2023-27
POWERLINK QUEENSLAND REVENUE PROPOSAL

Project Pack – PUBLIC

CP.xxxxx
Greenbank Secondary Systems Replacement

CP.xxxxx – Greenbank Secondary Systems Replacement

Project Status: Not Approved

1. Network Requirement

The 275kV Greenbank Substation, approx. 42km south-east of Brisbane, was established in 2006 and is a major switching substation for south-east Queensland and connects major 275kV transmission lines from the south-west. The substation includes an adjacent Static VAR Compensator (SVC) yard, commissioned in 2008 to provide reactive power support, voltage control and critical power system damping in the area. An outage of this asset would put up to 360MW of power and up to 7,500MWh of energy per day at risk[2].

A Condition Assessment (CA) carried out in February 2020 identified that most secondary system assets at Greenbank Substation will reach the end of their technical service lives between 2026 and 2028[1]. The equipment is, or is becoming, obsolete with no support from the manufacturer and limited spares available. Beyond their 20 year nominal service life, secondary systems suffer increased failure rates. Increasing failure rates, along with the increased time to rectify the faults due to equipment obsolescence, significantly affects the availability and reliability of these systems. There is therefore a need for Powerlink to address this emerging risk to ensure ongoing compliance with Schedule 5.1.9(c) of the National Electricity Rules (NER) and Australian Energy Market Operator's (AEMO's) Power System Security Guidelines (V95, 2019).

Energy Queensland forecasts confirm there is an enduring need to maintain electricity supply to the Moreton South area. The removal or reconfiguration of the Greenbank Substation due to secondary system failure or obsolescence would violate Powerlink's Transmission Authority reliability obligations (N-1-50MW / maximum 600MWh unserved energy). It would also significantly impact the power transfer capability between south-west and south-east Queensland and would impact the reliability of supply to the Moreton South and Gold Coast areas. Failure to address the obsolescence of this asset is likely to result in non-compliance with Powerlink's reliability and system security obligations[6].

2. Recommended Option

As this project is currently 'Not Approved', project need and options will be subjected to the public Regulatory Investment Test for Transmission (RIT-T) consultation process to identify the preferred option closer to the time of investment.

The current recommended option is to replace all 275kV secondary systems at Greenbank Substation by 2029[2].

The following options were considered but not proposed:

- Do Nothing – rejected due to non-compliance with reliability standards.
- Non-Network Option parameters identified – at this stage no viable non-network options have been identified.

Figure 2-1 shows the current recommended option reduces the forecast risk monetisation profile of the Greenbank Substation secondary systems to $10k per annum. The recommended option will extend the asset life by 20 years.

Where a 'Do Nothing' scenario is adopted, the forecast level of risk associated with the asset rapidly escalates from approximately $20k per annum in 2026 to an estimated $400k per annum in 2029 and continues to rise each year thereafter. The significant increase in risk cost in 2027 coincides with the depletion of available spares, which results in financial risks to replace the failed secondary systems in an unplanned (emergency) manner and network risks (unserved energy) from concurrent network outages due to equipment failures.[3]

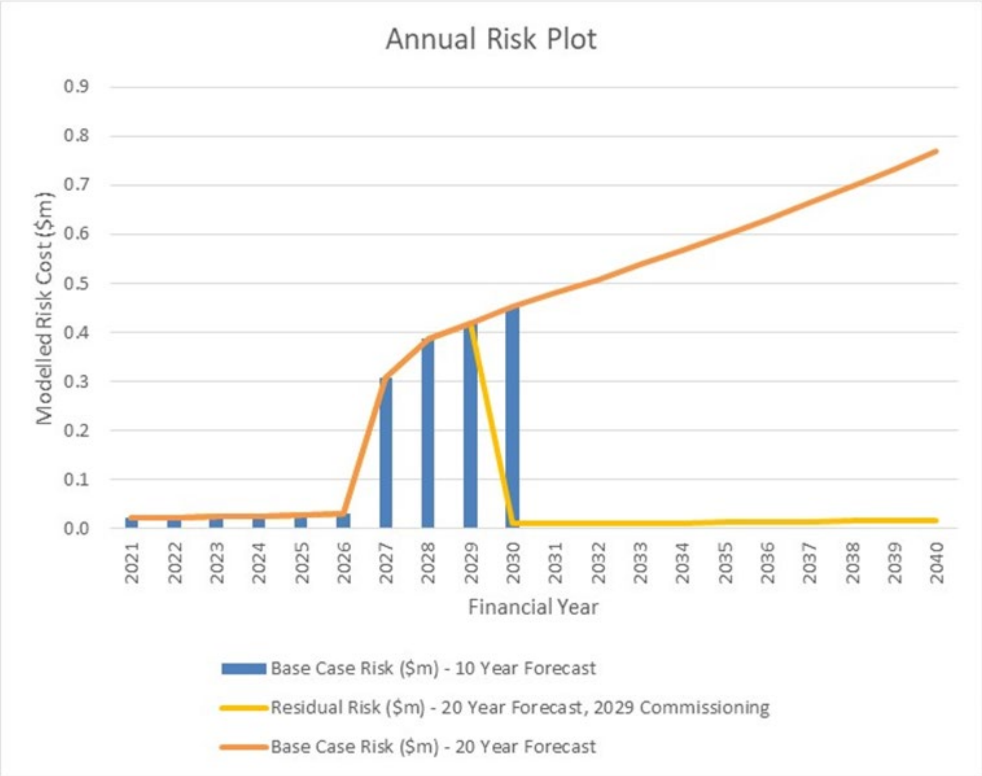

Figure 2-1 Annual Risk Monetisation Profile (Nominal)

3. Cost and Timing

The estimated cost to replace the 275kV secondary systems at Greenbank Substation is $29.6m ($2023/24)[5].

Target Commissioning Date: December 2029

4. Documents in CP.xxxxx Project Pack

Public Documents

1. Secondary System Condition Assessment Report – S003 Greenbank 275kV SVC, 275kV Substation
2. CP.0xxxx S003 Greenbank 275kV SVC and Secondary Systems Replacement – Planning Statement
3. Base Case Risk and Maintenance Costs Summary Report – Greenbank Secondary Systems Replacement
4. Project Scope Report CP.0xxxx Greenbank Secondary Systems Replacement
5. Concept Estimate for CP.0xxxx – Greenbank Secondary Systems Replacement

Supporting Documents

6. Asset Reinvestment Criteria - Framework
7. Asset Management Plan 2021

S003 Greenbank
275kV SVC
275kV Substation

Secondary Systems Condition Assessment Report

Document Details			
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1. Introduction

S003 275kV Greenbank Substation and Greenbank SVC is a major switching substation in South East Queensland. It was established in 2006 to accommodate network augmentation / expansion at the time. This substation is an integral part of the Queensland transmission backbone. Greenbank substation is located approximately 42 km South West of Brisbane CBD. The 275kV SVC, is adjacent to the substation, was commissioned in 2008 to provide fast reactive power support in the area.

The focus of the report is to assess the conditions of secondary systems assets and to recommend the reinvestment timing for these assets. Recommendations have been derived from the condition assessment of secondary systems assets and associated equipment. Considerations for network reconfigurations, network enduring needs, engineering solutions, refurbishment options and implementation methodologies are not in scope of this report.

Greenbank Substation and SVC primary equipment bays include:

Substation:

Table 1 – Greenbank Substation Network Elements

Local Substation (S003 Greenbank)					Remote Substation
	Voltage (kV)	**Quantity**	**Bay Designation**	**Operational Element**	
Feeders	275	13	=C04-Q10	8813	Loganlea
			=C04-Q20	8824	Molendinar
			=C05-Q10	8822	Belmont
			=C05-Q20	8825	Molendinar
			=C06-Q10	805	Swanbank E
			=C06-Q20	835	Mudgeeraba
			=C010-Q10	597 (Spare)	
			=C010-Q20	836	Mudgeeraba
			=C011-Q10	8888	Blackstone
			=C012-Q10	8887	Blackstone
			=C013-Q10	8848	Middle Ridge
			=C014-Q10	8849	Middle Ridge
			=C014-Q20	5811 (SVC)	
Capacitor Banks	275	5	=C08-Q10	Cap 3	
			=C08-Q20	Cap 4	
			=C15-Q10	Cap 5	
			=C15-Q20	Cap 6	
			=C16-Q20	Cap 8	
Reactors		0			
Transformers		1	=C14-Q20, -Q30	SVC M11	
Busbars	275	2	=KC1	1 Bus	

			=KC2	2 Bus	

SVC:

Table 2 - Greenbank SVC Network Elements					
Local Substation (S003 Greenbank SVC)					Remote Substation
	Voltage (kV)	Quantity	Bay Designation	Operational Element	
Transformer	17.2 / 275 kV	1	=C014-Q20 and –Q30	11 SVC	
Reactors	17.2	1	TCR1	TCR 1	
Capacitor Banks		5	TSC1	TSC 1	
			TSC2	TSC 2	
			HF5	5th Filter	
			HF7	7th Filter	
			HF11	11th Filter	
Busbars		1		SVC LV Bus	

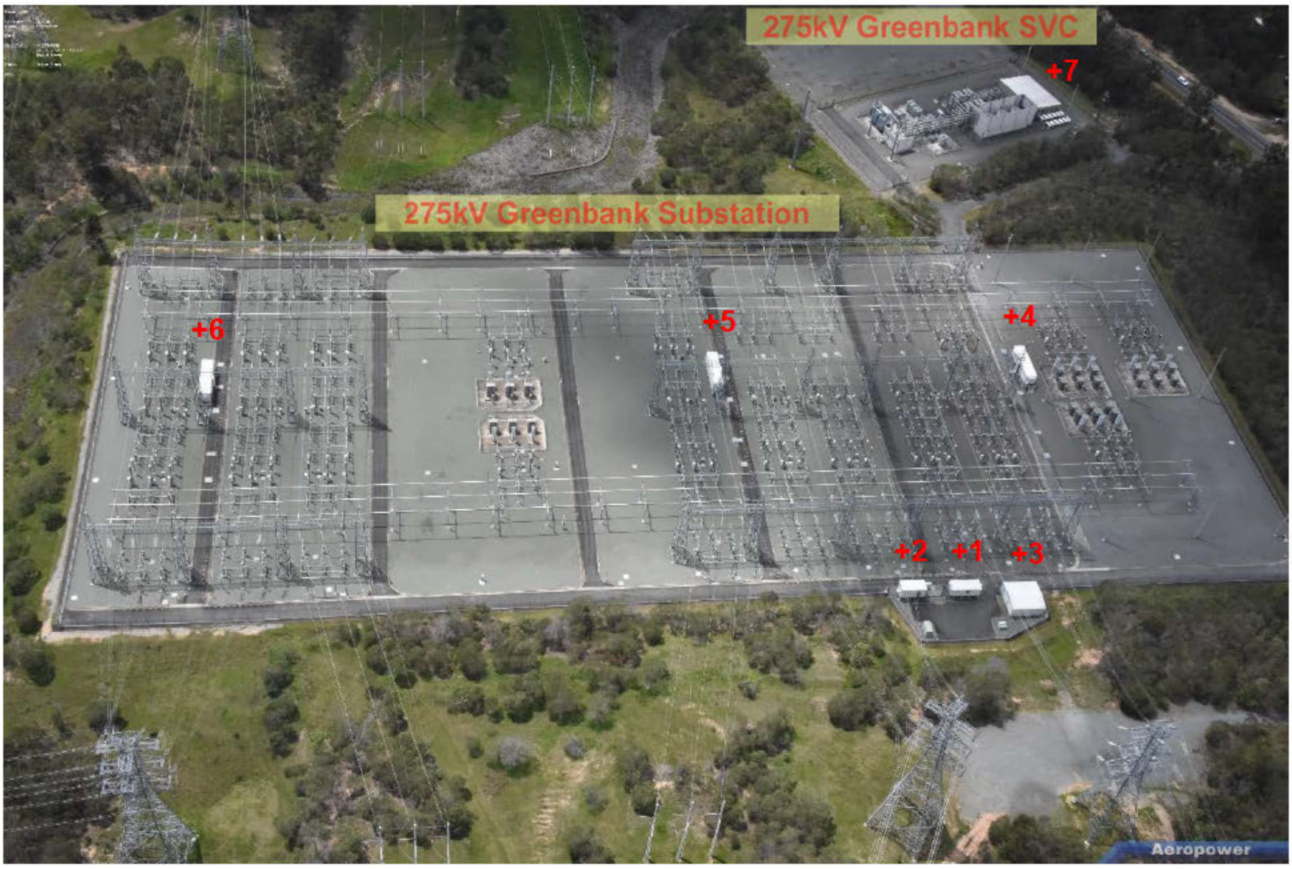


Figure 1 – 275kV Greenbank Substation and SVC and 275kV Substation Aerial View

[redacted]

Figure 2 – 275kV Greenbank Substation and SVC Electrical Single Line 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,
- Telecommunication assets, including 50VDC batteries and chargers.

3. Condition Assessment Principles and Methodology

Principles of secondary systems condition assessment were based on Powerlink' s Secondary Systems Asset Risk Model developed in [1], and "Powerlink – Asset Risk Management – Framework" in [2]. The methodology consists of two main parts – Desktop assessment based on [1, 2] and site visual inspection. The 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 since 1999. 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.

Health indices are modelled in the range from zero (0) to ten (10), where zero represents newly installed equipment and ten indicates equipment that have reached the end of their technical service life. 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 due to the obsolescence of the equipment.

The key outcome of this report is the recommended replacement timing for secondary systems assets and equipment detailed in the Appendix section based on their health indices and condition assessment data.

4. Buildings

4.1 Substation Secondary Systems Buildings

The substation secondary systems are housed in three (3) demountable control buildings, except that some small quantity of OpsWAN equipment are installed in the Amenities building (+1) and telecommunication building (+2). The buildings +1 to +6 are located within the substation perimeter fence.

4.2 SVC Control Building

The SVC building (+7) is located within the SVC perimeter fence, which is adjacent to the substation. It houses control and protection panels, OpsWAN, thyristor valves, cooling system, 125V DC battery and charger, analogue and digital interface panels, control cables and associated auxiliary equipment. This building has no spare capacity to accommodate additional secondary system panels if required.

Details of substation and SVC buildings are shown in Table 3.

Table 3 – Greenbank Substation and SVC Buildings

Building Description	Designation	Functional Use	Spare Sec Sys Panel Spaces
Amenities Building	+1	Amenities	N/A
Communications	+2	Comms equipment	N/A
Work shed	+3	Maintenance Workshop	N/A
Substation Secondary System Building +4	+4	Sec Sys Bays = C04, =C05, =C06	12
Substation Secondary System Building +5	+5	Sec Sys Bays = C08, =C09, =C10, =C11, =C12	9
Substation Secondary System Building +6	+6	Sec Sys Bays = C13, =C14, =C15, =C16	13
=M11 SVC Building +7	+7	SVC Sec Sys, Thyristor Valves and Valve Cooling	N/A

(a) Building +4

(b) Building +5

(c) Building +6

Figure 3 - S003 275kV Greenbank Substation secondary systems and SVC Buildings

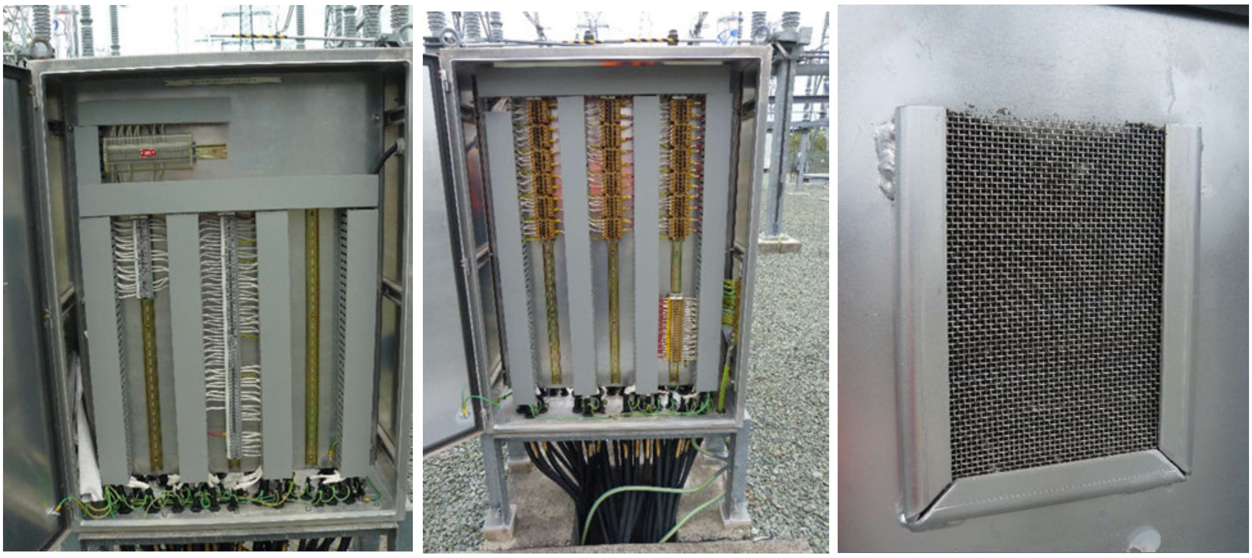
5. Condition Assessment

5.1 Secondary System Outdoor Marshalling Kiosks

Greenbank substation and SVC marshalling kiosks were installed between 2006 and 2008. The kiosks are still in serviceable condition and should last another 20 – 25 years. However, their internal components such as links, terminals and MCBs have already shown signs of deterioration due to harsh environmental conditions. In particular, some door seals and air filters, which appear to be made from low quality materials, have significantly degraded and should be replaced as part of routine maintenance. It is recommended that all outdoor marshalling kiosks be monitored as part of the substation routine inspection to identify any aggressive deterioration. An operational project (or maintenance work order) should be initiated to replace the internal components if they deteriorate beyond Powerlink's safety standards. Otherwise, any degraded links and terminals should be replaced as part of secondary system replacement project in 2027 / 28.

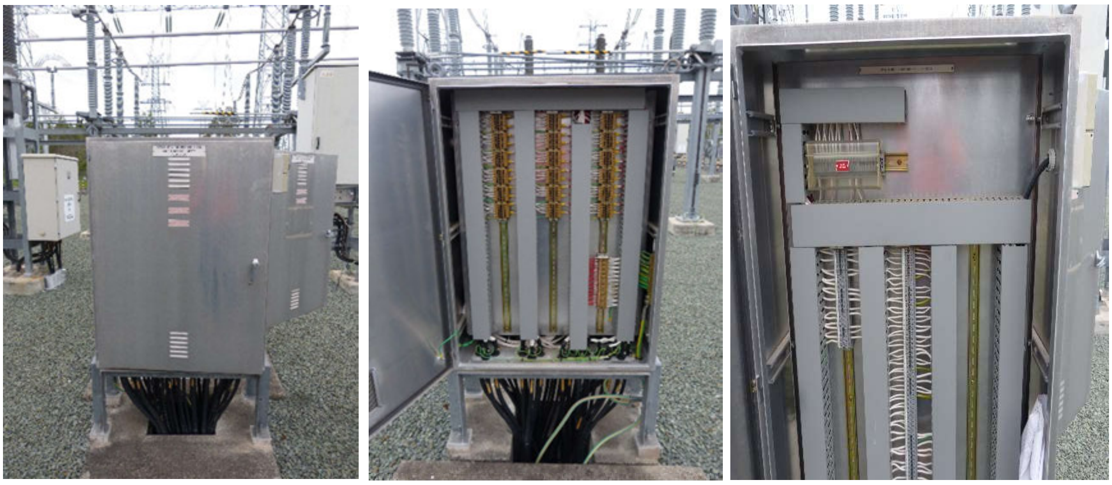
Health Indices of secondary system outdoor marshalling kiosks and recommended replacement timeframe have been detailed in **Appendix A**. Physical appearance of typical outdoor marshalling kiosks are illustrated in Figure 4 below.

(a) =C04-A10 Bay Marshalling Kiosk



(b) =C04-A20 Bay Marshalling Kiosk

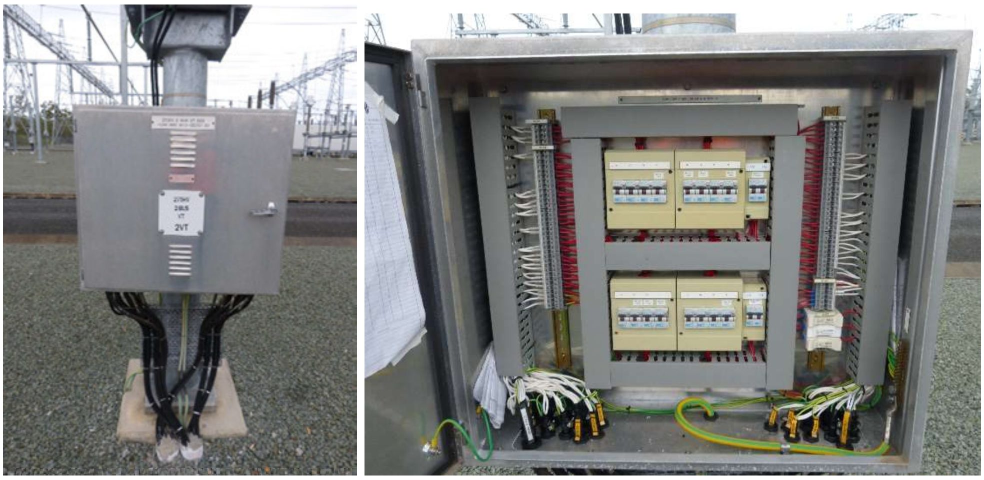
(c) =C05-A30 Bay Marshalling Kiosk



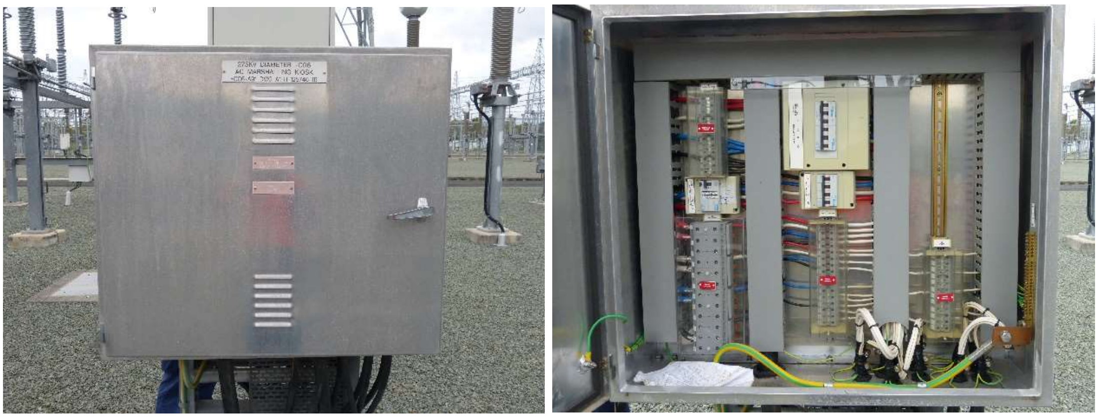
(d) =C05-A20 Bay Marshalling Kiosk

(e) =C08-A2 – 2 Bus CT Marshalling Kiosk

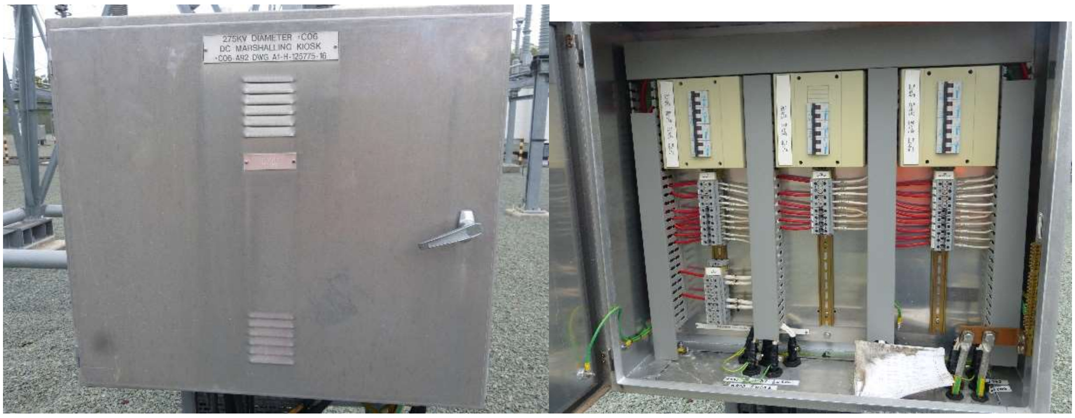
(f) =C08-A50 - 1 Bus VT Marshalling Kiosk



(g) =C08-A60 - 2 Bus VT Marshalling Kiosk



(h) =C06-A91 Diameter =C06 AC Marshalling Kiosk



(i) =C06-A92 Diameter =C06 DC Marshalling Kiosk

Figure 4 – Physical appearance of typical outdoor marshalling kiosks at Greenbank substation

5.2 Outdoor Secondary System Cables

Outdoor secondary system cables are still in good condition as shown in Figure 5. Visual inspection of these cables indicated that they can be kept in service until at least 2043.

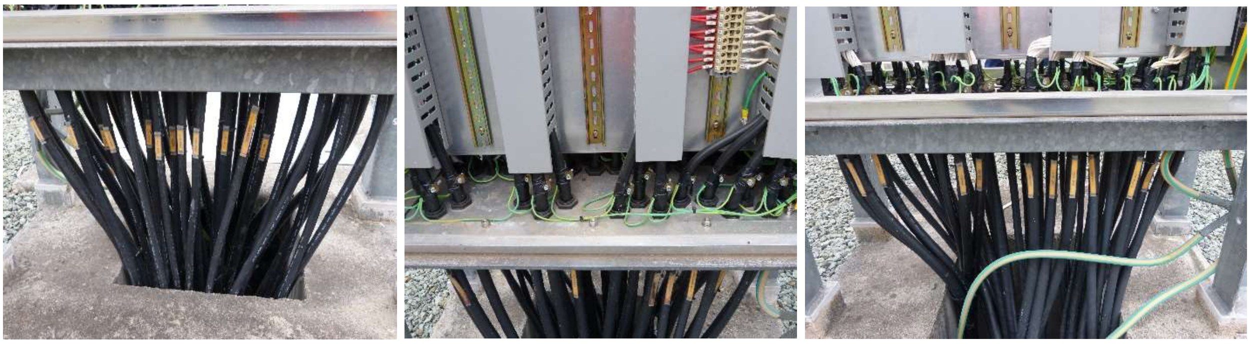


Figure 5 – Physical appearance of typical outdoor secondary system cables

5.3 Indoor Termination Racks / Yard Interface Cubicle

There is no building termination racks at Greenbank substation. Secondary system cables were installed directly between the indoor panels and outdoor marshalling kiosks. Therefore, new external termination racks may need to be installed external to the existing building to ease labour efforts required for the secondary system replacement projects.

5.4 Indoor Secondary System Cables

All cables inside the control buildings are considered to be in good condition as they have been in clean and air-conditioned environment since installed round 2006 / 2007. The replacement of indoor cables is deemed unnecessary until at least 2043.

5.5 Control and Protection Systems

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

5.5.1 Secondary Systems Panels

All secondary systems panels, including auxiliary parts e.g. links, terminals and internal wiring were installed between 2006 - 2008 and currently still in good condition. They are suitable for service until 2027/28.

=C04-Q20

=C04-Q30

=C04-Q20


=C05-Q10


=C05-Q30


=C05-Q10


=C10-Q10


=C10-Q30


=C10-Q10

Figure 6 – Typical Indoor Secondary Systems Panels at Greenbank Substation

(a) SVC Control and Protection Panels

(b) SVC AC Protection Panels

(c) HMI and SCADA Panel

(d) SVC Controller

(e) TCR and TSC Valve Base Electronics

(f) Digital Fault Recorder

(g) Yard Interface panel

(h) AC Changeover and Battery Charger

Figure 7 –Typical SVC Indoor Control and Protection Panels at Greenbank SVC

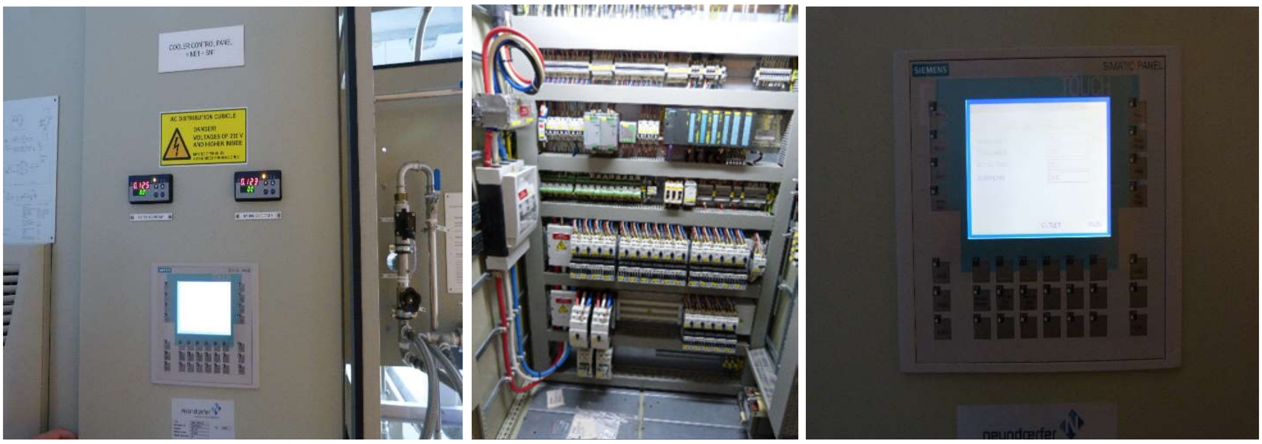


Figure 8 – SVC Cooling Control System Panel

5.5.2 Revenue Metering Panels

Greenbank Substation and SVC secondary system do not have revenue-metering panels.

5.5.3 OpsWAN System Panels

OpsWAN systems and equipment at this site were installed around the same time as the secondary systems, i.e. between 2006 and 2008. OpsWAN systems are still functioning and have an important role in operation and maintenance efficiencies. They are considered as auxiliary components of the power system. Their condition and performance generally do not have material impacts on the performance, reliability and availability of secondary systems and the power system.

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

+4 OpsWAN Panel +5 OpsWAN, LCF and NSCs +6 OpsWAN Panel

Figure 9 – Greenbank Substation and SVC OpsWAN Panel

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

5.5.4.1. Control, Protection, Auxiliary, Ancillary Equipment

Greenbank Substation and SVC secondary system comprises mostly microprocessor based control and protection equipment. There is a small number of solid state and modern electro-mechanical relays being used e.g. CB Fail Bus Trip relays, high impedance bus zone relays and SVC Multi-trip relays. Health indices and recommended replacement timeframe for substation and SVC secondary system equipment and associated ancillary equipment are tabled in the Appendix A.

Figure 10 – Greenbank Substation Typical Indoor Secondary System Equipment (2006 - 2008)

Figure 11 – Greenbank SVC Typical SVC Indoor Secondary System Equipment (2008)

5.5.4.2. Revenue Metering Equipment

Greenbank Substation and SVC system does not have revenue meters.

5.5.4.3. OpsWAN Equipment

Greenbank Substation and SVC's OpsWAN equipment were installed between 2006 and 2008. They should only be replaced as part of the SVC secondary system replacement project, anticipated in 2027/28.

Figure 12 – Greenbank Substation and SVC OpsWAN Equipment

5.5.5 Auxiliary Supply

5.5.5.1. AC Auxiliary Supply

AC auxiliary supplies, including station transformers and backup diesel generator/s are not in scope of this report. AC heaters and lights servicing secondary system panels should only be replaced as part of the secondary systems panels, recommended in 2027/28.

5.5.5.2. DC Batteries and Chargers

Greenbank Substation and SVC have four (4) sets of 125VDC X and Y batteries and associated chargers installed between 2006 and 2008 as detailed in the Appendix A. Generally, there is one set of duplicated batteries and chargers per secondary system building. Based on experience of battery and charger reliability, substation DC batteries' expected lifespan is 12 years while chargers' expected lifespan is 20 years. Therefore, all batteries at Greenbank substation and SVC should be replaced as soon as possible. Battery monitors and chargers should be replaced around the 20 year cycle.

(Buildings +4 and +5 Chargers - 2006)

(Buildings +6 Chargers - 2007)

(Buildings +7 - SVC 125V X and Y DC Batteries and Chargers - 2008)

Figure 13 – Greenbank Substation and SVC 125VDC Batteries and Chargers

6. Conclusion

This report details the conditions of Greenbank Substation and SVC secondary systems and equipment. The primary objective of the recommended replacement time is to maintain the current network reliability and availability and to minimise operational and compliance risks associated with secondary systems assets at Greenbank Substation and SVC. Health indices and replacement timeframe have also been recommended in Appendix A.

Please refer to the last four (4) columns in the Appendix A for the recommended replacement timing of:

- Chassis of Control and Protection Panels
- Secondary System Equipment, including batteries and charger
- Secondary System Cables
- Outdoor Marshalling Kiosks

Door seals and air filters of outdoor marshalling kiosks should be replaced as part of routine maintenance.

7. Attachments

- **Appendix A** – S003 275kV Greenbank Substation and SVC Secondary Systems Equipment Health Indices and Recommended Asset Placement Replacement Timeframe.

8. References

[1] "Modelling Substation control and Protection Asset Condition for Optimal reinvestment Decision Based on Risk, Cost and Performance", CIGRE PARIS 26-31 August 2018, T Vu, M. Pelevin, D. Gibbs, J.Horan, C. Zhang.

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

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

9. Appendix A

APPENDIX A - S003 GREENBANK 275KV SUBSTATION AND SVC SECONDARY SYSTEMS - EQUIPMENT HEALTH INDICES AND RECOMMENDED REPLACEMENT TIMEFRAME

Notes:
(a): Subject to Powerlink's O&M Safety Requirements, Current Standard Solutions and Implementation Methodologies, it may be more beneficial to align with the recommended replacement timeframe of sedondary systems equipment
(b): Recommended Timeframe is based on majority of Equipment Health Indices
(c): Based on Visual Inspection and Subject to the decision of the Control Building and Secondary Systems Panels. A number of New Cables may be requried if location of control building or secondary systems panels is changed.
(d): As a minimum requirement, Rubber Seals, Air filter and Terminals and Links are required to be repalced by the recommended timeframe. New Marshalling Kiosks should be considered if Exsiting Cables are to be reaplaced.

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

BAY	C&P PANEL				SECONDARY SYSTEMS EQUIPMENT						X-PROT		Y-PROT		AUX & CTRL		REVENUE METERING		OPSWAN		CABLES (HI)	YARD MARSHALLING KIOSKS (HI)	C&P PANELS (Chassis)	Sec Sys Eqiupment	CABLES	YARD MARSHALLING KIOSKS
Function	Panel Descripion	Panel No.	Year	HI	Functional Loc.	Description	Manufacturer	Model number	Obsolescence (Yes / No)	Spare Qty	Eff. Age	HI	Eff. Age	HI	Eff. Age	HI	Eff. Age	HI	Eff. Age	HI	C&P Panels to HV Yard Marshalling Kiosks (CB, MK, CT, VT, AC, DC, COOLING)	Yard Marshalling Kiosks (CB, MK, CT, VT, AC, DC, COOLING)	C&P Panels	Sec Sys Equipment & Auxiliary Components	C&P Panels to HV Yard Marshalling Kiosks (CB, MK, CT, VT, AC, DC, COOLING)	Yard Marshalling Kiosks (CB, MK, CT, VT, AC, DC, COOLING)
SVC CONTROLLER	SVC CONTROLLER	U1+SJ1	2008	3.43	S003-SSS-11SC-CONTSYS	SVC CONTROLLER	SIEMENS	SIMATIC TDC UR5213	No	1					16.67	8.33					3.43	3.43	> 2043	2028/29 (b)	> 2043	> 2043
					S003-SSS-11SC-INDMET	CURRENT ADAPTOR (=U1+SJ1-T15)	SIEMENS	0-1A-5A / 0-3.5V	No	8					11.08	5.54										
					S003-SSS-11SC-INDMET	CURRENT ADAPTOR (=U1+SJ1-T16)	SIEMENS	0-1A-5A / 0-3.5V	No	8					11.08	5.54										
					S003-SSS-11SC-INDMET	CURRENT ADAPTOR (=U1+SJ1-T13)	SIEMENS	0-1A-5A / 0-3.5V	No	8					11.08	5.54										
					S003-SSS-11SC-INDMET	CURRENT ADAPTOR (=U1+SJ1-T14)	SIEMENS	0-1A-5A / 0-3.5V	No	8					11.08	5.54										
					S003-SSS-11SC-INDMET	VOLT ADAPTOR (=U1+SJ1-T11)	SIEMENS		No	6					11.08	5.54										
					S003-SSS-11SC-INDMET	VOLT ADAPTOR (=U1+SJ1-T12)	SIEMENS		No	6					11.08	5.54										
SVC VBE	TCR, TSC1 TSC2 VBE	U2+SJ2	2008	3.43	S003-SSS-11SC-TCR1VBE	VALVE CONTROL UNIT (VBE)	SIEMENS	N-T722 3125-00003	N/A	N/A					11.24	5.62					3.43	3.43	> 2043	2028/29 (b)	> 2043	> 2043
					S003-SSS-11SC-TSC1VBE	VALVE CONTROL UNIT (VBE)	SIEMENS	N-T722 3125-00003	N/A	N/A					11.24	5.62										
					S003-SSS-11SC-TSC2VBE	VALVE CONTROL UNIT (VBE)	SIEMENS	N-T722 3125-00003	N/A	N/A					11.24	5.62										
SVC DCCT	DC-CT ELECTRONIC	U3+SJ3	2008	3.43	S003-SSS-11SC-EMVI	ELECTRONIC CURRENT TRANSDUCER RECEIVER	RITZ	EMVI 701HZ	No	2					11.08	5.54					3.43	3.43	> 2043	2028/29 (b)	> 2043	> 2043
					S003-SSS-11SC-EMVI	ELECTRONIC CURRENT TRANSDUCER RECEIVER	RITZ	EMVI 701HZ	No	2					11.08	5.54										
					S003-SSS-11SC-EMVI	ELECTRONIC CURRENT TRANSDUCER RECEIVER	RITZ	EMVI 701HZ	No	2					11.08	5.54										
SVC LAN / HMI	LAN / HMI / SERVICE	X1+SB1	2008	3.43	S003-SSS-11SC-HMI	MONITOR	FUJITSU SIEMENS	SCEENICVIEW P17-2	Yes	1					11.08	9.23					3.43	3.43	> 2043	2028/29 (b)	> 2043	> 2043
					S003-SSS-11SC-TIMING	GPS CLOCK	SIEMENS	SICLOCK TS	No	3					11.08	5.54										
					S003-SSS-11SC-OWNTWK	SWITCH (=X1+SB1-A5)	RUGGEDCOM	RS8000T	No	1					11.08	9.23										
					S003-SSS-11SC-OWSTNTWK	SWITCH (=X1+SB1-A10)	RUGGEDCOM	RS8000T	No	1					11.08	9.23										
					S003-SSS-11SC-RTU	REMOTE TERMINAL UNIT FOXBORO C50	FOXBORO	C50	Yes	4					11.08	5.54										
					S003-SSS-11SC-SVCNTWK	SWITCH (=X1+SB1-A3)	RUGGEDCOM	RS8000T	No	1					11.08	9.23										
					S003-SSS-11SC-DATCONV	DATA CONVERTER COMPUTER	IPCOMM	IPC 191 A	Yes	0					12.06	6.03										
SVC PROTECTION INTERFACE / DFR	PROTECTION INTERFACE / DFR	X2+SB2	2008	3.43	S003-SSS-11SC-BIPROT	BINARY INTERFACE MODULE (=X2+SB2-A1)	SIEMENS	SU200	Yes	1					12.10	6.05					3.43	3.43	> 2043	2028/29 (b)	> 2043	> 2043
					S003-SSS-11SC-DISTREC	TRANSIENT FAULT RECORDER (=X2+SB2-A4)	IBA	PADU	Yes	0					11.62	5.81										
					S003-SSS-11SC-DISTREC	TRANSIENT FAULT RECORDER (=X2+SB2-A5)	IBA	PADU	Yes	0					11.08	5.54										
					S003-SSS-11SC-DISTREC	TRANSIENT FAULT RECORDER (=X2+SB2-A6)	IBA	PADU	Yes	0					11.08	5.54										
					S003-SSS-11SC-DISTREC	TRANSIENT FAULT RECORDER COMPUTER	IBA	IBA RACK PC	Yes	0					16.74	8.37										
SVC TRANSFORMER PROTECTION	PROTECTION HV/LV/TFMR	R1+SR1	2008	3.43	S003-SSS-11SC-BUSXPROT	RELAY MULTIFUNCTION DIFF SIEMENS 7SJ62	SIEMENS	7SJ62	No	3	11.08	5.54									3.43	3.43	> 2043	2028/29 (b)	> 2043	> 2043
					S003-SSS-11SC-BUSYPROT	RELAY MULTIFUNCTION DIFF SIEMENS 7SJ62	SIEMENS	7SJ62	No	3			11.08	5.54												
					S003-SSS-11SC-TRFXPROT	RELAY MULTIFUNCTION DIFF SIEMENS 7UT635	SIEMENS	7UT635	No	2	11.08	5.54														
					S003-SSS-11SC-TRFYPROT	RELAY MULTIFUNCTION DIFF SIEMENS 7UT635	SIEMENS	7UT635	No	2			11.08	5.54												
TCR TSC PROTECTION	TSC TCR PROTECTION	R2+SR2	2008	3.43	S003-SSS-11SC-TCR1XPRO	RELAY MULTIFUNCTION DIFF SIEMENS 7UT612	SIEMENS	7UT612	No	4	11.08	5.54									3.43	3.43	> 2043	2028/29 (b)	> 2043	> 2043
					S003-SSS-11SC-TCR1YPRO	RELAY MULTIFUNCTION DIFF SIEMENS 7SJ61	SIEMENS	7SJ61	No	2			11.08	5.54												
					S003-SSS-11SC-TSC1XPRO	RELAY MULTIFUNCTION DIFF SIEMENS 7UT612	SIEMENS	7UT612	No	4	11.08	5.54														
					S003-SSS-11SC-TSC1XPRO	RELAY CAPACITOR/FILTER TRENCH CPR04	TRENCH	CPR04	No	5	11.08	5.54														
					S003-SSS-11SC-TSC1YPRO	RELAY MULTIFUNCTION DIFF SIEMENS 7SJ61	SIEMENS	7SJ61	No	2			11.08	5.54												
					S003-SSS-11SC-TSC2XPRO	RELAY MULTIFUNCTION DIFF SIEMENS 7UT612	SIEMENS	7UT612	No	4	11.08	5.54														
					S003-SSS-11SC-TSC2XPRO	RELAY CAPACITOR/FILTER TRENCH CPR04	TRENCH	CPR04	No	5	11.08	5.54														
					S003-SSS-11SC-TSC2YPRO	RELAY MULTIFUNCTION DIFF SIEMENS 7SJ61	SIEMENS	7SJ61	No	2			11.08	5.54												
HARMONIC FILTER PROTECTION	HARMONIC FILTER PROTECTION	R3+SR3	2008	3.43	S003-SSS-11SC-11HFXPRO	RELAY CAPACITOR/FILTER TRENCH CPR04	TRENCH	CPR04	No	5	11.08	5.54									3.43	3.43	> 2043	2028/29 (b)	> 2043	> 2043
					S003-SSS-11SC-11HFYPRO	RELAY MULTIFUNCTION DIFF SIEMENS 7SJ61	SIEMENS	7SJ61	No	2			11.08	5.54												
					S003-SSS-11SC-5HFXPROT	RELAY CAPACITOR/FILTER TRENCH CPR04	TRENCH	CPR04	No	5	11.08	5.54														
					S003-SSS-11SC-5HFXPROT	RELAY CAPACITOR/FILTER TRENCH CPR04	TRENCH	CPR04	No	5	11.08	5.54														
					S003-SSS-11SC-5HFYPROT	RELAY MULTIFUNCTION DIFF SIEMENS 7SJ61	SIEMENS	7SJ61	No	2			11.08	5.54												
					S003-SSS-11SC-7HFXPROT	RELAY CAPACITOR/FILTER TRENCH CPR04	TRENCH	CPR04	No	5	11.08	5.54														
					S003-SSS-11SC-7HFYPROT	RELAY MULTIFUNCTION DIFF SIEMENS 7SJ61	SIEMENS	7SJ61	No	2			11.08	5.54												
ANALOG YARD INTERFACE	ANALOG INTERFACE / YARD	X3+SB3	2008	3.43	S003-SSS-11SC-BISYARD	BINARY INTERFACE MODULE (SU200:8)	SIEMENS	SU200	Yes	2					11.08	5.54					3.43	3.43	> 2043	2028/29 (b)	> 2043	> 2043
					S003-SSS-11SC-BISYARD	BINARY INTERFACE MODULE (SU200:16)	SIEMENS	SU200	Yes	2					11.08	5.54										
					S003-SSS-11SC-BISYARD	BINARY INTERFACE MODULE (SU200:17)	SIEMENS	SU200	Yes	2					11.08	5.54										

APPENDIX A - S003 GREENBANK 275KV SUBSTATION AND SVC SECONDARY SYSTEMS - EQUIPMENT HEALTH INDICES AND RECOMMENDED REPLACEMENT TIMEFRAME

Notes:
(a): Subject to Powerlink's O&M Safety Requirements, Current Standard Solutions and Implementation Methodologies, it may be more beneficial to align with the recommended replacement timeframe of sedondary systems equipment
(b): Recommended Timeframe is based on majority of Equipment Health Indices
(c): Based on Visual Inspection and Subject to the decision of the Control Building and Secondary Systems Panels. A number of New Cables may be requried if location of control building or secondary systems panels is changed.
(d): As a minimum requirement, Rubber Seals, Air filter and Terminals and Links are required to be repalced by the recommended timeframe. New Marshalling Kiosks should be considered if Exsiting Cables are to be reaplaced.

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

BAY	C&P PANEL				SECONDARY SYSTEMS EQUIPMENT						X-PROT		Y-PROT		AUX & CTRL		REVENUE METERING		OPSWAN		CABLES (HI)	YARD MARSHALLING KIOSKS (HI)	C&P PANELS (Chassis)	Sec Sys Eqipment	CABLES	YARD MARSHALLING KIOSKS
Function	Panel Descripion	Panel No.	Year	HI	Functional Loc.	Description	Manufacturer	Model number	Obsolescence (Yes / No)	Spare Qty	Eff. Age	HI	Eff. Age	HI	Eff. Age	HI	Eff. Age	HI	Eff. Age	HI	C&P Panels to HV Yard Marshalling Kiosks (CB, MK, CT, VT, AC, DC, COOLING)	Yard Marshalling Kiosks (CB, MK, CT, VT, AC, DC, COOLING)	C&P Panels	Sec Sys Equipment & Auxiliary Components	C&P Panels to HV Yard Marshalling Kiosks (CB, MK, CT, VT, AC, DC, COOLING)	Yard Marshalling Kiosks (CB, MK, CT, VT, AC, DC, COOLING)
24VDC BINARY INTERFACE	24VDC BINARY INTERFACE	X4+SB4	2008	3.43	S003-SSS-11SC-BICOOL	INTERFACE MODULE (SU200:1)	SIEMENS	SU200	Yes	8					11.08	5.54					3.43	3.43	> 2043	2028/29 (b)	> 2043	> 2043
					S003-SSS-11SC-BICTRLAN	BINARY INTERFACE MODULE (SU200:12)	SIEMENS	SU200	Yes	8					11.08	5.54										
					S003-SSS-11SC-BICTRLAN	BINARY INTERFACE MODULE	SIEMENS	SU200	Yes	2					8.54	4.27										
					S003-SSS-11SC-BICTRLAN	BINARY INTERFACE MODULE	SIEMENS	SU200	Yes	8					8.54	4.27										
125VDC BINARY INTERFACE	125VDC BINARY INTERFACE	X5+SB5	2008	3.43	S003-SSS-11SC-BIPROT	BINARY INTERFACE MODULE (SU200:3)	SIEMENS	SU200	Yes	8					11.08	5.54					3.43	3.43	> 2043	2028/29 (b)	> 2043	> 2043
					S003-SSS-11SC-BIPROT	BINARY INTERFACE MODULE (SU200:5)	SIEMENS	SU200	Yes	8					11.20	5.60										
					S003-SSS-11SC-BISTN	BINARY INTERFACE MODULE (SU200:14)	SIEMENS	SU200	Yes	2					11.08	5.54										
SVC OPSWAN	SVC OPSWAN		2013	2.00	S003-SSS-11SC-OWCOVERT	DC/DC CONVERTER	PHOENIX	QUINT-PS-100	No	2									11.08	5.54	2.00	2.00	> 2048	2033/34 (b)	> 2048	> 2048
					S003-SSS-11SC-OWINVERT	INVERTER 125VDC/240VAC 1600W	LATRONICS	415-BKZ-CN125	No	3									11.08	5.54						
					S003-SSS-11SC-OWNTWK	GEN 4 SERVER OPSWAN	Esis	EB15002	No	2									2.36	1.96						
					S003-SSS-11SC-OWNTWK	LOCAL CONTROL FACILITY PC X TERMINAL	WYSE	7010	Yes	1									2.36	1.96						
					S003-SSS-11SC-OWNTWK	CHECK POINT 1200R IPS RUGGED APPLIANCE	CHECKPOINT		No	2									0.00	0.00						
					S003-SSS-11SC-OWPRINT	PRINTER	HEWLETT PACKARD	HP5200TN	Yes	0									11.08	9.23						
SVC COOLER CONTROL	SVC COOLER CONTROL PANEL	NE1+SN1	2008	3.43	S003-SSS-11SC-VCOOLCON	CONTROL UNIT	SIEMENS	SIMATIC TDC UR5213	No	2					16.67	8.33					3.43	3.43	> 2043	2028/29 (b)	> 2043	> 2043
					S003-SSS-11SC-VCOOLCON	PROGRAMMABLE LOGIC CONTROLLER (2of)	SIEMENS	S7300	?						11.08	5.54										

APPENDIX A - S003 GREENBANK 275KV SUBSTATION AND SVC SECONDARY SYSTEMS - EQUIPMENT HEALTH INDICES AND RECOMMENDED REPLACEMENT TIMEFRAME

Notes:
(a): Subject to Powerlink's O&M Safety Requirements, Current Standard Solutions and Implementation Methodologies, it may be more beneficial to align with the recommended replacement timeframe of sedondary systems equipment
(b): Recommended Timeframe is based on majority of Equipment Health Indices
(c): Based on Visual Inspection and Subject to the decision of the Control Building and Secondary Systems Panels. A number of New Cables may be requried if location of control building or secondary systems panels is changed.
(d): As a minimum requirement, Rubber Seals, Air filter and Terminals and Links are required to be repalced by the recommended timeframe. New Marshalling Kiosks should be considered if Exsiting Cables are to be replaced.

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

BAY	C&P PANEL				SECONDARY SYSTEMS EQUIPMENT						X-PROT		Y-PROT		AUX & CTRL		REVENUE METERING		OPSWAN		CABLES (HI)	YARD MARSHALLUNG KIOSKS (HI)	C&P PANELS (Chassis)	Sec Sys Equipment	CABLES	YARD MARSHALLING KIOSKS
Function	Panel Description	Panel No.	Year	HI	Functional Loc.	Description	Manufacturer	Model number	Obsolescence (Yes / No)	Spare Qty	Eff. Age	HI	Eff. Age	HI	Eff. Age	HI	Eff. Age	HI	Eff. Age	HI	C&P Panels to HV Yard Marshalling Kiosks (CB, MK, CT, VT, AC, DC, COOLING)	Yard Marshalling Kiosks (CB, MK, CT, VT, AC, DC, COOLING)	C&P Panels	Sec Sys Equipment & Auxiliary Components	C&P Panels to HV Yard Marshalling Kiosks (CB, MK, CT, VT, AC, DC, COOLING)	Yard Marshalling Kiosks (CB, MK, CT, VT, AC, DC, COOLING)
1 BUS ZONE	275KV 1 BUS - BUS ZONE AND CB FAIL BUS TRIP X , Y PROTECTION AND CONTROL CUBICLE	+5B11	2006	4.00	S003-SSS-1BUS-BAYCONT	REMOTE TERMINAL UNIT FOXBORO C50	FOXBORO	C50	Yes	15					13.54	6.77					4.00	4.00	> 2041	2026/27 (b)	> 2041	> 2041
					S003-SSS-1BUS-XPROT	RELAY DIFF AREVA MFAC34 RANGE: 25-325VAC	AREVA	MFAC34	No	4	13.54	6.77														
					S003-SSS-1BUS-XPROT	RELAY TRIPPING LOW BURDEN ALSTOM MVAJ13	AREVA	MVAJ13	No	18	13.54	6.77														
					S003-SSS-1BUS-XPROT	RELAY TRIPPING LOW BURDEN ALSTOM MVAJ13	AREVA	MVAJ13	No	18	13.54	6.77														
					S003-SSS-1BUS-XPROT	RELAY TRIPPING SUPPLY FAIL ALSTOM MVAX12	AREVA	MVAX12	No	9	13.54	6.77														
					S003-SSS-1BUS-XPROT	RELAY CB FAIL BUS TRIP RACK	RMS	CB FAIL TRIP RACK	No	3	13.54	6.77														
					S003-SSS-1BUS-XPROT	RELAY CB FAIL BUS TRIP RACK	RMS	CB FAIL TRIP RACK	No	3	13.54	6.77														
					S003-SSS-1BUS-YPROT	RELAY DIFF AREVA MFAC34 RANGE: 25-325VAC	AREVA	MFAC34	No	4			13.54	6.77												
					S003-SSS-1BUS-YPROT	RELAY TRIPPING LOW BURDEN ALSTOM MVAJ13	AREVA	MVAJ13	No	18			13.54	6.77												
					S003-SSS-1BUS-YPROT	RELAY TRIPPING LOW BURDEN ALSTOM MVAJ13	AREVA	MVAJ13	No	18			13.54	6.77												
					S003-SSS-1BUS-YPROT	RELAY TRIPPING SUPPLY FAIL ALSTOM MVAX12	AREVA	MVAX12	No	9			13.54	6.77												
					S003-SSS-1BUS-YPROT	RELAY CB FAIL BUS TRIP RACK	RMS	CB FAIL TRIP RACK	No	3			13.54	6.77												
					S003-SSS-1BUS-YPROT	RELAY CB FAIL BUS TRIP RACK	RMS	CB FAIL TRIP RACK	No	3			13.54	6.77												
1 BUS ZONE	275KV 1 BUS - BUS ZONE AND CB FAIL BUS TRIP X AND Y PROTECTION CUBICLE	+5A5	2007	3.71	S003-SSS-1BUS-XPROT	RELAY TRIPPING LOW BURDEN ALSTOM MVAJ13	AREVA	MVAJ13	No	18	12.17	6.09									3.71	3.71	> 2042	2027/28 (b)	> 2042	> 2042
					S003-SSS-1BUS-XPROT	RELAY TRIPPING LOW BURDEN ALSTOM MVAJ13	AREVA	MVAJ13	No	18	12.17	6.09														
					S003-SSS-1BUS-XPROT	RELAY TRIPPING SUPPLY FAIL ALSTOM MVAX12	AREVA	MVAX12	No	9	12.17	6.09														
					S003-SSS-1BUS-XPROT	RELAY CB FAIL BUS TRIP RACK	RMS	3A111K3	No	29	12.17	6.09														
					S003-SSS-1BUS-XPROT	RELAY CB FAIL BUS TRIP RACK	RMS	3A111K3	No	29	12.17	6.09														
					S003-SSS-1BUS-YPROT	RELAY TRIPPING LOW BURDEN ALSTOM MVAJ13	AREVA	MVAJ13	No	18			12.17	6.09												
					S003-SSS-1BUS-YPROT	RELAY TRIPPING LOW BURDEN ALSTOM MVAJ13	AREVA	MVAJ13	No	18			12.17	6.09												
					S003-SSS-1BUS-YPROT	RELAY TRIPPING SUPPLY FAIL ALSTOM MVAX12	AREVA	MVAX12	No	9			12.17	6.09												
					S003-SSS-1BUS-YPROT	RELAY CB FAIL BUS TRIP RACK	RMS	3A111K3	No	29			12.17	6.09												
					S003-SSS-1BUS-YPROT	RELAY CB FAIL BUS TRIP RACK	RMS	3A111K3	No	29			12.17	6.09												
2 BUS ZONE	275KV 2 BUS - BUS ZONE AND CB FAIL BUS TRIP X , Y PROTECTION AND CONTROL CUBICLE	+5B12	2007	3.71	S003-SSS-2BUS-XPROT	RELAY TRIPPING LOW BURDEN ALSTOM MVAJ13	AREVA	MVAJ13	No	18	12.16	6.08									3.71	3.71	> 2042	2027/28 (b)	> 2042	> 2042
					S003-SSS-2BUS-XPROT	RELAY TRIPPING LOW BURDEN ALSTOM MVAJ13	AREVA	MVAJ13	No	18	12.16	6.08														
					S003-SSS-2BUS-XPROT	RELAY TRIPPING SUPPLY FAIL ALSTOM MVAX12	AREVA	MVAX12	No	9	12.16	6.08														
					S003-SSS-2BUS-XPROT	RELAY CB FAIL BUS TRIP RACK	RMS	3A111K3	No	29	12.16	6.08														
					S003-SSS-2BUS-XPROT	RELAY CB FAIL BUS TRIP RACK	RMS	3A111K3	No	29	12.16	6.08														
					S003-SSS-2BUS-YPROT	RELAY TRIPPING LOW BURDEN ALSTOM MVAJ13	AREVA	MVAJ13	No	18			12.16	6.08												
					S003-SSS-2BUS-YPROT	RELAY TRIPPING LOW BURDEN ALSTOM MVAJ13	AREVA	MVAJ13	No	18			12.16	6.08												
					S003-SSS-2BUS-YPROT	RELAY TRIPPING SUPPLY FAIL ALSTOM MVAX12	AREVA	MVAX12	No	9			12.16	6.08												
					S003-SSS-2BUS-YPROT	RELAY CB FAIL BUS TRIP RACK	RMS	3A111K3	No	29			12.16	6.08												
					S003-SSS-2BUS-YPROT	RELAY CB FAIL BUS TRIP RACK	RMS	3A111K3	No	29			12.16	6.08												
2 BUS ZONE	275KV 2 BUS - BUS ZONE AND CB FAIL BUS TRIP X AND Y PROTECTION CUBICLE	+5A6	2006	4.00	S003-SSS-2BUS-BAYCONT	REMOTE TERMINAL UNIT FOXBORO C50	FOXBORO	C50	Yes	15					13.54	6.77					4.00	4.00	> 2041	2026/27 (b)	> 2041	> 2041
					S003-SSS-2BUS-XPROT	RELAY DIFF AREVA MFAC34 RANGE: 25-325VAC	AREVA	MFAC34	No	4	13.54	6.77														
					S003-SSS-2BUS-XPROT	RELAY TRIPPING LOW BURDEN ALSTOM MVAJ13	AREVA	MVAJ13	No	18	13.54	6.77														
					S003-SSS-2BUS-XPROT	RELAY TRIPPING LOW BURDEN ALSTOM MVAJ13	AREVA	MVAJ13	No	18	13.54	6.77														
					S003-SSS-2BUS-XPROT	RELAY TRIPPING SUPPLY FAIL ALSTOM MVAX12	AREVA	MVAX12	No	9	13.54	6.77														
					S003-SSS-2BUS-XPROT	RELAY CB FAIL BUS TRIP RACK	RMS	CB FAIL TRIP RACK	No	3	13.54	6.77														
					S003-SSS-2BUS-XPROT	RELAY CB FAIL BUS TRIP RACK	RMS	CB FAIL TRIP RACK	No	3	13.54	6.77														
					S003-SSS-2BUS-YPROT	RELAY DIFF AREVA MFAC34 RANGE: 25-325VAC	AREVA	MFAC34	No	4			13.54	6.77												
					S003-SSS-2BUS-YPROT	RELAY TRIPPING LOW BURDEN ALSTOM MVAJ13	AREVA	MVAJ13	No	18			13.54	6.77												
					S003-SSS-2BUS-YPROT	RELAY TRIPPING LOW BURDEN ALSTOM MVAJ13	AREVA	MVAJ13	No	18			13.54	6.77												
					S003-SSS-2BUS-YPROT	RELAY TRIPPING SUPPLY FAIL ALSTOM MVAX12	AREVA	MVAX12	No	9			13.54	6.77												
					S003-SSS-2BUS-YPROT	RELAY CB FAIL BUS TRIP RACK	RMS	CB FAIL TRIP RACK	No	3			13.54	6.77												
					S003-SSS-2BUS-YPROT	RELAY CB FAIL BUS TRIP RACK	RMS	CB FAIL TRIP RACK	No	3			13.54	6.77												
DIAMETER 10 COUPLER	275KV =C10-Q30 COUPLER X, Y PROTECTION AND CONTROL CUBICLE	+5A8	2006	4.00	S003-SSS-5010-BAYCONT	REMOTE TERMINAL UNIT FOXBORO C50	FOXBORO	C50	Yes	15					13.46	6.73					4.00	4.00	> 2041	2026/27 (b)	> 2041	> 2041
					S003-SSS-5010-XPROT	RELAY CB MGMT GE C60 (VER 2.93 FIRMWARE)	GE	C60 (VER 2.93)	Yes	9	12.46	6.23														
					S003-SSS-5010-YPROT	RELAY CB MGMT SEL 352 1A, 125Vdc, 4U	SCHWEITZER	SEL-352 (1A) (4U)	No	5			13.46	6.73												
					S003-SSS-5010-YPROT	FEEDER 836 SIT A (Y)	DEWAR	DM1200 DIGITAL	Yes	10			13.46	6.73												
					S003-SSS-5010-YPROT	FEEDER 836 SIT B (Y)	RFL ELECTRONICS	9745 DIGITAL	Yes	0			13.46	6.73												
DIAMETER 11 COUPLER	275KV =C11-Q30 COUPLER X, Y PROTECTION AND CONTROL CUBICLE	+5A11	2006	4.00	S003-SSS-5011-BAYCONT	REMOTE TERMINAL UNIT FOXBORO C50	FOXBORO	C50	Yes	15					13.53	6.77					4.00	4.00	> 2041	2026/27 (b)	> 2041	> 2041
					S003-SSS-5011-XPROT	RELAY CB MGMT GE C60 (VER 2.93 FIRMWARE)	GE	C60 (VER 2.93)	Yes	9	13.53	6.77														
					S003-SSS-5011-YPROT	RELAY CB MGMT SEL 352 1A, 125Vdc, 4U	SCHWEITZER	SEL-352 (1A) (4U)	No	5			13.53	6.77												
DIAMETER 12 COUPLER	275KV =C12-Q30 COUPLER X, Y PROTECTION AND CONTROL CUBICLE	+5A14	2006	4.00	S003-SSS-5012-BAYCONT	REMOTE TERMINAL UNIT FOXBORO C50	FOXBORO	C50	Yes	15					13.54	6.77					4.00	4.00	> 2041	2026/27 (b)	> 2041	> 2041
					S003-SSS-5012-XPROT	RELAY CB MGMT GE C60 (VER 2.93 FIRMWARE)	GE	C60 (VER 2.93)	Yes	9	13.54	6.77														
					S003-SSS-5012-YPROT	RELAY CB MGMT SEL 352 1A, 125Vdc, 4U	SCHWEITZER	SEL-352 (1A) (4U)	No	5			9.81	4.91												
DIAMETER 13 COUPLER	275KV =C13-Q30 COUPLER X, Y PROTECTION AND CONTROL CUBICLE	+6A2	2007	3.71	S003-SSS-5013-BAYCONT	REMOTE TERMINAL UNIT FOXBORO C50	FOXBORO	C50	Yes	15					12.16	6.08					3.71	3.71	> 2042	2027/28 (b)	> 2042	> 2042
					S003-SSS-5013-XPROT	RELAY CB MGMT GE C60 (VER 2.93 FIRMWARE)	GE	C60 (VER 2.93)	Yes	9	12.16	6.08														
					S003-SSS-5013-XPROT	BAY =C13-Q30 X PROT COUPLER CB FDR 8848 SIT A	DEWAR	DM1200 DIGITAL	Yes	10	12.16	6.08														
					S003-SSS-5013-XPROT	BAY =C13-Q30 X PROT COUPLER CB FDR 8848 SIT B	RFL ELECTRONICS	9745 DIGITAL	Yes	0	12.16	6.08														
					S003-SSS-5013-YPROT	RELAY CB MGMT SEL 352 1A, 125Vdc, 4U	SCHWEITZER	SEL-352 (1A) (4U)	No	5			12.16	6.08												

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Notes:
(a): Subject to Powerlink's O&M Safety Requirements, Current Standard Solutions and Implementation Methodologies, it may be more beneficial to align with the recommended replacement timeframe of sedondary systems equipment
(b): Recommended Timeframe is based on majority of Equipment Health Indices
(c): Based on Visual Inspection and Subject to the decision of the Control Building and Secondary Systems Panels. A number of New Cables may be requried if location of control building or secondary systems panels is changed.
(d): As a minimum requirement, Rubber Seals, Air filter and Terminals and Links are required to be repalced by the recommended timeframe. New Marshalling Kiosks should be considered if Exsiting Cables are to be reaplaced.

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

BAY	C&P PANEL				SECONDARY SYSTEMS EQUIPMENT						X-PROT		Y-PROT		AUX & CTRL		REVENUE METERING		OPSWAN		CABLES (HI)	YARD MARSHALLING KIOSKS (HI)	C&P PANELS (Chassis)	Sec Sys Eqiupment	CABLES	YARD MARSHALLING KIOSKS
Function	Panel Descripion	Panel No.	Year	HI	Functional Loc.	Description	Manufacturer	Model number	Obsolescence (Yes / No)	Spare Qty	Eff. Age	HI	Eff. Age	HI	Eff. Age	HI	Eff. Age	HI	Eff. Age	HI	C&P Panels to HV Yard Marshalling Kiosks (CB, MK, CT, VT, AC, DC, COOLING)	Yard Marshalling Kiosks (CB, MK, CT, VT, AC, DC, COOLING)	C&P Panels	Sec Sys Equipment & Auxiliary Components	C&P Panels to HV Yard Marshalling Kiosks (CB, MK, CT, VT, AC, DC, COOLING)	Yard Marshalling Kiosks (CB, MK, CT, VT, AC, DC, COOLING)
DIAMETER 14 COUPLER	275KV =C14-Q30 COUPLER X, Y PROTECTION AND CONTROL CUBICLE	+6A5	2007	3.71	S003-SSS-5014-BAYCONT	REMOTE TERMINAL UNIT FOXBORO C50	FOXBORO	C50	Yes	15					12.91	6.45					3.71	3.71	> 2042	2027/28 (b)	> 2042	> 2042
					S003-SSS-5014-XPROT	RELAY CB MGMT GE C60 (VER 2.93 FIRMWARE)	GE	C60 (VER 2.93)	Yes	9	12.16	6.08														
					S003-SSS-5014-XPROT	BAY C=14-Q30 X PROT COUPLER CB FDR 8849 SIT A	DEWAR	DM1200 DIGITAL	Yes	10	12.16	6.08														
					S003-SSS-5014-XPROT	BAY C=14-Q30 X PROT COUPLER CB FDR 8849 SIT B	RFL ELECTRONICS	9745 DIGITAL	Yes	0	12.16	6.08														
					S003-SSS-5014-YPROT	RELAY CB MGMT SEL 352 1A, 125Vdc, 4U	SCHWEITZER	SEL-352 (1A) (4U)	No	5			12.16	6.08												
DIAMETER 4 COUPLER	275KV =C04-Q30 COUPLER X, Y PROTECTION AND CONTROL CUBICLE	+4A6	2006	4.00	S003-SSS-504--BAYCONT	REMOTE TERMINAL UNIT FOXBORO C50	FOXBORO	C50	Yes	15					13.54	6.77					4.00	4.00	> 2041	2026/27 (b)	> 2041	> 2041
					S003-SSS-504--XPROT	RELAY CB MGMT GE C60 (VER 2.93 FIRMWARE)	GE	C60 (VER 2.93)	Yes	9	13.54	6.77														
					S003-SSS-504--YPROT	RELAY CB MGMT SEL 352 1A, 125Vdc, 4U	SCHWEITZER	SEL-352 (1A) (4U)	No	5			13.54	6.77												
					S003-SSS-504--YPROT	BAY C=04-Q30 Y PROT COUPLER CB FDR 8824 SIT A1	DEWAR	DM1200 DIGITAL	Yes	10			13.54	6.77												
					S003-SSS-504--YPROT	BAY C=04-Q30 Y PROT COUPLER CB FDR 8824 SIT A2	RFL ELECTRONICS	9745 DIGITAL	Yes	0			13.54	6.77												
					S003-SSS-504--YPROT	BAY C=04-Q30 Y PROT COUPLER CB FDR 8824 SIT B1	DEWAR	DM1200 DIGITAL	Yes	10			13.54	6.77												
					S003-SSS-504--YPROT	BAY C=04-Q30 Y PROT COUPLER CB FDR 8824 SIT B2	RFL ELECTRONICS	9745 DIGITAL	Yes	0			13.54	6.77												
DIAMETER 5 COUPLER	275KV =C05-Q30 COUPLER X, Y PROTECTION AND CONTROL CUBICLE	+4A9	2006	4.00	S003-SSS-505--BAYCONT	REMOTE TERMINAL UNIT FOXBORO C50	FOXBORO	C50	Yes	15					13.53	6.77					4.00	4.00	> 2041	2026/27 (b)	> 2041	> 2041
					S003-SSS-505--XPROT	RELAY CB MGMT GE C60 (VER 2.93 FIRMWARE)	GE	C60 (VER 2.93)	Yes	9	13.53	6.77														
					S003-SSS-505--XPROT	BAY C=05-Q30 X PROT COUPLER CB FDR 8822 SIT A	RFL ELECTRONICS	9745 DIGITAL	Yes	0	13.53	6.77														
					S003-SSS-505--XPROT	BAY C=05-Q30 X PROT COUPLER CB FDR 8822 SIT B	DEWAR	DM1200 DIGITAL	Yes	10	13.53	6.77														
					S003-SSS-505--YPROT	RELAY CB MGMT SEL 352 1A, 125Vdc, 4U	SCHWEITZER	SEL-352 (1A) (4U)	No	5			13.53	6.77												
					S003-SSS-505--YPROT	BAY C=05-Q30 Y PROT COUPLER CB FDR 8825 SIT A1	DEWAR	DM1200 DIGITAL	Yes	10			13.53	6.77												
					S003-SSS-505--YPROT	BAY C=05-Q30 Y PROT COUPLER CB FDR 8825 SIT A2	RFL ELECTRONICS	9745 DIGITAL	Yes	0			13.53	6.77												
					S003-SSS-505--YPROT	BAY C=05-Q30 Y PROT COUPLER CB FDR 8825 SIT B1	DEWAR	DM1200 DIGITAL	Yes	10			13.53	6.77												
					S003-SSS-505--YPROT	BAY C=05-Q30 Y PROT COUPLER CB FDR 8825 SIT B2	RFL ELECTRONICS	9745 DIGITAL	Yes	0			13.53	6.77												
DIAMETER 6 COUPLER	275KV =C06-Q30 COUPLER (CB 5062) X, Y PROTECTION AND CONTROL CUBICLE	+4A12	2006	4.00	S003-SSS-506--BAYCONT	REMOTE TERMINAL UNIT FOXBORO C50	FOXBORO	C50	Yes	15					13.46	6.73					4.00	4.00	> 2041	2026/27 (b)	> 2041	> 2041
					S003-SSS-506--XPROT	RELAY CB MGMT GE C60 (VER 2.93 FIRMWARE)	GE	C60 (VER 2.93)	Yes	9	13.46	6.73														
					S003-SSS-506--XPROT	BAY C=06-Q30 X PROT COUPLER CB FDR 805 SIT A	DEWAR	DM1200 DIGITAL	Yes	10	13.46	6.73														
					S003-SSS-506--XPROT	BAY C=06-Q30 X PROT COUPLER CB FDR 805 SIT B	RFL ELECTRONICS	9745 DIGITAL	Yes	0	13.46	6.73														
					S003-SSS-506--YPROT	RELAY CB MGMT SEL 352 1A, 125Vdc, 4U	SCHWEITZER	SEL-352 (1A) (4U)	No	5			13.46	6.73												
					S003-SSS-506--YPROT	BAY C=06-Q30 Y PROT COUPLER CB FDR 835 SIT A	DEWAR	DM1200 DIGITAL	Yes	10			13.46	6.73												
					S003-SSS-506--YPROT	BAY C=06-Q30 Y PROT COUPLER CB FDR 835 SIT B	RFL ELECTRONICS	9745 DIGITAL	Yes	0			13.46	6.73												
DIAMETER 14 SVC 2 BUS FDR	275KV =C14-Q20 SVC (CB 58112) X, Y PROTECTION AND CONTROL CUBICLE	+6A6	2008	3.43	S003-SSS-5811-BAYCONT	REMOTE TERMINAL UNIT FOXBORO C50	FOXBORO	C50	Yes	15					11.08	5.54					3.43	3.43	> 2043	2028/29 (b)	> 2043	> 2043
					S003-SSS-5811-XPROT	RELAY CB MGMT GE C60 (VER 2.93 FIRMWARE)	GE	C60 (VER 2.93)	Yes	9	11.08	5.54														
					S003-SSS-5811-YPROT	RELAY CB MGMT SEL 352 1A, 125Vdc, 4U	SCHWEITZER	SEL-352 (1A) (4U)	No	5			11.08	5.54												
DIAMETER 8 CAP 3 (1 BUS)	275KV =C08-Q10 (CB 5832) CAP 3 X, Y PROTECTION AND CONTROL CUBICLE	+5B3	2006	4.00	S003-SSS-583--BAYCONT	REMOTE TERMINAL UNIT FOXBORO C50	FOXBORO	C50	Yes	15					13.46	6.73					4.00	4.00	> 2041	2026/27 (b)	> 2041	> 2041
					S003-SSS-583--POWAVE	RELAY POINT ON WAVE ABB E213	ABB	SWITCHSYNC E213	Yes	0					13.46	6.73										
					S003-SSS-583--XPROT	RELAY DIFF AREVA MFAC34 RANGE: 25-325VAC	AREVA	MFAC34	No	4	13.46	6.73														
					S003-SSS-583--XPROT	RELAY CAP PROTN ABB SPAJ160C (A PHASE)	ABB	SPAJ160C	No	3	13.46	6.73														
					S003-SSS-583--XPROT	RELAY CAP PROTN ABB SPAJ160C (B PHASE)	ABB	SPAJ160C	No	3	13.46	6.73														
					S003-SSS-583--XPROT	RELAY CAP PROTN ABB SPAJ160C (C PHASE)	ABB	SPAJ160C	No	3	13.46	6.73														
					S003-SSS-583--XPROT	RELAY CB MGMT GE C60 (VER 2.93 FIRMWARE)	GE	C60 (VER 2.93)	Yes	9	13.46	6.73														
					S003-SSS-583--YPROT	RELAY CAP PROTN ABB SPAJ160C (A PHASE)	ABB	SPAJ160C	No	3			13.46	6.73												
					S003-SSS-583--YPROT	RELAY CAP PROTN ABB SPAJ160C (B PHASE)	ABB	SPAJ160C	No	3			13.46	6.73												
					S003-SSS-583--YPROT	RELAY CAP PROTN ABB SPAJ160C (C PHASE)	ABB	SPAJ160C	No	3			13.46	6.73												
					S003-SSS-583--YPROT	RELAY CBMAN SEL-351-1 (1A)	SCHWEITZER	SEL-351-1 (1A)	Yes	11			13.46	6.73												
DIAMETER 8 CAP 4 (2 BUS)	275KV =C08-Q20 CAP 4 X, Y PROTECTION AND CONTROL CUBICLE	+5B4	2006	4.00	S003-SSS-584--BAYCONT	REMOTE TERMINAL UNIT FOXBORO C50	FOXBORO	C50	Yes	15					13.46	6.73					4.00	4.00	> 2041	2026/27 (b)	> 2041	> 2041
					S003-SSS-584--POWAVE	RELAY POINT ON WAVE ABB E213	ABB	SWITCHSYNC E213	Yes	0					13.46	6.73										
					S003-SSS-584--XPROT	RELAY DIFF AREVA MFAC34 RANGE: 25-325VAC	AREVA	MFAC34	No	4	13.46	6.73														
					S003-SSS-584--XPROT	RELAY CAP PROTN ABB SPAJ160C (A PHASE)	ABB	SPAJ160C	No	3	13.46	6.73														
					S003-SSS-584--XPROT	RELAY CAP PROTN ABB SPAJ160C (B PHASE)	ABB	SPAJ160C	No	3	13.46	6.73														
					S003-SSS-584--XPROT	RELAY CAP PROTN ABB SPAJ160C (C PHASE)	ABB	SPAJ160C	No	3	13.46	6.73														
					S003-SSS-584--XPROT	RELAY CB MGMT GE C60 (VER 2.93 FIRMWARE)	GE	C60 (VER 2.93)	Yes	9	13.46	6.73														
					S003-SSS-584--YPROT	RELAY CAP PROTN ABB SPAJ160C (A PHASE)	ABB	SPAJ160C	No	3			13.46	6.73												
					S003-SSS-584--YPROT	RELAY CAP PROTN ABB SPAJ160C (B PHASE)	ABB	SPAJ160C	No	3			13.46	6.73												
					S003-SSS-584--YPROT	RELAY CAP PROTN ABB SPAJ160C (C PHASE)	ABB	SPAJ160C	No	3			13.46	6.73												
					S003-SSS-584--YPROT	RELAY CBMAN SEL-351-1 (1A)	SCHWEITZER	SEL-351-1 (1A)	Yes	11			13.46	6.73												

APPENDIX A - S003 GREENBANK 275KV SUBSTATION AND SVC SECONDARY SYSTEMS - EQUIPMENT HEALTH INDICES AND RECOMMENDED REPLACEMENT TIMEFRAME

Notes:

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

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

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

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

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

BAY	C&P PANEL				SECONDARY SYSTEMS EQUIPMENT						X-PROT		Y-PROT		AUX & CTRL		REVENUE METERING		OPSWAN		CABLES (HI)	YARD MARSHALLING KIOSKS (HI)	C&P PANELS (Chassis)	Sec Sys Eqiupment	CABLES	YARD MARSHALLIN G KIOSKS
Function	Panel Descripion	Panel No.	Year	HI	Functional Loc.	Description	Manufacturer	Model number	Obsolescence (Yes / No)	Spare Qty	Eff. Age	HI	Eff. Age	HI	Eff. Age	HI	Eff. Age	HI	Eff. Age	HI	C&P Panels to HV Yard Marshalling Kiosks (CB, MK, CT, VT, AC, DC, COOLING)	Yard Marshalling Kiosks (CB, MK, CT, VT, AC, DC, COOLING)	C&P Panels	Sec Sys Equipment & Auxiliary Components	C&P Panels to HV Yard Marshalling Kiosks (CB, MK, CT, VT, AC, DC, COOLING)	Yard Marshalling Kiosks (CB, MK, CT, VT, AC, DC, COOLING)
DIAMETER 15 CAP 5 (1 BUS)	275KV =C15-Q10 CAP 5 X, Y PROTECTION AND CONTROL CUBICLE	+6A7	2007	3.71	S003-SSS-585--BAYCONT	REMOTE TERMINAL UNIT FOXBORO C50	FOXBORO	C50	Yes	15					12.17	6.09					3.71	3.71	> 2042	2027/28 (b)	> 2042	> 2042
					S003-SSS-585--POWAVE	RELAY POINT ON WAVE ABB E213	ABB	SWITCHSYNC E213	Yes	0					12.17	6.09										
					S003-SSS-585--XPROT	RELAY DIFF AREVA MFAC34 RANGE: 25-325VAC	AREVA	MFAC34	No	4	12.17	6.09														
					S003-SSS-585--XPROT	RELAY CB MGMT GE C60 (VER 2.93 FIRMWARE)	GE	C60 (VER 2.93)	Yes	9	12.17	6.09														
					S003-SSS-585--XPROT	RELAY CAP PROTN ABB SPAJ160C (A PHASE)	ABB	SPAJ160C	No	3	12.17	6.09														
					S003-SSS-585--XPROT	RELAY CAP PROTN ABB SPAJ160C (B PHASE)	ABB	SPAJ160C	No	3	12.17	6.09														
					S003-SSS-585--XPROT	RELAY CAP PROTN ABB SPAJ160C (C PHASE)	ABB	SPAJ160C	No	3	12.17	6.09														
					S003-SSS-585--YPROT	RELAY CBMAN SEL-351-1 (1A)	SCHWEITZER	SEL-351-1 (1A)	Yes	11			12.17	6.09												
					S003-SSS-585--YPROT	RELAY CAP PROTN ABB SPAJ160C (A PHASE)	ABB	SPAJ160C	No	3			12.17	6.09												
					S003-SSS-585--YPROT	RELAY CAP PROTN ABB SPAJ160C (B PHASE)	ABB	SPAJ160C	No	3			12.17	6.09												
					S003-SSS-585--YPROT	RELAY CAP PROTN ABB SPAJ160C (C PHASE)	ABB	SPAJ160C	No	3			12.17	6.09												
DIAMETER 15 CAP 6 (2 BUS)	275KV =C15-Q20 CAP 6 X, Y PROTECTION AND CONTROL CUBICLE	+6A8	2007	3.71	S003-SSS-586--BAYCONT	REMOTE TERMINAL UNIT FOXBORO C50	FOXBORO	C50	Yes	15					12.16	6.08					3.71	3.71	> 2042	2027/28 (b)	> 2042	> 2042
					S003-SSS-586--POWAVE	RELAY POINT ON WAVE ABB E213	ABB	SWITCHSYNC E213	Yes	0					12.16	6.08										
					S003-SSS-586--XPROT	RELAY DIFF AREVA MFAC34 RANGE: 25-325VAC	AREVA	MFAC34	No	4	12.16	6.08														
					S003-SSS-586--XPROT	RELAY CB MGMT GE C60 (VER 2.93 FIRMWARE)	GE	C60 (VER 2.93)	Yes	9	12.16	6.08														
					S003-SSS-586--XPROT	RELAY CAP PROTN ABB SPAJ160C (A PHASE)	ABB	SPAJ160C	No	3	12.16	6.08														
					S003-SSS-586--XPROT	RELAY CAP PROTN ABB SPAJ160C (B PHASE)	ABB	SPAJ160C	No	3	12.16	6.08														
					S003-SSS-586--XPROT	RELAY CAP PROTN ABB SPAJ160C (C PHASE)	ABB	SPAJ160C	No	3	12.16	6.08														
					S003-SSS-586--YPROT	RELAY CAP PROTN ABB SPAJ160C (A PHASE)	ABB	SPAJ160C	No	3			12.16	6.08												
					S003-SSS-586--YPROT	RELAY CAP PROTN ABB SPAJ160C (B PHASE)	ABB	SPAJ160C	No	3			12.16	6.08												
					S003-SSS-586--YPROT	RELAY CAP PROTN ABB SPAJ160C (C PHASE)	ABB	SPAJ160C	No	3			12.16	6.08												
					S003-SSS-586--YPROT	RELAY CBMAN SEL-351-1 (1A)	SCHWEITZER	SEL-351-1 (1A)	Yes	11			12.16	6.08												
DIAMETER 15 CAP 8	275KV =C16-Q20 CAP 8 X, Y PROTECTION AND CONTROL CUBICLE	+6A9	2009	3.14	S003-SSS-588--BAYCONT	REMOTE TERMINAL UNIT FOXBORO C50	FOXBORO	C50	Yes	15					10.40	5.20					3.14	3.14	> 2044	2029/30 (b)	> 2044	> 2044
					S003-SSS-588--POWAVE	RELAY POINT ON WAVE ABB E213	ABB	SWITCHSYNC E213	Yes	0					10.40	5.20										
					S003-SSS-588--XPROT	RELAY CAP PROTN ABB SPAJ160C	ABB	SPAJ160C	No	3	10.40	5.20														
					S003-SSS-588--XPROT	RELAY CAP PROTN ABB SPAJ160C	ABB	SPAJ160C	No	3	10.40	5.20														
					S003-SSS-588--XPROT	RELAY CAP PROTN ABB SPAJ160C	ABB	SPAJ160C	No	3	11.21	5.61														
					S003-SSS-588--XPROT	RELAY CB MGMT GE C60 (VER 2.93 FIRMWARE)	GE	C60 (VER 2.93)	Yes	9	10.60	5.30														
					S003-SSS-588--XPROT	RELAY DIFF ALSTOM MFAC34 RANGE 25-325VAC	ALSTOM	MFAC34	No	4	10.40	5.20														
					S003-SSS-588--YPROT	RELAY CAP PROTN ABB SPAJ160C	ABB	SPAJ160C	No	3			10.40	5.20												
					S003-SSS-588--YPROT	RELAY CAP PROTN ABB SPAJ160C	ABB	SPAJ160C	No	3			10.40	5.20												
					S003-SSS-588--YPROT	RELAY CAP PROTN ABB SPAJ160C	ABB	SPAJ160C	No	3			10.40	5.20												
					S003-SSS-588--YPROT	RELAY CB MGMT SEL-451 1A, 125VDC	SCHWEITZER	SEL-451 (1A)	Yes	23			10.40	5.20												
DIAMETER 10 - FEEDER 1 (SPARE) (SPARE)	275KV =C10-Q10 - FEEDER 1 (SPARE) X, Y PROTECTION AND CONTROL CUBICLE	+5A7	2006	4.00	S003-SSS-597--BAYCONT	REMOTE TERMINAL UNIT FOXBORO C50	FOXBORO	C50	Yes	15					13.46	6.73					4.00	4.00	> 2041	2026/27 (b)	> 2041	> 2041
					S003-SSS-597--XPROT	CURR DIFF RELAY MICOM P544 + 2ND PORT	MICOM	P544 (+ 2nd Port)	Yes	9	13.53	6.77														
					S003-SSS-597--XPROT	COMMS INTERFACE UNIT ALSTOM P591	AREVA	P591 (50VDC)	Yes	90	13.46	6.73														
					S003-SSS-597--YPROT	RELAY DISTANCE SEL-421 (1A) (5U)	SCHWEITZER	SEL-421 (1A) (5U)	Yes	7			12.19	6.10												
					S003-SSS-597--YPROT	A11	SCHWEITZER	SEL 2506	No	1			0.00	0.00												
DIAMETER 06 - FEEDER 805	275KV =C06-Q10 FEEDER 805 (SWANBANK E) X, Y PROTECTION AND CONTROL CUBICLE	+4A11	2006	4.00	S003-SSS-805--BAYCONT	REMOTE TERMINAL UNIT FOXBORO C50	FOXBORO	C50	Yes	15					13.46	6.73					4.00	4.00	> 2041	2026/27 (b)	> 2041	> 2041
					S003-SSS-805--PSSITA	DEWAR DM1200 PROT SIG DIG 90-320V SUPPLY	DEWAR	DM1200 DIGITAL	Yes	10					13.25	6.62										
					S003-SSS-805--PSSITB	RFL 9745 PROT SIG DIG I/O 48-125V	RFL ELECTRONICS	9745 DIGITAL	Yes	0					13.25	6.62										
					S003-SSS-805--XPROT	RELAY CB MGMT GE C60 (VER 2.93 FIRMWARE)	GE	C60 (VER 2.93)	Yes	9	13.46	6.73														
					S003-SSS-805--XPROT	RELAY DIFF GE L90 2T H00 N6U-SXX-U6T-W7R	GE	L90 2T : H00 N6U U6T	No	7	13.98	6.99														
					S003-SSS-805--YPROT	CURR DIFF RELAY MICOM P544 + 2ND PORT	MICOM	P544 (+ 2nd Port)	Yes	9			13.46	6.73												
					S003-SSS-805--YPROT	COMMS INTERFACE UNIT ALSTOM P591	AREVA	P591 (50VDC)	Yes	90			13.46	6.73												
DIAMETER 06 - FEEDER 835	275KV =C06-Q20 FEEDER 835 (MUDGEERABA) X, Y PROTECTION AND CONTROL CUBICLE	+4A13	2006	4.00	S003-SSS-835--BAYCONT	REMOTE TERMINAL UNIT FOXBORO C50	FOXBORO	C50	Yes	15					13.46	6.73					4.00	4.00	> 2041	2026/27 (b)	> 2041	> 2041
					S003-SSS-835--PSSITA	DEWAR DM1200 PROT SIG DIG 90-320V SUPPLY	DEWAR	DM1200 DIGITAL	Yes	10					13.26	6.63										
					S003-SSS-835--PSSITB	RFL 9745 PROT SIG DIG I/O 48-125V	RFL ELECTRONICS	9745 DIGITAL	Yes	0					13.26	6.63										
					S003-SSS-835--XPROT	RELAY CB MGMT GE C60 (VER 2.93 FIRMWARE)	GE	C60 (VER 2.93)	Yes	9	13.46	6.73														
					S003-SSS-835--XPROT	RELAY DIFF GE L90 2T H00 N6U-SXX-U6T-W7R	GE	L90 2T : H00 N6U U6T	No	7	13.98	6.99														
					S003-SSS-835--YPROT	CURR DIFF RELAY MICOM P544 + 2ND PORT	MICOM	P544 (+ 2nd Port)	Yes	9			13.46	6.73												
					S003-SSS-835--YPROT	COMMS INTERFACE UNIT ALSTOM P591	AREVA	P591 (50VDC)	Yes	90			13.46	6.73												

APPENDIX A - S003 GREENBANK 275KV SUBSTATION AND SVC SECONDARY SYSTEMS - EQUIPMENT HEALTH INDICES AND RECOMMENDED REPLACEMENT TIMEFRAME

Notes:
(a): Subject to Powerlink's O&M Safety Requirements, Current Standard Solutions and Implementation Methodologies, it may be more beneficial to align with the recommended replacement timeframe of sedondary systems equipment
(b): Recommended Timeframe is based on majority of Equipment Health Indices
(c): Based on Visual Inspection and Subject to the decision of the Control Building and Secondary Systems Panels. A number of New Cables may be requried if location of control building or secondary systems panels is changed.
(d): As a minimum requirement, Rubber Seals, Air filter and Terminals and Links are required to be repalced by the recommended timeframe. New Marshalling Kiosks should be considered if Exsiting Cables are to be reaplaced.

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

BAY	C&P PANEL				SECONDARY SYSTEMS EQUIPMENT						X-PROT		Y-PROT		AUX & CTRL		REVENUE METERING		OPSWAN		CABLES (HI)	YARD MARSHALLING KIOSKS (HI)	C&P PANELS (Chassis)	Sec Sys Equipment	CABLES	YARD MARSHALLING KIOSKS
Function	Panel Descripion	Panel No.	Year	HI	Functional Loc.	Description	Manufacturer	Model number	Obsolescence (Yes / No)	Spare Qty	Eff. Age	HI	Eff. Age	HI	Eff. Age	HI	Eff. Age	HI	Eff. Age	HI	C&P Panels to HV Yard Marshalling Kiosks (CB, MK, CT, VT, AC, DC, COOLING)	Yard Marshalling Kiosks (CB, MK, CT, VT, AC, DC, COOLING)	C&P Panels	Sec Sys Equipment & Auxiliary Components	C&P Panels to HV Yard Marshalling Kiosks (CB, MK, CT, VT, AC, DC, COOLING)	Yard Marshalling Kiosks (CB, MK, CT, VT, AC, DC, COOLING)
DIAMETER 10 - FEEDER 836	275KV =C10-Q20 FEEDER 836 (MUDGEERABA) X, Y PROTECTION AND CONTROL CUBICLE	+5A9	2006	4.00	S003-SSS-836--BAYCONT	REMOTE TERMINAL UNIT FOXBORO C50	FOXBORO	C50	Yes	15					13.46	6.73					4.00	4.00	> 2041	2026/27 (b)	> 2041	> 2041
					S003-SSS-836--PMU	RELAY CB MGMT SEL-451-5 1A, 125VDC	SCHWEITZER	SEL-451-5 (1A)	No	3					7.25	3.62										
					S003-SSS-836--PSPITY	DEWAR DM1200 PROT SIG DIG 90-320V SUPPLY	DEWAR	DM1200 DIGITAL	Yes	10					13.24	6.62										
					S003-SSS-836--PSSITA	DEWAR DM1200 PROT SIG DIG 90-320V SUPPLY	DEWAR	DM1200 DIGITAL	Yes	10					13.24	6.62										
					S003-SSS-836--PSSITB	RFL 9745 PROT SIG DIG I/O 48-125V	RFL ELECTRONICS	9745 DIGITAL	Yes	0					13.24	6.62										
					S003-SSS-836--XPROT	CURR DIFF RELAY MICOM P544 + 2ND PORT	MICOM	P544 (+ 2nd Port)	Yes	9	13.46	6.73														
					S003-SSS-836--XPROT	COMMS INTERFACE UNIT ALSTOM P591	AREVA	P591 (50VDC)	Yes	90	13.46	6.73														
					S003-SSS-836--YPROT	RELAY DISTANCE SCHW'ZER 421-5 1A 24 LED	SCHWEITZER	SEL-421-5 (1A) (5U)	Yes	6			9.00	4.50												
DIAMETER 04 - FEEDER 8813	275KV =C04-Q10 FEEDER 8813 (LOGANLEA) X, Y PROTECTION AND CONTROL CUBICLE	+4A5	2006	4.00	S003-SSS-8813-BAYCONT	REMOTE TERMINAL UNIT FOXBORO C50	FOXBORO	C50	Yes	15					13.54	6.77					4.00	4.00	> 2041	2026/27 (b)	> 2041	> 2041
					S003-SSS-8813-XPROT	RELAY CB MGMT GE C60 (VER 2.93 FIRMWARE)	GE	C60 (VER 2.93)	Yes	9	13.54	6.77														
					S003-SSS-8813-XPROT	RELAY ABB RED670 REM END CCIS IPASS 6I6U	ABB	RED670 REM END CCIS	No	4	14.25	7.12														
					S003-SSS-8813-YPROT	RELAY DISTANCE SEL-421 (1A) (5U)	SCHWEITZER	SEL-421 (1A) (5U)	Yes	7			13.54	6.77												
DIAMETER 05 - FEEDER 8822	275KV =C05-Q10 FEEDER 8822 (BELMONT) X, Y PROTECTION AND CONTROL CUBICLE	+4A8	2006	4.00	S003-SSS-8822-BAYCONT	REMOTE TERMINAL UNIT FOXBORO C50	FOXBORO	C50	Yes	15					13.53	6.77					4.00	4.00	> 2041	2026/27 (b)	> 2041	> 2041
					S003-SSS-8822-PSPITY	DEWAR DM1200 PROT SIG DIG 90-320V SUPPLY	DEWAR	DM1200 DIGITAL	Yes	10					13.53	6.77										
					S003-SSS-8822-PSSITA	RFL 9745 PROT SIG DIG I/O 48-125V	RFL ELECTRONICS	9745 DIGITAL	Yes	0					13.53	6.77										
					S003-SSS-8822-PSSITB	DEWAR DM1200 PROT SIG DIG 90-320V SUPPLY	DEWAR	DM1200 DIGITAL	Yes	10					13.53	6.77										
					S003-SSS-8822-XPROT	CURR DIFF RELAY MICOM P544 + 2ND PORT	MICOM	P544 (+ 2nd Port)	Yes	9	13.53	6.77														
					S003-SSS-8822-YPROT	RELAY DISTANCE SEL-421 (1A) (5U)	SCHWEITZER	SEL-421 (1A) (5U)	Yes	7			13.53	6.77												
DIAMETER 04 - FEEDER 8824	275KV =C04-Q20 FEEDER 8824 (MOLENDINAR) X, Y PROTECTION AND CONTROL CUBICLE	+4A7	2006	4.00	S003-SSS-8824-BAYCONT	REMOTE TERMINAL UNIT FOXBORO C50	FOXBORO	C50	Yes	15					13.54	6.77					4.00	4.00	> 2041	2026/27 (b)	> 2041	> 2041
					S003-SSS-8824-PSSITA1	DEWAR DM1200 PROT SIG DIG 90-320V SUPPLY	DEWAR	DM1200 DIGITAL	Yes	10					13.27	6.64										
					S003-SSS-8824-PSSITA2	RFL 9745 PROT SIG DIG I/O 48-125V	RFL ELECTRONICS	9745 DIGITAL	Yes	0					13.27	6.64										
					S003-SSS-8824-PSSITB1	DEWAR DM1200 PROT SIG DIG 90-320V SUPPLY	DEWAR	DM1200 DIGITAL	Yes	10					13.27	6.64										
					S003-SSS-8824-PSSITB2	RFL 9745 PROT SIG DIG I/O 48-125V	RFL ELECTRONICS	9745 DIGITAL	Yes	0					13.27	6.64										
					S003-SSS-8824-XPROT	RELAY CB MGMT GE C60 (VER 2.93 FIRMWARE)	GE	C60 (VER 2.93)	Yes	9	13.54	6.77														
					S003-SSS-8824-XPROT	RELAY DIFF GE L90 2T H00 N6U-SXX-U6T-W7R	GE	L90 2T : H00 N6U U6T	No	7	13.98	6.99														
					S003-SSS-8824-YPROT	CURR DIFF RELAY MICOM P544 + 2ND PORT	MICOM	P544 (+ 2nd Port)	Yes	9			13.54	6.77												
					S003-SSS-8824-YPROT	COMMS INTERFACE UNIT ALSTOM P591	AREVA	P591 (50VDC)	Yes	90			13.54	6.77												
DIAMETER 05 - FEEDER 8825	275KV =C05-Q20 FEEDER 8825 (MOLENDINAR) X, Y PROTECTION AND CONTROL CUBICLE	+4A10	2006	4.00	S003-SSS-8825-BAYCONT	REMOTE TERMINAL UNIT FOXBORO C50	FOXBORO	C50	Yes	15					13.53	6.77					4.00	4.00	> 2041	2026/27 (b)	> 2041	> 2041
					S003-SSS-8825-PSSITA1	DEWAR DM1200 PROT SIG DIG 90-320V SUPPLY	DEWAR	DM1200 DIGITAL	Yes	10					13.53	6.77										
					S003-SSS-8825-PSSITA2	RFL 9745 PROT SIG DIG I/O 48-125V	RFL ELECTRONICS	9745 DIGITAL	Yes	0					13.53	6.77										
					S003-SSS-8825-PSSITB1	DEWAR DM1200 PROT SIG DIG 90-320V SUPPLY	DEWAR	DM1200 DIGITAL	Yes	10					13.53	6.77										
					S003-SSS-8825-PSSITB2	RFL 9745 PROT SIG DIG I/O 48-125V	RFL ELECTRONICS	9745 DIGITAL	Yes	0					13.53	6.77										
					S003-SSS-8825-XPROT	RELAY CB MGMT GE C60 (VER 2.93 FIRMWARE)	GE	C60 (VER 2.93)	Yes	9	13.53	6.77														
					S003-SSS-8825-XPROT	RELAY DIFF GE L90 2T H00 N6U-SXX-U6T-W7R	GE	L90 2T : H00 N6U U6T	No	7	13.98	6.99														
					S003-SSS-8825-YPROT	CURR DIFF RELAY ALSTOM P544 + 2ND PORT	MICOM	P544 (+ 2nd Port)	Yes	9			12.40	6.20												
					S003-SSS-8825-YPROT	COMMS INTERFACE UNIT ALSTOM P591	AREVA	P591 (50VDC)	Yes	90			13.53	6.77												
DIAMETER 13 - FEEDER 8848	275KV =C13-Q10 FEEDER 8848 (MIDDLE RIDGE) X, Y PROTECTION AND CONTROL CUBICLE	+6A1	2007	3.71	S003-SSS-8848-BAYCONT	REMOTE TERMINAL UNIT FOXBORO C50	FOXBORO	C50	Yes	15					12.17	6.09					3.71	3.71	> 2042	2027/28 (b)	> 2042	> 2042
					S003-SSS-8848-PSBLKA	DEWAR DM1200 PROT SIG DIG 90-320V SUPPLY	DEWAR	DM1200 DIGITAL	Yes	10					12.17	6.09										
					S003-SSS-8848-PSBLKB	DEWAR DM1200 PROT SIG DIG 90-320V SUPPLY	DEWAR	DM1200 DIGITAL	Yes	10					12.17	6.09										
					S003-SSS-8848-PSSITA	DEWAR DM1200 PROT SIG DIG 90-320V SUPPLY	DEWAR	DM1200 DIGITAL	Yes	10					11.57	5.78										
					S003-SSS-8848-PSSITB	RFL 9745 PROT SIG DIG I/O 48-125V	RFL ELECTRONICS	9745 DIGITAL	Yes	0					11.82	5.91										
					S003-SSS-8848-XPROT	CURR DIFF RELAY MICOM P544 + 2ND PORT	MICOM	P544 (+ 2nd Port)	Yes	9	12.17	6.09														
					S003-SSS-8848-XPROT	COMMS INTERFACE UNIT ALSTOM P591	AREVA	P591 (50VDC)	Yes	90	12.17	6.09														
					S003-SSS-8848-YPROT	RELAY DISTANCE SEL-421 (1A) (5U)	SCHWEITZER	SEL-421 (1A) (5U)	Yes	7			12.17	6.09												

APPENDIX A - S003 GREENBANK 275KV SUBSTATION AND SVC SECONDARY SYSTEMS - EQUIPMENT HEALTH INDICES AND RECOMMENDED REPLACEMENT TIMEFRAME

Notes:
(a): Subject to Powerlink's O&M Safety Requirements, Current Standard Solutions and Implementation Methodologies, it may be more beneficial to align with the recommended replacement timeframe of sedondary systems equipment
(b): Recommended Timeframe is based on majority of Equipment Health Indices
(c): Based on Visual Inspection and Subject to the decision of the Control Building and Secondary Systems Panels. A number of New Cables may be requried if location of control building or secondary systems panels is changed.
(d): As a minimum requirement, Rubber Seals, Air filter and Terminals and Links are required to be repalced by the recommended timeframe. New Marshalling Kiosks should be considered if Exsiting Cables are to be reaplaced.

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

BAY	C&P PANEL				SECONDARY SYSTEMS EQUIPMENT						X-PROT		Y-PROT		AUX & CTRL		REVENUE METERING		OPSWAN		CABLES (HI)	YARD MARSHALLING KIOSKS (HI)	C&P PANELS (Chassis)	Sec Sys Eqiupment	CABLES	YARD MARSHALLING KIOSKS
Function	Panel Descripion	Panel No.	Year	HI	Functional Loc.	Description	Manufacturer	Model number	Obsolescence (Yes / No)	Spare Qty	Eff. Age	HI	Eff. Age	HI	Eff. Age	HI	Eff. Age	HI	Eff. Age	HI	C&P Panels to HV Yard Marshalling Kiosks (CB, MK, CT, VT, AC, DC, COOLING)	Yard Marshalling Kiosks (CB, MK, CT, VT, AC, DC, COOLING)	C&P Panels	Sec Sys Equipment & Auxiliary Components	C&P Panels to HV Yard Marshalling Kiosks (CB, MK, CT, VT, AC, DC, COOLING)	Yard Marshalling Kiosks (CB, MK, CT, VT, AC, DC, COOLING)
DIAMETER 14 - FEEDER 8849	275KV =C14-Q10 FEEDER 8849 (MIDDLE RIDGE) X, Y PROTECTION AND CONTROL CUBICLE	+6A4	2007	3.71	S003-SSS-8849-BAYCONT	REMOTE TERMINAL UNIT FOXBORO C50	FOXBORO	C50	Yes	15					12.17	6.09					3.71	3.71	> 2042	2027/28 (b)	> 2042	> 2042
					S003-SSS-8849-PSPITY	DEWAR DM1200 PROT SIG DIG90-320V SUPPLY	DEWAR	DM1200 DIGITAL	Yes	10					12.17	6.09										
					S003-SSS-8849-PSSITA	DEWAR DM1200 PROT SIG DIG90-320V SUPPLY	DEWAR	DM1200 DIGITAL	Yes	10					11.57	5.78										
					S003-SSS-8849-PSSITB	RFL 9745 PROT SIG DIG I/O 48-125V	RFL ELECTRONICS	9745 DIGITAL	Yes	0					11.93	5.96										
					S003-SSS-8849-XPROT	CURR DIFF RELAY MICOM P544 + 2ND PORT	MICOM	P544 (+ 2nd Port)	Yes	9	12.17	6.09														
					S003-SSS-8849-XPROT	COMMS INTERFACE UNIT ALSTOM P591	AREVA	P591 (50VDC)	Yes	90	12.17	6.09														
					S003-SSS-8849-YPROT	RELAY DISTANCE SCHW'ZER 421-5 1A 24 LED	SCHWEITZER	SEL-421-5 (1A) (5U)	Yes	6			9.00	4.50												
DIAMETER 12 - FEEDER 8887	275KV =C12-Q10 FEEDER 8887 (BLACKSTONE) X, Y PROTECTION AND CONTROL CUBICLE	+5A13	2006	4.00	S003-SSS-8887-BAYCONT	REMOTE TERMINAL UNIT FOXBORO C50	FOXBORO	C50	Yes	15					13.54	6.77					4.00	4.00	> 2041	2026/27 (b)	> 2041	> 2041
					S003-SSS-8887-XPROT	CURR DIFF RELAY ALSTOM P544 + 2ND PORT	ALSTOM	P544 (+ 2nd Port)	Yes	9	13.47	6.73														
					S003-SSS-8887-XPROT	COMMS INTERFACE UNIT ALSTOM P591	AREVA	P591 (50VDC)	Yes	90	13.54	6.77														
					S003-SSS-8887-YPROT	RELAY DISTANCE SEL-421 (1A) (5U)	SCHWEITZER	SEL-421 (1A) (5U)	Yes	7			13.54	6.77												
DIAMETER 11 - FEEDER 8888	275KV =C11-Q10 FEEDER 8888 (BLACKSTONE) X, Y PROTECTION AND CONTROL CUBICLE	+5A10	2006	4.00	S003-SSS-8888-BAYCONT	REMOTE TERMINAL UNIT FOXBORO C50	FOXBORO	C50	Yes	15					13.53	6.77					4.00	4.00	> 2041	2026/27 (b)	> 2041	> 2041
					S003-SSS-8888-XPROT	RELAY CURR DIFF DISTANCE MICOM P546	SCHNEIDER	P546	Yes	14	9.61	4.80														
					S003-SSS-8888-YPROT	RELAY DISTANCE SEL-421 (1A) (5U)	SCHWEITZER	SEL-421 (1A) (5U)	Yes	7			13.53	6.77												
LOCAL WYES TERM BLDG 1	AMENITIES BUILDING (BUILDING 1) LAN EXTENSION CUBICLE	+1A5	2007	3.71	S003-SSS-NBAY-LCF1	LOCAL CONTROL FACILITY PC X TERMINAL	WYSE	V90L XPe 1GB/512MB	Yes	0					6.98	5.81					3.71	3.71	> 2042	2027/28 (b)	> 2042	> 2042
					S003-SSS-NBAY-LCF1	MONITOR TFT	HEWLETT PACKARD	L1740	Yes	1					0.78	0.65										
					S003-SSS-NBAY-OWNTWK1	SWITCH E/NET 32PRT RUGGED RSG2300 OPSWAN	RUGGEDCOM	RSG2300 (32PT) 48VDC	No	3									4.32	3.60						
					S003-SSS-NBAY-OWPRINT1	PRINTER	HEWLETT PACKARD	HP5100TN	Yes	0									0.78	0.65						
COMMS BLDG +2 OPSWAN	TELECOMMUNICATIONS BUILDING +2 MASTER OPSWAN CUBICLE	+2A1	2008	3.43	S003-SSS-NBAY-OWINVRT2	INVERTER 125VDC/240VAC 1600W	LATRONICS	UTRO 100	No	3									13.54	6.77	3.43	3.43	> 2043	2028/29 (b)	> 2043	> 2043
					S003-SSS-NBAY-OWNTWK2	[redacted]			No	3									8.53	7.11						
					S003-SSS-NBAY-OWNTWK2	[redacted]			No	2									8.53	7.11						
					S003-SSS-NBAY-OWSERV2	SERVER	ICP ELECTRONICS	3GHZ P4	Yes	15									12.00	10.00						
BLDG +4 COMMON OPSWAN	CONTROL BUILDING +4 COMMON RTU AND OPSWAN CUBICLE	+4B1	2006	4.00	S003-SSS-NBAY-LCF4	MONITOR	HEWLETT PACKARD	HP 1702	Yes	0					12.00	10.00					4.00	4	> 2041	2026/27 (b)	> 2041	> 2041
					S003-SSS-NBAY-LCF4	LOCAL CONTROL FACILITY PC X TERMINAL	WYSE	V90L XPe 1GB/512MB	Yes	0					11.28	9.40										
					S003-SSS-NBAY-OWCAM1	CANON ETHERNET CAMERA	CANON	VB-C10iR	Yes	0									12.00	10.00						
					S003-SSS-NBAY-OWCAM4	AXIS ETHERNET CAMERA ASSEMBLY	Take a Look	P5532E	No	0									8.03	6.69						
					S003-SSS-NBAY-OWINVRT4	INVERTER 125VDC/240VAC 1600W	LATRONICS	UTRO 100	No	3									13.54	6.77						
					S003-SSS-NBAY-OWNTWK4	[redacted]			Yes	0									12.00	10.00						
					S003-SSS-NBAY-OWNTWK4	[redacted]			Yes	0									12.00	10.00						
					S003-SSS-NBAY-RTUCOM4	REMOTE TERMINAL UNIT FOXBORO C50	FOXBORO	C50	Yes	0					13.54	6.77										
					S003-SSS-NBAY-TIMING4	GPS CLOCK - TEKRON TCG01	TEKRON	TCG01	Yes	0					13.54	6.77										
BLDG +5 LCF COMMON OPSWAN	CONTROL BUILDING +5 NSC/LCF AND COMMON RTU AND OPSWAN CUBICLE	+5B1	2006	4.00	S003-SSS-NBAY-LCF5	MONITOR	SUN	19" TFT LCD	Yes	0					12.00	10.00					3.73	4	> 2041	2026/27 (b)	> 2041	> 2041
					S003-SSS-NBAY-LCF5	LOCAL CONTROL FACILITY SUN ULTRA 25	SUN	SUN ULTRA 25	Yes	8					7.45	6.21										
					S003-SSS-NBAY-LCFINT5	REMOTE TERMINAL UNIT FOXBORO C50	FOXBORO	C50	Yes	0					13.54	6.77										
					S003-SSS-NBAY-NSCLNK15	REMOTE TERMINAL UNIT FOXBORO C50	FOXBORO	C50	Yes	0					13.54	6.77										
					S003-SSS-NBAY-NSCLNK25	REMOTE TERMINAL UNIT FOXBORO C50	FOXBORO	C50	Yes	0					13.54	6.77										
					S003-SSS-NBAY-OWNTWK5	SERVER SERIAL PORT	PERLE	04012086	Yes	0									12.00	10.00						
					S003-SSS-NBAY-RTUCOM5	REMOTE TERMINAL UNIT FOXBORO C50	FOXBORO	C50	Yes	0					13.54	6.77										
					S003-SSS-NBAY-TIMING5	GPS CLOCK - TEKRON TCG01	TEKRON	TCG01	Yes	0					13.54	6.77										
					S003-SSS-NBAY-TIMING5	CLOCK GPS TEKRON TCG01-E SDMV8	TEKRON	TCG01-E SDMV8	Yes	1					8.28	4.14										
					S003-SSS-NBAY-OWCAM2	AXIS ETHERNET CAMERA ASSEMBLY	Take a Look	P5532-E	No	0									5.51	4.59						
					S003-SSS-NBAY-OWINVRT5	INVERTER 125VDC/240VAC 1600W	LATRONICS	UTRO 100	No	3									13.54	6.77						
					S003-SSS-NBAY-OWNTWK5	[redacted]			Yes	0									12.00	10.00						

APPENDIX A - S003 GREENBANK 275KV SUBSTATION AND SVC SECONDARY SYSTEMS - EQUIPMENT HEALTH INDICES AND RECOMMENDED REPLACEMENT TIMEFRAME

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

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

BAY	C&P PANEL				SECONDARY SYSTEMS EQUIPMENT						X-PROT		Y-PROT		AUX & CTRL		REVENUE METERING		OPSWAN		CABLES (HI)	YARD MARSHALLING KIOSKS (HI)	C&P PANELS (Chassis)	Sec Sys Equipment	CABLES	YARD MARSHALLING KIOSKS
Function	Panel Descripion	Panel No.	Year	HI	Functional Loc.	Description	Manufacturer	Model number	Obsolescence (Yes / No)	Spare Qty	Eff. Age	HI	Eff. Age	HI	Eff. Age	HI	Eff. Age	HI	Eff. Age	HI	C&P Panels to HV Yard Marshalling Kiosks (CB, MK, CT, VT, AC, DC, COOLING)	Yard Marshalling Kiosks (CB, MK, CT, VT, AC, DC, COOLING)	C&P Panels	Sec Sys Equipment & Auxiliary Components	C&P Panels to HV Yard Marshalling Kiosks (CB, MK, CT, VT, AC, DC, COOLING)	Yard Marshalling Kiosks (CB, MK, CT, VT, AC, DC, COOLING)
BLDG +6 COMMON OPSWAN	CONTROL BUILDING +6 COMMON RTU AND OPSWAN CUBICLE	+6B1	2007	3.71	S003-SSS-NBAY-LCF6	LOCAL CONTROL FACILITY PC X TERMINAL	WYSE	V90L XPe 1GB/512MB	Yes	0					6.98	5.81					3.19	3.71	> 2042	2027/28 (b)	> 2042	> 2042
					S003-SSS-NBAY-LCF6	MONITOR TFT	HEWLETT PACKARD	L1740	Yes	1					0.78	0.65										
					S003-SSS-NBAY-OWCAM3	CANON ETHERNET CAMERA	CANON	VB-C50iR	Yes	0									12.00	10.00						
					S003-SSS-NBAY-OWNTWK6	[redacted]			Yes	7									12.00	10.00						
					S003-SSS-NBAY-OWNTWK6				Yes	7									12.00	10.00						
					S003-SSS-NBAY-OWNTWK6	SERVER PORT 48VDC PERLE 04030450 -OPSWAN	PERLE	IOLAN STS16DC	No	2									12.00	10.00						
					S003-SSS-NBAY-OWNTWK6	SERVER PORT 48VDC PERLE 04030450 -OPSWAN	PERLE	IOLAN STS16DC	No	2									12.00	10.00						
					S003-SSS-NBAY-OWNTWK6	[redacted]			No	6									12.00	10.00						
					S003-SSS-NBAY-OWINVRT6	INVERTER 125VDC/240VAC 1800W	LATRONICS	IRM18120C	No	3									13.54	6.77						
					S003-SSS-NBAY-RTUCOM6	REMOTE TERMINAL UNIT FOXBORO C50	FOXBORO	C50	Yes	0					12.17	6.09										
					S003-SSS-NBAY-TIMING6	GPS CLOCK TEKRON TCG01-D:1	TEKRON	TCG01	Yes	3					12.02	6.01										
BLDG +4 HSM	HIGH SPEED MONITORING BLD +4 DATA ACQUISITION UNIT	+4C14	2009	3.14	S003-SSS-NBAY-PSPM	LOCAL STORAGE UNIT HATHAWAY LSU 125VDC	HATHAWAY	LSU	Yes	0					10.43	5.22					2.79	3.14	> 2044	2029/30 (b)	> 2044	> 2044
					S003-SSS-NBAY-PSPM	RECORDER HATHAWAY IDM HSM 16CH 2A	HATHAWAY	IDM T3 HSM 16CH	Yes	0					10.43	5.22										
BLDG +5 HSM	HIGH SPEED MONITORING BLD +5 DATA ACQUISITION UNIT	+5C14	2009	3.14	S003-SSS-NBAY-PSPM	RECORDER HATHAWAY IDM HSM 16CH 2A	HATHAWAY	IDM T3 HSM 16CH	Yes	0					10.43	5.22					2.79	3.14	> 2044	2029/30 (b)	> 2044	> 2044
BLDG +6 HSM	HIGH SPEED MONITORING BLD +6 DATA ACQUISITION UNIT	+6C14	2009	3.14	S003-SSS-NBAY-PSPM	RECORDER HATHAWAY IDM HSM 16CH 2A	HATHAWAY	IDM T3 HSM 16CH	Yes	0					10.43	5.22					2.79	3.14	> 2044	2029/30 (b)	> 2044	> 2044
BLDG +4 DC AUXILIARY SUPPLY	BUILDING +4 125V DC X BATTERY		2006	10.00		BUILDING +4 125V DC X BATTERY	EXIDE	VRLA (MODEL 90A09)																2020 / ASAP		
	BUILDING +4 125V DC X BATTERY MONITOR AND CHARGER		2006	7.00		BUILDING +4 125V DC X BATTERY MONITOR AND CHARGER	RECTIFIER TECHNOLOGIES	RT48-110V/12A																2027 / 28		
	BUILDING +4 125V DC Y BATTERY		2006	10.00		BUILDING +4 125V DC Y BATTERY	EXIDE	VRLA (MODEL 90A09)																2020 / ASAP		
	BUILDING +4 125V DC Y BATTERY MONITOR AND CHARGER		2006	7.00		BUILDING +4 125V DC Y BATTERY MONITOR AND CHARGER	RECTIFIER TECHNOLOGIES	RT48-110V/12A																2027 / 28		
	BUILDING +4 125V DC DISTRIBUTION BOARD		2006	7.00		BUILDING +4 125V DC DISTRIBUTION BOARD																		2027 / 28		
BLDG +5 DC AUXILIARY SUPPLY	BUILDING +5 125V DC X BATTERY		2006	10.00		BUILDING +5 125V DC X BATTERY	EXIDE	VRLA (MODEL 90A09)																2020 / ASAP		
	BUILDING +5 125V DC X BATTERY MONITOR AND CHARGER		2006	7.00		BUILDING +5 125V DC X BATTERY MONITOR AND CHARGER	RECTIFIER TECHNOLOGIES	RT48-110V/12A																2027 / 28		
	BUILDING +5 125V DC Y BATTERY		2006	10.00		BUILDING +5 125V DC Y BATTERY	EXIDE	VRLA (MODEL 90A09)																2020 / ASAP		
	BUILDING +5 125V DC Y BATTERY MONITOR AND CHARGER		2006	7.00		BUILDING +5 125V DC Y BATTERY MONITOR AND CHARGER	RECTIFIER TECHNOLOGIES	RT48-110V/12A																2027 / 28		
	BUILDING +5 125V DC DISTRIBUTION BOARD		2006	7.00		BUILDING +5 125V DC DISTRIBUTION BOARD																		2027 / 28		
BLDG +6 DC AUXILIARY SUPPLY	BUILDING +6 125V DC X BATTERY		2007	10.00		BUILDING +6 125V DC X BATTERY	EXIDE	VRLA (MODEL 100A07)																2020 / ASAP		
	BUILDING +6 125V DC X BATTERY MONITOR AND CHARGER		2007	6.50		BUILDING +6 125V DC X BATTERY MONITOR AND CHARGER	RECTIFIER TECHNOLOGIES	MINICSU-2 125.0 V																2027 / 28		
	BUILDING +6 125V DC Y BATTERY		2007	10.00		BUILDING +6 125V DC Y BATTERY	EXIDE	VRLA (MODEL 100A07)																2020 / ASAP		
	BUILDING +6 125V DC Y BATTERY MONITOR AND CHARGER		2007	6.50		BUILDING +6 125V DC Y BATTERY MONITOR AND CHARGER	RECTIFIER TECHNOLOGIES	MINICSU-2 125.0 V																2027 / 28		
	BUILDING +6 125V DC DISTRIBUTION BOARD		2007	6.50		BUILDING +6 125V DC DISTRIBUTION BOARD																		2027 / 28		
SVC BLDG +7 DC AUXILIARY SUPPLY	SVC BUILDING +7 125V DC X BATTERY		2008	10.00		SVC BUILDING +7 125V DC X BATTERY	EXIDE	VRLA (MODEL 90A09)																2020 / ASAP		
	SVC BUILDING +7 125V DC X BATTERY MONITOR AND		2008	6.00		SVC BUILDING +7 125V DC X BATTERY MONITOR AND CHARGER	RECTIFIER TECHNOLOGIES	RT48-110V/12A																2027 / 28		
	SVC BUILDING +7 125V DC Y BATTERY		2008	10.00		SVC BUILDING +7 125V DC Y BATTERY	EXIDE	VRLA (MODEL 90A09)																2020 / ASAP		
	SVC BUILDING +7 125V DC Y BATTERY MONITOR AND		2008	6.00		SVC BUILDING +7 125V DC Y BATTERY MONITOR AND CHARGER	RECTIFIER TECHNOLOGIES	RT48-110V/12A																2027 / 28		
	SVC BUILDING +7 125V DC DISTRIBUTION BOARD		2008	6.00		SVC BUILDING +7 125V DC DISTRIBUTION BOARD																		2027 / 28		

Planning Statement	09/04/2020
Title	CP.0xxxx – S003 Greenbank 275kV SVC and Secondary Systems Replacement – Planning Statement [1]
Zone	Moreton
Need Driver	Emerging compliance risks arising from condition and obsolescence of Greenbank's ageing SVC and 275kV secondary systems.
Network Limitation	Greenbank Substation and SVC is needed to meet Powerlink Queensland's N-1-50MW/600MWh reliability obligations and maintain South West to South East Queensland power transfer capability.
Pre-requisites	None

Executive Summary

Ageing and obsolete secondary systems at Greenbank Substation, including the SVC, are increasingly at risk of failing to comply with Schedule 5.1.9(c) of the National Electricity Rules and AEMO's Power System Security Guidelines[2].

Energy Queensland's forecasts confirm there is an enduring need to maintain electricity supply into the Moreton South area. The removal or reconfiguration of the Greenbank Substation due to secondary system failure/obsolescence would violate Powerlink's N-1-50MW/600MWh Transmission Authority reliability standard and significantly impact the power transfer capability between South West and South East Queensland.

The preferred network solution for Powerlink to continue to meet its statutory obligations is the replacement of the at-risk secondary systems by 2028/29.

[1] *This report contains confidential information, which is the property of Powerlink, and the Registered Participant mentioned in the report, and has commercial value. It qualifies as Confidential Information under the National Electricity Rules (NER). The NER provides that Confidential Information:*

- *must not be disclosed to any person except as permitted by the NER;*
- *must only be used or copied for the purpose intended in this report;*
- *must not be made available to unauthorised persons*

[2] AEMO, Power System Operating Procedure SO_OP_3715, Power System Security Guidelines, V95, September 2019 (the Rules require AEMO to develop and publish Power System Operating Procedures pursuant to clause 4.10.1(b) of the Rules, which Powerlink must comply with per clause 4.10.2(b)).

1. Contents

2. Introduction

The Greenbank Substation (S003) is a major switching substation in South East Queensland located approximately 42km South East of Brisbane CBD.

It was established in 2006 to augment the network to meet reliability obligations. The substation is an integral part of the Southern Queensland transmission network. It connects major 275kV transmission lines from South West Queensland and is also a major switching station for other 275kV transmission lines supplying the Gold Coast and South Moreton areas.

The 275kV SVC, adjacent to the substation, was commissioned in 2008 to provide fast reactive power support in the area. A Power Oscillation Damper (POD) is integrated into the voltage control function of the SVC to also provide a critical power system damping function.

Figure 1 shows the existing 275 and 110 kV transmission networks in the area but omits the 33kV and lower voltage distribution networks, as well as the Energex owned 110kV networks.

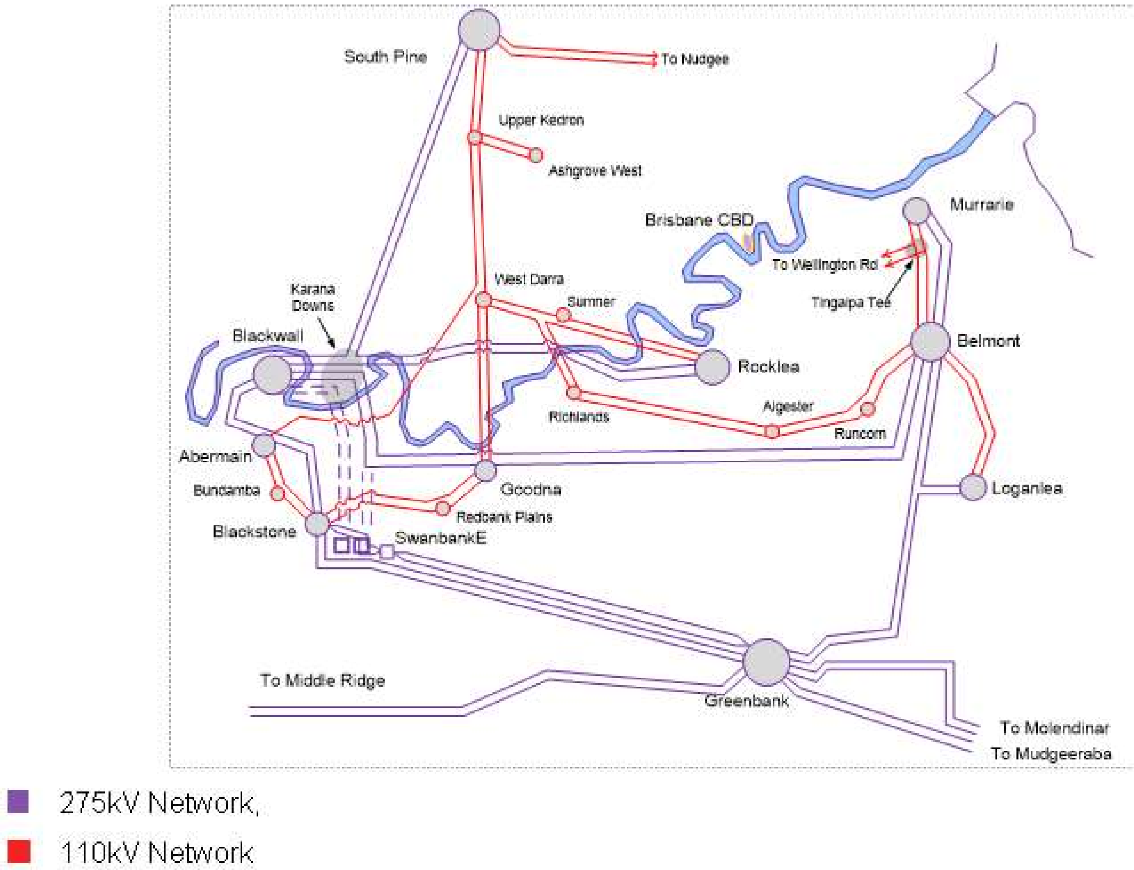

Figure 1: Moreton South 275kV and 110kV network

Figure 2 shows the existing connection configuration of the Greenbank Substation.

[redacted]

Figure 2: Greenbank surrounding transmission network

A condition assessment of the 275 secondary systems and 275kV SVC has determined they are approaching the end of their technical life, with many components becoming obsolete, i.e. no longer supported by the manufacturer and limited spares available. As secondary systems age they become more susceptible to failure 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). The condition assessment recommends that they be replaced by the end of 2028/29.

This condition driver has triggered the need to assess the enduring network need for the Greenbank Substation configuration and function.

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

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

3. Greenbank Demand Forecast

The Greenbank Substation functions as a bulk supply switching station to the South East of Greater Brisbane and Gold Coast for Energy Queensland's network. The Gold Coast, Loganlea, Belmont and Murarrie substations draw power from the Greenbank Substation. It is a critical alternative path that supplies power to the Trade Coast which are mostly industrial as well as supplying the Brisbane CBD east ring.

Figure 3 shows the 10% PoE and 50% PoE maximum consolidated demand forecast in the Greenbank area derived from both Energy Queensland's and Powerlink's forecasting models. The maximum demand in the area is forecast by approximately 12% over the 10-year period.

In addition, the Greenbank Substation is a critical node to maintain supply and reliability in the Brisbane region and surrounding suburbs.

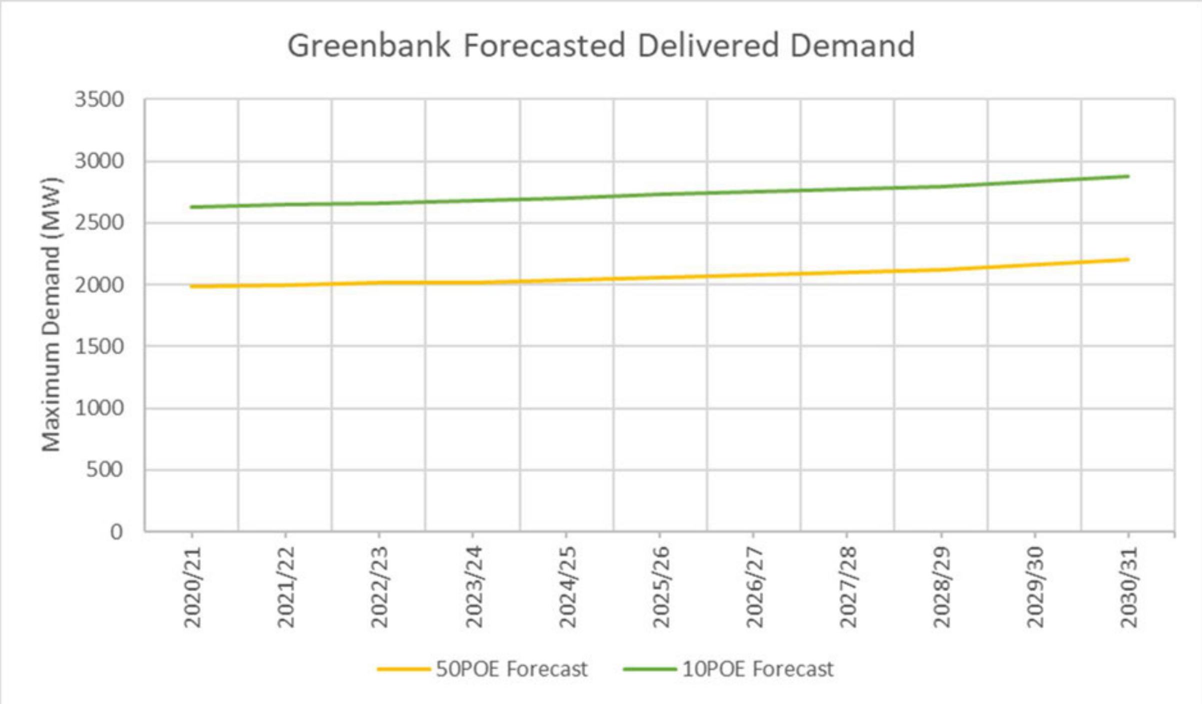

Figure 3 – Greenbank forecast delivered maximum demand

Figure 4 shows historical load duration curves for the Greenbank Substation. The load duration curve demonstrates the quantity of power (MW) that flows through Greenbank Substation into main injection points in the surrounding area.

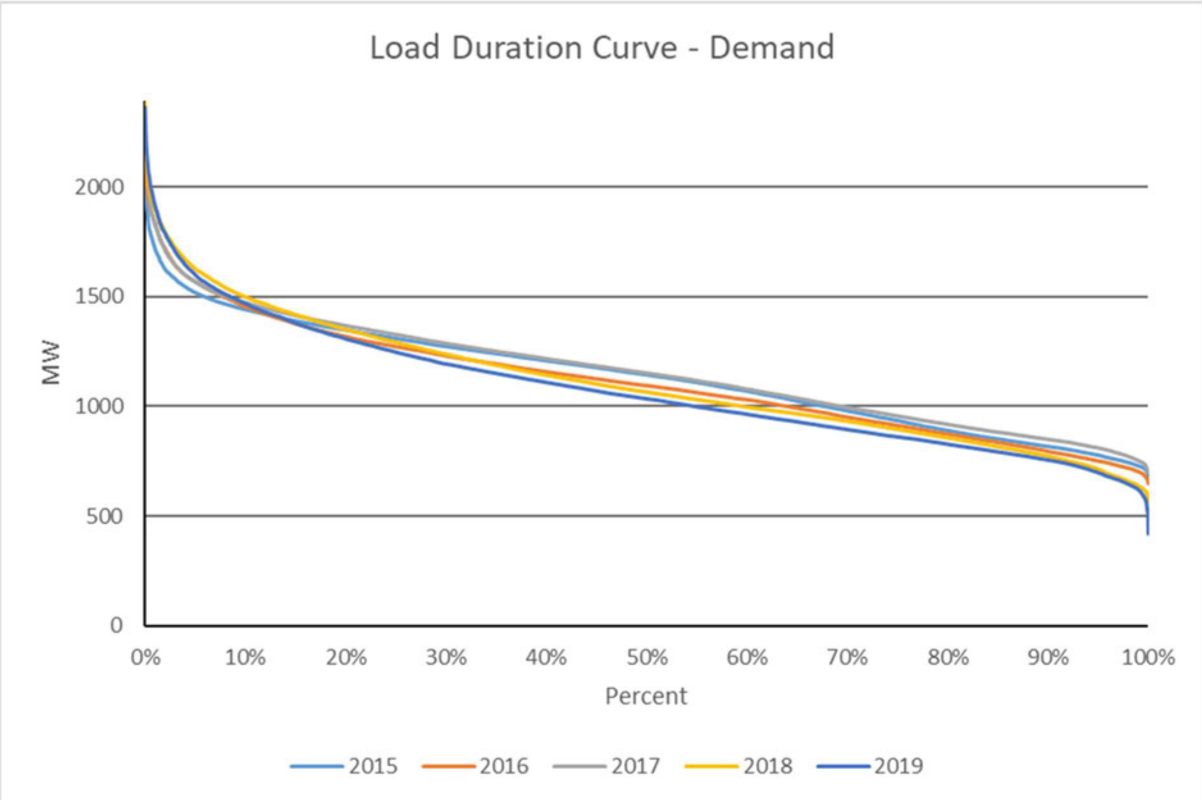

Figure 4 - Load duration curves for Greenbank Substation

4. Statement of Investment Need

As shown in Figure 5 the Greenbank Substation connects:

1. 11 x 275kV feeders,
2. 275kV SVC, and
3. 5 x 275kV capacitor banks.

Six 275kV feeders can be categorised as primarily connections to bulk supply substations (Loganlea, Belmont, Molendinar and Mudgeeraba). Three other 275kV connections provide connectivity between Blackstone/Swanbank E substations and Greenbank. The remaining 275kV feeders (from Mudgeeraba) are part of the SWQ to SEQ grid section.

Therefore, notwithstanding issues with distribution of power flows, there are not enough 275kV feeders delivering power to Greenbank to connect to feeders delivering power to bulk supply points. In addition, only the feeder from Swanbank E is connected to the same diameter as a load feeder (Greenbank – Mudgeeraba). As a result, to effectively by-pass the substation significant rearrangement of the feeders would be required in addition to establishing a tee connection to one load feeder. This would neither be economic or technically feasible from a network capability perspective.

Therefore, to maintain the functionality of the substation the 275kV bus must be maintained. This is also required to connect the SVC and other reactive power plant. The SVC, as well as providing dynamic voltage control, also provides critical damping for the oscillatory stability of the power system. This damping function is provided through a power oscillation damper (POD) input to the SVC voltage control loop. The POD uses frequency perturbations (at the power system oscillatory frequencies) to modulate the voltage to drive a load response that help damp the target oscillation. To do this the SVC must be connected to all of the feeders (via a 275kV bus). This allows the modulation of voltage to impact the largest load base possible to dive an improvement in damping.

The Greenbank Substation connects five 275kV capacitor banks. These capacitor banks are required to support high South East Queensland loads and power transfers into South East Queensland. As shown in Figure 3 load connected to the Greenbank Substation is forecast to grow over the outlook period. This is consistent with the future outlook for South East Queensland as shown in Table 2.22 of the 2020 Transmission Annual Planning Report (TAPR).

Power transfer limits into South East Queensland are limited by voltage stability. The 275kV network between SWQ and SEQ and between CQ and SQ operate well above the surge impedance loading and as such demand considerable reactive power from SEQ to supply the reactive power losses. In addition, in order for the power system to land in a *satisfactory state*, following a contingency, several capacitor banks are required to switch into service. AEMO is then required to resecure the power system in anticipation of the next contingency. This would require further reactive power to be scheduled.

As a result, it is not unexpected that all capacitor banks are not required to be in-service during system normal conditions. However, these capacitor banks, including those connected to the Greenbank Substation, are required to maintain the system in a secure state.

[redacted]

Figure 5: Greenbank Substation 275kV electrical layout

Therefore, as outlined in Section 2, the Greenbank Substation is a major transmission node between in South East Queensland. Removing the functionality of the substation would have a major impact on the performance of the SWQ-SEQ grid section as well as impacting the reliability of supply to the loads to the Moreton South and Gold Coast areas.

The secondary systems are required to operate Greenbank Substation. Therefore, the secondary systems at Greenbank Substation is required to avoid system failures that would result in loss of load in excess of Powerlink's N-1-50MW / 600MWh reliability standard. There would also be significant impact to the capacity of the South West Queensland – South East Queensland grid section.

5. Network Risk

Table 1 summarises the load and energy at risk.

N-1 Contingency	N-1-1 contingency	Max Load at Risk (MW)	Max Energy at Risk (MWh)	Ave. Energy at Risk (MWh)	Load Transfer (MW)
Middle Ridge-Greenbank	Middle Ridge-Greenbank	0	0	0	0
Blackstone -Greenbank	Blackstone-Greenbank	0	0	0	0
Belmont -Greenbank	Loganlea-Greenbank	97	161	1	36
Loganlea -Greenbank	Belmont-Greenbank	97	161	1	0
Molendinar -Greenbank	Molendinar -Greenbank	296	1827	106	
Molendinar -Greenbank	Molendinar -Greenbank	296	1827	106	0
Molendinar -Greenbank	Mudgeeraba T5	145	554	118	0
Mudgeeraba -Greenbank	Mudgeeraba -Greenbank	84	354	7.4	0
Swanbank E PS-Greenbank	Swanbank E PS-Blackstone	361	7566	2515	0

Table 1: Greenbank Load at Risk (24hr)

6. Non Network Options

Greenbank Substation provides flexibility to transmission network in the south east area of the Greater Brisbane also, provides alternative critical path to the Brisbane CBD east ring and the Brisbane Trade Coast.

To fully meet the Greenbank demand, the non-network solution must be capable of delivering up to 2300MW of power. Potential non-network solutions may also be able to provide supply to individual 275kV connections, (as per the load at risk table), to reduce the scope of this project (noting that this may have an adverse impact on the damping provided by the SVC that in itself may need to be addressed).

Powerlink is not aware of any Demand Side Solutions (DSM) in the Moreton South and Gold Coast areas supplied from Greenbank 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 prior to project approval.

7. Network Options

7.1 Proposed Option to address the identified need

Planning recommends the replacement of all 275 secondary systems at Greenbank Substation by 2027. This option ensures that all reliability of supply and asset condition criteria is met as well as maintaining the power transfer capability between South West Queensland to South East Queensland.

Further details of condition assessment for the Greenbank Substation secondary systems and their individual recommended replacement timing can be found in Reference 1.

7.2 Option Considered but Not Proposed

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

7.2.1 Do Nothing

"Do Nothing" would not be an acceptable option as the primary driver (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 Greenbank Substation and anticipates they will reach end of technical service life by 2027. It is therefore recommended that the systems be replaced by 2028/29.

Retaining Greenbank Substation will allow Powerlink to continue to meet its required reliability obligations (N-1-50MW/600MWh), maintain power transfer capability between south west and south east Queensland and maintain damping for critical power system modes of oscillation.

Powerlink is currently unaware of any feasible alternative options to minimise or eliminate the load at risk at Greenbank 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. S003 Greenbank 275kV SVC and 275kV Substation Secondary Systems Condition Assessment Report Feb 2020 - Version 1.0

2. Transmission Annual Planning Report 2020

3. Asset Planning Criteria Framework

Base Case Risk and Maintenance Costs Summary Report

Greenbank Secondary Systems Replacement

Version Number	Objective ID	Date	Description
1.0	A4418208	05/11/2020	Original document.

1 Purpose

The purpose of this model is to quantify the base case risk cost profiles for the secondary systems at Greenbank substation which are proposed for reinvestment by the end of the 2029 financial year.

Base case risk costs have been analysed over a ten-year study horizon.

2 Key Assumptions

In calculating the potential unserved energy (USE) arising from a failure of the ageing and obsolete secondary systems at Greenbank substation, the following modelling assumptions have been made:

- Spares for secondary system equipment items have been assumed to be available prior to the point of expected spares depletion, which coincides with the expected technical asset life. After this point the cost and time to return the secondary system back to service increases significantly;
- Historical load profiles have been used when assessing the likelihood of unserved energy under failure events;
- Due to the network and substation configuration, unserved energy generally accrues under concurrent failure events and consideration has been given to potential feeder trip events within the wider Queensland area;
- VCRs within the relevant climate zone published within the AER's 2019 Value of Customer Reliability Review Final Report have been used within this risk cost assessment; and
- Greenbank substation is one of the major 275kV substation hubs supplying the greater Brisbane and Gold Coast area comprising of residential, commercial and industrial loads. Accordingly the Queensland regional VCR value of $40,030 has been used when evaluating network risk cost.

3 Base Case Risk Analysis

3.1 Risk Categories

Four main categories of risk are assessed within Powerlink's risk approach; safety, network, financial and environmental. For the secondary systems at Greenbank, network and financial risks are considered material and are modelled in the risk cost analysis.

3.2 Secondary Systems Analysis

This section analyses the risks presented by the relevant secondary systems at Greenbank substation.

Table 1 - Risks associated with at risk secondary systems

	Mode of failure	
Equipment	**Peaceful**	**Explosive**
Secondary systems	Network risks (unserved energy due to concurrent network element outages). Financial risks to respond on-site and replace failed secondary systems in an emergency manner[1].	N/A

[1] Secondary systems spares are modelled as being available until equipment reaches 20 years of age. After this time, the cost to replace obsolete spares in an emergency manner is higher which is modelled as increased financial risk cost.

3.3 Base Case Risk Cost

The modelled and extrapolated total base case risk costs are shown in the following figures.

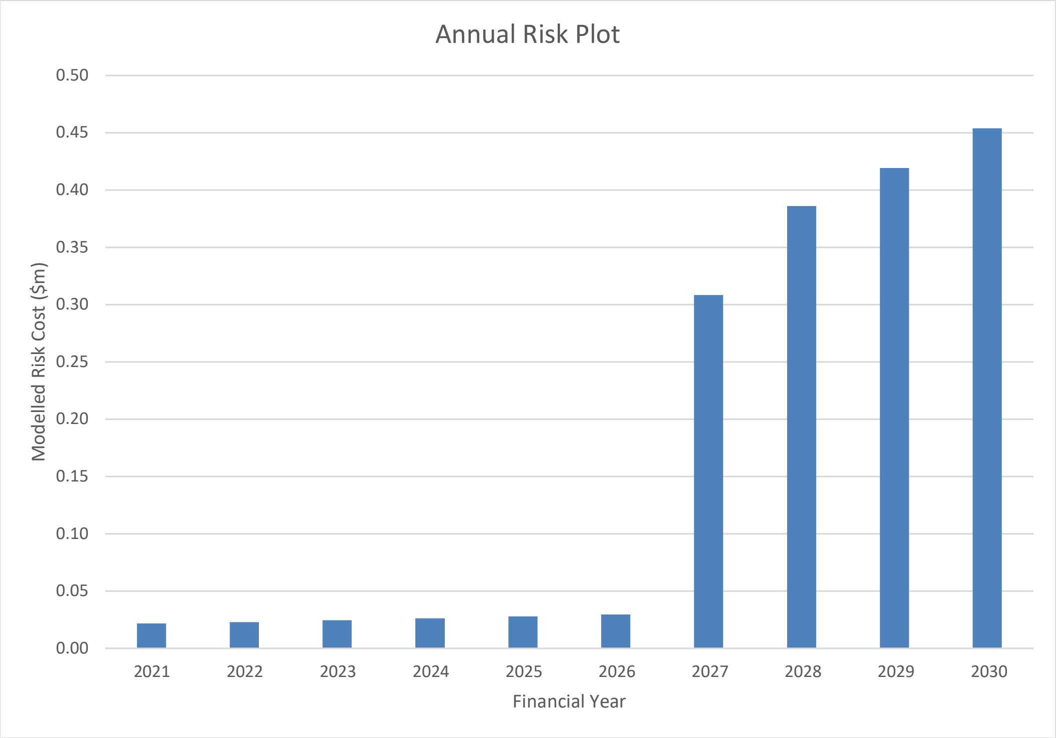

Figure 1 – Greenbank secondary systems total risk cost

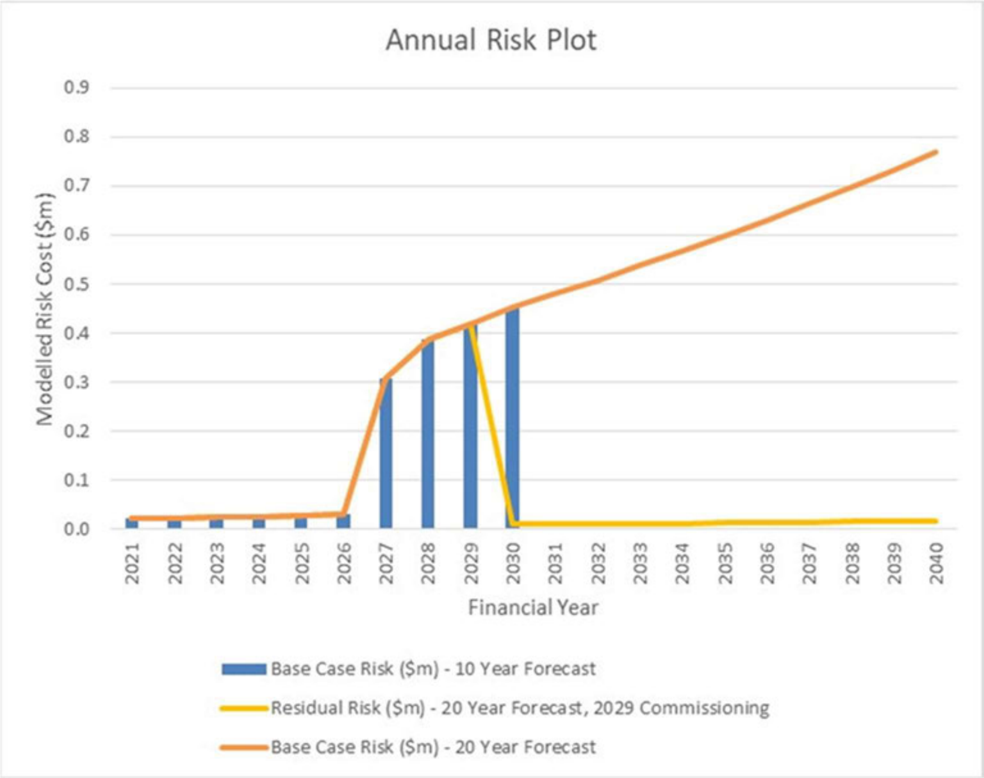

Figure 2 – Greenbank secondary systems risk cost (10 and 15 years)[2]

[2] The significant increase in modified risk cost in 2027 coincides with the depletion of available spares.

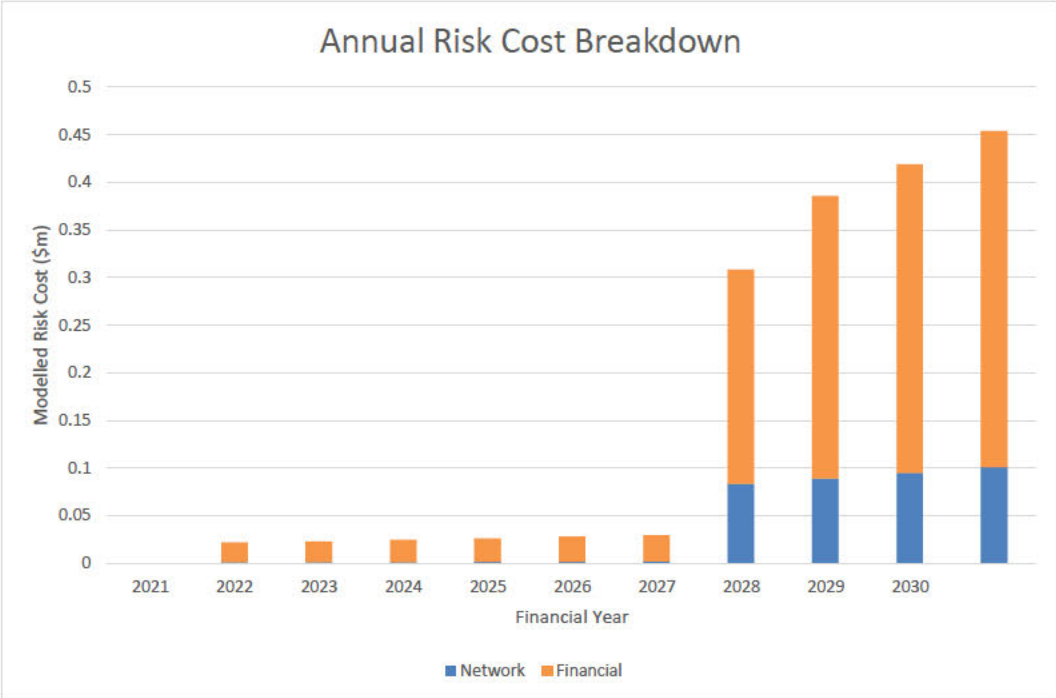

Figure 3 – Greenbank secondary systems risk cost by category

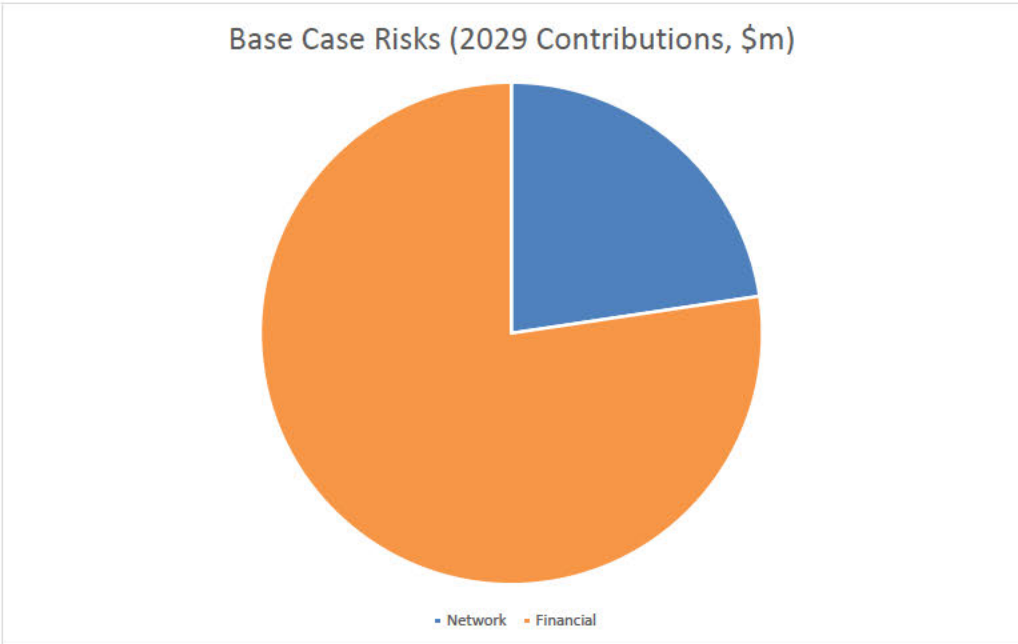

Figure 4 – Greenbank 2029 risk cost by category

3.4 Base case risk statement

The main base case risks for the secondary systems at Greenbank substation are associated with financial risks to replace the failed secondary systems in an unplanned (emergency) manner, and network risks (unserved energy) resulting from concurrent network outages associated with equipment failures.

4 Maintenance costs

Maintenance costs are still being developed. For the purposes of this report, maintenance has been modelled as 1.5% of the project capital. This is consistent with historical averages of maintenance costs as a percentage of capital investment. The total base case risk and maintenance cost is show below:

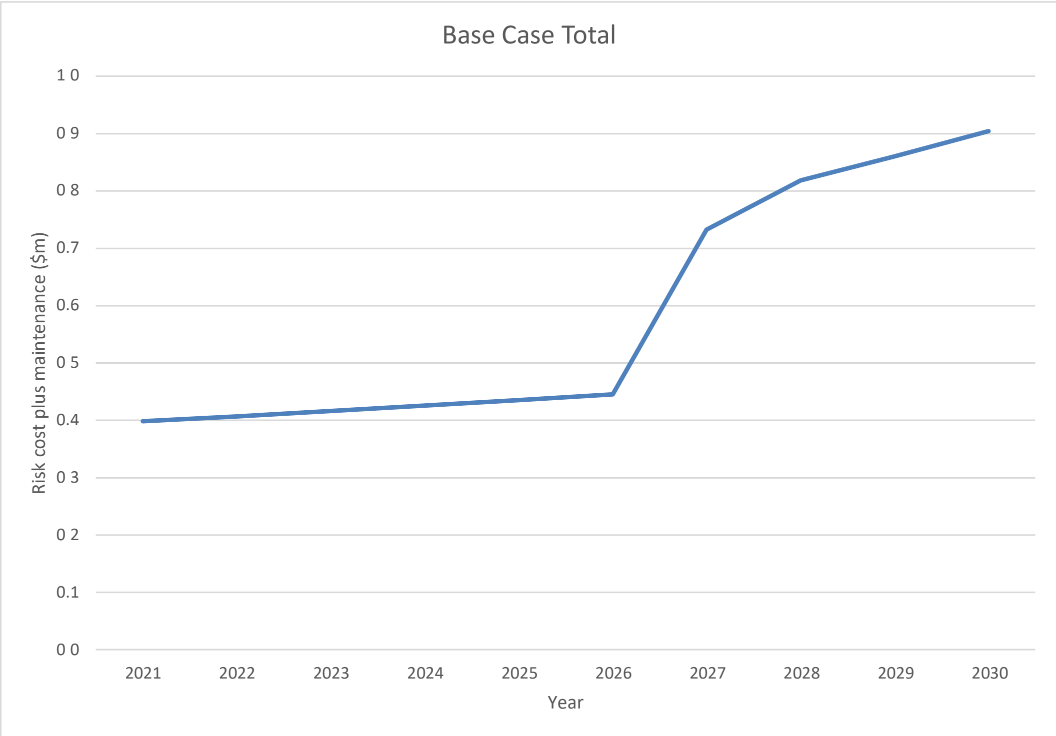

Figure 5 - Base Case Total (Risk Cost + Maintenance)

5 Participation factors

A sensitivity analysis was carried out 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 following figures.

As an example, the participation of VCR to risk cost post obsolescence is approximately 22%. Hence, an increase in VCR of 100% would increase the overall risk cost by around 22%.

Due to the non-linear nature of the risk cost model (specifically network risk costs which are a function of concurrent failures), the participation factor can change depending on the magnitude of input percentage change. The participation factors calculated below are based on an increase of input by 100%.

The model is most sensitive to emergency replacement cost followed by plant restoration time for both pre-secondary systems obsolescence and post-secondary systems obsolescence states.

Table 2 - Input values, secondary systems model

	Item	Value	Unit
Network	VCR	40,030	$/MWh
	Plant restoration time with spares	1	Day
	Plant restoration time with no spares	7	Days
Financial	Emergency replacement cost with spares	0.01	$million
	Emergency replacement cost with no spares	0.1	$million

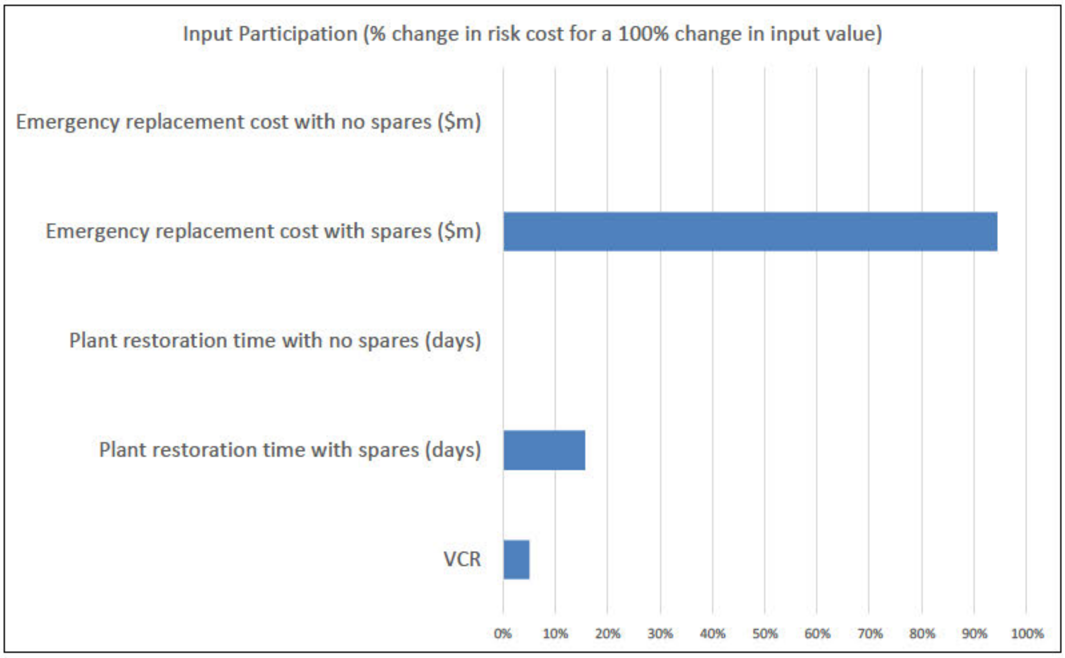

Figure 6 - Participation factors, secondary systems model – pre secondary systems obsolescence

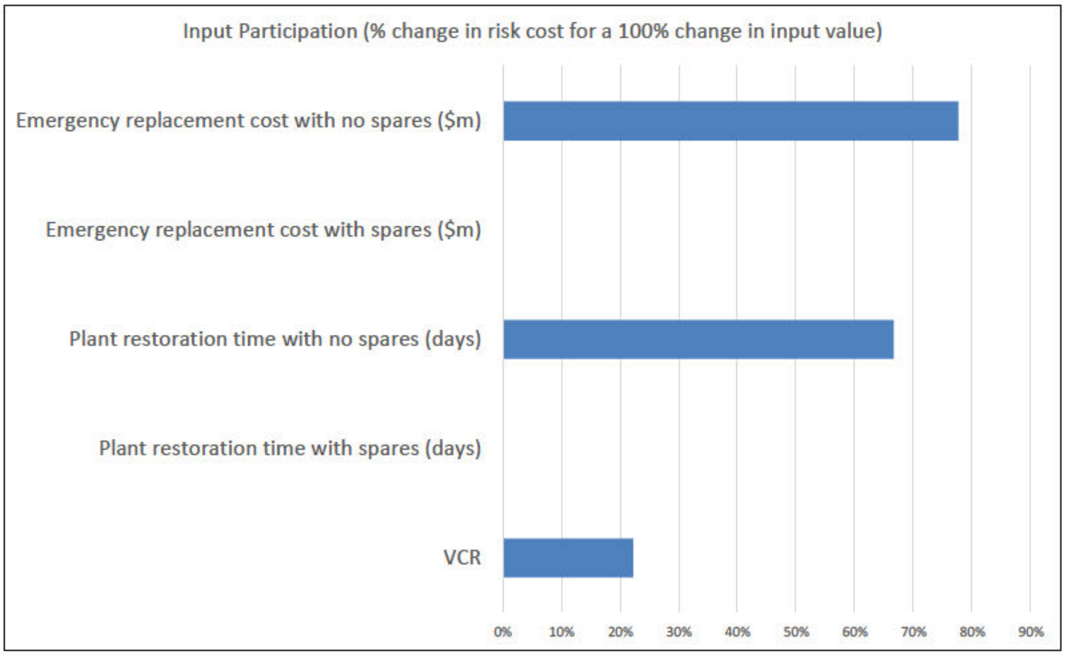

Figure 7 - Participation factors, secondary systems model – post secondary systems obsolescence

Project Scope Report

CP.0xxxx

Greenbank Secondary Systems Replacement

Concept – Version 1

Document Control

Change Record

Issue Date	Responsible Person	Objective Document Name	Background
01/05/20	[redacted]	Project Scope Report CP.0xxxx Greenbank Secondary Systems Replacement	Preliminary scope

Related Documents

Issue Date	Responsible Person	Objective Document Name
27/02/2020	[redacted]	S003 Greenbank Secondary Systems Condition Assessment Report - 26 February 2020(A3322504)

Project Contacts

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Team Leader Grid Planning	[redacted]	[redacted]
Manager Projects	TBD	Ext.
Project Manager	TBD	Ext.
Design Coordinator	TBD	Ext.

Project Details

1. Project Need & Objective

S003 275kV Greenbank Substation and Greenbank SVC is a major switching substation in South East Queensland. It was established in 2006 to accommodate network augmentation / expansion at the time. This substation is an integral part of the Queensland transmission backbone. Greenbank substation is located approximately 42 km South West of Brisbane CBD. The 275kV SVC, is adjacent to the substation, was commissioned in 2008 to provide fast reactive power support in the area.

A condition assessment was conducted in February 2020.. The assessment concluded that the majority of secondary systems for 275kV network will reach the end of technical asset live between 2026 and 2029 and recommended that secondary systems replacement at this site should be completed by 2028.

The objective of this project is to maintain the network reliability and availability within Powerlink' s current standards and practices, and to minimise operational and compliance risks associated with aging and obsolete secondary systems assets. The replacement of the secondary systems at S003 is to be completed by 31 December 2028.

2. Project Drawing

[redacted]

Figure 1 – Greenbank Single Line Diagram

Figure 2 – 275kV Greenbank Substation Aerial View

3. Project Scope

3.1. 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 5 Special Considerations*.

Briefly, this project option consists of a single stage replacement of the 275kV Secondary System panels in building +4 & +6 at S003 Greenbank. The replacement will utilise the spare space within each building to accomplish the replacement. Panels within building +5 will need to be installed into a new control building.

3.1.1. Transmission Line Works

Not Applicable

3.1.2. S003 Substation Works

In Building +4 replacement of all secondary system panels: -

- C05-Q20 FEEDER 8825 (MOLENDINAR) X, Y PROTECTION AND CONTROL CUBICLE
- C06-Q10 FEEDER 805 (SWANBANK E) X, Y PROTECTION AND CONTROL CUBICLE
- C06-Q30 COUPLER (CB 5062) X, Y PROTECTION AND CONTROL CUBICLE
- C06-Q20 FEEDER 835 (MUDGEERABA) X, Y PROTECTION AND CONTROL CUBICLE
- C04-Q10 FEEDER 8813 (LOGANLEA) X, Y PROTECTION AND CONTROL CUBICLE
- C04-Q30 COUPLER X, Y PROTECTION AND CONTROL CUBICLE
- C04-Q20 FEEDER 8824 (MOLENDINAR) X, Y PROTECTION AND CONTROL CUBICLE
- C05-Q10 FEEDER 8822 (BELMONT) X, Y PROTECTION AND CONTROL CUBICLE
- C05-Q30 COUPLER X, Y PROTECTION AND CONTROL CUBICLE
- CONTROL BUILDING +4 COMMON RTU AND OPSWAN CUBICLE
- HIGH SPEED MONITORING BLD +4 DATA ACQUISITION UNIT

In Building +6 replacement of all secondary system panels: -

- C13-Q10 FEEDER 8848 (MIDDLE RIDGE) X, Y PROTECTION AND CONTROL CUBICLE
- C13-Q30 COUPLER X, Y PROTECTION AND CONTROL CUBICLE
- C14-Q10 FEEDER 8849 (MIDDLE RIDGE) X, Y PROTECTION AND CONTROL CUBICLE
- C14-Q30 COUPLER X, Y PROTECTION AND CONTROL CUBICLE
- C14-Q20 SVC (CB 58112) X, Y PROTECTION AND CONTROL CUBICLE
- C15-Q10 CAP 5 X, Y PROTECTION AND CONTROL CUBICLE
- C15-Q20 CAP 6 X, Y PROTECTION AND CONTROL CUBICLE
- C16-Q20 CAP 8 X, Y PROTECTION AND CONTROL CUBICLE
- CONTROL BUILDING +6 COMMON RTU AND OPSWAN CUBICLE

For Building +5: -

- Design, procure, construct and commission a new 275kV control building for a staged cutover of secondary systems panels from the existing +5 building to the new building.
- Design, procure, construct and commission a new cable termination rack such that cables terminated directly between the existing secondary systems panels and marshalling kiosks can be relocated from the existing control buildings to new cable termination rack without need to re-run cables to the yard marshalling kiosks.

- Design, procure, construct and commission cable trenches to the new cable termination rack and run cables from the new cable termination rack to the new control building as appropriate;
- Replacement of the following secondary systems panels to the current standard: into the new control build: -

    - C11-Q10 FEEDER 8888 (BLACKSTONE) X, Y PROTECTION AND CONTROL CUBICLE
    - C11-Q30 COUPLER X, Y PROTECTION AND CONTROL CUBICLE
    - C12-Q10 FEEDER 8887 (BLACKSTONE) X, Y PROTECTION AND CONTROL CUBICLE
    - C12-Q30 COUPLER X, Y PROTECTION AND CONTROL CUBICLE
    - 275KV 1 BUS - BUS ZONE AND CB FAIL BUS TRIP X AND Y PROTECTION CUBICLE
    - 275KV 2 BUS - BUS ZONE AND CB FAIL BUS TRIP X AND Y PROTECTION CUBICLE
    - C10-Q10 - FEEDER 1 (SPARE) X, Y PROTECTION AND CONTROL CUBICLE
    - C10-Q30 COUPLER X, Y PROTECTION AND CONTROL CUBICLE
    - C10-Q20 FEEDER 836 (MUDGEERABA) X, Y PROTECTION AND CONTROL CUBICLE
    - 275KV 1 BUS - BUS ZONE AND CB FAIL BUS TRIP X , Y PROTECTION AND CONTROL CUBICLE
    - 275KV 2 BUS - BUS ZONE AND CB FAIL BUS TRIP X , Y PROTECTION AND CONTROL CUBICLE
    - C08-Q10 (CB 5832) CAP 3 X, Y PROTECTION AND CONTROL CUBICLE
    - C08-Q20 CAP 4 X, Y PROTECTION AND CONTROL CUBICLE
    - CONTROL BUILDING +5 NSC/LCF AND COMMON RTU AND OPSWAN CUBICLE
    - HIGH SPEED MONITORING BLD +5 DATA ACQUISITION UNIT

In Building +1&2 replacement of all secondary system panels: -

- AMENITIES BUILDING (BUILDING1) LAN EXTENSION CUBICLE
- TELECOMMUNICATIONS BUILDING +2 MASTER OPSWAN CUBICLE

Decommission and recover all redundant equipment, and update drawing records, SAP records, config files, etc. accordingly.

3.1.3. Remote End Substation Works

Modify remote end protection, control, automation and communications systems as required at Molendinar, Swanbank E, Mudgeeraba, Loganlea, Belmont, Blackstone and Middle Ridge.

3.1.4. Telecoms Works

Adjust telecoms for new protection/control equipment as required.

3.1.5. Easement/Land Acquisition & Permits Works

Not applicable

3.2. Key Scope Assumptions

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

- The replacement of panels will utilise the spare space within each building to accomplish the desired outcome.
- Spare panel space exists in the +4, +5 & +6 control buildings. Details of substation buildings panel space are shown in the Table below:

Greenbank Substation				
Building Description	**Designation**	**Functional Use**	**Panels to be replaced**	**Spare Sec Sys Panel Spaces**
Amenities Building	+1	Amenities	N/A	N/A
Communications	+2	Comms equipment	N/A	N/A
Work shed	+3	Maintenance Workshop	N/A	N/A
Substation Secondary System Building +4	+4	Sec Sys Bays =C04, =C05, =C06	11	12
Substation Secondary System Building +5	+5	Sec Sys Bays =C08, =C09, =C10, =C11, =C12	15	9
Substation Secondary System Building +6	+6	Sec Sys Bays =C13, =C14, =C15, =C16	9	13

- The replacement of any new control building should be done in a manner that minimizes the required cable runs.
- The location of the new cable termination rack should be such that cables terminated directly between secondary systems panels and the marshalling kiosks can be relocated from the existing control building to the new cable termination rack without need to re-run cables to the yard marshalling kiosks.
- Existing control cables are assumed to have sufficient remaining life so as not to require replacement.
- The 275kV SVC secondary systems are excluded from this project as they will be treated under a separate project.

4. Project Timing

4.1. Project Approval Date

The anticipated date by which the project will be approved is June 2025.

4.2. Site Access Date

Site access is available immediately for Powerlink construction works to commence.

4.3. Commissioning Date

The latest date for the commissioning of the new assets included in this scope the decommissioning and removal of redundant assets, where applicable, is 31 December 2028.

5. Special Considerations

The following issues are important to consider during the implementation of this project:

- any existing assets to be removed and disposed of as part of this scope must be identified within the estimate together with the forecast asset residual value at time of disposal;
- plant and equipment identified as suitable to be recovered for use as spares or returned to stores should be packaged and transported to an appropriate storage location, with a suitable allowance for the cost included in the estimate;
- as some of the outages may be difficult to get, the estimate should include some discussion on the delivery method to achieve a successful cutover of the secondary systems; and
- a high level project implementation plan including staging and outage plans should be considered as part of the estimate.

6. Asset Management Requirements

Equipment shall be in accordance with Powerlink equipment strategies.

Unless otherwise advised [redacted] will be the Project Sponsor for this project. The Project Sponsor must be included in any discussions with any other areas of Strategy and Business Development.

[redacted] will provide the primary customer interface with Energex. The Project Sponsor should be kept informed of any discussions with the customer.

7. Asset Ownership

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

The asset boundary with Energex will be the LV terminals of the 132/66kV transformer.

8. 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.

9. Division of Responsibilities

Not Applicable.

10. Related Projects

Project No.	Project Description	Planned Comm Date	Comment
Pre-requisite Projects			
	Greenbank SVC		
Co-requisite Projects			
Other Related Projects			

Concept Estimate for CP.0xxxx – Greenbank Secondary Systems Replacement

Record ID	A3352589	
Policy stream	Asset Management	
Authored by	Project Manager	[redacted]
Reviewed by	Team Leader	[redacted]
Approved by	Manager Projects	[redacted]

Table of Contents

1. Executive Summary

S003 275kV Greenbank Substation and Greenbank SVC is a major switching substation in South East Queensland. It was established in 2006 to accommodate network augmentation / expansion at the time. This substation is an integral part of the Queensland transmission backbone.

A condition assessment was conducted in February 2020 which recommended replacement timing for secondary systems assets and equipment based on their health indices and condition assessment data. The assessment concluded that the majority of secondary systems for 275kV network will reach the end of technical asset live between 2026 and 2029 and recommended that secondary systems replacement at this site should be completed by 2029.

The project option consists of a multi-stage replacement of the 275kV Secondary System panels in building +4 & +6 at S003 Greenbank. The replacement will utilise the spare space within each building to accomplish the replacement. Panels within building +5 will need to be installed into a new control building.

1.1 Project Estimate

Estimate Components		Base $	Escalated $
Estimate Class	5		
Estimate Accuracy	+100% / -50%		
Base Estimate		**29,604,197**	**39,441,175**
Mitigated Risk	[redacted]	[redacted]	[redacted]
Contingency Allowance	[redacted]	[redacted]	[redacted]
TOTAL		[redacted]	[redacted]

1.2 Project Financial Year Cash Flows

	June 2020 Base $	Escalated $
To June 2026	4,090,211	5,449,319
To June 2027	6,776,305	9,027,957
To June 2028	7,491,769	9,981,158
To June 2029	6,564,696	8,746,034
To June 2030	4,681,216	6,236,707
TOTAL	**29,604,197**	**39,441,175**

2. Project and Site Specific Information

2.1 Project Dependencies & Interactions

The latest date for the commissioning of the new assets included in this scope the decommissioning and removal of redundant assets, where applicable, is December 2028.

This project will have some level of interaction with the following projects tabulated below, however at time of preparing this estimate, none of these projects are approved. Actual impacts from these related project will be determined upon the execution stage of this project.

Project No.	Project Description	Planned Commissioning Date	Comment
Dependencies			
	Greenbank SVC Secondary Systems Replacement	June 2026	May be approved prior to this project.
Interactions			
	Greenbank to Molendinar Polymer insulator replacements	June 2028	Outage interactions Not Approved project
	Greenbank - Mudgeeraba 275kV TL Refit	June 2028	Outage interactions Not Approved project
Other Related Projects			
	Polymer Insulator Replacements Greenbank	June 2030	Not Approved project

2.2 Site Specific Issues

Greenbank substation is located approximately 42 km South West of Brisbane CBD. The 275kV SVC, that is adjacent to the substation, was commissioned in 2008 to provide fast reactive power support in the area.

The 275kV SVC secondary systems works are excluded from this project as they will be treated under a separate project.

3. Replacement in the existing building (in-situ equipment replacement)

3.1.1 Scope

Briefly, this project option consists of a multi-stage replacement of the 275kV Secondary System panels in building +4 & +6 at S003 Greenbank. The replacement will utilise the spare space within each building to accomplish the replacement. Panels within building +5 will need to be installed into a new control building.

[redacted]

Figure 1 Operational Diagram for S003

3.1.1.1 Substations Works

In Building +4 replacement of all secondary system panels:

- C05-Q20 feeder 8825 (Molendinar) X, Y protection and control cubicle
- C06-Q10 FEEDER 805 (SWANBANK E) X, Y PROTECTION AND CONTROL CUBICLE
- C06-Q30 COUPLER (CB 5062) X, Y PROTECTION AND CONTROL CUBICLE
- C06-Q20 FEEDER 835 (MUDGEERABA) X, Y PROTECTION AND CONTROL CUBICLE
- C04-Q10 FEEDER 8813 (LOGANLEA) X, Y PROTECTION AND CONTROL CUBICLE
- C04-Q30 COUPLER X, Y PROTECTION AND CONTROL CUBICLE
- C04-Q20 FEEDER 8824 (MOLENDINAR) X, Y PROTECTION AND CONTROL CUBICLE
- C05-Q10 FEEDER 8822 (BELMONT) X, Y PROTECTION AND CONTROL CUBICLE
- C05-Q30 COUPLER X, Y PROTECTION AND CONTROL CUBICLE
- CONTROL BUILDING +4 COMMON RTU AND OPSWAN CUBICLE
- HIGH SPEED MONITORING BLD +4 DATA ACQUISITION UNIT

In Building +6 replacement of all secondary system panels:

- C13-Q10 FEEDER 8848 (MIDDLE RIDGE) X, Y PROTECTION AND CONTROL CUBICLE
- C13-Q30 COUPLER X, Y PROTECTION AND CONTROL CUBICLE
- C14-Q10 FEEDER 8849 (MIDDLE RIDGE) X, Y PROTECTION AND CONTROL CUBICLE
- C14-Q30 COUPLER X, Y PROTECTION AND CONTROL CUBICLE
- C14-Q20 SVC (CB 58112) X, Y PROTECTION AND CONTROL CUBICLE
- C15-Q10 CAP 5 X, Y PROTECTION AND CONTROL CUBICLE
- C15-Q20 CAP 6 X, Y PROTECTION AND CONTROL CUBICLE

- C16-Q20 CAP 8 X, Y PROTECTION AND CONTROL CUBICLE
- CONTROL BUILDING +6 COMMON RTU AND OPSWAN CUBICLE

For Building +5:

- Design, procure, construct and commission a new 275kV control building for a staged cutover of secondary systems panels from the existing +5 building to the new building.
- Design, procure, construct and commission a new cable termination rack such that cables terminated directly between the existing secondary systems panels and marshalling kiosks can be relocated from the existing control buildings to new cable termination rack without need to re-run cables to the yard marshalling kiosks.
- Design, procure, construct and commission cable trenches to the new cable termination rack and run cables from the new cable termination rack to the new control building as appropriate;
- Replacement of the following secondary systems panels to the current standard: into the new control build: -
  - C11-Q10 FEEDER 8888 (BLACKSTONE) X, Y PROTECTION AND CONTROL CUBICLE
  - C11-Q30 COUPLER X, Y PROTECTION AND CONTROL CUBICLE
  - C12-Q10 FEEDER 8887 (BLACKSTONE) X, Y PROTECTION AND CONTROL CUBICLE
  - C12-Q30 COUPLER X, Y PROTECTION AND CONTROL CUBICLE
  - 275KV 1 BUS - BUS ZONE AND CB FAIL BUS TRIP X AND Y PROTECTION CUBICLE
  - 275KV 2 BUS - BUS ZONE AND CB FAIL BUS TRIP X AND Y PROTECTION CUBICLE
  - C10-Q10 - FEEDER 1 (SPARE) X, Y PROTECTION AND CONTROL CUBICLE
  - C10-Q30 COUPLER X, Y PROTECTION AND CONTROL CUBICLE
  - C10-Q20 FEEDER 836 (MUDGEERABA) X, Y PROTECTION AND CONTROL CUBICLE
  - 275KV 1 BUS - BUS ZONE AND CB FAIL BUS TRIP X , Y PROTECTION AND CONTROL CUBICLE
  - 275KV 2 BUS - BUS ZONE AND CB FAIL BUS TRIP X , Y PROTECTION AND CONTROL CUBICLE
  - C08-Q10 (CB 5832) CAP 3 X, Y PROTECTION AND CONTROL CUBICLE
  - C08-Q20 CAP 4 X, Y PROTECTION AND CONTROL CUBICLE
  - CONTROL BUILDING +5 NSC/LCF AND COMMON RTU AND OPSWAN CUBICLE
  - HIGH SPEED MONITORING BLD +5 DATA ACQUISITION UNIT

In Building +1&2 replacement of all secondary system panels:

- AMENITIES BUILDING (BUILDING1) LAN EXTENSION CUBICLE
- TELECOMMUNICATIONS BUILDING +2 MASTER OPSWAN CUBICLE
  - +2 MASTER OPSWAN CUBICLE

Decommission and recover all redundant equipment, and update drawing records, SAP records, configure files, etc. accordingly.

3.1.1.2 Transmission Line Works

Not applicable.

3.1.1.3 Telecommunication Works

Adjust telecoms for new protection/control equipment as required

3.1.1.4 Remote End Substation Works

Modify remote end protection, control, automation and communications systems as required at Molendinar, Swanbank E, Mudgeeraba, Loganlea, Belmont, Blackstone and Middle Ridge.

3.1.1.5 Easement/Land Acquisition & Permit Works

Not applicable

3.1.2 Major Scope Assumptions

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

- The replacement of panels will utilise the spare space within each building
- Sufficient spare panel space exists in the +4 & +6 control buildings.
- There is adequate space available for the installation of the new control building.
- The existing bay cables from primary plants will be sufficient for the new IEDs and the latest design standard, thus no new cable are required to run between primary plant to the MKs/Control Building
- Existing ground condition is suitable for the construction of control building foundations;
- An 8hr Return to service time has been assumed for 275kV feeder Bays.
- It is assumed that 275kV cap bank bays can remain out of service without the need of a return to service plan during the period its bay's been worked on as per staging plan.
- The location of the new cable termination rack should be such that cables terminated directly between secondary systems panels and the marshalling kiosks can be relocated from the existing control building to the new cable termination rack without need to re-run cables to the yard marshalling kiosks.
- Existing control cables are assumed to have sufficient remaining life so as not to require replacement;
- Existing bay marshalling kiosks will have all the CT terminal replaced and bring up to the latest design standard at time of the construction.
- No extension or modification to the security fence will be required;
- Internal design, contractor design and MSP resources are available as required;
- A geotechnical study has not been performed and estimates are based on previous findings in the area;

3.1.3 Scope Exclusions

- The 275kV SVC secondary systems are excluded from this project as they will be treated under a separate project
- Dealing with unidentified asbestos;
- Any extension of the existing platform, fence earth grid and roads is excluded. Rock is excluded from the base estimate;
- This estimate does not include any costs for repairing or modification to the primary plants;
- The estimate excludes upgrades for the following: earth grid, internal roads, lights, fences and gates.

3.2 Project Execution

3.2.1 Project Schedule

The duration of the project is 66 months. It is based on a start date of 02 June 2026 and final project commissioning date December 2029.

Task	Target Completion
Project Approval, PAN Issued	June 2024
DC Contract Award	Nov 2024
Design Ready for Panel Fabrication	August 2025
Procurement (building and panels)	Aug 2025 - April 2026
Construction and FAT	April 2026 - Oct 2026
Commissioning and stage cut over	Oct 2026 - Dec 2029
Project completion	December 2029

3.2.2 Network Impacts

The delivery of this project will require multiple outages to cutover each of the 275kV bays. The network will not only impact the main site S003 Greenbank but also the remote ends at Belmont, Blackstone, Mudgeeraba, Loganlea, Molendinar and Swanbank with the respective connected feeders

Further to this the following Network Impacts have also been identified:

- The 275kV cap bank bays can remain out of service for the short durations (as staged)
- 1 week Outages with a 8 hour return to service is expected to be available for the 275kV feeder bays. (details in outage restriction table below):

3.2.3 Project Staging

The project staging plan below details a sequential list of tasks with minor paralleled activities.

Stage	Description/Tasks
1	275kV 1Bus BZ & CB-Fail & Bus VTs
2	275kV 2Bus BZ & CB-Fail & Bus VTs
3	CAP 3 Sec Sys refurb
4	CAP 4 Sec Sys refurb
5	Feeder bay 836 (MUDGEERABA) Sec Sys refurb
6	Feeder bay 836 cut-over with line isolator/Earth Switch, line VT & remote-end mods
7	Bus Coupler CB50102 Sec Sys refurb.
8	Feeder bay 1 (SPARE) Sec Sys refurb
9	Feeder bay 836 reconnected to Bus Coupler.
10	Feeder bay 8888 (BLACKSTONE) Sec Sys refurb
11	Feeder bay 8888 cut-over with line isolator/Earth Switch, line VT & remote-end mods
12	Bus Coupler CB50112 Sec Sys refurb.
13	Feeder bay 8888 reconnected to Bus Coupler.
14	Feeder bay 8887 (BLACKSTONE) Sec Sys refurb
15	Feeder bay 8887 cut-over with line isolator/Earth Switch, line VT & remote-end mods
16	Bus Coupler CB50122 Sec Sys refurb.
17	Feeder bay 8887 reconnected to Bus Coupler.
18	Control bldg. +5 Decommission Pending on time of year/outage constraints can be used as a fill in stage
19	Feeder bay 8824 (MOLENDINAR) Sec Sys refurb
20	Feeder bay 8824 cut-over with line isolator/Earth Switch, line VT & remote-end mods

21	Bus Coupler CB5042 Sec Sys refurb.
22	Feeder bay 8813 (LOGANLEA) Sec Sys refurb
23	Feeder bay 8824 reconnected to Bus Coupler.
24	Feeder bay 8825(MOLENDINAR) Sec Sys refurb
25	Feeder bay 8825 cut-over with line isolator/Earth Switch, line VT & remote-end mods
26	Bus Coupler CB5052 Sec Sys refurb.
27	Feeder bay 8822 (BELMONT) Sec Sys refurb
28	Feeder bay 8825 reconnected to Bus Coupler.
29	Feeder bay 835 (MUDGEERABA) Sec Sys refurb
30	Feeder bay 835 cut-over with line isolator/Earth Switch, line VT & remote-end mods
31	Bus Coupler CB5062 Sec Sys refurb.
32	Feeder bay 805 (SWANBANK E) Sec Sys refurb
33	Feeder bay 835 reconnected to Bus Coupler.
34	Feeder bay 8848 (MIDDLE RIDGE) Sec Sys refurb
35	Feeder bay 8848 cut-over with line isolator/Earth Switch, line VT & remote-end mods
36	Bus Coupler CB50132 Sec Sys refurb.
37	Feeder bay 8848 reconnected to Bus Coupler.
38	SVC bay (CB 58112) Sec Sys refurb
39	SVC bay (CB 58112) cut-over with line isolator/Earth Switch, line VT & remote-end mods
40	Bus Coupler CB50142 Sec Sys refurb.
41	Feeder bay 8849 (MIDDLE RIDGE) Sec Sys refurb
42	Feeder bay 8849 reconnected to Bus Coupler.
43	CAP 5 Sec Sys refurb
44	CAP 6 Sec Sys refurb
45	CAP 8 Sec Sys refurb

3.2.4 Resourcing

The delivery of this project is based on utilising a combination of the following resources Powerlink Design, Powerlink MSP and Contractor.

Design

All detailed design will be completed internally for Primary, Civil/Structural, Telecommunications, Automation and Protection

Substation Construction

Construction work will be mostly conducted by the Contractor for all Civil works and Electrical Cable installations. All work that integrates with operational equipment will be performed by the Powerlink MSP.

Test and Commissioning

All testing and commissioning for the cut over of secondary systems will be performed by Powerlink MSP.

3.3 Project Estimate

Estimate Components		Base $	Escalated $
Estimate Class	5		
Estimate Accuracy	+100% / -50%		
Base Estimate		**29,604,197**	**39,441,175**
Mitigated Risk	[redacted]	[redacted]	[redacted]
Contingency Allowance	[redacted]	[redacted]	[redacted]
TOTAL		[redacted]	[redacted]

3.4 Project Financial Year Cash Flows

	June 2020 Base $	Escalated $
To June 2026	4,090,211	5,449,319
To June 2027	6,776,305	9,027,957
To June 2028	7,491,769	9,981,158
To June 2029	6,564,696	8,746,034
To June 2030	4,681,216	6,236,707
TOTAL	**29,604,197**	**39,441,175**

3.5 Project Asset Classification

Asset Class	Asset Life	Base $	Percentage
Secondary systems	15 years	24,777,170	84%
Communications	15 years	1,076,392	4%
Primary plant	40 years	3,750,634	13%
Transmission lines	50 years		
TOTAL		29,604,197	

4. References

Document name	Version	Date
Project Scope Report	1.0	01/05/2020