Proposed Goulburn River Solar Farm

LANDSCAPE CHARACTER AND VISUAL IMPACT ASSESSMENT

Prepared for Umwelt Pty Limited
April 2023

enVisage

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Australian Institute of Landscape Architects

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Envisage Consulting, specialists in visual impact assessment for over 15 years

We wish to acknowledge the Traditional Owners of country throughout Australia and recognise their continuing connection to land, waters and community. We pay our respects to them and their cultures; and to elders both past and present.

Cover image: Photomontage of proposed Goulburn River Solar Farm viewed from Wollara Road (photo taken 7 February 2023), prepared by Cambium Group.

(Note: Please do not compress this document more than 330ppi to maintain sufficient image quality to view photomontages)

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1	5 July 2022	Early draft	Alison Dodds	Stacey Brodbeck
2	27 October 2022	Draft	Alison Dodds	Stacey Brodbeck
3	21 November 2022	Soft lodgement DPE	Alison Dodds	Stacey Brodbeck
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5	23 March 2023	Report updated to meet NSW large-scale solar guideline	Alison Dodds	Stacey Brodbeck
6	14 April 2023	Final	Alison Dodds	Stacey Brodbeck
7	1 May 2023	Number of ACHAR identified sites and name of river corrected.	Alison Dodds	Stacey Brodbeck

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Abbreviations

AHIMS	Aboriginal Heritage Information Management System
AS/NZS	Australian Standard / New Zealand Standard
BESS	Battery Energy Storage System
CWO REZ	Central West Orana Renewable Energy Zone
DPE	NSW Department of Planning and Environment
EIS	Environmental Impact Statement
EP&A Act	NSW Environmental Planning and Assessment Act
ha	hectare
km	kilometre
kV	kilovolt
LCVIA	Landscape character and visual impact assessment
LGA	Local Government Area
m	metre
mm	millimetre
MW	megawatt
MWh	megawatt hours
MWp	megawatt peak
NP&WS	NSW National Parks and Wildlife Service
NPW Act	NSW National Parks and Wildlife Act
O&M	operations and maintenance building
PV	photovoltaic
SEARs	Secretary's Environmental Assessment Requirements
SAII	Serious and Irreversible Impacts
SSD	State significant development
VMP	Vegetation management plan
VP(s)	Viewpoint(s)
ZTV	Zone of theoretical visibility

1 Introduction

1.1 Purpose of this report

This landscape character and visual impact assessment (LCVIA) assesses the potential landscape character and visual impact of a proposed 550-megawatt peak (MWp) solar farm and Battery Energy Storage System (BESS) of up to 280 MW / 570 MWh (the Project).

The site is in the Upper Hunter region of NSW, approximately 28 kilometres (km) south of Merriwa, surrounded by Goulburn River National Park. The Project includes supporting infrastructure such as a substation and connection to an existing 500 kilovolt (kV) transmission line.

The Project is State Significant Development (SSD) and requires an Environmental Impact Statement (EIS) and development consent from the Minister for Planning under Part 4 of the *NSW Environmental Planning and Assessment Act 1979* (EP&A Act). This LCVIA informs the EIS prepared by Umwelt (Australia) Pty Ltd, on behalf of the proponent, Lightsource Development Services Australia Pty Ltd (Lightsource bp).

The LCVIA aims to:

- identify the likely visual effects of the Project
- estimate the magnitude of the effects
- assess the nature and significance of these effects and
- propose measures to avoid, reduce or compensate those effects.

1.2 Background

This LCVIA was initially prepared in 2022 to address visual matters referred to in the Secretary's Environmental Assessment Requirements (SEARs) issued by the Department of Planning and Environment (DPE) on 01/02/2022 (refer to SECTION 1.3). At that time, the NSW Government's revised *Large-Scale Solar Guideline* (the 'Guideline'), published in August 2022, did not apply to this Project, as the SEARs were issued before the revised Guideline's publication, and the EIS was intended to be lodged in 2022[1].

The EIS was not lodged before the end of January 2023, and therefore, the completed LCVIA 2022 has been updated to be consistent with the new landscape and visual assessment methodology presented in the *Technical Supplement – Landscape and Visual Impact Assessment* which accompanies the revised Guideline (refer to SECTION 2).

1.3 SEARs

In addition to being consistent with the revised Guideline, the LCVIA also addresses visual matters in the SEARs (SSD-33951458). Those visual matters and the sections of this report where these are addressed, is shown in Table 1-1.

Table 1-1: Visual matters in SEARs and where these are addressed in this report

Visual matters	Where addressed in this report
The EIS must address the following specific matters: **Visual** – including: - a detailed assessment of the likely visual impacts…	▪ The whole of this report addresses visual issues. ▪ The detailed assessment of impact on: - landscape character is provided in SECTION 4 - the preliminary visual impact is provided in SECTION 5 and - the detailed visual impact assessment is provided in SECTION 6.
(including any glare, reflectivity and night lighting)	▪ Glare and reflectivity are assessed in a separate glint and glare study and are not included in this LCVIA.

[1] The NSW DPE advised that the Guideline applies unless an applicant has been issued with SEARs before the publication of the guideline and lodges a DA and EIS before the end of January 2023 (Department of Planning and Environment Frequently Asked Questions, August 2022)

Visual matters	Where addressed in this report
	▪ Night lighting is addressed in SECTION 7.
of all components of the project (including arrays, transmission lines, substations, battery storage and any other ancillary infrastructure)	▪ A description of the Project components is provided in SECTION 3. ▪ The detailed assessment in SECTION 6 includes the visual impact of the Project components.
on surrounding residences and key locations, scenic or significant vistas, and road corridors in the public domain,	▪ The visual impact on surrounding residents, key locations, scenic or significant vistas and road corridors in the public domain is assessed in SECTION 4, 5 and 6.
and on the Siding Spring Observatory in accordance with the *Dark Sky Planning Guideline* (2016); and	▪ Night lightning associated with the Project is addressed in SECTION 7.
provide details of measures to mitigate and/or manage potential impacts	▪ Mitigation measures are provided in SECTION 6.5.
(including a draft landscaping plan for on-site perimeter planting, with evidence it has been developed in consultation with affected landowners)	▪ A draft landscape plan, and an outline of consultation with affected landowners as part of the development of the plan, is discussed in SECTION 6.5.2.

2 Assessment Methodology

2.1 Guidelines

The NSW State Government's revised *Large-scale Solar Energy Guideline* (August 2022) applies to SSD large-scale solar development with a minimum capital investment value of $30 million such as this Project. The Guideline requires that the applicant prepare a LCVIA in accordance with the Guideline's supporting document: *Technical Supplement - Landscape and Visual Impact Assessment*.

In addition, the Project's location is within a 200 km radius of Siding Spring Observatory and as such falls within the Dark Sky Region of New South Wales (NSW), and therefore the *Dark Sky Planning Guideline, 2016* applies.

The LCVIA methodology presented in the *Technical Supplement* is outlined below. Application of the *Dark Sky Planning Guideline* has been addressed in SECTION 7 of this LCVIA.

2.2 Assessment scope

In accordance with the *Technical Supplement*, the LCVIA includes two components:

- landscape character assessment – to understand the sensitivities of the landscape and to help determine the overall impact of the project on an area's character and sense of place; and
- visual impact assessment – to understand the likely impacts of the project on people's viewpoints within the private and public domain.

Both assessments require evaluation of an area's *'sensitivity'* (that is, how sensitive the existing area, or view, is to change) and the '*magnitude of change*' a project would have on an area (that is, its physical scale, how distant it is, and its contrast within in the existing landscape or view).

2.3 Landscape character assessment methodology

The first stage of the assessment is a baseline analysis of the existing landscape character and its sensitivity. The baseline analysis identifies and describes the physical landscape and key attributes, and identifies landscape values of the community (including the indigenous community), local council and affected landholders.

If the landscape includes distinct character areas with different qualities, the study area can be divided into different character zones. The scenic quality of the landscape is also classified.

The final stage determines the impact of the proposal on each landscape character zone, by evaluating the sensitivity of the landscape and the magnitude of the project's effects in that area. Sensitivity and magnitude are assigned a rating (low, moderate or high).

The landscape character assessment is presented in SECTION 4.

2.4 Visual impact assessment methodology

The process for visual impact assessment is broken into two phases:

- a preliminary assessment –to identify viewpoints requiring a detailed assessment, and
- the detailed assessment.

2.4.1 Preliminary assessment

The *Technical Supplement*'s steps to be undertaken for the preliminary assessment are:

1) to identify viewpoints from public roads and rail lines within 2.5km of the project
2) to identify other public and private viewpoints within 4 km of the project
3) to measure the distance from the viewpoints to the proposed development footprint

4) to determine the 'relative height difference'[2] between the project and each viewpoint
5) to plot the 'vertical field of view'[3] for each viewpoint
6) to measure the 'horizontal field of view'[4] of the development footprint at each viewpoint
7) to determine whether detailed assessment is required using the *Technical Supplement* matrix.

Preliminary assessment is presented in SECTION 5.

2.4.2 Detailed visual assessment

A detailed assessment is undertaken for viewpoints identified in the preliminary assessment. The process for the detailed assessment is presented in Figure 2-1.

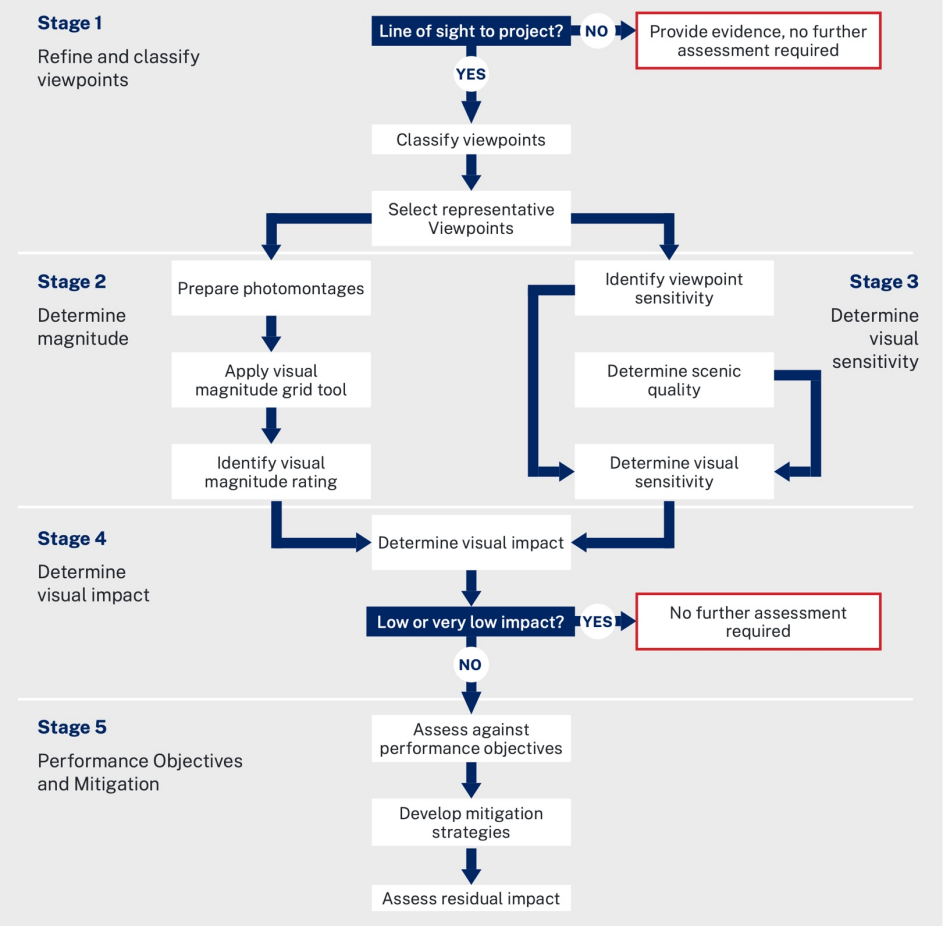


Figure 5 of the *Technical Supplement*

Figure 2-1: Detailed visual impact assessment process

In summary, the process involves the following stages:

- **Stage 1:** The identified viewpoints are refined by determining whether there is direct a line-of-sight to the project. Those viewpoints without a line-of-sight do not require further assessment. Those with a line-of-sight are classified to determine whether the view is primary or secondary (as per Table 2-1).
- **Stage 2:** The visual magnitude of the project is then determined by calculating the volume of the horizontal and vertical fields of view occupied by the project from each viewpoint. This is done by producing a 180-degree photomontage of the view (note that the photomontage is for analytical purposes only and not representative of what a viewer would see as it shows a far wider and visually distorted view) and overlaying the *Technical Supplement's* Visual Magnitude Grid

[2] 'Relative height difference' is calculated based on Figure 3 of the *Technical Supplement* and determined by the measuring the total Project elevation (highest point to lowest point) relative to the viewpoint elevation.
[3] 'Vertical field of view' is calculated based on Figure 2 of the *Technical Supplement* and reflects the visual height of the Project relative to the viewpoint.
[4] 'Horizontal field of view' is a measurement of degrees and reflects the visual width of the Project relative to the viewpoint.

Tool. The rating of magnitude is determined by the number of occupied cells (as per Table 2-2).

- **Stage 3:** The visual sensitivity of each viewpoint is then rated (from very low, low, moderate, or high) and combined with the assigned scenic quality category of the area in view (as per Table 2-3)
- **Stage 4:** The overall visual impact of each viewpoint is determined by combining the identified visual magnitude and visual sensitivity (as per Table 2-4)
- **Stage 5:** For viewpoints with a moderate or high rating, it is mandatory to investigate mitigation options to reduce impact.

The detailed visual assessment is presented in SECTION 6.

Table 2-1: 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

Table 2 from the *Technical Supplement*

Table 2-2: 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

Table 4 from the *Technical Supplement*

Table 2-3: Visual 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

Table 8 from the *Technical Supplement*

Table 2-4: 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

Table 9 from the *Technical Supplement*

2.5 Site investigations

Initial field investigations of the Project site and surrounding area were undertaken from 3 – 4 May 2022. The inspections included a walk over parts of the site and surrounding publicly accessible areas (including within Goulburn River National Park). Weather during the investigations was mostly

dry and sunny, with foggy mornings and periods of low cloud during the day. There were sufficient periods of clear sky and good visibility to undertake the assessment.

Further field investigations were undertaken between 6 – 8 February 2023 to update the assessment to be consistent with the landscape and visual assessment methodology presented in the Guideline.

2.6 Images

2.6.1 Photography

Unless otherwise noted, all photographs within this LCVIA were taken by Envisage Consulting. Photographs to illustrate landscape character and site features have been taken in landscape format using a full-frame sensor digital camera with a fixed 50 mm lens and GPS positioning.

Panoramic photography complies with the *Technical Supplement* photography requirements. That is:

- Photographs were taken with a full frame camera with a 50mm focal length of lens. The camera was positioned 1.5m above the ground. A tripod with levelling tools and panoramic head was used, and photographs were taken in portrait orientation.
- The horizon was positioned at the midpoint and a photograph was taken every 15 degrees.
- Best attempt was made to take photographs with minimal cloud cover, and between the hours of 9 am and 3 pm.

2.6.2 Photomontages

Photomontages, modelled views and spatial views presented in this report were independently prepared by Cambium Group and comply with the requirements prescribed in the *Technical Supplement*.

To produce the photomontages, photographs were merged and cropped to achieve a 180-degree horizontal field panoramic image, with a 27-degree vertical field of view. A 3D digital elevation model and master 3D Project model (including all elements of the Project) was then overlaid (and calibrated to the 180-degree panoramic image), then proposed materials and finishes were applied to the master 3D project model.

3 The Project

3.1 Location

The Project is located at 2335 Wollara Road, Merriwa, within the NSW Upper Hunter Local Government Area (LGA). The Project Area covers approximately 2,000 hectares (ha) of agricultural land zoned RU1-Primary Production, surrounded by the Goulburn River National Park. It includes two freehold properties and sections of Crown Land along Wollara Road.

The development footprint would occupy an area of approximately 779.5 ha (around 39% of the Project Area). The location of the Project Area is shown in Figure 3-1.

The nearest Renewable Energy Zone (REZ) to the Project Area is the Central West Orana REZ (based around the centres of Dubbo and Wellington) which is around 20 km to the west of the Project. The recently declared (9 December 2022) Hunter-Central Coast REZ is around 45 km to the east of the Project.

3.2 Project overview

The Project includes the construction, operation, maintenance, and decommissioning of an approximate 550 MWp of solar electricity generation and BESS of up to 280 MW / 570 MWh, connecting to an existing 500 kV transmission line via a proposed substation to be located in the south-eastern section of the Project Area. As a part of the Project, upgrades to the primary access road, being Ringwood Road, would be required for access to the Project Area.

The indicative layout of the proposed solar farm is shown in Figure 3-2. Key components of the Project include:

- Approximately 1 million bifacial solar PV modules in an east-west single-axis tracking arrangement with an average full-tilt height between 2.6 metres (m) and 2.98 m above ground level. On occasion, to accommodate undulating topography, module height may be raised to a maximum full-tilt height of 4 m above ground level.
- A BESS with an approximate 280 MWp and 570 MWh capacity, housed in a series of outdoor containers, aggregated in one central location near the proposed substation.
- An onsite 500 kV switchyard and substation, with underground electrical conduits and cabling leading into the yard and overhead lines reaching above to the existing transmission line.
- Onsite power line connection via underground electrical conduits and cabling.
- Communications tower associated with the substation, up to 30 m high, providing communications, radio and cellular services to the site and wider region.
- Internal access tracks allowing for site maintenance.
- Permanent site office and operations and maintenance (O&M) building with parking for the operations team.
- One primary solar farm site access point off Wollara Road (the existing main driveway), and two access points strictly for emergency access along the north-western boundary of the Project Area.
- Upgrades to Ringwood Road.
- Drainage line crossings, if and where required, to manage existing surface water flows (to be determined during further design development).
- Perimeter security fencing around the solar modules, crossing gates, water tanks and/or dams, and internal access points around the project boundary.

Figure 3-1
Project Area location

GOULBURN RIVER SOLAR FARM
LANDSCAPE CHARACTER AND VISUAL IMPACT ASSESSMENT

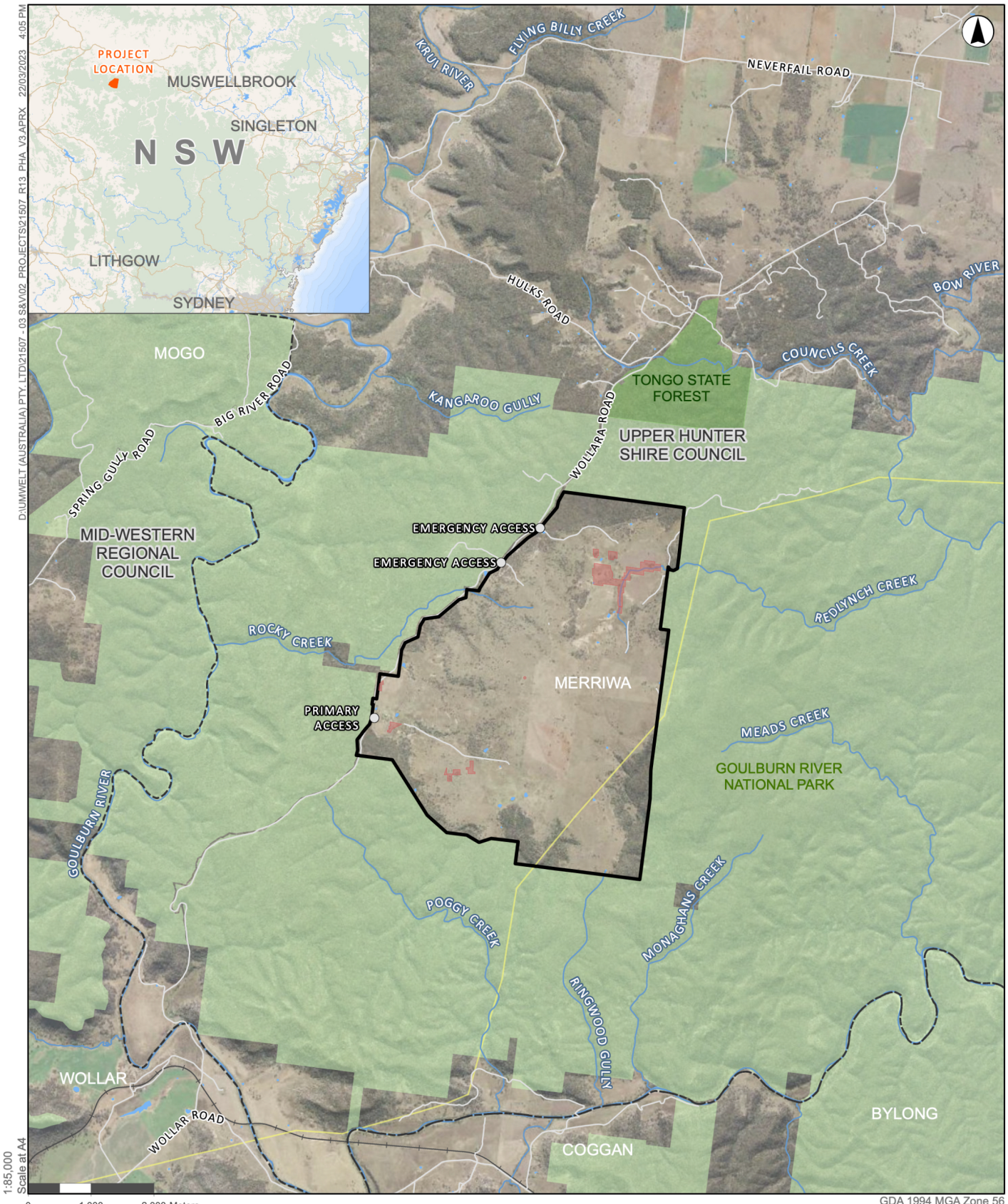
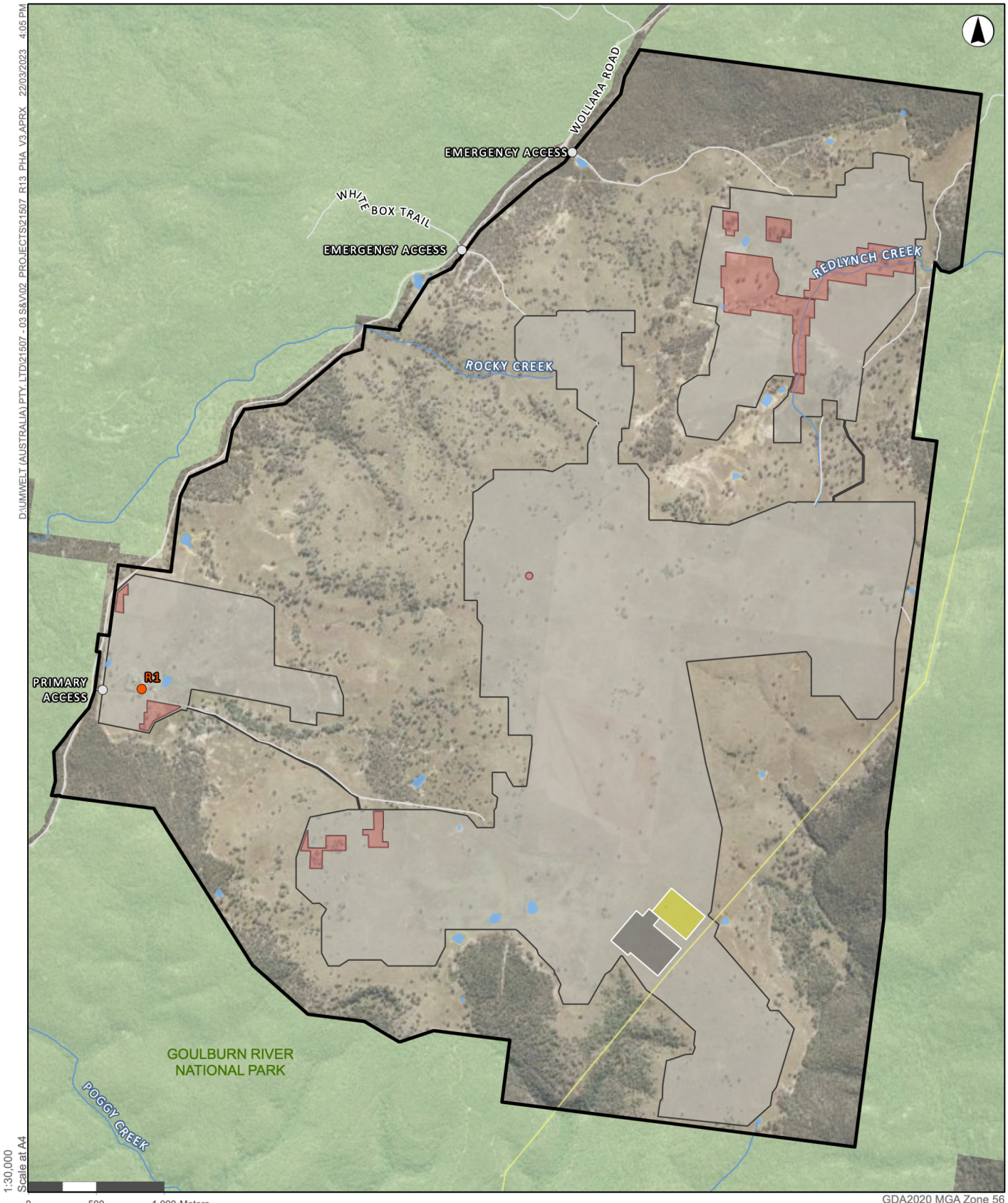


Figure 3-2
Project Layout

GOULBURN RIVER SOLAR FARM
LANDSCAPE CHARACTER AND VISUAL IMPACT ASSESSMENT



Indicative heights of the various infrastructure components are summarised in Table 3-1.

Table 3-1: Indicative heights of various infrastructure associated with the Project

Infrastructure	Indicative height
PV modules	On average between 2.6 m and 2.98 m above ground level (with an occasional maximum of 4 m)
Onsite substation	3.5 m with ancillary components up to 30 m (taller components include a communications tower, weather station and lightning mast)
BESS	3.5 m tall x approximately 12.2 m long x 2.5 m wide with ancillary components not greater than 10 m
O&M facilities	3.5 m with ancillary components not greater than 10 m

No new powerline construction would be necessary, as Project plans include connecting into the existing transmission network, with any new cabling required for the Project being underground.

3.3 Layout

The Project's conceptual layout includes designated environmental exclusion zones to provide appropriate setbacks to dense vegetated areas, creeks, and a timber slab hut within the Project Area. Exclusion zones include a 10 m APZ (asset protection zone), plus a minimum 4 m wide vegetation buffer along Wollara Road for proposed landscape screening.

3.4 Solar farm Project components

PV modules

An image of the type of solar PV modules and rows proposed is shown in Figure 3-3. Rows would be spaced around 5.5 m apart. The solar PV module material would be dark coloured[5], with an anti-reflective coating. The PV modules are bifacial (that is, they can produce electrical energy when illuminated on either surface, front or rear). The modules are typically sealed with a glass cover and aluminium frame. The modules are designed to maximise light absorption and are non-reflective.

Image supplied by Lightsource bp

Figure 3-3: Example of the type of solar modules and rows proposed

The modules would be fixed to, and supported by, ground-mounted framing with steel posts as foundations. Installation of the modules may require minor site levelling, and use of machinery such as a pole driver to install the steel posts.

On average, the modules would be between 2.6 m and 2.98 m above ground level, with an occasional maximum of 4 m if required due to undulating terrain. At the start and end of the day, the lower edge of each module would be at least 300 mm above the ground (allowing for potential sheep grazing underneath). An image showing the relative height of the PV solar modules is shown in Figure 3-4. The modules illustrated are 3.1 m above ground, which is slightly higher than the average module height proposed.

[5] Note regarding colour: The colour of PV solar modules appears slightly different depending on viewer position, distance, season, weather, and time of day; and ranges from lighter shades (blueish to white) to darker (deep grey or black). The visibility of solar modules also depends on the background colour of the landscape, and the extent to which the solar modules contrast (or stand out) against the background.