January 2026

Powerlink 2027-32 Revenue Proposal

Project Pack

CP.02855 Ashgrove West Secondary Systems Replacement

Project Status: Unapproved

Network Requirement

Ashgrove West Substation was originally established in the late 1970's to support bulk supply into the Brisbane CBD and the expanding residential areas in Brisbane's northwest. It is a shared Powerlink site with Energy Queensland (EQ) supplying EQ at 110kV as well as at 33kV through two 110/33kV transformers.

A condition assessment indicates that most secondary systems devices are reaching the end of their technical asset life, recommending replacement by 2026. It further notes that while the field cables are suitable for a further 15 to 20 years of service and that the secondary systems panels are in good condition and may be retained, the secondary systems are housed in the original brick control building which contains asbestos [1]. The driver for replacing secondary systems is the obsolescence and end of manufacturer support for the existing relays. 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.

Powerlink's 2025 Central scenario forecast confirms there is an enduring need to maintain electricity supply in the Brisbane CBD and western suburbs area. The removal or reconfiguration of the Ashgrove West 110/33kV Substation due to secondary system failure/obsolescence would violate Powerlink's N-1-50MW/600MWh Transmission Authority reliability standard and significantly impact electricity supply within the Brisbane area [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.

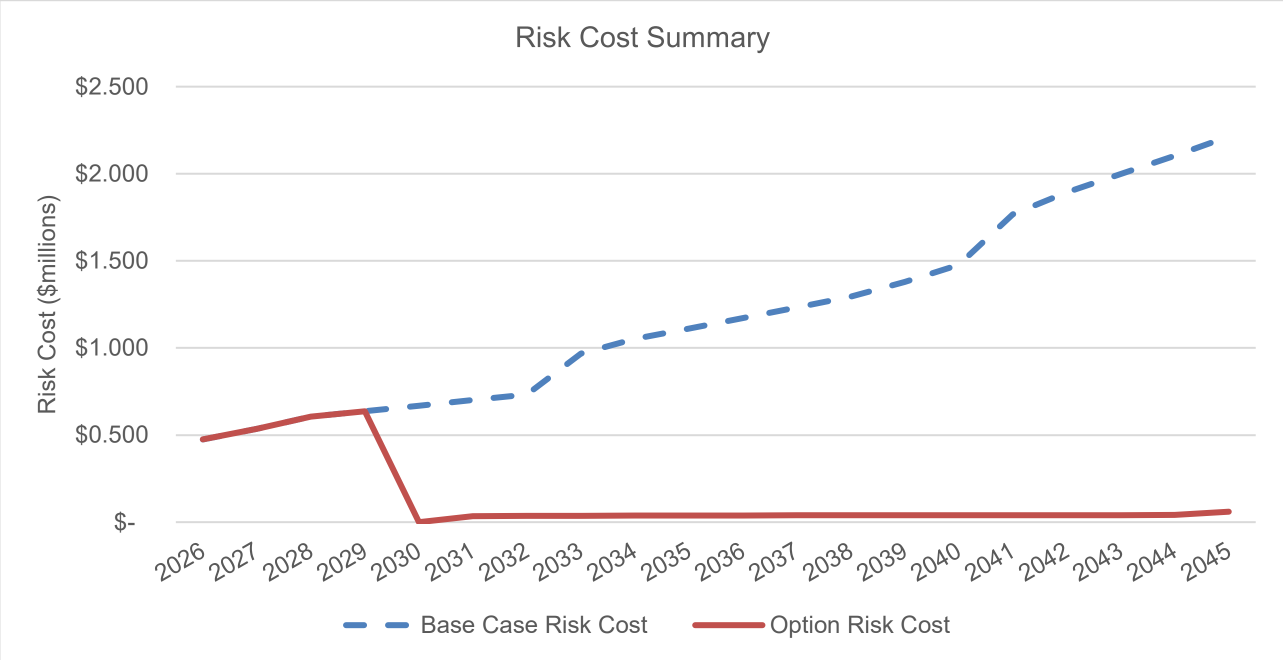
The current recommended option is to replace all secondary systems in a new demountable control building by 2029 [3].

Options considered but not proposed include:

- Replacement of selected secondary systems in the existing control building is expected to be higher cost due to greater complexity and additional risks relating to the confined spaces in the cable basement in the existing building. In addition, special work arrangements would be need to manage the risk due to asbestos containing materials in the existing building.
- Bypassing Ashgrove West at 110kV would require extensive reinforcement of the 33kV network and is not considered economic.

Figure 1 shows the current recommended option reduces the forecast risk monetisation profile of the Ashgrove West Substation secondary systems from around $0.65 million per annum in 2029 to less than $0.05 million from 2030 [5].

Figure 1 Annual Risk Monetisation Profile ($ Real, 2025/16)



Cost and Timing

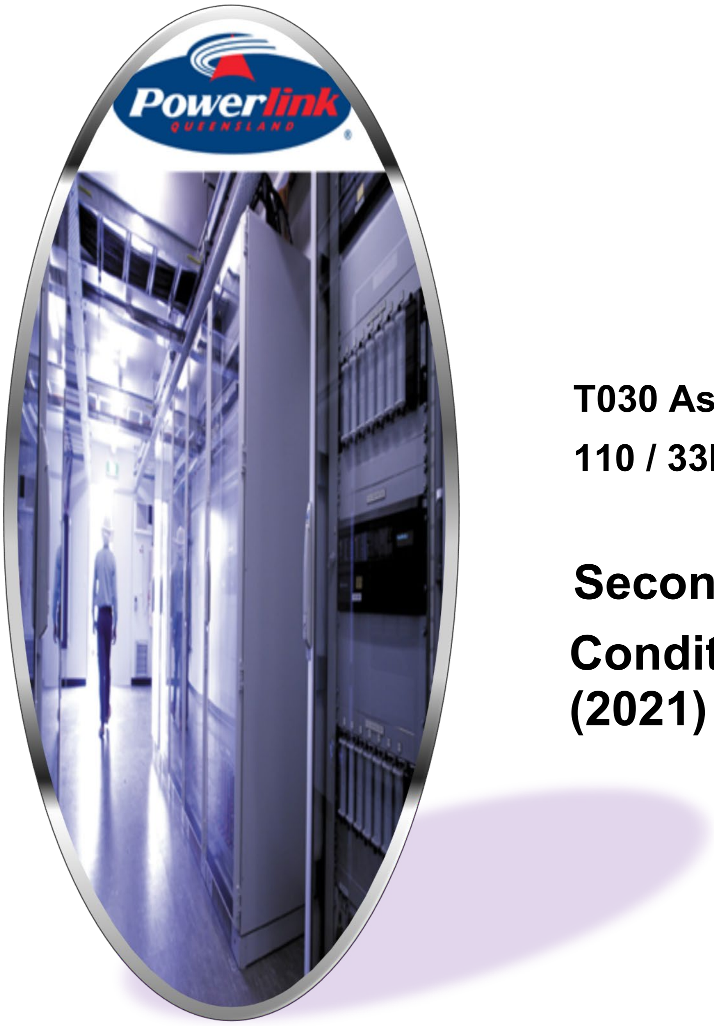
The estimated cost to replace secondary systems at Ashgrove West Substation is $25.2m ($2025/26) [4].

Target Commissioning Date: April 2029.

Document in CP.02855 Project Pack

Public Documents

1. T030 Ashgrove West Secondary Systems Condition Assessment Report
2. CP.02855 Ashgrove West Secondary Systems – Planning Statement
3. CP.02855 Ashgrove West Secondary Systems – Project Scope Report
4. CP.02855 Ashgrove West Secondary Systems – Concept Estimate
5. CP.02855 Ashgrove West Secondary Systems – Risk Cost Summary Report



T030 Ashgrove West
110 / 33kV Substation

Secondary Systems Condition Assessment Report (2021)

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1. Introduction

This report pertains to the secondary systems and associated site infrastructure of the 110/33kV T030 Ashgrove West substation. It is provided to assist with determining the future strategy and scope for refurbishment replacement works.

The assessment has been formulated with the assistance of data extracted from SAP, Forced Outage Database, discussion with maintenance staff and a site inspection. Photographs of items of major concern are included in the text and all photographs taken during the site visit have been retained for future reference.

The Ashgrove West substation site is located at 10 Trinder Road, Ashgrove. Emergency and routine maintenance of the secondary systems are conducted by Powerlink staff based at Virginia, 30 minutes drive away. Powerlink 110kV protection and control systems are housed in a single level brick building (shared with Energex protection and control systems) adjacent to the switchyard as shown in Figure 1.

Figure 1. 110/33kV Ashgrove West Substation Aerial View [2018].

Ashgrove West substation is a 110/33kV sub transmission substation located in Southern Queensland to provide power supply for the South of Queensland and local area. The Substation consists of one yard of 110kV operating voltage equipment, enclosed by the one perimeter fence with an Energex 33kV distribution system. The substation was built in 1978. Ashgrove West is a shared substation with Energex, comprised of:-

- 3 x 110kV buses,
- 4 x 110kV Underground Feeder Bays,
- 2 x 110/33kV 100/80MVA Transformers,
- 3 x 110kV Capacitor Banks,
- 1 x Bus Coupler.

Ongoing project works at Ashgrove west, under project CP.02355 shown in Figure 2, have installed new primary plant and marshalling kiosks in Bays 08, 05, 06 and 09 with Bay 03 and 04 currently under construction. Under this project, cabling between the new kiosks and primary plant have been replaced, as well as cabling between new kiosks and existing control and protection panels for these bays. The full project staging plan [A2792648] also outlines planned replacement of the cables to 2 bus 1 Voltage transformer.

[redacted]

Figure 2. CP.02355 Project Works Diagram [2020].

Currently the 110kV feeder 781 is connected to SSKVG [Energex], feeder 7256 is connected to Powerlink Upper Kedron substation H023, and feeders 7257 and 782 are connected in a temporary configuration between Energex SSMLT (Milton) and Powerlink Upper Kedron Substation H023, as shown in Figure 3.

[redacted]

Figure 3. 110/33kV Ashgrove West Substation Electrical Single Line Diagram [2021].

Two 110/33kV 100/80MVA transformers provide supply for Energex 33kV systems. The 3 x 110kV Capacitor banks provide reactive power compensation to support the voltage level. Powerlink's 315kVA pole mounted 33kV/433V station transformer provides local AC supply for the substation.

This report assesses the condition of secondary systems assets associated with the primary plant, as shown in Table 1, and makes recommendations on optimal reinvestment timing for these assets to maintain the current network reliability and availability. Recommendations in this report have been formulated based on asset conditions only, excluding considerations for network reconfigurations, network-enduring needs, economic options, engineering solutions and delivery methodologies.

Ashgrove West substation primary bays and network elements are listed in Table 1:

Table 1 – Ashgrove West Substation Network Elements

Local Substation (T030 Ashgrove West)					Remote Substation
	Voltage (kV)	**Quantity**	**Bay Designation**	**Operational Element**	
Feeder	110	4	=D06-F6	781	SSKVG [Energex]
			=D03-F3	782	SSMLT [Energex] [Temp bypass T030]
			=D04-F4	7257	H023 Upper Kedron [Temp bypass T030]
			=D05-F5	7256	H023 Upper Kedron
Cap Bank	110	3	=D10-A10	2 Cap	
			=D11-A10	3 Cap	
			=D01-A10	4 Cap	
Transformer	110/33	2	=D12-Q10	T1 CB 4412	110kV
			=D09-T3	T3 CB 4432	110kV
Bus Coupler	110	1	=D08-B23	CB 4122	
Busbar	110	3	=KD1	1 Bus	
			=KD2	2 Bus	110kV 1 VT
			=KD3	3 Bus	110kV 2 VT

1.1 Inclusions

Secondary systems and associated equipment provide monitoring, supervision, control and protection functions. 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.

1.2 Exclusions

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

- Condition of control buildings and associated light and power circuits, Civil structures, cable trenches and foundations,
- AC auxiliary supply systems (> 230VAC), including transformers, diesel generators and building power and light circuits,
- 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.
- 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,
- Telecommunication assets, including 50VDC batteries and chargers.

2. Condition Assessment Principles and Methodology

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 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 depends solely on the site visual inspection. Site visual inspection also provides moderation and manual update of desktop assessments to reflect the actual condition of operational equipment at site.

The desktop assessment models the equipment health indices based on the optimisation of risk, cost and performance of Powerlink's secondary assets since 1999. The 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.

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 end of their technical service life. Equipment with a health index close to ten represents only a moderate increased risk of functional failures, but significantly longer outage duration and higher risk of impacting system's availability and reliability.

The key outcome of this report is the recommended 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 into account the criticality of equipment that are (or are not) directly associated with the performance of secondary systems. For example, OpsWAN equipment with health indices close to ten may not need to be replaced urgently because 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.

3. Buildings

3.1 Substation Secondary Systems Buildings

The single level brick building contains Powerlink protection and control panels, Energex control and protection relays, Powerlink communications, metering, batteries, lunchroom and toilet. The control building is air-conditioned and clean and is located within the substation perimeter fence.

The building, constructed in 1978, has been well maintained and is in fair condition. There is satisfactory access to all panels, although many redundant panels remain installed without any active function and need to be removed. The building has a cable basement for the entry of all control cables.

There is also a demountable container used as a workshop and storage facility.

Asbestos is present throughout the building [ASB-REG-T030 Site Asbestos Register for Ashgrove West], and ensuring that the ACM is maintained in a condition that prevents exposure may be compromised if major refurbishment works are to be undertaken within the building.

The internal panel layout, [A1-H-124887-001], is used to reference Figures 5-11.

Figure 4. T030 110kV Ashgrove West Substation Secondary Systems Building +1 [2021].

Figure 5. Substation Secondary Systems Building +1 Internal View 1.

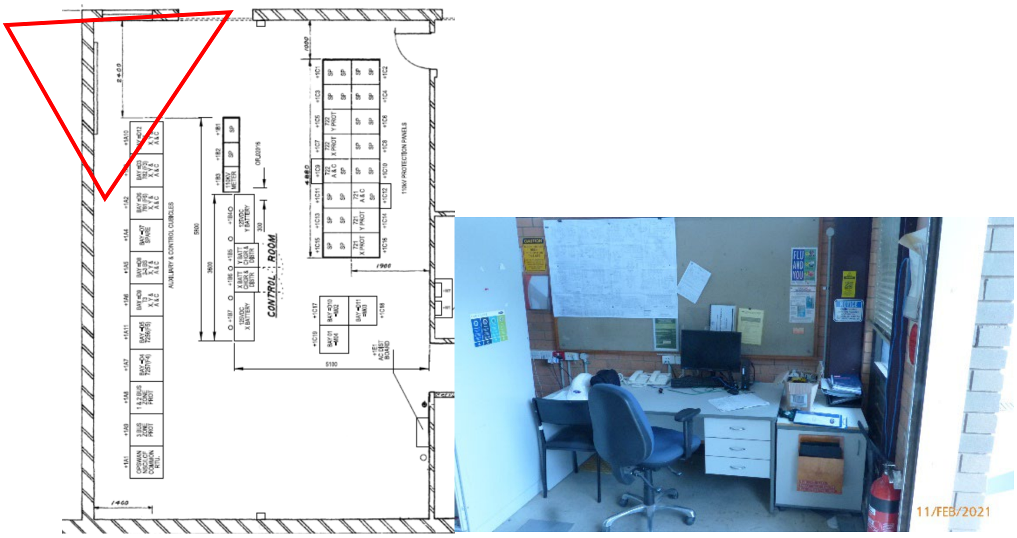


Figure 6. Substation Secondary Systems Building +1 Internal View 2.

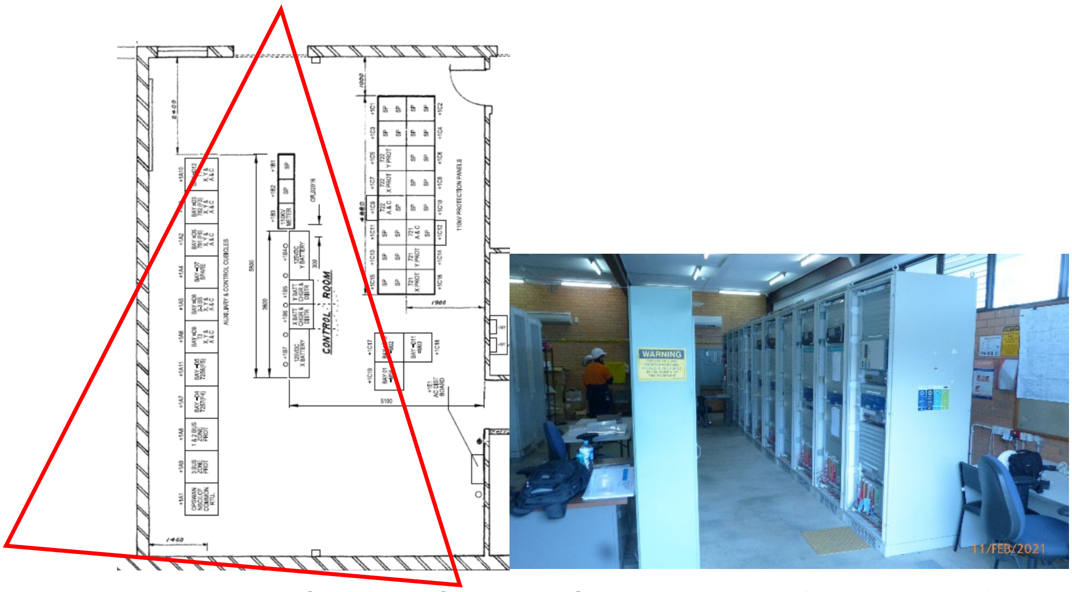


Figure 7. Substation Secondary Systems Building +1 Internal View 3.

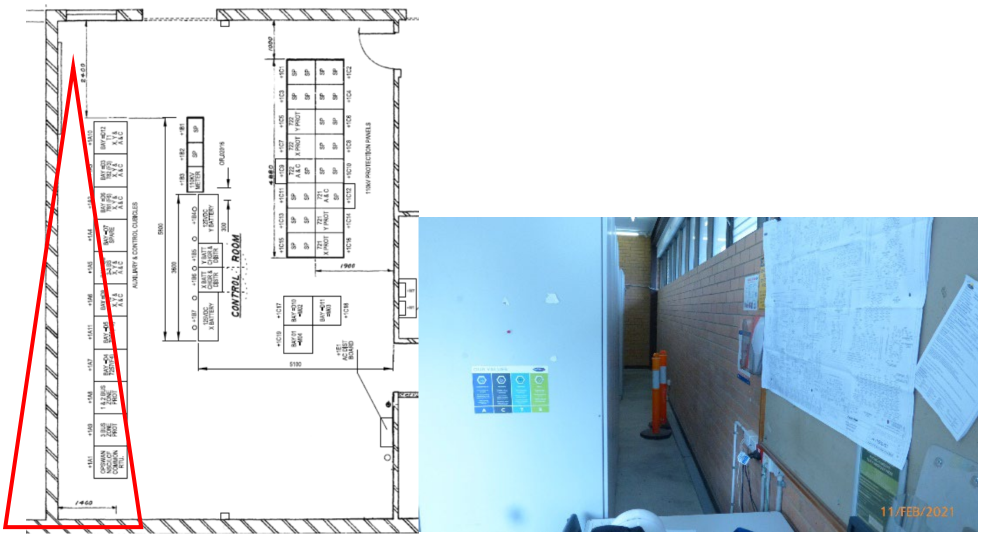


Figure 8. Substation Secondary Systems Building +1 Internal View 4.

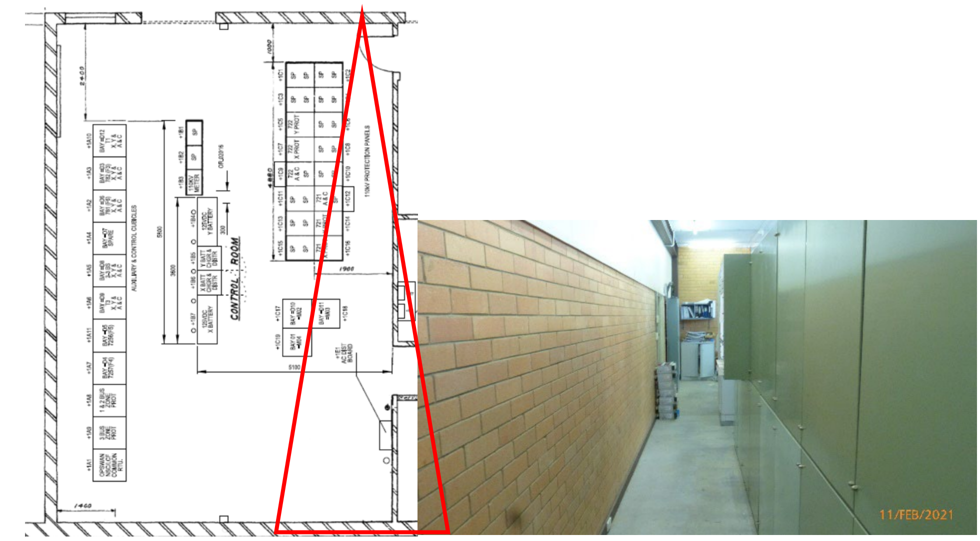


Figure 9. Substation Secondary Systems Building +1 Internal View 5.

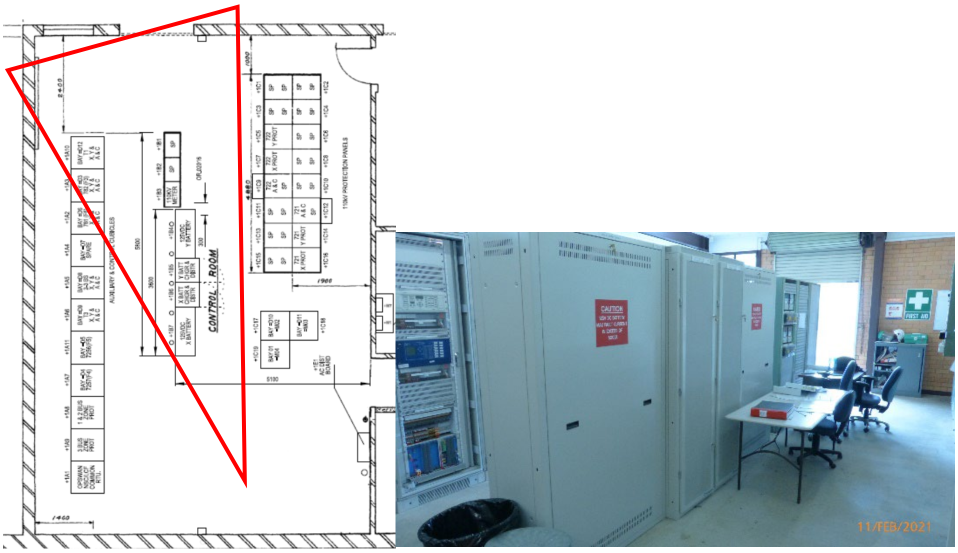


Figure 10. Substation Secondary Systems Building +1 Internal View 6.

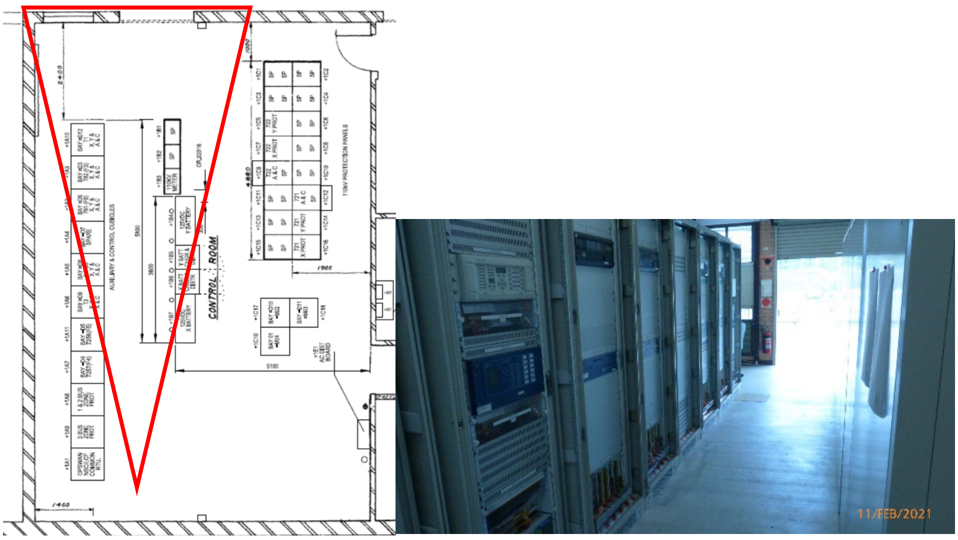
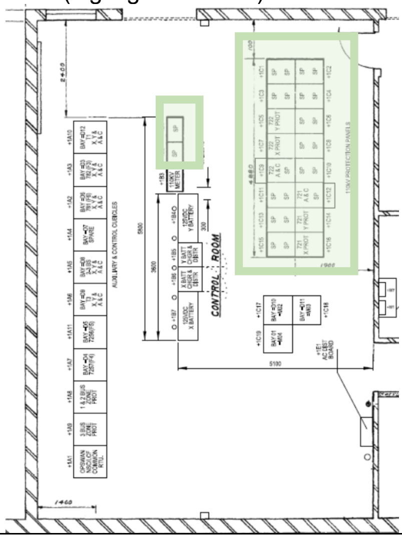


Figure 11. Substation Secondary Systems Building +1 Internal View 7.

Details of the substation control building are shown in Table 2.

Table 2 – Ashgrove West Substation Secondary System Building			
Building Description	**Designation**	**Functional Use**	**Spare Sec Sys Panel Spaces**
Substation & Communications Site Building	+1	Busbar Protection =KD2, =KD3 Sec Sys Bays =D01, =D03, =D04, =D05, =D06, =D08, D09, =D10, =D11, =D12 Revenue Meters Mux Communications Protection Signalling Station SCADA (NSC, LCF), Common RTU & OpsWAN 125V X&Y Batteries and Chargers	Sufficient Space to accommodate new secondary system panels in Building +1 once decommissioned panels (highlighted below) are removed. 

4. Condition Assessment

4.1 Secondary System Outdoor Marshalling Kiosks

Substation marshalling kiosks were recently replaced in 2019. The kiosks are in serviceable condition and can be kept in service until 2059. Some door seals and air filters, which appear to be made from unsuitable materials, show signs of degrading and should 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 all outdoor marshalling kiosks be monitored as part of the substation routine inspection to identify any aggressive deteroration. An operational project (or maintenance work orders) should be initiated to replace the internal components if they show signs of deterioration beyond Powerlink's safety standards.

Health Indices of secondary system outdoor marshalling kiosks and recommended replacement timeframe have been detailed in **Appendix A**. Physical appearance of typical outdooor marshalling kiosks and air filters are illustrated in Figure 12-25.

Figure 12. Transformer Interface Kiosk +U2-A10

Figure 13. Bay 11 3Capacitor Marshalling Kiosk +D11-A21

Figure 14. 2 VT Kiosk +KD3-A5

Figure 15. Bay 9 3Transformer Marshalling Kiosk +D09-A10

Figure 16. Bay 6 Marshalling Kiosk +D06-A10

Figure 17. Bay 5 Marshalling Kiosk +D05-A10

Figure 18. Bay 5 AC and DC Marshalling Kiosks +D05-A91, +D05-A92

Figure 19. Bay 8 Marshalling Kiosk +D08-A10

Figure 20. Bay 8 AC Marshalling Kiosk +D08-A91

Figure 21. 2 Bus VT Kiosk +KD2-A5

Figure 22. Bay 12 AC and DC Marshalling Kiosks +D12-A91, +D12-A92

Figure 23. Bay 10 2Capacitor Marshalling Kiosk +D10-A21

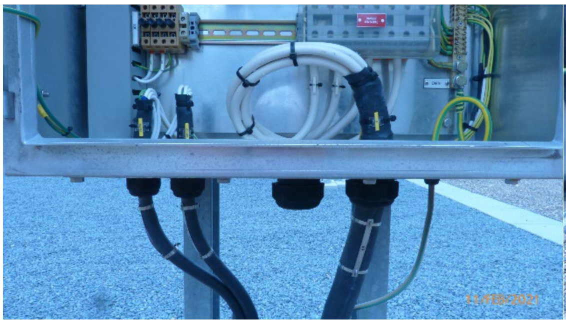
Figure 24. Bay 12 1Transformer Marshalling Kiosk +D12-A10

Figure 25. Bay 1 4Capacitor Marshalling Kiosk +D01-A21

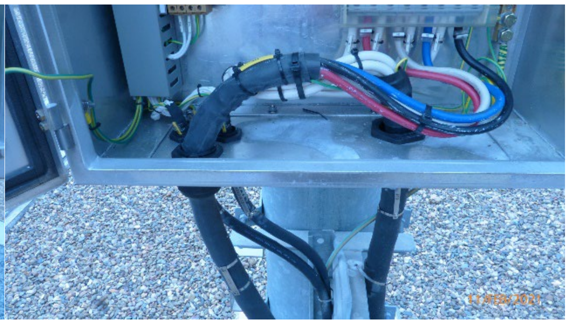
Marshalling kiosks for feeder bays D03 and D04 were under construction at the time of this condition report and photos were unable to be obtained due to the construction zone. The marshaling kiosks are in new condition and deemed suitable for service until 2059. The marshalling kiosks for 1VT, 2, 3 and 4 Capacitor, shown in Figures 21, 23, 13 and 25 respectively, are the oldest on site and are not in the scope of CP.02355. Consequently these kiosks are recommended for replacement and can be kept in service until 2044.

4.2 Outdoor Secondary System Cables

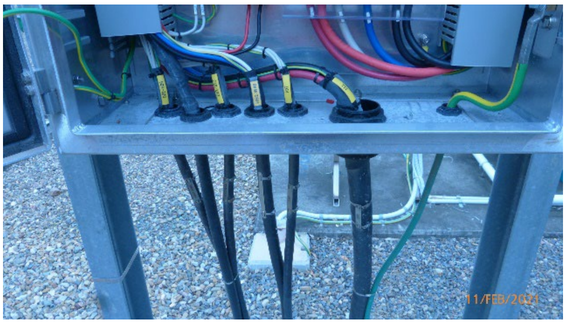
Outdoor secondary cables are in good condition as shown in Figures 26-28. The oldest cabling was observed in the three 110kV capacitor kiosks, shown in Figure 26, and visual inspection of these cables indicated that they can be kept in service until 2044. Cables into 2 Bus 1VT Marshalling Kiosk, shown in Figure 27, are in scope to be replaced under CP.02355 and, once completed, are consequently recommended for replacement by 2059. Field cabling to Bays 08, 05, 06 and 09 have been replaced, with Bays 03 and 04 in scope for replacement under CP.02355. Consequently, these cable can be kept in service until 2059, and examples are included in Figure 28.



(a)



(b)



(c)

Figure 26. Cabling in (a) 3 Capacitor, (b) 2 Capacitor and (c) 4 Capacitor Marshalling Kiosks.

Figure 27. Cabling in 2 Bus VT Marshalling Kiosk +KD2-A5

Figure 28. Cabling in Marshalling Kiosks replaced under CP.02355.

4.3 Indoor Termination Racks / Yard Interface Cubicle

There are no termination racks at Ashgrove West substation. Secondary system cables were installed directly between the indoor panels and outdoor marshalling cubicles through the cable basement.

4.4 Indoor Secondary System Cables

All cables inside the control buildings are considered to be in good condition as they have been in clean and air-conditioned environment since there were installed. The majority of field cabling into the panels was installed under CP.02355 and can be kept in service until 2059. The internal wiring of many control and protection panels was installed between 2004-2007, with the exception of Feeder 7256 and the uncommissioned feeder 7257 panel constructed in 2019. The replacement for this cabling has been recommended for 2044 and 2059 respectively. Examples of indoor cabling are given in Figure 29.

Figure 29. Cabling in Indoor Control and Protection Panels.

4.5 Control and Protection Systems

Condition assessment of control and protection systems, including cubicles, equipment, internal components such as links, terminals, wirings, MCBs, fuses, cables is summarised in **Appendix A**.

4.5.1 Secondary Systems Panels

A recent upgrade of the secondary system was undertaken, which included 11 new panels, but a mixture of old and new panels exist within the control building.

The original control and protection panels are of the old SEA (Southern Electric Authority) design with tunnel entry and exposed terminations. Tunnel entry panels with exposed terminations are not suitable for current safe work practices and risk assessment of the work site within the tunnel highlights the need to implement increased safety systems and extensive de-energisation of plant to allow work to proceed. Currently only feeder 7257 protection remains in this type of panel, as shown in Figure 30, with transition to a newer panel (+1A7) in the scope of CP.02355. Once this transition is complete, the existing older panels need to be removed as this is not covered in the project staging plan for CP.02355.

Figure 30. Feeder 7257 Control and Protection Panel [2021].

There are also newer modern rack mounted panels with front access. These panels, encompassing +1A1, +1A9, +1A8, +1A7, +1A11, +1A6, +1A5, +1A4 (SPARE), +1A2, +1A3, +1A10, +1C17, +1C18 and +1C19, were installed between 2004-2007 .These panels, including auxiliary parts e.g. links, terminals and internal wiring, can be kept in service until 2044.

Typical indoor secondary system panel conditions are shown in Figure 31 and capacitor bank panels are shown in Figure 32.

(a) +1A1 (b) +1A9 (c) +1A8 (d) +1A7

(e) +1A11 (f) +1A6 (g) +1A5 (h) +1A2

Figure 31. Typical Indoor Control and Protection Panels at Ashgrove West.

(a) +1C17 (b) +1C18 (c) +1C19

Figure 32. Capacitor Control and Protection Panels.

4.5.2 Control, Protection, Auxiliary, Ancillary, Metering and OpsWAN Equipment

4.5.2.1. Control, Protection, Auxiliary, Ancillary Equipment

Health indices and recommended replacement timeframes for substation secondary system equipment and associated ancillary equipment are tabled in **Appendix A**. Typical indoor secondary systems equipment are illustrated in Figure 33 below. This equipment is in need of a secondary systems upgrade project and can be kept in service until 2026, with the exception of Feeder 7256 installed in 2019, and the uncommissioned feeder 7257 panel to be installed in 2021 which can be kept in service until 2059.

Figure 33. Ashgrove West Typical Indoor Secondary Equipment.

4.5.2.2. Revenue Metering Panel

Ashgrove West substation revenue-metering panel, shown in Figure 34, is a rack mounted panel with rear entry. Auxiliary parts e.g. links, terminals and internal wiring are currently in good condition. The panel, internal wirings, links and terminals can be left service until 2040. The metering panel is situated next to two spare panels of the same vintage that should be removed.

Figure 34. Ashgrove West Substation Revenue Meter Panel.

4.5.2.3. Revenue Metering Equipment

Ashgrove West Substation metering equipment, shown in Figure 35, was installed between 2001-2018. The risk of revenue meter failure affecting the transmission network is considered to be moderate. They can be kept in service until 2030, and are recommended to be replaced as part of the secondary system replacement project, i.e. by 2026.

Figure 35. Ashgrove West Substation Revenue Meters

4.5.2.4. OpsWAN Systems and Equipment

OpsWAN systems and equipment at this site were installed and updated between 2002-2010, as illustrated in Figures 36 and 37. OpsWAN systems are still functioning and have an important role in operation and maintenance efficiencies. They are considered as auxiliary components of the power system. Their condition and performance generally do not have material impacts on the performance, reliability and availability of secondary systems and the power system.

Indoor OpsWAN systems and equipment are recommended to be replaced opportunistically as part of the secondary systems replacement project i.e. by 2026. OpsWAN cameras (outdoor OpsWAN equipment) should only be replaced under corrective maintenance when they fail and shall be excluded from secondary system refurbishment projects.

Figure 36. Ashgrove West Substation OpsWAN Panel

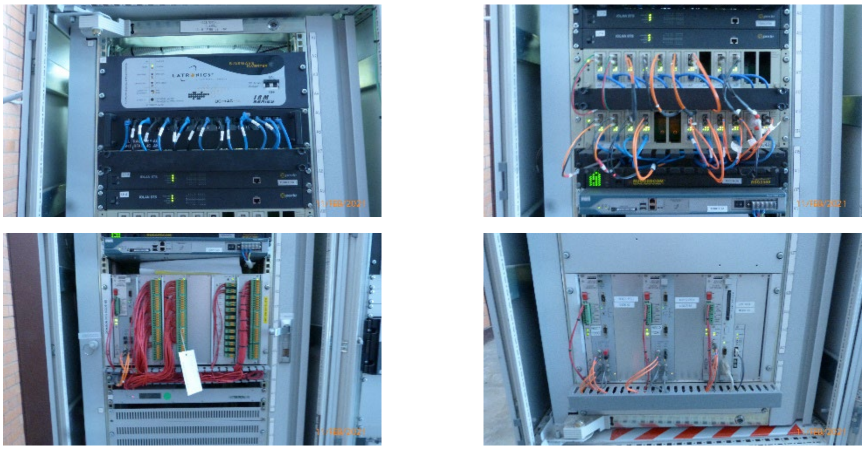


Figure 37. Ashgrove West Substation Typical OpsWAN Equipment

4.5.3 Auxiliary Supply

4.5.3.1. AC Auxiliary Supply

AC auxiliary supplies, including station transformers and backup diesel generator/s are not in scope of this report. AC heaters and lights servicing secondary system panels should only be replaced as part of secondary systems panels.

4.5.3.2. DC Batteries and Chargers

Ashgrove West substation 125VDC X and Y batteries, chargers and DC monitoring systems were upgraded in 2018, and are shown in Figure 38 below. Battery chargers and DC monitoring systems are not required to be replaced until 2040, however as the batteries have an expected lifespan of 12 years they are recommended for replacement by 2026 under the secondary systems project as recommended in **Appendix A.**

Figure 38. Ashgrove West Substation 125VDC Batteries and Chargers.

5. Secondary Systems Asset Strategies Recommendations

The recommendations in Table 3 have been strategically optimised based on the replacement timing (condition based timing) of individual equipment Health Indices (HIs) in **Appendix A.** Highlighted values are the equipment recommended to be included in the secondary systems replacement project. It is important that the responsible project team considers these recommendations in light of Powerlink delivery solutions, staging, resources and network outages to achieve safe and sustainable project delivery cost.

Marshalling kiosk door seals and air filters, showing signs of degradation, are to also be replaced as part of substation routine maintenance.

Table 3 – Recommended Asset Replacement Timing and Options – Building +1

Indoor Sec Sys Panels					Options	Outdoor Kiosks (Excl. Primary plant)			
ID	**Functions**	**Panel**	**Equipment**	**Cables**		**ID**	**Functions**	**Panel**	**Cables**
+1A8	110kV 1 & 2 Bus Zone X & Y Prot. CBF Bus Trip, 1VT	2044	2026	2044	A, B, C	+KD2-A5	1VT	2044	2059
+1A9	110kV 3 Bus Zone X & Y Prot. CBF Bus Trip, 2VT	2044	2026	2044	A, B, C	+KD3-A5	2VT	2059	2059
+1A6	110/33kV TFMR 3 CB 4432 (=D9-T3)	2044	2026	2044	A, B, C	=D09-A10	CB 4432	2059	2059
						=U2-A10	T1 Interface	2045	2045
+1A5	110kV 2-3 Bus Section CB 4122 (=D08-B23)	2044	2026	2044	A, B, C	=D08-A10	CB 4122	2059	2059
+1A10	110/33kV TFMR 1 CB 4412 (=D12-T1)	2044	2026	2044	A, B, C	=D12-A10	CB 4412	2045	2045
+1A2	110kV Feeder 781 CB 7812 (=D06-F6)	2044	2026	2044	A, B, C	+D06-A10	CB7812	2059	2059
+1A3	110kV Feeder 782 CB 7822 (=D03-F3)	2044	2026	2044	A, B, C	+D03-A10	CB7822	2059	2059
+1C17	110kV 2CAP CB 4822 (=D10-A10)	2044	2026	2044	A, B, C	+D10-A21	CB4822	2045	2045
+1C18	110kV 3CAP CB 4832 (=D11-A10)	2044	2026	2044	A, B, C	+D11-A21	CB4832	2045	2045
+1C19	110kV 4CAP CB 4842 (=D01-A10)	2044	2026	2044	A, B, C	+D01-A21	CB4842	2040	2040
+1B3	110kV Revenue Metering Cubicle	2044	2026	2044	A, B, C				
+1A1	Substation SCADA and OpsWAN	2049	2026	2049	A, B, C				
Bay 2 Rack 3	Master OpsWAN Server Panel	2059	2039	2059	A, B, C				
+1A11	110kV Feeder 7256 CB 72562 (=D05-F5)	2059	2040	2059	A, B, C	+D05-A10	CB72562	2059	2059
+1A7	110kV Feeder 7257 CB 72572 (=D04-F4)	2059	2040	2059	A, B, C	+D04-A10	CB72572	2059	2059
Building +1 – 125V DC (X & Y) Batteries, Monitors and Chargers	X Battery		2026		A, B, C				
	Y Battery				A, B, C				
	X DC Monitor & Charger		2040		A, B, C				
	Y DC Monitor & Charger								
	DC Distribution board								

Notes:

(i). Option A: In-Situ (Equipment) Replacement - Replace equipment in existing panel.
(ii). Option B: Install new panels / Systems in existing building.
(iii). Option C: Install new panels in new building. Existing Panels can be decommissioned or recovered for operational emergency spares
(iv). Unless specified, e.g. Transformer PLCs and some SICUs, all electronic equipment installed inside primary plant control cubicles (e.g. SICU, PASS M0 OLMs) are considered as integral parts of primary plant assets and are not in scope of this report.
(v). Innovative replacement solutions should be considered to maximise the use of available spaces in existing building to save cost.
(vi). Replacement timing for PASS M0 switchgear and its control cubicles depends on primary plant strategy.
(vii). Panel includes chassis, links, terminals and internal wirings.
(viii). Powerlink's asset lifespan for batteries is around 12 years, chargers and monitors is around 20 years.

6. Conclusion

This report details the conditions of Ashgrove West substation secondary systems and equipment. 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 T030 Ashgrove West are:-

1. Conduct the following secondary system replacements by 2026:-
    - Replace 110kV 1&2 Bus Zone protection and control equipment
    - Replace 110kV 3 Bus Zone protection and control equipment
    - Replace 110kV 2-3 Bus Section protection and control equipment
    - Replace 110kV TFMR 1 protection and control equipment
    - Replace 110kV TFMR 3 protection and control equipment
    - Replace 110kV Feeder 781 protection and control equipment
    - Replace 110kV Feeder 782 protection and control equipment
    - Replace 110kV 2 Capacitor protection and control equipment
    - Replace 110kV 3 Capacitor protection and control equipment
    - Replace 110kV 4 Capacitor protection and control equipment
    - Replace 110kV revenue metering equipment
    - Replace SCADA and OpsWAN equipment
    - Replace 125V DC X&Y Batteries

7. Attachments

- **Appendix A** – T030 110/33kV Ashgrove West Substation Secondary Systems Equipment Health Indices and Recommended Asset Placement Replacement Timeframe.

AppendixA.pd

- CIGRE 2018 - B3 - 205 - Modelling Substation control and Protection Asset Condition for Optimal reinvestment Decision Based on Risk, Cost and Performance.

B3 - 205 - Modelling
Substation control an

- Powerlink – Asset Risk Management – Framework, ASM-I&P-FRA-A2417558, Powerlink Queensland, 2019.

Powerlink Asset F

8. References

[1] "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.

[2] "Powerlink – Asset Risk Management – Framework", ASM-I&P-FRA-A2417558, Powerlink Queensland, 2019.

[3] CP.02355 T030 Ashgrove West Project Staging Plan A2792648.

9. Appendix A

APPENDIX A - T030 ASHGROVE WEST 33/110KV SUBSTATION SECONDARY SYSTEMS - EQUIPMENT HEALTH INDICES AND RECOMMENDED REPLACEMENT TIMEFRAME

Notes:

(a): Subject to Powerlink's O&M Safety Requirements, Current Standard Solutions and Implementation Methodologies, it may be more beneficial to align with the recommended replacement timeframe of secondary systems equipment

(b): Recommended Timeframe is based on majority of Equipment Health Indices

(c): Based on Visual Inspection and Subject to the decision of the Control Building and Secondary Systems Panels. A number of New Cables may be required if location of control building or secondary systems panels is changed.

(d): As a minimum requirement, Rubber Seals, Air filter and Terminals and Links are required to be repalced by the recommended timeframe. New Marshalling Kiosks should be considered if Exsiting Cables are to be replaced.

RECOMMENDED REPLACEMENT TIMMING (Based on Trigger Conditions only, Exclude considerations for Solutions, implementation methodologies)

BAY	C&P PANEL				SECONDARY SYSTEMS EQUIPMENT			[redacted]						X-PROT		Y-PROT		AUX & CTRL		REVENUE METERING		OPSWAN		CABLES (HI)	YARD MARSHALLING KIOSKS (HI)	C&P PANELS (Chassis)	Sec Sys Equipment		YARD MARSHALLING KIOSKS	Comments
Function	Panel Description	Panel No.	Year	HI	Functional Loc.	Description	Manufacturer	[redacted]	ManufPartNo.	Start-up date (FailureRate Table)	Obsolescence (Yes / No)	Spare Qty	Material	Eff. Age	HI	Eff. Age	HI	Eff. Age	HI	Eff. Age	HI	Eff. Age	HI	C&P Panels to HV Yard Marshalling Kiosks (CB, MK, CT, VT, AC, DC, COOLING)	Yard Marshalling Kiosks (CB, MK, CT, VT, AC, DC, COOLING)	C&P Panels	Sec Sys Equipment & Auxiliary Components	C&P Panels to HV Yard Marshalling Kiosks (CB, MK, CT, VT, AC, DC, COOLING)	Yard Marshalling Kiosks (CB, MK, CT, VT, AC, DC, COOLING)	Comments
110kV 1 & 2 Bus Zone X & Y PROT and CB Fail Bus Trip	Ashgrove West 110kV 1 and 2 Bus Zone X and Y protection and Circuit Breaker Fail Bus Trip Cubicle	+1A8	2004	4.25	T030-SSS-2BU4-BAYCONT	REMOTE TERMINAL UNIT FOXBORO C50	FOXBORO	[redacted]	0144-60-96	17/09/2004	Yes	0	26047					16.38	8.19					2 BUS VT 1VT cables in scope of CP.02355	4.25	2043-2044	2025/26 (b)	Cables Replaced in Scope of CP.02355	2043-2044	
					T030-SSS-2BU4-XPROT	RELAY CB FAIL BUS TRIP RACK	RMS	[redacted]	3A111K2	22/09/2004	No	3	29800	16.36	8.18															
					T030-SSS-2BU4-XPROT	RELAY BUS ZONE GE B30	GE	[redacted]	SEE INTERNAL NOTE	22/09/2004	Yes	3	32781	16.36	8.18															
					T030-SSS-2BU4-YPROT	RELAY CB FAIL BUS TRIP RACK	RMS	[redacted]	3A111K2	17/09/2004	No	3	29800			16.38	8.19													
					T030-SSS-2BU4-YPROT	RELAY BUS ZONE GE B30	GE	[redacted]	SEE INTERNAL NOTE	17/09/2004	Yes	3	32781			16.38	8.19													
110kV 3 Bus Zone X & Y PROT and CB Fail Bus Trip Cubicle	Ashgrove West 110kV 3 Bus Zone X and Y protection and Circuit Breaker Fail Bus Trip Cubicle	+1A9	2004	4.25	T030-SSS-3BU4-BAYCONT	REMOTE TERMINAL UNIT FOXBORO C50	FOXBORO	[redacted]	0144-60-96	17/09/2004	Yes	0	26047					16.38	8.19					0.5	0.5	2043-2044	2025/26 (b)	2058-2059	2058-2059	
					T030-SSS-3BU4-XPROT	RELAY CB FAIL BUS TRIP RACK	RMS	[redacted]	3A111K2	22/09/2004	No	3	29800	16.36	8.18															
					T030-SSS-3BU4-XPROT	RELAY BUS ZONE GE B30	GE	[redacted]	SEE INTERNAL NOTE	22/09/2004	Yes	3	32781	16.36	8.18															
					T030-SSS-3BU4-YPROT	RELAY CB FAIL BUS TRIP RACK	RMS	[redacted]	3A111K2	17/09/2004	No	3	29800			16.38	8.19													
					T030-SSS-3BU4-YPROT	RELAY BUS ZONE GE B30	GE	[redacted]	SEE INTERNAL NOTE	17/09/2004	Yes	3	32781			16.38	8.19													
110kV 3 TFMR CB 4432 [=D09-T3] - Control and Protection	Ashgrove West 110/33kV Transformer 3 Circuit Breaker T3 Bay D9 Protection and Control Cubicle	+1A6	2006	3.75	T030-SSS-443--BAYCONT	REMOTE TERMINAL UNIT FOXBORO C50	FOXBORO	[redacted]	0144-60-96	20/06/2006	Yes	0	26047					14.62	7.31					0.5	0.5	2045-2046	2027/28 (b)	2058-2059	2058-2059	
					T030-SSS-443--XPROT	RELAY TRANSF DIFF GE T60 (3.48)	GE	[redacted]	SEE INTERIM NOTE	20/06/2006	Yes	9	27193	14.62	7.31															
					T030-SSS-443--YPROT	RELAY BIASED DIFF SEL-387-5 (1A) (3U)	SCHWEITZER	[redacted]	0387514X1H2X4X1	3/06/2014	Yes	6	25465			6.67	3.68													
110kV Bus Section CB 4122 [=D08-B23] - Control and Protection	Ashgrove West 110kV Bay D8 Bus Section X and Y Protection Auxiliary and Control Cubicle	+1A5	2006	3.75	T030-SSS-412--BAYCONT	REMOTE TERMINAL UNIT FOXBORO C50	FOXBORO	[redacted]	0144-60-96	9/06/2006	Yes	0	26047					14.65	7.33					0.5	0.5	2045-2046	2027/28 (b)	2058-2059	2058-2059	
					T030-SSS-412--XPROT	RELAY CBMAN GE C60 (WITH WST MODULE)	GE	[redacted]	SEE INTERIM NOTE	9/06/2006	Yes	2	26151	14.65	7.33															
					T030-SSS-412--YPROT	RELAY CBMAN SEL-351-1 (1A)	SCHWEITZER	[redacted]	35111H4214 2X1	9/06/2006	Yes	10	25466			14.65	7.33													
110kV 1 TFMR CB 4412 [=D12-Q10]- Control and Protection	Ashgrove West 110kV Bay 12 Transformer T1 Protection and Control Panel	+1A10	2013	2	T030-SSS-441--BAYCONT	REMOTE TERMINAL UNIT FOXBORO C50	FOXBORO	[redacted]	0144-60-96(P3E)	9/10/2013	Yes	26	27350					7.32	5.10					0.5	0.5	2052-2053	2034/35 (b)	2058-2059	2058-2059	
					T030-SSS-441--XPROT	RELAY TX BIAS DIFF SIEMENS 7UT635	SIEMENS	[redacted]	7UT6351-5EB91-1BA1+L0G	9/10/2013	No	8	28744	7.32	4.23															
					T030-SSS-441--YPROT	RELAY BIASED DIFF SEL-387-5 (1A) (3U)	SCHWEITZER	[redacted]	0387514X1H2X4X1	9/10/2013	Yes	6	25465			7.32	3.68													
110kV 2 CAP CB 4822 [=M02, =D10-A10] - Control and Protection	Ashgrove West 110kV Bay D10 Capacitor Bank M02 X and Y Protection Cubicle	+1C17	2005	4	T030-SSS-482--BAYCONT	REMOTE TERMINAL UNIT FOXBORO C50	FOXBORO	[redacted]	0144-60-96	14/11/2005	Yes	0	26047					15.22	7.61					4	4	2044-2045	2026/27 (b)	2044-2045	2044-2045	
					T030-SSS-482--XPROT	RELAY CB MGMT GE C60 (VER 2.93 FIRMWARE)	GE	[redacted]	SEE INTERIM NOTE	14/11/2005	Yes	11	26931	15.22	7.61															
					T030-SSS-482--XPROT	RELAY CAP PROTN ABB SPAJ160C	ABB	[redacted]	RS 611 051-AA	14/11/2005	No	3	15980	15.22	7.61															
					T030-SSS-482--XPROT	RELAY 3PH O/C+E/F 1A/5A ABB SPAJ140C	ABB	[redacted]	RS 611 006-AA	17/06/1999	Yes	3	12182	21.63	10.82															
					T030-SSS-482--YPROT	RELAY CBMAN SEL-351-1 (1A)	SCHWEITZER	[redacted]	035111H4214X1	14/11/2005	Yes	10	25466			15.22	7.61													
					T030-SSS-482--POWAVE	RELAY POINT ON WAVE ABB E213	ABB	[redacted]		14/11/2005	Yes	1	25640					15.22	7.61											
110kV 3 CAP CB 4832 [=M03, =D11-A10] - Control and Protection	Ashgrove West 110kV Bay D11 Capacitor Bank M03 X and Y Protection Cubicle	+1C18	2005	4	T030-SSS-483--BAYCONT	REMOTE TERMINAL UNIT FOXBORO C50	FOXBORO	[redacted]	0144-60-96	21/11/2005	Yes	0	26047					15.20	7.60					4	4	2044-2045	2026/27 (b)	2044-2045	2044-2045	
					T030-SSS-483--XPROT	RELAY OC & EF ABB SPAJ140C	ABB	[redacted]	RS 611 006-AA	16/06/1999	No	3	12182	21.64	10.82															
					T030-SSS-483--XPROT	RELAY CB MGMT GE C60 (VER 2.93 FIRMWARE)	GE	[redacted]	SEE INTERIM NOTE	21/11/2005	Yes	11	26931	15.20	7.60															
					T030-SSS-483--XPROT	RELAY CAP PROTN ABB SPAJ160C	ABB	[redacted]	RS 611 051-AA	21/11/2005	No	3	15980	15.20	7.60															
					T030-SSS-483--YPROT	RELAY CBMAN SEL-351-1 (1A)	SCHWEITZER	[redacted]	035111H4214X1	21/11/2005	Yes	10	25466			15.20	7.60													
					T030-SSS-483--POWAVE	RELAY POINT ON WAVE ABB E213	ABB	[redacted]		21/11/2005	Yes	1	25640					15.20	7.60											
110kV 4 CAP CB 4842 [=M04, =D01-A10] - Control and Protection	Ashgrove West 110kV Bay 01 Capacitor Bank M04 X and Y Protection Cubicle	+1C19	2007	3.5	T030-SSS-484--BAYCONT	REMOTE TERMINAL UNIT FOXBORO C50	FOXBORO	[redacted]	0144-60-96(P3E)	28/09/2007	Yes	26	27350					13.35	6.68					3.5	3.5	2046-2047	2028/29 (b)	2046-2047	2046-2047	
					T030-SSS-484--XPROT	RELAY CAP PROTN ABB SPAJ160C	ABB	[redacted]	RS 611 051-AA	28/09/2007	No	3	15980	13.35	6.68															
					T030-SSS-484--XPROT	RELAY CB MGMT GE C60 (VER 2.93 FIRMWARE)	GE	[redacted]	SEE INTERIM NOTE	28/09/2007	Yes	11	26931	13.35	6.68															
					T030-SSS-484--XPROT	RELAY OC & EF ABB SPAJ140C	ABB	[redacted]	RS 611 006-AA	28/09/2007	Yes	3	12182	13.35	6.68															
					T030-SSS-484--YPROT	RELAY CBMAN SEL-351-1 (1A)	SCHWEITZER	[redacted]	035111H4214X1	28/09/2007	Yes	10	25466			13.35	6.68													
					T030-SSS-484--POWAVE	RELAY POINT ON WAVE ABB E213	ABB	[redacted]		28/09/2007	Yes	1	25640					13.35	6.68											
110kV FDR 7256 UPPER KEDRON CB 72562 [=D05-F5] - Control and Protection	Ashgrove West 110kV Bay 05 Feeder Protection and Control Panel	+1A11	2019	0.5	T030-SSS-7256-BAYCONT	REMOTE TERMINAL UNIT - STANDARD SCD5200	FOXBORO	[redacted]	SY-AU0154-70-96	21/11/2019	Yes	10	33993					1.20	4.78					0.5	0.5	2058-2059	2040/41 (b)	2058-2059	2058-2059	
					T030-SSS-7256-XPROT	RELAY CURR DIFF DISTANCE MICOM P546	SCHNEIDER	[redacted]	P546318A4N0510K	21/11/2019	Yes	14	28746	1.20	5.21															
					T030-SSS-7256-YPROT	RELAY DISTANCE SCHW'ZER 421-5 1A 24 LED	SCHWEITZER	[redacted]	04215611XC2X4H74474XX	21/11/2019	Yes	9	32105			1.20	4.79													
110kV FDR 7257 UPPER KEDRON CB 72572 [=D04-F4] - Control and Protection	Ashgrove West 110kV Bay 04 Feeder Protection and Control Panel	+1A7	2016	1.25	T030-SSS-7257-BAYCONT	REMOTE TERMINAL UNIT FOXBORO C50	FOXBORO	[redacted]	0144-60-105	29/08/2004	Yes	0	26407					16.43	8.22					0.5	0.5	2055-2056	2037/38 (b)	2058-2059	2058-2059	
					T030-SSS-7257-XPROT	RELAY CURR DIFF DISTANCE MICOM P546	AREVA	[redacted]	P546318A4N0510K	13/05/2016	Yes	14	28746	4.73	5.06															
					T030-SSS-7257-YPROT	RELAY DISTANCE SCHW'ZER 421-5 1A 24 LED	SCHWEITZER	[redacted]	04215611XC2X4H74474XX	13/05/2016	Yes	9	32105			4.73	4.79													
110kV FDR 781 KELVIN GROVE CB 7812 [=D06-F6] - Control and Protection	Ashgrove West 110kV Bay D6 Feeder X and Y Protection Cubicle	+1A2	2008	3.25	T030-SSS-781--BAYCONT	REMOTE TERMINAL UNIT FOXBORO C50	FOXBORO	[redacted]		19/12/2002	Yes	0	26047					18.13	9.06					0.5	0.5	2047-2048	2029/30 (b)	2058-2059	2058-2059	
					T030-SSS-781--XPROT	RELAY DIFF GE L90 2T H00 NXX-SXX-UXX-W7R	GE	[redacted]	SEE INTERNAL NOTE	19/12/2002	Yes	2	29605	18.13	9.06															
					T030-SSS-781--YPROT	RELAY DIFF 1A SCHWEITZER 311L-7 125VDC	SCHWEITZER	[redacted]	0311L7JBB421421XX	8/08/2014	Yes	9	28750			6.49	4.37													
110kV FDR 782 MILTON CB 7822 [=D03-F3] - Control and Protection	Ashgrove West 110kV Bay D3 Feeder X and Y Protection Cubicle	+1A3	2003	4.5	T030-SSS-782--BAYCONT	REMOTE TERMINAL UNIT FOXBORO C50	FOXBORO	[redacted]		23/01/2003	Yes	0	26047					18.03	9.01					0.5	0.5	2042-2043	2024/25 (b)	2058-2059	2058-2059	
					T030-SSS-782--XPROT	RELAY DIFF GE L90 2T H00 NXX-SXX-UXX-W7R	GE	[redacted]	SEE INTERNAL NOTE	23/01/2003	Yes	2	29605	18.03	9.01															
					T030-SSS-782--YPROT	RELAY DISTANCE SEL 311C 1A	SCHWEITZER	[redacted]	0311C01H2421421	23/01/2003	Yes	28	25388			18.03	9.01													
110kV Revenue Meters	Ashgrove West 110kV Revenue Metering Cubicle	+1B3	2009	3	T030-SSS-METR-INTSWIT	SWITCH E/NET 32PRT RUGGED RSG2300 OPSWAN	RUGGEDCOM	[redacted]	SEE INTERN.NOTE	7/06/2013	No	3	30818							7.66	7.66			3	3	2040-2041	2030/31 (b)	2040-2041	2040-2041	
					T030-SSS-METR-REVMET4	METER KWH/KVARH 1A 110V 3PH CL.5/1S REV	EDMI	[redacted]	SEE INTERNAL NOTE	15/07/2007	Yes	43	15879							13.56	6.78									
					T030-SSS-METR-REVMET4	KWH/KVARH EDMI 2000-0400 CL 0.5 (CHECK)	EDMI	[redacted]	SEE INTERNAL NOTE	30/06/2009	Yes	43	15879							11.60	5.80									
					T030-SSS-METR-REVMET5	WH/VARH METER (CHECK)	EDMI	[redacted]		31/10/2001	Yes	43	15879							19.26	9.63									
					T030-SSS-METR-REVMET5	METER KWH/KVARH EDMI (REVENUE)	EDMI	[redacted]	SEE INTERNAL NOTE	11/05/2018	Yes	43	15879							2.73	4.22									
Operational Network Hardware		+1A1	2010	2.75	T030-SSS-IONS-NETWORK	SWITCH E/NET 32PRT RUGGED RSG2300 OPSWAN	RUGGEDCOM	[redacted]	SEE INTERN.NOTE	21/05/2010	No	3	30818									10.71	10.71	2.75	2.75	2049-2050	2031/32 (b)			
					T030-SSS-IONS-NETWORK	ROUTER CISCO 2811 48VDC - OPSWAN	CISCO	[redacted]		21/05/2010	Yes	0	27651									10.71	10.71							
					T030-SSS-IONS-NETWORK	SERVER PORT 48VDC PERLE 04030450 -OPSWAN	PERLE	[redacted]	04030450	21/05/2010	No	2	27733									10.71	10.71							
					T030-SSS-IONS-NETWORK	PERLE IOLAN DS1, ETHERNET 10/100, DB9M	PERLE	[redacted]		2/08/2017	No	2	34320									3.51	1.75							
					T030-SSS-IONS-NETWORK	PERLE IOLAN DS1, ETHERNET 10/100, DB9M	PERLE	[redacted]			No	2	34320																	
					T030-SSS-IONS-NETWORK	Media Converter Rack	Alloy	[redacted]			No	5	29023																	
					T030-SSS-IONS-NETWORK	Media Converter Rack	Alloy	[redacted]			No	5	29023																	
					T030-SSS-IONS-HARDWARE	INVERTER 125VDC/240VAC 1600W	LATRONICS	[redacted]		27/09/2017	No	2	25941									3.35	3.20							
					T030-SSS-SAS--RTU	NSC LINK 1	FOXBORO	[redacted]	123852	19/12/2002	Yes	0	26044									18.13	9.06							
					T030-SSS-SAS--RTU	NSC LINK 2	FOXBORO	[redacted]	123852	19/12/2002	Yes	0	26044									18.13	9.06							
					T030-SSS-SAS--LCF	REMOTE TERMINAL UNIT FOXBORO C50	FOXBORO	[redacted]	123852	19/12/2002	Yes	0	26044									18.13	9.06							
					T030-SSS-SAS--RTU	REMOTE TERMINAL UNIT FOXBORO C50	FOXBORO	[redacted]	0144-60-106	23/06/2004	Yes	0	17276									16.61	8.31							
					T030-SSS-SAS--AUXCTRL	GPS CLOCK TEKRON TCG01-C:9	TEKRON	[redacted]	TCG01-C:9	28/10/2005	Yes	3	27092									15.27	7.63							
					T030-SSS-IONS-HARDWARE	SERVER WITH RAID 2405 CARD - OPSWAN	ICP ELECTRONICS	[redacted]	SEE INTERN NOTE	21/05/2010	Yes	2	30335									10.71	10.71							
Substation Automation Ancillary Parts		Bay 2 Rack 3	2018	0.75	T030-SSS-CORE-SASCNWK	SITE CORE SWITCH 2 +1	CISCO	[redacted]	CGS-2520-24TC	23/05/2018	No	2	40227									2.70	1.35	0.75	0.75	2057-2058	2039/40 (b)			
					T030-SSS-CORE-SASCNWK	SITE CORE SWITCH 1 +1	CISCO	[redacted]	CGS-2520-24TC	23/05/2018	No	2	40227									2.70	1.35							
					T030-SSS-IONS-NETWORK	CHECK POINT 1200R IPS RUGGED APPLIANCE	CHECKPOINT	[redacted]	CPAP-SG1200R-NGFW	23/05/2018	No	0	39989									2.70	3.53							
					T030-SSS-IONS-NETWORK	CHECK POINT 1200R IPS RUGGED APPLIANCE	CHECKPOINT	[redacted]	CPAP-SG1200R-NGFW	23/05/2018	No	0	39989									2.70	3.53							
110kV Building +1 DC Auxiliary Supply	BUILDING +1 125V DC X BATTERY	+1B7, +1B6	2018	2.5	T030-SIN-DCSU-125DCX1	BATTERY BANK DUAL 125VDC 300AH	CENTURY YUASA	[redacted]	20012	7/11/2018	No	0	32599													2057-2058	2030			
	BUILDING +1 125V DC X BATTERY CONTROL AND CHARGER		2018	1.5		CONTROL DEVICE - CXCR 125V CONTROLLER	ARGUS	[redacted]	CR3100	7/11/2018	Yes	30	33074														2040			
						RECTIFIER 125VDC YUASA CX125V 1.1KW	CORDEX	[redacted]		7/11/2018	No	20	33068																	
	BUILDING +1 125V DC Y BATTERY	+1B4, +1B5	2018	2.5	T030-SIN-DCSU-125DCY1	BATTERY BANK DUAL 125VDC 300AH	CENTURY YUASA	[redacted]	20012	7/11/2018	No	0	32599													2057-2058	2030			
	BUILDING +1 125V DC Y BATTERY CONTROL AND CHARGER		2018	1.5		CONTROL DEVICE - CXCR 125V CONTROLLER	ARGUS	[redacted]	CR3100	7/11/2018	Yes	30	33074														2040			
						RECTIFIER 125VDC YUASA CX125V 1.1KW	CORDEX	[redacted]		7/11/2018	No	20	33068																	
	BUILDING +1 DC MONITOR		2003	4.5	T030-SIN-DCSU-DCMON1	MONITOR BATTERY BDL3000 THYCON - COM10	THYCON	[redacted]		25/08/2004	Yes	0	27378														2024/25 (b)			
	BUILDING +1 50V DC A BATTERY		2017	3.33	T030-SIN-DCSU-50DCA1	BATTERY CELL YUASA 100AH 12V UXF100-12	CENTURY YUASA	[redacted]	UXF100-12FR	12/12/2017	Yes	0	28323													2047-2048	2029			
	BUILDING +1 50V DC A BATTERY MONITOR AND CHARGER		2008	6.5		MODULE MINICSU-2 110V CONTROLLER EXIDE	RECTIFIER TECHNOLOGIES	[redacted]	CONT-1189-AA	17/03/2010	No	10	27221														2030			
						RECTIFIER SM MODEL RT4B-48V/33A EXIDE	RECTIFIER TECHNOLOGIES	[redacted]	RECT-1146-FC	17/03/2010	No	10	27218																	
	BUILDING +1 50V DC B BATTERY		2017	3.33	T030-SIN-DCSU-50DCB1	BATTERY CELL YUASA 100AH 12V UXF100-12	CENTURY YUASA	[redacted]	UXF100-12FR	12/12/2017	Yes	0	28323													2047-2048	2029			
	BUILDING +1 50V DC B BATTERY MONITOR AND CHARGER		2008	6.5		MODULE MINICSU-2 110V CONTROLLER EXIDE	RECTIFIER TECHNOLOGIES	[redacted]	CONT-1189-AA	17/03/2010	No	10	27221														2030			
						RECTIFIER SM MODEL RT4B-48V/33A EXIDE	RECTIFIER TECHNOLOGIES	[redacted]	RECT-1146-FC	17/03/2010	No	10	27218																	
Local Control Equipment	HMI		2010	N/A	T030-SSS-SAS--LCF	LOCAL CONTROL FACILITY PC X TERMINAL	WYSE	[redacted]	909740-23L PREVIOUSLY -03L	2/08/2017	Yes	2	35961					3.51	6.19											
					T030-SSS-SAS--LCF	MONITOR	SUN	[redacted]	SUX7137A	19/12/2002	Yes	0	26221					18.13	9.06											
					T030-SSS-IONS-HARDWARE	PRINTER	HEWLETT PACKARD	[redacted]	Q7545A	21/05/2010	Yes	0	26840					10.71	5.35											

Planning Report		9 September 2025
Title	CP.02855 –Ashgrove West Secondary Systems Replacement	
Zone	Moreton	
Need Driver	Emerging operational and safety risks arising from the condition and obsolescence of Ashgrove West's ageing secondary systems requiring replacement to maintain ongoing compliance with requirements of the Electricity Act 1994, Electrical Safety Act 2002 and Electricity Safety Regulation 2013[1]	
Network Limitations	Ashgrove West Substation is required to meet Powerlink Queensland's N-1 50MW/600MWh Transmission Authority reliability standards.	
Pre-requisites	None	

Executive Summary

Ageing and obsolete secondary systems at Ashgrove West Substation 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[2].

Central scenario load forecasts confirm there is an enduring need to maintain electricity supply to industrial, commercial and residential loads supplied from Ashgrove West 110/33kV substation. These loads include the Brisbane western suburbs, Brisbane CBD and a Queensland Rail site.

The removal of functionality currently provided by Ashgrove West Substation would violate Powerlink's N-1-50MW/600MWh Transmission Authority reliability standard.

The preferred network solution for Powerlink to continue to meet its statutory obligations is the replacement of the secondary systems at Ashgrove West.

[1] *Electrical Safety Act 2002, section 29. Electrical Safety Regulation 2013, section 198(a). Electrical Safety Regulation 2013, section 198(d)*

[2] *AEMO, Power System Operating Procedure SO_OP_3715, Power System Security Guidelines, V95, September 2019 (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)).*

Table of Contents

1. Introduction

Ashgrove West 110kV Substation (T030) was established in 1978 and plays a critical role in supporting electricity supply to Brisbane's north-west corridor, including Ashgrove, Milton, and parts of the Brisbane CBD.

Figure 1 shows the existing Powerlink 275kV and 110kV transmission network supplying the greater Brisbane area. An Energex 110kV sub-transmission system extends from Ashgrove West Substation to supply the network within the north-western Brisbane area.

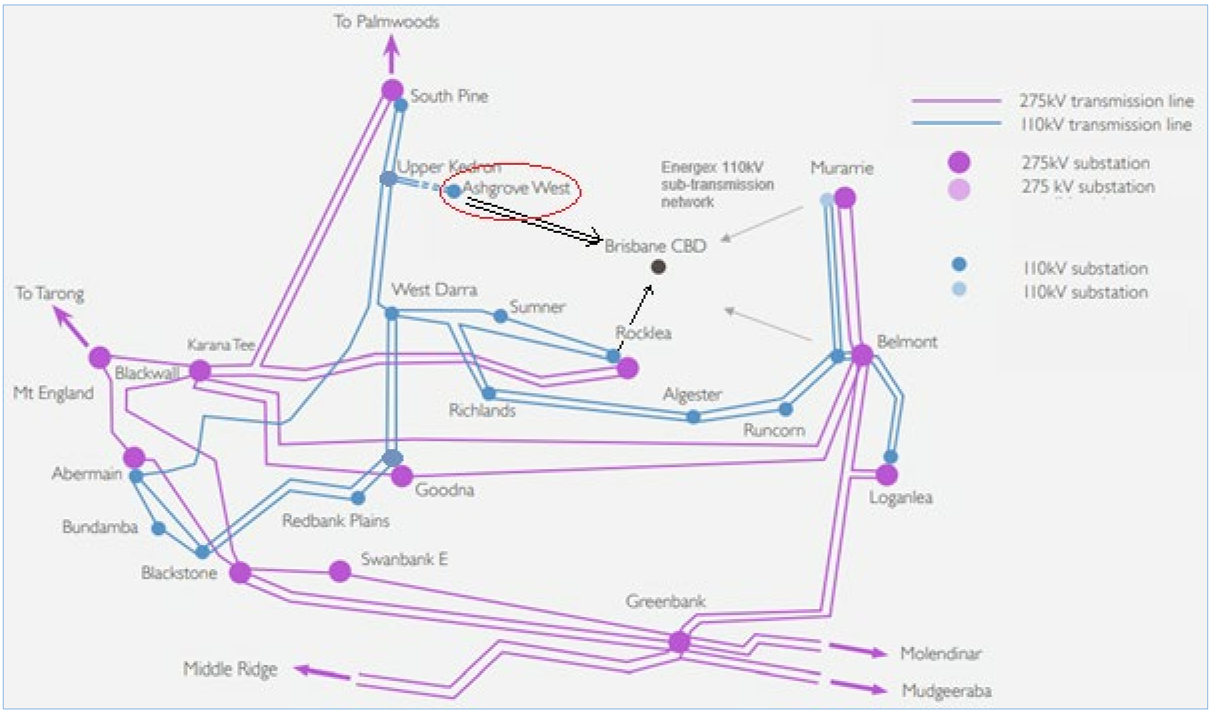


Figure 1. Powerlink Transmission Network within the Metropolitan Brisbane Area

A condition assessment [1] indicates that most secondary systems devices are reaching the end of their technical asset life. The driver for replacing secondary systems is the obsolescence and end of manufacturer support for the existing relays.

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.

This report assesses the impact that removal of end-of-life 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 Ashgrove West substation.

2. Ashgrove West Substation configuration

Figure 2 shows the system diagram for the portion of the Powerlink 275kV and 110kV network in western Brisbane, and the associated Energex 110kV sub-transmission system. With supply via 2 feeders from H023 Upper Kedron, Ashgrove West substation supplies injections into the Energex system as follows:

- Energex bulk supply point Milton substation (SSMLT) supplying residential, commercial and light industrial loads within the western Brisbane area.
- Energex bulk supply point Kelvin Grove substation (SSKVG) supplying residential and commercial loads in and around the Kelvin Grove urban village precinct.
- Energex bulk supply point Makerston Street substation (SSMST) supplying residential and commercial loads in and around Roma Street and the western CBD.
- Local residential and commercial load within the Ashgrove West area.

[redacted]

Figure 2. Powerlink and Energex 275kV and 110kV System Diagram

Figure 3 shows the operation diagram for Ashgrove West Substation.

[redacted]

Figure 3. Ashgrove West operational diagram

A condition assessment of the secondary systems at Ashgrove West Substation has determined that they are reaching the end of their technical service lives, with many components no longer supported by the manufacturer and limited spares available. 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 Ashgrove West 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 for network reliability and safety.

3. Demand Forecasts

Ashgrove West substation supplies residential, industrial and commercial loads within the north-west corridor, including Ashgrove, Milton, and parts of the Brisbane CBD.

Historical and forecasts for maximum native load supplied by Ashgrove West Substation are shown in Figure 4.

This confirms an enduring need for the existing functionality provided by Ashgrove West substation in suppling load within the north-west corridor and CBD of Brisbane.

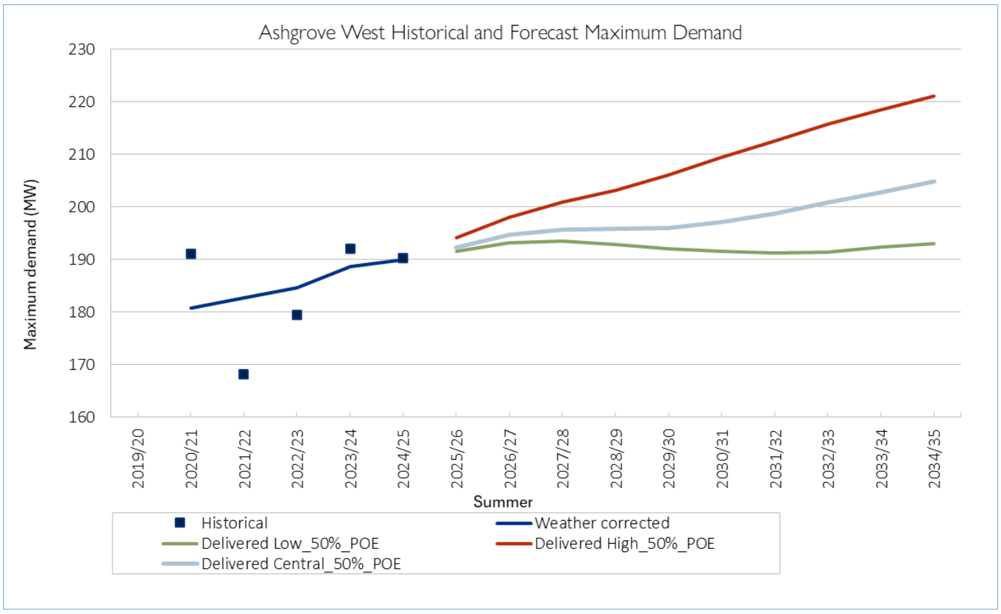


Figure 4. Ashgrove West Historic Load and Forecast Demand

Figure 5 shows the historical duration curve for the loads connected to T030 Ashgrove West Substation. This includes the downstream loads of the Brisbane western suburbs, Brisbane CBD and a Queensland Rail site.

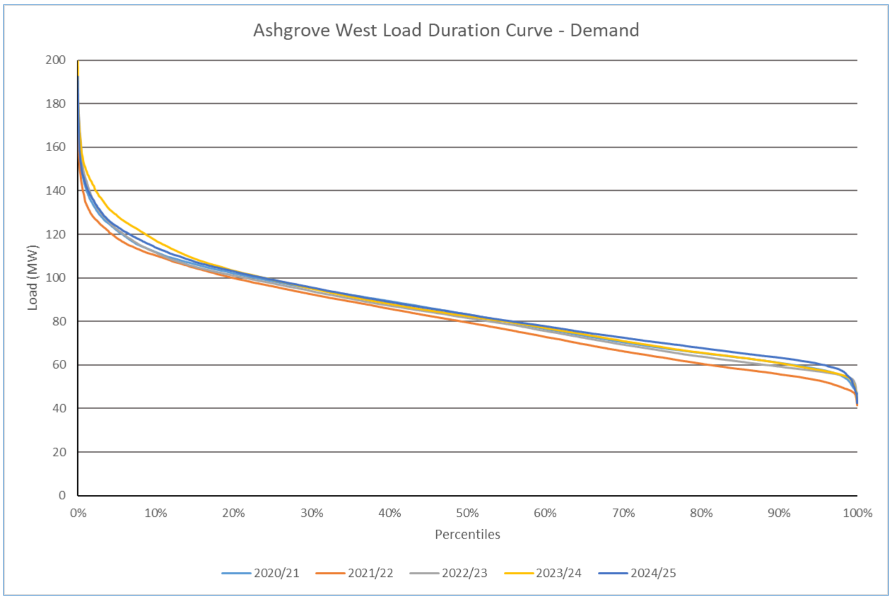


Figure 5. Ashgrove West Load Duration Curves

With the consideration of rooftop PV, the maximum 'underlying' demand is significantly greater than the delivered demand. Figure 6 shows the average summer day load profile for 2024/25 at Ashgrove West Substation, along with the estimated 'underlying' demand i.e. with rooftop

PV added to the load. This shows that the underlying demand could be 40MW more than delivered.

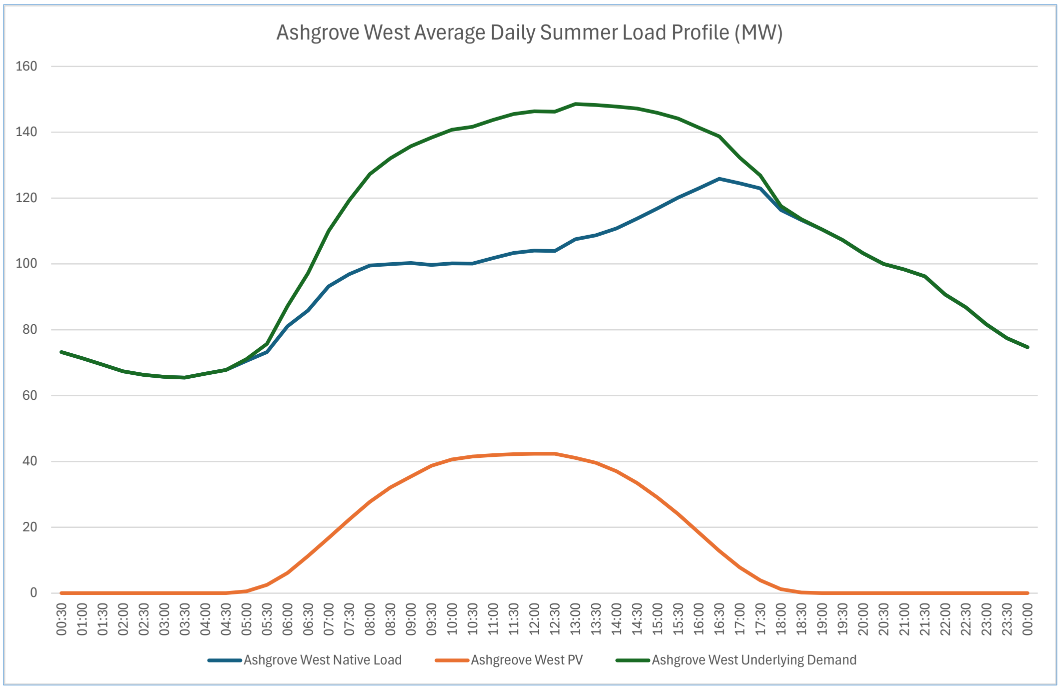


Figure 6. Ashgrove West daily demand profile

4. Statement of Investment Need

Ashgrove West 110kV substation is a critical substation for the Powerlink and Energex 110kV sub-transmission network supplying residential, commercial and industrial loads Brisbane area, particularly the north-west corridor, including Ashgrove, Milton, and parts of the Brisbane CBD.

Removing the functionality provided by Ashgrove West substation will mean that the existing network will no longer meet Powerlink's N-1-50MW / 600MWh Transmission Authority reliability standard.

As the secondary systems are required to operate Ashgrove West Substation, it is proposed that they be replaced to ensure ongoing compliance with Powerlink's NER and Transmission Authority obligations.

5. Network Risk

Table 1 summarises the load and energy at risk associated with Ashgrove West Substation. Rooftop PV is considered in an adjacent column to demonstrate the total level of customer load at risk of not being supplied.

Table 1. Ashgrove West Load and Energy at Risk

At Risk	Contingency	Metric*	2025	2025 + PV	2034/35	2034/35 + PV
Partial load at T030, SSMLT, SSKVG, SSQRT and SSMST	Outage of 7256 (sec sys) or Outage of 7257 (sec sys)	Max (MW)	7	8	18	20
		Average (MW)	0	0	0	0
		24h Energy Unserved Max (MWh)	8	8	20	22
		24h Energy Unserved Average (MWh)	0.03	0.03	0.2	0.2
Combined load at T030, SSMLT, SSKVG, SSQRT and SSMST	Outage of 7256 (sec sys) followed by outage of 7257 (sec sys, planned, unplanned)	Max (MW)	192	212	218	260
		Average (MW)	36	47	49	70
		24h Energy Unserved Max (MWh)	1937	2354	2415	3681
		24h Energy Unserved Average (MWh)	857	1138	1166	2028
Ashgrove West 33kV Load	Outage of 1T (sec sys) followed by outage of 3T (sec sys, planned, unplanned) or Outage of 3T (sec sys) followed by outage of 1T (sec sys, planned, unplanned)	Max (MW)	76	92	86	180
		Average (MW)	26	35	25	45
		24h Energy Unserved Max (MWh)	1069	1366	1354	2047
		24h Energy Unserved Average (MWh)	616	831	609	1081
½ Ashgrove West 33kV Load	Outage of 4122 (sec sys) followed by outage 3T (sec sys, planned, unplanned) (1) or Outage of 4122 (sec sys) followed by outage 2T (sec sys, planned, unplanned) (1)	Max (MW)	38	46	43	90
		Average (MW)	13	17	12	22
		24h Energy Unserved Max (MWh)	534	683	672	1023
		24h Energy Unserved Average (MWh)	308	415	304	540
Combined load at SSMLT,	Outage of 781 (sec sys) followed by	Max (MW)	50	54	74	121
		Average (MW)	3	5	13	27

At Risk	Contingency	Metric*	2025	2025 + PV	2034/35	2034/35 + PV
SSKVG, SSQRT and SSMST	outage of 782 (sec sys, planned, unplanned) or Outage of 782 (sec sys) followed by outage of 781 (sec sys, planned, unplanned)	24h Energy Unserved Max (MWh)	491	597	916	1435
		24h Energy Unserved Average (MWh)	77	117	319	641

Note:

(1) With an outage of the bus coupler 4122 the 33kV bus is assumed split.

6. Non Network Options

Potential non-network solutions would need to provide supply to all the 110kV load between Ashgrove West and Charlotte St. To meet the North-West Brisbane demand, the non-network solution must be capable of delivering up to 220MW and 2400MWh per day.

Partial non-network solutions may be able to provide supply to individual 110kV injection points, and this may reduce the scope of the secondary systems replacement project. For example, the substation hosts two 110/33kV transformers to facilitate supply to the local Energy Queensland load at Ashgrove West only. It also acts as a supply point for two feeders supplying substations at Kelvin Grove, Milton, QR Roma Street and Makerston Street.

Powerlink is currently not aware of any Demand Side Solutions (DSM) in the area supplied by Ashgrove West Substation. However, Powerlink will consider any proposed non-network solutions that may be able to contribute to the requirement functionality provided by Ashgrove West substation.

7. Network Options

7.1 Proposed Option to address the identified need

The proposed solution is to replace the at-risk secondary systems at Ashgrove West Substation.

Further details of end-of-life drivers for the secondary systems at Ashgrove West substation can be found in Reference 1.

7.2 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.

7.2.1 Do Nothing

"Do Nothing" would not be an acceptable option as the primary driver (cable condition) and associated safety, reliability and compliance risks would not be resolved. 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.

7.2.2 Bypass Ashgrove West and Reinforce EQL 33kV network

Connecting Kelvin Grove/Milton to Upper Kedron (i.e. bypassing Ashgrove West) would not provide the necessary 110/33kV injection at Ashgrove West. This would require extensive reinforcement of the 33kV network and not considered economic, as 33kV limitation were the original need for the establishment of the substation in 1978.

7.2.3 Reinforcement of H016 Rocklea substation and associated 110kV system

The reinforcement of the existing Rocklea 275/110kV substation and associated 110kV sub-transmission system to replace the functionality provided by Ashgrove West substation was examined but was not considered economically feasible due to the significantly higher cost compared to the secondary systems works proposed for Ashgrove West Substation. In addition, some level of partial secondary systems work at Ashgrove West substation would need to be performed.

8. Recommendations

Ageing and obsolete secondary systems at Ashgrove West Substation 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[3].

It is recommended to replace the at-risk secondary systems at Ashgrove West Substation.

Retaining Ashgrove West Substation capacity will allow Powerlink to continue to meet its required reliability obligations (N-1-50MW/600MWh).

Powerlink is currently unaware of any feasible alternative options to minimise or eliminate the load at risk at Ashgrove West but will, as part of the formal RIT-T consultation process, seek non-network solutions that can contribute significantly to ensuring it continues to meet its reliability of supply obligations.

9. References

1. T030 Ashgrove West Secondary Systems Condition Assessment Report Dec 2016
2. 2025 Transmission Annual Planning Report (A6049612)
3. Asset Planning Criteria - Framework (ASM-FRA-A2352970)
4. Powerlink Queensland's Transmission Authority T01/98

[3] *AEMO, Power System Operating Procedure SO_OP_3715, Power System Security Guidelines, V95, September 2019 (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)).*

Appendix A - Network Risk Methodology

Ashgrove West 33kV Load

Loss of both 110/ 33 kV Transformers results in loss of supply to the 33kV load at T030 Ashgrove West Substation.

Feeders 7257 OR 7256 - Combined load at T030, SSMLT, SSKVG, SSQRT and SSMST

The loads at T030 Ashgrove West, SSMLT Milton, SSKVG Kelvin Grove, SSQRT Queensland Rail and SSMST Makerston Street are supplied by feeders 7256 and 7257 from H023 Upper Kedron to T030 Ashgrove West as well as F830 SSWED West End to SSMST Makerston Street (which is supplied by F905 H016 Rocklea to SSWED West End).

The loss of a single Upper Kedron to Ashgrove West 110kV feeder, then all load between Ashgrove West and Charlotte Street becomes at risk. EQL has a POP scheme to protect the Rocklea to West End cable F905 from overload whereby feeders F807 and F7321 are tripped in the event of an overload on F905. The remaining feeder 7256/7257 lands within its contingency rating. However, then load has to be reduced to the emergency cyclic rating of 185MVA.

Loss of 7256 and 7257 from H023 Upper Kedron to T030 Ashgrove West will result in an overload of F905 H016 Rocklea to SSWED West End and F830 SSWED West End to SSMST Makerston Street. (F905 is affected worse).

Feeder F905 has a summer emergency cyclic rating of 124MVA. Subtracting West End load, means that when the combined exceeds approximately 50MW, then the shedding of all the load will occur.

It is then assumed that partial load could be restored up to the nominal 50MW (or 35MW in 2035). Table 1 of Section 4 assumes the Max (MW) as all the load, and average figures assuming 50MW is retained i.e. threshold = 50MW (or 35MW in 2035).

Feeders 781 OR 782 - Combined load at SSMLT, SSKVG, SSQRT and SSMST (i.e. T030 33kV excluded)

The loads at SSMLT Milton, SSKVG Kelvin Grove, SSQRT Queensland Rail and SSMST Makerston Street are supplied by feeders 782 T030 Ashgrove West to SSMLT Milton, 781 T030 Ashgrove West to SSKVG Kelvin Grove, as well as F830 SSWED West End to SSMST Makerston Street (which is supplied by F905 H016 Rocklea to SSWED West End).

Loss of 782 from T030 Ashgrove West to SSMLT Milton and 781 from T030 Ashgrove West to SSKVG Kelvin Grove will result in an overload of F905 H016 Rocklea to SSWED West End and / or F830 SSWED West End to SSMST Makerston Street. (F905 is affected worse).

Inclusion of Rooftop PV

Installed rooftop PV capacity is obtained for each substation. Energy generated by rooftop PV is unknown for some substations, particularly those owned by Energy Queensland. In these instances, an efficiency factor is calculated based on a reference substation (T030 Ashgrove West for this document). The efficiency factor is calculated by dividing the energy generated by the capacity of the PV. The PV generated for each substation is calculated by multiplying this efficiency factor by the installed PV capacity of the substation in question.

Assumptions

In practice, pre-contingent operational switching may mitigate the impact of possible outages with the above. A detail switching strategy would be formulated closer to the implementation period, but these values are indicative of the Network Risk costs.

Project Scope Report

CP.02855

Ashgrove West Secondary Systems Replacement

Concept – Version 3

Document Control

Change Record

Issue Date	Revision	Prepared by	Reviewed by	Approved by	Background
16/04/2025	1	[redacted]	[redacted]	[redacted]	Initial Issue
1/09/2025	2	[redacted]	[redacted]rell	[redacted]	Include Trench CVT replacement, Metering Move cost inclusion for later decision at approval stage
3/10/2025	3	[redacted]	[redacted]	[redacted]	Remove WAMPAC and add third option proposed by design. Addition of Special Consideration (Sect 7)

Related Documents

Issue Date	Responsible Person	Objective Document Name
28/11/2024	[redacted]	CP.02855 - T030 Ashgrove West Secondary Systems Replacement - Project Initiation Form 2024 (A5694229)
25/02/2021	[redacted]	T030 Ashgrove West Secondary Systems Condition Assessment Report Feb 2021 (A4650795)

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]
Connection & Development Manager	[redacted]
Strategist – HV/Digital Asset Strategies	[redacted]
Planner – Main/Regional Grid	[redacted]
Manager Projects	[redacted]
Project Manager	[redacted]
Design Coordinator	TBC

Project Details

1. Project Need & Objective

Ashgrove West Substation, located approximately 6km north west of the Brisbane CBD, was established in 1979 to supply the Brisbane central business district and the expanding residential areas to the North West of Brisbane. Ashgrove West substation, supplied from Upper Kedron, is a shared Powerlink site with Energy Queensland (EQ) supplying EQ at both 110kV and at 33kV via two 110/33kV transformers.

A recent condition assessment indicates that the secondary systems, including metering, is reaching the end of its technical asset life in 2026 and as a result, the declining condition of equipment is decreasing the reliability, and the unavailability of spare parts are causing maintainability issues. Therefore, to mitigate associated risks, it is recommended to replace selected secondary systems assets.

There are Trench CVT's at the site that are the subject of a global replacement program due to performance issues.

The customer metering (Energex) is on the 33kV side of the transformers whereas the connection point is the HV side of the transformers. Options to move this metering in line with Powerlink's preferred configuration must be presented with costs. This will be considered separately for inclusion or otherwise in the approval.

The objective of this project is to replace the majority of the secondary systems and the identified Trench CVT's at Ashgrove West by June 2029.

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

2. Project Drawing

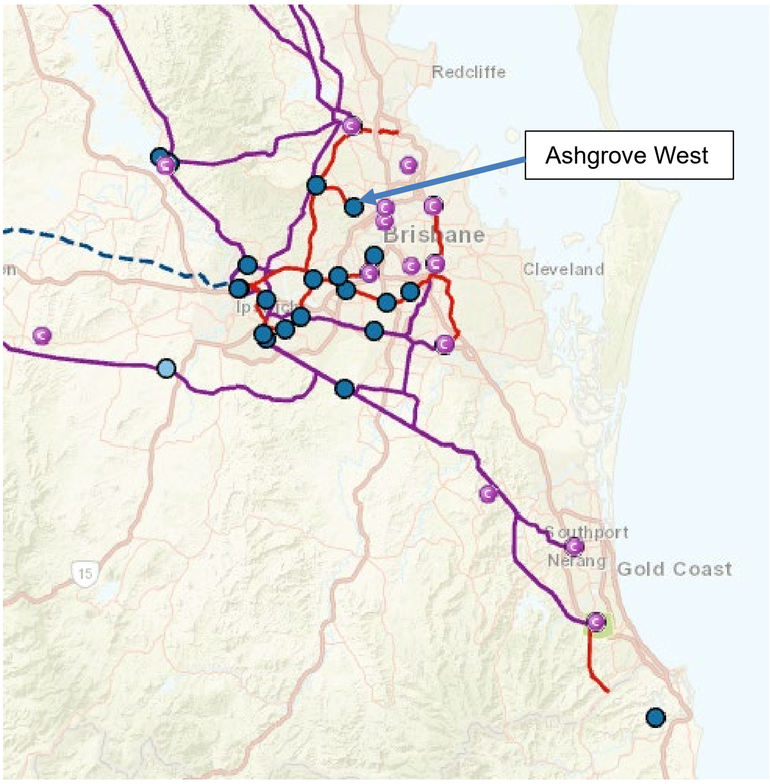


Figure 1 – Ashgrove West Locality

[redacted]

Figure 2 – Ashgrove West Single Line Diagram – Option 1

[redacted]

Figure 3 – Ashgrove West Single Line Diagram – Option 2

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 for the purposes of options analysis as required under the RIT-T:

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) for each of the three options

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 for each option

5. As this project will follow the two (2) stage approval process, provide a separate estimate for stage 2 development phase costs which include project planning, design and preliminary works. Also provide the schedule and time information to align with 2-stage approval

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, the project consists of the replacement of the majority of the secondary systems at Ashgrove West.

4.1.1. T030 Ashgrove West Substation Works

Design, procure, construct and commission replacement of the following selected 110kV secondary systems and selected CVT replacements for the options outlines in Section 11:

- X and Y Protection and control equipment – 2 Cap, 3 Cap, 4 Cap;
- X and Y Protection and control equipment – 1 & 2 Bus Zone, 3 Bus Zone;
- X and Y Protection and control equipment – 2-3 Bus Section;
- X and Y Protection and control equipment - 1 Transformer, 3 Transformer;
- X and Y Protection and control equipment– Feeder 781, Feeder 782;
- X and Y Protection and control equipment – Feeder 7256, Feeder 7257 (for Option 2 only);
- 110kV Revenue Metering;
- Non-bay – LCF, SCADA (Common, NSC1/NSC2 RTU;
- Replace 125V DC X and Y Batteries (excluding chargers) in Building +1 (Option 1 only). Full system for Option 2;
- Replacement of Trench CVT's – 1VT and 2VT.
- Customer metering (Energex) is on the 33kV transformer side, but the connection point is on the HV side. Present options and costs to reconfigure metering per Powerlink's preferred setup for consideration in the final scope of works.
- Implement outcome of Arc Flash Fuse replacement project OR.02429 Statewide Substation AC Switchboard Refurbishment (See Sect 7)
- Decommission and recover all redundant equipment, and update drawing records, SAP records, config files, etc. accordingly.

4.1.2. Telecoms Works

Upgrade of associated telecommunication equipment as necessary.

4.1.3. Easement/Land Acquisition & Permits Works

Not applicable

4.2. Key Scope Assumptions

Not applicable

4.3. Variations to Scope (post project approval)

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 December 2025.

6.2. Site Access Date

Ashgrove West is an existing Powerlink site. Access is already available.

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, where applicable, is 30 June 2029.

7. Special Considerations

OR.02429 Statewide Substation AC Switchboard Refurbishment advises the following actions for Ashgrove West. These are:

- Installation of signs,
- Main supply MCCB kiosk (+E01-A1):
    - Change MCCB Settings
- ACCO:
    - Change MCCB Settings
    - Retrofit fuse kit to mitigate arc flash in control compartment (currently being developed)

Liaise with OR.02429 Project Manager for most efficient delivery based on project status and progress.

8. Asset Management Requirements

Equipment shall be in accordance with Powerlink equipment strategies.

Unless otherwise advised [redacted] 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.

[redacted] 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.

The asset boundary with Energy Queensland will be at the cable sealing end of Feeders 781 and 782, the LV terminals of the 110/33kV 3 Transformer, and at the 1 Transformer (33kV) side of Energex isolator 3T19.

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.

11. Options

Provide class 5 estimate for the scope of work outlined in 4.1 for the following two options:

- Option 1 – Install new panels in the existing building. Retain the existing Secondary Systems panels for FDR 7256 and 7257 and associated Station Panel.
- Option 2 – Install new panels in a new building. Include secondary systems for FDR 7256 and 7257.

12. Division of Responsibilities

A division of responsibilities document will be required to cover the changes to the interface boundaries with Energy Queensland. 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.01822	Upper Kedron to Ashgrove West Cable Replacement	2031	
CP.01845	Upper Kedron to Ashgrove West Easement Acquisition	2028	

CP.02855 T030 Ashgrove West Secondary Systems Replacement

Concept Estimate

Table of Contents

1. Executive Summary

This concept estimate has been developed based on the CP.02855 Ashgrove West Secondary Systems Replacement PSR.

T030 Ashgrove West Substation, located approximately 6km northwest of the Brisbane CBD, was established in 1979 to supply the Brisbane central business district and the expanding residential areas to the northwest of Brisbane. Ashgrove West Substation, supplied from Upper Kedron, is a shared Powerlink site with Energy Queensland (EQ) supplying EQ at both 110kV and at 33kV via two 110/33kV transformers.

A recent condition assessment indicates that the secondary systems, including metering, is reaching the end of its technical asset life and as a result, the declining condition of equipment is decreasing the reliability, and the unavailability of spare parts are causing maintainability issues. Therefore, to mitigate associated risks, it is recommended to replace selected secondary systems assets.

The assessment in this proposal has established that the project can be delivered by June 2029.

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)		25,188,150
TOTAL		**25,188,150**

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 2026	337,691
To June 2027	7,327,984
To June 2028	7,049,920
To June 2029	10,097,386
To June 2030	375,168
TOTAL	**25,188,150**

2. Project and Site-Specific Information

2.1 Project Dependencies & Interactions

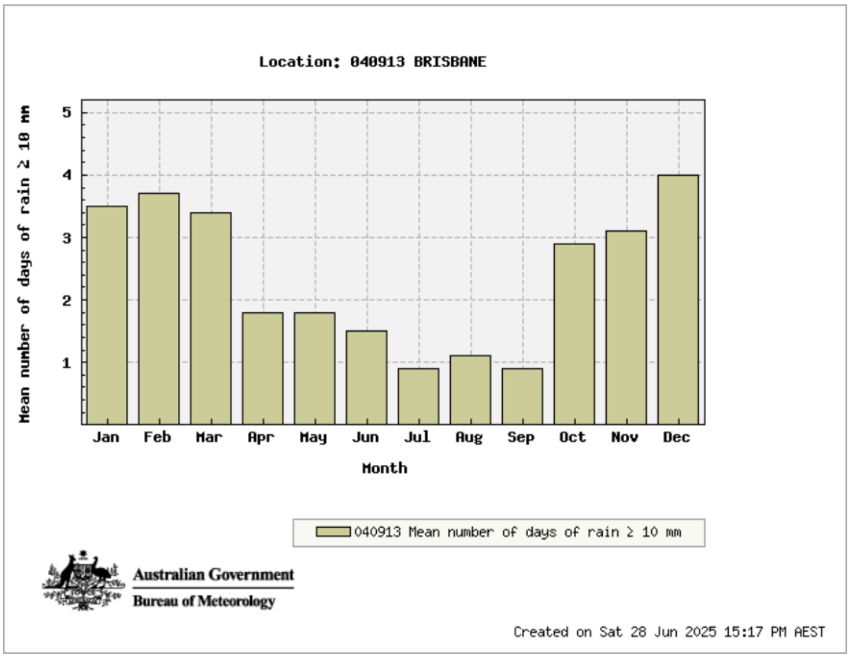
This project is related to the following projects:

Project No.	Project Description	Planned Commissioning Date	Comment
Dependencies			
Interactions			
CP.01822	Upper Kedron to Ashgrove West Cable Replacement	June 2028	Replacement of Underground Cable feeders associated with T030 Ashgrove West
CP.02813	Telecommunications Network Consolidation RAN4	June 2032	SDH and PDH Multiplexer replacement program
Other Related Projects			
CP.02984	Trench CVT Replacement – South Phase 1	Dec 2027	Statewide CVT Replacement

2.2 Site Specific Issues

- T030 Ashgrove West Substation is located at 10 Trinder Road, Ashgrove, 6km northwest of the Brisbane CBD, it is surrounded by a densely populated residential suburb with high community sensitivity.
- The substation consists of one yard of 110kV equipment and an Energy Queensland 33kV distribution system. Powerlink's 110kV protection and control systems are housed in a single level brick building, (shared with Energy Queensland protection and control systems) adjacent to the switchyard.
- Asbestos containing material (ACM) has been identified at T030 Ashgrove West Substation throughout the existing control building. Ensuring the ACM is maintained in a condition that prevents exposure may be compromised if major refurbishment works are undertaken within the building.

- The Brisbane area is subject to the following average number of days of rain. Consideration was given to this when developing the project schedule.



Statistics	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	Years
Mean number of days of rain ≥ 10 mm for years 1999 to 2025	3.5	3.7	3.4	1.8	1.8	1.5	0.9	1.1	0.9	2.9	3.1	4.0	28.6	25

Figure 1 - Number of Days of Rain >10mm Brisbane (Source: Bureau of Meteorology 28th June 2025)

3. Project Scope

The following works have been costed for in the estimate.

3.1 Substation Works

T030 Ashgrove West

Design, procure, construct and commission selective replacement of the T030 Ashgrove West Substation secondary systems equipment and selected CVT replacements.

Establish new secondary systems panels and associated common control, protection and monitoring equipment in a new Control Building. These require:

- New foundations for the new control building and marshalling kiosks.
- Trenching from the control building to the existing trenches in the yard including cable pits.
- Underground conduits where cables are leaving or entering trenches or trenches are not suitable.
- New cables installed between the new control building termination racks and bay marshalling kiosks.
- Replacement of the secondary systems and auxiliary equipment for the following assets:
  - 2CAP, 3CAP & 4CAP – X and Y Protection and Control Equipment
  - 1, 2 & 3 Bus Zone – X and Y Protection and Control Equipment
  - 2-3 Bus Section – X and Y Protection and Control Equipment
  - 1T & 3T – X and Y Protection and Control Equipment

- Feeder 781, 782, 7256, 7257 – X and Y Protection and Control Equipment
- All 110kV Revenue Metering
- LCF, SCADA (Common, NSC1/NSC2 RTU), and OpsWAN (Upgrade SCADA to DNP/IP)

- Establishment of WAMPAC schemes to trip 1T and 3T with consideration to trip one or more of the onsite Capacitor Banks.
- All Current Transformer (CT) link terminals associated with CT circuits, are to be replaced with a new physical disconnect terminal, as per Standards Update, SU0049.
- Coordinate modification of protection, control, automation and communications systems for Energy Queensland assets at T030 Ashgrove West (free issue of secondary systems relays).
- Decommission and recover all redundant equipment.
- Update drawing records, SAP records, config files, etc. accordingly.

Trench CVT Replacement

- 1VT and 2VT are to be replaced.

Remote Ends

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

- Feeders 7256 & 7257 from H023 Upper Kedron Substation.
- At the following Energex substations (free-issue of secondary systems relays).
  - SSKVG Kelvin Grove
  - SSMLT Milton

[redacted]

Figure 2 - Line Diagram of Proposed Works at T030 Ashgrove West Substation

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.

- Voice gateways and associated interface panels.

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 T030 Ashgrove West Secondary Systems. All works at the remote end substations will be completed by MSP.
- Powerlink Internal Design teams and Design Service Panel 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 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.
- MSP resources will be available to complete the works.
- Procurement of long lead items align with project delivery requirements.
- Energy Queensland design and construction resources will be available when required for remote end works. Timely agreement of Division of Responsibility (DOR) between Energy Queensland and Powerlink for all the works involved.
- Energy Queensland assets will remain in the existing control building at the completion of the project.
- Substation Electrical Design team has determined a bench extension is not required.

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

- Design standard of the new secondary systems will be of SDM9.3.
- All new secondary systems and auxiliary equipment will fit within a single new control building.
- There will be space within the new control buildings to house panels for WAMPAC schemes.
- 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.
- New building foundations will include the provision of bored piers and geo-tech costs.
- Drainage for any new pits shall be provided into the existing drainage system or off the substation platform.
- The CVTs will be replaced utilising existing foundations with use of either new structures or adaptor plates.

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 primary plants not listed to be replaced under the scope. That also includes the replacement of bushing CTs on PASS M0 circuit breakers, breaker's control cubicles and associated CT links.
- No allowance has been made for the demolition and removal of the existing control building, as it is required for customer assets.
- No modification and upgrading of the internal roads, lights, fences and gates.
- No modification on the existing transmission lines or HV underground cables is considered in this estimate.
- 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	May 2025
Class 5 Project Proposal Submission	November 2025
Request for Class 3 Estimate	January 2026
Class 3 Project Proposal Submission	July 2026
Stage 1 Approval (PAN1) includes funds for design & procurement, & ITT preparation	August 2026
RIT-T (assumed 26 weeks)	August 2026 – February 2027
Project Development Phase 1 & Phase 2	August 2026 – February 2027
ITT Submission (8 Weeks)	October 2026 – December 2026
Evaluate Tender, Reconcile Estimate and Submit PMP for Stage 2 Approval	January 2027 - February 2027
Stage 2 Approval (PAN2)	March 2027
Execute Delivery (including award of SPA contract)	March 2027
SPA Site Establishment	April 2027
SPA Civil Works and Construction	April 2027 – October 2027
MSP Site Establishment	May 2028
Staged Bay Construction and Commissioning	May 2028 – April 2029
Project Commissioning	April 2029
Final Decommissioning & Removal of Redundant Assets	May 2029 – June 2029

4.2 Network Impacts

Powerlink Net Ops – Operating Manual 02 – SE QLD provides the following recommendations for outages of T030 Ashgrove West feeders and transformers.

- Outages for both feeders 7256 & 7257 require the remaining 110kV feeders between H023 Upper Kedron and H016 Rocklea to be intact.
- If Feeder 7256 or 7257 is Out of Service and Earthed, then protection permits are required on the remaining in-service feeder.
- Load at risk – Upper Kedron and EQL.

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 contractors.

5. Project Asset Classification

Asset Class	Base ($)	Base (%)
Substation Primary Plant	742,369	3%
Substation Secondary Systems	23,054,268	92%
Telecommunications	1,391,513	6%
Overhead Transmission Line	-	0%
TOTAL	**25,188,150**	**100**

6. References

Document name and hyperlink	Version	Date
Project Scope Report	1.0	16/04/2025

Risk Cost Summary Report

CP. 02855

Ashgrove West Secondary Systems Replacement

Document Control

Change Record

Issue Date	Revision	Prepared by
17/12/2025	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 Ashgrove West substation which are proposed for reinvestment under CP.02855. 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 Ashgrove West 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, DC Batteries, 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 $29,110 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 $0.475 million in 2026 to $1.17 million in 2036 and $2.21 million by 2045. Key highlights of the analysis include:

- Financial risk accounts for approximately 90% of the overall risk cost in 2030 with network risk accounting for the remaining 10%.
- As the probability of failure (PoF) continues to grow over time, the network risk cost grows to become a greater proportion of the overall risk. In the year 2040, financial risk is 51% of the total risk cost (≈$1.4m) compared with network risk which contributes 49%.

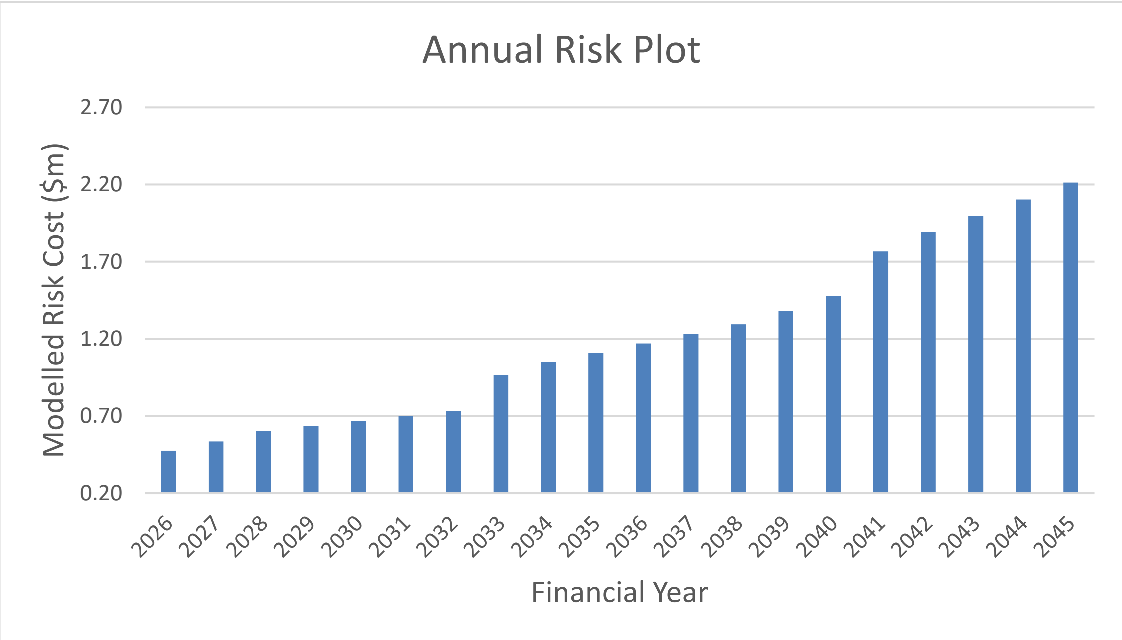


Figure 1: Total risk cost

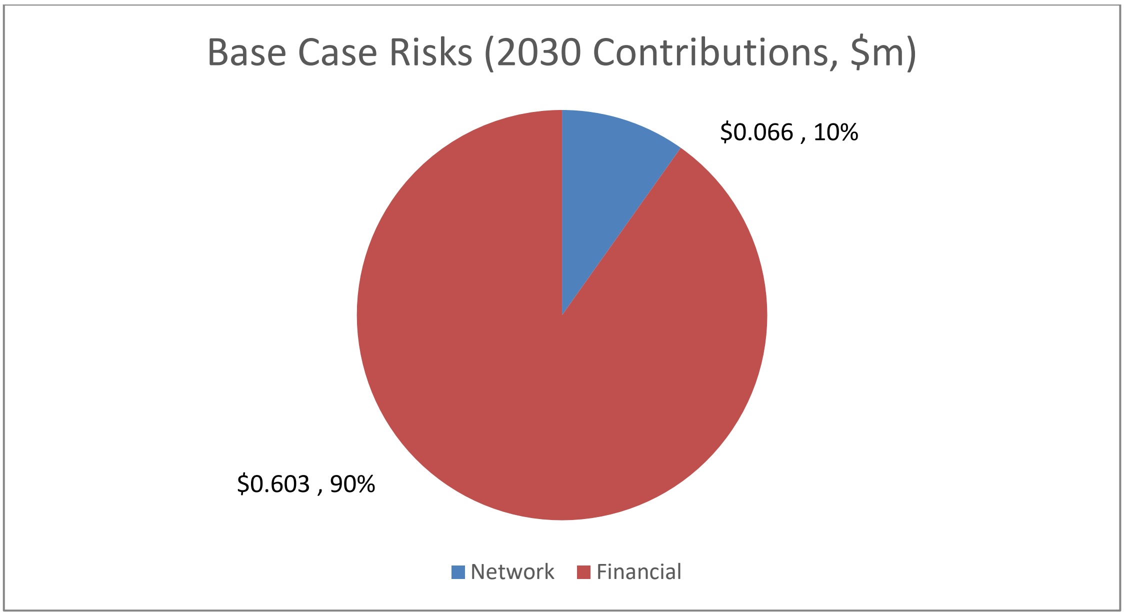


Figure 2: Base case risk cost by contributions (2030)

Option Risk Cost

For modelling purposes, the replacement of equipment at the Ashgrove West 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.

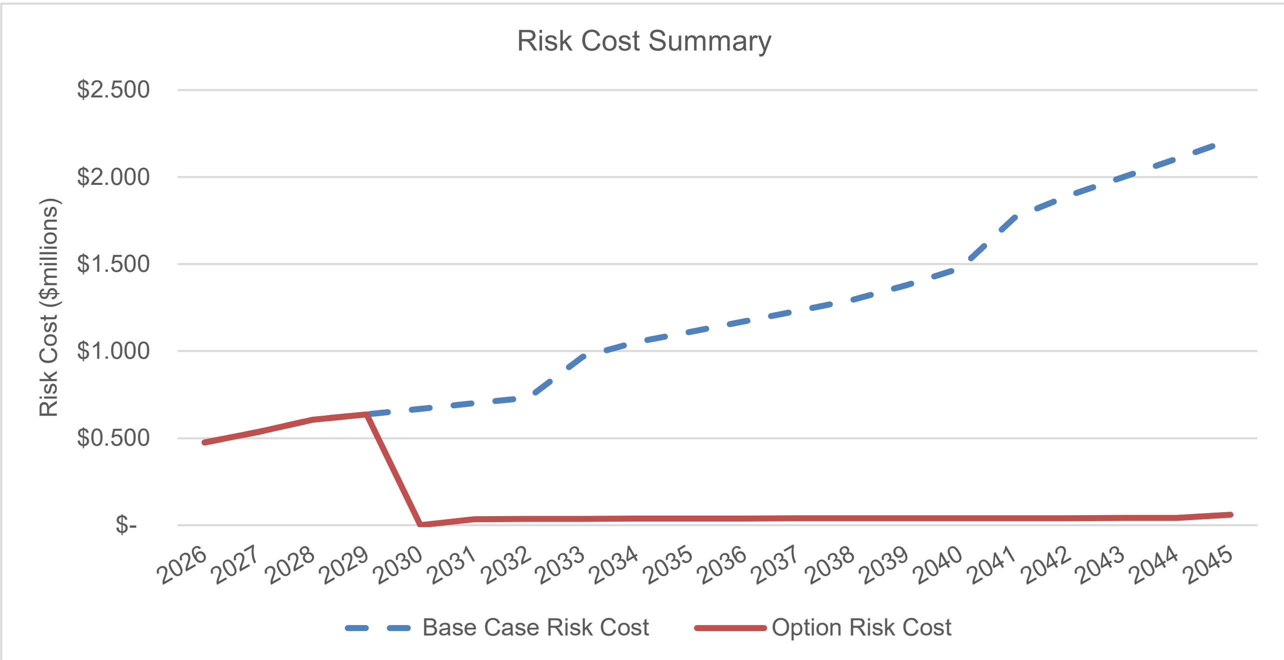


Figure 3: Project Option Risk Cost (compared to base case)

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.

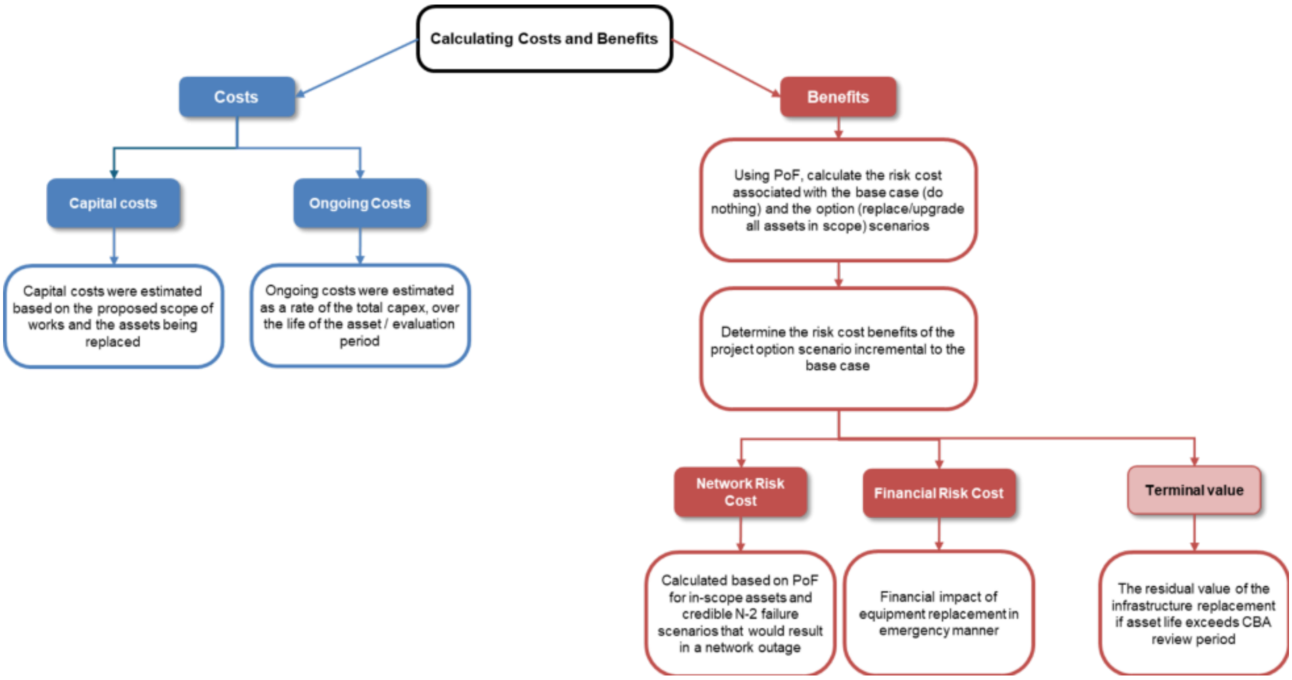


Figure 4: CBA methodology

The project is estimated to cost approximately $25.19 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	-$8.9	-$11.2	$-11.6
Benefit-Cost Ratio	ratio	0.61	0.43	0.34

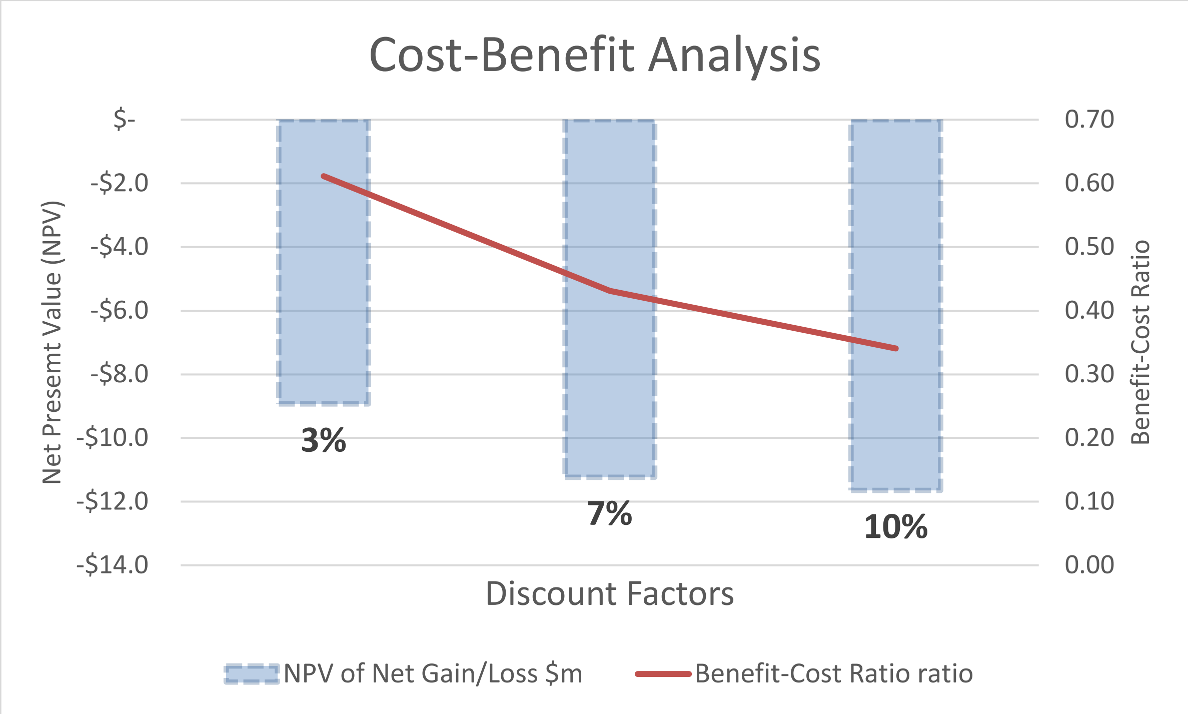


Figure 5: Cost benefit summary

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 bay controller emergency replacement cost without spares** (halving the time) results in a decrease in risk cost of $0.15 million, or approximately 23% of the original base risk.
- **changes in relay emergency replacement cost without spares** (halving the time) results in a decrease in risk cost of $0.14 million, or approximately 21% of the original base risk.

Table 3: Participation Factors

Input	Baseline value	Sensitivity value (-50%)	Change in risk cost at 2030 ($m)	Participation (%)
Network				
VCR ($/MWh)	29130	14565	-0.03	-4.91%
Restoration Time with spares – Relay (days)	2	1	-0.02	-2.83%
Restoration Time with no spares – Relay (days)	10	5	-0.05	-7.13%
Financial				
Emergency replacement cost with spares - Relay ($m)	0.02	0.01	0.00	-0.44%
Emergency replacement cost without spares – Relay ($m)	0.09	0.05	-0.14	-21.42%
Emergency replacement cost with spares – Bay Controller ($m)	0.02	0.01	0.00	-0.22%
Emergency replacement cost without spares – Bay Controller ($m)	0.20	0.10	-0.15	-23.00%