January 2026

Powerlink 2027-32 Revenue Proposal

Project Pack

CP.03197 South Pine 275kV Secondary Systems Replacement

Project Status: Unapproved

Network Requirement

H002 South Pine Substation, located in the northern suburbs of Brisbane, is a major 275/110kV injection point on the north side of Brisbane. It was first established as a 110kV substation in 1964 and later expanded to include 275/110kV transformation. In the mid-2000's a series of major equipment replacement projects were undertaken to address both primary plant and secondary systems equipment condition. An SVC was connected to the 275kV switchyard in 2008. In addition to being critical to supply the South Pine East and South Pine West 110kV switchyards the 275kV circuits switched at South Pine Substation allow bulk power transfers into and through the broader South East Queensland area.

Ageing secondary systems, which are no longer supported by the manufacturer are increasingly at risk of failing to comply with Schedule 5.1.9(c) of the National Electricity Rules, AEMO's Power System Security Guidelines and the reliability standard included in Powerlink's Transmission Authority.

A condition assessment of the South Pine substation secondary systems identifies various secondary systems components that require replacement [1]. In addition to the site-specific impacts of obsolescence at South Pine Substation, it is also important to note the compounding impact of equipment obsolescence occurring across the fleet of secondary systems assets installed in the Powerlink network. Running multiple secondary systems to failure across the network increases the likelihood of concurrent systemic faults with significant implications on network reliability and safety.

Powerlink's 2025 Central scenario forecast confirms there is an enduring need to maintain electricity supply to both the South Pine East and South Pine West switchyards. The removal or reconfiguration of the South Pine 275kV switchyard due to secondary system failure/obsolescence would violate Powerlink's N-1-50MW/600MWh Transmission Authority reliability standard [2].

In addition, an outage of a critical 275kV transmission line due to secondary systems failure at South Pine Substation will result in altered dispatch outcome in the National Electricity Market (NEM) and higher total system costs. Powerlink has undertaken market modelling to quantify the changes in costs for market participants due to those different dispatch outcomes [2].

Recommended Option

As this project is currently 'Unapproved', project need and options will be subjected to the public RIT-T consultation process to identify the preferred option closer to the time of investment.

The current recommended option is for full replacement of some 275kV secondary systems within their existing control building and full replacement of the remaining 275kV secondary systems in a new control building by 2031 [3].

Options considered but not proposed include:

- Replacement of some secondary systems and decommission some functionality – this option would require either or both of additional 110kV cable capacity from Rocklea Substation into the CBD West 110kV ring and additional 110kV capacity between the Sunshine Coast and South Pine Substation and neither is cost effective .

Figure 1 shows the current recommended option reduces the forecast risk monetisation profile of the South Pine 275kV Substation secondary systems from around $1.6 million per annum in 2031 to less than $0.1 million from 2032 [5]. In addition to this benefit of reduction in risk cost there are benefits available from lower cost market dispatch outcomes due to improved reliability and availability of South Pine 275kV Substation secondary systems.

Figure 1 Annualised Risk Monetisation Profile ($ Real, 2025/26)

Cost and Timing

The estimated cost to replace secondary systems at South Pine substation is $44.8m ($2025/26) [4].

Target Commissioning Date: December 2031

Document in CP.03197 Project Pack

Public Documents

1. H002 South Pine Secondary Systems Condition Assessment Report
2. CP.03197 South Pine 275kV Secondary Systems Replacement – Planning Statement
3. CP.03197 South Pine 275kV Secondary Systems Replacement – Project Scope Report
4. CP.03197 South Pine 275kV Secondary Systems Replacement – Concept Estimate
5. CP.03197 South Pine 275kV Secondary Systems Replacement – Risk Cost Summary

Date of Site Visit:	14/05/2025	
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Approved by:	Team Leader Sec Sys & Telecom Strategies	[redacted]

Version history

Version	Date	Section(s)	Summary of amendment	Author	Approver
1.0	12/12/2025	All	Original Document	[redacted]	[redacted]
1.1	12/01/2026	3.2	Additional considerations for H002 South Pine Secondary Systems	[redacted]	

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1 Purpose

This report is pertinent to H002 South Pine secondary systems. Recommendations in this report have been based on the current condition assessment of secondary systems assets and associated equipment. Considerations for network reconfigurations, engineering solutions, refurbishment options and implementation methodologies are not covered in this report.

2 Scope

The report is based on the site inspection conducted on 14/05/2025 and with inputs from the following attendees:-

Team	Position	Name
Secondary Systems & Telecommunications Strategies	Senior Secondary System Strategies Engineer	[redacted]
Secondary Systems & Telecommunications Strategies	Senior Secondary System Strategies Engineer	[redacted]

The report also considers data extracted from SAP, SPF, the Forced Outage Database (FOD) and discussion with maintenance staff. Photographs of items taken during the site visit have been stored in the following folder:

M:\Plant\Secondary Systems\H002 - SOUTH PINE\Plant Strategies\Condition Assessments\2025-05-14

3 Condition Assessment Boundary and Methodology

3.1 Inclusions and Exclusions

3.1.1 Inclusions

The condition assessment of the following systems and equipment will be covered in this report.

- Secondary system cables – All cables that are associated with secondary systems and equipment, including:
  - Cables between control and protection panels and termination racks,
  - Cables between termination racks and yard marshalling kiosks, AC and DC kiosks.
- OpsWAN panels, system and equipment,
- Secondary system AC and DC supply – Low voltage (LV) AC Panel heaters and lights, DC batteries and chargers,
- Secondary system panels and associated ancillary parts, including links, terminals, Input / Output modules, signal converters, transducers and power supplies.
- Indoor and outdoor secondary systems marshalling kiosks, AC and DC kiosks, Termination racks, including internal links, terminals, MCBs and fuses,
- Indoor and outdoor control cables to outdoor secondary systems kiosks, or cables from indoor secondary systems panels directly connected to primary equipment control kiosks.
- Secondary system equipment and systems, including protection relays, HMI computers, RTUs, data acquisition units, Programmable Logic Controllers (PLCs), Intelligent Electronic Devices (IED),
- Available space in existing control buildings to accommodate new secondary system panels.

3.1.2 Exclusions

The condition assessment of the following assets are not part of the scope of this report:

- Condition of control buildings and associated light and power circuits, Civil structures, cable trenches and foundations,
- HV AC supply systems (> 230VAC), including transformers, diesel generators, etc.,

- Substation flood lights,
- Primary equipment and associated components e.g. transformer and circuit breaker control cubicles,
- Primary equipment kiosks and associated components, e.g. Power transformer, circuit breaker control kiosks. PLCs and Intelligent Electronic Devices (IED), regardless of their installed location (could be in transformer and circuit breaker control kiosks) are considered as secondary systems equipment.
- Cables from secondary systems outdoor kiosks (e.g. bay marshalling kiosks) to primary plant control kiosks,
- Cables from primary plant control kiosks to primary plant equipment.

3.2 Secondary System Condition Assessment Principles and Methodology

The principles of secondary systems condition assessment were based on Powerlink' s Secondary Systems Asset Risk Model developed in [1], and "Powerlink – Asset Risk Management – Framework" in [2]. The methodology consists of two main parts – Desktop assessment based on [1, 2] and site visual inspection. The latter is considered more subjective than the former.

The desktop assessment is limited only to assets recorded in SAP asset database, e.g. protection relays, RTUs and IEDs. It is important to note that a significant number of secondary systems equipment, including cables, kiosks, terminals, links, panels, termination racks, auxiliary equipment and some IEDs are not recorded in SAP. The condition assessment of these relies on the site visual inspection. The site inspection also provides moderation and manual update of desktop assessments to reflect the actual condition of operational equipment at site.

The desktop assessment models equipment health indices based on the optimisation of risk, cost and performance of Powerlink' s secondary assets over the years – since 1999 [1]. Equipment health index is the key condition measurement for each equipment in service. The model takes into account equipment failure rates calculated based on operational data, environmental conditions where the equipment is installed and the mean physical ages of a group of equipment at bay and system (fleet) levels. It was found in [1] that the physical age of individual equipment alone does not provide reliable information on the reliability and availability of secondary systems assets at the bay and system level. Instead, the mean physical ages of a group of equipment, at bay or system level, correlate very well with the secondary systems reliability and availability to service the power system.

Health indices are modelled in the range from zero (0) to ten (10), where zero represents newly installed equipment and ten indicates equipment that have reached the optimum replacement ages. According to [1], the optimum replacement ages for Powerlink' s secondary systems assets signify an optimal replacement time period just before the secondary systems availability and reliability start to transition to a rapidly declined trajectory. Generally, equipment with condition scores close to ten represent moderate increase of functional failures, but longer outage duration and significantly higher risk of impacting system's availability and reliability. Findings in [1] concluded that delaying replacement of secondary systems assets beyond the optimal replacement timeframe does not always result in higher mal-tripping of network elements, but lower secondary systems availability and reliability. It is important to note that not every functional failure will necessarily result in an outage to a network element, but it does represent the loss of some of the normal functions of the protection and control system and can contribute to forced outage events of network elements.

The model in [1] projects that the effect of extending the mean replacement age of Powerlink' s secondary system assets from 20 years to 25 years is a near doubling of the annual duration of secondary systems functional outages due to functional failures. In addition, delaying the mean replacement ages of secondary system assets beyond the optimal replacement time would increase the yearly operation and maintenance cost for secondary system assets and put additional demands on field staff resources. The projection was based on Powerlink data and is a direct reflection of Powerlink' s environment, including the types of relays purchased, the conditions in which they are installed, the maintenance regime used, and the quantity of spares held.

The key outcome of this report is the recommended optimal replacement timing for secondary systems assets and equipment detailed in the Appendix section based on their health indices and condition assessment data. It also takes account of the criticality of equipment that are (or are not) directly associated with the performance of secondary systems. For example, some equipment show health indices close to ten, but may not need to be replaced urgently as their functions are considered to be non-critical to the secondary systems performance. In this case, they should only be opportunistically replaced as part of the secondary system replacement project to optimise cost.

The recommendations take account of the following considerations that apply to H002 South Pine Secondary Systems:

- The age factor for SDM7 protection and control equipment indicates that individual IEDs are reaching the end of their design life. It is known that failure rates generally double in the period between 20 and 25 years milestone. Based on earlier failure data, Powerlink have already carried out a proactive replacement of power supply modules on SDM7 GE protection relays. The installed relays however continue to deteriorate.

- Appendix 1 for H002 South Pine includes equipment comprehensive details on obsolescence, health index and available spares, based on which and secondary systems replacement is recommended at 20 years.

- With the majority of the relay and RTU installed population at H002 dating from 2006-2008, a small number of panels are relatively younger. Given the small number of relatively young panels it is considered necessary to replace all panels at this time, as the cost of operating two parallel systems as well as interfacing new and old will be prohibitive and will result in reduced overall functionality. At the start of the project every effort will be made to preserve and reuse whatever equipment is possible.

- The age factor also points to another set of challenges: 20 year old protection and control equipment are obsolete, no longer Vendor supported, cannot be procured in the compatible configurations and repairs are either no longer possible or uneconomical.

- SDM7 secondary systems spares are low and particularly bay controllers (C50 RTUs) spares stocks are critically low. It is envisaged that there is a benefit in targeting a larger site (H002) for replacement, as Powerlink can recover a larger number of SDM7 protection relays and RTUs. Although not ideal and knowing that a proportion of those recovered can no longer be put in service, a finite number can be selected to help sustain similar equipment in smaller sites until they are replaced under a project.

4 References

Document code	Document Details
A3348092	Modelling Substation control and Protection Asset Condition for Optimal reinvestment Decision Based on Risk, Cost and Performance, CIGRE PARIS 26-31 August 2018, T Vu, M. Pelevin, D. Gibbs, J.Horan, C. Zhang
A3348084	Powerlink – Asset Risk Management – Framework, ASM-I&P-FRA-A2417558, Powerlink Queensland, 21/12/2020
A527892	ASM-STD-A527892 Secondary Systems Design Standard, Powerlink Queensland, 10/01/2022
A533375	ASM-STD-A533375 OSD SCADA Requirements for Operational Purposes Standard, Powerlink Queensland, 24/04/202
A3372626	ASM-ID&TD-STD-A3372626 SU0049 New Physical Disconnect Terminal for CT Circuits Supersedes SU0031, Powerlink Queensland, 12/06/2020

Document code	Document Details
A3385483	ASM-SPE-A3385483 AM Substation Design Principles – Specification, Powerlink Queensland, 15/07/2021
A4982111	ASM-FRM-A4982111 ETR 10434011 OpsWAN camera lowering device task report.

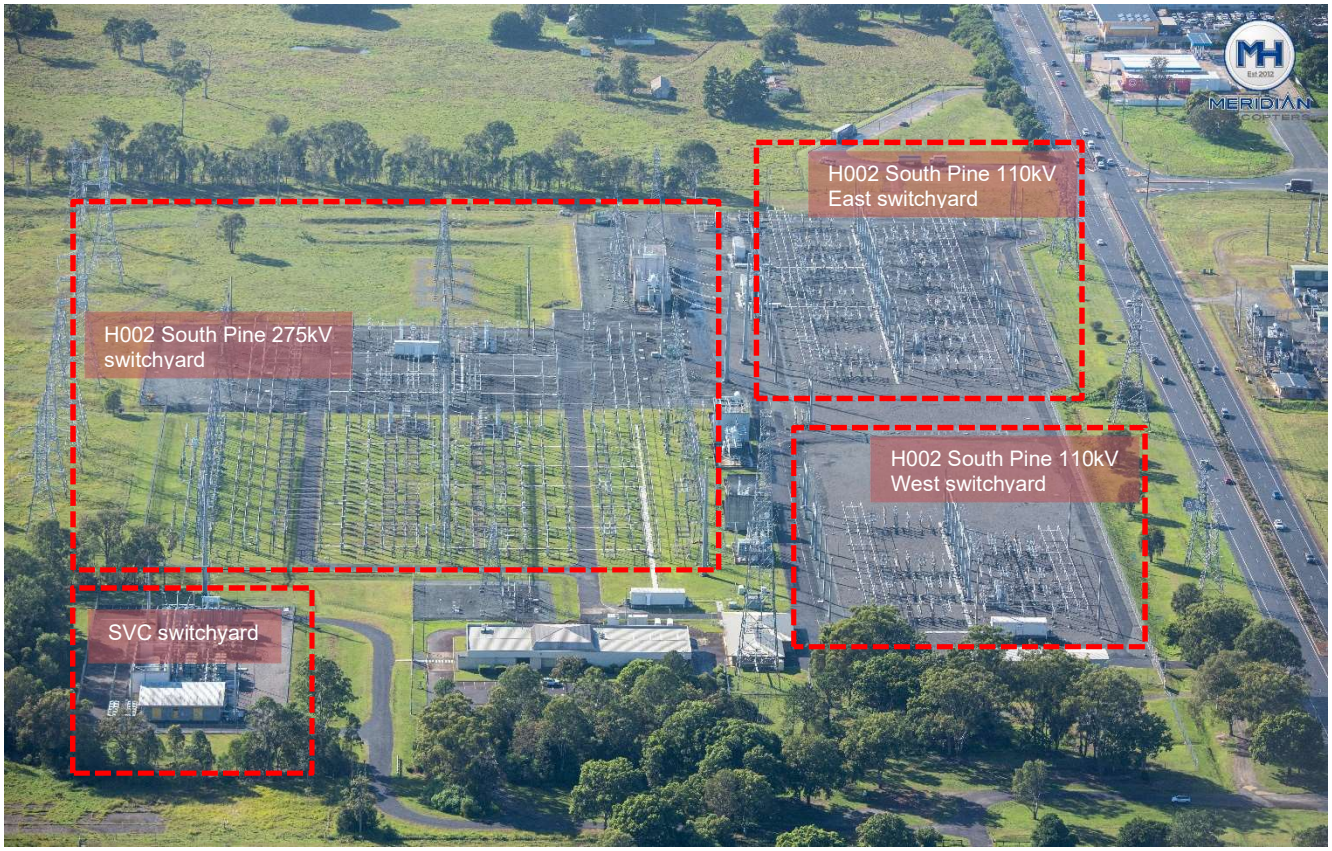
5 Monitoring and Compliance

Compliance with this document is mandatory and will be actively monitored by the Secondary Systems and Telecommunications Strategies Team.

6 Condition Assessment

6.1 Introduction

This report is in relation to South Pine 275kV and 110kV switchyards secondary systems. H002 South Pine is a major switching substation in Southeast Queensland. It was commissioned first in 1964, then further expanded in 1981 to accommodate the HV network expansion at the time. This substation is an integral part of the Southeast Queensland transmission backbone, providing electrical bulk supply to North Brisbane suburbs as well as Brisbane CBD. South Pine substation is located approximately 16 km North West of Brisbane CBD. The 275kV SVC, adjacent to the substation, was commissioned in 2008 to provide fast reactive power support in the area. The current operating secondary systems were replaced between 2005-2009. The recommendations included here are based on the secondary equipment condition as assessed at the time of the site visit and the subsequent analysis prior to the release of this document. Considerations for network reconfigurations, engineering solutions, refurbishment options and implementation methodologies are not in scope of this report.



275kV South Pine Substation Aerial View

[redacted]

H002 275kV single line diagram

H002 110kV single line diagram

Table 1 – South Pine Substation Network Elements					
Local Substation (South Pine)					Remote Substation
	Voltage (kV)	Quantity	Bay Designation	Operational Element	
Busbars	275	2	=KC1	1 Bus	N/A
			=KC2	2 Bus	N/A
	110	6	=KD3	3 Bus	N/A
			=KD4	4 Bus	N/A
			=KD7	7 Bus	N/A
			=KD8	8 Bus	N/A
			=KD9	9 Bus	N/A
			=KD10	10 Bus	N/A
Coupler	275	8	=C01-Q30	5072	N/A
			=C02-Q30	5062	N/A
			=C03-Q30	5052	N/A
			=C05-Q30	5032	N/A
			=C06-Q30	5022	N/A
			=C08-Q30	5082	N/A
			=C09-Q30	5092	N/A
			=C11-Q30	Subject to CP.02931	N/A
	110	5	=D49-Q10	4032	N/A

			=D83-Q10	4072	N/A
			=D65-Q10	4172	N/A
			=D66-Q10	4182	N/A
			=D51-Q10	4092	N/A
Transformers	275	5	=C06-Q10	5412 - 1 Transformer HV	N/A
			=C03-Q10	5442 - 4 Transformer HV	N/A
			=C02-Q10	5452 - 5 Transformer HV	N/A
			=C11-Q10	5462 - 6 Transformer HV CP.02931 will change that	N/A
			=C08-Q20	5472 - 7 Transformer HV	N/A
	110	5	=D71-Q10	4412 – 1 Transformer LV	N/A
			=D33-Q10	4442 – 4 Transformer LV	N/A
			=D38-Q10	4452 – 5 Transformer LV	N/A
			=D69-Q10	4462 - 6 Transformer LV	N/A
			=D60-Q10/Q20	4472/1, /2 - 7 Transformer LV	N/A
Feeders	275	8	=C01-Q20	809	H016 Rocklea
			=C02-Q20	838	H036 Blackwall
			=C03-Q20	825	H012 Mt England
			=C04-Q20	832	H18 Tarong
			=C05-Q20	807	H005 Woolooga
			=C06-Q20	808	H009 Palmwoods
			=C09-Q20	8700	H154 Kremzow
			=C11-Q20	8999	H154 Kremzow
	110	10	=D45-Q10	721	H023 Upper Kedron
			=D42-Q10	722	H023 Upper Kedron
			=D41-Q10	738	Energex Stafford SSSFD
			=D36-Q10	737	Energex Stafford SSSFD
			=D85-Q10	7504	Brendale BESS
			=D82-Q10	7345	Energex Griffin SSGFN
			=D79-Q10	7344	Energex Griffin SSGFN
			=D76-Q10	7342	Energex Nudgee SSNGE
			=D73-Q10	7341	Energex Nudgee SSNGE
			=D72-Q10	7299	Energex Brendale SSBRD
			=D67-Q10	744	Energex Brendale SSBRD
			=D64-Q10	743	Energex Brendale SSBRD
			=D61-Q10	740	Energex Sandgate SSSGT
			=D58-Q10	739	Energex Bald Hills SSQRH
			=D57-Q10	741	Energex Hays Inlet SHIL
			=D54-Q10	741	Energex Hays Inlet SHIL
			=D55-Q10	745	Palmwoods/Caboolture /Beerwah

			=D52-Q10	746	Palmwoods/Caboolture /Beerwah
Reactive Plant Bays	275	5	=C07-Q10	3 CAP	N/A
			=C07-Q20	4 Cap	N/A
			=C11-Q20	9 Cap	N/A
			=C11-Q10	8 Cap	N/A
	110	3	=D46-Q10	11 Cap	N/A
			=D78-Q10	12 Cap	N/A
			=D51-Q10	6 Cap	N/A
			=D51-Q20	7 Cap	N/A

The secondary systems for 110kV and 275kV switchyards at H002 South Pine are implemented based on Powerlink SDM7 design standard which includes swing frame panels grouped together in a control room. This is a modular concept where each HV bay is associated with one protection/control panel which includes a dedicated X protection, a Y protection and the bay controller (C50 RTU to cater for all bay related control, alarming, status, telemetry). All bay controllers are connected together via an optical fibre OptoNET ring.

6.2 Buildings

There are several buildings around the switchyard at South Pine as per the diagram below:

H002 South Pine location of buildings

To note: +1 is the old control brick building, +9 and +10 are the Work Sheds, +2 and +6 are the 275kV demountables, +4, +5, +7 are the 110kV demountables and +8 is the SVC building.

- **+1 Building**

This brick building was built around 1963 when the substation was first established. It has multiple rooms, some of them airconditioned. It includes an operational Telecommunications room, an office, kitchenette, toilet, storage, etc. It used to include the secondary systems but that functionality ceased when 275kV and 110kV secondary systems were replaced with SDM7 swing-frame panels in demountable buildings between 2005-2010. This building is in fair condition according to construction standards of 1960's.

- **+9 and +10 Buildings**

+9 and +10 are sheds used for storage and work. The brick shed dates back from 1981, whereas the metal shed was built in the 1990's. They offer additional space to the storage space available in building +1. These buildings are in fair condition according to construction standards at the time.

- **+2 Building**

+2 is an SDM7 designed demountable building installed under CP.01092 275kV refurbishment in 2005-2006. It is airconditioned and appears to be in good condition to be used further until 2046.
It accommodates secondary systems for the following 275kV diameters, plus additional related panels:
=C01, =C02, =C03, =C04, =C05, =C06, =C07, Bus Zone, Mux/Comms, Station.

There are no spare panel spaces in this building.

- **+6 Building**

+6 is an SDM7 designed demountable building installed under CP.01844 275kV work in 2007-2008. It is airconditioned and appears to be in good condition to be used further until 2048.
It accommodates secondary systems for the following 275kV diameters, plus additional related panels:
=C08, =C09, =C10, =C11, Station, Metering, WAMPAC,

There are nine (9) spare panel spaces in this building.

- **+4 Building**

+4 is an SDM7 designed demountable building installed under CP.01134 110kV refurbishment in 2008-2009. It is airconditioned and appears to be in good condition to be used further until 2049.
It accommodates secondary systems for the following 110kV bays, plus additional related panels: =D51, =D52, =D54, =D55, =D57, =D58, =D60 (T7 and Coupler), =D61, =D64, =D65, Bus Zone, Metering, PQM, Common/OpsWAN, Mux/Comms.

There are four (4) spare panel spaces in this building.

- **+5 Building**

+5 is an SDM7 designed demountable building installed under CP.01134 110kV refurbishment in 2010. It is airconditioned and appears to be in good condition to be used further until 2050.
It accommodates secondary systems for the following 110kV bays, plus additional related panels: =D66, =D67, =D70, =D71, =D72, =D73, =D76, =D77, =D78, =D79, =D82 (spare), =D83, =D85, Bus Zone, Station, Mux/Comms.

There are four (4) spare panel spaces in this building.

- **+7 Building**

+7 is an SDM7 designed demountable building installed under CP.01134 110kV refurbishment in 2010. It is airconditioned and appears to be in good condition to be used further until 2050.
It accommodates secondary systems for the following 110kV bays, plus additional related panels: =D33, =D36, =D38, =D41, =D42, =D45, =D46, =D49, Bus Zone, Station, Metering, Mux/Comms, PQM.

There are eight (8) spare panel spaces in this building, plus one space reserved for CP.02473.

- **+8 SVC Building**

H002 275kV South Pine SVC Control Building +8

+8 SVC building was established in 2008 to house SVC related components and systems.

6.3 Outdoor Marshalling Kiosks

All marshalling kiosks for the following 275kV bays were installed when the substation secondary systems were refurbished in 2005-2006 under CP.01092. An age/condition driven replacement would not be required until 2046:

- =KC1 and =KC2 - 275kV Buses
- =C01-Q10 SVC
- =C01-Q30
- =C01-Q20 Fdr809
- =C02-Q10
- =C02-Q30
- =C02-Q20 Fdr838
- =C03-Q10
- =C03-Q30
- =C03-Q20 Fdr825
- =C04-Q10
- =C04-Q20
- =C05-Q10
- =C05-Q30
- =C05-Q20 Fdr807
- =C06-Q10
- =C06-Q30
- =C06-Q20 Fdr808
- =C03-Q10 3Cap
- =C03-Q20 4Cap

Marshalling kiosks for following 275kV bays were installed in 2007-2008 and no condition driven replacement is required untill 2048:

- =C08-Q10
- =C08-Q30
- =C08-Q20
- =C09-Q10
- =C09-Q30
- =C09-Q20
- =C010-Q10
- =C10-Q30
- =C10-Q20

Marshalling kiosks for following 275kV bays were installed in 2024-2025 under CP.02931 and no condition driven replacement is required untill 2065.

- =C11-Q10
- =C11-Q20
- =C11-Q10

Marshalling kiosks for following 110kV bays were installed in 2008-2009 in the East switchyard under CP.01134 and no condition driven replacement is required untill 2049:

=D51, =D52, =D54, =D55, =D57, =D58, =D60 (T7 and Coupler), =D61, =D64, =D65, Bus Zones 9 and 10.

Marshalling kiosks for following 110kV bays were installed in 2010 in the East switchyard under CP.01134 and no condition driven replacement is required untill 2050:

=D66, =D67, =D70, =D71, =D72, =D73, =D76, =D77, =D78, =D79, =D82 (spare), =D83, =D85, Bus Zones 7 and 8.

Marshalling kiosks for following 110kV bays were installed in 2010 in the West switchyard under CP.01134 and no condition driven replacement is required untill 2050:

=D33, =D36, =D38, =D41, =D42, =D45, =D46, =D49, Bus Zones 3 and 4.

Marshalling kiosks were found to be in an acceptable state at the time of the condition assessment. In the event that marsahalling kiosk door seals and air filters are found to have degraded over time, they shall be replaced as part of substation routine maintenance. Degraded door seals and air filters can lead to premature failures of internal components, e.g. links and terminals. It is recommended that these outdoor marshalling kiosks be monitored as part of the substation routine inspection to identify any accelerated deteroration. In addition, as part of a secondary systems replacement, the associated CT links shall be replaced to mitigate safety risks according to SU0049 New physical disconnect terminal for CT circuits.

Health Indices of secondary system outdoor marshalling kiosks and recommended replacement timeframe have been detailed in Section 9, in the **Appendix**. Physical appearance of typical outdooor marshalling kiosks are illustrated in Section 6.3.

Only photos of marshalling cubicles were captured for 110kV yard as the 275kV yard was contained with RAZ (Restricted Access Zone) zone due to potental risk posed by [redacted]

6.3.1 Typical Bus Zone Marshalling Kiosk

110kV 4 Bus CT marshalling kiosk, +KD4-A1

6.3.2 Typical Coupler Bay Marshalling Kiosk

110kV bay 49 bus Coupler bay marshalling kiosk, +D49-A10

6.3.3 Typical Transformer Marshalling Kiosk

110kV T4 LV bay marshalling kiosk, +D33-A10

6.3.4 Typical Feeder Bay Marshalling Kiosks

110kV Bay 82 Feeder 7345 Bay marshalling kiosk +D82-A10

6.3.5 Typical Capacitor Bank Bay Marshalling Kiosks

110kV Bay 51 Capacitor bank M07 Bay marshalling kiosk, +D51-A10

6.3.6 Typical VT Box

110kV Feeder 746 VT box

7 Transformer 110kV LV VT box, +D60-A14

8 Bus 110kV VT box, +KD8-A10

6.3.7 Typical AC and DC Marshalling Kiosks

110kV bay =D73 AC marshalling kiosk, +D73-A91

110kV bay =D73 DC marshalling kiosk, +D73 -A92

6.4 Interface Cubicles

SVC Interface Kiosk 1, +C01-A98

Powerlink – Energy Queensland Interface Termination Cubicle +U93

6.5 Outdoor secondary systems multicore cables

Control cables for the 275kV and 110kV switchyards from the marshalling kiosks to the HV equipment and the control buildings were replaced under CP.01092 and CP1134 between 2005 and 2010 and subsequent work. Since the expected life of outdoor multicore cabling is 40 years, there is no condition driven replacement required untill 2045-2050.

Control Cables for 110kV system

6.6 Protection and Control Systems

The condition assessment of protection and control systems, including protection/control panel, equipment, internal components such as links, terminals, wiring, MCBs, fuses, is summarised below.

6.6.1 Secondary systems protection/control panels and cabling

Secondary systems for following bays were provided in Building +2 under CP.01092 between 2005-2006, with replacement recommended by 2026, panel frames being able to stay in service and be re-used by 2046:

- =KC1 and =KC2 - 275kV Buses
- =C01-Q10 SVC
- =C01-Q30
- =C01-Q20 Fdr809
- =C02-Q10
- =C02-Q30
- =C02-Q20 Fdr838
- =C03-Q10
- =C03-Q30
- =C03-Q20 Fdr825
- =C04-Q10
- =C04-Q20
- =C05-Q10
- =C05-Q30
- =C05-Q20 Fdr807
- =C06-Q10
- =C06-Q30
- =C06-Q20 Fdr808
- =C03-Q10 3Cap
- =C03-Q20 4Cap

Typical Protection/control panel in Building +2 (3 Cap)

Secondary systems for following bays were provided in Building +6 under CP.01184 between 2007-2008, with replacement recommended by 2028, panel frames being able to stay in service and be re-used by 2048:

- =C08-Q10
- =C08-Q30
- =C08-Q20
- =C09-Q10
- =C09-Q30
- =C09-Q20
- =C010-Q10
- =C10-Q30
- =C10-Q20
- =C11-Q10 added 2024-2025 under CP.02931
- =C11-Q20 added 2024-2025 under CP.02931
- =C11-Q10 added 2024-2025 under CP.02931
- WAMPAC, Metering, added 2024-2025 under CP.02931

Typical Protection/control panel in Building +6 (9 Cap)

Secondary systems for following bays were provided in Building +4 under CP.01134 between 2008-2009, with replacement recommended by 2029, panel frames being able to stay in service and be re-used by 2049:

- =D51, =D52, =D54, =D55, =D57, =D58, =D60 (T7 and Coupler), =D61, =D64, =D65, Bus Zone, Metering, PQM, Common/OpsWAN, Mux/Comms, established in 2008-2009

Typical Protection/control panel in Building +4 (Bay 55 Fdr panel)

Secondary systems for following bays were provided in Building +5 under CP.01134 in 2010, with replacement recommended by 2030, panel frames being able to stay in service and be re-used by 2050:

- =D66, =D67, =D70, =D71, =D72, =D73, =D76, =D77, =D78, =D79, =D82 (spare), =D83, =D85, Bus Zone, Station, Mux/Comms

Typical Protection/control panel in Building +5 (adjacent Bus Zone panels)

Secondary systems for following bays were provided in Building +7 under CP.01134 in 2010, with replacement recommended by 2030, panel frames being able to stay in service and be re-used by 2050:

=D33, =D36, =D38, =D41, =D42, =D45, =D46, =D49, Bus Zone, Station, Metering, Mux/Comms, PQM

Typical Protection/control panel in Building +7 (Bay 33 4T LV panel)

Panels and associated elements in the SVC Building +8 form part of a separate Condition Assessment.

6.6.2 Control, Protection, Auxiliary and Ancillary Equipment

Health indices and recommended replacement timeframes for substation secondary system equipment and associated ancillary equipment are tabled in the **Appendix document**.

6.7 Revenue Metering Equipment

There are 17 x metering NMIs allocated at South Pine Substation with MK3/MK6E meters for most of the following metering points:

- Fdr 7299
- Fdr 7341
- Fdr 7342
- Fdr 7344
- Fdr 7345
- Fdr 737
- Fdr 738
- Fdr 739
- Fdr 740
- Fdr 741
- Fdr 742
- Fdr 743
- Fdr 744
- Fdr 745
- Fdr 746
- Fdr 7504
- Fdr 8999

South Pine Substation metering equipment is detailed in a table below:

Functional Loc.	Manu facturer	Model number	Start-up date	Obsolescence (Yes / No)	Spare Qty	Material	Eff. Age	HI
H002-SSS-METR-7299CHK	EDMI	[redacted]	26/06/2009	Yes	11	15879	14.56	7.28
H002-SSS-METR-7299REV	EDMI		26/06/2009	Yes	11	15879	14.56	7.28
H002-SSS-METR-7341CHK	EDMI		28/12/2000	Yes	11	15879	23.05	11.53
H002-SSS-METR-7341REV	EDMI		3/11/2010	Yes	11	15879	13.21	6.60
H002-SSS-METR-7342CHK	EDMI		3/11/2010	Yes	11	15879	13.21	6.60
H002-SSS-METR-7342REV	EDMI		3/11/2010	Yes	11	15879	13.21	6.60
H002-SSS-METR-7344CHK	EDMI		31/10/2010	Yes	11	15879	13.21	6.61
H002-SSS-METR-7344REV	EDMI		31/10/2010	Yes	11	15879	13.21	6.61
H002-SSS-METR-7345CHK	EDMI		24/10/2010	Yes	11	15879	13.23	6.62
H002-SSS-METR-7345REV	EDMI		24/10/2010	Yes	11	15879	13.23	6.62
H002-SSS-METR-737CHK	EDMI		23/04/2010	Yes	11	15879	13.74	6.87
H002-SSS-METR-737REV	EDMI		12/01/2012	Yes	11	15879	12.01	6.01
H002-SSS-METR-738CHK	EDMI		22/04/2009	Yes	11	15879	14.74	7.37
H002-SSS-METR-738REV	EDMI		23/04/2010	Yes	11	15879	13.74	6.87
H002-SSS-METR-739CHK	EDMI		29/05/2009	Yes	11	15879	14.64	7.32
H002-SSS-METR-739REV	EDMI		29/05/2009	Yes	11	15879	14.64	7.32
H002-SSS-METR-740CHK	EDMI		5/06/2009	Yes	11	15879	14.62	7.31
H002-SSS-METR-740REV	EDMI		5/06/2009	Yes	11	15879	14.62	7.31
H002-SSS-METR-741CHK	EDMI		11/05/2009	Yes	11	15879	14.69	7.34
H002-SSS-METR-741REV	EDMI		11/05/2009	Yes	11	15879	14.69	7.34
H002-SSS-METR-742CHK	EDMI		17/05/2009	Yes	11	15879	14.67	7.34
H002-SSS-METR-742REV	EDMI		17/05/2009	Yes	11	15879	14.67	7.34
H002-SSS-METR-743CHK	EDMI		12/06/2009	Yes	11	15879	14.60	7.30
H002-SSS-METR-743REV	EDMI		12/06/2009	Yes	11	15879	14.60	7.30
H002-SSS-METR-744CHK	EDMI		18/06/2009	Yes	11	15879	14.58	7.29
H002-SSS-METR-744REV	EDMI		18/06/2009	Yes	11	15879	14.58	7.29

Functional Loc.	Manu facturer	Model number	Start-up date	Obsolescence (Yes / No)	Spare Qty	Material	Eff. Age	HI
H002-SSS-METR-745CHK	EDMI	[redacted]	16/04/2009	Yes	11	15879	14.76	7.38
H002-SSS-METR-745REV	EDMI		16/04/2009	Yes	11	15879	14.76	7.38
H002-SSS-METR-746CHK	EDMI		10/12/2020	Yes	28	42259	3.10	1.55
H002-SSS-METR-746REV	EDMI		9/12/2020	Yes	28	42259	3.11	1.55

Metering for Fdr 8700 and 8999 (both to H154 Kremzow) in building +6 are dated 2025 and include SEL735. The meters for the remaining metering points were all replaced with MK3 between 2009 and 2010. Meeting equipment MK3 type meters are obsolete, experience time drift issues and need to be replaced with major secondary system replacement by 2029-2030.

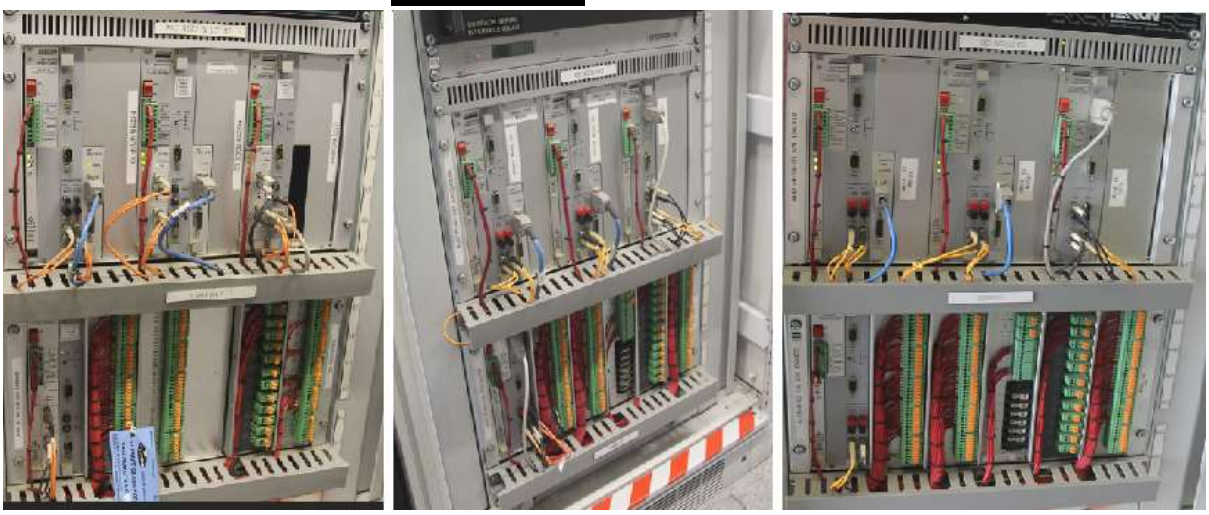
Revenue metering panel in Buildings +4, +6 and +7

6.8 SCADA and Automation

The existing SCADA system at H002 South Pine is in accordance with Powerlink SDM7 design standard, with three OptoNET rings (+2 and +6 for 275kV, 110kV West, 110kV East) covering RTUs in all control buildings, as detailed in the following table:

Functional Loc.	Manufacturer	Model number	Start-up date	Obsolescence (Yes / No)	Spare Qty	Material	Eff. Age	HI
H002-SSS-403--AUXCTRL	FOXBORO	[redacted]	23/04/2010	Yes	5	27350	13.74	6.87
H002-SSS-407--AUXCTRL	FOXBORO		24/10/2010	Yes	5	27350	13.23	6.62
H002-SSS-409--AUXCTRL	FOXBORO		16/04/2009	Yes	5	27350	14.76	7.38
H002-SSS-417--AUXCTRL	FOXBORO		16/04/2009	Yes	5	27350	14.76	7.38
H002-SSS-418--AUXCTRL	FOXBORO		16/04/2009	Yes	5	27350	14.76	7.38
H002-SSS-441--AUXCTRL	FOXBORO		27/05/2009	Yes	5	27350	14.64	7.32
H002-SSS-444--AUXCTRL	FOXBORO		13/05/2010	Yes	5	27350	13.68	6.84
H002-SSS-445--AUXCTRL	FOXBORO		23/04/2010	Yes	5	27350	13.74	6.87
H002-SSS-446--AUXCTRL	FOXBORO		16/04/2009	Yes	5	27350	14.76	7.38
H002-SSS-4471-AUXCTRL	FOXBORO		16/04/2009	Yes	5	27350	14.76	7.38
H002-SSS-4472-AUXCTRL	FOXBORO		16/04/2009	Yes	5	27350	14.76	7.38
H002-SSS-4811-AUXCTRL	FOXBORO		23/04/2010	Yes	5	27350	13.74	6.87
H002-SSS-4812-AUXCTRL	FOXBORO		24/10/2010	Yes	5	27350	13.23	6.62
H002-SSS-486--AUXCTRL	FOXBORO		16/04/2009	Yes	5	27350	14.76	7.38
H002-SSS-487--AUXCTRL	FOXBORO		16/04/2009	Yes	5	27350	14.76	7.38
H002-SSS-502--AUXCTRL	FOXBORO		21/07/2006	Yes	5	27350	17.49	8.75
H002-SSS-503--AUXCTRL	FOXBORO		14/12/2006	Yes	5	27350	17.09	8.55
H002-SSS-504--AUXCTRL	FOXBORO		12/10/2006	Yes	5	27350	17.27	8.63
H002-SSS-505--AUXCTRL	FOXBORO		6/06/2006	Yes	5	27350	17.62	8.81
H002-SSS-506--AUXCTRL	FOXBORO		5/07/2006	Yes	5	27350	17.54	8.77
H002-SSS-507--AUXCTRL	FOXBORO		3/08/2006	Yes	5	27350	17.46	8.73
H002-SSS-508--AUXCTRL	FOXBORO		13/12/2008	Yes	5	27350	15.09	7.55
H002-SSS-509--AUXCTRL	FOXBORO		13/12/2008	Yes	5	27350	15.09	7.55
H002-SSS-541--AUXCTRL	FOXBORO		18/09/2006	Yes	5	27350	17.33	8.67
H002-SSS-544--AUXCTRL	FOXBORO		7/06/2006	Yes	5	27350	17.61	8.81
H002-SSS-545--AUXCTRL	FOXBORO		21/07/2006	Yes	5	27350	17.49	8.75
H002-SSS-546--AUXCTRL	FOXBORO		13/12/2008	Yes	5	27350	15.09	7.55
H002-SSS-547--AUXCTRL	FOXBORO		13/12/2008	Yes	5	27350	15.09	7.55
H002-SSS-5810-AUXCTRL	FOXBORO		4/12/2008	Yes	5	27350	15.12	7.56
H002-SSS-583--AUXCTRL	FOXBORO		14/12/2006	Yes	5	27350	17.09	8.55
H002-SSS-584--AUXCTRL	FOXBORO		28/09/2006	Yes	5	27350	17.30	8.65
H002-SSS-588--AUXCTRL	FOXBORO		13/12/2008	Yes	5	27350	15.09	7.55
H002-SSS-589--AUXCTRL	FOXBORO		18/12/2008	Yes	5	27350	15.08	7.54
H002-SSS-5955-AUXCTRL	FOXBORO		14/12/2006	Yes	5	27350	17.09	8.55
H002-SSS-721--AUXCTRL	FOXBORO		23/04/2010	Yes	11	27352	13.74	6.87
H002-SSS-722--AUXCTRL	FOXBORO		30/04/2010	Yes	5	27350	13.72	6.86
H002-SSS-7299-AUXCTRL	FOXBORO		16/04/2009	Yes	5	27350	14.76	7.38
H002-SSS-7341-AUXCTRL	FOXBORO		25/10/2009	Yes	5	27350	14.23	7.11
H002-SSS-7342-AUXCTRL	FOXBORO		29/10/2009	Yes	5	27350	14.22	7.11
H002-SSS-7344-AUXCTRL	FOXBORO		31/10/2010	Yes	5	27350	13.21	6.61
H002-SSS-7345-AUXCTRL	FOXBORO		24/10/2010	Yes	5	27350	13.23	6.62
H002-SSS-737--AUXCTRL	FOXBORO		5/06/2010	Yes	5	27350	13.62	6.81
H002-SSS-738--AUXCTRL	FOXBORO		22/05/2010	Yes	5	27350	13.66	6.83
H002-SSS-739--AUXCTRL	FOXBORO		6/08/2009	Yes	5	27350	14.45	7.22
H002-SSS-740--AUXCTRL	FOXBORO		16/04/2009	Yes	5	27350	14.76	7.38
H002-SSS-741--AUXCTRL	FOXBORO		16/04/2009	Yes	5	27350	14.76	7.38
H002-SSS-742--AUXCTRL	FOXBORO		16/04/2009	Yes	5	27350	14.76	7.38
H002-SSS-743--AUXCTRL	FOXBORO		16/04/2009	Yes	5	27350	14.76	7.38
H002-SSS-744--AUXCTRL	FOXBORO		16/04/2009	Yes	5	27350	14.76	7.38
H002-SSS-745--AUXCTRL	FOXBORO		16/04/2009	Yes	5	27350	14.76	7.38
H002-SSS-746--AUXCTRL	FOXBORO		22/04/2009	Yes	5	27350	14.74	7.37
H002-SSS-807--AUXCTRL	FOXBORO		13/06/2006	Yes	5	27350	17.60	8.80
H002-SSS-808--AUXCTRL	FOXBORO		13/06/2006	Yes	5	27350	17.60	8.80
H002-SSS-809--AUXCTRL	FOXBORO		13/06/2006	Yes	5	27350	17.60	8.80
H002-SSS-825--AUXCTRL	FOXBORO		6/06/2006	Yes	5	27350	17.62	8.81
H002-SSS-832--AUXCTRL	FOXBORO		13/06/2006	Yes	5	27350	17.60	8.80
H002-SSS-838--AUXCTRL	FOXBORO		13/06/2006	Yes	5	27350	17.60	8.80

Functional Loc.	Manufacturer	Model number	Start-up date	Obsolescence (Yes / No)	Spare Qty	Material	Eff. Age	HI
H002-SSS-IONS-HDWR	DELL		1/07/2005	Yes	0		18.55	9.27
H002-SSS-IONS-HDWR	DELL		5/11/2019	Yes	0		4.20	5.53
H002-SSS-KC1--AUXCTRL	FOXBORO		14/12/2006	Yes	10	27351	17.09	8.55
H002-SSS-KC2--AUXCTRL	FOXBORO		6/06/2006	Yes	0	26407	17.62	8.81
H002-SSS-KD10-AUXCTRL	FOXBORO		16/04/2009	Yes	10	27515	14.76	7.38
H002-SSS-KD3--AUXCTRL	FOXBORO		23/04/2010	Yes	10	27515	13.74	6.87
H002-SSS-KD4--AUXCTRL	FOXBORO		23/04/2010	Yes	10	27515	13.74	6.87
H002-SSS-KD7--AUXCTRL	FOXBORO		16/04/2009	Yes	10	27515	14.76	7.38
H002-SSS-KD8--AUXCTRL	FOXBORO		16/04/2009	Yes	10	27515	14.76	7.38
H002-SSS-KD9--AUXCTRL	FOXBORO		16/04/2009	Yes	10	27515	14.76	7.38
H002-SSS-SAS--LCF	WYSE		17/07/2017	Yes	0	29180	13.01	6.50
H002-SSS-SAS--LCF	WYSE			Yes	0	29180		5.35
H002-SSS-SAS--LCF	WYSE		22/11/2017	Yes	1	40017	6.15	5.35
H002-SSS-SAS--LCF	SUN		14/10/2005	Yes	0	26626	36.52	18.26
H002-SSS-SAS--LCF	SUN			Yes	0	28784		0.00
H002-SSS-SAS--LCF	WYSE		20/12/2008	Yes	0	29180	30.15	15.08
H002-SSS-SAS--LCF	SUN		14/10/2005	Yes	0	26626	18.26	9.13
H002-SSS-SAS--LCF	HP			Yes	0	27399		
H002-SSS-SAS--LCF	SUN			Yes	0			
H002-SSS-SAS--RTU	FOXBORO		1/07/1978	Yes	0		45.55	22.77
H002-SSS-SAS--RTU	FOXBORO		1/07/1978	Yes	0		45.55	22.77
H002-SSS-SAS--RTU	FOXBORO		18/10/1999	Yes	0		24.25	12.12
H002-SSS-SAS--RTU	FOXBORO		18/10/1999	Yes	0		24.25	12.12
H002-SSS-SAS--RTU	FOXBORO		18/10/1999	Yes	0		24.25	12.12
H002-SSS-SAS--RTU	FOXBORO		18/10/1999	Yes	0		24.25	12.12
H002-SSS-SAS--RTU	FOXBORO		14/10/2005	Yes	0	17276	18.26	9.13
H002-SSS-SAS--RTU	FOXBORO		7/06/2006	Yes	11	27352	17.61	8.81
H002-SSS-SAS--RTU	FOXBORO		7/06/2006	Yes	0	27354	17.61	8.81
H002-SSS-SAS--RTU	FOXBORO		7/06/2006	Yes	0	27354	17.61	8.81
H002-SSS-SAS--RTU	FOXBORO		7/06/2006	Yes	0	27354	17.61	8.81
H002-SSS-SAS--RTU	FOXBORO		14/10/2005	Yes	0	26044	18.26	9.13
H002-SSS-SAS--RTU	FOXBORO		14/10/2005	Yes	0	26044	18.26	9.13
H002-SSS-SAS--RTU	FOXBORO		14/10/2005	Yes	0	26044	18.26	9.13
H002-SSS-SAS--RTU	FOXBORO		13/12/2008	Yes	0	17276	15.09	7.55
H002-SSS-SAS--RTU	FOXBORO		23/04/2010	Yes	0	27354	13.74	6.87
H002-SSS-SAS--RTU	FOXBORO		23/04/2010	Yes	0	27354	13.74	6.87
H002-SSS-SAS--RTU	FOXBORO		23/04/2010	Yes	0	27354	13.74	6.87
H002-SSS-SAS--RTU	FOXBORO		23/04/2010	Yes	0	17276	13.74	6.87
H002-SSS-SAS--RTU	FOXBORO		13/12/2008	Yes	0	17276	15.09	7.55
H002-SSS-SAS--RTU	FOXBORO		13/12/2008	Yes	0	17276	15.09	7.55
H002-SSS-SVC--AUXCTRL	FOXBORO		20/12/2008	Yes	2	27361	15.08	7.54



NSC Link and Common RTUs in Buildings +2, +4 and +7 respectively

Link RTUs (NSC1/NSC2) for one OptoNET ring provide two redundant communication paths between the substation and NSC and are used for communicating alarms, plant status, monitoring, telemetry, as well as substation remote control from Virginia. These RTUs are obsolete and need to be replaced as part of the secondary systems replacement project.

[redacted] Workstation is a Rev. 7 design used for the local control for substation's HV network . There are no spares available. This equipment needs to be replaced with major secondary system

[redacted] were installed between 2006 and 2010 in various site buildings provide local visibility and control by running a remote-control session of the [redacted]

6.9 Special Schemes

Power system monitoring and Wide Area Monitoring Protection & Control systems have been installed at South Pine Substation, including High Speed Monitoring (HSM) and Power Quality Monitoring (PQM, WAMPAC and are detailed in this paragraph.

6.9.1 Power System Monitoring

Power System Monitoring such as HSM (+6C14) and PQM (+6B4) have been installed at H002 South Pine substation.

HSM in Building +6

A variety of HSM devices HSM IDM 32CH, HSM IDM 16CH, HSM IDM 9CH were installed between 2009 and 2017 and PQM UP-2210-R were installed between 2014 and 2025, and there is no condition-driven replacement required until 2035 and 2037.

6.9.2 Phasor Measurement Unit

Phasor Measurement Unit for Feeder 838 was installed at H002 South Pine. These PMU data is streamed to AEMO for system security performance assessment. It needs to be replaced by 2035.

6.9.3 WAMPAC – Wide Area Monitoring Protection and Control

WAMPAC scheme across the network has been utilised to maintain the system stability. WAMPAC has been installed at H003 H002 South Pine Substation. Associated requirements need to be reviewed with Planning with major secondary system replacement.

6.10 Integrated Operation and Network Service (IONS)

IONS (Integrated Operation and Network Service), former OpsWAN systems and equipment at this site were installed from 2006 and are detailed in the table below:

Functional Loc.	Manufacturer	Model number	Start-up date	Obsolescence (Yes / No)	Spare Qty	Material	Eff. Age	HI
H002-SSS-IONS-HDWR		[redacted]	5/11/2019	Yes	0		4.20	2.10
H002-SSS-IONS-HDWR	VIDEO CAMERA		7/10/2021	No	5	33869	2.28	5.84
H002-SSS-IONS-HDWR	VIDEO CAMERA		20/04/2020	No	5	33869	3.74	5.32
H002-SSS-IONS-HDWR	VIDEO CAMERA		27/01/2016	No	5	33869	15.95	7.97
H002-SSS-IONS-HDWR	VIDEO CAMERA		20/04/2020	No	5	33869	3.74	5.32
H002-SSS-IONS-HDWR	VIDEO CAMERA		27/01/2017	No	5	33869	13.94	6.97
H002-SSS-IONS-HDWR	VIDEO CAMERA		27/01/2016	No	5	33869	15.95	7.97
H002-SSS-IONS-HDWR	VIDEO CAMERA		30/06/2021	No	5	33869	5.10	5.32
H002-SSS-IONS-HDWR	DC/DC CONVERTER		20/12/2008	No	5	27643	15.08	7.54
H002-SSS-IONS-HDWR	DC/AC INVERTER		5/11/2019	Yes	0		4.20	3.71
H002-SSS-IONS-HDWR	DC/AC INVERTER		5/11/2019	Yes	0		4.20	3.71
H002-SSS-IONS-HDWR	DC/AC INVERTER		5/11/2019	Yes	0		4.20	3.71
H002-SSS-IONS-HDWR	DC/AC INVERTER		5/11/2019	Yes	0		4.20	3.71
H002-SSS-IONS-HDWR	DC/AC INVERTER		1/07/2015	Yes	5	25941	8.55	4.27
H002-SSS-IONS-HDWR	DC/AC INVERTER		14/10/2005	Yes	5	25941	18.26	9.13
H002-SSS-IONS-HDWR	DC/AC INVERTER		23/04/2010	Yes	5	25941	13.74	6.87
H002-SSS-IONS-HDWR	DC/AC INVERTER		11/10/2017	Yes	0		6.27	3.13
H002-SSS-IONS-HDWR	DC/AC INVERTER		16/04/2009	Yes	5	25941	14.76	7.38
H002-SSS-IONS-HDWR	DC/AC INVERTER		5/11/2019	No	0		4.20	2.10
H002-SSS-IONS-HDWR	DC/AC INVERTER		5/11/2019	No	0		4.20	2.10
H002-SSS-IONS-HDWR	DC/AC INVERTER		5/11/2019	No	0		4.20	2.10
H002-SSS-IONS-HDWR	DC/AC INVERTER		1/12/2007	No	0		16.13	8.06
H002-SSS-IONS-HDWR	DC/AC INVERTER		5/11/2019	No	0		4.20	2.10
H002-SSS-IONS-HDWR	Monitors		1/07/2005	Yes	0		18.55	9.27
H002-SSS-IONS-HDWR	Monitors		5/11/2019	Yes	0		4.20	2.10

Functional Loc.	Manufacturer	Model number	Start-up date	Obsolescence (Yes / No)	Spare Qty	Material	Eff. Age	HI
H002-SSS-IONS-HDWR	Monitors	[redacted]	1/07/2005	Yes	0		18.55	9.27
H002-SSS-IONS-HDWR	PRINTER	[redacted]	20/12/2008	Yes	0	26840	15.08	7.54
H002-SSS-IONS-HDWR	PRINTER	[redacted]	6/03/2019	No	4	37469	4.87	2.43
H002-SSS-IONS-HDWR	NETW EQUIPMENT	[redacted]		Yes	7	29023		0.00
H002-SSS-IONS-HDWR	NETW EQUIPMENT	[redacted]	1/02/2008	Yes	7	29023	15.96	7.98
H002-SSS-IONS-HDWR	NETW EQUIPMENT	[redacted]	1/02/2008	Yes	7	29023	15.96	7.98
H002-SSS-IONS-HDWR	NETW EQUIPMENT	[redacted]	1/02/2008	Yes	7	29023	15.96	7.98
H002-SSS-IONS-HDWR	NETW EQUIPMENT	[redacted]	1/02/2008	Yes	7	29023	15.96	7.98
H002-SSS-IONS-HDWR	NETW EQUIPMENT	[redacted]	1/12/2007	Yes	7	29023	16.13	8.06
H002-SSS-IONS-HDWR	NETW EQUIPMENT	[redacted]	1/12/2007	Yes	7	29023	16.13	8.06
H002-SSS-IONS-HDWR	NETW EQUIPMENT	[redacted]	1/12/2007	Yes	7	29023	16.13	8.06
H002-SSS-IONS-HDWR	NETW EQUIPMENT	[redacted]	1/12/2007	Yes	7	29023	16.13	8.06
H002-SSS-IONS-HDWR	NETW EQUIPMENT	[redacted]	1/12/2007	Yes	7	29023	16.13	8.06
H002-SSS-IONS-HDWR	NETW EQUIPMENT	[redacted]	1/12/2007	Yes	7	29023	16.13	8.06
H002-SSS-IONS-HDWR	NETW EQUIPMENT	[redacted]	1/12/2007	Yes	7	29023	16.13	8.06
H002-SSS-IONS-HDWR	NETW EQUIPMENT	[redacted]	1/12/2007	Yes	7	29023	16.13	8.06
H002-SSS-IONS-HDWR	NETW EQUIPMENT	[redacted]	1/02/2009	Yes	7	29023	14.96	7.48
H002-SSS-IONS-HDWR	NETW EQUIPMENT	[redacted]	1/12/2007	Yes	7	29023	16.13	8.06
H002-SSS-IONS-HDWR	NETW EQUIPMENT	[redacted]	1/12/2007	Yes	7	29023	16.13	8.06
H002-SSS-IONS-HDWR	NETW EQUIPMENT	[redacted]	1/12/2007	Yes	7	29023	16.13	8.06
H002-SSS-IONS-HDWR	Monitors	[redacted]	1/07/2005	Yes	0		18.55	9.27
H002-SSS-IONS-HDWR	Monitors	[redacted]	5/11/2019	Yes	0		4.20	5.53
H002-SSS-IONS-NTWK	NETW EQUIPMENT	[redacted]	1/05/2017	Yes	0		6.71	9.12
H002-SSS-IONS-NTWK	NETW EQUIPMENT	[redacted]	22/11/2018	Yes	0	38819	5.15	6.43
H002-SSS-IONS-NTWK	DWDM OADM	[redacted]	1/12/2022	No	15	43302	1.13	0.56
H002-SSS-IONS-NTWK	NETWORK EQUIPMENT	[redacted]	29/12/2020	Yes	6	40228	3.05	1.53
H002-SSS-IONS-NTWK	NETWORK EQUIPMENT	[redacted]	29/12/2020	Yes	6	40228	3.05	1.53
H002-SSS-IONS-NTWK	NETW EQUIPMENT	[redacted]	1/05/2017	Yes	7	29023	6.71	3.36
H002-SSS-IONS-NTWK	NETW EQUIPMENT	[redacted]	1/12/2007	Yes	7	29023	16.13	8.06
H002-SSS-IONS-NTWK	NETWORK EQUIPMENT	[redacted]	24/09/1999	Yes	0		48.63	24.32
H002-SSS-IONS-NTWK	PORT SERVER	[redacted]	1/07/2008	Yes	9	27733	15.55	7.77
H002-SSS-IONS-NTWK	PORT SERVER	[redacted]	1/02/2008	Yes	9	27733	15.96	7.98
H002-SSS-IONS-NTWK	PORT SERVER	[redacted]	1/02/2008	Yes	9	27733	15.96	7.98
H002-SSS-IONS-NTWK	PORT SERVER	[redacted]	5/11/2019	Yes	9	27733	4.20	3.64
H002-SSS-IONS-NTWK	PORT SERVER	[redacted]	1/12/2007	Yes	9	27733	16.13	8.06
H002-SSS-IONS-NTWK	PORT SERVER	[redacted]	1/12/2007	Yes	9	27733	16.13	8.06
H002-SSS-IONS-NTWK	PORT SERVER	[redacted]	1/12/2007	Yes	9	27733	16.13	8.06
H002-SSS-IONS-NTWK	PORT SERVER	[redacted]	5/11/2019	Yes	9	27733	4.20	3.64
H002-SSS-IONS-NTWK	PORT SERVER	[redacted]	5/11/2019	Yes	9	27733	4.20	3.64
H002-SSS-IONS-NTWK	PORT SERVER	[redacted]	5/11/2019	Yes	9	27733	4.20	3.64
H002-SSS-IONS-NTWK	PORT SERVER	[redacted]	5/11/2019	Yes	9	27733	4.20	3.64
H002-SSS-IONS-NTWK	PORT SERVER	[redacted]	1/07/2005	Yes	9	27733	18.55	9.27
H002-SSS-IONS-NTWK	PORT SERVER	[redacted]	1/12/2007	Yes	9	27733	16.13	8.06
H002-SSS-IONS-NTWK	PORT SERVER	[redacted]	5/11/2019	Yes	9	27733	4.20	3.64
H002-SSS-IONS-NTWK	PORT SERVER	[redacted]	1/02/2009	Yes	9	27733	14.96	7.48
H002-SSS-IONS-NTWK	PORT SERVER	[redacted]	5/11/2019	Yes	9	27733	4.20	3.64
H002-SSS-IONS-NTWK	NETWORK EQUIPMENT	[redacted]	20/12/2008	Yes	4	29868	30.15	15.08
H002-SSS-IONS-NTWK	NETWORK EQUIPMENT	[redacted]	20/12/2008	Yes	4	29868	30.15	15.08
H002-SSS-IONS-NTWK	NETWORK EQUIPMENT	[redacted]	29/01/2020	No	3	30818	3.97	3.66
H002-SSS-IONS-NTWK	NETWORK EQUIPMENT	[redacted]	29/01/2020	No	3	30818	7.94	3.97
H002-SSS-IONS-NTWK	NETWORK EQUIPMENT	[redacted]	1/02/2009	No	3	30818	14.96	7.48
H002-SSS-IONS-NTWK	NETWORK EQUIPMENT	[redacted]	1/05/2008	Yes	17	27400	15.71	7.86
H002-SSS-IONS-NTWK	NETWORK EQUIPMENT	[redacted]	1/07/2005	Yes	17	27400	18.55	9.27
H002-SSS-IONS-NTWK	NETWORK EQUIPMENT	[redacted]	1/02/2008	Yes	17	27400	15.96	7.98
H002-SSS-IONS-NTWK	NETWORK EQUIPMENT	[redacted]	1/12/2007	Yes	17	27400	16.13	8.06

Functional Loc.	Manufacturer	Model number	Start-up date	Obsolescence (Yes / No)	Spare Qty	Material	Eff. Age	HI
H002-SSS-IONS-NTWK	NETWORK EQUIPMENT	[redacted]	1/12/2007	Yes	17	27400	16.13	8.06
H002-SSS-IONS-NTWK	NETWORK EQUIPMENT		1/04/2017	Yes	6	27632	13.59	6.80
H002-SSS-IONS-NTWK	NETWORK EQUIPMENT		1/05/2017	Yes	6	27632	6.71	4.71
H002-SSS-IONS-NTWK	NETWORK EQUIPMENT		11/10/2017	Yes	6	27632	6.27	4.71
H002-SSS-IONS-NTWK	NETWORK EQUIPMENT		1/12/2007	Yes	6	27632	16.13	8.06
H002-SSS-IONS-NTWK	NETWORK EQUIPMENT		1/12/2007	Yes	6	27632	16.13	8.06
H002-SSS-IONS-NTWK	NETWORK EQUIPMENT		1/12/2007	Yes	6	27632	16.13	8.06
H002-SSS-IONS-NTWK	NETWORK EQUIPMENT		1/12/2007	Yes	6	27632	16.13	8.06
H002-SSS-IONS-NTWK	NETWORK EQUIPMENT		1/07/2005	Yes	6	27632	18.55	9.27
H002-SSS-IONS-NTWK	NETWORK EQUIPMENT		5/11/2019	Yes	6	27632	4.20	4.71
H002-SSS-IONS-NTWK2	NETW EQUIPMENT		1/07/2017	Yes	0	25948	6.55	3.27
H002-SSS-IONS-NTWK2	NETW EQUIPMENT		1/07/2017	Yes	0	25948	6.55	3.27
H002-SSS-IONS-NTWK2	NETW EQUIPMENT		1/07/2017	Yes	0	25948	6.55	3.27
H002-SSS-IONS-NTWK2	NETW EQUIPMENT		1/07/2017	Yes	0	25948	6.55	3.27
H002-SSS-IONS-NTWK2	PORT SERVER		7/06/2006	Yes	0	27397	35.23	17.61
H002-SSS-IONS-NTWK2	PORT SERVER			Yes	0	27397		4.69
H002-SSS-IONS-NTWK2	NETWORK EQUIPMENT		1/07/2017	Yes	0	27392	6.55	3.97
H002-SSS-IONS-NTWK2	NETWORK EQUIPMENT			Yes	0	27392		3.97
H002-SSS-IONS-NTWK3	PORT SERVER		14/10/2005	Yes	0	25945	36.52	18.26
H002-SSS-IONS-NTWK3	NETWORK EQUIPMENT		14/10/2005	Yes	0	27392	36.52	18.26
H002-SSS-IONS-NTWK3	NETWORK EQUIPMENT		14/10/2005	Yes	0	27392	36.52	18.26
H002-SSS-IONS-NTWK4	NETWORK EQUIPMENT		29/12/2020	Yes	10	39260	3.05	1.53
H002-SSS-IONS-NTWK4	NETWORK EQUIPMENT		29/12/2020	Yes	10	39260	3.05	1.53
H002-SSS-IONS-NTWK4	NETWORK EQUIPMENT		29/12/2020	Yes	10	39260	3.05	1.53
H002-SSS-IONS-NTWK4	NETWORK EQUIPMENT		29/12/2020	Yes	10	39260	3.05	1.53
H002-SSS-IONS-NTWK5	NETWORK EQUIPMENT		29/12/2020	Yes	10	39260	3.05	1.53
H002-SSS-IONS-NTWK5	NETWORK EQUIPMENT		29/12/2020	Yes	10	39260	3.05	1.53
H002-SSS-IONS-NTWK5	NETWORK EQUIPMENT		29/12/2020	Yes	10	39260	3.05	1.53
H002-SSS-IONS-NTWK5	NETWORK EQUIPMENT		29/12/2020	Yes	10	39260	3.05	1.53
H002-SSS-IONS-NTWK7	NETWORK EQUIPMENT		29/12/2020	Yes	10	39260	3.05	1.53
H002-SSS-IONS-NTWK7	NETWORK EQUIPMENT		29/12/2020	Yes	10	39260	3.05	1.53
H002-SSS-IONS-NTWK7	NETWORK EQUIPMENT		1/02/2017	Yes	7	29023	6.96	3.48
H002-SSS-IONS-NTWK7	NETWORK EQUIPMENT		1/02/2017	Yes	7	29023	6.96	3.48
H002-SSS-IONS-NTWK7	PORT SERVER		23/04/2010	Yes	0	25945	27.47	13.74
H002-SSS-IONS-NTWK7	PORT SERVER		23/04/2010	Yes	0	25945	27.47	13.74
H002-SSS-IONS-NTWK7	NETWORK EQUIPMENT		1/02/2017	Yes	17	27400	6.96	4.55

Functional Loc.	Manufacturer	Model number	Start-up date	Obsolescence (Yes / No)	Spare Qty	Material	Eff. Age	HI
H002-SSS-IONS-NTWK7	NETWORK EQUIPMENT	[redacted]	20/02/2012	No	3	30818	23.82	11.91
H002-SSS-IONS-NTWK7	NETWORK EQUIPMENT	[redacted]	23/04/2010	Yes	6	27632	27.47	13.74

OpsWAN systems are still functioning and have an important role in the monitoring and maintenance of operational equipment. Their condition and performance generally do not have material impacts on the performance, reliability and availability of secondary systems.

Indoor IONS systems and present in buildings +1, +2, +4, +6 and +7. As the Data Network at South Pine is setup as a flat LAN, significant changes in hardware and configurations are envisaged with a secondary systems replacement project.

OpsWAN cameras (outdoor OpsWAN equipment), as they were installed in 2020, should only be replaced under corrective maintenance upon failure and shall be excluded from secondary system refurbishment projects. Ensure compliance with the findings of ETR 10434041 OpsWAN camera lowering device trial – task report (Objective ID: A982111).

Typical Station panels

6.11 Auxiliary Supplies

6.11.1 AC Supplies

Local AC 400VAC supplies for both 110kV and 275kV switch yards are organised in two separate systems (East and West) each supplied from 2x11kV Energex feeders, via Station Services Transformers and two outdoor AC changeover boards. Two diesel generators provide the Emergency supplies for the two East and West switchyard area systems.

This arrangement complies with the current Powerlink substation AC supply requirements.

Pad-mount Station Services transformer

Diesel Generator and AC change-over board with a weather cover

The two AC change-over boards were installed in 2005-2007 and there is no condition driven replacement required until 2047.

The AC distribution boards in building +1 were installed when the building was established in 1963 and had subsequent changes. Since a Secondary Systems upgrade is unlikely to affect this building, the AC boards will need to be assessed separately, should the need arise. A similar approach can be used when the AC distribution boards are assessed in the two workshops +9 and +10.

The AC distribution boards in the demountable buildings +2, +4, +6, +5, +7 were installed at the same time with the buildings. Although newer than the boards in the other buildings, they will need to be assessed for suitability (RCD, Arc-Flash, any Neutral-Earth links) as part of the substantial secondary systems replacement project.

Typical AC distribution board (building +6)

6.11.2 DC Supplies

The DC systems in the demountable buildings were installed when the buildings were first delivered and has subsequent changes:

- Building +2 125Vdc X System replaced 2025, battery bank 2022
- Building +2 125Vdc Y System replaced 2010, battery bank 2023
- Building +4 125Vdc X System replaced 2009, battery bank 2022
- Building +4 125Vdc Y System replaced 2009, battery bank 2022
- Building +5 125Vdc X System replaced 2009, battery bank 2022
- Building +5 125Vdc Y System replaced 2009, battery bank 2022
- Building +6 125Vdc X System replaced 2008, battery bank 2022
- Building +6 125Vdc Y System replaced 2008, battery bank 2023
- Building +7 125Vdc X System replaced 2010, battery bank 2023
- Building +7 125Vdc Y System replaced 2010, battery bank 2023
- Building +1 50Vdc Comms A System replaced 2017, battery bank 2023
- Building +1 50Vdc Comms BX System replaced 2017, battery bank 2023

With the exception of the X System in Building +2 (still needs to be confirmed on site), the rectifier racks in the other DC Systems are recommended for replacement by 2030.

A typical DC system at South Pine

The AC and DC distribution boards in building +3, +4, +4 and +6 between 2009 and 2010 and are in good condition. There are no condition driven replacement required until 2049-2050.

7 Foreseeable Primary Replacement Plan

There is no foreseeable significant primary replacement planned for the next 10 years.

8 Conclusion

This report details the condition of H002 South Pine substation secondary systems. The primary objective of the optimal replacement timeframe is to maintain the current network reliability and availability and to minimise operational and compliance risks associated with secondary systems assets.

Based on the condition assessment, the main recommendations for the replacement of secondary systems equipment at South Pine substation are:

Stage 1 - Conduct the following secondary system replacements by 2028:-

- Replace all 275kV Secondary Systems by 2028 with the exceptions below
- Although the Secondary Systems associated with Fdrs 8700 and 8999 are dated 2025, they will be required to undergo significant changes to integrate with the new Secondary Systems (subject to a detailed design assessment)
- Revenue metering in Building +6 is dated 2025 and will be integrated in the new Secondary Systems (subject to a detailed design assessment)

Stage 2 – Conduct the following secondary system replacements by 2029

- Replace all 110kV West and East switchyards Secondary Systems

These recommendations take account of the following considerations:

- The age factor for SDM7 protection and control equipment indicates that individual IEDs are reaching the end of their design life. It is known that failure rates generally double in the period between 20 and 25 years milestone. Based on earlier failure data, Powerlink have already carried out a proactive replacement of power supply modules on SDM7 GE protection relays. The installed relays however continue to deteriorate.

- Appendix 1 for H002 South Pine includes equipment comprehensive details on obsolescence, health index and available spares, based on which and secondary systems replacement is recommended at 20 years.

- With the majority of the relay and RTU installed population at H002 dating from 2006-2008, a small number of panels are relatively younger. Given the small number of relatively young panels it is considered necessary to replace all panels at this time, as the cost of operating two parallel systems as well as interfacing new and old will be prohibitive and will result in reduced overall functionality. At the start of the project every effort will be made to preserve and reuse whatever equipment is possible.

- The age factor also points to another set of challenges: 20 year old protection and control equipment are obsolete, no longer Vendor supported, cannot be procured in the compatible configurations and repairs are either no longer possible or uneconomical.

- SDM7 secondary systems spares are low and particularly bay controllers (C50 RTUs) spares stocks are critically low. It is envisaged that there is a benefit in targeting a larger site (H002) for replacement, as Powerlink can recover a larger number of SDM7 protection relays and RTUs. Although not ideal and knowing that a proportion of those recovered can no longer be put in service, a finite number can be selected to help sustain similar equipment in smaller sites until they are replaced under a project.

9 Appendix

H002 South Pine Secondary Systems CA Appendix

10 Distribution List

Divisional Distribution	Contact details
Chief Executive	N/A
Delivery and Technical Solutions	Manger Secondary System Design Team Leader Commissioning
Finance and Governance	N/A
Network and Business Development	Manager Asset Strategies
Operations and Service Delivery	Team Leader Secondary System Support
People and Corporate Services	N/A

Planning Report	29 August 2025
Title	CP.03197 South Pine 275kV Secondary Systems Replacement - Planning Statement
Zone	Moreton
Need Driver	Emerging compliance risks arising from condition and obsolescence of South Pine 275kV ageing secondary systems.
Network Limitations and statutory requirements	South Pine 275kV Substation is required to meet Powerlink Queensland's N-1-50MW/600MWh Transmission Authority reliability standards.
Pre-requisites	None

Executive Summary

South Pine Substation services a number of significant load centres in South East Queensland, and features five 275/110kV transformers split over two electrically isolated 110kV buses.

South Pine is a significant bulk supply point, supplying load to North Brisbane and Brisbane's CBD. The substation also includes a 275kV Static Var Compensator (SVC), instrumental in providing dynamic reactive power support in the region.

The Central scenario load forecast confirms there is an enduring need to maintain electricity supply to the South Pine west and east 110kV busses. Failing to address emerging condition and safety risks associated with the secondary systems will violate Powerlink's N-1-50MW/600MWh Transmission Authority reliability standard.

The 275kV circuits switched at South Pine are also critical for the supply of this load but also to allow power transfers through and into Sout East Queensland

Ageing and obsolete 275kV secondary systems at South Pine Substation, as defined in Reference [1], are increasingly at risk of failing to comply with Schedule 5.1.9(c) of the National Electricity Rules and AEMO's Power System Security Guidelines[1].

The preferred network solution for Powerlink to continue to meet its statutory obligations is the replacement of the at-risk 275kV secondary systems equipment.

[1] AEMO, Power System Operating Procedure SO_OP_3715, Power System Security Guidelines, V105, June 2024 (the Rules require AEMO to develop and publish Power System Operating Procedures pursuant to clause 4.10.1(b) of the Rules, which Powerlink must comply with per clause 4.10.2(b)).

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1. Introduction

The South Pine Substation (H002), established in 1963 provides essential switching and injection of power from Central and Southwest Queensland to Southeast Queensland loads. South Pine substation acts as a bulk supply point for suburbs in North Brisbane and Brisbane CBD.

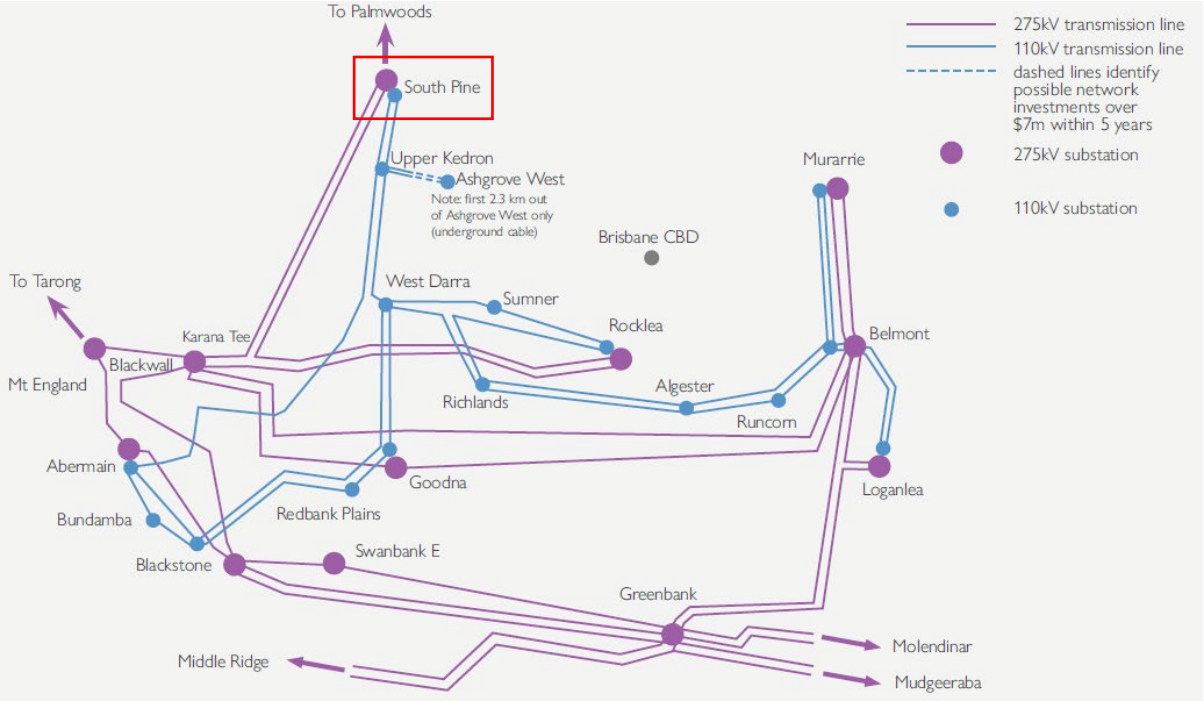

Figure 1. South Pine Substation – Moreton

The condition assessment [1] confirmed end of technical service life of the South Pine 275kV secondary systems equipment. There are condition and obsolescence issues, and related operational, safety and compliance risks with these assets remaining in service. Increasing failure rates, along with the increased time to rectify faults due to the obsolescence of the equipment, significantly affects the availability and reliability of these systems and their ability to continue to meet the requirements of the National Electricity Rules (the Rules).

In addition to the site-specific impacts of obsolescence at South Pine Substation, it is also important to note the compounding impact of equipment obsolescence occurring across the fleet of secondary systems assets installed in the Powerlink network. Running multiple secondary systems to failure across the network increases the likelihood of concurrent systemic faults with significant implications on network reliability and safety.

This report assesses the impact that removal of the functionality enabled by the at-risk secondary systems would have on the performance of the network and Powerlink's statutory obligations. It also establishes the indicative requirements of any potential alternative solutions to the current services provided by South Pine 275kV Substation.

2. H002 South Pine Substation configuration

The operational diagram of the South Pine Substation is shown in Figure 2. The 275kV bus connects:

1. A 275kV single circuit overhead line to Palmwoods

2. A 275kV single circuit overhead line to Woolooga
3. A 275kV single circuit overhead line to Tarong
4. A 275kV single circuit overhead line to Mt. England
5. A 275kV single circuit overhead line to Blackwall
6. A 275kV single circuit overhead line to Rocklea
7. A 275kV 200MVA SVC

Figure 1. South Pine 275kV - Substation Line Dagram

3. South Pine 275kV Demand Forecast

The South Pine 275kV Substation supplies North Brisbane and the Brisbane CBD. The 275kV secondary systems play a vital role in supporting the delivery of loads to these areas and maintain power transfer capability both into and through South East Queensland.

A full breakdown of the loads can be found in Appendix A – Load Mapping Methodology.

Figures 3 shows the maximum demand at South Pine 275kV, east and west combined. South Pine is forecasted to experience continuous growth in the coming years.

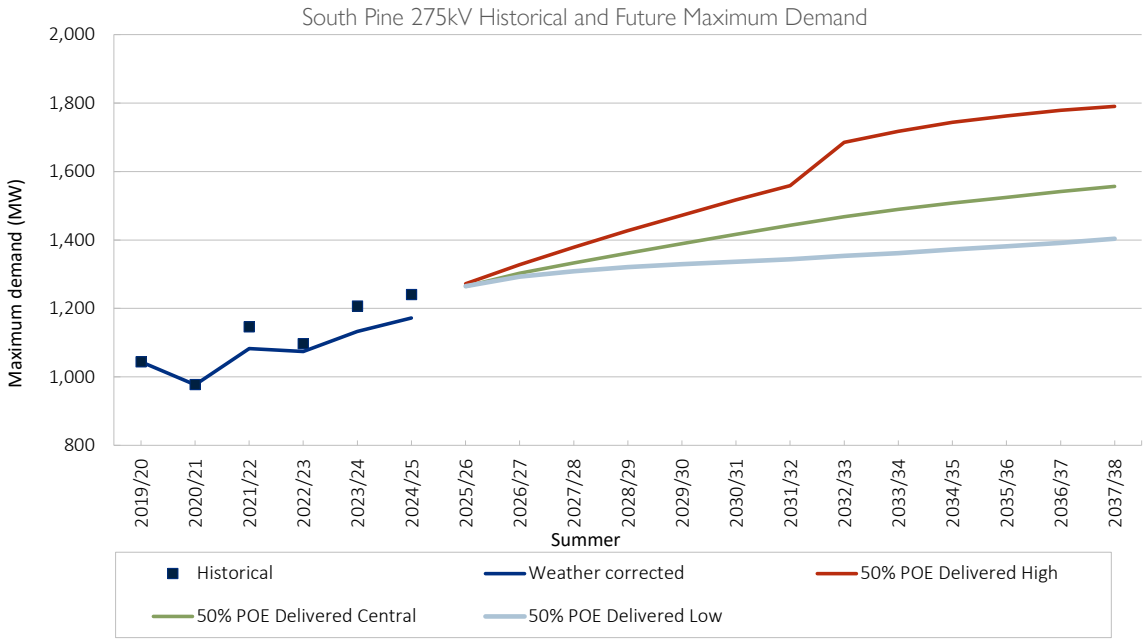

Figure 3. South Pine 275kV - Forecasted Maximum Demand

Figure 4 show the load duration curve for the delivered demand (i.e. with the contribution from the rooftop PV included).

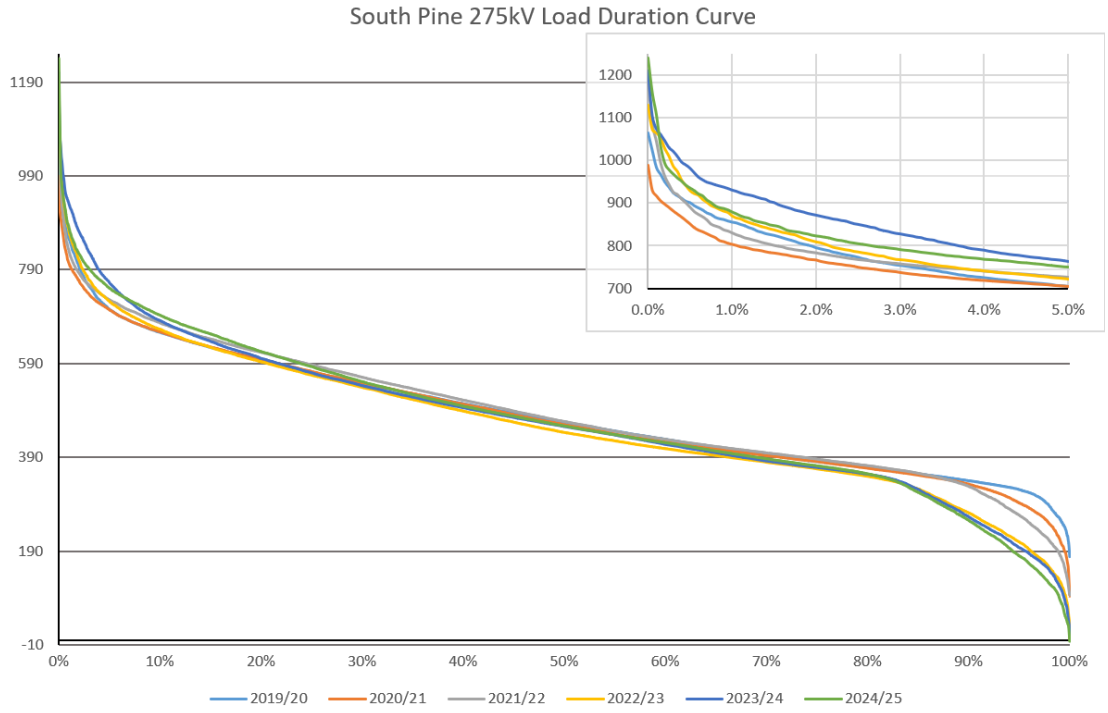

Figure 4. South Pine 275kV Load Duration Curve (rooftop PV in-service)

With consideration of rooftop PV within the Energex network, the maximum customer load is significantly higher. Figure 5 shows the average contribution from rooftop PV during summer.

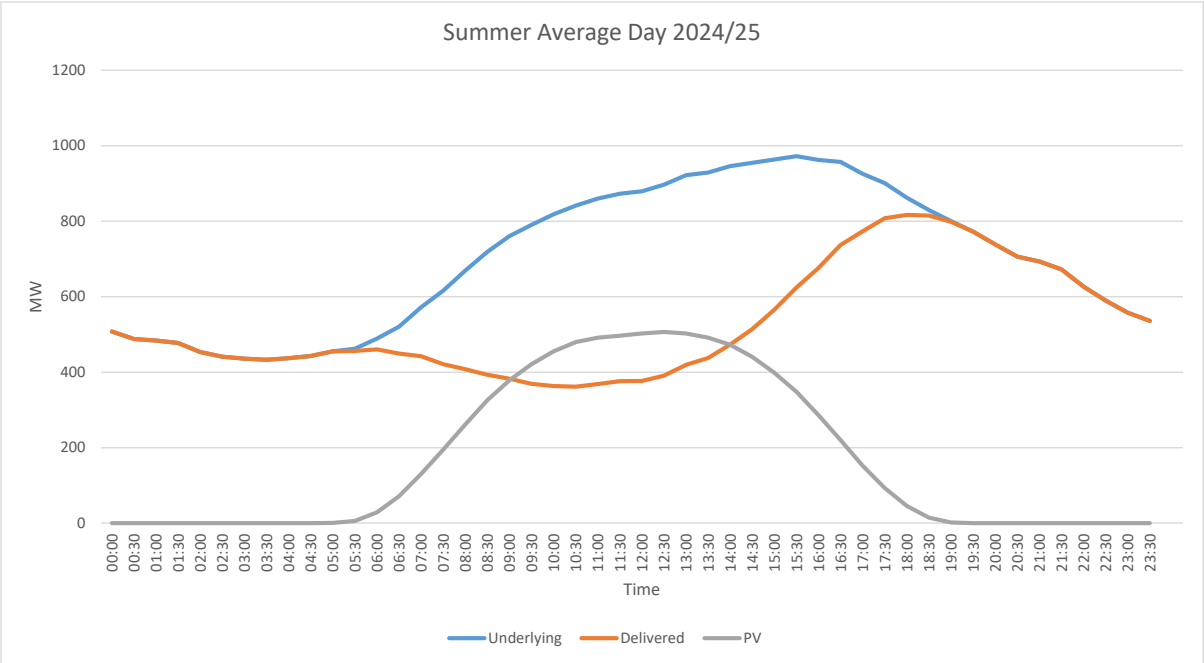

Figure 5. South Pine 275kV Forecasted Maximum Demand

4. Statement of Investment Need

The South Pine 275kV Substation supplies load to North Brisbane and the Brisbane CBD via five 275/110kV transformers. The substation also performs a major switch function for 275kV circuits from the south west and Central Queensland. This is critical for maintaining power transfer capability both into and through South Pine.

Therefore, addressing the risks arising from the condition of the secondary systems by removing the functionality of the South Pine 275kV Substation would have a major impact on both Powerlink's network and Energy Queensland's network in South East Queensland.

Thus, replacement of the secondary systems at South Pine is required to allow continued operation of the substation and maintain power transfer capability and avoid system failures that would result in loss of load exceeding Powerlink's N-1-50MW / 600MWh Transmission Authority reliability standard.

5. Network Risk

Table 1 define the maximum and average forecast load suppled (i.e. “Delivered”) from South Pine 275kV east and west bus. The “Underlying” load values represent the actual customer load (i.e. exclude the contribution from rooftop PV). For methodology regarding load mapping, see Appendix A.

Table 1. Load Data – South Pine 275kV Substation

Measure	2024/25	2034/35
Max Underlying Load (MW)	1,439	2,136
Avg Underlying Load (MW)	611	795
Max Delivered Load (MW)	1,240	1,438
Avg Delivered Load (MW)	471	546

Tables 2 and 3 summarise the load and energy at risk, for loads supplied from the South Pine Substation at 275kV. The underlying load considers the expected level of rooftop PV connected to the Energex network. This level of rooftop PV is discounted to capture the total level of customer load at risk of not being supplied.

South Pine 275kV connects to two separate 110kV busses, isolated from one another. The 110kV east bus supplies load into North Brisbane. The 110kV west bus supplies load into Brisbane’s CBD.

Table 2. South Pine 275kV

At Risk	Contingency	Measure	2025 underlying	2034 underlying	2025 delivered	2034 delivered
Brisbane CBD	South Pine – Rocklea (809) followed by trip of Blackwall-Rocklea (8818)	Max Load > Contingency Capacity (MW)	403	523	348	392
		Average Load > Contingency Capacity[1] (MW)	1	7	0	6
		24h Energy Constrained Max (MWh)	1,623	3,305	1,477	2,960
		24h Energy Constrained Average (MWh)	13	160	12	151
Sunshine Coast	South Pine – Palmwoods (808) followed by trip of Woolooga - Palmwoods (810)	Max Load > Contingency Capacity (MW)	611	983	376	385
		Average Load > Contingency Capacity[1] (MW)	32	70	24	64
		24h Energy Constrained Max (MWh)	4,722	4,675	2,229	2,892

At Risk	Contingency	Measure	2025 underlying	2034 underlying	2025 delivered	2034 delivered
		24h Energy Constrained Average (MWh)	761	1,673	582	1,545

Table 3. South Pine 110kV loads at risk

At Risk	Contingency	Measure	2025 underlying	2034 underlying	2025 delivered	2034 delivered
Brisbane CBD West, Stafford	275kV/110kV Transformers (T4 & T5)[1]	Max Load > Contingency Capacity (MW)	84	177	71	164
		Average Load > Contingency Capacity (MW)	0	7	0	6
		24h Energy Constrained Max (MWh)	347	1,599	280	1,350
		24h Energy Constrained Average (MWh)	5	159	4	152
Brisbane North, Beerwah, Caboolture	275kV/110kV Transformers (T6 & T7)[1, 2]	Max Load > Contingency Capacity (MW)	280	402	257	376
		Average Load > Contingency Capacity[1] (MW)	0	14	0	13
		24h Energy Constrained Max (MWh)	1,167	4,046	1,088	3,331
		24h Energy Constrained Average (MWh)	12	325	11	312

1 - Note: This load at risk includes loads that are connected to Palmwoods T7 and T8. During a credible contingency on T6 at South Pine, loads would be partially supplied by Palmwoods 110/66kV TXs.

2 – Contingency capacity limited by emergency cyclic rating of South Pine T1 (450MVA) and Palmwoods T7 and T8 (160MVA)

Given that the mean time to repair or replace a transformer is 10 to 12 weeks, the 600MWh limit of Powerlink's Transmission Authority will quickly be exceeded.

6. Market impacts

In addition to load at risk, market risks arises when network constraints prevent lower-cost generation from reaching demand centres. This effects generator dispatch, and in turn market prices.

Table 4 summarises the market impact of removing each of these circuits in-turn. For each outage in-turn the maximum and average difference in total system costs (including emission reduction benefits) per 24-hour period with and without the at-risk circuit in-service has been determined.

The analysis assumes that there is no impact on the generation investment pathway as a result of this outage.

The methodology used to assess these market impacts is outlined in Appendix B.

Table 4. Market impact of 275kV feeders into South Pine Substation out-of-service

At Risk	Contingency	Metric	$M
Transfer between Central and Southern Queensland	South Pine - Palmwoods (808)	Max 24h incremental system cost ($m)	0.239
		Average 24h incremental system cost ($m)	-0.0013
Transfer between Central and Southern Queensland	South Pine - Woolooga (807)	Max 24h incremental system cost ($m)	0.293
		Average 24h incremental system cost ($m)	0.0008
Transfer limitations between Mt England/Blackwall and South Pine	South Pine - Tarong (832)[3]	Max 24h incremental system cost ($m)	63.3
		Average 24h incremental system cost ($m)	0.362
	South Pine - Mt England (825)[3]	Max 24h incremental system cost ($m)	63.4
		Average 24h incremental system cost ($m)	0.364
	South Pine - Blackwall (838)	Max 24h incremental system cost ($m)	0.879
		Average 24h incremental system cost ($m)	0.0083
	South Pine – Rocklea (809)	Max 24h incremental system cost ($m)	0.153
		Average 24h incremental system cost ($m)	-0.0003

3 - Note: The outage pair of Tarong to South Pine and Mt England to South Pine leave only the low-capacity line (838) from Blackwall connected to South Pine. Supply to the northern Moreton area is therefore very reliant on transfers into South Pine from Woolooga. The market modelling shows that under certian system conditions there is insufficient generation in CQ and NQ to address this constraint and still meet all of the load. The high market impact is due to this unserved energy.

7. Non-Network Options

Potential non-network solutions would need to provide supply into North Brisbane and the Brisbane CBD. To meet this demand, the non-network solution must be capable of delivering at least:

- 165MW at peak and 1350MWh of energy per day into South Pine 110kV East Bus (Refer Table 3 – delivered load).
- 380MW at peak and 3340MWh of energy per day into South Pine 110kV East Bus (Refer Table 4 – delivered load).

Powerlink is not aware of any Demand Side Solutions (DSM) in the area supplied by South Pine Substation. However, Powerlink will consider any proposed solution that can contribute significantly to the requirements of ensuring that Powerlink continues to meet its required reliability of supply obligations as part of the RIT-T consultation process ahead of the actual investment decision.

8. Network Options

8.1 Proposed Option to Address Identified Need

To address the emerging age and obsolescence of South Pine's 275kV Substation secondary systems it is recommended that all secondary systems reaching end of life be replaced. This ensures that Powerlink's Transmission Authority reliability standard is maintained and power transfer capability both into and through South Pine Substation.

This option ensures that reliability of supply and asset condition criteria are met as well as maintaining the power transfer capability into Brisbane.

Powerlink considers the proposed network solution will not have any material inter-network impact, and as such does not need to formally consult with other Market Participants.

8.2 Option Considered but Not Proposed

This section discusses alternative options that Powerlink has investigated but does not consider technically and/or economically feasible to address the above identified issues and thus are not considered credible options.

6.2.1 Do Nothing

"Do Nothing" would not be an acceptable option as the primary driver (secondary systems condition and obsolescence) and associated safety, reliability and compliance risks are not addressed.

Furthermore, the "Do Nothing" option would not be consistent with good industry practice and would result in Powerlink breaching their obligations with the requirements of the System Standards of the National Electricity Rules and its Transmission Authority.

8.2.1 Increasing Network Capacity into CBD West from Rocklea Substation

Power is delivered to Brisbane's CBD West through Ashgrove West and West End substations. Ashgrove West is supplied from Upper Kedron Substation via a 110kV double circuit and West End Substation is supplied via a single 110kV cable from Rocklea Substation. Consequently, any interruption to the supply of electricity into Upper Kedron (or Rocklea) substation will significantly impact the capability to reliably supply the CBD West loads.

The cables between Rocklea, West End and Charlotte Street substations are at the greatest risk of overloading if any 110kV secondary systems for the western bus are retired from service. A second cable was modelled in parallel with F905 to reinforce the circuits carrying power into CBD West from Rocklea. The addition of the second cable is much more expensive, and unable to support the Stafford loads back at South Pine 110kV (west).

8.2.2 Increasing Network Capacity into North Brisbane from Palmwoods Substation

Power is delivered to North Brisbane through the South Pine 110kV east bus. Partial loads into Caboolture and Beerwah (via Energex feeders 746 and 745), as outlined in Appendix A – Load Mapping Methodology, are also supplied from Palmwoods substation. Transformers T7 and T8 at Palmwoods have a combined nameplate rating of 250MVA. To support the loads into Brisbane North, the capacity at Palmwoods would have to be greatly increase. The transfer capacity in this region would also need to be greatly increased.

9. Recommendation

Powerlink has assessed the condition of the secondary systems at South Pine 275kV Substation and concludes they will reach end of technical service life by December 2029. The growing risks are summarised in Section 4.

It is recommended that all secondary systems reaching end of life be replaced. These works are planned to be completed by June 2031.

Retaining the South Pine 275kV Substation capacity and functionality will allow Powerlink to continue to meet its required reliability obligations (N-1-50MW/600MWh) and maintain the power transfer capability into and through the South Pine Substation.

10. References

1. CP.03198 South Pine 110kV Secondary Systems Project Scope Report
2. H002 South Pine Secondary Systems Condition Assessment Report 2025
3. 2025 Transmission Annual Planning Report (A6049612)
4. Asset Planning Criteria - Framework (ASM-FRA-A2352970)
5. Powerlink Queensland's Transmission Authority T01/98

11. Appendix A – Load Mapping Methodology

Loads are allocated to South Pine as follows:

110kV East Bus

- QR Bald Hills (SSQRH)
- Beerwah (SSBWH) – *factor of 0.5, split between South Pine and Palmwoods*
- Brendale (SSBRD)
- Caboolture (T011 Caboolture) – *factor of 0.5, split between South Pine and Palmwoods*
- QR Caboolture (SSAR50) – *factor of 0.5, split between South Pine and Palmwoods*
- Griffin (SSGFN)
- Hays Inlet (SSHIL)
- Meeandah (Not visible below)
- Myrtletown (Not visible below)
- Nudgee (SSNGE)
- Sandgate (SSSGT)

110kV West Bus

- Ashgrove West (T030)
- Kelvin Grove (SSKVG)
- Makerston St (SSMST)
- Milton (SSMLT)
- QR Roma (SSQRT)
- Stafford (SSSFD)
- West End (SSWED)

12. Appendix B – Market Impact Assessment

Market modelling was used to assess the operational market impact of network limitations as a result from outages of secondary system equipment at the South Pine Substation.

The market modelling approach is consistent with the regulatory investment test for transmission requirements that a market benefit "must be a benefit to those who consume, produce and/or transport electricity in the market, that is, the change in producer plus consumer surplus." Critically, a market benefit must not "include the transfer of surplus between consumers and producers".[2]

As such, the market impact is assessed by comparing the changes in costs for market participants due to the differences in the operational and maintenance costs (including fuel costs), changes in involuntary load shedding (at the value of customer reliability [VCR] [3]), and changes in greenhouse gas emissions (at the value of emissions reduction [VER] [4])

The market modelling simulations considered committed and anticipated generators were commissioned on time, coal units closed according to their announced dates (as of December 2025), and modelled generation and storage projects consistent with the Queensland Energy Roadmap 2025.[5] The profiles of demand and energy available for variable energy resources followed the 2015 weather reference year as published by AEMO, as being a year found to result in 'median' outcomes.

A schedule of generator planned outages was modelled. However, generator forced outages were not considered. Instead, a reserve requirement is maintained via a reserve constraint equation, and therefore unserved energy may be underestimated in some circumstances.

Appropriate network detail (in the form of network constraints or sub-regional transfer limits) was added to adequately represent the network capability across major grid sections.

The outage (transmission lines as a result of the failure of secondary system equipment at South Pine Substation) was modelled as occurring in perpetuity to approximately capture the effect of this occurring at any time.

The market impact was then quantified as the differential total system cost (as above) for each hour between a base case with all transmission equipment in-service against the state of the world with an outage of impacted plant. Both the hourly and a moving 24-hour differential cost were determined.

The values in the report tables capture the maximum differential total system cost for any 24-hour period (averaged over the 5-year analysis period) and the average differential total system cost for a 24-hour period (over the 5-year analysis period).

[2] AER, November 2024, "Regulatory investment test for transmission", p4

[3] AER, December 2024, "Values of customer reliability: Final report on VCR values" available at

[4] AER, May 2024, "Valuing emissions reduction: AER guidance and explanatory statement"

[5] The State of Queensland (Queensland Treasury), October 2025, "Energy Roadmap"

E a

Project Scope Report

CP.03197

South Pine 275kV Secondary Systems Replacement

Concept – Version 1

Document Control

Change Record

Issue Date	Revision	Prepared by	Reviewed by	Approved by	Background
06/08/2025	1	[redacted]	[redacted]	[redacted]	Initial issue

Related Documents

Issue Date	Responsible Person	Objective Document Name
22/07/2025	[redacted]	PIF - H002 South Pine 275kV Secondary Systems Replacement - Project Initiation Form (A5894814)

Document Purpose

The purpose of this Project Scope Report is to define the business (functional) requirements that the project is intended to deliver. These functional requirements are subject to Powerlink's design and construction standards and prevailing asset strategies, which will be detailed in documentation produced during the detailed scoping and estimating undertaken by DTS (or OSD), i.e. it is not intended for this document to provide a detailed scope of works that is directly suitable for estimating.

Project Contacts

Project Sponsor	[redacted]
Connections Manager	[redacted]
Strategist – HV/Digital Asset Strategies	[redacted]
Planner – Main/Regional Grid	[redacted]
Manager Projects	[redacted]
Project Manager	TBA
Design Manager	TBA

Project Details

1. Project Need & Objective

H002 South Pine is a major switching substation in Southeast Queensland, commissioned in 1981 to support regional network expansion. It plays a vital role in the Southeast Queensland transmission backbone, providing bulk electricity supply to North Brisbane suburbs and the Brisbane CBD. Located approximately 16 km northwest of Brisbane's CBD, the substation also includes a 275 kV Static Var Compensator (SVC), commissioned in 2008, to deliver dynamic reactive power support in the region.

A condition assessment of the 275 kV and 110 kV secondary systems carried out in 2025 identified the need to replace the 275 kV secondary systems by December 2028 (asset need date). The key drivers for this recommendation are:

- Maintainability concerns: increasing obsolescence of equipment, limited availability of spare parts, and diminishing technical support; and
- Deteriorating condition: ageing secondary systems are elevating the risk of in-service failures, which may compromise network availability, operational reliability, and compliance with the National Electricity Rules (NER).

The objective of this project is to replace the 275 kV secondary systems at South Pine Substation by 30th June 2031 to ensure continued operational reliability and regulatory compliance.

This project will follow the two (2) stage approval process.

2. Project Drawing

Figure 1 – Location of South Pine Substation

Figure 2: Aerial View of South Pine Substation

Figure 3: Operational Diagram for South Pine 275kV Switchyard

3. Deliverables

The following deliverables are to be provided in response to this Project Scope Report. The requirement dates for these deliverables will be communicated separately.

This project will follow the two-stage approval process. The following deliverables are to be provided:

1. A report (e.g. Concept Estimate Report) detailing the works to be delivered, high level staging, resource requirements and availability, and outage requirements and constraints for each option.
2. A class 5 estimate (minimum).
3. A basis of estimate document and risk table, detailing the key estimating assumptions and delivery risks for each option.
4. Outline staging and outage plans.

4. Project Scope

4.1. Original Scope

The following scope presents a functional overview of the desired outcomes of the project. The proposed solution presented in the estimate must be developed with reference to the remaining sections of this Project Scope Report, in particular *Section 7 Special Considerations*.

Briefly, this project involves the replacement of all 275 kV secondary systems at South Pine Substation.

4.1.1. Transmission Line Works

Not applicable

4.1.2. H002 South Pine Substation Works

Design, procure, construct, and commission new 275 kV secondary systems for the switching bays listed below. Where applicable, this includes OpsWAN equipment, High-Speed Power System Monitoring (HSM), Wide Area Monitoring, Protection and Control (WAMPAC) systems, Power Quality Monitoring (PQM) systems, revenue metering, building AC and DC distribution boards, batteries, and chargers.

Complete diameters

- =C01-Q10 (SVC connection),
- =C01-Q30 Coupler,
- =C01-Q20 Fdr809 to Rocklea,

- =C02-Q10 5T HV connection,
- =C02-Q30 Coupler,
- =C02-Q20 Fdr 838 to Blackwall,

- =C03-Q10 4T HV connection,
- =C03-Q30 Coupler,
- =C03-Q20 Fdr 825 to Mt England,

- =C05-Q10 Stub, spare bay,
- =C05-Q30 Coupler,
- =C05-Q20 Fdr 807 to Woolooga,

- =C06-Q10 1T HV connection,
- =C06-Q30 Coupler,
- =C06-Q20 Fdr 808 to Palmwoods,

- =C11-Q10 6T HV connection,
- =C11-Q30 Coupler,
- =C11-Q20 Fdr 8999 to Kremzow.

Partial diameters

- =C04-Q30 Coupler,
- =C04-Q20 Fdr 832 to Tarong,

- =C07-Q10 3Cap,
- =C07-Q10 4Cap,

- =C08-Q30 Coupler,
- =C08-Q20 7T HV connection,

- =C09-Q30 Coupler,

- =C09-Q20 Fdr 8700 to Kremzow,

- =C10-Q10 8Cap,
- =C10-Q20 9Cap.

Bus Zone

- =KC1 1Bus Zone Protection,
- =KC2 2Bus Zone Protection.

- Integration with new secondary systems associated with 275 kV bays constructed under CP.03085 South Pine BESS Stage 3 (Anticipated commissioning date 2028).

- Decommission and recover all redundant equipment and ensure updates are made to all associated drawings, SAP records, configuration files, and documentation.

As per the recommendations within *ETR 10528572 In-Situ Replacement*, the following methodology shall be assumed for estimating purposes:

- In-situ panel replacement for the secondary systems in Building 6 (9 spare panels capacity at the time of assessment).

- A new control building will be required for the secondary systems within Building 2 as it has no capacity for in-situ panel replacement.

4.1.3. Remote End Substation Works

Modify protection, control, automation, and communication systems at remote ends - including H016 Rocklea, H036 Blackwall, H012 Mt England, H018 Tarong, H005 Woolooga, and H009 Palmwood - as required to ensure compatibility with the upgraded systems at H002 South Pine.

4.1.4. Telecoms Works

Telecommunications works to be coordinated with CP.02813 Telecommunication Network Consolidation RAN 4 (completion 2032) and CP.02822 OpsWAN and MPLS Replacement RAN 4 (completion 2033).

4.1.5. Easement/Land Acquisition & Permits Works

Not applicable.

4.2. Key Scope Assumptions

The following assumptions should be included in the estimating of this scope:

- Replacement of ABB IMB300 current transformers (CTs) under CP.03107 Replacement 275kV ABB IMB300 CTs – Metro will be completed prior to the commencement of secondary system replacement works.

- Telecommunications works under CP.02813 Telecommunication Network Consolidation RAN 4 and CP.02822 OpsWAN and MPLS Replacement RAN 4 will need to be coordinated with this project.

- In-panel replacement methodology will be successfully implemented under CP.02929 Sumner Secondary Systems Replacement prior to project approval.

- The in-panel replacement methodology is reliant upon the nominated building having spare capacity, which needs to be re-verified prior to project approval.

- Battery systems and cell replacements scheduled for the period 2028 to 2032 across multiple Powerlink substations and communication sites will be delivered as annual work packages under the following projects:
  - CP.03174 – DC System Replacement – 2028,
  - CP.03175 – DC System Replacement – 2029,
  - CP.03176 – DC System Replacement – 2030.

4.3. Variations to Scope (post project approval)

Not applicable.

5. Key Asset Risks

Asset risk management shall be in accordance with the Asset Risk Management Process Guideline (A4870713).

6. Project Timing

6.1. Stage 1 Approval Date

The anticipated date by which the project will be approved is 31st December 2029.

6.2. Site Access Date

Site access is immediately available as H002 South Pine is a Powerlink site.

6.3. Commissioning Date

The latest date for the commissioning of the new assets included in this scope and the decommissioning and removal of redundant assets, is 30th June 2031.

7. Special Considerations

The replacement of the secondary systems interface with the on-site SVC control system shall be included within the scope of this project.

CP.03085 H002 Brendale Supernode Data Centre and BESS Stage 3 is anticipated to be commissioned by 2028 - slightly ahead of the planned 275 kV secondary systems replacement. The following considerations should therefore be incorporated:

- Establishment of a new LAN structure at site, with appropriate planning and management of the transition from the existing to the new LAN throughout the site works.

- Implementation of the new Substation Design Manual (SDM) standard for the new BESS panels to ensure compatibility with the upgraded 275 kV secondary systems.

8. Asset Management Requirements

Equipment shall be in accordance with Powerlink equipment strategies.

Unless otherwise advised James Currell will be the Project Sponsor for this project. The Project Sponsor must be included in any discussions with any other areas of Network and Business Development including Asset Strategies & Planning.

Jay Tencate will provide the primary customer interface with Energy Queensland. The Project Sponsor should be kept informed of any discussions with the customer.

9. Asset Ownership

The works detailed in this project will be Powerlink Queensland assets.

10. System Operation Issues

Operational issues that should be considered as part of the scope and estimate include:

- interaction of project outage plan with other outage requirements;
- likely impact of project outages upon grid support arrangements; and
- likely impact of project outages upon the optical fibre network.

Restricted Access Zones are currently in place for the [redacted] where applicable. It is anticipated that these [redacted] will be replaced under CP.03107 – *Replace 275 kV* [redacted] *(completion 2029) – Metro* prior to the commencement of site works.

11. Options

Three secondary systems replacement options were presented by Asset Strategies in the Project Initiation Form. Based on the recommendations of ETR 10528572 *In-Situ Replacement*, South Pine has been identified as a suitable site for this approach. Accordingly, the in-situ replacement has been selected as the default option for estimation. This involves replacing equipment within existing panels, and where space and benefits allow, replacing old panels with new ones in an existing building.

12. Division of Responsibilities

The Project Manager will be required to draft the document and consult with the Project Sponsor who will arrange sign-off between Powerlink and the relevant customer.

13. Related Projects

Project No.	Project Description	Planned Comm Date	Comment
Pre-requisite Projects			
Co-requisite Projects			
Other Related Projects			
CP.03198	South Pine 110kV Secondary Systems Replacement	2031	Coordination will be required due to potential interface impacts with the existing 275 kV and 110 kV secondary systems.
C55.0429	H002 South Pine no. 5 Transformer replacement	2030	Coordination will be required, as interfaces with the existing 275 kV and 110 kV secondary systems may be affected.
CP.03085	South Pine BESS Stage 3	2028	Adding diameter C12 (incomplete diameter, two bays only).
CP.03195	H002 South Pine SVC Secondary Systems Replacement	2030	Coordination will be required, as interfaces with the existing 275 kV and 110 kV secondary systems may be affected.
CP.02813	Telecommunication Network Consolidation RAN4	June 2032	Works to be coordinated
CP.02822	OpsWAN and MPLS Replacement RAN3	June 2033	Works to be coordinated

CP.03197 South Pine 275kV Secondary Systems Replacement

Concept Estimate

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1. Executive Summary

This concept estimate has been developed based on the CP.03197 South Pine 275 kV Secondary Systems Replacement Project Scope Report (PSR).

H002 South Pine is a major switching substation in Southeast Queensland, commissioned in 1981 to support regional network expansion. It plays a vital role in the Southeast Queensland transmission backbone, providing bulk electricity supply to North Brisbane suburbs and the Brisbane CBD. Located approximately 16 km northwest of Brisbane's CBD, the substation also includes a 275 kV Static Var Compensator (SVC), commissioned in 2008, to deliver dynamic reactive power support in the region.

A condition assessment of the 275 kV and 110 kV secondary systems was carried out in 2025, and it identified a need to replace the 275 kV secondary systems by December 2028 (asset need date). The key drivers for this recommendation are:

- Maintainability concerns: Increasing obsolescence of equipment, limited availability of spare parts, and diminishing technical support.
- Deteriorating condition: Ageing secondary systems are elevating the risk of in-service failures, which may compromise network availability, operational reliability, and compliance with the National Electricity Rules (NER).

The assessment in this proposal has established that the project can be delivered by December 2031.

The project will follow the two (2) stage approval process.

1.1 Project Estimate

No escalation costs have been considered in this estimate.

		Total ($)
Estimate Class	5	
Base Estimate – Un-Escalated (2025/2026)		44,777,787
TOTAL		**44,777,787**

1.2 Project Financial Year Cash Flows

No escalation costs have been considered in this estimate.

DTS Cash Flow Table	Un-Escalated Cost ($)
To June 2027	542,700
To June 2028	2,156,313
To June 2029	9,768,427
To June 2030	11,124,466
To June 2031	11,124,466
To June 2032	10,061,414
TOTAL	**44,777,787**

2. Project and Site-Specific Information

2.1 Project Dependencies & Interactions

This project is related to the following projects:

Project No.	Project Description	Planned Commissioning Date	Comment
Dependencies			
CP.02929	Sumner Secondary System Replacement	September 2026	In-situ panel replacement is based on the successful completion of this project.
Interactions			
CP.03198	South Pine 110kV Secondary System Replacement	June 2031	South Pine 110kV Secondary Systems Replacement
CP.02478	H002 South Pine No. 5 Transformer replacement	2030	Coordination will be required, as interfaces with the existing 275 kV and 110 kV secondary systems may be affected.
CP.03085	South Pine BESS Stage 3	2028	Adding diameter C12 (incomplete diameter, two bays only).
CP.03195	H002 South Pine SVC Secondary Systems Replacement	2030	Coordination will be required, as interfaces with the existing 275 kV and 110 kV secondary systems may be affected.
CP.02822	OpsWAN and MPLS Replacement RAN3	June 2033	Works to be coordinated
CP.02813	Telecommunications Network Consolidation RAN4	June 2032	SDH and PDH Multiplexer replacement program
Other Related Projects			

2.2 Site Specific Issues

- H002 South Pine Substation is located at 16km northwest of the Brisbane CBD and plays a vital role in the Southeast Queensland transmission backbone, providing bulk electricity supply to North Brisbane suburbs and the Brisbane CBD
- Asbestos containing material (ACM) has been identified at H002 South Pine Substation Main building and Old Control building. For works in that area, the respective Asbestos Management Plan and Asbestos Register shall be reviewed, and appropriate actions taken.
- There are 5 [redacted] at H002 South Pine which have invoked a Restricted Access Zone(s) (RAZ) in the substation. The RAZ does not impact access to the H002 South Pine Control Buildings, however access to the 275kV substation yard is restricted. An appropriate RAZ Works Plan will be required if the RAZ is not revoked by the time of works where access is required.
- The Brisbane area is subject to the following average number of days of rain. Consideration was given to this when developing the project schedule.

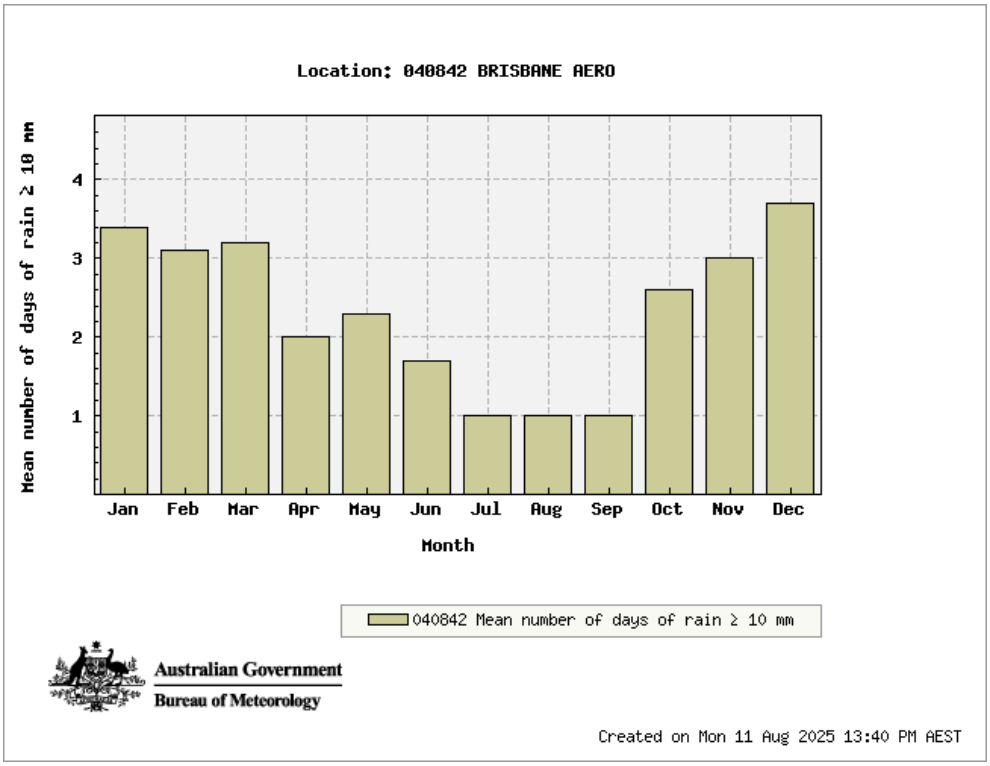

Figure 1 - Number of Days of Rain >10mm Brisbane (Source: Bureau of Meteorology 11th August 2025)

3. Project Scope

The following works have been costed for in the estimate based on the In-situ panel replacement methodology.

3.1 Substation Works

H002 South Pine

Design, procure, construct, and commission new 275 kV secondary systems for the switching bays listed below. This includes OpsWAN equipment, High-Speed Power System Monitoring (HSM), Wide Area Monitoring, Protection and Control (WAMPAC) systems, Power Quality Monitoring (PQM) systems, revenue metering, building AC and DC distribution boards.

- Complete Diameters:
  - =C01-Q10 (SVC connection)
  - =C01-Q30 Coupler
  - =C01-Q20 Feeder 809 to Rocklea
  - =C02-Q10 5T HV connection
  - =C02-Q30 Coupler
  - =C02-Q20 Feeder 838 to Blackwall
  - =C03-Q10 4T HV connection
  - =C03-Q30 Coupler
  - =C03-Q20 Feeder 825 to Mt England
  - =C05-Q10 Stub, spare bay
  - =C05-Q30 Coupler

  - =C05-Q20 Feeder 807 to Woolooga
  - =C06-Q10 1T HV connection
  - =C06-Q30 Coupler
  - =C06-Q20 Feeder 808 to Palmwoods
  - =C11-Q10 6T HV connection
  - =C11-Q30 Coupler
  - =C11-Q20 Feeder 8999 to Kremzow
- Partial Diameters:
  - =C04-Q30 Coupler
  - =C04-Q20 Feeder 832 to Tarong
  - =C07-Q10 3Cap
  - =C07-Q10 4Cap
  - =C08-Q30 Coupler
  - =C08-Q20 7T HV connection
  - =C09-Q30 Coupler
  - =C09-Q20 Feeder 8700 to Kremzow
  - =C10-Q10 8Cap
  - =C10-Q20 9Cap
- Bus Zone
  - =KC1 1Bus Zone Protection
  - =KC2 2Bus Zone Protection
- Integration with new secondary systems associated with 275 kV bays constructed under CP.03085 South Pine BESS Stage 3 (Anticipated commissioning date 2028).
- Decommission and recover all redundant equipment.
- Update drawing records, SAP records, config files, etc. accordingly.

Remote Ends

Coordinate modification of protection, control, automation and communications systems for:

- Feeders from H016 Rocklea
- Feeders from H036 Blackwall
- Feeders from H012 Mt England
- Feeders from H018 Tarong
- Feeders from H005 Woolooga
- Feeders from H009 Palmwoods

3.2 Telecommunication Works

An allowance has been made for telecommunications work. This includes the design, procure, construct and commissioning of the following equipment:

- Powerlink standard SDH equipment.
- Powerlink standard PDH equipment.

- Powerlink standard MPLS routers.
- Fibre optic cable, pits and associated termination panels.
- Establishment of a new LAN structure at site, with appropriate planning and management of the transition from the existing to the new LAN throughout the site works.

3.3 Major Scope Assumptions

The following key assumptions were made for this Project Estimate.

- Minor Secondary Systems works only is expected to integrate the remote end substation with the new H002 South Pine Secondary Systems. All works at the remote end substations will be completed by Maintenance Service Provider (MSP).
- Powerlink Internal Design teams and Design Service Panel (DSP) will be used for the Primary, Secondary Systems and Telecommunications design work.
- Estimate is based on Powerlink architectures, standards and equipment in place and available at the time of development.
- No Restricted Access Zone (RAZ) will be deployed on this site during construction.
- Outages will be available on request. Please refer to Section 4.2 Network Impacts for further details.
- Field and Asset Management (FAM) resources will be available to complete the works.
- Procurement of long lead items align with project delivery requirements.
- Replacement of ABB IMB300 Current Transformers (CTs) under CP.03107 Replacement 275kV ABB IMB300 CTs – Metro will be completed prior to the commencement of secondary system replacement works.
- As per the recommendations within ETR 10528572 In-Situ Replacement, the following methodology shall be assumed for estimating purposes:
    - In-situ panel replacement for the secondary systems in Building 6 (9 spare panels capacity at the time of assessment).
    - A new control building will be required for the secondary systems within Building 2 as it has no capacity for in-situ panel replacement.
- There is adequate space to put a new building within the substation.
- Telecommunications works under CP.02813 Telecommunication Network Consolidation RAN 4 and CP.02822 OpsWAN and MPLS Replacement RAN 4 will need to be coordinated with this project.
- The nominated buildings have spare capacity for the in-panel methodology.
- Battery systems and cell replacements scheduled for the period 2028 to 2032 across multiple Powerlink substations and communication sites will be delivered as annual work packages under multiple projects.

The following assumptions have been made with respect to Secondary Systems design:

- Design standard of the new secondary systems will be of SDM9.3.
- Bay marshalling kiosks to be re-used.
- AC Changeover board is fit for purpose and will be re-used.
- New relays considered for the upgrade of the remote sites will be suitable for the customer's needs and requirements.

The following assumptions have been made with respect to Civil design:

- The existing substation platform and yard drainage system drains freely and is fit for purpose.
- The existing internal substation road is fit for purpose.

- Drainage for any new pits shall be provided into the existing drainage system or off the substation platform.
- Existing structures and foundations are fit for purpose.

The following assumptions have been made with respect to Network outage Constraints:

- EQL to be co-ordinated for remote-end upgrade works and outages.
- Works to be carried out during the winter period to avoid summer outage period.

3.4 Scope Exclusions

- Easement acquisitions work, including permits, approvals, development applications are excluded. All works are within Powerlink-owned land.
- No allowance is included for any Energy Queensland projects that may impact Powerlink works.
- Additional time and cost for Design, Planning and Implementation of any restoration plans required for outages is not included in this estimate.
- No major modification to the earth grid is included in this estimate.
- Removal of rock or unsuitable material, including asbestos and other contaminants.
- This estimate does not include any costs for repairing or modification to the plant not listed to be replaced under the scope.
- No allowance has been made for the demolition and removal of the existing control buildings.
- No modification and upgrading of the internal roads, lights, fences and gates.
- No modification on the existing transmission lines or HV underground cables.
- No allowance has been made for Live substation works.

4. Project Execution

4.1 Project Schedule

This project will follow the two (2) stage approval process.

A high-level Project Schedule has been developed for the project stages:

Milestones	High-Level Timing
Request for Class 5 Estimate	July 2026
Class 5 Project Proposal Submission	November 2026
Request for Class 3 Estimate	January 2027
Class 3 Project Proposal Submission	July 2027
Stage 1 Approval (PAN1) includes funds for design & procurement, & ITT preparation	August 2027
RIT-T (assumed 26 weeks)	August 2027 – February 2028
Project Development Phase 1 & Phase 2	August 2027 – February 2028
ITT Submission (8 Weeks)	October 2027 – December 2027

Evaluate Tender, Reconcile Estimate and Submit PMP for Stage 2 Approval	January 2028 - February 2028
Stage 2 Approval (PAN2)	March 2028
Execute Delivery (including award of SPA contract)	March 2028
SPA Site Establishment	April 2028
SPA Civil Works and Construction	April 2028 – June 2028
MSP Site Establishment	April 2029
Staged Commissioning	May 2029 – December 2031
Project Commissioning	December 2031

4.2 Network Impacts

Powerlink Net Ops – Operating Manual 02 – SE QLD provides the following recommendations for outages of H002 South Pine Substation feeders and transformers.

An outage on Transformer 4T has the following network requirements and impacts.

- Network Requirement:
  - 5T in service
  - Feeder 905, 830, 776, 7258, 721 and 722 in service.
  - H062 Abermain 4T in service.
- Time of Year Guidelines:
  - Avoid scheduling in summer.
  - Outages constraint in summer during high loads if recall times > 1 hour or recalled before 15:00 if network will not land satisfactory for the next contingency.

An outage on Feeder 809/2T has the following network requirements and impacts.

- Network Requirement:
  - Feeder 275kV feeder 8818/H016 Rocklea 1T in service.
  - H002 South Pine 275/110kV 4T and 5T in service.
  - H002 South Pine to SSCST Charlotte St to SSWED West End 110 kV network intact.
  - 110kV feeders 7258, 791 and 7295 in service.
  - H016 Rocklea to T155 West Darra to T187 Richlands 110 kV network intact.
- Time of Year Guidelines:
  - Avoid scheduling in summer.
  - Outages constraint in summer during high loads if recall times > 1 hour or recalled before 15:00 if network will not land satisfactory for the next contingency.

An outage on Transformer 1T has the following network requirements and impacts.

- Network Requirement:
  - Remaining H002 South Pine Transformers (6T and/or 7T) in service; and

- If H002 South Pine transformer (1T+6T+7T) loading <450MVA (or <487MVA for 1T outage) network will require load transfers or splitting.

- Customer Impact
  - Load at risk – Energy Qld (Energex)
- Time of Year Guidelines:
  - Avoid scheduling in summer.

An outage on H002 South Pine SVC has the following network requirements and impacts.

- Network Requirement:
  - H036 Blackwall + S003 Greenbank SVCs in service.
- Time of Year Guidelines:
  - Avoid overnight outages during the shoulder period.

An outage on Feeder 825 has the following network requirements and impacts.

- 275kV feeders 832 + 838 in service.
- During Summer period ensure that feeders 8823 + 827 + 875 are also in service.

- Time of Year Guidelines:
  - Outages may be subjected to summer guidelines as defined by AEMO Guideline for Transmission Network Outage Planning.

An outage on Feeder 838 has the following network requirements and impacts.

- 275kV feeders 825 + 832 in service.
- 275kV feeders 809/H016 Rocklea 2T + 8818/H016 Rocklea 1T in service

- Time of Year Guidelines:
  - Outages may be subjected to summer guidelines as defined by AEMO Guideline for Transmission Network Outage Planning.

An outage on Feeder 807 has the following network requirements and impacts.

- 275kV feeders 808 + 810 in service.
- 275kV feeders 8810 + 8811 in service.
- H002 South Pine to H009 Palmwoods to H005 Woolooga 110kV and 132kV networks intact.
- 275kV feeders 832 + 827 + 875 + 8812 + 837 in service.

- Time of Year Guidelines:
  - Avoid scheduling in summer.
  - Outages may be subjected to summer guidelines as defined by AEMO Guideline for Transmission Network Outage Planning.

4.3 Resourcing

Design for the project will be completed by internal design resources with support from external design partners. The construction works will be completed by a combination of the Maintenance Service Providers and Substation Panel Agreement (SPA).

5. Project Asset Classification

Asset Class	Base ($)	Base (%)
Substation Primary Plant	887,967	2%
Substation Secondary Systems including New Building and associated civil works	42,784,744	96%
Telecommunications	1,105,076	2%
Overhead Transmission Line	-	-
TOTAL	**44,777,787**	**100**

6. References

Document name and hyperlink	Version	Date
Project Scope Report	1.0	6/08/2025

Risk Cost Summary Report

CP.03197

South Pine 275kV Secondary Systems Replacement

Document Control

Change Record

Issue Date	Revision	Prepared by
15/01/2026	1.0	Asset Strategies

Related Documents

Issue Date	Responsible Person	Objective Document Name

Document Purpose

The purpose of this model is to quantify the base case risk cost profiles for the secondary systems at South Pine substation which are proposed for reinvestment under CP.03197. These risk cost profiles are then included as part of the overall cost-benefit analysis (CBA) to understand the economic benefit of the proposed infrastructure upgrades. This process provides a benchmarking and internal gate process to support Powerlink in effectively identifying prioritised infrastructure upgrades.

The CBA was designed to demonstrate and quantify the value to be gained through specific infrastructure investments. To evaluate the CBA, an NPV is derived based on the present values of costs and benefits. The flow chart in Figure 4 below designates the methodology used in designing the CBA process.

Key Assumptions

In calculating the risk cost arising from a failure of the ageing secondary systems equipment at South Pine substation, the following modelling assumptions have been made:

- Whilst the re-investment scope of secondary system upgrade projects contains a range of supporting devices (i.e network switches, revenue metering, firewalls and human machine interfaces), for simplicity of risk cost modelling only main protection relays, bay controllers and RTUs were considered.
- Spares for secondary system equipment have been assumed to be available prior to the point of expected spares depletion, which coincides with the expected technical asset life (20 years). After this point the cost and time to return the secondary system back to service increases significantly.
- When calculating network risk cost, it has been assumed that after 24 hours of any network element being protected by a single protection system (due to failure of the alternate system) the Australian Energy Market Operator (AEMO) will direct Powerlink to de-energise the network element.
- A site-specific value of customer reliability (VCR) of $25,750 has been applied when calculating network risks.

Base Case Risk Analysis

Risk Categories

For this project, two main categories of risk are assessed as per Powerlink's Asset Risk Management Framework:

- Financial Risk
- Network Risk (including market impact if applicable)

Table 1: Risk categories

Risk Category	Failure Type	Equipment in Scope
Financial Risk	Failure of the equipment resulting in emergency onsite replacement	All equipment
Network Risk	Failure of equipment resulting in de-energisation of network elements after 24 hours	Main protection relays only

Base Case Risk Cost

The modelled and extrapolated total base case risk costs are shown in Figures 1 and 2 below.

Risk costs associated with the equipment in scope are expected to increase from $0.3 million in 2026 to $2.0 million in 2036 and $2.8 million by 2045. Key highlights of the analysis include:

- Financial risk accounts for approximately 99% of the overall risk cost in 2030 with network risk accounting for the remaining 1%.

Figure 1: Total risk cost

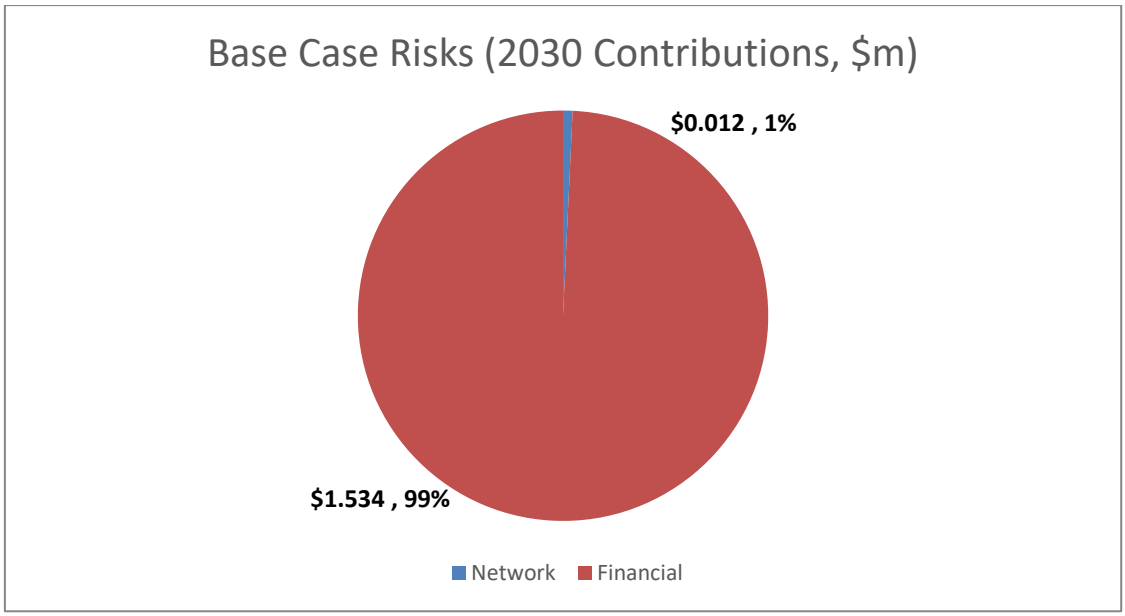

Figure 2: Base case risk cost by contributions (2030)

Option Risk Cost

For modelling purposes, the replacement of equipment at the South Pine substation reduces the probability of failure to zero in the year after investment, resulting in a lower risk cost.

The figures below set out the total project case risk cost, and associated risk cost savings incremental to the base case.

Figure 3: Project Option Risk Cost (compared to base case)

Following the investment, risk cost grows slowly over time as it is assumed sufficient spares are available resulting in lower responsive costs and shorter outage durations.

Cost Benefit Analysis

The methodology designed for the cost benefit is set out as per Figure 4 below.

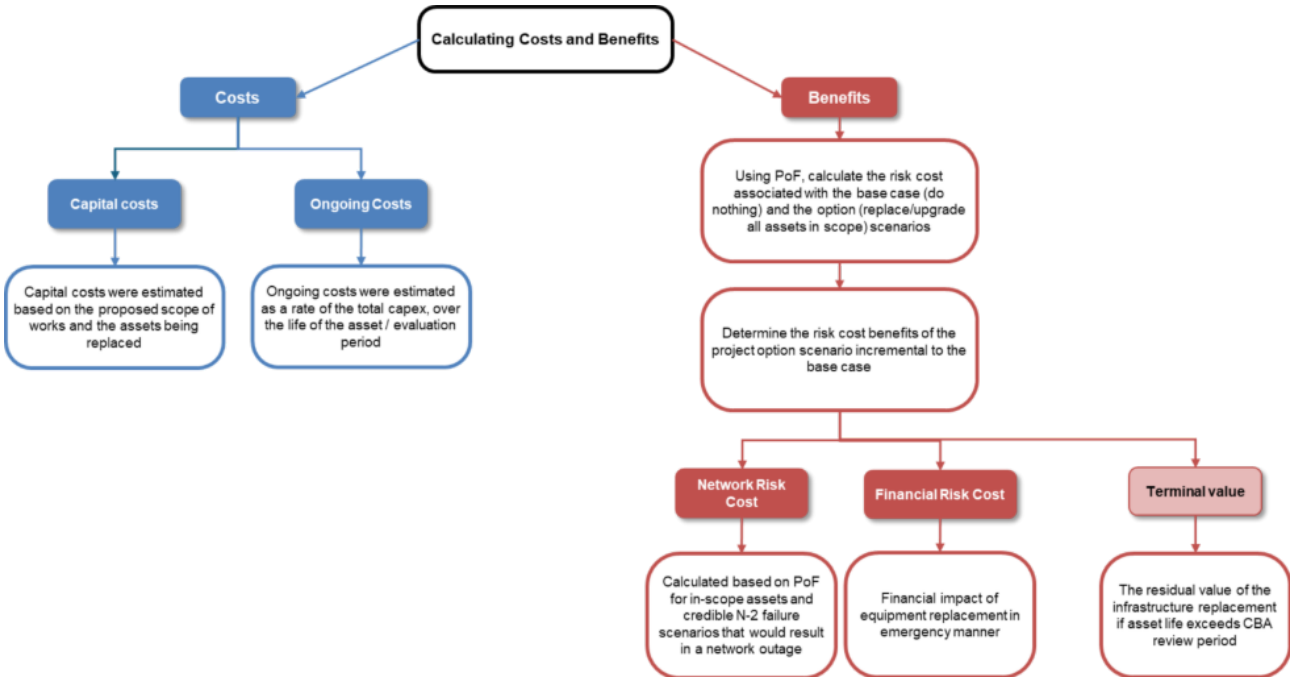

Figure 4: CBA methodology

The project is estimated to cost approximately $44.78 million resulting in a negative NPV and benefit-cost ratio (BCR) less than 1.

Table 2: Net Present Value and Benefit-Cost Ratio

		Present Value Table ($m)		
Discount rate	**%**	**3%**	**7%**	**10%**
NPV of Net Gain/Loss	$m	-18.1	-$18.6	-$17.7
Benefit-Cost Ratio	ratio	0.54	0.40	0.33

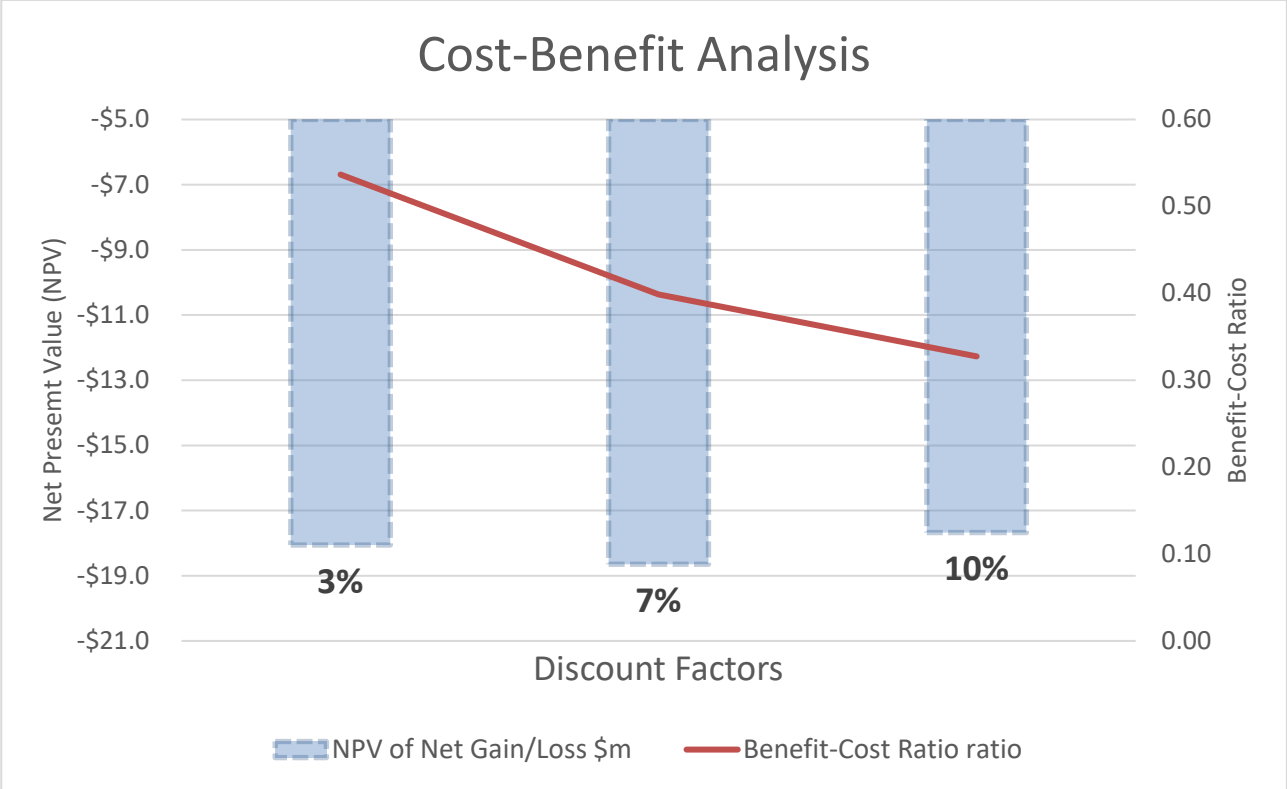

Figure 5: Cost benefit summary

Participation Factors

A sensitivity analysis was undertaken to determine the participation factors for key inputs to the risk cost models (i.e. to identify which inputs are most sensitive to overall risk cost).

The participation factor is defined as the ratio of percentage change in output (i.e. risk cost) to a percentage change in input (e.g. VCR). The participation factors for key model inputs are shown in the table below.

Due to the non-linear nature of the risk cost model (especially network risk costs, which are a function of concurrent failures), the participation factor can change depending on the magnitude of input percentage change.

The model is most sensitive to:

- **changes in the emergency replacement cost of a relay with no spares** (halving the cost) results in a decrease in risk cost of $0.46 million, or approximately 29.9% of the original base case risk (at 2030).
- **changes in the emergency replacement cost of a bay controller with no spares** (halving the cost) results in a decrease in risk cost of $0.3 million, or approximately 19.6% of the original base case risk (at 2030).

Table 3: Participation Factors

Input	Baseline value	Sensitivity value (-50%)	Change in risk cost at 2030 ($m)	Participation (%)
Network				
VCR ($/MWh)	25750	12875	-0.01	-0.37%
Restoration Time with spares – Relay (days)	2	1	0.00	0.00%
Restoration Time with no spares – Relay (days)	10	5	-0.01	-0.60%
Financial				
Emergency replacement cost with spares - Relay ($m)	0.02	0.01	0.00	-0.14%
Emergency replacement cost without spares – Relay ($m)	0.09	0.05	-0.46	-29.87%
Emergency replacement cost with spares – Bay Controller ($m)	0.02	0.01	0.00	-0.05%
Emergency replacement cost without spares – Bay Controller ($m)	0.20	0.10	-0.30	-19.56%