Appendix L Updated Preliminary Hazard Assessment (PHA)

PRELIMINARY HAZARD ANALYSIS

Oxley Solar Farm

September 2022

Project Number: 21-393

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Acronyms and abbreviations

AC	Alternating Current
APZ	Asset Protection Zone
BESS	Battery Energy Storage System
CCTV	Closed-circuit Television
DPIE	Department of Planning, Industry and Environment (NSW)
EIS	Environmental Impact Statement
EMFs	Electric and Magnetic Fields
EP&A Act	*Environmental Planning and Assessment Act 1979* (NSW)
EP&A Regulation	*Environmental Planning and Assessment Regulation 2000* (NSW)
FHA	Final Hazard Analysis
FRNSW	Fire and Rescue NSW
ha	hectares
km	kilometres
kV	kilovolts
LEP	Local Environment Plan
LGA	Local Government Area
m	metres
MW	Megawatt
MWh	Megawatt hours
O&M	Office and Maintenance
PCU	Power Conversion Unit
PHA	Preliminary Hazard Analysis
PPE	Personal protective equipment
RFS	(NSW) Rural Fire Service
SEARs	Secretary's Environmental Assessment Requirements
SEPP 33	*State Environmental Planning Policy No. 33 – Hazardous and Offensive Development and Applying*
SFARP	So Far As Reasonably Practicable
WHS	*Work Health and Safety*

1. Introduction

1.1 Background

The Oxley Solar Farm (the Proposal) is located on the southern side of Waterfall Way (Grafton Road), approximately 14 kilometres (km) south-east of Armidale. The proposed Oxley Solar Farm involves the construction, operation and decommissioning of a ground-mounted PV solar array and associated infrastructure. Approximately 215 Mega Watt (MW AC) of renewable energy would be generated and supplied directly to the national electricity grid. The Oxley Solar Farm is proposed by Oxley Solar Development (the Proponent). Of the 1,048 hectares (ha) Proposal site, the development footprint would represent approximately 267ha which would be developed for the solar farm and associated infrastructure. The Proposal site is zoned RU1 Primary Production under the *Armidale Dumaresq Local Environmental Plan 2012* (Armidale Dumaresq LEP).

NGH prepared an Environmental Impact Statement (EIS) on behalf of the Proponent. The EIS was prepared in accordance with Part 4 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) and Schedule 2 of the *Environmental Planning and Assessment Regulation 2000* (EP&A Regulation). The EIS was submitted to the Department of Planning, Industry and Environment (DPIE) in March 2021 and placed on public exhibition from 17 March 2021 until 14th April 2021.

Post public exhibition, DPIE has requested the preparation of this Preliminary Hazard Analysis (PHA) for battery storage in accordance with *Hazard Industry Planning Advisory Paper No.6 – Guidelines for Hazard Analysis* (DoP, 2011) (HIPAP 6) and *Multi-Level Risk Assessment* (DoP, 2011) (MLRA).

1.2 Objectives

The objective of this PHA is to develop a comprehensive understanding of the hazards and risks associated with the operation of the Battery Energy Storage System (BESS) for the Oxley Solar Farm and the adequacy of safeguards.

1.3 Scope

This PHA has been prepared to address the request from the DPIE as a submission to the project. The Secretary's Environmental Assessment Requirements (SEARs) for the Proposal additionally included:

> *a Preliminary Hazard Analysis (PHA) must be prepared in accordance with Hazard Industry Planning Advisory Paper No. 6 – Guidelines for Hazard Analysis (DoP, 2011) and Multi-Level Risk Assessment (DoP, 2011)*

This PHA provides a basis for an informed judgment to be made on the acceptability of the BESS.

1.4 Exclusion and limitations

This PHA is based on limited information since complete data on the design and precise safeguards is not available at this initial stage.

The scope of this PHA does not include:

- A transport route analysis since the proposed development does not exceed transport volumes of dangerous goods exceeding the State Environmental Planning Policy (Resilience and Hazards) 2021 guideline thresholds.

- Assessment of other risks, including, but not limited to, aviation safety, health, landslide/subsidence, telecommunications, electromagnetic field and bushfire.
- Quantitative risk data as BESS technology is relatively new and data is not yet available.
- Updating the PHA to a Final Hazard Analysis (FHA) during the design stage.

It is noted that safety controls, including fire suppression systems, will develop as the industry evolves and in response to safety incidents such as the recent battery fire in Victoria. Findings of the Victorian battery fire incident has been considered in this PHA. Additional controls have been included as an outcome of the recent battery fire in Victoria are presented in bold type in Table 4-4.

2. Site location and description

2.1 Site location

The Oxley Solar Farm is located approximately 14km south-east of Armidale, within the Armidale Regional Local Government Area (LGA). The Proposal will be accessed by a new access track off Waterfall Way (Grafton Road), north of the Proposal site. Waterfall Way (Grafton Road) is a state road, for which TfNSW is the managing authority. It runs in an east-west direction between the Pacific Highway at Raleigh and the New England Highway at Armidale. The Proposal site is also intersected by Gara Road in the south of the Proposal site. Gara Road is accessed by Silverton Road east of the Proposal site. Gara Road and Silverton Road are minor unsealed local rural roads, for which Armidale Regional Council is the managing authority. Both Gara and Silverton Roads intersect Waterfall Way (Grafton Road) 9km and 19km from Armidale, respectively. Silverton Road would not be used for access for the project during construction and operation. Only sections of Gara Road within the Proposal Site would be used for access for the Proposal.

The Proposal's development footprint is the land that would be used for the construction and operation of the solar farm and has a total approximate area of 267ha. This comprises the land required to construct the facility connection substation, the solar array, BESS, proposed internal access tracks and other onsite ancillary infrastructure. The intersection of the new access track and Waterfall Way is proposed to be upgraded to facilitate construction vehicle movements.

2.2 Surrounds

Armidale is the closest regional center and includes the University of New England campus. Education and training are the largest employer in the Armidale Regional LGA, followed by health care and social assistance, and agriculture (Armidale Regional Council, 2019).

The land immediately surrounding the Proposal Site includes agricultural land, predominantly large lot agricultural enterprises but also includes a landfill, other renewable energy projects and reserves including travelling stock reserves and national park. The Oxley Wild Rivers National Park is adjacent to the southern boundary of the Proposal site. The park contains World Heritage listed Gondwana rainforest, historic sites and waterfalls. It is a popular for recreational activities including walking, camping, bike and horse riding and fishing.

2.3 Sensitive receivers

Two involved residences are located within the Proposal site, 30 potential residences are located within 2km of the site and 169 potential residences are located within 7km. The closest non-involved residence is located immediately adjacent to the site (185m east), south of Gara Road.

A large portion of these residences are located along Castledoyle Road, south west of the Proposal site. This area is made up of large allotments. The remaining receivers to the north and east of the site are larger agricultural properties for mostly used for grazing and have sparse buildings.

3. Project description

3.1 Overview

The proposed Oxley Solar Farm involves the construction, operation and decommissioning of a 215MW AC solar farm and associated infrastructure. Of the 1,048ha Proposal site, the development footprint would represent approximately 267ha which would be developed for the solar farm and associated infrastructure. Two existing TransGrid 132kV transmission lines run parallel to each other within the northern section of the Proposal site and would be used to connect the solar farm to the national electricity grid. The primary access point during the construction and operational phases for light and heavy vehicles would be off Waterfall Way (Grafton Road), north of the site.

The Proposal Layout is presented in Figure 3-1 and includes:

- Approximately 385,280 PV solar panels mounted on either fixed or tracking systems, both of which are considered feasible:
  - Fixed-tilted structures in a north orientation; or
  - East-west horizontal tracking systems.
- Approximately 43 Power Conversion Units (PCU) composed of two inverters, a transformer and associated control equipment to convert DC energy generated by the solar panels to 33kV AC energy.
- An onsite 132kV substation containing up to two transformers and associated switchgear to facilitate connection to the national electricity grid via the existing 132kV transmission lines onsite.
- Steel mounting frames with driven or screwed pile foundations.
- Underground power cabling to connect solar panels, combiner boxes and PCUs.
- Underground auxiliary cabling for power supplies, data services and communications.
- Buildings to accommodate a site office, indoor 33kV switchgear, protection and control facilities, maintenance facilities and staff amenities.
- About 1km of access track off Waterfall Way (Grafton Road) to the site which would require construction to the proposed onsite substation.
- Internal access tracks for construction and maintenance activities.
- An energy storage facility with a capacity of up to 50MWh (i.e., 50 MW power output for one hour) and comprising of lithium-ion batteries with inverters.
- Perimeter security fencing up to 2.3m high.
- Native vegetation planting to provide visual screening onsite and for specific receivers.

The construction phase of the Proposal would take about 12 – 18 months. The peak construction period would be a shorter period of about 6 to 9 months. Approximately 300 workers would be required during construction.

The solar farm is anticipated to be operational for about 30 years. Around five fulltime equivalent operations and maintenance staff and service contractors would operate the facility.

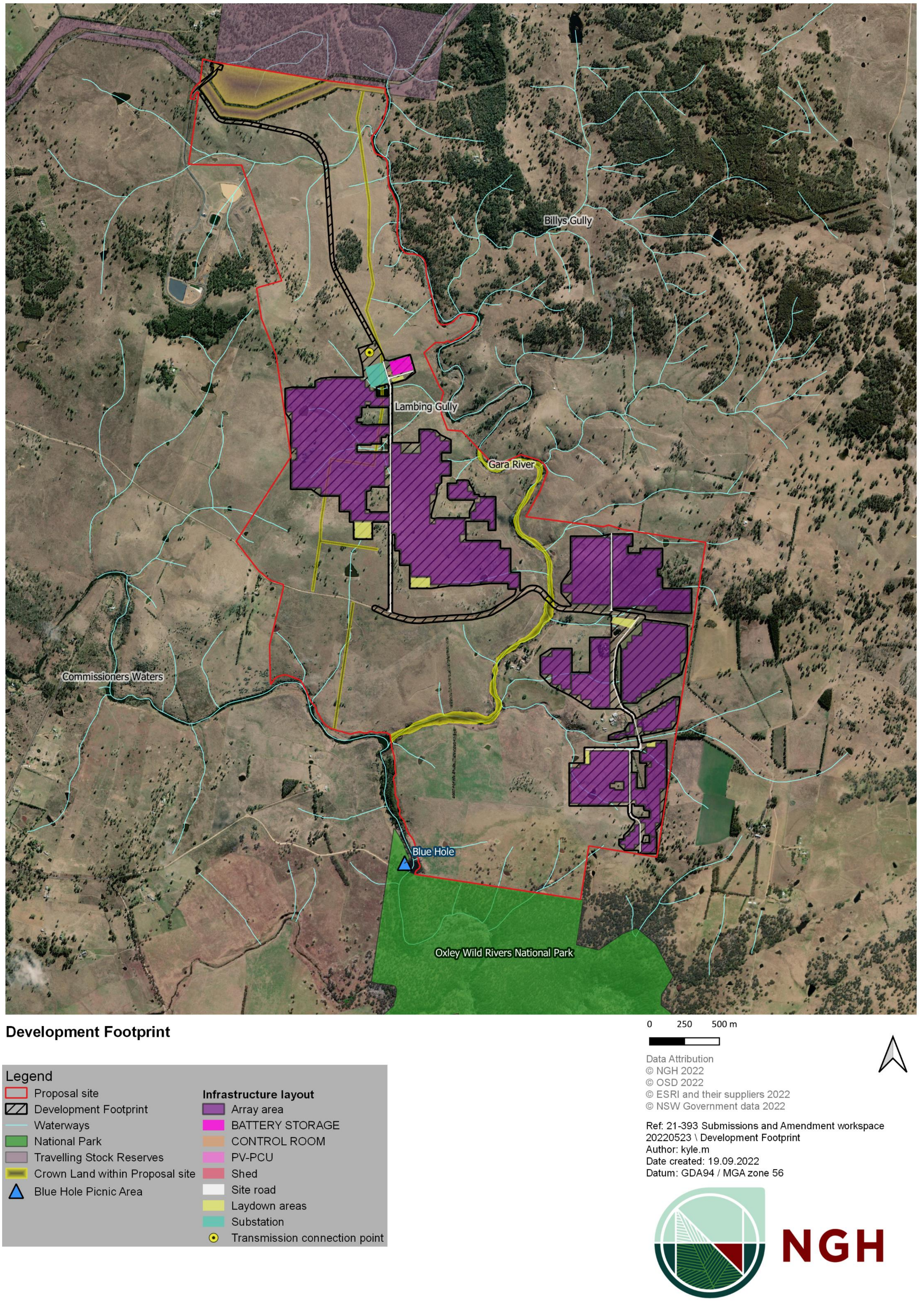

Figure 3-1 Proposal layout

3.2 Battery Storage

The proposed Oxley Solar Farm includes an energy storage facility with a capacity of up to 50MWh (i.e., 50MW power output for one hour). The BESS would consist of approximately 25 containers (40 foot each) housing lithium-ion batteries with inverters (Figure 3-2). They would be installed in one location near the substation (Figure 3-1), and not distributed through the site. The exact location of the future energy storage would be determined during detailed design but would be located within the development footprint.

The batteries would be actively cooled by air-conditioning units, with spare air-conditioning units in storage on-site for replacement. Each container would be temperature monitored, and the automated control system would stop their operation if the temperature exceeds pre-set levels to prevent overheating (e.g., if all aircon units fail).

The BESS unit would include an integrated fire suppression system, likely involving the storage and release of an inert gas within each battery container based on electrical detectors/ioniser, or mechanical release systems.

The BESS units would also be surrounded by an Asset Protection Zone (APZ) including gravel surfacing to minimise the risk of fire escaping from the Proposal and the risk of external fire affecting the Proposal.

The battery storage will be designed in accordance with the following:

- NFPA 855, Standard for the Installation of Stationary Energy Storage Systems;
- AS/NZ 5139:2019, Electrical installations - Safety of battery systems for use with power conversion equipment
- IEC 62897, Stationary Energy Storage Systems with Lithium Batteries - Safety Requirements
- UL 9540, Energy Storage Systems and Equipment
- UL 9540A; Testing the fire safety hazards associated with propagating thermal runaway within battery systems.
- FM Global DS 5-33 Property Loss Prevention Data Sheets
- FM Globals Development of Sprinkler Protection Guidance for Lithium Ion Based Energy Storage Systems.

Figure 3-2 Typical battery storage units, located together.

4. Preliminary hazard analysis

4.1 PHA methodology

The methodology undertaken to prepare this PHA includes:

- Identification of the nature and scale of all hazards at the Proposal, and the selection of representative incident scenarios.
- Analysis of the consequences of these incidents on people, property, and the biophysical environment.
- Evaluation of the likelihood of such events occurring and the adequacy of safeguards.
- Calculation of the resulting risk levels of the facility.
- Comparison of these risk levels with established risk criteria and identification of opportunities for risk reduction.

A schematic of the hazard analysis process is included below in Figure 4-1.

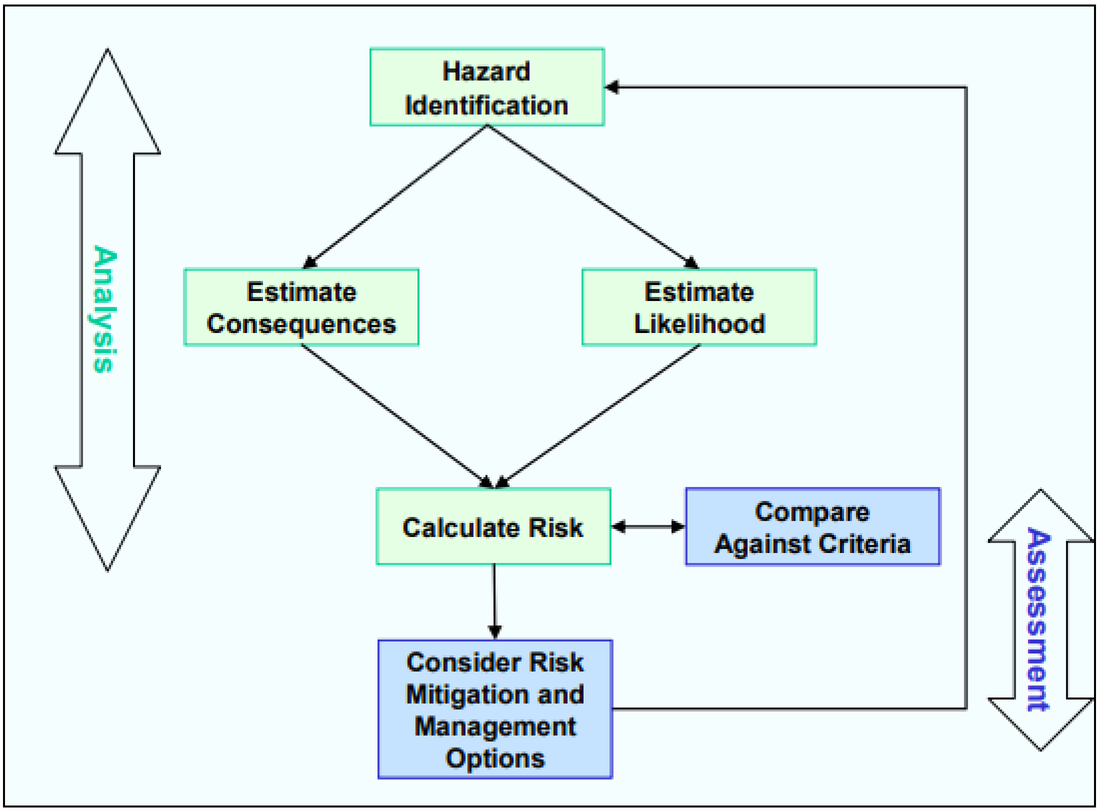

Figure 4-1 Basic methodology for hazard analysis (Source: HIPAP 6)

4.2 Hazard identification

Hazard identification includes the systematic identification of possible hazards, both on-site and off-site including:

- BESS activities and infrastructure
- Type of equipment
- Hazardous materials present
- Natural events such as floods, cyclones, earthquakes, or lightning strikes
- Hazardous events on neighbouring sites.

The identified BESS hazards and events are presented in Table 4-1.

Table 4-1 Identified hazards and events

Hazard	Event
Electrical	Exposure to voltage
Arc flash	Release of energy
Electric and Magnetic Fields (EMF)	Exposure to EMF
Fire	Infrastructure fire
Chemical	Release of hazardous materials
Reaction	Battery thermal runaway
External factors	Vandalism, flooding, bushfire

4.3 Consequence analysis

Consequence

For each identified event, the resulting consequence was qualitatively described. These include impacts to personnel (e.g., fatality/injury), environment and/or assets.

Likelihood

Using a qualitative approach, the likelihood of an event was estimated using the category scale shown in Table 4-2. The likelihood ratings were assigned based on quantitative knowledge of historical incidents in the industry. The likelihood ratings were assigned accounting for the initiating causes, resulting consequences with controls (prevention and mitigation) in place.

Table 4-2 Likelihood category

Category	Description
1. Extremely Unlikely	Never heard of in the industry, not realistically expected to occur
2. Very Unlikely	Heard of in the industry, but not expected to occur
3. Unlikely	Could occur in the next 10 years
4. Likely	Could occur in the next year

4.4 Hazard register

The identified hazards, events, applicable infrastructure and the relationships with causes, consequences, controls, and likelihood ratings are summarised in the hazard register. Information contained in the hazard register is provided in Table 4-3.

The hazard register for the BESS units is presented in Table 4-4.

Table 4-3 Information used in hazard register

Column Heading	Description
Hazard	Description of the source of potential harm
Event	Description of mechanism by which the hazard potential is realised
Cause	Description of the potential ways in which the event could arise
Consequence	Description of consequences of the event and potential impact to people, environment and/or asset
Controls	Any existing aspects of the design which prevent and/or mitigate against the event and resulting consequences
Likelihood Rating	Likelihood rating assigned for the event accounting for the initiating causes, resulting consequences with controls in place

Table 4-4 BESS units hazard register

ID	Hazard	Event	Cause	Consequence	Controls	Likelihood Rating
1	Electrical	Exposure to voltage	<u>Short circuit/electrical connection failure</u> • Faulty equipment • Incorrect installation • Incorrect maintenance • Human error during maintenance • Safety device/circuit compromised • Battery casing/enclosure damage	• Electrocution • Injury and/or fatality • Fire	• Equipment and systems will be designed and tested to comply with industry standards and guidelines • Engagement of reputable engineering and construction designers/contractors • Installation and maintenance will be done by suitably qualified and experienced personnel • Electrical lockout/tagout • Temperature monitoring and automated shutoff • Fire suppression system • Warning signs (electrical hazards, arc flash) • Emergency Response Plan • Fire Safety Plan • External assistance for firefighting (Fire and Rescue NSW; FRNSW & Rural Fire Service; RFS) • Use of appropriate Personal Protective Equipment (PPE) • Rescue kits (i.e., insulated rescue hooks)	Very Unlikely
2	Arc flash	Arc flash	• Incorrect procedure (i.e., installation/ maintenance) • Faulty equipment (e.g., corrosion on conductors) • Faulty design (e.g., equipment too close to each other) • Insulation damage • Human error during maintenance	• Burns • Injury and/or fatality • Exposure to intense light and noise • Arc blasts and resulting heat, may result in fires and pressure waves	• Equipment and systems will be designed and tested to comply with industry standards and guidelines • Engagement of reputable engineering and construction designers/contractors • Installation and maintenance will be done by suitably qualified and experienced personnel • Maintenance procedure (e.g., deenergize equipment; electrical lockout/tagout) • Preventative maintenance • Emergency Response Plan • Fire Safety Plan • External assistance for firefighting (FRNSW & RFS) • Warning signs (arc flash boundary) • Use of appropriate PPE for flash hazard	Very Unlikely

ID	Hazard	Event	Cause	Consequence	Controls	Likelihood Rating
3	EMF	Exposure to electric and magnetic fields	• Operations of power generation equipment	• High level exposure (i.e., exceeding the reference limits) may affect function of the nervous system (i.e., direct stimulation of nerve and muscle tissue and the induction of retinal phosphenes) • Personnel injury	• Location siting and selection (incl. separation distance) • Optimising equipment layout and orientation • Reducing conductor spacing • Incidental shielding • Balancing phases and minimising residual current • Equipment and systems will be designed and tested to comply with industry standards and guidelines • Exposure to personnel is short duration in nature (transient) • Physical warning signs (e.g., danger or restricted access)	Extremely Unlikely
4	Fire	Fire	• Escalated event from facility fire • Faulty equipment • Arc flash • External fire (e.g., bushfire, adjacent infrastructure)	• Injury/fatality • Asset damage	• Location siting and selection including as far as practical from any sensitive receptors or large stands of vegetation. • Equipment and systems will be designed and tested to comply with the relevant international standards and guidelines • Installation, operations and maintenance by trained personnel (e.g., reputable third party) in accordance with relevant procedures • Preventative maintenance (e.g., insulation, replacement of faulty equipment) • Installation of reliable automated monitoring (voltage and temperature), alarm and shutdown response systems • Installation of a reliable integrated fire detection and fire suppression systems (inert gas) • The battery and power conversion systems would be in cubicle design, manufactured of low combustible external materials. • A safety valve would automatically trigger safety mode, in case the battery cell is exposed in an over-heat environment.	Very Unlikely

ID	Hazard	Event	Cause	Consequence	Controls	Likelihood Rating
					• Design appropriate separation and isolation between battery containers and between batteries and other infrastructure, including gravel surfacing around the facility for a minimum 10 m in accordance with asset protection zone standards • Battery Fire Response Plan as part of the Fire Management Plan • Cooling water supply on-site • Defendable boundary for firefighting will be established (i.e., APZ) including: ○ An APZ of minimum 10m would be maintained between remnant or planted woody vegetation and solar farm infrastructure. The APZ around the perimeter of the site would incorporate a 4m wide gravel access track • Emergency Response Plan • Fire Safety Plan • External assistance for firefighting (FRNSW & RFS) • Facilitation of first responder training in the management of Lithium-ion battery fires at the site for local brigades. • Use of appropriate PPE • Vegetation management on site to limit fire fuel loads	
5	Reaction	Thermal runaway in battery	<u>Elevated temperature</u> • Bushfire • External fire (e.g., substation, transformer) <u>Electrical failure</u> • Short circuit • Excessive current/voltage • Imbalance charge across cells <u>Mechanical failure</u> • Internal cell defect	• Fire in the battery cell • Injury/fatality • Escalation to the enclosure/ building • Escalation to the entire BESS	• Equipment and systems will be designed and tested to comply with the relevant industry standards and guidelines • Equipment will be procured from reputable supplier • Engagement of reputable engineering and construction designers/contractors • Installation and maintenance will be done by suitably qualified and experienced personnel • Voltage control • Charge-discharge current control • Temperature monitoring and automated shutoff • HVAC system (i.e., air conditioning) • Cell chemistry selection (minimise runaway)	Very unlikely

ID	Hazard	Event	Cause	Consequence	Controls	Likelihood Rating
			• Damage (crush/penetration/puncture) <u>Systems failure</u> • Battery Management System (BMS) failure • HVAC failure		• Battery cell/pack design • BESS is housed in dedicated units • BESS is located in designated area • BESS fire protection system (enclosure/building) • Activation of emergency shutdown (ESD button; outside of BESS or remotely from the O&M building) • Fire suppression system that has enough suppression for a couple of days • Fire Management Plan • Emergency Response Plan • Fire Safety Plan • External assistance for firefighting (FRNSW & RFS)	
6	Chemical	Release of electrolyte (liquid/ vented gas) from the battery cell	<u>Mechanical failure/damage</u> • Dropped impact (installation/maintenance) • Damage (crush/penetration/puncture) <u>Abnormal heating/elevated temperature</u> • Thermal runaway • Bushfire • External fire (e.g., substation, transformer)	• Release of flammable liquid electrolyte • Vapourisation of liquid electrolyte • Release of vented gas from cells • Fire and/or explosion in battery enclosure/building • Release of toxic combustion products • Injury/fatality	• Equipment and systems will be designed and tested to comply with the relevant industry standards and guidelines • Equipment will be procured from reputable supplier • Engagement of reputable engineering and construction designers/contractors • Installation and maintenance will be done by suitably qualified and experienced personnel • BESS unit design and materials used • Spill cleanup using dry absorbent material • Fault detection and shut-off function • HVAC system (i.e., air conditioning) • BESS fire suppression/protection system (enclosure/building)	Very Unlikely

ID	Hazard	Event	Cause	Consequence	Controls	Likelihood Rating
7	Chemical	Coolant leak	• Mechanical failure/damage • Incorrect maintenance	• Irritation/injury for personnel on exposure (inhalation) • Short circuit resulting in electrical fire	• Equipment and systems will be designed and tested to comply with the relevant industry standards and guidelines • Equipment will be procured from reputable supplier • Engagement of reputable engineering and construction designers/contractors • **Cooling systems are fully pressure-tested when installed and inspected for leaks after testing.** • **Install battery module isolation loss alarm**. • Installation and maintenance will be done by suitably qualified and experienced personnel • BESS unit design and materials used • Spill cleanup using dry absorbent material • Fault detection and shut-off function • PPE	Unlikely
8	Chemical	Refrigerant leak	• Mechanical failure/damage • Incorrect maintenance	• Irritation/injury for personnel on exposure (skin contact)	• Equipment and systems will be designed and tested to comply with the relevant industry standards and guidelines • Equipment will be procured from reputable supplier • Engagement of reputable engineering and construction designers/contractors • Installation and maintenance will be done by suitably qualified and experienced personnel • BESS unit design and materials used • Fault detection and shut-off function • Air conditioner unit separation distance to other equipment • PPE	Very Unlikely
9	External factors	Fire	• Water ingress (e.g., rain, flood)	• Electrical fault/short circuit • Fire • Injury/fatality	• Location siting (i.e., outside of flood prone area) and 40m from waterways • Drainage system • Preventative maintenance (check for leaks)	Extremely Unlikely
10	External factors	Vandalism	• Unauthorised personnel access	• Asset damage • Potential hazard to unauthorized person (e.g., electrocution)	• Project infrastructures are located in secure fenced area • Onsite security protocol • Warning signs	Unlikely

ID	Hazard	Event	Cause	Consequence	Controls	Likelihood Rating
					• CCTV and security lighting (motion detectors) • During construction, the area will be patrolled, and fence will be installed	

5. Risk assessment

Risk is the likelihood of a defined adverse outcome. To calculate risk, it is necessary to consider the likelihood and the consequences of each of the hazardous scenarios identified.

Using a qualitative approach, the risk of an event was estimated using the study risk matrix shown in Figure 5-1.

For each identified hazard and associated event, the resulting consequences and likelihood pair was determined from the hazard register. The consequence and likelihood of the identified events are presented in Table 5-1.

			Likelihood			
			1 Extremely Unlikely	2 Very Unlikely	3 Unlikely	4 Likely
			Never heard of in the industry, not realistically expected to occur	Heard of in the industry, but not expected to occur	Could occur in the next 10 years	Could occur in the next year
Severity	4 Major	Fatality / Permanent Injury				
	3 Moderate	Severe injury / Lost time				
	2 Minor	Minor Injury / Visit to Doctor				
	1 Insignificant	Slight injury / First aid				

Risk Acceptance Criteria

High	Unlikely to be tolerable - review if activity should proceed.
Medium	Tolerable, if so far as reasonably practicable
Low	Broadly acceptable

Figure 5-1 Qualitative risk matrix

Table 5-1 Risk assessment

Hazard	Event	Consequence (Impact to People)	Likelihood	Risk
Electrical	Exposure to voltage	Major	Very Unlikely	Medium
Arc flash	Arc flash	Major	Very Unlikely	Medium
EMF	Exposure to EMF	Insignificant	Extremely Unlikely	Low
Fire	Bushfire	Major	Very Unlikely	Medium
Reaction	Thermal runaway in battery	Major	Very Unlikely	Medium
Chemical	Release of electrolyte from the battery cell (liquid/vented gas) resulting in fire and/or explosion	Major	Very Unlikely	Medium
	Battery coolant leak	Moderate	Unlikely	Medium
	Refrigerant leak	Minor	Very Unlikely	Low
External factors	Water ingress resulting in fire	Major	Extremely Unlikely	Medium
	Vandalism due to unauthorised personnel access	Moderate	Unlikely	Medium

6. Risk assessment results

6.1 Consequence

The risk assessment indicates that the worst-case consequence is a fire from a variety of causes (e.g., release of flammable materials, battery thermal runaway, infrastructure fire). These fires may have the potential to initiate bushfire to surrounding grasslands but is limited with appropriate control listed herein.

6.2 Likelihood

The risk assessment indicates that the highest likelihood rating for the identified events is unlikely (i.e., could occur in the next 10 years). This relates to battery coolant leak and unauthorised personnel access to the BESS resulting in vandalism/asset damage to the project infrastructure.

6.3 Risk assessment

A total of 10 risk events were identified. The breakdown of these events according to their risk ratings are as follows:

- 8 medium risk events
- 2 low risk events.

Based on the overall risk acceptance criteria used for the study, the risk profile for the project is considered to be tolerable if So Far As Reasonably Practicable (SFARP).

The majority of the medium risk events relate to fire events resulting from a variety of causes (e.g., release of flammable materials, battery thermal runway, infrastructure fire, bushfire, etc). The study identified proposed prevention controls to reduce the likelihood of these fire events and mitigation controls to contain the fires to minimise potential for escalated events (e.g., fire management plan, APZs, vegetation management etc.). Based on the identified controls, the highest likelihood for these events were rated as very unlikely (i.e., heard of in the industry, but not expected to occur).

One of the medium risk events identified is the battery coolant leak, and this is due to a recent fire within a battery facility being constructed within Victoria. It is understood that the fire commenced during setting up of the facility and was contained to the site. The most likely root cause of the fire was a leak within the liquid cooling system causing arcing in the power electronics of the Megapack's battery modules. This resulted in heating of the battery module's lithium-ion cells that led to a propagating thermal runaway event and the fire [1]. This incident has been considered in this assessment. Additional mitigation measures have been included to prevent this event occurring again such as pressure testing the cooling system and additional detection fault alarms that work when the system is offline. With the implementation of these measures the consequences would be significantly reduced. However due to how recent this event was, the risk event has still been considered moderate risk.

Based on the size of the Development Footprint, proposed location for project infrastructure within the Proposal Site, proposed controls and distance to neighbouring land uses (including

[1] https://victorianbigbattery.com.au/wp-content/uploads/2022/01/VBB-Fire-Independent-Report-of-Technical-Findings.pdf

neighbouring properties and agricultural operations), the exposure to fire events will primarily be to the project's construction and operations workforce. Offsite impacts would be expected to be minimal.

The risk assessment concluded that there is no potential for offsite fatality or injury. Therefore, the project meets the land use planning criteria. Risk events identified are onsite impacts and assessed against *Work Health and Safety* (WHS) *Act* requirements to reduce risk to SFARP. Risks were assessed by the project as tolerable if SFARP.

7. Conclusion

This PHA has been undertaken to respond to request from DPIE by demonstrating that BESS risk levels do not preclude approval. This PHA did not identify any major offsite consequences or societal risk. Therefore, a qualitative analysis is suitable.

This PHA has:

- Identified all hazards at the BESS, analysed the possible incident scenarios that could result from a hazardous incident and the consequences of these to people, property, and the biophysical environment.
- Estimated the likelihood of hazardous incidents that have the potential to result in significant consequences.
- Recommended controls to limit the consequences and likelihood of potentially hazardous incidents.

The risk assessment determined that the risk profile for the project is considered to be tolerable if SFARP. The majority of the medium risk events relate to fire events. The exposure to fire events will primarily be to the project's construction and operations workforce. Offsite impacts will be minimal. The risk assessment concluded that there is no potential for offsite fatality or injury identified and therefore the project meets the land use planning criteria.

8. Recommendations

It is recommended that the results of this PHA should be used as inputs into other safety studies required including:

- Fire management plan
- Emergency Response Plan
- Fire Safety Plan

9. References

Armidale Regional Council (2019). *Our Region*, accessed from http://www.armidaleregional.nsw.gov.au/our-region/tourism/our-region

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