umwelt
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lightsource bp

GOULBURN RIVER SOLAR FARM

Preliminary Hazard Analysis Addendum Report

FINAL

December 2023

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Prepared by
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on behalf of
Lightsource bp

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Acknowledgement of Country

Umwelt would like to acknowledge the traditional custodians of the country on which we work and pay respect to their cultural heritage, beliefs, and continuing relationship with the land. We pay our respect to the Elders – past, present, and future.

Document Status

Rev No.	Reviewer		Approved for Issue	
	Name	Date	Name	Date
V0	J Henderson-Wilson	04/12/2023	M Facey	04/12/2023
V1	T Procter	05/12/2023	J Henderson-Wilson	05/12/2023

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1.0 Introduction

Lightsource bp is proposing to develop the Goulburn River Solar Farm (the Project) to generate solar renewable energy to supply New South Wales (NSW) (refer to **Figure 1.1**).

The proposed Goulburn River Solar Farm (the Project), as described in the Environmental Impact Statement (EIS) (Umwelt, 2023) includes the construction, operation, maintenance and decommissioning of approximately 550 megawatt peak (MWp) of solar photovoltaic (PV) generation with a Battery Energy Storage System (BESS) with 280 MWp and 570 megawatt hour (MWh) capacity. The Project will also include supporting infrastructure, a substation and connection to an existing 500 kilovolt (kV) transmission line. Parts of Ringwood Road will be upgraded including two culverts at Bow River and Killoe Creek.

A number of amendments to the Project are proposed in response to public and agency submissions received following the public exhibition of the EIS and progression of the detailed design. This Preliminary Hazard Analysis addendum report (PHA Addendum) has been prepared to address the amendments to the Project (outlined in **Section 2.0**) and is supplementary to the previously prepared Umwelt report, *Goulburn River Solar Farm Preliminary Hazard Analysis, Final*, dated April 2023 (EIS PHA 2023).

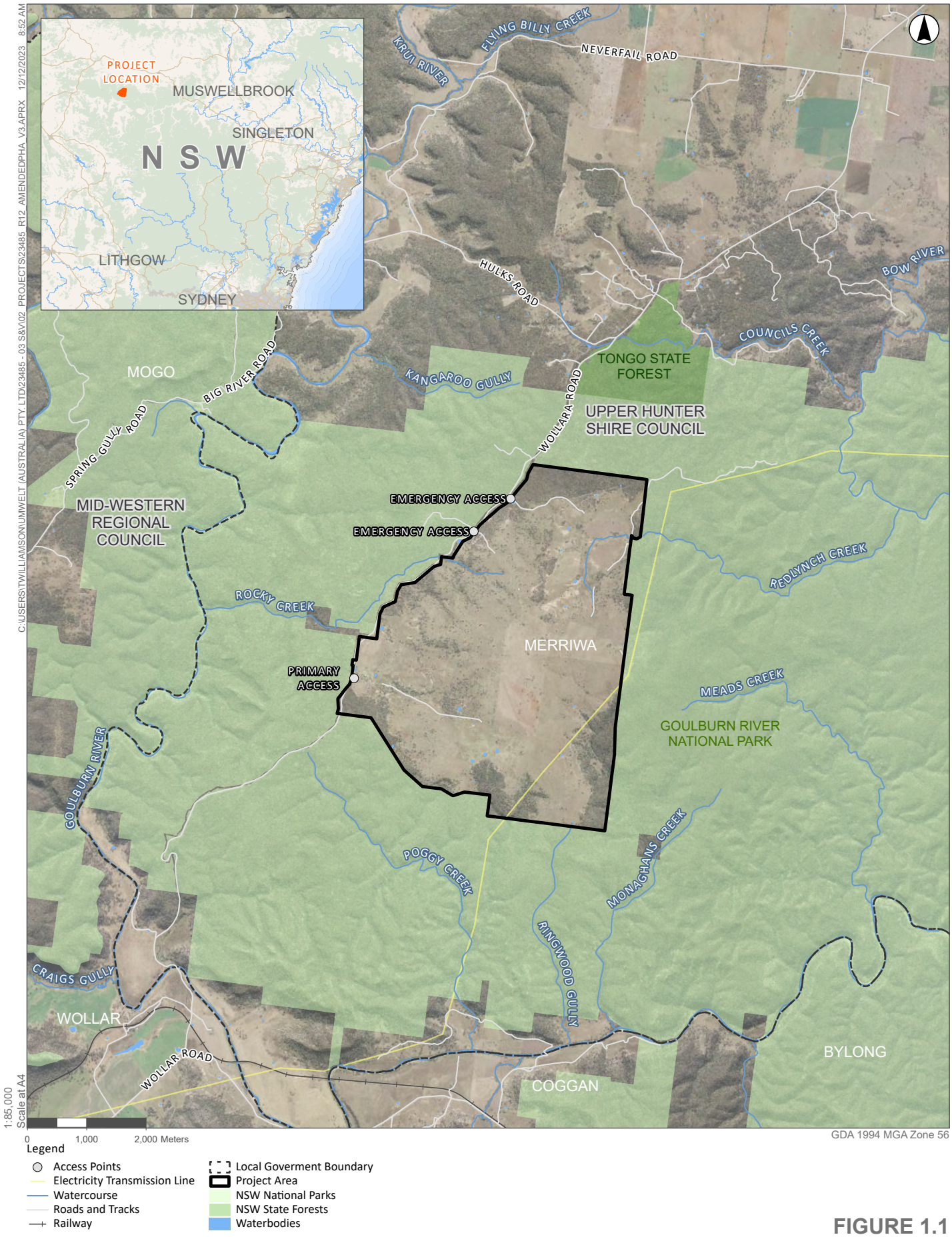


FIGURE 1.1

Locality

Image Source: ESRI Basemap (2022) **Data source:** NSW LPI (2022), NSW DSFI (2022); NPWS Estate (2022); Lightsource BP (2022)

2.0 Description of Amendments

The proposed amendments to the Project are summarised below and addressed further in the subsequent sections of this addendum report. **Table 2.1** provides a comparison of the proposed amendments to the EIS Project and the Amendment Project's BESS components.

- Transport route amendments and upgrade of the intersection of the Golden Highway and Ringwood Road.
- Upgrades to additional parts of Wollara Road and Ringwood Road.
- Options for the BESS including:
    - Increasing the capacity of the centralised BESS from 280 MWp/570 MWh to 450 MWp/900 MWh.
    - Constructing a decentralised BESS option consisting of 560 individual 6.1 m (i.e., 20 foot) battery containers and DC-DC converters, and associated infrastructure being situated next to the PV inverter stations located throughout the solar arrays.
    - Constructing a combination of the centralised and decentralised BESS units.
- Minor modifications to the Development Footprint and internal layout including:
    - removal of travelling stock route (TSR) 4481 from within the Project Area although site access will remain through the TSR with no access upgrades.
    - relocation and/or removal of solar arrays within the Development Footprint to avoid Regent Honeyeater Habitat, scattered trees and Box Gum Woodland.
    - increased width of selected internal access roads to accommodate subterranean power cables.
- Construction of an additional transmission tower within the existing easement of the 500 kV transmission line adjacent to the BESS/substation.
- Additional assessment and revised approach for workforce accommodation.

This PHA Addendum addresses the increased BESS capacity and option of a decentralised BESS and the choice to host both centralised and decentralised BESS units. The location of the BESS options addressed in this PHA Addendum report are illustrated in **Figure 2.1**.

Table 2.1 Comparison of Proposed Amendments to the Project's BESS

Project Stage	EIS Project	Amended Project	Difference Between EIS Project and Amended Project
BESS Configuration	Centralised BESS option proposed.	Centralised and decentralised BESS options proposed.	Addition of a decentralised BESS option or a combined centralised and decentralised combined BESS option. Project will be delivered with one of the three options permitted.
Centralised BESS capacity (MWp)	280 MWp	450 MWp	+170 MWp
Centralised BESS capacity (MWh)	570 MWh	900 MWh	+330 MWh
Decentralised BESS capacity (MWp)	Not proposed in EIS.	580 MWp	+580 MWp
Decentralised BESS capacity (MWh)	Not proposed in EIS.	1160 MWh	+1160 MWh
Centralised and Decentralised BESS capacity (MWp)	Not proposed in EIS.	1,030 MWp	+750 MWp
Centralised and Decentralised BESS capacity (MWh)	Not proposed in EIS.	2,060 MWh	+1,490 MWh
Transformers	4	4	No change.
Inverters (PCS)	104	140	+36

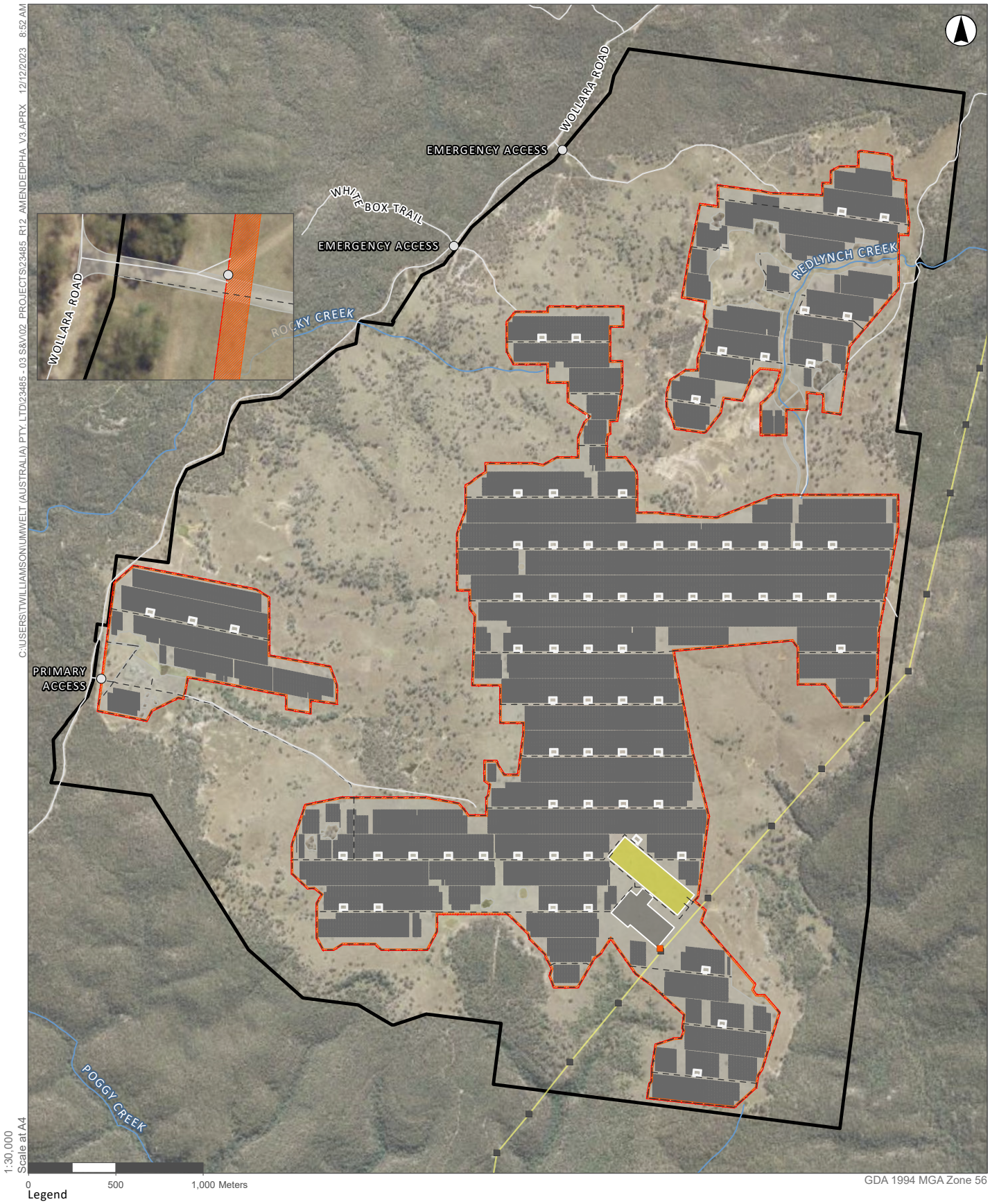


FIGURE 2.1

Amended Project – Development Footprint & Internal Layout

Image Source: ESRI Basemap (2022) **Data source:** NSW LPI (2022), NSW DSFI (2022); NPWS Estate (2022); Lightsource BP (2022)

3.0 Battery Energy Storage Systems

3.1 BESS Alternatives

The conceptual layout of the proposed AC Coupled (Centralised) BESS shown on **Figure 2.1** is presented in **Figure 3.1**. The proposed Centralised BESS includes:

- The installation of 700 battery cabinets each approximately 6 metres long and 2.5 metres wide and 2.9 metres high.
- An approximate aggregate energy storage capacity of 588 MW/2,583 MWh.
- A dedicated compound approximately 520 metres long by 150 metres wide.
- A buffer zone around the battery compound including a 10 metre Asset Protection Zone inside the compound fence.
- A perimeter road around the battery storage inside the compound fence.
- Access roads between each set of battery cabinets.
- Cabinets installed in rows with a minimum of 2.5 metre distance (length wise) between each battery cabinet and 3 metre space between cabinets.
- A battery storage footprint (including the internal access roads but not the perimeter road) of approximately 77,700 m^2. Based on a 2,583 MWh capacity, the approximate stored energy density of the Centralised BESS would be 33 kWh/m^2.

The conceptual layout of the proposed DC Coupled (Decentralised) BESS shown on **Figure 2.1** is presented in **Figure 3.2**. Each of the 68 proposed Decentralised BESS stations includes:

- The installation of 10 battery cabinets per station with each cabinet approximately 6 metres long, 2.5 metres wide and 2.9 metres high.
- A total approximate aggregate energy storage capacity of 571 MW/2,509 MWh.
- A dedicated compound for each Decentralised BESS station of approximately 25 metres long by 37 metres wide.
- A buffer zone between each battery station and the solar panels approximately 5 metre wide.
- An access road running adjacent to each battery station.
- Cabinets installed with a minimum of 2.5 metre distance (length wise) between each battery cabinet and 3 metre space between cabinets.
- A battery station would have a footprint of approximately 925 m^2. Based on a 36.9 MWh capacity, the approximate stored energy density of the Decentralised BESS station would be 40 kWh/m^2.

The conceptual layout of the proposed Project shown on **Figure 2.1** could also include a combination of both the AC Coupled (Centralised) BESS and the DC Coupled (Decentralised) BESS.

It is noted that FM Global's Property Loss Prevention Data Sheet 5-33 Lithium-Ion Battery Energy Storage Systems (2023) provides loss prevention recommendations for the minimum separation distances for battery storage installations. This includes:

- 1.8 m separation between the accessible face of LIB rack to non-combustible construction elements, non-combustible materials and adjacent racks.
- 2.7 m separation between accessible face of LIB rack to combustible construction elements and materials.
- Separation between non-accessible sides of adjacent racks to be determined by installation fire level testing (e.g. UL9540A testing).

Given the low energy density of the proposed battery storage for the Project, it is considered that there will be sufficient area within the battery storage compound(s) to enable adequate separation distances between adjacent battery cabinets and other sensitive equipment to achieve non-propagation of thermal incidents.

As noted in Section 4 of Appendix 17 of the EIS, the LIB cell type that will most likely be utilised at the Project will be lithium iron phosphate (LFP) which is considered to have greater thermal stability compared to other typical LIB cell types.

3.2 Separation Distances

The *Goulburn River Solar Farm Preliminary Hazard Analysis* (2023) reported the modelled consequence distances presented in **Table 3.1** from lithium-ion batteries (LIBs) to fatal impacts and injury associated with fire, explosion and toxic gas release events.

Table 3.1 Modelled Consequence Distances

Hazard Event	Distance (m)
Fatal Impacts	
Fire (12.6 kW/m^2 contour)	5
Explosion (14 kPa contour)*	26
Toxic Gas Release (HF AEGL 3 contour, 44 ppm contour)	42
Injury Impacts	
Fire (4.7 kW/m^2 contour)	9
Explosion (7 kPa contour)*	43
Toxic Gas Release – Injury (HF AEGL 2 contour, 24 ppm contour)	68

* *Conservative assumption.*

The proposed location of the AC Centralised BESS shown in **Figure 2.1** is over 1,000 m from the site boundary and over 3,000 m from the single involved dwelling to the west-northwest.

The distances from the DC Decentralised BESS stations to the Project boundary ranges from 530 m in the north, 200 from the eastern boundary, 210 m from the southern boundary and 260 m from Wollara Road in the west. The closest DC Decentralised BESS station to the single involved dwelling on the Project site is 330 metres to the north. Note: this dwelling will be vacated prior to construction.

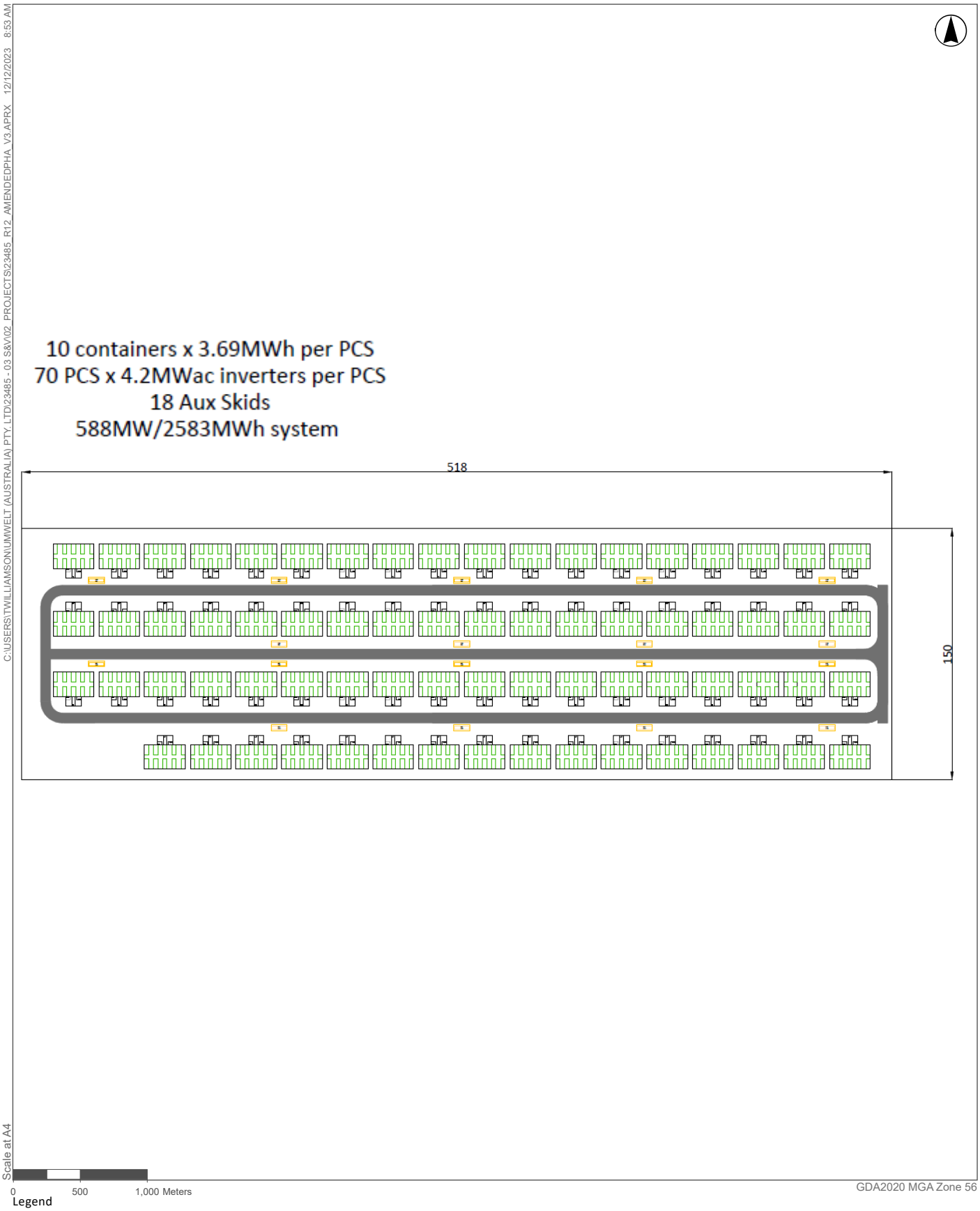
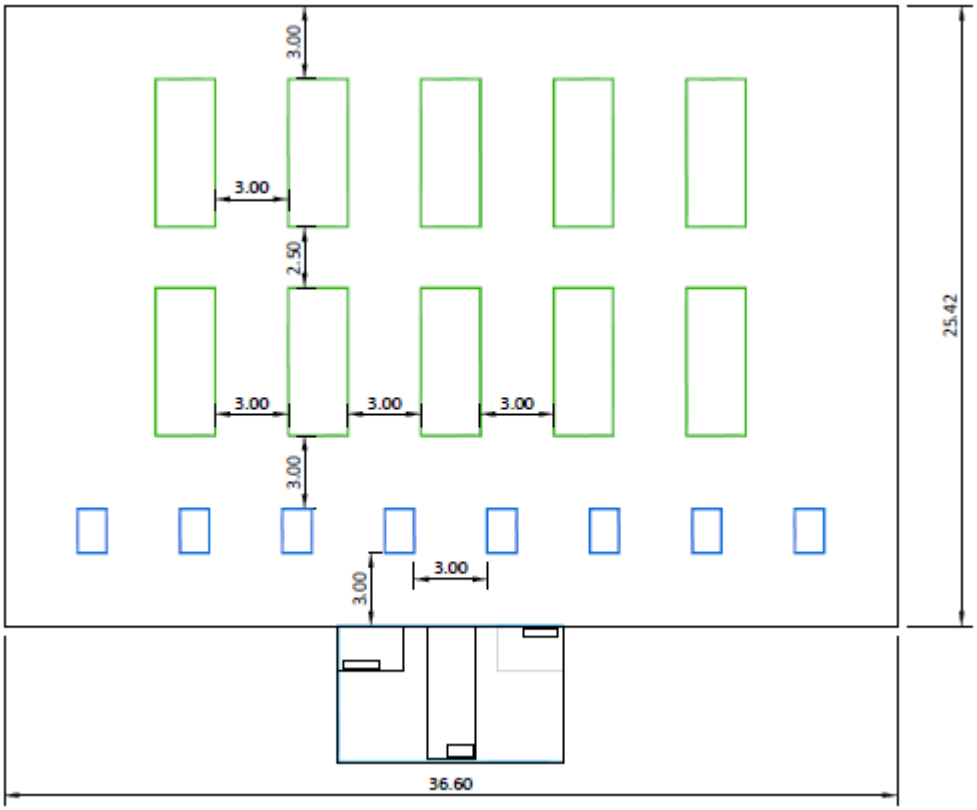


FIGURE 3.1

Indicative Layout of the AC Coupled Centralised BESS

Image Source: ESRI Basemap (2022) **Data source:** NSW LPI (2022), NSW DSFI (2022); NPWS Estate (2022); Lightsource BP (2022)

10 containers x 3.69MWh per PCS
2 Inverters x 4.2MWac per PCS
8 DC-DC converter x 1.12MW DC-DC converter per PCS
8.4MW/36.9MWh system



1:56,424
Scale at A4

0 500 1,000 Meters

GDA2020 MGA Zone 56

Legend

Hithium ESS Container 3.686MWh

DC-DC Converter

Power Conversion Station (PCS)

FIGURE 3.2

Indicative Layout of the DC Coupled Decentralised BESS

Image Source: ESRI Basemap (2022) **Data source:** NSW LPI (2022), NSW DSFI (2022); NPWS Estate (2022); Lightsource BP (2022)

4.0 Risk Management

The *Goulburn River Solar Farm Preliminary Hazard Analysis* (2023) provides a comprehensive description of the risk control strategies that would be implemented as part of the EIS Project. These remain applicable to the Amended Project.

In response to the agency submissions received during exhibition of the EIS, further information is provided regarding management of residual risks. The following section outlines LSbp's commitment to the development and documentation of the site-specific plans and procedures designed to manage the residual risk presented by the EIS Project following the implementation of technical and non-technical controls described in the EIS PHA. As stated above, these remain applicable to the Amended Project.

A Fire Safety Study (FSS) will be prepared in accordance with HIPAP 2 prior to commencing construction of the BESS. The FSS will consider:

- the operational capability of local fire agencies and the need for the facility to achieve an adequate level of on-site fire and life safety independence
- fire propagation and a worst-case scenario
- the requirements of the Fire Management Plan (FMP) that would be prepared in consultation with NSW Rural Fire Service.

It is noted the FSS will also inform the requirements of the FMP including:

- the methods and resources needed to manage and extinguish lithium battery fires
- the management of a defendable Asset Protection Zone (APZ) as described in *Planning for Bush Fire Protection* 2019.

The FSS will inform the requirements of an Emergency Response Plan (ERP) that will be prepared in accordance with HIPAP 2 prior to commencing construction of the BESS. The ERP will inform the requirements of an Emergency Services Information Package (ESIP) that would be prepared in accordance with FRNSW fire safety guideline – *Emergency services information package and tactical fire plans*. Both the ERP and the ESIP will:

- inform first responders of site-specific features and safety measures required to ensure they are able to undertake their duties effectively
- include agency specific Standard Operational Guidelines.

5.0 Conclusion

The *Goulburn River Solar Farm Preliminary Hazard Analysis* (2023) prepared for the EIS Project identified a number of hazard events involving lithium-ion batteries (LIBs) with the potential for harmful impacts. The consequence modelling identified maximum distances to fatal impacts and injury impacts for thermal radiation, explosion overpressure and toxic gas dispersion. The *Goulburn River Solar Farm Preliminary Hazard Analysis* (2023) found that these impacts were contained within the site and that the potential for adverse impacts was associated with first responders attending a hazard event.

The impacts from hazard events associated with the proposed amendments to the Project, specifically the increased BESS capacity and options of a decentralised BESS or the choice to host a combination of both centralised and decentralised BESS units will also be contained within the site. As noted above, the potential for adverse impacts would be associated with first responders attending a hazard event.
As outlined in **Section 4.0**, this will be address through LSbp's commitment to the development and documentation of the site-specific plans and procedure designed to manage the residual risk presented by the Project.

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