NEVERTIRE SOLAR FARM BESS

PRELIMINARY HAZARD ANALYSIS

Prepared for:

RPS Australia Asia Pacific
Level 13/255 Pitt Street
Sydney NSW 2000

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BASIS OF REPORT

This report has been prepared by SLR Consulting Australia Pty Ltd (SLR) with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with RPS Australia Asia Pacific (the Client). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

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DOCUMENT CONTROL

Reference	Date	Prepared	Checked	Authorised
610.30503-R02-v1.2	28 October 2021	Craig Simpson	Ewan Cummins	Craig Simpson
610.30503-R02-v1.1	26 October 2021	Craig Simpson	Ewan Cummins	Craig Simpson
610.30503-R02-v1.1	26 October 2021	Craig Simpson	Ewan Cummins	Craig Simpson

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1 Introduction

SLR Consulting Australia Pty Ltd (SLR) has been engaged by RPS Australia Asia Pacific (RPS) to undertake a Preliminary Hazard Analysis for the proposed installation and operation of a Battery Energy Storage System (BESS) at the Nevertire Solar Farm (NSF) located off the Mitchell Highway in Nevertire NSW. This assessment has been prepared to accompany the Modification Application for the proposal.

This Preliminary Hazard Analysis forms part of the supporting documentation for the Modification Application for the proposal in accordance with the Department of Planning, Industry and Environment's (DPIE) requirements for a Preliminary Hazard Analysis.

The Preliminary Hazard Analysis was prepared in accordance with the Department's Hazardous Industry Planning Advisory Paper No. 6, 'Hazard Analysis'(HIPAP 6) and Multi-Level Risk Assessment (MLRA).

HIPAP 6 provides guidance on the general approach recommended for hazard analysis. The objective of hazard analysis is to develop a comprehensive understanding of the hazards and risks associated with an operation or facility and of the adequacy of safeguards. The hazard analysis process may include qualitative and quantitative methods. Consideration should include:

- the nature and quantities of hazardous materials stored and processed on the site;
- the type of plant and equipment in use;
- the adequacy of proposed technical, operational and organisational safeguards;
- the surrounding land uses or likely future land uses; and
- the interactions of these factors.

The MLRA provides guidance on the criteria for using the results of the screening, classification and prioritisation steps to determine which of three levels of further analysis is appropriate.

Level 1 is an essentially qualitative approach based on comprehensive hazard identification to demonstrate that the activity does not pose a significant off-site risk.

Level 2 supplements the qualitative analysis by sufficiently quantifying the main risk contributors to show that risk criteria will not be exceeded.

Level 3 is a full quantitative analysis.

The MLRA guidance states a Level 1 qualitative assessment may suffice provided all or most of the following conditions are met:

- screening and risk classification and prioritisation indicate there are no major off-site consequences and societal risk is negligible;
- the necessary technical and management safeguards are well understood and readily implemented; and
- there are no sensitive surrounding land uses.

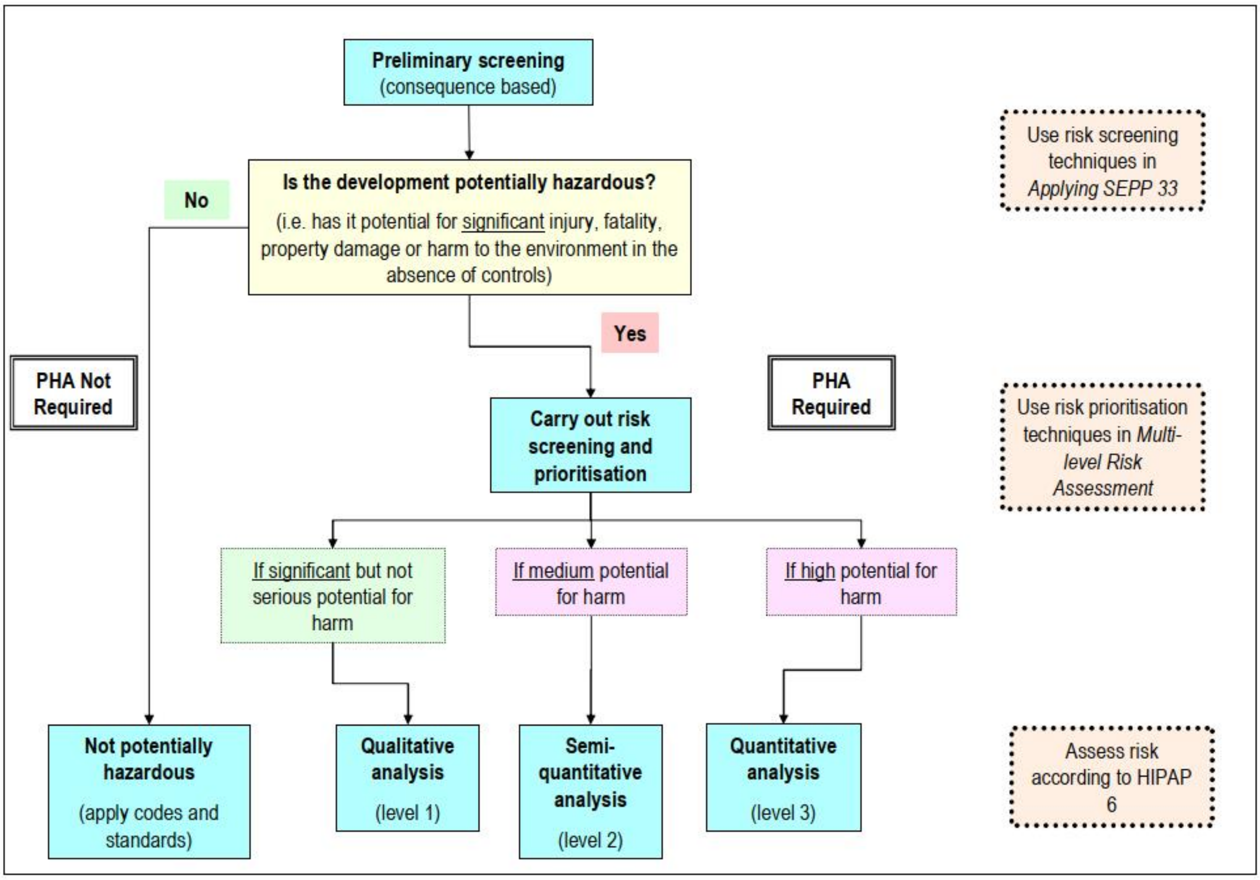
The current Preliminary Hazard Analysis study for this proposed Modification Application met the MLRA criteria for a Level 1 assessment. Being that the activity does not pose a significant off-site risk

It further states the following three stages are used in the assessment process:

- preliminary screening
- risk classification and prioritisation
- risk analysis and assessment.

The overall MLRA approach can be seen in Figure 1 below.

Figure 1 The Multi-Level Risk Assessment Approach*



(* Source Planning NSW, 2011a Multi-Level Risk Assessment, New South Wales Government, figure 3)

The Preliminary Hazard Analysis should estimate the cumulative risks from the existing and proposed development. To determine the level of risk to people, property and the environment at the proposed location and in the presence of controls.

If the risk levels exceed the criteria of acceptability and/or if the controls are assessed as inadequate, or unable to be readily controlled, then the development is classified as 'hazardous industry'. Where it is unable to prevent offensive impacts on the surrounding land users, the development is classified as 'offensive industry'.

A development may also be considered potentially hazardous with respect to the transport of dangerous goods. A proposed development may be potentially hazardous if the number of generated traffic movements (for significant quantities of hazardous materials entering or leaving the site) is above the cumulative annual or peak weekly vehicle movements. Applying SEPP 33: Hazardous and Offensive Development Application Guidelines (NSW Department of Planning, 2011), outlines the screening thresholds for transportation.

This report presents information pertaining to the Preliminary Hazard Analysis for the proposed modification.

1.1 Proposal Description

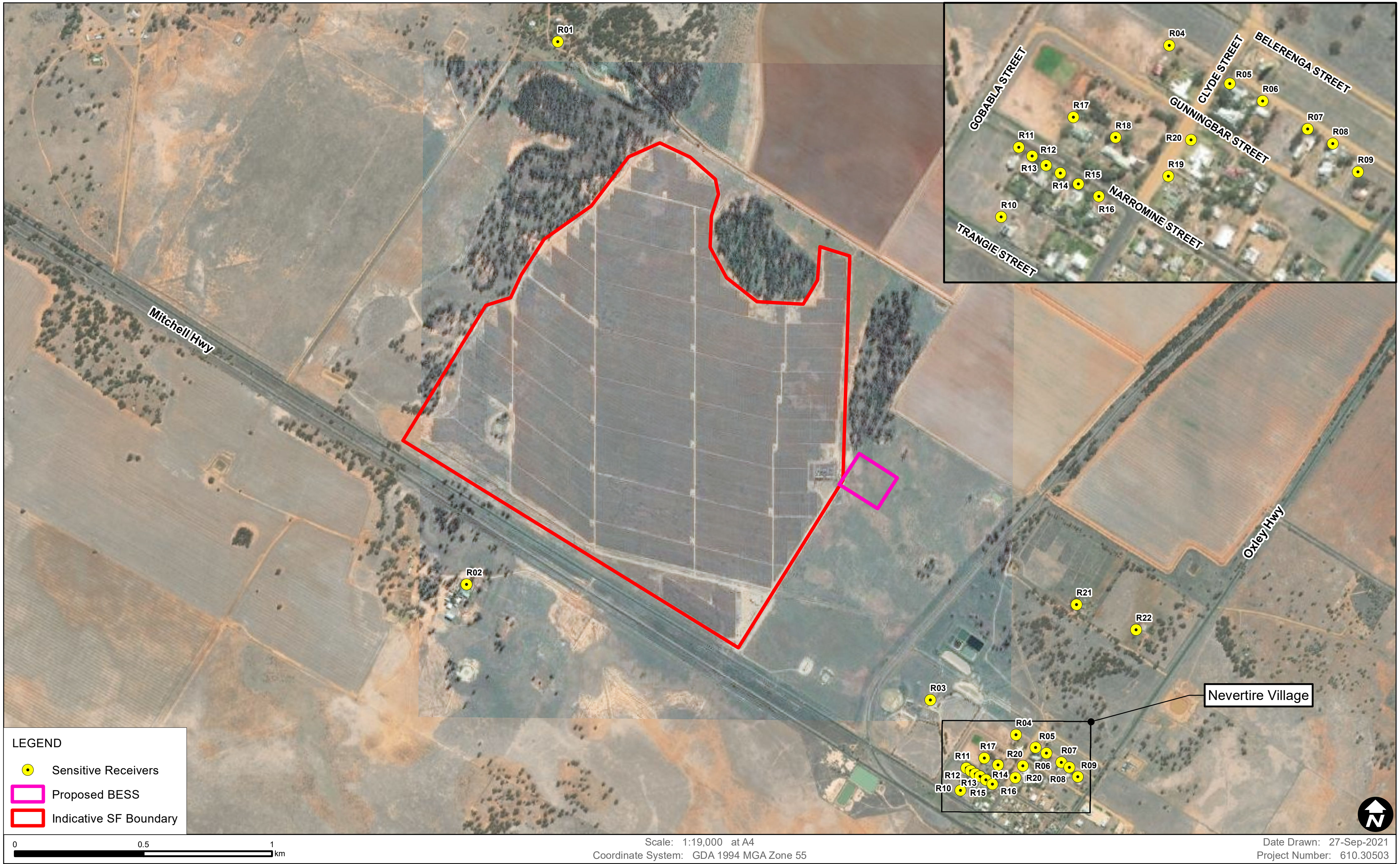
The Nevertire BESS is located on a 2.5-hectare portion of land across the access road from the NSF. It is approximately 1km northwest of the Nevertire village. It will have a capacity of up to 50 MW of power with energy storage of 100MWh which is 2 hours at capacity at full power rating.

It is expected that the Nevertire BESS will consist of up to 40 shipping container style battery energy storage packs (containerised battery energy storage system module) using a lithium technology or similar. The BESS will include battery storage containers, converters, ring main units (RMU), Low Voltage-High Voltage (LV-HV) step-up transformers, underground feeders, connection to the NSF 22kV switchboard and associated roads, tracks, fences, and control building.

The site location is shown in **Figure 2** and the proposed site layout is shown in **Figure 3**

The BESS will primarily be on automatic control 24 hours per day 7 days per week with very little human intervention. The BESS will typically be controlled by the BESS control system. This control system will automatically determine the state of charge or dis-charge as required.

The final layout and design of the NSF BESS is subject to the selection process of technology and original equipment manufacturers (OEM) specifications.



Scale: 1:19,000 at A4
Coordinate System: GDA 1994 MGA Zone 55

Date Drawn: 27-Sep-2021
Project Number: 610.30503

Data Source:
ESRI Basemaps

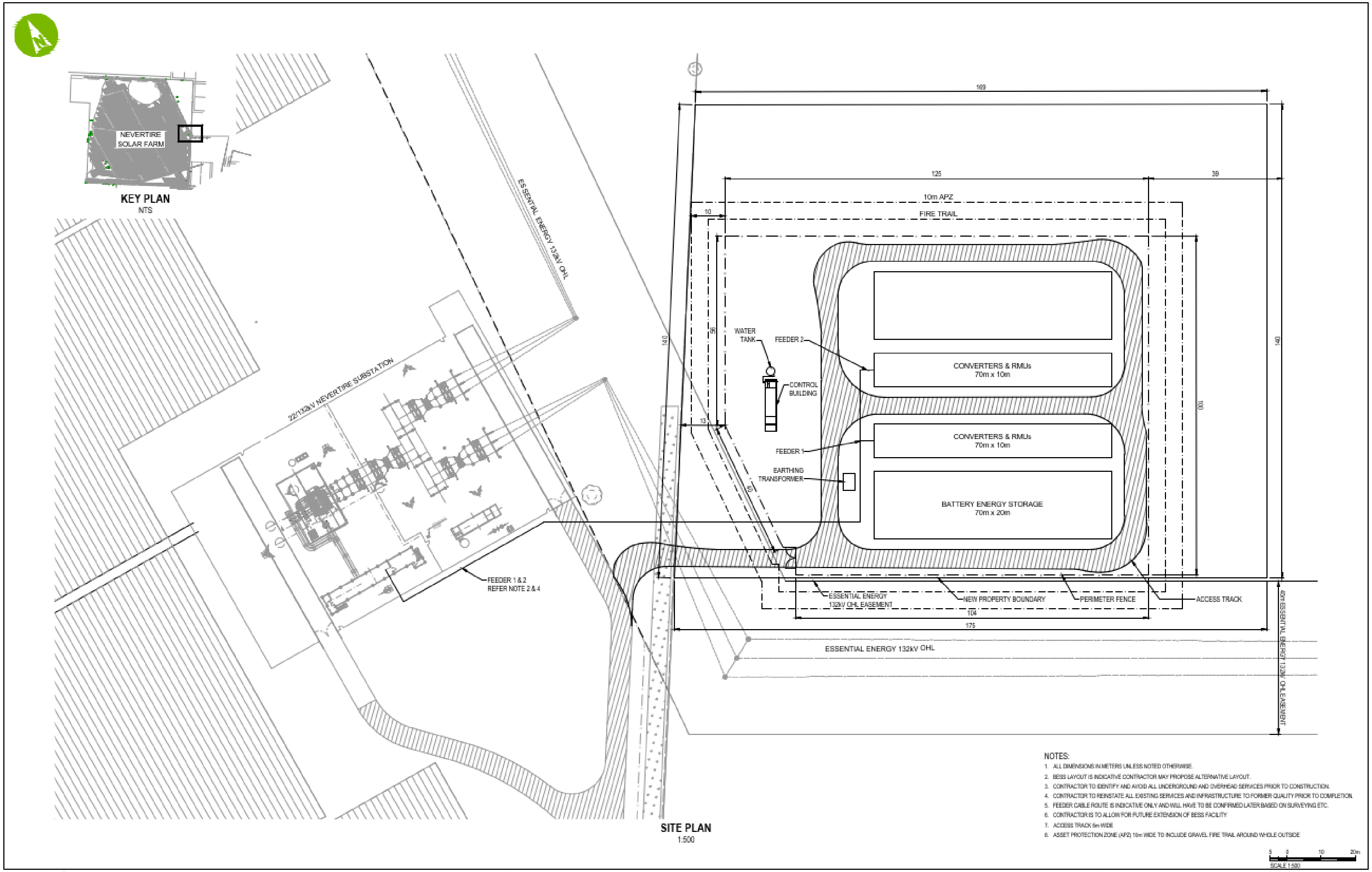
SLR

Site Location

FIGURE 2

\\au.slr.local\corporate\Projects-SLR\610-SrvSYD\610-SYD\610.30503.00000 Nevertire Elliott Green Power BESS\06 SLR Data\01 CADGIS\GIS\SLR6103053_Site_Location_01.mxd

Figure 3 Proposed Development



Source: Aurecon Site Plan (October 2021)

1.2 Nearest Receivers

The nearest sensitive receivers are residential properties located in the village of Nevertire to the southeast of the development with some other rural residential properties scattered around the area. The Nevertire Community Park is also located in the village and has been identified as a passive recreation receiver. The nearest receivers are presented in **Figure 2** and detailed in **Table 1**.

Table 1 Surrounding Sensitive Receivers

ID	Address	Receiver Type	Distance (m)	Direction
R01	9650 Oxley Hwy, Snakes Plain NSW	Residential	2,100	Northwest
R02	10811 Mitchell Hwy, Nevertire NSW	Residential	1,630	Southwest
R03	Nevertire Community Park, Gobabla St, Nevertire NSW	Passive Recreation	890	Southeast
R04	5 Clyde St, Nevertire NSW	Residential	1,140	Southeast
R05	2 Clyde St, Nevertire NSW	Residential	1,220	Southeast
R06	6 Gunningbar St, Nevertire NSW	Residential	1,260	Southeast
R07	12 Gunningbar St, Nevertire NSW	Residential	1,320	Southeast
R08	14 Gunningbar St, Nevertire NSW	Residential	1,360	Southeast
R09	5 Warren St, Nevertire NSW	Residential	1,400	Southeast
R10	2-12 Trangie St, Nevertire NSW	Residential	1,260	Southeast
R11	3 Narromine St, Nevertire NSW	Residential	1,180	Southeast
R12	5 Narromine St, Nevertire NSW	Residential	1,190	Southeast
R13	7 Narromine St, Nevertire NSW	Residential	1,210	Southeast
R14	9 Narromine St, Nevertire NSW	Residential	1,230	Southeast
R15	11 Narromine St, Nevertire NSW	Residential	1,250	Southeast
R16	15 Clyde St, Nevertire NSW	Residential	1,270	Southeast
R17	Narromine St, Nevertire NSW	Residential	1,170	Southeast
R18	9-13 Clyde St, Nevertire NSW	Residential	1,210	Southeast
R19	2 Narromine St, Nevertire NSW	Residential	1,280	Southeast
R20	6 Clyde St, Nevertire NSW	Residential	1,260	Southeast
R21	9650 Oxley Hwy, Nevertire NSW	Residential	930	Southeast
R22	9650A Oxley Hwy, Nevertire NSW	Residential	1,180	Southeast

2 PRELIMINARY RISK SCREENING

Preliminary risk screening of the proposed development is required under SEPP 33 to determine the need for a Preliminary Hazard Analysis. The preliminary screening assesses the storage of specific dangerous goods classes that have the potential for significant, off-site effects. Specifically, the assessment involves the identification of classes and quantities of all dangerous goods to be used, stored or produced on site with respect to storage depot locations as well as transported to and from the site.

2.1 Dangerous Goods Storage

There are no dangerous goods to be used or stored at the facility and therefore the facility is not considered potentially hazardous with regards to dangerous goods in accordance with the thresholds pertaining to SEPP 33.

However each of the 40 shipping container style battery energy storage packs (containerised battery energy storage system module) contain battery powerpack consisting of lithium ion batteries. Lithium ion batteries are classed as Class 9 Miscellaneous Dangerous Substances and articles, which are excluded from the SEPP 33 screening process. However the hazards associated with these batteries indicated that progression to Preliminary Hazard Analysis was required to further assess the hazards and risks associated with the lithium ion batteries. This will be covered later in this report.

2.2 Dangerous Goods Transport

There will be no transport of dangerous goods associated with the facility.

3 PRELIMINARY RISK SCREENING CONCLUSION

This report has reviewed and applied the requirements of SEPP 33 in order to determine whether the policy applies to the Project.

The SEPP 33 screenings for storage of dangerous goods indicate that the development may not be classified as a hazardous or offensive industry.

However the Lithium Ion batteries as a component of the development indicate a more detailed assessment of the hazard be undertaken in the following Preliminary Hazard Analysis.

4 PRELIMARY HAZARD ANALYSIS

A Preliminary Hazard Analysis must be prepared in accordance with Hazardous Industry Planning Advisory Paper No. 6 - Guidelines for Hazard Analysis (DoP, 2011). The Preliminary Hazard Analysis should estimate the cumulative risks from the existing and proposed development.

Where SEPP 33 identifies a development as potentially hazardous and/or offensive, developments are required to undertake a Preliminary Hazard Analysis to determine the level of risk to people, property and the environment at the proposed location and in the presence of controls.

The purpose of the Preliminary Hazard Analysis is to assess whether the proposed development impacts on the current surrounding land uses and/or if the development is offensive or hazardous, thereby posing an unacceptable risk to the surrounding community or if the proposed development may be potentially subject to hazards or risks from existing development in the surrounding area.

4.1 Hazard Identification

The hazard analysis and quantified risk assessment approach developed and recommended in HIPAP relies on a systematic and analytical approach to the identification and analysis of hazards and the quantification of off-site risks to assess risk tolerability and land use safety implications. HIPAP advocates a merit-based approach, the level and extent of analysis must be appropriate to the hazards present and therefore, need only progress to the extent necessary for the particular case.

4.1.1 Methodology

The procedures adopted by this study for assessing hazardous impacts involve the following steps:

Step 1: Hazard identification;

Step 2: Hazard analysis (consequence and probability estimations); and

Step 3: Risk evaluation and assessment against specific criteria.

The following sections of the report discuss the hazard identification and analysis process as prescribed in HIPAP.

4.1.2 Hazard Identification

This is the first step in the risk assessment. It involves the identification of all theoretically possible hazardous events as the basis for further quantification and analysis. This does not in any way imply that the hazard identified or the theoretically possible impact will occur in practice. Essentially, it identifies the particular characteristics and nature of hazards to be further evaluated in order to quantify potential risks.

To identify hazards, a survey of operations was carried out to isolate the events which are outside normal operating conditions and which have the potential to impact outside the boundaries of the site. These events do not include occurrences that are a normal part of the operation cycles of the site but rather the atypical and abnormal.

4.1.3 Hazard analysis

After a review of the events identified in the hazard identification stage and the prevention/protection measures incorporated into the design of the site, any events which are considered to have the potential to result in impacts off-site or which have the potential to escalate to larger incidents are carried to the next stage of analysis.

4.1.4 Consequence Estimation

This aspect involves the analysis and modelling of the credible events carried forward from the hazard identification process in order to quantify their impacts outside the boundaries of the site. These events typically include explosion, fire fume, dispersion/propagation and stormwater contamination and their potential effects on people and/or damage to property.

4.1.5 Probability Likelihood Estimation

Where necessary, the likelihood of incidents quantified as a result of Section 4.1.4 are determined by adopting probability and likelihood factors derived from published data.

4.1.6 Risk Evaluation and Assessment

The risk analysis includes the consequences of each hazardous event and the frequencies of each initiating failure. The results of consequence calculations (radiation and overpressure contours, and toxic exposure levels) together with the probabilities and likelihood's estimated are then compared against the accepted criteria, as specified by the HIPAP series applicable for the site. Whether it is considered necessary to conduct the predictions would depend on the probabilities and likelihood estimated and if the risk criteria are exceeded.

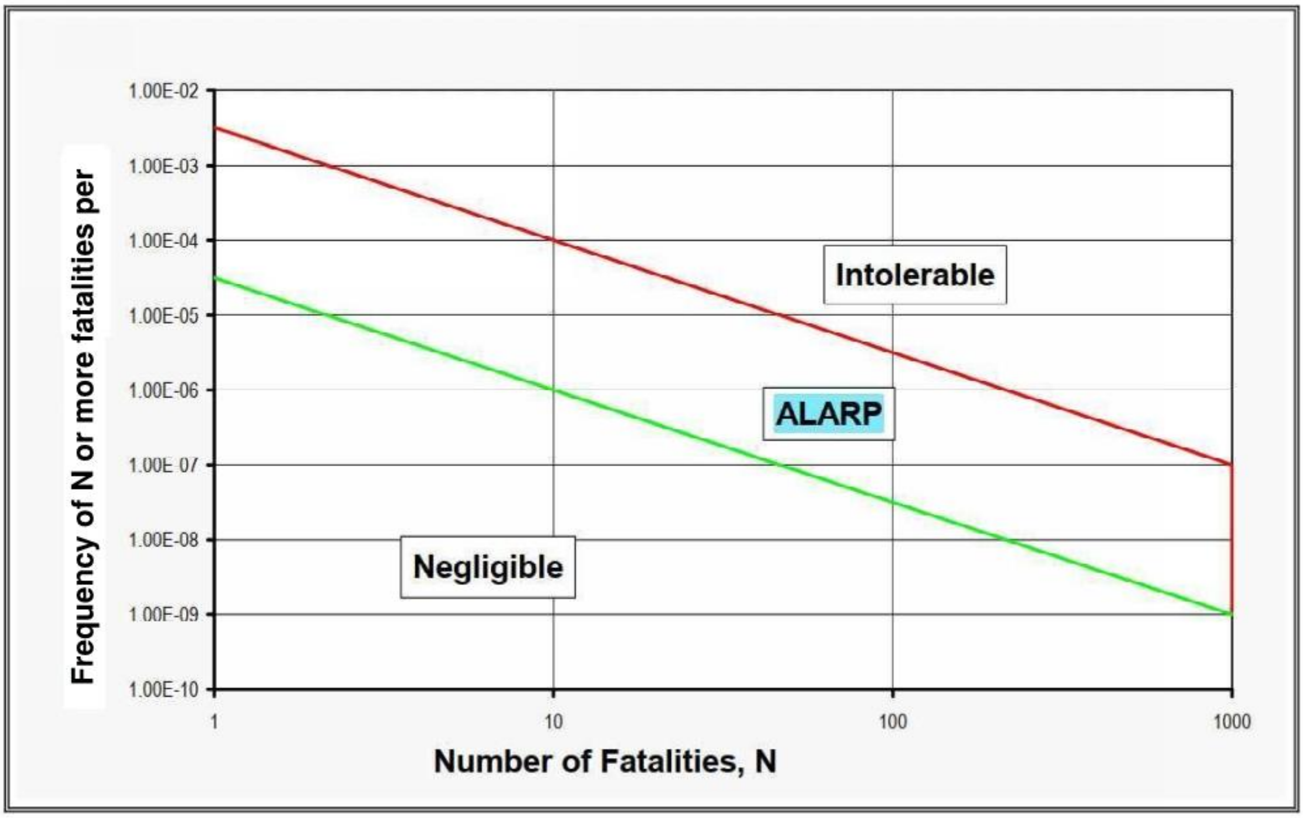
4.1.7 Risk Criteria

As part of the MLRA, hazards are identified and the risk from the hazards estimated. Risk criteria take into consideration surrounding land uses, and the category of risk. They encompass such elements as injury/ irritation, individual and societal risk of fatality, property damage and harm to the biophysical environment. Criteria may be expressed in qualitative or quantitative terms. (Planning NSW, 2011a) A key concept in the risk criteria is that societal risks should be "as low as reasonably practical", known as the ALARP principle.

ALARP is a principle that may be applied in relation to the degree of risk reduction that may be sought from a particular activity. It has been described by the UK Health and Safety Executive (HSE) in the following terms: 'In weighing the costs of extra safety measures the principle of reasonable practicability (ALARP) applies in such a way that the higher or more unacceptable a risk is, the more, proportionately, an employer is expected to spend to reduce it'.

The indicative societal risk criteria reflect these regions as three societal risk bands: negligible, ALARP and intolerable, as shown in the example below in **Figure 4**.

Figure 4 Indicative Societal Risk Criteria



(* Source Planning NSW, HIPAP 4, New South Wales Government, figure 3)

Below the negligible line, provided other individual criteria are met, societal risk is not considered significant. Above the intolerable level, an activity is considered undesirable, even if individual risk criteria are met. Within the ALARP region, the emphasis is on reducing risks as far as possible towards the negligible line. Provided other quantitative and qualitative criteria are met, the risks from the activity would be considered tolerable in the ALARP region.

The risk assessment in the current study was based on hazard identification, consequence assessment and likelihood assessment, to create an overall risk assessment. As set out in **figure 5**.

Figure 5 Risk Matrix

			Risk Rating		
Likelihood			**Consequence**		
	Low	**Minor**	**Medium**	**Major**	**Catastrophic**
Almost certain	Low	Medium	High	Extreme	Extreme
Likely	Low	Medium	High	Extreme	Extreme
Possible	Low	Low	Medium	High	Extreme
Unlikely	Low	Low	Medium	High	High
Rare	Low	Low	Low	Medium	High

In assessing the tolerability of risk from potentially hazardous development, the relevant general principles set out in HIPAP 6 are:

- the avoidance of all avoidable risks;
- the risk from a major hazard should be reduced wherever practicable, even where the likelihood of exposure is low;
- the effects of significant events should, wherever possible be contained within the site boundary; and
- where the risk from an existing installation is already high, further development should not pose any incremental risk.

4.1.8 Risk of Property Damage and Accident Propagation

The siting of an installation must account for the potential for propagation of an accident causing a "domino" effect on adjoining premises. This risk would be expected within an industrial estate where siting of hazardous materials on one site may potentially cause hazardous materials on an adjoining premises to further develop the size of the accident.

In the current study, the risk of property damage and accident propagation to adjoining property outside the site is considered unlikely. Based on the significant distances between the BESS site and the nearest sensitive recovers.

4.1.9 Criteria for Risk Assessment to the Biophysical Environment

The siting of potentially hazardous developments also needs to consider the risk from accidental releases into the biophysical environment.

The suggested criteria for sensitive environmental areas relate to the potential effects of an accidental release or emission on the long-term viability of the ecosystem or any species within it and are expressed as follows:

- Industrial developments should not be sited in proximity to sensitive natural environmental areas where the effects or consequences of the more likely accidental emissions may threaten the long-term viability of the ecosystem or any species within it; and
- Industrial developments should not be sited in proximity to sensitive natural environmental areas where the likelihood or probability of impacts that may threaten the long-term viability of the ecosystem or any species within it is not substantially lower than the existing background level threat to the ecosystem.

In the current study, the risk of biophysical damage outside the site is considered unlikely, based on the limited processes undertaken on the site, the engineering and design controls that will be in place and the rural nature of the surrounding environment.

4.2 Potential Hazardous Incidents Identified for Further Discussion

Following a review of surrounding land use a series of potentially hazardous events or scenarios were considered to identify if further comprehensive qualitative analysis is required. Each event or scenario shall be discussed in detail.

The Hazard Identification Word Diagram listing hazards considered can be found in **Appendix A, Table 3.**

The following potential hazards could not be eliminated through first review and require further examination:

- Hazards associated with lithium ion batteries in the BESS, specifically overheating and fire.
- Hazards associated with oils escaping from transformers.

4.2.1 Incident Scenarios and Control Measures

As previously stated, fire is the main hazard associated with lithium ion batteries in the BESS. Fires associated with powerpacks in containerised battery energy storage system modules (containerised modules), do not easily spread to adjacent containerised modules, when constructed and installed according to relevant standards and guidelines. For example, full scale fire testing of powerpacks including the scenarios of external heat sources, internal fires in a powerpack and finally forcing thermal runaway reactions in a powerpack, reported the fires were self limiting in a powerpack and unlikely to spread to adjacent powerpacks (NFPA, Hazard Assessment of Lithium Ion Battery Energy Storage Systems, 2016).

The control measures, provided below, are designed to maintain and contain the risks within the site boundary and reduce the risk to areas outside the site boundary. The technical and management safeguards required for BESS are self-evident and readily implemented as part of plant safety engineering. Following these safeguards, including codes and standards will ensure the risk level is ALARP and that the modification meets the principles of: .

- the avoidance of all avoidable risks;
- the risk from a major hazard should be reduced wherever practicable, even where the likelihood of exposure is low;
- the effects of significant events should, wherever possible be contained within the site boundary; and
- where the risk from an existing installation is already high, further development should not pose any incremental risk.

These technical and management safeguards required for BESS include but are not limited to guidance set out in the following:

- AS1768:2020 Lightning Protection
- AS 5139 Electrical Installations - Safety of Battery Systems for Use with Power Conversion Equipment
- Ditch, Ben & Zeng, Dong. (2019). Development of Sprinkler Protection Guidance for Lithium Ion Based Energy Storage Systems (FM Global Research Technical Report)
- FM Global Property Loss Prevention Data Sheets 5-33, Electrical Energy Storage
- IEC 62485-1:2015 Safety requirements for secondary batteries and battery installations - Part 1: General safety information
- IEC 62485-2:2010 Safety requirements for secondary batteries and battery installations - Part 2: Stationary Batteries
- IEC 62619:2017 Secondary cells and batteries containing alkaline or other non-acid electrolytes - Safety requirements for secondary lithium cells and batteries, for use in industrial applications
- IEC 62897 Stationary Energy Storage Systems with Lithium Batteries - Safety Requirements
- IEC 62933:2018 Electrical Energy Storage (ESS) Systems

- NFPA 855: 2020 Standard for the Installation of Stationary Energy Storage Systems
- UL 9540 Standard for Energy Storage Systems and Equipment
- UL 9540A ANSI/CAN/UL Standard for Test Method for Evaluating Thermal Runaway Fire Propagation in Battery Energy Storage Systems

It should be noted that implementation of controls including adherence to technical and management guidelines should be verified in the final detailed design for the site.

Major incidents possible at the facility along with potential outcomes, consequences and control measures and residual risk after the implementation of control measures have been outlined below in **Table 2** and the Hazard Identification Word Diagram can be found in **Appendix A**, **Table 3**.

Table 2 Summary of Potential Major Incident Scenarios & Residual Risk after Implementation of Controls

Major Incident	Description	Potential Outcomes	Frequency Estimate	Likely Consequences	Controls	Residual Risk Level*
Fire	Fire on site or bushfire impinges on BESS	Localised damage to containerised modules. Unlikely to spread to between containerised modules (NFPA, 2016)	Rare	Damage to individual containerised modules	Equipment to comply with international and Australian standards and guidelines (set out in section 4.2.1 above) Fire management plan or the like, be in place	Low
Explosion / Thermal Runaway reaction – powerpacks in containerised modules	Thermal runaway reaction occurs in powerpack from overcharging or fire	Localised damage to containerised modules. Gas / vapour release from containerised modules Unlikely to spread between containerised modules (NFPA, 2016)	Rare	Damage to individual containerised modules	Equipment to comply with international and Australian standards and guidelines (set out in section 4.2.1 above) Fire management plan or the like, be in place	Low

Major Incident	Description	Potential Outcomes	Frequency Estimate	Likely Consequences	Controls	Residual Risk Level*
Transformer failure and fire	Transformer catastrophically fails	Transformer oil spills and fire	Rare	Leakage of transformer oil to environment Localised fire	Equipment to comply with international and Australian standards and guidelines (set out in section 4.2.1 above) Use of fully bunded oil storage for transformers in accordance with AS1940 Regular tank inspections included in inspection requirements Fire management plan or the like, be in place	Low

Major Incident	Description	Potential Outcomes	Frequency Estimate	Likely Consequences	Controls	Residual Risk Level*
Electrical Hazards – short circuit /equipment failure	Exposure to high voltages	Electrocution	Rare	Injury / death	Equipment to comply with international and Australian standards and guidelines (set out in section 4.2.1 above) Site operating procedures in place to avoid workers coming in contact with electrified systems	Low

Note * Residual risk levels assessed as per section 4.1.7 and Fig.5

4.2.2 Potential for Offsite Impacts

The potential for offsite impacts from the scenarios reviewed is considered unlikely, based on the control systems being in place and the distance to the nearest residence being greater than 1 km.

5 Conclusions

The Preliminary Hazard Analysis has found that the main potential hazards associated with the site were fire associated with the lithium ion batteries in the powerpacks and to a lessor extent oil leaks from transformers.

The risks associated with these hazards were rated as low risk. As the risks can be reduced to ALARP levels by following the codes and standards set out above section 4.2.1.

The technical and management safeguards required are self-evident and readily implemented as part of plant safety engineering.

The implementation of controls including adherence to technical and management guidelines should be verified in the final detailed design.

Spill, fire and incident events are not likely to extend significantly beyond the boundary of the site, with the exception of a major plant fire where, regardless of the type of operation there will always be a risk of potentially harmful smoke plumes downwind from a fire. In the majority of large fires the buoyant nature of a smoke plume means any potentially harmful materials are rapidly dispersed.

It is the conclusion of this Preliminary Hazard Analysis that the proposed development meets all the requirements stipulated by DPIE and hence would not be considered, with suitable engineering controls in place to be an offensive or hazardous development on site.

References

AS1768:2020 *Lightning Protection*

AS 5139 *Electrical Installations - Safety of Battery Systems for Use with Power Conversion Equipment*

Commonwealth Government, 2020, *Australian Code for the Transport of Dangerous Goods by Road and Rail* (ADG Number 7.7).

Department of Planning NSW, 2011, *Applying SEPP 33* - Hazardous and Offensive Development Application Guidelines.

Ditch, Ben & Zeng, Dong. (2019). *Development of Sprinkler Protection Guidance for Lithium Ion Based Energy Storage Systems* (FM Global Research Technical Report).

FM Global *Property Loss Prevention Data Sheets 5-33, Electrical Energy Storage*

IEC 62485-1:2015 *Safety requirements for secondary batteries and battery installations - Part 1: General safety information*

IEC 62485-2:2010 *Safety requirements for secondary batteries and battery installations - Part 2: Stationary Batteries*

IEC 62619:2017 *Secondary cells and batteries containing alkaline or other non-acid electrolytes - Safety requirements for secondary lithium cells and batteries, for use in industrial applications*

IEC 62897 *Stationary Energy Storage Systems with Lithium Batteries - Safety Requirements*

IEC 62933:2018 *Electrical Energy Storage (ESS) Systems*;

NFPA 855: 2020 *Standard for the Installation of Stationary Energy Storage Systems*;

NFPA,2016 *Hazard Assessment of Lithium Ion Battery Energy Storage Systems*. Fire Protection Research Foundation and the National Fire Protection Association.

Planning NSW, 2011a *Multi-Level Risk Assessment*, New South Wales Government

Planning NSW, 2011b *Hazard Analysis* – Hazardous Industry Planning Advisory Paper No 6, New South Wales Government

UL 9540 *Standard for Energy Storage Systems and Equipment*;

UL 9540A ANSI/CAN/UL *Standard for Test Method for Evaluating Thermal Runaway Fire Propagation in Battery Energy Storage Systems*;

Appendix A Hazard Identification Word Document

Details of hazardous events, causes, consequences and controls have been set out in **Table 3** below.

Table 3 Hazard Identification Word Document

Hazardous Incident / Event	Possible Cause	Possible Consequences	Prevention / Protection Safeguards
Bushfire	Bushfire external to site causes fire to spread onto BESS	Damage to the BESS and the solar farm	Implementation of a fire break around the site Implementation of a fire management plan or the like Coordination with local fire authorities
Fire starting on site	Fire starting on site, cause other than starting in containerised module	Damage to the BESS and the solar farm	Implementation of a fire management plan or the like Coordination with local fire authorities
Explosion / Thermal Runaway reaction – powerpacks in containerised modules	Thermal runaway reaction occurs in powerpack from overcharging or fire Faulty powerpacks	Localised damage to containerised modules. Gas / vapour release from containerised modules Fire unlikely to spread between containerised modules (NFPA, 2016)	Equipment and systems will be designed and tested to comply with international and/ or Australian standards and guidelines (see section 4.2.1). Implementation of a fire management plan or the like

Hazardous Incident / Event	Possible Cause	Possible Consequences	Prevention / Protection Safeguards
Exposure of equipment to high voltage	Short circuit/ or equipment failure	Equipment failure and injury or fatality to personnel	Equipment and systems will be designed and tested to comply with international and/ or Australian standards and guidelines (see section 4.2.1). BESS BMS fault detection and safety shut-off systems provided Emergency Response Plan to cover all site hazards
Damage to batteries from vehicle collision	Light vehicle strike to batteries	Damage to battery cells Electrical risks	Use of perimeter fence around battery facility Use of internal access roads with appropriate turning circles Limit of speed limit within fenced facility Earthing system installed as per normal electrical facilities
Transformer Oil Leakage	Corrosion of tank base or leakage of oil tank	Leakage of transformer oil to environment Potential for pool fire in oil	Use of fully bunded oil storage for transformers in accordance with AS1940 Regular tank inspections included in inspection requirements

Hazardous Incident / Event	Possible Cause	Possible Consequences	Prevention / Protection Safeguards
Security Breach	Security breach into battery storage facility for theft of components	Theft of equipment or risk to personnel	Installation of security fencing around entire facility and also battery facility separately Installation of CCTV security system to monitor key areas Inspections to monitor for security breaches
Damage due to lightning strike	Lightning striking facility and causing damage	Lightning strike causing damage to facility or personnel	Completion of a lightning risk assessment in accordance with AS1768 Include lightning protection measures if deemed necessary
Flooding of facility causing damage	High rainfall and flooding to site	Damage to electrical equipment Restricted access to site	Where possible install electrical equipment elevated above ground level Ensure suitable site access and egress at different locations
Exposure to Electromagnetic Fields (EMF)	Electric fields and magnetic fields from operating electrical equipment and transmission lines	Personnel exposed to elevated EMF levels	Equipment and systems will be designed and tested to comply with international and/ or Australian standards and guidelines (see section 4.2.1). Follow industry guidance with respect to minimising exposure to EMF.

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