January 2026

Powerlink 2027-32 Revenue Proposal

Project Pack

CP.02796 Goodna Secondary Systems Replacement

Project Status: Unapproved

Network Requirement

The 275/110kV Goodna Substation, approx. 22km south-west of Brisbane CBD, was established in 2006 and is a bulk supply point for the Brisbane Southwest / Ipswich area. It also supports 275kV and 110kV network switching in the greater Brisbane meshed network.

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

A condition assessment of the Goodna substation secondary systems identifies various secondary systems components requiring replacement by 2026 [1].

Powerlink's 2025 Central scenario forecast confirms there is an enduring need to maintain electricity supply into the Brisbane Southwest / Ipswich area. The removal or reconfiguration of the Goodna Substation due to secondary system failure or obsolescence would violate Powerlink's N-1-50MW/600MWh Transmission Authority reliability standard [2].

Recommended Option

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

The current recommended option is for full replacement of all 275kV and 110kV secondary systems within existing control buildings by 2029 [3].

Options considered but not proposed include:

- Replacement of some secondary systems and decommission some functionality – this option would require additional transformer capacity at Blackstone and additional 110kV network capacity between Blackstone and Goodna and is not cost effective.

Figure 1 shows the current recommended option reduces the forecast risk monetisation profile of the Goodna Substation secondary systems from around $1.0 million per annum in 2030 to less than $0.05 million per annum from 2031 [5].

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

Cost and Timing

The estimated cost to replace secondary systems at Goodna substation is $39.0m ($2025/26) [4].

Target Commissioning Date: October 2029.

Documents in CP.02796 Project Pack

Public Documents

1. H038 Goodna Secondary Systems Condition Assessment Report
2. CP.02796 Goodna Secondary Systems Replacement – Planning Statement
3. CP.02796 Goodna Secondary Systems Replacement – Project Scope Report
4. CP.02796 Goodna Secondary Systems Replacement – Concept Estimate
5. CP.02796 Goodna Secondary Systems Replacement – Risk Cost Summary Report

H038 Goodna 275/110kV

Secondary Systems Condition Assessment Report

Document Details			
Version Number	1.0	**Principal Author**	[redacted]
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Issue Date	18/12/2019	**Authorised by**	[redacted]
Previous Document	N/A	**Team**	Secondary Systems and Telecommunications Strategies

Date	Version	Nature of Change	Author	Authorisation
18/12/2019	1.0	New document	[redacted]	[redacted]

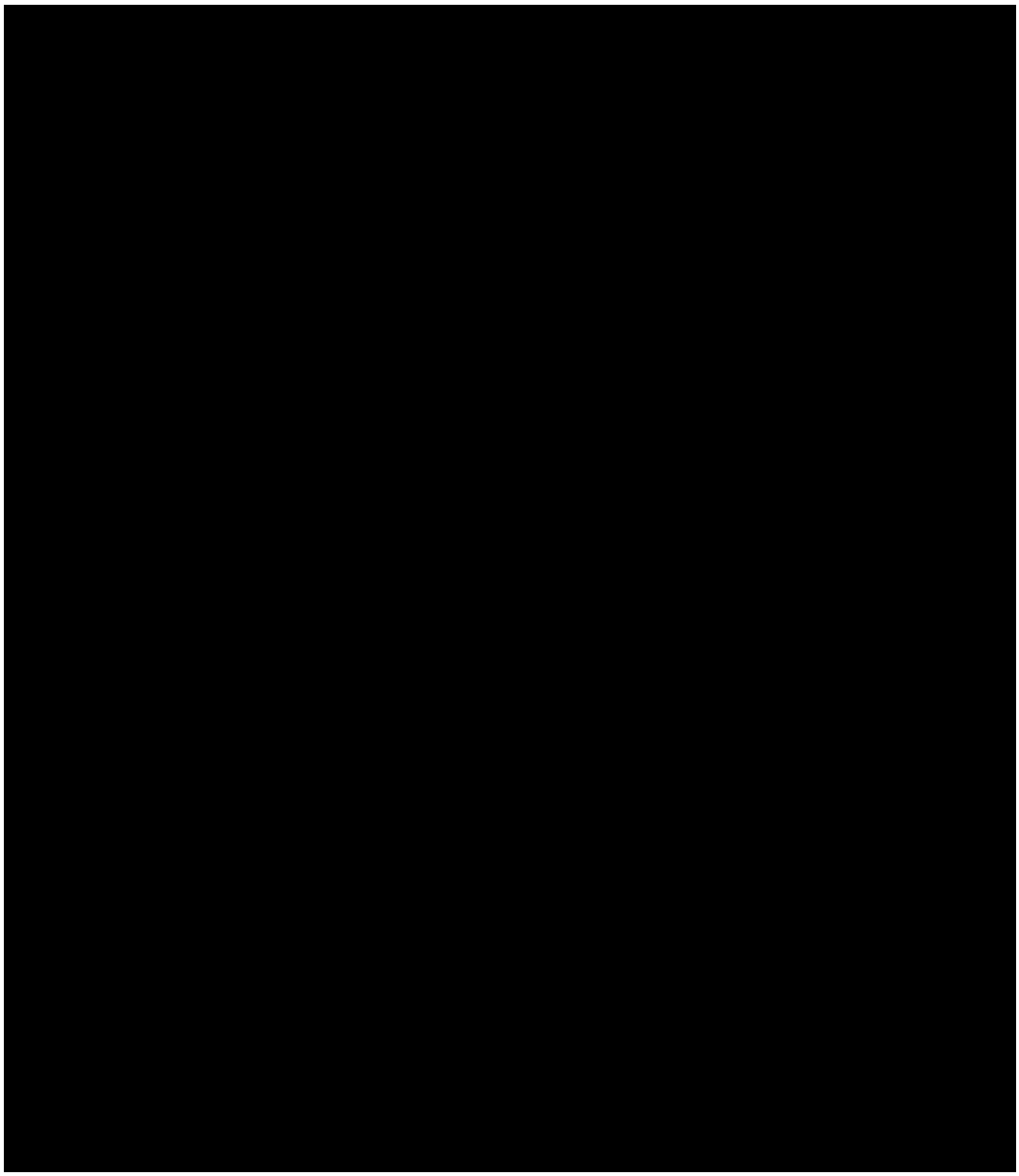
Table of Contents

1. Introduction

This report is pertinent to H038 Goodna substation 275/110kV secondary systems and associated site infrastructure. The report is provided to assist with determining the future asset strategies and scopes for refurbishment and replacement works of Goodna 275kV and 110kV secondary systems.

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

H038 Goodna was built to meet the increased demand in the South West Brisbane / Ipswich area in 2006. Associated secondary system for 275/110kV were implemented in 2006.



H038 Goodna operating diagram

2. Inclusions and Exclusions

2.1 Inclusions

Secondary system assets and 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.

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

3. Secondary System Assessment Methodology

Principles of secondary systems condition assessment were based on Powerlink' s Secondary Systems Asset Risk Model developed in [8], and "Powerlink – Asset Risk Management – Framework" in [9]. The methodology consists of two main parts – Desktop assessment and site visual inspection. The latter is considered more subjective than the former.

The desktop assessment is limited only to assets recorded in SAP asset database, e.g. protection relays, RTUs and IEDs. It is important to note that a significant number of secondary systems equipment, including cables, kiosks, terminals, links, panels, termination racks, auxiliary equipment and some IEDs are not recorded in SAP. The condition assessment of these depends 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 equipment health indices based on the optimisation of risk, cost and performance of Powerlink' s secondary assets over the last sixteen years – since 1999 [8]. Equipment health index is the key condition measurement for each equipment in service. The model takes into account equipment failure rates calculated based on operational data, environmental conditions where the equipment is installed and the mean physical ages of a group of equipment at bay and system (fleet) levels. It was found in [8] that the physical ages of individual equipment do not provide reliable information on the reliability and availability of secondary systems assets at the bay and system level. Instead, the mean physical ages of a group of equipment, at bay or system level, correlate very well with the secondary systems reliability and availability to service the power system.

Health indices are modelled in the range from zero (0) to ten (10), where zero represents newly installed equipment and ten indicates equipment that have reached the optimum replacement ages. According to [8], the optimum replacement ages for Powerlink' s secondary systems assets signify an optimal replacement time period just before the secondary systems availability and reliability start to transition to a rapidly declining trajectory. Generally, equipment with condition scores close to ten represent moderate increase of functional failures, but longer outage duration and significantly higher risk of impacting system's availability and reliability. Findings in [8] concluded that delaying replacement of secondary systems assets beyond the optimal replacement timeframe does not always result in higher mal-tripping of network elements, but does lower secondary systems availability and reliability. It is important to note that not every functional failure will necessarily result in an outage to a network element, but it does represent the loss of

some of the normal functions of the protection and control system[1] and can contribute to forced outage events of network elements.

The key outcome of this report is the recommended optimal replacement timing for secondary systems assets and equipment detailed in the Appendix section based on their health indices and condition assessment data. It also takes account of the criticality of equipment that are (or are not) directly associated with the performance of secondary systems. For example, some equipment with health indices are close to ten, but may not need to be replaced urgently if 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.

4. Site infrastructure

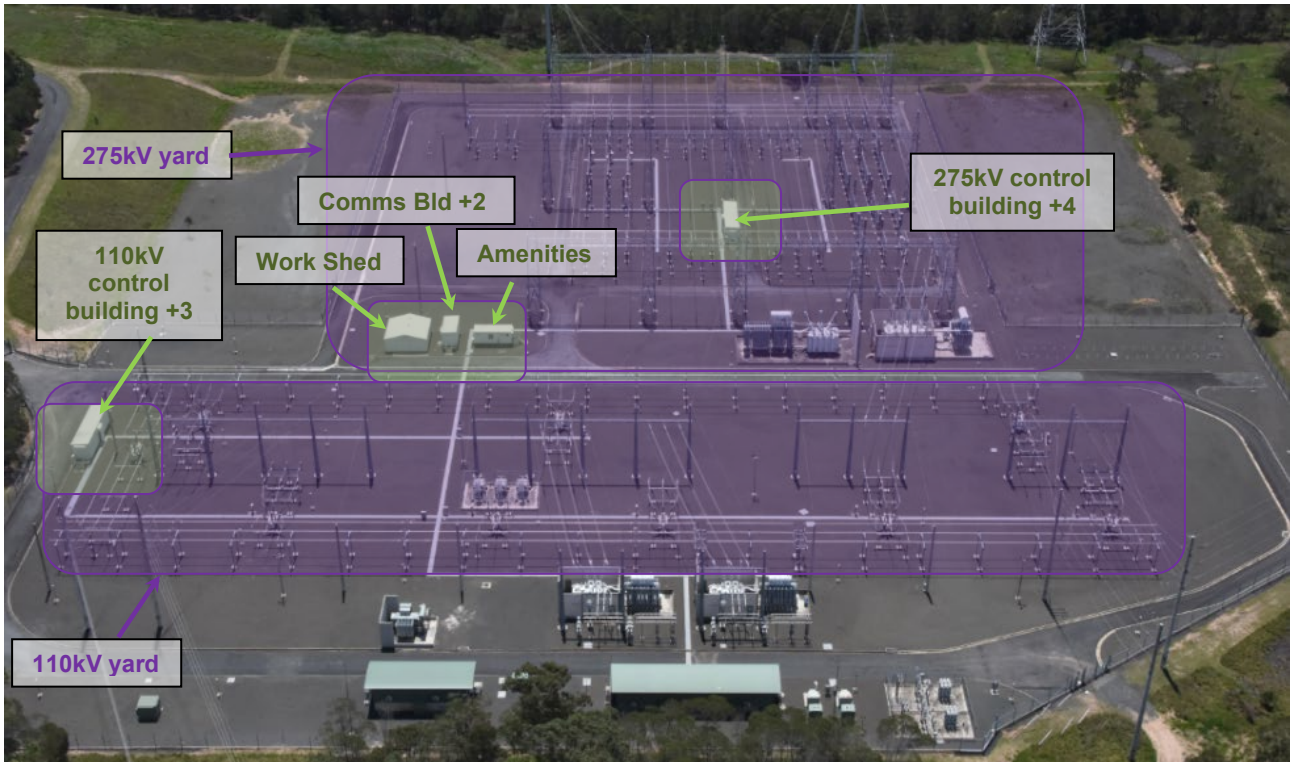
Goodna substation consists of one yard of 275kV and 110kV operating voltage enclosed by the one perimeter fence. The substation was built in 2006. Associated secondary systems were installed in 2006.

H038 Goodna Substation is a yard, with:-

- 2 x 275kV bus bays, =KC1 and =KC2;
- 2 x 275kV bus coupler bays, =C04-504 and =C07-507;
- 1 x 275/110kV transformer bays, =C07-541 and =D28-441 ;
- 2 x 275kV feeder bays, =C04-8819 and =C07-8842
- 3 x 110kV bus bays, =KD1, =KD2 and =KD3;
- 1 x 110kV bus coupler bay, =D01-411;
- 2 x 110/33kV transformer bays, =D17 and =D20;
- 4 x 110kV feeder bays, =D03.1, =D06.2, =D35.1 and =D36.3;
- 1 x 110kV Capacitor bank bay, =D14.2
- Energex 33kV assets owned by Energex

2 x 275kV feeder bays are energised through Blackwall and Belmont substation. 4 x 110kV feeder bays are connected to West Darra, Blackstone and Redbank Plains.

[1] *The functions that could be unavailable include auto-reclose, automatic voltage control, emergency voltage control, protection signalling, SCADA, remote control or others.*



Goodna substation yard bird view

The existing Goodna substation site is located at Kruger Parade. Emergency and routine maintenance of the secondary systems is done by Powerlink field staff.

4.1 Buildings

The condition assessment of buildings at H038 Goodna is included in a separate document and carried out by Substation Strategies. The following details are listed for information only.

There are 5 x buildings at H038 Goodna Substation, including:-

- Communication building +2
  The communication building +2 houses communication equipment and battery banks.
- 110kV control building +3
  The control building +3 houses all 110kV protection and control panels and battery banks
- 275kV control building +4
  The control building +4 houses all 275kV protection and control panels and battery banks
- Amenities building
- Work shed

Building +3 was established in 2006. It house all 132kV secondary systems such as protection and control panels. It is air-conditioned.

Control building +3

There are 10 x spare panel spaces available for future secondary system secondary system replacement or substation augmentation in the existing building +3.

Control building +3 inside

Building +4 was established in 2006. It house all 275kV secondary systems such as protection and control panels. It is air-conditioned.

Control building +4

There are 15 x spare panel spaces available for future secondary system secondary system replacement or substation augmentation in the existing building +4.

Control building +4 inside

The amenities building houses lunch room, office desk and washroom facilities. Also the AC change over panel is located within the amenities building.

Amenities building

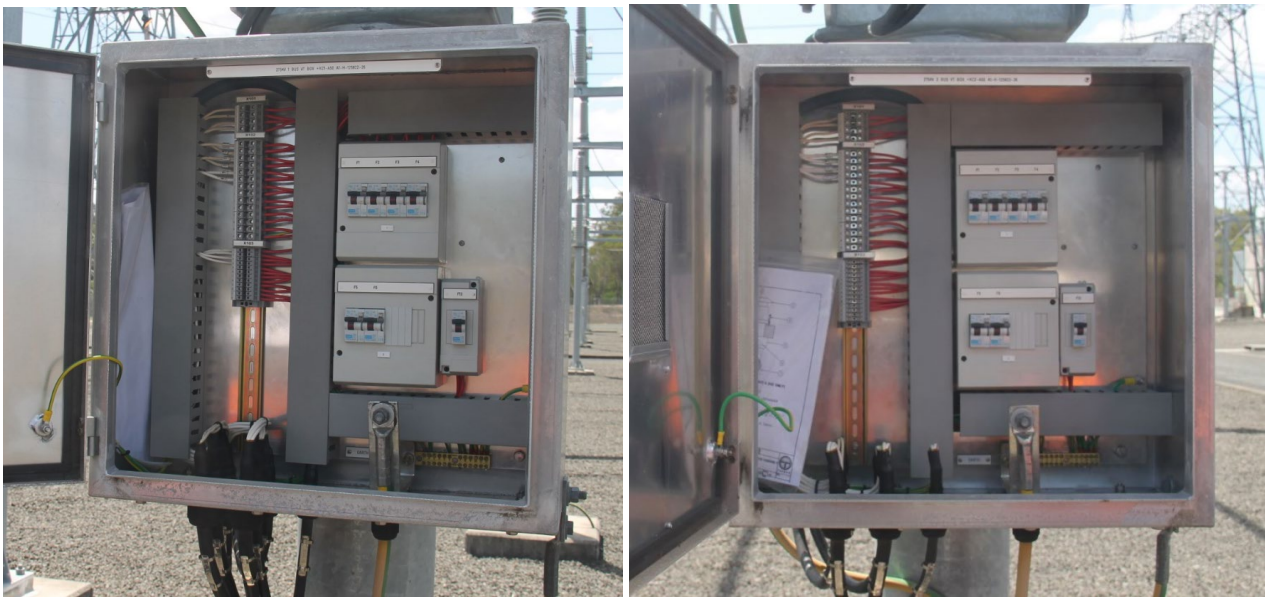
4.2 Trench, marshalling cubicles and control cables

Trenches are part of primary assets. Conditions of cable trenches are not included in this report.

Substation trenches

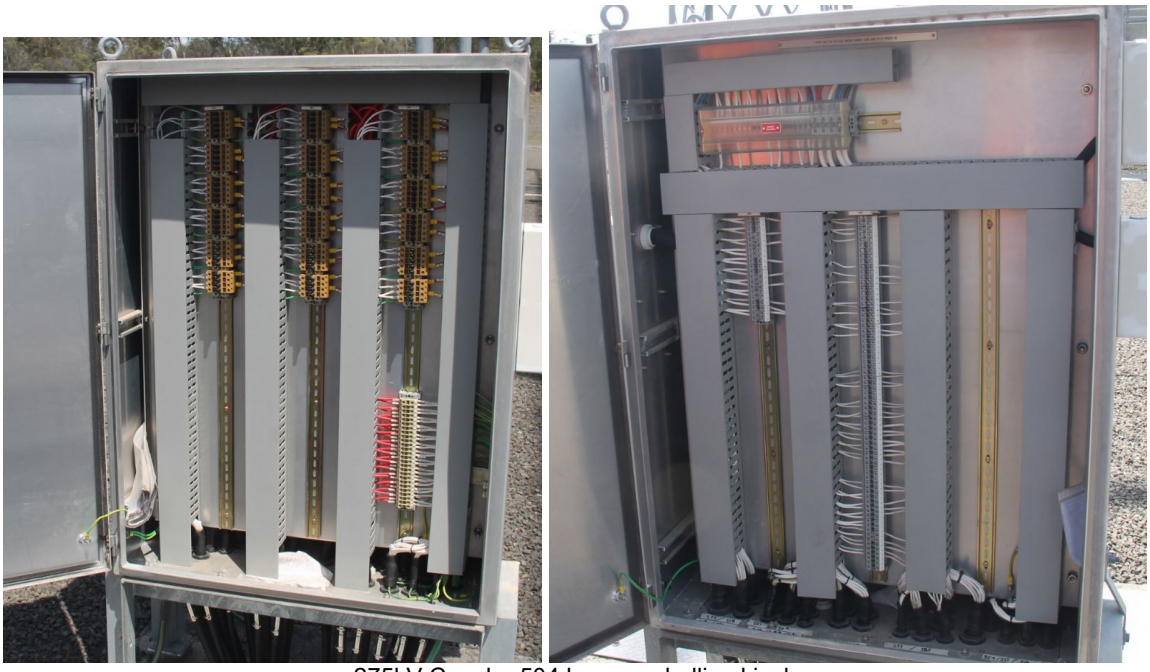
4.2.1 275kV yard

275kV bus marshalling kiosks and VT boxes were installed in 2005. Marshalling kiosks and associated control cables are in fair condition. There are no condition driven replacements required until 2045.

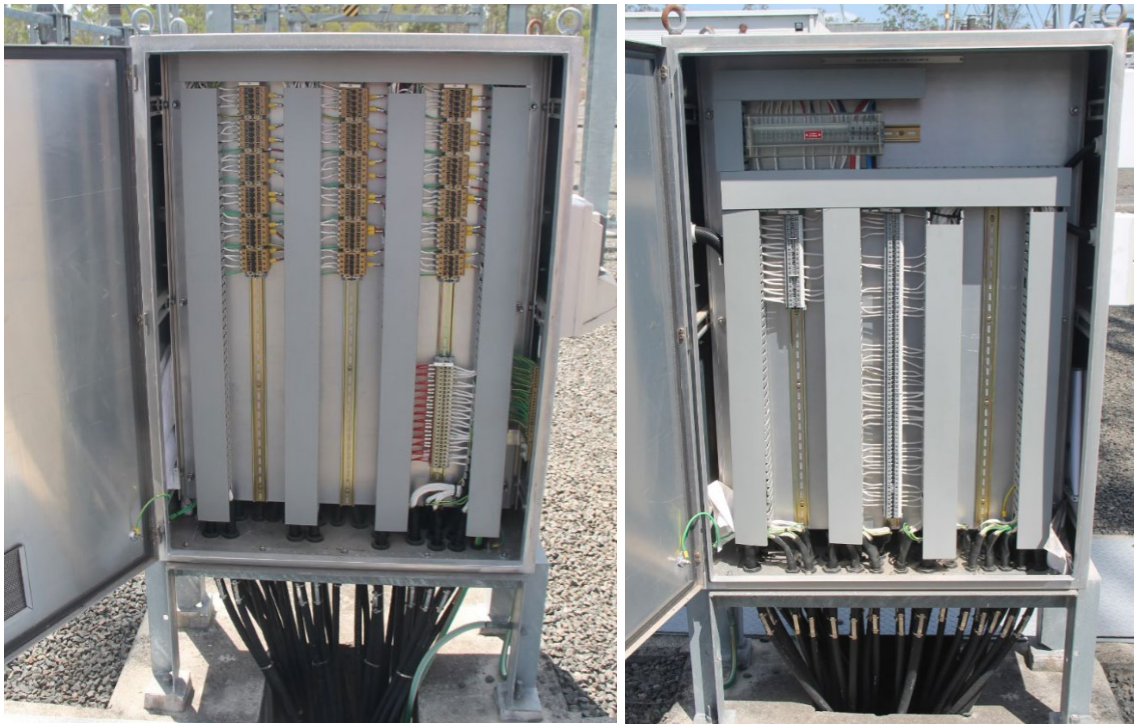


275kV Bus marshalling kiosk and VT box

Marshalling kiosks for 275kV bus coupler 504 and 507 were installed in 2005. Marshalling kiosks and associated control cables are in fair condition. There are no condition driven replacements required until 2045.

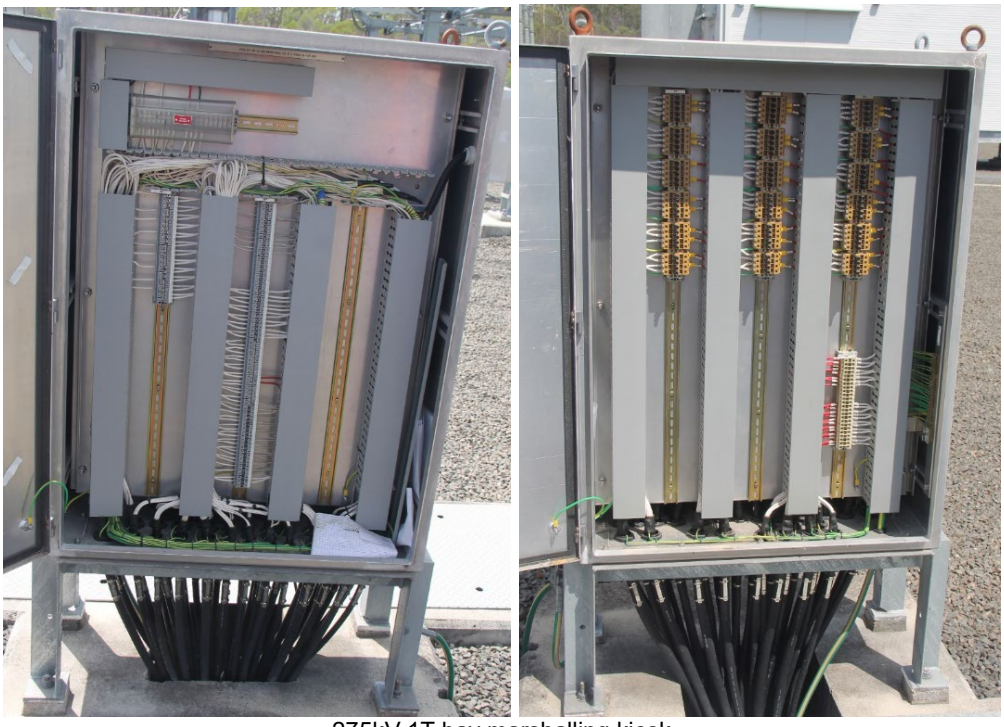


275kV Coupler 504 bay marshalling kiosk

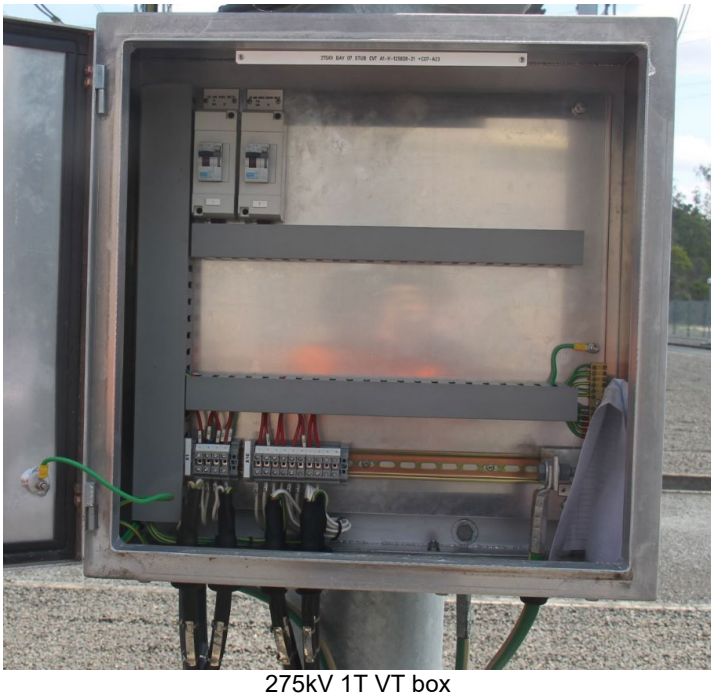


275kV Coupler 507 bay marshalling kiosk

Marshalling kiosks and VT boxes for 275kV 1 Transformer were installed in 2005. Marshalling kiosks and associated control cables are in fair condition. There are no condition driven replacements required until 2045.



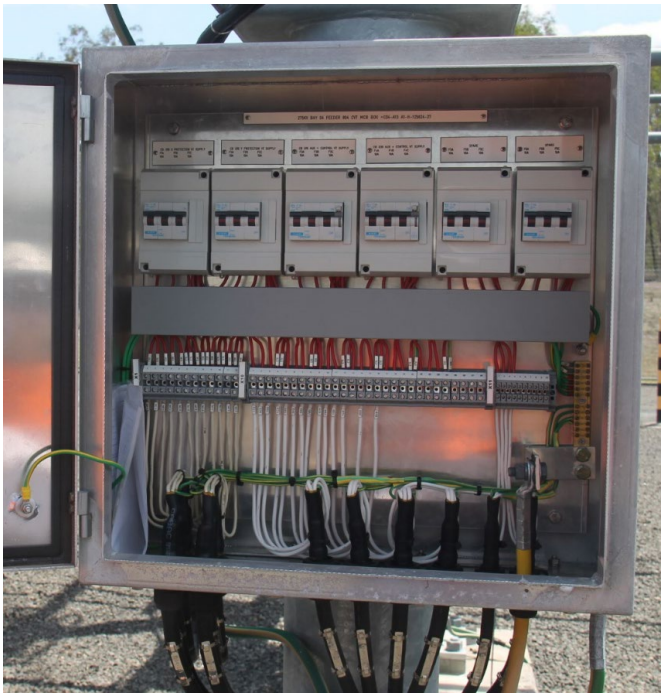
275kV 1T bay marshalling kiosk



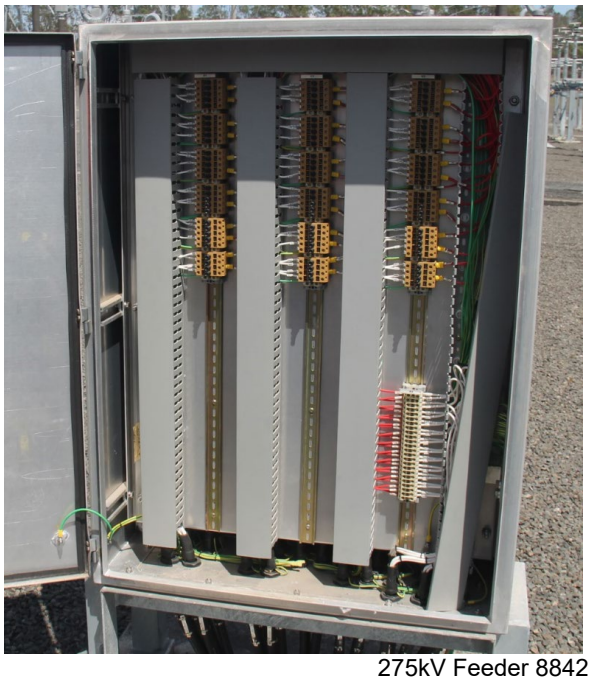
275kV 1T VT box

Marshalling kiosks and VT boxes for 275kV feeder 8819 and 8842 were installed 2005. They are in fair condition and there is no condition driven replacements required until 2045.

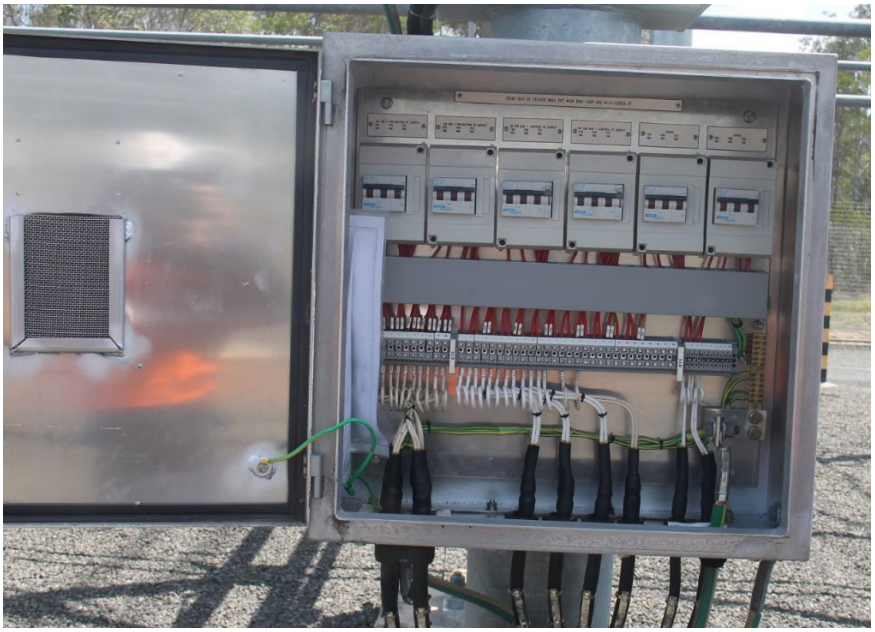
275kV Feeder 8819 bay marshalling kiosk



275kV Feeder 8819 VT box

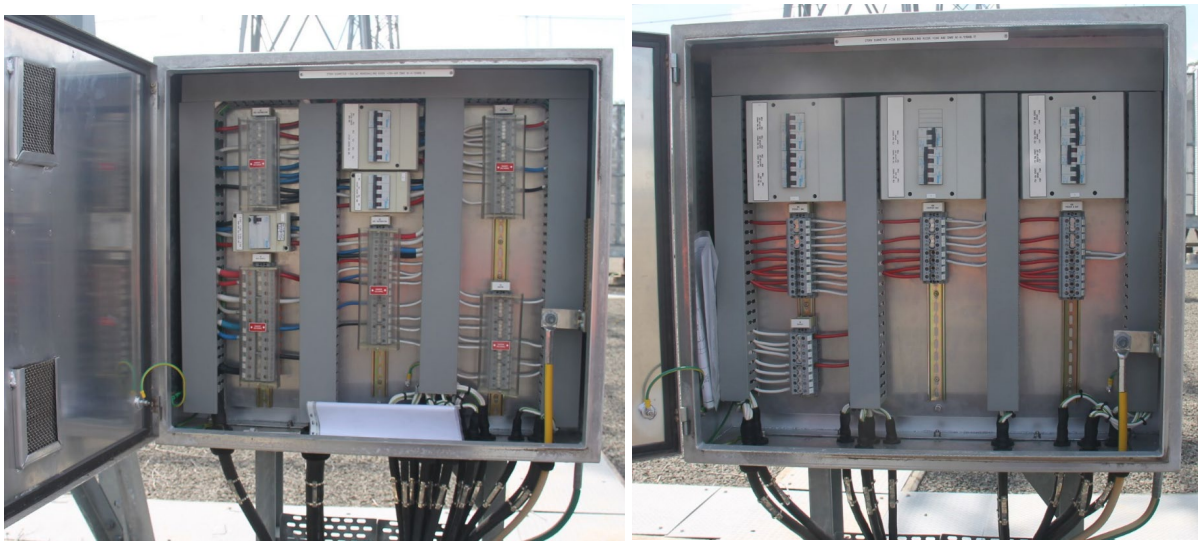


275kV Feeder 8842 marshalling kiosk



275kV Feeder 8842 VT box

Auxiliary kiosks for 275kV diameter =C04 and =C07 were commissioned/replaced in 2005. Marshalling kiosks and associated cables are in fair condition. There are no condition driven replacements required until 2045.

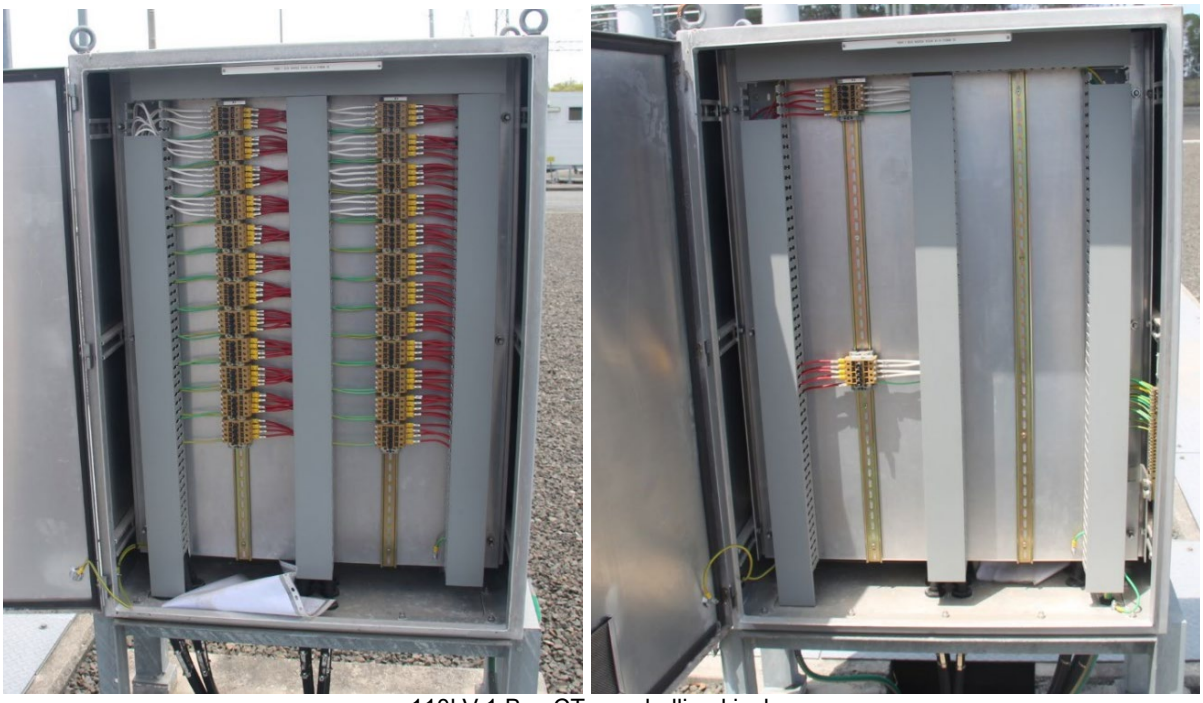


275kV =C04 AC and DC marshalling kiosk

275kV =C07 AC and DC marshalling kiosk

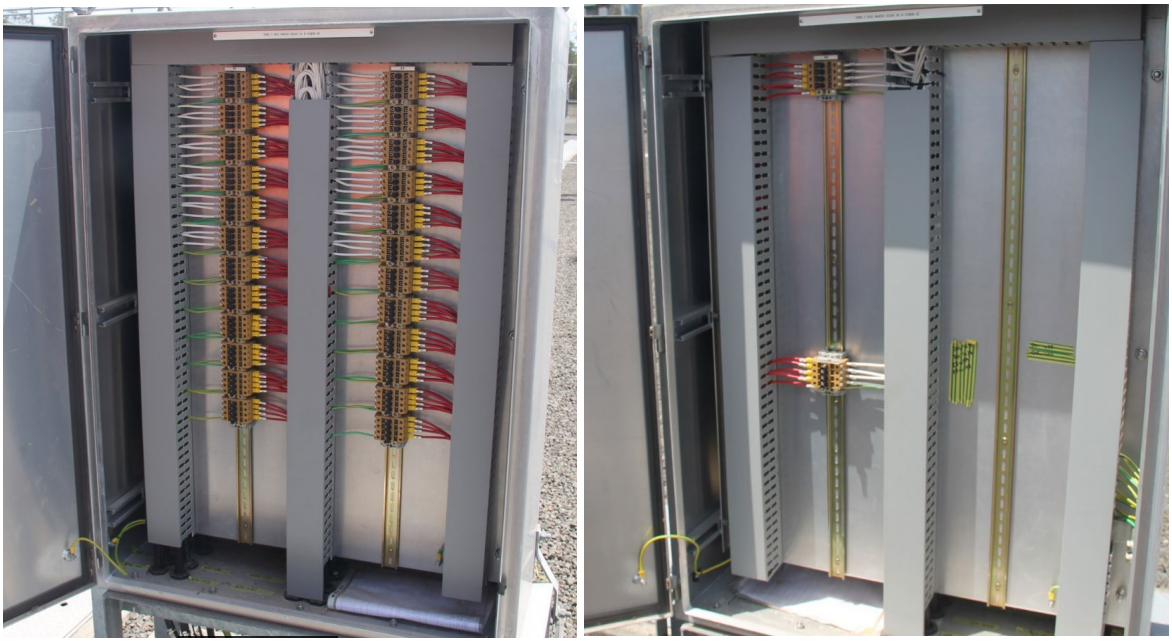
4.2.2 110kV yard

110kV bus and bus coupler marshalling kiosks (including VT boxes) were installed in 2005. These kiosks and associated control cables are in fair condition and there are no condition-driven replacements required until 2045.



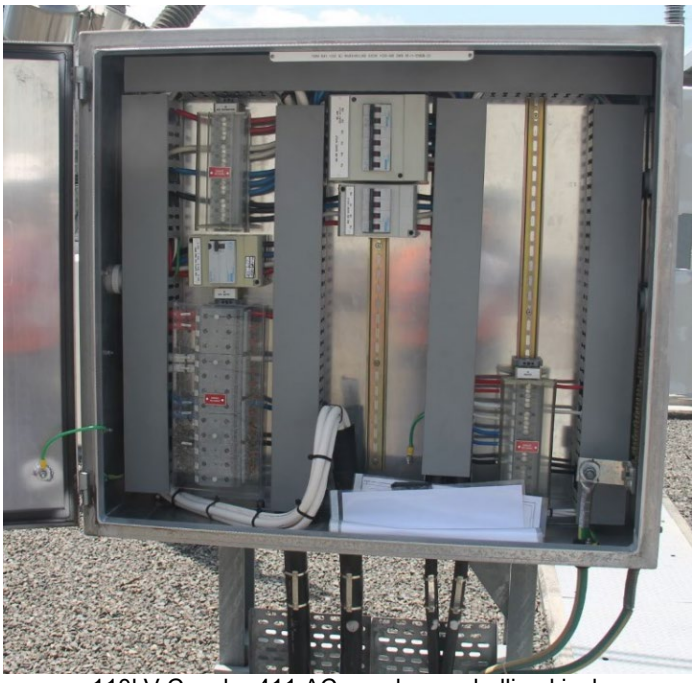
110kV 1 Bus CT marshalling kiosk

110kV 1 bus VT box



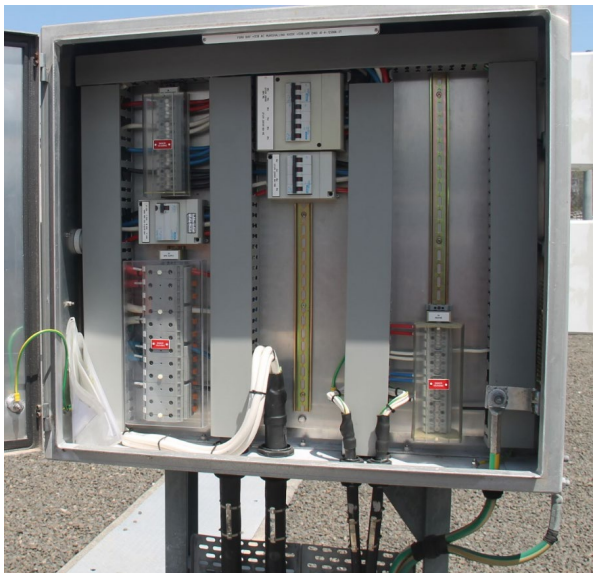
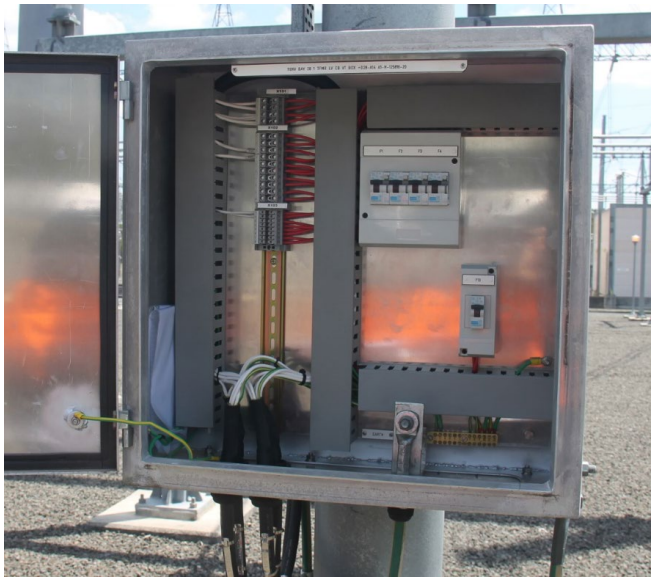
110kV 2 Bus CT marshalling kiosk

110kV 2 Bus VT box

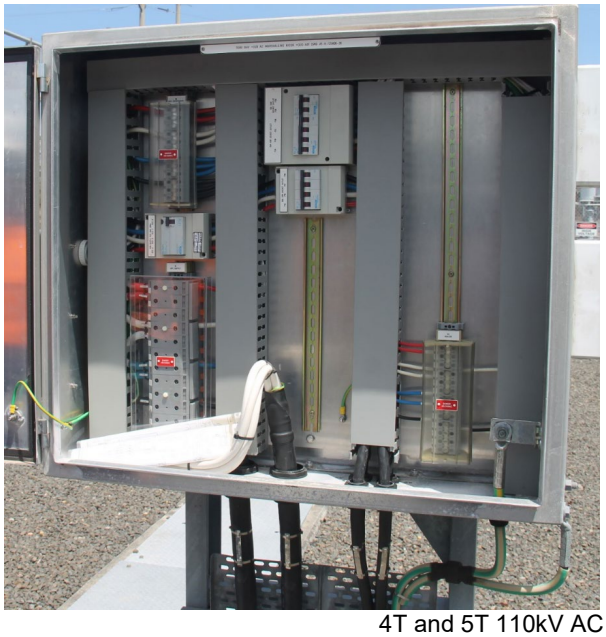
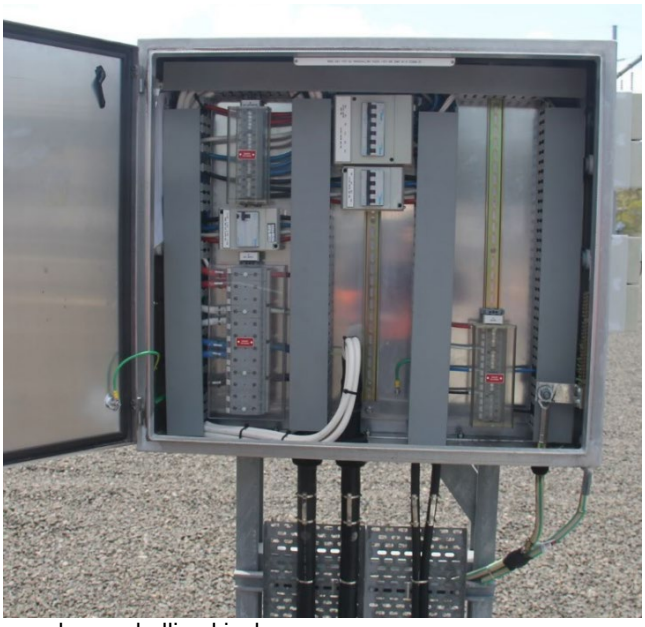


110kV Coupler 411 AC supply marshalling kiosk

Marshalling kiosks and VT boxes for 1 Transformer LV, 4 transformer and 5 Transformer were built in 2005. These kiosks and associated control cables are in fair condition and there are no condition-driven replacements required until 2045.

1 Transformer LV bay AC supply and VT box

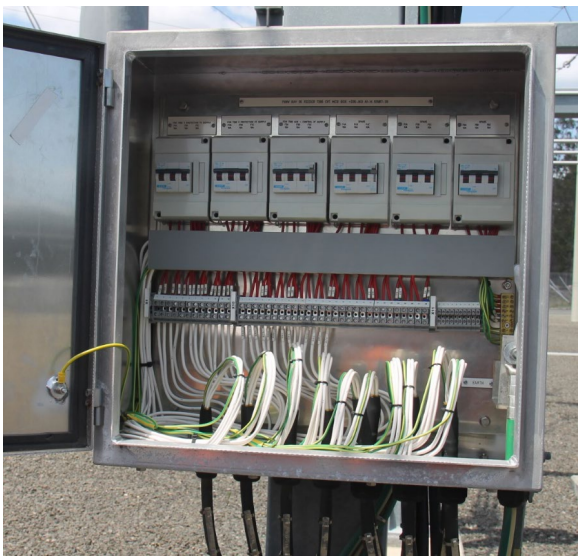



4T and 5T 110kV AC supply marshalling kiosk

T4 oil filter/maintenance outlet kiosk

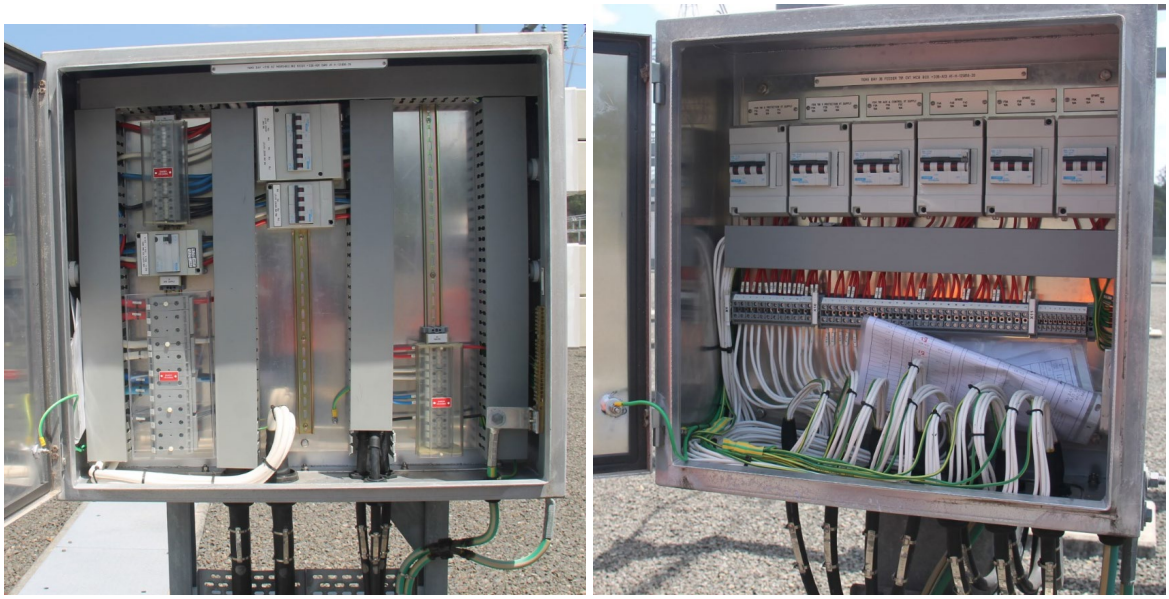
Marshalling kiosks and VT boxes for Feeder 718, 7295, 7296 and 791 were built in 2005. These kiosks and associated control cables are in fair condition and there are no condition-driven replacements required until 2045.

110kV Bay =D06 Feeder 718 bay AC supply and VT box

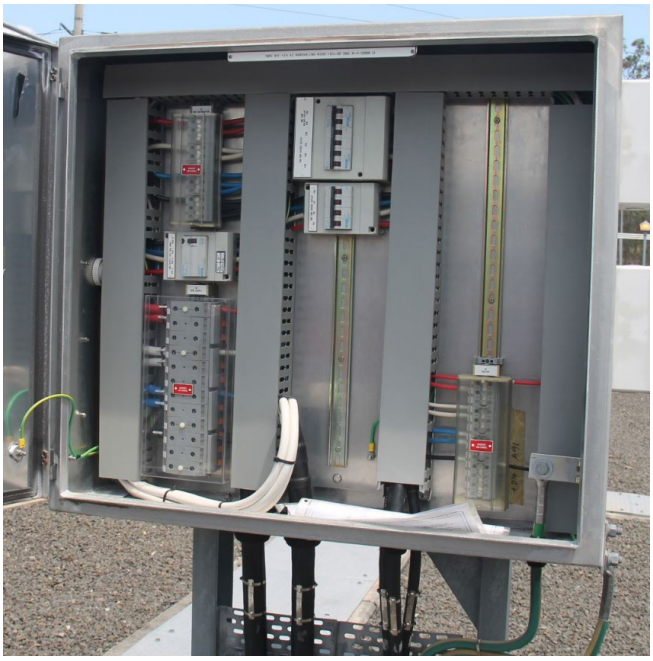
110kV Bay =D35 Feeder 7295 bay AC supply and VT box

110kV Bay =D03 Feeder 7296 bay VT box



110kV Bay =D36 Feeder 791 AC supply and VT box

AC marshalling kiosk for 1 CAP was built in 2005. The kiosks and associated control cables are in fair condition and there are no condition-driven replacements required until 2045.



110kV Bay =D14 3 Cap AC marshalling kiosks

Powerlink-Energex interface cubicle was built in 2005. The kiosks and associated control cables are in fair condition and there are no condition-driven replacements required until 2045.

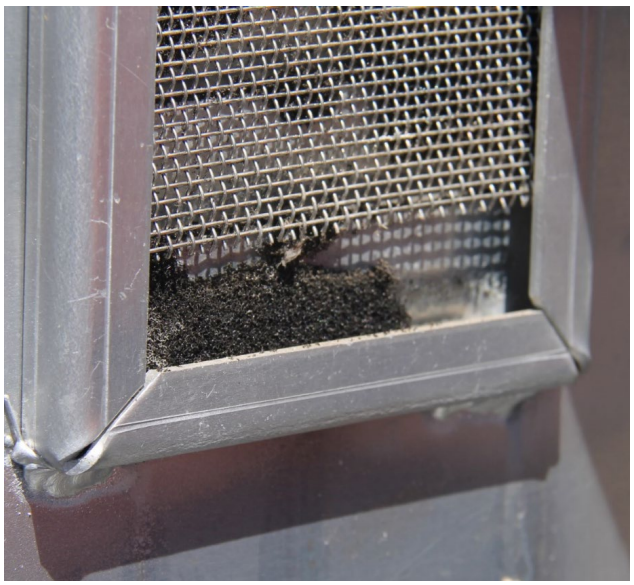
Powerlink-Energex interface cubicle

Electrical fence was installed at H038 Goodna in 2018.

Electric fence and associated control cubicle

4.2.3 Summary of marshalling kiosks

Marshalling kiosks in H038 Substation were installed in 2005 and are in fair condition. Although there is no major condition-based replacements required until 2045, the ventilation film has fallen in apart and needs to be retrofitted with major secondary system replacement.



Marshalling cubicle ventilation film

4.3 Control and protection bays

4.3.1 Protection and control panels

Secondary systems at Goodna are housed in a type of swing frame panel. These panels and associated panel wiring are in fair condition.

4.3.2 275kV Bus zones and couplers

Equipment details of 275kV bus zones and couplers are given below:

275kV Bus and coupler	Relay & control	Model	Startup Date	Still Manufactured?	Manufacture Support?	PLQ Spares	Health Index
1 Bus	X	[redacted]	2006	Yes	Yes	Yes	6.48
		[redacted]	2006	Yes	Yes	Yes	6.53
		[redacted]	2006	Yes	Yes	Yes	6.53
		[redacted]	2006	Yes	Yes	Yes	6.53
	Y	[redacted]	2006	Yes	Yes	Yes	6.48
		[redacted]	2006	Yes	Yes	Yes	6.53
		[redacted]	2006	Yes	Yes	Yes	6.53
		[redacted]	2006	Yes	Yes	Yes	6.53
	Bay control	[redacted]	2006	No	Yes	Yes	6.48
2 Bus	X	[redacted]	2006	Yes	Yes	Yes	6.53
		[redacted]	2006	Yes	Yes	Yes	6.53
		[redacted]	2006	Yes	Yes	Yes	6.45
		[redacted]	2006	Yes	Yes	Yes	6.53
	Y	[redacted]	2006	Yes	Yes	Yes	6.53

275kV Bus and coupler	Relay & control	Model	Startup Date	Still Manufactured?	Manufacture Support?	PLQ Spares	Health Index
		[redacted]	2006	Yes	Yes	Yes	6.53
		[redacted]	2006	Yes	Yes	Yes	6.53
		[redacted]	2006	Yes	Yes	Yes	6.53
	Bay control	[redacted]	2006	No	Yes	Yes	6.53
Coupler 504	X	[redacted]	2006	No	No	Yes	6.53
	Y	[redacted]	2006	No	Yes	Yes	6.53
	RTU	[redacted]	2006	No	Yes	Yes	6.53
Coupler 507	X	[redacted]	2006	No	No	Yes	6.53
	Y	[redacted]	2006	No	Yes	Yes	6.53
	RTU	[redacted]	2006	No	Yes	Yes	6.53

High impedance differential relays [redacted] relays are used to protect 275kV 1 and 2 bus. Powerlink has recovered modules of [redacted] RTU such as the [redacted] and [redacted] card. But these cards have been in service for more than 20 years and the capacitor electrolyte might have dried out. These recovered parts would be utilised only for emergency replacement. Powerlink has conducted a last buy in 2014 and are relying on these RTUs for maintenance spares. Health Index indicates that all protection and control systems for 275kV 1 and 2 Bus will reach the end of technical asset life and need to be replaced by 2026.


275kV 1 & 2 Bus protection and CB fail bus trip panel

Secondary systems for 275kV coupler 504 and 507 were installed in 2006. These secondary systems are in fair condition and there are no condition driven replacements required until 2026.

Coupler 504 protection and control panel

Coupler 507 protection and control panel

4.3.3 275/110kV transformer bays

Equipment for 275/110kV transformer bays is detailed below.

Transformer	Relay & control		Model	Startup Date	Still Manufactured?	Manufacture Support?	PLQ Spares	Health Index
1T	275kV	X	[redacted]	2006	No	No	Yes	6.53
				2006	Yes	Yes	Yes	6.53
				2006	No	No	Yes	6.53
		Y		2006	No	Yes	Yes	6.53
		Bay control		2006	No	Yes	Yes	6.53
	110kV	X CB MGMT		2006	No	No	Yes	6.48
		Y CB MGMT		2006	No	Yes	Yes	6.48
		Bay control		2006	No	Yes	Yes	6.48

Protection and control equipment including the panel for 275/110kV 1 Transformer were commissioned in 2006. Health index indicate that these secondary systems will reach the end of technical asset life and need to be replace by 2026.

1 Transformer 275/110kV protection and control panel

4.3.4 275kV feeder bays

Protection and control equipment for 275kV feeder bays are detailed in the following table.

Feeder	Relay & control	Model	Startup Date	Still Manufactured?	Manufacture Support?	PLQ Spares	Health Index
8819	X	[redacted]	2006	No	No	Yes	6.53
			2016	Yes	Yes	Yes	4.50
	Y		2014	Yes	Yes	Yes	4.45
	Bay control		2006	No	Yes	Yes	6.53
8842	X		2006	No	No	Yes	6.53
			2009	No	No	Yes	5.72
	Y		2006	Yes	Yes	Yes	6.53
	Protection Signalling		2006	Yes	Yes	Yes	6.53
			2006	Yes	Yes	Yes	6.66
	Bay control		2006	No	Yes	Yes	6.53

Majority of protection and control equipment (except [redacted] and [redacted] relay for Feeder 8819) for feeders 8819 and 8842 were commissioned in 2006. Health index shows that they will reach the end of technical asset life and need to be replaced in 2026.

Feeder 8819 protection and control panel

Feeder 8842 protection and control panel

4.3.5 110kV Bus zones and coupler bays

Secondary systems for 110kV bus zones and coupler bays are listed in a table below.

110kV Bus	Relay & control	Model	Startup Date	Still Manufactured?	Manufacture Support?	PLQ Spares	Health Index
1 Bus	X	[redacted]	2006	Yes	Yes	Yes	6.48
			2006	Yes	Yes	Yes	6.48
			2006	Yes	Yes	Yes	6.48

110kV Bus	Relay & control	Model	Startup Date	Still Manufactured?	Manufacture Support?	PLQ Spares	Health Index
		[redacted]	2006	Yes	Yes	Yes	6.48
	Y		2006	Yes	Yes	Yes	6.48
			2006	Yes	Yes	Yes	6.48
			2006	Yes	Yes	Yes	6.48
			2006	Yes	Yes	Yes	6.48
	Bay control		2006	No	Yes	Yes	6.48
2 Bus	X		2006	Yes	Yes	Yes	6.48
			2006	Yes	Yes	Yes	6.48
			2006	Yes	Yes	Yes	6.48
			2006	Yes	Yes	Yes	6.48
	Y		2006	Yes	Yes	Yes	6.48
			2006	Yes	Yes	Yes	6.48
			2006	Yes	Yes	Yes	6.48
			2006	Yes	Yes	Yes	6.48
	Bay control		2006	No	Yes	Yes	6.48
Coupler 411	X		2006	No	No	Yes	6.48
	Y		2006	No	Yes	Yes	6.48
	Bay control		2006	No	Yes	Yes	6.48

Secondary systems for 110kV bus zones and the bus coupler were installed in 2005. Health index indicate that these protection and control equipment will reach the end of technical asset life and need to be replaced by 2026.


110kV 1 Bus zone protection and control panel

110kV 2 Bus zone protection and control panel

110kV Bus coupler protection and control panel

4.3.6 110/33kV transformer bays

Secondary systems for 110/33kV transformer bays is detailed below.

Transformer	Relay & control		Model	Startup Date	Still Manufactured?	Manufacture Support?	PLQ Spares	Health Index
4T	110kV	X	[redacted]	2006	No	No	Yes	6.48
		Y		2006	No	Yes	Yes	6.48
		Bay control		2006	No	Yes	Yes	6.48
5T	110kV	X		2006	No	No	Yes	6.48
		Y		2006	No	Yes	Yes	6.48
		Bay control		2006	No	Yes	Yes	6.48

Secondary systems for 110/33kV 4 and 5 Transformer were installed under CP.01121 Goodna 110kV substation establishment in 2006. Associated health index indicate that these protection and control equipment will reach the end of technical asset life and need to be replaced by 2026.

110kV 4T protection and control panel

110kV 5T protection and control panel

4.3.7 110kV feeder bays

Secondary systems for 110kV feeder bays are detailed in a table below.

Feeder	Relay & control	Model	Startup Date	Still Manufactured?	Manufacture Support?	PLQ Spares	Health Index
718	X	[redacted]	2006	No	No	Yes	6.48
		[redacted]	2007	No	Yes	Yes	6.27
	Y	[redacted]	2006	Yes	Yes	Yes	6.48
	Bay control	[redacted]	2006	No	Yes	Yes	6.48
7295	X	[redacted]	2015	No	No	Yes	6.25
		[redacted]	2006	No	Yes	Yes	6.48
	Y	[redacted]	2006	Yes	Yes	Yes	5.13
	Protection Sig.	[redacted]	2006	No	Yes	Yes	6.48
	Bay control	[redacted]	2006	No	Yes	Yes	6.48
7296	X	[redacted]	2006	No	No	Yes	6.48
		[redacted]	2006	No	Yes	Yes	6.48
	Y	[redacted]	2006	Yes	Yes	Yes	6.48
	Bay control	[redacted]	2006	No	Yes	Yes	6.48
791	X	[redacted]	2006	No	No	Yes	6.45
		[redacted]1	2007	No	Yes	Yes	6.26
	Y	[redacted]	2006	Yes	Yes	Yes	6.49
	Protection Sig.	[redacted]	2006	No	Yes	Yes	6.48
	Bay control	[redacted]	2006	No	Yes	Yes	6.48

Majority of secondary systems for 110kV Feeder 718, 7295, 7296 and 791 were installed under CP.01121 Goodna 110kV substation establishment in 2006 (except for Feeder 7295 protection relay [redacted] which was faulty and replaced in 2015). Associated health index indicate that these protection and control equipment will reach the end of technical asset life and need to be replaced by 2026.

Feeder 718 protection and control panel

Feeder 7295 protection and control panel

Feeder 7296 protection and control panel

Feeder 791 protection and control panel

4.3.8 110kV 3 Capacitor bank

Secondary systems for 110kV 3 capacitor bank are detailed in the table below:

Capacitor	Relay & control	Model	Startup Date	Still Manufactured?	Manufacture Support?	PLQ Spares	Health Index
3 CAP	X	[redacted]	2006	No	Yes	Yes	6.48
		[redacted]	2006	No	Yes	Yes	6.48
		[redacted]	2006	No	No	Yes	6.48
	Y	[redacted]	2006	No	Yes	Yes	6.48
	POW	[redacted]	2007	No	No	No	6.32
	Bay control	[redacted]	2006	No	Yes	Yes	6.48

Secondary systems on 110kV 3 Capacitor bank were installed in 2006. Associated health index indicate that these protection and control equipment will reached the end of technical asset life and need to be replaced by 2026.

3 CAP protection and control panel

4.3.9 Power System Control and Monitoring

Currently there are no power system monitoring such as High Speeding Monitoring, Power Quality Monitoring and Phasor Measurement Unit installed at Goodna. Installation of power system monitoring needs to be reviewed under major secondary system replacement.

4.4 Metering

Energy meter has been installed to record customer electricity consumption at H038 Goodna Substation according National Electricity Rules. Associated metering equipment is detailed in the table below:-

Item	Model	Start-up Date	Still Manufactured ?	Manufacturer Support?	PLQ Spares	Health Index
REVMET1 Transformer 4	[redacted]	2015	No	Yes	Yes	4.72
	[redacted]	2006	No	Yes	Yes	6.48
REVMET2 Transformer 5	[redacted]	2006	No	Yes	Yes	6.48
	[redacted]	2006	No	Yes	Yes	6.48

Revenue and check meters have been installed for the customer connection points 4 and 5 Transformer. Health index shows that those meters will reach the end of technical asset life (except the check meter for 4T) and need to be replaced to maintain their reliable performance by 2026. Panel wirings are in fair condition.

As PSTN is being phased out and public network providers are moving to packed switched technologies with TCP/IP protocol, Powerlink is to roll out the metering based on IP based technology. As such, these meters need to be implemented based on IP metering technology under associated secondary system replacement.

Metering panel

4.5 Non-bays

Secondary systems for Non-bays at H038 Goodna are detailed in the following table:

NBay	Relay & control	Model	Startup Date	Still Manufactured?	Manufacture Support?	PLQ Spares	Health Index
Local control (+3)	HMI	[redacted]	2009	No	No	Limited	9.58

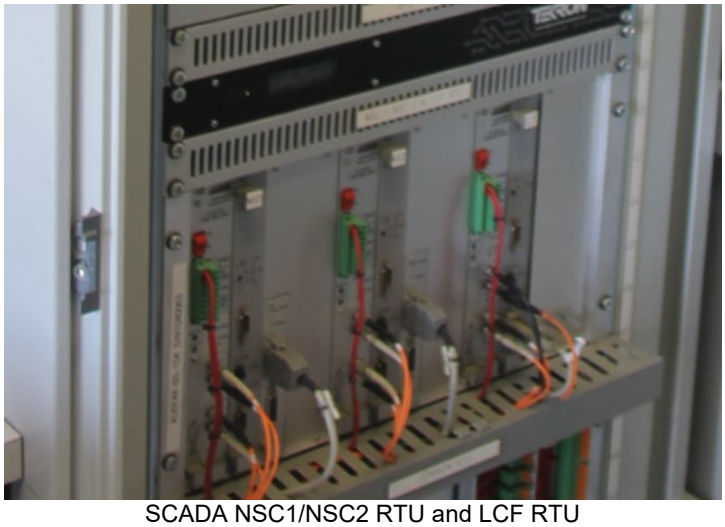
NBay	Relay & control	Model	Startup Date	Still Manufactured?	Manufacture Support?	PLQ Spares	Health Index
	LCF RTU	[redacted]	2006	No	Yes	Yes	6.53
	Common RTU		2006	No	Yes	Yes	6.53
Local control (+4)	HMI Terminal		2009	No	No	Yes	8.77
	Common RTU		2006	No	Yes	Yes	6.53
Master OpsWAN (+2)	Router		2006	Yes	Yes	Yes	10.00
	OpsWAN Switch		2017	Yes	Yes	Yes	2.50
	Switch Ethernet		2006	Yes	Yes	Yes	10.00
	OpsWAN Server		2019	Yes	Yes	Yes	0.35
Station OpsWAN (+3)	Switch Ethernet		2006	No	No	No	10.00
	Switch 8 port		2006	Yes	Yes	Yes	10.00
	Serial Port Server		2017	Yes	Yes	Yes	2.50
	OpsWAN Switch		2017	Yes	Yes	Yes	2.50
Station OpsWAN (+4)	Switch Ethernet		2006	No	No	No	10.00
	Switch 8 port		2006	Yes	Yes	Yes	10.00
	Serial Port Server		2017	Yes	Yes	Yes	2.50
	OpsWAN Switch		2017	Yes	Yes	Yes	2.50
SCADA (+3)	NSC1		2006	No	Yes	Yes	6.53
	NSC2		2006	No	Yes	Yes	6.53
Timing Clock	GPS Clock (+3)		2011	No	Yes	Yes	5.47
	GPA Clock (+4)		2006	Yes	Yes	Yes	6.53

4.5.1 SCADA, Control and OpsWAN

There is one 275/110kV OptoNet ring at H038 Goodna Substation as shown:-.

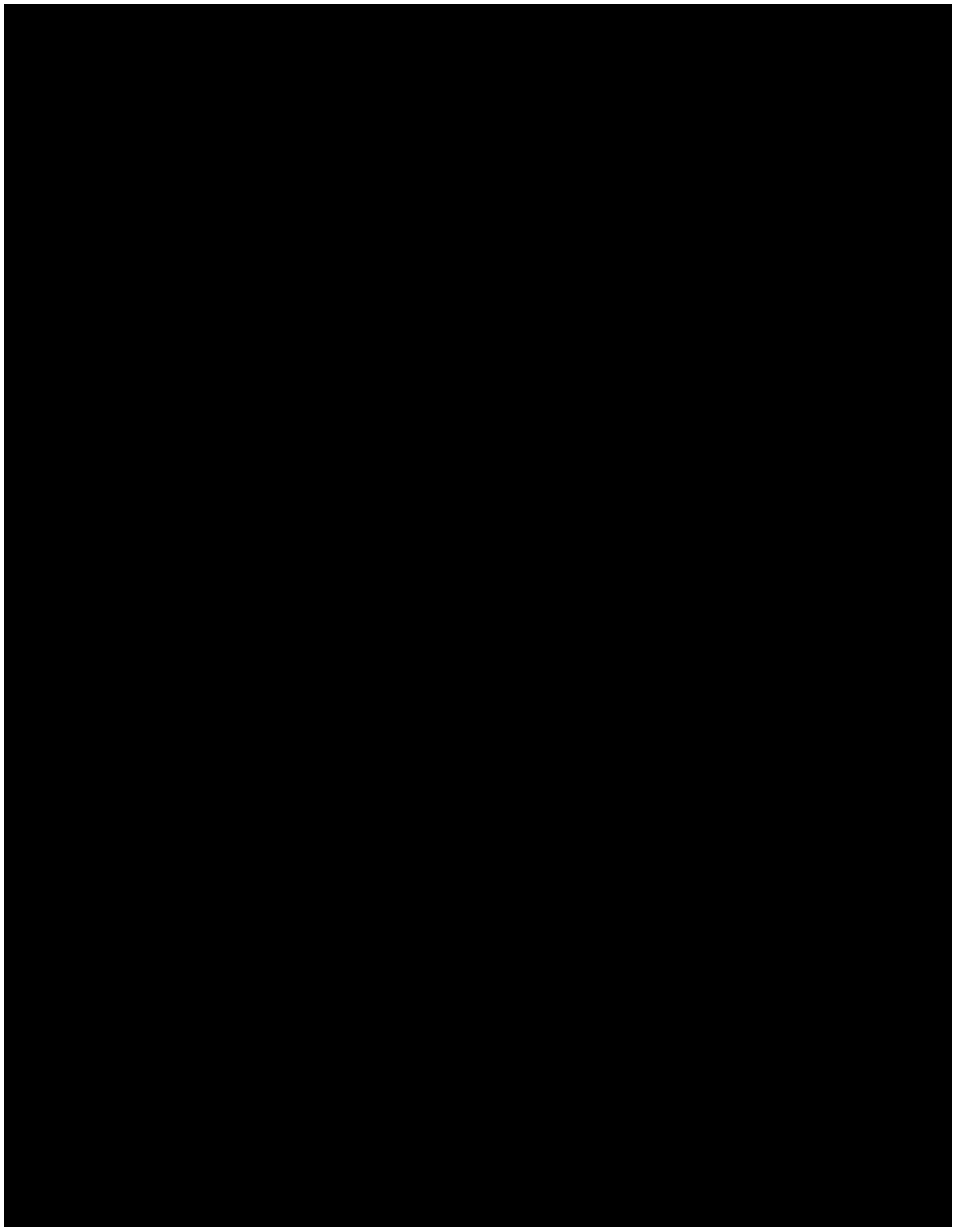
OptoNet network overview

Dedicated SCADA paths have been implemented for 275/110kV secondary systems at H038 Goodna. The SCADA system has independent NSC1 and NSC2 RTU to implement 2 x dual SCADA paths based on DNP serial protocol. The serial SCADA is being phased out and will need to be migrated to DNP over IP under major secondary system replacement.



SCADA NSC1/NSC2 RTU and LCF RTU

[redacted] is used for the local control. There are only limited spares available. This equipment needs to be replaced with major secondary system replacement.



The router and Ethernet switch for Master OpsWAN in +2 were installed in 2006. Health index indicates that these equipment have reached the end of technical asset life. Powerlink's strategy is to carry out associate replacement with major secondary system replacement projects.

Master OpsWAN panel in Building +2

Ethernet switches for OpsWAN equipment in Building +3 and +4 were installed in 2006. Health index indicates that these equipment have reached the end of technical asset life and need to be replaced with major secondary system replacement.

Station OpsWAN panel in Building +3 and +4

4.5.2 Auxiliary supply

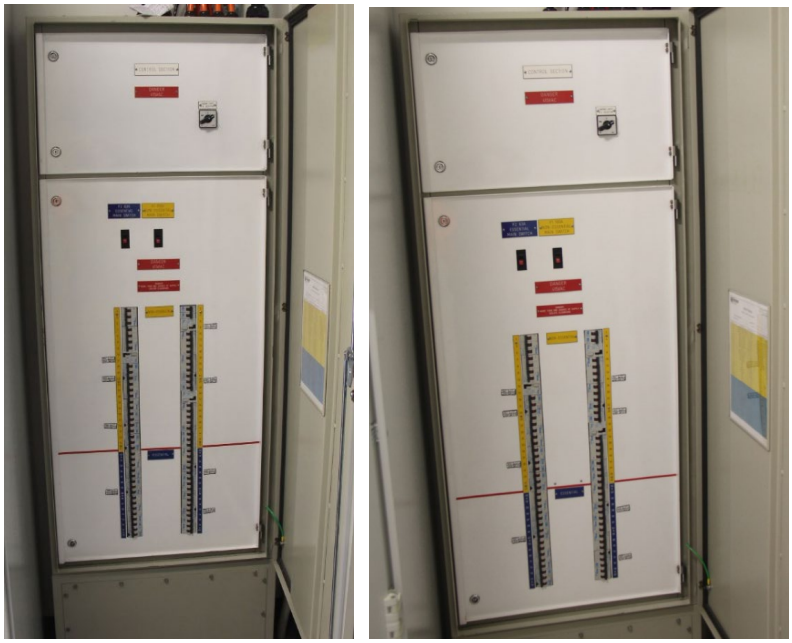
The 415VAC auxiliary supplies are derived from Energex 1 x 11kV/415V 300kVA and 1 x 33kV/415V 300kVA station transformers. Suitable monitoring and changeover arrangement are available for the site. The arrangement is considered acceptable for the situation.

Energex Station transformer TR8 and TR9

AC change over board was installed within the amenities building in 2005 and is in fair condition.

AC changeover board in Amenities building

The AC distribution boards in building +3 and +4 were installed in 2005 and are in fair condition.



AC distribution board in Building +3 and +4

The dual 125VDC and associated distribution boards in +3 and +4 were installed in 2006. DC batteries have reached the end of asset life and have been planned to be replaced under OR.02316 by 2020. Chargers need to be replaced with major secondary system replacement by 2026.

125VDC Batteries and charger in Building +3 and +4

Dual 48VDC batteries in Building +2 were replaced in 2015 and are in good condition. Associated chargers were installed in 2006. They will reach the end of technical asset life and need to be replaced by 2026.

48VDC Batteries and charger in telecommunication building +2

5. Telecommunication

Communication systems at H038 Goodna consist of fibre optic technology with [redacted] and [redacted] MUX devices. They have been providing reliable services for protection and control systems. [redacted] no longer manufacturers the PDH equipment, and the support for hardware replacement is provided by [redacted]

SDH and PDH at Building +2

PDH at Building +3 and +4

No MPLS network has been installed at H038 Goodna substation.

6. Summary of Asset Health

The asset health of H038 Goodna secondary system assets is determined by an assessment of the equipment aging profile, reliability, conditions (including the condition of panel wirings, control cables and marshalling cubicles) and equipment obsolescence. Asset health index of equipment at H038 Goodna are summarised in the table below:-

Bay	Functional Loc.	Description	Secondary System Equipment					Protection/Control Panel		Marshalling kiosk and control cables			
			Model number	In Service Date	Health Index	Obsolete?	To be replaced by	HI	To be replaced	Item	In service date	HI	To be replaced by
=KD1 110kV 1 BUS	H038-SSS-1BU4-BAYCONT	REMOTE TERMINAL UNIT FOXBORO C50	[redacted]	18/10/2006	6.48	Yes	2026	3.50	2046				
	H038-SSS-1BU4-XPROT	RELAY DIFF AREVA MFAC34 RANGE: 25-325VAC		18/10/2006	6.48	No							
	H038-SSS-1BU4-XPROT	RELAY TRIPPING LOW BURDEN ALSTOM MVAJ13		18/10/2006	6.48	No							
	H038-SSS-1BU4-XPROT	RELAY TRIPPING SUPPLY FAIL ALSTOM MVAX12		18/10/2006	6.48	No				110kV 1 Bus VT box	25/11/2005	3.53	2045
	H038-SSS-1BU4-XPROT	RELAY CB FAIL BUS TRIP RACK		18/10/2006	6.48	No				110kV 1 Bus CT marshalling kiosk	25/11/2005	3.53	2045
	H038-SSS-1BU4-YPROT	RELAY DIFF AREVA MFAC34 RANGE: 25-325VAC		18/10/2006	6.48	No							
	H038-SSS-1BU4-YPROT	RELAY TRIPPING LOW BURDEN ALSTOM MVAJ13		18/10/2006	6.48	No							
	H038-SSS-1BU4-YPROT	RELAY TRIPPING SUPPLY FAIL ALSTOM MVAX12		18/10/2006	6.48	No							
	H038-SSS-1BU4-YPROT	RELAY CB FAIL BUS TRIP RACK		18/10/2006	6.48	No							
=KC1 275kV 1 BUS	H038-SSS-1BU5-BAYCONT	REMOTE TERMINAL UNIT FOXBORO C50		10/11/2006	6.48	Yes	2026	3.50	2046				
	H038-SSS-1BU5-XPROT	RELAY DIFF AREVA MFAC34 RANGE: 25-325VAC		18/10/2006	6.48	No							
	H038-SSS-1BU5-XPROT	RELAY TRIPPING LOW BURDEN ALSTOM MVAJ13		18/09/2006	6.53	No							
	H038-SSS-1BU5-XPROT	RELAY TRIPPING SUPPLY FAIL ALSTOM MVAX12		18/09/2006	6.53	No							
	H038-SSS-1BU5-XPROT	RELAY CB FAIL BUS TRIP RACK		18/09/2006	6.53	No							
	H038-SSS-1BU5-YPROT	RELAY DIFF AREVA MFAC34 RANGE: 25-325VAC		18/09/2006	6.53	No							
	H038-SSS-1BU5-YPROT	RELAY TRIPPING LOW BURDEN ALSTOM MVAJ13		18/09/2006	6.53	No							
	H038-SSS-1BU5-YPROT	RELAY TRIPPING SUPPLY FAIL ALSTOM MVAX12		18/09/2006	6.53	No				1 Bus VT Box	24/11/2005	3.53	2045
	H038-SSS-1BU5-YPROT	RELAY CB FAIL BUS TRIP RACK		18/09/2006	6.53	No							
=KD2 110kV 2 BUS	H038-SSS-2BU4-BAYCONT	REMOTE TERMINAL UNIT FOXBORO C50		18/10/2006	6.48	Yes	2026	3.50	2046				
	H038-SSS-2BU4-XPROT	RELAY DIFF AREVA MFAC34 RANGE: 25-325VAC		18/10/2006	6.48	No				110kV 2 Bus marshalling kiosk	25/11/2005	3.53	2045
	H038-SSS-2BU4-XPROT	RELAY TRIPPING LOW BURDEN ALSTOM MVAJ13		18/10/2006	6.48	No							
	H038-SSS-2BU4-XPROT	RELAY TRIPPING SUPPLY FAIL ALSTOM MVAX12		18/10/2006	6.48	No							
	H038-SSS-2BU4-XPROT	RELAY CB FAIL BUS TRIP RACK		18/10/2006	6.48	No				110kV 2 Bus VT box	25/11/2005	3.53	2045
	H038-SSS-2BU4-YPROT	RELAY DIFF AREVA MFAC34 RANGE: 25-325VAC		18/10/2006	6.48	No							
	H038-SSS-2BU4-YPROT	RELAY TRIPPING LOW BURDEN ALSTOM MVAJ13		18/10/2006	6.48	No							
	H038-SSS-2BU4-YPROT	RELAY TRIPPING SUPPLY FAIL ALSTOM MVAX12		18/10/2006	6.48	No							
	H038-SSS-2BU4-YPROT	RELAY CB FAIL BUS TRIP RACK		18/10/2006	6.48	No							
=KC2 275kV 2 BUS	H038-SSS-2BU5-BAYCONT	REMOTE TERMINAL UNIT FOXBORO C50		18/09/2006	6.53	Yes	2026	3.50	2046				
	H038-SSS-2BU5-XPROT	RELAY DIFF AREVA MFAC34 RANGE: 25-325VAC		18/09/2006	6.53	No							
	H038-SSS-2BU5-XPROT	RELAY TRIPPING LOW BURDEN ALSTOM MVAJ13		18/09/2006	6.53	No				2Bus VT box	24/11/2005	3.53	2045
	H038-SSS-2BU5-XPROT	RELAY TRIPPING SUPPLY FAIL ALSTOM MVAX12		10/11/2006	6.45	No							
	H038-SSS-2BU5-XPROT	RELAY CB FAIL BUS TRIP RACK		18/09/2006	6.53	No							
	H038-SSS-2BU5-YPROT	RELAY DIFF AREVA MFAC34 RANGE: 25-325VAC		18/09/2006	6.53	No							
	H038-SSS-2BU5-YPROT	RELAY TRIPPING LOW BURDEN ALSTOM MVAJ13		18/09/2006	6.53	No							
	H038-SSS-2BU5-YPROT	RELAY TRIPPING SUPPLY FAIL ALSTOM MVAX12		18/09/2006	6.53	No							
	H038-SSS-2BU5-YPROT	RELAY CB FAIL BUS TRIP RACK		18/09/2006	6.53	No							
=D01 110kV Coupler 411	H038-SSS-411--BAYCONT	REMOTE TERMINAL UNIT FOXBORO C50		18/10/2006	6.48	Yes	2026	3.50	2046				
	H038-SSS-411--XPROT	RELAY CB MGMT GE C60 (VER 2.93 FIRMWARE)		18/10/2006	6.48	Yes				110kV coupler AC supply marshalling	22/11/2005	3.53	2045
	H038-SSS-411--YPROT	RELAY CBMAN SEL-351-1 (1A)		18/10/2006	6.48	Yes							
=D28-441 1T 110kV	H038-SSS-441--BAYCONT	REMOTE TERMINAL UNIT FOXBORO C50		18/10/2006	6.48	Yes	2026	3.50	2046				
	H038-SSS-441--XPROT	RELAY CB MGMT GE C60 (VER 2.93 FIRMWARE)		18/10/2006	6.48	Yes				1 Transformer 110kV VT box	25/11/2005	3.53	2045
	H038-SSS-441--YPROT	RELAY CBMAN SEL-351-1 (1A)		18/10/2006	6.48	Yes				1 Transformer 110kV AC supply marshalling	22/11/2005	3.53	2045
=D20 4T 110kV	H038-SSS-444--BAYCONT	REMOTE TERMINAL UNIT FOXBORO C50		18/10/2006	6.48	Yes	2026	3.50	2046				
	H038-SSS-444--XPROT	RELAY TRANSF DIFF GE T60 (3.48)		18/10/2006	6.48	Yes				4 Transformer 110kV AC supply marshalling	22/11/2005	3.53	2045

	H038-SSS-444--YPROT	RELAY BIASED DIFF SEL-387-5 (1A) (3U)	[redacted]	18/10/2006	6.48	Yes				4 Transformer maintenance outlet	20/10/2005	3.55	2045
=D17 5T 110kV	H038-SSS-445--BAYCONT	REMOTE TERMINAL UNIT FOXBORO C50		18/10/2006	6.48	Yes	2026	3.50	2046				
	H038-SSS-445--XPROT	RELAY TRANSF DIFF GE T60 (3.48)		18/10/2006	6.48	Yes				5 Transformer 110kV AC supply marshalling	22/11/2005	3.53	2045
	H038-SSS-445--YPROT	RELAY BIASED DIFF SEL-387-5 (1A) (3U)		18/10/2006	6.48	Yes							
=D14.2 110kV 3 Cap	H038-SSS-483--BAYCONT	REMOTE TERMINAL UNIT FOXBORO C50		18/10/2006	6.48	Yes	2026	3.50	2046				
	H038-SSS-483--POWAVE	RELAY POINT ON WAVE ABB E213		16/02/2007	6.32	Yes							
	H038-SSS-483--XPROT	RELAY CB MGMT GE C60 (VER 2.93 FIRMWARE)		18/10/2006	6.48	Yes				3 CAP AC supply marshalling kiosk	22/11/2005	3.53	2045
	H038-SSS-483--XPROT	RELAY OC & EF ABB SPAJ140C		18/10/2006	6.48	Yes							
	H038-SSS-483--XPROT	RELAY CAP PROTN ABB SPAJ160C		18/10/2006	6.48	Yes							
	H038-SSS-483--YPROT	RELAY CBMAN SEL-351-1 (1A)		18/10/2006	6.48	Yes							
=C04 275kV Coupler 504	H038-SSS-504--BAYCONT	REMOTE TERMINAL UNIT FOXBORO C50		18/09/2006	6.53	Yes	2026	3.50	2046				
	H038-SSS-504--XPROT	RELAY CB MGMT GE C60 (VER 2.93 FIRMWARE)		18/09/2006	6.53	Yes				Coupler 504	2/12/2005	3.52	2045
	H038-SSS-504--YPROT	RELAY CB MGMT SEL 352 1A, 125Vdc, 4U		18/09/2006	6.53	Yes							
=C07 275kV Coupler 507	H038-SSS-507--BAYCONT	REMOTE TERMINAL UNIT FOXBORO C50		18/09/2006	6.53	Yes	2026	3.50	2046				
	H038-SSS-507--XPROT	RELAY CB MGMT GE C60 (VER 2.93 FIRMWARE)		18/09/2006	6.53	Yes				Coupler 507	2/12/2005	3.52	2045
	H038-SSS-507--YPROT	RELAY CB MGMT SEL 352 1A, 125Vdc, 4U		18/09/2006	6.53	Yes							
=C07-541 1T 275kV	H038-SSS-541--BAYCONT	REMOTE TERMINAL UNIT FOXBORO C50		18/09/2006	6.53	Yes	2026	3.50	2046				
	H038-SSS-541--XPROT	RELAY TRANSF DIFF GE T60 (3.48)		18/09/2006	6.53	Yes				1 Transformer marshalling cubicle	6/12/2005	3.52	2045
	H038-SSS-541--XPROT	RELAY TRANSF O/LOAD GE F35 (2.93)		18/09/2006	6.53	Yes				1 Transformer 275kV 13 VT box	6/12/2005	3.52	2045
	H038-SSS-541--XPROT	RELAY DIFF 25-325V 1POLE GEC MFAC14		18/09/2006	6.53	No							
	H038-SSS-541--YPROT	RELAY BIASED DIFF SEL-387-5 (1A) (3U)		18/09/2006	6.53	Yes							
=D06.2 Feeder 718	H038-SSS-718--BAYCONT	REMOTE TERMINAL UNIT FOXBORO C50		18/10/2006	6.48	Yes	2026	3.50	2046				
	H038-SSS-718--XPROT	CURR DIFF RELAY MICOM P543 + 2ND PORT		18/10/2006	6.48	Yes				Feeder 718 AC supply marshalling cubicle	22/11/2005	3.53	2045
	H038-SSS-718--XPROT	COMMS INTERFACE UNIT ALSTOM P591		26/03/2007	6.27	Yes				Feeder 718 VT box	25/11/2005	3.53	2045
	H038-SSS-718--YPROT	RELAY DISTANCE SEL 311C 1A		18/10/2006	6.48	No							
==D35.1 Feeder 7295	H038-SSS-7295-BAYCONT	REMOTE TERMINAL UNIT FOXBORO C50		18/10/2006	6.48	Yes	2026	3.50	2046				
	H038-SSS-7295-PSDIT	DEWAR DM1200 PROT SIG DIG 90-320V SUPPLY		18/10/2006	6.48	No				AC Marshalling kiosk	22/11/2005	3.53	2045
	H038-SSS-7295-PSPIT	DEWAR DM1200 PROT SIG DIG 90-320V SUPPLY		18/10/2006	6.48	No				Feeder 7295 VT box	25/11/2005	3.53	2045
	H038-SSS-7295-XPROT	COMMS INTERFACE UNIT ALSTOM P591		18/10/2006	6.48	Yes							
	H038-SSS-7295-XPROT	CURR DIFF RELAY MICOM P543 + 2ND PORT		9/01/2015	5.13	Yes							
	H038-SSS-7295-YPROT	RELAY DISTANCE SEL 311C 1A		14/11/2006	6.45	No							
=D03.1 Feeder 7296	H038-SSS-7296-BAYCONT	REMOTE TERMINAL UNIT FOXBORO C50		18/10/2006	6.48	Yes	2026	3.50	2046				
	H038-SSS-7296-XPROT	CURR DIFF RELAY MICOM P543 + 2ND PORT		18/10/2006	6.48	Yes				Feeder 7296 VT box	25/11/2005	3.53	2045
	H038-SSS-7296-XPROT	COMMS INTERFACE UNIT ALSTOM P591		18/10/2006	6.48	Yes							
	H038-SSS-7296-YPROT	RELAY DISTANCE SEL 311C 1A		18/10/2006	6.48	No							
=D36.3 Feeder 791	H038-SSS-791--BAYCONT	REMOTE TERMINAL UNIT FOXBORO C50		18/10/2006	6.48	Yes	2026	3.50	2046	Feeder 791 AC supply	22/11/2005	3.53	2045
	H038-SSS-791--PSDIT	DEWAR DM1200 PROT SIG DIG 90-320V SUPPLY		18/10/2006	6.48	No				Feeder 791 VT box	25/11/2005	3.53	2045
	H038-SSS-791--PSPIT	DEWAR DM1200 PROT SIG DIG 90-320V SUPPLY		18/10/2006	6.48	No							
	H038-SSS-791--XPROT	COMMS INTERFACE UNIT ALSTOM P591		30/03/2007	6.26	Yes							
	H038-SSS-791--XPROT	CURR DIFF RELAY MICOM P543 + 2ND PORT		14/11/2006	6.45	Yes							
	H038-SSS-791--YPROT	RELAY DISTANCE SEL 311C 1A		18/10/2006	6.48	No							
=C04 Feeder 8819	H038-SSS-8819-BAYCONT	REMOTE TERMINAL UNIT FOXBORO C50		18/09/2006	6.53	Yes	2026	3.50	2046				
	H038-SSS-8819-XPROT	RELAY CB MGMT GE C60 (VER 2.93 FIRMWARE)		18/09/2006	6.53	Yes				Feeder 8819 marshalling cubicle	29/11/2005	3.52	2045
	H038-SSS-8819-XPROT	RELAY ABB RED670 REM END CCIS IPASS 6I6U		27/05/2016	4.50	No				Feeder 8819 VT Box	29/11/2005	3.52	2045
	H038-SSS-8819-YPROT	RELAY DISTANCE SCHW'ZER 421-5 1A 24 LED		6/11/2014	4.45	No				Diameter C04 AC and DC marshalling cubicle	19/10/2005	3.55	2045
=C07 Feeder 8842	H038-SSS-8842-BAYCONT	REMOTE TERMINAL UNIT FOXBORO C50		18/09/2006	6.53	Yes	2026	3.50	2046				
	H038-SSS-8842-PSPIT	DEWAR DM1200 PROT SIG DIG 90-320V SUPPLY		18/09/2006	6.53	No							
	H038-SSS-8842-PSPITY	DEWAR DM1200 PROT SIG DIG 90-320V SUPPLY		18/09/2006	6.53	No				Feeder 8842 Marshalling cubicle	23/11/2005	3.53	2045
	H038-SSS-8842-PSSITA	DEWAR DM1200 PROT SIG DIG 90-320V SUPPLY		18/09/2006	6.53	No				Feeder 8842 VT box	2/12/2005	3.52	2045
	H038-SSS-8842-PSSITB	RFL 9745 PROT SIG DIG I/O 48-125V		18/09/2006	6.66	No				Diameter =C07 AC and DC marshalling cubicle	19/10/2005	3.55	2045
	H038-SSS-8842-XPROT	RELAY CB MGMT GE C60 (VER 2.93 FIRMWARE)		18/09/2006	6.53	Yes							
	H038-SSS-8842-XPROT	RELAY DISTANCE MICOM P442 (WITH R/PORT		16/04/2009	5.72	Yes							
	H038-SSS-8842-YPROT	RELAY DISTANCE SEL-421 (1A) (5U)		18/09/2006	6.53	No							

Metering	H038-SSS-METR-REVMET1	TRANSF 2 WH/VARH METER (CHECK)	[redacted]	11/12/2015	4.72	Yes	2026	3.50	2046			
	H038-SSS-METR-REVMET1	METER KWH/KVARH EDMI (REVENUE)		18/10/2006	6.48	Yes						
	H038-SSS-METR-REVMET2	METER KWH/KVARH EDMI (CHECK)		18/10/2006	6.48	Yes						
	H038-SSS-METR-REVMET2	METER KWH/KVARH EDMI (REVENUE)		18/10/2006	6.48	Yes						
Non-bay	H038-SSS-NBAY-LCF3	LOCAL CONTROL FACILITY SUN BLADE		9/03/2009	9.58	Yes	To be replaced with major secondary system replacement	3.50	2046			
	H038-SSS-NBAY-LCF4	LOCAL CONTROL FACILITY PC X TERMINAL		29/12/2009	8.77	Yes						
	H038-SSS-NBAY-LCF4	LOCAL CONTROL FACILITY PC X TERMINAL		1/01/2017	2.50	Yes						
	H038-SSS-NBAY-LCFINT3	REMOTE TERMINAL UNIT FOXBORO C50		18/09/2006	6.53	Yes						
	H038-SSS-NBAY-NSCLNK13	REMOTE TERMINAL UNIT FOXBORO C50		18/09/2006	6.53	Yes						
	H038-SSS-NBAY-NSCLNK23	REMOTE TERMINAL UNIT FOXBORO C50		18/09/2006	6.53	Yes						
	H038-SSS-NBAY-OWNTWK2	SWITCH ETHERNET		18/09/2006	10.00	No						
	H038-SSS-NBAY-OWNTWK2	ROUTER		18/09/2006	10.00	No						
	H038-SSS-NBAY-OWNTWK2	SWITCH E/NET 32PRT RUGGED RSG2300 OPSWAN		1/01/2017	2.50	No						
	H038-SSS-NBAY-OWNTWK3	SWITCH ETHERNET		18/09/2006	10.00	No						
	H038-SSS-NBAY-OWNTWK3	SWITCH 8PORT		18/09/2006	10.00	No						
	H038-SSS-NBAY-OWNTWK3	SERIAL PORT SERVER 48VDC PERLE OPSWAN		1/01/2017	2.50	No						
	H038-SSS-NBAY-OWNTWK3	SWITCH E/NET 32PRT RUGGED RSG2300 OPSWAN		1/01/2017	2.50	No						
	H038-SSS-NBAY-OWNTWK4	SWITCH ETHERNET		18/09/2006	10.00	No						
	H038-SSS-NBAY-OWNTWK4	SWITCH 8PORT		18/09/2006	10.00	No						
	H038-SSS-NBAY-OWNTWK4	SERVER PORT 48VDC PERLE 04030450 -OPSWAN		1/01/2017	2.50	No						
	H038-SSS-NBAY-OWNTWK4	SWITCH E/NET 32PRT RUGGED RSG2300 OPSWAN		1/01/2017	2.50	No						
	H038-SSS-NBAY-OWSERV2	GEN 4 SERVER OPSWAN		31/07/2019	0.35	No						
	H038-SSS-NBAY-RTUCOM3	REMOTE TERMINAL UNIT FOXBORO C50		18/09/2006	6.53	Yes						
	H038-SSS-NBAY-RTUCOM4	REMOTE TERMINAL UNIT FOXBORO C50		18/09/2006	6.53	Yes						
	H038-SSS-NBAY-TIMING3	GPS CLOCK TEKRON TCG01-D:1		29/06/2011	5.47	No						
	H038-SSS-NBAY-TIMING4	GPS CLOCK - TEKRON TCG01		18/09/2006	6.53	No						
Powerlink Energex Interface										Powerlink-Energex Interface Cubicle	4/11/2005	3.54	2045

7. Conclusions

Based on the condition assessment, the main recommendations for the replacement of secondary systems equipment at H038 Goodna are:-

1. **Conduct following secondary system replacements by 2026:-**
   - Replace the ventilation film of all marshalling kiosks
   - Replace all 275kV 1 and 2 Bus protection and control equipment
   - Replace all 275kV coupler 504 and 507 protection and control equipment
   - Replace all 1 Transformer protection and control equipment (both 275kV and 110kV side)
   - Replace C60 relay and C50 RTU for feeder 8819
   - Replace all protection and control equipment for feeder 8842
   - Replace all protection and control equipment for feeder 110kV 1 & 2 Bus and bus coupler 411
   - Replace all protection and control equipment for 4 and 5 Transformer
   - Replace all protection and control equipment for 110kV feeder 718, 7295, 7296 and 791
   - Replace all protection and control equipment for 110kV 3 Cap
   - Install Power Quality Monitoring device
   - Replace all metering equipment based on current design standard
   - Replace NSC1, NSC2 and LCF RTU and upgrade the SDACA DNP serial to NP/IP
   - Replace common RTU in building +3 and +4
   - Replace Comms RTU in building +2
   - Replace HMI [redacted] workstation
   - Replace OpsWAN in Building +2 , +3 and Building +4
   - Replace [redacted] clock in building +4
   - Replace 125VDC battery charger in Building +3
   - Replace 125VDC battery charger in Building +4
   - Replace 48VDC charger in Building +2

2. **Carry out following replacement by 2035**
   - Replace Feeder 8819 RED670 and SEL-421-5 relay
   - Replace the check meter for 4T
   - Replace GPS clock in Building +3

8. References

(1) National Electricity Rules (NER) Version 106, AEMC, 27/02/2018
(2) AM-POL-0463 Protection Design, Powerlink, 25/02/2014
(3) AM-POL-0970 Secondary Systems Design, Powerlink, 05/05/2009
(4) OSD - SCADA Requirements for Operational Purposes - Standard, Powerlink, 13/01/2016
(5) AM-POL-0169 Secondary Systems Maintenance Policy, Powerlink, 3/11/2008
(6) AM-POL-0053 AC and DC Supplies, Powerlink, 08/05/2014
(7) SU0023 Clearance Requirements for Panels, Switchboard and Kiosks, ID&TS, 06/05/2016
(8) "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.
(9) "Powerlink – Asset Risk Management – Framework", ASM-I&P-FRA-A2417558, Powerlink Queensland, 2019.

Planning Report	5 September 2025
Title	CP.02796 – H038 Goodna Secondary Systems Replacement
Zone	Moreton
Need Driver	Emerging compliance risks arising from condition and obsolescence of Goodna's ageing secondary systems.
Network Limitations and statutory requirements	Goodna Substation is required to meet Powerlink Queensland's N-1-50MW/600MWh Transmission Authority reliability standard.
Pre-requisites	None

Executive Summary

Ageing and obsolete secondary systems at Goodna 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[1].

The 2025 Central scenario forecast confirms there is an enduring need to maintain electricity supply into the Brisbane Southwest/Ipswich area. The removal or reconfiguration of the Goodna 275/110kV Substation due to secondary system failure/obsolesce would violate Powerlink's N-1-50MW/600MWh Transmission Authority reliability standard.

Therefore, there is an enduring need to maintain the current function and capacity of the Goodna Substation by replacing the at-risk secondary systems.

[1] *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

Goodna Substation (H038) is located approximately 22km south-west of the Brisbane CBD. The substation was established in 2006 to meet growing demand in the Brisbane Southwest/Ipswich area and forms part of the greater Brisbane meshed network.

Goodna Substation contains two 275kV feeder bays energised from Blackwall and Belmont substations, a 275/110kV transformer and four 110kV feeder bays connected to West Darra, Blackstone and Redbank Plains substations. Further, it contains two 110/33kV transformers to supply the load in the local area.

Figure 1 and Figure 2 show the geographic location of the Goodna Substation.

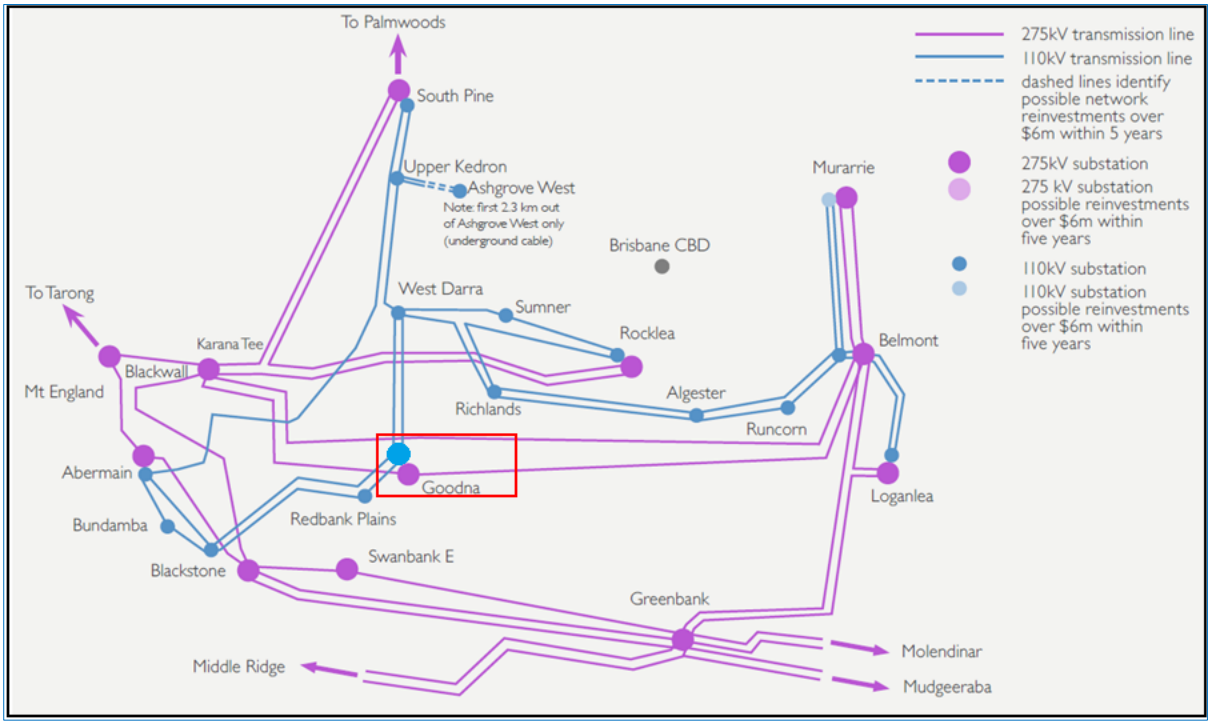


Figure 1. Goodna Substation – Greater Brisbane Transmission Zone

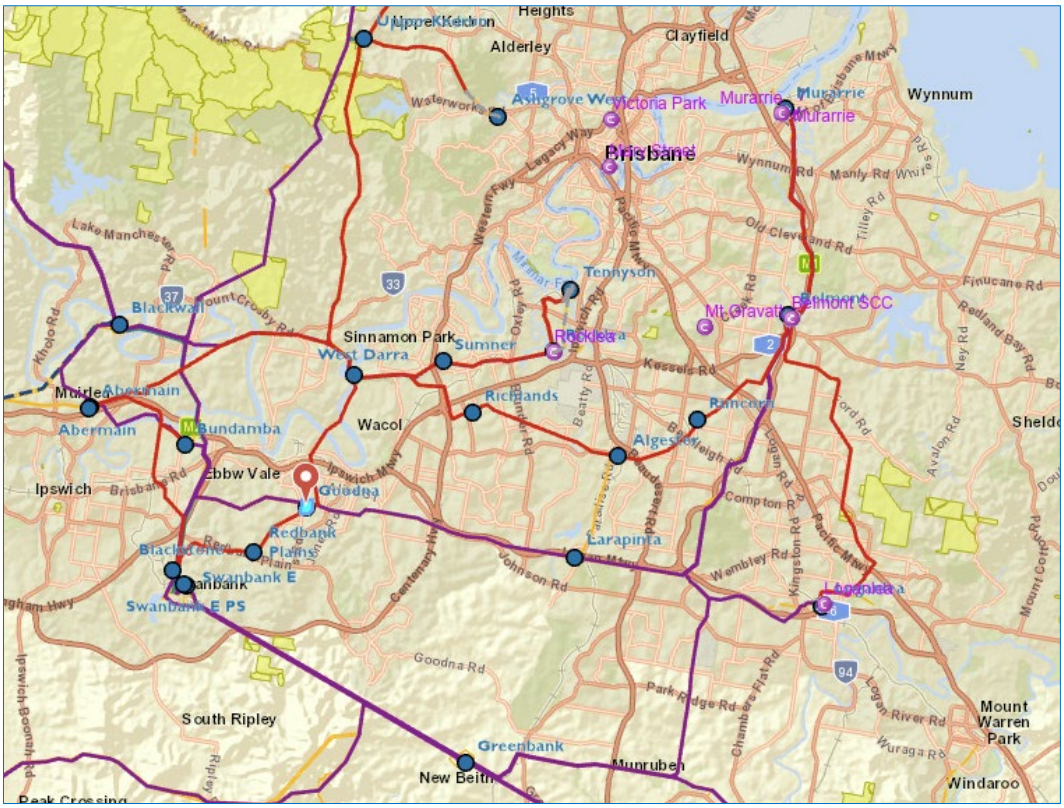


Figure 2. Goodna Substation – Greater Brisbane Transmission Zone

The condition assessment [1] confirmed end of technical service life, with many components no longer supported by the manufacturer and limited spares availability. 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 site-specific impacts of obsolescence at Goodna Substation, it is 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 impacts on network reliability and safety.

This report assesses the impact that removal of the functionality enabled by the secondary systems at Goodna Substation 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 Goodna Substation.

2. H038 Goodna Substation configuration

Figure 3 shows the existing connection configuration of the Goodna Substation.

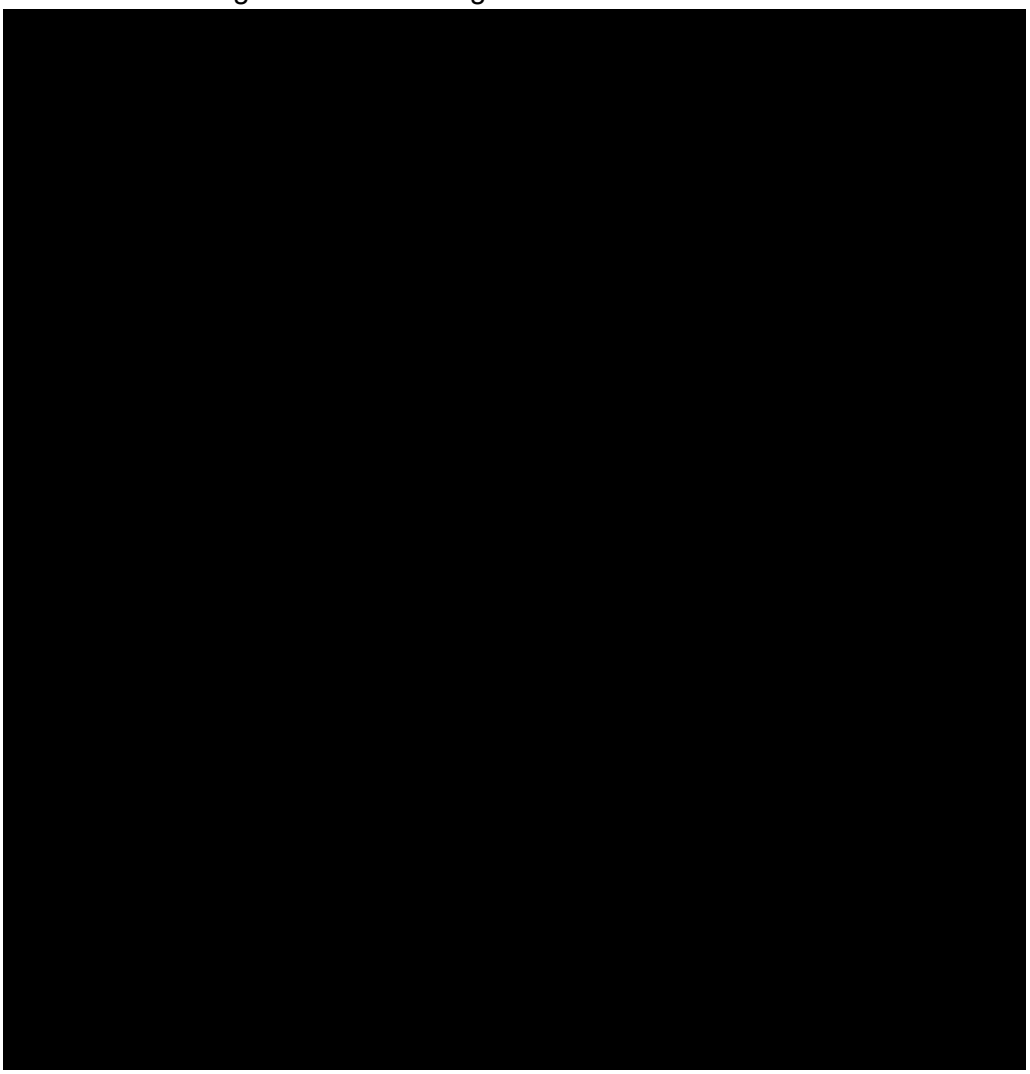


Figure 3. Goodna 275/110kV Operating Dagram

3. Goodna Demand Forecast

Historical and forecast maximum demand for the Goodna load is shown in Figure 4. Over the planning period, the maximum demand is forecasted to steadily increase.

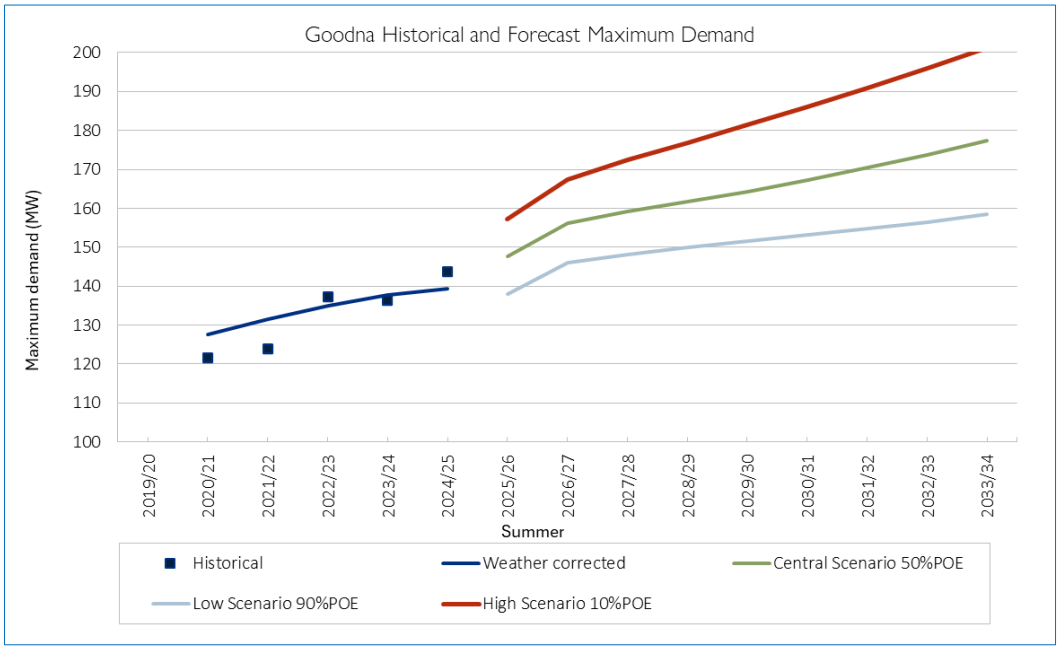


Figure 4. Goodna 33kV Maximum Demand

Figure 5 is the historical duration curve for the loads connected to Goodna's 110kV network.

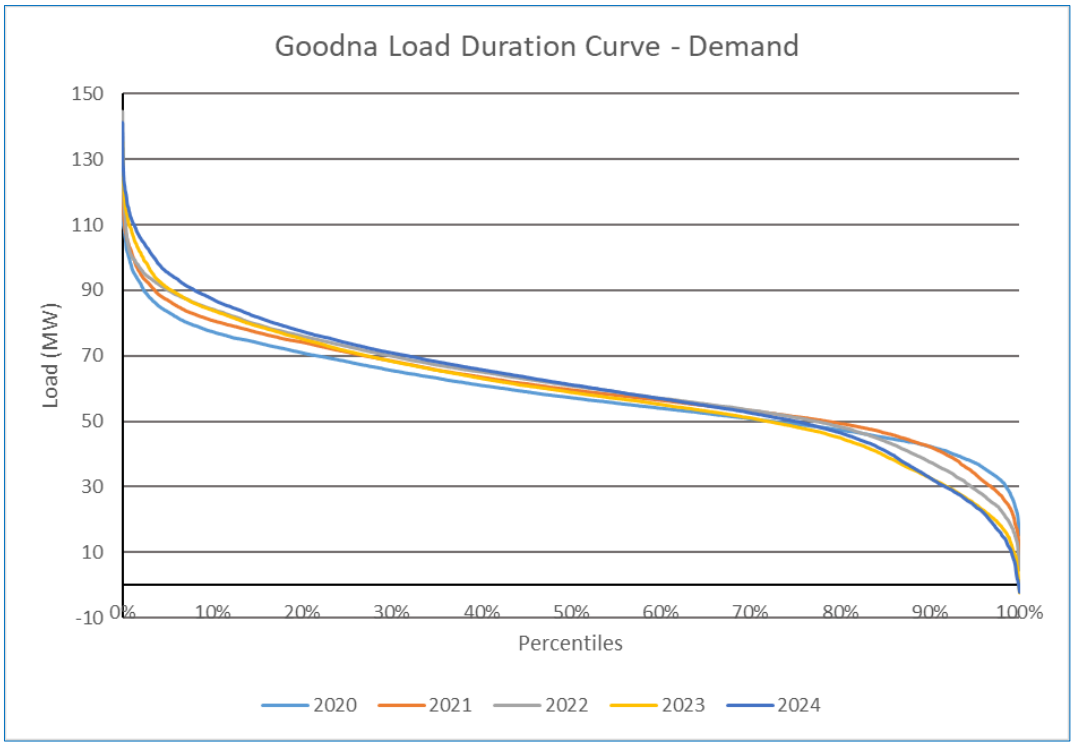


Figure 5. Goodna 110kV Load Duration Curve

The historical and forecast load (refer to Figure 4) and the load duration curve (refer to Figure 5) are as delivered by the network.

With consideration of rooftop PV within the Energex network supplied from Goodna, the magnitude of maximum load is significantly higher. The average summer day load profile for 2024/25 at Goodna Substation is shown in Figure 6 and shows that rooftop PV meets approximately 50MW of underlying demand.

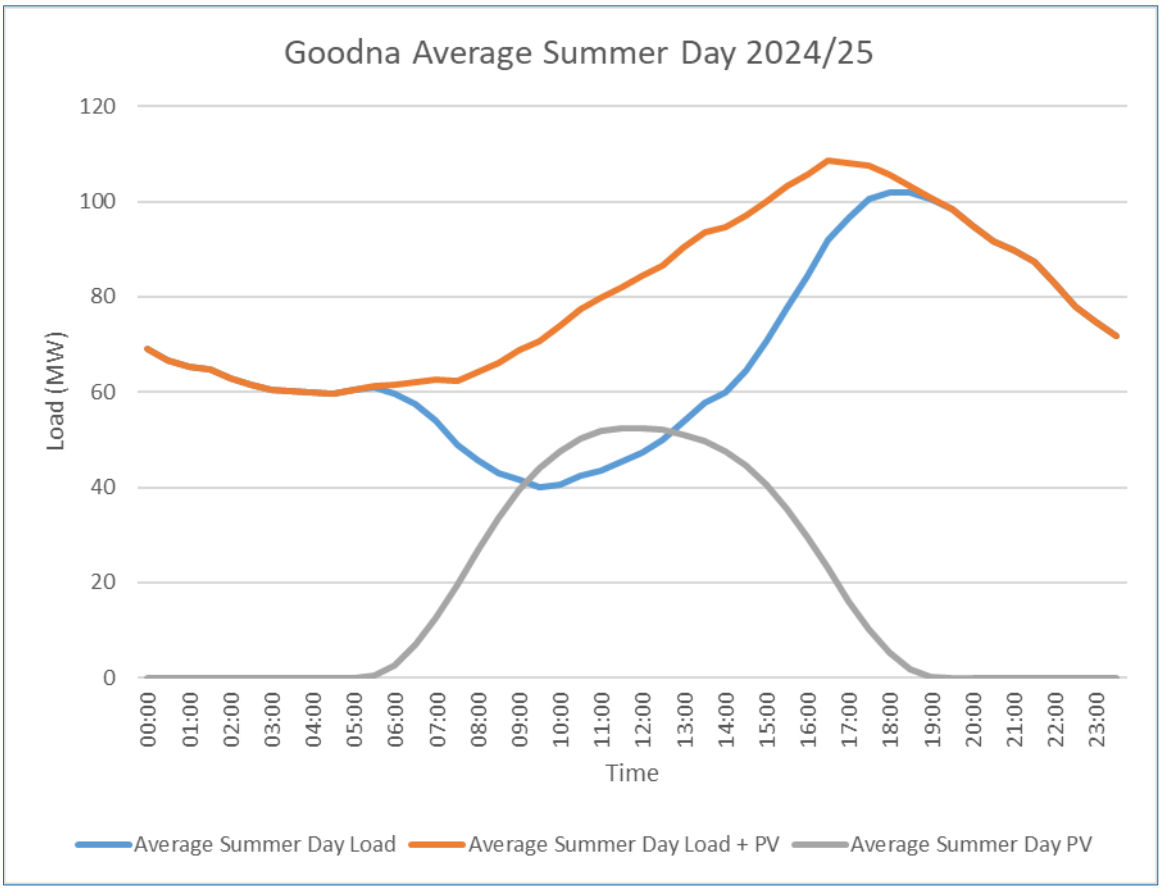


Figure 6. Goodna Average Summer Day profile

4. Statement of Investment Need

The Goodna Substation is a major bulk supply point for Energex loads in the Brisbane Southwest / Ipswich area. The local load supplied from 110/33kV transformers at Goodna Substation is forecast to exceed 160MW from 2028 (refer to Figure 4). The substation is also a key 275kV injection into the 110kV feeders that maintain the reliable power supply to 110kV substations in the Brisbane South region.

Therefore, addressing the risks arising from the condition of the secondary systems by removing the functionality of the Goodna Substation would have a major impact on the performance of the south Brisbane network as well reliability of supply to the local Goodna load. The removal of Goodna Substation due to secondary system failure would violate Powerlink's N-1-50MW / 600MWh Transmission Authority reliability standard.

5. Network Risk

The table below presents the load (MW) and energy (MWh) at risk for loads connected to the Goodna substation. The estimate includes both "delivered" demand, to reflect what a non-network solution would have to provide, as well as "underlying" demand which includes the estimated level of rooftop PV to capture the total level of customer load at risk of not being supplied.

Table 1. Load at Risk

At Risk	Contingency	Metric	2025	2025 +PV	2035	2035 +PV
Curtailment of Goodna Load	4T or 5T (110/33kV transformers) sec system failure	Max (MW)	11.82	12.5	44.4	44.4
		Average (MW)	0.0	0.0	0.3	0.3
		24h Energy Unserved Max (MWh)	23.3	24.6	176.1	178.2
		24h Energy Unserved Average (MWh)	0.1	0.1	8.2	8.2
Goodna Load	4T and 5T (110/33kV transformers) sec system failure followed by the trip of the remaining transformer	Max (MW)	147	180	179	332
		Average (MW)	61	80	72	114
		24h Energy Unserved Max (MWh)	2201	2934	2851	4081
		24h Energy Unserved Average (MWh)	1464	1909	1738	2747
Redbank Plains Load	7296 (Goodna-Redbank Plains) sec sys failure followed by trip of 717 (Blackstone-Redbank Plains)	Max (MW)	33	37	43	77
		Average (MW)	9	13	10	18
		24h Energy Unserved Max (MWh)	375	550	496	878
		24h Energy Unserved Average (MWh)	206	302	249	426
Belmont Area load curtailment	8819 (Goodna-Blackwall) sec sys failure followed by planned or unplanned outage of 8822, 817 and 8813 (1)	Max (MW)	93	101	543	891
		Average (MW)	0.1	0.1	190	237
		24h Energy Unserved Max (MWh)	314	334	8545	10908
		24h Energy Unserved Average (MWh)	1.5	1.6	4565	5695
Belmont Area load curtailment	8842 (Goodna-Belmont) sec sys failure followed by planned or unplanned outage of	Max (MW)	70	75	513	763
		Average (MW)	0.04	0.04	166	199
		24h Energy Unserved Max (MWh)	199	211	7825	9754

At Risk	Contingency	Metric	2025	2025 +PV	2035	2035 +PV
	8822, 817, 829 and 8813	24h Energy Unserved Average (MWh)	0.9	1.0	3987	4774
CBD Load curtailment	1T (275/110kV) sec sys failure followed by planned or unplanned outage of 721 or 722	Max (MW)	55	75	187	312
		Average (MW)	0.2	0.2	65	83
		24h Energy Unserved Max (MWh)	264	289	2,871	3977
		24h Energy Unserved Average (MWh)	4.5	5	1,562	1985
Goodna and Redbank Plains Area load curtailment	1T (275/110kV) sec sys failure followed by planned or unplanned outage of 718	Max (MW)	15	16	60	61
		Average (MW)	0	0	1.4	1.4
		24h Energy Unserved Max (MWh)	32	34	320	327
		24h Energy Unserved Average (MWh)	0.1	0.2	33	34
Goodna and Redbank Plains Area load curtailment	1T (275/110kV) sec sys failure followed by planned or unplanned outage of 717	Max (MW)	0	0	70	71
		Average (MW)	0	0	3	3
		24h Energy Unserved Max (MWh)	0	0	442	455
		24h Energy Unserved Average (MWh)	0	0	71	73

Note:

(1) for a prior outage the Goodna 275/110kV transformer is out-of-service

6. Non Network Options

The Goodna 275/110kV Substation is both a bulk supply point for EQL's Goodna 33kV loads as well as a key 275kV injection into the 110kV feeders that supply the Brisbane Southwest/Ipswich areas.

To meet the Goodna local 33kV demand alone, potential non-network solution must be capable to delivering up to 180MW and 2850MWh of energy each day (Refer row 2 of Table 1). The non-network solution would be required to be capable of operating during a contingency or outage on a continuous basis until normal supply can be restored.

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

7. Network Options

7.1 Proposed Option to address the identified need

Planning recommends the replacement of all secondary systems reaching end of life at the Goodna Substation by July 2026. This option ensures that all reliability of supply and asset condition criteria is met.

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 (secondary systems condition and obsolescence) 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.

8. Recommendations

Powerlink has reviewed the condition of the secondary systems at Goodna Substation and confirmed they are approaching the end of their technical service life. It is therefore recommended that the secondary systems be replaced.

Retaining Goodna Substation 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 Goodna but will, as part of the formal RIT-T consultation process, seek non-network solutions that can contribute to reduced overall investment needs whilst ensuring Powerlink continues to meet its reliability of supply obligations.

9. References

1. H038 Goodna 275/110kV Substation – Secondary Systems Condition Assessment Report

1. 2025 Transmission Annual Planning Report (A6049612)
2. Asset Planning Criteria - Framework (ASM-FRA-A2352970)
3. Powerlink Queensland’s Transmission Authority T01/98

10. Appendix A – Network Risk Methodology

Goodna 110/33kV transformers

Goodna substation consists of two parallel 110/33kV transformers to provide the bulk supply point for Energy Queensland's local network.

The loss of one of these transformers at peak load will already overload the parallel transformer, and an existing EQL overload scheme will shed some load to relieve this overload. The protection setting for this scheme is 135 MVA.

The loss of both of these transformers will result in the complete loss of supply to Goodna 33kV local area network.

110kV Goodna to Redbank Plains feeder 7296

Redbank Plains substation is fed from Goodna substation via feeder 7296, and from Blackstone substation via feeder 717. Losing both feeders will cut-off supply to Redbank Plains.

275kV Goodna to Blackwall feeder 8819

Feeder 8819 normally supplies power from Blackwall to Goodna Substation. If this feeder is out of service (OOS) then contingency outages, especially in 275kV network, could overload parallel feeders e.g. loss of 8822 overloads 817. Assessment is based on Goodna feeder 8819 OOS, then curtailing targeted load such that loss of feeder 8822 does not overload 817.

275kV Goodna to Belmont feeder 8842

This feeder normally supplies power from Goodna to Belmont substation. If this feeder is out of service (OOS) then it too, will lead to overloads on the parallel 275kV network e.g. loss of 8822 overloads 817. Assessment is based on Goodna feeder 8842 OOS, then curtailing targeted load such that loss of feeder 8822 does not overload 817.

Goodna 275/110kV transformer

This transformer is a key 275kV injection point for the power supply to Southwest/Ipswich area. Without this transformer, a contingent outage of a local 110kV feeder may overload the parallel feeder, requiring load curtailment. Assessment is based on Goodna 275/110kV transformer OOS, then curtailing targeted load to reduce the N-1 overload:

- ***110kV South Pine to Upper Kedron feeders 721 and 722***

  110kV Feeders 721 and 722 connect South Pine and Upper Kedron. With Goodna 275/110kV out of service, loss of supply to either 721 or 722 will result in overload of the other feeder.

- ***110kV Goodna to Blackstone feeder 717 (and 718)***

  With Goodna 275/110 kV transformer out of service, the feeders from Goodna to Blackstone feeder 718 and Redbank Plains to Blackstone feeder 717 affect each other – i.e. if one of these feeders is out of service, the other will overload.

Inclusion of Rooftop PV

Installed rooftop PV capacity is obtained for each substation. Historical energy generated by rooftop PV is then estimated. An efficiency factor is calculated for each substation (energy generated divided by capacity). The forecast PV generated for each substation is calculated by multiplying this efficiency factor by the installed forecast PV capacity of the substation in question. The forecast for 2035 predicts significant growth in native demand, and significant growth in rooftop PV. Consequently, a significant growth in the underlying demand.

Other Assumptions

Richlands to Algester 110kV feeders (7294 and 709) are considered to be switched out of service pre-contingent or permanently de-loaded. Refer *Table D.10 of TAPR 2024 - Possible network (retirements) in the Moreton zone*. This means Richlands will be supplied from Rocklea and West Darra, Algester and Runcorn substations will be supplied from H003 Belmont.

Project Scope Report

CP.02796

Goodna Secondary Systems Replacement

Concept – Version 1

Document Control

Change Record

Issue Date	Revision	Prepared by	Reviewed by	Approved by	Background
13/5/25	1	[redacted]	[redacted]	[redacted]	Initial issue for Revenue Reset

Related Documents

Issue Date	Responsible Person	Objective Document Name
18/12/19	[redacted]	PIF – H038 Goodna Secondary System Replacement – Project Initiation Form (A3277588)
18/12/19	[redacted]	H038 Goodna Secondary System Condition Assessment Report (A3276786)

Document Purpose

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

Project Contacts

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

Project Details

1. Project Need & Objective

H038 Goodna substation was built to meet the increased demand in the South West Brisbane / Ipswich area in 2006. Associated secondary systems for 275 and 110kV were implemented in 2006. Goodna substation consists of one yard of 275kV and 110kV operating voltages enclosed by one perimeter fence. Goodna substation is connected via two 275kV feeders from Blackwall and Belmont substations and four 110kV feeders from West Darra, Blackstone and Redbank Plains substations.

A condition assessment of H038 Goodna secondary systems was carried out in December 2019 (refer report A3276786, H038 Goodna Secondary System Condition Assessment Report). The assessment concluded that secondary systems for both the 275kV and 110kV network will reach the end of its technical asset life in 2026. As a result, it is recommended to replace these systems to mitigate risks including unavailability of spare parts, lack of technical support and declining condition of equipment causing decreased reliability.

The objective of this project is to replace selected 275kV and 110kV secondary systems at Goodna substation by November 2029.

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

2. Project Drawing

Figure 1 – Location of Goodna Substation

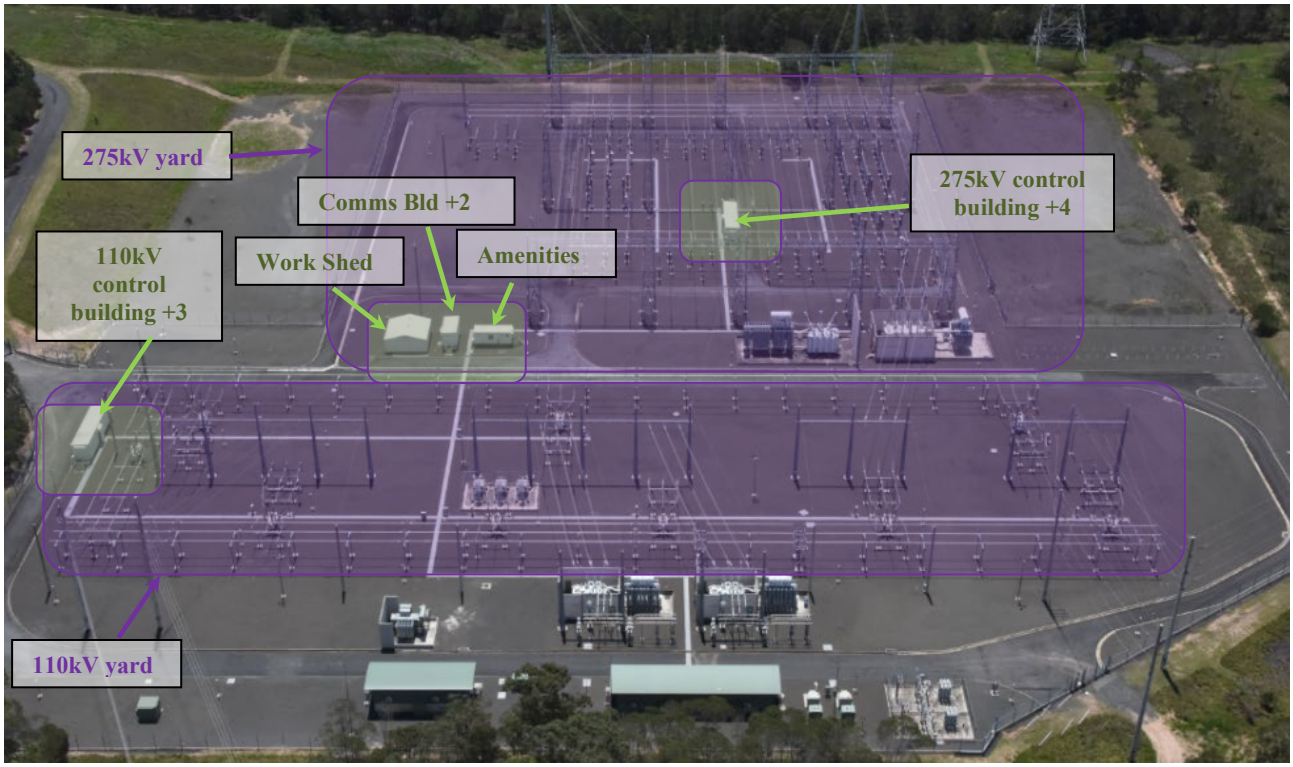


Figure 2: Aerial View of Goodna Substation

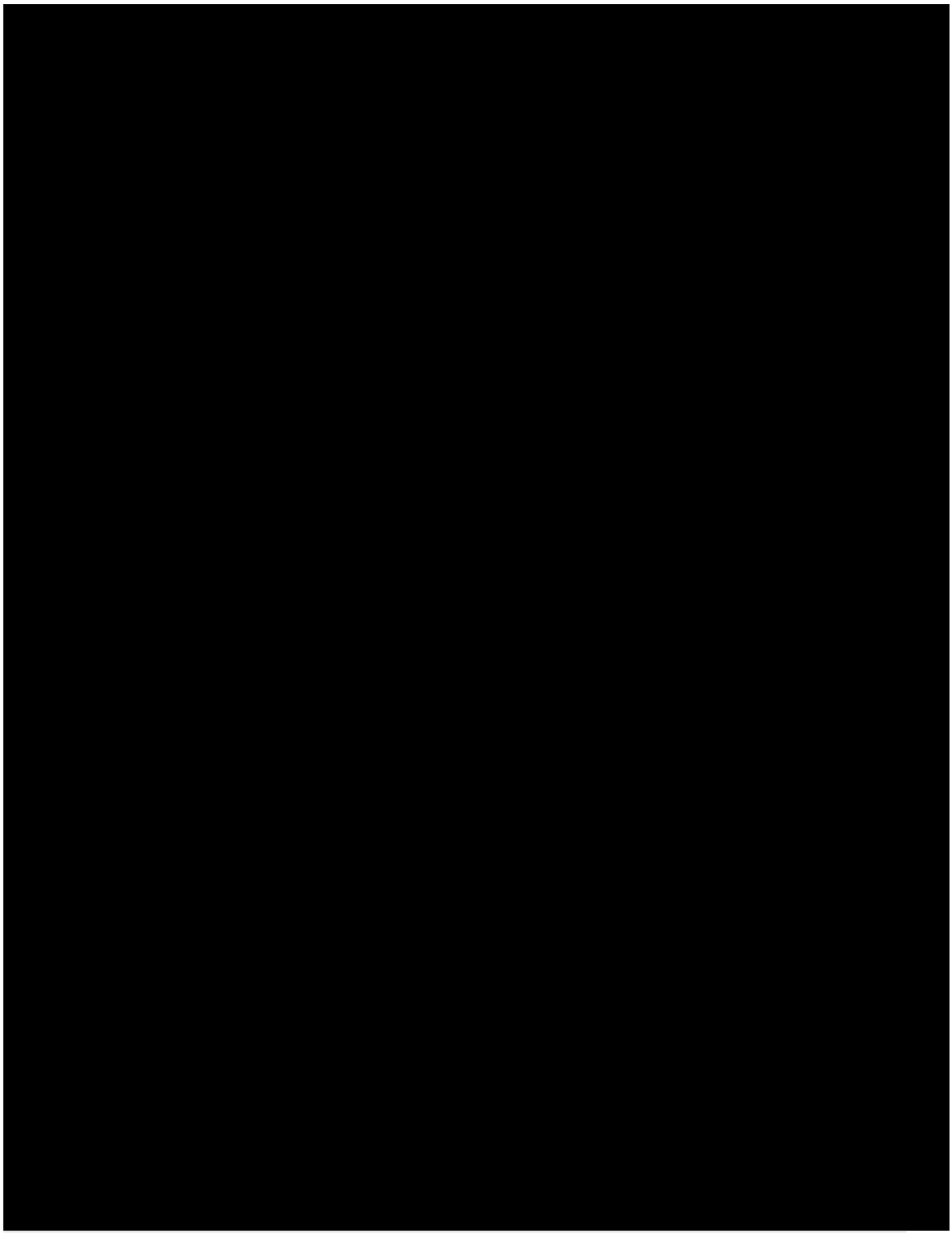


Figure 3: Operational Diagram for Goodna Substation

3. Deliverables

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

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

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

4. Project Scope

4.1. Original Scope

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

Briefly, the project consists of replacing 275kV and 110kV secondary systems at Goodna substation

4.1.1. Transmission Line Works

Not applicable

4.1.2. H038 Goodna Substation Works

- Design, procure, construct and commission new 275kV and 110kV secondary systems within the existing control buildings (+4 for 275kV and +3 for 110kV) for the following plant:
    - 275kV BUS ZONE 1
    - 275kV BUS ZONE 2
    - C04- 275kV BUS COUPLER
    - C04 - 275kV FEEDER 8819 TO BLACKWALL
    - C07 - TRANSFORMER 1 275kV
    - C07 - 275kV BUS COUPLER
    - C07 - 275kV FEEDER 8842 TO BELMONT
    - 110kV BUS ZONE 1
    - 110kV BUS ZONE 2
    - D01 - 110kV BUS COUPLER
    - D03 - 110kV FEEDER 7296 TO REDBANK PLAINS
    - D06 - 110kV FEEDER 718 TO BLACKSTONE
    - D14 – 3 CAPACITOR BANK = M03-3CAP

  - D17 - TRANSFORMER 5
  - D36 - 110kV FEEDER 791 TO WEST DARRA
  - D35 - 110kV FEEDER 7295 TO WEST DARRA
  - D28 - 110kV INCOMER FROM 275/110kV TX
  - D20 - TRANSFORMER 4
  - TRANSFORMER 4 AND 5 REVENUE METERING
  - SUBSTATION SCADA AND OPSWAN

- Install new WAMPAC panel to simultaneously trip transformers 4 and 5 HV and LV breakers as part of the CQSQ WAMPAC scheme;
- Replace all 125VDC battery charges in both Buildings +3 and +4 (note the 125V battery banks were replaced in 2021 and therefore, do not require replacement under this project);
- Replace 48VDC chargers and battery banks in Building +2;
- Replace OpsWAN equipment and relocate devices (except the camera) from the OpsWAN camera housing at the top of the pole to the camera patch box at the base of the pole;
- Replace the ventilation film of all marshalling kiosks;
- Modify customer interface kiosks as required;
- Review the existing AC and DC supply arrangements, modify as required to accommodate new secondary systems;
- Replace screw type CT links as required where modifying existing CT secondary circuits;
- Modify and upgrade telecommunications equipment as required to support the new secondary systems;
- Decommission and recover all redundant equipment, and update drawing records, SAP records, config files, etc. accordingly.

4.1.3. Remote End Substation Works

Modify remote end protection, control, automation and communications systems as required at H036 Blackwall, H003 Belmont, H072 Blackstone, T155 West Darra and T080 Redbank Plains.

4.1.4. Telecoms Works

As per Section 4.1.2. Telecommunications works to be coordinated with CP.02813 Telecommunication Network Consolidation RAN 4 and CP.02822 OpsWAN and MPLS Replacement RAN 4.

4.1.5. Easement/Land Acquisition & Permits Works

Not applicable

4.2. Key Scope Assumptions

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

- Metering is to be retained in its current location (33kV side of T4 and T5) as the cost of relocating it to align with the connection point (110kV side of T4 and T5) is considered to be grossly disproportionate to the project. This assumption will need to be confirmed with the Metering Coordinator and Legal team prior to project execution.
- As there are no termination racks on buildings +3 and +4 and limited space within the +3 building, the in-panel replacement methodology currently being utilised under CP.02929 T160 Sumner Secondary Systems Replacement is to be assumed for estimation purposes. This approach will need to be confirmed by the design team prior to project execution.
- ABB IMB300 CTs in bays C04-8819 and C07-8842 will be replaced prior to undertaking the secondary system replacement works.
- Telecommunications works under CP.02813 Telecommunication Network Consolidation RAN 4 and CP.02822 OpsWAN and MPLS Replacement RAN 4 will need to be coordinated with this project.

4.3. Variations to Scope (post project approval)

Not applicable

5. Key Asset Risks

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

6. Project Timing

6.1. Stage 1 Approval Date

The anticipated date by which the project will be approved is TBA.

6.2. Site Access Date

Site access is immediately available as H038 Goodna is a Powerlink site.

6.3. Commissioning Date

The latest date for the commissioning of the new assets included in this scope and the decommissioning and removal of redundant assets, is 31st October 2029.

7. Special Considerations

- Building +3 was established in 2006 and houses all 110kV secondary systems. There are ten spare panel spaces available in existing building +3. There are no termination racks installed in this building.

- Building +4 was established in 2006 and houses all 275kV secondary systems. There are fifteen spare panel spaces available in existing building +4. There are no termination racks installed in this building.

- Marshalling kiosks and associated control cables were installed in 2005 and are in fair condition. No condition driven replacements are required until 2045.

- 415VAC auxiliary supplies are derived from Energy Queensland's 11kV/415V 300kVA station transformers. The AC change over board was installed in the amenities building in 2005 and is in fair condition.

8. Asset Management Requirements

Equipment shall be in accordance with Powerlink equipment strategies.

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

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

9. Asset Ownership

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

The asset boundary with Energy Queensland is the LV terminals of the 110/33kV transformer.

10. System Operation Issues

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

- interaction of project outage plan with other outage requirements;

- likely impact of project outages upon grid support arrangements; and

- likely impact of project outages upon the optical fibre network.

Restricted Access Zones are currently in place for the [redacted] in C04-8819 and C07-8842 bays. It is anticipated that these [redacted] will be replaced prior to site works commencing under [redacted]

11. Options

Not applicable

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			
CP.02929	Sumner Secondary Systems Replacement	Nov 25	In panel replacement methodology to be proven under this project
Co-requisite Projects			
Other Related Projects			
CP.03107	Replace 275kV ABB IMB CTs - Metro	Jun 2033	
CP.02986	Trench CVT Replacement – South Phase 3	TBA	CVTs to be replaced at Goodna in conjunction with IMB300 CT replacements. Potential to coordinate with sec sys works.
CP.02813	Telecommunication Network Consolidation RAN4	June 2032	Works to be coordinated
CP.02822	OpsWAN and MPLS Replacement RAN3	June 2032	Works to be coordinated

CP.02796 Goodna Secondary Systems Replacement

Concept Estimate

Table of Contents

1. Executive Summary

This concept estimate has been developed based on the CP.02796 Goodna Secondary Systems Replacement PSR.

H038 Goodna substation, and the associated secondary systems for 275kV and 110kV, was built to meet the increased demand in the Southwest Brisbane / Ipswich area in 2006. Goodna substation consists of one yard of 275kV and 110kV operating voltages enclosed by one perimeter fence. It is connected via two 275kV feeders from Blackwall and Belmont substations and four 110kV feeders from West Darra, Blackstone and Redbank Plains substations.

A condition assessment of H038 Goodna secondary systems concluded that secondary systems for both the 275kV and 110kV network will reach the end of its technical asset life in 2026. As a result, it is recommended to replace these systems to mitigate risks including unavailability of spare parts, lack of technical support and declining condition of equipment causing decreased reliability.

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

This 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)		39,049,153
TOTAL		**39,049,153**

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	168,306
To June 2027	1,684,537
To June 2028	5,944,464
To June 2029	21,986,838
To June 2030	9,107,354
To June 2031	157,654
TOTAL	**39,049,153**

2. Project and Site-Specific Information

2.1 Project Dependencies & Interactions

This project is related to the following projects:

Project No.	Project Description	Planned Commissioning Date	Comment
Dependencies			
CP.02929	Sumner Secondary Systems Replacement	November 2025	First project to utilise the in-panel replacement methodology.
Interactions			
CP.02813	Telecommunications Network Consolidation RAN4	June 2032	SDH and PDH Multiplexer replacement program.
CP.02822	OpsWAN and MPLS Replacement RAN4	June 2032	OpsWAN and MPLS Router replacement program.
CP.03107	Replace 275kV ABB IMB CTs – Metro	April 2029	Statewide CT Replacement program.
CP.02986	Trench CVT Replacement – South Phase 3	December 2027	Definition Phase Statewide CVT Replacement program.
Other Related Projects			

2.2 Site Specific Issues

- H038 Goodna substation is located southwest of Brisbane CBD, it is surrounded by residential areas, a primary school 1km away and Ipswich City Council owned Parks and Reserves.
- The substation is comprised of a 275kV switchyard and 110kV switchyard, there is also Energy Queensland assets housed in a EQL owned building within the substation boundary.
- There are 6 [redacted] at H038 Goodna which have invoked a Restricted Access Zone(s) (RAZ) in the substation. The RAZ does not impact access to the H038 Goodna Control Buildings, however access to the 275kV substation yard is restricted. An appropriate RAZ Works Plan will be required if the RAZ is not revoked by the time of works where access is required. The [redacted] are planned to be replaced by September 2026 under CP.03107.
- The Ipswich area is subject to the following average number of days of rain. Consideration was given to this when developing the project schedule.

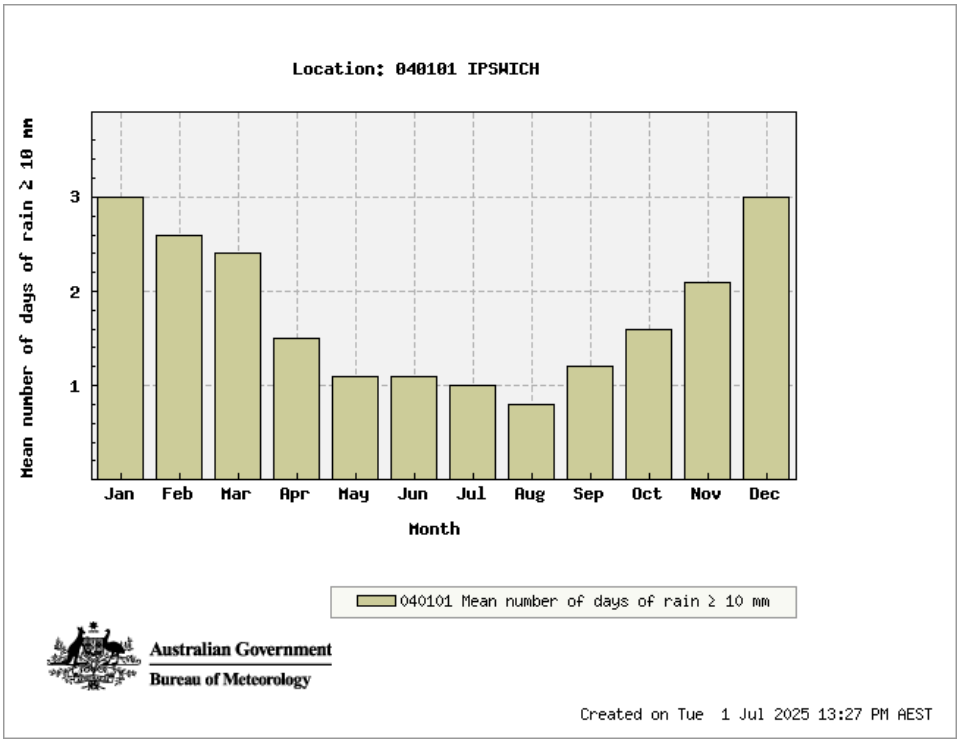


Figure 1 - Number of Days of Rain >10mm Ipswich (Source: Bureau of Meteorology 1st July 2025)

3. Project Scope

The following works have been costed for in the estimate.

3.1 Substation Works

H038 Goodna

Design, procure, construct and commission new 275kV and 110kV secondary systems within the existing control buildings (+4 275kV Control Building and +3 110kV Control Building) using the in-panel methodology, this includes:

- Replacement of the secondary systems and auxiliary equipment for the following assets in Control Building +4:
  - 275kV Bus Zone 1 & 2
  - 275kV =C04 Bus Coupler
  - 275kV =C04 Feeder 8819
  - 275kV =C07 1 Transformer
  - 275kV =C07 Bus Coupler
  - 275kV =C07 Feeder 8842
  - SCADA and OpsWAN
- Replacement of the secondary systems and auxiliary equipment for the following assets in Control Building +3:
  - 110kV Bus Zone 1 & 2
  - 110kV =D01 Bus Coupler
  - 110kV =D03 Feeder 7296

  - 110kV =D06 Feeder 718
  - 110kV =D14 3 Capacitor Bank
  - 110kV =D17 5 Transformer
  - 110kV =D36 Feeder 791
  - 110kV =D35 Feeder 7295
  - 110kV =D28 Incomer from 275/110kV Tx
  - 110kV =D20 4 Transformer
  - Transformer 4 & 5 Revenue Metering
  - SCADA and OpsWAN
- Installation of new WAMPAC panel to simultaneously trip transformers 4 and 5 HV and LV breakers as part of the CQSQ WAMPAC scheme.
- Replace all 125V DC Battery Chargers in both Buildings +3 and +4 (Battery Banks do not require replacement).
- Replace 48V DC Battery Chargers and Battery Banks in Building +2.
- Replace IONS (OpsWAN) equipment (except OpsWAN camera) and relocate all devices (except the camera) from the OpsWAN camera housing at the top of the pole to the camera patch box at the base of the pole. Refer to ASM-FRM-A4982111 and ETR 10434041.
- Replace the ventilation film of all marshalling kiosks.
- Modify Energy Queensland interface kiosk as required.
- Review the existing AC and DC supply arrangements, modifications as required to accommodate the new secondary systems.
- 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 H038 Goodna (free-issue of secondary systems relays).
- Decommission and recover all redundant equipment.
- Update drawing records, SAP records, config files, etc. accordingly.

Remote Ends

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

- H036 Blackwall: Fdr 8819
- H003 Belmont: Fdr 8842
- H072 Blackstone: Fdr 718
- T155 West Darra: Fdr 7295 and Fdr 791
- T080 Redbank Plains: Fdr 7296

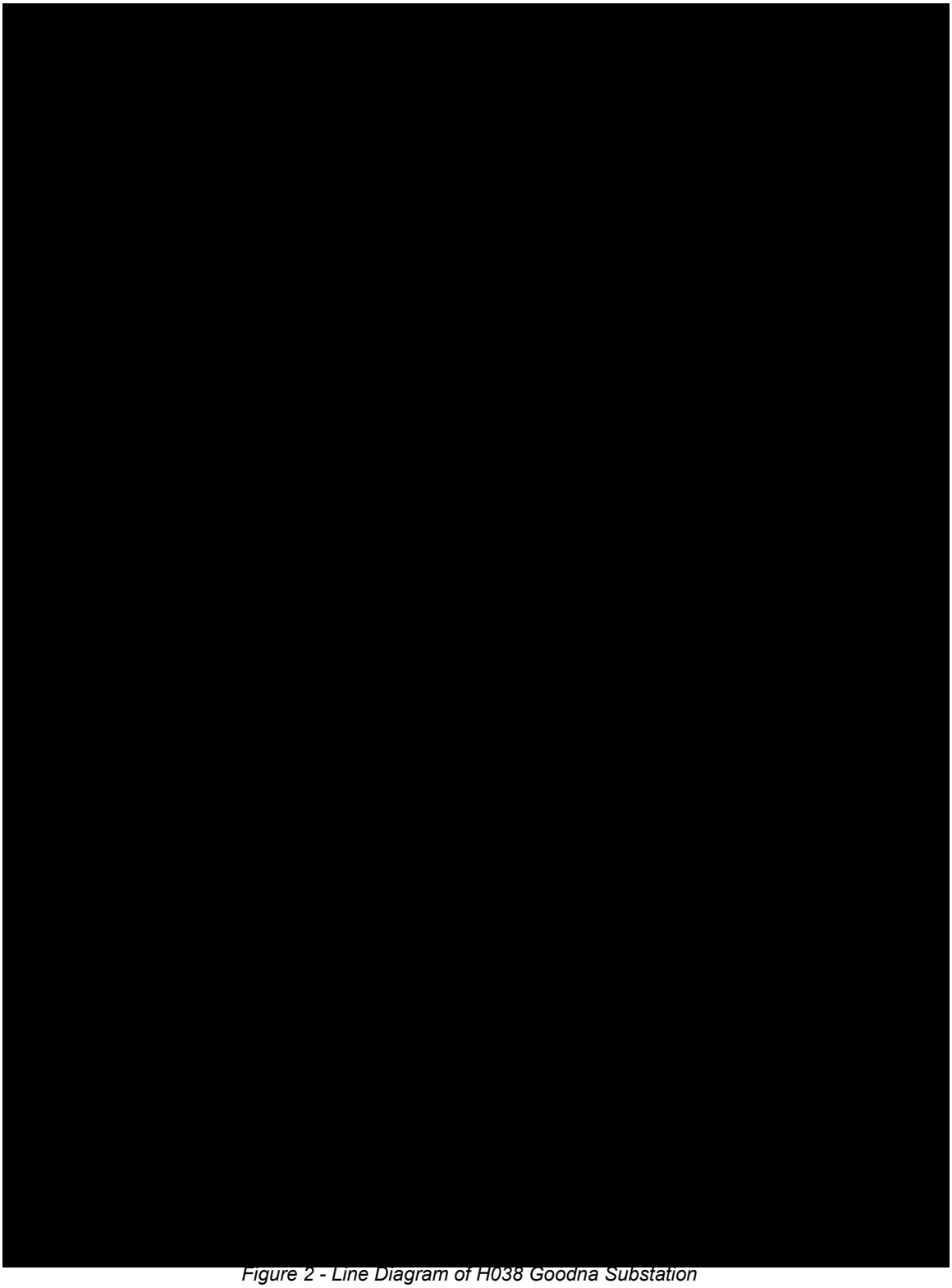


Figure 2 - Line Diagram of H038 Goodna Substation

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 work only is expected to integrate the remote end substations with the new H038 Goodna Secondary Systems. All works at the remote end substations will be completed by the MSP.
- Powerlink Internal Design teams and Design Service Panel will carry out the design works.
- Estimate is based on Powerlink architectures, standards and equipment in place and available at the time of development.
- H038 Goodna [redacted] will be replaced, revoking the Restricted Access Zones, prior to work starting on the site.
- No further Restricted Access Zone will be deployed on this site during project lifetime.
- Outages will be available as being 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.
- Metering is to be retained in its current locations (33kV side of T4 and T5). This will be confirmed with the Metering Coordinator and Legal team prior to project execution.

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

- Design standard of the new secondary systems will be SDM9.3.
- The In-panel Replacement Methodology will be accepted as the delivery method for this project; this will be further explored as part of the project development phase.
- There will be space within the existing control buildings to house additional panels and equipment as required for WAMPAC schemes.
- There will be sufficient space within the existing Control Buildings for In-panel Replacement of the substation secondary systems.
- Existing cables are fit for purpose and will be re-used.
- New termination racks will not be installed.
- Bay marshalling kiosks to be re-used.
- AC Changeover Board is fit for purpose and can 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 assumption 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.
- Existing building structures are suitable for any new loads due to the secondary system replacement.

3.4 Scope Exclusions

- Easement acquisitions work, including permits, approvals, development applications or the like. 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. That also includes the replacement of bushing CTs on PASS M0 circuit breakers and breaker control cubicles.
- No modification and upgrading of the internal roads, lights, fences and gates.
- No modification on the existing transmission lines 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	February 2026
Class 5 Project Proposal Submission	April 2026
Request for Class 3 Estimate	June 2026
Class 3 Project Proposal Submission	December 2026
Stage 1 Approval (PAN1) includes funds for design & procurement	January 2027
RIT-T (assumed 26 weeks)	March 2027 – September 2027
Project Development Phase 1 & Phase 2	February 2027 – September 2027
Reconcile Estimate (including RFQ) and Submit PMP for Stage 2 Approval	September 2027
Stage 2 Approval (PAN2)	November 2027
Execute & Delivery – Design and FAT	December 2027 – June 2028
MSP Site Establishment	July 2028
Staged Bay Construction and Commissioning	July 2028 – October 2029
Project Commissioning	October 2029
Final Decommissioning & Removal of Redundant Assets	October 2029 – November 2029

4.2 Network Impacts

Powerlink Net Ops – Operating Manual 02 – SE QLD provides the following recommendations for outages of H038 Goodna feeders and transformers.

275kV H038 Goodna Feeders and Transformers

- For an outage on Feeder 8819 the network requires the following elements in service, and the following 110kV network from H016 Rocklea to H038 Goonda must be intact:
  - Fdr 817, Fdr 8821, Fdr 8844, Fdr 8887, Fdr 8888, Fdr 8842, Fdr 8822, Fdr 8813, Fdr 829.
- For an outage on Feeder 8842 the network requires the following elements in service:
  - Fdr 8822, Fdr 817, Fdr 8813, Fdr 829.
- Outages on Feeder 8819 & 8842 are to avoid the summer period.
- For an outage on Transformer 1 the network requires the following elements in service:
  - H072 Blackstone 1T & 2T.
  - H062 Abermain 4T.
  - During high load periods also avoid concurrent outages on: Fdr 721, Fdr 722, Fdr 717, Fdr 7296 or Fdr 718.

110kV H038 Goodna Feeders and Transformers

- For an outage on Feeder 7296 the network requires the following elements in service:
  - Fdr 717, H038 Goodna 1T.
- For an outage on Feeder 718 the network requires the following elements in service:
  - Fdr 7296, H038 Goodna 1T.
- For an outage on Feeder 791 or 7295 the network requires the following elements in service:
  - The remaining Fdr 791/7295, Fdr 8818/H016 Rocklea 1T, Fdr 721 & Fdr 722 (during peak loads).
- Avoid scheduling outages for multiple elements during high load periods.

4.3 Resourcing

Design for the project will be completed by internal design resources with support from external design partners. The construction and commissioning works will be completed by Maintenance Service Providers.

5. Project Asset Classification

Asset Class	Base ($)	Base (%)
Substation Primary Plant	-	0%
Substation Secondary Systems	38,144,345	98%
Telecommunications	904,807	2%
Overhead Transmission Line	-	0%
TOTAL	**39,049,153**	**100**

6. References

Document name and hyperlink	Version	Date
Project Scope Report	1.0	13/05/2025

Risk Cost Summary Report

CP.02796

Goodna Secondary Systems Replacement

Document Control

Change Record

Issue Date	Revision	Prepared by
24/12/2025	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 Goodna substation which are proposed for reinvestment under CP.02796. 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 Goodna substation, the following modelling assumptions have been made:

- Whilst the re-investment scope of secondary system upgrade projects contains a range of supporting devices (i.e network switches, revenue metering, firewalls and human machine interfaces), for simplicity of risk cost modelling only main protection relays, bay controllers and RTUs were considered.
- Spares for secondary system equipment have been assumed to be available prior to the point of expected spares depletion, which coincides with the expected technical asset life (20 years). After this point the cost and time to return the secondary system back to service increases significantly.
- When calculating network risk cost, it has been assumed that after 24 hours of any network element being protected by a single protection system (due to failure of the alternate system) the Australian Energy Market Operator (AEMO) will direct Powerlink to de-energise the network element.
- A site-specific value of customer reliability (VCR) of $22,800 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 $0.25 million in 2026 to $1.3 million in 2036 and $2.41 million by 2045. Key highlights of the analysis include:

- Financial risk accounts for approximately 78% of the overall risk cost in 2030 with network risk accounting for the remaining 22%.

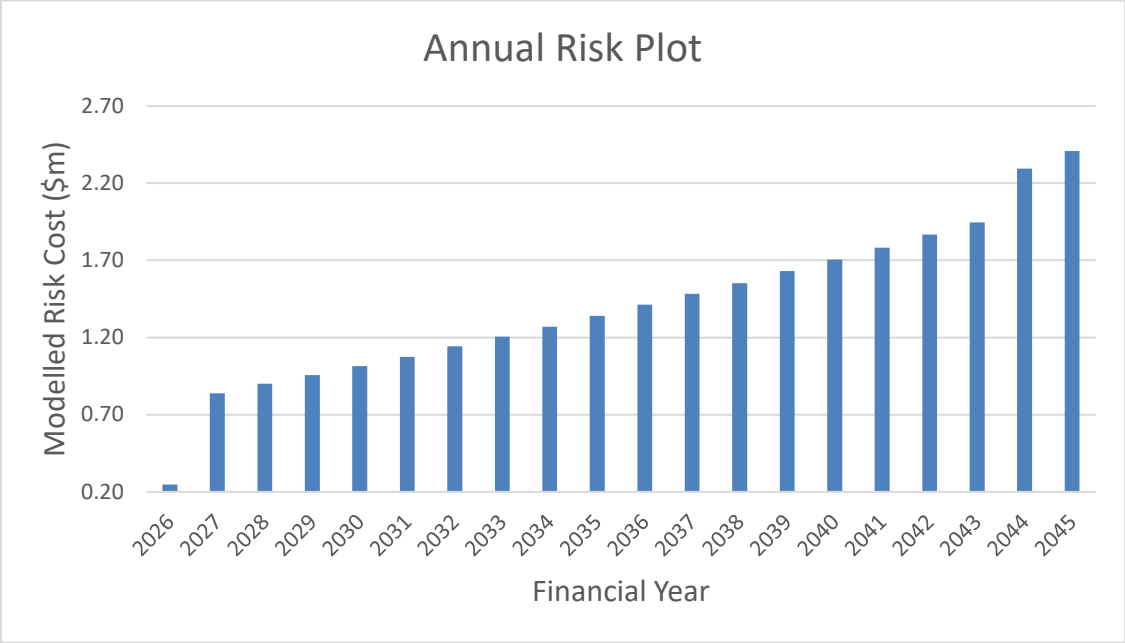


Figure 1: Total risk cost

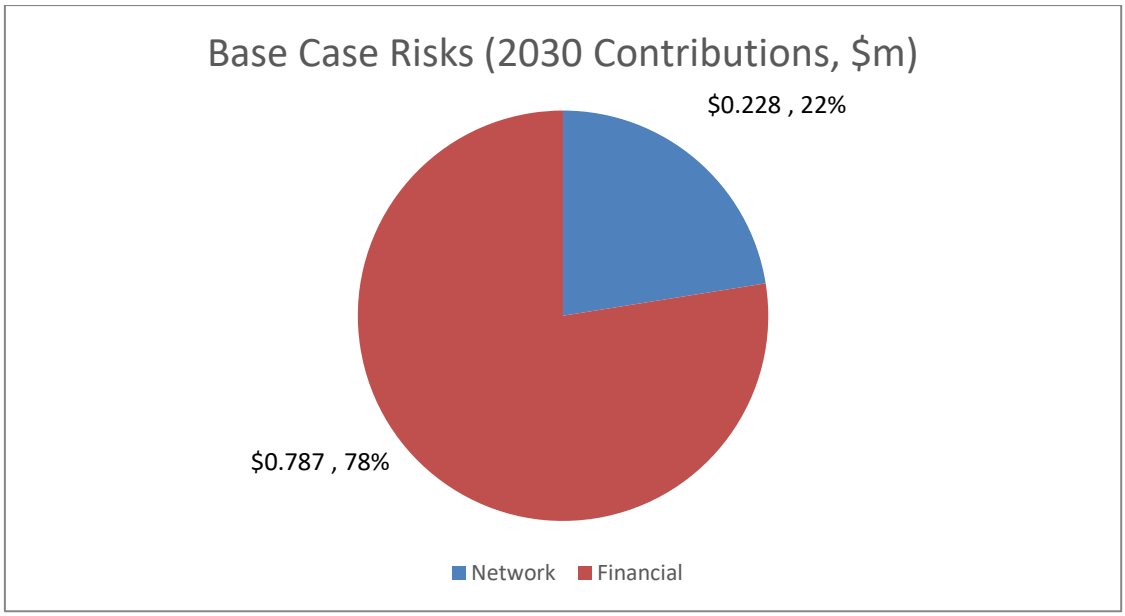


Figure 2: Base case risk cost by contributions (2030)

Option Risk Cost

For modelling purposes, the replacement of equipment at the Goodna 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.

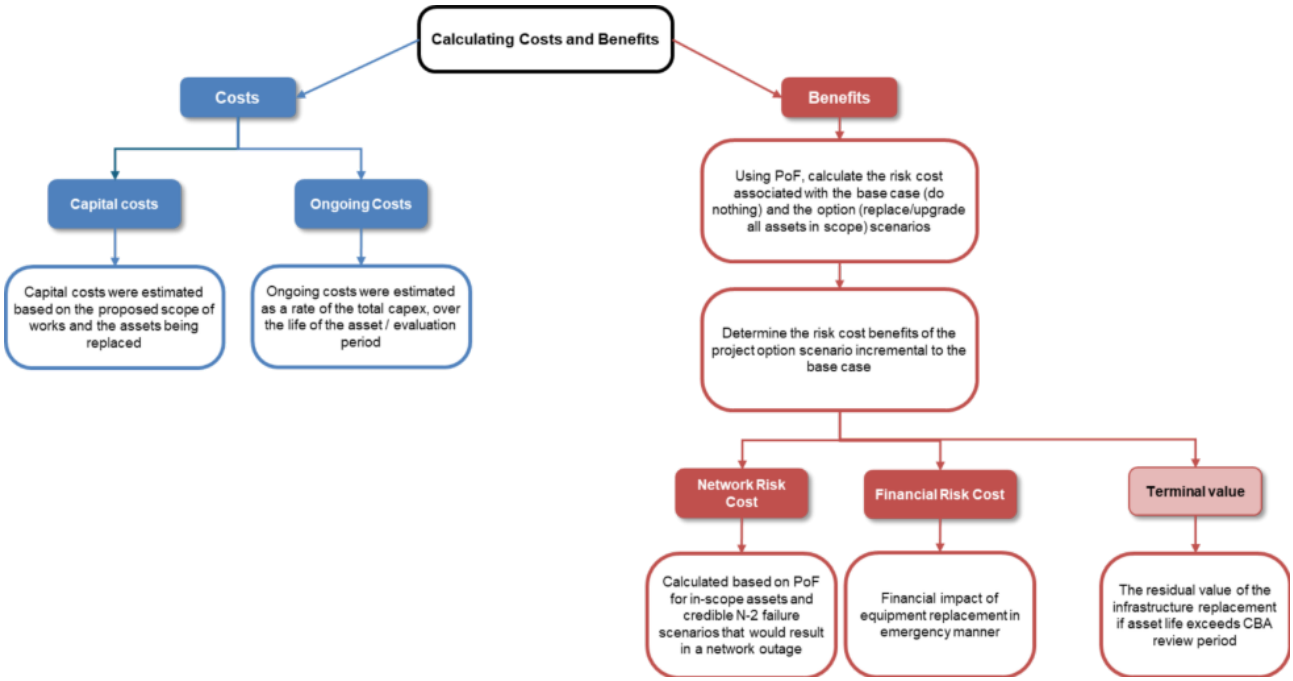


Figure 4: CBA methodology

The project is estimated to cost approximately $39.1 million resulting in a negative NPV and benefit-cost ratio (BCR) less than 1 as per table 2 below.

Table 2: Net Present Value and Benefit-Cost Ratio

		Present Value Table ($m)		
Discount rate	**%**	**3%**	**7%**	**10%**
NPV of Net Gain/Loss	$m	-$19.2	-$19.3	-$18.3
Benefit-Cost Ratio	ratio	0.45	0.33	0.27

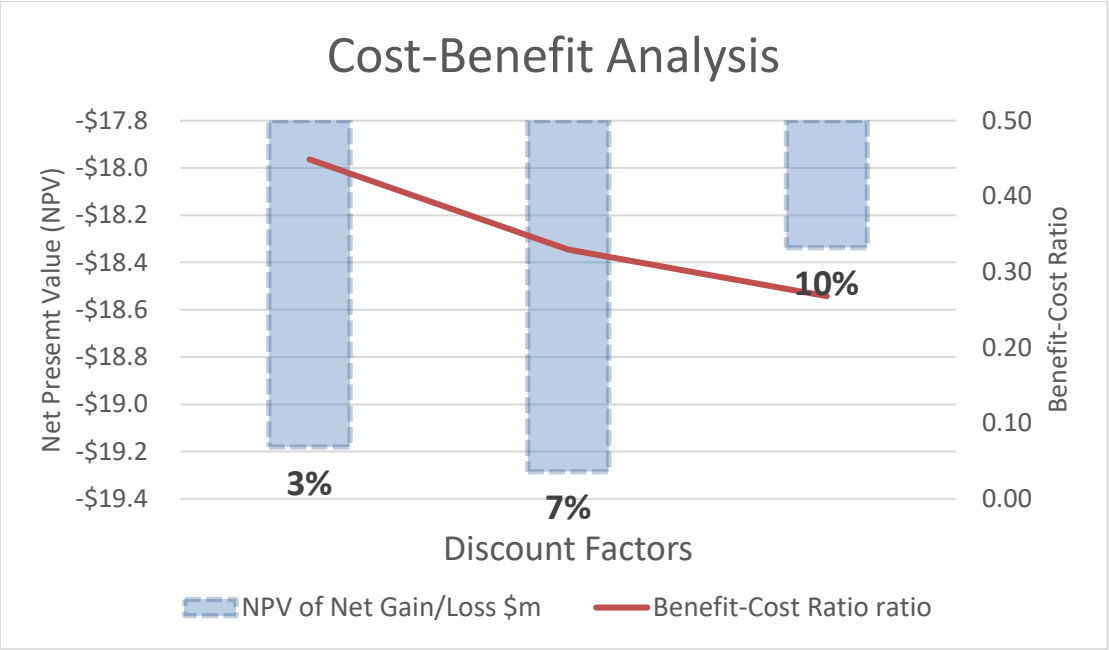


Figure 5: Cost benefit summary

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** (halving the cost) results in a decrease in risk cost of $0.22 million, or approximately 22% of the original base risk (at 2030).
- **changes in the restoration time of a relay with no spares** (halving the restoration time) results in a decrease in risk cost of $0.18 million, or approximately 17.8% of the original base case risk (at 2030).
- **changes in relay emergency replacement cost** (halving the cost) results in a decrease in risk cost of $0.17 million, or approximately 16.5% of the original base risk (at 2030).

Table 3: Participation Factors

Input	Baseline value	Sensitivity value (-50%)	Change in risk cost at 2030 ($m)	Participation (%)
Network				
VCR ($/MWh)	22800	11400	-0.11	-11.24%
Restoration Time with spares – Relay (days)	2	1	-0.01	-0.9%
Restoration Time with no spares – Relay (days)	10	5	-0.18	-17.81%
Financial				
Emergency replacement cost with spares - Relay ($m)	0.02	0.01	0.00	-0.25%
Emergency replacement cost without spares – Relay ($m)	0.09	0.05	-0.17	-16.49%
Emergency replacement cost with spares – Bay Controller ($m)	0.02	0.01	0.00	0.00%
Emergency replacement cost without spares – Bay Controller ($m)	0.20	0.10	-0.22	-22.02%