

Limondale Solar Farm

Battery Energy Storage System (BESS) - Modification Report

Prepared for
Limondale Sun Farm Pty Ltd

17 March 2022

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17 March 2022

Limondale Solar Farm

Battery Energy Storage System (BESS) - Modification Report



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Acronyms and Abbreviations

Name	Description
AHIP	Aboriginal Heritage Impact Permit
AC	Alternating Current
AEMO	Australian Energy Market Operator
APZ	Asset Protection Zone
Balranald LEP	Balranald Local Environmental Plan 2010
BC Act	Biodiversity Conservation Act 2016
BESS	Battery Energy Storage System
BoM	Australian Bureau of Meteorology
BOS	Biodiversity Offset Scheme
Committee	Limondale Solar Farm Community Engagement Committee
DAWE	Commonwealth Department of Agriculture, Water and Environment
dBA	A-weighted decibel
DC	Direct Current
Development consent	Development Consent SSD 8025 approved under delegated authority of the Minister for Planning on 31 August 2017, as amended.
Development footprint	Temporary or permanent disturbance areas, or areas that may be disturbed, within the Project Area, as assessed in 'the EIS' i.e. the 'Project Area' minus any exclusion zones
Dispatchable Firming Resources	Sources of electricity that can be dispatched on demand at the request of power grid operators or the plant owner according to the needs of the market
DPE	NSW Department of Planning and Environment
EIS	Environmental Impact Statement
the EIS	*Limondale Sun Farm Environmental Impact Statement* (EMM Consulting Pty Ltd, 10 April 2017) as amended by: – *Limondale Solar Farm Response to Submissions* (Overland Sun Farming, 30 June 2017); – Applicant's letter dated 30 August 2017; and – *Limondale Sun Farm Modification 1 Environmental Impact Assessment* (Limondale Sun Farm Pty Ltd, 29 June 2018).
EP&A Act	Environmental Planning and Assessment Act 1979
EP&A Regulation	Environmental Planning and Assessment Regulation 2000
EPBC Act	Environmental Protection and Biodiversity Conservation Act 1999
ERM	Environmental Resources Australia Pty Ltd
FM Act	Fisheries Management Act 1994

Name	Description
GW	Gigawatt
GWh	Gigawatt hour
ha	Hectare
Heritage Act	*Heritage Act 1977*
HNML	Highly Noise-affected Management Level
HVAC	Heating Ventilation and Air Conditioning
ICNG	*NSW Interim Construction Noise Guideline (*NSW Department of Environment and Climate Change, July 2009)
ISP	Integrated System Plan
km	Kilometre
kV	Kilovolt
LEP	Local Environmental Plan
LFP	Lithium Iron Phosphate
LGA	Local Government Area
LSF	Limondale Sun Farm Pty Ltd
m	Metres
MNES	Matters of National Environmental Significance
Mod	Modification
MW	Megawatt
MWh	Megawatt hour
MVA	Megavolt-Amperes
NEM	National Electricity Market
NML	Noise management levels
NPI	*NSW Noise Policy for Industry (*NSW Environment Protection Authority, October 2017)
NPW Act	*National Parks and Wildlife Act 1974*
NSW	New South Wales
NVIA	Noise and Vibration Impact Assessment (EMM, 2017)
NW Act	*Noxious Weeds Act 1993*
PHA	Preliminary Hazards Assessment
PMST	Protected Matters Search Tool
POEO Act	*Protection of the Environment Operations Act 1997*
Project Area	The area within and including the Project Boundary
Project Boundary	The absolute extent of the Project Area, identified as a red line of figures
PV	Photovoltaic
RBL	Rating Background Noise Level
Regional Plan	The Far West Regional Plan 2036
RNP	NSW Road Noise Policy (NSW Department of Environment, Climate Change and Water, March 2011)
Roads Act	*Roads Act* 1993
SEPP 33	*State Environmental Planning Policy No.33 – Hazardous and Offensive Development*
SSD	State Significant Development
the Strategy	The NSW Electricity Strategy (DPE, 2019)
TECs	Threatened ecological communities
TSC Act	*Threatened Species Conservation Act 1995*
The Project	The Limondale Solar Farm
Wakool LEP	Wakool Local Environmental Plan 2013
WM Act	*Water Management Act 2000*

EXECUTIVE SUMMARY

Environmental Resources Management Australia Pty Ltd (ERM) was engaged by Limondale Sun Farm Pty Ltd (LSF) to provide town planning and environmental consulting services relating to this proposed Modification to the Limondale Solar Farm (the Project). The Project is a State Significant Development (SSD) and was granted development consent (SSD 8025) under delegated authority of the Minister for Planning pursuant to the former Section 89E (currently, Section 4.38) of the NSW Environmental Planning and Assessment Act 1979 (EP&A Act) on 31 August 2017.

LSF seeks to modify SSD 8025 to permit the installation and operation of a Battery Energy Storage System (BESS) within the existing approved Project Area and development footprint, hereafter referred to as the 'Modification'. The overall objective of the proposed Modification is to construct and operate a BESS at the Project Area, to provide the facility with dispatchable firming resources and enhanced electricity grid and service capabilities, while also avoiding and minimising environmental, community and landholder impacts.

This report has been prepared to support the proposed Modification. It documents applicable planning requirements, stakeholder engagement, an assessment of environmental impacts and any necessary environmental management measures required to maintain an acceptable level of impact consistent with the existing development consent.

This modification report assesses the impacts of the proposed Modification and presents three alternative BESS options which are currently being considered by LSF. The modification report is prepared such that all options are fully assessed and evaluated, however only one option will be selected by LSF subject to commercial and operational factors. The three BESS options are:

- *A decentralised direct current (DC) coupled (DC-coupled) lithium-ion BESS of up to 200MW/800MWh capacity;*
- *A centralised alternating current (AC) coupled (AC-coupled) lithium-ion BESS of up to 200MW/800MWh capacity; and*
- *A centralised AC-coupled flow battery system of up to 200MW/800MWh capacity.*

The AC-coupled BESS options would be located within the 'AC-coupled zone' discussed in ***Chapter 1*** *this modification report. This zone represents a broader area within which the AC-coupled layout would be constructed. It consists of two areas, one north and one south of the site access road. At this stage a fixed location for the AC-coupled layout is being evaluated by LSF and would be selected subject to detailed design, and consideration of commercial and operational factors. This modification report has been prepared to assess potential worst-case impacts associated with the AC-coupled layout being positioned at any location within the nominated AC-coupled zone. Further detail regarding the updated Project description, including the Modification is provided in* ***Chapter 1*** *and* ***Appendix A****.*

This modification report considers the combined effect of the solar farm and proposed Modification (AC-coupled and DC-coupled options) but does not seek to reassess environmental impacts associated with the approved Project, where no changes are proposed.

A planning review of all relevant Commonwealth, State and local legislation, policies, guidelines and strategies has been conducted to evaluate the proposed Modification with regard to Section 4.15 of the EP&A Act. This proposed Modification is requested pursuant to the provisions of Section 4.55(2) of the EP&A Act.

Summary of Environmental Impacts

*Consideration of the planning review (**Chapter 4**), stakeholder consultation (**Chapter 5**), environmental impacts (**Chapter 6**) and environmental mitigation and management measures (**Chapter 7** and **Appendix B**) has identified that a modification application pursuant to Section 4.55(2) of the EP&A Act would remain substantially the same development. Furthermore, the proposed Modification would result in an acceptable level of impact that can be maintained consistent with the existing development consent. This statement is consistent for either AC-coupled or DC-coupled options. Further, the AC-coupled zone (discussed in **Chapter 1** of this report) has no effect on impacts. A summary of these impacts is provided in the **Table E-1** below.*

Summary of Environmental Measures and Safeguards

*Based on the summary of environmental impacts (and the detail provided within the relevant sections below), a consolidated set of environmental mitigation and management measures, and safeguards have been established. These would form part of the Project and would apply to the Modification, as documented in **Chapter 7** and **Appendix B** of this modification report.*

Environmental measures and safeguards outlined in this modification report would be incorporated into an updated Environmental Management Strategy (EMS). These measures and safeguards will minimise potential adverse impacts arising from the Modification on the surrounding environment.

*The key areas where measures and safeguards are required as a result of the proposed Modification are summarised in **Appendix B**. All other environmental aspects will continue to be managed in accordance with the existing environmental management and mitigation measures within the EMS.*

Evaluation and Conclusion

The overall objective of the proposed Modification is to develop a BESS at the Project Area and to ensure that the power system remains physically secure with the support of dispatchable firming resources and enhanced electricity grid and service capabilities, while also avoiding and minimising the impacts to the environment, community and landholders.

*This modification report has demonstrated that these objectives can be achieved and an acceptable level of impact can be maintained consistent with the existing development consent. This statement is consistent for either AC-coupled or DC-coupled options. The AC-coupled zone (discussed in **Chapter 1** of this report) has no material effect on impacts.*

In addition to achieving these objectives the proposed Modification has a number of benefits, including:

- *Contributing to the strategic objectives and targets of the NSW and Commonwealth governments for renewable energy storage;*
- *Contributing to increased energy security of the National Electricity Market (NEM) through valuable contributions to dispatchable energy storage; and*
- *Providing ongoing economic benefits for regional NSW through both the diversification of regional income streams and provision of additional employment opportunities at the site during construction and operation of the Project.*

Accordingly, the authors of this report support approval of the proposed Modification application pursuant to Section 4.55(2) of the EP&A Act.

Table E-1 Summary of Environmental Impacts

Environmental Component	*Summary of Impacts*	*Location in modification report*
Biodiversity	*The Modification is proposed to be wholly within the Project Area and development footprint previously assessed and approved under SSD 8025 and SSD 8025 MOD 1. As a part of the previous Environmental Impact Statement (EIS), the Biodiversity Assessment Report (Biosis, 2017a) concluded that no threatened flora species were identified within the study area as verified by targeted surveys. The Project Area is not currently mapped on the Biodiversity Values Map (NSW DPE, June 2021).* *The proposed Modification will not require any additional clearing of native vegetation since the Project Area had been previously cleared of native vegetation and remains un-rehabilitated. The Modification also supports the existing Biodiversity Offset arrangements currently in place, therefore no further changes are required to the existing Offset package.* *Mitigation measures contained in the EMS and the Biodiversity Management Plan (2018a) which are suitable for either AC-coupled or DC-coupled options, will minimise any indirect impacts to surrounding habitats. Additionally, it may be noted that the AC-coupled zone (discussed in **Chapter 1** of this report) has no effect on biodiversity impacts, or the necessary mitigation and management measures outlined in the Biodiversity Management Plan (2018a).*	***Section 6.1***
Aboriginal Heritage	*The Modification is proposed to be wholly within the Project Area and development footprint previously assessed and approved under SSD 8025 and SSD 8025 MOD 1. Sites identified as part of the EIS within the development footprint have previously been subject to salvage and impact as part of the approved Project works. Management of these sites within the development footprint has previously been completed in accordance with the development consent. No further constraints associated with the above sites are present within the development footprint.* *Review of the updated area specific Cultural Heritage Management Plan (CHMP) (Biosis, 2021) confirms that constraints associated with the identified human remains (Limondale Burial 1 (AHIMS # 51-5-0319)) are limited to the footprint of Block 84. The Modification would not extend into the boundary of Block 84 or the established human remains exclusion zones and subsequently the identified human remains do not present additional heritage constraints.* *The Heritage Management Plan (HMP) and CHMP is suitable for either AC-coupled or DC-coupled options. It may be noted that the AC-coupled zone (discussed in **Chapter 1** of this report) has no effect on Aboriginal heritage impacts, or the necessary mitigation and management measures outlined in the HMP/CHMP.*	***Section 6.2***
Historic Heritage	*An updated search of online heritage databases was undertaken on 31 May 2021 confirmed that there are no listed heritage items located within the Project Area. During the previous EIS, one historic site within the Project Area was identified through a 2017 cultural heritage survey (Biosis, 2017b). The site had been assessed to not be impacted by the development and consequently the significance of the item was not formally accessed as part of the EIS.* *Neither the proposed AC-coupled or DC-coupled option would result in a change to the approved Project Boundary and subsequently the Modification would not result in an increased impact to the identified historic site.*	***Section 6.3***

Environmental Component	***Summary of Impacts***	***Location in modification report***
	*The project HMP (Biosis, 2021) is suitable for either AC-coupled or DC-coupled options and provides provision for the identified of unexpected historic heritage items. The Modification would proceed under the management measures of the existing HMP. It may be noted that the AC-coupled zone (discussed in **Chapter 1** of this report) has no effect on historic heritage impacts, or the necessary mitigation and management measures outlined in the HMP.*	
Traffic	*The Project is in close proximity to a major road network consisting of Yanga Way (MR 694), Sturt Highway and Stony Crossing Road which constitute the Project's transport route/s and was approved under SSD 8025. No amendments to the transport routes, heavy vehicle restrictions, length of heavy vehicles, internal access tracks and parking are sought under this Modification. Further, the Modification does not propose to substantially increase the number of employees required to support the operation of the Project.* *The Secretary's Assessment Report for the Project concluded:* *"There would be minimal traffic to and from the solar farm during the operation of the development. Consequently, the only material traffic impacts would occur during construction, decommissioning and major infrastructure upgrades … Subject to the recommended conditions, the Department, RMS and Council are satisfied that the project would not result in significant impacts on road network capacity, efficiency or safety".* *As the recommended traffic conditions have been satisfied by the Proponent, and due to the scale of the Modification relative to the Project, it is deemed that the Modification will not exceed the traffic impacts already assessed and approved, for either AC-coupled or DC-coupled options. It is noted that the AC-coupled zone (discussed in **Chapter 1** of this report) has no effect on traffic impacts, or the necessary mitigation and management measures outlined in the Traffic Management Plan (TMP).*	***Section 6.4***
Noise and vibration	*The key noise issues potentially associated with the Modification relate to general construction plant, equipment and activities undertaken and Project related road traffic noise emissions (on public roads) within and near to the Project Area. In concurrence with the previous EIS and based on the equipment and activities identified for the construction works and operation of the Project, potential sources of vibration are very limited.* *A quantitative assessment of potential construction and operational noise impacts has been undertaken as an addendum to the EIS. It identifies that the potential for construction and operational impacts (incl. road traffic) is minimal with the introduction of the Modification. Accordingly, any existing impacts will be maintained as negligible. As noted in the construction noise assessment discussion, good-practice mitigation and management measures should continue to apply for the Modification, for either AC-coupled or DC-coupled options. Beyond this, no further recommendations for construction and operational mitigation and management measures are warranted or provided in this assessment.* *Operational emissions are assessed to be compliant with the NSW Noise Policy for Industry (NPI) 2017 requirements for either AC-coupled or DC-coupled options. Traffic related mitigation and management measures to minimise road traffic noise impacts should continue to apply for the Modification, for either AC-coupled or DC-coupled options.*	***Section 6.5***
Visual	*A qualitative visual assessment has been undertaken for the proposed Modification utilising the same eight viewpoints selected in the previous assessment completed as a part of the EIS. As observed during the site inspection and as is evident in the photographs*	***Section 6.6***

Environmental Component	***Summary of Impacts***	***Location in modification report***
	*provided in **Section 6.6** of this modification report, the as-built solar farm (with 4 metre (m) panel height solar arrays) was not visible from any of the identified viewpoints.* *The Li-ion BESS containers selected for installation as part of the Modification are approximately 2.9 m in height, one metre lower than the solar arrays and a similar height to other associated infrastructure (e.g. buildings etc.). The height of the Flow BESS enclosures are approximately 15 ft (~4.5 m) high on the eave and approximately 19 ft (~6 m) high on the peak, which exceeds the current height of existing solar arrays and associated infrastructure. The height of the BESS containers may increase subject to container selection or with the addition of cooling apparatuses (i.e., HVAC) to protect the BESS containers. Detailed design will establish final BESS container/enclosure heights but they are unlikely to result in a structure far exceeding the heights described above.* *The storage tanks proposed as a component of the Flow BESS are approximately 25 ft high (~7.6 m), which would exceed the height of the existing structures at the as-built solar farm. As such, it is expected that the storage tanks may be partially visible from nearby viewpoints, but are unlikely to substantially impact the visual landscape given the distance from the viewpoints to the Project Area.* *LSF confirmed that there will be no visual difference between the two transmission line/cabling design options, as the majority of cabling will occur underground, and the connection to the on-site substation / switchyard will be similar, regardless of what option is selected. The distance from the Project Area to the selected viewpoints, coupled with the presence of screening vegetation at certain viewpoints, results in minimal visual effect of the Project. This is unlikely to change with the inclusion of either AC-coupled or DC-coupled BESS options. As a result, the Modification is highly unlikely to impact upon the visual landscape of the wider area beyond the Project Boundary. Management and mitigation measures are not required beyond those identified in the EIS that was prepared in support of SSD 8025 and SSD 8025 MOD 1.*	
Hydrology	*A review of the existing hydrological impact assessment in the context of the Modification concluded that it is unlikely to have a significant impact on local or regional flooding, as it will not require significant earthworks or changes to the general topography of the Project Area. Further, negligible impacts on surface water and groundwater are also expected, given the sufficient distances to surface water resources and limited amount of subsurface disturbance activities required during installation and decommissioning of infrastructure for the proposed Modification.* *Additional management and mitigation measures are not required beyond those identified in the EIS water assessment, however it is recommended that the BESS (either AC-coupled or DC-coupled option) and associated Project infrastructure should be included within the Soil and Water Management Plan (SWMP) prepared for the Project, a commitment stated in the EIS water assessment. The inclusion of BESS infrastructure should also be positioned to minimise the potential obstruction of surface water flows and storm-water runoff, in line with the commitments stated in the EIS water assessment.*	***Section 6.7***

Environmental Component	*Summary of Impacts*	*Location in modification report*
Hazards and Risks	***SEPP33 Risk Screening Assessment**: Chapter 7 of the NSW Department of Planning - Applying SEPP 33 Hazardous and Offensive Development Application Guidelines, dated 2011 (the Guidelines) provides a risk screening procedure to facilitate determination of whether a proposed development is applicable under SEPP 33.* *Lithium-ion batteries are among the current preferred battery type as the major component of the BESS, however other battery options may be considered subject to detailed design. Lithium-ion batteries are identified as 'Class 9' dangerous goods under the Guidelines. Class 9 dangerous goods are excluded from the risk screening process, as they pose little threat to people or property, but should be considered in terms of their potential for environmental harm. If a different battery type is selected during detailed design it would have an equivalent SEPP33 risk or better. An ethylene glycol solution may also proposed as part of the BESS cooling system. This solution is not listed as a dangerous good within the Guidelines. As lithium-ion batteries and ethylene glycol are excluded from the screening process, there is no threshold quantity for their storage within the Guidelines, and as such, a Preliminary Hazzard Assessment (PHA) is not required for the Project.* *However, environmental assessments for recent large-scale BESS projects in NSW have conservatively included PHA's for completeness, due to emerging information on this matter and at the request of DPE. In order to satisfy DPE requirements and in consideration of completeness of the environmental assessment, a PHA has been prepared to support this modification report. The PHA is summarised below with the detailed technical study provided in **Appendix G** of this modification report.* *The second technology currently being considered by LSF is the Flow BESS. This option would result in the following dangerous goods being present on site: Electrolyte tanks (anolyte and catholyte) consisting of Class 8 materials. As the quantity of Class 8 materials exceeds 25 tonnes, SEPP 33 would apply. The PHA Addendum (Arriscar, 2022) addresses the storage and handling of Class 8 materials.*	***Section 6.8.1***
	***Preliminary Hazards Assessment**: DPE requested in a letter to the Proponent dated 28 May 2021 (refer **Appendix E.1**) that a PHA be prepared to support this modification report. The objective of a PHA is to develop a comprehensive understanding of the hazards and risks associated with an operation or facility and of the adequacy of safeguards (Department of Planning, 2011). The PHA, summarised in **Section 6.8.2** and included as **Appendix G** of this modification report, was prepared in accordance with the Department's Hazardous Industry Planning Advisory Paper No. 6, 'Hazard Analysis' (HIPAP 6) (2011) and Multi-Level Risk Assessment (MLRA), as requested in the letter from DPE (**Appendix E.1**). Post-preparation of the PHA, an Addendum report (Arriscar, 2022) was prepared to provide supplementary assessment of the Flow BESS option.* *A hazard identification register was compiled in Table 6 of the PHA (Arriscar, 2021), building upon the information presented in the EIS to include additional hazards associated with the Modification. A detailed risk analysis was subsequently prepared for the additional hazards associated with the Modification which were not assessed as part of the EIS. Potential hazards relating to the Flow BESS option were presented in Table 1 of the PHA Addendum (Arriscar, 2022).* *In summary, the assessment concluded that with the implementation of adequate mitigation and management measures:*	***Section 6.8.2***

Environmental Component	*Summary of Impacts*	*Location in modification report*
	Lithium-ion BESS Option ■ *Thermal radiation, explosion and toxic gas effects of BESS fires would be confined within the site and there would be no potentially injurious offsite effects;* ■ *Toxic gas concentrations that produce injury or irritation level would also be confined entirely within the site boundary, and would not reach ground level, except for HCN concentrations that may reach outside the site boundary, but not so far as to impact residential areas or sensitive land uses;* ■ *The thermal radiation impacts from transformer fires are confined within the site boundary with no potentially offsite effects; and* ■ *The proposed development complies with the relevant DPE criteria for land use safety planning.* *Flow BESS Option* ■ *The risk from the Flow BESS satisfies the risk criteria in HIPAP No.4;* ■ *There are no fire hazards identified in the Flow BESS;* ■ *Explosion would be confined within the site and there would be no potentially injurious offsite effects. The separation distance between containers should enable approach by emergency services personnel;* ■ *A separation distance of 4 m between adjacent modules should be considered to prevent escalation from a hydrogen explosion in one module; and* ■ *An air change of 25 per hour for the modules to keep a minor release of hydrogen below 20% LFL, and a full release of hydrogen below LFL (assuming 25% free volume).*	
	***Electric and Magnetic Fields (EMF)**: An assessment of electromagnetic interference (including Electromagnetic fields, EMF) was undertaken as a component of the EIS. A review of the existing assessment in the context of the Modification has subsequently been undertaken to consider potential EMF impacts that may arise from the BESS installation. The EIS EMF assessment indicated that there is no established evidence that exposure to magnetic fields from power lines, substations, transformers or other electrical sources causes any health effects. As a result, the findings from the EIS EMF assessment indicate that adverse impacts from EMF are unlikely, given the combination of low exposure rates and the intermittent exposure of staff to the EMF-generating Project infrastructure.* *The BESS would be designed in accordance with relevant electrical safety standards and codes, in line with the existing Project infrastructure, to minimise the potential for unwarranted increases in EMF as a result of faulty equipment. This combined with the substantial distance offset to nearby residences (≥ 2.9 km) means that the inclusions of either AC-coupled or DC-coupled BESS options are unlikely to substantially increase the existing extent and degree of EMF exposure within the Project Area and wider areas outside the Project Boundary. This statement is consistent regardless of the position of the AC-coupled BESS system within the AC-coupled zone discussed in **Chapter 1** of this report.*	***Section 6.8.3***

Environmental Component	*Summary of Impacts*	*Location in modification report*
	***Bushfire**: A review of the NSW RFS Bushfire Prone Land mapping (accessed 22 June 2021) confirms that the Project Area is not mapped as bushfire prone land. Bushfire risk factors including vegetation hazard, topography and fire history within the Project Area have been discussed. There are no mapped vegetation hazards within 100 m of any of the BESS infrastructure. The risk that the Modification itself will cause a fire is minimal and the location of BESS (either AC-coupled or DC-coupled BESS option) is unlikely to result in any increased bushfire risk above that already assessed and approved for the Project. Any upgrades to the internal roadway network within the Project Area would increase the level of access available to fire fighters and would assist to reduce the likelihood of a widespread fire. A minimum 10 m wide 'Asset Protection Zone' (APZ) will also be provided around the proposed BESS to ensure that these assets have a defendable space on all sides and will not increase the risk of a fire spreading across the landscape. It is noted that the AC-coupled zone (discussed in **Chapter 1** of this report) has no effect on bushfire risk, or the necessary mitigation and management measures outlined in **Chapter 7** and **Appendix B** of this report.* *The existing Emergency Response Plan (ERP) shall be updated in conjunction with relevant stakeholders, including local fire services, NSW RFS, NSW Fire and Rescue, adjoining property owners and employees to include the Modification. With specific regard to the Modification (AC-coupled or DC-coupled options), the BESS containers, switch-room structures and large buildings will have fire protection systems installed. A fire suppression (which is an advanced aerosol technology environmentally friendly) would also be included within the container.*	***Section 6.8.4***
Cumulative Impacts	*A search of the NSW DPE Major Projects website (DPE, 2021) was undertaken at the time of this modification report preparation (March 2022), to determine whether any additional SSD projects have received project approval since the development consent was granted for SSD 8025 and SSD 8025 MOD 1. The results of the search indicated that there are no new major projects within the potential area of influence of the Project.* *The EIS concluded that with the implementation of appropriate mitigation measures, potential for cumulative impacts to be encountered during the concurrent construction and operation of the Project would be reduced to manageable levels. LSF remains committed to the ongoing management of cumulative impacts and is in contact with other nearby developments to remain informed of their construction and operational planning, such that proactive decision making can occur and be implemented for the Project.* *This modification report has assessed the total effect of the Project and the inclusion of either BESS option, and concludes that the Modification would not increase the potential for cumulative impacts to the biophysical and social environment. This statement is consistent for either the AC-coupled or DC-coupled BESS option. It is noted that the AC-coupled zone (discussed in **Chapter 1** of this report) has no effect on cumulative impacts, or the necessary mitigation and management measures.*	***Section 6.9***

1 INTRODUCTION

Environmental Resources Management Australia Pty Ltd (ERM) was engaged by Limondale Sun Farm Pty Ltd (LSF) to provide planning and environmental consulting services relating to this proposed Modification to the Limondale Solar Farm (the Project). The Project is a State Significant Development (SSD) and was granted development consent (SSD 8025) under delegated authority of the Minister for Planning pursuant to the former Section 89E (currently, Section 4.38) of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) on 31 August 2017.

This report has been prepared to support the proposed Modification. It documents applicable planning requirements, stakeholder engagement, an assessment of environmental impacts and any necessary environmental management measures required to maintain an acceptable level of impact consistent with the existing development consent.

The Project was approved on 31 August 2017, which permits the construction and operation of a solar farm and associated infrastructure with an estimated nominal capacity of 249 megawatts (MW). It was originally approved under Section 4.38 of the EP&A Act and was previously modified on 27 July 2018 (SSD 8025 MOD 1) under Section 4.55(1A) of the EP&A Act, to permit extended hours of construction. The Project construction of the Limondale Solar Farm is near completion and consists of the following:

- Approximately 872,000 solar panels mounted on single axis-tracker frames, with a modified height of 4 metres (m);
- Up to 114 inverter stations (up to 2.3 m in height), each containing an inverter and a 22 or 33 kilovolt (kV) transformer, and an onsite switchyard containing a transformer and associated switchgear;
- Internal access tracks, staff amenities, offices, car parking, laydown areas, security fencing;
- A 220 kV underground power line connecting to the existing Balranald Substation that is situated 500 m to the east of the Project; and
- Modified Project Area allotments following the approved subdivision of Lot 12 DP 751179.

1.1 Proposed Modification

The Limondale Sun Farm *Environmental Impact Statement* (EMM Consulting Pty Ltd, 10 April 2017) noted the future potential of the installation of battery and energy storage devices within the development footprint subject to technologies available. Schedule 3, Condition 1 of the development consent (SSD 8025) stipulates that battery energy storage is not permitted onsite; however, a modification of the consent may permit future battery storage within the Project Area. For the purpose of this modification report 'the EIS' is defined as follows unless specifically noted:

- *Limondale Sun Farm Environmental Impact Statement* (EMM Consulting Pty Ltd, 10 April 2017), as amended by:
  - Limondale Solar Farm Response to Submissions (Overland Sun Farming, 30 June 2017);
  - Applicant's letter dated 30 August 2017; and
  - Limondale Sun Farm Modification 1 Environmental Impact Assessment (Limondale Sun Farm Pty Ltd, 29 June 2018).

LSF seeks to modify SSD 8025 to facilitate the installation and operation of a Battery Energy Storage System (BESS) within the approved Project Area and development footprint, hereafter referred to as the 'proposed Modification' or 'Modification'.

The overall objective of the proposed Modification is to develop a BESS at the Project, to provide the facility with dispatchable firming resources and enhanced grid and service capabilities, while also avoiding and minimising environmental, community and landholder impacts.

This modification report assesses the impacts of the Modification and presents three BESS options which are currently being considered by LSF. The modification report is prepared such that all options are fully assessed and evaluated, however only one option will be selected by LSF subject to commercial and operational factors.

The three BESS options are:

- A **decentralised direct current coupled (DC-coupled) Lithium-ion** (Li-ion) BESS of up to 200MW/800MWh capacity.
  - This system option involves 260 (20 foot) battery containers and associated infrastructure i.e., BESS Heating Ventilation and Air Conditioning (HVAC), DC-DC converters and connecting electrical wires being situated next to photovoltaic (PV) inverter stations located throughout the solar arrays.
  - Despite the decentralised design, all infrastructure resides entirely within the approved Project Area and development footprint considered under the original development consent.
  - This option would cover a combined area of approximately 289,877 m^2.
  - This DC-coupled option has a combined area greater than the AC-coupled option due to the distribution of equipment and infrastructure across the Project Area, and spacing between key item e.g., BESS containers.
- A **centralised alternating current coupled (AC-coupled) Li-ion** BESS of up to 200MW/800MWh capacity.
  - The AC-coupled BESS option would be located within the 'AC-coupled zone' identified in this modification report. This zone is situated near the approved construction site facility and storage area that is adjacent to the solar farm access. The AC-coupled zone may also include a new substation and connection options to either the on-site Limondale substation or the Balranald Substation (or an alternate future connection option). The AC-coupled zone represents a broader area within which the AC-coupled layout would be constructed. It consists of two areas, one north and one south of the site access road.
  - At this stage a fixed location for the AC-coupled layout is being evaluated by LSF and would be selected subject to detailed design, and consideration of commercial and operational factors. This modification report has been prepared to assess potential worst-case impacts associated with the AC-coupled layout being positioned in any location within the nominated AC-coupled zone.
  - Regardless of its position within the identified zone, the AC-coupled Li-ion BESS option would consist of 320 (20 foot) battery containers and associated infrastructure i.e., BESS HVAC, inverters, transformers and connecting electrical wires.
  - The AC-coupled zone represents an area of ~307,810 m^2 whilst the AC-coupled layout (i.e., the actual surface area of the AC-coupled Li-ion option once constructed) would cover a smaller area within the AC-coupled zone.
- An **AC-coupled Flow** BESS of up to 200MW/800MWh.
  - This AC-coupled Flow BESS option would be located within the AC-coupled zone identified in this modification report.
  - Regardless of its position within the identified zone, the AC-coupled Flow BESS option would consist of 48 flow energy centres and associated infrastructure, including power train enclosures, external anolyte and catholyte storage tanks (25 ft) and fluid pumps located within secondary containment basins, HVAC (if required), inverters, transformers and connecting electrical wires.

- Each flow energy centre contains 10 power trains and associated electrical equipment, housed within an enclosure measuring ~15 ft high on the eave and ~19 ft high on the peak. A total of 480 individual power trains are proposed (10 power trains per energy centre x 48 energy centres proposed).
- The AC-coupled Flow layout (i.e., the actual surface area of the AC-coupled flow option once constructed) would cover an area of ~139,718 m^2.

This modification report considers the combined effect of the solar farm and proposed BESS Modification (AC-coupled Li-ion and Flow, and DC-coupled options) but does not seek to reassess environmental impacts associated with the approved Project where no changes are proposed.

1.2 The Proponent

LSF is the proponent for the Project and will be implementing the Project.

1.3 Report Purpose

This report has been prepared to support the proposed Modification. It documents the relevantly applicable planning requirements, stakeholder engagement, an assessment of environmental impacts and any necessary environmental management measures required to maintain an acceptable level of impact consistent with the existing development consent.

Following consideration of likely key environmental risks, this modification report is supported by the following technical assessments:

- Preliminary Hazards Assessment (PHA) and Addendum PHA – this is a newly prepared report that was not required under the original approval or subsequent modification. It is prepared and documented herein due to the introduction of the Li-ion and Flow BESS containers (and associated equipment / electrical interactions) and emerging information regarding their hazard risk.
- Qualitative Noise and Vibration Assessment – this is prepared as an addendum to the original noise assessment documented in the '*Limondale Sun Farm EIS - Appendix G – Noise and Vibration Impact Assessment*' report, prepared for Overland Sun Farming Pty Ltd and dated 23 March 2017.
- Qualitative Visual Assessment – this is prepared as an addendum to the original visual assessment documented in the '*Limondale Sun Farm EIS - Appendix F – Visual Impact Assessment*' report, prepared for Overland Sun Farming Pty Ltd and dated 7 April 2017.
- Traffic Intersection Assessment – this is prepared as an addendum to the original traffic assessment documented in the '*Limondale Sun Farm EIS - Appendix H – Traffic Impact Assessment*' report, prepared for Overland Sun Farming Pty Ltd and dated 7 April 2017.
- Bushfire Assessment – this is prepared as an addendum to the original bushfire assessment documented in the '*Limondale Sun Farm EIS'* main report (*Section 6.10.2*), prepared for Overland Sun Farming Pty Ltd and dated April 2017.

1.4 Report Structure

The structure of this report is as follows:

- **Chapter 1: Introduction** – a short overview of the Modification and modification report purpose.
- **Chapter 2: Strategic Context** – overview of the Federal, State and Local strategic context under which the Modification aligns.
- **Chapter 3**: a description of the Modification components and features, providing a comparison between the modified Project to the original approved Project, in addition to an outline of construction and decommissioning activities.
- **Chapter 4: Statutory Planning** – outlines the planning context of the Modification including Federal, State and Local Government legislation and additional policies, which are of relevance to the Modification.
- **Chapter 5: Stakeholder Engagement** – overview of the engagement activities carried out before and during the preparation of the Modification, as well as opportunities for ongoing engagement.
- **Chapter 6: Environmental Impact Assessment** – describes the existing environment and assessment associated with the potential and actual environmental risks and impacts of the Modification, and mitigation and management measures proposed to minimise these risks and impacts. Further describes the potential cumulative impacts of the Modification in combination with existing and other publicly proposed developments in the region.
- **Chapter 7: Environmental Management** – provides a high level overview of the environmental management strategy of the original approved Project and the Modification, and introduces Appendix B, which provides a consolidated summary of all proposed safeguards and environmental mitigation measures that form part of the Modification.
- **Chapter 8: Justification and Benefits –** provides a justification and evaluation of the modified Modification as a whole, having regard to the economic, environmental and social impacts of the modified project and the principles of ecologically sustainable development.
- **Chapter 9: Evaluation and Conclusion** – presents the conclusions of the Modification.
- **References**
- **Appendices:**
  - **Appendix A**: Updated Project Description
  - **Appendix B**: Updated Mitigation and Management Measures
  - **Appendix C**: PMST Report
  - **Appendix D**: Scoping Letter
  - **Appendix E**: Agency Consultation
  - **Appendix F**: Community Consultation
  - **Appendix G**: Preliminary Hazards Analysis (PHA) Report and Addendum PHA Report

2 STRATEGIC CONTEXT

Since the time of the original Project EIS completion (April 2017), the strategic context in NSW (and more broadly across Australia) in support of renewable energy development has changed. Both the NSW and the Australian Governments have developed renewable energy targets and strategies to assist in the reduction of greenhouse gas emissions, achieve the outcomes of global climate agreements, and to provide reliable, renewable energy to Australian citizens.

The sections below summarise the Federal, State and Local strategic context under which the Project aligns.

2.1 Federal Context

A legally binding international treaty to address climate change was made in November 2015 at the 21st session of the United Nations Framework Convention on Climate Change (UNFCCC) Conference of the Parties (COP21) in Paris, referred to as the 'Paris Agreement'. At COP21, Australia committed to reducing its carbon emissions to 26-28% when compared to 2005 levels, by 2030.

Six years later at the 26th UNFCCC COP (i.e. COP26) in Glasgow, the Australian Government agreed to 'phase down' the use of coal-powered industries under the 'Glasgow Climate Pact', and pledged to reach net-zero carbon emissions by 2050.

The approved Project and proposed Modification will contribute to the reduction in carbon emissions from energy generation, in line with the Paris Agreement, Glasgow Climate Pact, and the overarching objectives of the UNFCCC.

2.2 State Context

2.2.1 Net Zero Plan Stage 1: 2020-2030

The Net Zero Plan Stage 1: 2020–2030 (DPE, 2020) sets the foundation for NSW's action on climate change and how the NSW Government will deliver on its objective to achieve net zero emissions by 2050. The Plan is the NSW Government's overarching strategy to reduce emissions and mitigate the impacts of climate change.

In September 2021, the NSW Government announced ambitious new emission reductions, with an updated objective to reduce emissions by 50% below 2005 levels by 2030 under the Net Zero Plan Stage 1: 2020 – 2030 Implementation Update (September 2021).

This Project will give effect to the Net Zero Plan, including the NSW Government's updated 2030 50% target through supporting existing grid-scale renewable energy resources with dispatchable firming resources and enhanced grid and service capabilities. NSW is still some way off achieving the 2030 50% reduction target. Shovel ready renewable energy projects are required to achieve the NSW government targets.

2.2.2 NSW Electricity Infrastructure Roadmap

The Electricity Infrastructure Roadmap (DPE, 2020) (the Roadmap) is the NSW Government's plan to coordinate investment in the transmission, generation, and storage of energy. The Roadmap sets out a coordinated framework to support private investment in at least 12 gigawatts (GW) of renewable energy generation infrastructure and at least 2GW of long duration storage infrastructure and supporting network infrastructure by 2030. The Roadmap aims to reduce NSW electricity emissions by 90 million tonnes by 2030, working towards net-zero emissions by 2050.

A key component of the Roadmap, in conjunction with the NSW Electricity Strategy (DPE, 2019) discussed in **Section 2.2.2** below, is the establishment of the first five Renewable Energy Zones (REZs) across NSW, identified by the NSW Government as target areas for renewable energy development, building on the NSW Transmission Infrastructure Strategy (DPE, 2018).

The Project is located within the South-West REZ in and around Hay, NSW, indicatively outlined in red in **Figure 2-1** below. The South-West REZ will be supported by EnergyConnect, an interconnector being built by TransGrid and ElectraNet between Wagga Wagga in NSW and Robertstown in South Australia. EnergyConnect will support the South-West REZ by unlocking up to 1.2GW of additional transmission capacity, transporting electricity from the REZ to homes and businesses across NSW.

The overarching approved project and proposed Modification is suitably located within the South-West REZ, in line with the objectives of the Roadmap.

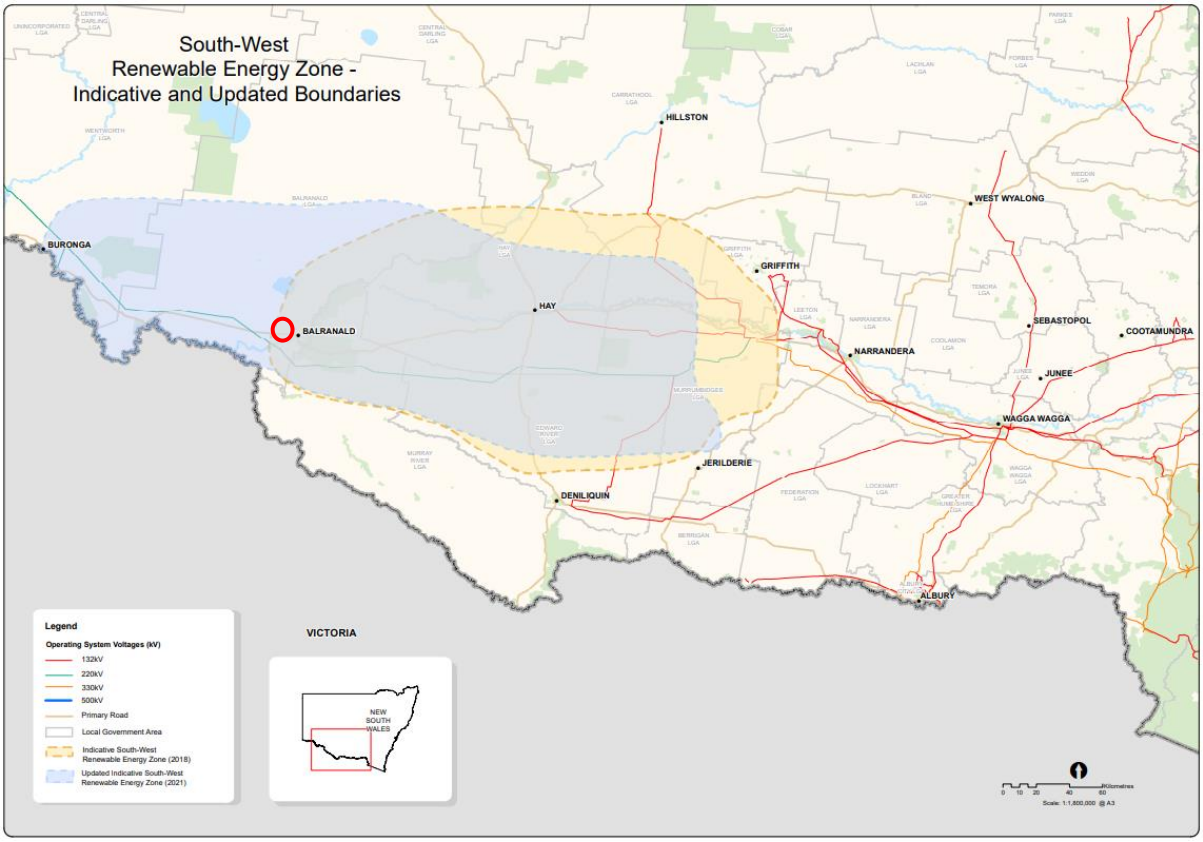


Figure 2-1 South West Renewable Energy Zone and Indicative Project Location (red circle) (*DPE, 2021)*

2.2.3 NSW Electricity Strategy

The *NSW Electricity Strategy* (DPE, 2019) (the Strategy) is the NSW Government's plan to achieve the three objectives of reliability, affordability and sustainability for the NSW electricity system, and will support an estimated $8 billion of private investment in NSW's electricity system over the next decade. The Strategy is underpinned by the following four strategic propositions:

- New generation, delivered by competitive markets, should reduce electricity prices and protect the environment;
- Governments remain ultimately accountable for electricity reliability because electricity is an essential service;
- Government action should limit costs to taxpayers and consumers; and
- Government action should be consistent with NSW's other policy objectives, including its commitment to the NEM.

An aim of the Strategy is to improve the efficiency and competitiveness of the NSW electricity market by reducing risk, cost, government caused delays, and by encouraging investment in new price-reducing generation and energy saving technology. Identified in the Strategy is the NSW Government's commitment to energy security, including additional capacity increases. The Strategy aligns closely with the NSW Government's *Net Zero Plan Stage 1: 2020-2030*.

The Modification is consistent with the Strategy as it provides renewable energy storage capacity that, together with other renewable generation and storage projects, is expected to result in lower cost of power in comparison to wholesale prices. As aforementioned, the Modification provides valuable contributions to dispatchable energy storage, therefore enhancing the grid and service capabilities of solar energy generation.

2.2.4 Far West Regional Plan 2036

The *Far West Regional Plan 2036* (Regional Plan) is the NSW Government's strategy for guiding land use planning decisions for the Far West region for the next 20 years. It applies to the Balranald Shire Council Local Government Area (LGA).

The Regional Plan sets out three goals for the Far West region:

- A diverse economy with efficient transport and infrastructure networks;
- Exceptional semi-arid rangelands traversed by the Barwon-Darling River; and
- Strong and connected communities.

The Regional Plan includes the direction "Diversify energy supply through renewable energy generation" while highlighting that the Balranald LGA has been identified as having capacity for high renewable energy generation. An action of the Regional Plan is to facilitate small-scale renewable energy projects including storage technologies through Local Environmental Plans (LEPs).

The Modification is consistent with the Regional Plan as it provides valuable contributions to dispatchable energy storage, therefore enhancing the grid and service capabilities of solar energy generation.

3 DESCRIPTION OF MODIFICATIONS

An overview of the proposed Modification to the Project is provided in **Table 3-1** , providing a comparison between the modified Project to the original approved Project as outlined in the EIS (EMM, 2017).

Table 3-1 Modified Project Summary Table

Project Component	Approved Project & MOD 1	Proposed Modification
Project Layout and Components		
Project Area	2,049 ha	No change.
Development Footprint	1,025 ha	■ DC-coupled Li-ion BESS option = No change. ■ AC-coupled Li-ion BESS option = ~1,106 ha. ■ AC-coupled flow BESS option = ~1,117 ha.
Energy Capacity	250MW solar PV energy generation	■ No change to solar PV energy generation ■ One of three potential BESS options (DC Li-ion, AC Li-ion or AC Flow) with up to 200MW/800MWh capacity.
BESS	Not proposed	■ DC-coupled Li-ion BESS of up to 200MW/800MWh capacity. – involves ~260 (20 ft) battery containers and associated infrastructure i.e., BESS HVAC, DC-DC converters and connecting electrical wires being situated next to photovoltaic (PV) inverter stations located throughout the solar arrays. – all infrastructure resides entirely within the approved Project Area and development footprint considered under the original development consent. – combined area of ~289,877 m^2. ■ AC-coupled Li-ion BESS of up to 200MW/800MWh capacity. – Located within the 'AC-coupled zone', situated near the approved construction site facility and storage area adjacent to the solar farm access. – Consists of ~320 (20 foot) battery containers and associated infrastructure i.e., BESS HVAC, inverters, transformers and connecting electrical wires. ■ An AC-coupled Flow BESS of up to 200MW/800MWh. – Located within the AC-coupled zone. – Consists of 24 flow energy centres and associated infrastructure, including power train enclosures, external anolyte and catholyte storage tanks (25 ft) and fluid pumps located within secondary containment basins, HVAC (if required), inverters, transformers and connecting electrical wires. – Each flow energy centre contains 10 power trains and associated electrical equipment, housed within an enclosure measuring ~15 ft high on the eave and ~19 ft high on the peak.

Project Component	Approved Project & MOD 1	Proposed Modification
Electricity Network Connection	Connection via the approved on-site switchyard or directly to Balranald Substation, utilising the existing TransGrid 220 kV electricity distribution network.	Connection via a new substation within the AC-coupled zone, the approved on-site switchyard or directly to the Balranald Substation (or an alternate future connection option if required), utilising the existing TransGrid 220 kV electricity distribution network.
Project Construction		
Duration and Staging	Approximately 12-15 months	Approximately 15 months.
Construction Hours	■ Monday to Friday, 6 am to 6 pm; and ■ Saturdays 6 am to 6 pm.	No change.
Construction Workforce	During the peak construction period, a workforce of approximately 200 people will be required on site.	During construction phase of the proposed Modification, it is anticipated that up to 40 personnel would be required at the Project Area per day.
Project Operation and Decommissioning		
Hours of Operation	During daylight hours, seven days per week, 365 days per year.	24 hours a day, seven days per week, 365 days per year.
Operational and Maintenance Workforce	Between four and seven full-time equivalent (FTE) employees.	Once operating, the Project is expected to require up to 20 employees on an ongoing basis to manage the operation of the Project.
Decommissioning and Rehabilitation	Once the project reaches the end of its investment and operational life, project infrastructure will be decommissioned and the site returned to its pre-existing land use, or other land use in consultation with the landholder(s). Decommissioning to be undertaken in accordance with a site decommissioning plan.	Decommissioning of the proposed BESS would occur as part of the broader Project decommissioning works, guided by the site decommissioning plan.

3.1 Modification Components and Features

3.1.1 Lithium-ion BESS

At the time this modification report was prepared (March 2022), the Contemporary Amperex Technology Co., Limited (CATL) 20 foot BESS container was the preferred Li-ion option for the proposed Modification (subject to detailed design). It has been referenced herein to inform all relevant Li-ion BESS-related aspects and assessments within this modification report.

CATL is considered a global leader in the development and manufacturing of BESS. Their energy storage systems provide energy storage and output management in power generation with battery technology and renewable energy power generation technology forming a joint system. Based on information provided by CATL, the following would be enabled with the implementation of its BESS:

- Power generation to restore a stable power grid;
- Optimize the power output curve;
- Reduce solar curtailment;
- Provide system inertia and the functions of frequency and peak modulation;

- Increase the proportion of renewable energy in total power generation; and
- Optimize the energy structure.

CATL's BESS provides smart load management for power transmission and distribution, and also has the function to accommodate future capacity increases/expansion, as well as backup power supply. It can adopt more renewable energy in power transmission and distribution in order to ensure the safe, stable, efficient and low-cost operation of the power grid.

A concept representation of the CATL 20 ft BESS container is shown in **Figure 3-1** , and an example of an existing Li-ion BESS is shown in **Figure 3-2** .

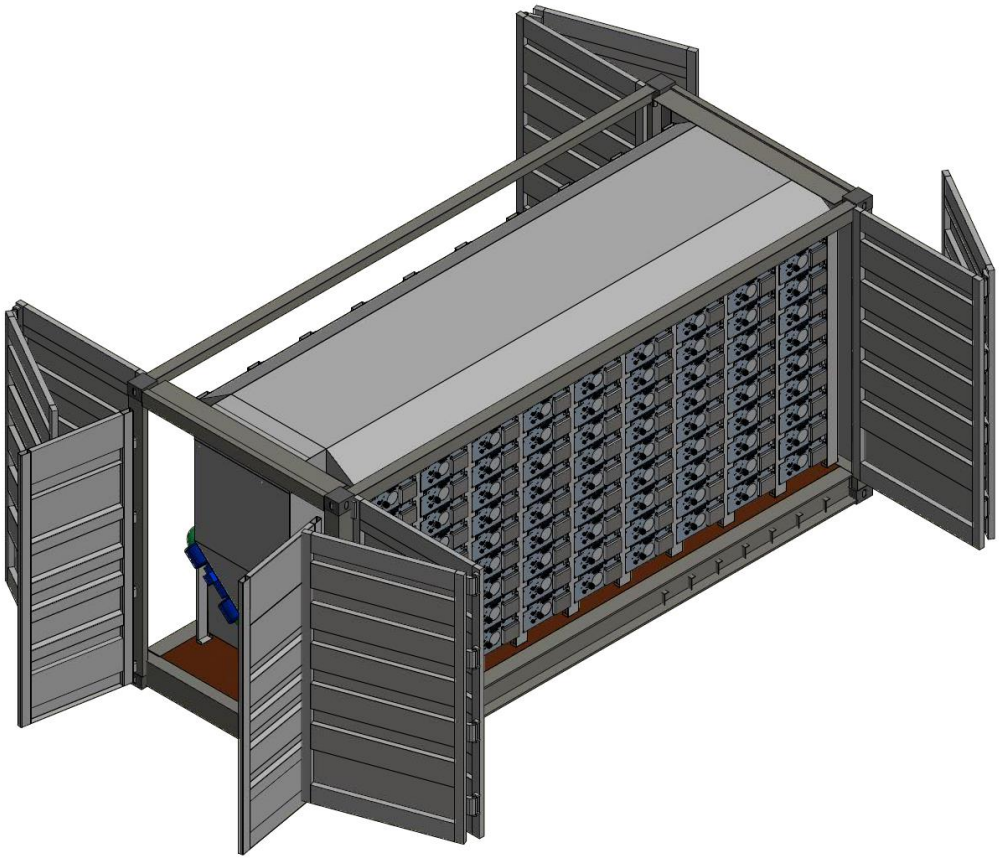


Figure 3-1 CATL 20 ft Li-ion BESS Container



Figure 3-2 Li-ion BESS Example

3.1.2 Flow BESS

At the time this modification report was prepared (March 2022), the ESS, Inc (ESS) Energy Centre™ was the preferred Flow BESS option for the proposed Modification (subject to detailed design). It has been referenced herein to inform all relevant Flow BESS-related aspects and assessments within this modification report.

ESS designs, builds and deploys environmentally sustainable, low-cost, iron flow batteries for long-duration commercial and utility-scale energy storage applications requiring flexible energy capacity. The ESS Energy Centre uses earth-abundant iron, salt, and water for the electrolyte storage tanks, resulting in a long-life, environmentally conscious energy storage solution for renewable energy infrastructure. Based on information provided by ESS, the following would be enabled with the implementation of the Energy Centre:

- Time-shifting renewable energy use;
- Ancillary grid services;
- Smoothing the intermittency of renewables; and
- Support in servicing current and future capacity demands.

ESS's Flow BESS also has the function to accommodate future capacity increases/expansion by adding additional electrolyte to the system to increase energy capacity and discharge duration. A concept representation of the ESS Iron Flow Energy Centre BESS is shown in **Figure 3-3**.



Figure 3-3 ESS Iron Flow Energy Centre (Concept Design)

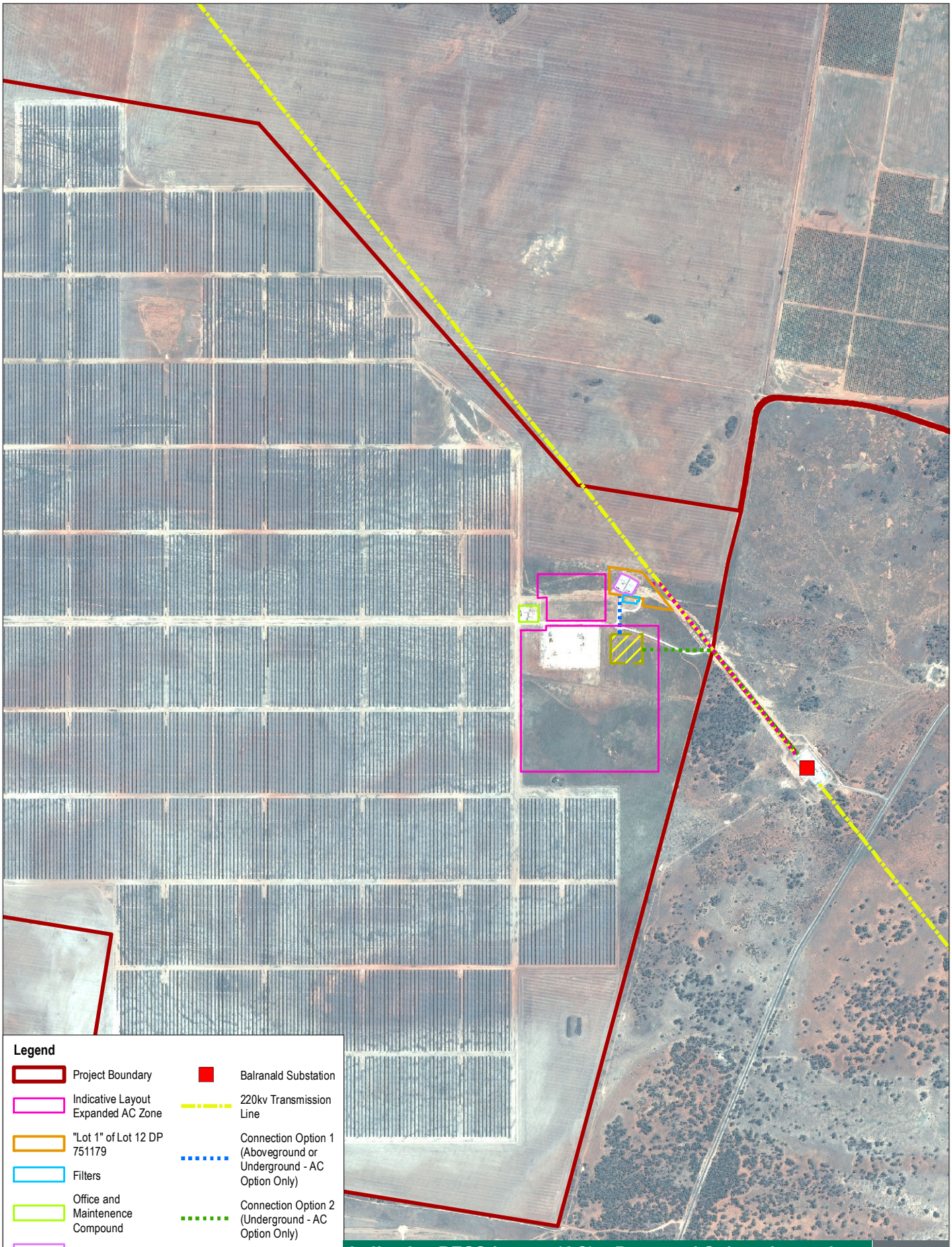
Further information regarding the Modification components and their features, for both the AC-coupled and DC-coupled options are provided in **Table 3-2**. The indicative project layout for both design options are then shown in **Figure 3-4** and **Figure 3-5** below.

As noted in **Section 1.1** of this modification report, either AC-coupled BESS option would be located within the 'AC-coupled zone' that is situated near the approved construction site facility and storage area, adjacent to the solar farm access. The AC-coupled zone may also include a new substation and connection options to either the on-site Limondale substation or the Balranald Substation (or an alternate future connection option), discussed in detail within **Appendix A**. The need for the additional substation, along with its anticipated size and location within the AC-coupled zone are indicative at this stage, and would be determined during final Project design. This AC-coupled zone in shown in **Figure 3-4**.

At this stage a fixed location for the AC-coupled layout is being evaluated by LSF and would be selected subject to detailed design and consideration of commercial and operational factors. Regardless of its position within the identified zone, the AC-coupled BESS components and features described in this modification report would be the same i.e. there would be minimal additional equipment required for any specific position within the zone, except for electrical cabling in some cases.

Table 3-2 Modification Components and Features (AC-coupled and DC-coupled Options)

Feature	AC-coupled Flow	AC-coupled BESS	DC-coupled BESS	Comment
Capacity	Up to 200MW/800MWh AC-coupled system	Up to 200MW/800MWh AC-coupled system	Up to200MW/800MWh DC-DC system	Subject to final design
Total Installed Capacity	799.2 MWh	1,185 MWh	969.02 MWh	Subject to final design
Annual generation storage capacity	292 GWh	292 GWh	292 GWh	Subject to final design
BESS Containers / Energy Centres	48	360	260	CATL 20 ft. 10 strings per container, 8 modules per string, and 52 cells per module.
BESS HVAC unit	48	360	260	HVACs – these will be used as part of the BESS to maintain the batteries at a temperature that will optimise their lifetime and performance.
BESS Transformers	96	90	0	Typically LV to MV transformers and MV to HV transformers, situated with each BESS container.
AC Inverters	96	90	0	Designed specifically for solar farm and battery storage needs they convert DC to AC. The inverter/transformer nominal power is 4,600 KVA per unit. Subject to final design and choice of inverter OEM.
DC-DC Converters	0	0	438	Designed specifically for solar farm and battery storage needs they convert DC from one voltage to another.
Underground cabling and grid connection	-	-	-	Grid connection will occur via TransGrid assets as described in **Appendix A** of this report.
Site access and access tracks	-	-	-	As per the approved Project and entirely within the existing project footprint.
Fire protection system	To be designed	To be designed	To be designed	Key project areas i.e., BESS, switch-room structures and large buildings will have fire protection system installed. These are commonly an active gas based system with thermal sensors and smoke/gas detectors, however design of this asset is yet to occur. Design will occur and adhere to relevant standards applicable to the system. Recommendations to this affect are provided within the PHA.



Legend

- Project Boundary
- Indicative Layout Expanded AC Zone
- "Lot 1" of Lot 12 DP 751179
- Filters
- Office and Maintenence Compound
- Switch Yard
- Balranald Substation
- 220kv Transmission Line
- Connection Option 1 (Aboveground or Underground - AC Option Only)
- Connection Option 2 (Underground - AC Option Only)
- Original Approved Underground Connection
- BESS AC Zone Substation

Data Sources:
Imagery : P1A Satellite Imagery (30 Jan 2021)
Layout : 29_06_2021_LIM- SITE Battery storage DC&AC_LAYOUT.dwg

Indicative BESS Layout (AC) – Proposed Substation and Connection

34

Drawing No:	0591786m_LIMSFG_G007_R4.mxd	**Limondale Solar Farm - BESS**
Date:	04/03/2022	Drawing Size: A4
Drawn By:	KV/CB	Reviewed By: CT
Client:	RWE Renewables Australia	

Coordinate System: GDA 1994 MGA Zone 54

0 250 500m

N

This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.

ERM



Legend

- Project Boundary
- Indicative DC Option
- "Lot 1" of Lot 12 DP 751179
- Filters
- Office and Maintenence Compound
- Switch Yard

Data Sources:
Imagery : P1A Satellite Imagery (30 Jan 2021)
Layout : 29_06_2021_LIM- SITE Battery storage DC&AC_LAYOUT.dwg

Indicative BESS Layout (DC)

3-5

Drawing No:	0591786m_LIMSFG_G002_R3.mxd	
Date:	04/03/2022	Drawing Size: A4
Drawn By:	KV/CB	Reviewed By: CT

Coordinate System: GDA 1994 MGA Zone 54

0 250 500m

N

Limondale Solar Farm - BESS

Client: RWE Renewables Australia

This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.

ERM

3.2 Construction

At the time this modification report was prepared (March 2022), construction of the approved solar farm is near completion. Although a detailed construction methodology and schedule is yet to be established, BESS-related works, if approved, would occur after the end of the solar farm construction schedule. This timing has occurred simply by virtue of the previous approvals i.e., approved works are largely complete and presents a benefit to the Project and surrounding community with key construction impacts. For example, traffic and noise impacts will be minimised due to the reduced interaction of concurrent works and transportation.

The BESS-related construction activities are estimated to take 15 months to reach completion, and will require up to 40 people on the site per day, per shift. The works will include:

- Site establishment and preparation for BESS equipment items situated entirely within the existing approved development footprint;
- Construction of concrete pads for the BESS equipment to be situated. This construction aspect would vary for the decentralised DC and centralised AC options, but all works would occur entirely within the existing approved development footprint;
- Transportation of:
    - BESS modules to site via heavy vehicles. With 20 ft (~6 m) containers currently being the preferred option, a single truck will carry two battery modules, equivalent to a 40 ft container (13 m load);
    - Additional AC inverters or DC-DC Converters to site via heavy vehicle;
    - Materials, such as concrete, soil, Glycol water mix for cooling systems via ridged heavy vehicles and/or truck and dogs;
    - Mobile plant equipment (e.g., crane, forklift, excavator) via rigid trucks and/or semi-trailers; and
- Light vehicles (workforce and miscellaneous) accessing the Project, and water trucks being used across the site for dust suppression.

3.2.1 Approved Construction Hours

All construction works associated with the Modification would occur during the approved extended hours for construction. This approval was documented in the DPE approval letter dated 19 October 2018, which outlined the following hours:

- Monday to Friday, 6 am to 6 pm; and
- Saturdays 6 am to 6 pm.

The approved extension to standard construction hours also allowed for works on Sundays and public holidays. The DPE approval letter dated 19 October 2018 does not specify time periods for works on Sundays and public holidays, however the 6 am to 6 pm time period was requested when the approval was sought and the Modification works may occur on these days between 6 am and 6 pm, should they be required.

3.3 Operations and Maintenance

Following construction of the Modification (either AC-coupled or DC-coupled options), the Modification will move into the operations and maintenance phase.

The Modification would be operated during daylight hours in line with the proposed solar farm operations, and operated remotely during night time hours with the exception of ad-hoc emergency maintenance activities (as required) to ensure the safe and effective operation of the Modification.

The inclusion of infrequent night works and ad-hoc emergency maintenance would result in a negligible increase in traffic generation associated with the operation and maintenance of the proposed Modification (both AC-coupled and DC-coupled options), as discussed in **Section 6.4.2.3** below. Negligible traffic generation will also result in a negligible increase in noise, and as such additional operation noise assessment of emergency traffic is not warranted to accompany this modification report.

The operation and maintenance of the Modification would create a range of direct and indirect employment opportunities. It is expected that up to 20 FTE operational jobs would be generated across the Modification and proposed operational workforce required to operate the wider solar farm Project.

3.4 Decommissioning

Decommissioning of the proposed BESS would occur as part of the broader Project decommissioning works.

The Project will be guided by a decommissioning and rehabilitation plan such that once it reaches the end of its investment and operational life, Project infrastructure will be decommissioned. The Project site will be returned to its pre-existing land use, or other land use (e.g., agricultural production) in consultation with the landholder, as far as practicable.

In accordance with Schedule 3, Condition 29, within 18 months of the cessation of operations (unless the Secretary agrees otherwise), the Project Area shall be rehabilitated to the satisfaction of the Secretary. The Project's commitments to decommissioning, including the implementation of management and mitigation measures would be extended to include all aspects of the Modification.

4 STATUTORY PLANNING

4.1 Commonwealth Legislation

4.1.1 Environment Protection and Biodiversity Conservation Act 1999

The *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) is the primary Commonwealth legislation relating to the environment, heritage protection and biodiversity conservation.

The Commonwealth Department of Agriculture, Water and Environment (DAWE), through the implementation of the EPBC Act, is the responsible authority for determining whether development activities are likely to have a significant impact on Matters of National Environmental Significance (MNES). Under the EPBC Act, any action that has, or is likely to have, a significant impact on a MNES requires referral to the Commonwealth Minister for the Environment. The EPBC Act defines an 'action' as a project, development, undertaking, activity or series of activities, or alteration to any of these.

A search of the EPBC Protected Matters Search Tool (PMST) was undertaken on 9 April 2021 to understand the presence of MNES within the Project Area and its 5 km buffer. The results of the PMST is provided in **Appendix C** of this modification report, and are summarised in **Table 4-1**.

Table 4-1 Assessment of Potential Impacts to MNES

Matters of National Environmental Significance	Application to the Project Site	Relevant Sections of Mod Report
World heritage properties	None identified within the Project Area	Not Applicable
National heritage places	None identified within the Project Area	Not Applicable
Ramsar wetlands of international importance	Search results listed four (4) Wetlands of International Importance, however these all over 50 km or greater upstream of the Project Area: ■ Banrock Station Wetland Complex (200 - 300km upstream); ■ Hattah-Kulkyne Lakes (50 - 100km upstream); ■ Riverland (200 - 300km upstream); and ■ The Coorong, and Lakes Alexandrina and Albert Wetland (300 - 400km upstream).	Not Applicable
Listed threatened species and communities	Threatened species and threatened ecological communities have been recorded within the locality.	**Chapter 6.1**
Internationally protected migratory species	Internationally protected migratory species have been recorded within the locality.	**Chapter 6.1**
Commonwealth marine areas	None identified within the Project Area	Not Applicable
The Great Barrier Reef Marine Park	Not identified within the Project Area	Not Applicable
Nuclear actions	Not applicable	Not applicable
A water resource, in relation to coal seam gas development and large coal mining development	Not applicable	Not applicable

4.2 NSW Legislation

4.2.1 Environmental Planning and Assessment Act 1979 and Regulation 2000

4.2.1.1 Overview

The principle NSW planning legislation is the *Environmental Planning and Assessment Act 1979* (EP&A Act) and the accompanying *Environmental Planning and Assessment Regulation 2000* (EP&A Regulation).

The EP&A Act provides a system of environmental planning and assessment administered by DPE. The EP&A Act establishes when and how a development or activity is to be assessed and identifies a relevant approval or determining authority.

4.2.1.2 Objects of the EP&A Act

Section 1.3 of the EP&A Act defines the objects of the Act, being:

(a) to promote the social and economic welfare of the community and a better environment by the proper management, development and conservation of the State's natural and other resources,

(b) to facilitate ecologically sustainable development by integrating relevant economic, environmental and social considerations in decision-making about environmental planning and assessment,

(c) to promote the orderly and economic use and development of land,

(d) to promote the delivery and maintenance of affordable housing,

(e) to protect the environment, including the conservation of threatened and other species of native animals and plants, ecological communities and their habitats,

(f) to promote the sustainable management of built and cultural heritage (including Aboriginal cultural heritage),

(g) to promote good design and amenity of the built environment,

(h) to promote the proper construction and maintenance of buildings, including the protection of the health and safety of their occupants,

(i) to promote the sharing of the responsibility for environmental planning and assessment between the different levels of government in the State,

(j) to provide increased opportunity for community participation in environmental planning and assessment.

The Modification is consistent with the relevant objects outlined in the EP&A Act by:

- promoting the social and economic welfare of the community and a better environment by supporting the transition from fossil fuels and providing network stability through battery storage as part of this energy transition;
- promoting the orderly and economic use of the land through the provision of a use and development that is compatible with existing energy generation activities at Limondale Solar Farm. The Modification is also a compatible use of land zoned RU1 Primary Production and does not conflict with ongoing operations or existing surrounding land uses;
- actively engaging with the community and other stakeholders (refer Chapter 6 of this report), with ongoing commitments for continual communications and engagement; and
- promoting ecologically sustainable development through supporting renewable energy generation through improved grid stability and reliability.

4.2.1.3 Approval Pathway

Section 4.55 of the EP&A Act provides pathways for the modification of development consents. This Modification is sought for under the provisions of Section 4.55(2) of the EP&A Act. Consideration of these provisions in relation to the Modification has been undertaken in **Table 4-2**. An evaluation of Section 4.15(1) of the EP&A Act is also provided in **Table 4-3** below.

Table 4-2 Requirements of S4.55(2)

Section	Modification
(a) it is satisfied that the development to which the consent as modified relates is substantially the same development as the development for which consent was originally granted and before that consent as originally granted was modified (if at all), and	The proposed Modification is considered substantially the same development as the development for which consent was originally granted, for reasons stated below: ■ There will be no change to the approved use of the development being electricity generation, nor the method of electricity generation, i.e., solar panels; ■ The proposed Modification will be located entirely within the existing Project Area and development footprint; ■ There will be no change to the land parcels forming the development (i.e., no additional allotments); ■ The proposed Modification would result in an acceptable level of impact that can be maintained consistent with the existing development consent (refer **Chapter 6**); and ■ There will be no change to the Project life.
(b) it has consulted with the relevant Minister, public authority or approval body (within the meaning of Division 4.8) in respect of a condition imposed as a requirement of a concurrence to the consent or in accordance with the general terms of an approval proposed to be granted by the approval body and that Minister, authority or body has not, within 21 days after being consulted, objected to the modification of that consent, and	A scoping letter that provided a brief outline of the Modification was prepared and submitted to DPE on 11 May 2021 (refer **Appendix D**). A scoping meeting was then attended by the Proponent (and ERM) with DPE on May 24 2021 to further discuss the Modification. A letter response (refer **Appendix E.1**) was then received from DPE on 28 May 2021, which stated that DPE were generally satisfied with the issues identified in the scoping letter and those to be addressed in the modification report. Consultation with the NSW EPA has also been undertaken to discuss the proposed Modification. No issues were raised (refer to **Appendix E.6**).
(c) it has notified the application in accordance with— (i) the regulations, if the regulations so require, or (ii) a development control plan, if the consent authority is a council that has made a development control plan that requires the notification or advertising of applications for modification of a development consent, and	Noted, it is assumed DPE will notify the Modification in accordance with the regulations, if the regulations so require.

Section	Modification
(d) it has considered any submissions made concerning the proposed modification within the period prescribed by the regulations or provided by the development control plan, as the case may be.	Noted, it is assumed DPE will consider any submissions made concerning the proposed Modification within any period prescribed by the regulations.
(3) In determining an application for modification of a consent under this section, the consent authority must take into consideration such of the matters referred to in section 4.15(1) as are of relevance to the development the subject of the application. The consent authority must also take into consideration the reasons given by the consent authority for the grant of the consent that is sought to be modified.	Noted, it is assumed DPE will consider the matters referred to in section 4.15(1) during the determination of this Modification. These matters have been evaluated in **Table 4-3** below.

Table 4-3 Evaluation of the EP&A Act (S4.15(1))

Section	Modification
(1) **Matters for consideration**—general in determining a development application, a consent authority is to take into consideration such of the following matters as are of relevance to the development the subject of the development application— (a) the provisions of (i) any environmental planning instrument, and	The Modification is considered to be generally consistent with the relevant EPIs, including Balranald LEP 2010, SEPP 33, ISEPP, Koala SEPP 2020 and Koala SEPP 2021 (refer to **Table 4-3**). The site is zoned RU1 Primary Production under the Balranald LEP 2010. Electricity generation is not permitted with or without consent under the RU1 zone in the Balranald LEP 2010. However, under Clause 34 of the ISEPP, development for the purposes of electricity generating works is permissible on prescribed rural lands with consent.
(ii) any proposed instrument that is or has been the subject of public consultation under this Act and that has been notified to the consent authority (unless the Planning Secretary has notified the consent authority that the making of the proposed instrument has been deferred indefinitely or has not been approved), and	There are no proposed instruments of relevance to this Modification.
(iii) any development control plan, and	There are currently no development control plans applicable to the Balranald Shire Council LGA (DPE, 2021).
(iiia) any planning agreement that has been entered into under section 7.4, or any draft planning agreement that a developer has offered to enter into under section 7.4, and	Section 6.27(2b) of the BC Act stipulates an application to retire a biodiversity credit may be made by the holder of the credit— for the purpose of complying with a requirement to retire biodiversity credits of a planning agreement under section 7.4 of the EP&A Act. On 19 September 2018 the Proponent made payments into the Biodiversity Conservation Fund to satisfy an obligation of SSD 8025 to retire biodiversity credits for the following biodiversity credits: ■ Black Box grassy open woodland; ■ Black Oak – Western Rosewood Management Zone 1; and ■ Black Oak – Western Rosewood Management Zone 2.

Section	Modification
	The Modification supports the existing Biodiversity Offset arrangements currently in place, therefore no further changes are required to the existing Offset package.
(iv) the regulations (to the extent that they prescribe matters for the purposes of this paragraph),	This modification report has been prepared in accordance with the relevant provisions of the EP&A Regulation.
(b) the likely impacts of that development, including environmental impacts on both the natural and built environments, and social and economic impacts in the locality,	It is considered that the likely impacts of the development have been satisfactorily addressed within this modification report (refer to Chapter 6).
(c) the suitability of the site for the development,	The Modification is proposed to be wholly within the Project Area and development footprint previously assessed and approved under SSD 8025 and SSD 8025 MOD 1.
(d) any submissions made in accordance with this Act or the regulations,	It is assumed DPE will notify the Modification in accordance with the regulations, if the regulations so require. Any submissions made in response to the Modification will be addressed during the response to submission stage.
(e) the public interest.	The Modification is considered to be in the public interest as it: ■ Contributes to the strategic objectives and targets of the NSW and Commonwealth governments for renewable energy storage; ■ Contributes to increased energy security of the National Electricity Market (NEM) through valuable contributions to dispatchable energy storage; and ■ Provides ongoing economic benefits for regional NSW through both the diversification of regional income streams and provision of employment opportunities during construction and throughout the operation of the Project. Justification and benefits of the Modification are further provided in **Chapter 8** of this modification report.

4.2.2 Other Applicable Legislation

Table 4-4 below summaries other applicable legislation relevant to the Modification.

4.2.3 State Environmental Planning Policies

Table 4-5 below summarise other policies considered relevant to the Modification

Table 4-4 Other Applicable Legislation

Statutory Requirements	Description	Relevance to the Modification	Location in Modification Report
Biodiversity Conservation Act 2016 (BC Act)	The BC Act 2016 came into effect on 25 August 2017. The BC Act establishes mechanisms for: ■ The management and protection of listed threatened species of native flora and fauna (excluding fish and marine vegetation) and threatened ecological communities (TECs); ■ The listing of threatened species, TECs and key threatening processes; ■ The development and implementation of recovery and threat abatement plans; ■ The declaration of critical habitat; ■ The consideration and assessment of threatened species impacts in development assessment process; and ■ Biodiversity Offsets Scheme, including the Biodiversity Values Map and method to identify serious and irreversible impacts (SAII).	The Modification is proposed to be wholly contained within the existing Project Area and development footprint as previously assessed and approved under SSD 8025 and SSD 8025 MOD 1. The Project Area is not currently mapped on the Biodiversity Values Map (DPE, 2021). The Project Area been previously cleared of native vegetation and remains un-rehabilitated. The Modification will not require any additional clearing of native vegetation. On 19 September 2018 the Proponent pursuant to Section 6.33 of the BC Act made payments into the Biodiversity Conservation Fund to satisfy an obligation of SSD 8025 to retire biodiversity credits for the following biodiversity credits: ■ Black Box grassy open woodland; ■ Black Oak – Western Rosewood Management Zone 1; and ■ Black Oak – Western Rosewood Management Zone 2. The Modification supports the existing Biodiversity Offset arrangements currently in place, therefore no further changes are required to the existing Offset package. Further discussion on biodiversity matters is provided in **Chapter 6.1**. Mitigation measures contained in the EMS and the Biodiversity Management Plan will minimise any indirect impacts to surrounding habitats.	**Section 6.1**
Protection of the Environment Operations Act 1997 (POEO Act)	The POEO Act is the primary waste and pollution control legislation in NSW. Under the POEO Act, EPLs are required to authorise and regulate certain activities relating to air pollution, water pollution, noise pollution and waste management.	The generation of electricity from solar energy is not a scheduled activity under the POEO Act; therefore, SSD 8025 does not require an Environmental Protection Licence (EPL). This Modification (installation and operation of a BESS) further does not trigger licencing requirements under the POEO Act.	This table
Heritage Act 1977 (Heritage Act)	The Heritage Act provides for the conservation of items of environmental heritage in NSW. It protects environmental heritage through:	A search of the State Heritage Inventory on 31 May 2021 indicated that there are three heritage items listed under the Heritage Act located within 14 km of the Project Area:	**Section 6.3**

Statutory Requirements	Description	Relevance to the Modification	Location in Modification Report
	1. listing on the State Heritage Register; 2. protection of certain non-Aboriginal relics; and 3. various kinds of orders.	■ Balranald Fire Station (Balranald LEP 2010 – I2), located approximately 14 km north of the Project Area; ■ Fish traps (Balranald LEP 2010 – I3), located along the Murrumbidgee River, approximately 12.8 km north of the Project Area; and ■ Dippo Ceremonial Ground (Balranald LEP 2010 – I4), also located along the Murrumbidgee River, approximately 13.4 km north of the Project Area. The Modification will occur entirely within the existing Project Area and development footprint as approved under SSD 8025 and SSD 8025 MOD 1 and will not impact any items of local, State, National or World heritage significance identified on the State Heritage Register, Balranald LEP or Australian Heritage Database.	
National Parks and Wildlife Act 1974 (NPW Act)	Sections 86, 87 and 90 of the NPW Act provide that Aboriginal objects and places must not be harmed or desecrated except in accordance with an Aboriginal Heritage Impact Permit (AHIP). AHIPs are issued by Heritage NSW.	The Project Area is not identified as an Aboriginal Place under the provisions of the NPW Act. The closest Aboriginal Place is the Dippo Ceremonial Ground which is located approximately 13.4 km north of the site along the Murrumbidgee River. The EIS identified that three registered Aboriginal objects were located within with Project Area. These sites were approved for impact under SSD 8025. Management measures of these sites have been completed and the objects pose no further constraints to the Modification. An Extensive search of the Aboriginal Heritage Information Management Systems (AHIMS) database was conducted on 31 May 2021 which identified that no additional Aboriginal objects had been recorded in the Project Area. A Cultural Heritage Management Plan (CHMP) for the Project has been prepared in accordance with Condition 20 of Schedule 3 of SSD 8025 and SSD MOD 1 and was approved by the Planning Secretary on 17 March 2021. Review of the CHMP identified an additional Aboriginal object within the Project Area. This object included Aboriginal human remains which are managed through an exclusion zone. The exclusion zone and management for these remains area are delineated in the CHMP. The Modification would not impact the human remains exclusion zone and subsequently this object does not pose a constraint to the Modification. The Modification would not impact on any recorded Aboriginal sites.	**Section 6.2**

Statutory Requirements	Description	Relevance to the Modification	Location in Modification Report
Water Management Act 2000 (WM Act)	Among other things, the WM Act contains licence/approval requirements for water use, water management works, drainage or flood works, controlled activities and aquifer interference.	SSD projects do not require a water use approval under Section 89, a water management work approval under Section 90 or an activity approval (other than an aquifer interference approval) under Section 91 of the WM Act, in accordance with Section 4.41 of the EP&A Act. The activities associated with the Modification will not intercept groundwater and approvals relating to aquifer interference are not required. No changes to existing water licencing and allocations for the Project are required.	This table
Roads Act 1993 (Roads Act)	The Roads Act addresses authorities, function and regulation of activities relating to the use and type of roads. Approval under Section 138 of the Roads Act is required to impact or carry out work on or over a public road.	SSD 8025 gained approval from the Roads and Maritime Services (RMS) for the intersection improvements at the site access road intersection on Yanga Way under the Roads Act, which are now complete and in use for the solar farm construction works. As required by Condition 7 of Schedule 3, a Traffic Management Plan (TMP) has been prepared for the Project to the satisfaction of the Secretary. No further road works are proposed on public roads as a result of the Modification. The Modification will require additional heavy and light vehicle movements to construct the BESS, and for the operational and decommissioning phase. Vehicle movements will remain within the limit previously assessed and approved under SSD 8025.	**Section 6.4**

Table 4-5 Relevant State Environmental Planning Policies

Statutory Requirements		Description	Relevance to the Modification	Location in Modification Report
New *State Environmental Planning Policy (Resilience and Hazards) 2021* Resilience and Hazards SEPP	Former *State Environmental Planning Policy No.33 – Hazardous and Offensive Development* (SEPP 33)	The Resilience and Hazards SEPP consolidates and repeals the provisions of the former SEPP 33. It is noted that as of 1 March 2022, the provisions of the former SEPP 33 were transferred to Chapter 3 of the Resilience and Hazards SEPP. No policy changes have been made, and the overarching SEPP consolidation does not change the legal effect of the existing SEPP 33. As such, the below provisions of the former SEPP 33 apply. SEPP 33 aims to ensure that in considering any application to carry out potentially hazardous or offensive development, the consent authority has sufficient information to assess whether the development is hazardous or offensive and to impose conditions to reduce or minimise any adverse impact. SEPP 33 applies to any development which falls under the policy's definition of 'potentially hazardous industry' or 'potentially offensive industry'.	A risk screening assessment has been undertaken to determine whether the Project involves carrying out potentially hazardous development, in accordance with the *Applying SEPP 33 Hazardous and Offensive Development Application Guidelines* (Department of Planning, 2011). The results of the risk screening assessment indicate that the proposed Modification would not be classified as potentially hazardous development. However, for completeness and at the request of DPE, a Preliminary Hazard Assessment (PHA) has been prepared to support this modification report.	**Section 6.8 and Appendix G**
New *State Environmental Planning Policy (Transport and Infrastructure) 2021* Transport and Infrastructure SEPP	Former *State Environmental Planning Policy (Infrastructure) 2007 (ISEPP)*	The Transport and Infrastructure SEPP consolidates and repeals the provisions of the former ISEPP. It is noted that as of 1 March 2022, the provisions of the former ISEPP were transferred to Chapter 2 of the Transport and Infrastructure SEPP. No policy changes have been made, and the overarching SEPP consolidation does not change the legal effect of the existing SEPP. As such, the below provisions of the former ISEPP apply. The ISEPP provides development controls for infrastructure and services and permissibility. Provisions relevant to the Project include: ■ Clause 34(1)(b): Development for the purpose of electricity generating works may be carried out by any person with consent on any prescribed rural, industrial or special use zone. ■ Electricity generating works means a building or place used for the purpose of making or generating electricity or electricity storage.	Under clause 34(1) of the ISEPP, electricity generating works are permitted with consent under a prescribed rural zone. The Modification is classified as 'electricity generating works', as 'electricity storage' is included in the definition of 'electricity generating works' under Clause 33 of the ISEPP. The Modification is therefore permissible with consent under the ISEPP.	This table

Statutory Requirements		Description	Relevance to the Modification	Location in Modification Report
New *State Environmental Planning Policy (Biodiversity and Conservation) 2021* Biodiversity and Conservation SEPP	Former *State Environmental Planning Policy (Koala Habitat Protection) 2021 (Koala SEPP 2021)*	The Biodiversity and Conservation SEPP consolidates and repeals the provisions of the former Koala SEPP 2021 and the former Koala SEPP 2020. It is noted that as of 1 March 2022, the provisions of the former Koala SEPP 2021 and Koala SEPP 2020 were transferred to Chapter 4 and Chapter 3 (respectively) of the Biodiversity and Conservation SEPP. No policy changes have been made, and the overarching SEPP consolidation does not change the legal effect of the existing SEPPs. As such, the provisions of the former Koala SEPPs apply The Koala SEPP 2021 was made and commenced on 17 March 2021. It reinstates the policy framework of SEPP Koala Habitat Protection 2019 to 83 local government areas (LGAs). For all RU1, RU2 and RU3 zoned land outside of the Sydney Metropolitan Area and the Central Coast, Koala SEPP 2020 continues to apply. Koala habitat is defined in Part 1 (4) of the Koala SEPP 2021 as: ***core koala habitat*** *means-* *(a) an area of land which has been assessed by a suitably qualified and experienced person as being highly suitable koala habitat and where koalas are recorded as being present at the time of assessment of the land as highly suitable koala habitat, or* *(b) an area of land which has been assessed by a suitably qualified and experienced person as being highly suitable koala habitat and where koalas have been recorded as being present in the previous 18 years.*	The Modification is located on lands zoned RU1 and is located in the Riverina region of south-western NSW, therefore this policy does not apply.	This table
New *State Environmental Planning Policy (Biodiversity and Conservation) 2021* Biodiversity and Conservation SEPP	Former *State Environmental Planning Policy (Koala Habitat Protection) 2020 (Koala SEPP 2020)*	The Koala SEPP 2020 commenced on 30 November 2020 and replaced the Koala Habitat Protection SEPP 2019. The Koala SEPP 2020 replicates the objectives and provisions of the former SEPP 44 – Koala Habitat Protection (SEPP 44) which was in force from 1995 through to 2019.	Balranald LGA is not listed in Schedule 1 of the Koala SEPP 2020, therefore this policy does not apply.	This table

4.3 Local Statutory Context

4.3.1 Balranald Local Environmental Plan 2010

The Project Area is situated within the Balranald Shire Council LGA. It is located within land zoned RU1 Primary Production under the Balranald LEP 2010.

The objectives of the RU1 Primary Production zone are summarised below in **Table 4-6**.

Table 4-6 Objectives of the RU1 Primary Production Zone

<table>
<tr><th>Objective</th><th>Modification</th></tr>
<tr><td>To encourage sustainable primary industry production by maintaining and enhancing the natural resource base;</td><td>The proposed Modification will not alter the Projects' consistency with this objective. In accordance with Schedule 3, Condition 29 of SSD 8025, within 18 months of the cessation of operations (unless the Secretary agrees otherwise), the Project Area shall be rehabilitated to the satisfaction of the Secretary, in accordance with the following objectives:
<table>
<tr><th>Feature</th><th>Objective</th></tr>
<tr><td>Development site (as a whole)</td><td>■ Safe, stable and non-polluting;
■ Minimise the visual impact of any above ground ancillary infrastructure agreed to be retained for an alternative use;</td></tr>
<tr><td>Solar farm infrastructure</td><td>■ To be decommissioned and removed, unless the Secretary agrees otherwise;</td></tr>
<tr><td>Land use</td><td>■ Restore land capability to pre-existing agricultural use; and</td></tr>
<tr><td>Community</td><td>■ Ensure public safety.</td></tr>
</table>
A decommissioning and rehabilitation plan has been prepared for the Project and incorporates the above rehabilitation objectives to return the site to agricultural production.</td></tr>
<tr><td>To encourage diversity in primary industry enterprises and systems appropriate for the area;</td><td>The proposed Modification will not alter the Projects' consistency with this objective. The Project will support the growth in the renewable energy market in Australia, as well as economic diversification through employment opportunities during all phases of the Project, which also creates additional patronage for local businesses.</td></tr>
<tr><td>To minimise the fragmentation and alienation of resource lands;</td><td>The proposed Modification is to be located within the existing Project Area and development footprint already assessed and approved under SSD 8025 and SSD 8025 MOD1.</td></tr>
<tr><td>To minimise conflict between land uses within this zone and land uses within adjoining zones;</td><td>The proposed Modification will not lead to land use conflict within the zone. The proposed Modification is to be located within the existing Project Area and development footprint already assessed and approved under SSD 8025 and SSD 8025 MOD 1. As aforementioned, SSD 8025 requires that the Project Area be rehabilitated in a manner which restores land capability to its pre-existing agricultural use.</td></tr>
<tr><td>To encourage development that is in accordance with sound management and land capability practices, and that takes into account the environmental sensitivity and biodiversity of the locality;</td><td>The proposed Modification is to be located within the Project Area and development footprint already assessed and approved under SSD 8025 and SSD 8025 MOD 1. No additional clearing of native vegetation will occur as a result of the Modification. A Biodiversity Management Plan has been prepared for the Project and will be reviewed prior to construction, subject to Modification approval, and will be updated accordingly.</td></tr>
</table>

Objective	Modification
To support rural communities; and	The proposed Modification will support the growth of the renewable energy market in Australia, as well as greater economic diversification through employment opportunities during all phases of the Project. This will also create additional patronage for local businesses, including demand for short and medium term accommodation options (e.g., motels, rental accommodation) during construction.
To ensure the provision of accommodation for itinerant workers.	As required by Schedule 3, Condition 28, an Accommodation and Employment Strategy has been prepared for the Project. The construction workforce required for the proposed Modification will be subsequent to the construction phase of the Limondale Solar Farm and less than what was required for the Project. Subject to approval of this Modification application, this strategy will be reviewed prior to construction, and will be updated accordingly.

Electricity generation is not permitted with or without consent under the RU1 zone in the Balranald LEP 2010. However, under Clause 34 of the ISEPP, development for the purposes of electricity generating works is permissible on prescribed rural lands with consent. 'Electricity storage' is included in the definition of 'electricity generating works' under Clause 33 of the ISEPP. The Modification is therefore permissible development. As stated in **Table 4-5**, the Modification will not alter the permissibility of the approved development under the ISEPP.

4.3.2 Balranald Development Control Plan

There are currently no development control plans applicable to the Balranald Shire Council LGA (DPE, 2021).

5 STAKEHOLDER ENGAGEMENT

LSF is committed to ongoing engagement with regulators, the community and stakeholders regarding its activities at the Limondale Solar Farm. LSF has undertaken consultation with relevant government agencies and the community as detailed herein.

5.1 Agency Engagement

Engagement that has been undertaken with government agencies associated with the Modification is summarised in **Table 5-1**.

Table 5-1 Summary of Agency Consultation

<table>
<tr><th>Government Agency</th><th>Consultation undertaken by LSF</th></tr>
<tr><td>NSW Department of Planning and Environment (DPE)</td><td>Scoping Letter
An initial scoping letter (refer Appendix D) was prepared for DPE on 11 May 2021 which provided a brief outline of the Modification and the approach for the modification report.
Scoping Meeting
A scoping meeting was arranged and attended on 24 May 2021 by the Proponent and ERM for further discussions.
Response Received
DPE facilitated the meeting and summarised the requirements for the modification report in a letter response (refer Appendix E.1) dated 28 May 2021.
The letter noted that while DPE is generally satisfied with the issues identified in the scoping letter to be addressed in the modification report, DPE also requests that the modification report includes the following:
<table>
<tr><th>Requirement</th><th>Where addressed</th></tr>
<tr><td>■ A Preliminary Hazard Analysis (PHA) prepared in accordance with the DPE Hazardous Industry Planning Advisory Paper No. 6, ‘Hazard Analysis’ (HIPAP 6) and Multi-Level Risk Assessment (MLRA). The PHA should also have regard to recent developments in research and standards for BESS including NFPA 855; AS 5139; IEC 62897; UL 9540; UL 9540A; FM Global DS 5-33; and FM Global’s Development of Sprinkler Protection Guidance for Lithium Ion Based Energy Storage Systems;</td><td>Section 6.8.2 and Appendix G</td></tr>
<tr><td>■ A quantitative noise impact assessment prepared in accordance with the Interim Construction Noise Guidelines (DECC, 2009) and the Noise Policy for Industry (EPA, 2017); and</td><td>Section 6.5</td></tr>
<tr><td>■ Details of consultation and feedback with all relevant stakeholders including Balranald Shire Council, TransGrid and potentially affected residents in the locality.</td><td>This section</td></tr>
</table>
DPE also considered that the Modification could be made under Section 4.55(2) of the EP&A Act.
Flow Battery and Hazards Meeting
A meeting was arranged and attended on 30 November 2021 by the Proponent and ERM to discuss the proposed flow battery system and potential hazards with the DPE Hazard Team.</td></tr>
<tr><td>Transport for NSW</td><td>Phone call
A phone call to the Team Leader (Development Services South Regional and Outer Metropolitan) of Transport for NSW was made on 25 June 2021 to provide a brief outline of the Modification, in particular, the traffic assessment.</td></tr>
</table>

Government Agency	Consultation undertaken by LSF
	Email The Proponent emailed the Team Leader (Development Services South Regional and Outer Metropolitan) of Transport for NSW on 30 June 2021 to encapsulate the phone call and to provide a factsheet on BESS (refer **Appendix E.2**). A subsequent round of consultation was undertaken to outline the updates to the proposed Modification. An information letter was sent via email on 24 November 2021 which outlined the updates to the proposed Modification (**Appendix E.3**). This additional information letter was also provided to TransGrid, DPE and Balranald Shire Council. Response Received A response from the Team Leader (Development Services South Regional and Outer Metropolitan) of Transport for NSW was provided on 15 July 2021. No issues were raised and the Proponent was informed that Transport for NSW will assess the development application and supporting documentation upon its submission to DPE (refer **Appendix E.4**).
TransGrid	Meeting A meeting with Transgrid was attended on 17 June 2021 by the Proponent with Maheshini Weerackoon and Jahan Peiris from the TransGrid Connections Team to provide a brief outline of the Modification and to discuss Transgrid infrastructure and assets. No issues were raised during this discussion. Landowners Consent Ongoing consultation was undertaken with TransGrid from September 2021 to obtain landowners consent for the proposed Modification. Landowners consent was obtained from TransGrid and has been included in the Modification application (refer to **Appendix E.5**).
Balranald Shire Council	Meeting A meeting was attended by the Proponent with the Director of Infrastructure and Development from Balranald Shire Council on 23 June 2021, to provide an outline of the modification report. Response Received A written letter was supplied from the Director of Infrastructure & Development from Balranald Shire Council on 12 July 2021 in response. The letter expressed support for the Proponent submitting an 'appropriately detailed' application for the Modification for consideration by DPE. Balranald Shire Council further expressed their interest in sustainable investment in the Balranald Shire LGA, and the economic benefits that sustainable investment can deliver to the community (refer **Appendix E.6**).
NSW Environmental Protection Authority (EPA)	Consultation Letter A Project briefing letter was provided to NSW EPA on 2 December 2021 to provide an overview of the proposed Modification, at the request of DPE. After a review of the information provided, NSW EPA had no further comment on the proposed Modification (refer **Appendix E.7**).
DPE (Crown Lands)	Landowners Consent Ongoing consultation was undertaken with Crown Lands from August 2021 to obtain landowners consent for the proposed Modification. After ongoing consultation, Crown Lands indicated that as there are no impacts to Crown Land, and provided a letter of consent to accompany the development application. Refer to **Appendix E.8** for evidence of consultation including the letter of consent.

5.2 Community Engagement

The Proponent has a strong ongoing relationship with the local community and undertakes regular community consultation through the existing Limondale Solar Farm Community Committee associated with the Project. A summary of community consultation undertaken by LSF is summarised below **Table 5-2**.

Table 5-2 Summary of Community Consultation

Stakeholder	Consultation undertaken by LSF
Host Landowner	The Proponent has had ongoing discussions with the host landowner. Landowner consent for the lodgement of the Modification was provided on 23 August 2021. Subsequent consultation has since been undertaken following updates to the proposed Modification. The information letter contained in **Appendix F.3** was provided to the host landowner and no issues were raised.
Adjoining Landowners	All adjoining landowners and residential receptors have been consulted with about the Modification by the Proponent. The residential receptors consulted were within the potential area of influence of the Modification. <u>Fact Sheet</u> A fact sheet was issued to the adjoining landowners of Limondale Solar Farm to provide an outline of the Modification (refer **Appendix F.1**). The fact sheet included a contact email address and phone number for the recipient to contact a project representative as needed. The information letter contained in **Appendix F.3** was also provided to adjoining landowner following updates to the proposed Modification. A letter was also provided to Coniston Station on 7 July 2021 which provided an outline of the proposed Modification (refer **Appendix F.2**). <u>Response Received</u> No issues have been raised to the Proponent by adjoining landowners to date regarding the Modification. A letter of support was received from Condoulpe Station Balranald on 29 June 2021 (refer **Appendix F.3**).
Limondale Solar Farm Community Engagement Committee	The Limondale Solar Farm Community Committee (the Committee) was established for the Project during construction and will operate during the life of the Project. The Committee consists of a number of community representatives. The Committee will be engaged during the exhibition of the modification report to seek feedback from the community representatives about the Modification.
Nearby developments (Sunraysia Solar Farm and goFARM)	<u>Phone call / Email</u> Sunraysia and goFARM have separately been consulted about the Modification by the Proponent via various phone calls and email correspondence. <u>Response Received</u> No issues were raised during these discussions. A letter of support was received from the Chief Executive officer of Australian Farming Services on behalf of goFarm on 28 June 2021 (refer **Appendix F.4**).
Balranald Inc.	Balranald Inc. is a local committee group within the region. The Proponent has had ongoing community consultation with the membership of Balranald Inc., including the provision of the aforementioned Limondale BESS factsheet on 8 June 2021. Balranald Inc. responded in favour of the proposed Modification (refer **Appendix F.5**).

5.3 Ongoing Stakeholder Engagement

Ongoing community consultation relating to the Modification will include:

- Ongoing community consultation relating to the Modification with government agencies, as relevant;
- Consultation with the Committee in future Committee meetings regarding the status of the Modification; and
- Engagement with other community members as requested.

The Limondale Stakeholder Engagement Plan (Doc ID: LSPL-0005) has been prepared by RWE and includes a summary of engagement activities (refer **Table 5-3** below), which may be used by the Project Team for ongoing engagement with government agencies and the community during the construction and operations of the Modification.

Table 5-3 Summary of Engagement Activities

Proposed Activity	Description	Stakeholder	Timing	Level of Engagement
1800 number	The dedicated 1800 314 768 number is established to ensure all stakeholders have easy access to information and RWE at a time suitable to them.	All	As per the RWE Complaints Handling Procedure (CHPR-0006) during construction and operations	High
Dedicated email address	A project email address individual to each project is created and accessible: limondalesolarfarm@RWE.com	All	Ongoing, during construction and operations	High
Community Day	An opportunity for locals and other interested parties to visit the site at specific dates	Local community; Local government; Media; Other key stakeholders	As required during operations or when major milestones occur	High
Website Updates	All project specific, contact details and public company information	All	During construction: quarterly During operations: as required or when change occurs	Medium - High
Newspaper advertising	Advertising to update the local community on the development of the solar farm	Local stakeholders	When exceptional events occur (outside of website coverage)	Medium
Newsletters and fact sheet	Provide project updates and keep the community informed	Local residents; Balranald Shire Council; Other key stakeholders	As required	Medium
Media releases	Distributed when there is specific news to share not listed on the Website, for example, a new sponsorship arrangement	Media; Broader community	As required	Medium

Proposed Activity	Description	Stakeholder	Timing	Level of Engagement
Council engagements	Presentations to Council on the project's progression; Either verbal or emailed, depending on needs of Council	Balranald Shire Council	As requested during construction. During operations only if specifically requested.	High
Personal meetings	Individual meetings with key stakeholders as required or requested	Stakeholders as requested – most likely to be local or key government bodies or neighbours	As requested	High
Community Engagement Committee	The creation and establishment of the local committee to help administer the Community Benefit Fund	Local community	Prior to full operation of site	High
Community Benefit Fund	Project-sponsored funds to be awarded to community initiatives with help of Community Engagement Committee. Funding arrangements will be governed by a detailed written Corporate Social Responsibility Concept to ensure impartiality and to avoid conflicts of interest or undue influence on any official or commercial decisions.	Project senior management; Community Engagement Committee; Local community	Once a year during operations and construction	High

6 ENVIRONMENTAL IMPACT ASSESSMENT

This chapter provides a description of the existing environment and an assessment of the environmental impacts associated with the Modification, along with recommended safeguards and management measures to minimise impacts to the environment.

As noted in **Chapter 1**, this modification report considers the combined effect of the solar farm and proposed BESS Modification (AC-coupled Li-ion and Flow, and DC-coupled options) but does not seek to reassess environmental impacts associated with the approved Project, where no changes are proposed. Hence all aspects below are provided as an addendum to the assessments conducted for SSD 8025 and SSD 8025 MOD 1.

The Preliminary Hazards Assessment (PHA) is however an exception to the statement above. The PHA is a newly prepared report that was not required under the original approval or subsequent Modification. It is prepared and documented herein due to the introduction of the BESS containers (and associated equipment / electrical interactions) and emerging information regarding their hazard risk.

Also as noted in **Section 1.1** of this modification report, the AC-coupled BESS option would be located within the 'AC-coupled zone' that is situated near the approved construction site facility and storage area, adjacent to the solar farm access. At this stage a fixed location for the AC-coupled layout is being evaluated by LSF and would be selected subject to detailed design, and consideration of commercial and operational factors. This modification report has been prepared to assess potential worst-case impacts associated with the AC-coupled layout being positioned at any location within the nominated AC-coupled zone. This is of particular relevance to the noise assessment and PHA that have assessed a worst-case position with respect to off-site (a focus for noise) and on-site (the PHA focus as off-site impacts are negligible) receptors.

As aforementioned, the Modification is proposed to be wholly contained within the Project Area previously assessed in the EIS and approved under SSD 8025 and SSD 8025 MOD 1.

6.1 Biodiversity

6.1.1 Existing Environment

A Biodiversity Assessment Report (Biosis, 2017a) was prepared to support the EIS. It describes that the Project Area is situated within the NSW Murray Darling Depression Bioregion and the South Olary Plain sub-region. This bioregion is in the Western Division of NSW and is dominated by a warm semi-arid climate in the south and eastern section.

The Project Area is relatively flat, cleared agricultural land with undulating dune/swale topography. The landscape is scattered with remnant vegetation in isolated patches within cropped paddocks, along roadsides or boundary fences or within road reserves. There are no mapped watercourses or drainage lines located within the Project Area, although there are two farm dams (Biosis, 2017a).

The Project Area would provide habitat for large mammals or highly mobile avian species capable of disbursing across the fragmented landscape only. Fauna habitat features are limited to areas of remnant patch vegetation, scattered trees and mistletoe.

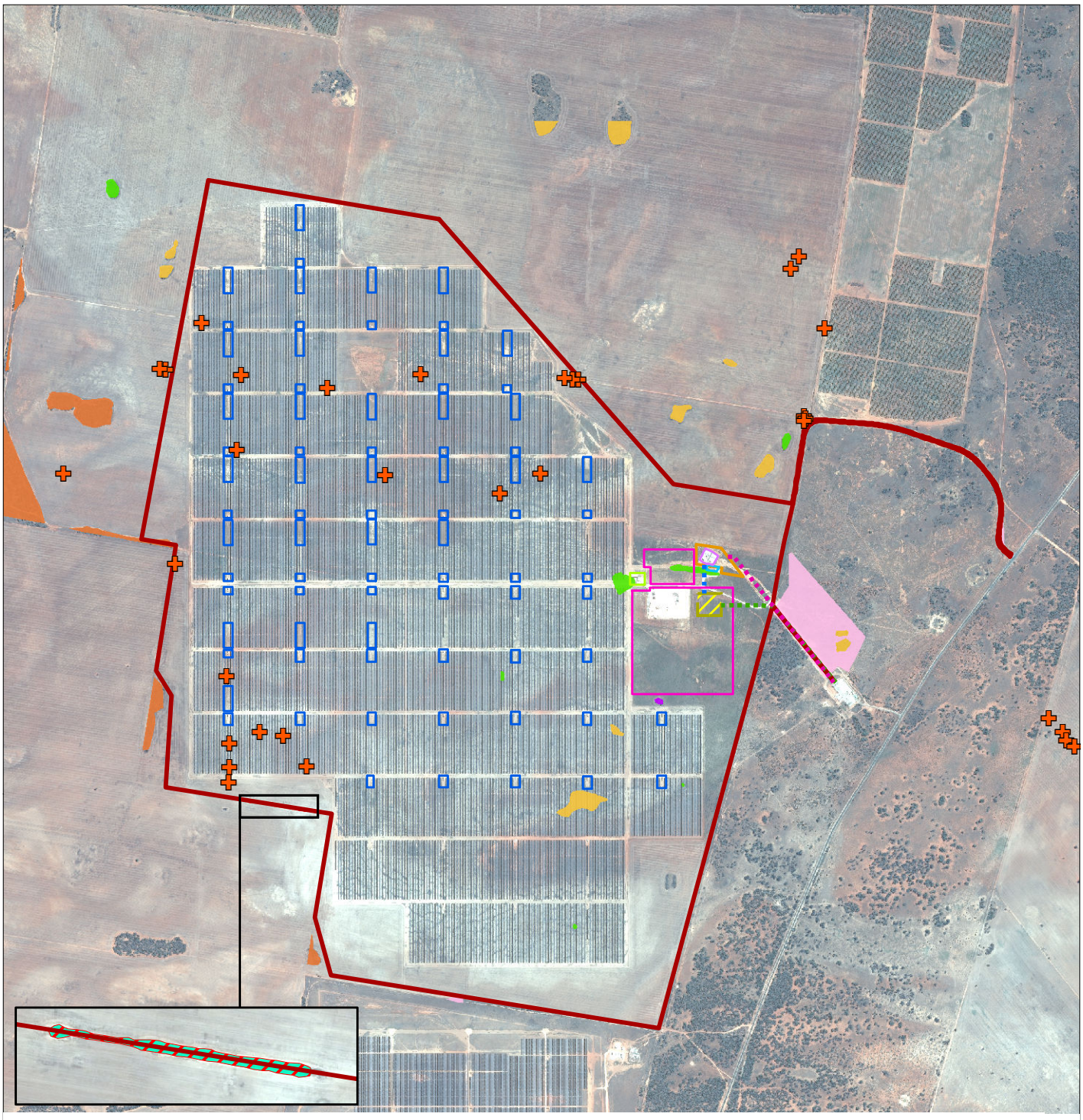
Large old trees generally provide good habitat for a range of threatened species; however, due to the fragmented and isolated nature of these trees, it is unlikely they provide key habitat for any listed threatened species (Biosis, 2017a).

In addition, Yanga National Park lies from the north to the east of the Project Area, which at its closet point, lies approximately 3 km to the east.

Key ecological values identified within the Biodiversity Assessment Report are presented within **Figure 6-1,** and include:

- 11.94 hectares of the PCT 16 Black Box grassy open woodland of rarely flooded depressions, south western NSW (MR518);
- 17.81 hectares of the PCT 58 Black Oak – Western Rosewood open woodland on deep sandy loams mainly in the Murray Darling Depression Bioregion (MR521);
- 39.5 hectares of the PCT 170 Chenopod sandplain mallee woodland/shrubland of the arid and semi-arid (warm) zones (MR542);
- 0.27 hectares of the PCT 23 Yarran tall open shrubland of the sandplains and plains of the semi-arid (warm) and arid climate zones (MR464). This PCT represents the NSW threatened ecological community Acacia melvillei shrubland in the Riverina and Murray-Darling Depression bioregions;
- 32 hollow bearing trees across the entire Project Area (paddock trees); and
- BC Act listed Major Mitchell's Cockatoo was observed in the Project Area foraging amongst cereal crops.

No threatened flora species were identified within the study area by Biosis (2017a) despite targeted surveys being undertaken.



Legend

- Project Boundary
- BESS AC Zone Substation
- Indicative Layout Expanded AC
- "Lot 1" of Lot 12 DP 751179
- Indicative Layout DC Option
- Filters
- Office and Maintenence Compound
- Switch Yard
- Connection Option 1 (Aboveground or Underground - AC Option Only)
- Connection Option 2 (Underground - AC Option Only)
- Original Approved Underground
- Hollow-bearing Trees (Biosis 2017)
- *Acacia melvillei* Shrubland EEC (Biosis 2017)

Plant Community Types (Biosis 2017)

- PCT 16 - Black Box grassy open woodland wetland of rarely flooded depressions in south western NSW (mainly Riverina Bioregion and Murray Darling Depression Bioregion), Moderate/good, (MR518)
- PCT 170 - Chenopod sandplain mallee woodland/shrubland of the arid and semi-arid (warm) zones, Moderate/good, (MR542)
- PCT 23 - Yarran tall open shrubland of the sandplains and plains of the semi-arid (warm) and arid climate zones, Moderate /good, (MR464)
- PCT 58 - Black Oak - Western Rosewood open woodland on deep sandy loams mainly in the Murray Darling Depression Bioregion, Moderate/good, (MR521)
- PCT 58 - Black Oak - Western Rosewood open woodland on deep sandy loams mainly in the Murray Darling Depression Bioregion, Moderate/good, Derived grassland(MR521)
- Woody weeds / planted vegetation

Data Sources:
Hollow-bearing trees : Biosis 2017 Report
PCT : Biosis 2017 Report
EEC : Biosis 2017 Report
Imagery : P1A Satellite Imagery (30 Jan 2021)
Base Imagery : ESRI World Imagery 2016
Layout : 22_04_2021_LIM- SITE Battery storage DC&AC_LAYOUT.dwg

Vegetation Mapping within the Biosis (2017) Study Area

6-1

Drawing No:	0591786m_LIMSFB_G002_R4.mxd		**Limondale Solar Farm - BESS**
Date:	04/02/2022	Drawing Size: A4	
Drawn By:	KV/CB	Reviewed By: LB	Client: RWE Renewables Australia

Coordinate System: GDA 1994 MGA Zone 54

0 500 1,000m

N

This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.

ERM

6.1.1.1 Threatened Ecological Communities

The *Acacia melvillei Shrubland in the Riverina and Murray-Darling Depression bioregions* threatened ecological community (TEC) was identified immediately adjacent to the southern Project Boundary Mitigation and avoidance measures were put in place to ensure no impact to this TEC.

6.1.1.2 Threatened Species

The EPBC Act listed Major Mitchell's Cockatoo was observed in the Project Area foraging amongst cereal crops. Biosis (2017a) note that this species may utilise crops and crop weeds, such as Wild Melon *Citrullus sp*., as a food source, however, this vegetation does not provide key habitat. Impacts to this species were not avoided within the EIS and were considered in the ecosystem credit requirements.

6.1.1.3 Weeds

Biosis (2017a) confirms the presence of African Boxthorn (*Lycium ferocissimum*) within the Project Area. African Boxthorn is one of Australia's most widespread weeds. It is listed as a Weed of National Significance and is declared a noxious weed in all Australian states. Under the *Biosecurity Act 2015*, it is prohibited to move, import into the state or sell African Boxthorn.

This species is also listed within the *Western Regional Strategic Weed Management Plan* (Local Land Services, 2017) as a priority weed for the Western region with the following additional requirements applying for land managers:

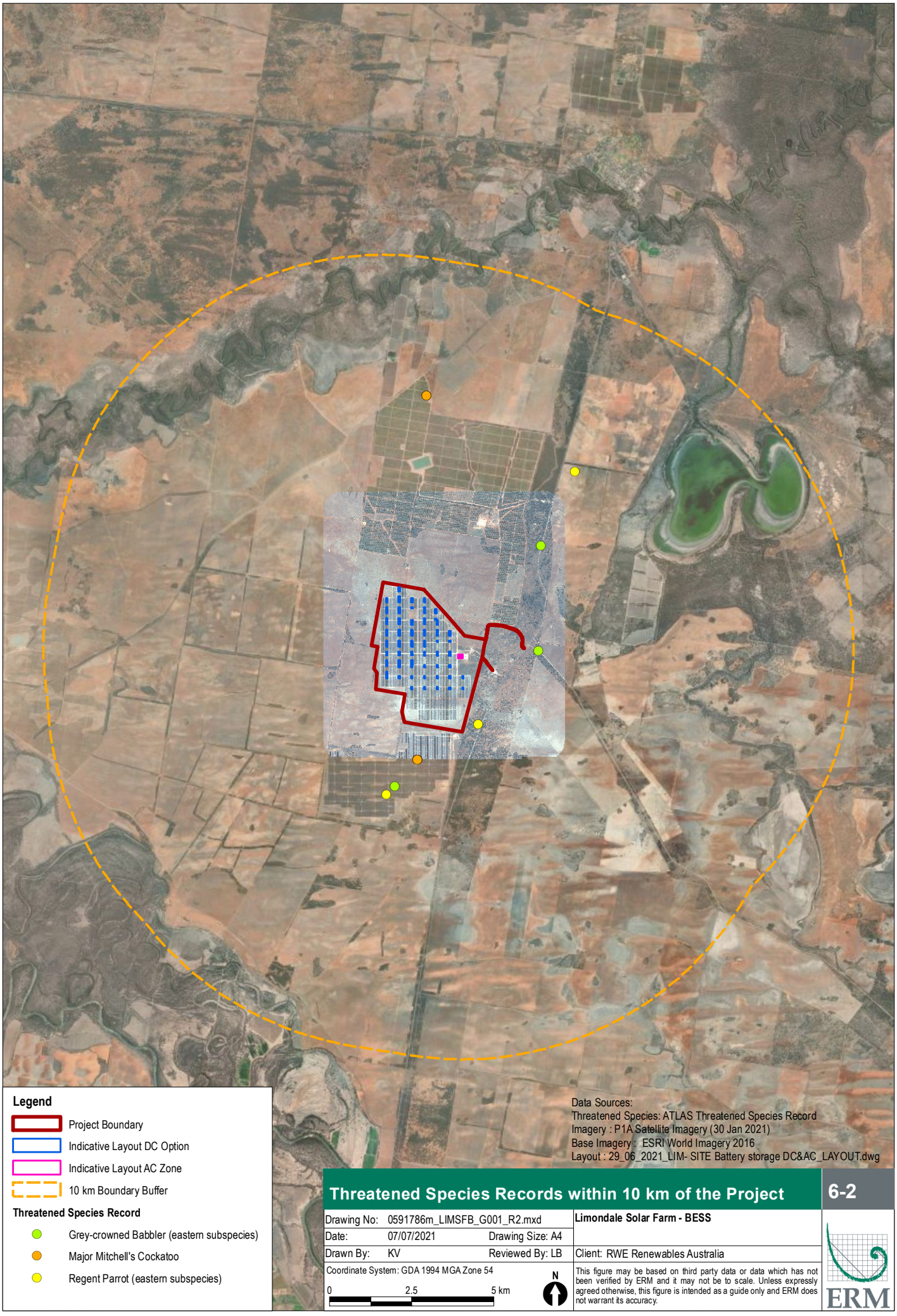
- mitigate the risk of the plant spreading from their land; and
- reduce impact of plant on priority assets (riparian areas and floodplains).

6.1.1.4 Updated Biodiversity Database Searches

An updated search of online biodiversity databases was undertaken as follows:

- NSW threatened Biodiversity Data Collections, including the Wildlife atlas (BioNET), Vegetation Information System (VIS) database and threatened species profiles, accessed on 11 June 2021;
- Results of the Commonwealth Department of Environment and Energy (DoEE) Protected Matters Search Tool (PMST) identifying threatened species and communities with potential to occur within the locality (10 km buffer around the Project Boundary), accessed on 11 June 2021;
- NSW SEED mapping to identify PCT, listed threatened species or communities or known or likely to occur at the Project Area; Mitchell Landscapes, map of interim Biographic Regionalisation of Australia (IBRA) version 7, accessed on 11 June 2021;
- NSW DPI Fisheries key fish habitat mapping, accessed on 11 June 2021;
- Weeds of National Significance and Priority Weeds within the LGA;
- Biodiversity Offset Scheme Entry Threshold (BOSET) mapping, version 8, accessed online on 11 June 2021;
- Atlas of Living Australia (ALA) database, accessed online on 11 June 2021; and
- Local Government databases.

A review of the Biodiversity Values Map and Threshold Tool (BVMT) on 11 June 2021 confirmed that no areas within the Project Area are mapped as areas of Biodiversity Value under the BC Act. BioNet threatened species records within 10 km of the Project site are presented in **Figure 6-2**. No additional biodiversity values, threatened species or ecological communities above those already assessed by Biosis (2017a) are located within the Project Area.



Threatened Species Records within 10 km of the Project

6-2

Drawing No:	0591786m_LIMSFB_G001_R2.mxd	**Limondale Solar Farm - BESS**
Date:	07/07/2021	Drawing Size: A4
Drawn By:	KV	Reviewed By: LB
Client:	RWE Renewables Australia	

Coordinate System: GDA 1994 MGA Zone 54

0 2.5 5 km

N

This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.

ERM

6.1.1.5 Existing Management of Biodiversity Values

To offset impacts arising from the Project and approved under SSD 8025 and SSD 8025 MOD 1, the Proponent has made payments into the Biodiversity Conservation Fund to retire 158 ecosystem credits in full for the following residual:

- Removal of 2.18 hectares of PCT 16 Black Box grassy open woodland of rarely flooded depressions, south western NSW (MR518). This vegetation is composed of two small patches surrounded by cropping land.
- Removal of 3.14 hectares of the PCT 58 Black Oak - Western Rosewood open woodland on deep sandy loams mainly in the Murray Darling Depression Bioregion (MR521). This vegetation is composed of five small patches surrounded by cropping land and small areas of derived vegetation that will be impacted by ancillary infrastructure.

A Biodiversity Management Plan has also been prepared by Biosis (2018a) for the Project and includes the following mitigation measures:

- Biodiversity inductions will be prepared and delivered by a suitably qualified environmental advisor.
- Prior to the commencement of earthworks, exclusion fencing will be installed along the boundaries of vegetated areas to be retained (including the areas of TEC).
- Sediment and erosion control measures will be implemented prior to construction works (e.g. install silt fences, sediment traps), to protect drainage channels to the west and to the south. These will conform to relevant guidelines and be maintained throughout the construction period.
- Prior to works commencing, undertake a weed assessment / mapping to provide a baseline for monitoring actions. Any machinery, equipment and PPE will be washed down off-site to remove soil and weed seeds. Weed control methods must be selected to ensure that retained native vegetation is not subjected to any increased impacts.
- Undertake pre-clearance surveys of all hollow-bearing trees if clearing will be undertaken between July and November, this will focus on identifying nesting trees for hollow-dependent species such as Major Mitchell's Cockatoo.
- A licenced wildlife salvage team will be on-site during vegetation removal to catch and relocate (if appropriate) any wildlife encountered in vegetation or hollow-bearing trees.
- Temporarily disturbed areas will be left to naturally regenerate with a mix of local native colonisers and non-native pastures following the reinstatement of the original topsoil.

6.1.2 Updated Legislative Requirements

The EIS and Biodiversity Assessment Report (Biosis, 2017a) was assessed against key biodiversity legislation and government policy, applicable at that time including:

- EPBC Act;
- EP&A Act;
- Threatened Species Conservation Act 1995 (TSC Act);
- Fisheries Management Act 1994 (FM Act);
- NSW Biosecurity Act 2015; and
- Balranald LEP 2010.

A number of changes have occurred since the preparation of the EIS, specifically the BC Act came into effect on 25 August 2017. The BC Act repealed the TSC Act. The BC Act incorporates many of the provisions of the TSC Act as well as the flora and fauna protection provisions of the NPW Act.

The BC Act also establishes the Biodiversity Offset Scheme (BOS) which has replaced the previous Biobanking Scheme.

As confirmed by DPE on 10 October 2018, the credit requirements calculated under the BC Act are considered equivalent to the credit requirements in Schedule 3, Condition 9 of SSD 8025. SSD 8025 MOD 1 was approved prior to the confirmation of credits but did not trigger additional credits as the assessment found no additional impact on native vegetation, fauna and fauna habitat. The credits were retired in full on the 19 September 2018 and no further assessment under the BOS is required to support this Modification.

6.1.3 Assessment of Impacts

The Modification is proposed to be wholly contained within the Project Area and development footprint previously assessed and approved under SSD 8025 and SSD 8025 MOD 1 and supports the existing Biodiversity Offset arrangements currently in place. The Modification will not require any additional clearing of native vegetation and no additional management or mitigation measures are proposed.

6.1.4 Mitigation and Management Measures

Management measures already contained within the Biodiversity Management Plan (2018a) will continue to apply. The Biodiversity Management Plan (2018a) is suitable for either AC-coupled or DC-coupled options. Further, the AC-coupled zone (discussed in **Chapter 1** of this report) has no effect on biodiversity impacts, or the necessary mitigation and management measures outlined in the Biodiversity Management Plan (2018a).

6.2 Aboriginal Heritage

Biosis completed an Aboriginal Cultural Heritage Assessment Report (ACHAR) (2017b) to support the EIS. Background assessment completed for the ACHAR noted that the Project Area had been historically utilised for grazing activities and cereal cropping which had resulted in high levels of modification and disturbance across the Project Area. Despite this, the ACHAR noted that the landscape contained Aboriginal heritage with earth mounds, hearths and artefact sites as commonly identified site types within the broader study area considered in the EIS.

The ACHAR identified 13 Aboriginal sites within the broader study area considered in the EIS with five sites located within the Project Area and subject to impact as part of the Project (shaded in grey in **Table 6-1**).

Table 6-1 Summary of Aboriginal Sites Identified within the EIS Study Area (from Biosis 2017b)

Site name	AHIMS ID	Site type	Assessed degree of harm
Limondale 1	AHIMS # 47-5-0045	Artefact, Hearth	Total
Limondale 2	AHIMS # 47-6-0826	Artefact, Earth Mound	None
Limondale 3	AHIMS # 47-6-0827	Hearth	None
Limondale 4	AHIMS # 47-6-0828	Earth Mound	None
Limondale 5	AHIMS # 47-6-0829	Earth Mound	None
Limondale 6	AHIMS # 47-6-0830	Modified Tree (Carved or Scarred)	None
Limondale 7	AHIMS # 47-6-0831	Hearth	None
Limondale 8	AHIMS # 47-6-0834	Hearth	None
Limondale 9	AHIMS # 47-5-0046	Artefact	Total

Site name	AHIMS ID	Site type	Assessed degree of harm
Limondale 11	AHIMS # 47-6-0833	Hearth	Total
Limondale 12	AHIMS # 47-6-0832	Hearth, Potential Archaeological Deposit (PAD)	None
Transmission Line 5	AHIMS # 47-6-0605	Hearth, Potential Archaeological Deposit (PAD)	Total
Transmission Line 6	AHIMS # 47-6-0606	Hearth, Potential Archaeological Deposit (PAD)	Total

6.2.1 Updated AHIMS Search

An updated search of the Aboriginal Heritage Information Management System (AHIMS) database was completed on 31 May 2021 (ID: 595067). The search was undertaken between the following coordinates with a 0 metre buffer:

GDA Zone 54 725603 – 733545 mE 6144978 – 6153669 mS

The search was completed to identify if any additional Aboriginal sites had been recorded within the Project Area since completion of the EIS. A total of 20 Aboriginal sites were identified within the search area. Of those, five were located within the Project Area (those highlighted grey in **Table 6-1** above). All registered sites within the Project Area were previously identified and assessed as part of the EIS.

The results of the updated AHIMS search are illustrated in **Figure 6-3** below.

6.2.2 Existing Management of Aboriginal Sites

The five Aboriginal sites (Limondale 1, Limondale 9, Limondale 11, AHIMS # 47-6-0605 and AHIMS # 47-6-0606) within the Project Area were unable to be avoided by the proposed works, and test excavation and surface salvage of these sites was recommended by the ACHAR.

In accordance with SSD 8025, a Heritage Management Plan (HMP) was completed by Biosis (2018b) which provided a methodology for archaeological test excavation of AHIMS # 47-6-0605 and AHIMS # 47-6-606 as well as surface salvage of sites Limondale 1, Limondale 9 and Limondale 11.

Salvage reporting (Biosis, 2018b) for the Project confirms archaeological test excavation of AHIMS # 47-6-0605 and AHIMS # 47-6-606 was undertaken as well as surface salvage of Limondale 1, Limondale 9 and Limondale 11 in accordance with Schedule 3, Condition 19 of SSD 8025. Site impact recording forms were lodged with the AHIMS database on 8 July 2021 to confirm that these sites had been destroyed as part of the approved works.

During construction, an unexpected find in the form of a human burial was identified within Block 84 and Block 85 (EMM 2020). In accordance with the HMP (Biosis, 2018b) works were halted and an exclusion zone was placed surrounding the remains. NSW Police were subsequently contacted who assessed the remains as likely to be Aboriginal ancestral remains. Consultation with the Registered Aboriginal Parties (RAPs) for the Project identified that in-situ retention of the remains was preferred. It was recommended that a specific management plan be developed for Block 84 and Block 85 (EMM, 2020). The articulated human remains as well as additional bone fragments and artefacts were registered on the AHIMS database as Limondale burial 1 (AHIMS # 51-5-0319)[1].

[1] Note: The location of this site was not identified within the AHIMS search due to an inaccuracy with the original site location recording. An AHIMS site card update has been submitted to update the site location of the burial

The updated management plan and site card associated with Limondale burial 1 confirmed that management of the identified human remains involved the establishment of a fenced exclusion zone in June 2020 (see **Figure 6-4** below). At this time fragmented ex-situ human remains on an access track directly outside of the exclusion zone were relocated into the established exclusion zone. The updated CHMP (Biosis, 2021) recommended the following controls for works within Block 84:

- Access to the exclusion zone in Block 84 is only permissible under supervision by someone who knows the cultural features and issues associated with the area. This includes for rubbish collection or site inspections.
- Access to the exclusion zone in Block 84 should only be when necessary. If access is granted by the supervisor, all personnel should be made aware of no-go zones and their visual presentation on site prior to undertaking the activity, and informed that the grave must not be approached.
- Should any future works be proposed within Blocks 84 and 85, discussion should occur with Belectric's heritage advisor as the nature and location of the works to assess the requirement for any monitoring to occur.
- A heritage professional and/or Aboriginal representative should be present for any ground disturbance within other parts of Blocks 84 and 85 where previous ground disturbance from the development has not already occurred.

6.2.3 Assessment of Impact

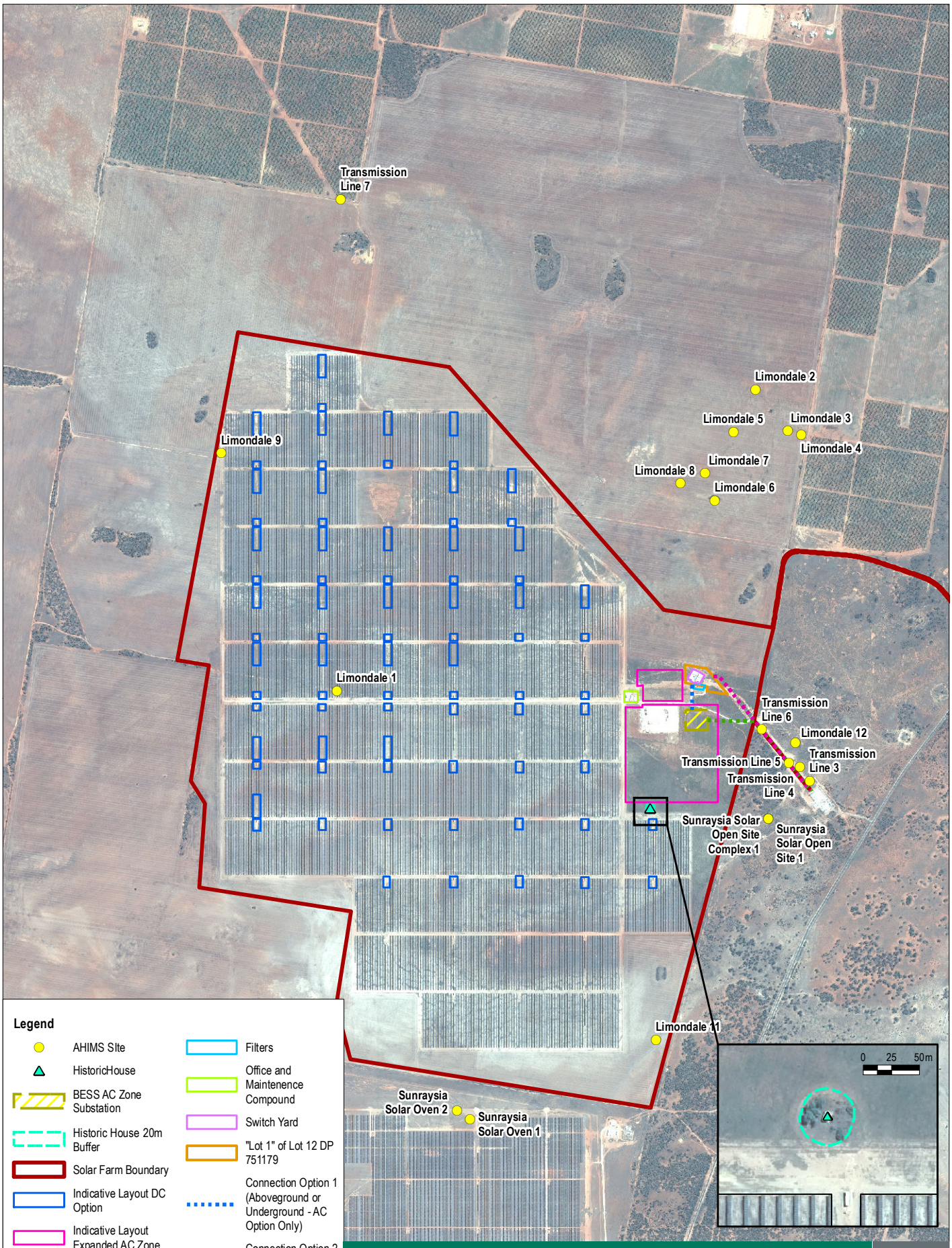
The Modification is located entirely within the approved Project Area and development footprint. Sites identified as part of the EIS within the development footprint have previously been subject to salvage and impact as part of the approved project works. Management of these sites within the development footprint has previously been completed in accordance with the development consent. No further constraints associated with the above sites are present within the development footprint.

Review of the updated CHMP (Biosis, 2021) confirms that constraints associated with the identified human remains (Limondale Burial 1 (AHIMS # 51-5-0319)) are limited to the footprint of Block 84. The Modification will not extend into the boundary of Block 84 or the established human remains exclusion zones and subsequently the identified human remains do not present additional heritage constraints.

6.2.4 Mitigation and Management Measures

The management of Aboriginal Heritage within the development footprint is currently managed under the Project HMP (Biosis, 2018b), which details procedures for chance Aboriginal finds and the procedures for the identification of human remains during works. This plan as well as the area specific CHMP (Biosis, 2021) developed in response to the identification of human remains within Blocks 84 and 85 would be adhered to during the Modification.

The HMP (and CHMP) is suitable for either AC-coupled or DC-coupled options. Further, the AC-coupled zone (discussed in **Chapter 1** of this report) has no effect on Aboriginal heritage impacts, or the necessary mitigation and management measures outlined in the HMP/CHMP.



Legend

- AHIMS SIte
- HistoricHouse
- BESS AC Zone Substation
- Historic House 20m Buffer
- Solar Farm Boundary
- Indicative Layout DC Option
- Indicative Layout Expanded AC Zone
- Filters
- Office and Maintenence Compound
- Switch Yard
- "Lot 1" of Lot 12 DP 751179
- Connection Option 1 (Aboveground or Underground - AC Option Only)
- Connection Option 2 (Underground - AC Option Only)
- Original Approved Underground Connection

Data Sources:
AHIMS : AHIMS, Environment and Heritage NSW
Imagery : P1A Satellite Imagery (30 Jan 2021)
Layout : 29_06_2021_LIM- SITE Battery storage DC&AC_LAYOUT.dwg

AHIMS Sites

6-3

Drawing No:	0591786m_LIMSFH_G001_R5.mxd		Limondale Solar Farm - BESS
Date:	04/03/2022	Drawing Size: A4	
Drawn By:	KV	Reviewed By: AH	Client: RWE Renewables Australia

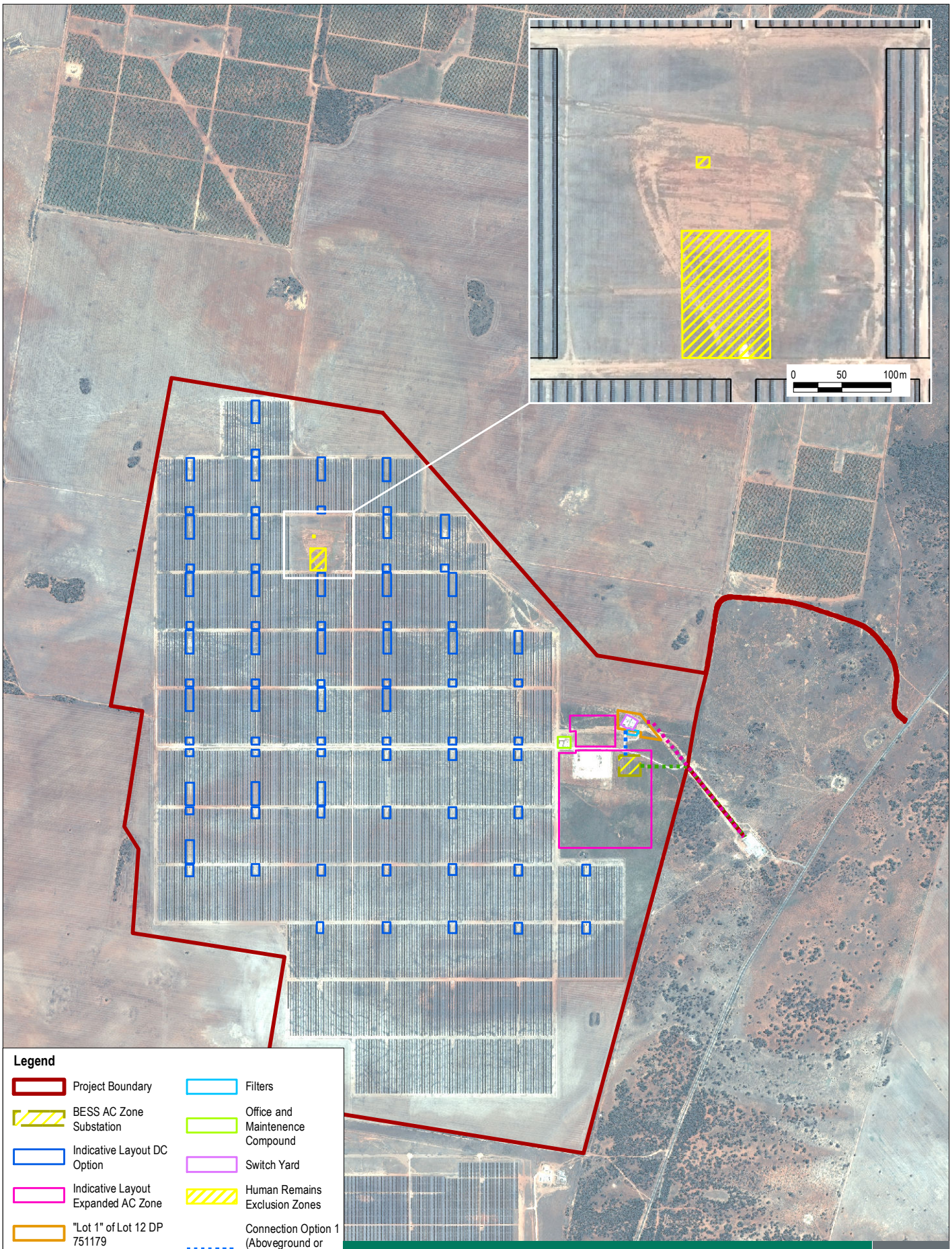
Coordinate System: GDA 1994 MGA Zone 54

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ERM


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Legend
Project Boundary
BESS AC Zone Substation
Indicative Layout DC Option
Indicative Layout Expanded AC Zone
"Lot 1" of Lot 12 DP 751179
Filters
Office and Maintenence Compound
Switch Yard
Human Remains Exclusion Zones
Connection Option 1 (Aboveground or Underground - AC Option Only)
Connection Option 2 (Underground - AC Option Only)
Original Approved Underground Connection
Data Sources:
Imagery : P1A Satellite Imagery (30 Jan 2021)
Layout : 29_06_2021_LIM- SITE Battery storage DC&AC_LAYOUT.dwg
Human Remains Exclusion Zones
6-4
Drawing No: 0591786m_LIMSFH_G002_R4.mxd
Limondale Solar Farm - BESS
Date: 04/03/2022
Drawing Size: A4
Drawn By: KV/CB
Reviewed By: AH
Client: RWE Renewables Australia
Coordinate System: GDA 1994 MGA Zone 54
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This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.
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6.3 Historic Heritage

6.3.1 Existing Environment

During preparation of the EIS, EMM completed a desktop assessment of the potential impact of the Project on historic heritage. The desktop assessment included a review of the existing environment, a literature review and a search of historic heritage registers. No heritage items were identified within the Project Area.

A subsequent cultural heritage survey completed as part of ACHAR (Biosis, 2017b) identified a series of weatherboard structures with corrugated iron roofing within the Project Area. The remains were identified to be deteriorating and generally in poor condition. These structures were assessed to not be impacted by the development and consequently their significance was not formally accessed as part of the EIS.

6.3.1.1 Updated Heritage Register Searches

An updated search of online heritage databases was undertaken on 31 May 2021. The following online databases were reviewed:

- Australian Heritage Database;
- NSW State Heritage Inventory (SHI);
- NSW State Heritage Register (SHR); and
- Schedule 5 of relevant Local Environmental Plans.

The updated search identified that there are three heritage items located within 14 km of the Project Area:

- Balranald Fire Station (Balranald LEP 2010 – I2), located approximately 14 km north of the Project Area;
- Fish traps (Balranald LEP 2010 – I3) located along the Murrumbidgee River, approximately 12.8 km north of the Project Area; and
- Dippo Ceremonial Ground (Balranald LEP 2010 – I4), also located along the Murrumbidgee River, approximately 13.4 km north of the Project Area.

No listed heritage items are located within the Project Area.

6.3.1.2 Existing Management of Identified Historic Heritage and Chance Finds

The EIS noted that a buffer zone of at least 20 m would be maintained around the historic site during the life of the Project, which was excised from the approved Project Area. As the historic site and buffer zone is outside of the approved Project Area the historic site would not be impacted by the proposed works associated with the Modification.

A HMP for the Limondale Solar Farm (SSD-8025-PA-28) was prepared in accordance with Schedule 3, Condition 20 of SSD 8025 and was approved by the Planning Secretary on 17 March 2021. The HMP provided a procedure to follow in the event of unexpected non-Aboriginal finds.

6.3.2 Assessment of Impact

The Modification (either AC-coupled or DC-coupled option) would not result in a change to the approved Project Area and subsequently the proposal would not result in an increased impact to the identified historic site.

6.3.3 Mitigation and Management Measures

The project HMP (Biosis, 2021) currently provides provision for the identified of unexpected historic heritage items. The Modification would proceed under the management measures of the existing HMP. The HMP is suitable for either AC-coupled or DC-coupled options. Further, the AC-coupled zone (discussed in **Chapter 1** of this report) has no effect on historic heritage impacts, or the necessary mitigation and management measures outlined in the HMP.

6.4 Traffic

6.4.1 Existing Environment

The Project is in close proximity to a major road network which readily enables the transport of infrastructure and equipment, as well as facilitating movement of the workforce to and from the Project.

The three roads that are primarily used by the Project are as follows:

- **Yanga Way (MR 694)**: a state funded main road, which connects between the Sturt Highway, 1 km south of Balranald and the Murray Valley Highway, and Mallee Highway within Victoria;
- **Sturt Highway**: a major NSW state highway, which connects from the Balranald area to Buronga/Mildura and the Silver City Highway in the west and travels through Hay and several other major townships in the east to Wagga Wagga; and
- **Stony Crossing Road**: a local road, which connects from Yanga Way, near Kyalite, approximately 20 km south of the Project Site, to Swan Hill in Victoria.

These roads, which constitute the Project's transport route/s are shown in **Figure 6-5** below.

Use of these transport routes was previously assessed in the EIS (EMM, 2017a), and approved under SSD 8025. No amendments to the transport routes was sought under SSD 8025 MOD 1 or is sought under this Modification.

Regarding the information presented above, and all traffic information presented herein, a vehicle movement has been classified as one vehicle entering and leaving the site (i.e., two vehicle movements).

6.4.1.1 Heavy Vehicle Restrictions

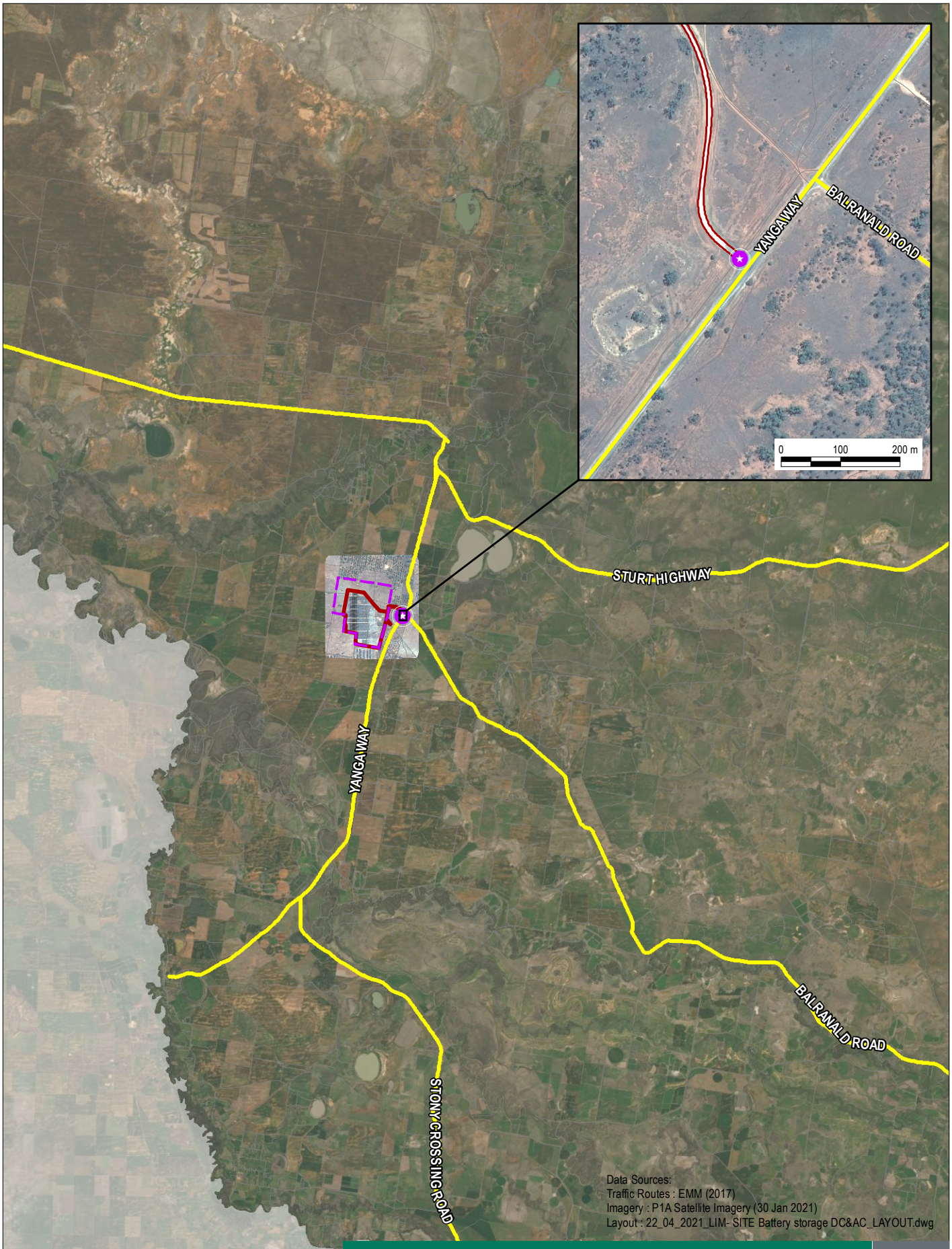
The number of heavy vehicle movements entering and leaving the Project Area is currently restricted by Condition 2, Schedule 3 of the development consent. It stipulates that on the public road network, the Project shall not generate more than 54 heavy vehicle movements a day during construction, upgrading or decommissioning; and 2 heavy vehicle movements a day during operations.

No amendments to the heavy vehicle restrictions is sought under this Modification.

The length of any vehicles used for the Project was originally restricted to ≤26 m by Condition 2, Schedule 3 of the development consent, unless the Secretary agreed otherwise. On 19 October 2018, the Secretary's nominee approved the Proponent's request to increase the length of heavy vehicles to be used during construction of the Project to 36.5 m. Prior to approval, consultation was carried out with relevant stakeholders, including TfNSW.

No amendments to the length of heavy vehicles is sought under this Modification.

Condition 3, Schedule 3 of the development consent stipulates that the Proponent must keep accurate records of the number of heavy vehicles entering or leaving the Project Site each day. During peak construction of the Project, the highest daily volume of heavy vehicle movements entering or leaving the Project was 18, in compliance with the development consent. More recently, in the month of June 2021, the highest daily volume of heavy vehicle movements was recorded as 2, reflective of how the Project is well progressed and near completion.



Legend

- Project Boundary
- Lot Boundary
- Traffic Route
- Road
- Site Access

Traffic Distribution, Site Access and Parking

6-5

Drawing No:	0591786m_LIMSFT_G001_R2.mxd		**Limondale Solar Farm - BESS**
Date:	04/03/2022	Drawing Size: A4	
Drawn By:	KV/CB	Reviewed By: NB	Client: RWE Renewables Australia

Coordinate System: GDA 1994 MGA Zone 54

0 2.5 5 km

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This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.

ERM

6.4.1.2 Site Access

Schedule 3, Condition 4 of the development consent requires that all vehicular traffic associated with the Project must travel to and from the Project via Yanga Way and the approved site entry point (site access) as shown above in **Figure 6-5**.

The approved site access was a new intersection along Yanga Way that was constructed prior to the commencement of construction of the Project, in accordance with Schedule 3, Condition 5 of the development consent.

The approved site access is located approximately 150 m south of the existing intersection of Yanga Way and Balranald Road, and includes:

- New Basic Right Turn (BAR) and Basic Left Turn (BAL) treatment to accommodate the largest vehicle accessing the intersection, in accordance with the Austroads Guide to Road Design (as amended by RMS supplements).
- Provision for 2-way vehicular movement between the approved site access' intersection with Yanga Way and the existing access track, which is sealed for 50 m from its intersection with Yanga Way.

Figure 6-6 below provides the engineering drawing of the approved site access intersection design. These upgrades have been constructed to the satisfaction of TfNSW as evident by the RMS letter dated 14 October 2019. The former site entry off Yanga Way has been reinstated to match the surrounding roadside landform, to the satisfaction of RMS and Council as evident by the aforementioned letter.

Figure 6-7 to **Figure 6-10** below depicts the approved site access to the Project. All vehicles are currently loaded and unloaded within the Project Area, and enter and leave the Project in a forward direction. Vehicles leaving the Project Area are in a clean condition and do not result in dirt being tracked onto the public road network. No amendments to site access is sought under this Modification.

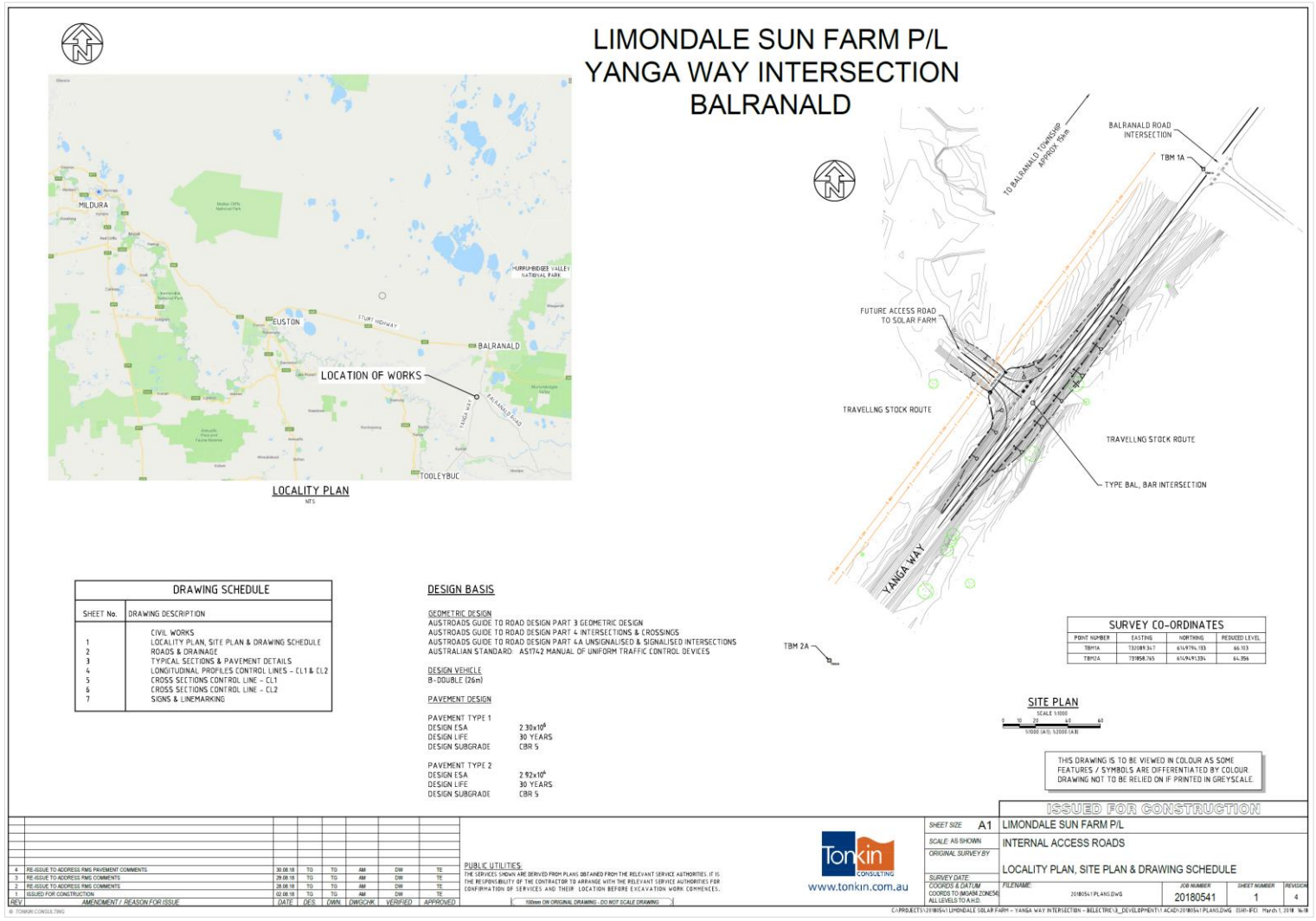


Figure 6-6 Site Access Intersection Design

Source: Tonkin Consulting (ref: 20180541 PLANS.DWG



Figure 6-7 Looking North along Yanga Way, adjacent to Approved Site Access



Figure 6-8 Opposite Approved Site Access on Yanga Way



Figure 6-9 Approved Site Access with 50 m seal



Figure 6-10 Aerial View of Approved Site Access (Google Earth)

6.4.1.3 Internal Access Tracks and Parking

Internal (unsealed) access tracks have been constructed for the Project to accommodate traffic movements throughout the Project Area, in accordance with Schedule 3, Condition 6 of the development consent. The internal access tracks are approximately 4 to 6 m wide, and have been constructed as all-weather tracks.

Parking has been provided within the management hubs as no parking on the public road network in the vicinity of the Project Area is permitted under the development consent. These parking arrangements have been deemed sufficient by LSF to accommodate the Project and the Modification cumulatively, therefore no amendments to internal access tracks and parking is sought under this Modification.

6.4.2 Assessment of Impacts

The Secretary's Assessment Report for the Project concluded:

"There would be minimal traffic to and from the solar farm during the operation of the development. Consequently, the only material traffic impacts would occur during construction, decommissioning and major infrastructure upgrades … Subject to the recommended conditions, the Department, RMS and Council are satisfied that the project would not result in significant impacts on road network capacity, efficiency or safety".

As discussed above, the recommended traffic conditions have been satisfied by LSF. Due to the scale of the Modification relative to the Project, it is deemed highly unlikely that the Modification will exceed the traffic impacts already assessed and approved, as further explored in the below sections.

6.4.2.1 Construction and Operational Workforce

During construction phase of the proposed Modification, it is anticipated that up to 40 personnel would be required at the Project Area per day (average shift of 8 hours per day, per person). Approximately 50 per cent of this workforce is planned to be local hire which would mitigate traffic impacts experienced on the broader road network. Comparatively, 250 personnel were required on site per day during peak Project construction associated with the broader solar farm.

As contained in Section 3.1.2 of the Accommodation and Employment Strategy, once operating, the Project is expected to require up to 20 employees on an ongoing basis to support the operation of the Project.

6.4.2.2 Workforce Origin

The existing Traffic Management Plan (TMP) for the Project remains current when considering the Modification. The majority of daily light vehicle workforce related traffic will travel from towns in the region, or from Mildura if flying into the region for work shifts. Estimated vehicle origins for light vehicles travelling to the Project Area on a daily basis and the likely route to the Project Area are detailed in **Table 6-2,** which has been extracted from the TMP.

Table 6-2 Origin of Workforce-related Light Vehicles

Origin (town)	Route to Project Site
Balranald	■ Sturt Highway travelling east; and ■ Yanga Way travelling south.
Euston	■ Sturt Highway travelling east; and ■ Yanga Way travelling south.
Tooleybuc	■ Yanga Way travelling north.
Hay	■ Sturt Highway travelling west; and ■ Yanga Way travelling south.
Swan Hill	■ Murray Valley Highway (Victoria) travelling north; and ■ Yanga Way travelling north. ■ Swan Hill Road travelling north; ■ Stony Crossing Road travelling north; and ■ Yanga Way travelling north.
Mildura (unlikely that many workers would make a daily commute from Mildura however fly-in-fly-out workers may use this route regularly)	■ Sturt Highway travelling east; and ■ Yanga Way travelling south.

6.4.2.3 Traffic Generation

Table 6-3 and **Table 6-4** below provide the indicative traffic generation for workforce traffic movements, and heavy vehicle traffic movements for the construction phase of the Modification. The Project and the Modification have been considered cumulatively for the operational phase.

The information below demonstrates that Modification will be well below the 54 daily heavy vehicle movement limit currently conditioned.

The inclusion of infrequent night works and ad-hoc emergency maintenance (as outlined in **Section 3.3**) is not expected to noticeably increase traffic generation associated with the operation of the Project including the proposed Modification.

Table 6-3 Construction/Operation Phase Traffic Generation (AC-coupled)

Factor	Average Construction	Average Construction	Peak Construction	Peak Construction	Project Operations	Project Operations
	Daily Traffic	**Peak Hour Traffic**	**Daily Traffic**	**Peak Hour Traffic**	**Daily Traffic**	**Peak Hour Traffic**
Workforce (car) traffic movements	20	10	25	15	7	2
Delivery (truck) traffic movements	20	4	26	6	0 – 2	1
Total site traffic movements	40	14	51	21	7 – 10	3

Table 6-4 Construction/Operation Phase Traffic Generation (DC-coupled)

Factor	Average Construction	Average Construction	Peak Construction	Peak Construction	Project Operations	Project Operations
	Daily Traffic	Peak Hour Traffic	Daily Traffic	Peak Hour Traffic	Daily Traffic	Peak Hour Traffic
Workforce (car) traffic movements	20	10	25	15	7	2
Delivery (truck) traffic movements	14	2	21	4	0 – 2	1
Total site traffic movements	34	12	46	19	7 – 10	3

6.4.3 Mitigation and Management Measures

This section outlines the mitigation and management measures that should continue to apply for the Modification, either AC-coupled or DC-coupled options. It is noted that the AC-coupled zone (discussed in **Chapter 1** of this report) has no effect on traffic impacts, or the necessary mitigation and management measures outlined below.

6.4.3.1 Record of Heavy Vehicle Movements

Condition 3, Schedule 3 of the development consent stipulates that LSF must keep accurate records of the number of heavy vehicles entering or leaving the Project each day. LSF reaffirms its commitment to maintaining this information during construction of the Modification, and throughout the life of the Project.

6.4.3.2 Traffic Management Plan

A TMP was prepared and approved on 26 July 2018 to manage traffic impacts of the Project.

As contained in *Section 5.2* of the TMP, during construction, the TMP will be reviewed internally every six months to:

- Assess the continuing suitability of the TMP in relation to construction progress, changing conditions and information, and will include review of matters such as:
  - requirements to utilize heavy load vehicles exceeding the weights or dimensions for unrestricted road access, specified in the HVNL;
  - actual traffic volumes compared to predicted volumes in the TMP, and any required amendments to traffic control measures; and
  - interaction with the Sunraysia Solar Farm.
- Incorporate feedback from external stakeholders, including BSC, road authorities and the general community.

Subject to the approval of this Modification, and subsequent selection of a final design, LSF commits to an internal review of the TMP that would occur prior to the commencement of construction associated with the Modification. LSF reaffirms its commitment to review the TMP internally every six months.

Section 1.2.3 of the TMP outlines relevant standards, policies and guidelines relating to traffic which will continue to be applied for the construction of the Modification.

Where the review process identifies material changes to the TMP, relevant stakeholders (i.e., TfNSW, Council and Western Local Land Services) will be consulted with. Approval for the proposed changes would be sought from the relevant stakeholders, and the TMP resubmitted to DPE for approval where material changes are required.

6.5 Noise and Vibration

Potential for nuisance, or an unacceptable level of noise and/or vibration impact upon amenity, may arise from construction or operational activities associated with new or existing developments. This section addresses these potential issues and provides recommendations for noise and/or vibration mitigation and management measures (if required). These measures are based on the magnitude and extent of potential impacts and are designed to reduce noise and/or vibration levels as far as practicable to maintain an appropriate level of acoustic amenity at receptor locations.

This section is provided as an addendum to the '*Limondale Sun Farm EIS - Appendix G – Noise and Vibration Impact Assessment*' report, prepared for Overland Sun Farming Pty Ltd and dated 23 March 2017 (EMM, 2017b) and similarly concludes that due to the Project's considerable distance offset to nearby receptors, impacts during construction and operation are considered negligible.

The key noise issues potentially associated with the Modification relate to general construction plant, equipment and activities undertaken within and near to the Project Area. Potential noise issues associated with operation of the Project and Project-related road traffic noise emissions (on public roads) are also addressed here.

Vibration: based on the equipment and activities identified for the construction works and operation of the Project potential sources of vibration are very limited. This feature combined with the ≥100 m distance offset (vibration dissipates rapidly with distance) to the closest sensitive receptor or buildings identifies that vibration impacts will be appropriately mitigated. These findings are consistent with the EIS.

Sleep Disturbance: the report also considered potential sleep disturbance impacts associated with impulsive or transient noise events. The Project does not include any features that could generate such impulsive or transient noise events, and as such any impacts avoided. These findings are consistent with the EIS.

Given the limited potential for any **vibration** or **sleep disturbance** noise impacts to occur, no further requirements for mitigation and management measures are warranted or provided in this modification report. The focus of this section is therefore related to general construction and operational noise impacts herein.

6.5.1 Policy Setting

This noise and vibration assessment has been conducted with due regard to and in accordance with the following key policy and guidelines. Other local and international acoustics standards have been adopted where relevant to the assessment.

- NSW Environment Protection Authority (EPA) – NSW *Noise Policy for Industry* (NPI, 2017), October 2017;
- NSW Department of Environment and Climate Change – *NSW Interim Construction Noise Guideline* (ICNG, 2009), July 2009;
- NSW Department of Environment and Conservation – *Assessing Vibration: A Technical Guideline*, (the Technical Guideline, 2006), February 2006; and
- NSW Department of Environment, Climate Change and Water – *NSW Road Noise Policy* (RNP, 2011), March 2011.

In accordance with *Item 5* of the NSW EPA '*Implementation and transitional arrangements for the Noise Policy for Industry (2017)*' guidance (that relates to project modifications) the NPI (2017) has been adopted where relevant to the assessment of the Modification. By comparison to the EIS this has in summary included a review and revision of the adopted minimum daytime baseline noise level values and revision to corresponding noise limits. Although important to acknowledge this has had no effect to the most stringent night-time noise limits that are the same values as previously adopted in EIS. All assessment aspects of the NPI (2017) have been applied to operational noise emissions associated with the Project.

6.5.2 Existing Noise Environment

A key element in assessing noise impacts is an understanding of the existing ambient and background noise levels in the vicinity of the closest and/or potentially most affected noise sensitive receptors situated near a site. The noise environment in the vicinity of the Project is best described as 'rural' defined by the NPI (2017) as an area with an acoustical environment that is dominated by natural sounds, having little or no road traffic noise and generally characterised by low background noise levels.

A 'rural' area may be located in either a rural landscape, large lot residential, primary production, primary production small lots or environmental living zone, as shown on a council zoning map, pursuant to an LEP or other Environmental Planning Instrument.

The main sources of noise from the Project are due to construction activities and operation of the BESS. Existing noise sources within the study area (i.e., the general area beyond the Project Area and encompassing selected receptors) include rural farming activities and road traffic noise along Yanga Way and Balranald Road.

6.5.3 Sensitive Receptors

For the purpose of this assessment, sensitive receptors have been considered based on their distance from the Project boundary. Only residential receptors have been identified within the potential area of influence of this Project.

These receptors have been adopted from the initial assessment undertaken as part of the EIS. The number of residential receptors with various distances from the Project Boundary are presented in **Table 6-5** below. These receptors are also presented in **Figure 6-11** below.

Table 6-5 Distance Offset to Residential Receptors around the Project

	Distance from the Project Boundary (km)				
	<1	**1-2**	**2-3**	**3-5**	**≥6**
Number of Receptors	0	0	2	2	2

6.5.4 Estimated Background Noise Levels

In the absence of measured ambient and background noise level data for the site and surrounding area, the minimum NPI, 2017 values were adopted for the purpose of this assessment.

The Rating Background Noise Level (RBL) can be accurately established based on the review of aerial photography and knowledge of existing background noise levels of similar acoustical environments. Due to the rural setting of the Project, the existing noise environment of the surrounding area can be accurately described as having low background noise levels.

The adopted RBL for the daytime ($L_{90,\ 11\text{-hour}}$), evening ($L_{90,\ 4\text{-hour}}$) and night-time ($L_{90,\ 9\text{-hour}}$) are presented in Table 5 6 below.

Table 6-6 Rating Background Noise Levels (RBL)

Parameter	Day	Evening	Night
Rating Background Noise Level (L_{90})	35	30	30

Time of day is defined as follows:

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

6.5.5 Noise limits and Criteria

All project-specific construction Noise Management Levels (NML) and operational criteria have been established based on the background noise level presented in accordance with a) the ICNG, 2009 for construction, b) the NPI 2017 for operations, and c) the RNP 2011 for road traffic.

For the purposes of the construction and operational assessment, the $L_{Aeq,\ 15\text{-}minute}$ parameter has been adopted for all receptors assuming that emissions will generally occur throughout the total duration of any given assessment period. L_{Aeq} is an A-weighted noise level representing the equivalent or average noise energy during a measurement period. A-weighting is an adjustment made to sound-level measurement to approximate the response of the human ear.

The $L_{Aeq,\ 15\text{-}minute}$ noise descriptor simply refers to the L_{Aeq} noise level calculated over a 15-minute period. For road traffic noise, the L_{Aeq} parameter also applies with assessment periods of one hour, nine hours or 15 hours depending on the type of road and time of day.

6.5.6 Construction Noise

The ICNG, 2009 defines the following standard hours for construction activities where noise is audible at residential premises:

- Monday to Friday, 7 am to 6 pm;
- Saturday, 8 am to 1 pm; and
- No construction work is to take place on Sundays or public holidays.

All construction works associated with the Modification would occur during the approved extended hours for construction, which are as follows:

- Monday to Friday, 6 am to 6 pm; and
- Saturdays 6 am to 6 pm.

The approved extension to standard construction hours also allowed for works on Sundays and public holidays. The DPE approval letter dated 19 October 2018 does not specify time periods for works on Sundays and public holidays, however the 6 am to 6 pm time period was requested when the approval was sought and the Modification works may occur on these days between 6 am and 6 pm, should they be required.

Hence, the ICNG, 2009 NMLs for residential premises for both standard and outside of standard hours of construction apply. The noise management levels recommended for residential premises are based on the RBLs identified in **Table 6-6** above.

During construction, the Highly Noise-affected Management Level (HNML) also applies to residential receptors during standard daytime hours and is a fixed value of 75 dBA. Construction NMLs are presented in **Table 6-7** below.

Table 6-7 Construction Noise Management Levels (NML)

Receptor Type	Daytime (Standard Hours)	Out-of-Hours		
		Day	Evening	Night
	LAeq, 15 minute	LAeq, 15 minute	LAeq, 15 minute	LAeq, 15 minute
Residential	45	40	35	35

Time of day is defined as follows:

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

6.5.7 Operational Noise

All project-specific operational noise criteria are presented in **Table 6-8**. These values have been determined with due regard to the NPI, 2017 utilising the RBLs identified above.

Table 6-8 Operational Noise Criteria

Receptor Type	Day	Evening	Night
	LAeq, 15 minute	LAeq, 15 minute	LAeq, 15 minute
Residential	40	35	35

Time of day is defined as follows:

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

6.5.8 Road Traffic Noise

For road traffic noise the criteria values have been determined with due regard to the RNP. In accordance with the RNP, criteria values for residential receptors are fixed levels to maintain an appropriate level of acoustic amenity. They are not derived from measured ambient and background noise levels. Road traffic noise criteria are presented in **Table 6-9**.

Table 6-9 Road Traffic Noise Criteria

Road Category	Assessment Criteria - dBA	
	Day (7 am - 10 pm)	Night (10 pm - 7 am)
Freeway / Arterial / sub-arterial roads[1]	60 $L_{Aeq, 15\ hour}$ (external)	55 $L_{Aeq, 9\ hour}$ (external)
Local roads[2]	55 $L_{Aeq, 1\ hour}$ (external)	50 $L_{Aeq, 1\ hour}$ (external)

1. *Existing residences affected by additional traffic on existing freeways/arterial/sub-arterial roads generated by land use developments.*
2. *Existing residences affected by additional traffic on existing local roads generated by land use developments*.

Where existing traffic noise levels are above the noise assessment criteria, the primary objective is to reduce these through feasible and reasonable measures to meet the assessment criteria.

A secondary objective is to minimise adverse amenity impact as a result of the Project by applying the relative increase criteria.

In assessing feasible and reasonable mitigation measures, an increase of up to 2 dBA represents a minor impact that is considered barely perceptible to the average person.

6.5.9 Assessment Methodology

To assess noise impacts from construction and operations, modelling has been undertaken utilising the Brüel and Kjær's Predictor 7810 (Version 2020) noise modelling software package. Noise levels were calculated using ISO 9613:2, 1996 noise propagation algorithms (international method for general purpose).

Due to the undeveloped nature of the surrounding land, a ground factor absorption coefficient of 0.75 was used in all modelling scenarios. Meteorological conditions for the model have been adopted as initially assessed in the NVIA undertaken for the EIS and based on annual weather data publically available from the Bureau of Meteorology (BOM) Weather Station situated at Swan Hill Aerodrome (AWS 077094). This includes the following:

- **Standard meteorological conditions:** daytime, evening and night Pasquill–Gifford stability Category D conditions and calm winds, temperature of 20 °C and humidity of 70%.
- **Worst-case Noise-enhancing meteorological conditions**: Pasquill–Gifford stability Category F (temperature inversion) condition, light source-to-receiver winds (2 m/s), temperature of 9 °C and humidity of 70%.

Construction noise modelling has adopted standard conditions only (representing conditions commonly experienced during the daytime period, when works would mostly occur) and calm winds for all scenarios.

Modifying factors (penalties) for annoying noise characteristics such as tonality and low frequency components etc. were considered as per the requirements of NPI. Based on the noise source data presented in this assessment and model outputs, penalties were not applied to the results in this assessment.

6.5.10 Noise Impact Assessment

6.5.10.1 Construction Noise

Construction activities will generally involve site preparation and establishment, concreting and foundations, and installation of the BESS. A summary of each construction scenario, including the anticipated equipment and duty factor (i.e., percentage operation within the assessment period) are presented in **Table 6-10**. The placement of this equipment within the model was optimised to ensure worst-case noise levels were predicted and assessed, in either the AC-coupled or DC-coupled options. As no detailed information is currently available regarding construction methods, these details will be the same between the Li-ion and Iron-Flow BESS options for the AC layout.

Table 6-10 Construction Phase Equipment

Description	Scenario ID	Equipment	Quantity	Duty Factor	Sound Power Level (L_W) per unit (dBA)[1]
Site Preparation and Establishment	CON01	Excavator	1	75%	104
		Dozer	1	50%	110
		Light vehicle	2	50%	76
		Front End Loader	1	50%	105
		Road truck (deliveries)	1	50%	103
		Dump truck	2	50%	108
		Grader	1	75%	108
		Roller	1	75%	116
		Compactor	1	50%	112
		Crane	1	75%	106
		Forklift	1	50%	106
		Water truck	1	50%	96
		Generator	2	50%	98
Concreting and Foundations	CON02	Road truck (deliveries)	1	50%	103
		Crane	1	75%	106
		Excavator	1	75%	104
		Concrete truck	1	75%	113
		Light vehicle	2	50%	76
BESS Installation	CON03	Powered hand tools	1	75%	97
		Compressor	1	75%	108
		Generator	1	50%	98
		Crane	1	50%	106
		Road truck (deliveries)	1	50%	103
		Light vehicle	2	50%	76

1. *All sound power levels (LW) (i.e., source noise emission values) are expressed in decibels (dB, re: 10^{-12} Watts, W) with the "A-weighting" curve applied.*

Based on the construction assessment scenarios and associated data presented in above, $L_{eq,15\text{-minute}}$ noise levels (in dBA) have been predicted.

The resultant values for the worst-case construction scenario (either AC-coupled or DC-coupled options) are presented in **Table 6-11** below.

Table 6-11 Construction Phase Noise Levels

Design Option	Receptor	Predicted Noise Levels, $L_{Aeq,\ 15\ min}$ in (dBA)[1]		
		CON01	CON02	CON03
AC-coupled	R01	19	15	15
	R02	12	9	9
	R03	12	8	9
	R04	19	15	15

Design Option	Receptor	Predicted Noise Levels, $L_{Aeq, 15\ min}$ in (dBA)[1]		
		CON01	CON02	CON03
	R05	16	12	12
	R06	12	9	10
DC-coupled	R01	19	15	14
	R02	11	8	8
	R03	10	7	8
	R04	16	13	13
	R05	18	14	14
	R06	13	10	10

1. All predicted sound pressure levels are expressed in decibels (dB, re: 2 x 10^{-5} Pascals, Pa) with the "A-weighting" curve applied.

Discussion: some noise from construction sites is inevitable, however given the large distance offset between the Project and noise receptors it is predicted that the NMLs for construction are not likely to be exceeded when measured at potentially affected sensitive receptors.

Good-practice construction noise mitigation and management measures should continue to be implemented on site, consistent with those already implemented for the construction of the solar farm approved under SSD 8025 and SSD 8025 MOD 1. Good-practice mitigation and management measures should continue to apply for the Modification, for either AC-coupled or DC-coupled options. It is noted that the AC-coupled zone (discussed in **Chapter 1** of this report) has no effect on noise impacts, or the necessary mitigation and management measures outlined here.

To avoid any misunderstanding, and as the predicted noise levels for construction are substantially below the Project NMLs, no further recommendations for construction noise mitigation and management measures are warranted or provided in this assessment.

6.5.10.2 Operational Noise

A quantitative assessment of potential impacts associated with the operation of either Li-ion BESS or Iron-Flow BESS options has been undertaken. As discussed below the targeted BESS predictions have been combined with the EIS noise level predictions to assess overall emissions and compliance associated with the solar farm, and Modification. The options currently under consideration for the BESS are summarised below:

- **Li-ion AC-coupled Option**: this will include noise emissions from BESS HVAC systems, BESS transformers and BESS inverters. All equipment is located in a centralised area in the east of the Project Area. The placement of equipment within the model was optimised to ensure worst-case noise levels were predicted and assessed for the AC-coupled zone, previously discussed in **Chapter 1** of this report.
- **Li-ion DC-coupled Option**: this will include noise emissions from BESS HVAC systems and DC-DC converters only. The BESS units and converters are distributed across the Project near the solar panel arrays.
- **Iron-Flow AC-coupled Option**: this will include noise emissions from an electrical substation as per the Li-ion AC-coupled option, in addition to noise emissions from a network of pumps attached to battery storage tanks located to the south of the substation. In addition to the pumps a series of power trains will also be attached to the storage tanks. The power trains are fully enclosed within solid sheds, except for air vents used for passive cooling. As they are fully enclosed they have been assumed to be a negligible contributor to noise.

It is noted that due to the very large distance offsets to receptors (≥ 2.9 km), the actual position of either AC-coupled system within the identified zone has little or no effect on the modelling or assessment outcomes. Regardless, a worst-case situation was modelled as described above.

As a worst-case scenario, the HVAC system has been assumed to operate in heating mode 100% of the time. A summary of each operational noise emission source, including the anticipated equipment quantity for each layout option is presented in **Table 6-12**.

Table 6-12 Operational Phase Equipment (per BESS unit)

Description	Quantity Li-ion AC Option	Quantity Li-ion DC Option	Quantity Iron-Flow AC Option	Duty Factor (%)	Sound Power Level (L_w) per unit (dBA)[1]
HVAC Heating (worst-case noise emission)	160	141	160	100	74.3
Inverter	45	0	45	100	74.9
DC-DC Converter	0	423	0	100	93.0
Transformer	45	0	45	100	30.6
Storage Pump	0	0	720	100	77.5[2]

Note:

1. *Manufacturers supplied data was adopted in all cases.*
2. *Sound power level has been determined from manufacturer sound pressure level of 60 dB at 3 metres*

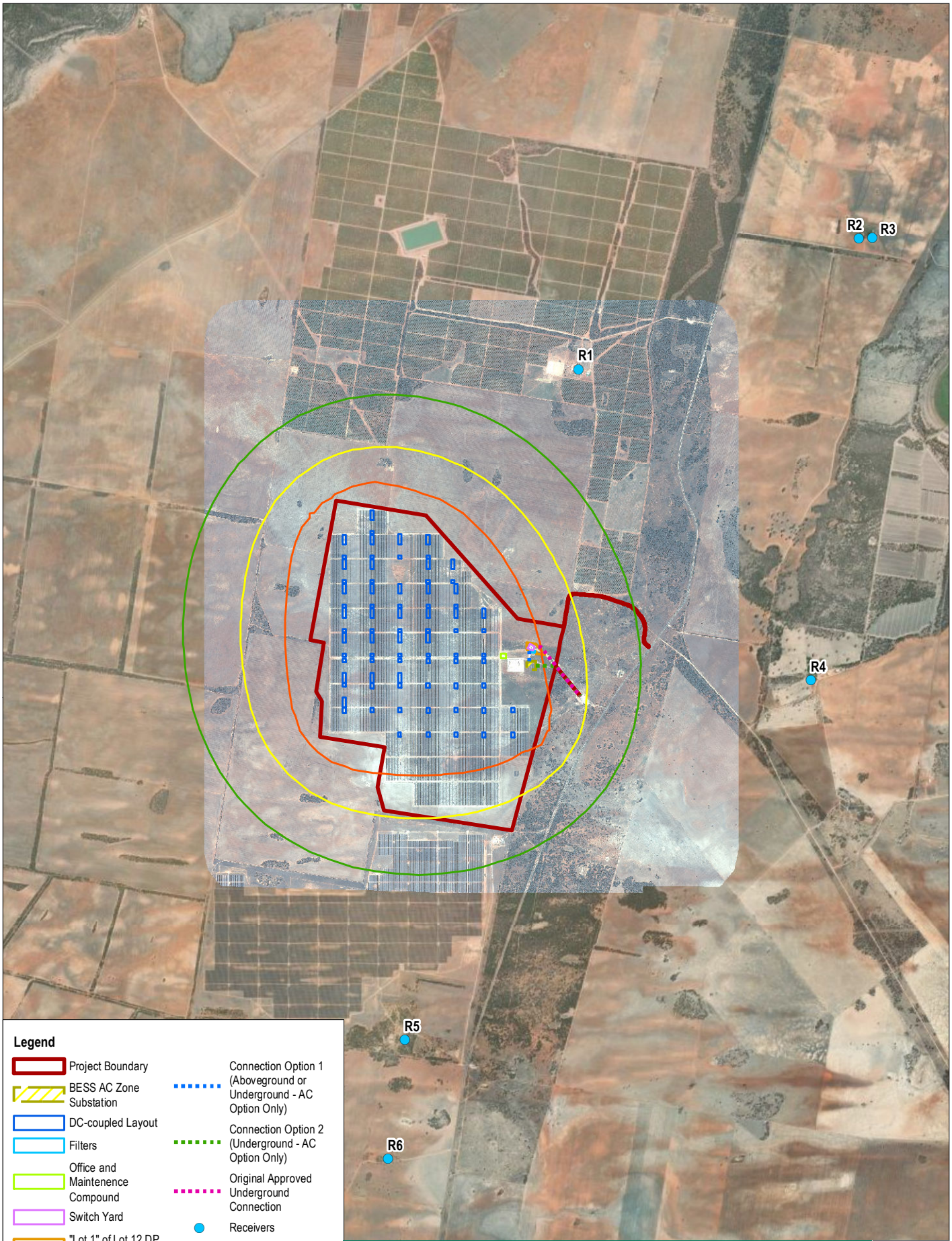
Based on the operational equipment and associated data presented in above, $L_{eq,15\text{-}minute}$ noise levels (in dBA) have been predicted. The predicted noise levels ($L_{eq,15\text{-}minute}$ in dBA) for each receptor and layout option are presented in **Table 6-13** below.

The worst-case scenario is the DC-coupled option, and as such, noise contours for this scenario are presented in **Figure 6-11**.

Table 6-13 Predicted Operational Noise levels

Design Option	Receptor	Predicted Noise Levels, $L_{Aeq,\ 15\ min}$ in (dBA)[1]	
		Standard Meteorological Conditions	Noise Enhancing Meteorological Conditions
AC Layout	R01	<5	<5
	R02	<5	<5
	R03	<5	<5
	R04	<5	5
	R05	<5	<5
	R06	<5	<5
DC Layout	R01	22	24
	R02	11	11
	R03	11	10
	R04	18	19
	R05	18	20
	R06	14	14
Iron-Flow AC Layout	R01	<5	6
	R02	<5	<5
	R03	<5	<5
	R04	<5	7
	R05	<5	<5
	R06	<5	<5

Note: All predicted sound pressure levels are expressed in decibels (dB, re: 2 x 10^{-5} Pascals, Pa) with the "A-weighting" curve applied.



Legend

- Project Boundary
- BESS AC Zone Substation
- DC-coupled Layout
- Filters
- Office and Maintenence Compound
- Switch Yard
- "Lot 1" of Lot 12 DP 751179
- Connection Option 1 (Aboveground or Underground - AC Option Only)
- Connection Option 2 (Underground - AC Option Only)
- Original Approved Underground Connection
- Receivers

Noise Level

- 30
- 35
- 40

Data Sources:
Imagery : P1A Satellite Imagery (30 Jan 2021)
Layout : 29_06_2021_LIM-SITE Battery storage DC&AC_LAYOUT.dwg

Worst-case Operational Noise Contours

6-11

Drawing No:	0591786m_LIMSFN_G001_R6.mxd		**Limondale Solar Farm - BESS**
Date:	04/03/2022	Drawing Size: A4	
Drawn By:	KV/CB	Reviewed By:CGW	Client: RWE Renewables Australia

Coordinate System: GDA 1994 MGA Zone 54

0 500 1,000m

N

This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.

ERM

Discussion: the predicted $L_{eq,15\text{-minute}}$ noise levels identified above are substantially below the most stringent noise criteria and indicate that all BESS options are compliant with the most stringent night-time criteria of 35 dBA.

As outlined in the EIS noise assessment, the nearest receptor is located approximately 2.9 km from the site, and noise levels from the broader solar farm operation were predicted to be '*well below 30 dBA*' during the worst-case assessable meteorological conditions.

Based on a conservative logarithmic addition of potential operational noise from the solar farm (i.e., 30 dBA) and the highest predicted operational noise level of the BESS (i.e., 24 dBA), predicted noise levels for the concurrent operation of the solar farm and the BESS result in a total noise level of 31 dBA at the closest and most affected receptor.

This is a conservative assessment as it assumes a solar farm noise level of 30 dBA despite the EIS '*well below 30 dBA*' statement. Regardless, Project noise levels including the Modification are still below the most stringent night-time criteria of 35 dBA.

Operational emissions are therefore compliant with the NPI, 2017 requirements. As such, no recommendations for operational noise mitigation and management measures are warranted or provided in this assessment. This applies to all Li-ion or Iron-Flow BESS operations.

6.5.10.3 New Substation within AC BESS Zone (MOD2)

If a centralised AC BESS design is selected as the most appropriate option during detailed Project design, a third connection option may be required, which may involve the development of a new substation within the AC-coupled BESS 'Zone', as previously shown in in **Figure 3-4**. The new substation would then connect via underground high voltage cables to either "proposed Lot 1" in subdivision of Lot 12 DP 751179, or directly to the Balranald Substation (or a future connection option, if required).

The exact layout and precise location of the substation is not finalised yet, however, noise limits to the substation were modelled to provide guidance during the detailed design phase and equipment selection phase.

Conservative noise predictions were modelled for the new substation. The predicted noise limit of the substation is a sound pressure level (SPL) of 111 dBA measured at one metre from the noise source. Typically, substation transformer SPLs are in the range 75-95 dBA. The predicted noise limit of the potential new substation includes penalties for identified noise characteristics such as low frequency, tonality and impulsiveness in accordance with the NSW NPI. By meeting this limit, the most stringent criteria of 35 dBA will be met at the closest receptor.

By meeting the criteria at the closest receptor, compliance will be achieved at receptors located further away due to distance noise attenuation.

6.5.11 Road Traffic Noise

Road traffic noise was initially assessed in the NVIA undertaken for the EIS and concluded that traffic generated by the Project was not expected to result in any noticeable increase in average road traffic noise levels at the nearest residential receptors.

The construction and operation of the BESS is not anticipated to change this outcome as the daily vehicle movements associated with the Project (i.e., total vehicle movements from the solar farm and the BESS) are not anticipated to significantly increase.

As such, no recommendations for construction or operational road traffic noise mitigation and management measures are warranted or provided in this assessment.

Notwithstanding, the traffic related mitigation and management measures outlined in **Section 6.4.3** of this modification report should continue to apply for the Modification, either AC-coupled or DC-coupled options. Those measures will assist to ensure that potential for any noise impacts would be mitigated. It is noted that the AC-coupled zone (discussed in **Chapter 1** of this report) has no effect on traffic noise impacts, or the necessary mitigation and management measures outlined in **Section 6.4.3**.

6.5.12 Cumulative Noise

Cumulative noise was initially addressed in the NVIA undertaken for the EIS and concluded that cumulative noise impacts were unlikely given that construction, operational and road traffic noise generated by the Project were well below the applicable NMLs and criteria.

Given that predicted noise levels for the construction and operation of the Limondale Solar Farm and BESS are also well below the applicable NMLs and criteria, cumulative noise impacts are not anticipated for the Project. This statement is consistent for either Lithium-Ion or Flow BESS options.

6.5.13 Mitigation and Management Measures

As noted in the noise assessment above, the potential for construction and operational impacts (incl. road traffic) is minimal with the introduction of the Modification. Accordingly, any impacts will be maintained as negligible. As noted in the construction noise assessment discussion, good-practice mitigation and management measures should continue to apply for the Modification. Beyond this, no further recommendations for construction and operational mitigation and management measures are warranted or provided in this assessment.

6.6 Visual

A visual impact assessment was undertaken to support the EIS, as documented in the '*Limondale Sun Farm EIS - Appendix F – Visual Impact Assessment'* report, prepared for Overland Sun Farming Pty Ltd and dated 7 April 2017. A review of the existing assessment in the context of the Modification has subsequently been undertaken in the form of a qualitative visual assessment, prepared and documented below as an addendum to the original visual assessment.

6.6.1 Previous 'Visual Impact Assessment' Summary

The visual impact assessment was completed for the Project to assess impacts from eight representative viewpoints surrounding the site. The viewpoints were selected to represent views close to private residential properties and road corridors (i.e., Yanga Way and Windomal Road) nearest to the Project's development footprint. The viewpoint locations have been replicated from the visual impact assessment as **Figure 6-12** below.

It included an assessment of potential landscape and visual impacts resulting from the Project, applying the assessment techniques set out in the *Guidelines for Landscape and Visual Impact Assessment* (Landscape Institute, 2013) and the former NSW Department of Planning and Environment *Wind Energy: Visual Assessment Bulletin for State Significant Wind Energy Development* ('the Bulletin') (DPE, 2016).

The methodology included a review of the proposal, identification of landscape qualities, the visual catchment and sensitive receivers. This information was then used to identify the potential for impacts and associated mitigation measures, where necessary.

The visual assessment determined that, of the viewpoints assessed, infrastructure may be visible from viewpoints 4, 5, 6 and 8. However, based on the presence of vegetation and topography, combined with the relatively low height of the Project's infrastructure and overall distance, visual impacts would be minimal.

The authors of this report acknowledge that the EIS assessment was conducted on the basis of a 2 m solar panel height, which was modified to 4 m under the SSD MOD 1 approval. This feature is considered and addressed in the addendum assessment provided in the sections below. We also note that the site inspection (described below) occurred following the construction of the solar arrays (4 m height) and other on-site infrastructure e.g., Operations and Maintenance building.

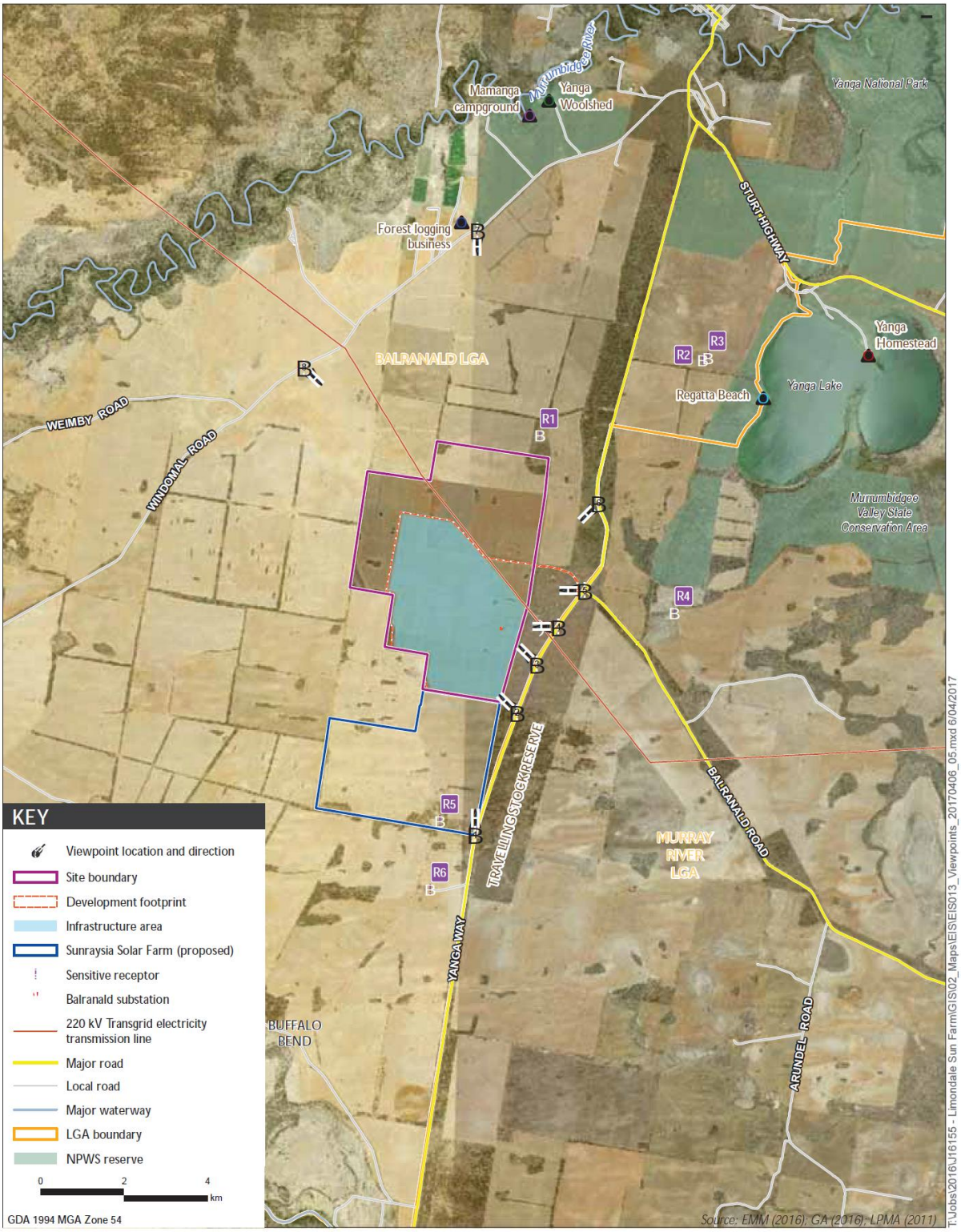


Figure 6-12 Viewpoint Locations

Source: Limondale Sun Farm EIS – Appendix F – Visual Impact Assessment

6.6.2 Qualitative Assessment of Visual Impacts

A qualitative visual assessment has been undertaken for the proposed Modification utilising the same eight viewpoints selected in the previous assessment. A site inspection was undertaken on 4 June 2021 and photographs were taken from a number of the representative viewpoint locations, to understand the potential impact the inclusion of the BESS (AC-coupled and DC-coupled options) would have on existing viewpoints. The photographs of each viewpoint utilised for this qualitative assessment are provided below.

Viewpoint 1 – Yanga Way – South of the Project Area near Sunraysia Solar Farm (Site Inspection, 2021)



Viewpoint 2 – Yanga Way looking towards south-eastern corner of the Project Area (Site Inspection, 2021)



Viewpoint 3 – Yanga Way - South of Balranald Substation, facing north-west towards the Project Area (Site Inspection, 2021)



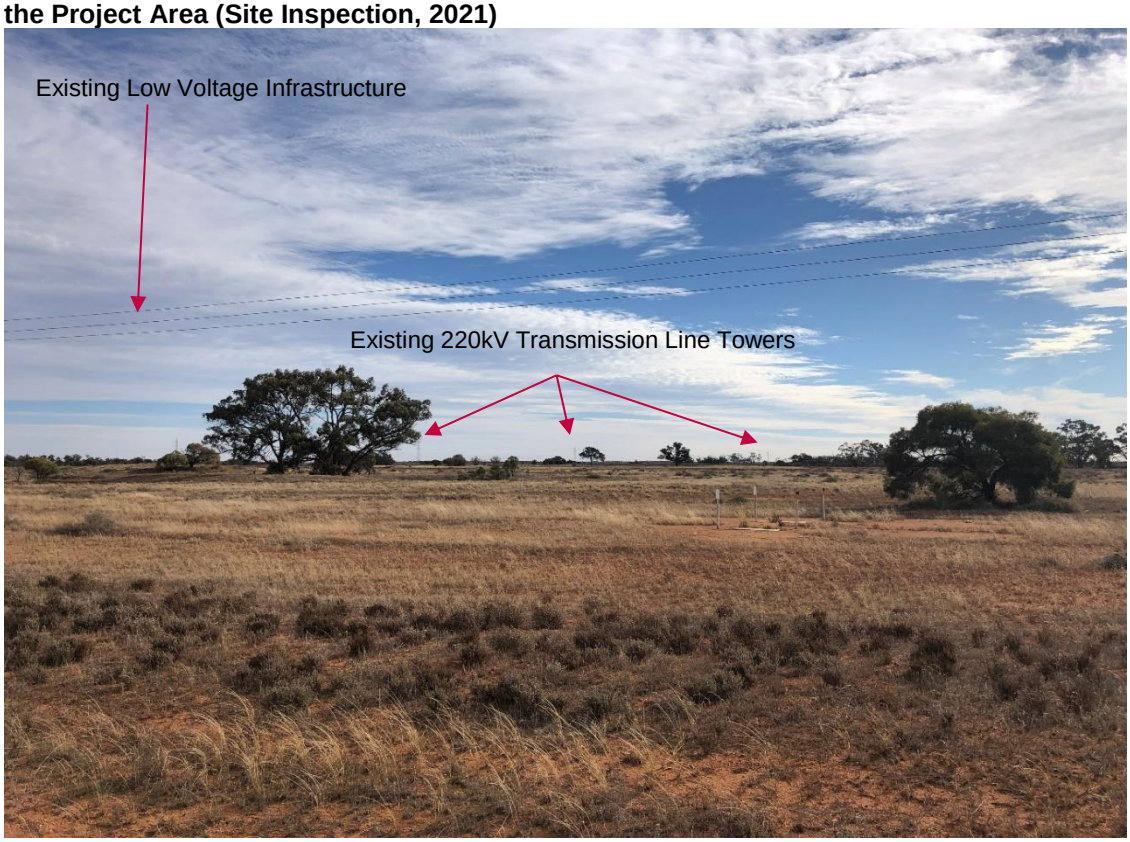
Viewpoint 4a – Yanga Way – North of Balranald Substation, facing west towards Project Area (Site Inspection, 2021)



Viewpoint 4b - North of Balranald Substation, facing west towards Project Area (Site Inspection, 2021)



Viewpoint 5a – Just south of the Yanga Way/Balranald Road intersection, facing west towards the Project Area (Site Inspection, 2021)



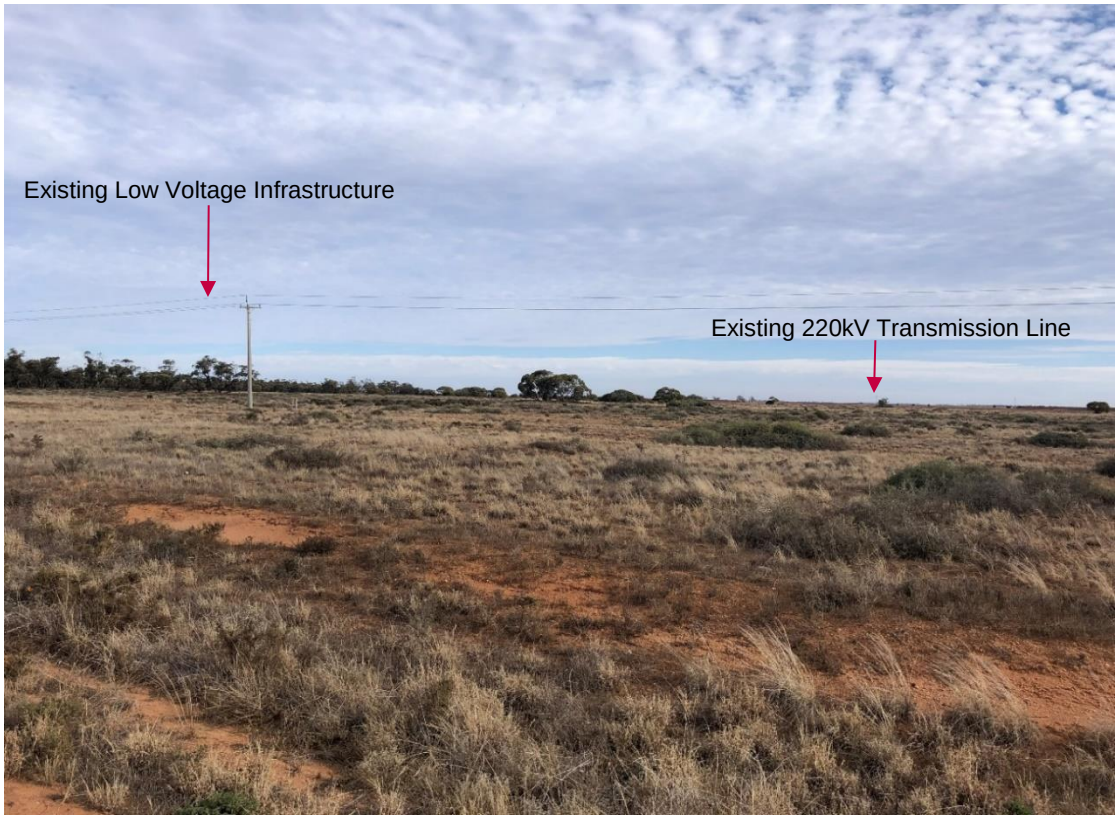
Viewpoint 5b – Representative view of a motorist approaching the intersection of Yanga Way and Balranald Road, looking south-west (Site Inspection, 2021)



Viewpoint 5c – Representative view of a motorist entering Yanga Way after turning left out of Balranald Road, looking south (Site Inspection, 2021)



Viewpoint 6 – Yanga Way, north of the Project access point, facing south-west towards the Project Area (Site Inspection, 2021)



Viewpoint 7 – Windomal Road – North of the existing transmission line, facing south towards the Project Area (Site Inspection, 2021)



Viewpoint 8 – Windomal Road – South of the existing transmission line, facing south-east towards the Project Area (Site Inspection, 2021)



6.6.2.1 Potential Visual Impacts

As observed during the site inspection and as is evident in the photographs provided above, the as-built solar farm (with 4 m panel height solar arrays) was not visible from any of the identified viewpoints.

The Li-ion BESS containers selected for installation as part of the Modification are approximately 2.9 m in height, one metre lower than the solar arrays and a similar height to other associated infrastructure (e.g., buildings etc.). The height of the Flow BESS enclosures is approximately 15 ft (~4.5 m) high on the eave and approximately 19 ft (~6 m) high on the peak, which exceeds the current height of existing solar arrays and associated infrastructure. The height of the BESS containers may increase subject to container selection or with the addition of cooling apparatuses (i.e., HVAC) to protect the BESS containers. Detailed design will establish final BESS container/enclosure heights but they are unlikely to result in a structure far exceeding the heights described above.

The storage tanks proposed as a component of the Flow BESS are approximately 25 ft high (~7.6 m), which would exceed the height of the existing structures at the as-built solar farm. As such, it is expected that the storage tanks may be partially visible from nearby viewpoints, but are unlikely to substantially impact the visual landscape, given the distance from the viewpoints to the Project Area.

The colour (and any external design) of the BESS containers and storage tanks are currently being reviewed but LSF confirmed the selected colours/design would be compatible with the existing solar array infrastructure. As a result, the magnitude of visual effect (i.e., the size, scale and overall extent of change) as a result of the Modification is considered minimal.

Consultation with LSF occurred during the preparation of this addendum visual impact assessment, regarding the likely transmission line differences between the Li-ion BESS (AC-coupled or DC-coupled), or AC-coupled Flow BESS options. LSF confirmed that there will be no visual difference between the design options, as the majority of cabling will occur underground and the connection to the on-site substation / switchyard will be similar, regardless of what option is selected. This statement is consistent regardless of the position of the AC-coupled Li-ion or Flow BESS within the AC-coupled zone, discussed in **Chapter 1** of this report.

The distance from the Project Area to the selected viewpoints, coupled with the presence of screening vegetation at certain viewpoints would result in minimal visual effect from the Project. This is unlikely to change with the inclusion of the Li-ion BESS (AC-coupled or DC-coupled), or AC-coupled Flow BESS options. Furthermore, the AC-coupled zone (discussed in **Chapter 1** of this report) has no effect on visual impacts, or the limited mitigation and management measures outlined below.

As a result, the Modification i.e., the proposed inclusion of any BESS option and associated infrastructure, is unlikely to impact upon the visual landscape of the Project Area. Visual impacts

6.6.3 Mitigation and Management Measures

Additional management and mitigation measures are not required beyond those identified in the EIS that was prepared in support of SSD 8025 and SSD 8025 MOD 1, as the inclusion of BESS (either AC-coupled or DC-coupled options) is highly unlikely to impact upon the visual landscape of the wider area beyond the Project Boundary. It is noted that the AC-coupled zone (discussed in **Chapter 1** of this report) has no effect on visual impacts, or the limited mitigation and management measures discussed here.

6.7 Hydrology

An assessment of the potential impacts of the Project on flooding, groundwater and surface water resources was completed as part of the EIS. In addition, a Soil and Water Management Plan (SWMP) has been prepared for the Project to satisfy Schedule 3, Condition 22 and Condition 23 of SSD 8025, in line with commitments stated in the EIS. A review of the existing assessment in the context of the Modification has subsequently been undertaken to consider hydrological impacts that may arise from the BESS installation, and to identify whether additional management and mitigation measures are warranted.

6.7.1 Previous Hydrological Assessment

The EIS water assessment was prepared in accordance with the SEARs issued for the original project, which included a review of relevant publicly available information, and consultation with the landholder, affected landowners and local community.

The results of the assessment indicated that the infrastructure to be established within the Project Area and development footprint is unlikely to have a significant impact on local or regional flooding, as it will not require significant earthworks or changes to the general topography of the site.

Negligible impacts on surface water and groundwater were also expected, given the sufficient distances to surface water resources and limited amount of subsurface disturbance activities required during installation and decommissioning of Project infrastructure.

6.7.2 Potential Hydrological Impacts

Stormwater runoff from the proposed BESS modules would fall onto the ground, with the majority of runoff being absorbed into the surface soils, similar to the hydrological environment expected for the existing solar arrays and wider Project Area.

Construction of raised footing pads for the BESS containers would be required for either the AC-coupled or DC-coupled options proposed under the Modification and would constructed wholly within the existing approved Project Area. For the DC-coupled option, the BESS containers would be situated next to PV inverter stations throughout the solar arrays. It is considered that the small scale of the proposed BESS modules in the context of the overall Project Area, and their consolidation with the solar arrays, would result in a negligible change in volume of stormwater runoff within the Project Area.

The inclusion of the centralised AC-coupled BESS option would involve a singular raised pad located within the AC-coupled zone, proposed near to the approved construction site facility and storage area, that is adjacent to the solar farm access location. It is expected that any runoff would occur at the edges of the raised pad, and be absorbed into the subsurface soils, resulting in minimal changes in stormwater runoff within the Project Area. This statement is consistent regardless of the position of the AC-coupled BESS system within the AC-coupled zone discussed in **Chapter 1** of this report.

6.7.2.1 Flood Risk

The results of the EIS water assessment indicated that the site is not subject to inundation from a 100-year average recurrence interval flood event, and that the site is located outside of the inundation extent for the Lower Murrumbidgee Floodplain.

Minimal earthworks and alterations to the existing topography are required for the inclusion of either AC-coupled or DC-coupled BESS option, which will mean that existing flood water flow paths are maintained. As such, the addition of the AC-coupled or DC-coupled option are unlikely to impact on local or regional flooding. This statement is consistent regardless of the position of the AC-coupled BESS system within the AC-coupled zone discussed in **Chapter 1** of this report.

6.7.2.2 Surface Water and Groundwater Impacts

The results of the EIS water assessment indicated that impacts to surface water and groundwater are unlikely to occur. Nearby surface water resources, like the Murrumbidgee River and Wakool River, are still located at far enough distances to avoid impacts that could occur from the Modification, which remains wholly within the Project Area. Additionally, minimal alterations are required to the existing subsurface to accommodate either AC-coupled or DC-coupled BESS option. Combined with the previously estimated depth of the groundwater, impacts to groundwater would also be considered unlikely. This statement is consistent regardless of the position of the AC-coupled BESS system within the AC-coupled zone discussed in **Chapter 1** of this report.

6.7.3 Mitigation and Management Measures

The inclusion of BESS infrastructure should be positioned to minimise the potential obstruction of surface water flows and stormwater runoff, in line with the commitments stated in the EIS water assessment.

Additional management and mitigation measures are not required beyond those identified in the EIS water assessment prepared to support the development consent, and the Soil and Water Management Plan (SWMP) prepared for the Project. The SWMP provides guidance to site personnel regarding the implementation of the erosion and sediment control and water management measures required during the construction and operations phases of the Project.

The key objective of the SWMP is to ensure that impacts to soil integrity and water quality during the construction and operations phases of the project are minimised and within the scope permitted by the planning approval. To achieve this objective, the following will be undertaken:

- Provide best management practice controls and procedures for implementation during construction and operations to avoid or minimise potential impacts to soil and water quality;
- Protect topsoil and prevent erosion of the Project site and offsite sedimentation;
- Maintain existing water and soil quality of surrounding surface and ground water courses;
- Protection of the environmental values of the site and surrounding areas; and
- Provide best management practice controls and procedures to comply with all relevant legislation and other requirements.

It is however noted that the SWMP will be reviewed and updated as necessary for the inclusion of BESS (either AC-coupled or DC-coupled option) and associated Project infrastructure.

It is noted that the AC-coupled zone (discussed in **Chapter 1** of this report) has no effect on hydrology impacts, or the necessary mitigation and management measures outlined above.

6.8 Hazards and Risks

6.8.1 SEPP 33 Risk Screening Assessment

Chapter 7 of the *Applying SEPP 33 Hazardous and Offensive Development Application Guidelines* (DoP, 2011) (the Guidelines) provide a risk screening procedure to facilitate determination of whether a proposed development is applicable under SEPP 33. In accordance with the Guidelines, if SEPP 33 is triggered under this screening procedure, Clause 12 of SEPP 33 requires that any Project carrying out a potentially hazardous development must be supported by a Preliminary Hazard Analysis (PHA).

Appendix 4 of the Guidelines provide a detailed explanation of the risk screening procedure, including classes of dangerous goods that are excluded from a risk screening assessment.

6.8.1.1 Implications for the Project

Lithium-ion BESS Option

Lithium-ion batteries are among the current preferred battery type as the major component of the BESS, however other battery options may be considered subject to detailed design. Lithium-ion batteries are identified as ‘Class 9’ dangerous goods under the Guidelines. Class 9 dangerous goods are excluded from the risk screening process, as they pose little threat to people or property, but should be considered in terms of their potential for environmental harm. If a different battery type is selected during detailed design it would have an equivalent SEPP33 risk or better. An ethylene glycol solution is also proposed as part of the BESS cooling system. This solution is not listed as a dangerous good within the Guidelines.

As lithium-ion batteries and ethylene glycol are excluded from the screening process, there is no threshold quantity for their storage within the Guidelines, and as such, a PHA is not required for the Project.

However, environmental assessments for recent large-scale BESS projects in NSW have conservatively included PHA’s for completeness, due to emerging information on this matter and at the request of DPE. In order to satisfy DPE requirements and in consideration of completeness of the environmental assessment, a PHA has been prepared to support this modification report.

The PHA has been prepared to qualitatively assess the potential operational risks of the Project, with particular regard to potential risk to people, property and the biophysical environment that may occur as a result of the installation and operation of the BESS. The methodology, key findings and mitigation measures presented in the PHA have been summarised below. The detailed technical study is provided in **Appendix G** of this modification report.

Flow BESS Option

The second technology currently being considered by LSF is the Flow BESS. This option would result in the following dangerous goods being present on site: Electrolyte tanks (anolyte and catholyte) consisting of Class 8 materials (chlorides of iron, hydrochloric acid in aqueous solution).

As the quantity of Class 8 materials exceeds 25 tonnes, SEPP 33 would apply. The PHA Addendum (Arriscar, 2022) addresses the storage and handling of Class 8 materials.

6.8.2 Preliminary Hazard Analysis (PHA)

DPE requested in a letter to the Proponent dated 28 May 2021 (refer **Appendix DE.1**) that a PHA be prepared to support this Modification report. The objective of a PHA is to develop a comprehensive understanding of the hazards and risks associated with an operation or facility and of the adequacy of safeguards (Department of Planning, 2011).

Arriscar Pty Limited (Arriscar) was engaged by ERM to prepare the PHA (2021), and PHA Addendum prepared in February 2022. The PHA (Arriscar, 2021) only considered the Lithium-ion BESS option when assessing BESS hazards. The PHA Addendum (Arriscar, 2022) was prepared to provide supplementary assessment of the Flow BESS option. The PHA and Addendum PHA in full are provided in **Appendix G**.

6.8.2.1 Assessment Methodology

The DPE letter requested that the PHA be prepared in accordance with the Department's *Hazardous Industry Planning Advisory Paper No. 6, 'Hazard Analysis'* (HIPAP 6) (2011) and Multi-Level Risk Assessment, as well having regard to recent developments in research and standards for BESS including:

- NFPA 855: Standard for the Installation of Stationary Energy Storage Systems;
- AS/NZS 5139: Electrical Installations - Safety of Battery Systems for use with Power Conversion Equipment;
- IEC 62897: ED1 Stationary Energy Storage Systems with Lithium Batteries - Safety Requirements;
- UL 9540: Energy Storage System (ESS) Requirements;
- UL 9540A: Test Method for Evaluating Thermal Runaway Fire Propagation in Battery Energy Storage Systems;
- FM Global Property Loss Prevention Data Sheet 5-33: Electrical Energy Storage Systems; and
- FM Global's Development of Sprinkler Protection Guidance for Lithium Ion Based Energy Storage Systems.

A review of these guidelines and standards was undertaken by Arriscar (refer Chapter 6 of PHA) and were used in the preparation of the PHA when suitable. In particular, NFPA 855 was found to be applicable for the purposes of land use planning safety, and a review of compliance with relevant sections of NFPA 855 is provided in Appendix A of the PHA.

HIPAP 6 states that there are two main components of hazard analysis (as illustrated in **Figure 6-13**):

1. **Analysis**, in which hazards are identified leading to an estimation of the risk based on the consequences of credible accidents and their likelihood; and
2. **Assessment**, in which the risks are compared against relevant criteria and risk mitigation and management options are evaluated.

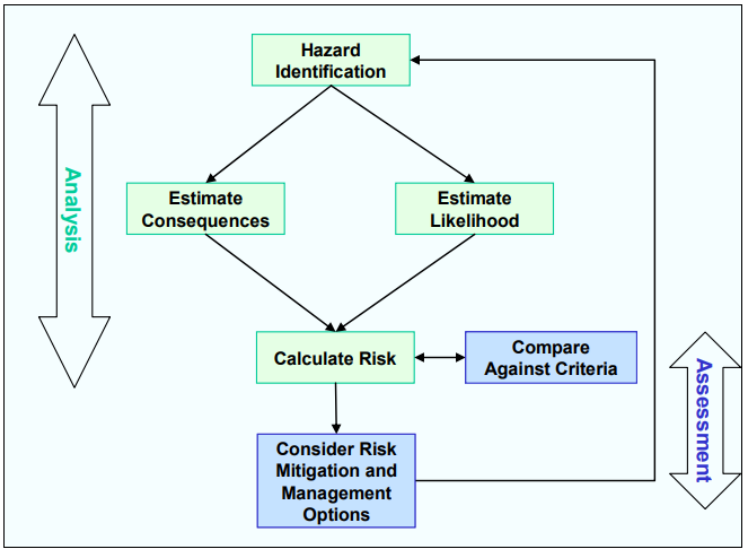


Figure 6-13 Basic Methodology for Hazard Analysis (Department of Planning, 2011)

A hazard identification register was compiled in Table 6 of the PHA (Arriscar, 2021). The register built upon the information presented in the EIS to include additional hazards associated with the Modification.

The PHA register assess and recommends mitigation and management measures for the following hazard scenarios:

- Solar farm activities;
- Lithium-ion BESS activities, including:
  - battery fire;
  - arc flashing and release of energy line-to-line or line-to-ground fault; and
  - battery explosion.
- Vehicle interaction with infrastructure;
- Electromagnetic radiation from high voltage sources;
- Natural hazards (earth tremor, adverse weather, bush fires);
- Dangerous goods storage and handling;
- Electrical hazards;
- Site Security; and
- Construction.

In the hazard identification, Arriscar identified Lithium-ion BESS hazard scenarios with the potential for off-site consequences. A detailed risk analysis was subsequently prepared for the additional hazards associated with the Modification, which were not assessed as part of the EIS.

Potential hazards relating to the Flow BESS option are presented in Table 1 of the PHA Addendum (Arriscar, 2022), and include:

- Release of electrolyte from containment;
- Release of hydrogen from electrolyte leaks;
- Exposure during handling of makeup chemicals; and
- Ignition of vented hydrogen from electrolyte tanks.

Arriscar (2022) state that the hazard scenarios analysed indicate that there would be no off-site consequences and no impact on land uses outside the site boundary. Therefore, a likelihood assessment was not carried out (Level 2 assessment in the Multi-Level risk assessment).

6.8.2.2 Assessment of Impacts

Lithium-ion BESS Option

The Lithium-ion battery is classified as a Class 9 dangerous good (UN No. 3480) for transport purposes. The main hazards are:

- Overheating with toxic gas generation and emission to atmosphere and potential exposure to toxic gases such as Carbon Monoxide (CO), Hydrogen Chloride (HCl), Hydrogen Fluoride (HF) and Hydrogen Cyanide (HCN);
- Overheating with flammable gas generation within the container (CO, Hydrogen, hydrocarbons such as Benzene, Ethylene), ignition and explosion within the container, and potential for escalation to adjacent containers; and
- Fire in Lithium-ion battery, escalating into the packs in the container, with potential for escalation to adjacent containers.

The key findings of the PHA include the following:

- Thermal radiation, explosion and toxic gas effects of BESS fires would be confined within the site and there would be no potentially injurious offsite effects;
- Toxic gas concentrations that produce injury or irritation level would also be confined entirely within the site boundary, and would not reach ground level, except for HCN concentrations that may reach outside the site boundary, but not so far as to impact residential areas or sensitive land uses;
- The thermal radiation impacts from transformer fires are confined within the site boundary with no potentially offsite effects;
- The proposed development complies with the relevant DPE criteria for land use safety planning; and
- The DPE risk criteria for land use safety planning in HIPAP No. 4 do not apply to the O&M building and the BESS since these facilities are within the boundary of the proposed development.

Flow BESS Option

A search by Arriscar (2022) suggests there might be no formal dangerous goods classification for an iron flow battery. However, given that the cells contain electrolytes that are acidic, the battery system including the electrolyte tanks can be considered as a Class 8 dangerous good.

The electrolyte itself has a UN No. of 1760 (Corrosive Liquids). The main hazards are:

- Release of electrolyte from battery cells / circulating pipework / pumps and exposure to corrosive materials;
- Release of electrolyte from battery cells / circulating pipework / pumps and release of trapped hydrogen in the energy centre, with fire or explosion if ignited;
- Fire of combustible materials that make up the cells. An external fire is necessary to initiate such a fire, and there are no flammable or other combustible materials present to start a fire;
- Explosion in the energy centre with potential for escalation to adjacent energy centres and / or Li-ion BESS containers; and
- Ignition of hydrogen vented from the electrolyte tank vents and a vent fire above the tank.

The key findings of the assessment include:

- The risk from the Flow BESS satisfies the risk criteria in HIPAP No.4;
- There are no fire hazards identified in the Flow BESS;
- Explosion would be confined within the site and there would be no potentially injurious offsite effects. The separation distance between containers should enable approach by emergency services personnel;
- A separation distance of 4 m between adjacent modules should be considered to prevent escalation from a hydrogen explosion in one module; and
- An air change of 25 per hour for the modules to keep a minor release of hydrogen below 20% LFL, and a full release of hydrogen below LFL (assuming 25% free volume).

6.8.2.3 Mitigation and Management Measures

Lithium-ion BESS Option

Should the Proponent proceed with the Lithium-ion BESS option, the following key recommendations which were made in the PHA (Arriscar, 2021) will be considered in its final design and operation:

- The separation distance between containers should enable approach of the fire by firefighting personnel; however, if entry into a container is required for firefighting this will require self-contained breathing apparatus due to the potentially toxic fumes;
- A separation distance of 3 m between adjacent containers should be considered to prevent escalation from an explosion of off gases generated in one container from battery overheating;
- The transformers in separate bunds should be protected by firewalls if a separation distance of 10 m from each other cannot be achieved;
- Forced ventilation should be installed in the BESS containers (minimum 30 air changes per hour);
- An alarm should be installed to indicate loss of ventilation flow through the containers;
- Installing a CO detector on the ventilation exhaust duct (CO is present whether the gas is ignited or not) should be considered, with shutdown of the BESS charging/ discharging if CO is detected. The HVAC should be kept on, and alarm if HVAC flow stops;
- If a high CO alarm is raised, then personnel entry into a BESS container is not advisable due to the potential for an explosion. The ventilation system should be maintained, and the unit shut down until the alarm is cleared;
- Bollards/protective barriers around be provided around key battery areas and infrastructure; and
- The Emergency Response Plan should be updated to address the specific hazards identified in the PHA (Arriscar, 2021) (e.g., battery overheating, fires, explosions etc.) and ensure emergency response personnel take appropriate precautions to protect themselves from the hazards and escalating events.

General measures identified within the PHA to mitigate and management Lithium-ion BESS hazards are summarised in **Table 6-14** below and will be incorporated into the design and operation of the BESS.

Table 6-14 General Measures for Lithium-ion BESS Hazards

Lithium-ion BESS Hazard	Mitigation and Management Measure
Battery Fire	■ Battery inspection and testing during installation; ■ HVAC system to maintain temperatures within operating limits; ■ Adequate spacing between battery packs for HVAC air circulation for heat dissipation; and ■ Implement a regular inspection and maintenance regime for the battery assemblies.
Arc Flashing and release of energy line-to-line or line-to-ground fault	■ Proper equipment labelling; ■ Defined maintenance procedures; ■ Adjust the trip time settings of the overcurrent protective devices feeding the array collection system; ■ Possible interlock of container door opening with AC overcurrent trip system; and ■ Use of smaller string inverters in place of large central inverters on the DC side.
Battery Explosion	■ HVAC system for temperature control; ■ Temperature monitoring and high temperature trip by BMS; and ■ Off gas monitoring and alarm through a CO detector at the ventilation exhaust recommended.

Flow BESS Option

Should the Proponent proceed with the Flow BESS option, the following key recommendations which were made in the PHA Addendum (Arriscar, 2022) will be considered in its final design and operation:

- A separation distance of 4 m between adjacent containers should be considered to prevent escalation from a hydrogen explosion in one container to an adjacent container;
- Forced ventilation should be installed in the IFBS power modules (minimum 25 air changes per hour assuming 25% free volume);
- An alarm should be installed to indicate loss of ventilation flow through the containers; and
- On detection of electrolyte leak, an electrostatic discharge must be initiated that will stop electrolyte circulation and hydrogen generation.

General mitigation and measures identified within the PHA Addendum (Arriscar, 2022) to mitigate and management Flow BESS hazards are summarised in **Table 6-15** below and will be incorporated into the design and operation of the BESS.

Table 6-15 General Measures for Flow BESS Hazards

Flow BESS Hazard	Mitigation and Management Measure
Release of electrolyte from containment	■ Equipment inspection and leak testing during installation and commissioning; ■ Implement a regular inspection and maintenance regime for the battery assemblies; ■ PPE worn by personnel
Release of hydrogen from electrolyte leaks	■ Equipment inspection and leak testing during installation and commissioning; ■ Implement a regular inspection and maintenance regime for the battery assemblies; ■ Ventilation of energy centre modules to clear any hydrogen; and ■ Hazardous area classification

Flow BESS Hazard	Mitigation and Management Measure
Exposure during handling of makeup chemicals	■ Handling procedures; ■ PPE; and ■ Small volumes are handled infrequently.
Ignition of vented hydrogen from electrolyte tanks	■ Hazardous area classification around vent locations; and ■ Spark arrestor on the vent.

Future Assessment

The final design of the proposed BESS may vary from the current preferred design. As such, further hazard analysis will be conducted on the final BESS design to ensure that appropriate and achievable design measures are included for the confirmed components of the BESS.

6.8.3 Electric and Magnetic Fields (EMF)

An assessment of electromagnetic interference (including Electromagnetic fields, EMF) was undertaken as a component of the EIS. A review of the existing assessment in the context of the Modification has subsequently been undertaken to consider potential EMF impacts that may arise from the BESS installation.

6.8.3.1 Previous EMF Assessment / Existing EMF Environment

The construction of the wider solar farm includes the installation of electrical infrastructure within the Project Area including cabling, inverters, switchgear and the onsite switchyard, as well as connection infrastructure to connect to the Balranald Substation, and the installation of a large number of PV solar panels. This infrastructure will be involved in the generation, transmission and distribution of electricity, and will be capable (once operational) of generating EMF.

The extent and degree of EMF exposure within the Project Area would vary, depending on proximity to different components of the Project infrastructure. Exposure levels within the Project Area would be intermittent, and limited to exposure encountered during ongoing maintenance of Project infrastructure within the site.

Public access to the Project Area will be restricted throughout the life of the Project, and surrounding landholders accessing adjacent areas will not be exposed to Project-related EMF for extended periods of time, limiting impacts of EMF emanating from the Project boundary.

The EIS EMF assessment indicated that there is no established evidence that exposure to magnetic fields from power lines, substations, transformers or other electrical sources causes any health effects. As a result, the findings from the EIS EMF assessment indicate that adverse impacts from EMF are unlikely, given the combination of low exposure rates and the intermittent exposure of staff to the EMF-generating Project infrastructure.

6.8.3.2 Impact Assessment

As described in **Chapter 3** (and **Appendix A**) of this modification report, components of the proposed BESS (AC-coupled or DC-coupled options) would comprise batteries, inverters, transformers, HVAC and fire protection, some of which will be capable of generating EMF.

The Modification would be located within the approved Project Area which has allowed significant setbacks between residential dwellings and project components capable of generating EMF. The closest sensitive receptor is located approximately 2.9 km north of the Project Boundary and will not be exposed to a higher level of EMF as a result of the Modification. As noted above public access to the Project Area will be restricted, thus excluding general public exposure from any BESS-related EMF.

There is limited information on typical measurement of magnetic fields around BESS, however it is understood that BESS EMF will vary depending on configuration, capacity and type of housing. The BESS would be designed in accordance with relevant electrical safety standards and codes, in line with the existing Project infrastructure, to minimise the potential for unwarranted increases in EMF as a result of faulty equipment.

The inclusions of either AC-coupled or DC-coupled BESS option is unlikely to substantially increase the existing extent and degree of EMF exposure within the Project Area and wider areas outside the Project Boundary. This statement is consistent regardless of the position of the AC-coupled BESS system within the AC-coupled zone discussed in **Chapter 1** of this report.

6.8.3.3 Mitigation and Management Measures

Additional management and mitigation measures are not required beyond those identified in the EIS assessment prepared to support the development consent. It is noted that the AC-coupled zone (discussed in **Chapter 1** of this report) has no effect on EMF impacts, or the necessary mitigation and management measures outlined above.

6.8.4 Bushfire

6.8.4.1 Existing Environment

The Modification is proposed to be wholly contained within the Project Area and development footprint that was previously assessed and approved under SSD 8025 and SSD 8025 MOD 1. Bushfire hazards and risks were identified within *Section 6.10.2* of the EIS in accordance with 'Planning for Bushfire Protection' (PBP, NSW Rural Fire Service (RFS), 2006).

The *Rural Fires Act 1997* imposes obligations on land occupiers to take all practicable steps to prevent the occurrence and spread of wildfire to adjoining lands from lands under their care and management. This chapter identifies potential bushfire hazards associated with the Modification and provides management and mitigation measures designed to address these obligations. It does not assess the risk associated with individual design or engineering components of the BESS (AC-coupled or DC-coupled options). These are addressed in the PHA as summarised in **Section 6.8.2** of this modification report and reproduced in **Appendix G**.

A review of the NSW RFS Bushfire Prone Land mapping (accessed 22 June 2021) confirms that the Project Area is not mapped as bushfire prone land. The Project Area as described by Biosis (2017) is relatively flat, cleared agricultural land with undulating dune/swale topography. The landscape is scattered with remnant vegetation in isolated patches within cropped paddocks, along roadsides or boundary fences or within road reserves. There are no mapped watercourses or drainage lines located within the Project Area, although there are two farm dams.

An existing Project Bushfire Management Measures and Emergency Response Plan (ERP) has been prepared and considers bushfire risk. The key ERP features that apply to the Project include but are not limited to:

- A 10 m defendable space that permits unobstructed vehicle access is to be provided around the perimeter of the solar array area. The defendable space and solar array area must be managed as an 'Asset Protection Zone' (APZ).
- Overhead electrical transmission lines will be installed and managed in accordance with relevant guidelines prescribing safety clearances from vegetation. We note that this feature is more relevant to the Project as a whole, rather than the Modification that constitutes underground cabling.
- AS/NZS 1596:2008 'The storage and handling of Liquefied Petroleum (LP) gas' will be followed for bottled gas installation and maintenance (if required), including the use of metal piping.
- An emergency evacuation procedure including routes and assembly points.

- Water storage facilities. Water for the Project is stored in two on-site water tanks. 'Tank A' consists of a 250 kilolitre (kL) capacity tank fitted with a 65 mm 'Storz Fitting', located at the eastern extent of an existing solar array, approximately 720 m north-north-west of the operations and maintenance building. 'Tank B' consists of a 20,000 L tank located outside the operations and maintenance building. Tank B is not fitted with a 'Storz Value'.

6.8.4.2 Updated Legislative Requirements

Bushfire hazards and risks were assessed in the EIS in accordance with PBP 2006. These guidelines have been updated and were legislatively adopted in the *Environmental Planning & Assessment Regulations* on 1 March 2020. PBP 2019 is the culmination of significant investment in scientific research and policy development to provide appropriate bush fire protection whilst still having due consideration for development potential and economic sustainability.

PBP 2019 applies to all development applications on land that is classified as bushfire prone land on a council's Bushfire Prone Land Mapping. Although the Project is not located on bushfire prone land, it is noted that the broader region is prone to bushfires and consideration has been given to the following overall aims and objectives of PBP 2019:

- Afford buildings and their occupants' protection from exposure to a bushfire.
- Provide for a defendable space to be located around buildings.
- Provide appropriate separation between a hazard and buildings which, in combination with other measures, minimises material ignition.
- Ensure that appropriate operational access and egress for emergency service personnel and residents is available.
- Provide for ongoing management and maintenance of bushfire protection measures.
- Ensure that utility services are adequate to meet the needs of firefighters.

PBP 2019 provides specific requirements for solar farm development and notes that wind and solar farms require special consideration and should be provided with adequate clearances to combustible vegetation as well as firefighting access and water.

6.8.4.3 Assessment of Impacts

The following steps were undertaken in the assessment process:

- Determine whether the Project Area has been mapped as bushfire prone land (in this case the Project is not mapped) and whether the Project is in compliance with NSW RFS guidelines including PBP, 2019.
- Identification of the bushfire risk factors such as slope, vegetation classification, bushfire history and known bushfire behaviour in the Project Area and within the surrounding lands.
- Identify infrastructure that may be subject to direct flame contact or requires protection from bushfire.
- Produce risk mitigation and management treatments and satisfy PBP 2019 requirements.

6.8.4.4 Vegetation Hazard

Descriptions of the vegetation types including species composition and structural diversity is summarised in **Section 6.1** of this modification report. As the Modification is proposed to be wholly contained within the Project Area and development footprint previously assessed and approved under SSD 8025 and SSD 8025 MOD 1, there are no mapped vegetation hazards within 100 m of any of the BESS infrastructure.

It is noted that the surrounding landscape is considered low threat due to factors such as flammability, moisture content and fuel load. In accordance with PBP 2019, grass, whether exotic or native, which is regularly maintained at or below 10 centimetres (cm) in height is regarded as managed land. It is however recognised that some grassed areas are capable of sustaining a fire and consideration of the objective of PBP 2019 is warranted.

The risk posed by grass fires is different to that of fires in other vegetation types. Grass fires burn at a higher intensity and spread more rapidly with a shorter residence time. Embers produced by grass fires are smaller and fewer in number than those produced from forest fires.

6.8.4.5 Topography

Steeper slopes significantly increase the rate of spread of fires, and the relationship of the steepness of slope, and whether a fire moves upslope or downslope, is vital to understanding bushfire behaviour potential. For every 10˚ slope, the fire will double its speed. Slope and wind are often the major factors determining the direction of fire spread. However, the Project Area is relatively flat and does not contribute to any increased fire hazard or risk to the proposed Modification.

6.8.4.6 Fire History within the Project site

A review of the NSW RFS Fire History Mapping available via SEED maps does not identify any previous fires within the Project Area or the adjacent properties.

6.8.4.7 Summary of Bushfire Risk Factors

The risk that the Modification itself will cause a fire is minimal and the location of BESS (either AC-coupled or DC-coupled option) is unlikely to result in any increased bushfire risk above that already assessed and approved for the Project. Any upgrades to the internal roadway network within the Project Area would increase the level of access available to fire fighters and would assist to reduce the likelihood of a widespread fire. A minimum 10 m wide APZ will also be provided around the proposed BESS to ensure that these assets have a defendable space on all sides and will not increase the risk of a fire spreading across the landscape.

The above summary is consistent for either the AC-coupled or DC-coupled BESS option. It is noted that the AC-coupled zone has no effect on bushfire risk, or the necessary mitigation and management measures outlined in **Section 6.8.4.9** below.

6.8.4.8 Climate Change and Bushfires

Eastern Australia is documented to be one of the most bushfire-prone areas in the world. As reported by the Bureau of Meteorology (BOM 2021 http://www.bom.gov.au/weather-services/fire-weather-centre/bushfire-weather/index.shtml), human induced climate change is influencing the frequency and severity of dangerous bushfire conditions in Australia and other regions of the world, influencing temperature, environmental moisture, weather patterns and fuel conditions.

Observed changes in southern and eastern Australia include more extreme conditions during summer, as well as an earlier start to the bushfire season with dangerous weather conditions occurring significantly earlier in spring than they used to.

While climate change might not ignite the fire, it is giving fires the chance to turn into catastrophic fires by creating warmer temperatures, increasing the amount of fuel (dried vegetation) available, and reducing water availability due to higher evaporation. In relation to fire ignition, there is some indication that human induced climate change could also influence the risk of ignitions from dry-lightning (i.e., lightning that occurs without significant rainfall).

Bushfire weather conditions in future years are projected to increase in severity for many regions and should be considered within an ERP. This would result in:

- an earlier start to the bushfire season;
- reduced opportunities for fuel reduction burning;
- management of fire risk to property, people and biodiversity will become increasingly challenging; and
- an increase in the number of extreme fire danger days.

6.8.4.9 Mitigation and Management Measures

Despite the mitigation measures and treatments that are put in place, it is noted that some bushfire risk will always remain and that some of the infrastructure may be subject to direct flame contact. It is important that the existing ERP is updated in conjunction with relevant stakeholders, including local fire services, NSW RFS, NSW Fire and Rescue, adjoining property owners and employees to include the Modification. The updates should consider:

- Adaptive management and mitigation measures to address climate change and the earlier start to the bushfire seasons.
- Work that should not be carried out during total fire bans.
- The BESS (AC-coupled and/or DC-coupled options) and all associated infrastructure, including a 10 m wide defendable space maintained to the standard of an Inner Protection Area for the life of the development.
- Providing a manifest (and safety data sheets) for any battery, diesel or other dangerous goods storage/handling, including the class identification, quantity, type (bulk or packaged) and location. Note that the quantity/class of 'dangerous goods' to be stored presents a minimal risk, as justified and documented in **Section 6.8.1**, **Section 6.8.2** and the PHA within **Appendix G**.
- Appropriate material (including absorbent, neutralisers, equipment and personal protective equipment) for the clean-up of spills being provided and available onsite.
- Provision and maintenance of an automated fire suppression system that is incorporated into the BESS container selection and design.
- That the Project including access, utilities and services are consistent within the PBP 2019, which has replaced PBP 2006.
- Actively monitoring and managing length of grass to minimise risk.

With specific regard to the Modification (AC-coupled or DC-coupled options), the BESS containers, switch-room structures and large buildings will have fire protection systems installed. These are commonly an active gas based system with thermal sensors and smoke/gas detectors, however design of this asset is yet to occur. Design will occur and adhere to relevant standards applicable to the system. The CATL (20 foot) BESS container includes two type of detectors within the container itself: smoke detectors and carbon monoxide gas detectors. A fire suppression (which is an advanced aerosol technology environmentally friendly) would also be included within the container.

It is reiterated that the AC-coupled zone (discussed in **Chapter 1** of this report) has no effect on bushfire risk, or the necessary mitigation and management measures outlined above.

6.9 Cumulative Impacts

An assessment of cumulative impacts of the original project was undertaken during the development of the EIS. The assessment included consideration of impacts to nearby proposed and existing developments, including Sunraysia Solar Farm and goFARM.

Consultation was undertaken with the abovementioned proponents, to discuss potential cumulative impacts to their respective projects, focussing primarily on visual amenity, compatibility of land use, capacity of the electricity transmission network, traffic and construction noise impacts.

The EIS concluded that with the implementation of appropriate mitigation measures, potential for cumulative impacts to be encountered during the concurrent construction and operation of the Project would be reduced to manageable levels. Further mitigation and management measures were included in sub-plans of the Environmental Management Strategy for the Project. In summary the key measures identified for the management of cumulative impacts included:

- Provide notification around the timing of the Project's peak construction period to Balranald Shire Council and local stakeholders;
- Consultation with Sunraysia Solar Farm and goFARM regarding the proposed construction schedule for the Sunraysia Solar Farm and goFARM's;
- Preparation of a plan prepared in consultation with Sunraysia Solar Farm which outlines:
  - Location of site access for construction of both developments;
  - UHF call in procedures for vehicles approaching both sites;
  - Additional traffic safety controls such as signage, reduced speed limits (where warranted); and
  - Contact details for the principle contractors of each development.

LSF remains committed to the ongoing management of cumulative impacts and is in contact with other nearby developments to remain informed of their construction and operational planning, such that proactive decision making can occur and be implemented for the Project. A summary of community consultation undertaken by LSF is provided in **Table 5-2** of this modification report, and notes contact with nearby developments i.e., Sunraysia Solar Farm and goFARM.

A search of the NSW DPE Major Projects website (DPE, 2021) was undertaken at the time of this modification report preparation (March 2022), to determine whether any additional SSD projects have received development consent since consent was granted under SSD 8025 and SSD MOD 1. The results of the search indicate that one new major project (Burrawong Wind Farm) is currently in the 'Request for SEARs' stage of a SSD application, after submitting a Scoping Report to DPE in November 2021. The Burrawong Wind Farm project involves the construction and operation of approximately 107 Wind Turbine Generators, with a generation capacity of approximately 750MW, and is located immediately east of the LSF Project boundary, on the eastern side of Yanga Way.

An increase in renewable energy projects within the region is expected, with the recent announcement by the NSW Government of the planning and delivery of the South-West REZ in and around Hay, NSW (including Balranald). This new REZ has been identified by the NSW Government as a target area for renewable energy development throughout the NSW Transmission Infrastructure Strategy (DPE, 2018) and Electricity Infrastructure Roadmap (DPE, 2020).

There are no additional new major projects considered within the area of influence of the Project.

This modification report has assessed the total effect of the Project and the inclusion of a BESS option, and concludes that the Modification would not increase the potential for cumulative impacts to the biophysical and social environment. This statement is consistent for either the AC-coupled BESS options (Li-ion and Flow) or DC-coupled BESS option. It is noted that the AC-coupled zone (discussed in **Chapter 1** of this report) has no effect on cumulative impacts, or the necessary mitigation and management measures outlined above.

7 ENVIRONMENTAL MANAGEMENT

7.1 Existing Framework

The Environmental Management Strategy (EMS) (EMM, 2018) outlines the framework for implementation of environmental management for construction and operation of the Project. It documents the environmental management measures, roles and responsibilities required to comply with the relevant legislative requirements and other applicable licences, approvals and permits.

The EMS includes sub-plans which detail the environmental performance criteria and site-specific management measures and procedures to be implemented during construction and during operation. These sub-plans include the following:

- Biodiversity Management Plan;
- Heritage Management Plan;
- Traffic Management Plan;
- Soil and Water Management Plan;
- Emergency Response Plan;
- Accommodation and Employment Strategy; and
- Decommissioning and Rehabilitation Plan.

The EMS has been prepared in accordance with the requirements of Schedule 4, Condition 1 of the development consent.

7.2 Mitigation and Management Measures

Mitigation and management measures for the wider Limondale Solar Farm Project were presented in Section 7 of the EIS.

The proposed Modification does not generally alter the existing mitigation and management measures defined in the EIS. However, this modification report has identified additional measures to be implemented in response to the assessment of impacts for the proposed Modification.

The updated mitigation and management measures table inclusive of these additional measures is presented in **Appendix B** of this modification report.

8 JUSTIFICATION AND BENEFITS

8.1 Overview

Energy storage was once an emerging technology but is now increasingly common practice for both small and large-scale energy projects. For large-scale solar projects, storage technologies, especially BESS, are becoming important to allow for the management of energy flow to the electricity grid. As explained in the *NSW Electricity Strategy* (NSW Electricity Strategy, DPE, November 2019), this management of energy flow relates to the storage of electricity '*produced by generators for use when it is needed later. For example, a battery can be used to store electricity from a solar farm during the day so that it can be later used at night*'.

Also from the NSW Electricity Strategy, November 2019, renewables are firmed as the *'cheapest type of new reliable generation'.* The strategy furthers that *'wind and solar are the cheapest forms of new electricity generation. These technologies are the most environmentally friendly. When paired with batteries, pumped hydro or gas-fired generators, they can reliably supply electricity when the sun is not shining and the wind is not blowing, and are the lowest cost option to replace power stations as they close*'.

As is evident from the above discussion and **Section 2.2**, the introduction of BESS (AC-coupled or DC-coupled options) to the Project aligns with NSW Government's broader electricity strategy and will allow for a more reliable supply of dispatchable renewable energy.

Without the proposed Modification and subsequent installation (post-approval) of either the AC-coupled or DC-coupled BESS options, the Project would be reliant on the traditional supply of solar PV energy, or what is commonly called a 'traditional linear energy system'. The introduction of BESS to the Project aligns the energy production with current industry standards and technologies, commonly referred to as a 'modern complex energy system'. These systems are illustrated in **Figure 8-1** below, with areas relevant to the Project's solar energy production and storage highlighted.

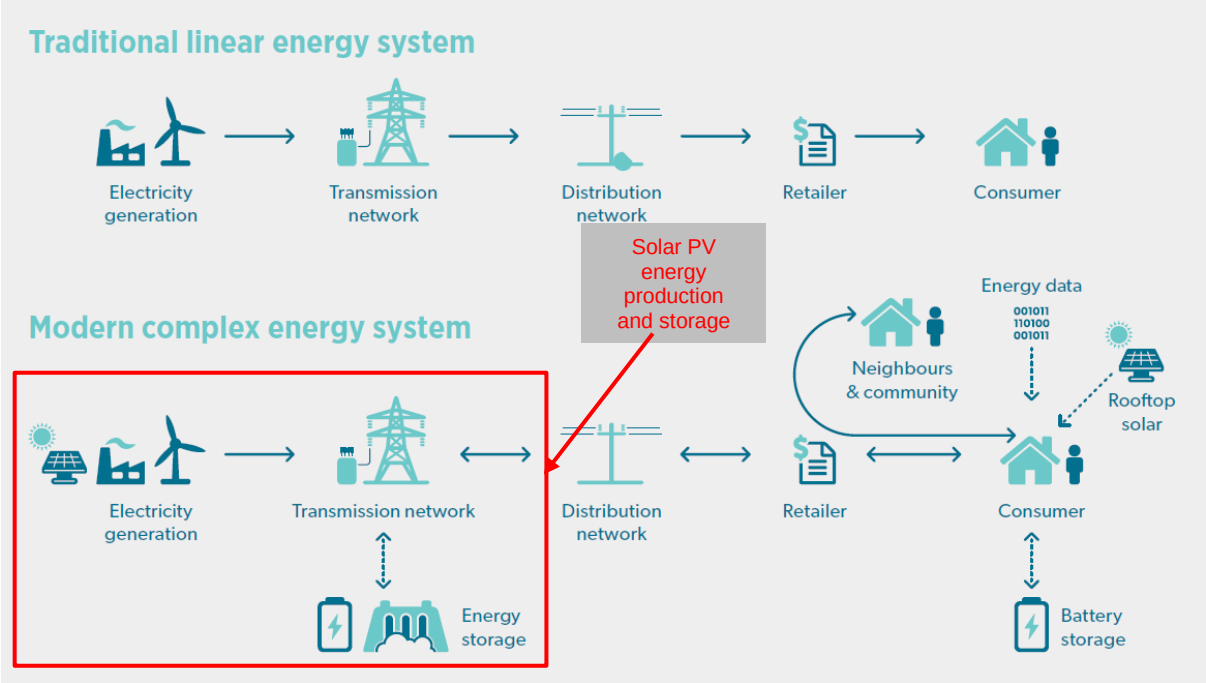


Figure 8-1 Traditional and Modern Energy Systems

Source: NSW Electricity Strategy, November 2019

The Modification to the Project to allow for a BESS system is designed to maximise the commercial benefits of the Project. The BESS (either the Li-ion or Flow AC-coupled option, or DC-coupled option) does however align with current NSW Government and industry expectation, and will provide firming capacity for the renewable energy project.

8.2 Modification Benefits

The Modification has a number of benefits, in summary it will:

- Contribute to the strategic objectives and targets of the NSW and Commonwealth governments for renewable energy storage;
- Contribute to increased energy security of the National Electricity Market (NEM) through valuable contributions to dispatchable energy storage; and
- Provide ongoing economic benefits for regional NSW through both the diversification of regional income streams and provision of employment opportunities during construction and throughout the operation of the Project**.**

The strategic objectives and targets of the NSW and Commonwealth governments for renewable energy storage is further addressed in **Chapter 2**.

Further, consideration of the planning review (**Chapter 4**), stakeholder consultation (**Chapter 5**), environmental impacts (**Chapter 6**) and environmental mitigation and management measures (**Chapter 7** and **Appendix B**) has identified that a modification application pursuant to Section 4.55(2) of the EP&A Act would remain substantially the same development. The proposed Modification would result in an acceptable level of impact that can be maintained consistent with the existing development consent. This statement is consistent for either AC-coupled or DC-coupled options.

8.2.1 Supporting the NEM through Dispatchable Energy

The latest Integrated System Plan (ISP) modelling prepared by AEMO (2020a) confirms that the least-cost and least-regret transition of the NEM is from a system dominated by centralised coal-fired generation to a highly diverse portfolio of behind-the-meter and grid-scale renewable energy resources that are supported by dispatchable firming resources and enhanced grid and service capabilities, to ensure the power system remains physically secure.

The 2020 ISP identified that between 6 GW and 19 GW of flexible, dispatchable resources are needed by 2040 to back up renewable generation. This includes large-scale battery energy storage systems, distributed batteries capable of charging at times of high distributed PV, if appropriately incentivised, to help increase minimum demand levels.

AEMO (2019) forecasts a continued elevated risk of expected unserved energy over the next 10 years, and accordingly states '*… targeted actions must be taken now to provide additional dispatchable capacity to reduce the risks of supply interruptions during peak summer periods* '.

A substantial pipeline of generation and storage projects will help mitigate risks associated with unserved energy, in which storage according to AEMO (2019) will have the greatest impact. This includes battery energy storage systems to help increase minimum demand levels (AEMO, 2020b).

The Modification aligns with these objectives.

8.2.2 AC-coupled or DC-coupled BESS Options

LSF considers both AC-coupled and DC-coupled BESS options to be commercially viable for the Project. Following approval, either BESS option could be feasibly and reasonably incorporated into the Project's design with any and all consideration of common BESS design aspects, such as:

- Short circuit ratio of the transmission grid when connected.
- Capital expenditure.

- The additional AC inverters associated with the AC-coupled option.
- The DC-DC converters associated with the DC-coupled option.
- Clipping losses: lost energy caused in solar PV systems due to the inverter derating its output to meet either its maximum power rating or the maximum allowable power at the grid connection.
- Cycling losses: lost energy caused by electricity cycling between DC and AC, and then back to DC at the grid connection.

8.3 Ecologically Sustainable Development Principles

Ecologically sustainable development (ESD) principles requires the effective integration of the social, economic and environmental considerations into the decision-making processes.

For the purposes of this report, the relevant definition of ESD is found in Schedule 2, Part 3 Section 7 of the EP&A Regulation. **Table 8-1** below describes how the ESD principles have been applied by the Project.

Table 8-1 Application of ESD Principles

ESD Principle	Application
Precautionary principle	Three BESS options for the Project have been considered having regard to a number of environmental impacts, such as biodiversity, noise and vibration, visual, and hazards. The environmental impacts of the Project have been carefully evaluated in this modification report and environmental impacts have where practicable been avoided, mitigated or managed (**Chapter 6** and **Appendix B**). The Modification is proposed to be wholly within the Project Area and development footprint previously assessed and approved under SSD 8025 and SSD 8025 MOD 1. During operations, management plans will be reviewed and updated where relevant to incorporate the adaptive management principles described in **Appendix B**.
Inter-generational equity	The Project is consistent with the principle of inter-generational equity because it involves support existing grid-scale renewable energy through enhancing grid and service capabilities, ultimately contribute to increased energy security. As outlined in **Chapter 2**, the Project gives effect to the strategic vision and targets of the NSW and Commonwealth governments for renewable energy storage.
Conservation of biological diversity and ecological integrity	The Project is consistent with the principle of conservation of biological diversity and ecological integrity because as it does not require any clearing of native vegetation. As outlined in **Section 6.1.3**, the Project supports the existing Biodiversity Offset arrangements currently in place.
Improved valuation, pricing and incentive mechanisms	The Project is consistent with the principle of improved valuation, pricing and incentive mechanisms, as it is a solution to an environmental problem, being gaps in dispatchable solar energy to the NEM during periods of no sunlight. Among the benefits of the Lithium-ion BESS option is the ability for power generation to restore a stable power grid; optimize the power output curve; reduce solar curtailment; provide system inertia and the functions of frequency and peak modulation; increase the proportion of renewable energy in total power generation; and optimize the energy structure (refer **Section 3.1.1**). Among the benefits of the Flow BESS option, is the ability for time-shifting renewable energy use; ancillary grid services; smoothing the intermittency of renewables; and support in servicing current and future capacity demands (refer **Section 3.1.2**). Further, as stated above, the Project supports the existing Biodiversity Offset arrangements currently in place.

8.3.1 Consequences of Not Proceeding

The Project will continue commissioning and operations without the Modification. However, the addition of either the AC-coupled or DC-coupled option would align the Project with current Government and/or industry expectations and would provide firming capacity for the renewable energy project. These would not be achieved without the proposed Modification proceeding.

9 EVALUATION AND CONCLUSION

ERM has provided LSF planning and environmental consultancy services to support a proposed Modification to the Project that was granted development consent (SSD 8025) under Section 4.38 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) in 2017.

LSF is seeking a modification relating to the installation and operation of a BESS within the existing Project Area and development footprint i.e., the 'Modification'. The overall objective of the Modification is to develop a BESS at the Project Area, to provide the facility with dispatchable firming resources and enhanced grid and service capabilities, while also avoiding and minimising environmental, community and landholder impacts.

This report has been prepared to support the proposed Modification. It documents applicable planning requirements, stakeholder engagement, an assessment of environmental impacts and any necessary environmental management measures required to maintain an acceptable level of impact consistent with the existing development consent.

This modification report assessed the impacts of the Modification and supports the approval of three BESS options which are currently being considered by LSF. The modification report is prepared such that all options are fully assessed and evaluated, however only one option will be selected by LSF subject to commercial and operational factors. The BESS options are:

- A decentralised DC-coupled Li-ion BESS of up to 200MW/800MWh capacity;
- A centralised AC-coupled Li-ion BESS of up to 200MW/800MWh capacity; and
- A centralised AC-coupled Flow BESS of up to 200MW/800MWh capacity.

Either of the two AC-coupled BESS options would be located within the 'AC-coupled zone' identified in **Chapter 1** and **Appendix A** this modification report. This zone represents a broader area within which the AC-coupled layout would be constructed. It consists of two areas, one north and one south of the site access road. At this stage a fixed location for either of the AC-coupled options is being evaluated by LSF and would be selected subject to detailed design, and consideration of commercial and operational factors. This modification report has been prepared to assess potential worst-case impacts associated with the AC-coupled layout being positioned at any location within the nominated AC-coupled zone. Further detail regarding the Project description, including the proposed Modification is provided in **Chapter 3** and **Appendix A**.

This modification report considers the combined effect of the solar farm and proposed BESS Modification (AC-coupled and DC-coupled options) but does not seek to reassess environmental impacts associated with the approved Project, where no changes are proposed.

A planning review of all relevant Commonwealth, State and local policies, guidelines and strategies has been conducted to evaluate the Modification with regard to Section 4.55 of the EP&A Act in 2017, which provides pathways for the modification of development consents. This Modification is sought for under the provisions of Section 4.55(2) of the EP&A Act.

9.1 Summary of Environmental Impacts

Consideration of the planning review (**Chapter 4**), stakeholder consultation (**Chapter 5**), environmental impacts (**Chapter 6**) and environmental mitigation and management measures (**Chapter 7** and **Appendix B**) has identified that a modification can occur under Section 4.55(2) of the EP&A Act and that an acceptable level of impact can be maintained consistent with the existing development consent. This statement is consistent for either AC-coupled or DC-coupled options. Further, the AC-coupled zone (discussed in **Chapter 1** of this report) has no material effect on impacts.

9.2 Summary of Environmental Measures and Safeguards

Based on the impacts summarised above (and the detail provided within the relevant sections) a consolidated set of environmental mitigation and management measures, and safeguards have been established. These would form part of the Project and would apply to the Modification, as documented **Chapter 7** and **Appendix B** of this modification report.

Environmental measures and safeguards outlined in this modification report would be incorporated into an updated EMS. These measures and safeguards will minimise potential adverse impacts arising from the Modification on the surrounding environment.

All other environmental aspects will continue to be managed in accordance with the existing environmental management and mitigation measures within the EMS.

9.3 Evaluation and Conclusion

As noted above the overall objective of the Modification is to develop a BESS at the Project Area, to support the facility with dispatchable firming resources and enhanced grid and service capabilities to ensure that the power system remains physically secure, while also avoiding and minimising environmental, community and landholder impacts.

This modification report has demonstrated that these objectives can be achieved and an acceptable level of impact can be maintained consistent with the existing development consent. This statement is consistent for either AC-coupled or DC-coupled options. The AC-coupled zone has no material effect on impacts.

In addition to achieving these objectives the Modification has a number of benefits, including:

- Contributing to the strategic objectives and targets of the NSW and Commonwealth governments for renewable energy storage.
- Contributing to increased energy security of the National Electricity Market (NEM) through valuable contributions to dispatchable energy storage.
- Providing ongoing economic benefits for regional NSW through both the diversification of regional income streams and provision of employment opportunities during construction and throughout the operation of the Project**.**

Accordingly, the authors of this report support the approval of the Modification under Section 4.55(2) of the EP&A Act.

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APPENDIX A UPDATED PROJECT DESCRIPTION



Limondale Solar Farm

APPENDIX A – Updated Project Description

Prepared for
Limondale Sun Farm Pty Ltd

17 March 2022

Project No.: 0591786

The business of sustainability

ERM

Document details	
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Document subtitle	APPENDIX A – Updated Project Description
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Date	17 March 2022
Version	v0.2
Author	Thomas Buchan, Murray Curtus
Client Name	Limondale Sun Farm Pty Ltd

Signature Page

17 March 2022

Limondale Solar Farm

APPENDIX A – Updated Project Description



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A. UPDATED PROJECT DESCRIPTION

The Project Area is approximately 14 kilometres (km) south of the township of Balranald and 230 km west of Griffith in the Riverina region of south-western NSW. It is situated within the Balranald Shire Council Local Government Area (LGA) and has a Project Area of 2,049 hectares (ha), including a 1,025 ha development footprint.

The Modification will not result in changes to the existing approved project area or development footprint.

The Project Area is wholly zoned RU1 Primary Production pursuant to the *Balranald Local Environmental Plan 2010* (Balranald LEP). The land surrounding the Project Area is also predominately zoned RU1 Primary Production under the Balranald LEP and the *Wakool Local Environmental Plan 2013* (Wakhool LEP).

The Project Area sits within the Murrumbidgee catchment. Land use within this catchment is dominated by extensive agricultural operations such as grazing, dryland cropping and horticulture, conservation, and irrigation (Office of Water 2011 cited in the EIS). Accordingly, the Project Area has been modified to a large extent by previous and current land uses, including land clearing, cropping, livestock grazing, and most recently, broad acre cropping for hay.

The Project Area is not identified as land subject to flooding within the Flood Planning Area Map under the Balranald LEP and is outside the boundary of the Lower Murrumbidgee Floodplain Water Management Plan.

Yanga National Park lies from the north to the east of the Project Area, which at its closet point, lies approximately 3 km east of the Project Area. This area is zoned E1 National Parks and Nature Reserves under the Balranald LEP and the Wakool LEP.

A.1 Project Approval History

An overview of the Project's planning approval process is summarised in **Figure A-1** below. A summary of the original development consent and its first modification (approved) is also provided.

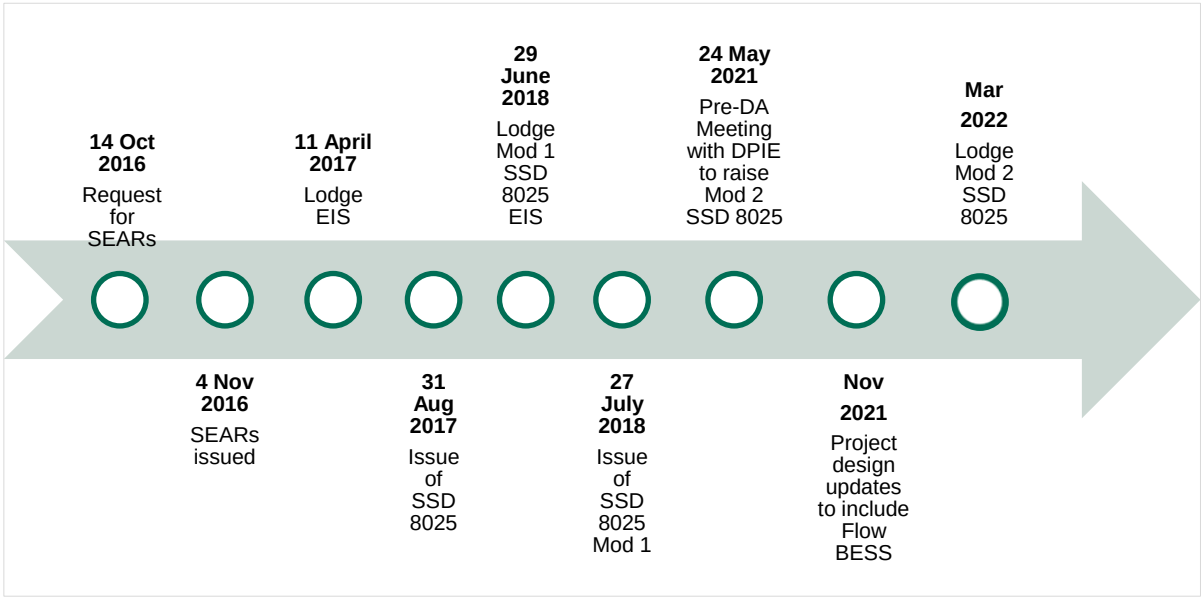


Figure A-1 Overview of Planning Approval Process

A.1.1 State Significant Development (SSD 8025)

As described in the EIS (EMM Consulting Pty Ltd, 10 April 2017), the Project is a large-scale solar PV generation facility with an estimated nominal capacity in the order of 349 MW DC / 249 MW AC, and includes associated infrastructure such as an onsite switchyard, internal access tracks, staff amenities, car parking, and laydown areas. The Project comprises of a network of approximately 872,000 solar panels which are connected to the TransGrid electricity distribution network that originates at the Balranald Substation, as well as the other following key components:

- Electrical collection systems, switchyard and control room;
- A management hub, including demountable offices and amenities and equipment sheds;
- Parking and internal access tracks; and
- Connection infrastructure to the Balranald Substation.

The Balranald Substation was an existing asset 500 m from the Project Area and is owned and operated by TransGrid.

The PV solar panels are connected in series and the electricity generated by the Project is directed via underground electrical collection systems to the inverters. The inverters connect to a project electrical switchyard, which uses the connection infrastructure to export electricity to the grid network. All electricity generated by the PV solar panels passes through the Balranald Substation and then be transmitted into the grid network.

The onsite electrical collection systems will be placed underground in trenches of between 600 to 1,200 mm in depth. The electrical cabling necessary to connect the PV solar panels in series will be positioned underneath the panels.

The electricity and associated environmental products that are generated from the solar farm is sold to the National Electricity Market (NEM) that is operated by the Australian Energy Market Operator (AEMO). The Project will provide enough electricity to power up to 100,000 homes each year (AEMC, 2016 cited in EMM Consulting Pty Ltd, 10 April 2017).

The EIS (EMM Consulting Pty Ltd, 10 April 2017) stated that full commercial operation of the solar farm was planned to commence in the first quarter (Q1) of 2021. The solar farm construction has been completed with the plant still performing tests for the grid connection. This commissioning work is expected to finish in Q3 of 2021. The Modification construction is planned to occur between Q3 2022 and Q4 2024; however, the schedule is yet to be confirmed and this indicative timeframe is subject to change.

A.1.2 State Significant Development 8025 (MOD 1)

The Minister's Development Consent for Limondale Solar Farm was modified on 27 July 2018 (SSD 8025 MOD 1). It included the subdivision of part of the Project Area (Lot 12 DP751179) to enable TransGrid to take ownership of their portion of the subdivided site, and to improve the Project's energy generating efficiency by increasing its maximum panel solar height from 2 m to 4 m.

The subdivision of Lot 12 DP751170 resulted in the creation of:

- Lot 1 – A 2 ha lot at the site of TransGrid's onsite substation / switchyard:
  - This lot accommodates the TransGrid owned components of the approved onsite switchyard that includes ancillary connection equipment, transformers, connecting transmission lines, maintenance building, staff amenities, associated switchgear, control and telecommunications equipment, security fence, access track and gravel areas.
- Lot 2 – A 17.8 ha residual lot comprising a portion of the Limondale Sun Farm:
  - This lot accommodates the solar array infrastructure as well as the Limondale Sun Farm components of the switchyard.

The NSW Department of Planning, Industry and Environment (DPIE) in their assessment report concluded that the modification (MOD 1) would not result in any significant impacts beyond those that were already assessed and approved.

A.2 Project Area

The Project Area as described in this modification report is wholly within the area previously assessed in the EIS and is consistent with the Panel Height and Subdivision modification (SSD 8025 Mod 1).

This includes a total Project Area of 2,049 ha, including a 1,025 ha development footprint (excluding the proposed Modification).

Accordingly, the Project relates to the allotments as described below in **Table A-1**.

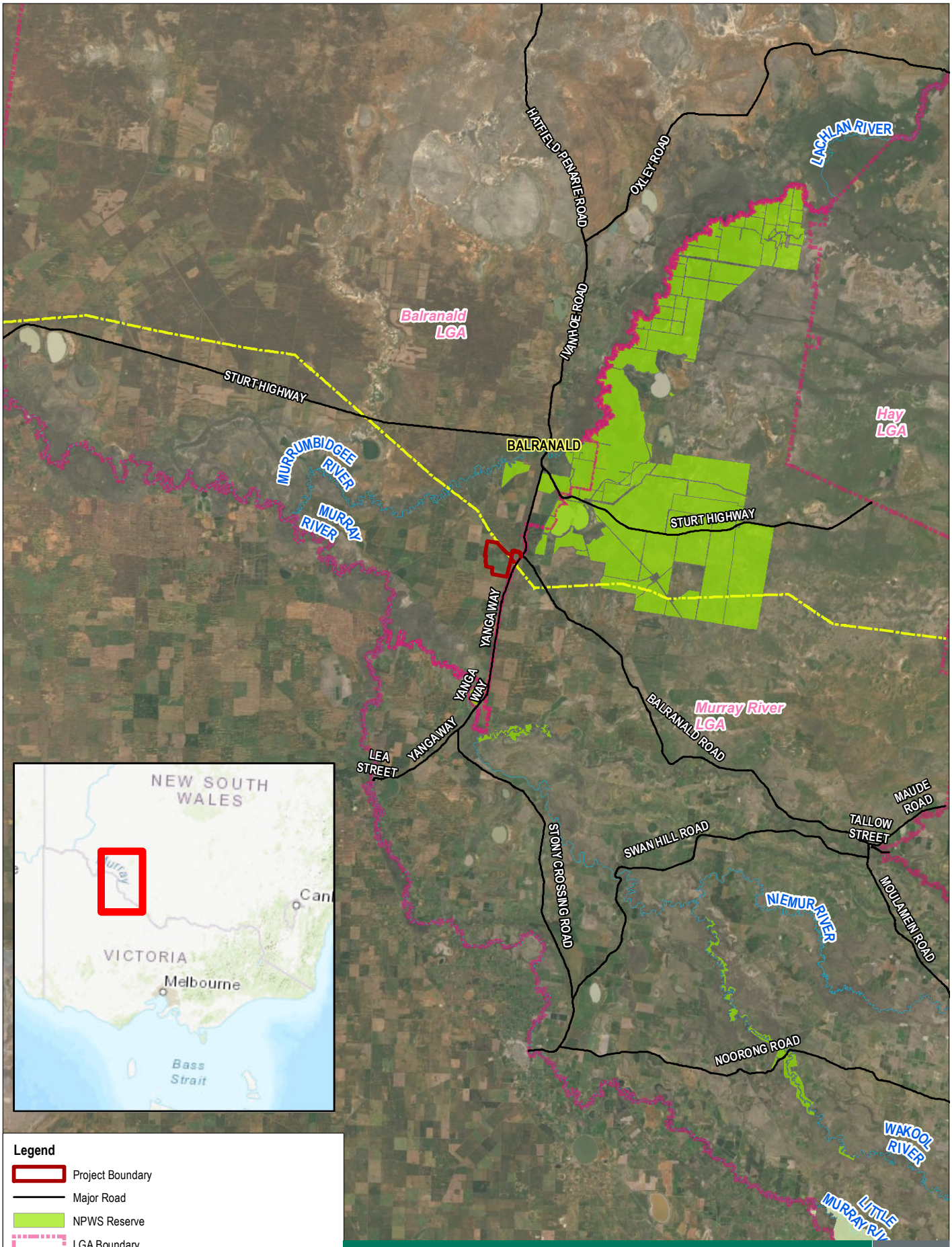
Table A-1 Lot and DP Numbers for Project Area

Lot Number	Deposited Plan (DP)	Tenure	Project Elements
4, 12[1], 13, 15, 21, 71	751179	Limondale Investments Pty Ltd (ABN 56 623 320 052)	Project infrastructure
11, 12	751173	Limondale Investments Pty Ltd (ABN 56 623 320 052)	
2	1017111	Limondale Investments Pty Ltd (ABN 56 623 320 052)	
1, 2	1190069	Limondale Investments Pty Ltd (ABN 56 623 320 052)	
7306, 7307	1158277	Crown Lands travelling stock reserve	Site access road
7301	1157986		
48	1015985	TransGrid substation	Connection infrastructure to TransGrid substation

1. As noted in **Section 2.2.2** Lot 12 DP751179 has been approved to be subdivided into two separate lots under SSD 8025 MOD 1. Further information regarding this matter is provided in **Section 2.3.1** below.

Site access to the Project is via a new intersection with Yanga Way, connecting to an existing access track to the site. A new intersection has been constructed approximately 150 m south of the intersection of Balranald Road and Yanga Way and a short section of new access road has been constructed from the new intersection to the existing access track. Consistent with existing construction activities, the Modification will utilise the new intersection and access roads.

A locality plan is provided in **Figure A-2** and a site layout plan is provided in **Figure A-3**. Property access, ownership and lot boundaries are then presented in **Figure A-4** below. Land zoning is presented in **Figure A-5**.



Legend

- Project Boundary
- Major Road
- NPWS Reserve
- LGA Boundary
- State Forest
- Watercourse
- 220kV Transmission Line

Data Sources:
Base Data : DCDB & DTDB NSW
Imagery : P1A Satellite Imagery (30 Jan 2021)
Layout : 22_04_2021_LIM- SITE Battery storage DC&AC_LAYOUT.dwg

Locality Plan

A.2

Drawing No:	0591786m_LIMSFG_G004_R3.mxd	**Limondale Solar Farm - BESS**
Date:	04/03/2022	Drawing Size: A4
Drawn By:	KV/CB	Reviewed By: CT
Client:	RWE Renewables Australia	

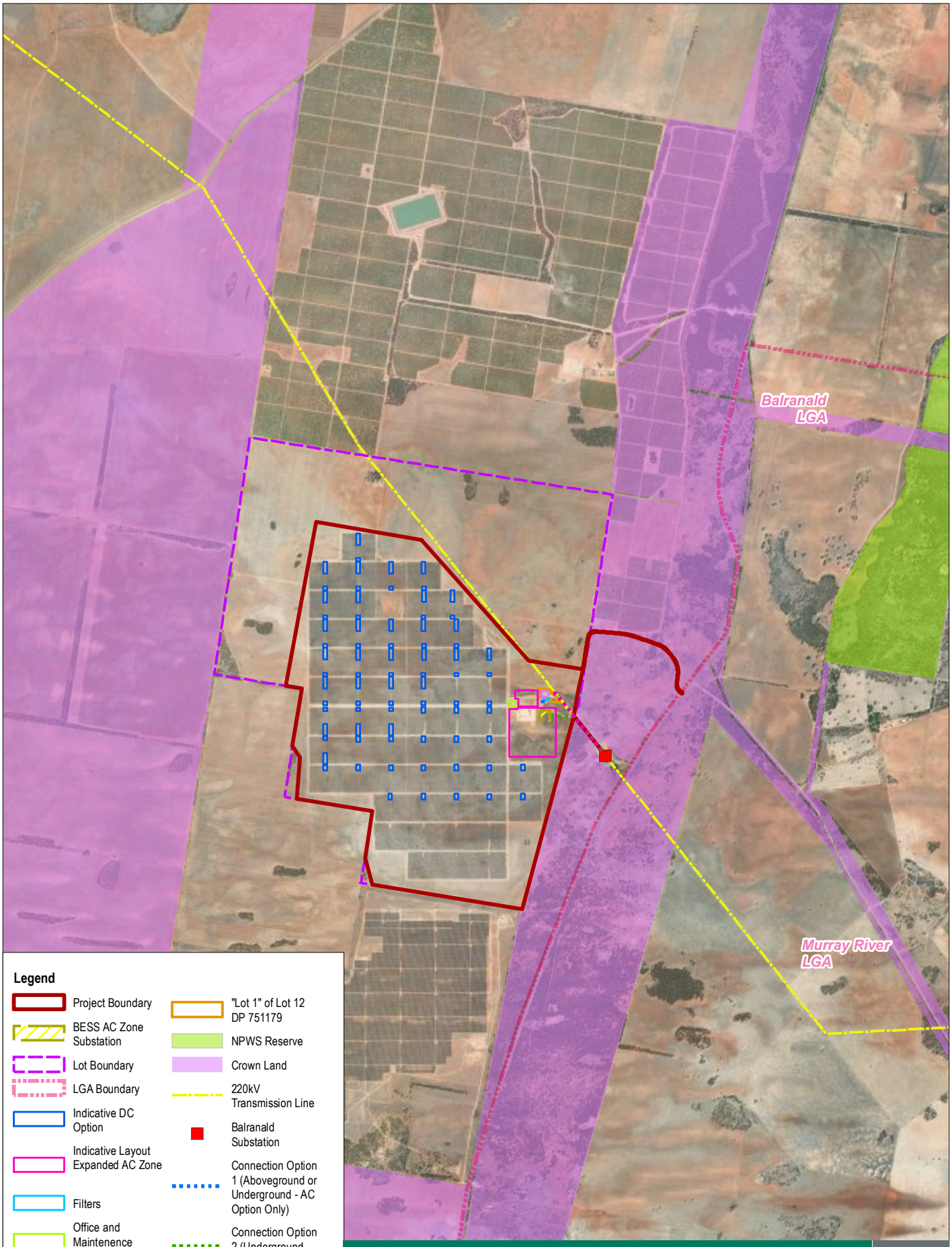
Coordinate System: GDA 1994 MGA Zone 54

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This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.

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Legend

- Project Boundary
- BESS AC Zone Substation
- Lot Boundary
- LGA Boundary
- Indicative DC Option
- Indicative Layout Expanded AC Zone
- Filters
- Office and Maintenence Compound
- Switch Yard
- "Lot 1" of Lot 12 DP 751179
- NPWS Reserve
- Crown Land
- 220kV Transmission Line
- Balranald Substation
- Connection Option 1 (Aboveground or Underground - AC Option Only)
- Connection Option 2 (Underground - AC Option Only)
- Original Approved Underground Connection

Data Sources:
Base Data : DCDB & DTDB NSW
Imagery : P1A Satellite Imagery (30 Jan 2021)
Layout : 29_06_2021_LIM- SITE Battery storage DC&AC_LAYOUT.dwg

Site Layout Plan

A.3

Drawing No:	0591786m_LIMSFG_G005_R6.mxd	**Limondale Solar Farm - BESS**
Date:	04/03/2022	Drawing Size: A4
Drawn By:	KV / CB	Reviewed By: CT
Client:	RWE Renewables Australia	

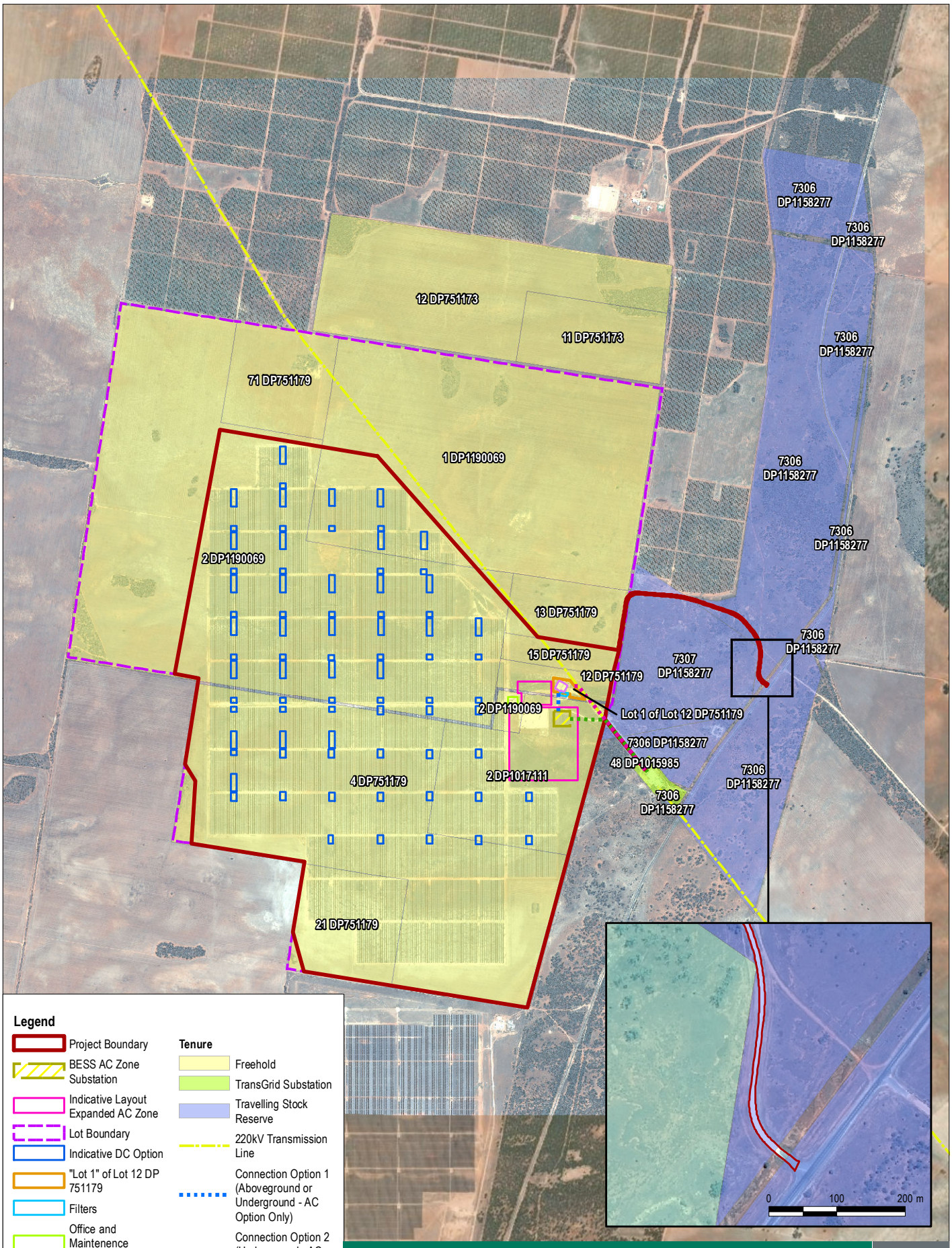
Coordinate System: GDA 1994 MGA Zone 54

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This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.

ERM



Legend

- Project Boundary
- BESS AC Zone Substation
- Indicative Layout Expanded AC Zone
- Lot Boundary
- Indicative DC Option
- "Lot 1" of Lot 12 DP 751179
- Filters
- Office and Maintenence Compound
- Switch Yard

Tenure

- Freehold
- TransGrid Substation
- Travelling Stock Reserve
- 220kV Transmission Line
- Connection Option 1 (Aboveground or Underground - AC Option Only)
- Connection Option 2 (Underground - AC Option Only)
- Original Approved Underground Connection

Data Sources:
Base Data : DCDB & DTDB NSW
Imagery : P1A Satellite Imagery (30 Jan 2021)
Layout : 29_06_2021_LIM- SITE Battery storage DC&AC_LAYOUT.dwg

Property Access, Owndership and Lot Boundaries

A.4

Drawing No:	0591786m_LIMSFG_G006_R5.mxd	Limondale Solar Farm - BESS
Date:	04/03/2022	Drawing Size: A4
Drawn By:	KV/CB	Reviewed By: CT
Client:	RWE Renewables Australia	

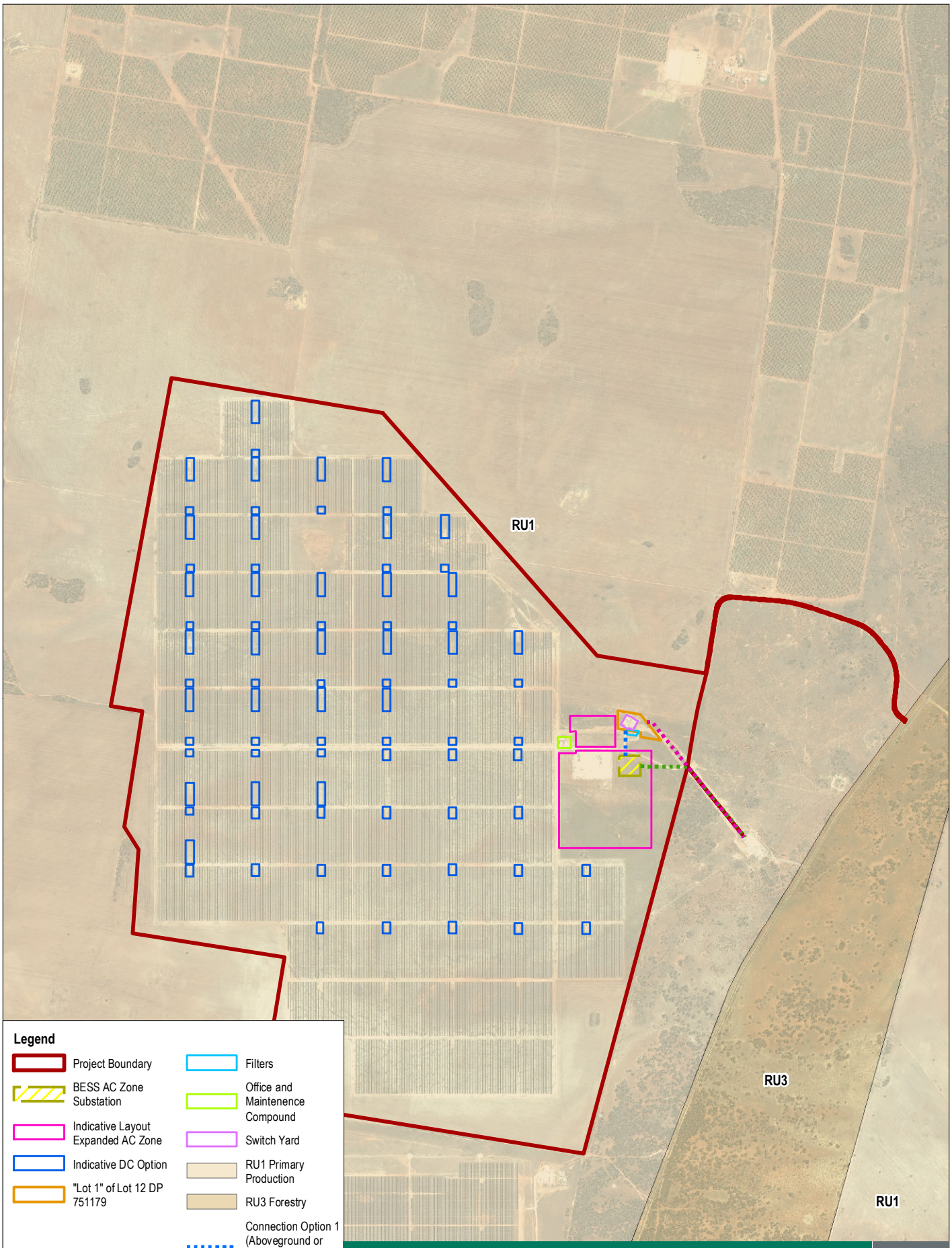
Coordinate System: GDA 1994 MGA Zone 54

0 0.5 1 km

N

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ERM



Legend

- Project Boundary
- BESS AC Zone Substation
- Indicative Layout Expanded AC Zone
- Indicative DC Option
- "Lot 1" of Lot 12 DP 751179
- Filters
- Office and Maintenence Compound
- Switch Yard
- RU1 Primary Production
- RU3 Forestry
- Connection Option 1 (Aboveground or Underground - AC Option Only)
- Connection Option 2 (Underground - AC Option Only)
- Original Approved Underground Connection

Data Sources:
Land Zoning : EPI NSW
Imagery : P1A Satellite Imagery (30 Jan 2021)
Layout : 29_06_2021_LIM- SITE Battery storage DC&AC_LAYOUT.dwg

Land Zoning

A.5

Drawing No:	0591786m_LIMSFG_G003_R5.mxd	**Limondale Solar Farm - BESS**
Date:	04/03/2022	Drawing Size: A4
Drawn By:	KV/CB	Reviewed By: CT
Client:	RWE Renewables Australia	

Coordinate System: GDA 1994 MGA Zone 54

0 500 1,000m

N

This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.

ERM

A.3 Modification Components and Features

A.3.1 Lithium-ion BESS

At the time this modification report was prepared (March 2022), the Contemporary Amperex Technology Co., Limited (CATL) 20 ft BESS container was the preferred Li-ion option for the proposed Modification (subject to detailed design). It has been referenced herein to inform all relevant Li-ion BESS-related aspects and assessments within this modification report.

CATL is considered a global leader in the development and manufacturing of BESS. Their energy storage systems provide energy storage and output management in power generation with battery technology and renewable energy power generation technology forming a joint system. Based on information provided by CATL, the following would be enabled with the implementation of its BESS:

- Power generation to restore a stable power grid;
- Optimize the power output curve;
- Reduce solar curtailment;
- Provide system inertia and the functions of frequency and peak modulation;
- Increase the proportion of renewable energy in total power generation; and
- Optimize the energy structure.

CATL's BESS provides smart load management for power transmission and distribution, and also has the function to accommodate future capacity increases/expansion, as well as backup power supply. It can adopt more renewable energy in power transmission and distribution in order to ensure the safe, stable, efficient and low-cost operation of the power grid. A concept representation of the CATL 20 ft BESS container is shown in **Figure A-6** below, and an example of an existing Li-ion BESS is shown further below in **Figure A-7** .

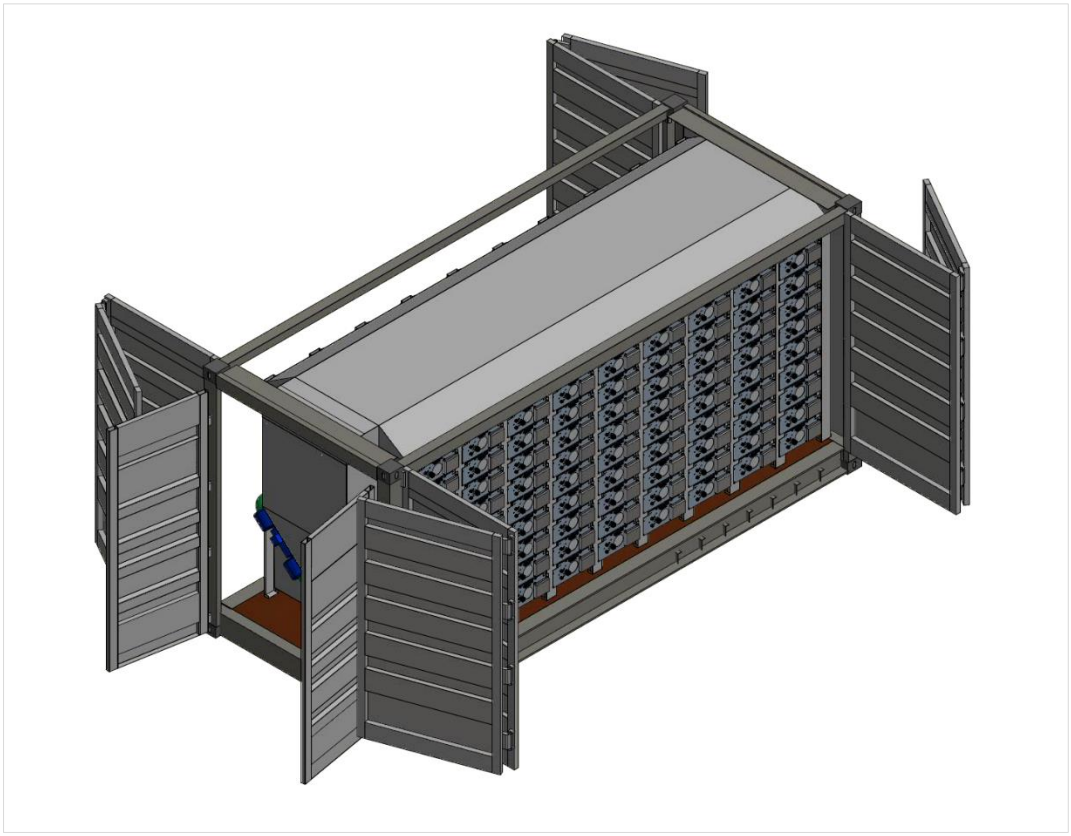


Figure A-6 CATL 20 foot Li-ion BESS Container



Figure A-7 Li-ion BESS Example

A.3.2 Flow BESS

At the time this modification report was prepared (March 2022), the ESS, Inc. (ESS) Energy Centre™ was the preferred Flow BESS option for the proposed Modification (subject to detailed design). It has been referenced herein to inform all relevant Flow BESS-related aspects and assessments within this modification report.

ESS designs, builds and deploys environmentally sustainable, low-cost, iron flow batteries for long-duration commercial and utility-scale energy storage applications requiring flexible energy capacity. The ESS Energy Centre uses earth-abundant iron, salt, and water for the electrolyte storage tanks, resulting in a long-life, environmentally conscious energy storage solution for renewable energy infrastructure. Based on information provided by ESS, the following would be enabled with the implementation of the Energy Centre:

- Time-shifting renewable energy use;
- Ancillary grid services;
- Smoothing the intermittency of renewables; and
- Support in servicing current and future capacity demands.

ESS's Flow BESS also has the function to accommodate future capacity increases/expansion by adding additional electrolyte to the system to increase energy capacity and discharge duration. A concept representation of the ESS Iron Flow Energy Centre BESS is shown in **Figure A-8** .



Figure A-8 ESS Iron Flow Energy Centre (Concept Design)

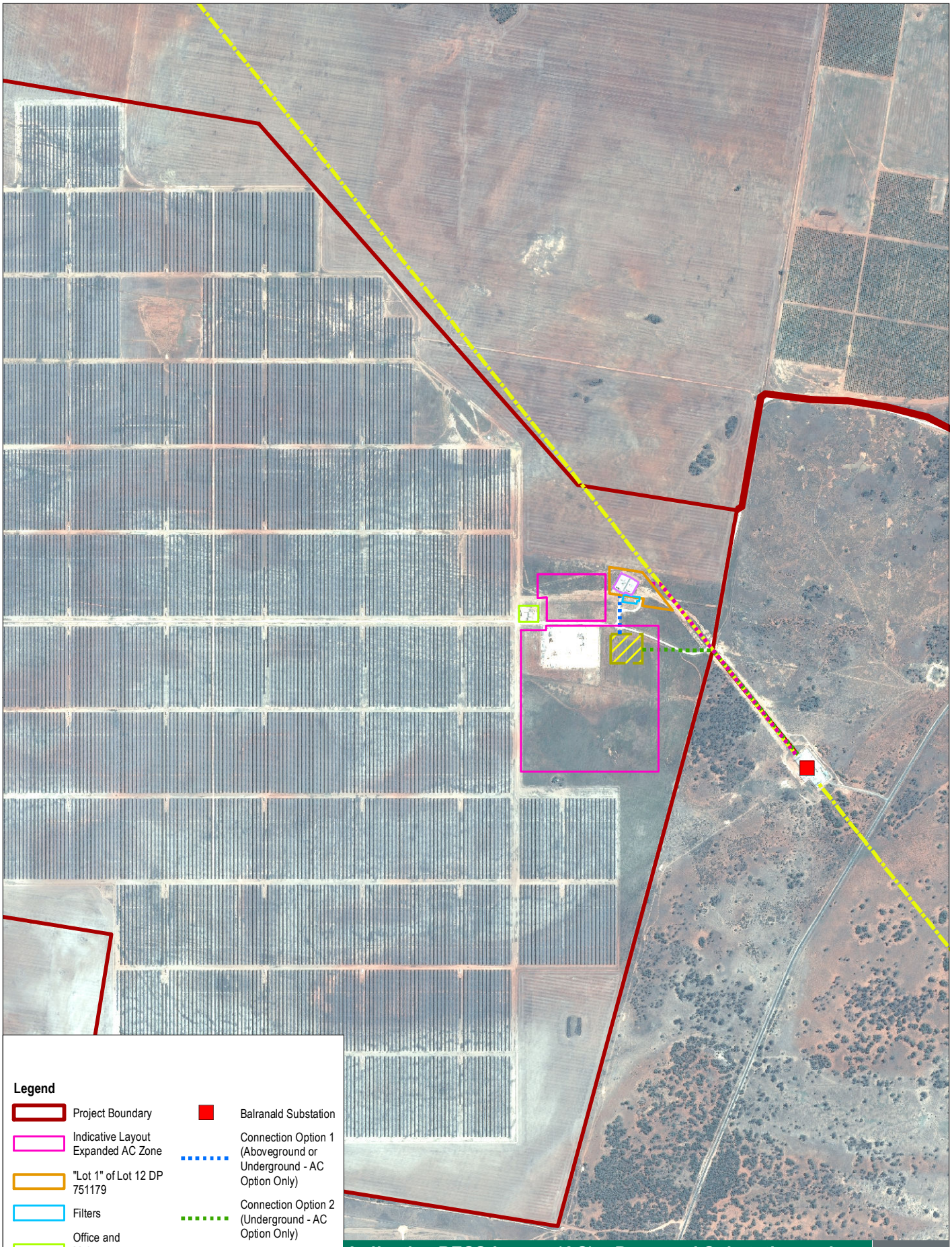
Further information regarding the Modification components and their features, for both the AC-coupled and DC-coupled options are provided in **Table A-2**. The indicative project layout for both design options are then shown in **Figure A-9** and **Figure A-10** below.

As noted in **Chapter 1** of this modification report, either AC-coupled BESS option would be located within the 'AC-coupled zone' that is situated near the approved construction site facility and storage area, adjacent to the solar farm access. The AC-coupled zone may also include a new substation and connection options to either the on-site Limondale substation or the Balranald Substation (or an alternate future connection option), as discussed in **Section A.1.2** above. The need for the additional substation, along with its anticipated size and location within the AC-coupled zone are indicative at this stage, and would be determined during final Project design. This AC-coupled zone in shown in **Figure A-9**.

At this stage a fixed location for the AC-coupled layout is being evaluated by LSF and would be selected subject to detailed design and consideration of commercial and operational factors. Regardless of its position within the identified zone, the AC-coupled BESS components and features described in this modification report would be the same i.e., there would be minimal additional equipment required for any specific position within the zone, except for electrical cabling in some cases.

Table A-2 Modification Components and Features (AC-coupled and DC-coupled Options)

Feature	AC-coupled Flow	AC-coupled BESS	DC-coupled BESS	Comment
Capacity	Up to 200MW/800MWh AC-coupled system	Up to 200MW/800MWh AC-coupled system	Up to 200MW/800MWh DC-DC system	Subject to final design
Total Installed Capacity	799.2 MWh	1,185 MWh	969.02 MWh	Subject to final design
Annual generation storage capacity	292 GWh	292 GWh	292 GWh	Subject to final design
BESS Containers / Energy Centres	48	360	260	CATL 20 ft. 10 strings per container, 8 modules per string, and 52 cells per module.
BESS HVAC unit	48	360	260	HVACs – these will be used as part of the BESS to maintain the batteries at a temperature that will optimise their lifetime and performance.
BESS Transformers	96	90	0	Typically LV to MV transformers and MV to HV transformers, situated with each BESS container.
AC Inverters	96	90	0	Designed specifically for solar farm and battery storage needs they convert DC to AC. The inverter/transformer nominal power is 4600 KVA per unit. Subject to final design and choice of inverter OEM.
DC-DC Converters	0	0	438	Designed specifically for solar farm and battery storage needs they convert DC from one voltage to another.
Underground cabling and grid connection	-	-	-	Grid connection will occur via TransGrid assets as described in **Section 0** below.
Site access and access tracks	-	-	-	As per the approved Project and entirely within the existing project footprint.
Fire protection system	To be designed	To be designed	To be designed	Key project areas i.e., BESS, switch-room structures and large buildings will have fire protection system installed. These are commonly an active gas based system with thermal sensors and smoke/gas detectors, however design of this asset is yet to occur. Design will occur and adhere to relevant standards applicable to the system. Recommendations to this affect are provided within the PHA.



Legend

- Project Boundary
- Indicative Layout Expanded AC Zone
- "Lot 1" of Lot 12 DP 751179
- Filters
- Office and Maintenence Compound
- Switch Yard
- Balranald Substation
- Connection Option 1 (Aboveground or Underground - AC Option Only)
- Connection Option 2 (Underground - AC Option Only)
- Original Approved Underground Connection
- BESS AC Zone Substation

Data Sources:
Imagery : P1A Satellite Imagery (30 Jan 2021)
Layout : 29_06_2021_LIM- SITE Battery storage DC&AC_LAYOUT.dwg

Indicative BESS Layout (AC) – Proposed Substation and Connection

A.9

Drawing No:	0591786m_LIMSFG_G007_R5.mxd	**Limondale Solar Farm - BESS**
Date:	04/03/2022	Drawing Size: A4
Drawn By:	KV/CB	Reviewed By: CT
Client:	RWE Renewables Australia	

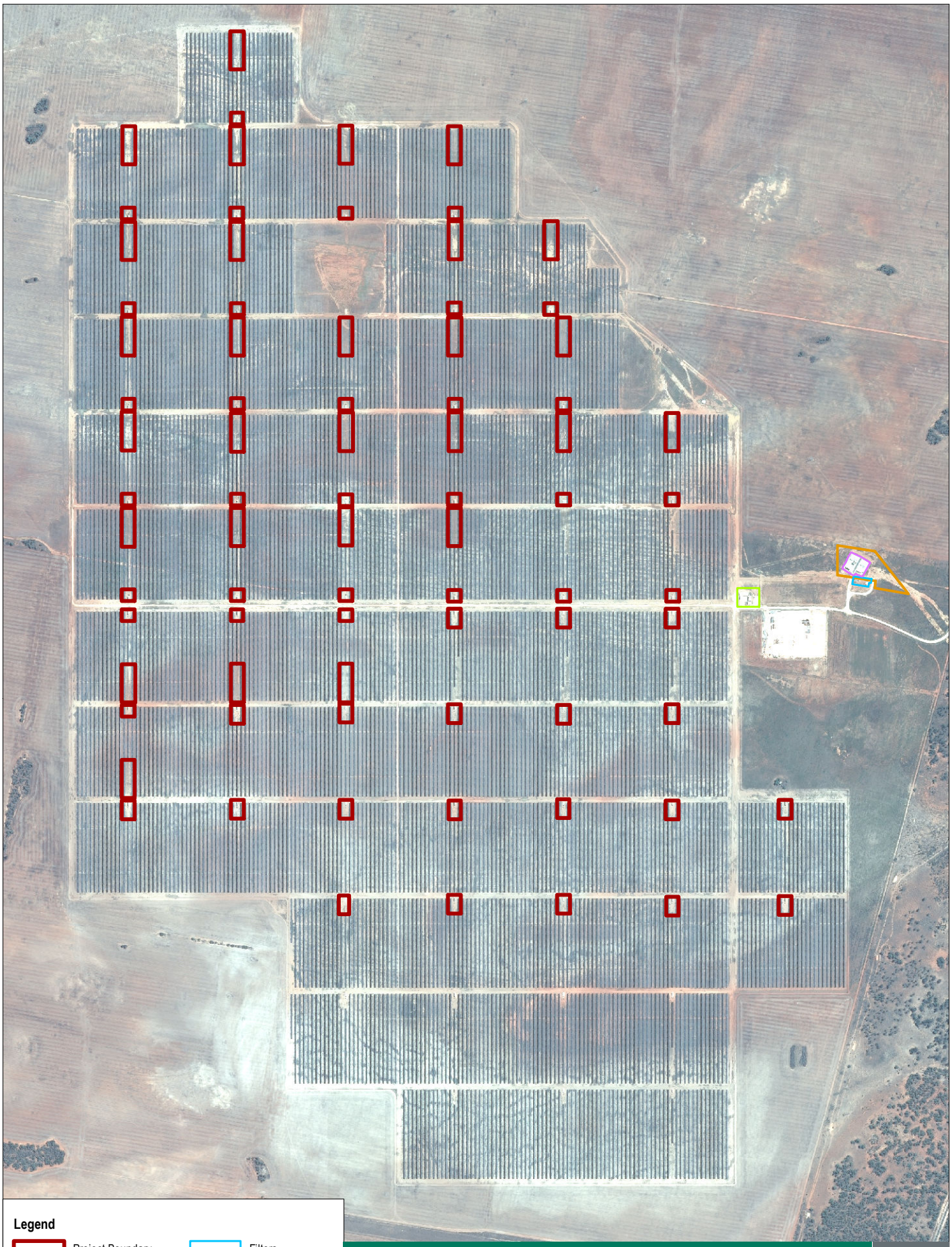
Coordinate System: GDA 1994 MGA Zone 54

0 250 500m

N

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ERM



Legend

- Project Boundary
- Indicative DC Option
- "Lot 1" of Lot 12 DP 751179
- Filters
- Office and Maintenence Compound
- Switch Yard

Data Sources:
Imagery : P1A Satellite Imagery (30 Jan 2021)
Layout : 29_06_2021_LIM- SITE Battery storage DC&AC_LAYOUT.dwg

Indicative BESS Layout (DC)

A.10

Drawing No:	0591786m_LIMSFG_G002_R4.mxd	
Date:	04/03/2022	Drawing Size: A4
Drawn By:	KV	Reviewed By: CT

Coordinate System: GDA 1994 MGA Zone 54

0 250 500m

N

Limondale Solar Farm - BESS

Client: RWE Renewables Australia

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A.3.3TransGrid Infrastructure and Assets

The AC-coupled BESS options would be connected to the NEM via an underground high voltage cable connection at two potential locations, either (1) via "proposed Lot 1" in subdivision of Lot 12 DP 751179 that was previously approved to be subdivided under SSD 8025 MOD 1, or (2) directly to the Balranald Substation. The DC-coupled BESS option would not require any connection changes, and would utilise existing cabling to connect to the NEM as the Limondale Solar Fam is currently connected.

If either AC-coupled BESS option is selected as the preferred option during detailed Project design, a third connection option may be required, which may involve the development of a new substation within the AC BESS 'Zone' outlined in **Figure A-9** below. The new substation would then connect via underground high voltage cables to either "proposed Lot 1" in subdivision of Lot 12 DP 751179, or directly to the Balranald Substation (or a future connection option, if required).

"Proposed Lot 1" (approximately two ha) would accommodate the TransGrid owned infrastructure with the remaining 17.8 ha comprising the residual land of Lot 12 DP 751179 after subdivision. "Proposed Lot 1" would comprise the TransGrid owned components of the approved onsite substation / switchyard that includes:

- Ancillary connection equipment;
- Transformers;
- Connecting transmission lines;
- Maintenance building;
- Staff amenities;
- Associated switchgear;
- Control and telecommunications equipment;
- Security fence; and
- Access track and gravel areas.

The subdivision and TransGrid infrastructure arrangements are unchanged due to this Modification; however, two underground cable network alignments have been identified and form part of the Modification. As part of the BESS connection, some alterations to TransGrid's onsite substation / switchyard would be required such as the construction of a new switchbay, cable connections and other ancillary works.

Connection from the TransGrid infrastructure or Balranald Substation to the existing 220 kV transmission line would occur via the abovementioned "connecting transmission lines" within "proposed Lot 1". These are unchanged with this Modification and would occur and as per the original project approvals and technical specification established by TransGrid.

A.4 Construction

At the time this modification report was prepared (March 2022), construction of the approved solar farm is near completion. Although a detailed construction methodology and schedule is yet to be established, BESS-related works, if approved, would occur after the end of the solar farm construction schedule. This timing has occurred simply by virtue of the previous approvals i.e., approved works are largely complete and presents a benefit to the Project and surrounding community with key construction impacts. For example, traffic and noise impacts will be minimised due to the reduced interaction of concurrent works and transportation.

The BESS-related construction activities are estimated to take 15 months to reach completion, and will require up to 40 people on the site per day, per eight-hour shift. The works will include:

- Site establishment and preparation for BESS equipment items situated entirely within the existing approved development footprint;
- Construction of concrete pads for the BESS equipment to be situated. This construction aspect would vary for the decentralised DC and centralised AC options, but all works would occur entirely within the existing approved development footprint;
- Transportation of:
  - BESS modules to site via heavy vehicles. With 20 ft (~6 m) containers currently being the preferred option, a single truck will carry two battery modules, equivalent to a 40 ft container (13 m load);
  - Additional AC inverters or DC-DC Converters to site via heavy vehicle;
  - Materials, such as concrete, soil, Glycol water mix for cooling systems via ridged heavy vehicles and/or truck and dogs;
  - Mobile plant equipment (e.g., crane, forklift, excavator) via rigid trucks and/or semi-trailers; and
- Light vehicles (workforce and miscellaneous) accessing the Project, and water trucks being used across the site for dust suppression.

A.4.1 Approved Construction Hours

All construction works associated with the Modification would occur during the approved extended hours for construction. This approval was documented in the DPIE approval letter dated 19 October 2018, which outlined the following hours:

- Monday to Friday, 6 am to 6 pm; and
- Saturdays 6 am to 6 pm.

The approved extension to standard construction hours also allowed for works on Sundays and public holidays. The DPIE approval letter dated 19 October 2018 does not specify time periods for works on Sundays and public holidays, however the 6 am to 6 pm time period was requested when the approval was sought and the Modification works may occur on these days between 6 am and 6 pm, should they be required.

A.5 Operations and Maintenance

Following construction of the Modification (either AC-coupled or DC-coupled options), the Modification will move into the operations and maintenance phase.

The Modification would be operated during daylight hours in line with the proposed solar farm operations, and operated remotely during night time hours with the exception of ad-hoc emergency maintenance activities (as required) to ensure the safe and effective operation of the Modification. The inclusion of infrequent night works and ad-hoc emergency maintenance would result in a negligible increase in traffic generation associated with the operation and maintenance of the proposed Modification (both AC-coupled and DC-coupled options), as discussed in **Section A.3** below. Negligible traffic generation will also result in a negligible increase in noise, and as such additional operation noise assessment of emergency traffic is not warranted to accompany this modification report.

The operation and maintenance of the Modification would create a range of direct and indirect employment opportunities. It is expected that up to 20 FTE operational jobs would be generated across the Modification and proposed operational workforce required to operate the wider solar farm Project.

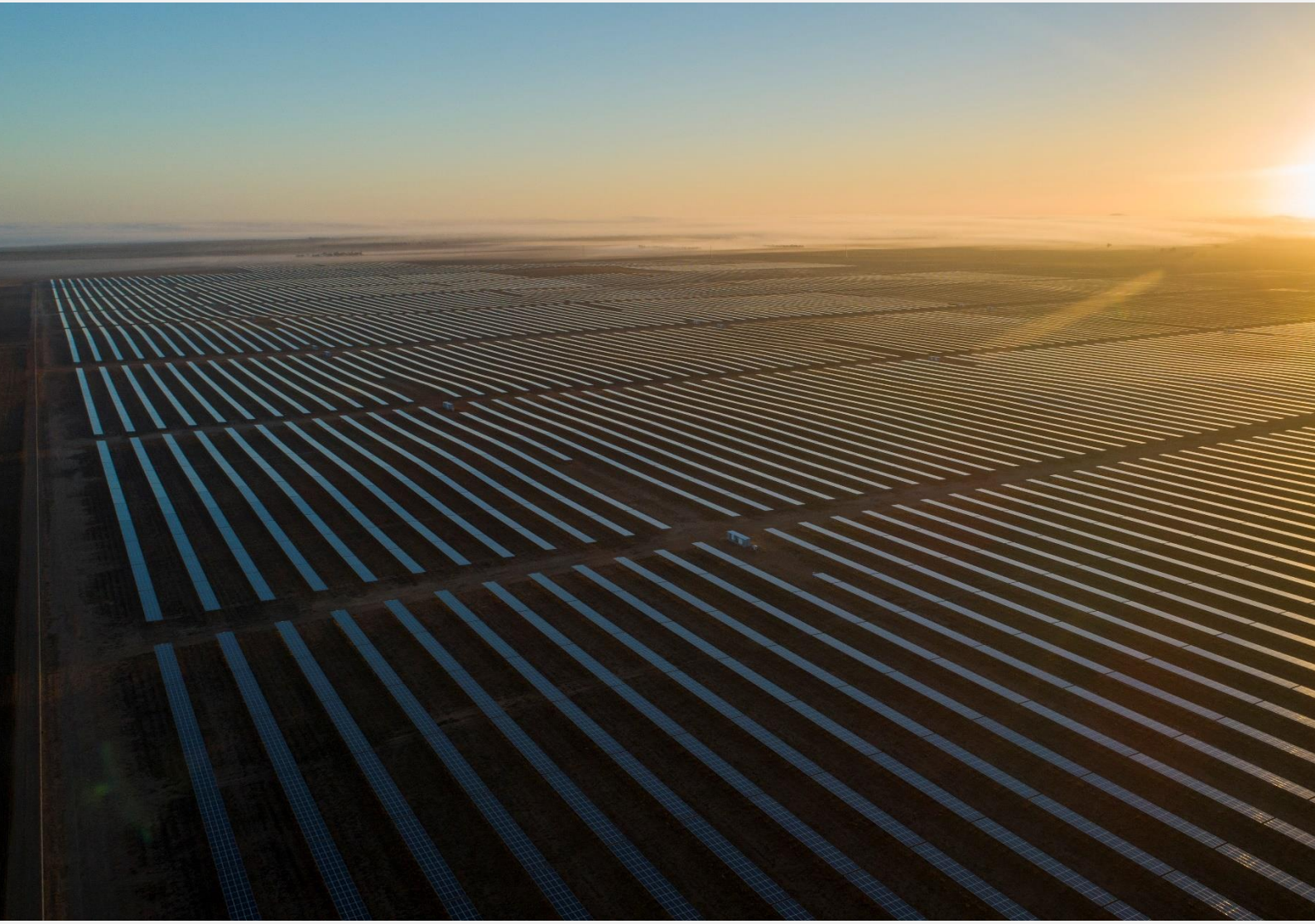
A.6 Decommissioning

Decommissioning of the proposed BESS would occur as part of the broader Project decommissioning works.

The Project will be guided by a decommissioning and rehabilitation plan such that once it reaches the end of its investment and operational life, Project infrastructure will be decommissioned. The Project site will be returned to its pre-existing land use, or other land use (e.g., agricultural production) in consultation with the landholder, as far as practicable.

In accordance with Schedule 3, Condition 29, within 18 months of the cessation of operations (unless the Secretary agrees otherwise), the Project Area shall be rehabilitated to the satisfaction of the Secretary. The Project's commitments to decommissioning, including the implementation of management and mitigation measures would be extended to include all aspects of the Modification.

APPENDIX B UPDATED MITIGATIONS AND MANAGEMENT MEASURES



Limondale Solar Farm

APPENDIX B – Modification Report Mitigation and Management Measures

11 February 2022

Prepared for
Limondale Sun Farm Pty Ltd

Project No.: 0591786

The business of sustainability

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Document details	
Document title	Limondale Solar Farm
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Project No.	0591786
Date	11 February 2022
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Author	Thomas Buchan, Murray Curtis
Client Name	Limondale Sun Farm Pty Ltd

Document history

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				Name	Date	Comments
Draft	00	Thomas Buchan	Mark Davey	Mark Davey	11/02/2022	

Signature Page

11 February 2022

Limondale Solar Farm

APPENDIX B – Modification Report
Mitigation and Management Measures



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UPDATED MITIGATION AND MANAGEMENT MEASURES

Environmental Aspect	Mitigation Measure
Original Project Approval (SSD 8025) (EMM, 2017)	
Biodiversity	■ disturbance will be restricted to the development footprint identified impacting a total of 5.32 ha of native vegetation; ■ installation of appropriate exclusion fencing around trees and vegetation to be retained in, or directly adjacent to, the development footprint; ■ all material stockpiles, vehicle parking and machinery storage will be within cleared areas or areas proposed for clearing, and not in areas of retained native vegetation; ■ a licensed wildlife salvage team will be on-site during vegetation removal to catch and relocate (if appropriate) any wildlife encountered in vegetation or hollow-bearing trees; ■ where practical, all scattered hollow-bearing trees to be removed will be placed in areas of retained vegetation to provide additional fauna habitat; ■ where appropriate native vegetation cleared from the development footprint will be mulched for reuse on the site, to stabilise bare ground; ■ dust suppression measures will be implemented during construction; ■ implementation of temporary stormwater controls during construction will be considered if necessary to ensure that runoff is consistent with existing conditions; ■ an erosion and sediment control plan in accordance with Managing Urban Stormwater: Soils & Construction (Landcom 2004) will be prepared in consultation with BSC and will be implemented and monitored during the life of the project to minimise impacts; and ■ impacts to native vegetation will require retirement of 158 biodiversity credits.
Aboriginal Heritage	■ Limondale 1, 9 and 11 will be salvaged prior to construction; ■ further assessment of AHIMS sites 47-6-0605 and 47-6-0606 within the transmission line corridor will be completed prior to construction, in the form of sub-surface testing; ■ consultation with the RAPs will continue in regards to the management of Aboriginal cultural heritage sites within the site boundary throughout the life of the project in keeping with the Aboriginal cultural heritage consultation requirements for proponents 2010 (DECCW 2010); ■ should any unanticipated Aboriginal objects be encountered during works associated with this project, works will cease in the vicinity and the find will not be moved until assessed by a qualified archaeologist; ■ should unanticipated relics be discovered during the course of the project, work in the vicinity will cease and an archaeologist will be contacted to make a preliminary assessment of the find. The Heritage Council will be notified if the find is assessed as a relic; and ■ if any suspected human remains are discovered during any activity the following will occur: ▪ all work will immediately cease at that location and remains will not be further moved or disturbed; ▪ the NSW Police and OEH's Environmental Line (131 555) will be notified of the details of the remains and their location as soon as practicable;

Environmental Aspect	Mitigation Measure
Original Project Approval (SSD 8025) (EMM, 2017)	
	▪ work will not recommence at that location unless authorised in writing by OEH; and ▪ if the human remains are likely to be Aboriginal in origin, the find will be reported to the RAPs and OEH. If the find is likely to be non-Aboriginal in origin and more than 100 years in age, the Heritage Council of NSW will be notified of the find under s.146 of the *Heritage Act 1977*.
Historic Heritage	■ an unexpected finds protocol will be followed if unexpected historical archaeology is discovered during construction of the project; and ■ if unexpected historical archaeology is discovered during construction, work in the immediate area will cease and an archaeologist will be contacted to make a preliminary assessment of the find. If it is determined to be a relic under the *Heritage Act 1977*, further investigation may be required and the Heritage Council may need to be notified.
Land	■ a site access protocol will be developed that lists the relevant landholder contact details and includes measures to minimise adverse impacts, such as, driving carefully to minimise disturbance to livestock, crops and pastures; ■ the timing of construction and the location/design of temporary access routes (Figure 3.1 of the EIS) will be positioned to minimise impacts on neighbouring agricultural operations; ■ access tracks to and from the site will remain accessible to the landholder to avoid any impacts to the operation and sustainability of neighbouring agricultural businesses; ■ soil resources will be managed to ensure the future viability of the site for agricultural production, including: ▪ optimisation and recovery of useable topsoil and subsoil; ▪ establishment of effective soil amelioration procedures; and ▪ separate storage of topsoil and subsoil to ensure that soil is replaced in the right order and to avoid unnecessary impacts on soil and existing vegetation structure; ■ an erosion and sediment control plan in accordance with Managing Urban Stormwater: Soils & Construction (Landcom 2004) will be prepared in consultation with BSC and will be implemented and monitored during the life of the project to minimise impacts; ■ the EMP will include weed management protocols and will consider BSC's Noxious Weeds Policy (BSC 2005). Weed management protocols will include measures for the identification, management and ongoing monitoring of weeds on the site; ■ the EMP will include a spill response plan which will be implemented during construction and throughout the project's operational stage to avoid potential for contamination; ■ vehicle movements will be restricted to the formed access tracks; ■ during decommissioning, all above ground facilities will be removed from the site; ■ during decommissioning underground electrical collection systems will be left in situ in order to avoid unnecessary ground disturbance; and ■ a site decommissioning plan will be prepared following the completion of project construction and commissioning and will feature rehabilitation objectives and strategies for returning the site to agricultural production

Environmental Aspect	Mitigation Measure
Original Project Approval (SSD 8025) (EMM, 2017)	
Visual	■ suitable colours will be chosen for project infrastructure to minimise visual impacts; ■ buildings and materials will be designed to be consistent with the local farming landscape and will be similar to existing farm buildings located in the surrounding area; ■ all night lighting will be motion activated and comply with Australian Standard AS4282 (INT) 1997 – Control of Obtrusive Effects of Outdoor Lighting; and ■ the panel designs considered for the project, feature anti-reflective surface treatment.
Noise and Vibration	No mitigation measures proposed.
Traffic and Transport	■ a new intersection is proposed for site access, approximately 150 m south of the intersection between Yanga Way and Balranald Road; ■ OVERLAND will be required to lodge a Section 138 Certificate (Work on Public Lands) for RMS approval prior to road work for the site access intersection construction; and ■ an EMP will be prepared for the construction of the proposed site access intersection.
Water	■ project infrastructure will be positioned to minimise the potential obstruction of the surface water flows and stormwater runoff to minimise the possibility of surface water flooding within the development footprint; ■ an erosion and sediment control plan in accordance with Managing Urban Stormwater: Soils & Construction (Landcom 2004) will be prepared in consultation with BSC and will be implemented and monitored during the life of the project to minimise impacts. This plan will include provisions to: ▪ install erosion and sediment controls (if required) prior to and during construction; ▪ regularly inspect erosion and sediment controls, particularly following large rainfall/wind events; ▪ ensure that all vehicles, plant and equipment leaves the site in a clean condition to avoid tracking of sediment on Yanga Way; ▪ during excavation, separate topsoils and subsoils to ensure that they are replaced in their natural configuration; ▪ stockpile topsoil appropriately to minimise weed infestation and maintain soil organic matter, soil structure and microbial activity; and ▪ minimise the total area of disturbance from excavation and compaction.
Hazards	■ all project infrastructure will be designed in accordance with relevant industry standards; ■ all relevant procedures in relation to a high voltage installation will be adhered to throughout the life of the project; ■ APZs will be provided and managed to enable fire fighting vehicle access and to distance vulnerable structures from vegetation which represents a fire hazard; and ■ the risk of the project initiating a bushfire will be minimised through the implementation of appropriate management measures.
Air Quality	■ use of a water truck(s) during construction for dust suppression along internal, unsealed access roads and disturbed areas; ■ vehicle movements will be minimised where possible;

Environmental Aspect	Mitigation Measure
Original Project Approval (SSD 8025) (EMM, 2017)	
	■ all vehicles, plant and equipment will be cleaned and washed regularly; ■ all vehicles, plant and equipment will be switched off when not in continuous use; ■ all vehicles, plant and equipment will be regularly inspected and maintained to ensure that they are operating efficiently; ■ regular maintenance of unsealed access roads will be undertaken to minimise wheel generated dust; ■ a 50 m section from the site access road to the intersection of Yanga Way will be sealed to prevent the transport of soil and dust to the surrounding road network; and ■ dust suppression requirements during construction will take into consideration weather and the likelihood of extended dry periods which could exacerbate impacts
Socio Economic	■ a preference for local employment wherever possible; ■ a preference for use of local businesses such as motels, motor inns, restaurants and service providers wherever possible; ■ consideration of demand on local short-term accommodation demand and potential conflicts with the region's major festivals and annual events; and ■ provision of information to the community about the timing of project construction period and need for employees and services from local business and services.
Cumulative	■ to avoid and minimise cumulative impacts, OVERLAND will consult with Sunraysia Solar Farm Two Pty Ltd and goFARM regarding the proposed construction schedule for the Sunraysia Solar Farm and goFARM's expanded agricultural operations and temporary accommodation camp, respectively; and ■ OVERLAND will consult with BSC and local stakeholders to provide information about the timing of the project's peak construction period.
Proposed Mitigation Measures (ERM, 2022)	
Environmental Management Strategy (EMS)	Ongoing monitoring and review of the performance and implementation of the EMS will be undertaken as required. ■ the EMS and supporting plans are will be reviewed and if necessary revised within one month of the submission of an incident report under Schedule 3, Condition 3 or any modification to the development consent. Accordingly, subject to Modification approval, LSF will review and the update the EMS and other strategies and plans prior to construction of the Modification. ■ the EMS will be resubmitted for approval where material changes are required. Stakeholders will be consulted before submission is made, and approval will be obtained before making material changes.
EMS Sub Plans	

Environmental Aspect	Mitigation Measure
Proposed Mitigation Measures (ERM, 2022)	
Biodiversity Management Plan	■ the biodiversity assessment in **Section 6.1** of this modification report concludes that the Modification does not further impact on biodiversity values to those already assessed and approved under SSD 8025 and SD 8025 MOD 1. Biodiversity impacts from the Project have been offset in accordance with the Biodiversity Offset Scheme. ■ a Biodiversity Management Plan (BMP) has been prepared for the Project to satisfy Schedule 3, Condition 11 of the development consent. Subject to Modification approval, the BMP will be reviewed and updated as deemed necessary, and will continue to be applied for the construction of the Modification, and during the operational phase of the wider Project. ■ as committed to in *Section 5.3* of the BMP, an informal monthly report will be supplied to the Office of Environment and Heritage (OEH) during the construction period which will include, but is not limited to any environmental issues encountered and responses implemented to address issues. ■ an annual report will be provided to OEH summarising results of monitoring, identifying opportunities for improvement or recommended changes to the program, and including relevant monitoring data.
Heritage Management Plan	■ the management of Aboriginal Heritage within the development footprint is currently managed under the project HMP (Biosis 2017), which details procedures for chance Aboriginal finds and the procedures for the identification of human remains during works. This plan as well as the area specific CHMP (Biosis 2021) developed in response to the identification of human remains within Blocks 84 and 85 would be adhered to during the Modification. ■ the Project HMP (Biosis 2021) currently provides provision for the identification of unexpected historic heritage items. The Modification would proceed under the management measures of the existing HMP
Traffic Management Plan	■ subject to Modification approval, an internal review of the TMP will be conducted prior to the commencement of construction for the Modification, and every six months thereafter. ■ *Section 1.2.3* of the existing TMP outlines relevant standards, policies and guidelines relating to traffic and access which will be applied during construction. They will also be reviewed for currency and updated as required. ■ where the review process identified material changes to the TMP, relevant stakeholders will be consulted regarding the changes. Approval for the proposed changes will be sought from the relevant stakeholders. The TMP will be resubmitted to DPIE for approval where material changes are required.

Environmental Aspect	Mitigation Measure
Proposed Mitigation Measures (ERM, 2022)	
Soil and Water Management Plan	■ the SWMP has been prepared in accordance with the Project approvals including SSD 8025 and the EIS. The SWMP has been prepared specifically to comply with Schedule 3, Condition 22 and Condition 23. ■ the SWMP provides guidance to site personnel regarding the implementation of the erosion and sediment control and water management measures required during the construction and operations phases of the Project. ■ additional management and mitigation measures are not required beyond those identified in the EIS water assessment prepared to support the development consent, and the SWMP prepared for the Project. ■ it is recommended that the SWMP be reviewed and updated as necessary for the inclusion of BESS (either AC-coupled or DC-coupled option) and associated Project infrastructure. For example, the inclusion of BESS infrastructure should be positioned to minimise the potential obstruction of surface water flows and stormwater runoff, in line with the commitments stated in the EIS water assessment.
Emergency Response Plan	■ an Emergency Response Plan has been prepared to meet the requirements of Schedule 3, Conditions 26 of the SSD 8025. ■ the Emergency Response Plan should be updated to address the specific hazards and mitigation measures identified in the PHA (Arriscar, 2021) (refer **Appendix G** and as captured in **Section 5.8.2**) (e.g. battery overheating, fires, explosions etc.) and ensure emergency response personnel take appropriate precautions to protect themselves from the hazards and escalating events.
Accommodation and Employment Strategy	■ it is anticipated that no new mitigation and management measures are required for the Accommodation and Employment Strategy as a result of the Modification. ■ nonetheless, the strategy will be subject to review, and if necessary, revised within one month of Modification approval.
Decommissioning and Rehabilitation Plan	■ decommissioning of the Modification would occur as part of the broader Project decommissioning, which is guided by a Decommissioning and Rehabilitation Plan. ■ the objectives of the plan are to describe how project infrastructure will be removed after operations cease, and to establish the methodology by which the post-development soil conditions at the Project site are capable of being returned to agricultural activities consistent with the previous use. ■ subject to approval of the Modification, an internal review of the plan will be undertaken prior to commencement of construction, and will be updated as required. ■ the Project site will be returned to its pre-existing land use, or other land use (e.g. agricultural production) in consultation with the landholder, as far as practicable within 18 months of the cessation of operations (unless the Secretary agrees otherwise).

APPENDIX C PMST REPORT

Australian Government

Department of Agriculture, Water and the Environment

EPBC Act Protected Matters Report

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

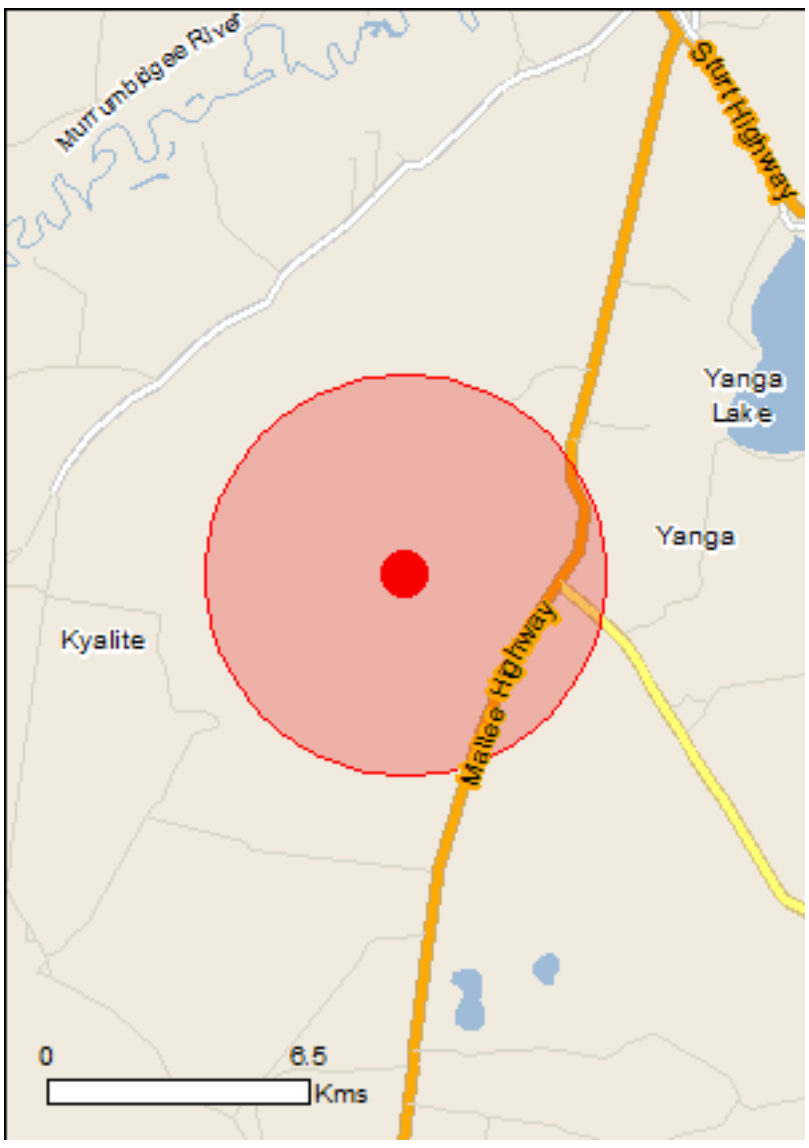
Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

Report created: 09/04/21 16:20:24

Summary
Details
- Matters of NES
- Other Matters Protected by the EPBC Act
- Extra Information

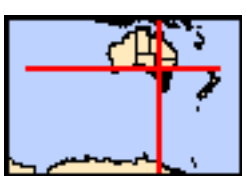
Caveat
Acknowledgements



This map may contain data which are ©Commonwealth of Australia (Geoscience Australia), ©PSMA 2015

Coordinates

Buffer: 5.0Km



Summary

Matters of National Environmental Significance

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

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	4
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	3
Listed Threatened Species:	17
Listed Migratory Species:	9

Other Matters Protected by the EPBC Act

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

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

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

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

Extra Information

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

State and Territory Reserves:	None
Regional Forest Agreements:	None
Invasive Species:	19
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Wetlands of International Importance (Ramsar) [Resource Information]

Name	Proximity
Banrock station wetland complex	200 - 300km upstream
Hattah-kulkyne lakes	50 - 100km upstream
Riverland	200 - 300km upstream
The coorong, and lakes alexandrina and albert wetland	300 - 400km upstream

Listed Threatened Ecological Communities [Resource Information]

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

Name	Status	Type of Presence
Buloke Woodlands of the Riverina and Murray-Darling Depression Bioregions	Endangered	Community may occur within area
Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia	Endangered	Community may occur within area
Weeping Myall Woodlands	Endangered	Community may occur within area

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat likely to occur within area
Grantiella picta Painted Honeyeater [470]	Vulnerable	Species or species habitat likely to occur within area
Leipoa ocellata Malleefowl [934]	Vulnerable	Species or species habitat likely to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pedionomus torquatus Plains-wanderer [906]	Critically Endangered	Species or species habitat may occur within area
Pezoporus occidentalis Night Parrot [59350]	Endangered	Extinct within area
Polytelis anthopeplus monarchoides Regent Parrot (eastern) [59612]	Vulnerable	Species or species

Name	Status	Type of Presence
		habitat likely to occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area
Fish		
Craterocephalus fluviatilis Murray Hardyhead [56791]	Endangered	Species or species habitat likely to occur within area
Galaxias rostratus Flathead Galaxias, Beaked Minnow, Flat-headed Galaxias, Flat-headed Jollytail, Flat-headed Minnow [84745]	Critically Endangered	Species or species habitat may occur within area
Frogs		
Litoria raniformis Growling Grass Frog, Southern Bell Frog, Green and Golden Frog, Warty Swamp Frog, Golden Bell Frog [1828]	Vulnerable	Species or species habitat likely to occur within area
Mammals		
Nyctophilus corbeni Corben's Long-eared Bat, South-eastern Long-eared Bat [83395]	Vulnerable	Species or species habitat likely to occur within area
Plants		
Brachyscome papillosa Mossgiel Daisy [6625]	Vulnerable	Species or species habitat may occur within area
Lepidium monoplocoides Winged Pepper-cress [9190]	Endangered	Species or species habitat likely to occur within area
Swainsona murrayana Slender Darling-pea, Slender Swainson, Murray Swainson-pea [6765]	Vulnerable	Species or species habitat likely to occur within area

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat may occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within

Name	Threatened	Type of Presence
		area
Gallinago hardwickii		
Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Numenius madagascariensis		
Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species		[Resource Information]
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos		
Common Sandpiper [59309]		Species or species habitat may occur within area
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba		
Great Egret, White Egret [59541]		Species or species habitat likely to occur within area
Ardea ibis		
Cattle Egret [59542]		Species or species habitat may occur within area
Calidris acuminata		
Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris ferruginea		
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos		
Pectoral Sandpiper [858]		Species or species habitat may occur within area
Chrysococcyx osculans		
Black-eared Cuckoo [705]		Species or species habitat likely to occur within area
Gallinago hardwickii		
Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Haliaeetus leucogaster		
White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area

Name	Threatened	Type of Presence
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat likely to occur within area

Extra Information

Invasive Species	[Resource Information]

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

Name	Status	Type of Presence
Birds		
Carduelis carduelis European Goldfinch [403]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Turdus merula Common Blackbird, Eurasian Blackbird [596]		Species or species habitat likely to occur within area
Mammals		
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Capra hircus Goat [2]		Species or species habitat likely to occur

Name	Status	Type of Presence within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Lepus capensis Brown Hare [127]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Carrichtera annua Ward's Weed [9511]		Species or species habitat may occur within area
Chrysanthemoides monilifera subsp. monilifera Boneseed [16905]		Species or species habitat likely to occur within area
Lycium ferocissimum African Boxthorn, Boxthorn [19235]		Species or species habitat likely to occur within area
Opuntia spp. Prickly Pears [82753]		Species or species habitat likely to occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area

Caveat

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

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

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

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

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

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

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

- migratory and
- marine

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

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

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

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

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

Coordinates

-34.7666 143.50155

Acknowledgements

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

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

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

Please feel free to provide feedback via the Contact Us page.

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APPENDIX D SCOPING LETTER

ERM

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Iwan Davies
NSW Department of Planning, Industry and Environment (DPIE)
4 Parramatta Square, 12 Darcy St,
PARRAMATTA NSW 2150

iwan.davies@planning.nsw.gov.au

11 May 2021

Reference: 0591786

Dear Iwan,

Subject: Proposed Modification to Limondale Solar Farm (SSD 8025) for Battery Energy Storage System – Scoping Letter

1. INTRODUCTION

Environmental Resources Management Australia Pty Ltd (ERM), on behalf of Limondale Sun Farm Pty Ltd (LSF) provides this Scoping Letter to the Department of Planning, Industry and Environment (DPIE) relating to a proposed modification to the Limondale Solar Farm (SSD 8025).

The Limondale Solar Farm was approved on 31 August 2017, permitting the construction and operation of a 250 megawatt (MWac) solar farm near Balranald, NSW. A modification to SSD 8025 (MOD 1) was approved on the 27 July 2018 associated with the subdivision of a portion of the project site for the TransGrid substation, and an increase in the maximum solar panel height from two metres (m) to four metres.

LSF are now seeking to modify SSD 8025 to enable the installation and operation of a Battery Energy Storage System (BESS), hereafter referred to as 'the Modification'.

This Scoping Letter has been developed to provide DPIE with an overview of the Modification to inform the Scoping Meeting.

1.1 Purpose

The purpose of this Scoping Letter is to provide DPIE with the background to the Modification to SSD 8025 and to seek confirmation from DPIE on:

- the planning pathway for the Modification under Section 4.55 of the Environmental Planning and Assessment Act 1979 (EP&A Act); and
- DPIE assessment, exhibition and consultation requirements associated with the future modification application.

Registered office
Environmental Resources Management Australia Pty Ltd
Level 15, 309 Kent Street
Sydney NSW 2000 Australia

ABN: 12 002 773 248
ACN: 002 773 248

Offices worldwide

A member of the ERM Group

2. BACKGROUND

The approved state significant development (SSD 8025), as modified, includes:

- a network of PV solar panel arrays with an estimated nominal capacity of 250MWac;
- electrical collection systems, switchyard and control room;
- a management hub inclusive of demountable offices, amenities and equipment storage sheds;
- parking and access road; and
- connection infrastructure to the existing TransGrid Balranald substation.

The site of the development is located within a rural area approximately 14 km south of the township of Balranald. Agriculture is the predominate industry in the locality. The closest sensitive receptor is located approximately 2.9 km to the north of the solar farm, with an additional five sensitive receptors approximately 6 km from the site. Yang Way, a State funded main road provides an important transport link between Balranald and the Sturt Highway to the north and is located to the east of the Limondale solar farm.

3. PROPOSED MODIFICATION

The Modification to SSD 8025 includes the construction and operation of an AC or DC battery energy storage system (BESS) within the approved development footprint of the Limondale Sun Farm, up to a capacity of 200MW utilizing a 2 hour system.

The AC connected option will be located adjacent to the existing Sun Farm's Operations & Maintenance facility on a hardstand used during construction. In the case of a DC solution, the BESS will be distributed throughout the Limondale Solar Farm with battery containers, and DC-DC converters located beside existing Medium Voltage Power Stations (MVPS's).

Only one option (ie AC or DC) will proceed to installation and operation, based on design, operational needs and cost considerations.

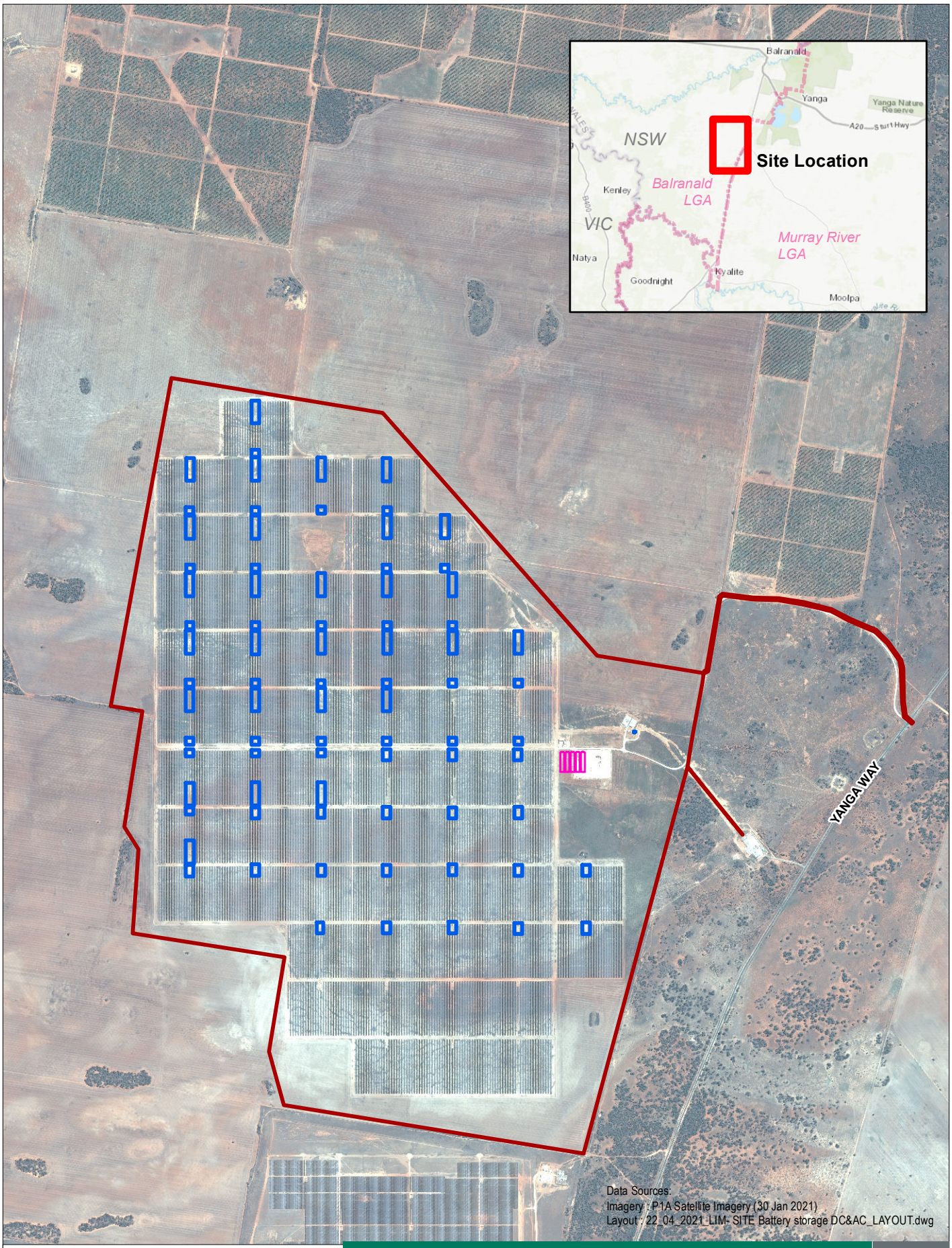
The AC or DC options will be sited within the development footprint of SSD 8025, being the area assessed and approved for impact. Indicative locations of the AC and DC options are detailed Figure 1.

4. JUSTIFICATION

BESS's help maintain reliable and affordable energy supply, especially in times of peak demand and assist in the reduction of the frequency of blackouts and need for load shedding in instances where there is an imbalance.

The Modification provides for increased efficiencies for sustainable power generation through:

- enabling the better management of energy flow from the solar farm to the grid;
- allowing surplus energy generated during peak solar yield periods to be stored rather then lost; and
- improving grid stability by providing frequency control ancillary services (FCAS).



Legend

- Solar Farm Boundary
- Indicative DC Option
- Indicative Layout AC Option

Site Locality and Indicative DC and AC Footprint Areas

F1

Drawing No:	0591786m_LIMSF_G01_R1.mxd	**Limondale Solar Farm - BESS**
Date:	12/05/2021	Drawing Size: A4
Drawn By:	GR	Reviewed By: AA
Client:	RWE Renewables Australia	

Coordinate System: GDA 1994 MGA Zone 54

0 500 1,000 m

N

This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.

ERM

5. STATUTORY APPROVALS

5.1 Substantially the Same Development

The Project is considered to be 'substantially the same development' as that originally approved under SSD 8025 as:

The Modification is considered to be 'substantially the same development' as that originally approved under SSD 8025 as it:

- is for the same purpose, being a solar farm for renewable energy generation;
- will occur within the same approved development footprint as that previously assessed; and
- will involve minimal construction and operational changes to the already approved solar farm.

A qualitative and quantitative comparison of the Modification to the original Limondale Solar Farm approval (SSD 8025) is summarised in Table 1 to support the "substantially the same" test as set out in Section 4.55 of the EP&A Act.

Table 1: Comparison to SSD 8025

Key Project Element	SSD 8025	Proposed Modification
Development Footprint	1,103 ha	No change
Approved Project Capacity – Direct to Grid	250 MW	No change
Approved Project Capacity – Storage	Nil	Installation and operation of 200MW/400MWh BESS
Grid Connection	Balranald Substation	No change
Hours of construction and operation	Construction: 7am – 6pm Monday to Friday 8am – 1pm Saturday Operation: PV solar panels operate during daylight hours seven days per week, 365 days year.	Construction: No change Operation: BESS to operate 24 hrs day, 7 days per week
Construction Duration	12 – 15 month construction period (now practically complete)	Additional construction period of approximately 15 months
Workforce	Construction: Average workforce 90 people, peak 200 people (construction practically complete). Operations: Between four and seven FTE;	BESS construction workforce of approximately 20 FTE Operation: no change

5.2 Environmental Impact Assessment

The Modification application will be supported by a Modification Report incorporating both the AC and DC option with the following environmental assessments:

- SEPP 33 screening assessment;
- Qualitative Noise Assessment;
- Qualitative Visual Assessment;
- Traffic Intersection Assessment;
- Bushfire Assessment in accordance with the Planning for Bushfire Protection Guidelines; and
- Desktop assessments utilising the previous findings and outcomes of the EIS, including:
  - Biodiversity including updated register searches; and
  - Heritage including updated register searches.

The Modification application is anticipated to be submitted in June 2021.

6. SUMMATION

We seek confirmation from DPIE that the planning pathway will be under Section 4.55 of the EP&A Act. In addition, confirmation of any specific requirements relating to the modification application, exhibition requirements that will apply to the application, consultation requirements, and anticipated assessment timeframe of the application would be appreciated.

Should you have any questions, please contact the undersigned.



Amanda Antcliff
Consultant Director



Murray Curtis
Partner

APPENDIX E AGENCY CORRESPONDENCE

Mr Django Tricker
Project Developer
RWE Renewables Australia Pty Ltd
Suite 5, Level 9
350 Collins Street
Melbourne Victoria 3000

28/05/2021

Dear Mr Tricker

Limondale Solar Farm (SSD-8025)
Modification 2 – Battery Energy Storage System

I refer to your letter regarding a proposed modification to the development consent for Limondale Solar Farm (SSD-8025) to incorporate a Battery Energy Storage System (BESS) within the project site.

The Department is generally satisfied with the issues identified in your letter to be addressed in the Modification Report. However, the Department also requests that the Modification Report includes:

- a Preliminary Hazard Analysis (PHA) prepared in accordance with the Department's Hazardous Industry Planning Advisory Paper No. 6, 'Hazard Analysis' (HIPAP 6) and Multi-Level Risk Assessment (MLRA). The PHA should also have regard to recent developments in research and standards for BESS including NFPA 855; AS 5139; IEC 62897; UL 9540; UL 9540A; FM Global DS 5-33; and FM Global's Development of Sprinkler Protection Guidance for Lithium Ion Based Energy Storage Systems.

- a quantitative noise impact assessment prepared in accordance with the *Intermin Construction Noise Guidelines (DECC, 2009)* and the *Noise Policy for Industry (EPA, 2017)*.

- details of consultation and feedback with all relevant stakeholders including Balranald Shire Council, TransGrid and potentially affected residents in the locality.

Based on the information provided, the Department considers that the proposed modification could be made under section 4.55(2) of the Environmental Planning and Assessment Act 1979.

Your next step will be to lodge your modification application through your dashboard on the major projects website (http://www.planningportal.nsw.gov.au/major-projects).

If you have any questions, please contact Karl Okorn on 9995 5207 or karl.okorn@planning.nsw.gov.au

Yours sincerely,



Iwan Davies
A/Director
Energy Assessments

Radford, William

From: Radford, William
Sent: Wednesday, 30 June 2021 3:21 PM
To: 'MORGAN Maurice W'
Subject: Limondale Solar Farm Modification for Battery Energy Storage System
Attachments: Limondale_BESS_Factsheet.pdf

Hi Maurice,

Thanks for the call last week, good to speak with you again.

As I mentioned on the call we are planning a modification to our existing planning consent to allow for the addition of a Battery System.
This would be located within the same development footprint and would utilize all the existing infrastructure installed for the project.

I've attached some documentation regarding the proposed BESS. It is worth noting that we are still in the process of sizing and finalizing the design of the system and as a result are not able to offer concrete details on some topics. We have generally sized the system based on what we believe to be the largest practically feasible design.

A traffic assessment is being conducted and will be submitted along with the modification however it is clear that the traffic volumes will be significantly below that of the solar farm. For some context I would expect something like 200-300 HV movements to bring equipment and materials to site. More details will be included in the completed traffic assessment.
At this stage is unclear which route these vehicles would take. Both Melbourne and Adelaide can make sense as ports for the project. I don't foresee any difference in impacts considering the different routes however please advise if there is a preference.

The project is aware of the energy connect project, and there is engagement between the parties to manage any potential use of the access road for that project. Should the timing's coincide we would work withthat project to ensure no impacts.

If you have any concerns regarding the details above or need any further information please let me know. Otherwise please flick me back a short note and we can include that in the application as evidence of this early consultation.

--

Kind Regards,

William Radford
RWE Renewables Australia

RWE
Suite 5, Level 9
350 Collins Street
Melbourne, 3000, Australia
M+61 (0) 409 905 273

W: www.rwe.com
mailto: william.radford@rwe.com

RWE Renewables Australia
Suite 5, Level 9
350 Collins Street
Melbourne, 3000, Australia

24 November 2021

To whom it may concern,

Following our previous consultation regarding the proposed modification to allow for the addition of a Battery Energy Storage System (BESS) at the Limondale Solar Farm. We would like to reach out with an update.

We are planning to submit the modification early in the new year. In the process of refining the plant designs, we have identified that there is potential for a larger battery.

With this in mind we have decided to increase the maximum possible size to 800MWh from 400MWh. The details of this will be described in our modification request to the Department of Planning. However, it is our view that this modification doesn't have a significant impact on the project. The battery system would still sit within the solar farm footprint and connect in a similar manner.

We have also identified some other possible technologies to store the energy and are seeking to also allow within the modification for the energy storage system to be a flow battery rather than a lithium ion battery. A flow battery system consist of buildings which house the electrical equipment and tanks that store the electrolyte as well as the same electrical equipment as previously considered. The videos here (https://essinc.com/iron-flow-battery-video/) provide a clear picture of one supplier's technology.

It is worth noting that these changes and the weblink above don't reflect the final plans for a BESS project at Limondale but rather accounts for some more possibilities that could be built.

If you have any comment or question on the proposed changes please reach out on the details below. We will happily include any comments we receive in our information to the Department of Planning.

Kind Regards,

William Radford

william.radford@rwe.com

0409 905 273

From: Maurice Morgan <Maurice.MORGAN@transport.nsw.gov.au>
Sent: Thursday, 15 July 2021 6:17 PM
To: Radford, William <william.radford@rwe.com>
Subject: RE: Limondale Solar Farm Modification for Battery Energy Storage System

William

Based on your email and our phone discussions I see no obvious issues to be raised at this stage.

I understand that the proposed development will likely represent a significant development and will require development approval.

At this stage TfNSW will assess the application and supporting documentation when the application is submitted.

Happy to discuss

Maurice Morgan
Team Leader, Development Services South
Regional and Outer Metropolitan

T: (02) 6923 6611
193 Morgan Street, Wagga Wagga NSW 2650



From: william.radford@rwe.com [mailto:william.radford@rwe.com]
Sent: Thursday, 15 July 2021 3:14 PM
To: Maurice Morgan <Maurice.MORGAN@transport.nsw.gov.au>
Subject: FW: Limondale Solar Farm Modification for Battery Energy Storage System

CAUTION: This email is sent from an external source. Do not click any links or open attachments unless you recognise the sender and know the content is safe.

Hi Maurice,

Hope you are going well.

Just following up on the below. We are planning to submit in a couple of weeks.

Please let us know if you have any comments on the below.

--

Kind Regards,

William Radford
RWE Renewables Australia

M+61 (0) 409 905 273

From: Radford, William
Sent: Wednesday, 30 June 2021 3:21 PM
To: 'MORGAN Maurice W' <Maurice.MORGAN@rms.nsw.gov.au>
Subject: Limondale Solar Farm Modification for Battery Energy Storage System

Hi Maurice,

Thanks for the call last week, good to speak with you again.

As I mentioned on the call we are planning a modification to our existing planning consent to allow for the addition of a Battery System.
This would be located within the same development footprint and would utilize all the existing infrastructure installed for the project.

I've attached some documentation regarding the proposed BESS. It is worth noting that we are still in the process of sizing and finalizing the design of the system and as a result are not able to offer concrete details on some topics. We have generally sized the system based on what we believe to be the largest practically feasible design.

A traffic assessment is being conducted and will be submitted along with the modification however it is clear that the traffic volumes will be significantly below that of the solar farm. For some context I would expect something like 200-300 HV movements to bring equipment and materials to site. More details will be included in the completed traffic assessment.
At this stage is unclear which route these vehicles would take. Both Melbourne and Adelaide can make sense as ports for the project. I don't foresee any difference in impacts considering the different routes however please advise if there is a preference.

The project is aware of the energy connect project, and there is engagement between the parties to manage any potential use of the access road for that project. Should the timing's coincide we would work withthat project to ensure no impacts.

If you have any concerns regarding the details above or need any further information please let me know. Otherwise please flick me back a short note and we can include that in the application as evidence of this early consultation.

--

Kind Regards,

William Radford
RWE Renewables Australia

RWE
Suite 5, Level 9
350 Collins Street
Melbourne, 3000, Australia
M+61 (0) 409 905 273
W: www.rwe.com
mailto: william.radford@rwe.com

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other defects. Transport for NSW assume no liability for any loss, damage or other consequences which may arise from opening or using an attachment.



Consider the environment. Please don't print this e-mail unless really necessary.

Kiersten Fishburn
The Secretary
NSW Department of Planning, Industry & Environment
GPO Box 39
SYDNEY NSW 2001

Dear Ms Fishburn,

Owner's Consent to lodge Modification Application for
State Significant Development (SSD-8025) - Lot 48 in DP 1015985
Limondale Sun Farm Pty Ltd – Limondale Battery Energy Storage System

The Electricity Transmission Ministerial Holding Corporation is owner of land located at Balranald, NSW, being Lot 48 in DP 1015985 (the **Land**). We refer to the development consent associated with State Significant Development 8025, granted under the *Environmental Planning & Assessment Act 1979* (NSW) on 31 August 2017, and the proposed modification application by Limondale Sun Farm Pty Ltd to include a Battery Energy Storage System under the development consent (**Modification Application**).

Please accept this letter as consent (for the purpose of clause 49 of the *Environmental Planning and Assessment Regulation 2000* (NSW)) of the owner of the Land (and the 200kV Balranald Substation) for Limondale Sun Farm Pty Ltd to lodge the Modification Application in relation to the Limondale Battery Energy Storage System.

Yours sincerely

23/12/21

Angelo Kriketos
As agent for Michael Pratt, NSW Treasury Secretary
(Treasurer's delegate under delegation dated 24 November 2015)
on behalf of the Electricity Transmission Ministerial Holding Corporation

BALRANALD SHIRE COUNCIL

ALL COMMUNICATIONS
MUST BE ADDRESSED TO
THE GENERAL MANAGER

70 Market Street, Balranald NSW 2715
PO Box 120, Balranald NSW 2715
Tel: 03 5020 1300
Fax: 03 5020 1620
Email: council@balranald.nsw.gov.au
Web: www.visitbalranald.com.au

Contact: RD:NMR:D21.53674

12 July 2021

William Radford
RWE Renewables Australia
Suite 5, Level 9
350 Collins Street
MELBOURNE VIC 3000

Dear William,

Re: RWE Limondale Solar Farm Battery Storage System

Following on from our meeting of the 23rd June 2021 Council wishes to confirm that representatives of RWE attended the Balranald Shire Council Offices to brief Council on a proposed battery storage system augmentation of the Limondale Solar Farm.

Council understands that the project is likely to be in the order of 160 containerised batteries and associated infrastructure with 200-400MW peak output capacity to mitigate congestion issues and improve generation efficiencies at the Limondale Solar Farm. The project would also provide an employment opportunity of up to 20 construction personnel over a 12 month construction timeframe.

Council is always keen to see sustainable investment in our local government area and the economic benefits that a project such as this can deliver to our community.

Council is supportive of RWE submitting an appropriately detailed application for modification of consent to the Limondale State Significant Development approval for the NSW State Governments consideration.

For further information in relation to this matter, please do not hesitate to contact the undersigned during normal office hours.

Yours faithfully,

Ray Davy
Director Infrastructure & Development

Thomas Buchan

From: william.radford@rwe.com
Sent: Monday, 20 December 2021 10:33 AM
To: Thomas Buchan
Cc: Sedat Erol
Subject: FW: Limondale Solar Farm Battery Modification Consultation

CAUTION: This email originated from outside of the organization. Do not click links or open attachments unless you recognize the sender and know the content is safe.

Hi Thomas,

Please see below the email response from the EPA.

--

Kind Regards,

William Radford
RWE Renewables Australia

M+61 (0) 409 905 273

From: Nicholas van Lijf <Nicholas.VanLijf@epa.nsw.gov.au>
Sent: Monday, 20 December 2021 9:28 AM
To: Radford, William <william.radford@rwe.com>
Subject: Re: Limondale Solar Farm Battery Modification Consultation

Hi William,

I refer to your email received by the Environment Protection Authority (EPA) on 2 December 2021 seeking consultation on the Limondale Solar Farm Development Modification for the addition of an energy storage system.

As discussed, the EPA has reviewed the information provided and can provide the following advice –

The EPA has responsibilities for pollution control and environmental management for scheduled activities under the Protection of the Environment Operations Act 1997 (POEO Act). Based on the information provided, we understand that the proposed project is not scheduled under the POEO Act and the proposed works do not require an Environment Protection Licence. Balranald Shire Council will be the appropriate regulatory authority for matters relating to the POEO Act for this development.

Should the development modification application be approved, the appropriate consent authority should consider the following as conditions of the consent.

- The proponent must take all necessary precautions and implement measures to prevent pollution of waters during construction works.
- Dust control measures must be implemented where appropriate to minimise dust emissions during construction works.

- Noise emissions and hours of operation during construction works must be in accordance with the NSW EPA Interim Construction Noise Guideline.
- Illegal fill and/or waste materials must not be received or deposited at the site.
- All waste generated from the construction works must either be lawfully recycled or disposed of at a site that can lawfully accept the waste.

Based on the information provided the EPA has no further comment to make on the proposal.

If you have any further enquiries about this matter please do not hesitate to contact me.

Kind regards,

Nick van Lijf
Operations Officer
Regulatory Operations
NSW Environment Protection Authority
D 02 6969 0704 | **M** 0499 688 394



www.epa.nsw.gov.au @NSW_EPA

The EPA acknowledges the traditional custodians of the land and waters where we work. As part of the world's oldest surviving culture, we pay our respect to Aboriginal elders past, present and emerging.

Report pollution and environmental incidents 131 555 or +61 2 9995 5555

This email is intended for the addressee(s) named and may contain confidential and/or privileged information. If you are not the intended recipient, please notify the sender and then delete it immediately.
Any views expressed in this email are those of the individual sender except where the sender expressly and with authority states them to be the views of the Environment Protection Authority.

PLEASE CONSIDER THE ENVIRONMENT BEFORE PRINTING THIS EMAIL

Thomas Buchan

From: william.radford@rwe.com
Sent: Tuesday, 1 February 2022 4:10 PM
To: Murray Curtis
Cc: Thomas Buchan; Sedat Erol
Subject: FW: HPE CM: RE: Limondale Solar Farm Near Balranald.
Attachments: Letter to RWE Renewables - Limondale Solar Farm - No objections to Modification (BESS).pdf

CAUTION: This email originated from outside of the organization. Do not click links or open attachments unless you recognize the sender and know the content is safe.

Hi Murray and all,

Please see attached consent from Crown Lands.

--

Kind Regards,

William Radford
RWE Renewables Australia

M+61 (0) 409 905 273

From: Vanessa Woodham <vanessa.woodham@crownland.nsw.gov.au>
Sent: Tuesday, 1 February 2022 3:46 PM
To: Radford, William <william.radford@rwe.com>
Subject: RE: HPE CM: RE: Limondale Solar Farm Near Balranald.

Hello Will

As discussed yesterday, I have attached the letter for inclusion in your application to Planning.

Thank you for your patience in this matter.

Should you have any further enquiries regarding this matter please contact me via the details below, noting I do not work on Fridays.

Kind Regards

Vanessa Woodham | Property Services Officer
Crown Lands – Far West Area | Department of Planning and Environment
45 Wingewarra Street DUBBO NSW 2830 | PO Box 2185 DANGAR NSW 2309
Direct Line: 02 6883 5433 | **T**: 1300 886 235
E: vanessa,woodham@crownland.nsw.gov.au |
W: www.crownland.nsw.gov.au | **W**: www.dpie.nsw.gov.au
Initial enquiries should be addressed to cl.western.region@crownland.nsw.gov.au

The Department of Planning and Environment acknowledges that it stands on Aboriginal land.
We acknowledge the traditional custodians of the land and we show our respect for elders past, present and emerging through thoughtful and collaborative approaches to our work, seeking to demonstrate our ongoing commitment to providing places in which Aboriginal people are included socially, culturally and economically.

Due to Covid-19 the Far West regional staff are currently working remotely. Contact via telephone and email will continue as usual during this time.

From: william.radford@rwe.com <william.radford@rwe.com>
Sent: Tuesday, 25 January 2022 11:23 AM
To: Vanessa Woodham <vanessa.woodham@crownland.nsw.gov.au>
Subject: HPE CM: RE: Limondale Solar Farm Near Balranald.

Hi Vanessa,

Happy New Year, I hope you're well.

I'm back from leave and very grateful to Heidi for supplying the required info while I was away.
How are things travelling on this? Is there any additional information that is required?

--

Kind Regards,

William Radford
RWE Renewables Australia

M+61 (0) 409 905 273

From: Creighton, Heidi <heidi.creighton@rwe.com>
Sent: Wednesday, 12 January 2022 11:54 AM
To: Vanessa Woodham <vanessa.woodham@crownland.nsw.gov.au>
Cc: Radford, William <william.radford@rwe.com>
Subject: RE: Limondale Solar Farm Near Balranald.

Hello Vanessa

Happy New Year to you also. I hope you had an enjoyable break.

Please find attached the original consent from the Department of Industry – Lands dated 6 April 2017. Would you kindly confirm if this is the information that you required.

Please do not hesitate to contact me should you wish to discuss.

Kind regards

Heidi Creighton
RWE Renewables Australia

RWE
Suite 5, Level 9
350 Collins Street
Melbourne, 3000, Australia
M+61 (0) 458 008 774
W: www.rwe.com
mailto:heidi.creighton@rwe.com

From: Vanessa Woodham <vanessa.woodham@crownland.nsw.gov.au>
Sent: 11 January 2022 10:53 AM
To: Radford, William <william.radford@rwe.com>
Cc: Creighton, Heidi <heidi.creighton@rwe.com>
Subject: RE: Limondale Solar Farm Near Balranald.

Hello Heidi

Happy New Year to both of you!

In Will's absence, can you please provide me with a copy of Crown Lands **Original** Land Owner's Consent?

This will enable me to progress this matter.

Thanks in advance

Kind Regards

Vanessa Woodham | Property Services Officer
Crown Lands – Far West Area | Department of Planning, Industry and Environment
45 Wingewarra Street DUBBO NSW 2830 | PO Box 2185 DANGAR NSW 2309
Direct Line: 02 6883 5433 | T: 1300 886 235
E: vanessa,woodham@crownland.nsw.gov.au |
W: www.crownland.nsw.gov.au | W: www.dpie.nsw.gov.au

Please Note: I DO NOT WORK FRIDAYS

Due to Covid-19 the Far West regional staff are currently working remotely.
Contact via telephone and email will continue as usual during this time.

Please Note: All enquiries should be addressed to cl.western.region@crownland.nsw.gov.au
This will ensure prompt attention to your enquiry by the appropriate staff member

NSW GOVERNMENT | Planning, Industry & Environment

From: william.radford@rwe.com <william.radford@rwe.com>
Sent: Thursday, 23 December 2021 9:38 AM
To: Vanessa Woodham <vanessa.woodham@crownland.nsw.gov.au>
Cc: heidi.creighton@rwe.com
Subject: RE: Limondale Solar Farm Near Balranald.

Hi Vanessa,

Thank you, the Department of Planning has expressly requested that we acquire landholder consent from each of the parties who originally consented.
I understand that from the Crown Lands perspective this may not be required but I'm hoping you might be able to provide us a consent letter so that we can move ahead with the planners at the Department of Planning.
I'm not sure if you have a standard template, but in the hope that might simplify things, I've attached a draft that we understand will satisfy the department. Please review but I have updated with what I believe are the lots in question.

Also I'm off from tomorrow about midday until the 24th of Jan, as a result I'm cc'ing my colleague Heidi who is going to keep things moving in my absence.
Any questions or comments please let us know.

--

Kind Regards,

William Radford
RWE Renewables Australia

M+61 (0) 409 905 273

From: Vanessa Woodham <vanessa.woodham@crownland.nsw.gov.au>
Sent: Monday, 20 December 2021 12:00 PM
To: Radford, William <william.radford@rwe.com>
Subject: RE: Limondale Solar Farm Near Balranald.

Hello Will

Thanks for the emails below.

As there is no impact to Crown Land, the changes are noted and we will place it on our file.

No Crown Consent required

Very best wishes to you and yours for Christmas and the New Year
Please Note: The ofice will close on Friday 24 December 2021 and re-open on Monday 10 January 2022

Kind Regards

Vanessa Woodham | Property Services Officer
Crown Lands – Far West Area | Department of Planning, Industry and Environment
45 Wingewarra Street DUBBO NSW 2830 | PO Box 2185 DANGAR NSW 2309
Direct Line: 02 6883 5433 | T: 1300 886 235
E: vanessa,woodham@crownland.nsw.gov.au |
W: www.crownland.nsw.gov.au | W: www.dpie.nsw.gov.au



Please Note: I DO NOT WORK FRIDAYS

Due to Covid-19 the Far West regional staff are currently working remotely.
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This will ensure prompt attention to your enquiry by the appropriate staff member

NSW GOVERNMENT | Planning, Industry & Environment

From: william.radford@rwe.com <william.radford@rwe.com>
Sent: Monday, 20 December 2021 10:43 AM
To: Vanessa Woodham <vanessa.woodham@crownland.nsw.gov.au>
Subject: FW: Limondale Solar Farm Near Balranald.

Hi Vanessa,

Happy holiday season!

Just following up on the below to make sure that all made sense and also to seek a bit of an update.
Things are slowing down for the year and I'm just wondering what is left to be done and when you expect we might get the consent or otherwise.

I'm off from the end of the week until the 24th of Jan, so just wondering if it makes sense to hand this over to a colleague if an update is expected in that time?

--

Kind Regards,

William Radford
RWE Renewables Australia

M+61 (0) 409 905 273

From: Radford, William
Sent: Monday, 6 December 2021 7:04 PM
To: Vanessa Woodham <vanessa.woodham@crownland.nsw.gov.au>
Cc: Natalie Ryan <natalie.ryan@crownland.nsw.gov.au>
Subject: RE: Limondale Solar Farm Near Balranald.

Hi Vanessa,

Hope you are going well.
We've been working away on the modification for Limondale solar farm and have decided to update the modification to allow for a broader set of options.
The attached letter gives an update on that. The letter details at a high level updates that will be made to the modification report I've previously sent through.

I don't see any impacts from these changes to Crown Lands. The activities on the crown land associated with the project remain unchanged.

If you have any questions or queries please let me know. Our objective is to submit the modification in a couple of weeks but as we come to the end of the year it is quite possible that things push into next year.

--

Kind Regards,

William Radford
RWE Renewables Australia

M+61 (0) 409 905 273

From: Vanessa Woodham <vanessa.woodham@crownland.nsw.gov.au>
Sent: Wednesday, 17 November 2021 11:10 AM
To: Radford, William <william.radford@rwe.com>
Cc: Natalie Ryan <natalie.ryan@crownland.nsw.gov.au>
Subject: RE: Limondale Solar Farm Near Balranald.

Hello Will

Thank you for your email and the attachments.

Unfortunately you have not provided the Land Owner's Consent Application as per request and as one of your attachments is Development Consent from the Department of Planning I believe the Land Owner's Consent application is now redundant.

For future reference the consent of the land owner must come *prior* to lodging the Development Application whether it is with Council or Department of Planning. Land Owner's Consent (LOC) is *consent to lodge the Development Application* so you have 'skipped' an important step in the process.

Should you have any questions regarding this matter please contact me via the details below, noting I do not work on Friday's.

Kind Regards

Vanessa Woodham | Property Services Officer
Crown Lands – Far West Area | Department of Planning, Industry and Environment
45 Wingewarra Street DUBBO NSW 2830 | PO Box 2185 DANGAR NSW 2309
Direct Line: 02 6883 5433 | T: 1300 886 235
E: vanessa,woodham@crownland.nsw.gov.au |
W: www.crownland.nsw.gov.au | W: www.dpie.nsw.gov.au

Please Note: I DO NOT WORK FRIDAYS

Due to Covid-19 the Far West regional staff are currently working remotely.
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Please Note: All enquiries should be addressed to cl.western.region@crownland.nsw.gov.au
This will ensure prompt attention to your enquiry by the appropriate staff member

NSW GOVERNMENT | Planning, Industry & Environment

From: william.radford@rwe.com <william.radford@rwe.com>
Sent: Friday, 5 November 2021 4:53 PM
To: Vanessa Woodham <vanessa.woodham@crownland.nsw.gov.au>
Cc: Natalie Ryan <natalie.ryan@crownland.nsw.gov.au>
Subject: RE: Limondale Solar Farm Near Balranald.

Hi Vanessa,

Apologies for the delay we have made a couple of changes to the modification and that took a lot longer than I'd an
Please see attached a copy of the application form and a draft version of the modification report.
We are still working on a couple of minor changes to the report which would likely affect the technology that would be implemented in terms of the batteries. However this won't affect the connections detailed in the report and hence won't affect the crown land in question.

I hope this is all the information that you need?
If it is helpful I'd be happy to have a quick call to run you thought the details of the planned modification.

--

Kind Regards,

William Radford
RWE Renewables Australia

M+61 (0) 409 905 273

From: Vanessa Woodham <vanessa.woodham@crownland.nsw.gov.au>
Sent: Thursday, 9 September 2021 11:39 AM
To: Radford, William <william.radford@rwe.com>
Cc: Natalie Ryan <natalie.ryan@crownland.nsw.gov.au>
Subject: RE: Limondale Solar Farm Near Balranald.

Hello Will

Thanks for your email below.

If you lodge it direct to my email address, an invoice will be raised and posted to you.
You may then pay via BPay.

Please contact me via the details below should you have any further questions regarding this matter.

Kind Regards

Vanessa Woodham | Property Services Officer
Crown Lands – Far West Area | Department of Planning, Industry and Environment
45 Wingewarra Street DUBBO NSW 2830 | PO Box 2185 DANGAR NSW 2309
Direct Line: 02 6883 5433 | T: 1300 886 235
E: vanessa.woodham@crownland.nsw.gov.au |
W: www.crownland.nsw.gov.au | W: www.dpie.nsw.gov.au

Please Note: I DO NOT WORK FRIDAYS

Due to Covid-19 the Far West regional staff are currently working remotely.
Contact via telephone and email will continue as usual during this time.

Please Note: All enquiries should be addressed to cl.western.region@crownland.nsw.gov.au
This will ensure prompt attention to your enquiry by the appropriate staff member



From: william.radford@rwe.com <william.radford@rwe.com>
Sent: Thursday, 9 September 2021 11:30 AM
To: Vanessa Woodham <vanessa.woodham@crownland.nsw.gov.au>
Cc: Natalie Ryan <natalie.ryan@crownland.nsw.gov.au>
Subject: RE: Limondale Solar Farm Near Balranald.

Thanks Natalie,

Hi Vanessa,

Apologies it is taking me a couple of days to complete the from.
I had stated to Natalie that there would be no further required construction on the sections of crown land.
I questioned some topics with the team and there is in fact the possibility that we would need to construct another cable connection to the Balranald Substation. With that in mind I'm just finalizing some changes to the Modification Application before submitting the request for consent.

Regarding payment of the Fee is it possible for Crown Lands to Invoice us once the application is submitted (or to pay by credit card). We don't normally do cheque or money order?

--

Kind Regards,

William Radford
RWE Renewables Australia

M+61 (0) 409 905 273

From: Natalie Ryan <natalie.ryan@crownland.nsw.gov.au>
Sent: Tuesday, 7 September 2021 3:47 PM
To: Radford, William <william.radford@rwe.com>
Cc: Vanessa Woodham <vanessa.woodham@crownland.nsw.gov.au>
Subject: FW: Limondale Solar Farm Near Balranald.

Hi Will

As discussed, Land Owners Consent (LOC) will be required and the correct process is to submit the attached form and pay the associated fee.

If you have any questions please contact Vanessa Woodham Phone: 02 6883 5433 Email: vanessa.woodham@crownland.nsw.gov.au

Regards

Natalie Ryan
Property Management Project Officer

As a result of Covid19 the Far West regional staff are currently working remotely. Contact via telephone and email will continue during this time.

Crown Lands – Far West | Department of Planning, Industry and Environment
T 02 6883 5444 | **E** natalie.ryan@crownland.nsw.gov.au
Level 1, 45 Wingewarra Street, DUBBO NSW 2830 (Po Box 2185, DANGAR NSW 2309)

www.dpie.nsw.gov.au



Our Vision: Together, we create thriving environments, communities and economies.

The Department of Planning, Industry and Environment acknowledges that it stands on Aboriginal land. We acknowledge the traditional custodians of the land and we show our respect for elders past, present and emerging through thoughtful and collaborative approaches to our work, seeking to demonstrate our ongoing commitment to providing places in which Aboriginal people are included socially, culturally and economically.

From: Crownland Western Region Mailbox <cl.western.region@crownland.nsw.gov.au>
Sent: Wednesday, 1 September 2021 9:43 AM
To: Vanessa Woodham <vanessa.woodham@crownland.nsw.gov.au>
Cc: Shaun Barker <shaun.barker@crownland.nsw.gov.au>; Natalie Ryan <natalie.ryan@crownland.nsw.gov.au>; Fiona Sissian <fiona.sissian@crownland.nsw.gov.au>
Subject: Fw: Limondale Solar Farm Near Balranald.

FYI

From: william.radford@rwe.com <william.radford@rwe.com>
Sent: Wednesday, 1 September 2021 9:34 AM
To: Peter Bisset <peter.bisset@crownland.nsw.gov.au>; Crownland Western Region Mailbox <cl.western.region@crownland.nsw.gov.au>
Subject: RE: Limondale Solar Farm Near Balranald.

Hi Peter and Western Region,

The lots in question are lots 7306 and 7307 of Deposited Plan 1158277.
As you correctly interpret the modification will not require any further work on these lots.
That said DPIE has requested that we provide consent as these lots were included in the initial planning permit to allow for a cable run to be added into the trans grid easement.

For your reference the original application was SSD 8025 and I have attached a short flyer (now a little out of date) including the high level details of the modification.

--

Kind Regards,

William Radford
RWE Renewables Australia

M+61 (0) 409 905 273

From: Peter Bisset <peter.bisset@crownland.nsw.gov.au>
Sent: Wednesday, 1 September 2021 8:28 AM
To: Crownland Western Region Mailbox <cl.western.region@crownland.nsw.gov.au>
Cc: Radford, William <william.radford@rwe.com>
Subject: Limondale Solar Farm Near Balranald.

Hi Western Region,

Can you please respond to William with regards the proposed addition of a Battery Storage System to the Limondale Solar Farm (shown on the email below).

I have asked William to provide the Lot/DP of which the Batteries will be located on as I feel it will be within the freehold and won't impact on Crown land.



Peter Bisset
Natural Resource Management Project Officer

Crown Lands | Department of Planning, Industry and Environment
T 02 6990 1801 | E peter.bisset@crownland.nsw.gov.au
126 Lachlan Street, HAY NSW 2711
www.dpie.nsw.gov.au

Planning, Industry & Environment

Our Vision: Together, we create thriving environments, communities and economies.

The Department of Planning, Industry and Environment acknowledges that it stands on Aboriginal land. We acknowledge the traditional custodians of the land and we show our respect for elders past, present and emerging through thoughtful and collaborative approaches to our work, seeking to demonstrate our ongoing commitment to providing places in which Aboriginal people are included socially, culturally and economically.

From: william.radford@rwe.com <william.radford@rwe.com>
Sent: Friday, 27 August 2021 2:44 PM
To: Grant Marsden <grant.marsden@crownland.nsw.gov.au>
Subject: Limondale Development Modification

Hi Grant,

RWE Australia is the owner and operator of the Limondale Solar Farm.

We are working on a modification to our conditions of consent to allow us to install a Battery Energy Storage System (BESS) to the nearly completed Limondale Solar Farm.

I've attached a very brief flyer on the plan (now a little out of date, apologies). It is worth noting this addition will be entirely within the footprint of the existing DA.

We recently submitted out modification to the department, along with landholder consent for the affected parcels of land however the Department of Planning has advised that we need consent from all the landholders and lots involved with the initial consent. The initial project had a cable run across the travelling stock route and we were able to get your consent at that time for the submission of the application.

Please let me know the process and information you would require provide consent to this modification.

Any questions or issues please feel free to call any time.

--

Kind Regards,

William Radford

RWE Renewables Australia

RWE

Suite 5, Level 9

350 Collins Street

Melbourne, 3000, Australia

M+61 (0) 409 905 273

W: www.rwe.com

mailto: william.radford@rwe.com

Department of Planning and Environment

Mr William Radford
RWE Renewables Australia
350 Collins St
Melbourne Vic 3000

Our ref: DOC22/011270
File: 17/04398#03

1 February 2022

Dear Mr Radford

Consent for Development Comprising:	Modification to Original Application SSD 8025 Battery Energy Storage System (BESS)
Land	Freehold Lots 12 & 15 DP 751179 Owned by Limondale Investments Pty Ltd
Parish	Chadwick
County	Caira

Noting the above modification *does not* impact Crown land, the Department of Planning and Environment – Crown Lands has no objections to the lodgement of applications for approval under the *Environmental Planning and Assessment Act 1979*, and other associated applications required under other legislation, for the development proposal described above.

This letter should be submitted to the relevant consent or approval authority in conjunction with the development application and/or any other application. You are responsible for identifying and obtaining all other consents, approvals and permits required under NSW and Commonwealth laws from other agencies for the proposed development.

For further information, please contact Vanessa Woodham on 02 6883 5433 or vanessa.woodham@crownland.nsw.gov.au.

Yours sincerely

Vanessa Woodham
Property Services Officer
Department of Planning and Environment
Crown Lands, Far West Area

APPENDIX F COMMUNITY CORRESPONDENCE

Limondale Battery Energy storage system

Overview:

RWE, owner of the Limondale solar farm, is proposing to install a Battery Energy Storage System (BESS) alongside the existing Limondale Solar Farm. A BESS would enable excess electricity generated during the day to be used during the evening or early morning, reducing the reliance on fossil fuels and lowering greenhouse gas emissions from the electricity sector.

Strategic Rationale:

The existing high voltage transmission line that the Limondale Solar farm connects into currently experiences congestion issues during peak solar generation times. Not only does this result in wasted electricity, it also causes stability issues within the transmission network. A BESS has the ability to remedy both of these issues by storing energy generated during the day and releasing it night, as well as providing frequency control services to ensure the voltage within the lines stays at an acceptable level.

Benefits:

- $150 million of additional investment
- Improved grid stability resulting in a more reliable electricity supply
- 20 jobs created during 12 month construction period
- Cleaner electricity for consumers

Project details:

While still in the early stages of development, a technical analysis has shown that the site could hold a BESS with peak output of 200MW / 400MWh. A project this size would consist of 160, 20ft Lithium Iron Phosphate (LiFePO4) battery containers and could generate up to 150,000 gigawatt hours of energy per year. The entire BESS, including all associated infrastructure will sit within the existing project boundary of the Limondale solar farm. T his will reduce the impact of the project on the surrounding environment.



Source: RWE AG, Project Herdecke, North Rhine-Westphalia

RWE Renewables Australia Pty Ltd | Suite 5, Level 9 | 350 Collins Street | Melbourne, VIC 3000
limondale.battery@rwe.com

Project Status:

RWE is currently preparing a Modification Application for the Limondale Solar Farm Permit. This application will be submitted to the NSW Department of Planning, Industry, and Environment for approval in June 2021 with an outcome expected before the end of the year.
To inform the application, RWE is currently in the process of consulting with key stakeholders to ensure that the proposed design meets all requirements and the broader community are aware and understand what is being proposed. This includes, but is not limited to, assessing the project's impact on; native vegetation, Aboriginal cultural heritage, traffic, noise, and visual landscape.
The design submitted in the Modification Application will create a project ceiling, meaning nothing larger can be built, but something smaller could be. This is the rationale behind the 200MW / 400MWh system, it is the largest technically possible solution however RWE will need to conduct further analysis to determine the exact BESS size.



Solar Farm Construction update:

Limondale Solar Farm's construction has largely been completed. All panels are installed, tracker rows are following the sun and the work crews have left site.
Limondale is undergoing commissioning procedures which stress tests the electrical performance of the project as a whole. The site is currently capable of exporting just under 70% of its power output. RWE is working closely with AEMO and grid operators to finish putting the solar farm through its paces. The operations team have begun to look after the site and complete any maintenance as it is required during commissioning.

SF Community Stakeholder Update:

Limondale has a stakeholder engagement plan which guides its approach to engaging with the local community. As with all of RWE's projects, we understand that engaging meaningfully with communities and key stakeholders around our projects is critical for building and operating successful projects.
The plan sets out our commitments to regular engagement with communities through all parts of the project lifecycle, responding to all queries in a timely manner and delivering a $40,000/year community fund to support local community projects. Applications for the Limondale community fund will be opened in 2021, and further information will be shared prior on our project website.

RWE Renewables Australia Pty Ltd | Suite 5, Level 9 | 350 Collins Street | Melbourne, VIC 3000
limondale.battery@rwe.com

RWE Renewables Australia
Suite 5, Level 9
350 Collins Street
Melbourne, 3000, Australia

7/7/2021

To whom it may concern,

We are writing to you to inform you of our plan to build a Battery Energy Storage System (BESS) alongside the Limondale Solar Farm. RWE Renewables Australia (formerly Innogy Renewables Australia) is the owner and operator of the Limondale Solar Farm.

The battery project is still in the concept stage and we are currently evaluating 2 design options; a 200MW 2hr DC coupled system, or a 200MW 2hr AC coupled system. Both designs sit within the existing solar farm boundary.

As it stands our permit granted by NSW Department of Planning, Industry, and Environment (DPIE) does not allow for a BESS and as such we are in the process of preparing a Modification Application to amend the permit. We are targeting to submit the permit in July 2021, and expect an outcome to be reached by November 2021.

Our planning consultant has already conducted an analysis the impact of a BESS on noise, traffic, cultural heritage, and ecology, determining the overall impact will be minor compared to that of the solar farm.

We are seeking to open a dialogue with our neighbours prior to submitting the Modification Application to hear and address any concerns you may have.

Should there be any further information you require or anything relevant you wish to discuss, feel free to reach out via phone or email to the contact details below.

Kind Regards,

William Radford

william.radford@rwe.com

0409 905 273

Letter mailed to:

Landowner

Coniston Station

Yanga Way

Kyalite 2715

On the 7/7/2021

Letter of Support

29/6/2021

I DAVID LOCKHART located at Condoulpe Station Balranald, have been informed by RWE of the proposal to develop a Battery Energy Storage System (BESS) within the development footprint of the Limondale Solar Farm.

I am aware of the proposal to modify the existing planning permit to allow for either a DC coupled (decentralised) or AC coupled (centralised) BESS both being up to a maximum size of 200MW 2 hour systems.

I am comfortable with the information which I have been provided by RWE, and as such I am in support of RWE's proposal to modify SSD 8025 to allow for a BESS to be installed.

Your Sincerely

DAVID LOCKHART

(Print Name)

D Lockhart

(Signature)

0429 461112

(Contact Number)

AUSTRALIAN FARMING SERVICES

28 June 2021

To whom it may concern,

RWE has advised and consulted with Australian Farming Services on their intention to modify their SSD to allow for the installation of a Battery Energy Storage System (BESS) within the development footprint of the Limondale solar farm site. We understand there is still design work to be completed but that the intention is to install either a DC coupled (decentralised) or AC coupled (centralised) BESS both being up to a maximum size of 200MW 2 hour systems.

As neighbours of the Limondale solar farm we do not envisage that the changes will have any significant impacts on our operations. We have no in principle objections to the proposal and generally support RWE's development.

Yours sincerely



David Armstrong
Chief Executive Officer

Radford, William

From: iain@fieldfinancialconsulting.com.au
Sent: Tuesday, 8 June 2021 2:41 PM
To: Wildschütte, Berit
Cc: paika2715@outlook.com
Subject: Re: Limondale Battery Factsheet

Thanks Berit. An interesting read & nice to see the construction jobs. Cheers, Iain

Sent from my iPhone

On 8 Jun 2021, at 2:05 pm, berit.wildschuette@rwe.com wrote:

Dear Dianne and Ian,

Pleaser find attached the battery factsheet I was referring to in our call this morning for your reference.

If you have any questions please do not hesitate to reach out.

Kind regards

Berit Wildschütte
RWE Renewables Australia

<image001.png>
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Melbourne, 3000, Australia
M+61 (0) 401 741 670
W: www.rwe.com
mailto:berit.wildschuette@rwe.com

<Limondale_BESS_Factsheet_V2.pdf>

APPENDIX G PRELIMINARY HAZARD ANALYSIS REPORT

Preliminary Hazard Analysis of Limondale Solar Farm and BESS

For Environmental Resources Management Australia Pty Ltd

17 March 2021



Doc. No.: J-000464 - Limondale Solar Farm and BESS PHA

Revision: 2

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B	13 Aug 2021	RR	Final draft with client comments	GT	RR
0	7 Mar 2022	RR	Final issue with 200MW/800 MWh BESS capacity	PS	RR
1	8 Mar 2022	RR	Updated with minor corrections	PS	RR
2	17 Mar 2022	RR	Final update with amendments	PS	RR

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Notation

Abbreviation	Description
AC	Alternating Current
ACH	Air Changes per Hour
APZ	Asset Protection Zone
Arriscar	Arriscar Pty Limited
AS	Australian Standard
BESS	Battery Energy Storage System
BMS	Battery Management System
C_2H_4	Ethylene
C_2H_6	Ethane
C_3H_8	Propane
C_6H_6	Benzene
C_7H_8	Toluene
CH_4	Methane
CO	Carbon Monoxide
CO_2	Caron Dioxide
DC	Direct Current
DPIE	NSW Department of Planning, Industry and Environment
EI	Energy Institute
EIS	Environmental Impact Statement
EMF	Electro-Magnetic Field
EMR	Electro Magnetic Radiation
ESS	Energy Storage System
FM	Factory Mutual
ha	hectares
HCl	Hydrogen Chloride
HCN	Hydrogen Cyanide
HF	Hydrogen Fluoride
HIPAP	Hazardous Industry Planning Advisory Paper
HVAC	Heating, Ventilation and Air-Conditioning
ICNIRP	International Commission on Non-Ionizing Radiation Protection
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers

Abbreviation	Description
ISO	International Organisation for Standardisation
km	kilometres
kV	kilo-volt
kVA	Kilo-Volt Amps
LFL	Lower Flammability :Limit
LEP	Local Environment Plan
LFP	Lithium Iron Phosphate (cathode)
LGA	Local Government Area
LIB	Lithium Ion Battery
LiFeP4	Lithium Iron Phosphate
LiPF6	Lithium Phosphate
LTO	Lithium Oxide (cathode)
m	metres
MIC	Monitoring, Information exchange and Control
MLRA	Multi-Level Risk Assessment
MW	Mega Watt
MWh	Mega Watt hour
NFPA	National Fire Protection Association
NMC	Nickel-Manganese-Cobalt (cathode)
O&M	Operations and Maintenance
PHA	Preliminary Hazard Assessment
PV	Photo Voltaic
RFS	Rural Fire Service (NSW)
SCADA	Supervisory Control and Data Acquisition
SDS	Safety Data Sheet
SSD	State Significant Development
TARP	Triggered Action Response Plan
UFL	Upper Flammability Limit
UL	Underwriters Laboratories
UN	United Nations

1 INTRODUCTION

1.1 Background

Environmental Resources Management Australia Pty Ltd (ERM) was engaged by Limondale Solar Farm Pty Ltd (LSF) to provide planning and environmental support relating to a proposed modification to the currently approved Limondale Solar Farm (the Project). The Project is State Significant Development (SSD) and was granted development consent (SSD 8025) under Section 4.38 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) in 2017.

This report has been prepared to support the proposed modification. It documents applicable planning requirements, stakeholder engagement, an assessment of environmental impacts and any necessary environmental management measures required to maintain an acceptable level of impact consistent with the existing development consent.

The Project was first approved on 31 August 2017, which permits the construction and operation of a solar farm and associated infrastructure with an estimated nominal capacity of 250 megawatts (MW). It was originally approved under Section 4.38 of the EP&A Act and was further modified on 27 July 2018 (SSD 8025 MOD 1) under Section 4.55(1A) of the EP&A Act. The Project, as constructed consists of the following:

- Approximately 872,000 solar panels mounted on single axis-tracker frames, with a modified height of 4 metres (m).
- Up to 114 inverter stations (up to 2.3 m in height), each containing an inverter and a 22 or 33 kilovolt (kV) transformer, and an onsite switchyard containing a transformer and associated switchgear.
- Internal access tracks, staff amenities, offices, car parking, laydown areas, security fencing.
- A 220 kV underground power line connecting to the existing Balranald substation that is situated 500 m to the east of the Project.
- Modified Project Area allotments following the approved subdivision of Lot 12 DP 751179.

1.2 Proposed Modification

The Limondale Solar Farm *Environmental Impact Statement* (EMM Consulting Pty Ltd, 10 April 2017) (1) noted the future potential of the installation of battery and energy storage devices within the development footprint subject to technologies available. Schedule 3, Condition 1 of the development consent (SSD 8025) stipulates that battery energy storage is not permitted onsite, however a modification of the consent may permit future battery storage within the Project Area.

LSF is now seeking a modification relating to the installation and operation of a Battery Energy Storage System (BESS) within the approved Project Area and development footprint.

1.3 Objectives and Scope

For the BESS modification, NSW DPIE have requested a Preliminary Hazard Analysis (PHA) (2) prepared in accordance with the Department's Hazardous Industry Planning Advisory Paper No. 6, 'Hazard Analysis' (HIPAP 6) and Multi-Level Risk Assessment (MLRA).

The PHA should also have regard to recent developments in research and standards for BESS including:

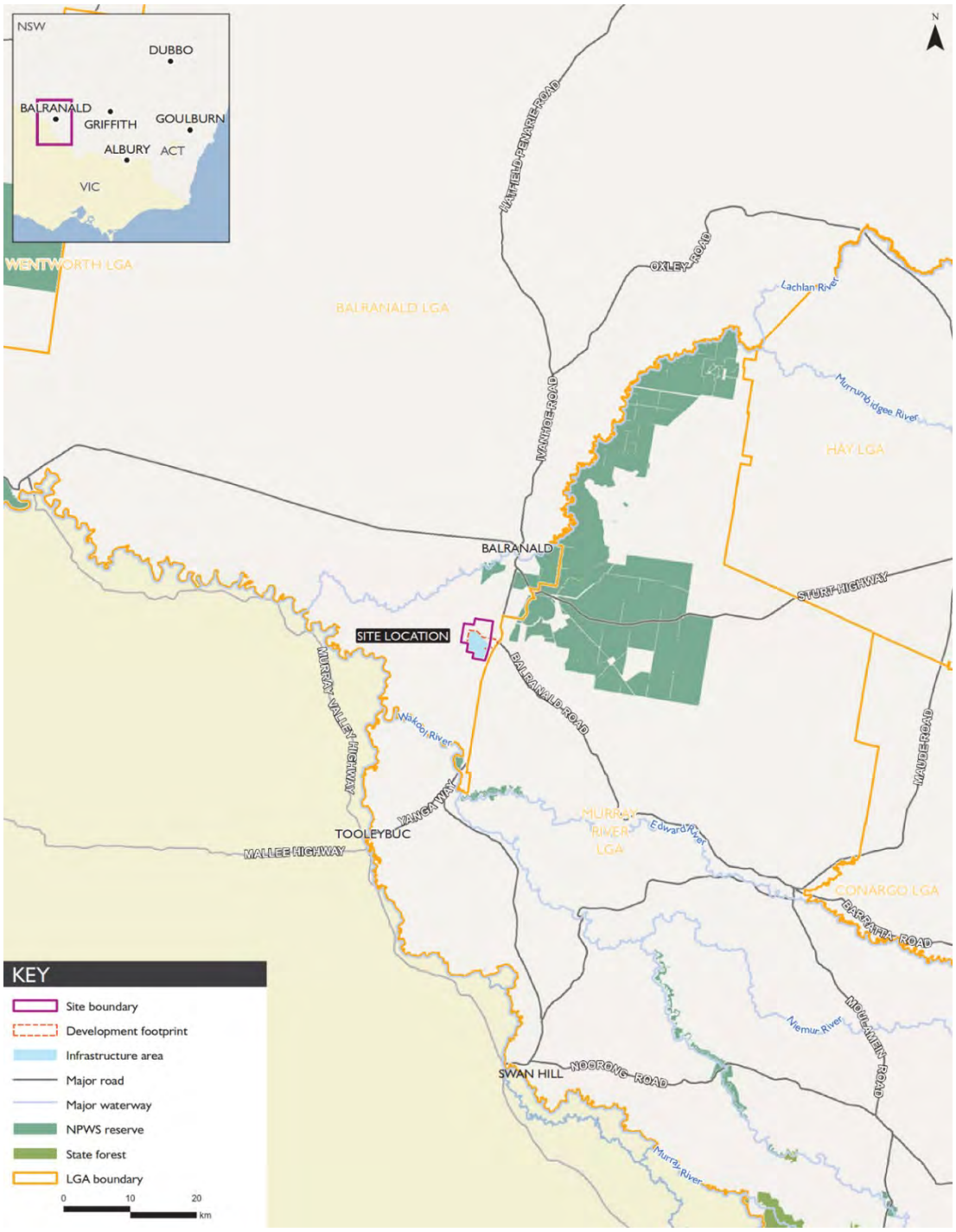
- NFPA 855: Standard for the Installation of Stationary Energy Storage Systems;
- AS/NZS 5139: Electrical Installations - Safety of Battery Systems for use with Power Conversion Equipment;
- IEC 62897: ED1 Stationary Energy Storage Systems with Lithium Batteries - Safety Requirements;
- UL 9540: Energy Storage System (ESS) Requirements;
- UL 9540A: Test Method for Evaluating Thermal Runaway Fire Propagation in Battery Energy Storage Systems;
- FM Global Property Loss Prevention Data Sheet 5-33: Electrical Energy Storage Systems; and
- FM Global's Development of Sprinkler Protection Guidance for Lithium Ion Based Energy Storage Systems.

2 SITE LOCATION AND SURROUNDING USES

2.1 Location

The site is approximately 14 km south of the township of Balranald, NSW. The site boundary encompasses an area of approximately 2,049 hectares (ha) (refer to Figure 1). The project also comprises approximately 2.8 ha of Crown land.

Figure 1: Location of Limondale Solar Farm



2.2 Surrounding Land Uses

The site is part of the Murrumbidgee catchment. Land use within this catchment is dominated by extensive agricultural operations with grazing occupying 64.4% of the total catchment area. Dryland cropping and horticulture (15.5%); conservation (6.4%); and irrigation (5.1%) are also prevalent across the catchment area.

The majority of land surrounding the site is zoned RU1 Primary Production under the Balranald LEP and the Wakool Local Environmental Plan 2013. Agricultural production activities undertaken in the Balranald Shire LGA and wider region are dominated by sheep, beef cattle and grain farming (cereals).

The site is part of a larger agricultural landholding which extends to the west and north to the Murrumbidgee River. The site is surrounded by several large farming properties, including a large-scale agricultural operation directly adjacent to the site's northern boundary, which is owned and operated by goFARM Australia Pty Ltd. There is a forest logging business west of Windomal Road approximately 5 km north of the site. The land to the south of the site includes the Sunraysia Solar Farm.

Yanga National Park (which is part of the Murrumbidgee Valley National Park) covers an area of approximately 76,000 ha. At its closest point, Yanga National Park is approximately 3 km east of the site, with additional areas north and north-east of the site. This area is zoned E1 National Parks and Nature Reserves under the Balranald LEP and the Wakool LEP. Murrumbidgee Valley State Conservation Area is approximately 10 km east of the site and covers an area of 34,579 ha. This area is also zoned E1 National Parks and Nature Reserves under the Wakool LEP.

2.3 Access

The site will be fenced off by a chain mesh fence, which will be approximately 1.8 – 2.4 m high. Fencing will restrict public access to the site.

The approved site access was a new intersection along Yanga Way (see Figure 2). This was built prior to commencement of project construction. The approved site access is located approximately 150m south of the existing intersection of Yanga Way and Balranald Road, and includes:

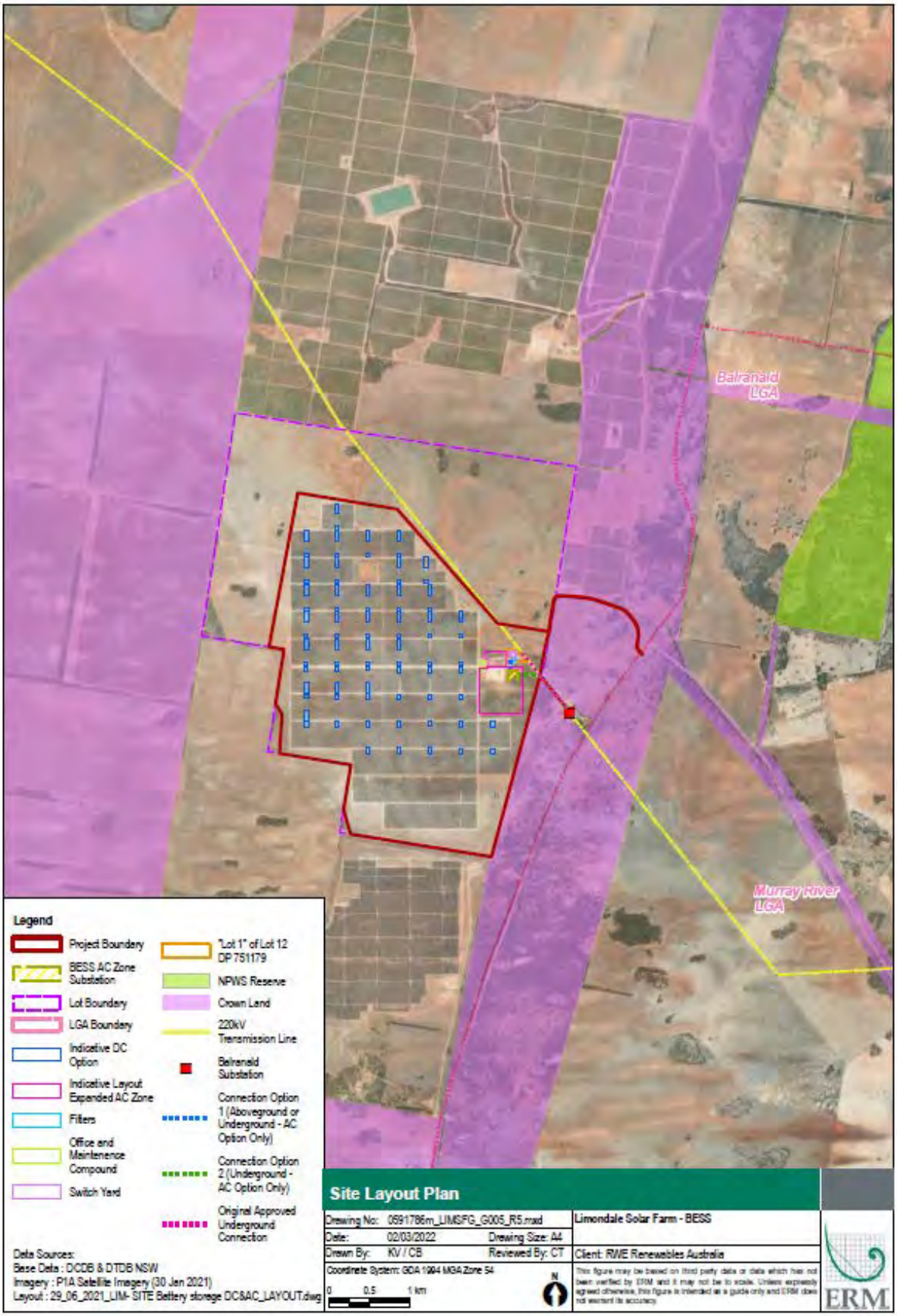
- A new Basic Right Turn (BAR) and Basic Left Turn (BAL) treatment to accommodate the largest vehicle accessing the intersection, in accordance withn Ausroads Guide to Road design (as amended by RMS supplements).
- Provision for two-way vehiclular movements between this approved site access intersection with Yanga Way and the existing access track. The existing access track is sealed for 50m from the intersection with Yanga Way.

Internal (unsealed) access tracks have been constructed for the Project to accommodate traffic movements throughout the Project Area. The internal access tracks are approximately 4-6m wide, all-weather tracks.

2.4 Residential Dwellings

The nearest dwelling is approximately 2.9 km north of the development footprint, with a further five dwellings within approximately 6 km. For further detail see Figure 2.1 of the EIS (1).

Figure 2: Limondale Solar Farm Site Layout Plan



2.5 Meteorology

The nearest weather station to Limondale Solar Farm Project is Balranald RSL, which is approximately 14km to the north. However, the data for Mildura Airport is more comprehensive and available on hourly basis for 25 years. Therefore, the Mildura airport data was used in this assessment.

2.5.1 Monthly Average Temperatures

Table 1: Mean Temperature Data for Balranald RSL

Temp. °C	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean	33.1	32.6	29.2	24.1	19.4	16.1	15.7	17.6	21.0	24.6	28.2	31.0
Highest Monthly Mean	38.1	37.1	33.8	28.6	23.3	20.0	20.8	25.4	24.9	30.5	32.8	34.9
Lowest Monthly Mean	29.5	28.6	25.3	16.3	16.4	13.2	12.4	14.7	16.9	19.8	23.4	24.5
Highest Daily	47.7	46.2	42.2	39.0	35.6	25.6	27.0	30.1	37.6	40.8	44.6	46.2
Lowest Daily	20.0	12.5	14.0	13.3	10.6	7.1	7.5	9.1	11.5	11.5	13.9	16.7

2.5.2 Monthly Average Humidity

Table 2: Humidity Data for Balranald RSL

Humidity %	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean 9am	55	59	62	68	81	87	85	78	67	58	58	54
Mean 3pm	30	32	35	41	52	59	57	49	43	38	34	31

2.5.3 Flooding

Flooding was a consideration in the site selection and project design process. Available flood mapping indicates the site is not subject to inundation from a 100-year average recurrence interval flood event. The infrastructure to be established within the development footprint is unlikely to have a significant impact on local or regional flooding, as it will not require significant earthworks or changes to the general topography of the site. Therefore, existing flow paths are expected to be maintained.

At its closest point, the site is approximately 6.5 km south-east of the Murrumbidgee River point and approximately 12 km north-east of the Wakool River, respectively.

2.5.4 Prevailing Winds

The nearest weather station to the project is Balranald (3). Weather data from this station is limited as wind speed and direction are only available at 9am and 3pm, and the Bureau of Meteorology recommend using Mildura Airport (4). The Mildura Airport wind speed and direction are available hourly.

The following figures shows the comparison between Balranald and Mildura Airport. Balranald wind speed appears to be consistently between 4-5 km/h lower than that at Mildura Airport. The wind directions are consistent between Balranald and Mildura Airport.

For the purposes of consequence and risk modelling the meteorological data for Mildura Airport was used as it is available on hourly basis over a 25-year period (1/1/1990 to 31/12/2014).

Figure 3: Balranald Wind Rose 9am

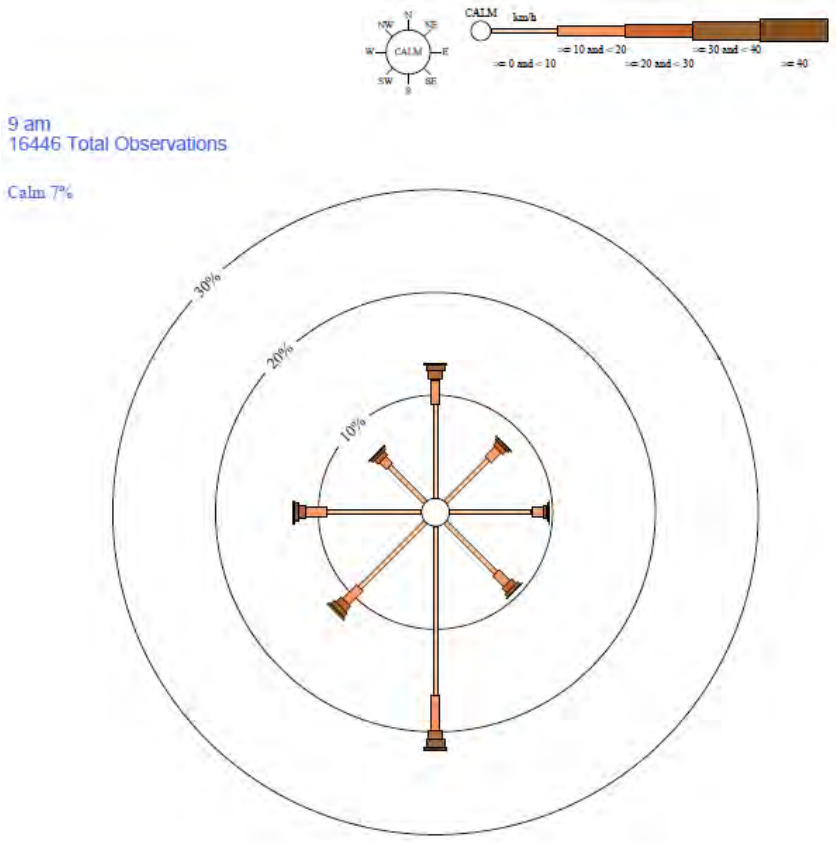


Figure 4: Balranald Wind Rose 3pm

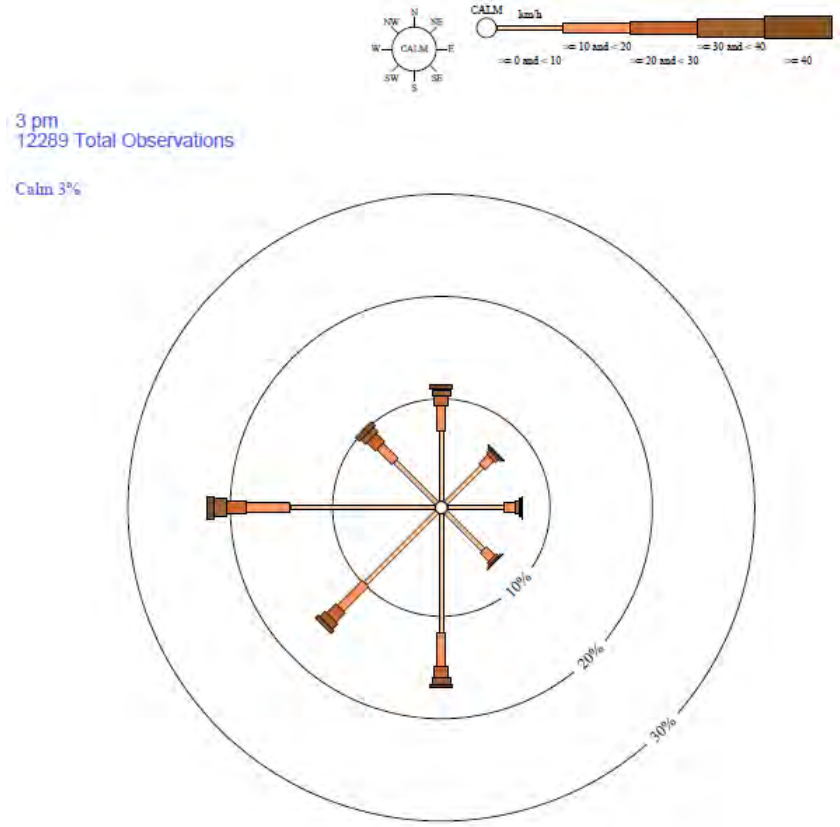


Figure 5: Mildura Airport Wind Rose 9am

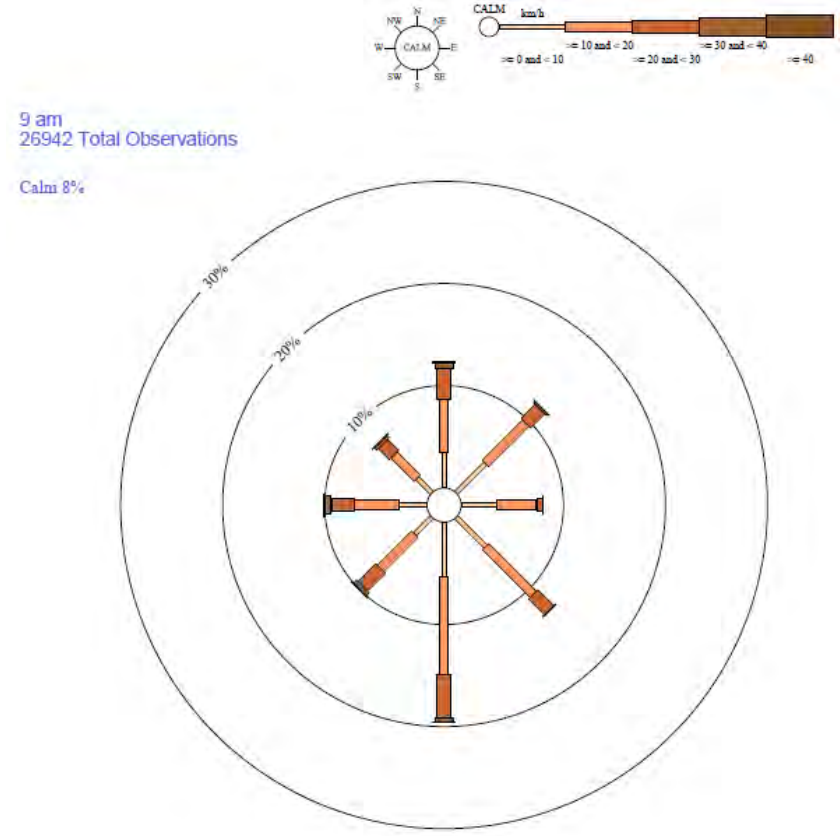


Figure 6: Mildura Airport Wind Rose 3pm

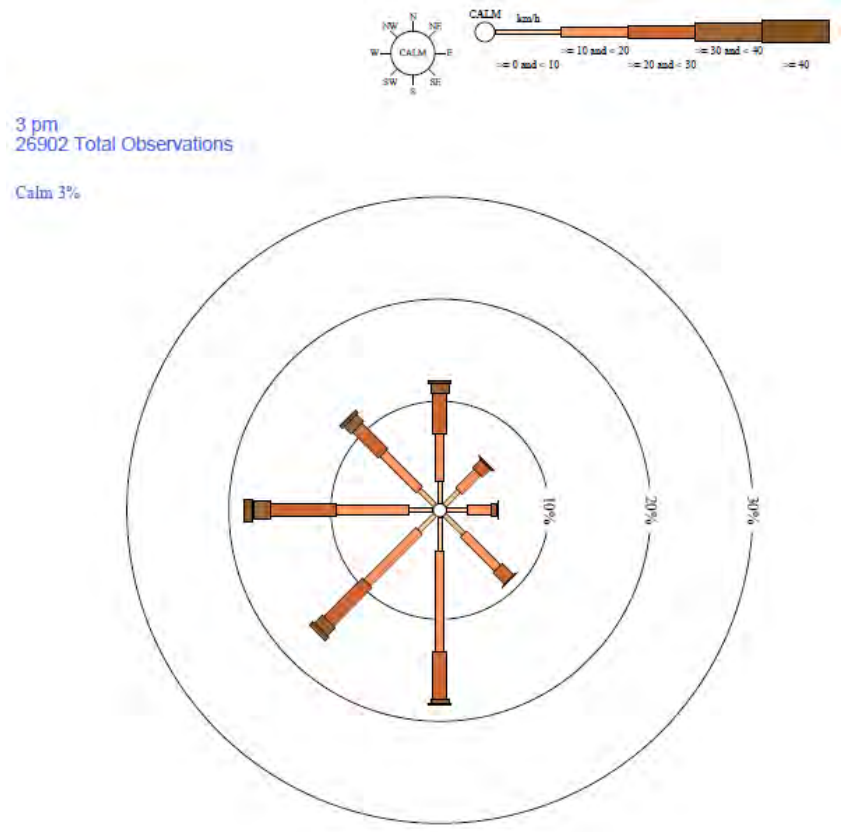
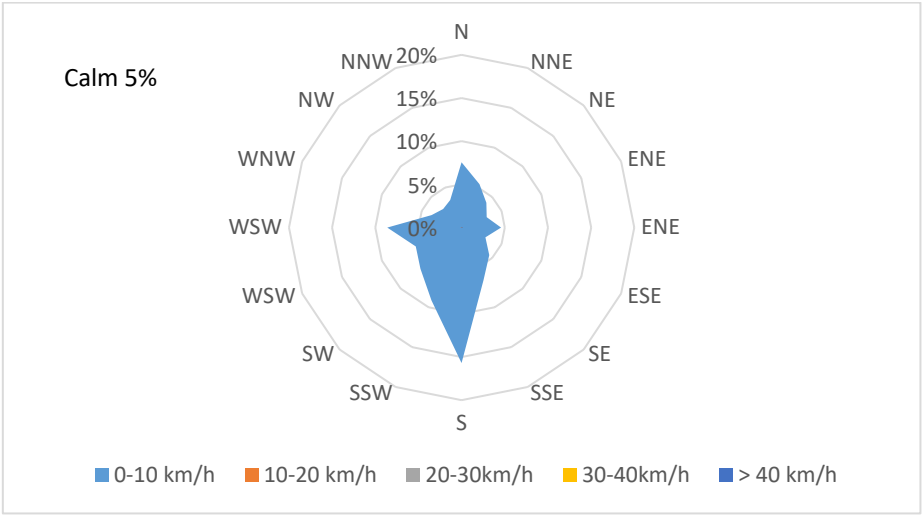


Figure 7: Mildura Airport Wind Rose all data



2.5.5 Summary of Meteorological Data for Mildura Airport

The data (mean cloud cover, temperature, wind speeds) was collected by the Bureau of Meteorology at Mildura Airport. This raw data was rationalised in a form appropriate for BESS offgases dispersion calculations.

The data has been processed into a rationalised form consisting of six wind speed/Pasquil stability group classes arranged into sixteen wind direction groups. The arrangement into wind speed/

stability group classes followed the criteria set out below in the table below and the rationalised wind weather data is shown in the following table.

Table 3: Rationalised Weather Data (Day time)

	B3.1	D7.3	D1.6	D4.1	E3	F1.4	Total
N	0.0115	0.026	0.006	0.047	0.001	0.002	**0.094**
NNE	0.0077	0.012	0.004	0.032	8E-04	6E-04	**0.057**
NE	0.007	0.005	0.003	0.02	7E-04	8E-04	**0.037**
ENE	0.0067	0.002	0.004	0.015	3E-04	7E-04	**0.029**
E	0.0108	0.002	0.005	0.021	4E-04	0.001	**0.041**
ESE	0.0096	0.002	0.003	0.018	2E-04	6E-04	**0.033**
SE	0.0127	0.005	0.004	0.03	3E-04	8E-04	**0.053**
SSE	0.013	0.008	0.005	0.038	8E-04	0.001	**0.066**
S	0.0262	0.018	0.011	0.083	0.002	0.004	**0.144**
SSW	0.0125	0.011	0.005	0.044	0.001	0.002	**0.076**
SW	0.008	0.014	0.004	0.035	7E-04	0.001	**0.063**
WSW	0.0071	0.019	0.003	0.035	7E-04	0.001	**0.067**
W	0.0108	0.031	0.006	0.051	0.001	0.002	**0.102**
WNW	0.0064	0.014	0.003	0.023	7E-04	9E-04	**0.048**
NW	0.0066	0.008	0.003	0.021	7E-04	0.001	**0.041**
NNW	0.0083	0.01	0.003	0.027	7E-04	0.001	**0.05**
TOTAL	**0.1648**	**0.187**	**0.072**	**0.542**	**0.013**	**0.021**	**1**

Table 4: Rationalised Weather Data (Night time)

	B3.1	D7.3	D1.6	D4.1	E3	F1.4	Total
N	0	0.0063	0.0015	0.0243	0.0141	0.0183	**0.0644**
NNE	0	0.0043	0.0006	0.0244	0.0143	0.0117	**0.0553**
NE	0	0.0019	0.0010	0.0167	0.0141	0.0152	**0.0490**
ENE	0	0.0006	0.0012	0.0108	0.0100	0.0158	**0.0384**
E	0	0.0006	0.0022	0.0141	0.0173	0.0231	**0.0572**
ESE	0	0.0004	0.0012	0.0080	0.0079	0.0134	**0.0309**
SE	0	0.0007	0.0014	0.0113	0.0116	0.0175	**0.0425**
SSE	0	0.0032	0.0017	0.0229	0.0232	0.0219	**0.0728**
S	0	0.0072	0.0035	0.0574	0.0619	0.0564	**0.1863**
SSW	0	0.0057	0.0020	0.0395	0.0418	0.0258	**0.1148**
SW	0	0.0061	0.0015	0.0290	0.0219	0.0204	**0.0789**
WSW	0	0.0045	0.0017	0.0201	0.0127	0.0149	**0.0539**
W	0	0.0062	0.0019	0.0295	0.0225	0.0193	**0.0794**
WNW	0	0.0030	0.0009	0.0109	0.0079	0.0086	**0.0313**
NW	0	0.0012	0.0006	0.0079	0.0054	0.0076	**0.0228**
NNW	0	0.0011	0.0010	0.0077	0.0050	0.0071	**0.0220**
TOTAL	**0**	**0.0529**	**0.0238**	**0.3346**	**0.2917**	**0.2970**	**1.0000**

3 DESCRIPTION OF FACILITIES

The Project involves the construction, operation and commissioning of a solar farm together with associated and ancillary infrastructure. The solar farm has an approximate energy generating capacity of 250 megawatts (MW) AC and this modification will include a 200MW/800 MWh battery energy storage system (providing 4 hours of storage for 200MW).

The key components of the Project are:

- Approximately 868,000 ground mounted tracking PV solar panels;
- Underground electrical collection system and fibre optic cabling including approximately ninety (90) 2.5 MW inverters;
- a central 220 kV electrical substation, including transformers, insulators, switchyard and other ancillary equipment;
- an operations and management hub;
- a 220 kV single circuit twin conductor overhead transmission line (transmission line). The transmission line will connect the onsite substation to the existing 220 kV TransGrid Balranald substation;
- internal unsealed access roads;
- an intersection on Yanga way to connect a short new access road to an existing access track.
- a proposed battery energy storage system (BESS) of 200MW/800 MWh (4 hours of storage for 200MW), with two proposed BESS configurations to be evaluated;

3.1 PV Solar Panels

The approved part of the project involves the installation of Photo Voltaic (PV) solar panels, arranged in a series of rows positioned to maximise the use of the solar resource available at the site. This part of the project has been constructed in a single axis tracking configuration, which allows the PV solar panels to rotate from east to west during the day tracking the sun's movement. Panels are fixed to and supported by ground-mounted framing.

The average height of the PV solar panel rows is 2.4 m. During the early morning and late afternoon tracking periods, the maximum height of the PV solar panel rows can be up to 4 m.

The typical dimensions of the PV solar panels are 1.7 m by 1 m, which provide a surface area of approximately 1.65 square metres (m^2) per PV solar panel. PV solar panels are constructed of solar glass with an anti- reflective surface treatment.

Approximately 868,000 PV solar panels are installed at the site, providing an estimated nominal capacity in the order of 250 MW.

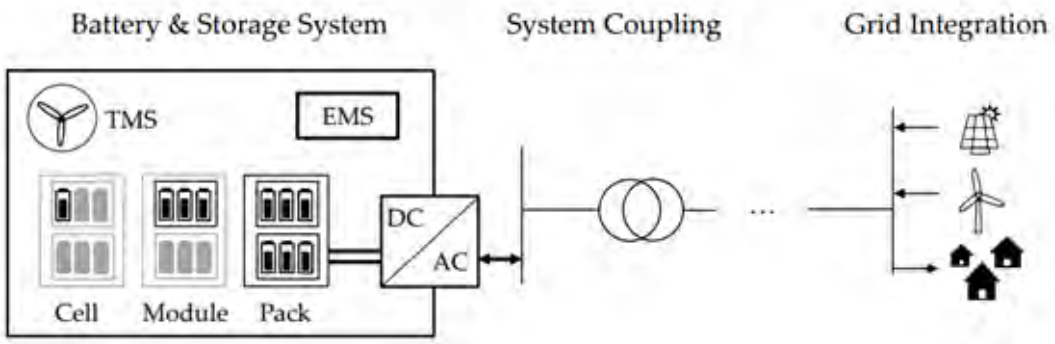
3.2 Battery Energy Storage System (BESS)

A Battery Energy Storage System (BESS) is an advanced technology developed for storing the electricity generated by solar or wind power by using specially developed batteries.

The BESS includes battery cells, assembled into modules and packs, and stored in cabinets inside buildings or containers (ISO containers) in the open. The DC electricity from the packs is fed through energy converters (inverters) to convert to AC, voltage boosted through power transformers and fed to the power grid.

A schematic of an example BESS is shown in Figure 8 (5).

Figure 8: Schematic of Example Battery Energy Storage System



3.2.1 Lithium-Ion Battery

The most common BESS consists of an array of lithium-ion batteries (LIB). There are different LIBs, but they all use the technology of transferring lithium ion between an anode and cathode. The anode is mainly carbon, due to its cost effectiveness and higher energy density. The differences are in the cathodes.

The cathode accepts lithium ions during discharge and releases them during the charge cycle. The cathode consists of metal oxides such as Nickel-Manganese -Cobalt oxide (NMC), Lithium-Iron Phosphate (LFP) and Lithium Oxide (LTO) (5), (6).

The electrolyte is typically composed of an organic solvent and a lithium-based salt, commonly Lithium Fluorophosphate (LiPF6). In between the anode and cathode is a polymer membrane separator.

Because of the mixture of a range of chemicals, a decomposition reaction from overheating of the cell can result in the evolution of flammable and toxic gases. Ignition of these gases can result in a battery fire or explosion in the confined volume.

The preferred technology used for Limondale Solar Farm is Lithium-Iron Phosphate (LFP) (7).

3.2.2 Battery Storage

Multiple cells are typically assembled into a module by connecting them in series and parallel arrangements. The modules are stacked and interconnected in a battery rack. The racks are stored in a cabinet for small installations and containerised storage for large installations. Depending on the capacity of BESS, several containers can be stored.

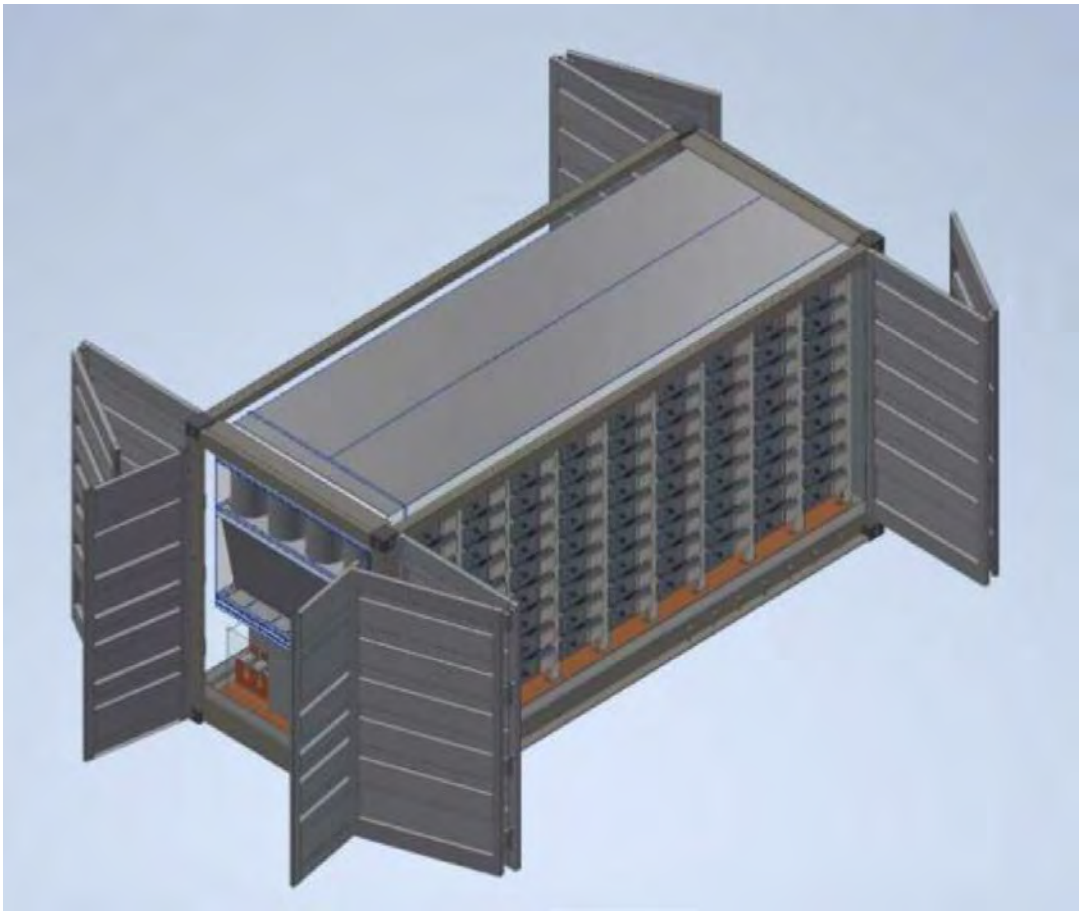
The BESS will consist of several storage containers. An existing facility by the same company, similar to the proposed development shown in Figure 9 (8).

Figure 9: Example of an Existing BESS



An example BESS container is shown in Figure 10. The container itself is an ISO shipping container, 20’ long (8).

Figure 10: Concept BESS Container



The container is typically modified for the following purposes:

- Cable penetrations.
- Fire protection system installation.
- HVAC installation
- Strengthening of the walls for blast protection, where required.

The batteries are stacked and connected to the Battery Management System (BMS). The BMS is typically designed with a range of safeguards, such as:

- Prevention of overcharging and current surges.
- Maintaining voltage levels.
- System trip in the event of electrical shorts or overheating.
- A HVAC system maintaining the container temperature within safe operating limits.

3.3 BESS Arrangements Considered for Study

The proposed development will have a capacity of 200 MW providing energy for 4 hours (800 MWh).

Each individual BESS is containerised, and the preferred BESS will use lithium-iron (LiFeP4) cell. The expected configurations are summarised in Table 5.

Table 5: Features of BESS

Option	No. of containers (20 ft)	Features per container
AC Coupled	360	10 strings per container, 8 modules per string, and 52 cells per module.
DC Coupled	260	

It is assumed that each container will have its own Battery Management System (BMS), power converter and HVAC system and that the BESS will be monitored by a SCADA system with remote monitoring facility. The detailed design of the BESS is unavailable currently. The following configurations are being assessed for this PHA.

Two BESS options are considered.

3.3.1 AC-Coupled System

This consists of a **centralised alternating current coupled** BESS of up to 200MW/800MWh capacity.

The AC-coupled BESS option would be located within the 'AC-coupled zone' identified in this modification report. This zone is situated near the approved construction site facility and storage area that is adjacent to the solar farm access. The AC-coupled zone represents a broader area within which the AC-coupled layout would be constructed. It consists of two smaller areas, one north and one south of the site access road.

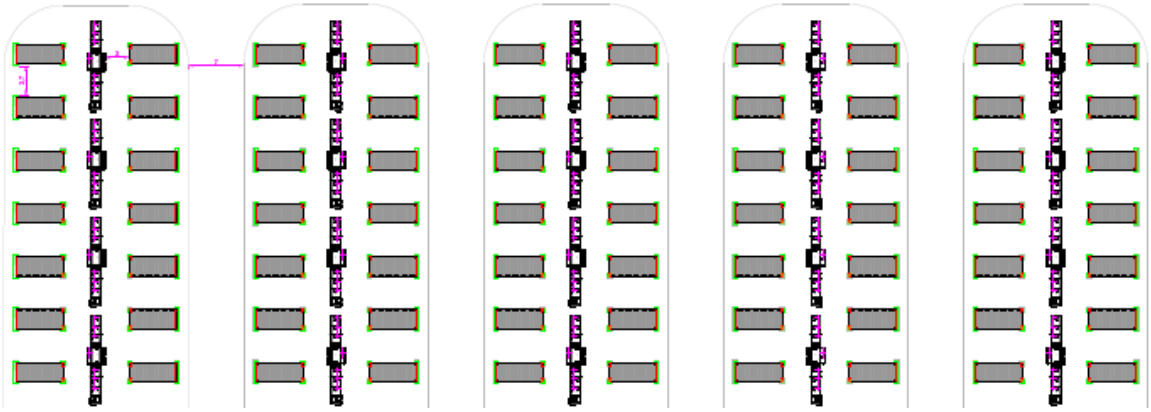
At this stage a fixed location for the AC-coupled layout is being evaluated by LSF and would be selected subject to detailed design, and consideration of commercial and operational factors. This modification report has been prepared to assess potential worst-case impacts associated with the AC-coupled layout being positioned at any location within the nominated AC-coupled zone.

Regardless of its position within the identified zone, the AC-coupled BESS option would consist of ~360 (20 foot) battery containers and associated infrastructure i.e. BESS Heating Ventilation and Air Conditioning (HVAC), inverters, transformers and connecting electrical wires.

The AC-coupled zone represents an area of ~180,317 m^2 whilst the AC-coupled layout (i.e. the actual surface area of the AC-coupled options once constructed) would cover a smaller area, totalling ~14,000 m^2.

The AC coupled system consists of 360 x 0.6255MW/3.3MWh Blocks (Containers) with 90transformers each with a nominal power of 5040kVA per unit. An example of the BESS arrangement can be seen in Figure 11.

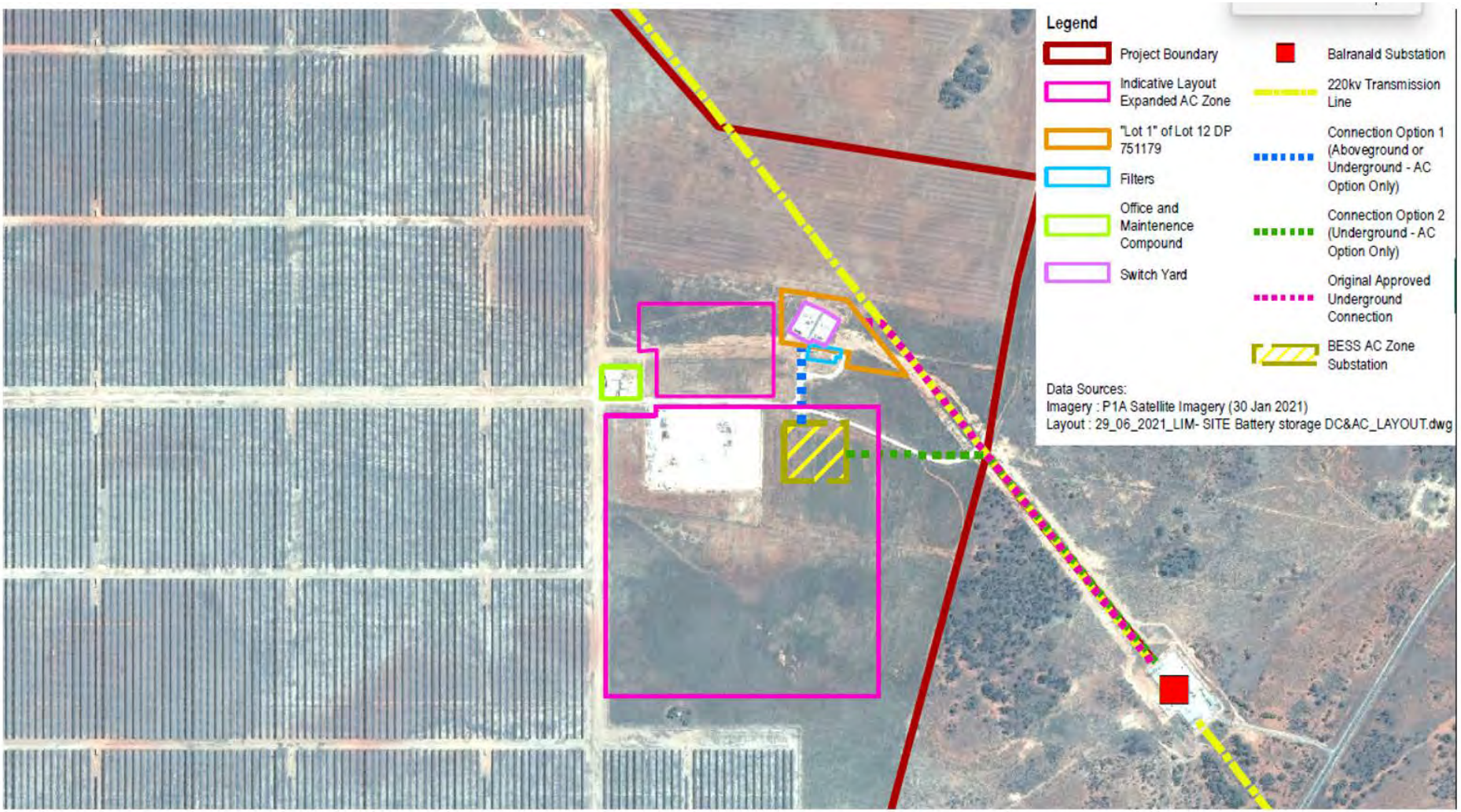
Figure 11: Example of AC Coupled BESS Layout



Potential areas for the AC Coupled BESS Zone are shown in Figure 12.

.

Figure 12: AC Coupled BESS Zone



3.3.2 DC-Coupled System

The second option consists of a **decentralised direct current coupled** BESS of up to 200MW/800MW capacity.

This system option involves 260 (20 foot) battery containers and associated infrastructure i.e. BESS HVAC, DC-DC converters and connecting electrical wires being situated next to photovoltaic (PV) inverter stations located throughout the solar arrays.

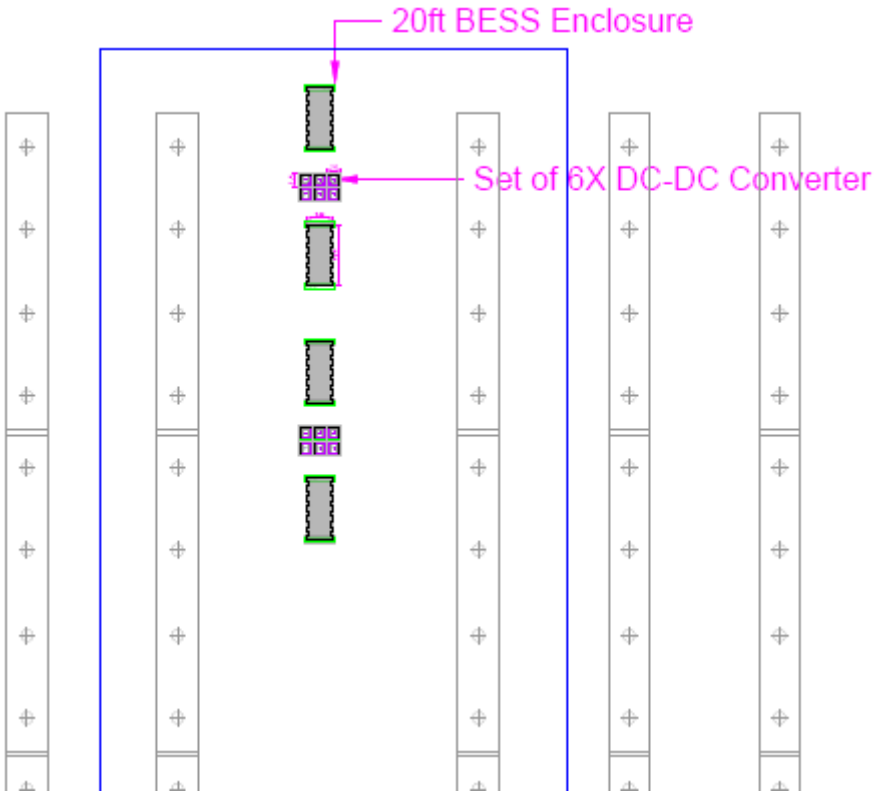
Despite the decentralised design, all infrastructure resides entirely within the approved Project Area and development footprint considered under the original development consent.

This option would cover a combined area of approximately 289,877 m^2.

This DC-coupled option has a combined area greater than the AC option due to the distribution of equipment and infrastructure across the Project Area, and spacing between key item e.g. BESS containers.

The system consists of 260 x 0.77MW/3.7MWh Blocks (Containers) and 438 DC-DC converters. The individual BESS containers and DC-DC converters are distributed through the solar farm. The maximum number of adjacent containers is 4, with associated DC-DC converters. Examples of this arrangement embedded in the solar farm are shown in Figure 13.

Figure 13: Example of DC Coupled BESS embedded in solar farm



Indicative BESS layouts are shown in Figure 14 for AC coupling and Figure 15 for DC coupling respectively.

Figure 14: Indicative BESS Layout (AC)

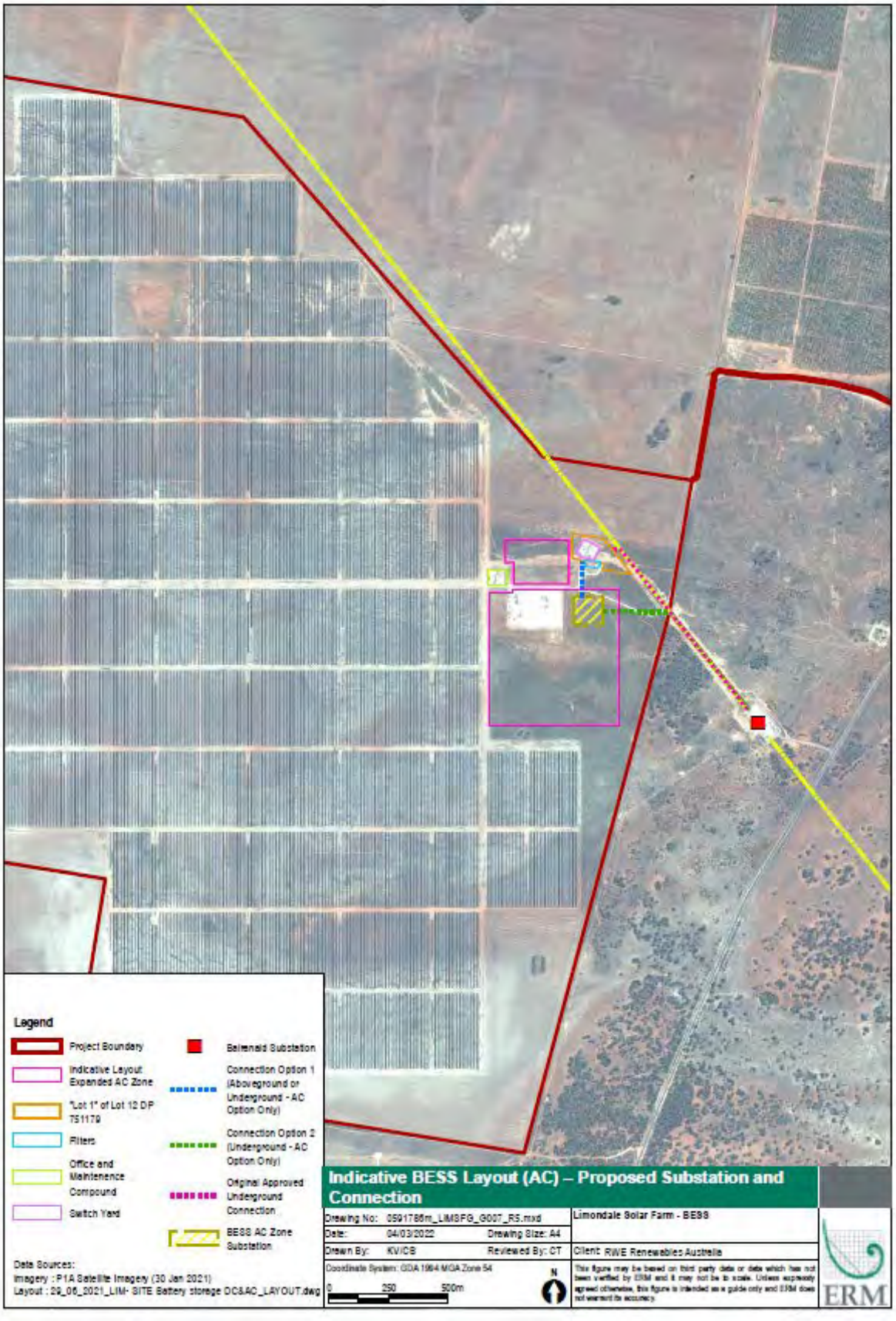


Figure 15: Indicative BESS Layout (DC)



3.4 HVAC System

Maintaining the temperature within limits is critical to the safety of the operations and this is typically achieved by dedicated HVAC system for each container and controlled by the BMS.

It is assumed that the BMS can shut down the BESS if the temperature limits are exceeded.

3.5 Electrical Collection System and Switchyard

The PV solar panels will be connected in series and the electricity generated by the project will be directed via underground electrical collection systems to the inverters. The inverters will connect to a project electrical switchyard and substation, which will use the connection infrastructure to export electricity to the grid network. All electricity generated by the PV solar panels will pass through the Balranald Substation and then be transmitted into the grid network.

The electrical switchyard and substation include (Figure 2):

- 220kV/33kV 250 MVA power transformer and associated bunding
- 33kV/415V earthing/auxiliary transformer and associated bunding
- 220kV & 33kV switchgear and switchgear buildings
- Auxiliary services building and storage
- Spill oil tank
- Electrical filters

The on-site electrical collection systems will be placed underground in trenches of between 600 to 1,200 mm in depth. The electrical cabling necessary to connect the PV solar panels in series will be positioned in cable trays mounted underneath the panels. It is estimated that 90, 2.5 MW inverters will be required; however, this will be dependent on the final detailed design.

It assumed that fire detection and protection in the switchyard will be to Australian Standards.

3.6 Operations and Management Hub

The site operations are managed from an operations and management hub (constructed). Structures include a demountable office control building, including staff amenities, and equipment storage sheds (see Figure 2). These are the receival point for all equipment delivery during construction and all management activities during the project's operational period.

Car parking facilities are also provided for employee and service vehicles.

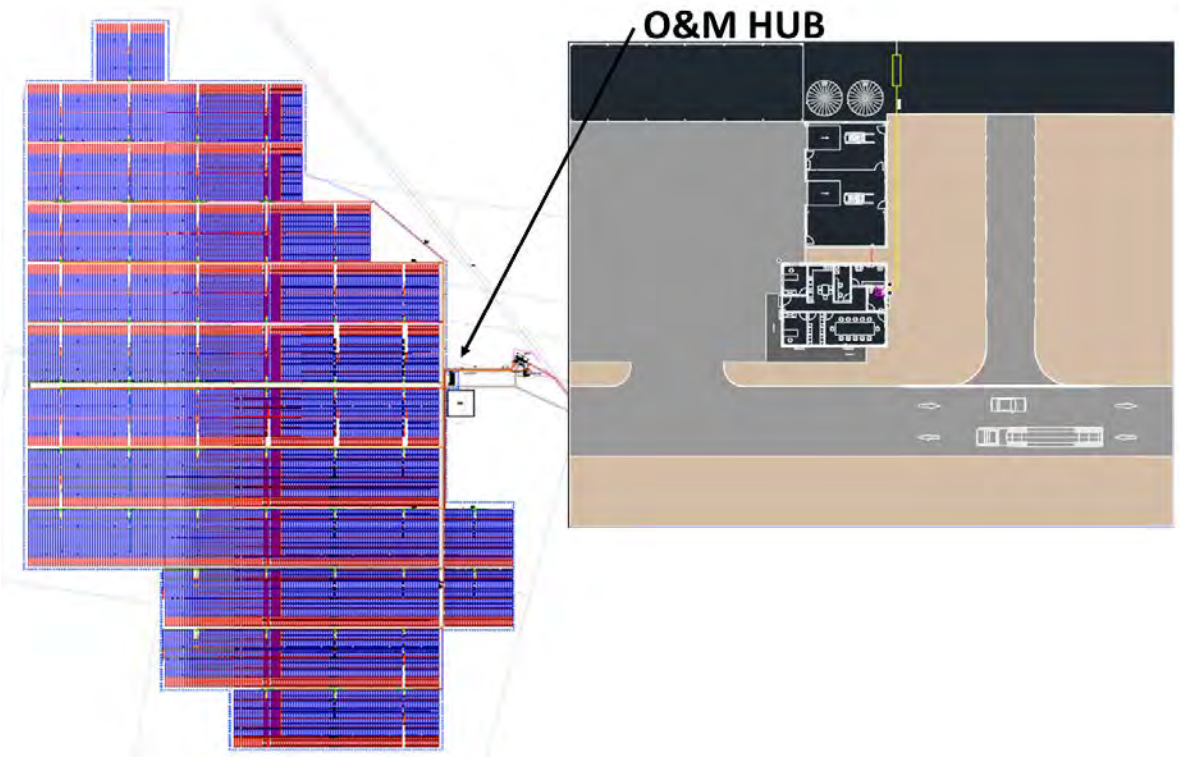
During normal operations, a maximum of 8.5 permanent staff will occupy these premises during shift overlap days. Whilst most activity is anticipated to occur during business hours, access to the Project Area will be required on a 24-hour basis, seven days a week, with 60% of their time spent in the O&M Hub.

Normal facility working hours are 8 hours per day, 7 days per week.

An additional 3 contractors may at site during a shift for specific maintenance activities, for approximately 3 months per year, with 60% of their time spent in the O&M Hub.

This facility has been constructed to meet Section 3 of Australian Standard 3959 – 2009 Construction of buildings in bushfire prone areas (see Page 127 of the EIS).

Figure 16: O & M Hub Location and Detail



3.7 Fire Protection System

The following fire protection is reported in the EIS (1):

- Page 84 *"Balranald Fire Station in the township of Balranald, approximately 14 km north of the site"*
- Page 126 *"The availability of water is a critical element in the control of a bushfire. Water for the project will be supplied by truck and stored in an on-site water tank, which will be available for firefighting if required."* This storage tank has a capacity of 250 kilolitres and is fitted with fire brigade approved Storz couplings. The storage tank is located approximately 725m north of the main entrance to the site, inside the fence line.
- Page 127 *"fire extinguishers will be maintained in buildings, vehicles and refuelling areas"*

It is noted that the BESS containers have smoke and carbon monoxide detectors and have a fixed fire suppression system (9). The system alarms on the activation of one detector and can activate the fire suppression system and electrically isolate the BESS container (9). The fire protection and suppression system for the BESS will be designed to meet the requirements of NFPA 855 (10) (or equivalent - See Appendix A for details).

4 HAZARD IDENTIFICATION

4.1 BESS Hazards

The Lithium-ion battery is classified as a Class 9 dangerous good (UN No. 3480) for transport purposes. The main hazards are (11):

- Overheating with toxic gas generation and emission to atmosphere and potential exposure to toxic gases such as Carbon Monoxide (CO), Hydrogen Chloride (HCl), Hydrogen Fluoride (HF) and Hydrogen Cyanide (HCN).
- Overheating with flammable gas generation within the container (CO, Hydrogen, hydrocarbons such as Benzene, Ethylene), ignition and explosion within the container, and potential for escalation to adjacent containers.
- Fire in Lithium-ion battery, escalating into the packs in the container, with potential for escalation to adjacent containers.

4.2 Electrical Hazards

- Power converter fire and explosion.
- High voltage transformer fire/ explosion, and potential for escalation.
- Electrical fire in sub-station (arcing etc.).
- Contact with electricity.

4.3 Other Hazards

Other hazards identified in the EIS include:

- Vehicle interaction with infrastructure.
- Electromagnetic radiation from high voltage sources.
- Natural hazards (earth tremor, adverse weather, bush fires).
- Dangerous goods storage and handling.

4.4 Hazard Register

A hazard identification register has been compiled, outlining the consequences of the identified hazards and the safeguards provided in the design towards prevention and mitigation. This register provided in Table 6.

Table 6: Hazard Identification and Safeguards Summary

No.	Hazard Scenario	Causes	Consequence	Potential for Offsite Impact	Identified / Recommended Safeguards
I	**Solar Farm Hazards**				
1	Solar power generation	- Damaged Connectors	- Installation faults System age	Fire	- Regular structural and equipment inspections.
		- Water Ingress to solar system	- Panel manufacturing faults Installation faults System age	Low Output Electric shock	• Regular structural and equipment inspections.
		- Earthing Failure	- Installation faults System age	Arc fault leading to: Explosion Fire Electric shock	• Regular structural and equipment inspections.
		- System voltage even if disconnected	- Storm Damaged Solar Panels - DC Coupled system can still charge during daylight hours	Electric shock	• restricted and remote access to site • mandatory site and electrical inductions • engineering controls
		- Arc fault	- Continuity disruption (series fault) or unintended current between two conductors due to ground fault (parallel arc fault)	No	• System trip/shutdown • Regular structural and equipment inspections.
3	Fire	- Electrical failures	- Injury/ potential fatality - Panel fire, with potential for escalation to adjacent panels - Toxic gas generation from panel fire - Scrub fire under the panels	Yes	• Electrical systems designed and installed to relevant standards • Site Emergency Response Plan • Bushfire management plan • firefighting equipment • fire warden training • early notification of emergency services

No.	Hazard Scenario	Causes	Consequence	Potential for Offsite Impact	Identified / Recommended Safeguards
		- Poor control of ignition sources			• Electrical systems designed and installed to relevant standards • Smoking in designated area only • Hot works procedure (including permits)
		- Refuelling	- Injury/ potential fatality		• Refuelling undertaken in designated refuelling bays • Plant and equipment to be electric powered/diesel fuelled where practicable • Spill kits & fire equipment
4	Occupational hazards	- Fall from height during inspection and maintenance – tops of panels can be 4m from the ground	- Injury/ potential fatality	No	• Competency training • Job safety analysis • Safety equipment for working at heights • Permit to work for high risk tasks
		- Mechanical pinch points from solar panel tracking equipment	- Injury	No	• Competency training • Permit to work for high risk tasks • Job safety analysis
II	**BESS Hazards**				
5	Battery Fire	- Electrical failures – overcharging/ over discharging - Internal short-circuit - Damaged battery - Battery overheating - Frequent charging and discharging of the battery capacity and degradation of battery	- Thermal runaway from exothermic reaction - Escalation to other battery packs and modules - Thermal radiation and escalation to adjacent battery container - Toxic gas generation (CO, HF, benzene and other flammable gases - Part of the offgases may combust depending on generation rate and	Yes	• Battery inspection and testing during installation • HVAC system to maintain temperatures within operating limits • Adequate spacing between battery packs for HVAC air circulation for heat dissipation • Implement a regular inspection and maintenance regime for the battery assemblies.

No.	Hazard Scenario	Causes	Consequence	Potential for Offsite Impact	Identified / Recommended Safeguards
		resulting in overheating (12)	oxygen availability, but combustion gases are still toxic (HF, HCl)		
	Arc Flashing and release of energy line-to-line or line-to-ground fault	- Maintenance performed when the DC side of the solar array is always energized whenever it is exposed to solar radiation	- Explosion resulting in intense heat, light, and pressure. - Potential fatality on exposure	Yes, through escalation on site.	Some safeguards are listed in Ref. (13): • proper equipment labelling • defined maintenance procedures • adjust the trip time settings of the overcurrent protective devices feeding the array collection system. • Possible interlock of container door opening with AC overcurrent trip system • use of smaller string inverters in place of large central inverters on the DC side
6	Battery Explosion	- Battery overheating and offgases generation that are flammable. - Ignition of offgases within enclose resulting in confined explosion	- Significant damage to the container - Explosion may be followed by fire - Escalation to adjacent containers	Yes	• HVAC system for temperature control • Temperature monitoring and high temperature trip by BMS • Off gas monitoring and alarm through a CO detector at the ventilation exhaust recommended
III	**Vehicle Interaction**				
7	Vehicle collision with site infrastructure	- Vehicle movements in vicinity of personnel, - Vehicle impact to infrastructure	Personal injury Damage to equipment	No	• Construction management plan that includes standard traffic rules and signage. • Traffic management plan that includes implementation of site speed limits, ensuring driver competency, fencing / bollards and positioning of batteries to minimise vehicle interaction. • Transport of dangerous goods will comply with the requirements of the Australian Code for the

No.	Hazard Scenario	Causes	Consequence	Potential for Offsite Impact	Identified / Recommended Safeguards
					Transport of Dangerous Goods by Road and Rail (the ADG Code). • Install bollards/protective barriers around key battery areas and infrastructure. • Ensuring driver competency through licensing and induction
IV	**Electromagnetic Radiation**				
8	EMR	- EMR generated from BESS, High Voltage Power lines, Grid infrastructure)	Exposure to EMR and personal injury	No	• All designs will be in accordance with the Guidelines for limiting exposure to Time varying Electric, Magnetic and Electromagnetic Fields (ICNIRP, 1998; ICNIRP, 2010b) and relevant codes and industry best practice standards in Australia. • All relevant procedures in relation to a high voltage installation will be adhered to throughout the life of the Project. • The security system for the site, including safety fencing and closure of gates, will be maintained throughout the construction and operation, to provide safe exposure distances to the public. • Restricted access to site and access only to safety inducted personnel. • Refer to Section 13.3 of the EIS for the EMR assessment.
V	**Natural hazards**				
9	Earthquake	- Earthquake	Personal injury, Solar Farm shut down	Yes– typically a large scale external event	• Project infrastructure will be built to relevant construction codes.

No.	Hazard Scenario	Causes	Consequence	Potential for Offsite Impact	Identified / Recommended Safeguards
10	Lightning	- Lightning	Personal injury, Solar Farm shut down	Yes - typically a large scale external event	• Project infrastructure to be constructed in accordance with electrical standards. • Lightning TARP (Triggered Action Response Plan) to guide site personnel response before/during/after lightning storm.
11	Bushfires	- Bushfires	Personal injury, Solar Farm shut down, Possible fire	Yes – typically a large scale external event	• The Bushfire Emergency Management and Operations Plan prepared in consultation with the RFS will be updated. This plan includes but is not limited to the following aspects: - Management of activities with a risk of fire ignition. - Management of fuel loads onsite. - Storage and maintenance of firefighting equipment, including siting and provision of adequate water supplies. • Respond to the requirements of the '*Planning for Bush Fire Projection 2018*' regulation, including: - Implementing APZ setbacks to mitigate external fire hazards, as well as mitigation of propagation of external fires to outside the Project boundary. - Implementing increased APZs for the BESS system, substation and switching station, and positioning outside of the flame throw distance, as detailed in the bushfire assessment. - Providing adequate egress/access to site, including multiple entrances and exits to site. - Emergency evacuation measures - ensuring that site staff and contractors are aware of evacuation measures and emergency procedures.
12	External fire (adjacent to site)	- Fire or explosion from adjacent land users	Asset damage, Solar Farm shut down, Personal injury	No	

No.	Hazard Scenario	Causes	Consequence	Potential for Offsite Impact	Identified / Recommended Safeguards
					• Operational procedures relating to mitigation and suppression of bush fire relevant to the operation of the Project. • Ensuring that there are on site fire protection systems to protect exposures. • Design buildings and structures to appropriate codes and standards. • Manage fuel for vehicles and machinery on site to appropriate standards. • There is a current Vegetation Management Plan and Emergency Management Plan that covers the listed controls.
VI	**Flammable and Combustible Materials Storage and Handling**				
13	Loss of containment of chemicals, including dangerous goods	- Damaged to chemical containers, spill during transport - Decanting of chemicals	Environmental impairment Personal injury	No	• Construction Environmental Management Plan and Operation Environmental Management Plan including spill containment and management. • Store chemical in line with appropriate Australian standards. • Implement a regular inspection and maintenance schedule for chemical storage areas. • Develop Safe Work Method Statement detailing methods for handling chemicals. • Provide spill kits to be used for accidental spill clean-up. • Safety Data Sheets (SDS's) available on site and referred to in handing processes. • Provide correct PPE to all staff (as per SDS).
VII	**Electrical Hazards**				

No.	Hazard Scenario	Causes	Consequence	Potential for Offsite Impact	Identified / Recommended Safeguards
14	Power converter fire/ explosion	- internal failure of a power capacitor - Overvoltage and cables overheated - Overcurrent and cables overheated - Arc fault	Localised fire damage. Plant shutdown Injury if personnel present in the vicinity	No	• Equipment certified and installed to relevant standards • Inverters tested for compliance with Australian Standard AS 4777.1-2015 • Voltage rating to match maximum open circuit voltage • Overcurrent trip if maximum current exceeded • Quality checks of installation before commissioning
15	Inverter failure	- Reverse polarity of cables, human error -	Electric shock and serious injury/ fatality	No	• Certified electrician • Quality checks of installation before commissioning
		- Overvoltage	Overheating and fire Electric shock	No	• System trip/shutdown • Voltage rating to match maximum open circuit voltage • Equipment tested & approved
15	Power Transformer Fire	- Coolant leak and ignition - Overheating - Earth leakage	- Transformer fire - Injury to personnel in the vicinity - Potential for escalation	No	• Designed to AS 2374.8:2000 – Power Transformers – Application Guide • Fire protection provided • Separation distance/ fire isolation of transformers
16	Transformer explosion	- Gases generation inside transformer enclosure (hydrogen)	- Overheating of transformer and explosion from overpressure	No	• Relief valve on transformer to vent off gases • High temperature trip
17	Contact with electricity	- Vermin exposing conductors - Contact with live electrical sources; - Cranes impacting overhead lines;	- Personal injury / fatality	No	• Implement Isolation procedures. • Install fit for purpose electrical systems. • Ensure that installation is carried out by suitably qualified electrical personnel. • Adherence to AS 3000. • Site and Electrical Inductions

No.	Hazard Scenario	Causes	Consequence	Potential for Offsite Impact	Identified / Recommended Safeguards
		- Hitting underground services; - Overhead services damaged during natural hazards; and - Security issues with trespassers in contact with electrical lines.			• Follow underground utility identification protocols, including Dial Before You Dig. • Contractor management, including: - Sign on/off registers. - Ensuring familiarity with site WHS procedures. - Appropriate permit to work procedures. - Crane height limitations where works are undertaken in the vicinity of overhead power lines – overhead work height limits.
VIII	**Site Security**				
18	Security breach	- Persons seeking theft of property/battery components	- Theft of equipment Personal injury	No	• Installation of fencing around facility and battery facility separately. • CCTV where practical on critical infrastructure/battery units. • Alarms/locks on battery doors. • Inspections to monitor for potential security concerns.
IX	**Construction Related Hazards**				
19	Construction risks	- General miscellaneous construction risks	- Personal injury / fatality	No	• Implement a Workplace Health and Safety (WHS) plan. • Conduct a detailed Safety in Design processes during project execution.
20	Transport and delivery (manual handling)	- Personnel injury though manual handling of equipment during operations	- Personal injury	No	• Adhere to requirement of a WHS plan and the ADG code. • Ensure batteries have specific equipment handling advice where appropriate for staff.

Only the hazards that could result in an offsite impact, and those hazards that may impact on emergency service providers are analysed in detail in Section 5.

5 RISK ANALYSIS

5.1 Battery Fires

The causes of battery fires are outlined in Table 6. This section describes fire modelling of a battery storage fire and its consequences.

There is no established methodology for quantitatively assessing fire hazards. Earlier studies were based on the total quantity of electrolyte in the container and treated the fire like other batteries. This had led to unrealistic separation distances (14).

Experiments on a Tesla Battery Pack conducted by Exponent Inc. (14) found the following:

- The propagation of fire within the container is slow when the source of fire was inside the container.
- The smoke is associated with thick white fumes vented through the container vent, with flames of up to 4m in height.
- At the centre of fire, temperatures up to 1100˚C were experienced, but outside temperature of container was not significantly higher than the ambient.
- The walls of the container did not fail for a fire that lasted 90 minutes. Many panels were unaffected and could be reused.

The study concluded that separation distances between containers was not required except for access to the end door(s). NFPA has included mitigation controls for these findings in the newly published NFPA 855 (10).

Some of the earlier studies on BESS fire assessment (15) have postulated a fire temperature of the panel as 500˚C and calculated thermal radiation from a planar surface (battery panel dimensions) to a receiving plane. The distances were quite short, 3m to 4.7 kW/m^2, and 1m to 23 kW/m^2. This approach does not reflect the nature of the battery fires described in the experiment (14).

A battery container fire behaves quite differently whether the container is naturally ventilated or forced ventilated. In more detailed study sponsored by the NFPA in the USA, Hutchison (6) described a battery container fire development with forced ventilation as follows:

(a) Local heating and generation of off gases containing significant flammables.

(b) Ignition of flammables resulting in jet fire of high intensity but does not last long.

(c) The fire further heats the battery racks and generates more off gases and jet fire.

(d) Thus, the fire is a cyclical phenomenon, alternating between a jet fire and developing fire in target racks.

(e) Not only the decomposing electrolyte, but the battery materials, cables and insulation materials containing plastics also get involved in the fire, as the fire spreads.

(f) Without fire protection, the fire spreads to the whole of the container, whose wall may collapse due to excessive pressure inside, if the ventilation system cannot remove the smoke layer effectively.

(g) In a fully developed fire, the radiating rectangular surface of the container wall can radiate heat to the surrounds by heating an adjacent container and generating off gases from the battery rack on the heat receiving container.

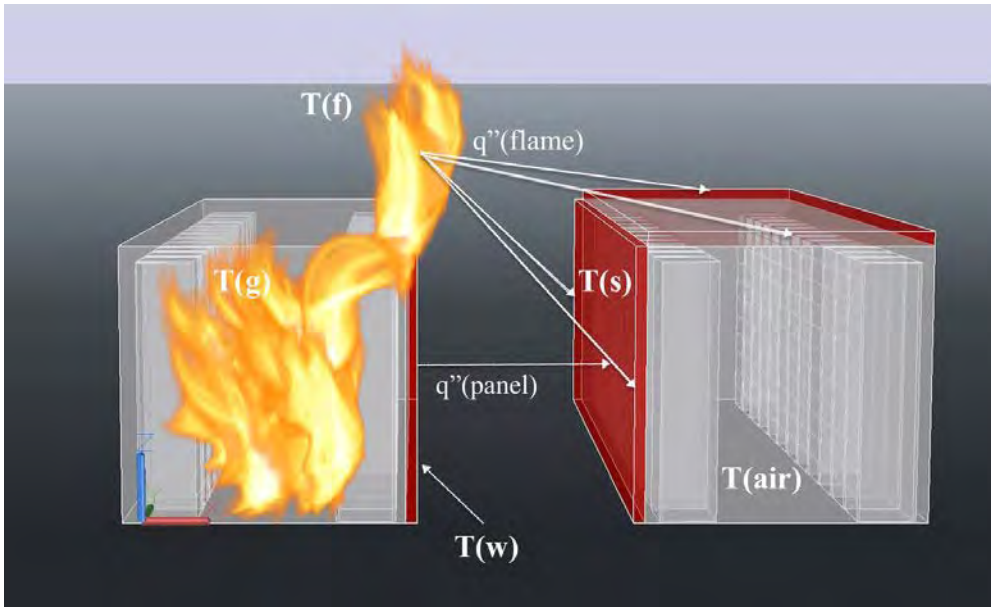
(h) The fully developed fire may be modelled as a surface fire of the whole side wall of the container, radiating with a surface temperature of 500^{O}C, and high emissivity, similar to a plastic material fire.

(i) With fire protection, the container would remain intact and while the fire gradually abates, the generated gases and combustion products are vented through the ventilation exhaust duct on the roof.

(j) The vent itself can catch fire and the torch fire of ignited flammable gases can radiate high intensity thermal radiation to the surroundings, an additional source of thermal radiation that helps to heat up adjacent container and impact on personnel in the vicinity.

The fire growth is schematically shown in Figure 17, reproduced from (6).

Figure 17: BESS Container Fire Radiation Modelling Schematic



While Figure 17 shows the fully developed fire, it is necessary to take into account the fire protection aspects into account as an integral part of fire modelling, which makes the modelling more complex, but more representative of the fire.

Since the BESS fire modelling is still in the developmental stages, with limited field data and some planned experimental data (14), this study has not quantitatively modelled BESS fires. Instead, based on the available data, it can be concluded that, provided adequate fire protection is provided, including cooling adjacent containers, fire escalation to adjacent containers can be prevented with the separation distance already provided for explosion escalation prevention, described in the next section.

It may be concluded that the thermal radiation effects of BESS fires would be confined within the site and there would be no offsite thermal radiation effect. The separation distance between containers also enables approach of the fire by firefighting personnel.

In the case study shown, the fire brigade decided to let the unit burn out and protect surrounding units from exposure.

5.2 Toxic Gas Exposure

When a battery pack gets overheated, it produces off gases that are flammable and toxic. Typical composition of off gas for Lithium Iron Phosphate battery is listed in Table 7 (11).

Table 7: Off Gas Composition from Overheating of Lithium Phosphate BESS

Chemical	Name	% in offgas
CO_2	Carbon Dioxide	36.9
CO	Carbon Monoxide	11.9
CH_4	Methane	5.9
C_2H_6	Ethane	21.1
C_2H_4	Ethylene	6.1
C_3H_8	Propane	4.7
HCl	Hydrogen Chloride	1.1
HF	Hydrogen Fluoride	3.8
HCN	Hydrogen Cyanide	0.6
C_6H_6	Benzene	0.3
C_7H_8	Toluene	0.7
C_2H_5OH	Ethanol	4.2
CH_3OH	Methanol	2.6
	Total	100.0
Average Molecular weight		35.41

The total flammable gas content is 54.7%. Toxic gas concentration is 17.4% (CO, HCl, HF and HCN).

The off gas generation rate is calculated as follows (normalised to 25^{O}C), and using the molecular weight in Table 7:

- It is assumed that one string (8 modules) can be overheated over a period of 240 sec, based on the data in Ref. (16).
- The rating of a cell is taken as 1.5 Ah, and offgas generation rate = 4 L/Ah (11).
- Off gas generated = [8x52 x 1.5/240] x4 L/Ah x (1/1000) m^3/s] / [24.44 m^3/kg mol] x 35.41 kg/ kmol] = 0.01 kg/s.
- Emission temperature = 75^{O}C.

Gas dispersion calculation were conducted for a generation rate of 0.01 kg/s emitted through the roof vent, at a height of 3m above ground level, using the gas composition in (11).

The DNV software package PHAST 8.4 was used for dispersion.

Toxic exposures were tracked at the following concentrations for HCl, HF, HCN, CO and CO_2. The definitions of ERPG are reproduced from Ref. (17).

- ERPG 2: The maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to one hour without experiencing or developing irreversible or other serious health effects or symptoms that could impair an individual's ability to take protective action.

  Evacuation required as soon as possible. Emergency services to approach with breathing apparatus, as the fire could escalate.

- ERPG 3: The maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to one hour without experiencing or developing life-threatening health effects.

  Immediate evacuation required. Emergency services to approach with breathing apparatus

The ERPG concentrations are listed in Table 8 (18).

Table 8: ERPG Concentrations for Toxic Components

No.	Component	Symbol	ERPG2, ppm	ERPG3, ppm
1	Hydrogen Chloride	HCl	20	150
2	Hydrogen Fluoride	HF	20	50
3	Carbon Monoxide	CO	350	500
4	Hydrogen Cyanide	HCN	10	25

5.2.1 Injury Concentrations

The dispersion modelling results are shown in Figure 18, Figure 19, Figure 20 and Figure 21 for HCl, HF, HCN and CO, respectively. The injury concentration is taken as the ERPG-3 level, at which a person may experience life-threatening effects if exposed for more than 1 hour.

Figure 18: Dispersion Profile (Side View) for HCl to ERPG-3

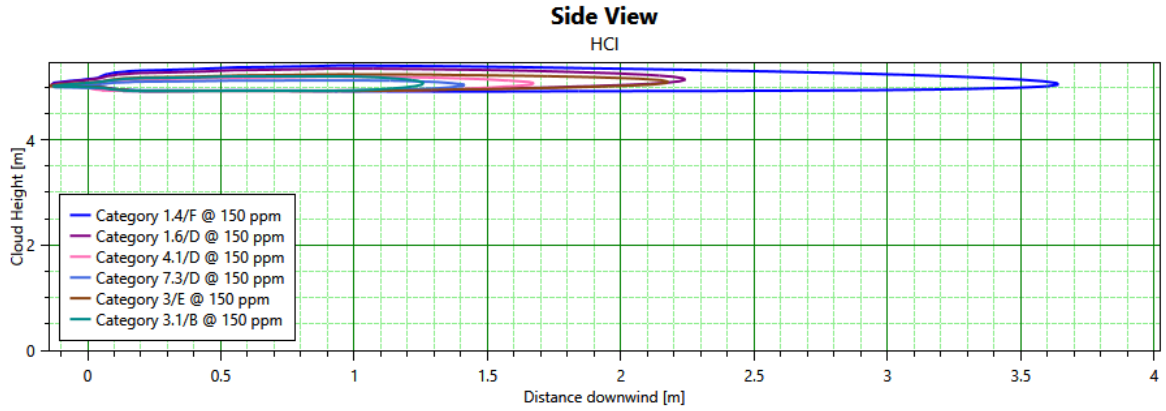


Figure 19: Dispersion Profile (Side View) for HF to ERPG-3

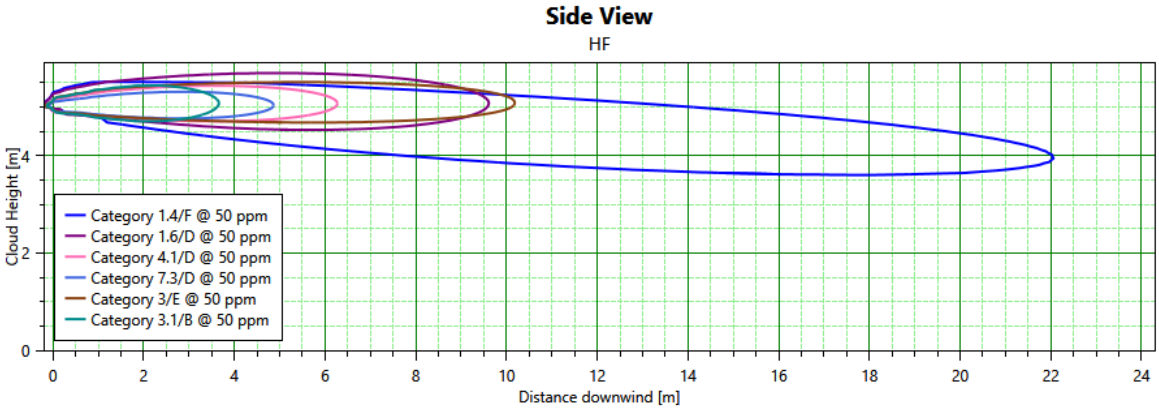


Figure 20: Dispersion Profile (Side View) for HCN to ERPG-3

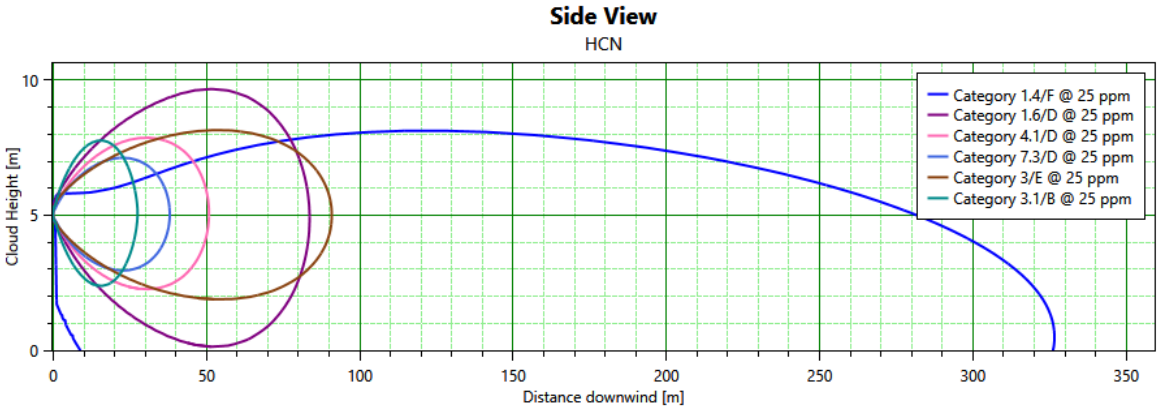
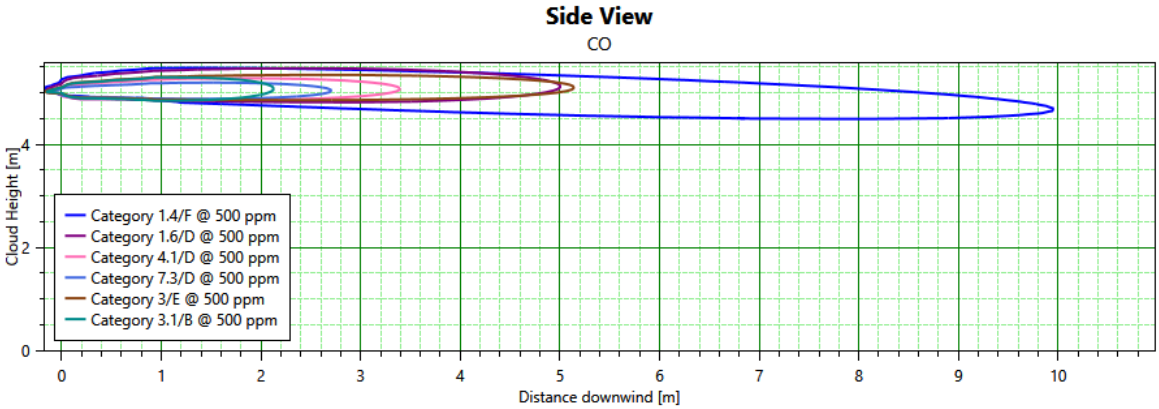


Figure 21: Dispersion Profile (Side View) for CO to ERPG-3



Findings from the dispersion modelling are summarised below:

- For HCl, HF and CO dispersions, the toxic substance stays in the dispersing plume, released 5m above ground level and does not result in injury producing concentrations at ground level.

- For HCN dispersion, the maximum distance to a concentration that can produce 0.1% lethal effect is 21-91m from the container vent. except for wind conditions F1.4 (1.4m/s, Pasquil stability F), the ERPG-3 stays within the site boundary. For stable wind conditions the ERPG-3 concentration of 25 ppm would reach 325m and exceed the site boundary.
- For CO, the 0.1% lethality concentration is less than the ERPG3 concentration of 500 ppm, which can occur up to 10m. The distance of 10m from a container is within the site boundary. The concentration, however, does not reach ground levels.
- There is no toxic injury impact to personnel or public from CO, HCl and HF in the emission of off gases as the toxic concentrations do not reach ground level.
- Entry into the container for firefighting will require self-contained breathing apparatus to be worn by the fire fighters.

5.2.2 Irritation/ Discomfort Concentrations

The toxic concentrations at which a person exposed may experience irritation and discomfort, but not injury effects, are taken as the ERPG-2 levels.

The dispersion modelling results for ERPG-2 levels are shown in Figure 22, Figure 23, Figure 24 and Figure 25 for HCl, HF, HCN and CO, respectively.

Figure 22: Dispersion Profile (Side View) for HCl to ERPG-2

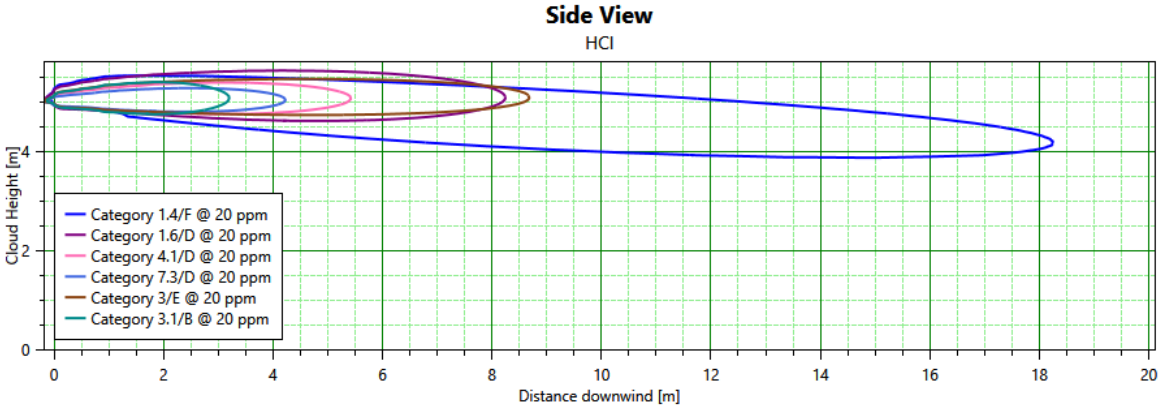


Figure 23: Dispersion Profile (Side View) for HF to ERPG-2

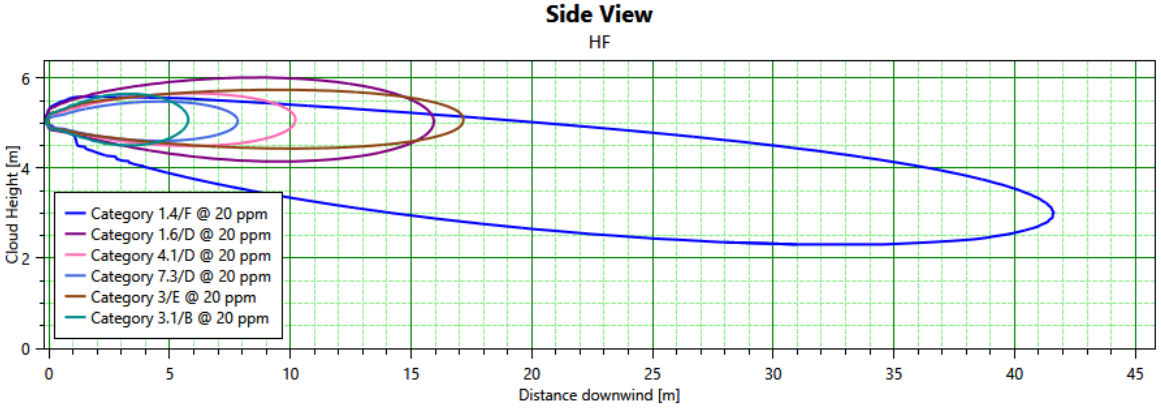


Figure 24: Dispersion Profile (Side View) for HCN to ERPG-2

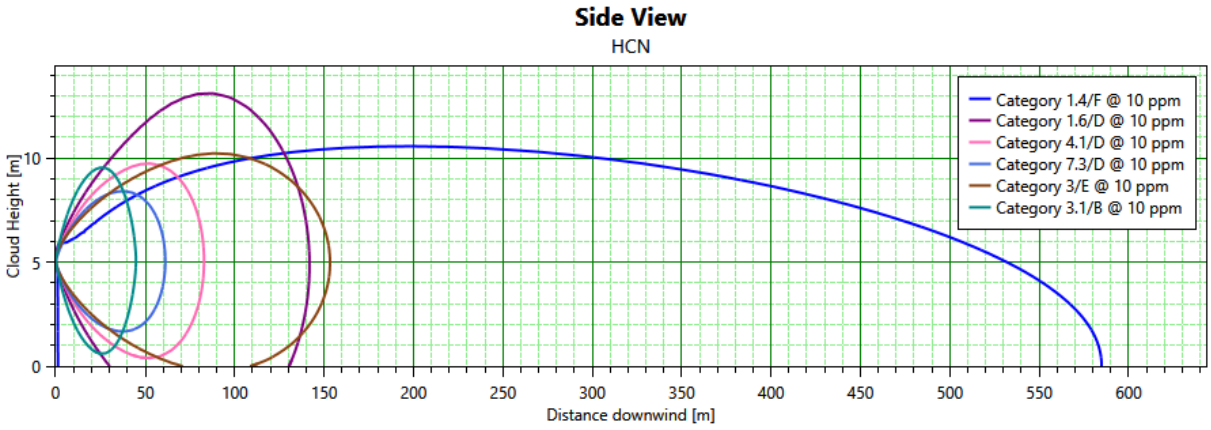
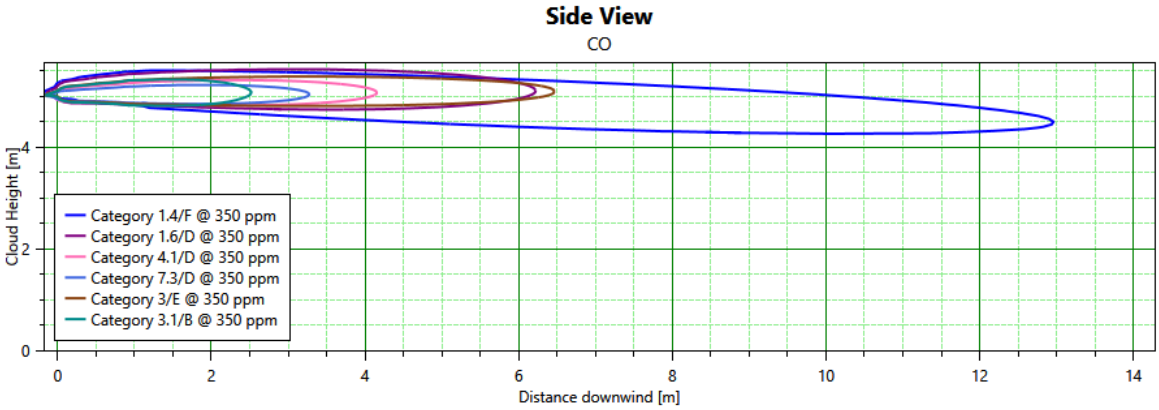


Figure 25: Dispersion Profile (Side View) for CO to ERPG-2



Findings from the dispersion modelling are summarised below:

- Toxic concentrations to ERPG-2 level do not reach ground level, except for HCN at low wind speeds.
- Toxic concentrations to ERPG-2 level for HCl, HF and CO cover a range of 14-42m and are confined entirely within the site boundary.
- Toxic concentrations to ERPG-2 level for HCN can extend to a distance of 585m and can extend outside the site, but does not reach residential areas or sensitive land uses.
- F stability occurs for only 2% of time during day time, but can occur for up to 30% of the time at night.
- The only offsite impact is from HCN in the offgases, and may reach the Sunraysia solar farm OMG area. Site emergency response plan needs to address potential impact on adjacent solar farm. This impact is not fatal, but can produce discomfort/ injury.
- A frequency assessment was not carried out because injury / irritation risk criteria are only relevant for residential & sensitive uses, and the consequence distances do not reach these areas.

5.3 Battery Storage Container Explosion

When a battery pack gets overheated, it produces off gases that are flammable and toxic.

The off gas composition in Table 7 does not show hydrogen. According to Ref. (11), hydrogen evolves as part of the off gases, and gets consumed in the process by the time the gas reaches the sensors and hence H_2 was not reported. A maximum of 30% hydrogen could be present. The DNV study (11) assumed 30% in the off gas and normalised the composition of the measured gas to arrive at the gas composition as it is evolved from the battery pack.

The gas composition adjusted for hydrogen is shown in Table 9.

Table 9: Calculated Off Gas Contents Incorporating Assumed Hydrogen Content of 30%

Chemical	Name	% in offgas
CO_2	Carbon Dioxide	31.3
CO	Carbon Monoxide	10.1
CH_4	Methane	5.1
C_2H_6	Ethane	18.2
C_2H_4	Ethylene	5.1
H2	Hydrogen	30.3
	Total	100.0
	Molecular weight	24.91

The off gas generation rate is calculated as follows (normalised to 25^{O}C):

- Overheating is assumed to evolve off gases until ignition occurs, after which the gas themselves would be combusted in the flame (19). The duration to spread through a module is estimated to be 240-280 seconds (16). The lower value was used for conservatism.
- One string (8 modules) assumed to be involved in the overheating, with 52 cells to a module.
- The capacity of a cell is 1.5 Ah (Ampere-hours) (11). Total capacity overheating = 8x52x1.5 = 624 Ah.
- Thus, the capacity emitting off gases = [624 Ah] /240 s] = 2.6 Ah/s. The emission, however, would be continuous as the runaway escalated to other modules.
- Volume of off gases = 4 L/Ah (11).
- Thus, flammable off gas generation rate = [4 L/Ah x 2.6 Ah/s x (1/1000) m^3/s] / [24.44 m3/kg mol] x 24.91 kg/ kmol]= 6.89E-03 kg/s.

5.3.1.1 Flammable Concentration in Container

The lower flammability limit (LFL) of the gas mixture in the container is calculated using the Le Chatelier principle as follows:

Table 10: Calculation of Lower Flammability Limit of Off Gas Mixture

Gas	LFL,%	UFL,%	% in off gas
CO_2	-	-	31.3
CO	12	75	10.1
CH_4	4.4	16.4	5.1
C_2H_6	3	12.4	18.2
C_2H_4	2.75	28.6	5.1
H2	4	75	30.3
Molecular weight			24.91
Molecular weight (flammables alone)			16.2

$$LFL_{mixture} = \frac{\sum y_i}{\sum \frac{y_i}{LFL_i}}$$

Where yi = mole fraction of component 'I' and LFL_i is the lower flammability limit (volume fraction) of component 'I'.

Therefore, LFL = (1-0.313)/ [(0.101/0.12+0.051/0.044+0.182/0.03+0.051/0.0275+0.303/0.04)] = 0.0393 (v/v), or (flammables alone)

On mass basis, LFL mixture = 0.0223 kg/m^3

Container volume = 12.2m x 2.62m x 2.44m = 77.93 m^3.

Free volume in container (i.e. volume not occupied by battery modules) = 25% (19.48 m^3).

Flammables concentration in container is calculated as follows:

$$V\, dc/dt = v.\, c_0 - v.\, c + w$$

Where V = free volume in container; c = concentration in container kg/m^3; v = HVAC flow rate m^3/s; w = flammable off gas generation rate; and t = time; c_0 = flammable gas concentration in incoming air = 0.

v can also be expressed as an air change rate per hour (ACH) = v/V x 3600

Solving, c =(w/v) [1- exp(-v.t/V)].

Steady state concentration in the container = w/v.

A sensitivity analysis for various ACH values gave the results shown in Table 11.

Table 11: Flammable Gas Concentrations in Container for Various ACH

No.	ACH	v, m^3/s	C (steady state) = w/v kg/m^3	LFL mixure kg/m^3	Flammable mixture in container?	Time to reach LFL, min
V_{free} = 19.48 m^3; w = 0.01 kg/s (total); w = 6.89E-03 kg/s (Flammable)						
1	6	0.032	2.12E-01	2.23E-02	Yes	0.99
2	12	0.065	1.06E-01	2.23E-02	Yes	1.05
3	20	0.108	6.37E-02	2.23E-02	Yes	1.15

No.	ACH	v, m^3/s	C (steady state) = w/v kg/m^3	LFL mixure kg/m^3	Flammable mixture in container?	Time to reach LFL, min
4	30	0.162	4.25E-02	2.23E-02	Yes	1.32
5	40	0.216	3.18E-02	2.23E-02	Yes	1.60
6	50	0.271	2.55E-02	2.23E-02	Yes	2.22
7	57	0.308	2.23E-02	2.23E-02	No	Not reached

If the ACH is < 57, the off gas mixture in the container can be still flammable and an ignition may result in an explosion.

For ACH >57 or higher, an explosion can be averted.

If HVAC fails, any off gas would quickly accumulate and result in an explosion if ignited.

It is desirable to have a CO detector on the ventilation exhaust duct (CO is present whether the gas is ignited or not), and shutdown the BESS charging / discharging if CO is detected. HVAC should be kept on, and alarm if HVAC flow stops. These aspects are covered in the recommendations.

5.3.1.2 Explosion Consequence

If ignition if off gases occurs, at the time of ignition, the total amount of flammable gas present in the container is taken as the stoichiometric mixture (worst case explosion scenario).

The flammable gas concentration in the container at the time of ignition is taken as 0.0591 kg/m^3 (the geometric mean of LFL and UFL), and the flammable gas content is 1.15 kg.

The flammable gas compositions are in Table 10, except for the CO_2.

The explosion overpressures generated by ignition of the gas cloud are calculated using the TNT explosion model in PHAST 8.4.

The explosion overpressures generated are summarised in Table 12.

Table 12: BESS Explosion Results

Explosion overpressure, kPa	Distance from Container, m	Consequences	Offsite Impact?
7	10.4	Damage to battery pack Injury to personnel on site	No
14	6.6	Damage to battery pack Injury to personnel on site	No
21	5.1	Major damage to storage Potential for damage to adjacent container	No
35	3.4	Escalation to adjacent BESS container and damage to battery package in adjacent container, propagating to other containers	No

It was found that there would be no offsite impact from a battery storage container explosion.

If two containers are within 3m of one another, an explosion in one container may result in incident escalation and domino effect.

It is recommended that to protect adjacent containers, they be located with a minimum distance of 3 m from one another. This is consistent with the requirements of NFPA 855.

If a high CO alarm is raised, then personnel entry into a BESS container is not advisable due to the potential for an explosion. The ventilation system should be maintained, and the unit shut down until the alarm is cleared.

5.4 Electrical Hazards

5.4.1 Transformer Fire

The BESS produces 600V DC. This needs to be converted into ultimate grid voltage of 220 kV AC through a series of power transformers.

There are several configurations possible and the optimum configuration will be finalised during detailed design. For sake of the PHA, the following configuration is selected:

BESS (600 V DC) ⟶ Inverter (690 V AC) ⟶ Booster Transformer (0.69/35 kV)

⟶ Power transformer (35 kV to 220 kV to grid)

The power transformer has a capacity of 415kVA - 35/220 kV. The transformer oil volume in circulation is assumed to be 800 Litres (20). The oil tank of capacity 12,000 L is located on top of the transformer. The transformer is located in a bund.

5.4.2 Impairment Criteria

The levels of heat radiation selected to examine the heat effects were 4.7, 12.5, 23, 30, and 37.5 kW/m^2, as given in HIPAP No.4 (21).

The general effects of these levels of heat radiation are summarised in Table 13. These heat flux radiation effects are widely accepted by industry and is appropriate for this analysis.

Table 13: Heat Radiation Effects

Heat Radiation (kW/m^2)	Effect
4.7	Maximum heat radiation level to which fire-fighting personnel may be exposed.
12.5	Thin steel with insulation on the side away from the fire may reach a thermal stress level high enough to cause structural failure. 30% chance of fatality for long exposure. High chance of injury.
23	Unprotected steel will reach thermal stress temperatures to cause failure. Pressure vessels need to be relieved, or failure will occur. 100% chance of fatality for long exposure and 10% chance of fatality for instantaneous exposure.
37.5	100% chance of fatality for instantaneous exposure.

5.4.3 Material Modelled

The transformer oil is a mineral oil, comprising of hydro-treated light naphthenic and paraffinic distillates. On this basis, dodecane (C12) was selected as a representative single component material for the consequence modelling.

PHAST 8.4 models both the luminous and smoky part of the flame for calculating thermal radiation impact distances.

5.4.4 Pool Fire Results

The results in the following table represent the maximum ground level impact distance measured from the centre of the bund in a downwind orientation. The flame height represents the length of the flame from the pool surface to the tip of the flame.

Substation layout design details are not available at the stage of the EIS. Two sets of transformers in parallel are assumed.

The heat radiation hazard zones are determined using PHAST 8.4. The bund fire was modelled as a circular pool with an equivalent area to that of the area of the rectangular bund (equivalent 8m diameter).

Table 14: Transformer Bund Pool Fire Heat Radiation Impact Distances

Stability Class /Wind Speed	Maximum Surface Emissive Power (kW/m²)	Pool Diameter (m)	Flame Height (m)	Wind Tilt (deg)	Distance to heat radiation kW/m² (m)			
					4.7	12.6	23	35
D 1.6	86.4	8	11.8	30.6	22.5	15.3	11.1	7.8
D 4.1	86.4	8	11.8	34.9	23.4	16.6	13.0	8.8
D 7.3	86.4.	8	11.8	58.9	23.5	17.8	14.5	9.4

*pool fire diameter based on the equivalent diameter of the bund.

The thermal radiation impacts from transformer fires are confined within the site boundary with no potentially injurious offsite effects. The separation distances between transformers and to protected works on site is specified in AS-2067 (2016).

From fire hydrants available, the fire can be fought with fire water and foam. Based on a recent fire in Victoria (22), the fire brigade approach appears to be to let a container burn itself out, evacuate non-essential personnel and protect exposures – i.e. other containers exposed to the original fire.

It is necessary that that all bund penetrations, including conduits, are sealed with a suitable fire-resistant packing or sealant.

6 STANDARDS APPLICABLE TO BESS

Several Australian and International standards exist or are in development for battery energy storage systems. The relevance of each standard to the Limondale Solar Farm BESS is discussed below.

6.1 NFPA 855: Standard for the Installation of Stationary Energy Storage Systems

The purpose of this standard (10) is to provide the minimum requirements for mitigating the hazards associated with stationary energy storage systems.

6.2 AS/NZS 5139: Electrical Installations - Safety of Battery Systems for use with Power Conversion Equipment

This standard (23) only applies if "each individual BESS is no more than 200 kWh". Current advice is that each individual BESS unit will be 2.5 MWh. Therefore AS/NZS 5139 is not applicable.

6.3 IEC 62897: ED1 Stationary Energy Storage Systems with Lithium Batteries - Safety Requirements

This standard is still under development, and therefore not applicable.

6.4 IEC 62933 Series

This standard (24) is currently under development, with the following sections published:

- IEC 62933-1:2018, Electrical energy storage (ESS) systems – Part 1: Vocabulary

  Defines terms applicable to electrical energy storage (EES) systems including terms necessary for the definition of unit parameters, test methods, planning, installation, safety and environmental issues.

  This terminology document is applicable to grid-connected systems able to extract electrical energy from an electric power system, store it internally, and inject electrical power to an electric power system. The step for charging and discharging an EES system may comprise an energy conversion.

- IEC 62933-2-1:2017, Electrical energy storage (ESS) systems – Part 2-1: Unit parameters and testing methods – General specification

  Focuses on unit parameters and testing methods of EES systems. The energy storage devices and technologies are outside the scope of this document. This document deals with EES system performance defining:

  - unit parameters,
  - testing methods.

- IEC TS 62933-3-1:2018, Electrical energy storage (ESS) systems – Part 3-1: Planning and performance assessment of electrical energy storage systems - General specification

  Is applicable to EES systems designed for grid-connected indoor or outdoor installation and operation. This document considers:

  - necessary functions and capabilities of EES systems
  - test items and performance assessment methods for EES systems

- requirements for monitoring and acquisition of EES system operating parameters
- exchange of system information and control capabilities required.

- IEC TS 62933-4-1:2017, Electrical energy storage (ESS) systems – Part 4-1: Guidance on environmental issues – General specification

  Describes environmental issues associated with electrical energy storage systems (EES systems), and presents guidelines to address the environmental impacts to and from EES systems including the impacts to humans due to chronic exposure associated with the mentioned environmental impacts.

- IEC TS 62933-5-1:2017, Electrical energy storage (ESS) systems – Part 5-2: Safety requirements for grid integrated ESS systems – electrochemical based systems

  Specifies safety considerations (e.g. hazards identification, risk assessment, risk mitigation) applicable to EES systems integrated with the electrical grid.

  This document provides criteria to foster the safe application and use of electric energy storage systems of any type or size intended for grid-integrated applications.

- IEC 62933-5-2:2020, Electrical energy storage (ESS) systems – Part 5-2: Safety requirements for grid integrated ESS systems – electrochemical based systems

  Primarily describes safety aspects for people and, where appropriate, safety matters related to the surroundings and living beings for grid-connected energy storage systems where an electrochemical storage subsystem is used.

6.5 UL 9540: Energy Storage System (ESS) Requirements

These requirements (25) cover energy storage systems that are intended to receive and store energy in some form so that the energy storage system can provide electrical energy to loads or to the local/area electric power system (EPS) when needed. The types of energy storage covered under this standard include electrochemical, chemical, mechanical, and thermal. This standard is covered/referred to by NFPA 855.

6.6 UL 9540A: Test Method for Evaluating Thermal Runaway Fire Propagation in Battery Energy Storage Systems

This standard (26) is a test method for BESS fires, and is covered/referred to by NFPA 855.

6.7 FM Global Property Loss Prevention Data Sheet 5-33: Electrical Energy Storage Systems

This data sheet (27) describes loss prevention recommendations for the design, operation, protection, inspection, maintenance, and testing of electrical energy storage systems (ESS) that use lithium-ion batteries.

6.8 FM Global's Development of Sprinkler Protection Guidance for Lithium Ion Based Energy Storage Systems

This guidance document (28) is only relevant for commercial occupancies and is not applicable for Limondale Solar Farm BESS.

6.9 IEEE Std 2030.2.1-2019: Guide for Design, Operation, and Maintenance of Battery Energy Storage Systems, both Stationary and Mobile, and Applications Integrated with Electric Power Systems

IEEE Std 2030.2.1 (29) provides guidance in understanding and defining the general structure of a battery energy storage system, its basic technical characteristics and general applications in an electric system, and how to design the battery system, power conversion system, monitoring, information exchange, and control (MIC) system. Furthermore, the standard also fills the need for guidance key to operating and maintaining a battery energy storage system in its application, including functional performance, optimization especially for batteries, and countermeasures for different emergencies.

6.10 EI Battery Storage Guidance Note 1: Battery Storage Planning

This publication (30) provides guidance covering various aspects of planning a battery storage facility. It provides an overview of battery storage types, planning regulations in the UK, and information on safety issues that should be considered during planning and risk assessments.

The UK planning regulations are not relevant here. The safety issues that should be considered for planning provides useful guidance.

6.11 EI Battery Storage Guidance Note 2: Battery Energy Storage System Fire Planning and Response

This publication (31) provides guidance on how to respond to BESS fires. It represents the 'current state' of knowledge (in 2019), but also identifies gaps in knowledge. The guidance covers primarily non-domestic battery installations, although the guidance may also generally be applicable to smaller, domestic-scale incidents. It provides an overview of the fire risk of common battery chemistries, briefly describes how battery fires behave, and provides guidance on personnel response, managing combustion products, risks to firefighters, pre-fire planning, and fire-aftermath.

Although much of this guidance is generally applicable to other battery chemistry types, this guidance is of particular relevance to fires involving Lithium-ion (Li-ion) chemistries, except where otherwise noted.

This publication provides useful guidance that would be input to an emergency response plan.

6.12 EI Battery Storage Guidance Note 3: Design, Construction and Maintenance

This publication (32) aims to capture learning and experience from battery storage construction projects, with special emphasis on ensuring the safety of such projects to people and environment. Based on industry interviews and available literature, this publication covers a large range of issues that have caused, or can potentially cause, issues during battery storage projects during design, construction, commissioning, or maintenance, including site selection, using containerised solutions, construction, maintenance, and decommissioning. Its purpose is not to provide a 'how to' document on constructing a battery storage system, but rather to share experience and help others to avoid some of the pitfalls that have affected previous projects, helping to avoid safety issues and project delays.

6.13 Summary

All the publications offer useful information on the safety requirements for battery energy storage systems. For the purposes of land use planning safety, NFPA 855 and FM Global DS 5-33 are most applicable.

As an example, an assessment of the two options for Limondale Solar Farm BESS against NFPA 855 has been conducted and the results shown in Appendix A.

7 RISK ASSESSMENT

7.1 Risk Criteria Comparison

The following table details a comparison of the risk analysis with the NSW DPIE Hazardous Industry Planning Advisory Paper No. 4, 'Risk Criteria for Land Use Safety Planning' (21).

Table 15: Risk Criteria Comparison

Criterion Description	Criterion Value, per year	Comment
Individual Fatality Risk Criteria		
Hospitals, schools, child-care facilities, old age housing.	0.5×10^{-6}	Distances to fatal consequences from fires and explosions are not reached at these land uses for hazards associated with the solar farm (refer to Section 5), BESS (refer to Section 5.1). Therefore, frequency assessment was not carried out. There is also significant uncertainty in frequency assessment of this evolving technology. Consequences resulting in potential fatality do not reach industrial areas.
Residential, hotels, motels, tourist resorts.	1×10^{-6}	
Commercial developments including retail centres, offices, and entertainment centres.	5×10^{-6}	
Sporting complexes and active open space.	10×10^{-6}	
Industrial	50×10^{-6}	
Injury Risk		
Incident heat flux radiation at residential and sensitive use areas should not exceed 4.7 kW/m^2.	50×10^{-6}	Potentially hazardous consequences (viz. >4.7 kW/m^2 or >7 kPa) are not reached at these land uses for fire / explosion hazards associated with the, BESS (refer to Section 5.1)
Incident explosion overpressure at residential and sensitive use areas should not exceed 7 kPa.	50×10^{-6}	
Toxic concentrations in residential and sensitive use areas should not exceed a level which would be seriously injurious to sensitive members of the community following a relatively short period of exposure.	10×10^{-6}	Potentially hazardous consequences are not reached at these land uses for fire hazards associated with the BESS (refer to Section 5.1).
Toxic concentrations in residential and sensitive use areas should not cause irritation to eyes or throat, coughing or other acute physiological responses in sensitive members of the community.	50×10^{-6}	

Criterion Description	Criterion Value, per year	Comment
Risk of Property Damage and Accident Propagation		
Incident heat flux radiation at neighbouring potentially hazardous installations or at land zoned to accommodate such installations should not exceed the 23 kW/m^2 heat flux level.	50 x 10^{-6} / year	Potentially hazardous consequences (viz. >23 kW/m^2 or >14 kPa) are not reached at these land uses for fire / explosion hazards associated with the BESS (refer to Section 5.1) and electrical systems (refer to Section 5.4).
Incident explosion overpressure at neighbouring potentially hazardous installations, at land zoned to accommodate such installations or at nearest public buildings should not exceed the 14 kPa explosion overpressure level.	50 x 10^{-6} / year	
Societal Fatality Risk	Refer to HIPAP No. 4, Figure 3: 'Indicative Societal Risk Criteria'	There is no offsite risk of fatality and hence there are no societal risk implications.

8 FINDINGS AND RECOMMENDATIONS

8.1 Findings

The key findings of the assessment include:

- The thermal radiation, explosion and toxic gas effects of BESS fires would be confined within the site and there would be no potentially injurious offsite effects. The separation distance between containers should enable approach of the fire by firefighting personnel; however, if entry into a container is required for firefighting this will require self-contained breathing apparatus due to the potentially toxic fumes.
- A separation distance of 3m between adjacent containers should be considered to prevent escalation from an explosion of off gases generated in one container from battery overheating (refer to Section 5.3.1.2).
- Toxic gas concentrations that produce injury or irritation level are confined entirely within the site boundary, and do not reach ground level, except for HCN concentrations that may reach outside the site boundary, but not to residential areas or sensitive land uses.
- If a high CO alarm is raised, then personnel entry into a BESS container is not advisable due to the potential for an explosion. The ventilation system should be maintained, and the unit shut down until the alarm is cleared.
- The thermal radiation impacts from transformer fires are confined within the site boundary with no potentially injurious offsite effects.
- The proposed development complies with the relevant DPIE criteria for land use safety planning (refer to Section 7.1).
- The DPIE risk criteria for land use safety planning in HIPAP No. 4 do not apply to the O&M building and the BESS since these facilities are within the boundary of the proposed development. To comply with Section 2.4.2.1 of HIPAP No. 4, "Individual fatality risk levels for industrial sites at levels of 50 in a million per year (50×10^{-6} per year) should, as a target, be contained within the boundaries of the site where applicable".

8.2 Recommendations

Recommendations based on the key findings of the assessment include:

1. A separation distance of 3m between adjacent containers should be considered to prevent escalation from an explosion of off gases generated in one container from battery overheating.
2. The transformers in separate bunds should be protected by firewalls if a separation distance of 10m from each other cannot be achieved.
3. Forced ventilation should be installed in the BESS containers (minimum 30 air changes per hour).
4. An alarm should be installed to indicate loss of ventilation flow through the containers.
5. Installing a CO detector on the ventilation exhaust duct (CO is present whether the gas is ignited or not) should be considered, with shutdown of the BESS charging/ discharging if CO is detected. The HVAC should be kept on, and alarm if HVAC flow stops.

6. Firefighting in a BESS container will require breathing apparatus protection to prevent exposure to potentially lethal toxic fumes.

7. Bollards/protective barriers around be provided around key battery areas and infrastructure.

8. The Emergency Response Plan for the proposed development should address the specific hazards identified in the PHA (e.g. battery overheating, fires, explosions etc.) and ensure emergency response personnel take appropriate precautions to protect themselves from the hazards and escalating events. Additional recommendations based on a gap analysis against the recommendations of NFPA 855 are also included in Appendix A.

NFPA 855 Compliance Requirements

9. Confirm HVAC monitoring, alarming and thermal or other trip systems for individual BESS containers. See also NFPA 855 4.2.9.2.

10. Confirm BESS is listed with UL 9450.

11. Confirm that BESS charge controllers, inverters and converters are UL 1741 listed or are provided as part of a listed ESS.

12. Confirm safety, automation and energy management systems meet the requirements of Section 4.2.9 of NFPA 855.

13. Any use of reused or repurposed storage batteries at the proposed facility should be subject to additional assessment and approval (As per Section 4.2.10 of NFPA 855).

14. Confirm that fire department access to the AC Coupled BESS layout complies with the requirements of FRNSW.

15. Complete a Hazardous Area Zoning Study for the solar farm, substation, O&M Hub, battery storage area plot.

16. Ensure in detailed design that BESS containers have fire control and suppression as recommended in NFPA 855 Section 4.11 (or equivalent).

17. The battery cell & module testing and certification have been completed, but unit level testing is yet to be completed. Confirm if BESS containers require explosion control as recommended in NFPA 855 Section 4.12 (or equivalent).

18. Confirm water supply meets the fire control & suppression demands from NFPA 855 Section 4.11 (or equivalent) and Australian Standards.

19. There are multiple carbon monoxide and smoke detectors in the BESS container. Confirm thermal runaway protection meets the recommendations of NFPA 855 Section 9.3 (or equivalent).

20. Confirm allowed storage of Used or Off-Specification Batteries at the O&M Hub and battery storage area plot. Confirm the storage meets the recommendations of NFPA 855 Section 14 (or equivalent).

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APPENDICES

Appendix A Review of Compliance with NFPA 855

An assessment of the Limondale Solar Farm preferred BESS against the relevant sections of NFPA 855 (10) and has been conducted and the results are shown below. This highlights any gaps against this standard, and where further information is required. Only the specific and relevant sections of NFPA 855 (10) are included.

Note that the date of publishing of NFPA 855 was August 25, 2019, and that is labelled the 2020 Edition. The pace of developments in battery energy storage systems and the development of their standards has been proceeding in parallel. Thus, some of the parts of NFPA 855 would not have been known during the development of the Limondale Solar Farm Project.

It is also acknowledged that items such as UL listing of components or systems can take time to complete.

NFPA 855 Paragraph	Potential Gap/s	Comment
4.1.1 ESS Gas Release ESS shall not release toxic or highly toxic gas creating conditions in excess of the permissible exposure limit (PEL) in the room or space in which they are located during normal charging, discharging, and use.	No Gap Identified	BESS containers have air conditioning for operational reasons. Recommendation B1: Confirm HVAC monitoring, alarming and thermal or other trip systems for individual BESS containers. See also NFPA 855 4.2.9.2.
4.1.2 Construction Documents	Not currently applicable	Project is not at construction phase. This section does provide a useful check of the requirements.
4.1.3 Emergency Planning and Training	Not currently applicable	Project is not at construction phase. This section does provide a useful check of the requirements.
4.1.4 Hazard Mitigation Analysis	No Gap Identified	This PHA study meets this requirement.
4.1.5.1 Where required elsewhere in this standard, large scale fire testing in accordance with 4.1.5 shall be conducted on a representative ESS in accordance with UL 9450A or equivalent test standard.	No Gap Identified	BESS is compliant with UL 9450A.
4.2.1 Listings ESS shall be listed in accordance with UL 9450, unless specifically exempted in other sections of this standard.	Unknown	Recommendation B2: Confirm BESS listed with UL 9450.

NFPA 855 Paragraph	Potential Gap/s	Comment
4.2.2 Repairs	Not currently applicable	Project is not at construction phase. This section does provide a useful check of the requirements.
4.2.3 Retrofits	Not currently applicable	Project is not at construction phase. This section does provide a useful check of the requirements.
4.2.4 Replacements	Not applicable	Project is not at construction phase. Any replacements should be evaluated as new ESS's as per this section.
4.2.5 Increase in Power Rating or Maximum Stored Energy	Not currently applicable	It is envisaged that the planning approval would set a maximum stored energy value for the BESS. Any increase would thereby be subject of an amendment or new planning approval.
4.2.6 Environment The temperature, humidity, and other environmental conditions in which an ESS is located shall be maintained in accordance with the listing and the manufacturer's specifications.	Unknown	See recommendations B1 & B2.
4.2.7 Charge Controllers	Unknown	Recommendation B3: Confirm BESS charge controllers are UL 1741 listed or are provided as part of a listed ESS.
4.2.8 Inverters and Converters	Unknown	Recommendation B4: Confirm BESS inverters and converters are UL 1741 listed.
4.2.9 Energy Storage Management System (ESMS)	Unknown	Recommendation B5: Confirm safety, automation and energy management systems meet the requirements of this section.
4.2.10 Reused and repurposed equipment	Unknown	Recommendation B6: Any use reused or repurposed storage batteries at the proposed facility should be subject to additional assessment and approval (As per Section 4.2.10 of NFPA 855).

NFPA 855 Paragraph	Potential Gap/s	Comment
4.3 Installation	Not currently applicable	Detailed engineering for the project has not commenced. Installation to relevant standards is assumed in the EIS. It is noted that no comment about seismic risk is made in the EIS apart from compliance with relevant standards. Commentary about seismic risk is included in this PHA Report.
4.4.3.1 Classification	No Gap Identified	Classification is set as *Remote locations*. DC Coupled – nearest BESS container is more than 30.5m from any exposure hazards. AC Coupled – the BESS container layout will be designed more than 30.5m from the O&M Hub and more than 30.5m from the Travelling Stock Reserve.
4.4.3.2 Maximum Size 4.4.3.2.1 Outdoor walk-in containers or enclosures housing ESS shall not exceed 53 ft x 8.5 ft x 9.5 ft (16.2 m x 2.6 m x 2.9 m), not including HVAC and other equipment.	No Gap Identified	BESS containers are 5.960 m x 2.358 m x 2.9 m.
4.4.3.3 ESS located outdoors shall be separated by a minimum of 10 ft (3048 mm) from the following exposures:		
(1) Lot lines	No Gap Identified	No BESS container within 3048 mm of a lot line.
(2) Public ways	No Gap Identified	No BESS container within 3048 mm of a public way.
(3) Buildings	No Gap Identified	BESS containers are more than 30.5 from the nearest exposure hazards by design.
(4) Stored combustible materials	No Gap Identified	Compliance to relevant industry standards Identified as mitigation in the EIS.
(5) Hazardous materials	No Gap Identified	Compliance to relevant industry standards Identified as mitigation in the EIS.
(6) High-piled stock	No Gap Identified	Compliance to relevant industry standards Identified as mitigation in the EIS.

NFPA 855 Paragraph	Potential Gap/s	Comment
(7) Other exposure hazards not associated with electrical grid infrastructure	No Gap Identified	Compliance to relevant industry standards Identified as mitigation in the EIS, including a Bushfire Management Plan.
4.4.3.3.6 Exhaust outlets from an ESS that exhaust other than ventilation air shall be located at least 15 ft (4.572 m) from the heating, ventilating and air conditioning (HVAC) air intakes, windows, doors, loading docks, ignition sources, and other openings into buildings and facilities.	Unknown	Unclear whether containers have or need fire/explosion venting. See 4.12 Explosion Control.
4.4.3.4 Means of Egress Separation	Gap Identified	AC Coupled - Compliance to relevant industry standards Identified as mitigation in the EIS, however, means of egress from the BESS plot is unclear. Recommendation B7: Confirm that the means of egress from the AC Coupled BESS layout comply with relevant industry standards.
4.4.3.5 Walk-in Units	No Gap Identified	BESS containers are not occupied work centres.
4.4.3.6 Vegetation Control	No Gap Identified	Asset Protection Zones as identified as bushfire mitigation measures in the EIS meet this requirement.
4.4.3.7 Enclosures	No Gap Identified	Compliance with AS3000 is a mitigation measure identified in the EIS.
4.4.3.8 Access Roads	Gap Identified	AC Coupled - Compliance to relevant industry standards Identified as mitigation in the EIS, however, fire department access to the BESS plot is unclear. Recommendation B8: Confirm that fire department access to the AC Coupled BESS layout complies with the requirements of FRNSW.
4.4.3.9 Hazardous Atmospheres The ESS shall not be located in a classified area as defined in *NFPA 70* or IEEE C2 unless listed and approved for the specific installation	Unknown	Unclear that Hazardous Area Zoning study has occurred. Recommendation B9: Complete a Hazardous Area Zoning Study for the solar farm, substation, O&M Hub, battery storage area plot.

NFPA 855 Paragraph	Potential Gap/s	Comment
4.6.4 The AHJ shall be permitted to approve groups with larger energy capacities or smaller group spacing based on large-scale fire testing complying with 4.1.5.	No Gap Identified	BESS is compliant with UL 9450A.
4.7 Occupied Work Centres ESS in occupied work centres shall comply with this section	No Gap Identified	BESS containers are not occupied work centres.
4.8 Maximum Stored Energy	No Gap Identified	BESS is compliant with UL 9450A.
4.9 Exhaust Ventilation	Not applicable	Compliance to this section not required for Lithium-Ion batteries as per Table 9.2
4.10 Smoke and Fire Detection	No Gap Identified	BESS containers have smoke and gas detection
4.11 Fire Control and Suppression	Unknown	An Aerosol fire suppression system is used in each container. Recommendation B10: Confirm BESS containers have fire control and suppression as recommended in NFPA 855 Section 4.11 (or equivalent).
4.12 Explosion Control	Unknown	Recommendation B11: Whilst battery cell & module testing and certification have been completed, unit level testing has not been completed. Confirm if BESS containers require explosion control as recommended in NFPA 855 Section 4.12 (or equivalent).
4.13 Water Supply	Unknown	Detailed engineering for the project has not commenced. Recommendation B12: Confirm water supply meets the fire control & suppression demands from NFPA 855 Section 4.11 (or equivalent) and Australian Standards.
4.14 Spill Control	Not applicable	Compliance to this section not required for Lithium-Ion batteries as per Table 9.2.
4.15 Neutralization	Not applicable	Compliance to this section not required for Lithium-Ion batteries as per Table 9.2.

NFPA 855 Paragraph	Potential Gap/s	Comment
4.16 Remediation Measures	Not currently applicable	Project is not at construction phase. These requirements can be included in 4.1.3 Emergency Planning and Training.
5 System Interconnection	No Gap Identified	Compliance with relevant industry standards is a mitigation measure identified in the EIS.
6 Commissioning	Not currently applicable	Project is not at construction phase, and the battery supplier for the BESS has not been selected. There will be some iterative detailed design. This section does provide a useful check of the requirements.
7 Operation and Maintenance	Not currently applicable	Project is not at construction phase, and the battery supplier for the BESS has not been selected. There will be some iterative detailed design. This section does provide a useful check of the requirements.
8 Decommissioning	No Gap Identified	Requirement for a decommissioning plan is identified in the EIS.
9.3 Thermal Runaway Protection	Unknown	Detailed engineering for the project has not commenced. Recommendation B13: There are multiple carbon monoxide and smoke detectors in the BESS container. Confirm thermal runaway protection meets the recommendations of NFPA 855 Section 9.3 (or equivalent).
14 Storage of Used or Off-Specification Batteries	Unknown	Detailed engineering for the project has not commenced. Recommendation B14: Confirm allowed storage of Used or Off-Specification Batteries at the O&M Hub and battery storage area plot. Confirm the storage meets the recommendations of NFPA 855 Section 14 (or equivalent).

Addendum to Preliminary Hazard Analysis of Limondale Solar Farm and BESS

Iron Flow Battery System

For Environmental Resources Management Australia Pty Ltd

17 March 2022

Doc. No.: J-000518 - 01

Revision: 1

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Notation

Abbreviation	Description
ACH	Air Changes per Hour
Arriscar	Arriscar Pty Limited
AS	Australian Standard
BESS	Battery Energy Storage System
BMS	Battery Management System
DG	Dangerous Goods
DPIE	NSW Department of Planning, Industry and Environment
EIS	Environmental Impact Statement
ESS	Energy Storage System
HCl	Hydrogen Chloride
HIPAP	Hazardous Industry Planning Advisory Paper
HVAC	Heating, Ventilation and Air-Conditioning
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers
IFBS	Iron Flow Battery System
km	kilometres
LFL	Lower Flammability Limit
m	Metres
m^2	Square metres
m^3	Cubic metres
MLRA	Multi-Level Risk Assessment
MW	Mega Watt
MWh	Mega Watt hour
NFPA	National Fire Protection Association
PG	Packing Group
SEPP	NSW State Environmental Planning Policy
SDS	Safety Data Sheet
SSD	State Significant Development
UFL	Upper Flammability Limit
UN	United Nations

1 INTRODUCTION

1.1 Background

Environmental Resources Management Australia Pty Ltd (ERM) was engaged by Limondale Solar Farm Pty Ltd (LSF) to provide planning and environmental support relating to a proposed modification to the currently approved Limondale Solar Farm (the Project). The Project is State Significant Development (SSD) and was granted development consent (SSD 8025) under Section 4.38 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) in 2017.

LSF is seeking a modification relating to the installation and operation of a Battery Energy Storage System (BESS) within the approved Project Area and development footprint.

For the BESS modification, NSW DPIE have requested a Preliminary Hazard Analysis (PHA) (1) prepared in accordance with the Department's Hazardous Industry Planning Advisory Paper No. 6, 'Hazard Analysis' (HIPAP 6) and Multi-Level Risk Assessment (MLRA).

A PHA was prepared by Arriscar Pty Ltd (2). The study found that the proposal complied with the risk criteria in the HIPAP No.4 (3) guideline and relevant standards.

LSF is considering using an iron flow battery system (IFBS) as an AC coupled alternative option to the Lithium ion battery system, on the basis of improved inherent safety and economic considerations.

This addendum to the Limondale project PHA was prepared by Arriscar to address the IFBS. The system considered is an iron flow battery system, as an alternative to the Li-ion battery system.

1.2 Objectives and Scope

The objectives of the PHA Addendum are:

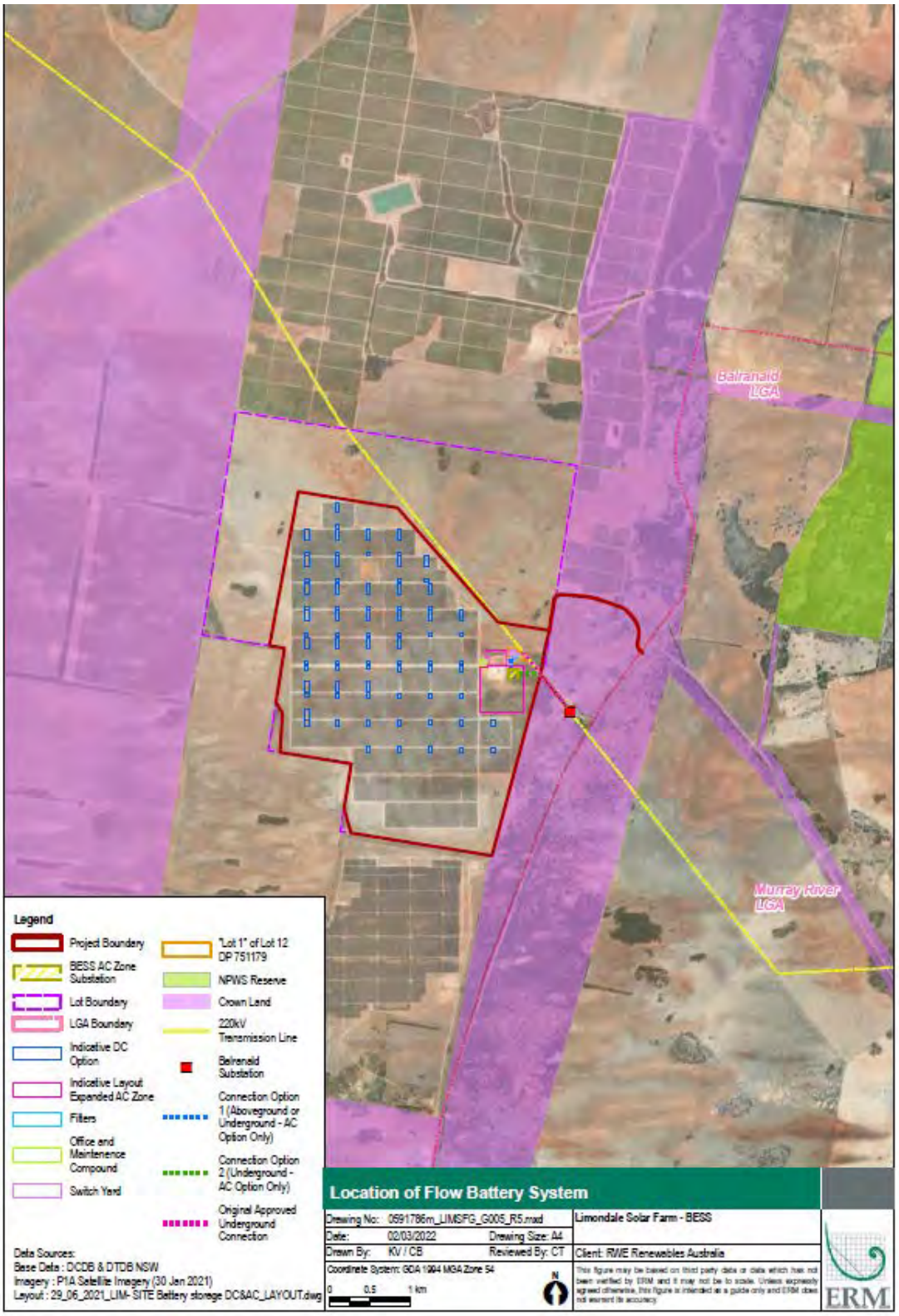
- Identify the hazards in the IFBS;
- Evaluate the consequences of potential hazardous events and their likelihood (semi-quantitative); and
- Demonstrate compliance with the NSW risk criteria in HIPAP No.4.

This report focuses only on the IFBS and hence details of the project relating to the solar farm and the Li-ion battery system in the PHA are not repeated.

2 LOCATION OF THE FLOW BATTERY SYSTEM

It is proposed to locate the iron flow battery system near the eastern boundary of the site. A layout is shown in Figure 1.

Figure 1: Location of Flow Battery System



3 DESCRIPTION OF FLOW BATTERY SYSTEM

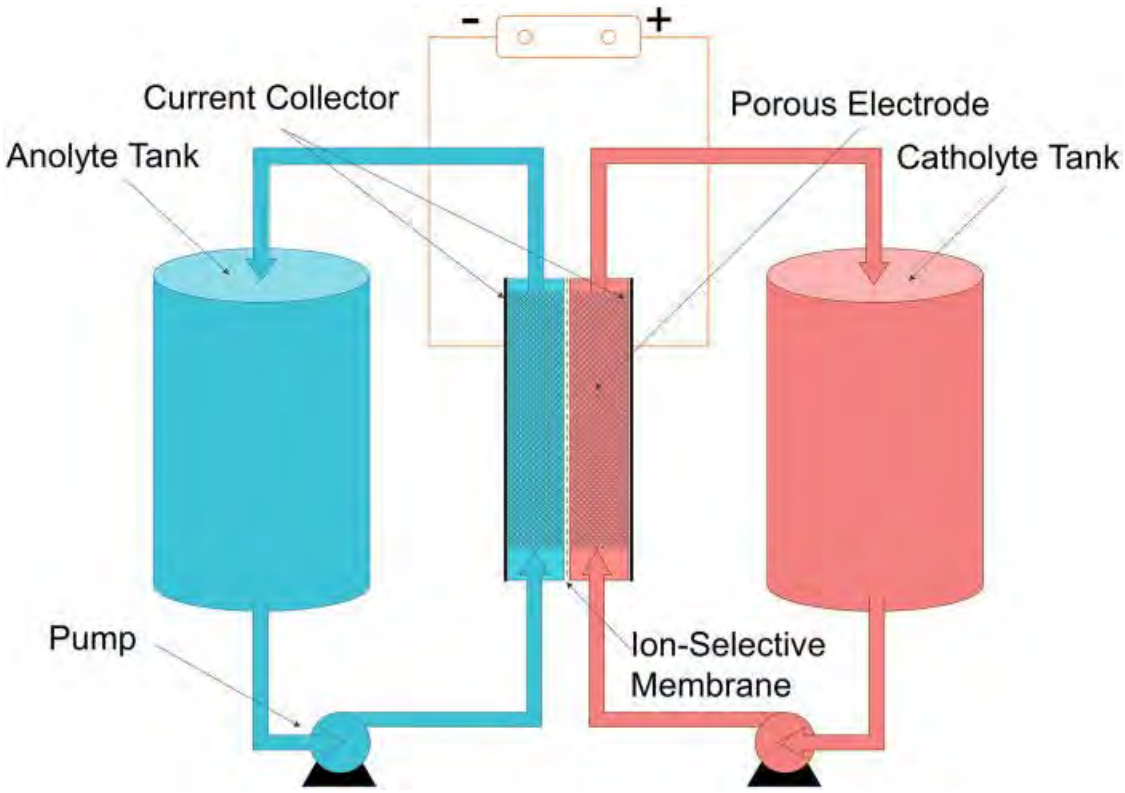
3.1 Flow Battery Systems

A flow battery system is an alternative to fixed battery storage as in the Li-ion battery systems. Flow batteries are electrochemical storage devices operating under the redox principle. The term 'redox' refers to the oxidation and reduction reactions that help to store the energy in liquid electrolyte solutions through a battery of electrochemical cells during charge and discharge.

Flow batteries are based on a fuel cell divided into two sections by a membrane. On one side is the anolyte and on the other side is the catholyte. Two aqueous electrolytes serving as anolyte and catholyte with different charges are pumped from separate storage tanks across the membrane in a fuel cell.

A schematic diagram is shown in Figure 2 (4).

Figure 2: Schematic Diagram of a Flow Battery Cell

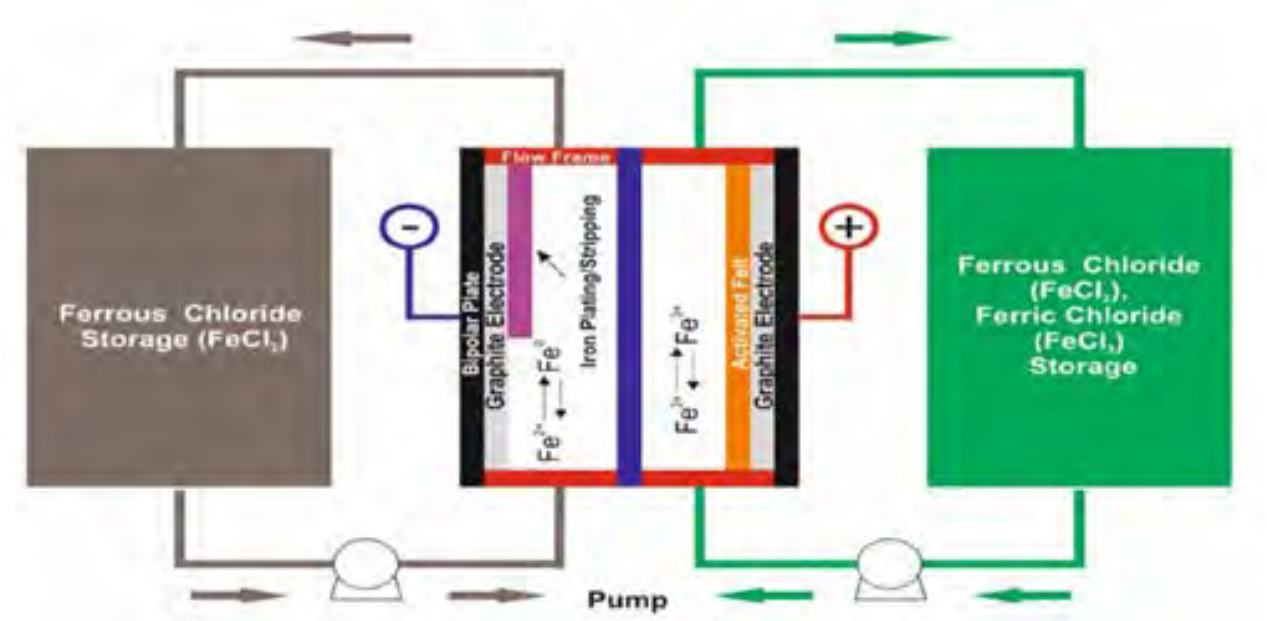


There many types of flow batteries, depending on the electrolytes selected.

3.2 Iron Flow Battery System (IFBS)

A schematic of an all-iron flow battery is shown in Figure 3 (5).

Figure 3: Schematic Diagram of an All-Iron Flow Battery



The system consists of two tanks containing the anolyte (+ve electrolyte) and the catholyte (-ve electrolyte). The anolyte is an aqueous solution of Ferrous Chloride ($FeCl_2$) and the catholyte is a mixture of ferrous chloride and ferric chloride ($FeCl_3$). Dedicated pumps circulate the electrolytes through the cell.

The cell is enclosed by bipolar plates, and graphite electrodes are used. The electrodes themselves are not involved in the electrochemical reactions, but offer a surface for the reactions by providing a pathway for the electrons to enter and leave the electrolyte. The membrane has low permeability to the electrolytes.

When the electrolyte is circulated through the cells, iron is electroplated on the negative electrode in each battery module cell. The plating thickness is equivalent to 12-hours discharge. During discharge, the plated iron dissolves back into the electrolyte solution. The flow rates can be up to 100 L/min per power module (a power train of 10 cells and associated tanks) at an operating pressure up to 240 kPa.

The advantages of all-iron flow battery system are:

- The runaway temperature fire hazard in a Li-ion battery is eliminated;
- Aqueous solutions are used with little fire hazard; and
- Lower cost of power production.

The disadvantages are:

- Hydrogen generation during the charge cycle. An electrolyte leak can result in hydrogen release with potential for fire/ explosion;
- Potential for exposure to corrosive substances (electrolyte handling); and
- Low voltage (needs more cells).

The hydrogen is handled by capturing it with the electrolyte and degassing in the electrolyte tank outside the battery system enclosure.

The battery room is well ventilated to keep any potential hydrogen release to less than its lower flammability limit. This is a NFPA 855 code requirement.

3.3 Flow BESS Arrangements Considered for Study

The IFBS development will have a capacity of 200 MW providing energy for 4 hours (800 MWh).

At the time this report was prepared, the ESS Inc (ESS) Energy Centre™ was the preferred Flow BESS option for the proposed Modification (subject to detailed design).

ESS designs, builds and deploys iron flow batteries for long-duration commercial and utility-scale energy storage applications requiring flexible energy capacity. The ESS Energy Centre uses iron, salt, and water for the electrolyte storage tanks, resulting in a long-life energy storage solution for renewable energy infrastructure. Based on information provided by ESS, the following would be enabled with the implementation of the Energy Centre:

- Time-shifting renewable energy use;
- Ancillary grid services;
- Smoothing the intermittency of renewables; and
- Support in servicing current and future capacity demands.

ESS's Flow BESS also has the function to accommodate future capacity increases/expansion by adding additional electrolyte to the system to increase energy capacity and discharge duration. A concept representation of the ESS Iron Flow Energy Centre BESS is shown in Figure 4**.**

Figure 4: ESS Iron Flow Energy Centre (Concept Design)



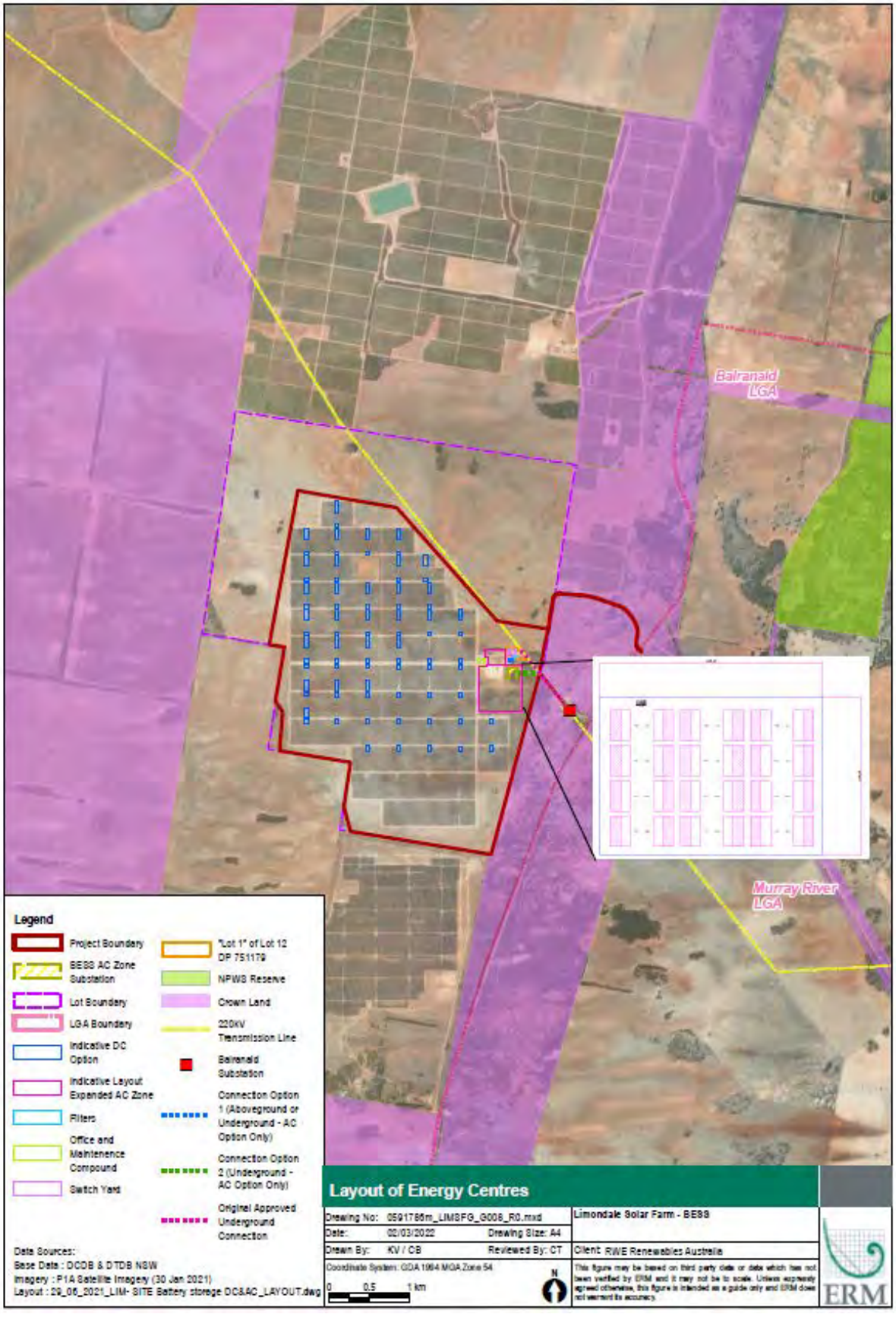
At this stage a fixed location for the AC-coupled layout is being evaluated by LSF and would be selected subject to detailed design and consideration of commercial and operational factors.

Each energy centre contains ten (10) power trains, each power train with its own electrolyte tanks and pumps. The electrolyte tanks and the circulation pumps are located outside the building.

There will be 48 energy centres located within a warehouse type building, each energy centre with a capacity of 16.7 MWh storage. The floor area of the building is approximately 45mx 35m.

A layout is shown in Figure 5.

Figure 5: Layout of Energy Centres



Each energy centre has 30 electrolyte tanks of 18 kL capacity each in a bunded area. The electrolyte tanks bund for secondary containment will be designed to comply with the requirements of AS 3780-2008 (6). The tank dimensions are approximately 7.5m in height and 1.75m in diameter.

The following requirements apply:

- Minimum bund volume should be 110% of the capacity of the largest tank.
- The horizontal distance from the tanks in the bund to the edge of the bund must be at least 50% of the height of the tank (the distance rule).
- Sufficient space between tanks for maintenance and emergency access.

3.4 Ventilation System

Maintaining the energy centre building atmosphere hydrogen free and at operating limits is essential for the safety of the operations and this is typically achieved by a dedicated ventilation system for the building.

The proposed ventilation system consists of an integrated forced draft fan of capacity 8,500 m^3/hour. NFPA 855 requires a minimum flow of 5.1L/min per square metre of floor area of the building.

There are a number of safety functions built into the battery operation that can trip the battery by stopping the electrolyte circulation pumps. On stoppage of flow, any H_2 generation ceases immediately.

3.5 Fire Protection System

The iron-flow battery system and components pose a very low fire hazard. The electrolytes are water based and non-combustible. The construction materials may contain polymers that are combustible, but need an external fire to initiate an incident.

The main potential for fires are electrical fires (switch gear and transformers), and accidental release of circulating electrolyte and release of hydrogen in the warehouse building.

The iron-flow battery energy centres will have smoke detectors and have hose reels for fire water supply. The system alarms on the activation of one detector and on activation of two detectors would automatically shut down the electrolyte pumps.

Key project areas i.e., BESS, switch-room structures and large buildings will have fire protection system installed. These are commonly an inert gas-based system with thermal sensors and smoke/gas detectors.

The applicable standards are:

1. NFPA 855 (7) (or equivalent).
2. NFPA 850 – Transformer Fire Protection.
3. AS2067- 2016 - Substations and high voltage installations exceeding 1 kV.
4. AS/IEC 60079.10.1-2009 – Explosive atmospheres, Part 10.1: Classification of areas - Explosive gas atmospheres. This applies to electrolyte tank vapour space and vents.

4 HAZARD IDENTIFICATION

4.1 Dangerous Goods on Site for Iron Flow Battery System

The following dangerous goods will be present on site for the IFBS modification:

1. Batteries consisting of fuel cells with electrolytes on either side of the membrane. The inventory per battery is small, and similar to a lead/acid battery in volume.
2. Electrolyte tanks (anolyte and catholyte) consisting of Class 8 materials (chlorides of iron, hydrochloric acid in aqueous solution).

4.2 SEPP 33 Screening

The only dangerous goods in process are the electrolytes (corrosive liquids). These can be classified as Corrosive Liquids n.o.s. UN 1760. Under the ADG Code, they fall under Class 8 liquids.

State Environment Planning Policy No.33 (8), (9) specifies that if a threshold inventory of 25 tonnes is exceeded for Class 8 Packing Group II DGs, regardless of the separation distance between the storage and the site boundary, SEPP would apply. The Packing Group for the electrolyte is PG II.

The total capacity of Class 8 tanks is calculated as follows:

Individual Tank capacity 18 m^3

Tanks per energy centre 30

Total energy centres in building 48

Total capacity of Class 8 liquids `= 18 x 30 x 48 = 25920 m^3.

Density of electrolyte = 1200 kg/m^3

Total capacity of electrolyte storage = 25920 x 1200/1000 = 31104 tonnes.

The total capacity exceeds the threshold of 25 tonnes for PG II and hence SEPP 33 applies.

During the operations, there is no requirement to keep adding the electrolyte additives and hence additives storage inventory is low. Further, apart from initial supply, transport of Class 8 dangerous goods is minimal. Therefore, the transport provisions of SEPP 33 do not apply to the proposed development.

4.3 Statutory Requirements

The following requirements apply to the proposed modification:

1. State Environment Planning Policy No.33 (8), (9).

   The quantity of Class 8 PG II materials exceeds 25 tonnes and hence SEPP 33 would apply, regardless of the distance to the boundary. The PHA Addendum addresses the storage and handling of Class 8 materials.

2. Australian Standard AS-3780 (6).

   The standard provides guidelines for storage and handling of corrosive substances, separation distances and bunding requirements.

4.4 Non-statutory Standards

4.4.1 NFPA 855: Standard for the Installation of Stationary Energy Storage Systems

The purpose of this standard (7) is to provide the minimum requirements for mitigating the hazards associated with stationary energy storage systems.

Fire protection and ventilation requirements are also specified.

4.4.2 IEC TS 62933-5-2:2020, Electrical energy storage (ESS) systems - Part 5-2

This Standard (10) describes safety requirements for grid integrated ESS systems – electrochemical based systems.

Specifies safety considerations (e.g. hazards identification, risk assessment, risk mitigation) applicable to EES systems integrated with the electrical grid.

This document provides criteria to foster the safe application and use of electrochemical based energy storage systems of any type or size intended for grid-integrated applications.

4.5 Iron Flow Battery System Hazards

There appears to be no formal dangerous goods classification for an iron flow battery. However, given that the cells contain electrolytes that are acidic, the battery system including the electrolyte tanks can be considered as a Class 8 dangerous good.

The electrolyte itself has a UN No. of 1760, Corrosive liquids, n.o.s.

The main hazards are:

- Release of electrolyte from battery cells/ circulating pipework/ pumps and exposure to corrosive materials.
- Release of electrolyte from battery cells/ circulating pipework/ pumps and release of trapped hydrogen in the energy centre, with fire or explosion if ignited.
- Fire of combustible materials that make up the cells. An external fire is necessary to initiate such a fire, and there are no flammable or other combustible materials present to start a fire.
- Explosion in the energy centre with potential for escalation to adjacent energy centres and/ or Li-ion BESS containers.
- Ignition of hydrogen vented from the electrolyte tank vents and a vent fire above the tank.

Other hazards in the Limondale facility are described in the PHA (2).

4.6 Hazard Register

A hazard identification register has been compiled, outlining the consequences of the identified hazards and the safeguards provided in the design towards prevention and mitigation. This register provided in Table 1.

Table 1: Hazard Identification and Safeguards Summary

No.	Hazard Scenario	Causes	Consequence	Potential for Offsite Impact	Identified / Recommended Safeguards
I	**IFBS Hazards**				
1	Release of electrolyte from containment	- Pipework failure - Fitting failure - Pump seal failure	- Potential for skin injury to exposed persons	No	• Equipment inspection and leak testing during installation and commissioning • Implement a regular inspection and maintenance regime for the battery assemblies • PPE worn by personnel
2	Release of hydrogen from electrolyte leaks	- Hydrogen generated during charging is trapped in the electrolyte and degassed in the electrolyte tank	- Fire/ Explosion in Energy Centre Potential for injury/ fatality. - Potential for escalation to adjacent energy centre modules	No	• Equipment inspection and leak testing during installation and commissioning • Implement a regular inspection and maintenance regime for the battery assemblies • Ventilation of energy centre modules to clear any hydrogen • Hazardous area classification
3	Exposure during handling of make up chemicals	- Some additives are corrosive	- Skin injury	No	• Handling procedures • PPE • Small volumes are handled infrequently
4	Ignition of vented hydrogen from electrolyte tanks	- Flammable hydrogen/air mixture at the vent location	- Hydrogen torch fire at the vent - Potential for damage to electrolyte tank from vent fire	No	• Hazardous area classification around vent locations • Flame arrestor on the tank vent to be investigated in final design

Only the hazards that could result in an offsite impact and/or may impact on emergency service providers are analysed in detail in Section 5.

5 RISK ANALYSIS

5.1 Electrolyte Leak and Exposure

A typical composition of electrolyte is given in Table 2.

Table 2: Electrolyte Composition

Chemicals	Name	% by weight
HCl	Hydrogen Chloride	<1%
Other	Additives	<5%
Chlorides	Metal salts	<30%
$FeCl_2$	Ferrous Chloride	<20%
H_2O	Demineralised water	<50%

The electrolyte can be broadly described as ferrous chloride in demineralised water. During the Redox process, the ferrous chloride would be oxidised to ferric and reduced to ferrous again, all contained within the tanks and circulating electrolyte.

- Electrolyte temperature = 30 ^{O}C
- Density = 1200- 1300 kg/m^3
- Electrolyte circulation rate through each power module = 100 L/min
- Assuming the worst case of a full bore leak, the leak rate would be restricted to the pumping rate, 0.1 m^3/min x 1200 kg/m^3 /60= 2.0 kg/s.
- Pump discharge pressure = 240 kPa
- An example flange/ fitting leak of 6mm hole size would give a leak rate of:

$$w = C_D A [2 \rho \Delta P]^{1/2}$$

$$= (0.8) [\pi (0.006\text{^}2)/4] [2. 1200. 2.4E5]^{1/2}$$

$$= 0.542 \text{ kg/s}$$

The electrolyte will be released as a liquid spray and cause skin in injury on exposure. The leaked liquid will be contained in bunded areas. The liquid is non-flammable.

The electrolyte spill will be confined to the specific energy centre, but the hydrogen released from the electrolyte may disperse in the building. The safeguards are:

- Material selection of vessels and pipework for the corrosive duty.
- Installation QA.
- Regular inspection and maintenance.
- Housekeeping practices.
- PPE for the operators appropriate to the chemicals handled.
- Provision for spill cleanup and disposal.

5.2 Hydrogen Generation in Cells

There is no information available regarding hydrogen generation rates in the flow batteries. The information available is for lead-acid batteries (11).

The hydrogen generation rate in a lead-acid battery (2.3V) is reported as 1.85×10^{-5} L/h/AH/cell. This can increase by 20 fold, if the voltage increases to 2.5V.

For the iron flow battery, the operating voltage is 1.2V. While hydrogen generation can occur, whether it would be higher than lead-acid battery is not known.

One advantage in iron flow battery system is that there is no release of hydrogen within the energy centre building. The hydrogen is carried with the circulating electrolyte and degassing occurs in the electrolyte tank, and is vented through the tank vent. Therefore, the only way hydrogen can be present in the energy centre building is through a circulating line leak/ rupture and electrolyte release.

Ref. (12) demonstrates a method to calculate hydrogen generation from lead-acid batteries. The value reported is 1.27×10^{-4} L/s/Amp.

The same value has been assumed for the iron flow battery. There is no information to validate this assumption. Therefore, to address the uncertainty, the hydrogen release is doubled for the analysis.

Power output from flow battery = 200 MW

Number of energy centres = 48

Voltage = 1.2 V

Amps = (200000/48)/1.2 = 3472 A per energy centre

Hydrogen rate / module = (1.27E-04 x 3472) L/s = 0.441 L/s

Mass rate of hydrogen/energy centre = 3.63E-05 kg/s

With sensitivity assumption, hydrogen release rate = 3.63E-05 x 2 = 7.25E-05 kg/s

This value is very small.

5.3 Hydrogen Explosion in Iron Flow Battery Building

The lower flammability limit (LFL) of hydrogen is 4% (v/v). On mass basis, LFL of H_2 = 3.3E-03 kg/m^3.

NFPA 855 requires that for a given ventilation, expected H_2 concentration remains below 25% LFL, i.e. 8.25E-04 kg/m^3.

An approximate assessment of the hydrogen concentration in the building has been made, based on the following assumptions:

Assumptions:

1. The ventilation flow through the building is uniform. Air will be blown from a single fan, and the air distributed through ports on the walls of the building and vented through the roof.
2. Hydrogen can be released only from one energy centre at any time (electrolyte circulating line rupture).
3. The released hydrogen would escape through the exhaust ports at the roof level, local to the release location, i.e. mixing of hydrogen fully within the room is not allowed for. This is a conservative assumption, as dilution of released hydrogen outside the energy centre volume is not considered.

4. The 'free volume', i.e. volume not occupied by the energy centre equipment in the building is assumed to be 50%.
    - Building volume = 44m x 35m x 5m = 7700 m^3. It is assumed that the ventilation is uniformly distributed through the inlet ports on the wall.
    - Since there are 48 energy centres, approximate volume for each centre = 160.4 m^3.
    - Free volume per energy centre assumed (i.e. volume not occupied by power train)

      = 50% (80.2 m^3).
    - The concentration of hydrogen local to the energy centre where release occurs:

      c = w/v

      where c = hydrogen concentration in the selected volume kg/m^3;

      v = Local ventilation flow rate for the energy centre m^3/s;

      w = hydrogen generation rate per energy centre, kg/s.
    - The ventilation fan capacity is 8500 m^3/hour for the building as a whole. Per energy centre, this becomes

      v = 8500/(3600 x 48 energy centres) = 0.05 m^3/s
    - Local maximum hydrogen concentration = (w/v) = (7.25E-05/0.05) = 1.45E-03 kg/m^3.
    - The above hydrogen concentration is less than ½ LFL close to the energy centre, but will be further diluted in the building to less than 25% LFL concentration of 8.25E-04 kg/m^3.
    - The average hydrogen concentration in the building would be less than 25% LFL and thus satisfies the NFPA 855 requirement.

The above assessment is approximate as there will be cross flow and further dilution of released hydrogen outside the zone of the energy centre. For a reasonably accurate concentration profile of hydrogen, a computational fluid dynamic software modelling would be required. However, such complexity is not considered necessary here, as a sensitivity analysis indicates that the hydrogen concentration is unlikely to rise above 25% LFL concentration in the building.

Another aspect to consider is that the likelihood of a line rupture and electrolyte release is low. Failure rates of steel pipes from mechanical damage are reported to be of the order of 1.E-07/metre/year. The value for non-metallic pipe is likely to be higher than steel, but still considered low. Any forklift movements within the building for maintenance must avoid collision potential with equipment.

If the ventilation fan fails, any hydrogen release would quickly accumulate and may result in a localised explosion if ignited.

If ventilation fan flow stops, it should raise an alarm. These aspects are covered in the recommendations.

5.4 Risk Assessment

The hazard scenarios analysed indicate that there would be no off-site consequences and no impact on land uses outside the Limondale facility. Therefore, a likelihood assessment was not carried out (Level 2 assessment in the Multi-Level risk assessment).

The risk from the iron flow battery system satisfies the risk criteria in HIPAP No.4 as no off-site consequences and no impact on land uses outside the Limondale facility were identified.

6 FINDINGS AND RECOMMENDATIONS

6.1 Findings

The key findings of the assessment include:

- There are no fire hazards identified in the iron flow battery system, apart from localised electrical fires from electrical equipment, that can be managed by smoke alarms and portable fire extinguishers.
- Hydrogen concentration is estimated to be less than 25% LFL and hence ignition is unlikely except at source of leak (before hydrogen is dispersed).

6.2 Recommendations

Recommendations based on the key findings of the assessment include:

1. Locations of ventilation inlet and exhaust ports must be carefully selected to ensure as uniform distribution of air in the building as possible.
2. An alarm should be installed to indicate loss of ventilation flow through the building.
3. On detection of electrolyte leak, an ESD must be initiated that will stop electrolyte circulation and hydrogen generation.
4. Once design details are available, the hydrogen generation rate and dispersion must be reassessed in the final hazard analysis.
5. Investigate the need for a hazardous area classification according to AS/IEC 60079.10.1 and flame arrestor on the tank vent in the final design.

7 REFERENCES

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