

AGL

Broken Hill Solar Plant

ENVIRONMENTAL ASSESSMENT

Volume 1 – Environmental Assessment:
Executive Summary to Chapter 6
October 2012

Broken Hill Solar Plant

ENVIRONMENTAL ASSESSMENT

Final

October 2012

Certification

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In respect of:	AGL Broken Hill Solar Plant

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We certify that we have prepared the contents of this Environmental Assessment and to the best of our knowledge the information contained in the Assessment is neither false nor misleading.

Signature:		Signature:	
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Date:	16 October 2012	Date:	16 October 2012

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Executive Summary

The project

AGL Energy Limited (AGL) is proposing to construct and operate a solar photovoltaic (PV) power plant at Broken Hill in far western New South Wales (NSW). This proposal is referred to throughout this report as the Broken Hill Solar Plant or "the project".

AGL has been selected by the Australian Government as the successful proponent in the solar PV category of the Solar Flagships Program independent reassessment process. The project will be one of two solar PV power stations built by AGL under the Solar Flagships Program, with the second project being constructed at Nyngan in central NSW. The Australian Government and NSW Government have committed funding to support project implementation.

Planning approval requirements

On 12 November 2010, by order of the Minister for Planning, the Broken Hill Solar Plant was declared to be a project to which Part 3A of the *Environmental Planning and Assessment Act 1979* (EP&A Act) applies due to its State and regional planning significance. The Director-General's Requirements (DGRs) for the environmental assessment of the project under Part 3A of the EP&A Act were issued on 8 December 2010. While recent changes to the planning system have included the repeal of Part 3A, transitional provisions in the EP&A Act mean that projects that have received DGRs within the last two years will continue to be assessed in accordance with Part 3A provisions.

Purpose of this report

This report has been prepared to support AGL's project approval application under Part 3A of the EP&A Act for the proposed construction and operation of the Broken Hill Solar Plant. It addresses the DGRs for the environmental assessment and includes AGL's Draft Statement of Commitments for environmental impact mitigation and management.

Consultation

The consultation process for the project has been developed and implemented in accordance with the NSW Department of Planning & Infrastructure's *Guidelines for Major Project Community Consultation* (DoP, 2007). This has included the development of a Communications Plan to support the environmental assessment and planning approvals process.

The consultation process to date has involved sending letters to adjoining neighbours, surrounding properties, relevant agencies and other key stakeholders. An advertisement has also been placed in the local newspaper, the Barrier Local Truth. Consultation has also included establishment and operation of a free-call 1800 number and project email address for community enquiries and complaints.

The letters sent to agencies and key stakeholders provided information on the project and invited stakeholders to raise any issues or concerns. Responses were received from directly affected landholders, the Australian Rail Track Corporation Ltd, the Environment Protection Authority (formerly NSW Office of Environment and Heritage), Lower Murray Darling Catchment Management Authority, PlatSearch NL, Department of Primary Industries (formerly Land and Property Management Authority) and Roads and Maritime Services (RMS, formerly Traffic Authority of NSW (RTA)). Landholders had no specific issues to raise in the environmental assessment.

Consultation will continue throughout the planning approval process and, should the project proceed, throughout the detailed design and construction phases.

Need for the project

As part of the Solar Flagships program, the project would assist the Australian Government to achieve its Renewable Energy Target (RET), which calls for 20 per cent of Australia's electricity supply to be derived from renewable sources by 2020. The main drivers for the Solar Flagships Program and its component solar projects are the need to:

- Demonstrate that large scale solar power plants can be constructed and operated within major electricity grids in Australia.
- Optimise the business models for constructing, generating and wholesaling electricity generated from large scale solar power plants.
- Develop the solar power industry in Australia.
- Provide research infrastructure for solar power generation.
- Encourage regional development.
- Build initial infrastructure for further development of solar power.
- Develop Australian intellectual property and know-how in solar power.
- Develop and share technical and economic knowledge of the operation of large scale solar power plants in a competitive energy market.

Suitability of the proposed project site

The proposed project site meets a number of essential site conditions for a solar PV plant and provides an appropriate balance in terms of other site location criteria. Of particular importance, the site has a high solar production potential and the necessary access to the existing electrical grid. Additional factors that increase the site's suitability are as follows:

- It has relatively flat topography, which enhances its solar production potential and reduces construction costs and risks.

- It does not contain any threatened ecological communities or significant wetlands and is considered unlikely to provide important habitat for threatened or migratory species.
- It is more than one kilometre from the nearest existing residential dwelling and is unlikely to result in noise or visual impacts to the local community or adjacent land uses.

Description of the project

The project incorporates the following three key elements:

- A nominal 50 MW solar PV plant located about five kilometres south west of Broken Hill city.
- A 22kV double circuit transmission line, approximately 2.7 kilometres long, connecting the solar PV plant to an existing TransGrid substation at Broken Hill with a 30 metre wide easement.
- Realignment of an existing 22kV transmission line around the solar PV plant with a 20 metre wide easement.

The proposed solar PV plant would occupy approximately 200 hectares of land bounded by the Barrier Highway to the north and the Peterborough-Broken Hill rail line to the south (refer to **Figure 1-1**). The site comprises a cleared, relatively flat area of rural land traversed by numerous unsealed access tracks and containing one residential building and several farm sheds. The site is located within the unincorporated area administered by the Department of Primary Industries, Catchments and Lands Division and falls entirely within one Crown land holding. There is currently a Western Lands (perpetual) grazing lease on this land, however no agricultural activities are currently undertaken on the site.

The proposed 22kV transmission line would be constructed within a 30 metre wide easement that parallels an existing 22kV transmission line. It would be constructed on concrete poles approximately 14 metres high and spaced approximately 100 metres apart. The easement would be located on rural land within the Broken Hill LGA and would traverse four land holdings, including the Peterborough - Broken Hill rail line and its associated easement. The Peterborough - Broken Hill rail line is owned and operated by the Australian Rail Track Corporation Ltd (ARTC).

There is an existing rural residential dwelling on the site that would relocated to the west of the solar PV plant site, approximately 100 metres from the PV site boundary, on the remaining portion of Western Lands Lease 14240. The residential dwelling would be approximately 400 metres form the solar plant infrastructure itself, and would be located behind a low hill such that the solar plant would not be visible from the residence. No other rural residences would be affected (the closest residence being located about 1.3 kilometres distant).

Main access to the solar plant would be via an existing unsealed private road from the Barrier Highway. This road has a minimum width of eight metres and is sufficiently wide to accommodate

proposed construction and operational vehicles. The need for surface upgrades to this access road would be evaluated during detailed design. Maintenance access to the 22 kV transmission line would be required and would be via an existing unsealed track that occurs within the existing 22kV line easement.

The solar PV plant would be constructed using cadmium telluride (CdTe) thin film solar PV modules installed in regular arrays. Infrastructure within the solar PV plant site boundaries would include:

- A system of inverters and step up transformers throughout the arrays.
- Aboveground and underground electrical conduits and cabling to connect the arrays to the inverters and transformers.
- Marshalling switchgear to collect the power from the multiple array blocks.
- A supervisory control and data acquisition (SCADA) control system.
- A site office and maintenance building.
- Internal access tracks to allow for site maintenance.
- Perimeter security fencing and landscaping.

Temporary construction facilities, such as construction site compounds, lay-down areas and stockpiles would be established during the construction period. These construction facilities would be located on relatively level ground in areas that do not require substantial clearance of vegetation.

Construction of the project is anticipated to begin in mid-2014, subject to the outcome of the Environmental Assessment and planning approval process, grid connections and discussion with stakeholders. Construction of the project is expected to take approximately 17 months, with commissioning anticipated to take place in late 2015. Construction activities would be undertaken during standard construction hours, being:

- 7:00am to 6:00pm Monday to Friday.
- 8:00am to 1:00pm Saturdays.
- No work on Sundays or public holidays.

Assessment of environmental issues

The DGRs identified the following as key issues for the environmental assessment:

- Visual impacts.
- Noise impacts.
- Flora and fauna.
- Indigenous heritage.

- Traffic and transport.
- Hazard and risks.
- Water supply, water quality and waterways.

An environmental risk analysis was carried out as part of this environmental assessment to identify any additional potential key issues. No additional key issues were identified.

The detailed studies carried out as part of this environmental assessment have demonstrated that the construction and operation of the project can occur without significant environmental impacts. A summary of the potential impacts in relation to the key environmental issues identified in the DGRs is provided below.

Summary of potential impacts for key environmental issues

Environmental issue	Summary of potential impacts
Visual impacts	Visual impacts would generally be low to negligible. The only area of potentially high impact is along the Barrier Highway near the north-eastern corner of the solar PV plant site where the solar PV plant would impact views south west to 'The Pinnacles'. This impact may be mitigated with plantings along the boundaries of the site. There is a remote possibility of glare impacts on some sections of the Barrier Highway during early morning and late afternoon, although these impacts are expected to be minor. The transmission line would have very low visual impacts, especially for locations separated by more than 1 - 2km.
Noise impacts	The noise impacts of the project would be negligible. Construction noise is predicted to comply with the Interim Construction Noise Guidelines and is unlikely to have a significant impact on any sensitive receivers. Project operation would not generate any significant noise. Operational noise would be limited to occasional maintenance activities with very low noise emissions. The increase in vehicles on the Barrier Highway as a result of construction traffic would be very small relative to existing traffic volumes and is unlikely to have a measurable impact on traffic noise. Similarly, traffic noise during operation would be limited to four vehicles per day and would have no measurable impact. Given the distance between the project site and the nearest residential receiver, there would be no vibration impacts during either construction or operation.
Flora and fauna	The project would remove approximately 149.3 ha of native shrubland vegetation, and this would not affect any threatened flora species, populations or ecological communities. While the project site contains suitable habitat for three threatened bird species, the project is unlikely to impose a significant impact on local populations of any threatened fauna species or their habitats given the relatively small scale of the habitat disturbance involved and the presence of similar habitats in the surrounding landscape. The project would not significantly reduce the area of habitat occurring in the surrounding landscape or the wider bioregion, or have a significant impact on habitat connectivity. However, it is considered that the project will contribute to the potential cumulative loss of habitat in the region in the longer term. No nationally threatened flora or fauna species were identified on the project site and no such species are expected to occur.
Aboriginal heritage	Fourteen Aboriginal heritage sites were recorded within or close to the project impact footprint. Twelve of these sites are located within the project footprint and are likely to be affected during project construction. Management of these sites would be carried out through an Aboriginal Heritage Management Plan. The Aboriginal Heritage Management Plan would be developed to specify how the sites

Environmental issue	Summary of potential impacts
	would be protected in-situ, re-located or salvaged.
Traffic and transport	The project would not have a significant impact on traffic or transport. Transport of construction staff, materials and equipment to/from the project site would be along the Barrier Highway. The resultant increase in traffic volumes on the highway is anticipated to be approximately 132 movements per day. This would be very minor and would be unlikely to have a significant effect on traffic flows or disrupt any public or private access routes. The existing private access road from the Barrier Highway to the project site is sufficiently wide to accommodate the proposed construction traffic and widening of the road is not required. The road surface will be upgraded with compacted gravel as part of initial site works. The intersection of the access road with the Barrier Highway will be upgraded as required based on consultation with RMS. A detailed Traffic Assessment followed by a Traffic Management Plan will be prepared once traffic volumes and routes are confirmed by the appointed construction contractor/s and supplier/s. Once operational, daily traffic to the plant would be reduced to approximately four vehicle movements per day along the Barrier Highway and site access road. This volume of operational traffic would have a negligible impact on traffic and transport.
Hazards and risk	Hazards and risks associated with the project include electric and magnetic fields (EMFs), bushfire risks, potential impacts on aircraft, and the use of hazardous materials during construction. These hazards and risks have been examined and do not present a significant threat to human health or the environment. The alignment of the transmission line has been selected to avoid human exposure to EMFs. The bushfire and hazardous material risks during construction are typical of construction projects and can be adequately mitigated using standard environmental management practices. The bushfire risks associated with operation would be very minor as the solar PV plant would not be a source of heat or ignition, and the transmission line easement would be managed to prevent vegetation coming into contact with the conductors. Hazardous materials would not be permanently stored or routinely used on the site. The proposed transmission line poles are not high enough to affect any low-flying aircraft. Potential glare impacts from the solar PV plant are not likely to be an issue for aviation.
Water supply, water quality and waterways	The project does not involve use of water during operation and is therefore unlikely to affect the local water supply. Small volumes of water will be required for dust suppression during construction and this will be sourced from Essential Water, the responsible water supply authority in Broken Hill. AGL will consult with Essential Water to ensure sufficient water (up to 200 kL/day) is available for construction purposes and sufficient water for domestic purposes (to service up to two people per day) is available for operations. The project is unlikely to affect groundwater or salinity given that it does not involve deep excavation, other activities that could result in interception of groundwater, or other activities (such as irrigation), that could impact the water table. The project would not divert or alter any water courses, disturb the bed or banks of any waterways, or involve any discharges to waterways. The risks of accidental water pollution through chemical spills or off site transport of eroded sediment during construction would be minimised as far as practicable with the use of standard environmental management measures. The project is not located on a floodplain or within a flood prone area. The infrastructure associated with the project would be unlikely to obstruct any overland flood flows or significantly alter flood behaviour.

Conclusion

The Broken Hill Solar Plant represents a major investment by AGL for the development of large scale, grid-connected, solar power. The selection of Broken Hill was based on its high solar production potential and ease of access to the existing electrical grid. The site is also located on

relatively flat terrain and away from environmentally sensitive areas. The use of the selected site is compatible with existing and future land uses in the area and would not sterilise or affect future land use potential. Proposed potential impacts will be minor following the implementation of mitigation and management measures identified in this report, and would be outweighed by the overall project benefits. A draft Statement of Commitments (SoC) has been included in this environmental assessment. This SoC represents AGL's commitment to mitigate and manage potential impacts during construction and operation of the project.

1. Introduction

This chapter describes the background and objectives of the project and outlines the purpose and structure of this document. It also outlines the statutory approval framework for the project under NSW and Commonwealth legislation.

1.1. Purpose of this Document

This report has been prepared to support AGL Energy Limited's project approval application under Part 3A of the *Environmental Planning and Assessment Act 1979* (EP&A Act) for the construction and operation of the proposed Broken Hill Solar Plant Project (the project). It addresses the environmental assessment requirements for the project, which have been issued by the Director-General of Planning under Section 75F of the EP&A Act.

1.2. Background to the Project

AGL has been selected as the successful proponent in the solar PV category of the Australian Government's Solar Flagships Program independent reassessment process. AGL proposed the Broken Hill Solar Plant as one of two large-scale solar projects to be built as part of its application to the Program. A second project will be built at Nyngan in central NSW.

The location of the Broken Hill Solar Plant is shown in **Figure 1-1**.

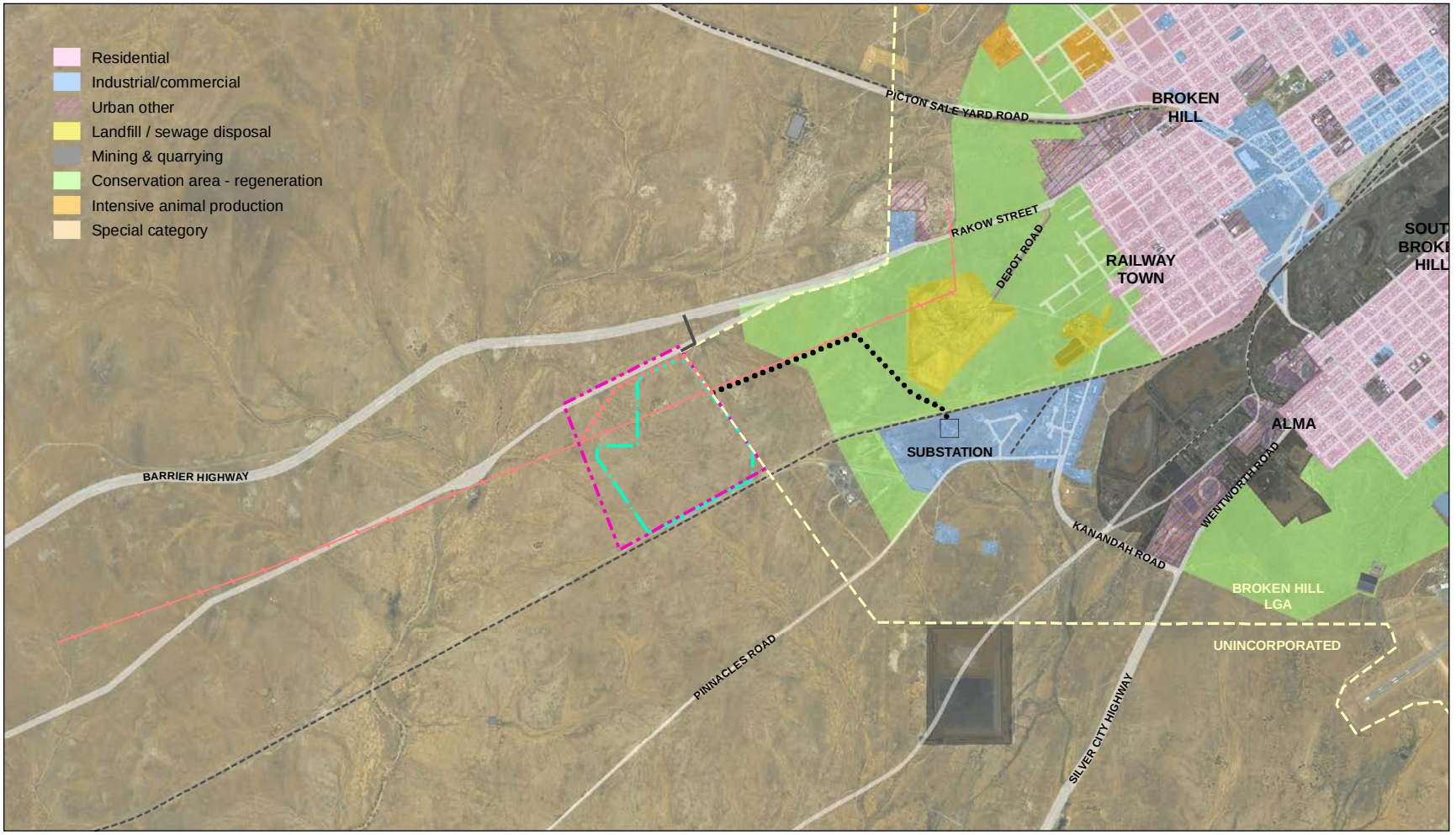

Figure 1-1 Project area and surrounds

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Spatial Team - Prepared by : JC
Checked by : JL

1.3. Objectives of the Project

The primary objective of the Solar Flagships Program is to provide the foundation for large scale, grid-connected, solar power to play a significant role in Australia's electricity supply and to operate within a competitive electricity market. Specific objectives of the program are to:

- Develop a solar industry in Australia.
- Encourage regional development.
- Provide research infrastructure.
- Develop Australian intellectual property in solar power generation.
- Develop and share technical and economic knowledge from the Solar Flagships Program.

As a component of the Solar Flagships Program, the proposed Broken Hill Solar Plant has been designed to be consistent with and contribute to the achievement of these objectives.

1.4. Overview of the Project

The project involves construction and operation of a nominal 50 MW solar PV plant, approximately five kilometres south-west of Broken Hill in far western NSW. The plant would comprise a series of PV solar panels mounted on fixed frames and would occupy approximately 200 hectares of land (refer to **Figure 1-1**). The project also includes installation and operation of a double circuit 22kV overhead transmission line, approximately 2.7 kilometres in length, to connect the PV plant to the electricity grid at the TransGrid Broken Hill substation. There is an existing 22 kV transmission line that traverses the proposed plant site. This would be realigned around the solar PV plant (refer to **Figure 1-1**). A detailed description of the key elements of the project is provided in Chapter 4.

1.5. The Proponent

AGL Energy Limited is the Proponent for the Broken Hill Solar Power Plant. AGL is the largest private owner, operator and developer of renewable energy generation in Australia and has invested well over $2 billion in renewable energy. AGL has major investments in hydro and wind, as well as ongoing developments in key renewable energy areas, including solar, landfill gas and biogas. AGL also operates retail, merchant energy and upstream gas businesses, and has over three million customer accounts.

1.6. Statutory Framework

The Director-General's Requirements

The Environmental Assessment must include consideration of any relevant statutory provisions including the consistency of the project with the objects of the Environmental Planning and Assessment Act 1979, Western Lands Act 1901, Crown Lands Act 1989 and any relevant development control plans.

1.6.1. Environmental impact assessment process

On 12 November 2010, the Director, Infrastructure Projects under delegation from the Minister for Planning formed the opinion that the project is a development of a kind that is described in clause 24 of Schedule 1 of the *State Environmental Planning Policy (Major Development) 2005* (Major Development SEPP) and was declared to be a project to which Part 3A of the EP&A Act applies. The Minister for Planning's record of opinion is attached in **Appendix A**.

Following recent changes to the NSW planning system, Part 3A was repealed from the EP&A Act. Clause 2(1)(c) of Schedule 6A to the EP&A Act provides that a project for which environmental assessment requirements were last notified or adopted within 2 years before the relevant Part 3A repeal date, is a "transitional Part 3A project". The DGRs were issued on 8 December 2010 being within 2 years before Part 3A was repealed on 1 October 2011.

The project is therefore a transitional Part 3A project.

Clause 3(1) of Schedule 6A provides that Part 3A (as in force immediately before it was repealed and as modified under Schedule 6 after that repeal) continues to apply to a transitional Part 3A project.

For that purpose, clause 3(2) of Schedule 6A provides that:

(a) *any State environmental planning policy or other instrument made under or for the purposes of Part 3A, as in force on the repeal of Part 3A (and as amended after the repeal) continues to apply to transitional Part 3A project, and*

(b) *declarations, orders, directions, determinations or other decisions with respect to a transitional Part 3A project continue to have effect and may continue to be made under Part 3A.*

The project will therefore continue to be assessed and determined under Part 3A of the EP&A Act. This environmental assessment has been prepared in accordance with the Director-General's Requirements (DGRs) issued on 8 December 2010 and attached in **Appendix B**.

1.6.2. Environmental Planning and Assessment Act 1979

Development in NSW is subject to the requirements of the EP&A Act and its associated regulations. Environmental planning instruments prepared pursuant to the EP&A Act set the framework for approval and assessment of development proposals.

Major development

Section 75B(1) of the EP&A Act (which continues to apply under the transitional arrangements) provides that Part 3A of the EP&A Act applies to the carrying out of development that is declared to be a project to which Part 3A applies by a State environmental planning policy (**SEPP**) or by order of the Minister published in the Gazette.

Relevantly, the Major Development SEPP identifies categories of developments that require assessment under Part 3A of the EP&A Act. Specifically, clause 24(a) of Schedule 1 applies to projects that involve:

> "*Development for the purpose of a facility for the generation of electricity or heat or their co-generation (using any energy source, including gas, coal, bio-fuel, distillate and waste and hydro, wave, solar or wind power), being development that:*
>
> *(a) has a capital investment value of more than $30 million, or…*"

The project is development as described in clause 24(a) of Schedule 1 and has a capital investment value greater than $30 million. The Minister has relevantly formed this opinion and the project has been declared to be a project to which Part 3A applies.

As part of the transitional arrangements for the staged repeal of Part 3A of the EP&A Act, on 28 September 2011, the Minister for Planning and Infrastructure delegated various function to the Planning Assessment Commission (PAC) including the function to determine Part 3A project applications made on or before 1 October 2011 (including critical infrastructure projects).

Critical infrastructure

The Minister for Planning and Infrastructure has declared under Section 75C of the EP&A Act, by order dated 27 November 2009 published in NSW Government Gazette (No. 184), that the following developments would be a critical infrastructure project for the purposes of section 75C of the EP&A Act:

> "*Development for the purpose of a facility for the generation of electricity derived from renewable fuel sources (that is, wind energy, solar energy, geothermal energy, hydro energy, wave energy and bio energy), being development that:*

(a) is the subject of an application lodged pursuant to section 75E or section 75M of the Environmental Planning and Assessment Act 1979 lodged after the date of this declaration; and

(b) is the subject of an application that proposes a development with a capacity to generate at least 30 megawatts."

Critical infrastructure projects under Section 75C of the EP&A Act are developments which, in the opinion of the Minister for Planning and Infrastructure, are essential to the State of NSW for economic, environmental or social reasons. The declaration provides increased certainty for industry and the community in the development of new renewable energy projects.

As the project is a development for the purpose of generating electricity from renewable sources and has a generation capacity greater than 30 MW, it is a critical infrastructure project for the purposes of section 75C of the EP&A Act.

Objectives of the EP&A Act

Development in NSW is subject to the requirements of the *Environmental Planning and Assessment Act* 1979 (EP&A Act). The objects of the EP&A Act relevant to this project are to encourage:

- the proper management, development and conservation of natural and artificial resources, including agricultural land, natural areas, forests, minerals, water, cities, towns and villages for the purpose of promoting the social and economic welfare of the community and a better environment;
- the promotion and co-ordination of the orderly and economic use and development of land;
- the protection, provision and co-ordination of communication and utility services;
- the protection of the environment, including the protection and conservation of native animals and plants, including threatened species, populations and ecological communities, and their habitats;
- ecologically sustainable development;
- increased opportunity for public involvement and participation in environmental planning and assessment.

The objects of the EP&A Act have been considered throughout this environmental assessment. The project aims to promote the orderly and economic use of the land through the provision of utility services (power generation). The project site has been located such that it will avoid protected areas and generally minimise the use of natural and artificial resources while still promoting the social and economic welfare of the local community.

The principles of ecologically sustainable development have also been addressed throughout the assessment and described for the project in Section 14.4.

1.6.3. Environmental planning instruments

Section 75R(3) of the EP&A Act excludes the application of environmental planning instruments (other than SEPPS) to approved projects. While SEPPs apply to the carrying out of a project, they only apply to critical infrastructure projects (such as this project) to the extent that the provisions of the SEPP expressly provide that they apply to the particular project (section 75R(2)(b) of the EP&A Act). There are no SEPPs that expressly apply to the project.

Nevertheless, in deciding whether or not to approve a project, the Minister for Planning and Infrastructure (and/or PAC) may (but is not required to) take into account the provisions of relevant environmental planning instruments that would not (because of section 75R) apply to the project, if approved (section 75J(3) of the EP&A Act).

Provisions of SEPPs that would have applied to the project but for the application of Part 3A have been reviewed and considered below.

State Environmental Planning Policy (Major Development) 2005

The State Environmental Planning Policy (Major Development) 2005 defines certain developments that are major projects to be assessed under Part 3A of the EP&A Act and determined by the Minister for Planning. It also provides planning provisions for State significant sites.

The Broken Hill Solar Plant has been classified as a major project under the provisions of this SEPP. Further explanation of this process was provided in **Section 1.6.2**.

SEPP (Infrastructure) 2007)

The SEPP (Infrastructure) 2007 was introduced to facilitate the effective delivery of infrastructure across the State by improving regulatory efficiency through a consistent planning regime for infrastructure and services across NSW. Specifically, Clause 34(7) of the SEPP provides that the development for the purpose of 'Solar energy systems' may be carried out with consent on any land, except as prescribed by subclause 34(8). Clause 34(8) of the SEPP states that development for the purpose of a photovoltaic electricity generating system may be carried out by a person with consent on land in a prescribed residential zone only if the system has the capacity to generate no more than 100 kW. As the proposed project site is not in a prescribed residential zone, clause 34(8) does not apply.

Clause 104 of the SEPP relates to the generation of traffic relevant to the development specified in Column 1 of the Table to Schedule 3 – Traffic generating developments to be referred to Roads and Maritime Services (RMS). For the purposes of power generation, the requirements of Schedule 3 do not apply as the project would result in the generation of fewer than 200 vehicles per day during construction or operation.

SEPP No. 55 - Remediation of Land

SEPP No. 55 aims to promote the remediation of contaminated land for the purpose of reducing the risk of harm to human health or any other aspect of the environment. The SEPP applies to the whole of the State.

Clause 7 of the SEPP No. 55 requires that the remediation of land be considered by a consent authority in determining a development application. Although the Minister is not required to take into account the provisions of SEPP No. 55 (for the reasons discussed above), the principles of SEPP No. 55 have nonetheless been considered.

A search of the Office of Environment and Heritage contaminated land register was undertaken for the proposed project site on 9th June, 2012. There were no records in the vicinity of the site recorded. Additionally, field surveys and a review of existing and past land use on this site did not suggest the likelihood of any contaminated sites being present.

Broken Hill Local Environmental Plan 1996 (Broken Hill LEP)

The proposed solar PV plant site is located in the unincorporated area administered by the NSW Department of Primary Industries, Catchments and Lands Division. Local environmental planning instruments are not applicable to this area. The Broken Hill Local Environmental Plan 1996 (as amended) controls land use and development within the Local Government Area (LGA). An LEP allows Council and the community to guide development according to local values and characteristics in conjunction with State policies. Part of the proposed transmission line to connect the plant to the existing TransGrid substation is located in the Broken Hill LGA on land zoned *1(a) General Rural* under the Broken Hill LEP (see Figure 1-1).

Development for the purposes of electricity generation is permissible with consent within the 1(a) General Rural Zone. The project is consistent with the objectives of the Broken Hill LEP in that it seeks to provide utility services (power transmission) while ensuring the protection, enhancement and conservation of rural resources. Additionally, the project is consistent with objective 1(e) which is to provide land for development for other non-agricultural purposes, in accordance with the need for that development. In addition to Broken Hill City Council, the Department of Primary Industries, Catchments and Lands Division, is a key stakeholder in this process and would also be consulted regarding future use of this site.

Broken Hill City Council has a number of Development Control Plans (DCPs) which provide detailed guidance with regard to specific development design and location. Of relevance to this project, the Rural DCP establishes and outlines development guidelines relating to rural and Rural Small Holdings development. The objective of the Rural DCP is to also maintain a high degree of environmental quality and minimum conflict between Rural Small Holdings land use and the rural activities and amenity within the area.

The development standards outlined within the DCP were generally considered particularly during the planning and assessment of the transmission line component of the Project.

1.6.4. Other legislation

NSW legislation

Section 75U of the EP&A Act specifies certain approvals that are not required for an approved project under Part 3A. Consequently, if the Minister grants approval to carry out the project under Section 75J (1) of the EP&A Act, the following approvals would not be required:

1) Concurrence under Part 3 of the *Coastal Protection Act 1979* from the Minister administering that Part.
2) Permits under Section 201, 205 or 219 of the *Fisheries Management Act 1994*.
3) An approval under Part 4s or an excavation permit under Section 139 of the *Heritage Act 1977*.
4) An Aboriginal heritage impact permit under Section 90 of the *National Parks and Wildlife Act 1974*.
5) An authorisation referred to in Section 12 of the *Native Vegetation Act 2003* (or under any Act to be repealed by that Act) to clear native vegetation or State protected land.
6) A bush fire safety authority under Section 100B of the *Rural Fires Act 1997*.
7) A water use approval under Section 89, a water management work approval under Section 90 or an activity approval under Section 91 of the *Water Management Act 2000*.

Under Section 75V of the EP&A Act, if the project is granted approval under Part 3A of the EP&A Act, certain approvals, if necessary for carrying out the approved project, cannot be refused by the relevant approval authority and such approvals must be substantially consistent with the terms of the project approval. These approvals are described below.

Protection of the Environment Operations Act 1997

The *Protection of the Environment Operations Act 1997* (POEO Act) is administered by the Office of Environment and Heritage (OEH) and the Environment Protection Authority (EPA). Under Section 48 of the POEO Act, premise-based scheduled activities (as defined in Schedule 1 of the POEO Act) require an Environment Protection Licence (EPL). Clause 17 of Schedule 1 of the POEO Act concerns electricity generation works. General electricity works is a scheduled activity

and requires an EPL where the activity has the capacity to generate more than 30 MW of electrical power. General electricity generation works is defined as "the generation of electricity by means of electricity plant that, wherever situated, is based on, or uses, any energy source other than wind power or solar power. Although the works have a capacity to generate more than 30 MW of electrical power, electricity generation from solar power is not a scheduled activity. Accordingly, an EPL is not required under the POEO Act.

Nevertheless, any water pollution resulting from the proposed development that is not in accordance with an EPL would constitute a breach of the Act under Section 120. Under Section 148 of the Act, AGL would be required to immediately notify the relevant authorities, including EPA, of any pollution incidents that occur as a consequence of the construction or operation of the project.

Roads Act 1993

The *Roads Act 1993* (Roads Act) provides for the classification of roads and for the declaration of the Roads and Maritime Services of NSW (RMS) and other public authorities as roads authorities for both classified and unclassified roads. It also regulates the carrying out of various activities in, on and over public roads. Under Section 138 of the Roads Act, the consent of the relevant roads authority is required to erect a structure or carry out works in, on or over a public road.

The Barrier Highway is a classified road and falls under the jurisdiction of the RMS. The intersection of the site access road with the Barrier Highway will be upgraded as required based on consultation with RMS. Consent of RMS is required under Section 138 of the Roads Act before the intersection upgrade works commence.

Native Vegetation Act 2003

The Native Vegetation Act 2003 (NV Act) regulates the clearing of native vegetation on all land in NSW except for land listed in Schedule 1 of the Act. The proposed project site is not on any land described in Schedule 1. Native vegetation is any species of vegetation that existed in NSW before European settlement, including trees, saplings, scrub, groundcover or plants in a wetland. The provisions of the NV Act have been considered for this project. The key findings of the Flora and Fauna assessment undertaken for the project are outlined within **Chapter 7** and described in detail in **Appendix E**.

Threatened Species Conservation Act 1996

The *Threatened Species Conservation Act 1995* (TSC Act) provides for the conservation of threatened species, populations and ecological communities of animals and plants. The TSC Act sets out a number of specific objects relating to the conservation of biological diversity and the promotion of ecologically sustainable development.

The provisions of the TSC Act have been considered for this project. The key findings of the Flora and Fauna assessment undertaken for the project are outlined within **Chapter 7** and described in detail in **Appendix E**.

National Parks and Wildlife Act 1974

Under the National Parks and Wildlife Act, the Director-General of the NPWS is responsible for the care, control and management of all national parks, historic sites, nature reserves, reserves, Aboriginal areas and state game reserves. State conservation areas, karst conservation reserves and regional parks are also administered under the Act. The Director-General is also responsible under this legislation for the protection and care of native fauna and flora, and Aboriginal places and objects throughout NSW.

The provisions of the Act have been considered for this project. The project is not in or in the vicinity of any protected areas as defined in the Act. The key findings of the Flora and Fauna assessment undertaken for the project are outlined within **Chapter 7** and described in detail in **Appendix E**. An assessment of impacts to Aboriginal Heritage is described in **Chapter 8** and **Appendix F**.

Western Lands Act 1901 and Crown Lands Act 1989

The proposed solar PV plant site is located on Crown land which is managed by the Department of Primary Industries, Catchments and Lands Division, in accordance with the *Western Lands Act 1901* and the *Crown Lands Act 1989*. The *Western Lands Act 1901* regulates the manner in which land in the West Region can be used, how roads and rights of way are created and how leases are issued. The property is currently held under a Western Lands Lease. AGL will work with the current lessee and the Catchments and Lands Division to subdivide the existing Western Lands Lease, and then will acquire the subdivided portion of the existing lease. AGL will then surrender the existing lease and will negotiate a new lease under the *Crown Lands Act*. The Project has been considered against the objects of both the *Crown Lands Act* and the *Western Lands Act*, specifically regarding the principles of Crown Land management and is considered to be consistent with the objects of both Acts as described in **Table 1-1** and **Table 1-2.**

Table 1-1 Assessment of the project against the objects of the Western Lands Act and the Crown Lands Act

Objects of the Act	Assessment of consistency
Western Lands Act 1901	
(a) to establish an appropriate system of land tenure for the Western Division, and to facilitate new land uses and development opportunities for land in the Western Division,	The Broken Hill Solar Plant project is considered to facilitate an improved use of the existing land on which the project is proposed, through the provision of large scale, grid-connected, solar power generation.
(b) to regulate the manner in which land in the Western Division may be dealt with,	This object is not relevant to the proposed project.
(c) to provide for the establishment of a formal access network, by means of roads and rights of way, in the Western Division,	This object is not relevant to the proposed project
(d) to establish the rights and responsibilities of lessees and other persons with respect to the use of land in the Western Division,	All directly affected landowners and the lessee were notified in writing by the proponent within 14 days of the Project Application being lodged in accordance with clause 8F(3)(c) of the *Environmental Planning and Assessment Regulation 2000*.
(e) to ensure that land in the Western Division is used in accordance with the principles of ecologically sustainable development referred to in section 6 (2) of the Protection of the Environment Administration Act 1991,	AGL recognises the value of environmental resources and aims to minimise the impacts of its activities and operations by conducting thorough assessments of its activities and implementing appropriate impact mitigation measures. An assessment of the principles of ecologically sustainable development is provided in **Section 14.4.**
(f) to promote the social, economic and environmental interests of the Western Division, having regard to both the indigenous and non-indigenous cultural heritage of the Western Division,	The project will promote socio-economic interests of the West Region through the creation of new construction jobs for the duration of the construction period and economic stimulus of the Broken Hill region (refer **Section 12.18**). Indigenous and non indigenous heritage impacts have been assessed within the environmental assessment. Identified heritage sites have been assessed as having a low scientific significance, although the salvage and transfer of the identified Aboriginal artefacts will provide an opportunity for the artefacts to be used to reinforce Aboriginal cultural traditions and their association and linkages to the landscape.
(g) to make other provision for the effective integration of land administration and natural resource management in the Western Division.	This object is not relevant to the proposed project.
Crown Lands Act 1989	
The objects of this Act are to ensure that Crown land is managed for the benefit of the people of New South Wales and in particular to provide for:	
(a) a proper assessment of Crown land,	A detailed environmental assessment has been conducted for the proposed project on Crown land.
(b) the management of Crown land having regard to the principles of Crown land management contained in this Act,	The principles of Crown land management are discussed in **Table 1-2.**

Objects of the Act	Assessment of consistency
(c) the proper development and conservation of Crown land having regard to those principles,	The principles of Crown land management are discussed in **Table 1-2.**
(d) the regulation of the conditions under which Crown land is permitted to be occupied, used, sold, leased, licensed or otherwise dealt with,	Department of Primary Industries (Catchments and Lands Division) has been consulted and would continue to be consulted regarding future use of the site. This is discussed in **Section 12.1.2**.
(e) the reservation or dedication of Crown land for public purposes and the management and use of the reserved or dedicated land, and	The land on which the project is proposed would not be made available for public use however the project is providing benefits to the public through the provision of additional power supply.
(f) the collection, recording and dissemination of information in relation to Crown land.	This object is not relevant to the proposed project

Table 1-2 Assessment of the project against the principles of Crown land management

Principles of Crown land management	Assessment of consistency
(a) that environmental protection principles be observed in relation to the management and administration of Crown land	Environmental protection principles have been considered and addressed throughout this environmental assessment. Mitigation measures are presented in each of the relevant Chapters of the environmental assessment.
(b) that the natural resources of Crown land (including water, soil, flora, fauna and scenic quality) be conserved wherever possible,	Impacts to the natural resources of the project site have been assessed within the environmental assessment with mitigation measures provided where possible to avoid or reduce impacts to those resources. The project is not considered to have a significant impact on any natural resources of Crown land.
(c) that public use and enjoyment of appropriate Crown land be encouraged,	The land on which the project is proposed would not be made available for public use however the project is providing benefits to the public through the provision of additional power supply.
(d) that, where appropriate, multiple use of Crown land be encouraged,	This object is not relevant to the proposed project.
(e) that, where appropriate, Crown land should be used and managed in such a way that both the land and its resources are sustained in perpetuity, and	AGL recognises the value of environmental resources and aims to minimise the impacts of its activities and operations by conducting thorough assessments of its activities and implementing appropriate impact mitigation measures. An assessment of the principles of ecologically sustainable development is provided in **Section 14.4.**
(f) that Crown land be occupied, used, sold, leased, licensed or otherwise dealt with in the best interests of the State consistent with the above principles.	Department of Primary Industries (Catchments and Lands Division) has been consulted and would continue to be consulted regarding future used of the site. This is discussed in **Section 12.1.2**.

Commonwealth legislation

Environment Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is administered by the Commonwealth Department of Sustainability, Environment, Water, Population and Communities (DSEWPC). Under the EPBC Act, proposed actions that are likely to have a significant impact on a matter of national environmental significance (NES) must be referred to the Minister for Sustainability, Environment, Water, Population and Communities. The EPBC Act identifies seven matters of NES:

- World Heritage properties.
- National heritage places.
- Ramsar wetlands of international significance.
- Threatened species and ecological communities.
- Migratory species.
- Commonwealth marine areas.
- Nuclear actions (including uranium mining).

If the Minister for Sustainability, Environment, Water, Population and Communities determines that an action is a 'controlled action' which will have or is likely to have a significant impact on a matter of NES then the action may not be undertaken without prior approval from the Minister under the EPBC Act.

A search of the EPBC Act Protected Matters Search Tool indicates that there are no World Heritage or National Heritage areas or items within the study area. The project is located in the same catchment as Lake Pinaroo, which is a listed Ramsar Wetland, although it would be unlikely to affect this wetland due to its nature and it being 320 kilometres distant from the project site. The results of the flora and fauna assessment indicate that there are no EPBC Act listed threatened species, threatened ecological communities or migratory species that are likely to be impacted by the project. The project would not affect any marine areas or Commonwealth land. Accordingly, the proposed actions are not required to be referred to DSEWPC for assessment and a decision as to whether project is a controlled action.

Native Title Act 1993

The *Native Title Act 1993* (Cth) provides a legislative framework for the recognition and protection of common law native title rights. Native title is the recognition in Australian law that Indigenous people had a system of law and ownership of their lands before European settlement. The law recognises native title where a traditional connection to land and waters have been maintained and where such rights have not otherwise been extinguished.

People who hold native title have a right to consult or continue to practice their law and customs over traditional lands and waters while respecting other Australian laws. This could include visiting to protect important places, making decisions about the future use of the land or waters, hunting, gathering and collecting bush medicines. Further, when a native title claimant application is registered by the National Native Title Tribunal (NNTT), the people seeking native title recognition gain a right to consult or negotiate with anyone who wants to undertake a project on the area claimed.

Native title may exist in areas such as:

- Vacant Crown land.
- Some national parks, forests and public reserves.
- Some types of pastoral lease.
- Some land held for Aboriginal communities.
- Beaches, oceans, seas, reefs, lakes, rivers, creeks, swamps and other waters that are not privately owned.

A search of the NNTT register was undertaken in August 2010 for the area potentially affected by the project to determine whether it may be affected by a Native Title determination, application or Indigenous land use agreement. The results of this search indicated that there is a Native Title Claimant in the project area, being the Barkandji Traditional Owners. To the extent that native title exists in relation to the land, AGL will comply with the requirements under the Native Title Act in progressing the project.

1.7. Structure of this Report

This environmental assessment report has been prepared in accordance with relevant guidelines and the DGRs (refer to **Appendix B**). The report is structured as follows:

- **Introduction (Chapter 1) –** provides a broad overview of the project, outlines the statutory requirements and explains the steps in the assessment and approval process. A risk assessment for the project is provided.
- **Strategic justification (Chapter 2) –** provides the strategic context, outlines the need for the project and reviews the alternatives considered in developing the project.
- **Community and stakeholder consultation (Chapter 3) –** describes the consultation undertaken and identifies the corresponding issues raised.
- **Project description (Chapter 4) –** provides a detailed description of the project, including the construction and operation of the solar PV plant and transmission line.

- **Environmental assessment of key issues (Chapters 5 to 11) –** identifies the key environmental issues, potential environmental impacts and the corresponding impact mitigation and management requirements.
- **Assessment of other issues (Chapter 12) –**addresses the other issues to identify the potential impacts and corresponding impact mitigation and management requirements.
- **Draft Statement of Commitments (Chapter 13) –** outlines how the environmental impacts of the project will be mitigated, managed and monitored.
- **Project justification and conclusion (Chapter 14) –** provides a justification for the project and conclusion for the environmental assessment.
- **References (Chapter 15)**.
- **Maps/figures/tables** – are indicative only and subject to detailed design

1.8. General Environmental Risk Analysis

1.8.1. Overview

The Director-General of the Department of Planning and Infrastructure (DoPI) requires AGL to undertake an environmental risk analysis to identify potential environmental issues associated with the construction and operation of the project.

The risk analysis process began at the Project Application and Preliminary Environmental Assessment phase, and was further developed during the environmental assessment phase. The risk analysis process was used to scope the environmental investigations and guide project design.

Risk analysis enabled the environmental assessment to:

- Target those issues identified as key issues in the Preliminary Environmental Assessment. This took into account the significance of the potential environmental impacts and the effectiveness of the proposed management measures in preventing degradation or deterioration of the biophysical or social environment.
- Identify those potential impacts that are not key issues for the project, including those issues that would be expected to respond well to appropriate impact mitigation and management measures.
- Identify the residual impacts that are likely to remain after application of the proposed impact mitigation measures. Where residual impacts are significant, this may require further measures to mitigate adverse effects or, in some instances, refinement of the design at that location.

1.8.2. Identification of key issues

The Preliminary Environmental Assessment identified the issues considered to be the key issues for the project and informed the subsequent identification of key issues in the DGRs. The DGRs identified the following key issues for the environmental assessment:

- Visual impacts.
- Noise impacts.
- Flora and fauna.
- Indigenous heritage.
- Traffic and transport.
- Hazard and risks.
- Water supply, water quality and waterways.

These key issues have been the focus of the environmental assessment and are addressed in Chapters 5 to 11 of this report.

1.8.3. Risk analysis methodology

The environmental risk analysis was undertaken in accordance with the principles of the Australian and New Zealand standard *AS/NZS ISO 31000:2009 – Risk Management*. It involved:

- Ranking the risk of each identified potential impact by identifying the consequences of the impact and the likelihood of each impact occurring.
- Considering the probable effectiveness of the proposed mitigation measures to determine the likely residual risk of each impact.

The first step involved identification of the consequence levels, should an impact occur. The levels are defined in **Table 1-3.**

Table 1-3 Risk analysis consequence definitions

Consequence Level	Definition
Catastrophic	Would result in a major prosecution under relevant environmental legislation. Would cause long-term and irreversible impacts.
Major	Would result in a fine or equivalent under relevant environmental legislation. Would cause medium-term, potentially irreversible impacts.
Moderate	Would result in medium-term, reversible impacts.
Minor	Would result in short-term, reversible impacts.
Insignificant	Would result in minor, negligible impacts.

The next step involved a definition of the risk rating categories. This was done by considering the frequency of activities that may cause the impact and the probability (or likelihood) of the impact occurring during that activity. The level of likelihood was classed as:

- Very likely – the event is almost certain to occur in the course of normal or abnormal operating circumstances.
- Likely – the event is likely to occur in the course of normal operations.

- Unlikely – the event could occur in the course of normal or abnormal operating circumstances.
- Very unlikely – the event may occur in exceptional circumstance only.

The risk rating of each potential impact was then determined by combining the consequence and likelihood according to the risk matrix in **Table 1-4.** Impacts were allotted a risk rating score of between one and six. A risk rating score of one represents an impact with major to catastrophic consequences that is likely or very likely to occur. A risk rating score of six represents an impact with minor or insignificant consequences that is unlikely or very unlikely to occur.

Table 1-4 Risk matrix

Consequence	Likelihood			
	Very likely	Likely	Unlikely	Very unlikely
Catastrophic	1	1	2	3
Major	1	2	3	4
Moderate	2	3	4	5
Minor	3	4	5	6
Negligible	4	5	6	6

The risk rating scores identified from the risk matrix, were categorised as shown in **Table 1-5**.

Table 1-5 Risk rating categories

Risk rating score	Risk category	General description
1, 2 or 3	High	Detailed assessment and planning are necessary to develop appropriate measures to mitigate and manage the potential impacts.
4 or 5	Medium	Potential impacts can be mitigated through the application of relatively standard environmental management measures.
6	Low	Potential impacts either require no specific management measures or are mitigated adequately through other working controls (such as detailed design requirements, normal working practice, quality and safety controls).

The potential effectiveness of the proposed impact mitigation measures was assessed and classified as follows:

- Very effective – the measure would increase the risk rating score by 3 points – for example, from 3 (high) to 6 (low).
- Effective – the measure would increase the risk rating score by 2 points – for example, from 2 (high) to 4 (medium).
- Partly effective – the measure would increase the risk rating score by 1 point – for example, from 3 (high) to 4 (medium).

- Not effective – the measure would not change the risk rating.

1.8.4. Environmental risk analysis results

The environmental risk analysis was based on investigations and a review of the issues during preparation of this environmental assessment, as well as knowledge from other major infrastructure projects. The analysis also considered the input provided by various government agencies and other stakeholders during the consultation process and the principles for ecologically sustainable development. The results of the environmental risk analysis are presented in **Table 1-6.**

1.8.5. Risk analysis conclusions

Key issues

The environmental risk analysis has shown that four of the key issues - visual impacts, flora and fauna, Aboriginal heritage and water management - have a high level of potential risk but a medium level of residual risk with the implementation of the proposed impact mitigation measures. The remaining three key issues – noise, traffic and transport, and hazards and risks – also have a low or medium level of residual risk. None of the key issues has a high level of residual risk.

The key issues are addressed in Chapters 5-11 of this report. For each of these issues, an appropriate level of assessment was undertaken to determine the likely extent of impacts and the requirements for impact mitigation and management.

Other issues

The other (non-key) environmental issues for the project were found to have a low level of residual risk. These issues are:

- Land use.
- Non-Indigenous heritage.
- Socio-economic issues.
- Geology and soils.
- Air quality and climate.
- Waste management.

Although these issues can be effectively managed with standard impact mitigation and management measures, further assessment was undertaken to confirm the extent of impacts and the management requirements. This assessment has been presented in **Sections 12.1** to **12.6** of this chapter.

Table 1-6 Environmental risk assessment results

Environmental issues	Potential adverse impacts	Overall consequence	Overall likelihood	Risk rating	Impact mitigation measures	Effectiveness	Residual risk rating
Visual impacts	Temporary visual impacts on landscape views during construction due to the presence of a construction site. The solar PV plant would impact the view of 'The Pinnacles' for motorists using the Barrier Highway.	Moderate	Likely	3 High	Ch 5	Effective	Medium
Noise impacts	The project is unlikely to have any significant noise impacts during either construction or operation.	Negligible	Unlikely	6 Low	Ch 6	Effective	Low
Flora and fauna	Clearing of around 149.3 ha of native vegetation and habitat. The vegetation/habitat to be cleared is common in the surrounding landscape and the clearing is unlikely to have adverse effects on any species, population or ecological community, or habitat thereof.	Moderate	Likely	3 High	Ch 7	Effective	Medium
Aboriginal heritage	Potential disturbance/destruction of 12 Aboriginal heritage sites. Potential disturbance of previously unidentified Aboriginal heritage objects and places.	Moderate	Likely	3 High	Ch 8	Effective	Medium
Traffic and transport	Impacts on local and regional traffic as a result of construction traffic.	Minor	Likely	4 Medium	Ch 9	Effective	Medium
Hazard and risks	The transmission line conductors present a potential ignition source and corresponding bushfire risk.	Moderate	Unlikely	4 Medium	Ch 10	Effective	Low

Environmental issues	Potential adverse impacts	Overall consequence	Overall likelihood	Risk rating	Impact mitigation measures	Effectiveness	Residual risk rating
Water supply, water quality and waterways	Impacts on surface water quality during construction due to off-site transport of sediment and/or contaminants.	Moderate	Unlikely	4 Medium	Ch 11	Effective	Low
Land use	Impact on exploration and mining leases. Loss of potential grazing land.	Minor	Likely	4 Medium	Ch 12	Partly effective	Medium
Non-Indigenous heritage	Potential disturbance of previously unidentified non-Indigenous objects and places.	Minor	Unlikely	5 Medium	Ch 12	Effective	Low
Socio-economic issues	Temporary impacts on local community amenity during construction.	Minor	Likely	4 Medium	Ch 12	Effective	Low
Contamination	Disturbance to a contaminated site during construction	Minor	Unlikely	5 Medium	Ch 12	Effective	Low
Geology and soils	Erosion and sedimentation impacts during construction.	Minor	Likely	4 Medium	Ch 12	Effective	Low
Air quality and climate	Dust generation during construction.	Negligible	Unlikely	6 Low	Ch 12	Effective	Low
Waste management	Generation of waste and potential for impacts on landfill and other waste disposal facilities.	Minor	Likely	4 Medium	Ch 12	Effective	Low

2. Strategic Justification

This chapter provides the strategic justification for the project in the context of the Solar Flagships Program. In accordance with the Director-General's requirements, it includes: a strategic assessment of project need, scale, scope and location; details of the project's greenhouse gas benefits; an analysis of the suitability of the project with respect to potential land use conflicts; and a description of the alternatives considered for all project components.

The Director-General's Requirements

The Environmental Assessment must:

- *Include a strategic assessment of the need, scale, scope and location for the project in relation to predicted electricity demand, predicted transmission constraints and the strategic direction of the region and the State in relation to electricity supply, demand and electricity generation technologies, and its role within the Commonwealth's Renewable Energy Target Scheme.*
- *Include a clear demonstration of quantified and substantiated greenhouse gas benefits, taking into consideration sources of electricity that could realistically be replaced and the extent of their replacement.*
- *Include an analysis of the suitability of the project with respect to potential land use conflicts with existing and future surrounding land uses (including rural residential development, land of significant scenic or visual value, land of high agricultural value, mineral reserves (including exploration and extraction within the proximity of the subject area), and conservation areas), taking into account local and strategic land use objectives including the potential loss of agricultural land.*
- *Describe the alternatives considered (location and/or design) for all project components, and provide justification for the preferred project demonstrating its benefits including community benefits (for example community enhancement programmes) on a local and strategic scale and how it achieves stated objectives.*

2.1. Need for the Project

2.1.1. Electricity demand

The National Electricity Market (NEM) operates as a wholesale market for the supply of electricity to retailers and end-users in Queensland, New South Wales (NSW), the Australian Capital Territory, Victoria, South Australia and Tasmania. The Australia Energy Market Operator (AEMO) was established to manage the NEM and gas markets (AEMO, 2010).

The AEMO publishes the Electricity Statement of Opportunities (ESOO) (AEMO, 2012a) and a National Electricity Forecasting Report (AEMO, 2012b) annually to provide the energy industry and potential investors with information about demand forecasts, generation capacities, and supply adequacy in the NEM for the next 10 years. **Table 2-1** presents the recent actual energy, and medium, high and low economic growth scenario energy projections for NSW. Energy use is

projected to increase over the next 10 years at an annual average rate of 1.16 per cent under the medium growth scenario (AEMO, 2012b).

Table 2-1 NSW energy projections (GWh)

Financial year	Actual use	High growth use estimate	Medium growth use estimate	Low growth use estimate
2006/07	75,436	-	-	-
2007/08	75,878	-	-	-
2008/09	75,488	-	-	-
2009/10	74,772	-	-	-
2010/11	74,512	-	-	-
2011/12 (estimate)	71,468			
2012/13	-	70,354	70,007	69,551
2013/14	-	71,507	70,887	70,015
2014/15	-	73,006	72,133	70,341
2015/16	-	74,503	73,128	70,750
2016/17	-	75,757	73,912	70,929
2017/18	-	77,268	75,106	71,540
2018/19	-	77,886	75,518	71,282
2019/20	-	78,805	76,181	71,322
2020/21	-	79,902	76,948	71,578
2022/22		80,894	77,669	71,633
Average annual growth	-	1.56%	1.16%	0.33%

Source: Table 4-1 in AEMO (2012b)

A probability of exceedance (POE) refers to the likelihood that a maximum demand (MD) projection would be met or exceeded. The various probabilities (generally 90 per cent, 50 per cent and 10 per cent) provide a range of likelihoods that analysts can use to determine a realistic range of power system and market outcomes. The MD in any year will be affected by the weather conditions, and an increasing proportion of demand is sensitive to, for example, temperature and humidity conditions. In an average year, the expectation is that the 50 per cent POE MD will occur. In an extreme season, expected to occur one year in ten, the 10 per cent POE MD can occur. In a mild season, occurring one year in ten, the MD can be as low as the 90 per cent POE projection (AEMO, 2011).

The summer 10 per cent POE maximum demand for NSW (including ACT) is projected to increase over the next 10 years (to 2012/22) at an annual average rate of 1.51 per cent, 1.18 per cent and 0.47 per cent under the high, medium and low growth scenarios, respectively (AEMO, 2012b). The winter 10 per cent POE maximum demand for NSW (including ACT) is projected to increase over

the next 10 years (to 2012/22) at an annual average rate of 1.52 per cent, 1.19 per cent and 0.58 per cent under the high, medium and low growth scenarios, respectively (AEMO, 2012b).

The ESOO report (AEMO, 2012a) presents the projected NSW summer supply-demand outlook for 2012/13 to 2021/22. The generational capacity projections at the time of NSW summer and winter MD for 2012/13 are 16,327 MW and 16,388 MW, respectively. Current projections by AEMO indicate that NSW will not experience a shortfall of electricity prior to 2021/22 (AEMO, 2012a). There has been significant interest in generation as indicated by investment across the various sectors of electricity generation sources. A total of 13,192 MW has been publicly announced of which solar represents 600 MW (AEMO, 2012a).The Broken Hill Solar Plant would contribute a nominal 50 MW.

Congestion and network constraints also exist in certain areas of the NSW transmission network. Typically, the loading on transmission networks is highest during summer and winter. The main network constraints relate to thermal overload and line rating and voltage control issues (TransGrid, 2010). The number of locations where new generation could be connected to the NSW transmission network without the need to augment the network is now limited. It is essential that the transmission network is developed so that it has adequate capability to transfer power under a range of future generation development scenarios (TransGrid, 2010).

2.1.2. Renewable energy target scheme

In August 2009, the Australian Government implemented the Renewable Energy Target (RET) scheme, which is designed to meet its ongoing commitment that, by 2020, 20 per cent of Australia's electricity supply will be derived from renewable sources. The RET expands on the previous Mandatory Renewable Energy Target developed in 2001, which targeted the generation of 9,500 GWh of extra renewable electricity per year by 2010.

Following the review of the RET, the Federal Parliament passed legislation in June 2010 to separate the RET into two parts: the Large-scale Renewable Energy Target (LRET) and the Small-scale Renewable Energy Scheme (SRES). These targets commenced on 1 January 2011. The LRET covers large-scale renewable energy projects (such as wind farms, commercial solar plants and geothermal plants) and would deliver the majority of the 2020 RET. The SRES has been designed for households, small businesses and small community groups and covers small-scale technologies such as solar panels and solar water heaters. Combined, the new LRET and SRES are expected to deliver more than 45,000 GWh in 2020, which would exceed the 20 per cent national RET.

The new LRET targets for 2011 to 2030 are listed in **Table 2-2**. The project would assist in reaching these targets. This project has a nominal capacity of 50MW and would generate approximately 125 GWh per annum. The project is anticipated to be operational at the end of 2015.

Given that the LRET target for 2015 would be 18,000 GWh, the project would equate to approximately 0.69 per cent of the LRET for 2015.

Table 2-2 LRET annual targets

Year	LRET annual targets (GWh)
2011	10,400
2012	16,338
2013	18,238
2014	16,100
2015	18,000
2016	20,581
2017	25,181
2018	29,781
2019	34,381
2020 - 2030	41,000

Source: Australian Government Department of Climate Change and Energy Efficiency. http://www.climatechange.gov.au/en/government/initiatives/renewable-target/fs-enhanced-ret.aspx. Accessed 14 May 2012.

In support of the Federal Government's renewable energy target, the Solar Flagships Program will accelerate the delivery of large scale, grid connected solar power into the NEM. As of the 10th July 2011 the Australian Renewable Energy Agency (ARENA) has taken over the responsibility of managing the funds for the Solar Flagships Program. DRET continues to provide ARENA with advice on the funding considerations throughout the remaining review process.

As part of the Solar Flagships Program, AGL is seeking to construct and operate the Broken Hill Solar Plant. The main drivers for the project are the need to:

- Demonstrate that large scale solar power plants can be constructed and operated within major electricity grids in Australia.
- Optimise the business models for constructing, generating and wholesaling electricity generated from large scale solar power plants.
- Develop the solar power industry in Australia.
- Provide research infrastructure for solar power generation.
- Encourage regional development.
- Build initial infrastructure for further development of solar power.
- Develop Australian intellectual property and know-how in solar power.
- Develop and share technical and economic knowledge of the operation of large scale solar power plants in a competitive energy market.

2.1.3. Strategic direction of the region and State

In June 2005, the NSW Government became the first Australian jurisdiction to commit to long-term emission reduction targets. In line with the Australian Government's target, the NSW Government committed to achieving a 60 per cent cut in greenhouse gas emissions by 2050, as shown in **Figure 2-1**. This target is included in the State Plan (NSW Government, 2010).

Current greenhouse gas emissions levels in NSW, as measured in 2007, are just below 163 million tonnes CO_2e. The 60 per cent reduction target equates to achieving a net greenhouse gas emissions level of 61.3 million tonnes CO_2e in 2050.

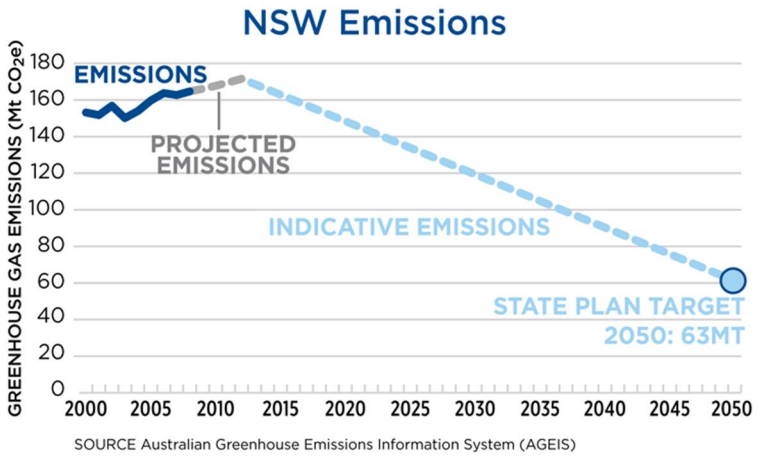


Figure 2-1 NSW emissions including projected emissions and targets

Other commitments made in the NSW State Plan include achieving 20 per cent renewable energy consumption by 2020 to take advantage of the Australian Government RET. The objectives of the State Plan include developing a clean energy future by driving major change in the energy sector and stimulating the deployment of new technologies and low carbon fuels. The State Plan also addresses specific renewable energy sources, including large solar power plants for NSW under the Australian Government's Solar Flagships Program (NSW Government, 2010). The project is consistent with the region and State's strategic direction in reducing greenhouse gas emissions and increasing renewable energy sources.

2.1.4. Community benefits

The project would have a number of community benefits by contributing to job creation and economic development in the region. AGL would aim to source local goods and services, with flow on effects expected. These would include job creation in hospitality and retail to accommodate additional construction workforce. A large proportion of wages paid to the construction workforce is expected to be spent in the region. Further information is provided in **Section 14.2.2**.

2.2. Greenhouse Gas Benefits

The greenhouse gas benefits of the project are twofold:

- The use of PV technologies to generate energy avoids greenhouse gas emissions relative to conventional fossil-fuel energy generation technologies.
- The use of thin film PV technology results in lower greenhouse gas production during the manufacturing process relative to traditional crystalline-silicon PV technology.

The greenhouse gas benefits of the project are described below for both life-cycle and operating emissions.

2.2.1. Life-cycle emissions

Table 2-3 presents a comparison of greenhouse gas intensity for electricity generation technologies. The total greenhouse gas intensity for traditional crystalline silicon PV technology has been estimated as 106 g CO_2-e/kWh. By comparison, electricity generated by wind turbines, run-of-river hydroelectricity and nuclear technologies were calculated to have lower greenhouse gas intensities. Fossil fuel technologies were found to have significant higher greenhouse gas intensities.

The project will utilise cadmium telluride (CdTe) thin film PV technology. In general, thin film PV technologies require less energy in their manufacturing than crystalline silicone PV technologies, and this translates to a lower greenhouse gas intensity (Fthenakis *et al*, 2008). Therefore the greenhouse gas intensity of the PV technology used in the project would be expected to be lower than the figure shown in **Table 2-3**.

2.2.2. Operating emissions

Overall, all PV technologies - including the advanced thin film CdTe technology that would be used for the project - would generate fewer air emissions per gigawatt hour (GWh) than conventional fossil-fuel based electricity generation technologies, as PV does not require any fuel to operate. By using PV technology in place of fossil-fuel based generation, greenhouse gas emissions, as well as sulphur dioxide (SO_2), nitrous oxides (NOx) and heavy metals emissions could be avoided (Fthenakis *et al*, 2008). The project has the capacity to reduce greenhouse gas emissions by approximately 140,000 tonnes of CO_2 equivalent per annum, assuming a rate of 1.15 tonnes per MWh of electricity, when compared to conventional methods of fossil-fuel energy generation.

Table 2-3 Greenhouse gas intensity for electricity technologies

Technology	Typical intensities		Min ($g CO_2$-e/kWh)	Max ($g CO_2$-e/kWh)
	Energy intensity (kWh)	Greenhouse gas intensity ($g CO_2$-e/kWh)		
Brown coal subcritical	3.46	1175	1011	1506
Black coal PF fuel	2.85	941	843	1171
Black coal supercritical	2.62	863	774	1046
Natural gas turbine – open cycle	3.05	751	627	891
Natural gas – combined cycle	2.35	577	491	655
Photovoltaic generation (crystalline silicon)	**0.33**	**106**	**53**	**217**
Nuclear – heavy water reactors	0.20	65	10	120
Nuclear – light water reactors	0.18	60	10	130
Wind power	0.066	21	13	40
Hydro power	0.046	15	6.5	44

Source: Lenzen (2008)

2.3. Suitability of the Site

The proposed project site near Broken Hill meets a number of essential site conditions and provides an appropriate balance in terms of other site location criteria. Of particular importance, the site has a high solar energy production potential and the required access to the existing electrical grid. Additional factors that increase the site's suitability are as follows:

- It has relatively flat topography, which enhances its solar energy production potential and reduces construction costs and risks.
- It does not contain any threatened ecological communities or significant wetlands and is considered unlikely to provide important habitat for threatened or migratory species.
- It is currently more than one kilometre from the nearest existing residence and is unlikely to result in noise or visual impacts on the local community or adjacent land uses.

The proposed project is located on rural land. There is currently a Western Lands (perpetual) lease for grazing purposes on the solar PV plant site, although no agricultural activities are currently undertaken on the site. As such, the project would not result in loss of land of high agricultural value. The change in land use from grazing purposes to solar power generation is not considered to be significant given the relatively small area of land involved and that the site is not currently being used for agricultural activities. There are no State Forests or conservation areas in the vicinity of the project. The existing rural residential dwelling on the site would be relocated to the west of the solar PV plant site, approximately 100 metres from the PV site boundary, on the remaining portion

of Western Lands Lease 14240. The residential dwelling would be approximately 400 metres form the solar plant infrastructure itself, and would be located behind a low hill such that the solar plant would not be visible from the residence. No other rural residences would be affected (the closest residence being located about 1.3 kilometres distant).

There are currently four Exploration Licences and two Consolidated Mining Leases over the project site as detailed in **Section 12.2**. There is a potential for the project to impact planned exploration and extraction activities. It is possible, however, that any short-term future mineral exploration and extraction schedules could be managed around the planned timeframe for construction. Once operational, the presence of the solar PV plant and the transmission line easement would prevent the carrying out of exploration and extraction activities in those locations.

The potential land use impacts on any planned exploration or extraction activities are considered to be low, given that the project intersects only a very small proportion of the areas covered by the exploration licences and the mining lease (refer to **Section 12.2**). Specifically, the solar PV plant site and associated transmission line intersects approximately:

- 6.5 hectares or 0.1 per cent of the total land covered by EL2921.
- 25.3 hectares or 0.2 per cent of the total land covered by EL6132.
- 6.5 hectares or 0.2 per cent of the total land covered by EL6774.
- 144 hectares or 1.5 per cent of the total land covered by EL6689.
- 0.85 hectares or 0.1 per cent of the total land covered by CML13.
- 0.7 hectares or 0.1 per cent of the total land covered by CML10.

The proposed solar PV plant site is located in the unincorporated area administered by the Department of Primary Industries (DPI), Catchments and Lands Division. There are currently no existing or future land use objectives that apply to this site. The proposed transmission line that connects the plant to the existing TransGrid substation within the Willyama Common in the Broken Hill LGA is located on land zoned 1(a) General Rural under the Broken Hill LEP. Under the Willyama Common Plan of Management, uses which can be conducted on the Common include land management and conservation, mining and extractive industries, recreation and tourism, commercial agriculture and horticulture, urban/industrial development and community purposes and other land uses which are approved by the Willyama Common Trust. The proposed transmission line is consistent with the land uses stated under the Plan of Management.

The solar PV plant would generally have a low or negligible visual impact except along the Barrier Highway, near the north-eastern corner of the site, where the solar PV plant would impact views south west to ‘The Pinnacles’. This view has a relatively high scenic value for motorists heading west along the Barrier Highway and the presence of the solar PV plant has the potential to result in

a major change to the visual experience. In contrast to the solar PV Plant, the proposed transmission line would largely visually integrate with other existing transmission lines in the area and have a very low visual impact. Further analysis on visual impacts is provided in **Chapter 5**.

Overall, the main land use conflict would be the potential to affect exploration or extraction activities. However, given that the project intersects only a very small proportion of the areas covered by the exploration licences and the mining lease, land use impacts are determined to be low. As the project would not affect any other existing and future surrounding land uses, it is considered that the site is suitable for the project.

2.4. Consideration of Alternatives

During the development of the project, a number of alternative locations and layouts were considered. Minimising environmental and community impacts and maximising efficiency have been major considerations in the evaluation of alternatives. The alternatives considered for the project and the Solar Flagships Program as a whole included building a single large solar PV project at one site as well as smaller solar PV projects across multiple sites in Australia. Multiple smaller solar PV projects were selected as the preferred option given that:

- Selection of suitable sites that avoid significant environmental and community impacts is easier if multiple small areas of land are required rather than a single large area of land.
- The local communities that would be most affected by the presence of a new solar PV project are more likely to be accepting of a relatively small solar PV project than a large solar PV project.
- Multiple small projects would provide the opportunity to better manage increasing peak demands during summer in multiple locations, rather than one location.
- A geographic spread of sites would reduce the risks associated with unfavourable climatic conditions (such as cloud cover) as all sites would be unlikely to be affected by the same climatic conditions at the same time.
- Job creation, skills transfer, and economic development would occur in multiple locations, rather than one location.
- Smaller installations make the physical connection to the grid easier.

Sites considered during this process included:

- Broken Hill, NSW.
- Moree, NSW.
- Nyngan, NSW.
- Port Augusta, SA.
- Mildura, VIC.

Each of these sites had many attractive advantages of merit and some were considered to be viable. However, the Broken Hill site was identified as the preferred location for one of the solar PV projects in the Solar Flagships Program based on the following:

- Availability of an abundant solar resource.
- Access to an electricity grid connection.
- Availability of appropriate land.
- Suitability of the site in terms of the interests of other stakeholders and the environment.

The other favourable location was Nyngan, NSW due to the proximity to the network, constructability and local support. This project is being developed concurrently with the Broken Hill site and is subject to separate approval processes.

The above items indicate the Project is consistent with the objectives as stated in **Section 1.3**. These objectives are further justified in **Section 14**.

3. Community and Stakeholder Consultation

This chapter describes the extent of liaison and consultation with government and the community, identifies the issues raised during that consultation and outlines how those issues were addressed in the Environmental Assessment.

The Director-General's Requirements

The Proponent must undertake a consultation program as part of the environmental assessment process, including consultation with, but not necessarily limited to, the following parties:

- *Department of Primary Industries (formerly Land and Property Management Authority).*
- *Lessee.*
- *Broken Hill Shire Council.*
- *Department of Environment, Climate Change and Water Environmental Protection and Regulation(now Office of Environment and Heritage)*
- *NSW Office of Water.*
- *Industry and Investment NSW.*
- *NSW Roads and Traffic Authority (now Roads and Maritime Services).*
- *Australian Rail Track Corporation Ltd.*
- *NSW Rural Fire Service.*
- *Western Catchment Management Authority.*
- *Lower Murray-Darling Catchment Management Authority*
- *TransGrid.*
- *Relevant minerals stakeholders (including exploration and mining title holders).*
- *The local community and landowners.*

The consultation process shall include measures for disseminating information to increase awareness of the project as well as methods for actively engaging stakeholders on issues that would be of interest/concern to them. The Environmental Assessment must:

- *Demonstrate effective consultation with stakeholders, and that the level of consultation with each stakeholder is commensurate with their degree of interest/concern or likely impact.*
- *Clearly describe the consultation process undertaken for each stakeholder/group including details of the dates of consultation and copies of any information disseminated as part of the consultation process (subject to confidentiality).*
- *Describe the issues raised during consultation and how and where these have been addressed in the Environmental Assessment.*

3.1. Overview of the Consultation Process

The consultation process for the project has been developed and implemented in accordance with the NSW Department of Planning & Infrastructure's *Guidelines for Major Project Community Consultation* (DoPI, 2007).

A Communications Plan has been developed to support the environmental assessment and planning approvals process. The Communications Plan was developed based on the principles of transparency, timeliness, genuine approach, awareness, flexibility, inclusivity, honesty and collaboration. These principles were maintained during the environmental assessment of the project and will continue to shape consultation during subsequent stages of project planning and delivery.

3.2. Identification of Stakeholders

Table 3-1 provides an outline of the stakeholders and their concerns or interests in the project, as identified in the Communications Plan.

Table 3-1 Stakeholders identified for the project

Stakeholder group	Specific stakeholders	Concern or interest in project
Federal government	• Department of Climate Change and Energy Efficiency • Office of the Renewable Energy Regulator • Department of Sustainability, Environment, Water, Population and Communities • Department of Infrastructure and Transport • NECA: National Electrical and Communications Association	• Planning approvals • Regulatory compliance • Environmental management • Consultation and communication
NSW government (Note some agencies have had name changes from June 2011)	• Department of Planning & Infrastructure • Office of Environment and Heritage (formerly Department of Environment, Climate Change and Water (DECCW), Environment Protection and Regulation) • Roads and Maritime Services (formerly Roads and Traffic Authority of NSW) • Department of Primary Industries, Catchments and Lands Division (formerly Land and Property Management Authority) • Industry and Investment NSW • NSW Office of Water (Department of Primary Industries as of June 2011) • Western Catchment Management Authority • Murray-Darling Catchment Management Authority	• Planning approvals • Regulatory compliance • Environmental management • Consultation and communication
Local government	• Broken Hill City Council • Mayor Cr Wincen Cuy • Deputy Mayor Cr Neville Gasmier • Crs Christine Adams, Robert (Bob) Algate, Marion Browne, John Groenendijk, Tom Kennedy, Jamie	• Planning approvals • Health and safety of local residents • Impact on local business

Stakeholder group	Specific stakeholders	Concern or interest in project
	Mitchell, Raymond Steer, and Darriea Turley	• Local impacts, including access, traffic, roads and visual amenity • Community consultation and communication • Community wellbeing
Elected Representatives	• Sussan Ley: Federal Member for Farrer • Peter Lawrence Black: State Member for Murray-Darling	• Impact on local constituents
Utilities	• Essential Energy • TransGrid	• Impact on assets • Potential for construction program to clash with asset maintenance
Business	• Local retailers • Broken Hill Chamber of Commerce • Australian Rail Track Corporation	• Access to business for customers and deliveries • Potential for loss of trade
Community	• Local residents, landholders and property owners • Directly affected residents and nearest neighbours • Broken Hill Public School, Broken Hill High School, Morgan Street Public School, Willyama High School, Western TAFE – Broken Hill College, Playtime Pre-School Centre, Happy Day Pre-School, Rainbow Pre-School and Alma Bugdlie Pre School • Broken Hill Base Hospital and Health Services and key health facilities • Ten local churches • Broken Hill Historical Society and Barrier Field Naturalist Club	• Access to private property • Environmental management • Health and safety of local residents • Traffic impacts • Access to services • Noise, dust and visual amenity • Weed control • Electric and magnetic fields • Perceived impacts on valued places
Indigenous community	• Yancowinna Local Aboriginal Land Council • Local indigenous groups and community leaders	• Impact on Indigenous heritage
Media	• Barrier Daily Truth • ABC Broken Hill • Hill FM • 2DRY FM • Hype FM	• Community and environmental impacts • Delivery / Cost
Other	• Broken Hill South Fire Brigade (NSW Rural Fire Service) • Broken Hill Police Station • Perilya Broken Hill Limited and PlatSearch NL	• Community impacts • Access to properties • Mineral exploration

3.3. Key Consultation Activities

3.3.1. Consultation with agencies and key stakeholders

Consultation with agencies and key stakeholders has been undertaken by AGL in November and December 2010 and in March 2011. A summary of the consultation and the feedback received is provided below.

AGL sent a letter to the following agencies in November 2010, to inform them of the project and provide an opportunity to raise any issues to be considered in the Environmental Assessment.

- Australian Rail Track Corporation (ARTC).
- Bemax Resources Limited.
- Broken Hill City Council.
- Lower Murray Darling Catchment Management Authority (CMA).
- Western CMA.
- Essential Energy.
- Office of Environment and Heritage (formerly Department of Environment, Climate Change and Water (DECCW) Environment Protection and Regulation).
- Lessee.
- Industry and Investment NSW.
- NSW Department of Primary Industries (formerly Land & Property Management Authority).
- NSW Office of Water (Department of Primary Industries as of June 2011).
- Perilya Limited.
- PlatSearch NL.
- NSW Rural Fire Service.
- Roads and Maritime Services (formerly Roads and Traffic Authority of NSW (RTA)).
- TransGrid.

All directly affected landowners and the lessee were notified in writing by the proponent in December 2010 (within 14 days of the Project Application being lodged in accordance with clause 8F(3)(c) of the *Environmental Planning and Assessment Regulation 2000*). An example of this notification can be found in **Appendix H.**

Responses to letters sent in November 2010 were received from the lessee, Department of Climate Change and Water (DECCW), Land and Property Management Authority, Lower Murray Darling CMA, PlatSearch NL and the RMS. The lessee had no specific issues to raise in the environmental

assessment. The main issues raised in the received correspondence are listed in **Table 3-2**, together with the section of the environmental assessment where the issue is addressed.

Supplementary consultation was undertaken with the Land and Property Management Authority (LPMA) (now Department of Primary Industries) in March 2011 requesting input to the preparation of this EA. Matters requested by LPMA to be considered within this EA are also included in **Table 3-2** below.

Table 3-2 Issues raised during preparation of the environmental assessment

Issues raised	Where addressed
Office of Environment and Heritage (formerly Department of Environment, Climate Change and Water)	
An assessment of the impacts the project may have on threatened species and their habitat and the action that will be taken to avoid or mitigate impacts or compensate unavoidable impacts.	Chapter 7
An assessment of the impacts on Aboriginal cultural heritage and the action that will be taken to avoid or mitigate impacts or compensate unavoidable impacts.	Chapter 8
Lower Murray Darling Catchment Management Authority	
The need to preserve and respect the Indigenous heritage of the area, particularly during the construction phase.	Chapter 8
PlatSearch NL	
Access - development of the project may sterilise large areas of land and prevent access to a potentially large deposit for both exploration and mining.	Chapter 12 (Section 12.2)
Roads and Maritime Services (formerly Roads and Traffic Authority)	
A traffic impact study including: hours and days of construction; schedule for phasing/staging of the project; traffic volumes including existing, project-related for each stage of the project (construction, operation and decommissioning) and future (including project-related traffic); traffic volumes are to include a description of the ratio of light vehicles to heavy vehicles, peak times for existing traffic and project-related traffic and transportation hours; the origin, destination and routes for employee and contractor light traffic, heavy traffic, oversize and overmass traffic.	Chapter 9
A description of all oversize and overmass vehicles and the cargo to be transported.	Chapter 9
Access to classified roads is to be minimised and existing accesses and intersections are to be used wherever practicable.	Chapter 9
The shortest and least trafficked route is to be given priority for the movement of materials and machinery to minimise the risk and impact to other motorists so far as is reasonably practicable.	Chapter 9
The impact on the public road network of project-related traffic during construction, operation and decommissioning.	Chapter 9
The need for improvements to the road network, and the improvements proposed such as road widening and intersection treatments, to cater for and to mitigate the impact of project-related traffic.	Chapter 4 and Chapter 9
Proposed road facilities, access and intersection treatments are to be identified and in accordance with the Austroads Guide to Road Design and relevant RMS supplements.	Chapter 4 and Chapter 9
The layout of the internal road network, parking facilities and infrastructure within the project boundary.	Chapter 4

Issues raised	Where addressed
Assessment of traffic noise and dust effects.	Chapter 6 and Chapter 12 (Section 12.6)
A Traffic Management Plan is to be developed in consultation with the RMS.	Chapter 9
Department of Primary Industries (formerly Land and Property Management Authority)	
Topographic character of the site, including slopes, aspects, and elevations.	Chapter 12 (Section 12.5)
Size of total development footprint.	Chapter 4
Method and schedule of construction, and location of on-site solar photovoltaic power infrastructure, electricity transmission lines, other site buildings, and access tracks, including machinery to be used and demountable buildings (incl. number and location).	Chapter 4
Weed and feral animal control, including noxious weeds.	Chapter 7
Soil issues, including soil types, amount and effect of disturbance, and reversibility of any soil degradation.	Chapter 12 (Section 12.5)
Wind and water erosion potential, including control methods, and methods for site stabilisation of the project site and access tracks.	Chapter 4, Chapter 11 and Chapter 12 (Section 12.5)
Air quality issues, including type and amount of greenhouse gases, dust, smoke, chemicals, and odours generated.	Chapter 12 (Section 12.6)
Noise and vibration issues, including maximum noise travel vs. direction plot, and impacts on residents/ neighbours during transportation of the SPPP components through Broken Hill.	Chapter 6
Impacts on threatened flora and fauna species, populations and ecological communities, and habitats, including full outline of survey methods, survey results, and methods for minimising impacts.	Chapter 7
Ecological effects, including impacts on corridors, connectivity, and vegetation diversity.	Chapter 7
Alteration to water sources, including water flow and run-off regimes, groundwater levels and quality, and likelihood of sedimentation of local water courses.	Chapter 11
Amount, source and quality of water for construction and operation of the project, including dust suppression activities.	Chapter 11
Amount and source of gravel, sand and other materials for the upgrade of roads and access tracks, and provision of hardstand areas.	Chapter 4
Proposed locations and methods for the safe storage of construction and operating materials, including bunding of hydrocarbons, and storage of sand/gravel.	Chapter 4
Waste disposal, including demolition of the existing residence, left-over construction material (such as concrete and steel), hydrocarbons, general waste/rubbish, and sewage/grey water.	Chapter 12 (Section 12.7)
Methods for contamination control, and clean-up of hydrocarbon spills and other contamination.	Chapter 10
Rehabilitation/ regeneration of construction sites and disused access tracks, and monitoring programs (timing and method of rehabilitation, species to be reintroduced).	Chapter 4 and Chapter 7
Project costs, incomes, and other expenditures, including rehabilitation costs.	Chapter 4
Proposed construction time frame, including hours of operation during construction, and schedule of maintenance activities during operation.	Chapter 4

Issues raised	Where addressed
Impacts on European and Aboriginal cultural heritage, including full outline of survey methods and results, and methods for minimising impacts on identified sites and artefacts.	Chapter 8 and Chapter 12 (Section 12.3)
Traffic generation, including proposed road and access track upgrades, and impacts on residents during transportation of the project components through Broken Hill.	Chapter 9
Utility needs, including potable water requirements, electricity requirements for the construction phase, and amenities/toilets.	Chapter 4
Employment opportunities, including number of full-time equivalent jobs, and any associated secondary jobs (such as service personnel).	Chapter 12 (Section 12.4)
Concurrent land-use opportunities.	Chapter 12 (Section 12.2)
Impacts on the visual/aesthetic/scenic amenity of the local landscape.	Chapter 5
Site security and access details, including fences, locked gates, and access by emergency services (if required).	Chapter 4
Site signage details, including road usage/access (e.g. trucks turning), construction area signs, OH&S requirements (such as Personal Protective Equipment), substation/high voltage signs, and other signage requirements.	Chapter 4
OH&S issues, including public safety control and management (such as accidents or injury), and other Work Cover Authority of NSW requirements.	Chapter 4 and Chapter 13
Human health issues associated with high-voltage electricity generation and supply.	Chapter 10 (Section 10.1)
If Development Consent for the project is granted and all investigations by LPMA prove satisfactory, the LPMA could authorise the development of the land for the project and validate the occupation of the land either under the provisions of the *Crown Lands Act 1989* or the *Western Lands Act 1901.* The term of any tenure which may issue has not yet been determined but may be for a period of up to 30 years, with a possible option for an extension of a similar term.	Chapter 1 (Section 1.6.4)
The High Court must determine whether or not Native Title in any particular site has been extinguished.	Chapter 1 (Section 1.6.4)

3.3.2. Community consultation

Community consultation for the project has included establishment and operation of a free-call 1800 number and creation of a project email address for project enquiries and complaints.

Community engagement work undertaken to date includes:

- Letters to the 13 adjoining neighbours and key stakeholders, including questionnaire and fact sheets.
- Letters to all properties within a three kilometre radius of the site (approximately 330 properties), including a questionnaire and fact sheets.
- The 'Energy Cube', located in Broken Hill township from 13 – 15 September 2012.
- Advertisement in the Barrier Daily Truth, promoting the 'Energy Cube'.

Community consultation activities will be ongoing and would include:

- Distribution of newsletters to the region of Broken Hill to inform residents of the project.
- Placement of advertisements in relevant local media, outlining the details of the proposed project, the status of the planning and approvals process and the target construction timeframe.
- Establishment of a project website, http://agl.com.au/brokenhill/.
- Community information sessions.
- Displays and public exhibition of the EA.

3.4. Future and Ongoing Consultation

3.4.1. Consultation during Environmental Assessment exhibition

The Environmental Assessment will be advertised and placed on public exhibition for a minimum period of 30 days as required under Part 3A of the EP&A Act. The dates and venues of the public exhibition will be advertised in local and metropolitan media and will be available from the Department of Planning & Infrastructure (DoPI) website (www.planning.nsw.gov.au).

During the exhibition period for the Environmental Assessment, the community, government agencies and other interested parties are invited to make written submissions to the DoPI on the project. Following exhibition of the Environmental Assessment, the Director-General of DoPI will consider the submissions received and provide copies of submissions or a report containing a summary of the issues raised to the proponent. The Director- General will prepare a report on the project. The Minister for Planning will then decide whether or not to approve the project and the conditions to be attached.

3.4.2. Consultation proposed during detailed design and construction

If the project were approved, AGL would continue to work closely with the stakeholders and the community during detailed design and construction to ensure that they are kept well informed about the project and that all agency, utility and land and property requirements have been satisfied. Specific requirements for the detailed design phase of the project would include (but would not necessarily be limited to) consultation with:

- ARTC regarding works over the rail easement and the spanning of the Peterborough-Broken Hill rail line by the transmission line (refer to **Section 12.2.1**).
- TransGrid regarding the connection of the transmission line to the TransGrid Broken Hill substation (refer to **Section 12.2.1**).
- RMS and Broken Hill City Council regarding the upgrading of the solar PV plant access road intersection (refer to **Section 1.6.4**).
- The Department of Primary Industries regarding the existing Western Lands (perpetual) lease on the solar PV plant site (refer to **Section 12.2.1**).

- Broken Hill City Council regarding the crossing of the Willyama Common by the transmission line (refer to **Section 12.2.1**).
- The Department of Trade and Investment, Regional Infrastructure and Services and other relevant parties regarding the existing exploration licences and consolidated mining leases on land affected by the project (refer to **Section 12.2.1**).
- Essential Water regarding water supply for the project (refer to **Section 11.2.2**)
- The Native Title Tribunal and Native Title Claimant regarding the current Native Title claim on the project site (refer to **Section 1.6.4** and **Section 8.2.3**).

A Community Involvement Plan would be developed and implemented prior to and during the construction phase of the project. The community would be kept informed of the works by regular project updates (such as letterbox drops and newsletters), notification of any works that could potentially affect the community (including noisy activities), and provision of contact details for enquiries. Targeted consultation would occur as necessary with affected individuals or groups during construction (such as affected landowners and other stakeholders).

4. Project Description

This chapter provides a detailed description of the key elements of the project, including construction, operation and decommissioning aspects. The solar PV plant and associated connection infrastructure are described.

The Director-General's Requirements

The Environmental Assessment must include a detailed description of the project for both the solar photovoltaic power plant and transmission line including:

- *A site plan at an adequate scale and dimensions, showing the exact location, orientation, site coverage, and including all access roads and entrances to public roads.*
- *Construction, operation and decommissioning details.*
- *The location and dimensions of all project components including the solar module array, underground and above ground cabling, electrical substation and transmission line linking the solar farm to the substation, fencing and landscaping around the solar farm, on-site office, operations and maintenance buildings, temporary construction infrastructure and compounds, and access roads/road upgrades (including access tracks).*
- *A timeline identifying the project's proposed construction and operation components, their envisaged lifespan and arrangements for decommissioning and staging.*
- *Supporting maps/plans clearly identifying existing environmental features (e.g. .watercourses, vegetation), infrastructure and land use (including nearby residences and approved residential developments or subdivisions) and the location/ siting of the project (including associated infrastructure) in the context of this existing environment.*
- *Resourcing requirements (including, but not limited to, water supply and gravel).*

4.1. Site Location

The project is located in far western NSW, approximately five kilometres south west of the city of Broken Hill. The location of the project is shown on **Figure 1-1**.

The proposed solar PV plant site is Crown land located within an unincorporated area which is administered by the NSW Department of Primary Industries, Catchments and Lands Division. The solar PV plant site is located between the Barrier Highway to the north and the Peterborough - Broken Hill rail line to the south, wholly within Lot 6806 Plan 823918.

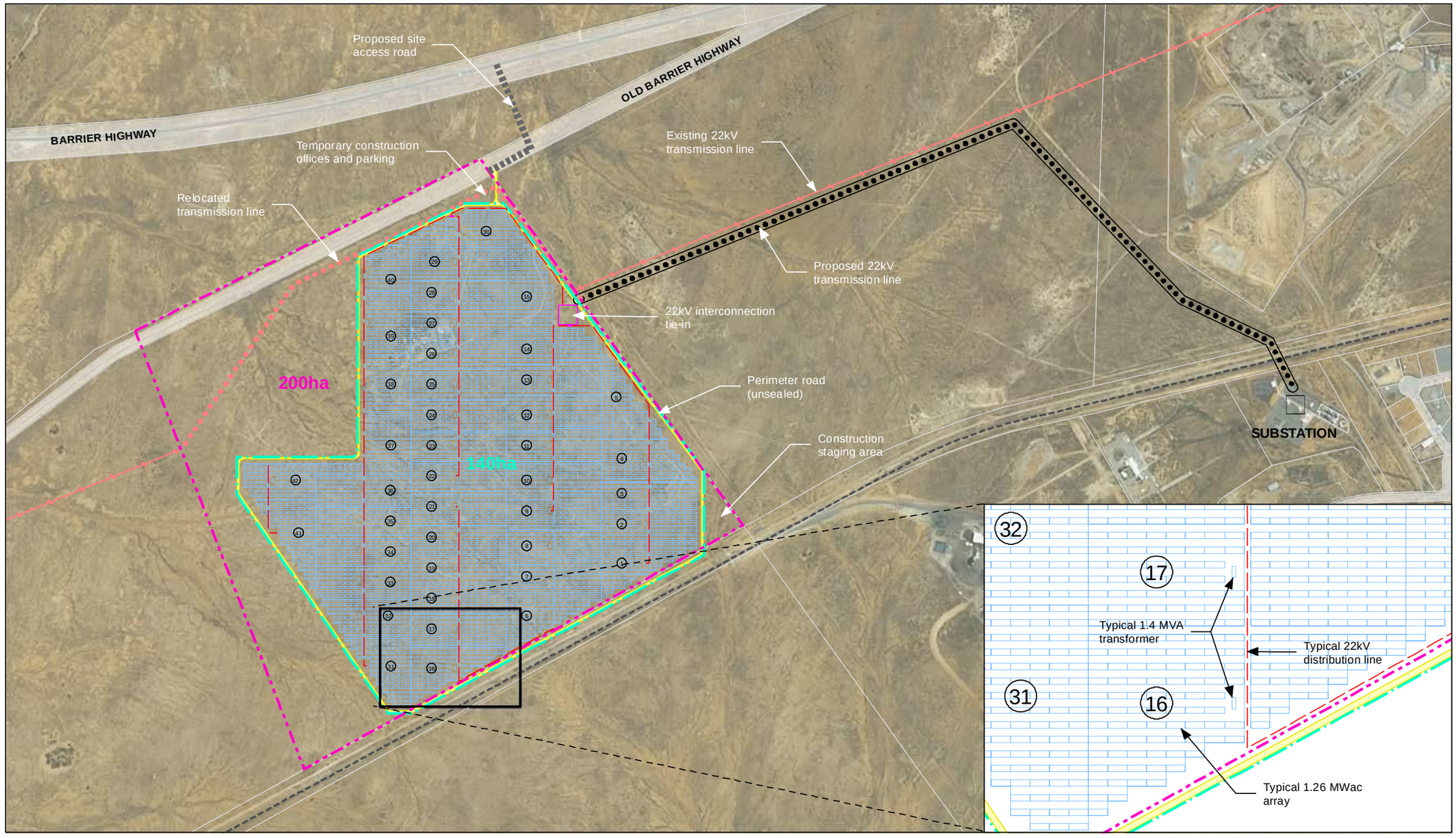
Approximately 200 hectares of land would be required for the proposed nominal 50 MW plant. The site comprises a cleared, relatively flat area with numerous unsealed access tracks scattered throughout. There is currently one residence located in the northern part of the property with several other sheds located nearby.

Along with the solar PV plant, the proposed development would also include the installation and operation of a double circuit 22kV overhead transmission line, approximately 2.7 kilometres long, to connect the solar PV plant to the TransGrid Broken Hill substation. The easement to accommodate construction and maintenance of the new proposed transmission line would be 30 metres wide. The easement for the proposed realignment of the existing transmission line would be 20 metres wide. The proposed transmission line would be located within the Broken Hill LGA and would traverse four land holdings, including the Peterborough - Broken Hill rail line and its associated easement. An indicative site layout of the project is shown in **Figure 4-1.** The site layout would be optimised during detailed engineering and site boundaries would be subject to detailed survey as part of the subdivision process with the Department of Primary Industries (Catchment and Lands Division).

4.2. Elements of the Project

The project would comprise the following key elements:

- A solar PV plant constructed using cadmium telluride (CdTe) thin film solar PV modules, installed in regular arrays with an aggregate nominal capacity of approximately 50 MW. Each solar module would be fixed at a 25^0 tilt from the horizontal with a 0^0 north azimuth.
- A new 22kV double circuit transmission line approximately 2.7 kilometres long to connect the site to Transgrid's Broken Hill substation.
- Diversion of an existing 22kV transmission line around the solar PV plant.
- Aboveground and underground electrical conduits and cabling which connect the arrays to the inverters and transformers.
- A system of inverters and step up transformers throughout the arrays.
- Marshalling switchgear to collect the power from the multiple array blocks.
- Internal access tracks to allow for maintenance of the site.
- Perimeter security fencing and landscaping around the site.
- Supervisory control and data acquisition (SCADA) control system.
- Site office and maintenance building.
- Temporary infrastructure associated with site construction including the site compound and storage areas.



■ **Figure 4-1 Indicative site layout of the project**

SINCLAIR KNIGHT MERZ

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Spatial Team - Prepared by : JC
Checked by : JL

4.2.1. Solar PV array

A PV cell is a semiconductor device that converts sunlight into electricity. Multiple cells can be combined to form a PV module. The efficiency of a PV module is measured by its ability to absorb light particles called photons. The more photons that are absorbed, the more efficient the panel is at converting light into electricity.

When light strikes a PV cell, some of the light energy is absorbed within the semiconductor material. The energy knocks electrons loose, allowing them to flow freely. The electrons will flow in one direction within the module and exit through connecting wires as solar electricity, ultimately providing power for residential and commercial users.

The modules are connected together in strings. These strings are then connected together to form arrays. This is required to provide a certain amount of voltage and current to the input of the inverters.

The proposed solar PV plant would comprise a series of arrays using the First Solar CdTe thin film 80 watt (or greater) Series 3 PV modules. First Solar PV modules are manufactured on glass and are thinner and lighter than traditional crystalline silicon modules. First Solar modules provide superior energy output in low, indirect, and diffuse light conditions, producing relatively more electricity on cloudy days. These modules also have a lower temperature coefficient than traditional crystalline silicon modules, resulting in superior performance at higher ambient temperatures.

The PV modules would be supported on mounting frames consisting of vertical posts and horizontal rails. The modules would be mounted facing due north at a fixed tilt from horizontal of 25 degrees.

The overall plant capacity would be rated at a nominal 50 MW AC. The plant would comprise 42 x 1.26 MW AC arrays, consisting of over 650,000 modules. Indicatively, each array would comprise 36 rows of modules with approximately 45.6 kW-dc installed in each row. The rows would be spaced at 5.4864 metres (18 foot) on centre. Each row will consist of 32 strings (approximately), with approximately 15 modules (up to 95 watts each) per string. Each 1.26 MW AC array will consist of (approximately) 17,280 modules installed in (approximately) 1,152 strings. The standard 1.26 MW AC block is shown in **Figure 4-2**.

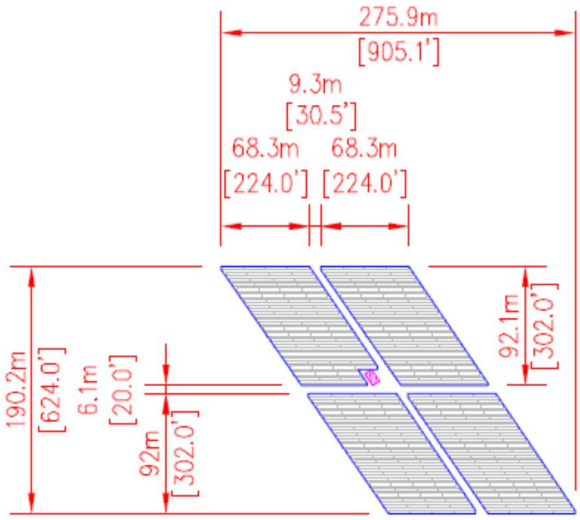


Figure 4-2 Standard 1.26 MW AC building block

The PV mounting structure would comprise steel posts driven approximately 1.5 metres below ground using a pile driver. Module racking tables would be installed on the vertical steel posts. The modules would be fixed to the tables with up to four rows of modules installed in a landscape shaped arrangement. Electrical cablings would be attached beneath the modules. A similar PV project under construction showing the posts, racking and modules installed in landscape orientation is shown in **Figure 4-3** and a cross section of a typical PV table is shown in **Figure 4-4**.

Figure 4-3 Example of solar modules and racking tables

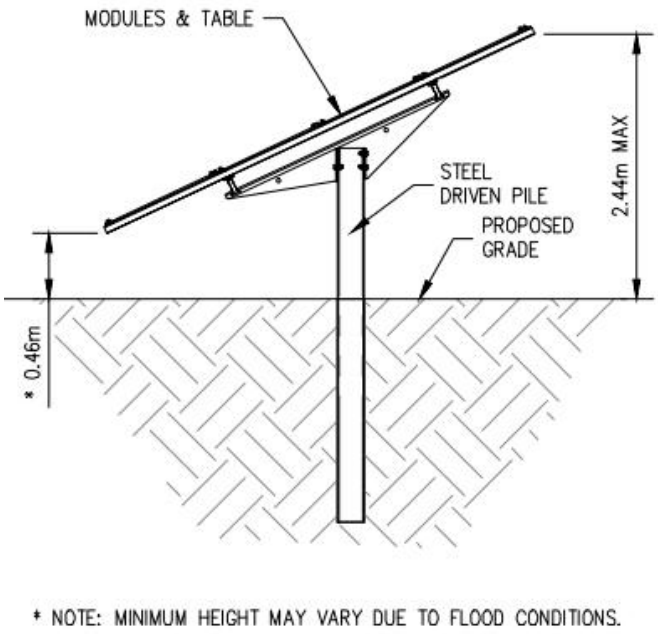


Figure 4-4 Cross section of typical PV table

4.2.2. Inverters and transformers

An inverter is a device which converts direct current (DC) to alternating current (AC) that can be fed into the grid network. The DC power produced by the panels would be converted by the inverters before being fed into a transformer. A transformer is an electrical device by which the AC of one voltage is changed to another AC voltage. The power from the transformers would then be fed into the electricity grid. A total of 42 inverters and transformers would be installed as part of the project.

One inverter and one transformer per array would be installed on a pad-mounted kiosk. The transformers would feed into 22kV reticulation cables that would be connected to combining switchgear installed in the project switchyard.

4.2.3. Electrical connections

A proposed double circuit 22 kV overhead transmission line would be required to connect the PV plant to the existing TransGrid Broken Hill substation. The transmission line would be approximately 2.7 kilometres long and the proposed easement would be 30 metres wide. The transmission line would be located within the Broken Hill LGA and would traverse three land holdings and the Peterborough - Broken Hill rail line. The poles would be approximately 14 metres high and approximately 100 metres apart. **Figure 4-5** shows a sketch of a transmission line pole similar to the one proposed.

Underground electrical cables would also be required to connect the PV panels to the inverters and the transformers, and then from the transformers to the combiner switchgear. All underground cabling would be installed in trenches, generally measuring approximately 800 mm deep by 600 mm wide. Sand bedding would be placed under the cabling. Once the cables are installed, the cables would be covered by a layer of sand and the trench backfilled with existing fill. Direct buried cables would have a nylon jacket for termite protection.

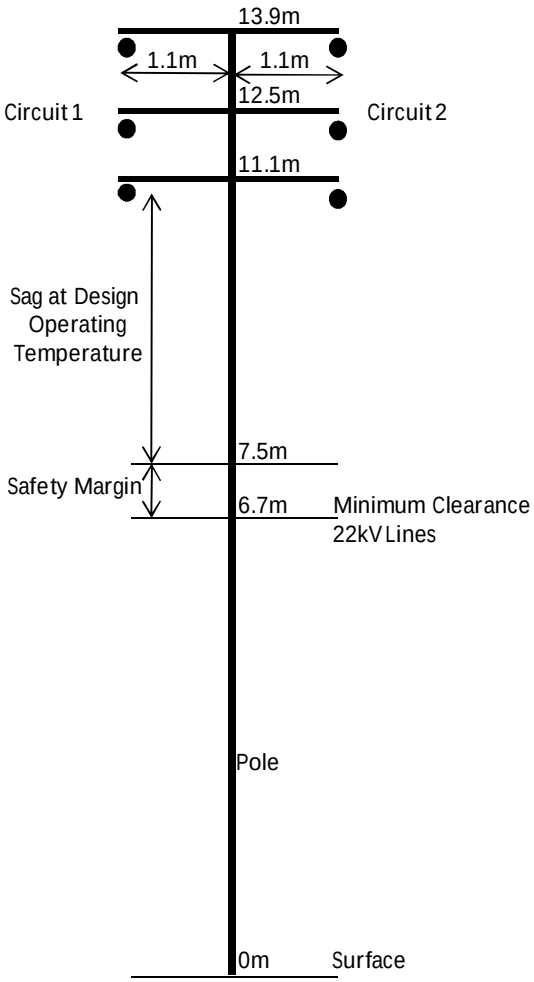


Figure 4-5 Sketch of a transmission line pole similar to the one proposed

The existing 22 kV transmission line running through the PV solar plant site would be realigned to the boundary of the site (see **Figure 4-1**).

4.2.4. Fencing and landscaping

The Broken Hill Solar Plant would be completely enclosed by fencing around the perimeter for security purposes with an integrated security monitoring system. The preferred fencing would include top and bottom rails and three barbed wires along the top. Fencing would feature:

- Single support cable.
- Chain link light or heavy duty fabric.
- Galvanised pipe top and bottom rails.
- Straight linked posts and corner posts with galvanised steel caps and concrete footings to secure the posts.

The fence would be approximately 2,370 to 2,970 millimetres high. Double gates would be constructed at access points across the site. Gates would be approximately six metres wide. Landscaping would also be undertaken around the site for visual amenity purposes.

4.2.5. Operations and maintenance building

An operations and maintenance building would be required to provide an office area for staff and to store equipment for plant operation. A supervisory and data acquisition (SCADA) control system would also be installed to monitor and control the solar plant. A septic tank would be installed adjacent to the building (refer **Figure 4-1**). The location of the building will be optimised during detailed design.

4.2.6. Temporary construction infrastructure and compounds

Temporary construction facilities such as the construction site compound, lay-down areas and stockpiles would be established during the construction period. These construction facilities would be located in areas that do not require substantial clearance of vegetation and on relatively level ground. The construction site compound would be required for personnel and temporary portable offices. A lay-down area would be constructed for materials, plant, and parking. A number of stockpile sites would also be required to store bulk materials such as topsoil and other materials such as drainage pipes, steel pipes and electrical cabling required for construction.

4.2.7. Access roads

Access tracks would be provided inside and around the perimeter of the site to allow for maintenance activities. An existing unsealed access road from the Barrier Highway to the site would be utilised. This road is 8 metres wide and is an adequate width to accommodate construction vehicles and equipment. This track would be upgraded with compacted gravel to allow for the load of vehicles expected during construction. The main access road would lead to a designated parking area located near to the operations and maintenance building. The access road is discussed further in **Section 9.3.2**.

4.3. Construction

Plant construction would be modular, with the standard construction unit being being a 1.26 MW AC array. The plant would consist of 21 arrays. Array construction would start with civil works, then proceed to mechanical/structural works, followed by electrical works, and finally block commissioning. The grid connection would be completed at the beginning of the project which would allow the plant to be progressively commissioned.

4.3.1. Construction activities

The main construction and commissioning activities for the project would include:

- Site access and site establishment.
- Grid connection.
- Civil works.
- Mounting structure.
- In-ground cabling and power conversion stations.
- PV module installation.
- Commissioning and testing.
- Landscaping and de-mobilisation.

The works would be divided into several areas, allowing many of the stages to occur simultaneously.

Site access and establishment

Construction activities would commence with the building of the access road, site offices, facilities and a parking area that would all be located within the area designated as temporary construction offices and parking in **Figure 4-1**. Services such as power, water, sewer and communications would be connected to the site facilities within this area. An existing 22kV OHL would be diverted around the site. The entire site would be fenced to provide a secure work area. Consultation with RMS would be undertaken to identify the requirement for any turning lanes or upgrade of the intersection with Barrier Highway. Appropriate signage would be installed as necessary. Materials storage and laydown areas required during construction would be established in the south east corner of the site illustrated in Figure 4-1 as the designated construction staging area.

Grid connection

The on-site combiner switchgear and the high voltage feeders to the network connection point would typically be constructed at the same time as the solar PV plant works. However, the grid connection works may be undertaken earlier if necessary to meet available network outage windows.

Civil works

The civil works generally involve limited grading of the site followed by compaction of the surface. Stormwater drainage and sedimentation controls would be installed. An unsealed perimeter road around the footprint of the proposed solar arrays would then be constructed. Water trucks would be utilised during civil works for dust suppression.

Mounting structures

Rows of steel posts would be driven into the ground using piling rigs. A framing structure would be bolted to the tops of the posts. The framing structure would be inclined at the tilt angle of 25 degrees and would provide the support for the PV modules.

In-ground cabling and power conversion stations

In-ground DC cabling would run from each row of mounting structures to the power conversion stations. AC cabling would then be run from the power conversion stations to the on-site combiner switchgear. The power conversion stations would contain the inverters, transformers and SCADA equipment for each array of PV modules. The power conversion stations would be constructed off-site.

PV module installation

PV modules would be installed onto mounting structures using clips that are pre-fixed to the supporting frame. Once installed and aligned, the modules cables would be plugged together in series to form strings. The strings would then be connected in combiner boxes, which would then be connected via in-ground cabling to the power conversion stations.

Commissioning and testing

The commissioning and testing phase involves the testing of all cabling and all equipment as each array is finished. The completed array would then be tested in operation to verify performance with commissioning specifications.

Landscaping and de-mobilisation

Once site works are complete, all temporary facilities and roadworks would be removed, services would be decommissioned and the site would be landscaped, as appropriate.

Figure 4-6 provides an overview of the construction process that would be followed for the Broken Hill Solar Plant project. **Figure 4-7** provides a timeline for the planning, construction and operation of the project.

Figure 4-6 Construction process

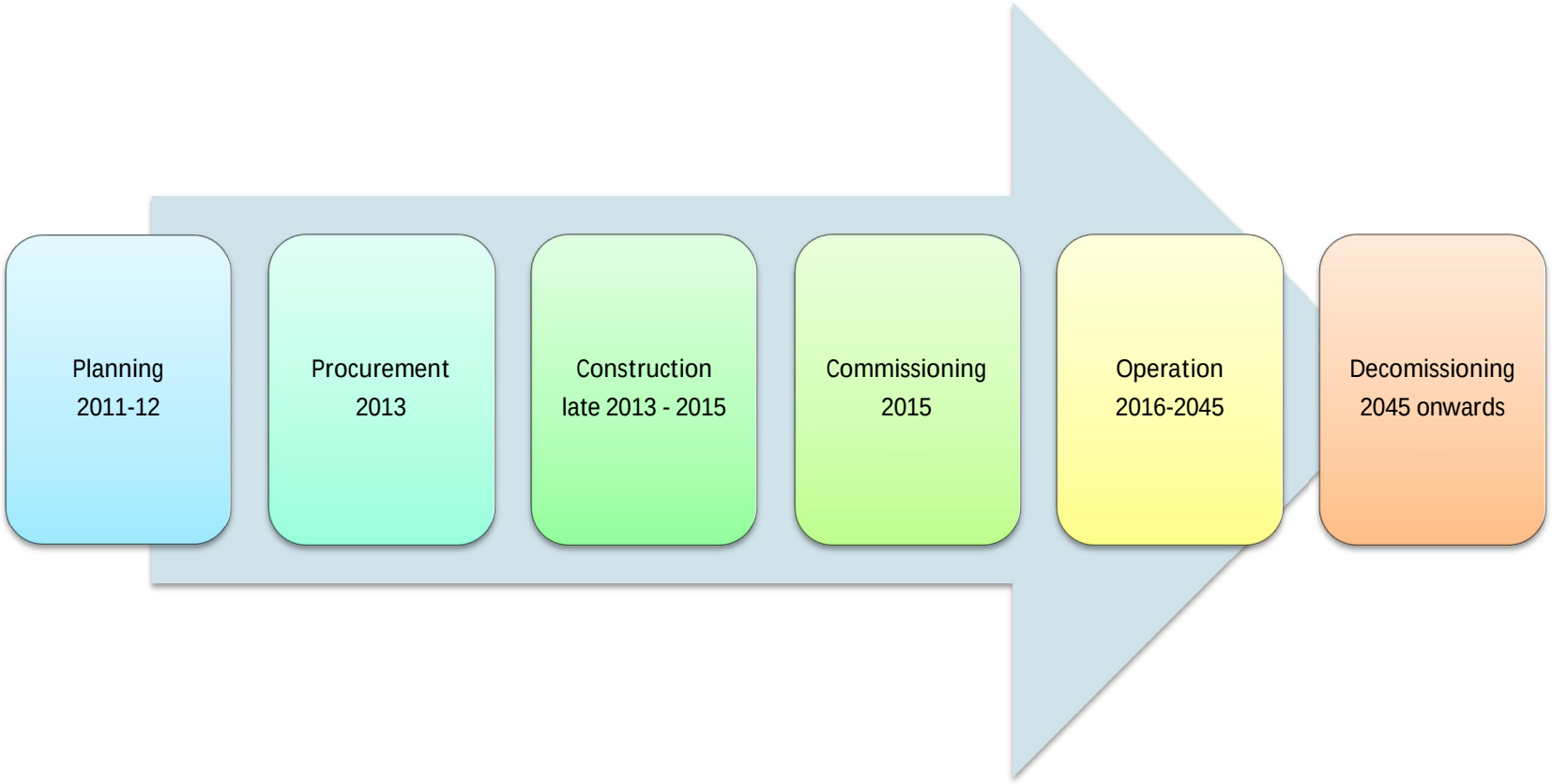


Figure 4-7 Project timeline

4.3.2. Construction program and hours

The project development would occur in 2012 and 2013 and procurement would begin in 2014. The construction of the project is anticipated to begin in mid-2014, subject to the outcome of the Environmental Assessment and planning process, granting of project approval, grid connections and discussion with stakeholders. Construction of the project would be anticipated to take approximately 17 months and the project is anticipated to be commissioned in late 2015. Prior to commencement of works, the construction contractor would prepare a detailed construction program.

Construction activities would be undertaken during standard hours for construction works, as follows:

- 7:00am to 6:00pm Monday to Friday.
- 8:00am to 1:00pm Saturdays.
- No work on Sundays or public holidays.

Any construction or commissioning activities outside of these standard working hours would require approval from relevant authorities. Any affected local residences would be informed of the timing and duration of the proposed activities, prior to the commencement of any works.

4.3.3. Construction workforce

Key construction management staff would relocate to Broken Hill for the duration of the construction period. These staff would be accommodated in the Broken Hill area. Construction supervisors would be recruited locally. The general labour force would consist primarily of construction labourers and electricians.

Construction labourers would be hired locally for the civil works, post and racking construction, and module installation and would account for approximately 70 per cent of the work force. These staff would be recruited locally and from regional centres. Specialist electrical workers would also be hired locally or recruited from other parts of Australia. It is anticipated that all workers can be accommodated at existing accommodation within Broken Hill.

During the17 month construction period, there would be a peak labour force of up to 220 workers.

4.4. Operation

The project is anticipated to operate for approximately 30 years. A minimal number of personnel would be required for the operation and maintenance of the project. It is expected that the solar PV plant would require up to four personnel for its operation to manage day-to-day operations and maintenance activities.

4.5. Decommissioning

The project would be decommissioned at the end of its operational lifespan. Key elements of project decommissioning include:

- The solar PV power plant would be disconnected from the electrical grid.
- PV modules and all equipment would be disconnected.
- PV modules would be removed from racking and packaged and returned to the supplier for recycling.
- All underground cabling would be removed from site and recycled at approved facilities where possible.
- All buildings and equipment would be removed and recycled, wherever possible.
- Racking would be disassembled and recycled.
- Posts and cabling would be removed and recycled.
- Fencing would be removed.
- The site would be re-vegetated as necessary to return it to its original site, as far as practicable.

4.6. Resource Use

4.6.1. Water

Limited water would be used during construction and operation. Small volumes of water, up to 200 kL/day) would be required during construction for dust control. No water (other than for office use sufficient for approximately two people per day) would be required during plant operation. The PV modules are not typically cleaned during operations and therefore no water would be required for this purpose.

Onsite storage of water for bushfire response purposes is not considered necessary as the risk of bushfires on the site is considered low (refer to **Section 10.2**). Liaison and consultation with the NSW Rural Fire Service, NSW Fire Brigades and other relevant government departments will be carried out during operations regarding bush-fire related matters.

Consultation with the responsible water supply authority, Essential Water, has been undertaken to confirm water supply requirements for the construction and operational phases of the project.

4.6.2. Gravel

Gravel may be required for construction of the site access road and internal access tracks. If required, it is anticipated that the gravel would be sourced locally from a licensed quarry. The amount of gravel required would be confirmed during detailed design.

4.6.3. Other resources

A small amount of concrete would be required for building foundations. Steel will be required for the solar PV plant support framework.

5. Visual Amenity

This chapter summarises the key findings of the Visual Impact Assessment undertaken for the project. The Visual Impact Assessment report is attached as **Appendix C**.

The Director-General's Requirements

The Environmental Assessment must:

- *Include a full assessment of the visual impacts associated with the solar farm, including identification and documentation of all key viewing points and corridors particularly from identified sensitive lands. This should also include the associated transmission line and a comprehensive assessment of the landscape character and values and any scenic or significant vistas of the area potentially affected by the project.*
- *Include photomontages of the project taken from potentially affected residents, settlements and significant public view points, and provide a clear description of proposed visual amenity mitigation and management measures for the solar farm.*
- *Provide an assessment of the feasibility, effectiveness and reliability of proposed mitigation measures and any residual impacts after these measures have been implemented.*
- *Provide an assessment of the potential for reflectivity from the panels and associated infrastructure, and any safety impacts for motorists, trains or aircraft.*

The following stakeholder comments have been addressed in the preparation of this chapter:

Issues raised	Chapter location
Department of Primary Industries (formerly Land and Property Management Authority)	
Impacts on the visual/aesthetic/scenic amenity of the local landscape.	Section 5.3

5.1. Assessment Methodology

5.1.1. Overview

The visual footprint of the project would be dominated by the solar modules of the solar PV plant and the overhead transmission line. The remaining components of the project (which include a site office and maintenance building, access tracks, fencing and ancillary electrical infrastructure such as conduits and cabling) are not expected to make a significant contribution to the overall visual footprint. For this reason, the assessment of visual impacts focuses on the solar PV plant and the transmission line. It is assumed that the site office and maintenance building would be similar in appearance to the farm sheds that are already common in the area.

The visual impact assessment was based on recognised visual impact assessment guidelines. It involved:

- Defining the key visual receptors for the project.
- Identifying the types of potentially impacted landscapes and the sensitivity of those landscapes to visual change.
- Assessing the level of potential impact using both viewshed and viewpoint analysis techniques.

5.1.2. Definition of the study area or visual catchment

The study area for the visual impact assessment was based on the 'visual catchment' of the project, being the area within which the development would be easily discernible. In defining this area, the assumptions of clear weather conditions and maximum visibility were adopted to accommodate a worst case visibility scenario.

The solar PV plant is likely to have a greater visual footprint than the transmission line even though the transmission poles are taller. This is because the solar panels will read as one large object from a substantial distance away whereas the poles, which will read as separate objects, have the capacity to visually integrate with other similar sized linear elements when viewed from the same distance. The physical characteristics of the solar PV plant have therefore been used to define the study area for the visual impact assessment.

The solar PV plant arrays, at 1.5 – 2 metres tall, would have a relatively low profile and therefore low visual impact when viewed from the side at the same ground elevation. If viewed from a higher elevation, however, the solar PV plant would occupy much more of a person's field of vision, thereby significantly increasing the level of visual impact. The study area was therefore selected to include most of the prominent elevated positions near the site that have the potential to offer views down onto the solar PV plant. A conservative distance of 10 kilometres from the site boundary was found to be sufficient to include most of these locations. **Figure 5-1** shows the boundaries study area for the visual impact assessment.

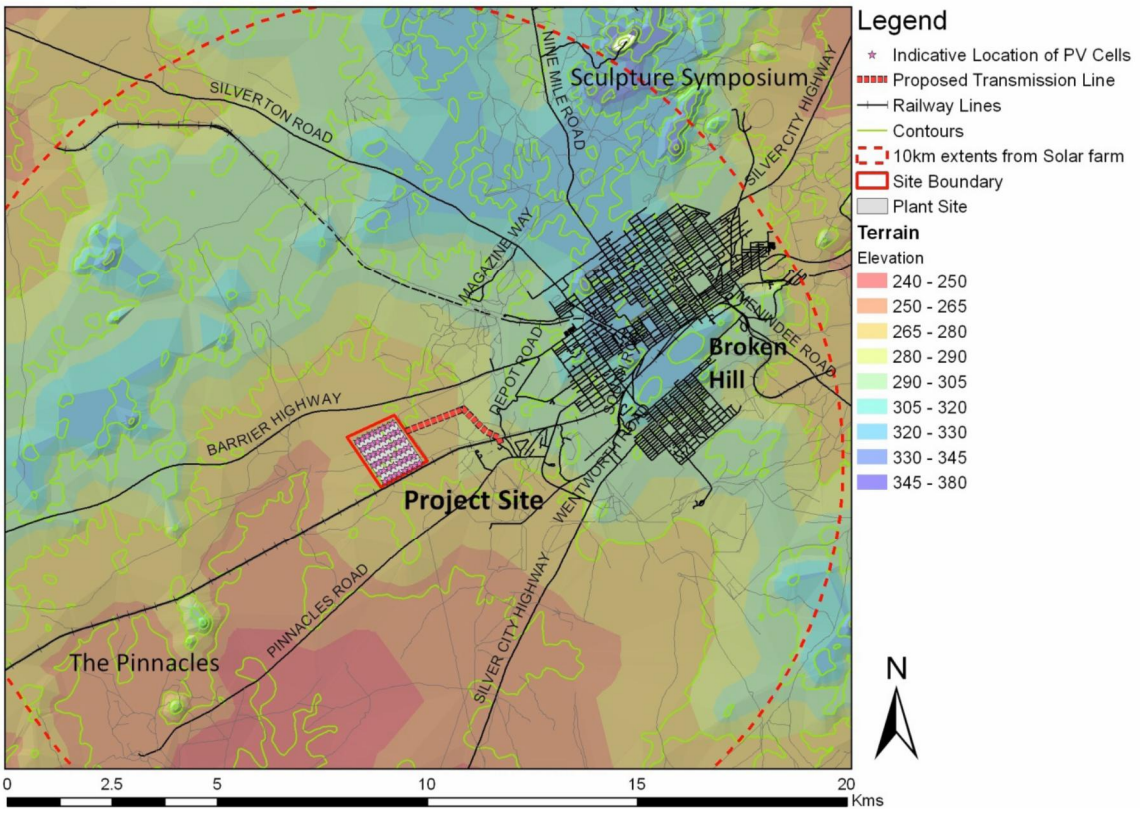


Figure 5-1 Study area for the visual impact assessment

5.1.3. Viewshed and viewpoint analysis

A viewshed analysis is a GIS mapping process that calculates areas on the terrain that offer a clear line of sight toward one or several points. Within the software, these points can be positioned to represent various elements of the proposed development and offset at specific heights above the terrain, reflective of the proposed heights of the structures. An offset height can also be given to represent the viewing height in the surrounding landscape, which is typically 1.7 metres based on the average height of a person.

Viewshed analysis is based on terrain data and does not take into consideration any site specific conditions that may reduce or screen visual impacts, such as the presence of vegetation or buildings. In effect, it disregards the presence of existing vegetation and buildings, resulting in a conservative analysis that displays a worst-case scenario.

For the project, a separate viewshed analysis was carried out for the solar PV plant and transmission line components. The viewshed analysis for the solar PV plant was conservatively based on the top of the solar panels being two metres above ground level. The viewshed analysis

for the transmission line was undertaken in a similar way with the transmission poles given a conservative height of 15 metres and a spacing of around 100 metres.

For the viewpoint analysis, a range of viewpoints (20 in total) were selected from key publicly accessible locations and locations adjacent to residences. These were selected to form a representative sample of locations with views toward the project. For each viewpoint, the existing landscape was described and analysed and an assessment made as to the degree of visual impact of the solar PV Plant and transmission line.

The locations of viewpoints used in the analysis are presented in **Figure 5-2**. With the exception of Viewpoint 20, all viewpoints are located within the defined project study area, being all areas within 10 kilometres of the solar PV plant site boundary (refer to **Section 5.1.2**). Viewpoint 20 is located just beyond the study area boundary but was included in the analysis because site observations revealed that it offered clear views to the project site.

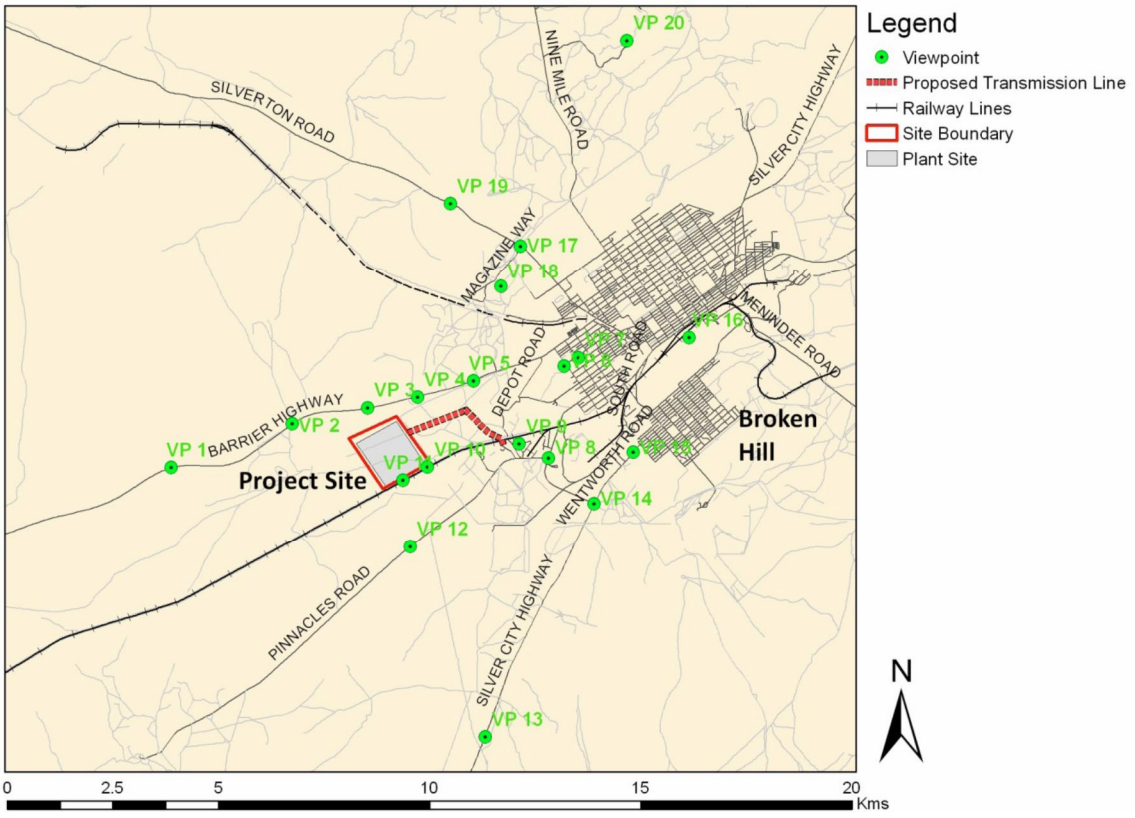


Figure 5-2 Locations of viewpoints used in the analysis

5.1.4. Visual impact ratings

The visual impact assessment was assessed based on the combined consideration of three factors:

- Degree of visual exposure, or the number of people that are likely to experience visual impacts.
- Visual sensitivity of the landscape.
- Distance between the viewer and the project site.

Each of these factors was assessed individually, using the rating criteria identified in **Table 5-1.** The ratings for each factor were then synthesised to give the overall level of visual impact for various viewpoints and receptors. The rating levels used for overall visual impact are defined in **Table 5-2**.

Table 5-1 Impact ratings for the three component factors of the visual impact assessment

Assessment factor	Assessment ratings	Description
Visual exposure	High	A high rating is given to those areas that experience a high degree of visual exposure or a high frequency of visits. This includes areas such as major roads, parks and recreation reserves and scenic lookouts. Special priority is given to locations with the express purpose of appreciating the landscape as well as views from residential locations.
	Medium	A medium rating is given to secondary roads and less frequented areas.
	Low	A Low rating is given to infrequently visited locations.
Landscape sensitivity	High	Includes Parks and Recreation Reserves and The Pinnacles landscape types.
	Medium	Includes Pastoral, Commercial, Residential, Conservation Area and Creeks and Drainage Systems landscape types.
	Low	Includes Mining and Industrial landscape types.
Distance to project site	High	A high impact rating is given where the proposed development would be a dominant element in the view (i.e. within 2 km for the solar PV plant and within 1 km for the transmission line).
	Medium	A medium impact rating is given where the proposed development would be a moderately dominant element in the view (i.e. 2 - 5 km for the solar PV plant and 1 - 2km for the transmission line).
	Low	A low impact rating is given to those locations where the proposed development would appear to recede into the distance (i.e. 5 – 10 km for the solar PV plant and 2 – 10 km for the transmission line).

Table 5-2 Overall visual impact ratings

Overall impact rating	Description
High impact	A large and detrimental change to visual amenity that cannot be avoided or mitigated.
Medium impact	The level of change would be moderately substantial but may be mitigated.
Low impact	The level of change may be noticeable, however it would not result in a substantial change to the visual characteristics of the landscape.
Negligible impact	The level of change would be virtually unnoticeable.
Nil	The project would not be visible.
Positive impact	A change which results in a positive contribution to the visual amenity of the landscape.

5.2. Existing Environment

The project site is located approximately five kilometres south west of Broken Hill, occupying 200 hectares of predominantly cleared and relatively flat land between the Barrier Highway to the north and the Peterborough - Broken Hill railway line to the south. The proposed 2.7 kilometre long transmission line would run through predominantly cleared grazing land, traversing three land holdings and the Peterborough Broken Hill railway line. The location is shown in **Figure 5-1** above.

The landscape of the Broken Hill area has a distinctive weathered appearance that is commonly associated with the Australian outback. Key characteristics include wide open spaces and deep red sands. Much of the landscape of the Broken Hill area has also been transformed by mining activity.

The Barrier Ranges located to the north of Broken Hill form ridges up to 300 metres above the surrounding plains. The foothills of these ranges extend into the northern and central areas of Broken Hill and offer views across the landscape. Hard rock outcrops also occur throughout the landscape, with a prominent example being 'The Pinnacles' approximately five kilometres to the south west of the solar PV plant site. Other areas, particularly around the project site, consist of gently undulating and flatter alluvial plains with a network of ephemeral watercourses and drainage lines.

The solar PV plant is set on the northwest facing side of a shallow ridge, which helps to conceal views toward the site from areas to the south and east. The highest point on the site is 280 metres AHD (on the south east corner) and the lowest point is 270 metres (on the northwest corner). The transmission line route climbs up a gentle slope from the solar PV plant site to a height of 282 metres before turning south east and reaching a maximum elevation of approximately 290 metres at the railway crossing.

The vegetation surrounding the project site is mainly composed of shrubland and grasses with a few isolated trees sparsely scattered throughout. The existing vegetation provides only limited

visual screening of the solar PV plant and transmission line, with long distance views over the landscape being possible from most areas.

Closer to Broken Hill township, there are instances of large established banks of trees along roadsides and also in the conservation areas on the periphery of the town. Views toward the project site from Broken Hill are usually inhibited by the terrain, with the trees providing additional screening.

5.3. Potential Impacts

5.3.1. Construction

The construction of the project may give rise to visual impacts associated with the presence of cranes, materials and general construction activity. These impacts would be limited to the construction period, which is expected to be approximately 17 months. On completion of construction, all construction plant, equipment and materials would be removed from the project site and all disturbed areas would be restored to a level that matches or improves upon their pre-construction condition. For this reason, the visual impact assessment focuses on the impacts that would be experienced once construction is completed over the lifetime of the project's operation.

5.3.2. Operation

Scale of the project

The photovoltaic infrastructure will occupy most of the area within the allocated 200 hectares. The total height of the solar PV plant arrays is anticipated to be around 1.5 – 2 metres. An example of a 40 MW plant built in Germany using similar photovoltaic modules is shown in **Figure 5-3**.

The proposed transmission line would comprise 2.7 kilometres of overhead line supported by galvanised steel poles. The poles would be approximately 14 metres high and spaced at intervals of around 100 metres. It would be similar in appearance to the existing transmission line adjacent to the project site (refer to **Figure 5-4**).

Figure 5-3 An example of a 40 MW plant in Germany

Figure 5-4 Existing 22kV transmission line near the site

Visual receptors

The term 'visual receptors' refers to specific areas within the landscape that are frequented by people and may therefore be associated with visual impacts. The greater the number of people frequenting a given location with a clear view to the project, the greater the potential visual impact (all else being equal). The purpose of a person's site visitation also has a large influence on the visual impact experienced. Tourist drives, for instance, are generally relatively sensitive to visual changes in the landscape, while major roads that are predominantly utilitarian in nature are likely to be less sensitive.

Within the project study area, the main visual receptors are:

- Major roads, including the Barrier Highway, Silver City Highway and Silverton Road.
- The Peterborough - Broken Hill rail line.
- Broken Hill Airport.

These receptors are shown on **Figure 5-2** and described in the following sections. It is important to note that the rail line to the north of the project site is not used for passenger services and has therefore not been considered as a visual receptor.

Major roads

The greatest visual impact is likely to be experienced from the major roads surrounding the project site as these locations coincide with the greatest number of viewers. It is important to note, however, that views from moving vehicles are constantly changing and generally transient, with the end result that the level of visual impact experienced from roads is generally less than that experienced from static viewpoints such as lookouts.

The Barrier Highway is the closest main road to the project site, passing within 350 metres of the site boundary. When approaching Broken Hill from Adelaide on the Barrier Highway, a motorist would first see the Pinnacles on the right before coming over a crest and seeing Broken Hill in the distance approximately 10 kilometres away. The solar PV plant would also come into view at this point. It is therefore considered possible that the solar PV plant could act as a new gateway icon, symbolising a new industry of renewable energy. The existing gateway icon on the Barrier Highway approach to Broken Hill consists of a mining headframe symbolising the mining heritage of the town.

Silver City Highway connects Mildura (to the south) with Broken Hill and many northern destinations such as Sturt National Park, Cameron Corner and the village of Tibooburra in the remotest, northwest corner of NSW. There is a high probability of tourists using this road to access those outback destinations. Upon approaching Broken Hill, the road offers mostly unimpeded views over gently undulating plains, with the Pinnacles being a prominent landmark. Views toward the solar PV plant from this road would, however, be mostly constrained by topography.

Silverton Road is a secondary road connecting Broken Hill to Silverton, a notable tourist destination approximately 20 kilometres to the north west. The road skirts the foothills of the Barrier Ranges and gradually rises to offer elevated views toward the project site.

Peterborough - Broken Hill rail line

The Peterborough - Broken Hill rail line is predominantly used for the transport of minerals between Broken Hill and Adelaide. It is also used by two passenger services – the CountryLink Outback Explorer and the Indian Pacific. The CountryLink Outback Explorer runs between Sydney and Broken Hill and does not pass the project site. The project would be visible from the Indian Pacific, however, as it approaches Broken Hill from Adelaide.

The Indian Pacific is one of the last coast to coast rail journeys in the world and the longest train trip in Australia. It is mainly promoted as a leisure trip and a chance to experience the Australian landscape. The key selling point of the journey is the diversity of the terrain and viewing experiences, including historic mining towns, agricultural landscapes, the red earth of the outback and a 478 kilometre straight section through the Nullarbor Plain. In this light, views toward a new solar PV plant would be a welcome addition. The solar PV plant may also act as a gateway icon to passengers travelling from Adelaide.

Broken Hill Airport

Broken Hill Airport is located to the south of Broken Hill township and services Regional Express, The Royal Flying Doctors Service of Australia, chartered planes and helicopters as well as scenic flight operators. The major (sealed) runway is aligned from south west to north east and the project would not be in direct line of sight for fixed-wing aircraft either landing or taking off. It would, however, be in the line of sight of helicopters, which are able to approach the airport from any direction.

For operators of scenic flights, the solar PV plant would have a large visual footprint when seen from directly above. This provides an opportunity for operators to incorporate the site as part of the tour. Operators are usually keen to incorporate any new elements of the landscape that have the potential to enhance the overall experience of passengers.

Landscape types and sensitivity to change

For the purposes of the viewpoint analysis, the landscapes within the study area were classified into eight landscape types based on their visual characteristics. Each landscape type was also classified according to its sensitivity to visual change brought about by built works. A summary of each landscape type and its sensitivity to visual change is presented in **Table 5-3**. The location and extent of each landscape type is shown in **Figure 5-5**.

Table 5-3 Landscape types and sensitivity to visual change

Landscape type	Description	Sensitivity
Pastoral	Exhibits numerous signs of modifications and is able to visually absorb further modifications. However it is environmentally fragile and is often valued for its 'outback' scenic qualities.	Low to Medium
Mining	A highly degraded landscape devoid of vegetation and other naturalistic forms or scenic qualities. Typically many visually dominant structures present.	Low
Industrial/ Commercial	Significantly modified landscape with many utilitarian buildings and infrastructure dominating the view. Commercial areas with heritage buildings provide greater visual amenity but is still a highly modified landscape.	Low to Medium
Residential	Residential areas typically have a higher sensitivity rating owing to resident's sense of attachment to the landscape. Some residential areas with clear views to the project site and surrounds, however many disturbances to the landscape are also in view.	Medium
Parks & Recreation Reserves	Typically have medium to high sensitivity to visual changes depending on the nature of activities undertaken (passive or active recreation). Also depends on available views out across the landscape.	Medium to High
Conservation Area	The identified conservation areas are utilitarian in nature and not specifically designed for landscape and visual amenity. Sparse tree cover permits views across the landscape.	Medium
The Pinnacles	Highly valued topographical feature with indigenous and non-Indigenous significance. The Pinnacles are a local icon.	High
Creeks and Drainage Systems	Due to their ephemeral nature, they are often difficult to distinguish from the pastoral landscape. Dry creek beds are often subject to artistic expression however and are representative of the harsh conditions of the outback. No nature walks observed along the creek beds.	Medium

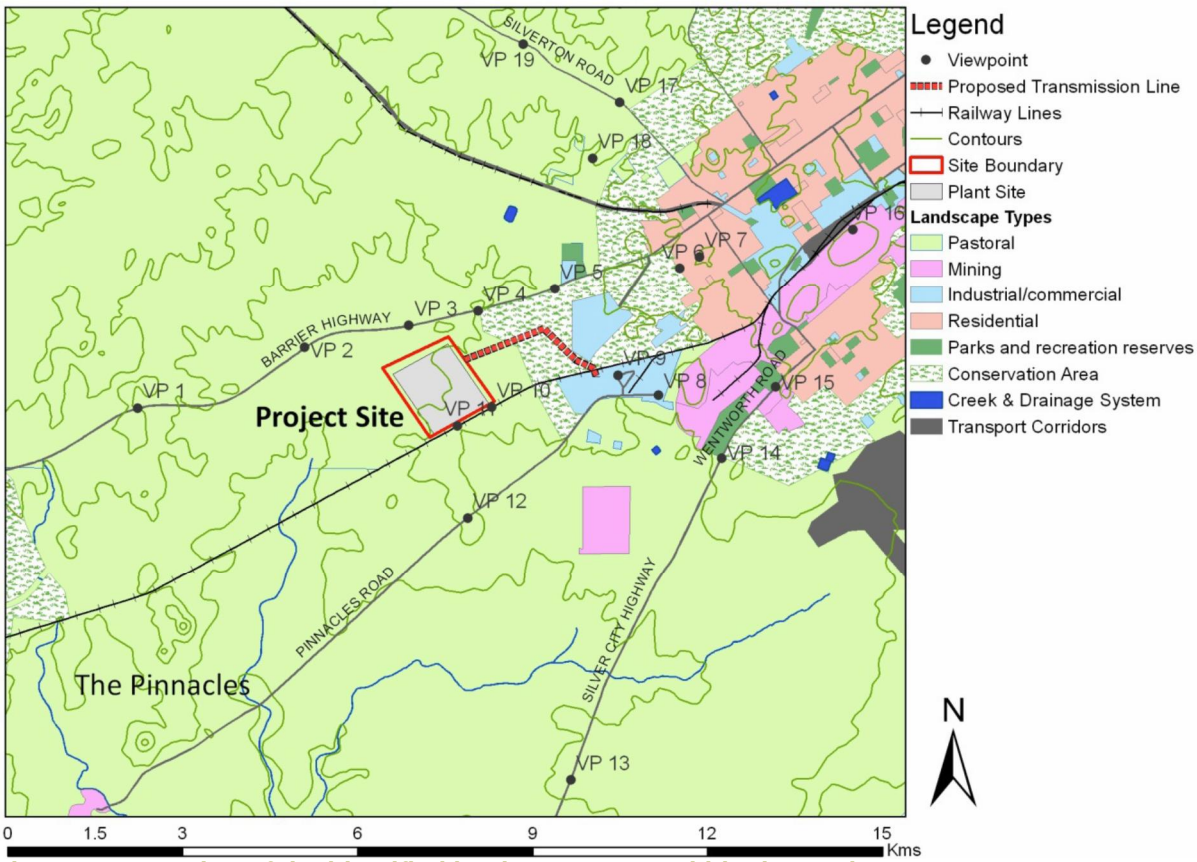


Figure 5-5 Location of the identified landscape types within the study area

Results of the viewshed analysis

The results of the viewshed analysis for the solar PV plant are presented in **Figure 5-6**. An indicative number of 48 points were used to represent the solar panels. The results are colour coded to show the number of points (solar panels) viewable from each area, with the dark blue regions representing the areas with the most visual exposure to the solar PV plant[1]. The roads with the highest visual exposure are the Barrier Highway and to a lesser extent Pinnacles Road, Silverton Road and Wentworth Road. The Peterborough - Broken Hill rail line also has high exposure where it runs immediately adjacent to the site, as do the elevated residential areas of Lunam Street. The large dark blue areas to the south east are not accessible and were not investigated during the site visit.

[1] Note that the viewshed analysis is conservative and many of the mapped dark blue areas do not permit actual views to the site due to factors such as intervening vegetation, buildings and minor topographical features that are not accounted for in the GIS terrain data.

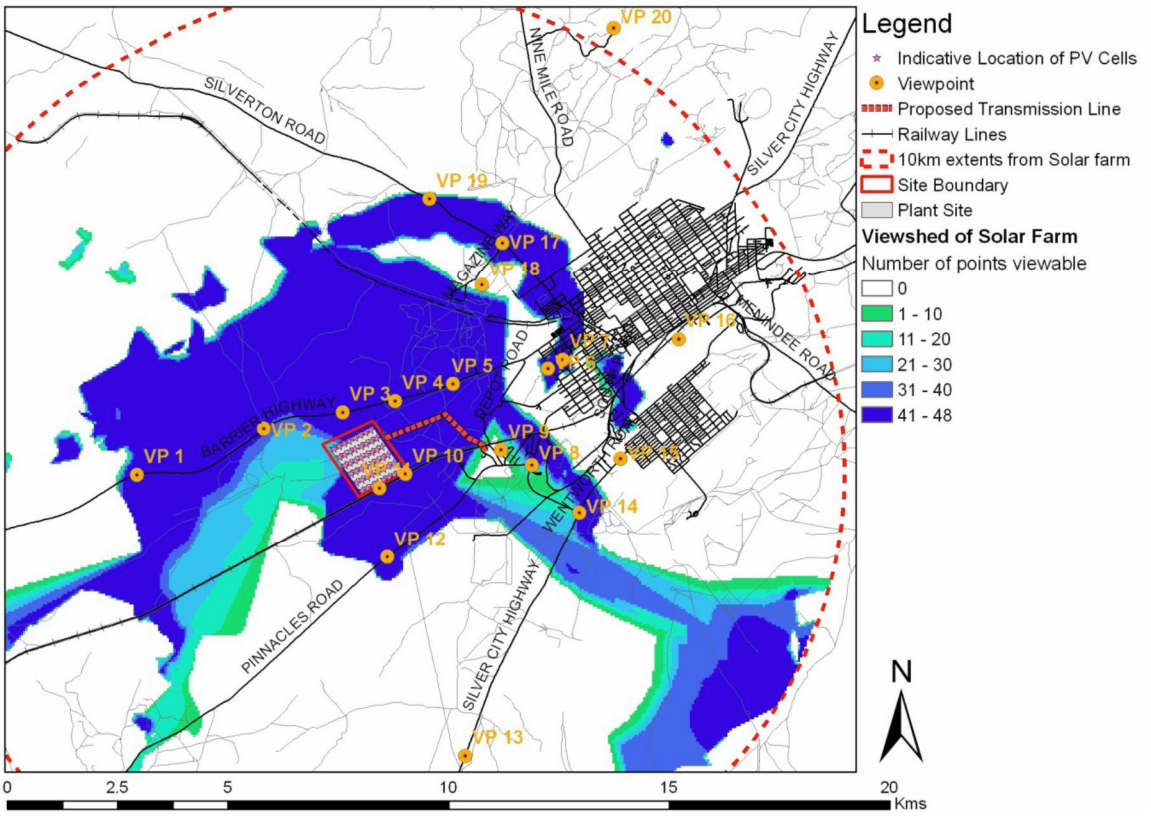


Figure 5-6 Results of the viewshed analysis for the solar PV plant

The results of the viewshed analysis for the transmission line are presented in **Figure 5-7**. The results indicate that the areas of highest visual exposure to the transmission line generally coincide with the areas of highest visual exposure to the solar PV plant.

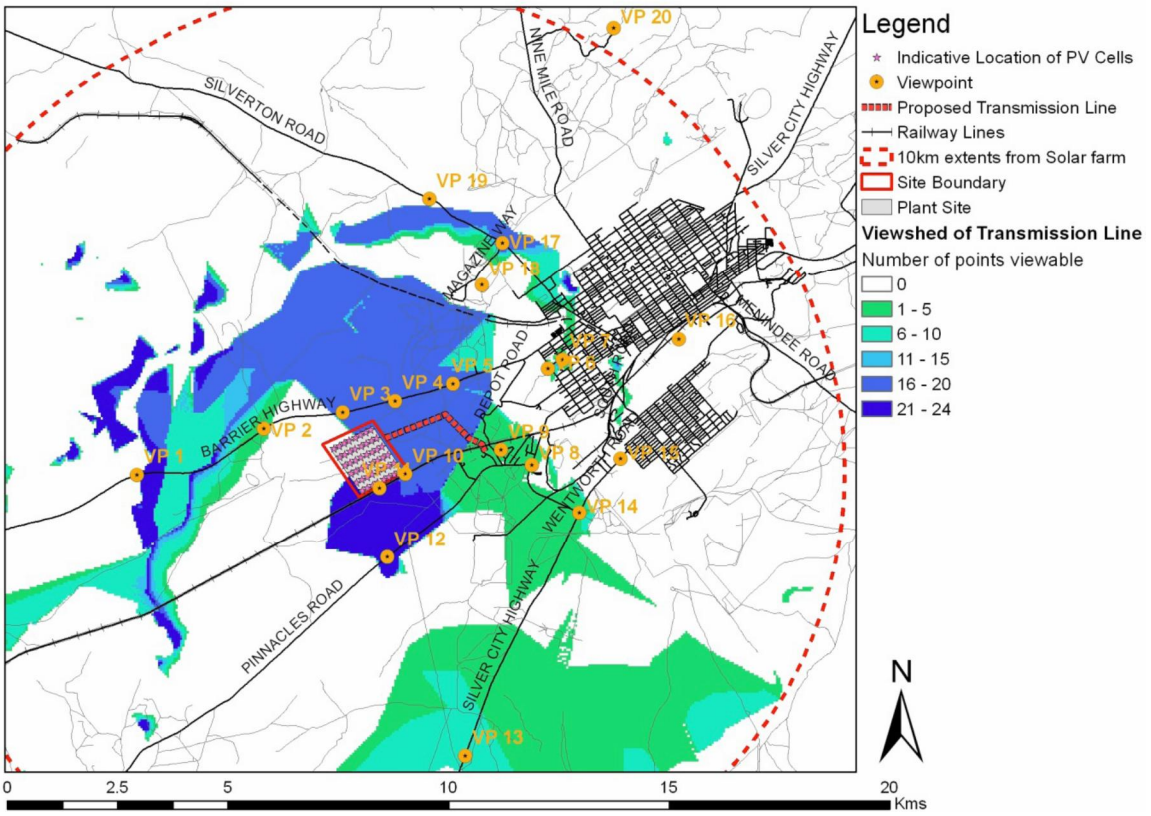


Figure 5-7 Results of the viewshed analysis for the transmission line

Results of the viewpoint analysis

The results of the viewpoint analysis indicate that, for the most part, the solar PV plant would have a low or negligible visual impact. The only area where it would have a high impact is along the Barrier Highway viewing southwest toward 'The Pinnacles'. A medium impact has been assigned to locations along Silverton Road and Magazine Way, which offer similar views of 'The Pinnacles'.

The transmission line would have a very low visual impact, especially for locations beyond two kilometres distant. In many cases, it will visually integrate with the many other transmission lines that exist in the area. A summary of visual impacts as determined by the viewpoint analysis is provided in **Table 5-4**.

A common tool for forecasting the degree of visual change from a particular viewpoint is via the preparation of photomontages using computer generated imagery. Photomontages illustrate how a proposed development would potentially appear in the landscape and provide a useful tool for comparing pre-and post-development conditions. To inform the visual assessment, four photomontages have been prepared (refer to **Figures 5-8, 5-9, 5-10, and 5-11**).

Figures 5-8 to 5-10 provide existing and post project development views looking south west, south and south east from the Barrier Highway towards the project site. Views south west take in 'The Pinnacles' and an area of the landscape which is relatively undisturbed apart from small fences. There is an existing small transmission line in view in the distance to the south. The silo of the mineral separation plant is also visible.

This view has a relatively high scenic value for motorists heading west along the Barrier Highway. The proposed PV modules would cover most of the ground beneath the view of 'The Pinnacles', resulting in a major change to the visual characteristics of the view. The transmission line would, however, visually integrate with other existing transmission lines in the vicinity.

The overall visual impact of the proposed solar PV plant from this viewpoint is considered to be high due to its proximity to the viewpoint and its effect on the view of 'The Pinnacles'. By contrast, the visual impact of the transmission line component of the project would be low as it would visually integrate with the numerous other vertical elements across the landscape

Figure 5-11 provides existing and post project development views looking south west from the Lunam Street residential area (north east of the project site) towards the project site. This viewshed takes in a pastoral landscape, mining and industrial activity, and existing transmission lines. 'The Pinnacles' are visible as a backdrop to this view.

From this viewpoint, the solar PV plant component of the project would appear as a narrow dark band in the distant landscape below 'The Pinnacles', while the transmission line would visually integrate with numerous other vertical elements across the landscape. The overall visual impact of the proposed solar PV plant on this viewpoint is considered to be low due to its distance from the viewpoint and the presence of other manmade modifications in the landscape. The overall visual impact of the transmission line component of the project from this viewpoint is considered to be negligible due the distance between the viewpoint and the proposed transmission line easement.

Table 5-4 Results of viewpoint analysis - solar PV plant and transmission line

VP	Location	Landscape type	Sensitivity	Exposure	Distance from site (km)	Description	Overall visual impact	
							PVP	TL
1	Barrier Highway #1	Pastoral	Low to Medium	High	4.44 (PVP) 5.69 (TL)	View east from Barrier Highway toward Broken Hill. Small transmission lines also in view. Mining activity, towers and other disturbances viewable in distance. This would be the first sighting of the PVP from the Barrier Highway while heading east towards Broken Hill. The PVP would appear against other modifications to the landscape. The TL would not be discernible.	Low	Negligible
2	Barrier Highway #2	Pastoral	Low to Medium	High	1.59 (PVP) 2.75 (TL)	View south east across the project site from Barrier Highway with Broken Hill Mineral Separation Plant on crest. Existing transmission towers and other infrastructure also in view. The PVP would occupy a large proportion of the view, however it would not extend above the horizon line and would be low in profile. The TL would visually integrate with other existing transmission lines visible in the distance. Potential for the PVP to act as a gateway icon.	Low to Positive	Low
3	Barrier Highway #3	Pastoral	Low to Medium	High	0.59 (PVP) 1.11 (TL)	View south east from Barrier Highway directly adjacent to the site. Broken Hill Mineral Separation Plant can also be seen from this location. The PVP would occupy most of the horizontal field of view. Views across the PVP would form rhythmic patterns for motorists. Potential for the PVP to act as a gateway icon. The TL would visually integrate with other existing transmission lines.	Low to Positive	Low
4	Barrier Highway #4	Pastoral & The Pinnacles	Low to High	High	0.77 (PVP) 0.70 (TL)	View south west takes in 'The Pinnacles' and an area of the landscape that is relatively undisturbed. There is a small transmission line in view in the distance to the south. The silo of the Broken Hill Mineral Separation Plant is also visible. This view has relatively high scenic value for motorists heading west along the Barrier Highway. The PVP would cover most of the ground beneath the view of The Pinnacles and result in a major change to the visual characteristics of the view. The TL would visually integrate with other existing transmission lines.	High	Low

VP	Location	Landscape type	Sensitivity	Exposure	Distance from site (km)	Description	Overall visual impact	
							PVP	TL
5	Barrier Highway #5	Pastoral & Industrial	Low to Medium	High	2.08 (PVP) 0.72 (TL)	View south west along the Barrier Highway with 'The Pinnacles' in the distance. Existing transmission line in view on crest of hill to south. Larger 220kV transmission line also in view in distance. A refuse area and the TransGrid substation are in view beyond the hill. The PVP may be partially hidden from this viewpoint by terrain. The TL would visually integrate with existing transmission lines in the vicinity. The view to the TL is partially degraded by the refuse area.	Low	Low
6	Creedon Street	Conservation Area	Medium	Low	3.93 (PVP) 2.28 (TL)	View south west from the rear of residential properties adjacent to Creedon Street looks out across a conservation area toward the project. Numerous existing transmission lines in view. Broken Hill Mineral Separation Plant is also just in view. This location is not meant to be and does not appear to be frequented by people. The PVP and TL would not be visible from this location.	Nil	Nil
7	Lunam Street	Pastoral, Mining, Residential & The Pinnacles	Low to High	High	4.31 (PVP) 2.65 (TL)	View south west from residential area taking in pastoral, mining and industrial landscapes with 'The Pinnacles' in the background. Existing transmission lines are also in view. The PVP would appear as a narrow dark band in the distant landscape below 'The Pinnacles'. The new TL would visually integrate with the numerous vertical elements across the landscape.	Low	Negligible
8	Kanandah Road	Industrial	Low	Medium	2.82 (PVP) 1.11 (TL)	Kanadah and Pinnacles Road are flanked with industrial factories and sheds. High chain wire mesh security fencing is a common feature within the view. There are small transmission lines on both sides of the roads. Views toward the project site would be constrained by terrain, buildings and vegetation.	Nil	Nil
9	Pinnacles Place	Industrial	Low	Medium	2.17 (PVP) 0.38 (TL)	Views are dominated by a crane, bus depot, large warehouses, the existing substation and small (22 kV) and large (220 kV) transmission lines. Chain wire security fencing lines are a common element. Train line runs beside the substation. The new transmission line would cross the train line before connecting with the substation. It would be difficult to discern the new TL through the existing infrastructure in the foreground. No views to the PVP.	Nil	Negligible

VP	Location	Landscape type	Sensitivity	Exposure	Distance from site (km)	Description	Overall visual impact	
							PVP	TL
10	Railway Line #1	Pastoral & Mining	Low to Medium	Medium	0.07 (PVP) 0.94 (TL)	View takes in the Mineral Separation Plant, 220 kV and 22 kV transmission lines, fences and access tracks. 'The Pinnacles' are visible in the distance but not in direct line of sight to PVP. This view would be mainly experienced by passengers on board the Indian Pacific for whom the PVP may provide an interesting visual experience. The TL would visually integrate with existing power lines.	Low to Positive	Low
11	Railway Line #2	Pastoral & Mining	Low to Medium	Medium	0.06 (PVP) 1.14 (TL)	View takes in the Mineral Separation Plant, 220 kV and 22 kV transmission lines, fences and access tracks. 'The Pinnacles' are visible in the distance but not in direct line of sight to PVP. This view would be mainly experienced by passengers on board the Indian Pacific for whom the PVP may provide an interesting visual experience. The TL would visually integrate with existing power lines.	Low to positive	Low
12	Pinnacles Road	Pastoral & Mining	Low to Medium	Medium	1.52 (PVP) 2.71 (TL)	Views take in mining activity, the Mineral Separation Plant, 220 kV transmission lines and 'The Pinnacles'. 'The Pinnacles' are not viewed in the same direction as the project site. This is a little used dead end dirt track used mainly by utility vehicles. The PVP would not be visible from this location owing to an intervening ridgeline to the north. The elevation difference was too slight to be taken into account in the viewshed analysis. The TL would be visible only at the northern most point where it connects with the substation, however, it would be some way off in the distance.	Nil	Negligible
13	Silver City Highway #1	Pastoral	Low to Medium	High	6.32 (PVP) 6.90 (TL)	Views toward the project site take in the relatively flat expanse of the pastoral landscape as well as the existing 220 kV transmission line and Perilya mine site. Views toward 'The Pinnacles' are not in direct line of sight with the project. The PVP would not be visible. The TL might be viewable from this view point although well beyond easily discernible range.	Nil	Negligible
14	Silver City Highway #2	Pastoral & Mining	Low to Medium	High	4.01 (PVP) 2.55 (TL)	View of Perilya mine in the middle distance. Small utility shed in view in the foreground. The PVP would not be visible from this location owing to an intervening ridgeline. The TL would be mostly hidden by roadside vegetation.	Nil	Negligible

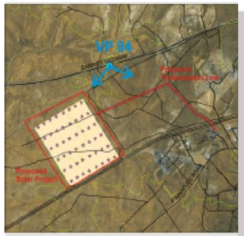
VP	Location	Landscape type	Sensitivity	Exposure	Distance from site (km)	Description	Overall visual impact	
							PVP	TL
15	Wentworth Road	Parks and Recreation Reserves	Medium to High	High	4.85 (PVP) 3.09 (TL)	View south west to north west over park with lake and water feature. Twin Lakes is managed by Perilya mining operation. Established tall roadside vegetation effectively inhibits all views to the project site.	Nil	Nil
16	Line of Lode Lookout	Residential, Industrial, Pastoral & The Pinnacles	Low to High	High	6.83 (PVP) 5.07 (TL)	A widely promoted lookout within Broken Hill. Views take in Broken Hill township, train station, rail yards, water tanks, transmission lines and other infrastructure. The PVP would appear between 'The Pinnacles' and the water tanks in the far distance. The PVP and TL would be hard to discern from this distance.	Negligible	Negligible
17	Silverton Road #1	Pastoral & The Pinnacles	Low to High	High	5.01 (PVP) 4.11 (TL)	Views toward the project site take in farm sheds, fencelines, tracks and 'The Pinnacles' in the distance. The PVP would be discernible as a dark band to the left of 'The Pinnacles'. View of the site residence is in line with 'The Pinnacles'. This location is one of only a few along Silverton Road where breaks in roadside vegetation allow such views. The TL would be barely discernible from this distance. The residence on the eastern side of the road would not have views of the PVP due to roadside vegetation.	Medium	Negligible
18	Magazine Way	Pastoral & The Pinnacles	Low to High	Low	3.96 (PVP) 3.06 (TL)	View south west to south east from a little used track running from Silverton Road. This area may potentially be developed in future to accommodate urban growth. 'The Pinnacles' are a prominent visual element in this view. The PVP would appear directly beneath 'The Pinnacles', however there would be few visitors to observe the change in the landscape. The TL would visually integrate with the numerous vertical elements in the distance and would be difficult to discern.	Medium	Negligible
19	Silverton Road #2	Pastoral & The Pinnacles	Low to High	High	5.19 (PVP) 4.90 (TL)	View south west to south east along Silverton Road offering elevated views across the gently undulating pastoral landscape toward the project site. The PVP would be visible but would not be in the direct line of sight of 'The Pinnacles'. The TL would be hard to discern from this location.	Medium	Negligible

VP	Location	Landscape type	Sensitivity	Exposure	Distance from site (km)	Description	Overall visual impact	
							PVP	TL
20	Sculpture Symposium Lookout	Pastoral & The Pinnacles	Low to High	High	10.44 (PVP) 9.55 (TL)	This is a highly promoted vantage point providing 180 degree views of Broken Hill township, mining activity, the Barrier Ranges and surrounding plains. The Pinnacles and the Mineral Separation Plant are also visible. The PVP may be just discernible in the far distance but would only be seen in one direction whereas the visual experience covers 180 degrees. It would therefore not greatly change the visual experience. The TL would be difficult to detect.	Negligible	Negligible

VP – viewpoint analysis;
PVP – PV plant;
TL – transmission line

Existing view looking south west from Barrier Highway (north east of site).

Photomontage of proposed solar power project and transmission line.



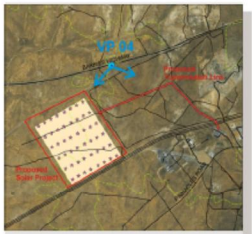
SITE DATA

Location:	Barrier Highway
GPS:	E 537597 N 6462202
Projection:	GDA 1994 MGA Zone 54
Camera:	Nikon D3 (Digital SLR)
Lens Size:	90mm
Photo Direction:	South West
No of Photos:	4
Overlap:	1/3
Date of Photography:	16th March 2011
Date of Photomontage:	13th May 2011
Project Reference:	HA01345

Figure 5-8 Photomontage 1

Existing view looking south from Barrier Highway (north east of site).

Photomontage of proposed solar power project and transmission line.



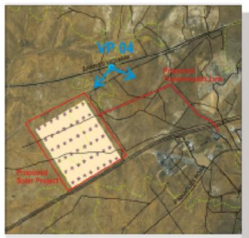
SITE DATA

Location:	Barrier Highway
GPS:	E 537597 N 6462202
Projection:	GDA 1994 MGA Zone 54
Camera:	Nikon D3 (Digital SLR)
Lens Size:	90mm
Photo Direction:	South
No of Photos:	4
Overlap:	1/3
Date of Photography:	16th March 2011
Date of Photomontage:	13th May 2011
Project Reference:	HA01345

Figure 5-9 Photomontage 2

Existing view looking south east from Barrier Highway (north east of site).

Photomontage of proposed solar power project and transmission line.

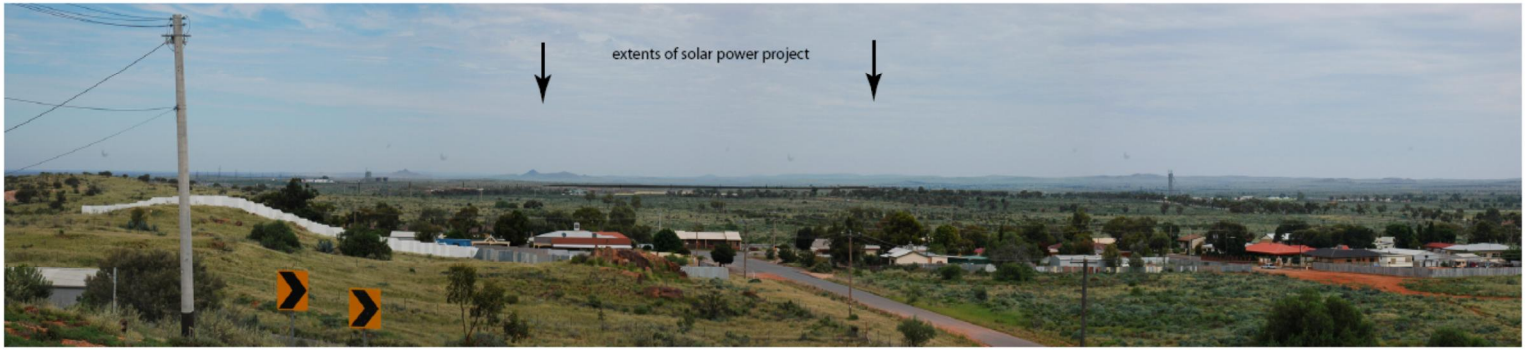


SITE DATA

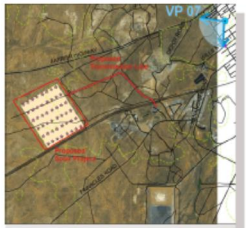
Location:	Barrier Highway
GPS:	E 537597 N 6462202
Projection:	GDA 1994 MGA Zone 54
Camera:	Nikon D3 (Digital SLR)
Lens Size:	90mm
Photo Direction:	South East
No of Photos:	4
Overlap:	1/3
Date of Photography:	16th March 2011
Date of Photomontage:	13th May 2011
Project Reference:	HA01345

Figure 5-10 Photomontage 3

Existing view looking south west from Lunam Street Residential Area (north east of site).



Photomontage of proposed solar power project and transmission line.



SITE DATA

Location:	Lunam Street
GPS:	E 541401 N 6463137
Projection:	GDA 1994 MGA Zone 54
Camera:	Nikon D3 (Digital SLR)
Lens Size:	90mm
Photo Direction:	South West
No of Photos:	4
Overlap:	1/3
Date of Photography:	16th March 2011
Date of Photomontage:	13th May 2011
Project Reference:	HA01345

Figure 5-11 Photomontage 4

Reflectivity

The purpose of a solar PV module is to absorb as much light as possible for conversion to electricity. Any light reflected from a solar panel would thereby reduce its efficiency. The First Solar FS series solar modules planned for use in the project are expected to have minimal reflective qualities compared with normal glass. These modules appear darker than traditional crystalline silicon PV modules in nearly all conditions, indicating less light reflection. Studies in Germany and the USA, based on existing solar PV plants, indicate that solar panels typically emit less glare than many other materials and surfaces common in the landscape. The solar panels of the project therefore would not noticeably alter the site's current amount of reflected and indirect sunlight in most conditions. Specific potential glare effects on air, road and rail travel are discussed in the following sections.

Air travel

There have been a number of precedents, mainly in the USA, where solar plants have been installed directly adjacent to airports. In these cases, there have been no reports of these installations causing glare issues for pilots, even during the critical landing and taking off stages. Large glass panels associated with terminal buildings have a greater propensity to emit glare.

Anecdotal evidence obtained from a pilot of Wettenhall Air Services (operating out of Broken Hill Airport) has indicated that glare is rarely an issue while flying. Glare is usually only a problem if the object in question is in direct line of sight of the runway. The proposed project site is not in the direct line of sight of the Broken Hill Airport runway. Heading into the sunrise or sunset represents the worst conditions for landing and taking off, with direct light being more of an issue than reflected light. Pilots are highly skilled professionals who are able to deal with a range of adverse climactic and lighting conditions and will usually choose an option that best avoids risks.

Road travel

The road that is most likely to experience glare impacts is the Barrier Highway, given its close proximity to the north side of the project site (refer to **Figure 5-1**). Assessment of the potential glare emissions from the proposed solar PV plant, taking into consideration the full range of sunlight angles likely to strike the site, indicates that motorists on the Barrier Highway may potentially be impacted by glare under the following conditions:

- When heading west toward the site when the sun is low on the western horizon (late afternoon), particularly in summer months.
- When heading east toward the site when the sun is low on the eastern horizon (early morning), particularly in summer months.

The occurrence of actual glare impacts on motorists would, however, be influenced by the complex interaction between the sun's position in the sky (which is influenced by the time of day and time

of year), the specific location of motorists on the road and the corresponding elevation and slope of the road, the weather conditions and air quality, and the final configuration of the solar panels. It can be concluded, however, that any glare impacts are likely to be minor for the following reasons:

- Any glare impacts experienced would be temporary and would shortly pass as the motorist progresses along the highway.
- Not all panels would reflect light toward the same vehicle as they would be in a fixed unidirectional orientation.
- The amount of reflected light would remain below 10 per cent of the sun's strength for angles of incidence below 50 degrees.
- The sun would have to be quite low for a significant amount of glare to be emitted. The low sun in itself would be more of a problem than the potential glare issue and most responsible drivers would be expected to take extra precaution under these conditions.

Rail travel

The Peterborough - Broken Hill rail way is the closest rail line to the project, running to the south of the proposed site. As the solar panels would face north, glare impacts on this rail line are expected to be minor. The only exception to this would be if a train were heading south west toward the site when the sun was low on the western horizon. The only people to experience this impact would be the driver and crew. As trains are on a fixed path, there is no real danger of losing control of the vehicle. Reflection from natural features such as salt lakes and sandy plains, which are common features along this rail line, would likely be far higher than those from the solar panels.

Local and regional landscape context

As part of this assessment, the characteristics and values of the local and regional landscape were examined to determine the degree of compatibility between the project and its context. The characteristics and values of the landscape were determined by studying the landscape itself, in addition to the various cultural expressions that use the landscape as a source of inspiration. Existing and future industrial developments were taken into consideration as these have a strong influence on how well the project would integrate with the landscape. The characteristics of the landscape that are highly valued by local, regional and wider communities were also examined to determine if the project is likely to adversely affect these values.

The main findings of this component of the assessment were as follows:

- The semi arid and relatively featureless landscape of the Broken Hill region is highly valued from both a cultural and commercial perspective. It is important to the film and tourism industries, has a strong influence on local and regional art, offers an important experience for visitors, and has become a significant part of the lives of residents.

- The scale of the landscape surrounding Broken Hill is vast and can accommodate many large scale developments without them necessarily appearing to be out of context.
- Man-made modifications to the landscape, particularly associated with the mining industry, have been historically embraced by the local and regional community and form an important part of the historical context of the region.
- The Broken Hill landscape is undergoing a process of continuous long term change, driven by ongoing industrial development.

Summary of operational impacts

For the most part, the solar PV plant would have a low or negligible visual impact. The only area where it has been predicted to have a high impact is along the Barrier Highway, close to the northeast corner of the site, where it would impact views south west towards 'The Pinnacles' (**Figure 5-8**). This area coincides with Viewpoint 4 (refer to **Table 5-4** and **Figure 5-7**). This viewpoint is located in a relatively elevated position with a clear view to 'The Pinnacles'. The foreground has relatively few manmade elements and the presence of the solar PV plant would result in a substantial change to the visual characteristics of the landscape. A medium level of visual impact was also determined for locations along Silverton Road and Magazine Way, which offer similar views of 'The Pinnacles' (i.e. locations corresponding to Viewpoints 17, 18 and 19).

The transmission line component of the project would have a very low visual impact, especially for locations more than one or two kilometres distant. In the majority of cases it would visually integrate with other existing transmission lines in the area, many of which are much larger than the proposed 22 kV line.

The visual impact of the solar PV plant from the Barrier Highway may be mitigated through the consideration of planting of low shrubby vegetation. This will inhibit views of the solar PV plant while maintaining views toward 'The Pinnacles', which are an important landscape icon.

Views east toward the site from the Barrier Highway will take in the solar PV plant against the backdrop of numerous industrial and mining developments. It is for this reason that impact mitigation is not considered to be required for these locations. The presence of the solar PV plant may in fact offer a positive contribution to the viewing experience and act as a gateway icon when approaching Broken Hill from Adelaide. This is especially relevant considering the vast, flat and featureless landscape that would be traversed on route from Adelaide to Broken Hill.

The landscape surrounding Broken Hill is diverse. It already contains and can accommodate many other large scale developments. The landscape is undergoing a process of continuous change driven by ongoing industrial development. While the protection of natural landscape resources is important, the addition of the solar PV plant could add to the diversity of visual experiences in the

region. Interpretive signage with viewing areas could be used to capitalise on the educational value of the installation.

5.3.3. Decommissioning

The project is anticipated to operate for approximately 30 years. Decommissioning after this period would involve removal of the photovoltaic modules, brackets and posts, electrical cabling and equipment, and all buildings and fencing. The site would be revegetated as necessary to return it to its original state, as far as practicable. There would be no significant or enduring visual impacts once the project has been decommissioned.

5.4. Impact Mitigation and Management Measures

5.4.1. Overview

Mitigation of visual impacts typically involves planting vegetation to visually integrate the development into the landscape or to filter it from view. This can be achieved by either planting directly adjacent to the development or planting along roadsides and other visually impacted locations with a clear line of sight to the project. Occasionally, there may be a conflict whereby the planting of vegetation not only mitigates the visual impact of the new development but also blocks views to other landscape features that may be valued for their visual qualities. Impact mitigation options should therefore be carefully considered so that such conflicts would be avoided as far as practicable. Other impact mitigation options include changes to the design of the structures to assist with visual integration into the surrounding landscape.

5.4.2. Impact mitigation requirements for the project

The only location where the project is predicted to have a high visual impact is the area on the Barrier Highway coinciding with Viewpoint 4 (Barrier Highway #4), approximately 770 metres to the north east of the solar PV plant site, where the PV plant would affect views south west toward ‘The Pinnacles’. The planting of locally indigenous, shrubby vegetation along the north eastern and part of the north western boundary of the solar PV plant site would reduce this adverse impact by a considerable amount while also preserving the visual amenity of ‘The Pinnacles’. Planting along these site boundaries would also reduce the impact experienced from viewpoints 17, 18 and 19 on Silverton Road and Magazine Way.

Visual impact mitigation is not required along the other boundaries of the solar PV plant site or for the proposed transmission line.

5.4.3. Proposed impact mitigation measures

The proposed measures to mitigate the visual impacts of the project are as follows:

- Plantings of locally indigenous, shrubby vegetation along the north eastern and part of the north western boundary of the solar PV plant site would be used to mitigate the visual impacts

predicted to be experienced along the Barrier Highway, Silverton Road and Magazine Way. For the proposed plantings, care would be taken to select species that would not block views of 'The Pinnacles'.

- Access tracks would be constructed from locally sourced gravel that matches the colour of the existing site surface as far as practicable.
- The colour of above-ground ancillary electrical equipment associated with the solar PV plant would be selected to best integrate with the surrounding landscape, with preference given to earthy tones such as pale green and pale brown.
- Underground cabling would be used where possible.
- Any glare impacts at specific locations along the Barrier Highway would be ameliorated through roadside planting.
- Vegetation removal would be avoided as far as practicable during construction. Any native vegetation near the outside edge of the PV project site boundary would be cordoned off to minimise the risk of accidental disturbance.
- Vehicles would remain on designated paths during construction to avoid degradation of the landscape.
- Construction equipment and infrastructure would be demobilised from site as soon as practicable and all unnecessary project flagging and signage would be removed and disposed of at the completion of construction.

Residual impact after the implementation of mitigation measures will be minimal.

6. Noise

This chapter summarises the key findings of the *Noise and Vibration Assessment* undertaken for the project. The *Noise and Vibration Assessment* report is attached as **Appendix D**.

The Director-General's Requirements

The Environmental Assessment must:

- *Include a comprehensive noise assessment of all phases and components of the project including, but not limited to construction noise (focusing on high noise-generating activities and any works proposed outside of standard construction hours), traffic noise during construction and operation, and vibration generating activities (including blasting) during construction and/ or operation. The assessment must identify noise/vibration sensitive locations, baseline conditions based on monitoring results, the levels and character of noise (e.g. tonality, impulsiveness etc.) generated by noise sources, noise/vibration criteria, modelling assumptions and worst case and representative noise/vibration impacts.*
- *Include monitoring to ensure that there is adequate background noise data that is representative for all sensitive receptors.*
- *Provide justification for the nominated average background noise level used in the assessment process, considering any significant difference between daytime and night time background noise levels if there are noise generating activities at night.*
- *Clearly outline the noise mitigation, monitoring and management measures that would be applied to the project. This must include an assessment of the feasibility, effectiveness and reliability of proposed measures and any residual impacts after these measures have been incorporated.*

The assessment must be undertaken consistent with the following guidelines:

- *Substation – NSW Industrial Noise Policy (EPA, 2000).*
- *Site Establishment and Construction - Interim Construction Noise Guidelines (DECC, 2009).*
- *Traffic Noise - Environmental Criteria for Road Traffic Noise (NSW EPA, 1999).*
- *Vibration - Assessing Vibration: A Technical Guideline (DECC, 2006).*

The following stakeholder comments have been addressed in the preparation of this chapter:

Issues raised	Chapter location
Roads and Maritime Services (formerly Roads and Traffic Authority)	
Assessment of traffic noise and dust effects.	Section 6.3
Department of Primary Industries (formerly Land and Property Management Authority)	
Noise and vibration issues, including maximum noise travel vs. direction plot, and impacts on residents/ neighbours during transportation of the SPPP components through Broken Hill.	Sections 6.2, 6.3

6.1. Assessment Methodology

6.1.1. Construction noise

Comments received by relevant stakeholders during the finalisation of the DGRs have been addressed throughout this noise assessment.

Criteria for the assessment and management of construction noise impacts are provided by the DECC (2009) *Interim Construction Noise Guideline* (ICNG), which is administered by the NSW EPA. The ICNG establishes a framework for managing the impacts of construction noise based on the following steps:

- Identifying the types of sensitive land uses that may be affected.
- Identifying the time of day when the proposed construction works would take place.
- Identifying the potential noise impacts on the identified sensitive land uses.
- Selecting and applying feasible and reasonable work practices and measures to minimise noise impacts.

The ICNG recommends that a quantitative noise impact assessment based on a worse case construction scenario be carried out for all major construction projects. The quantitative assessment method involves predicting the construction noise levels that would be experienced at sensitive receiver locations and comparing these with the appropriate noise management levels (NMLs) set out in the ICNG.

The NMLs identified in the ICNG are intended to guide the requirements for noise impact mitigation. That is, where the predicted noise from construction is above the project-specific NMLs, the proponent should apply all feasible and reasonable work practices to minimise noise impacts. The proponent should also inform potentially affected parties of the activities to be carried out, the expected noise impacts and the duration.

The NMLs defined in the ICNG are expressed in terms of levels of exceedance of the rating background level, being the overall single-figure background noise level measured in each relevant assessment period (i.e. during or outside the recommended standard hours for construction work). This then provides the framework for establishing project-specific NMLs based on the measured background noise levels at the relevant sensitive receiver locations.

The existing noise environment for the project site, including the sensitive receiver locations and corresponding background noise levels, are identified in **Section 6.2**, while the predicted construction noise levels are identified in **Section 6.3**. This information has been used to identify the NMLs for construction of the project (refer to **Table 6-1**). Further information on the derivation of these project-specific construction NMLs is provided in the *Noise and Vibration Assessment report* (refer to **Appendix D**).

Likely construction noise levels have been based on the CONCAWE noise attenuation algorithm, and calculated using the equipment shown in **Table 6-5**. Meteorological conditions have been assumed to be adverse, with a Met Class of 6 assigned to the calculations. The calculations do not consider the absorption of noise by local geography, structures or vegetation. In addition, it has been assumed that all equipment described below would be operating at the same time at the nearest point to the receiver. As such these calculations should be seen as possible maximum noise levels, and may not be reached in actuality.

Table 6-1 Project-specific Noise Management Levels for construction noise

Receiver type	Noise Management Level
Residential receivers	40 dB(A)
Industrial receivers	75 dB(A)

The NMLs identified in **Table 6-1** are based on construction being carried out within the standard construction hours recommended by the ICNG. These are as follows:

- Monday to Friday: 7.00am to 6.00pm.
- Saturday 8.00am to 1.00pm.
- No work on Sunday or public holidays.

6.1.2. Operational noise

The EPA (2000) *Industrial Noise Policy* (INP) (2005) provides a framework for deriving project specific noise limits for industrial premises and applies in principle to the operation of the project. However, as the operation of the project would not generate any noise that would be audible at sensitive receivers, identification of operational noise criteria is not required. Further discussion of operational noise is provided in **Section 6.3**.

6.1.3. Road traffic noise

The EPA (1999) *Environmental Criteria for Road Traffic Noise* (ECRTN) contains noise guidelines for assessing and managing the impacts of road traffic noise, including road traffic noise generated by land use development. The specific road traffic noise criteria and guidelines to be applied to different types of development are set out in Tables 1 and 2 of the ECTRN. For the proposed project, the daytime criteria set out in Table 1 of the ECRTN for development type number 7 - *Land use developments with potential to create additional traffic on existing freeways/arterials* - are considered to apply. These criteria are presented in **Table 6-2**.

The majority of traffic movements generated by the project would be during the construction phase. Once the plant is operational, relatively few operational staff would be required and daily traffic movements would be insignificant. For this reason, only the daytime criteria of the ECTRN

are considered to be applicable to the project. A qualitative assessment of road traffic noise impacts has been included in **Section 6.3.**

Table 6-2 Applicable ECTRN noise levels

Development type	Daytime levels (7am-10pm)
Land use developments with potential to create additional traffic on existing freeways/arterials	$L_{Aeq\ (15hour)}$ 60 dB(A)

6.1.4. Vibration

The DECC (2006) guideline *Assessing Vibration - A Technical Guideline* identifies levels of vibration that may cause disturbance to human occupants of buildings. This guideline was used to assess the potential vibration impacts associated with construction and operation of the project. The vibration criteria contained within the guideline are based on the British Standard BS 6472-1992 *Evaluation of human exposure to vibration in buildings* (1-80Hz). The relevant criteria that have been considered in the assessment of the project are summarised in **Table 6-3**.

Table 6-3 Vibration criteria

Building type	Peak particle velocity (mm/s)
Residential	0.2
Workshop (considered to be applicable to industrial areas)	0.8

6.2. Existing Environment

6.2.1. Overview

The existing noise environment on the project site is influenced by the Barrier Highway (located to the north), the Bemax Mineral Separation Plant (located to the east) and the main east west rail corridor (located to the south). Accordingly, heavy vehicle and road train traffic, train and freight services and 24 hour processing activities at Bemax Mineral Separation Plant are the dominant noise sources in the area.

The locations of potential sensitive receivers with respect to noise from the project are shown in **Figure 6-1**. The closest residential receiver is located about 1.3 kilometres from the project site on the Barrier Highway, while the main residential areas of Broken Hill are approximately 3.7 kilometres to the north east of the project site.. A number of light industrial businesses are also located within 1.5 kilometres of the project site and within one kilometre of the proposed alignment of the transmission line.

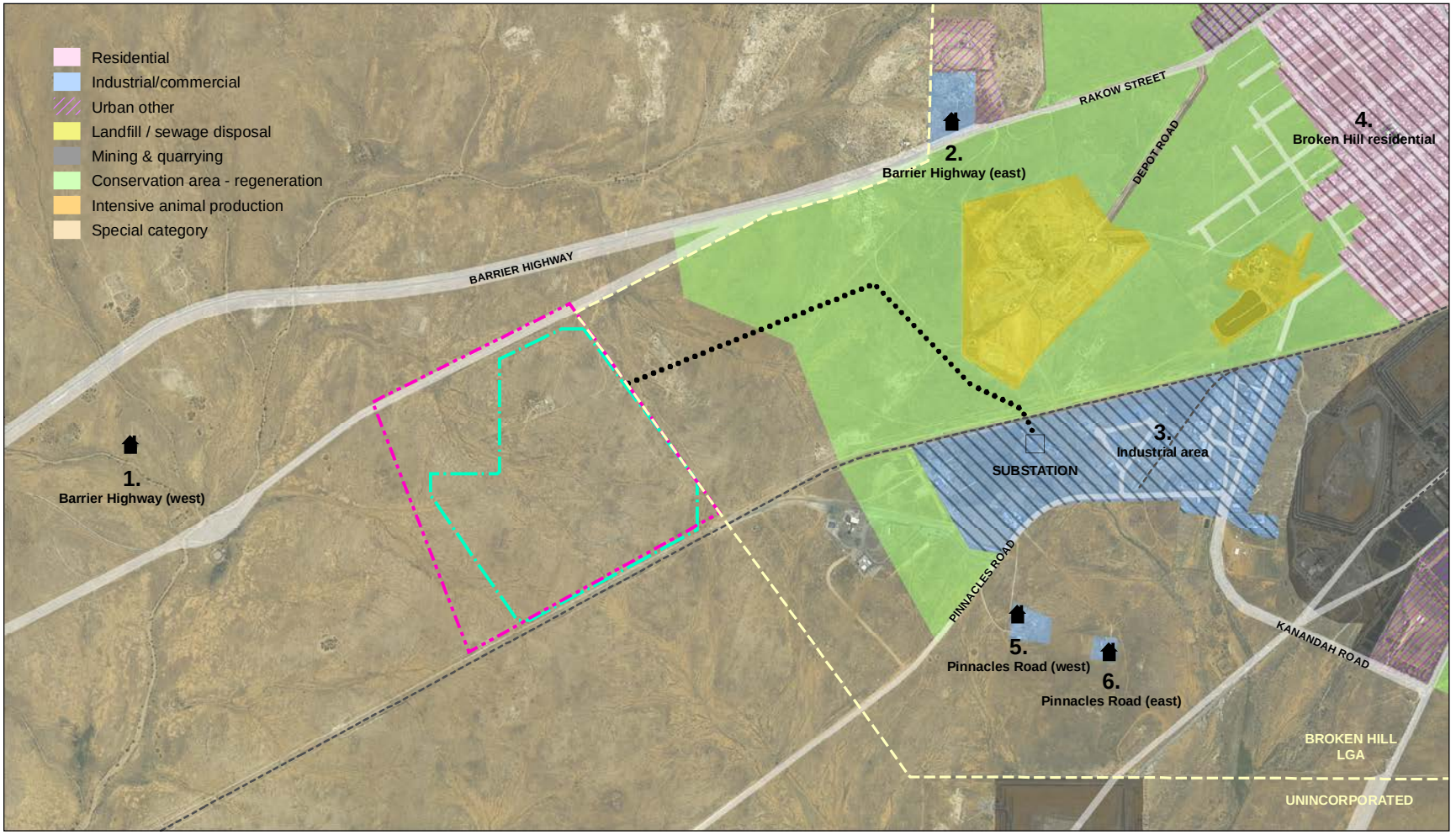


Figure 6-1 Locations of noise sensitive receivers

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Spatial Team - Prepared by : JC
Checked by : JL

6.2.2. Background noise

Monitoring to establish the existing ambient noise environment (or background noise levels) at sensitive receiver locations has been undertaken for the project. Measurements of background noise levels take into account typical daytime and night-time variations in noise levels to provide a representative estimate of the ambient noise environment. Background noise levels are measured prior to proposed development projects going ahead to provide a basis for assessing potential noise impacts and establishing project noise goals.

For the proposed project, background noise monitoring has been conducted at the residential property on the project site occupied by the lessee. Although this property will be vacated prior to the commencement of construction, this receiver is considered representative of other nearby rural residences where potential noise impacts may be experienced. The results of background noise monitoring are provided in **Table 6-4**.

When measuring noise levels, the use of statistical descriptors is necessary to understand and describe how variations in the noise environment occur over any given period. A list of common descriptors, including those used in **Table 6-4**, is as follows:

- L_{A10} – the noise level exceeded for 10% of the 15 minute measurement interval. Commonly referred to as the average-maximum level.
- L_{A90} – the noise level exceeded for 90 percent of the 15 minute measurement interval. Commonly referred to as the background noise level and represents the quietest 90 seconds in a 15 minute period.
- L_{Aeq} – the noise level having the same energy as the time varying noise level over the 15 minute measurement interval.
- Rating Background Level – the overall, single-figure, background level representing each of the day, evening or night assessment periods over the whole monitoring period. It is calculated as the median value of all measurements for each of the day, evening and night-time periods and is the level used for assessment purposes.

Table 6-4 Background noise levels

	L_{A10} dB	L_{Aeq} dB	L_{A90} dB
Day (7am - 6pm)	39.5	39.5	28.8
Evening (6pm - 10pm)	43.9	41.7	31.8
Night (10pm - 7am)	41.0	38.8	29.6

6.3. Potential Impacts

6.3.1. Construction noise

During the construction phase, there would be three main stages from a noise generation perspective. **Table 6-5** lists these stages and identifies the typical noise levels for the various types of plant and equipment that may be required for each stage. Construction of the project would not require blasting.

Construction would be undertaken during standard working hours as defined in the ICNG. Out of hours or night-time work is not expected to be required.

Table 6-5 Construction stages and equipment and associated L_{AeQ} Sound Power Levels

Construction stage	Estimated equipment list	Typical Sound Power Level (L_{Aeq} dB(A))
Stage 1 – Clearing and grubbing	Tree Mulcher Tracked Excavator with claw Dozer D8 Dump Truck	115 104 108 108
Stage 2 – Deliveries and assembly	Dump Truck Truck mounted crane Ratchet Gun (Air) Tracked Excavator Bored Piling Rig	108 105 101 104 104
Stage 3 – Connection / transmission lines	Dump Truck Truck Mounted Crane Ratchet Gun (Air) Bored Piling Rig	108 105 101 104

The information presented in **Table 6-5** has been used to predict the likely impacts of construction noise on identified receivers. The construction noise levels predicted to be experienced at the identified receiver locations are presented in **Table 6-6**. This indicates that the noise levels at all receivers during all three stages of construction would comply with the project-specific NMLs derived from the ICNG (refer to **Table 6-1**).

Table 6-6 Predicted construction noise level at closest receiver

Location ID	Construction noise criteria L_{Aeq} dB(A)	Predicted noise level - dB(A) L_{Aeq}		
		Stage 1 – Clearing	Stage 2 - Assembly	Stage 3 – Transmission line
1. Barrier Hwy (West)	40	39	34	22
2. Barrier Hwy (East)	40	29	26	37
3. Industrial Area	75	40	35	48
4. Broken Hill Residential	40	21	17	28
5. Pinnacles Road (East)	40	30	26	34

Location ID	Construction noise criteria L_{Aeq} dB(A)	Predicted noise level - dB(A) L_{Aeq}		
		Stage 1 – Clearing	Stage 2 - Assembly	Stage 3 – Transmission line
6. Pinnacles Road (West)	40	34	29	37

6.3.2. Operational noise

The proposed solar PV panels at the site would be a fixed tilt system and are thus a non-tracking system with no ongoing sources of mechanical noise from drive systems.

Low levels of noise may be generated by maintenance activities, which would be carried out on an 'as needed' basis. The exact nature and extent of these maintenance activities is not known at this stage, however they are anticipated to comprise minor, non-intrusive works with low levels of noise emission.

The site would require the operation of transformers. Noise levels for these units have been calculated in accordance with AS/NZS 60076.10.2009 Power Transformers Part 10 Determination of Sound Levels. These noise levels at the nearest receivers have been included in **Table 6-7** below.

Table 6-7 Predicted operational noise levels

Location ID	Noise Criteria LAeq dB(A)	Distance (m)	Predicted noise level dB(A)
1. Barrier Hwy (West)	30	1,300	14
2. Barrier Hwy (East)	30	2,300	9
3. Industrial Area	30	1,200	14
4. Broken Hill Residential	30	3,700	5
5. Pinnacles Road (East)	30	2,250	9
6. Pinnacles Road (West)	30	1,800	11

These predictions represent a conservative indication of noise impacts that may be associated with transformer noise. The results of these calculations show that transformers are expected to be inaudible at all sensitive receiver locations.

6.3.3. Road traffic noise

Traffic noise generated during construction would be limited to movements during standard construction hours. As described in Chapter 9, there are approximately 3,700 traffic movements along Barrier Highway per day. The following daily traffic movements have been calculated as a likely maximum for the entire construction period and are based on traffic data contained in **Table 9-1.**

- Heavy vehicles: 32 per day
- Light vehicles: 100 per day

Construction traffic noise is predicted to be in the order of 28dB(A) at the nearest sensitive receiver. This noise level complies with the construction noise criteria of 40dB(A). Where construction noise approaches the project criteria, traffic noise at this level would not contribute to cumulative noise levels.

Road traffic associated with operation of the project would be limited to vehicles required for maintenance activities. It is anticipated that there would be a maximum of four vehicle movements per day during maintenance periods. Given the daily traffic volumes on the Barrier Highway, this additional traffic would not result in any perceptible change in existing road traffic noise levels.

6.3.4. Vibration

Considering the distance between the nearest residential receiver it has been determined that there would be no vibration impacts associated with construction of the project. Similarly, there would be no vibration related impacts associated with operation of the project given the separation between potential sources of vibration and the nearest residences. Any vibration generated during operation of the project would be negligible.

6.4. Impact Mitigation and Management Measures

As described in **Section 6.3**, the project is not expected to result in any significant noise or vibration impacts that would trigger the need for noise or vibration mitigation, i.e. they are likely to comply with criteria, even where mitigation measures are not adopted. Therefore the residual noise and vibration impacts are considered low. Notwithstanding this, the following management measures would be implemented.

6.4.1. Construction

- Construction noise and vibration would be minimised as far as practical through the implementation of all feasible and reasonable measures. These measures would be confirmed during detailed design and specified within a Construction Noise and Vibration Management Plan (CNVMP). The CNVMP would also include project-specific objectives and protocols for management of construction noise.
- Construction activities would take place during standard working hours (7.00am to 6.00pm Monday to Friday, 8.00am to 1.00pm Saturday and no work on Sunday or public holidays). Any work outside of theses hours would be undertaken in accordance with the ICNG. The CNVMP will specify approval and notification requirements for out-of-hours work.

- Where feasible and reasonable, restrictions may be placed on the timing of noisy construction activities. These restrictions may include requirements for respite periods and/or the scheduling of noisy activities in consultation with sensitive receivers.
- Construction plant, equipment and methodologies would be selected in consideration of the need to minimise noise levels where feasible and reasonable.

Residual impact after the implementation of mitigation measures will be minimal.

6.4.2. Operation

Operation of the project is not anticipated to result in any significant noise impacts. As such, there is no requirement to identify specific noise impact mitigation measures for the operational phase of the project. Operation of the project would be carried out in accordance with AGL's existing environmental policies and procedures.