

An aerial photograph of a landscape at sunrise or sunset. The sun is a bright, glowing orb in the upper left, casting a warm, golden light across the scene. Below the sun, a layer of mist or fog blankets the middle ground, partially obscuring a dense forest of trees. In the foreground, a winding road or path cuts through the landscape, and some small structures or buildings are visible. The sky is a pale blue with a few wispy clouds. A large, dark blue diagonal shape overlays the right side of the image, containing the title text.

Appendix D
Landscape and
Visual Assessment

**Whitehaven
Solar Farm Project**

Environmental Impact Statement



WHITEHAVEN COAL

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1 INTRODUCTION

The Whitehaven Solar Farm Project (the Project) is located approximately 25 kilometres (km) south-east of Narrabri and approximately 60 km north-west of Gunnedah, within the Narrabri Shire Council Local Government Area, in the New England North West region of New South Wales (NSW) (Figure 1).

The Project would be located adjacent to the existing Narrabri Mine on Whitehaven Coal Limited (Whitehaven Coal)-managed land and would include approximately 26 megawatts (MW) direct current (DC) of solar electricity generation and the construction of a 10 Megawatt Hour DC Battery Energy Storage System (BESS). The Project would provide behind-the-meter electricity supply to the Narrabri Mine via the existing 66 kilovolt (kV) electricity transmission line (ETL).

Whitehaven Energy Pty Ltd (Whitehaven Energy), a wholly owned subsidiary of Whitehaven, is the proponent of the Project and is seeking approval for the Project as a State Significant Development (SSD) under Section 4.36 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

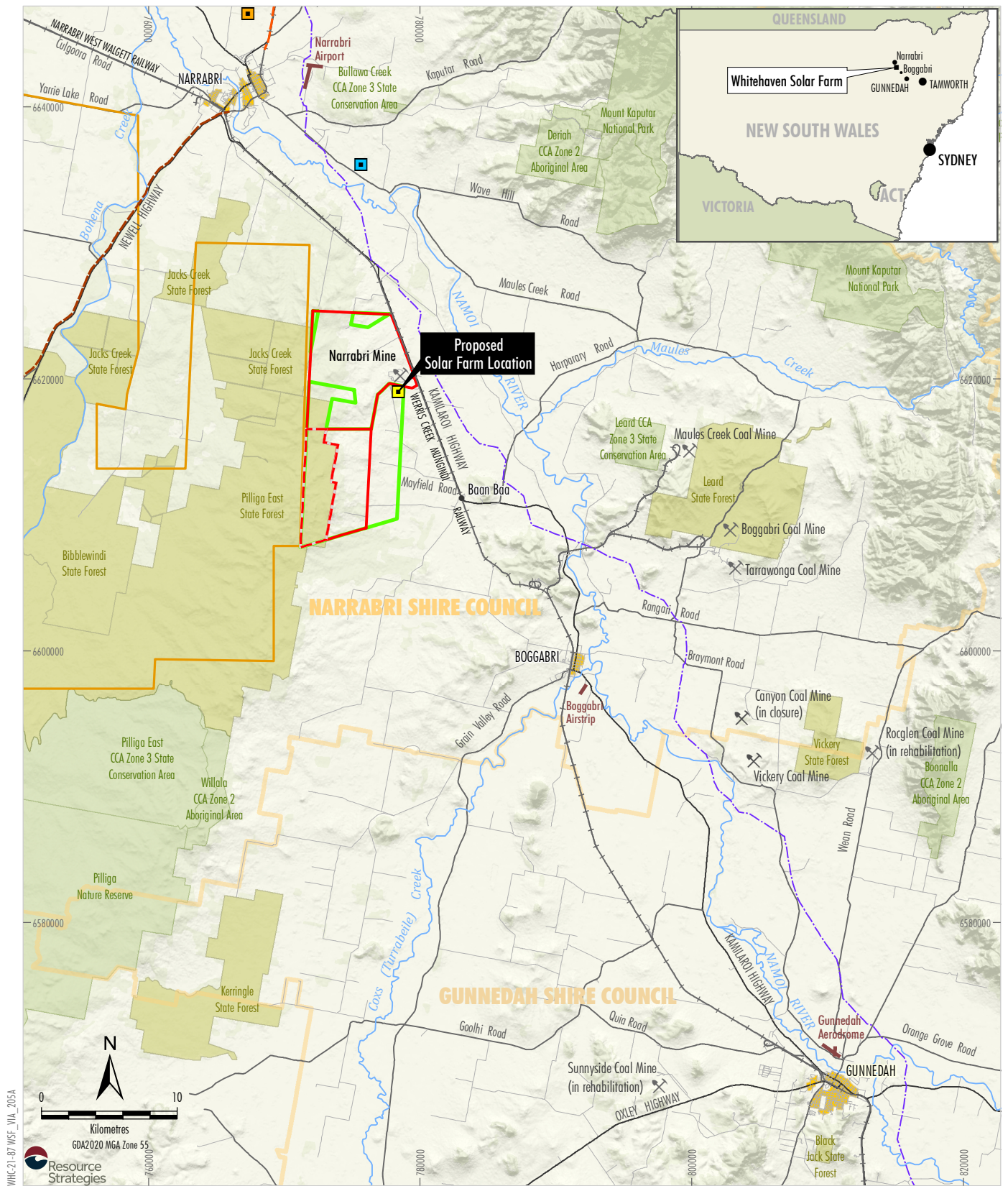
The Project would include the following primary components and activities (Figure 2):

- construction and operation of approximately 50,000 solar photovoltaic (PV) panels to provide electricity supply for the Narrabri Mine;
- construction of a substation that facilitates connection to the existing 66 kV overhead ETL;
- construction of an overhead ETL to connect the proposed substation to the existing 66 kV overhead ETL, north of Kurrajong Creek Rd;
- construction and operation of ancillary infrastructure including access roads, inverter stations, temporary staging areas, perimeter fencing and operations and maintenance buildings;
- construction and operation of a BESS;
- ongoing maintenance activities; and
- decommissioning and rehabilitation of the site.

Table 1 provides a summary of the key attributes of the Project.

Table 1
Summary of Key Project Attributes

Project Component	Summary Description
Size and Purpose	26 MW DC, 20 MW alternating current (AC) for behind-the-meter electricity supply to the Narrabri Mine.
Project Area	Development site footprint of approximately 100 hectares (ha).
Solar Configuration	■ Approximately 50,000 PV panels in a north to south alignment. ■ East to west tracking system (single axis).
Access Route	The proposed access route is via the Kamilaroi Highway and Kurrajong Creek Road.
Power Infrastructure	■ Substation. ■ 66 kV connector to the existing 66 kV ETL. ■ BESS.
BESS	■ 10 Megawatt Hour DC. ■ Centralised system. ■ Lithium battery.
Site Entry	Site entry would be via a constructed access point on Kurrajong Creek Road.
Construction	■ Construction period of approximately six to nine months. ■ Employment of approximately 30 personnel on average during its construction, with peak construction requiring approximately 65 personnel. ■ Construction undertaken during daylight hours.
Operational Life	The design operational life is approximately 50 years.
Decommissioning and Rehabilitation	Decommissioning at the end of the of Project life, involving the removal of all infrastructure with a proposed final land use to comprise a combination of native vegetation and agricultural (pasture).
Capital Investment	Approximately \$55 million.
Hours of Operation	24 hours per day with scheduled maintenance activities generally undertaken during daytime hours.



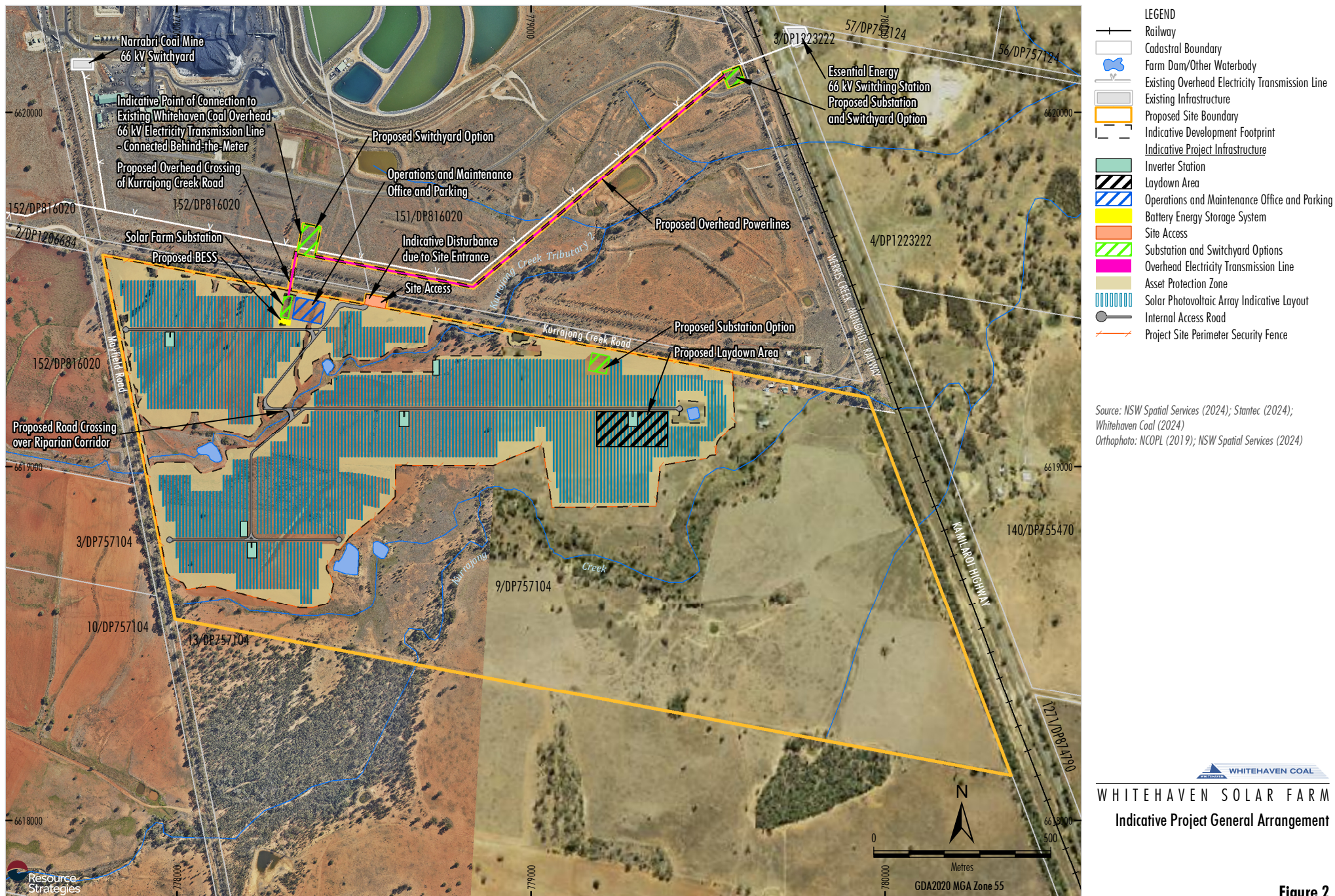
LEGEND

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|--|---|--|--|
| | Proposed Solar Farm Location | | Other Major Projects |
| | Mine Site | | Narrabri South Solar Farm |
| | Exploration Licence (EL 6243) | | Silverleaf Solar Farm |
| | Mining Lease (ML 1609, ML 1839) | | Narrabri Gas Project (Santos NSW [Eastem] Pty Ltd) |
| | Provisional Mining Lease Application Area | | Inland Rail (Narrabri to North Star - Phase 1) |
| | Local Government Boundary | | Proposed Inland Rail (Narramine to Narrabri) |
| | State Forest | | Proposed Queensland Hunter Gas Pipeline Alignment |
| | State Conservation Area, Aboriginal Area | | |



WHITEHAVEN SOLAR FARM
Regional Location

Figure 1



1.1 PURPOSE AND SCOPE

This Landscape and Visual Impact Assessment forms part of an Environmental Impact Statement (EIS) which has been prepared to accompany a Development Application made for the Project in accordance with Part 4 of the EP&A Act.

This Landscape and Visual Impact Assessment has been prepared to assist with addressing the following components of the Secretary's Environmental Assessment Requirements for the Project:

The EIS must address the following specific matters:

...

Landscape and Visual – including

- *a landscape and visual impact assessment, prepared in accordance with the Solar Guideline and the Technical Supplement – Landscape and Visual Impact Assessment;*
- *a detailed assessment of the likely visual impacts of all components of the project on surrounding residences (including approved developments, lodged development applications and dwelling entitlements), and key locations, scenic or significant vistas and road corridors in the public domain;*
- *details of measures to mitigate and/or manage potential impacts (including a draft landscaping plan for on-site perimeter planting, with evidence it has been developed in consultation with affected landowners); and*
- *detailed consideration on the Siding Spring Observatory in accordance with the Dark Sky Planning Guideline (2023).*

...

This Landscape and Visual Impact Assessment considers the *Dark Sky Planning Guideline* (NSW Department of Planning and Environment [DPE], 2023) in relation to potential night-lighting impacts.

The following components are included as part of this Landscape and Visual Impact Assessment:

- Characterisation of the existing landscape and visual setting (Section 2).
- Description of the Project components that could have potential visual impacts (Section 3).
- Assessment of potential landscape impacts (Section 4).
- Assessment of potential visual impacts (Section 5).
- Performance objectives of visual impacts for the Project (Section 6).
- Proposed mitigation and management measures (Section 7).
- Summary of the landscape character and visual impact assessments (Section 8).
- Documents referenced in Sections 1 to 8 of this Landscape and Visual Impact Assessment (Section 9).

2 ASSESSMENT METHODOLOGY

2.1 INTRODUCTION

This assessment considers how the proposed Project would potentially alter the existing landscape and/or potential visual impacts from the Project.

This assessment comprises two discrete components:

- Landscape character assessment (the assessment of potential impact on an area's cumulative built, natural and cultural character or sense of place).
- Visual impact assessment (the assessment of potential impacts on views).

This Landscape and Visual Impact Assessment has been prepared in consideration of the methodology described in the *Technical Supplement – Landscape and Visual Impact Assessment: Large-Scale Solar Energy Guideline* (the Technical Supplement) (DPE, 2022). The Technical Supplement provides quantitative assessment techniques that can be applied to evaluate the potential visual impacts of the Project.

2.2 PREVIOUS VISUAL ASSESSMENTS

In accordance with the Technical Supplement, a Preliminary Visual Assessment was undertaken to identify viewpoints that will require assessment as part of the Landscape and Visual Impact Assessment in the EIS. The Preliminary Visual Assessment was included in Attachment C of the Scoping Report and identified two viewpoints that fulfill the Technical Supplement viewpoint selection criteria.

This assessment considers the findings of the Preliminary Visual Assessment and implements quantitative assessment methodology from contemporary guidelines (i.e. the Technical Supplement) as a means to assess the potential landscape and visual impacts of the proposed Project.

2.3 LANDSCAPE CHARACTER ASSESSMENT

Landscape character assessment is the process for determining the overall impact of a development on an area's character and sense of place, including the community's and broader society's perceptions of the proposal.

A landscape character assessment can help to understand the cumulative effect of a project on a broader area (DPE, 2022).

The Technical Supplement identifies key tasks to be undertaken in a landscape character assessment, which are summarised below.

2.3.1 Baseline Analysis

A landscape character analysis should identify and describe the following (DPE, 2022):

- the elements that make up the landscape in the study area, including:
 - physical influences (such as geology, soils, landform, natural drainage and water bodies);
 - ecological characteristics and land cover of an area (such as whether it is forested, wetland, scrub, grass etc.) and the quality and type of vegetation cover;
 - the influence of human activity, including land use and management and the character of any settlements and buildings; and
 - key landscape features or attributes of the landscape associated with high visual interest or quality that stand out visually in the landscape, including natural features (such as a distinctive mountain peak or hilltop), cultural or agricultural features;
- the aesthetic and perceptual aspects of the landscape, particularly emphasising those that are key characteristics contributing to the distinctive character of the landscape (such as its scale, complexity, openness, tranquillity or wildness);
- aspects of the landscape that have important Aboriginal cultural heritage value (with the exception of artefacts and intangible values that would be assessed in detail as part of an Aboriginal Cultural Heritage Assessment), including why they are valuable to the community;
- the overall character of the landscape in the study area, including any distinctive landscape character types or areas that can be identified (see further guidance below);
- the condition of the landscape, including the condition of elements or features such as buildings or vegetation;
- the planning designations of an area relating to landscape character, including sensitive land use designations, zonings and heritage listings; and
- the location of any existing operational or approved large scale energy developments within a regional and local context, including projects which may have the potential to create direct or indirect cumulative impacts with the proposal.

2.3.2 Identify Landscape Character Zones

If the landscape has distinct areas with different qualities, the study area is to be divided into different character zones (DPE, 2022).

Landscape character zones divide the landscape based on common distinguishing visual characteristics including landforms and major land cover features (i.e. a combination of vegetation, water bodies and landforms) from which key landscape features can be identified (DPE, 2022).

2.3.3 Assess the Landscape Character Impact

The impact of the Project on each landscape character zone is to be determined through an evaluation of the sensitivity of the landscape and the magnitude of the proposal's specific impacts (DPE, 2022).

The sensitivity and magnitude are to be assigned a rating of either low, medium or high, which will determine the overall impact to landscape character on any given zone (DPE, 2022).

Landscape Sensitivity

Landscape sensitivity is a measure of the ability of a landscape to withstand change arising from development without negative impacts on the landscapes character and value (Tudor, 2019). Landscape sensitivity considers the susceptibility of associated visual resources of specific developments or other changes that are considered to contribute to the landscape character.

The landscape sensitivity of the development depends on a range of landscape characteristics. The primary characteristics used in this landscape assessment are character, aesthetics and perceptual aspects of the landscape (i.e. landscape sensitivity decreases as the landscape becomes more modified) (DPE, 2022).

The levels of sensitivity applied to each Land Character Zone (LCZ) includes (Tudor, 2019):

- High Sensitivity – landscape characteristics that are very susceptible to change and are unable to accommodate the development without significant landscape character impacts.
- High to Moderate Sensitivity – landscape characteristics are susceptible to change and may have the potential to accommodate the development in limited situations without significant character impacts. The threshold for significant change is low.
- Moderate Sensitivity – landscape characteristics are susceptible to change and may have the potential to accommodate the development in some situations without significant character impacts. The significant threshold for change is intermediate.
- Moderate to Low Sensitivity – landscape characteristics are resilient and have a low susceptibility to change and can accommodate the development in many situations without significant character impacts. The threshold for significant change is high.
- Low Sensitivity – landscape characteristics are not susceptible to change and can accommodate the development without any significant character change. The threshold for significant change is very high.

Landscape Magnitude

Landscape magnitude is defined as the measurement of the scale, form and character of a development proposal when compared to the existing condition. In terms of landscape assessments, landscape magnitude also relates to how much of a change the landscape will experience related to the Project. Combined with sensitivity, landscape magnitude provides a measurement of impact. The landscape magnitude of a project can vary depending on a number of factors, including the proportion of the landscape affected, the size and scale of the change and the level of contrast and compatibility with the surrounding landscape (Australian Institute of Landscape Architects, 2018).

The following should be considered when assigning magnitude ratings (DPE, 2022):

- size and scale including:
 - the extent of existing landscape elements that may be lost and the contribution of that element to the character of the landscape;
 - the extent to which the project becomes a minor or major element in the landscape and its dominance in the visual catchment;
 - the extent to which the project changes the key characteristics of the landscape, which are critical to its distinctive character;

- geographical area – the area of the landscape over which the effects will be experienced, having regard to the nature and scale of the proposal’s effects. This could vary from the immediate setting of the site to larger scales where the proposal may influence several landscape characters zones; and
- duration and reversibility of the effects on the landscape.

As the Technical Supplement does not provide a method for assessing the overall landscape character impact, this assessment has adopted the matrix provided in Table 2 to make conclusions regarding landscape character impacts. This matrix has been adapted from the visual impact matrix provided in the Technical Supplement (DPE, 2022).

Table 2
Landscape Character Impact Matrix

	High Landscape Sensitivity	Moderate Landscape Sensitivity	Low Landscape Sensitivity	Very Low Landscape Sensitivity
Very High Magnitude	High	High	Moderate	Moderate
High Magnitude	High	Moderate	Moderate	Low
Moderate Magnitude	Moderate	Moderate	Low	Low
Low Magnitude	Moderate	Low	Low	Very Low
Very Low Magnitude	Low	Low	Very Low	Very Low

2.4 VISUAL IMPACT ASSESSMENT

Under the Technical Supplement, a visual impact assessment involves two key stages – a preliminary assessment and a detailed viewpoint assessment.

2.4.1 Preliminary Assessment

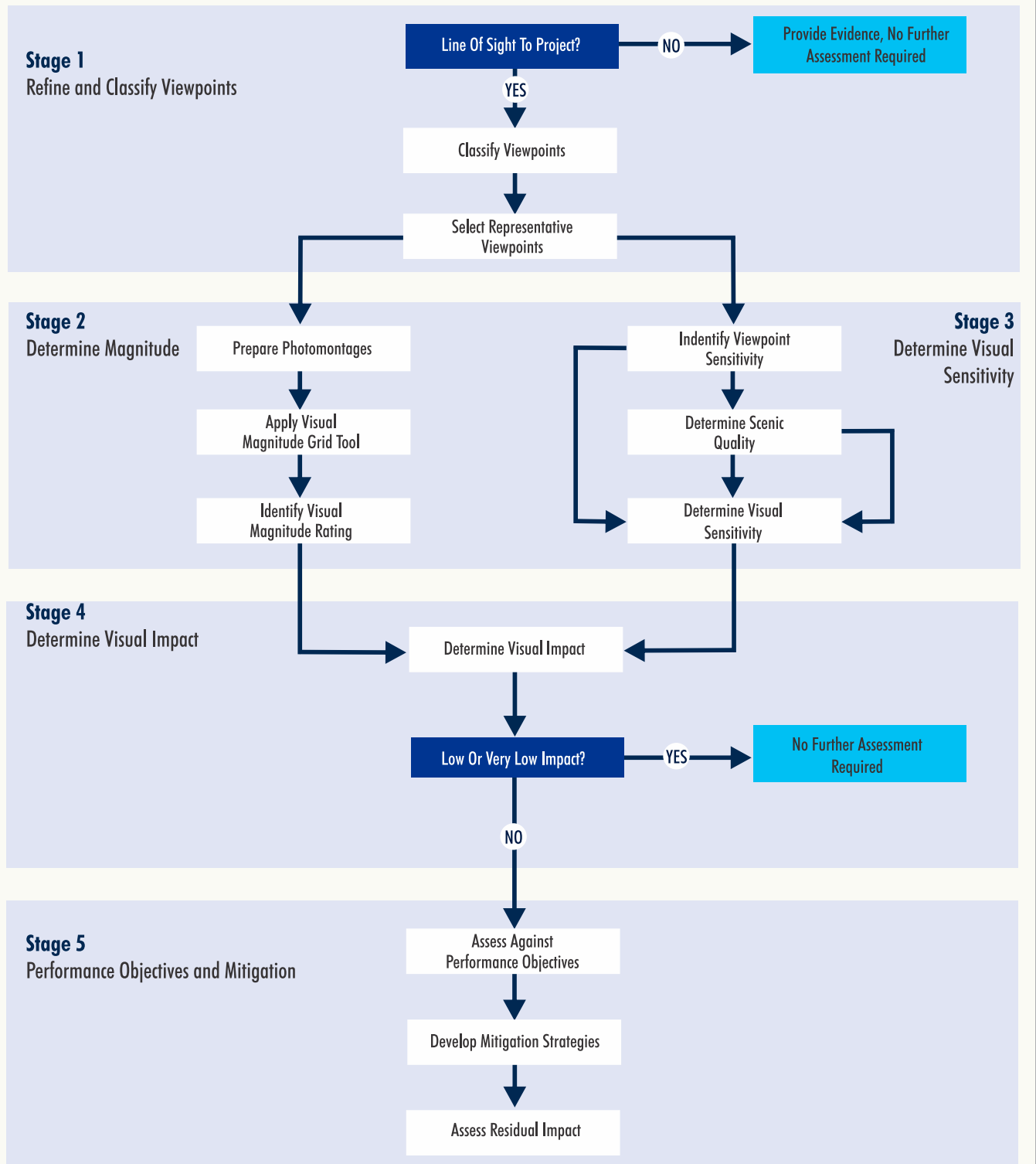
The preliminary assessment stage is used to identify viewpoints that will inform the remaining components of a visual impact assessment.

As described in Section 2.2, a Preliminary Visual Assessment was undertaken in accordance with the Technical Supplement to identify viewpoints that will require assessment as part of the Landscape and Visual Impact Assessment in the EIS. The Preliminary Visual Assessment was included in Attachment C of the Scoping Report.

Further detail on the Preliminary Visual Assessment undertaken for the Project is described in Section 6.1.

2.4.2 Detailed Viewpoint Assessment

This stage is used to undertake a comprehensive assessment of visual impacts on the viewpoints to be assessed. The process is described below and shown in detail on Figure 3.



Source: DPE (2022)

Figure 3

Consideration of Visual Magnitude

The visual magnitude of a proposal is its apparent size determined by the volume of the horizontal and vertical fields of view occupied.

The steps described below are used to determine the visual magnitude for each viewpoint (DPE, 2022):

- Capture a panoramic photograph that comprises 180 degrees (°) of horizontal field of view.
- Produce a photomontage by overlaying a 3D model of the proposed development on the panoramic photo.
- Overlay the Visual Magnitude Grid Tool (the Grid Tool) on the photomontage.
 - The Grid Tool is a transparent grid that can be overlaid onto a photomontage to quantitatively determine the visual magnitude of a development. The Grid Tool divides a photomontage into 720 individual cells each comprising a 1° vertical and 10° horizontal field of view.
- Identify and count the number of grid cells that the project would occupy.
- Determine the magnitude rating based on the number of cells and the thresholds in Table 3.

Table 3
Visual Magnitude Thresholds

Number of Occupied Cells	Visual Magnitude Rating
1-6	Very Low
7-12	Low
13-21	Moderate
22-30	High
31+	Very High

Source: DPE (2022).

Consideration of Visual Sensitivity

Visual sensitivity refers to the quality of the existing view and how sensitive the view is to the proposed change. In accordance with the Technical Supplement, visual sensitivity is determined by identifying the sensitivity of each viewpoint and categorising the scenic quality of the area in view (DPE, 2022).

Viewpoint sensitivity refers to the relative importance of viewpoints and the value that the community or visitors may place on landscapes viewed from public use areas, public travel ways and private viewpoints (i.e. dwellings). Views from dwellings are categorised based to their importance (i.e. primary or secondary views, as described in Table 4). Viewpoint sensitivity is classified into one of four ratings (very low, low, moderate and high) (DPE, 2022).

Viewpoint sensitivity classifications and relevant examples are provided in Table 5.

Scenic quality refers to the relative scenic, cultural or aesthetic value of the landscape within the viewshed based on the presence or absence of key landscape features known to be associated with community perceptions of low, moderate, or high scenic quality (DPE, 2022).

The scenic quality classification criteria and relevant examples are provided in Table 6.

Once the viewpoint sensitivity and scenic quality are determined, these can be combined using the matrix shown in Table 7 to determine the overall visual sensitivity for each viewpoint.

Determination of Visual Impact

The overall visual impact rating of each viewpoint must be determined for each assessable viewpoint by combining the visual magnitude and visual sensitivity ratings using the matrix provided in Table 8.

Table 4
Primary and Secondary Viewpoints from Rural Dwellings

Primary Viewpoint	Secondary Viewpoint
Principal/frequented living spaces (e.g. living rooms, kitchens, dining areas)	Less frequented living and service areas (e.g. bedrooms, laundries, bathrooms, garages, studies)
Front and rear views from a dwelling, particularly from any porch, balcony, veranda, deck or patio	Side views from a dwelling

Source: DPE (2022).

Table 5
Viewpoint Sensitivity Levels and Examples

Viewpoint Type	Very Low Viewpoint Sensitivity	Low Viewpoint Sensitivity	Moderate Viewpoint Sensitivity	High Viewpoint Sensitivity
Residential	No place of residence present.	Secondary view from dwellings in rural areas (zoned RU1, RU2, RU3, RU4 and RU6), large lot residential areas (zoned R5) and in environmental or conservation areas (zoned C2, C3 and C4).	Primary view from dwellings in rural areas (zoned RU1, RU2, RU3, RU4 and RU6), large lot residential areas (zoned R5) and in environmental or conservation areas (zoned C2, C3 and C4).	Dwellings in residential areas and rural villages (land zoned R1, R2, R3, R4 and R5). Historic rural homesteads/residences on the national, state or local heritage list.
Transport/ Infrastructure	Local sealed and unsealed roads. Passenger rail lines with daily daylight services. State highways, freeways and classified main roads. Walking tracks and navigable waterways.	Tourist roads and scenic drives. Walking tracks and navigable waterways.	N/A	N/A
Social/ Cultural	Private recreation areas and sporting fields (defined as land zoned RE2).	Cemeteries, memorial parks.	Tourist and visitor accommodation and places of worship (such as bed and breakfasts, motels, hotels). Tourist uses in tourist areas (zoned SP3). Publicly accessible green and open spaces including picnic areas, parks, public recreation areas. Town centres and central business districts.	N/A

Source: DPE (2022).

Table 6
Scenic Quality Levels and Frame of Reference

Viewpoint Type	Low Scenic Quality	Moderate Scenic Quality	High Scenic Quality
Landform	Large expanses of flat or gently undulating terrain. Indistinct, dissected or unbroken landforms that provide little illusion of spatial definition or landmarks with which to orient.	Steep, hilly and undulating ranges that are not visually dominant. Broad shallow valleys Moderately deep gorges or moderately steep valley walls. Minor rock outcrops.	Isolated peaks, steep rocky ridges, cones or escarpments with distinctive form and/or colour contrast that become focal points. Large areas of distinctive rock outcrops or boulders. Well defined, steep sided valley gorges.
Vegetation	Extensively cleared and cropped areas with very limited variation in colour and texture. Pastoral areas, human created paddocks, pastures or grasslands and associated buildings typical of grazing lands.	Predominantly open forest or woodland combined with some natural openings in patterns that offer some visual relief. Vegetative stands that exhibit a range of size, form, colour, texture and spacing including human influenced vegetation such as vineyards, and orchards.	Strongly defined patterns with combinations of native forest, naturally appearing openings, streamside vegetation and/or scattered exotics. Distinctive stands of vegetation that may create unusual forms, colours or textures in comparison to surrounding vegetation.
Waterbodies	Absence of natural waterbody. Farm dams, irrigation canals or stormwater infrastructure.	Intermittent streams, lakes, rivers, swamps and reservoirs.	Visually prominent lakes, reservoirs, rivers, streams, wetlands and swamps. Presence of harbour, inlet, bay or open ocean.
Social/ Transport	Places of worship, cemeteries/memorial parks, private open spaces.	Local heritage sites. Distinguishable entry ways to a regional city identified in the Transport and Infrastructure SEPP.	Culturally important sites, world heritage areas, national parks/reserves. Commonwealth and state heritage sites.
Human Presence	Dominating presence of infrastructure, human settlements, highly modified landscapes and higher density populations such as regional cities, industrial areas, agricultural transport or electricity infrastructure.	Dispersed yet evident presence of human settlement such as villages, small towns, isolated pockets of production and industry, lower scale and trafficked transport infrastructure.	Natural/undisturbed landscape. Minimal evidence of human presence and production.

Source: DPE (2022).

Note: Transport and Infrastructure SEPP = *State Environmental Planning Policy (Transport and Infrastructure) 2021*.

Table 7
Viewpoint Sensitivity Matrix

	High Scenic Quality	Moderate Scenic Quality	Low Scenic Quality
High Viewpoint Sensitivity	High	High	Moderate
Moderate Viewpoint Sensitivity	High	Moderate	Moderate
Low Viewpoint Sensitivity	Moderate	Low	Low
Very Low Viewpoint Sensitivity	Low	Very Low	Very Low

Source: DPE (2022).

Table 8
Visual Impact Matrix

	High Visual Sensitivity	Moderate Visual Sensitivity	Low Visual Sensitivity	Very Low Visual Sensitivity
Very High Magnitude	High	High	Moderate	Moderate
High Magnitude	High	Moderate	Moderate	Low
Moderate Magnitude	Moderate	Moderate	Low	Low
Low Magnitude	Moderate	Low	Low	Very Low
Very Low Magnitude	Low	Low	Very Low	Very Low

Source: DPE (2022).

Performance Objectives and Impact Mitigation

The Technical Supplement outlines performance objectives that are applicable to large-scale solar development, including avoidance, mitigation, re-siting and re-sizing of solar components. It is noted some measures that are highly applicable to a modular solar development may be less applicable to a mining context.

Visual impact mitigation measures to be implemented for the Project are described in Section 7.

3 EXISTING ENVIRONMENT AND VISUAL SETTING

3.1 INTRODUCTION

This section describes the existing landscape character and visual environment associated with the Project. This is necessary to establish a baseline upon which to assess the landscape and visual impacts of the Project.

3.2 EXISTING LANDSCAPE AND VISUAL SETTING

The landscape and visual setting for the Project is largely associated with native vegetation coverage and an altered topography which is a result of existing mining operations and historical agricultural land uses within the region.

The landscape and visual setting surrounding the Project is primarily characterised by areas of cleared agricultural land interspersed with scattered vegetation that is generally associated with road reserves, dwellings and other farm buildings.

Located immediately north of the Project is the existing Narrabri Mine, which is associated with altered topography commonly attributed to coal mining operations.

Kurrajong Creek, a tributary of Namoi River, is located directly south of the Project. Kurrajong Creek is associated with scattered native vegetation lining the creek banks.

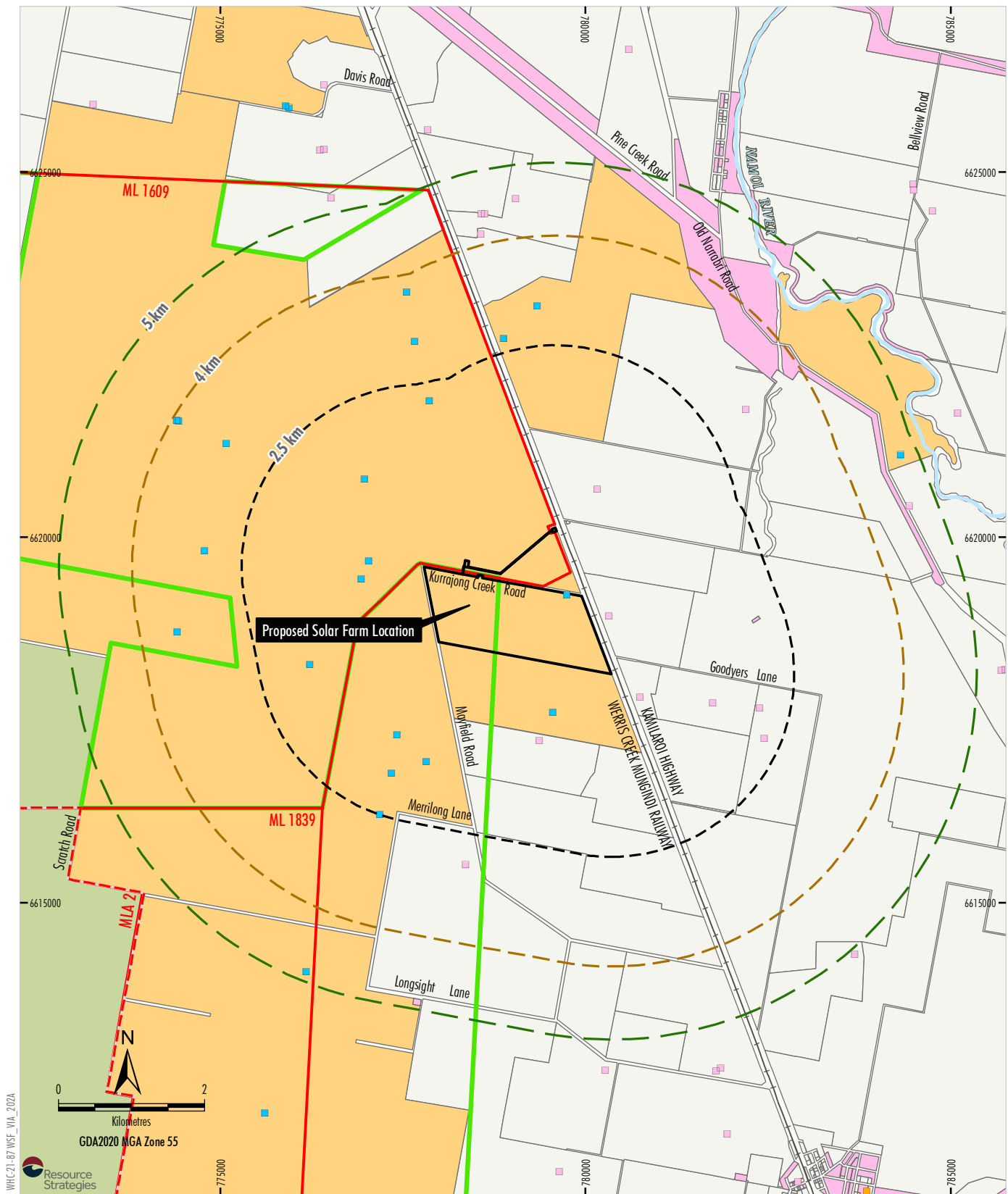
The landscape and visual setting to the west of the Project is characterised by the vegetated, hilly country of Jacks Creek State Forest and Pilliga East State Forest to the west, grading down to the alluvial plains associated with Namoi River to the east.

There are no villages or towns proximal to the Project. There are a number of privately-owned dwellings in the Landscape Character Assessment Area, predominantly to the north, south and east of the Project (Figure 4).

3.3 ASSESSMENT AREA

In accordance with the Technical Supplement, different components of this assessment are required to be informed by different study areas. As such, the following study areas will be used to inform this assessment based on setback distance from the Project Development Application Area (refer Figure 4):

- Landscape Character Assessment Area considers landscape elements and features within a 5 km radius of the Project.
- General Visual Impact Assessment Area considers private and public viewpoints within a 4 km radius of the Project.
- Transport Visual Impact Assessment Area considers visual impacts to public roads and rail lines within 2.5 km of the Project.



Source: NCOPL (2022); NSW Spatial Services (2022)

- LEGEND**
- | | |
|---|---|
| Mining Lease (ML 1609, ML 1839) | Transport Visual Impact Assessment Area |
| Exploration Licence (EL 6243) | General Visual Impact Assessment Area |
| Provisional Mining Lease Application Area | Landscape Character Assessment Area |
| State Forest | |
| Crown Land | |
| NCOPL Owned Land | |
| Privately Owned Land and Other Land | |
| Proposed Site Boundary | |
| Private Dwelling | |
| Crown Land Dwelling | |
| NCOPL Owned Dwelling | |

WHITEHAVEN COAL
WHITEHAVEN SOLAR FARM
 Land Ownership & Assessment Areas

Figure 4

3.4 LAND OWNERSHIP AND LAND USE

The existing/approved land use, in the vicinity of the Project, is characterised by a combination of mining operations (i.e. Narrabri Mine) and agricultural land uses (grazing, cereal production and horticulture), as well as the Pilliga East State Forest and Jack Creek State Forest.

The Project Development Application area is predominately located on Narrabri Coal Operation Pty Ltd (NCOPL)-owned land. Relevant ownership information for land parcels surrounding the Project is provided on Figure 4. Private land parcels are located to the north, south and east of the Project where a number of small-scale rural landholdings and residences are sensitive to the potential visual impacts of the Project.

The Narrabri township, located north of the Project also has a number of sensitive viewing locations but is located at a greater distance from the Project which influences visual sensitivity (Section 6).

4 PROJECT DESCRIPTION

As described in Section 1, the Project would include the construction, operation and decommissioning of the proposed solar farm to provide behind-the-meter electricity supply to the Narrabri Mine via the existing 66 kV ETL. The Project would allow for the supply of 26 MW DC and the construction of a 10 Megawatt Hour BESS.

The following sub-sections provide a more detailed description of major aspects of the Project that could potentially impact the visual landscape.

4.1 PROJECT AREA

The Project is located on Whitehaven-managed land, wholly within the Narrabri LGA. The Project would be located within and adjacent to land associated with the existing Narrabri Mine.

The Project Development Application Area is approximately 227 ha. The current indicative Project general arrangement is approximately 100 ha.

Figure 2 shows the indicative general arrangement of the Project, with a more detailed description of the Project provided in Section 3 of the EIS.

4.2 CONSTRUCTION

Construction activities for the Project would likely include:

- surveying and delineation of work areas;
- geotechnical investigations, including test pits and shallow augur holes;
- installation of sediment and erosion control measures (e.g. silt fencing);
- site clearing, grubbing and stripping;
- access road and laydown area construction;
- installation of office and maintenance areas;
- delivery and lay down of Project components;
- perimeter security fencing and entrance gate installation;
- foundation construction (substation and inverter stations);
- racking, east-west tracking system and photovoltaic panel installation;
- installation of inverters, intermediate step-up transformers (note these would generally be located next to the photovoltaic arrays), substation, communication towers and lighting;
- electrical cable installation (underground and/or aboveground); and
- site restoration, re-vegetation and landscaping.

Site access would occur off Kurrajong Creek Road from which the Project components (e.g. solar panels, mounting structures, inverters, fencing and ETL poles/conductors) would be delivered.

The Project would include construction of a 66 kV ETL to connect the Project to the existing 66 kV ETL located north of Kurradjong Creek Road. The ETL would transmit electricity from the substation and connect to the existing ETL via overhead transmission lines. The distribution line will be supported by poles which would be installed with augured holes.

The duration of the construction period is expected to be in the order of six to nine months. It is anticipated the Project activities would commence as soon as practicable after all necessary consents, approvals and licenses have been obtained.

4.3 PROJECT INFRASTRUCTURE

Key components of the Project general arrangement include solar panels, a substation, inverters and transformers, a BESS, internal access roads, operations and maintenance buildings, fencing and an overhead crossing. An indicative Project general arrangement is shown on Figure 2.

The indicative Project general arrangement includes two potential locations for the substation and switch room infrastructure (Figure 2). The potential locations are further discussed in Section 4.3.2.

Further details on Project infrastructure are described below. It should be noted that Whitehaven Energy would determine the most viable option and location of the below Project infrastructure as part of the detailed design phase.

4.3.1 Photovoltaic Panels

The Project would involve the installation and operation of approximately 50,000 solar PV panels. The panels would be supported by a racking system with structural racks aligned in rows from north to south. The solar panels would be mounted on a single-axis tracking system that would rotate the panels to follow the position of the sun as it moves from east to west to maximise solar power generation.

The solar panels would generally consist of a mono-crystalline cell type with a module size of approximately 2.2 metres (m) high and 1.3 m wide. Each solar panel is approximately 2.5 square metres (m²) in surface area and consists of many individual PV cells.

The solar panel rows would be approximately 7 m apart, supported by ground-mounted framing.

The solar panels and racking system would be approximately 4 m in height. Foundations would be screwed into the ground at a depth of approximately 3 m, varying due to geological conditions.

Once operational, the solar panels would stand at a maximum height of approximately 2.75 m when fully tilted. The lower end of the solar panel would be approximately 0.36 m above the ground level.

4.3.2 Supporting Electrical Infrastructure

The Project would include the construction and operation of approximately six inverter stations, a collection system, a substation, a switch room, a BESS and other behind-the-meter connection infrastructure.

Inverter Station Infrastructure

The Project consists of approximately six inverter stations (each inverter station comprising of an inverter and step-up transformer). Each inverter station converts the solar DC to three phase 33 kV AC electricity. The footprint of each inverter station would be approximately 6.5 m by 4 m (i.e. 26 m²).

The 33 kV AC electricity would be collected from the inverter stations via underground cables (i.e. the collection system) and connect to the 33 kV substation via underground cabling.

Substation Infrastructure

Whitehaven Energy is currently proposing to install a SMA Medium Voltage Power Station as the substation for the Project (or similar/equivalent infrastructure). The SMA Medium Voltage Power Station comprises a central inverter, transformer and switchgear, and operates at a voltage of 1,500 Volts DC.

The solar farm substation will accept the 33 kV AC electricity from the inverter stations and step-up the electricity to 66 kV AC via a step up transformer.

The prefabricated substation would be located within a separate fenced area containing the transformers, 33 kV and 66 kV switchgear, metering and control equipment and communication equipment. The footprint of the substation would be approximately 50 m by 30 m (i.e. 1,500 m²).

The Project general arrangement considers two potential locations for the substation and switch room infrastructure (Figure 2).

One of the potential locations consists of the substation being located adjacent to the BESS and maintenance building (Figure 2). The switch room would be located adjacent to the existing 66 kV ETL, north of Kurrajong Creek Road (Figure 2). In this case, the substation would transmit solar generated electricity to the switch room via overhead powerlines which would cross over Kurrajong Creek Road.

Alternatively, the substation and switch room would be located adjacent to the Narrabri Mine sealed site access road off Kamilaroi Highway (Figure 2). The substation and switch room would consist of overhead powerlines that run adjacent to the existing 66 kV ETL and would connect to the existing 66 kV ETL via a connection point north of Kurrajong Creek Road (Figure 2).

For both options, the switch room would connect to the existing Narrabri Mine 66 kV ETL, however the connection point would change.

As part of the detailed design phase, Whitehaven Energy would determine the most viable option for the substation and switch room infrastructure.

Battery Energy Storage System Infrastructure

A 10 Megawatt Hour DC small-scale BESS would be constructed as part of the Project. The inclusion of a BESS within the Project would enable increased energy storage flexibility, increased renewable energy provision to the mine and improve overall power supply optionality.

Whitehaven Energy is indicatively anticipating installing a Tesla Megapack BESS. The BESS would indicatively be approximately 30 m in length, 12 m in width and 2.5 m in height.

The BESS would be located adjacent to the switch room and would consist of a lithium battery with an integral inverter. As the system is proposed to be located in one location, a centralised BESS is proposed.

Electrical Transmission Line

The Project would include construction of a 66 kV ETL to connect the Project to the existing 66 kV ETL located north of Kurrajong Creek Road.

The ETL would be transmit electricity from the substation and connect to the existing ETL via overhead transmission lines. The distribution line will be supported by poles which would be installed with augured holes.

The overhead transmission lines would be located across Kurrajong Creek Road with an easement width of approximately 6 m. The connection location of the proposed ETL to the existing 66 kV ETL is subject to endorsement from Essential Energy. It is expected the transmission line corridor will be supported by power poles approximately 13 m in height which would be installed in the ground with augured holes.

Detailed ETL designs would be conducted in consultation with Essential Energy.

4.3.3 Operations and Maintenance Office

An operations and maintenance building of a temporary transportable-type construction would be installed. It would function as a data collection point, as well as a storage facility for spare parts to maintain the system. It is expected the office and maintenance building for the Project would be approximately 12 m in length and 3 m in width.

Once operational, it is expected that ongoing employment activities would involve less than one full-time equivalent worker, where monitoring and assessments/diagnostics would predominantly being completed off-site. Thus, it is not expected that the office space would be occupied frequently after construction.

4.4 PROJECT LANDFORMS

The Project Area is comprised of generally flat topography, predominantly cleared of vegetation for agricultural use. The elevations of the Project area rise gently from the south-east to the north-west ranging from approximately 245 to 275 m Australian Height Datum (Minesoils, 2024). Given the relatively flat topography of the Project area, the development will not involve modification of the landform.

Potential views of the Project would be limited by surrounding vegetation and/or landscape features (e.g. bunds) in the vicinity of the Project.

4.4.1 Vegetation Clearance

Prior to the commencement of construction activities, general site preparation works would involve:

- vegetation clearance in areas where Project construction activities would occur;
- installation of sedimentation and erosion controls; and
- soil stripping and stockpiling.

Site preparation would be undertaken progressively, ahead of specific construction areas.

Landform shaping may be required in some areas to enable construction and to improve drainage.

4.4.2 Landform Profiling and Rehabilitation

The design operational life of the Project is 50 years, at which point the Project would be reconditioned with updated technology or decommissioned. As the Narrabri Mine, which is currently permitted to operate to 2044, is expected to close prior to the expiration of the design life of the solar farm, Whitehaven Energy would look at opportunities to divest the solar farm to third parties or decommission the Project at that earlier stage.

As the Project would not require significant changes to the current landform of the Project area, rehabilitation of the Project area would be limited to revegetation of ground disturbance. This would include the ground mountings, Project infrastructure and associated disturbance. Rehabilitation activities would be undertaken upon completion of the Project.

4.4.3 Night-lighting

It is not likely that lighting would be necessary for construction activities as construction would only occur during daylight hours. However, lighting would be installed in the construction areas during the Project construction, and around the site offices during the Project operation for safety purposes.

Potential night-lighting associated with the Project would be emitted from the following sources:

- stationary work lights;
- fixed/permanent lights; and
- vehicle-mounted lights.

Direct views of night-lighting sources associated with the Project would occur from public roads and scattered private residences surrounding the Project, where intervening topography and vegetation permit. Lighting on taller infrastructure, such as the powerline poles, would also be visible.

The scale and intensity of night-lighting for the Project would be lower in intensity compared to the existing night-lighting at other nearby coal mining operations (i.e. Maules Creek and Boggabri Coal Mines) and the intensity for the Narrabri Mine.

The potential impacts of night-lighting associated with the Project are discussed in Section 6.6.

5 LANDSCAPE CHARACTER ASSESSMENT

This landscape assessment considers how the Project would affect elements that comprise the landscape, aesthetic and perceptual aspects of the landscape and its distinctive character (DPE, 2022).

5.1 BASELINE ANALYSIS OF LANDSCAPE CHARACTER

Elements of the regional landscape within a 5 km radius of the Project include extensively cleared terrain used primarily for agricultural and pastoral production, remnant woodland, the Namoi River floodplain and surrounding foothills.

It is noted that the existing landscape character is also strongly influenced by the historical dominance of agriculture in the region, in addition to the modified landscapes associated with the existing Narrabri Mine, which neighbours the Project.

Residential character areas are primarily associated with scattered rural residences.

Landscape Character and Surrounding Environment

The following landscapes described in Mitchell (2002) (i.e. Mitchell Landscapes) have been identified within the Landscape Character Assessment Area (Mitchell, 2002):

- **Cubbo Uplands** – stepped sandstone ridges with low cliff faces and high proportion of rock outcrop. Long gentle outwash slopes intersected by sandy streambeds and prior stream channels. General elevation of 400 m to 550 m. This landscape is densely vegetated, and comprises various forests and woodlands.
- **Bugaldie Uplands** – stepped stony ridges and abundant outcrop on ridge tops. General elevation of 350 m to 490 m with extensive joint controlled stream network. Vegetation primarily comprises native vegetation.
- **Liverpool Alluvial Plains** – undulating hills and sloping plains with alluvial channels and floodplains. General elevation 300 m to 350 m with local relief <10 m. Vegetation comprises open grassland with native vegetation along streams.
- **Namoi Channels and Floodplains** – Holocene fluvial sediments of channel and meander plain facies of the Namoi River alluvial fan and distributary stream system, relief in the channels 10 to 15 m. Stream flow is nearly permanent. Vegetation comprises predominantly native species.

Agriculture

Agricultural operations within in the Namoi River catchment and on surrounding areas has been the dominant factor in the development of regional landscape character. Land in and surrounding the Project consists of a predominately cleared land and derived native grassland with patches of woodland and scattered trees (Ausecology Pty Ltd, 2024).

NCOPL currently leases non-mining NCOPL-owned agricultural land in the vicinity of the Project to original landowners or other local farmers for ongoing productive use, and this practice would continue for the Project. This agricultural land is subject to a number of uses including grazing, cereal production and horticulture.

Existing Mining and Industrial Operations

The existing landscape character within the Landscape Character Assessment Area is influenced by the modified landscape associated with the existing Narrabri Mine.

It is noted that other approved coal mines are located in the vicinity of Project, which contribute to the overall regional landscape character. Existing coal mining operations include:

- Maules Creek Coal Mine.
- Boggabri Coal Mine.
- Tarrawonga Coal Mine.
- Vickery Coal Mine.

Landscape and visual impacts associated with these operations have been extensively assessed and approved as part of the environmental approvals process for these mines.

Private Landholdings

Land ownership in the Landscape Character Assessment Area primarily consists of NCOPL-owned land, which includes the existing Narrabri Mine and NCOPL-owned agricultural land that is leased to local farmers. As described in Section 3.4, the Project is located on NCOPL-owned land.

To the immediate north of the Project is the existing Narrabri Mine and associated surface infrastructure.

Land ownership to the east of the Project includes generally scattered rural residences and agricultural landholdings that are typically zoned as “RU1 – Primary Production”.

There are no towns located within the Landscape Character Assessment Area. The township of Baan Baa is the closest town located approximately 7 km south-east of the Project. Review of the *Narrabri Local Environmental Plan 2012* (Narrabri LEP) indicates that land within the town of Baan Baa is primarily zoned as “RU5 – Village”.

Consideration of Heritage

An Aboriginal Cultural Heritage Assessment has been prepared in support of the Project (Whincop Archaeology Pty Ltd, 2024).

A review of designations or classifications of the broader landscape setting from a cultural perspective was undertaken.

There were no citations in the NSW State Heritage Inventory, NSW State Heritage Register, Narrabri LEP, Gunnedah LEP or Australian Heritage Database for the Project area or surrounds (Niche Environment and Heritage Pty Ltd [Niche], 2020).

5.2 LANDSCAPE CHARACTER ZONES

In consideration of the discussion above, the landscape within the Landscape Character Assessment Area can be categorised into the following broad LCZs (Figure 5):

- LCZ 1 – Agricultural Plain;
- LCZ 2 – Rivers and Waterways;
- LCZ 3 – Existing Mining Operations;
- LCZ 4 – State Forest; and
- LCZ 5 – Woodland Areas.

Further discussion regarding these broad classifications is provided below.

5.3 LANDSCAPE CHARACTER IMPACT ASSESSMENT

In consideration of the LCZs identified above, an assessment of potential landscape character impacts associated with the Project is provided below.

5.3.1 Landscape Character Zone 1 – Agricultural Plain

LCZ 1 (Agricultural Plain) consists of the broad scale agricultural land use within the Landscape Character Assessment Area. Agricultural areas in the vicinity of the Project are located to the north, south, east and west and generally have little variation in topography. Rural residences associated with agricultural land uses within LCZ 1 (Agricultural Plain) are sparsely distributed and are located within the open landscape. Access roads within LCZ 1 (Agricultural Plain) are limited to sealed and unsealed roads with existing vegetation lining the area.

Landscape Sensitivity

The landscape associated with the LCZ has been highly modified by historical agricultural operations.

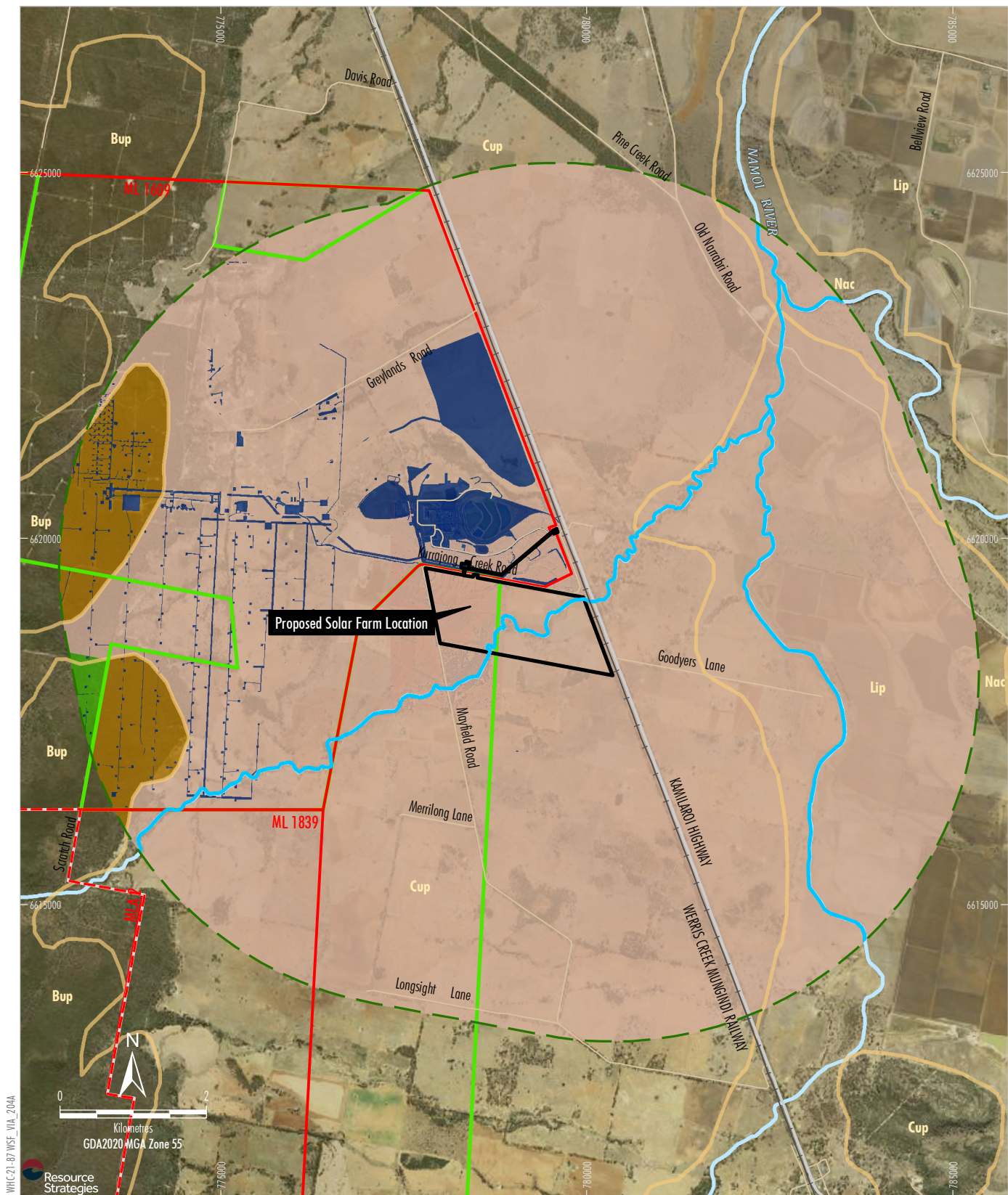
Human modification of agricultural areas is evident in the flat topography and widespread clearance of vegetation, as well as the presence of roadways, dwellings and ancillary agricultural infrastructure. As such, the LCZ is considered to have capacity to absorb landscape character impacts associated with the Project.

The landscape sensitivity of agricultural areas in the vicinity of the Project is considered to be Low.

Landscape Magnitude

The Project would be partially located within LCZ 1 (Agricultural Plain). As such, direct landscape character impacts associated with the Project would occur within the LCZ.

Infrastructure associated with the Project, including the ETL line, would be visible from some locations within the LCZ although it is noted that intervening topography and screening vegetation would significantly limit views of the Project. The Project would therefore be considered a minor landscape element.



- LEGEND**
- Mining Lease (ML 1609, ML 1839)
 - Exploration Licence (EL 6243)
 - Provisional Mining Lease Application Area
 - Proposed Site Boundary
 - Mitchell Landscapes
 - Bup Bugaldie Uplands
 - Cup Cubbo Uplands
 - Lip Liverpool Alluvial Plains
 - Nac Namoi Channels and Floodplains
 - Landscape Character Assessment Area
 - Landscape Character Zone
 - LCZ 1 – Agricultural Plain
 - LCZ 2 – Rivers and Waterways
 - LCZ 3 – Existing Mining Operations
 - LCZ 4 – State Forest
 - LCZ 5 – Woodland Areas

Source: NCOPL (2022); NSW Spatial Services (2022);
Stantec (2024)
Aerial Mosaic: NCOPL (2019); NSW Public Imagery (2022)

WHITEHAVEN COAL

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Landscape Character Zones

Figure 5

The Project would not significantly alter the landscape character of the LCZ. This is because Whitehaven Energy has committed to implementing agrisolar practices for the Project, which would enable the continuation of agricultural land uses during the operational phase of the Project.

Additionally, it is noted that the Project neighbours the approved Narrabri Mine. The Project infrastructure is comparatively smaller in scale and form than existing surface infrastructure associated with the Narrabri Mine. The Project would not be associated with permanent landscape character impacts to the LCZ. The Project would therefore have a negligible impact to the landscape character of LCZ 1 (Agricultural Plain) when compared to the Narrabri Mine.

In consideration of the above, the magnitude of landscape impacts on the LCZ are considered to be Low.

Landscape Character Impacts

In consideration of the matrix in Table 2 and Table 8, there is expected to be a Low landscape character impact to LCZ 1 (Agricultural Plain) as a result of the Project.

5.3.2 Landscape Character Zone 2 – Rivers and Waterways

LCZ 2 (Rivers and Waterways) primarily consists of Kurrajong Creek and its tributaries. It is noted that a small segment of Namoi River is located within the Landscape Character Assessment Area. Kurrajong Creek is a tributary of the Namoi River, which is a major regional river that is largely located approximately 7 km from the Project. Vegetation within LCZ 2 (Rivers and Waterways) is associated with riparian remnant vegetation along the meandering waterways where landscape elevations are slightly lower.

Landscape Sensitivity

LCZ 2 (Rivers and Waterways) is associated with higher density vegetation than LCZ 1 (Agricultural Plains). Kurrajong Creek is located immediately south of the Project development footprint (refer Figure 2) where remnant vegetation is present along the creek line. Landscape sensitivity of LCZ 2 (Rivers and Waterways) is considered to be Moderate to Low as the landscape is susceptible to change however, is able to accommodate the development without significant character impacts.

Landscape Magnitude

The Project would be partially located within LCZ 2 (Rivers and Waterways). As such, direct landscape character impacts associated with the Project would occur within the LCZ.

Infrastructure associated with the Project is relatively small-scale (when compared to infrastructure associated with the neighbouring Narrabri Mine). The Project would therefore be considered a minor landscape element.

The Project would be visible from the LCZ due to the proximity of Kurrajong Creek. Notwithstanding, the Project is expected to occupy a small proportion of LCZ 2 (Rivers and Waterways), and would not be associated with permanent landscape character impacts. Therefore, the Project would not significantly alter the landscape character of the LCZ.

In consideration of the above, the magnitude of landscape impacts on the LCZ are considered to be Low.

Landscape Character Impacts

In consideration of the matrix in Table 2 and Table 8, there is expected to be a Low landscape character impact to LCZ 2 (Rivers and Waterways) as a result of the Project.

5.3.3 Landscape Character Zone 3 – Existing Mining Operations

The LCZ consists of the existing Narrabri Mine located within the Landscape Character Assessment Area. The Narrabri Mine is a coal mining operation which neighbours the Project to the north. The LCZ is associated with extensively cleared vegetation and a permanently altered topography commonly attributed to coal mining operations.

Landscape Sensitivity

The LCZ comprises the Narrabri Mine, and as such the landscape associated with this LCZ has been highly modified by human activities. Given the high degree of human influence, this LCZ has a high capacity to absorb landscape impacts associated with the Project.

In consideration of the above, the sensitivity of the LCZ would be considered Very Low.

Landscape Magnitude

The Project is located immediately south of this LCZ and is not expected to directly impact the landscape character of the LCZ.

As the landscape character of the LCZ has been strongly influenced by historical and contemporary human activities, the Project would not change key landscape elements or characteristics associated with LCZ 3 (Existing Mining Operations).

In consideration of the above, the magnitude of landscape impacts on the LCZ are considered to be Low.

Landscape Character Impacts

In consideration of the matrix in Table 2 and Table 8, there is expected to be a Very Low landscape character impact to LCZ 3 (Existing Mining Operations) as a result of the Project.

5.3.4 Landscape Character Zone 4 – State Forest

LCZ 4 (State Forest) includes a small area of the Jacks Creek State Forest and Pilliga East State Forest located some 4 to 5 km east of the Project. LCZ 4 (State Forest) is associated with higher elevations and is heavily vegetated. It is noted that both Jacks Creek State Forest and Pilliga East State Forest are managed by the Forestry Corporation of NSW.

Landscape Sensitivity

LCZ 4 (State Forest) is located approximately 5 km from the Project, with the existing vegetation primarily including densely vegetated areas.

The landscape character of the LCZ is largely undisturbed by human activities and comprises steep slopes and densely vegetated woodlands. However, the LCZ would not be highly sensitive to changes associated with the Project given the intervening distance.

Due to the distance from the Project, the sensitivity of the LCZ would be considered Moderate.

Landscape Magnitude

The Project is located approximately 5 km away from LCZ 4 (State Forest). Therefore, it is unlikely for the LCZ to experience direct or indirect impacts associated with the Project.

Due to the distance, the Project is not expected to be visible from within the LCZ. As such, it is considered unlikely that the Project would impact the landscape character of LCZ 4 (State Forest).

In consideration of the above, the magnitude of landscape impacts on the LCZ are considered to be Very Low.

Landscape Character Impacts

In consideration of the matrix in Table 2 and Table 8, there is expected to be a Very Low landscape character impact to LCZ 4 (State Forest) as a result of the Project.

5.3.5 Landscape Character Zone 5 – Woodland Areas

LCZ 5 (Woodland Areas) is characterised by areas of dense vegetation coverage and high tree clusters. This LCZ is similar to LCZ 4 (State Forest), with the exception that LCZ 5 (Woodland Areas) is not within a declared State Forest and is therefore not managed by Forestry Corporation of NSW for forestry uses.

Landscape Sensitivity

LCZ 5 (Woodland Areas) is located to the west of the Project. LCZ 5 (Woodland Areas) largely comprises dense vegetation, although it is noted the LCZ has been slightly modified by historical human activities (i.e. areas of vegetation clearing and unsealed roads).

The LCZ would not be highly sensitive to landscape changes associated with the Project given the intervening distance (approximately 4 km).

Given the distance to the Project, the sensitivity of the LCZ would be considered Moderate to Low.

Landscape Magnitude

The Project is located approximately 5 km away from LCZ 5 (Woodland Areas). Therefore, it is unlikely for the LCZ to experience direct or indirect impacts associated with the Project.

Due to the distance, the Project is not expected to be visible from within the LCZ. As such, it is considered unlikely that the Project would impact the landscape character of LCZ 5 (Woodland Areas).

In consideration of the above, the magnitude of landscape impacts on the LCZ are considered to be Very Low.

Landscape Character Impacts

In consideration of the matrix in Table 2 and Table 8, there is expected to be a Very Low landscape character impact to LCZ 5 (Woodland Areas) as a result of the Project.

5.4 SUMMARY OF LANDSCAPE CHARACTER IMPACTS

Overall, the Project is expected to result in moderate to low levels of potential landscape impacts within relevant LCZ (Section 4).

A summary of the potential landscape character impacts discussed in Section 4.3 is shown in Table 9.

Table 9
Summary of Landscape Character Assessment

Landscape Character Zone	Sensitivity	Magnitude	Potential Impact
LCZ 1 (Agricultural Plain)	Low	Low	Low
LCZ 2 (Rivers and Waterways)	Moderate to Low	Low	Low
LCZ 3 (Existing Mining)	Very Low	Low	Very Low
LCZ 4 (State Forest)	Moderate	Very Low	Very Low
LCZ 5 (Woodland Areas)	Moderate to Low	Very Low	Very Low

6 VISUAL IMPACT ASSESSMENT

This visual impact assessment considers the likely impacts of the Project on key viewpoints within the private and public domain (DPE, 2022). The Project general arrangement, including all Project infrastructure components described in Section 4.3 were considered within this Visual Impact Assessment.

The generally flat topography in the vicinity of the Project aids in the direct line of sight between the Project and a viewpoint. As such, viewshed analysis has been excluded from the visual impact assessment as the existing landscape does not limit the line of sight of a viewpoint.

6.1 PRELIMINARY VISUAL ASSESSMENT

As described in Section 2.4, a Preliminary Visual Assessment was undertaken for the Project in accordance with the Technical Supplement and was presented as Attachment C of the Scoping Report.

The Technical Supplement requires identification of public and private receivers within 4 km of the Project area as well as identification of viewpoints from public road and rail lines within 2.5 km of the Project area.

To inform the selection of public and private receiver locations, a desktop review of the landscape and visual environment was undertaken identifying land with the potential to view components of the Project.

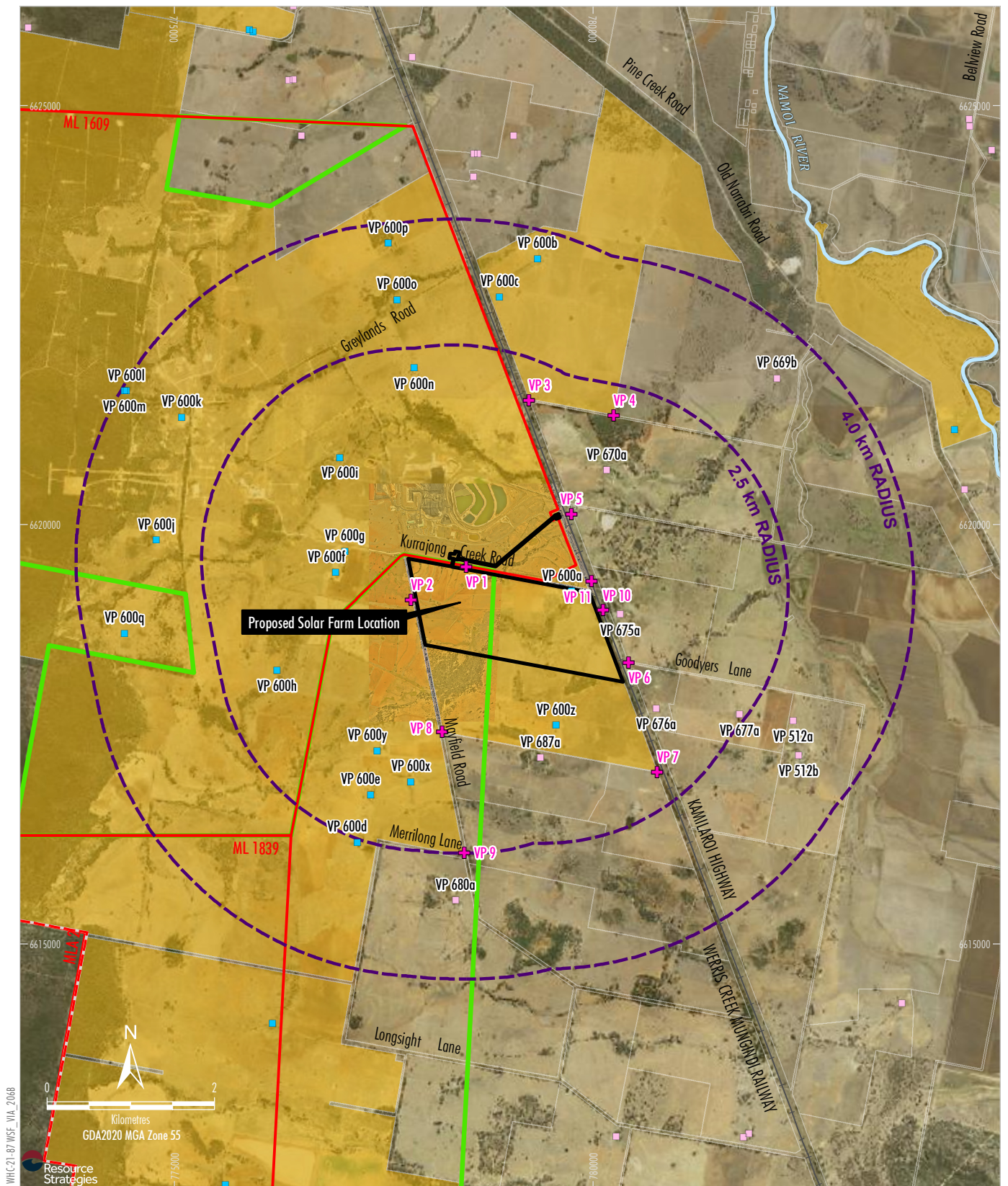
Eleven (11) potential viewpoints (VP 1, VP 2, VP 3, VP 4, VP 5, VP 6, VP 7, VP 8, VP 9, VP 10, and VP 11) from public roads and rail lines within 2.5 km of the Project were identified and were included in the Preliminary Visual Assessment, representing views from the Kamilaroi Highway, Kurrajong Creek Road, Mayfield Road and other local roads surrounding the Project. Twenty-eight (28) potential viewpoints from dwellings were identified within a 4 km radius of the Project. Dwellings owned by Narrabri Coal Operations Pty Ltd were excluded from this assessment. As such, nine private dwellings (VP 512a, VP 512b, VP 677a, VP 669b, VP 676a, VP 675a, VP 670a, VP 687a, and VP 680a) were included in the Preliminary Visual Assessment.

Figure 6 displays the potential viewpoints from public road, rail lines and private dwellings considered in the Preliminary Visual Assessment.

The results of the Preliminary Visual Assessment determined that two viewpoints (VP 1 and VP 2) required further detailed assessment. Viewpoints VP 1 and VP 2 represent potential views from Kurrajong Creek Road and Mayfield Road, respectively, which are publicly accessible local roads with low levels of traffic.

In addition to the two viewpoints that require further detailed assessment, Whitehaven Energy identified in the Preliminary Visual Assessment that an additional viewpoint, located to the north-east of the Project on Kamilaroi Highway, would potentially be included in the detailed assessment. Though not required to be included in the detailed assessment according to the results of the Preliminary Visual Assessment, a viewpoint located on the Kamilaroi Highway represents a potential viewpoint which would experience a high number of viewers (motorists) over the Project life and would be included to broaden the assessment.

The private receivers assessed as part of the Preliminary Visual Assessment were determined to not require further detailed assessment as the horizontal field of view and vertical field of view did not meet the assessment requirements provided in the Technical Supplement.



Source: NCOPL (2022); NSW Spatial Services (2022)
Aerial Mosaic: NCOPL (2019); NSW Public Imagery (2022)

- LEGEND**
- Mining Lease (ML 1609, ML 1839)
 - Exploration Licence (EL 6243)
 - Provisional Mining Lease Application Area
 - Proposed Site Boundary
 - Assessment Radius from Study Area
 - Cadastral Boundary
 - NCOPL Owned Land
 - Private Dwelling
 - NCOPL Owned Dwelling
 - + Public Road


WHITEHAVEN SOLAR FARM
Preliminary Visual Assessment
Viewpoint Locations

Figure 6

6.2 CLASSIFICATION OF VIEWPOINTS

Potential views of the Project may be available from locations including:

- portions of Kurrajong Creek Road looking south towards the Project;
- portions of the Kamilaroi Highway looking west towards the Project;
- portions of Mayfield Road looking east towards the Project;
- private dwellings located to the west of the Project;
- private dwellings located east of the Project;
- private dwellings located south of the Project; and
- accessible areas of Narrabri Mine.

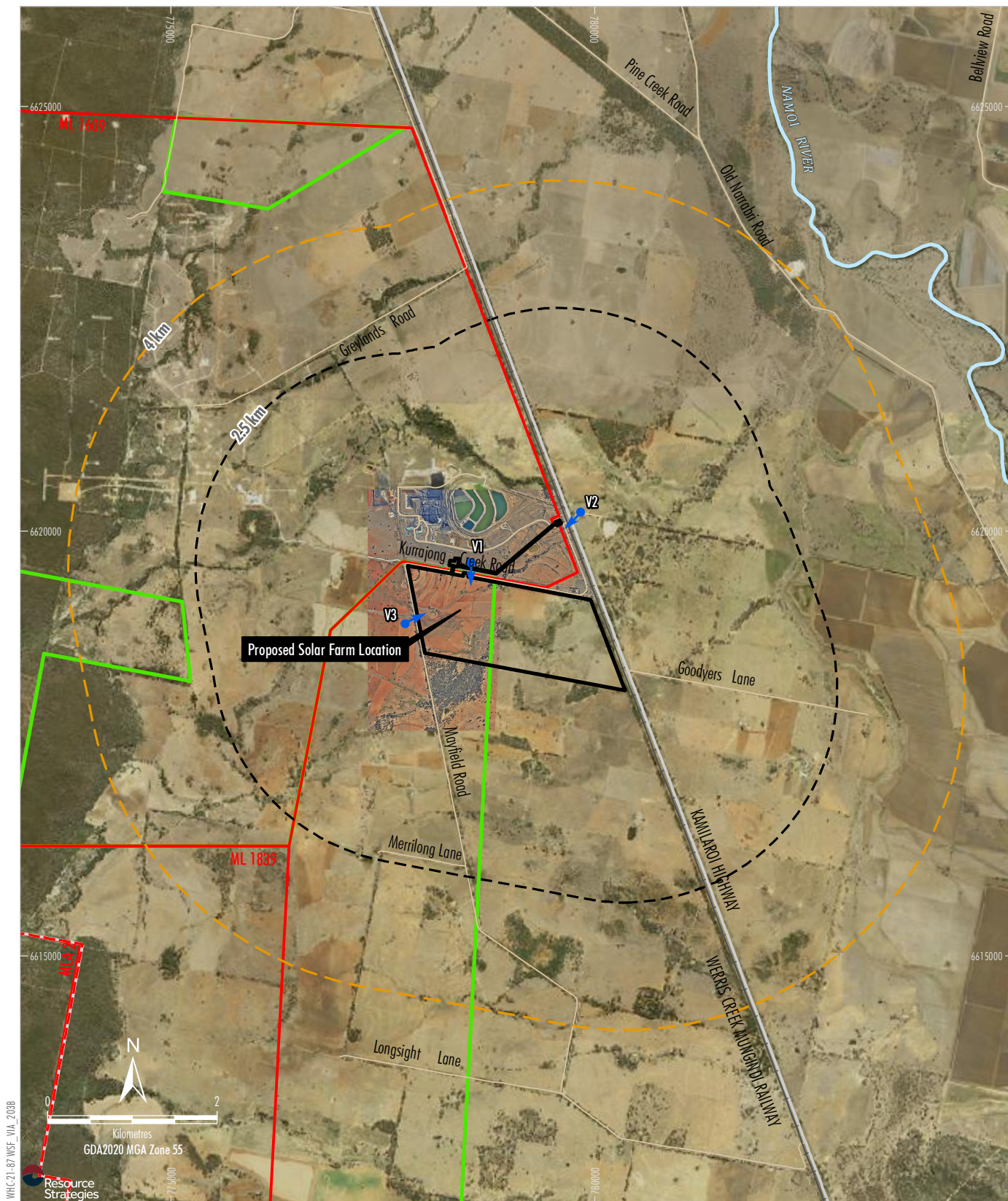
Agricultural production land has been considered to have low visual sensitivity and, therefore, has not been considered further.

The Jacks Creek State Forest and Pilliga East State Forest are not routinely accessed by the public, and any views of the Project from parts of the Jacks Creek State Forest and Pilliga East State Forest that are accessible are obstructed by dense vegetation. Therefore, visual impacts from the Jacks Creek State Forest and Pilliga East State Forest due to the Project are expected to be very low and are not considered further in this assessment.

Views of the Project from residential dwellings in rural areas proximal to the Project site are largely obscured by intervening topography and screening vegetation. As such, visual impacts to residential dwellings are not considered further in this assessment.

Viewpoints representative of the locations with potential views of the Project are shown on Figure 7 and summarised in Table 10.

Three (3) viewpoints were selected as being representative of the sensitive visual setting which may experience potential views of the Project. The classification of these viewpoints is discussed further below and summarised in Table 10.



- LEGEND**
- Mining Lease (ML 1609, ML 1839)
 - Exploration Licence (EL 6243)
 - Provisional Mining Lease Application Area
 - Proposed Site Boundary
 - Viewpoint
 - Assessment Area
 - Transport Visual Impact Assessment Area
 - General Visual Impact Assessment Area

Source: NCOPL (2022); NSW Spatial Services (2022);
 Stantec (2024)
 Aerial Mosaic: NCOPL (2019); NSW Public Imagery (2022)


WHITEHAVEN SOLAR FARM
 Detailed Visual Assessment
 Viewpoints & Visual Simulation Locations

Figure 7

Table 10
Locations of Viewpoints

Viewpoint	Easting	Northing	Distance from Indicative Project Infrastructure	Distance from Proposed Project Boundary	Description	Potential View of Project
Viewpoint 1 – Kurrajong Creek Road	778541.851	6619489.487	3.7 m (Site Access)	3.7 m	Representative of potential views experienced by people travelling east and west along a local road.	The Project would be directly visible, with minimal screening vegetation present.
Viewpoint 2 – Kamilaroi Highway	779736.485	6620125.530	137.9 m (Substation and Switchyard Option)	137.9 m	Representative of potential views experience by people travelling north and south along a main road.	Intermittent views of the Project would be available due to the elevation of intervening topography and existing vegetation.
Viewpoint 3 – Mayfield Road	777894.052	6618970.958	23.6 m (Fence Line)	20.2 m	Representative of potential views experienced by people travelling north and south along a local road.	The Project would be partially visible through intervening vegetation.

Viewpoint 1 – Kurrajong Creek Road East

Kurrajong Creek Road is a local sealed road located directly north of the Project area. Kurrajong Creek Road would be utilised by the Narrabri Mine, rural landholders and the Project workforce. Viewpoint 1 is located adjacent to the Project site access and represents the view from the proposed access point looking south towards the Project (refer Figure 8). Views from Kurrajong Creek Road are not associated with a dwelling and would be representative of a transport/infrastructure viewpoint type.

Viewpoint 2 – Kamilaroi Highway

Kamilaroi Highway is a State Road located to the east of the Project area. The Kamilaroi Highway runs generally north-south adjacent to the Project area and is commonly utilised for private road use as the highway provides access through regional centres such as Gunnedah, Boggabri and Narrabri. Viewpoint 2 is located adjacent to the proposed substation and switchyard option and is representative of potential views experienced by people travelling along the Kamilaroi Highway (Figure 9). Views from Kamilaroi Highway are not associated with a dwelling and would be representative of a transport/infrastructure viewpoint type.

Viewpoint 3 – Mayfield Road

Mayfield Road is a local sealed road located directly west of the Project area. Mayfield Road would be utilised for access to private residences and NCOPL-owned dwellings. Viewpoint 3 represents views from publicly accessible local roads (Figure 10). Views from Mayfield Road are not associated with a dwelling, and would be representative of the transport/infrastructure viewpoint type.

6.3 VISUAL SENSITIVITY

Visual sensitivity refers to the quality of the existing view and how sensitive the view is to the proposed change (DPE, 2022). Visual sensitivity can also be related to the direction a viewpoint is facing or where a proposed development can be viewed from (e.g. a living room in a residential dwelling).

Visual sensitivity is determined by identifying the individual sensitivity of a viewpoint in concert with the scenic quality of the viewshed (refer Table 7).

Viewpoint 1 – Kurrajong Creek Road East

The viewpoint is located along Kurrajong Creek Road (i.e. a sealed local road). Viewpoint Sensitivity is therefore classified as Very Low (refer Table 5).

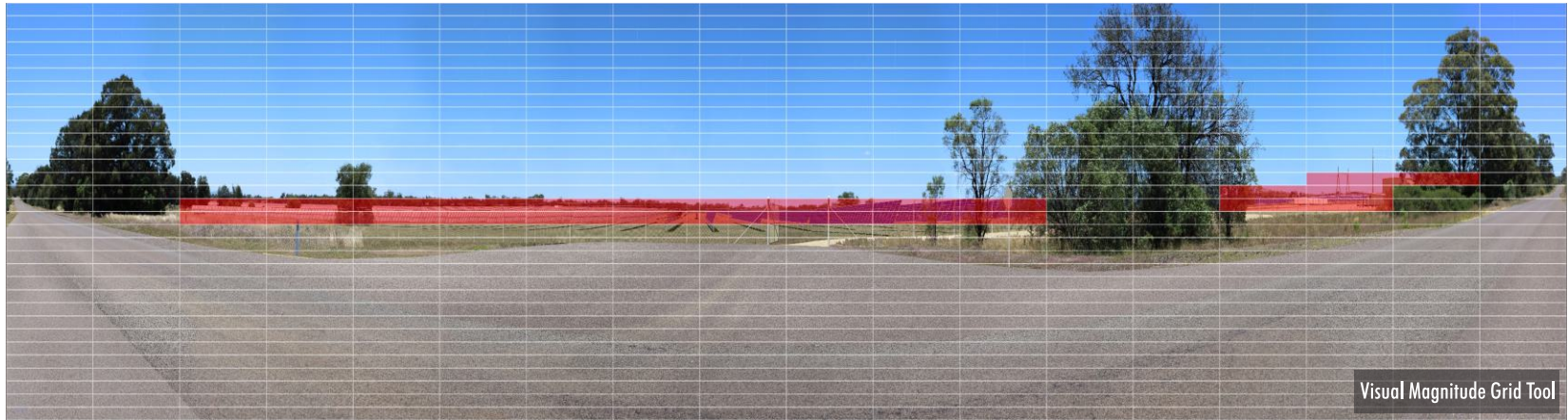
The viewshed contains a largely flat terrain, where vegetation has been cleared to support agricultural land uses. It is noted that scattered trees are evident in the foreground, and dense vegetation is noticeable in the background. There is dispersed evidence of human presence throughout the viewshed (i.e. fencing and Kurrajong Creek Road). The overall scenic quality of the viewpoint is conservatively considered to be Moderate.

Overall visual sensitivity is considered to be Very Low (refer Table 7).



LEGEND,
Visual Magnitude Tool
 Occupied Cell

Source: Greenpond (2024)



WHITEHAVEN COAL
 WHITEHAVEN SOLAR FARM
 Viewpoint 1
 Kurrajong Creek Road

Whitehaven Solar Farm Photomontage

Figure 8



LEGEND,
Visual Magnitude Tool
Occupied Cell

Source: Greenpond (2024)



WHITEHAVEN SOLAR FARM
Viewpoint 2
Kamilaroi Highway

Whitehaven Solar Farm Photomontage

Figure 9



LEGEND,
Visual Magnitude Tool
 Occupied Cell

Source: Greenpond (2024)



WHITEHAVEN COAL
 WHITEHAVEN SOLAR FARM
 Viewpoint 3
 Mayfield Road

Whitehaven Solar Farm Photomontage

Figure 10

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Viewpoint 2 – Kamilaroi Highway

Located to the east of the Project, the viewpoint is positioned along the Kamilaroi Highway, which is a State classified road. Viewpoint sensitivity is therefore Very Low (refer Table 5).

The scenic quality of the viewshed has been highly altered by human presence (i.e. Kamilaroi Highway, Werris Creek Mungindi Railway, electrical infrastructure, local roads and paddock fencing). The landform comprises a predominantly flat topography, and vegetation has been mostly cleared, with some instances of scattered trees evident throughout the viewshed. More dense vegetation is noticeable in the background. The overall scenic quality of the viewpoint is considered to be Low.

Overall visual sensitivity is considered to be Very Low (refer Table 7).

Viewpoint 3 – Mayfield Road

The viewpoint is located immediately west of the Project along Mayfield Road, which is a local sealed road and has a very low viewpoint sensitivity.

The existing viewshed includes a flat, unbroken terrain that has been largely cleared for agricultural land uses. There is evidence of vegetation in the immediate foreground. There is dispersed evidence of human presence throughout the viewshed (i.e. paddock fencing, Mayfield Road and the cleared terrain and Kurrajong Creek Road). The overall scenic quality of the viewpoint is conservatively considered to be Moderate.

Overall visual sensitivity is considered to be Very Low (Table 7).

The overall visual sensitivity of each viewpoint (including viewpoint sensitivity and scenic quality) is summarised in Table 11.

Table 11
Summary of Visual Sensitivity

Viewpoint	Viewpoint Classification	Viewpoint Sensitivity	Scenic Quality	Overall Visual Sensitivity
Viewpoint 1 – Kurrajong Creek Road	Public Road	Very Low	Moderate	Very Low
Viewpoint 2 – Kamilaroi Highway	State Highway	Very Low	Low	Very Low
Viewpoint 3 – Mayfield Road	Public Road	Very Low	Moderate	Very Low

6.4 VISUAL MAGNITUDE

The visual magnitude of a proposal refers to its apparent size relative to the existing visual environment, as determined by the volume of the horizontal and vertical fields of view occupied, as per the Technical Supplement (DPE, 2022). This quantitative methodology for determining the visual magnitude of the development is further described in Section 2.4.2.

Application of the Grid Tool to incremental simulations each viewpoint is provided in Attachment A.

Photomontages used to inform this visual assessment have been prepared by GreenpondTSG and considered all Project infrastructure components described in Section 4.3.

Viewpoint 1 – Kurrajong Creek Road East

This viewpoint has a Very Low visual sensitivity.

The Grid Tool conservatively indicates that 26 cells are occupied by the Project (Attachment A), which indicates a High visual magnitude.

Viewpoint 2 – Kamilaroi Highway

This viewpoint has a Very Low visual sensitivity.

The Grid Tool conservatively indicates that 2 cells are occupied by the Project (Attachment A), which indicates a Very Low visual magnitude.

Viewpoint 3 – Mayfield Road

This viewpoint has a Very Low visual sensitivity.

The Grid Tool conservatively indicates that 9 cells are occupied by the Project (Attachment A), which indicates a Low visual magnitude.

Visual magnitude ratings for each viewpoint are summarised in Table 12

Table 12
Visual Magnitude Ratings

Viewpoint	Number of Cells occupied	Visual Magnitude
Viewpoint 1 –Kurrajong Creek Road	26	High
Viewpoint 2 – Kamilaroi Highway	2	Very Low
Viewpoint 3 – Mayfield Road	9	Low

6.5 VISUAL IMPACT

The overall visual impact rating of each viewpoint is determined by combining the visual magnitude and visual sensitivity using the matrix provided in Table 8.

The visual impact of the Project upon each viewpoint is summarised in Table 13.

Table 13
Visual Impact Assessment

Viewpoint	Viewpoint Type	Viewpoint Sensitivity	Scenic Quality	Overall Viewpoint Sensitivity	Occupied Cells	Visual Magnitude	Visual Impact
Viewpoint 1 – Kurrajong Creek Road	Public Road	Very Low	Moderate	Very Low	26	High	Low
Viewpoint 2 – Kamilaroi Highway	State Highway	Very Low	Low	Very Low	2	Very Low	Very Low
Viewpoint 3 – Mayfield Road	Public Road	Very Low	Moderate	Very Low	9	Low	Very Low

6.6 LIGHTING IMPACTS

There are two types of lighting effects that may be experienced from the Project:

- **Direct Light Effects** – result from when the light source is directly visible and would be experienced if there is a direct line of sight between the light source and viewpoint.
- **Diffuse Light Effects** – relate to the general night-glow (diffuse light) that results from light of sufficient strength being reflected into the atmosphere.

The potential visual impacts of night-lighting associated with the Project are discussed below.

Direct Night-Lighting

Direct views of Project lighting sources would be possible from public roads and some residences. Lights associated with the Project that may be directly visible from some public roads and residences include stationary work lights, fixed/permanent lights and vehicle-mounted lights. Direct views to the lighting sources would be obscured from most residences by vegetation within the landscape and around residences.

Some rural residences may have views of lighting sources from the Project area, which would be partially obscured by the existing vegetation surrounding the residences as well as existing bunds that are installed along Kamlaro Highway.

Measures to mitigate potential impacts from direct night-lighting are discussed in Section 7.3.

Indirect Night-Lighting

There is potential for the Project to spill a certain amount of light from vehicles and stationary work lights producing sky glow, and when there is cloud cover at night this may also result in some reflection off the cloud base.

Lighting of night-time works is essential for the safety of personnel operating at the Project. The intensity, nature and degree of night-lighting for the Project would be similar to, or slightly less than, the existing night-lighting at the existing Narrabri Mine, as well as the other surrounding mining operations.

A number of mining operations, power stations, residences and agricultural activities in the vicinity of the Project already contribute to diffuse light effects into the night sky (sky glow). The influence of lighting associated with the surrounding mining operations and towns would reduce the potential visual sensitivity of indirect light emanating from the Project.

Existing control measures and lighting requirements are in place at the existing Narrabri Mine and would be applied to the Project to manage any potential sky glow as a result of operations.

Siding Springs Observatory

The Siding Springs Observatory is located approximately 115 km to the south-west of the Project. As such, the Project is within the Dark Sky Region (i.e. within 200 km radius of the Siding Spring Observatory), as defined in the *Dark Sky Planning Guideline* (DPE, 2023). There are a number of light sources and small towns (e.g. Coonabarabran) between the Project and the Siding Springs Observatory, which may contribute to sky glow at the Siding Springs Observatory.

Any potential impact associated with the night-lighting required for the Project (i.e. for safety reasons) would be similar to the existing Narrabri Mine and other surrounding mining operations. This would be minimised as far as practicable through the mitigation measures described in Section 7.3, which include the implementation of 'good lighting principles' provided by the *Dark Sky Planning Guideline* (DPE, 2023) where practicable and without compromising operational safety.

Dust

Dust emissions (and any potential impacts associated with visible dust) would be mitigated through the implementation of dust management practices as a component of a relevant management plan.

6.7 CUMULATIVE VISUAL IMPACTS

The assessment of potential cumulative visual impacts considers the combined effects of the Project with the effects of the existing Narrabri Mine.

The Project would allow for the supply of 26 MW DC, 20 MW AC of solar electricity generation to the Narrabri Mine via the existing ETL. The Project is also located in the regional setting with the Tarrawonga Coal Mine, Boggabri Coal Mine and Maules Creek Coal Mine. Therefore, the Project locality has already been subject to considerable modification due to these existing mining operations.

Due to the location of the Project, as well as other intervening landscape features in the wider area, the Project would not incrementally increase cumulative visual impacts.

Therefore, it is expected that the cumulative visual impacts of the Project would be Very Low.

6.8 PERFORMANCE OBJECTIVES

As outlined in the Technical Supplement, impact assessment against relevant performance objectives are required where viewpoints experience Medium or High visual impacts. As described in Section 6.5, no viewpoints for the Project will experience Medium or High visual impacts, and as such further assessment against performance objectives is not required.

Notwithstanding, Whitehaven Energy would employ numerous visual impact mitigation methods to ensure maintenance of landscape and visual amenity surrounding the Project (refer Section 7).

7 MITIGATION MEASURES

The mitigation and management measures that would be implemented for the maintenance of landscape and visual amenity at the Project are described below.

7.1 REHABILITATION AND REVEGETATION

The design operational life of the Project is 50 years, at which point the Project would be reconditioned with updated technology or decommissioned. As the Narrabri Mine, which is currently permitted to operate to 2044, is expected to close prior to the expiration of the design life of the solar farm, Whitehaven Energy would look at opportunities to divest the solar farm to third parties or decommission the Project at that earlier stage.

Reconditioning

The Project is a behind-the-meter proposal and is not currently designed to export renewable electricity to the grid. Following mine closure, and should the prevailing NSW network infrastructure at the time have improved sufficiently to allow solar-generated power to be exported to the grid, the Project applicant may look to pursue potential opportunities available to export renewable energy produced to the grid.

There also may be an opportunity for the Project to be reconditioned at the end of its operational life to continue renewable energy generation.

Decommissioning

Decommissioning activities would include removal of any above ground infrastructure and site restoration works to return the land to its pre-development land capability and use.

The equipment, including solar panels, structures and ancillary infrastructure, would be dismantled and sold to a third party for recommissioning and ongoing use, or disposed of for recycling and/or scrapping.

Any transfer, recycling or scrapping would be processed in line with the existing legislation at the time.

It is also possible that access roads would be removed depending on the proposed future land use and landowner requirements at the time of decommissioning.

Whitehaven Energy would fund and execute the decommissioning of the Project. When decommissioning occurs:

- key stakeholders including landholders, NSC and relevant regulators would be consulted;
- in general, all above ground structures would be removed and the land rehabilitated to ensure it can be returned to agricultural use;
- some infrastructure may be retained in situ (e.g. internal access tracks) where beneficial and as agreed with the landholder; and
- some below ground infrastructure may be left in situ to avoid further disturbance and minimise clearing of revegetated areas, unless otherwise agreed with the landholder and/or relevant regulators.

Whitehaven Energy would aim to recycle all dismantled and decommissioned infrastructure and equipment, removed from the Project, where possible and feasible. Materials that cannot be recycled would be disposed of at a licensed waste management facility.

Rehabilitation

The Project would be rehabilitated to a safe, stable and non-polluting landform of a similar character to surrounding areas.

Rehabilitation would be undertaken progressively as soon as reasonably practicable as areas become available following operations.

Upon completion of the Project, infrastructure and equipment that are not required for site would be decommissioned and reused, recycled or disposed of, where appropriate. The Project area would be rehabilitated, and typically revegetated with native pasture.

Following decommissioning of the Project, the final land use will revert to the preference of the host landholder, with consideration of the land use objectives of the RU1 – Primary Production zone. For the purposes of rehabilitation and mine closure planning for the Project, Whitehaven Energy proposes the post-development land use of the Project would continue to comprise a combination of native vegetation and agricultural (pasture) land uses.

Project infrastructure (e.g. access road) may be retained for alternate post-development uses (where agreed with relevant landholders).

7.2 VISUAL SCREENING

Existing vegetative screening along main and local roads within the vicinity of the Project aids in reducing any potential views of the Project. Established vegetative screens and bunds, would mitigate some of the visual impacts only the Kamilaroi Highway, although it is anticipated that residual visual impacts would be experienced by motorists due to the close proximity to the Project area.

In addition, upon receiving a request from an owner of any privately-owned dwelling within direct views of the Project, Whitehaven Energy would assess whether there is a high visual impact. In the event the Project is concluded to be resulting in a high visual impact at a dwelling, Whitehaven Energy would implement reasonable and feasible visual mitigation measures in consultation with the owner to minimise the visibility of the Project from the dwelling.

7.3 NIGHT-LIGHTING CONTROLS

Measures to mitigate potential impacts from night-lighting (including sky glow) could include one or more of the following, where practicable and without compromising operational safety:

- All external lighting associated with the Project would comply with AS 4282:1997 – *Control of the Obtrusive Effects of Outdoor Lighting*, including the minimisation of light spill through the following:
 - Adequate aiming of lights (including consideration of mounting heights).
 - Use of shielded fittings where practicable.
- Implementation of ‘good lighting design principles’ provided by the *Dark Sky Planning Guideline* (DPE, 2023), such as:
 - Use of warm white coloured bulbs on fixed lighting, with an objective of maintaining colour temperature below 3,500 Kelvin, where appropriate.

- Use of asymmetric beams on fixed lighting, where appropriate.
- Night-lighting would be restricted to the minimum required for operations and safety requirements so as to avoid over-lighting.
- Appropriate positioning and orientation of lights.
- Screens would be installed along sections of the Project rail spur to mitigate potential train lighting impacts to neighbouring residents and users of the Kamilaroi Highway.
- Mitigation measures at private residences, where warranted and if requested by the landholder (e.g. curtains, cladding, screens and tree planting).

8 CONCLUSION

The Project would include approximately 26 MW DC of solar electricity generation and the construction of a 10 Megawatt Hour DC BESS. The Project would provide behind-the-meter electricity supply to the Narrabri Mine via the existing 66 kV ETL.

Landscape Character Impacts

Five unique LCZs were assessed within a 5 km boundary of the Project, including:

- LCZ 1 – Agricultural Plain;
- LCZ 2 – Rivers and Waterways;
- LCZ 3 – Existing Mining Operations;
- LCZ 4 – State Forest; and
- LCZ 5 – Woodland Areas.

Impacts of the Project to each LCZ are summarized in Table 14.

Table 14
Summary of Landscape Character Assessment

Landscape Character Zone	Sensitivity	Magnitude	Potential Impact
LCZ 1 (Agricultural Plain)	Low	Low	Low
LCZ 2 (Rivers and Waterways)	Moderate to Low	Low	Low
LCZ 3 (Existing Mining)	Very Low	Low	Very Low
LCZ 4 (State Forest)	Moderate	Very Low	Very Low
LCZ 5 (Woodland Areas)	Moderate to Low	Very Low	Very Low

Higher landscape character impact ratings are anticipated for LCZ 1 (Agricultural Plain) and LCZ 2 (Rivers and Waterways). The Project would extend into these LCZs and are thus associated with direct landscape character impacts from the Project.

Visual Impacts

Three (3) viewpoints were selected as being representative of the sensitive visual setting which may experience potential views of the Project.

Visual impacts associated with the Project are summarised in Table 15.

Table 15
Visual Impact Assessment

Viewpoint	Overall Visual Sensitivity	Visual Magnitude	Potential Visual Impact
Viewpoint 1 – Kurrajong Creek Road	Very Low	High	Low
Viewpoint 2 – Kamlaroi Highway	Very Low	Very Low	Very Low
Viewpoint 3 – Mayfield Road	Very Low	Low	Very Low

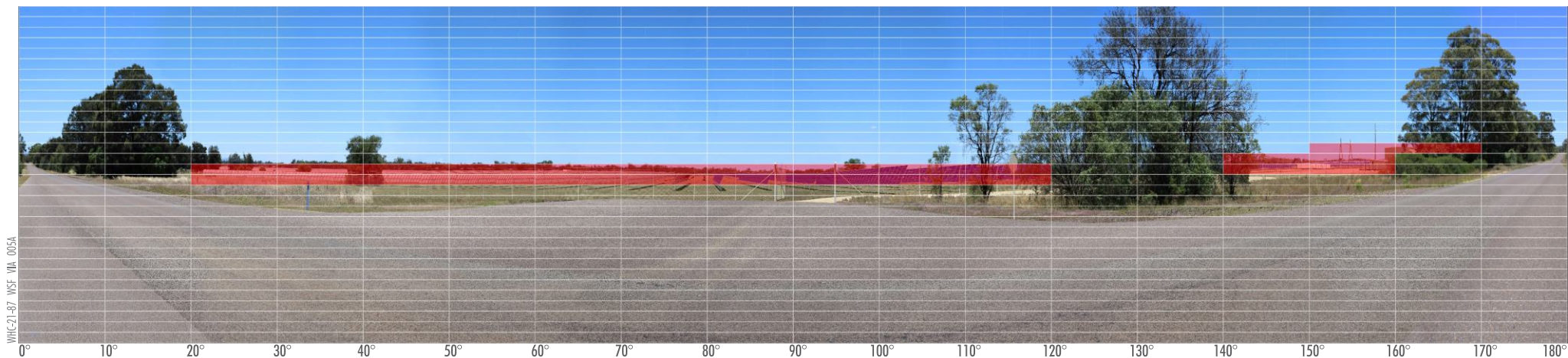
As all viewpoints are assessed as having a Low or Very Low visual impact rating, assessment against performance objectives is not required.

Notwithstanding, Whitehaven Energy would employ numerous visual impact mitigation methods to ensure maintenance of landscape and visual amenity surrounding the Project (refer Section 7).

9 REFERENCES

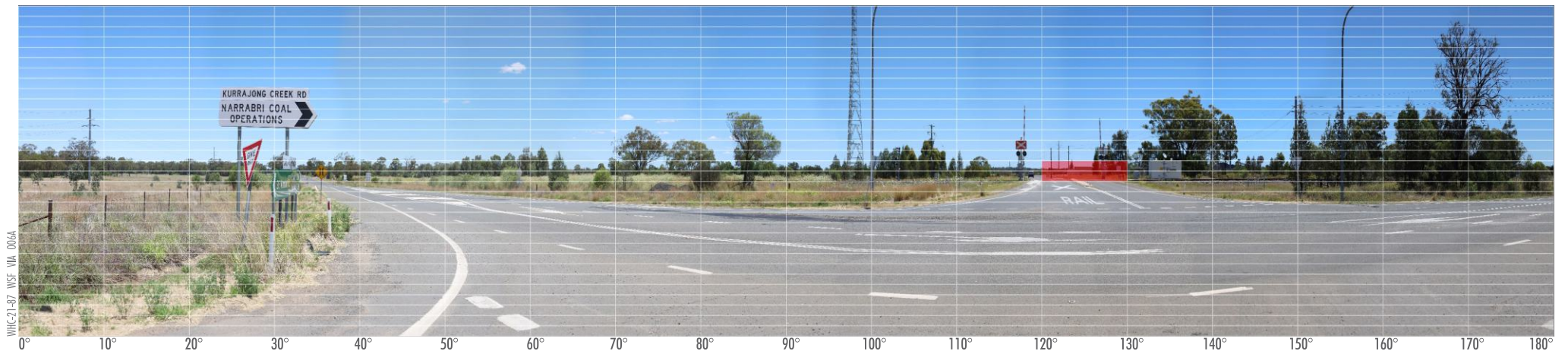
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ATTACHMENT A
VISUAL MAGNITUDE GRID TOOL VIEWPOINT ANALYSIS



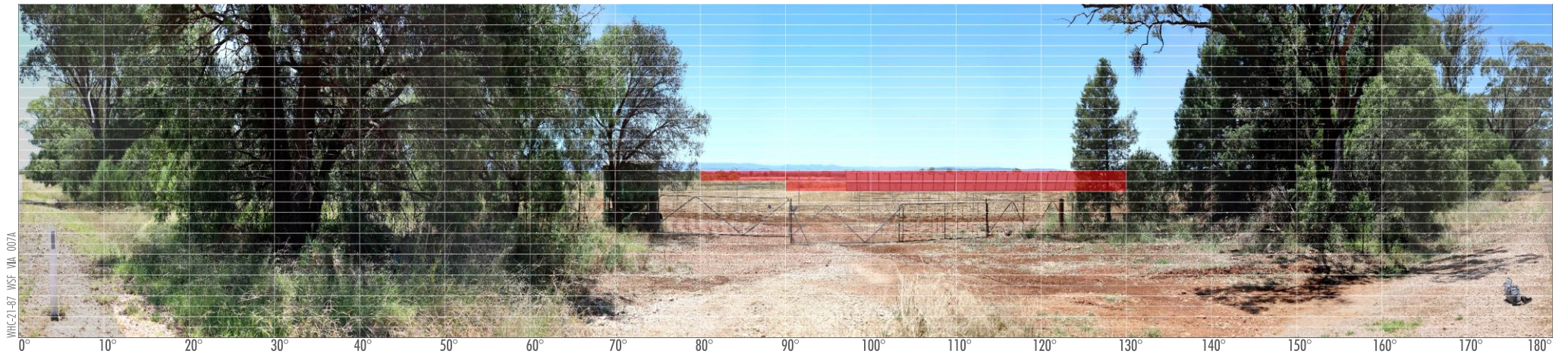
LEGEND
Visual Magnitude Tool
Occupied Cell

Source: Greenpond (2024)



LEGEND
Visual Magnitude Tool
 Occupied Cell

Source: Greenpond (2024)



Source: Greenpond (2024)

LEGEND
Visual Magnitude Tool
 Occupied Cell



WHITEHAVEN SOLAR FARM
 Viewpoint 3
 Mayfield Road
 Visual Magnitude

Figure A-3