distribution but they remain owners of the data and should be contacted directly for further information.

The likelihood of occurrence for each EPBC Act and NPW Act species identified from the Protect Matters Report and BDBSA data extraction was then deliberated based on habitat availability in the project area, date of last record and the conspicuousness of the species.

4.2 Field survey

4.2.1 Vegetation associations and condition

The vegetation associations and condition were mapped over the Project area from 21 – 23 October 2015. The surveyors traversed the Project area via vehicle and foot, to determine the extent of each vegetation association and score its condition. The vegetation association descriptions were assigned based on the dominant overstorey and understorey species as well as the height and density of the dominant layer. For each vegetation association, all flora species (native and exotic) present were identified. The condition scores of vegetation were based upon the Significant Environmental Benefit (SEB) ratios developed by the Native Vegetation Council (Table 2).

4.2.2 Flora

The Project area was traversed from 21 – 23 October 2015 to determine whether species of National or State conservation concern were present. A follow-up survey was conducted from 16-18 August 2017, targeting the presence of the three threatened plant species, considered to potentially occur within the Project area. The plant species targeted were:

- *Frankenia plicata* (Braided Sea-heath) (EPBC: EN, SA: V) – Perennial forb.
- *Calandrinia sphaerophylla* (Bead Purslane) (SA: R) – Annual or short lived perennial forb.
- *Citrus glauca* (Desert Lime) (SA: V) – Perennial large shrub or small tree.

4.2.3 Fauna

Fauna were surveyed over the Project area from 21 – 23 October 2015 (spring 2015) and 16-18 August 2017 (winter 2017). The fauna survey focused on birds, as no threatened species from other fauna taxa were identified in the desktop assessment. In addition to this, birds can be rapidly surveyed and used to determine the importance and health of ecosystems within the Project area. Birds were surveyed systematically using point count sites and were also recorded opportunistically. Mammals and reptiles were recorded opportunistically, through direct observation of individuals and signs of their presence, i.e. scats and tracks. While traversing the Project area, the potential for National and State listed threatened species to occur was assessed.

Opportunistic Records

All fauna observed opportunistically outside of point count sites were recorded. For each observation, the following data was noted:

- Species;
- Number of individuals;
- GPS location;
- Method, i.e. sight or sound; and

- Habitat.

Point Counts

Six point count locations were established over the Project area (Appendix 1; Figure 3). Each of the six point count sites was surveyed for 20 minutes in the morning (<10:30 am) and 20 minutes in the afternoon (>2 pm), with the observer recording all birds heard and observed within a 100 m radius of the centre of the site. If birds were heard or observed outside the 100 m search radius, they were recorded as 'off-site', and treated as opportune records. Bird activity (e.g. flying overhead, flying over circling, resting or foraging on tree/shrub/ground), number of individuals observed, distance from observer, and any other notable observations were recorded.

Wedge-tailed Eagle nest checks

Two Wedge-tailed Eagle nests are known to occur within the Project area (Appendix 2; Figure 3). Nest checks were performed each survey to determine:

- The location, size and condition of nests;
- Whether nests were active (whitewash, nest material);
- Nest success (number of fledglings).

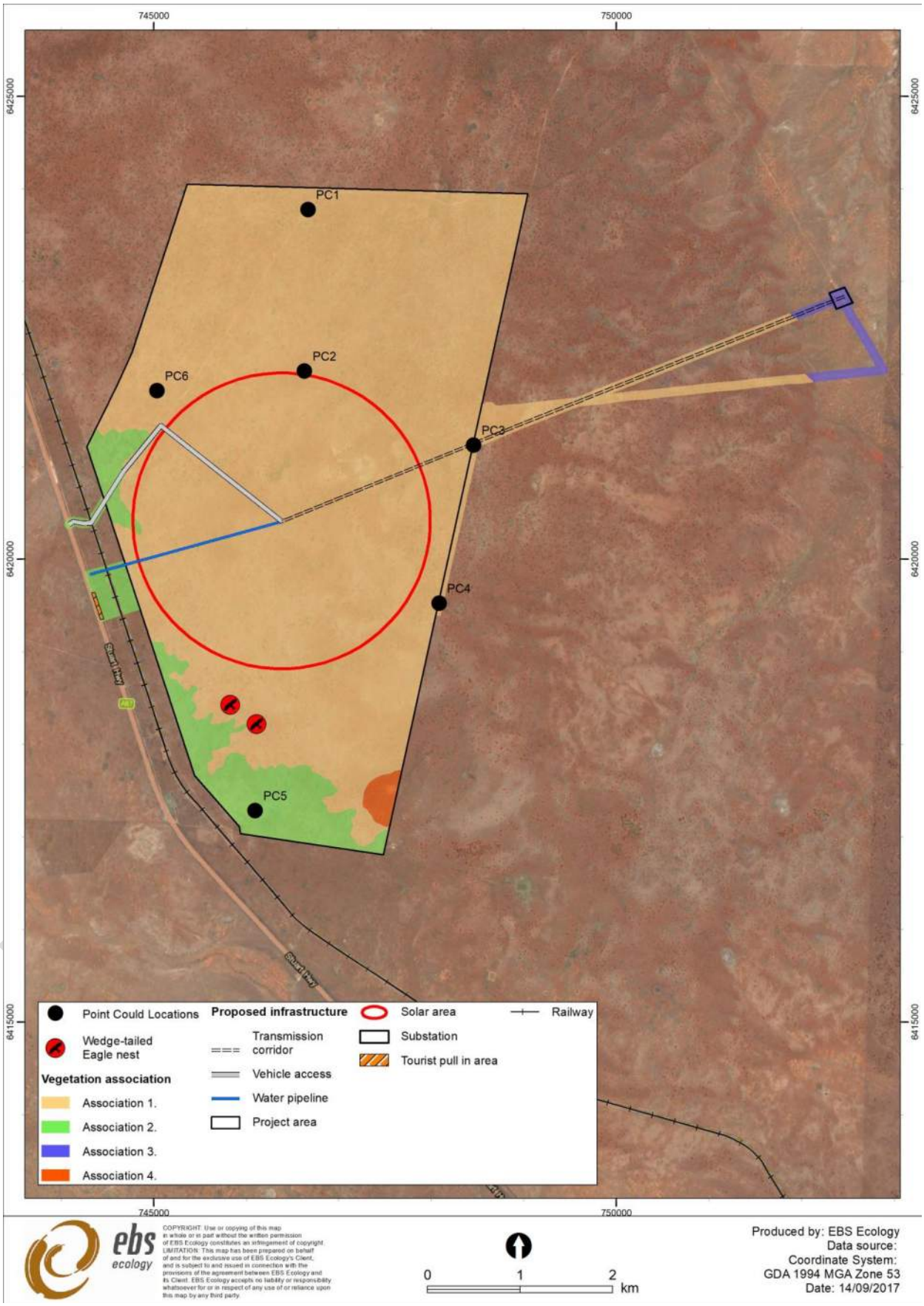


Figure 3. Location of Wedge-tailed Eagle nests and Point Counts over the Project area.

4.3 Limitations

Biological Database of SA (BDBSA) flora and fauna records were limited to a 10 km buffer around the Project area. The reliability of the BDBSA data ranges from 10 m to over 100 km. Fauna species, in particular birds, also have the ability to traverse distances in excess of 10 km. Hence, the BDBSA records provided may not adequately highlight all threatened flora and fauna species that may occur in the area. Similarly, without carrying out intensive trapping or spot lighting, it is not possible to detect all terrestrial animals that may use the site. However the assessment of habitats, together with the site observations made and the database records are considered adequate to make a reasonable assessment of potential impacts of the proposed Project on the fauna within the Project area.

At the times the surveys were undertaken, not all plant species may have been visibly present. Some species such as native orchids and lilies are particularly hard to detect when not in flower. As a consequence, it is possible that species were not detected. It should be noted however, that the number of species missing from the species list is expected to be low and data collected is considered adequate to make a reasonable assessment of potential impacts of the proposed works on flora and fauna.

A large proportion of the bird community in the arid zone is transient or nomadic. Therefore, the bird species recorded during the field survey would not represent the complete bird community that would occur within the Project area.

Table 2. Assessment criteria for the condition of vegetation communities.

Condition	SEB ratio	% indigenous cover	Overstorey condition description	Understorey condition description	Indicators	NVC Interim Policy (1.2.11)
Very Poor	**0:1**	<10%	No overstorey stratum remaining.	Complete destruction of indigenous understorey* (by grazing &/or introduced plants).	Vegetation structure no longer intact (e.g. removal of one or more vegetation strata). Scope for regeneration, but not to a state approaching good condition without intensive management. Dominated by very aggressive weeds. Partial or extensive clearing (> 50% of area). Evidence of heavy grazing (tracks, browse lines, species changes, complete depletion of soil surface crust).	Where proposed clearance is considered to be minor and of limited biodiversity impact, e.g. lopping of overhanging limbs only or minor clearance of shrubs in areas otherwise considered as highly disturbed.
	1:1	10-19%	Scattered trees in poor health and/or representing an immature stand.	Almost complete destruction of indigenous understorey* (by grazing &/or introduced plants) - reduced to scattered clumps and individual plants.		Where proposed clearance is in areas dominated by introduced species, the area of native vegetation is largely reduced to scattered trees, indigenous understorey reduced to scattered clumps and individual plants.
	2:1	20-29%	Scattered trees either immature in good health or mature in poor/moderate health. Alternatively, the dominant overstorey stratum is largely intact and is an immature stand (or regrowth), and is generally in poor health.			
Poor	**3:1**	30-39%	Dominant overstorey stratum is largely intact and is a moderately healthy mature stand.	Heavy loss of native plant species (by grazing &/or introduced plants). The understorey* consists predominately of alien species, although a small number of natives persist.	Vegetation structure substantially altered (e.g. one or more vegetation strata depleted). Retains basic vegetation structure or the ability to regenerate it. Very obvious signs of long-term or severe disturbance. Weed dominated with some very aggressive weeds. Partial clearing (10 – 50% of area). Evidence of moderate grazing (tracks, browse lines, soil surface crust extensively broken).	Where the proposed clearance is of mostly intact overstorey vegetation but there is still considerable weed infestation amongst the understorey flora.
	4:1	40-49%	Dominant overstorey stratum is largely intact and is a healthy mature stand with high wildlife habitat value (e.g. hollows).			
Moderate	**5:1**	50-59%	Dominant overstorey stratum is largely intact – any condition+	Moderate loss of native understorey diversity. Weed-free areas small. Substantial invasion of aliens resulting in significant competition, but native	Vegetation structure altered (e.g. one or more vegetation strata depleted). Most seed sources available to regenerate original structure.	Where the proposed clearance is of mostly intact overstorey vegetation with moderate but not severe weed infestation amongst the understorey flora.

Condition	SEB ratio	% indigenous cover	Overstorey condition description	Understorey condition description	Indicators	NVC Interim Policy (1.2.11)
				understorey* persists; for example, may be a low proportion of native species and a high native cover, or a high proportion of native species and low native cover.	Obvious signs of disturbance (e.g. tracks, bare ground). Minor clearing (<10% of area). Considerable weed infestation with some aggressive weeds. Evidence of some grazing (tracks, soil surface crust patchy).	Clearance is not seriously at variance with the Principles.
	6:1	60-69%	Dominant overstorey stratum is largely intact – any condition+	Moderate but not severe weed infestation amongst the understorey flora.		
Good	**7:1**	70-79%	Original overstorey stratum is still dominant and intact – any condition+	Understorey only slightly modified. High proportion of native species and native cover in the understorey*; reasonable representation of probable pre-European vegetation.	Vegetation structure intact (e.g. all strata intact). Disturbance minor, only affecting individual species. Only non-aggressive weeds present. Some litter build-up.	Where the proposed clearance is of mostly intact overstorey and understorey vegetation, weed infestation is moderate to low, but the original vegetation is still dominant. Clearance is assessed by the NVC to be at variance with the Principles.
	8:1	80-89%	Original overstorey stratum is still dominant and intact – any condition+	Understorey only slightly modified. High proportion of native species and native cover in the understorey*; reasonable representation of probable pre-European vegetation.		
Excellent	**9:1**	> 89%	Original vegetation is still dominant and intact. Overstorey individuals in good condition and represent a mature stand.	Diverse vegetation with very little weed infestation.Understorey largely undisturbed, minimal loss of plant species diversity. Very little or no sign of alien vegetation in the understorey*; resembles probable pre-European condition.	All strata intact and botanical composition close to original. Little or no signs of disturbance. Little or no weed infestation. Soil surface crust intact. Substantial litter cover.	Where the proposed clearance is of diverse vegetation with very little weed infestation. Clearance is assessed by the NVC to be seriously at variance with the Principles.
	10:1		Original vegetation is still dominant and intact. Overstorey individuals in good condition and represent a mature stand, with high habitat value (e.g. hollows).			

* Or all strata if the upper and lower strata are difficult to distinguish.
\+ Ratio assessment will largely depend upon condition of understorey associated with an intact overstorey stratum.
Adapted from *Guide to Roadside Vegetation Survey Methodology for South Australia* (Stokes et al. 1998) and *Guidelines for a Native Vegetation Significant Environmental Benefit Policy* (DWLBC 2005).

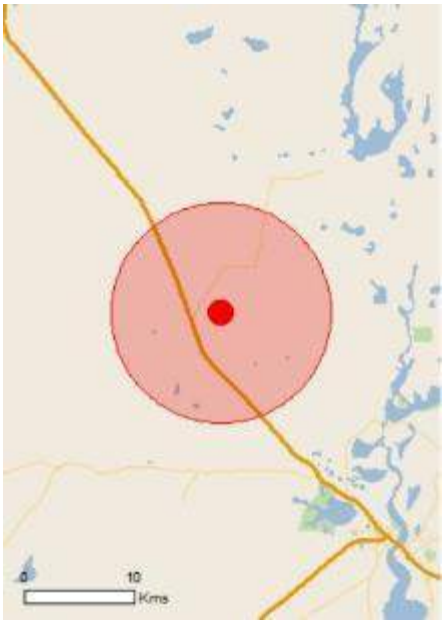
5 RESULTS

5.1 Desktop assessment

5.1.1 Matters of national environmental significance

The EPBC Act Protected Matters Search highlighted the following matters of national significance that may be relevant to the project area. The search identified five threatened species and nine migratory bird species listed under the EPBC Act as potentially occurring or having suitable habitat within the project area (Table 3).

Table 3. Summary of the results from the EPBC Protected Matters Search (10 km buffer)

Search area (10 km buffer)	Matters of NES under the EPBC Act	Identified within search area
	World Heritage Properties	None
	National Heritage Places	None
	Wetlands of International Importance	None
	Nationally Important Wetlands	1
	Commonwealth Marine Areas	None
	Commonwealth Land	1
	Commonwealth Reserves	None
	Commonwealth Heritage Places	None
	Critical Habitats	None
	Nationally Threatened Species	5
	Nationally Threatened Ecological Communities	None
	Migratory Species	9
	State and Territory Reserves	None
	Invasive Species	23

5.1.2 Threatened ecological communities

There were no threatened ecological communities identified in the Protected Matters Search.

5.1.3 Threatened flora

The Protected Matters Search identified one nationally threatened flora species; *Frakenia plicata* (Bearded Sea-heath) that could potentially occur within the Project area. *Frakenia plicata* is listed as endangered under the EPBC Act and vulnerable under the NPW Act. The desktop assessment determined that *F. plicata* could potentially occur; however, it was been downgraded to unlikely following the two field trips (see 6.2.1).

The BDBSA search identified two species listed under the NPW Act, in addition to *F. plicata*, that may occur within the Project area. The two species with potential to occur in the Project area were *Calandrinia sphaerophylla* (Bead Purslane), State rare, and *Citrus glauca* (Desert Lime), State vulnerable. The likelihood of these two species occurring in the Project area has subsequently been downgraded to unlikely following the two field trips (see 6.2.1).

Table 4. Threatened flora species potentially occurring within the project area.

Scientific name	Common name	Conservation status		Source	Last record (year)	Likelihood of occurrence within project area
		Aus	SA			
Calandrinia sphaerophylla	Bead Purslane		R	2	1990	Unlikely
Citrus glauca	Desert Lime		V	2	1993	Unlikely
Frankenia plicata	Bearded Sea-heath	EN	V	1	N/A	Unlikely
Gratwickia monochaeta	One-bristle Everlasting		R	2	2001	Unlikely
Senecio megaglossus	Large-flower Groundsel	VU	E	2	1999	Unlikely

Aus: Australia (*Environment Protection and Biodiversity Conservation Act 1999*). SA: South Australia (*National Parks and Wildlife Act 1972*). Conservation codes: CE: Critically Endangered. EN/E: Endangered. VU/V: Vulnerable. R: Rare.

Source of Information

1. EPBC Act Protected Matters Report (data extraction 27/10/2015) – 10 km buffer applied to project area.
2. Biological Database of South Australia (data extract 9/9/2015) - 10 km buffer applied to project area.

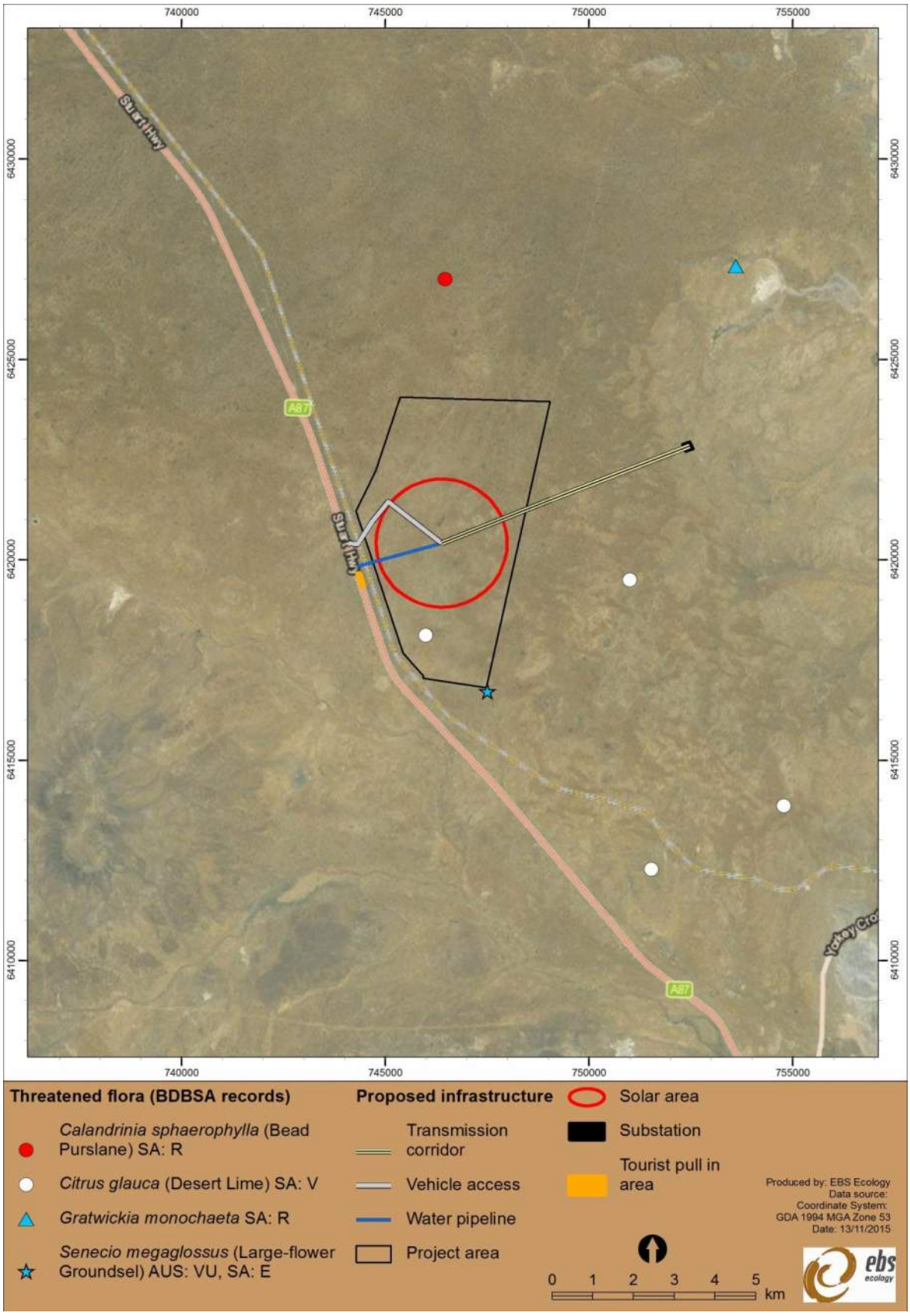


Figure 4. Threatened flora, 10 km BDBSA Database search buffer.

5.1.4 Threatened fauna

The Protected Matters search identified one nationally threatened species; Western Grasswren (*Amytornis textilis myall*), and one migratory species; Fork-tailed Swift (*Apus pacificus*), listed under the EPBC Act that have potential to occur within the Project area. The likelihood of occurrence of Western Grasswren in the Project area was downgraded following the two field surveys (see 6.3.1).

The BDBSA search identified two species which could potentially occur within the Project area; the White-browed Treecreeper (*Climacteris affinis*), State rare, and Blue-winged Parrot (*Neophema chrysostoma*), State vulnerable. The Blue-winged Parrot was observed within the Project area on the spring 2015 and winter 2017 surveys.

Table 5. Threatened fauna species potentially occurring within the project area.

Scientific name	Common name	Conservation status		Data Source	Last record (year)	Likelihood of occurrence within project area
		Aus	SA			
Amytornis textilis myall	Western Grasswren (Gawler Ranges)	VU		1	N/A	Unlikely
Apus pacificus	Fork-tailed Swift	Mi		1	N/A	Possible
Ardea ibis	Cattle Egret		R	1	N/A	Unlikely
Charadrius veredus	Oriental Plover	Mi		1	N/A	Unlikely
Climacteris affinis	White-browed Treecreeper		R	2	1965	Possible
Gallinago hardwickii	Japanese Snipe	Mi	R	1	N/A	Unlikely
Haliaeetus leucogaster	White-bellied Sea-Eagle		E	1	N/A	Unlikely
Hamirostra melanosternon	Black-breasted Buzzard		R	2	1991	Unlikely
Leipoa ocellata	Malleefowl	VU	V	1	N/A	Unlikely
Motacilla cinerea	Grey Wagtail	Mi		1	N/A	Unlikely
Motacillia flava	Yellow Wagtail	Mi		1	N/A	Unlikely
Neophema chrysostoma	Blue-winged Parrot		V	2	1991	Known
Pezoporus occidentalis	Night Parrot	EN	E	1	N/A	Unlikely
Pandion haliaetus	Osprey	Mi	E	1	N/A	Unlikely
Rostratula australis	Australian Painted Snipe	EN	V	1	N/A	Unlikely

Conservation status

Aus: Australia (Environment Protection and Biodiversity Conservation Act 1999). SA: South Australia (National Parks and Wildlife Act 1972). Conservation Codes: CE: Critically Endangered. EN/E: Endangered. VU/V: Vulnerable. R: Rare. ssp.: the conservation status applies at the sub-species level. Mi: listed as migratory under the EPBC Act. Ma: listed as marine under the EPBC Act.

Source of Information

1. **EPBC Act Protected Matters Report (data extraction 27/10/2015) – 10 km buffer applied to project area.**
2. **Biological Database of South Australia data extract (data extract 9/9/2015) - 10 km buffer applied to project area**

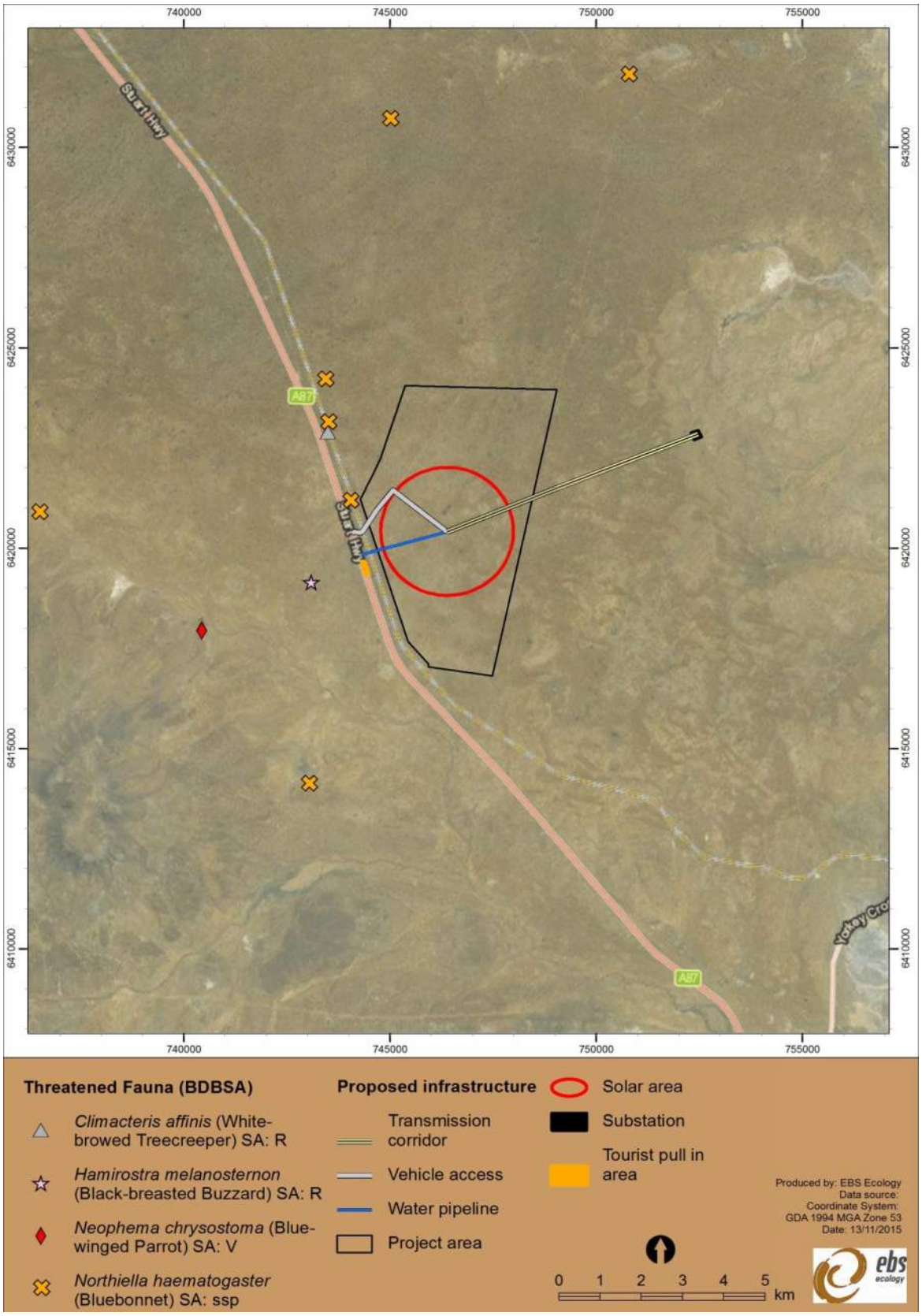


Figure 5. Threatened fauna, 10 km BDBSA search buffer

5.2 Field survey

5.2.1 Vegetation associations

Four vegetation associations were recorded within the Project area and footprint for associated infrastructure. The four vegetation associations were mapped over the 2487 ha Project area and assigned an SEB ratio condition score. Table 6 provides a summary; Figure 10 and Figure 11 show the distribution of the vegetation associations and condition across the area surveyed. The following section describes each vegetation association in more detail.

Table 6. Overall summary of vegetation associations and condition within the project area and associated infrastructure.

Vegetation association		Condition	Area
1	*Acacia papyrocarpa* (Western Myall) open woodland +/-*Myoporum platycarpum* ssp. *platycarpum* (False Sandalwood) +/-*Alectryon oleifolius* ssp. *canescens* (Bullock Bush) over *Maireana pyramidata* (Black Bluebush) / *Maireana sedifolia* (Bluebush).	4:1	3 ha
1	*Acacia papyrocarpa (Western Myall) open woodland +/- Myoporum platycarpum ssp. platycarpum (False Sandalwood) +/- Alectryon oleifolius ssp. canescens (Bullock Bush) over Maireana pyramidata (Black Bluebush) / Maireana sedifolia (Bluebush).*	6:1	916 ha
1	*Acacia papyrocarpa (Western Myall) open woodland +/- Myoporum platycarpum ssp. platycarpum (False Sandalwood) +/- Alectryon oleifolius ssp. canescens (Bullock Bush) over Maireana pyramidata (Black Bluebush) / Maireana sedifolia (Bluebush).*	8:1	1319 ha
2	*Maireana pyramidata (Black Bluebush) / Maireana sedifolia (Bluebush) shrubland.*	5:1	29 ha
2	*Maireana pyramidata* (Black Bluebush) / *Maireana sedifolia* (Bluebush) shrubland.	6:1	188 ha
3	*Atriplex vesicaria* (Bladder Saltbush) / *Maireana astrotricha* (Low Bluebush) / *Maireana pyramidata* (Black Bluebush) / *Tecticornia medullosa* mixed low shrubland.	7:1	16 ha
4	*Acacia aneura* (Mulga) open woodland	7:1	16 ha
	Grand Total		**2487 ha**

Vegetation Association 1. *Acacia papyrocarpa* (Western Myall) open woodland +/- *Myoporum platycarpum* ssp. *platycarpum* (False Sandalwood) +/- *Alectryon oleifolius* ssp. *canescens* (Bullock Bush) over *Maireana pyramidata* (Black Bluebush) / *Maireana sedifolia* (Bluebush).

Vegetation Association 1 was the dominant association over the Project area, covering 2238 ha (89.99% of the area surveyed) (Figure 6; Figure 10). This association occurred predominantly on sandy loam to clay soils and occasionally on sand dunes. There were a few low-lying areas with minor drainage lines over the Project area; however, no water was present in these areas at the time the survey was conducted.

The overstorey of Vegetation Association 1 was dominated by *Acacia papyrocarpa* (Western Myall). *Acacia papyrocarpa* were scatted throughout the association at varying densities, which were highest in the east of the Project area where *Maireana sedifolia* (Bluebush) dominated the midstorey. The dominant midstorey species altered between *Maireana pyramidata* (Black Bluebush) and *M. sedifolia*.

Vegetation Association 1 varied in condition from 4:1 (poor) to 8:1 (good) over the Project area (Figure 11). The area rated at 4:1 (3 ha) occurred around an existing stock water point. The south and west of the Project area, where there were low lying areas, dunes and areas of high stock activity, were rated at 6:1 (916 ha). Vegetation Association 1 occurred in its highest condition (8:1) in the north and east of the Project area (1319 ha). Weed abundance was low, with *Medicago polymorpha* var. *polymorpha* (Burr-medic) common in some areas, while other weeds such as *Marrubium vulgare* (Horehound) and *Emex australis* (Three-corner Jack) were scattered closer to access tracks and low lying areas.

A total of 81 flora species were recorded within Association 1, of which 70 were indigenous and 11 were introduced (Table 7). No flora species recorded were listed as conservation significance.

Table 7. Summary of vegetation association 1 - *Acacia papyrocarpa* (Western Myall) open woodland +/- *Myoporum platycarpum* ssp. *platycarpum* (False Sandalwood) +/- *Alectryon oleifolius* ssp. *canescens* (Bullock Bush) over *Maireana pyramidata* (Black Bluebush) / *Maireana sedifolia* (Bluebush).

Overstorey species	*Acacia papyrocarpa* (Western Myall), *Myoporum platycarpum* ssp. *platycarpum* (False Sandalwood), *Alectryon oleifolius* ssp. *canescens* (Bullock Bush)
Midstorey species	*Acacia burkittii (Pin-bush Wattle), Lycium australe (Australian Boxthorn), Acacia oswaldii (Umbrella Wattle), Maireana pyramidata* (Black Bluebush), *Maireana sedifolia* (Bluebush), *Templetonia egena* (Broombush Templetonia)
Understorey species	*Actinobole uliginosum* (Flannel Cudweed), *Aristida contorta* (Curly Wire-grass), *Atriplex vesicaria* (Bladder Saltbush), *Maireana georgei* (Satiny Bluebush), *Austrostipa* spp. (Spear Grass), *Gnephosis tenuissima* (Dwarf Golden-tip), *Ptilotus incanus/obovatus* (Silver Mulla Mulla)
Threatened species	*Neophema chrysostoma* (Blue-winged Parrot)
Declared weeds	*Emex australis* (Three-corner Jack), *Marrubium vulgare* (Horehound)
Conservation value	None
Vegetation condition	6:1 - 8:1

Figure 6. Vegetation Association 1, located at the centre of the proposed "Solar area" looking south.

Vegetation Association 2. *Maireana pyramidata* (Black Bluebush) / *Maireana sedifolia* (Bluebush) shrubland.

Vegetation Association 2 occurred to the south and west of the Project area and covered 217 ha (8.73% of the area surveyed) (Figure 7; Figure 10). The association was present upon sandy loam to clay soils. The association is a shrubland, with the dominant shrub species alternating between *M. pyramidata* and *M. sedifolia*. Scattered individuals of *A. papyrocarpa* and small groups of *Alectryon oleifolius* ssp. *canescens* (Bullock Bush) occurred over the association.

Vegetation condition was recorded as 6:1 (Good) (Figure 11), although weeds such as *M. polymorpha* var. *polymorpha* were common. Other weeds such as *Carthamus lanatus* (Saffron Thistle) and *Carrichtera annua* (Ward's Weed) were observed as scattered individuals and in small groups within Association 2.

A total of 45 flora species were recorded within Association 2, of which 34 were indigenous and 11 introduced.

Table 8. Summary of vegetation association 2 - *Maireana pyramidata* (Black Bluebush) / *Maireana sedifolia* (Bluebush) shrubland.

Overstorey species	*Acacia papyrocarpa* (Western Myall), *Myoporum platycarpum* ssp. *platycarpum* (False Sandalwood), *Alectryon oleifolius* ssp. *canescens* (Bullock Bush).
Midstorey species	*Maireana pyramidata* (Black Bluebush), *Maireana sedifolia* (Bluebush), Pimelea microcephala (Shrubby Riceflower).
Understorey species	*Atriplex vesicaria* (Bladder Saltbush), *Dissocarpus paradoxus* (Ball Bindyi), *Medicago polymorpha* var. *polymorpha* (Burr-medic), *Rytidosperma caespitosum* (Common Wallaby-grass)
Threatened species	None
Declared weeds	*Echium plantagineum* (Salvation Jane), *Emex australis* (Three-corner Jack), *Marrubium vulgare* (Horehound)
Conservation value	None
Vegetation condition	6:1

Figure 7. Representative photo of Vegetation Association 2.

Vegetation Association 3. *Atriplex vesicaria* (Bladder Saltbush) / *Maireana astrotricha* (Low Bluebush) / *Maireana pyramidata* (Black Bluebush) / *Tecticornia medullosa* mixed low shrubland.

Vegetation Association 3 occurred to the far east of the project area towards the end of the proposed transmission line and substation, and covered 16 ha (0.64% of the Project area (Figure 8; Figure 10). The association was present upon stony plains on clay / sandy soils with cracking clay and Gilgai's.

Vegetation condition was recorded as 7:1 (Good) (Figure 11) with weeds such as *C. lanatus*, *M. polymorpha* var. *polymorpha* and *Sisymbrium erysimoides* (Smooth Mustard) scattered in low densities (Table 9). A total of 36 flora species were recorded within Association 3, of which 31 were indigenous and five were introduced.

Table 9. Summary of vegetation association 3 - *Atriplex vesicaria* (Bladder Saltbush) / *Maireana astrotricha* (Low Bluebush) / *Maireana pyramidata* (Black Bluebush) / *Tecticornia medullosa* mixed low shrubland.

Overstorey species	None
Midstorey species	None
Understorey species	*Atriplex vesicaria* (Bladder Saltbush), *Tecticornia medullosa*, *Maireana astrotricha* (Low Bluebush), *Sclerolaena brachyptera* (Short-wing Bindyi)
Threatened species	None
Declared weeds	None
Conservation value	None
Vegetation condition	7:1

Figure 8. Representative photo of Vegetation Assocation 3.

Vegetation Association 4. *Acacia aneura* (Mulga) open woodland.

Vegetation Association 4 occurred on a sandy, low dune rise in the south east of the Project area and covered 16 ha (0.64% of the area surveyed) (Figure 9; Figure 10).

Vegetation condition was recorded as 7:1 (Good) (Figure 11) due to a low level of weed invasion. Weeds present included *M. polymorpha* var. *polymorpha*, which were common, and *C. lanatus* and *E. australis*, which were scattered over the extent of the association.

A total of 22 flora species were recorded within Association 4, which included 17 native and five introduced species (Table 10).

Table 10. Summary of vegetation association 4. *Acacia aneura* (Mulga) open woodland.

Overstorey species	*Acacia aneura* (Mulga), *Myoporum platycarpum* ssp. *platycarpum* (False Sandalwood)
Midstorey species	*Maireana pyramidata* (Black Bluebush), *Maireana sedifolia* (Bluebush)
Understorey species	*Medicago polymorpha* var. *polymorpha* (Burr-medic),*Austrostipa* spp (Spear Grass), *Gnephosis tenuissima* (Dwarf Golden-tip)
Threatened species	None
Declared weeds	*Emex australis* (Three-corner Jack)
Conservation value	None
Vegetation condition	7:1

Figure 9. Representative photo of Vegetation Association 4.

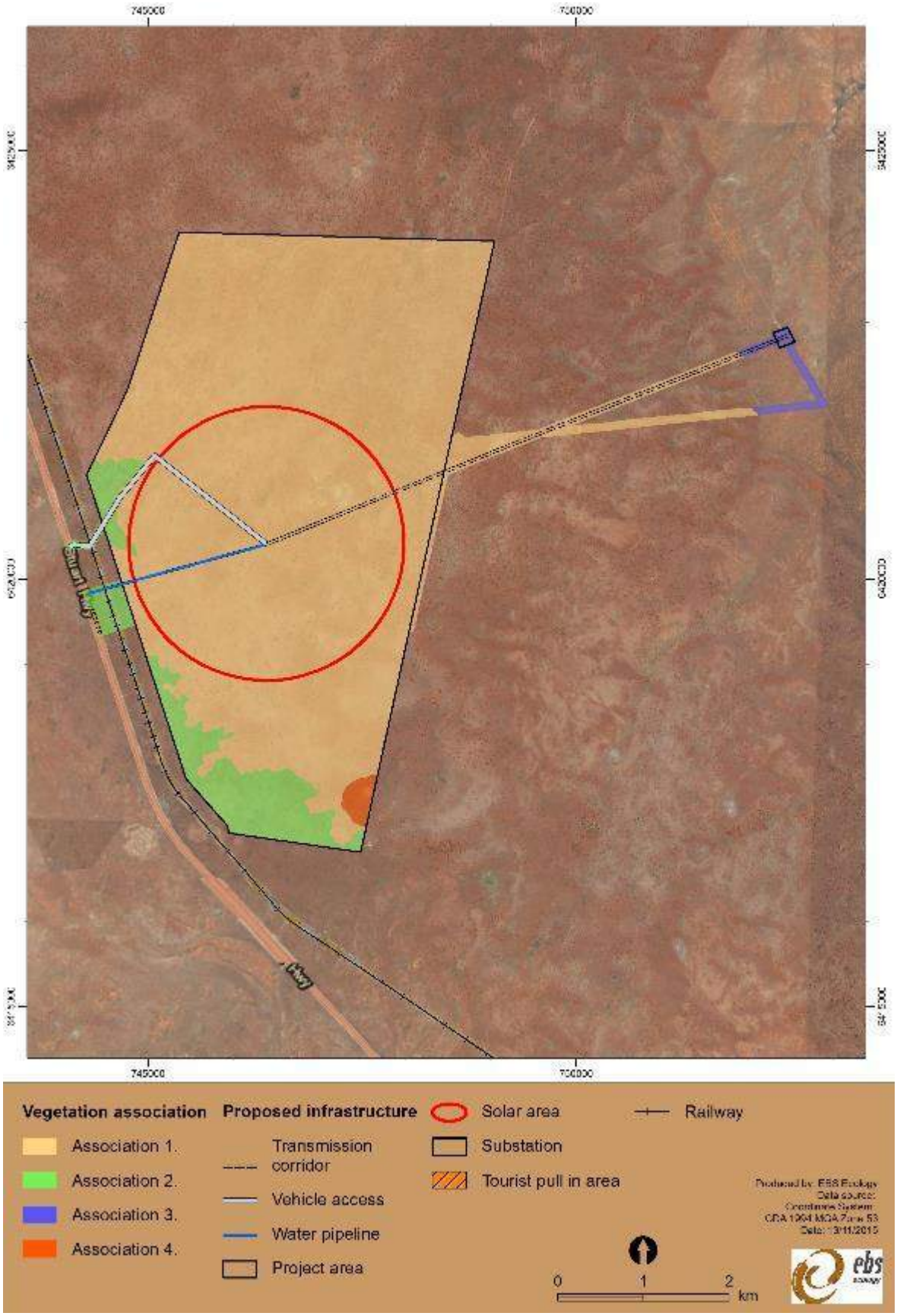


Figure 10.Vegetation Associations recorded within the project area and footprint of associated infrastructure.

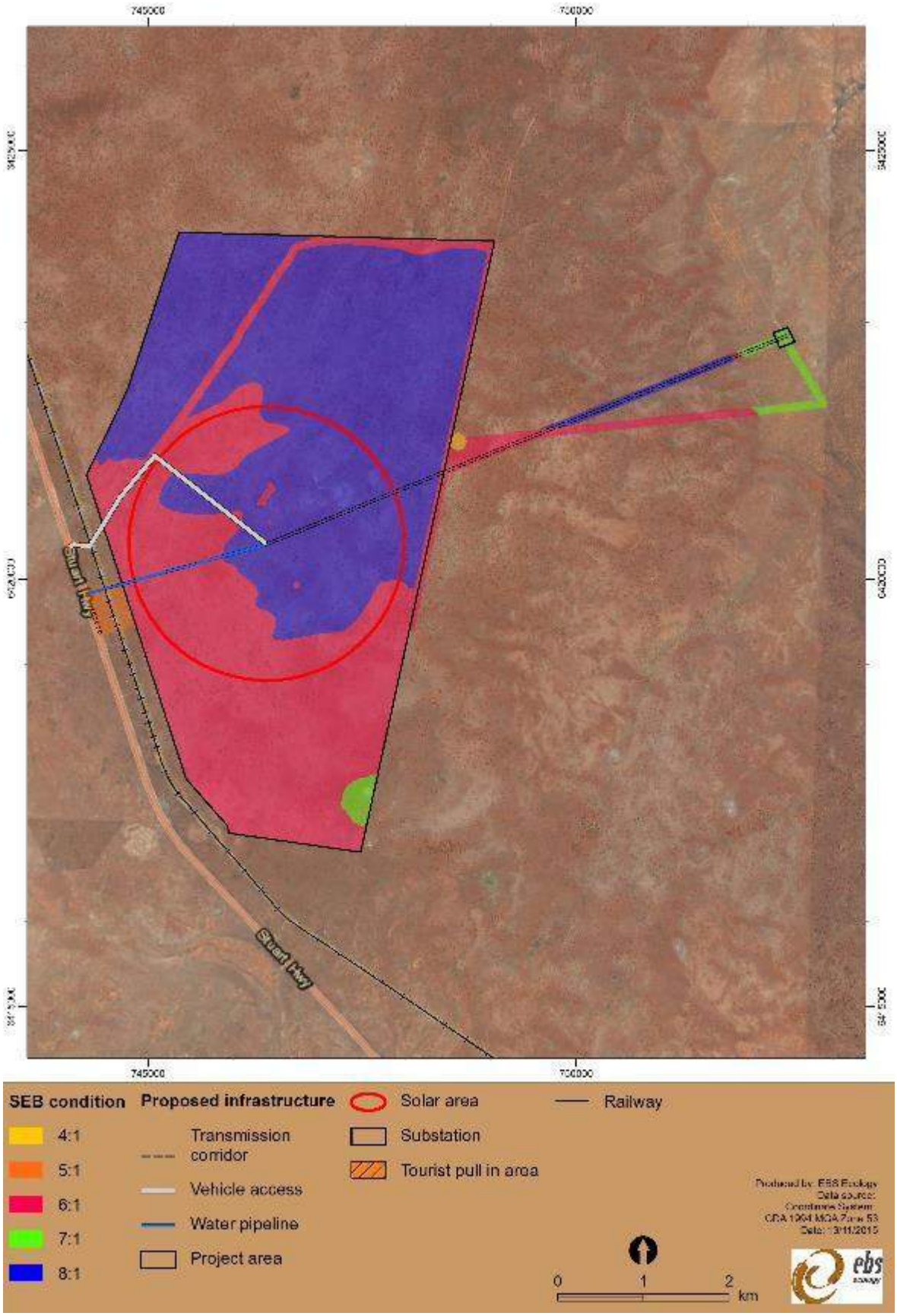


Figure 11.Vegetation condition recorded within the project area and footprint of associated infrastructure.

5.2.2 Flora

Spring 2015

A total of 92 flora species were identified within the proposed Solar Farm development, including 79 indigenous species and 13 introduced species (Appendix 3). No species identified were listed under the EPBC Act or the NPW Act.

Weeds were scattered at varying densities over the Project area. High densities of weeds were recorded in disturbance areas, such as access tracks, locations of high grazing intensity, rail line, low lying areas and dunes. The most common weed species observed was *M. polymorpha* var. *polymorpha*, which occurred in high densities in areas of high grazing.

Three weed species, which are declared under the *Natural Resources Management Act 2004*, *Echium plantagineum* (Salvation Jane), *Marrubium vulgare* (Horehound), and *E. australis*. *Echium plantagineum* were observed near the rail line in low densities. *Marrubium vulgare* was observed at low to medium densities, around the perimeter of low lying areas which have been subjected to seasonal water logging. *Emex australis* was observed scattered around the edge of vehicle access tracks. An additional declared weed species; *Cenchrus ciliaris* (Buffel Grass) was recorded outside of the Project area, within the rail line corridor.

Targeted survey for threatened species

None of the three targeted threatened species; *F. plicata*, *C. sphaerophylla* and *C. glauca*, were recorded over the winter 2017 survey.

5.2.3 Fauna

Birds

Project area

A total of 42 bird species were recorded over the Project area during the winter 2017 survey (Appendix 4). The most species richness families were Acanthizidae (Australasian warblers) and Meliphagidae (honeyeaters) with five species, respectively. The most abundant species on site were Southern Whiteface (*Aphelocephala leucopsis*) (61 individuals), White-browed Babbler (*Pomatostomus superciliosus*) (42 individuals) and the White-winged Fairywren (*Malurus leucopterus*) (40 individuals).

The spring 2015 survey recorded 48 species, of which 33 were also recorded in winter 2017 (Appendix 4). Nine species were observed in winter 2017, which had previously not been recorded in spring 2015.

There were no species listed under the EPBC Act recorded during the spring 2015 and winter 2017 surveys. The Blue-winged Parrot (*Neophema chrysostoma*), which is listed under the NPW Act as vulnerable was observed during both the spring 2015 and winter 2017 surveys. This species was observed foraging on *M. pyramidata* seed in winter 2017.

Point Count Sites

A total of 107 birds from 18 species were recorded across six point count sites (Table 11). The Spiny-cheeked Honeyeater (*Acanthagenys rufogularis*) and Singing Honeyeater (*Gavicalis virescens*) were recorded at the greatest number of sites (four sites). The most abundant species were the White-browed Babbler (*Pomatostomus superciliosus*) (19 individuals), Southern Whiteface (16 individuals) and Singing Honeyeater (12 individuals).

Table 11. The number of individuals of each bird species observed at the six point count sites over the Project area.

Scientific Name	Common Name	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Grand Total
Acanthagenys rufogularis	Spiny-cheeked Honeyeater	5		1	2		2	10
Acanthiza uropygialis	Chestnut-rumped Thornbill				4			4
Anthus australis	Australian Pipit		3			2	1	6
Aphelocephala leucopsis	Southern Whiteface	2		8		6		16
Cacomantis pallidus	Pallid Cuckoo	1						1
Colluricincla harmonica	Grey Shrikethrush			2				2
Daphoenositta chrysoptera	Varied Sittella	4						4
Epthianura albifrons	White-fronted Chat					6		6
Epthianura aurifrons	Orange Chat					2		2
Gavicalis virescens	Singing Honeyeater	3		6	1		2	12
Malurus lamberti	Variegated Fairywren				2			2
Malurus leucopterus	White-winged Fairywren				3	5		8
Malurus splendens	Splendid Fairywren				5			5
Microeca fascinans	Jacky Winter	1						1
Northiella haematogaster	Bluebonnet						3	3
Petroica goodenovii	Red-capped Robin				4			4
Pomatostomus superciliosus	White-browed Babbler	8		11				19
Psephotus varius	Mulga Parrot			2				2
Grand Total		**24**	**3**	**30**	**21**	**21**	**8**	**107**

Wedge-tailed Eagle nest checks

Two Wedge-tailed Eagle nests were identified in spring 2015. Nest 2 was determined to be recently active in spring 2015, due to the presence of droppings, considered to be less than a month old. Nest 1 was not active in spring 2015. The two nests were re-investigated in winter 2017 to determine their condition and whether they were active. Neither of the two nests were active in winter 2017; however, Nest 2 remained in good condition (Table 12).

Table 12. Wedge-tailed Eagle nest condition and activity

Nest #	Height (m) in tree	Diameter (m)	Depth (m)	Nest Material	White Wash	Intact/dilapidated	Condition	Active/not active
1	4	1	0.5	Absent	Absent	Intact	Poor	Not active
2	5	1.4	0.75	Absent	Absent	Intact	Good	Not active

Mammals

Two native mammal species were observed in winter 2017; the Western Grey Kangaroo (*Macropus fuliginosus*) and Red Kangaroo (*Macropus rufus*). Western Grey Kangaroos were abundant across the Project area, with 30 individuals recorded (Appendix 4). The Red Kangaroo was irregularly observed, with two individuals recorded. Both macropod species were also observed in spring 2015; however, Red Kangaroos observed in greater numbers (Appendix 4). Two Euros (*Macropus robustus*) were observed in spring 2015; however, were not recorded in winter 2017. None of the native mammals species observed are listed under the EPBC Act or the NPW Act.

Introduced grazers, both feral and domestic, are present within the Project area. The Project area was grazed by domestic sheep (*Ovis aries*) during both the spring 2015 and winter 2017 surveys. The abundance of feral goats (*Capra hircus*) was significantly higher in winter 2017, with approximately 200 individuals observed at a water point. In contrast, four feral goats were observed during the spring 2015 surveys. There were no observations of European rabbits (*Oryctolagus cuniculus*) in winter 2017; however, two individuals and scats were present in spring 2015.

The Red Fox (*Vulpes vulpes*) was recorded in the Project area in the spring 2015 and winter 2017 surveys. An individual has not been observed; however, scats were recorded in spring 2015 and tracks were identified in winter 2017.

Reptiles

One reptile species, the Sleepy Lizard (*Tiliqua rugosa*) was observed during the winter 2017 survey. An additional, three species were observed in spring 2015: Central Bearded Dragon (*Pogona vitticeps*), Crested Dragon (*Ctenophorus cristatus*) and Gould's Goanna (*Varanus gouldii*). None of the reptile species observed are listed under the EPBC Act or NPW Act.

6 DISCUSSION

6.1 Vegetation associations and condition

The Project footprint overlaps with the following three associations:

- Vegetation Association 1 - *Acacia papyrocarpa* (Western Myall) open woodland +/- *Myoporum platycarpum* ssp. *platycarpum* (False Sandalwood) +/- *Alectryon oleifolius* ssp. *canescens* (Bullock Bush) over *Maireana pyramidata* (Black Bluebush) / *Maireana sedifolia* (Bluebush);
- Vegetation Association 2 - *Maireana pyramidata* (Black Bluebush) / *Maireana sedifolia* (Bluebush) shrubland; and
- Vegetation Association 3 - *Atriplex vesicaria* (Bladder Saltbush) / *Maireana astrotricha* (Low Bluebush) / *Maireana pyramidata* (Black Bluebush) / *Tecticornia medullosa* mixed low shrubland.

All three vegetation associations are described as being reasonably conserved within the Eyre Peninsula and Western Pastoral Environmental Provinces (Neagle 1995).

The condition of vegetation within the Project footprint varies from moderate to good. . A total of 435.41 ha (53.56%) occurs over vegetation in good condition (7:1 – 8:1), while 377.53 ha (46.44%) occurs over vegetation in moderate condition (5:1 – 6:1).

6.2 Flora

A total of 92 flora species were recorded during the spring 2015 field survey, which included 13 exotic species. All vegetation associations exhibited a degree of weed invasion (see section 6.2.2 for further information in regards to weeds) and damage from stock grazing. Grazing pressure was observed mainly occurring on annual flora species with high pressure observed around stock water points.

Appendix 1 summarises the flora species recorded in each of the four vegetation associations (including exotic species). No flora species of national or state conservation significance were recorded during the two flora surveys (see 6.2.1).

6.2.1 Threatened Species

Frankenia plicata (Braided Sea-heath) – Endangered (EPBC Act), Vulnerable (NPW Act)

Frankenia plicata is listed as endangered under the EPBC Act and vulnerable under the NPW Act. The species is endemic to South Australia, with its distribution extending north of Port Augusta along the Stuart Highway to the Northern Territory border and from Port Augusta north-east to Marree. *Frankenia plicata* grows in a range of habitats, including on small hillside channels, which take the first run-off after rain (EPBC 2008).

The targeted survey did not record *F. plicata* nor any common *Frankenia* species. *Frankenia* species may be grazed by stock. Therefore, given the history of overgrazing within the Project area and the

results of the two flora surveys, where no individuals were observed, it is unlikely that this species occurs within the Project area.

Calandrinia sphaerophylla (Bead Purslane) – Rare (NPW Act)

Calandrinia sphaerophylla is listed as rare under the NPW Act. The species is endemic to South Australia and is located on the Nullabor and Eyre Peninsula. *Calandrinia sphaerophylla* inhabits *A. papyrocarpa* woodland and saltbush plains, where it grows on red sandy clay soils.

The targeted survey did not record *C. sphaerophylla* nor any common *Calandrinia* species. *Calandrinia* species are known to be heavily grazed by sheep. Therefore, given the history of overgrazing within the Project area and that no individuals were observed over the two flora surveys, it is unlikely that this species occurs within the Project area.

Citrus glauca (Desert Lime) – Vulnerable (NPW Act)

Citrus glauca is listed as vulnerable under the NPW Act. The species is a small, thorny shrub that is distributed in South Australia, New South Wales and Queensland. In South Australia, the species occurs north of Port Augusta and south of Lake Torrens. *Citrus glauca* is an uncommon species found in sandy *A. papyrocarpa* woodland areas.

The preferred habitat and locations of previous BDBSA records of *C. glauca* were searched. The BDBSA record of *C. glauca*, which falls within the Project area, has a spatial accuracy of 10 km and was observed in 1965. Therefore, this record indicates their local presence rather than occurrence within the Project area. The species was also recorded approximately 5 km from the Project area in 1993. *Citrus glauca* is a conspicuous species and therefore, if it were to be present within the Project area it would have been recorded over the past two flora surveys.

6.2.2 Weeds

The three declared weed species observed within the Project area predominantly occurred within existing disturbance areas such as vehicle tracks and areas of grazing. These species have potential for further expansion in their area of occupancy within the Project area. For example, the thorny fruit from *E. australis* became lodged in vehicle tyres in spring 2015, after driving through infected areas. The thorny fruit were removed from tyres with hand tools.

The declared weed species, *C. ciliaris* was observed in the rail corridor adjacent to the Project area. Management of this species should be considered in the Construction Environment Management Plan (CEMP), as it has the potential to spread throughout the Project area during and following construction.

6.3 Fauna

6.3.1 Threatened species

Western Grasswren (Amytornis textilis myall) – Vulnerable (EPBC Act)

The Western Grasswren is listed as Vulnerable under the EPBC Act. The species is distributed over north-eastern Eyre Peninsula, where it primarily occurs along drainage lines. Western Grasswrens

predominantly occur in shrublands dominated by *M. pyramidata* and *Lycium australe* (Australian Boxthorn), as well as low *A. papyrocarpa* woodlands (Black *et al.* 2011). Therefore, while the distribution of the species does not overlap with the Project area, potentially suitable habitat was considered to be present. The species is considered unlikely to be present within the Project area, as the distribution of the species does not overlap with and the Project area, and the species has not been observed over the two fauna surveys following extensive search effort.

Fork-tailed Swift (Apus pacificus) – Migratory (EPBC Act)

The Fork-tailed Swift is listed as migratory under the EPBC Act. The species is a non-breeding visitor to Australia, migrating from its breeding grounds which extend from northern India to western Russia. The species is more common in coastal and sub-coastal areas,; however, regularly occurs in inland Australia. Fork-tailed Swifts are nearly exclusively aerial in Australia and fly over a wide range of habitats, including open plains, forests and cities (Pizzey and Knight 2007; ALA 2017; DotE 2017). Therefore, it is possible that the species can occur flying over the Project area.

Blue-winged Parrot (Neophema chrysostoma) – Vulnerable (NPW Act)

The Blue-winged Parrot is listed as vulnerable under the NPW Act. The species is distributed over south-eastern Australia during the non-breeding season. Blue-winged Parrots migrate during the non-breeding season (March – October) and their range extends inland and to the Eyre Peninsula (Pizzey and Knight 2007). As the species was observed in the Project area in late October 2015, their breeding range may extend to the Port Augusta region.

Blue-winged Parrots inhabit mulga, open woodland and chenopod shrublands, and therefore, suitable habitat occurs over the entire Project area. A male and two female Blue-winged Parrots were observed in the Project area in winter 2017 foraging upon the seed of *M. pyramidata*, a shrub species well distributed over the Project area. The hollows in *A. papyrocarpa* could provide suitable nesting locations.

White-browed Treecreeper (Climacteris affinis) – Rare (NPW Act)

The White-browed Treecreeper is listed as Rare under the NPW Act. The species is well distributed across the arid and semi-arid zone in central and southern Australia (Pizzey and Knight 2007). Within its distribution, the White-browed Treecreeper inhabits tall shrubland and woodland, which are dominated by acacia, casuarina or cypress-pines (Radford 2002). The structure and floristics of understorey vegetation may be of low importance to the species, as it may inhabit open areas dominated by grasses as well as closed areas dominated by shrubs (Radford 2002). The habitat within the Project area is therefore suitable for White-browed Treecreepers. A BDBSA record of the species from 1965 adjacent to the Project area may have high spatial uncertainty; however, would suggest that the species was locally present. While the species has not been observed over the two fauna surveys, this species is still considered to potentially occur.

6.3.2 Birds overview

The variations between species lists recorded in spring 2015 and winter 2017 were primarily due to the presence and/or absence of transient and nomadic species, e.g. Woodswallows (*Artamus spp.*),

Rainbow Bee-eaters (*Merops ornatus*) and Budgerigars (*Melopsittacus undulatus*). Nomadic and transient species comprise a large proportion of the bird community in the arid zone (Reid and Gillen 2013). The distribution of nomadic and transient species is highly variable, driven by food productivity and landscape features (Reid and Gillen 2013). As such, their presence and/or absence can greatly influence bird abundances and species diversity over the Project area.

The hollows present within *A. papyrocarpa* are expected to be utilised by a range of hollow nesting species, such as parrots, treecreepers and nightjars. Bluebonnets (*Northiella haematogaster*) were observed feeding chicks located within an *A. papyrocarpa* hollow during the fauna survey.

Passerines were also identified to be nesting in the Project area. Old nests, considered to have been constructed by medium-sized passerines, such as Spiny-cheeked Honeyeaters (*Acanthagenys rufogularis*), Singing Honeyeaters (*Lichenostomus virescens*) and White-browed Babblers (*Pomatostomus superciliosus*) were found to be in high densities within dense stands of *A. papyrocarpa* and *A. aneura* within the Project area. Furthermore, White-fronted Chats (*Epthianura albifrons*) were performing their 'broken-wing display' to divert the attention of the observer from their nests located nearby within *M. sedifolia*.

6.3.3 Wedge-tailed Eagle nest buffers

The Wedge-tailed Eagle is not a species of conservation concern in South Australia; however, it is considered to be a flagship species. As such, efforts are made to ensure that development does not adversely impact the species. One such measure, is the establishment of nest buffers. Spatial buffers have been established for raptor species worldwide to mitigate the adverse impact of disturbance on nest success (USFS 2011).

In Tasmania, a buffer of between 500-1000 m was applied to nests of the endangered Tasmanian subspecies of the Wedge-tailed Eagle (*Aquila audax fleayi)* when conducting forestry operations during the breeding season. The majority of nests for *A. audax fleayi* occur in eucalypt forests with a closed canopy (Bell and Mooney 1998).

In comparison, the mainland species (*Aquila audax audax*) is not as restricted in its nesting preference and breeds in open woodland and forested land. Therefore, a 500 m nest buffer is regularly prescribed for mainland Wedge-tailed Eagles (G. Carpenter - DEWNR pers. comm. 2011).

It is recommended that the minimum 500 m buffer be applied to the two Wedge-tailed Eagle nest locations within the Project area, as breeding pairs often switch between multiple nest sites within their territory from one year to the next.

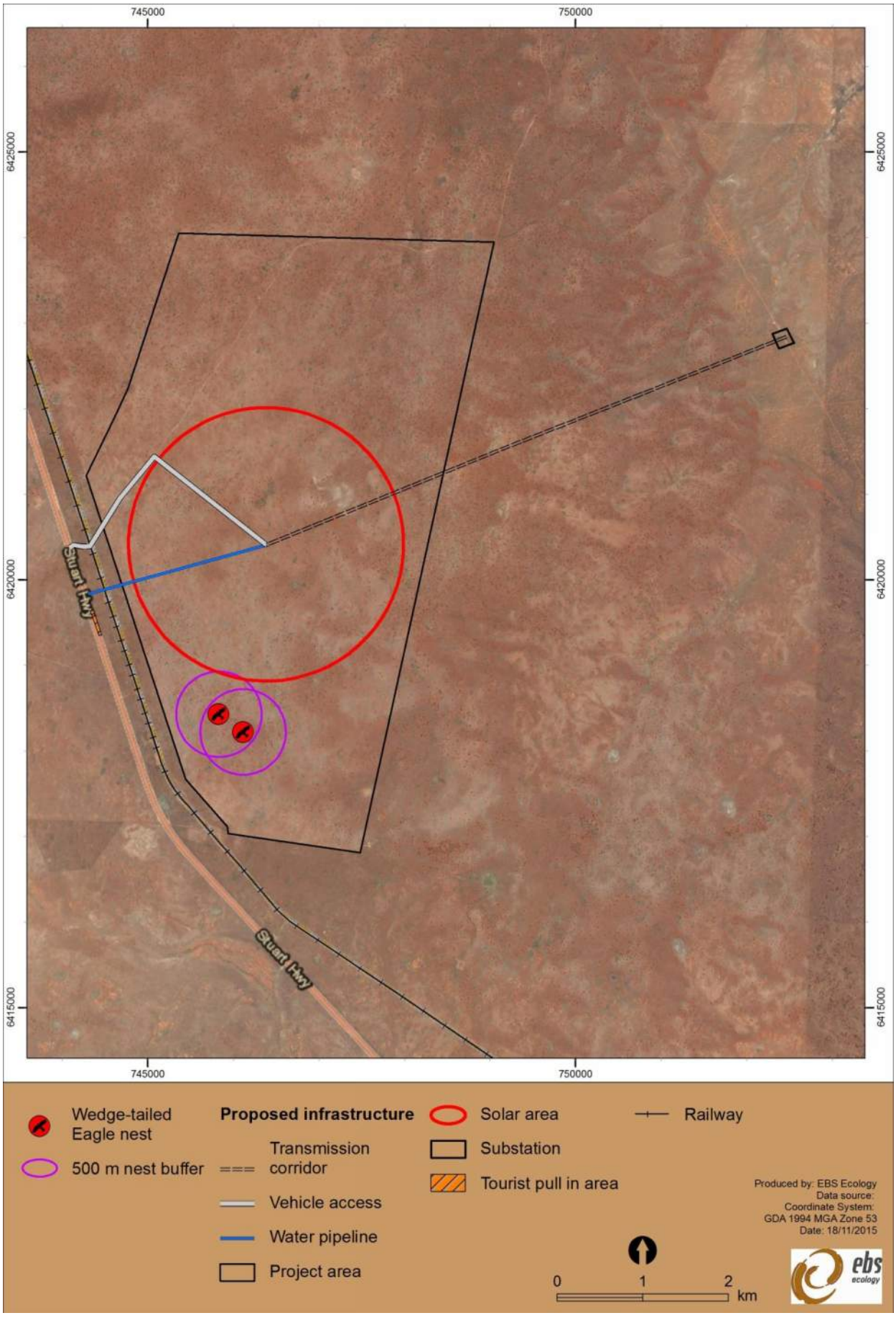


Figure 12. Wedge-tailed Eagle nest buffers (500 m) with respect to the development footprint.

6.3.4 Reptiles overview

Four species of reptile were positively identified during the two fauna surveys; however, a further two species of *Ctenotus* sp. (Stiped skink) were observed in spring 2015 but not formally identified. Targeted reptile trapping over the Project area was not performed, and therefore, it would be expected that the true diversity of reptiles present would be significantly higher than that recorded during the fauna survey. None of the species recorded or identified in the desktop assessment are listed under the EPBC Act or NPW Act.

6.3.5 Mammals overview

A total of three feral mammal species were recorded over the two fauna surveys: the fox, the European Rabbit and the Feral Goat. There was no evidence of the ubiquitous Feral Cat (*Felis catus*)*;* however, this species is likely to be present if not common on the site.

Targeted mammal surveys were not performed, and therefore, only three macropod species, which are highly conspicuous, were observed. It would be expected that a suite of microbats species would utilise the woodland habitat, roosting within the hollows and crevices of old-growth *A. papyrocarpa*. In addition to this, native rodents and Dasyurids may be present; however, this could only be confirmed with trapping. None of the mammal species identified in the desktop assessment are considered to potentially occur within the Project area.

7 SIGNIFICANT ENVIRONMENTAL BENEFIT

7.1 What is a significant environmental benefit (SEB)

The project area is situated within area subject to the *Native Vegetation Act 1991* and *Regulations 2003*. An assessment against the Native Vegetation Clearance Principles is not required as the clearance is considered to comply with *Exemption 5 (1)(d) Building or provision of infrastructure including infrastructure in the public interest.*

Even if the native vegetation clearance falls under an exemption, approval for native vegetation clearance is generally conditional on providing a significant environmental benefit (SEB). An SEB can be achieved through several options including:

- managing and/or formally protecting an area of native vegetation for conservation purposes (Heritage Agreement)
- undertaking a revegetation program on the site of the operation or within the same region of the State or alternatively
- making a payment into the Native Vegetation Fund.

The primary aim of the SEB is to achieve a net environmental gain, which contributes to improving the biodiversity values of the region, rather than simply off-setting the vegetation clearance.

7.2 Clearance specifications comments

The following are the clearance areas used to calculate the SEB calculations in section 7.3 (Table 13).

Table 13. Infrastructure clearance specifications.

Infrastructure type	Specifications	Clearance area (hectares)	Comment
Solar Heliostat collector field	1.6 km radius	806 ha	
Access track	3.2 km	-	No SEB calculated for access track. 1.6km occurs within the existing track located at the north east, remaining 1.6 km occurs within the Solar field area.
Underground water pipeline	4 m wide, 2.15 km length	0.15 ha	1.6 km occurs within the Solar field area.
Overhead transmission line	4m wide access track, 6.5 km length, 10m^2 area for each pole, a pole is required every 300 m - 400 m	2.1ha	1.6 km occurs within the Solar field area. Estimated 16 poles.
Substation	107 m x 186 m	3.38 ha	
Public viewing platform	39.5 m x 303 m	1.14 ha	

7.3 SEB Calculations

If the proposed development is to progress, clearance of remnant native vegetation will be required. The following section calculates the area and the possible payments that would be required to offset the removal of the remnant native vegetation in the development area.

The SEB requirements for remnant vegetation clearance within the development area were calculated based on the Native Vegetation Council (NVC) policy document *Guidelines for a Native Vegetation Significant Environmental Benefit Interim Policy* (DWLBC 2005).

Approximately 812.93 ha of native vegetation is required to be cleared for the Solar Farm development.

All native vegetation within the project was considered as patches of intact or degraded remnant vegetation (as opposed to scattered trees). The SEB offset area for vegetation patches is derived by multiplying the clearance area by the appropriate SEB ratio. The ratio is assigned according to the condition of the vegetation proposed for clearance as per Table 2.

Should a payment into the Native Vegetation Fund be the preferred option by GHD to satisfy the required SEB, the following formula is utilised to convert required set-aside area into dollar value:

Formula for calculating SEB payment into Native Vegetation Fund =

(land value[1] per ha x required SEB in ha) + (management fee per ha[2] x area cleared)

[1] Land value (Clearance occurs on pastoral land outside Local Governments Area) = $20 (as indicated by the Native Vegetation Management Unit).

[2] Management fee = $800 per ha (flat rate calculated by the Native Vegetation Council)

Should native vegetation within the proposed Solar Farm project area require clearance, the maximum SEB offset requirement is: **5743.5 ha** or **$765,215.64** payment into the Native Vegetation Fund (Table 14).

Table 14. Clearance and SEB calculation details.

Infrastructure	SEB ratio	Total Estimated Clearance (ha)	Management fee ($)	Land Value per ha ($)	Required SEB (ha)	SEB payment into NV Fund ($)
Solar field	8:1	430.67	$800	$20	3445.36	413,443.20
Solar field	6:1	375.49	$800	$20	2252.94	345,450.80
Water pipeline (proportion outside the solar area)	5:1	0.15	$800	$20	0.75	135.00
Transmission route (5m wide access track and 10 m^2 poles) (proportion outside the solar area)	6:1	0.75	$800	$20	4.49	688.16
Transmission route (5m wide access track and 10 m^2 poles) (proportion outside the solar area)	7:1	0.23	$800	$20	1.62	218.08
Transmission route (5m wide access track and 10 m^2 poles) (proportion outside the solar area)	8:1	1.125	$800	$20	8.94	1080
Public viewing area	5:1	1.14	$800	$20	5.76	1,026.00
Substation	7:1	3.38	$800	$20	23.64	3,174.40
Total		**812.93ha**			**5743.50ha**	**$765,215.64**

8 RECOMMENDATIONS

The following recommendations have been made to mitigate the impacts of the development of the proposed Aurora Solar Power Project on native vegetation, native species and ecological communities / habitat occurring within the project area:

- Buffer known Wedge-tailed Eagle nests by 500 m;
- Develop a weed hygiene standard operation procedure specific to the site conditions;
- Seek approval from the NVC regarding any vegetation clearance that is required. All native vegetation within the project area is protected by the *Native Vegetation Act 1991* and any proposed clearance will need to be assessed against native vegetation principles (unless under exemption). A clearance application to the Native Vegetation Council is required if the proposed infrastructure involves the clearance of native vegetation not covered by exemptions;
- Undertake construction during times when woodland species are not nesting within the project area;
- Construction Environmental Management Plan (CEMP);
- Best practice environmental management measures;
- Staff training and awareness;
- On-going monitoring.

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10 APPENDICES

Appendix 1. Point Count Locations

Point Count Site	Vegetation Association	53 H	
		Easting	Northing
1	1	746670	6423777
2	3	746631.1	6422033
3	1	748459	6421231
4	1	748086.7	6419524
5	2	746099.5	6417282
6	1	745038.1	6421819

Appendix 2. Wedge-tailed Eagle Nest Locations

Nest ID	53 H	
	Easting	Northing
1	746114	6418221
2	745832	6418428

Appendix 3. Flora species observed within the project area.

Scientific Name	Common Name	Conservation status		Vegetation association			
		Aus	SA	1	2	3	4
Acacia aneura	Mulga			✓			✓
Acacia burkittii	Pin-bush Wattle			✓			✓
Acacia oswaldii	Umbrella Wattle			✓			✓
Acacia papyrocarpa	Western Myall			✓	✓		
Acacia victoriae	Elegant Wattle			✓	✓		✓
**Acetosa vesicaria*	Rosy Dock				✓		
Actinobole uliginosum	Flannel Cudweed			✓	✓	✓	✓
**Aira caryophyllea*	Silvery Hair-grass			✓		✓	✓
**Aira* sp.	Hair-grass			✓	✓		
Alectryon oleifolius ssp. *canescens*	Bullock Bush			✓	✓		✓
Amyema quandang var. *quandang*	Grey Mistletoe			✓			
Aristida contorta	Curly Wire-grass			✓	✓	✓	✓
Atriplex holocarpa	Pop Saltbush					✓	
Atriplex vesicaria	Bladder Saltbush			✓	✓	✓	
Austrostipa elegantissima	Feather Spear-grass			✓	✓		
Austrostipa nitida	Balcarra Spear-grass			✓	✓	✓	✓
Austrostipa nodosa	Tall Spear-grass			✓	✓	✓	✓
Austrostipa scabra group	Falcate-awn Spear-grass			✓	✓		
Brachyscome sp.	Native Daisy			✓			
Bromus sp.	Brome			✓		✓	
Callitris glaucophylla	White Cypress-pine			✓			
Calotis hispidula	Hairy Burr-daisy			✓			
**Carrichtera annua*	Ward's Weed			✓	✓	✓	✓
**Carthamus lanatus*	Saffron Thistle			✓	✓	✓	✓
Centipeda cunninghamii	Common Sneezeweed			✓			
Centipeda thespidioides	Desert Sneezeweed			✓			
Chenopodium nitrariaceum	Nitre Goosefoot			✓			

Scientific Name	Common Name	Conservation status		Vegetation association			
		Aus	SA	1	2	3	4
Chrysocephalum sp.	Everlasting			✓			
**Citrullus colocynthis*	Colocynth			✓	✓		
Convolvulus remotus	Grassy Bindweed			✓		✓	
Crassula colorata	Dense Crassula			✓			
**Cucumis* sp.	Melon			✓	✓		
Cullen sp.	Scurf-pea			✓			
Dissocarpus paradoxus	Ball Bindyi			✓	✓	✓	
Dodonaea viscosa ssp. *spatulata*	Sticky Hop-bush			✓	✓		
***Echium plantagineum*	Salvation Jane				✓		
***Emex australis*	Three-corner Jack			✓	✓		✓
Enchylaena tomentosa	Ruby Saltbush			✓			
Enneapogon avenaceus	Common Bottle-washers			✓	✓	✓	
Eremophila longifolia	Weeping Emubush			✓			
Eriochloa australiensis	Australian Cupgrass			✓			
Euphorbia drummondii				✓	✓	✓	
Exocarpos aphyllus	Leafless Cherry			✓			
Gnephosis tenuissima	Dwarf Golden-tip			✓			
Gunniopsis sp.	Pigface					✓	
Hakea leucoptera ssp. *leucoptera*	Silver Needlewood			✓			
Leiocarpa sp.	Plover-daisy			✓	✓		
Lepidium phlebopetalum	Veined Peppercress			✓	✓	✓	✓
**Limonium lobatum*	Winged Sea-lavender			✓			
Lycium australe	Australian Boxthorn			✓	✓		
Maireana appressa	Pale-fruit Bluebush					✓	
Maireana astrotricha	Low Bluebush					✓	
Maireana georgei	Satiny Bluebush			✓	✓	✓	
Maireana integra	Entire-wing Bluebush					✓	
Maireana pyramidata	Black Bluebush			✓	✓		✓
Maireana sedifolia	Bluebush			✓		✓	✓
Maireana spongiocarpa	Spongy-fruit Bluebush			✓	✓	✓	
***Marrubium vulgare*	Horehound			✓	✓		
Marsilea drummondii	Common Nardoo			✓			
**Medicago polymorpha* var. *polymorpha*	Burr-medic			✓	✓	✓	✓
Minuria cunninghamii	Bush Minuria			✓	✓	✓	
Myoporum platycarpum ssp. *platycarpum*	False Sandalwood			✓	✓		✓
Oxalis perennans	Native Sorrel			✓			
Pimelea microcephala	Shrubby Riceflower			✓	✓		
Pimelea simplex	Desert Riceflower			✓			
Pittosporum angustifolium	Native Apricot			✓	✓		✓
Plantago drummondii	Dark Plantain			✓		✓	
Polycalymma stuartii	Poached-egg Daisy			✓			✓
Portulaca sp.	Purslane			✓	✓	✓	
Pterocaulon sp.	Apple-bush			✓	✓		
Ptilotus incanus / obovatus	Silver Mulla Mulla			✓			✓
Pycnosorus pleiocephalus	Soft Billy-buttons			✓			✓

Scientific Name	Common Name	Conservation status		Vegetation association			
		Aus	**SA**	**1**	**2**	**3**	**4**
Rhagodia spinescens	Spiny Saltbush			✓		✓	
Rhodanthe stricta	Slender Everlasting			✓	✓	✓	
Rytidosperma caespitosum	Common Wallaby-grass			✓	✓		
Santalum acuminatum	Quandong			✓	✓		
Scaevola spinescens	Spiny Fanflower			✓	✓		
Sclerolaena bicuspis	Two-spine Bindyi			✓	✓		
Sclerolaena brachyptera	Short-wing Bindyi					✓	
Sclerolaena diacantha	Grey Bindyi				✓	✓	
Sclerolaena intricata	Tangled Bindyi					✓	
Sclerolaena obliquicuspis	Oblique-spined Bindyi			✓		✓	
Senna artemisioides ssp. *artemisioides* x ssp. *coriacea*	Desert Senna			✓			
Senna artemisioides ssp. *petiolaris*	Senna			✓			
Sida intricata	Twiggy Sida			✓		✓	
**Sisymbrium erysimoides*	Smooth Mustard			✓	✓	✓	
Solanum petrophilum	Rock Nightshade			✓	✓		
Tecticornia medullosa						✓	
Templetonia egena	Broombush Templetonia			✓			
Thysanotus baueri	Mallee Fringe-lily			✓			
Vittadinia cuneata	Fuzzy New Holland Daisy			✓	✓	✓	
Zygophyllum aurantiacum				✓			

Aus: Australia (*Environment Protection and Biodiversity Conservation Act 1999*). **SA:** South Australia (*National Parks and Wildlife Act 1972*). **Conservation Codes: CE:** Critically Endangered. **EN/E:** Endangered. **VU/V:** Vulnerable. **R:** Rare. *** =**Introduced species. ****** Declared species under the Natural Resources Management Act 2004.

Vegetation association

1 =*Acacia papyrocarpa* (Western Myall) open woodland +/- *Myoporum platycarpum* ssp. *platycarpum* (False Sandalwood) +/- *Alectryon oleifolius* ssp. *canescens* (Bullock Bush) over *Maireana pyramidata* (Black Bluebush) / *Maireana sedifolia* (Bluebush).

2 = *Maireana pyramidata* (Black Bluebush) / *Maireana sedifolia* (Bluebush) shrubland.

3 =*Atriplex vesicaria* (Bladder Saltbush) / *Maireana astrotricha* (Low Bluebush) / *Maireana pyramidata* (Black Bluebush) / *Tecticornia medullosa* mixed low shrubland.

4 =*Acacia aneura* (Mulga) open woodland.

Appendix 4. The abundance of each fauna species recorded within the Project area on the spring 2015 and winter 2017 surveys.

*	Scientific name	Common name	Conservation status		Spring 2015	Winter 2017
			Aus	SA		
	Acanthagenys rufogularis	Spiny-cheeked Honeyeater			3	20
	Acanthiza apicalis	Inland Thornbill			6	
	Acanthiza chrysorrhoa	Yellow-rumped Thornbill				3
	Acanthiza uropygialis	Chestnut-rumped Thornbill			5	4
	Anthus australis	Australian Pipit			6	10
	Aphelocephala leucopsis	Southern Whiteface			6	61
	Aquila audax	Wedge-tailed Eagle			4	1
	Artamus cinereus	Black-faced Woodswallow			13	15
	Artamus personatus	Masked Woodswallow			>70	
	Artamus superciliosus	White-browed Woodswallow			6	
	Barnardius zonarius	Australian Ringneck				2
	Cacomantis pallidus	Pallid Cuckoo				4
	Calamanthus campestris	Rufous Fieldwren			2	3
	Chalcites basalis	Horsfield's Bronze Cuckoo			1	6
	Cheramoeca leucosterna	White-backed Swallow			1	
	Cincloramphus cruralis	Brown Songlark			4	1
	Circus assimilis	Spotted Harrier			2	
	Climacteris picumnus	Brown Treecreeper			1	
	Colluricincla harmonica	Grey Shrikethrush				3
	Coracina novaehollandiae	Black-faced Cuckoo shrike			1	3
	Corvus coronoides	Australian Raven			7	3
	Corvus mellori	Little Raven				2
	Cracticus torquatus	Grey Butcherbird			2	1
	Daphoenositta chrysoptera	Varied Sittella			8	10
	Dicaeum hirundinaceum	Mistletoebird			4	
	Dromaius novaehollandiae	Emu			2, old eggs	3
	Elanus axillaris	Black-shouldered Kite			P	
	Eolophus roseicapilla	Galah			6	2
	Epthianura albifrons	White-fronted Chat				11
	Epthianura aurifrons	Orange Chat			7	8
	Epthianura tricolor	Crimson Chat			5	
	Falco berigora	Brown Falcon			1	
	Falco cenchroides	Nankeen Kestrel			2	4
	Gavicalis virescens	Singing Honeyeater			5	15
	Grallina cyanoleuca	Magpielark			1	1
	Gymnorhina tibicen	Australian Magpie			2	4
	Hirundo neoxena	Welcome Swallow			1	3
	Malurus lamberti	Variegated Fairy-wren			8	2

*	Scientific name	Common name	Conservation status		Spring 2015	Winter 2017
			Aus	SA		
	Malurus leucopterus	White-winged Fairywren			11	40
	Malurus splendens	Splendid Fairywren				5
	Manorina flavigula	Yellow-throated Miner			4	7
	Melopsittacus undulatus	Budgerigar			2	
	Merops ornatus	Rainbow Bee-eater			3	
	Microeca fascinans	Jacky Winter			5	1
	Milvus migrans	Black Kite			P	1
	Neophema chrysostoma	Blue-winged Parrot		V	P	3
	Northiella haematogaster	Bluebonnet			14	20
	Ocyphaps lophotes	Crested Pigeon			7	4
	Oreoica gutturalis	Crested Bellbird			4	6
	Pachycephala rufiventris	Rufous Whistler			2	
	Petrochelidon nigricans	Tree Martin				3
	Petroica goodenovii	Red-capped Robin			1	7
	Pomatostomus superciliosus	White-browed Babbler			13	42
	Psephotus varius	Mulga Parrot			12	12
	Psophodes cristatus	Chirruping Wedgebill			2	
	Pyrrholaemus brunneus	Redthroat				4
	Rhipidura albiscapa	Grey Fantail			3	
	Rhipidura leucophrys	Willie Wagtail			2	3
*	*Capra hircus*	Goat (Feral Goat)			4	201
	Macropus fuliginosus	Western Grey Kangaroo			Many	30
	Macropus robustus	Euro			2	
	Macropus rufus	Red Kangaroo			Many	2
*	*Oryctolagus cuniculus*	Rabbit (European Rabbit)			2, scats	
*	*Ovis aries*	Domestic Sheep			many	many
*	*Vulpes vulpes*	Fox (Red Fox)			Scats	Tracks
	Ctenophorus cristatus	Crested Dragon			1	
	Pogona vitticeps	Central Bearded Dragon			1	
	Tiliqua rugosa	Sleepy Lizard				2
	Varanus gouldii	Sand Goanna			1	

Aus: Australia (*Environment Protection and Biodiversity Conservation Act 1999*). SA: South Australia (*National Parks and Wildlife Act 1972*). Conservation codes: CE: Critically Endangered. EN/E: Endangered. VU/V: Vulnerable. R: Rare. *: Introduced.

Appendix 5. Flora species recorded in the BDBSA within 10 km of the project area (DEWNR 2015).

*	Scientific name	Common name	Conservation status		Last sighting (year)
			Aus	SA	
	Acacia aneura var. *aneura*	Mulga			10/09/1982
	Acacia ayersiana	Blue Mulga			9/11/1928
	Acacia burkittii	Pin-bush Wattle			21/07/1990
	Acacia papyrocarpa	Western Myall			1/04/2007
*	*Acetosa vesicaria*	Rosy Dock			11/10/1969

*	Scientific name	Common name	Conservation status		Last sighting (year)
			Aus	SA	
	Alectryon oleifolius ssp. *canescens*	Bullock Bush			22/10/1991
*	*Alyssum linifolium*	Flax-leaf Alyssum			19/07/1968
	Amyema miraculosa ssp. *boormanii*	Fleshy Mistletoe			15/12/1991
	Amyema quandang var. *quandang*	Grey Mistletoe			15/04/2002
*	*Anagallis arvensis*	Pimpernel			7/01/1993
	Arabidella filifolia	Thread-leaf Cress			25/06/1992
	Arabidella nasturtium	Yellow Cress			16/09/2008
	Arabidella procumbens	Creeping Cress			11/08/2008
	Arabidella trisecta	Shrubby Cress			20/08/1968
*	*Asphodelus fistulosus*	Onion Weed			20/08/1968
*	*Asteriscus spinosus*	Golden Pallensis			12/01/1993
	Atriplex angulata	Fan Saltbush			19/04/1997
	Atriplex holocarpa	Pop Saltbush			19/04/1997
	Atriplex limbata	Spreading Saltbush			3/08/1969
	Atriplex lindleyi ssp. *conduplicata*	Baldoo			19/04/1997
	Atriplex lindleyi ssp. *lindleyi*	Baldoo			19/04/1997
	Atriplex vesicaria	Bladder Saltbush			1/04/2007
	Austrostipa nitida	Balcarra Spear-grass			11/09/1990
*	*Avena barbata*	Bearded Oat			26/10/1992
	Brachyscome ciliaris var. *lanuginosa*	Woolly Variable Daisy			30/11/1992
	Brachyscome dichromosomatica var. *dichromosomatica*	Large Hard-head Daisy			4/10/1992
	Brachyscome lineariloba	Hard-head Daisy			29/07/1991
*	*Brassica tournefortii*	Wild Turnip			5/09/1966
*	*Bromus hordeaceus* ssp. *hordeaceus*	Soft Brome			20/10/1992
*	*Bromus rubens*	Red Brome			26/09/1991
	Bulbine alata	Winged Bulbine-lily			19/11/1992
	Calandrinia sphaerophylla	Bead Purslane		R	18/08/1990
	Calotis cymbacantha	Showy Burr-daisy			5/10/1992
	Calotis erinacea	Tangled Burr-daisy			23/10/1992
	Calotis hispidula	Hairy Burr-daisy			5/10/1992
*	*Carrichtera annua*	Ward's Weed			5/09/1966
*	*Carthamus lanatus*	Saffron Thistle			4/12/1991
*	*Centaurea melitensis*	Malta Thistle			4/12/1991
	Centipeda cunninghamii	Common Sneezeweed			26/03/2007
	Chenopodium curvispicatum	Cottony Goosefoot			5/09/1966
	Chrysocephalum apiculatum	Common Everlasting			11/10/1969
	Citrus glauca	Desert Lime		V	14/02/1993
	Convolvulus remotus	Grassy Bindweed			11/06/1967
*	*Conyza bonariensis*	Flax-leaf Fleabane			12/01/1993
	Crassula colorata var. *acuminata*	Dense Crassula			23/10/1992
	Crassula colorata var. *colorata*	Dense Crassula			19/08/1968
	Cullen australasicum	Tall Scurf-pea			7/06/1992
*	*Cynodon dactylon* var. *dactylon*	Couch			12/01/1993
*	*Datura inoxia*	Downy Thorn-apple			12/12/1992
*	*Datura leichhardtii*	Leichhardt's Thorn-apple			19/04/1997
	Daucus glochidiatus	Native Carrot			19/08/1968
	Disphyma crassifolium ssp. *clavellatum*	Round-leaf Pigface			15/10/1990
	Dissocarpus paradoxus	Ball Bindyi			10/06/1967

*	Scientific name	Common name	Conservation status		Last sighting (year)
			Aus	SA	
*	*Dittrichia graveolens*	Stinkweed			17/06/1977
	Dodonaea microzyga var. *microzyga*	Brilliant Hop-bush			28/07/1990
	Duma florulenta	Lignum			26/03/2007
	Dysphania cristata	Crested Crumbweed			26/03/2007
	Dysphania plantaginella	Plantain Crumbweed			13/05/1992
*	*Emex australis*	Three-corner Jack			8/09/1968
	Enchylaena tomentosa var. *tomentosa*	Ruby Saltbush			10/06/1967
	Enneapogon avenaceus	Common Bottle-washers			5/06/1990
	Enneapogon caerulescens	Blue Bottle-washers			24/05/1992
	Enneapogon cylindricus	Jointed Bottle-washers			13/05/1992
	Enneapogon nigricans	Black-head Grass			15/06/1992
	Enteropogon ramosus	Umbrella Grass			20/03/1992
	Eremophila duttonii	Harlequin Emubush			
	Eremophila glabra ssp. *glabra*	Tar Bush			20/08/1968
	Eremophila latrobei ssp. *glabra*	Crimson Emubush			1/08/1979
	Eremophila longifolia	Weeping Emubush			26/03/2007
	Eriochlamys behrii	Woolly Mantle			14/10/1995
	Erodiophyllum elderi	Koonamore Daisy			11/06/1967
*	*Erodium aureum*				20/08/1968
	Erodium carolinianum	Clammy Heron's-bill			19/08/1968
	Erodium crinitum	Blue Heron's-bill			16/09/1992
	Euphorbia multifaria				10/06/1967
	Euphorbiaceae sp.	Spurge Family			26/03/2007
	Exocarpos aphyllus	Leafless Cherry			10/06/1967
*	*Galenia pubescens* var. *pubescens*	Coastal Galenia			26/03/2007
	Glycine canescens	Silky Glycine			6/08/1991
	Gnephosis arachnoidea	Spidery Button-flower			5/06/1990
	Gnephosis tenuissima	Dwarf Golden-tip			11/10/1969
	Goodenia lunata	Stiff Goodenia			11/06/1967
	Goodenia pinnatifida	Cut-leaf Goodenia			3/09/1991
	Gratwickia monochaeta			R	1/10/1985
	Gunniopsis quadrifida	Sturt's Pigface			19/11/1992
*	*Helianthus annuus*	Sunflower			27/04/2002
*	*Heliotropium curassavicum*	Smooth Heliotrope			24/09/1990
*	*Heliotropium europaeum*	Common Heliotrope			26/03/2007
	Hyalosperma glutinosum ssp. *glutinosum*	Golden Sunray			6/08/1991
	Hyalosperma semisterile	Orange Sunray			7/08/1991
	Jasminum didymum ssp. *lineare*	Native Jasmine			11/06/1967
	Juncus bufonius	Toad Rush			22/10/1990
	Lawrencia glomerata	Clustered Lawrencia			30/11/1992
	Leiocarpa leptolepis	Pale Plover-daisy			1/10/1985
	Lemooria burkittii	Wires-and-wool			20/08/1968
	Lepidium fasciculatum	Bundled Peppercress			25/08/1992
	Lepidium oxytrichum	Green Peppercress			20/08/1968
	Lepidium papillosum	Warty Peppercress			6/08/1991
	Lepidium phlebopetalum	Veined Peppercress			11/08/2008
	Lycium australe	Australian Boxthorn			6/08/1991
*	*Lycium ferocissimum*	African Boxthorn			25/06/1991
	Lysiana exocarpi ssp. exocarpi	Harlequin Mistletoe			11/06/1967

*	Scientific name	Common name	Conservation status		Last sighting (year)
			Aus	SA	
	Maireana appressa	Pale-fruit Bluebush			3/02/1937
	Maireana astrotricha	Low Bluebush			1/04/2007
	Maireana brevifolia	Short-leaf Bluebush			5/06/1990
	Maireana georgei	Satiny Bluebush			16/09/1992
	Maireana pyramidata	Black Bluebush			1/04/2007
	Maireana sedifolia	Bluebush			1/04/2007
	Maireana turbinata	Top-fruit Bluebush			5/09/1966
*	*Medicago polymorpha* var. *polymorpha*	Burr-medic			6/08/1991
	Menkea crassa	Fat Spectacles			8/08/1991
*	*Mesembryanthemum aitonis*	Angled Iceplant			21/09/1963
	Microseris lanceolata	Yam Daisy			7/08/1991
	Millotia myosotidifolia	Broad-leaf Millotia			20/08/1968
	Minuria annua	Annual Minuria			30/11/1992
	Minuria cunninghamii	Bush Minuria			24/09/1990
	Mollugo cerviana	Wire-stem Chickweed			12/05/1992
	Myoporum platycarpum ssp. *platycarpum*	False Sandalwood			17/10/1999
*	*Nicotiana glauca*	Tree Tobacco			5/06/1990
	Nicotiana velutina	Velvet Tobacco			26/03/2007
	Olearia pimeleoides	Pimelea Daisy-bush			20/08/1968
*	*Oligocarpus calendulaceus*				21/08/1992
	Omphalolappula concava	Burr Stickseed			19/08/1968
	Osteocarpum dipterocarpum	Two-wing Bonefruit			21/09/1963
	Owenia acidula	Sour Plum			6/08/1991
	Pachymitus cardaminoides	Sand Cress			7/08/1991
	Parietaria cardiostegia	Mallee Smooth-nettle			20/08/1968
*	*Peganum harmala*	African Rue			16/10/2009
*	*Phalaris paradoxa*	Paradox Canary-grass			20/10/1992
	Phlegmatospermum cochlearinum	Downy Cress			7/08/1991
	Phyllanthus lacunarius	Lagoon Spurge			26/03/2007
	Pimelea microcephala ssp. *microcephala*	Shrubby Riceflower			19/08/1966
	Plantago drummondii	Dark Plantain			11/08/2008
	Portulaca oleracea	Common Purslane			26/03/2007
	Pterocaulon sphacelatum	Apple-bush			15/10/1990
	Ptilotus obovatus				21/11/2003
	Pycnosorus pleiocephalus	Soft Billy-buttons			24/09/1990
	Rhodanthe moschata	Musk Daisy			20/08/1968
	Rhodanthe polygalifolia	Milkwort Everlasting			7/08/1991
	Rhodanthe pygmaea	Pigmy Daisy			20/08/1968
	Rhodanthe stricta	Slender Everlasting			19/08/1968
	Rhodanthe stuartiana	Clay Everlasting			24/09/1990
	Santalum acuminatum	Quandong			19/04/2010
	Scambopus curvipes				9/09/2009
	Schenkia australis	Spike Centaury			22/10/1990
*	*Schismus barbatus*	Arabian Grass			11/06/1967
	Senecio glossanthus	Annual Groundsel			19/08/1968
	Senecio gregorii	Fleshy Groundsel			21/08/1968
	Senecio megaglossus	Large-flower Groundsel	**VU**	E	26/09/1999
	Senecio runcinifolius	Thistle-leaf Groundsel			16/09/1992
	Senna artemisioides ssp. *petiolaris*				10/06/1967
	Sida intricata	Twiggy Sida			10/03/2000

*	Scientific name	Common name	Conservation status		Last sighting (year)
			Aus	SA	
	Sida petrophila	Rock Sida			26/09/1991
*	*Sisymbrium erysimoides*	Smooth Mustard			26/03/2007
*	*Sisymbrium irio*	London Mustard			21/08/1992
	Solanum ellipticum	Velvet Potato-bush			10/06/1967
	Solanum esuriale	Quena			12/01/1993
	Solanum petrophilum	Rock Nightshade			26/03/2007
	Solanum quadriloculatum	Plains Nightshade			23/10/1982
*	*Sonchus oleraceus*	Common Sow-thistle			20/08/1968
	Stemodia florulenta	Bluerod			9/12/1978
	Stuartina hamata	Prickly Cudweed			20/08/1968
	Tecticornia indica ssp. *leiostachya*	Brown-head Samphire			26/03/2007
	Tecticornia pruinosa	Bluish Samphire			7/08/1991
	Tetragonia eremaea	Desert Spinach			26/03/2007
	Teucrium racemosum	Grey Germander			27/12/1997
	Thysanotus baueri	Mallee Fringe-lily			11/10/1969
	Tragus australianus	Small Burr-grass			13/03/1997
	Trianthema triquetra	Red Spinach			20/03/1992
	Trichanthodium skirrophorum	Woolly Yellow-heads			5/09/1966
	Tulostoma berteroanum				14/07/2002
*	*Verbena supina* var. *erecta*	Trailing Verbena			16/09/1992
*	*Verbena supina* var. *supina*	Trailing Verbena			26/03/2007
	Vittadinia eremaea	Desert New Holland Daisy			5/10/1992
	Wahlenbergia communis	Tufted Bluebell			5/06/1990
	Wahlenbergia gracilenta	Annual Bluebell			19/08/1968
	Wurmbea australis	Inland Nancy			25/06/1991
*	*Xanthium spinosum*	Bathurst Burr			26/03/2007
	Zygochloa paradoxa	Sandhill Cane-grass			16/02/1997
	Zygophyllum apiculatum	Pointed Twinleaf			24/10/1992
	Zygophyllum aurantiacum ssp. *aurantiacum*	Shrubby Twinleaf			5/09/1966
	Zygophyllum crenatum	Notched Twinleaf			7/08/1991
	Zygophyllum eremaeum				20/08/1968
	Zygophyllum iodocarpum	Violet Twinleaf			20/08/1968

Aus: Australia (*Environment Protection and Biodiversity Conservation Act 1999*). SA: South Australia (*National Parks and Wildlife Act 1972*). Conservation codes: CE: Critically Endangered. EN/E: Endangered. VU/V: Vulnerable. R: Rare. *: Introduced.

Appendix 6. Fauna species recorded in the BDBSA within 10 km of the project area (DEWNR 2015).

*	Scientific name	Common name	Conservation status		Last sighting (year)
			Aus	SA	
	Acanthagenys rufogularis	Spiny-cheeked Honeyeater			26/03/2007
	Acanthiza apicalis	Inland Thornbill			25/05/1965
	Acanthiza chrysorrhoa	Yellow-rumped Thornbill			6/10/2001
	Acanthiza iredalei iredalei	Slender-billed Thornbill (western ssp)		R	25/05/2003
	Acanthiza uropygialis	Chestnut-rumped Thornbill			25/09/2000
	Accipiter cirrocephalus	Collared Sparrowhawk			15/06/2000
	Accipiter fasciatus	Brown Goshawk			25/09/2000
	Actitis hypoleucos	Common Sandpiper		R	24/09/2000

*	Scientific name	Common name	Conservation status		Last sighting (year)
			Aus	SA	
	Amytornis textilis	Western Grasswren			31/08/2006
	Anas gracilis	Grey Teal			27/07/2005
	Anthus australis	Australian Pipit			31/08/2006
	Aphelocephala leucopsis	Southern Whiteface			26/03/2007
	Aquila audax	Wedge-tailed Eagle			31/08/2006
	Ardea pacifica	White-necked Heron			24/09/2000
	Artamus cinereus	Black-faced Woodswallow			26/03/2007
	Artamus personatus	Masked Woodswallow			26/03/2007
	Artamus superciliosus	White-browed Woodswallow			25/09/2000
	Aythya australis	Hardhead			27/07/2005
	Barnardius zonarius	Australian Ringneck			6/10/2001
	Cacatua sanguinea	Little Corella			25/09/2000
	Cacomantis flabelliformis	Fan-tailed Cuckoo			24/09/2000
	Cacomantis pallidus	Pallid Cuckoo			24/09/2000
	Calamanthus (Calamanthus) *campestris*	Rufous Fieldwren			25/05/2003
	Calidris canutus	Red Knot			24/09/2000
*	*Capra hircus*	Goat (Feral Goat)			1/01/2007
	Certhionyx variegatus	Pied Honeyeater			26/03/2007
	Chalcites basalis	Horsfield's Bronze Cuckoo			26/03/2007
	Chalcites osculans	Black-eared Cuckoo			26/03/2007
	Chenonetta jubata	Maned (Australian Wood Duck)			27/07/2005
	Cheramoeca leucosterna	White-backed Swallow			26/09/2000
	Chlidonias hybrida	Whiskered Tern			24/09/2000
	Chroicocephalus novaehollandiae	Silver Gull			25/09/2000
	Cincloramphus cruralis	Brown Songlark			31/08/2006
	Cincloramphus mathewsi	Rufous Songlark			6/10/2001
	Cinclosoma castanotum	Chestnut-backed Quail-thrush (Chestnut Quail-thrush)			30/10/1988
	Circus assimilis	Spotted Harrier			6/10/2001
	Climacteris affinis	White-browed Treecreeper		R	25/05/1965
	Colluricincla harmonica	Grey Shrike-thrush			25/09/2000
	Coracina maxima	Ground Cuckoo-shrike			24/09/2000
	Coracina novaehollandiae	Black-faced Cuckoo-shrike			26/09/2000
	Corvus coronoides	Australian Raven			31/08/2006
	Corvus sp.				6/09/2002
	Coturnix pectoralis	Stubble Quail			6/09/2002
	Cracticus torquatus	Grey Butcherbird			26/03/2007
	Crinia signifera	Common Froglet			3/10/2004
	Ctenophorus fionni	Peninsula Dragon			30/10/1971
	Ctenophorus fordi	Mallee Dragon			29/11/1991
	Ctenotus leae	Centralian Coppertail			24/11/1991
	Ctenotus olympicus	Saltbush Ctenotus			29/11/1991
	Ctenotus uber (NC)	Spotted Ctenotus			29/11/1991
	Dicaeum hirundinaceum	Mistletoebird			26/09/2000
	Diplodactylus furcosus	Ranges Stone Gecko			1/01/1950
	Diporiphora winneckei (NC)	Canegrass Dragon			25/11/1991
	Dromaius novaehollandiae	Emu			1/01/2006
	Egretta garzetta	Little Egret		R	24/09/2000
	Egretta novaehollandiae	White-faced Heron			24/09/2000
	Elanus axillaris	Black-shouldered Kite			24/09/2000
	Elseyornis melanops	Black-fronted Dotterel			24/09/2000

*	Scientific name	Common name	Conservation status		Last sighting (year)
			Aus	SA	
	Eolophus roseicapilla	Galah			6/10/2001
	Epthianura albifrons	White-fronted Chat			26/03/2007
	Epthianura aurifrons	Orange Chat			25/09/2000
	Epthianura tricolor	Crimson Chat			31/08/2006
	Eremiascincus richardsonii	Broad-banded Sandswimmer			29/11/1991
	Erythrogonys cinctus	Red-kneed Dotterel			24/09/2000
	Falco berigora	Brown Falcon			11/01/2001
	Falco cenchroides	Nankeen Kestrel			6/10/2001
	Falco longipennis	Australian Hobby			27/07/2005
	Fulica atra	Eurasian Coot			24/09/2000
	Gavicalis virescens	Singing Honeyeater			26/03/2007
	Geopelia cuneata	Diamond Dove			26/09/2000
	Grallina cyanoleuca	Magpielark			25/09/2000
	Gymnorhina tibicen	Australian Magpie			29/05/2001
	Hamirostra melanosternon	Black-breasted Buzzard		R	6/09/1991
	Hirundo neoxena	Welcome Swallow			6/09/2002
	Lalage tricolor	White-winged Triller			26/03/2007
	Lerista terdigitata	Southern Three-toed Slider			29/11/1991
	Limnodynastes tasmaniensis	Spotted Marsh Frog			3/10/2004
	Lucasium damaeum	Beaded Gecko			25/11/1991
	Macropus fuliginosus	Western Grey Kangaroo			1/01/2006
	Macropus robustus	Euro			1/01/2006
	Macropus rufus	Red Kangaroo			1/01/2007
	Malacorhynchus membranaceus	Pink-eared Duck			27/07/2005
	Malurus lamberti	Variegated Fairywren			31/08/2006
	Malurus leucopterus	White-winged Fairywren			26/03/2007
	Malurus splendens	Splendid Fairywren			26/09/2000
	Manorina flavigula	Yellow-throated Miner			29/05/2001
	Melanodryas cucullata	Hooded Robin			25/09/2000
	Melopsittacus undulatus	Budgerigar			26/09/2000
	Microeca fascinans	Jacky Winter			20/09/1965
	Milvus migrans	Black Kite			31/08/2006
	Morethia adelaidensis	Adelaide Snake-eye			22/11/1991
	Morethia boulengeri	Common Snake-eye			4/09/1986
	Neophema chrysostoma	Blue-winged Parrot		V	14/07/1991
	Neophema elegans	Elegant Parrot		R	31/08/2006
	Neophema splendida	Scarlet-chested Parrot		R	1/01/1900
	Nephrurus levis	Smooth Knob-tailed Gecko			29/11/1991
	Ninox boobook	Southern Boobook			24/09/2000
	Northiella haematogaster	Bluebonnet			26/03/2007
	Nymphicus hollandicus	Cockatiel			25/09/2000
	Ocyphaps lophotes	Crested Pigeon			26/03/2007
	Oreoica gutturalis	Crested Bellbird			6/10/2001
*	*Passer domesticus*	House Sparrow			25/09/2000
	Peltohyas australis	Inland Dotterel			25/09/2000
	Petrochelidon ariel	Fairy Martin			6/09/2002
	Petrochelidon nigricans	Tree Martin			24/09/2000
	Petroica goodenovii	Red-capped Robin			31/08/2006
	Phalacrocorax sulcirostris	Little Black Cormorant			24/09/2000
	Phaps chalcoptera	Common Bronzewing			31/08/2006
	Poliocephalus poliocephalus	Hoary-headed Grebe			24/09/2000

*	Scientific name	Common name	Conservation status		Last sighting (year)
			Aus	SA	
	Pomatostomus superciliosus	White-browed Babbler			26/03/2007
	Psephotus haematonotus	Red-rumped Parrot			26/09/2000
	Psephotus varius	Mulga Parrot			26/03/2007
	Pseudechis australis	Mulga Snake			12/04/1992
	Pseudonaja nuchalis (NC)	Western Brown Snake			28/10/1994
	Psophodes cristatus	Chirruping Wedgebill			31/08/2006
	Pyrrholaemus brunneus	Redthroat			31/08/2006
	Rhipidura albiscapa	Grey Fantail			15/06/2000
	Rhipidura leucophrys	Willie Wagtail			26/03/2007
	Stiltia isabella	Australian Pratincole			24/09/2000
	Strophurus intermedius	Southern Spiny-tailed Gecko			3/11/2000
*	*Struthio camelus*	Common Ostrich			26/09/2000
*	*Sturnus vulgaris*	Common Starling			11/01/2001
	Tachybaptus novaehollandiae	Australasian Grebe			24/09/2000
	Taeniopygia guttata	Zebra Finch			25/09/2000
	Todiramphus pyrrhopygius	Red-backed Kingfisher			24/09/2000
	Tribonyx ventralis	Black-tailed Native hen			24/09/2000
	Tympanocryptis tetraporophora	Eyrean Earless Dragon			20/11/1991
	Vanellus miles	Masked Lapwing			27/07/2005
	Vanellus tricolor	Banded Lapwing			24/09/2000
	Varanus gouldii	Sand Goanna			26/03/2007
*	*Vulpes vulpes*	Fox (Red Fox)			1/01/1989
	Zosterops lateralis	Silvereye			15/06/2000

Aus: Australia (*Environment Protection and Biodiversity Conservation Act 1999*). SA: South Australia (*National Parks and Wildlife Act 1972*). Conservation codes: CE: Critically Endangered. EN/E: Endangered. VU/V: Vulnerable. R: Rare. *: Introduced.

EBS Ecology
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Torrensville, SA 5031
www.ebsecology.com.au
t. 08 7127 5607
f. 08 8352 1222

Report 2a

Native Vegetation Clearance Application

APPLICATION TO CLEAR NATIVE VEGETATION

In accordance with NATIVE VEGETATION ACT 1991

In South Australia, under the *Native Vegetation Act 1991* (the Act), all clearance of native vegetation requires the approval of the Native Vegetation Council (NVC) unless it is covered by a specific exemption contained within the *Native Vegetation Regulations 2003*. To apply to clear native vegetation, an applicant must complete and submit this form to the Native Vegetation Council. The application form must be accompanied with an application fee and a data report that has been completed by an accredited consultant.

- Please read and complete all pages of this application form.
- Please submit a clearance Data Report completed by an accredited consultant.
- Completed, signed and dated forms should be forwarded, with the application fee *(see "Notes for Applicant" on page 2 for fee payable)* and a clearance data report to:

Native Vegetation Council
Postal Address
GPO Box 1047
ADELAIDE SA 5001

Or

Native Vegetation Council
81-95 Waymouth Street
ADELAIDE SA 5001

APPLICANT DETAILS

LANDOWNER'S NAME:

Postal Address

Postcode:

Phone Wk:
Phone Hm:
Mobile:
Facsimile:
Email:

AUTHORISED AGENT (if applicable) SolarReserve Australia II Pty Ltd

Postal Address Level 25, 108 St Georges Terrace
Perth, Western Australia

Postcode: 6000

Phone Wk: 08 6557 8967
Phone Hm:
Mobile: 0428 928 894
Facsimile:
Email: daniel.thompson@solarreserve.com

DETAILS OF PROPERTY

District Council	Hundred(s)	Section(s)	Title Details CT, CL or CR
Pastoral Lease PE2496		2	C__ Vol. 1436 Folio 40
Pastoral Lease PE2257			C__ Vol. 1282 Folio 43
			C__ Vol. Folio
			C__ Vol. Folio

Please provide any additional title details on a separate sheet of paper if required.

DETAILS OF PROPOSED CLEARANCE

Type of clearance and brief description. Please tick appropriate box and add comments where indicated to show the reason for the proposed clearance e.g. viticulture, forestry, irrigation.

NOTE: The Native Vegetation Act 1991 does not permit the Native Vegetation Council (NVC) to grant consent to the clearance of "intact bushland".

❑ **Scattered trees** Number: Purpose: _____

❑ **Other type of vegetation** Hectares: 813 Purpose: Construction and operation of a concentrating solar thermal electricity generation facility

Government of South Australia

PREPARATION OF DATA REPORT

Landowners lodging applications must include a data report prepared by a person accredited by the NVC as part of each application. The data report is essential before the application can be considered by the NVC.

The report will contain information regarding the vegetation to be cleared (e.g. the plant species proposed to be cleared, including numbers, density, health and rarity), the extent and location of the clearance, if the clearance is at variance with the principles of the Act and the proposed significant environmental benefit offset for the clearance.

Please contact the Native Vegetation Management Unit, or check the NVC website at http://www.environment.sa.gov.au/managing-natural-resources/Native_vegetation/Managing_native_vegetation for a current list of consultants approved by the NVC.

NOTES FOR APPLICANT

'Clearance' in relation to native vegetation means:

- the killing, destruction or removal of native vegetation
- the severing of branches, limbs, stems or trunks of native vegetation
- the burning of native vegetation, and
- any other substantial damage to native vegetation, and includes the severing of roots, draining or flooding of land, or any other activity that causes the killing or destruction of native vegetation.

'Native Vegetation' means plants indigenous to South Australia (and includes those intentionally sown or planted as a condition previously imposed or as declared by the NVC).

Application Fees as of 1 July 2016 (all fees are GST exempt). Please make cheques or money orders payable to the '*Native Vegetation Council'*. Cash payments can be received and receipted at the office.

$583, except where the Native Vegetation Council has resolved to vary that fee in accordance with the following:

- For single trees, the application fee is $145.75 per tree to a maximum of $583 (four or more trees)
- For mallee trees the application fee is $145.75 per three mallee trees, to a maximum of $583 (twelve or more trees)
- For applications to cut brush (*Melaleuca uncinata*) the application fee is $291.50
- For applications associated with works under a Landcare or similar project where the proposed works will result in an environmental benefit, the application fee is $145.75.

A consent to undertake clearance remains valid for two years or for a longer period as specified by the NVC at the time of granting consent, or subsequently on application by a person who has the benefit of the consent.

You may amend or withdraw this application at any time before a decision is made.

The Native Vegetation Council may request additional information before making a decision. Supplying this information promptly will reduce delays.

For Crown Land under Lease or License the approval of the Minister for Sustainability, Environment and Conservation is required for any application for consent to clear native vegetation. The NVC will submit to the Minister as appropriate after its review.

For further information and assistance, contact the Native Vegetation Management Unit:

Ph. (08) 8303 9777 **Email: nvc@sa.gov.au** **Web: http://www.nvc.sa.gov.au**

DECLARATION

I hereby certify that the above information is accurate to the best of my knowledge and confirm the required items are attached. The Landowner (not agent or manager) must sign this form.

Signed: (Landowner)  **Date** 20 / 6 / 2017

Name (please print): .Daniel Thompson……..

OFFICE USE ONLY			
APPLICATION NO. / /	**Application Fee Paid:**	**$**	
Date registered by NVC / /	**Receipt No.**	**Dated** / /	

Report 3
Traffic Impact Assessment

SolarReserve

Aurora Solar Energy Project

Traffic Impact Assessment Report

September 2017

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Figure index

1. Project Description

SolarReserve is the leading worldwide developer of solar thermal solutions with energy storage, exclusive technology and a proven record of accomplishment for success. South Australia is currently the leading state in Australia for renewable energy. SolarReserve's elite technology, being powered entirely by the sun, without the need for any backup fuel and able to provide electricity price certainty over its 30-year life expectancy, places South Australia as the leading state for solar thermal energy with the Aurora Solar Energy Project.

The Aurora Solar Energy site is located approximately 30km north of Port Augusta in South Australia, on land owned by the State Government. However, it operates under a long-term pastoral lease to private pastoralists who utilise the land for sheep grazing and natural vegetation.

SolarReserve's patented molten salt power technology with integrated energy storage, 110-megawatt hour's capacity with 800-megawatt hours (8 hours) of full load storage produces approximately 480,000-megawatt hours of electricity annually.

SolarReserve has executed an *Option and Lease Agreement* with the two pastoralists for 20km^2 of land, far greater than Aurora Solar Energy requires. The Port Augusta City Council is decidedly supportive of the SolarReserve Project and the location selected.

The construction of the $650 million plant by SolarReserve will provide Port Augusta and the region with significant job opportunities during the construction phase and a number of ongoing full-time workers once the plant is operational. This will be the world's largest solar thermal generation plant of its kind.

The main entrance to the site is of the Stuart Highway, a major road connecting South Australia to the Northern Territory, as well as a water pipeline to the Department of Defence at Woomera, a rail line, and 132kV and 275kV transmission lines, which service BHP's Olympic Dam mine together with the communities of Woomera and Roxby Downs.

2. Traffic Impact Assessment

A Traffic Impact Assessment (TIA) is one of several key technical studies undertaken in preparation of the Development Application (DA) which details the principal impacts of the traffic, and transport related activities associated with SolarReserve's, Aurora Solar Energy Project during the development construction phase of the project.

Some of the key issues with regard to traffic and transport matters for the Aurora Solar Energy Project is the additional vehicle movements that will be required to gain access/egress to the site during the site preparation and construction phase initially, and then the ongoing operational requirements, day to day running of the site.

Main access/egress to the site is via the Stuart Highway, which has been categorised to take large amounts of traffic, in particular heavy vehicles.

The many small dirt access roads to the private pastorals will require adequate modification to accommodate the expected vehicle capacity required during each phase. Further clarification on this matter is under *Section 2.4 Traffic Impact Assessment*, of this report.

2.1 Location – Existing Conditions

The location of the site is approximately 30km north of Port Augusta, and currently consists of a long-term pastoral lease to private pastoralists who use the land for sheep grazing in which natural vegetation occupies majority of the land, as shown below in Figure 1.

Figure 1 Existing pastoral land and natural vegetation

The property is enclosed with multiple fenced off areas in which access roads on the property are small, one-directional, undulating, dirt tracks, passing over an existing rail corridor and water line, just off the main access/egress from the Stuart Highway as shown in Figure 2.

Figure 2 Access roads, fenced areas and undulated dirt tracks, off the Stuart Highway

Below in Figure 3, is an overall location plan of the site showing the position of the site from Adelaide to Port Augusta and details of the Aurora Solar Energy Site including road and rail links, project site boundary, transmission line and indicative location of the facility itself.

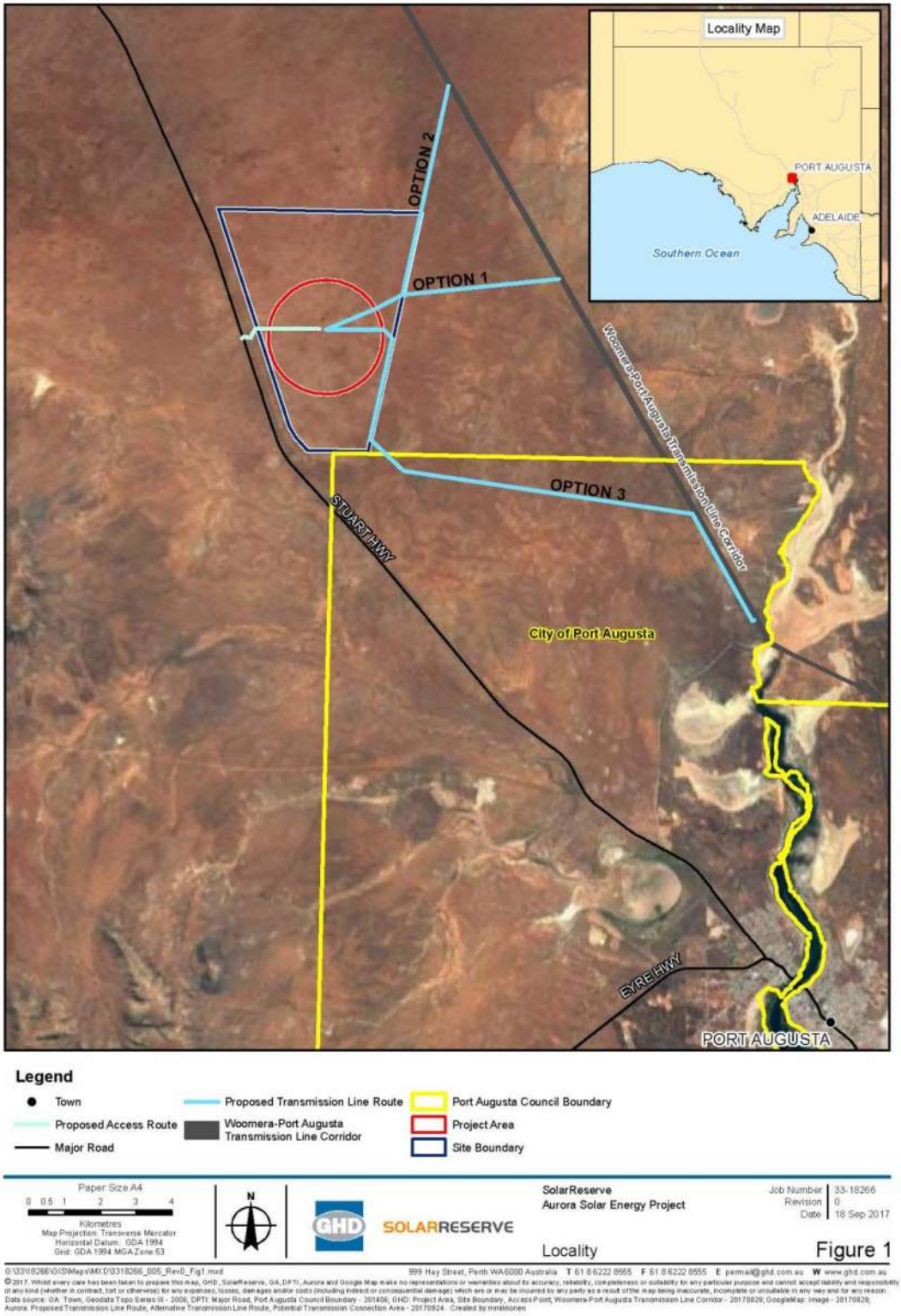

Figure 3 Site Location Plan

2.1.1 Access and Perimeter Roads

SolarReserve have provided proposed construction to the access and perimeter roads leading to the Aurora Solar Energy site and within the site itself as follows.

Primary access roads, consisting of paved roadways with graded shoulders, will be provided from the power block to the main access gate. The power block will be encompassed by a power block ring road, with concrete ramps to provide ingress/egress into the molten salt containment area.

In addition, a perimeter ring road will encircle the boundaries of the heliostat field, while unpaved roadways within the heliostat field will provide access for cleaning of the heliostats.

The primary access roads will be constructed with adequate width for two directions of travel with a minimum of 1.2 metre wide shoulders on each side of the road. These paved roads will be extended to provide access to the power block. All roads within the power block will be surfaced with asphalt.

Grading for these access roads will include the removal of existing vegetation, filling of ruts and depressions, and widening to a width of 7.0 metres. The solar field perimeter road will be groomed and surfaced with approximately 0.13 metres of road base. This road will then be compacted with a heavy roller to provide all-weather access. In addition, this road will be sloped to allow natural runoff or drainage structures, i.e. culverts will be installed as needed.

This includes a crown or cross-slope of the roadway, as well as longitudinal sloping in accordance with horizontal and vertical curve design guidelines. The proposed minimum road width is 7.0 metres for the main access road, and 6.0 metres for the perimeter ring roads.

The corresponding roadway sections, including subgrade and aggregate base, will be defined by the geotechnical report. The predominant traffic to/from the site will occur during construction, and will primarily be construction crew commuter traffic. At the site, an all-weather gravel road will be constructed from the Stuart Highway leading into the site.

All above proposed upgrades will need to be in accordance with Austroads Guides, Australian Standards and DPTI Standards.

2.1.2 Stuart Highway

Classification of the Stuart Highway is as a primary arterial road and is the primary interstate transport route between South Australia and Northern Territory. The road is under the care, control and management of the Department of Planning, Transport and Infrastructure (DPTI), and typically designed with two traffic lanes divided by a painted centreline.

The Stuart Highway has been gazetted for Level 4A access under the PBS (Performance-Based Standards) classification system and in which the Annual Average Daily Traffic (AADT) carries approximately 900 vpd or vehicles per day, estimated for 24 hour, two-way flows in the area between Port Augusta to Pimba with 29% or 261 being heavy vehicles, governed by a speed limit of 110km/h.

2.1.3 Crash Statistics

A review of the crash data from Location SA Map Viewer (2015) indicates the span of this section of road to have a majority of crashes seen in Table 1 and Figure 4.

The main cause of the crashes along this section of the Stuart Highway is hitting animals. With such a vast, open space/span of land, it is hard to minimise these crashes from occurring.

Table 1 Recorded crash data Stuart Highway

Number of Crashes	Reason	Additional information
1 crash	Hit animal	At night
1 crash	Hit animal	1 injured, 1 seriously injured
1 crash	Car roll over	At night
1 crash	Hit animal	At night
1 crash	Over corrected	2 casualties

Figure 4 Location of crashes highlighted from Location SA Map Viewer (2015)

2.2 Transport Requirements

The transport requirements of the development will vary during the different phases of the project. The site preparation and construction phase will generate the most traffic, particularly heavy vehicles, in order to deliver the infrastructure (equipment and materials) associated with the proposed development.

Port Augusta also operates a regional airport owned, operated and maintained by the Port Augusta City Council. Sharp Airlines provide regular passenger transport between Port Augusta and Adelaide with ten (10) return flights per week or two (2) services per day.

This is only relevant for employees/contractors commuting from Adelaide to Port Augusta, as there will be no accommodation on site at Aurora. The Port Augusta City Council is aware of the importance of the airport to the Port Augusta community and surrounding region.

2.2.1 Site Preparation and Construction

The site preparation phase will have limited traffic movements due to the onsite removal of remnant native vegetation and the excavation of the site to being managed within the site itself. Thereby, reducing the need for repeated truck movements to/from the site to Port Augusta. Only the initial travelling to site to undertake the work which includes large, heavy equipment such as bulldozers, scrapers, motor graders, excavators, water trucks, water wagons, loaders, and compactors.

The infrastructure associated with the proposed development construction includes, but is not limited to the following:

- Heliostats;
- Tower infrastructure;
- Additional control building infrastructure;
- Internal access tracks; and
- Modification to current access/egress from the Stuart Highway.

Notification has been received by SolarReserve that equipment for the site including the above mentioned will be imported from overseas and then transported from Port Adelaide through greater Adelaide and Port Augusta, directly to the site.

2.2.2 Ongoing Operation – Vehicle & People Movement

The operational phase will primarily consist of employee movements associated with the day-to-day operation of the site and the need to travel to Aurora from Port Augusta.

Information received from SolarReserve and the Crescent Dunes CSP project in the United States, estimated that the peak traffic movements is expected to be approximately 90 truck (heavy vehicle) movements per day and approximately 400 vpd, totaling approximately 490 vpd.

Rostering requirements for staff/personnel to be on-site has been estimated to be in either two (2) 12-hour shifts or three (3) 8-hour shifts, seven (7) days per week. SolarReserve has not provided any actual staff/personnel numbers at this point.

The SolarReserve Crescent Dunes CSP project in the United States produced around 80 heliostats per day for approximately a six (6) month period. Therefore, is has been assumed that the estimated heliostat material truck movements are included in the overall truck movements for the Aurora Solar Energy site.

2.2.3 Vehicle Types

Heavy (over mass and over dimensional) vehicle loads will be typical for a common power plant or process facility and may include items such as the step-up transformer, the solar receiver panels, steam turbines, generator and tanks. With this, SolarReserve has clearly indicated that there will be no specific oversize loads, as with similar, associated wind farm projects.

Where Council owned roads are to be utilised for transportation of equipment, an agreement will need undertaken and approved between SolarReserve and Port Augusta City Council to establish the maintenance responsibilities of the road during the site preparation and construction phase of the project.

This will be vital if any alternative routes to the Aurora Solar Energy site are required to be used, i.e. Yorkeys Crossing Road, which currently can only accommodate up to 26.0m B-Double vehicles and is not accessible at all times of the year as described in *Section 2.4.1* below.

An assumption that 19.0m Semi-Trailer and 26.0m B-Double vehicles would be able to transport the construction materials and equipment to the site. SolarReserve has advised that local construction capability is available for supply of equipment and materials i.e. concrete, earthworks plant and crane, which will definitely be required from Port Augusta as there will be no batching plant facilities available on site.

SolarReserve has not yet provided the exact tonnage of concrete required for the construction of the project. Concrete will require the shortest possible route, being via the Joy Baluch Bridge, formally Port Augusta Bridge.

2.3 Site Access Routes

All road routes from Adelaide are principally either National Highways or State Roads and are subject to statutory permit conditions, which could affect the proposed Aurora Solar Energy Project transportation requirements related over dimensional and over mass vehicles.

However, as mentioned above in *Section 2.2.2*, SolarReserve has clearly indicated that there will be no specific oversize loads (over dimensional or over mass) as with similar, associated wind farm projects. Therefore, no over dimensional or over mass vehicles will be deployed for the transportation of materials to the Aurora Solar Energy site.

2.3.1 Port Adelaide (via Greater Adelaide) to Port Augusta

Equipment for the Aurora Solar Energy Project will be imported from overseas as discussed above in *Section 2.2.1* and arrive at Port Adelaide. Due to ship size limitations and water depths, Port Adelaide is the only port destination along the Spencer Gulf capable of receiving such shipments.

The shortest possible route to Port Augusta from Port Adelaide is 303km, just over 3 hours via *National Highway A1* along Port Wakefield Road and Augusta Highway to Port Augusta and the Stuart Highway, *National Highway A87*, commencing north of Port Augusta, as shown below in Figure 5.

Subsequently, the Port Wakefield Road and Port Augusta Highway are categorised for heavy vehicles up to 36.5m, with the Stuart Highway rated for heavy vehicles up to 53.5m. The Port Wakefield Road and Augusta Highway *(National Highway A1)* are categorised as PBS (Performance Based Standards) classification system, Level 3A (up to A-Double) and Stuart Highway *(National Highway A87)* is categorised as PBS, Level 4A (up to A-Triple).

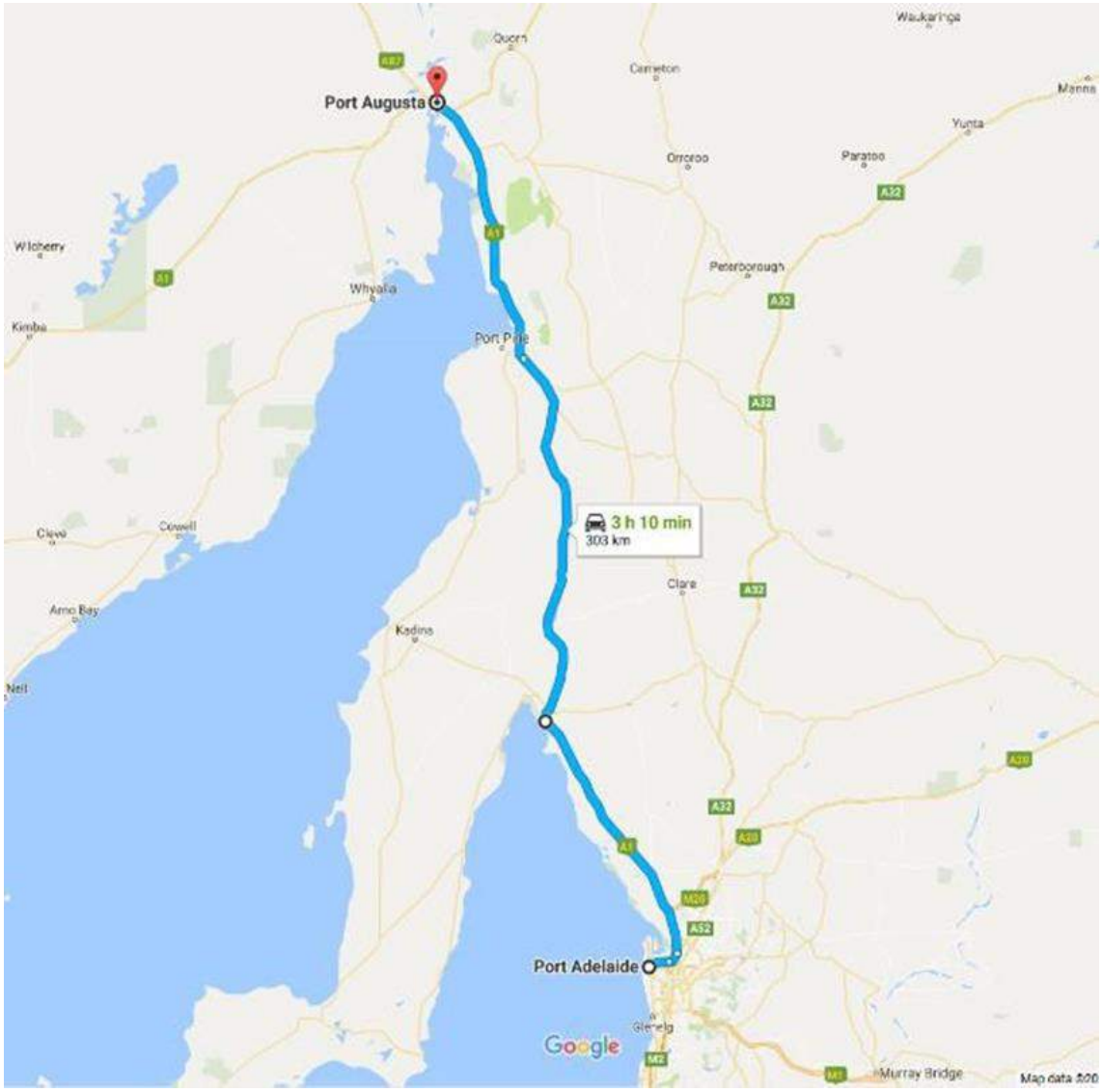

Figure 5 Predicted Route from Port Adelaide to Port Augusta

2.3.2 Required Site Access Improvements

The access/egress to/from the Stuart Highway will require considerable improvement to be able to accommodate large, heavy vehicles leaving the highway and being able to undertake the necessary turning manoeuvres required both into and out-off the main access/egress from Aurora.

It is important to identify the type and size of heavy vehicles that will need to gain access to the development. This will help in determining the appropriate design vehicle and checking vehicle to be used in the development's design. An assumption has been made that 19.0m Semi-Trailer and 26.0m B-Double vehicles will be used as a minimum.

The desirable lane width on rural roads is 3.5 m. This width allows large vehicles to pass or overtake without either vehicle having to move sideways towards the outer edge of the lane.

The lane width and the road surface condition have a substantial influence on the safety and comfort of users of the roadway. The intervening sections of the approach road must carry the total predicted traffic volume (through traffic plus development traffic), and the traffic approaching the development must be in the correct lane (left or right); auxiliary lanes will therefore be required.

Auxiliary lanes are used to remove traffic that is causing disruption to the smooth flow of traffic in the through lanes to a separate lane to allow the through traffic to proceed relatively unhindered by the disruption.

They are a means of separating the elements of the traffic stream on the basis of the speed difference between them, thereby improving the safety of the road as well as its capacity and level of service provided.

The following type of auxiliary lanes will possibly be required for the Aurora Solar Energy Project and access/egress from site to Stuart Highway:

- Acceleration Lanes – acceleration lanes are provided at intersections and interchanges to allow an entering vehicle to access the traffic stream at a speed approaching or equal to the 85th percentile speed of the through traffic. They are usually parallel to and contiguous with the through lane with appropriate tapers at the entering point. The warrants for this type of auxiliary lane and the desirable road layouts are discussed in the Guide to Road Design Part 4: Intersections and Crossings: General (Austroads 2009b).
- Deceleration Lanes – deceleration lanes are provided at intersections and interchanges to allow exiting vehicles to depart from the through lanes at the 85th percentile speed of the through lanes and decelerate to a stop or to the 85th percentile speed of the intersecting road, whichever is appropriate for the circumstances. These lanes are usually parallel to and contiguous with the through lanes with appropriate tapers at the departure point on the through lane. At intersections, the deceleration lane can be placed on either the right or the left of the through lanes, depending on the type of turn being effected. At interchanges, it is preferred that the exit be from the left side for most ramps and the deceleration lane will therefore be on the left in most cases. Details of the requirements for deceleration lanes are given in the Guide to Road Design Part 4: Intersections and Crossings: General (Austroads 2009b).

Further considerations will need to be given, but are not limited to the following:

- Consider network management implications (*Guide to Traffic Management Part 4*
- (Austroads 2016a))
- Consider road management (mid-block) issues such as road space allocation on the surrounding network (*Guide to Traffic Management Part 5* (Austroads 2014a))
- Develop traffic management arrangements for intersections and crossings *(Guide to Traffic Management Part 6* (Austroads 2013c))
- Analyse the traffic performance of options (*Guide to Traffic Management Part 2, 3* and *9*
- (Austroads 2015d, 2013b, 2014b))
- Develop traffic control, sign and marking schemes (*Guide to Traffic Management Part 10*
- (Austroads 2009d))
- Manage the interface between the development and adjacent local areas (*Guide to Traffic Management Parts 7* and *Part 8* (Austroads 2015e and 2008a))
- Relevant Australian Standards, i.e. AS 1742.
- DPTI Pavement Marking Manual – March 2015.

2.3.3 Road Safety Considerations

Road safety is one of the most important aspects of managing the road system. This has been clearly recognised with the advent of the Safe System approach to road operation and planning, in which planning decisions can strongly affect road safety outcomes.

Some of the elements to consider in traffic management of developments like the Aurora Solar Energy Project are as follows:

- Sight Distance
- Stopping Sight Distance (SSD)
- Driver Eye Height
- Driver Reaction Time
- Longitudinal Deceleration
- Overtaking Sight Distance
- Headlight Sight Distance

Refer to the Guide to Road Design Part 4A: Unsignalised and Signalised Intersections (Austroads 2010a) for further information regarding Truck SSD at intersections. Consideration should be given to providing Truck SSD at the following potentially hazardous locations:

- On the approaches to railway level crossings; and
- On intersection approaches where truck speeds are close to or equal to car speeds.

2.4 Alternative Route – Yorkeys Crossing Road

Yorkeys Crossing Road (RN 1000) is a rural local road maintained by Port Augusta City Council, which forms a northern bypass route around the top of the gulf. It is primary an unsealed road, approximately a 22km gravel roadway and currently carries less than 50 vpd. The southern end of the bypass route is an anti-directional route through residential / industrial areas of Port Augusta.

Yorkeys Crossing Road is depreciating much faster than there are available funds for its replacement, and offers Council a significant challenge. In 2011-2012, DPTI undertook an assessment in which preliminary costs to upgrade Yorkeys Crossing Road to an all-weather crossing totaled approximately $45 million, however this was not considered a priority at that time and is not currently programmed.

2.4.1 Joy Baluch Bridge (formally Port Augusta Bridge)

The Joy Baluch Bridge is the main crossing for the Upper Spencer Gulf, which carries approximately 17,500 vpd and has restrictions for Over Dimensional (OD) vehicles greater than 4.0 metres wide and 5.8 metres high.

If there are disruptions to traffic conditions on the Joy Baluch Bridge out of Port Augusta, consideration can only be given to utilising Yorkeys Crossing Road as an alternative to the main route through Port Augusta if vehicles are smaller than B-Doubles, and can be an unsafe and inaccessible route during wet weather conditions. As shown below in Figure 6.

The anticipated additional traffic generated from the site preparation and construction phase of the Aurora Solar Energy Project (approx. 490 vpd) with the existing current volumes of around 900 vpd, totaling 1,390 vpd will not impact on the day to day operations of traffic over the Joy Baluch Bridge or through Port Augusta itself.

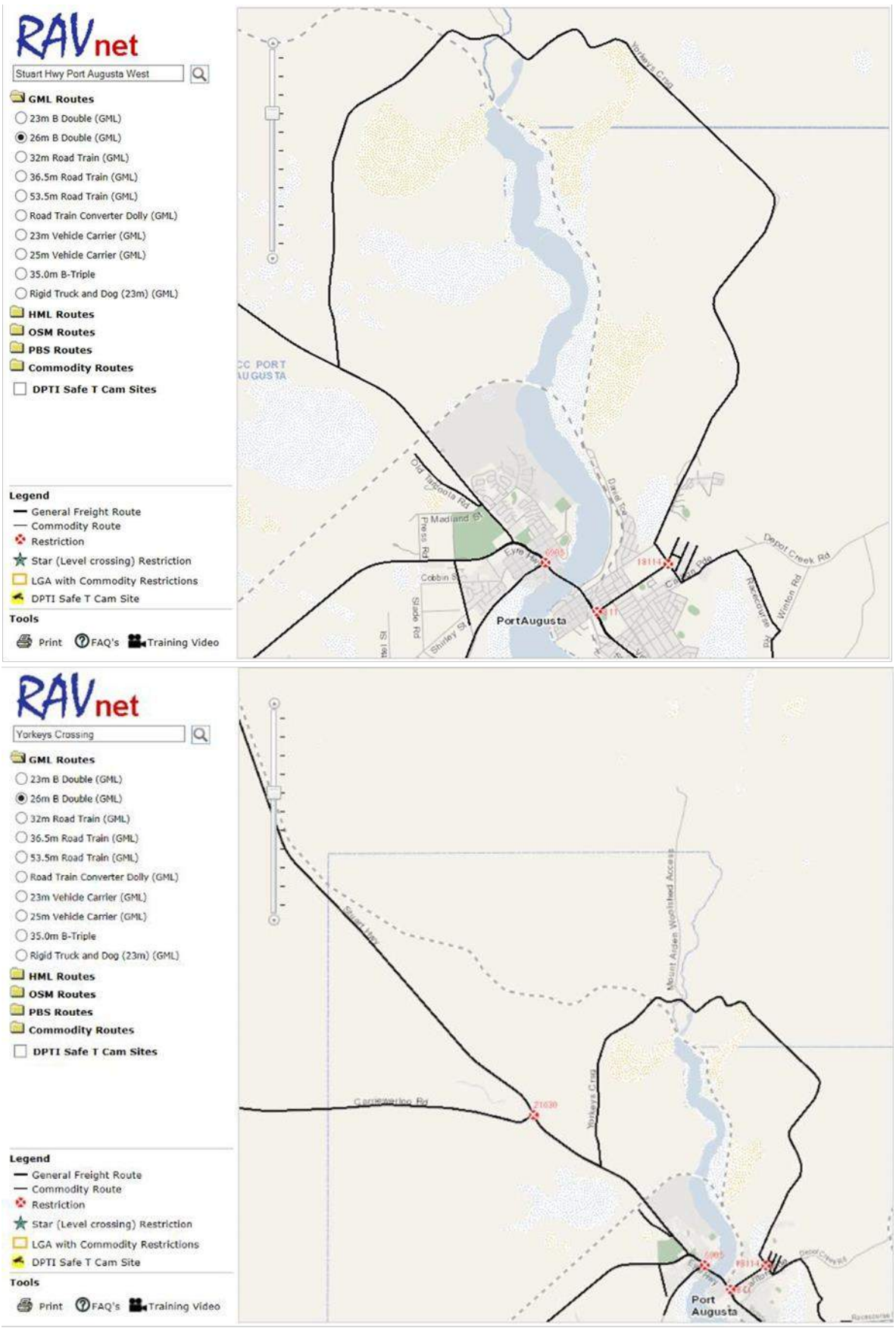

Figure 6 Alternative route via Yorkeys Crossing Road from DPTI RAVnet site

2.5 Traffic Impact Assessment

The estimated future traffic generation for the proposed development is to be at its highest during the initial site preparation and construction phases of the project. Based on this assessment and the following assumptions:

- Construction period would likely extend across 3 to 4 years.
- Vehicles movements (including AM and PM peak periods) have been estimated at 90 truck (heavy vehicle) movements per day and approximately 400 vpd, totaling an additional 490 vpd.
- Existing annual average daily traffic (AADT) volumes on the Stuart Highway are approximately 900 vpd in the area between Port Augusta to Pimba with 29% or 261 being heavy vehicles – current speed limit is 110km/h.
- Rostering requirements for staff/personnel to be on-site has been estimated to be in either two (2) 12-hour shifts or three (3) 8-hour shifts, seven (7) days per week.
- Actual trip generation of staff from Port Augusta to the Aurora Solar Energy site are not able to be determined as SolarReserve has not provided any actual or estimated staff/personnel numbers at this point in time.

Given the rural location of the proposed development and the foreseen traffic volumes generated by the development (approx. 490 vpd) as well as the existing traffic volumes on the Stuart Highway (approx. 900 vpd), it is therefore anticipated that the total traffic, including from the development will be approximately 1,390 vpd.

This anticipated 1,390 vpd, is considered not to adversely impact or compromise the safety or operation of the existing road network which in its current form and classification as a high capacity road and one of Australia's major highways able to carry up to an estimated 15,000 vpd.

There will be a requirement for temporary speed signage and truck warning signage to be implemented on approach to the intersection of Stuart Highway leading to the Aurora Solar Energy site as well as the private pastoral access roads within the site. DPTI will need to make a determination as to whether a reduction in the posted speed limit would be required leading up to the sites access/egress, i.e. 60 or 80 km/h.

It is recommended that a Road Safety Audit (RSA) is undertaken as this is one of the most important aspects of managing the road system ensuring that the Safe System approach is adopted to the road operation and planning which affect road safety outcomes.

A detailed assessment of glint and glare was undertaken for the SolarReserve project in Nevada in order to determine whether there were likely to be health or distraction issues associated with the project. Two aspects were consider: impacts from the tower and impacts from the heliostats.

The existing Sundrop Solar tower located on the outskirts of Port Augusta heading north, although smaller is tower size, and the source of light pointing towards the gulf, the solar array produces significant light, which whilst driving is not distracting or provides any glare and/or glint to the driver, during daylight or night time hours as shown in Figure 7 below.

Figure 7 Sundrop Farm Solar Array Tower

The light emitted from the tower will be visible from some distance as is experienced by the Sun drop farms development which is a smaller scale example of this type of development.

In the Crescent Dunes example, the closest viewing point is 1.2 km from the tower. The investigations for Crescent Dunes found that at this distance the glare from the receiver will not cause potential eye damage, and is unlikely to leave an after-image in the retina.

A worst-case calculation has been undertaken for the Aurora project to determine the likely level. In this case the, the closest viewing point from the road will be approximately 2.2 km from the tower, at which will point the luminance level will be similar to a 60W incandescent light bulb from a distance of 0.51 metres.

Furthermore, this light source will not result in unintended driver distraction as the tower will be visible from some distance (i.e. it will not 'appear' as a surprise) and will not 'blind' drivers if they happen to look at the tower.

The heliostats are arranged to 'face' the tower, which means that they present their backs (or undersides) to the external perimeter. The heliostats that might present a reflection at ground level will be those located on the opposite side of the viewing point. In the Aurora example, if a person were to stand on the edge of the Stuart Highway, the heliostats on the far eastern side (at least 2.4 km away) could be reflecting light in the direction of the viewer. However, the backs of the heliostats on the western side of the field will screen any view of the eastern side.

As such, reflection form the heliostats is an issue for aviation and remote elevated viewing locations rather than land based travel.

3. Summary of Findings

- The site preparation, construction and ongoing operational phases of site will require the existing access/egress point from Stuart Highway to be upgraded to accommodate the expected increase of traffic to the site being generated which is approximately 490 vpd, in which site access improvements will be required as indicated in *Section 2.3.2*;
- Majority of traffic expected to be right in and left out, in which an Auxiliary or Channelised Right Turn (CHR) lane into the site and auxiliary (merging) lane out of the site to accommodate for all vehicle (especially heavy vehicle) movements. This will require consultation with DPTI to ensure appropriate sight distance and road safety requirements are met, again as indicated in *Section 2.3.2* and *2.3.3, Road Safety Considerations*;
- During the construction phase, temporary speed signage and truck warning signage will need to be implemented on approach to the intersection of Stuart Highway leading to the Aurora Solar Energy site. DPTI will need to make a determination as to whether a reduction in the posted speed limit would be required leading up to the sites access/egress, i.e. 60 or 80 km/h;
- Construction of current internal access (small dirt) tracks on the private pastoral lands will need to be upgraded to accommodate two-way vehicle movement, which a minimum of 7.0m has been proposed, and graded back to a smooth, trafficable surface, including a crown or cross-slope of the roadway, and longitudinal sloping in accordance with horizontal and vertical curve design as indicated in *Section 2.1.1*;
- Additional work on the rail corridor and gas line/water pipe needs to be undertaken to ensure that crossings do not compromise the existing infrastructure, this needs to be in accordance with the following:
  - *Australian Standards, AS 1742.7:2016 – Manual of uniform traffic control devices – Railway crossings;*
  - *DPTI Railway Crossing Safety Strategy, 2017;*
  - *Austroads, Measures for Managing Safety of Heavy Vehicles at Passive and Active Railway Level Crossings;*
  - *Austroads, Improved Railway Road Design for Heavy Vehicles;*
  - *SA Water Technical Standard 142, Vehicle Cross-overs for above ground trunk mains (Dec 2010)*
- Finally, with an additional 490 vpd, and the existing AADT of approximately 900 vpd, a total of approximately 1,390 vpd will travel along the Stuart Highway due to the development. Therefore, it is considered that the increase of approximately 490 vpd will not to adversely compromise the safety or operation of the existing road network, which in its current form and classification as a high capacity road is capable of carrying up to an estimated 15,000 vpd, hence this development has been deemed to have a minimal impact.

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Revision	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
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Report 4
Aviation Impact Assessment

Aviation Impact Statement

Final Report

Aurora Solar Energy Project SA

14 September 2017

Gutteridge Haskins Davey

GHD

Project	Client	Project No.	Version No.	Author
Aurora Solar Energy Project	Gutteridge Haskins Davey	**LB00039**	001	Barrie Slingo
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VERSION NO.	BASIS OF ISSUE	DATE	REVIEWERS
001	Draft Report Outline for submission to Client	28/08/17	BR
002	Draft Report	07/09/17	BWS
003	Final Report	14/09/17	BR

Contents

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1. Introduction

Landrum and Brown has been tasked by GHD Adelaide to prepare an Aviation Impact Statement (AIS) and aviation safety case for the proposed Aurora Solar Energy Project (ASEP). The ASEP is to be located approximately 30 km north of Port Augusta in South Australia. From an aviation aspect, the following items have been addressed in the preparation of this AIS:

- Consideration of the potential impact to "prescribed airspace" in the vicinity of the ASEP. This involves consideration of relevant Acts and Regulations applicable to developments in the vicinity of airports and air traffic routes. The major relevant documents include: The ***Airports Act 1996, Airports (Protection of Airspace) Regulations 1996*** and ***CASR Part 139 Manual of Standards – Aerodromes;***
- Analysis of Obstacle Limitation Surfaces (OLS);
- Analysis of Procedures for Air Navigation Services – Aircraft Operations (PANS-OPS);
- The ASEP involves the installation of ground mounted solar reflectors (Heliostats) to transfer heat to a tall centrally located tower that generates hydro-electric power. Glare, both direct and reflected from the solar cells and the central tower may cause visual impacts to pilots operating in the vicinity of the ASEP, especially when operating at lower altitudes on final approach to a runway. The Australian Civil Aviation Safety Authority (CASA) does not publish specific regulations in relation to solar glare but requires:
  - to be advised of all developments in the vicinity of airports or designated airspace that may impact on the safety of aircraft operations; and
  - preparation of a safety case AIA in the application to the airport owner/operator, CASA, and the Department of Defence (DoD). DoD provides guidelines for consideration of reflective surfaces in their document "Extraneous Lighting and Reflective Surfaces Guidance".
- Consideration of potential impacts on Airservices Australia (AsA) air traffic control, navigation aids, communications and surveillance systems.

Details of Aerodromes, Navigation Aids, Surveillance Sensors and Airspace were obtained from the Australian Information Publications (AIP), AsA sources and CASA publications.

A Glossary of Aeronautical terms and Abbreviations is shown at Appendix A.

2. The Proposed Aurora Solar Energy Project

The principle of the Aurora Solar Energy Project involves the collection and storage of solar heat to produce hydro–electric energy, and is technically known as "molten salt power tower technology with integrated energy storage". ASEP will have a capacity of 110 megawatt hours with 880 megawatt hours (8 hours) of full load storage. Height of the central collector/receiver tower will be approximately 214 m AGL and there will be a total of 11,838 automatic, individually controlled, dual axis tracking heliostats. Molten salt power tower technology electricity production is as follows:

1. Sunlight is concentrated and directed from the large field of heliostats (reflecting mirrors) to the receiver mounted on the centrally located tower;
2. Liquid salt from a cold salt tank is pumped through the receiver where it is heated to 566 °C;
3. The heated salt from the receiver is stored in a hot salt tank;
4. Hot salt is pumped from the hot salt tank through a steam generator to create steam, which drives a steam turbine, generating electricity;
5. Cold salt at 288 °C flows back to the cold salt tank; and
6. Condensed steam from the steam turbine is recirculated for reuse.

Unlike other solar energy projects, the ASEP by storing energy is capable of continuous production of electricity but the facility can be calibrated to deliver power 24/7, or act as a peaking power plant. The collector/receiver mounted at the top of the central tower, is a high luminance source and has been the subject of pilot complaints in the US. A typical solar energy project of the type proposed for the Port Augusta installation is shown in Fig. 2.1.

Fig. 2.1 – Typical Solar Energy Installation

The proposed ASEP is located approximately 30 km north of Port Augusta adjacent to the Stuart Highway in South Australia. The location of the ASEP and its proximity to the city of Port Augusta is shown in Figure 2.2 below.

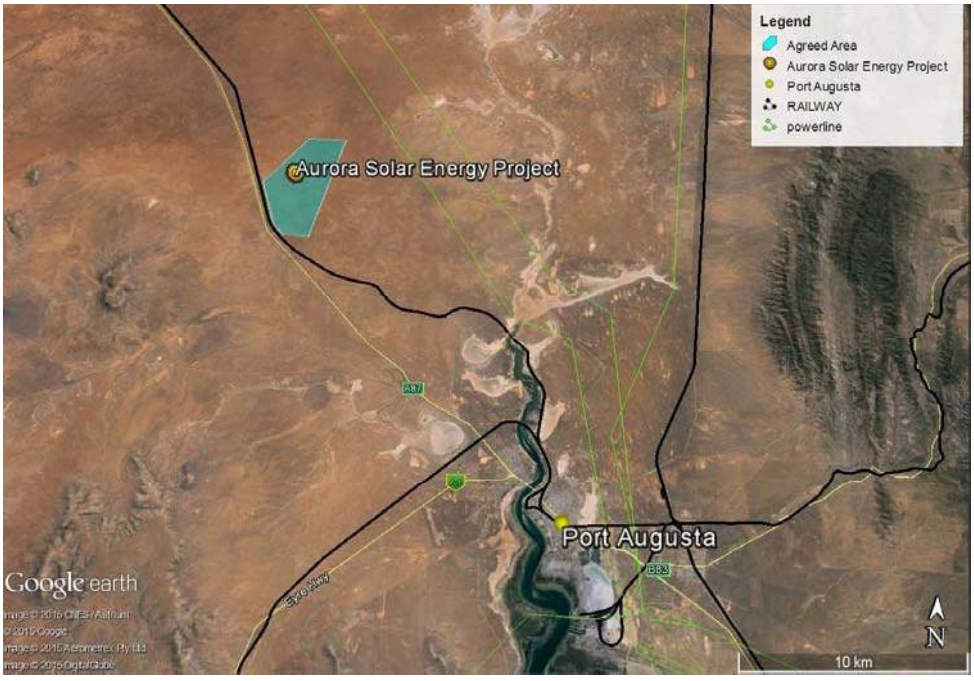


Figure 2.2 Location of the Aurora Solar Energy Project

3. Aerodromes within 30 km of the Aurora Solar Energy Project

As the heliostats are low level mounting, these would not normally penetrate Prescribed Airspace surfaces for aerodromes. However, the central collector/receiver tower is some 214 m AGL and cranes that may be used in the construction of the tower may exceed this height. Consideration was therefore given to the OLS and PANS-OPS surfaces of the aerodromes within the vicinity of the ASEP.

4. Consideration of Obstacle Limitation Surfaces

There is one certified Aerodrome within the vicinity of the ASEP, situated at Port Augusta (YPAG). This airport is located approximately 6 km to the west of Port Augusta and is approximately 23 km from the ASEP site. The OLS for YPAG extends to approximately 15 km from the runway threshold and is thus well short of the ASEP.

The Obstacle Limitation Surface for Port Augusta Airport is shown in Fig. 4.1 below. An enlarged version of Figure 4.1 is at Appendix A.

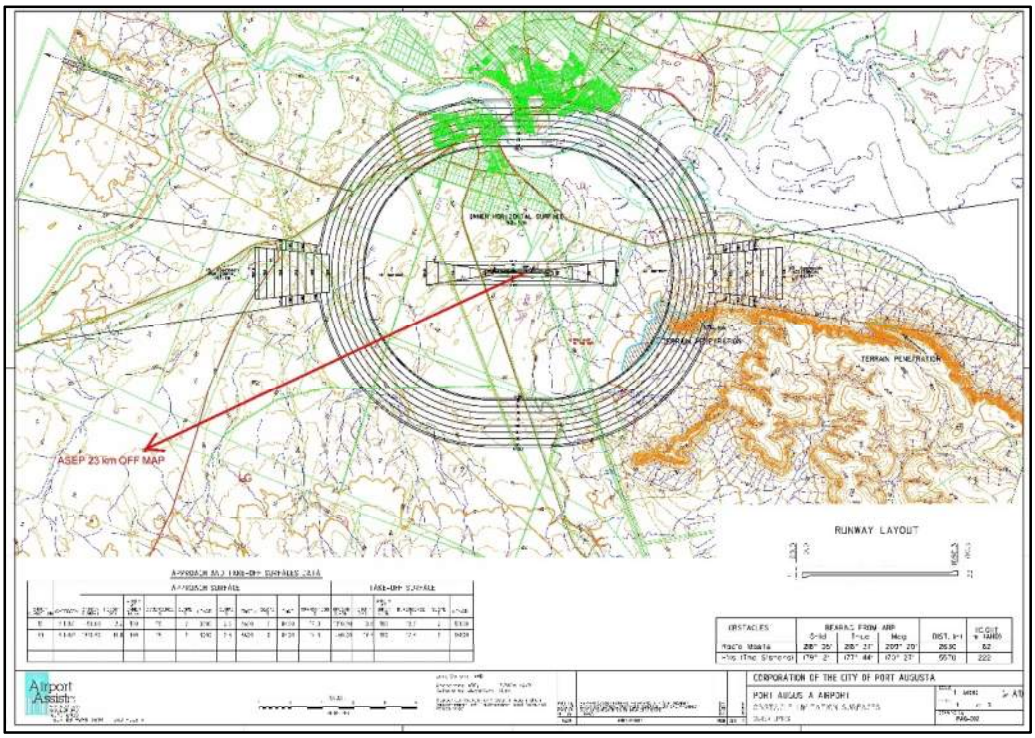


Fig. 4.1 Port Augusta Airport – Obstacle Limitation Surfaces

A landing field is also located at Alamein, some 2-3 km further west of YPAG and is an Army Base. This airfield is approximately 25 km from the ASEP. The Department of Defence will need to be notified of the ASEP development. As a landing field, OLS surfaces are not prescribed for this airfield.

There are a number of other landing fields in the vicinity of the ASEP, but as these landing fields are not certified or registered, they do not have OLS or PANS OPS surfaces.

In summary, the Aurora Solar Energy Project will not impact on the Obstacle Limitation Surfaces of any airport in the vicinity of the Project.

5. Designated Air Routes, Restricted and Danger Areas.

There are several Designated Air Routes, Restricted Areas and Danger Areas in the vicinity of the ASEP as indicated in the extract from the ERC 7 Low AIP Chart at Fig. 5.1 below. Note that this chart is not aligned to true north, bearings are in degrees magnetic, altitudes are in ft AHD and distances are in nautical miles (nm).

Designated air routes and Lowest Safe altitudes (LSALTs) that pass over or close to the ASEP are:

W764 2500 ft

W328 4200 ft

Z92 4200 ft (Grid)

J37 4200 ft

The Lowest LSALT for W764 is 2500ft AHD (approx.762m AHD), and when the Minimum Obstacle Clearance (MOC) of 1000 ft is applied the result is 1500 ft or 457 m AHD. This is in excess of the height of the ASEP central tower of approximately 264 m AHD and the cranes to be used during construction.

Figure 5.1 Designated Air Routes, Restricted Areas and Danger Areas

There are no Restricted or Danger areas near the AESP. However, general aviation aircraft can operate at altitudes down to 500ft AGL (approx. 152 m AGL) or 500 ft above the highest point or obstacle (including the ASEP tower) on the terrain below. These aircraft should therefore fly 500 ft above the ASEP central collector/receiver.

As aircraft may fly below 500 ft above the tower due to weather conditions, it will be necessary to advise the aviation authorities so that the location of the ASEP can be clearly identified on aeronautical charts. Further, operators in the vicinity of the ASEP should be formally notified of the proposed ASEP.

6. Consideration of PANS-OPS Surfaces

Figure 6.1 is an extract from the AIP DAP, and shows the RNAV-Z (GNSS) approach procedure for YPAG. This is the only procedure published for YPAG, and there are associated PANS-OPS surfaces. As these are not published in the Port Augusta Airport Master Plan, the consultants have calculated the PANS-OPS surfaces over the AESP, in accordance with CASA MOS Part 173 and ICAO Doc 8168 PANS-OPS.

Note that in the chart in Figure 6.1, bearings are in degrees magnetic, altitudes are in ft AHD and distances are in nautical miles (nm).

The approximate location of the AESP is also shown.

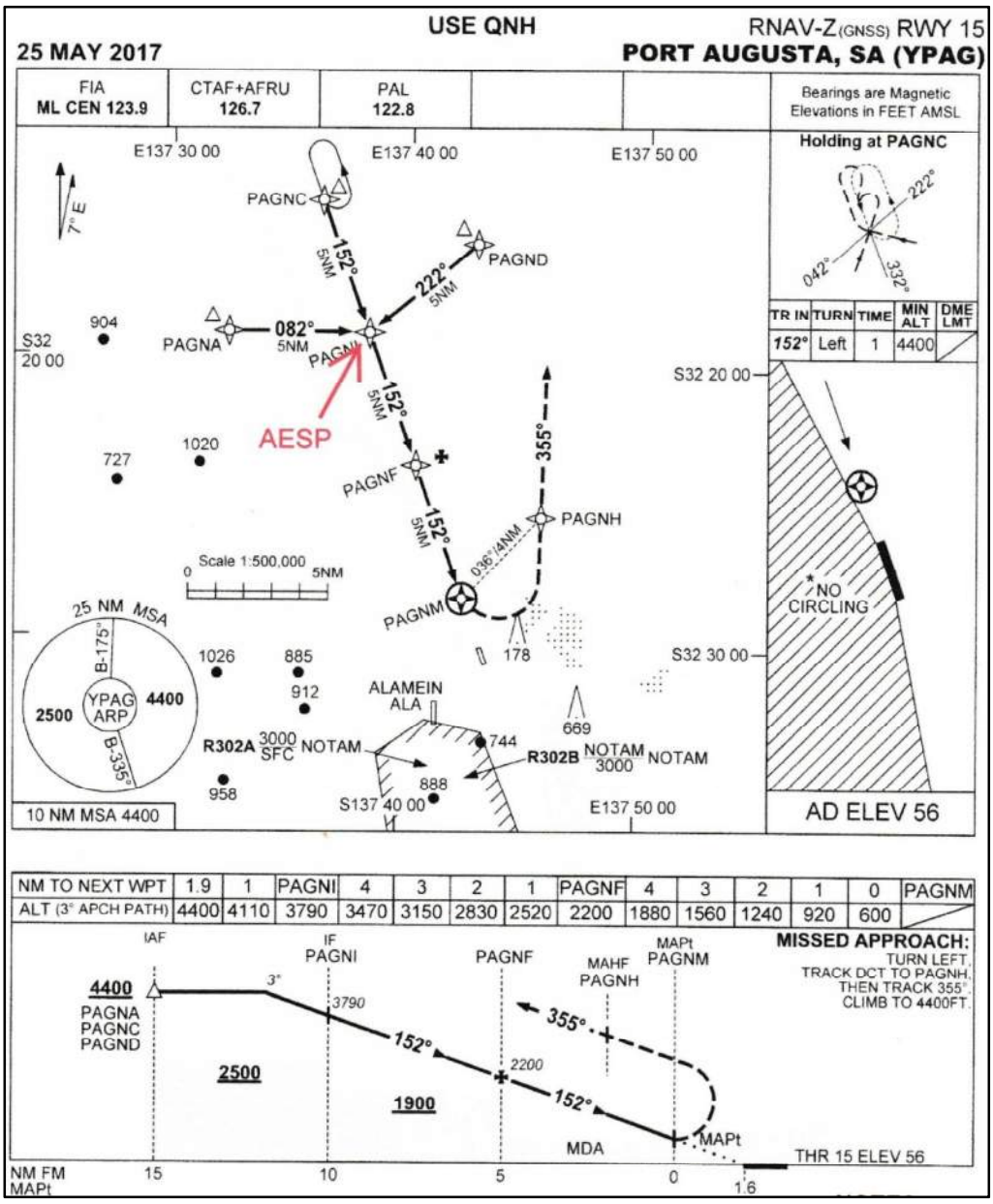


Figure 6.1 YPAG RNAV-Z GNSS) Approach Procedure

Figure 6.2 shows a more accurate location of the AESP in relation to the Waypoints PAGNI and PAGNF on the final approach track.

Figure 6.2 RNAV (GNSS) RWY 15 Approach Track and Waypoints and the AESP

As can be seen in Figures 6.1 and 6.2 the AESP is located approximately 1 nm to the south west of the Initial Approach Fix (IF) waypoint PAGNI. At this location, the AESP is within the 2.5 nm navigation tolerance of the waypoint.

The lowest sector altitude between the IF PAGNI and Final Approach Fix (FAF) PAGNF is 1900 ft (profile drawing in Figure 6.1). When the MOC of 500 ft is applied, the result is 1400 ft or 426 m AHD, which is the PANS-OPS surface at the AEST.

As the AESP mast height is 264 m AHD it is 162 m below the PANS-OPS surface. Provided construction cranes are limited to below 426 m AHD, the AESP will not penetrate the PANS-OPS surface.

7. Potential Impacts to Airways Facilities

There are no airways navigation aids or communications facilities in the vicinity of the ASEP. The nearest surveillance (radar) sensors are located at Adelaide Airport and Summertown over 300 km to the south east of the ASEP. It is assessed that these radar sensors are too far from the ASEP to be impacted.

8. Potential Impacts of Solar Glare

Installation of this type of solar energy facility has been the subject of pilot complaints in the USA, mainly due to the excessive glare emitted from the central tower. However, the ground mounted

heliostats are effectively mirrors that track the position of the sun to maximise the distribution of energy to the collector/receiver. Various studies have been undertaken in the US that indicate that the problem of reflected glare to pilots operating at low levels near the facility mainly occurs within close proximity of the installation. The US Federal Aviation Authority (FAA) has issued a publication "*Technical Guidance for Evaluating Solar Technologies on Airports"* that seeks to provide advice as to whether solar energy generation is compatible with aviation due specifically to issues such as glare, radar interference, and physical penetration of airspace. While the publication concentrates on solar energy systems located on an airport and the desired economic and sustainability benefits of electrical energy production, it does give some consideration to off-airport solar systems. Again, the main interests of concern from an aviation aspect are direct and reflected glare, radar interference, and physical penetration of prescribed airspace.

As indicated above, the ASEP installation is sited beneath several low level designated air routes and in the vicinity of Restricted Areas and Danger Areas, and pilots operating at low levels may be subjected to direct and reflected glare.

As can be seen in Figure 6.1, aircraft on tracks to the IF at PAGNI from PAGNA, PAGNC and PAGND will be tracking directly towards the AESP tower, which is adjacent to PAGNI. There will be potential glare from the solar panels, and also from the collector/receiver on top of the tower. Once past the tower and PAGNI there will be no solar glare.

Ocular Safety

The following is an edited extract from the "Central Tower Receiver Glint/Glare" Blue Book as provided by SolarReserve.

There can be safety concerns around solar power projects of the type proposed for the ASEP due to the bright glare from the high rise central tower. When sunlight is focused on the receiver, it will absorb well over 90% percent of the light – but what is not absorbed will be reflected back out, and will appear to be a bright white light. If an observer were standing close to the receiver, the bright light reflected by the receiver could be harmful to the eyes (although the focused solar flux would probably be a much greater concern.) However, at typical distances – especially distances of typical outside observers – there is no danger to ocular safety. In short, the tower will appear bright, but injury is unlikely. This subject has been studied quantitatively for projects in the United States.

Best practice for ocular safety analysis is to separate it from the visual impact analysis. Ocular safety is a safety issue, not a visual impact issue.

Data gathered by the pyrotechnic industry in the USA indicates that the central tower receiver surface temperature of 621.1 °C (1,150 °F) would exhibit a bright red and slight orange colour. The amount of radiation in the visible spectrum (~390 - 750 nm) will be negligible.

The data also indicates that the higher the temperature of the radiating body, such as the case of the sun, the more visible light that the body emits. For this reason, it is expected that the visible light of the sun reflected from the receiver will dominate the illuminance, i.e. reception on the human eye. In terms of brightness to the human eyes, the receiver illuminance received by the eye can be estimated by assuming that the receiver flux has the same characteristics as those from the sun. The visual impact of the receiver to an observer is a function of the central tower receptor distance from the receiver.

9. Consideration of Tall Structures

CASA Advisory Circular AC 139 08 (0) "Reporting of Tall Structures" requires the proponent to notify of a building or structure that is:

> *30 m or above ground level if within 30 km of an aerodrome; or*
> *45 metres or more above ground level elsewhere.*

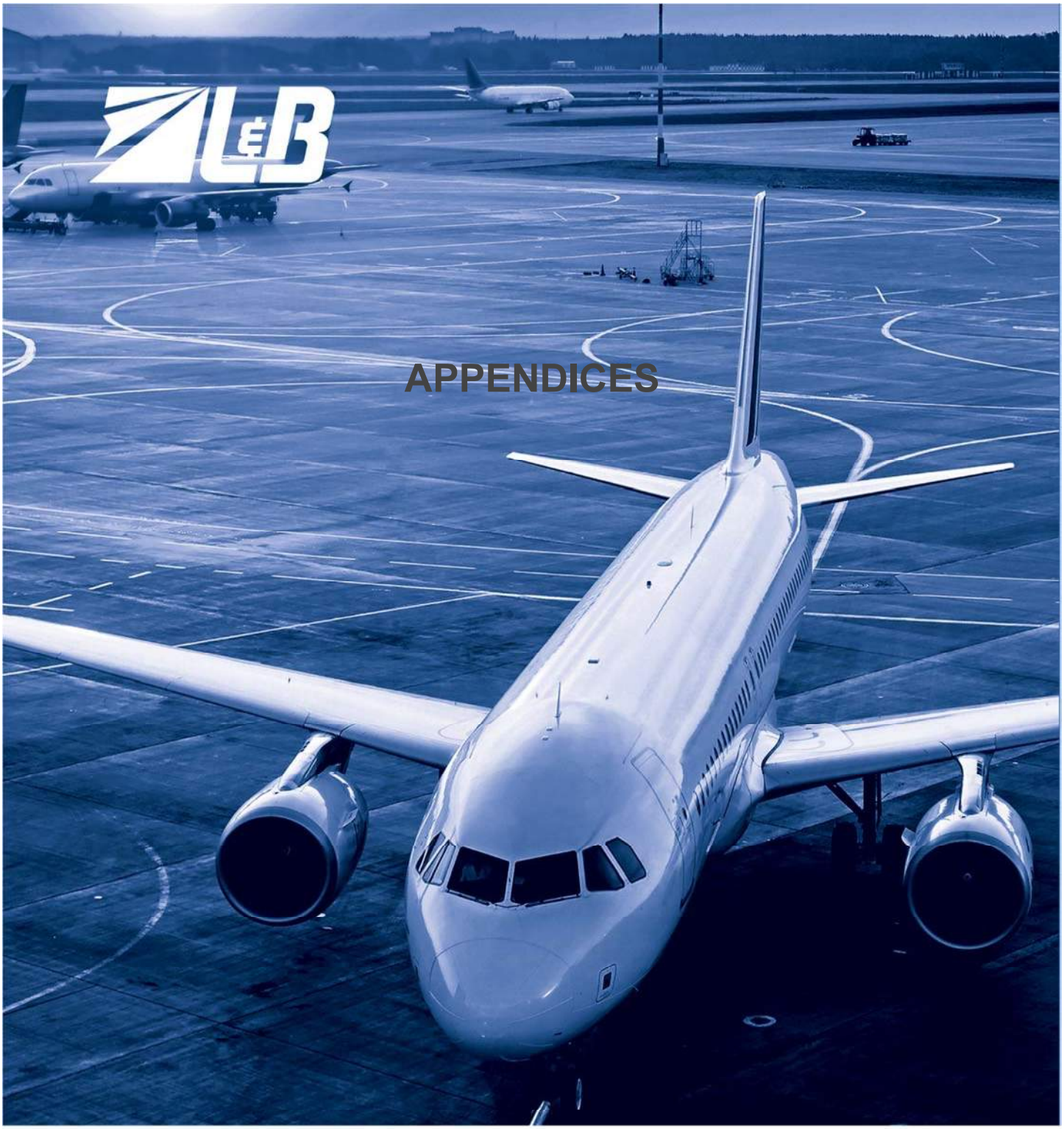
As the central collector/receiving tower of the ASEP will exceed 45 m above ground level, notification in accordance with the Advisory Circular is required. CASA does not publish specific regulations in relation to solar glare, the only requirement is to present a safety case AIS in the application to the airport owner/operator, AsA, CASA and DoD.

It is also understood that the solar farm proponent is considering an electrical reticulation system from the ASEP to the main power grid and that the reticulation supporting towers may be some 50-60 m AGL. As such towers will meet the above referenced "Tall Structure" criteria, it will be necessary to gain relevant aviation authority approval for such towers in the vicinity of Port Augusta Airport. If required, the consultants can prepare the requisite safety case for consideration by the aviation authorities.

10. Conclusions

The results of the Aviation Impact Assessment for the Aurora Solar Energy Project are:

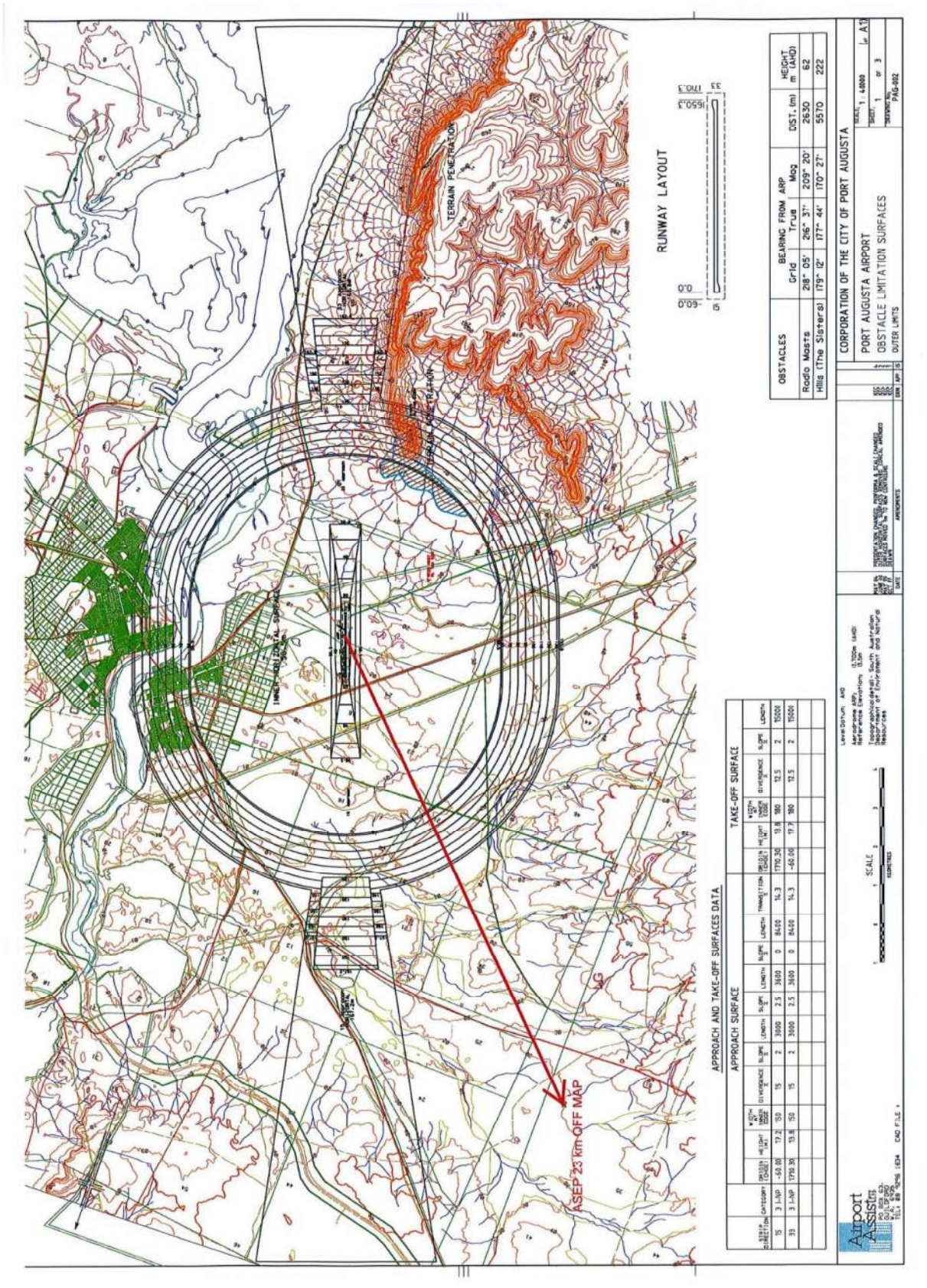
- The Aurora Solar Energy Project will not impact on the OLS and PANS-OPS surfaces for any aerodrome within 30 km;
- The Aurora Solar Energy Project will not impact on the Lowest Safe Altitudes of Air Routes in the vicinity;
- The Aurora Solar Energy Project will not impact on the performance of any navigation aids or airspace surveillance sensors;
- Notification of the proposed heights of the central receiving tower and construction cranes must be provided in accordance with AC 139 08 (0);
- As the power reticulation system will be located in the vicinity of Port Augusta Airport and may comprise towers some 50-60 m AGL, an aviation safety case may be required; and
- Direct and reflected glare from the Aurora Solar Energy Project may result in pilot visibility impacts. Appropriate notification is to be provided to nearby airports, aero clubs, operators, CASA, AsA, and Department of Defence. It is also recommended that the location of the Aurora Solar Energy Project be clearly indicated in AIPs.



APPENDICES

APPENDIX A

Port August Airport – Obstacle Limitation Surface


CORPORATION OF THE CITY OF PORT AUGUSTA
PORT AUGUSTA AIRPORT
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APPENDIX B

GLOSSARY OF AERONAUTICAL TERMS AND ABBREVIATIONS

To facilitate the understanding of aviation terminology used in this report, the following is a glossary of terms and acronyms that are commonly used in aeronautical impact assessments and similar aeronautical studies.

AC (Advisory Circulars) are issued by CASA and are intended to provide recommendations and guidance to illustrate a means, but not necessarily the only means, of complying with the *Regulations*.

Aeronautical study is a tool used to review aerodrome and airspace processes and procedures to ensure that safety criteria are appropriate.

AIPs (Aeronautical Information Publications) are publications promulgated to provide operators with aeronautical information of a lasting character essential to air navigation. They contain details of regulations, procedures and other information pertinent to flying and operation of aircraft. In Australia, AIPs may be issued by CASA or Airservices Australia.

Air routes exist between navigation aid equipped aerodromes or waypoints to facilitate the regular and safe flow of aircraft operating under IFR.

Airservices Australia is the Australian government-owned corporation providing safe and environmentally sound air traffic management and related airside services to the aviation industry.

Altitude is the vertical distance of a level, a point or an object, considered as a point, measured from mean sea level.

ATC (Air Traffic Control) service is a service provided for the purpose of:

a. preventing collisions:
    1. between aircraft; and
    2. on the manoeuvring area between aircraft and obstructions; and
b. expediting and maintaining an orderly flow of air traffic.

CASA (Civil Aviation Safety Authority) is the Australian government authority responsible under the *Civil Aviation Act 1988* for developing and promulgating appropriate, clear and concise aviation safety standards. As Australia is a signatory to the ICAO *Chicago Convention,* CASA adopts the standards and recommended practices established by ICAO, except where a difference has been notified.

CASR (Civil Aviation Safety Regulations) are promulgated by CASA and establish the regulatory framework *(Regulations)* within which all service providers must operate.

Civil Aviation Act 1988 (the Act) establishes the CASA with functions relating to civil aviation, in particular the safety of civil aviation and for related purposes.

ICAO (International Civil Aviation Organization) is an agency of the United Nations which codifies the principles and techniques of international air navigation and fosters the planning and development of international air transport to ensure safe and orderly growth. The ICAO Council

adopts standards and recommended practices concerning air navigation, its infrastructure, flight inspection, prevention of unlawful interference, and facilitation of border-crossing procedures for international civil aviation. In addition, the ICAO defines the protocols for air accident investigation followed by transport safety authorities in countries signatory to the Convention on International Civil Aviation, commonly known as the *Chicago Convention*. Australia is a signatory to the *Chicago Convention.*

IFR (Instrument Flight Rules) are rules applicable to the conduct of flight under IMC. IFR are established to govern flight under conditions in which flight by outside visual reference is not safe. IFR flight depends upon flying by reference to instruments in the flight deck, and navigation is accomplished by reference to electronic signals. It is also referred to as, "a term used by pilots and controllers to indicate the type of flight plan an aircraft is flying," such as an IFR or VFR flight plan.

IMC (Instrument Meteorological Conditions) are meteorological conditions expressed in terms of visibility, distance from cloud and ceiling, less than the minimum specified for visual meteorological conditions.

LSALT (Lowest Safe Altitudes) are published for each low level air route segment. Their purpose is to allow pilots of aircraft that suffer a system failure to descend to the LSALT to ensure terrain or obstacle clearance in IMC where the pilot cannot see the terrain or obstacles due to cloud or poor visibility conditions. It is an altitude that is at least 1,000 feet above any obstacle or terrain within a defined safety buffer region around a particular route that a pilot might fly.

MOS (Manual of Standards) comprises specifications (Standards) prescribed by CASA, of uniform application, determined to be necessary for the safety of air navigation.

NOTAMs (Notices to Airmen) are notices issued by the NOTAM office containing information or instruction concerning the establishment, condition or change in any aeronautical facility, service, procedure or hazard, the timely knowledge of which is essential to persons concerned with flight operations.

Obstacles. All fixed (whether temporary or permanent) and mobile objects, or parts thereof, that are located on an area intended for the surface movement of aircraft or that extend above a defined surface intended to protect aircraft in flight.

OLS (Obstacle Limitation Surfaces) are a series of planes associated with each runway at an aerodrome that defines the desirable limits to which objects may project into the airspace around the aerodrome so that aircraft operations may be conducted safely.

PANS-OPS (Procedures for Air Navigation Services - Aircraft Operations) is an Air Traffic Control term denominating rules for designing instrument approach and departure procedures. Such procedures are used to allow aircraft to land and take off under Instrument Meteorological Conditions (IMC) or Instrument Flight Rules (IFR). ICAO document 8168-OPS/611 (volumes 1 and 2) outlines the principles for airspace protection and procedure design which all ICAO signatory states must adhere to. The regulatory material surrounding PANS-OPS may vary from country to country.

PANS OPS Surfaces. Similar to an Obstacle Limitation Surface, the PANS-OPS protection surfaces are imaginary surfaces in space which guarantee the aircraft a certain minimum obstacle clearance. These surfaces may be used as a tool for local governments in assessing building development. Where buildings may (under certain circumstances) be permitted to penetrate the

OLS, they cannot be permitted to penetrate any PANS-OPS surface, because the purpose of these surfaces is to guarantee pilots operating under IMC an obstacle free descent path for a given approach.

Prescribed airspace is an airspace specified in, or ascertained in accordance with, the Regulations, where it is in the interests of the safety, efficiency or regularity of existing or future air transport operations into or out of an airport for the airspace to be protected. The prescribed airspace for an airport is the airspace above any part of either an OLS or a PANS OPS surface for the airport and airspace declared in a declaration relating to the airport.

Regulations (Civil Aviation Safety Regulations)

VFR (Visual Flight Rules) are rules applicable to the conduct of flight under VMC. VFR allow a pilot to operate an aircraft in weather conditions generally clear enough to allow the pilot to maintain visual contact with the terrain and to see where the aircraft is going. Specifically, the weather must be better than basic VFR weather minima. If the weather is worse than VFR minima, pilots are required to use instrument flight rules.

VMC (Visual Meteorological Conditions) are meteorological conditions expressed in terms of visibility, distance from cloud and ceiling, equal or better than specified minima.

ABBREVIATIONS

Abbreviations used in this report, and the meanings assigned to them for the purposes of this report are detailed in the following table.

Abbreviation	Meaning
AC	Advisory Circular (document support CAR 1998)
ACFT	Aircraft
AD	Aerodrome
AHD	Australian Height Datum
AHT	Aircraft height
AIP	Aeronautical Information Publication
Airports Act	Airports Act 1996, as amended
AIS	Aeronautical Information Service
Alt	Altitude
AMSL	Above Mean Sea Level
APARs	Airports (Protection of Airspace) Regulations, 1996 as amended
ARP	Aerodrome Reference Point
AsA	Airservices Australia
ATC	Air Traffic Control(ler)
ATM	Air Traffic Management
BRA	Building Restricted Area (for GP)
CAO	Civil Aviation Order
CAR	Civil Aviation Regulation
CASA	Civil Aviation Safety Authority
CASR	Civil Aviation Safety Regulation
Cat	Category
DAP	Departure and Approach Procedures (charts published by AsA)
DER	Departure End of (the) Runway
DEVELMT	Development
DME	Distance Measuring Equipment
Doc nn	ICAO Document Number nn
DIT	Department of Infrastructure and Transport. (Formerly Dept. of Infrastructure, Transport, Regional Development and Local Government and Department of Transport and Regional Services (DoTARS))
DOTARS	See DIT above
ELEV	Elevation (above mean sea level)
ENE	East North East
ERSA	Enroute Supplement Australia
FAF	Final Approach Fix
FAP	Final Approach Point
ft	feet
GBAS	Ground Based Augmentation System (satellite precision landing system)
GNSS	Global Navigation Satellite System
GP	Glide Path
IAS	Indicated Airspeed

Abbreviation	Meaning
ICAO	International Civil Aviation Organisation
IHS	Inner Horizontal Surface, an Obstacle Limitation Surface
ILS	Instrument Landing System
ISA	International Standard Atmosphere
km	kilometres
kt	Knot (one nautical mile per hour)
LAT	Latitude
LLZ	Localizer
LONG	Longitude
m	metres
MAPt	Missed Approach Point
MDA	Minimum Descent Altitude
MGA94	Map Grid Australia 1994
MOC	Minimum Obstacle Clearance
MOS	Manual of Standards, published by CASA
MSA	Minimum Sector Altitude
MVA	Minimum Vector Altitude
NASAG	National Airports Safeguarding Advisory Group
NDB	Non Directional Beacon
NE	North East
NM	Nautical Mile (= 1.852 km)
nnDME	Distance from the DME (in nautical miles)
NNE	North North East
NOTAM	NOtice To AirMen
OAS	Obstacle Assessment Surface
OCA	Obstacle Clearance Altitude
OCH	Obstacle Clearance Height
OHS	Outer Horizontal Surface
OIS	Obstacle Identification Surface
OLS	Obstacle Limitation Surface
PANS-OPS	Procedures for Air Navigation Services – Operations, ICAO Doc 8168
PBN	Performance Based Navigation
PRM	Precision Runway Monitor
QNH	An altimeter setting relative to height above mean sea level
REF	Reference
RL	Relative Level
RNAV	aRea NAVigation
RNP	Required Navigation Performance
RPA	Rules and Practices for Aerodromes — replaced by the MOS Part 139 — Aerodromes
RPT	Regular Public Transport
RTCC	Radar Terrain Clearance Chart
RWY	Runway
SFC	Surface
SID	Standard Instrument Departure
SOC	Start Of Climb

Abbreviation	Meaning
STAR	Standard ARrival
SGHAT	Solar Glare Hazard Analysis Tool
TAR	Terminal Approach Radar
TAS	True Air Speed
THR	Threshold (Runway)
TNA	Turn Altitude
TODA	Take-Off Distance Available
V_n	aircraft critical Velocity reference
VOR	Very high frequency Omni directional Range
WAC	World Aeronautical Chart

Report 5

Cultural Heritage Assesment

ebs heritage

The Aurora Solar Energy Project
Heritage Desktop Assessment

The Aurora Solar Energy Project Cultural Heritage Desktop Assessment

06 September 2017

Version 2

Prepared by EBS Heritage for GHD on behalf of SolarReserve

Document Control				
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1	23/18/17	Draft	Electronic	Michael Scott (GHD)
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ABBREVIATIONS

Abbreviation	Definition
AHA	*Aboriginal Heritage Act* 1988
BAC	Barngarla Aboriginal Corporation
CHMP	Cultural Heritage Management Plan
DSD-AAR	Department of State Development – Aboriginal Affairs and Reconciliation
EPBC	*Environmental Protection and Biodiversity Conservation Act* 1999
NTA	*Native Title Act* 1993
SA	South Australia / South Australian
s.13	Section 13

EXECUTIVE SUMMARY

EBS Heritage was engaged by GHD on behalf of SolarReserve to undertake a detailed Risk Assessment and Cultural Heritage Desktop Assessment for the proposed Aurora Solar Energy Project Area (the Project Area), located approximately 30 km north of Port Augusta in South Australia. The Aurora Solar Energy Project will include the construction of a 110 MW Concentrating Solar Power facility with 8 hours of molten salt storage, representing 880 MWh of energy storage to be located near Port Augusta.

EBS has conducted a Cultural Heritage Risk Assessment for the Project Area and provides recommendations based on a review of available background literature, including both primary and secondary sources, and an assessment of previous disturbances at the current project location. EBS Heritage has provided the risk assessment as a map showing areas of high, moderate and low risk including mitigation and recommendations for management of these areas during construction works.

All previously recorded Aboriginal heritage sites should be treated in accordance with the requirements of the South Australian *Aboriginal Heritage Act 1988* (AHA).Section 23 of the AHA states that it is an offence to damage, disturb or interfere with any Aboriginal site or object, without the approval from the Minister. No previously recorded sites are located within the Project Area.

Resulting from the cultural heritage risk assessment, EBS Heritage makes the following recommendations. EBS Heritage recommends that:

- SolarReserve should undertake community consultation with the recognised Aboriginal Traditional Owners for the region before the construction phase of the project;
- A cultural heritage site avoidance survey is undertaken for the proposed infrastructure footprint, including the transmission line route options that are being explored. This would involve a pedestrian survey by archaeologists / anthropologists and representatives from the recognised Aboriginal Traditional Owners for the region. If any heritage sites are located, the client has the capacity to modify their proposed construction footprint to avoid any sites. If the client is able to avoid all sites, there is no requirement to apply for a Section 23 (Ministerial consent to damage, disturb or interfere with Aboriginal Heritage Sites) under the South Australian *Aboriginal Heritage Act 1988*;
- Should the future cultural heritage survey identify any previously unreported Aboriginal sites within the Project Area that cannot be avoided, then Section 23 approval will be required to damage, disturb or interfere with those sites; and
- After the cultural heritage survey, a Cultural Heritage Management Plan (CHMP) should be developed to provide long term management of Aboriginal sites within the Project Area that can be avoided and will not be subject to Section 23 approval. This CHMP should include a site discovery procedure (refer Appendix 1).

EBS Heritage understands that there are a number of transmission line options that are being explored at the time of this report. The risk assessment made during this desktop assessment would apply to any transmission option within this local area / context.

In the event that archaeological material is encountered during works, the material should be dealt with under the *South Australian Aboriginal Heritage Act 1988* (SA) and by following the guidelines set out in the Aboriginal Site Discovery Procedure (Appendix 1).

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1 INTRODUCTION

EBS Heritage was engaged by GHD on behalf of SolarReserve to undertake a detailed Risk Assessment and Cultural Heritage Desktop Assessment for the proposed Aurora Solar Energy Project Area (the Project Area), located approximately 30 kilometres (km) north of Port Augusta, in South Australia. The Aurora Solar Energy Project will include the construction of a 110 MW Concentrating Solar Power facility with eight hours of molten salt storage, representing 880 MWh of energy storage to be located near Port Augusta.

This report includes a review of primary sources including journals, newspaper articles, original drawings and photographs of the Project Area, as well as a review of any available cultural heritage assessments and reports. This assessment also includes the results of the DSD-AAR Register search, as well as the results of other State Heritage database searches.

EBS Heritage has assessed the risk to heritage and provided recommendations on the management of these risks on the basis of the construction techniques, available geotechnical data, and background research of previous disturbances at the project location.

1.1 Objectives

- Conduct background research including a review of heritage register searches, such as the DSD-AAR Register and the South Australian Heritage Database as well as background research of primary and secondary sources and previous heritage reports for the Project Area;
- Review archival aerial photographs where available to determine levels of historical disturbance in Project Area;
- Identify State and Commonwealth legislative requirements pertinent to heritage in the current Project Area;
- Determine the likelihood or risk of cultural heritage sites being present as well as the potential impacts for any known heritage within the Project Area in accordance with the South Australian Aboriginal Heritage Act 1988; and
- Prepare risk management recommendations for future works and provide recommendations in relation to any potential impacts the proposed activities could have on locations of heritage significance, in light of clients' responsibilities under the South Australian *Aboriginal Heritage Act 1988.*

2 PROJECT DESCRIPTION

2.1 Project Area

The Project Area is located approximately 30 km north of Port Augusta, in South Australia (refer Figure 1).

2.2 Topography & Geology

The topography of the local area is characterised by flat plains intersected by geological features known as Tent Hills. The Tent Hill formation is contained on the Stuart Shelf. To the south west of the Project Area is Lincoln Gap and the Tent Hill, which would have allowed a natural pathway to the next series of flat topped hills. The Tent Hills consist of an 'upper white quartzite unit, frequently ripple marked and cross bedded, which is underlain by soft micaceous sandstone with a shale horizon at the base' (Corbett 1987; Lemon 1996; Welsh 2005).

The plains and foothills west of the southern Flinders Ranges are generally calcareous soils of loams and sands. The geology of the general Port Augusta region contains Quaternary Sediments, Tertiary Sediments and Proterozoic Basement Rocks (Table 1). The sand dunes systems that are located in the area have been argued to be a part of a linear dune field that formed during the Pleistocene (17,000 to 15,000 years ago), from the west-northwest winds. Bowler (1975) has suggested that more modern winds have stripped the upper sections of the dunes exposing a firm horizon that form the base for the remaining cultural material (Field *et. al* 2014).

Table 1: Local geology (Australian Water Environments 2009; Field *et. al* 2014)

Name	Description
Quaternary Sediments	Mixture of gravel, sand and clay layers. Deposited in outwash alluvium along the present and ancient creek lines.
Tertiary Sediments	Comprise a mixture of sand, limestone and clay layers.
Proterozoic Basement Rocks	In the Flinders Ranges and the Stuart Shelf. It also underlies the sedimentary layers in the low topographic areas.

2.3 Land Use

The Project Area is owned by the State, but operates under a long term pastoral lease to private pastoralist who utilise the land for sheep grazing. The Stuart Highway Is located to the west of the Project Area. There is also a water pipeline which supplies water to the Department of Defence at Woomera; a rail line and 132 kV and 275 kV transmission lines that service BHP's Olympic Dam mine.

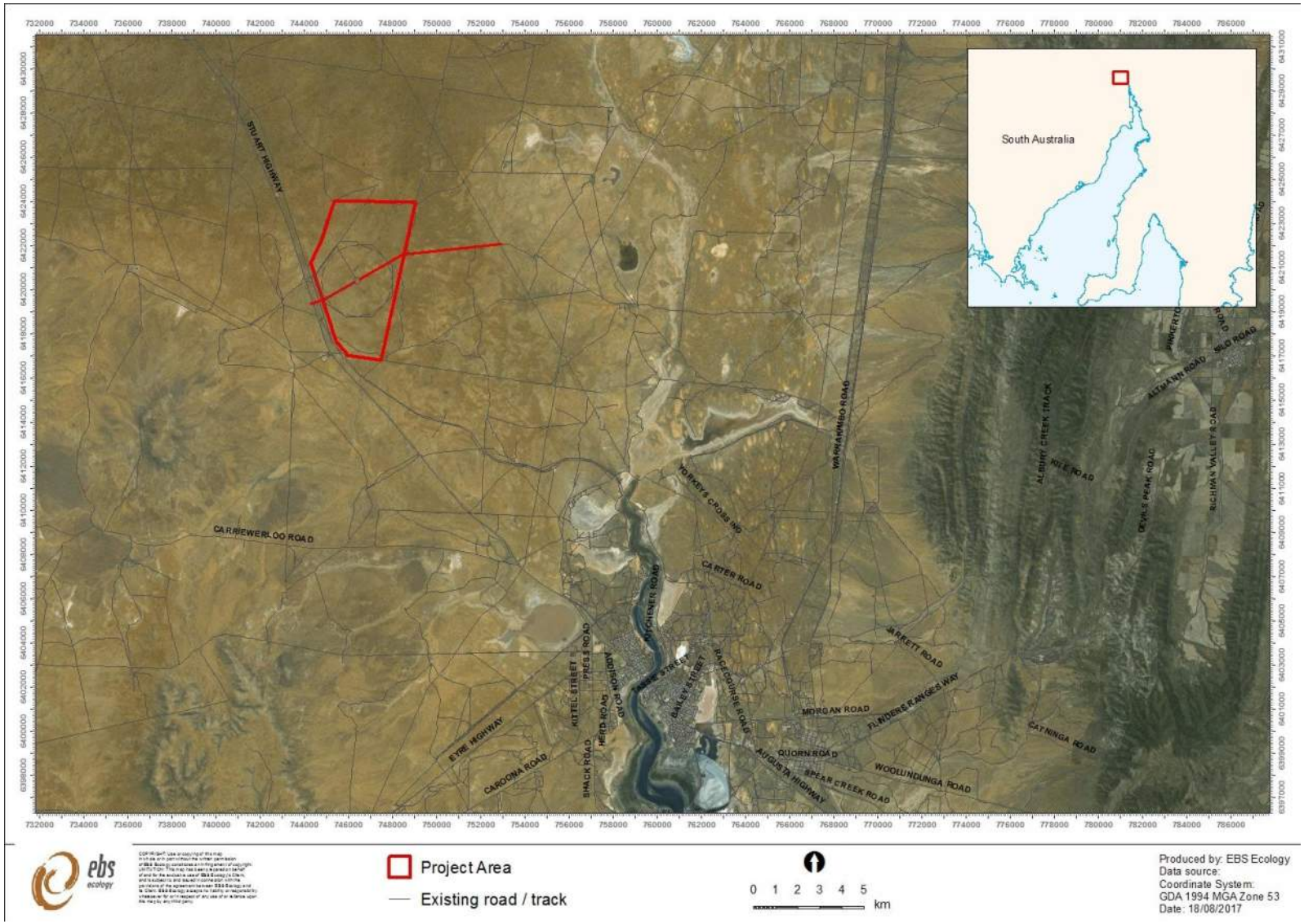

Figure 1: Location of the Project Area

3 COMPLIANCE AND LEGISLATIVE SUMMARY

3.1 Aboriginal Heritage Act 1988 (SA)

The South Australian *Aboriginal Heritage Act 1988* (AHA) is administered by the South Australian Department of State Development, Aboriginal Affairs and Reconciliation division (DSD-AAR). This legislation outlines that any Aboriginal site, object or remains whether previously recorded or not, are covered by the AHA. The Act provides the following definition of an Aboriginal site in Section 3.

"Aboriginal Site" means an area of land;

a) That is of significance according to Aboriginal tradition; and / or

b) That is of significance according to Aboriginal archaeology, anthropology or history.

The AHA states that it is an offence under Section 23 (s.23) of the AHA to 'damage, disturb or interfere' with an Aboriginal site, object or remains unless written authorisation is obtained from the Minister for Aboriginal Affairs and Reconciliation. Penalties for an offence under s.23 are up to $10,000 or six months' imprisonment for an individual or $50,000 in the case of a corporate body.

It is also an offence under s.35 of the Act to divulge information relating to an Aboriginal site, object, remains or Aboriginal tradition without authorisation from the relevant Aboriginal group or groups. Penalties for an offence under this section are up to $10,000 or six months imprisonment.

The *Aboriginal Heritage Act 1988* is the most relevant piece of legislation for this particular project. The cultural heritage desktop and risk assessment have been conducted to determine if the proposed project is likely to damage, disturb or interfere with any cultural heritage sites.

3.2 Native Title Act 1993 (Commonwealth)

The Commonwealth *Native Title Act 1993* (NTA) is part of the Commonwealth's response to the High Court's decision in Mabo v Queensland (No.2) and adopts the common law definition of Native Title which is defined as the rights and interests that are possessed under the traditional laws and customs of Aboriginal people in lands and waters.

The NTA recognises the existence of Indigenous land ownership tradition where connections to country have been maintained and where acts of government have not extinguished this connection.

The Project Area is located within the Barngarla Native Title Determination area, which officially recognises that the Barngarla people are the primary Aboriginal owners of the region within which the Project Area is located (refer Figure 2). The DSD-AAR has also noted that the following Aboriginal groups / organisations / traditional owners may have an interest: The Kokatha Aboriginal Corporation and the Nukunu Peoples Council Inc.

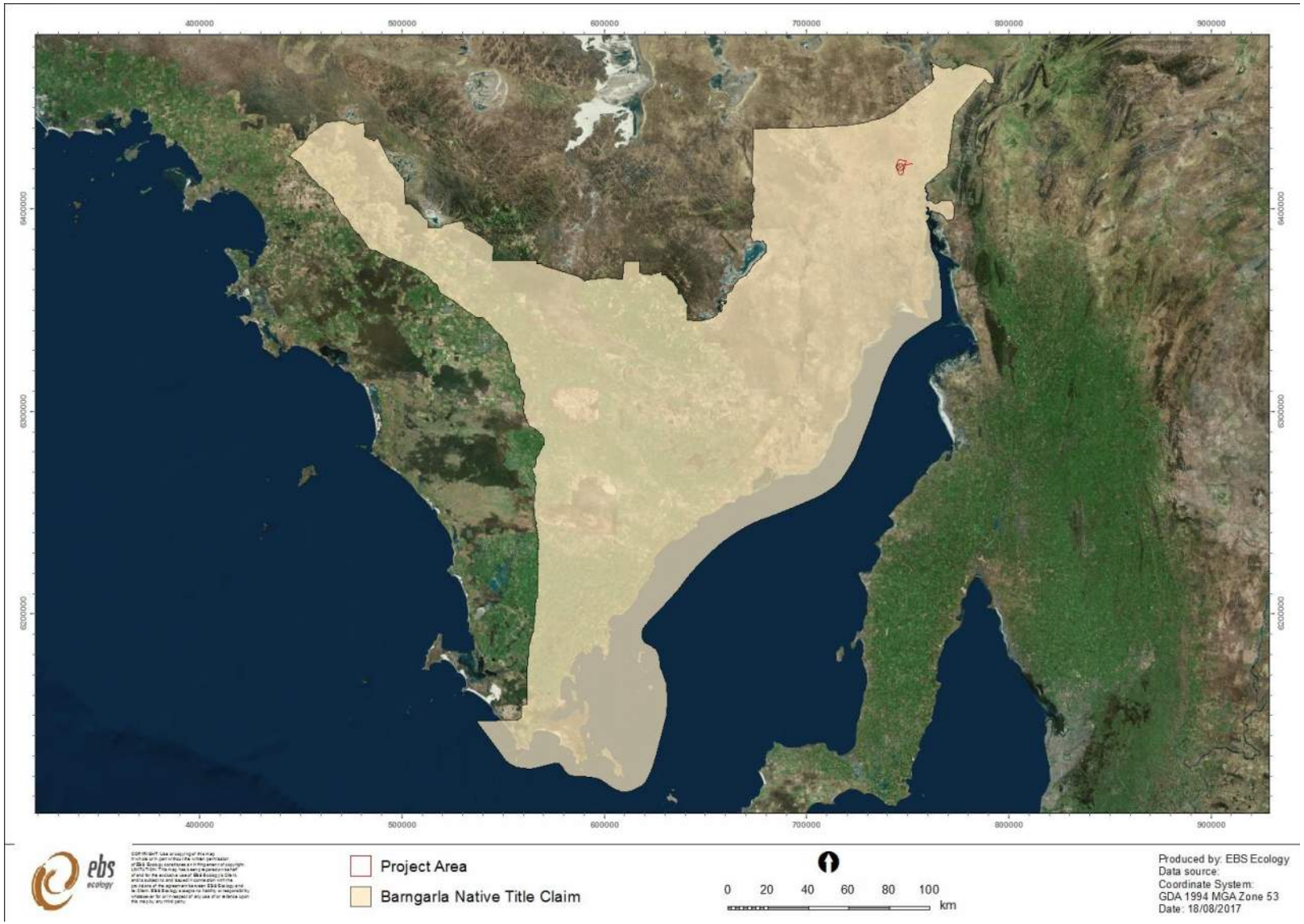

Figure 2: Barngarla People's Native Title Area

3.3 Aboriginal & Torres Strait Islander Heritage Protection Act 1984

The Commonwealth *Aboriginal and Torres Strait Islander Heritage Protection Act 1984* provides a mechanism for the Commonwealth Minister for Environment to make declarations regarding the protection of an Aboriginal area when the Minister is not satisfied that under State or Territory Law there is effective protection of the area from a threat of injury or desecration. Declarations made under this Act involve restricting activities and/or access to an Aboriginal site.

Under Section 21H of the *Aboriginal and Torres Strait Islander Protection Act 1984* it is an offence to conduct behaviour or partake in an action that contravenes a declaration made by the Minister. Penalties under this section are $10,000 or imprisonment for 5 years, or both for an individual, or $50,000 for a corporate body where an Aboriginal place is concerned and $5,000 and imprisonment for 2 years or both for an individual, or $25,000 for a corporate body where an Aboriginal object is concerned.

If the requirements of the South Australian Aboriginal Heritage Act are adhered to and sufficiently protect any Aboriginal heritage in the eyes of the Federal Minister, the *Aboriginal and Torres Strait Islander Heritage Protection Act 1984* will not be relevant for any cultural heritage site that may be in the project area.

3.4 Environmental Protection & Biodiversity Conservation Act 1999 (amended 2003).

The Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) (amended 2003) protects places of national cultural and environmental significance from damage and interference by establishing a National Heritage list (for places outside of Commonwealth land) and a Commonwealth Heritage List (for places within Commonwealth land). Under the EPBC Act any action that has, will have, or is likely to have a significant impact on a place of national culture and/or environmental significance must be referred to the Minister for the Environment for approval. The EPBC Act sets out a procedure for obtaining approval, which may include the need to prepare and environmental impact statement for the proposed action (an action is defined in section 523 to include a project, development or undertaking or an activity or series of activities).

The EPBC Act is only relevant in relation to Aboriginal heritage sites if the site is entered onto the National Heritage List or the Register of the National Estate. If no sites are entered, there is no requirement for a referral under the EPBC Act and this Act, therefore, has little relevance for an Aboriginal site that may be in the Project Area.

4 HERITAGE REGISTER SEARCHES

4.1 DSD-AAR Register Search

The Central Archive is maintained by Aboriginal Affairs and Reconciliation (DSD-AAR) and includes the Register of Aboriginal Sites and Objects. The Central Archive is a record of previously recorded heritage sites in South Australia and allows the identification of known sites. The Central Archive is not an exhaustive list of heritage sites in a specific area, it contains only sites that have been reported and/or registered.

A search of the DSD-AAR Register was conducted for the proposed project footprint and adjacent areas with 23 sites recorded in the Register of Aboriginal Sites and Objects (Refer to Appendix 10.2). No sites were located within the actual footprint of the Project Area, however sites 6433 5983 (Archaeological) and 6433 5982 (Archaeological) are located in very close proximity (refer to Figure 3). DSD-AAR advises that all Aboriginal sites recorded are protected under the *Aboriginal Heritage Act* 1988 and pursuant to the Act, it is an offence to damage, disturb or interfere with any Aboriginal site or damage any Aboriginal object (registered or not) without Authority from the Minister for Aboriginal Affairs and Reconciliation.

Table 2: DSD-AAR Registered Sites in close proximity to the Project Area

Site Number	Site Status	Site Type
3186	Registered	Archaeological
3197	Registered	Cultural
6398	Reported	Archaeological
224	Registered	Cultural
1683	Registered	Cultural
1912	Registered	Historic
1913	Registered	Historic
1914	Registered	Historic
3167	Registered	Cultural
3168	Registered	Archaeological
3180	Registered	Cultural
3181	Registered	Archaeological
3195	Registered	Cultural
3196	Registered	Cultural
5886	Reported	Historic
5968	Reported	Cultural
5978	Reported	Archaeological
5979	Reported	Archaeological
5982	Reported	Archaeological
5983	Reported	Archaeological
6025	Reported	Archaeological
6733	Reported	Archaeological
6842	Reported	Archaeological

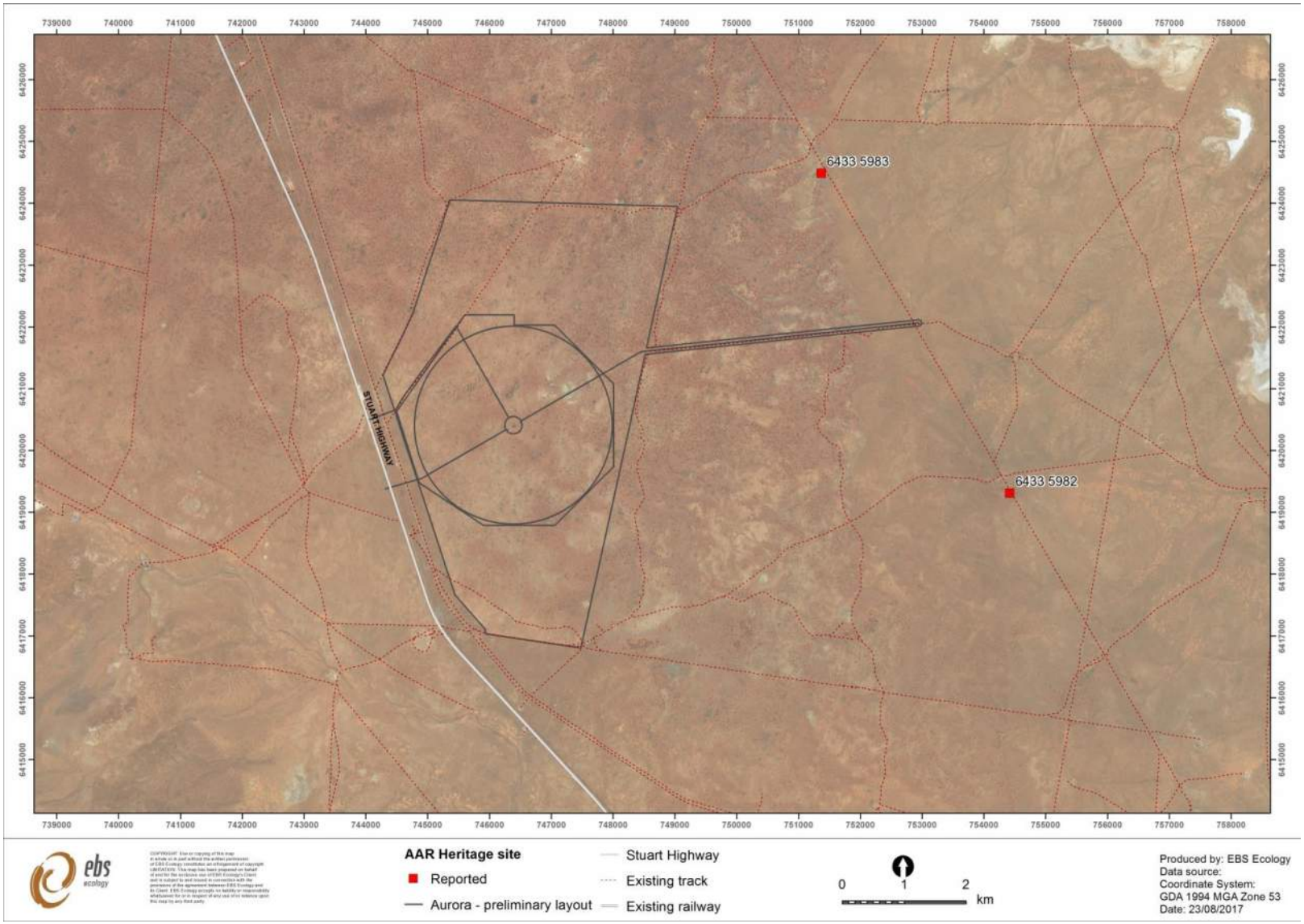

Figure 3: DSD- AAR site located in close proximity to the current Project Area

4.2 SA Museums Database

The South Australian Museum Database (SAM) contains information regarding culturally sensitive finds such as human remains and items recorded prior to the establishment of the DSD-AAR Register. Where available, the database contains information on how the item(s) came into the collection, the location in which it was found and the date it was acquired.

EBS Heritage conducted a search of the SAM Database for references to Port Augusta, Tent Hill, Victory Dam, Yorkeys Crossing, Emeroo Station and the Central Lakes. A total of 514 entries were found that made reference to Port Augusta, two for Tent Hill and 2,629 for the Central Lakes. Although not all of these entries are related directly to Aboriginal heritage items, a number did make reference to stone tools and grinding implements. Of interest for this assessment are the locations recorded and their proximity to the current Project Area. Some of these locations include Tent Hill (12 km south west), Victory Dam (NE), Yorkeys Crossing (S), Dampseys Lagoon (S), Stirling (S), Yadlamalka (N), Iron Knob, Lincoln Gap (SW), Corunna Hill (S/SW), Uno Station (SW), Salt lagoon (SW), Douglas Point (SW), Harris Bluff (SW), Cultana (SW), Nectar Brook (SE) and Woolundunga (SE). There are also more vague descriptions including 'two miles north of Port Augusta', 'campsite immediately north of Port Augusta', 'Sandhill site north of town' and 'windblown pan west of town'.

As the SAM database does not always specify exactly where cultural material items and human remains were found and its contents are often the result of specifically targeted expeditions and accidental finds, the database is best viewed as an indicative tool. The results indicate that a significant level of cultural activity has occurred in the vicinity of Port Augusta. Of note are the entries regarding human remains located around Port Augusta. This information, combined with the other research indicates that it is likely that unrecorded Aboriginal sites are located within undisturbed sections of the Project Area.

Results from the SAM database that reference human remains are presented in Table 3.

Table 3: Results for SAM database that reference human remains in the local region.

Heritage ID	Description	Location
A38715	Skull, jaw and part skeleton.	Port Augusta
A25562	Skull	Port Augusta
A25561	Skull	Port Augusta
A11511	Skull with jaw and part skeleton	Port Augusta
A38887	Bones, 1 pt. parietal, 1 pt. temporal, 1 pt. occipital, 2 pt. scapula.	Saltia

4.3 European Heritage

The South Australian (SA) Heritage Places Database is maintained by the South Australian Government Department of Planning and Local Government. This database holds information relating to places on the SA Heritage Register, Local Heritage Places from SA Development Plans and Contributory Items from SA Development Plans.

No listings were found for places of historical significance within a 1 km distance from the Project Area. The following table outlines the registered historical sites in close proximity to the Project Area (Table 4 and Figure 4). Although these places are not within the area subject to development, they play a role in the general history of the area.

Table 4: Heritage listed items in close proximity to the Project Area.

ID	Name	Class	Details
16261	12 Tassie Street PORT AUGUSTA	State	Seaview House (former Bank of South Australia Port Augusta Branch)
16262	52 Commercial Road PORT AUGUSTA	State	Port Augusta Institute
16263	9 Church Street PORT AUGUSTA	State	St Augustine's Anglican Church
16264	34 Flinders Terrace PORT AUGUSTA	State	Former Port Augusta School of the Air
16265	54 Commercial Road PORT AUGUSTA	State	Port Augusta Town Hall
16266	1 Jervois Street PORT AUGUSTA	State	Port Augusta Courthouse
16267	Beauchamp Lane PORT AUGUSTA	State	Port Augusta Cultural Centre (Former Port Augusta Waterworks workshop, storeroom, stables and courtyard)
16268	Beauchamp Lane PORT AUGUSTA	State	Gladstone Square Bandstand
16269	Beauchamp Lane PORT AUGUSTA	State	Beatton Memorial Drinking Fountain, Gladstone Square
16270	Mitchell Terrace PORT AUGUSTA WEST	State	Port Augusta West Water Tower
16271	Commercial Road PORT AUGUSTA	State	Curdnatta Art Gallery (former first Port Augusta Railway Station)
16272	Stirling Street PORT AUGUSTA	State	Second Port Augusta Railway Station
16273	Off Tassie Street PORT AUGUSTA	State	Port Augusta Wharf
14	Emeroo Station, Via STIRLING NORTH	State	Former Ostrich Farm, Emeroo Station, including Original Homestead, Ruins of Hatching Shed, Exotic Plants and Ostrich Fences
14	Emeroo Station, Via STIRLING NORTH	State	Former Ostrich Farm, Emeroo Station, including Original Homestead, Ruins of Hatching Shed, Exotic Plants and Ostrich Fences

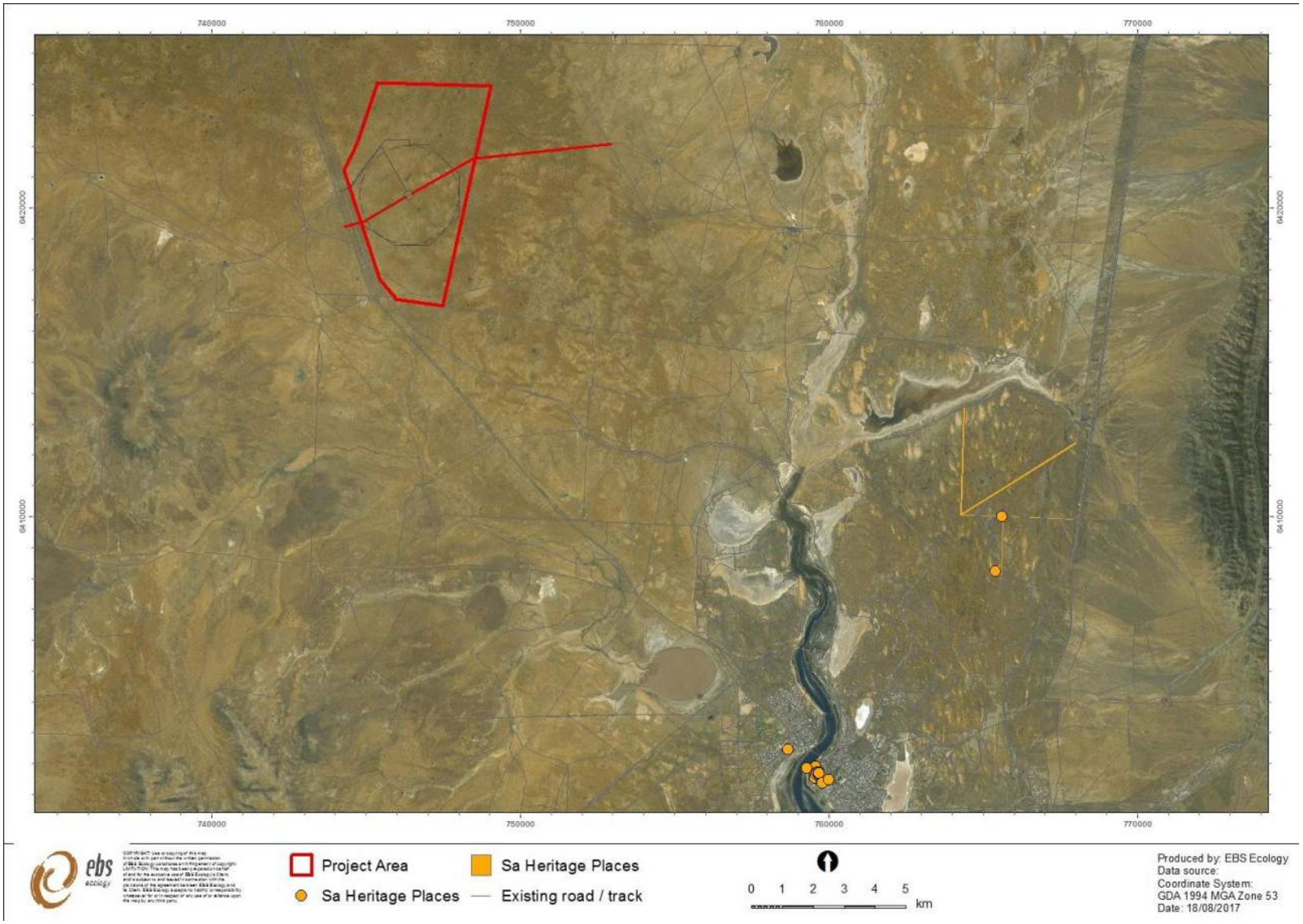

Figure 4: Heritage Register Search Results

5 PREVIOUS WORK

5.1.1 ACHM Draper, Mott & Mollan 2005a

In 2005, ACHM was engaged by ElectraNet to undertake an Aboriginal Cultural Heritage Survey for the proposed Davenport Substation Expansion with representatives of the Barngarla people. A previously recorded archaeological site was re-assessed and the boundary was revised. Monitoring was undertaking and two areas were classified as sensitive landforms. Recommendations for further monitoring were also made by the Barngarla.

5.1.2 ACHM Draper, Mott & Mollan 2005b

In 2005 ACHM was engaged further by ElectraNet to undertake an Aboriginal Cultural Heritage Survey for the proposed Davenport Substation Expansion with representatives of the Kokatha people. The results from this assessment were similar to previous ones, with new recommendations for Kokatha monitoring works.

5.1.3 Walshe and Bonell 2005

Walshe and Bonell were engaged by Wind Energy Solutions Pty Ltd, to undertake a cultural heritage assessment, which was a required component of the Environmental Impact Assessment for the proposed Lincoln Gap Wind Farm. The assessment revealed that there were seven reported or registered sites located in close proximity to the study area. A number of these sites were mythological sites. The assessment concluded that there was a high potential for scattered artefacts and mythological sites and a lower potential for stone arrangements and engraving / painting sites to be recorded in the proposed area.

5.1.4 Wood and Fitzpatrick 2005

Vivienne Wood Heritage Consultant Pty Ltd was engaged by ElectraNet to undertake heritage assessment. Vivienne Wood and Phil Fitzpatrick undertook two field studies of the proposed Davenport Substation near Port Augusta. The field studies were undertaken with representatives of the Nukunu people. The recommendations from the survey were that the works could proceed with a number of restrictions. Monitoring was recommended for a number of locations, along with salvaging of cultural material, with the exception of skeletal remains. This assessment also predicted that there would be a high potential for pre-contact artefact scatters and / or campsites and for mythological sites and a lower potential for stone arrangements, painting or engraving sites.

5.1.5 ACHM Mott 2008

In 2008, ACHM were engaged by the Department of Planning, Transport and Infrastructure to undertake an Aboriginal cultural heritage survey of two truck parking bays and one turning land at Warnertown and Winninowie, South Australia. The survey was undertaken with representatives of the Nukunu people. No new archaeological or anthropological sites were identified within the survey area. Although no sites were located, due to the likelihood of undisturbed sediments that could hold cultural material, recommendations

were made that Aboriginal monitors be present to any excavations carried out at a depth greater than 30 cm and further heritage surveys be undertaken of proposed borrow pits.

5.1.6 ACHM Field & Morley 2014

ACHM was engaged by DP Energy Australia Pty Ltd, to undertake an anthropological and archaeological heritage survey of the proposed Port Augusta Renewable Energy Park. During the anthropological survey, it was determined that the survey area was clear of anthropological significance. However, several areas within the survey area were deemed to be of higher risk of containing Aboriginal heritage sites. These areas included ephemeral and permanent water sources and watercourses, sand dunes and areas of undisturbed native vegetation. The recommendations from this assessment were that an archaeological pedestrian cultural heritage survey be undertaken prior to the commencement of ground disturbance work for the entire projects footprint and a Cultural Heritage Management Plan should be developed to provide for long term management of heritage sites for those sites not subject to a Section 23 application to destroy.

5.1.7 EBS Heritage 2017

EBS Heritage was engaged by Nexif Australia to conduct a cultural heritage assessment of the proposed Lincoln Gap Wind Farm. Archaeological and anthropological field surveys were carried out by EBS consultants, members of the Barngarla Aboriginal Corporation (BAC) and a representative of the UQ Cultural Heritage Unit between 16 January and 12 April, 2017 for the proposed Lincoln Gap Wind Farm design layout, located 15 km west of Port Augusta, in South Australia.

One archaeological site was located during the field survey. The anthropological consultation for the project layout and wider area resulted in ethnographic clearance being given for the proposed works along with a request that water courses, stone outcrops and clay pans be avoided. The BAC further requested that impacts on mature native vegetation be avoided where possible and that any further development activities or additional clearance outside of the areas surveyed and cleared be revisited by male and female BAC representatives.

5.1.8 EBS Ecology 2017

EBS Ecology was engaged to undertake a flora and fauna assessment for the proposed Aurora Solar Energy Project Area (the Project Area), located approximately 30 kilometres (km) north of Port Augusta, in South Australia. During the assessment the field team identified a number of Aboriginal stone artefacts, which was later confirmed by EBS Heritage staff (Plate 1 to Plate 4). The cultural material is located within the current Project Area (Location: 53H 752100 6421910) and could constitute a significant Aboriginal site under the AHA (Figure 3).

Plate 1: Potential site location

Plate 2: Stone artefact within potential site location

Plate 3: Stone artefacts within the potential site location

Plate 4: Stone artefact within the potential site

6 BACKGROUND RESEARCH

This section documents the results of background research into the occupation, land use and cultural heritage of the Project Area and surrounding lands. The following provides an overview of previous research and an ethno-historic background of the Project Area, which provides insight into Aboriginal social organisation, land use and daily life, and the effects of European settlement.

6.1 Aboriginal Occupation

The Project Area is located within the Barngarla Native Title Determination area, which officially recognises that the Barngarla people are the primary Aboriginal owners of the region within which the Project Area is located.

Following settlement, the rapid expansion of European colonial interests quickly impacted upon the traditional settlement patterns of the local Aboriginal people through Australia (Harris 2009:41-42). With traditional resources being depleted in the region due to the increase in pastoralism, many Aboriginal people became dependant on rations provided from the State, whilst other Aboriginal people found employment on the pastoral stations. Aboriginal people subsequently concentrated around ration camps set up in both Port Augusta and Iron Knob. Fringe camps were established on the outskirts of Port Augusta and the Davenport Mission was established in the 1930's (Gara 1989; Mattingley *et. al* 1988; Walshe 2005). Towards the end of the Second World War the government had accepted more responsibility for Aboriginal welfare and had to make more vigorous attempts to improve their living conditions. This resulted in more Aboriginal people moving back into the township of Port Augusta (Gibbs 1969; Filed *et. al* 2014).

6.1.1 Ethnographic Background

Occupation of this area has been expressed throughout the landscape in complex tangible (physical) and intangible (not physical) locations of significance. Myths associated with the constellations known as the Pleiades and Orion, are the most widely recorded in the world. In Australia these myths can extend across the entire country, crossing the boundary of a number of tribal groups. These myths are generally associated with Dreamtime Beings and can be dived into several categories, which can be restricted depending on a person's gender and tribal association. For this reason information about these stories is not often published and is still considered highly sensitive for Aboriginal people (Field *et al.* 2014). Archaeological sites represent tangible connections to country where as dreaming stories and song lines represent an intangible connection between people and certain places. Stanner (1991) stated in his work that this creates an 'interrelated responsibility between people and country'.

Several important Ancestor Creation (or Dreaming) stories travel through the Port Augusta region, linking the local tribal groups through ceremony and ritual (Field *et al.* 2014; Walshe 2005). A number have been recorded previously including the "Seven Sisters", "Willuroo Man", "Moon", "Native Cat" and "Urumbula" song lines.

Tindale wrote a definitive description of the Kungkarungkara or "Seven Sisters" myth:

> *In Western Desert lore the Pleiades and the Morning Star are ancestral Women Beings…They climbed into the sky and became stars to escape the attentions both of a man named Njiru, and of his son Jula. These women attacked Njiru with packs of dogs that they kept as their protectors. In the sky of autumn, the early morning appearance of the Pleiades, low down in the east, marks to beginning of the aboriginal New Year and the commencement of the season when dingo dogs (papa) give birth to their young. Since these pups serve as food for men, Increase Ceremonies for the dingo are a feature of the autumn season. The stories of the would-be virgin women are made complex because the names of some of the principal beings are changed and even become transposed in some tribal versions of the story (Tindale 1959: 305).*

The Kungkarungkara women are then believed to have fled south and Tindale stated that Jangkundjara senior men told him that they understood that the Kungkarungkara women went south into:

> *…the Pangkala territory near Port Augusta with Njiru still in pursuit. They have the idea that the Beings made a circuitous eastward journey returning again to the north. During the journey Njiru and the Kelilbi (Star Women) are supposed to have visited a big jabu (hill) beside the sea, south and east of Port Augusta… (Tindale 1959: 321).*

Work done by Hagen has also stated that accounts given to him by various informants does confirmed that the Kunkaralinya or "Seven Sisters" story refers to starting in Port Augusta. Hagen stated:

> *Arcoona the sisters travelled to the west, creating the sand-hills in the Phillip Ridge area, and at the site of the proposed new town (see Mountford, 1976 for an analogous version from parts of Central Australia). They travel on through Lake Blanche (Matlumpa), heading towards Kingoonya, then turn to the north-east, towards Stuart Ck…They travel to a place west of Fregon…This track also passes through the Cane Grass Dam area according to my informants* (Hagen 1983: 7- 8). (Field *et al.* 2014).

The "Urumbula" story line is of interest to this Project Area, as it travels from Port Augusta north to the Gulf of Carpentaria in the Northern Territory. This story line is concerned with the travels of the Malbunga, or the Native Cat and his followers. (Field *et al.* 2014; Gara 1989; Gorring 2017; Hercus 1996; Walshe 2005).

Louise Hercus has also made mention of another creation story in their work, related to the salty lakes above Spencers Gulf. Hercus was told by Nukunu man Gilbert Bramfield that:

> *An Ancestor from Pt Germain made that kangaroo bone and made that sea right through (he carved out Spencer Gulf). The bloke that went this way with his kangaroo bone he broke it at Pt Augusta, and then he was digging with a really short stumpy one and made all these lakes all the way through (the salty lakes up from Pt Augusta) (Hercus 1992: 16).*

The other story line relevant to this Project Area is the 14 point "Adnyamathantha" song cycle that travels from the Flinders to Quorn, into Yorkeys Crossing then to Tent Hill. Ten Hill is approximately 12 km south west of the Project Area and Yorkeys Crossing is approximately 13 km south east. Jacobs and Potter (1981) have also noted within their work that song cycles relating to the "Moon", "Seven Sisters" and "The Chase" travel through Yorkeys Crossing.

6.1.2 Language

Connections between the languages of the people of the Gawler Ranges and the Port Augusta area have been identified (Barefoot 1997; Field *et al.* 2014; Hercus & Simpson n.d; O'Grady 1966). Hercus and Simpson wrote:

> *O'Grady (1966) claimed that the languages of central and southern Australia surrounding Spencer's Gulf and the Gulf of St Vincent form a subgroup, dubbed 'Yura'. These languages include at least Barngala, Nukunu, Narrangu, Kuyani, Ngadjuri, Adnyamathanha and Kaurna, with Nauo and Wirangu as possible outliers. We support this supposed subgroup by reconstruction of an ancestral case system for those languages for which inflectional data is recorded (Barngala, Nukunu, Kuyani, Adnyamathanha, Kaurna and Wirnagu).*

6.1.3 Aboriginal Archaeological Background

The area around Port Augusta is characterised by deep, red sand dunes inter-linking with salt lakes that have been well documented to contain large and dense artefact scatters and campsites, normally associated with fresh water (Lilley & Hughes, Gara 1989; Walshe *et. al* 2001; Walshe 2005). The sand dunes systems that are located in the area have been argued to be a part of a linear dune field that formed during the Pleistocene (17,000 to 15,000 years ago), from the west-northwest winds. Bowler (1975) has suggested that more modern winds have stripped the upper sections of the dunes exposing a firm horizon that form the base for the remaining cultural material (Field *et. al* 2014).

Recent work done by Walshe at Dempsey's Lake has resulted in an Aboriginal hearth being dated to ca 40,000 years' old, making it the oldest known site in South Australia. Dempsey's Lake is a small lake approximately 6 km northwest of the centre of Port Augusta and is also a documented palaeontological site. The Aboriginal site dated by Walshe is located in Coopers Dune, a sand dune in a series of late Quaternary-aged dunes situated west of Port Augusta. Dempsey's Lake is located approximately 15 km south east of the current Project Area and the same Quaternary-aged dune system runs east of the current Project Area (Walshe 2005; Walshe 2012).

There has also been a lot of archaeological work done at Olympic Dam, north of the current Project Area. The central lakes area is known for having high numbers of archaeological sites. During their work at Olympic Dam Hughes and Hiscock developed an environmentally-based predictive model that used terrain pattern mapping based on a combination of landform types and underlying geology. Landform types were used to predict the location and frequency of sites. The main types of archaeological sites recorded were stone artefacts scatters.

The model predicted that the frequency of occurrence of sites on gibber plains is the lowest of all of the landform types, however the number of stone artefacts at sites located in this environmental zone is significantly higher. Large artefact scatters found in quarry or knapping floor sites are subsequently characterises of the gibber plains (Hughes *et al.* 2011).

The archaeological work done in the region so far has emphasised the high likelihood of the current Project Area could contain Aboriginal sites or objects that are protected under the *Aboriginal Heritage Act 1988*.

6.2 European Settlement History

The history of European settlement within South Australia, or Adelaide, had its beginning in 1836 when Colonel William Light (the inaugural surveyor-general for the colony of South Australia) undertook a survey of the Adelaide plains to identify a suitable location for the future capital city. Before Adelaide was first surveyed, Captain Mathew Flinders, sailed his ship the *Investigator* into the head of Spencers Gulf on the 21 February 1802. This was one of his many stops made during his discovery and circumnavigation of Australia. The gulf was named by Flinders in honour of the First Lord of Admiralty, George John the Second Earl Spencer (Flannery 2000). By March the 10th 1802 Flinders' party had already ascended a nearby peak, now named Mount Brown, which is located 40 km south east of the current Project Area (Walshe 2005).

When the Province of South Australia was established in 1834 by an Act of British Parliament, provisions were made for local government when the colony's population passed 50,000. That figure was reached in 1849, but the first attempt of establishing local government outside of Adelaide was made in the form of District Boards of Roads, based on the surveyed Hundreds. By the 1850s the South Australian government had established a standard hierarchy of Counties, Hundreds, rural sections and town allotments. By 1860 no land could be sold unless located within a proclaimed County and Hundred (Susan 2012).

Port Augusta the town was not officially surveyed until 1854, after increasing demand (due to increasing pastoralism) for an established port up the gulf. The Mount Remarkable Mining Company first undertook the task of surveying the inlet at the head of the gulf, naming the place Port Augusta. Originally Port Augusta was only a small settlement of tents and temporary buildings until blocks of land were auctioned off in Adelaide. Copper was also discovered in the region by 1863, increasing the export trade from the port, which was previously predominantly wool.

Major infrastructure like the Overland Telegraph line reached the area in 1872 and the railway in 1878. In the early 1900s, Port Augusta became the headquarters for the rail extension across the Nullarbor Plain to Western Australia. This expansion has been credited with easing the effects of the 1930s depression and assisting with Australia's war efforts (Field *et.al*. 2014; Port Augusta City Council 2009: 6; Walshe 2005).

By 1866, a Thomas Elder had seen the need for a more efficient form of transport for the goods needing to reach the port. The traditional method of Bullock drays had proven dangerous when travelling through the Flinders Ranges. Elder subsequently imported 38 camels from Karachi, along with forty skilled camel drivers. These camel trains would be used throughout the area to transport goods (Donovan 1991; Mincham 1971; Walshe 2005).

Ostrich farming was also attempted in 1883 at Emeroo Station, approximately 22 km south east from the Project Area. Previous attempts in Australia had been unsuccessful but a Frank Bignell and a W. Campbell attracted assistance from the Government to commence the farm. In 1901 due to persistent droughts, unfortunately the farm was forced to close down (Anderson 1988).

Figure 5: Ostrich farm, north of Port. Augusta 1888 (State Library of SA)

The construction of Eyre's Highway in 1942 and the Transcontinental Railway line in 1952 and eventually resulted in the official closure of the Port Augusta port in 1974 (Port Augusta City Council 2009: 6).

Although no registered heritage places of significance were found during this assessment, it can be expected that there still could be areas of historical importance within the Project Area.

7 CULTURAL HERITAGE RISK ASSESSMENT

7.1 Environmental Landforms

There is often a close association between particular landscape features and archaeological and / or ethnographic sites. Waterways, streams, rivers and other bodies of water are often associated with creation stories and long term occupation sites; therefore the presence of the Spencer Gulf and the beginnings of the Central Lakes system increases the likelihood for heritage sites in this area.

EBS Heritage conducted a cultural heritage risk assessment for the Project Area. The risk assessment does not include the results of any community consultation and is based on a desktop based analysis of existing environmental features, background research including modern disturbances and impacts since European arrival to South Australia, and the experience of EBS Heritage consultants.

Cultural Heritage sites are often found to be associated with very specific environmental features and the following presents a guide of environmental landforms present in the Project Area which can be associated with cultural heritage sites. This is based on information from elsewhere in South Australia and Australia. The information is presented to assist in managing heritage risks and to ensure no cultural heritage sites are adversely affected by the proposed construction program.

7.2 Analysis of Environmental Features

EBS Heritage has conducted an analysis of the existing environmental features in the Project Area to assess specific landforms and landscape features where Aboriginal sites (ethnographic or archaeological) are known to be traditionally located. The results of this analysis have been broken down into risk categories; high, moderate and low. The use of environmental modelling when used in conjunction with historical background information can provide a guide for determining the risk of the proposed works encountering previously unidentified heritage in the current Project Area.

High Risk: identifies landforms where traditionally cultural heritage sites have been found and there is a high risk of proposed works encountering cultural heritage sites. This risk has been assessed based on the limited modern disturbance in these areas and the intactness of soil profiles. Areas traditionally considered to be of ‘high’ risk include undisturbed, natural waterways such as rivers and streams and mature trees pre-dating European settlement.

Moderate Risk: identifies areas which were traditionally or opportunistically used by Aboriginal people and where cultural heritage sites have been found in comparable locations. These areas would generally be identified as “high” risk areas but the level of past disturbance is not known or unverifiable; therefore there is a moderate risk that soil profiles have not been previously impacted and there is a moderate risk of project activities disturbing in situ cultural heritage. Areas traditionally considered to be ‘moderate’ risk may include secondary waterways, or areas which may have once been classified as ‘high’ risk, but for which there is evidence of modern disturbance.

Low Risk: identifies areas where there is a very low or no chance of encountering cultural heritage sites and where there is a low likelihood of proposed works impacting heritage sites. Areas assessed as having a 'low' risk are areas where there has been considerable modern impact and disturbance and therefore there is a low likelihood for cultural heritage sites to remain undisturbed.

7.3 Cultural Heritage Risk Assessment

Understanding the environmental landscape and historical disturbances to an area can be instrumental in assessing the likelihood of proposed construction works encountering in situ and previously undisturbed cultural heritage sites. This cultural heritage risk assessment is based on a number of sources, including consultation with the relevant Aboriginal communities, can help to clarify whether landforms are associated with ethnographic cultural heritage ties. Consultation would be undertaken as part of the cultural heritage survey.

7.3.1 High Risk

The Project Area have been assessed as having a high likelihood of the proposed works encountering unidentified heritage sites (refer Figure 6). The background research has indicated that the Project Area has not undergone any previous large-scale land disturbance, which indicates that the subsurface deposit could have intact, undisturbed, subsurface cultural material. The background research has indicated that the Project Area is located in an environmental zone that is likely to contain Aboriginal sites. Within the region Aboriginal sites have been recorded in sand dunes and on gibber plains if they are associated with sand dunes and fresh water sources. The proximity of the salt lakes in the east, known significant archaeological sites at Dempsey's Lake 15 km south west, the possible heritage site identified by EBS Ecology has given the Project Area a high risk rating.

7.3.2 Medium Risk

There is also a medium risk that the Project Area will contain any non-tangible anthropological sites, including mythological sites and connections to Creation Ancestor stories. The background research has indicated that Port Augusta in general and more specifically the top of Spencer's Gulf (near Yorkeys Crossing and Tent Hill) are heavily associated with mythological sites. The Project Area has only been given a medium rating because of the absence of the major environmental features that these types of sites are often attributed to (hills, salt lakes and waterways). However, its close proximity to these areas, including Tent Hill, has given it a medium rating.

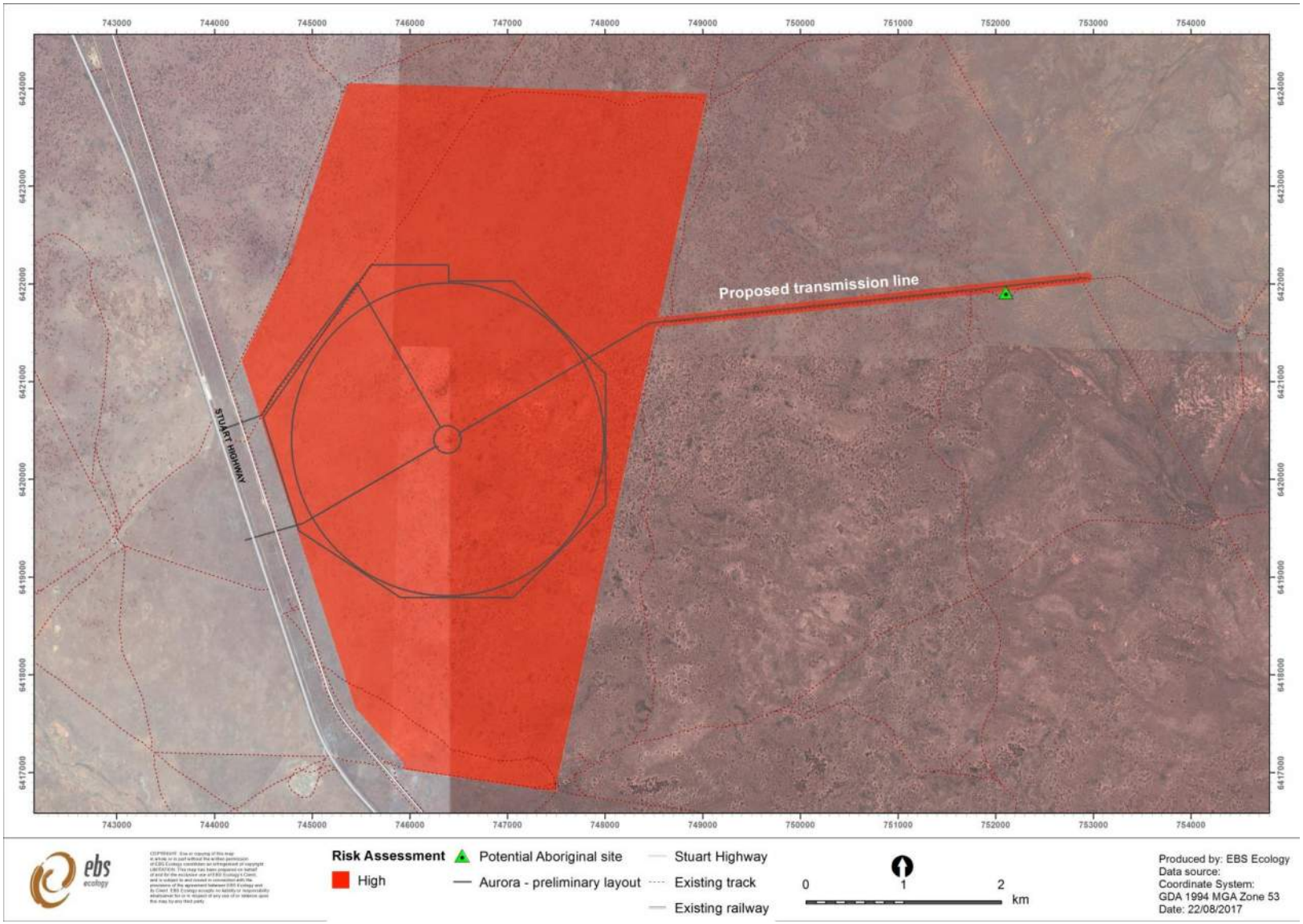

Figure 6: Cultural Heritage Risk Assessment

8 SUMMARY AND RECOMMENDATIONS

8.1 Summary

EBS Heritage has been engaged to conduct a cultural heritage assessment and risk assessment for the proposed Aurora Solar Energy Project Area, situated approximately 30 km north of Port Augusta in South Australia. This assessment considers the available historical, ethnographic and archaeological resources in order to assess the risk of encountering in situ cultural heritage by proposed ground disturbance works.

All previously recorded Aboriginal heritage sites should be treated in accordance with the requirements of the South Australian *Aboriginal Heritage Act 1988* (AHA).Section 23 of the AHA states that it is an offence to damage, disturb or interfere with any Aboriginal site or object, without the approval from the Minister. No previously recorded sites are located within the Project Area.

8.2 Recommendations

Resulting from the cultural heritage risk assessment, EBS Heritage makes the following recommendations:

- SolarReserve should undertake community consultation with the recognised Aboriginal Traditional Owners for the region before the construction phase of the project;
- A cultural heritage site avoidance survey is undertaken for the proposed infrastructure footprint, including the transmission line route options that are being explored. This would involve a pedestrian survey by archaeologists / anthropologists and representatives from the recognised Aboriginal Traditional Owners for the region. If any heritage sites are located, the client has the capacity to modify their proposed construction footprint to avoid any sites. If the client is able to avoid all sites, there is no requirement to apply for a Section 23 (Ministerial consent to damage, disturb or interfere with Aboriginal Heritage Sites) under the South Australian *Aboriginal Heritage Act 1988*;
- Should the future cultural heritage survey identify any previously unreported Aboriginal sites within the Project Area that cannot be avoided, then Section 23 approval will be required to damage, disturb or interfere with those sites; and
- After the cultural heritage survey, a Cultural Heritage Management Plan (CHMP) should be developed to provide long term management of Aboriginal sites within the Project Area that can be avoided and will not be subject to Section 23 approval. This CHMP should include a site discovery procedure (refer Appendix 1).

EBS Heritage understands that there are a number of transmission line options that are being explored at the time of this report. The risk assessment made during this desktop assessment would apply to any transmission line option within this local area / context.

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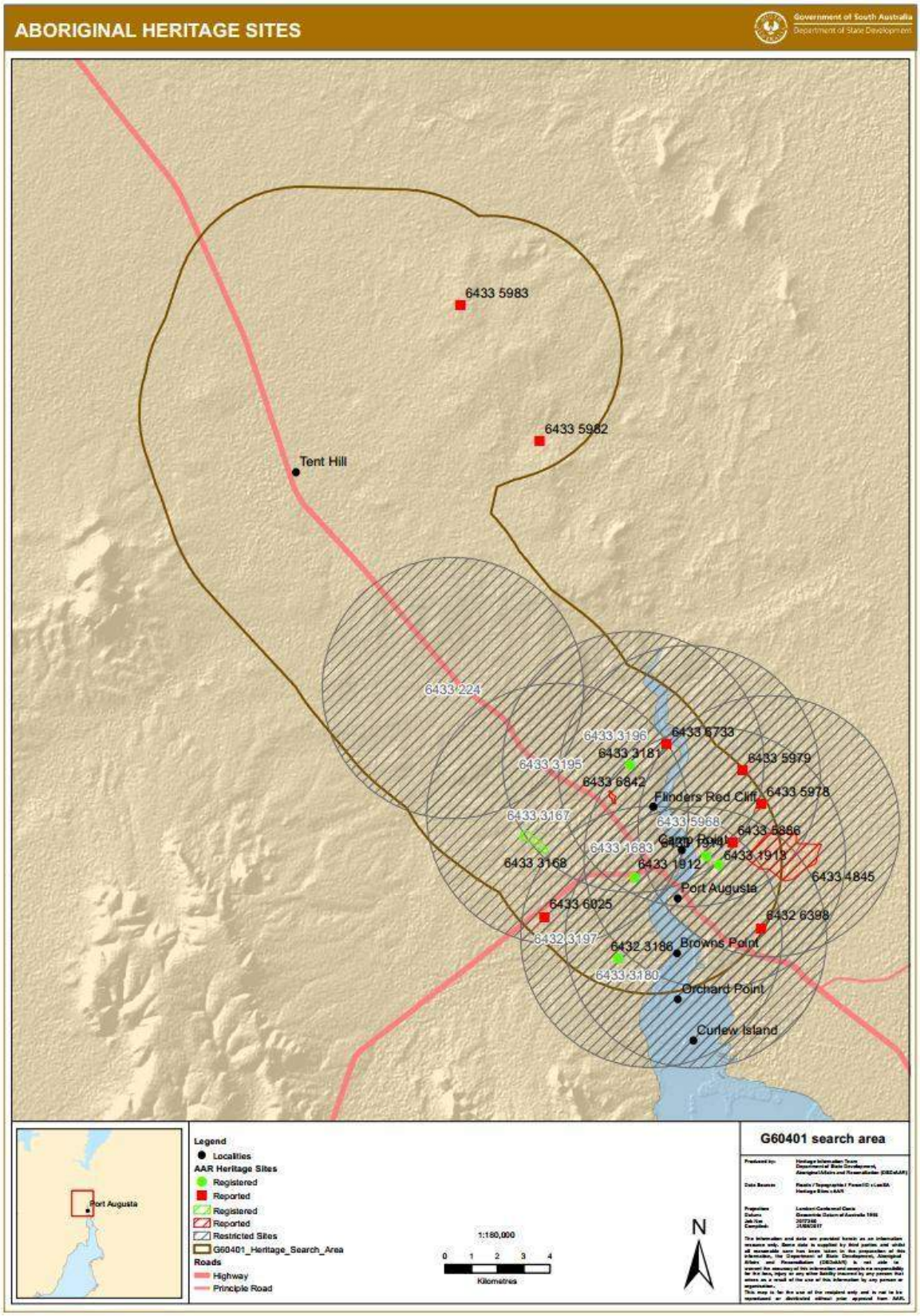
10 APPENDIX

10.1 Site Discovery Procedure

10.2 DSD-AAR search results



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