ENVIRONMENTAL IMPACT STATEMENT

Middlebrook Solar Farm

June 2023

Project Number: 22-180


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DECLARATION

EIS declaration	Details	Response
Project details	Project name	Middlebrook Solar Farm
	Application number	SSD-10455
	Address of the land in respect of which the development application is made	Lot 60 DP 755343, Lot 61DP755343, Lot 14 DP37547, Lot 15 DP 37547 760 Middlebrook Road, Loomberah in the Tamworth Regional Local Government Area (LGA).
Applicant details	Applicant name	Middlebrook Solar Farm Pty Ltd.
	Applicant address	10-12 Gwynne Street Cremorne, VIC, 3121
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Declaration by registered environmental assessment practitioner	Name	Brooke Marshall
	Registration number	Specialist certification IA11090 REAP certification R80042
	Organisation registered with	EIANZ
	Declaration: The undersigned declares that this EIS: • Has been prepared in accordance with Schedule 2 of the Environmental Planning and Assessment Regulation 2000, • Contains all available information relevant to the environmental	

EIS declaration	Details	Response
	assessment of the development, activity or infrastructure to which the EIS relates, • Does not contain information that is false or misleading, • Addresses the Planning Secretary's environmental assessment requirements (SEARs) for the Project, • Identifies and addresses the relevant statutory requirements for the Project, including any relevant matters for consideration in environmental planning instruments, • Has been prepared having regard to the Department's *State Significant Development Guidelines - Preparing an Environmental Impact Statement*, • Contains a simple and easy to understand summary of the Project as a whole, having regard to the economic, environmental and social impacts of the Project and the principles of ecologically sustainable development, • Contains a consolidated description of the Project in a single chapter of the EIS, • Contains an accurate summary of the findings of any community engagement, and • Contains an accurate summary of the detailed technical assessment of the impacts of the Project as a whole.	
	Signature:	
	Date:	24 June 2023

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ACRONYMS

AHIMS	Aboriginal Heritage Information Management System
APZ	Asset protection zone
ASC	Australian Soil Classification
ASL	Above sea level
BC Act	*Biodiversity Conservation Act 2016* (NSW)
BESS	Battery Energy Storage System
BSAL	Biophysical Strategic Agricultural Land
CCTV	Closed-Circuit Television
Cth	Commonwealth
DPE	Department of Planning and Environment, NSW (formerly DPIE)
EEC	Endangered Ecological Community – as defined under relevant law applying to the Project
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
EMF	Electric and Magnetic Fields
EPA	NSW Environment Protection Authority
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Cth)
EP&A Act	*Environmental Planning and Assessment Act 1979* (NSW)
EP&A Regulation	*Environmental Planning and Assessment Regulation 2021* (NSW)
EPC	Engineering and Procurement Contract
ESD	Ecologically Sustainable Development
ha	hectares
km	kilometres
LALC	Local Aboriginal Land Council
LEP	Local Environment Plan
LGA	Local Government Area
LUCRA	Land Use Conflict Risk Assessment
m	metres
MNES	Matters of National Environmental Significance, under the EPBC Act
OSOM	Oversized and Over Mass (vehicle)
REP	Regional Environmental Plan
RET	Renewable Energy Target (Australian Government)
REZ	Renewable Energy Zone
RFS	Rural Fire Services
SEARs	Planning Secretary's Environmental Assessment Requirements
SIA	Social Impact Assessment
SSD	State Significant Development

TABLE OF DEFINITIONS

Applicant	Middlebrook Solar Farm Pty Ltd as trustee for the Middlebrook Solar Farm Project Trust
Project	The proposed Middlebrook Solar Farm.
Subject land	All lots affected by the development.
Assessment area	The study area investigated prior to identifying the constraints and exclusions [1].
Development footprint	The uppermost area of land that would be impacted by the Project (including during construction, operation and decommissioning).
Indicative infrastructure layout	Shows the indicative location of key infrastructure components and most closely represents the area of operational impact area of the solar farm. The final infrastructure layout will be subject to detailed design with appointed contractors, informed by detailed topographic and geotechnical surveys.
Exclusion zones	Specific areas that have been identified as requiring protection from Project impacts.
Associated receivers	These dwellings are associated with the Project. As the landowners would host Project infrastructure, they are considered Project-involved and impacts are not required to be assessed for these receivers.
Non-associated receivers	These constructed and / or approved dwellings are not associated with the Project. All potential impacts are assessed for non-associated receivers.

[1] Some specialist reports use alternative terms but in this EIS, terms have been rationalised as per this table.

EXECUTIVE SUMMARY

The purpose of this Environmental Impact Statement is to assess the economic, environmental and social impacts of the Middlebrook Solar Farm. This report is structured to help the community, local council, government agencies and the consent authority to get a better understanding of the proposed Project and its impacts, so they can make informed submissions and decisions on the merits of the Project.

Proposed location and values

Broad setting between Renewable Energy Zones

Middlebrook Solar Farm (the Project) is located in the Tamworth Regional Local Government Area (LGA), approximately 22 km south of Tamworth. It is not within the New England Renewable Energy Zone (REZ) but is located on the New England Highway, between the New England and Hunter-Central Coast REZs, approximately 27 km west of the New England REZ and 76 km north of the Hunter-Central Coast REZ. REZs are being created by the NSW Government to concentrate power generation, transmission, and storage in identified areas to unlock new capacity for the energy grid. These strategic locations will also bring new employment and economic stimulus to the surrounding communities. To meet state and national clean energy targets, renewable energy Projects are and will continue to be required outside of the REZ areas.

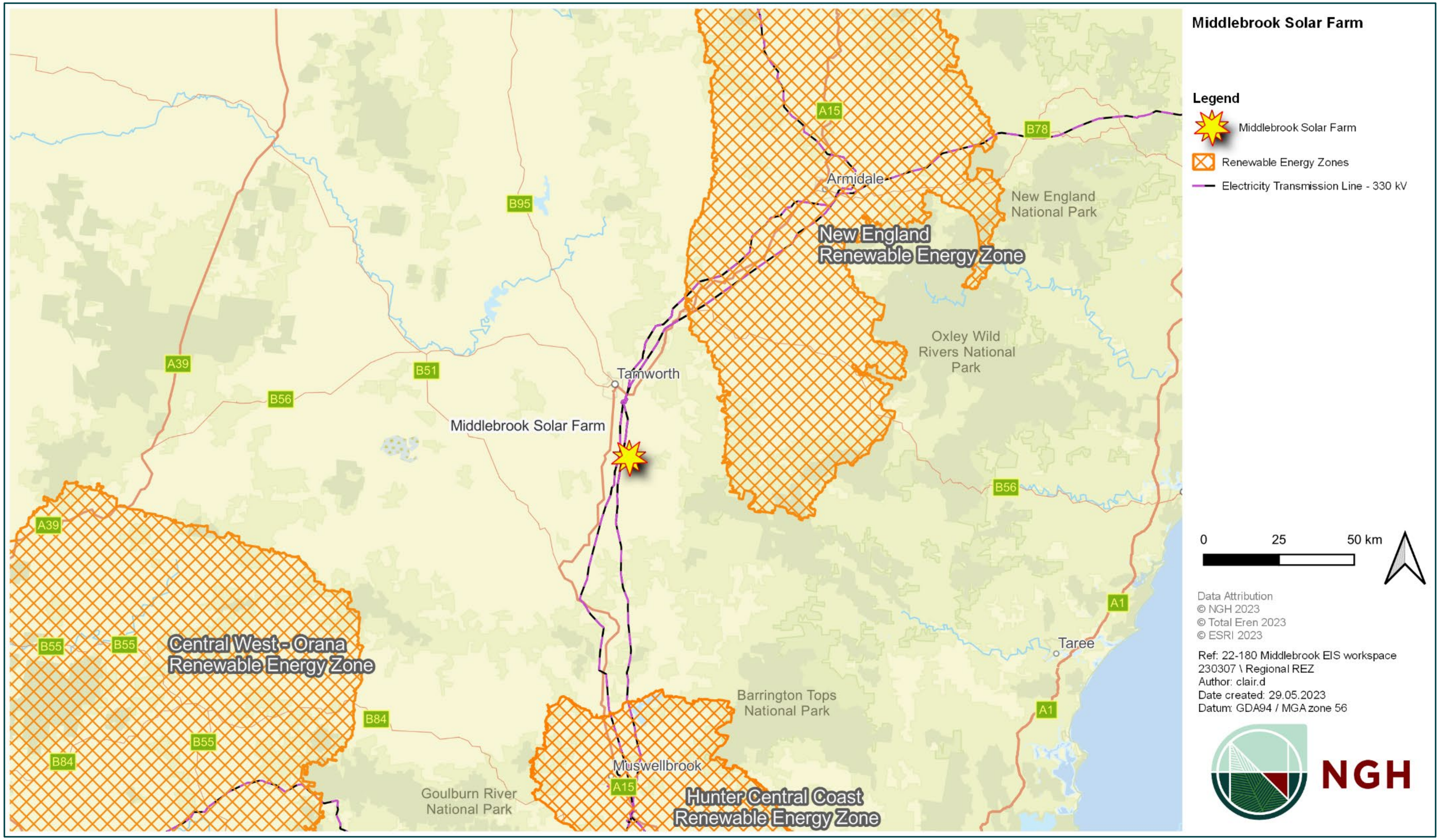

Figure ES-1 Location near to the adjacent REZs.

Site selection and Project refinement

The site proposed for the Middlebrook Solar Farm was initially identified following a detailed desktop review of the region which considered:

- Suitable connection capacity to the grid and proximity to demand centres.
- Suitable terrain and access to keep costs of construction low.
- Ability to avoid or manage impacts on the social and environmental values of the site.

The Project site was identified which initially comprised four freehold lots. Environmental investigations and consultation with the local community began.

At the end of 2020, work towards the assessment and consultation activities for the Project were placed on hold, as COVID 19 lock downs made travel and face to face consultation difficult. In March 2022, the Applicant signed a Case-Managed Project Service Charter with the Department of Planning and Environment, to support the assessment process for the Middlebrook Solar Farm. Candidates for this program are evaluated on the basis of strategic alignment, economic benefit, public benefit, design excellence and existing infrastructure and high likelihood of delivery.

A Gap Analysis was completed in May 2022 (NGH 2022) to bring the draft Middlebrook Solar Farm assessment up to date. Final investigations to inform the scale for the Project, mitigation strategies and community benefits recommenced in early 2023, including community surveys, renewed Aboriginal heritage stakeholder consultation and more detailed consultation with near neighbours regarding impacts and benefits. Important decisions were made to reduce the scale of the Project to make it more responsive to the site's values and new assessment directives.

Site values

The Subject land (all lots affected by the updated Middlebrook Solar Farm Project) now constitutes three freehold lots. They are zoned RU1 Primary Production under the Tamworth Regional Local Environmental Plan 2010. No Crown land is relevant, but sections of the Tamworth Regional Council administered Middlebrook Road, as well as its connection with the New England Highway, a major transport corridor in the region, are relevant to the Project's access requirements.

The Subject land is gently undulating. It has been mostly cleared of native vegetation and is used for stock grazing and cropping which are also the dominant land uses in the locality. White Box (*Eucalyptus albens*) is the dominant canopy species observed in the higher areas. Lower lying areas near watercourses have a higher proportion of the Yellow Box (*Eucalyptus melliodora*) and Blakely's Red Gum (*Eucalyptus blakelyi*). Depending on condition and extent, some of these native vegetation remnants are considered conservation significant Box Gum Woodland. Several threatened species are associated with this community.

Three named watercourses cross the site: Banyandah Creek, Algona Creek and Spring Creek (Strahler stream orders 3, 4 and 5 respectively [2]). The soils have been surveyed and results show the topsoils across the site generally have good capability for agricultural use. They have a pH range suitable for plant growth, low to very low salinity and a high ability to retain plant nutrients. A corridor, verified by the soil surveys, of Biophysical Strategic Agricultural Land (BSAL[3]) has been excluded from the Project. The Project would impact areas categorized as Class 4 (459.75 ha) and Class 5 (50.47 ha) land. Limitations noted for these areas include erosion and waterlogging.

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[2] Under this classification scheme, the stream order increases when streams of the same order intersect; the intersection of two minor first-order streams will create a larger second-order stream, and so on.
[3] Biophysical Strategic Agricultural Land has soil and water resources that can sustain high levels of agricultural productivity, as categorised under NSW Government 2013b.

Figure ES-3 sets out some of the key local features and land uses in the locality, which include:

- Tourism / nature-based recreation opportunities, such as:
    - Chaffey Reservoir (approximately 10 km southeast).
    - Peel River, (16 km east).
    - Crawney Pass National Park (28 km).
    - Ben Halls Gap Nature Reserve (33 km).
    - Tomalla Nature Reserve (37 km).
- Tourism operations, providing accommodation and or restaurants, such as:
    - Goonoo Goonoo station – an accommodation and events venue approximately 3.5 km west.
    - Rural Bed and Breakfast's are popular to the north - around the localities of Kingswood and Timbumburi, about 8–10 km north of the site.

There is also a private landing strip and Goonoo Goonoo Station.

Goonoo Goonoo station image (MLA 2023)

Social values

Aboriginal cultural heritage

The site is located within Gamilaraay Country of the Gamilaraay/Yuwaalaraay/Yuwaalayaay language group. The Gamilaraay nation covers a large portion of northern NSW and extends into southern Queensland. Dispossession from traditional lands commencing from around 1842 has meant great social upheaval and disrupted or destroyed access to traditional resources. Surveys of the Middlebrook Solar Farm Assessment area, undertaken with Aboriginal parties registering an interest in Project, have verified areas of high cultural value remain in the area, including areas along Spring Creek. Potential modified trees and artefacts from stone quarrying (as isolated finds and scatters) were also identified in the surveys.

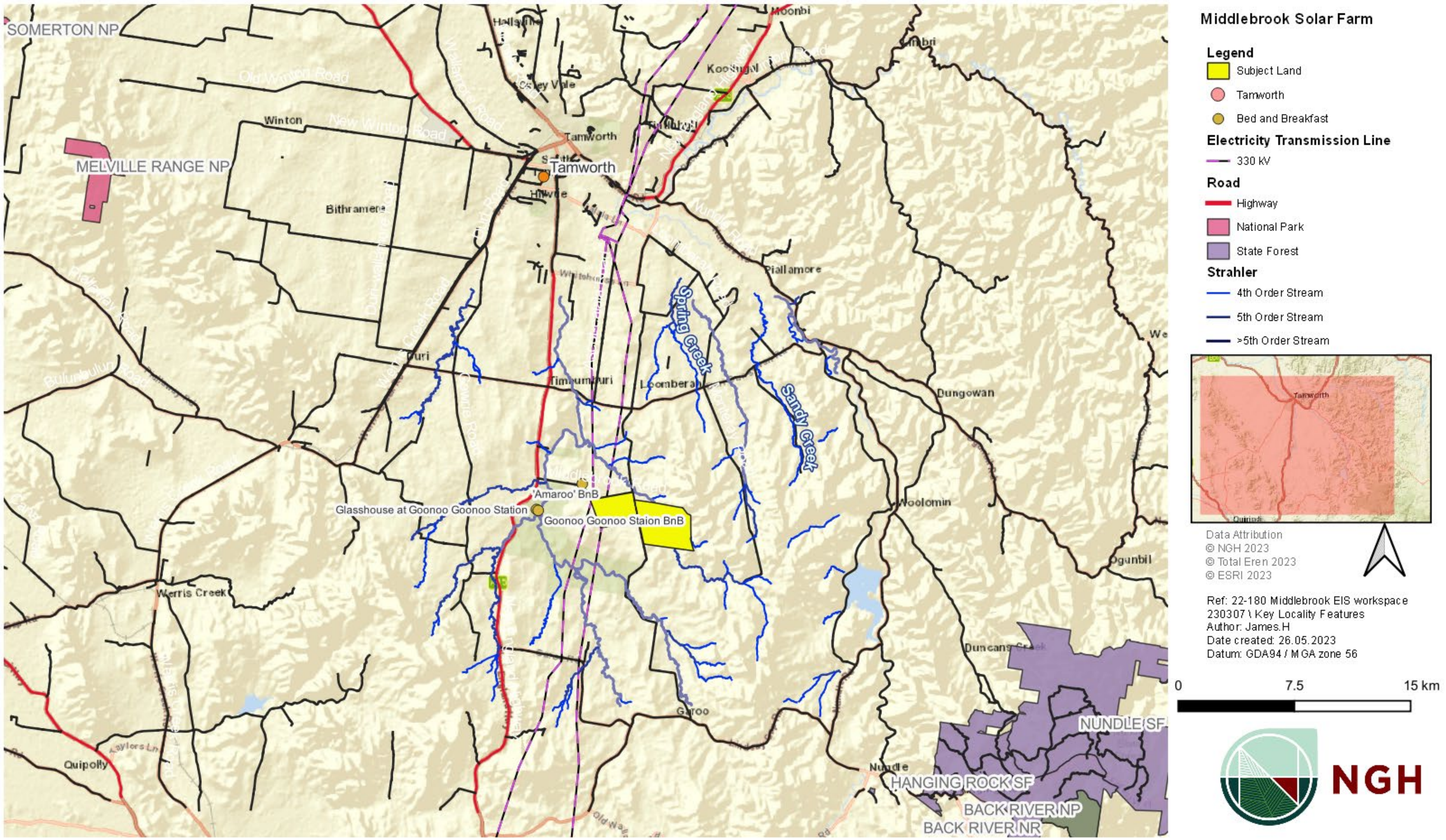


Figure ES-2 Key features within the locality

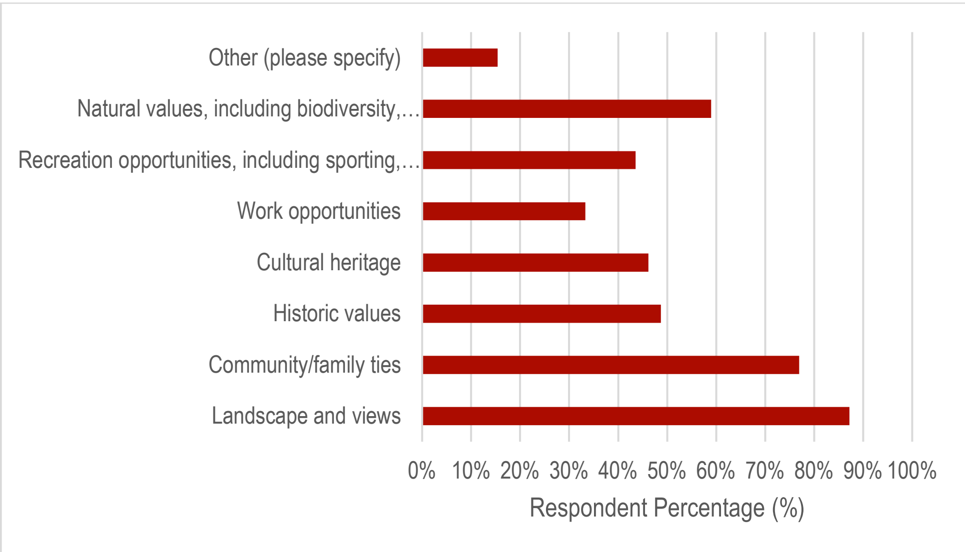
Local values in relation to renewable energy

Engagement was undertaken to understand the community's values and concerns regarding the site and the proposed Middlebrook Solar Farm Project. The survey results also implied there was currently a lack of support for renewable energy projects in the region, with 67% of respondents (26 responses) identifying that they 'reject renewable energy development in the region' whereas only 8% of participants identified they ' embrace it' or 'approve of it'. The most prominent amenity and social, economic, and environmental factors identified by participants were 'visual impacts for near neighbours' (100% of respondents), 'potential impacts to property values' (84%), 'disruption to community cohesion' (74%), and 'use of agricultural land' (92%).

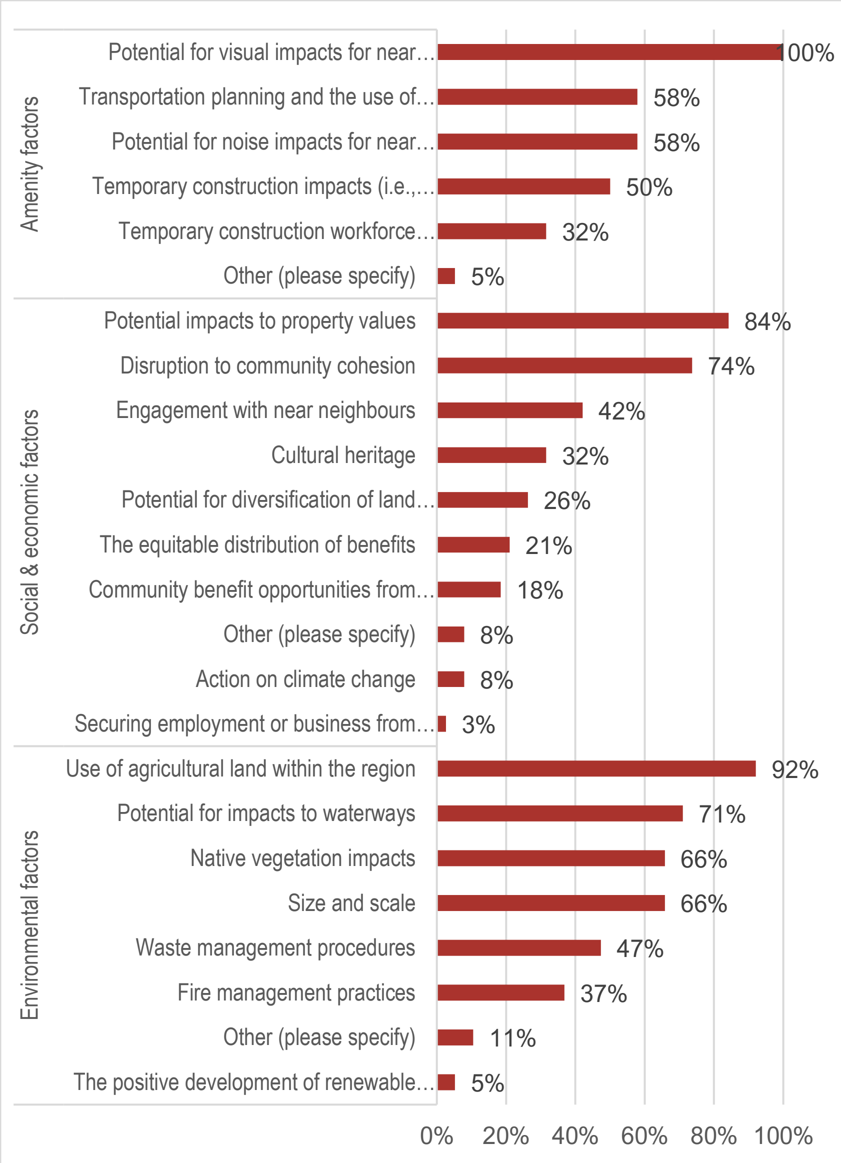
When asked about 'key challenges that the community is facing', common response themes included renewable energy developments and loss of agricultural land which indicated the requirement for coordinated and robust engagement with local community members during the project lifecycle would be important to increase benefits and reduce negative impacts form the project. The near neighbours identified that though they were supportive of renewable energy, they generally opposed the project due to visual impacts. Key survey results regarding environmental and socio-economic values are summarised below.

Table ES-1 Social survey results summary:

What do you most value about the local area?



In terms of the proposed Middlebrook Solar Farm, what are the most important environmental, social & economic, and amenity factors to you?



Middlebrook Solar Farm Project response

The engagement undertaken with the community makes clear that there is concern about how this and other renewable energy developments could impact on the values of this area. Many of the participants who provided their views knew of another project in the local area; there was confusion about how the projects might be related and what it might mean for future development if one or both were approved. The Middlebrook Solar Farm Project has sought to differentiate itself as a solar project of appropriate scale, that can be supported by the community. In restarting the Project in 2023, key decisions were made to ensure the community concerns were addressed. These are set out below.

Table ES-2 Middlebrook Solar Farm Project differentiators

Protecting amenity values

- No greater than low visual impact for any residence.
- No more than low visual impact for any local viewpoint.
- No construction or operational noise exceedance of applicable criteria for any non-associated receivers.
- Site access will be restricted to the closest location to New England Highway, to reduce local traffic impacts including dust.

Protecting native vegetation and habitat

- Most Box Gum Woodland remnants will be avoided, prioritising the better condition, larger remnants.
- No barbed wire on security fencing where entanglement risks for gliders and bats exists.

Protecting agricultural values

- No impact on BSAL land.
- Protecting riparian land.
- Continued stock grazing of the operational solar farm allowed for.
- Soil surveys used to inform specific remedial treatments where required.
- Ongoing ground cover monitoring and management to protect soils and pastures under the array during operation of the solar farm.
- Rehabilitation commitments part of decommissioning planning to preserve land soil capability.

Protecting Aboriginal cultural heritage

- No impacts to two potential modified trees of significance.
- No impacts to a key area of archaeological sensitivity identified on Spring Creek.
- Salvage program and Cultural Smoking Ceremony to be undertaken prior to Project impacts, with representatives of the registered Aboriginal parties.

Building opportunities for the community

- A Community Benefit Fund established to be run by locals for local projects to maximise the benefit.
- A voluntary Neighbouring Benefit Fund for residents within 3 km.
- An Accommodation and Employment Strategy to maximise local benefits from the Project.
- Waste initiative developed to ensure sourcing as locally as practical and to pre-emptively consider reuse / disposal options as locally as practical. For example:
    - Timber and metal supplied to trade schools and local craft workshops.
    - Composted materials supplied to local gardeners and farms.

Middlebrook Solar Farm Project summary

Consent is being sought for the Middlebrook Solar Farm as summarised below.

Table ES-3 Project summary

Project element	Summary of the Project
Project	Middlebrook Solar Farm.
Location	Street address: 760 Middlebrook Road Loomberah Lot 60 DP 755343, Lot 61 DP 755343, Lot 14 DP 37547, Lot 15 DP 37547 Middlebrook Road, Loomberah in the Tamworth Regional Local Government Area (LGA).
Applicant	Middlebrook Solar Farm Pty Ltd as trustee for the MSF Project Trust ACN 639 743 310 ABN 93 808 561 672
Associated receivers	As the landowners would host Project infrastructure, these dwellings considered to be associated with the Project; R1, R 2, R3, R7.
Non-associated receivers	• 5 non-associated receivers are located within 1 km, and • 5 non-associated receivers are located within 1–2 km of the Development footprint. All potential impacts are assessed for these receivers.
Nominal capacity	320 MW (AC) / Up to approx. 450 MW (DC) Note: the approximate capacity is based on the proposed technology available at the time of the EIS but may change through the solar farm's life as technological advances occur.
Development footprint	Approximately 530 ha would be required to construct and operate the solar farm. Refer to Figure ES 4. The Indicative infrastructure layout would be located within this area.
Indicative infrastructure layout	The Indicative infrastructure layout, located within the Development footprint, most closely represents the operational footprint of the solar farm. Refer to Figure ES 5. The final infrastructure layout will be subject to detailed design with appointed contractors, informed by detailed topographic and geotechnical surveys.
Exclusion zones	• Bio Strategic Agricultural Land (BSAL) • 3 significant Aboriginal cultural heritage sites • Most Commonwealth listed Box Gum Woodland remnants including riparian buffers. These features are shown on Figure ES 4.
LGA and zoning	Tamworth Regional Council; RU1 rural land zoning. Adjacent land is also zoned RU1.

Project element	Summary of the Project
Solar array	Up to 750,000 solar panels mounted in arrays, arranged in rows on single-axis trackers with a maximum height of up to 3 m above the natural ground level. The mounting structures would comprise steel posts driven approximately 1.2-2.5 m into the ground.
Modular inverters	The Project would include up to 100 inverter stations across the site, each up to 2.6 m in height.
On-site substation and switchyard	A substation with one or two transformers up to 384 MVA would be constructed in a gravelled hardstand area with security fencing, within the Development footprint. Most infrastructure in this area would be less than 9 m. The substation would be located adjacent to the existing (TransGrid-owned) 330 kV transmission line. Substation assets would be gifted to TransGrid and formally subdivided from Project.
Battery Energy Storage System (BESS)	A 300 MW / 600 MWh DC coupled BESS would be established in conjunction with the Solar Farm to regulate electricity supply to the grid. The BESS would be distributed across the site, located next to the inverters in containers. The storage duration of the battery will be 2 MW hrs.
Transmission line connections	A 330 kV transmission line crosses the site. No offsite works are required to connect the Project to the grid.
Traffic and access	All Project access during construction and operation would be via the New England Highway, off Middlebrook Road, at the north-west corner of the site. One east – west crossing of Middlebrook Road will connect the eastern and western portions of the Project but no direct access from Middlebrook Road will be allowed in this location. Road upgrades include: • Intersection upgrade for New England Highway / Middlebrook Road; Basic Left Turn. • Upgrade to 7 m unsealed surface 3.8 km of Middlebrook Road to the site access. • Intersection upgrade, signage and upgrade to 7 m unsealed surface of Middlebrook Road where it connects the eastern and western portions of the Project.
Internal tracks and waterway crossings	Approximately 48 km of internal access tracks 3–5 m in width would be constructed, topped with crushed stone or gravel to minimise dust.
Operations and maintenance buildings	Buildings would be constructed to provide a site office, control room, switch room and storage facilities for the solar farm.
Security fencing, lighting and Closed-Circuit Television (CCTV)	Continuous security lighting (infra-red) and CCTV cameras would be installed on posts up to 3.5 m high adjacent to the perimeter security fencing and around the operation and maintenance buildings. Security fencing installed around the site would indicatively be 2.4 m high. Barbed wire would only be used where it was not considered a fauna entanglement risk.

Project element	Summary of the Project
Decommissioning and rehabilitation	All infrastructure would be removed with the exception of: • Substation to remain, a permanent asset transferred to TransGrid to assist broader electricity network operations. • Cabling below 500 mm deep. Decommissioning commitments include: • All areas of disturbance rehabilitated. • Ensure land soil capability is the same or better than pre development. • Recycle 100% of the solar array infrastructure.
Construction timing and workforce	21 to 30 months anticipating commencement in the 2nd Quarter 2024. Generally, 7.00am to 6.00pm Monday to Friday, and 8.00 am to 1.00 pm on Saturday. Workforce during Construction – during the peak period (around 18 months) approximately 400 workers.
Operational timing and workforce	Operational life of 30 years, operating 24/7. Approximately 15 full-time equivalent staff and service contractors.
Capital investment value	Approximately $856,000,000 ex GST.

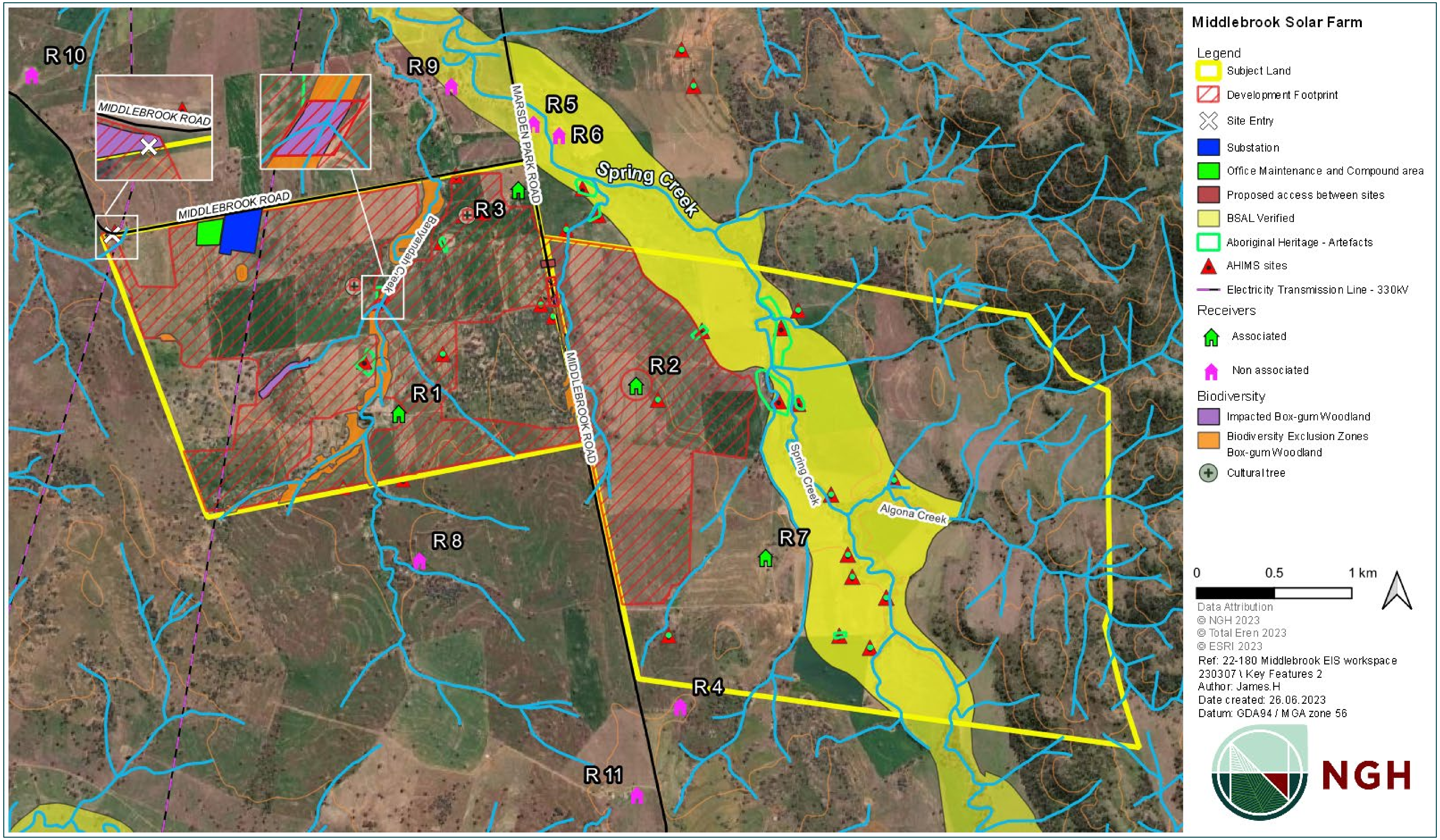


Figure ES-4 Key features of the Subject land

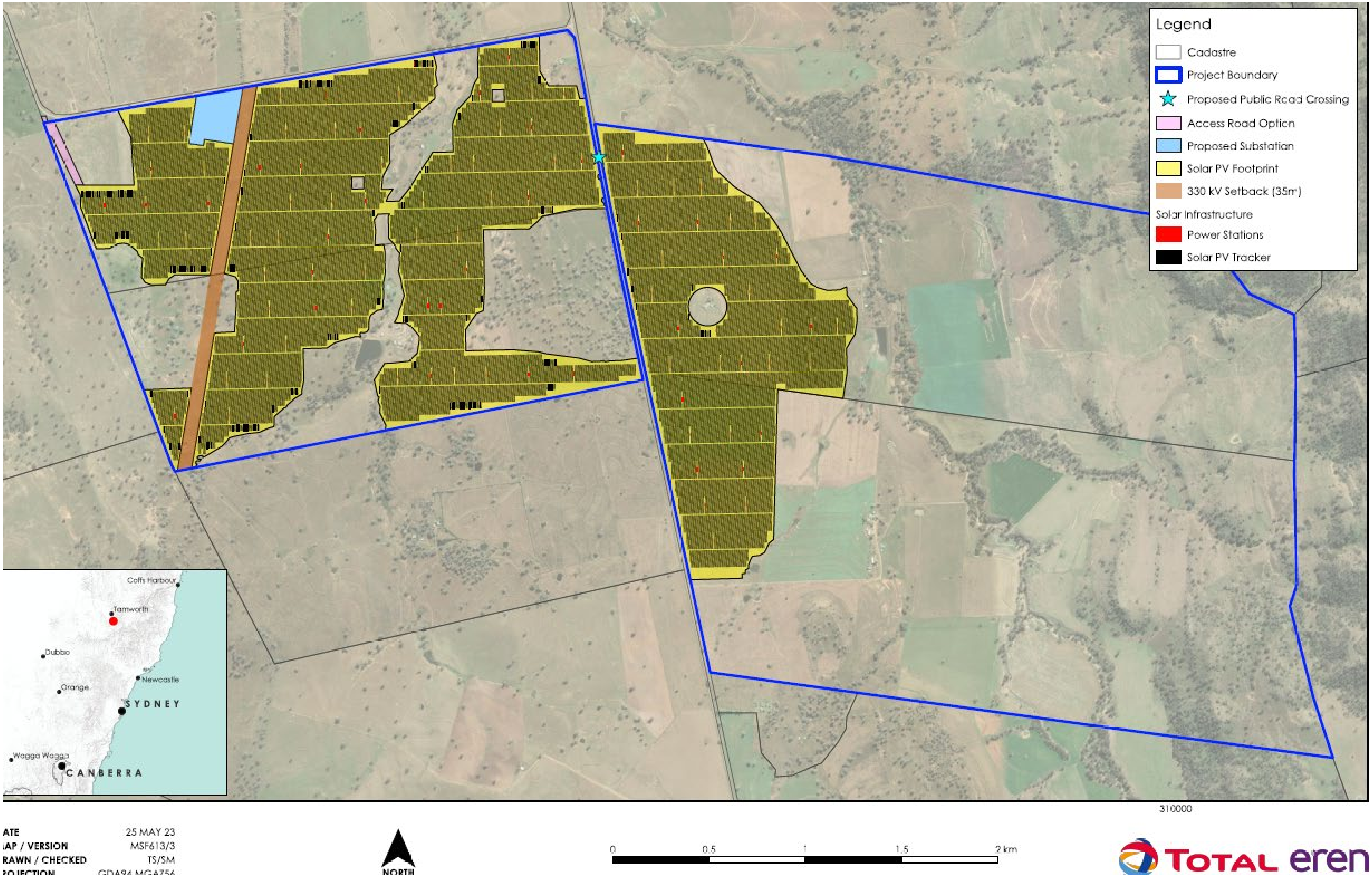


Figure ES-5 Indicative infrastructure layout

Assessment requirements

The Project is considered a State Significant Development because it is a private electricity generating project with a capital investment value greater than $30 million. The *State Environmental Planning Policy (Planning Systems) 2021* (SEPP Planning Systems) dictates the environmental assessment must be undertaken in accordance with:

- Part 4 of the NSW *Environmental Planning and Assessment Act 1979.*
- Schedule 2 of the NSW *Environmental Planning and Assessment Regulation* 2021.
- The Project-specific Secretary's Environmental Assessment Requirements (SEARs; refer to Appendix A cross reference to see where SEARs requirements are addressed in this EIS).

Key environmental matters

The specialist assessments undertaken for the Project have helped to shape the Project's scale, ensuring it is responsive to the site's values. The key results are summarised below, presenting issues of most interest to near neighbours first.

Table ES-4 Key results and Project outcomes

Visual	• Visual assessment included modelling and preparation of photomontages as well as consideration of local values, important views and landscape characteristics. • Three non-associated receivers (dwellings) required detailed assessment (wire frame modelling showed moderate impact, on the basis of topography alone, without consideration of intervening vegetation). • In all cases, the detailed assessment showed the impacts were reduced to low, in consideration of existing screening by vegetation. Photomontages support this conclusion and have been provided to these landowners. • All other residential views low, without mitigation. • Public viewpoints, low visual impact, prior to any mitigation including Goonoo Goonoo Station. • Potential for glare in specific sections of Middlebrook Road can be addressed by operational restrictions on panel tracking. • No glare impacts for any residents, rail lines, airstrips.
Noise	• Construction and operational noise were modelled assuming low level background rural noise, considering the typical traffic and infrastructure power levels. • No construction or operational noise exceedances were found at any non-associated receiver (dwelling). • No vibration or traffic noise exceedances were found at any non-associated receiver. • Reasonable and practical mitigation strategies can be adopted to further reduce construction noise and a complaints process will be active through construction and operational stages of the Project.

Traffic	• Traffic modelling considering the proposed number and type of vehicles as well as the existing traffic volumes on the New England Highway and Middlebrook Road. • The road network is able to accommodate the Project's traffic volumes, including during peak construction periods and considering the cumulative traffic generated by other major projects within the surrounding area. • Upgrades are required however, to ensure the road assets can accommodate the size of the larger vehicles as follows: o A Basic Left Turn Treatment will be provided at the New England Highway / Middlebrook Road intersection (a Channelised Right Turn is already present). o Upgrade from 6 m to 7 m wide, the unsealed surface of Middlebrook Road to the site access point (approximately 3.2 km in length). o Create a connecting access, 7 m wide with signage, across Middlebrook Road, where it connects the eastern and western portions of the Project (no site access will be allowed from Middlebrook Road in this location; only one site access is proposed).
Land compatibility	• Soil surveys verified the existing Land and Soil Capability mapping for the Subject land and with Project refinements to protect the higher capability land, the Project now results in: o No impacts on Class 3 (Biophysical Strategic Agricultural Land) o Impacts confined to Class 4 and 5 land (459.75 hectares and 50.47 hectares respectively). • Land Use Conflict Risk Assessment (LUCRA) methodology used to demonstrate: o Low impact on agricultural capability of the site or adjoining enterprises o Low impact on rural residential land use and transport corridors. • The Project will allow continued grazing during operation and is highly reversable; no resultant impact on soil capability or land use options after decommissioning.

Biodiversity	• Most of the Project is now confined to areas considered Category 1 Land; exempt from most aspects of biodiversity assessment, being highly modified from extensive agricultural practices (99%).
	• With Project refinements to protect the higher value vegetation, the Project now results in:
	  ○ Removal of 2.52 ha of native vegetation remnants, consisting of two Plant Community Types (PCTs), both of which are listed as conservation significant Box Gum Woodland (including three hollow bearing trees)
	  ○ Removal of 194 scattered trees occurring in exotic pasture (many trees contain hollows)
	  ○ No Serious and Irreversible Impacts.
	  ○ No referral on the basis of Matters of National Environmental Significance.
	• The Biodiversity Development Assessment Report (BDAR) was used to demonstrate avoidance has been appropriately applied, using mitigation and offsets only where avoidance was not possible.
	• Mitigation strategies to reduce risks of vehicle strikes, manage weeds and pathogens and reduce impacts on habitat connectivity will be adopted during construction and operation.
	• The in-perpetuity offset obligation will be met in accordance with the Biodiversity Conservation Act and includes:
	  ○ 27 ecosystem credits for PCT 433 White Box grassy woodland to open woodland on basalt flats and rises in the Liverpool Plains sub-region
	  ○ 8 ecosystem credits for PCT 599 Blakely's Red Gum - Yellow Box grassy tall woodland on flats and hills in the Brigalow Belt South Bioregion and Nandewar Bioregion
	  ○ 24 species credits credits each for Silky Swainson-pea Swainsona sericea, Belson's Panic Homopholis belsonii and Finger Panic Grass Digitaria porrecta (all three assumed to occur, as the survey was not sufficient to not rule these species out)
	  ○ 104 credits generated by scattered trees.
	• This reasonably low offset requirement for a Major Project is likely to be most effectively met by paying out the cost of the obligation directly to the Biodiversity Conservation Trust. The Trust uses these funds to secure and protect in-perpetuity biodiversity offsets.

Aboriginal heritage	• An Aboriginal Cultural Heritage Assessment was undertaken with Aboriginal parties who registered an interest in the Project in 2019-2020. This included development of a survey method. • The survey fieldwork was undertaken from the 17-21 and 23-26 August 2020 including walked transect surveys (no test pitting was undertaken). • 11 new artefact scatters and 19 new isolated finds were identified in addition to three more significant sites which will be avoided. These include two potential modified trees and an area of archaeological sensitivity adjacent to Spring Creek. • Avoidance areas will be buffered and protected from any impacts. • Salvage protocols have been developed to remove other artefacts prior to construction in collaboration with the registered Aboriginal parties.

Historic heritage	• Three historic heritage listings were considered in relation to the Project and no historic heritage impacts are anticipated:
	  ○ Tamworth Post Office: no potential for direct or indirect impacts from the Project due to distance from the Project.
	  ○ Swamp Creek Bridge: The New England Highway is a main transport corridor assessed as able to tolerate the additional traffic generated by the Project. No potential for direct or indirect impacts from the Project.
	  ○ Goonoo Goonoo Station Group: no potential for direct impacts. The Visual assessment determined the overall impact for Goonoo Goonoo Station would be low.
	• No sites were identified within the Project site but an 'unexpected finds protocol' will be developed to address any relics identified during works.

Social and economic	• Surveys were undertaken with local residents in 2023 to understand their current values and concerns in relation to the Project.
	• Within the Loomberah locality, residents are aware of another solar project – the Acacia Solar Farm – that is in the pre-scoping phase (not yet available on the register).
	• Key concerns raised by near neighbours during interviews and surveys included:
	  ○ Potential for visual impacts / landscape changes.
	  ○ Potential to decrease property values and insurance premiums.
	  ○ Potential to create stress and affect community cohesion.
	  ○ Potential to decrease agricultural land uses.
	  ○ Potential to exacerbate local dust and traffic impacts.
	• The broader community (including Tamworth) raised jobs training and business opportunities, housing impacts and potential for skills drain.
	• The Project scale has been reduced in scale and consultation will continue to address the concerns above and ensure local benefits are maximised. This has included:
	  ○ Additional photomontages produced for specific landowners, to demonstrate the low visual impacts on their residences.
	  ○ A series of FAQ sheets prepared to increase understanding of industry issues as well as local initiatives that would accompany this Project.
	• Significant benefits would accompany construction and operation where local skills, employment, community investment and a local contribution to climate change accrue. A detailed impact management framework is proposed including a:
	  ○ Community and Stakeholder Engagement Strategy
	  ○ Industry Participation Plan
	  ○ Community Benefit Sharing Program.

Hazards	• Preliminary Hazard Analysis (PHA) was undertaken to develop a comprehensive understanding of the hazards and risks associated with the operation of the Battery Energy Storage System (BESS):
	    o The risk profile for the project is considered to be tolerable 'in so far as reasonably practicable'.
	    o Based on the size of the development footprint, proposed location for project infrastructure within the development footprint, proposed controls and distance to neighbouring land uses, the exposure to fire events will primarily be to the project's construction and operations workforce. Offsite impacts would be minimal.
	    o The assessment concludes there is no potential for offsite fatality or injury.
	• Electric and Magnetic Fields (EMFs) were considered separately. All EMF producing infrastructure would follow Australian and industry standards and on this basis are considered acceptable. The following components of the Project are most relevant to EMFs:
	    o Onsite substation/transformers
	    o Solar arrays including cabling and PCUs
	    o Energy storage facility (BESS).
	• Bushfire was considered separately. The Project would not present a substantial bushfire threat or represent an unacceptable hazard in the event of a bush fire. Mitigation measures have been developed for design, construction and operational stages of the Project to manage the identified risks.

Hydrology and water use	• Risks of flooding are low and mitigated by adhering to the hazard vulnerability modelling produced for the site. • Erosion risks considered low due to the construction methods employed and ground cover management practices to be adopted in operation. o Best practice guidelines used to avoid riparian land where possible and guide restoration actions for limited water crossing impacts.
Air quality and climate	• Risks from dust concentrated during the construction stage considered manageable. • Potential heat island effects will be low on surrounding properties. • The greatest impact of the Project in relation to climate is the positive contribution to addressing climate change effects, by assisting in the transition to renewable energy generation.
Resources and waste	• High potential to reuse and recycle construction and decommissioning waste streams. • Waste initiative developed to ensuring sourcing as locally as practical and pre-emptively find reuse / disposal options as locally as practical.
Cumulative impacts	• Key cumulative impacts centre on visual, noise, traffic, land use, biodiversity and socio-economic impacts; all are assessed as negligible adverse cumulative impact. • There is potential for a net socio-economic benefit, due to due to Project commitments to local employment, and the benefits from sales of local goods and services impacts and increased employment and skills, primarily during construction of the solar farm. • A key benefit of the Project is its positive impact on reducing greenhouse gas emissions and moving electricity generation towards cleaner electricity generation. The Project would power the equivalent of about 153,000 NSW homes.

The consolidated set of mitigation commitments is provided in Appendix B of the EIS, and together with the Project as outlined in Section 3, constitute the Project's commitment to developing a best practice solar farm that can be supported by the local community. Environmental protection and management measures would be implemented via a series of Project and site-specific Environmental Management Plans. These plans would be prepared sequentially, prior to each stage of works (construction, operation and decommissioning). These management plans would incorporate all of the specific mitigation measures contained in this EIS and any additional applicable agency requirements, pending project approval.

Justification

The Project as presented in this EIS meets all relevant planning provisions and guidelines and is considered justifiable and acceptable. In addition, it has been selected for inclusion in the Priority Assessment Program, acknowledging its strategic alignment with government policies and ability to make fast and significant contributions to the renewable energy transition in NSW. These are set out against the program's five criteria, below.

On balance, the Project is considered appropriate to both:

- To the site's location, where it will supply nearby population centres with renewable energy to assist the required transition away from coal generated electricity.
- To the site's environmental values, and the values identified by the local and broader community; impacts have generally been assessed as low and mitigation strategies with high confidence have been adopted to manage residual risks.

Refer to Figure ES-4.

ES Table-5 Middlebrook Solar Farm Priority assessment criteria response

Participation criterion	Project's response
Strategic alignment	• With local, state and Australian government policies to promote the renewable energy transition. • With existing land uses and land values. • Synergies; located between the REZs in a location able to bring fast benefits in term of addressing energy loads, local benefits.
Economic benefit	• Significant (greater than $250 M) capital investment value. • Commitments to local employment and economic stimulus.
Public benefit	• A Community Benefit Fund • A voluntary Neighbouring Benefit Fund for residents within 3 km • Local waste initiative
Design excellence & existing infrastructure	• Connection of the Project is not contingent on other projects or upgrades proposed for the REZs. • Makes use of existing 330 KV electricity infrastructure and the main transport corridor between two REZs. • Agricultural co use agreement with the host land owner to continue grazing.
High likelihood of delivery	• Total Eren is a global renewable energy company that builds, owns and operates its renewable energy assets. In Australia, the Total Eren has built and owns the 256 MWp Kiamal solar farm, the largest solar farm in Victoria. The Middlebrook Solar Farm is a Proprietary Limited company established specifically for the purpose of developing and constructing this Project, which will draw on Total Eren's experience in Australia and overseas. • Working with NSW's most experienced environmental consultants to raise the bar for delivering environmental and socially appropriate project's the community can trust. • Commitment to commence construction within 18 months of approval.

Where to from here

During the public exhibition of this EIS, the community, local council and government agencies are invited to make informed submissions in relation to the Project. The consent authority would consider any formal submissions made during the exhibition period. The Applicant's response to all matters raised in submissions will also be exhibited as the Department of Planning and Environment commence preparation of their own assessment of the Project's impacts and its merits and make a recommendation regarding its ability to be approved.

Please take the opportunity to make a submission directly to the Department of Planning and Environment and to participate in the future engagement activities planned prior to the Project's determination.

1. INTRODUCTION

1.1. Format of this Environmental Impact Statement

The purpose of this Environmental Impact Statement (EIS) is to assess the economic, environmental and social impacts of the Middlebrook Solar Farm (the Project). The Project is located in the Tamworth Regional Local Government Area (LGA), approximately 22 km south of Tamworth.

This EIS is structured to help the community, local council, government agencies and the consent authority get a better understanding of the Project so they can make informed submissions or decisions on the merits of the Project.

This EIS has been prepared in two parts:

1. The main report describes the Project, summarises the findings of consultation activities and the detailed environmental assessment of the proposed project including any potential impact and mitigation measures proposed to manage the impacts.
2. The supporting appendices include:
    a. The Project specific Secretary's Environmental Assessment Requirements (SEARs) which prescribe the structure and content of this EIS.
    b. A consolidated table of proposed mitigation measures which form commitments of the Project, if approved.
    c. Community engagement activities relevant to the Project.
    d. Detailed supporting specialist assessments, which have helped to shape the Project now presented and its mitigation commitments.

The assessment process and the key point at which the community can make submissions directly to the Department of Planning and Environment are shown below.

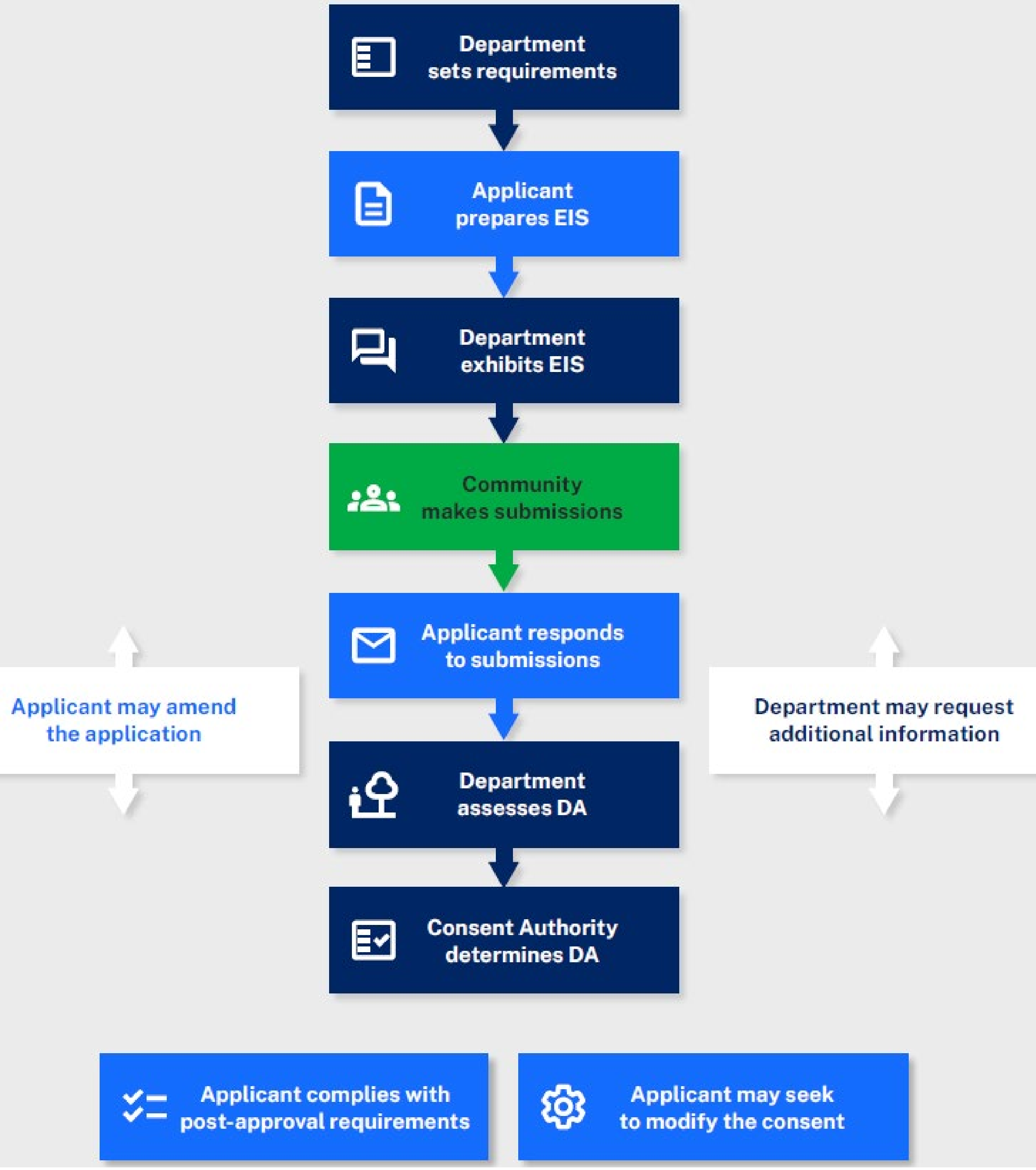


Figure 1-1 State significant development assessment and approval process (NSW DPE August 2022).

1.2. Applicant details

Company name	Middlebrook Solar Farm Pty Ltd as trustee for the MSF Project Trust
ABN	93 808 561 672
Address	Suite 2, Level 30, North Tower, 80 Collins Street, Melbourne VIC 3000

Total Eren is a global renewable energy company that builds, owns and operates its renewable energy assets. In Australia, the Total Eren has built and owns the 256 MWp Kiamal solar farm, the largest solar farm in Victoria. Stage 2 of the Kiamal solar farm, currently under construction, has received a 10-year offtake agreement (under competitive tender) with the Victorian Government.

The Middlebrook Solar Farm is a Proprietary Limited company established specifically for the purpose of developing and constructing this Project, which will draw on Total Eren's experience in Australia and overseas.

1.3. Project overview

1.3.1. Project objectives

The objectives of the Middlebrook Solar Farm are to select and develop a site which is not only suitable for commercial scale solar electricity generation but one which is appropriate to its site values and can be supported by the community.

In doing so, the Project aims to:

- Assist the NSW and Australian Governments to meet Australia's renewable energy, energy generation and carbon emission reduction goals.
- Provide electricity generation close to an identified consumption centre.
- Provide downward pressure on electricity costs, by providing more competition in the solar market, currently providing the least cost for new electricity generation.
- Actively engage with the local community to ensure the Project and its mitigation strategies align with local values.
- Provide local and regional employment opportunities and other social benefits during all stages of the Project.
- Avoid and minimise environmental and cultural impacts where practicable through careful design and best practice environmental protection and impact mitigation.

1.3.2. Infrastructure proposed

The Project proposed includes the construction, operation and eventual decommissioning of a solar farm that would be connected into the electricity grid. During its operational life of approximately 30 years, it would provide electricity generation and storage, assisting the grid's transition to renewable energy sources, as fossil fuel electricity generation is reduced.

The Project would incorporate the following permanent infrastructure components (which are detailed in section 3):

- Up to 750,000 solar panels mounted in arrays, arranged in rows on single-axis trackers (mounting structured comprise steel posts driven approximately 1.2–2.5 m into the ground)
- Up to 100 inverter stations across the site and transformers
- A BESS, 300 MW / 600 MWh of lithium-ion batteries DC coupled; 2 hr storage duration.
- An onsite 330 kilovolt (kV) substation connected to the existing 330 kV transmission line that passes through the site
- Underground cabling to connect solar modules, Power Conversion Units (PCUs) and batteries, data services and communications
- Internal tracks, new and upgraded sections, totalling approximately 48 km
- Perimeter security fencing (where required), closed-circuit television (CCTV) and security lighting at the switching station, BESS and O&M building areas only
- Operations and maintenance buildings would include a site office, switchgear, protection and control facilities, maintenance facilities, storage and staff amenities.

During the construction phase, temporary facilities would include a laydown area with a secure compound, construction site offices and amenities and car and bus parking areas for construction staff. After decommissioning, most above ground infrastructure would be removed and the site returned to its existing land capability, for continued agricultural or alternative appropriate uses. The Project summary is provided below, and the detailed Project description is set out in Section 3.

1.3.3. Land ownership, use and subdivision

The proposed Middlebrook Solar Farm Project Street address is: 760 Middlebrook Road Loomberah, NSW, within the Tamworth Regional Local Government Area (LGA).

The Project would affect the following lots:

Table 1-1 Schedule of affected lots

Freehold landowner 1	Lot 60 DP 755343
Freehold landowner 1	Lot 61 DP 755343
Freehold landowner 2	Lot 14 DP 37547
Freehold landowner 3	Lot 15 DP 37547
Council Road Reserve	Middlebrook Road (3.8 km for main site access in addition to one crossing of Middlebrook Road)
Transport for NSW	New England Highway (intersection with Middlebrook Road)

The areas required for the operational solar farm will be leased for the life of the Project. The lease will be registered on the title under the Real Property Act.

All associated landowners would host Project infrastructure. The associated dwellings have accepted all impacts including noise and visual impacts. There are no negotiated neighbour agreements.

A subdivision is expected to be limited to delineating areas for TransGrid assets, within the substation area of approximately 6 ha.

1.4. Background

Early investigations

The site proposed for the Middlebrook Solar Farm was initially selected following a detailed desktop review of the region which considered:

- Suitable connection capacity to the grid and proximity to demand centres.
- Suitable terrain and access to keep costs of construction low.
- Ability to avoid or manage key environmental values of the site.

Several site visits were undertaken and interest from the landowners was confirmed. More detailed consideration was then given to the key impacts generally associated with solar farms, including:

- Biodiversity
- Visual amenity
- Cultural heritage
- Land use compatibility.

Preliminary community consultation was undertaken, and key matters raised included impacts on views and important agricultural land. Detailed environmental investigations commenced and began to shape the Project in terms of its scale. At this stage the Project included five involved landholders with land totalling approximately 1,882 ha.

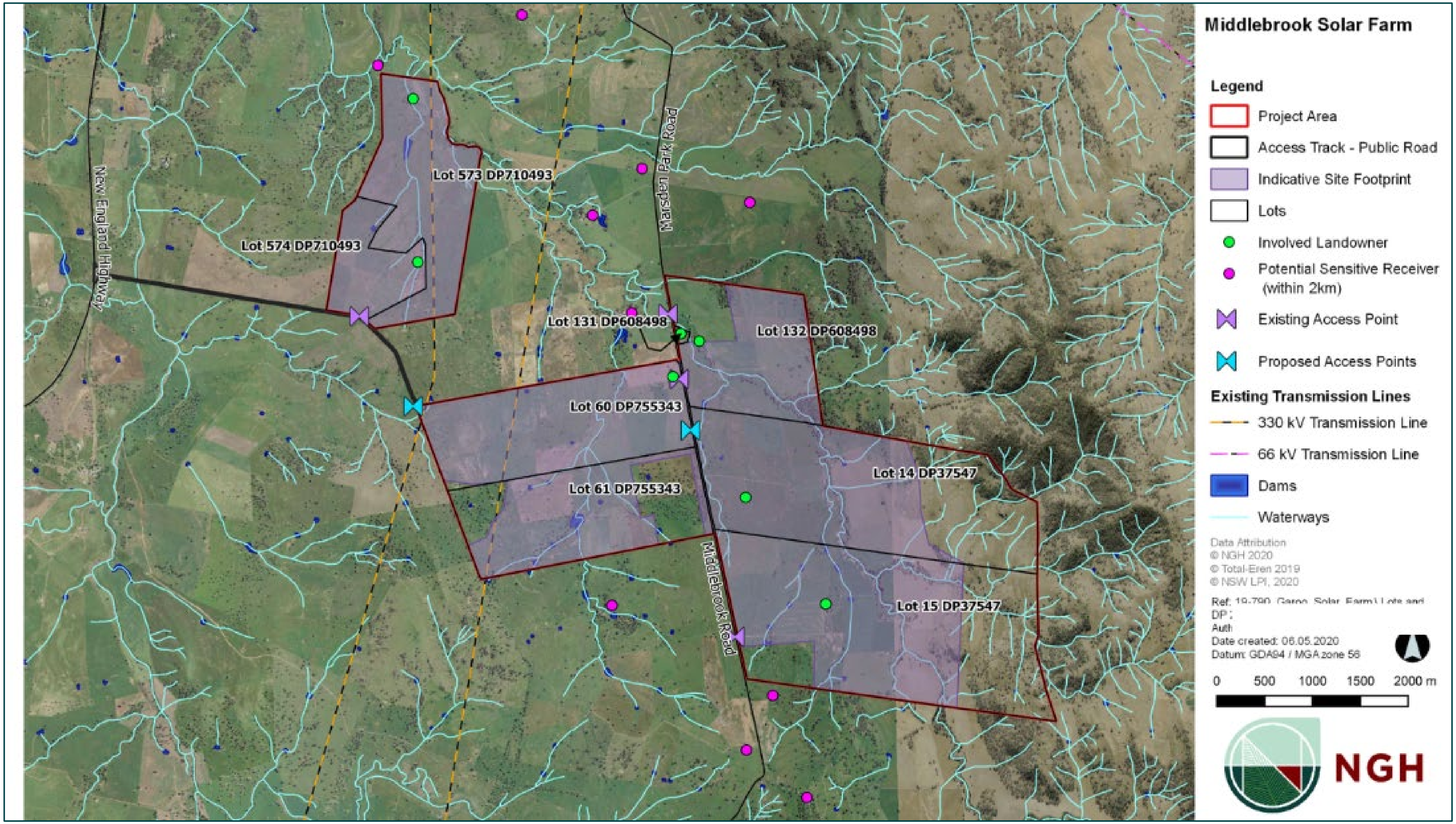


Figure 1-2 Indicative early site layout presented in Middlebrook Solar Farm Scoping Report (NGH 2020).

Effects of COVID 19

At the end of 2020, work towards the assessment and consultation activities for the Project were placed on hold, as COVID 19 lock downs and made travel and face to face consultation difficult. Uncertainty for all parties was high at this time.

In March 2022, the Applicant signed a Case-Managed Project Service Charter to support the assessment process for the Middlebrook Solar Farm. The agreement is intended to complement existing regulatory processes, by confirming:

- that the Applicant agrees to act as a 'model proponent'.
- that DPE and the Applicant take all reasonable steps to meet or accelerate the timeframes. and completion dates identified in the assessment process schedule.
- that DPE and the Applicant agree to meet regularly to monitor performance against these commitments and resolve any project-specific issues.

On 1 July 2021 the Environmental Planning and Assessment Amendment (Major Projects) Regulation 2021 (Amending Regulation) commenced. Among other things, the Amending Regulation included provisions that introduced a new 2-year expiry for SEARs granted after 1 July 2021, and sunset provisions for SEARs that were issued prior to this time. This resulted in an extension to the SEARs for the Middlebrook Solar Farm Project; in May 2022, DPE advised the Applicant that the SEARs would be extended to July 2023.

The combination of the service charter and the SEARs extension provided important impetus to restart the Project's assessment in a post COVID context.

Project restart

In May 2022, NGH provided a Gap analysis to provide a framework for completion of the EIS to meet updated guidelines standards. It included input from specialists, primarily biodiversity, heritage, traffic and visual impact consultants. The analysis indicated significant additional work would be required to address:

- Aboriginal heritage assessment - as six months has elapsed since Registered Aboriginal Parties had been contacted, renewed consultation was required to ensure all Aboriginal stakeholders wishing to participate in the Project's assessment could do so, in accordance with clause *80C of the National Parks and Wildlife Amendment (Aboriginal Objects and Aboriginal Places) Regulation 2010*.
- Biodiversity - updates to the NSW Biodiversity Assessment Method and calculator identified additional species for consideration.
- Visual assessment - previous work to date did not meet current best practice assessment criteria finalised by DPE in August 2022.
- Social impact assessment - Further assessment was required to meet new guidelines, finalised by DPE in July 2021.
- Cumulative impacts - Further small scope of work required to address new guidelines, finalised by DPE in July 2021.
- Updates to re format the EIS to reflect new guidelines finalised by DPE in December 2021.

Other changes included:

- A Registered Environmental Assessment Practitioner was now required to author the EIS.

In terms of the Project description, important Project decisions were made to ensure the Project would be responsive to the changed guidelines but also the changing community expectations in the region. These changes have had the following effects:

- Biodiversity
  - Reduced impacts on Box Gum Woodland community: Serious and Irreversible Impact (SAII) candidate under NSW BC Act and Endangered under the Commonwealth EPBC Act.
  - Most of the Commonwealth listed areas were delineated as 'exclusion zones' to be protected from Project impacts.
- Agriculture
  - Reduced impact on higher capability soils; all BSAL (Class 1 Land capability areas) were excluded from Project impacts.
  - Agreement with host landowner to retain grazing in the solar array area in operation.

The updated Development footprint now proposed is shown with reference to the site's key environmental features in Figure 2-2 (also provided in the Executive Summary as Figure ES-4).

This process has resulted in a protracted environmental assessment process where many of the specialists had to be re-engaged to address updated assessment guidelines as well as changes to community and agency expectations. The delays and 'stop – start' has also caused frustration within the community. However, the result is one which demonstrates that the Project:

- Responds appropriately to its current social and environmental context.
- Addresses the current best practice guidelines and mitigations measures, underpinned by specialists in their fields.
- Provides additional justification, as required by the Priority Assessment Program criteria, with regard to:
  - Economic benefit
  - Strategic alignment
  - Public Benefit
  - Design excellence & existing infrastructure
  - High likelihood of delivery

1.5. Related development

No related developments have been identified.

1.6. Restrictions applicable to the site

The existing 330 kV TransGrid electricity line and associated easement crosses the site, however, no restrictions have been identified; there are no Crown lands relevant to the Project.

2. STRATEGIC CONTEXT

The strategic context of this Project is set out below. It is an important background to the proposed Project as it demonstrates how the Middlebrook Solar Farm:

1. Aligns with federal, state and regional renewable energy policies.
2. Aligns with regional and local land use plans.
3. Is part of an important energy transition, bringing solar generation and battery storage benefits to the grid.
4. Responds to the site's unique environmental and social context, including:
    - Biophysical Strategic Agricultural Land (BSAL)
    - Significant Aboriginal cultural heritage sites
    - Conservation significant Box Gum Woodland remnants
    - Waterway buffers

In consideration of these matters, alternatives to the Project are examined at the end of this section and 'site suitability' is fully evaluated, specific to solar farm development.

2.1. Alignment with federal, state and regional renewable energy policies

2.1.1. Paris Agreement

The Paris Agreement is a legally binding international treaty on climate change adopted by 196 Parties (including Australia) at Conference of Parties 21 in Paris, on 12 December 2015 and entered into force on 4 November 2016 (United Nations Climate Change, 2018)). Australia proposed to reduce emissions by 26–28% below 2005 levels by 2030. The Project assists in this reduction through the generation of electricity from renewables, not fossil fuels.

2.1.2. Climate Change Bill 2022

On 4 August 2022, the federal government's Climate Change Bill (2022) passed the House of Representatives. The Bill enshrines into law (*Climate Change Act, 2022* (Cth)) an emissions reduction target of 43 percent from 2005 levels by 2030, and net zero emissions by 2050. In addition, the Bill ensures a whole-of government approach to drive towards the target. The government has formally lodged this target as an enhanced Nationally Determined Contribution under the Paris Agreement. The Bill supports the Labor Government's Powering Australia Plan, which is focused on creating jobs, cutting power bills and reducing emissions by boosting renewable energy.

2.1.3. Australian Government Renewable Energy Target (RET)

The RET scheme was developed to achieve large-scale renewable generation (LRET) of 33,000GWh in 2020, by encouraging additional generation of electricity from renewable sources, thus reducing emissions of GHG in the electricity sector. The LRET of 33,000GWh target was met in September 2019, however, the scheme will continue to require high-energy users to meet their obligations under the policy until 2030 and is frequently used as a mechanism to prove voluntary emission reduction. This Project would assist in meeting this requirement for high-energy users required to purchase ‘large-scale generation certificates’ from large renewable energy power stations (such as the Middlebrook Solar Farm).

2.1.4. Net Zero Plan Implementation Update 2022

The Net Zero Plan Implementation Update 2022 (Office of Energy and Climate Change, 2022) sets NSW’s action on climate change and sets a target to reach net zero emissions by 2050, with an objective to deliver a 50% cut in emissions by 2030 compared to 2005 levels. This Project would assist the NSW government in reaching these targets by providing a renewable energy source for electricity generation.

2.1.5. NSW Climate Change Policy Framework

The NSW Climate Change Policy framework outlines NSW’s long-term objectives to achieve net-zero emissions by 2050 and to make NSW more resilient to a changing climate. It guides the NSW Government’s policy and programs, including the NSW Climate Change Fund and the NSW Electricity Infrastructure Roadmap. This Project aids in meeting the net-zero emissions by the 2050 target.

2.1.6. NSW Electricity Strategy

The three objectives of the NSW Government for the state’s electricity system, as stated in the NSW Electricity Strategy, are:

1. Reliability
2. Affordability
3. Sustainability.

The NSW Government’s Electricity Strategy will:

- Improve the efficiency and competitiveness of the NSW electricity market by reducing risk, cost, Government caused delays and by encouraging investment in new price-reducing generation and energy saving technology.
- Prompt Government to act if there is a forecast breach of the Energy Security Target which private sector Projects are unlikely to address. This should be done in a way that minimises costs to consumers and taxpayers and does not give rise to moral hazard risk.
- Ensure that there are appropriate powers available for Government to analyse and respond to electricity supply emergencies, should they arise.
- This Project would contribute to the NSW government’s plan to achieve the objectives for the electricity system which include reliability, affordability and economic growth and sustainability. The contribution of the Project to local employment and economy is set out in detail in Section 5 of this EIS.

2.1.7. Renewable Energy Zones

Renewable Energy Zones (REZs) are being created by the NSW Government to concentrate power generation, transmission, and storage in identified areas to unlock new capacity for the energy grid. The Middlebrook Solar Farm is not directly located within a REZ however it is adjacent to the New England REZ.

The NSW Government’s revised Large Scale Solar Guidelines (DPE, 2022) recognises that to meet state and national clean energy targets, renewable energy Projects are also required outside of the REZ areas. To date about 70% of existing solar development is outside of a REZ. The location of the Middlebrook Solar Farm is appropriate due to its location along an existing high voltage transmission line feeding directly into the energy grid.

2.2. Alignment with regional and local land use plans

2.2.1. Tamworth Regional Local Environmental Plan 2010 (Tamworth LEP)

The subject land is zoned RU1 Primary Production under the Tamworth LEP. Land use objectives in this zone and other relevant provisions are considered below.

Table 2-1 Project's response to LEP provisions

LEP provision	Project's response
RU 1 objectives	
To encourage sustainable primary industry production by maintaining and enhancing the natural resource base.	The solar farm has been evaluated as having highly manageable soil and water resource risks. By resting the shaded areas beneath the arrays in operation (around 90% of the Development footprint) and the commitment to maintain soil capability after decommissioning, the Project will address these risks. By committing to planting and best practice water crossing design and rehabilitation, the natural resource base is likely to be enhanced.
To encourage diversity in primary industry enterprises and systems appropriate for the area.	The solar farm would be highly reversable with no adverse impact on land capability and therefore primary industry enterprises, after it is decommissioned. The impact of the Project on offsite agricultural activities, agricultural value and agricultural support infrastructure has been evaluated in Appendix D.4 (summarised in Section 6.4) as negligible.
To minimise the fragmentation and alienation of resource lands. The Subject land is small in comparison to similar agricultural land in the region.	No fragmentation or alienation would result.
To minimise conflict between land uses within this zone and land uses within adjoining zones.	Adjoining zones are also RU1. The Land Use Conflict Risk Assessment (LUCRA) included in Section 6.3 demonstrates low impact on adjacent land uses activities.
To permit subdivision only where it is considered by the Council to be necessary to maintain or increase agricultural	The one-off subdivision for the substation is 6 ha and this is not considered large enough to significantly impact on the maintenance of agricultural production.

LEP provision	Project's response
production	
To restrict the establishment of inappropriate traffic generating uses along main road frontages.	Increase in traffic volume would be temporary. Improvements to road treatment would be undertaken prior to construction to enable safe passage and turning off the highway onto Middlebrook Road.
To ensure sound management of land which has an extractive or mining industry potential and to ensure that development does not adversely affect the extractive industry.	There are no mining leases over the subject land and would not adversely affect the extractive industry.
To permit development for purposes where it can be demonstrated that suitable land or premises are not available elsewhere.	While solar irradiance is high in all parts of NSW, with respect to solar farm development, proximity to consumption centres, grid capacity, access as well as suitable terrain to minimise construction costs are more important factors which are met at this site.
7.1 Earthworks; consideration of:	
the likely disruption of, or any detrimental effect on, existing drainage patterns and soil stability in the locality,	The disruption to the soils would be minimal and will be limited to track construction, laydown areas, piling operations, BESS and management compounds. A sediment and erosion control plan and construction management will manage risks to soils.
the effect of the proposed development on the likely future use or redevelopment of the land,	The proposed development would restore the land to the same or higher quality during decommissioning.
the quality of the fill or the soil to be excavated, or both	Soil surveys have verified the soil conditions and provide a base line to assist with remediation actions where required.
the effect of the proposed development on the existing and likely amenity of adjoining properties,	Visual assessment using photomontages and modelling in accordance with best practice guidance has verified that all receivers are shown to have an unmitigated low, very low or nil visual impact. Noise modelling indicates that there will be no exceedances at non-associated dwellings.
the source of any fill material	Minimal excavation is required. the key material will be road

LEP provision	Project's response
and the destination of any excavated material,	base for track upgrades, sourced locally.
the likelihood of disturbing relics,	Specialist assessment indicates that there is low likelihood of disturbing historic heritage relics. Consultation through the ACHA process has identified exclusion zones for Aboriginal specific high value heritage sites.
proximity to and potential for adverse impacts on any watercourse, drinking water catchment or environmentally sensitive area.	The site is not within a drinking water catchment and riparian buffers have been included on 3rd order streams and above to protect the local catchment.

2.2.2. New England North West Regional Plan 2041

The *New England North West Regional Plan 2041* (DPE, 2022) was published on September 2022 on the NSW Department of Planning and Environment's webpage. The Regional Plan's Part 3 Objective 9 'Lead renewable energy technology and investment' addresses the region's goal in adapting to climate change and resilience to threats from it. It addresses the need for the '*integration of land use planning with resilience planning to avoid, prepare for, respond to, and recover from climate induced shocks'* (DPE, 2022).

Objective 9 of the Regional Plan discusses the promotion of diversification of energy supplies through renewable energy generation. It acknowledges potential opportunities for potential renewable energy industries, with the region's existing transmission infrastructure (high voltage power lines) and its opportunity to increase energy resilience. The project directly contributes to Objective 9 of the Regional Plan by:

- Contributing to the national renewable energy target.
- Promoting energy security through a more diverse energy mix.
- Taking advantage of the region's transmission infrastructure and exploring its potential to connect with the electricity network.
- Increasing energy efficiency and moving to lower emission energy sources.

2.3. Energy transition context

Fossil fuels contributed 76% of total electricity generation in 2020, including coal (54%), gas (20%) and oil (2%) (Department of Industry, Science, Energy and Resources, 2020). Approximately one-third of Australia's coal-fired power stations closed during 2012–2017, with most of the remainder expected to close over coming decades (Burke, Best, & Jotzo, 2018). Recent examples being the closure of the new Eraring Coal Fire Power Station (2,880 MW) which is being brought forward by seven years and will close in 2025 and Loy Yang A, which will close ten years earlier than planned in 2035.

The key environmental benefit of solar farm development is in relation to reducing the greenhouse gas emissions and climate change impacts of electricity generation as the grid transitions from coal dominated electricity generation to more sustainable sources. Australian renewable energy supplied 32.5% of Australia's total electricity in 2021. Large-scale solar contributed 12.3% of renewable generation (equivalent of powering 1,994,468 households over a year), medium-scale solar contributed 1.1% of renewable generation (equivalent of powering 171,169 households over a year), and small-scale solar contributed 24.9% of renewable generation (equivalent of powering 4,048,611 households over a year). Solar farms are a sustainable energy resource and do not produce any greenhouse gas emissions during electricity generation. As such, developing renewable resources for electricity generation will help meet growing demand while arresting current emission trends.

The NSW Department of Planning and Environment Large-Scale Solar Energy Guideline (August 2022) sets out that in March 2020, the NSW Government released the first stage of its Net Zero Plan, which outlines a clear objective to achieve net zero emissions by 2050 while also creating new jobs, reducing household costs and attracting investment to NSW. An increasing supply of renewable energy generation, including solar power, will be required over the coming decades to meet the NSW Government's net zero target. The NSW Government's Electricity Infrastructure Roadmap sets out a 20-year plan to deliver this generation infrastructure, as well as the storage, firming and transmission infrastructure required to ensure NSW has continued access to cheap, clean and reliable energy as coal-fired power stations are retired. Large-scale solar energy projects can support jobs and investment in regional NSW and have the potential to increase the resilience of regional towns during the state's transition to renewable energy generation. The roadmap is estimated to attract up to $32 billion of private sector investment in electricity infrastructure by 2030, supporting 6,300 construction jobs and 2,800 ongoing jobs, most of which will be in regional NSW.

2.4. Environmental and social context

2.4.1. The region and locality

The proposed Middlebrook Solar Farm is located approximately 22 km south of Tamworth, New South Wales. Tamworth is approximately 414 km North-North West of Sydney. The Tamworth Regional Council area is serviced by the New England Highway, Oxley Highway and North western Railway line.

The region is considered 'Big Sky Country', featuring expansive pastoral views as well as views of distant ranges. It features many National Parks and tourist attractions including music festivals, waterfalls, tourist drives, rodeo's and an Annual NCHA Cutting Futurity event which alone brings in 2.3 million to the local economy.

It is not within the New England Renewable Energy Zone (REZ) but is located between the New England and Hunter-Central Coast REZs, approximately 27 km west of the New England REZ and 76 km north of the Hunter-Central Coast REZ. REZs are being strategically located by the NSW Government to concentrate power generation, transmission, and storage. This will increase the amount of renewable energy that can be connected to the grid, as older thermal power plants are retired.

The dominant land use is agricultural; sheep and cattle grazing with some cropping. At distance from the service centres of Tamworth and Armidale, the region can be characterised as a quiet rural setting.

Community profile

A brief overview of the area's key social characteristics is summarised below (extracted from a more detailed community profile is available at Appendix D.6).

- The population of Tamworth Local Government Area (LGA) in 2021 was 63,070 people; of which 43,874 people lived in the Tamworth urban area, and 552 people lived in the locality of Loomberah. The population of Tamworth is growing.
- Loomberah is characterised by a high proportion of family households.
- Reflecting its rural character, all housing in Loomberah locality is separate houses.
- Consultation confirmed that Tamworth has an extremely tight rental market, and housing availability and affordability are key issues for the region. Tamworth is an expensive place to live, as compared to its surrounding regional areas.
- There are up to 5,000 short-term accommodation beds in the LGA. Median weekly incomes in Loomberah ($2,086) were higher than the NSW average ($1,829) and considerably higher than for the LGA ($1,416).
- The Tamworth LGA supports 29,586 jobs and has a Gross Regional Product (GRP) estimated at $3.56 billion, which represents 0.6% of NSW's Gross State Product.
- Tamworth is a busy regional centre, with a diverse and growing economy. It is centrally located between Sydney and Brisbane, and it is a key inland regional centre.
- The main industries in the Tamworth LGA are manufacturing, food processing and agriculture.
- Tamworth experiences key issues with availability and retention of staff, and these issues are compounded by lack of housing. The presence of the mines in the broader region acts to both attract people to the area but also to drain workers away. Consultation indicated that there are labour shortages and shortfalls in staff at all levels within the town.
- There is a strong construction workforce in Tamworth, yet skills shortages.
- Tamworth LGA has strong agricultural foundations in poultry, beef cattle, lamb processing and cropping.
- The locality of Loomberah is principally comprised of privately owned farmland. It is a fertile valley that has been extensively cleared and highly modified by farming practices. When asked in the online survey about what people value most about the local area, 87% of respondents (34 responses) stated 'landscape and views', and when asked what views or landscape characteristics in the region and local area are important to them, the responses centred around the farming lands and rural landscapes.
- Stakeholders noted in consultation activities for this Project that the health system is already under pressure in Tamworth.
- Consultation indicated that there are emerging pockets of opposition to renewable energy developments growing within the broader New England region and beyond.

2.4.2. Subject land and immediate surrounds

The Middlebrook Solar Farm Project Subject land includes 4 freehold lots, zoned RU1 Primary Production under the Tamworth Local Environmental Plan 2014.

- Lot 14 DP 37547
- Lot 15 DP 37547
- Lot 61 DP 755343
- Lot 60 DP 755343.

The Subject land is bordered by eight neighbouring lots, also zoned RU1 Primary Production. Grazing and cropping are the dominant enterprises. There are 10 receivers within 2 km:

- 5 non-associated receivers within 1 km, and
- 5 non-associated receivers within 1–2 km of the proposed Development footprint.

Local roads including Middlebrook and Marsden Park Road are unsealed and used for bikes and horse riding as well as local vehicle traffic.

2.4.3. Key values and risks

The site is located within Gamilaraay Country of the Gamilaraay/Yuwaalaraay/Yuwaalayaay language group. Water has been identified as a crucial element of the Gamilaraay traditional way of life with a wide variety of animal and plant resources seasonally available in the river systems. Terrestrial animals such as the possum were noted by many early observers as a prime food source and the skins were often made into fine cloaks. A range of reptiles and other mammals were also food sources. Plant foods were equally as important and mostly consisted of grasses seeds, roots, tubers, yams, berries and fruits (Gott 1982) and ground grass seeds were used to make a flour and baked loaves (Boileau 2007).

Soils in the Assessment area range from Capability Class 3 (high capability land) on the eastern plains adjacent to Spring Creek, Class 4 (moderate capability) on the far eastern and western slopes, and class 5 (moderate to low capability) on areas of the southern and far western steeper slopes, and the drainage line. Class 3 land coincides with Biophysical Strategic Agricultural Land (BSAL) transects the subject land, adjacent to the left and right banks of Spring Creek waterways.

The surrounding area is predominantly rural and mostly used for grazing animals (sheep and cattle) and has large areas of high value agricultural land suitable for lucerne and cereal growing. Heritage listed Goonoo Goonoo Homestead is located to the west of the Project and the area has cafes and bed and breakfast enterprises that showcase the areas quiet rural lifestyle and historic past.

The majority of the Assessment area (89%) has been cleared of native vegetation and is used for stock grazing and cropping however, native vegetation remnants remain. These include scattered trees over exotic pastures and more extensive remnants along waterways. White Box (*Eucalyptus albens*) is the dominant canopy species observed in higher areas of the site. Lower lying areas, proximal to watercourses tend to have a higher proportion of the Yellow Box (*Eucalyptus melliodora*) and occasional Blakely's Red Gum (*Eucalyptus blakelyi*). Dominant species within riparian areas includes White Box, followed by Rough-barked Apple (*Angophora floribunda*), Blakey's Red Gum, Yellow Box, and occasional White Cedar (*Melia azedarach*).

These can be categorised as the following Plant Community Types (PCTs):

- PCT 433: White Box grassy woodland to open woodland on basalt flats and rises in the Liverpool Plains sub-region, BBS Bioregion
- PCT 599: Blakely's Red Gum - Yellow Box grassy tall woodland on flats and hills in the Brigalow Belt South Bioregion and Nandewar Bioregion
- PCT 84: River Oak - Rough-barked Apple - red gum - box riparian tall woodland (wetland) of the Brigalow Belt South Bioregion and Nandewar Bioregion.

Depending on their current condition and the size and connectivity of the remnant, some areas of PCT 433 and 599 have conservation significance as Threatened Ecological Communities.

Broader engagement was undertaken to understand the community's values and concerns regarding the site and the proposed Middlebrook Solar Farm Project. A strong value link was identified between farming land, clean living, local amenity and community. Highest scenic values were attributed to grazing land, rivers/creeks and hills (all over 80%) as well as ridgelines, vegetation, bushland areas, cropped farmland (between 64–75%). Key vantage points were noted as from residences and from lookouts. Views of properties and productive agricultural land uses were noted as important. The locality's expansive views are highly valued.

There is localised concern regarding the Project that is balanced by a high level of support and encouragement from sections of the broader community. The strong concerns expressed by near neighbours were primarily focused on the following topics:

- Change of land use and the perception that the soil quality is too high to host a solar farm.
- Visual changes that a solar farm would bring, including changes to the character of the area.
- Concern of potential impacts (particularly visual impacts) on property values.
- Concern of perceived loss of agricultural outputs.
- Concern of impacts on neighbour's insurance premiums
- Concerns regarding dust and heavy vehicle movement during construction.

Support in relation to the Project was based on the following topics:

- Generation of renewable energy.
- Future-proofing the community against global warming.
- Job creation within the area.

2.4.4. Potential cumulative effects of the Project

There are 25 other Major Projects listed on the Major Projects Register within the Tamworth Regional LGA including three large-scale solar farms, two wind farms, one renewable energy hub and two Battery Energy Storage Systems, and several with modifications at various stages of the assessment process. There are 16 Large-scale renewable energy projects within the adjacent New England REZs (detailed in Section 7.5).

There is a proposed renewable project located 6.5 km north of the proposed Middlebrook Solar Farm which has started public consultation. It is unclear if the proposal will continue to scoping, or what cumulative impacts this may have. This information is not currently in the public arena.

Key cumulative impacts for consideration centre on visual, noise, traffic, land use, biodiversity and socio-economic impacts. A key benefit of the Project is its positive impact on reducing greenhouse gas emissions and moving electricity generation towards cleaner electricity generation. The Project would power the equivalent of about 153,000 NSW homes.

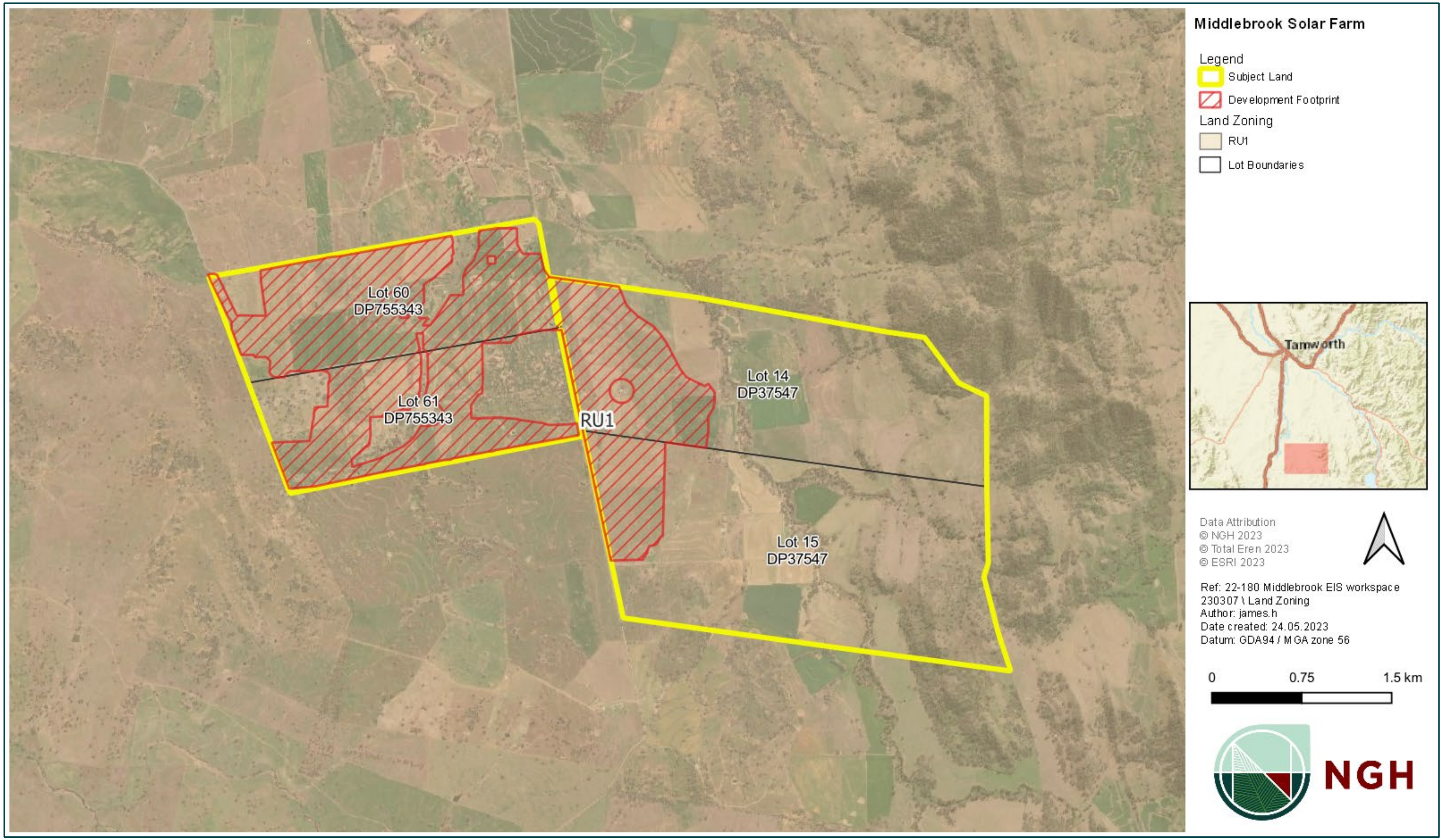


Figure 2-1 Land zoning within and surrounding the Subject land

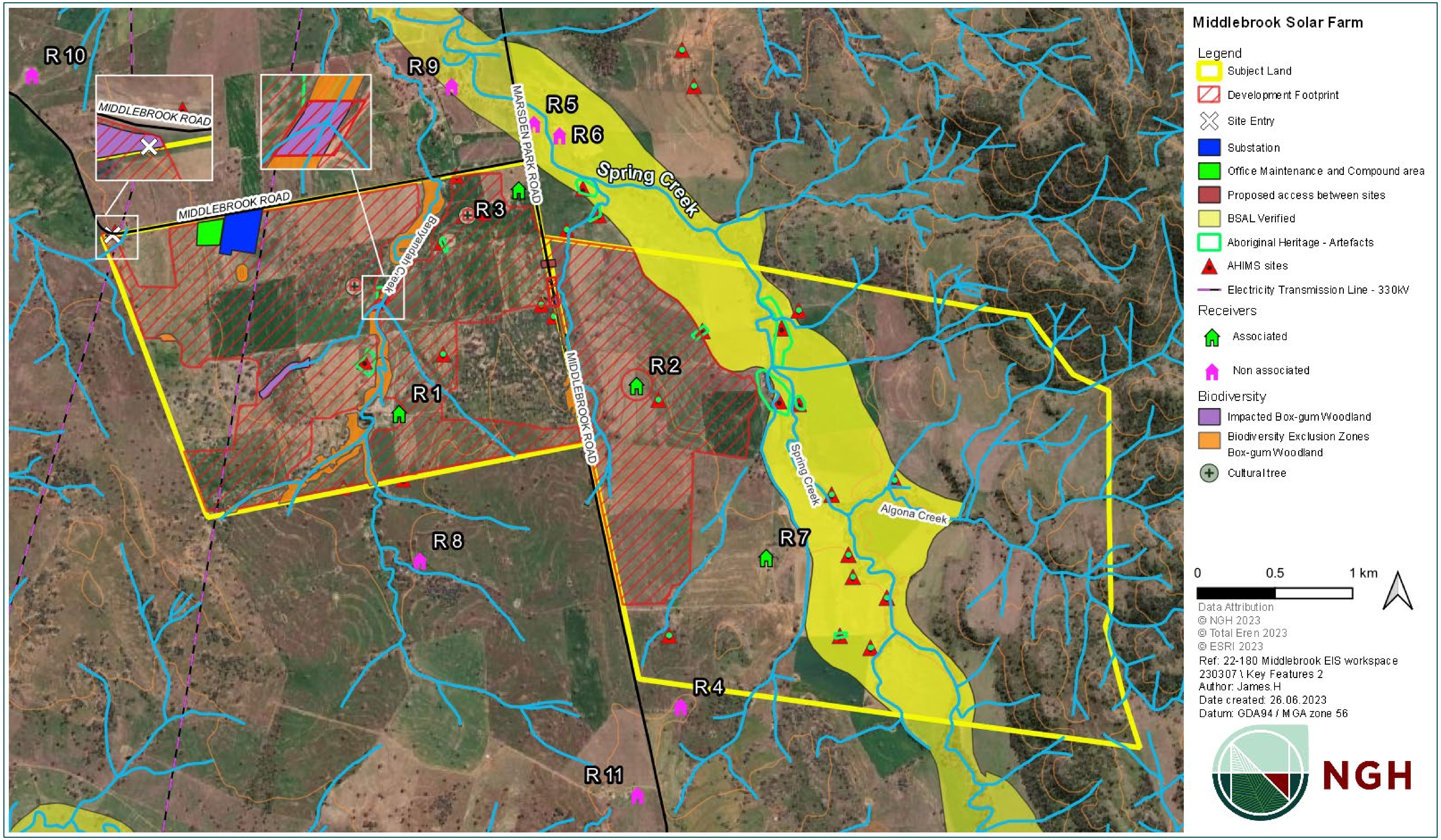


Figure 2-2 Key features of the Subject land

2.5. Project alternatives

In considering the development of utility scale solar energy generation and energy storage in the local area, feasible alternatives that were considered by the Applicant included:

- Not developing the Project
- Alternative technology types
- Alternative site locations
- Alternative scale of the Project.

2.5.1. The 'do nothing' option

The consequences of not proceeding with the Project would be to forgo the identified benefits. This would result in the **loss** of:

- Opportunity to reduce GHG emissions and move towards cleaner electricity generation.
- A renewable energy supply that would assist in reaching the LRET.
- Additional electricity generation and supply into the Australian grid.
- Social and economic benefits created through the provision of direct and indirect employment opportunities during the construction and operation of the solar farm.
- Opportunities for farmers to diversify their income leading to resilience to drought and unpredictable market prices.

The 'do nothing option' would avoid the impacts of development identified in this EIS but would forgo these above-mentioned benefits.

2.5.2. Technology alternatives

Other forms of largescale renewable energy accounted for in the Large Scale Renewable Energy Target include wind, hydro, biomass, and tidal energy.

Superior solar resources have been identified in NSW, providing excellent opportunities for solar projects in the Tamworth Regional area. Photo Voltaic solar technology was chosen because it is cost-effective, low profile, durable and flexible regarding layout and siting. It is a proven and mature technology which is readily available for broadscale deployment at the site. Immediate grid access enables energy production without the need to construct additional transmission lines to connect to the network.

A Battery Energy Storage System (BESS) is now considered an essential component of renewable energy projects. It accommodates the grid's demand and supply profiles during the transition from fossil fuels to more renewable energy generation.

2.5.3. Alternative site locations

During the site selection process for the Project, the applicant reviewed the solar generation potential of many areas in NSW using a combination of computer modelling and analysis, on the ground surveying, and observation and experience of the applicant. The proposed site was selected because it provides the optimal combination of:

- Low environmental constraints (predominantly cleared cropping and grazing land).
- Low-rise terrain for cost-effective construction.

- High quality solar resource.
- Sparse residential dwellings.
- Suitable planning context.
- Acceptable flood risk.
- Artillery road access.
- Access to the distribution network.
- Sufficient levels of available capacity on the grid distribution system.

The Assessment area is of a scale that allows for flexibility in the design, allowing site constraints identified during the EIS process to be avoided or effectively mitigated.

The design of the Project is the result of an iterative process. The design has been adapted progressively as information regarding site constraints, and the potential impacts and risks associated with the development of the Project have become available.

Based on biodiversity, heritage and other investigations carried out for the EIS, the proposed layout achieves the objective of efficient electricity production while minimising environmental impacts overall.

The two 330 kV lines that traverse through the region are part of the major network connection between NSW and Queensland. TransGrid is also planning to upgrade these lines in the future to increase their capacity even further. There are no other large-scale solar farms that have sought SEARs in the area south of Tamworth, the closest is Tamworth Solar Farm located approximately 30 km west of Tamworth. However, another early-stage solar proposal is known located 6.5 km north of the site.

2.5.4. Scale of the Project

The scale of the Project has been influenced by:

- Transmission grid capacity.
- Property boundaries.
- The location of existing onsite dams, vegetation, and plant communities.
- Consideration of Aboriginal cultural heritage values.
- Demand for new renewable electricity generation to meet generation targets.
- Commercial investment and viability considerations.

The proposed scale of the solar farm successfully responds to the constraints and opportunities inherent in these factors. Refer to Table 2-2 below.

2.5.5. Evaluation of suitability

NSW Department of Planning and Environment Large-Scale Solar Energy Guideline (August 2022) acknowledges that there are many technical and commercial factors that need to be considered when selecting a site for large-scale solar energy development. Applicants must also consider other environmental issues and land use conflicts when selecting a site, such as the agricultural productivity of the land, visibility and topography of the site and biodiversity values. These are summarised below for the Middlebrook Solar Farm Project.

Site selection factors often compete with each other. Consequently, the Project aims to avoid impacts as far as possible while striking an appropriate balance between competing environmental and social factors. Refer to the key features mapping to show the Project's response to onsite environmental values, Figure 2-2.

Table 2-2 Site evaluation

Evaluation criteria	Relevance to the Project
Proximity to electrical network	Onsite connection to 330 kV line.
Connection capacity	Confirmed by TransGrid.
Optimal solar resources	
Distance to major towns / energy users	Approximately 22 km to nearest town (Tamworth), a major consumption centre.
Proximity to major roads and transport infrastructure	Located directly off the New England Highway, a major transport corridor connecting the New England and Hunter-Central Coast REZs.
Size and shape of land parcels	Low relief terrain in a consolidated arrangement of land parcels.
Development restrictions	NA.
Potential for land use conflict	Highly compatible with adjacent agricultural land uses and continued grazing (limited) in operation. Highly reversable in terms of decommissioning; agricultural operations could recommence in full.
Environmental values	
Important agricultural land	• No impact on BSAL land. • Protect riparian land. • Continued grazing of the operational solar farm allowed for • Soil surveys to inform specific remedial treatments where required. • All above ground infrastructure to be removed during decommissioning. • All buried infrastructure would be recovered during decommissioning.
Visibility and topography	Low number of dwellings in the area. Amenity impacts assessed to be minimal. • Visual, all nearby receivers have been assessed as having a low impact. • Noise, there would be no noise exceedance at any non-associated receiver for construction, operation or decommissioning.
Aboriginal cultural heritage	• No impacts to two possible modified trees

Evaluation criteria	Relevance to the Project
	• No impacts to area of archaeological sensitivity- Spring Creek • Salvage program and Cultural Smoking Ceremony to be undertake prior to Project impacts, with representatives of the registered Aboriginal parties
Biodiversity	• Better condition / extent areas of Box Gum Woodland protected from development. • No barbed wire on security fencing (to reduce entanglement risks for gliders and bats) • Best practice restoration actions for the one water way crossing required
Natural hazards	• No identified asbestos, pollution, acid sulphate soils.

3. PROJECT DESCRIPTION

3.1. Addressing uncertainty for State Significant Development

An indicative infrastructure layout is provided in this section however, for utility solar farm developments, it is noted that the detailed design stage commences only *after approval has been granted*. It will be informed by further topographic and geotechnical surveys and will be subject to commercial tendering and procurement processes to arrive at the final design and construction program. This will ensure the Project is optimised in terms of yield and efficiency, within the parameters of the approval. To address the uncertainty that this brings to the assessment and approval process:

1. Submission of the final detailed design to DPE *prior to construction* is a standard feature of approved State Significant Development (SSD) consent conditions. This provides the final check that the detailed design is consistent with the EIS's assumptions.
2. As the final specifications and location of infrastructure are subject to change during detailed design, the impact assessment documented in this EIS considers a realistic 'worst case'; for example:
    - The largest development footprint that may be impacted – in terms of clearing and soil disturbance that may be required.
    - The noisiest machinery during construction, operating concurrently.
    - The tallest block of infrastructure that may be installed – in terms of modelling how visible the Project will be to near neighbours.

The Project description described and assessed in this EIS is therefore intended to *over-estimate impacts* and *over-scope mitigation strategies.* It is a conservative strategy to address uncertainty. Areas of uncertainty are clearly identified, and specific strategies are included to address these in the later stages of the Project, where required. This approach is consistent with the *State Significant Development Guidelines – Preparing an Environmental Impact Statement* (DPE, 2022) which states:

> *… with some large, complex Projects this flexibility is often essential as it is difficult, if not impossible, to deal with all aspects of the design of these Projects at the EIS stage.*

3.2. Permanent infrastructure components

The solar farm would consist of the solar panels, mounted within an array area and ancillary infrastructure. Ancillary infrastructure is taken to include all supporting inverters, transformers, BESS, substation and switching station, electrical connections and cabling, onsite buildings, access roads and parking, fencing and lighting. In addition, road upgrades will be required to access the site from public roads.

The Project will incorporate:

- Up to 750,000 single axis tracker PV solar panels, Maximum height of 3 m
- Approximate solar panel dimensions 2.3 m x 1.2 m
- Inter row spacing up to 8 m
- Up to 100 inverter stations – 2.6 m high
- 6 ha area for the substation, some components up to 9 m high
- 300 MW/600 MWhr DC BESS

- Underground cabling
- 3.5 m security camera
- Approximately 2.4 m security fencing
- Up to two high voltage transformers
- Site office 3.8 m x 19.8 m x 4.4 m (high)
- Switch room 4.1 m x 17.9 m x 4 m (high)
- Lighting.

Each permanent infrastructure component required for the Project is detailed in the subsections below. Illustrative photographs of the typical components are provided throughout this section.

In subsequent sections

- Additional temporary construction facilities are detailed in Section 3.2.7.
- Row spacing between modules, approximately 8 m
- Height, limited to a maximum 3 m above ground level.

3.2.1. Solar arrays

The Project will utilise ground-mounted solar PV single portrait solar arrays which will be mounted on a single-axis tracking system. This will include:

- Up to 750,000 solar modules
- Up to 9,900 single-axis tracking arrays
- Row spacing between modules, approximately 8 m
- Clear space between panels, approximately 3–5 m or greater (spacing may increase between rows to respond to local topography).
- Height limited to a maximum of 3.0 m above ground level.

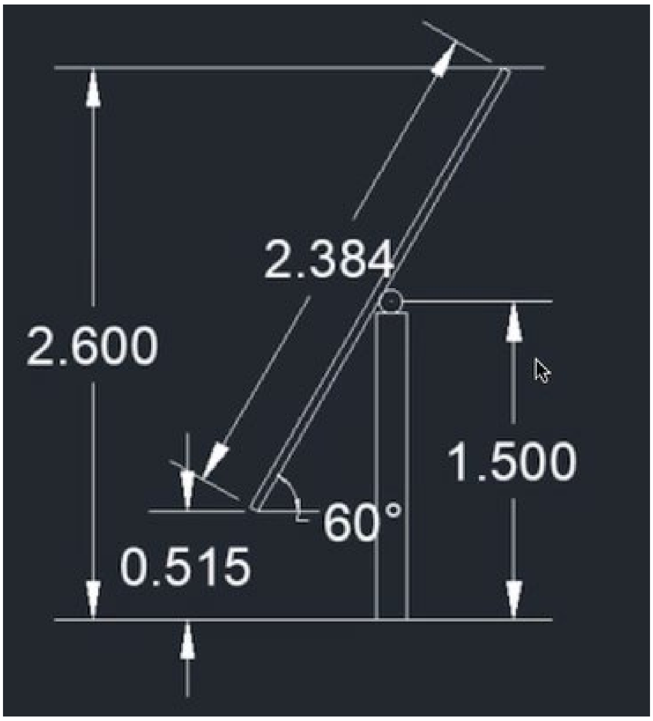


Figure 3-1 Typical array dimensions

Typically, the tracker structures will be approximately 1.5 m above ground and at maximum tilt angle, the panels would reach a maximum height of less than 3.0 m. Steel piles are used to support the tracker structures where solar modules are mounted. Where possible, driven pile foundations would be used to support the solar modules and the mounting systems. Where possible, driven-pile foundations would be used to minimise the soil disturbance, and these can be installed quickly. Helical or screw piles may be used in locations where the soil is incompatible with driven piles. If bedrock is encountered, this may require additional processes such as pre-drilling and grouting.

The combined solar arrays will have a total generating capacity of approximately 320 MW_{AC} (up to 450 MWp).

3.2.2. Inverters and transformers

The purpose of the inverters / transformer stations (also known as power conversion units) is to convert direct current (DC) electricity, generated by the solar panels and BESS, to alternate current (AC) which the National Electricity Grid uses, and to increase the voltage of the power before transferring it to the substation. For this Project, the inverters and transformers will be co-located together in single, container-style buildings (stations) and will be distributed throughout the array area, for power conversion separately from the array. An inverter/transformer station is approximately 6.5 m X 2.6 m x 3.0 m (length, width, height) with an example shown below.

Approximately 100 inverters next to transformer stations are envisaged distributed throughout the project area.

3.2.3. Battery Energy Storage System

A BESS is proposed to store power generated by the Project, providing a more reliable release of energy to the grid or an option to export energy to the grid to meet demand outside of sunlight hours. Lithium-ion (‘Li-ion’) is currently the preferred technology for storing energy generated from solar sources and is likely to dominate battery chemistry for the next 20 years.

A 300 MW/600 MWh DC coupled BESS would be established in conjunction with the Solar Farm to regulate the supply of electricity to the grid. The BESS transformers would be distributed across the site, located next to the Inverters (as stated in Section 3.2.2).

Risk mitigation strategies considered in siting the BESS include:

- Adequate space of provision of an Asset protection zone (APZ)
- Provision of fire safety separation distances.
- Proximate to site entry for expedient access.
- Fire detection and alarms.
- Emergency shut down response.
- Emergency response plan.

The climate-controlled battery storage units (either containerised or mounted on racks outside) would be constructed on concrete footings approximately 300 mm above ground level. Ventilation and cooling units will be provided for the BESS modules as required.

The BESS is monitored on a constant basis, utilising NEM compliant metering arrangements that are automated and with individualised control and diagnosis of individual battery modules. The BESS will incorporate a Battery Management System (BMW) for control and safety, ensuring the correct functionality of the battery at all times. This is possible due to the dedicated power electronics and system architecture that isolate the batteries from the common DC bus.

It is anticipated that the battery modules would have secondary containment to ensure that any one battery module failure (e.g., any battery fires or thermal runaway event) is contained. This is an integral design feature of the system's architecture with one of the applicant's key suppliers.

3.2.4. Onsite substation and switch room

To connect the Project to the National Electricity Grid, the Project will require a substation and switching station. The substation would have a nominal transfer capacity of approximately 384 MVA and host up to two transformers with a maximum height of 9 m.

The substation would be built on the eastern edge of the development footprint and cover and area of approximately 6 ha. Part of the substation compound i.e., the substation and the power transformers would be owned by TNSP (Transmission Network Service Provider). Overhead cabling would connect the switching station to the 330 kV transmission line.

National Energy Market metering equipment will be on-site within the substation compound.

3.2.5. Transmission line connections

The Project requires connection to the electricity network. This will occur within the Development footprint. No offsite works are required to connect the Project to the grid.

Connection to the grid is assessed in this EIS. Once constructed, the connection infrastructure will be gifted to TransGrid, to be managed as part of their network. To ensure that TransGrid can manage their own assets, a subdivision will be sought through Council post approval, to delineate areas required for permanent TransGrid assets within the Development footprint.

3.2.6. Underground cabling (on the solar farm)

Underground cabling on the Assessment area would be designed in accordance with Australian and International standards with the goal of minimising ground disturbance. Both AC and DC cables are required.

AC underground cabling at the reticulation voltage would be installed at a depth of at least 500 mm with the electrical reticulation typically buried to either 600 mm (low voltage) or 800 mm (high voltage) depth, following the relevant Australian Standard. Underground cables and pipes would be buried to ensure agricultural land capabilities are not reduced if underground infrastructure is left in situ after decommissioning.

Prior to excavating the cable trench, the topsoil would be stripped and stockpiled for use in rehabilitating the trench line. Depending on the quality of the excavated material, sand may be used in the trench to create a cable bed (the site overlies a considerable sand deposit). If the natural sand is unsuitable, imported sand may be required. Once the cables are installed another layer of sand may be placed above the cable prior to covers and markers being installed. The trench would later be backfilled with excavated material. Finally, topsoil would be replaced and sown with perennial grasses to assist the revegetation of the disturbed areas.

Cables would be protected in accordance with *Australian Standard (AS) 3000:2007 Electrical Installations.*

3.2.7. Onsite buildings

Operations and Maintenance building

The operation compound would comprise an administration office and reception would be located near the main access point at the north-western corner of the Assessment area. Indicative designs for these buildings are provided in Figure 2-2. The office building and control room would contain essential fire safety equipment, including fire extinguishers and hose reels.

A single storey office building, approximately 3.8 m x 19.8 m x 4.4 m (high), would be constructed for the Applicant administration on concrete footings. The building would likely be clad in unobtrusive Colorbond sheeting. Guttering and a water tank would be installed to collect rainwater. The office building would contain an office and staff amenities (toilet, kitchen and storage). The switch room would be a separate building with approximate dimensions 4.1 m x 17.9 m x 4 m (high).

3.2.8. Fencing

The security fencing installed around the site would be approximately 2.4 m high, providing adequate access points for project maintenance, land management purposes and for emergency egress. An example of the security fencing installed is shown in Figure 3-2 and Figure 3-3.

Security fencing would be installed surrounding and within the substation in accordance with TransGrid's *Substation Primary Design Standard*.

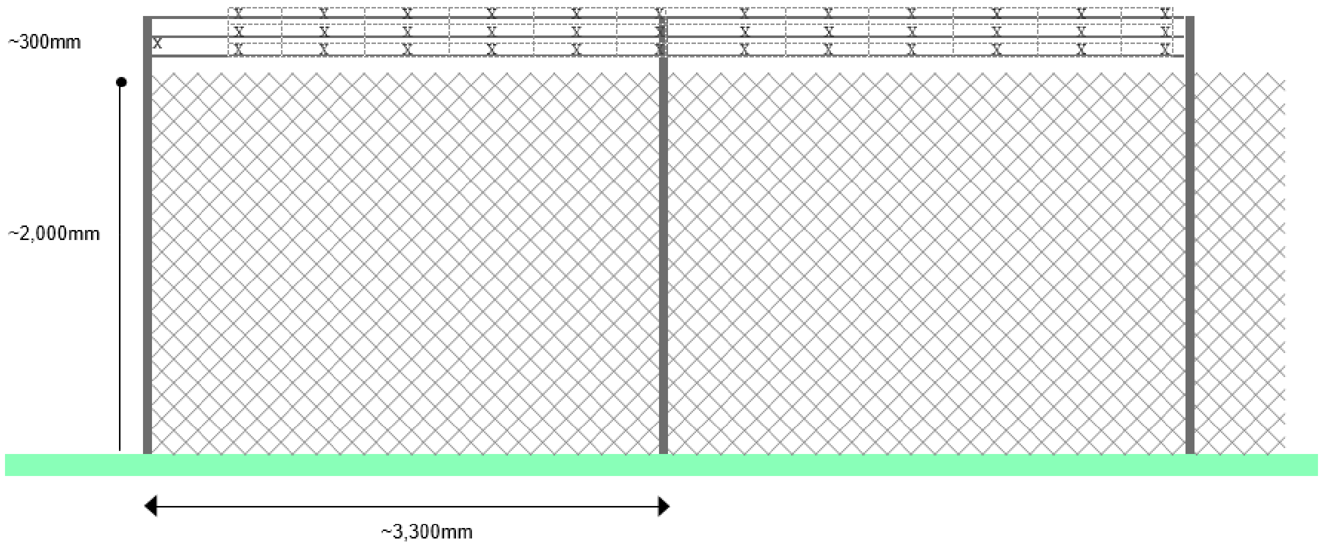


Figure 3-2 Security Fencing schematic

Figure 3-3 Example of security fencing with barbed wire.

Fencing the substation / battery area

The substation area would be enclosed by a security fence in accordance with TransGrid requirements. This is expected to be a steel security fence approximately 2 m high with barbed wire topping, or similar.

Where necessary, fencing both perimeter and internal fencing will be devoid of barbed wire to protect entanglement of endangered species (refer Figure 3-4).

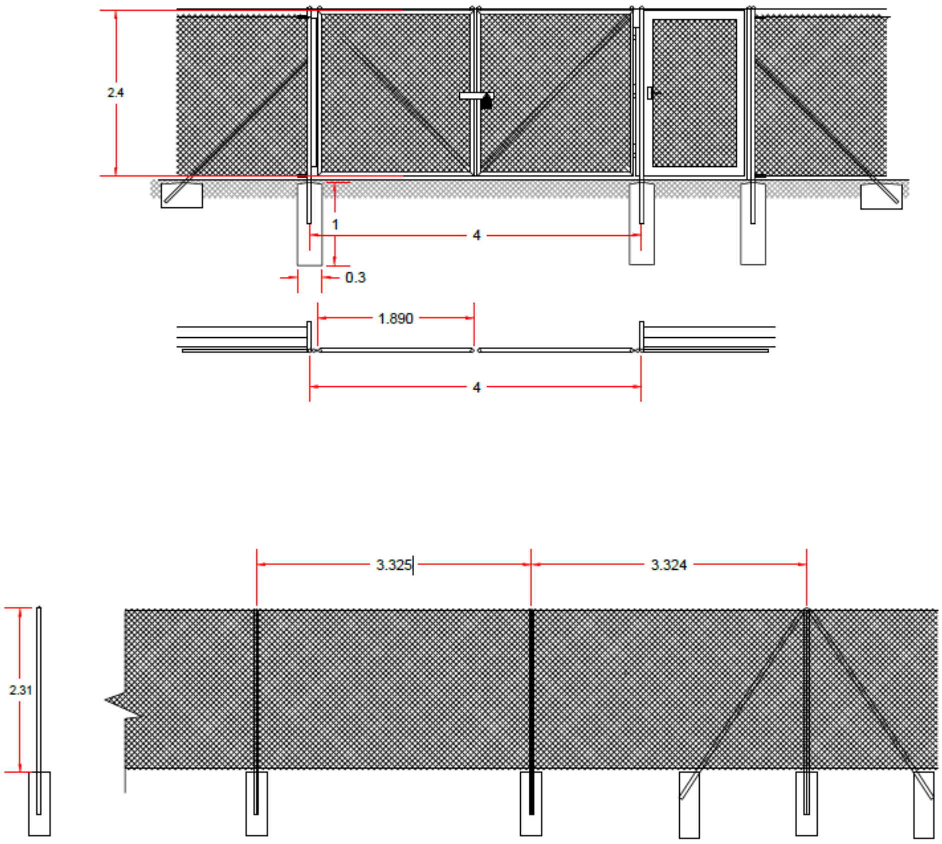


Figure 3-4 Indicative security fencing with no barbed wire (units in meters)

3.2.9. Lighting and monitoring

Lighting across the Assessment area would be reactive to prevent disrupting the rural nightscape largely devoid of light pollution and would be limited to the office building and other critical infrastructure. Lighting is expected to arise mainly from staff working in offices after nightfall, vehicles entering and leaving the Project and external motion-sensing lighting provided for safety.

Lighting at the substation would be in accordance with TransGrid's *Substation Primary Design Standard*, which requires lights for:

- walking in open areas likely to be accessed.
- walking in closed or constrained areas (e.g., stairs).
- the substation security fence in areas unlikely to be accessed as a deterrent.

The substation would be owned and operated by TransGrid.

The Applicant would procure a well-designed closed-circuit television (CCTV) system that would deliver both high quality video surveillance as well as early detection of unauthorized entry to the solar farm-associated compound area. Cameras would be installed alongside the perimeter monitoring the area between the fence line and the solar panels. If human movement is detected, a relay would be activated, communicating to the 24-hour offsite security control room.

Along with this system, cameras and access controls would be installed at the office building and entry gate to protect against unauthorised access and provide video surveillance. All cameras that cover the perimeter are internet protocol (IP) rated and mounted on a 4 m high CCTV pole spaced between 200 m to 300 m apart and for every change of direction of fencing.

3.3. Temporary construction facilities

Temporary facilities established at the site during the construction phase may include:

- Material laydown areas.
- Temporary construction site office.
- Temporary car and bus parking areas for construction workers.
- Staff amenities (kitchen and toilet/s).
- Temporary security lighting and CCTV at construction compound.
- Containers for the use of subcontractors.
- Bunded area for refuelling.
- Storage area.
- Generator for construction compound power supply.
- Skips with wind shield and lid.

A hardstand area in the compound would consist of compacted stone to provide a clean, firm, level and free draining surface suitable for cabins and heavy traffic. Temporary staff amenities would be designed to accommodate the number of workers at the peak of the construction period (estimated at 400 workers for an 18 month period).

3.4. Access requirements

3.4.1. Haulage route

Road transport is the preferred option for the delivery of construction infrastructure to the site. It is expected that the haulage route for most vehicles, including heavy and over-dimensional vehicles during construction would be from Sydney Port.

Traffic accessing the site will do so from the New England highway and Middlebrook Road. Staff will primarily be located in Tamworth and the surrounding areas with all plant expected to be delivered from Port Botany.

3.4.2. Vehicle type breakdown

Construction traffic generated by the solar farm can broadly be separated into the following three categories:

- Light vehicles associated with transporting staff to/from site.
- Medium and Heavy Rigid Trucks will be used to deliver raw materials and smaller plant.
- Articulated vehicles and B-Doubles will be used to transport larger plant.

Restricted Access Vehicles / Oversized and Over Mass (OSOM) vehicles will be required for the delivery of larger plant to the site such as the substation transformer and are subject to separate permit applications and regulations.

It is anticipated that during the peak construction the site could generate up to 80 heavy and 86 light vehicle movements per day. Overall, approximately 35 vehicle movements during the morning and evening peak hours in the peak construction period is expected to reduce to 19 vehicle movements after the peak (remaining eight months of construction).

Table 3-1 Vehicle type breakdown and peak movements

Vehicle type	Average vehicle movements per day		Peak vehicle movements per day	
	Daily (vph)	Peak hour (vph)	Daily (vph)	Peak hour (vph)
Light Vehicle (car/4WD)	40	10	86	22
Shuttle Bus	6	3	8	4
MRV/HRV	8	1	16	2
Truck and dog	10	1	20	2
AV	8	1	16	2
B-Double	10	3	20	3
Total	**82**	**19**	**166**	**35**

Overall, the site is expected to generate approximately 35 vehicle movements during the morning and evening peak hours during the peak construction period, which will reduce to 19 vehicle movements over the typical construction periods.

3.4.3. Site access

Three access upgrades are required:

1. One Basic Left Turn (BAL) treatment is required at the New England Highway intersection with Middlebrook Road. The existing Channelised Right Turn exceeds the Project's traffic safety requirements.
2. One site access point is required off Middlebrook Road, at the north western corner of Lot 60 DP 755343. Middlebrook Road is sealed from the intersection with the New England Highway for 500 m. From this point, the unsealed 6 m carriageway would be upgraded to 7 m (unsealed) in accordance with the Traffic Impact Assessment completed by Amber (Appendix D.3). The length of this upgrade is 3.3 km. The unsealed 6 m carriageway would be upgraded to 7 m (unsealed) in accordance with the Traffic Impact Assessment completed by Amber (Appendix D.3).
3. A crossing of Middlebrook Road is required on the eastern side of Lot 60 DP 755343 and the western side of Lot 14 DP 37547 to connect the east and western portions of the Project. The unsealed 6 m carriageway would be upgraded to 7 m (unsealed) in accordance with the Traffic Impact Assessment completed by Amber (Appendix D.3). No access onto or off Middlebrook Road would be allowed at this location.

The widths proposed will allow two B-Double vehicles to pass. Sight distances have been verified as appropriate and the treatments are supported by swept path analyses. Consultation has been undertaken with Tamworth Regional Council who have reviewed these proposed treatments (refer to the Traffic Impact Assessment completed by Amber; summarised in Section 6.3 and appended as Appendix D.3.

Table 3-2 Schedule of road upgrades

Asset owner	Road and location	Treatment
Transport for NSW	New England Highway (Intersection with Middlebrook Road)	BAL treatment.
Tamworth Regional Council Road Reserve	Middlebrook Road (From 0.5–3.8 km from intersection with New England Highway)	3.3 km unsealed carriage way, width increased from 6 m to 7 m.*
Tamworth Regional Council Road Reserve	Middlebrook Road (East-west crossing from the eastern side of Lot 60 DP 755343 to the western side of Lot 14 DP 37547)	7 m width unsealed carriage way established across Middlebrook Road.

* It is noted that no non-associated free hold lots are proposed to be impacted by road upgrades although in one location, on a bend in Middlebrook Road, this will mean the widening is only to the north, to stay within the reserve.

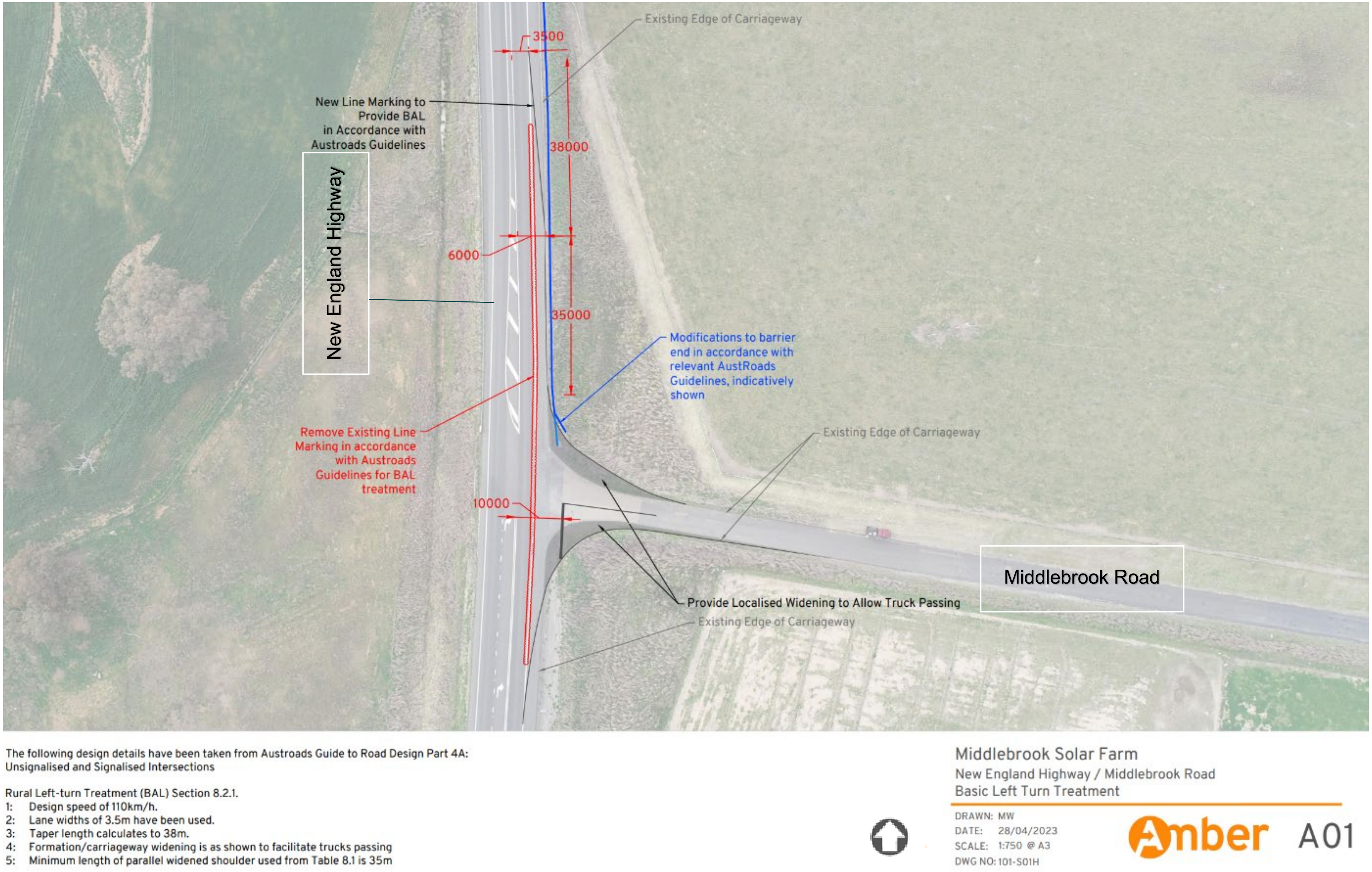


Figure 3-5 BAL treatment at New England highway intersection

Figure 3-6 Middlebrook Road site access upgrade

Figure 3-7 Proposed connecting east-west crossing of Middlebrook Road

Internal access tracks

The internal roads would be approximately 3.5 m to 5 m wide. The crossovers are proposed to be designed in accordance with Council's standard drawing for a typical rural driveway. Accordingly, the access will be able to accommodate the largest design vehicle.

The site access and all internal tracks would be maintained throughout the construction and operation of the solar farm. If required, water trucks would be used to suppress dust on unsealed access roads and tracks during construction. Additional stabilising techniques and/or environmentally acceptable dust control would also be applied where required to suppress dust.

The final location and design for new access tracks and new parts of existing access tracks will be subject to detailed design following the approval. Some or all of the internal access tracks would be constructed of local or engineered fill, crowned for run-off and topped with a gravel cap.

Wherever possible, native soil disturbance will be minimised, and access tracks will be installed on top of the existing soils by laying imported fill and gravel over the native soil (i.e., the topsoil will not be removed).

Access tracks would be clearly marked on the OEMP and passing lanes and turning circles would be provided to internal tracks in line with the Bushfire Management Plan (BMP).

3.5. Set backs

The 10 m minimum bushfire protection setback from solar farm infrastructure would be applied to any woody vegetation plantings undertaken around the perimeter of the solar farm, as well as remnant woodland vegetation, in accordance with Planning for Bushfire Protection guidelines (RFS, 2019). The setback area may include a 3.5 m - 5 m wide (plus shoulders and required drainage) perimeter access track.

The solar array would be mounted above ground and would enable groundcover species to persist during operation. Management of the Asset Protection Zone (APZ) will include grazing. Suitable perennial groundcover would be maintained beneath the panels and grazed to reduce biomass for bushfire management. Sheep grazing would also maximise efficient use of the land meaning that the Assessment area would be used for livestock and energy generation, retaining a contribution to the local agricultural economy. Groundcover grass species would be selected which are tolerant of limited shading conditions and suitable for the soil type and climate at the proposed site.

3.6. Stages of the Project

3.6.1. Timeline

An indicative timeline for the Project is outlined in below.

Table 3-3 Indicative timeline

Stage	Approximate commencement	Approximate duration
Detailed design	Q4 2023	6 months
Construction	Q2 2024	21 to 30 months
Operation	Q4 2026-Q4 2056	30 years
Decommissioning	2056-2057	12 months

These timelines are indicative only. The Project could be re-powered and, as such, the operational life could be longer.

3.6.2. Design

The detailed design phase of the Project will only occur pending Project approval.

An indicative infrastructure layout is provided in lieu of the detailed design at this stage. Refer to Figure 3-8.

Detailed design will be informed by further topographic and geotechnical surveys and will be subject to commercial tendering and procurement processes to arrive at the final design and construction program. This will ensure the Project is optimised in terms of yield and efficiency, within the parameters of the approval.

3.6.3. Construction

Site preparation and earthworks

Soils within the Assessment area, which have been showing to have agricultural limitations, have been highly modified by decades of farming activities including regular cropping and grazing. Ground disturbance resulting from earthworks associated with the Project would be minimal and limited to:

- The installation of the piles supporting the solar panels, which would be driven or screwed into the ground to a depth of 1.5 m – 2.5 m.
- Construction of internal access tracks and access points and associated drainage.
- Substation bench preparation.
- Concrete or steel pile foundations for the inverter stations, substation and O&M storage facilities.
- Cable trenches up to 1,500 mm deep.
- Establishment of temporary staff amenities and offices for construction.
- Construction of perimeter security fencing and CCTV.

Topsoil under the footprint of the array area would remain in-situ during the construction of the solar farm. Topsoil salvaged from the construction of the access tracks and other works would be securely stored for use in site rehabilitation.

The Assessment area is currently largely devoid of groundcover. Establishing native perennial groundcover prior to construction would reduce the risk of erosion and would also benefit local biodiversity. Where required, weed treatments would be undertaken prior to earthworks commencing to reduce the potential spread of these species within the development footprint.

Construction activities

The construction phase is expected to last approximately 21 to 30 months with a peak construction period of 18 months. The main construction activities would include:

- Site establishment and preparation for construction - fencing, ground preparation, construction of the internal track system, upgrade of existing access points/intersections, preliminary civil works and drainage.
- Installation of steel post and framing system for the solar panels.
- Installation of underground cabling (trenching) and installation of inverter stations.
- Installation of PV panels.
- Construction of office building and control room.
- Construction of the substation and connections.
- Removal of temporary construction facilities and rehabilitation of disturbed areas.
- Landscaping.

Pending the finalisation of the construction schedule, it is expected some stages of construction would occur concurrently. Temporary construction facilities would be situated predominantly at the north-western corner of the development footprint.

Labour machinery and equipment

It is anticipated that approximately 400 construction personnel would be required onsite during the peak construction period of 18 months. Construction supervisors and the construction labour force, made up of labourers and technicians, would be hired locally where possible.

It is anticipated that a significant number of workers would be local, and those who are not would use existing accommodation within Tamworth and the surrounding region. It is proposed that bus transfers will be provided (where practicable) to minimise traffic volumes and transit risks during construction.

Equipment used during construction would include:

- Earth-moving equipment for civil works (excavators, graders)
- Small piling or drilling rigs for installation of the posts of the solar arrays
- Diesel generators
- Trucks
- Light vehicles
- Large transit vehicles, including delivery and waste removal vehicles.
- Forklifts
- Cable trencher or excavator
- Cable laying equipment
- Cranes including 50 T mobile crane.

Materials

Construction materials would be sourced from local suppliers where practical and possible. Tamworth is a large population centre and a likely place to source of the bulk of aggregate material required for construction such as gravel, sand, and concrete; followed by Armidale, Port Macquarie, and Newcastle.

Approximately 7,600 m^3 of gravel would be required to surface the access road and internal service track network, inverter areas and substation hardstand. Loam mix may be required for the bedding of underground cables, depending on electrical design and ground conditions. Concrete may be required for most infrastructure footings, including containers hosting the battery and inverters, the substation and CCTV footings, fencepost fittings and the site office. The steel posts used to mount the PV structures are normally driven approximately 1.2-2.5 m into the ground using a pile driver. However, in some areas there may be necessary to use concrete to secure the steel posts.

The solar arrays would be constructed primarily of panels (comprising glass, graphite, with small amounts of safe metals such as copper and zinc) on steel frames. Office and amenity buildings would be standard 'kit" buildings fabricated from corrugated iron, plastic panelling etc. Prefabricated buildings and solar arrays would be reusable after a project life of 30-years and/or recyclable.

Approximately 100 ML of non-potable water would be required during construction, mostly for dust suppression, but also for cleaning, concreting, onsite amenities and landscaping. The bulk of this water would be obtained from a council standpipe or supplied through a contractor.

Water for dust suppression would be obtained from a Council standpipe in Tamworth.

A small amount of potable (drinking) water would be used onsite during the construction period on an as needs basis and stored within temporary water tanks at the staff amenities area.

Work hours

Construction activities would predominantly be undertaken during standard daytime construction hours (7.00 am to 6.00 pm Monday to Friday and 8.00 am to 1.00 pm on Saturdays). Any construction outside of these normal or agreed working hours, if required, would only be undertaken with prior approval from relevant authorities, or unless in emergency circumstances e.g. to make work safe.

3.6.4. Operation

Operation activities

Operation activities would include:

- Routine visual inspections general maintenance and cleaning operations of the solar arrays as required.
- Routine visual inspections general maintenance and cleaning operations of the substation as required.
- Vegetation management, likely using sheep to control grass growth beneath the panels. Groundcover vegetation would be maintained over the site to minimise erosion, dust and weeds. Groundcover would be monitored and remediation (such as reseeding, soil protection or destocking) undertaken as required.

- Site security response (24 hr), if required.
- Site operational response (24 hr), if required.
- Replacement of equipment and infrastructure as required.
- Maintenance of landscaping and screening plantings as required.
- Pest plant and animal control as required.

Materials and resources

During operation, potable water would be required for watering trees, cleaning panels and watering livestock. Around 10 ML per year would be required for cleaning, sourced from council standpipes/ delivered by contractor. Screen planting would be carried out during the higher rainfall months of winter and spring. This coupled with good site preparation means the need for watering can be significantly reduced or eliminated altogether.

A steel or concrete tank would be installed at the site to store water for bushfire protection and other non-potable water uses, with a minimum of 50,000 L reserved for fire-fighting purposes. Potable water would be required for staff using imported supplies or rainwater collected from tanks beside site buildings.

Personnel and work hours

Operation activities would predominantly be undertaken during standard daytime construction hours (7.00 am to 6.00 pm Monday to Friday and 8.00 am to 1.00 pm on Saturdays), however, most operation activities would be unobtrusive such as inspecting equipment.

Any operation activities outside of these normal or agreed working hours, that have the potential to be intrusive such as slashing firebreaks, or noisy maintenance works would be undertaken with approval from relevant authorities, or unless in emergency circumstances.

The solar farm would be monitored and operated by approximately 15 full time equivalent (FTE) employees. TransGrid would operate and maintain their substation separately.

The majority of plant maintenance including inverter station, transformer and HV switchgear, PV arrays, ground and vegetation and the trackers would be conducted by site staff on a rolling basis with activities scheduled consistently throughout the year.

Transport and access

Staff and service contractors would primarily use light vehicles (4WD) during the operation phase. Up to 16 light vehicles and would access the Assessment area with up to 20 vehicle movements per day, comprising staff movements to and from work. Heavy vehicles would be infrequent.

Traffic associated with the operation and maintenance of the solar farm would also use the routes specified for the construction phase (refer 6.3.3)

Refurbishment and upgrading

The type of lithium batteries proposed for the BESS currently have a life of approximately 15 years. As such the BESS would require a complete refurbishment once, mid-way through the project's initial 30-year life. The Applicant may also replace or upgrade solar panels or other infrastructure within the existing development footprint during the projected 30-year life of the solar farm.

3.6.5. Decommissioning

At the end of its operational life, the solar farm would be decommissioned. At this stage, the Project commits only to the objectives of this decommissioning plan which will describe how key project infrastructure will be removed and the methodology to return the site to a safe, stable and non-polluting state, capable of sustaining the pre solar farm agricultural land uses or other preferred land use.

What will be removed and what will be retained

The substation is intended to remain. After construction, it will become the permanent asset of TransGrid. It will be the subject of a small subdivision to reflect TransGrid's ownership of this asset and would not be decommissioned as part of this Project.

Certain other infrastructure may be retained by mutual agreement with the landowner at the time of decommissioning, as they may be of value to future onsite activities. This may include tracks, site fencing, vegetative buffers and ancillary buildings.

However, unless specifically requested by the landowner, all above ground infrastructure would be removed as part of decommissioning. In addition, all below ground cabling buried up to 500 mm below ground level would be removed.

How will decommissioning proceed

Decommissioning is expected to proceed in the reverse order of construction:

- The solar arrays would be removed, including the foundation posts. Materials would be sorted and packaged for removal from the site for recycling or reuse where practicable.
- Site amenities and equipment would be removed including buildings, inverter modules and materials recycled or reused wherever possible.
- Posts and cabling would be removed and recycled.
- Fencing would be removed including small concrete footings.
- Gravel pavement materials would be recovered and reused as general fill in an appropriate location.
- Soil remediation treatments would be applied as required, for example, sodic soil would be treated as necessary with lime or gypsum. Areas subject to compaction would have the topsoil ripped to a depth suitable for seeding, if appropriate.
- Ground cover vegetation would be restored with disturbed areas seeded, in consultation with the landowners.

The decommissioning plan would reference the updated equivalent of:

- The Australian Soil and Land Survey Handbook (CSIRO, 2009).
- The Guidelines for Surveying Soil and Land Resources (CSIRO, 2008).
- The Land and Soil Capability Assessment Scheme: Second Approximation (OEH, 2012).

Traffic requirements would be similar in type but of shorter duration than that required for the construction phase.

Recycling commitments

Recycling is a commitment of the Project. This is captured in mitigation measure WM2, which states:

Solar panel arrays would be recycled at a facility with the capacity to recover 100% of the end – of – life solar PV modules and all associated material.

3.7. Land ownership, use and subdivision

The areas required for the operational solar farm will be leased for the life of the Project. The Applicant will lease the approximately 530 ha Development footprint area and the lease boundary will be registered on the title of the Subject land, under the Lease of Premises as set out in the Registrar General's Guidelines.

The existing land use of grazing is likely to continue within the operational areas of the solar farm, for the life of the Project. The options agreement with the landowners includes 'grazing principles' to manage this activity. This EIS provides further information on the management of grazing within the operation areas of the solar farm to ensure soil and water resources are protected as a primary objective. Grazing yield is a secondary objective for the life of the Project.

A formal subdivision is expected to be limited to delineating areas for TransGrid assets within the substation area of approximately 6 ha. Refer to Figure 3-8.

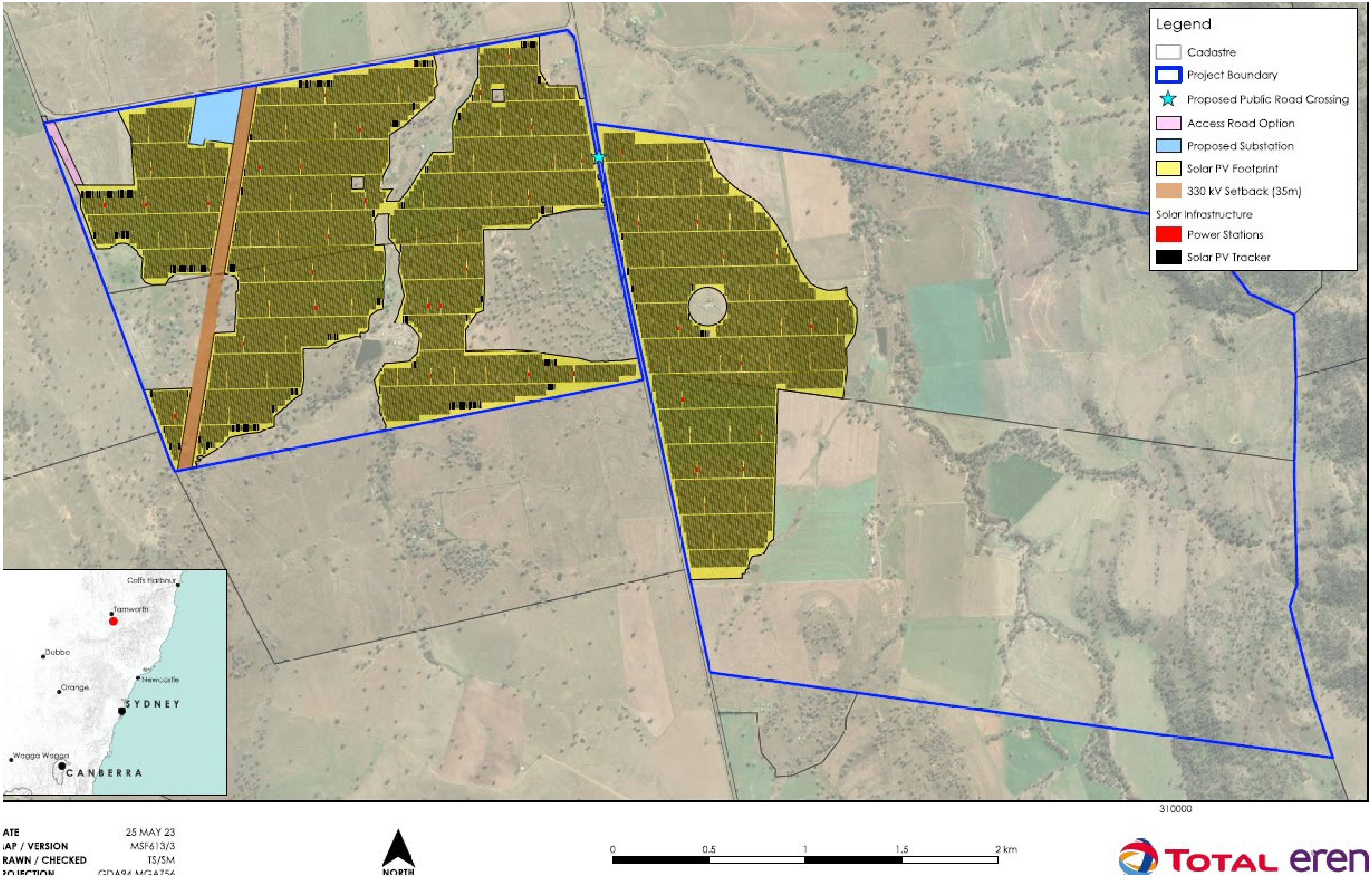


Figure 3-8 Subdivision will include approximately 6 ha for the substation assets

3.8. Project agreements

3.8.1. Voluntary planning agreements

The Applicant has discussed the Voluntary Planning Agreement (VPA) with the Tamworth Regional Council and will continue its consultation with the Council throughout the development, construction and operation of the Project.

3.8.2. Negotiated landowner agreements

Negotiated agreements are established where a receiver agrees to become 'Project-associated' and accept specific Project impacts. No receivers will be exposed to greater than low amenity impacts from the Middlebrook Solar Farm Project.

There are no negotiated landowner agreements in place for this Project.

4. STATUTORY CONTEXT

That statutory context of the proposed Middlebrook Solar Farm is set out below.

Table 4-1 Statutory requirements

Statutory requirements	Description
Power to grant approval	The Project requires development consent under the *Environmental Planning and Assessment Act 1979* (EP&A Act). The Project would have a capital investment cost of more than $30 million (approximately $800 million). Therefore, the Project is State Significant Development (SSD) according to section 20 Schedule 1 of the State Environmental Planning Policy (Planning Systems) 2021 (Planning Systems SEPP). Pursuant to section 4.5 of the EP&A Act, the Minister for Planning and Public Spaces is the consent authority for this Project.
Permissibility	The Project is defined as' electricity generating works', which is permitted with consent in the RU1 Primary Production zone under the Tamworth Regional Local Environmental Plan 2010 (Tamworth LEP).
Other approvals	**Relationship to Part 5 assessment** The Project requires connection to the electricity network. This will occur within the Development footprint. No offsite works are required to connect the Project to the grid. Connection to the grid is assessed in this EIS. Once constructed, the connection infrastructure will be gifted to TransGrid, to be managed as part of their network. To ensure that TransGrid can manage their own assets, a subdivision will be sought through Council post approval, to delineate areas required for permanent TransGrid assets within the Development footprint. TransGrid require approval under Part 5 of the EP&A Act to undertake activities. However, as the construction of connection infrastructure is required for the Project, this EIS considers the construction and subdivision of these assets. **Consistent approvals** Consent under Section 138 of the Roads Act for road upgrades to the public road network. **Other approvals *not required* for SSD projects.** An Aboriginal Heritage Impact Permit (AHIP) under Section 90 of the National Parks and Wildlife Act 1974. Controlled activity approval under Sections 89, 90 and 91 of the Water Management Act 2000. Applications for permits under Sections 201, 205 or 219 of the Fisheries Management Act 1994.

4.1. Pre-condition to exercising the power to grant approval

Statutory reference	Pre-condition	Relevance	Section in EIS
State Environmental Planning Policy (Transport and Infrastructure) 2021	Section 2.122 of the Transport and Infrastructure SEPP requires 'traffic generating development' to be referred to TfNSW.	The Project would result in the generation of fewer than 200 vehicles per hour during peak construction and operation, thus the Project is not considered traffic generating development.	Section 6.3
State Environmental Planning Policy (Biodiversity and Conservation) 2021	Chapter 3 of the Biodiversity and Conservation SEPP states, before a council may grant consent to a development application for consent to carry out development on land to which this Part applies, the council must be satisfied as to whether or not the land is a potential koala habitat. Chapter 4 applies to each LGA listed in Schedule 2 of this SEPP, Tamworth Regional LGA is listed.	The site contains potential Koala habitat and mitigates connectivity impacts for this species. No Koala were identified onsite during targeted surveys.	Section 6.5
Tamworth Regional Local Environmental Plan (LEP) 2010	Section 2.3 – Zone objectives and Land Use Table. The consent authority must have regard to the objectives for development in a zone when determining a development application in respect of land within the zone.	The Project is defined as' electricity generating works', which is permitted with consent in the RU1 Primary Production zone under the Tamworth LEP.	Section 2.2.1
	Section 5.21 – Flood planning, development consent must not be granted unless the consent authority is satisfied of certain flood matters such as compatibility of the development with flood	The site is not mapped as flood prone and the hydrological assessment demonstrates works will avoid higher flood hazard mapping	Section 7.1

Statutory reference	Pre-condition	Relevance	Section in EIS
	behaviour, the occupation and evacuation arrangements, risk to life and to the environment.		

4.2. Mandatory matters for considerations

Statutory reference	Mandatory consideration	Section in EIS
Consideration under the EP&A Act and EP&A Regulation		
Section 1.3	Relevant objects of the Act: • To promote the social and economic welfare of the community and a better environment by the proper management, development and conservation of the State's natural and other resources • To facilitate ecologically sustainable development by integrating relevant economic, environmental and social considerations in decision-making about environmental planning and assessment • To promote the orderly and economic use and development of land • To protect the environment, including the conservation of threatened and other species of native animals and plants, ecological communities and their habitats.	Section 8
Section 4.15	Relevant environmental planning instruments and any proposed instruments: • State Environmental Planning Policy (Transport and Infrastructure) 2021 • State Environmental Planning Policy (Planning Systems) 2021 • State Environmental Planning Policy (Resilience and Hazards) 2021 • State Environmental Planning Policy (Biodiversity and Conservation) 2021 • Tamworth LEP Relevant planning agreement or draft planning agreements: • NA Regulations	Section 4

Statutory reference	Mandatory consideration	Section in EIS
	• EP&A Regulation 2021 • Biodiversity Conservation Regulation 2017	
	Likely impacts of the development (environmental, social and economic)	Sections 2.4, 5 and 8
	Suitability of the site for development	Section 2.5.5
	Submissions made in accordance with the Act or regulations	Executive summary: Where to from here
	Public interest	Section 8
Considerations under other legislation		
Biodiversity Conservation Act 2016 –	The Minister for Planning is to consider the likely impact of the proposed development on biodiversity values as assessed in the biodiversity development assessment report. The Minister for Planning may (but is not required to) further consider under that Act the likely impact of the proposed development on biodiversity values.	Section 6.5
Mandatory relevant consideration under EPIs		
SEPP Resilience and Hazards – Section 6.9	Section 3.12 of the SEPP Resilience and Hazards requires the consent authority to consider the Project's preliminary hazard analysis (PHA). The Project includes a BESS which requires preparation of a PHA. Consideration must be given to current circulars or guidelines published by DPE as follows: • Hazard Industry Planning Advisory Paper No. 4 – Risk Criteria for Land Use and Safety Planning, • Hazard Industry Planning Advisory Paper No. 6 – Guidelines for Hazard Analysis, and • Multi-level Risk Assessment	Section 6.9
	Section 4.6 of the SEPP Resilience and Hazards requires the contamination and remediation of land to be considered by a consent authority, when determining a DA.	Section 6.9

Statutory reference	Mandatory consideration	Section in EIS
Tamworth LEP	• Objectives and land uses for zone RU1 Primary Production • Section 7.1 Earthworks	• Section 2.2.1 Strategic alignment with LEP provisions • Detailed consideration within Sections 6.4 Land compatibility, 7.1 Hydrology erosion and water resources and Soil 7.2

5. ENGAGEMENT

Engagement with stakeholders is an important part of developing a Project that responds to its social and environmental context, while also achieving community support and social license to operate. For solar farm projects, with their unique contribution to the broader environmental impacts of climate change and energy security, and their concentration of local benefits (economic stimulus and employment), engagement is particularly important to:

- Ensure impacts will be acceptable to the community, and
- Spread the benefits to all those who will be impacted.

5.1. Community engagement and consultation

This section summarises the detailed consultation activities undertaken to achieve these goals, considering community, specific Aboriginal community and government agency stakeholders. It identifies:

- Issues and views raised by stakeholders.
- Opportunities to influence the Project.
- Plans for future engagement.

5.1.1. Background

The Middlebrook Solar Farm Project is one of two proposed solar farms that have been the subject of engagement and passionate community discussions in and around Loomberah, New South Wales in recent years.

In 2022, a community-driven action group was formed in response to the other proposed solar farm proposed within the Loomberah area. Concerns were voiced by elected representatives in relation to the other solar farm at a face-to-face community engagement session. These concerns were shared in a highly publicised way, and this created a heightened level of awareness of solar farms in the area.

The concerns of this group, which includes residents in the greater Loomberah area, has driven a lot of the received feedback within the EIS assessments and the associated engagement activities.

Equally, the project's assessment and engagement program has responded to the growing level of support for renewable energy developments demonstrated by the broader Tamworth community.

The strongest representation of this support has been voiced by the Australian Parents for Climate Action group, which was formed in 2019 by six regional, rural and urban mums in four states and territories to progress the interests of the community in supporting improved environmental outcomes. This group, and many others engaged during the project planning to date have demonstrated strong support for renewable energy developments in the region.

The community engagement and consultation summary in this chapter outlines the steps taken to engage directly with both the issues and opportunities associated with the project through a broad range of engagement activities spanning from 2020 to May 2023.

The Applicant recognises the value community feedback has provided in refining the project's design, the way it can share benefits locally and how it can contribute to the broader aspirations of the region.

Scoping phase engagement

The Applicant commenced community engagement and consultation in October 2019. Over a seven-month period, The Applicant met with a wide variety of stakeholders including organisations, community groups and local community members to discuss the project with the nearby neighbours.

Meetings were held with Tamworth Regional Council, the Local Chamber of Commerce, and the Tamworth Regional Landcare Association to inform and discuss the project. The Applicant also contacted First Nations groups in the Loomberah/Tamworth area and invited their input, with some parties indicating interest in being RAPs for the Project. Nearby landowners were met and consulted with in person, and those who could not be met in person due to COVID-19 were contacted by phone where possible and sent a letter via post when not.

During the early stages of the Middlebrook Solar Farm consultation, the community feedback and submissions captured a sense of the perceived issues and opportunities of the project. The main issues and opportunities for ongoing discussion and consideration during the EIS included:

- General support of renewable energy and the opportunities it brings to the community.
- Opportunities for further involvement throughout the EIS period.
- Concerns in relation to dust during the construction period.
- Concern for visual amenity impact on near neighbours.

These issues and opportunities were explored further during the EIS engagement activities and the responses and adaptations applied to the Project are outlined in the section below.

Overall, the proponent and the NSW government recognised that a significant level of consultation, engagement and information sharing was required during the EIS development and beyond. As a result, the proponent delivered a communications and engagement program that represented genuine investment in engagement and consultation with the local community.

The Applicant continued community consultation for the Middlebrook Solar Farm EIS Report after submission of the Scoping Report in May 2019. Due to COVID-19 impacts, the Project was put on hold, and engagement and communication activities were paused until further notice.

Recommencement in 2023

Community consultation recommenced in March of 2023. From this point, the Applicant discussed the Project with stakeholders including near neighbours, targeted stakeholders and the broader community. A community information drop-in session was held at the West Diggers Club in Tamworth for the broader community while the project team and attended meetings with nearby residents to discuss the Project. A meeting was also held with the Tamworth Regional Council and members of the Total Eren team. Ongoing liaison via email, phone calls and meetings continued throughout the engagement period.

During the Middlebrook Solar Farm consultation, the community feedback and submissions captured a strong sense of the key issues/opportunities, building upon the sentiment gathered during pre-COVID-19 engagement activities. The main issues and opportunities highlighted throughout this period included:

- Concern regarding changes in land use and local character.
- Concerns regarding local visual impacts on neighbours.
- Support for local jobs and development of skills relevant to an energy transition.

- Pockets of concern in relation to a skill shortage in the area if local tradespeople were employed by the project.
- Concern regarding the development occurring within the Loomberah area, due to the community sentiment towards the other solar farm.
- The potential for the Project to support local skills development and environmental conservation activities.
- Concern regarding impacts on property prices and local businesses (in relation to Airbnb activities in the area).
- Support for increased revenue in the area due to the works related to the Solar Farm.

These opportunities and concerns were continuously explored throughout conversations and engagement activities facilitated throughout the EIS phase.

5.1.2. Key community stakeholders

A Project team led by NGH was responsible for developing and implementing the Engagement Action Plan (refer Appendix C) in collaboration with the Applicant. A detailed list of stakeholders was developed to inform the Engagement Action Plan. This analysis considered the level of impact, influence, and engagement approach, in keeping with the International Association of Public Participation (IAP2) Engagement Framework. The engagement approach adopted for each stakeholder group identified is summarised in Appendix C.

5.1.3. Overview of activities

The EIS period included a broad range of engagement activities aimed at broadening awareness of the Project, responding to concerns, working through issues and capturing opportunities. Importantly, the proponent committed to developing very detailed answers in response to local enquiries.

Given the level of interest in the Project, a wide range of communication and engagement activities were applied. The engagement program sought to reach out across the Loomberah and Tamworth community while continuing the conversation and issue specific discussions with near neighbours. The types of activities included:

- Drop-in information session
- Direct communications (letters, emails, phone calls)
- Newspaper advertisements
- Flyers advertising the information session pinned up around Loomberah.
- Property visits
- Use of online communication tools; website and survey
- Presentations, meetings and briefings.

The focus and timing of these activities is summarised below.

Table 5-1 Project stakeholder breakdown and engagement approach

Stakeholder Group	Details	Objectives and opportunities	Influence High, Medium or Low	Impact High, Medium or Low	Engagement approach
Host Landowner	3 involved landholders	• Develop a strong ongoing relationship. • Contribution to engagement planning and delivery • Contribution to the Project's progress, ability to provide local knowledge, advice and input.	H	H	Consult Involve Collaborate
Near neighbours	Neighbouring property owners	• Keep neighbours informed about the Project from early in the planning phase and undertake detailed consultation. • Identify impacts and mitigations – such as visual screening) through a collaborative process. • Discuss neighbour benefit sharing options directly. • Provide opportunities to raise issues and provide feedback.	H	H	Consult Involve Collaborate
Neighbours within 3 km	Property owners within 3 km	• Develop a strong partnership with the community. • Keep property owners informed about the Project from early in the planning phase. • Identify impacts and mitigations – such as visual screening) through a collaborative process. • Discuss benefit sharing options directly. • Provide opportunities to raise issues and provide feedback.	H	M	Consult Involve Collaborate
Local community Loomberah Tamworth	General community	• Develop an understanding of and opportunity to participate in the Project. • Provide opportunities to raise issues and provide feedback. • Discuss Community Benefit Sharing options.	M	M	Consult Involve
Tamworth Regional Council	Planning and Development team	• Develop and maintain a positive relationship. • Build on previous discussions. • Identify opportunities to support the local economy. • Identify and Leverage council communication channels.	H	M	Consult Involve Collaborate

Stakeholder Group	Details	Objectives and opportunities	Influence High, Medium or Low	Impact High, Medium or Low	Engagement approach
State MP	Hon. Kevin Anderson MP Member for Tamworth (Nationals)	• Introduce the Project and its details • Identify the members policies, concerns, and opportunities in relation to the Project.	M	M	Inform Consult
Federal MP	Hon. Barnaby Joyce MP Member for New England (Nationals)	• Introduce the Project and its details • Identify the members policies, concerns, and opportunities in relation to the Project.	M	M	Inform Consult
Traditional Owners – Indigenous community	Gomeroi and Kamilaori RAPs and Local Aboriginal Land Councils	• Engage with the relevant Local Aboriginal Land Council and Gomeroi and Kamilaori RAPs through the formal process (refer to Section 6.6) • Look for opportunities to contribute to the local story of country and contribute to the local Aboriginal Community. • Involve local community organisations in Community Benefit Sharing initiatives.	H	H	Consult Involve Collaborate
RFS/ Urban fire/emergency services	RFS and emergency services	• Liaise to ensure fire truck access is considered in the design, share information on how to manage fires in the solar farm and ensure the Project activities abide by safety and regulatory requirements.	M	M	Consult Involve
CASA	Civil Aviation Safety Authority	• Continue to liaise with CASA and seek approval letter to be submitted with EIS.	H	H	Inform Consult
Schools, TAFEs and Universities	University of Newcastle Department of Rural Health Tamworth Education Centre UNE Tamworth	• Ensure organisations are updated on education and vocational opportunities associated with the Project. • Identify relevant community benefit scheme opportunities.	L	L	Consult Involve

Stakeholder Group	Details	Objectives and opportunities	Influence High, Medium or Low	Impact High, Medium or Low	Engagement approach
	TAFE Tamworth Public, Private and Catholic Schools				
Business groups / industry stakeholders	• Tamworth Business Chamber • Biodiversity Conservation Trust (BCT) • National Parks and Wildlife – Somerton National Park, Wallabadah National Park, Crawney Pass National Park • Tamworth Agricultural Institute	• Work with the chamber to identify any local businesses that may be impacted by the Project (positive or negative) • Identify opportunities to develop or utilise local capability.	M	M	Consult Involve
Groups of solar farm objectors	• Loomberah NO Solar Action Group • RED4NE • Hills of Gold Preservation Committee	• Identify and address concerns as required. • Prepare responses to known concerns based on previous Projects. • Manage issues constructively and efficiently. • Ensure equity in the engagement (allow other stakeholders time to talk in information sessions).	M	L	Consult Involve

Stakeholder Group	Details	Objectives and opportunities	Influence High, Medium or Low	Impact High, Medium or Low	Engagement approach
Advocacy groups	• Tamworth Regional Landcare Association • Tamworth Parents and Friends for Climate Action	• Consider opportunities for partnerships and community events. • Consider advocacy opportunities. • Potential for partnerships.	M	M	Consult Involve
Community organisations	Apex, Rotary, Lions, Animal shelters, environmental groups, CWA, local sporting organisations, tourism groups	• Identify interests and opportunities to partner and contribute • Look for opportunities to address concerns in the CWA regarding impacts on productive land.	M	M	Consult Involve

Table 5-2 Overview of EIS phase engagement activities

Activity	Focus	Delivery timing and reach
Information sessions		
Drop-in Information Session Tamworth West Diggers Club	Explain the Project, outline the EIS process, discuss issues/opportunities, and engage with local stakeholders. Materials were produced in large format to discuss with people, Project Overviews and FAQ documents were available to take away and the team completed feedback forms capturing discussions and sentiment. People were also encouraged to complete the online survey by scanning a QR code to access it and then complete it in their own time.	• Thursday 27 April 2023 • Reach: Approximately 26 attendees and face-to-face conversations

Activity	Focus	Delivery timing and reach
Near neighbour consultation		
Letter drop to residents within 5 km of the site (Appendix C.1)	Provide an update on the Project, highlight opportunities to learn more, offer visual impact assessments, information to find the project website, respond to key issues and highlight benefit sharing opportunities.	• Distribution date: 22 March 2023 • Reach: 36 properties
Letters posted to residents within 3–5 km of the site (Appendix C.2)	Along with the letter drop that was completed in March, letters were sent via Australia post to neighbours living within 3–5 km of the proposed site. The letter invited neighbours to attend the drop-in information session, highlighted opportunities to learn more, respond to key issues and complete the survey.	• Distribution date: Thursday 6 April 2023 • Reach: 21 properties
Letters posted to residents within 0–3 km of the site (Appendix C.2)	Along with the letter drop that was completed in March, letters were sent via express post to near neighbours within 0–3 km of the proposed site. The letter invited neighbours to attend the drop-in information session, highlighted opportunities to learn more, respond to key issues and complete the survey.	• Distribution date: Thursday 6 April 2023 • Reach: 15 properties
Targeted phone calls/liaison	Phone calls were made to support discussions around: • coordinating visual assessments. • following up on emails (to understand more about concerns). • coordinating social impact assessment-focused interviews.	• More than 11 calls were made throughout the EIS engagement period.
Property visits for visual assessments	The LVIA consultant instructed, identified a list of priority properties to be considered for visual impact assessments. These properties were identified as having the highest potential impact through viewshed and associated modelling. These properties were prioritised for property visits, while residents within 5 km of the proposed site were encouraged to contact the Project team if they desired an assessment. Through discussions and follow-up phone calls, 10 of the nearest neighbours agreed to visual assessments and these properties were visited on Tuesday 11 April – Wednesday 12 April 2023. There were follow-up face-to-face VIA meetings offered for late May with the seven residents who participated in the VIA and requested photo montages.	Visit dates: • 11-12 April 2023 Number of visits: • 13 Follow-up meetings in late May. Reach: TBA

Activity	Focus	Delivery timing and reach
Property visits with social impact assessment	Members of NGH Communications & Engagement and Social Development teams visited several properties that were identified for the SIA. Through discussions and follow-up phone calls, three of the nearest neighbours agreed to social impact assessments and these properties were visited on Thursday 13 April 2023.	Visit dates: • 13 April 2023 Number of visits: • 3
Traditional media		
Public notices	Public notices (see Appendix C) were placed in the Northern Daily Leader ahead of the information sessions at the Tamworth West Diggers Club. To explain the Project and: • promote the information sessions. • encourage people to visit the Project website to read the Frequently Asked Questions, and complete the feedback survey. • encourage people to set up a meeting with the Project team.	• Thursday 20 April 2023
Flyers	Flyers (see Appendix C) were placed around the township of Loomberah ahead of the information sessions at the Tamworth West Diggers Club. • promote the information sessions. • encourage people to visit the Project website to read the Frequently Asked Questions, and complete the feedback survey. encourage people to set up a meeting with the Project team.	• Thursday 6 April 2023
Digital tools		
Website	Provide a central location for updates, information, an online survey, and a detailed list of frequently asked questions.	Available throughout the Scoping and EIS phase – and will be ongoing as the Project progresses
Online Survey	The online survey (See Appendix C) aimed at capturing thoughts on the Project in a way that informed the Social Impact Assessment and follow up engagement discussions. The survey was	The survey was live for six weeks

Activity	Focus	Delivery timing and reach
	promoted through the letters, emails, information sessions, stakeholder briefings, phone calls and both organic and paid Facebook campaigns.	between 22 March and 2 May. Results from the survey included: • 38 surveys completed • 74% of respondents strongly opposed the project • 13% opposed the project • 8% somewhat opposed the project • 5% strongly supported the project.
Stakeholder group presentations / briefings		
Tamworth Regional Council (TRC)	The Applicant and NGH held many discussions with TRC between February and May 2023. The initial discussions focused on providing an update on the Project, outline the EIS process, discussion of key issues and opportunities, and asking for feedback and ideas for benefit sharing and local industry engagement. Subsequent discussions were held to inform the opportunities for benefit sharing included in the EIS.	• Direct briefing held with Council Development Manager and Development Assessment Team Leader in April 2023. • Provided update on the Drop-in session in Late April. • Informed the council of the project progress and submission target.
Tamworth Business Chamber	The Project team provided an update on the Project, outline the EIS process, information on benefit sharing, details on how to complete the survey and provide feedback, and requested a meeting for a verbal briefing.	18 April 2034

Activity	Focus	Delivery timing and reach
Tamworth Local Aboriginal Land Council and local RAPS	Indigenous stakeholders were engaged through the Heritage and Social Impact Assessment process. The Heritage assessment engagement involved direct liaison with the LALC in addition to public advertising to request involvement of RAPs to inform the assessment process. A LALC representative was interviewed through the Social Impact Assessment process to discuss impacts and opportunities associated with the Project, including local Indigenous employment opportunities.	April–July 2022
Tamworth Regional Landcare Association	The Project team provided an update on the Project, outline the EIS process, information on benefit sharing, details on how to complete the survey and provide feedback, and requested a meeting for a verbal briefing.	18 April 2023
Tamworth Parents and Friends for Climate Action	The Project team provided an update on the Project, outline the EIS process, information on benefit sharing, details on how to complete the survey and provide feedback, and requested a meeting for a verbal briefing.	18 April 2023
<u>Educational Institutions:</u> TAFE NSW - Tamworth UNE Tamworth University of Newcastle - Tamworth (Department of Rural Health) Woolomin Public School Farrer Memorial Agricultural High School Carinya Christian School Liberty College Timbunburi Public School Dungowan Public School Duri Public School	The Project team provided an update on the Project, outline the EIS process, information on benefit sharing, details on how to complete the survey and provide feedback.	18 April 2023

Activity	Focus	Delivery timing and reach
<u>Local Community Groups:</u> Lions Club Rotary Club - Tamworth West Loomberah Hall Committee Tamworth Clay Target Club	The Project team provided an update on the Project, outline the EIS process, information on benefit sharing, details on how to complete the survey and provide feedback, and requested a meeting for a verbal briefing.	18 April 2023
Tamworth Local Aboriginal Land Council (LALC)	The Project team provided an update on the Project, outline the EIS process, information on benefit sharing, details on how to complete the survey and provide feedback. Project Team offered to meet up with local Elders and wider LALC members to discuss the Project further.	18 April 2023
Tamworth NAIDOC Group	The Project team provided an update on the Project, outline the EIS process, information on benefit sharing, details on how to complete the survey and provide feedback. The Project team offered to meet up with local Elders and NAIDOC Group members to discuss the Project further.	18 April 2023
Federal MP, Member for Tamworth	The Project team provided a brief update on the Project and offered to brief Barnaby Joyce MP in person. Supporting information was provided by email to the electoral office.	11 April 2023
State MP, Member for Tamworth	The Project team provided a brief update on the Project and offered to brief Kevin Anderson MP in person. Supporting information was provided by email to the electoral office.	11 April 2023

5.1.4. Summary of findings

Overall sentiment

The engagement activities undertaken throughout the EIS phase demonstrated that there is localised concern regarding the Project that is balanced by a high level of support and encouragement from sections of the broader community.

The strong concerns expressed by near neighbours were primarily focused on the following topics:

- Change of land use and the perception that the soil quality is too high to host a solar farm.
- Visual changes that a solar farm would bring, including changes to the character of the area.
- Concern of potential impacts (particularly visual impacts) on property values
- Concern of perceived loss of agricultural outputs
- Concern of impacts on neighbour's insurance premiums
- Concerns regarding dust and heavy vehicle movement during construction.

Comments from two respondents in the online survey flagged that they felt positively towards the Project and felt that the noise that the Loomberah No Solar Action Group was creating was speaking on behalf of the whole community and drowning out other opinions. Support in relation to the Project was based on the following topics:

- Generation of renewable energy.
- Future-proofing the community against global warming.
- Job creation within the area.

Loomberah No Solar Action Group

The Project team has interfaced with the Loomberah No Solar Action Group throughout the EIS stages. Approximately 10-15 members of the Loomberah No Solar Action Group attended the Community Drop-in Session held at the Tamworth Wests Diggers Club in April.

Members of the group mentioned that the Project would not affect them if it were to go ahead, however, they had major concerns that the approval of one solar farm in the Loomberah area would mean that it would be easier for the second proposed development to receive approval.

All attending members of the Loomberah No Solar Action Group were very forthright in their opposition to the proposed Middlebrook Solar Farm, primarily due to the changes in the character and fabric of the local landscape and loss of perceived prime agricultural land that the Project would bring.

Numerous members of the organisation stated that they were against solar energy as a concept as a whole and did not want to see it within Loomberah. Other members stated that they supported renewable energy but did not feel that Loomberah was an appropriate location for a solar farm due to operating farmlands and pristine views.

Many of the attending action group members said they were attending the community drop-in session as they felt that they needed to be consistent in their views and actions by standing against this Project given their vocal opposition to the other proposed solar farm.

Members of the group mentioned that the Project would not affect them if it were to go ahead, however, they had major concerns that the approval of one solar farm in the Loomberah area would mean that it would be easier for the second proposed development to receive approval.

Online survey feedback

Communication tools such as posted letters, electronic emails, a face-to-face information session and stakeholder briefings resulted in 38 responses to the online survey for the social impact assessment.

The survey saw a strong response in relation to attitudes towards the project due to the community sentiment and input from action group members, who banded together in relation to the other solar farm proposed in the area. 74% of respondents strongly opposed the project, 13% opposed the project, 8% somewhat opposed the project and 5% strongly supported the project.

The survey results indicate that a large majority of the sentiment towards the project is not directly aimed toward Middlebrook Solar Farm itself, but rather the idea of renewable energy development in the region overall.

A detailed breakdown of the survey findings is included in the Social Impact Assessment in section 6.8.

5.1.5. Summary of key issues and opportunities

The Project team responded to many community queries and views on the Project. These issues varied across topics, and details regarding these concerns can be found below:

Table 5-3 Key community Project issues and opportunities

Topic	Strategic category (as per EIS requirement)	Details and project team responses
Loss of rural character	Economic, environmental, and social impacts of the Project	The vast majority of objections to the Project centred around the loss of the 'rural character' that a solar farm in this area may create. Members of the Loomberah Action Group were of the opinion that a solar farm should not be placed in a pristine area renowned for rolling paddocks. Members of the group said they had moved to the area to take advantage of the views and character of the landscape – all if which they feel would be taken away by the addition of a solar farm.
Cumulative effects of two proposed Solar Farms in close proximity	Economic, environmental, and social impacts of the Project	Feedback at the Community Drop-in Session revolved around the cumulative impact of having two separate proposed solar farms in such proximity. The community members in attendance expressed concerns regarding the overall loss of character in the broader locality as well as the impact the proposed solar farms were having on the mental health of some local residents.
Impacts on Agricultural Land	Economic, environmental, and social impacts of the Project	The Loomberah Action Group and near neighbours expressed concerns regarding the change of land use for the site and expressed a view that the site was comprised of quality soil that should be held for agricultural purposes. Members of the Action Group said they knew the area well and refuted the current land classifications in that area. Local residents also expressed concerns about any planned agri-solar operations on the land, saying that the land would be covered in weeds.
Health and wellbeing	Social	Members of the local community described that they were 'feeling under attack' due to the two proposed solar farms being in close proximity. Members of the local community had concerns about neighbours experiencing anxiety and deteriorating mental health as a result of having two Projects within the Loomberah area.

Topic	Strategic category (as per EIS requirement)	Details and project team responses
Visual impacts	Economic, environmental, and social impacts of the Project	Near neighbours and members of the Loomberah Action Group expressed strong views on the visual impact of the Project. The concern centred around the change the Project would bring to the area, including the close nature of the site to some of the nearby residents. As noted above, the Project team recognised the importance of this issue and engaged directly with near neighbours to complete visual assessments and residents within 5 km were offered the opportunity to book a visual assessment. Nine visual impact assessments were completed.
The site selection	Justification and evaluation of the Project as a whole	Near neighbours questioned why the Proponent selected the Loomberah site and continued to raise concerns about the removal of prime agricultural land and the visual impact on near neighbours. The Project team explained in detail why the site was selected which included grid capacity, site location, limited sensitive receivers, the ability to mitigate visual impacts effectively and appropriate land classification. This communication was also detailed in Project engagement materials which were circulated via email, postal mail, phone calls and at the May information session.
Engagement	Social Impacts of the Project	Concerns were raised by near neighbours about the engagement process of the project. Near neighbours said they had been unable to contact the Proponent for the three years following the Scoping Report. The neighbours were very concerned that their phone calls and emails were not returned during this period. This lack of engagement during the time the project was on hold resulted in a heightened sense of anxiety surrounding the project.
Construction – noise and dust	Economic, environmental, and social impacts of the Project	Near neighbours expressed concerns about the effect the Project would have during construction – particularly relating to dust and increased truck movement. One near neighbour operates a Bed and Breakfast adjacent to the site and expressed concerns about the impact of increased traffic, noise, and dust on his business. Other near neighbours expressed concern regarding large trucks sharing Middlebrook Road with their children on bikes and horses being in the area.
Property Values and effect on business	Economic and social impacts of the Project	Near neighbours and members of the Loomberah Action Group expressed concern at the effect the Project would have on land valuation. A number of local businesses, including Bed and

Topic	Strategic category (as per EIS requirement)	Details and project team responses
		Breakfast and Airbnb hosts, also expressed concern about the effect the Project would have on their businesses. Both sets of concern revolved around the loss of character and visual impacts.

5.1.6. Future engagement

As the Project progresses, the following engagement is planned for the Project commensurate with the findings of engagement carried out during the preparation of this EIS. Please refer to the SIA for further engagement needs, impacts and benefits.

Table 5-4 Planned future engagement activities

Group	Construction	Operation
Stakeholders	Near neighbours, TRC, Tamworth Chamber, Loomberah Action Group, LALC,	Near neighbours, TRC, Tamworth Chamber, Loomberah Action Group, LALC,
Key actions	• The Applicant to provide updates to near neighbours on the results of visual impact assessments conducted on their property. • The Applicant to engage with near neighbours in relation to planned traffic arrangements, construction activities and impact mitigations. • The Applicant to provide detailed engagement with neighbours in relation to visual impact mitigations, including proactive planting of screening vegetation. • The Applicant to engage with the LALC and other groups regarding local industry participation opportunities. • The Applicant to provide updates via email, letters (to a 3 km radius) and public notices regarding construction	• The Applicant to continue to engage with near neighbours with key details regarding operation details of the site. • The Applicant to continue with the local community and key community groups such to highlight benefits and key milestones during operation. • The Applicant to engage via email and posted letters to residents within a 3 km radius should any maintenance work be carried out during operation and mitigate any impacts that may arise. • Continue to foster strong relationships with the community via the establishment of community partnerships and industry participation.

Group	Construction	Operation
	activities, employment opportunities and expected impacts (traffic, noise, dust). • Delivery of updates to interested stakeholder groups such as near neighbours, Loomberah Action Group, Rotary and Tamworth Regional Council. • Ongoing engagement to finalise benefit-sharing arrangements.	• Proactively communicate decommissioning strategy (including damaged panels) to interested stakeholder groups and the wider community.
Consistency with 'Undertaking Engagement Guidelines for State Significant Projects' (DPIE, 2021)	• Proactive, transparent and collaborative engagement, spanning from informing on construction activities to involving and collaborating through benefit-sharing opportunities. • The Applicant will also gather ideas from locals regarding opportunities to work with local businesses and minimise construction impacts.	• The Applicant will continue to actively engage during the operation and decommissioning stage of the Project in line with the conditions of approval. • The Applicant will also continue to foster strong relationships with key stakeholders and further liaise with Tamworth Regional Council regarding the implementation of benefit sharing within the local community.
Monitoring of effectiveness for community participation	• The Applicant will continue to liaise with stakeholders and monitor community sentiment and resolve key issues and opportunities. • Explain to stakeholders at post-approval how community views were considered when reaching decisions. • The Applicant will utilise local knowledge and expertise with suppliers and contractors. • The Applicant will ensure they use appropriate engagement techniques when targeting specific groups, for example, Aboriginal and Torres Strait Islander groups where engagement should be planned and undertaken by Indigenous Engagement specialists.	• The Applicant will continue to proactively engage through the operation and decommissioning stage to ensure the local community and interested stakeholder groups are well-informed on key elements of the Project. • Proactive engagement will make it easy for the community to access information.

5.2. Aboriginal community engagement

5.2.1. Pre-COVID-19 engagement

Consultation with Aboriginal stakeholders was undertaken in accordance with clause *80C of the National Parks and Wildlife Amendment (Aboriginal Objects and Aboriginal Places) Regulation 2010* following the consultation steps outlined in the guide provided by OEH. The guide outlines a four-stage process of consultation as follows:

- Stage 1 – Notification of project. Project and registration of interest.
- Stage 2 – Presentation of information about the proposed project.
- Stage 3 – Gathering information about cultural significance.
- Stage 4 – Review of draft cultural heritage assessment report.

The full list of consultation steps, including those groups and individuals that were contacted and a consultation log is provided in the Aboriginal Cultural Heritage Assessment (ACHA) which is provided as Appendix D.7 of the EIS. A summary of actions carried out in following these stages, is as follows.

Stage 1. Letters outlining the development Project and the need to carry out an ACHAR were sent to the Tamworth Local Aboriginal Land Councils (LALCs) and various statutory authorities including BCD, as identified under the OEH guide. An advertisement was placed in the local newspaper, the *Northern Daily Leader* on the 20 March 2019 seeking registrations of interest from Aboriginal people and organisations. In each instance, the closing date for submission was 14 days from receipt of the letter.

Five Aboriginal groups registered their interest in the Project. These groups were:

- Tamworth LALC.
- Galamaay Cultural Consultants.
- Gunjeewong Cultural Heritage Corporation.
- Corroboree Aboriginal Corporation.
- DFTV Enterprises.

No other party registered their interest.

Stage 2. On 4 December 2019, an *Assessment Methodology* document for the Project was sent to the Tamworth LALC and all other Registered Aboriginal Parties (RAPs) and individuals as listed above. This document provided details of the background to the Project, a summary of previous archaeological surveys and the proposed heritage assessment methodology for the Project. The document invited comments regarding the proposed methodology and sought any information regarding known Aboriginal cultural significance values associated with the subject area and/or any Aboriginal objects contained therein. A minimum of 28 days was allowed for a response to the document. No comments were received on the methodology from the registered parties; however, all expressed an interest in participating in fieldwork.

Stage 3. The *Assessment Methodology* outlined in Stage 2 included a written request to provide any information that may be relevant to the cultural heritage assessment of the study area. It was noted that sensitive information would be treated as confidential. No response regarding cultural information was received in response to the methodology.

The fieldwork was organised, and the five registered groups were asked to participate in the fieldwork. The fieldwork was carried out between 16 and 27 August 2020 by an archaeologist from NGH with local Aboriginal representatives of the groups that registered an interest.

Stage 4 In early October 2020, a draft version of the ACHA had been prepared however, the Project was then placed on hold.

5.2.2. Recommencement in 2023

NGH were re-engaged in 2023 to finalise the ACHA. No changes to the legislative context, or field work methods or requirement for further survey was identified. The proposed Development footprint had been much reduced from that assessed in the draft ACHA. The assessment report was updated to reflect the reduced Development footprint with no changes to the mitigation strategies for artefacts which could not be avoided.

The updated ACHA was forwarded to the RAPs who originally registered for the Project. The review period was completed on 14 June 2023 and the ACHA reflecting any comments is appended to this EIS; Appendix D.5 and summarised in Section 6.6.

Additional consultation is occurring concurrent with the exhibition of the EIS with additional RAPs who registered after the Project was recommenced.

5.3. Agency engagement

5.3.1. Agency consultation

As part of preparing the EIS for the SSD development application, the SEARs require that the relevant State or Government authorities, infrastructure and service providers, community groups, affected landowners, exploration licence holders, quarry operators and mineral title holders be consulted.

Table 5-5 summarises the method of consultation, issues raised where they are addressed in this EIS. The SEARS, including a cross reference table showing where each specific matter is provided in the EIS, is included in Appendix A..

Table 5-5 Agency consultation summary

Agency	Matter	Details
Department of Planning and Environment (DPE)	Secretary's Environmental Assessment Requirements (SEARs)	May 2020 An extension to the SEARs was granted on 29 May 2020 (stating further consultation with DPE is required if the EIS is not lodged within 2 years of this date)
Transport for NSW	Traffic assessment	June – August 2020 TfNSW were contacted via phone and email. Comments were provided via TfNSW Officers within an email dated 28 August 2020 regarding • New England Highway usage and appropriate turn treatments for the intersection of New England Highway and Middlebrook Road.

Agency	Matter	Details
		• Requirements for guardrail adjustments in accordance with the Austroads Guide. • Requirements for A Construction Traffic Management Plan. • Agreement that a BAL treatment was acceptable within the existing road reserve. All comments are addressed in the Traffic Assessment, provided as Appendix D.3, and further consultation details are provided in its appendices.
Biodiversity Conservation Division (BCD)	Draft Land Category Assessment (LCA)	BCD (Acting Principal Project Manager; North West Region) were contacted regarding the draft LCA on 6 April 2023. Updates to the LCA based on BCD comments (received 27 April 2023) are now included and have followed through into the BDAR, in terms of areas excluded from the biodiversity assessment. This includes: • More refined mapping of Category 1 Land • Consideration of all paddock tress and patches of native vegetation as Category 2 Land. • Include data within the Biodiversity Development Assessment Report (BDAR)
	Biodiversity Development Assessment Report (BDAR)	BCD (Acting Principal Project Manager; North West Region) were provided a summary of the assessment of Serious and Irreversible Impact (SAII) candidates 31 May 2023, in advance of formal lodgement of the BDAR. Project refinements to reduce impacts on SAII candidates were outlined and a summary of the BDAR, including SAII and Commonwealth referral matters conclusions, was provided. BCD provided email confirmation on 19 June 2023, that the current approach to assumed presence of two species and impacts of the Middlebrook Road upgrade is sufficient at this stage to exhibit the BDAR but that these limitations should be clearly stated in the BDAR and commitments to address these matters should be included. Appendix C.2 includes email verification of this.
NSW Heritage	Registered Aboriginal Parties (RAPs)	Advice received from NSW Heritage was that due to the delay prior to the Project recommencing in February 2023, re-advertising for RAPs would be appropriate in addition to continued consultation with the existing RAPs for this Project. This additional Aboriginal consultation is continuing concurrent with the EIS exhibition, and this is considered appropriate as: • The Aboriginal Cultural Heritage Consultation Requirements for Proponents guidelines (which are specifically noted in the SEARs for this project in relation to Heritage and Aboriginal community consultation) do not specify a time requirement for consultation with RAPs to be considered continuous. Therefore, this additional Aboriginal community consultation is considered above

Agency	Matter	Details
		and beyond the required consultation already undertaken to date for this Project. • All original RAPs have had 28 days to comment on the ACHA provided in this EIS (the mandatory timeframe for comments from the original RAPs lapsed following 14 June 2023). • The final version of the ACHA , including updated additional consultation, will be provided as part of the Submissions reporting, where all public, agency and additional RAP comments can be included. NSW Heritage provided email confirmation on 19 June 2023 that this approach is accepted given the specific circumstances of this Project, provided in Appendix C.2.
Tamworth Regional Council	Voluntary Planning Agreement (VPA)	The Applicant contacted Council to confirm: • *VPA and benefit sharing commitments.* On 20 June 2023, Council responded that they would defer their formal position on these matters until a DA is lodged and they conduct a formal review (email provided in Appendix C.2).
	Project update	The Applicant met with members of the Tamworth Regional Council on 6 April 2023 and discussed the Project. Points discussed included project background, the outline of the project and consultation events, and expectation in respect to VPA.
	Traffic assessment	August 2020 Council was contacted via phone and email. Council officers visited the site and commented on: • Middlebrook Road remaining unsealed with a 6.5 m recommended carriageway; supported. • Noted local dust issues. • Requirements for signage on Middlebrook Road at the one lane bridge. • Supported road dilapidation surveys. All comments are addressed in the Traffic Assessment, provided as Appendix D.3, and further consultation details are provided in its appendices. Regarding the connecting access across Middlebrook Road (connecting the east and western portions of the Project), no specific comments have been made about this but is has been reviewed by Council and Council's letter is included within the Traffic Assessment. When contacted in June 2023, Council responded that they would defer any further advice on road upgrade requirements until a DA is lodged and they conduct a formal review (email provided in Appendix C.2).
TransGrid	Connection capacity of the grid with	Dates Since March 2020 – Ongoing Consultation

Agency	Matter	Details
	respect to Middlebrook Solar Farm Project	TransGrid have indicated in their Preliminary and Detailed Response that it may be possible to connect a ~500 MW AC output solar farm at the proposed location. TransGrid have issued the Network Modelling Study Pack which allows grid consultants to start the grid studies. These studies will determine compliance of the plant or remediation / upgrade works required to satisfy AEMO and TransGrid's technical requirements.
	Connection works	May 2023 As the Project will impact TransGrid assets, TransGrid have provided their consent for the EIS to be submitted.

6. ASSESSMENT OF KEY IMPACTS

The assessment of environmental and social impacts is provided in Sections 6 and 7 of this EIS. Generally, the order follows those issues of most interest or concern to near neighbours:

- Visual impacts
- Noise impacts
- Traffic impacts
- Land use compatibility; agriculture and other activities
- Biodiversity
- Aboriginal and historic heritage impacts
- Social impacts
- Hazards; battery hazards and other risks.

Section 7 contains supporting information and issues more readily addressed by standard mitigation protocols; Hydrology and water, soils, air quality, resources and waste. It concludes with consideration of the cumulative impacts between the Project and other large projects which may act to exacerbate impacts.

The assessment has been directed by the Project-specific Planning Secretary's Environmental Assessment Requirements (provided with cross reference table in Appendix A). Each section below sets out the specific:

Assessment approach	Where applicable, specialist assessments are appended in full in Appendix D.
Existing environment	Which forms a base line to consider existing values and sensitivities
Potential impacts	That may result during the construction, operation and decommissioning of the Project
Key uncertainties	And how they have been addressed
Mitigation measures	Commitments of the Project, to manage identified impacts, should it be approved.

6.1. Visual impact assessment

Moir Landscape Architecture prepared a Landscape and Visual Impact Assessment for the Project, provided in full in Appendix D.1 and summarised below.

It includes consideration both a landscape character assessment and a visual impact assessment, Landscape character assessment is the process for determining the overall impact of a project on an area's character and sense of place including what people think and feel about it and how society values it. Visual impact assessment is the process for determining the day-to-day visual effects of a project on people's views (what people see at a place, when they are there) from the private and public domain. The likely impacts of a large-scale solar energy development can only be determined by understanding the sensitivity of an area or view to change and the magnitude of a Project in that area or view. It also includes consideration of glare.

The *Large-Scale Solar Energy Guideline* (NSW DPIE, 2022) and the accompanying *Technical Supplement – Landscape and Visual Impact Assessment*, released in August 2022 have been applied, as required.

6.1.1. Assessment approach

Landscape charter and visual assessment

Field work, community consultation, terrain modelling and photomontages were undertaken to establish the existing landscape character of the area and its sensitivity. The purpose of community consultation is to establish key landscape features, areas of scenic quality and key public viewpoints valued by the community. The preliminary assessment stage is used to identify viewpoints in the public and private domain that require a detailed assessment.

The preliminary assessment includes:

- Application of Preliminary Assessment Tools
- Viewshed mapping, to understand areas of the site that would be visible from surrounding lands.

The detailed assessment stage is used to undertake a comprehensive assessment of the visual impacts on viewpoints identified through the preliminary assessment. This stage is undertaken through five stages:

Stage 1: Site inspections

Stage 2: Refine and classify viewpoints.

Stage 3: Determine the visual magnitude.

Stage 4: Determine the visual sensitivity.

Stage 5: Determine the overall visual impact for each viewpoint.

Photomontages have been produced to portray the look of the Project from key locations.

In addition to the proposed PV arrays, the associated infrastructure has the potential to contrast with the existing visual landscape. This has been assessed as 'associated infrastructure'.

Terms

The detailed assessment methodology is provided in full in the Landscape and Visual Impact Assessment for the Project, Appendix D.1. Key concepts used as required by the *Large-Scale*

Solar Energy Guideline (NSW DPIE, 2022) and the accompanying *Technical Supplement – Landscape and Visual Impact Assessment*, include:

- *Visual sensitivity*

  Visual sensitivity combines the *viewer sensitivity* with the *scenic quality* of the view. It takes into account the number of viewers and duration of a view, as well as the activity taking place at the viewing location. Locations from which a view would potentially be seen for a longer duration, where there are higher numbers of potential viewers and where visual amenity is important to viewers, would be regarded as having a higher visual sensitivity.

- *Magnitude of change*

  The Project's 'apparent size determined by the volume of the horizontal and vertical fields of view occupied' (p 19, DPE 2022). This new method of assessing magnitude of change is standardised and can quantify impacts at a location. These are shown pictorially in the chapter below.

- *Assigning impact levels*

  The impact level is then determined for each view by combining the sensitivity and magnitude according to the matrix presented in Table 6-3 of *Technical Supplement – Landscape and Visual Assessment*, DPE 2022 (Table 9, p.28, DPE 2022).

Glare and glint

The glint and glare assessments were undertaken using Solar Glare Hazard Analysis Tool (SGHAT) developed by Sandia National Laboratories. The SGHAT is used to evaluate glare resulting from solar farms at different receivers, based on proximity, orientation and specifications of the PV modules. This tool is recognised by the Australian Government Civil Aviation Safety Authority (CASA).

SGHAT is used to indicate the nature of glare that can be expected at each potential receiver. Glare can be broadly classified into three categories and presented by the following three colours:

- Green Glare: Low potential for temporary after-image
- Yellow Glare: Potential for temporary after-image
- Red Glare: Retinal burn, not expected for PV.

Terms

For the assessment of glare risk, key concepts include:

Specular reflection

The law of reflection is that an angle of incidence (entrance angle of the sun's ray) is equal to the angle of reflection (exit angle of the potential glare). Assuming specular reflection (the mirror-like reflection of light from a smooth surface) and excluding all other factors, the geometric possibility of glare can be accurately predicted.

Ocular impact

An ocular impact is an impact on the eye or on vision. Ocular impact from solar glare can be quantified 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).

Photovoltaic modules do not focus reflected sunlight and therefore, it is not possible for photovoltaic modules to produce retinal burn (red glare). Yellow and green glare categories are risk ratings. They identify a *potential for glare*, rather than an actual glare effect. There are a range of atmospheric conditions that influence the potential for glare, including clouds, dust, smoke, rain as well as distance.

6.1.2. Existing environment

Landscape characteristics

Within the Assessment area, the landform is characterised by flat or gently sloping plains that become more undulating within the immediate surrounds, most notably to the east (Figure 6-1) where hills range from 500–850 m in elevation (DPIE, 2023). Flat areas are generally cleared and modified to support agricultural activities, with remnant vegetation situated in areas of increasing topographic relief. A network of creeks and gullies, including Spring Creek, Algona Creek and Banyandah Creek are located within Project Area Potential impacts (Figure 6-2)

Figure 6-1 View towards undulating areas to the east of the Subject site

Figure 6-2 Local creek traversing agricultural land with a view to distant hills and ranges

The Project surrounds are generally located across agricultural areas at low to mid elevation that are characterised by scattered vegetation, typically box woodlands on clay or loam soils. Land within 5 km of the Project has been predominantly cleared of remnant vegetation to support agricultural activities, however this excluding more undulating areas and along major riparian corridors. The majority of the landscape is characterised as modified pastures used for livestock grazing and dryland cropping, with areas of native vegetation and grazing.

The New England Highway is located approximately 3.8 km west of the Project and is the main highway connecting to Tamworth. Middlebrook Road connects to the New England Highway and runs between the Project in a north-south direction, and then east-west along the northern boundary eventually meeting with the Highway to the west. The nearest major settlement is the city of Tamworth, which is located approximately 22 km north of the Project. Smaller settlements in the vicinity include the heritage-listed Goonoo Goonoo Station located within 5 km to the west of the Project Area. Goonoo Goonoo Station is located approximately 3.5 km west of the Project. It is listed as a Local General Heritage Item I125

The Peel River is the closest major watercourse and runs in a north-south direction approximately 12 km to the west of the Project. Goonoo Goonoo Creek runs generally north south approximately 3.5 km west of the Project. Other significant landscape features include the ridgelines to the east of the Project which form a visual backdrop to views, particularly from the New England Highway.

Landscape condition

The Assessment area has predominantly been heavily modified for cropping and grazing. Vegetation has been predominantly cleared to support grazing and agricultural activities. Vegetation is located along creek lines, road corridors and around dwellings.

The New England Highway is located west of the Project. Other major transport routes include Middlebrook Road and Marsden Park Road.

Several man-made dams occur within the Assessment area. These are used to provide water for pastoral activities.

A number of rural residential dwellings are scattered around the Project, clustered primarily along New England Highway. Three (3) dwellings are located within the Subject Land and all three dwellings are associated with the project.

Land use

All land within the Subject land is categorised as RU1- Primary Production under the Tamworth Regional LEP 2010. Land use within the 5 km of the Project Area is comprised of grazing modified pastures or dryland cropping where native vegetation has been cleared to support modified pastures and cropping for livestock foraging. The Project will be located on land dedicated to grazing pastures or dryland cropping.

Areas to the east are associated with the partially vegetated hills are designated as minimal use, due to the steep undulating terrain.

Large scale development in the area

In accordance with the *Cumulative Impact Assessment Guidelines* (DPE, 2021), the area chosen to assess relevant cumulative impacts from other developments should not be unnecessarily large or include areas where the cumulative impacts are likely to be negligible, relative to the baseline condition of the relevant Project.

The Project is located outside the New England Renewable Energy Zone, however, the occurrence of large-scale renewable energy projects within a region has the potential to alter the perception of the overall landscape character irrespective of being viewed in a single viewshed as these projects could become part of the existing landscape. It is important to determine whether the effect of multiple projects and other major infrastructure within the region would combine to become the dominant visual element, altering the perception of the general landscape character.

The closest of these is the Tamworth BESS which is located approximately 17 km north of the Project. Following this, the Calala Battery Energy Storage System is located approximately 28 km north of the Project. Due to distance and scale of these Projects these Projects are unlikely to be viewed in combination with the Project. The remainder of the proposed, in operation or approved renewable energy projects are located in excess of 30 km from the Project and are unlikely to have the potential to be viewed in combination with the Project.

Community values

Landscape values are highly subjective and can differ depending on location, local context and place attachment. The results of specific questions posed during engagement activities with the local community assisted in the identifying key areas of concern and ensuring a comprehensive assessment taking into account landscape values held by the community. The common themes in the responses are set out below, along with the survey results breakdown and key landscape features of interest.

Farming/Agricultural Land:

- *Bushland and farmland.*
- *Open countryside of Natural views and farming land.*
- *Driving through the countryside looking at productive farm/grazing land, Seeing stock and farming operation's working.*
- *This is highly valuable grazing and farming country.*
- *Farmland, lots of locals live out here to escape dense population and industrial sites, cropped farmland and grazed fields are our choice of the best views.*
- *open clear and clean spaces, filled with agricultural productivity.*
- *Uninterrupted views of agricultural land.*
- *Driving along Goonoo Road and looking at all the farmland is the best outlook in the area*.

Rural/natural landscape:

- *The natural landscape throughout Loomberah.*
- *Rural farming / bush land outlooks.*
- *The farming areas around Loomberah, Kingswood, Kootingal, Nemingha, Piallamore etc the mountains, and untouched are the beauty I haven't seen anywhere else in Australia.*
- *The rural outlook from any direction around Tamworth.*
- *Live stock, crops, dams, rivers, minimal infrastructure.*

Mountains, valleys, plains and hills:

- *Dungowan Valley.*
- *The slopes and plains and valleys in our area.*
- *Mountains.*
- *The Tamworth area is surrounded by beautiful hilly views visible from all over the LGA.*
- *The beautiful Peel Valley and mountains from Nundle to Barbara.*
- *The rolling hills and outlook.*
- *Beautiful rolling hills, fertile land along the flats. Everywhere is beautiful.*

Views:

- *The view up Monteray Road Valley. The view from the top of "Gunagulla".*
- *Tamworth lookout*
- *From many of the properties along Marsden Park, there is a beautiful view that ranges from Moonbi Hill to Nundle/Hanging Rock. This view encompasses local properties fields that is utilised for crop and beef farming.*

Loomerah:

- *The whole area of Loomberah is a beautiful landscape with many spots to enjoy the scenic views.*
- *Valley views of the peel. I feel the Loomberah farmlands are the best and most prosperous in the Tamworth region.*
- *The uninterrupted views from the valley from the peak of the Middlebrook Road towards Tamworth.*
- *The view from Ingalala is one of the best in the region.*

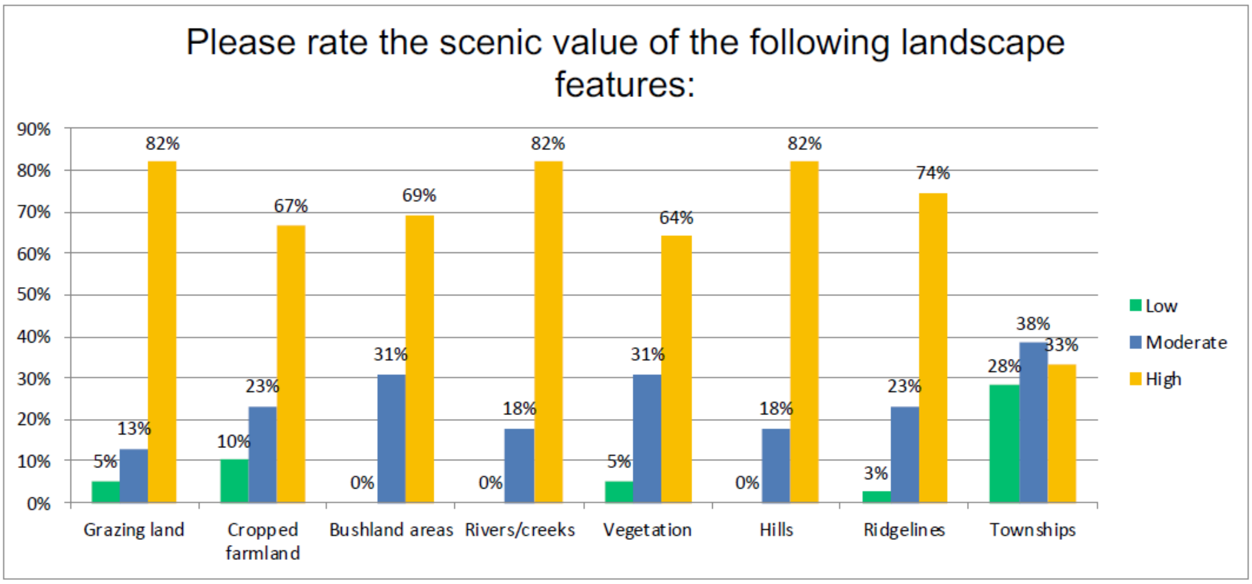


Figure 6-3 Survey results: valued landscape features

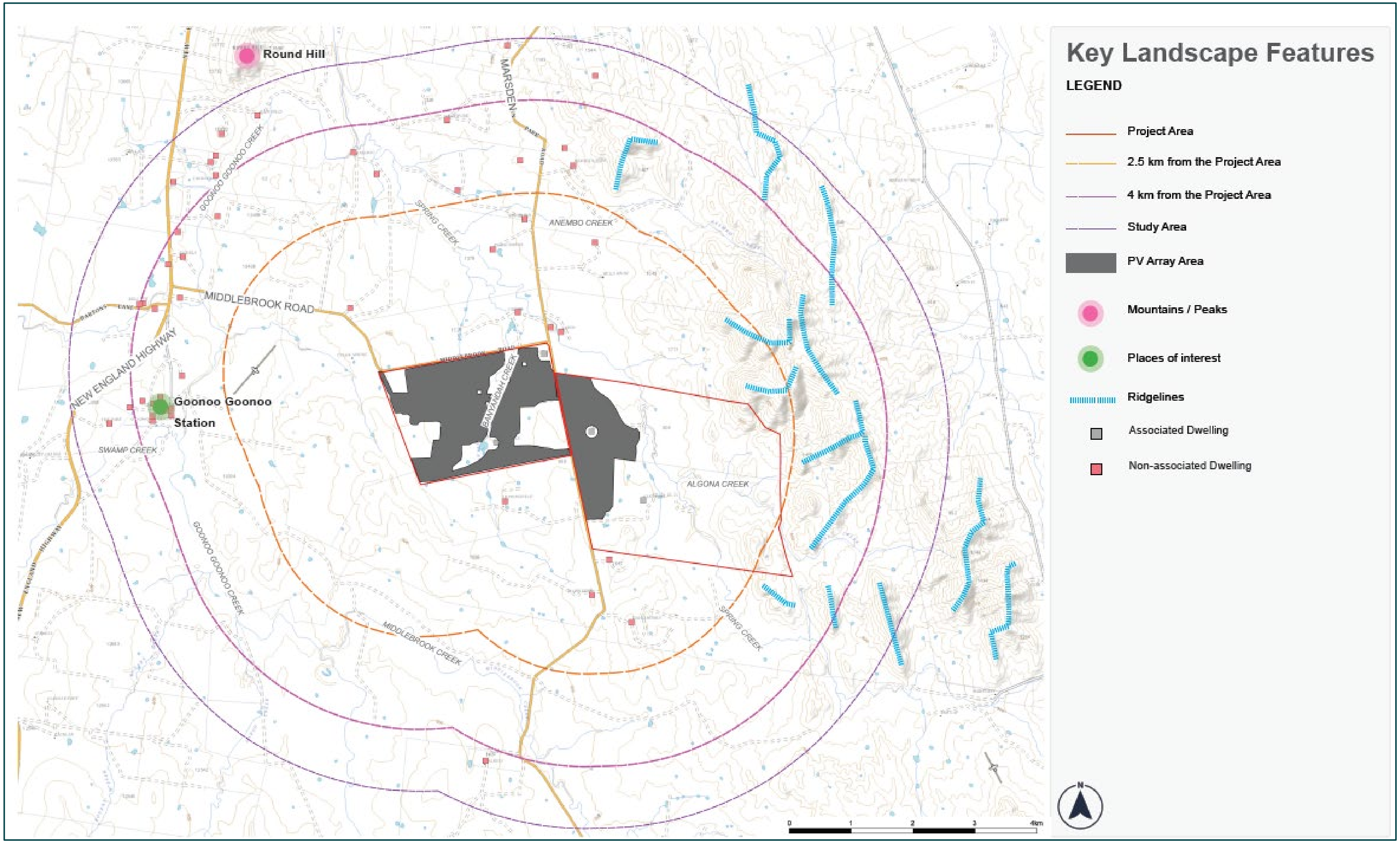


Figure 6-4 Key landscape features

Landscape character zones

Landscape character zones (LCZ) can be used to group areas with distinct qualities. The area surrounding the Subject land was divided into three zones and the scenic quality rated for each.

Partially vegetated ridges

Landforms within this LCZ is typically defined by the vegetated ridgelines and gullies and partially cleared lower peaked hills with planar river valleys. Vegetation has been predominantly modified or cleared for pastoral grazing or settlement toward the lower areas of the hills with less productive areas along ridgelines and slopes featuring remnant native vegetation. Vegetation typically found in this LCZ is characteristic of Peel Subregion - Nandewar IBRA Bioregion. Species that are common include White box grassy woodlands and Blakely's Red Gum with Rough-barked apple, River Oak and River red gum along major streams (NPWS 2003). Several seasonal creeks and gullies drain the elevated areas including Algona Creek and Anembo Creek. Human intervention in the form of unsealed roads and farm infrastructure are visible.

Overall,

- The scenic quality in this zone is rated as moderate
- The sensitivity is rated as low
- The magnitude is rated as low
- Therefore, the landscape character impact is assessed as low.

Creek corridors

Landforms within this zone are characteristic of flat valleys typical of the bioregion. Vegetation has been cleared with some remnant riparian vegetation visible along creeklines. Several creeks and gullies form an integral element, including Goonoo Goonoo Creek, Middlebrook Creek, Spring Creek, Algona Creek and Anembo Creek. Goonoo Goonoo Creek has been found to be of a high cultural significance to the local community. Land adjacent to this zone has been cleared to support agricultural and pastoral grazing in some areas. Human intervention in the form of transmission easements are visible throughout the LCZ.

Overall,

- The scenic quality in this zone is rated as low.
- The sensitivity is rated as moderate.
- The magnitude is rated as low.
- Therefore, the landscape character impact is assessed as low.

Grazing and cropping pastures

Landforms within this zone are characteristic of gently undulating grazing pastures. Vegetation is predominantly cleared to support livestock grazing. Waterbodies are generally in the form of man-made farm dams or seasonal creeks. Landscapes are highly modified through human intervention in the form of transport corridors and infrastructure easements.

Overall,

- The scenic quality in this zone is rated as low.
- The sensitivity is rated as low.
- The magnitude is rated as low.
- Therefore, the landscape character impact is assessed as low.

6.1.3. Potential impacts

Preliminary assessment tools

A viewshed map identifies areas surround the Project which would have a 'theoretical' view of the Project infrastructure. Viewshed mapping can be achieved by using geographic information systems (GIS) that account for topography and line of sight between viewpoints and the project.

The purpose of the viewshed map is to further eliminate the need to assess viewpoints that fall below the lines in the Preliminary Assessment Tool if the analysis shows there is intervening terrain that would block line of sight to a particular viewpoint. It is important to note that the viewshed map provides an assessment based on topography alone and does not take into account intervening elements such as vegetation and structures. The viewshed map, therefore, represents a theoretical worst-case scenario and is a starting point to establish if a detailed assessment is required.

The view shed map is presented in Figure 6-5. The key conclusions of this assessment were that:

- Due to the undulating terrain and a low horizontal scape of the Project, areas to the west and southeast are likely to have views towards a small portion of the Project (approximately between the range of 1-25%).
- Based on topography alone, views towards the Project are contained. The majority of the views are contained to the immediate surroundings of the Project.
- Views towards a greater portion of the Project are likely from dwellings located to the north, northeast and east of the Project. These areas are elevated in relation to the Project.
- Up to 24 non-associated dwellings identified within 4 km of the Project Area would theoretically view a small portion of the western array.
- Up to 16 non-associated dwellings would theoretically view the majority of the Project.
- Due to relatively low horizontal scale and undulating topography, approximately 8 non-associated dwellings will have views to the central portions of the Project.

Applying the preliminary assessment tool to consider the 'vertical field of view' (a combination of distance from the site and elevation difference between the viewpoint and the Project), and 'horizontal field of view' (the angle that will be occupied by the Project) the Technical supplement methodology requires that 10 residential view points and three public view point's require further detailed assessment. These are:

- Non-associated dwellings: R4, R5, R6, R8, R9, R10, R11, R12, R13, R15
- Public viewpoints: V02, V03, V05.

Further detailed assessment and ground-truthing during field work was undertaken based on these preliminary results.

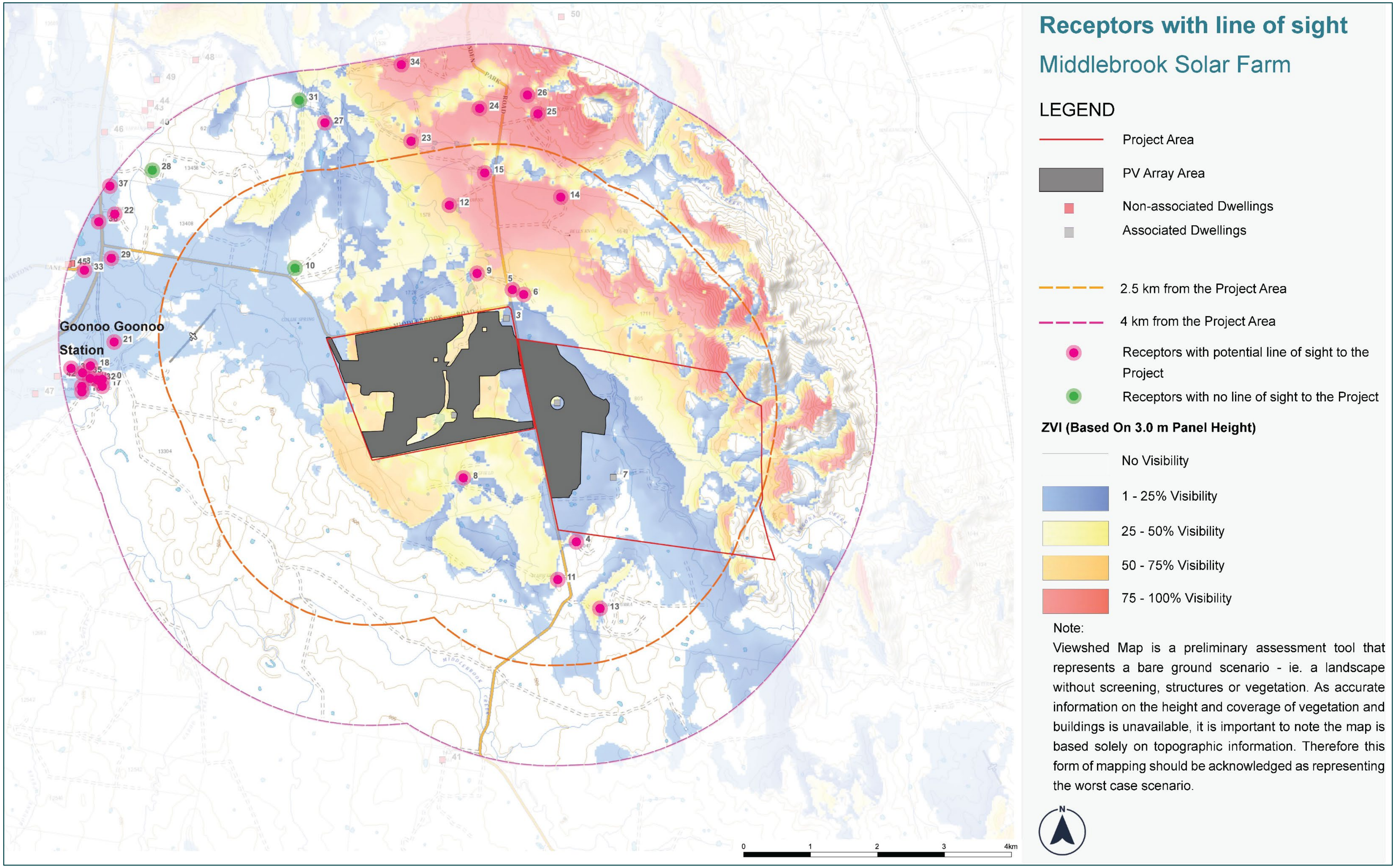


Figure 6-5 View shed mapping

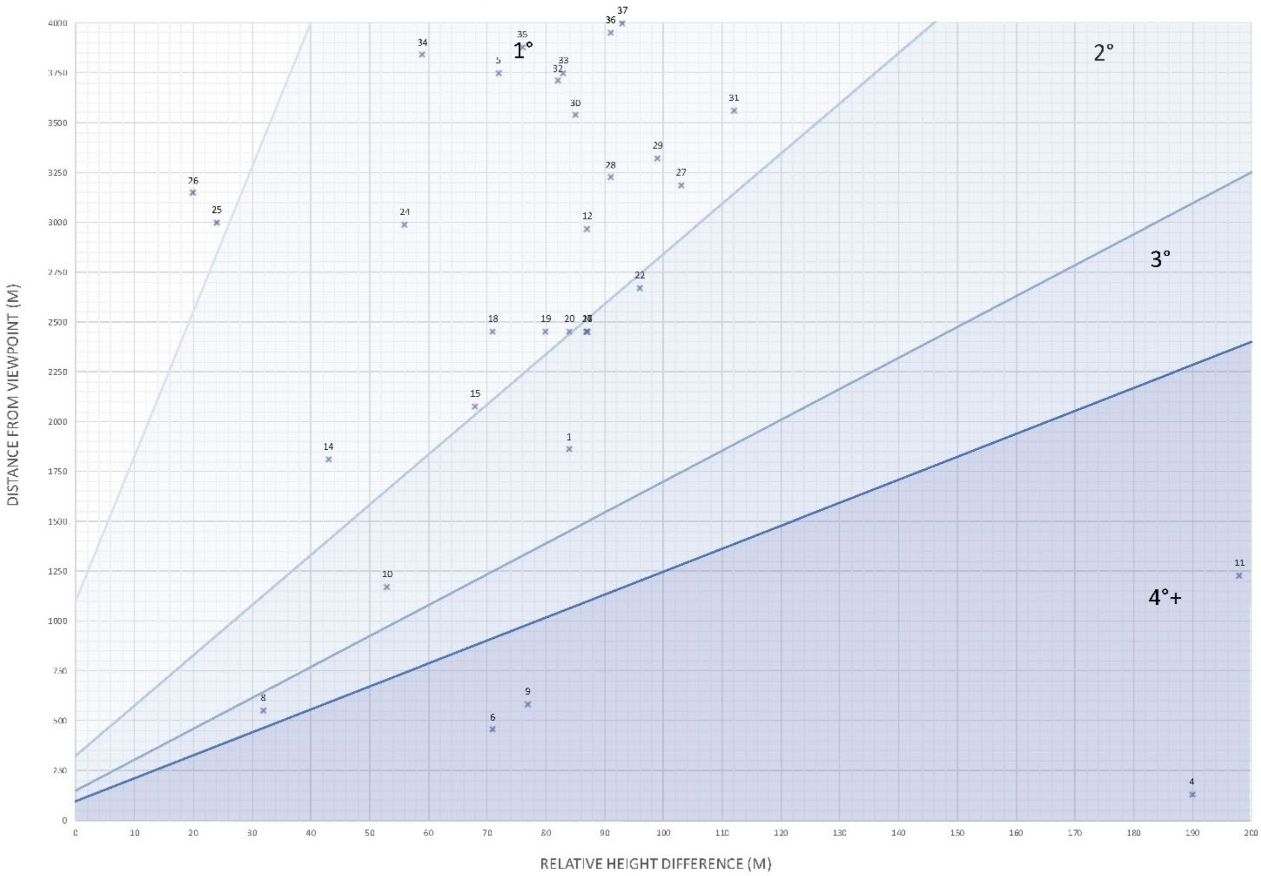


Figure 6-6 Vertical field of view: private receptors (associated and non associated dwellings)

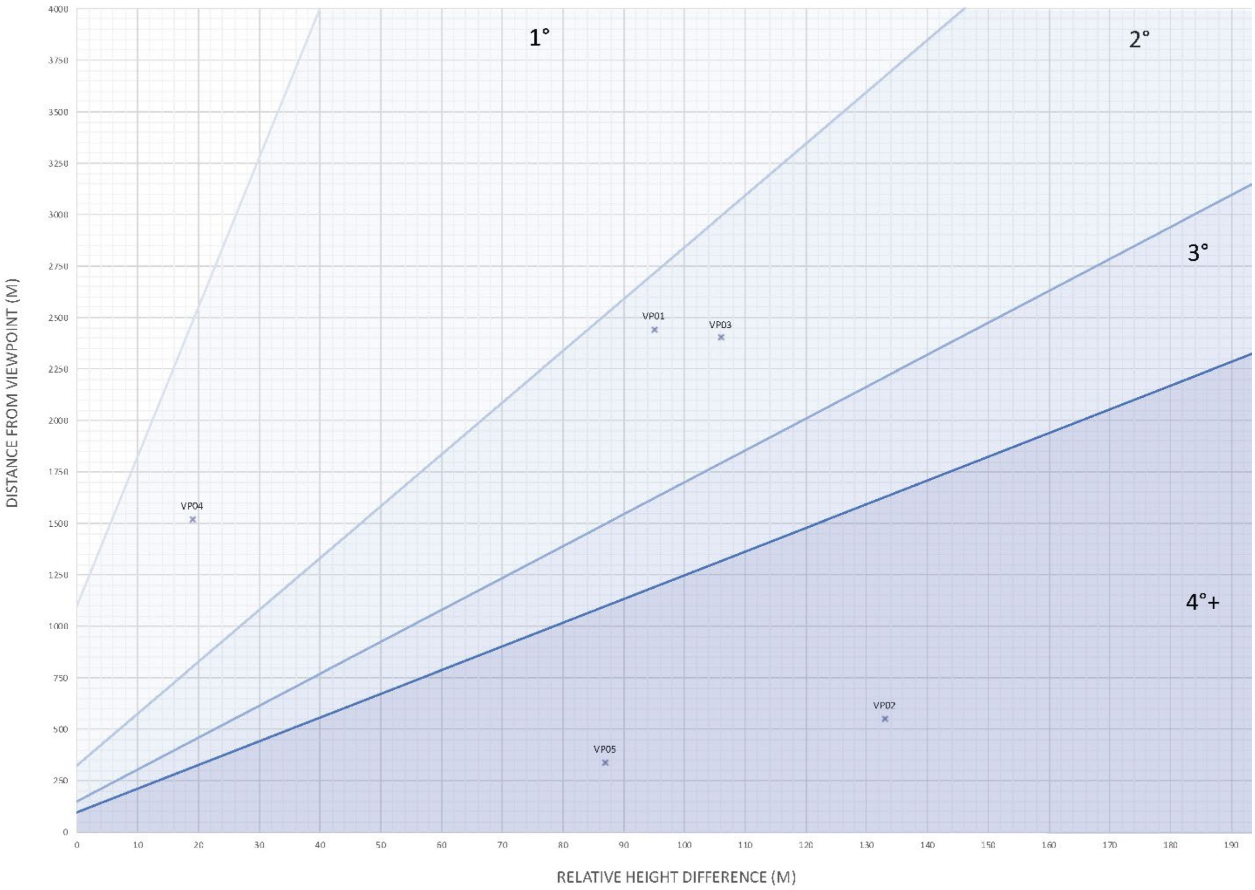


Figure 6-7 Vertical field of view: public receptors

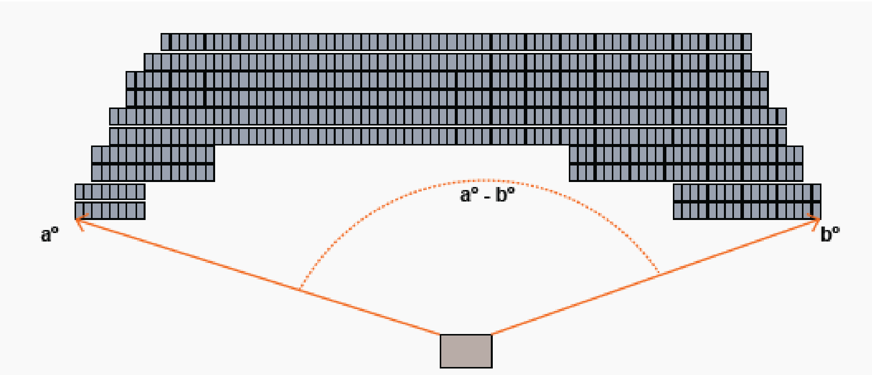


Figure 6-8 How horizontal view is calculated; the solar array can be seen from a-b degrees.

Detailed assessment tools

Wire frame modelling was used based on terrain modelling to show the precise visual magnitude from each of the above locations. In a detailed assessment, the visual magnitude is now found by overlaying the grid tool to determine the number of cells that would be occupied by the Proposal from this viewpoint. The R5 wire frame analysis is provided below to demonstrate the method.

The summary of the wire frame analysis is shown below. All but three residential receivers can be shown to have low visual impact on the basis of this terrain modelling. The result is still conservative as any intervening vegetation is not considered. Public viewpoints were shown to have low to very low visual impact.

Table 6-1 Wire frame analysis results: residential viewpoints

Receptor ID:	Distance to the Project Area:	Receptor Type:	Land Zoning	Receptor Sensitivity:	LCZ:	Scenic Quality:	Overall Visual Sensitivity:	Occupied Cells:	Magnitude Rating:	Visual Impact Rating:
4	0.66 km	Residental Receptor	RU1	Moderate	LCZ03	Low	Moderate	12	Low	Low
5	0.36 km	Residental Receptor	RU1	Moderate	LCZ03	Low	Moderate	17	Moderate	Moderate
6	0.46 km	Residental Receptor	RU1	Moderate	LCZ03	Low	Moderate	19	Moderate	Moderate
8	0.54 km	Residental Receptor	RU1	Moderate	LCZ03	Low	Moderate	17	Moderate	Moderate
9	0.53 km	Residental Receptor	RU1	Moderate	LCZ03	Low	Moderate	12	Low	Low
10	1.15 km	Residental Receptor	RU1	Moderate	LCZ03	Low	Moderate	0	Very Low	Low
11	1.23 km	Residental Receptor	RU1	Moderate	LCZ03	Low	Moderate	5	Very Low	Low
12	1.87 km	Residental Receptor	RU1	Moderate	LCZ03	Low	Moderate	7	Low	Low
13	1.75 km	Residental Receptor	RU1	Moderate	LCZ03	Low	Moderate	7	Low	Low
15	2.05 km	Residental Receptor	RU1	Moderate	LCZ03	Low	Moderate	8	Low	Low

Table 6-2 Wire frame analysis results: public view points

Receptor ID:	Distance to the Project Area:	Receptor Type:	Land Zoning	Receptor Sensitivity:	LCZ:	Scenic Quality:	Overall Visual Sensitivity:	Occupied Cells:	Magnitude Rating:	Visual Impact Rating:
VP02	1.87 km	Public Receptor	RU1	Very Low	LCZ03	Low	Low	4	Very Low	Very Low
VP03	1.88 km	Public Receptor	RU1	Very Low	LCZ03	Low	Low	9	Low	Very Low
VP05	3.53 km	Public Receptor Heritage listed residence	RU1	High	LCZ03	Low	Moderate	1	Very Low	Low

Three non-associated receivers, R5, R6 and R8, have been identified as having a moderate visual impact through the application of the detailed assessment Visual Magnitude Grid Tool. The next step is to verify the actual conditions.

Photomontages were prepared from each of these residential receptors to take into account existing conditions (such as screening) and their impacts upon the proposed view of the Project. All three montages are provided in the following pages.

A summary of the findings is provided in the table below. When intervening vegetation is taken into account, all impacts are reduced to low. No mitigation is required (such as tree planting or infrastructure setbacks) for low and very low visual impacts.

Table 6-3 Summary of detailed assessment results (based on photomontages)

ID	Distance to solar array (km)	Viewpoint sensitivity	Scenic quality	Overall visual sensitivity	Occupied cells	Magnitude rating	Visual impact rating	Mitigation required
R5	0.36	Moderate	Low	Moderate	6	Very Low	Low	No
R6	0.46	Moderate	Low	Moderate	6	Very Low	Low	No
R8	0.54	Moderate	Low	Moderate	3	Very Low	Low	No

All receivers requiring photomontage modelling have been provided with the results relevant to their residential views. In addition, the Applicant has commissioned additional photomontages for near neighbours so they can have a better understanding of what the Project impact would be on their specific views. While mitigation is not required, the Applicant is open to consider further mitigation options based on further neighbour consultation in consideration of the assessment findings.

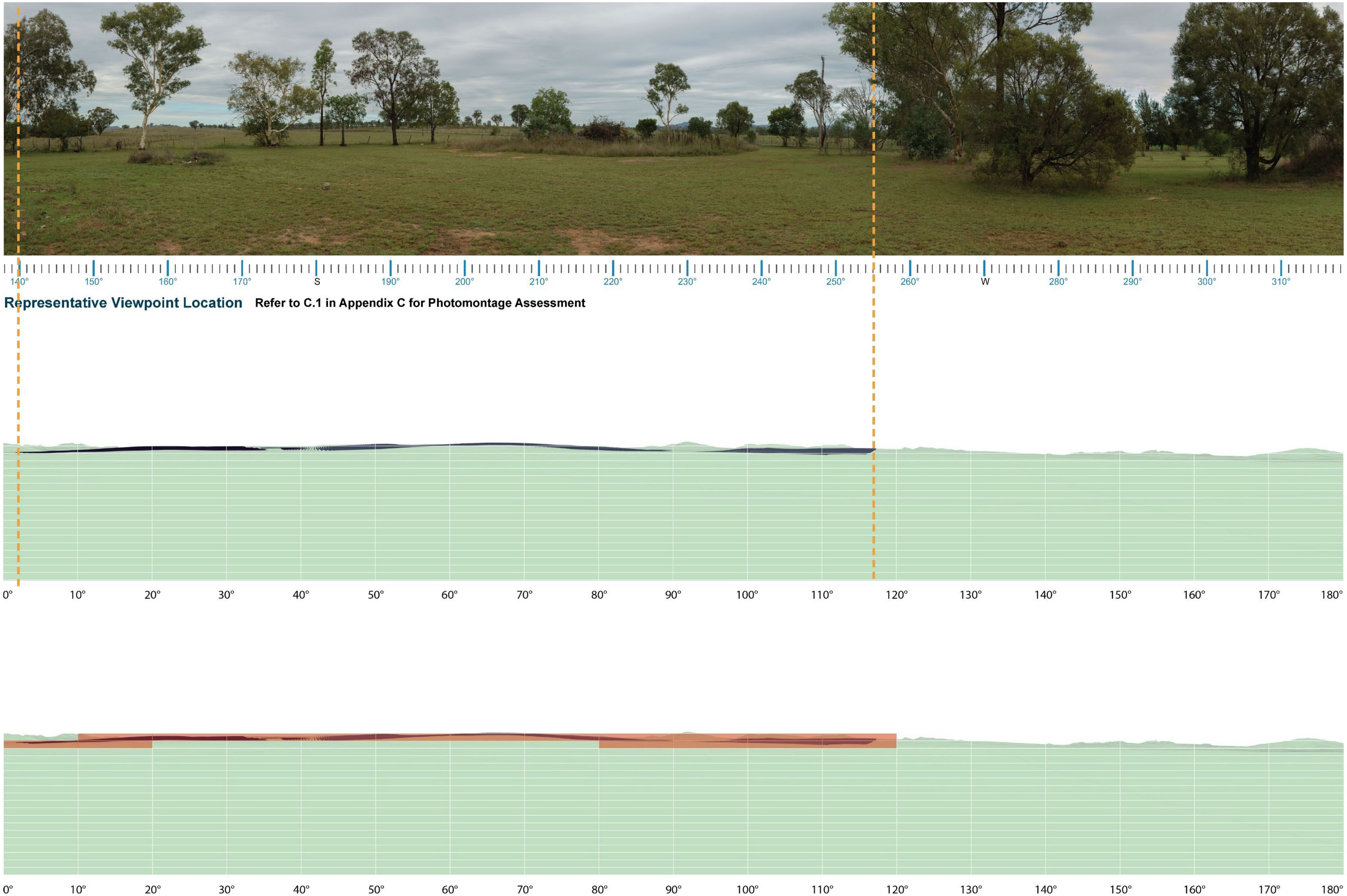


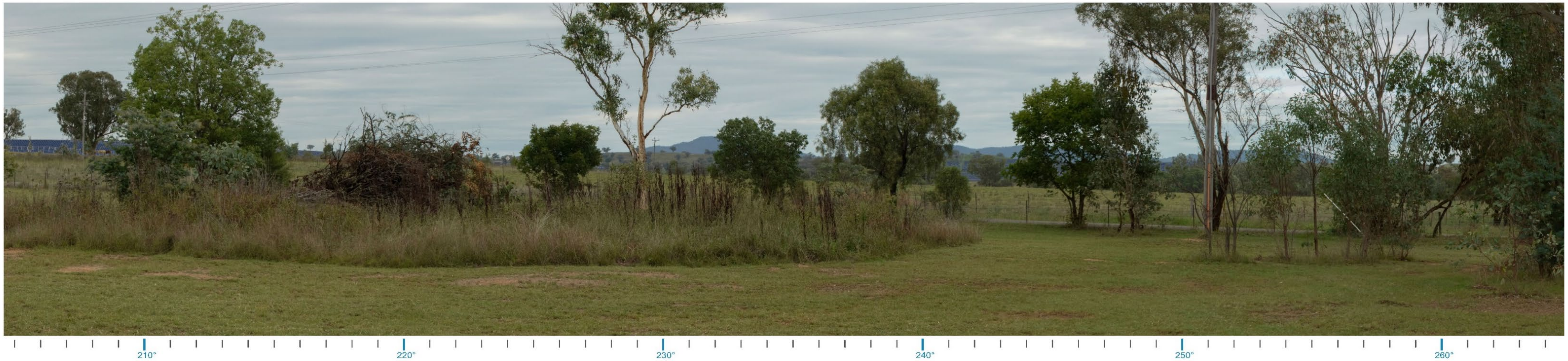
Figure 6-9 R5 Wireframe analysis, showing extent of view and the corresponding cells (coloured red) that are used to assign a magnitude rating in a detailed assessment.

Inset 1

Note: The inset image provides an accurate representation of the view when the document is viewed at 100% zoom on a screen or held at arms length when printed at

Figure 6-10 R5 Photomontage; including inset 1

Inset 1



Note: The inset image provides an accurate representation of the view when the document is viewed at 100% zoom on a screen or held at arms length when printed at A3 size.

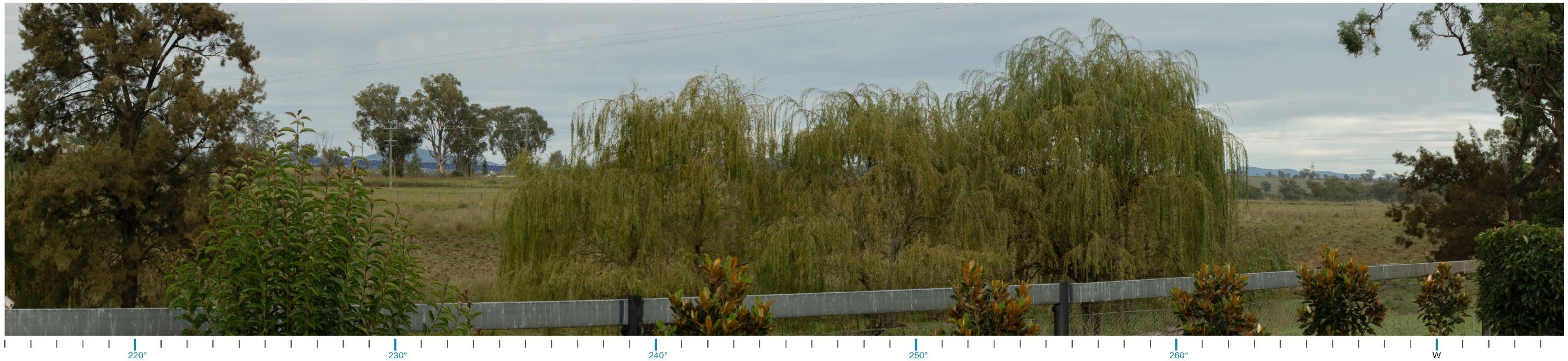
Figure 6-11 R5 Photomontage; including inset 2

Inset 1

Note: The inset image provides an accurate representation of the view when the document is viewed at 100% zoom on a screen or held at arms length when printed at A3 size.

Figure 6-12 R6 Photomontage; including inset 1

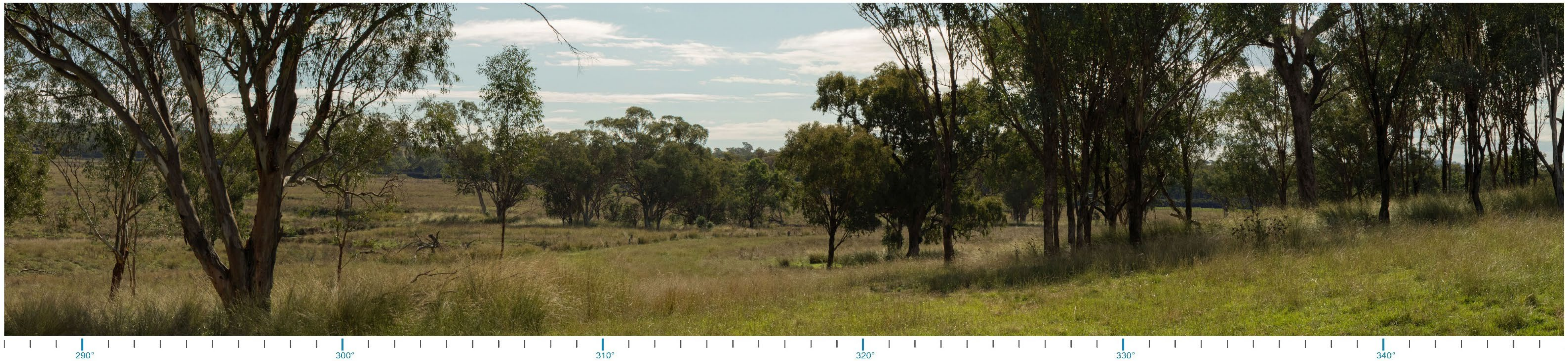
Inset 2



Note: The inset image provides an accurate representation of the view when the document is viewed at 100% zoom on a screen or held at arms length when printed at A3 size.

Figure 6-13 R6 Photomontage; including inset 2

Inset 1



Note: The inset image provides an accurate representation of the view when the document is viewed at 100% zoom on a screen or held at arms length when printed at A3 size.

Figure 6-14 R8 Photomontage; including inset 1

Inset 2

Note: The inset image provides an accurate representation of the view when the document is viewed at 100% zoom on a screen or held at arms length when printed at A3 size.

Figure 6-15 R8 Photomontage; including inset 2

Other visual impacts

Associated infrastructure

In addition to the proposed PV arrays, the associated Project infrastructure has the potential to contrast with the existing visual landscape. Due to the relatively low scale and siting of the Project, elements such as the substation, BESS, fencing, access, inverters and transformers were considered unlikely to alter the existing visual landscape outside of the immediate vicinity.

Heritage receiver

The assessment above included Goonoo Goonoo Station, a heritage site of local significance under the Tamworth Regional LEP 2010 (shown on Figure 6-4 and assessed as VP05).

The viewshed mapping, based on topography alone, determined that views from Goonoo Goonoo Station precinct would theoretically have views of up to 25% of the Project from the northern section of the area. Further wire frame assessment found that views toward the Project were likely to result in a low visual impact. No further assessment or mitigation was considered warranted.

Night lighting

Night lighting has the potential to pollute the night sky. Due to the relatively isolated location of the Project, very little existing sources of lighting are present in the night-time landscape of the subject land. Isolated receivers within the subject land experience a dark night sky with minimal light sources.

The requirements for night lighting of ancillary infrastructure for this Project is generally limited to security lighting to the substation, and within the operations & maintenance facility. The light sources are limited to low-level lighting for security, night-time maintenance and emergency purposes. There will be no permanently illuminated lighting installed. The proposed ancillary infrastructure has been carefully sited to minimise visibility from existing residences and publicly accessible viewpoints. It is unlikely the proposed night lighting associated with the ancillary infrastructure would create a noticeable impact on the existing night-time landscape. Mitigation measures are included to reduce this risk.

Glint and Glare

The main focus of the glint and glare assessment is yellow glare, which can occur from PV panels. Red glare is not expected for PV and green glare has a low potential to cause after image and deemed negligible. Residential receivers within 3 km of the subject land were assessed in accordance with the Technical Supplement and the Guidelines.

The desktop assessment identified:

- No rail receivers located within 1 km of the Project – no impact.
- Aviation - a private landing strip occurs within 5 km of the development footprint – no impact.
- 13 residential receivers within 3 km of the Project Area – no impact.
- Middlebrook Road and Marsden Park Road were assessed as ‘Road Receivers within 1 km of the Project Area’ in accordance with the Technical Supplement and the Guidelines.

No sections of Marsden Park Road will experience glare from the Project. Existing topography will likely filter glare.

Specific sections of Middlebrook Road were shown likely to experience 107.9 hours of ‘Yellow’ glare per year in total during these periods:

- Very late September to mid-March: between 5:30am-6:30am
- November to very early February: between 06:30pm - 07:05pm.

The Project is recognised as having a ‘high’ potential for an after image at these times in specific locations. Note this result does not take into account the effect existing vegetation screening may have to reduce glare.

This effect can be mitigated entirely by operational constraints which limit the ‘tracking’ of panels to limit potential glare at these specific times. Specific areas of vegetation screening (refer Figure 6-16) are another option but would take some time to establish and may impede the open pastoral views valued by residents. Recommendations are provided below to allow either of these options to reduce glare.

6.1.4. Key uncertainties of the assessment

The impact of changes in the landscape or to particular views can be subjective. This assessment follows the standardised assessment method prescribed in NSW for utility solar farms.

The Glint and glare assessment is based on a theoretical worst-case scenario and does not take into account weather conditions, intervening elements such as vegetation and built structures. The assessment is considered conservative.

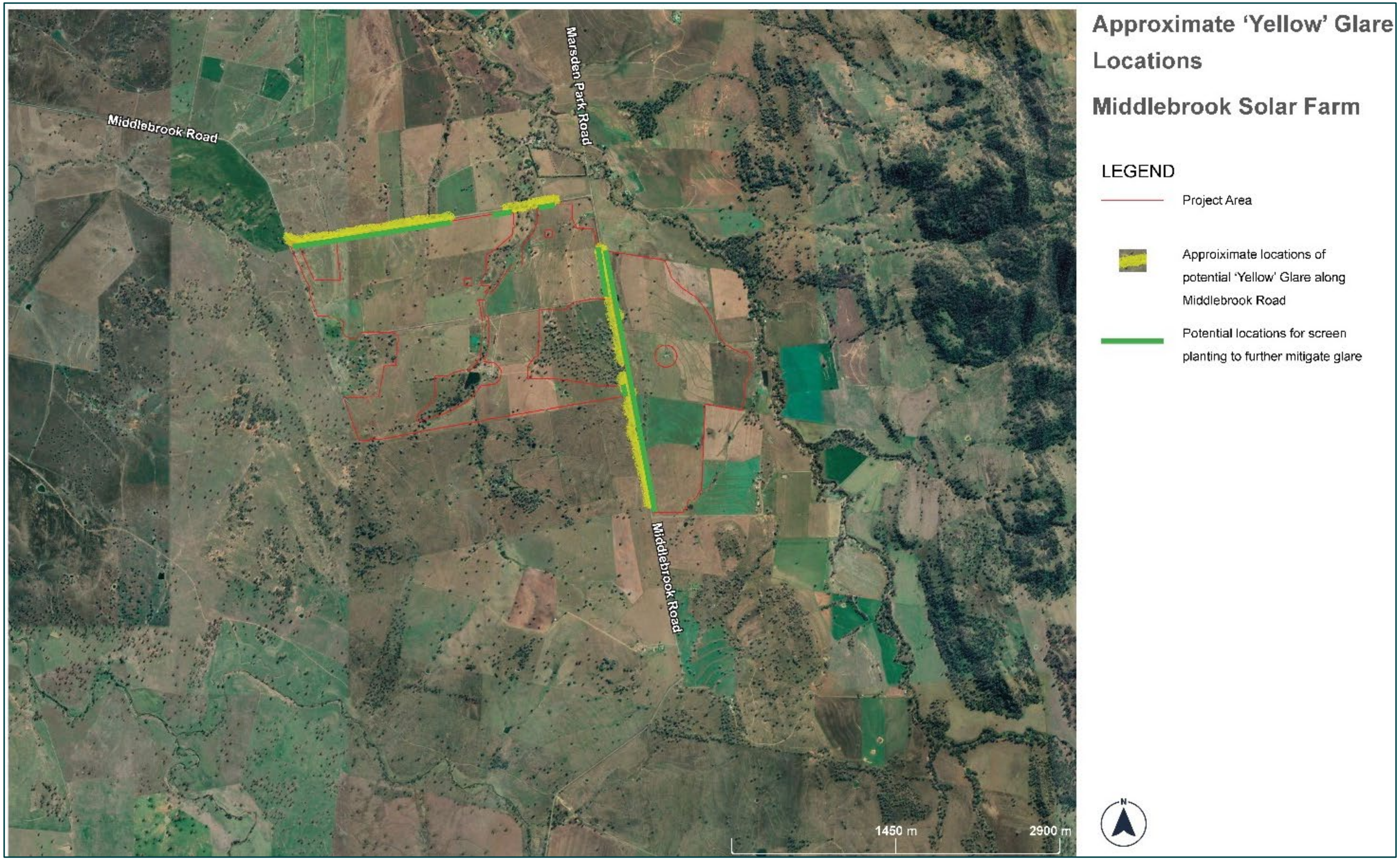


Figure 6-16 Areas subject to yellow glare and potential screen planting

6.1.5. Mitigation measures

Table 6-4 Visual mitigation measures

<table>
<tr><th>ID</th><th>Mitigation measures</th><th>Project stage</th></tr>
<tr><td>V1</td><td>Control the level of lighting
Only use lighting for areas that require lighting i.e., paths building entry points
Reduce the duration of lighting.
Switch off lighting when not required.
Consider the use of sensors to activate lighting and timers to switch off lighting.
Lighting at the construction compound would be designed and operated in accordance with AS/NZS 4282:2019 Control of the obtrusive effects of outdoor lighting.</td><td>All Stages</td></tr>
<tr><td>V2</td><td>Lighting design
Use the lowest intensity required for the job.
Use energy efficient bulbs and warm colours.
Direct light downwards.
ensure lights are not directed at reflective surfaces.
Use non-reflective dark coloured surfaces to reduce reflection of lighting.
Keep lights close to the ground and or directed downwards.
Use light shield fittings to avoid light spill.</td><td>Design, Construction</td></tr>
<tr><td>V3</td><td>Glint and Glare
Control glare potential on Middlebrook Road either by operational tracking restrictions or supplementary vegetation screening. This is restricted to Sept to mid-March (between 5:30am and 6:30am) and November to early February (between 6:30pm and 7:05pm).</td><td>Design, construction</td></tr>
</table>

6.2. Noise and vibration

6.2.1. Assessment approach

Renzo Tonin prepared a noise assessment for the Project, provided in full in Appendix D.2 and summarised below. It assesses separately:

- Construction noise and vibration
- Operational noise including:
  - Intrusive noise
  - Noise amenity
  - Sleep disturbance noise
- Road traffic noise assessment (construction and operation).

The NSW Interim Construction Noise Guideline (ICNG, 2009) provides the key guidelines for assessing noise generated during the construction phase of developments. The key components of the guideline that are incorporated into this assessment include:

- Qualitative versus quantitative assessment
  - A qualitative assessment is recommended for small projects with duration of less than three weeks. Given the length of the construction works proposed, a quantitative assessment is appropriate for the assessment of the Middlebrook Solar Farm Project.
- Use of LAeq[4] as the descriptor for measuring and assessing construction noise
  - NSW noise policies, including the Noise Policy for Industry (NPfI), Road Noise Policy (RNP) and Rail Infrastructure Noise Guideline (RING) have moved to the primary use of LAeq over any other descriptor.
  - As an energy average, LAeq provides ease of use when measuring or calculating noise levels since a full statistical analysis is not required as when using, for example, the LA10 descriptor.
- Conservative background noise assumptions
  - To ensure a conservative assessment, the minimum assumed background noise (Rating Background Levels; RBLs) were adopted at all receiver locations.
  - No noise monitoring was undertaken.
- Application of reasonable and feasible noise mitigation measures for receivers.

6.2.2. Existing environment

The locality is sparsely populated with the existing noise sources generally consisting of:

- Local road noise from Middlebrook Lane.
- Agricultural activities such as motorbikes, tractors and farm vehicles.

Background noise varies over the course of any 24-hour period, typically from a minimum at 3am in the morning to a maximum during morning and afternoon traffic peak hours. Therefore, the Noise Policy for Industry requires that the level of background and ambient noise be assessed

[4] LAeq is defined as the equivalent continuous sound pressure level. Leq or LAeq, is the constant noise level that would result in the same total sound energy being produced over a given period.

separately for the daytime, evening and night-time periods. The Noise Policy for Industry defines these periods as follows:

- Day is defined as 7:00am to 6:00pm, Monday to Saturday and 8:00am to 6:00pm Sundays & Public Holidays.
- Evening is defined as 6:00pm to 10:00pm, Monday to Sunday & Public Holidays.
- Night is defined as 10:00pm to 7:00am, Monday to Saturday and 10:00pm to 8:00am Sundays & Public Holidays.

The identified receivers surrounding the Project site are all classified as rural under NPfI guidelines and the minimum background noise level (Rating Background Levels; RBLs) are adopted for all receiver locations. The noise criteria are shown below for each time of day.

Table 6-5 Construction noise management levels

Time of day	Minimum RBL, dB(A)[1]	Noise affected dB(A)	Highly noise affected dB(A)
Day	35	RBL + 10 = 45	75
Evening	30	RBL + 5 = 35	75
Night	30	RBL + 5 = 35	75

* 1 - In accordance with Table 2.1 of the NSW NPfI

Table 6-6 Receivers (dwellings) assessed for noise (Project-associated receivers are shown in italics as strictly speaking they do not require assessment).

ID	Address	Description
R1 Associated receiver	*760 Middlebrook Road, Loomberah (associated property)*	*Property located approximately 35 m from the development Footprint.*
R2 Associated receiver	*805 Middlebrook Road, Loomberah (associated property)*	*805 Middlebrook Road, Loomberah.*
R3 Associated receiver	*666 Middlebrook Road, Loomberah (associated property)*	*Residential property located approximately 110 m north-east of the development footprint.*
R4	1047 Middlebrook Road, Loomberah	*Residential property located approximately 670 m south of the development footprint.*
R5	1739 Marsden Park Road, Loomberah	*Residential property located approximately 400 m north-east of the development footprint.*

ID	Address	Description
R6	*1711 Marsden Park Road, Loomberah*	*Residential property located approximately 450 m north-east of the development footprint.*
R7 *Associated receiver*	*838 Monteray Road, Loomberah*	*Residential property located approximately 480 m east of the development area.*
R8	*908 Middlebrook Road, Loomberah*	*Residential property located approximately 560 m south of the development footprint.*
R9	*1728 Marsden Park Road, Loomberah*	*Residential property located approximately 575 m north of the development footprint.*
R10	*279 Middlebrook Road, Lomberah*	*Residential property located approximately 1,100 m north-west of the development footprint.*

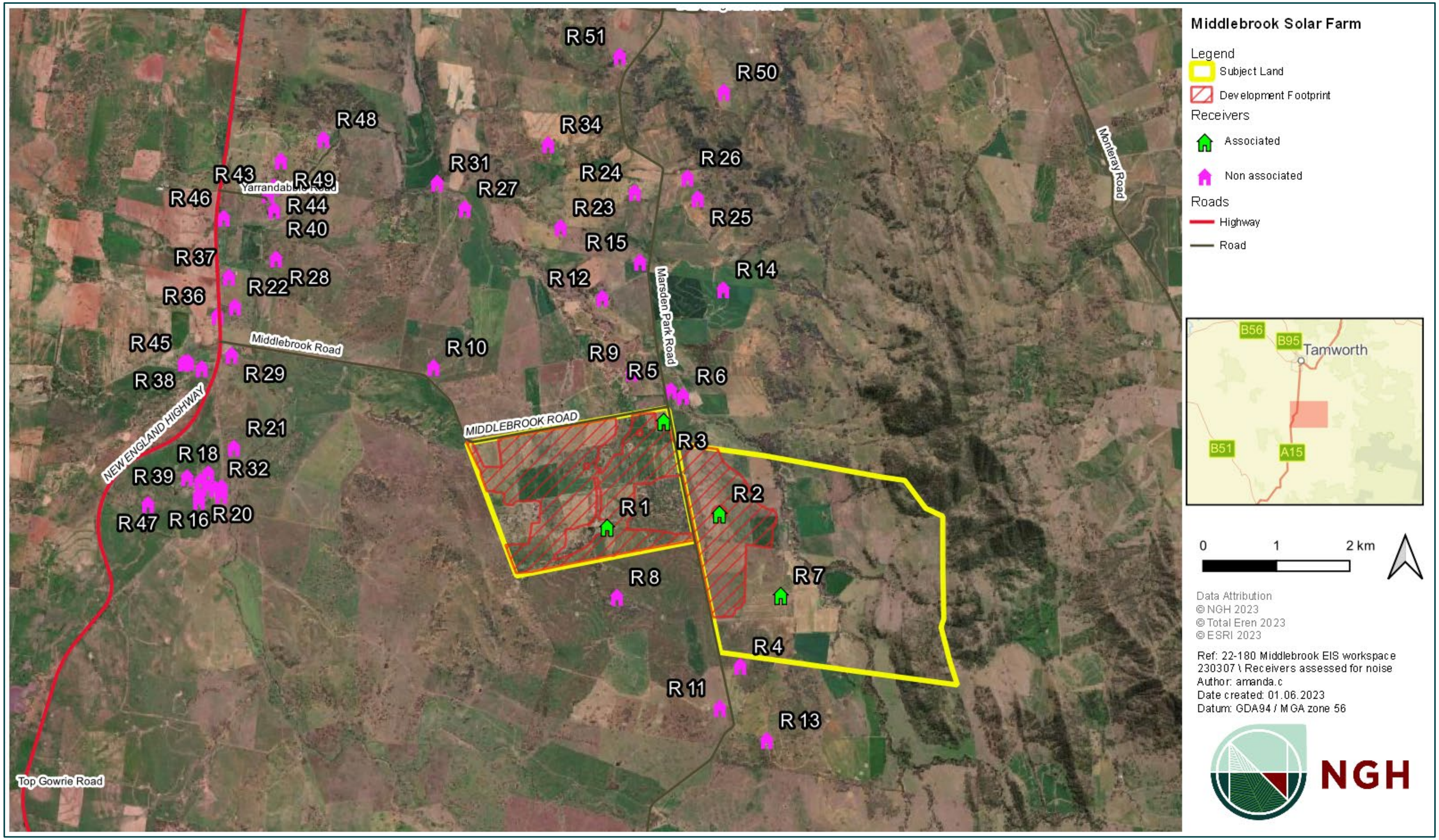


Figure 6-17 Associated and non-associated receivers (dwellings)

6.2.3. Potential impacts

Construction noise

Construction noise sources and the quantities assumed to be used during construction are shown below. Their indicative sound power levels were used to model the construction noise that may be generated by the Project during construction.

Table 6-7 Noise sources during construction

Source	Quantity	Sound power level
Small pile drilling rig	6	114
Crane	2	110
Drum roller	2	109
Padfoot roller	2	109
Wheeled loader	2	109
Dump truck	4	108
30t excavator	8	107
Grader	4	107
Chain trencher	2	104
Water truck	4	104
Telehandler	4	98
Forklift	4	90

Noise emissions were predicted by modelling the noise sources, receiver locations, topographical features of the intervening area, and possible noise control treatments using the CadnaA (version 2023) noise modelling computer program. The program calculates the contribution of each noise source at each specified receptor point and allows for the prediction of the total noise from a site.

The noise prediction models take into account:

- Location of noise sources and receiver locations
- Height of sources and receivers
- Separation distances between sources and receivers
- Ground type between sources and receivers (soft)
- Attenuation from barriers (natural and purpose built).

Noise levels at any receptors resulting from construction would depend on the above and the type and duration of construction being undertaken. Furthermore, noise levels at receivers would vary substantially over the total construction program due to the transient nature and large range of plant and equipment that could be used.

Based on the predicted construction noise levels, the construction Noise Management Level would be exceeded when works are conducted at the three closest receivers – R1, R2 and R3, these receivers are all are project-associated. Assuming the three noisiest noise sources are operating concurrently, the predicted noise levels are 71, 60 and 58 db(A), respectively. All receivers are predicted to be below the highly noise affected level of 75 dB(A).

No operational noise exceedances are expected at non-associated dwellings. Predicted construction noise levels at all other receivers would comply with the construction NML. Assuming the three noisiest noise sources are operating concurrently, the next highest predicted noise levels occur for non-associated receivers are:

- R5, 45 dB(A)
- R6, 45 dB(A)
- R8, 43 dB(A).

Road traffic noise assessment

Noise impact from the potential increase in traffic on the surrounding road network due to construction and operational activities is assessed against the NSW Road Noise Policy (RNP), using the estimated construction traffic volumes below.

Table 6-8 Estimated construction traffic volumes

Vehicle Type	Daily Peak Vehicle Movements (two-way)
Light Vehicle (car/4WD)	86
Shuttle Bus	8
MRV/HRV	16
Truck and Dog	20
AV	16
B-Double	20
Total	166

Noise criteria relevant to Middlebrook Road (categorised as an arterial road) are:

- Day time – LAeq 60 db(A)
- Night-time – LAeq 55 db(A).

The Road Noise Policy states that for existing residences and other sensitive land uses affected by additional traffic on existing roads, any increase in the total traffic noise level should be limited to 2 dB above that of the corresponding ‘no build option’.

Results of the construction traffic noise predictions are presented below. It is noted that the predicted noise levels represent the traffic noise contribution from the vehicle movements associated with the construction works and does not take into account existing traffic noise levels due to existing general traffic flows as existing traffic volumes along Middlebrook Road are unknown. However, road traffic noise level contributions from the vehicle movements associated with the Middlebrook Solar Farm construction works are at least 10 dB(A) below the applicable noise criterion based on dwellings being approximately 20 m from the road. The site access point Given that residences are located significantly greater than 20 m from the access route, the site access point and the Development footprint where traffic may be moving internally, all receivers are predicted to comply with the criteria.

Table 6-9 Predicted construction traffic noise on public roads

Receiver	Criteria	Traffic Movements	Speed (km/h)[1]	Distance to Road[2]	Predicted noise level	Exceed
Residences on Middlebrook Road	$L_{Aeq\ 15hr}$ 60	As per Table 7.1 of Appendix D.2	100	20 m	50	No

Traffic noise levels as a result of the construction works would not adversely contribute to the existing traffic noise levels at the most affected residences along the surrounding roads.

During the operational stage, vehicle access to the site will be maintenance vans or delivery trucks which would occur on an irregular basis. Traffic noise impacts during the operational stage of the project would be minimal and insignificant and were not assessed further.

Vibration assessment

Vibration generating activities would occur only during the construction phase of the project. There are no vibration generating activities expected during the operational phase.

Vibration generated by construction plant set out in Table 6-7, was estimated and potential vibration impacts were assessed to be:

- Low risk for R1 – associated receiver, monitoring recommended.
- Very low risk for all other receivers, no monitoring required.

Operational noise

Noise emissions were predicted by modelling the noise sources, receiver locations, topographical features of the intervening area, and possible noise control treatments using the CadnaA (version 2023) noise modelling computer program. The program calculates the contribution of each noise source at each specified receptor point and allows for the prediction of the total noise from a site. The operational equipment modelled is shown below.

Table 6-10 Noise sources during operation

Source	Quantity	Sound power level
PCU/Inverters	94	81
Tracker	9,900	50
Battery units (Narada or similar)	188	80
MV Transformer (Wilson 384 MVA 330/33/33 kV)	1	97

The NPfI noise predictions were prepared for the following standard and noise-enhancing meteorological conditions:

1) Standard meteorological conditions – 0.5 m/s wind velocity at 10 m from ground level between each noise source and each noise receiver. Wind direction was based on wind travelling from the source to the receiver.
2) Slight to gentle breeze – 3 m/s wind velocity at 10 m from ground level between each noise source and each noise receiver (as per NPfI default wind conditions). Wind direction was based on wind travelling from the source to the receiver.
3) Moderate temperature inversion – applicable for noise predictions during night-time periods only. F-class temperature inversion with 2 m/s wind velocity at 10 m from ground level between each noise source and each noise receiver.

The assessment indicates that the project noise trigger levels are exceeded at one associated receiver location, Receiver R1 (a project associated receiver), by up to 2 dB(A). This is considered a negligible exceedance that would not be noticeable or discernible by the average person.

No operational noise exceedances are expected at non-associated dwellings. The next highest predicted noise levels for non-associated receivers are:

1) Standard conditions - R8, 23 dB(A)
2) Slight to gentle breeze - R8, 25 dB(A)
3) Moderate temperature inversion - R8, 25 dB(A).

Sleep Disturbance Assessment (noise)

During the night-time period, only mechanical plant will be operating, including battery stacks, inverters and transformers. Noise emissions from these plant items are considered to be continuous with no potential for high peak noise level events. Therefore, the LAmax noise levels experienced at the identified receivers will be similar to the operational predictions above.

No sleep disturbance noise exceedances are expected at non-associated dwellings.

6.2.4. Key uncertainties of the assessment

Where uncertainty was present, the assessment has taken a precautionary approach:

- Rather than use actual noise logging, which may be impacted by highway and farm machinery noise, the quietest rural background noise level was assumed.
- To understand the interaction of equipment used in the construction program, the three noisiest plant were modelled as operating concurrently.

These measures provide a conservative outcome and ensure noise mitigation strategies will similarly conservative, reducing risks of adverse noise impacts and complaints.

6.2.5. Mitigation measures

While no exceedances are predicted for any non-associated receivers, a range of reasonable and practical measures can be implemented to further minimise noise impacts of the Project, as set out below.

Table 6-11 Safeguards and mitigation measures to manage noise and vibration for non-associated receivers.

ID	Mitigation measures	Project stage
NV1	Establish a complaints procedure, including signage and other means to advertise the contact number regarding complaints. Respond to complaints in a timely manner and keep relevant parties informed of progress.	All stages
NV2	Develop noise management plan to ensure the following actions minimise noise: • All engine covers would be kept closed while equipment is operating. • Where possible use less noisy plant and equipment. • Provide special attention to the use and maintenance of 'noise control' or silencing kits fitted to machines to ensure they perform as intended. • Plant and equipment should be properly maintained. • Avoid any unnecessary noise when carrying out manual operations and when operating plant. • Switch off plant when not in use. • Trucks should not be left idling where possible. • As far as possible, heights from which materials are dropped, into or out of trucks, would be minimised. • Machines found to produce excessive noise compared to industry best practice would be removed from the site or stood down until repairs or modifications can be made.	During construction

6.3. Traffic and transport

A traffic impact assessment was prepared Amber Organisation Pty Ltd to assess the construction, operational and decommissioning traffic impacts of the solar farm. The assessment is summarised below and appended in full, in Appendix D.3.

The aim of the traffic impact assessment is to:

- Assess peak and average traffic generation, including over-dimensional vehicles and construction worker transportation.
- Assess the likely transport impacts to the site access route (including, but not limited to, Middlebrook Road, Marsden Park Road and New England Highway), site access point(s), any Crown land, particularly in relation to the capacity and condition of the roads.
- Assess cumulative traffic impacts from nearby developments.
- Provide details of measures to mitigate and/or manage potential impacts including a schedule of all required road upgrades.

The access arrangements and schedule of road upgrades required is included as part of the Project description, Section 3.

6.3.1. Assessment approach

The traffic assessment sources desktop traffic information sources to understand the current traffic environment. Predicted traffic volumes estimated by the Applicant are then modelled to assess whether any upgrades or other safety measures are required to be implemented as part of the Project. Road counts were undertaken to understand road usage. The assessment has included consultation with the roads' authorities, Transport for NSW and Tamworth Regional Council, summarised within Section 5.3 as well as detailed in the appended Traffic Impact Assessment, Appendix D.3.

It is noted that as the components and vehicle dimensions aren't known at this time, the assessment assumptions are to use the largest vehicle predicted (in particularly for swept path assessment from New England Highway to the site).

Proactive consultation is ongoing with TfNSW as we understand agency expectations are changing in relation to traffic for SSD. On 9 June 2023, Amber agreed a method for engaging TfNSW to assess their roads and confirm the vehicle is able to be accommodated on their road network. This requires collaboration with RJA and then an application to be submitted to TfNSW for their assessment.

6.3.2. Existing environment

The proposed Middlebrook Solar Farm would be accessed via the New England Highway and Middlebrook Road.

New England Highway is a State Road under the care and management of Transport for New South Wales (TFNSW). It runs in a northwest-southeast alignment from Newcastle to Muswellbrook, before running in a northern alignment to its termination at the Queensland Border. Within the vicinity of the site, it has a sealed carriageway width of approximately 13 meters, accommodating one lane traffic in each direction and sealed shoulders on both sides of the road. It has a speed limit of 100 km/hr.

Middlebrook Road is a municipal local road that extends east from New England Highway before running south from its connection with Marsden Park Road to its connection with Lindsays Gap

Road. It has a sealed carriageway for approximately 550 metres extending east from New England Highway, with the remainder of the road having a gravel surface. The sealed section has a carriageway width of 6.0 metres and the unsealed section has an approximate width of 6.0 metres accommodating simultaneous two-way vehicle movement.

A single-lane bridge is located 400 metres east of New England Highway on Middlebrook Road. It has a length of approximately 50 metres.

The intersection of Middlebrook Road with New England Highway is priority controlled and is provided with a right turn lane from New England Highway to facilitate turn movements. No left-turn facility is currently provided at the intersection.

Existing traffic volumes

New England Highway

A turning movement count survey was carried out at the intersection of New England Highway and Middlebrook Road to determine the existing traffic conditions at the intersection. The survey was undertaken on Wednesday 5 April 2023 during predicted peak traffic movements from 6:00am to 9:00am and from 4:30pm to 6:00pm.

The survey results indicate the intersection currently carries a moderate level of traffic, in the order of 305 and 315 vehicle movements in the morning and evening peak hour, respectively. The morning peak hour was recorded from 8:45am to 9:45am and the evening peak hour was recorded from 4:00pm to 5:00pm. The majority of vehicle movements are through movements on New England Highway. Overall, the results indicate both roads accommodate a low level of traffic for the respective classifications and are able to accommodate an increase in vehicle movement.

Traffic volume data for New England Highway was obtained from the TfNSW Traffic Volume Viewer. A summary of the traffic volumes is provided in Table 6-12. In order to calculate the current 2023 traffic volumes on the road network, an annual growth rate of 1.5% has been applied to the 2011 survey data.

Table 6-12 Traffic volume summary New England Highway

Survey Location	Station ID	Survey Year	Recorded Volume	Heavy Vehicle Percent	Growth Factor	Estimated current Volumes
670 m North of Middlebrook Road	92323	2011	2912 vpd AM – 194 vph (11am) PM 213 vph (5pm)	20%	1.5%	3534 vpd AM – 235 vph PM – 258 vph

vpd – vehicles per day

vph – vehicles per hour

The traffic volumes have been provided for each hour and separated into northbound and southbound movements to show the daily traffic volume profile. The traffic volumes are shown in Figure 6-18 which has utilised a 1.5% growth factor to estimate the 2023 traffic volumes.

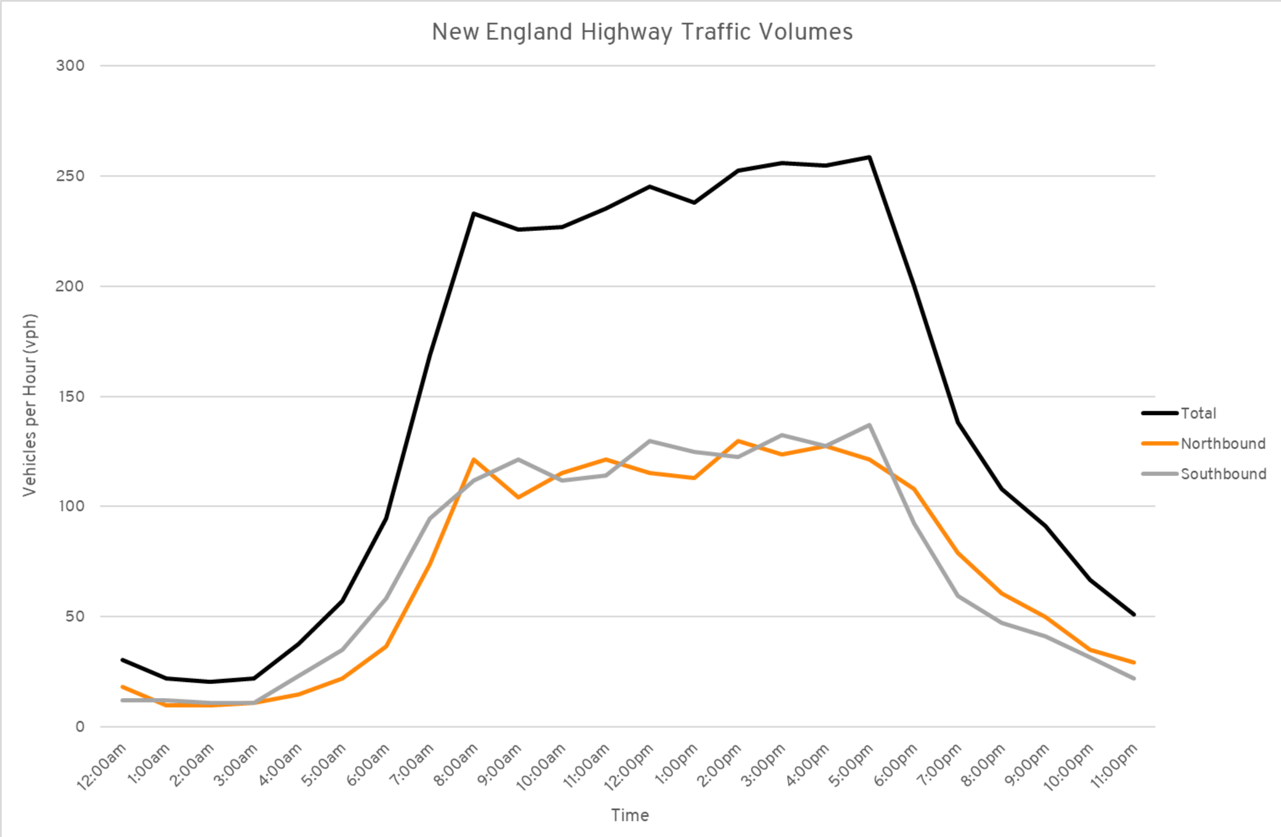


Figure 6-18 New England Highway traffic volume data (source Amber 2023)

The TfNSW survey data indicates that the New England Highway currently experiences most traffic movements between the hours of 8:00am and 5:00pm with a relatively flat distribution between the peak hours.

Middlebrook Road

Traffic count data for Middlebrook Road has been provided by Tamworth Regional Council. The survey site is located 600 metres east of New England Highway and recorded and average daily traffic volume of 57 vehicles per day over 12 days in December 2017. The survey found that heavy vehicles account for 12% of all vehicle movements.

Overall, the survey results indicate the surrounding road network currently accommodates as a low to moderate level of traffic for the respective road classifications and is able to accommodate an increase in vehicle movement.

Restricted vehicle access

The TfNSW Restricted Vehicle Access Map for the surrounding area is provided below. The green line indicates approved B-Double routes, while the black lines represent approved routes with travel conditions.

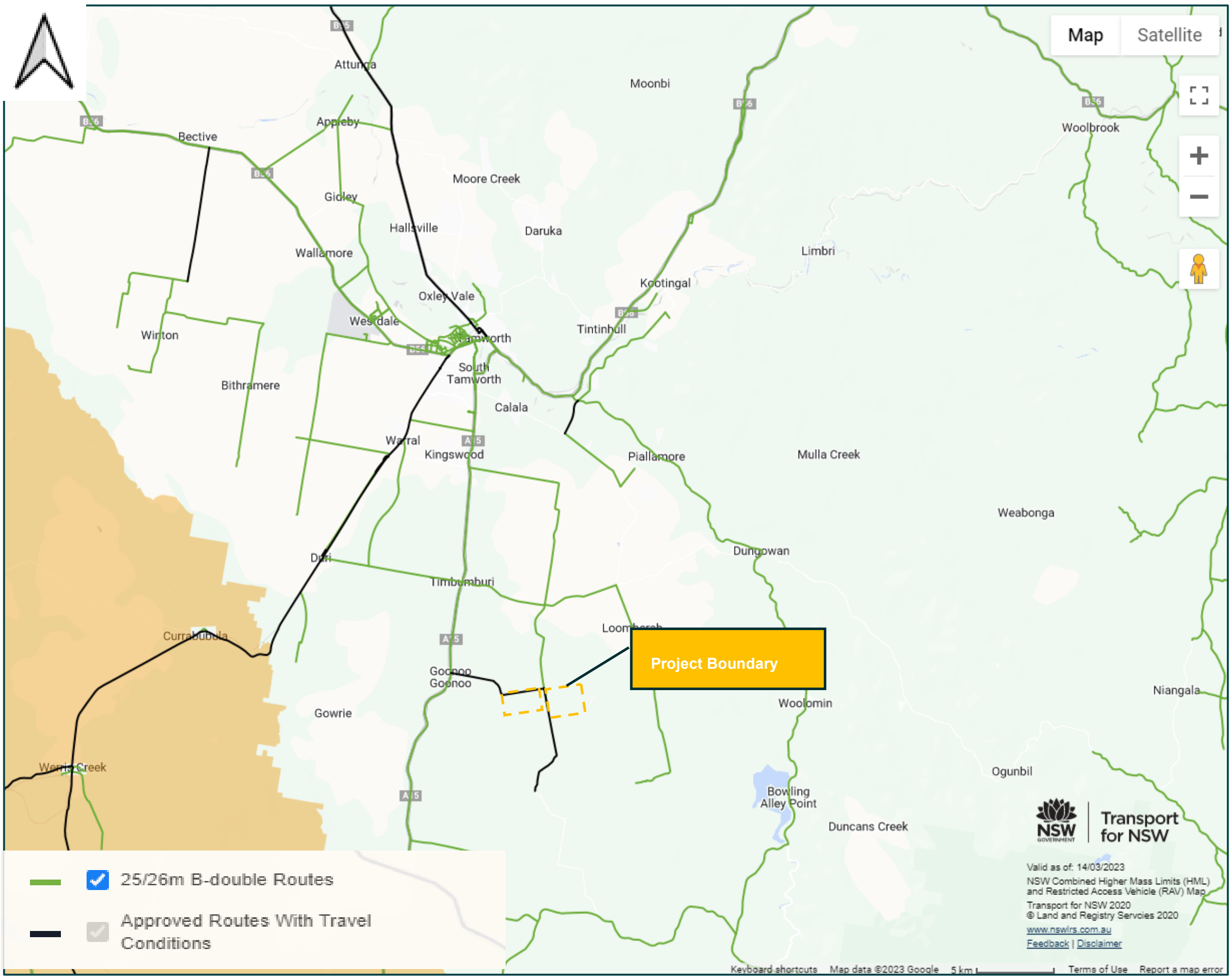


Figure 6-19 TfNSW Restricted access vehicle map

Crash history

A review of the TfNSW Centre for Road Safety Crash and Casualty Statistics database for all injury crashes with the following criteria:

- Middlebrook Road between New England Highway and the southern site boundary
- Within 1.0 km of the intersection of New England Highway and Middlebrook Road.

The crash database provides the location and severity of all injury and fatal crashes for the five-year period form 2017 and 2021. The search revealed one right rear crash on New England Highway which occurred midblock approximately 400 m south of Middlebrook road and resulted in serious injuries.

Given the road classification and associated traffic volumes, it is concluded that the road network is currently operating in a relatively safe manner.

Public transport

No public transport services are provided within the vicinity of the site.

A school bus service is operated by Hannaford Bus along Middlebrook Road which passes the site at approximately 7:30am for the school pick-up service and 4:30pm for the drop-off service.

6.3.3. Potential impacts

Impacts of the Project on local traffic could include:

- Damage to the road assets, including Middlebrook Road which is a Council asset.
- Delays for local traffic, including school buses.
- Increased risks to road users.

Impacts are most relevant to peak construction, when Project traffic volumes would be at their highest, but operational impacts are also considered where relevant in the evaluation below.

Construction traffic

Traffic volumes

The solar farm construction is expected to take approximately 21–30 months, with the peak construction period expected to take 18 months. A maximum workforce of 400 personnel would be on-site during peak construction periods with one shift proposed per day.

Construction traffic generated by the solar farm can broadly be separated into the following four categories:

- Light vehicles associated with transporting the workforce to/from site.
- Up to four 40-seater shuttle buses are proposed to transport the majority of the workforce between the site and nearby towns.
- Medium and heavy ridge trucks (MRV and HRV) would be used to deliver raw materials and smaller plant.
- Truck and Dog vehicles would be used to transport earthwork material to/from the site.
- 19 metre long Articulated Vehicles and 26-metre long B-Doubles (AV and B-Double) would be sued to transport larger plant.

Restricted Access Vehicles / oversized and overmass (OSOM) vehicles would be required for the delivery of larger plant to the site such as the substation transformer and are subject to separate permit applications and regulations.

It is anticipated that during peak construction, the site could generate up to 80 heavy and 86 light vehicle movements per day. It is noted that a vehicle movement is classified as a vehicle traveling in one direction (i.e., a truck accessing the site would generate one movement towards the site and one movement away from the site when it departs). Table 6-13 summarises the daily movements of vehicles.

Table 6-13 Estimated daily vehicle movements

Vehicle type	Vehicle size	Average vehicle movements per day		Peak vehicle movements per day	
		Daily	Peak hour	Daily	Peak hour
Light vehicle	Light vehicle Car/4WD	40	10	86	22
Heavy vehicle	Shuttle Bus	6	3	8	4
	MRV/HV	8	1	16	2
	Truck and dog	10	1	20	2

Vehicle type	Vehicle size	Average vehicle movements per day		Peak vehicle movements per day	
		Daily	Peak hour	Daily	Peak hour
	AV	8	1	16	2
	B-Double	10	3	20	3
Total		**82**	**19**	**166**	**35**

Overall, the site is expected to generate approximately 35 vehicle movements during the morning and evening peak hours during the peak construction period which will reduce to 19 vehicle movements of the typical construction periods.

Traffic distribution

Traffic accessing the site will do so via New England Highway and then Middlebrook Road, before entering the site using the access point in the northwest corner of the site. Access to the eastern portion of the site would be provided through the western portion and a single crossing point on Middlebrook Road.

The workforce is expected to predominantly be located within Tamworth with all plant expected to be delivered from Port of Newcastle. The following provides a breakdown of the access distribution for each of the vehicle classifications.

- Light vehicles: It is anticipated that 90% of the workforce would be located in Tamworth and would travel to/from the north with the remaining 10% traveling to/from the south.
- Shuttle bus: All vehicle movements would be to/from Tamworth which is located to the north of the site.
- MRV and HRV: These vehicles will predominantly be water trucks and vehicles Transporting materials such as concrete and fencing supplies which will be sourced within the surrounding area. The Applicant has advised that all movements will be to/from the north.
- Truck and dog: These vehicles will transport quarry material and are expected to predominantly travel to/from the north with 90% accessing the site from the north and 10% accessing the site from the south.
- AV and B-Doubles: Plant would be transported from Port of Newcastle to the site along New England Highway from the south.

The peak hour for construction would occur at the start and the end of the day when the workforce are transported to the site. The majority of the workforce typically arrive on-site between 6:00am and 7:00am. However, they generally have staggered finish times which results in the evening peak hour being less pronounced. For the purposes of the assessment, it has been assumed that all staff depart between 5:00pm and 6:00pm and the evening peak traffic volume on the road network is 80% of the morning peak volume.

During the morning peak all vehicle movements will be towards the site and in the evening peak all vehicle movements will be away from the site. Heavy vehicle movements will be distributed throughout the day and will be split evenly between inbound and outbound movements.

Cumulative traffic impacts

Cumulative impacts, when other traffic generating developments may coincide, exacerbating traffic impacts, are most relevant to peak construction. The primary traffic impact of the solar farm is generated during construction which is anticipated to start in 2025 and take approximately 21-30 months, with the peak construction period expected to take 18 months.

Assessment of 19 projects in the region (shown in full within the appended Traffic Impact Assessment; (Appendix D.3) identified six projects with relevance to the Middlebrook Solar Farm Project. These projects have potential to generate additional vehicle movements on New England Highway at Middlebrook Road (refer to Figure 6-20) which includes these and other large projects known within the region):

1. Hills of Gold Wind Farm
2. Yarraman Abattoir and Feedlot
3. Willow Tree Gravel Extension
4. Ardglen Quarry
5. Werris Creek Coal Mine Expansion
6. Chaffey Dam Upgrade.

The vehicle movements generated by these projects at the intersection with Middlebrook Road have been estimated based on the available information with the conservative assumption that the peak construction periods coincide with the peak construction period of the Middlebrook Solar Farm.

Projected traffic volumes for both northbound and southbound direction for both morning and evening peak hour at the intersection of New England Highway at Middlebrook Road:

- Light vehicles 13 each direction
- Heavy vehicles 12 each direction.

It is noted that no projects are expected to generate vehicle movements on Middlebrook Road.

The assessment concludes that the road network is able to accommodate the project traffic during peak construction periods, including the cumulative traffic generated by other major projects within the surrounding area. The cumulative impact of Project’s traffic with nearby developments is expected to be minimal.

Route assessment

The Port of Newcastle has been identified as the preferred port where the solar farm plant will be imported. Figure 6-21 shows the proposed access route form the port which is the proposed route to be undertaken for all transport vehicles from the port.

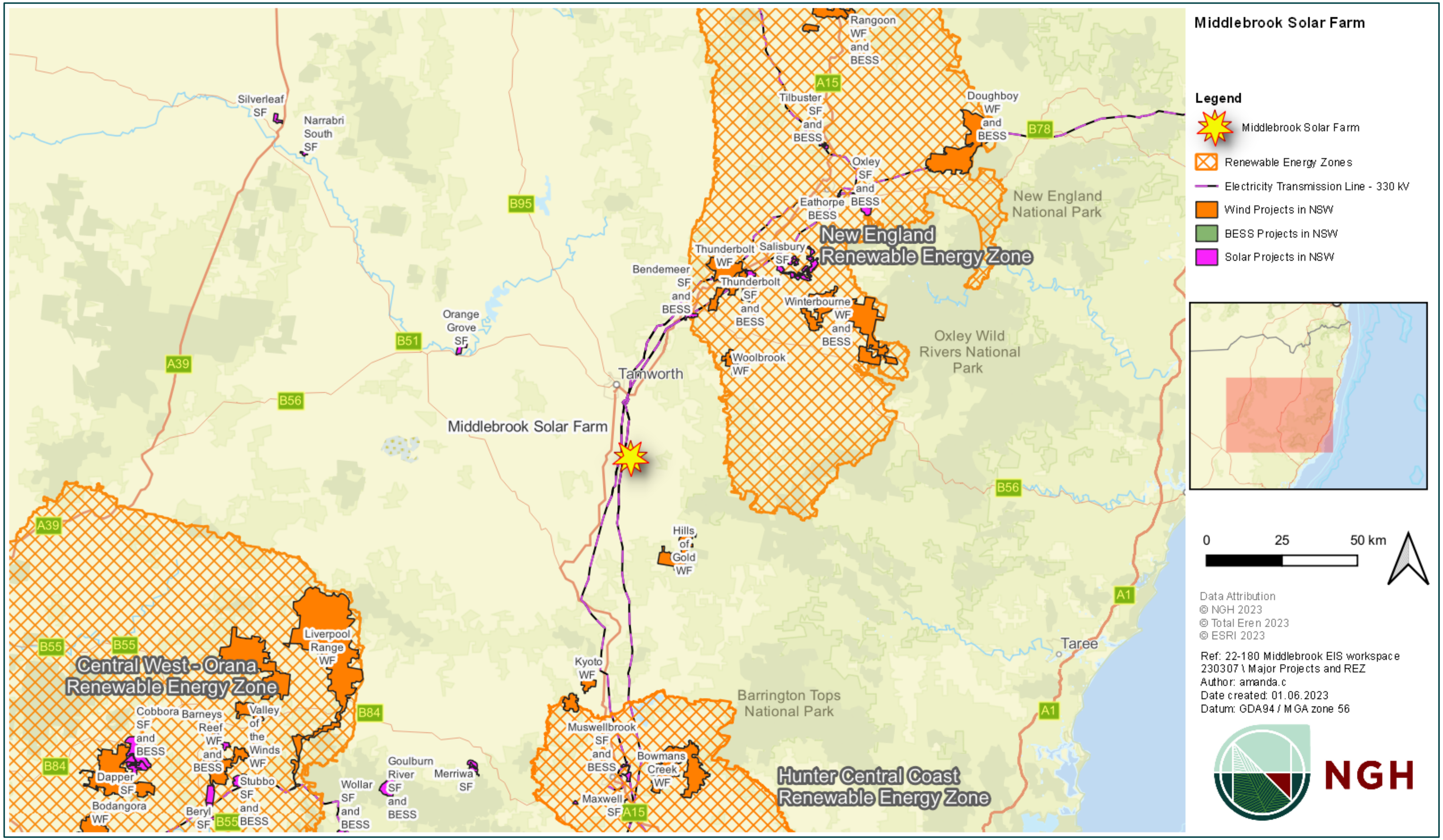


Figure 6-20 Major Renewable Projects

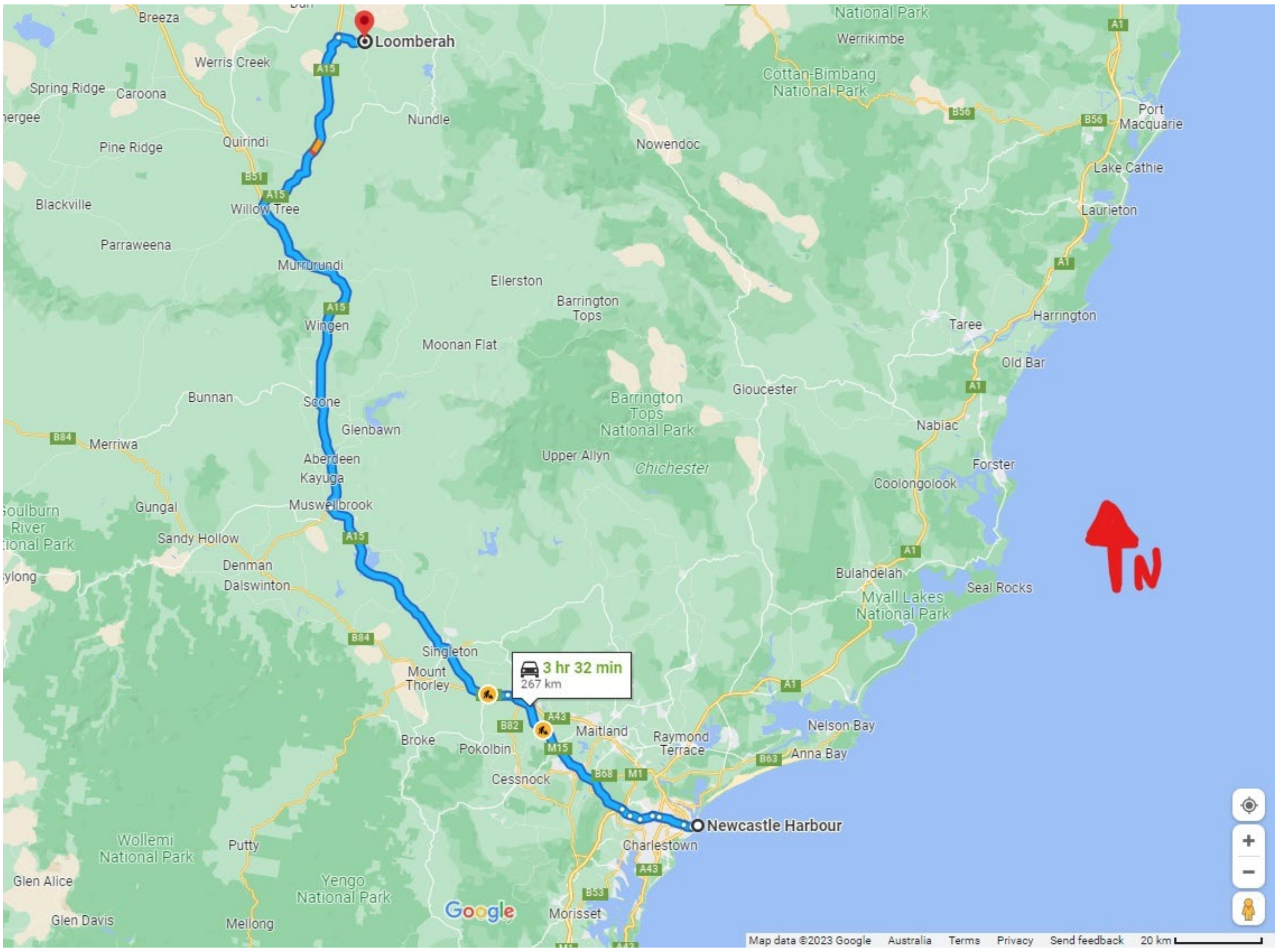


Figure 6-21 Access Route from Port of Newcastle to site (source, Amber, 2023)

The proposed construction traffic access route from the Port of Newcastle to the site is as follows:

- Selwyn Street
- George Street
- Industrial Drive
- Maitland Road
- New England Highway
- John Renshaw Drive
- Hunter Expressway
- New England Highway
- Middlebrook Road.

The access route utilised roads that are designated for B-Double vehicles as outlined within the TfNSE Restricted Access Vehicle Map. It is noted that Middlebrook road is not to be used during periods of wet weather and Tamworth Regional Council is to be notified during these times regarding accessibility. The requirement to consult with Council is captured in the mitigation measures below.

Intersection assessment

Turn treatments

Austroad's *Guide to Traffic Management Part 6: Intersections, Interchanges, and Crossings* (Austroads, 2020) specifies the turning treatments required at intersections. The figure below specifies the Guide's required turn treatments on the major road at unsignalised intersections.

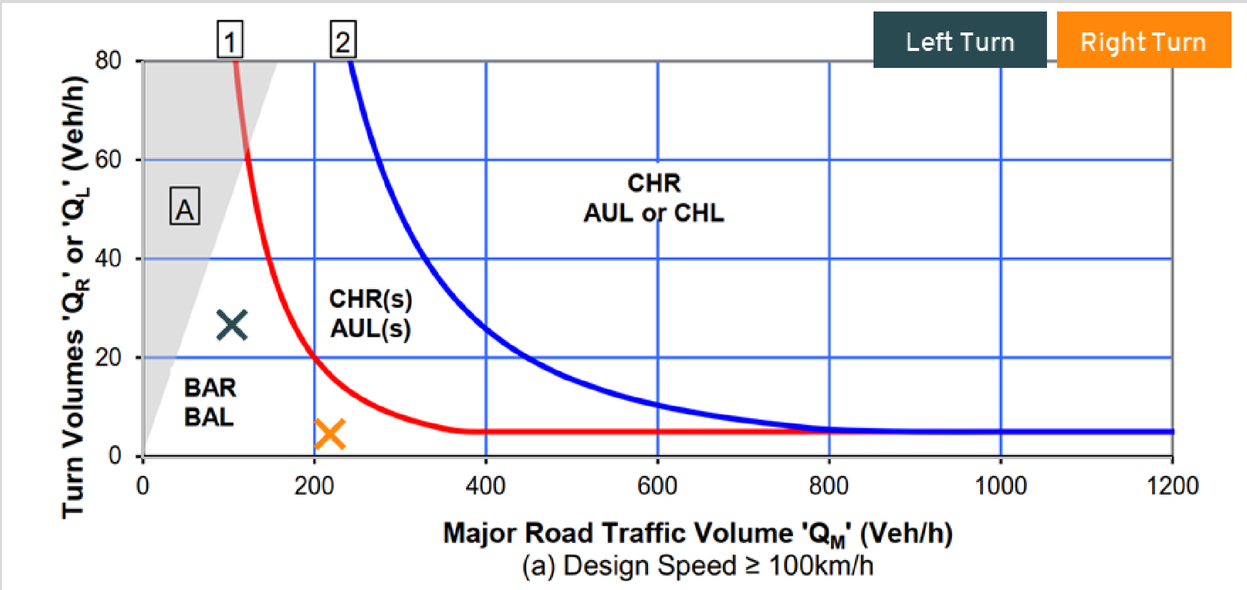


Figure 6-22 Figure 3.25 of Austroads Guide to Traffic Management Part 6 (source, Amber, 2023)

BAL	*Basic Left Turn*
BAR	*Basic Right Turn*
CHR	*Channelised Right Turn*
CHL	*Channelised Left Turn.*

The assessment concludes that the requirement to provide turn facilities at the intersection of New England Highway and Middlebrook Road is during the morning peak hour between 6:00am and 7:00am. The intersection would require a Basic Left Turn (BAL) and a Basic Right Turn (BAR) treatment.

Table 6-14 Turning volumes and turn treatment requirements

Turning Treatment	Traffic volume (vph)		Requirement
	Turn volume	Major road	
Right Turn	5	219	BAR
Left Turn	27	105	BAL

Right turn requirements

The intersection is currently provided with a Channelised Right Turn (CHR) and therefore, the right-turn treatment exceeds the requirement of the Austroads Guide.

Left turn requirements

No left turn treatment is currently provided at the intersection. In order to facilitate left-turn movements it is proposed to amend the existing line marking and provide some localised widening at the intersection to provide a BAL turn treatment. This is included as part of the Project description in Section 3.5.3.

Amber have provided B-Double and OSOM swept path assessment to demonstrate that the vehicles can turn to and from New England Highway based on this new treatment refer Figure 6-23, Figure 6-24, Figure 6-25, Figure 6-26, Figure 6-27, and Figure 6-28.

Site access

New England Highway

Austroads *Guide to Road Design Part 4A: Unsignalised and Signalised Intersections* (Austroads, 2023) specifies the safe intersection sight distance as the minimum sight distance which should be provided along the major road at any intersection. The guide specifies the safe intersection sight distance required for various design speeds. Given New England Highway has a speed limit of 100 km/hr, a design speed of 110 km/hr has been adopted which requires a safe intersection sight distance of 285 metres based on a reaction time of 2.0 seconds. The site line and site distance meet this requirement. Vehicles are expected to be able to safely enter New England Highway from Middlebrook Road.

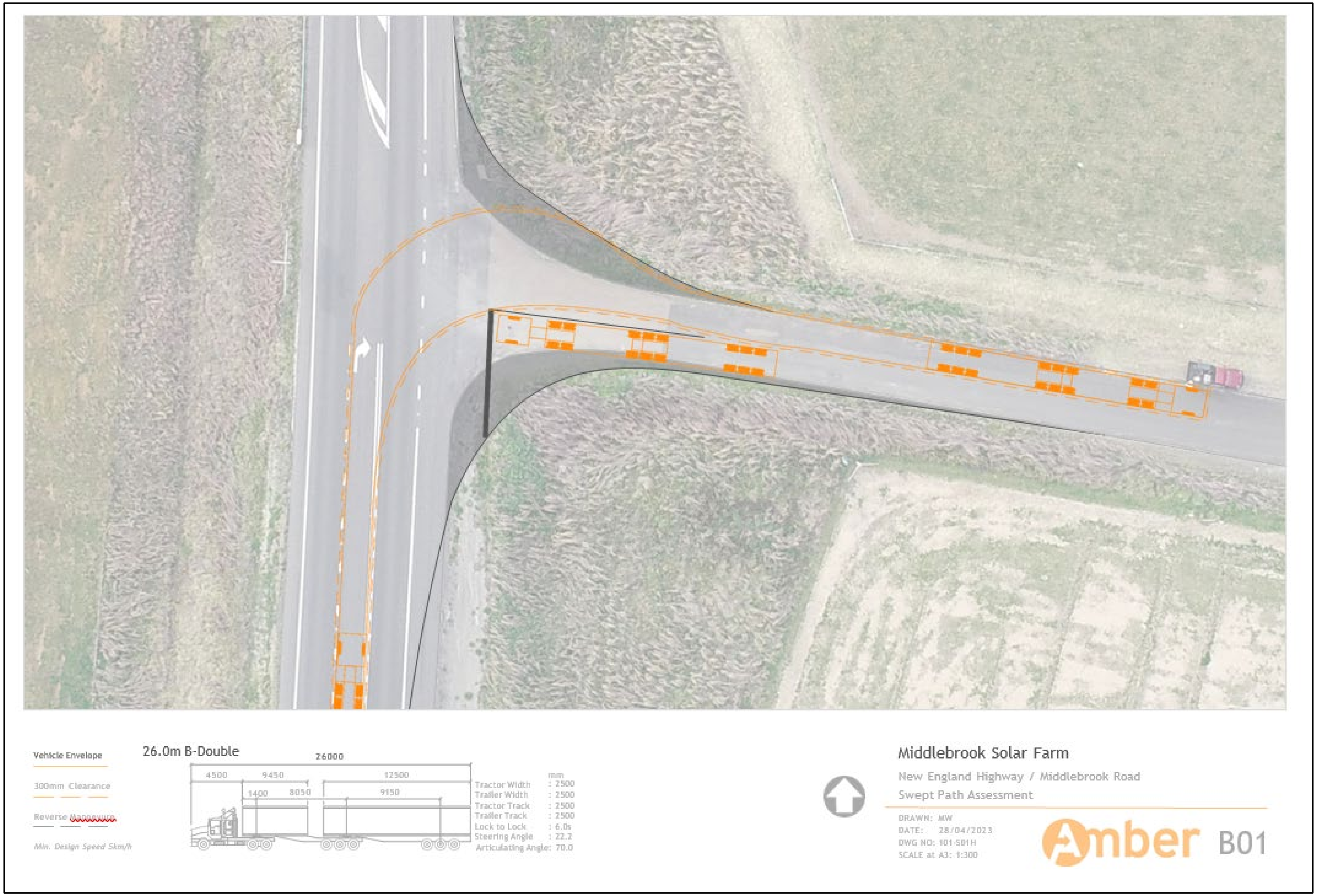


Figure 6-23 B-Double entry (from the south) swept path assessment

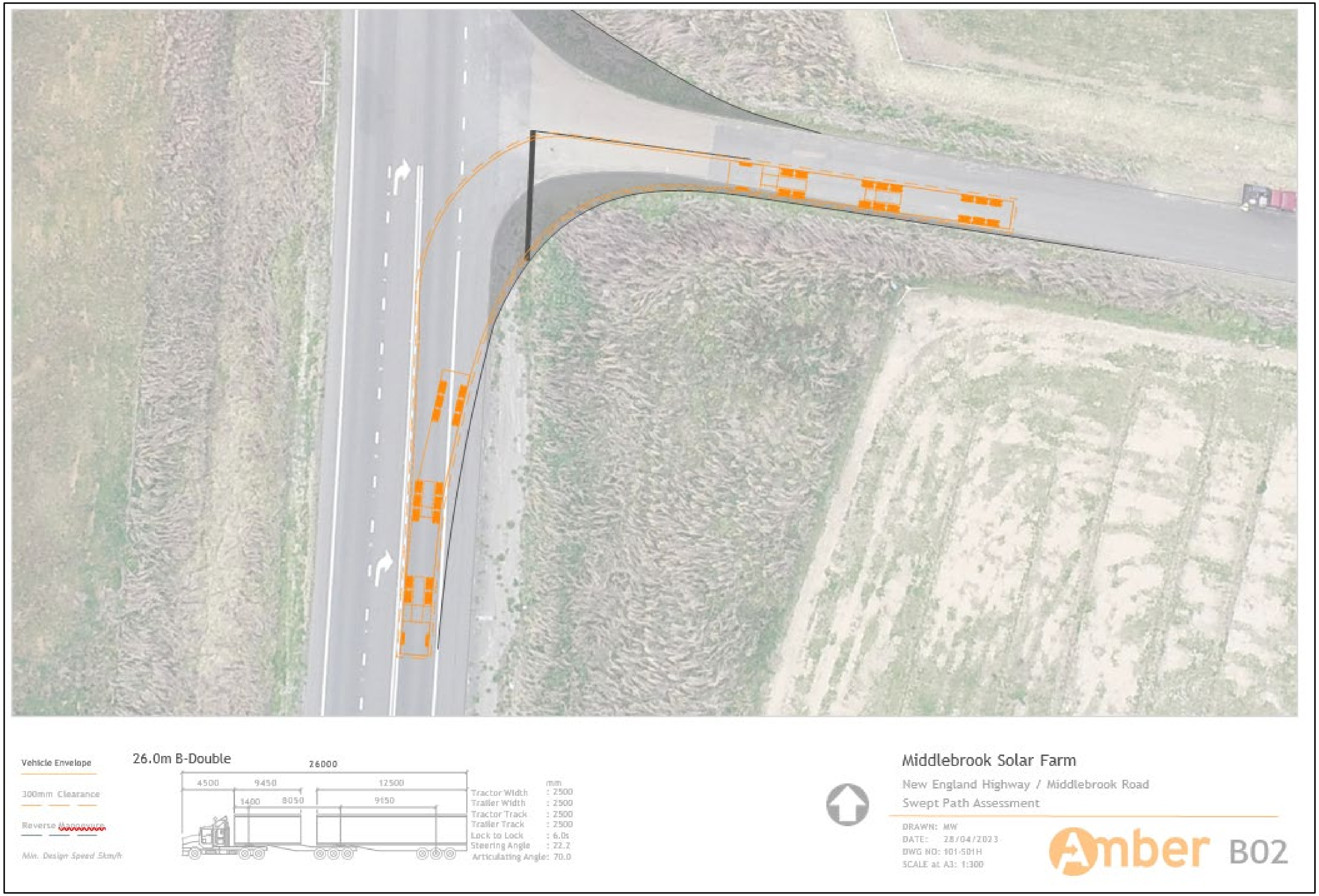


Figure 6-24 B-Double exit (southbound) swept path assessment

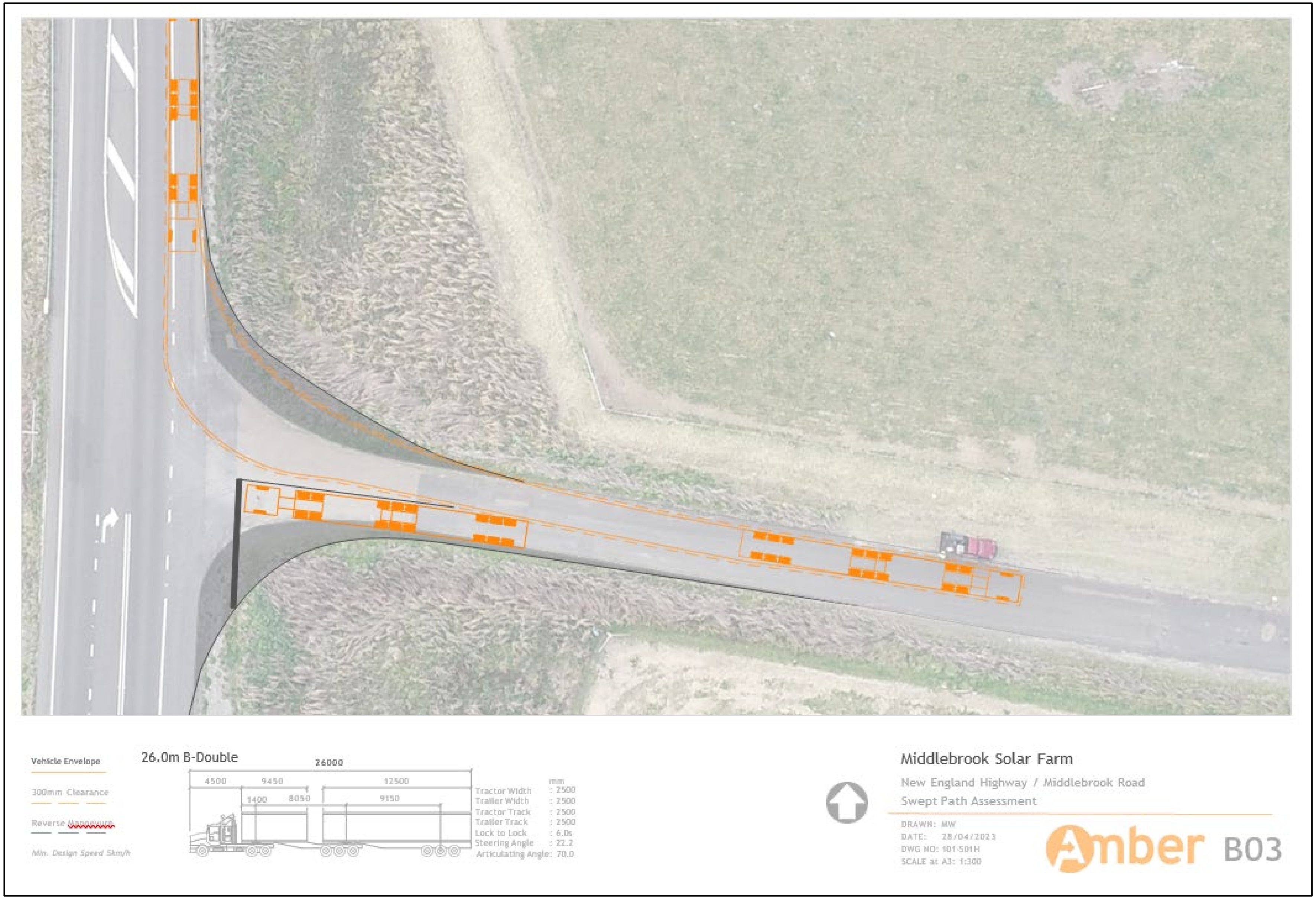


Figure 6-25 B-Double Entry (from the north) swept path assessment

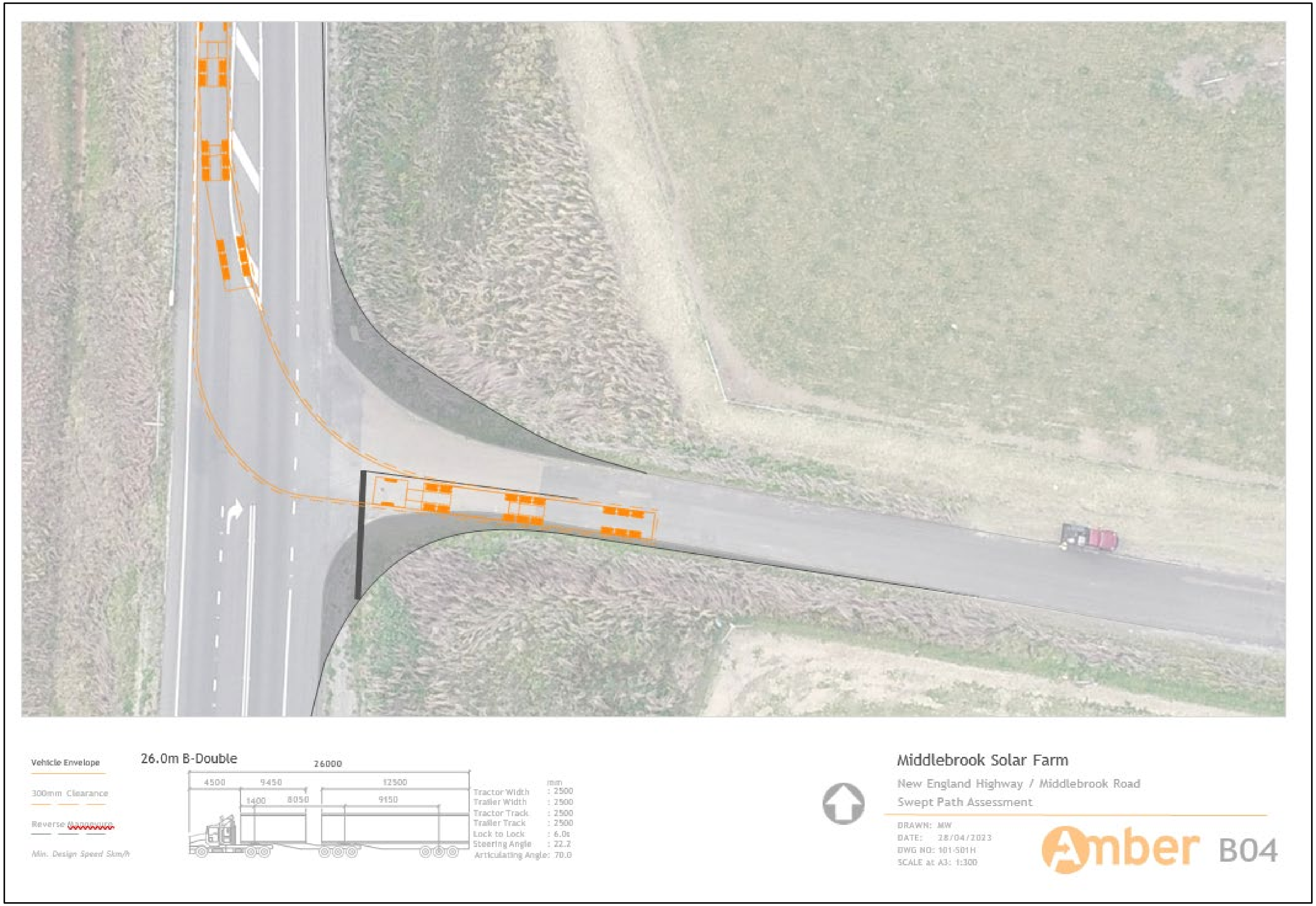


Figure 6-26 B-Double exit (northbound) swept path assessment

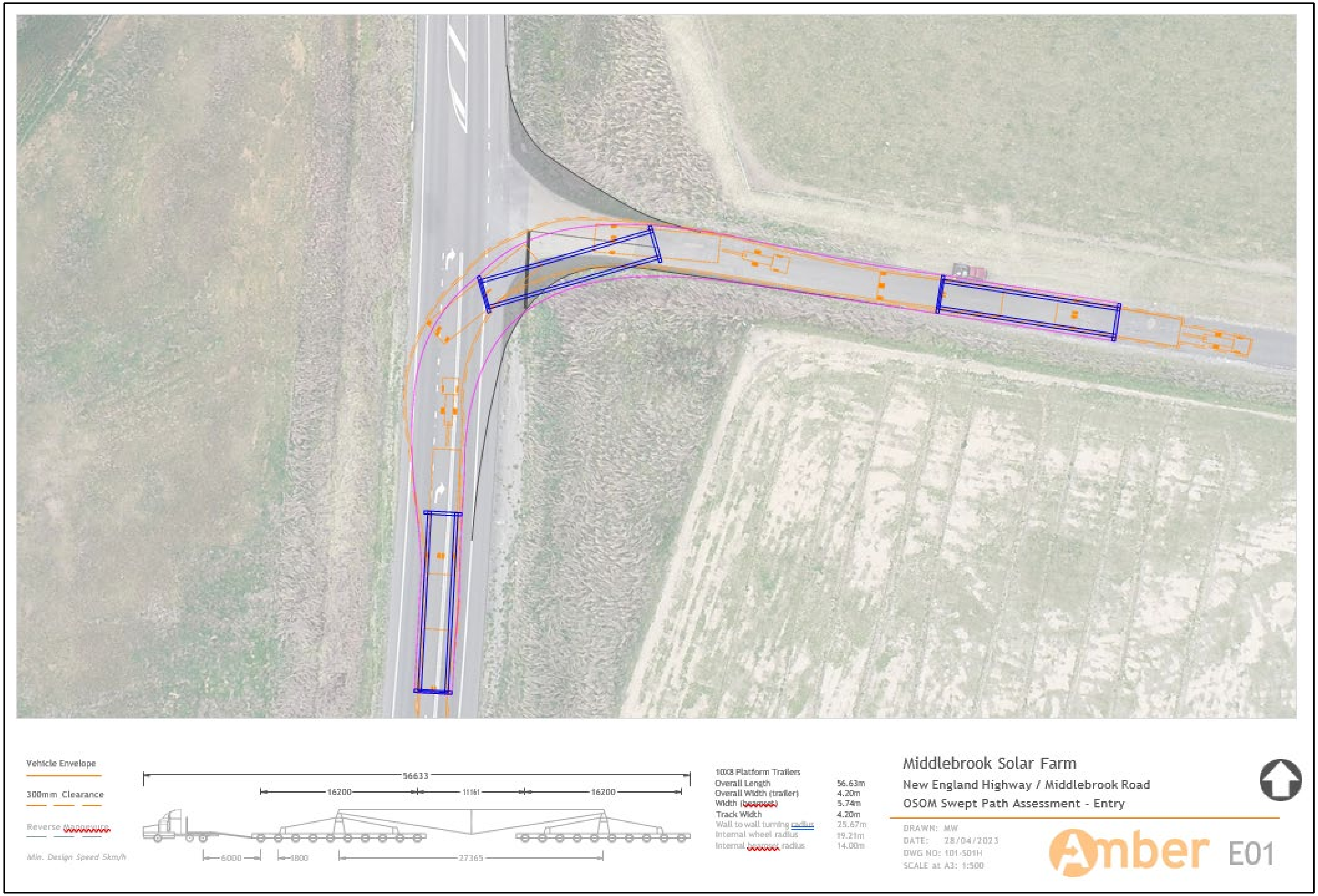


Figure 6-27 OSOM swept path assessment entry

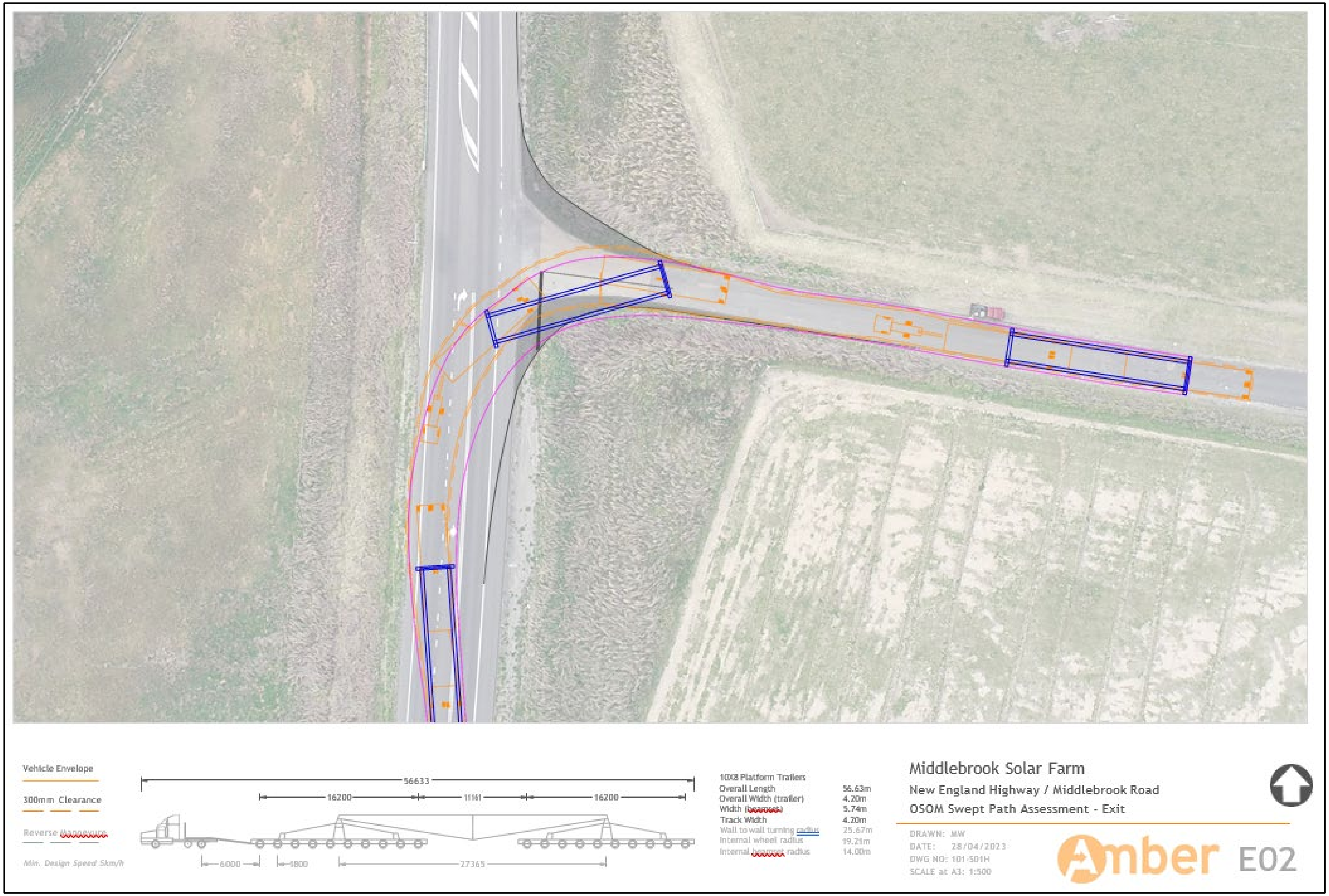


Figure 6-28 OSOM swept path assessment exit

Figure 6-29 Sight distance at access off Middlebrook Road, 3,995 m east of New England Highway intersection

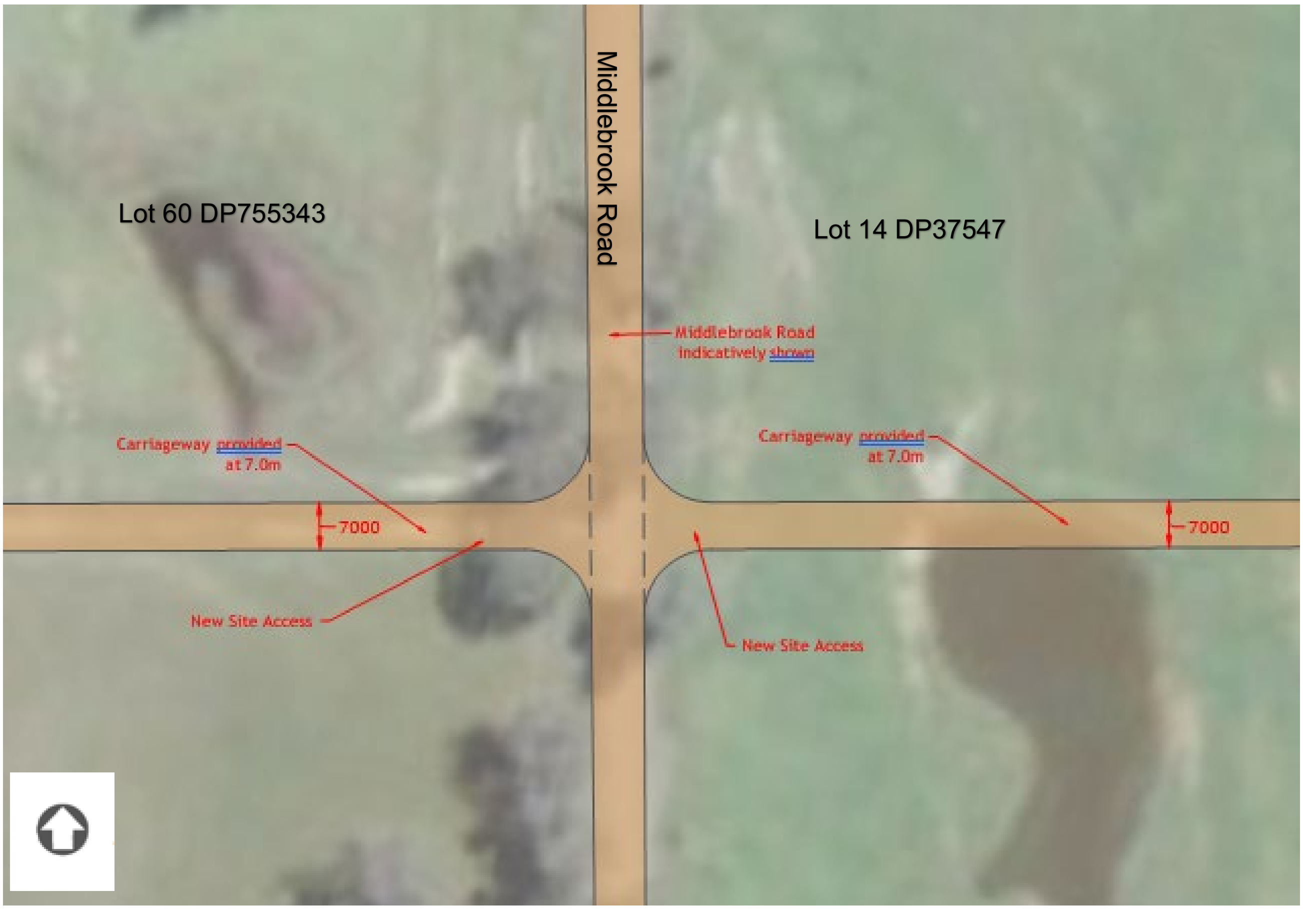


Figure 6-30 Sight distance at connecting access across Middlebrook Road

Middlebrook Road site access

The safe intersection sight distance for the Project access is, in accordance with the Austroads Guide to Road Design – Part 4A, based on the 85th percentile speed recorded on Middlebrook Road. This is found to be 75 km/hr, based on the traffic count data provided by Tamworth Regional Council. Accordingly, a design speed of 80 km/hr has been adopted which results in a sight distance requirement of 181 metres. The sight distance available at the site access greatly exceeds this requirement.

The existing carriage way is 6 m unsealed. To accommodate two-way truck movements, and in accordance with the ARRB guidelines, it is now proposed to increase this to 7 m.

Middlebrook Road connecting access

All project site access with be via Middlebrook Road, 3,995 m east of the New England Highway intersection. However, Middlebrook Road then heads south and divides the project area into two areas, east and west of this section of Middlebrook Road. Vehicles wishing to access the western site will utilise the internal access roads and cross Middlebrook Road at one location via opposing driveways. This location is shown in Figure 2-2.

As for the site access point above, a design speed of 80 km/hr has been adopted which results in a sight distance requirement of 181 metres. The sight distance available at this connecting access point greatly exceeds this requirement.

As for the site access point above, the existing carriage way is 6 m unsealed. At the connecting access point across Middlebrook Road, this would be constructed to 7 m in width.

Amber have provided B-Double and OSOM swept path assessments to demonstrate that both access locations (the site access and the connecting access) will accommodate simultaneous two-way vehicle movements for B-Double vehicles, in consideration of these width upgrades.

Operational traffic

During operation the solar farm is expected to generate a minimal level of traffic associated with maintenance and operation services. The solar farm is expected to be operated by up to 15 staff resulting in traffic generation of up to 20 vehicle movements per day which would result in a negligible change to traffic environment.

Decommissioning traffic

At the end of the operational life of the Project all above ground infrastructure will be dismantled and removed from the Project site. Internal roads, if not required for ongoing farming purposes or fire access, would be removed and the site reinstated as close as possible to its original state. Traffic generation during decommissioning would be similar to traffic generation during the average construction period.

A comprehensive Construction Traffic Management Plan would be prepared prior to the decommissioning phase in conjunction with the relevant road authorities. This would aim to ensure adequate road safety and road network operations are maintained.

6.3.4. Key uncertainties of the assessment

It is anticipated that up to four shuttle busses each carrying 40 persons, would be provided that can transport staff to/from the site reducing the number of private vehicles used. However, for the purposes of assessment it has been assumed that all staff arrive in private vehicles in order to undertake a conservative assessment. A requirement to use shuttlebuses is however, a commitment of the Project.

Cumulative traffic loads factoring in other large developments cannot be known with certainty so far in advance of construction. A mitigation measure to address this is captured below.

6.3.5. Mitigation measures

Table 6-15 Safeguards and mitigation measures for traffic and transport.

ID	Mitigation measures	Project stage
T1	A Construction Traffic Management Plan (CTMP) will be prepared and implemented. The following provisions will be included to minimise the impact of the proposal's construction traffic: • Prior to construction, a pre-condition survey of the relevant sections of the existing road network be undertaken, in consultation with Council. During construction the sections of the road network utilised by the proposal are to be monitored and maintained to ensure continued safe use by all road users, and any faults attributed to construction of the solar farm would be rectified. At the end of construction, a post-condition survey would be undertaken to ensure the road network is left in the consistent condition as at the start of construction. • Vehicles are recommended to drive at slower speeds when travelling on unsealed roads. This can reduce the amount of dust created and the amount of dirt tracked onto the public road network. Standard mitigation measures such as a water trucks to dampen the roads and reduce the amount of dust in the air, can also be considered to reduce dust levels. • Neighbours of the solar farm be consulted and notified regarding the construction program and peak periods. • The use of shuttle busses to minimise traffic during construction would be undertaken.	Prior to and during construction
T2	During periods of wet weather, contractor to liaise with Tamworth Regional Council in order to determine if Middlebrook Road is suitable to be utilised by B-Double vehicles as outlined within the TfNSW Restricted Vehicle Access Map.	Construction
T3	Heavy vehicle movements should avoid peak school bus times to limit the interaction of larger	Construction

ID	Mitigation measures	Project stage
	vehicles and vulnerable road users. A school bus service is operated by Hannaford Bus along Middlebrook Road which passes the site at approximately 7:30am for the school pickup and 4:30pm for the drop-off service.	
T4	Any OSOM vehicle movement are to be timed so that they do not coincide with other OSOM Vehicles within the surrounding area to limit the impact to the road network, which can be undertaken as part of the permit application.	Construction
T5	Upgrade Midddlebrook Road from 6 m to 7 m to comply with the ARRB Guide in order to allow two trucks to pass.	Prior to construction
T6	Single lane bridge on Middlebrook Road requires a review of signage and line marking to ensure it is in accordance with the relevant standards and any deficiencies rectified. Structural weight capacity of the bridge is required to be assessed prior to any OSOM vehicle movements accessing the site.	Prior to construction
T7	Upgrade the intersection of New England Highway and Middlebrook road to provide a BAL turn treatment.	Prior to construction

6.4. Land compatibility

The assessment of the Project's compatibility with the existing and adjacent land uses takes in a number of environmental considerations, as it must assess not only what the land is currently used for, but what it is capable of supporting in the future and what other developments may interact with it in the future.

6.4.1. Assessment approach

As required by the SEARs, the aim of this chapter is to consider potential impacts of the development on existing land uses on the site and adjacent land, including:

- Agricultural land (including Biophysical Strategic Agricultural Land), flood prone land, Crown lands.
- Soil survey to determine the soil characteristics and consider the potential for erosion to occur.
- Cumulative impact assessment of nearby developments.
- Assessment of the compatibility of the development with existing land uses, during construction, operation and after decommissioning, including:
- Consideration of the zoning provisions applying to the land, including subdivision, and.
- Completion of a Land Use Conflict Risk Assessment in accordance with the Department of Industry's Land Use Conflict Risk Assessment Guide.

This assessment is supported by:

- Soil surveys (covered in greater detail in Section 7.2)
- Land and Soil Capability (LSC) mapping
- A Land Use Conflict Risk Assessment (LUCRA) in accordance with the Department of Industry's Land Use Conflict Risk Assessment Guide (DPI, 2011). The LUCRA sources background information presented in earlier sections of the EIS to minimise duplication, where appropriate. It is used to separate out the detailed interactions of the land uses identified and the potential to manage them.
- Database searches including:
  - MinView and common viewer databases
  - The NSW land use dataset (NSW Govenment, 2017).

6.4.2. Existing environment

Agricultural land use and soil capability

The current land use on site is mixed cropping and grazing. The site comprises four lots, which have been previously cleared and repeatedly cropped. Mixed (non-irrigation) cropping and grazing agricultural land activities like those of the Project area are widespread in the region. There is no evidence of horticulture or other intense farming activities within the surrounding area.

The Project will provide full time equivalent employment for up to 15 persons, and contribute to regional rural economy, and utilising local products and services in relation to these activities.

Land and Soil Capability Assessment Scheme

The Land and Soil Capability Assessment Scheme (OEH, 2012) uses the biophysical features of the land and soil to derive detailed rating tables for a range of land and soil hazards. The scheme consists of eight classes and considers both:

- The biophysical features of the land and associated hazards.
- The ability to manage the hazards; the level of inputs, expertise and investment required to manage the land sustainably.

The hazards assessed include water erosion, wind erosion, soil structure decline, soil acidification, salinity, water logging, shallow soils and rockiness as well as mass movement. Each hazard is assessed against set criteria tables and ranked from 1 through to 8 ranging from:

Class 1 Extremely high capability land:
Land has no limitations. No special land management practices required. Land capable of all rural land uses and land management practices.
Class 8 Extremely low capability land:
Limitations are so severe that the land is incapable of sustaining any land use apart from nature conservation. There should be no disturbance of native vegetation.

It is noted that Classes 1–3 are considered important agricultural land and would typically not be considered appropriate for solar farm development without strong justification.

All sites within the Development footprint are mapped as LSC Class 4 or LSC Class 5 (refer to Figure 6-31.

- LSC Class 4 is considered to have moderate agricultural capability with moderate to high limitations for high-impact land uses which restrict land management options for regular high-impact land uses such as cropping, high-intensity grazing and horticulture.
- LSC Class 5 is considered to have moderate-low agricultural capability and has severe limitations for high impact land management uses such as cropping. This land is generally more suitable for grazing with some limitations or very occasional cultivation for pasture establishment.

It is noted that according to Appendix A of the recently released *Large-Scale Solar Energy Guideline* (DPE, 2022) a Level 2 – reduced assessment is required as the Development footprint is located on rural zoned land mapped as Land and Soil Capability (LSC) Class 4 and 5.

High capability Class 3 land present in the east of the Subject land (refer to Figure 6-31).

Biophysical Strategic Agricultural Land (BSAL)

Biophysical Strategic Agricultural Land is land with a rare combination of natural resources highly suitable for agriculture. These lands intrinsically have the best quality landforms, soil and water resources which are naturally capable of sustaining high levels of productivity and require minimal management practices to maintain this high quality.

The soils survey undertaken by NGH in Appendix D.4 and verified that land mapped as BSAL in Figure 6-31 does conform to BSAL under the *Interim protocol for site verification and mapping of biophysical strategic agricultural land* (NSW Government, 2013).

Current and potential future land uses

The following land uses are currently relevant to the Subject land and surrounding areas (refer to Figure 6-32 and Figure 6-33) and are discussed further below.

	Subject land	Surrounding areas
Agricultural activities (grazing and cropping)	✓	✓
Residential infrastructure	✓	✓
Transport (including road, rail and airports)	✓	✓
Water resources (drinking water, dams, reservoirs)	✓	✓
Flood prone land / water resources	✓ [5]	✓
Crown land	NA	✓
Mining, quarries, mineral or petroleum rights	NA	✓

[5] Footprint Pty Ltd have modelled flood behaviour for the Subject land and shown areas of H5 flood hazard associated with the central second order stream and areas to the north of the site. Refer to Section 7.1 and Appendix D.8 and not duplicated in this chapter.

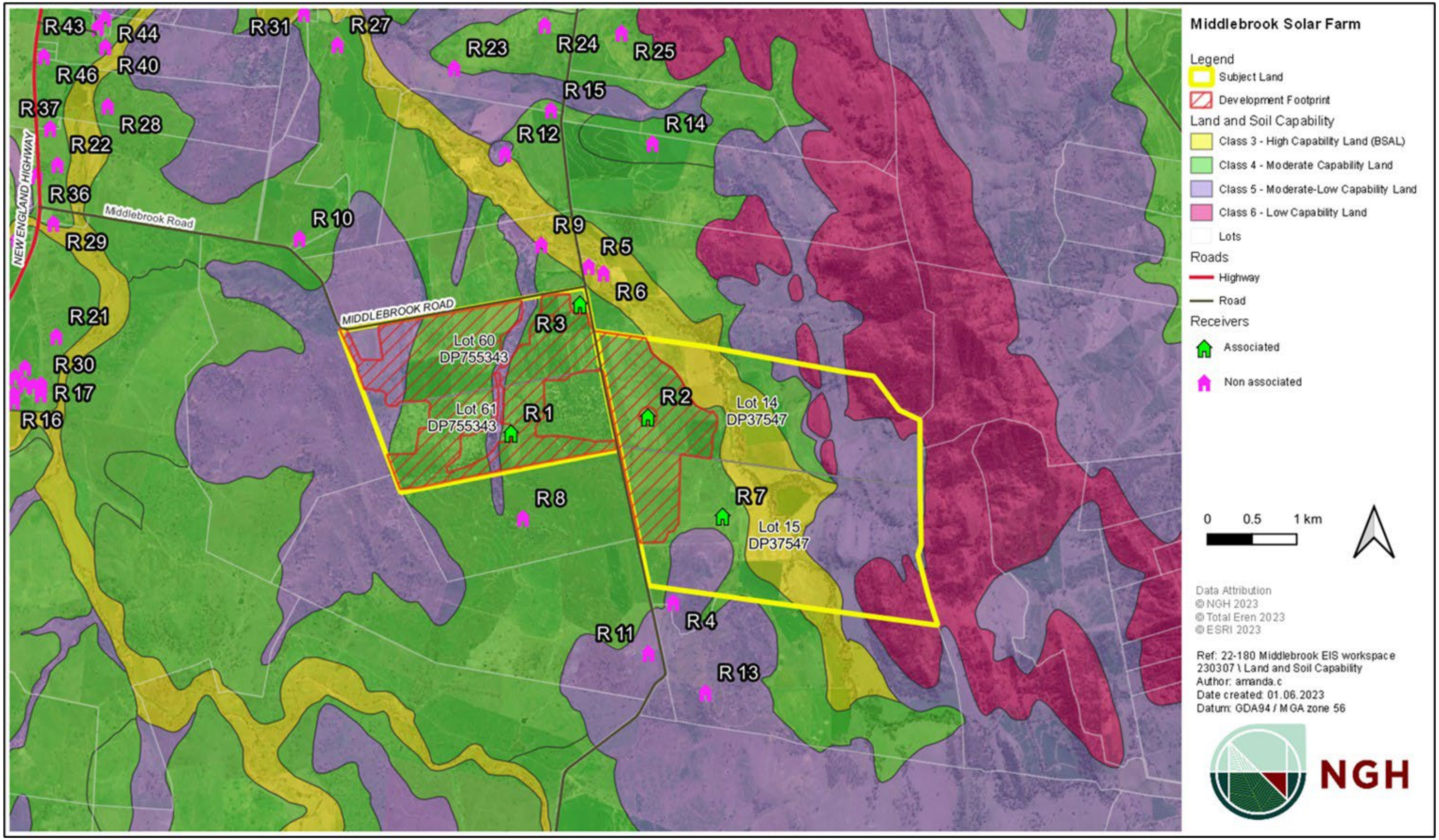


Figure 6-31 Land and Soil Capability

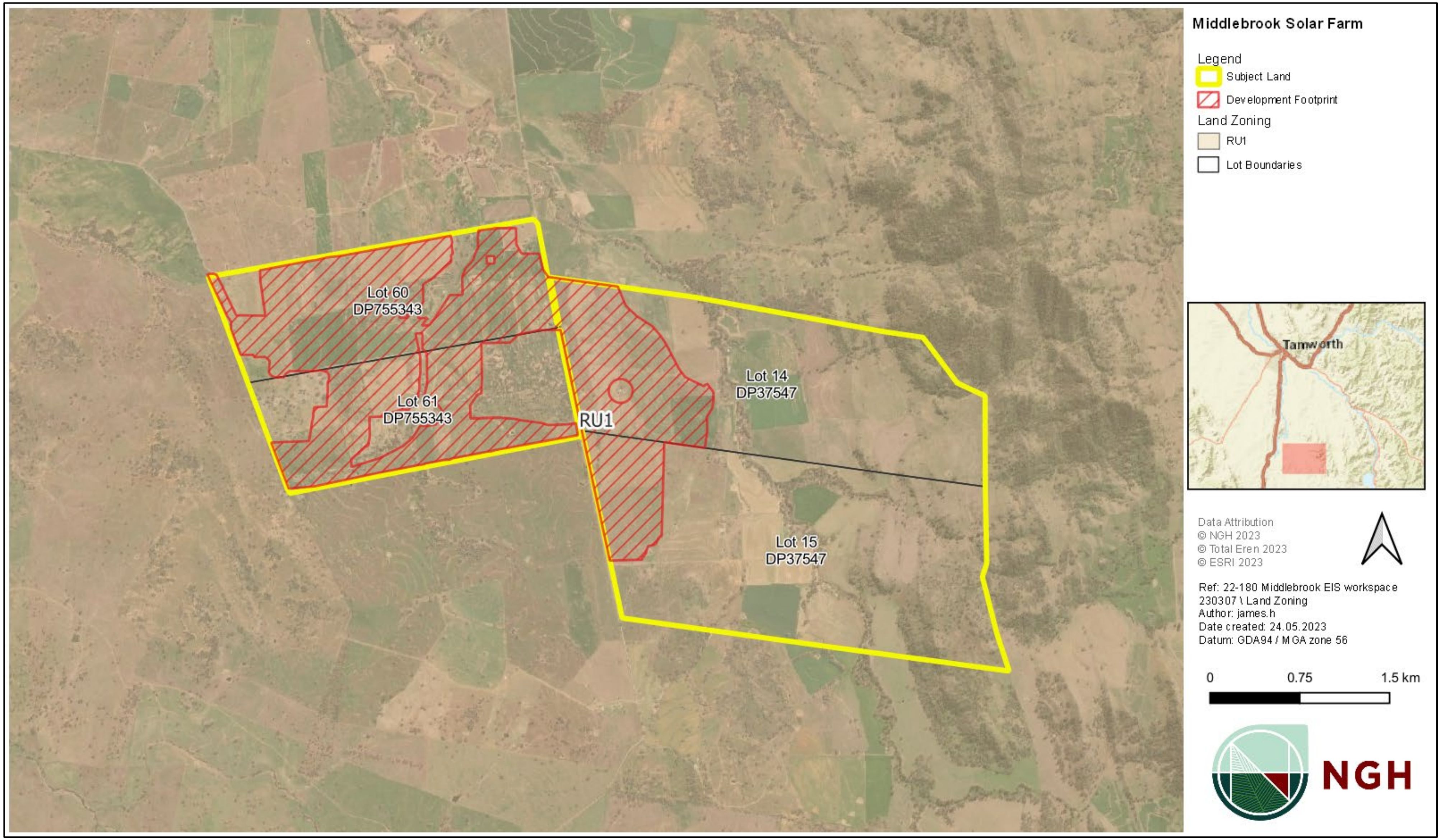


Figure 6-32 Land zoning

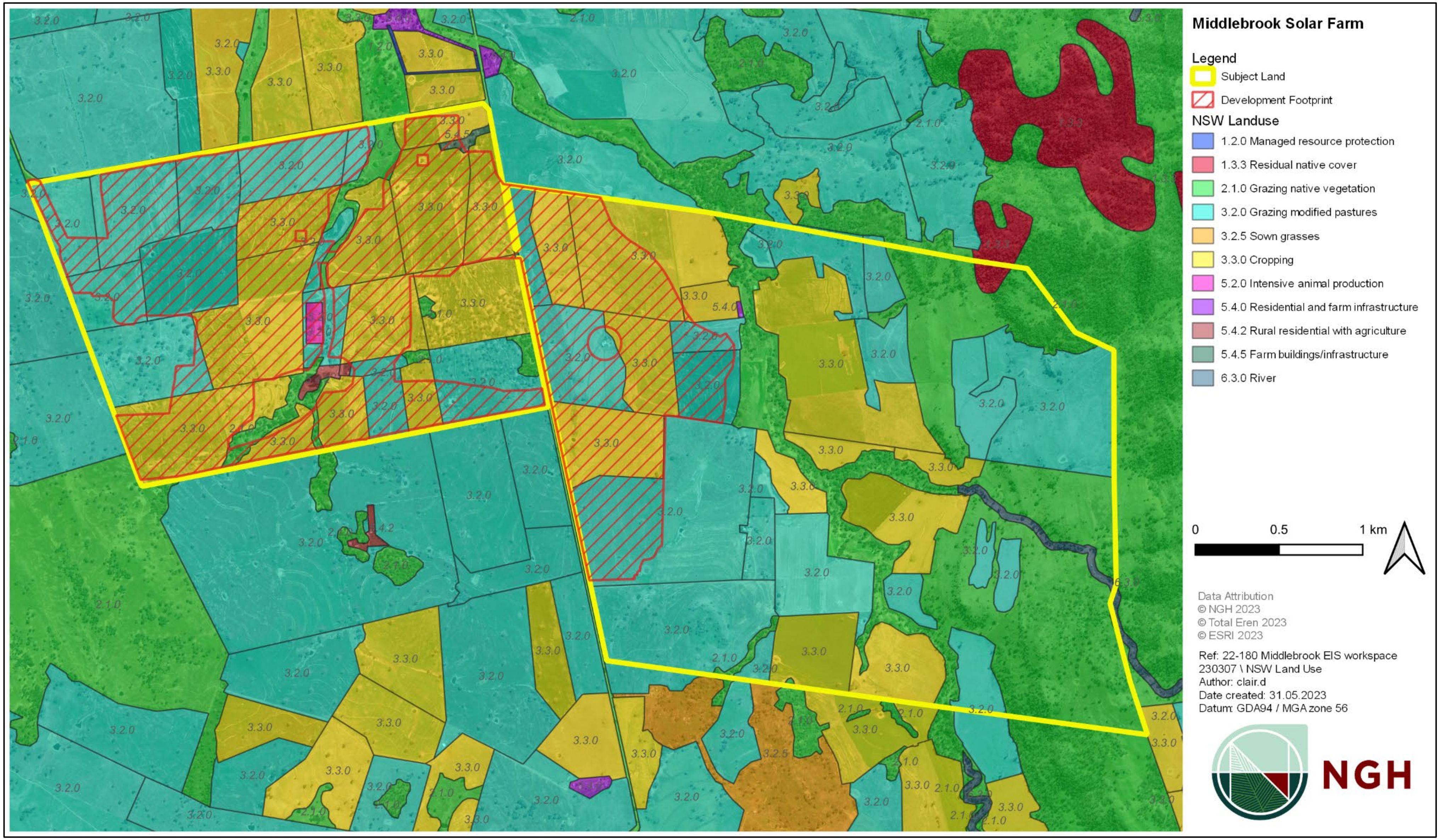


Figure 6-33 Land use categorisations

Agriculture

Agriculture within the Tamworth LGA is based on grazing and large-scale cropping. The surrounding areas of the New England Tablelands and the North West Slopes and Plains are well known for their wool production. Other notable industries include cattle, and cereal crops. Agriculture is a key industry in the locality, with 9.8% of people in Loomberah employed by the beef cattle farming industry. In 2020/21, the total value of agricultural output in Tamworth LGA was $305 m. The largest commodity produced was from livestock processing, which accounted for 75.4% of the LGAs total agricultural output in value terms (id.community, 2021).

Agricultural support infrastructure within the Tamworth LGA includes the New England Highway, and Oxley Highway as the major arterial roads, and rail infrastructure such as the main northern rail line which connects regional areas to Newcastle. The closest livestock selling centre, Tamworth regional Livestock Exchange is located just outside of Tamworth, approximately 25 km north-west of the site. The site is currently occupied by open grazing pastures and dryland cereal crops with 25 dams on the Subject Land.

Residential infrastructure and growth

Four associated residences are located on the Subject land, these have been excluded from the Development footprint. While land in the immediate vicinity of the Project is zoned RU1 Rural land, there are a number of residential properties around the site. The main impacts to residences are considered to be visual and noise, these impacts are detailed in Sections 6.1 and 6.2:

- No greater than low visual impacts for any non-associated receivers.
- No greater than low visual impact for any assessed public viewpoint.
- No glare at any non-associated receiver.
- No glare at any public viewpoint.
- No construction or noise exceedances at any non-associated receivers.

The Project would be located in the rural area south-east of Tamworth, on a major transport corridor. It is not identified within or near any areas identified for '*residential expansion*' in the Draft Tamworth Local Strategic Planning Statement. It is also note within the Subject Land of the Tamworth Regional city area under the TISEPP.

Transport corridors, including rail and airports

The Project is intersected by the Marsden Park Road and would be accessed primarily by Middlebrook Road, which shares an intersection with the New England Highway. The Main Northern Railway Line is located about 14 km to the northwest of the Project site. The Tamworth Airport is located approximately 25 km northwest of the Project site. Tamworth also has a local bus network including a coach to Sydney.

Visual impacts are detailed in Sections 6.1:

- No glare at any airstrip, rail or roadway (subject to operational mitigation requirements to protect areas of Middlebrook Road).

Water resources

The Project site is traversed by the 6th order Spring Creek waterway and the 3rd order Banyandah Creek. These tributaries flow north into Goonoo Goonoo Creek about 3.6 km from the site (refer to Figure 6-36. The main watercourses within the Project site could be described as ephemeral and would only contain flowing water during wet periods. There are three bores on site, these are for stock and domestic use. These resources are important for current agricultural uses. The Project site is not located within a Drinking Water Catchment.

Potential future land uses

All of the land uses discussed above seem likely to have potential to continue as future land uses in the surrounding areas. Being located in a predominantly agricultural area it is unlikely that the surrounds would be subject to great levels of change throughout the life of the Project, it is noted, however, that the expansion of utility scale renewable energy generation and storage may be the largest change in the region over the coming decades.

Analysis of the socio-economic context (provided in full Appendix D.6 and informed by local consultation activities) points to:

- A strong economic outlook with high living standards for the region
- An increase in population growth to 100,000 people in Tamworth by 2041
- A strong focus on maintaining current farming processes into the future through the preservation of agricultural land.
- In increase in large infrastructure projects such as renewable energy but also agricultural enterprises such as the state significant development Baiada Loomberah Road Poultry Facility located approximately 12.5 km northeast of the project
- An opening for tourism / nature-based recreation opportunities, such as:
    - Chaffey Reservoir is located approximately 10 km southeast of the development site.
    - Peel River 16 km east of the Project site.
    - Crawney Pass National Park
    - Ben Halls Gap Nature Reserve (33 km).
    - Tomalla Nature Reserve (37 km)
- Tourism operations, providing accommodation or restaurants etc., such as:
    - Goonoo Goonoo station provides accommodation and a venue for events approximately 3.5 km west of the Project. There is also a private landing strip and Goonoo Goonoo Station.
    - Rural Bed and Breakfast’s are already popular north of the site especially around the localities of Kingswood and Timbumburi about 8–10 km north of the site.

Tenure and other interests in the land

A Minview search was carried out on 13 March 2023. No Crown land, mine, quarries, mineral or petroleum rights leases are current for the Development footprint. The nearest Crown Lands curtilage is about 3.5 km north west of the Development footprint.

6.4.3. Potential impacts

Key land use impacts relevant to the Project include:

- Construction
    - Land use conflict with existing or adjacent activities – primarily due to noise, visual and traffic impacts associated with earthworks activities in peak periods of construction.

    - Potential for land degradation, through physical impacts such as erosion or contamination risks where impacts are not managed.
- Operation
    - Land use conflict with existing or adjacent activities – agriculture, lifestyle blocks, residential uses.
    - Potential for land degradation, through physical impacts such as weed ingress or contamination risks.
    - Loss of agricultural land, for the life of the project.
- Decommissioning
    - All of the above impacts are also relevant to decommissioning.

Land use conflict risk assessment

A Land Use Conflict Risk Assessment (LUCRA) has been applied to analyse the compatibility of a change in land use as a result of the Middlebrook solar farm. A LUCRA has been carried out in accordance with the DPI *Land Use Conflict Risk Assessment Guide* (DPI, 2011). The LUCRA assessment primarily is used focus on agricultural developments but can be used to assess other activities (DPI, 2011). Given some of the surrounding land uses are different to the proposed solar farm, specifically agriculture, this assessment aims to identify and rank potential land use conflicts to ensure they are adequately managed. Where expected conflicts are adequately managed, the rights of the existing and proposed land uses can be protected.

The risk ranking in Table 6-17 has been determined using the risk ranking matrix shown in Table 6-16 and in accordance with the probability table and measure consequence table in Department of Primary Industries Land Use Conflict Risk Assessment Guide (DPI, 2011). The matrix ranks the risk of impacts according to the probability of occurrence and the consequence of the impact. Probability ‘A’ is described as ‘almost certain’ to probability ‘E’, which is described as ‘rare’. The level of consequence starts at 1 – Severe to 5 – Negligible. The risk ranking from 1 to 25 is a result of the probability and consequence. For example, a risk ranking of 25 is the highest magnitude of risk.

Potential impacts of the Project are assessed against the land use conflict risk assessment table from the Land Use Conflict Risk Assessment Guide (DPI 2011) in Table 6-17.

Table 6-16 LUCRA Risk ranking matrix

PROBABILITY	A	B	C	D	E
Consequence					
	25	24	22	19	15
	23	21	18	14	10
	20	17	13	9	6
	16	12	8	5	3
	11	7	4	2	1

Table 6-17 LUCRA assessment for Middlebrook Solar Farm

Identified Potential Conflict	Risk Ranking		Management Strategy	Revised Risk Ranking	
Agricultural expansion (land opportunities)	B3	17	The Development footprint has been designed in such a way that it avoids the highest agricultural land on the Project site BSAL The Project would result in the reduction of agricultural activities over 530 ha (Development footprint) of the Project site leaving 868 ha free from infrastructure. All areas outside the Development footprint could be grazed or cropped as the landholder wishes. The Project is unlikely to impact large agricultural enterprises such as the Baiada Loomberah Road Poultry Facility	B5	7
Contaminated surface water runoff	B3	17	Implementation of a soil and water management plan and an erosion and sediment control plan would minimise the potential impact.	D4	5
Dust	B3	17	Dust generated during the construction and decommissioning stages to be managed using water carts when required. Dust is not expected to generate a significant land use conflict during operation.	C4	8
Fire/ Bushfire	C1	22	Implementation of a Bushfire Management Plan and a minimum 10 m Asset Protection Zone would significantly reduce the probability of the Project starting a fire or a bushfire damaging the Projects infrastructure.	D3	9
Visual amenity	C3	13	Existing vegetation and topography within the area would screen the Project as identified would substantially mitigate expected impact on visual amenity, however, it is noted that some elevated dwellings would still receive views of the solar farm.	C4	8
Noise	B3	17	Noise generated during construction and decommissioning stages would be minimised through the implementation of mitigation measures. Where regular maintenance practices are incorporated into operation, noise is not expected to generate a land use conflict. The Noise assessment in Section 6.2 notes that no receiver is expected to be significantly impacts by noise during construction or operation.	C5	4

Identified Potential Conflict	Risk Ranking		Management Strategy	Revised Risk Ranking	
Traffic generation and disruption	B3	17	Traffic generation and disruptions during construction and decommissioning stages are considered likely, however, the impact would be temporary and able to be managed (refer to Section 6.3.3). During construction it is noted that Middlebrook Road may be operate at limited capacity during wet weather. This presents a risk to project timelines that could prolong construction impacts such as dust and road degradation. The Applicant is responsible for remediating any damage caused by the Project.	B4	12
Weed and pest control	A3	20	Implementation of pest and weed management plan during construction and operation stages.	D4	5
Tourism	C4	8	Tourism opportunities would be affected by amenity issues discussed above such as visual, noise and traffic. Existing tourist accommodation in the area is not located in the immediate vicinity of the project so this impact is considered low. There is a potential for eco-tourist to be interested in the solar farm which could present niche tourism opportunities in the area, given its close proximity to the New England Highway.	C5	4

Construction and operation

Agricultural value of the land

The Project has excluded from any Project impact the BSAL land to minimize its impact on high value agricultural operations. There is approximately 1,525,462 ha of mapped BSAL within the New England North West Region (NSW Government 2012). 225 ha of BSAL occurs within the Project site and has been excluded from the Development footprint. It is identified as land capability class 3 in Figure 7-8.

The Development footprint would impact upon the following classes under the Land and Soil Capability Assessment Scheme:

- Class 3 (BSAL) – 0 ha
- Class 4 – 459.75 ha
- Class 5 – 50.47 ha.

The development of a solar farm would potentially result in the following agricultural impacts:

- Cropping would not be possible over the life of the Project. However, the opportunity to rest the land would provide a multitude of benefits including returning soil organisms, soil carbon, soil moisture and soil structure to the areas previously cropped and grazed. Diversity in groundcover and native perennial species of grasses would be encouraged to increase soil stability, increase organic material and reduce evaporation losses.

- Sheep grazing may continue within development site if managed appropriately. Continuing grazing would maintain groundcover, reduce fire risk (compared to no grazing) and reduce soil compaction (Figure 6-34 shows an image of sheep grazing around solar panels). Grazing can be undertaken in accordance with a monitoring regime to manage this.

Figure 6-34 Sheep grazing among solar panels at Lilyvale Solar Farm in Queensland

Agricultural economy impacts

The Project would result in the loss of approximately 530 ha of potential cropping land for the life of the solar farm (Approximately 30 years). This represents 0.068% of available agricultural land in the Tamworth Regional LGA and does not significantly reduce the availability of agricultural land for primary production in the region. For the construction period, there would be a complete cessation in agricultural activities within the development site. During the operational phase, not all agricultural activities would be precluded, and it is highly likely sheep grazing would continue. Some landholders have elected to graze cattle over sheep due to the presence of wild dogs in the area. Pest animal control measures and security fencing around the perimeter of the development site would again make sheep grazing a feasible alternative for the Project area. The nature of the agricultural activities would change from cropping and grazing to grazing within the development site.

Impacts on adjacent agricultural operations

Key concerns raised by the community in relation to this and other solar farms NGH has assessed in agricultural areas include:

- Heat island effect
- Land devaluation and insurance premiums
- Movement of large plant in relation to transmission lines or other barriers in relation to the solar farm.
- Offsite impacts; erosion, flooding, biosecurity
- Resource loss and fragmentation.

It is considered unlikely that traffic movements associated with the Project activities would generate a land use conflict with movement of local stock. The likelihood of conflict can be further minimised by consulting with local landholders.

Heat Island effect

The topic has been subject to recent consideration by a Victorian Planning Panel for solar farms proposed in Greater Shepparton for solar farms proposed by Neoen and X-Elio. This is detailed in the *Panel Report for the Greater Shepparton Solar Energy Facility Planning Permit Application 2017-162, 2017-274, 2017-301 and 2017-344* (Planning Panels Victoria, 2018). Neoen, in preparation of a response to key issues raised in objecting submissions, commissioned a *Statement of Evidence by Greg Barron-Gafford* from the Research Group Biography, Ecosystem Science (University of Arizona) (Barron-Gafford, 2018).

Barron-Gafford (2018), in his Statement of Evidence (SoE) to the Victorian Planning Panel included results on the radius of the measured heat effects. This identified that the PVHI effect was indistinguishable from air temperatures over native vegetation when measured at a distance of 30 m from the edge of the PV array (Figure 6-35). In his SoE Barron-Gafford states that:

> *'this pattern held true for both daytime and night-time conditions. Because the PV panels themselves trap the energy from diffuse sunlight that was able to reach the ground underneath them, air temperatures remain elevated within a PV array. As you leave this "overstorey" of PV panels, energy is able to radiate back towards the atmosphere, as it does in a natural setting, and the PVHI quickly dissipates'*.

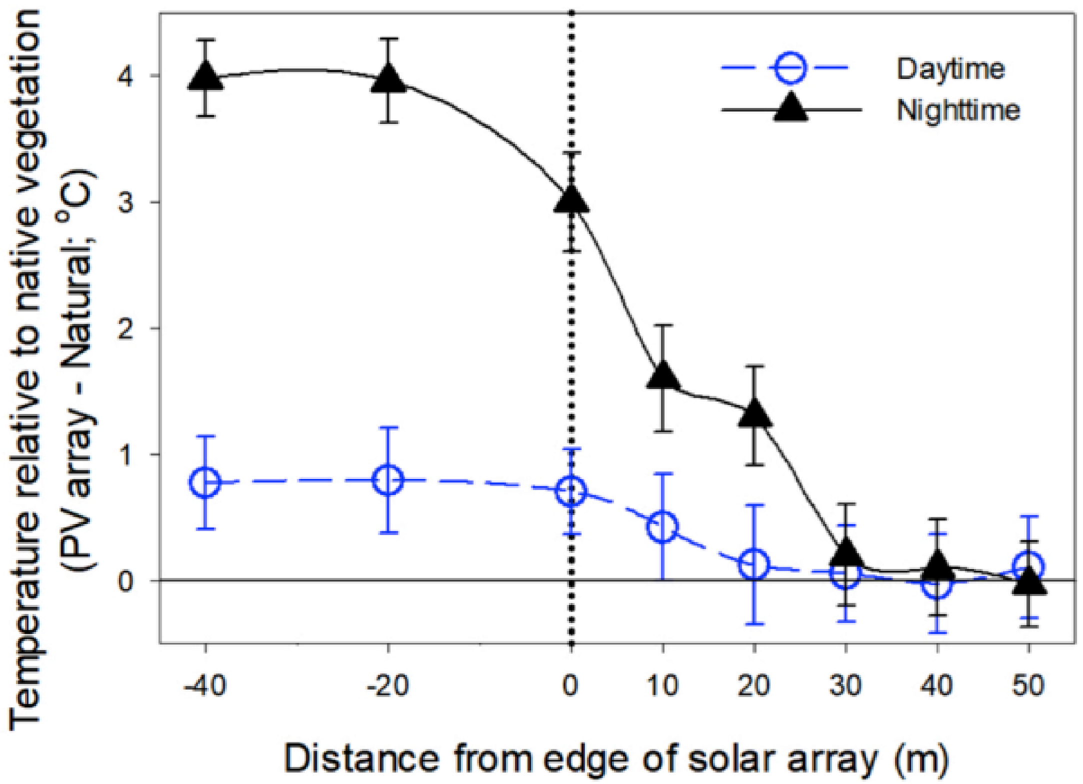


Figure 6-35 Measures of air temperature within (negative values on the X-axis) and outside of the PV array (positive values on the X-axis) were used to quantify the spatial extent of the heat island effect. The dotted line represents the edge of the PV array (Barron-Gafford, 2018).

The Victorian Planning Panel Report accepted that solar arrays affect air and soil temperatures within the solar array perimeter, but that in relation to outside of the solar array perimeter a heat island effect is unlikely to occur. It identified that any temperature increase within the solar array would be marginal and a 30 m setback from any neighbouring property boundary could be implemented. The Project is designed including sufficient setbacks.

Disturbance of farming operations and livestock

It is important to note that solar farms do not preclude the use of land for agriculture. Groundcover growth under solar panels at the operational Lilyvale Solar Farm in Queensland is shown in Figure 6-34 as an example of the ability to maintain grazing productivity.

Adjacent farming operations are compatible with the Project. Noise from nearby farming practices over the day would not impact on the proposed solar farm. The proposed solar farm construction and decommissioning would largely occur in daylight hours and would not conflict with adjacent farming activity.

The Project has explored the ability to use a range of construction water sources to reduce the Project's demand on potable scheme water. Water for construction would be transported to site from a Tamworth Regional Council standpipe or from an authorised contractor. The Project has been mindful to reduce the Project's impact on water availability for surrounding landholders.

When grazing recommences following construction, livestock would become accustomed to the solar panels as they do not inhibit groundcover, and provide valuable shade, wind and rain cover for sheep. During operations, sheep would be watered using groundwater in accordance with existing stock and domestic water extraction licence conditions.

The impacts from dust on local and regional air quality, and farming operations are expected to be negligible during operation. During regular operation, only a small number of vehicles would be present at the site on a regular permanent basis and would be largely restricted to the compound where site offices would be located.

Overall, the adverse impacts related to alienation of resources are expected to be low and restricted only to the period of operation, with benefits resulting from shading and perennial pasture maintenance, in comparison to ongoing cropping of this land.

Financial impacts on adjacent land uses

Land values

The land value driver at this site and its immediately surrounds is considered likely to be primarily related to its agricultural production capacity and close proximity to Tamworth and the New England Highway. The surrounding land use is rural and dominant land uses are currently rural.

While the Project would reduce the production capacity onsite for the life of the Project, grazing would continue to some extent and the income stream delivered by the solar farm lease will significantly increase current farm income. This is likely to have flow on socio-economic benefits for the locality. As set out above, there will be a low level of impact on adjacent agricultural land uses and so the Project would be unlikely to affect any income derived from these activities. However, it is recognised that smaller lots and tourist industries, such as cafes and accommodation, also occur in the area.

Regarding impacts on near neighbour property values, it is noted that there is much concern and relatively poor data which can provide the type of site-specific high confidence answers to this question. Using surrogates for Australian solar, the below discussion sources another Australian large scale renewable development, wind, as well as overseas solar experience.

Australian studies generally lack sufficient sample size to derive meaningful trends. The key Australian study examining the impacts of *wind farms* on property prices found there to be insufficient sales data to make definitive conclusions (Urbis, 2016) and no Australian research examining the impacts of solar farms is available. An earlier Australian study conducted by CSIRO which examined community acceptance of rural *wind farms* found that property prices had not been found to increase or decrease, although the potential market for buyers may be decreased (Hall, Ashworth, & Shaw, 2012).

Looking to larger sample sizes abroad, a study examining the impacts of wind and solar farms on houses prices in the Netherlands concluded that, within that context, there may be small decreases in house prices (2 - 3%) for houses located within 1 km of solar farms ((Dröes & Kroster, 2021).

A study of large-scale photovoltaic solar projects on residential home prices in the United States has recently been published (Elmallah, Hoen, Fujita, Robson, & Brunner, 2023). Reviewing six states and over 1.8 million home transactions, two questions posed:

1. What effect does large-scale photovoltaic solar have on home prices?
2. Does the effect of large-scale photovoltaic solar on home prices differ based on the prior land use on which the projects are located, their size, or a home's urbanicity[6]?

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[6] In this EIS discussion, urbanicity is being used to consider the smaller lot sizes and non-rural land use activities such as cafes, accommodation and tourist establishments.

The results showed an average home price reduction of 1.5% when comparing homes within 800 m to homes 3.2–6.4 km. Statistically significant effects were not found at distances over 1.6 km [7] from the solar farm. The results were considered high contextual. Key factors were the size of the project and the land use, particularly where solar displaces agriculture. Key learnings included the need to consider neighbour impacts, measures that ameliorate impacts (including vegetative shading), land use co-location and compensation for neighbours.

The NSW Government's revised Large Scale Solar Guidelines (DPE, 2022) address many of these issues. They include siting guidance and set out detailed assessment requirements where projects may substantially affect visual amenity, agricultural use for example. They also set out guidance in relation to compensation (negotiated agreements).

The Middlebrook Solar Farm Project has applied the NSW Government's revised Large Scale Solar Guidelines (DPE, 2022) and has undertaken a thorough assessment of visual, agricultural and social impacts in accordance with this guidance and committed to mitigation strategies to address residual impacts. By appropriately sighting the Project and its scale to ensure no greater than low visual impact, by excluding all Class 3 BSAL land from Project impacts and by developing a Community Fund and distributional equity compensation, the Project reflects current evidence and advice provided to minimise impacts on land values to neighbours.

Insurance premiums

The Applicant will have insurance in place to cover damage to neighbouring properties as a result of Project activities. Careful consideration is currently underway regarding the government policy framework to manage issues arising alongside the growth in the renewable energy and agriculture sector including the impact on neighbouring insurance premiums. The newly released NSW Agricultural Commissioner's report (November 2022) has recommended:

> *… Project applicants in the renewable energy sector should cover any additional public liability insurance costs incurred by neighbouring landholders as a result of proximity and risk to new energy facilities. In cases where suitable insurance cannot be obtained, the applicant should indemnify the neighbour for reasonable risk in relation to typical public liability cover.*

The report stated that:

> *The principle for addressing this increase in risk and liability should be that adjacent landholders bear no additional net costs due to the installation of these new facilities...*

The NSW Government has so far taken no action to endorse this recommendation, stating it…

> *…recognises the concerns raised by landholders in relation to fire and insurance risks as a result of neighbouring renewable developments and considers further information and analysis is required to understand the extent of the problem and to respond appropriately. The NSW Government is undertaking this analysis to determine appropriate action on the issue, including further consultation with the Australian Energy Infrastructure Commissioner and the Clean Energy Council.*

As part of the EIS and the development of the Project's mitigation strategies, the study has investigated onsite risks and developed best practice management strategies, in accordance with agency advice. These relate to:

a) Detailed design of higher risk infrastructure (battery energy storage system)
b) Ground cover management plan to monitor and manage the retention of ground cover beneath the panels including fuel management.

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[7] US miles have been converted to kilometres in this this EIS discussion.

c) Biosecurity management strategy
d) Bushfire management plan
e) Fire safety study and emergency response protocols
f) Rehabilitation commitments to ensure the decommissioned project retains or improves the land soil capability classes present onsite.

When compared to the existing onsite agricultural site operations, the Project may to reduce risks of fire, soil, water and biosecurity impacts, specifically. That is, in combination with the improved site access and onsite network of access tracks that accompany the Project, these mitigation commitments a) to f) will ensure the site is well managed and monitored and neighbours will benefit from this management regime.

From these investigations, our assessment is that the construction and operation of a solar farm on an adjoining property should not substantively impact the cost of the public liability policy of the property. While an insurer will determine and apply their own risk framework, acceptance criteria and pricing model, the expected risks are well understood and can be mitigated with high confidence.

Biosecurity risks – pests, diseases and weeds

The primary risk to biosecurity is the spread of weeds that may result from the increased movement of vehicles in and out of the development site. Weed seeds can be transported through and from the development site on the tyres and undercarriages of vehicles and on staff clothing. During construction, the risk of weed dispersal would primarily be mitigated by confining vehicle and machinery movements to formed access tracks during all stages of the Project. Strict wash down procedure for vehicles entering the development site will be required. During operation of the solar farm, vehicles would remain largely on formed internal roads would be much less likely to come into contact with weeds or transfer them from one location to another.

A Pest and Weed Management Plan would be prepared for the construction and decommissioning stages, based on Tamworth Regional Council and NSW DPI requirements. Management measures would focus on early identification of invasive weeds and effective management controls. During operations, the Pest and Weed Management Plan would manage impacts associated with weeds such as the risk of weed ingress along the boundary of the development site and the importation and spread of weeds through vehicle movements. The plan would focus on weed control techniques including herbicide and grazing pressure.

Establishment of a temporary construction site compound, specifically rubbish bins containing food, can potentially increase the risk of pest animals at the development site (mostly cats and foxes). Covered rubbish bins and regular waste removal during construction and operation would minimise this risk by removing the food source. Rabbit and fox numbers would be controlled through targeted pest management during the operational phase of the Project. Grazing pressure and reduced plant biomass would also reduce resources and cover for pest species.

Mining licences

There are no mining leases or exploration licences over the Development footprint.

Other land uses

During construction and operation of the Solar Farm, there is unlikely to be any impacts on other land uses including:

- Industry and commercial use (transmission line) – minimal impact is anticipated during construction to the existing 330 kV transmission line onsite, consultation with Transgrid would be undertaken. All works would be undertaken within land that is zoned for electricity infrastructure.

- Crown Land – there is no Crown land intersecting the Development footprint.
- Tourism: as stated above tourism occurs in the localities surrounding the site however to date these activities are significantly distant from the site with no tourism or accommodation providers noted in Loomberah.

Decommissioning

The potential impacts of the Project during decommissioning on surrounding land uses is considered to be manageable with the implementation of the mitigation measures presented in this EIS. The Project is considered reversible given the relatively low impact on the soil surface. Following decommissioning, rehabilitation of the site would be undertaken to restore the site to its pre-existing condition. All above ground infrastructure would be removed upon decommissioning and alternate land uses including agriculture and mining could resume.

Potential impacts to surrounding land uses are most relevant to agricultural activities. Existing agricultural land uses, or future agricultural land uses on the Development footprint or adjacent land are not anticipated to be impacted due to the reversible nature of the Project. The construction of the Solar farm would not require substantive soil disturbance or extensive excavation. Following the removal of the infrastructure, topsoil would be reinstated, and the area could be revegetated.

A Rehabilitation Plan associated with decommissioning activities would be developed and implemented with the objectives of:

- Returning the land to its pre-solar capability and improving the current state of the land.
- Soil resource management.
- Landform and land use areas.
- Development of completion criteria and monitoring reporting.

The plan would be informed by soil information derived from a soil survey using the Australian Soil and Land Survey Field Handbook (CSIRO, 2009) and The Australian Soil Classification (Isbell, 2021) and the Guidelines for Surveying Soil and Land Resources (McKenzie, Grundy, Webster, & Ringrose-Voase, 2008).

Impacts during decommissioning for the other surrounding land uses would be similar to construction and operation, as discussed above.

6.4.4. Key uncertainties of the assessment

The key uncertainties relevant to land use compatibility are the specific effects of panel shading on pasture at this site in operation and the changing values that the community may have in relation to the land's value and its utility.

The measures recommended below, which form Project commitments, are considered industry standard and have high confidence of retaining the soil's productive value.

6.4.5. Mitigation measures

Potential for land use impacts is proposed to be addressed via the mitigation measures in Table 6-18. Note that most impact discussed in this Section have been covered by mitigation measures in other impact chapters. As such no measures have been duplicated.

Table 6-18 Safeguards and mitigation measures for land use impacts.

ID	Mitigation measures	Project stage
LU1	A Rehabilitation and Decommissioning Management Plan is to be prepared in consultation with NSW Department of Primary Industries prior to decommissioning. The Rehabilitation and Decommissioning Management Plan is to include: • Removal of all above ground infrastructure with the exception of TransGrid connection assets and substation. • Removal of all cabling to a maximum depth of 500 mm • Verification that no adverse impact on land capability for the Disturbance footprint • Verification of a safe, stable and non-polluting site.	Decommissioning

6.5. Biodiversity

6.5.1. Assessment approach

NGH prepared a Biodiversity Development Assessment Report (BDAR) to assess the impacts of the Project in accordance with the *Biodiversity Conservation Act 2016* (BC Act). The BDAR is summarised below and appended in full, Appendix D.4.

The Biodiversity Assessment Method (BAM), legislated under the Act, was applied using a site based (not linear) assessment. Comprehensive mapping and field surveys were completed in accordance with the requirements of the BAM. A series of targeted field surveys were undertaken in:

- May 2020
- August 2020
- October 2020
- November 2020.

As no spring survey period has occurred since the Project restarted in February 2023, presence is assumed for two species at this time. Further surveys are planned prior to Project determination. The results will be included in the updated BDAR which will be provided to address any BCD's comments received on the publicly exhibited BDAR.

No expert reports were relied upon, and no local data were relied upon for the purpose of the BDAR.

Terms

It is noted that the definition of Subject land and Development footprint in the BDAR specialist report differ from the usage adopted in the EIS; BDAR terms are prescribed under the BAM. Terms have been changed in this summary, so the EIS reads consistently.

'Assessment area' is used below to refer to the broader area of land surveyed in relation to the project (refer Figure 6-36).

The BDAR's Development footprint has been altered to exclude those areas of high value vegetation where impact will not be permitted, in order that the offset requirement is as accurate as it can be at this time. These exclusions are carried through onto the Key features of the Project (provided as Figure ES-4 and Figure 2-2), shown as biodiversity exclusion areas.

The EIS and BDAR Development footprints relate as follows:

EIS Development footprint	**530.0**	**hectares**
Minus BDAR exclusion zones	27.5	hectares
Including most EPBC listed Box Gum Woodland and most peripheral areas of BC listed Box Gum Woodland.		
BDAR Development footprint assessed for impacts and offsets	**502.5**	**hectares**

Currency

NGH commenced investigation in 2020 prior to the Project work ceasing during Covid lockdown periods and restarting in February 2023. All survey work was completed prior to 2023. Several changes to the BAM and credit calculator occurred since the work commenced. This assessment reflects the latest BAM and credit calculator versions and is considered current.

Exclusions

A Land Category Assessment has been completed to identify areas historically cultivated and which can be excluded from the BAM. This was provided to BCD and updated in response to BCD comments. It is included in the summary below and provided in full in Appendix D.1.

The intersection of the New England Highway and Middlebrook Road was surveyed and consisted entirely of exotic vegetation. It is excluded from the Subject land assessed in the BDAR.

The Middlebrook Road verge, approximately 3.3 km unsealed carriageway 6m wide, was not surveyed and requires an upgraded unsealed carriageway, to 7m wide. An environmental risk assessment was completed for this aspect of the Project noting the environmental impacts risk rating is low for biodiversity impacts (EIS Appendix D10). It is understood that it is BCD's preference to provide a conservative approach when presenting the potential environmental values present within areas yet to be surveyed. At this time however, the 0.33 ha (1 m x 3.3 km) has not been included within the BDAR's subject land for assessment. The restart of the Project in February 2023 has not allowed a further spring survey program as yet, to address this area specifically. The Project commits (mitigation measure B10) to conduct field validation to gain an informed understanding of the environmental values in this area. This will be carried out in consultation with BCD. The results will be included in the updated BDAR which will be provided to address any BCD's comments received on the publicly exhibited BDAR.

BAM mandate

A key requirement of the Biodiversity Assessment Method is to demonstrate 'avoid / minimise' in advance of considering offset options. The Middlebrook Solar Farm:

- Avoids impacts to biodiversity through site selection, iterative design, and utilising existing cleared Category 1 land where possible (99% of the Development footprint is Category 1 land).
- Minimises impacts through:
    - Utilising areas of poorer condition native vegetation, and
    - Development of specific mitigation strategies for the Project.

Specifically:

- No solar panels are proposed in any Box Gum Woodland remnants with vegetation integrity score of over 30. In these higher condition remnants only infrastructure that cannot be relocated would be allowed, fences and crossings.

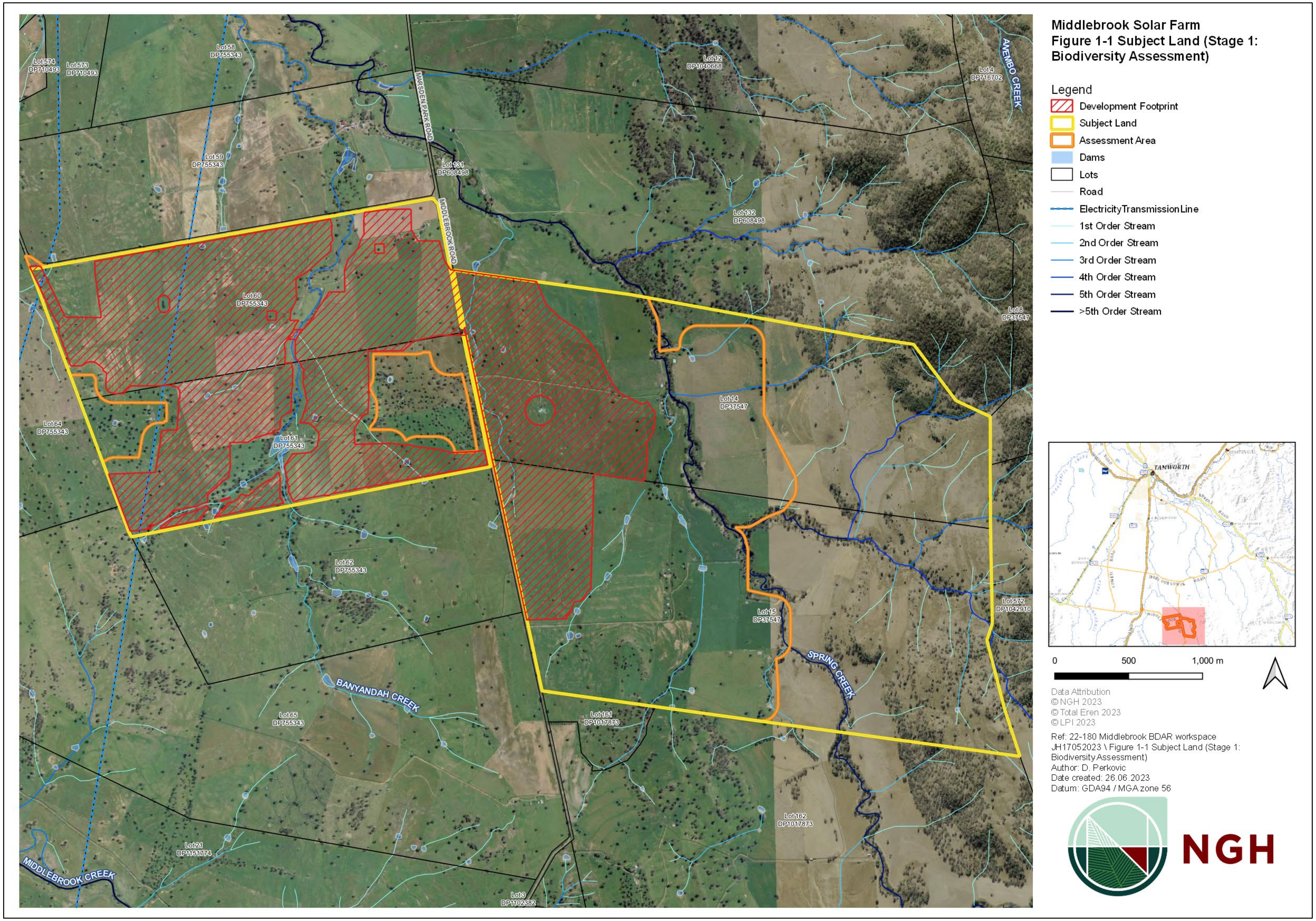

Figure 6-36 Assessment area (called Subject Land in the BDAR in accordance with the BAM)

6.5.2. Existing environment

The site is located within the Nandewar Bioregion and within the Peel IBRA subregion, characterised by box woodlands that occur on clay or loam soils, typically at low to mid elevation in agriculturally productive areas. The Peel subregion is characterised by fine grained Silurian to Devonian sedimentary rocks, strongly folded and faulted with marked northwest alignment. Areas of sub-horizontal Carboniferous shales and sandstones occur in the north with limited areas of basalt cap from the Nandewar and Liverpool Ranges.

The Peel River is located approximately 16 km east of the Subject Land. The nearest reserved lands include Back River Nature Reserve (28 km), Crawney Pass National Park (28 km), Ben Halls Gap Nature Reserve (33 km), and Tomalla Nature Reserve (37 km), all located southeast of the site.

The majority of the Assessment area has been cleared of native vegetation and is used for stock grazing and cropping which are the dominant land uses in the locality. White Box (*Eucalyptus albens*) is the dominant canopy species observed in higher areas of the site. Lower lying areas, proximal to watercourses tend to have a higher proportion of the Yellow Box (*Eucalyptus melliodora*) and occasional Blakely's Red Gum (*Eucalyptus blakelyi*). Dominant species within riparian areas includes White Box, followed by Rough-barked Apple (*Angophora floribunda*), Blakey's Red Gum, Yellow Box, and occasional White Cedar (*Melia azedarach*). Native groundcover is present as well as areas of high-density exotic species. There are several waterways and 23 dams within the Assessment area.

Considering land within 1500 m of the Assessment area, desktop resources show this to be significantly cleared and heavily fragmented. The remnant woody vegetation along Spring Creek provides the best connectivity and runs in a north to south direction through the Subject Land. This vegetation connects to a large area of Eucalyptus woodland growing on hilltops east of the Project. This remnant vegetation is largely unfragmented and connects to the Nature Reserves and National Parks. Refer to Figure 6-37.

Applied the Development footprint, the Project is comprised of:

- 495 ha of Category 1 Land – Exempt Land (99%)
- 7 ha of Category 2 – Regulated Land (1%).

Category 1 Land is exempt from most aspects of the BAM, being highly modified from extensive agricultural practices. A Land Category Assessment is provided as Appendix F of the BDAR supporting this result. BCD input has been incorporated into the final Land Category Assessment refer Figure 6-38.

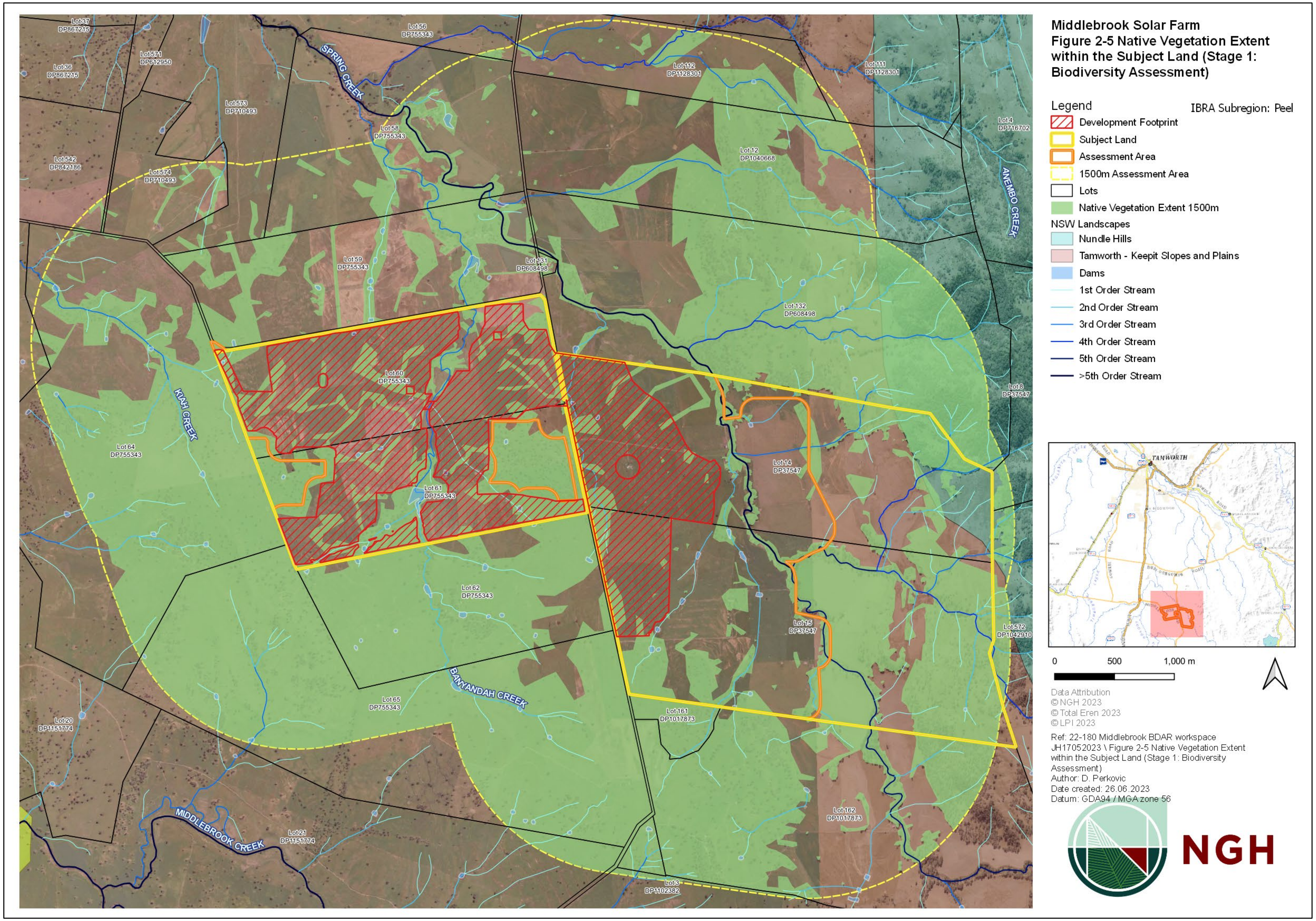

Figure 6-37 Native vegetation extent within 1,500 m of the site

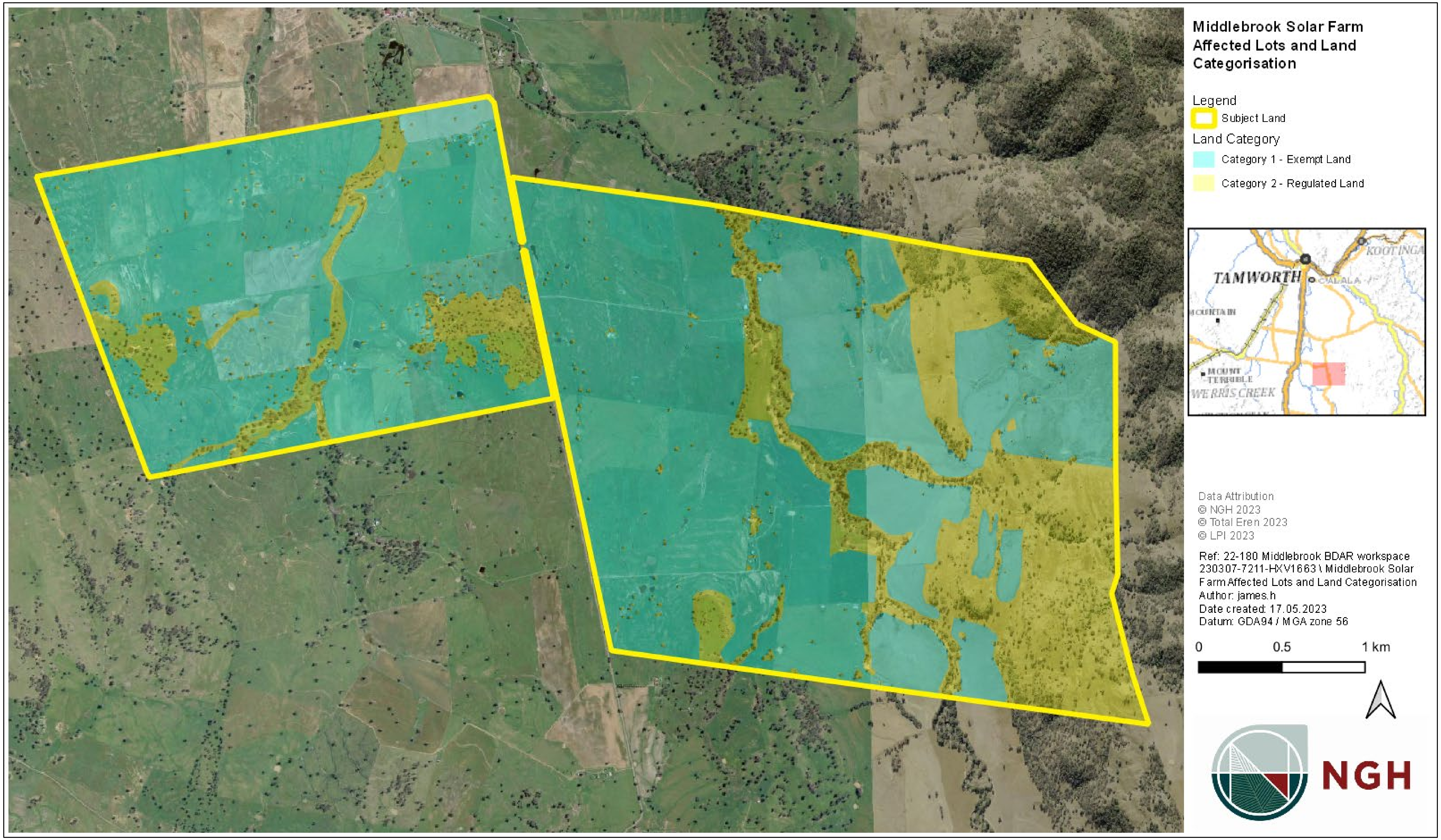

Figure 6-38 Land Category Assessment

Native vegetation extent

The majority of the Assessment area is dominated by non-native vegetation. It has a long history of agricultural use and has been extensively cropped and grazed as evidenced by recent aerial imagery and verification from site visits.

Approximately 75.90 ha of native vegetation occurs within the Assessment area. These have been classified as the following Plant Community Types (PCTs) refer Figure 6-44:

- 15.21 ha of PCT 433: White Box grassy woodland to open woodland on basalt flats and rises in the Liverpool Plains sub-region, BBS Bioregion

  Listed under the BC Act as: White Box Yellow Box Blakely’s Red Gum Woodland Critically Endangered Ecological Community (CEEC).

  Listed under the EPBC Act as: White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC.

  All areas mapped as PCT 433 conform to the BC Act listing for Box-gum Woodland CEEC. Some of these areas also conform to the EPBC listing.
- 32.29 ha of PCT 599: Blakely's Red Gum - Yellow Box grassy tall woodland on flats and hills in the Brigalow Belt South Bioregion and Nandewar Bioregion.

  Listed under the BC Act as: White Box Yellow Box Blakely’s Red Gum Woodland CEEC.

  Listed under the EPBC Act as: White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC.

  All areas mapped as PCT 599 conform to the BC Act listing for Box-gum Woodland CEEC. Some of these areas also conform to the EPBC listing.
- 28.40 ha of PCT 84: River Oak - Rough-barked Apple - red gum - box riparian tall woodland (wetland) of the Brigalow Belt South Bioregion and Nandewar Bioregion.

  Not associated with any threatened ecological community listing.

Within each PCT, differences in structure and condition were acknowledged by the creation of zones. Nine zones result in total as described below.

In addition, there are 414 scattered trees within the Assessment area refer Figure 6-45. All have a percent foliage cover that is less than 25% of the benchmark for tree cover for the most likely Plant Community Type and are on Category 2-regulated land and surrounded by Category 1- Exempt land on the Native Vegetation Regulatory Map under the LLS Act.

Table 6-19 Vegetation zones within the Subject Land and Development Footprint

Zone	PCT	Condition description	Vegetation integrity score (out of 100)	Conservation significance	Impact area
1	PCT 433 Woodland High	Areas of canopy over predominantly native grassland and very occasional midstory	57.5	BC Listing and EPBC Listing	0.09
2	PCT 433 Woodland Disturbed	Areas of canopy over a mix of native and exotic understory	35.8	BC Listing and EPBC Listing	0.13
3	PCT 433 Woodland Exotic)	Areas of canopy over an exotic dominated understory	30.6	BC Listing only	0.06
4	PCT 433 Grassland Disturbed	Areas cleared of canopy with a mixed native and exotic understory	17.2	BC Listing only	1.87
5	PCT 599 Woodland High	Areas of canopy over predominantly native grassland and very occasional midstory	62.6	BC Listing and EPBC Listing	0
6	PCT 599 Woodland Disturbed	Areas of canopy over a mix of native and exotic understory	56.1	BC Listing and EPBC Listing	0
7	PCT 599 Grassland High	Areas cleared of canopy with predominantly native understory	22.8	BC Listing and EPBC Listing	0.37
8	599 Grassland Disturbed	Areas cleared of canopy with a mixed native and exotic understory	9.9	BC Listing and EPBC Listing	0
9	PCT 84 Riparian Woodland	Areas of high condition riparian vegetation	59.9	NA	0

Figure 6-39 Example of PCT 433: Woodland – High (Zone 1, Plot 1)

Figure 6-40 Example of PCT 433: Grassland – Disturbed (Zone 4, Plot 8)

Figure 6-41 Example of PCT 599: Woodland – High (Zone 5, Plot 9)

Figure 6-42 Example of PCT 599: Grassland – Disturbed (Zone 8, Plot 20)

Figure 6-43 Example of PCT 84: Riparian Woodland (Zone 9, Plot 24)

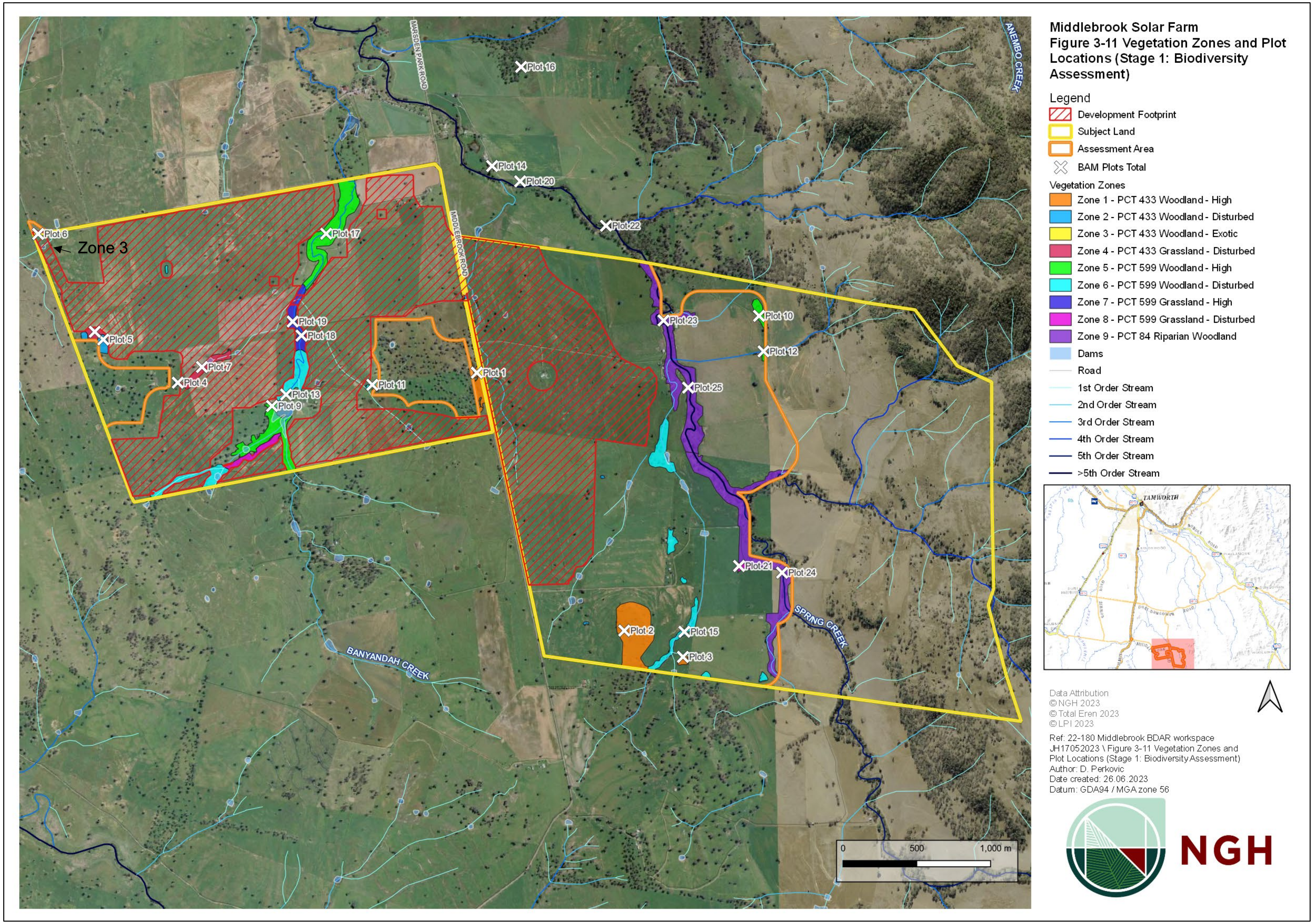

Figure 6-44 Vegetation zones and plot locations within the Subject Land (note Zone 3 occurs as only one polygon in the site access point, top left).

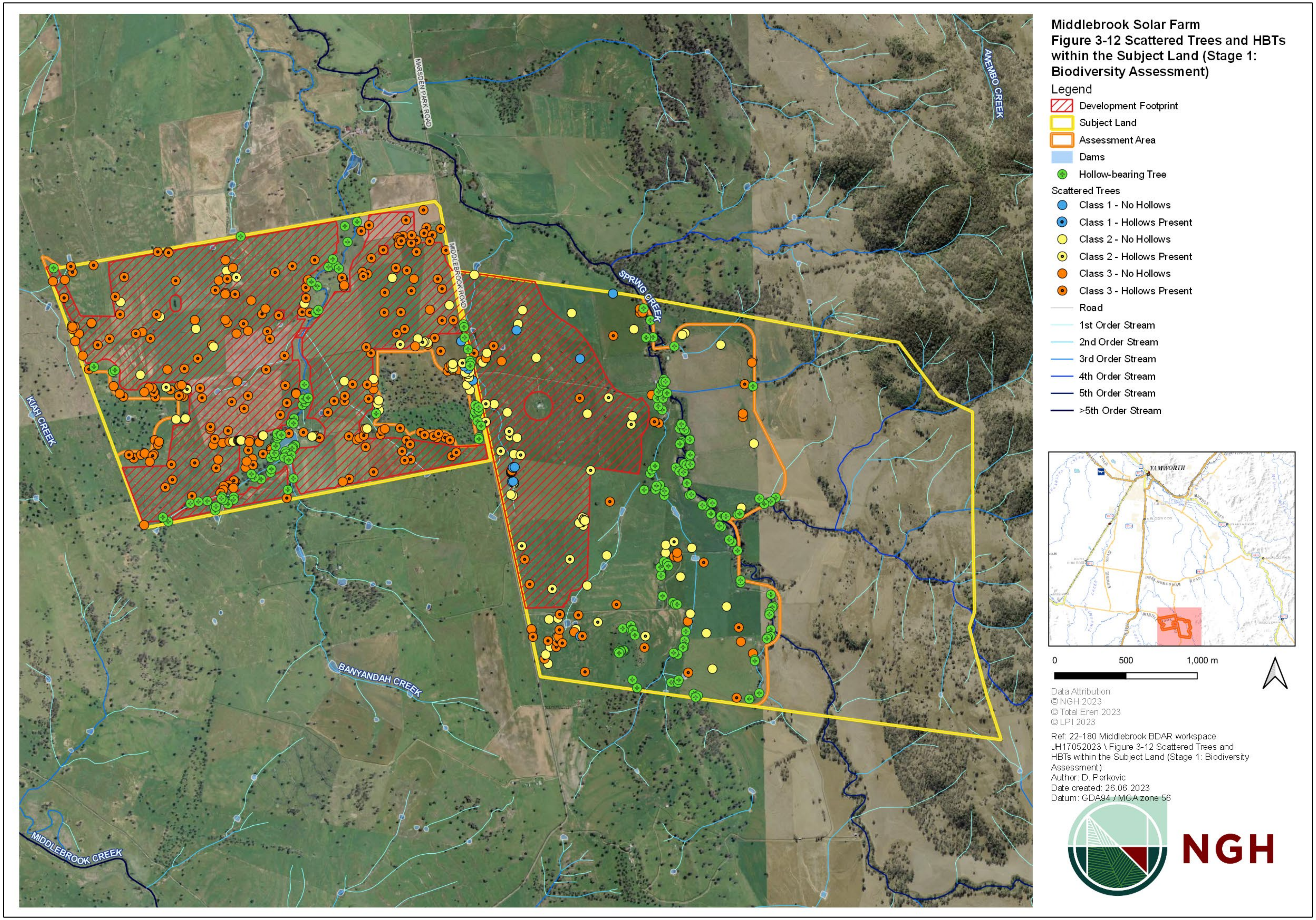

Figure 6-45 Scattered Trees and HBTs within the Subject Land

Species credit species

The BAM Calculator predicted the following species credit species to occur within the Development Footprint (Table 6-20 below). Twelve species are excluded on the basis that:

1. Key habitat features do not exist, or they are geographically limited and / or,
2. Habitat quality so degraded such that they could not occur.

A targeted field survey program followed prescribed survey methodologies to demonstrate presence or absence of the species. Species specific surveys are fully detailed in the appended BDAR. Three candidate species, Silky Swainson-pea *Swainsona sericea*, Belson's Panic *Homopholis belsonii* and Finger Panic Grass *Digitaria porrecta,* could not be ruled out based on surveys as the surveys were undertaken outside their required seasonal window; presence has been assumed in all suitable vegetation zones for these three species. For all other candidate species, the targeted surveys conducted to date are considered sufficient to rule out the presence of each species targeted within the Development footprint (no direct impacts, indirect impacts have been considered however). The area of assumed habitat within the Development footprint defined for each species (species polygons) is the same and totals 2.52 ha.

Table 6-20 Candidate species credit species included or excluded from further assessment

Species Credit Species	Conservation status [8]	Suitable habitat quality and abundance on site	Included or excluded
Acacia atrox Myall Creek Wattle	BC Act Endangered	Habitat present within PCT 599 (Zones 5 & 6)	Included
Adelotus brevis - endangered population Tusked Frog population in the Nandewar and New England Tableland Bioregions	BC Act Endangered Population	Habitat present with PCT 599 along Banyandah Creek and PCT 84	Included
Aepyprymnus rufescens Rufous Bettong	BC Act Vulnerable	Degraded and unlikely habitat present within PCT 599	Excluded
Anthochaera phrygia Regent Honeyeater (Breeding)	BC Act Critically Endangered EBC Act Critically Endangered	Not mapped as an important habitat area	Excluded
Aprasia parapulchella Pink-tailed Legless Lizard	BC Act Vulnerable EPBC Act Vulnerable	Associated with PCTs 599 and 433, however, Subject Land generally lacks microhabitat (such as embedded rocks) that the species requires	Excluded
Asterolasia beckersii Dungowan Starbush	BC Act Critically Endangered EPBC Act Critically Endangered	Habitat present within PCT 84	Included

[8] Status under the Biodiversity Conservation Act and / or Environment Protection and Biodiversity Conservation Act.

Species Credit Species	Conservation status [8]	Suitable habitat quality and abundance on site	Included or excluded
Burhinus grallarius Bush Stone-curlew	BC Act Endangered	Degraded habitat present within woodland zones of PCTs 433 and 599	Excluded
Callistemon pungens Callistemon pungens	EPBC Act Vulnerable	Marginal habitat present in PCT 84 and PCT 599 (Zones 5 & 6)	Included
Callocephalon fimbriatum Gang-gang Cockatoo (Breeding)	BC Act Vulnerable EPBC Act Endangered	Breeding habitat present within associated PCT 84.	Included
Calyptorhynchus lathami Glossy Black-Cockatoo (Breeding)	BC Act Vulnerable EPBC Act Vulnerable	Hollow-bearing trees present within the Subject Land.	Included
Cercartetus nanus Eastern Pygmy-possum	BC Act Vulnerable	Degraded and unlikely woodland habitat present within associated PCTs 433 and 599. Remnant PCTs lack structural and species diversity required to support this species: canopy present only.	Excluded
Chalinolobus dwyeri Large-eared Pied Bat	BC Act Vulnerable EPBC Act Vulnerable	Subject Land within habitat constraints	Included
Dichanthium setosum Bluegrass	BC Act Vulnerable EPBC Act Vulnerable	Habitat present within associated PCTs	Included
Digitaria porrecta Finger Panic Grass	BC Act Endangered	Habitat present within associated PCTs	Included
Euphrasia arguta Euphrasia arguta	BC Act Critically Endangered EPBC Act Critically Endangered	Habitat present within better condition zones of PCT 599 and PCT 84.	Included
Haliaeetus leucogaster White-bellied Sea-Eagle (Breeding)	BC Act Vulnerable	Dams (one significant) and creeks present	Included
Hieraaetus morphnoides Little Eagle (Breeding)	BC Act Vulnerable	Breeding habitat present within woodland zones	Included
Homopholis belsonii Belson's Panic	BC Act Endangered EPBC Act Vulnerable	Habitat present within associated PCTs 433 and 599.	Included
Hoplocephalus bitorquatus Pale-headed Snake	BC Act Vulnerable	Habitat present within PCT 84	Included
Lathamus discolor	BC Act Endangered	Outside mapped important areas	Excluded

Species Credit Species	Conservation status [8]	Suitable habitat quality and abundance on site	Included or excluded
Swift Parrot (Breeding)	EPBC Act Critically Endangered	(DPE	
Litoria booroolongensis Booroolong Frog	BC Act Endangered EPBC Act Endangered	Degraded and unlikely habitat present within PCT 84 along Spring Creek	Excluded
Lophoictinia isura Square-tailed Kite (Breeding)	BC Act Vulnerable EPBC Act Vulnerable	Breeding habitat present	Included
Miniopterus orianae oceanensis Large Bent-winged Bat (Breeding)	BC Act Vulnerable	Breeding habitat constraints not present	Excluded
Ninox connivens Barking Owl (Breeding)	BC Act Vulnerable	Breeding habitat present	Included
Petaurus norfolcensis Squirrel Glider	BC Act Vulnerable	Habitat present within PCT 84	Included
Phascogale tapoatafa Brush-tailed Phascogale	BC Act Vulnerable EPBC Act Vulnerable	Degraded and unlikely woodland habitat present with associated PCTs 433 and 599	Excluded
Phascolarctos cinereus Koala (Breeding)	BC Act Endangered EPBC Act Endangered	Potential breeding habitat present	Included
Picris evae Hawkweed	BC Act Vulnerable EPBC Act Vulnerable	Potential habitat present within parts of PCT 599 Zone 5	Included
Prasophyllum sp. Wybong Prasophyllum sp. Wybong	EPBC Act Critically Endangered	Marginal habitat present within associated PCTs (433 and 599)	Excluded
Pteropus poliocephalus Grey-headed Flying-fox (Breeding)	BC Act Vulnerable EPBC Act Vulnerable	No breeding camps present	Excluded
Thesium Austral Austral Toadflax	BC Act Vulnerable EPBC Act Vulnerable	No *Themeda* recorded or noted across any vegetation zone.	Included
Tylophora linearis Tylophora linearis	BC Act Vulnerable EPBC Act Endangered	Potential habitat present within parts of PCT 599 Zone 5	Included
Tyto novaehollandiae Masked Owl	BC Act Vulnerable	Breeding habitat present	Included

Species Credit Species	Conservation status [8]	Suitable habitat quality and abundance on site	Included or excluded
(Breeding)			
Uvidicolus sphyrurus Border Thick-tailed Gecko Swainsona sericea Silky Swainson-pea	BC Act Vulnerable EPBC Act Vulnerable BC Act Vulnerable EPBC Act Vulnerable	Lack of suitable habitat such as rocky areas. Found in native grasslands and box gum woodlands	Excluded Included
Vespadelus troughtoni Eastern Cave Bat	BC Act Vulnerable	Area contains old buildings and sheds	Included

Matters of National Environmental Significance

An EPBC Act Protected Matters Report was updated on 23/03/2023 to identify Matters of National Environmental Significance (MNES) that have the potential to occur within 10 km of the Development Footprint (Appendix D.4). Those relevant to this BDAR include:

- Wetlands of International Importance.
- Threatened Ecological Communities.
- Threatened species.
- Migratory species.

One of Threatened Ecological Community (Box-gum Woodland CEEC) occurs within the Subject Land, predominately along Banyandah Creek plus several smaller occurrences on the eastern side. Areas of PCT 433 and 599 within the Subject Land are considered to be Box-gum Woodland CEEC where they meet specific diversity and extent criteria; 38.45 occurs within the Assessment area. The Project would remove approximately 0.59 ha of this community, or 1.5% of the community within the Assessed area and less than 0.01% in the locality. A significant impact is unlikely and as such, referral to DCCEEW has not been recommended on this basis.

Two threatened species were considered in relation to the Project's impacts.

- Koala: The majority of wooded vegetation within the Assessment area contains foraging habitat in the form of known Koala feed trees. However, historical clearing has reduced the quality of this habitat with the highest quality habitat persisting along Spring Creek. No evidence of Koala was not observed during targeted and incidental surveys across May, August, October, and November 2020.
- Bluegrass: This species was surveyed for during its optimal period. Bluegrass was not recorded and is not considered to occur.

Two migratory species were considered likely to utilise habitat in the Assessment area: Rainbow Bee-eater *Merops ornatus* and Satin Flycatcher *Myiagra cyanoleuca*. Both species are widespread migratory species occurring across much of mainland Australia. These species were heard during the November targeted bird surveys in vegetation along Spring Creek. A significant impact is unlikely and as such, referral to DCCEEW has not been recommended on this basis.

No other matters are considered relevant to the Project.

6.5.3. Potential impacts

Construction

Direct impacts

Direct impacts as a result of construction were identified in the BDAR as follows:

- Habitat clearance for permanent and temporary construction facilities
  - 2.52 ha of native vegetation (which includes 3 hollow bearing trees)
  - 194 scattered trees (including 8 Class 1, 29 Class 2 and 88 Class 3 trees; 92 of the scattered trees contain hollows).

This impact could result in direct loss of native flora and fauna habitat, potential over-clearing of habitat outside proposed Development Footprint, injury and mortality of fauna during clearing of fauna habitat and habitat trees, disturbance to stags, fallen timber, and bush rock.

- Injury or death or displacement of resident fauna; this could result in direct loss of native fauna, decline in local fauna populations.
- Disruption to connectivity; this could result in direct loss of native fauna, decline in local fauna populations.
- Removal of habitat features including:
  - 3 HBTs within vegetation zones.
  - 92 scattered trees containing hollows.

  This could result in direct loss of native fauna, decline in local fauna populations.

Indirect impacts

The potential for indirect impacts was also considered to include:

- Inadvertent impacts on adjacent habitat or vegetation
- Transport of weeds and pathogens from the site to adjacent vegetation
- Increased risk of starvation, exposure and loss of shade or shelter
- Loss of breeding habitats
- Rubbish dumping.
- Earthworks and mobilisation of sediments.

Prescribed impacts

Vehicle strike

Particularly during construction, the Project would result in an increase in traffic along Middlebrook Road. Avoiding vehicle strikes is action that takes place on a situational basis; however, the risk can be minimised. To increase the likelihood that vehicle strikes are avoided, mitigation measures such as warning signage, speed limits, and education of construction personnel would be implemented. Squirrel Glider is the only threatened fauna species known to currently inhabit the site and is at little to no risk of vehicle strike given the buffer between construction and habitat along Spring Creek. However, potential habitat is considered present elsewhere for Koala. The Development Footprint would be fenced prior to construction to reduce risks to Koala.

Operation

Direct impacts

Direct impacts as a result of the operation of the Middlebrook Solar Farm were identified as follows:

- Shading by solar infrastructure; approximately 70% of solar array across 2.52 ha of native vegetation. This could result in modification of native fauna habitat, potential loss of ground cover resulting in unstable ground surfaces and sedimentation of adjacent waterways.
- Existence of permanent solar infrastructure; This could result in modification of habitat beneath the array, reduced fauna movements across landscape due to fencing, collision risks to birds and microbats (fencing).

Indirect impacts

The potential for indirect impacts was also considered to include:

- Reduced viability of adjacent habitat due to edge effects
- Reduced viability of adjacent habitat due to noise, dust or light spill
- Transport of weeds and pathogens from the site to adjacent vegetation
- Increased risk of starvation, exposure and loss of shade or shelter
- Rubbish dumping.
- Increase risk of fire.

Prescribed impacts

Habitat connectivity

'Prescribed impacts' as defined under the BAM, relevant to operation, include habitat connectivity impacts. The connectivity along Spring Creek most benefits native fauna that require consistent canopy cover including Squirrel Glider. However, Banyandah Creek is unlikely to be utilised due to surrounding patchiness and significant disconnects in canopy cover. Banyandah Creek would certainly be used by mobile native fauna such as birds and microbats. The Development Footprint has been located so that direct impacts to Spring Creek and Banyandah Creek have been avoided.

The Development Footprint would be permanently fenced. This fence would not contain barbed wire and is set back more than 50 m from Squirrel Glider habitat along Spring Creek so that individuals are unlikely to be affected. There will be no direct impacts to Squirrel Glider or any connectivity that aids the species in moving across its range. Similarly, the threatened microbats recorded would not be prevented from moving across their range. Permanent fencing will not contain barbed wire to alleviate the risk of microbats encountering fencing and becoming entangled. Fencing is not proposed across Banyandah Creek in preference for creating separate fenced compounds on either side of the creek. Spring Creek would not be fenced in any way. Mitigation measures are included to protect habitat connectivity.

Water bodies, water quality and hydrological processes

Twenty-three farm dams occur within the Subject Land. One of these is of considerable size and is located adjacent to Banyandah Creek. The current hydrological process of the site sustains Box-gum Woodland CEEC, Squirrel Glider habitat, and Belson's Panic and Finger Panic Grass which are assumed to be present. Section 7.1 investigates hydrology in more detail and concludes that no significant change to the site's hydrology or hydrological impact offsite are likely as a consequence of the Project.

6.5.4. Key uncertainties of the assessment

While survey guidelines have been adhered to, it is acknowledged that a survey is a snapshot in time and not conclusive in terms of species absence. However, it is understood that the BAM has been developed in recognition of this and the BAM assessment undertaken is sufficient to assess and mitigate the potential impacts of the Project appropriately.

Importantly, adaptive management during construction and operation will be receptive to any new and relevant data that may arise through ongoing assessment and monitoring and is key to the successful implementation of the relevant management plans. This will allow ongoing flexibility to manage objectives, allow for relevant feedback and modifications. Construction management plans will contain management plans for flora and fauna, which will have an adaptive management component. This includes measures to monitor predicted impacts of vehicle strikes, thresholds for species mortality based on relevant literature, which will trigger additional management actions where required.

Serious and Irreversible Impacts

The Applicant has made changes to the Project to avoid impacts to Box-gum Woodland CEEC as much as possible. As a result, of the 47.50 ha of Box-gum Woodland CEEC that occurs within the Assessment area, only 2.52 ha (5.3%) will be directly impacted. These are made up of:

- 0.28 ha of CEEC above VI score of 30 (zones 1, 2, 3 and 6)
- 2.24 ha of CEEC below VI score of 30 (zones 4 and 7).

A directive of the Project was to avoid all EPBC listed CEEC, where possible, and minimise as much as possible impacts on BC listed CEEC with the intention of ensuring only those impacts that are essential to the Project remain. The 0.28 ha with above VI score of 30 cannot be further reduced as the impacts are required for:

- The main access to the site, 0.06 ha, and
- Small areas each less than 0.13 in area, totalling 0.22 ha.

There have been at least 4 iterations of the Development Footprint layout in response to biodiversity investigations. The initial Development Footprint layout covered approximately 806.82 ha. This has been reduced to approximately 502.88 in the final Development Footprint layout, a reduction of 38%. The final Development Footprint layout has been located and designed to avoid and minimise impacts to native vegetation and biodiversity values as much as possible, particularly in regard to Box-gum Woodland CEEC.

The 2.52 ha of Box-gum Woodland CEEC to be removed by the Project would be offset by the retiring of 30 ecosystem credits for the management and improvement of the community thus ensuring no net loss. The preparation of a vegetation management plan for the protection of native vegetation to be retained would benefit Box-gum Woodland CEEC in the region by rehabilitating disturbed areas and managing weeds which may spread off site.

6.5.5. Mitigation measures and offsets

Mitigation measures

Table 6-21 Mitigation measures proposed to avoid and minimise impacts on native vegetation and habitat

ID	Mitigation measures	Project stage

B1	A Biodiversity Management Plan will be prepared to manage construction activities. It must include:
	• Timing protocols:
	    o Construction works to avoid critical life cycle events such as breeding or nursing.
	    o Where practicable, hollow-bearing trees would not be removed during breeding and hibernation season (June to January) to mitigate impacts. If clearing outside of this period cannot be achieved, pre-clearing surveys would be undertaken by an ecologist or suitably qualified person to ensure no impacts to fauna would occur.
	• Clearing protocols (for pre-clearing surveys, daily surveys and staged clearing) must include:
	    o Presence of a trained ecological or licensed wildlife handler during clearing events where required.
	    o Pre-clearing checklist
	    o Tree clearing procedure.
	    o Staged habitat removal
	    o Relocation of habitat features (fallen timber, hollow logs) from within Development footprint to adjacent area for habitat enhancement.
	    o Approved clearing limits are clearly delineated with temporary fencing or similar prior to construction commencing.
	    o Vegetation to be retained is identified and protected from inadvertent damage and soil disturbance.
	    o Where clearing occurs adjacent to areas to be retained, chainsaws would be used rather than heavy machinery to minimise risk of unauthorised disturbance.
	• Best practice measures for removal and disposal of vegetation
	• An unexpected threatened species finds procedure.
	• No stockpiling or storage within dripline of any mature trees
	• Noise management measures to reduce impacts of noise.
	• Light management measures:
	    o Light shields or daily/seasonal timing of construction to reduce impacts of light spill.
	    o Direct lights away from vegetation
	• Dust management
	• Sediment erosion control measures
	• Hygiene protocols to prevent the spread of weeds or pathogens, including:
		Construction

<table>
<tr><th>ID</th><th>Mitigation measures</th><th>Project stage</th></tr>
<tr><td></td><td>A procedure to prevent and minimise the spread of weeds. This would include a management protocol for declared priority weeds under the Biosecurity Act 2015 during and after construction.
Weed hygiene protocol in relation to plant, machinery, and fill.
Rehabilitation of disturbed areas</td><td></td></tr>
<tr><td>B2</td><td>Temporary fencing to protect significant environmental features including:
Identified Squirrel Glider species habitat including fencing off the Subject Land boundary in the east.
Buffer of riparian zone, drainage lines and farm dams to be retained.
Karst/caves and rocks.</td><td>Construction
Operation
Decommissioning</td></tr>
<tr><td>B3</td><td>Fencing design to control animal and vehicle interactions: Subject Land to be fenced entirely during construction and operation</td><td>Design</td></tr>
<tr><td>B4</td><td>Fencing / crossing location to limit impacts on connectivity at Banyandah Creek:
No fencing across Banyandah Creek
Banyandah Creek crossing to allow passage of ground dwelling fauna underneath.</td><td>Design</td></tr>
<tr><td>B5</td><td>Staff training and site briefing to communicate environmental features to be protected and measures to be implemented will include:
Site induction
Toolbox talks
Site speed limits to be enforced to minimise fauna strike.</td><td>Construction
Operation
Decommissioning</td></tr>
<tr><td>B6</td><td>The Project’s offset obligation will be met in accordance with the NSW Biodiversity Offsets Scheme (BOS), and will be achieved by either:
Retiring credits under the Biodiversity Offsets Scheme based on the like-for-like rules, or
Making payments into the Biodiversity Conservation Fund using the offset payments calculator, or
Funding a biodiversity action that benefits the threaten entities impacted by the development.</td><td>Prior to construction</td></tr>
<tr><td>B7</td><td>No solar panels would be constructed in any Box Gum Woodland remnants with vegetation integrity score of over 30. In these higher condition remnants only infrastructure than cannot be relocated would be allowed; access ways, fences and water way crossings.</td><td>Design</td></tr>
<tr><td>B8</td><td>Middlebrook Road, for the 3.8 km from New England Highway to the site access, would be surveyed subject to final upgrade designs to confirm (or update) biodiversity assessment assumptions that it can be excluded from assessment and offsets.</td><td>Prior to approval</td></tr>
</table>

ID	Mitigation measures	Project stage
B9	Further surveys would be conducted for species assumed to occur, prior to approval.	Prior to approval

Offset requirement

The Offset requirement required for the Project is provided below. It is noted the species credits are assumed to occur and further surveys may further inform this requirement (refer Figure 6-46). The retirement of credits must be carried out in accordance with the NSW Biodiversity Offsets Scheme, and will be achieved by:

- Acquiring or retiring credits under the Biodiversity Offsets Scheme,
- Making payments into the Biodiversity Conservation Fund, or
- Funding a biodiversity action that benefits the threatened entity(ies) impacted by the development.

Table 6-22 Ecosystem credits generated by the Project

Zone ID		Area Impacted (ha)	Vegetation Integrity Score	Ecosystem credits required
1	433 Woodland High	0.09	57.5	3
2	433 Woodland Disturbed	0.13	35.8	3
3	433 Woodland Exotic	0.06	30.6	1
4	433 Grassland Disturbed	1.87	17.2	20
6	599 Woodland Disturbed	0.08	56.1	0
7	599 Grassland High	0.38	22.8	8
Total				**35**

Table 6-23 Species credits generated by the Project

Species Credit Species	Biodiversity risk weighting	Area of habitat or count of individuals lost	Species credits required	Suitable IBRA Subregion for offset
Belson's Panic *Homopholis belsonii* Finger Panic Grass *Digitaria porrecta*	2	2.52 ha	28 for each species	Any in NSW
Swainsona sericea *Silky Swainson-pea*	2	2.52 ha	28	Any in NSW

Table 6-24 Scattered trees credits generated by the Project

Class	Number of trees	Contain hollows	Ecosystem credits required per tree	Credits required
PCT 599				
2	9	No	0.50	5
2	4	Yes	0.75	3
2	12	No	0.50	6
2	1	Yes	0.75	1
2	2	No	0.50	1
2	1	Yes	0.75	1
3	1	Yes	1.00	1
3	11	No	0.75	8
3	48	Yes	1.00	48
3	16	No	0.75	12
3	8	Yes	1.00	8
3	2	No	0.75	2
3	2	Yes	1.00	2
Subtotal				**98**
PCT 433				
2	12	No	0.50	6
Subtotal				**6**
Total				**104**

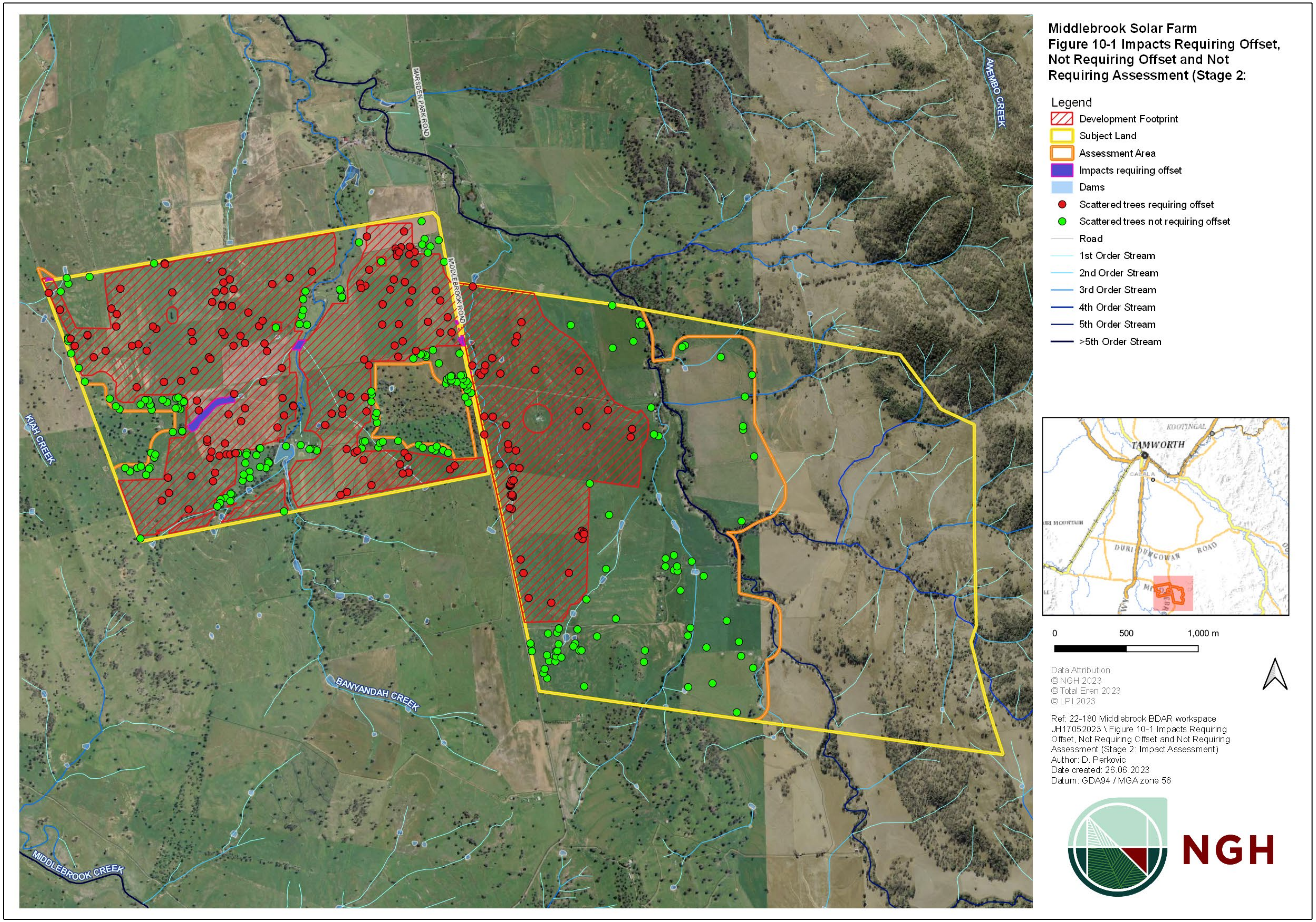

Figure 6-46 Impacts requiring offsets, not requiring offsets, and not requiring assessment

6.6. Aboriginal cultural heritage

The specialist Aboriginal Cultural Heritage Assessment (ACHA) report was prepared by NGH Consulting. It is summarised below and appended in full in Appendix D.5.

As required by SEARs, it must:

- Assess the likely impact on Aboriginal Heritage (cultural and archaeological) impacts of the development.
- Provide evidence of consultation with Aboriginal communities in determining and assessing impacts in accordance with the Aboriginal *Cultural Heritage Consultation Requirements for Proponents*.

6.6.1. Assessment approach

Consultation with Aboriginal stakeholders undertaken in accordance with Section 60 of the *National Parks and Wildlife Amendment (Aboriginal Objects and Aboriginal Places) Regulation 2020* following the consultation steps outlined in the ACHCRP guide. The guide outlines a four-stage process of consultation as follows:

- Stage 1 – Notification of project. Project and registration of interest.
- Stage 2 – Presentation of information about the proposed project.
- Stage 3 – Gathering information about cultural significance.
- Stage 4 – Review of draft cultural heritage assessment report.

Consultation commenced in March 2019 and is set out in Section 5.2 of this EIS.

6.6.2. Existing environment

Landscape context

The Project Area is situated within undulating to rolling low hills and flats and floodplains surrounding Spring Creek. Prior to European land modifications this area would have provided resources, shelter, water, and food for Aboriginal people. Spring Creek is a higher order water course and its immediate surrounding flats, which are within 200 m of the creek, are noted to have higher archaeological sensitivity than the surrounding area. Spring Creek and its immediate area are therefore considered likely to have been a major focus for Aboriginal people within the Project Area.

Landforms were determined based on topographic identification during the visual inspection of the Project Area in the course of the field survey and from the review of detailed contour and digital elevation mapping (DEM).

Four landforms were identified within the Project Area and area assessed, which are shown in Figure 6-47 and listed below:

- Spurs and hill crests;
- Slopes and undulating ground;
- Low lying flats and drainage lines; and
- Disturbed Road corridor (which covers the intersection road upgrade areas).

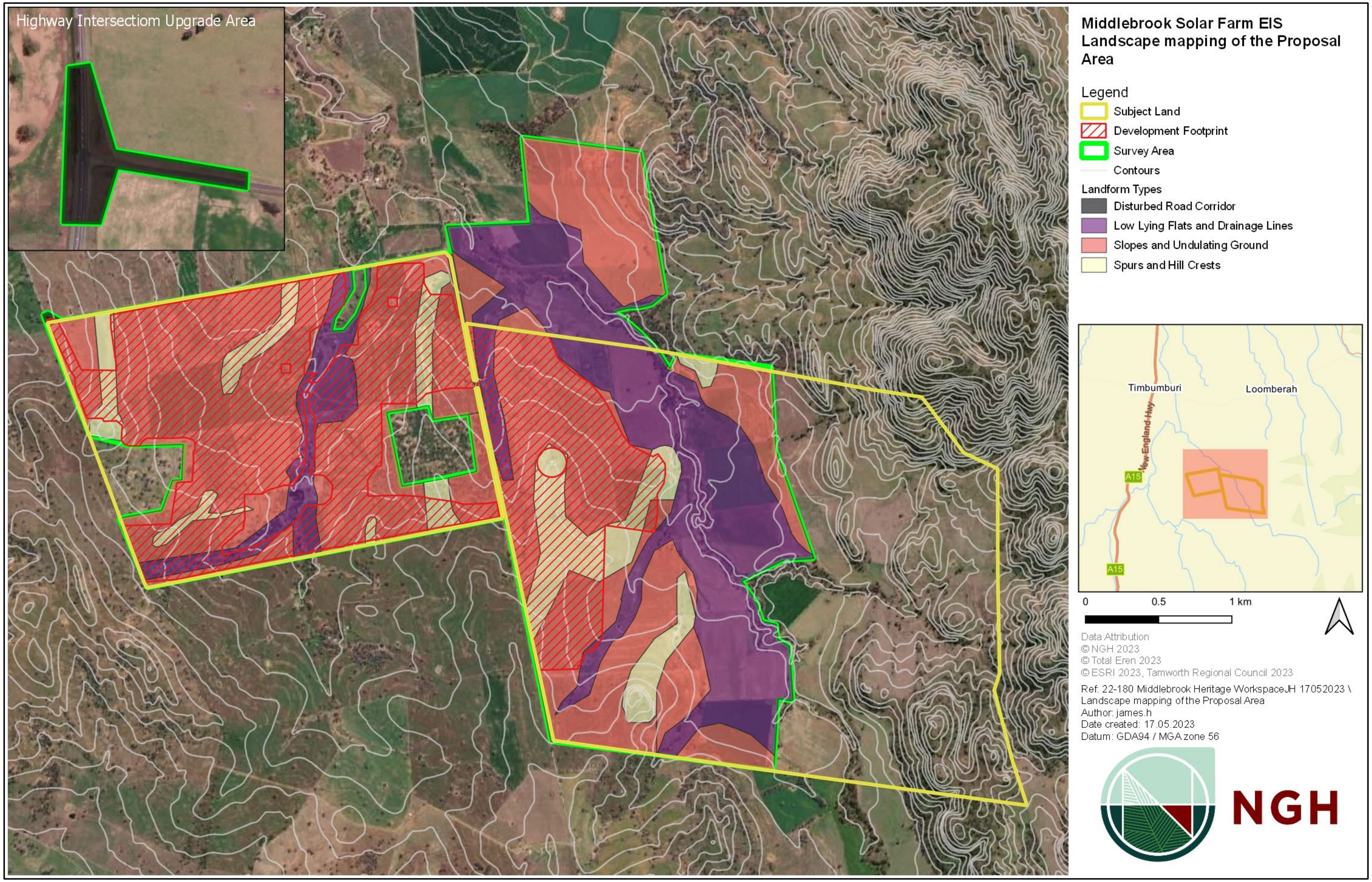

Figure 6-47 Landscape mapping of the Project Area

Archaeological context

The Project Area is located within what today is regarded as Gamilaraay Country of the Gamilaraay/Yuwaalaraay/Yuwaalayaay language group, which is an assemblage of many small clans and bands speaking a number of similar dialects (Howitt 1904; Horton 1994; Tindale 1974; Austin 2008).

The Gamilaraay territory is extensive, stretching from the Upper Hunter Valley along Moonbi and Nandewar Ranges western escarpment to the Gwydir River and near Moree. In the Northwest, the boundary can be roughly outlined northward around the lower McIntyre and Moonie Rivers, both sides of Barwon River to Walgett, down to Warrumbungle Ranges and back to the Upper Hunter Valley and Liverpool Range (Ferry 2002:19). Although the Gamilaraay nation covers a large portion of northern NSW and extends into southern Queensland the borders were fluid.

In 1842, first Commissioner of Crown Lands and Protector of Aborigines for the Liverpool Plains estimated there were about 4,000 Aboriginal people living in the area between the Namoi, Peel and Gwydir Rivers. However, by this time the Aboriginal population in the area was already in decline due to diseases such as smallpox and influenza. Dispossession from traditional lands and other acts of violence against the Aboriginal people meant there was great social upheaval and partial disintegration of the traditional way of life. Access to traditional resource gathering and hunting areas, religious life, marriage links and access to sacred ceremonial sites were disrupted or destroyed.

The increasing numbers of settlers in the region and disruptions to Gamilaraay way of life created tensions that led to conflicts. The drought of 1837-45 along with the European settlers' destruction of the ecology of country increasingly forced the Gamilaraay to reduce hunting and gathering and rely on wages and handouts from settlers.

The goldrushes of the 1850-60s created a labour shortage on pastoral stations that was largely filled by Aboriginal workers. In this way, the Gamilaraay people were able to retain their relationships with their country and sites through working on stations throughout the region.

From 1883 the Aboriginal Protection Board established a number of "Aboriginal stations/ reserves" which included Walhallow near Caroona, Burra Dee Dee near Coonabarabran, Sevingtong near Inverell, Terri Hie Hie near Moree and Angledool. Many of the Aboriginal population in the Tamworth region were removed to Terri Hei Hei and Walhallow.

Water has been identified as a crucial element of the Gamilaraay traditional way of life with a wide variety of animal and plant resources seasonally available in the river systems. Terrestrial animals such as the possum were noted by many early observers as a prime food source and the skins were often made into fine cloaks that evidently were very warm. Kangaroos were eaten, and their skins made into cloaks as well (Evans 1815; Oxley 1820; Mitchell 1839). A range of reptiles and other mammals were also food sources. Fish and mussels would have been prevalent from the rivers and creeks, and insects were also a common food type, in particular grubs, ants, and ant eggs (Pearson 1981; Fraser 1892). Birds, including emus, were common as a food source, being caught in nets made from fibres of various plants. Bird hunts were undertaken as group activities, with emus, ducks and other species of birds targeted via groups of people flushing them out and driving them into pre-arranged nets (Ramson 1983). Plant foods were equally as important and mostly consisted of grasses seeds, roots, tubers, yams, berries and fruits (Gott 1982). At the time of European contact, the Gamilaraay people largely relied on small baked loaves that were made by grounding grass seeds to make a flour (Boileau 2007).

The early observations also note that some weapons and tools were carried, some made from wood such as spears, spear throwers, clubs, shields, boomerangs, digging sticks, bark vessels and canoes. Other materials were observed in use such as stone axes, shell and stone scrapers and bone needles.

In an archaeological context, few of these items would survive, particularly in an open site context. Anything made from bark and timber and animal skins would decay quickly in an open environment. However, other items, in particular those made of stone, would survive where they were made, placed or dropped. Shell material may also survive in an archaeological context. Utilisation of sources of raw materials, such as the extraction of wood or bark would leave scars on trees that are archaeologically visible, although few trees of sufficient age survive in the modern context. Outcropping stone sources also provide clues to their use through flaking, although pebble beds may also provide sources of stone, which leave no archaeological trace.

The Aboriginal Heritage Information Management System (AHIMS) provides a database of previously recorded Aboriginal heritage sites in NSW. A search provides basic information about any sites previously identified within a search area. However, a register search is not conclusive evidence of the presence or absence of Aboriginal heritage sites, as it requires that an area has been inspected and details of any sites located have been provided to the register to be added. As a starting point, the search will indicate whether any sites are known within or adjacent to the Project Area.

A search of the AHIMS database was initially conducted on 25 June 2020 (Client ID 515678) for this project. However, as AHIMS data is only valid for a 12-month period, an updated extensive search of AHIMS was conducted on 14 April 2023 to ensure the validity of the data. The details of the most recent AHIMS search are detailed in the ACHA report in Appendix D.5.

Other heritage register searches were also undertaken to identify any items or places in proximity to the Project Area, with a focus on the Project Area and surrounding landscape. The following resources were used as part of this assessment:

- The NSW State Heritage Inventory (SHI), this includes items on the State Heritage Register and items listed by state agencies and local Government, to identify any items currently listed within or adjacent to the Project site.
- The Australian Heritage Database, this includes items on the National and Commonwealth Heritage Lists, to identify any items that are currently listed within or adjacent to the Project site.

The results of the NSW SHI database search indicated that there are no Aboriginal Places listed under the *National Parks and Wildlife Act* within the Tamworth Regional LGA

The results of the NSW SHI database search indicated that there are nine previously recorded heritage sites listed under the *NSW Heritage Act* within the Tamworth Regional LGA. None of the sites are located within or adjacent to the Project Area.

Survey methods and effort

The survey strategy objective was to cover the development footprint (at the time of the survey, hereby referred to as the Survey Area) and as much of the ground surface within that area as possible. Although the actual ground impact from the construction method for the proposed solar farm is likely to be low, the placement of solar arrays across the landscape has the potential to cover any cultural heritage sites. Consequently, the survey strategy was devised to walk a series of transects across the landscape to achieve maximum coverage. Because the Survey Area was generally disturbed and cleared, transects were spaced evenly with the survey team spread apart at 30 m intervals, walking in parallel lines. At the end of each transect, the team would reposition along a new transect line at the same spacing and walk back on the same compass bearing. The nature of the Survey Area made this an ideal survey strategy allowing for maximum survey coverage and opportunity to identify any heritage objects.

The survey strategy was amended for one paddock during the fieldwork due to its having knee to waist high crops. At the request of the RAPs, the survey team walked the boundary of this paddock while a single archaeologist surveyed the paddock with transects spaced at 50 m intervals (refer Figure 6-49).

The Survey Area was divided into four landforms based on the landscape maps and visual inspection of the area during the field survey. The landforms are listed below and shown in Figure 6-48.

- Spurs and hill crests
- Slopes and undulating ground
- Low lying flats and drainage lines; and
- Disturbed Road corridor (which covers the intersection road upgrade area).

The survey fieldwork was undertaken from 17 to 26 of August 2020 (excluding 22 August 2020 due to poor weather conditions). During the survey notes were made about visibility, photographs were taken, and any possible Aboriginal objects or features identified were inspected, assessed, and recorded if deemed to be Aboriginal in origin.

The following finds were observed within the Survey Area of the Subject Land, two possible modified trees, 11 new artefact scatters, 19 new isolated finds, one new area of archaeological sensitivity and one previously recorded AHIMS site.

A summary of the Aboriginal objects recorded during the field survey of the Survey Area is provided in Table 6-25 below.

Table 6-25 Summary of all Aboriginal objects recorded during the survey

AHIMS Site ID	Name	Type	No. of Artefacts
29-2-0400	Middlebrook Solar Farm Project AFT1	Isolated Find	1
29-2-0399	Middlebrook Solar Farm Project AFT2	Isolated Find	1
29-2-0398	Middlebrook Solar Farm Project AFT3	Artefact scatter	4
29-2-0397	Middlebrook Solar Farm Project AFT4	Artefact scatter	6
29-2-0396	Middlebrook Solar Farm Project AFT5	Isolated Find	1
29-2-0395	Middlebrook Solar Farm Project AFT6	Isolated Find	1
29-2-0394	Middlebrook Solar Farm Project AFT7	Isolated Find	1
29-2-0393	Middlebrook Solar Farm Project AFT8	Artefact scatter	3
29-2-0392	Middlebrook Solar Farm Project AFT9	Isolated Find	1
29-2-0391	Middlebrook Solar Farm Project AFT10	Isolated Find	1
29-2-0390	Middlebrook Solar Farm Project AFT11	Isolated Find	1

AHIMS Site ID	Name	Type	No. of Artefacts
29-2-0389	Middlebrook Solar Farm Project AFT12	Isolated Find	1
29-2-0388	Middlebrook Solar Farm Project AFT13	Artefact scatter	19
29-2-0387	Middlebrook Solar Farm Project AFT14	Artefact scatter	3
29-2-0386	Middlebrook Solar Farm Project AFT15	Isolated Find	1
29-2-0385	Middlebrook Solar Farm Project AFT16	Isolated Find	1
29-2-0384	Middlebrook Solar Farm Project AFT17	Artefact scatter	32
29-2-0383	Middlebrook Solar Farm Project AFT18	Isolated Find	1
29-2-0382	Middlebrook Solar Farm Project AFT19	Artefact scatter	41
29-2-0381	Middlebrook Solar Farm Project AFT20	Artefact scatter	2
29-2-0380	Middlebrook Solar Farm Project AFT21	Artefact scatter	5
29-2-0378	Middlebrook Solar Farm Project AFT22	Isolated Find	1
29-2-0379	Middlebrook Solar Farm Project AFT23	Isolated Find	1
29-2-0377	Middlebrook Solar Farm Project AFT24	Isolated Find	1
29-2-0376	Middlebrook Solar Farm Project AFT25	Isolated Find	1
29-2-0375	Middlebrook Solar Farm Project AFT26	Isolated Find	1
29-2-0374	Middlebrook Solar Farm Project AFT27	Artefact Scatter	4
29-2-0373	Middlebrook Solar Farm Project AFT28	Artefact scatter	3
29-2-0372	Middlebrook Solar Farm Project AFT29	Isolated Find	1
29-2-0371	Middlebrook Solar Farm Project AFT30	Isolated Find	1
NA	Middlebrook Solar Farm Project ST 1 – Possible	Possible Modified Tree	
NA	Middlebrook Solar Farm Project ST 2 – Possible	Possible Modified Tree	

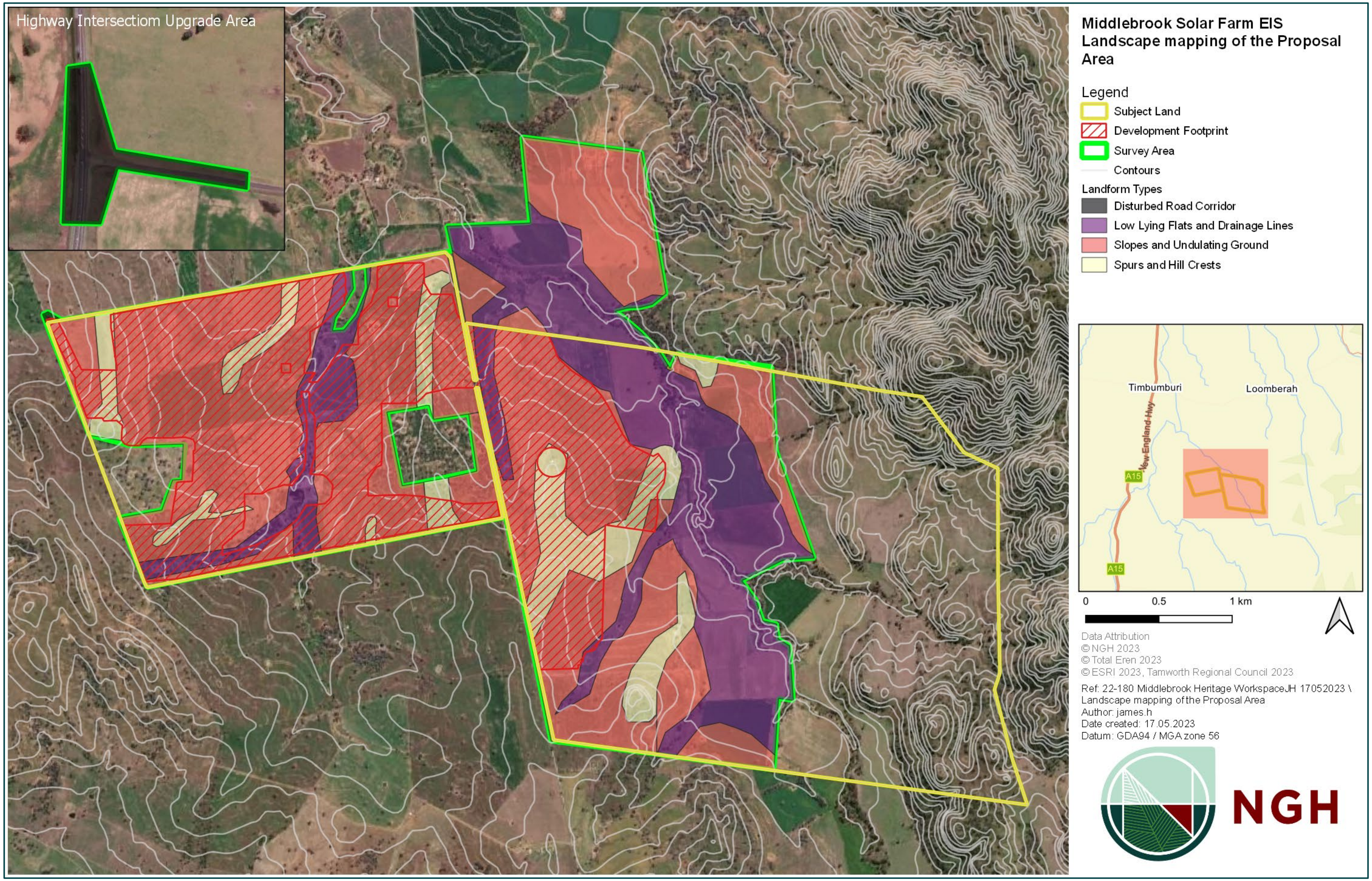

Figure 6-48 Landscape mapping (ACHA)

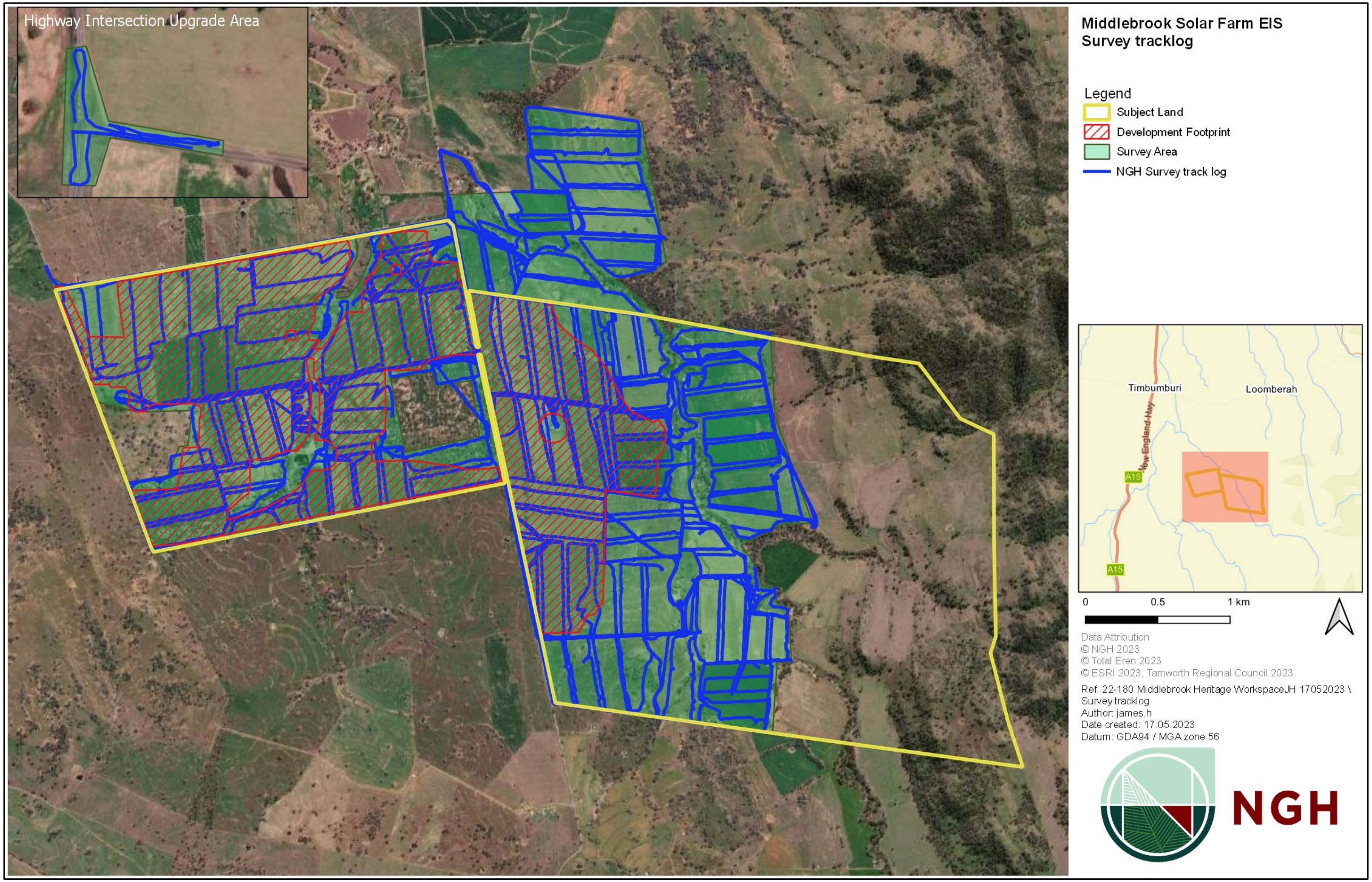

Figure 6-49 Survey tracklog

Significance

Significance forms the basis for the management of Aboriginal cultural heritage. There are four main criteria for assessing the significance of Aboriginal cultural heritage sites listed in the *Guide to investigating, assessing, and reporting on Aboriginal cultural heritage in NSW (NSW Office of Environment and Heritage (OEH), 2011)*. These are social or cultural significance, aesthetic significance, historic significance, and scientific significance.

Each criterion of significance are rated low, moderate, or high. The following questions can be asked to help guide this rating (OEH, 2011):

- **Research potential:** does the evidence suggest any potential to contribute to an understanding of the area and/or region and/or state's natural and cultural history?
- **Representativeness:** how much variability (outside and/or inside the subject area) exists, what is already conserved, how much connectivity is there?
- **Rarity:** is the subject area important in demonstrating a distinctive way of life, custom, process, land-use, function or design no longer practised? Is it in danger of being lost or of exceptional interest?
- **Education potential:** does the subject area contain teaching sites or sites that might have teaching potential?

A summary of cultural heritage values and corresponding significance assessment for the sites with known Aboriginal objects within the Survey Area is provided in Table 6-26 below.

Table 6-26 Summary of significance

Site Name	Site type	Cultural Value	Scientific Value	Aesthetic Value	Historic Value	Other Value	Overall Value	Rarity
Middlebrook Solar Farm Project AFT1	Isolated Find	High	Low	Low	N/A	N/A	Low	Common
Middlebrook Solar Farm Project AFT2	Isolated Find	High	Low	Low	N/A	N/A	Low	Common
Middlebrook Solar Farm Project AFT3	Artefact scatter	High	Low	Low	N/A	N/A	Low	Common
Middlebrook Solar Farm Project AFT4	Artefact scatter	High	Low	Low	N/A	N/A	Low	Common
Middlebrook Solar Farm Project AFT5	Isolated Find	High	Low	Low	N/A	N/A	Low	Common
Middlebrook Solar Farm Project AFT6	Isolated Find	High	Low	Low	N/A	N/A	Low	Common
Middlebrook	Isolated Find	High	Low	Low	N/A	N/A	Low	Common

Site Name	Site type	Cultural Value	Scientific Value	Aesthetic Value	Historic Value	Other Value	Overall Value	Rarity
Solar Farm Project AFT7								
Middlebrook Solar Farm Project AFT8	Artefact scatter	High	Low	Low	N/A	N/A	Low	Common
Middlebrook Solar Farm Project AFT9	Isolated Find	High	Low	Low	N/A	N/A	Low	Common
Middlebrook Solar Farm Project AFT10	Isolated Find	High	Low	Low	N/A	N/A	Low	Common
Middlebrook Solar Farm Project AFT11	Isolated Find	High	Low	Low	N/A	N/A	Low	Common
Middlebrook Solar Farm Project AFT12	Isolated Find	High	Low	Low	N/A	N/A	Low	Common
Middlebrook Solar Farm Project AFT13	Artefact scatter	High	Low	Low	N/A	N/A	Low	Common
Middlebrook Solar Farm Project AFT14	Artefact scatter	High	Low	Low	N/A	N/A	Low	Common
Middlebrook Solar Farm Project AFT15	Isolated Find	High	Low	Low	N/A	N/A	Low	Common
Middlebrook Solar Farm Project AFT16	Isolated Find	High	Low	Low	N/A	N/A	Low	Common
Middlebrook Solar Farm Project AFT17	Artefact scatter	High	Low	Low	N/A	N/A	Low	Common
Middlebrook Solar Farm Project AFT18	Isolated Find	High	Low	Low	N/A	N/A	Low	Common
Middlebrook Solar Farm Project AFT19	Artefact scatter	High	Low	Low	N/A	N/A	Low	Common
Middlebrook	Artefact	High	Low	Low	N/A	N/A	Low	Common

Site Name	Site type	Cultural Value	Scientific Value	Aesthetic Value	Historic Value	Other Value	Overall Value	Rarity
Solar Farm Project AFT20	scatter							
Middlebrook Solar Farm Project AFT21	Artefact scatter	High	Low	Low	N/A	N/A	Low	Common
Middlebrook Solar Farm Project AFT22	Isolated Find	High	Low	Low	N/A	N/A	Low	Common
Middlebrook Solar Farm Project AFT23	Isolated Find	High	Low	Low	N/A	N/A	Low	Common
Middlebrook Solar Farm Project AFT24	Isolated Find	High	Low	Low	N/A	N/A	Low	Common
Middlebrook Solar Farm Project AFT25	Isolated Find	High	Low	Low	N/A	N/A	Low	Common
Middlebrook Solar Farm Project AFT26	Isolated Find	High	Low	Low	N/A	N/A	Low	Common
Middlebrook Solar Farm Project AFT27	Artefact Scatter	High	Low	Low	N/A	N/A	Low	Common
Middlebrook Solar Farm Project AFT28	Artefact scatter	High	Low	Low	N/A	N/A	Low	Common
Middlebrook Solar Farm Project AFT29	Isolated Find	High	Low	Low	N/A	N/A	Low	Common
Middlebrook Solar Farm Project AFT30	Isolated Find	High	Low	Low	N/A	N/A	Low	Common
Middlebrook Solar Farm Project ST 1 – Possible	Possible Modified Tree	High	Moderate to High	High	N/A	N/A	High	Uncommon
Middlebrook Solar Farm Project ST 2 – Possible	Possible Modified Tree	High	Moderate to High	High	N/A	N/A	High	Uncommon

Site Name	Site type	Cultural Value	Scientific Value	Aesthetic Value	Historic Value	Other Value	Overall Value	Rarity
Area of archaeological sensitivity-Spring Creek	Culturally and archaeological sensitive area	High	Low to Moderate	High	N/A	N/A	High	NA

The values potentially impacted by the development are any social and cultural values attributed to the artefacts and the sites by the local Aboriginal community. The extent to which the loss of the sites or parts of the sites would impact on the community is only something the Aboriginal community can articulate.

The impact to scientific values for this development are summarised in Section 5 of the ACHA (Appendix D.5). A total of 12 new stone artefact sites and one previously recorded AHIMS site, which are all assessed as having low scientific value, are proposed to be impacted by the development of the Middlebrook Solar Farm. While the majority of the stone artefact sites are rated as having total loss of scientific value it is argued that there are likely to be a number of similar sites in the local area and therefore the impact to the overall local archaeological record is low.

The stone artefacts from the sites which are proposed to be impacted have little research value apart from what has already been gained from the information obtained during the present assessment. This information relates more to the presence of the artefacts and in the development of Aboriginal site modelling, which has largely now been realised by the recording. The intrinsic values of the artefacts themselves may be affected by the development of the Project Area. Any removal of the artefacts, or their breakage would reduce the low scientific value they retain.

The two possible modified trees and the area of archaeological sensitivity along Spring Creek will not be impacted by the proposed development.

Figure 6-50 shows the location of the sites to be impacted by the proposed development footprint for the Middlebrook Solar Farm.

No other values have been identified that would be affected by the development Project.

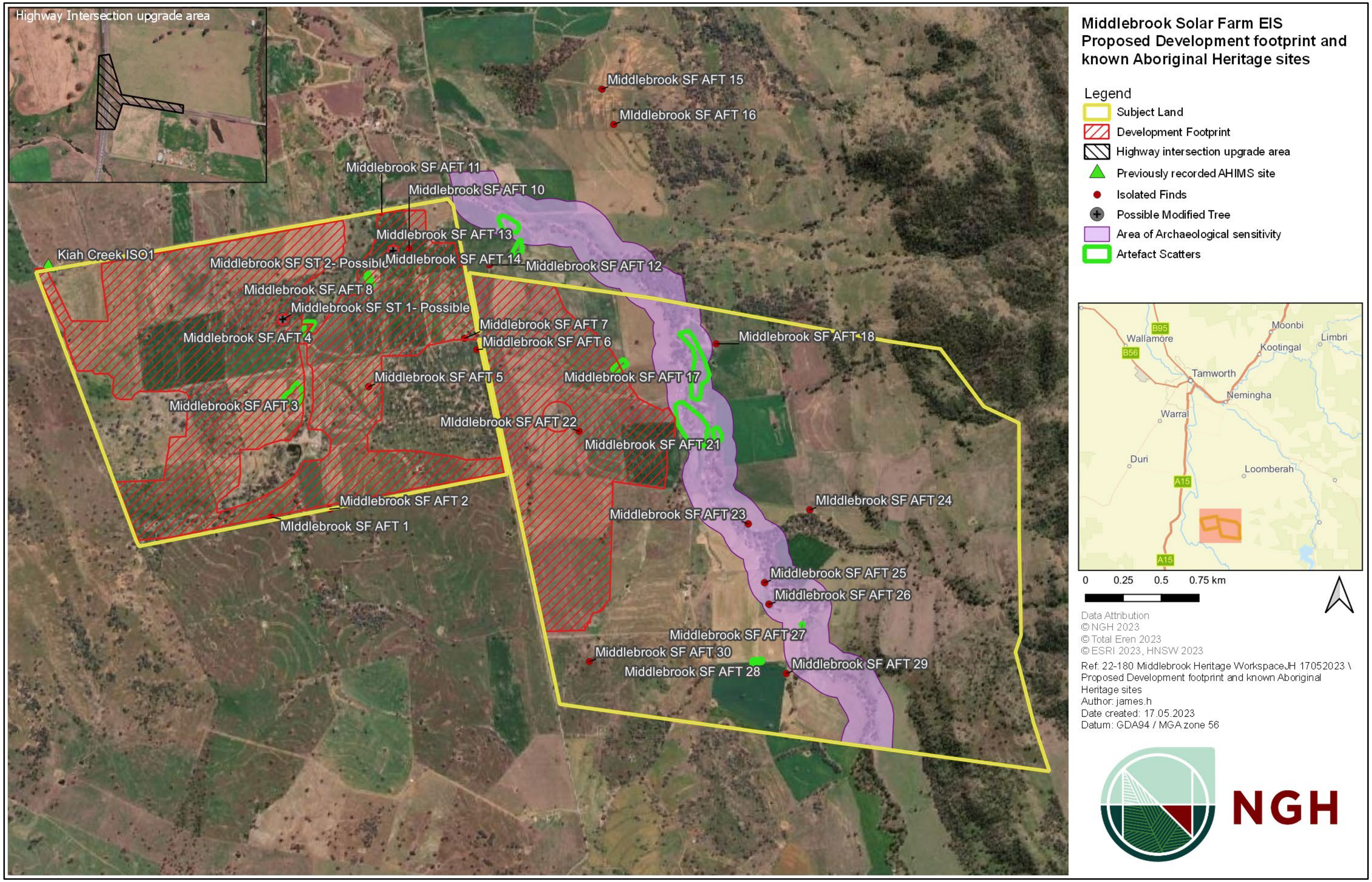

Figure 6-50 Proposed development footprint and impacts to known Aboriginal sites

6.6.3. Potential impacts

It is likely that the Project will impact Aboriginal objects. The potential harm from construction activities from the Project will include:

- Installation of solar panels
- Construction of internal access roads
- Ancillary power conversion infrastructure
- Perimeter fencing
- Construction material storage.

As described in this report, a total of 19 isolated finds, 11 artefact scatters and two possible modified trees were recorded within the Survey Area with a single previously recorded AHMIS site located in close proximity to the proposed Middlebrook Road access point into the solar farm.

It should be noted that significant design changes and reduction to the Middlebrook Solar Farm development design and the proposed impact footprint have been made subsequent to the Aboriginal heritage survey being completed that have ensured the two possible modified trees are avoided and that there are no development works within the archaeologically sensitive area of Spring Creek.

All impacts to the possible modified trees, which is a site type noted to have higher cultural value, the removal of development on the western side of Spring Creek, and the implementation of the 150 m buffer on Spring Creek means the majority of stone artefacts recorded within the Survey Area will now be avoided by the proposed development works for the Middlebrook Solar Farm, as shown in Table 6-27.

Table 6-27 Summary of sites to be impacted and avoided by the proposed development

Sites impacted	Sites avoided
Middlebrook Solar Farm Project AFT 1 (Isolated Find) Middlebrook Solar Farm Project AFT 2 (Isolated Find) Middlebrook Solar Farm Project AFT 3 (Artefact scatter) Middlebrook Solar Farm Project AFT 4 (Artefact scatter) Middlebrook Solar Farm Project AFT 5 (Isolated Find) Middlebrook Solar Farm Project AFT 7 (Isolated Find) Middlebrook Solar Farm Project AFT 8 (Artefact scatter) Middlebrook Solar Farm Project AFT 9 (Isolated Find) Middlebrook Solar Farm Project AFT 10 (Isolated Find) Middlebrook Solar Farm Project AFT 11 (Isolated Find) Middlebrook Solar Farm Project AFT 20 (Artefact scatter) Middlebrook Solar Farm Project AFT 22 (Isolated Find) AHIMS# 29-2-0263/Kiah Creek ISO 1 (Isolated Find)	Middlebrook Solar Farm Project AFT 6 (Isolated Find) Middlebrook Solar Farm Project AFT 12 (Isolated Find) Middlebrook Solar Farm Project AFT 13 (Artefact scatter) Middlebrook Solar Farm Project AFT 14 (Artefact scatter) Middlebrook Solar Farm Project AFT 15 (Isolated Find) Middlebrook Solar Farm Project AFT 16 (Isolated Find) Middlebrook Solar Farm Project AFT 17 (Artefact scatter) Middlebrook Solar Farm Project AFT 18 (Isolated Find) Middlebrook Solar Farm Project AFT 19 (Artefact scatter) Middlebrook Solar Farm Project AFT 21 (Artefact scatter) Middlebrook Solar Farm Project AFT 23 (Isolated Find) Middlebrook Solar Farm Project AFT 24 (Isolated Find) Middlebrook Solar Farm Project AFT 25 (Isolated Find) Middlebrook Solar Farm Project AFT 26 (Isolated Find) Middlebrook Solar Farm Project AFT 27 (Artefact scatter) Middlebrook Solar Farm Project AFT 28 (Artefact scatter) Middlebrook Solar Farm Project AFT 29 (Isolated Find) Middlebrook Solar Farm Project AFT 30 (Isolated Find) Middlebrook Solar Farm Project ST 1 (Possible modified

Sites impacted	Sites avoided
	tree) Middlebrook Solar Farm Project ST 2 (Possible modified tree) Area of archaeological sensitivity-Spring Creek

Given that there is Aboriginal archaeological material present within the Project Area and its surrounds, it is likely that other artefacts will be present within the development footprint, although in similar low densities. The proposed level of disturbance for the construction of the solar farm will likely impact some of the stone artefacts recorded during the field survey and others that may be present within other areas of the development footprint.

Of the 19 isolated finds, 11 artefact scatters and two possible modified trees recorded within the Survey Area, eight isolated finds and four artefact scatters are situated within the Project Area and the development footprint of the proposed solar arrays, tracks, fencing and associated infrastructure. These 12 newly recorded sites would be impacted by the proposed development. The impact to these 12 sites is likely to be most extensive where earthworks occur such as the installation of cabling and the transmission line poles, which may involve the removal, breakage or displacement of artefacts. It should also be noted that two of these low-density artefact scatter sites (Middlebrook Solar Farm Project AFT 4 and AFT 20) will only be partially impacted. Both total and partial harm to any site is considered an impact on the sites and the Aboriginal objects by the development in its present form. The previously recorded AHIMS site (Kiah Creek ISO 1) is located directly adjacent to the Project Area and is therefore considered likely to be impacted by the access road works. During the most recent survey, it was unable to be located however, as such has been deemed as low risk.

The proposed construction methodology for the Middlebrook Solar Farm will, however, result in only small areas of disturbance. The construction of access and maintenance tracks may involve some grading but given the general cleared nature of the majority of the terrain, this is likely to be minimal. The installation of the solar arrays involves drilling or screwing the piles into the ground and no widespread ground disturbance work such as grading is required to accomplish this. The major ground disturbance will likely be for the construction of the substation near the existing transmission line, trenching for cables and vehicle movement during construction.

The remaining 18 sites with stone artefacts within the Project Area, the two possible modified trees, and the area of archaeological sensitivity along Spring Creek will not be impacted by the proposed development.

Due to detail design and avoidance of high value sites, the assessment of harm overall for the Project is assessed as low.

6.6.4. Key uncertainties of the assessment

Ecologically Sustainable Development (ESD) principles relevant to the assessment of the Project as it relates to Aboriginal cultural heritage include:

- The precautionary principle - Full scientific certainty about the threat of harm should never be used as a reason for not taking measures to prevent harm from occurring.
- The principle of inter-generational equity - The present generation should make every effort to ensure that the health, diversity and productivity of the environment – which includes cultural heritage – is available for the benefit of future generations.

A thorough archaeological survey of the Project was conducted to identify and minimise the harm to Aboriginal objects as guided by the precautionary principle. The Project will avoid two identified possible modified trees, the entire Spring Creek area and parts of identified artefact scatter as identified in Table 6-27.

6.6.5. Mitigation measures

As a general principal, avoidance of impact to sites of Aboriginal cultural heritage is the preferred method of management. This is advocated in the Burra Charter as well as various other guidelines and codes of practice.

Avoiding harm to all the Aboriginal sites identified within the Project Area is technically possible through avoidance. However, the scattered nature of the archaeological sites across the Project Area would pose serious design and viability constraints on the proposed development of a solar farm. Additional measures to redesign the development footprint for the Middlebrook Solar Farm are not considered to be necessary in this instance based on the already significantly reduced footprint and in consideration of the likely impacts by the construction methods.

Mitigation of harm has been incorporated into this project design in the following ways already:

- the reduction of the size of the Project Area and development footprint compared to the Survey Area.
- the avoidance of the two possible modified trees which had high cultural value.
- the avoidance of the area of archaeological sensitivity that encompasses the 150 m buffer around Spring Creek.

The 12 newly recorded stone artefact sites within the development footprint that will be impacted by the works for the Middlebrook Solar Farm are conducive to surface collection salvage as a mitigation strategy. The artefacts should be collected and moved to a safe area within the property that will not be subject to any solar farm related ground disturbance works. The Aboriginal community representatives present during the survey suggested that any artefacts collected during the salvage programme should be buried in close proximity to either of the possible modified trees, near Spring Creek or an area outside the proposed development footprint which will not be impacted by works.

The following mitigations measures are required to be implemented.

Table 6-28 Safeguards and mitigation measures for Aboriginal heritage

ID	Mitigation measures	Project stage
AH1	The development must avoid the two possible modified trees (Middlebrook SF Modified Tree 1 & 2). A minimum 20 m buffer would be in place around each of the possible modified trees to prevent any inadvertent impacts to the canopy and/or root system.	Prior to construction - ongoing
AH2	Where they can be avoided, a minimum 5 m buffer should be observed by the Project around all stone artefact sites recorded. If complete avoidance to any of the isolated finds and/or artefact scatters recorded within areas to be impacted is not possible, a reasonable attempt to collect the surface stone artefacts recorded must occur prior to construction works commencing. Until surface collection salvage has occurred a minimum 5 m buffer must be observed around each stone artefact site.	Prior to construction - ongoing
AH3	The collection and relocation of the surface artefacts would be undertaken by an archaeologist with representatives of the registered Aboriginal parties, as selected by the Proponent, and be consistent with Requirement 26 of the *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales.*	During construction - ongoing
AH4	All objects salvaged must have their burial location submitted to the AHIMS database. An Aboriginal Site Impact Recording Form must be completed and submitted to AHIMS following harm for each site collected or destroyed from salvage and/or construction works as approved for impacts in line the development consent for this State Significant Development.	Prior to construction - ongoing
AH5	A Cultural Smoking Ceremony would take place to cleanse any artefacts salvaged and the burial location, as requested by the Aboriginal community.	Prior to construction - ongoing
AH6	Unmitigated impacts may only occur post development consent at the previously recorded AHIMS site Kiah Creek ISO 1 (AHIMS# 29-2-0263).	During construction - ongoing
AH7	Additional assessment and Aboriginal consultation would be required in any areas required to be impacted outside the assessed Development footprint. Specifically, Middlebrook Road, for the 3.8 km from New England Highway to the site access, would be surveyed subject to final upgrade designs to confirm (or update) heritage assessment assumptions that it can be excluded from assessment.	During construction - ongoing
AH8	The Applicant should prepare a Cultural Heritage Management Plan (CHMP) to address the potential for finding additional Aboriginal artefacts during the construction of the Middlebrook Solar Farm and for the management of known sites, artefacts and the archaeologically sensitive area within the Proposal	During construction - ongoing

ID	Mitigation measures	Project stage
	Area. The Plan should include the unexpected finds procedure to manage any objects suspected to be Aboriginal in origin during the construction, maintenance, operational and decommissioning works and include requirements for heritage to be included as part of the site inductions, the monitoring of sites which will be avoided and a methodology for surface collection. Preparation of the CHMP should be undertaken in consultation with the registered Aboriginal parties.	
AH9	In the unlikely event that human remains are discovered during the construction of the Middlebrook Solar Farm, all work must cease in the immediate vicinity. The appropriate heritage team within Heritage NSW and the local police should be notified. Further assessment would be undertaken to determine if the remains were Aboriginal or non-Aboriginal. If the remains are deemed to be Aboriginal in origin Heritage NSW would be sought to advise the Proponent on the appropriate actions required.	During construction - ongoing
AH10	Prior to any development consent being issued for this project the drafted conditions which relate to Aboriginal heritage should be reviewed by a qualified archaeologist.	Prior to Construction

6.7. Historic heritage

6.7.1. Assessment approach

A desktop study was undertaken to identify any historic heritage (non-indigenous) items or places in proximity to the study area, with a particular focus on the Assessment area. Tamworth Regional LGA was used in the search as the Assessment area is situated within the LGA. The searches were undertaken on 13 March 2023 and included:

- The NSW State Heritage Inventory (SHI) (OEH, 2020c) (includes items on the State Heritage Register and items listed by State agencies and local government) to identify any items currently listed within or adjacent to the Assessment area. The area searched was Tamworth Regional LGA.
- The Australian Heritage Database (includes items on the National and Commonwealth Heritage Lists) to identify any items that are currently listed within or adjacent to the Assessment area.
- The Environmental Heritage (Schedule 5) of the Tamworth Regional LEP for locally listed heritage items that are within or adjacent to the Assessment area.

A general site inspection of the Project site was also undertaken in 2020 to verify if other unlisted items of likely heritage value occurred onsite. All areas shown as the Development footprint, in Figure 6-51 were inspected.

The potential for the Project to impact listed or unlisted items is evaluated below.

6.7.2. Existing environment

No World Heritage or National Heritage items were returned from the searches. One Commonwealth Heritage List item was returned, the Tamworth Post Office located in the Tamworth town centre, approximately 25 km from the site. None of the 59 items listed in the State Heritage Register (inclusive of nine listed State Heritage items) are located within or adjacent to the Project. Swamp Creek Bridge is, however, located approximately 5.4 km from the Project site on the New England Highway. Refer discussion below. One Tamworth Regional LEP item is located near to the Project. This group of buildings is located on the New England Highway, approximately 1.3 km from the closest point of the Project site. Refer Figure 6-51 and discussion below.

The table below summarises the nearby listed Historic Heritage items for the Tamworth Regional LGA.

Table 6-29 Summary of nearby historic heritage listings

Name of register	Number of listings	Relevant to Project
World Heritage List	0	
National Heritage List	0	
Commonwealth Heritage List	1	
NSW State Heritage Register	9	
State Agency Heritage Register (incorporates State Heritage Register)	59	1; Swamp Creek Bridge
Tamworth Region Local Environmental Plan (LEP) Register	554	1; Goonoo Goonoo Station

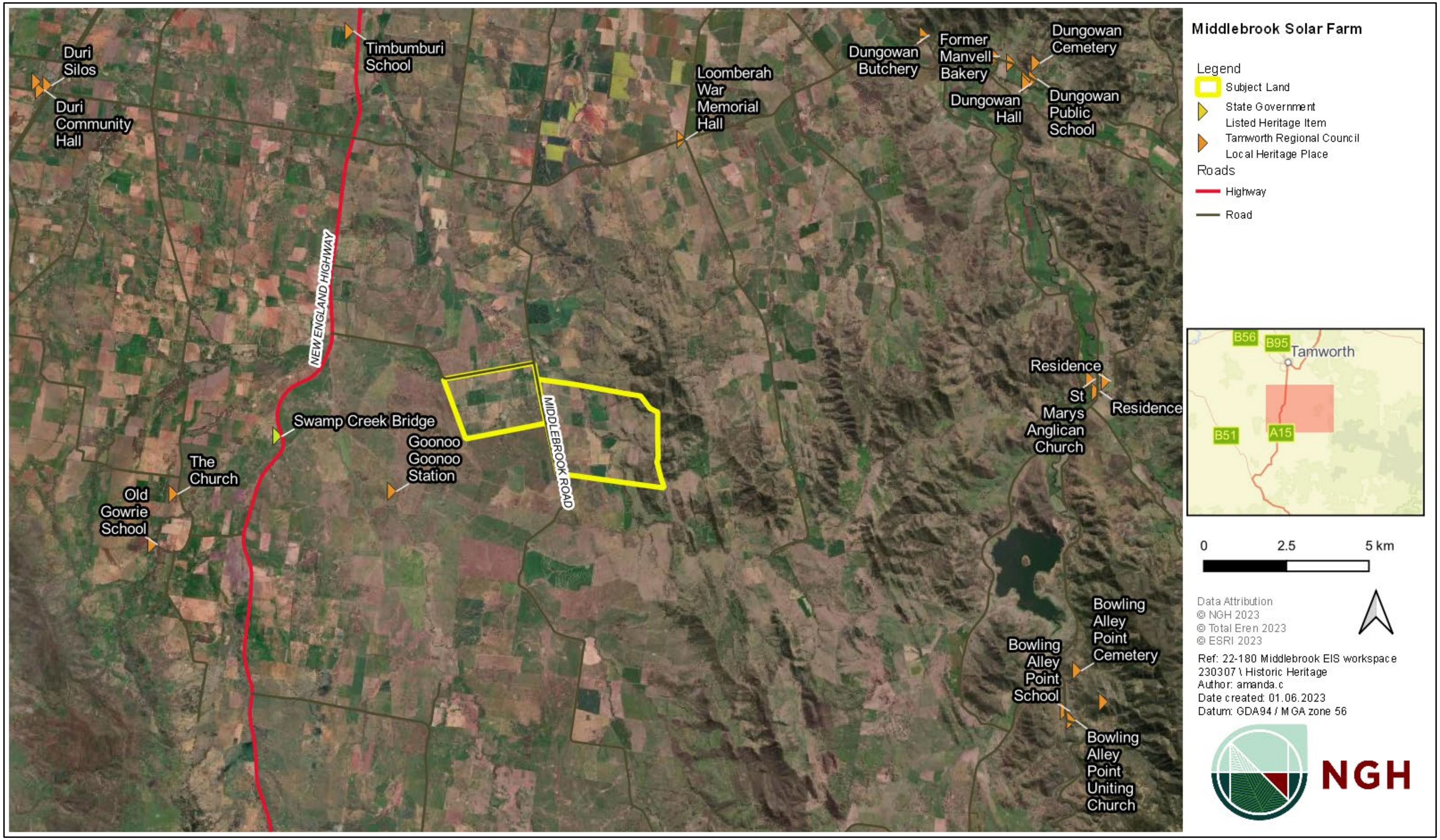

Figure 6-51 Historic Heritage

Swamp Creek Bridge, State Heritage Register listing

The reinforced concrete beam bridge demonstrates the principal physical characteristics and the processes (historical and constructional) of this simple, economical and effective form. Typically, such bridges were an improvement on an earlier bridge crossing to cope with changing modes of transport. Its location on an early access route into the area provides a strong association with the national historic themes of developing local, regional, and national economies.

Swamp Creek Bridge is associated with the NSW historic themes of transport, communications, and commerce and the national historic themes of developing local, regional, and national economies. From a technical perspective the bridge represents an effective solution to widening an existing bridge, with the final outcome presenting an attractive appearance which enhances the original design which, itself, was visually pleasant. Swamp Creek Bridge is a component of the broader state highways improvement programme aimed at bringing the state's roads up to a standard suited to motor vehicle traffic, a programme which as a whole was a significant activity in the state's cultural history. The development of this simple, economical and effective bridge form grew from the aim of providing efficient road transport over thousands of kilometres over the State and facilitated the achievement of that aim. Whilst the deck form is not unusual, the method of widening is unusual if not unique, and by using stub cantilevers to support new edge beams, provides additional width without devaluing the aesthetics of the original design (SHI, 2005).

Goonoo Goonoo Station Group of Buildings, LEP listing

As cited from Heritage NSW (Department of Premier and Cabinet 2020):

> *The Goonoo Goonoo Station Group of Buildings is highly significant. Historically, it represents one of the first settlements of the Peel Valley and was the headquarters of the Australian Agricultural Company dealings in the area. The buildings are linked to the historically significant figures of Edward Parry, Henry Dangar, Henry Dumaresq, Phillip Parker King and Phillip Gidley King, son and grandson of Governor King. Some of the buildings have significant technical and aesthetic merit. They have as a group a very high potential to yield cultural information concerning the running of a pastoral homestead in the 19th century and is considered to be representative of such homesteads. The group of buildings is therefore considered to possess rare aspects of cultural history.*

The item is considered to meet the requirements for SHR Criteria a: Historical Significance.

Due to the trajectory of the highway and the intervening landscape characters, the proposed project is no inline of site for Swamp Creek Bridge.

For Goonoo Goonoo Station, the main buildings are in line of sit of the project, however, the visual assessment has rated the impact as low. Goonoo Goonoo Station does share their eastern boundary with the subject site, and depending on the location of people conducting routine activities on the property would have full view of the proposed project.

6.7.3. Potential impacts

Impacts to historic heritage can be direct, such as damage caused by impact or vibration, as well as indirect, such as a reduction of the visual amenity of the site or its surroundings.

The three relevant listings were evaluated as follows:

1. Tamworth Post Office: no potential for direct or indirect impacts from the Project.
2. Swamp Creek Bridge: The New England Highway is a main transport corridor assessed as able to tolerate the additional traffic generated by the Project.

3. Goonoo Goonoo Station Group: no potential for direct impacts from the Project. Low visual impact, in consideration of topographic screening. Existing vegetation between the site and the Project would reduce this further (refer Section 6.1.3).

The Project is not considered likely to have a significant impact on heritage values in accordance with the Heritage Act, EP&A Act and the EPBC Act.

6.7.4. Key uncertainties of the assessment

Unlisted items were not identified in the site inspection within the Development footprint however, a protocol has been developed to ensure that, if identified, further assessment and consideration of appropriate mitigation will be triggered.

6.7.5. Mitigation measures

Table 6-30 Safeguards and mitigation measures for social and economic impacts

ID	Mitigation measures	Project stage
HH 1	In the unlikely event that an item of historic heritage is identified, the Heritage NSW must be contacted prior to further work being carried out in the vicinity.	Construction, operation and decommissioning
HH 2	Any additions or changes to the scope not outlined within this report may require additional heritage assessment.	Construction, operation and decommissioning

6.8. Social and economic impacts

6.8.1. Assessment approach

NGH completed a Social Impact Assessment (SIA) for Middlebrook Solar Farm Project to assess the likely impacts of the Project on the local community and social infrastructure, including consideration of the construction workforce accommodation requirements. This was a requirement of the SEARs, provided in Appendix A. The SIA is summarised below and appended in full, Appendix D.6.

The assessment aims to identify, predict and evaluate the likely social impacts and benefits arising from the project, and to propose appropriate responses to mitigate and manage negative impacts and enhance positive benefits. An overview of the key tasks in the preparation of the SIA is as follows:

As required by the SIA Guideline (DPIE, 2021a) for each project activity, social impacts were assessed across the following social impact categories: way of life, community, accessibility, culture, health and wellbeing, surroundings, livelihoods, and decision-making systems.

SIA stakeholder engagement was also undertaken to inform and validate the social baseline and assessment of social impacts. This involved:

- Ten stakeholder interviews (face-to face and online/phone)
- Employment and training workshop (face-to-face) (three attendees)
- Online survey (thirty-nine responses)
- Attendance at the Community Information Session.

The social impact evaluation built on the social impact scoping, and involved further review of relevant inputs, e.g., relevant EIS technical reports, engagement findings, and comparative studies. An assessment was then carried out to determine the likely significance of each potential impact, based on its predicted likelihood and magnitude as defined in the Guideline. The information gathered has been used to ensure a detailed assessment of issues raised by the community in other sections of this EIS (cross references are provided further below in Section 6.8.3 to avoid duplication). Finally, measures to avoid, minimise or mitigate potential negative impacts and enhance positive benefits were developed to address impacts.

6.8.2. Existing environment

The Tamworth LGA is bounded by the LGAs of Gwydir (north), Uralla (northeast), Walcha (southeast), Upper Hunter (south), Liverpool Plains (southwest), Gunnedah (west), and Narrabri (northwest). The Tamworth region is a major service centre with a diverse economy, including agriculture (particularly cattle grazing and large-scale cropping), tourism, retail, manufacturing, education, and transport industries (TRC, 2020a).It is the predominant provider in the broader region for health, aviation, and employment services and is located in the Namoi Regional Job Precinct (DPE, 2022). During the past five years, residents of the New England North West have confronted seasonal challenges which has required ongoing recovery from drought, bushfire and floods, mice plagues, and the global pandemic (DPE, 2022).

Situated on the Peel River, Tamworth is the regional centre of the LGA, and is the largest and most populated city in the north-western region; 63,070 (ABS, 2021). Other towns, villages, and localities within the LGA include Attunga, Bendemeer, Barraba, Kootingal, Manilla, Somerton, and Nundle. Tamworth is located approximately 381 km from the Queensland border, almost midway between Sydney and Brisbane. It is an important commercial centre for the broader region and is well serviced by road, rail, and air networks, linking the region to the coast and the Australian eastern seaboard. Tamworth is known as the “Country Music Capital of Australia” and is famous for the Tamworth Country Music Festival, held annually in late January. Tamworth is also recognised for its equine events and is home to the Australian Equine and Livestock Events Centre.

The rural locality of Loomberah consists of dispersed rural properties and has a church and a public hall. It has a population of 552 people (ABS, 2021). The rural land within the region is used primarily for agriculture, including mixed cropping and grazing. Consultation conformed that rural views are highly valued by residents.

The landscape is gently undulating, with hills in the distance and several watercourses, including Spring Creek and tributaries. To the southeast of Loomberah, the Peel River flows into the Chaffey Dam, a popular scenic destination for nature lovers and recreational activities, including water sports, bushwalking, and camping. Several national parks and nature reserves are located to the southeast of Loomberah, including Back River, Ben Halls Gap, and Tomalla Nature Reserves, and Crawney Pass National Park. On the western side of the project, across the New England Highway sits the Heritage listed Goonoo Goonoo Homestead and property. The nearest State Significant Development to the project is the Chaffey Dam Upgrade, approximately 11 km to the east. The site is also occupied by several dwellings which gain access from Middlebrook Road.

Policy and planning setting

Socio-economic planning setting

New England North West Regional Plan (The Regional Plan) (DPE, 2022) focuses strongly on ensuring the region’s economy is positioned to maximise unprecedented opportunities presented by the growing renewable energy sector, green technology, and food and fibre processing. A key objective of the Regional Plan is to 'lead renewable energy technology and investment'. This highlights the need for a strategic and integrated approach to renewable energy development in the region. The Regional Plan states that:

> *"The future of energy generation is renewable, and with potential sources of solar, bio-waste, hydro, wind and geothermal across the New England North West, the region is positioned to be a leader in renewable energy".*

Tamworth Regional Council's priorities are stated as including:

- Supporting appropriately located wind, solar and other renewable energy production opportunities, as well as battery storage facilities.
- Delivering a variety of dwelling types and levels of affordability in Tamworth, including for temporary workers (DPE, 2022).

At the local level, the Tamworth Regional Council has developed the Tamworth Blueprint 100 Strategy. A key theme is "Design with Nature", with the objective of protecting and supporting the natural environment through responsive initiatives and development practices. This includes promoting energy efficiency and renewable energy (TRC, 2020a). Council is generally supportive of renewable energy initiatives. The Local Strategic Planning Statement identifies that Council has a role to play as a stakeholder for large scale renewable energy proposals and sets out an action to investigate the formulation of development controls to address such proposals (TRC, 2020b).

Renewable energy policy and setting

While not located within a Renewable Energy Zone (REZ), the project is close to the New England REZ and well positioned to be a part of the significant changes occurring in the REZ for these communities. REZs are being established to be the equivalent of modern-day power stations in that they combine:

- New renewable energy infrastructure, including generators (such as solar and wind farms)
- Storage (such as batteries and pumped hydro)
- High-voltage transmission infrastructure.

The New England REZ is expected to deliver up to $10.7 billion in private sector investment, and support around 830 operational jobs and 1,250 construction jobs (EnergyCo, 2022). The indicative location is shown below in Figure 6-52. The REZ is centred around the Armidale Regional LGA but encompasses some eastern sections of the Tamworth LGA, and it is likely that Tamworth and surrounding areas will be impacted by the scale of development in the REZ.

A growing number of renewable energy projects and other major development projects are being proposed within the region broadly, and at the local level. Renewable projects at various stages of development, construction, and operation that are listed on the Major Projects Register within the Tamworth LGA are outlined in the table below. Within the Loomberah locality, residents are aware of another solar project – the Acacia Solar Farm – that is in the pre-scoping phase (not yet available on the register).

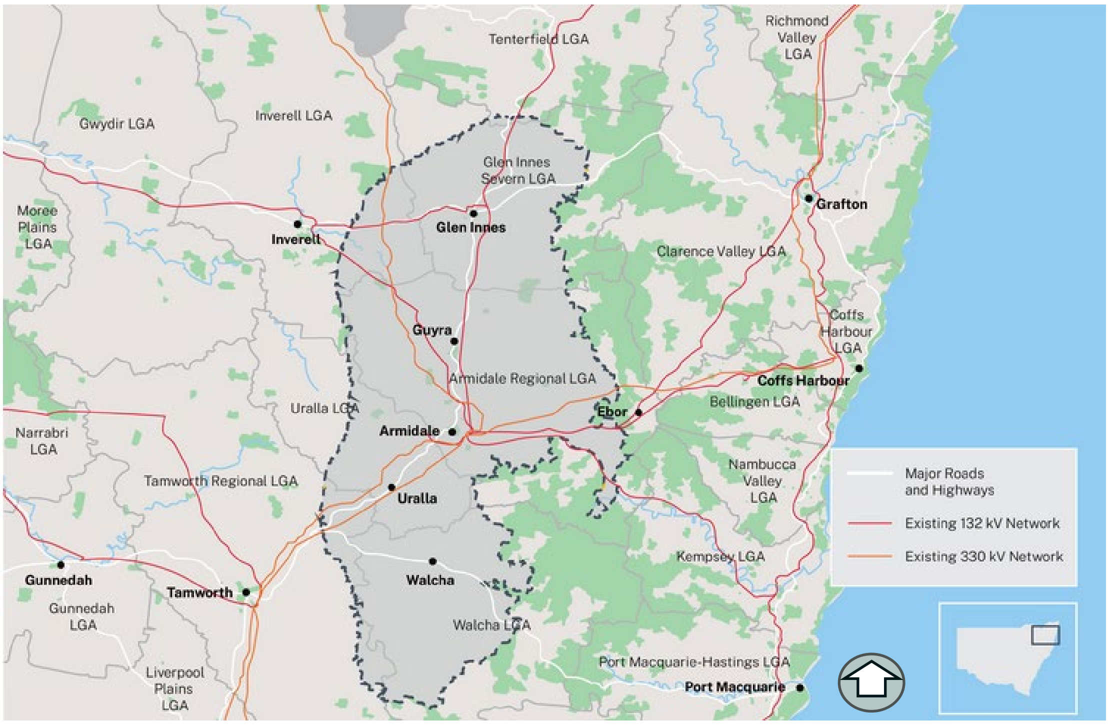

Figure 6-52 New England REZ (Source: EnergyCo: https://www.energyco.nsw.gov.au/ne-rez)

Refer also Figure 6-52 to see location of other nearby REZs.

Table 6-31 Key issues raised by the broader Tamworth community

Project	LGA	Stage of delivery
Hills of Gold Wind Farm	Tamworth Regional Upper Hunter Shire Liverpool Plains	Assessment
Tamworth BESS	Tamworth Regional	Prepare EIS
Tamworth Solar Farm	Tamworth Regional	Approved
Calala BESS	Tamworth Regional	Prepare EIS
Bendemeer Renewable Energy Hub	Tamworth Regional	Prepare EIS
Orange Grove Solar Farm	Tamworth Regional	Approved
Thunderbolt Wind Farm	Tamworth Regional Uralla Shire	Response to submissions

Online survey results

The online survey results also depicted a robust rural community with strong family and environmental values. When asked in the survey 'what you value most about the local area?', 87% (34 responses) stated 'landscapes and views', 77% (30 responses) stated 'community/family ties' and 59% (23 responses) stated 'natural values'.

The survey results also implied there was currently a lack of support for renewable energy projects in the region, with 67% of respondents (26 responses) identifying that they 'reject renewable energy development in the region' whereas only 8% of participants identified they ' embrace it' or 'approve of it'. The most prominent amenity and social, economic, and environmental factors identified by participants were 'visual impacts for near neighbours' (100% of respondents), 'potential impacts to property values' (84%), 'disruption to community cohesion' (74%), and 'use of agricultural land' (92%).

When asked about 'key challenges that the community is facing', common response themes included renewable energy developments and loss of agricultural land which indicated the requirement for coordinated and robust engagement with local community members during the project lifecycle would be important to increase benefits and reduce negative impacts form the project.

The near neighbours identified that though they were supportive of renewable energy, they generally opposed the project due to visual impacts. Issues of primary concern identified during discussions with near neighbours are summarised below.

Table 6-32 Key issues raised by near neighbours

• **Visual impact**	Highly valued expansive views across the Loomberah Valley from peoples' homes will be impacted.
• **Potential property devaluation**	Perception that property values will be impacted. Neighbours are highly invested in the homes and lifestyles they have created there. "Who would want to buy this place with a solar farm next to it?".
• Stress	Uncertainty over what is happening; stress about loss of property value; change to 'dream home' surroundings.
• **Lack of engagement**	Neighbours feel that this has just recently come back on the radar, and they haven't been given adequate information about what is going on.
• **Industrialisation of landscape**	Feeling that they will be left as an 'island' amongst solar farms.
• **Dust / road safety / traffic noise / road damage**	The gravel roads create much dust. The community uses the roads (bike riding etc).
• **Loss of agricultural land**	Residents identified that anything could be done with the proposed site such as crop, graze etc.
• **Distributional fairness**	Feeling of unfairness that involved landholders will benefit from this project, but uninvolved landholders will not, and everyone experiences impacts.

For the Loomberah community, their perceptions about this project were to varying degrees tied to their perceptions about the proposed Acacia Solar Farm. Some Loomberah based attendees at the Community Information Session suggested that they felt compelled to oppose this project, given that they oppose the Acacia project. Whereas others simply expressed their opposition to any solar projects moving into the Loomberah Valley. There has been much vocal expression of community opposition to the Acacia Solar Farm, which has created a heightened level of caution about solar farms in the locality.

Table 6-33 Key issues raised by the Loomberah community

Landscape change	Concern that the local landscape was becoming industrialised. These concerns are cumulative to varying degrees and were related to impacts of the nearby proposed Acacia Solar Farm.
Distributional fairness	There was a general questioning of why this community had to bear the costs for electricity generation. Sentiments expressed at the Community Information Session that solar farms should be located elsewhere. For example, a Loomberah resident stated" put them in Sydney".
Insufficient engagement	A general sense was conveyed at the Community Information Session that most Loomberah people wouldn't know about this project; the general sense was that if more people did know about it, they wouldn't like it.

For the broader Tamworth community there was a sense that this project would not concern most people within the Tamworth LGA as most people wouldn't be able to see it as part of their daily lives. Through interviews, the workshop and the Community Information Session, there was a sense of acceptance of the transition to renewable energy.

Table 6-34 Key issues raised by the broader Tamworth community

Potential for jobs, training and business opportunities	Projects of this scale bring significant economic potential to the region.
Housing impacts	There is a tight rental market in Tamworth.
Skills drain	Businesses in the region are unprepared for the opportunities and challenges that will arise as part of the REZ and as other renewable energy project developments roll out in the area.

6.8.3. Potential impacts

Positive and negative potential impacts were identified in the Social Impact Assessment. Mitigation strategies have been developed for negative impacts of medium (or greater) significance. Measures have also been developed for positive impacts to enhance benefits. These are listed in the table overleaf. The residual impact significance rating represents the likely significance of an impact once the proposed mitigation measure has been successfully implemented.

Positive socio-economic impacts (all Project stages)

Positive impacts centred around increased income, employment, training and community investment opportunities as well as local actions on climate change. These are the key community benefits of the Project. Key issues are summarised below and in Table 6-36 and provided in full in Appendix D.6.

The project would directly and indirectly, enhance local supply chains by increasing demand for goods and services such as accommodation, food, construction materials, and freight. It was likely that local businesses in Tamworth and to a lesser extent the broader New England region, would supply some of these services. In addition, increased income and spending by construction workers and others also would potentially increase supply chains and stimulate local economies in both Tamworth and the broader New England region.

The Project is anticipated to generate between 400 full time equivalent jobs during construction, and 15 full time equivalent jobs during operation, for its 30-year life. Ensuring the realisation of employment and procurement opportunities for local people and businesses was identified as a key contributor to building social license. Tamworth has strong capability for construction works and achieving a high proportion of local employment and procurement for this Project is considered achievable. Consultation highlighted that in light of skills and labour shortages, it made economic sense for the proponent to focus on upskilling local people.

The key themes that stakeholders suggested that a Community Fund could support included:

- Support for local schools
- Localised infrastructure (i.e., in Loomberah)
- Business support and training.

Community members and stakeholders within the Tamworth LGA community valued action on climate change. However, only 8% of survey respondents (3 responses) stated that “action on climate change” was one of the most important social and economic factors to them. The near neighbours who were interviewed during the SIA stated that they generally supported renewable energy. However, they also argued that the project was in “the wrong spot” and would be better suited “out west” where the landscape was flat and property holdings much larger.

Negative socio-economic impacts (all Project stages)

Negative impacts centred around:

- Amenity impacts (visual and dust)
- Financial impacts (potential for land devaluation, distributional inequity)
- Impacts on local assets and values (roads, social infrastructure, agricultural uses,)
- Increased stress and impacts on community cohesion.

Key issues are summarised below and in Table 6-36 and provided in full in Appendix D.6.

For near neighbours, visual impacts and industrialisation of the local landscape was the principal issue of concern. The visual impacts were compounded with the possibility of other potential nearby solar projects. Some were deeply concerned that they would be left as an island amid an ‘industrial landscape’ of solar farms. Neighbours were also concerned about the glare of the solar panels. In particular, how the glare was likely to impact their current enjoyment of their living environment. More broadly, for the people of the Tamworth LGA, there was a general sentiment conveyed in SIA interviews that ‘if people can’t see it, then they won’t care’.

The potential impact on surrounding land values of renewable energy developments is a common source of conflict between proponents and residents. Eighty-four percent of survey respondents (32 responses) stated that ‘potential impacts to property values’ was one of the most important social and economic factors to them. Some near neighbours who were interviewed expressed high levels of concern about potential negative impacts to property values, stemming from the visual impact and impacts on the lifestyle that the locality affords. One neighbour identified that they had been informed by a local real estate agent that there would be a reduced pool of buyers and a reduced price if he was to sell. For another neighbour, there was concern that the solar farm would severely limit the attractiveness of future subdivision.

Changes produced by the project to land, and property values are complex and subject to a range of interacting influences, which made it difficult to articulate individual causal factors. To date, no definitive research that clarifies whether the presence of large-scale renewable energy projects negatively impacts upon nearby property values that could reliably inform an assessment of impact was available.

Development projects can create psychological stress, uncertainty, and anxiety in people who oppose the project and/or are directly impacted (Prenzel & Vanclay, 2014). This can result from fears about health impacts associated with construction noise, dust, lighting, and/or toxic materials, as well as potential safety hazards during operation. Stress can also result from fears about the future, including potential changes to individuals’ home environment and surrounding landscape. The concept of ‘solastalgia’ describes the distress produced by environmental change that individuals experience while they are directly connected to their home environment. This distress is exacerbated by a sense of powerlessness or lack of control over the unfolding change process (Albrecht, et al., 2007).

In the case of renewable energy projects, the time between planning and development approval and then actual development can be years, increasing uncertainty and stress for some people. The way that the project’s engagement had been delivered to date had heightened their stresses. When project engagement “went quiet” during and after COVID, neighbours interpreted this as meaning that the project would not proceed. This was experienced by near neighbours who were interviewed for the SIA as relief and “a weight off their shoulders”. But when word starting trickling through the neighbourhood that the project was active again, neighbours expressed they felt “boom…it’s on again”. Near neighbours indicated that they felt a lack of power relating to this project.

Another key amenity impact of concern to the local community were impacts related to dust from potential use of local gravel roads. Fifty-eight percent of survey respondents (22 responses) stated that “transportation planning and the use of local roads”, and fifty percent stated that temporary construction impacts (i.e., noise, traffic, dust) were some of the most important amenity factors to them. Clouds of dust from every car traversing Marsden Park Rd (unsealed) were observed during SIA interviews with neighbours, with neighbours noting that this was how the roads were despite it being a good rainfall year. Neighbours reported that houses become enveloped in dust with single B-doubles going past and that dust affects the water quality to such an extent that one neighbour reported having to put filters in.

Residents were also concerned about other aspects of potential local road use by the project, particularly in construction. They were worried about safety implications, road conditions and commuter traffic disruptions. The local roads surrounding the site are used by the Loomberah community (including children) for horse riding, bike riding, walking, and for stock movements. Near neighbours are concerned about the safety impacts that a construction workforce might pose for these road uses.

A recent Australian study of attitudes towards large-scale solar highlighted the importance of distributional fairness in shaping positive attitudes, social acceptance, and supportive behaviours (Walton, et al., 2021). Conversely, the perception of unfairly distributed impacts and benefits can negatively affect social acceptance and increase the likelihood of oppositional behaviours. Twenty-one percent of survey respondents (8 responses) stated that 'the equitable distribution of benefits' as one of the most important social and economic factors to them. For this project, some issues have arisen relating to distributional fairness. Firstly, there is unevenness in benefits and impacts between involved and non-involved landholders. Everybody in the vicinity of the project is impacted by it, but only some are compensated. Secondly, and more broadly, some of the Loomberah community have stated that "we take the brunt of the impacts" for the generation of electricity that is used elsewhere.

Regarding the potential loss of agricultural land, near neighbours and the broader Loomberah community maintain that Loomberah is a very fertile valley; that anything can grow there, and that the agricultural lands are scenic assets. The area has bumper yields in good years, which is then an injection into the agricultural sector and inputs. There is also concern that loss of agricultural land would have flow on effects on wildlife corridors and create a heat island. These concerned stakeholders are questioning why a solar farm is being considered on such good agricultural land. Ninety-two percent of survey respondents (35 responses) stated that, in terms of this project, 'the use of agricultural land within the region' was one of the most important environmental factors to them. Further, some local people (in SIA interviews and the Community Information Session) expressed a high level of doubt about the potential for agri-solar at the site, believing that it won't happen and that the site would all be weeds. Some neighbours interviewed for the SIA also expressed doubt that the land would be arable post de-commissioning. They believe that the project will leave behind metal, glass, nuts, bolts and other refuse throughout the soil, and that this will mean the land would be unusable.

Table 6-35 Social impact summary - positive

Potential impact	Social impact category	Project phase	Key affected stakeholders	Perceived stakeholder significance	Significance unmitigated	Mitigation / enhancement measures	Residual impact significance
Increased generation of income	Livelihoods	Construct.	Local/regional businesses, contractors, suppliers Local govt Broader community	High	High (Likely, moderate)	Industry Participation Plan (including Accommodation and Employment Strategy, Local Procurement Policy) Community and Stakeholder Engagement Strategy	NA
Increased local employment and procurement opportunities	Livelihoods	Construct. Operation	Job seekers Local/regional businesses, contractors, suppliers Local govt Broader community	High	Medium (Possible, moderate)	Industry Participation Plan (including Accommodation and Employment Strategy, Local Procurement Policy) Community and Stakeholder Engagement Strategy	NA
Increased community investment	Community	Operation	Near neighbours and Loomberah community Community groups Broader community	Medium	Medium (Almost certain, minor)	Community Benefit Fund	NA
Increased education and training outcomes	Livelihoods	Construct.	Job seekers Local/regional employment and training providers Local/regional businesses	Medium	Medium (Unlikely, moderate)	Industry Participation Plan (including Accommodation and Employment Strategy) *Potential to further develop this benefit through Community Benefit Scheme*	NA

Potential impact	Social impact category	Project phase	Key affected stakeholders	Perceived stakeholder significance	Significance unmitigated	Mitigation / enhancement measures	Residual impact significance
Local action on climate change	Community	Planning & assess. Pre-construct. Construct. Operation	Community groups Broader community Local govt	Low-Medium	Medium (Almost certain, minor)	NA *Potential to further develop this benefit through Community Benefit Scheme*	NA

Table 6-36 Social impact summary – negative

Potential impact	Social impact category	Project phase	Key affected stakeholders	Perceived stakeholder significance	Significance unmitigated	Mitigation / enhancement measures	Residual impact significance
Visual impacts and industrialisation of the local landscape	Surroundings	Operation	Near neighbours	Very High	Low (Potential glare from public & private viewpoints)	Potential for Landscape Management Plan Community and Stakeholder Engagement Strategy	Medium (Likely, minor)
			Loomberah community	Medium-High	Low (Potential glare from public & private viewpoints)	Potential for Landscape Management Plan Community and Stakeholder Engagement Strategy	Medium (Likely, minor)
			Broader community	Low	Low	NA	NA
Impacts to property values	Livelihoods	Planning & assess.	Some near neighbours	Very High	High (possible, major)	Potential for Landscape Management Plan	Medium (Likely, minor)

Potential impact	Social impact category	Project phase	Key affected stakeholders	Perceived stakeholder significance	Significance unmitigated	Mitigation / enhancement measures	Residual impact significance
		Pre-construct. Construct. Operation				Community and Stakeholder Engagement Strategy Neighbouring Benefit Fund	
Increased stress	Health and wellbeing	Planning & assess. Pre-construct. Construct. Operation	Some near neighbours	High	High (almost certain, moderate)	Community and Stakeholder Engagement Strategy	High (Likely, moderate)
Decreased personal agency	Decision-making systems	All phases	Near neighbours Loomberah community	High	High (almost certain, moderate)	Community and Stakeholder Engagement Strategy	Medium (Likely, minor)
Amenity impacts	Way of life Surroundings	Construct.	Near neighbours Loomberah community	High	High (almost certain, moderate)	Construction Traffic Management Plan Community and Stakeholder Engagement Strategy	Medium (possible, minor)
		Operation	Near neighbours	Low	Low (likely, minimal)	NA	NA
Increased accommodation demand (for housing)	Access	Construct.	Residents Local businesses	Medium	High (likely, moderate)	Community and Stakeholder Engagement Strategy Industry Participation Plan (including Accommodation and Employment Strategy)	Medium (Possible, moderate)
Increased accommodation	Access	Construct.	Tourists, visitors Vulnerable populations	Low-Medium	High (likely, moderate)	Community and Stakeholder Engagement Strategy	Medium (Possible,

Potential impact	Social impact category	Project phase	Key affected stakeholders	Perceived stakeholder significance	Significance unmitigated	Mitigation / enhancement measures	Residual impact significance
demand (for short-term accom)			in short-term accommodation			Industry Participation Plan (including Accommodation and Employment Strategy)	minor)
Skills drain from local businesses	Livelihoods	Construct.	Local businesses	Low-Medium	High (almost certain, minor)	Industry Participation Plan Community and Stakeholder Engagement Strategy	Medium (likely, minor)
Distributional inequity	Decision-making systems	All phases	Near neighbours	Medium	High (almost certain, moderate)	Community and Stakeholder Engagement Strategy Neighbouring Benefit Fund	Medium (possible, minor)
			Loomberah community	Low-Medium	Medium (possible, minor)	Community and Stakeholder Engagement Strategy Community Benefit Fund	Low (possible, minimal)
Impacts to local roads	Access Way of life	Construct.	Near neighbours Residents along the haulage route Loomberah community	Medium	High (likely, moderate)	Construction Traffic Management Plan Community and Stakeholder Engagement Strategy	Low (unlikely, minor)
Loss of agricultural land	Livelihoods Community	Construct. Operation De-comm.	Near neighbours Loomberah community Broader community	Medium	Medium (almost certain, minor)	Community and Stakeholder Engagement Strategy	NA
Decreased community cohesion	Community	Planning & assess. Pre-construct. Construct.	Near neighbours Loomberah community	Medium	Medium (almost certain, minor)	Community and Stakeholder Engagement Strategy Community Benefit Scheme	Medium (possible, minor)

Potential impact	Social impact category	Project phase	Key affected stakeholders	Perceived stakeholder significance	Significance unmitigated	Mitigation / enhancement measures	Residual impact significance
Increased demand for social infrastructure	Access	Construct.	Broader community Local government Service providers	Low	Medium (possible, minor)	Community and Stakeholder Engagement Strategy Industry Participation Plan (particularly Accommodation and Employment Strategy)	Low (unlikely, minimal)
Concern about environmental impacts	Surroundings	Operation	Near neighbours Loomberah community Environmental groups	Low	Medium (possible, minor)	Environmental Management Plan	Low (unlikely, minimal)
Disruption to the community	Way of life Community	Construct.	Tamworth LGA community	Low	Low (unlikely, minor)	Industry Participation Plan (particularly Accommodation and Employment Strategy)	NA
Concern about impacts on Aboriginal cultural heritage	Culture	Construct.	Aboriginal community	Low	Low (unlikely, minor)	Aboriginal Cultural Heritage Management Plan	NA
Public safety and hazard risks (i.e., grass fires, BESS fire)	Surroundings	Operation	Near neighbours Loomberah community Emergency services Environmental/ community groups Broader community	Low	Low (unlikely, minor)	Bushfire Emergency Management and Operations Plan	NA

Assessment of impacts

The enhancement and mitigation measures outlined below directly respond to the potential social impacts (positive and negative) associated with the project. These measures have been identified through consideration of project impacts, existing knowledge, and stakeholder and community consultation.

Key components of the social impact management framework include:

1. Community and Stakeholder Engagement Strategy
2. Industry Participation Plan
3. Community Benefit Sharing Program.

As a part of these, consideration would be given to the potential to work together (at least to some extent) with any other renewable energy proponents that seek to establish operations in the local area. This would allow some degree of coordination (or even integration) of social impact management intentions and actions of any potential proponents that end up operating in the local area. This would likely need to be facilitated by an external government or similar agency (e.g., Tamworth Regional Council or local industry body), and may need to be supported as a discrete project.

Some social impacts of the project will be managed primarily through the various environmental management strategies identified in the EIS. These include the Construction Traffic Management Plan, Noise Management Plan, Bush Fire Management Plan, Emergency Response Plan, and the Construction Environmental Management Plan. The Community and Stakeholder Engagement Strategy will be the platform that ensures adequate linkage between these management plans and community concerns relating to these matters.

In addition to these measures, the proponent has also demonstrated their commitment to avoid potential project impacts through amending project design. This included the amendments that were made to the project design to limit both Biophysical Strategic Agricultural Land and cultural heritage impacts.

The proponent has committed to hiring locally (where possible) to reduce accommodation and service burdens. Also, for this project, the construction timeframe is relatively extended, which would spread the worker influxes over a longer time frame, thus decreasing the peak at any one time.

However, even with this approach and with the development of an Industry Participation Plan (IPP), there is likely to be influxes of non-resident construction workers for this project. As such, non-resident workers utilising short-term accommodation and rental housing (likely in Tamworth) site would increase demand for local housing and temporary accommodation during the construction stage.

This has the potential to generate positive economic benefits for accommodation and rental housing providers in Tamworth and surrounds. However, as detailed in the baseline, Tamworth was experiencing severe housing pressures with its “massive shortfall of housing”, and this influx of workers may further constrain the availability of accommodation options for residents and tourists. This has been experienced in other areas in the context of large development projects. In the local area, the same circumstance had been experienced in Uralla with the development of the New England Solar Farm.

Non socio-economic matters

The information above has been used to ensure a detailed assessment of key issues raised by the community. The cross-reference table below shows where some of the impacts more relevant to other sections of the EIS, are addressed specifically along with their mitigation strategies.

Table 6-37 Impact assessment cross-reference for more general environmental matters (non-socio-economic matters)

Key negative impact	Impact assessed within this EIS	Project response
• Visual impacts and industrialisation of the local landscape	Section 6.1 Visual impacts	• Community and Stakeholder Engagement Strategy
• Impacts to local roads	Section 6.3 Traffic impacts	• Construction Traffic Management Plan • Community and Stakeholder Engagement Strategy
• Impacts to property values. • Loss of agricultural land	Section 6.4 Land compatibility	• Community and Stakeholder Engagement Strategy
• Concern about impacts on Aboriginal cultural heritage	Section 6.6 Aboriginal cultural heritage	• Aboriginal Cultural Heritage Management Plan
• Public safety and hazard risks (i.e., grass fires, BESS fire)	Section 6.9 Hazards and risks	• Bushfire Emergency Management and Operations Plan
• Amenity impacts; dust	Section 7.3 Air quality	• Construction Traffic Management Plan

6.8.4. Key uncertainties of the assessment

The EIS and associated engagement activities for this project were put on hold due to COVID in late 2020 and re-commenced in February 2023. The engagement process suffered from this approach; the delay was raised specifically by many respondents. It may have affected the number of participants willing to be surveyed and their responses.

The survey sample sizes are small and may misrepresent the broader trends summarised. Notwithstanding, the results have provided important information which has been used to inform a Project more able to be supported by particularly, the local community.

The effectiveness of the mitigation strategies cannot be known for certain. Table 6-36 includes a 'residual impact significance' rating which identifies the higher priority residual risks.

6.8.5. Mitigation measures

Table 6-38 Safeguards and mitigation measures for social and economic impacts.

ID	Mitigation measures	Project stage
SE 1	Community and Stakeholder Engagement Strategy updated in accordance with the recommendations of the Social Impact Assessment, Appendix D.6. This will include: • More meaningful and in-depth engagement with near neighbours • More inclusion of the broader Loomberah community • Ground-truth and further develop the draft Community Benefit Fund framework. • Develop the Industry Participation Plan • Strong engagement about the construction phase • Engage in broader social/economic development planning. • Evaluate engagement effectiveness	Prior to construction
SE 2	Develop an Industry Participation Plan in accordance with the recommendations of the Social Impact Assessment, Appendix D.6. This will include: • Consideration of local employment and procurement, as well as the accommodation of the non-resident construction workforce. • Targeted towards the people and businesses within Tamworth LGA, as well as giving consideration to the wider New England region. • Specific opportunities for Aboriginal people and businesses, women, and young people • A Local Procurement Policy • An Accommodation and Employment Strategy	Prior to construction
SE 3	Develop a model of Community Benefit Sharing comprising a: • Community Benefit Fund • Neighbouring Benefit Fund in accordance with the recommendations of the Social Impact Assessment, Appendix D.6. The model will ensure benefits of the project are shared with the community in a way that adds value to the local area and enhances the social and economic outcomes.	Prior to construction

6.9. Hazards and risks

In general, solar farms make use of standard construction methodologies and operate with minimal moving parts and therefore present relatively low risks to the surrounding environment. However, with the addition of battery storage, a specific risk assessment methodology is appropriate.

Triggered by the operational battery storage component of the Project being greater than 30 MW, Section 6.11.1 summarises a specialist Preliminary Hazard Analysis (PHA), appended in full in Appendix D.7. It has been prepared by NGH and Pando consultants, in accordance with State Environmental Planning Policy (Resilience and Hazards) 2021, Qualitative risk assessment against Hazard Industry Planning Advisory Paper No. 4 and 6.

Secondary risks have been identified as Electric and Magnetic Fields (EMFs), most relevant to operational infrastructure, and bushfire, relevant to both construction and operation. These assessments have been completed using desktop assessment and are presented in Section 6.11.2 and 6.11.3.

6.9.1. Preliminary Hazard Analysis (PHA)

Assessment approach

The objective of the PHA is to develop a comprehensive understanding of the hazards and risks associated with the operation of the Battery Energy Storage System (BESS) for the Middlebrook Solar Farm and the adequacy of safeguards. The methodology includes:

1. Identification of the nature and scale of all hazards at the proposed development, and the selection of representative incident scenarios.
2. Analysis of the consequences of these incidents on people, property and the biophysical environment.
3. Evaluation of the likelihood of such events occurring and the adequacy of safeguards.
4. Calculation of the resulting risk levels of the facility.
5. Comparison of these risk levels with established risk criteria and identification of opportunities for risk reduction.

The results are presented as a risk assessment matrix and evaluation against the HIPAP 4 qualitative risk criteria.

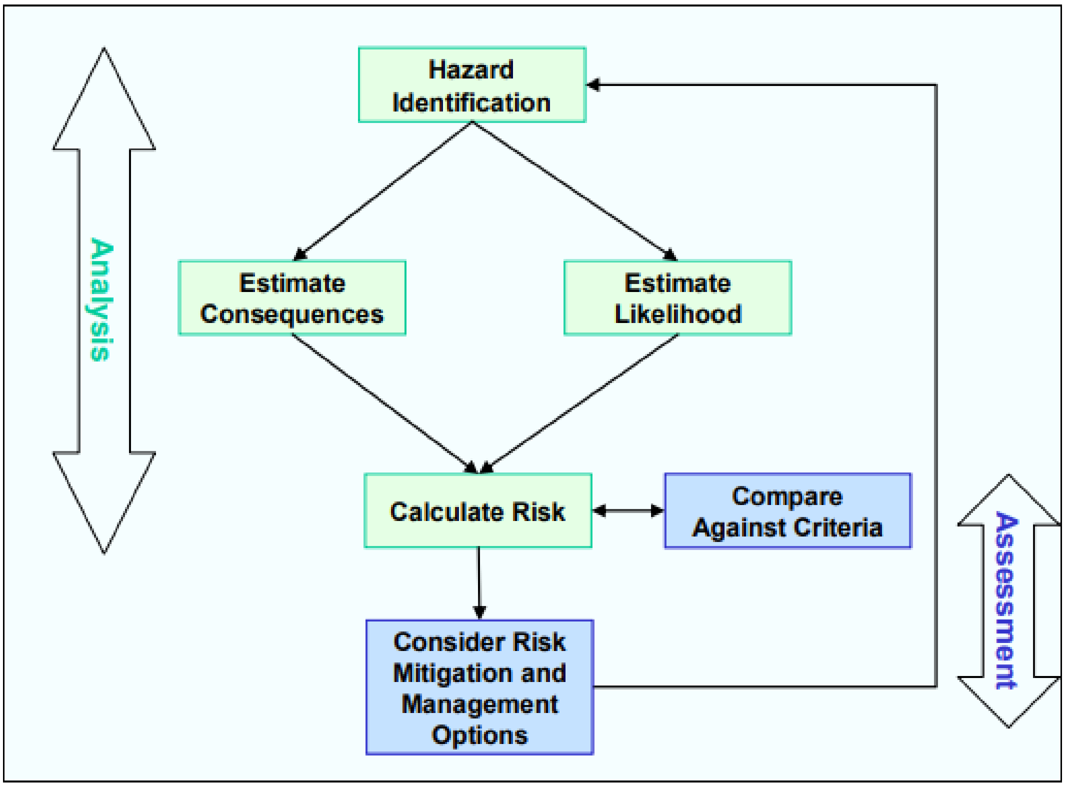

Figure 6-53 Basic methodology for hazard analysis (Source: HIPAP 6)

Risk assessment methodology

For each identified event;

The consequence was qualitatively described as well as quantitatively ranked. These include impacts to personnel (e.g., fatality/injury), environment and/or assets.

The likelihood of an event was also estimated. The likelihood ratings were assigned based on knowledge of historical incidents in the industry.

The resulting risk rating is the likelihood of a defined adverse outcome. To calculate risk, it is necessary to consider the likelihood and the consequences of each of the hazardous scenarios identified.

Using a qualitative approach, the risk of an event was estimated using the study risk matrix shown in Figure 6-54.

For each identified hazard and associated event, the resulting consequences and likelihood pair was determined from the hazard register. The consequence and likelihood of the identified events are presented in Table 6-39.

			Likelihood			
			1 Extremely Unlikely	2 Very Unlikely	3 Unlikely	4 Likely
			Never heard of in the industry, not realistically expected to occur	Heard of in the industry, but not expected to occur	Could occur in the next 10 years	Could occur in the next year
Severity	4 Major	Fatality / Permanent Injury				
	3 Moderate	Severe injury / Lost time				
	2 Minor	Minor Injury / Visit to Doctor				
	1 Insignificant	Slight injury / First aid				

Risk Acceptance Criteria

High	Unlikely to be tolerable - review if activity should proceed.
Medium	Tolerable, if so far as reasonably practicable
Low	Broadly acceptable

Figure 6-54 Qualitative risk matrix (HIPAP 4)

Potential impacts

Impacts are relevant to the design and operational stages primarily. The results of the risk assessment and assessment against the qualitative land use planning risk criteria from HIPAP 4 are provided below. The Applicant has made Project decisions on the basis of the recommendations provided in the Victorian Big Battery Fire Statement of Technical Findings – Victorian Government 2021, as set out further below.

Table 6-39 Risk assessment

Hazard	Event	Consequence (Impact to People)	Likelihood	Risk
Electrical	Exposure to voltage	Major	Very Unlikely	**Medium**
Arc flash	Arc flash	Major	Very Unlikely	**Medium**
EMF	Exposure to EMF	Insignificant	Extremely Unlikely	**Low**
Fire	Fire – transformers and PCUs	Major	Very Unlikely	**Medium**
	Fire – switch rooms	Major	Extremely Unlikely	**Medium**
	Fire – temporary construction facilities	Major	Very Unlikely	**Medium**
	Bushfire	Major	Very Unlikely	**Medium**
Reaction	Thermal runaway in battery	Major	Very Unlikely	**Medium**
Chemical	Release of electrolyte from the battery cell (liquid/vented gas) resulting in fire and/or explosion	Major	Very Unlikely	**Medium**
	Battery coolant leak (Tesla Power Pack)	Minor	Very Unlikely	**Low**
	Refrigerant leak (BESS and refrigeration/chiller units)	Minor	Very Unlikely	**Low**
	Exposure to hazardous material (herbicide/pesticide)	Minor	Very Unlikely	**Low**
	Release of diesel from storage tank, filling point or during handling resulting in fire	Major	Very Unlikely	**Medium**
	Release of gasoline from storage tank or filling point resulting in fire	Major	Very Unlikely	**Medium**
External factors	Water ingress resulting in fire (BESS, PCUs or switch rooms)	Major	Extremely Unlikely	**Medium**
	Vandalism due to unauthorised personnel access	Moderate	Unlikely	**Medium**
	Lightning strike	**Major**	**Very Unlikely**	**Medium**

A total of 17 risk events were identified. The breakdown of these events according to their risk ratings are as follows:

- 13 medium risk events
- 4 low risk events.

Based on the risk acceptance criteria used for the study, the risk profile for the project is considered to be tolerable in so far as reasonably practicable.

The majority of the medium risk events relate to fire events resulting from a variety of causes (e.g., release of flammable materials, battery thermal runaway, transformer fire, bushfire, etc). The study identified proposed prevention controls to reduce the likelihood of these fire events and mitigation controls to contain the fires to minimise potential for escalated events (e.g., fire management plan). Based on the identified controls, the highest likelihood for these events were rated as very unlikely (i.e. heard of in the industry, but not expected to occur).

Based on the size of the development footprint, proposed location for project infrastructure within the development footprint, proposed controls and distance to neighbouring land uses (including neighbouring properties and agricultural operations), the exposure to fire events will primarily be to the project's construction and operations workforce. Offsite impacts would be minimal.

The risk assessment concluded that there is no potential for offsite fatality or injury. Therefore, the project meets the land use planning criteria. Risk events identified are onsite impacts and assessed against Work Health and Safety (WHS) Act requirements to reduce risk in so far as reasonably practicable. Risks were assessed by the project as tolerable so far as reasonably practicable.

Hazard Industry Planning Advisory Paper number 4

An assessment of the BESS against the qualitative land use planning risk criteria from HIPAP 4 is provided in Table 6-40.

Table 6-40 HIPAP 4 qualitative risk criteria assessment

HIPAP 4 qualitative risk criteria	Option 1: DC-coupled Distributed BESS
All 'avoidable' risks should be avoided. This necessitates the investigation of alternative locations and alternative technologies, wherever applicable, to ensure that risks are not introduced in an area where feasible alternatives are possible and justified.	Alternative locations: The distributed BESS are required to be located within proximity of the solar arrays to reduce the development footprint and increase the financial feasibility of the project. No other locations, outside the development footprint, have been considered as this would introduce avoidable risks to a new area. The separation distances and distances to nearby receivers described, will further reduce the fire risks from the BESS. Alternative technologies: Lithium Ion BESS are the most common electrochemical BESS type for grid scale developments due to their high energy densities, high efficiency, and size. All 'avoidable' risks have been avoided and no feasible alternatives are possible or justified.

HIPAP 4 qualitative risk criteria	Option 1: DC-coupled Distributed BESS
The risk from a major hazard should be reduced wherever practicable, irrespective of the numerical value of the cumulative risk level from the whole installation. In all cases, if the consequences (effects) of an identified hazardous incident are significant to people and the environment, then all feasible measures (including alternative locations) should be adopted so that the likelihood of such an incident occurring is made very low. This necessitates the identification of all contributors to the resultant risk and the consequences of each potentially hazardous incident. The assessment process should address the adequacy and relevancy of safeguards (both technical and locational) as they relate to each risk contributor.	The risk assessment presented above includes feasible controls that reduce hazards wherever practicable. The outcome of the risk assessment, including the separation distances described for the Project and the distances to nearby receivers, indicates that the controls are adequate and relevant.
The consequences (effects) of the more likely hazardous events (i.e., those of high probability of occurrence) should, wherever possible, be contained within the boundaries of the installation.	The risk assessment presented above indicates that hazardous events are likely to be contained within the boundaries of the development footprint. The separation distances described in the Project description will minimise fire propagating between BESS modules and reduce the intensity of any fire (and therefore reduce the likelihood of fire extending beyond the development site).
Where there is an existing high risk from a hazardous installation, additional hazardous developments should not be allowed if they add significantly to that existing risk.	There are no other known high risk hazardous installations in the area.

Recommendations provided in the Victorian Big Battery Fire Statement of Technical Findings

The Applicant has made Project decisions on the basis of the recommendations provided in the Victorian Big Battery Fire Statement of Technical Findings – Victorian Government 2021, as set out below.

Table 6-41 Project response to recommendations of the Victorian Big Battery Fire

Victorian Big Battery Fire Statement of Technical Findings - lessons learned and preventing a recurrence	Middlebrook Solar Farm Project response
Tesla Megapack	The Proponent is unlikely to use the Tesla Megapack. If they do, they will implement all recommendations from the Victorian Big Battery Fire Statement of Technical Findings – Victorian Government 2021
Each Megapack cooling system is to be fully functionally and pressure tested when installed on site and before it is put into service	Following installation, the Proponent will commission any liquid chillers and cooling pipes to check they are fully functional and undertake subsequent pressure tests.
Each Megapack cooling system in its entirety is to be physically inspected for leaks after it has been functionally, and pressure tested on site	The Proponent will undertake physical inspections of any liquid chillers following commissioning and pressure testing.
The Supervisory Control And Data Acquisition (SCADA) system has been modified such that it now 'maps' in one hour and this is to be verified before power flow is enabled to ensure real-time data is available to operators	The Proponent is unlikely to use the Tesla Megapack. If they do, the SCADA will be modified in accordance with this recommendation.
A new 'battery module isolation loss' alarm has been added to the firmware; this modification also automatically removes the battery module from service until the alarm is investigated	The Proponent is unlikely to use the Tesla Megapack. Any selected BESS units will include a battery module isolation loss alarm that automatically removes the battery module from service until the alarm is investigated.
Changes have been made to the procedure for the usage of the key lock for Megapacks during commissioning and operation to ensure the telemetry system is operational	The Proponent is unlikely to use the Tesla Megapack. If they do, the procedure for the usage of the key lock for Megapacks during commissioning and operation will ensure the telemetry system is operational
The high voltage controller (HVC) that operates the pyrotechnic fuse remains in service when the key lock is isolated	DC fuses remain in service for protection purpose no matter if the key lock is isolated or not.

Key uncertainties / limitation of the assessment

This PHA is based on concept design, industry design standards and guidelines, and standard safety controls. Some information is limited as complete data on the design and precise controls is not available at the concept design stage.

The scope of this PHA does not include:

- A transport route analysis.
- Assessment of other risks, including, but not limited to, aviation safety, health, landslide/subsidence, telecommunications, electromagnetic field and bushfire.
- Quantitative risk data as BESS technology is relatively new and data is not yet available.
- Updating the PHA to a Final Hazard Analysis (FHA) during the design stage.

The PHA has assessed a generalised DC coupled distributed BESS and considered lithium-ion batteries only. No other BESS chemistry has been considered.

Mitigation measures

Table 6-42 Safeguards and mitigation measures for in relation to BESS hazards.

ID	Mitigation measures	Project stage
H1	Controls set out the PHA hazards register will be implemented throughout all stages of the Project. This is reproduced at the end of this table.	All stages
H2	The results of the PHA will be included in a Project specific: • Bushfire Emergency Management and Operations Plan • Fire Management Plan • Emergency Response Plan • Fire Safety Plan.	All stages
H3	Following a decision of the BESS Original Equipment Manufacturer, the detailed design of the BESS will be undertaken to comply with the requirements of Section 3.3.1 of the PHA.	Design
H4	If the Proponent chooses to use the Tesla Megapack, all recommendations from the Victorian Big Battery Fire Statement of Technical Findings – Victorian Government 2021 will be implemented.	Design
H5	The distributed BESS are required to be located within proximity of the solar arrays to reduce the development footprint and increase the financial feasibility of the project.	Design
H6	The separation distances and distances to nearby receivers described in the PHA	Design, Construction

ID	Mitigation measures	Project stage
	(Appendix D.7), will be maintained to further reduce the fire risks from the BESS	
H7	Rack separation would be subject to compliance with UL9540A.	Design, All stages
H8	Battery to battery clearance as per table 3.3 Appendix D.7 NPFA 855 14.2.2 states Containers must be 0.9 m from other battery collection containers and combustible materials	Design, All stages
H9	Power conversion Unit would maintain Minimum of 900 mm distance between battery system and Power Conversion Equipment as per ASNZS 5139.2019 6.2.6.2	Design, All stages
H10	DC/DC Converter Minimum of 900 mm distance between battery system and Power Conversion Equipment as per ASNZS 5139.2019 6.2.6.2	Design, All stages

Table 6-43 BESS units hazard register

ID	Controls	ID	Controls
1	Equipment and systems will be designed and tested to comply with international standards and guidelines Engagement of reputable contractors Independent certifiers/owner's engineers Installation and maintenance will be done by trained personnel Electrical switch-in & switch-out protocol (pad lock) BESS BMS fault detection and safety shut-off BESS fire protection system (enclosure/building) Warning signs (electrical hazards, arc flash) Emergency Response Plan External assistance for firefighting (FRNSW & RFS) Use of appropriate PPE Rescue kits (i.e., insulated hooks)	9	Equipment and systems will be designed and tested to comply with the relevant international standards and guidelines Equipment will be procured from reputable supplier Independent certifiers/owner's engineers Engagement of reputable contractors Installation and maintenance will be done by trained personnel Layers of battery case (pod and external casing) Spill cleanup using dry absorbent material BMS fault detection and shut-off function HVAC system (regulate air flow) BESS fire protection system (enclosure/building)
2	Equipment and systems will be designed and tested to comply with international standards and guidelines Engagement of reputable contractors Independent certifiers/owner's engineers Site induction/substation training (i.e., high voltage areas) Installation and maintenance will be done by trained personnel Maintenance procedure (e.g., deenergize equipment) Preventative maintenance (insulation) Emergency Response Plan External assistance for firefighting (FRNSW & RFS) Warning signs (arc flash boundary) Use of appropriate PPE for flash hazard	10	Equipment and systems will be designed and tested to comply with the relevant international standards and guidelines Equipment will be procured from reputable supplier Independent certifiers/owner's engineers Engagement of reputable contractors Maintenance will be done by trained personnel Layers of battery case (pod and external casing) Spill cleanup using dry absorbent material BMS fault detection and shut-off function PPE
3	Location siting and selection (incl. separation distance) Optimising equipment layout and orientation	11	Equipment and systems will be designed and tested to comply with the relevant international standards and guidelines Equipment will be procured from reputable supplier

ID	Controls	ID	Controls
	Reducing conductor spacing Balancing stages and minimising residual current Incidental shielding (i.e., BESS building/enclosure, switch room) Equipment and systems will be designed and tested to comply with international standards and guidelines Exposure to personnel is short duration in nature (transient) Physical warning signs (e.g., danger or restricted access) Studies found that the EMF for commercial solar power generation facilities comply with ICNIRP occupational exposure limits		Independent certifiers/owner's engineers Engagement of reputable contractors Maintenance will be done by trained personnel BESS layers of battery case (pod and external casing) BESS BMS fault detection and shut-off function Chiller Unit separation distance to other equipment PPE
4	Equipment and systems will be designed and tested to comply with the relevant international standards and guidelines Equipment will be procured from reputable supplier Independent certifiers/owner's engineers All relevant Transgrid's requirements will be met Inverter/transformers (PCUs) are in designated area Installation, operations and maintenance by trained personnel (e.g., reputable third party) in accordance with relevant procedures Preventative maintenance (e.g., insulation, replacement of faulty equipment) Activation of emergency shutdown (ESD button) Fire Management Plan Emergency Response Plan External assistance for firefighting (FRNSW & RFS)	12	Product will be stored in dedicated storage area in a bund A spill kit will be kept near the dedicated storage area Quantity kept in work area will be minimised No spraying will be done during high wind Limited usage prior to and during rain events PPE (as required by Safety Data Sheet)
5	Equipment and systems will be designed and tested to comply with the relevant international standards and guidelines Equipment will be procured from reputable supplier Independent certifiers/owner's engineers All relevant Transgrid's requirements will be met Inverter/transformers (PCUs) are in designated area Installation, operations and maintenance by trained personnel (e.g., reputable third party) in accordance with relevant procedures	13	Equipment and systems will be designed and tested to comply with Australian standards & guidelines (e.g., AS 1940) Engagement of reputable contractors Independent certifiers/owner's engineers Installation and maintenance will be done by trained personnel Diesel is a combustible liquid and will be stored away from other flammable materials (e.g., gasoline) Secondary containment (i.e., bunding)

ID	Controls	ID	Controls
	Preventative maintenance (e.g., insulation, replacement of faulty equipment) Electrical switch-in & switch-out protocol (pad lock) Circuit breakers Substation is locked and located in designated area Security fence and controlled access Activation of emergency shutdown (ESD button) Fire Management Plan Emergency Response Plan External assistance for firefighting (FRNSW & RFS)		Warning signs (combustible material) Fire Management Plan Defendable boundary for firefighting will be established Emergency Response Plan External assistance for firefighting (FRNSW & RFS) Use of appropriate PPE
6	Fire Management Plan Cooling water supply on-site Defendable boundary for firefighting will be established (i.e., asset protection zone) Dedicated smoking area Fire protection system in the temporary construction facilities Emergency Response Plan External assistance for firefighting (FRNSW & RFS) Use of appropriate PPE	14	Equipment and systems will be designed and tested to comply with Australian standards & guidelines (e.g., AS 1940) Engagement of reputable contractors Independent certifiers/owner's engineers Installation and maintenance will be done by trained personnel Secondary containment (i.e., bunding) Warning signs (flammable material) Fire Management Plan Defendable boundary for firefighting will be established Emergency Response Plan External assistance for firefighting (FRNSW & RFS) Use of appropriate PPE
7	Fire Management Plan Cooling water supply on-site Defendable boundary for firefighting will be established (i.e., APZ) Emergency Response Plan External assistance for firefighting (FRNSW & RFS) Use of appropriate PPE	15	Location siting (i.e., outside of flood prone area) Switch rooms and BESS are housed in dedicated enclosure/building. which will be constructed in accordance with relevant standards Drainage system Preventative maintenance (check for leaks)
8		16	Project infrastructures are in secure fenced area

ID	Controls	ID	Controls
	Equipment and systems will be designed and tested to comply with the relevant international standards and guidelines Equipment will be procured from reputable supplier Independent certifiers/owner's engineers BMS Smoke detector Voltage control Charge-discharge current control Grounding system Temperature monitoring Safety shut-off function HVAC system Cell chemistry selection (minimise runaway) Battery cell/pack design BESS is housed in dedicated container/outdoor rack including 2-hour resistance rating for containerised BESS solution BESS is in designated area BESS fire protection system Activation of emergency shutdown (ESD button; outside of BESS or remotely from the O&M building) Fire Management Plan Emergency Response Plan External assistance for firefighting (FRNSW & RFS)		Onsite security protocol Warning signs During construction, the area will be patrolled, and fence will be installed
		17	Earthing Lightning protection mast (Substations) PPE

6.9.2. Electric and magnetic fields

Assessment approach

Electric and magnetic fields, known as electromagnetic fields (EMFs) are invisible areas of energy associated with electrical power and lighting (NIEHS, 2022) and can also occur naturally such as discharge during thunderstorms.

Electric fields are produced by voltage and magnetic fields are produced by current. When electricity flows, EMFs exist close to the wires that carry electricity and close to operating electrical devices and appliances (WHO, 2007). Electric and magnetic field strength reduces rapidly with distance from the source, and while electric fields are insulated by air and insulation material, magnetic fields are not.

In Australia electrical devices including transmission lines and substations fall within the 50Hz and 60Hz frequency which is within the Extremely Low Frequency (ELF) range of 0-300Hz (Repacholi, 2003).

The International Commission on Non-Ionizing Radiation Protection (ICNPR) published Guidelines for limiting exposure to time-varying electric, magnetic and electromagnetic fields (1Hz-100kHz) which were updated in 2010. The objective of the paper was to establish guidelines for limiting EMF exposure that would provide protection against known adverse health effects.

To prevent health-relevant interactions with Low Frequency fields, ICNIRP recommends limiting exposure to these fields so that the threshold at which the interactions between the body and the external electric and magnetic field causes adverse effects inside the body is never reached.

The exposure limits, called basic restrictions, are safety levels designed to limit adverse health effects from exposure to EMF and are conveyed as the internal electric fields which can be tolerated in the body without experiencing adverse health effects. The exposure limits outside the body, called reference levels, are derived from the basic restrictions using worst-case exposure assumptions, in such a way that remaining below the reference levels (in the air) implies that the basic restrictions would also be met (in the body) (ICNIRP, 2016). Reference levels for occupational and general public exposure are shown below.

Table 6-44 Reference levels for EMF exposure

Exposure characteristics	Electric field strength (kVolts per metre – kV/m)	Magnetic flux density (microteslas - μT)
Occupational	10	1000
General public	5	200

Potential impacts

Construction and decommissioning

There is low potential for EMF impacts during the construction and decommissioning stages of the project. The maximum magnetic field of the proposed transmission line is well under the 200 μT and 1000 μT limits respectively recommended for public and occupational exposure.

Staff would be exposed to EMF's over intermittent periods during works at and around the existing 66 kV overhead transmission line. Exposure to EMFs during the construction of the substation and its connection to the existing transmission line would be short term, therefore the effects are likely to be negligible.

The construction site would be fenced to protect the public from construction health and safety risks.

Operation

During operation of the Project, the following sources of EMF would be present:

- Onsite substation/transformers.
- Solar arrays including cabling and PCUs.
- Energy storage facility (BESS).

The main source of EMF would be the onsite substation/transformers. The magnetic fields at distances of 5–10 m from the substation fence are generally indistinguishable from typical background levels in a home. The site is surrounded by agricultural land. Public access would be restricted by fencing around the site including substation during the operational phase. Given the levels associated with the infrastructure components, and the distance to the site perimeter fence, EMFs from the solar farm are likely to be indistinguishable from background levels at the boundary fence. The underground cabling would not produce external electric fields due to shielding from soil, and its magnetic fields are expected to be well within the public and occupational exposure levels recommended by Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) and ICNIRP.

Research into electric and magnetic fields undertaken at utility scale PV installations in California by Chang and Jennings (1994), indicated that magnetic fields were significantly less for solar arrays than for household applications, with magnetic fields from solar arrays not distinguishable from background levels at the site boundary.

The Project would require installation of DC wiring between panels and the PCUs. This cabling would be underground and would have a voltage of around 1600V. The potential for electromagnetic interference as a result of the solar array cabling is considered to be negligible.

PCUs would be installed across the Development footprint. The PCUs would be located within the fenced Assessment area with no public access and would operate only during the day reducing the total time that EMFs are generated by the solar panel infrastructure.

Lithium-ion batteries that would be used in the BESS are not associated with high-levels of EMF which would be well below ICNIRP reference levels.

Key uncertainties of the assessment

The EMF assessment has considered that all EMF producing infrastructure would follow Australian and industry standards. The final designs and material choices will comply to this guidance through the implementation of the mitigation measures below.

Mitigation measures

With the implementation of the following measures, which form commitments of the Project, the impacts are considered manageable.

Table 6-45 EMF Mitigation measures

ID	Mitigation measures	Project stage
E1	All electrical equipment will be designed in accordance with relevant codes and industry best practice standards in Australia.	Design
E2	All design and engineering will be undertaken by qualified and competent person/s with the support of specialists as required.	Design
E3	Design of electrical infrastructure will minimise EMFs.	Design

6.9.3. Bushfire

Existing environment

Bush fire presents a threat to human life and assets and can adversely impact ecological values, air and water quality. Bush fire risk can be evaluated and managed by considering environmental factors that increase the risk of fire (fuel load and type, topography and weather patterns), as well as specific activities (such as hot works) or infrastructure components that exacerbate combustion or ignition risks (such as transmission lines, energy storage systems and other electrical components).

This Project is an SSD and is therefore exempt from requiring a bush fire safety authority (BFSA) under Section 4.41(f) Environmental Planning and Assessment Act 1979. Section 5.16(3) requires "the Planning Secretary is to consult relevant public authorities and have regard to the need for the requirements to assess any key issues raised by those public authorities", which includes consulting with the New South Wales Rural Fire Service (NSW RFS) in regard to bush fire considerations.

The site is mostly identified as Category 3 bushfire prone land with small areas of Category 1 (DPIE, 2023) refer Figure 6-55. Discussions with the local community highlight that the area has experienced significant fires over the past few years; the risk of which is higher in the hot, dry summer months.

The existing natural bushfire hazards within the Assessment area are as follows:

- Remnant eucalypt woodland corridor along Spring Creek and Banyandah Creek.
- Remnant patches of vegetation on the southwest and northeast sections of the subject land of the subject land.

Groundcover within the subject land has largely been maintained at low levels due to cultivation practices and grazing and is considered a lower-level fire risk. Where areas are enhanced, crash grazing may be used to ensure understorey growth does not accumulate to unacceptable levels.

The local bushfire danger period occurs between October and March, where conditions are most conducive to bushfire ignition - being hot and dry. The harvest period of November to mid-December is considered a prime risk period due to the use of machinery (ignition source) in crops (fuel) and the generally high activity in the rural sector. January and February present the highest temperatures, coupled with low humidity and dry crop stubble over extensive areas. Prevailing wind direction is from northwest to southeast, during the dry season (BoM, 2020b).

There are 36 Rural Fire Service (RFS) brigades listed for the Tamworth Regional Council, with the nearest located within 30 km of the Assessment area. The closest RFS is about 22 km away on The Ringers Road, Hillview (a southern suburb of Tamworth).

In the event of a bushfire originating on a property outside of the solar farm, the RFS (Incident Controllers) would be expected to undertake defensive operations and not enter a perimeter around electricity infrastructure – i.e., they would protect the facility from an encroaching bush or grass fire, or if the solar farm is on fire, attempt to prevent the spread of fire from the solar farm. This approach is the same as currently followed for electrical substations in the path of a fire, or one that was alight. RFS crews could, however, access ancillary infrastructure on fire, such as offices, buildings, carparks, etc. that are not actual electricity generation/storage infrastructure.

In terms of resources to fight fire, a steel or concrete tank would be installed at the site to store water for bushfire protection and other non-potable water uses, with a minimum of 50,000 L reserved for fire-fighting purposes. Potable water would be required for staff using imported supplies or rainwater collected from tanks beside site buildings.

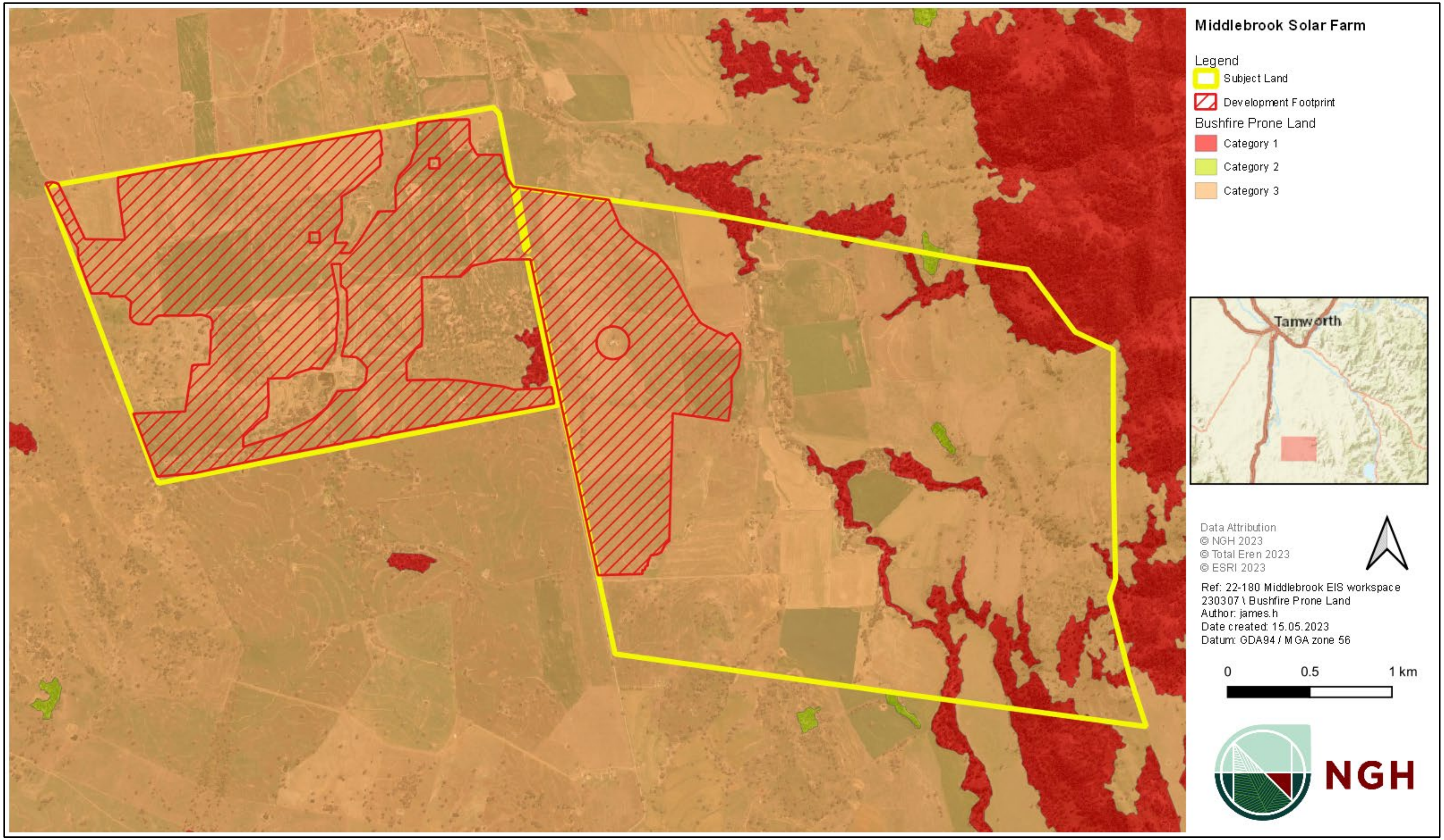

Figure 6-55 Bushfire Prone Land

Guidelines

According to NSW RFS Planning for Bush Fire Protection 2019 (PBP) (NSW RFS, 2019) an acceptable level of protection from bush fire is achieved for developments through a combination of strategies which:

- Control the types of development permissible in bush fire prone areas.
- Minimise the impact of radiant heat and direct flame contact by separating development from bush fire hazards.
- Minimise the vulnerability of buildings to ignition and fire spread from flames, radiation and embers.
- Enable appropriate access and egress for the public and firefighters.
- Provide adequate water supplies for bush fire suppression operations.
- Focus on property preparedness, including emergency planning and property maintenance requirements; and
- Facilitate the maintenance of Asset Protection Zone (APZ), fire trails, access for firefighting and on-site equipment for fire suppression.

The PBP guidelines provide six key Bush Fire Protection Measures (BPMs) for developments:

1. APZ's
2. Access
3. Construction, siting and design
4. Landscaping
5. Services; and
6. Emergency and evacuation planning.

Regarding Section 8.3.5 (of PBP), solar farms are identified and require the following measures to be incorporated into the design and operation of the Project:

- A minimum 10 m APZ for the structures and associated buildings/infrastructure.

The APZ must be maintained to the standard of an inner protection area for the life of the development (to the specifications identified in Appendix 4 of PBP).

The PBP also requires a bush fire emergency management and operations plan, covering:

- Work that should not be carried out during total fire bans.
- Detailed measures to prevent or mitigate fires igniting.
- Notification of the local NSW RFS Fire Control Centre for any works that have the potential to ignite surrounding vegetation, proposed to be carried out during a bush-fire fire danger period to ensure weather conditions are appropriate.
- Appropriate bush fire emergency management planning and availability of fire-suppression equipment, access and water.
- Storage and maintenance of fuels and other flammable materials., covering:
- The suspension of work involving risk of ignition during total fire bans.
- The availability of fire-suppression equipment, storage and maintenance of flammable materials.
- Notification of the local NSW RFS District Fire Control Centre for any works during the fire danger period that have the potential to ignite surrounding vegetation.

- Bush fire emergency management planning.

A 10 m or greater defensible space (Asset Protection Zone), Bush Fire Emergency Management and Operations Plan (BFEMOP), fire management plan, fire safety plan and emergency response plan are proposed as part of the Middlebrook Solar Farm Project.

Potential impacts

Construction and decommissioning

The potential for increased bush fire risk may coincide with the construction and decommissioning stages of the Project. Ignition sources during these stages include:

- Earthworks and slashing machinery causing sparks.
- Hot works activities such as welding, soldering, grinding and use of a blow torch.
- Sparks and contact ignition from vehicles in long combustible vegetation
- Smoking and careless disposal of cigarettes
- Use of petrol-powered tools
- Operating plant fitted with power hydraulics on land containing combustible material.
- Electrical faults during testing and commissioning
- Storage of chemicals and hazardous materials.

The Development footprint proposed within the Assessment area is predominantly on undulating land in a low fuel (grassland) environment. As such, bush fire risks during construction and decommissioning are considered to be low and would be managed through the mitigation measures recommended in this EIS.

Existing access roads and informal farm roads, as well as proposed APZ tracks, and solar farm service roads will provide RFS and emergency service access throughout the site.

Operational

The operational stage of the Project has the following associated bush fire risks:

- Overheating in the substation
- Grass fire ignition from vehicles and maintenance machinery
- Poor groundcover management and associated increase in fuel loads.
- During operation of the solar farm, bush fire and structural fire risks are considered manageable provided the following strategies are adopted:
- Control of grass fuels including maintenance of groundcover beneath panels
- Maintenance of equipment
- Application of best practice and technical standards
- Design of electrical components to minimise ignition potential.

The key risk identified and discussed below is in relation to the operation of Lithium-ion batteries.

Lithium-ion batteries

Fire risks

Lithium-ion cells contain highly flammable electrolytes within a metal prismatic can or metalized pouch that have seals designed for a 10 to 20-year service life. The ambient operating temperature range for Lithium-ion systems can span -10 to 50 degrees Celsius but the cells inside the containers are kept within a smaller range, 10 to 30 degrees Celsius, through the enclosure's thermal management system that is sized to keep the cells within the recommended operating temperature range under normal conditions. Excessive overcharging leads to heating within cells that can initiate 'thermal runaway' triggering new chemical reactions through breakdown of the electrolyte, additional heat generation and ultimately the venting of gases containing carbon monoxide, carbon dioxide and hydrogen.

Gas combustion occurs when the electrolyte vapours or combustible decomposition products come into contact with air and there is an ignition source, or the temperature reaches the autoignition point of 350–400°C (Recharge, 2013). Monitoring of module temperature and voltage combined with a well-designed controls system prevents excessive overcharging and heating by taking the system offline before critical conditions are reached. Since thermal runaway in one battery cell can initiate thermal runaway in adjacent cells it is important to design features that prevent propagation of fire among modules in the event that a fire is initiated. More detailed analysis of this hazard is included in the PHA report which is attached in Appendix D.7.

Fire causes

Battery overheating may be caused by a range of factors including electrical shorting, rapid discharge, overcharging, manufacturers defect, poor design and mechanical damage (Recharge, 2013). Lithium-Ion Battery (LIB) do not produce any exhaust gases during normal operation, but they can produce flammable and toxic gases if there is a fault (Department of Commerce (WA), 2017). The main failure modes for these battery systems are either latent (manufacturing defects, operational heating, etc.) or abusive (mechanical, electrical, or thermal) (Blum & Long, 2016).

A large majority of incidents involving Lithium-ion batteries have been due to failure to adhere to packing and transport requirements, use by non-professionals for innovative applications or use in non-controlled storage conditions (Recharge, 2013).

Risk and incident management

Factors listed in Department of Commerce (Department of Commerce (WA), 2017) to avoid and mitigate battery fire impacts include:

- Building codes applicable to batteries (national and local), changes to floor loadings and National Construction Code requirements for battery installations
- Manufacturer's recommendations to protect the system from weather and extreme heat, light and temperature.
- Adequate ventilation
- Containment of electrolyte spills
- Adequately fire-rated walls are used to avoid or delay the spread of fire.
- Adequate access/egress for installation and maintenance
- Adequate mechanical protection.

Battery location and spatial design are also important safety factors. Large-scale Lithium-ion energy storage systems can further mitigate widespread impact by isolating different parts of a system.

Fire containment and suppression systems need to be employed to deal with a potential battery fire event, applying the Suppression through Cooling, Isolation, and Containment (SCIC) approach (Butler, 2013).

Lithium-ion fires require specific training, planning, storage, and extinguishing interventions, catering for both progressive burn-off or explosive events (Butler, 2013).Though the specific battery manufacturer and model has not yet been determined, it is anticipated that each battery module within the implemented solution would have its temperature and voltage monitored.

The fire suppression system within the Energy Storage System would comprise the storage and release of inert gas within each battery container using either electrical detectors/ionisers, or a mechanical system in which the heat destroys a seal to release the gas.

There would be spare air-conditioning units in storage on site for replacement. In the event of failure of one of the units, the system would be able to maintain safe operating temperatures. If all air-conditioning units fail, the auto shutdown of the batteries would prevent overheating.

Standards and guidelines

The installation of lithium-ion batteries has been identified as in need of relevant standards and Standards Australia is developing a new standard (AS/NZS 5139) for smaller scale battery installations (Standards Australia, 2017). The Clean Energy Council provides requirements for accredited installers, the Australian Energy Storage Council has produced a Guide for Energy Storage Systems, and the WA Department of Commerce has released a guide for electrical contractors in relation to battery storage systems (Department of Commerce (WA), 2017).

Asset Protection Zone

Section 8.3.5 of the PBP guidelines provides minimum APZ requirements for solar farm developments located in designated bush fire prone land. These APZ prescriptions would be applied to the solar farm infrastructure to provide defendable space and to manage heat intensities at the infrastructure interface.

In accordance with Section 8.3.5 of PBP, an APZ of a minimum width of 10 m would be provided around the solar farm buildings, substation and BESS, and around the outside perimeter of the solar array. The 10 m APZ set back requirement would also be applied to any woody vegetation plantings undertaken around the perimeter of the solar farm. All the APZs would be managed as an Inner Protection Area, to the specifications of Appendix 4 of PBP.

The APZ surrounding the proposed BESS unit and substation would include gravel surfacing to minimise the risk of fire escaping from the facilities and the risk of external fire affecting the facilities. The vegetation and bushfire mapping do not suggest that an APZ greater than 10 m would be required.

Fuel hazard management

According to the PBP guidelines, the APZ should provide a tree canopy cover of less than 15% located greater than 2 m from any part of the roofline of a building and should not overhang any building. Trees should have lower limbs removed up to a height of 2 m above the ground. The understorey should be managed (mowed) to treat all shrubs and grasses on an annual basis in advance of the fire season.

There would be no trees or shrubs within the APZ established for the solar farm, or within the solar array area. Grassland Fuel Hazard is a function of grass height and cover, with variation according to curing and species fuel characteristics. Grass fuel would be monitored and managed using stock grazing or mowing to maintain safe fuel levels. Grass height within the APZ would be maintained at or below 5 cm throughout the November to February fire season. Grass height outside the APZ, including beneath the solar array, would be maintained at or below 10 cm throughout the fire season.

Site access

Access specifications would comply with Section 7.4a of the PBP guidelines, including:

- A minimum carriageway width of 4 m
- Minimum vertical clearance of 4 m
- Capacity for passing using reversing bays and/or passing bays every 200 m suitable for fire tankers.
- Property access roads are two-wheel drive, all-weather roads.
- Property access must provide a suitable turning area in accordance with Appendix 3 (of PBP).
- The turn radius and swept path clearance on access roads would be suitable for Category 1 Tankers (Medium Rigid Vehicle), refer to Section 6.3.

Fire-fighting Resources and Preparedness

Water storage tanks would be installed within the Development footprint for fire-fighting and other non-potable water uses, with a 65 mm Storz outlet, a metal valve and a minimum of 20,000 litres reserved for fire-fighting purposes. Rainwater tanks installed beside site buildings for staff amenities would also enable RFS connectivity of Storz outlets. Suitable fire extinguishers and Personal Protection Equipment (PPE) would be maintained at site buildings.

A Bushfire Emergency Management and Operations Plan (BFEMOP) would be developed prior to commissioning in consultation with the local NSW RFS District Fire Control Centre to manage fire risks, resources and preparedness. Following commissioning of the solar farm, the preparedness of local RFS and Fire and Rescue brigades would be enhanced through site orientation and information events and the facilitation of training in the management of Li-ion battery fires. An Emergency Response Plan, including an Evacuation Plan, BFEMOP (with a specific battery fire response section) Flood Response Plan and Spill and Contamination Response Plan would also be developed to enable rapid, safe and effective incident response.

The Project would not present a substantial bushfire threat or represent an unacceptable hazard in the event of a bush fire affecting the Assessment area. Implementation of the mitigation measures in this EIS are considered sufficient in managing the identified risks.

Key uncertainties of the assessment

The final layout of bushfire management infrastructure such as water storage tank locations has not been confirmed. The final design would be confirmed in consultation with NSW Rural Fire Service and Fire and Rescue NSW and will take on recommendations from these agencies.

Mitigation measures

Bush fire risks during construction and decommissioning are low and would be managed through standard mitigation strategies. During operation of the solar farm, specific fire risks strategies would be adopted including:

- Adequate setbacks, access and firefighting facilities maintained onsite.
- Control of grass fuels including maintenance of groundcover beneath panels in addition to an area around the BESS and other ancillary infrastructure.
- Proper design and maintenance of equipment.
- Application of best practice and technical standards.

These form commitments of the Projects, as set out below.

Table 6-46 Safeguards and mitigation measures bushfire

ID	Mitigation measures	Project stage
BF1	Dangerous or hazardous materials would be stored and handled in accordance with AS1940-2004: *The storage and handling of flammable and combustible liquids*.	Construction/ operation/ decommissioning
BF2	Develop a Bush Fire Emergency Management and Operations Plan to include but not be limited to: • Detailed measures to prevent or mitigate fires igniting. • Work that should not be carried out during total fire bans. • Availability of fire-suppression equipment, access and water. • Storage and maintenance of fuels and other flammable materials. • Notification of the local NSW RFS Fire Control Centre for any works that have the potential to ignite surrounding vegetation, proposed to be carried out during a bush-fire fire danger period to ensure weather conditions are appropriate. • Appropriate bush fire emergency management planning. • In developing the BFEMOP, NSW RFS and FRNSW would be consulted on the volume of water supplies, fire-fighting equipment maintained on-site, fire truck connectivity requirements, proposed APZ and access arrangements, communications, vegetation fuel levels and hazard reduction measures.	Construction/ operation/ decommissioning
BF3	An APZ of minimum 10 m would be maintained between remnant or planted woody vegetation and solar farm infrastructure. Average grass height within the APZ would be maintained at or below 5 cm on average throughout the November to February fire season. Average grass height outside the APZ, including beneath the solar array, would be maintained at or below 10 cm throughout the fire season.	Construction/ operation
BF4	Non-combustible (steel or concrete) water storage tanks should be installed adjoining the main internal access road, or nearby the BESS, for fire-fighting and other non-potable water uses, with a 65 mm Storz outlet, a metal valve and a minimum of 20,000 litres reserved for fire-fighting purposes, in accordance with PBP. The final location/s of water tanks will be determined in agreement with NSW RFS and FRNSW recommendations.	Construction
BF5	Appropriate fire-fighting equipment would be held on site to respond to any fires that may occur at the site during construction. This equipment would include fire extinguishers, a 1000 litre water cart (fitted with suitable hosing, fittings and diesel firefighting pump) retained on site on a precautionary basis, particularly during any blasting and welding operations. Equipment lists would be detailed in Work Method Statements.	Construction
BF6	The NSW RFS and Fire and Rescue NSW would be provided with a	Construction/ operation

ID	Mitigation measures	Project stage
	contact point for the solar farm, during construction and operation.	
BF7	Following commissioning of the solar farm, the local NSW RFS and Fire and Rescue brigades would be invited to an information and orientation day covering access, infrastructure, firefighting resources on-site, fire control strategies and risks/hazards at the site	Operation
BF8	The perimeter access track would comply with the requirements of property access roads in accordance with Table 5.3b of the PBP. All access and egress tracks on the site would be maintained and kept free of parked vehicles to enable rapid response for firefighting crews and to avoid entrapment of staff in the case of bush fire emergencies. Access tracks would be constructed as through roads as far as practicable. Dead end tracks would be signposted and include provision for turning firefighting vehicles.	Construction/ operation/ decommissioning
BF9	A Hot Works Permit system would be applied to ensure that adequate safety measures are in place. Fire extinguishers would be present during all hot works. Where practicable hot works would be carried out in specific safe areas (such as the Construction Compound temporary workshop areas).	Construction/ operation/ decommissioning
BF10	Machinery capable of causing an ignition would not be used during bushfire danger weather, including Total Fire Ban days.	Construction/ operation/ decommissioning
BF11	Prior to operation of the solar farm, an Emergency Response Plan (ERP) would be prepared in consultation with Council, the RFS and Fire and Rescue NSW. This plan must include but not be limited to: Specifically addresses foreseeable on-site and off-site fire events and other emergency incidents. Risk control measures would include the level of personal protective clothing required to be worn, the minimum level of respiratory protection required, decontamination procedures, minimum evacuation zone distances and a safe method of shutting down and isolating the PV system (either in its entirety or partially, as determined by risk assessment). Outline other risk control measures that may need to be implemented in a fire emergency due to any unique hazards specific to the site. Two copies of the ERP are stored in a prominent 'Emergency Information Cabinet' which is located in a position directly adjacent to the site's main entry point/s. Once constructed and prior to operation, the operator of the facility would contact the relevant local emergency management committee.	Operation
BF12	Prior to commissioning the solar farm, in consultation with Fire and Rescue NSW, develop: • Fire Safety Study developed in accordance with the requirements of Hazardous Industry Planning Advisory Paper (HIPAP) No.21 and is to meet the operational requirements of FRNSW. It must consider the operational capability of local	Pre-commissioning

ID	Mitigation measures	Project stage
	fire agencies and the need for the facility to achieve an adequate level of on-site fire and life safety independence. The FSS should consider worst-case fire scenarios including a full BESS unit fire and demonstrate no fire propagation within the facility. It is required to include an Initial Fire Safety Report (IFSR) and / or Performance-Based Design Brief / Fire Engineering Brief Questionnaire (FEBQ). • A comprehensive Emergency Response Plan (ERP) for the site in accordance with HIPAP No.12. • An Emergency Services Information Package (ESIP) in accordance with FRNSW fire safety guideline – Emergency services information package and tactical fire plans. An Emergency Responders Induction Package for the site.	
BF13	Fire risks associated with the lithium-ion energy storage facility would include: • Locating the BESS as far as practicable from any sensitive receptors or large stands of vegetation. • Installing reliable automated monitoring (voltage and temperature), alarm and shutdown response systems. • Installing reliable integrated fire detection and fire suppression systems (inert gas). • Ensuring the battery containers are not vulnerable to external heat effects in the event of a bush fire. • Designing appropriate separation and isolation between battery containers and between batteries and other infrastructure, including gravel surfacing around the facility for a minimum 10 m in accordance with APZ. • Compliance with all relevant guidelines and standards. • Preparation of a specific Battery Fire Response Plan, under the general BFEMOP, in consultation with fire authorities, fire suppression experts and in reference to relevant standards and guidelines. Facilitation of first responder training in the management of Lithium-ion battery fires at the site for local brigades.	Design

7. ASSESSMENT OF ADDITIONAL IMPACTS

7.1. Hydrology and water resources

7.1.1. Assessment approach

A hydrological assessment was undertaken by Footprint to understand surface water impacts, particularly, how the local catchment functions with regard to water flow paths and flooding. The Development footprint was then modelled to understand how this infrastructure affects:

- The velocity of run off (or its erosive potential)
- Flooding extent.

The assessment is provided in full as Appendix D.8 and summarised below.

In addition, this section is supplemented with a desktop analysis of:

- Groundwater resources (including Spring Creek, Banyandah Creek and Algona Creek traversing the site and surrounding water courses),
- Groundwater dependent ecosystems
- Water related infrastructure, licenses, and basic landholder rights.

7.1.2. Existing environment

Surface water and terrain

The main watercourse (Spring Creek) traverses the eastern portion of the Subject Land in a south-east to north-west direction and is categorised as a Strahler fifth and sixth order stream. Banyandah Creek (third order stream) and Algona Creek (fifth order stream), which are both tributaries of Spring Creek, traverse the western and eastern portions of the site, respectively. The Subject land also contains numerous other minor un-named tributaries of the above creeks, most of which are first or second order watercourses. All watercourses within the Subject land would be described as ephemeral and would only contain flowing water during and shortly after rainfall events. There are approximately 25 small farm dams. These features are presented in Figure 7-1.

The Subject land, and in particular the Development footprint, has been extensively cleared of woody vegetation and has been highly modified by historical farming practices. Small remnants of woodland are still present along riparian corridors.

The Subject land typically falls from south-east to north-west with elevation ranging from about 635 m to 460 m Australian Height Datum (AHD). On its eastern flank, the area is bound by relatively steep terrain which rises to an elevation of about 850 m AHD.

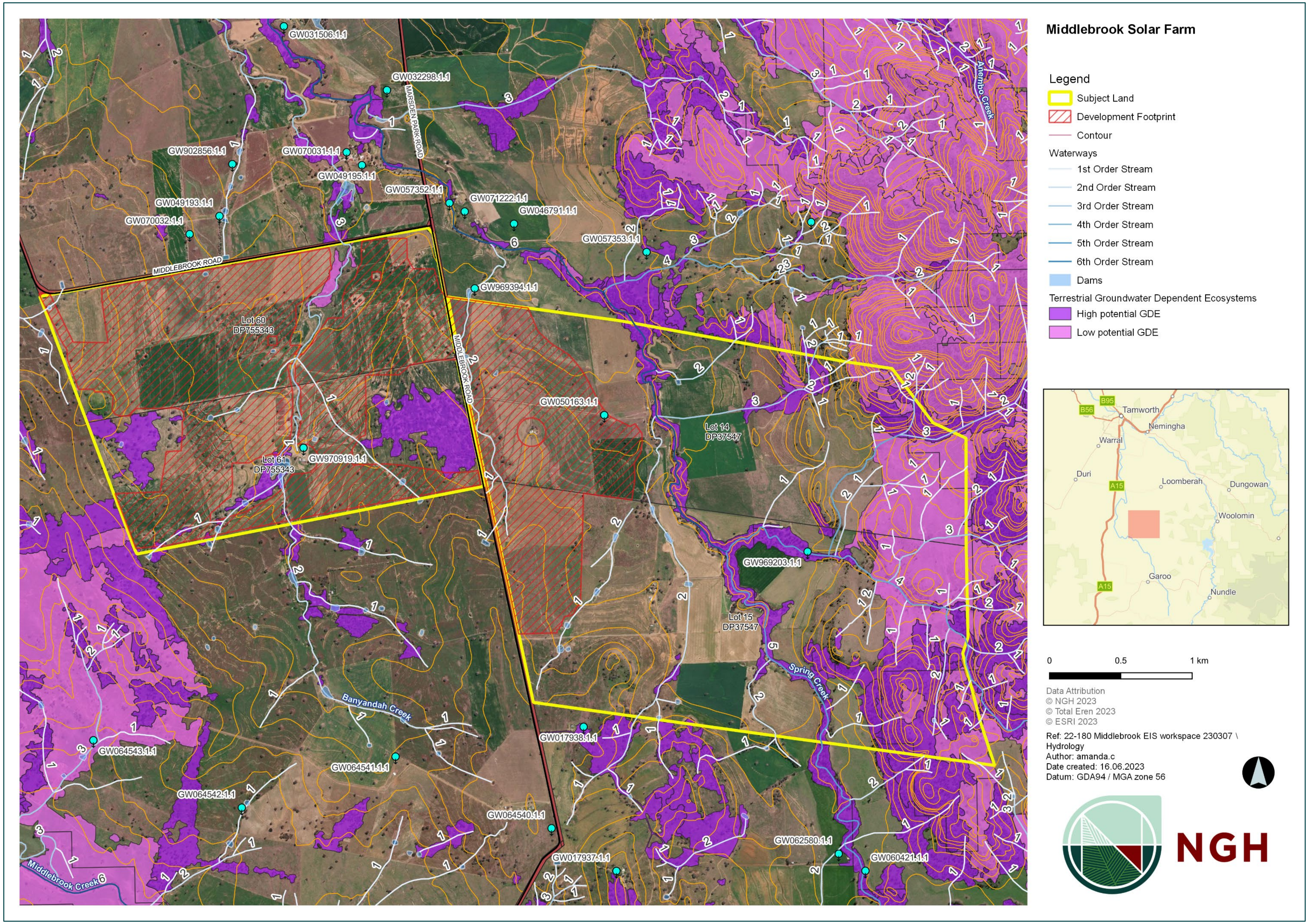

Figure 7-1 Hydrological Features (*Contours at 5m)

Flooding

Modelling considered the catchment boundaries, their roughness, flow routes through the catchment, rainfall depth data and temporal patterns and included critical durations and storms.

The results include mapping the existing flood hazard vulnerability over the Subject land in accordance with the following criteria: H1 to H6 refer to Table 7-1 and Figure 7-3.

Table 7-1 Flood hazard vulnerability classifications

Hazard vulnerability classification	Description
H1	Generally safe for vehicles, people and buildings
H2	Unsafe for small vehicles
H3	Unsafe for vehicles, children and the elderly
H4	Unsafe for vehicles and people
H5	Unsafe for vehicles and people. All buildings vulnerable to structural damage. Some less robust buildings subject to failure
H6	Unsafe for vehicles and people. All building types considered vulnerable to failure.

The mapping shows that flooding within the Subject land is primarily classified as a H1 hazard vulnerability in the 5% Annual Exceedance Probability (AEP) used to describe how likely a flood is to occur in a given year)[9] and 1% AEP events, except for:

- Flooding within Spring Creek; reaching H6
- Banyandah and Algona Creeks; typically, H5 but reaching H6 in some areas.

As expected, hazard increases over the proposal area in the Potential Maximum Flood (PMF) (extreme) event[10]. The following maps show the existing (pre-development) flood levels and flood hazard mapping.

[9] For example, a 1% AEP flood represents a 1 in 100 chance this flood level will be exceeded, in any one year.
[10] PMF is the response of the catchment to the probable maximum precipitation and is the largest flood event that can reasonably be expected to occur at a location.

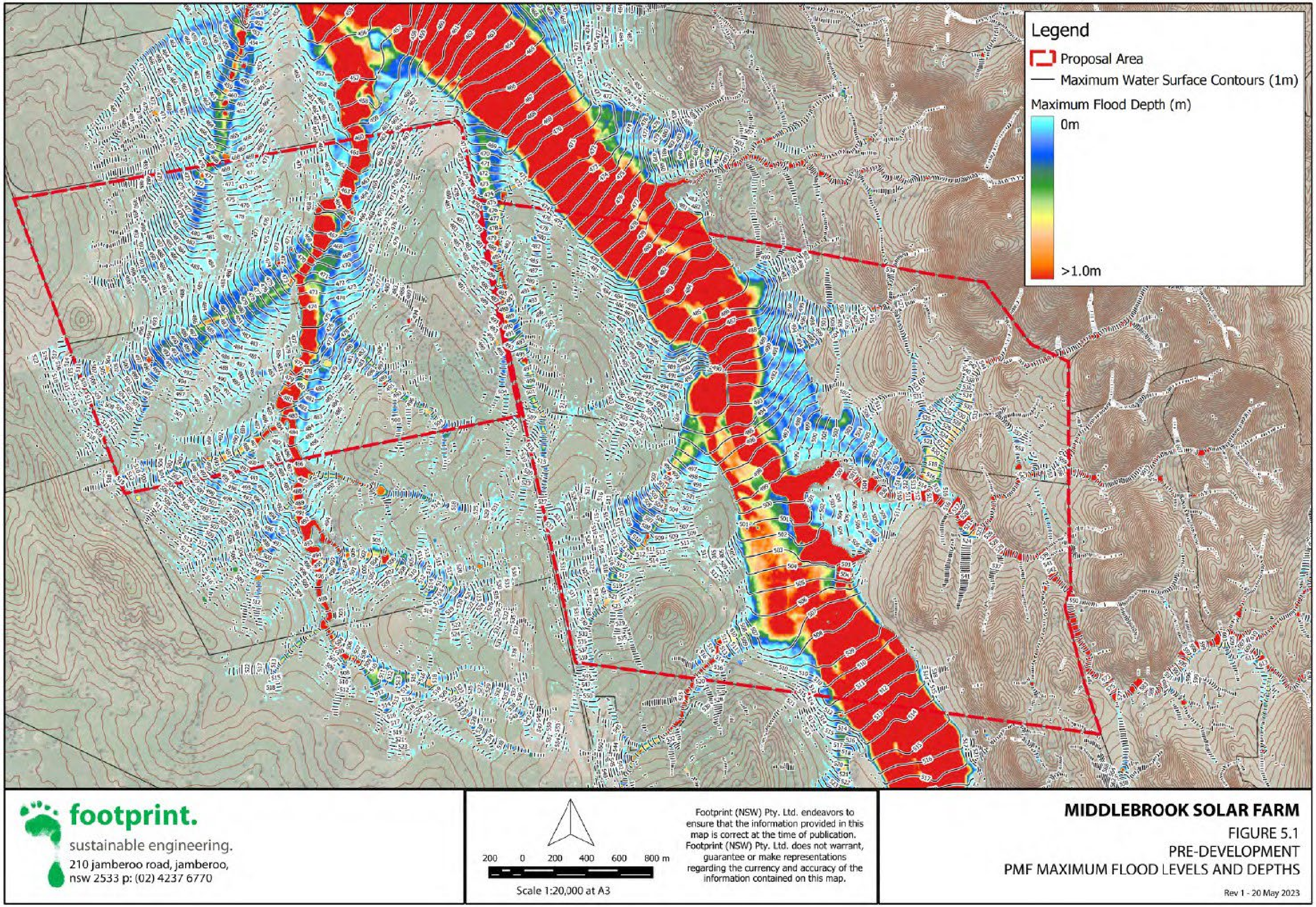

Figure 7-2 Pre development PMF maximum flood levels and depths

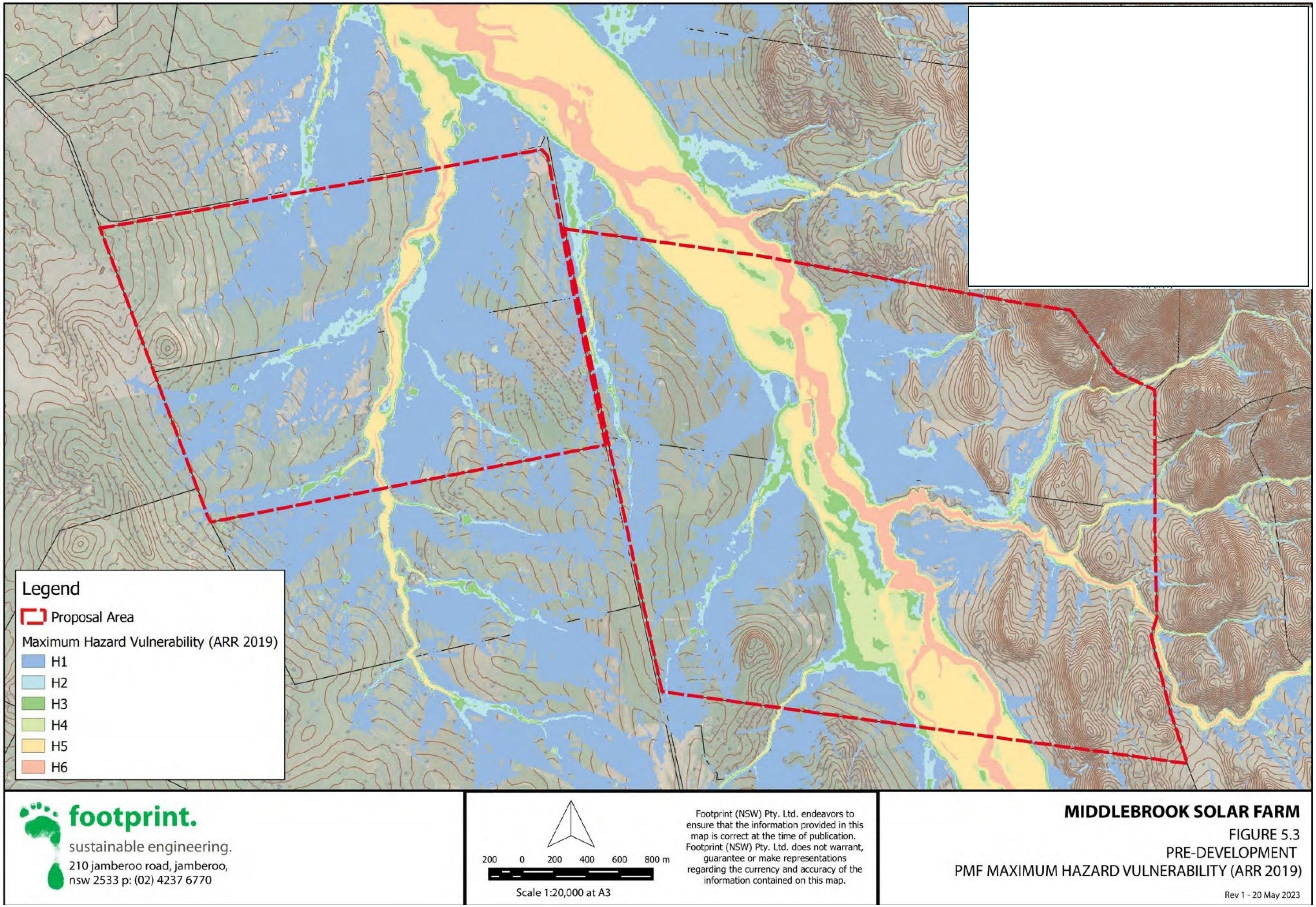

Figure 7-3 Predevelopment PMF hazard vulnerability

Groundwater

The Australian Groundwater Explorer database (accessed 19 May 2023) of groundwater lists two bores within the Assessment area, these are listed in Table 7-2.

These bores are not currently used for extracting water.

Table 7-2 Australian Groundwater Explorer search results

Bore ID	Bore depth (m)	Purpose	Status
GW969394.1.1	17.7	Stock and domestic	Functioning
GW970919.1.1	91.5	Stock and domestic	Functioning

Under the Water Management Act 2000 (WM Act), landholders can take water under basic landholder rights. Owners or occupiers of land which overlies an aquifer can take water for domestic consumption or stock watering.

- Domestic consumption means the use of water for normal household purposes in domestic premises which are situated on the land.
- Stock watering means the watering of stock animals being raised on the land. It does not include raising stock animals on an intensive commercial basis where the animals are housed or kept in feedlots or buildings.

Stock and domestic bores would not be accessed to provide water for construction purposes. They may be accessed during operation for providing water to grazing stock.

Water related infrastructure, licenses, rights and supply options

Water supply options include accessing groundwater for livestock from an existing ground water bore which is licensed to an associated landowner. Extraction of the Peel Valley aquifer is over allocated, extraction limits apply, and actual allowable extraction limits may change from year to year. These limits are set by WaterNSW each July and limits are based on 5-year extraction data.

There is no active groundwater sharing plan for the Tamworth LGA, the relevant Water Sharing Plan (WSP) is the *Water Sharing Plan for the Namoi Alluvial Groundwater Sources Order 2020* (NSW Legislation, 2023). The water licenses and supply around the Subject Land is from the Peel Alluvium. The Peel Alluvium is shallow and has less storage capacity in comparison to other ground water systems and is prone to decline from ground water pumping.

The extraction limit for Peel Alluvium Groundwater Source is 9,344 ML/year (NSW Government, 2023). In the Peel Alluvium there are 1012 ground water licenses.

The Tamworth region sources its town water from three sources being Chaffey Dam (primary source), Dungowan Dam and The Paradise Drift Wells (used in emergency only). Tamworth Regional Council provides Metered Standpipe hire facilities to approve customers (Tamworth Regional Council, 2023). The applicant would engage a contractor on their behalf to apply for and secure access to utilise the metered standpipe to meet the needs of the project during construction.

While high potential Terrestrial Groundwater dependent ecosystems traverse the site, exclusion areas designed around sensitive features have led to the avoidance of these ecosystems and would not be directly impacted by the solar farm infrastructure.

7.1.3. Potential impacts

Construction and decommissioning

Surface water risks

The construction phase has potential to impact water quality and quantity. Construction of the solar farm would disturb soils and potentially lead to sediment or other pollutants being present in runoff, mobilising and entering local waterways, adversely impacting on water quality. Activities that may contribute to this include:

- Excavations for the construction of internal roads and associated drainage, parking areas, footings for onsite substation, inverters and maintenance building and footings for temporary staff amenities and offices during construction.
- Trenching for underground cable installation.
- Construction of waterway crossings for internal access roads.
- Construction of hardstand areas and access tracks would result in soil compaction, consequently reducing soil permeability, increasing surface water runoff and the potential for concentrated flows.

During construction, as much groundcover as possible would be retained and protected, by rationalising laydown areas and tracks. Only discrete footprints would be levelled where required or footings or hardstand areas.

Groundcover and the soil profile would remain largely undisturbed in areas where the solar arrays would be mounted. These would use steel piles that are driven or screwed into the ground rather than excavated footings which would result in comparatively insignificant soil disturbance radii.

Water crossings across the proposal site will be upgraded in accordance with Guidelines for Watercourse Crossings on Waterfront Land (NSW DPI, 2012a). One such crossing is proposed to traverse Banyandah Creek (third order stream) and would also be subject to mitigations to minimise biodiversity impacts (refer to Section 6.5.5)

The construction phase would entail the following water pollution risks that will require management:

- A hydrocarbon spill risk from use and re-fuelling of construction vehicles and machinery.
- On-site concreting for building and equipment foundations.
- Wash off from curing asphalt pavement and road seal.
- Storage and use of paints, cleaning solvents and other chemicals.
- Pesticide and herbicide storage and use.
- Fertilisers used for revegetation.
- Runoff from waste materials.

During the decommissioning stage, the potential impacts on water quality and quantity would be similar to or less than construction. It is likely the risk and area of disturbance during decommissioning would be less than construction due the existing access tracks and reduced ground disturbance required, as footings and cables greater than 500 mm would remain in place.

Activities with the potential for adverse water quality impacts would be managed through the development of site-specific sediment control plans and spill control plans during the construction, operation and decommissioning stages. Additionally, impacts to local water quality can be minimised by ensuring erosion and sediment control plans include measures to ensure 'Blue Book' (Landcom, 2004) criteria are met prior to discharge of water offsite.

Flooding hazard

Sections of the site may be at risk of temporary minor flooding during high rainfall events and high flows within the vicinity of the sites 2nd to 1st order tributaries and existing farm dams. Temporary localised flooding has the potential to interfere with construction and decommissioning and poses a safety risk for workers onsite. The proposal has potential to create the following hazards in the event of a localised flood:

- Electrical hazards to staff, emergency workers and assets due inundation of infrastructure.
- Pollution risks from leakage of stored pollutants (hydrocarbons, pesticides, solvents).
- Physical damage from the mobilisation of components in flood waters.

No temporary components required for construction and decommissioning are considered susceptible to becoming mobile and entering waterways, as all plant and material would be restricted to areas outside the modelled flood risk area and delineated waterway exclusion zones. All potential pollutants stored on-site during construction would be stored in accordance with storing hazardous materials (HAZMAT) requirements and bunded.

Flooding risks on site during the construction phase would be managed through the implementation of An Emergency Response Plan (ERP). The ERP would detail what staff should do in the event the site is flooding, and the site manager would indicate when works should cease after rainfall, to avoid unnecessary risk to people or property.

Groundwater vulnerability and groundwater dependent ecosystems

There is no groundwater vulnerability under the Tamworth Region LEP which is the level of risk a development poses to polluting vulnerable ground water resources relating to the physical characteristics of the location such as depth to the water table and soil type. It is considered that the Project would have negligible impact on groundwater quality given the low pollution potential of the solar farm.

While high potential Terrestrial Groundwater dependent ecosystems traverse the site, exclusion areas designed around sensitive features have led to the avoidance of these ecosystems predominantly along Banyandah Creek and would not be directly impacted by the solar farm infrastructure. Spring Creek and Algona creek at the eastern flank of the Subject land would likewise not be impacted.

Water use

Water use during construction would be minimal and largely used for dust suppression on unsealed roads and for the construction of new roads. The water requirement would vary, dependent on weather conditions, and is estimated to be up to 100 ML of non-potable water in total, based on an estimate of approximately 100 kL of water per ha for dust suppression. About 200 kL of potable water would be required for employees and contractors (refer to Table 7-3).

Table 7-3 Water requirements during construction

Water quality	Annual construction water requirement	Potential sources	Availability
Potable (drinking)	200 kL (for ~30 months)	Council standpipe	Available as required
Non-potable	100 ML (for ~30 months)	Council standpipe	Available as required

Non-potable construction water can be obtained, and potable water (for worker amenities) acquired from a Tamworth Regional Council standpipe. Any potable scheme water used would be trucked in and stored onsite. Confirmation of construction water availability would be provided by the Tamworth Regional Council regarding use of their standpipe.

There are no know existing groundwater licenses beyond stock and domestic within the development footprint. This basic landholder right does not extend to taking water beyond stock and domestic consumption. As such, no water would be extracted under these licences and supply would be restricted to the Tamworth Regional Council standpipe.

Operation

Surface water risks

During operation, there is minimal potential for any impacts to surface water quality to occur. Suitable drainage features would be constructed along internal roads to minimise the risk of polluted water leaving the site or entering the waterways.

Surface water would still drain via the existing ephemeral drainage lines where the installation of solar panels in these 2nd order streams has been demonstrated not to change the local hydrological patterns upon operation (refer Appendix D.8)

As part of pre-construction, the site would be revegetated with grass cover with the exception of internal roads, parking areas and areas around the substation. Solar panels are typically placed in rows with 6–8 m apart and therefore does not concentrate flows off the leading edge to any substantive degree. Permeable soils and shading effects mean while slightly more vegetation may grow at leading edge of panels providing a natural protection to increased water flow / moisture in this area.

As such, water quality impacts during operation would be low and not considered substantially different to the existing potential water quality impacts occurring from onsite activities including grazing, cropping and use of vehicles and machinery.

Flooding modelling results

During operation, the location of permanent infrastructure in areas susceptible to flooding can:

- Increase the risk of flood occurrence or severity, where they impede flow paths,
- Create hazards in the event of a flood to workers onsite, and as for construction and decommissioning,
- Cause pollution risks from leakage of stored pollutants (hydrocarbons, pesticides, solvents)
- Cause physical damage from the mobilisation of components in flood waters.

The addition of the solar arrays and their associated infrastructure will result in an increase in surface roughness over the site, from grazed/cropped pasture to a regular grid of steel piers.

Hydrological modelling was conducted in DRAINS[11] using a RAFTS storage routing model.

The change in floodplain roughness associated with the proposed solar arrays was assessed using the Modified Cowan Method for Floodplain Roughness and is shown in Table 7-4. It demonstrates that the roughness (Mannings's n) is anticipated to slightly increase because of the proposed development.

Table 7-4 Modified Cowan for estimation of floodplain roughness

Roughness component	Existing use (grazing pasture)	Proposed use (solar farm)
Floodplain material (n_b)	n_b	n_b
Degree of irregularity (n_1)	n_1	n_1
Variation in floodplain cross section (n_2)	n_2	n_2
Effect of obstructions (n_3)	0.000	0.003[12]
Amount of vegetation (n_4)	n_4	n_4
Change in roughness (n_5)	0.000	0.003

The effect of obstructions modelled a 2.5% flow area obstruction with panel rows 6-8m apart which resulted in Manning's *n* value adjustment of obstruction effect as 0.003 (refer Appendix D.8)

The area nominated for the proposed substation, battery storage and O&M facilities, including parking areas was assigned a Manning's n value of 3 to reflect the impact of the proposed buildings and structures in these areas. It should be noted that the proposed development would include a network of access roads and these would be constructed from gravel and within the floodplain itself would be constructed at the existing surface level so as not to result in adverse impact on flood behaviour

The hydraulic model was re-run to assess the impact of an increase in surface roughness on flood behaviour. The results demonstrate that there is not predicted to be a significant impact on flood behaviour due to the Project. Specifically:

- Some minor increase in flood level of up to about 20 mm is expected within the solar array field (Figure 7-4).
    - Up to approximately 400 mm increase in flood level within the substation site occurs for the 1% AEP event, with a contrasting reduction in flood levels downstream, due to the significant increase in Manning's n applied to this area. In reality the substation area would likely be subject to cut and fill and local drainage constructed

[11] DRAINS is a hydraulic modelling software program which incorporates Australian Rainfall and Runoff guidelines and is inclusive of sub-catchments and overflow and runoff routes.
[12] Based on an obstruction of 2.5% of available flow area (i.e., 150 mm piers at 5–6 m intervals).

to manage and divert upslope flows around this area so the modelled impacts are likely to overrepresent the actual impact at this location.

- The 1% AEP velocities remain largely unchanged by the development (refer to Figure 7-5), except in the location of the proposed substation site, due to the significant increase in Manning's n at this location, as above.

Installation of the solar array piles within areas traversing ephemeral waterways (1st and 2nd order streams) has likewise shown not to change the maximum flood level by more than 20 mm upon operation (refer Appendix D.8). Changes in maximum flood velocity was shown to be virtually unchanged within the array area which indicates that the overall impact of solar array construction and operation within ephemeral waterways is negligible. This further indicates that these ephemeral waterways are highly intermittent and directly depend on rainfall. Mitigation measures regarding the design of the solar panels will ensure sufficient freeboard from inundation and flood events.

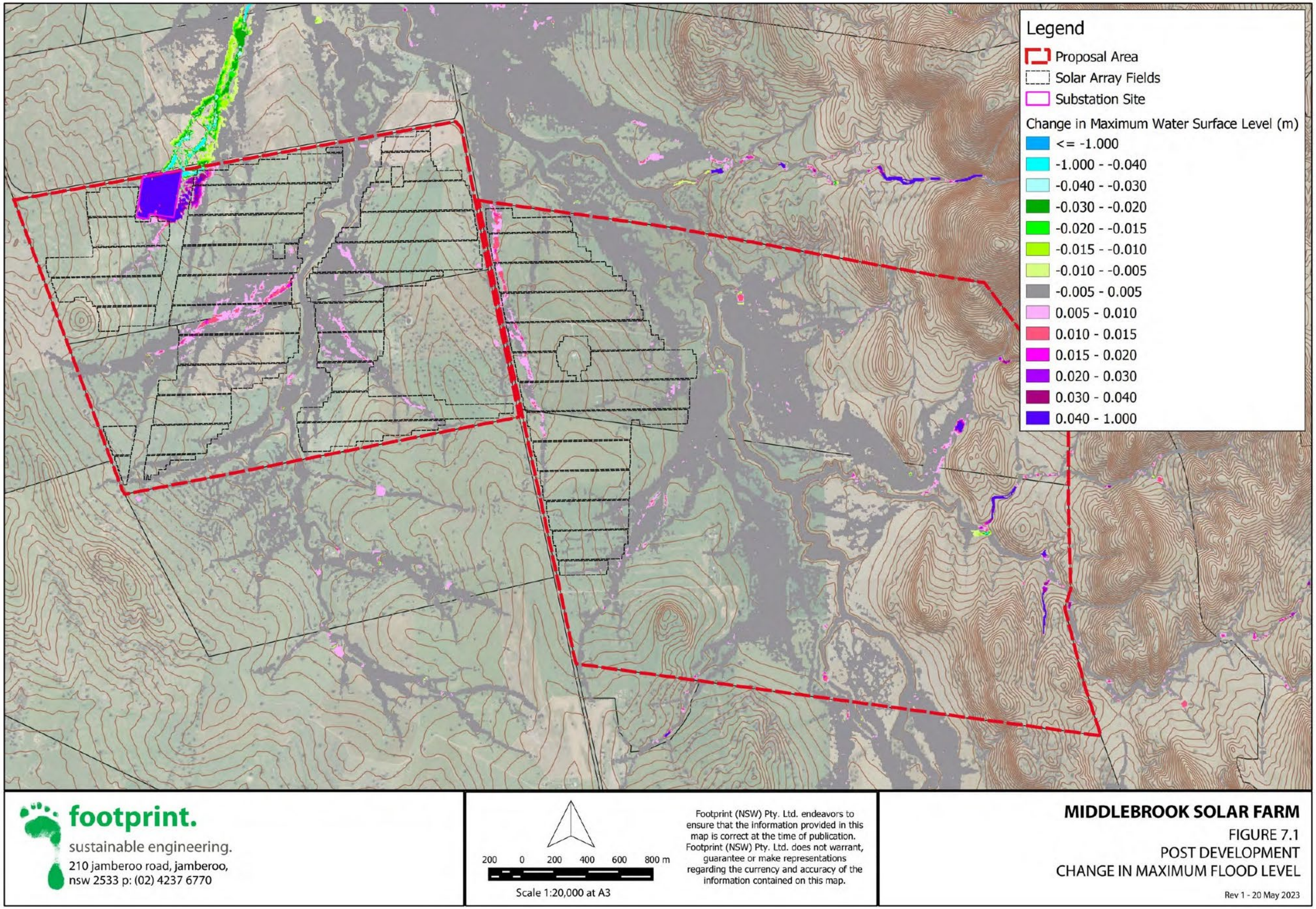

Figure 7-4 Change in maximum flood level (contour interval 1m)

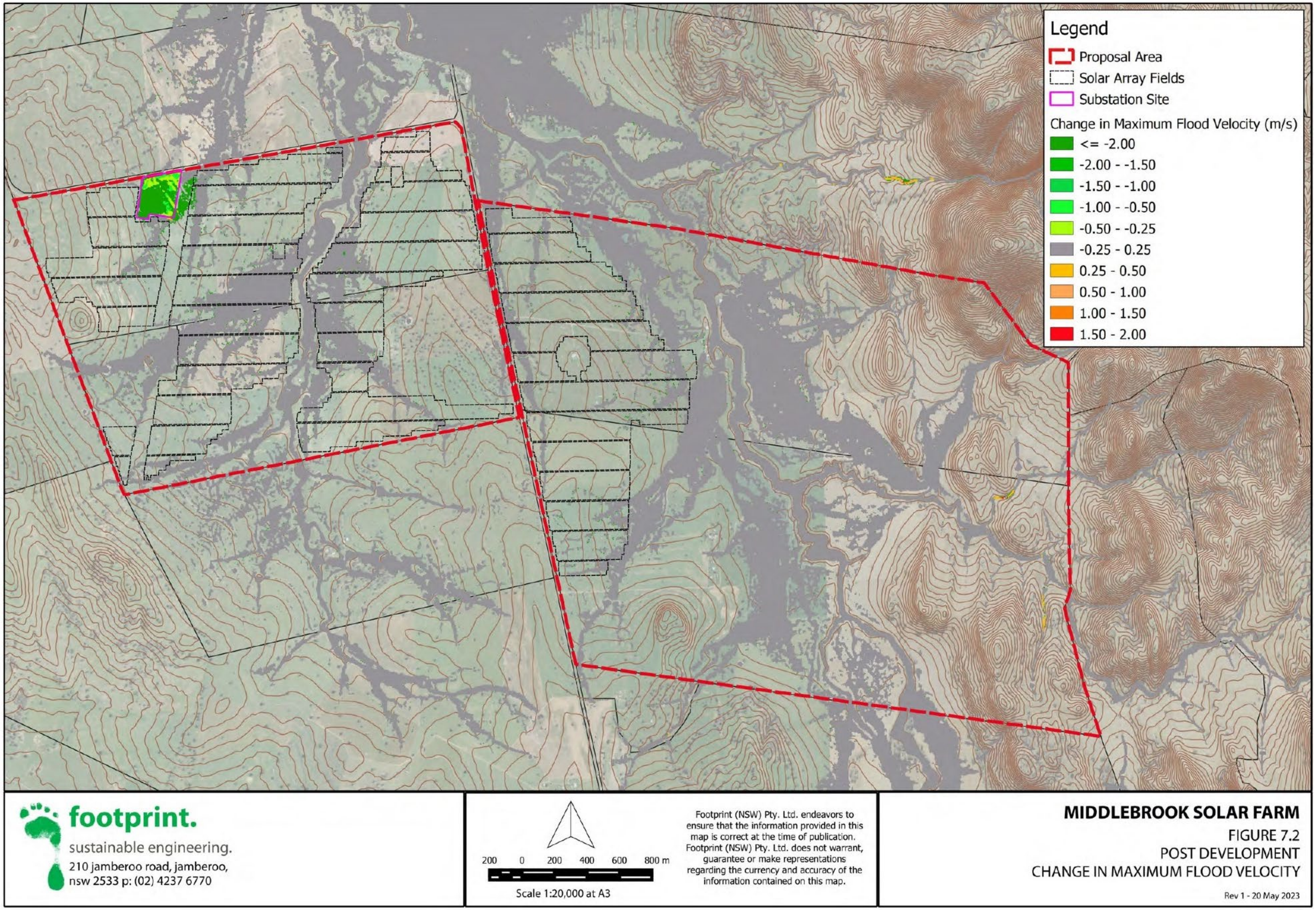

Figure 7-5 Change in maximum flood velocity (contour interval 1m)

Water use

Water use volumes during operation would be minimal, at approximately 10 ML per year, which would be used largely for washing panels and a small amount for plant watering and staff amenities. Panel cleaning requirements would be fully dependant on the weather conditions with washing only being necessary during prolonged periods without rainfall. Some solar plants are never cleaned, others require more than two cleanings per year. Should water be required for panel cleaning, this would be attained from a Council standpipe.

Ablution facilities would be connected to a septic tank installed in line with Tamworth Regional Council requirements.

Approval under section 68 of the *Local Government Act 1993* is required to operate an onsite sewage management system and to draw water from a council standpipe.

Groundwater

The Hydrological Assessment (refer Appendix D.8) has demonstrated that local hydrological patterns would be maintained upon operation and therefore no observable changes to pre-development groundwater conditions are expected. Mitigation measures regarding drainage controls to maintain local hydrology would be incorporated by the detailed designs.

No operational activities would affect groundwater.

7.1.4. Key uncertainties of the assessment

This assessment is modelled using the most reliable computer modelling available at the time of assessment. Actual events may occur more or less frequently, or with more or less intensity then predicted. Adherence to the recommended mitigation measures would minimise any change in hydrological function.

Exact water requirements and supply arrangements will be informed by more detailed evaluation during the final infrastructure and civil works design phase. This will be determined through a competitive tender process to maximise innovation and efficiency and will reflect current water supply availability.

7.1.5. Mitigation measures

The risks of erosion and water quality are considered low given the nature of the development and are well understood with reference to base line soil surveys. Management protocols using standard strategies have a high confidence level in managing the risks identified.

Flooding and impacts on local hydrology have largely been mitigated by restricting the Development footprint to avoiding waterways and areas of increased flood hazard. A suite of design measures is provided within the Hydrological Assessment (refer Appendix D.8) and captured below, to ensure that these risks are further minimised in the design and construction of Project components.

Table 7-5 Safeguards and mitigation measures for hydrology, erosion and water resources.

ID	Mitigation measures	Project stage
W1	Buildings and structures • Located outside high Hazard areas (H5 and above).	Design

ID	Mitigation measures	Project stage
	- Finished floor level of all buildings would be a minimum 500 mm above the 1% AEP flood level. - Drainage works at and around the proposed substation site to manage and divert upslope flows around the area to ensure it remains free of flooding up to the PMF event. Solar panel modules - The tracking axis located above the 1%AEP flood level plus 500 mm freeboard, and the modules rotated to the horizontal during significant flood events to provide maximum clearance to the predicted flood level. - Where located in the floodplain the solar array mounting piers designed to withstand the forces of floodwater (including any potential debris loading) up to the 1% AEP flood event, giving regard to the depth and velocity of floodwaters. Electrical infrastructure - All electrical infrastructure including power conversion stations and substation located above the 1% AEP flood level ***plus*** minimum 500 mm freeboard. Perimeter fencing - Avoid/minimise security fencing in floodplain. - If required, security fencing should be constructed to minimise the effect of flow of the floodwater and be designed to withstand the forces of floodwater or collapse in a controlled manner to prevent impediment to floodwater. - Any fencing across Banyandah Creek should be avoided in preference to creating separate fenced compounds on either side of the creek. Works in waterways - Flood warning signs and flood level indicators placed on each approach to the proposed crossings. - A Business Floodsafe Plan be prepared for the development to ensure the safety of employees during flood events in general accordance with the NSW SES “Business Floodsafe Toolkit and Plan”. - Crossings designed to minimise any hydraulic impact in accordance with Laying Pipes and Cable in Watercourses on Waterfront Land (DPE, 2022) - Crossings designed in accordance with Guidelines for Watercourse Crossings on Waterfront Land (DPIE, 2022). Access roads - Floodplain – keep as close to natural ground levels as possible. Surface treatment – give regard to velocity of floodwaters to minimise potential for souring during flood events.	
W2	All staff would be appropriately trained through toolbox talks for the minimisation and management of accidental chemical (e.g., fuel) spills.	Prior to construction

ID	Mitigation measures	Project stage
W3	All fuels, chemicals, and liquids would be stored at least 50 m away from any drainage lines and would be stored in an impervious bunded area.	Pre-construction Construction
W4	All chemicals and fuels used on-site must be stored and handled in accordance with: The requirements of all relevant Australian Standards. The NSW EPA's *Storing and Handling of Liquids: Environmental Protection – Participants Handbook* if the chemicals are liquids. In the event of an inconsistency, the most stringent requirement must prevail to the extent of the inconsistency.	All stages
W5	Adequate incident management procedures would be incorporated into the Construction and Operation Environmental Management Plans, including requirement to notify EPA for incidents that cause material harm to the environment (refer s147-153 POEO Act).	Construction Operation Decommissioning
W6	The refuelling of plant and maintenance of machinery would be undertaken in impervious bunded areas and at least 50 m away from any drainage lines.	Pre-construction Construction
W7	Machinery would be checked daily to ensure there is no oil, fuel or other liquids leaking from the machinery.	Pre-construction
W8	Ensure appropriate operational drainage controls are incorporated into the design.	Design

7.2. Soil

This Soil Survey (the Report) describes the soil characteristics at the site of the proposed Middlebrook Solar Farm (the Project). It assesses the potential for erosion during construction, operation and decommissioning and provide a benchmark for soil condition for rehabilitation. The solar farm would be located approximately 22 km south of the township of Tamworth, New South Wales (NSW). The Project would generate 500 Megawatts (MW) alternating current (AC) of renewable energy, which would be exported to the national electricity grid.

The Applicant has received the Department of Planning, Industry and Environment (DPIE) Secretary's Environmental Assessment Requirements (SEARs) for the preparation of an Environmental Impact Statement (EIS) for the Project.

The SEARs include a requirement for *'a soil survey to determine the soil characteristics and consider the potential for erosion to occur'*. The SEARs indicate that the land requirements must be prepared in accordance with:

- a soil survey to determine the soil characteristics and consider the potential for erosion to occur.
- A full soil survey to be undertaken prior to works commencing as a benchmark for rehabilitation.
- Acid sulfate soils (Class 1, 2, 3 or 4 on the Acid Sulfate Soil Planning Map).

7.2.1. Assessment approach

A soil survey was undertaken to determine the soil characteristics of the site. The full report is included as Appendix D.9 and is summarised in this section. Specifically, it:

- Sets out the method and results of the soil surveys
- Determines the soil characteristics based on these surveys and desktop resources, including areas that qualify as Biophysical Strategic Agricultural Land
- Assesses the potential for erosion to occur
- Provides a benchmark for rehabilitation strategies, which now form commitments of the Project.

(Note: This soil section is referenced in the detailed assessment of land use compatibility and risks, in Section 6.4).

Desktop resources

The desktop assessment indicates that the topsoil and subsoil of the proposed development footprint is a combination of one or four soil landscapes (Figure 7-6). Soil landscapes include:

- Duri
- Fullwoods Hill
- Goonoo Goonoo
- Warral Station.

Sheet, rill and gully erosion hazards are associated with the soils in most of these soil landscapes, particularly on hillslopes. Suitable erosion and sediment control measures would be required to mitigate the potential for widespread erosion.

Additionally, the desktop assessment indicates that Biophysical Strategic Agricultural Land is mapped within the Subject Land.

Field soil survey methods

The soil sampling and classification was undertaken in accordance with the *Australian Soil and Land Survey Field Handbook* (2009) and the *Australian Soil Classification* (Isbell 1996).

The density of boreholes was undertaken in accordance with the *Guidelines for Surveying Soil and Land Resources* (CSIRO 2008) for a moderately high (detailed) intensity level; thirty-two boreholes were surveyed across the site.

The soil was analysed for topsoil and subsoil pH, electrical conductivity (EC), dispersion, nutrients and cations.

7.2.2. Existing environment

Topography, geology and soil nomenclature

The Subject land typically falls from south-east to north-west with elevation ranging from about 635 m AHD to 460 m AHD. On its eastern flank, the area is bound by relatively steep terrain which rises to an elevation of about 850 m AHD.

Spring Creek is located at approximately 480 metres (m) Australian Height Datum (AHD) at the southern area of the Assessment area and 470 m AHD in the northern area of the Assessment area. Landscape gradient, within the Development footprint to the east of Spring Creek rises from 470 m AHD - 480 m AHD to 500 m AHD. Landscape gradient to the west of Spring Creek, within the development footprint, rises from 470 m AHD - 480 m AHD to 510 m AHD. A 300 m section of the Assessment area rises to a topographic high of 520 m AHD in the north western corner of the Assessment area. A ridgeline is located to the east with maximum topographic highs of 700 m AHD and to the west, topographic highs of 570 m AHD.

The geology of the subject land is predominantly comprised of Carboniferous sedimentary rocks (Geological Survey of NSW 2020). A corridor of Devonian sedimentary rocks (Geological Survey of NSW 2020) occurs in a south – north direction through the middle of the Assessment area. Both geologies incorporate a variety of sedimentary rocks, which include conglomerate, sandstone, siltstone and mudstone (Geological Survey of NSW 2020).

Four soil landscapes occur across the Assessment area and are described in Figure 7-6.

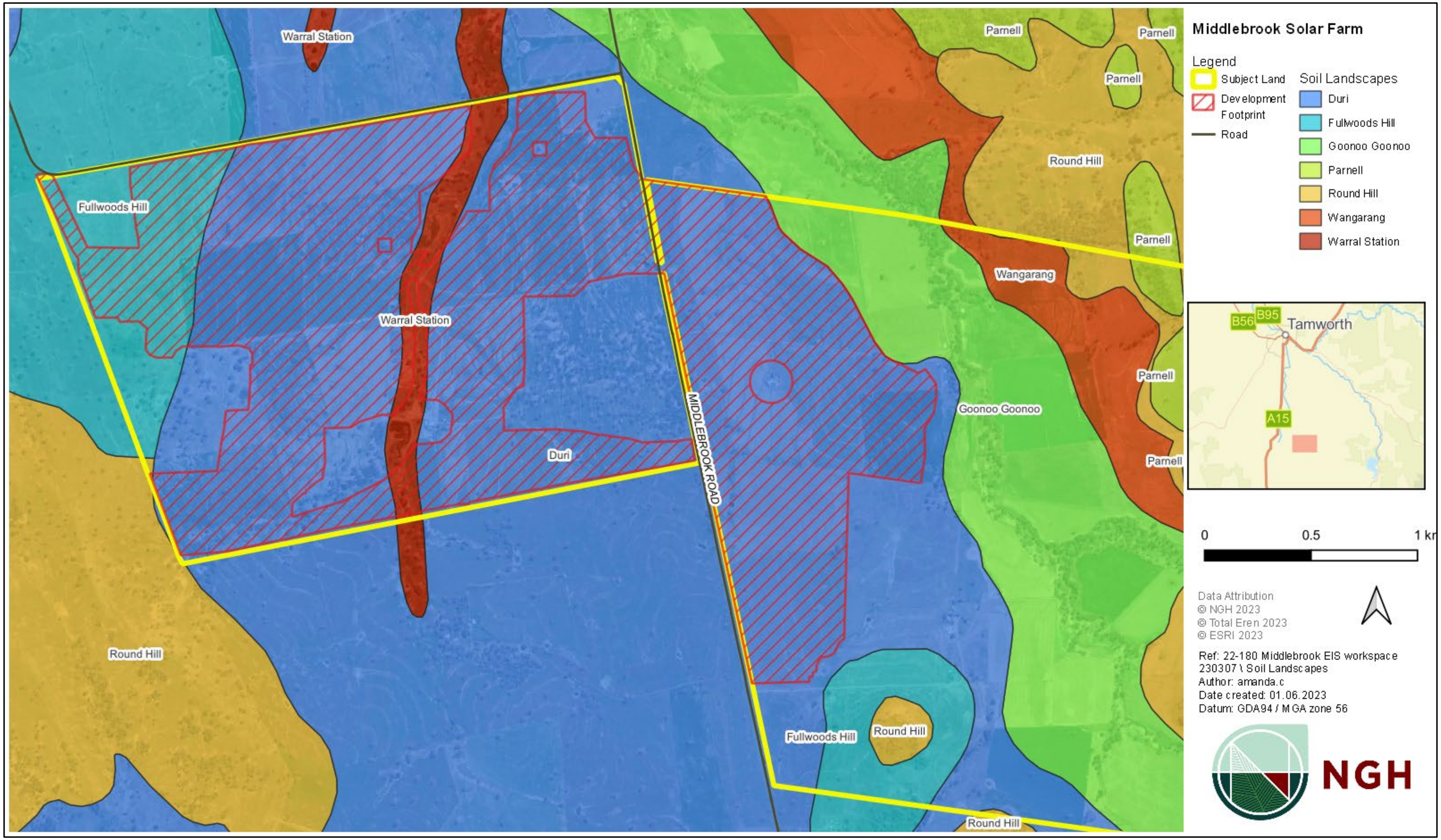

Figure 7-6 Soil Landscapes

Land and Soil Capability Mapping

Land capability is the inherent physical capacity of the land to sustain a range of land uses and management practices in the long term without degradation to soil, land, air and water resources (OEH, 2012). The NSW land and soil capability assessment scheme (OEH, 2012) describes and maps eight land and soil capability classes. The classes range from 1 (best, highest capability land) and 8 (worst, lowest capability land). The classification is based on the biophysical features of the land and soil (including landform position, slope gradient, drainage, climate, soil type and soil characteristics) and susceptibility to hazards. Hazards include water erosion, wind erosion, soil structure decline, soil acidification, salinity, waterlogging, shallow soils and mass movement.

The Project is located on land mapped in Capability Class 3 (high capability land) on the eastern plains adjacent to Spring Creek, Class 4 (moderate capability) on the far eastern and western slopes, and class 5 (moderate to low capability) on areas of the southern and far western steeper slopes, and the drainage line. Class 3 is defined as having moderate agricultural limitations with careful management required. Class 4 has moderate to high agricultural limitations with restricted management options. Class 5 is defined as having high to severe limitations for high impact land management uses.

Table 7-6 provides and overview of Class 3, Class 4 and Class 5 under the *Land and Soil Capability Assessment Scheme* (OEH, 2012). Land capability across the site is mapped in Figure 7-8.

Table 7-6 Land and soil capability class, 3, 4 and 5

Class	Broad category	Description
Class 3	High capability land	Land has moderate limitations and is capable of sustaining high-impact land uses, such as cropping with cultivation, using more intensive, readily available and widely accepted management practices. However, careful management of limitations is required for cropping and intensive grazing to avoid land and environmental degradation.
Class 4	Moderate capability land	Land has moderate to high limitations for high-impact land uses. Would restrict land management options for regular high-impact land uses such as cropping, high-intensity grazing and horticulture. These limitations can only be managed by specialised management practices with a high level of knowledge, expertise, inputs, investment and technology.
Class 5	Low to moderate capability land	Land has high to severe limitations for high impact land management uses such as cropping. Very few land management practices can overcome this severe limitation. Land is generally more suitable for grazing and very occasional cultivation for pasture management.

Biophysical Strategic Agricultural Land

A corridor of mapped Biophysical Strategic Agricultural Land (BSAL) transects the subject land, adjacent to the left and right banks of Spring Creek (Figure 7-8). The BSAL land is managed under the Strategic Regional Land Use Plan – New England North West (NSW Government 2012). BSAL land features quality soil and water resources that can sustain high levels of agricultural productivity (NSW Government 2013).

The BSAL assessment for the Project has followed the prescribed procedures for site assessment of BSAL in the *Interim protocol for site verification and mapping of biophysical strategic agricultural land* (NSW Government 2013). The area mapped as Class 3 Agricultural land has been tested and verified as mapped BSAL (refer Figure 7-7).

The purpose of mapping BSAL is to ensure competing land use Projects on this category of land are managed effectively.

Soil limitations

The topsoils across the site indicate good capability for agricultural use. The results show the soils have:

- pH range most suitable for plant growth.
- Salinity low to very low.
- Cation exchange capacity indicates a high ability for the soil to retain plant nutrients.
- Exchangeable sodium percentage indicates non-sodic topsoils.

The physical and chemical properties of the soils indicate that the productive capacity can be improved with the addition of nutrients and soil conditioners.

Limitations to sustained agricultural use were also identified. These include susceptibility to erosion and temporary localised waterlogging.

Through comprehensive testing of soils in the site, Class 4 and Class 5 land were also verified as mapped accurately in the soil landscape mapping database.

Potential contamination

A search of the NSW EPA contaminated land public record (NSW EPA 2020) was undertaken for contaminated sites within the Tamworth LGA on 13 March 2023. None are relevant to the site.

It is noted that unrecorded contamination can be associated with past agricultural activities (such as use and storage of pesticides and fuel) and may be relevant to this site. No evidence of contamination was observed during the field work, however.

The NSW Government (2023) mapping of Acid Sulfate Soil (ASS) indicates the site is not in an area of risk. SEED mapping (NSW Government 2023) was undertaken on 27 March 2023; no known acid sulphate soil deposits occur in proximity to the subject land. SEED mapping is a NSW government resource which contains up to date spatial data for different data sets such as soil, hydrology and Groundwater Dependent Ecosystems.

The Tamworth LGA is classed as an area identified by NSW EPA (2020b) as containing geological units with low, medium and high naturally occurring asbestos (NOA) potential. The geological units of the range around 12 km east of the Project contains geological units with low to high NOA. However, it is unlikely that the minor earthworks required during construction would impact on any NOA.

Table 7-7 Soil landscapes within the Development footprint

Landscape unit in Assessment area	Soil landscape	Geology	Soil fertility	Typical soil erosion
Rolling hills west of Spring Creek and not including drainages	DURI (du)	Geological Unit as described in the Soil Landscape: Devonian and Carboniferous sedimentary rocks. Parent Rock: conglomerate, sandstone, siltstone and mudstone. Parent Material: In situ weathered parent rock with alluvium in the drainage lines.	Moderate	High erodibility under concentrated and non-concentrated flows. Low erosion hazard for sheet-flow under grazing conditions and moderate to high under cropping.
Topographic highs of the western and southern areas of the development footprint	FULLWOODS HILL (fh)	Geological Unit as described in the Soil Landscape: Folded Devonian and Carboniferous rocks of the Duri Hills. Parent Rock: Lithologies in the Devonian formations include arenite, polymictic conglomerate, greywacke and mudstone. Lithologies in the Carboniferous formations include arenite, sandstone, polymictic conglomerate and siltstone. Parent Material: In situ weathered parent rock with alluvium in the drainage lines.	Moderate	Sheet erosion is common on hillsides. Decline of soil structure common where compacted by stock. High to very high erodibility and erosion hazard under concentrated flows. Dispersible sodosol subsoils create extremely high erosion risk (*Alt et al*. 2009). Moderate to high shrink-swell potential in subsoils.
Tributary drainage (Banyandah Creek)	WARRAL STATION (ws)	Geological Unit as described in the Soil Landscape: Permian and Carboniferous metasediments and sedimentary rocks. Parent Rock: Metasediments and sedimentary rocks. Parent Material: Alluvium derived from metasediments and sedimentary rocks. Regolith includes coarse gravels, clay sands and silts.	Variable	Sheet and gully erosion risks of the drainage plains caused by high run-on. Soils have high erodibility and erosion hazard under concentrated flows. Sodic and saline soils present a high erosion hazard (Alt et al. 2009). Moderate to high shrink-swell potential in subsoils.

Table 7-8 Soil limitations by soil type

Soil type	Erosion hazard	Salinity risk	Acid Soil	Waterlogging risk	Acid Sulphate Soils	Infrastructure stability
Chromosol	Low	Low	Yes	Moderate and localised.	No	Low
Sodosol	Very high	Low	No	Moderate and localised.	No	High – due to erosion hazard

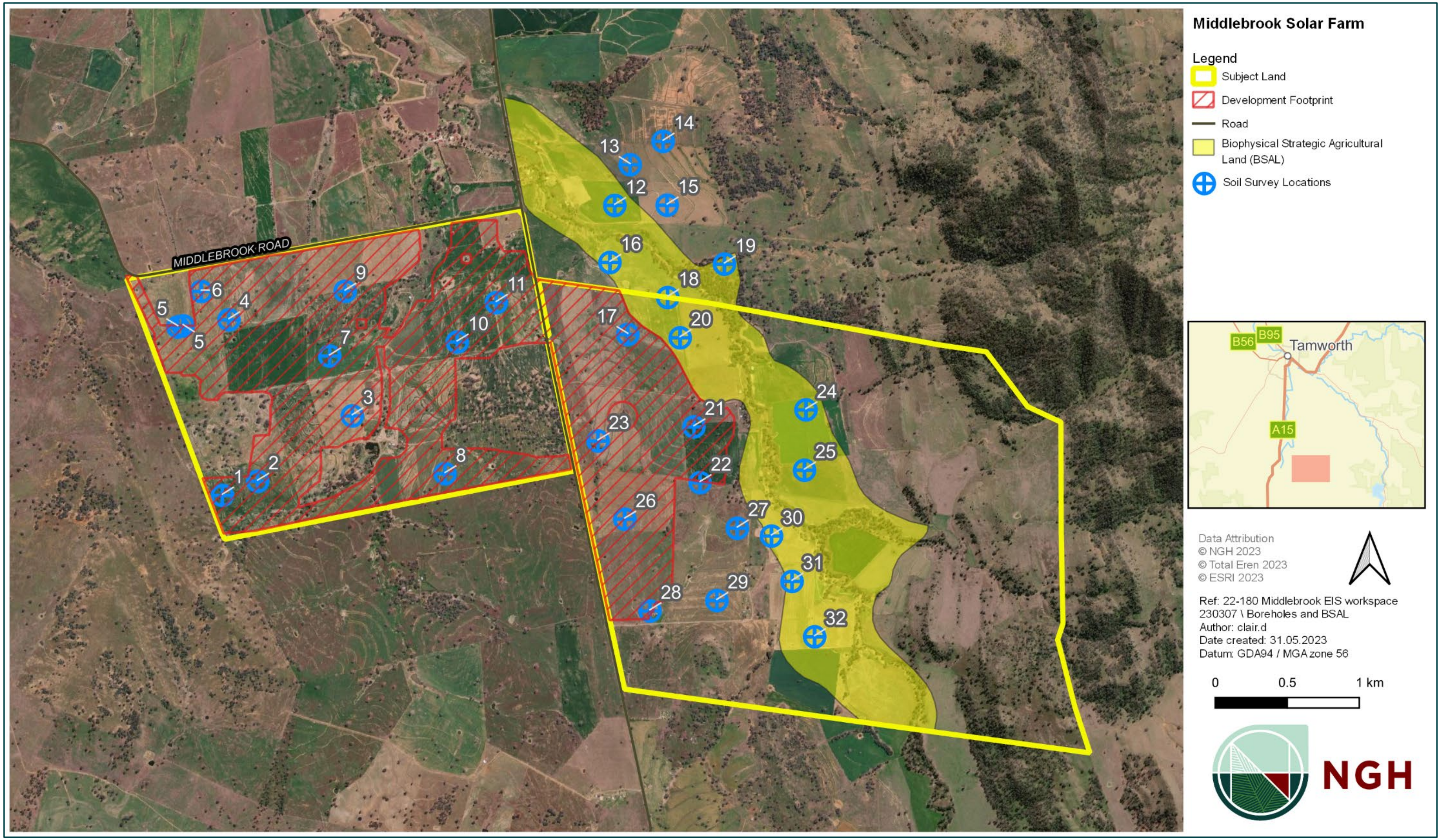

Figure 7-7 Soil survey locations and results

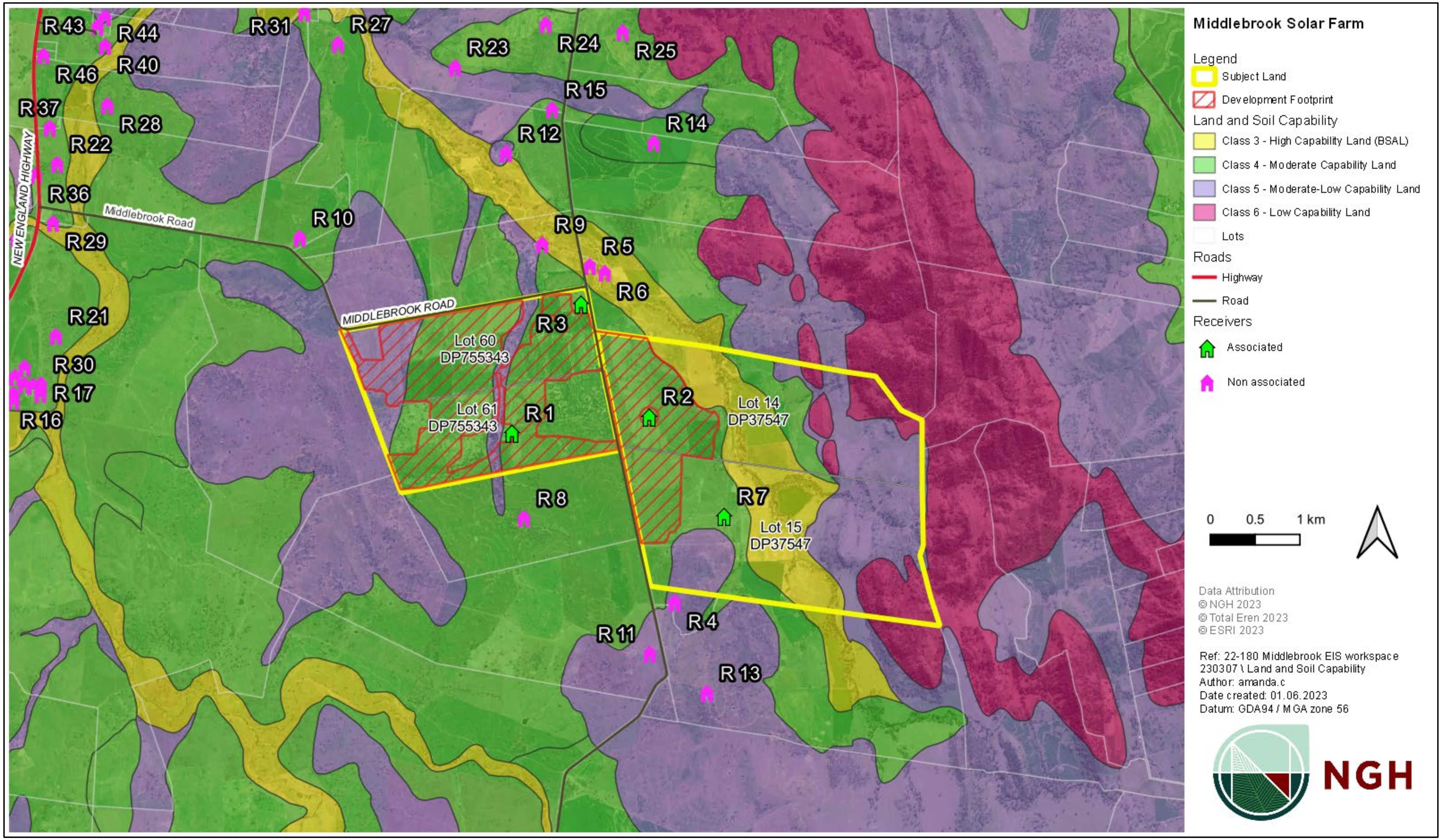

Figure 7-8 Soil capability and BSAL

7.2.3. Potential impacts

Construction and decommissioning

Construction activities and decommissioning activities would be similar in terms of their impacts on soils. The key construction activities impacting soils would be excavation and associated earthworks to establish:

- Road upgrades on Middlebrook Road and its intersection with the New England Highway, and associated drainage.
- A network of access tracks, including drainage, throughout the Development footprint and along its perimeter.
    - 50 km of internal tracks this would be approximately 25 ha of disturbance which represents 4.7% of the total development footprint.
- Benching for the substation area.
- Footings for the battery and substation components, operations and maintenance buildings as well as temporary staff amenities and offices required for the construction phase only.
- Hardstands for construction compound and parking areas.
- The Project would be decommissioned at the end of its operational life, removing all above ground infrastructure and all infrastructure to a maximum depth of 500 mm below ground level with the exception of the onsite substation and TransGrid connection assets. Rehabilitation targets set in relation to site soil surveys will ensure the site is returned to its existing (or better) land capability for future generations.
- Verification of no adverse restoration of land capability.

These activities have the potential to disturb soils, cause soil erosion and generate sedimentation if they are not managed carefully.

These areas would be rehabilitated progressively as soon as practical, either as part of the construction program for temporary construction areas or during decommissioning for operational infrastructure. During decommissioning, this would include removal of all footings, all cabling up to 500 mm deep and the restoration of the soil profile and seeding to re-establish ground cover. These commitments are set out in Section 7.2.5.

For the vast majority of the Development footprint, soil disturbance would be limited:

- Existing ground cover beneath the array areas would be retained as piles or discrete footings are installed to support the solar panels modules (piles would be driven or screwed into the ground to a depth of 1.5 m – 2.5 m).
- Small area linear impacts that would be stabilised and rehabilitated progressively include:
    - Cable trenches up to 5 m wide and 1,500 mm deep.
    - Construction of perimeter security fencing, 16.23 linear kilometres

Areas most vulnerable to soil erosion are those mapped as Fullwoods Hill located at the northwest side of the site where the site entry and laydown areas would be located (refer Figure 7-6). Warral Station soil type is associated with Banyandah Creek which traverses the western side of the site.

Best practice soil management practices can be employed to minimise risks of erosion, soil compaction and contaminants being introduced to the soil profile. The key management tool is the

Soil and Water Management Plan during construction. Key management strategies to be detailed in this plan include:

- Excavated subsoils would be stockpiled and contained to avoid potential dispersion and sediment transfer.
- Topsoil salvaged from the construction of the access tracks and other works would be handled and stockpiled as per The Blue Book (Landcom 2004) and used in site rehabilitation.
- Groundcover would be retained as far as practicable prior to and during construction.
- Compacted areas (such as construction compound areas) would be rehabilitated as part of the construction program.
- Storage and handling of potential pollutants would be strictly managed, and spill protocols developed to be implemented in the event of a spill.

The soil properties and topography indicate that construction and decommissioning can be managed to protect the soil resource. Conditioning treatments may be used to assist the rehabilitation process.

High risk windows are considered to be related to weather. Prolonged wet weather will increase the damage caused by construction and may increase the risk of pollutants being discharged and spreading in the landscape. It will also slow restoration actions. Wet weather contingency planning is included in the mitigation commitments to address this higher risk issue.

Operation

The primary risk to soils during operation is the development of bare ground and subsequent erosion. The leading edge of panels will deposit rain fall in a more concentrated manner, creating a higher risk area. Soil landscapes Warral Station and Fullwoods Hill show greater vulnerability to erosion. Warral Station are located predominantly along Banyandah Creek and represents 10 ha of the development footprint. Fullwoods Hill landscapes represent approximately 40 ha and is located in the northwest of the site.

Generally, in consideration of the soil properties and the solar panel row spacing of up to 8 m and module size of up to 3 m in height, concentrated runoff from the panels is not anticipated to lead to erosion but to drain freely. It is more common for operational solar farms to show higher grass growth beneath the leading edge of the panel as a response to this increase in moisture and other microclimate effects of the panels. The panel tracking system as opposed to fixed panels also reduces this risk, spreading rainfall more than a fixed system. The commitment to monitor ground cover throughout operation and develop triggers for remedial actions ensures the risks will be well managed.

Other operational effects include:

- Less soil disturbance when compared to ceased agricultural activities, such as tilling or harvesting. There is potential for the resting afforded to the site to improve soil health.
- Less compaction when compared to ceased agricultural. Operational maintenance activities and vehicles would be confined to the formalised access tracks, minimising impacts to soils.

There would remain a risk of soil contamination in the event of a chemical spill (fuels, lubricants, herbicides), although there would be only small quantities of such chemicals kept on site. This is considered highly manageable.

7.2.4. Key uncertainties of the assessment

The indicative layout may change during the detailed design in consideration of optimisation that comes out of the Engineering Procurement Contract stage. However, it is likely to be less not more than the areas assessed above, ensuring this assessment and its mitigation strategies are robust to minor changes that occur at this time.

The soil characteristics presented in this assessment are considered to have high confidence as they have been validated by site surveys and the mitigation strategies adopted are standard approaches with high confidence of successful implementation.

7.2.5. Mitigation measures

As the total area of soil disturbance exceeds 0.2 ha, a Soil and Water Management Plan is appropriate. This would incorporate site specific sediment control plans and protocols to manage unexpected finds (contaminants) and spills, as detailed below. Operational management plans include ground cover management and spill protocols.

Table 7-9 Safeguards and mitigation measures for soils

ID	Mitigation measures	Project stage
SO1	A Soil and Water Management Plan (SWMP) including site specific Erosion and Sediment Controls would be prepared, implemented and monitored during the construction of the proposal, to minimise soil and water impacts. The SWMP would be prepared in accordance with the 'Blue Book' Volume 1 Managing Urban Stormwater: Soils and Construction (Landcom 2004) and include: • At the commencement of the works, and progressively during construction, install the required erosion control and sediment capture measures. • Regularly inspect erosion and sediment controls, particularly following rainfall. • Maintain a register of inspection and maintenance of erosion control and sediment capture measures. • Ensure that machinery leaves the site in a clean condition to avoid tracking sediment onto public roads. • In all excavation activities, separate subsoils and topsoils and ensure that they are replaced in their natural configuration to assist revegetation. • Stockpile topsoil appropriately to minimise weed infestation, maintain soil organic matter, and maintain soil structure and microbial activity. • Manage works in consideration of heavy rainfall events. • Areas of disturbed soil would be rehabilitated promptly and progressively during construction. • Spill procedure. • Unexpected, contaminated finds procedure.	Construction
SO2	Best practice management measures should be employed where applicable to reduce the risk of erosion and sedimentation control:	Construction

ID	Mitigation measures	Project stage
	• Preserve and stabilise disturbed areas, drainageways and steep slopes. • Minimise the extent and duration of disturbance. • Install perimeter controls. • Employ the use of sediment control measures to prevent off- and on-site damage. • Control stormwater flows onto, through and from the site in stable drainage structures.	

SO3	A Groundcover Management Plan developed in consultation with a soil scientist and an agronomist would take into account soil survey results to ensure perennial grass cover is established across the site as soon as practicable and maintained throughout the operation phase. The Groundcover Management Plan would cover:
	• Soil restoration and preparation requirements.
	• Species selection.
	• Soil preparation.
	• Establishment techniques.
	• Maintenance requirements.
	• Perennial groundcover targets, indicators, condition monitoring, reporting and evaluation arrangements:
	    ○ Live grass cover would be maintained at or above 70% to protect soils, landscape function and water quality.
	    ○ Any grazing stock would be removed from the site when cover falls below this level.
	    ○ Grass cover would be monitored using an accepted methodology.
	• Contingency measures to respond to declining soil or groundcover condition.
	• Identification of baseline conditions for rehabilitation following decommissioning.
		Operational

SO4	The array would be designed to allow sufficient space between panels to establish and maintain groundcover beneath the panels and facilitate weed control.	Design
SO5	Wet weather contingency planning would be undertaken to protect soils from compaction.	Construction

7.3. Air quality and climate

7.3.1. Assessment approach

Consideration of local climate is important in managing construction and operational impacts of Projects. Climatic conditions can have a strong relationship to:

- Soil and water impacts and management
- Rehabilitation of disturbed areas and groundcover management
- Traffic impacts, including dust.

A desktop assessment was undertaken to understand air quality and climate impacts particularly:

- Existing conditions, which provide a base line to evaluate Project impacts.
- Risks, such as prolonged dry or wet weather events which may exacerbate impacts.

The results of community consultation activities have also been included specifically in relation to:

- Local conditions.

The broader climate impacts of the Project are also considered.

7.3.2. Existing environment

Local air quality

A search of the National Pollutant Inventory (Australian Government, 2023) identified 64 air substance emissions facilities located within the Tamworth Region LGA. The nearest of these is the Baiada Loomberah Road Poultry Facility located approximately 12.5 km northeast of the Project.

The population density in the locality is sparse, ten residences are located within 2 km of the Assessment area. Adjoining land use is agricultural, including grazing and cropping for agriculture, however, accommodation is also offered at Goonoo Goonoo Station at least one local Air BnB.

In this context, the air quality around the Assessment area is expected to be good and typical of that found in a rural setting in northern NSW. Existing sources of air pollution are few, dominated by:

- Vehicle emissions from the New England Highway, a major transport corridor for the region.
- Dust from the local unsealed road network.
- Agricultural activities including sowing, harvesting, applications of soil treatments (fertilisers and lime applications), applications of herbicides, as well as limited burning and earth moving activities.
- Smoke from residential wood burning stoves and fires.

Climate

The Tamworth Region LGA is part of the NSW Brigalow Belt South Bioregion, Lachlan Plains subregion. The Brigalow Belt South lies within Australia's semi-humid climatic zone with minor patches to the southeast within temperate zone, with a warm summer and no dry season (OEH 2016).

The BoM (2020b) climate records available from the nearest climate station at Tamworth Airport (station no. 055325, approximately 22 km northwest of the Project) indicate a mean summer maximum of 33.1°C (January) and a mean winter minimum of 2.2°C (July) (BOM, 2023).

Rainfall records from the same station show a mean annual rainfall of 618.3 mm, and that rainfall is generally greatest over summer, with the average monthly maximum occurring in November (81.2 mm).

Extended dry weather is known to exacerbate from the local unsealed road network.

Extended wet weather is known to comprise the trafficability of some sections of the local unsealed road network.

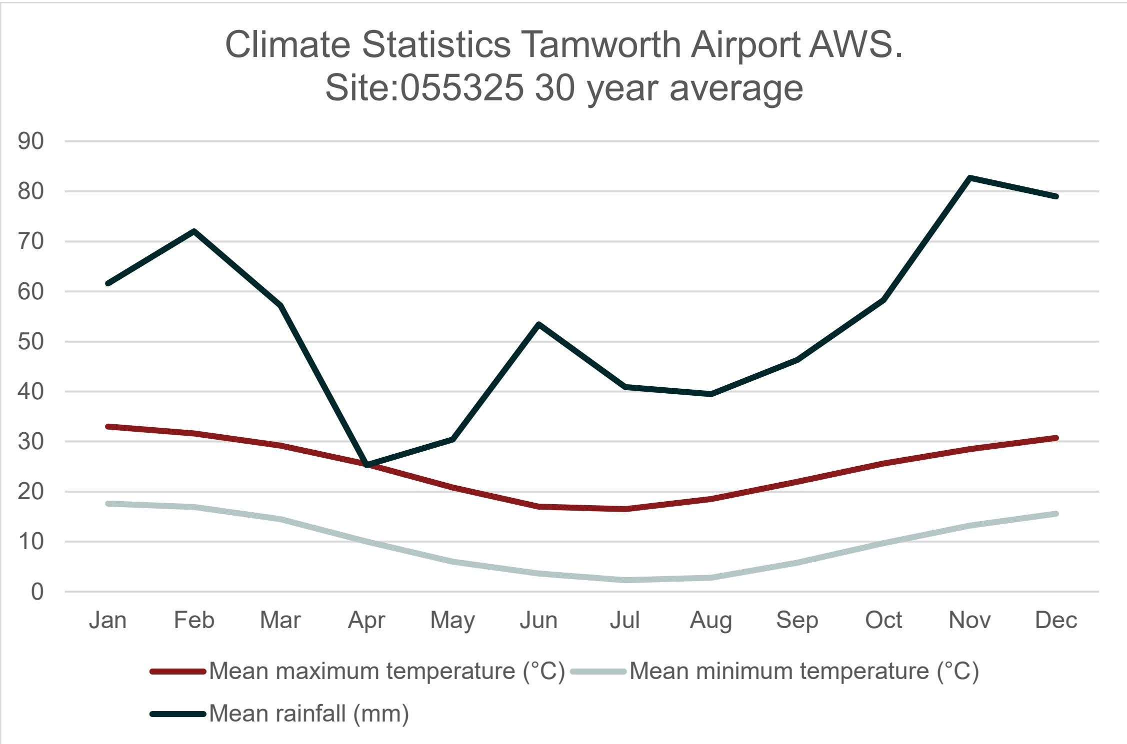

Figure 7-9 Climate statistics for weather station nearest to the Project (BOM, 2023).

Climate change

Climate change refers to the warming temperatures and altered climatic conditions, largely associated with the increased concentration of greenhouse gases in the atmosphere. These include carbon dioxide, methane and water vapour.

Climate change projections for Australia include continued warming with more extremely hot days and fewer extremely cool days, A further decrease in cool season rainfall across many regions of the south and east more intense short duration heavy rainfall events and a longer fire season for the south and east and an increase in the number of dangerous fire weather days (BOM, 2022). Considered specifically by region, in 2014, the NSW OEH published climate change projection snapshot reports for the NSW and ACT governments as part of the NSW and ACT Regional Climate Modelling (NARCliM) project. The study focused on projections for two future 20-year time periods: 2020-2039 as the near future and 2060-2079 as the far future. The snapshot included the analysis of over 100 climate variables, including temperature, rainfall, and wind.

The projected climatic changes by 2030 (near future) for the New England North West region of NSW, which the Project site is located in, included increased temperatures and a change in the rainfall distribution, as follows:

- Maximum temperatures are projected to increase by 0.4 to 1.0 degrees Celsius.
- Minimum temperatures are projected to increase by 0.5 to 1.0 degrees Celsius.
- The number of hot days would increase and cold night decrease.
- Rainfall is projected to decrease in winter and increase in autumn.
- The risk of fire is projected to increase during summer, spring and winter.

Rural and regional communities are considered to be disproportionately affected by the impacts of climate change, through worsening extreme weather events and impacts to capacity, productivity and resilience in some rural industries (Climate Council, 2016). A significant proportion of Australian exports are agricultural products that are sensitive to global warming impacts (AGO, 2003). Some incremental adaptations in agricultural enterprises would be straightforward, but the more transformational adaptive changes may be risky and expensive, especially for individual farmers (Climate Council, 2016).

7.3.3. Potential impacts

Construction and decommissioning

The key impacts of the project on air quality and climate during construction and decommissioning relate to the generation of dust and vehicle emissions. Dust and emissions can be a nuisance, interfere with visibility when driving or lead to adverse health impacts when severe or prolonged (Dean and Green 2017). Emission of greenhouse gases from vehicles and plan are likely to contribute to climate change.

The areas of excavation and associated earthworks for the Project (as set out in Section 7.2 Soils), are relatively discrete in relation to the size of the site; as a percentage of the Development footprint, these areas can be quantified as around 5% or 26 ha, based on the indicative layout presented in Section 3.

The construction phase is expected to last between 24 and 30 months, with a peak period lasting approximately 18 months. During this time, emissions would be generated from earth-moving equipment, diesel generators, trucks, cranes and pile driving equipment. Vehicles accessing the site would include the construction labour force, largely using shared (shuttle bus) transport, (up to 400 construction personnel during the peak period) and haulage traffic delivering construction components (as detailed in 6.3). Plant and machinery would generate emissions during operation as well as dust when travelling on 3,955 m of unsealed access way between the New England Highway and the site access on Middlebrook Road, onsite, via the 50 km network of unsealed access tracks on site and for 30 m to cross Middlebrook Road, to connect the west and eastern portions of the Project site.

The closest uninvolved receivers to these impacts would be R10 located 182 m from Middlebrook road on the unsealed section and R29 located 158 m from Middlebrook road on the sealed section between the highway and the bridge.

Climate can act to influence the impacts of construction and decommissioning on the environment. For example, hot, dry or windy conditions can exacerbate adverse air quality impacts (such as dust; Dean and Green 2017). For Middlebrook the higher impact seasonal windows are anticipated to be Summer and Autumn.

It is noted that the NSW *Pollution of the Environment and Operations Act* 1997 regulates emissions. It requires that no vehicle shall have continuous smoky emissions for more than ten seconds. Limits on dust emission of less than 4 mg/m^2/month are also specified by the NSW Environmental Protection Agency.

In addition, the Project can take measures to minimise dust generated on local roads and the Project site by providing water trucks to dampen roads when required and enforcing strict traffic protocols (to regulate site access and traffic speeds). These provisions have been recommended in Section 7.1.5 and now form commitments of the Project.

Operation

The impacts discussed above would negligible during operation.

Maintenance traffic would be low. During operation the Project is expected to generate a maximum of 20 vehicles per day. The lithium batteries within the BESS are expected to need replacing at least once during operation resulting in additional heavy vehicle movements. This would result in some minor, localised vehicle emissions and generation of dust from vehicles travelling on the unsealed access roads, although traffic protocols would continue to be enforced during operation.

Reduction of dust causing agricultural activities, such as ploughing and burning stubble, would offset the dust generated by the Project. The Project's commitment to rehabilitate all areas disturbed during construction and to maintain perennial ground cover beneath the panels for the life of the Project, will lead to less erosion and dust than under conventional agricultural land use.

Operational emissions would be present for light vehicles accessing the site and general maintenance of the site, movement of livestock in operation times such as mustering or moving paddocks, movement with equipment such as quadbikes, side by sides and light vehicles related to animal husbandry practices.

The operation of the solar farm would produce minimal CO_2 emissions when compared to current agricultural operations and many times less when compared to conventional electricity generation projects, such as coal and gas fired powered stations (Table 7-11). As discussed in section 2.1, a key benefit of the Project is its positive impact on reducing greenhouse gas emissions and moving electricity generation towards cleaner electricity generation. The Project would power the equivalent of about 153,000 NSW homes.

Table 7-10 Comparison of CO_2 equivalent emissions produced per kilowatt hour for the lifecycle of the asset.

Generation method	Emissions produced (grams CO_2 equivalent per kWh)	Source
Photovoltaic solar farm	19-59	Wright and Hearps (2010)
Coal-fired power station	800-1000	Wright and Hearps (2010)
Combined cycle gas turbine	400	Alsema *et al.* (2006)

7.3.4. Key uncertainties of the assessment

The key driver for site conditions is the impact of climate change, dust generated during dry periods is expected to be higher in dry and windy weather and is expected to be generated from traffic/agricultural machinery on unsealed roads and bare areas of ground. During colder months, there may be a small increase in air contaminants due to smoke emissions from the operation of solid fuel heating. Locally this would be negligible given the low density of settlement within the locality. The behaviour of the smoke emissions may, however, be determined by the movement of air through the landscape.

The mitigation strategies presented below are considered industry standard. There is a high degree of confidence they will manage dust and emissions effectivity, particularly in relation to near neighbours.

7.3.5. Mitigation measures

Table 7-11 Air quality mitigation measures

ID	Mitigation measures	Project stage
A1	Management protocols will include measures to minimise impacts on air quality including: • Identification of high-risk construction activities with potential to generate dust, and control measures for the activities. • A process for monitoring dust on-site and weather conditions, as well as procedures for altering management measures where required. • A map identifying locations of sensitive receivers. • Notification of relevant stakeholders to hours of work and duration of work • An accessible complaints process with a timely response protocol.	All stages
A3	Dust generation by vehicles accessing the site and earthworks at the site will be suppressed using water applications or other means as required, using visual cues and in response to complaints.	Construction/ decommissioning
A4	Stockpiles will be covered or stored in areas not subject to high winds, and vehicle loads of material which may create dust would be covered while using the public road system.	Construction/ decommissioning
A5	All vehicles and machinery used at the site will be in good condition, fitted with appropriate emission controls and comply with the requirements of the POEO Act, relevant Australian standards and manufacturer’s operating recommendations. Plant will be operated efficiently and turned off when not in use.	All stages
A6	Fires and material burning is prohibited on the Solar Farm site.	All stages
A7	Works that disturb vegetation, soil or stockpiles will not be carried out during strong winds (over 40 km/h).	Construction

ID	Mitigation measures	Project stage
A8	The use of renewable fuels/power sources for construction will be investigated and implemented where appropriate.	Construction
A9	Materials will be delivered as full loads, and local suppliers utilised where possible, to minimise haulage emissions.	Construction

7.4. Resource use and waste generation

7.4.1. Assessment approach

Key resources required to construct and operate the Middlebrook Solar Farm, and their estimated quantities, have been included in Section 3. This section investigates the availability of these resources, potential for avoiding waste as well as reuse, recycling and disposal options. It has been undertaken by desktop research, based on the experiences at other solar farms and through research into emerging disposal opportunities in Australia.

The legal requirements for the management of waste are established under the NSW *Protection of the Environment Operations Act* 1997 and the *Protection of the Environment Operations (Waste) Regulation 2005* (POEO Act). Unlawful transportation and deposition of waste is an offence under section 143 of this act.

The NSW *Waste Avoidance and Resource Recovery Act 2001* sets out the resource management hierarchy principles to encourage the most efficient use of resources and to reduce environmental harm. Adopting these principles is also consistent with the principles of Ecologically Sustainable Development. The *Environmental Planning & Assessment Act 1979* (EP&A Act) references five principles relevant to Ecologically Sustainable Development:

1. Intergenerational equity
2. Protection of biodiversity and maintenance of essential ecological processes
3. Integration of economic, social and environmental factors
4. The precautionary principle
5. Adoption of policy instruments such as improved valuation, pricing and incentive mechanisms.

7.4.2. Existing environment

The site is utilised for agricultural practices, and therefore current waste streams pertain to agricultural products such as chemical disposal, machinery waste (e.g., batteries, tyres), and general waste such as packaging, and minor building materials.

Regional capabilities are highly relevant for ensuring reuse, recycle options are fully explored. In the local there are:

- Waste disposal and recycling at Tamworth waste management facility located 123A Forest Road North Tamworth approximately 37 km from site
- Scrap metal recycling facilities are located within Tamworth
- Private plastic waste and Bottle recycling available within Tamworth
- Local high schools with trade programs
- Local gardeners and farmers who may be interested in composted materials.

The table below summarised the likely resources and waste streams relevant to the Project, by stage.

Table 7-12 Resources and wastes relevant to the Project stages and potential for reuse

	Components	Stage	Reduce/Avoid	Reuse	Recycle
Fuels and lubricants	Fuels and lubricants	All Stages	Fuelled in appropriately bunded area. Fuels and lubricants to be kept in appropriate containment areas.	N/A	N/A
Fertilisers and herbicides	Plastic containers Packaging Chemical waste	All Stages	Fertilisers, herbicides kept in appropriately bunded and locked shed	N/A	Empty containers triple rinsed and disposed of at accredited drumMUSTER site.
Vegetation	Landscaping products. Vegetation recovered from site.	Construction and decommissioning	Minimise disturbance areas	Mulch stored away from infrastructure.	90% composted for reuse in landscaping onsite or in local initiatives
Soil	Excavation	Construction	Minimise disturbance footprint, ensure cut and fill balance.	Soil to be retained and reused onsite.	N/A
Packaging (timber)	Pallets, Timber cable drums	Construction Operation	N/A	Offer to local TAFE, High School and Art community	90% repurpose pallets and cable drums
Packaging (plastics)	Component packaging	Construction, Operation	Avoid non-recyclable/non biodegradable options	N/A	Sort and recycle at appropriate facility
Packaging (cardboard, paper)	Component packaging	All stages	N/A	N/A	90% recycled at appropriate facility
Excess building materials	Metal, timber	Construction	Avoid plastics	Offer to local TAFE and high schools	90% recycled. Metal, cabling, plastic to be sorted and recycled at appropriately licensed facilities
Putrescible waste	Construction worker consumables Food waste, single use bottles (glass, plastic), food packaging	All stages	Avoid plastic	N/A	Sort on site (glass, plastic, green) 90% recycle
Infrastructure construction	Concrete aggregates Timber products. Masonry products Concrete wash	Construction	Reduce water consumption by installing water saving appliances	Offer to local TAFE and high schools	Recyclable material to be sorted and disposed at appropriate facilities
Infrastructure component removal	Buildings	Decommissioning	N/A	Modular ancillary buildings transported and reused post construction	N/A
Battery	Lithium Ion batteries	All stages	N/A	N/A	100% recycled at approved recycling facility
Solar panels (PV arrays)	PV arrays Mounting poles	All stages	N/A	N/A	100% recycled at approved recycling facility that can recover 100% of components
Cabling	Left over electrical cables Recovered electrical cables at decommissioning	All stages	N/A	N/A	Recycled at licensed and approved metal recycling facility
Wastewater	Grey water	All stages	Minimise water use, install water saving appliances.	Re-use onsite for vegetation screening watering	N/A
Bio waste (septic)	Black water	All stages	Install water saving appliances. Install bioseptic tank or wormfarm waste composting septic (or similar) tank to reduce volume of biohazard black water.	Utilise local composting facilities to incorporate into their activities for end use to be on farm (Middlebrook Solar Farm) soil improvement.	Managed and maintained by appropriately licensed contractor

Transport of the resources to the site, and to reuse / disposal options is highly relevant to the waste hierarchy. Fuels are a scare resource and vehicle emissions have impacts for local air quality and climate more broadly, as investigated in section 7.3.

An important part of the Project's waste strategy must be:

- Sourcing as locally as practical
- Finding reuse / disposal options as locally as practical

This is an emerging opportunity for the Renewable Energy Zones and those areas nearby, in terms of both material sourcing and disposal options for large scale solar developments. Community and business initiatives could see substantial benefits from Project waste streams that lead to:

- Timber and metal supplied to trade schools and local craft workshops
- Composted materials supplied to local gardeners and farms
- Biowastes treated to allow for use as an agricultural land treatment

7.4.3. Potential impacts

During operation and decommissioning, resources would be associated with maintenance activities and use of machinery and vehicles. Water requirements during operation are estimated to be 10 ML/year, water for livestock and watering screening vegetation.

Resource use and availability

While increasing scarcity of resources and environmental impacts are emerging from the use of non-renewable resources, the supply of the materials required for the Project's construction are not currently limited or restricted. In the volumes required, the Project is unlikely to place significant pressure on the availability of local or regional resources. The use of the required resources is considered reasonable given the benefits of offsetting fossil fuel electricity generation.

In operation, electricity production using photovoltaics emits no pollution, produces no greenhouse gases, and uses no finite fossil-fuel resources (US Department of Energy 2004). Only limited amounts of fuels would be required for maintaining vehicles during operation of the solar farm.

It is likely that some electrical components, such as inverters, transformers, and electrical cabling, would need replacement over the proposed life of the solar farm. This would require further use of metal and plastic based products. However, these activities are expected to occur infrequently.

Lifecycle analysis is a method to assess the energy and material flows associated with a given process to identify the resource impacts of that process and potential for resource recovery. Lifecycle analysis estimates energy and emissions based on the total lifecycle of materials used for a project, being the total amount of energy consumed in procuring, processing, working up, transporting and disposing of the respective materials (Schleisner, 2000).

PV panels

A lifecycle inventory of multi-crystalline PV panels was undertaken by European and US photovoltaic module manufacturing companies in 2005-2006. Over the 30-year lifetime of the panels, it is expected that 28 g of GHG emissions would be produced per kWh of energy generated (Fthenakis, et al., 2011). The 'energy payback time' for multi-crystalline PV panels is dependent on the geographical location, however, on average it is estimated to be 1.5 years. A solar installation in Southern Europe would be even less than 1.5 years (Fraunhofer ISE 2015), which is considered comparable to the Middlebrook Solar Farm.

The purification of the silicon, which is extracted from quartz, accounts for 30% of the primary energy to produce the panel. This stage also produces the largest amount of pollutants with the use of electricity and natural gas for heating (Fthenakis, et al., 2011). The waste produced during production of the panels which can be recycled include graphite crucibles, steel wire and waste slurry (silicon and polyethylene glycol). However, silicon crystals cannot be recycled during this stage (Fthenakis, et al., 2011). The production of the frames and other system components, including cabling, would also produce emissions and waste but less than the production of panels.

The energy yield ratio of a product is a ratio of the energy produced by, in this case, a solar PV system over its lifetime, to the energy required to make it is referred to as the system's. PV system energy yield ratio in Northern Europe was estimated to be more than ten, indicating the system would produce more than ten times the amount of energy required to make it (Fraunhofer Institute for Solar Energy Systems (ISE), 2015). This positive energy yield ratio also means that GHG emissions generated from the production of solar energy systems are more than offset over the systems' lifecycle (GA and ABARE, 2010).

Li-ion Batteries

Li-ion batteries are classified as hazardous waste under the Commonwealth *Hazardous Waste Act 1989*, and Dangerous Goods under the Australian Code for the Transport of Dangerous Goods by Road and Rail (ADG Code). The code has a special provisions and packaging instructions for Li-ion batteries transported for disposal or recycling. The average life of the Li-ion PV solar batteries is assumed to be 10 years (Randell Environmental Consultancy, 2016) and therefore batteries may require replacement 2-3 times during the life of the solar farm.

Presently, there is one B-Cycle accredited, EPA- permitted and licensed recycler of mixed batteries including Li-ion batteries in Australia that are collecting, sorting and processing entirely onshore. The number of recycling plants with these accreditations will grow with demand. B-Cycle is a government backed scheme which is run by the Battery Stewardship Council and authorised by the ACCC to promote the safe use and disposal of batteries including Lithium-Ion Batteries.

Any spent batteries would be recycled at a B-Cycle accredited, EPA permitted and licensed recycler of Lithium-Ion Batteries. Batteries would be handled, stored, and transported according to manufacturer's guidelines and the ADG Code.

Given the rapid rise of Li-ion battery use in Australia, including in renewable energy Projects and electric cars, cost-effective local recycling may be available at the time of battery replacement or decommissioning. AEMO (2015) predict strong growth in the consumption of Li-ion batteries for both electric vehicles and PV solar over the next 20 years. This growth would begin to significantly affect the waste stream from 2025 (Randell Environmental Consultancy, 2016).

Solar farms in general

When compared to the major electricity generating methods employed in Australia, solar farms are favourable for the following reasons:

- CO2 emissions generated per kilowatt hour of energy produced.
- Short energy payback time in comparison to the life span of the project.
- Potential to reuse and recycle component parts.

As the industry becomes established in NSW, further opportunities are identified.

Waste management

Construction

Solid waste is one of the major pollutants caused by construction. Several construction activities would produce solid wastes, such as earth works, construction of buildings and array modules and rehabilitation activities. Most waste generated during the construction phase would be classified as building and demolition waste within the class general solid waste (non-putrescible). Ancillary facilities in the site compound would also produce liquid wastes and sanitary (clinical waste), classified in accordance with the POEO Act.

A detailed waste management strategy will be required to be prepared in accordance with definitions in the POEO Act and associated waste classification guidelines. Key strategies which can begin to be implemented now, ahead of procurement, is setting out the commitment to environmental best practice, seeking:

- Panels to be supplied in biodegradable / non-plastic packaging
- Careful procurement procedures to reduce over ordering and waste
- Up front identification of local substitution options.

All waste would be transported and disposed of in accordance with the Waste Classification Guidelines (NSW EPA, 2014) and the POEO Act.

The impact from waste generation, on regional waste facilities is assessed to be moderate without the implementation of any recycling or re-use measures. However, with the implementation of a Waste Management Plan and identification of recycling waste facilities in the LGA, the impacts from construction waste disposal on regional landfills, the biological environment and social environment is assessed to be minor.

It will be important for the Project to work with Tamworth Regional Council and commercial services to ensure that local facilities are not overwhelmed by disposal requirements and to maximise reuse and recycle opportunities.

Operation

During operation, the solid waste streams would be associated with maintenance activities and presence of employees. Some materials, such as fuels and lubricants, and metals may require replacement over the operational life of the solar farm. These materials would be reused or recycled wherever possible. Given the minimal number of moving parts and limited wear tear of equipment, the operational waste streams generated by the solar farm would be very low and impacts to regional waste disposal facilities would be minor.

Decommissioning

Decommissioning of the site would involve the recycling or reuse of materials including:

- Solar panels and mounting system.
- Metals from posts, cabling, fencing.
- Buildings and equipment such as the inverters, transformers and similar components would be removed for resale or reuse, or for recycling as scrap.

The vast majority of solar panel materials can be recycled. Items that cannot be recycled or reused would be disposed of in accordance with applicable regulations and to appropriate facilities. All infrastructure above ground and to a depth of 500 mm would be removed from the site during decommissioning.

During decommissioning, all above ground infrastructure and materials would be removed from the site and recycled or otherwise disposed of at approved facilities.

- Ancillary buildings would be transportable and reused elsewhere.
- Buildings and major electrical equipment would be removed for resale or reuse, or for recycling as scrap.
- All underground cabling (and buried infrastructure) to a maximum depth of 500 mm would be removed.
- The Li-ion PV solar batteries would be disposed in accordance with the hazardous waste policies active at the time of decommissioning. Australia currently only recycles 2% of its lithium-ion battery waste, compared to 98% of lead acid batteries, however, the CSIRO is confident that lithium-ion batteries are highly recyclable would be used to manufacture new batteries in the future as the demand for these batteries increases (CSIRO, 2019).

The majority of infrastructure would be constructed using highly recyclable materials including aluminium or steel frames. The panels would be primarily constructed from glass, graphite, and copper. Cables would be made from copper and plastic. Items that cannot be recycled or reused, would be disposed of at appropriate facilities in accordance with applicable regulations. The majority of the Project components are recyclable and mitigation measures are in place to maximise reuse and recycling in accordance with resource management hierarchy principles.

7.4.4. Key uncertainties of the assessment

The fast-paced rate of technological change with regard to PV and battery technology means that the some of the data supporting this assessment may be out of date by the time the Project approaches construction stage. However, the trend is very much toward longer lived infrastructure and increased recyclable content.

The Clean Energy Council of Australia has noted the following national solar PV recycling research projects/funding taking place:

1. The NSW Government has committed $10 M to boost solar panel recycling.
2. Researchers at Deakin University working to develop a solar panel recycling solution to recycle silicon.
3. $15.14 million awarded through the Australian Renewable Energy Agency (ARENA) to support research teams at six Australian universities including investigating new solutions, including upfront solar PV panel designs and end of life processing, that increase the cost-effectiveness of sustainable end-of-life management of solar PV panels.

As the solar industry becomes established in NSW, further opportunities are considered likely to be identified regarding local and regional reuse and recycle options. The Middlebrook Solar Farm is committed to being part of this positive process.

7.4.5. Mitigation measures

A Waste Management Plan would be developed to minimise waste and maximise the opportunity for reuse and recycling. Impacts are proposed to be addressed via the mitigation measures in the table below.

Table 7-13 Safeguards and mitigation measures for resource use and waste generation

ID	Mitigation measures	Project stage
R1	With the exception of permanent assets agreed by the landowners to be retained, all below ground infrastructure to a depth of *500 mm* would be removed during decommissioning, to assist the reintroduction of agricultural land uses.	Decommissioning
R2	A Waste Management Plan (WMP) would be developed to minimise waste, including: • Identification of opportunities to avoid, reuse and recycle, in accordance with the waste hierarchy. • Quantification and classification of all waste streams. • Provision for recycling management on-site. • Provision of toilet facilities for on-site workers and identify that sullage would be disposed of (i.e., pump out to local sewage treatment plant). • Tracking of all waste leaving the site. • Disposal of waste at facilities permitted to accept the waste. • Requirements for hauling waste (such as covered loads).	Construction/ Operation/ Decommissioning
R4	Solar panel arrays would be recycled at a facility with the capacity to recover 100% of the end-of-life solar PV modules and all associated materials.	Decommissioning
R5	Lithium-Ion Batteries would be kept, stored, managed and transported according to manufacturer's instructions and the ADG Code Any spent batteries would be recycled at a B-Cycle accredited, EPA permitted and licensed recycler of Li-Ion batteries.	Construction/ Operation/ Decommissioning
R6	A septic system would be installed and operated according to the Tamworth Regional Council	Construction/ Operation/ Decommissioning

7.5. Cumulative impacts

7.5.1. Assessment approach

Cumulative impacts with other major projects and developments have been taken into account in the assessments in Sections 6 and 7 where relevant (particularly for visual, noise, traffic, land use, biodiversity and socio-economic impacts) however, this chapter addresses new cumulative assessment guidelines specifically.

The NSW Government *Cumulative Impact Assessment Guidelines for State Significant Projects* (DPIE 2021) (CIA Guidelines) defines cumulative impact to be a result of incremental, sustained and combined effects of human action and natural variations over time and can be both positive and negative. They can be caused by the compounding effects of a single Project or multiple Projects in an area, and by the accumulation of effects from past, current and future activities as they arise. This section follows the CIA Guidelines and addresses the SEARs requirement to include:

- An assessment of the likely impacts of all stages of the development, (which is commensurate with the level of impact), including any cumulative impacts of the site and existing or proposed developments in the region, taking into consideration any relevant legislation, environmental planning instruments, guidelines, policies, plans and industry codes of practice.

The assessments in Sections 6 and 7 of this EIS deal with the potential impacts of the Project on the existing condition of the environment. *Existing condition* includes past environmental changes and the effects of other developments which are currently operating in the Subject land. They also consider 'combined incremental' impacts such as road upgrades, visual and land use changes, vegetation clearing, and the increase in traffic, dust and noise generated as a result of the Project.

This section considers the cumulative impacts as the additional impacts arising from further *planned or foreseeable* future developments, combined with the impacts of the Project on the existing environment. It is broken down into strategic-level and project-level cumulative impact assessment (CIA).

A summary of each key impact assessed in this CIA includes:

Strategic-level CIA

- Alignment with federal and state regional renewable energy policies
- Alignment with regional and local land use plans
- Reduction in energy prices
- Energy transition.

Project-level CIA

- Large-scale projects which have the potential to produce material cumulative impacts around the project site
- Regional and local cumulative impacts, including:
    - Visual and landscape character impacts
    - Noise impacts
    - Biodiversity impacts
    - Traffic impacts

- Pressure on local facilities, goods and services
- Potential decrease in land value
- Local agricultural impacts.

These issues were investigated in direct consultation with neighbouring landholders, Council and other stakeholders throughout the SIA and community consultation process, as well as desktop assessment of potential impacts of other SSD developments.

7.5.2. Strategic-level CIA

Alignment with federal and state regional renewable energy policies

As detailed within Section 2.1 of this Report and summarised below in Table 7-15, the proposed Middlebrook Solar Farm will cumulatively be contributing to the following federal and state regional energy policies and reduction targets.

Table 7-14 Contribution to renewable energy policies.

Relevant policy	Target
Paris Agreement	The Project will contribute to Australia's target of reducing emissions by 26-28% below 2005 levels by 2030, through the generation of electricity from renewables. A key benefit of the Project is its positive impact on reducing greenhouse gas emissions and moving electricity generation towards cleaner electricity generation. The Project would power the equivalent of about 153,000 NSW homes.
Climate Change Bill 2022	The Project will assist in achieving emissions reduction target of 43 percent from 2005 levels by 2030, and net zero emissions by 2050 by introducing up to 320 MW AC of renewable energy and 300 MW / 600 MWhr DC energy storage into the NEM.
Australian Government RET	The LRET of 30% (33,000GWh) target was met in September of 2019. However, the Project will assist in fulfilling the new obligations under the *Climate Change Bill 2022* to reach an overall target of 43% by 2050.
Net Zero Plan Implementation Update 2022	As detailed above, the Project will assist in meeting obligations under the Net Zero Plan of meeting net-zero emissions by 2050 and delivering a 50% cut in emissions by 2030 – a substantial increase from the proposed Paris Agreement. This Project would assist the NSW government in reaching these targets by providing a renewable energy source for electricity generation.
Electricity Infrastructure Roadmap	The Roadmap sets out a 20-year plan to deliver renewable generation infrastructure, as well as the storage, firming and transmission infrastructure required to ensure NSW has continued access to cheap, clean and reliable energy as coal-fired power stations are retired. Large-scale solar energy projects, such as the Middlebrook Solar Farm, can support jobs and investment in regional NSW and have the potential to increase the resilience of Tamworth and surrounds during the state's transition to renewable energy generation.
NSW Climate Change Policy Framework	The Framework guides the NSW Government's policy and programs, including the NSW Climate Change Fund and the NSW Electricity Infrastructure

Relevant policy	Target
	Roadmap. This Project aids in meeting the net-zero emissions by the 2050 target as discussed above.
NSW Electricity Strategy	The Project would contribute to the NSW government's plan to achieve the objectives for the electricity system which include reliability, affordability and sustainability. The contribution of the Project to local employment and economy is set out in detail in Section 6.8 of this Report

Alignment with regional and local land use plans

As detailed within Section 2.2 of this report, Table 7-16 below summarises what the proposed Middlebrook Solar Farm will cumulatively be contributing to the following regional and local land use plans.

Table 7-15 Project summary table

Relevant plan	Target
New England North West Regional Plan 2041	A major theme of the Regional Plan is to lead renewable energy technology and investment, to address the region's goal in adapting to climate change and resilience to threats from it. It addresses the need for the '*integration of land use planning with resilience planning to avoid, prepare for, respond to, and recover from climate induced shocks*'. A number of renewable energy projects have been developed or are currently undergoing approval within the New England North West region, including those within the adjacent New England REZ. As such, the Project will assist cumulatively to directly support the region in the achievement of this goal. The Regional Plan also discusses the promotion of diversification of energy supplies through renewable energy generation. The Project directly contributes to this theme by taking advantage of the transmission infrastructure that crosses the site and exploring its potential to connect with the electricity network.
Blueprint 100 – Our Community Plan 2023-2033	A major theme of the Blueprint 100 – Tamworth Strategic Plan – is to work with and protect the environment. Specifically, "work with nature". The objective of the theme is protecting and supporting the natural environment through responsive initiatives and development practices. This includes to increase the take up and use of affordable and clean energy across the region and increase the percentage of renewable energy used. Cumulatively, the Middlebrook Solar Farm will contribute to this theme.
Tamworth Tomorrow – Economic Development and Investment Strategy 2022-2026	The Tamworth Tomorrow Strategy identified that the Tamworth region is well positioned to capitalise on growing demand for renewable energy, especially being nearby the New England REZ. As such, there is an emerging opportunity to invest in renewable energy development. The Middlebrook Solar Farm will contribute to investment opportunities in the identified renewable energy sectors and technology, through community benefits and economic stimulus in the community.
Renewable Energy Zones	REZs are being created by the NSW Government to concentrate power generation, transmission, and storage in identified areas to unlock new capacity for the energy grid. As detailed above, the Middlebrook Solar Farm is not directly

Relevant plan	Target
	located within a REZ however it is adjacent to the New England REZ. The NSW Government's revised Large Scale Solar Guidelines (DPE, 2022) recognises that to meet state and national clean energy targets, renewable energy Projects are also required outside of the REZ areas. The Middlebrook Solar Farm is such an example that will cumulatively assist in meeting energy targets.
Renewable Energy and Regional Cities, TISEPP	The TISEPP provides for the specific consideration of renewable energy Projects in regional cities, including Tamworth. However, the Middlebrook Solar Farm falls outside of the Tamworth Regional Cities subject land. As such, no cumulative impacts are expected that would infringe the aims and goals of the Renewable Energy and Regional Cities section of the TISEPP.
Tamworth Regional LEP – Land zoning	The Tamworth LGA covers an area of approximately 9,884 km^2 (~988,400 ha). According to the zoning of the Tamworth Regional LEP, approximately 919,913 ha of land is used for or has potential for agricultural use in the LGA (being zoned RU1, RU2 or RU4). The temporary loss of 530 ha of agricultural land within the Tamworth Regional LGA represents a small fraction (~0.058% within the LGA). As such, cumulative impacts to the region's agricultural capacity under provisions in the LEP are negligible.

Reduction in energy prices

The CSIRO and AEMO released the GenCost 2021-22 report in July of 2022, with the GenCost 2022-23 report currently in draft and open for consultation. The report confirmed that renewables (lead by wind and solar) are the cheapest source of electricity generation and storage in Australia and are the fastest growing source of electricity on the market. The role of electricity is expected to increase materially over the next 30 years with electricity technologies presenting some of the lowest cost abatement opportunities.

The report confirmed renewable energy sources will continue to be the cheapest sources of new electricity generation in Australia, although cost reductions could be impacted over the next 12 months due to inflationary pressures. It concluded that after the current inflationary cycle ends that wind, solar and batteries are all projected to keep getting cheaper still.

The best way to put downward pressure on energy prices for households and businesses is to help ramp up investment in renewables.

The AEMO Quarterly Energy Dynamics – Q1 2023 report suggest surging renewable energy output has pushed fossil fuel-fired generation down to record low levels in Australia's biggest electricity grid, triggering large falls in wholesale prices. The report showed wholesale spot prices in the NEM averaged $83/MWh, down more than a 10th from the December quarter and two-thirds lower than the record average $264/MWh in the June quarter last year (2022).

The Middlebrook Solar Farm will contribute cumulatively to the downward pressure on energy prices, introducing up to 320 MW AC into the NEM.

Energy transition

As detailed above in Section 2.3 above, Australian renewable energy supplied 32.5% of Australia's total electricity in 2021. Large-scale solar contributed 12.3% of renewable generation (equivalent of powering 1,994,468 households over a year), medium-scale solar contributed 1.1% of renewable generation (equivalent of powering 171,169 households over a year), and small-scale solar contributed 24.9% of renewable generation (equivalent of powering 4,048,611 households over a year). Developing renewable resources for electricity generation such as the Middlebrook Solar Farm will cumulatively help meet growing demand while arresting current emission trends.

7.5.3. Project-level CIA

Large-scale projects within the Tamworth Regional LGA

There are 25 other Major Projects listed on the Major Projects Register within the Tamworth Regional LGA including three large-scale solar farms, two wind farms, one renewable energy hub and two Battery Energy Storage Systems, and several with modifications at various stages of the assessment process:

1. Tamworth Hospital Redevelopment – Operational (NA)
2. Peel Valley Tamworth Abattoir Modifications – Operational (NA)
3. Tamworth Solar Farm – Approved
4. Tamworth BESS – Prepare EIS
5. Calala BESS – Prepare EIS
6. Chaffey Dam Upgrade – Approved
7. Chaffey Dam pipeline project – Withdrawn (NA)
8. Hills of Gold Wind Farm – Assessment
9. Werris Creek Coal Mine Expansion – Approved
10. Werris Creek Mine Mod 4 – Precursor storage facility and alterations – Approved
11. Keepit Dam Upgrade Project – Approved
12. Manilla Hospital – Approved
13. Rushes Creek Poultry Production Farm – Approved
14. Dungowan Dam – Response to Submissions
15. Yarraman Abattoir and Feedlot – Prepare EIS
16. Willow Tree Gravel Extension – Prepare EIS
17. Ardglen Quarry – Approved
18. Caroona Coal Project – Approved
19. Final Landform Modification – Response to submissions
20. Tamworth Battery Energy Storage System – Prepare EIS
21. Calala Battery Energy Storage System- Prepare EIS
22. Baiada Integrated Poultry Processing Facility – Approved
23. Thunderbolt Wind Farm – Response to Submissions
24. Bendemeer Solar Farm – Prepare EIS.
25. Orange Grove Solar Farm – Approved

The locations of these Projects are shown in Figure 6-20.

Large-scale renewable energy projects within the adjacent New England REZs

In addition to those in the Tamworth Regional LGA, the following largescale renewable energy projects are at various stages of the assessment process and may present regional and cumulative impacts. In particular, traffic impacts due to having a common haulage route from Sydney and Newcastle, and social impacts due to accommodation, labour and resource shortages.

1. Eathorpe BESS – Prepare EIS
2. Thunderbolt Solar Farm – Withdrawn (NA)
3. Tilbuster Solar Farm - Approved
4. Sapphire Solar Farm - Approved
5. Bendemeer Solar Farm – Prepare EIS
6. Oxley Solar Farm - Assessment
7. Sundown Solar Farm – Prepare EIS
8. Salisbury Solar Farm – Prepare EIS
9. Doughboy Wind Farm – Prepare EIS
10. Glen Innes Wind Farm - Approved
11. Rangoon Wind Farm – Prepare EIS
12. Sapphire Wind Farm - Approved
13. Thunderbolt Wind Farm – Response to Submissions
14. White Rock Wind Farm - Approved
15. Winterbourne Wind Farm – Response to Submissions
16. Woolbrook Wind Farm – Withdrawn (NA)

Regional and local cumulative impacts

Visual and landscape character impacts

As detailed within Section 6.1, the Project is located outside the New England Renewable Energy Zone. However, the occurrence of large-scale renewable energy projects within a region has the potential to alter the perception of the overall landscape character irrespective of being viewed in a single viewshed, as these projects could become part of the existing landscape. It is important to determine whether the effect of multiple projects and other major infrastructure within the region would combine to become the dominant visual element, altering the perception of the general landscape character.

The closest of these projects is the Tamworth BESS which is located approximately 17 km north of the Project. Following this, the Calala Battery Energy Storage System is located approximately 28 km north of the Project. Due to distance and scale of these Projects these Projects are unlikely to be viewed in combination with the Project. The remainder of the proposed, in operation or approved renewable energy projects are located in excess of 30 km from the Project and are unlikely to have the potential to be viewed in combination with the Project.

The Visual Impact Assessment indicates that all public viewpoints were shown to have low to very low visual impact from the Middlebrook Solar Farm Project. All residential receivers are also no more than low visual impact. This is in most part due to the undulating topography of the area, the Project's location in the lower landscape and the scale of the Project. Impacts are further reduced by existing vegetation between the site and viewpoints.

The size and magnitude of visual change is assessed to be low, and the relative geographic area of the development site is small. The visual assessment notes the duration of the Project is medium term, and the change is reversable. In addition, there would be a low magnitude of change to a landscape character area of moderate sensitivity resulting in a low landscape character impact. As such, cumulatively it was determined there would be negligible impacts to the overall landscape character.

On balance, adverse cumulative visual impacts are anticipated to be manageable due to the ability to effectively screen infrastructure and topology.

Noise impacts

Given that all other proposed large-scale projects in the area are 17 km or greater away from the Project, cumulative construction and operational noise impacts through the use of plant, machinery and vehicles would not be heightened if the construction of other developments is undertaken concurrently, due to distance.

As detailed within the Noise and Vibration Assessment, summarised in Section 6.2, the base line noise environment was modelled using the lowest rural background noise, rather than via noise logging. This produces a conservative baseline and is not impacted by existing traffic noise and other machinery. The predicted traffic noise for the Project's construction did not account for additional traffic noise levels along Middlebrook Road. However, the road traffic noise level contributions from the vehicle movements associated with the construction works were noted as significantly below the applicable noise criterion, based on dwellings being 20 m from the roads. Given that residences are located significantly greater than 20 m from the access route, the site access point and the Development footprint where traffic may be moving internally, all receivers are predicted to comply with the criteria.

Therefore, cumulative traffic noise levels as a result of the construction works of this Project or any other proposed large-scale projects in the area using Middlebrook Road are not expected to adversely affect residences. No operational cumulative impacts are relevant to the project.

Traffic impacts

As detailed within Section 6.3, the primary traffic impact of the solar farm is generated during construction. This is anticipated to start mid-2024 and be completed late 2026 (a 21-30 month program). The assessment outlined above demonstrates that the road network will continue to operate with ample spare capacity even during the 18-month peak construction period. This is assisted by the longer construction period, reducing daily vehicle numbers and spreading peak construction over a longer less intense period.

Surrounding Major Projects have the potential to generate a number of staff vehicle movements during the peak periods associated with construction. In particular, a number of staff will be located in Tamworth and the Projects may generate additional traffic movements on the New England Highway.

The road network is expected to continue to operate with a good level of service with ample spare capacity. As such, the combined increase in traffic generated by the site and these Projects is expected to have a minimal cumulative impact on the road network. Further, it is noted that the peak traffic generated by these Projects during construction occurs before 7am and after 5pm which is outside of the peak times of the road network, and no additional projects are expected to generate vehicle movements on Middlebrook Road.

Biodiversity impacts

The clearing of native vegetation, which is a key threatening process at both the State and Commonwealth level, is considered a major factor in the loss of biological diversity. At least 61 % of native vegetation in NSW has been cleared, thinned or significantly disturbed since European settlement, with the portion of area cleared varying between regions and community type (NSW

Scientific Committee Key Threatening Process Determination). The removal of vegetation at the Project is contributing to this process.

As detailed in Section 6.5, the following residual biodiversity impacts are considered relevant to the construction stage of the Project:

- 2.52 ha of native vegetation clearing, including the clearing of three hollow bearing trees, 3 of which contain hollows.
- Removal of 194 scattered paddock trees, 92 of which contain hollows.

This impact could result in direct loss of native flora and fauna habitat, potential over-clearing of habitat outside proposed Development Footprint, injury and mortality of fauna during clearing of fauna habitat and habitat trees, disturbance to stags, fallen timber, and bush rock.

The cumulative impact of similar renewable energy projects can be considerable given that many poorly conserved vegetation communities have a substantial portion of their extent represented on private land where most renewable energy projects are proposed. Small losses of vegetative communities may accumulate over time to cause a significant reduction in the extent of remnant patches. The conservation significance Box Gum Woodland habitats are already over cleared in the region and particularly the nearby New England Renewable Energy Zone.

Cumulative impacts are considered best addressed by avoiding and minimising. Where avoidance is not possible the impact of each contributing project is assessed on a case-by-case basis. Long term mechanisms like biodiversity offsetting is structured to address the ongoing impacts of multiple projects in a cohesive manner.

The Middlebrook Solar Farm:

- Avoids impacts to biodiversity through site selection, iterative design, and utilising existing cleared Category 1 land where possible (99% of the Development footprint is Category 1 land).
- Avoids impacts to better condition Box-gum Woodland Critically Endangered Ecological Community as much as possible.
- No solar panels are proposed in any Box Gum Woodland remnants with vegetation integrity score of over 30. In these higher condition remnants only infrastructure that cannot be relocated would be allowed such as fences and water crossings.

For the Project, an in-perpetuity biodiversity offset is generated. This means a ‘like for like’ area will be managed and protected to account for this clearing.

On balance, the Project has considered the ‘avoid and minimise’ biodiversity impacts mandate and the residual impacts are able to be offset.

Local agriculture impacts

The loss of high-quality agricultural land is identified as a concern by the local community. The cumulative impact of similar renewable energy projects, particularly where BSAL is involved, can be considerable given mapped but unverified BSAL occurs on private land where most renewable energy projects are proposed. Small losses of BSAL may be insignificant at a local level but may accumulate over time to cause a significant reduction in the extent of BSAL available for agricultural use.

As detailed within Section 6.4 of this report, the Project will avoid all BSAL and Class 3 Land (as defined under the Land and Soil Capability Assessment Scheme (OEH, 2012) and verified using soil surveys obtained from the site).

Approximately 530 ha of cropping and grazing land would be converted into solar farm development for the operational life of the Project. Section 7.2 considers the soils more specifically; for the vast majority of the Development footprint, soil disturbance would be limited:

- Existing ground cover beneath the array areas would be retained as piles or discrete footings are installed to support the solar panels modules (piles would be driven or screwed into the ground to a depth of 1.5–2.5 m).
- Small area linear impacts that would be stabilised and rehabilitated progressively include:
  - Cable trenches up to 5 m wide and 1,500 mm deep.
  - Construction of perimeter security fencing, 16.23 linear kilometres.

Continued use of this land for livestock production could be maintained. The Project would not fragment any resource lands throughout the operational period. Upon decommissioning of the solar farm, the development footprint would require rehabilitation to restore it to its pre-existing productive capacity for agricultural land use.

Existing and proposed large-scale projects on rural land within the Tamworth LGA have the potential to increase the cumulative impacts affecting land use change and local agriculture. However, as detailed above, the Tamworth LGA covers an area of approximately 9,884 km^2 (~988,400 ha). According to the zoning of the Tamworth Regional LEP, approximately 919,913 ha of land is used for or has potential for agricultural use in the LGA (being zoned RU1, RU2 or RU4). The temporary loss of 530 ha of agricultural land within the Tamworth Regional LGA represents a small fraction (~0.058% within the LGA). As such, cumulative impacts to the region’s agricultural capacity under provisions in the LEP are negligible.

The land can be returned to agricultural use following decommissioning of the Projects. There are many benefits of resting the land for a period of time (NSW Government 2012) and include:

- Increased groundcover and diversity of groundcover with biosecurity management.
- Increase in soil moisture and nutrients.
- Increases in soil organic matter means less evaporation, less impact of raindrops, less impact of runoff and less erosion.
- Controlled stocking rates will reduce soil compaction.
- Perennial grasses can be encouraged to increase soil stability of the grassland around the panels.
- A return of soil organisms for decomposition of organic matter, nutrient cycling and improving soil structure.

Potential loss of about 0.058% of agricultural land within the region should be measured against wider government strategic goals and environmental benefits, which include:

- Strategic goals of the Commonwealth and NSW Governments for renewable energy development going forward.
- The environmental benefits of solar energy production, in particular the reduction of greenhouse gas emissions.
- The economic benefits of using an area with reliable solar resources and access to existing electricity infrastructure.
- The benefits of alternative and increased energy supply for grid stability and reliability.

It is likely that the potential cumulative impact of the reduction in agricultural employment in the LGA would be balanced by the additional employment during construction and on-going employment of staff during operation. Additional local services could be maintained during operation.

As such, cumulative impacts to agricultural enterprise or local agricultural land use are expected to be negligible. Agricultural impacts are considered low and manageable. Substantive benefits may also result in driving local employment and skills.

Pressure on local facilities, goods and services

As detailed within Section 6.8 of this report, there is potential that concurrent construction programs would increase pressures on local community values and services including:

- Community cohesion
- Accommodation and rental housing
- Employment and labour opportunities.

There is also a potential for positive cumulative economic effects from the construction of multiple developments in the area. Socio-economic benefit in relation to developments in the region will be a continuous ongoing benefit for the community with increased jobs and economic input into local business.

Operationally, there is also a potential project benefit of increased community investment across the region, providing a local response to climate change, and providing increased access to renewable energy.

Mitigation measures were developed to directly respond to the potential positive and negative social impacts associated with the Project.

The Project would not likely result in significant impacts to local businesses, residents and road users, subject to the range of identified mitigation measures. Due to the number of local communities in the area, any cumulative impacts on local services are likely to be spread between communities. There is sufficient residual capacity within the existing communities. It is unlikely that there would be negative cumulative impacts to local facilities, goods and services.

7.5.4. Potential cumulative impacts with other large-scale projects

Table 7-16 below summarises the anticipated interactions between the Projects identified and the proposed Middlebrook Solar Farm. Key issues include:

- Traffic interactions during the construction stage of overlapping large Projects
- Use of local accommodation, suppliers and labour force.

The primary traffic impact of the Middlebrook Solar Farm is generated during construction; anticipated to mid-2024 and be completed late 2026 (a 21-30 month program). The cumulative traffic assessment (summarised in Section 6.3 and above) demonstrates that the road network will continue to operate with ample spare capacity even during the peak construction period, and the combined increase in traffic generated by the site and other large scale Projects is expected to have a minimal cumulative impact on the road network. Further, it is noted that the peak traffic generated by these Projects during construction occurs before 7am and after 6pm which is outside of the peak times of the road network.

The combined increase in traffic generated by the site and these Projects is expected to have a minimal cumulative impact on the road network in the surrounding area.

The primary social impact of the Middlebrook Solar Farm is also generated during the construction period. The assessment in section 6.8 and above demonstrates that concurrent construction programs would increase pressures on local community values and services. Operationally, there is also a potential project benefit of increased community investment across the region, providing a local response to climate change, and providing increased access to renewable energy.

The Project would not likely result in significant impacts to local businesses, residents and road users, subject to the range of identified mitigation measures.

No other issues have been identified as likely to pose cumulative impacts. Specifically:

- There are no large Projects identified that would be seen together with the Middlebrook Solar Farm, or sequentially within the landscapes surrounding Middlebrook (with the closest being Tamworth BESS 17 km away). Therefore, there would be no cumulative landscape character, visual or glare risk impacts.
- Cumulative biodiversity impacts are unlikely to be significant primarily due to minor clearing requirements. Exclusion zones and proposed plantings will enhance the existing riparian area and thereby improve catchment processes and water quality.
- The cumulative socio-economic impacts are expected to be primarily positive, due to Project commitments to local employment, and the benefits from sales of local goods and services impacts and increased employment and skills, primarily during construction of the solar farm.

Project	Proposed activity	Status	Distance from Subject land	Relevant issues	Potential for cumulative impact
Large-scale projects in the Tamworth LGA					
Chaffey Dam Upgrade	Raising of the existing dam wall and spillway, to increase the size of the reservoir	Approved Conditions of consent issued February 2014	74 km northeast	No visual impact anticipated. Overlapping construction phases may increase traffic impacts.	Low, given the relatively short construction period of the Chaffey Dam upgrade
Werris Creek Coal Mine Expansion	Extension of the coal resource to the north of the approved open cut area.	Approved	45 km southwest Tamworth	No visual impact anticipated. Small percentage of coal trucks 5% may interact with project traffic.	Low
Werris Creek Mine Mod 4	Precursor storage facility and alterations	Approved (200)	45 km southwest Tamworth	No visual anticipated No traffic issues anticipated	Low
Keepit Dam	The dam is located on the Namoi River. Upgrade works involving raising of the dam concrete monoliths and main embankment.	Approved	75 km northwest	No visual impact. Potential for construction to overlap. Potential for traffic generation increase within Tamworth.	Low
Manilla Hospital	Redevelopment of an existing hospital increasing by 3 beds and 4 staff	Approved	67 km northwest	No visual impact No anticipated traffic impact	Low due to construction type and distance to the proposed Project
Rushes Creek Poultry Production Farm	Construction and operation of an intensive poultry production farm comprising 1016 hectares, located within the catchment of the Namoi	Approved	82 km northwest	No visual impact Traffic generation may interact within the township of Tamworth.	Low due to distance from proposed Project

Project	Proposed activity	Status	Distance from Subject land	Relevant issues	Potential for cumulative impact
	River and Like Keepit				
Dungowan Dam	Construction oaf a new dam (approx., 22.5 gigalitre capacity), 33 km pipeline and ancillary infrastructure.	Response to Submissions	33 km southeast Tamworth	No visual impact Overlapping construction stages may increase traffic impacts in Tamworth. Primary access for both sites are different and commuters for this project are not anticipated to travel through the intersection of the New England Highway and Middlebrook Road	Low to Moderate depending on overlapping construction stage.
Yarraman Abattoir and Feedlot	Construction of a modern abattoir and feedlot near Denman.	Prepare EIS	130 km South	Vehicles carrying plant and equipment may interact to/from the Port of Newcastle Livestock Truck (incoming) movements are estimated to be of the order of 10-12 per day occurring mostly during very early morning and late afternoon. There is expected to be allow probability of these vehicle movements occurring on the New England Highway during the peak hours of construction.	Low to Moderate
Willow Tree Gravel Extension	An extension of an existing quarry to increase production, located outside Willow tree	Prepare EIS	55 km south	No visual impact There is potential for construction of both projects to overlap. The traffic generated by the project and operation of the quarry may interact with the township of Tamworth and along the New England Highway. The project would generate up to 800 vehicle movements per day. It is assumed that 10% of the movements are generated during the peak hour and 50% travel to/from the north through	Moderate to High

Project	Proposed activity	Status	Distance from Subject land	Relevant issues	Potential for cumulative impact
				the intersection of the New England Highway and Middlebrook road.	
Ardglen Quarry	A 17.8 ha extension of an existing quarry.	Approved	58 km south	No visual impact. No predicted increase in heavy and light vehicles as a result of this project.	Low
Caroona Coal Project	A development of an underground mine, involving longwall mining of coal and other associated mining activities.	Determination	65 km Southwest of Tamworth	No visual impacts Traffic generated by the projects may interact within the township of Tamworth	Low
Final Landform Modification	A modification of the final landform and rehabilitation strategy of an existing open cut coal mine.	Response to submissions	45 km southwest of Tamworth	No visual impacts No predicted increase in vehicles as a result of the projects.	Low
Baiada Integrated Poultry Processing Facility	Construction of an integrated poultry processing facility and ancillary amenities	Approved	10 km west of Tamworth	No visual impacts Potential for projects to overlap. Both projects are anticipated to have staff located in Tamworth.	Low
Large-scale renewable projects within the Tamworth LGA					
Tamworth Solar Farm	Development of Solar farm on soldiers Settlement Road and Oxley Highway.	Approved (2020)	22 km north	Construction periods could potentially overlap. Staff would be located in Tamworth and utilise the same transport route to deliver plant and equipment to/from Port of Newcastle	Moderate
Tamworth BESS	Development of a 200MW battery	Prepare EIS	23 km north	Construction periods could potentially overlap.	Moderate

Project	Proposed activity	Status	Distance from Subject land	Relevant issues	Potential for cumulative impact
	energy storage facility with ancillary infrastructure.			Staff would be located in Tamworth and utilise the same transport route to deliver plant and equipment to/from Port of Newcastle	
Calala BESS	Development of a battery energy storage system (300MW/1200MWh) and underground transmission lines connecting to Tamworth substation plus ancillary works.	Prepare EIS	23 km north	Construction periods could potentially overlap. Staff would be located in Tamworth and utilise the same transport route to deliver plant and equipment to/from Port of Newcastle	Moderate
Hills of Gold Wind Farm	Erection of 65 Turbine windfarm.	Assessment	31 km south-east	Construction periods could potentially overlap. Staff would be located in Tamworth and utilise the same transport route to deliver plant and equipment to/from Port of Newcastle. Light vehicles would utilise New England Highway past Middlebrook Road in the morning and evening peak period.	Moderate
Thunderbolt Wind Farm	The Thunderbolt Windfarm and energy hub would be approximately 500MW plus a 400MW battery	Response to submissions	55 km north-east	No visual effect. Potential for construction of both projects to overlap. Both projects are anticipated to have staff located in Tamworth. Both projects would utilise the same transport route to deliver plant form the Port of Newcastle.	Moderate
Bendemeer Solar Farm	Development of 280MW solar farm and ancillary infrastructure.	Prepare EIS	50 km north-east	No visual effect. Potential for construction of both projects to overlap. The traffic generated by the projects may interact within the township of	Moderate – social, supply of workforce.

Project	Proposed activity	Status	Distance from Subject land	Relevant issues	Potential for cumulative impact
				Tamworth where staff for both projects are proposed to be located.	
Orange Grove Solar Farm	Development of 110MW solar farm and ancillary infrastructure	Approved	67 km north-west	No visual Anticipated to be completed prior to MSF construction	Low
Large-scale renewable projects within the New England REZ (not in the Tamworth LGA)					
Eathorpe BESS	Development of 100MW/200 MWH Battery Energy Storage System	Request for SEARS	108 km north-east	Due to distance from the Middlebrook Solar Farm, potential impacts would be limited to overlapping construction phases that may increase traffic impacts and put pressure on local businesses and accommodation	Low to moderate (if the construction stages overlaps) considering the distance between sites.
Tilbuster Solar Farm	The development of 150 MW solar farm, energy storage facility and associated infrastructure.	Approved	121 km north-east		
Sapphire Solar Farm	Development of 180 MW solar farm and associated infrastructure	Approved	179 km north		
Oxley Solar Farm	Development of a 225 MW solar farm with up to 50MW of battery energy storage and associated infrastructure	Assessment	135 km north-east		
Sundown Solar Farm	Development of a 325MW solar farm with energy storage and associated infrastructure.	Prepare EIS	170 km north		
Salisbury Solar Farm	Proposes to develop a 600MWAC (700MWDC) photovoltaic (PV) solar	Prepare EIS	80 km north-east		

Project	Proposed activity	Status	Distance from Subject land	Relevant issues	Potential for cumulative impact
	farm.				
Doughboy Wind Farm	Development of a wind energy generation project including up to 52 wind turbines, battery energy storage facility, grid connection and ancillary infrastructure.	Prepare EIS	139 km north-east		
Glen Innes Wind Farm	Development of Wind energy generation project	Approved (2016)	177 km north-east		
Rangoon Wind Farm	Development of a 130MW windfarm with energy storage and associated infrastructure	Prepare EIS	159 km north-east		
White Rock Wind Farm	Development of Wind energy generation project	Approved	170 km north		
Winterbourne Wind Farm	Development of a wind farm with up to 119 wind turbines, energy storage and associated infrastructure.	Response to submissions	75 km north-east		
Woolbrook Wind Farm	Electricity generation - Wind	Withdrawn	42 km north-east		

7.5.5. Key uncertainties of the assessment

There is a proposed renewable project located 6.5 km north of the proposed Middlebrook Solar Farm which has started public consultation. It is unclear if the proposal will continue to scoping, or what cumulative impacts this may have. This information is not currently in the public arena.

7.5.6. Mitigation measures

The proposed impact mitigation strategies set out in Sections 6 and 7 will be sufficient to address most cumulative impacts identified. The cumulative impacts identified for the Project are considered to be best managed by dealing with each component individually. The following measures provide further certainty that cumulative impacts will be managed appropriately.

ID	Mitigation measures	Project stage
C 1	Environmental management plans for all stages of the Project will ensure provisions to consider to most relevant cumulative impacts within concurrent projects at the time of implementation, such as: • Traffic management: provisions to manage peak construction traffic and likely interactions with large nearby projects. • Housing: provisions to accommodate and transport workers • Employment: provisions to maximise local employment, in consideration of other local business requirements	Construction, operation and decommissioning

8. PROJECT JUSTIFICATION

8.1. Key findings of environmental assessment

8.1.1. Assessment requirements

The Project is considered a State Significant Development because it is a private electricity generating project with a capital investment value greater than $30 million. The *State Environmental Planning Policy (Planning Systems) 2021* (SEPP Planning Systems) dictates the environmental assessment must be undertaken in accordance with:

- Part 4 of the NSW *Environmental Planning and Assessment Act 1979.*
- Schedule 2 of the NSW *Environmental Planning and Assessment Regulation* 2021.
- The Project-specific Secretary's Environmental Assessment Requirements (SEARs; refer to Appendix A cross reference to see where SEARs requirements are addressed in this EIS).

8.1.2. Assessment results

The specialist assessments undertaken for the Project have helped to shape the Project's scale. The key results are summarised below, presenting issues of most interest to near neighbours first. The results demonstrate the Project has generally:

- Low-level impacts
- Uncertainty has been addressed by building in conservatism and mechanisms to monitor or update assumptions
- The assessment has cited appropriate guidance in the assessment and management of impacts identified.

Cumulative impacts are summarised last. They consider the interaction between the Project's different stages and components as well as with other unrelated Projects.

- Key cumulative impacts centre on visual, noise, traffic, land use, biodiversity and socio-economic impacts; all are assessed as negligible adverse cumulative impact.
- There is potential for a net socio-economic benefit, due to due to Project commitments to local employment, and the benefits from sales of local goods and services impacts and increased employment and skills, primarily during construction of the solar farm.
- A key benefit of the Project is its positive impact on reducing greenhouse gas emissions and moving electricity generation towards cleaner electricity generation. The Project would power the equivalent of about 153,000 NSW homes.

Table 8-1 Environmental assessment summary

	Results of assessment	Approach to uncertainty	Assessment requirements
Visual	Three non-associated receivers (dwellings) required detailed assessment (wire frame modelling showed moderate impact, on the basis of topography alone, without consideration of intervening vegetation). In all cases, the detailed assessment showed the impacts were reduced to low, in consideration of existing screening by vegetation. Photomontages support this conclusion and have been included in Section 6.1. All other residential views low, without mitigation. Public viewpoints, low visual impact, prior to any mitigation including Goonoo Goonoo Station. Potential for glare in specific sections of Middlebrook Road can be addressed by operational restrictions on panel tracking. No glare impacts for any residents, rail lines, airstrips.	Terrain modelling is used to evaluate viewpoints, which does not take into account any existing screening by structures or vegetation. Detailed assessment then includes site inspections and photo imagery. While all impacts have been found to be low, due to the subjective nature of visual impact, the Applicant will continue to work with near neighbours with regard to specific vegetation screening options.	The *Large-Scale Solar Energy Guideline* (NSW DPIE, 2022) ('Final Guideline') and the accompanying *Technical Supplement – Landscape and Visual Impact Assessment* ('Technical Supplement'), released in August 2022 have been applied, as required.
Noise	No construction or operational noise exceedances were found at any non-associated receiver (dwelling). No vibration or traffic noise exceedances were found at any non-associated receiver. Reasonable and practical mitigation strategies can be adopted to further reduce construction noise and a complaints process will be active through construction and operational stages of the Project.	The quietest rural background noise level was assumed (conservative as this is not affected by highway or other machinery noise). To understand the interaction of equipment used in the construction program, the 3 noisiest plant were modelled as operating concurrently. This provides a conservative outcome. A noise management plan will further minimise noise by	NSW 'Interim Construction Noise Guideline' (ICNG – DECC, 2009). NSW 'Noise Policy for Industry' (NPfI – EPA, 2017). 'Assessing Vibration: A Technical Guideline' (DECC, 2006). NSW 'Road Noise Policy' (RNP – DECCW, 2011).

	Results of assessment	Approach to uncertainty	Assessment requirements
		managing staff behaviour onsite, equipment use and consulting with neighbours promptly regarding any noise complaints.	
Traffic	The road network can accommodate the Project's traffic volumes, including during peak construction periods and considering the cumulative traffic generated by other major projects within the surrounding area. Upgrades are required however, to ensure the road assets can accommodate the size of the larger vehicles as follows: A Basic Left Turn Treatment will be provided at the New England Highway / Middlebrook Road intersection (a Channelised Right Turn is already present). Upgrade from 6 m to 7 m wide, the unsealed surface of Middlebrook Road to the site access point (approximately 3.2 km in length). Create a connecting access, 7 m wide with signage, across Middlebrook Road, where it connects the eastern and western portions of the Project (no site access will be allowed from Middlebrook Road in this location; only one site access is proposed).	Permits required for over size over mass vehicles, closer to construction. Shuttle busses may be provided that can transport staff to/from the site reducing the number of private vehicles used. However, for the purposes of assessment it has been assumed that all staff arrive in private vehicles in order to undertake a conservative assessment	The assessment includes a Traffic assessment, Route assessment, Cumulative assessment and Intersection assessment as required The *RTA Guide to Traffic Generating Developments* and relevant Austroads Guidelines have been cited.
Land compatibility (including soil and agricultural impacts)	No impacts on Class 3 (Biophysical Strategic Agricultural Land) Impacts confined to Class 4 and 5 land (459.75 hectares and 50.47 hectares respectively). Land Use Conflict Risk Assessment (LUCRA) methodology used to demonstrate: • Low impact on agricultural capability of the site or adjoining enterprises • Low impact on rural residential land use and transport corridors. • The Project will allow continued grazing during operation and is highly reversable; no resultant impact on soil capability or land use options after decommissioning.	Soil surveys verified the existing Land and Soil Capability mapping for the Subject land	Soils surveys at required intensity. Level 2 reduced assessment, in accordance with large scale solar guidance. No further assessments required

	Results of assessment	Approach to uncertainty	Assessment requirements
Biodiversity	Most of the Project is now confined to areas considered Category 1 Land; exempt from most aspects of biodiversity assessment, being highly modified from extensive agricultural practices (99%). With Project refinements to protect the higher value vegetation, the Project now results in: • Removal of 2.52 ha of native vegetation remnants, consisting of two Plant Community Types (PCTs), both of which are listed as conservation significant Box Gum Woodland (including three hollow bearing trees) • Removal of 194 scattered trees occurring in exotic pasture (many trees contain hollows) • No Serious and Irreversible Impacts. • No referral on the basis of Matters of National Environmental Significance. The in-perpetuity offset obligation includes: • 27 ecosystem credits for PCT 433 White Box grassy woodland to open woodland on basalt flats and rises in the Liverpool Plains sub-region • 8 ecosystem credits for PCT 599 Blakely's Red Gum - Yellow Box grassy tall woodland on flats and hills in the Brigalow Belt South Bioregion and Nandewar Bioregion • 28 species credits each for Silky Swainson-pea *Swainsona sericea,* Belson's Panic *Homopholis belsonii* and Finger Panic Grass *Digitaria porrecta* (all three assumed to occur, as the survey was not sufficient to not rule these species out) • 104 credits generated by scattered trees	Two species assumed to occur due to unsuitable survey timing. Mitigation strategies to reduce risks of vehicle strikes, manage weeds and pathogens and reduce impacts on habitat connectivity will be adopted during construction and operation.	All relevant aspects of the Biodiversity Assessment Methodology have been applied including the 'avoid, minimise, offset' mandate. Mitigation strategies are in line with agency expectations. The in-perpetuity offset obligation will be met in accordance with the Biodiversity Conservation Act.
Aboriginal heritage	An Aboriginal Cultural Heritage Assessment was undertaken with Aboriginal parties who registered an interest in the Project in 2019-2020. This included development of a survey method. The survey fieldwork was undertaken from the 17-21 and 23-26 August 2020	A thorough archaeological field survey of the Project was conducted to identify Aboriginal objects.	The Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW (OEH, 2011), Aboriginal Cultural Heritage Consultation

	Results of assessment	Approach to uncertainty	Assessment requirements
	including walked transect surveys (no test pitting was undertaken). 11 new artefact scatters and 19 new isolated finds were identified in addition to three more significant sites which will be avoided. These include two potential modified trees and an area of archaeological sensitivity adjacent to Spring Creek. Avoidance areas will be buffered and protected from any impacts. Salvage protocols have been developed to remove other artefacts prior to construction in collaboration with the registered Aboriginal parties.	This included areas outside the refined Development footprint.	Requirements for Proponents (DECCW, 2010) and the Code of Practice for the Archaeological Investigation of Aboriginal Objects in NSW (DECCW) have been applied. Notably, additional consultation is occurring concurrent with EIS exhibition to capture new RAPs. Any further updates to the ACHA based on this can be incorporated in the Submissions reporting, prepared after EIS exhibition to capture all public and agency responses.
Historic heritage	Three historic heritage listings were considered in relation to the Project and no historic heritage impacts are anticipated: • Tamworth Post Office: no potential for direct or indirect impacts from the Project due to distance from the Project. • Swamp Creek Bridge: The New England Highway is a main transport corridor assessed as able to tolerate the additional traffic generated by the Project. No potential for direct or indirect impacts from the Project. • Goonoo Goonoo Station Group: no potential for direct impacts. The Visual assessment determined low impact on the basis of topography alone. Considering intervening vegetation this would be lower again.	Impact to historic heritage is considered a very low risk; conclusions are based on historical studies and site surveys. No sites were identified within the Project site but an 'unexpected finds protocol' will be developed to address any relics identified during works.	The impact assessment has regard to the NSW Heritage Manual.
Social and economic	Key concerns raised by near neighbours during interviews and surveys included: • Potential for visual impacts / landscape changes • Potential to decrease property values and affect insurance premiums	A key uncertainty includes the availability of information. The SIA has been undertaken with information that is known	The SIA was informed by the principles of best practice as outlined in Social Impact Assessment Guideline (DPIE,

<table>
<tr><th></th><th>Results of assessment</th><th>Approach to uncertainty</th><th>Assessment requirements</th></tr>
<tr><td></td><td>Potential to create stress and affect community cohesion
Potential to decrease agricultural land uses
Potential to exacerbate local dust and traffic impacts
The broader community (including Tamworth) raised jobs training and business opportunities, housing impacts and potential for skills drain.
The Project scale has been reduced in scale and consultation will continue to address the concerns above and ensure local benefits are maximised. This has included:
Additional photomontages produced for specific landowners, to demonstrate the low visual impacts on their residences.
A series of FAQ sheets prepared to increase understanding of industry issues as well as local initiatives that would accompany this Project.
A detailed impact management framework is proposed including a:
Community and Stakeholder Engagement Strategy
Industry Participation Plan
Community Benefit Sharing Program.</td><td>about the Project and the social context at the time of writing, and social impacts have been predicted based on this information</td><td>July 2021)</td></tr>
<tr><td>Hazards</td><td>Preliminary Hazard Analysis (PHA) to develop a comprehensive understanding of the hazards and risks associated with the operation of the Battery Energy Storage System (BESS) conclude the risk profile for the project is considered to be tolerable ‘in so far as reasonably practicable’.
Offsite impacts would be minimal. The assessment concludes there is no potential for offsite fatality or injury.
Bushfire was considered separately. The Project would not present a substantial bushfire threat or represent an unacceptable hazard in the event of a bush fire. Mitigation measures have been developed for design, construction and operational stages of the Project to manage the identified risks.</td><td>The approach taken is a risk-based approach.
It is noted that the BESS model has not been selected. Assumptions are made clear in the assessment.
All EMF producing infrastructure would follow Australian and industry standards.</td><td>Management plans will be developed to reflect site specific conditions and final infrastructure selections:
Bush fire Emergency Management and Operations Plan
Fire Management Plan
Emergency Response Plan
Fire Safety Plan</td></tr>
<tr><td>Hydrology and water</td><td>Risks of flooding are low and mitigated by adhering to the hazard vulnerability modelling produced for the site.</td><td>Modelled using the most reliable computer modelling available at the time of</td><td>Mitigation specifically addresses Managing Urban Stormwater: Soils</td></tr>
</table>

	Results of assessment	Approach to uncertainty	Assessment requirements
use	Erosion risks considered low due to the construction methods employed and ground cover management practices to be adopted in operation. Best practice guidelines used to avoid riparian land where possible and guide restoration actions for limited water crossing impacts.	assessment	& Construction (Landcom 2004)
Air quality and climate	Risks from dust concentrated during the construction stage considered manageable. Potential heat island effects will be low on surrounding properties The greatest impact of the Project in relation to climate is the positive contribution to addressing climate change effects, by assisting in the transition to renewable energy generation.	The closest site access point has been selected and no other site access will be allowed, to reduce local dust from roads.	The NSW the POEO Act and relevant Australian standards and manufacturer's operating recommendations are referenced to management air quality / emissions impacts.
Resources and waste	High potential to reuse and recycle construction and decommissioning waste streams Waste initiative developed to ensuring sourcing as locally as practical and pre-emptively find reuse / disposal options as locally as practical.	Upper limit estimates of impact areas and material quantities are used to address uncertainty, building conservatism into the assessment and mitigation.	While a license is not required, wastes will be managed in accordance with the *Protection of the Environment Operations Act 1997* and *Waste Avoidance and Resource Recovery Act 2001.*
Cumulative impacts	Key cumulative impacts centre on visual, noise, traffic, land use, biodiversity and socio-economic impacts; all are assessed as negligible adverse cumulative impact. There is potential for a net socio-economic benefit, due to due to Project commitments to local employment, and the benefits from sales of local goods and services impacts and increased employment and skills, primarily during construction of the solar farm. A key benefit of the Project is its positive impact on reducing greenhouse gas emissions and moving electricity generation towards cleaner electricity generation. The Project would power the equivalent of about 153,000 NSW homes	As the timing of these relevant Projects is largely unknown, the assumption is that they may occur concurrent with either construction or operation of the solar farm. Measures to ensure that this accounted for in final management planning closer to construction have been included.	the *Cumulative Impact Assessment Guidelines for State Significant Projects* (DPE, 2021) is referenced.

8.2. Project objectives and context

The objectives of the Middlebrook Solar Farm are to select and develop a site which is not only suitable for commercial scale solar electricity generation but one which is appropriate to its site values and can be supported by the community. This objective is considered achievable.

The key community values and concerns, the Project's response to these matters are summarised below. The broader policy context of the Project and the Project's ability to deliver strategic benefits in this context are also provided. These demonstrate a Project which is:

- Responsive to local matters
- Significant in terms of local economic benefits
- Important in the renewable energy transition

8.2.1. Community values and concerns

Surveys were undertaken with local residents in 2023 to understand their current values and concerns in relation to the Project. Within the Loomberah locality, residents are aware of another solar project – the Acacia Solar Farm – that is in the pre-scoping phase (not yet available on the register). Key concerns raised by near neighbours during interviews and surveys included:

- Potential for visual impacts / landscape changes
- Potential to decrease property values and insurance premiums
- Potential to create stress and affect community cohesion
- Potential to decrease agricultural land uses
- Potential to exacerbate local dust and traffic impacts.

The broader community (including Tamworth) raised jobs training and business opportunities, housing impacts and potential for skills drain.

It is clear from the engagement undertaken with the community that there is concern about how renewable energy development could impact on the values of this area. The Middlebrook Solar Farm Project responses to community issues have helped shape the Project's benefits as set out below.

8.2.2. Project response

The Middlebrook Solar Farm Project has sought to differentiate itself as a solar project of appropriate scale, that can be supported by the community. In restarting the Project in 2023, key decisions were made to 'raise the bar' for other developers so that the broader industry can address the community concerns raised and become the positive transition to a more renewable generation future that is required. Specifically, the Middlebrook Solar Farm Project has been reduced in scale and designed to reflect local values and provide real opportunities.

Table 8-2 Middlebrook Solar Farm Project differentiators

Protecting amenity values

- No greater than low visual impact for any residence
- No more than low visual impact for any local viewpoint
- No construction or operational noise exceedance of applicable criteria for any non-associated receivers.
- Site access will be restricted to the closest location to New England Highway, to reduce local traffic impacts including dust.

Protecting native vegetation and habitat

- Most Box Gum Woodland remnants will be avoided, prioritising the better condition larger remnants.
- No barbed wire on security fencing where entanglement risks for gliders and bats exist.

Protecting agricultural values

- No impact on BSAL land.
- Protecting riparian land.
- Continued stock grazing of the operational solar farm allowed for.
- Soil surveys used to inform specific remedial treatments where required
- Ongoing ground cover monitoring and management to protect soils and pastures under the array during operation of the solar farm.
- Rehabilitation commitments part of decommissioning planning to preserve land soil capability.

Protecting Aboriginal cultural heritage

- No impacts to two potential modified trees of significance.
- No impacts to a key area of archaeological sensitivity identified on Spring Creek
- Salvage program and Cultural Smoking Ceremony to be undertaken prior to Project impacts, with representatives of the registered Aboriginal parties.

Building opportunities for the community

- A Community Benefit Fund established to be run by locals for local projects to maximise the benefit.
- A voluntary Neighbouring Benefit Fund for residents within 3 km.
- An Accommodation and Employment Strategy to maximise local benefits from the Project
- Waste initiative developed to ensure sourcing as locally as practical and to pre-emptively consider reuse / disposal options as locally as practical. For example:
  - Timber and metal supplied to trade schools and local craft workshops
  - Composted materials supplied to local gardeners and farms.

8.2.3. Strategic position

The Middlebrook Solar Farm has been selected for inclusion in the Priority Assessment Program, acknowledging its strategic alignment with government policies and ability to make fast and significant contributions to the renewable energy transition in NSW. The Project is evaluated against the program's criteria below.

Renewable energy policy context

The Middlebrook Solar Farm Project is in alignment with local, state and Australian government policies including the:

- Paris Agreement
- Climate Change Bill 2022
- Australian Government Renewable Energy Target (RET)
- Net Zero Plan Implementation Update 2022
- NSW Climate Change Policy Framework
- NSW Electricity Strategy
- Tamworth Regional Local Environmental Plan 2010 (Tamworth LEP)
- New England North West Regional Plan 2041.

The Middlebrook Solar Farm Project is in alignment with existing land uses and land values. It can:

- Avoid higher capability land, riparian land and maximise opportunities for continued stock grazing during the operational life of the solar farm.
- Provide a long-term income stream for the host landowners that will assist them to focus on working land with proven ability for more sustained agricultural use.
- Ensure local amenity values (views to pastoral land as well as hills and ranges) are minimised.

In this location, the scale of the Project and its ability to respond to the community and site's values, ensures that it will bring the many economic opportunities to the Loomberah and broader Tamworth community of the energy transition, without risking the local values. This is the kind of Project that communities can support and will raise the bar for successive developments in the region, including in the Renewable Energy Zones (REZs).

The Middlebrook Solar Farm Project is well located to realise synergies between the REZs. It is located to bring fast benefits in term of addressing energy loads and local benefits. It is:

- Not within the New England Renewable Energy Zone but is located on the major transport corridor between the New England and Hunter-Central Coast REZs.
- Not contingent on any future offsite network upgrades or connection of other projects. The Applicant is working closely with TransGrid to complete grid connection studies and provide for TransGrid to own and operate the onsite substation asset; the only connection works required. Grid stability will not be an issue for connection in the near future as it may be in areas with more projects in the REZs.
- Located close to the load and connected to the 330 kV network between Tamworth to Liddle and therefore is well located to bring up to 320 MW capacity of renewable energy generation to the region quickly, as coal fired power stations are retired. As more coal

generators go offline, the Middlebrook Solar Farm is in a strategically beneficial location to help fill the gap.

- By including battery storage, the Project would also 'sure up' the supply of electricity to the grid, at an important time, as more coal fire power stations reach the end of their operational life and reconfiguring the operation of the grid to deal with more intermittent sources such as wind and solar becomes more important.

Economic benefit

The Project would bring a significant (greater than $250 M) capital investment value to the region. The Capital Investment value (CIV) for the Middlebrook Solar Farm would be approximately $856,000,000 ex GST. This includes the costs to employ up to 400 workers during peak construction phase and up to 15 full-time equivalent jobs during the operation phase. This will diversify and boost the economic activities in the region through the existing service sector i.e., provision of recreation and accommodation services as well directly through onsite employment.

Commitments to local employment and economic stimulus include:

- A Community Benefit Fund established to be run by locals for local projects to maximise the benefit
- A voluntary Neighbouring Benefit Fund for residents within 3 km
- An Accommodation and Employment Strategy to maximise local benefit from the Project.

Public benefit

As an important part of the renewable energy transition, the Project will:

- Drive down the price of electricity for consumers, by increasing the amount of solar currently the cheapest new generation cost.
- Provide electricity generation close to consumption centres including the supply of the equivalent of the annual energy consumption of about 153,000 NSW homes.
- Bring broader benefits in addressing climate change and greenhouse gas emissions, an issue of high importance to local communities.

It is clear, however, from the engagement undertaken with the community for this Project, that there is concern about how renewable energy development could impact on the values of this area. The Middlebrook Solar Farm Project has therefore sought to differentiate itself as a Project of appropriate scale, that can be supported by the community, that has been designed to reflect the local values as providing real opportunities. As well the economic stimulus discussed above, the Project includes:

- A Community Benefit Fund established for and run by locals and local projects. Several local initiatives have been identified as of benefit, but this decision would reside with the local community.
- A voluntary Neighbouring Benefit Fund for residents within 3 km.
- Waste initiative: early development of a strategy to sourcing as locally as practical and pre-emptively find reuse / disposal options as locally as practical. For example, timber and metal supplied to trade schools and local craft workshops, composted materials supplied to local gardeners and farms, biowastes treated to allow for use as an agricultural land treatment.

The Project aims to demonstrate how solar projects can engage communities to benefit from the development of the renewable energy industries, such as:

- Local training initiatives
- Local business support
- Local infrastructure initiatives (charging stations, solar power, cycles ways, water supply).

The Middlebrook Solar Farm Project has also developed a number of Frequently Asked Questions (FAQ) sheets tailored to concerns within the community. These have been used to promote discussion with the community during consultation events and provided for reference on the Project's website. The address issues raised most frequently by the community and include:

- Property devaluation
- Cumulative impacts of solar farm and renewable energy development
- Agricultural impacts
- Potential for employment and training, business opportunities.

Design excellence & existing infrastructure

As above, the project is not contingent on other projects or upgrades proposed for the REZs. It makes use of the existing 330 kV electricity infrastructure and the main transport corridor between two REZs. The Project would be located close to the load and connected to the 330 kV network between Tamworth to Liddle and therefore is well located to bring up to 320 MW capacity of renewable energy generation to the region quickly, as coal fired power stations are retired. As more coal generators go offline, the Middlebrook Solar Farm is in a strategically beneficial location to help fill the gap.

Opportunities to continue grazing as a groundcover management strategy are also being investigated and will form part of the Project design. The panels would be high enough to support sheep grazing beneath them. Several solar farms in NSW have now successfully incorporated sheep grazing under and around the panels. The Applicant is in discussions with the landowners and is keen to work with them to achieve a balanced approach and maintain some agricultural activities within the solar farm.

Central to compatible land use under solar panels is the requirement to retain a year-round stable ground cover to protect soil and water resources. Timing and intensity of grazing will be managed to protect these values first, with broader local environmental benefits in the catchment.

One of the benefits of allowing small sheep to graze and coexist within the project site is that the solar panels can be a form of shelter in more extreme conditions, during storms and extreme heat. They can also assist with fuel management to ensure reduced fire risk around the panels. A lesser stocking rate will be required to but will also reduce soil compaction due to grazing.

High likelihood of delivery

Total Eren is a global renewable energy company that builds, owns and operates its renewable energy assets. In Australia, the Total Eren has built and owns the 256 MWp Kiamal solar farm, the largest solar farm in Victoria. Stage 2 of the Kiamal solar farm, currently under construction, has received a 10-year offtake agreement (under competitive tender) with the Victorian Government. The Middlebrook Solar Farm is a Proprietary Limited company established specifically for the purpose of developing and constructing this Project, which will draw on Total Eren's experience in Australia and overseas.

NGH have been involved in the Project since 2019, advising on best practice industry standards with regard to the environmental performance of the Project. Middlebrook Solar Farm has chosen to differential itself from its competitors, to raise the bar for delivering environmental and socially appropriate project's the community can trust. This is considered essential to ensuring there are approvable projects that can be supported in the energy transition.

The proposed Middlebrook Solar farm's construction is set to begin in Q2 2024. As this will be contingent on the timing of approval, the Project would commence construction within 18 months of approval.

8.3. Scale and nature of impacts

Considering all stages of development, construction, operation and decommissioning, solar farm development can be undertaken with limited impacts on the soils and pastures they rest on.

- The majority of soil disturbance required will be for establishing access tracks as well as excavating footings for the substation and operational buildings, as well as inverters and battery units located throughout the solar array. This represents a very small percentage of the Development footprint; less than 5%.
- The remaining areas will retain pasture. It will be shaded beneath the solar panels. This will result in some microclimate effects, most noticeable in extreme conditions when pasture growth and stock may benefit from the shelter they provide.
- In decommissioning, all above ground infrastructure would be removed and most will be repurposed / reused or recycled. The areas of disturbance will be rehabilitated to ensure the site is returned to its predevelopment soil capability or better. The substation would remain, a permanent asset transferred to TransGrid to assist broader electricity network operations.
- Adverse cumulative impacts are assessed as negligible. There is potential for a net socio-economic benefit, due to due to Project commitments to local employment, and the benefits from sales of local goods and services impacts and increased employment and skills, primarily during construction of the solar farm.
- The Project would provide a meaningful contribution to reducing greenhouse gas emissions and moving electricity generation towards cleaner electricity generation. The Project would power the equivalent of about 153,000 NSW homes.

8.4. Compliance and monitoring

The recommendations of the assessments outlined above have been captured in a consolidated set of mitigation commitments (Appendix B) and together with the Project description in Section 3, constitute the Project's commitment to developing a best practice solar farm.

Pending approval, environmental protection and management measures would be implemented via an environmental management framework, including construction, operational and decommissioning environmental management plans (EMPs). These plans would be prepared sequentially, prior to each stage of works.

Key EMPs identified in this EIS, and which would be prepared in consultation with relevant stakeholders, include:

Table 8-3 Specific management plans required for the Middlebrook Solar Farm Project

Management plan	Project stage
Biodiversity Management Plan	Construction
Cultural Heritage Management Plan	During construction - ongoing
Rehabilitation and Decommissioning Management Plan	Decommissioning
Soil and Water Management Plan	Construction
Groundcover Management Plan	Operation
Noise Management Plan	Construction
Community and Stakeholder Engagement Strategy update	Prior to construction
Industry Participation Plan	Prior to construction
Community Benefit Sharing comprising a: • Community Benefit Fund • Neighbouring Benefit Fund	Prior to construction
Traffic Management Plan	Construction
Bushfire Emergency Management and Operations Plan	All stages
Fire Management Plan	All stages
Emergency Response Plan	All stages
Fire Safety Plan.	All stages
Waste Management Plan	All stages

The management plans would each include performance indicators, timeframes, implementation and reporting responsibilities, communications protocols, a monitoring program, auditing and review arrangements, emergency responses, induction and training and complaint/dispute resolution procedures. Adaptive management would be used to ensure that improvements are made in response to the outcomes being reported. The plans would incorporate all of the specific protocols and mitigation measures contained in this EIS and any additional applicable requirements from the DPE's Conditions of Consent. They would be submitted to DPE for endorsement prior to commencement of works. To not fulfil the requirement of these plans would constitute a breach of the Project's consent.

In addition to the Project specific management plans, in line with other State Significant Development consents, it is expected that the DPE would condition the following in relation to this Project:

- Detailed plans of the final layout, showing comparison to the approved layout, prior to commencing construction.
- Incident and non-compliance notification requirements.
- Independent environmental audits.

8.5. Evaluation of the Project

The environmental and socio economic impacts of the Project have been evaluated above and the results in Table 8-1 demonstrate the Project has generally low level impacts, uncertainty has been addressed and the assessment has cited appropriate guidance in the assessment and management of impacts identified.

The Project is considered to comply with the principles of Ecologically Sustainable Development as follows:

- The precautionary principle has been adopted in the assessment of impact; all potential impacts have been considered and mitigated commensurate with risk. Where uncertainty exists, measures have been included to address the uncertainty. For example, a 'worst case' impact assessment has been undertaken to account for the uncertainty in the final impact footprint.
- Potential impacts have been assessed as likely to be localised and reversable and would not diminish the options regarding land and resource uses and nature conservation available to future generations. Importantly, the Project provides additional renewable energy that contributes to minimising the risk of climate change to current and future generations by reducing the carbon emissions produced in comparison to alternative fossil fuel electricity generation options. Opportunities to improve the soil health and landscape character have been identified.
- The Project would be decommissioned at the end of its operational life, removing all above ground infrastructure and all infrastructure to a maximum depth of 500 mm below ground level with the exception of the onsite substation and TransGrid connection assets. Rehabilitation targets set in relation to site soil surveys will ensure the site is returned to its existing (or better) land capability for future generations.
- Verification of no adverse restoration of land capability
- The value of the environment is made clear in the Project's commitment to the site's important social and environmental features. The long-term impacts have been considered and the project commitments ensure that natural resource use and pollution risks have been fully assessed and costs would be solely borne by the Applicant.

8.6. Conclusion

The Middlebrook Solar Farm, as set out in this EIS, meets all relevant planning provisions and guidelines and is considered justifiable and acceptable.

On balance, the Project is considered appropriate to the:

- Site's location, where it will supply nearby population centres with provide the grid with renewable energy to assist the transition away from coal generated electricity.
- Site's environmental values, where it has demonstrated key values can protected.

The specific values identified by the Project's neighbours, local and broader community have been incorporated into Project to ensure it is one which will maximise social license to operate.

Where to from here.

During the public exhibition of this EIS, the community, local council and government agencies are invited to make informed submissions in relation to the Project. The consent authority would consider any formal submissions made during the exhibition period. The Applicant's response to all matters raised in submissions will also be exhibited as the Department of Planning and Environment commence preparation of their own assessment of the Project's impacts and its merits and make a recommendation regarding its ability to be approved.

Please take the opportunity to make a submission directly to the Department of Planning and Environment and to participate in the future engagement activities planned prior to the Project's determination.

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