



STATEMENT OF ENVIRONMENTAL EFFECTS

Establishment of Solar PV Power Generation Plant

211 Vine Lane, Boggabri NSW 2382

PREPARED FOR PROVIDENCE ASSET GROUP | DECEMBER 2020



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As of October 2nd 2020, **KDC has joined the SLR Consulting team**. To learn more about SLR, and the additional expertise that we can now provide our clients, [take a read here >](#)

1 INTRODUCTION

This Statement of Environmental Effects (SEE) is submitted to Narrabri Shire Council (Council) in support of a Development Application (DA) for a solar photovoltaic (PV) power generation plant at 211 Vine Lane, Boggabri NSW 2382 (the site).

Specifically, the proposed development includes:

- + Establishment of a grid-connected solar photovoltaic (PV) plant including associated electrical generation, supplying no greater than 5 megawatts (MW);
- + New 3-5.5m wide access road at the eastern boundary of the site;
- + High chain link security fencing 2.3m high; and
- + Other associated site improvements as shown on the Plans at Appendix A.

This SEE has been prepared by KDC Pty Ltd (KDC) on behalf of Providence Asset Group (PAG). It describes the site, its environs, the proposed development and provides an assessment of the proposal in terms of the matters for consideration under Section 4.15 (1) of the Environmental Planning and Assessment Act 1979 (EP&A Act 1979). It should be read in conjunction with the supporting information and Plans prepared by Balance Power and Energy Pty Ltd appended to this report (Appendix A).

1.1 PROVIDENCE ASSET GROUP

Providence Asset Group (PAG) is an Australian innovation led investment and asset management firm focusing on ethical investment within an environmental, social and corporate governance framework. Through collaborative partnerships, PAG supports and invests in projects aligned to new forms of renewable and clean energy.

PAG have now secured over 30 solar farm sites in regional NSW and Victoria, including a partnership with Manilla Community Renewable Energy Inc. to develop Australia's first community owned solar farm. Once constructed the 5MW Manilla project will be able to power the community of Manilla during daylight hours. The project is also a recipient of a NSW Government grant to develop PAG's a world first energy storage technology which will enable PAG's solar projects to provide stable energy well into the early morning and evening peak electricity consumption periods.

1.2 CONSULTATION WITH COUNCIL

Pre-development advice was provided by Narrabri Shire Council representative Erika Dawson via email on 23 November 2020. Overall, the feedback was positive. Table 1 summarises the matters raised by Council within the pre-lodgement advice email and provides comments on each of the matters raised.

Table 1 – Consultation with Narrabri Shire Council

Matters Raised	Comments
DA Plans The following plans are to be submitted with the DA: + An existing site plan; + A proposed site plan; + A floor plan (of any buildings and structures); + Elevation Plans (of any buildings and structures).	The appropriate plans have been included with this report, see Appendix A.
Statement of Environmental Effects	This Statement of Environmental Effects provides a detailed description of the proposal during both the

Matters Raised	Comments
A SEE is to be provided with the DA that: + Provides a clear and detailed description of the entire development proposed, and is to include: + Details of all construction related works employee numbers, traffic generated, water requirements; + Details of all operations, including details on maintenance requirements, vegetation management, employee numbers, traffic generated, water requirements; + Any road or other infrastructure upgrade requirements; + Details of remediation of the site post use as a solar farm. + An outline of the grid connection + Consideration of the applicable Environmental Planning Instruments, DCPs and other applicable legislation. In partial: - SEPP 55; - Koala Habitat Protection SEPP; - Infrastructure SEPP; - Narrabri LEP, including Earthworks (Clause 6.1), and Essential Services (clause 6.5) + Identification of the environmental impacts + Measures taken to protect the environment or to lessen the expected harm.	construction and operational stages. All required legislation is identified within this report. All identified environmental impacts have been addressed.
Traffic A Traffic Impact Assessment should be included with the DA, prepared by a suitably qualified consultant in accordance with Austroads Guide to Traffic Management Part 12 Integrated Transport Assessments for Developments. The assessment is to: + Provide an assessment of the existing conditions of the local traffic networks to be affected by both construction and operation of the development; + Outline the traffic generated by the development including for both construction and operation. This will include transport routes for deliveries, peak hour traffic generated, the size of vehicles required to access the site. + Consideration of transport impacts to the development including: - Impact of development traffic on capacity of local road network and functioning of utilised intersections;	A Traffic Impact Assessment (TIA) has been prepared for the proposal and is located at Appendix D. Within the TIA is an assessment of pre-existing conditions of the roads, traffic generation, vehicle access points, manoeuvring and identification of any road upgrade work required.

Matters Raised	Comments
- Demonstration, via provision of swept paths, that the largest vehicle to enter the site will be able to manoeuvre through all intersections - Identification of any road upgrade works required to facilitate the development.	
Biodiversity Impact Advice is to be provided by an ecologist to demonstrate: - Whether the development is likely to significantly affect threatened species or ecological communities, or their habitats, according to the test in section 7.3 of the biodiversity Conservation Act 2016; - Whether the development exceeds the biodiversity offsets scheme threshold; - A Biodiversity Development Assessment Report (BDAR) is to provided if any of the above responses is affirmative.	A Flora and Fauna Assessment Report has been prepared for this application, which identifies and assesses the potential impacts of the development and outlines mitigation measures. The Flora and Fauna report is located at Appendix H.
Koala SEPP 2019 Information is to be prepared by a suitably qualified and experienced ecologist in accordance with the Guideline, to demonstrate that the land subject of the development application: - Does not include any trees belonging to the koala use trees species listed in Schedule 2 for the relevant koala management area, or - Is not core koala habitat Information, prepared in accordance with the Guideline to demonstrate the land: - Does not include any trees with a diameter at breast height over bark of more than 10cm or - Includes only horticultural or agricultural plantations.	Consideration has been made of the requirements of the Koala SEPP 2019. Refer to Section 4.9 of the SEE which address the proposal against the Koala SEPP 2019 and the Flora and Fauna Assessment at Appendix H.
Glare A Glare Analysis prepared by a suitably experiences consultant to consider potential glare impacts from the development on residential receptors and other potentially affected receptors	A Reflectivity Report has also been conducted for the application and is located at Appendix E.
Visual Impact A Visual Impact Assessment prepared by a suitably qualified consultant to consider potential visual impacts from the development on residential receptors and other potentially affected receptors.	A Visual Impact Assessment has been prepared for the proposal and is located at Appendix E.
Watercourse	There are no mapped waterways within 40m of the site. This is discussed further in Section 4.3 Water Management Act.

Matters Raised	Comments
The site contains a number of watercourses. It was discussed that it they be clearly shown on the site plans. Any works within 40m on the top of the bank of the watercourse (i.e. waterfront land) will require a referral to the Natural Resources Access Regulator, as integrated development. Full details of any works within waterfront land will be required as part of the DA.	
Staff Amenities If any staff amenities are proposed as part of the development, a waste water treatment report will be required to be submitted with the DA, along with details on the site plan of the location of the effluent management system and land application area.	Temporary construction staff amenities will be provided on site. No permanent staff amenities are proposed given the nature of the ongoing operation.

2 THE SITE AND SURROUNDS

2.1 SITE DESCRIPTION

The land is legally known as part Lot 151 DP755475 and is generally referred to as 211 Vine Lane, Boggabri, NSW 2382 (refer to Figure 1). The land is currently used for agricultural purposes including livestock grazing with historical improved pastures and cultivation. In terms of topography, the site is relatively flat with a gradual slope from northwest to southeast.

The site area is primarily flat agricultural lands with scattered vegetation. The eastern border of the entire site area includes the Werris Creek-Mungindi Railway Reserve and extends to approximately 56.88 hectares. Running east-west through the proposed development site is an unnamed waterway, which is examined further in Sections 4.3.

The proposed development site is a 7-sided polygon shape which is generally flat and comprises approximately 13.5 hectares. The development site is located in the northern section of Lot 151 DP755475, holding a frontage of approximately 400 metres to Vine Lane. Access to the site is via Vine Lane, which is a dirt road that connects the site to the Boggabri township to the south and the state classified road Kamilaroi Highway.

As noted within the provided Certificate of Title for Lot 151 DP755475, there are no easements and restrictions which are applicable to the site. An investigation of the obtained Deposited Plan (DP) for Lot 151 DP755475 shows no specific easement located within the nominated development area. Based on the above, the location of the solar PV farm is clear of registered easements and/or restrictions on the land.

Figure 1 – Locality Plan (Source: Six Maps)

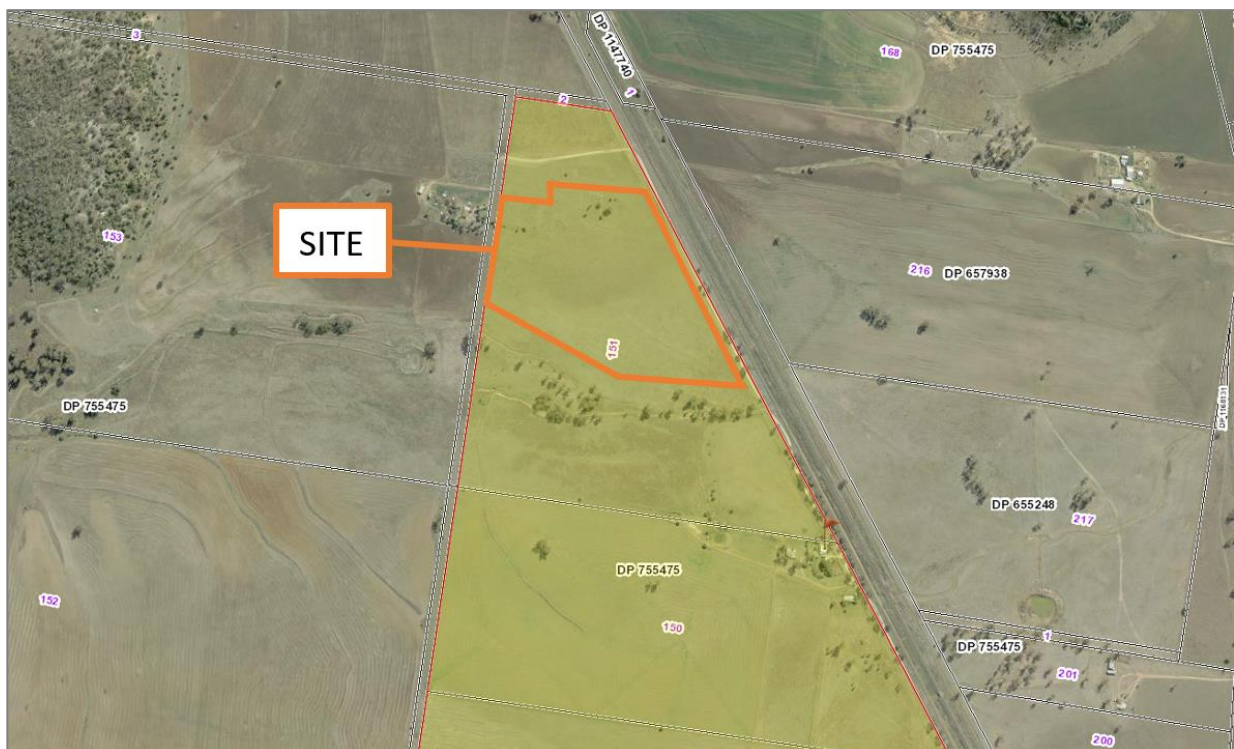
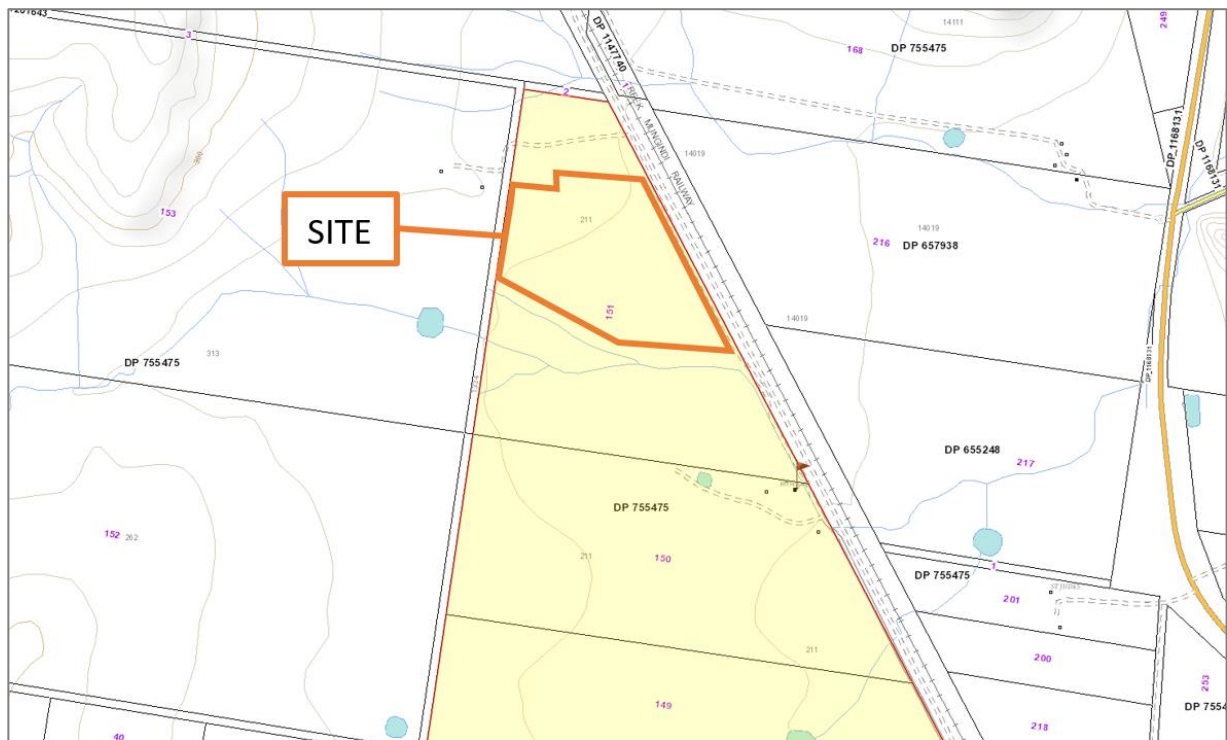


Figure 2 – Cadastral Plan (Source: Six Maps)



2.2 SITE LOCATION AND CONTEXT

The site is located approximately 3.2km north of the Boggabri town centre within the Narrabri Shire Council Local Government Area (LGA). Vine Lane is a single lane, unsealed road, which commences at the north of the Boggabri township and has no kerb or guttering on either side.

Surrounding lands are similar to the proposed site area consisting of agricultural land with rural dwellings, sheds, dams, and scattered remnant vegetation. There is an unnamed watercourse running through the site east to west, immediately south of the development area. The closest residential dwellings to the proposed development site are to the south of the site on Lot 150 DP755475 and west on Lot 153 DP755475.

3 PROJECT DESCRIPTION

The Boggabri Solar Farm project is one of PAG's solar initiatives to be rolled out across regional Australia, with multiple benefits for rural and regional communities.

The proposal includes a no larger than 5MW grid-connected solar PV installation. The solar farm will be connected to Essential Energy's network via an 11 kV distribution line running adjacent to the eastern boundary of the site. It is noted that a separate application process is being undertaken with Essential Energy for this connection.

The proposed development aims to erect an estimated 11,648 solar PV panels with a nameplate rating of 540W. Other electrical generation infrastructure is proposed on the site including a skid-mounted MV Power Station consisting of inverters, transformer and switchgear. Due to the capacity of the inverter system, the proposed development will produce less than 5MW. Most of the infrastructure would be pre-fabricated off-site, delivered and assembled on-site.

The PV arrangement will consist of 153 ground mounted single axis trackers. The PV arrays will have a clearance above the existing ground surface and extend to approximately 2.6m at maximum tilt. The PV mounting structure would comprise steel posts driven to approximately 1.5m below ground using a small pile driver. Additional support structures will be attached to the piles, which would then support the PV panels.

The proposed development will not require the entire removal of vegetation within the development area, it is noted that the site has already been cleared for agricultural purposes in the past. The proposal will not involve clearing of native vegetation that exceeds the Biodiversity Offset Scheme (BOS) threshold for the site. The proposal will result in the removal of 0.54 hectares of native groundcover however, most of the grasslands will be retained.

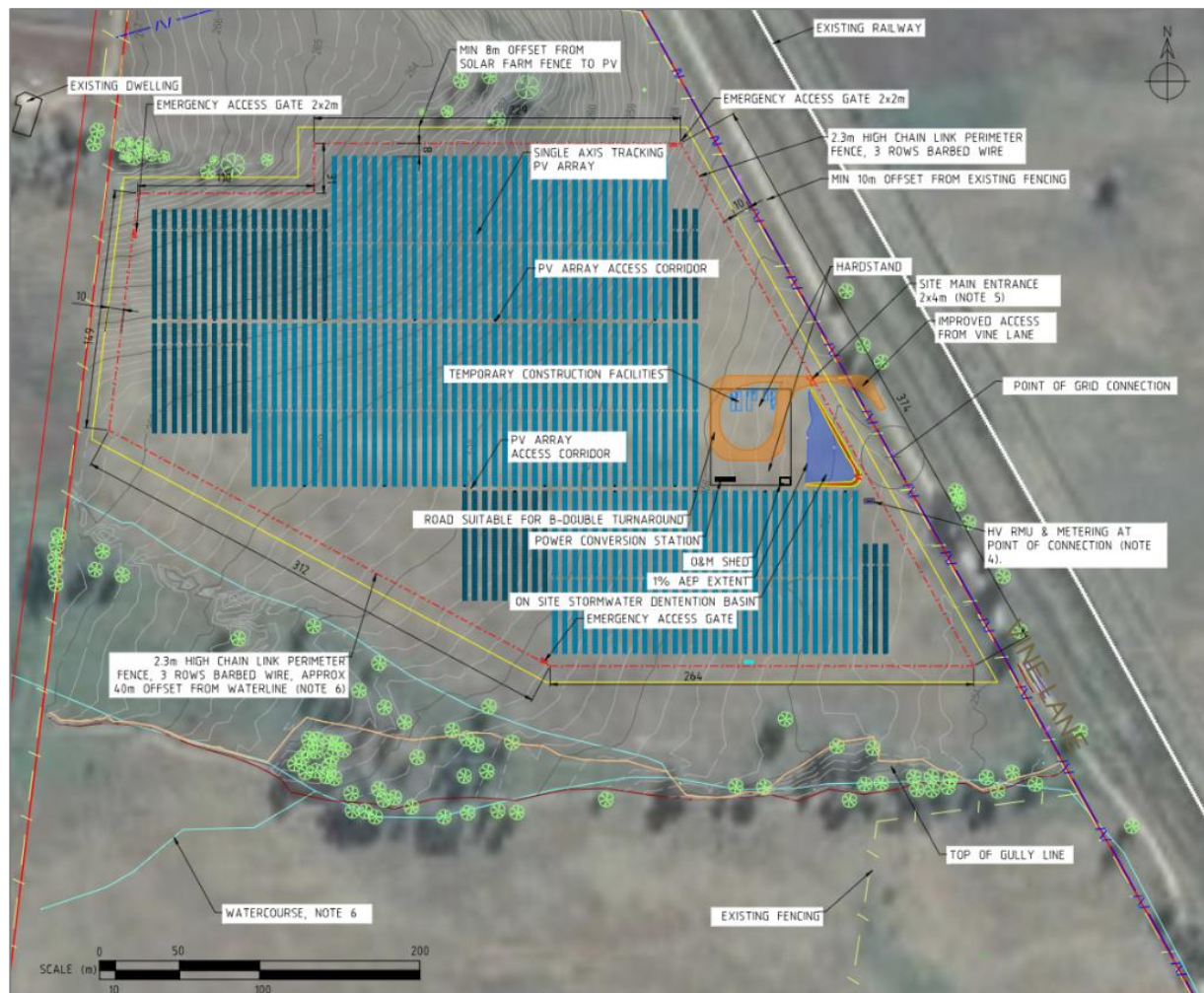
A 5m wide access road is proposed connecting the solar farm off Vine Lane at the south eastern corner of the lot. The solar farm will be fully fenced with a 2.3m security fencing including barbed wire at the top. Gate access is provided on the eastern border of the site. A car park area, off load area and temporary construction office are indicatively shown on the General Arrangement Plan (refer to Figure 3). Motion activated security lighting may be installed at the site.

A stormwater management system is proposed including an onsite detention basin holding a total volume of 150m³ supported with a low flow outlet. Refer to the Stormwater Management Plans at Appendix B. Earthworks for the project are generally limited to the establishment of the access road, drainage swales and batters, laydown area, and detention basin.

The solar PV farm would operate 24 hours a day, 7 days a week, with no permanent staff on site. Maintenance inspections will be undertaken daily or on an as needs basis.

During the construction period there is estimated to be up to 30 personnel on site for up to 6 months.

Figure 3 – Proposed Development Layout



4 RELEVANT LEGISLATION AND PLANNING CONTROLS

The following Environmental Planning Instruments (EPIs) and Development Control Plans (DCPs) are relevant to the proposed development as explored within this Section of the report:

- + Environment Protection and Biodiversity Conservation Act 1999;
- + Environmental Planning and Assessment Act 1979;
- + Water Management Act 2000;
- + National Parks and Wildlife Act 1974;
- + Biodiversity Conservation Act 2016;
- + State Environmental Planning Policy (Infrastructure) 2007;
- + State Environmental Planning Policy (Koala Habitat Protection) 2019;
- + State Environmental Planning Policy (State and Regional Development) 2011;
- + State Environmental Planning Policy 55 – Remediation of Land;
- + Narrabri Local Environmental Plan 2012;
- + Narrabri Development Control Plan 1993;
- + New England North West Regional Plan 2036;
- + New England North West Strategic Land Use Plan 2012; and
- + Local Land Services Act 2013.

4.1 ENVIRONMENTAL PROTECTION AND BIODIVERSITY CONSERVATION ACT 1999

Consideration of the EPBC Act 1999 revealed that impacts on Matters of National Environmental Significance (MNES) are unlikely to occur. No EPBC listed species, ecological communities, migratory species or important habitat for such entities was identified within the subject site. The assessment determined that impacts to Matters of National Environmental Significance (MNES) are unlikely; therefore, an EPBC referral to the Commonwealth Minister for the Environment is not recommended.

Full details are included in the Flora and Fauna Assessment Report at Appendix H.

4.2 ENVIRONMENTAL PLANNING AND ASSESSMENT ACT 1979

The proposal, as with all development applications, is subject to the provisions of the Environmental Planning and Assessment Act 1979 (EP&A Act). Section 4.15(1) of the EP&A Act, 1979 provides criteria which a consent authority is to take into consideration, where relevant, when considering a DA. An assessment of the subject DA, in accordance with the relevant matters prescribed under Section 4.15(1), is provided within this SEE.

4.3 WATER MANAGEMENT ACT 2000

Under this Act, waterfront land includes the bed and bank of any river, lake or estuary and all land within 40m of the highest bank of the river, lake or estuary (NRAR, 2018). Mapped waterways pass through the southern portion of the

study area in an eastern direction. The proposed site layout has been designed to avoid the mapped waterways, which are between 46m and 67m from the southern edge of the development footprint.

4.4 NATIONAL PARK AND WILDLIFE ACT 1974

The National Parks and Wildlife Act 1974 includes provisions for the protection and recording of Aboriginal objects in NSW.

An Aboriginal site investigation has been undertaken in accordance with the provisions of the National Parks and Wildlife Regulations 2009 and the accompanying Due Diligence Code of Practice for the Protection of Aboriginal Objects in NSW (OEH 2010). See Appendix F for a copy of the Due Diligence Report for the proposal prepared by Virtus Heritage.

4.5 BIODIVERSITY CONSERVATION ACT

The Biodiversity Conservation Act 2016 (BC Act 2016) aims to maintain a healthy, productive and resilient environment for the greatest well-being of the community, now and into the future, consistent with the principles of ecologically sustainable development. To achieve its goals, the BC Act 2016 governs endangered species and communities and provides a framework for a Biodiversity Offset Scheme.

An assessment was undertaken by Kleinfelder in accordance with Section 7.3 of the BC Act 2016 to determine the significance of potential impacts of the proposed development on any threatened species or communities which are listed within the Act.

No threatened ecological communities or any listed flora or fauna were identified on site with the proposed development unlikely to cause any significant impact to any threatened species, populations or communities listed within the BC Act. Entry into the NSW BOS is not triggered by the proposed development. Further details are provided in Section 5.4 of this Report.

4.6 STATE ENVIRONMENTAL PLANNING POLICY (STATE AND REGIONAL DEVELOPMENT) 2011

Regional development classification applies to both local and designated development applications exceeding certain criteria defined by Schedule 7 of the SEPP SRD.

5 Private infrastructure and community facilities over \$5 million

Development that has a capital investment value of more than \$5 million for any of the following purposes:

*(a) air transport facilities, **electricity generating works**, port facilities, rail infrastructure facilities, road infrastructure facilities, sewerage systems, telecommunications facilities, waste or resource management facilities, water supply systems, or wharf or boating facilities,*

(b) affordable housing, child care centres, community facilities, correctional centres, educational establishments, group homes, health services facilities or places of public worship.

The proposed electricity generating works is considered to be private infrastructure with a CIV greater than \$5 million and as a result the development is deemed to be regionally significant development and the application will be referred to the Regional Planning Panel (RPP) for determination.

4.7 STATE ENVIRONMENTAL PLANNING POLICY (INFRASTRUCTURE) 2007

Division 4 Electricity generating works or solar energy systems

One of the aims of SEPP (Infrastructure) 2007 is to provide greater flexibility in the location of infrastructure and service facilities. This SEPP identifies certain electricity generating works that are permitted with consent, without consent, as exempt development, as complying development and works that are prohibited.

In this Division—

electricity generating works has the same meaning as it has in the Standard Instrument.

Note—

The term electricity generating works is defined by the Standard Instrument as follows—

electricity generating works means a building or place used for the purpose of—

- (a) making or generating electricity, or
- (b) electricity storage.

Clause 34 Development permitted with consent

(1) Development for the purpose of **electricity generating works** may be carried out by any person with consent on the following land—

- (a) in the case of electricity generating works comprising a building or place used for the purpose of making or generating electricity using waves, tides or aquatic thermal as the relevant fuel source—on any land,
- (b) in any other case—any land in a prescribed rural, industrial or special use zone.

Definition:

prescribed rural, industrial or special use zone means any of the following land use zones or a land use zone that is equivalent to any of those zones—

- (a) RU1 Primary Production,
- (b) RU2 Rural Landscape,
- (c) RU3 Forestry,
- (d) RU4 Primary Production Small Lots,
- (e) IN1 General Industrial,
- (f) IN2 Light Industrial,
- (g) IN3 Heavy Industrial,
- (h) IN4 Working Waterfront,
- (i) SP1 Special Activities,
- (j) SP2 Infrastructure.

The Development Area is zoned RU1 Primary Production, the proposed solar PV project is therefore permitted with consent under Clause 34 of SEPP (Infrastructure) 2007.

Clause 45 Determination of development applications—other development

The proposed development will require works to connect to the overhead electricity power lines and as a result constitutes works within 5m of powerlines. Due to the location and nature of the proposed development referral to the electricity supply authority, Essential Energy, will be required during the assessment period.

Clause 104 - Traffic-generating development

The proposed development will not generate greater than 50 vehicle movements per hour and as such does not trigger traffic generating development under the SEPP. Referral under this clause to Transport for NSW is therefore not required.

4.8 STATE ENVIRONMENTAL PLANNING POLICY NO 55 REMEDiation OF LAND

This SEPP requires the consent authority to consider the potential contamination status of the land prior to approving a development.

A search of the NSW EPA's '*List of NSW contaminated sites notified to the EPA*' and '*POEO Public Register*' has been undertaken which revealed no contaminated sites listed on or in the vicinity of the site. A total of 9 licences have been issued under the Protection of the Environment Operations Act in Boggabri, however, none are noted within proximity to the site. Environmental protection licences issued within Boggabri include:

- + Licence 12407 – Boggabri Coal Operations Pty Ltd – 386 Leard Forest Road, Boggabri – Operational;
- + Licence 20404 – Boggabri Coal Operations Pty Ltd – Goonbri Road, Boggabri– Surrendered;
- + License 5112 – Coal & Allied Industries Limited – Maules Creek Coal Lease No. 375, Boggabri – Surrendered;
- + Licence 21116 – HMS Australia Operations Pty Ltd – 1216 Braymont Road, Boggabri – Operational;
- + Licence 20221 – Maules Creek Coal Pty Ltd – Therribri Road, Boggabri – Operational;
- + License 10852 – Namoi Cotton Limited – Blairmore Road, Boggabri – Operational;
- + License 12365 – Tarrawonga Coal Pty Ltd – 469 Goonbri Road, Boggabri – Operational
- + License 21283 – Vickery Coal Pty Ltd – Blue Vale Road, Boggabri – Operational
- + License 10094 – Whitehaven Coal mining Limited – Hoad Lane, Boggabri – Surrendered

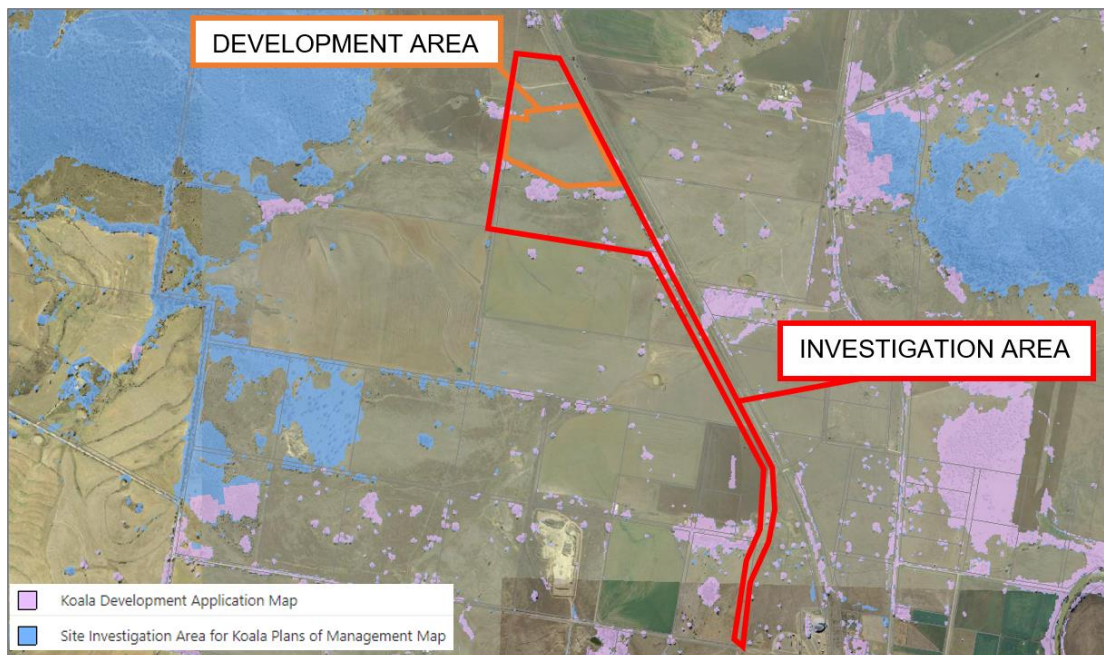
The proposed development is not considered to be sensitive in nature and as a result is considered to be appropriate for the site in its current state in accordance with SEPP55.

4.9 STATE ENVIRONMENTAL PLANNING POLICY (KOALA HABITAT PROTECTION) 2019

The State Environmental Planning Policy (Koala Habitat Protection) 2019 (Koala SEPP) aims to encourage the conservation and management of areas of natural vegetation that provide habitat to koalas to support a permanent free-living population over their present range and reverse the current trend of koala population decline.

The Development Area is partly identified as a Koala Development Application Map area and a site investigation area for Koala Plans of Management, refer to Figure 4. The Flora and Fauna Assessment (located at Appendix H) found no resident population of koalas in the area and no koala feed trees within the subject site. Further discussion can be found in the Flora and Fauna Assessment Report located at Appendix H.

Figure 4 – Koala Habitat Mapping (Source: <https://webmap.environment.nsw.gov.au>)



4.10 NARRABRI LOCAL ENVIRONMENTAL PLAN 2012

The Development Area is zoned RU1 Primary Production under the Narrabri Local Environmental Plan 2012 (LEP 2012), see Figure 5.

Figure 5 – Land Zone Extract Narrabri LEP 2012 (LZN_004)



Zone RU1 Primary Production

1 Objectives of zone

- + *To encourage sustainable primary industry production by maintaining and enhancing the natural resource base.*
- + *To encourage diversity in primary industry enterprises and systems appropriate for the area.*
- + *To minimise the fragmentation and alienation of resource lands.*
- + *To minimise conflict between land uses within this zone and land uses within adjoining zones.*
- + *To allow for non-agricultural land uses that will not restrict the use of other land for agricultural purposes.*

2 Permitted without consent

Building identification signs; Environmental protection works; Extensive agriculture; Farm buildings; Forestry; Home occupations; Intensive plant agriculture; Roads

3 Permitted with consent

Air transport facilities; Airstrips; Animal boarding or training establishments; Aquaculture; Bed and breakfast accommodation; Boat launching ramps; Boat sheds; Camping grounds; Cellar door premises; Cemeteries; Community facilities; Depots; Dual occupancies; Dwelling houses; Environmental facilities; Extractive industries; Farm stay accommodation; Flood mitigation works; Freight transport facilities; Helipads; Home businesses; Home industries; Information and education facilities; Intensive livestock agriculture; Landscaping material supplies; Open cut mining; Plant nurseries; Recreation areas; Recreation facilities (major); Recreation facilities (outdoor); Research stations; Roadside stalls; Rural industries; Rural workers' dwellings; Signage; Turf farming; Water recreation structures; Water supply systems

4 Prohibited

Any development not specified in item 2 or 3

The proposed land use, defined as *electricity generating works* (see below), is not permitted on the site with consent under the Narrabri LEP2012 the RU1 zone as *any other development not specified in item 2 or 3*. Notwithstanding, the proposal is permissible under Clause 34 of SEPP (Infrastructure) as discussed in Section 4.7.

LEP 2012 Definition:

electricity generating works means a building or place used for the purpose of—

- (a) *making or generating electricity, or*
- (b) *electricity storage.*

The proposed development is consistent with the relevant objectives of the RU1 zone, including that it will provide a sustainable rural land use whilst maintaining and enhancing the existing natural resource base.

Clause 4.1 Minimum Subdivision Lot Size

The minimum lot size for subdivision across the investigation area is 100 hectares. No subdivision is proposed as part of this application.

Clause 4.3 Height of Buildings

This clause has not been adopted under LEP 2012.

Clause 4.4 Floor Space Ratio

This clause has not been adopted under LEP 2012.

Clause 5.10 Heritage Conservation

The investigation area does not contain a listed heritage item nor are any listed heritage items located in proximity to the area. The area is not mapped as a heritage conservation area under the LEP 2012.

Clause 6.1 Earthworks

The objectives of this clause are:

(1) The objective of this clause is to ensure that earthworks for which development consent is required will not have a detrimental impact on environmental functions and processes, neighbouring uses, cultural or heritage items or features of the surrounding land.

The solar panels themselves retain the natural landform and only minor earthworks are required for the underground cabling and supporting infrastructure (access roads, stormwater management etc). The earthworks proposed will have minimal impact on surrounding lands and will be supported with appropriate sediment and erosion controls.

Clause 6.2 Flood Planning

The investigation area is not mapped within a flood prone land area under the LEP 2012. The Planning Certificate for the site does not identify the site as being flood prone.

Clause 6.3 Airspace Operation

The objective of this clause is to provide for the effective and ongoing operation of the Narrabri Airport and to protect the community for undue risk from that operation. Narrabri Airport is approximately 45km north-west of the proposed development site. The Planning Certificate confirms that the site has not been identified as being within the Narrabri Airport Obstacle Limitation Surfaces.

Clause 6.5 Essential Services

Provision of services, including stormwater drainage, and vehicular access suitable for the proposed development will be satisfactory provided for the site.

In summary, the proposal is compliant with the relevant clauses and controls contained within NLEP 2012 with the exception of permissibility, which is overridden by SEPP Infrastructure.

4.11 NARRABRI DEVELOPMENT CONTROL PLAN 1993

The Narrabri Development Control Plan (DCP) 1993 applies to all land within the Narrabri Local Government Area (LGA), including the subject site. The project has been assessed against the *Industrial Development Code* and the *Parking Code* of the DCP 1993.

A full assessment against the relevant components of the DCP is included in table format at Appendix C.

4.12 NEW ENGLAND NORTH WEST REGIONAL PLAN 2036

The New England North West Regional Plan 2036 (the Regional Plan) provides an overall strategic plan to manage development in the New England region.

The Regional Plan distinctly highlights the role of renewable energy in the growth of the New England region with the plan's visions outlining the need for the area to harness the solar and wind potential. *Goal 1 – A strong and dynamic regional economy* identifies renewable energy as a priority growth sector. Direction 5 the Plan further calls for the promotion and growth of the renewable energy sector, specifically the solar sector through supporting and facilitating smaller-scale renewable solar projects.

Furthermore, the Plan outlines the future economic narrative for Narrabri Shire LGA. The Plan states that a priority for the Narrabri LGA is to improve electricity infrastructure to cater for the forecasted population growth. Direction 2.3 of the Regional Plan seeks to increase opportunities for renewable energy generations such as solar, with the Plan identifying 2 solar farms (120MW & 300MW) that were already being developed in Narrabri.

The proposed development on the subject site will align with the goals of the Regional Plan as it will provide an appropriately sized renewable energy project in a location with ready access to the electrical network which will support the regional development of Boggabri and the larger Narrabri LGA and New England Region.

4.13 NEW ENGLAND NORTH WEST STRATEGIC LAND USE PLAN 2012

The New England North West Land Use Strategy aims to guide future development and land use within the New England region for the next 20 years. The preparation of the strategy provides the basis for future planning decisions and provide certainty to the community whilst encouraging favourable development and the protection of the environment.

The New England region has been identified as one of six renewable energy precincts across NSW. Additionally, the Narrabri LGA has been marked to have excellent conditions for solar power farms due to high solar irradiation levels and a suitable average temperature range for photovoltaic systems.

4.14 LOCAL LAND SERVICES ACT 2013

60H Category 1-exempt land mapping

(1) Land is to be designated as category 1-exempt land if the Environment Agency Head reasonably believes that—

- (a) the land was cleared of native vegetation as at 1 January 1990, or*
- (b) the land was lawfully cleared of native vegetation between 1 January 1990 and the commencement of this Part.*

(2) Land is to be designated as category 1-exempt land if the Environment Agency Head reasonably believes that—

- (a) the land contains low conservation value grasslands, or*
- (b) the land contains native vegetation that was identified as regrowth in a property vegetation plan referred to in section 9 (2) (b) of the Native Vegetation Act 2003, or*
- (c) the land is of a kind prescribed by the regulations as category 1-exempt land.*

(3) Land is to be designated as category 1-exempt land if the land is biodiversity certified under Part 8 of the Biodiversity Conservation Act 2016 or under any Act repealed by that Act.

(4) However—

(a) land described in subsection (1) or (2) is not to be designated as category 1-exempt land if section 60I (2) requires the land to be designated as category 2-regulated land, and

(b) land described in subsection (1) (a) is not to be designated as category 1-exempt land if the land was unlawfully cleared of native vegetation after 1 January 1990, and

(c) land described in subsection (2) (a) is not to be designated as category 1-exempt land if the land was unlawfully cleared of native vegetation after 1 January 1990.

(5) The regulations may make provision for the purposes of determining whether grasslands are low conservation value grasslands for the purposes of this Division.

The proposed development area in the subject site of Lot 151 of DP755475 has been under regular cropping, grazing and pasture improvement since prior to 1990. Therefore, in accordance with the Local Land Services Act 2013, the full project development area can be considered as category 1-exempt land.

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5 ASSESSMENT OF PLANNING ISSUES

The following is an assessment of the environmental effects of the proposed development as described in the preceding sections of this SEE. The assessment considers only those matters under Section 4.15(1) of the EP&A Act 1979 that are relevant to the proposal.

5.1 COMPLIANCE WITH PLANNING INSTRUMENTS AND CONTROLS

Unless otherwise stated, the proposed development either complies with or is consistent with all relevant planning instruments and controls set out in Section 4 of this SEE, in that:

- + The proposed development is permissible under SEPP Infrastructure in the RU1 Primary Production zone;
- + The proposed Solar PV Farm is consistent with the relevant objectives of the RU1 zone, including that it will provide a sustainable rural land use whilst maintaining and enhancing the existing natural resource base;
- + The proposed Solar Farm will have minimal impact on any potential listed flora or fauna under the BC Act 2016;
- + The development is classified as Regional Development under SEPP State and Regional Development and will therefore be determined by the RPP;
- + The proposal complies with the requirements of SEPP Infrastructure and referral to the road authority will not be required as the proposal is not classified as traffic generating development; and
- + The proposal is generally consistent with the objectives and relevant controls within Narrabri DCP 1993. A detailed assessment of the proposed development against the relevant provisions of the DCP is provided in the table at Appendix C.

5.2 TRAFFIC, ACCESS AND PARKING

Traffic

A Traffic Impact Assessment (TIA) has been undertaken by Intersect Traffic and is attached at Appendix D. The anticipated rates of traffic likely to be generated from the proposed development (both during construction and once operational) are discussed in the TIA.

The majority of traffic movements associated with the development will occur during the construction of the solar farm (approximate 6-month period) with the delivery of panels and prefabricated structural supports. Deliveries during construction works would be expected to be within rigid and articulated vehicles and the access road has been designed to safely accommodate these vehicles.

Traffic movements generated during operation would include a single staff light vehicle movement associated with maintenance inspections and specific maintenance work (on an as needs basis) which would be short term and infrequent.

Peak hour construction traffic has been calculated with a predicted peak of 18 vehicle trips per hour consisting of 10 light vehicles, 3 roadwork vehicles, and 2 delivery vehicles. Based on the data collected from traffic surveys the surrounding road network has sufficient capacity to cater to the projected construction traffic with capacity to spare for future development in the area. It is noted that construction traffic is temporary in nature and will be managed through a future Construction Management Plan.

The TIA notes the existing condition of the surrounding road network in particular the two-way unsealed Vine Lane with a 6-metre carriageway. At the time of assessment, Vine Lane was found to be in fair condition and is considered suitable

to cater for the short-term heavy vehicle increase as required during the construction phase. It is considered the local and state road network would be suitable to cater for the expected construction traffic associated with the development.

The TIA found nearby roads including Caloola Road, Boston Street and Kamilaroi Highway all in good condition and suitable for the heavy vehicle traffic during construction.

In summary, the additional traffic anticipated from the proposal has been assigned to the road network where it was found that the surrounding road network (both now and in 10 years) is capable of accommodating the expected additional traffic from the proposal.

Access and Internal Circulation

During the construction phase of the development there will be a construction access point off Vine Lane at the eastern boundary of the site. Access to the site will be via a new access road with turnaround area off Vine Lane, approximately 400 metres north of the existing rural access to the existing dwelling on the site. The proposed width at the combined entry/ exit access is 3-5.5m wide, however the proposed entrance width will be a minimum of 12.5m wide. This access point off Vine Lane, while established for the purposes of construction and operation of the Solar Farm, is anticipated to also be used for access to the existing agricultural land present on site. The proposed driveway will provide for the turning movements of cars and service vehicles, in accordance with Council controls and the Australian Standard for Parking Facilities (Part 1: Off-street car parking and Part 2: Off-street commercial vehicle facilities), AS 2890.1:2004 and AS 2890.2 –2002. Furthermore, sight distance at the proposed access point was observed to be in excess of 250 metres in each direction and therefore complies with the relevant Australian Standards.

Parking

The Narrabri Shire DCP 1993 sets out the relevant on-site car parking rates for land uses within the Boggabri area. No specific car park rate is provided for solar projects. No gross floor area is proposed as part of the development.

Adopting the factory rates for this project, the relevant on-site car parking provision during the operation of the Solar Farm is 1 space per 100m² GFA.

With no buildings on the site and only 1 employee engaged in the day to day operation of the Solar Farm, the development is not required to provide any on-site parking space under the DCP requirements. However, with a single maintenance vehicle visiting the site between 1 to 5 times per fortnight, at least one vehicle car park within the development would be satisfactory.

Consideration of construction parking demand has also been considered with potential for up to 30 employees projected. A total of 10 car parks are proposed with additional space afforded for potential onsite overflow if required. The car parking area would comply with the requirements of Australian Standard AS2890.1-2004 Parking Facilities – Part 1 Off-street car parking with parking bay sizes 2.4 m x 5.4 m and aisle widths of 5.8 metres. Therefore, the on-site car parking is considered suitable for the development ensuring all vehicle movements to and from the site off Vine Lane will be undertaken in a forward direction.

5.3 STORMWATER, SOIL AND EROSION CONTROL

The proposed stormwater management system has been designed to reduce post-development flows to align with the pre-development conditions on the site. To achieve this, a detention basin is proposed at the south-western corner of the development area. This basin provides a holding volume of 150m³ and is supported with a low flow pipe and overflow weir. The stormwater management system proposed has been designed in accordance with Council requirements and with the proposed mitigation measures achieves compliance with the pre-development stormwater flows.

The stormwater drainage strategy for the development can be summarised as:

- (i) All impervious runoff from the proposed Photovoltaic Arrays will discharge to the existing ground surface where the natural flow regime will be maintained.
- (ii) Runoff from the proposed gravel/hardstand area catchment will be conveyed via sheet flow to the proposed above ground onsite stormwater detention basin.
- (iii) Discharge from the above ground onsite stormwater detention basing will be limited to the pre-development flow rates

In accordance with the stormwater drainage philosophy proposed for the site, the Boggabri Solar Farm will limit the Post-Development peak flows to Pre-Development flow rates for the 1 EY, 10% AEP and 1% AEP events.

Detailed Stormwater Plans and Report including DRAINS modelling have been prepared DRB Consulting Engineers provided at Appendix B.

5.4 FLORA AND FAUNA

Kleinfelder have undertaken a Flora and Fauna Assessment of the proposed development (refer Appendix H). This assessment has been undertaken with reference to the EP&A Act 1979 as well as the BC Act 2016 and the EPBC Act 1999.

As noted within the Flora and Fauna Report, the site is mainly cleared of vegetation due to previous agricultural development. As such, removal of native vegetation within the site will be limited to the removal of 0.54 hectares of degraded native groundcover however, most of the grasslands will be retained. The proposed site is not within or in close proximity to any mapped Areas of Outstanding Biodiversity Value. Impacts on biodiversity values have been addressed through an iterative design process to avoid areas of higher biodiversity value within the site.

Field surveys undertaken by qualified ecologist(s) recorded no threatened flora or fauna species on the site with the proposed development unlikely to cause a significant impact to any threatened species, populations or ecological communities listed under the NSW BC Act. Entry into the NSW BOS is not triggered by the proposed development.

No EPBC listed species, ecological communities, migratory species or important habitat for such entities were identified within the Development Area. The Flora and Fauna Assessment determined that impacts to Matters of National Environmental Significance are unlikely; therefore, an EPBC referral to the Commonwealth Minister for the Environment is not recommended.

Inclusion of the avoidance and mitigation measures made within the Flora and Fauna Report in relation to erosion control, dust control and chemical spills, will be followed to reduce potential impacts to biodiversity values within the subject site and the environment.

5.5 NOISE

A Noise Assessment (NA) undertaken by Muller Acoustic Consultants measured and modelled the potential noise generation for the operation (both during construction and once operational) including sleep disturbance noise emissions (refer to Appendix G).

Operational Noise

The results of the NA demonstrate that emissions from the project would satisfy the relevant Project Noise Trigger Levels (PNTL) at all assessed receivers for all assessment periods once the noise controls are implemented. Furthermore, sleep disturbance is not anticipated, as emissions from impact noise are predicted to remain below the EPA screening criterion for sleep disturbance and awakenings.

Based on the NA results, there are no noise related issues which would prevent the approval of the project. The results of the assessment shows compliance with the relevant operational and road noise criteria. Accordingly, no additional ameliorative measures will be required.

Construction Noise

Modelled noise emissions from all four project construction activities identify that relevant noise management levels may be exceeded at one receiver location across the site. Hence, noise management measures as provided in the enclosed Noise Assessment (refer to Appendix G) are to be implemented to reduce potential impacts on surrounding receivers during construction activities. Road noise emissions are predicted to satisfy the relevant Road Noise Policy (RNP) criteria at all receivers along the proposed transportation route. Vibration impacts from the proposed works are considered to be negligible.

Construction noise mitigation measures to be implemented include:

- + A construction noise management protocol to minimise noise emissions, manage out of hours (minor) works to be inaudible, and to respond to potential concerns from the community;
- + Where possible use localised mobile screens or construction hoarding around piling rig/plant to act as barriers between construction works and receivers, particularly where equipment is near the site boundary and/or a residential receiver including areas in constant or regular use (eg unloading and laydown areas);
- + Operating plant in a conservative manner (no over-revving), shutdown when not in use, and be parked/started at farthest point from relevant assessment locations;
- + Selection of the quietest suitable machinery available for each activity;
- + Minimise noisy plant/machinery working simultaneously where practicable;
- + Minimise impact noise wherever possible;
- + Utilise a broadband reverse alarm in lieu of the traditional high frequency type reverse alarm;
- + Provide toolbox meetings, training and education to drivers and contractors visiting the site during construction so they are aware of the location of noise sensitive receivers and to be cognisant of any noise generating activities;
- + Signage is to be placed at the front entrance advising truck drivers of their requirement to minimise noise both on and off-site; and
- + Utilise project related community consultation forums to notify residences within proximity of the site with project progress, proposed/upcoming potentially noise generating works, its duration and nature and complaint procedure.

5.6 LANDSCAPE AND VISUAL IMPACT

Visual Impact

It is relevant to consider the visual impact of the proposal given the existing rural landscape character of the area and location of a number of neighbouring properties within 1km radius of the site. SLR Consulting has undertaken a Visual Impact Assessment (VIA) to assess the potential visual amenity changes which may occur as a result of the proposed development, see Appendix E.

Based on the appraisal and findings of the Visual Impact Assessment, it can be considered the proposed solar farm would have a 'minor' visual impact rating on the existing landscape character and values of the site and its local context. Although the subject site is a relatively short distance from Boggabri, views of the existing site from public viewpoints are very limited due to the presence of obstructions such as topographic features, vegetation and built elements.

The views of the site from public viewpoints were from Kamilaroi Highway, Caloola Road and Vine Lane. Due to the scale of the Solar Farm in relation to the overall landscape surrounding the site, the degree of change is considered to be relatively low.

Given the distance of the site from notable public vantage points, the visual impacts are relatively low.

Implementation of the mitigation measures as detailed within the VIA will provide an effective visual buffer compatible with the rural landscape of the Boggabri area enhancing the visual amenity for local residents and visitors to the area.

Landscaping

In line with the recommendations of the VIA (Appendix E), SLR Consulting have prepared a Landscape Plan to compliment development at the site (refer Appendix E). The Landscape Plan aims to provide screening of the development from Vine Lane and Kamilaroi Highway and nearby residences through the provision of screening trees along the eastern boundary.

Given the height and nature of the proposed solar farm and the distance from public vantage points with a moderate level of users, mitigation measures are only required on the eastern side of the development. Further, the planting of trees directly adjoining the solar farm would not be encouraged due to potential overshadowing. The informal planting of native shrubs to compliment the existing rural landscape character along the Vine Lane (eastern) side of the lease area would assist in minimising any visual impacts.

5.7 GLARE ANALYSIS

A Reflective Glare Assessment (RGA) has been undertaken by SLR Consulting to assess the potential for reflected light induced impacts on aviation, road operations, rail operations, industrial and heavy machinery operations, and residential amenity (refer Appendix E).

The proposed solar PV panels include solar trackers which results in minimal potential for horizontal reflectivity to occur as light is generally reflected upwards. The RGA found no impact would be made in regard to Motorist 'Traffic Disability' Glare or Rail Traffic 'Disability' Glare. Reflections from the proposed Solar Farm may be visible from surrounding residences, although the impacts are calculated are minimal. It is recommended that if modules are required to be near horizontal for extended periods, then they should be positioned at a slightly eastwards tilt angle of at least 10°.

Due to the site's large distances from nearby airports, it is concluded the proposal will have no impact on airport operations however aerial spraying has been considered. A generic flight scenario has been quantitatively analysed using SGHAT model and found potential for aviation glare was negligible all year round due to the low incidence angle of reflected rays resulting from the tilting action of the tracking system.

Glare resulting from onsite lighting will be mitigated in accordance with AS4282-1997 *Control of the Obtrusive Effect of Outdoor Lighting* effectively controlling potential for light spill and glare generated by the proposed development.

Due to the use of high-quality solar tracking systems and site buffer distances to surrounding receivers and transport networks, potential for glare impacts on the surrounding area is considered to be negligible. For further detail and discussion see Appendix E

5.8 HERITAGE

5.8.1 INDIGENOUS CULTURAL HERITAGE

Virtus Heritage undertook preliminary Aboriginal archaeological advice (Appendix F) for the proposed development area in accordance with the Due Diligence Code of Practice for the Protection of Aboriginal Objects in NSW (2010) and where

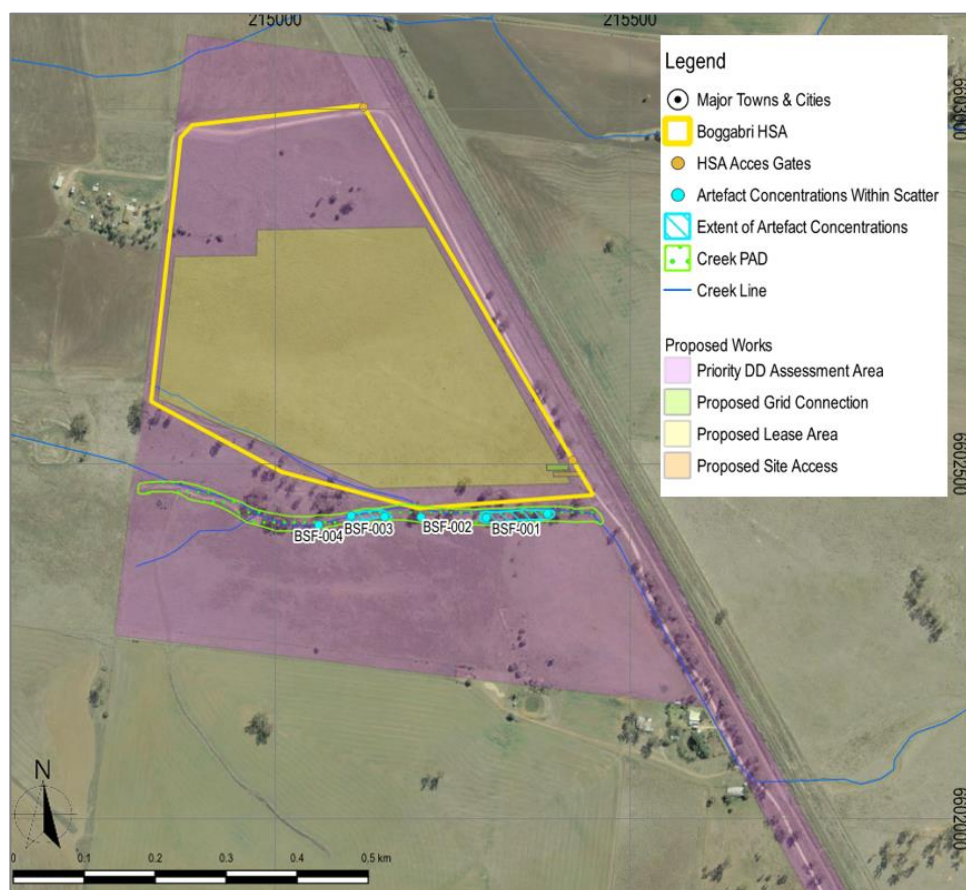
applicable, the requirements of the Code of Practice for Archaeological Investigation of Aboriginal Objects, NSW (2010). See Appendix F for further discussion.

A site inspection was undertaken on 27 October 2020 within the Red Chief Local Aboriginal Lands Council (LALC) area. The inspection was carried out by Senior Archaeologist Elaine Li accompanied by two site officers of the Red Chief LALC, Dave Horton and Cindy Foley.

Sites and landforms of high sensitivity within the property, including unnamed creek lines, were surveyed in full. Visibility within the paddocks were generally zero to very low due to overgrowth of pasture vegetation species. The rare areas with exposure were targeted for the survey. Primarily, the exposure areas were along eroded tracks, fence lines, and where vegetation was absent. No new sites were recorded in the few exposed areas surveyed within the development area.

One new Aboriginal site recording has been undertaken for the project area to archival standards. Four artefact scatter objects, including tool types and materials, found along the creek line and banks were consolidated into one single site to be managed. The highest artefact density was at the confluence between the two creek lines. The second creek line was too overgrown to be assessed. With the presence of the new site, it is expected that during works within the development area, unexpected findings are likely. Based on the site inspection findings and due diligence process, an ACHA/AHIP application will be undertaken in parallel with this development application.

Figure 6 – Indigenous Cultural Heritage Map (Source: Virtus Heritage)



5.8.2 EUROPEAN HERITAGE

The site does not contain any listed heritage items under Schedule 5 of LEP 2010, nor is it located within a heritage conservation area. No other heritage items are located in proximity to the site.

5.9 SOCIAL AND ECONOMIC IMPACTS

The proposed establishment of a solar farm on the site is anticipated to have an ongoing positive social and economic impact on the local Boggabri area and the broader community.

A review of existing renewable projects along with NSW State Government research reveals support for renewable energy projects is generally favourable within the North West Region (including the broader Boggabri region). This research revealed:

- + 94 per cent of respondents supported using renewables to generate electricity in NSW;
- + 81 per cent believed NSW should increase the use of renewables over the next five years; and
- + 95 per cent supported the use of solar farms in NSW, 92 per cent in their local region, and 84 per cent within 1–2 kilometres of where they lived.

The most common perceived advantages of renewables included environmental benefits and lower cost of electricity. The most common perceived disadvantages included higher cost and concerns about efficiency and reliability. In the North West, 74 per cent were prepared to use renewables 'provided I don't have to pay more for my electricity' and 22 per cent were prepared to pay more to support them.

The proposed solar farm is predicted to improve intergenerational equity through its beneficial contribution to Australia's Climate Change and greenhouse gas minimisation efforts, specifically:

- + Directly contribute to helping Australia in meeting the Renewable Energy Target;
- + Reduce greenhouse gas emissions required to meet Australia's international climate conditions; and
- + Assist in the transition towards cleaner electricity generation.

This is achieved by the potential to generate up to 5MW of electricity potentially powering 2,000 homes during daylight hours whilst reducing CO2 emissions by around 200,000 tonnes over the lifespan of the project.

Ongoing communication with the community has been highlighted as an imperative to maximise social benefits of the proposed development. Further recommendations include the following:

- + Liaison with local industry representatives to maximise the use of local contractors, manufacturing facilities, materials;
- + Establish visual screening early to minimise the visual impact on the solar farm. Visual screening should be done in consultation with closest property holders in accordance with Visual Impact Assessment and Landscaping Plan;
- + Establish good relations with people living in the vicinity of the proposal site at the beginning of the proposal and maintain; and
- + Implement a community consultation plan to manage impacts to community stakeholders, including but not limited to:
 - o mitigation measures to reduce potential construction impacts
 - o protocols to keep the community updated about the progress of the Proposal and proposal benefits
 - o protocols to inform relevant stakeholders of potential impacts (haulage, noise, air quality etc.)

- protocols to respond to any complaints received
- information on how potential customers can access the renewable energy source
- a process to monitor the predicted social impacts and amend mitigation and management measures as required.

In summary, the proposed establishment of a Solar PV Farm on the site is anticipated to have an ongoing positive social and economic impact on the local area and the broader Boggabri community. Overall, it is considered that the development:

- + Is consistent with the regulatory and business development framework, including state government legislation and the Narrabri Shire Council strategic plans;
- + Will have positive impacts intergenerational equity, with the provision of cleaner energy in the future;
- + Supports Commonwealth and NSW climate change commitments;
- + Will generate enough clean, renewable energy for about 2,000 homes;
- + Is an appropriate development in relation to the projected changes to population and demographics in the region;
- + Is unlikely to have significant negative social impacts to the locality and region; and
- + Would be a benefit contributing to the overall community sustainability of the Boggabri community.

6 CONCLUSION

The proposed solar PV electrical generation operation located at 211 Vines Lane Boggabri NSW 2382 will provide electrical power to support the needs of Boggabri and the surrounding agricultural operations, along with rural towns and villages. With the growth of the Boggabri area, the new electrical generator proposed under this DA will greatly assist in meeting the growing electrical demands required to support that growth.

The site has been chosen for its suitability in terms of land use zoning, relatively flat topography, limited trees and vegetation and access to high capacity transmission lines.

The proposed solar PV electrical generation plant is consistent with the objectives of the RU1 Primary Production zone as it will provide a compatible land use which minimises land use conflict in the area whilst contributing to the land use diversity of the area. The proposal will not increase demand for public services or facilities and will have minimal impact on native vegetation and wildlife corridors or on waterways, wetlands or riparian zones. The development is compliant with the relevant LEP clauses, presenting no variations to any development standard. The proposal is generally compliant with the requirements of Narrabri DCP 1993.

The design of the development incorporates appropriate stormwater management, respects the natural environment, and minimises potential amenity impacts on neighbouring properties.

Due to the use of high-quality solar tracking systems and site buffer distances to surrounding receivers and transport networks, potential for glare impacts on the surrounding area is considered to be negligible.

This SEE has addressed the potential impacts arising from the proposal on surrounding properties including traffic, access and parking, noise, visual amenity, ecological, and waste and water management. Where necessary, mitigation measures are proposed to minimise these potential impacts and reduce potential risk associated with the development.

Given the merit of the design and the absence of any significant adverse environmental impacts or planning issues, the DA is considered to be in the public's interest and worthy of Council's support.

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Appendix A – Architectural Plans

Balance, Power and Energy Pty Ltd

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Appendix B – Stormwater Management Plan

DRB Consulting Engineers Pty Ltd

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Appendix C – Compliance Tables

KDC Pty Ltd

Table 2 – Narrabri DCP 1993 – Industrial Development

Control	Requirement	Comment	Compliance
Industrial Development Code			
4.3 Open Storage and Work Areas	(a) Where any work or storage of materials is proposed to be undertaken outside the confines of a building, full details of those parts of the site to be used, and of the materials to be stored, are to be provided with the application. (b) Approved open work and storage areas are to be located at the rear of industrial developments and screened from view by the use of landscaping and screen fencing. Such fencing is to be constructed of masonry materials or pre-coloured metal cladding, having a minimum height of 2.0 metres.	N/A, no open work or storage areas are proposed. N/A, no open work or storage areas are proposed.	N/A N/A
4.4 Security Fencing	Security fencing should be visually unobtrusive and, wherever practicable, should be located behind the landscape setback area.	A 2.3m high security fence will be located around the site area. It will be visually unobtrusive in design.	Y
4.6.1 Setbacks	A front building setback of eight (8) metres from the property boundary should be provided. This eight (8) metre front setback is to be intensively landscaped. Side and rear setbacks will be determined by the requirements of Ordinance 70 under the Local Government Act, 1919.	A 10m front setback area is proposed from the existing fence onsite to the proposed security fence. A 10m rear setback is proposed and appropriate side setbacks are proposed, with no development in proximity to the sides of the site.	Y Y
4.7 Landscaped Treatment	(a) To improve the visual quality and amenity of industrial development through the effective landscape treatment of industrial sites; (b) To provide a natural buffer between industrial development and adjoining or adjacent non-industrial land uses whilst enhancing the general streetscape and amenity of Narrabri's industrial areas.	The landscaping requirements have been achieved, refer to Appendix E for landscaping plans. A natural buffer has been provided with shrub planting proposed to screen views from the Highway.	Y Y
4.7.1 Areas required to be landscaped	(a) The front building setback; (b) Side and rear setbacks where visible from a public place or an adjoining residential area; (c) Areas adjacent to building entrances and pedestrian access points; (d) The perimeter of all approved open storage areas and staff/visitor parking	The landscaping requirements have been achieved, refer to Appendix E for landscaping plans.	Y

	areas. (See also Section 4.3 of this Code). Large car parking areas should be interspersed with internal planting bays to reduce the visual impact of large areas of paved surfaces		
4.7.2 Landscape Guidelines	(a) Landscaped areas are to be an integral part of the site, and may, due to the size and scale of development proposed, require the incorporation of mounding to add visual relief to the development.	Refer to Appendix E for landscaping plans.	Y
	(b) Landscaped areas should be planted and maintained with suitable trees, shrubs and ground cover in accordance with a landscape plan, which must be submitted for approval prior to the release of building plans.	Shrub planting is proposed along the eastern boundary of the site as shown on the Landscape Plans included in Appendix E.	Y
	(c) Landscaping should be completed in accordance with the approved landscape plan prior to the occupation of the development and shall be suitably maintained throughout the life of the development.	A Landscape Plan has been provided at Appendix E. All landscaping will be completed in accordance with this plan.	Y
	(d) Every effort should be made to preserve existing trees on proposed development sites. All existing trees should be shown on the plan submitted with the application, and those which are required to be removed should be clearly highlighted.	No trees are required to be removed for this proposal.	Y
	(e) Trees shall be planted on the Council footpath, 900mm in from the kerb, along the entire frontage of the property, at intervals of approximately 10 metres (making allowance for the location of the driveways). The tree types that can be used are included in Annexure 1, and shall be approved by the Shire Engineer.	No tree planting on Council footpath is proposed.	Y
F.4.8.1 Access, Parking and Off Street Loading/Unloading Facilities – General Requirements	(a) The design, layout and construction of access, parking and service areas for all industrial development shall be in accordance with the requirements of the Narrabri Shire Parking Code.	As above, due to the nature of the development, no prescribed parking rate is applicable. However, the DCP allows for merit-based assessment of parking needs. A Traffic Impact Assessment is provided at Appendix D detailing site access.	Y
	(b) Council is required to consult the NSW Traffic Authority to obtain advice on traffic and safety aspects for major traffic generating	The proposed development is not considered a traffic generating development.	Y

	developments. This consultation is a statutory requirement prescribed by State Environmental Planning Policy No. 11. Additional information about the consultation procedure can be obtained by contacting Council's Environmental Services Section. c) Industrial development should be designed to ensure that all vehicles can enter and leave the site in a forward direction. Details of vehicle size and manoeuvring areas should be submitted with the development application to enable an adequate assessment of these aspects. (d) Individual parking bays should be clearly delineated and have minimum dimensions of 2.6 metres x 5.5 metres, except where it is adjacent to a solid obstruction when a 3.0 metre width should be provided.	The proposed access and turning circle proposed for the site will allow all vehicles to enter and exit the site in a forward direction. The proposed parking bay for the site will be constructed according to parking requirements.	Y Y
4.8.2 Access and Road Construction Requirements	(a) The following road works are generally required in conjunction with industrial development: • Industrial type vehicular gutter crossings; • Construction of kerb, gutter and road shoulder between the lip of the gutter and the edge of the existing bitumen seal, footway formation and paving and associated road drainage for the full frontage of the site. (b) Access drives to have a minimum width of six (6) metres; Note – major traffic generating developments may require a greater access width divided at the property line. (c) The location of access driveways at intersections shall be in accordance with the Traffic Authority of NSW 'Policy, Guidelines and Procedures for Traffic Generating Developments', however the minimum distance shall be 6.0 metres from the intersecting boundaries; (d) Access driveways across the footpath should hard sealed, consisting of either concrete, two coat bitumen seal, asphaltic concrete, paving blocks or other approved material.	Required road works are proposed with this development, including a vehicle access road via Vine Lane which is suitable for B-Double access and a turnaround around. The proposed access driveway width at the combined entry/ exit gate is proposed to be 5 metres wide. It is considered this is an adequate width for the proposed development type. The proposed development is not considered as 'traffic generating development.' A new access road is proposed off Vine Lane and Boston Street intersection approximately 400 metres north of the existing rural access. No access driveway proposed across a footpath.	Y Y Y

	(e) All driveways, parking areas, loading bays and vehicular turning areas are to be constructed with a base course of adequate depth to suite design traffic, and are to be sealed with either bitumen asphaltic concrete, concrete or interlocking pavers. Full details should be indicated on the plans submitted with the Development Application.		Y
4.8.3 Parking Requirements	On-site car parking should be provided in accordance with Council's adopted Car Parking Code, copies of which are available from Council.	As above, due to the nature of the development, no prescribed parking rate is applicable. However, the DCP allows for merit-based assessment of parking needs.	Y
4.10 Services and Drainage	(a) To ensure that services provided are adequate for the scale of the development proposed. (b) To ensure adequate drainage facilities are provided within the site to collect and carry stormwater to external drainage systems; (c) To reduce the hazard of flooding and the diversion or concentration of water onto adjoining properties.	A Stormwater Management Plan has been provided at Appendix B detailing the stormwater drainage strategy during both pre-development and post-development.	Y
4.10.3 Trade Waste	A Trade Waste Application will be required where liquid wastes other than sewerage are to be discharged to Council's sewerage system. Council levies a charge for the disposal of the Trade Waste to the sewer based on the volume and strength of the discharge.	No liquid waste is expected to be produced. A Waste Management Plan is provided at Appendix I.	Y
4.10.4 Drainage	(a) Stormwater runoff from roofs and paved areas is to be collected and disposed of to the street drainage or direct to Council's underground system. (b) The Council will not permit the erection of buildings over drainage easements under its control. (c) A contribution towards Downstream Drainage may be required based on the increased run-off generated by the development.	A Stormwater Management Plan has been provided at Appendix B detailing the stormwater drainage strategy during both pre-development and post-development.	Y
Parking Code No. 1 1993			
Construction	1. All parking areas are to be paved, and the manoeuvring and parking spaces are to be clearly delineated. The parking area is to be drained to Council's stormwater network.	The provided parking and manoeuvring area will be paved. Further details are provided in the Traffic Impact assessment located at Appendix D.	Y

	2. Upon an application being lodged, the paving required may be waived, if the applicant can demonstrate that the parking turnover will not adversely effect the proposed pavement.		
Landscaping	It is suggested that carparking areas be landscaped, especially with shade trees.	Due to the nature of the development, and the lack of requirement for car parking spaces, the proposed car parking landscaping control is not considered necessary.	Y
Parking Requirements	Parking Rates: Factories: - 1.3 spaces per 100m² GFA	As above, due to the nature of the development, no prescribed parking rate is applicable. However, the DCP allows for merit-based assessment of parking needs. As there is no building proposed for the development, no on-site parking is required to be provided under DCP requirements. However, as indicated in the Traffic Impact Assessment located at Appendix D, sufficient on-site parking will be provided for construction staff during construction, and the one maintenance vehicle during operation.	Y

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Appendix D – Traffic Impact Assessment

Intersect Traffic

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Appendix E – Visual Impact Assessment, Landscaping Plans and Glare Analysis

SLR Consulting

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Appendix F – Preliminary Aboriginal Archaeological Advice

Virtus Heritage

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Appendix G – Acoustic Assessment

Muller Acoustic Consulting

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Appendix H – Flora and Fauna Assessment

Kleinfelder

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Appendix I – Waste Management Plan

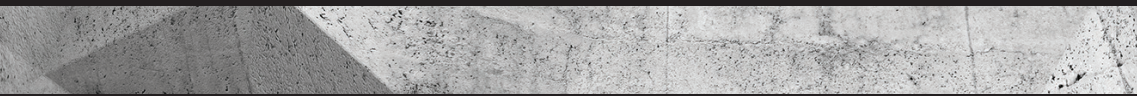
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Appendix J – Quantity Surveyors Report

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BOGGABRI SOLAR FARM

Visual Analysis, Landscape Concept and Reflectivity Statement

Prepared for:

Providence Asset Group

704/99 Bathurst Street, SYDNEY NSW 2000

SLR Ref: 631.00000-20399 Version No: -v0.2 December 2020





PROJECT NAME

Location	Lot 151 DP1048145 211 Vine Lane, Boggabri NSW 2382
Project Number	631.00000.20399
Client	Providence Asset Group

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BASIS OF REPORT

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DOCUMENT CONTROL

Reference	Date	Prepared	Checked	Authorised
620.00000.20399-v0.1	10 December 2020	Dallas Ellis	Dean Butcher	Dean Butcher
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1. INTRODUCTION

1.1 Background

This Visual Analysis and Landscape Concept has been prepared for the proposed Solar Farm near Boggabri, NSW.

This visual analysis assessment has been prepared to provide an effective and objective assessment of the anticipated high level impacts of the project on the surrounding visual environment.

SLR has worked closely with other members of the project team in determining and rating visual impacts of the proposed solar farm project works on its immediate surrounds as well as suggesting mitigation measures to further reduce any impacts that may occur.

There are 3 parts to this report.

- Visual Analysis
- Reflectivity Analysis and
- Landscape Concept

1.2 Site Location

The land on which the Solar Farm is located (the subject site) for the proposed Solar Farm (the project) is situated approximately 2.4km north east of the township of Boggabri, NSW.

The site is located at 211 Vine Lane, Boggabri NSW 2382. The proposed development will consist of solar panels mounted on single-axis trackers connected to a power conversion station with an access and hardstand area from Vine Lane. The development will be confined to Lot 151 DP755475 (**Figure 1**).

LEGEND

-  Proposed Lease Area (Subject Site)
-  Railway



Figure 1. Locality Plan

2. BASELINE VISUAL ENVIRONMENT

2.1 Subject Site and Surrounding Context

The subject site is located on the western side of Vine Lane, Boggabri and is a typically open grassed rural site, similar to those rural properties surrounding it. The site falls generally from northwest to southeast from approximately AHD 267m to AHD 254m.

2.1.2 Roads and Access

The subject site is accessed by one road, Vine Lane which is unsealed and is aligned to the east of the subject site and parallel to the railway line adjacent to the site. The Kamilaroi Highway (B51) is located approximately 1km to the east of the subject site. It is a sealed classified state highway and joins Boggabri to the south. There are a number of other local and unsealed roads to the east and south of the subject site.

2.1.3 Vegetation

The subject site is largely cleared of vegetation (trees and shrubs), except for scattered trees on the northern side of the proposed Solar Farm lease area and trees along the existing creek line to the south of the proposed Solar Farm. There are also a number of established medium sized trees along Vine Lane adjacent to the proposed Solar Farm.

2.1.4 Structures

There are no structures on the subject site. The existing residential dwelling on the western side of the proposed Solar Farm is single storey and has a number of smaller, residential scale ancillary structures around it.

2.1.5 Infrastructure

Apart from Vine Lane, the only other relevant infrastructure in the vicinity of the subject site is the Rail Line to the east and power poles and lines also to the east adjoining Vine Lane.

3. LANDSCAPE CHARACTER ANALYSIS

3.1 Regional Context

The landscape character of the region surrounding the site is typically flat, open rural lands used for a mix of pastoral and agricultural uses. Whilst the vegetation is sparse on the agricultural lands, it is typically concentrated on the elevated local hills surrounding the site on the north, east and western sides. Although not as prominent as the vegetated hills in the region, vegetation along the Namoi River and local tributaries and creek lines also contributes to the local rural character.

3.2 Baseline Visual Character of Subject Site and Surrounds

The subject site is typical of the rural landscape character of the region in that it is open, generally flat and grassed (minimal tree coverage). As the size of the site is small in the context of its surrounds, it utilises the ‘borrowed landscape’ of the adjoining rolling hills to define its visual context and define local views. The vegetation on the hills provides the local visual context a more vegetated feel when viewing the site from the south and east. When viewed from the north the site appears more exposed without the benefit of the hills that terminate local views.



4. PROPOSAL

4.1 Project Description

A full description of the proposal is provided within the main Statement of Environmental Effects and site plans, but a brief description is as follows. Section 4.1.1 identifies key elements of the proposal that are of particular relevance to an assessment of impacts on the visual analysis

4.1.1 Indicative project Layout

The solar electricity generating facility will consist of the following elements:

- Solar array area of approximately 8.8 hectares within a total fenced area of approximately 12 hectares
- Solar array mounted on trackers (153 sets)
 - Rectangular photovoltaic module
 - Trackers area horizontal single-axis type
 - Solar array up to 2.6m high with +/-60° rotation angle
 - Trackers orientated north - south
- Associated infrastructure
 - Power Conversion Station (PCS)
 - Site access from Vine Lane via a 4m wide road
 - Security fencing
 - Car park area
 - Off-load and hardstand area
- Onsite stormwater detention basin

During construction, temporary facilities located within the site may include:

- Construction office

4.1.2 Solar panel dimensions and arrangement

The proposed solar array module dimensions are approximately 1.1 m wide x 2.3m high. They are mounted on a tracking system that will maximise the electricity production. The tracking system rotates about a north-south axis to follow the sun with the aim of orienting each panel to be as close to perpendicular as possible to the incoming sun.

The tracking systems will be arranged in rows running in a north-south direction as indicated in **Figure 2** The enclosure for the solar panel arrays and associated equipment will cover approximately 12Ha.

The diagram in **Figure 2.1** illustrates the dimensions and rotation of the panels. The panels only rotate from east to west and are not tilted toward the north.

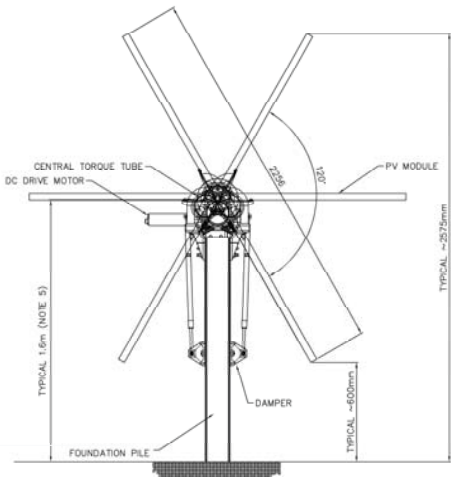


Figure 2.1 Solar panel / tracking system

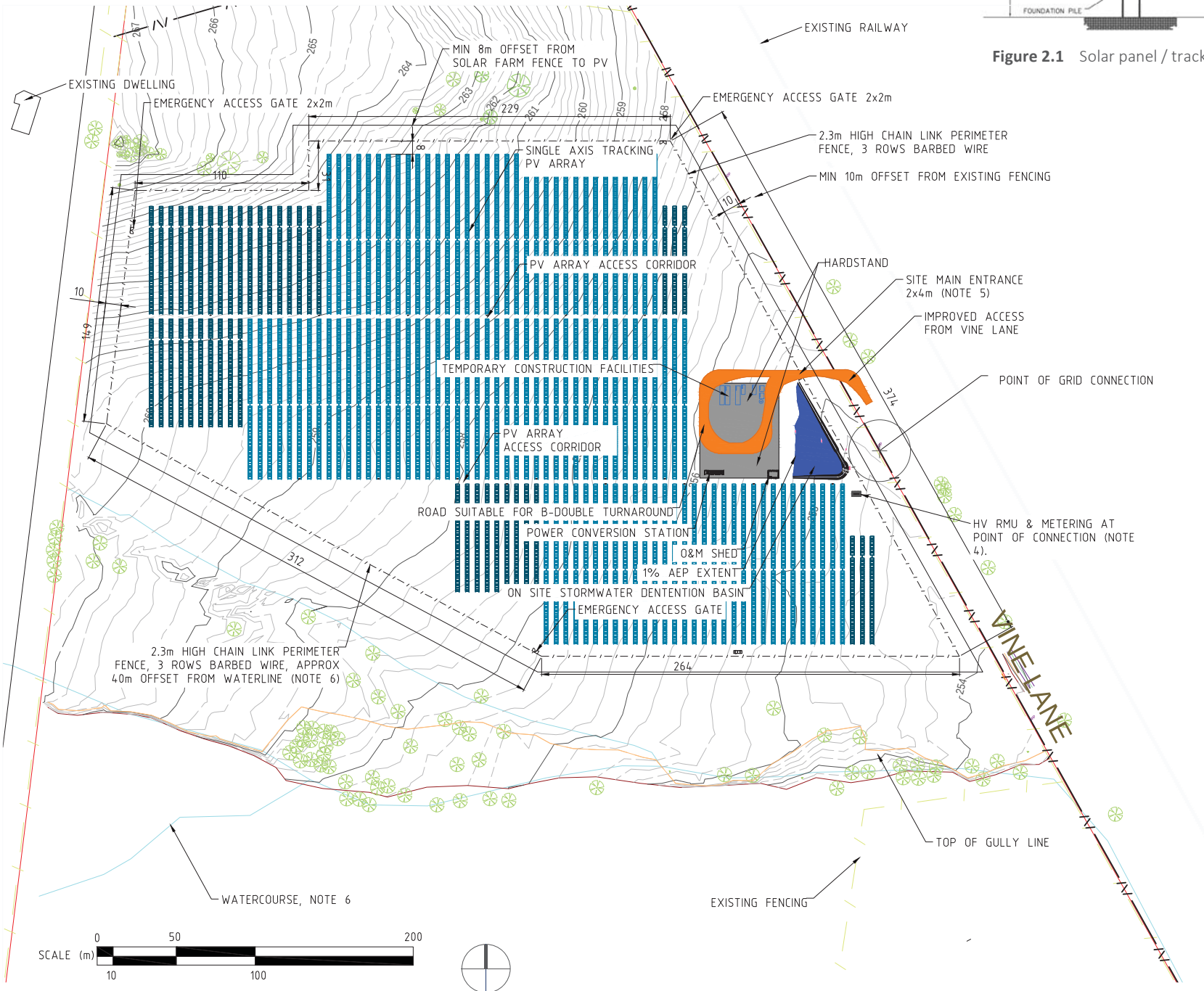


Figure 2. Concept layout of the project

5. VISUAL IMPACT ASSESSMENT

5.1 Process

The Visual Impact Analysis generally applies the assessment techniques set out in the ‘Guidelines for Landscape and Visual Impact Assessment, Third Edition’ (2013) prepared by The Landscape Institute and the Institute for Environmental Management and Assessment (UK).

The analysis includes the following:

- Review of the proposal (scale, bulk, height, technical specifications and landscape);
- Analysis of the subject site (visual exposure, visual qualities and landscape values);
- Identification of potential impacts on key receptors including the rating of magnitude for each receptor group;
- Rating of impact significance for each receptor group.
- The significance is evaluated as a product of the sensitivity or value of the receptor, and the magnitude of impacts on the receptor; and
- Potential mitigation measures to meet the necessary planning requirements and any community expectations.
- The report included a desktop analysis and a visual site investigation in November 2020. The desktop review included the review of aerial photography, site topography and vegetation cover.

Photo-montages were also prepared to inform the analysis.

5.2 Assessment of Visual Impacts for Key Receptors

Photographic imagery was taken of the site to assist in the assessment of visual impacts. Photos were taken with a Canon EOS 6D Mark II digital single-lens reflex (DSLR) camera with a 50 mm lens.

Three photomontage images were prepared to assist in the Visual Analysis process; all from public receptor points.

The receptors used in the photomontage were selected to investigate a range of visual solutions and illustrating views from areas of perceived sensitivity. During the site investigation, local areas around the site were observed to determine the potential visibility of the proposed Solar Farm.

For the purposes of this Visual Analysis a Photomontage image was produced from each of the three viewpoints chosen. The approximate extent of the proposed Solar Farm has been identified to give a general impression of the location on site and the approximate height.

The Photo montage Images are represented in Section 5.8 and show the following overlays of information.

- Existing visual baseline (existing landform);
- Overlay of the final solar farm proposed development

5.3 Receptor Sensitivity

The receptor sensitivity is derived from a combination of factors including:

- Receptors interest in the visual environment (high, medium or low interest in their everyday visual environment and the duration of the effect);
- Receptors viewing opportunity (prolonged, regular viewing opportunities); and
- Number of viewers and their distance/ angle of view from the source of the effect, extent of screening/ filtering of view.

Whilst the assessment of visual values and effects is largely measured on a qualitative basis, assessment against scale enables a more objective evaluation and comparison of sensitivity of receptors and magnitude of effects. The Receptor Sensitivity Rating is described as being High, Medium, Low or Negligible as described in **Table 1**.

5.4 Magnitude of Landscape Change

The Magnitude of Change to the landscape character depends on the nature, scale, intensity, extent and duration of the impacts/ change due to proposal. The magnitude of change also depends on the loss, change or addition of any feature to the existing landscape and is based on the character type that is most likely to be impacted by the project prior to the addition of any mitigation measures.

The Magnitude of Change is described as being High, Medium, Low or Negligible as described in **Table 2**.

Descriptions of Magnitude and Sensitivity are illustrative only and there is no defined boundary between levels of impacts.

Table 1. Receptor Sensitivity Rating

Receptor Sensitivity	Description
High	• Visitors to heritage sites, regionally important locations, scenic routes, lookouts within 2.5km with quality views, important views of the site and surrounding areas where landscape is the specific focus. • High numbers of visitors • Views to landscape that are rare and or unique and are possibly vulnerable to change • Views from residences within 1km of the site or are representative of high quality views
Medium	• Travellers/visitors along roads or rail routes that are not scenic routes but offer quality views within 2.5km of the site • Medium numbers of visitors/ residents (rural communities or townships) • Views that are representative of local character or sense of place but are not rare or unique • Views from residences beyond immediate vicinity (1km-5km) of the site or are representative of moderate quality views • Recreational users/ viewers beyond 2.5km from the site with moderate interest in their surrounds
Low	• Travellers/visitors along roads or rail routes that are not scenic routes but offer reasonable views within 4km of the site • People at place of work where setting or views not important to quality of working environment • Recreational users not dependent on views or scenic quality of landscape • View experience takes in broad context with which site is visible but not an important element. • Small numbers of visitors with passing interest in their surroundings (those travelling along mid-level roads) • Viewers whose interest is not specifically focused on landscape or scenic qualities (commuters, workers)
Negligible	• Very occasional or low level of users with passing interest in their surrounds (those travelling along minor roads or views from the air) • Travellers/visitors along unsealed roads offering views greater than 4km of the site

5.5 Impact of Significance on Landscape Character

The Impact Significance is evaluated according to 2 key criteria as noted above and is reflected in **Table 3**. The rating is a means of comparing impacts on different receptors. Professional judgement and experience have been applied in order to identify the level of significance for each character type which has been assessed on its own merits.

- The sensitivity of the receptor or existing landscape; and
- The magnitude of the change or impact that is likely to occur.

The process of assessment and the use of the ratings tables reflect typical outcomes for visual impacts.

- Impacts on receptors that are particularly sensitive to change in views and visual amenity are more likely to be significant.
- Impacts that constitute a substantial change to the visual environment are likely to be more significant than the impacts that do not cause substantial change.

5.6 Summary of Potential Landscape Character Impacts

The following sheets summarise the assessment of impacts on each of the identified visual receptor groups.

Three representative viewpoints were identified where the site could be seen preferably from public locations. Due to the distances from the site, presence of topographic and vegetated features, surrounding structures and the limited views from publicly accessible areas, the choice of viable views was limited. The following sheets describe and rate the sensitivity of each viewpoint, the nature and magnitude of impacts likely to occur and the resultant significance of impacts for each receptor.

Typically views to the site from local roads and other public locations in the area were very limited. Photos from each receptor are provided and photomontages prepared to show how the proposed Solar Farm will be perceived from that particular viewpoint. Mitigation measures have been included where appropriate.

Table 2. Magnitude of Change

Magnitude of Change	Description
High	Dominant Change - Major change in view at close distances, affecting substantial part of the view continuously visible for a long duration or obstructing a substantial part or important elements of the view - Overwhelming loss or additional features in the view such as the nature of view or character of landscape fundamentally changed - Views to key landscape features affected - Visual amenity of local residents or road users substantially diminished - Substantial change to the landscape due to loss of and or change to elements, features or characteristics of the landscape creating an overall worsening of landscape quality
Medium	Considerable Change - Clearly perceptible changes in views at intermediate distances resulting in either distinct new element in a significant part of the view or a more widely ranging, less concentrated change across a wider area - Significant loss or addition of features in the view, such that nature of view or character of landscape is altered - Noticeable contrast of any new features in the view such that the nature of the view or landscape character is changed - Noticeable contrast of any new features or changes compared to existing landscape - Views to key landscapes partially obstructed but views remain intact
Low	Noticeable Change - Minor memorable change to the landscape or views - Temporary or reversible impact - Landscape dominant element and built form/ development well integrated within it - Little permanent change or no fundamental change to local landscape character
Negligible	Barely Perceptible Change No memorable or rarely perceptible change to landscape character or key views

Table 3. Effect Significance Rating

Receptor Sensitivity	Magnitude of Change in Landscape				
		High (Dominant Change)	Medium (Considerable Change)	Low (Noticeable Change)	Negligible (Barely Perceptible Change)
	High	High	Moderate-High	Moderate	Minor-Moderate
	Medium	Moderate-High	High	Minor-Moderate	Minor
	Low	Moderate	Minor-Moderate	Minor	Minor-Negligible
	Negligible	Minor-Moderate	Minor	Minor-Negligible	Negligible

5.6.1 Selected Viewports



Figure 3. Selected Visual Receptors and Direction of View

5.6.2 Viewpoint 1 - Existing



Receptor - VP1	Kamilaroi Highway, Boggabri
Coordinate Location	30°40'39.756" S 150°2'26.232" E
View Description	View from the Kamilaroi Highway looking west toward the solar farm site.
Distance from Site	approx. 1km
Comments - Open rural (pastoral) landscape, with minimal canopy vegetation in the foreground is a dominant landscape character type in the region - Vegetated hills to the north and west of the subject site from this viewpoint are clearly visible and terminate views.	

5.6.3 Viewpoint 1 - Proposed



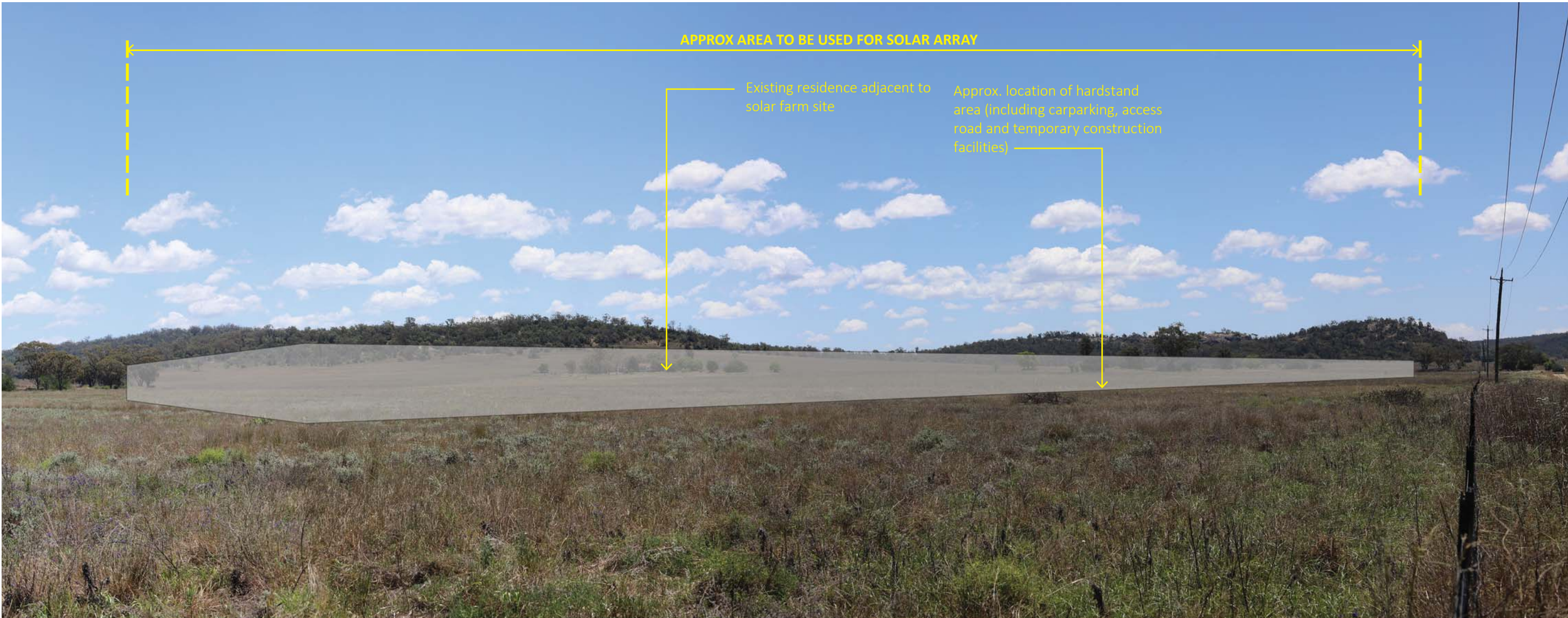
Receptor - VP1 Summary of Impact Assessment	
Receptor Sensitivity	Medium
View Magnitude of Landscape Change	Low
Impact Significance	Minor - Moderate
Mitigation Measures	Possible shrub planting (native species to 3m) outside of security fence and within the lease boundary on the eastern side only that screens (or primarily screens) views from the viewpoint.

5.6.4 Viewpoint 2 - Existing



Receptor - VP2	Vine Lane, Boggabri
Coordinate Location	30°40'35.226" S 150°1'46.584" E
View Description	View towards the site from Vine Lane.
Distance from Site	approx. 50m
Comments - Open rural (pastoral) landscape, with minimal canopy vegetation in the foreground is a dominant landscape character type in the region - The site slopes up gently from Vine Lane towards the vegetated hills	

5.6.5 Viewpoint 2 - Proposed



Receptor - VP2 Summary of Impact Assessment	
Receptor Sensitivity	Negligible
View Magnitude of Landscape Change	Medium
Impact Significance	Minor
Mitigation Measures	Possible shrub planting (native species to 3m) outside of security fence and within the lease boundary on the eastern side only that screens (or primarily screens) views from the viewpoint.

5.6.4 Viewpoint 3 - Existing



Receptor - VP3	Vine Lane, Boggabri
Coordinate Location	30°40'18.21" S 150°1'37.488" E
View Description	View from Vine Lane, looking south into the solar farm site
Distance from Site	Approx. 180m
Comments Views south terminated by local topographic features and creek line vegetation	

5.6.5 Viewpoint 3 - Proposed



Receptor - VP3 Summary of Impact Assessment	
Receptor Sensitivity	Negligible
View Magnitude of Landscape Change	Minor
Impact Significance	Minor - Negligible
Mitigation Measures	Possible shrub planting (native species to 3m) outside of security fence and within the lease boundary on the eastern side only that screens (or primarily screens) views from the viewpoint.

5.6.4 Viewpoint 4 - Existing



Receptor - VP4	Caloola Road, Boggabri
Coordinate Location	30°41'46" S 150°1'38" E (Approx)
View Description	View from Caloola Road, looking north into the solar farm site past rural landscapes
Distance from Site	Approx. 2200m
Comments	Views south terminated by topographic features (hills in the background). Generally open views with scattered vegetation.

5.6.5 Viewpoint 4 - Proposed



Receptor - VP4 Summary of Impact Assessment	
Receptor Sensitivity	Low
View Magnitude of Landscape Change	Low
Impact Significance	Minor
Mitigation Measures	No mitigation measures required for this viewpoint.

6. SUMMARY OF ASSESSMENT

6.1 Summary of Assessment

The visual environment for the subject site and surrounding area is characterised by open, flat rural land.

Whilst, the subject site itself has been cleared of tree vegetation, heavy stands of existing tree vegetation located on the elevated hills to the north, east and west of the site contribute to the natural rural character of the area.

Although the subject site is located within a relatively short distance from Boggabri, views of the existing site from public viewpoints are very limited due to the presence of obstructions such as topographic features, vegetation and built elements. The only views from public viewpoints as described within the report were from the Kamilaroi Highway, Caloola Road and Vine Lane.

The nature of the array as outlined above including its height have meant that the relative visual impacts of the Solar Farm are generally low, especially given the distance from most notable public vantage points.

The relative distance of the receptors from the site as viewed from the Kamilaroi Highway as well as the speed being travelled would, mean that views would be relatively distant and of short duration. Because of the scale of the solar farm in relation to the overall landscape surrounding the site the degree of change could be considered relatively low.

The views form Vine Lane whilst representing a moderate change to the landscape could be considered to have a low impact significance primarily based on the low number of public visitations along the road and the resulting lower level of significance of the views.

Based on the appraisal and findings of this Visual Analysis it can be considered that the proposed Boggabri Solar Farm Project would have a ‘minor’ visual impact rating on the existing landscape character of the site and its local context.

Table 4. Summary of Visual Impact Ratings for each Receptor

Magnitude of Change in Landscape			
VP1	Low	Low	Minor
VP2	Negligible	Medium	Minor
VP3	Negligible	Minor	Minor

6.2 Mitigation Measures

As described in the summary for each of the 4 viewpoints, the height and nature of the proposed solar farm and the distance from public vantage points with a moderate level of users would therefore dictate that mitigation measures would only be required on the eastern side of the development.

Given the relatively low height of the Solar Farm, the informal planting of native shrubs to compliment the existing rural landscape character along the Vine Lane (eastern) side of the lease area, outside of the fence line would assist in minimising any visual impacts of the development on the surrounding rural landscapes. The planting of trees directly adjoining the solar farm would not be encouraged due to the potential for shadows to be cast over the array during certain times of the day.

Whilst this planting will help screen the Solar Farm as viewed from the Kamilaroi Highway, its benefits will be of lesser value to those viewpoints along Vine Lane.

7. REFLECTIVE GLARE

7.1 Glare Conditions Assessed

The following potential glare conditions have been considered:

- Daytime Reflective glare (and glint) arising from the solar PV panels within the facility;
- Aviation Sector Reflective Glare;
- Motorist “Disability” Reflective Glare and Pedestrian “Discomfort” Reflective Glare;
- Rail Operator Reflective Glare;
- Industrial critical machinery operators (heavy vehicles, etc.) Reflective Glare; and
- Residential “Nuisance” Glare
- Night-time Illumination glare if any 24/7 security lighting is incorporated into the Project in the future; none is currently planned.

7.2 Key Project Characteristics Relevant to Glare

The proposed solar array would consist of 153 trackers oriented in a north-south direction, each supporting either 52 or 84 x 540W solar panels (11,648 panels in total);

- The trackers are “single-axis” capable of rotating solar panels to a maximum of $\pm 60^\circ$ - **refer Figure 4**;
- Individual panels (2.3 m x 1.1 m) reach a maximum height above ground of 2.57 m at their full 60° tilt angle; and
- The trackers are oriented north-south and spaced 6.25m apart.

7.3 Receivers and Associated Impacts

The issues of concern assessed in this study in relation to daytime reflective glare and night-time illumination glare are detailed below – **refer Figure 5** for receivers of interest.

7.3.1 Aviation-Related Glint & Glare

Potential impacts on pilots during landing and air traffic control tower operations (if relevant).

7.3.2 Traffic Disability & Pedestrian Discomfort Glare

Potential impacts on motorist disability glare and pedestrian discomfort (relevant to pedestrian crossings).

7.3.3 Train Driver Disability Glare

Potential impacts on train operator’s activities, eg reflections obscuring railway signals.

7.3.4 Industrial Critical Machinery Operators

Potential impacts on operators of critical industrial machinery, eg mining draglines.

7.3.5 Residential Nuisance Glare

Potential impacts on surrounding residences in relation to “nuisance” glare and light spill from night-time illumination (if relevant)

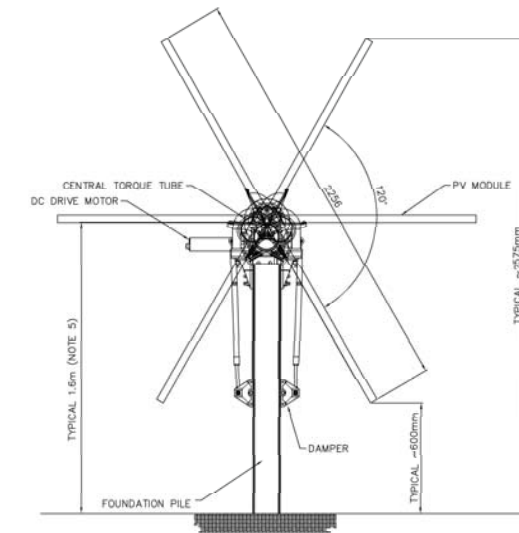


Figure 4 Boggabri Solar Farm Single-Axis Trackers

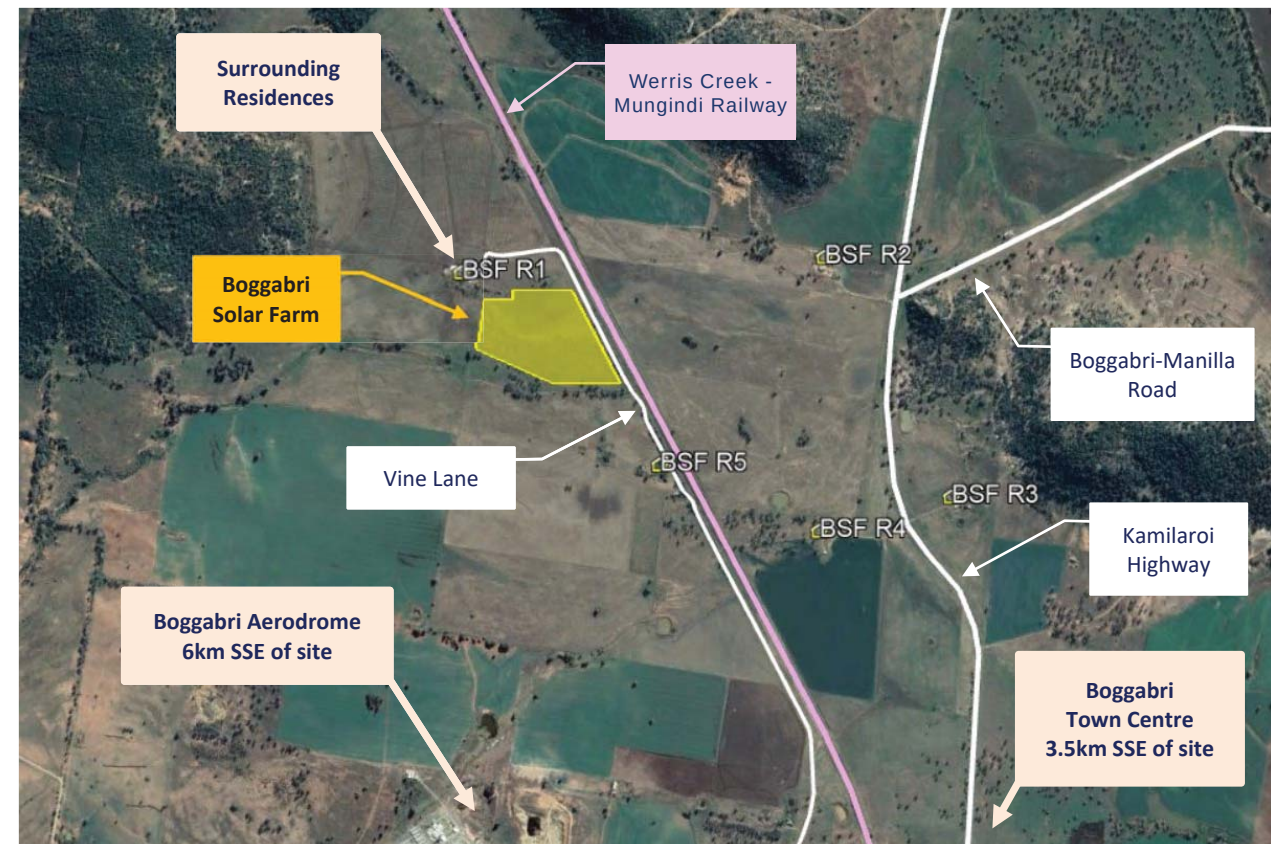


Figure 5 Surrounding Receivers of Interest

7.4 Glare Criteria

7.4.1 Aviation-Related Glint & Glare

In relation to the potential impact of solar PV systems on aviation activity, guidance is available from the US FAA which regulates and oversees all aspects of American civil aviation.

- FAA, “*Technical Guidance for Evaluating Selected Solar Technologies on Airports*”, Federal Aviation Administration, Washington, D.C., Version 1.1, April 2018.

In support of the above, the FAA contracted Sandia Labs to develop their **Solar Glare Hazard Analysis Tool** (SGHAT) software as the standard tool for measuring the potential ocular impact of any proposed solar facility. SGHAT utilises the Solar Glare Ocular Hazard Plot to determine and assess the potential for glare.

A sample SGHAT Ocular Hazard Plot is shown in **Figure 6**. The analysis contained in this plot is derived from solar simulations that extend over the ENTIRE CALENDAR YEAR in 1-MINUTE intervals, sunrise to sunset.

The SGHAT criteria state that a proposed solar facility should satisfy the following:

- Airport Traffic Control Tower (ATCT) cab: NO Glare
- Final approach paths for landing aircraft: Glare to NOT exceed “Low Potential for After-Image”

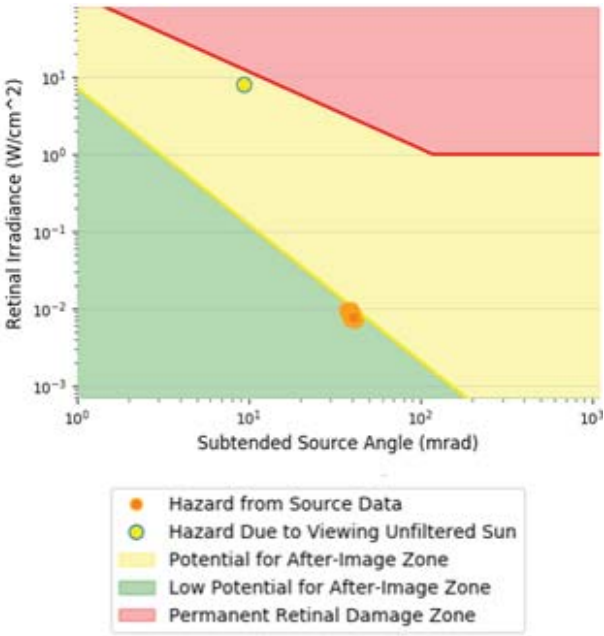


Figure 6 Example SGHAT Plot

In **Figure 6**, the following is noted:

- SGHAT ocular impact is a function of both the “retinal irradiance” (ie the light seen by the eye) and “subtended source angle” (ie how wide an arc of view the light appears to be arriving from).
- The occurrence of glare is shown in the plot as a series of **orange** circles, one circle for each minute that a reflection is visible.
- SGHAT ocular impact falls into three categories:
 - GREEN: low potential to cause “after-image”
 - YELLOW: potential to cause temporary “after-image”
 - RED: potential to cause retinal burn (permanent eye damage)
- “After Image” can occur for example when a photo with flash is taken in front of a person who then sees spots in front of their eyes for a few seconds. A more extreme example of “after-image” occurs when staring at the sun.
- The SGHAT plot also provides an indication of the relative intensity of the sources of light itself (ie the sun) – refer the **green** circle in the plot.
- Finally, in relation to PV Solar facilities, it is important to note that a “RED” category outcome is **not possible**, since PV modules DO NOT FOCUS reflected sunlight.

7.4.2 Motorist Disability & Pedestrian Discomfort Glare

The criteria commonly used by Australian Local Government Authorities to assess the acceptability or otherwise of potential adverse reflections from glazed façade systems onto surrounding roadways and pedestrian crossings utilise the so-called **Threshold Increment** (TI) Value of the reflection condition, defined in AS/NZS 4282:2019 as:

“the measure of disability glare expressed as the percentage increase in contrast required between an object and its background for it to be seen equally well with a source of glare present. Note: Higher values of TI correspond to greater disability glare.”

The TI Value is calculated as the ratio of “veiling” luminance (eg from a reflection) to the overall average background (“adaptation”) luminance, with the necessary constant and exponent parameters provided in AS 1158.2:2005.

The formula for calculating the TI Value is ...

TI = 65 Lv / Ltb0.8, where:

- Lv = veiling luminance from a source of interest (eg reflection) – Cd/m2
- Ltb = so-called “adaptation” luminance (total background) – Cd/m2

For (Motorist) Traffic Disability Glare, the TI Value should remain:

- Below 10 for major roads
- Below 20 for minor roads

For Pedestrian Discomfort Glare, the TI Value should remain:

- Below 2 at critical locations such as pedestrian crossings
- Below 3 for other locations

7.4.2 Rail Operators Reflective Glare

Almost all Australian Rail Authorities have guidelines covering glare in general (ie not specific to solar PV panel glare) aimed at avoiding discomfort/distraction to train operators and obscuring train signals. Most guidelines refer either to Table 2.10 of AS 1158.3.1 for the TI Value criterion and/or Table 3.2 of AS 1158.4 for the Cd (Candela) criterion associated with the control of glare.

For Rail Traffic Disability Glare, the relevant AS1158 criteria are:

- The TI Value should remain below 20
- The Cd Value at 70° incidence should remain below 6,000.

7.4.3 Residential “Nuisance” Glare

There are currently no national or state guidelines in Australia governing the acceptability or otherwise of residential nuisance glare specific to solar PV.

Existing guidance from state governments that exists in relation to solar panels typically covers installation audits and compliance checks.

Accordingly, to assist in addressing residential nuisance glare, reference has been made of the concepts used for TI Value pedestrian discomfort glare acceptability criteria outlined in the preceding sections.

7.4.4 Industrial Critical Machinery Operations

There are currently no (Australian) national or state guidelines governing the acceptability or otherwise of reflective glare for industrial site critical operations (eg dragline operations). Instead, the concepts used for the TI Value acceptability criteria can assist when dealing with this issue.

7.4.5 Night-Time Illumination Glare

The effect of light spill from outdoor lighting impacting on residents, transport users, transport signalling systems and astronomical observations is governed by AS 4282-2019.

The adverse effects of light spill from outdoor lighting are influenced by a number of factors:

- The topology of the area. Light spill is more likely to be perceived as obtrusive if the lighting installation is located higher up than the observer. Lighting installations are usually directed towards the ground and an observer could hence have a direct view of the luminaire.
- The surrounding area. Hills, trees, buildings, fences and general vegetation have a positive effect by shielding the observer from the light installation.
- Pre-existing lighting in the area. Light from a particular light source is seen

as less obtrusive if it is located in an area where the lighting levels are already high, eg in cities. The same lighting installation would be seen as far more bothersome in a less well-lit residential area.

- The zoning of the area. A residential area is seen as more sensitive compared to commercial areas where high lighting levels are seen as more acceptable.

The Project is located outside the Boggabri township area and has the potential to impact on surrounding residential properties – refer **Figure 5**. As these properties are not located within township environs proper, they would therefore be classed as being in a residential area with “Dark Surrounds” - refer AS 4282-2019.

It is noted that night-time lighting is not currently incorporated into the Project.

If at some point of time in the future such lighting is incorporated into the facility, the following criterion will apply:

- Light spill from the Project onto the facades of any surrounding residential dwellings should be kept below 1 lux during relevant curfew hours.

Finally, it has been known for some time that night-time artificial lighting has the potential to disrupt the natural behaviour of nocturnal fauna species such as arboreal mammals, large forest owls and microbats. Biodiversity associated with the Project is discussed in the Flora and Fauna Assessment Report prepared for the Project. As far as is known, no adverse eco-lighting issues are apparent.

7.5 Glare Impact Assumptions

7.5.1 Project Site Solar Angles

One of the challenging issues encountered with daytime solar panel glare is the varying nature of the reflections, whose duration will vary with time of day and day of the year as the sun’s rays follow variable incoming angles between the two extremes of the summer and winter solstices.

Any solar glare analysis must take into account the complete cycle of annual reflection variations noted above.

The potential range of incoming solar angles at the Project site relevant to daytime glare is shown in **Figure 7** with relevant critical angles summarised in **Table 5**.

Table 5 Key Annual Solar Angle Characteristics

Day of Year	Summer Solstice	Equinox	Winter Solstice
Sunrise	5:02 am	6:05 am	6:58 am
Sunset	7:02 pm	6:08 pm	4.59 pm
Daily Azimuth Range	±118° E/W	±91° E/W	±63° E/W
Max Altitude	82.7°	59.9°	35.9°

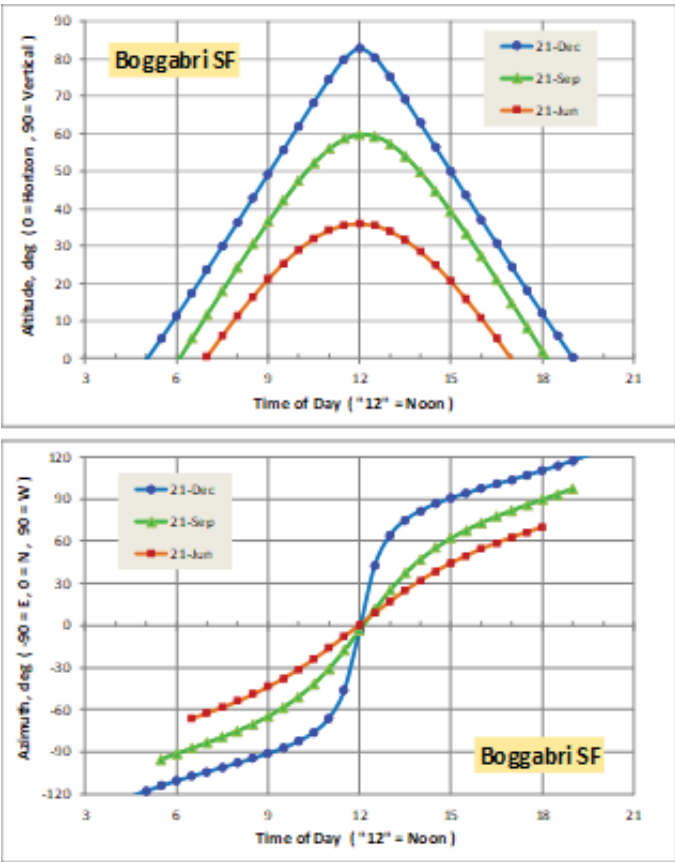


Figure 7 Project Site Solar Angle Variations

7.5.6 Project Site Panel Reflection Angles

The project will use single-axis tracking panels with a north-south axis of rotation). In “plan” view, reflections from the Project’s panels will be directed as shown in **Figure 8** for a representative area of panels, with the direction of reflected rays shown for typical mid-summer days. As a result of the tracking motion of the solar panels throughout the day, reflections will generally be directed upwards and hence not visible by ground-based receivers at roughly the same elevation as the facility.

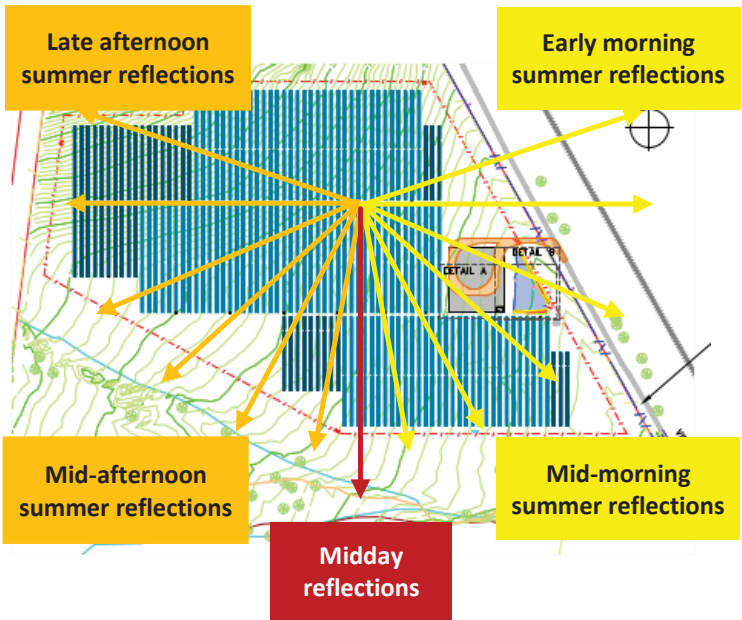


Figure 8 Potential Summer Reflection Angles

7.5.7 Solar Panel Reflectivity

Solar PV panels are designed to capture (absorb) the maximum possible amount of light within the layers below the front (external) surface. Consequently, solar PV panels minimise reflections which are a function of:

- the angle at which the light is incident onto the panel (which will vary depending on the specific location, time of day and day of the year), and
- the index of refraction of the panel surface and associated degree of diffuse (non-directional) versus specular (directional or mirror-like) reflection. Typical values of the refractive index “n” range from n = 2.0 (fresh, flaky snow) to n = 1.3 (standard solar glass).

Figure 9 shows the reflectivity off typical solar panel surfaces and the still surface of a lake as a function of incidence angle.

The reflectivity of the PV panels assumed in this study is the same as that shown for the standard solar glass shown in **Figure 9**.

- When an oncoming solar ray strikes the surface of a solar PV panel close to perpendicular to the panel surface (i.e. low “incident” angle), the reflectivity percentage is minimal (less than 5% for all solar panel surface types).
- It is only when an incoming solar ray strikes the panel at a large “incidence” angle, i.e. almost parallel to the panel, that reflectivity values increase. When this happens, reflections become noticeable and potentially at “glare” level for all solar panel surface types.
- However, for very high incidence angle, it would almost always be the case that the observer (motorist, train driver, pedestrian, etc) would perceive reflections coming from virtually the same direction as the incoming solar rays themselves. Such a condition would not constitute a glare situation as the intensity of the incoming solar ray itself would dominate the field of vision perceived by the observer.

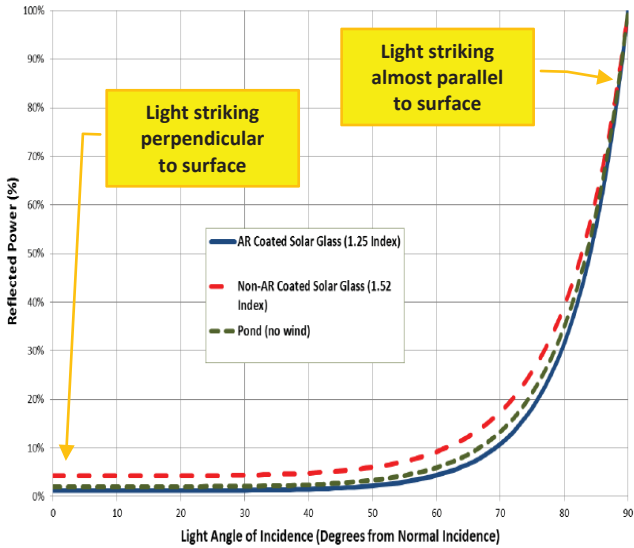


Figure 9 Typical Reflectivity v Incidence Angle

7.5.8 Operational Tracking Axis Configurations

Current single-axis tracking systems, as would be used for this project, are capable of operating in a number of different panel position modes. Possible options are shown in **Figure 10**.

- “A”: Fixed Tilt Mode:** in this mode, all panels are assumed to remain at a user-defined fixed angle all day long, eg horizontal, 15°East, 10°West, etc;
- “B”: Normal Tracking Mode:** in this mode, panels move between maximum tilt angles once the sun is above the relevant altitude angle (eg an altitude angle of 30° for ±60° single-axis trackers). They remain at the maximum tilt angles at all other times, switching over during the night;
- “C”: Normal Tracking Mode / Fixed Tilt Stowed:** in this mode, panels move during the day in “normal tracking”: mode, but then move (instantaneously) to any user-defined fixed tilt angle at all other times, eg 0° (horizontal);
- “D”: “Real-World Back-Tracking”:** in this mode, panels move during the day in “normal tracking”: mode, but then gradually move to a horizontal position, thereby minimising shading of one panel array from adjacent arrays – the example shown is from an operating solar farm.



Figure 10 Single-Axis Tracking Mode Options

7.6 Glare Impact Assessment

7.6.1 Aviation Glint & Glare

As can be seen in **Figure 5** , the nearest airfield to the Project site is Boggabri Aerodrome (6km south-southeast of the site). Gunnedah Airport is 38km southeast of the site and Narrabri Airport is 44km north-northwest of the site.

Due to the distances involved (refer above) and the possible angles of reflections from the Project’s solar PV panels (refer **Figure 12**) in relation to the pilot line of sight on landing approach in the case of Boggabri Aerodrome, potential glare conditions for aircraft on any possible approach paths for all the nearest airports are deemed non-existent.

Helicopter flight paths can be highly variable and landing approach paths often vary in relation to an airfield’s standard runway glide paths. However, again, due to the distances involved, potential glare conditions for any possible helicopter landing approach paths are deemed non-existent.

Accordingly, a quantitative analysis (eg using Sandia Labs SGHAT) is not deemed necessary to assess the potential for adverse and unacceptable glare (and glint) conditions.

7.6.2 Aerial Spraying / Crop Dusting

Given the surrounding agricultural land usage in the vicinity of the Project site, it is possible that aerial spraying might take place within several kilometres of the Project. There are no “standard” aircraft flight paths associated with such aviation activity.

SLR has previously undertaken quantitative analyses using the SGHAT software tool of such activities, for the following scenario:

- Assume potential flight paths whereby an aircraft is flying horizontally towards a Project site from any direction and at an elevation of 200 ft (60 m) above local ground level;
- Assume that the aircraft can get as close as 1 km to the nearest part of the Project’s solar array; and
- Assume that solar panels track the sun during the day, tilting from 60 east to 60 west, about a horizontal axis oriented north-south.

When run for a full year of potential incoming solar angles at latitudes similar to the Project site (hence similar incoming solar angles), the resulting SGHAT Ocular Plots showed that the potential for aviation glare was negligible. This was primarily due to the low incidence angle of reflected rays (regardless of the time of the year) arising from the tilting action of the tracking systems.

7.6.3 Motorist Disability & Pedestrian Discomfort Glare

The “major” and “minor” thoroughfares in the immediate vicinity of the Project (refer **Figure 5**) are:

MAJOR (TI Values should be less than 10)

- Kamilaroi Highway – southbound, northbound
- Boggabri-Manilla Road - westbound

MINOR (TI Values should be less than 20)

- Vine Lane - northbound

Important factors influencing the potential for traffic disability glare include:

- Any difference in elevation between the motorist and the solar panel array;
- Obstructions by intervening terrain, vegetation and topography; and
- The difference between the line of sight of a driver (i.e. in the direction of the road) and the line of sight relative to incoming reflections. Significant TI values can only occur when this difference is small. In some cases, eg when traffic is moving away from the line of incoming reflections, such reflections become essentially non-visible to the motorist, eg east moving traffic on Boggabri-Manilla Road.

TI calculations have been made for the roadways surrounding the Project site. The results, shown in **Table 6**, indicate the following:

- TI Values registered for all carriageways were zero at all times of the year for the “±60° Normal Tracking” mode, where reflections are directed upwards for all incoming solar angles, all year round.
- Low TI Values are possible if the panels are left in a FIXED TILT eastwards mode at a low angle to the horizontal – this applies to west moving traffic on Boggabri-Manilla Road and traffic moving northwards along Vine Lane.

In the FIXED TILT mode cases examined the relevant Motorist Traffic Disability Glare criteria and Pedestrian Discomfort Glare criteria are satisfied. The primary reason for this result is the difference in elevation for motorists and the solar array panels: for example, a motorist facing west on Boggabri-Manilla Road at the intersection with Kamilaroi Highway would be over 15 m lower than the elevation of the solar array.

- The primary reason for this result is the difference in elevation for motorists and the solar array panels: for example, a motorist facing west on Boggabri-Manilla Road at the intersection with Kamilaroi Highway would be over 15 m lower than the elevation of the solar array.

Table 6 Roadway TI Value Calculation Results

Roadway	TI Values	Comment
Kamilaroi Highway	nil	All year round
Boggabri-Manilla Road	nil	All year round
Vine Lane	Max 3	If panels left tilted slightly eastwards (near horizontal)

7.6.4 Train Driver Disability Glare

Figure 5 shows the Mungindi Rail Line running just to the east of the eastern perimeter of the Project site.

SLR has undertaken TI Value calculations for the section of the line approaching from the south focussing on positions where the line of sight of train drivers was closest to the angle of potential incoming solar reflected rays (note that no reflection angles are possible when viewed from the north).

- For the standard operational “±60° Normal Tracking” mode, the TI Values for Disability Glare were NIL, as reflections are directed upwards for all incoming solar angles, all year round.
- For any scenarios involving panels being left in a FIXED TILT eastwards mode, reflections may be visible on the Mungindi Rail Line for late afternoon periods after the equinox months of the year. These reflections would be visible for periods less than a minute. The associated TI Values are modest and below the limiting criteria of TI=20 as a result of the difference in line of sight of the train driver and the incoming solar rays and associated reflections (which would roughly be from due west).

7.6.5 Industrial Critical Machinery Operators

There are no industrial operations in the vicinity of the Project (e.g. mining operations) and none planned (mining or otherwise), with the kind of machinery where the relevant operators have the potential to experience reflective glare from the Project, eg elevated cabins in draglines, etc.

7.6.6 Residential Nuisance Glare

The nearest residential receivers to the Project are identified in **Figure 5**.

- They surround the site at varying distances from the nearest respective site boundary.
- Their ground elevations are mostly LOWER than the Project’s solar array, with the exception of BSF R1 (refer **Figure 5**) which is at the same elevation.

There are no formal criteria governing residential reflective nuisance glare from solar facilities.

Accordingly, SLR has carried out TI Value calculations for the receivers discussed above, to gain an understanding of the potential for nuisance glare conditions from the project. The results are shown in **Table 7**.

Table 7 Residential TI Value Calculations Results

Receivers	TI Values	Comment
BSF R1	Up to ~3	If panels left tilted slightly westwards (near horizontal)
BSF R2-R5	nil	All year round

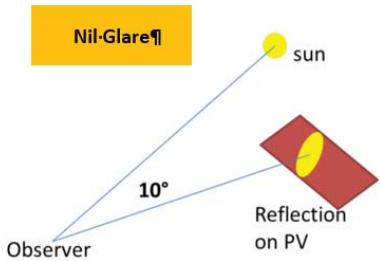


Figure 11 Nil Glare Condition for Residential Nuisance Glare

The results indicate the following:

- For the standard operational “±60° Normal Tracking” mode, the TI Values were NIL at all receivers;
- For FIXED TILT eastwards and FIXED TILT 0° modes, reflections will not be visible for receivers to the east of the site due to the elevated position of the Project solar array relative to these receivers;
- For a FIXED TILT westwards mode (low angle, ie near horizontal), reflections will be potentially visible to BSF R1 for up to 4 months of the year and up to 5 minutes per day. Because these reflections occur early in the morning, visible reflections would be in the same line of sight as the solar rays themselves – this would not constitute a glare condition – as is shown in **Figure 11**.
- In the preceding analysis, no account was taken of the potential “shielding” benefit to residence BSF-R1 from the trees lying between the property and the Project site.

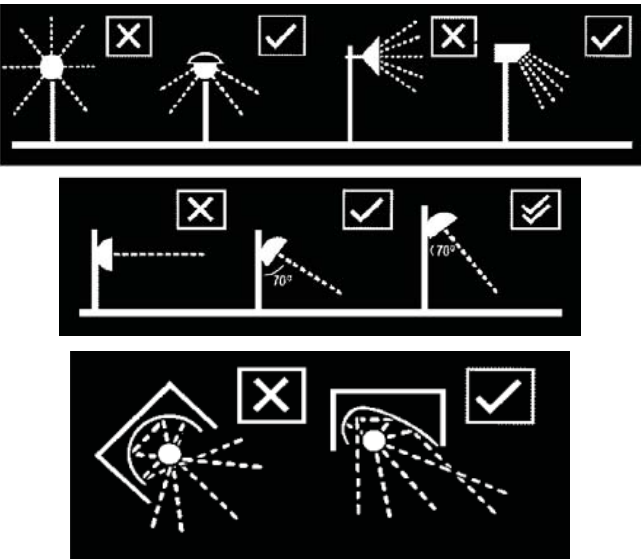


Figure 12 Luminance Design Features that Minimise Light Spill

7.6.7 Night-Time Illumination Glare

Although presently not fully defined, it is assumed that an area within the Boggabri Solar Farm Project site will be set aside for an Operation and Maintenance building, power conversion unit, fire access routes and egress, etc, and that some of these may need to be operational 24/7.

Although night-time illumination is not presently planned for the Project, it may be required in the future for some of the above relevant areas and, as such, is addressed in principle in this assessment.

The only potential for any future night-time illumination glare would be associated with the nearest thoroughfares and residential and other sensitive receivers to the Project. Consideration has also been given to the potential for adverse eco-lighting impacts on nocturnal fauna habitats in close proximity to the Project site, especially within any close-by native vegetation areas. On the basis of the Flora and Fauna Assessment Report carried out for the Project, there are no such habitats close to the Project site.

The recommendations set out below are therefore made in the event that future 24/7 lighting is incorporated into the Project, to achieve the best lighting performance (taking into account safety considerations) while having a minimal impact on the surrounding properties, carriageways and nocturnal fauna.

In terms of any future potential night-time lighting, the adopted goal of limiting night-time light spill to no more than 1 lux falling on the nearby residential facades during curfew hours will be easily achieved given the distances to the nearest residential and other receivers.

Accordingly, the potential for any future nuisance glare will be non-existent.

AS4282-1997 Control of the Obtrusive Effect of Outdoor Lighting sets out general principles that should be applied when designing outdoor light to minimise any adverse effect of the light installation.

- Direct lights downward as much as possible and use luminaires that are designed to minimise light spill, e.g. full cut-off luminaires where no light is emitted above the horizontal plane, ideally keeping the main beam angle less than 70°.
- Less spill-light means that more of the light output can be used to illuminate the area and a lower power output can be used, with corresponding energy consumption benefits, but without reducing the illuminance of the area – refer **Figure 12**.
- Do not waste energy and increase light pollution by over-lighting.
- Wherever possible use floodlights with asymmetric beams that permit the front glazing to be kept at or near parallel to the surface being lit.

7.7 Glare Assessment Conclusion

7.7.1 Aviation-Related Potential Glare

There will be nil impact from the Project in relation to aviation-related glare.

7.7.2 Motorist “Traffic Disability” Glare

Primarily due to the selection of the single-axis tracking system for the mounting of the ground-based array panels, there will be nil glare from the Project in relation to traffic disability glare.

7.7.3 Rail Traffic “Disability” Glare

Similarly, there will be nil glare from the Project in relation to rail traffic disability glare.

7.7.4 Residential Nuisance Glare

Reflections from the proposed facility may be visible at one surrounding residence, although the TI Values calculated for this occurrence are minimal. To avoid the potential for visible reflections, it is recommended that if panels need to be left at a near horizontal position, they should be left with a slightly eastwards fixed tilt angle of at least 10°.

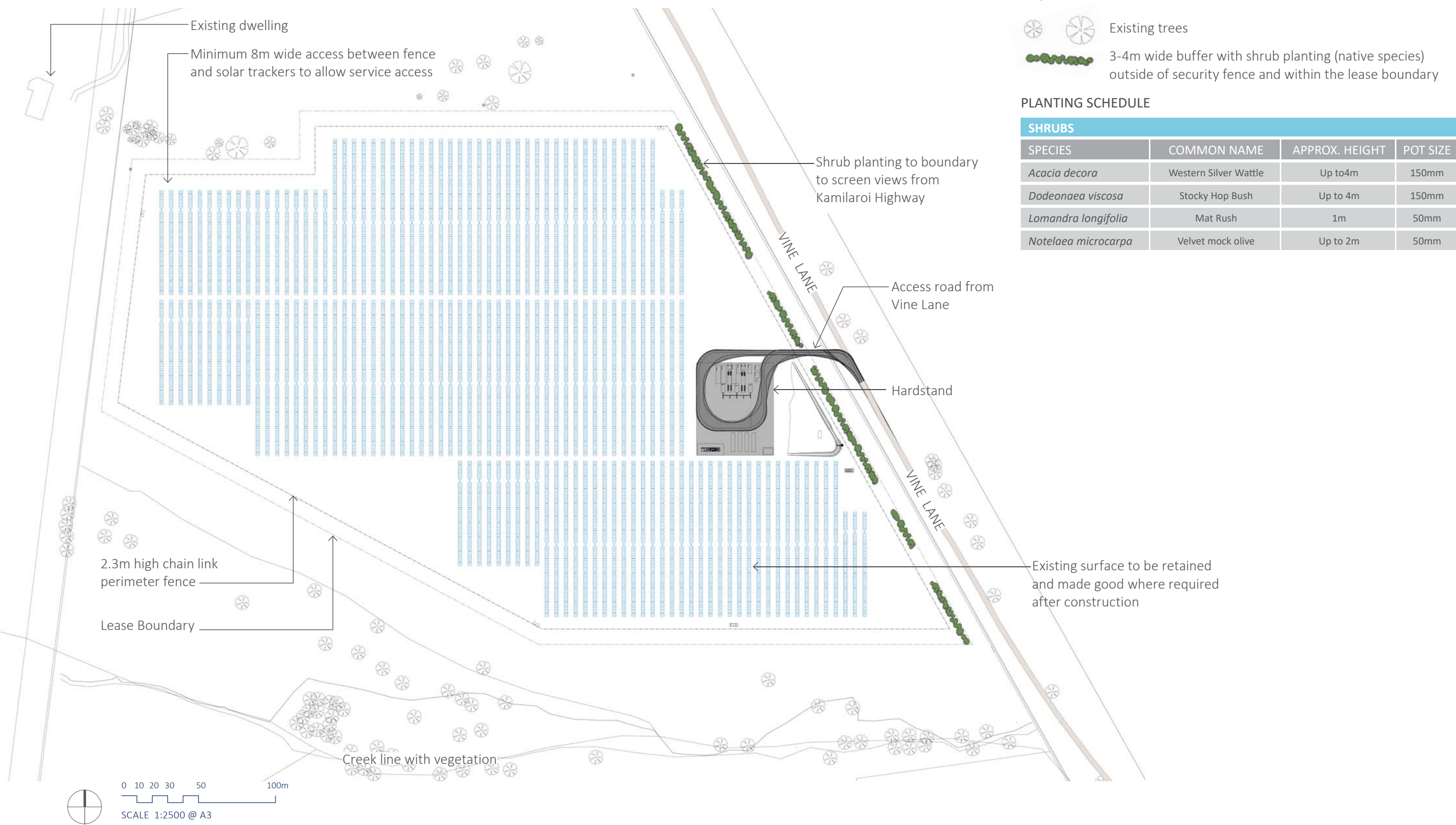
7.7.5 Night-Time Illumination Glare

Although presently not incorporated into the Project, consideration has been given to the future potential for night-time lighting related to equipment and/or buildings, fire access routes and egress, etc.

Recommendations have been made to ensure that the potential for any future possible night-time illumination glare will be non-existent.

8. LANDSCAPE CONCEPT

8.1 LANDSCAPE PLAN



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07/12/2020

Project Number: 200523

STORMWATER MANAGEMENT REPORT

at

BOGGABRI SOLAR FARM | VINE LANE BOGGABRI NSW

for

PROVIDENCE ASSET GROUP

Project No. 200523

Revision: B – Reissued for DA

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1. Introduction

DRB Consulting Engineers (DRB) were engaged by Providence Asset Group Pty Ltd to undertake a Stormwater Management Plan for the proposed Boggabri Solar Farm, located at Lot 151 DP 755475 Vine Lane, Boggabri NSW.

This report will provide commentary on the impact the proposed development will have on the existing site with regard to stormwater quantity.

It should be noted that, this report has been prepared to a level suitable for Development Application only.

This report should be read in conjunction with the Concept Stormwater Management plans 200523/CIV01-02.

2. Site Description & Proposed Development

The site is located at Vine Lane, Boggabri. The site is located on the eastern side of Vine Lane and is identified as Lot 151 DP 755475.

The proposed Boggabri Solar Farm will be located in the centre portion of the site, known as the Investigation Area (IA).

At the time of this investigation, the IA was a vacant rural parcel of land approximately 13.492 Ha in area. The IA had a good grass coverage and sloped from the northwest to the southeast at slopes of approximately 1.5 – 3.0%.

The IA had an existing watercourse passing through the south of the IA. During rainfall events, surface runoff from the IA would sheetflow towards the existing watercourse.

Figure 1 below shows the existing site and investigation area.



Figure 1 – Existing Site Boundaries

The proposed Solar Farm layout can be seen in Figure 2 below.



Figure 2 – Proposed Solar Farm

3. Council Requirements

A review of Narrabri Shire Council's Development Plan and Engineering Guidelines did not provide guidance on developments of this nature. As such, based on previous experience of design of solar farms, we understand our requirements to be:

- *The proposed development must detain stormwater runoff to ensure Post-Development flow rates are reduced to Pre-Development flow rates for all storm events up to and including the 1 in 100 year storm event.*

Furthermore, the site must discharge legally without causing nuisance flows onto neighbouring properties.

4. Water Quantity Analysis (Onsite Stormwater Detention)

4.1. Overview

The proposed development area has been split into two separate catchments for the assessment of Stormwater Quantity; the Photovoltaic Array stage and the Gravel / Hardstand catchments. Figure 3 below shows the proposed catchment boundaries.

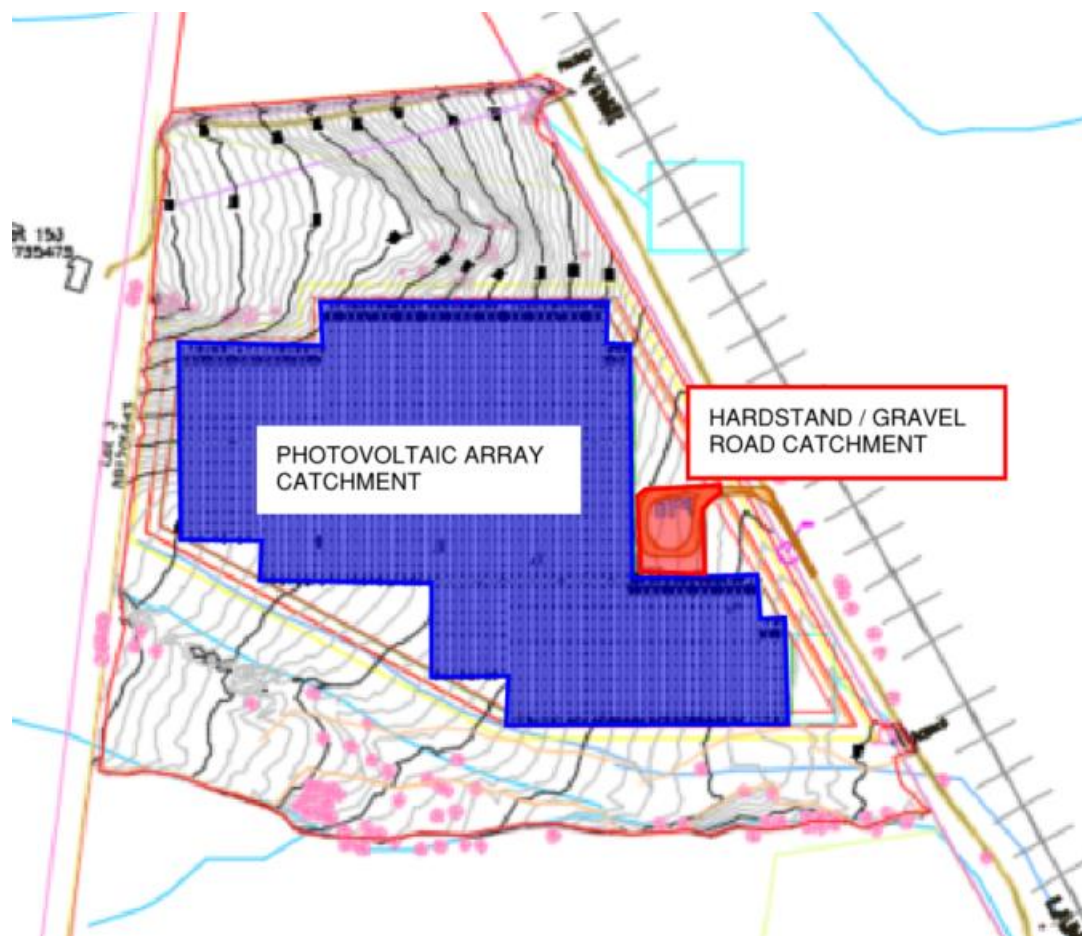


Figure 3 – Proposed Catchment Boundaries

4.2. Photovoltaic Array

The Photovoltaic Array will consist of 136 x Ground Mounted Single Axis Trackers. The array structure will be steel pile supported and will have approximately 600mm clearance above the existing ground surface.

4.2.1. Pre-Development Peak Flows

The catchment characteristics for the Pre-Development catchment area can be seen in Table 1 below:

Construction Stage	Parameter	
Photovoltaic Array Catchment Pre-Development	Sub-Catchment Area	88,104.70 m ²
	Percentage Impervious	0 %
	Flowpath Length	535.16 m
	Flowpath Slope	2.02 %
	Retardance Coefficient 'n'	0.075

Table 1 – Existing Catchment Parameters

A DRAINS model was developed to determine the pre-development peak flow rates. The DRAINS model used the *ARR 2019 Initial loss - Continuing loss (IL-CL) hydrological model* and 2016 IFD data. The pervious area initial loss from the 2016 IFD data hub was estimated to be 60mm. This seemed to be quite a high rate for initial loss. As such, the model was developed using a more conventional, and conservative, 35mm. The Hydrological model parameters were determined using the ARR data hub and can be seen in Figure 4 below.

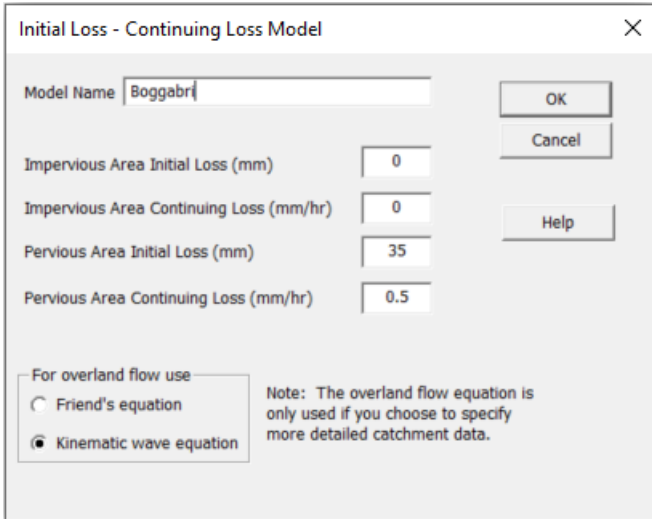


Figure 4 – Hydrological Model Parameters

The model was developed for the 1 EY (Exceedances per year), 10% AEP (Annual Exceedance Probability) and 1% AEP events and analysed the following storm durations.

5 minutes	45 minutes	9 hours
10 minutes	1 hour	12 hours
15 minutes	2 hours	18 hours
20 minutes	3 hours	24 hours
25 minutes	4.5 hours	
30 minutes	6 hours	

The Results of the DRAINS model can be seen below in Table 2.

Construction Stage	Storm Event (Exceedance Probability / Annual Exceedance Probability)	Peak Flow
Photovoltaic Array Catchment	1EY	0.089 m ³ /s
Pre-Development	10% AEP	0.653 m ³ /s
	1% AEP	1.430 m ³ /s

Table 2 – Pre-Development Peak Flow

4.2.2. Post-Development Peak Flows

The Post-Development site conditions can be summarised below:

- (i) The proposed arrays will be at varying angles, however, in a worst-case runoff scenario, it is assumed the arrays are horizontal to the existing ground surface level.
- (ii) Runoff from the proposed arrays will fall immediately on to the untouched natural ground surface.
- (iii) The pervious area under the arrays will not receive direct rainfall, however, it will be available for both initial and continuing loss for the runoff of the array immediately upslope.

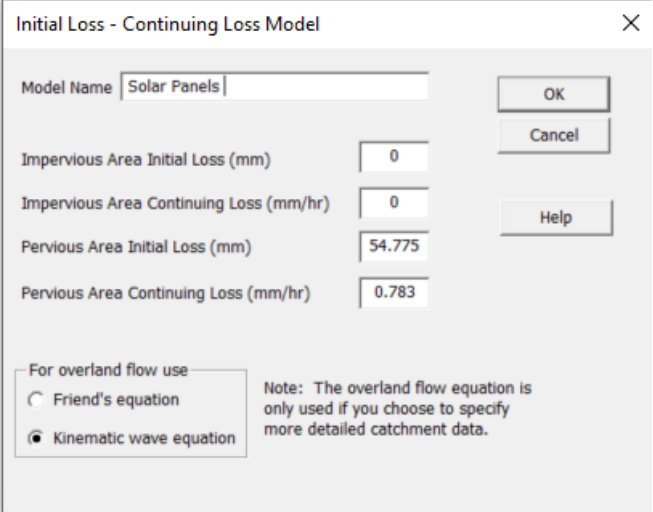
The catchment characteristics for the Post-Development catchment area can be seen in Table 3 below:

Construction Stage	Parameter	
Photovoltaic Array Catchment	Sub-Catchment Area	88,104.70 m ²
Pre-Development	Percentage Impervious	36.10 %
	Flowpath Length	535.16 m
	Flowpath Slope	2.02 %
	Retardance Coefficient 'n'	0.075

Table 3 – Proposed Development Catchment Parameters

To replicate the proposed site conditions and consider the available pervious areas located underneath the proposed arrays, the Pervious Area Initial and Continuing Loss was factored up by 1.565. This allowed the total pervious area to be included in the assessment.

The Hydrological model parameters used in the Post-Development model can be seen in Figure 5 below.



Initial Loss - Continuing Loss Model

Model Name: Solar Panels

Impervious Area Initial Loss (mm): 0

Impervious Area Continuing Loss (mm/hr): 0

Pervious Area Initial Loss (mm): 54.775

Pervious Area Continuing Loss (mm/hr): 0.783

For overland flow use:

☐ Friend's equation

☒ Kinematic wave equation

Note: The overland flow equation is only used if you choose to specify more detailed catchment data.

Buttons: OK, Cancel, Help

Figure 5 – Hydrological Model Parameters

The Results of the DRAINS model can be seen below in Table 4.

Construction Stage	Storm Event (Exceedance Probability / Annual Exceedance Probability)	Pre- Development Peak Flow	Post- Development Peak Flow	Difference
Photovoltaic Array Catchment	1EY	0.473 m ³ /s	0.198 m ³ /s	- 0.275 m ³ /s
	10% AEP	1.150 m ³ /s	0.745 m ³ /s	- 0.405 m ³ /s
Post-Development	1% AEP	2.150 m ³ /s	1.570 m ³ /s	- 0.580 m ³ /s

Table 4 – Post-Development Peak Flow

4.2.3. Conclusion

By discharging the runoff from proposed Photovoltaic Array's directly to the existing ground surface and maintaining the existing natural surface levels and travel paths the proposed development area catchment limited the increase to peak runoff to negligible values, and reduced the peak runoff during the 1% AEP.

4.3. Gravel / Hardstand Area

The Gravel / Hardstand Area includes the proposed roads, gravel laydown area and temporary buildings located within the Investigation Area.

It is proposed that runoff from this area will generally follow the existing contours, with the existing swales to capture the runoff and convey these flows to a new above ground onsite stormwater detention basin. The basin will then reduce flows to the pre-development levels.

4.3.1. Pre-Development Peak Flows

The catchment characteristics for the Pre-Development catchment area can be seen in Table 5 below:

Catchment	Parameter	
Pre-Developed	Sub-Catchment Area	46.644.82 m ²
	Percentage Impervious	0 %
	Flowpath Length	413.2 m
	Flowpath Slope	2.45 %
	Retardance Coefficient 'n'	0.075

Table 5 – Existing Catchment Parameters

A DRAINS model was developed to determine the pre-development peak flow rates. The DRAINS model used the *ARR 2019 Initial loss - Continuing loss (IL-CL) hydrological model* and 2016 IFD data. The Hydrological model parameters were determined using the ARR data hub (see Figure 4 above) and was developed for the 1 EY (Exceedances per year), 10% AEP (Annual Exceedance Probability) and 1% AEP events.

The Results of the DRAINS model can be seen below in Table 6.

Catchment	Storm Event (Exceedance Probability / Annual Exceedance Probability)	Combined Peak Flow
Pre-Developed	1EY	0.307 m ³ /s
	10% AEP	0.735 m ³ /s
	1% AEP	1.35 m ³ /s

Table 6 – Pre-Development Peak Flow

4.3.2. Post-Development Peak Flows

The Post-Development site conditions can be summarised below:

- (i) The proposed gravel roads and hardstand areas will be assumed to be impervious.
- (ii) A retardance coefficient of 0.013 was adopted for both the proposed gravel road and hardstand area.
- (iii) The runoff from the impervious area was then treated as sheet flow along the natural ground surface and conveyed to the proposed above ground onsite stormwater detention basin via sheetflow.

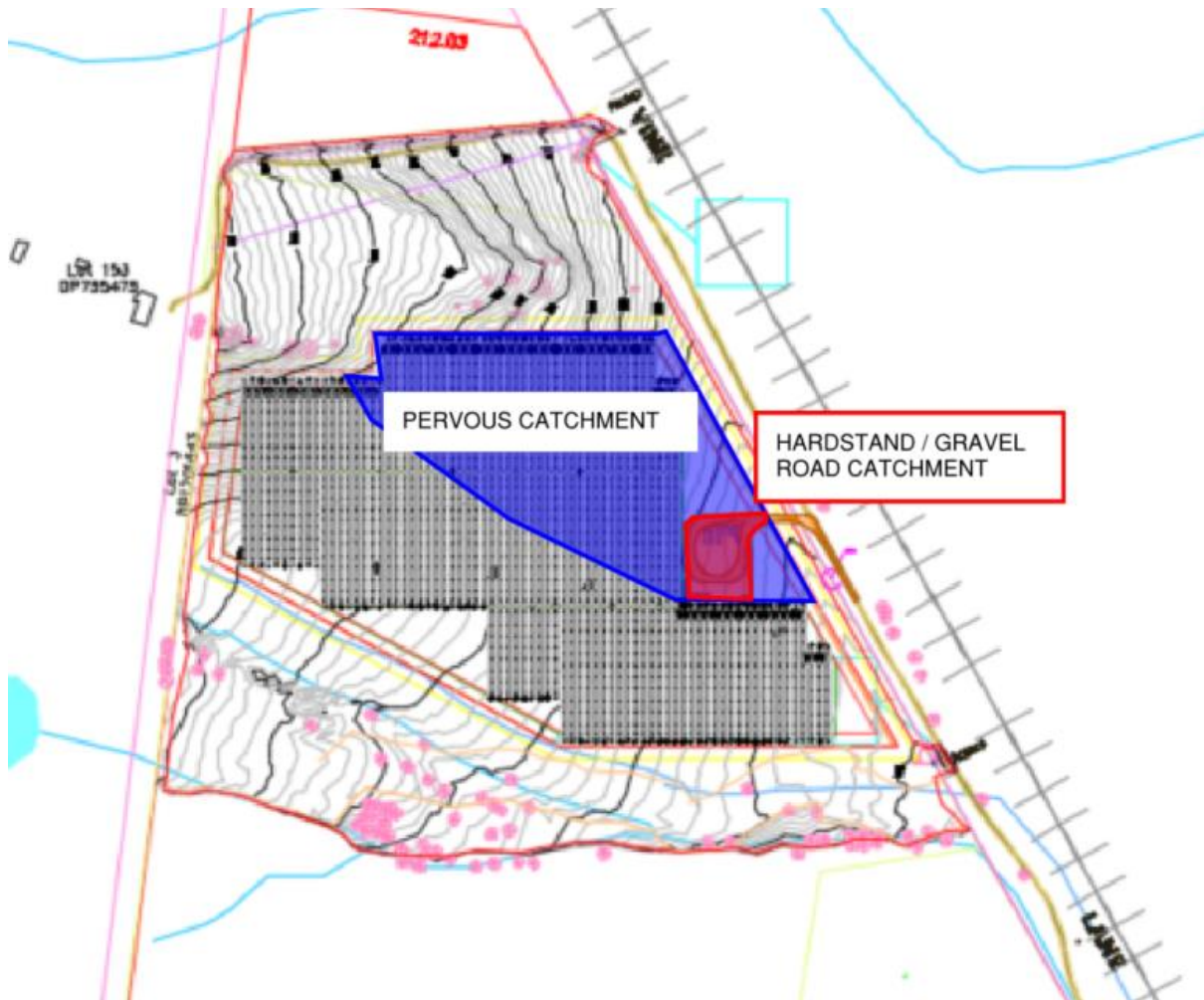


Figure 6 – Post-Development Catchment Boundaries

The catchment characteristics for the Post-Development catchment area can be seen in Table 7 below:

Catchment	Parameter	
Hardstand / Proposed Gravel Road	Sub-Catchment Area	3,446.14 m ²
	Percentage Impervious	100 %
	Flowpath Length	107 m
	Flowpath Slope	1.17 %
	Retardance Coefficient 'n'	0.013
Pervious	Sub-Catchment Area	43,109.70 m ²
	Percentage Impervious	0 %
	Flowpath Length	413.2 m
	Flowpath Slope	2.45 %
	Retardance Coefficient 'n'	0.075

Table 7 – Proposed Development Catchment Parameters

The Gravel / Hardstand Catchment drained directly into an above ground Onsite Stormwater Detention Basin. The Basin characteristics can be seen in Table 7 below.

OSD Basin	
Basin Invert	254.8m AHD
Basin – Top of Bank	255.2m AHD
Low flow pipe diameter	300mm
Low flow pipe invert	254.80m AHD
Base of Weir Width	6.4 m
Base of Weir Level	255.00m AHD
Top of Weir Width	10.4 m
Top of Weir Level	255.20 AHD
Basin Volume	150 m ³

Table 7 – Proposed OSD Basin Characteristics

The Results of the DRAINS model can be seen below in Table 8.

Storm Event	Pre-Dev. Peak Flow	Post-Dev. Peak Flow	Post-Dev. Peak Flow - Mitigated	Difference	Top Water Level
1EY	0.307 m ³ /s	0.344 m ³ /s	0.299 m ³ /s	- 0.008 m ³ /s	255.07m AHD
10% AEP	0.735 m ³ /s	0.812 m ³ /s	0.715 m ³ /s	- 0.020 m ³ /s	255.13m AHD
1% AEP	1.35 m ³ /s	1.478 m ³ /s	1.307 m ³ /s	- 0.043 m ³ /s	255.20m AHD

Table 8 – Post-Development Peak Flow

4.3.3. Conclusion

By discharging the runoff from proposed Gravel / Hardstand Area through the proposed OSD basin, the Post-development peak flows for the entire Investigation Area are reduced back to the Pre-development peak flow values.

5. Conclusion

The stormwater drainage strategy for the proposed Boggabri Solar Farm at Vine Lane, Boggabri can be summarised as:

- (i) All impervious runoff from the proposed Photovoltaic Arrays will discharge to the existing ground surface where the natural flow regime will be maintained.
- (ii) Runoff from the proposed gravel/hardstand area catchment will be conveyed via sheet flow to the proposed above ground onsite stormwater detention basin.
- (iii) Discharge from the above ground onsite stormwater detention basing will be limited to the pre-development flow rates.

Provided the above stormwater drainage philosophy is adopted for the site, the proposed Boggabri Solar Farm will limit the Post-Development peak flows to Pre-Development flow rates for the 1 EY, 10% AEP and 1% AEP events.

Should you require any further advice or clarification of any of the above, please do not hesitate to contact us.

Yours faithfully
DRB CONSULTING ENGINEERS PTY LIMITED



Mathew McNamara
BEng (Civil) Hons MIE Aust



Flora and Fauna Assessment Report



KDC Pty Ltd

Boggabri Solar Farm

Lot 151 DP 755475, 211 Vine Lane,
Boggabri, NSW

14 December 2020

Flora and Fauna Assessment Report

Boggabri Solar Farm

Lot 151 DP 755475, 211 Vine Lane, Boggabri, NSW

Kleinfelder Document Number: NCA20R119114

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Project No: 20212718

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Version	Description	Date	Author	Peer Reviewer
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- Appendix 2: Flora Species List
- Appendix 3: Threatened Species 'Likelihood of occurrence'
- Appendix 4: EPBC Act Protected Matters Search Report
- Appendix 5: Assessment of significance (pursuant to Section 7.3 of the BC Act)
- Appendix 6: Licenses and Permits

1. INTRODUCTION

1.1 PROJECT BACKGROUND

Kleinfelder has been engaged by KDC Pty Ltd (KDC) on behalf of Providence Asset Group to prepare a Flora and Fauna Assessment Report for a proposed solar farm located at Lot 151 DP 755475, 211 Vine Lane, Boggabri 2382 (**Figure 1**). The project will be assessed under Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) with Narrabri Shire Council as the determining authority.

The following terms are used throughout this report to describe geographical areas (**Figure 2**):

- Study area – Lot 151 DP 755475 (23.87 ha).
- Subject site (development footprint) – areas of the study area proposed for development (13.5 ha).
- Locality – land within a 5 km radius of the study area.

This report identifies flora, fauna and threatened species present, or likely to occur within the study area based on species and/or habitats detected during field surveys and threatened flora and fauna records from the locality. An assessment of the likely impacts on identified threatened species, habitat features, wildlife corridors and vegetation communities as a result of the proposed development has also undertaken.

1.2 SITE DESCRIPTION

The study area is located on the outskirts of the township of Boggabri, approximately 50 km from the township of Narrabri within the Narrabri Shire Local Government Area (LGA). The study area is zoned 'RU1 – Primary Production under the *Narrabri Local Environmental Plan 2012* (LEP).

The eastern boundary of the study area is bordered by Werris Creek Mungindi Railway. An unnamed access road runs from Vine Lane through the study area to a rural dwelling in the north west portion of the study area. Surrounding lands are predominantly used for agricultural purposes, as the topography within the area is relatively flat. The study area has a somewhat even topography with an elevation ranging from 211 m in south west to 300 m in the north

east. The native vegetation within the study area has previously been cleared and cultivated (see historical aerial photography). Remaining native vegetation consists of areas of woodland and native grassland communities.

There are three mapped waterways which pass through the study area in an eastern direction. These are comprised of a third order stream and two first order streams that converge in the central southern portion of the site. The converged waterway is a tributary of the Namoi River which occurs approximately three km to the northeast. No other major wetlands or streams are mapped within the study area.

Site photographs are provided in **Appendix 1**.

1.3 PROPOSED DEVELOPMENT

The Boggabri Solar Farm project will include a 5 MW grid-connected solar PV installation. The proposed project layout is approximately 13.5 ha in area and is provided in **Figure 3**. The location of the proposed solar farm is situated in the centre of the study area. Access and connection to the grid will be achieved via Vine Lane.

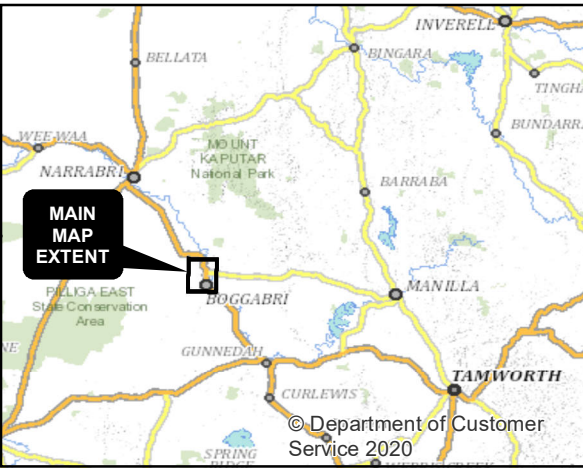
1.4 REPORT OBJECTIVES

The objectives of the Flora and Fauna Assessment Report include:

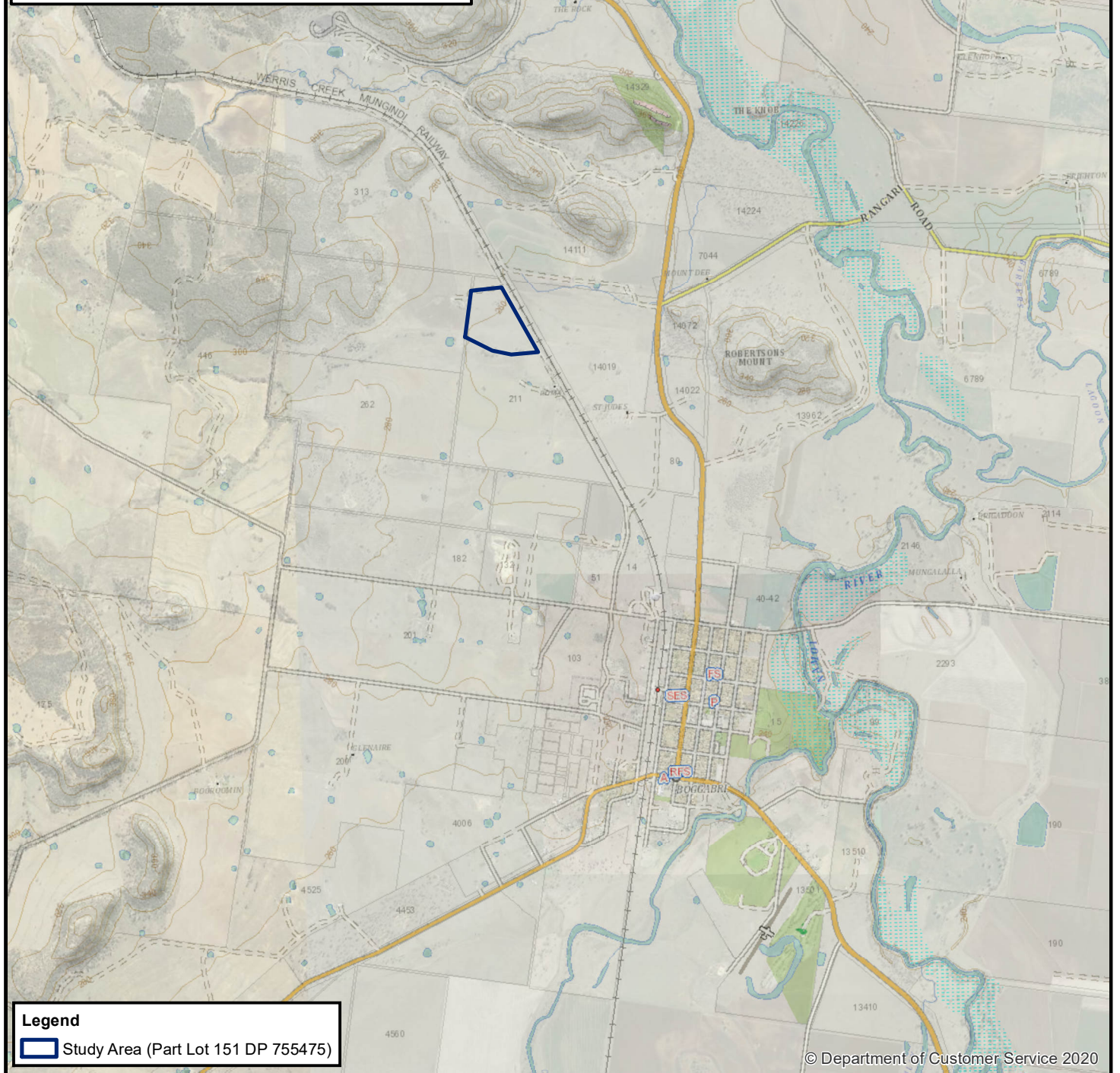
- Describe the flora and fauna (and their habitats) present on, or likely to occur on the subject site.
- Assess the relevance and value of the subject site for threatened species and ecological communities (and their habitats) listed under the NSW *Biodiversity Conservation Act 2016* (BC Act).
- Assess the potential impacts of the proposed development on threatened species and ecological communities, pursuant to Section 7.3 of the BC Act (5-part test).
- Comment on the likely occurrence and relevance of matters of national environmental significance listed under the Commonwealth *Environment Planning and Biodiversity Conservation Act 1999* (EPBC Act).
- Describe steps to avoid and mitigate any identified impacts on flora and fauna and to protect the natural environment of the subject site.

Regional Context

0 10 20 40 60 80 100 km

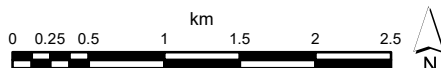


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Legend

Study Area (Part Lot 151 DP 755475)



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Locality

Flora and Fauna Assessment Report
Boggabri Solar Farm
Lot 151 DP 755475
211 Vine Lane, Boggabri NSW

FIGURE:

1



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Legend

- Study Area (Part Lot 151 DP 755475)
- Subject Site
- Local Road
- Track
- Unnamed Watercourse



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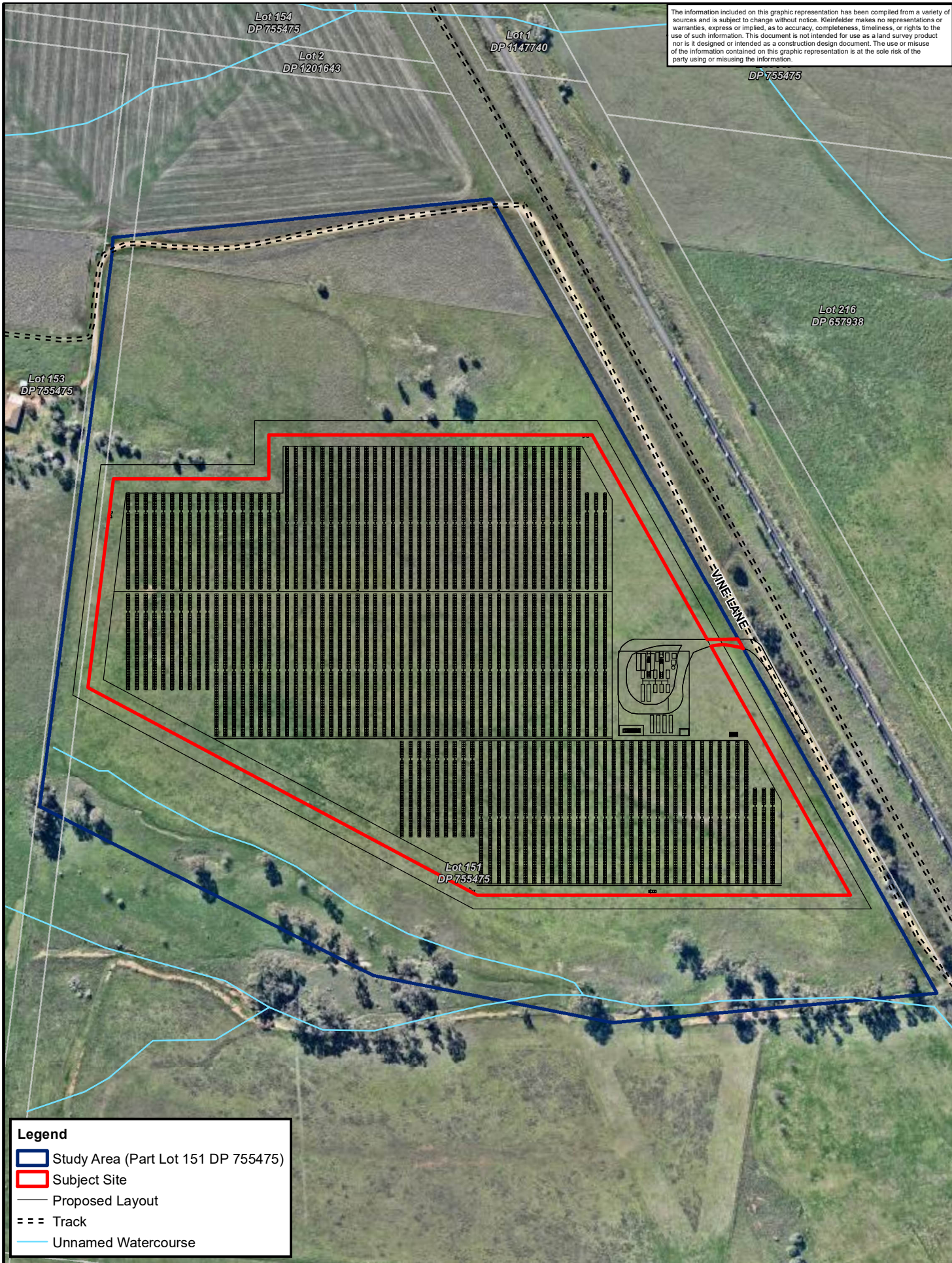
Study Area and Subject Site

Flora and Fauna Assessment Report
Boggabri Solar Farm
Lot 151 DP 755475
211 Vine Lane, Boggabri NSW

FIGURE:

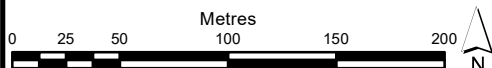
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Legend

- Study Area (Part Lot 151 DP 755475)
- Subject Site
- Proposed Layout
- Track
- Unnamed Watercourse



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Proposed Site Layout

Flora and Fauna Assessment Report
Boggabri Solar Farm
Lot 151 DP 755475
211 Vine Lane, Boggabri NSW

FIGURE:

3



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2. LEGISLATIVE CONTEXT

2.1 COMMONWEALTH LEGISLATION

2.1.1 Environment Protection & Biodiversity Conservation Act 1999

The purpose of the EPBC Act is to ensure that actions likely to cause a significant impact on 'matters of national environmental significance' undergo an assessment and approval process. Under the EPBC Act, an action includes a proposal, a development, an undertaking, an activity or a series of activities, or an alteration of any of these things. An action that 'has, will have or is likely to have a significant impact on a Matter of National Environmental Significance (MNES)' is deemed to be a 'controlled action' and may not be undertaken without prior approval from the Australian Minister for the Environment.

The EPBC Act identifies nine MNES:

- World heritage properties.
- National heritage places.
- Wetlands of international importance (Ramsar Wetlands).
- Threatened species and ecological communities.
- Migratory species.
- Commonwealth marine areas.
- The Great Barrier Reef Marine Park.
- Nuclear actions (including uranium mining).
- A water resource, in relation to coal seam gas development and large coal mining development.

As part of the current assessment, MNES that are predicted to occur within the locality (applying a 5 km buffer) were obtained from the on-line Protected Matters Search Tool (DAWE, 2020a). These records are discussed in **Section 4**. The EPBC Act has been further addressed in this assessment through:

- Field surveys for EPBC Act listed threatened biota and migratory species.
- Assessment of potential impacts on EPBC Act listed threatened species and migratory biota.

- Identification of suitable impact mitigation and environmental management measures for EPBC Act listed threatened species and migratory biota.

2.2 STATE LEGISLATION

2.2.1 Environmental Planning and Assessment Act 1979

The EP&A Act forms the legal and policy platform for proposal assessment and approval in NSW and aims to ‘*encourage the proper management, development and conservation of natural and artificial resources*’. All development in NSW is assessed in accordance with the provisions of the EP&A Act and the EP&A Regulation 2000.

Development activities that require consent are assessed and determined in accordance with Part 4 of the EP&A Act. The determining authority for the project is Narrabri Shire Council.

2.2.2 Biodiversity Conservation Act 2016

The NSW BC Act, the NSW *Biodiversity Conservation Regulation 2017* (NSW BC Regulation) and amendments to the NSW *Local Land Services Act 2013* (LLS Act) commenced on 25 August 2017. The legislation aims to deliver “a strategic approach to conservation in NSW while supporting improved farm productivity and sustainable development”. The NSW BC Act repeals several pre-existing Acts, most notably the NSW *Threatened Species Conservation Act 1995*, the NSW *Nature Conservation Trust Act 2001* and the NSW *Native Vegetation Act 2003*.

In accordance with the NSW BC Act, entry into the Biodiversity Offsets Scheme (BOS) is not required for the proposed development due to the following:

- The proposed development is not deemed to be ‘State Significant’ under the NSW EP&A Act.
- The proposed development will not impact an Area of Outstanding Biodiversity Value (AOBV) as listed under Part 3 of the NSW BC Act.
- The proposed development is unlikely to cause a significant impact on a threatened species, population or ecological community, as listed under Schedules 1 and 2 of the NSW BC Act, as determined by application of a five-part-test of significance under Section 7.3 of the NSW BC Act.

- The proposed development will not impact areas mapped as having 'high biodiversity value' as indicated by the NSW Biodiversity Values Map (BV Map).
- The proposed development will directly remove 0.54 ha of low condition derived native grassland (further discussed in **Section 5.1.1**). The project will not exceed the BOS threshold for the site (1 ha threshold for a minimum lot size of 100 ha) as determined by the NSW *Biodiversity Conservation Regulation 2017*.

In consideration of the criteria listed above, a Biodiversity Development Assessment Report (BDAR) is not required for the proposed development. As part of the current assessment, threatened species and ecological communities as listed under the NSW BC Act that have previously been recorded within the locality (applying a 5 km buffer) were obtained from the on-line BioNet Atlas of NSW Wildlife (DPIE, 2020a). These records are discussed in **Section 4** of this report.

The NSW BC Act has been further addressed in this assessment through:

- Field surveys to assess the presence of threatened species, populations and ecological communities, as listed under Schedules 1 and 2 of the NSW BC Act, within the subject site.
- Assessment of potential impacts threatened species, populations and ecological communities, as listed under Schedules 1 and 2 of the NSW BC Act, as determined by application of a five-part-test of significance under Section 7.3 of the NSW BC Act.
- Identification of suitable impact mitigation and environmental management measures.

2.2.3 Biosecurity Act 2015

The *NSW Biosecurity Act 2015* provides a streamlined statutory framework to protect the NSW economy, environment and community from the negative impact of pests, diseases and weeds. The primary objective of the Act is to provide a framework for the prevention, elimination and minimisation of biosecurity risks posed by biosecurity matter, dealing with biosecurity matter, carriers and potential carriers, and other activities that involve biosecurity matter, carriers or potential carriers.

In NSW, all plants are regulated with a general biosecurity duty to prevent, eliminate or minimise any biosecurity risk they may pose. Any person who deals with any plant, who knows (or ought to know) of any biosecurity risk, has a duty to ensure the risk is prevented, eliminated or minimised, so far as is reasonably practicable.

Weed species recorded within the subject site during the current investigation are discussed in **Section 4**.

2.2.4 National Parks and Wildlife Act 1974

The NSW *National Parks and Wildlife Act 1979* (NPWS Act) aims to conserve nature, objects, places or features (including biological diversity) of cultural value within the landscape. The Act also aims to foster public appreciation, understanding and enjoyment of nature and cultural heritage, and provides for the preservation and management of national parks, historic sites and certain other areas identified under the Act.

No areas of National Park estate occur within or adjacent to the subject site.

2.2.5 Water Management Act 2000

Controlled activities carried out in, on or under waterfront land are regulated by the NSW WM Act. The NSW Natural Resource Asset Regulator (NRAR) administers the WM Act and is required to assess the impact of any proposed controlled activity to ensure that no more than minimal harm will be done to 'waterfront land' as a consequence of carrying out the controlled activity. Waterfront land includes the bed and bank of any river, lake or estuary and all land within 40 m of the highest bank of the river, lake or estuary (NRAR, 2018). This means that a controlled activity approval must be obtained from the NRAR before commencing the activity.

Mapped waterways pass through the southern portion of the study area in an eastern direction. The proposed site layout has been designed to avoid the mapped waterways, which are between 46 m and 67 m from the southern edge of the development footprint. No vegetation clearing or disruption to the creek is likely to occur as a result of the construction of the solar array or the grid connection.

Notwithstanding, the application of the WM Act and an assessment of indirect impacts of the proposed development on aquatic habitat and downstream aquatic habitats is provided in **Section 5.1**.

2.2.6 State Environmental Planning Policy (Koala Habitat Protection) 2019

State Environmental Planning Policy (Koala Habitat Protection) aims to encourage the conservation and management of areas of natural vegetation that provide habitat for Koalas to support a permanent free-living population over their present range and reverse the current trend of Koala population decline.

A Koala Plan of Management (KPoM) has not been prepared for the study area; therefore, provisions of Clause 9 of the SEPP (Koala Habitat Protection) is applicable to the proposed development. As such, Council must take into account the requirements of the Koala Habitat Assessment Guideline (DPIE, 2020b), or information prepared by a suitably qualified and experienced person in accordance with the guideline to determine if the land is classified as Highly Suitable Koala Habitat or Core Koala Habitat.

See **Section 4.9** for a summary of the Koala habitat assessment.

2.3 LOCAL PLANNING INSTRUMENTS

2.3.1 Narrabri Local Environmental Plan 2012

The study area is located within the Narrabri Shire Council LGA. The Narrabri Shire LEP 2012 (LEP) is the principal legal document for controlling development at a Local Government level. The zoning provisions establish acceptability of uses and standards regulate the degree of development.

2.3.2 Narrabri Shire Council Development Control Plans

The Narrabri Shire Development Control Plans (DCP's) provide a clear guideline regarding the types of development that may occur on specific sites. DCP's are prepared and adopted by Council after consultation with the community. DCP's are supporting documents to Council's LEP.

3. MATERIALS AND METHODS

3.1 DESKTOP ASSESSMENT

Existing information on the flora and fauna of the subject site and the locality, including relevant threatened biota was obtained from:

- Regional vegetation mapping: *Border Rivers Gwydir / Namoi Regional Native Vegetation Map Version 2.0. VIS_ID 4204* (OEH 2015).
- The BioNet Atlas of NSW Wildlife (DPIE, 2020a) for previous records of threatened species, populations and ecological communities (as listed under the BC Act) within a 5 km radius of the subject site (data retrieved 25/11/2020).
- The Department of the Environment and Energy (DAWE, 2020a) Protected Matters Search Tool, which involved a search for matters of national environmental significance within a 5 km radius of the subject site (conducted on 25/11/2020).
- Relevant published literature on threatened biota (see References).

The results of the database searches were used to compile a list of threatened species, populations and communities, as listed under the BC Act and EPBC Act that could potentially occur on the subject site, and their likelihood of occurrence.

3.2 FIELD SURVEY

3.2.1 Vegetation Assessment

A diurnal inspection of the subject site and surrounds was undertaken on 11 November 2020 to provide specific observations for this report.

Native vegetation types were identified based on dominant flora species present within each structural layer (i.e. canopy, shrub and ground layers). Exotic or highly modified native vegetation was defined based on structure and species composition. Boundaries of vegetation types and communities were marked with a hand-held GPS and mapped using geographical information system (GIS) software.

Vegetation types were assessed against identification criteria for State and Commonwealth listed threatened ecological communities (DAWE, 2020c; DPIE, 2020c). Vegetation and habitats were compared with descriptions provided in the BioNet Vegetation Classification to identify Plant Community Types (PCTs).

Four 400 m² floristic plot/transects were sampled in accordance with Section 5.3.4 of the NSW Biodiversity Assessment Method (BAM) (OEH, 2017). Percentage cover and relative abundance was recorded for all plant species within each plot/transect. Plot/ transects were positioned to sample areas that were most representative of the floristic characteristics of each PCT.

Plant identification and nomenclature were based on species descriptions presented within The Flora of New South Wales Volumes 1 to 4 (Harden, 1993) and with reference to taxonomic updates in PlantNET - The Plant Information Network System of Botanic Gardens Trust, Sydney, Australia (Botanic Gardens Trust, 2020). The locations of all floristic plot/ transects are presented in **Figure 4**.

3.2.2 Fauna Habitat Assessment

The locations of any important habitat features, such as microbat roosting habitat, hollow-bearing trees, terrestrial refugia and nests/burrows were captured with a handheld GPS device and photographed where appropriate.

Searches for potential habitat for threatened fauna species included but were not limited to:

- Koala feed trees.
- Foraging trees for threatened birds.
- Hollow-bearing trees.
- Potential roosts for microbats.
- Vegetated ponds, riparian vegetation and drainage lines for frogs and waterbirds.
- Woody debris, leaf litter and bush rock.

Diurnal opportunistic observations of fauna species and fauna activity such as scats, tracks, burrows or other traces were recorded during survey.

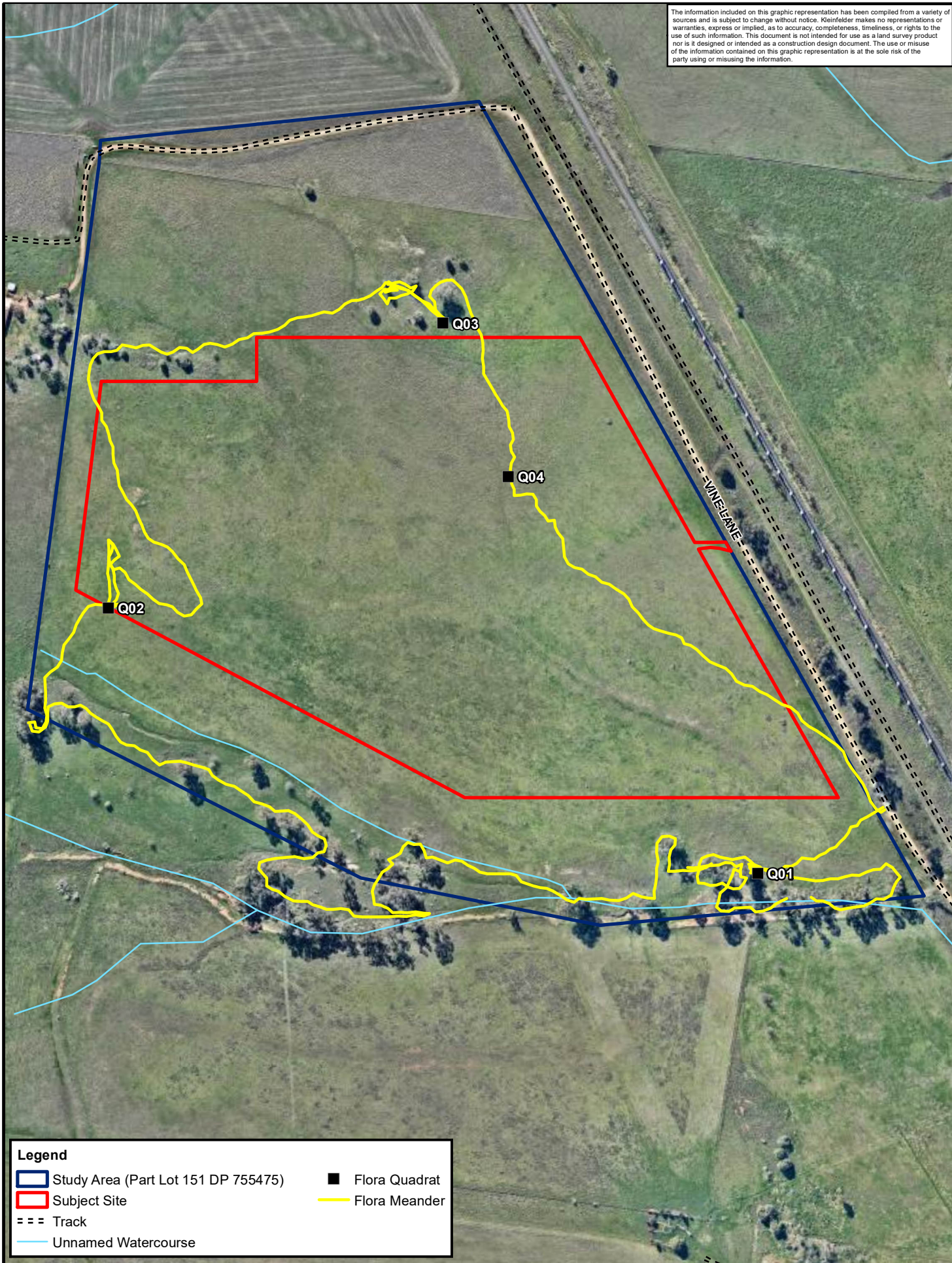
3.3 SURVEY LIMITATIONS

The survey techniques and survey effort applied for this study were commensurate with the nature and condition of the subject site. Due to these limitations, priority was given to habitat assessment for relevant threatened biota. A 'likelihood of occurrence' assessment was applied to all species previously recorded or predicted to occur within the locality based on State and Commonwealth information sources.

The field survey was undertaken during an eight-hour survey period by one ecologist. While a moderate diversity of native and exotic flora species was recorded, a longer survey duration or multiple seasonal surveys would likely result in the detection of a greater diversity of species. The majority of the subject site is considered to be degraded and unsuitable for most threatened plant species known to occur in the locality; therefore, the survey effort that is recommended in *The NSW Guide to Surveying Threatened Plants* (OEH, 2016) is not considered to be applicable.

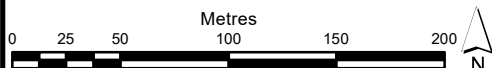
No targeted fauna surveys, microchiropteran bat surveys (i.e. Anabat), fauna trapping or targeted surveys for cryptic fauna species was undertaken, as the proposed development will avoid the watercourses and will not clear any significant habitat features. No 'call playback' for arboreal fauna, large forest owl species were conducted. Given the historical use of the site as agricultural land and the limited amount of clearing required for the proposed development, the survey effort was considered adequate.

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Legend

- Study Area (Part Lot 151 DP 755475)
- Subject Site
- Track
- Unnamed Watercourse
- Flora Quadrat
- Flora Meander



PROJECT REFERENCE: 20212647

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DATA SOURCE:
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Nearmap - 2020

Survey Effort

Flora and Fauna Assessment Report
Boggabri Solar Farm
Lot 151 DP 755475
211 Vine Lane, Boggabri NSW

FIGURE:

4

4. RESULTS

4.1 PLANT DIVERSITY

A total of 48 plant species were identified during the assessment. These were comprised of 23 exotics and 25 natives. A complete list of flora species is presented in **Appendix 2**. The majority of the exotic plant species were comprised of annual herbs and grasses associated with the grasslands. Native plant species were comprised mainly of grasses and low-lying shrubs (Chenopods). Native tree and shrub species were restricted to woodland areas outside the development footprint.

4.2 WEEDS

No major infestations of priority weeds (DPI, 2020) or Weeds of National Significance (DAWE, 2020d) were identified. Minor infestations of weeds were identified, including the following species:

- Prickly Pear *Opuntia stricta*.
- African Box Thorn *Lycium ferocissimum*

Mitigation measures to prevent the spread of weeds are presented in **Section 5.2**.

4.3 PLANT COMMUNITY TYPES

The Regional vegetation mapping for the study area identifies two small patches of woodland vegetation within the study area as *PCT 101 - Poplar Box - Yellow Box - Western Grey Box grassy woodland on cracking clay soils mainly in the Liverpool Plains, Brigalow Belt South Bioregion*. PCT 101 is dominated by Poplar Box *Eucalyptus populnea*, Yellow Box *E. melliodora* and Grey Box *E. microcarpa*.

The assessment determined that the regional vegetation mapping for the area is reasonably accurate with PCT 101 occurring within areas to the north and south of the proposed development area.

The assessment revealed that the entirety of the subject site is comprised of degraded native grassland. The grasslands were very dry at the time of the assessment; however, the dominant species observed was *Aristida aristiglumis* (Plains Grass). Other groundcover species that occurred to a lesser extent include *Austrostipa verticillata* (Slender Bamboo Grass), *Chloris truncata* (Windmill Grass), *Vittadinia cuneata* (Fuzzweed), *Solanum esuriale* (Quena), *Sida corrugata* (Corrugated Sida), *Portulaca oleracea* (Pigweed) and *Boerhavia dominii* (Tartvine). *Sclerolaena birchii* (Galvanised Burr) and *Sclerolaena muricata* (Black Roly-poly) were also dominant in some areas of the study area.

Despite the occurrence of native grasses and herbs, the grasslands are considered to be degraded (low condition) due to the high coverage of exotic plant species. The dominant exotic species were *Bromus catharticus* (Prairie Grass), *Malva parviflora* (Small-flowered Mallow), *Carthamus lanatus* (Saffron Thistle), *Rapistrum rugosum* (Wild Mustard), *Centaurea solstitialis* (St Barnaby's Thistle), *Sida rhombifolia* (Paddy's Lucerne), *Echium plantagineum* (Patterson's Curse), *Medicago polymorpha* (Burr Medic), *Erodium cicutarium* (Common Storksbill), *Trifolium pratense* (Red Clover), *Lactuca serriola* (Prickly Lettuce), and *Silybum marianum* (Variegated Thistle).

The grasslands contain low densities of leaf litter and woody debris. In addition to the high coverage of exotic flora, this suggested that the site has a long history of agricultural development.

4.4 THREATENED ECOLOGICAL COMMUNITIES

One Threatened Ecological Community (TEC) listed as endangered under the BC Act occurs within the study area (i.e. to the north and south of the development footprint). Areas mapped as PCT 101 are commensurate with *Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions*, which is listed as "endangered" under the BC Act (NSW Scientific Committee, 2011). Although this community is generally dominated by *Eucalyptus microcarpa* (Inland Grey Box), *Eucalyptus populnea* is also listed in the scientific determination as an associated species.

The woodland vegetation described above also likely to be commensurate with *Poplar Box Grassy Woodland on Alluvial Plains*, which is listed as "endangered" under the EPBC Act (DAWE, 2020b).

The potential for impacts to the TEC have been assessed via an ‘assessment of significance’ pursuant to Section 7.3 of the BC Act in **Appendix 5**.

Given that the community will not be directly impacted, an Assessment of Significance using the EPBC Significant Impact Criteria is not relevant.

4.5 THREATENED FLORA SPECIES

No threatened flora species were identified within the subject site during the assessment.

A search of the BioNet Atlas of NSW Wildlife (DPIE, 2020a) returned one record of a threatened plant species within a 5 km radius of the study area: Finger Panic Grass *Digitaria porrecta*. A “likelihood of occurrence” assessment determined that habitat for this species does occur within the subject site (**Appendix 3**).

An EPBC Protected Matters Search returned a list of five threatened plant species predicted to occur within a 5 km radius of the study area (**Appendix 4**). A “likelihood of occurrence” assessment determined that habitat is not present within the subject site for any of the predicted matters.

The potential for impacts to Finger Panic Grass have been assessed via an ‘assessment of significance’ pursuant to Section 7.3 of the BC Act in **Appendix 5**.

4.6 FAUNA HABITAT

The assessment revealed that the vegetation within the subject site is comprised mainly of grassland with occasional scattered paddock trees. At the time of the assessment, the grasslands were sparse and dry. Leaf-litter and woody debris was generally absent. A total of six hollow bearing trees (Poplar Box *Eucalyptus populnea*) were identified within the study area, none of which occur within the subject site.

The subject site was found to lack vegetation with a complex structure, shrubs and midstorey species were generally absent. The habitat is likely to support a low diversity of native fauna, including birds and mammal species common within agricultural landscapes. In summary, the fauna habitat assessment determined the following:

- The isolated trees within the subject site may provide marginal foraging and nesting habitat for several common native bird species.
- The grasslands may provide foraging habitat for a range of native birds and terrestrial mammals such as macropods (Kangaroos and Wallabies).
- The grasslands may provide hunting habitat for native predatory birds, such as Falcons, Kestrels and Large Forest Owls.
- No hollow-bearing trees, nests or rocky outcrops were identified within the subject site.

4.7 FAUNA SPECIES

Opportunistic fauna observations included sightings of common bird species such as Apostlebirds (*Struthidea cinerea*). No reptile or amphibian species were opportunistically identified during survey.

4.8 THREATENED FAUNA SPECIES

No threatened fauna species were detected within the subject site. A search of the BioNet Atlas of NSW Wildlife (DPIE, 2020a) returned a list of 13 threatened fauna species that have previously been recorded within 5 km radius of the subject site.

A “likelihood of occurrence” assessment determined that the habitat is too degraded and does not contain suitable habitat to support populations of any of these species (**Appendix 3**).

4.9 KOALA HABITAT

Poplar Box is a listed preferred Koala food tree species under Schedule 2 of the SEPP for Koala Habitat Protection (2019) for the Northwest Slopes region, however this species does not occur within the subject site and will not be impacted by the proposed development.

An assessment of Koala habitat within the subject site determined that no Highly Suitable Koala Habitat, or Core Koala Habitat is present. This is based on the following:

- No evidence of a resident population of Koalas was detected during the assessment (i.e. No Koala individuals, scats or scratch marks were identified).
- There are no Koala feed trees within the subject site.

4.10 EPBC ACT PROTECTED MATTERS

A 'likelihood of occurrence' assessment was conducted for all threatened species and migratory species returned by the EPBC Protected Matters Search (**Appendix 3**). The habitats present within the subject site were considered to be too degraded for all species, with the exception of the Fork-tailed Swift *Apus pacificus* and the White-throated Needletail *Hirundapus caudacutus*.

Both of these bird species may forage aerially over a very wide range of habitats including vegetated and non-vegetated areas. The proposed development will not remove habitat features considered to be important to these species. The extent of foraging habitat is likely to be unaffected.

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Legend

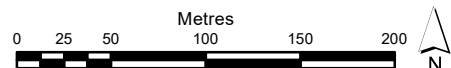
- Study Area (Part Lot 151 DP 755475)
- Subject Site
- == Track
- Unnamed Watercourse



Hollow-bearing Tree

Plant Community Types

- PCT 101: Poplar Box - Yellow Box - Western Grey Box grassy woodland on cracking clay soils mainly in the Liverpool Plains, Brigalow Belt South Bioregion (EEC)
- Degraded Native Grasslands
- Tracks



PROJECT REFERENCE: 20212647

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DRAWN BY: GJoyce

DATA SOURCE:
NSW DFSI - 2020
KDC - 2020
Nearmap - 2020

Vegetation Mapping and Habitat Trees

Flora and Fauna Assessment Report
Boggabri Solar Farm
Lot 151 DP 755475
211 Vine Lane, Boggabri NSW

FIGURE:

5



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5. DISCUSSION

5.1 IMPACT ASSESSMENT

5.1.1 Removal of Native Vegetation

Removal of native vegetation within the subject site will be limited to the removal of native groundcover (**Figure 5**). It is estimated via GIS analysis that approximately 0.54 ha of native vegetation will be disturbed/ removed as shown in **Table 1**.

Table 1 Vegetation (Groundcover) Removal for the proposed development

Activity	Length (m)	Width (m)	Qty	Area (m2)
Trenching	920	1	1	920.0
Piling (3 string tracker)	0.153162	0.1016	1320	20.5
Piling (3 string tracker)	0.153162	0.1016	344	5.4
Hardstand/Roads	-	-	-	3446.0
Berm for Stormwater detention basin	-	-	-	240.0
Security Fence	1469	0.5	1	734.5
Total (m2)				5366
Total (Ha)				0.54

5.1.2 Impacts to Fauna

Potential indirect impacts of the proposed development on resident fauna populations include the following:

- Noise and lighting during the construction phase may cause minor disturbance to resident fauna within the locality and disrupt their natural behaviour.
- Pollution such as chemical spills from construction machinery may have adverse effects on the water quality and biota within the constructed dam and aquatic habitat.
- Ground disturbance by machinery during the construction phase may create dust and facilitate the movement of sediment. Sedimentation could adversely affect the water quality within the aquatic habitat.

Management measures are presented in **Section 5.2** to reduce the potential for these impacts.

5.1.3 Impacts to Threatened Species

No threatened species were identified during the assessment. A “likelihood of occurrence” assessment determined that habitat occurs within the subject site for Finger Panic Grass. In accordance with Section 7.3 of the BC Act, an ‘assessment of significance’ determined that the proposed development is unlikely to have a significant impact on this species.

5.1.4 Impacts to Threatened Ecological Communities

One TEC listed under the BC Act and the EPBC Act was identified within the study area, *Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia*. This community does not occur within the subject site and will not be directly impacted by the proposed development.

The potential for impacts to *Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia* have been assessed via an ‘assessment of significance’ pursuant to Section 7.3 of the BC Act in **Appendix 5**.

5.1.5 Impacts to Aquatic Habitat

The proposed development has been designed to avoid directly impacting the mapped waterways within the study area. Potential indirect impacts include the following:

- The excavation of soil within the subject site during the construction phase has the potential to facilitate erosion and sediment movement. Runoff from the subject site has the potential to introduce nutrients and other toxins to aquatic habitats.
- The introduction of chemicals such as fuels for vehicles and machinery during the construction phase has the potential to cause pollution to downstream aquatic habitat.

Recommendations to reduce the potential for adverse environmental impacts to aquatic habitat are presented in **Section 5.2**.

5.1.6 Cumulative Impacts

Cumulative impacts arise from the interaction of individual elements associated with the proposed development and the additive effects of other external projects. No other known

projects within the locality are known to have relevance to this project that could exacerbate cumulative impacts.

5.2 IMPACT AMELIORATION

5.2.1 Avoidance Measures

Impacts on biodiversity values have been addressed through an iterative design process to avoid areas of higher biodiversity value within the subject site. The design of the solar panel array will ensure that few trees and native vegetation will be removed within the study area.

5.2.2 Erosion Control

Mitigation measures to reduce soil erosion and pollutant run-off during construction activities should include:

- Installation of erosion and sediment control structures within 40 m of any water features prior to any construction works.
- Regular inspection of erosion and sediment control measures, particularly following rainfall events to ensure their ongoing functionality.
- The immediate removal offsite of any excavated materials.
- Avoid stockpiling of materials adjacent to native vegetation, but instead use areas that are already cleared/ disturbed.
- Undertake maintenance of silt fences and other mitigation measures to isolate runoff.

5.2.3 Dust Control

Specific measures to minimise the generation of dust and associated impacts on adjacent natural environments should include:

- Setting maximum speed limits for all traffic within the subject site to limit dust generation.
- Use of a water tanker to spray unpaved access tracks during the construction phase where required.
- Application of dust suppressants or covers on soil stockpiles.

5.2.4 Chemical Spills

Specific measures to minimise the potential for chemical spills and associated impacts on adjacent natural environments should include the following:

- All chemicals must be kept in clearly marked bunded areas.
- Regularly inspect vehicles and mechanical plant for leakage of fuel or oil.
- No re-fuelling of vehicles, washing of vehicles or maintenance of vehicles and plant to be undertaken within 20 m of natural drainage lines and / or water features.

5.2.5 Weed Management

The following recommendations are to be implemented during construction and operation to minimise the impact of weeds within the Subject Site:

- All vehicles should be cleaned prior to entering the site to prevent the introduction of new weed species,
- The site should be monitored during and after construction to ensure that Priority Weeds for the region and Weeds of National Significance are not introduced.

5.2.6 Offset Provisions

As described previously in **Section 2.2.2**, entry into the Biodiversity Offsets Scheme (BOS) is not required for the proposed development.

5.3 CONCLUSION

The proposed development will mainly affect areas of degraded native grassland (agricultural land). The habitat is considered to be generally unsuitable habitat for threatened species; therefore, the proposed development is unlikely to cause a significant impact to any threatened species, populations or ecological communities listed under the NSW BC Act. Entry into the NSW BOS is not triggered by the proposed development.

No EPBC listed species, ecological communities, migratory species or important habitat for such entities was identified within the subject site. The assessment determined that impacts to MNES are unlikely; therefore, an EPBC referral to the Commonwealth Minister for the Environment is not recommended.

Avoidance and mitigation measures have been presented to reduce potential impacts to biodiversity values within the subject site and the environment.

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APPENDIX 1: SITE PHOTOGRAPHS



Plate 1: Native grassland (degraded) within the central portion of the study area



Plate 2: Grassy Woodland in the southern portion of the study area

APPENDIX 2: FLORA SPECIES LIST

Table 2: Flora list

Growth Form	Species	Q1		Q2		Q3		Q4	
		Cov.	Abun.	Cov.	Abun.	Cov.	Abun.	Cov.	Abun.
Exotic Cactus	<i>Opuntia stricta</i>	0.1	2	1	1			1	5
Exotic Grass	<i>Bromus catharticus</i>			0.1	20				
Exotic Grass	<i>Hordeum leporinum</i>			1	100				
Exotic Grass	<i>Lolium rigidum</i>	5	1000	20	1000	5	100		
Exotic Grass	<i>Phalaris aquaticus</i>							2	500
Exotic Herb	<i>Carthamus lanatus</i>	0.5	200	1	50			40	10000
Exotic Herb	<i>Centaurea solstitialis</i>			5	500	2	500	2	500
Exotic Herb	<i>Datura ferox</i>	0.1	20						
Exotic Herb	<i>Echium plantagineum</i>	2	200	0.1	20	2	100	2	50
Exotic Herb	<i>Erodium cicutarium</i>	1	20					0.1	20
Exotic Herb	<i>Gomphocarpus physocarpus</i>			0.1	2				
Exotic Herb	<i>Lactuca serriola</i>	0.5	100			0.5	50		
Exotic Herb	<i>Lupinus sp.</i>							0.1	50
Exotic Herb	<i>Malva parviflora</i>	40	10000			5	1000	0.1	5
Exotic Herb	<i>Medicago polymorpha</i>	1	1000			2	1000	2	500
Exotic Herb	<i>Plantago lanceolata</i>							0.1	10
Exotic Herb	<i>Rapistrum rugosum</i>	10	500			0.5	50		
Exotic Herb	<i>Rumex crispus</i>			0.1	10				
Exotic Herb	<i>Sida rhombifolia</i>	2	200			5	100		
Exotic Herb	<i>Silybum marianum</i>			0.1	10	0.1	5	0.5	20
Exotic Herb	<i>Sonchus oleraceus</i>					0.1	20		
Exotic Herb	<i>Trifolium pratense</i>					0.1	5	1	100

Growth Form	Species	Q1		Q2		Q3		Q4	
		Cov.	Abun.	Cov.	Abun.	Cov.	Abun.	Cov.	Abun.
Exotic Shrub	<i>Lycium ferocissimum</i>	10	20						
Native Chenopod	<i>Einadia trigonos</i>	0.1	1			0.5	50	0.1	5
Native Chenopod	<i>Sclerolaena birchii</i>	20	1000	30	500	5	100	2	50
Native Chenopod	<i>Sclerolaena muricata</i>	10	1000	40	500			1	20
Native Grass	<i>Austrostipa aristiglumis</i>			5	500	70	10000	50	10000
Native Grass	<i>Austrostipa verticillata</i>	2	1000						
Native Grass	<i>Chloris truncata</i>	0.1	10					0.1	10
Native Herb	<i>Boerhavia dominii</i>	1	20			0.1	10		
Native Herb	<i>Calotis lappulacea</i>					0.1	20		
Native Herb	<i>Calotis sp.</i>			5	500				
Native Herb	<i>Dichopogon sp.</i>					0.1	1	0.1	10
Native Herb	<i>Euchiton sphacelata</i>							0.1	5
Native Herb	<i>Oxalis perrenans</i>	0.1	10	0.1	50	0.1	20		
Native Herb	<i>Polymeria longifolia</i>			0.1	20				
Native Herb	<i>Portulaca oleracea</i>	0.1	50	0.1	20	1	500		
Native Herb	<i>Sida corrugata</i>	1	10	2	500				
Native Herb	<i>Sida trichopoda</i>							0.1	20
Native Herb	<i>Solanum esuriale</i>	2	200	1	20	0.1	20		
Native Herb	<i>Tribulus terrestris</i>	1	20			0.1	5		
Native Herb	<i>Vittadinia cuneata</i>	21	500	1	100			1	50
Native Herb	<i>Wahlenbergia communis</i>			0.1	20			0.1	5
Native Shrub	<i>Notelaea microcarpa</i>	5	2						
Native Tree	<i>Brachychiton populneus</i>	0.1	1			5	1		
Native Tree	<i>Callitris glaucophylla</i>					5	1		
Native Tree	<i>Eucalyptus populnea</i>	30	3						
Native Tree	<i>Geijera parviflora</i>	5	3			5	1		



Notes: High Threat exotics (HTE) are classified in accordance with the DPIE HTE List. Growth forms were classified in accordance with the DPIE growth forms data.

APPENDIX 3: THREATENED SPECIES 'LIKELIHOOD OF OCCURRENCE'

Table 3: Likelihood of occurrence

No.	Species	Legal Status*		No. of Records	Source#	Habitat Preferences	Likelihood of occurrence	Potential Impact
		BC Act	EPBC Act					
Flora								
1.	<i>Androcalva procumbens</i>	V	V	-	PMST	Endemic to NSW, mainly confined to the Dubbo-Mendooran-Gilgandra region, but also in the Pilliga and Nymagee areas. Recent collections made from the Upper Hunter region. Grows in sandy sites, often along roadsides. Recorded in <i>Eucalyptus dealbata</i> and <i>Eucalyptus sideroxylon</i> communities, <i>Melaleuca uncinata</i> scrub, under mallee eucalypts with a <i>Calytrix tetragona</i> understorey, and in a recently burnt Ironbark and Callitris area. Other associated species include <i>Acacia triptera</i>, <i>Callitris endlicheri</i>, <i>Eucalyptus melliodora</i>, <i>Allocasuarina diminuta</i>, <i>Philotheca salsolifolia</i>, <i>Xanthorrhoea species</i>, <i>Exocarpos cupressiformis</i>, <i>Leptospermum parvifolium</i> and <i>Kunzea parvifolia</i>. A readily identifiable species that is detectable at all times of year. The subject site lacks most of the species commonly associated with its occurrence. The species was not detected within the subject site during the assessment.	Low	Low

No.	Species	Legal Status*		No. of Records	Source#	Habitat Preferences	Likelihood of occurrence	Potential Impact
		BC Act	EPBC Act					
2.	<i>Cadellia pentastylis</i>	V	V	-	PMST	Occurs along the western edge of the North West Slopes from north of Gunnedah to west of Tenterfield. The natural range of Ooline is from 24°S to 30°S in the 500 to 750 mm per annum rainfall belt. Forms a closed or open canopy mixing with eucalypt and cypress pine species. There appears to be a strong correlation between the presence of Ooline and low- to medium-nutrient soils of sandy clay or clayey consistencies, with a typical soil profile having a sandy loam surface layer, grading from a light clay to a medium clay with depth. A readily identifiable species that is detectable at all times of year. The species was not detected within the subject site during the assessment.	Low	Low
3.	<i>Digitaria porrecta</i> Finger Panic Grass	E	-	356	BioNet	Finger Panic Grass occurs in NSW and Queensland. In NSW it is found on the North West Slopes and Plains, from near Moree south to Tambar Springs and from Tamworth to Coonabarabran. It is often associated with <i>Eucalyptus albens</i> and <i>Acacia pendula</i>. Common grasses and forbs include <i>Austrostipa aristiglumis</i>, <i>Enteropogon acicularis</i>, <i>Cyperus bifax</i>, <i>Hibiscus trionum</i> and <i>Neptunia gracilis</i>. It is found in native grassland, woodlands or open forest with a grassy understorey, on richer soils and along roadsides and travelling stock routes where there is light grazing and occasional fire. A readily identifiable species that is detectable at all times of year. The subject site lacks most of the species commonly associated with its occurrence. The species was not detected within the subject site during the assessment, however potential habitat is present. There are a large number of records within the locality.	Low - Moderate	Low

No.	Species	Legal Status*		No. of Records	Source#	Habitat Preferences	Likelihood of occurrence	Potential Impact
		BC Act	EPBC Act					
4.	<i>Dichanthium setosum</i> Bluegrass	V	V	-	PMST	Bluegrass occurs on the New England Tablelands, North West Slopes and Plains and the Central Western Slopes of NSW, extending to northern Queensland. It is associated with heavy basaltic black soils and red-brown loams with clay subsoil. It is often found in moderately disturbed areas such as cleared woodland, grassy roadside remnants and highly disturbed pasture. (Often collected from disturbed open grassy woodlands on the northern tablelands, where the habitat has been variously grazed, nutrient-enriched and water-enriched). Was not detected within the subject site during the assessment, no records in the locality.	Low	Low
5.	<i>Swainsona murrayana</i> Slender Darling Pea	V	V	-	PMST	Found throughout NSW, it has been recorded in the southern riverine plain, the Hay plain as far north as Willandra National Park and in various localities between Dubbo and Moree. Grows in a variety of vegetation types including bladder saltbush, black box and grassland communities on level plains, floodplains and depressions and is often found with <i>Maireana</i> species. Plants have been found in remnant native grasslands or grassy woodlands that have been intermittently grazed or cultivated. A readily identifiable species that was detectable during the time of survey. The species was not detected within the subject site during the assessment.	Low	Low
6.	<i>Tylophora linearis</i>	V	E	-	PMST	Grows in dry scrub and open forest. Recorded from low-altitude sedimentary flats in dry woodlands of <i>Eucalyptus fibrosa</i>, <i>Eucalyptus sideroxylon</i>, <i>Eucalyptus albens</i>, <i>Callitris endlicheri</i>, <i>Callitris glaucophylla</i> and <i>Allocasuarina luehmannii</i>. The majority of the subject site has been grazed by cattle. The species was not detected within the site during the assessment. The site is considered to be too degraded to support a population of this species.	Low	Low

No.	Species	Legal Status*		No. of Records	Source#	Habitat Preferences	Likelihood of occurrence	Potential Impact
		BC Act	EPBC Act					
Threatened Ecological Communities								
1.	Coolibah - Black Box Woodlands of the Darling Riverine Plains and the Brigalow Belt South Bioregions	E	E	-	PMST	The structure of the community may vary from tall riparian woodlands to very open 'savanna like' grassy woodlands with a sparse midstorey of shrubs and saplings. Typically, these woodlands form mosaics with grasslands and wetlands, and are characterised by Coolibah (<i>Eucalyptus coolabah</i>) and, in some areas, Black Box (<i>E. largiflorens</i>). Other tree species may be present including River Cooba (<i>Acacia stenophylla</i>), Cooba (<i>A. salicina</i>), Belah (<i>Casuarina cristata</i>) and Eurah (<i>Eremophila bignoniiflora</i>). The community was not detected within the subject site during the assessment.	Nil	Nil
2.	Grey Box (<i>Eucalyptus microcarpa</i>) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia	E	E	-	PMST	Inland Grey Box Woodland includes those woodlands in which the most characteristic tree species, <i>Eucalyptus microcarpa</i> (Inland Grey Box), is often found in association with <i>E. populnea</i> subsp. <i>bimbil</i> (Bimble or Poplar Box), <i>Callitris glaucophylla</i> (White Cypress Pine), <i>Brachychiton populneus</i> (Kurrajong), <i>Allocasuarina luehmannii</i> (Bulloak) or <i>E. melliodora</i> (Yellow Box), and sometimes with <i>E. albens</i> (White Box). Shrubs are typically sparse or absent, although this component can be diverse and may be locally common, especially in drier western portions of the community. A variable ground layer of grass and herbaceous species is present at most sites. At severely disturbed sites the ground layer may be absent. The community was detected within the study area during the assessment. This community does not occur within the subject site boundary.	High	Low

No.	Species	Legal Status*		No. of Records	Source#	Habitat Preferences	Likelihood of occurrence	Potential Impact
		BC Act	EPBC Act					
3.	<i>Natural grasslands on basalt and fine-textured alluvial plains of northern New South Wales and southern Queensland</i>	-	CE	-	PMST	is strongly reliant on soil type as it is associated with fine textured, often cracking clays* derived from either basalt or quaternary* alluvium. The ecological community generally occurs on flat to low slopes, of no more than 5% (or less than 1 degree) inclination. As slope increases, grassy woodlands dominated by trees such as <i>Acacia pendula</i> (weeping myall), <i>Eucalyptus coolabah</i> (coolibah), <i>E. populnea</i> (poplar box) or <i>E. melliodora</i> (yellow box) occur. The community was not detected within the subject site during the assessment.	Nil	Nil
4.	<i>Poplar Box Grassy Woodland on Alluvial Plains</i>	-	E	-	PMST	Temperate to semi-arid grassy eucalypt woodland that is sparsely scattered inland of the Great Dividing Range from around Cowra in NSW to near Collinsville in Queensland. This eucalypt woodland is mainly associated with alluvial plains including back plains, higher terraces and levees along rivers, ephemeral watercourses and depressions. The ecological community varies from a grassy woodland to grassy open woodland with an overstorey dominated by <i>Eucalyptus populnea</i> (poplar/bimble box) and an understorey mostly composed of native perennial forbs and grasses but may include some shrubs and sedges, depending on the season, rainfall and location in the landscape. Patches of the ecological community generally lack a substantial mid (tall shrub) layer. The community was not detected within the subject site during the assessment.	Nil	Nil

No.	Species	Legal Status*		No. of Records	Source#	Habitat Preferences	Likelihood of occurrence	Potential Impact
		BC Act	EPBC Act					
5.	<i>Weeping Myall Woodlands</i>	-	E	-	PMST	Occurs on the inland alluvial plains west of the Great Dividing Range in NSW and QLD, generally on flat areas, shallow depressions or Gilgai's on raised alluvial plains. The Weeping Myall Woodlands range from open woodlands to woodlands, generally, 4 to 12m high. The overstorey is dominated by Weeping Myall (<i>Acacia pendula</i>) trees and in some cases this species may be the only tree canopy species. The community was not detected within the subject site during the assessment.	Nil	Nil
6.	<i>White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland</i>	CE	CE	-	PMST	An open woodland community (sometimes occurring as a forest formation), in which the most obvious species are one or more of the following: White Box <i>Eucalyptus albens</i> , Yellow Box <i>E. melliodora</i> and Blakely's Red Gum <i>E. blakelyi</i> . Intact sites contain a high diversity of plant species, including the main tree species, additional tree species, some shrub species, several climbing plant species, many grasses and a very high diversity of herbs. The community was not detected within the subject site during the assessment.	Nil	Nil
Birds								
1.	<i>Artamus cyanopterus</i> Dusky Woodswallow	V	-	1	BioNet	Primarily inhabit dry, open eucalypt forests and woodlands with an open or sparse understorey of eucalypt saplings, acacias and other shrubs, and groundcover of grasses or sedges and fallen woody debris. Also found in farmland, usually at the edges of forest or woodland. May aerially forage over the subject site. More suitable habitat is available in the study area and surrounding lands.	Low	Low

No.	Species	Legal Status*		No. of Records	Source#	Habitat Preferences	Likelihood of occurrence	Potential Impact
		BC Act	EPBC Act					
2.	<i>Chthonicola sagittate</i> Speckled Warbler	V	-	11	BioNet	The Speckled Warbler lives in a wide range of <i>Eucalyptus</i> dominated communities that have a grassy understory, often on rocky ridges or in gullies. Typical habitat would include scattered native tussock grasses, a sparse shrub layer, some eucalypt regrowth and an open canopy. Large, relatively undisturbed remnants are required for the species to persist in an area. May aerially forage over the subject site. More suitable habitat is available in the study area and surrounding lands.	Low - Moderate	Low
3.	<i>Daphoenositta chrysoptera</i> Varied Sittella	V	-	1	BioNet	Inhabits eucalypt forests and woodlands, especially those containing rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland. Feeds on arthropods gleaned from crevices in rough or decorticated bark, dead branches, standing dead trees and small branches and twigs in the tree canopy. The subject site is comprised of agricultural lands that contain few native trees. The habitat in the subject site is unsuitable for this species.	Low	Low
4.	<i>Glossopsitta pusilla</i> Little Lorikeet	V	-	6	BioNet	Forages primarily in the canopy of open Eucalyptus forest and woodland, yet also finds food in Angophora, Melaleuca and other tree species. Riparian habitats are particularly used, due to higher soil fertility and hence greater productivity. Isolated flowering trees in open country, e.g. paddocks, roadside remnants and urban trees also help sustain viable populations of the species. May aerially forage over the subject site. More suitable habitat is available in the study area and surrounding lands.	Low	Low

No.	Species	Legal Status*		No. of Records	Source#	Habitat Preferences	Likelihood of occurrence	Potential Impact
		BC Act	EPBC Act					
5.	<i>Grantiella picta</i> Painted Honeyeater	V	V	1	BioNet PMST	Inhabits Boree/ Weeping Myall (<i>Acacia pendula</i>), Brigalow (<i>A. harpophylla</i>) and Box-Gum Woodlands and Box-Ironbark Forests. This species is a specialist feeder on the fruits of mistletoes growing on woodland Eucalypts and Acacias. Prefers mistletoes of the genus <i>Amyema</i> . The subject site is comprised of agricultural lands that contain few native trees. No mistletoe was identified. The habitat is considered to be too degraded to support this species.	Low	Low
6.	<i>Ninox connivens</i> Barking Owl	V	-	2	BioNet	Inhabits woodland and open forest, including fragmented remnants and partly cleared farmland. Sometimes able to successfully breed along timbered watercourses in heavily cleared habitats due to the higher density of prey found on these fertile riparian soils. Roost in shaded portions of tree canopies, including tall midstorey trees with dense foliage such as <i>Acacia</i> and <i>Casuarina</i> species. During nesting season, the male perches in a nearby tree overlooking the hollow entrance. May use the subject site for foraging, however no roost sites or tall midstorey trees with dense foliage are present within the subject site.	Low	Low
7.	<i>Pomatostomus temporalis temporalis</i> Grey-crowned Babbler (eastern subspecies)	V	-	1	BioNet	Inhabits open Box-Gum Woodlands on the slopes, and Box-Cypress-pine and open Box Woodlands on alluvial plains. Woodlands on fertile soils in coastal regions. May use the subject site for aerial foraging.	Low	Low

No.	Species	Legal Status*		No. of Records	Source#	Habitat Preferences	Likelihood of occurrence	Potential Impact
		BC Act	EPBC Act					
2.	<i>Anthochaera phrygia</i> Regent Honeyeater	CE	CE	-	PMST	Inhabits dry open forest and woodland, particularly Box-Ironbark woodland, and riparian forests of River Sheoak. Regent Honeyeaters inhabit woodlands that support a significantly high abundance and species richness of bird species. The subject site is comprised of agricultural lands that contain few native trees. The habitat is considered to be too degraded to support this species.	Low	Low
3.	<i>Botaurus poiciloptilus</i> Australasian Bittern	E	E	-	PMST	Favours permanent freshwater wetlands with tall, dense vegetation, particularly bullrushes (<i>Typha spp.</i>) and spikerushes (<i>Eleocharis spp.</i>). No suitable aquatic habitat is present within the subject site.	Nil	Nil
4.	<i>Calidris ferruginea</i> Curlew Sandpiper	E	CE	-	PMST	It generally occupies littoral and estuarine habitats, and in New South Wales is mainly found in intertidal mudflats of sheltered coasts. It also occurs in non-tidal swamps, lakes and lagoons on the coast and sometimes inland. No suitable estuarine habitat is present within the subject site.	Nil	Nil

No.	Species	Legal Status*		No. of Records	Source#	Habitat Preferences	Likelihood of occurrence	Potential Impact
		BC Act	EPBC Act					
6.	<i>Falco subniger</i> Black Falcon	V	-	2	Bionet PMST	The Black Falcon is widely, but sparsely, distributed in New South Wales, mostly occurring in inland regions. Some reports of 'Black Falcons' on the tablelands and coast of New South Wales are likely to be preferable to the Brown Falcon. In New South Wales there is assumed to be a single population that is continuous with a broader continental population, given that falcons are highly mobile, commonly travelling hundreds of kilometres (Marchant & Higgins 1993). The Black Falcon occurs as solitary individuals, in pairs, or in family groups of parents and offspring. The subject site is comprised of agricultural lands that contain few native trees. May aerially forage over the subject site.	Low	Low
7.	<i>Falco hypoleucos</i> Grey Falcon	E	-	-	PMST	The Grey Falcon is sparsely distributed in NSW, chiefly throughout the Murray-Darling Basin, with the occasional vagrant east of the Great Dividing Range. Usually restricted to shrubland, grassland and wooded watercourses of arid and semi-arid regions, although it is occasionally found in open woodlands near the coast. Also occurs near wetlands where surface water attracts prey. No suitable habitat is present within the subject site. May aerially forage over the subject site.	Low - Moderate	Low
11.	<i>Rostratula australis</i> Australian Painted Snipe	E	E		PMST	Prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber. No suitable aquatic habitat is present within the subject site.	Nil	Nil
Mammals								

No.	Species	Legal Status*		No. of Records	Source#	Habitat Preferences	Likelihood of occurrence	Potential Impact
		BC Act	EPBC Act					
1.	<i>Chalinolobus dwyeri</i> Large-eared Pied Bat	V	V	-	PMST	Roosts in caves (near their entrances), crevices in cliffs, old mine workings and in the disused, bottle-shaped mud nests of the Fairy Martin (<i>Petrochelidon ariel</i>), frequenting low to mid-elevation dry open forest and woodland close to these features. No cave habitat is present within the subject site.	Nil	Nil
2.	<i>Dasyurus maculatus</i> (SE mainland population) Spot-tailed Quoll	V	E	4	BioNet PMST	This species has been recorded across a range of habitat types, including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline. Individual animals use hollow-bearing trees, fallen logs, small caves, rock outcrops and rocky-cliff faces as den sites. The subject site is comprised of agricultural lands that contain few native trees. The habitat is considered to be too degraded to support this species.	Nil	Nil
3.	<i>Phascolarctos cinereus</i> (combined populations of Qld, NSW and the ACT) Koala	V	V	-	BioNet	In NSW, Koalas occur along the coast, extending west to the Darling Riverine Plains and Mulga Lands bioregions in the north of the state; to the Cobar Peneplain bioregion in the centre of the state; and to the Riverina and eastern most parts of the Murray-Darling Depression bioregions in the south. The koala is found in a variety of forest types. Feed on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, but in any one area will select preferred browse species. No Koalas or Koala feed trees were identified during assessment within the subject site.	Low	Low

No.	Species	Legal Status*		No. of Records	Source#	Habitat Preferences	Likelihood of occurrence	Potential Impact
		BC Act	EPBC Act					
4.	<i>Saccolaimus flaviventris</i> Yellow-bellied Sheath-tail-bat	V	-	-	BioNet	Roosts singly or in groups of up to six, in tree hollows and buildings; in treeless areas they are known to utilise mammal burrows. When foraging for insects, flies high and fast over the forest canopy, but lower in more open country. Forages in most habitats across its very wide range, with and without trees; appears to defend an aerial territory. The subject site provides marginal foraging habitat. The habitat is not considered to be important to this species.	Low	Low
5.	<i>Nyctophilus corbeni</i> Corben's Long-eared Bat	V	V		BioNet PMST	Inhabits a variety of vegetation types, including Mallee, Bulloke <i>Allocasuarina leuhmanni</i> and box eucalypt dominated communities, but it is distinctly more common in box/ironbark/cypress-pine vegetation that occurs in a north-south belt along the western slopes and plains of NSW and southern Queensland. The subject site is comprised of agricultural lands that contain few native trees. The habitat is considered to be too degraded to support this species.	Low	Low
6.	<i>Vespadelus troughtoni</i> Eastern Cave Bat	V	-		BioNet	A cave-roosting species that is usually found in dry open forest and woodland, near cliffs or rocky overhangs; has been recorded roosting in disused mine workings. Occasionally found along cliff-lines in wet eucalypt forest and rainforest. The subject site does not contain suitable habitat.	Nil	Nil
7.	<i>Pteropus poliocephalus</i> Grey-headed Flying-fox	V	V	12	PMST	Occurs across a wide range of habitat types along the eastern seaboard of Australia, depending on food availability. Fruit from myrtaceous trees and rainforest trees form the major components of their diet. Potential marginal foraging habitat is present; however, no camps were detected. The habitat is not considered to be important to this species.	Low	Low
Reptiles								

No.	Species	Legal Status*		No. of Records	Source#	Habitat Preferences	Likelihood of occurrence	Potential Impact
		BC Act	EPBC Act					
1.	<i>Aprasia parapulchella</i> Pink-tailed Worm Lizard	V	V	-	PMST	Inhabits sloping, open woodland areas with predominantly native grassy groundlayers, particularly those dominated by Kangaroo Grass (<i>Themeda australis</i>). Sites are typically well-drained, with rocky outcrops or scattered, partially buried rocks. The subject site is comprised of agricultural lands that contain few native trees. The subject site does not contain suitable habitat for this species.	Nil	Nil
Migratory Species								
1.	<i>Apus pacificus</i> Fork-tailed Swift	-	M	-	PMST	Forages aerially over a very wide range of habitats includes both vegetated and non- vegetated areas. Potential aerial foraging habitat above the subject site.	Moderate	Low
2.	<i>Hirundapus caudacutus</i> White-throated Needletail	-	M	-	PMST	Forages in high open spaces over varied habitat types. Potential aerial foraging habitat above subject site.	Moderate	Low
3.	<i>Motacilla flava</i> Yellow Wagtail	-	M	-	PMST	Typically inhabits inundated fields, saltmarsh and wetlands and occasionally coastal areas. No suitable habitat within the subject site.	Nil	Low
4.	<i>Myiagra cyanoleuca</i> Satin Flycatcher	-	M	-	PMST	Found in tall forests, preferring wetter habitats such as heavily forested gullies, but not rainforests. No suitable habitat within the subject site.	Nil	Low

APPENDIX 4: EPBC ACT PROTECTED MATTERS SEARCH REPORT



EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about [Environment Assessments](#) and the EPBC Act including significance guidelines, forms and application process details.

Report created: 25/11/20 13:40:33

[Summary](#)

[Details](#)

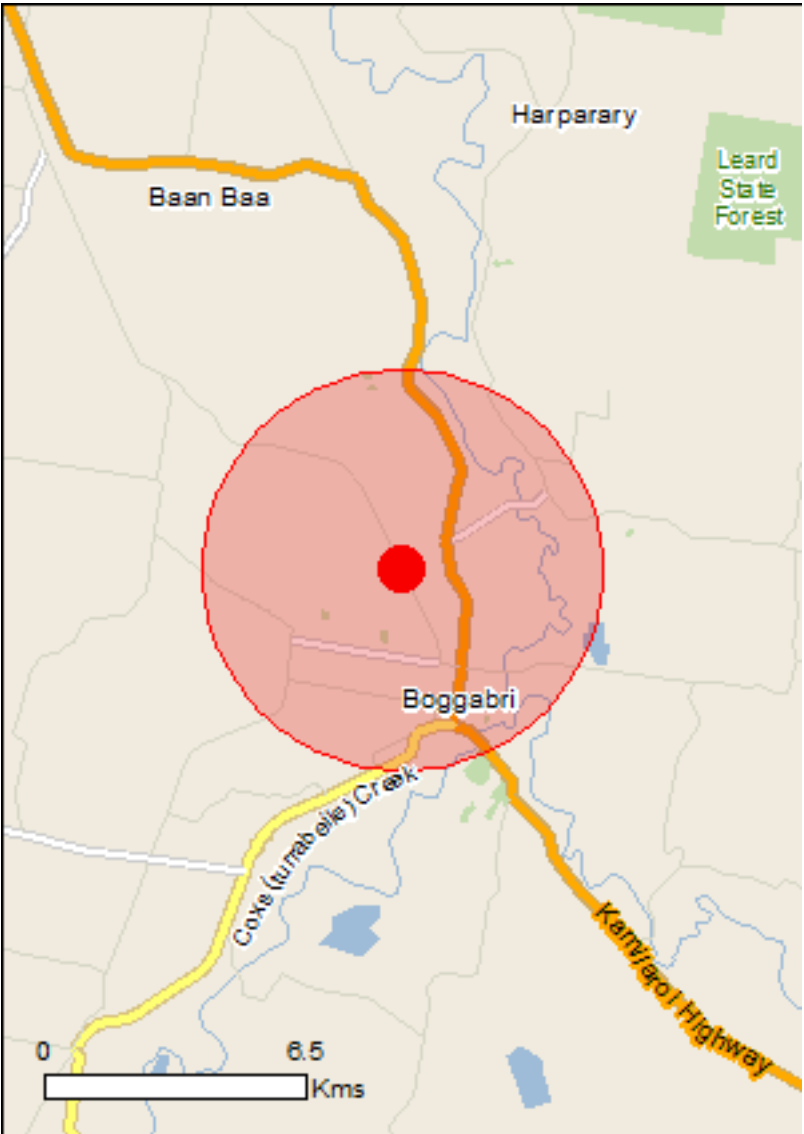
[Matters of NES](#)

[Other Matters Protected by the EPBC Act](#)

[Extra Information](#)

[Caveat](#)

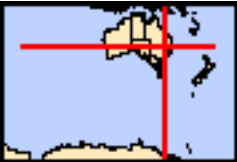
[Acknowledgements](#)



This map may contain data which are
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[Coordinates](#)

[Buffer: 5.0Km](#)



Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the [Administrative Guidelines on Significance](#).

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	3
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	6
Listed Threatened Species:	20
Listed Migratory Species:	9

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at <http://www.environment.gov.au/heritage>

A [permit](#) may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	1
Commonwealth Heritage Places:	None
Listed Marine Species:	15
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	None
Regional Forest Agreements:	None
Invasive Species:	25
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Wetlands of International Importance (Ramsar)		[Resource Information]
Name	Proximity	
Banrock station wetland complex	900 - 1000km upstream	
Riverland	900 - 1000km upstream	
The coorong, and lakes alexandrina and albert wetland	1100 - 1200km	

Listed Threatened Ecological Communities	[Resource Information]
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For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Name	Status	Type of Presence
Coolibah - Black Box Woodlands of the Darling Riverine Plains and the Brigalow Belt South Bioregions	Endangered	Community may occur within area
Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia	Endangered	Community may occur within area
Natural grasslands on basalt and fine-textured alluvial plains of northern New South Wales and southern Queensland	Critically Endangered	Community likely to occur within area
Poplar Box Grassy Woodland on Alluvial Plains	Endangered	Community likely to occur within area
Weeping Myall Woodlands	Endangered	Community may occur within area
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	Critically Endangered	Community likely to occur within area

Listed Threatened Species	[Resource Information]
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Name	Status	Type of Presence
Birds		
Anthochaera phrygia Regent Honeyeater [82338]	Critically Endangered	Foraging, feeding or related behaviour may occur within area
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat likely to occur within area
Grantiella picta Painted Honeyeater [470]	Vulnerable	Species or species habitat known to occur within area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat likely to occur within area
Leipoa ocellata Malleefowl [934]	Vulnerable	Species or species

Name	Status	Type of Presence
Rostratula australis Australian Painted Snipe [77037]	Endangered	habitat likely to occur within area Species or species habitat likely to occur within area
Fish		
Maccullochella peelii Murray Cod [66633]	Vulnerable	Species or species habitat known to occur within area
Mammals		
Chalinolobus dwyeri Large-eared Pied Bat, Large Pied Bat [183]	Vulnerable	Species or species habitat likely to occur within area
Dasyurus maculatus maculatus (SE mainland population) Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population) [75184]	Endangered	Species or species habitat may occur within area
Nyctophilus corbeni Corben's Long-eared Bat, South-eastern Long-eared Bat [83395]	Vulnerable	Species or species habitat likely to occur within area
Phascolarctos cinereus (combined populations of Qld, NSW and the ACT) Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	Vulnerable	Species or species habitat known to occur within area
Pteropus poliocephalus Grey-headed Flying-fox [186]	Vulnerable	Foraging, feeding or related behaviour may occur within area
Plants		
Androcalva procumbens [87153]	Vulnerable	Species or species habitat likely to occur within area
Cadellia pentastylis Ooline [9828]	Vulnerable	Species or species habitat likely to occur within area
Dichanthium setosum bluegrass [14159]	Vulnerable	Species or species habitat likely to occur within area
Swainsona murrayana Slender Darling-pea, Slender Swainson, Murray Swainson-pea [6765]	Vulnerable	Species or species habitat likely to occur within area
Tylophora linearis [55231]	Endangered	Species or species habitat may occur within area
Reptiles		
Aprasia parapulchella Pink-tailed Worm-lizard, Pink-tailed Legless Lizard [1665]	Vulnerable	Species or species habitat likely to occur within area
Listed Migratory Species		[Resource Information]
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat likely to occur within area

Name	Threatened	Type of Presence
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat may occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land	[Resource Information]
The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.	

Name	Threatened	Type of Presence
Commonwealth Land - Telstra Corporation Limited		
Listed Marine Species		[Resource Information]
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Species or species habitat likely to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area

Name	Threatened	Type of Presence
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Chrysococcyx osculans Black-eared Cuckoo [705]		Species or species habitat likely to occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat likely to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat may occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat likely to occur within area

Extra Information

Invasive Species

[[Resource Information](#)]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		
Acridotheres tristis Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
Carduelis carduelis European Goldfinch [403]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Turdus merula Common Blackbird, Eurasian Blackbird [596]		Species or species habitat likely to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Capra hircus Goat [2]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Lepus capensis Brown Hare [127]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Cylindropuntia spp. Prickly Pears [85131]		Species or species habitat likely to occur within area
Lycium ferocissimum African Boxthorn, Boxthorn [19235]		Species or species habitat likely to occur within area
Opuntia spp. Prickly Pears [82753]		Species or species habitat likely to occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within

Name	Status	Type of Presence
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		area Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
Solanum elaeagnifolium Silver Nightshade, Silver-leaved Nightshade, White Horse Nettle, Silver-leaf Nightshade, Tomato Weed, White Nightshade, Bull-nettle, Prairie-berry, Satansbos, Silver-leaf Bitter-apple, Silverleaf-nettle, Trompillo [12323] Tamarix aphylla Athel Pine, Athel Tree, Tamarisk, Athel Tamarisk, Athel Tamarix, Desert Tamarisk, Flowering Cypress, Salt Cedar [16018]		Species or species habitat likely to occur within area

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-30.67949 150.03014

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

- [Office of Environment and Heritage, New South Wales](#)
- [Department of Environment and Primary Industries, Victoria](#)
- [Department of Primary Industries, Parks, Water and Environment, Tasmania](#)
- [Department of Environment, Water and Natural Resources, South Australia](#)
- [Department of Land and Resource Management, Northern Territory](#)
- [Department of Environmental and Heritage Protection, Queensland](#)
- [Department of Parks and Wildlife, Western Australia](#)
- [Environment and Planning Directorate, ACT](#)
- [Birdlife Australia](#)
- [Australian Bird and Bat Banding Scheme](#)
- [Australian National Wildlife Collection](#)
- Natural history museums of Australia
- [Museum Victoria](#)
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- [Queensland Herbarium](#)
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- [Royal Botanic Gardens and National Herbarium of Victoria](#)
- [Tasmanian Herbarium](#)
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- [Western Australian Herbarium](#)
- [Australian National Herbarium, Canberra](#)
- [University of New England](#)
- [Ocean Biogeographic Information System](#)
- [Australian Government, Department of Defence](#)
- [Forestry Corporation, NSW](#)
- [Geoscience Australia](#)
- [CSIRO](#)
- [Australian Tropical Herbarium, Cairns](#)
- [eBird Australia](#)
- [Australian Government – Australian Antarctic Data Centre](#)
- [Museum and Art Gallery of the Northern Territory](#)
- [Australian Government National Environmental Science Program](#)
- [Australian Institute of Marine Science](#)
- [Reef Life Survey Australia](#)
- [American Museum of Natural History](#)
- [Queen Victoria Museum and Art Gallery, Inveresk, Tasmania](#)
- [Tasmanian Museum and Art Gallery, Hobart, Tasmania](#)
- Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the [Contact Us](#) page.

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APPENDIX 5: ASSESSMENT OF SIGNIFICANCE (PURSUANT TO SECTION 7.3 OF THE BC ACT)

Factors of Assessment - *Biodiversity Conservation Act 2016*

The five factors considered in the test of significance under s.7.3 of BC Act are shown in the table below. The tests of significance for all threatened species, populations and ecological communities considered likely to occur within the study area are provided in the proceeding sub-sections.

Table 4: Factors addressed in the assessment of significance

Factor	Species	Population	Ecological Community
in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.	X		
in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity: is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction			X
in relation to the habitat of a threatened species, population or ecological community: the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality	X		X
whether the proposed development or activity is likely to have an adverse effect any declared area of outstanding biodiversity value (either directly or indirectly).	NA	NA	NA
whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of, a key threatening process.	X	X	X

Threatened Flora

Table 5: Finger Panic Grass *Digitaria porrecta*

Factors	Assessment of Significance
(a) Effect on life cycle	Finger Panic Grass <i>Dicanthium setosum</i> was not detected within the subject site during the assessment; however, records of the species occur in the locality and suitable habitat has been identified within the subject site. The proposed development will require ground disturbance that would result in the removal of some groundcover vegetation; however, most of the grasslands will be retained in their current state. Given that no areas of the subject site were found to contain Finger Panic Grass and the majority of the habitat for the species will be retained, it is unlikely that the proposed development will adversely affect the lifecycle of the species, such that a local population would be at risk of extinction.
(c) (i) Habitat Removal	The majority of the habitat for the species will be retained within the subject site following the proposed development.
(c) (ii) Habitat Fragmentation	The groundcover habitat to be removed is comprised of exotic/native agricultural grassland. This vegetation is widespread within the study area and surrounding lands. The proposed development will not cause further habitat fragmentation for the species within the locality.
(c) (iii) Habitat importance	The habitat to be removed is comprised of exotic/native grassland and is not considered important to the species. Removal of this habitat is unlikely to put a local population at risk of extinction.
(d) Effect on biodiversity value	The proposed development does not occur within an Area of Outstanding Biodiversity Value (AOBV).
(e) KTP	The following KTPs are listed in order of their relevance to the species and the proposed development: Removal of native vegetation Given that the subject site is already a highly modified environment the proposed development is likely to facilitate the above listed KTPs to a minor extent. Impacts are likely to be negligible.
Conclusion	As the proposed development will not impact an area containing a known occurrence of Finger Panic Grass and the majority of the habitat for the species will be retained. The proposed development is considered unlikely to have a significant impact on this species in the locality.

Threatened Ecological Community

Table 6: Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia

(a) Effect on life cycle	Not applicable
(b) Effect on Ecological Community	The proposed activity does not require the removal of any of Grey Box (<i>Eucalyptus microcarpa</i>) Grassy Woodlands and Derived Native Grasslands community. The Grey Box Grassy Woodlands and Derived Native Grasslands occurs approximately 50 m from the subject site. The proposed activity is unlikely to place this TEC at risk of local extinction.
(C) (i) Habitat Removal	The proposal will not result in the removal of any of this community. The impacts on this TEC due to the proposed development is expected to be minimal to negligent.
(C) (ii) Habitat Fragmentation	No clearing of habitat will result from the proposed activity; therefore, it is unlikely to cause or increase any habitat fragmentation.
(C) (iii) Habitat importance	No clearing of habitat will result from the proposed activity; therefore, it is unlikely to cause a decrease in the importance of this TEC within the locality.
(d) Effect on biodiversity value	The proposed action is not within or in close proximity to any mapped Areas of Outstanding Biodiversity Value.
(E) Key threatening process	The proposal will contribute to one key threatening process relevant to these species: • Clearing of native vegetation. The proposal also has the potential to contribute to: • Anthropogenic climate change • Infection of native plants by <i>Phytophthora cinnamomi</i> • Invasion, establishment and spread of <i>Lantana camara</i>. • Introduction and establishment of Exotic Rust Fungi of the order <i>Pucciniales</i> pathogenic on plants of the family <i>Myrtaceae</i> The mitigation measures outlined in Section 5 would avoid and minimise the risk of these key threatening processes as a result of the proposed action.
Conclusion	No clearing of habitat will result from the proposed activity. As a result, the proposed activity is unlikely to significantly affect the occurrence of this TEC within the locality or significantly hinder any species that may utilise the habitat.

APPENDIX 6: LICENSES AND PERMITS

Kleinfelder employees involved in the current study are licensed or approved under the *National Parks and Wildlife Act 1974* (License Number: SL100730, Expiry: 31 March 2021) and the *Animal Research Act 1985* to harm/trap/release protected native fauna and to pick for identification purposes native flora and to undertake fauna surveys.

Noise Assessment

Boggabri Solar Farm
Boggabri, NSW



Document Information

Noise Assessment

Boggabri Solar Farm

Boggabri, NSW

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APPENDIX A – GLOSSARY OF TERMS		

1 Introduction

Muller Acoustic Consulting Pty Ltd (MAC) has been commissioned by Providence Asset Group (PAG) to prepare a Noise Assessment (NA) for the proposed Boggabri Solar Farm near Boggabri, NSW (the 'project'). This report presents the methodology and findings of the NA for the construction and operation of the project.

1.1 Purpose and Objectives

A NA is required as part of the environmental assessment to be submitted to Narrabri Shire Council as part of the Development Application (DA). The purpose of the NA is to quantify potential environmental noise emissions associated with the construction and operation of the project. Where impacts are identified, the assessment includes recommendations for potential noise mitigation and management measures.

1.2 Scope of the Assessment

The NA includes the following key tasks:

- review construction and operating activities to identify key noise generating plant, equipment, machinery or activities proposed to be undertaken as part of the project;
- identify the closest and/or potentially most affected receivers situated within the area of influence to the project;
- determine project-specific construction Noise Management Levels (NMLs), and operational noise criteria;
- undertake 3D noise modelling to predict levels that may occur as a result of the construction and operation of the project at the closest and/or potentially most affected receivers;
- provide a comparison of predicted noise levels against relevant construction and operational criteria;
- assess the potential noise impacts associated with construction and operational aspects of the project
- assess the potential noise impacts associated with road traffic noise during construction; and
- provide feasible and reasonable noise mitigation and management measures, and monitoring options, where criteria may be exceeded.

The assessment has been undertaken in accordance with the following documents:

- NSW Department of Environment and Climate Change (DECCW) – NSW Interim Construction Noise Guideline (ICNG), July 2009;
- NSW Environment Protection Authority (EPA), Noise Policy for Industry (NPI) 2017;
- NSW Department of Environment, Climate Change and Water (DECCW) – NSW Road Noise Policy (RNP), March 2011;
- Australian Standard AS 1055:2018 - Acoustics - Description and measurement of environmental noise - General Procedures; and
- International Standard ISO 9613:1993 - Acoustics - Attenuation of sound during propagation outdoors.

A glossary of terms, definitions and abbreviations used in this report is provided in **Appendix A**.

2 Project Description

2.1 Background

PAG propose to construct and operate a 5 Megawatt (MW) solar farm using photovoltaic (PV) technology at 211 Vine Lane, Boggabri NSW, NSW approximately 1km north west of Boggabri, NSW.

2.2 Description of Proposed Construction Works

The project includes installation of groups of north facing PV modules on mounting structures of 1.3m to 1.5m in height. Approximately 11,600 PV panels will be installed using a single axis tracking system, tilting along the north-south axis. The PV mounting structure would comprise steel posts driven into the ground using a small pile driver. Additional support structures would be attached to the piles, which would then support the PV panels.

Where cabling of each PV array/module to inverters is required to be underground, earthworks will primarily involve trenching. Other minor earthworks would be completed for the preparation of the site and in most cases a concrete slab would be required to support the ancillary infrastructure. Most of the infrastructure would be pre-fabricated off-site, delivered and assembled on-site.

It is anticipated that the solar farm would be constructed in stages, with construction of two to three stages occurring at any one time over a six month period during standard construction hours.

All vehicles would access the project via Boston Street and Vine Lane during construction and operational phases.

During construction, traffic generated by the project would include employee and delivery vehicles. During the peak construction period, the daily traffic volume is expected to be up to four heavy vehicles (semi-trailers or B-doubles) per hour and 20 light commercial vehicles or equivalent for worker transport during the morning and afternoon peaks.

2.3 Description of Proposed Operation

PV infrastructure on site will comprise of groups of PV panels installed in rows running north to south. The PV modules will be on a single axis tracker system which will follow the sun and move in an east to west direction. Electrical cabling would be attached beneath the modules and would connect the individual PV modules to each other. Inverters will be located centrally and connected by underground cables. The project will be contained solely within the site as shown in **Figure 1**.

The project would operate 24 hours a day, 7 days a week, with no permanent staff on site. During operation, the PV panels would generate electricity which would be fed into the power grid via the adjacent existing powerline. Key noise emissions from the operation of the project are associated with the inverter and transformer(s). It is noted that emissions from these sources are anticipated to be acoustically insignificant compared to ambient background noise levels at assessed receivers.

When required, maintenance activities will occur during standard working hours (except for emergencies) and are expected to include:

- panel cleaning;
- repairs or replacement of infrastructure, as required; and
- land management including mowing to control vegetation as required.

Typical noise sources associated with maintenance activities would include light vehicle movements on site and maintenance of equipment.

2.3.1 Receiver Review

Using aerial photography, geospatial information and other project design information, MAC has identified the following potentially sensitive receivers that may be affected by noise from operation or construction activities and project related road traffic. **Table 1** presents a summary of receiver identification, type, address and coordinates. These are reproduced visually in **Figure 1**.

Table 1 Receiver Locations

Receiver	Description	Receiver Type	Coordinates (GDA94/MGA56)	
			Easting	Northing
R01	313 Vine Lane	Residential	789634	6602744
R02 ¹	211 Vine Lane	Residential	790425	6601981
R03	14111 Kamilaroi Highway	Residential	791108	6602769
R04	7044 Rangari Road	Residential	791832	6602882
R05	14022 Kamilaroi Highway	Residential	791569	6601804
R06	14019 Kamilaroi Highway	Residential	791050	6601630
R07	51 Vine Lane	Residential	790882	6600559
R08	262 Caloola Road	Civeo Mine Camp	789567	6600531
R09	201 Coolala Road	Residential	789227	6600038
R10	446 Coolala Road	Residential	787486	6601449
R11	7 Coolala Road	Residential	791159	6599893
R12	2 Boston Street	Residential	791370	6599942
R13	4 Boston Street	Residential	791483	6599909
R14	13852 Kamilaroi Highway	Residential	791609	6600145
R15	39 Finchs Lane	Residential	792007	6600360

Note 1: R02 is project related.

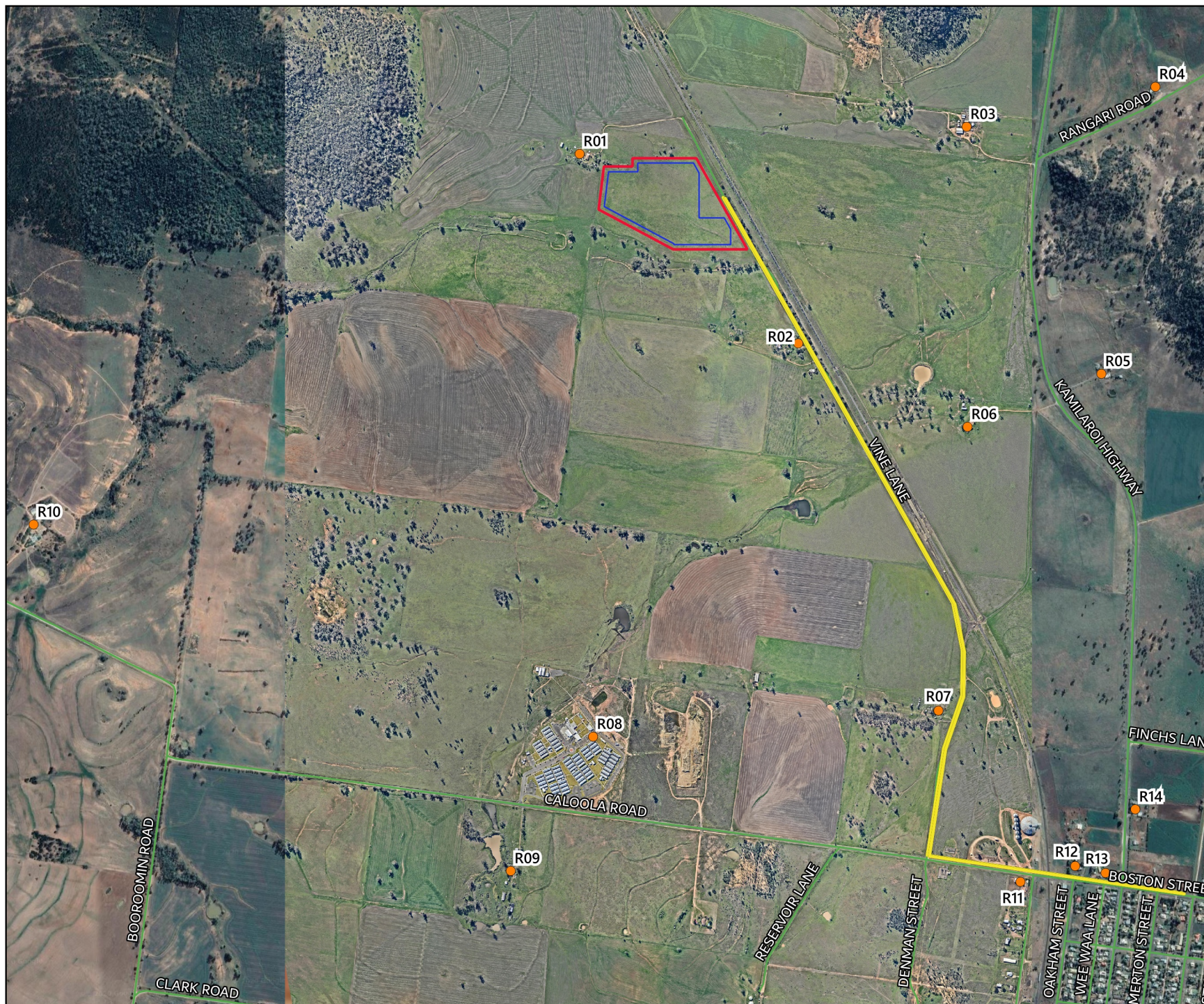


FIGURE 1
Project Layout
MAC201186-03
Boggabri Solar Farm

KEY

- Receivers
- Access Route
- Panel Array
- Project Boundary



3 Noise Policy and Guidelines

3.1 Interim Construction Noise Guideline

The ICNG sets out procedures to identify and address the impacts of construction noise on residences and other sensitive land uses. This section provides a summary of noise objectives that are applicable to the assessment. The ICNG provides two methodologies for the assessment of construction noise emissions:

- Quantitative, which is suited to major construction projects with typical durations of more than three weeks; and
- Qualitative, which is suited to short term infrastructure maintenance (< three weeks).

The qualitative assessment methodology is a more simplified approach that relies on noise management strategies. This study has adopted a quantitative assessment approach which is summarised in **Figure 2**. The quantitative approach includes identification of potentially affected receivers, derivation of the construction noise management levels, quantification of potential noise impact at receivers via predictive modelling and, provides management and mitigation recommendations.

3.1.1 Standard Hours for Construction

Table 2 summaries the ICNG recommended standard hours for construction works.

Table 2 Recommended Standard Hours for Construction	
Daytime	Construction Hours
Monday to Friday	7am to 6pm
Saturdays	8am to 1pm
Sundays or Public Holidays	No construction

These recommended hours do not apply in the event of direction from police, or other relevant authorities, for safety reasons or where required in an emergency to avoid the loss of lives, property and/or to prevent environmental harm.

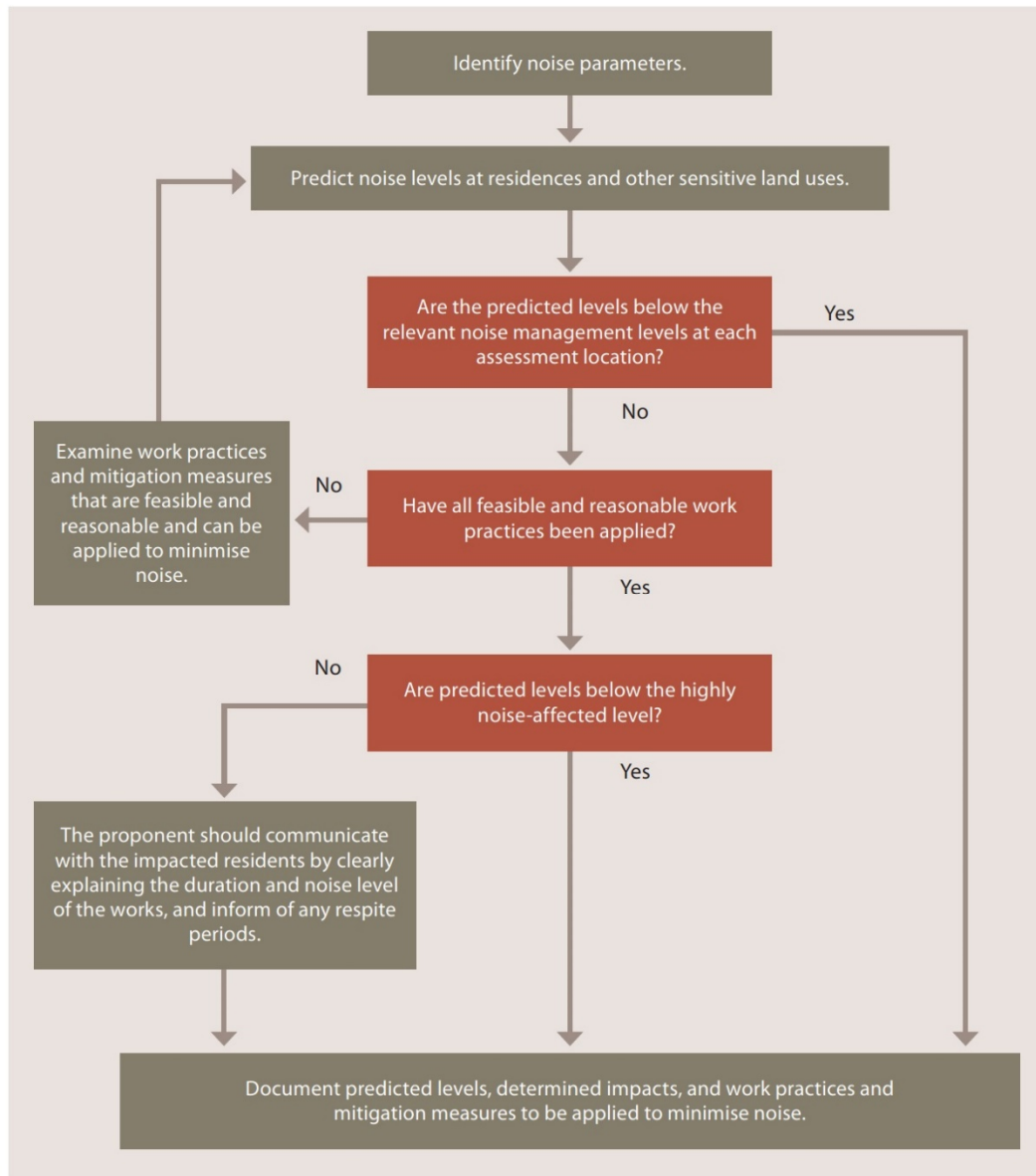
Construction activities are anticipated to be undertaken during standard construction hours.

3.1.2 Out of Hours Construction

Works conducted outside of recommended standard hours are considered out of hours work (OOH). The ICNG suggests that any request to vary the hours of construction activities as identified above shall be:

- considered on a case by case basis or activity-specific basis;
- accompanied by details of the nature and need for activities to be undertaken during the varied construction hours; and
- accompanied by written evidence that activities undertaken during the varied construction hours are strongly justified; appropriate consultation with potentially affected receivers and notification of the relevant regulatory authorities has occurred; and all practicable and reasonable mitigation measures will be put in place.

Figure 2 Quantitative Assessment Processes for Assessing and Managing Construction Noise



Source: Department of Environment and Climate Change, 2009.

3.1.3 Construction Noise Management Levels

Section 4 of the ICNG (DECC, 2009) details the quantitative assessment method involving predicting noise levels and comparing them with the Noise Management Level (NML) and are important indicators of the potential level of construction noise impact. **Table 3** reproduces the ICNG Noise Management Level (NML) for residential receivers. The NML is determined by adding 10dB (standard hours) or 5dB (OOH) to the Rating Background Level (RBL) for each specific assessment period.

Table 3 Noise Management Levels

Time of Day	Management Level	
	LAeq(15min) ¹	How to Apply
Recommended standard hours: Monday to Friday 7am to 6pm Saturday 8am to 1pm No work on Sundays or public holidays.	Noise affected RBL + 10dB	The noise affected level represents the point above which there may be some community reaction to noise. Where the predicted or measured LAeq(15min) is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. The proponent should also inform all potentially impacted residents of the nature of work to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise affected 75dBA	The highly noise affected level represents the point above which there may be strong community reaction to noise. Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account times identified by the community when they are less sensitive to noise (such as before and after school for work near schools, or mid-morning or mid-afternoon for work near residences; and if the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
Outside recommended standard hours.	Noise affected RBL + 5dB	A strong justification would typically be required for work outside the recommended standard hours. The proponent should apply all feasible and reasonable work practices to meet the noise affected level. Where all feasible and reasonable practices have been applied and noise is more than 5dBA above the noise affected level, the proponent should negotiate with the community. For guidance on negotiating agreements see section 7.2.2.

Note 1: The Rating Background Level (RBL) is an overall single figure background level representing each assessment period over the whole monitoring period. The RBL is used to determine the construction noise management levels for noise assessment purposes and is the median of the ABL's.

3.1.4 Construction Sleep Disturbance

Section 4.3 of the ICNG (DECC, 2009) states that a sleep disturbance assessment is required where construction activities are planned to occur for more than two consecutive nights. Given that construction activities are anticipated to occur during standard construction hours, sleep disturbance has not been considered in this assessment.

3.2 Noise Policy for Industry

The EPA released the Noise Policy for Industry (NPI) in October 2017 which provides a process for establishing noise criteria for consents and licenses enabling the EPA to regulate noise emissions from scheduled premises under the Protection of the Environment Operations Act 1997.

The objectives of the NPI are to:

- provide noise criteria that is used to assess the change in both short term and long-term noise levels;
- provide a clear and consistent framework for assessing environmental noise impacts from industrial premises and industrial development proposals;
- promote the use of best-practice noise mitigation measures that are feasible and reasonable where potential impacts have been identified; and
- support a process to guide the determination of achievable noise limits for planning approvals and/or licences, considering the matters that must be considered under the relevant legislation (such as the economic and social benefits and impacts of industrial development).

The policy sets out a process for industrial noise management involving the following key steps:

1. Determine the Project Noise Trigger Levels (PNTLs) (ie criteria) for a development. These are the levels (criteria), above which noise management measures are required to be considered. They are derived by considering two factors: shorter-term intrusiveness due to changes in the noise environment; and maintaining the noise amenity of an area.
2. Predict or measure the noise levels produced by the development with regard to the presence of annoying noise characteristics and meteorological effects such as temperature inversions and wind.
3. Compare the predicted or measured noise level with the PNTL, assessing impacts and the need for noise mitigation and management measures.
4. Consider residual noise impacts - that is, where noise levels exceed the PNTLs after the application of feasible and reasonable noise mitigation measures. This may involve balancing economic, social and environmental costs and benefits from the proposed development against the noise impacts, including consultation with the affected community where impacts are expected to be significant.

5. Set statutory compliance levels that reflect the best achievable and agreed noise limits for the development.
6. Monitor and report environmental noise levels from the development.

3.2.1 Project Noise Trigger Levels (PNTL)

The policy sets out the procedure to determine the PNTLs relevant to an industrial development. The PNTL is the lower (ie, the more stringent) of the **Project Intrusiveness Noise Level (PINL)** and **Project Amenity Noise Level (PANL)** determined in accordance with Section 2.3 and Section 2.4 of the NPI.

3.2.2 Rating Background Level (RBL)

The Rating Background Level (RBL) is a determined parameter from noise monitoring and is used for assessment purposes. As per the NPI, the RBL is an overall single figure background level representing each assessment period (day, evening and night) over the noise monitoring period.

3.2.3 Project Intrusiveness Noise Level (PINL)

The PINL ($L_{Aeq}(15min)$) is the RBL + 5dB and seeks to limit the degree of change a new noise source introduces to an existing environment. Hence, when assessing intrusiveness, background noise levels need to be measured.

3.2.4 Project Amenity Noise Level (PANL)

The PANL is relevant to a specific land use or locality. To limit continuing increases in intrusiveness levels, the ambient noise level within an area from all combined industrial sources should remain below the recommended amenity noise levels specified in Table 2.2 (of the NPI). The NPI defines two categories of amenity noise levels:

- **Amenity Noise Levels (ANL)** – are determined considering all current and future industrial noise within a receiver area; and
- **Project Amenity Noise Level (PANL)** – is the recommended level for a receiver area, specifically focusing the project being assessed.

Additionally, Section 2.4 of the NPI states: “to ensure that industrial noise levels (existing plus new) remain within the recommended amenity noise levels for an area, a project amenity noise level applies for each new source of industrial noise as follows”:

PANL for new industrial developments = recommended **ANL** minus 5dBA.

The following exceptions apply when deriving the PANL:

- areas with high traffic noise levels;
- proposed developments in major industrial clusters;
- existing industrial noise and cumulative industrial noise effects; and
- greenfield sites.

Where relevant this assessment has considered influences of traffic with respect to amenity noise levels (ie areas where existing traffic noise levels are 10dB greater than the recommended amenity noise level).

The recommended amenity noise levels as per Table 2.2 of the NPI are reproduced in **Table 4**.

Table 4 Amenity Criteria

Receiver Type	Noise Amenity Area	Time of day	Recommended amenity noise level dB LAeq(period)
Residential	Rural	Day	50
		Evening	45
		Night	40
	Suburban	Day	55
		Evening	45
		Night	40
	Urban	Day	60
		Evening	50
		Night	45
Hotels, motels, caretakers' quarters, holiday accommodation, permanent resident caravan parks.	See column 4	See column 4	5dB above the recommended amenity noise level for a residence for the relevant noise amenity area and time of day
School Classroom	All	Noisiest 1-hour period when in use	35 (internal) 45 (external)
Hospital ward			
- internal	All	Noisiest 1-hour	35
- external	All	Noisiest 1-hour	50
Place of worship			
- internal	All	When in use	40
Passive Recreation	All	When in use	50
Active Recreation	All	When in use	55
Commercial premises	All	When in use	65
Industrial	All	When in use	70

Notes: The recommended amenity noise levels refer only to noise from industrial noise sources. However, they refer to noise from all such sources at the receiver location, and not only noise due to a specific project under consideration. The levels represent outdoor levels except where otherwise stated.

Types of receivers are defined as rural residential; suburban residential; urban residential; industrial interface; commercial; industrial – see Table 2.3 and Section 2.7 of the NPI.

Note: Day - the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays; Evening - the period from 6pm to 10pm; Night - the remaining periods.

3.2.5 Maximum Noise Assessment Trigger Levels

The potential for sleep disturbance from maximum noise level events from a project during the night-time period needs to be considered. The NPI considers sleep disturbance to be both awakenings and disturbance to sleep stages.

Where night-time noise levels from a development/premises at a residential location exceed the following criteria, a detailed maximum noise level event assessment should be undertaken:

- LAeq(15min) 40dB or the prevailing RBL plus 5dBA, whichever is the greater, and/or
- LAmax 52dB or the prevailing RBL plus 15dBA, whichever is the greater.

A detailed assessment should cover the maximum noise level, the extent to which the maximum noise level exceeds the rating background noise level, and the number of times this happens during the night-time period. Other factors that may be important in assessing the impacts on sleep disturbance include:

- how often the events would occur;
- the distribution of likely events across the night-time period and the existing ambient maximum events in the absence of the development;
- whether there are times of day when there is a clear change in the noise environment (such as during early morning shoulder periods); and
- current understanding of effects of maximum noise level events at night.

3.3 Road Noise Policy

The road traffic noise criteria are provided in the Department of Environment, Climate Change and Water NSW (DECCW), Road Noise Policy (RNP), 2011. The policy sets out noise criteria applicable to different road classifications for the purpose of quantifying traffic noise impacts. Road noise criteria relevant to this assessment are presented in detail in **Section 4.5**.

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4 Noise Assessment Criteria

Background noise monitoring has not been conducted for this project and hence, the minimum applicable Rating Background Levels (RBL) of 35dBA for the daytime period and 30dBA for the evening and night time periods have been adopted in accordance with NPI methodology.

4.1 Construction Noise Criteria

The relevant Noise Management Levels (NMLs) for standard construction hours are presented in Table 5.

Table 5 Construction Noise Management Levels			
Receiver Type	Assessment Period	Adopted RBL dB LA90	NML dB LAeq(15min)
Urban Residential	Standard Hours	35	45 (RBL+10dBA)
Suburban Residential	Standard Hours	35	45 (RBL+10dBA)
Rural Residential	Standard Hours	35	45 (RBL+10dBA)
Educational	When in use	N/A	45 (internal) 60 (external) ¹
Hospital Wards	When in use	N/A	45 (internal) 60 (external) ¹
Place of Worship	When in use	N/A	45 (internal) 60 (external) ¹
Active Recreation Areas	When in use	N/A	65 (external)
Passive Recreation Areas	When in use	N/A	60 (external)
Industrial Premises	When in use	N/A	75 (external)
Community Centres	When in use	N/A	Refer to AS2107 for maximum internal levels and specific use
Commercial Premises	When in use	N/A	70 (external)

Note 1: External level based on 15dB loss through partially open window.

4.2 Construction Vibration

Department of Environment and Conservation (DEC) 2006, *Assessing Vibration: A Technical Guideline* (the 'Guideline') provides guidance on determining effects of vibration on buildings occupants. The guideline does not address vibration induced damage to structures, blast induced vibration effects or structure borne noise effects.

The Construction Noise & Vibration Strategy (CNVS, V4.1 Transport for NSW, 2019) sets out safe working distances to achieve the human response criteria for vibration. The key vibration generating source proposed to be used is small pile driver used to drive the piles into the ground on which the PV mounting structures are mounted and vibratory roller for road construction. The CNVS sets a safe working distance of 50m for a hammer piling rig and 100m for a large vibratory roller to achieve the residential human response criteria for continuous vibration. Therefore, as the nearest non project related receivers to the project are greater than 100m from the project boundary, human exposure to vibration is anticipated to be minimal. Furthermore, where the human response criteria are satisfied, the structural or cosmetic criteria for sensitive receivers will be achieved. Therefore, vibration impacts are not considered to be a significant issue and have not been considered further in this assessment.

4.3 Operational Noise Criteria

4.3.1 Project Intrusiveness Noise Levels

The PINLs for the project are presented in **Table 6** and have been determined based on the RBLs +5dBA.

Table 6 Project Intrusiveness Noise Levels			
Receiver	Period ¹	Adopted RBL dB LA90(period)	PINL dB LAeq(15min)
All Residential Receivers	Day	35	40
	Evening	30	35
	Night	30	35

Note 1: Day - the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays; Evening - the period from 6pm to 10pm; Night - the remaining periods.

4.3.2 Project Amenity Noise Levels

The PANL for residential receivers and other receiver types (ie non-residential) potentially affected by the project are presented in **Table 7**.

Table 7 Amenity Noise Levels and Project Amenity Noise Levels					
Receiver Type	Noise Amenity Area	Assessment Period ¹	Recommended ANL dB LAeq(period)	ANL dB LAeq(period) ²	PANL dB LAeq(15min) ³
Residential	Rural	Day	50	45	48
		Evening	45	40	43
		Night	40	35	38
Residential	Suburban	Day	55	50	53
		Evening	45	40	43
		Night	40	35	38
Residential	Urban	Day	60	55	58
		Evening	50	45	48
		Night	45	40	43
Hotels Motels	Rural/Urban/ Suburban	Day	ANL +5dB	ANL +5dB	ANL +5dB
		Evening	ANL +5dB	ANL +5dB	ANL +5dB
		Night	ANL +5dB	ANL +5dB	ANL +5dB
Educational		When in use	35 (internal 1 hr)	30 (internal 1 hr)	33 (internal 1 hr) 48 (external 1 hr) ⁴
Hospital Wards		When in use	35 (internal 1 hr)	30 (internal 1 hr)	33 (internal 1 hr)
			50 (external 1 hr)	45 (external 1 hr)	48 (external 1 hr)
Place of worship		When in use	40 (internal)	35 (internal 1 hr)	38 (internal 1 hr)
					53 (external 1 hr) ⁴
Passive Recreation		When in use	50	45	48
Active Recreation		When in use	55	50	53
Commercial		When in use	65	60	63
Industrial		When in use	70	65	68
Industrial Interface		When in use	ANL +5dB	ANL +5dB	ANL +5dB

Note 1: Monday – Saturday, Day 7am to 6pm; Evening 6pm to 10pm; Night 10pm to 7am. On Sundays and Public Holidays, Day 8am to 6pm; Evening 6pm to 10pm; Night 10pm to 8am.

Note 2: Project Amenity Noise Level equals the Amenity Noise Level as there is no other industry in the area.

Note 3: Includes a +3dB adjustment to the amenity period level to convert to a 15-minute assessment period as per Section 2.2 of the NPI.

Note 4: External level based on 15dB loss through partially open window.

4.3.3 Project Noise Trigger Levels

The PNTLs are the lower of either the PINLs or the PANLs. **Table 8** presents the derivation of the PNTLs in accordance with the methodologies outlined in the NPI. For this assessment the night time PNTL of 35dB LAeq(15min) is the limiting criteria for residential receivers.

Table 8 Project Noise Trigger Levels				
Catchment	Assessment Period ¹	PINL dB LAeq(15min)	PANL dB LAeq(15min)	PNTL dB LAeq(15min)
Residential Receivers (Rural)	Day	40	53	40
	Evening	35	48	35
	Night	35	43	35
Industrial	When in use	--	68	68

Note 1: Day - the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays; Evening - the period from 6pm to 10pm; Night - the remaining periods.

4.4 Maximum Noise Assessment Trigger Levels

The maximum noise trigger levels shown in **Table 9** are based on night time RBLs and trigger levels as per Section 2.5 of the NPI. The trigger levels will be applied to transient noise events that have the potential to cause sleep disturbance.

Table 9 Maximum Noise Trigger Level	
L1 Rural Residential Receivers	
52dB LAmax or RBL + 15dB	
Trigger	52
RBL 30+15dB	45
Highest	52

Note: Monday to Saturday; Night 10pm to 7am. On Sundays and Public Holidays Night 10pm to 8am.

Note: NPI identifies that maximum of the two values is to be adopted which is shown in bold font.

4.5 Road Traffic Noise Criteria

The road traffic noise criteria are provided in the RNP. For this assessment, the 'sub arterial road' category for Boston Street and Vine Lane has been adopted. It is acknowledged that the functional classification of Vine Lane is a 'Collector Road' in accordance with the Roads and Maritime Noise Criteria Guideline (April 2015). However, the Road Noise Policy does not provide separate noise criteria for Collector Roads but applies the sub-arterial category to all roads that are not classified as local roads. The relevant road traffic noise criteria are provided in the RNP and are presented in **Table 10** for residential receivers.

Table 10 Road Traffic Noise Assessment Criteria

Road category	Type of project/development	Assessment Criteria – dBA	
		Day (7am to 10pm)	Night (10pm to 7am)
Freeways/arterial/ sub-arterial Roads	Existing residences affected by additional traffic on freeways/arterial/sub- arterial roads generated by land use developments	60dB LAeq(15hr)	55dB LAeq(9hr)
Local roads	Existing residences affected by additional traffic on local roads generated by land use developments	55dB LAeq(1hr)	50dB LAeq(1hr)
School Classrooms		40dB LAeq(1hr) (internal) when in use	N/A
Hospital Wards		35dB LAeq(1hr) (internal)	35dB LAeq(1hr) (internal)
Places of Worship		40dB LAeq(1hr) (internal)	40dB LAeq(1hr) (internal)
Open Space (active use)		60dB LAeq(1hr)	N/A
Open Space (passive use)	Proposed road projects and traffic generating developments	55dB LAeq(1hr)	N/A
Isolated residences in commercial or industrial zones		Refer to AS2107 for internal levels	
Mixed Use development		Each component to be considered separately	
Childcare Facilities		Sleeping rooms 35dB LAeq(1hr) (internal) Indoor play areas 40dB LAeq(1hr) (internal) Outdoor play areas 55dB LAeq(1hr) (external)	

Additionally, the RNP states where existing road traffic noise criteria are already exceeded, any additional increase in total traffic noise level should be limited to 2dBA, which is generally accepted as the threshold of perceptibility to a change in noise level.

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5 Modelling Methodology

A computer model was developed to quantify project noise emissions to neighbouring receivers for typical construction activities and operations. DGMR (iNoise, Version 2020.0) noise modelling software was used to quantify noise emissions from typical construction activities and operations. iNoise is a new intuitive and quality assured software for industrial noise calculations in the environment. 3D noise modelling is considered industry best practice for assessing noise emissions from projects.

The model incorporated a three-dimensional digital terrain map giving all relevant topographic information used in the modelling process. Additionally, the model uses relevant noise source data, ground type, attenuation from barrier or buildings and atmospheric information to predict noise levels at the nearest potentially affected receivers. Where relevant, modifying factors in accordance with Fact Sheet C of the NPI have been applied to calculations.

The model calculation method used to predict noise levels was in accordance with ISO 9613-1 'Acoustics - Attenuation of sound during propagation outdoors. Part 1: Calculation of the absorption of sound by the atmosphere' and ISO 9613-2 'Acoustics - Attenuation of sound during propagation outdoors. Part 2: General method of calculation' including corrections for meteorological conditions using CONCAWE¹. The ISO 9613 standard from 1996 is the most used noise prediction method worldwide. Many countries refer to ISO 9613 in their noise legislation. However, the ISO 9613 standard does not contain guidelines for quality assured software implementation, which leads to differences between applications in calculated results. In 2015 this changed with the release of ISO/TR 17534-3. This quality standard gives clear recommendations for interpreting the ISO 9613 method. iNoise fully supports these recommendations. The models and results for the 19 test cases are included in the software.

5.1 Construction Assessment Methodology

Construction activities are proposed to be progressive (trenching, piling and assembly) and will occur at several locations simultaneously. Noise emissions were modelled for the following four scenarios:

- earthworks for internal roads and compound construction including the stripping of topsoil and unsuitable soil and the placement and compaction of road base for internal roads;
- earthworks involving trenching for cabling;
- piling of panel supports; and
- assembly of the panels.

¹ Report no. 4/18, "the propagation of noise from petroleum and petrochemical complexes to neighbouring communities", Prepared by C.J. Manning, M.Sc., M.I.O.A. Acoustic Technology Limited (Ref.AT 931), CONCAWE, Den Haag May 1981

It is envisaged that all four construction scenarios have the potential to occur simultaneously at up to two key locations across the site. Noise emission data and assumptions used in this assessment are summarised in **Table 11**. All significant noise generating construction activities will be limited to standard construction hours. Where low intensity construction activities are required to be undertaken outside standard construction hours, such as cabling, minor assembly, use of hand tools etc, they will be managed such that they are not audible at any residential receivers.

Table 11 Construction Equipment Sound Power Levels, Lw dBA (re 10⁻¹² W)

Noise Source/Item	Utilisation %	Quantity	Lw/Item	Total Lw
Trenching & Earthworks				
Backhoe	80	1	104	103
Light vehicle	25	2	76	73
Total – Trenching & Earthworks				105
Piling				
Piling Rig (hydraulic)	80	1	113	112
Tele-handler	75	1	106	105
Light vehicle	25	2	76	73
Total – Piling				113
Assembly				
Mobile Crane/HIAB	75	1	104	103
Tele-handler	75	1	106	105
Light vehicle	25	2	76	73
Hand tools/Power tools	50	1	102	99
Welder	50	1	105	102
Total – Assembly				109
Transport (on site)				
Heavy vehicle	40	1	104	101
Tele-handler	50	1	106	103
Total – Transport				105

5.2 Operational Assessment Methodology

For this assessment, noise predictions were modelled for a typical worst-case operational scenario over a 15-minute assessment period based on the assumptions and sound power levels in **Table 12**. Plant noise emission data used in modelling for this assessment were obtained from manufacturers data or the MAC database. Where relevant, modifying factors in accordance with Section 3.3 and Fact Sheet D of the NPI have been applied to calculations.

Table 12 Operational Equipment Sound Power Levels, Lw dBA (re 10⁻¹² W)

Noise Source/Item	Activity	Quantity	Lw/Item	Total Lw
PV Panel Tracking Motor ^{1,2}	All tracking motors in operation	153	78	83
	1 minute per 15-minute period			
2.5MW Inverter ²	Constant	2	81	84
5MVA Transformer ²	Constant	1	77	77

Note 1: Tracking motor is situated underneath the PV panel, -5dB attenuation applied to account for shielding provided by the panel.

Note 2: Modifying factor penalty of +5dB added for low frequency and +5dB added for tonality.

5.2.1 Meteorological Analysis

Noise emissions can be influenced by prevailing weather conditions. Light stable winds (<3m/s) and temperature inversions have the potential to increase noise at a receiver.

Fact Sheet D of the NPI provides two options when considering meteorological effects:

- adopt the noise enhancing conditions for all assessment periods without an assessment of how often the conditions occur – a conservative approach that considers a source to receiver winds for all receivers and F class temperature inversions with wind speeds up to 2m/s at night; or
- determine the significance of noise enhancing conditions. This requires assessing the significance of temperature inversions (F and G Class stability categories) for the night time period and the significance of light winds up to 3m/s for all assessment periods during stability categories other than E, F or G.

Standard meteorological conditions and noise-enhancing meteorological conditions as defined in Table D1 of the NPI are reproduced in **Table 13**.

Table 13 Standard and Noise-Enhancing Meteorological Conditions

Meteorological Conditions	Meteorological Parameters
Standard Meteorological Conditions	Day/evening/night: stability categories A–D with wind speed up to 0.5m/s at 10m AGL.
Noise Enhancing Meteorological Conditions	Daytime/evening: stability categories A–D with light winds (up to 3 m/s at 10m AGL). Night-time: stability categories A–D with light winds (up to 3m/s at 10m AGL) and/or stability category F with winds up to 2m/s at 10 m AGL.

A detailed analysis of the significance of noise enhancing conditions has not been undertaken and hence, the (worst case) NPI noise enhancing meteorological conditions have been applied to the noise modelling assessment are presented in **Table 14**.

Table 14 Modelled Meteorological Parameters

Assessment Condition ¹	Temperature	Wind Speed ² / Direction	Relative Humidity	Stability Class ²
Day	20°C	3m/s all directions	50%	D
Evening	10°C	3m/s all directions	50%	D
Night	10°C	2m/s all directions	50%	F

Note 1: Day 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays; Evening 6pm to 10pm; Night - the remaining periods.

Note 2: Implemented using CONCAWE meteorological corrections.

5.3 Road Traffic Noise Assessment Methodology

Due to the low traffic volume generated by the project over a typical day during the construction phase, road traffic noise calculation methods such as Calculation of Road Traffic Noise (CRTN - ISBN 0 11 550847 3) by Department of Transport (UK) 1988 or Traffic Noise Model (TNM) by the United States Department of Transport, Federal Highway Administration are not considered appropriate as they are primarily intended to calculate noise emissions from motorways and highways. Whilst each method has a low volume correction, the project traffic volume is out of the scope of these methods. Therefore, road traffic noise has been modelled using iNoise modelling software using ISO 9613-1 and ISO 9613-2 calculation methods, representing the road traffic as “moving sources” along the transport route using the parameters presented in **Table 15**.

Table 15 Road Traffic Noise Modelling Parameters

Noise Source/Item	Lw dBA re 10 ⁻¹² W	Movements/hr	Speed, km/h	Source Height, m ¹
Heavy vehicle (rigid, semi trailer or b-double)	104	8	50	1.5
Light Vehicle	96	20	50	0.75

Note 1: Height above ground level.

6 Noise Assessment Results

6.1 Construction Noise Assessment

Noise levels were predicted all identified receivers at 1.5m above ground level for typical construction activities for standard construction hours. **Table 16** summarises the predicted noise level range and maximum predicted noise level for each of the construction scenarios (trenching, piling and assembly) at identified receivers.

Table 16 Predicted Construction Noise Levels

Receiver ID	Description/Address	Predicted Noise Level Range dB LAeq(15min) ¹	Highest Predicted Noise Level dB LAeq(15min)	NML Standard Hours dB LAeq(15min)	Compliance Achieved
R01	313 Vine Lane	35-56	56	45	✗
R03	14111 Kamilaroi Highway	<30-40	40	45	✓
R04	7044 Rangari Road	<30-31	31	45	✓
R05	14022 Kamilaroi Highway	<30-35	35	45	✓
R06	14019 Kamilaroi Highway	<30-38	38	45	✓
R07	51 Vine Lane	<30	<30	45	✓
R08	262 Coolala Road	<30-32	32	45	✓
R09	201 Coolala Road	<30	<30	45	✓
R10	446 Coolala Road	<30	<30	45	✓
R11	7 Coolala Road	<30	<30	45	✓
R12	2 Boston Street	<30	<30	45	✓
R13	4 Boston Street	<30	<30	45	✓
R14	13852 Kamilaroi Highway	<30	<30	45	✓
R15	39 Finchs Lane	<30	<30	45	✓

Note 1: Noise levels from construction activities vary due to their position across the project site with respect to surrounding receivers.

Note 2: R02 is project related.

Noise levels are expected to exceed the NMLs at one receiver (R01) when works are at their nearest proximity. Exceedances at this receiver are expected from all construction activities (piling, trenching & assembly), however, would be of a temporary and of short duration.

6.2 Operational Noise Assessment

Noise levels were predicted all identified receivers at 1.5m above ground level for all operational sources and are presented in **Table 17**. Noise levels are expected to satisfy the PNTLs at all receivers.

Table 17 Predicted Operational Noise Levels

Location	Description/Address	Predicted Noise Level	PNTL dB LAeq(15min)	Compliance
		dB LAeq(15min)	Day/Eve/Night ¹	
R01	313 Vine Lane	<30	40/35/35	✓
R03	14111 Kamilaroi Highway	<30	40/35/35	✓
R04	7044 Rangari Road	<30	40/35/35	✓
R05	14022 Kamilaroi Highway	<30	40/35/35	✓
R06	14019 Kamilaroi Highway	<30	40/35/35	✓
R07	51 Vine Lane	<30	40/35/35	✓
R08	262 Caloola Road	<30	40/35/35	✓
R09	201 Coolala Road	<30	40/35/35	✓
R10	446 Coolala Road	<30	40/35/35	✓
R11	7 Coolala Road	<30	40/35/35	✓
R12	2 Boston Street	<30	40/35/35	✓
R13	4 Boston Street	<30	40/35/35	✓
R14	13852 Kamilaroi Highway	<30	40/35/35	✓
R15	39 Finchs Lane	<30	40/35/35	✓

Note 1: Day - the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays; Evening - the period from 6pm to 10pm; Night - the remaining periods.

Note 2: R02 is project related.

6.3 Maximum Noise Level Assessment

A detailed maximum noise level assessment is not required as predicted noise levels for night time operations do not exceed the maximum noise level screening criterion of 40dB LAeq(15min) and there are no operational noise sources that generate significant maximum noise events.

6.4 Road Traffic Noise Assessment

The major transport route for all vehicles to access the project site is via Boston Street and Vine Lane from the Kamilaroi Highway. During construction, traffic generated by the project includes employee/subcontractor and delivery vehicles. The traffic volume over a typical day for standard construction hours is expected to be up to four heavy vehicles (semi-trailers or B-doubles) per hour and 20 light commercial vehicles or equivalent mini buses for worker transport during the morning and afternoon peak hour periods.

Predicted noise levels from project related construction traffic at the closest receivers (R02, R07) on Vine Lane, and the closest receiver on Boston Street (15m) has been completed using the methodology described in **Section 5.3** and the parameters presented in **Table 15**. The results presented in **Table 18** show the calculated $LA_{eq}(1hr)$ noise level and the adjusted $LA_{eq}(15hr)$ noise level to align with RNP assessment periods.

Table 18 Predicted Construction Road Traffic Noise Levels

Road Name	Offset Distance to Receiver	Predicted Noise Level		RTN Criteria	Compliance Achieved
Vine Lane (R02)	20m	47dB $LA_{eq}(1hr)$	45dB $LA_{eq}(15hr)$	60dB $LA_{eq}(15hr)$	✓
Vine Lane (R07)	52m	41dB $LA_{eq}(1hr)$	39dB $LA_{eq}(15hr)$	60dB $LA_{eq}(15hr)$	✓
Boston Street	15m	48dB $LA_{eq}(1hr)$	46dB $LA_{eq}(15hr)$	60dB $LA_{eq}(15hr)$	✓

Results demonstrate that project construction traffic noise levels would comply with the relevant RNP criteria.

Existing road traffic flows on the Kamilaroi Highway are not available. The project proposes to add an additional 20 light vehicles per day and 100 heavy vehicles over a six month construction period, which would be considered a negligible increase to existing traffic flows resulting in a negligible increase in road traffic noise.

Therefore, it is concluded that project related road traffic noise levels would satisfy the relevant RNP criteria at any residential receiver along the proposed transport routes and not increase existing noise levels by more than 2dB.

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7 Recommendations

7.1 Construction Noise Recommendations

It is noted that construction noise emissions are anticipated to exceed the relevant NMLs depending on the type of construction and proximity of activities to receivers. The following noise mitigation measures should be considered during the construction phase to reduce emissions to the surrounding community:

- a construction noise management protocol to minimise noise emissions, manage out of hours (minor) works to be inaudible, and to respond to potential concerns from the community;
- where possible use localised mobile screens or construction hoarding around piling rig/plant to act as barriers between construction works and receivers, particularly where equipment is near the site boundary and/or a residential receiver including areas in constant or regular use (eg unloading and laydown areas);
- operating plant in a conservative manner (no over-revving), shutdown when not in use, and be parked/started at farthest point from relevant assessment locations;
- selection of the quietest suitable machinery available for each activity;
- minimise noisy plant/machinery working simultaneously where practicable;
- minimise impact noise wherever possible;
- utilise a broadband reverse alarm in lieu of the traditional high frequency type reverse alarm;
- provide toolbox meetings, training and education to drivers and contractors visiting the site during construction so they are aware of the location of noise sensitive receivers and to be cognisant of any noise generating activities;
- signage is to be placed at the front entrance advising truck drivers of their requirement to minimise noise both on and off-site; and
- utilise project related community consultation forums to notify residences within proximity of the site with project progress, proposed/upcoming potentially noise generating works, its duration and nature and complaint procedure.

The reduction achieved from the mitigation measures will depend on the specific measures implemented. Monitoring with and without the measures in place will provide an indication of the reduction achieved.

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8 Discussion and Conclusion

Muller Acoustic Consulting Pty Ltd (MAC) has completed a Noise Assessment for a proposed Solar Farm near Boggabri, NSW.

The results of the Noise Assessment demonstrate that construction noise levels have potential to exceed relevant construction NMLs at two receiver locations. Recommendations have been provided to minimise the potential noise impacts from construction, albeit of a temporary nature during the daytime over a six month construction period.

The results of the Noise Assessment demonstrate that emissions from the project would satisfy the operational PNTLs at all identified receivers.

Furthermore, sleep disturbance is not anticipated, as there are no operational noise sources that generate significant maximum noise events and noise emissions from the project are predicted to satisfy the EPA maximum noise criteria.

Road noise emissions associated with the project are anticipated to satisfy the relevant RNP criteria at all receivers along the proposed transportation route.

A qualitative assessment of potential vibration impacts has been completed. Due to the nature of the works proposed and distances to potential vibration sensitive receivers, vibration impacts from the project would be negligible.

Based on the Noise Assessment results, there are no noise related issues which would prevent approval of the proposed project.

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Appendix A – Glossary of Terms

A number of technical terms have been used in this report and are explained in **Table A1**.

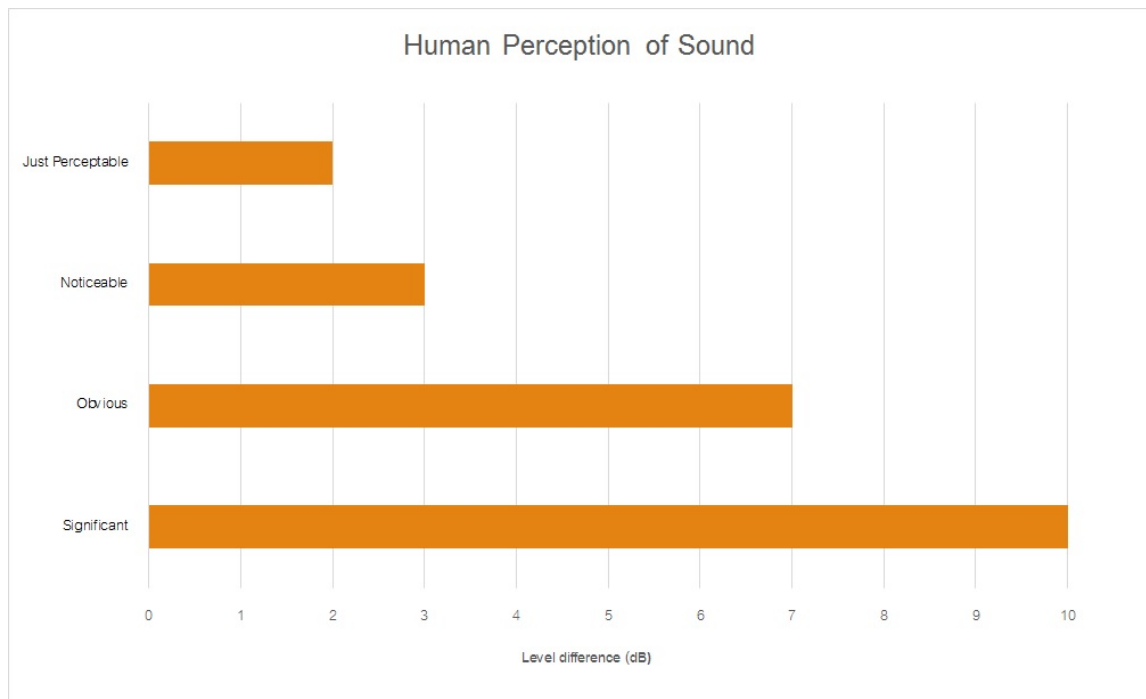
Table A1 Glossary of Acoustical Terms	
Term	Description
1/3 Octave	Single octave bands divided into three parts
Octave	A division of the frequency range into bands, the upper frequency limit of each band being twice the lower frequency limit.
ABL	Assessment Background Level (ABL) is defined in the NPI as a single figure background level for each assessment period (day, evening and night). It is the tenth percentile of the measured L90 statistical noise levels.
Ambient Noise	The total noise associated with a given environment. Typically, a composite of sounds from all sources located both near and far where no particular sound is dominant.
A Weighting	A standard weighting of the audible frequencies designed to reflect the response of the human ear to sound.
Background Noise	The underlying level of noise present in the ambient noise, excluding the noise source under investigation, when extraneous noise is removed. This is usually represented by the LA90 descriptor
dBA	Noise is measured in units called decibels (dB). There are several scales for describing noise, the most common being the 'A-weighted' scale. This attempts to closely approximate the frequency response of the human ear.
dB(Z), dB(L)	Decibels Z-weighted or decibels Linear (unweighted).
Extraneous Noise	Sound resulting from activities that are not typical of the area.
Hertz (Hz)	The measure of frequency of sound wave oscillations per second - 1 oscillation per second equals 1 hertz.
LA10	A sound level which is exceeded 10% of the time.
LA90	Commonly referred to as the background noise, this is the level exceeded 90% of the time.
LAeq	Represents the average noise energy or equivalent sound pressure level over a given period.
LAmx	The maximum sound pressure level received at the microphone during a measuring interval.
Masking	The phenomenon of one sound interfering with the perception of another sound. For example, the interference of traffic noise with use of a public telephone on a busy street.
RBL	The Rating Background Level (RBL) as defined in the NPI, is an overall single figure representing the background level for each assessment period over the whole monitoring period. The RBL, as defined is the median of ABL values over the whole monitoring period.
Sound power level (Lw or SWL)	This is a measure of the total power radiated by a source in the form of sound and is given by $10 \cdot \log_{10} (W/W_0)$. Where W is the sound power in watts to the reference level of 10^{-12} watts.
Sound pressure level (Lp or SPL)	the level of sound pressure; as measured at a distance by a standard sound level meter. This differs from Lw in that it is the sound level at a receiver position as opposed to the sound 'intensity' of the source.

Table A2 provides a list of common noise sources and their typical sound level.

Table A2 Common Noise Sources and Their Typical Sound Pressure Levels (SPL), dBA

Source	Typical Sound Pressure Level
Threshold of pain	140
Jet engine	130
Hydraulic hammer	120
Chainsaw	110
Industrial workshop	100
Lawn-mower (operator position)	90
Heavy traffic (footpath)	80
Elevated speech	70
Typical conversation	60
Ambient suburban environment	40
Ambient rural environment	30
Bedroom (night with windows closed)	20
Threshold of hearing	0

Figure A1 – Human Perception of Sound



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TRAFFIC IMPACT ASSESSMENT

SOLAR PHOTOVOLTAIC (PV) POWER GENERATING FARM & ASSOCIATED SUPPORTIVE INFRASTRUCTURE

**LOT 151 DP 755475
211 VINE LANE, BOGGABRI**

PREPARED FOR: PROVIDENCE ASSET GROUP

DECEMBER 2020

20/192

**TRAFFIC IMPACT ASSESSMENT
PROVIDENCE ASSET GROUP****SOLAR PHOTOVOLTAIC (PV) POWER FARM**
LOT 151 DP755475
211 VINE LANE, BOGGABRI

Intersect Traffic Pty Ltd (ABN: 43 112 606 952)

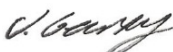
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This document has been prepared, checked and released in accordance with the Quality Control Standards established by Intersect Traffic Pty Ltd.

Issue	Date	Description	By
A	22/11/20	Draft	JG
B	23/11/20	Edit	JG
C	15/12/20	Final Proof	JG
D	15/12/20	Approved	JG

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Date 15th December 2020**Disclaimer**

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1.0 INTRODUCTION

Intersect Traffic Pty Ltd (Intersect Traffic) has been engaged by Providence Asset Group to prepare a traffic impact assessment report for a proposed Solar Photovoltaic (PV) Power Farm (up to 5MW) on Lot 151 DP 755475 211 Vine Lane, Boggabri.

The proposed development involves installation of solar panel banks, off-load area, inverter and AC combiner area, HV switchboard area, MV power station area, direct connection to a suitable existing power line in the south-east corner of the site, on-site car parking and temporary construction office. Vehicular access to the site will be via a new access road with turnaround area off Vine Lane approximately 400 metres north of the existing rural access to the existing dwelling on the site. The development concept plans are shown in **Attachment A**.

This report is required to support a development application to Narrabri Shire Council and allow the Council to assess the proposal in respect of its impact on the local and state road network.

This report presents the findings of the traffic and parking assessment and includes the following:

1. An outline of the existing situation near the site.
2. Assessment of the additional traffic generated by the proposal, identifies a preferred delivery route and the additional traffic's impact on the local road network.
3. Review of the adequacy of the proposed vehicular access to the site.
4. Review of the suitability and provision of on-site car parking through assessment against Council and Australian Standards requirements.
5. Presentation of conclusions and recommendations.

2.0 SITE DESCRIPTION

The subject site is shown in **Figure 1** below. It is located on the western side of Vine Lane, Boggabri approximately 2.5 km's north of Caloola Road and approximately 3.2 kilometres north-west of the Boggabri village centre. The site currently contains vacant rural pasture used for agricultural purpose.

The property has the formal title of Lot 150 DP755475, 211 Vine Lane, Boggabri with road frontage access directly off Vine Lane. The development area for the proposal is approximately 14 hectares. The site is currently zoned RU1 – Primary Production pursuant to the Narrabri LEP (2012).

The proposed vehicular access to the site will be provided off Vine Lane approximately 400 metres north of the existing unsealed rural access to the dwellings at 211 Vine Lane, Boggabri. Deliveries to the site will use the identified delivery road shown on **Figure 1** being via the Kamilaroi Highway from the south from Sydney and Newcastle or from the north from Brisbane. Noting Vine Lane is not a designated B-Double route, Council will need to provide special permission for B-Doubles to deliver materials to the site. It is considered that the short length of Vine Lane to be used by B-Double delivery vehicles is suitable to carry these vehicles for the short construction period with large ARTC ballast trucks already using Vine Lane. **Photograph 1** below shows the existing development site from Vine Lane **Photograph 2** shows the existing Kamilaroi Highway / Boston Street T-intersection near the site which lies on the proposed construction vehicle delivery route.

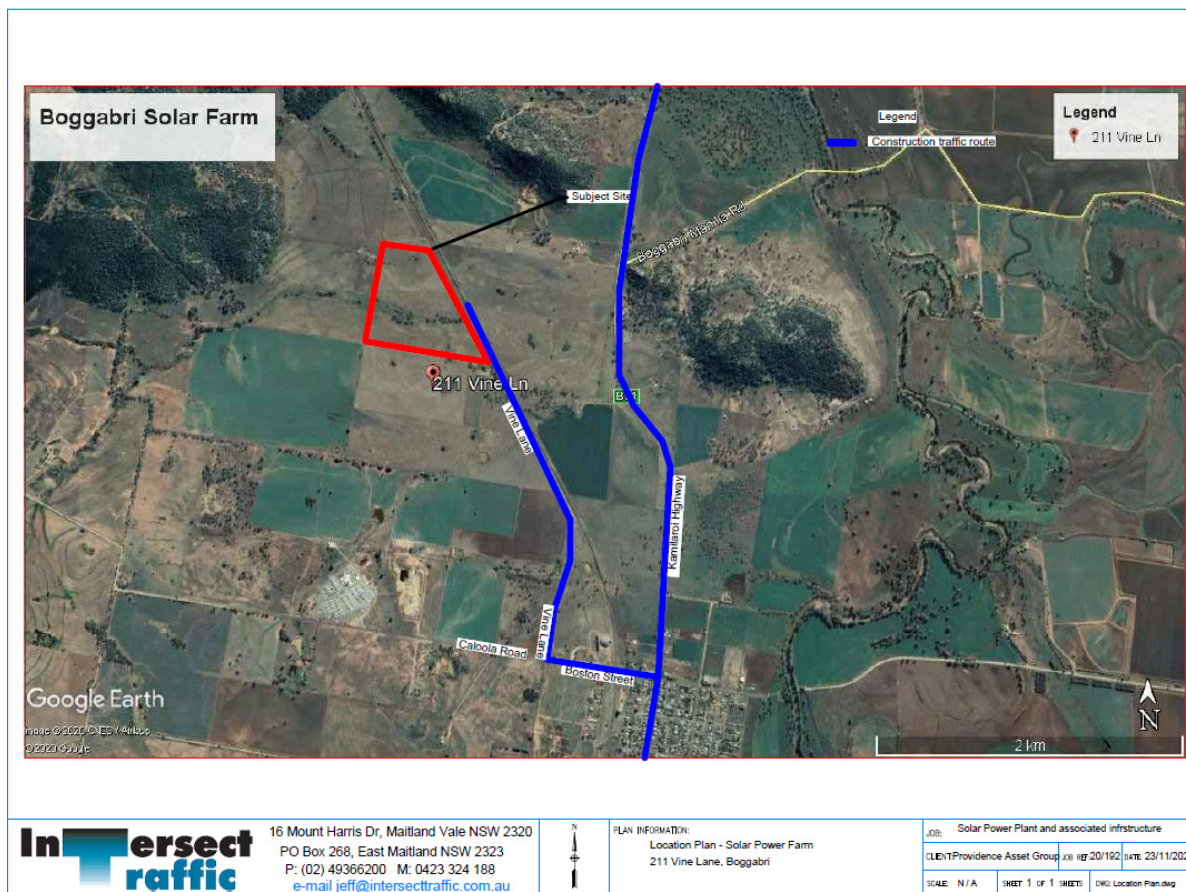


Figure 1 – Site Location



Photograph 1 – Development site from Vine Lane



Photograph 2 – Kamilaroi Highway / Boston Street give way controlled intersection.

3.0 EXISTING ROAD NETWORK

3.1 Kamilaroi Highway

The Kamilaroi Highway is a classified state highway (SH29) with its primary function to connect the New England Highway at Willow Tree to the Mitchell Highway at Bourke through Gunnedah, Boggabri, Narrabri, Wee Waa, Walgett and Brewarrina. As such it is an arterial road and major NSW transport route from inland NSW to the NSW coastal area. As a sealed rural arterial road the Kamilaroi Highway is under the care and control of Transport for NSW (TfNSW).

Near Boggabri the Kamilaroi Highway is a two-lane two-way sealed rural road with a 9-metre wide sealed carriageway consisting of 3.5 metre wide travel lanes and 1 metre wide sealed shoulders. Additional turning lanes are provided at major intersections along its length. Near the site the speed zoning is 100 km/h north and south of Boggabri 50 km/h through Boggabri. At the time of inspection the Kamilaroi Highway was observed to be in good condition as shown in **Photograph 3** below. It is considered suitable for use by heavy vehicle traffic.



Photograph 3 – Kamilaroi Highway, near site.

3.2 Boston Street

Boston Street is a local sealed urban road with its primary function to provide vehicular access to properties along its length. As a local urban road it is under the care and control of Narrabri Shire Council and a 50 km/h speed zoning would apply to Boston Street. Note Boston Street is also a designated B-Double route.

Boston Street is a two lane two sealed with the section impacted by the development running west from Kamilaroi Highway to an at grade level railway crossing 290 metres west of the Kamilaroi Highway. It has a 7 metre wide sealed pavement and gravel / grass shoulders and verge that comfortably allows two lanes of traffic flow, one in each direction with parking or pull over areas along its length. It currently services a number of residential properties along its length as well as commercial and agricultural activities west of the railway crossing where Boston Street becomes Caloola Road. At the time of inspection Boston Street near the Kamilaroi Highway was found to be in good condition as shown in **Photograph 4** below. The railway level crossing at the western end of Boston Street is shown in **Photograph 5**.



Photograph 4 – Boston Street west of Kamilaroi Highway.

3.3 Caloola Road

Caloola Road is a local sealed rural road with its primary function to provide vehicular access to properties along its length. As a local rural road it is under the care and control of Narrabri Shire Council and a 50 km/h speed zoning would apply to Caloola Road. Note Caloola Road is also a designated B-Double route.

Near the site the Caloola Road is a two-lane two-way sealed rural road with an 8-metre wide sealed carriageway which comfortably allows two way traffic flow. It currently service the grain silos as well as a number of agricultural and industrial land uses. At the time of inspection Caloola Road near Vine Lane was found to be in good condition as shown in **Photograph 6** below.



Photograph 5 – Boston Street to Caloola Road railway level crossing.



Photograph 6 – Caloola Road near Vine Lane.

3.4 Vine Lane

Vine Lane is a local unsealed rural road with its primary function to provide vehicular access to properties along its length. As a local rural road it is under the care and control of Narrabri Shire Council and as a rural road an unrestricted speed zoning would apply to Vine Lane, though the standard of construction and alignment would not encourage speeds above 80 km/h. Note Vine Lane is not a designated B-Double route.

Near the site the Vine Lane is a two-way unsealed rural road with a 6-metre wide unsealed carriageway which comfortably allows two way traffic flow. It currently services a number of rural properties but is also used by ARTC for maintenance access to the adjoining railway line including the use of heavy vehicle ballast supply trips. Vine Lane is considered suitable to cater for a short term heavy vehicle trip increase resulting from this development. At the time of inspection Vine Lane was found to be in fair condition as shown in **Photograph 7** below.



Photograph 7 – Vine Lane near the site.

4.0 ALTERNATE TRANSPORT MODES

There are no regular public transport (bus) services within Boggabri though a number of charter companies run school services in the area. Therefore the site is not serviced at all by public transport services.

As a rural area there are no pedestrian footpaths or on / off road cycleways within the local road network. Near the site pedestrians are generally required to utilise the grass verges and road shoulders / pavement while cyclists are required to utilise the road shoulders or share the travel lanes with other vehicles.

5.0 DEVELOPMENT PROPOSAL

The proposed development involves the construction of a Solar Photovoltaic (PV) Power Farm on the site. The development concept plans are shown in **Attachment A** with the specific works involved in the expansion listed below:

- Installation of temporary construction office and amenities.
- Installation of Solar Panel arrays.
- Earthworks for construction lay-down area, hardstand areas and internal roads.
- Installation of inverters, transformers and switchgear.
- Construction of unsealed access road from Vine Lane to the construction site.
- Construction of security fence and entrance gate; and
- Drainage and landscaping to Narrabri Shire Council requirements.

The development will require a team of 30 construction employees for a period of up to 6 months working 7 am to 5 pm Monday to Friday and 8 am – 1 pm on Saturdays. The majority of traffic movements associated with the development will occur during the construction of the solar power farm. Traffic movements generated by the operation of the development would include a single staff light vehicle movement associated with maintenance inspections as required and specific maintenance work which would be short term and infrequent. Deliveries during construction works would be expected to be within rigid and articulated vehicles. More detail on construction traffic is provided later in this report.

6.0 TRAFFIC IMPACTS

6.1 – Traffic Generation and Trip Distribution

The TfNSW publication “*RTA’s Guide to Traffic Generating Developments (2002)*” provides advice on the traffic generating potential of different land uses. However this document does not cover Solar Farms therefore determining traffic generation is reliant on advice from the applicant regarding construction and operation of the development.

From an operational perspective traffic generation is expected to be minimal with only regular daily maintenance inspections carried out when necessary. Therefore based on 1 visit per day per week a peak hour traffic generation of 2 vehicle trips per hour (vtp/h) has been assumed for this assessment. There may be times when specific maintenance tasks have to be undertaken but these will be infrequent, short-term and undertaken under a construction traffic management plan for the work. Construction traffic estimates for the development are as follows based on the information provided in **Attachment C**.

- Construction employees on-site – Maximum 30 transported in up to 10 light vehicles per day arriving between 6 am and 7 am and departing between 5 pm and 6 pm.
- Deliveries – Mainly heavy rigid vehicles and articulated vehicles (AV). Maximum – 8 per day but average of 5 per day between 10 am and 4 pm. Whilst these are likely to mostly arrive outside the peak hour traffic generation periods associated with the arrival and departure of employees, logistically there could be occurrences when due to circumstances out of the control of the contractor, a delivery arrives during the peak hour periods.
- Other vehicles – Some earthworks plant may be required on-site as well as concrete agitators and road base material deliveries during construction of the access. It would be expected a maximum frequency of 3 deliveries within a peak hour is assumed.
- Construction period – up to 6 months

Based on this advice the likely peak hour traffic generation which will occur in the AM peak coinciding with employees arriving on site and in the PM peak coinciding with employees leaving

the site is calculated below. It is also noted deliveries involve 2 trips with an inbound trip and an outbound trip.

AM peak = 10 inbound employees + 3 x 2 roadworks and other plant + 1 x 2 deliveries = 18 vtp/h (14 inbound and 4 outbound).

PM peak = 10 outbound employees + 3 x 2 roadworks and other plant + 1 x 2 deliveries = 18 vtp/h (14 outbound and 4 inbound).

It is expected that the distribution of trips will be all east towards Boggabri, then 50 % north (Narrabri) and 50 % south (Gunnedah) with deliveries being via the New England Highway and Kamilaroi Highway from the south or via Newell Highway and Kamilaroi Highway from the north originating from either Newcastle or Sydney or Brisbane. In accessing the site the likely transportation routes as envisaged is shown on the location plan (**Figure 1**) in this report.

Existing traffic volumes in the area were recorded by Intersect Traffic at the Kamilaroi Highway / Boston Street and Caloola Road / Vine Lane intersections during the likely peak AM and PM traffic periods (road network) i.e. 8 am – 9 am and 4.00 pm – 5.00 pm on Tuesday 10th November 2020 and Monday 9th November 2020 respectively. These periods were chosen following interrogation of Transport for NSW (TfNSW) data in the area on its Traffic Volume Viewer application. The data sheets for these counts are provided in **Attachment B**.

These traffic counts determined that the relevant peak hour two-way mid-block traffic volumes on the state and local road network in the AM and PM periods during this period were.

- Kamilaroi Highway north of Boston Street - 189 vtp/h in the AM peak and 267 vtp/h in the PM peak.
- Kamilaroi Highway south of Boston Street – 183 vtp/h in the AM peak and 242 vtp/h in the PM peak.
- Boston Street west of the Kamilaroi Highway – 16 vtp/h in the AM peak and 51 vtp/h in the PM peak.
- Caloola Road east of Vine Lane – 9 vtp/h in the AM peak and 29 vtp/h in the PM peak; and
- Vine Lane north of Caloola Road – 0 vtp/h in the AM peak and 1 vtp/h in the PM peak.

Given the construction will be completed within a 6 month period and the peak operational traffic volume from the site is only 2 vtp/h there is no need to do a 2030 (10 year horizon period) assessment of this development.



6.2 – Road Capacity

Table 4.5 of the TfNSW publication “*RTA’s Guide to Traffic Generating Developments*” provides some guidance on likely mid-block capacity of two-lane two-way rural roads. This table is reproduced below as **Table 1**:

Table 1 – Rural Road Mid-Block Capacity Table

Table 4.5
peak hour flow on two-lane rural roads (veh/hr)
(Design speed of 100km/hr)

Terrain	Level of Service	Percent of Heavy Vehicles			
		0	5	10	15
Level	B	630	590	560	530
	C	1030	970	920	870
	D	1630	1550	1480	1410
	E	2630	2500	2390	2290
Rolling	B	500	420	360	310
	C	920	780	650	570
	D	1370	1140	970	700
	E	2420	2000	1720	1510
Mountainous	B	340	230	180	150
	C	600	410	320	260
	D	1050	680	500	400
	E	2160	1400	1040	820

The data for Table 4.5 assumes the following criteria:

- terrain level with 20% no overtaking.
- rolling with 40% no overtaking.
- mountainous with 60% no overtaking.
- 3.7 m traffic lane width with side clearances of at least 2m.
- 60/40 directional split of traffic.

Source: - RTA’s Guide to Traffic Generating Developments (2002)

It is assumed that the appropriate terrain levels for the Kamilaroi Highway, Caloola Road and Vine Lane are Level, Rolling and Rolling respectively and that a satisfactory level of service (LoS) on the road network is a LoS C. Therefore after adopting a 5 % heavy vehicle percentage on traffic volumes the above table suggests the relevant two-way mid-block road capacities for a LoS C are as follows.

- Kamilaroi Highway – 1,550 vtp; and
- Vine Lane – 1,140 vtp.

However as local roads performing a property access function only it is considered that two-way mid-block traffic volumes on Boston Street, Caloola Road and Vine Lane should be restricted to the Environmental Capacity Guidelines contained in Table 4.6 of *RTA’s Guide to Traffic Generating Developments* which are reproduced as **Table 2** below. This table therefore indicates two-way mid-block traffic volumes on Boston Street, Caloola Road and Vine Lane should be restricted to below 300 vtp.

Therefore the two-way mid-block road capacity thresholds adopted in this assessment are.

- Kamilaroi Highway – 1,550 vtp; and
- Boston Street, Caloola Road and Vine Lane – 300 vtp.

Table 2 – Environmental Road Capacity Table

Table 4.6
Environmental capacity performance standards on residential streets

Road class	Road type	Maximum Speed (km/hr)	Maximum peak hour volume (veh/hr)
Local	Access way	25	100
	Street	40	200 environmental goal 300 maximum
Collector	Street	50	300 environmental goal
			500 maximum

Note: Maximum speed relates to the appropriate design maximum speeds in new residential developments. In existing areas maximum speed relates to 85th percentile speed.

Source: - RTA's Guide to Traffic Generating Developments (2002)

As the combination of the two-way mid-block peak hour traffic data and traffic generation figures reported in **Section 6.1** in the AM and PM peak hour traffic volumes on the local and state road network during construction of the Solar Farm will be well below the existing capacity thresholds determined above then the local and state road network has sufficient spare two-way mid-block capacity to cater for the construction and operation of the Solar Farm. The addition of up to 18 vtpd will not cause the capacity thresholds determined above to be reached therefore it can be concluded that the proposed development will not adversely impact on the local and state road network mid-block efficiency.

6.3 – Intersection Capacity

The main intersection impacted by the construction of the development is the Kamilaroi Highway / Boston Street priority controlled give way T-intersection. However traffic volumes at this intersection are well below the thresholds sourced from Austroads *Guide to Traffic Management Part 6 – Intersections, Interchanges and Crossings (2010)*, reproduced below in **Table 3** of this report. The Guide states that if traffic volumes are not above these thresholds, then uninterrupted flow conditions can be assumed and little or no delay will be experienced by motorists at these intersections. No further intersection analysis is then required.

Table 3 – Uninterrupted flow condition thresholds at an intersection

Major road type ¹	Major road flow (vph) ²	Minor road flow (vph) ³
Two-lane	400	250
	500	200
	650	100
Four-lane	1000	100
	1500	50
	2000	25

Source: - Austroads *Guide to Traffic Management – Part 6: Intersections, Interchanges and Crossings (2010)*

With traffic flows on the Kamilaroi Highway being less than 270 vtpd and traffic flows on Boston Street being less than 50 vtpd then it is clearly seen that the intersection is currently operating with uninterrupted flow conditions which was confirmed by observation on site. The additional 18 vtpd generated by the construction of the Solar Farm will not result in the thresholds within the above table being reached therefore it can be concluded that during construction and post development the Kamilaroi Highway / Boston Street intersection will continue to operate with uninterrupted flow conditions therefore it is reasonable to conclude that the development does not adversely impact on the operation of this intersection or any other intersection on the local and state road network.

6.4 Access Assessment

In terms of width, the access to the development providing access to a user class 1 (long term) car parking facility with less than 25 car spaces fronting a local road is required to be a category 1 access (Table 3.1 of the Standard). Table 3.2 of the Standard then specifies a category 1 access facility as a combined entry / exit between 3.0 to 5.5 metres wide. However the proposed entrance width at the combined entry / exit access at Vine Lane will need to be a minimum 12.5 metres wide to cater for the swept turning paths for delivery vehicles during the construction stage and satisfy the requirements of Australian Standard *AS2890.1-2004 Parking Facilities – Part 1 Off-street car parking* and Australian Standard *AS2890.2-2002 Parking Facilities – Part 2 Off-street commercial vehicle facilities*.

Sight distance at the proposed access off Vine Lane was observed to be in excess of 250 metres in each direction which therefore complies with the requirements of Figure 3.2 of Australian Standard *AS2890.1-2004 Parking Facilities – Part 1 Off-street car parking (160 metres minimum SSD for 100 km/h)* as well as Austroads *Guide to Road Design – Part 4A – Unsignalised and signalised intersections - Table 3.2 (248 metres for 100 km/h)* for safe intersection sight distance.

It is therefore concluded that the proposed site access is suitably located and satisfactory for use for the Solar Farm as it complies with the requirements of Australian Standard *AS2890.1-2004 Parking Facilities – Part 1 Off-street car parking* and Australian Standard *AS2890.2-2002 Parking Facilities – Part 2 Off-street commercial vehicle facilities*.

The main issue with access for construction vehicles to the site is the suitability of the local road network to safely cater for heavy vehicle deliveries. In this regard it is noted that Vine Lane has an unsealed pavement a minimum 6 metres wide, therefore complies with Austroads Standards for Rural Roads with less than 500 vtp. It would therefore allow two heavy vehicles to pass each other at slow speed. Therefore it is considered the proposed transportation route to the site is suitable to carry heavy vehicles and thus is suitable to cater for the construction traffic from the Solar Farm construction. However, the additional heavy vehicle loading from the construction may accelerate the deterioration in the unsealed pavement along the transportation route and create additional dust nuisance for dwellings within 60 metres of the road of which there are 3 dwellings along the construction delivery route. It is therefore recommended that a dilapidation report be prepared for the project in regard to Vine Lane caused by the construction of the Solar Farm and ensure the road network is repaired to Council's satisfaction post the construction stage of the development. This will require pre and post construction stage inspections of the road pavement along the proposed transport routes. As an unsealed pavement, maintenance works during construction may also need to be considered in the dilapidation report process including watering during particularly dry periods.

Overall with a suitable condition of consent included for the preparation of a dilapidation report covering Vine Lane and the satisfactory repair of the local road network post construction it is considered the local and state road network would be suitable to cater for the expected construction traffic associated with the development.

7.0 ON-SITE CAR PARKING

On-site car parking for the proposal is required to comply with the Industrial Development controls of the Narrabri Shire Council's Development Control Plan – Parking Code No. 1. Adopting the factory rates for this project the relevant on-site car parking provision during the operation of the Solar Farm is.

- 1.3 spaces per 100m² GFA .

With no building proposed for the Solar Farm the development is theoretically not required to provide any on-site car parking space under the DCP requirements. However with a single maintenance vehicle visit to the site likely to occur at most once a week it would be prudent to provide at least 1 on-site vehicle car park within the development. However it is the responsibility of the applicant to also provide sufficient on-site car parking for construction employees during the duration of the construction of the development for the development to comply with the car parking objectives of the DCP. Construction employee car parking will be provided on the hard stand area identified as the construction lay down area and this is large enough to cater for the expected storage requirements during construction as well as the provision of at least 10 on-site car parks for construction employees which is the expected traffic generation from employees to the site as well as being in excess of the Industrial land use requirements of the Narrabri Shire Council Development Control Plan – Parking Code No. 1. With significant overflow parking areas also on site it is considered reasonable to conclude the development provides sufficient on-site car parking that complies with the objectives and controls related to car parking required within Narrabri Shire Council's Development Control Plan – Parking Code No. 1.

The employee car parking area would need to comply with the requirements of Australian Standard *AS2890.1-2004 Parking Facilities – Part 1 Off-street car parking* with parking bay sizes 2.4 m x 5.4 m and aisle widths of 5.8 metres. There is sufficient room on-site to ensure compliance with this requirement which could be covered by a suitable condition of consent. Overall it is considered suitable on-site car parking can be provided for the development ensuring all vehicle movements to and from the site off Vine Lane will be undertaken in a forward direction.



8.0 ALTERNATE TRANSPORT MODES

The proposed development will not generate any increase in public transport demand during both the construction and operational phases of the development particularly given the site is not currently serviced by convenient public transport. Therefore there is no nexus for the provision of new services or improved infrastructure resulting from the development. Similarly, the development will not generate any additional pedestrian or cycle traffic during both the construction and operation phases of the development therefore no nexus exists for the provision of additional pedestrian paths or cycle ways near the site.

9.0 CONCLUSIONS

This traffic and parking assessment for the proposed Solar Photovoltaic (PV) Power Farm (up to 5MW) on Lot 150 DP755475, 211 Vine Lane, Boggabri has determined the following:

- The development during construction will generate up to an additional 18 vehicle movements to and from the site during the weekday AM and PM peak periods but only 2 vtpd during the operation of the Solar Farm.
- The existing peak traffic volumes on the local and state road network are well below the two-way mid-block capacity threshold of 1,550 vtpd for the Kamilaroi Highway (LoS C) as well as the environmental capacity of 300 vtpd for the local road network (Boston Street, Caloola Road and Vine Lane). Traffic volumes will remain below these thresholds during the construction and operation of the development.
- The Kamilaroi Highway / Boston Street give way controlled intersection will continue to operate with uninterrupted flow conditions during and post construction of the Solar Farm with little if any impact on the operation of the intersection resulting from the development.
- It is also reasonable to conclude the development will not adversely impact on the intersections on the wider state road network given the high levels of intersection control on the major intersections.
- Therefore, the additional construction and operational traffic generated by this development will not adversely impact on the efficiency or effectiveness of the local and state road network.
- The proposed site access is suitable for use for construction and operation of the development being compliant with Australian Standard and Austroads requirements.
- With a suitable condition of consent included for the preparation of a dilapidation report covering Vine Lane and the satisfactory repair of the local road network post construction it is considered the local and state road network would be suitable to cater for the expected construction traffic associated with the development.
- There is sufficient area on-site to accommodate the expected peak parking demand generated by the development during both construction and operation with the provision of an AS2890.1-2004 compliant car park within the construction laydown area for a minimum 10 spaces as well as the provision of numerous overflow parking areas on the site.
- The proposed development will not generate any increase in public transport demand therefore no nexus exists for the provision of new services or improved infrastructure resulting from the development. Similarly, the development will not generate any additional pedestrian or cycle traffic therefore no nexus exists for the provision of additional pedestrian paths or cycle ways near the site.

10.0 RECOMMENDATION

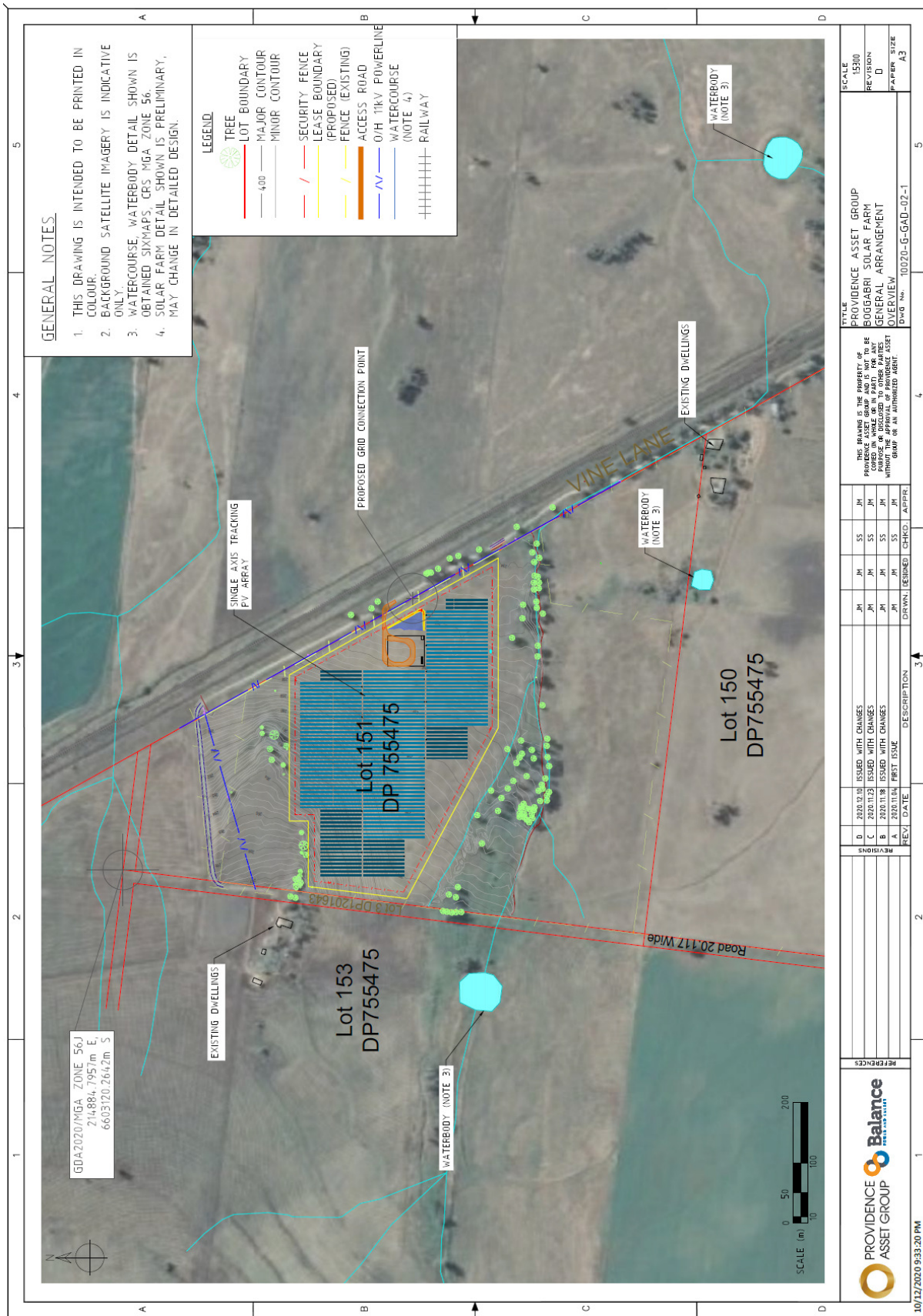
Having carried out this traffic and parking assessment for the proposed Solar Photovoltaic (PV) Power Farm (up to 5MW) on Lot 150 DP755475, 211 Vine Lane, Boggabri, it is recommended that the proposal can be supported from a traffic perspective as the development will not adversely impact on the local road network and complies with all relevant requirements of Narrabri Shire Council, Austroads, Australian Standards and TfNSW.



JR Garry BE (Civil), Masters of Traffic
Director
Intersect Traffic Pty Ltd

ATTACHMENT A

DEVELOPMENT PLANS

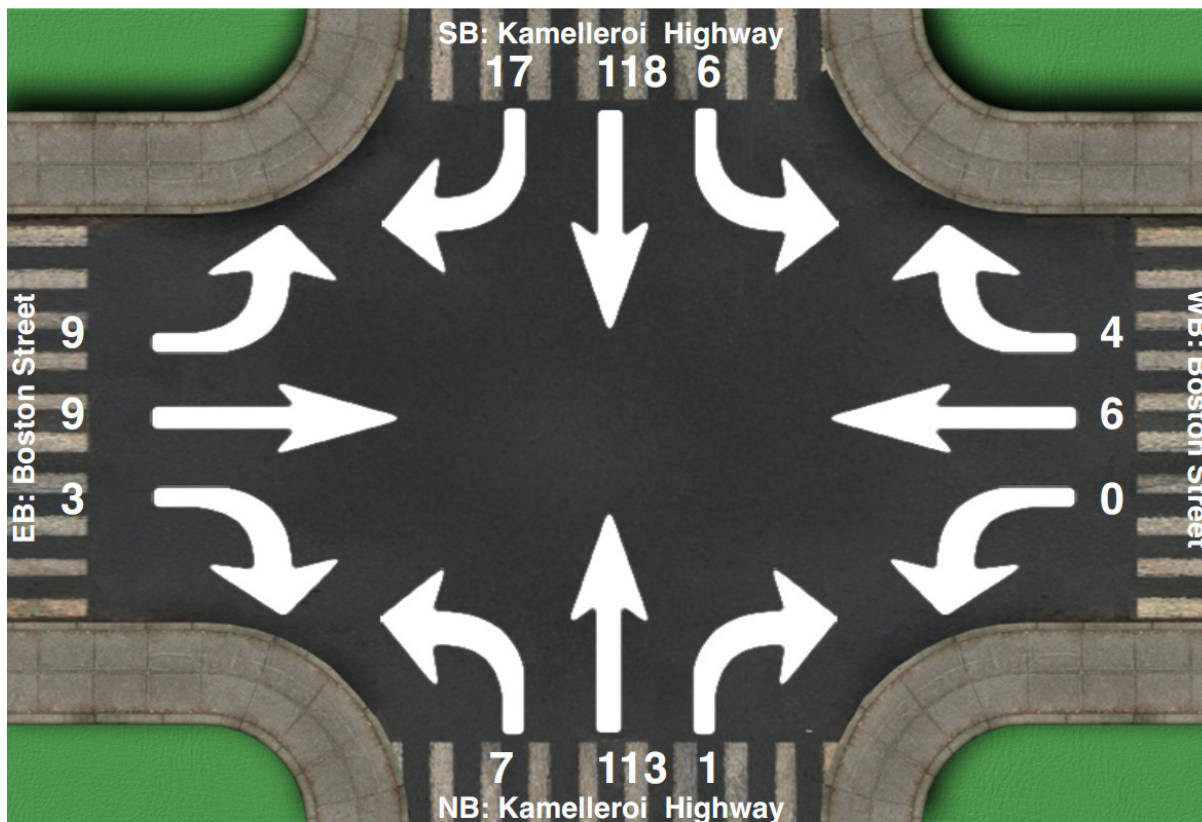


ATTACHMENT B

TRAFFIC COUNT DATA

Intersection Peak Hour

Location: Kamelleroi Highway at Boston Street, Boggabri
 GPS Coordinates:
 Date: 2020-11-09
 Day of week: Monday
 Weather:
 Analyst: Jeff



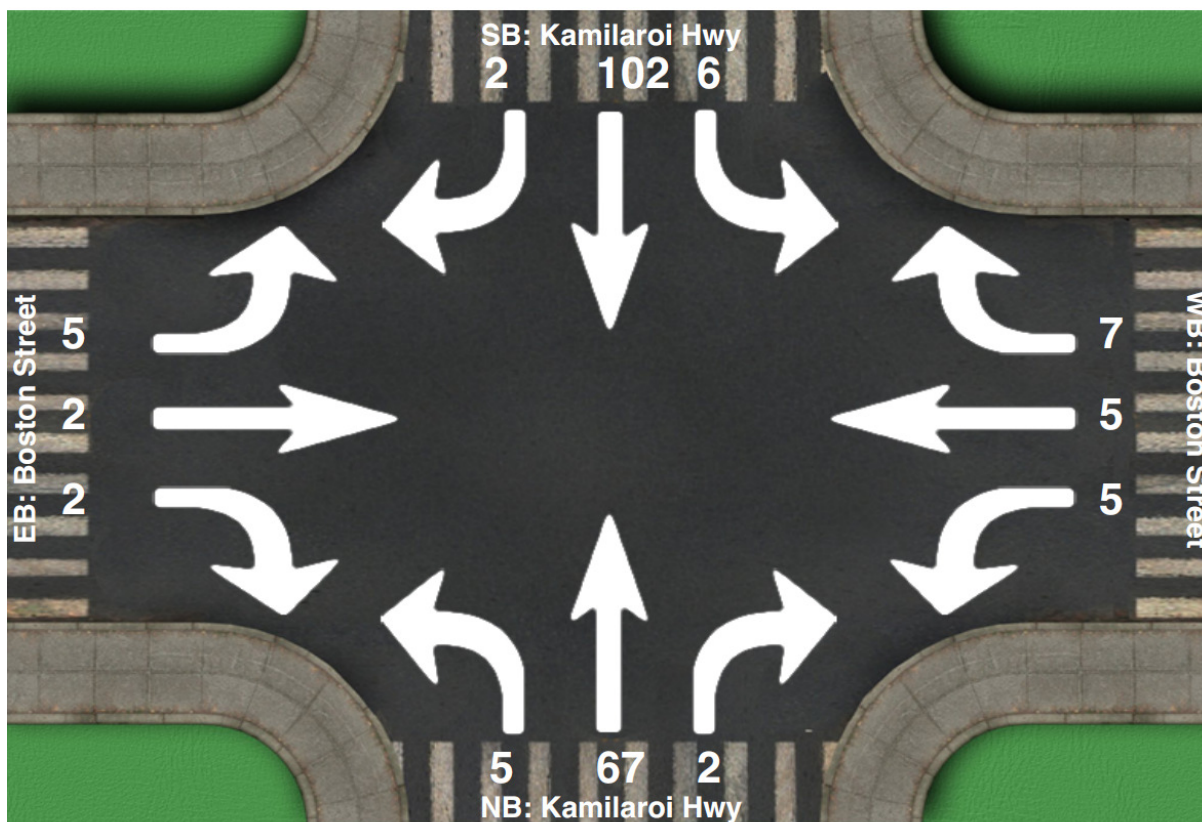
Intersection Peak Hour

16:00 - 17:00

	SouthBound			Westbound			Northbound			Eastbound			Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
Vehicle Total	6	118	17	0	6	4	7	113	1	9	9	3	293
Factor	0.38	0.84	0.71	0.00	0.50	0.33	0.58	0.86	0.25	0.45	0.56	0.38	0.88
Approach Factor	0.86			0.42			0.86			0.66			

Intersection Peak Hour

Location: Kamilaroi Hwy at Boston Street, Boggabri
GPS Coordinates:
Date: 2020-11-10
Day of week: Tuesday
Weather:
Analyst: Jeff



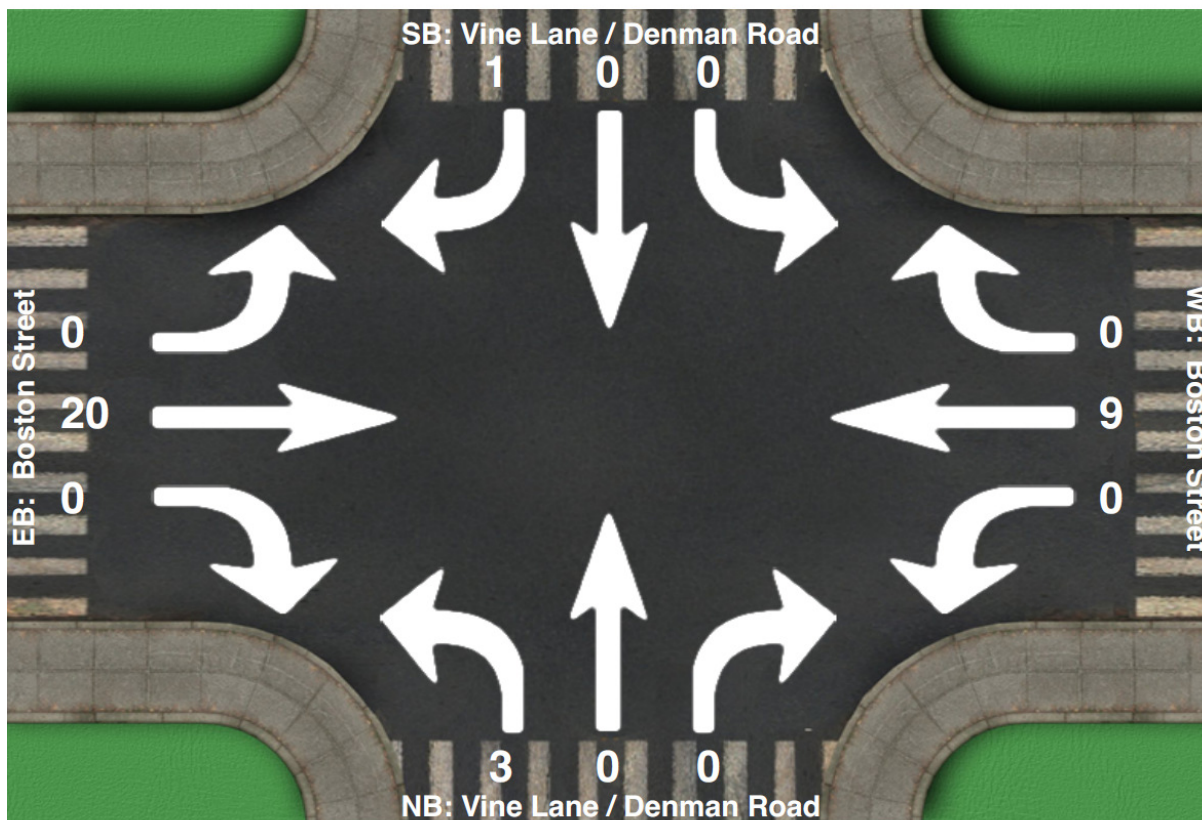
Intersection Peak Hour

08:00 - 09:00

	SouthBound			Westbound			Northbound			Eastbound			Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
Vehicle Total	6	102	2	5	5	7	5	67	2	5	2	2	210
Factor	0.50	0.77	0.25	0.42	0.31	0.44	0.62	0.73	0.50	0.42	0.25	0.25	0.83
Approach Factor	0.83			0.71			0.77			0.45			

Intersection Peak Hour

Location: Vine Lane / Denman Road at Boston Street, Boggabri
 GPS Coordinates:
 Date: 2020-11-09
 Day of week: Monday
 Weather:
 Analyst:



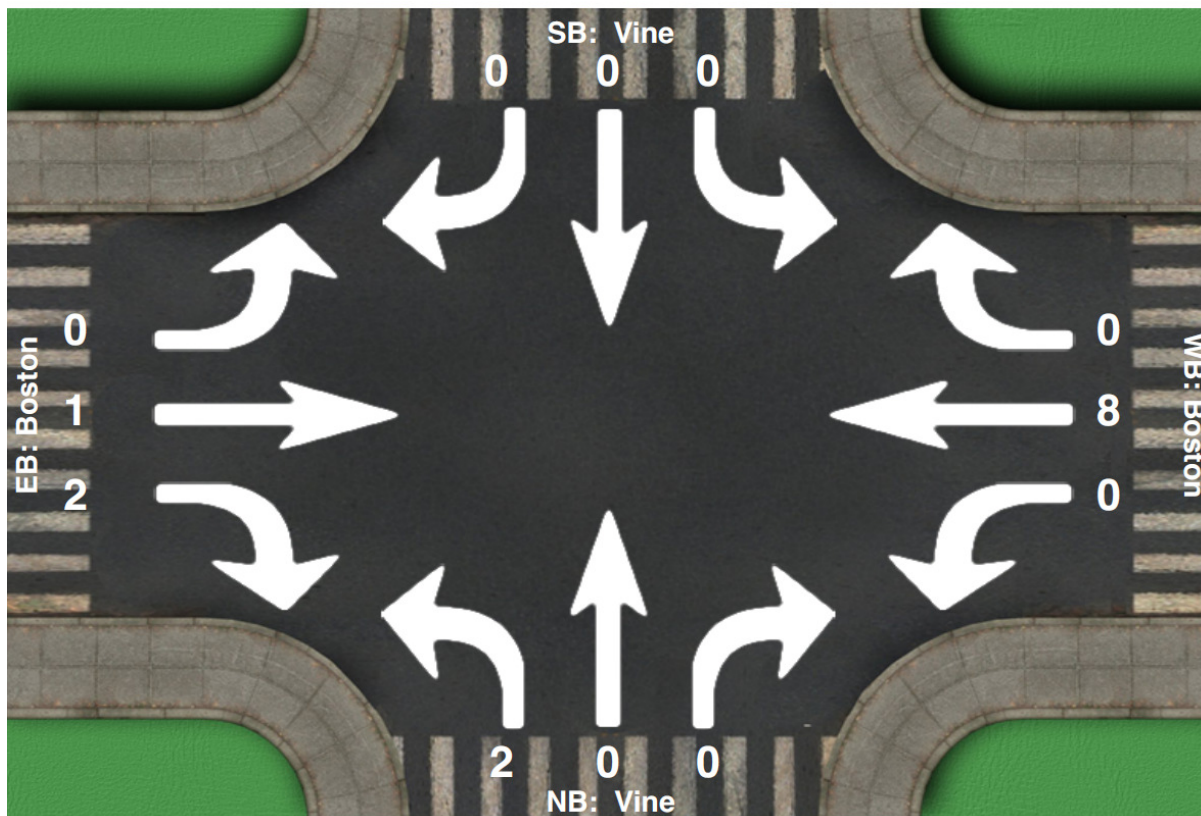
Intersection Peak Hour

16:00 - 17:00

	SouthBound			Westbound			Northbound			Eastbound			Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
Vehicle Total	0	0	1	0	9	0	3	0	0	0	20	0	33
Factor	0.00	0.00	0.25	0.00	0.75	0.00	0.25	0.00	0.00	0.00	0.71	0.00	0.69
Approach Factor	0.25			0.75			0.25			0.71			

Intersection Peak Hour

Location: Vine at Boston, Boggabri
 GPS Coordinates:
 Date: 2020-11-10
 Day of week: Tuesday
 Weather:
 Analyst:



Intersection Peak Hour

08:00 - 09:00

	SouthBound			Westbound			Northbound			Eastbound			Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
Vehicle Total	0	0	0	0	8	0	2	0	0	0	1	2	13
Factor	0.00	0.00	0.00	0.00	0.67	0.00	0.25	0.00	0.00	0.00	0.25	0.25	0.65
Approach Factor	0.00			0.67			0.25			0.38			

ATTACHMENT C

TRAFFIC GENERATION INFORMATION

Preliminary Solar Farm Vehicle Movement Guidance

27/03/2020

1 Traffic Generated by Construction Works

During the construction of the solar farm, it is estimated that approximately 50 x 40 ft containers will be transported to site. Added to these containers are waste traffic, equipment, temporary installations and workforce transport to and from site. A logistics agent will be engaged to manage the freight from the delivery port [TBC] to the solar farm site.

An estimation of the traffic created by the worksite is provided in Figure 1, below.

The vehicular traffic for the transport vehicles is based on a 3-axle rigid truck. The General Mass Limit (GML) for a 3-axle load is assumed to be 20 tonnes based on The Australian Trucking Association's 'Technical Advisory Procedure for Truck Configurations' [24]. Depending on the availability of vehicles it may be possible that a conventional B-doubles will transport equipment to site. The GML for this vehicle is 40 tonnes. In this case the vehicular traffic for the container loads will reduce by a factor of 2 for each B-double transporting equipment to site.

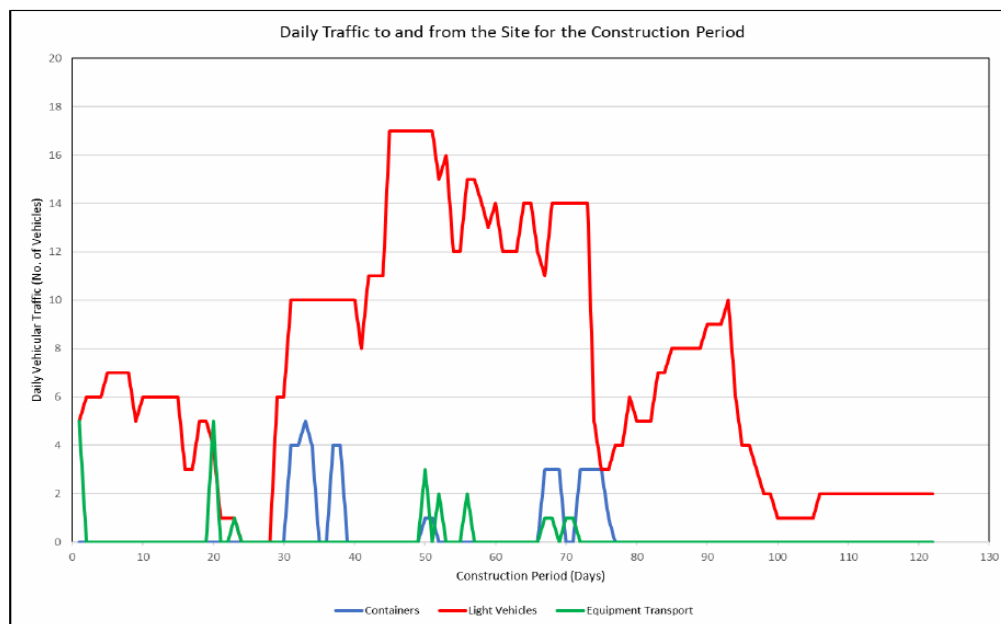


Figure 1 - Daily Traffic to and from Site for the Construction Period

At the peak of the equipment supply, the number of transport vehicles entering and leaving the solar farm site will be 4 to 5 daily for a period of just over a month into the construction period. There will be another busy week midway through the construction period where there will be approximately 3 transport vehicles entering and leaving the site daily.

All heavy transport to and from the site will predominantly be on standard working days between 8am and 4pm.



It is anticipated that there will be up to 30 personnel working on the site during the construction period that will generate the anticipated light vehicle traffic.

The light traffic will be concentrated at the beginning and the end of the day around 6-7am and 4-5pm. The container transport will be concentrated between 10am and 3pm.

2 Impact on Existing Traffic

With a maximum of eight to ten light vehicles and six to eight heavy vehicles travelling to and from the site daily, it is not anticipated that the increased traffic due to construction works will have any significant impact on the existing traffic.

3 Additional Road Signage of Existing Road

It is suggested that road signage is provided for the proposed site entrance on Manilla Road. The recommended locations of the warning signs be placed at distances of 200 metres approaching the intersection to the north and south. The warning signs will indicate that it is a construction site entrance. The entrance to the site on Mannum Road will be designed for the anticipated heavy transport loads volumes during the construction period that are detailed in Section 1. A Traffic Control Plan will be submitted to the DPTI Traffic Management Centre for approval, with all signage to be placed and maintained to the satisfaction of the Commissioner of Highways.

4 Parking

All parking for site personnel will be on site. This will be sign posted at the site entrance. Balance will not permit parking on Mannum Road and will incorporate this in the site induction.

5 O&M Traffic

Once the solar farm has been constructed and has entered the “operations and maintenance” stage the traffic onto site will consist of light vehicles, with few exceptions, at a frequency of 1 to 5 visits per fortnight.

5MW Solar Farm - Typical Vehicle Movements			
Construction - Major Equipment	Load	Quantity	Comments
Piling & Tracker Components	40' Container / Trailer	24	Doubles if permitted / practical
PV Modules	40' Container / Trailer	26	Doubles if permitted / practical
Switchgear	20' Container / Trailer	1	
Inverters	20' Container / Trailer	2	
Cranes	~50T	3	
Cables	40' Container / Trailer	2	Doubles if permitted / practical
Balance of Plant (BOP)	40' Container / Trailer	3	
Civil Plant	Float or Drop Deck	8	4ea at mob / demob
Piling Plant	Float or Drop Deck	4	2ea at mob / demob
Site Facilities	Float/Drop Deck/40' Trailer	8	4ea at mob / demob
Light trucks - 6 wheelers	local deliveries - sand, gen fteight etc	10	
Light trucks - 4 wheelers	local deliveries - sand, gen fteight etc	10	
		101	
Construction - Light Vehicles / Other	Load	Quantity	Comments
Light Vehicle - 4WD ute or similar	Personell / tools	384	Average 4 per day
Light Vehicle - ?	Workforce private vehicles	576	Average 6 per day - depends on engagement of workforce
		960	
O&M	Load	Quantity	Comments
Light Vehicle - 4WD ute or similar	fortnightly inspection	30	1 per fortnight, plus additional
Light Vehicle - 4WD ute or similar	3 monthly Inspections	8	2 visits, 4 times per year
Light Vehicle - 4WD ute or similar	Faults	4	
Light trucks - 4 wheelers	PV Module cleaning	2	Once per Year
		44	



WASTE MANAGEMENT PLAN

Establishment of Solar PV Power Generation Plant

211 Vine Lane, Boggabri NSW 2382

PREPARED FOR PROVIDENCE ASSET GROUP | DECEMBER 2020



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Address: 211 Vine Lane, Boggabri NSW 2382

Proposal: Establishment of Solar PV Power Generation Plant

OBJECTIVES FOR THE WASTE MANAGEMENT ON THIS SITE

- + To minimise resource requirements and construction waste through reuse and recycling; and the efficient selection and ordering of resources.
- + To ensure the waste management systems are compatible with the relevant waste collection services.

The management of waste is addressed in this WMP in the following sections, according to the stages of the development:

- + Site preparation and construction; and
- + Ongoing operation.

1 SITE PREPERATION AND CONSTRUCTION STAGE

Construction waste will be separated on site by builder's contractors and builder's laborer's during the construction stage.

The site manager will erect a sign on site for waste areas and will inform the builder's staff where material is to be collected for recycling, and will set aside on site an area to store the recyclable materials for transportation to local recycling plants. The site manager and/or builder will impose the execution of the waste separation policy on a regular basis and to have on-going checks.

Stockpiles shall be located and managed appropriately to prevent sediment runoff and ensure minimal environmental impact from the building site.

A suitable all-weather vehicular access points shall be provided for the construction phase, and all sediment and erosion control devices implemented on site prior to commencement of construction works.

Type of waste generated	Estimates Volume in m ³ or area m ² or weight in tonne (t)	Reuse and Recycling		Disposal
		On-Site	Off-Site	
Green Waste	<8t		Directed for green waste reuse by local recycler.	
Excavated Material	<10m ³	Possible reuse of soil onsite.	Un-recyclable excavated material to be disposed at local waste facility.	
Metal (Ferrous) Eg. Steel	3t		Sent to local metal recycler by contractor.	
Metal (Non-ferrous) Eg. Aluminium	<1t		Sent to local metal recycler by contractor.	
Packaging (Wood) Eg. Pallets, dunnage	39.5t		Reuse by logistics contractor. Broken directed to recycler.	
Packaging (Other) (Plastic, cardboard etc)	4.8t		Cardboard/paper sent to recycler by contractor.	Disposed of at local waste facility by contractor
Other waste e.g. pvc plastics, paint, paper / cardboard	<2t	-		Disposed of at local waste facility by contractor

2 OPERATION STAGE

Staff will separate general waste and recyclables within the waste storage / management area. A minimum of two separate bins (general and recycle bins) will be located within the waste area. Waste and recycling bins will be clearly labelled and identifiable. The bins and waste storages areas will be cleaned by staff with protective gloves as required.

Type of waste generated	Estimated Volume per week	Reuse and Recycling		Disposal
		On-Site	Off-Site	
Food and General Waste	20L			Disposed of at local landfill by waste contractor on an as needs basis
Recyclable Waste	20L			Disposed of at local recycle plant by waste contractor on an as needs basis
Green Waste	20L			Disposed of at local recycle plant by waste contractor on an as needs basis



23 November 2020

Patrick Quinlan
Client Director/Associate
KDC
Suite 2B, 125 Bull Street,
NEWCASTLE WEST NSW 2302

Dear Patrick,

Preliminary Aboriginal archaeological advice for Lot 151 of DP755475, 211 Vine Lane, Boggabri, NSW for Providence Asset Group

This letter aims to provide Providence Asset Group preliminary Aboriginal archaeological advice for Lot 151 of DP755475, 211 Vine Lane, Boggabri, NSW. This letter summarises the preliminary results from the site inspection and includes recommendations for further management of Aboriginal cultural heritage values.

Site Inspection Summary

A site inspection was undertaken at the proposed Boggabri Solar Farm location on 27 October 2020 with two sites officers from Red Chief LALC, Dave Horton and Cindy Foley. Landforms of high sensitivity, i.e. the creek line running E-W within the property and partially along the project area's southern boundary were surveyed in full. Numerous east-west transects traversing the lease area were also undertaken. Visibility within the paddocks was generally zero to very low due to overgrowth by pasture vegetation species, with areas of exposure totalling less than 2% inhibiting detection of Aboriginal objects.

Within the paddocks, the rare areas with exposures (with approx. 80 - 100% visibility) were targeted for survey. These exposures were primarily along eroded tracks, fencelines, and where vegetation was absent due to shading from large trees. No new sites were recorded in the few exposures in the field, and areas with particularly long grass were avoided due to multiple snake sightings prior to and during the foot survey. The northern portion of the lease area on the Springfield property was also surveyed (south of the Springfield driveway) and no new sites were recorded due to a lack of visibility and exposures (0-5% visibility; <2% exposures). The survey area appeared to have been partially overgrown with pasture species, and contained large sandstone fragments and angular blocks which appear to have been moved to the fenceline of the paddock by machine.

One new Aboriginal site recording has been undertaken for the project area to archival standards, and will be submitted to AHIMS this week. We have consolidated the previous four artefact scatters along the creekline and banks into one single site to be managed within a potential archaeological deposit (PAD). An updated map of the site "Boggabri Creek 001" has been attached, showing the extent of the PAD and the four main concentrations of artefacts within the PAD and scatter. The artefact scatter contained a diversity of tool types and materials. The creekline runs partially along the eastern part of the southern proposed works boundary. The highest artefact density was at the confluence between the two creeklines. The second creekline is fully within the project lease area, comprising the entire southern boundary. It was too overgrown to be assessed. The presence of the new site and the richness of the artefact assemblage suggests that unexpected finds during works in the central paddock areas is likely. There is high potential for background scatter (Aboriginal objects of lower densities) and Aboriginal objects in highly modified contexts or in situ that can't be seen due to poor ground surface visibility.

Recommendations

Following on from the site inspection, we recommend the following:

- J Design of works to avoid the southern creekline and the new site "Boggabri Creek 001" if possible;
- J Completion of an AHIMS site recording form for Boggabri Creek 001 and any associated deposits and submission to the AHIMS database to comply with Section 91 of the National Parks and Wildlife Act, in consultation with the Red Chief Local Aboriginal Land Council; and
- J Consultation with the Red Chief Local Aboriginal Land Council on the outcomes of this preliminary advice and formal comment on cultural heritage values and the results of the site inspection; and
- J Commencing preparation of an Aboriginal Cultural Heritage Assessment and Archaeological Assessment (ACHA/AA) to assist with AHIP application.
 - O this will cover unexpected finds and additional Aboriginal objects found in the future during community collection when ground disturbing works occur and also may need to consider potential for archaeological testing/salvage if triggered.

We are happy to discuss any aspect of this summary and look forward to planning ahead with you for the next stage of this project.

Yours sincerely



Dr Mary-Jean Sutton

Principal Archaeologist/Company Director



Figure 1
Map Showing Locatic of Site
"Boggabri Creekline 001"

- Legend
- Major Towns & Cities
 - Boggabri HSA
 - HSA Acces Gates
 - Artefact Concentrations Within Scatter
 - Extent of Artefact Concentrations
 - Creek PAD
 - Creek Line

- Proposed Works
- Priority DD Assessment Area
 - Proposed Grid Connection
 - Proposed Lease Area
 - Proposed Site Access



Source: NSW Spatial Services, AHIMS, KDC
Projection: GDA94
Document Set ID: 1881768
Version 1, Version Date: 05/01/2021
Map content may be based on third party data, may not be to scale and are intended for use as a guide only. Virtus Heritage does not warrant the accuracy of such maps or figures.

