

Town Planning Assessment Report

Appendix 5 – Bushfire Hazard Assessment



Energy Queensland Limited

**Jimboomba West Substation
Bushfire and Fire Hazard Assessment**

MWS00365-000-FR-RPT-0001

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Client: Energy Queensland Limited

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Prepared By: MWS Risk Pty Ltd
PO BOX 261
Spring Hill QLD 4004
Australia
info@mwsrisk.com
www.mwsrisk.com
ABN: 95 630 711 536

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Appendix A: OM-03.01 Assessment

Appendix B – Main Transformer Information

1. Introduction

MWS Risk Pty Ltd (MWS Risk) has been engaged on behalf of Energy Queensland Ltd (EQL) to provide bush/fire risk consultation for the proposed new Jimboomba West Substation (JBW) at 2-12 and 14 Glynton Road, Riverbend, QLD 4280 (the Project).



Figure 1-1: Site Location (Green Rectangle)

This report assesses the site, including the proposed development layout, surrounding vegetation, separation distances, bushfire exposure, and fire risks relevant to the proposed substation infrastructure. The proposed development comprises two (2) modular buildings, two (2) 33/11 kV main transformers, and associated ancillary substation equipment. MWS Risk has conducted a fire risk assessment to support the Development Application (DA) submission to Logan City Council (LCC).

1.1 Property Details

The property details for the proposed development are:

Address:	2-12 and 14, Riverbend, Queensland, 4280
Lot/DP:	Lot 1 SP239500, Lot 2 SP351565
Zoned:	Rural Residential
Precinct:	Park Living
Council:	Logan City Council (LCC)
Fire Authority:	Queensland Fire and Emergency Services (QFES) Station 59, auxiliary, Jimboomba Fire Station, Johanna Street, Jimboomba
Current Land Use:	Vacant land
Proposed Land Use:	Substation

Adjoining Properties: Rural residential and Council owned road

1.2 Abbreviations

The following abbreviations are used in this report:

Table 1-1: Abbreviations

Abbreviation	Meaning
AC	Alternating Current
AS	Australian Standards
AFLC	Adio Frequency Load Control
AHJ	Authority Having Jurisdiction
BAL	Bushfire Attack Level
DA	Development Application
DC	Direct Current
EQL	Energy Queensland Ltd
FHA	Fire Hazard Assessment
FFDI	Forest Fire Danger Index
HV	High Voltage
HIPAP	NSW Hazardous Industry Planning Advisory Papers
IEEE	Institute of Electrical and Electronics Engineers
JBW	Jimboomba West Substation
LCC	Logan City Council
LPS	Logan Planning Scheme 2015 version 9
LV	Low Voltage
ONAN	Oil Natural Air Natural
ODAN	Oil Directed Air Natural
ODAF	Oil Directed Air Forced
OM	Overlay Map
MVA	Megavolt-amperes
NCC	National Construction Code 2022
PD	Planning Development
QFES	Queensland Fire and Emergency Services
SCADA	Supervisory Control and Data Acquisition communication

1.3 Stakeholders

The following relevant stakeholders have been identified and shall review this document and provide comment:

Table 1-2: Project Stakeholders

Name	Company	Title
Trent Pease	EQL	Senior Engineer (Civil and Structural)
Tom Sexton	EQL	Town Planner
Daniel Ahn	EQL	Civil and Structural Engineer
Bill Elson	EQL	Senior Substation Designer
Adrian MacHunter	MWS Risk	Senior Fire Safety Engineer
Nazmul Khan	MWS Risk	Fire Safety Engineer

1.4 Purpose

The purpose of this report is to document the fire hazards that have been identified, determine what consequences these hazards have the potential to cause and then prescribe the most effective fire risk mitigation method for controlling the risk.

1.5 Scope of Work

The scope of this Fire Hazard report is limited to the EQL JBW substation installation Project within the Project boundary, at 2-12 and 14, Riverbend, Riverbend, QLD 4280.

The report is based on the relevant project information, documentation and drawings as listed in Section 1.8.

The report will be issued to EQL who will then be responsible to issue to the Project stakeholders and any Authority Having Jurisdiction (AHJ) as part of their submissions and for approval.

1.6 Fire Safety Objectives

The fire safety objectives and priorities differ between the project stakeholders, however, in general, the projects fire safety objectives fall into three groups: building regulatory, other regulatory and non-regulatory.

The building regulatory objectives are those that are set out by building legislation, such as the Queensland Building Act 1975 and Regulations 2021 and the National Construction Code (NCC 2022).

Other regulatory objectives are those broad objectives set out by other legislation such as:

- Queensland Work Health and Safety Act 2011.
- Queensland Work Health and Safety Regulations 2011.
- Queensland Fire and Emergency Services (QFES).

The non-regulatory objectives are those that are set by the client, designers, insurers and other stakeholders.

The general fire safety objectives for the project are as follows:

- Protect building and facility occupants.
- Ensuring the safety of all persons affected by the workplace, including employees, visitors, contractors and community.
- Ensuring the safety of emergency services personnel and allowing for the facilitating the emergency response activities.
- Preventing the spread of fire between buildings, areas, structures and process equipment.
- Limiting structural damage and ensuring integrity of strategic structures during fire.
- Limiting building contents and equipment damage.
- Maintaining business continuity.
- Limiting the release of hazardous substances.
- Safeguarding community interests and infrastructure.

1.7 Standards, Codes and Legislation

1.7.1 Legislation

The following legislation is relevant to this project.

Table 1-3: Legislation

Number	Title
NCC	National Construction Code, 2022
QLDBA	Queensland Building Act 1975
QLDBR	Queensland Building Regulation 2021
QLDHSA	Queensland Work Health and Safety Act, 2011
QLDHSR	Queensland Work Health and Safety Regulation, 2011
QLDPA	Queensland Planning Act, 2016
QLDPR	Queensland Planning Regulation, 2017

1.7.2 Australian Standards

The following Australian Standards are relevant to this project.

Table 1-4: Australian Standards

Number	Title
AS 1670.1:2024	Fire detection, warning, control and intercom systems – System design, installation and commissioning. Part 1: Fire
AS 1851:2012	Routine service of fire protection systems and equipment
AS 1940:2017	The storage and handling of flammable and combustible liquids

AS 2067:2016	Substations and high voltage installations exceeding 1.1 kV a.c.
AS 2444:2001	Portable fire extinguishers and fire blankets – Selection and location
AS 3000:2018	Electricity wiring rules
AS ISO 31000:2018	Risk management - Guidelines
AS 3959:2018	Construction of buildings in bushfire-prone areas

1.8 Relevant Documents

The following documents are referred to throughout this report:

Table 1-5: Documents

Number	Title	Revision
SSJBW-GA001-01	JBW Jimboomba West Substation Check General Arrangement	A
881-B648-11	Station Services Transformer	A02
00031-GA08	AC Changeover Board	2
SSJBW-GA002-01	Modular Building +1 Equipment Layout Plan	A
SSJBW-GA003-01	Modular Building +2 Equipment Layout Plan	A
Attachment A	Site Location Map	29/05/2026
Attachment B	Proposed Functional Arrangement	29/05/2026
Attachment C	Level & Detail Survey for Substation Design Glynton Road, Riverbend	A
Attachment D	Site Photos	25/05/2026
JBW Civil Earthworks	Model-GA - Dimensions	30/07/2026
JBW site layout	JBW Jimboomba West Substation Civil Model Sketch	29/07/2026
3057510	Standard for Climate and Natural Hazard Resilience	25/07/2023
SPP-map-export	Map	26/05/2026
10019947-01	General Arrangement of 15/25 MVA 33/11 kV ONAN/ODAN/ODAF Transformer	B
10019928	25 MVA 33/11 kV ONAN/ODAN/ODAF Transformer	A
10027082-01	Foundation Concrete Works	A
10027082-02	Foundation Concrete Works Section & Details	A

1.9 The Project

The Project is the development of a new substation, at 2-12 and 14, Riverbend, Riverbend, QLD 4280, comprised of:

- 2 x 33/11 kV main transformers.

- 2 x 315 kVA 11/0.433 kV pad mount station service transformers.
- 1 x 33 kV switchroom modular building.
- 1 x 11 kV switchroom modular building.
- 2 x Audio Frequency Load Control (AFLC) coupling cells.
- 1 x Automatic Changeover (ACO) and main AC distribution board.
- 1 x Oil/water separator.
- 1 x Toilet block.
- Ancillary site infrastructure.

The plan layout of the development is shown in Figure 1-2. The surrounding areas are zoned rural residential under the Logan City Council Planning Scheme, 2015 version 9 (LPS).

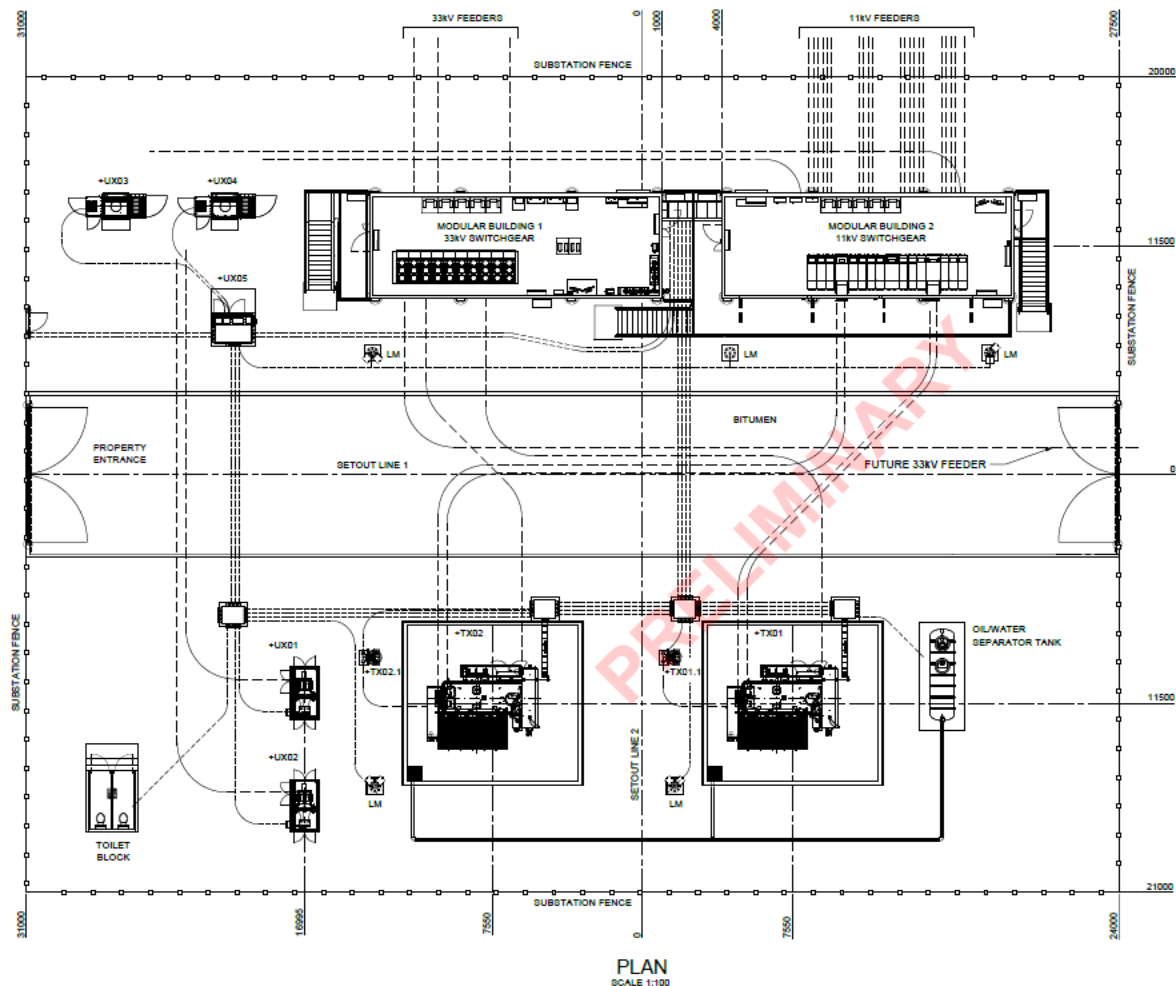


Figure 1-2: Plan Layout of Substation

2. Study Author and Reviewer

Nazmul Khan, Fire Engineer at MWS Risk, is the author of this report and holds the following qualifications:

- Graduate diploma in fire safety engineering, 2024, University of Western Sydney.
- PhD in CFD based fire modelling, 2017, University of Sydney.
- Bachelor's in mechanical engineering, 1999, Bangladesh University of Engineering and Technology.
- Registered Professional Engineer in Queensland (Fire Safety, Mech), RPEQ33521.
- Registered Professional Engineer (Fire Safety) in Victoria, PE0015979.

These qualifications, and Nazmul's 12+ years in fire engineering science, building and wildland fire safety consultancies, achieve the required competencies to execute this work.

Adrian MacHunter, Director of MWS Risk, is the reviewer of this report and holds the following qualifications:

- Bachelor of Materials Engineering, 2003, University of Queensland.
- Masters of Fire Safety Engineering, 2011, University of Western Sydney.
- Chartered Professional Engineer (CPEng), Engineers Australia, 3486659.
- Registered Professional Engineer in Queensland (RPEQ in mechanical, fire safety and fire engineering), 13662.
- Accredited Fire Safety Engineer (C10) in New South Wales, BPB2236.
- Registered Professional Fire Safety Engineer in Victoria (RPEV), PE0003888.
- Asia Pacific Economic Cooperation (APEC) Engineer.
- Chartered Engineer (CEng), UK Engineering Council, Institution of Fire Engineers, 52659.
- Professional Process Safety Engineer, Institution of Chemical Engineers, 100174892.

These qualifications, and Adrian's 20+ years in industrial fire engineering and fire system design, achieve the required competencies to execute this work.

3. Bushfire Hazard Assessment

3.1 Bushfire Hazard Overlay Code

3.1.1 Purpose

The purpose of the bushfire hazard overlay code presented in the LPS is to protect people and premises in a bushfire hazard area.

This will be achieved where the development protects people and premises from bushfire risk:

- Through allotment design and siting of development envelope areas and asset protection zones.

- ### 3.1.2 Proposed Site Overlay

The lots are currently vacant land owned by EQL. The proposed substation development will be located within the existing cleared portions of the site, with vegetation clearance minimised where practicable to support the retention of existing vegetation and maintain ecological connectivity associated with the Council's biodiversity corridor objectives.

3.1.3 Acceptable Development

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Table 3-1: OM.03.01 Performance Outcomes and Acceptable Outcomes

Performance Outcomes	Acceptable Outcomes
PO1: Development is designed to: - Minimise risk of bushfire hazard. - Provide safe premises. - Create efficient emergency access for fire-fighting and other emergency vehicles.	AO1: Development: - Does not increase the number of persons living in, or lots in, the Bushfire hazard area identified on Bushfire hazard overlay map OM-03.00; or - Is on a site that a bushfire hazard assessment prepared in accordance with the methodology in Planning scheme policy 6 - Management of bushfire hazard determines is of low bushfire hazard.
PO2: Development is sited and constructed to minimise the bushfire hazard and maximise the protection of life and property from bushfire.	AO2: Development is located and constructed: - Where there is no bushfire management plan approved by an existing development approval: - Such that the bushfire attack level is less than or equal to BAL-29. - Away from the most likely direction of a fire front. - So that elements of the development least susceptible to fire are sited closest to the bushfire hazard. - Such that asset protection zones are sited on land with a slope less than 18°. - Such that asset protection zones are entirely within the boundaries of the private property of the development site. Or - Where an approved bushfire management plan directs development to be located.
PO3: Reconfiguring a lot ensures that lots are designed to minimise bushfire hazard and provide safe sites for people, property and buildings.	AO3 Lots: - Are suitable for people, property and buildings by: - Having a bushfire attack level less than or equal to BAL-29. Or - Containing a development envelope area that has a bushfire attack level less than or equal to BAL-29; - Provide asset protection zones that: - Are located on land with a slope less than 18 degrees. - Are located on the same lot.
PO4: Access for fire management and evacuation is provided by access that: - Separates premises from adjoining vegetation. - Is safely accessible by fire fighting vehicles.	AO4: Access for fire management and evacuation is provided by vehicular access in the form of a perimeter road: - With a minimum reserve width of 20 m. - Located between the premises and adjoining vegetation. - With a maximum gradient of 12.5%.

Performance Outcomes	Acceptable Outcomes
- Has regular vehicular access points for bushfire management, response and evacuation. - Has regular vehicle passing and turning areas for bushfire management, response and evacuation. - Allows access at all times for fire fighting vehicles. - Allows for maintenance, burning off and bushfire response. - Has vehicular links to an alternative through road. - Is readily maintained.	- Constructed to otherwise comply with section 3.4 of Planning scheme policy 5 – Infrastructure. - That has a layout that does not include a cul-de-sac.
PO5: Development has access to adequate water supply for firefighting purposes.	AO5: Development: - is connected to a reticulated water supply scheme that has sufficient flow and pressure characteristics for fire fighting purposes at all times with a minimum flow and pressure of 10 L/s at 200 kPa. Or - Has an on-site water storage in accordance with the LPS, Table 8.2.3.3.2 - Water storage for firefighting, dedicated or retained for firefighting purposes that is made of fire resistant materials and is: - A separate tank. Or - A reserve section in the bottom part of the main water supply tank.
PO6: Community infrastructure is not located in a bushfire hazard area or is able to function effectively during and immediately after a bushfire event.	AO6: Community infrastructure is: - Not located in a Bushfire hazard area identified on Bushfire hazard overlay map OM-03.00. Or - Located to ensure that: - The core services provided by the community infrastructure is able to function effectively during bushfire events. - Access to the community infrastructure is not compromised by bushfire events. - The safe storage of valuable records, public records and items of cultural or historic significance is able to be maintained during a bushfire event.
PO7: Public safety and the environment are not adversely affected by the adverse impacts of	AO7: Hazardous materials:

Performance Outcomes	Acceptable Outcomes
bushfire on hazardous materials including fuels, explosives and flammable chemicals manufactured or stored in bulk on premises.	- Storage is in compliance with AS 1940 - The storage and handling of flammable and combustible liquids; - Manufacturing does not occur in a Bushfire hazard area on Bushfire hazard overlay map OM-03.00.

3.2 Bushfire Hazard and Risk

Forest Fire Danger Index (FFDI) of 40 is specified in AS 3959 for all of Queensland for building design and approval purposes.

3.2.1 Vegetation

Determining the vegetation classification is important for several reasons, primarily because it indicates the level of fire intensity and fire behaviour associated with specific types of vegetation.



Figure 3-2: Vegetation Classification

It provides an indication of the fuel loads that may exist in certain locations. According to AS 3959, Construction of Buildings in Bushfire Prone Areas requires any classified vegetation within 100 m of the proposed works to be assessed.

The proposed new development area will be fenced, clear of all vegetation and have blue stone road base compacted covering, thus the bushfire hazard relates to the area outside the fence.

The 100 m area of assessment is pursuant to the provisions of AS 3959 and relates to that area which may experience effects of ember attack and radiant heat exposure, is based upon research with regard to property loss within 100 m of classifiable vegetation.

The classification of vegetation, within 100 m of the site (indicated with the red circle in Figure 3-2), mainly comprises of grassy eucalypt bushland with trees under 30 m in height and approximately 30% foliage cover, with only a small number of shrubs. In accordance with Table 2.3 of AS 3959, the vegetation is classified as Group B **Woodland** 05.

3.2.2 Effective Slope

The effective slope relates to the topography of the ground beneath the vegetation and subject building, which can influence the fire spread. The speed of bushfire propagation will typically double for every 10° in incline.

The effective slope across the proposed development site was assessed using the topographic contour information provided by EQL. The slope directions and gradients are shown in Figure 3-3, which illustrates the elevation changes represented by the different contour lines.

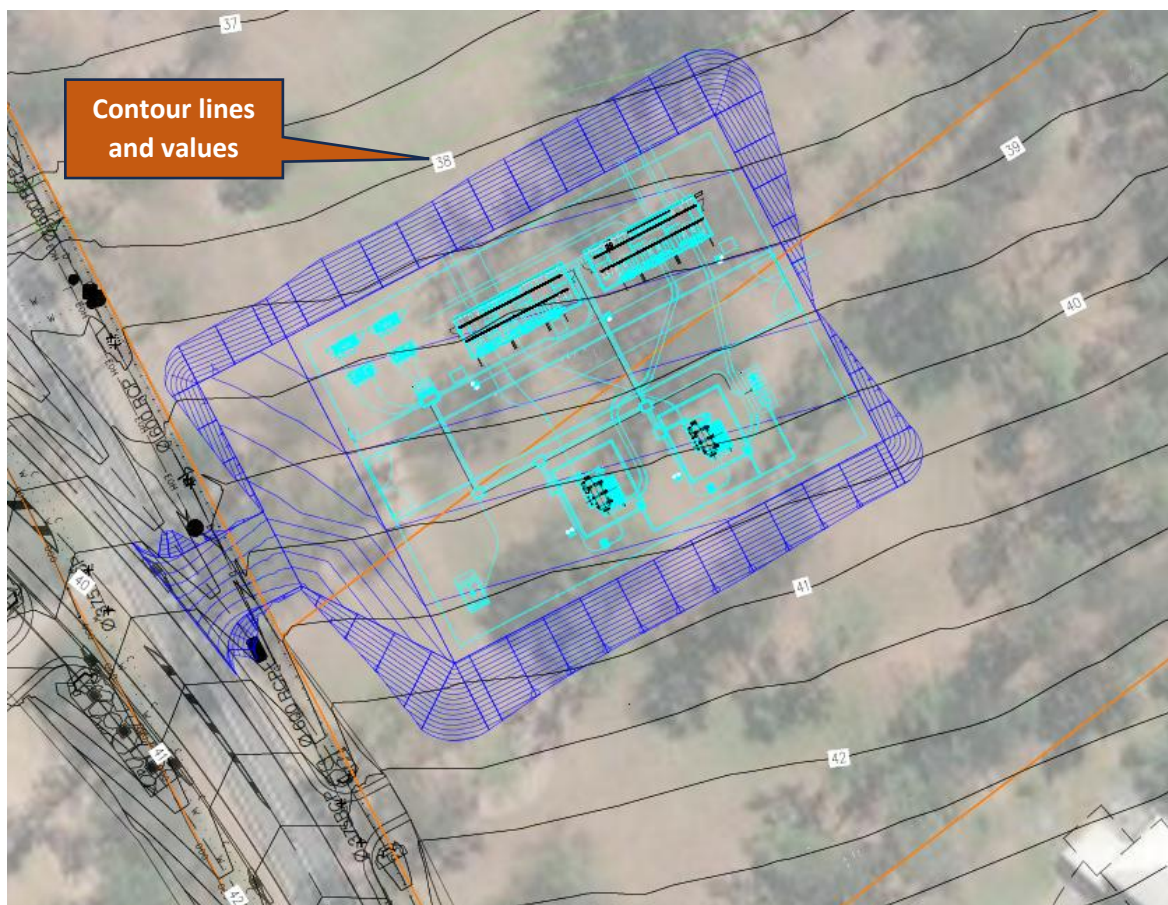


Figure 3-3: JBW West Substation Civil Model Sketch – Contour Lines

The northern boundary of Lot 1 on SP239500 is located at approximately the 38.0 m contour, while the southern boundary of Lot 2 is located at approximately the 40.5 m contour, resulting in an elevation difference of 2.5 m over a distance of approximately 138 m in the north to south direction. This corresponds to an elevation change of approximately 1%. However, the contour lines are straight and exhibit no change in elevation in the west to east direction. Therefore, the effective slope in this direction is considered to be approximately 0°. Dense vegetation is located to the northeast of the proposed development. Assessment of the topographic contours between the

hazardous vegetation and the proposed development indicates no variation in elevation along the direction of potential bushfire impact.

Therefore, based on the above contours, an effective slope of 0° applies to the site.

3.2.3 Bushfire Attack Level

EQL has nominated to construct the new modular buildings in accordance with the AS 3959 requirements of BAL-19.

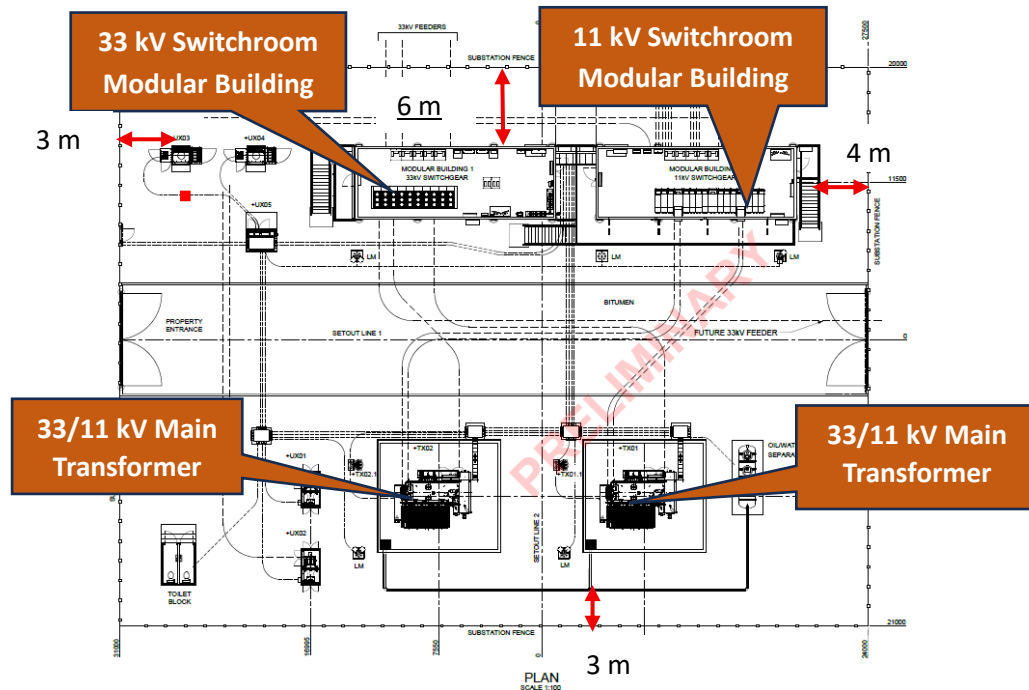


Figure 3-4: Layout of the Major Equipment and Distances Between the Equipment and the Fence



Figure 3-5: Minimum Setback from Lot Boundaries (Green Markup) and Vegetation Clearances (Red Markup) around the Development

As the transformers and open yard electrical equipment are not classified as buildings under the NCC, these elements are not subject to direct BAL construction provisions. Instead, a risk-based fire assessment has been undertaken for the transformers and open yard electrical equipment to address bushfire exposure and ignition risk, including consideration of separation distances, non-combustible surfaces, ember protection measures, and relevant electrical and fire safety standards.

The layout of the proposed development and associated measurements are shown in Figure 3-4, which illustrates general arrangement of equipment and the distances between the equipment and propose fenceline.

Based on FFDI 40 and Table 2.7 of AS 3959, a minimum separation distance of 13 m is required between the site equipment and the woodland vegetation to achieve a BAL rating of 19 for all upslopes and flat land.

The proposed layout shows that the northeastern fence is located 4 m from the modular building, as shown in Figure 3-4. Therefore, an additional vegetation clearance of 9 m beyond the fence is required to achieve the separation distance necessary for a BAL-19 classification. Similarly, the required vegetation clearances have been determined for all sides of the development and are summarised below:

- Northeastern: 9 m.
- Southeastern: 10 m.
- Glynton Road: 10 m.
- Teviot Road: 7 m.

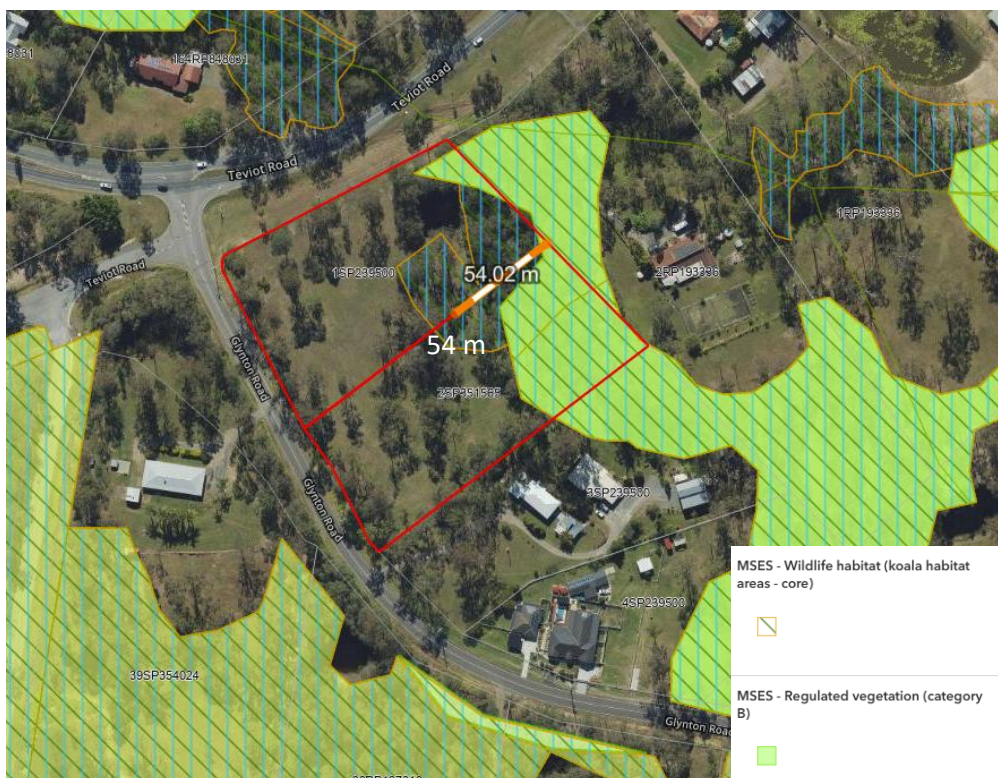


Figure 3-6: Regulated Vegetation B and Koala Habitat Areas

The entire site is designated as a biodiversity corridor, with areas of regulated category B vegetation (remnant native vegetation) and mapped Koala habitat, as shown in Figure 3-6. The existing dense vegetation along the north-eastern boundary will be retained approximately 54 m from the boundary line, as shown in Figure 3-6. The proposed layout has been designed to minimise vegetation clearing and retain most of the existing dense vegetation along the north-eastern boundary while limiting clearing along the remaining boundaries. This approach provides a balance between the operational requirements of the substation and the protection of vegetation connectivity and ecological values within the broader landscape.

The access to the development site will be provided via Glynton Road. The access road will be an all-weather road for emergency vehicle access and firefighting activities. Therefore, a 10 m vegetation clearance is required on this side excluding this area, where the vegetation clearance will be up to Glynton Road as part of the access road requirements.

The BAL and corresponding radiant heat exposure, in accordance with AS 3959, are shown below.

Table 3-2: AS 3959 BAL and Radiant Heat Exposure

Bushfire Attack Level (BAL)	Radiant Heat Exposure (AS 3959)	Description of Predicted Bushfire Risk
BAL-Low	Insignificant	The risk is very low, radiant heat on the building is insignificant to warrant specific construction requirements. However, ember attack may still occur.
BAL-12.5	0 to 12.5 kW/m ²	Primarily risk of ember attack. Risk of radiant heat is considered low.
BAL-19	12.5 to 19 kW/m ²	Risk is considered moderate with increasing levels of ember attack and burning debris ignited by wind borne embers. Increasing likelihood of exposure to radiant heat.
BAL-29	19 to 29 kW/m ²	Risk is considered to be high. Increasing levels of ember attack and burning debris ignited by wind borne embers. Increasing likelihood of exposure to radiant heat.
BAL-40	29 to 40 kW/m ²	Risk is considered to be very high. Increasing levels of ember attack and burning debris ignited by wind borne embers. Increasing likelihood of exposure to radiant heat and some direct exposure to flames possible.
BAL-FZ	40 kW/m ² plus (flame contact)	Risk is considered to be extreme. Direct exposure to flame from the fire front is likely in addition to high levels of radiant heat exposure and ember attack.

3.3 Bushfire Hazard Mitigation

Effective mitigation and management of bushfire hazards and risks necessitate the integration of a variety of measures throughout the design, construction, and operational phases of any development. These measures encompass:

1. Access: The design phase must ensure that the layout of roads and driveways, and the positioning, size, and orientation of infrastructure is strategically aligned to address bushfire risks.

2. Firefighting: The provision of firefighting infrastructure including access to water supplies, fire breaks and trails must be provided to facilitate effective firefighting and bushfire management.
3. Construction: The design, construction specifications, and material selection of any infrastructure of concern must conform to AS 3959, where relevant, and be such that it does not result in higher than acceptable consequences or propagate the fire.
4. Vegetation Management: The vegetation should be managed to achieve an acceptable level of risk, but still balanced with the conservation and ecological values of the natural environment.
5. Property Maintenance: Landscape design and property maintenance must be considered to assist with the mitigation of bushfire risks.
6. Community: Promoting community awareness, education, and training to enhance bushfire preparedness and response, and an understanding of the BESS and transformer installation.
7. Signage: Clearly identifying the parties responsible for specific bushfire management tasks and actions, and emergency response for the site, to ensure accountability, effective implementation and emergency response.

These integrated measures are essential for enhancing the resilience of developments to bushfire hazards and ensuring the safety and sustainability of the built environment in bushfire-prone areas.

3.3.1 Access and Egress

Access and egress provisions must be included in the design to ensure that any workers or visitors to the site, and any nearby residents can evacuate safely and to allow for firefighters to perform firefighting tasks, fire control tasks and to facilitate hazard reduction and back burning where needed.

Access to the site is provided via Glynton Road, which is capable of accommodating a service vehicle of up to 25 m in length. An all-weather road will be provided for emergency vehicle access and firefighting activities.

The proposed development does not impact the ability for adjacent residents to access their property or egress during a bushfire.

3.3.2 Firefighting

The proposed development does not include any site-specific fire water supplies. However, LCC designated water filling and hydrant fill point is located (Hydrant Fill Point 14) at Teviot Road near the Glynton Road, which is approximately 65 m of the main entrance of the proposed development.

QFES would initially undertake firefighting operations using the onboard water supplies of their fire tenders. Once these supplies are exhausted, firefighting operations would be supported by the LCC designated water filling location, Hydrant Fill Point 14, which is located near the development.

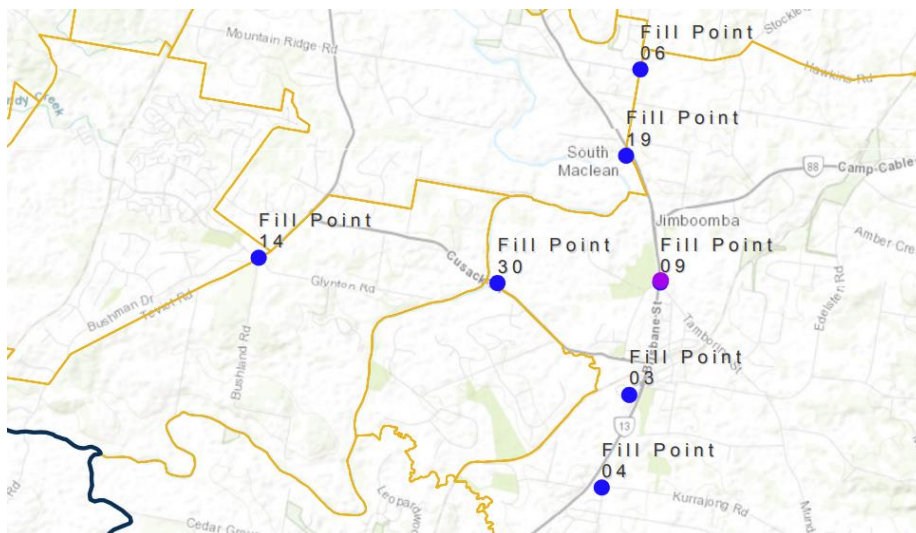


Figure 3-7: LCC Water Filling and Hydrant Fill Points

There are water filling and hydrant fill points located at:

- Teviot Road near Glynton Road, which is within the site (indicated as Fill Point 14 in Figure 3-7).
- Cusack Lane (approx. 600 m from St Jude Circuit before the bridge, entrance approx. 190 m before the bridge), which is approximately 4.1 km east (indicated as Fill Point 30 in Figure 3-7).

3.3.3 Construction

The proposed new installation, comprising of modular buildings, transformers, and associated yard infrastructure, is also constructed of non-combustible walls (metal) with some plastics and cable insulation present.

The project equipment is expected to be exposed to a heat flux no greater than 19 kW/m² as a worst-case bushfire scenario.

3.3.4 Vegetation Management

The potential severity of bushfires in an area can be significantly reduced by managing vegetation to lower or eliminate potential fuel loads. Failure to appropriately manage vegetation fuel loads in reserves can lead to high-intensity bushfires, which have detrimental ecological impacts on the reserve and pose unnecessary hazards to adjacent urban areas and infrastructure.

The project is expected to clear the vegetation to maintain the separation distances in accordance with AS 3959 as stated in Section 3.2.3.

3.3.5 Property Maintenance

Vegetation management extends to the appropriate and effective onsite vegetation and landscape management, which are crucial for maintaining low hazard conditions. Property maintenance includes activities such as:

- Reducing combustibles and the build-up of fuel loads.

- Reducing the fire propagation path, by ensuring combustibles do not accumulate between fuel loads, thus providing a means to spread.
- Establishing and maintaining defensible space.
- Implementing appropriate landscaping.
- Ensuring that the proposed lot size of the development constrains the development of any additional bushfire hazard.

3.3.6 Community

The warning systems now implemented by QFES and local authorities provides timely information and advice to residents living in bushfire prone areas. It is critical that residents understand what to do in the event of bushfire and what to do immediately after the fire front has passed. The QFES 'Bushfire Survival Plan' provides detailed information on how to prepare for the bushfire season and how to take action to survive in the event of bushfire.

(<https://www.qfes.qld.gov.au/prepare/bushfires>).

In the lead up to the fire season, Energex and Ergon Energy Networks conduct a program of public awareness campaigns outlining bushfire mitigation measures. This is enhanced through online media, traditional media and other forms of mass media.

EQL has a Bushfire Risk Management Plan 2022-24 currently in place that covers all EQL assets.

3.3.7 Signage

Clear signage should be located on the main entry to the proposed installation with the following minimum information:

- Site Plan, indicating all entry points, hazardous materials, transformers, modular buildings, HV electrical installations and distribution boards, isolation and de-energising points, any fire equipment, fire water supplies and nearest hydrant (if applicable), and evacuation / muster points.
- Site Personal Protective Equipment (PPE) requirements.
- Site location identification.
- A sign detailing the emergency response plan, including emergency phone numbers for the community to call, and for emergency responders to gain access and have the site / equipment isolated and de-energised, and the minimum safe distance.

3.4 Mitigation Methods

The following is a list of bushfire mitigation methods that are recommended for the development to further lower the risks associated with bushfire:

- Clear signage as stated in Section 3.3.7.
- Maintain the site fire breaks around the site installation as per Section 3.2.3, stored combustibles, buildings (not associated with the electrical distribution), and public ways. Ensure a minimum of 13 m between the equipment and woodland bush is maintained.
- Access roads that are intended for emergency response vehicles should be at least 4 m wide and arranged such that emergency responders can perform firefighting and

exposure protection activities under any wind condition and reach all areas of the site installation, other equipment and fire break.

- All roads intended for use by emergency responders should be capable of accommodating vehicles weighing 15 tonnes.
- Clear vegetation and keep well maintained access to the main gate, for emergency responders.

A construction phase fire risk assessment should be completed to ensure the fire risks, including any associated with bushfires, are identified and mitigated accordingly.

4. Fire Engineering Assessment

4.1 Fire Engineering Methodologies

4.1.1 General Philosophy

The fire risk management process, where applicable, follows AS ISO 31000 Risk Management Guidelines.

The fire risk management process consists of the following five stages, refer to Figure 4-1:

- Establish the context: This stage involves developing the fire risk evaluation criteria and fire safety objectives, identifying the relevant stakeholders and developing a fire risk plan for the project.
- Fire hazard identification: This stage includes obtaining data on similar facilities, identifying hazardous materials and operations on-site and forming meaningful fire scenarios.
- Fire hazard analysis: This stage involves determining the likelihood and consequence of the identified fire scenarios.
- Fire hazard evaluation: A fire risk rating can then be developed to prioritise the risks.
- Fire risk treatment: Fire risk treatment options are identified and evaluated / tested against specific criteria to determine the best method to satisfy the fire safety objectives of the project.

The fire risks and mitigation methods are monitored and reviewed throughout all stages to ensure they represent any design changes and are implemented correctly. This is achieved by ensuring that Design Reviews, Project risk assessments such as hazards studies and any Management of Change process includes 'Fire' as a focal point.

Communication between the relevant internal and external stakeholders throughout the fire risk management process is essential to ensure all parties are kept informed and their requirements are met.

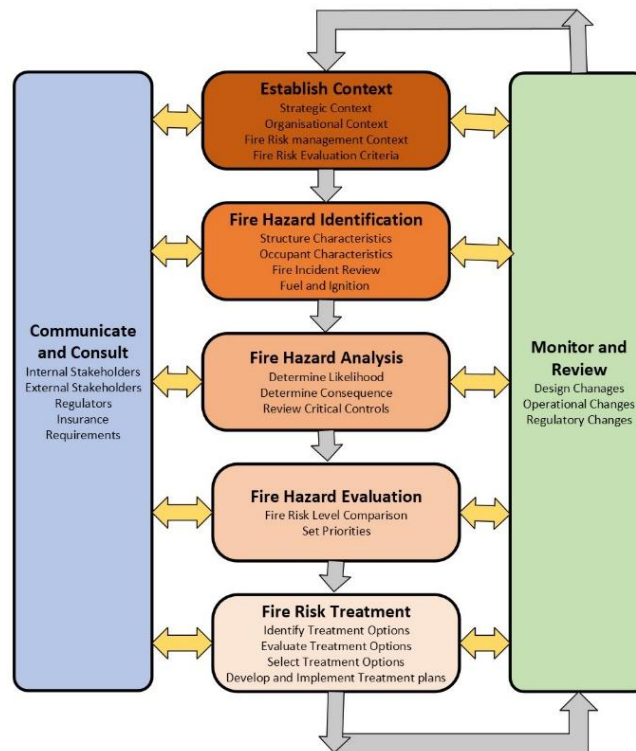


Figure 4-1: Fire Risk Management Process

4.1.2 Fire Hazard Assessment

The principle of a Fire Hazard Assessment (FHA) is that the fire mitigation solutions should be based on the specific analysis of hazards, consequences and likelihood and that the elements of the proposed or existing solutions should be tested against that analysis. This will produce a better outcome than the application of generalised codes and standards alone.

The treatment of fire risks shall utilise a hierarchy of control, which requires designers to eliminate the risk where possible, or if not, control by a suitable measure (either physical or procedural), refer to Figure 4-2.

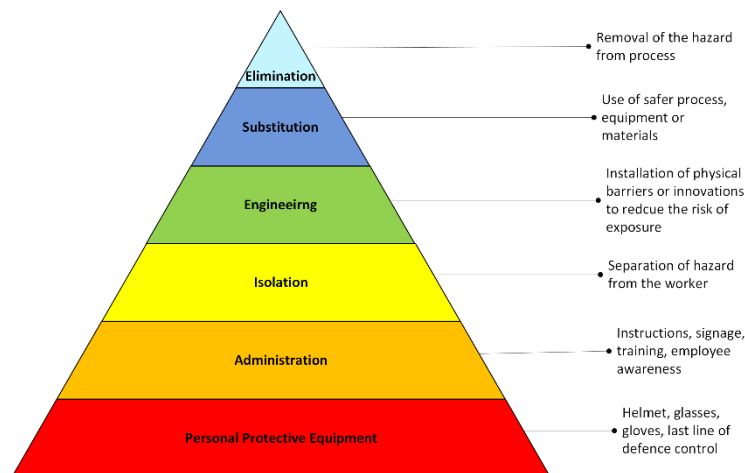


Figure 4-2: Hierarchy of Control

Active fire protection systems such as suppression systems, hydrants and fire extinguishers should be considered the 'last line of defence', and as such shall not be relied upon as the only means to reduce the fire risk.

Defining the hazard potential of a plant and operations involves the process of hazard identification and estimation of the potential consequences and likelihood of credible incidents. The FHA report may require updating throughout the Project as the design progresses to stay current.

In addition to the hazard potential a number of other factors must be taken into account in the selection of mitigation solutions. These include:

- Safety consideration, such as, the introduction of hazards as a result of adding safety systems.
- The impact of incidents on the surrounding land uses, and the sensitivity of these land uses.
- Infrastructure available such as water mains supply, emergency planning, fire brigade response times and access.
- External factors such as other hazardous plant or units in the vicinity, bushfires, weather, etc.
- Requirements of statutory bodies.

The importance of prevention in fire protection cannot be emphasized enough. The hazard potential and the risk of death or injury, property loss, or damage to the biophysical environment are as dependent on the design, layout and the management of a facility as on the nature of the activities involved and the nature and quantity of hazardous materials.

The FHA is concerned with all the effects of fire. It therefore addresses the following:

- Direct effects of flame.
- Radiant heat and explosion.
- Potential for the release of toxic materials and toxic combustion products in the event of a fire.
- Potential for the release of contaminated firefighting water.

4.1.3 Risk Assessments

This FHA shall be finalised with a formal review process, which shall include all relevant stakeholders with expertise in this type of facility and risks.

As the project design progresses it may be necessary to update the FHA and this report to ensure the most current fire risks are captured and mitigated and all of the relevant stakeholders are informed.

4.2 Fire Hazard Identification and Analysis

The primary sources of fire risk and potentially harmful hazards are:

- Transformer oil.
- LV electrical and communication cables.

- HV electrical equipment.
- Bushfires.

4.2.1 Hazardous Materials

The following is a comprehensive list of the hazardous materials that will be present on site:

Table 4-1: Hazardous Materials

Chemical	Class	UN No.	HAZCHEM Code	Inventory	Storage
Transformer oil - Mineral oil	-	-	-	24, 000 L	2x 33/11 kV transformer
Transformer oil -Envirotemp FR3 insulating liquid	-	-	-	1,010	2 x 315 kVA 11/0.433 KV padmount station service transformer

The storage and handling of all chemicals, fuels and oils will comply with the relevant Australian Standards.

4.2.2 Risk Matrix

The following risk matrix is used on the Project and provides context to the Projects risk appetite.

Table 4-2: Consequence Rating Matrix

Score	Rating	Health and Safety	Environment	Financial
1	Low	Minor first aid or no injury.	Minor harm to the environment (eg. noise complaint).	<100k loss
2	Minor	Disabling injury (less than 5 days off work).	Temporary harm to the environment (eg. small area of contamination).	\$100k - \$1M loss
3	Moderate	Serious injury (amputation, permanent disability).	Harm to the outside environment.	\$1M - \$10M loss
4	Major	One fatality.	Extensive damage to the environment (eg. large area of contamination).	\$10M - \$100M loss
5	Catastrophic	More than one fatality.	Massive, irreversible damage to the environment.	>\$100M loss

Table 4-3: Likelihood Rating Matrix

Score	Rating	Likelihood
A	Almost Certain	Is expected to occur in most circumstances. Occurs more often than once in two years or is almost constant.
B	Likely	Will probably occur in most circumstances. Not unusual. Occurs once in every 2 to 5 years.
C	Possible	Might occur at some time. Possible sequence of coincidence is unusual. Occurs once in 10 years.

D	Unlikely	Could occur at some time but would require remotely possible coincidences. Occurs once in 50 years.
E	Rare	May occur in exceptional circumstances. Occurs once in 100 years or more.

Table 4-4: Risk Matrix

Likelihood	Consequence				
	1. Low	2. Minor	3. Moderate	4. Major	5. Catastrophic
A. Almost Certain	Low	Medium	High	Extreme	Extreme
B. Likely	Low	Medium	High	Extreme	Extreme
C. Possible	Low	Low	Medium	High	Extreme
D. Unlikely	Low	Low	Medium	High	High
E. Rare	Low	Low	Low	Medium	High

In assessing the tolerability of risk from potentially hazardous development the following relevant general principles should be considered:

- 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.
- Where the risk from an existing installation is already high, further development should not pose any incremental risk.

4.3 Transformers

4.3.1 General

The proposed installation includes the following transformers:

- Two (2) ONAN/ODAN/ODAF 25 MVA 33/11 kV transformers.
- Two (2) Pad mounted 315 kVA 11/0.433 kV transformers.

4.3.2 Hazard Location

Refer to Figure 1-2 for the location of transformer.

4.3.3 Potential Fire Scenario

Failures leading to a fire in electro-technical equipment containing insulating liquids, such as transformer, is rare, however it is evident that any equipment transmitting a high level of electrical energy and containing a significant quantity of combustible liquid has both the ignition source and the fuel to present a fire risk. The transformer contains mineral oil, which has a flash point in the range of 160 °C to 180 °C. The transformer is banded as per AS 1940, which reduces the chances of fire spread to the nearby equipment.

The main worst case fire scenarios that exist with the transformers are:

- Overloading of the transformer plus the failure of the shutdown and control systems may result in high energy internal faults within the transformer. This can lead to the transformer expending tremendous power, rupturing the transformer casing, releasing oil and missiles and subsequently igniting, causing a pool fire.
- External fire sources, such as bushfire and adjacent equipment

4.3.4 Analysis of Consequence

The proposed development includes two (2) ONAN/ODAN/ODAF 25 MVA 33/11 kV Wilsons transformers, each containing 12,000 L of mineral oil.

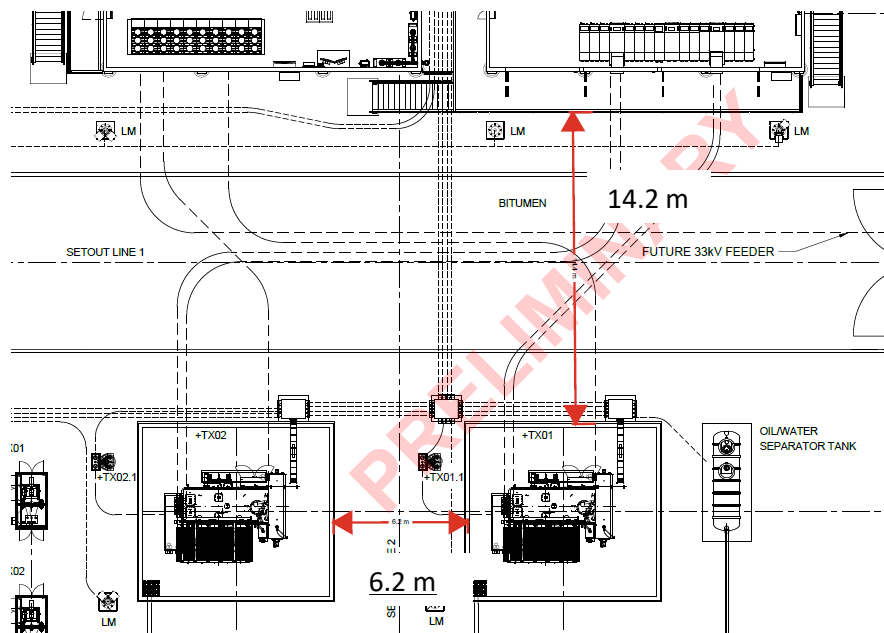


Figure 4-3: The Separation Distances between Equipment

The separation distance between the two main transformers is 6.2 m, while the minimum separation distance between the transformers and the modular buildings is 14.2 m, refer to Figure 4-3, which satisfies the separation requirements of Table 6.1 of AS 2067 based on volume of mineral oil and type of insulating oil.

The main transformers are installed in separate bunds measuring 8.8 m x 7.8 m and 0.3 m deep, which has a capacity of 20 kL. Therefore, the bund has a net capacity of more than 110% of the total liquid volume, which satisfies the bund requirements of AS 1940.

A credible transformer fire scenario is expected to result in the complete loss of the main transformer, with minor damage to surrounding cabling and possibly adjacent equipment. Fire propagation to the modular buildings is not considered credible as the minimum distance between the main transformer and the modular buildings is 14.2 m. The separation distance between the two main transformers is 6.2 m, exceeding the minimum clearance requirement of 3 m specified in Table 6.1 of AS 2067. Therefore, adequate separation is provided to reduce the likelihood of fire spread between the main transformers in the event of a fire involving one transformer. Other electrical equipment located adjacent to the main transformers includes structure mounted Neutral Earthing Transformers (NEXs) (TX01.0 and TX02.1), AFLC coupling cells (+UX01 and +UX02), and an oil/water separator tank. In the event of a main transformer fire, this adjacent equipment may be exposed to

elevated thermal radiation and may be damaged depending on the severity and duration of the fire event.

The estimated cost associated with this event would be \$4M for the replacement of the 25 MVA transformer. This evaluates to a Moderate consequence with a financial loss in between \$1M - \$10M.

The substation is unmanned during normal operations, and considering compliance with AS 2067 and AS 1940, an injury resulting from a transformer fire is not considered a credible scenario. The event can be considered Low in the context of health and safety, with any potential consequence limited to minor first aid treatment or no injury to operational or maintenance personnel present during the event.

Contaminated firefighting water and minor chemical spills may result in minor harm to a small area, but not result in an offsite incident, thus evaluates to a Low consequence in environmental context.

4.3.5 Analysis of Likelihood

IEEE Standard 493 lists the typical failure rate of oil filled transformers at 0.0041 failures per year, or one failure every 243.9 years. This number is intended to give a probability of failure of any given transformer in a year. It can be used to predict the number of expected transformer failures over the entire site for a given time period. Not every failure will result in a loss of containment of oil, a fire or a rupturing of the transformer casing. The likelihood of a transformer fire causing the complete destruction of the transformer is therefore conservatively, considered Rare (once in 100 years or more).

4.3.6 Risk Ranking

The residual risk ratings for this event are calculated using the risk matrix as follows:

Financial: Moderate (3) consequence x Rare (E) likelihood = Low.

Health and Safety: Moderate (3) consequence x Rare (E) likelihood = Low.

Environment: Low (1) consequence x Rare (E) likelihood = Low.

4.4 Modular Buildings

4.4.1 General

The modular buildings are constructed of insulated steel cladding and measure 14.4 m in length, 5.0 m in width, and 3.44 m in height. The buildings are classified as a Class 8 buildings in accordance with the NCC.

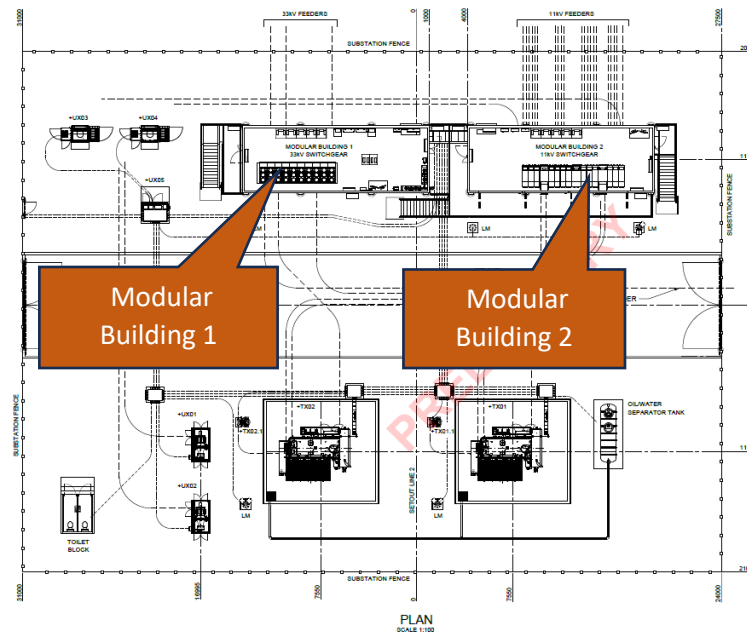


Figure 4-4: General Arrangement Layout Plan for the Modular Buildings

Modular Building 1 contains:

- 33 kV switchgear.
- Transformer protection panels.
- Bus zone protection panels.
- Building services SCADA and local control panels.
- DC Batteries and 110 V DC battery charger and distribution equipment.
- LV distribution board.
- Fire panel.
- Networking and communications panels.

Modular Building 2 contains:

- 11 kV feeder switchgear.
- Transformer switchgear and voltage selection panels.
- Bus section/riser switchgear.
- 110 V DC distribution sub-boards.
- LV distribution board.
- High voltage panels.
- Building services SCADA panels.
- Fire panel.

- Networking and communications panels.
- AFLC transmitter panel.

The NCC requires the following minimum fire protection requirements for class 8 buildings:

- Exit signs in accordance with Clause E4D5.
- Portable extinguishers in accordance with Clause E1D14.

4.4.2 Hazard Location

Refer to Figure 1-2 for the location of modular building.

4.4.3 Potential Fire Scenario

The typical fire scenarios associated with these buildings are:

- Electrical arcing or arc flash within switchboards or busbars may ignite cable insulation and internal combustible components.
- Overheating of electrical equipment due to overloaded circuits, loose terminations or insulation failure may result in ignition of electrical components.
- Cable fires caused by short circuits or insulation breakdown may spread along cable trays and generate significant smoke.
- Dust or moisture ingress into electrical equipment may increase the likelihood of short circuits, tracking and arcing faults.

4.4.4 Analysis of Consequence

The modular buildings are critical to the operations of the relevant equipment, and as such the loss of one of the buildings would result in the loss of the protection, control and metering equipment and critical communications equipment and thus the ability to operate the relevant transformer and switching equipment. The buildings are non-combustible, metal clad structures and are designed to comply with AS 3959 BAL-19 requirements.

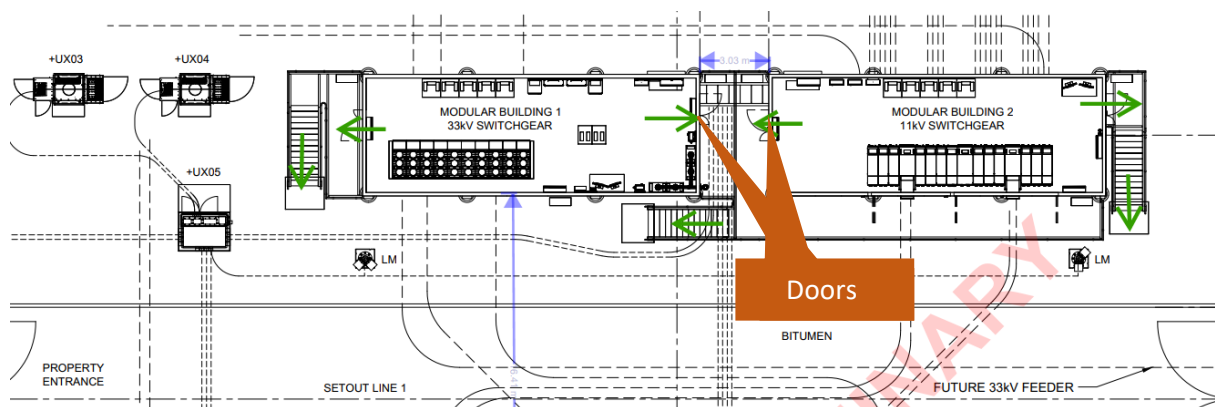


Figure 4-5: Egress Options from the Modular Buildings, Green Arrow Indicates Exit Routes

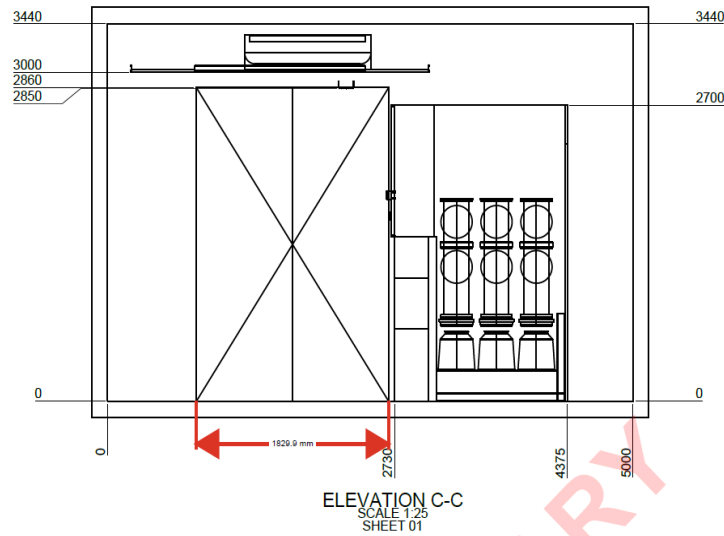


Figure 4-6: Door in Modular Buildings

However, there is a door opening facing the door and external wall of adjacent modular building as shown in Figure 4-5, therefore, a fire within a modular building could spread to the nearby modular building. To estimate the radiation heat exposure to the nearby modular building through the opening, thermal radiation is calculated considering the door as a radiating panel. The size of the door is 1.8 m wide and 2.85 m high, refer to Figure 4-6.

The radiant heat flux emitted from the door opening to the nearby modular building will be determined via the following radiation formula detailed in the International Fire Engineering Guidelines (Section 2.4.2.3).

$$qr = \Phi Es S Tf^4$$

where: qr is the radiant heat flux received (kWm^{-2})

Es is the emissivity of the emitter = 0.9

S is the Stefan Boltzman Constant = $56.7 \times 10^{-12} (\text{kWm}^{-2} \text{K}^{-4})$

Tf is the flame temperature of the emitting surface (K)

Φ is the configuration factor for parallel radiation panel defined (SFPE handbook) as:

$$\phi = \frac{1}{2\pi} \left[\frac{X}{\sqrt{1+X^2}} \tan^{-1} \left[\frac{Y}{\sqrt{1+X^2}} \right] + \frac{Y}{\sqrt{1+Y^2}} \tan^{-1} \left[\frac{X}{\sqrt{1+Y^2}} \right] \right]$$

$$X = \frac{a}{b} \quad Y = \frac{c}{b}$$

Figure 4-7: Parallel Panel and Configuration Factor

Figure 4-7 illustrates the parallel heat transfer from the emitter (the door opening) to the receiver (the adjacent modular building), together with the governing equation for the configuration factor. For a cellulosic fire involving typical building contents (e.g. timber, paper and furniture), the flame temperature generally ranges from 800°C to 1,000°C (Drysdale). Accordingly, a flame temperature ((T_f)) of 900°C has been adopted for the modular building fire scenario, which represents a conservative assumption for the radiation heat flux calculation.

For the risk ranking criteria, the thermal radiation outlined in Hazardous Industry Planning Advisory Papers (HIPAP No.4) is used for this analysis. The effects of thermal radiation in accordance with the HIPAP 4 for risk analysis criteria are shown in Table 4-5.

Table 4-5: Thermal Radiation and Consequences

Thermal radiation (kWm ⁻²)	Effects of thermal radiation
12.6	Thin steel with insulation on the side away from the fire may reach a thermal stress level high enough to cause structural failure
23	Unprotected steel will reach thermal stress temperatures which can cause failure
35	Cellulosic material will pilot ignite within one minute's exposure

Parallel Radiation Calculation				Abbreviation: Fire Source Feature (FSF)			
Heat Flux: $q_r = \sigma \epsilon_{1-2} T_f^4$				From subject opening to adjacent building			
Configuration factor: $\phi = \frac{1}{2\pi} \left\{ \frac{X}{\sqrt{1+X^2}} \tan^{-1} \left[\frac{Y}{\sqrt{1+X^2}} \right] + \frac{Y}{\sqrt{1+Y^2}} \tan^{-1} \left[\frac{X}{\sqrt{1+Y^2}} \right] \right\}$				3.00 m At FSF			
$X = \frac{a}{c}$ $Y = \frac{b}{c}$				a	b	c	ϕ_{1-2} q
				Panel A	0.91	1.425	3.00 0.0380 3.700
				Panel B	0.91	1.425	3.00 0.0380 3.700
				Panel C	0.91	1.425	3.00 0.0380 3.700
				Panel D	0.91	1.425	3.00 0.0380 3.700
				Total			0.152 14.80000
				4.00 m 1m from FSF			
				a	b	c	ϕ_{1-2} q
				Panel A	0.91	1.425	4.00 0.0231 2.2
				Panel B	0.91	1.425	4.00 0.0231 2.2
				Panel C	0.91	1.425	4.00 0.0231 2.2
				Panel D	0.91	1.425	4.00 0.0231 2.2
				Total			0.092 8.800
				6.00 m 3m from FSF			
				a	b	c	ϕ_{1-2} q
				Panel A	0.91	1.425	6.00 0.0109 1.1
				Panel B	0.91	1.425	6.00 0.0109 1.1
				Panel C	0.91	1.425	6.00 0.0109 1.1
				Panel D	0.91	1.425	6.00 0.0109 1.1
				Total			0.044 4.400
				9.00 m 6m from FSF			
				a	b	c	ϕ_{1-2} q
				Panel A	0.91	1.425	9.00 0.0050 0.5
				Panel B	0.91	1.425	9.00 0.0050 0.5
				Panel C	0.91	1.425	9.00 0.0050 0.5
				Panel D	0.91	1.425	9.00 0.0050 0.5
				Total			0.020 2.000
Panel width - a			1.82 m				
Panel height - b			2.85 m				
Offset - y			0.00 m				
Offset - z			0.00 m				
Distance to FSF - c			3.00 m				
Emissivity of the Surface - E			0.9				
Emitting Temperature of Radiator - T			900 °C				
Stefan Boltzman Constant - S			5.67E-08 W/m²K				
Calculations							
From subject building to boundary							
Emitting Locations	ϕ_{1-2}	q_r (radiation Heat Flux					
3.00 m At FSF	0.1519	14.8					
4.00 m 1m from FSF	0.0923	8.8					
6.00 m 3m from FSF	0.0436	4.4					
9.00 m 6m from FSF	0.0199	2.0					

Figure 4-8: Thermal Radiation from the Door Opening

The thermal radiation assessment predicts a maximum incident heat flux of 14.8 kW/m² at the adjacent modular building. This exposure falls within the 12.6 kW/m² to 23 kW/m² consequence range identified in HIPAP, within which thin steel sections may experience sufficient thermal stress to result in structural failure. The proposed non-combustible and BAL-19 construction reduces the likelihood of ignition and subsequent fire spread to the adjacent building.

The worst-case scenario involving a fully developed fire within a modular building, will result in the complete loss of the building and the electrical equipment within, together with damage to associated electrical cable, however, it is not expected to propagate to the adjacent modular building or other electrical infrastructure on site. The cost of clean-up, damage assessment, demolition, and reinstatement of all affected cables and equipment is estimated to be in the order of \$4M. Accordingly, the financial consequence is assessed as Moderate, corresponding to a loss of between \$1M - \$10M in accordance with the risk matrix.

A modular building fire is not considered likely to cause any significant environmental impact, as the building is constructed of metal cladding and fire development is expected to be largely contained within the building. Contaminated firefighting water and minor chemical spills may result in temporary harm to a small area, thus evaluates to a Low consequence.

The Egress options are shown in Figure 4-5, which shows two alternative egress options available in both buildings. The buildings are small and typically unmanned. If a fire started while the room was manned, operators could easily and quickly egress. Although a fatality is always possible with a fire event, it is not considered plausible that a significant health and safety risk could result from a room fire scenario. The event can be considered Medium in the context of health and safety, with the potential consequence limited to a disabling injury resulting in less than five days off work for operational or maintenance personnel present during the event.

4.4.5 Analysis of Likelihood

The likelihood of a fire in a standalone modular building is generally considered low, as electrical equipment is designed with protective devices, insulation standards and fault isolation systems to prevent escalation of electrical faults. In normal operating conditions, properly maintained switchgear, circuit breakers and control systems significantly reduce the probability of ignition, making major fire events relatively infrequent.

IEEE Standard 493 provides typical failure rate data for individual electrical components, including switchgear, circuit breakers, bus systems, cables, and relays. For reliability assessment purposes, a modular building is conservatively represented as a combined system of these components, where system failure is governed by the aggregate effect of individual equipment failures. Based on ranges derived from IEEE 493 data, the combined modular building failure rate is typically in the order of 0.02 to 0.10 failures per year. This corresponds to an indicative frequency of approximately one failure every 10 to 50 years. Not all failures will result in the identified fire consequences and as such, a conservative estimate for the likelihood of a fire within the building, is an event that could occur at some time but would require remotely possible coincidences, occurs once in 50 years, which is “Unlikely”, in accordance to the risk matrix.

4.4.6 Risk Ranking

The residual risk ratings for this event are calculated using the risk matrix as follows:

Financial: Moderate (3) consequence x Unlikely (D) likelihood = Medium.

Health and Safety: Moderate (3) consequence x Rare (E) likelihood = Low

Environment: Low (1) consequence x Rare (E) likelihood = Low.

5. Fire Prevention and Intervention Strategies / Measures

5.1 General

Every fire situation requires the combination of an initial heat source, fuel and an event that brings them together. The most effective element of fire hazard reduction is prevention, through appropriate design, layout of the facility and fire zones and safe operating procedures.

Incorporating the fire prevention measures into the plant design and plant procedures can minimise the likelihood or reduce the severity of a fire incident. The measures incorporated into this project include:

- Building design and compliance with local building regulations.
- Incorporation of passive fire prevention measures into the transformer, such as separation distances and bunding in accordance with AS 2067 and AS 1940.
- Providing administration controls such as hot work permits, lockout / tag out, etc.
- Elimination or minimisation of hazardous material in storage or the build-up of combustible waste materials onsite.
- Correct earthing of components.
- Maintaining the required separation distances to combustible materials including vegetation.
- Providing emergency access for QFES to perform firefighting and bushfire management activities safely and effectively.

5.2 Fire Zones

A fire zone is defined as a geographical area which is segregated by distance, passive fire barriers, spill containments, etc. to minimise the size of the largest single fire incident.

Separate fire zones are created in order to separate risks and limit the probability of fire escalation. Minimising the fire zone size also allows for a smaller worst case fire scenario and thus less fire water demand. Simultaneous independent hazardous events in two separate fire zones are not considered reasonable scenarios (single jeopardy concept).

A fire zone is considered as independent only if an incident occurring within the zone will not spread to or impact any adjacent zone.

The modular building is designed to comply with the minimum requirements of the NCC. The transformer is designed in accordance with AS 2067 for separation distances and AS 1940 for bunding requirements. A bushfire hazard assessment has been undertaken for the site.

5.3 Emergency Plan

Appropriate emergency plans and procedures are an important part of fire mitigation and intervention.

An operations emergency plan, including a Fire Management Plan (FMP) will be developed prior to commissioning of the plant and a construction emergency plan shall be developed prior to the commencing of construction. These will be developed in consultation with the QFES and the local council.

The following major fire scenarios will be considered:

- A fire involving an oil-filled transformer due to overloading, internal fault, or failure of the control/protection system may result in a pool fire within the substation yard, potentially impacting adjacent equipment.
- A fire within the modular building.
- A major fire incident at the site boundary, such as a bush / scrub fire.

The FMP must, as a minimum, shall include:

- 24-hour emergency contact details including alternative telephone contacts.
- Site infrastructure plan.
- Identification of the electrical risk, the isolation of energised equipment and confirmation that the yard can be and has been isolated prior to QFES entering site.
- Site access and internal road plan.
- Construction of Asset Protection Zones (APZ), which is the management of vegetation to reduce the bushfire risk, and their continued maintenance.
- Location of hazards (physical, chemical, electrical) that will impact on firefighting operations and procedures to manage identified hazards during firefighting operations.

The closest fire brigade is QFES Jimboomba Fire Station, located at 22 – 24 Johanna Street, Jimboomba, which is an auxiliary station (On Call), is approximately 6.8 km to the site and 7 min drive. The QFES Yarrabilba permanent Fire Station, located at 23 – 31 Adler Court, Yarrabilba, is approximately 16.4 km and 18 min drive.

It is difficult to estimate the response time for an incident as the detection relies on the EQL Operational Control Centre and not a fire detection system that is connected and monitored by the QFES. QFES will be notified of an incident once the EQL has been alerted and have verified the incident, or a local resident has noticed and called '000'.

Once QFES have been alerted of an incident the anticipated response time is:

- Call processing and turnout time: 2 minutes.
- Drive to site: 18 minutes, from Yarrabilba (permanent) fire station.
- Site access, mobile onsite and setup: 5 minutes.

EQL representatives will meet QFES onsite to unlock the entry gate and relay any necessary information, such as electrical equipment status.

The response time is mainly governed by the detection and alert time, however, is not expected to be greater than 40 minutes. A Fire Brigade Intervention Model (FBIM) assessment has not been undertaken, however, this can be done in the next project phase if deemed as required.

5.4 Traffic and Site Access

The site is accessed directly from Glynton Road. The site access driveways provide normal light vehicle traffic, heavy vehicles for major repairs or replacements, pedestrian traffic and emergency vehicle access.

Access to the site will be controlled through a locked gate and signage.

The entire fenced area, where equipment is installed, is blue stone (gravel), providing all weather access to the site and equipment.

5.5 Housekeeping and Prevention Measures

Good housekeeping and preventative maintenance are essential to fire prevention and preservation of life and property during an incident. Site procedures and operation and maintenance manuals shall address:

- The removal of trade wastes and packaging.
- The removal and management of vegetation onsite.
- Regular maintenance, inspection and testing in accordance with the manufacturers recommendations.
- Regular maintenance of installed facilities and equipment, including any fire protection equipment.
- The clearance and checking of drains and collection pits.

Preventative maintenance shall be done to satisfy all relevant Australian Standards, manufacturers' recommendations and industry best practices.

All fire protection equipment shall be inspected, tested and maintained in accordance with AS 1851. The maintenance frequencies in AS 1851 are regarded as the minimum.

5.6 Safe Work Practices

Safe work practices should be developed:

- To comply with the relevant Australian Standards, codes and regulations.
- With considerations of material data including safety data sheets.
- With consideration of any hazardous area classifications.
- To comply with any manufacturers recommendations around the installation, commissioning, operation and maintenance of their equipment.

The safe work practices have important bearing on fire safety and should be developed with fire risks and emergency procedures in mind.

Procedures and practices covering high risk work should be carefully considered, especially hot work, confined space and excavation controls and permits and gas/vapour checks. The fire risks shall be clearly identified in these procedures as well as the fire safety measures that must be present and operational before these tasks commence.

5.7 Site Security

Fire preconditions and fires themselves are sometimes caused by intruders and as such site security has implications for fire safety. The entire site is fenced with a locked gate for access.

Arrangements to restrict access to critical areas or plant components should also be considered in order to reduce the possibility of employee or visitor actions which could lead to fire or fire pre-conditions for example:

- Key access to critical equipment.
- Area specific induction to inform personnel of the critical safety equipment in the area, associated fire risks and the required precautions for performing tasks.

6. Active Fire Protection

Recognising that fire prevention methods will never eliminate fire hazards completely; it is necessary to plan and design so as to mitigate damages if fire occurs. The strategies used to mitigate these damages are called Fire Protection, which can be Active (this section) or Passive (Section 7). Active fire protection consists of detection, alarm and suppression. Detection and alarm incorporate devices to detect the onset of fire, alert persons to evacuate areas and alarm emergency response personnel to attend the situation. Suppression incorporates devices both automatic and manually operated to combat or control the fire.

6.1 Modular Buildings

The facility is operated unmanned. The buildings will be provided with the following fire protection systems:

- Point type smoke detectors, photoelectric and heat multi-sensor (Brooks EIB3024).
- Portable fire extinguishers shall be provided in accordance with AS 2444, comprising two (2) 5.0 kg CO₂ fire extinguishers (Class E), and one (1) 4.5 kg dry chemical powder fire extinguisher (Class ABE).
- Manual call point to interface with EQL network control centre.
- Supervisory Control and Data Acquisition communication (SCADA) system for EQL Operational Control Centre notification.
- Local Brooks FAC20 Locate/Silence/Test panel.
- IP66 fire strobe.
- Surface mounted sounder.

The detectors are connected to the SCADA system to provide automatic notification to the EQL Operational Control Centre in the event of a fire.

6.2 Transformers

In the event of a transformer fire, QFES would initially undertake firefighting operations using the onboard water supplies of their fire tenders. Additional water supply would be provided from the nearest street hydrant supply as required.

7. Passive Fire Protection

Passive fire protection consists of measures to confine the fire. This prevents the fire from spreading, allows safe egress and allows safe access for emergency response personnel attending the fire situation.

7.1 Vegetation Control and Fire Breaks

The vegetation (grasses) on the area outside the fenced area, but within the clear vegetation distance as determined by the bushfire assessment, will be regularly slashed to maintain an effective fire break. The entire fenced area will be blue stone (gravel) with no vegetation or combustible materials used in construction.

7.2 Transformers

All main transformers will use mineral insulating fluid, while the pad mounted station service transformers will use FR3 insulating fluid. The proposed bund design and layout have been developed in accordance with AS 1940, while the transformer layout and separation clearances comply with the requirements of AS 2067.

7.3 Modular Buildings

The modular buildings will be constructed in accordance with the BAL-19 requirements of AS 3959 to ensure that the building elements provide adequate protection against bushfire exposure, including radiant heat, ember attack, and direct flame contact.

8. Conclusion

The risk of fire associated with the proposed development at 2-12 and 14, Riverbend, Riverbend, QLD 4280 has been assessed. The assessment considers the risk of fire from hazardous vegetation and the proposed development layout, including transformers, modular buildings, and other equipment that may impact the site and areas beyond the lot boundary. The assessment also considers the fire protection system requirements for the site in accordance with the NCC and relevant Australian Standards.

The risk of a fire event within the site impacting beyond the boundary is controlled and mitigated adequately considering the risk mitigation measures proposed in this report.

This report is based on and assumes that the following measures will be implemented on the site and as such forms part of the fire safety solution:

Table 8-1: Fire Safety Measures Required

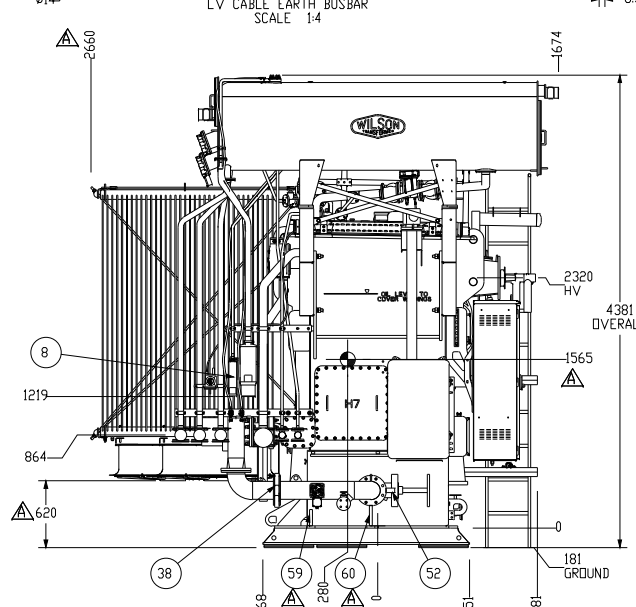
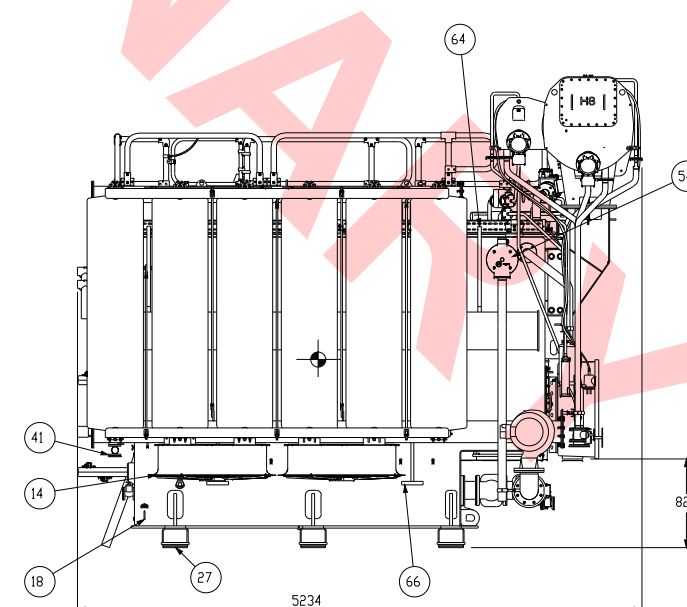
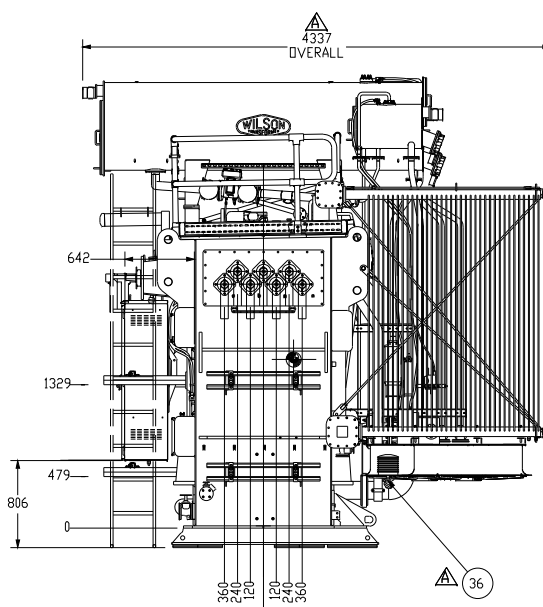
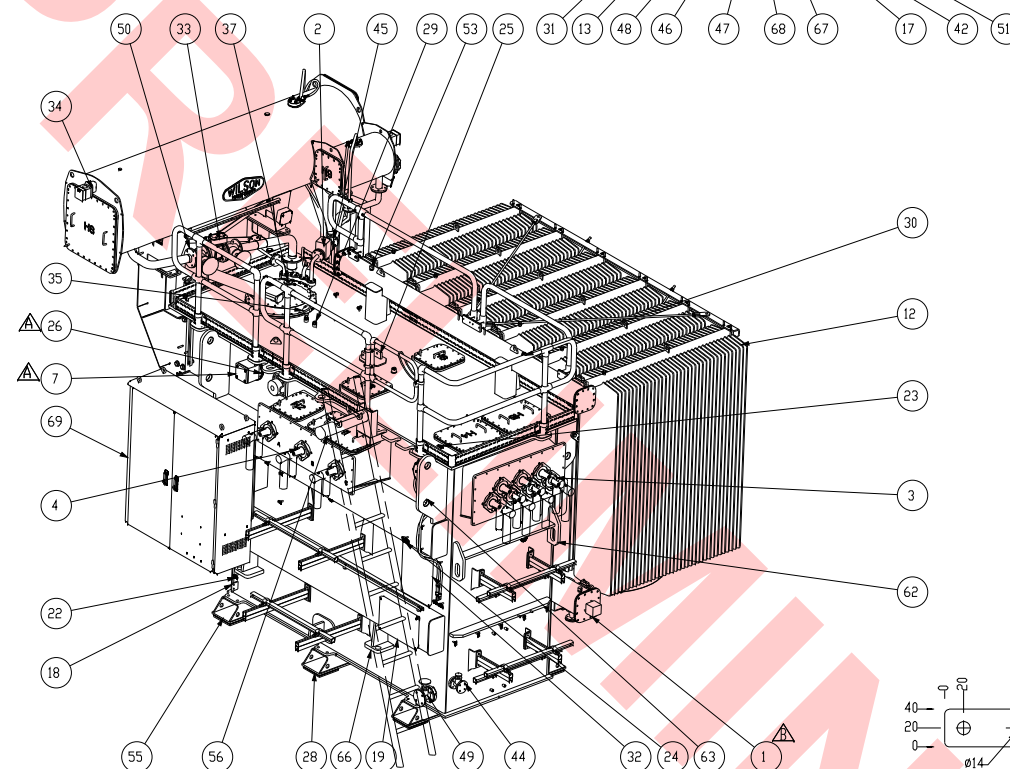
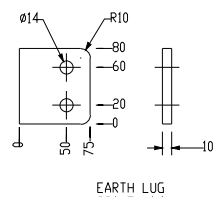
No.	Requirement
R1	Vegetation clearances shall be maintained as described in this report. The entire Project fenced area shall be Blue Stone (gravel) and void of vegetation.
R2	The modular buildings shall be constructed in accordance with the BAL-19 construction requirements of AS 3959.
R3	The installation shall achieve compliance with all relevant Australian Standards listed in this report, such as AS 3000 series, AS 1940, AS 3959 and AS 2067.
R4	The storage and handling of all chemicals, fuels and oils on the site shall comply with the relevant Australian Standards for that substance.
R5	The site shall be fully fenced, locked with access control and have signage to deter unauthorised access.
R6	The site access driveways shall consider normal light vehicle traffic, heavy vehicles for major repairs or replacements, pedestrian traffic and emergency vehicle access
R7	The 33/11 kV main transformer shall be banded in accordance with AS 1940.
R8	Ensure all administration controls such as safe work practices, procedures, processes, hot work permits, lockout / tag out requirements, are in place before operations commence. The site procedures and operation and maintenance manuals shall promote good housekeeping and industry good practice preventative maintenance
R9	Hazardous materials in storage and build-up of combustible waste materials onsite shall be eliminated, where possible or minimised.
R10	All components that are required under an Australian Standard or by the equipment manufacturer shall be correctly earthed.
R11	An operations emergency plan, including a fire management plan shall be developed prior to commissioning of the new equipment. It shall be developed in consultation with the local council and QFES and in accordance with this report.

Appendix A: OM-03.01 Assessment

Performance Outcomes	Acceptable Outcomes	Proposed Development	Criteria Achieved
PO1: Development is designed to: 1. Minimise risk of bushfire hazard. 2. Provide safe premises. 3. Create efficient emergency access for fire-fighting and other emergency vehicles.	AO1: Development: 1. Does not increase the number of persons living in, or lots in, the Bushfire hazard area identified on Bushfire hazard overlay map OM-03.00; or 2. Is on a site that a bushfire hazard assessment prepared in accordance with the methodology in Planning scheme policy 6 - Management of bushfire hazard determines is of low bushfire hazard.	The proposed development does not increase the number of persons living in, or Lots in, the Bushfire hazard area	YES
PO2: Development is sited and constructed to minimise the bushfire hazard and maximise the protection of life and property from bushfire.	AO2: Development is located and constructed: 1. Where there is no bushfire management plan approved by an existing development approval: a) Such that the bushfire attack level is less than or equal to BAL-29. b) Away from the most likely direction of a fire front. c) So that elements of the development least susceptible to fire are sited closest to the bushfire hazard. d) Such that asset protection zones are sited on land with a slope less than 18°. e) Such that asset protection zones are entirely within the boundaries of the private property of the development site. Or 2) Where an approved bushfire management plan directs development to be located.	The proposed development is arranged such that the bushfire attack level is less than or equal to BAL-29 (BAL-19). The development is on flat land (approximately 0°), and all equipment is within the boundaries of the development.	YES
PO3: Reconfiguring a lot ensures that lots are designed to minimise bushfire hazard and provide safe sites for people, property and buildings.	AO3 Lots: 1) Are suitable for people, property and buildings by: a) Having a bushfire attack level less than or equal to BAL-29. Or b) Containing a development envelope area that has a bushfire attack level less than or equal to BAL-29; 2) Provide asset protection zones that: a) Are located on land with a slope less than 18 degrees. b) Are located on the same lot.	The proposed development is arranged such that the bushfire attack level is less than or equal to BAL-29 (BAL-19). The development is on flat land (approximately 0°), and all equipment is within the boundaries of the development.	YES
PO4: Access for fire management and evacuation is provided by access that: 1) Separates premises from adjoining vegetation. 2) Is safely accessible by fire fighting vehicles. 3) Has regular vehicular access points for bushfire management, response and evacuation. 4) Has regular vehicle passing and turning areas for bushfire management, response and evacuation. 5) Allows access at all times for fire fighting vehicles. 6) Allows for maintenance, burning off and bushfire response. 7) Has vehicular links to an alternative through road. 8) Is readily maintained.	AO4: Access for fire management and evacuation is provided by vehicular access in the form of a perimeter road: 1) With a minimum reserve width of 20 m. 2) Located between the premises and adjoining vegetation. 3) With a maximum gradient of 12.5 %. 4) Constructed to otherwise comply with section 3.4 of Planning scheme policy 5 – Infrastructure. 5) That has a layout that does not include a cul-de-sac.	The proposed development is located on a main road (Glynton Road) and has clear access via Glynton Road and Teviot Road. The slope of the land to all sides is less than 12.5% and the three external facing sides are trafficable. The designated access roads will be designed to allow access for a fire tender (15 tonnes) under all weather conditions.	YES

Performance Outcomes	Acceptable Outcomes	Proposed Development	Criteria Achieved
PO5: Development has access to adequate water supply for firefighting purposes.	AO5: Development: 1) Is connected to a reticulated water supply scheme that has sufficient flow and pressure characteristics for fire fighting purposes at all times with a minimum pressure and flow of 10 L/s at 200 kPa. Or 2) Has an on-site water storage in accordance with Table 8.2.3.3.2 - Water storage for fire fighting, dedicated or retained for fire fighting purposes that is made of fire resistant materials and is: a) A separate tank. Or b) A reserve section in the bottom part of the main water supply tank.	The proposed development does not include the installation of a fire hydrant system, and there is a street hydrant at Teviot Road near Glynton Road, which is approximately 65 m from the main entrance of the proposed development. The development does not change the current bushfire management plan for the area. QFES would perform firefighting operations utilising their on-board water supplies. Once exhausted, they would need to use nearby LCC hydrant point for firefighting operations.	Complies with the Performance Objectives, since the proposed development does not increase the firefighting demand on the Lot and existing approved infrastructure.
PO6: Community infrastructure is not located in a bushfire hazard area or is able to function effectively during and immediately after a bushfire event.	AO6: Community infrastructure is: 1) Not located in a Bushfire hazard area identified on Bushfire hazard overlay map OM-03.00. Or 2) Located to ensure that: a) The core services provided by the community infrastructure is able to function effectively during bushfire events. b) Access to the community infrastructure is not compromised by bushfire events. c) The safe storage of valuable records, public records and items of cultural or historic significance is able to be maintained during a bushfire event.	The equipment for the proposed development is located 13 m from the nearest bushfire hazard and is expected to remain fully functional during a bushfire event. The electrical supply grid is designed such that the loss of the equipment within the proposed development will not result in the loss of power to the community. The site has clear access directly from Glynton Road, which is not expected to be compromised by bushfire events.	YES
PO7 Public safety and the environment are not adversely affected by the adverse impacts of bushfire on hazardous materials including fuels, explosives and flammable chemicals manufactured or stored in bulk on premises.	AO7: Hazardous materials: 1) Storage is in compliance with AS1940 - The storage and handling of flammable and combustible liquids; 2) Manufacturing does not occur in a Bushfire hazard area on Bushfire hazard overlay map OM-03.00.	All combustible and flammable liquids are contained within the equipment it serves. The transformer bunds, drainage and oil/water separation equipment comply with the relevant requirements of AS 1940 and all equipment specific Australian Standards and equipment listings.	YES

Appendix B – Main Transformer Information



ITEM	DESCRIPTION	QTY.	MAKE	PARTN
1	SWITCH K&N FANS ISOLATOR IP56	1		
2	PROTECTIVE RELAY - RS2001 (MR)	1		
3	LV BUSHING EUROMOLD M400AR-4/1 36KV 1250A BIL170 (INTERFACE C2)	7		040-238
4	HV BUSHING EUROMOLD M400AR-4/1 36KV 1250A BIL200 (INTERFACE C2)	3		040-238
5	BOX WTV HV & LV CT SECONDARY 6	1	-	045-009
6	FIBRE OPTIC EARTH TERMINAL BOX	1	CEDASPE	045-066
7	BOX FIBRE OPTIC PROBES	1		045-102
8	BREATHER WTC2 VALVED FILTER WTC	1	WTC	050-150
9	BREATHER WTC5 VALVED FILTER WTC	1	WTC	050-150
10	HV-BARRE EARTH BUSBAR	1	-	061-238
11	LV CABLE EARTH BUSBAR	1	-	061-238
12	RADIATOR 36/2200	6	TIANTONG	122-213
13	DEVICE GROUND LEVEL TEST ETI RA-GA 'B'	1	ETI	167-000
14	FAN EC 990 DIA W3G990-CU28-80	2	EMBPAPST	214-005
15	OIL LEVEL INDICATOR TRANSFORMER	2	ABB-COMEM	288-006
16	INSULATOR 33KV	4	-	388-002
17	OIL FLOW INDICATOR-MESSKO L to R	1		381-006
18	LUG EARTH	2		501-076
19	VALVE POSITION PLATE	1		598-230
20	LABEL CORE EARTH	2	-	598-578
21	LABEL FRAME EARTH	2	-	598-578
22	LABEL EARTHING POINT	2	-	598-578
23	LABEL ACCESS PAPER SAMPLE	1	-	598-578
24	LABEL ACCESS POINT FOR LADDER	1	-	598-578
25	PERSONAL FALL ARREST DEVICE & SUPPORT PLATE - UNI-ANCHOR	1		665-097
26	FIBRE OPTIC FEEDTHROUGH PLATE 8 PROBES	1	FISO	665-106
27	PAD ANTIVIBRATION (BLACK)	5	GOODYEAR SUP.	668-007
28	PAD ANTIVIBRATION (BLACK)	4	GOODYEAR SUP.	668-007
29	POCKET THERMOMETER LONG	2	-	678-017
30	POCKET THERMOMETER SHORT	2	-	678-017
31	PUMP 150NB TEIKOKU OK37-150b 3.7kW	1	TEIKOKU	681-001
32	RATING AND DIAGRAM PLATE	1		728-230
33	GAS RLY ETI G080 GAS INJ 120 CM/SEC 3 CONT 04-11IC	1	ETI	732-002
34	SWITCH KOBOLD NKP 1401 (AIRBAG RUPTURE DETECTOR)	2	-	794-033
35	THERMOMETER Pt 100 RTD ASSY - OIL TEMP.	1		842-015
36	THERMOMETER Pt 100 RTD ASSY - AMBIENT TEMP.	1		842-015
37	OLTC	1		851-230
38	VALVE BUTTERFLY 150NB PUMP ISOLATION	12		901-015
39	VALVE BUTTERFLY 80NB DIN	3	VIAT	901-017
40	VALVE GATE 25NB BRASS D/F TABLE 'D' WITH IND - OLTC CONSERVATOR DRAIN	1		901-108
41	VALVE GATE 25NB BRASS D/F TABLE 'D' WITH IND - BOTTOM HEADER DRAIN	1		901-108
42	VALVE GATE 25NB BRASS D/F TABLE 'D' WITH IND - BOTTOM OIL PIPE DRAIN	1		901-108
43	VALVE GATE 25NB BRASS D/F TABLE 'D' WITH IND - OLTC DRAIN	1		901-108
44	VALVE GATE 25NB BRASS D/F TABLE 'D' WITH IND - BOTTOM SAMPLE	1		901-108
45	VALVE GATE 25NB BRASS D/F TABLE 'D' WITH IND - OLTC SUPPLY ISOLATION	1		901-108
46	VALVE GATE 50NB BRASS D/F TABLE 'D' WITH IND - MAIN CONSERVATOR DRAIN	1		901-108
47	VALVE GATE 50NB BRASS D/F TABLE 'D' WITH IND - MAIN CONSERVATOR VACUUM	1		901-108
48	VALVE GATE 50NB BRASS D/F TABLE 'D' WITH IND - OLTC CONSERVATOR VACUUM	1		901-108
49	VALVE GATE 50NB BRASS D/F TABLE 'D' WITH IND - TANK DRAIN	1		901-108
50	VALVE GATE 80NB BRASS D/F TABLE 'D' WITH IND - BOCHOLZ RELAY ISOLATION	2		901-108
51	VALVE GATE 80NB BRASS D/F TABLE 'D' WITH IND - FILL/FILTER	1		901-108
52	VALVE GATE 150NB CAST IRON D/F TABLE 'D' WITH IND - HEADER ISOLATION BOTTOM	1		901-111
53	AIR VENT DIN42558 SIZE 12	2		902-006
54	VENT PRESSURE RELIEF MESSKO 8psi/ 0.55bar	1	MESSKO	902-007
55	SKID BASE FOOT	3		2307-049
56	LADDER BRACKET	1		2307-042
57	TRANSFORMER	1		2307-108
58	BALL CONSERVATOR	1		2307-108
59	LUG TX HAULAGE	1	-	2307-501
60	LUG TX HAULAGE	1	-	2307-501
61	LASHING LUG	1	-	2307-501
62	LASHING LUG	2	-	2307-501
63	LIFTING LUG - HV	2	-	2307-501
64	LIFTING LUG - LV	2	-	2307-501
65	LASHING LUG	1	-	2307-501
66	JACKING PAD	4	-	2307-668
67	VALVE BALL MAIN CONSERVATOR	1		2307-991
68	VALVE BALL OLTC CONSERVATOR	1		2307-991
69	PENTROL CUBICLE 1450H 1220W 400D AL	1		

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