POWERLINK QUEENSLAND
DRAFT REVENUE PROPOSAL

PROJECT PACK – PUBLIC

CP.02392
Woolooga Secondary Systems Replacement

2022/23 – 2026/27
REGULATORY PERIOD

SEPTEMBER 2020

H005 Woolooga
275kV SVC
132/275kV Substation

Secondary Systems Condition Assessment Report

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Table of *Contents*

1. Introduction

H005 Woolooga Substation, including SVC yard, is a significant transmission substation located approximately 165km north-west of Brisbane. It was established in 1973 to assist with CQSQ power transfer. The substation is comprised of two switchyards;

1. The 275kV switchyard, which has feeders connecting to Gin Gin, South Pine, Palmwoods and Teebar Creek, and
2. The 132kV switchyard, which provides 3 X 132 kV connections to Ergon and 2 X 132 kV connections to Energex for supply to Wide Bay, Gympie and North Coast Regions.

The SVC located adjacent to the substation, commissioned in in 2008, provides reactive power support for the CQSQ transfer.

The focus of the report is to assess the condition of secondary systems assets and to recommend the optimal reinvestment timing for these assets based on expected remaining technical life, performance and obsolescence. 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. Woolooga Substation and SVC primary equipment bays include:

Substation:

Table 1 – Woolooga Substation Network Elements

Local Substation (H005 Woolooga SVC)					Remote Substation
	Voltage (kV)	**Quantity**	**Bay Designation**	**Operational Element**	
Feeders	275	6	=C01-Q20, -Q30	813/2	Calliope River Tee Gin Gin
			=C02-Q10, -Q30	807	South Pine
			=C02-Q20, -Q30	814/2	Calliope River Tee Gin Gin
			=C03-Q10, -Q30	810	Palmwoods
			=C03-Q20, -Q30	8850	Teebar Creek
			=C07-Q10, -Q30	584 (SVC)	
	132	5	=D02-Q10	764	Kilkivan
			=D03-Q10	765	Kilkivan
			=D14-Q10	7190	Mungar
			=D18-Q10	748/2	Cooroy Tee Gympie
			=D19-Q10	747/2	Traverstone Tee Gympie
Capacitor Banks	275	1	=C06-Q10	Cap 1	
	132	2	=D11-Q10	Cap 2	
			=D12-Q10	Cap 3	
Reactors		0			

Transformers	275	3	=C07-Q20, -Q30	3 Transf	
			=C07-Q10, -Q30	4 Transf (SVC =M04)	
			=C04-Q20, -Q30	5 Transf	
	132	2	=D17-Q10	3 Transf	
			=D04-Q10	5 Transf	
Busbars	275	2	=KC1	1 Bus	
			=KC2	2 Bus	
	132	2	=KD1	1 Bus	
			=KD2	2 Bus	

SVC:

Table 2 - Woolooga SVC Network Elements					
Local Substation (H005 Woolooga SVC)					**Remote Substation**
	Voltage (kV)	**Quantity**	**Bay Designation**	**Operational Element**	
Transformer	18.0/ 275 kV	1	=C07-Q10, -Q30	4 Transf (SVC =M04)	
Reactors	18.0	1	TCR1	TCR 1	
Capacitor Banks	18.0	5	TSC1	TSC 1	
			TSC2	TSC 2	
			HF5	5th Filter	
			HF7	7th Filter	
			HF11	11th Filter	
Busbars	18.0	1		SVC LV Bus	

Figure 1 – 132kV/275kV Woolooga Substation and SVC Aerial View

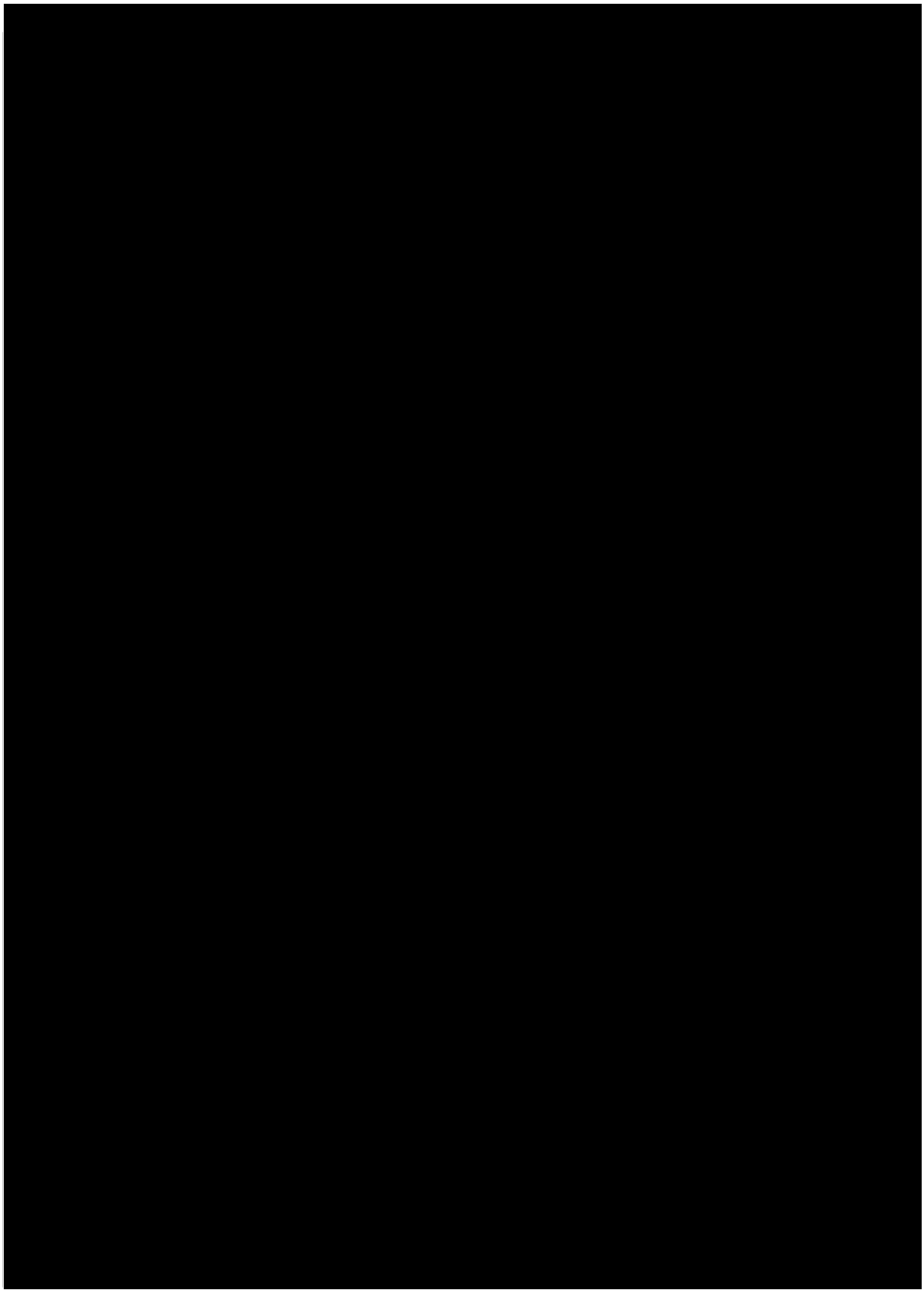


Figure 2 – 132kV/275kV Woolooga Substation and SVC Electrical Single Line Diagram

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

The desktop assessment models the equipment health indices based on the optimisation of risk, cost and performance of Powerlink's secondary assets since 1999. The health index is the key condition measurement for each equipment in service. The model takes into account equipment failure rates calculated based on operational data, environmental conditions where the equipment is installed and the mean physical ages of a group of equipment at bay and system (fleet) levels.

Health indices are modelled in the range from zero (0) to ten (10), where zero represents newly installed equipment and ten indicates equipment that have reached the end of their technical service life. Equipment with a health index close to ten represents only a moderate increased risk of functional failures, but significantly longer outage duration and higher risk of impacting system's availability and reliability due to the lack of manufacturer support and available spares.

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 two (2) demountable control buildings, building +2 and building +3, except a small quantity of OpsWAN equipment are still housed in the communication equipment room in building +1. All buildings associated with the substation are located within the substation perimeter fence, including the work shed.

4.2 SVC Control Building

The SVC building (+4) is located within the SVC perimeter fence, which is built on a separate platform 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 some spare capacity to accommodate additional secondary system panels if required.

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

Table 3 – Woolooga Substation and SVC Buildings

Building Description	Designation	Functional Use	Spare Sec Sys Panel Spaces
Old Control Building +1	+1	Comms equipment, amenities	Old control room is completely empty (Approx. 30+ spare panel spaces)
Substation Secondary System Building +2	+2 (275kV)	Sec Sys Bus =KC1, =KC2 Sec Sys Bays =C01, =C02, =C03, =C04, =C05, =C06, =C07	5
Substation Secondary System Building +3	+3 (132kV)	Sec Sys Bus =KD1, =KD2 Sec Sys Bays =D02, =D03, =D04, =D05, =D11, =D12, =D14 , =D17 , =D18, =D19 Revenue Metering Power Quality Monitoring	8
=M04 SVC Building +4	+4	SVC Sec Sys, Thyristor Valves and Valve Cooling	Spare capacity not measured
Work shed	+5	Maintenance Workshop	N/A

(a) Empty (Brick) Control Building +1

(b) 275kV Demountable Control Building +2

(c) 132kV Demountable Control Building +3

(d) SVC Building +4

Figure 3 – H005 275/132kV Woolooga Substation secondary systems and SVC Buildings

5. Condition Assessment

5.1 Secondary System Outdoor Marshalling Kiosks

Woolooga substation and SVC marshalling kiosks were installed between 2008 and 2010. The kiosks are still in serviceable condition and should last until 2043/44. 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.

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 and air filters are illustrated below:

- Bay Marshalling Kiosks: in Figure 4;
- AC/DC Marshalling Kiosks: in Figure 5;
- Air Filters: in Figure 6.

(a) =D03-A10 Bay Marshalling Kiosk

(b) =D11-A10 Bay Marshalling Kiosk

(c) =D18-A10 Bay Marshalling Kiosk

(d) =C02-A30 Bay Marshalling Kiosk

(e) =C04-A20 Bay Marshalling Kiosk

(f) =C06-A10 Bay Marshalling Kiosk

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

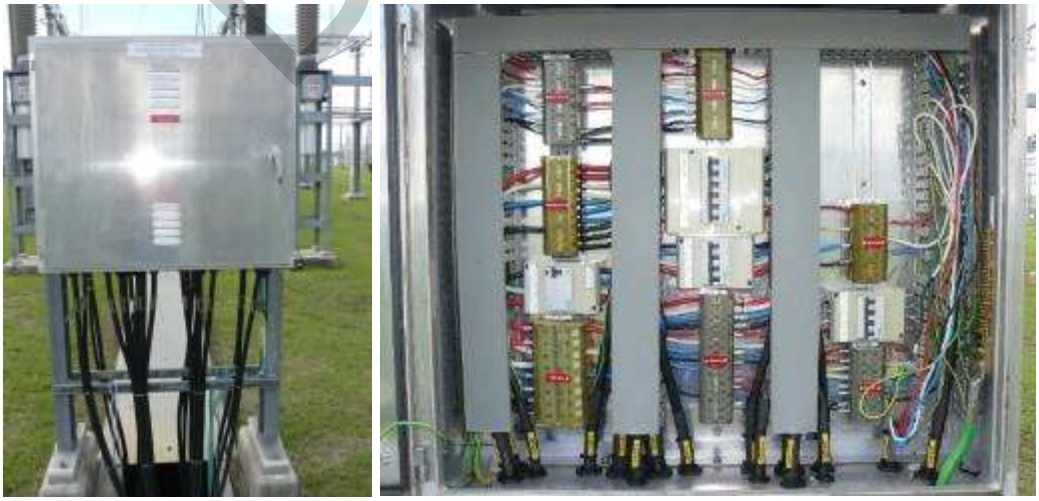
(a) =D07-A91 Bay AC Marshalling Kiosk

(b) =D07-A92 Bay DC Marshalling Kiosk

(c) =D15-A91 Bay AC Marshalling Kiosk

(d) =D15-A92 Bay DC Marshalling Kiosk

(e) =C01-A91 Bay AC Marshalling Kiosk



(f) =C04-A91 Bay AC Marshalling Kiosk

(g) =C04-A92 Bay DC Marshalling Kiosk

Figure 5 – Physical appearance of typical outdoor AC/DC marshalling kiosks at Woolooga substation

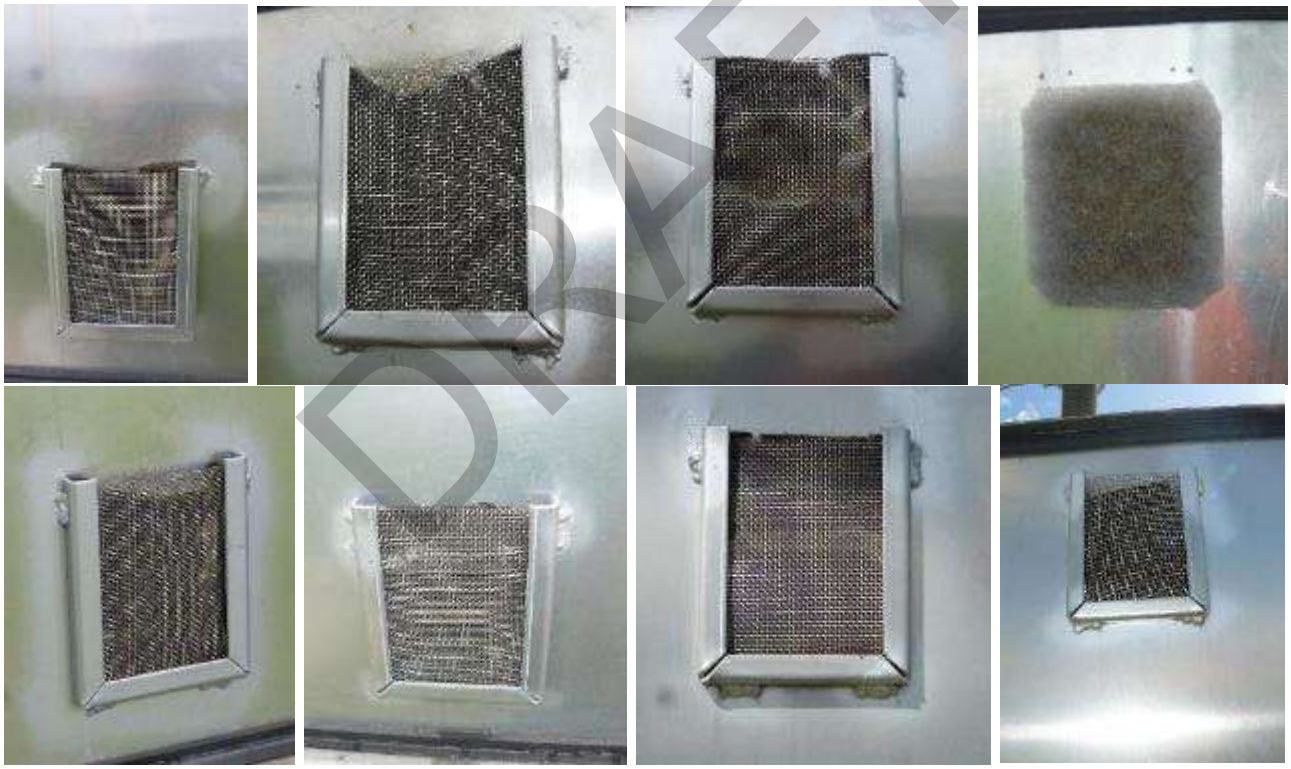


Figure 6 – Physical appearance of typical outdoor marshalling kiosks air filters at Woolooga substation

5.2 Outdoor Secondary System Cables

Outdoor secondary system cables are still in good condition as shown in Figure 7. Visual inspection of these cables indicated that they can be kept in service until 2043/44.

Figure 7 – Physical appearance of typical outdoor secondary system cables

5.3 Indoor Termination Racks / Yard Interface Cubicle

There is no building termination racks at Woolooga 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 facilitate the secondary system replacement projects.

5.4 Indoor Secondary System Cables

All cables inside the control buildings are in good condition as they have been in a clean and air-conditioned environment since being installed around 2008/09. The replacement of indoor cables is deemed unnecessary until 2043/44.

5.5 Control and Protection Systems

Condition assessment of Woolooga 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 2008 – 2011, excluding Power Monitoring which was installed in 2014, and are currently still in good condition. They are suitable for service until 2028/29.

Bay: =D14-Q10

Bay Coupler: =D05-Q10

Bus: =KD1 & =KD2

Cap: =D11-Q10

Transformer=D04-Q10

Multiplex

Power Quality Monitoring

Figure 8 – Typical Indoor 132kV Secondary Systems Panels at Woolooga Substation

Bay: =C02-Q20

Bay Coupler: =C03-Q30

Bus: =KC2

Cap: =C06-Q10

SVC: =Q10

Transformer=C04-Q10

Multiplex

Figure 9 – Typical Indoor 275kV Secondary Systems Panels at Woolooga Substation

SVC X Protection Panels

SVC 400V AC Auxiliary / Changeover Panel

HMI Human Machine Interface

SVC Control

SVC Interface Valve Control

Figure 10 –Typical SVC Indoor Control and Protection Panels at Woolooga SVC

Figure 11 – SVC Cooling Control System Panel

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

5.5.2.1. Control, Protection, Auxiliary, Ancillary Equipment

Woolooga 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 12 – Woolooga Substation Typical Indoor Secondary System Equipment (2008 - 2010)

Figure 13 – Woolooga SVC Typical SVC Indoor Secondary System Equipment (2008)

5.5.2.2. Revenue Metering Panels

Woolooga Substation revenue-metering panels, including auxiliary parts e.g. links, terminals and internal wiring were installed in 2009 and currently still in good condition. They are suitable for service until 2029/30.

Figure 14 – Revenue Metering Panel

5.5.2.3. Revenue Metering Equipment

Woolooga Substation and SVC's metering equipment were installed in 2009. They are suitable for service until 2029/30.

Figure 15 – Woolooga Substation and SVC Metering Equipment

5.5.2.4. OpsWAN System Panels

OpsWAN systems and equipment at this site were installed between 2007-2009. 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 be replaced 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 replacement projects.

+1 Master OpsWAN

+2 OpsWAN, LCF and NSCs

+3 OpsWAN, LCF and NSCs

+4 SVC OpsWAN LCF and NSCs

Figure 16 – Woolooga Substation and SVC OpsWAN Panel

5.5.2.5. OpsWAN Equipment

Woolooga Substation and SVC's OpsWAN equipment were installed between 2007 and 2009. They should only be replaced as part of the SVC secondary system replacement project, anticipated in 2028.

Figure 17 – Woolooga Substation and SVC OpsWAN Equipment

5.5.3 Auxiliary Supply

5.5.3.1. AC Auxiliary Supply

AC auxiliary supplies, including station transformers and backup diesel generator/s are not in scope of this report. AC heaters and lights servicing secondary system panels should only be replaced as part of the secondary systems panels, recommended in 2029.

5.5.3.2. DC Batteries and Chargers

Woolooga Substation and SVC have three (3) sets of 125VDC X and Y batteries and associated chargers installed between 2008 and 2010 as detailed in the Appendix A. Generally, there is one set of duplicated batteries and chargers per secondary system building. According to the requirements of secondary systems and telecoms asset strategies, substation DC batteries' lifespan are now set at 12 years and chargers' lifespan would be set at 20 years. Therefore, all batteries at Woolooga Substation and SVC should be replaced by 2020/21. Battery monitors and chargers should be replaced around 20-year cycle.

(Buildings +2 Chargers – 2010)

(Buildings +3 Chargers – 2009)

(Buildings +4 - SVC 125V X and Y DC Batteries and Chargers - 2008)

Figure 18 – Woolooga Substation and SVC 125VDC Batteries and Chargers

6. Conclusion

This report details the condition of Woolooga Substation and SVC secondary systems and equipment. The primary objective of the replacement is to maintain the current network reliability and availability and to minimise operational and compliance risks associated with secondary systems assets at Woolooga Substation and SVC. Health indices and replacement timeframe have also been recommended in 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** – H005 110/275kV Woolooga 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.

9. Appendix A

APPENDIX A - H005 WOOLOOGA 132/275KV SUBSTATION AND SVC SECONDARY SYSTEMS - EQUIPMENT HEALTH INDICES AND RECOMMENDED REPLACEMENT TIMEFRAME

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

RECOMMENDED REPLACEMENT TIMINGS (Based on Trigger Conditions only. Include considerations for Solutions, Implementation methodologies)

BAY	C&P PANEL				SECONDARY SYSTEMS EQUIPMENT					S-PROT		T-PROT		AUX & CTRL		REVENUE METERING		OPSMAN		CABLES (HI)	YARD MARSHALLING 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)	HT. Age	HI	HT. Age	HI	HT. Age	HI	HT. Age	HI	HT. Age	HI	C&P Panels to HV Yard Marshalling Kiosks (CB, MR, CT, VT, AC, DC, COOLING)	Yard Marshalling Kiosks (CB, MR, CT, VT, AC, DC, COOLING)	C&P Panels	Sec.Sys Equipment & Auxiliary Components	C&P Panels to HV Yard Marshalling Kiosks (CB, MR, CT, VT, AC, DC, COOLING)	Yard Marshalling Kiosks (CB, MR, CT, VT, AC, DC, COOLING)
1 BUS ZONE (275kV +BC1)	275kV 1 BUS - BUS ZONE, CB FAIL BUS TRIP X AND Y PROTECTION CUBICLE	+BA1	2009	3.14	H005-SSS-1B1S-BAPCONT	REMOTE TERMINAL UNIT FOXBORO C50	FOXBORO	C50	Yes					10.68	5.44					3.14	3.14	>2044	2035/30 (L)	>2044	>2044
					H005-SSS-1B1S-XPROT	RELAY DIFF ARIVA MIACH4 RANGE 25-325VAC	ARIVA	MIACH4	No	13.88	5.44														
					H005-SSS-1B1S-XPROT	RELAY TRIPPING LOW BURDEN ALSTOM MVAX13	ARIVA	MVAX13	No	13.88	5.44														
					H005-SSS-1B1S-YPROT	RELAY TRIPPING LOW BURDEN ALSTOM MVAX13	ARIVA	MVAX13	No	13.88	5.44														
					H005-SSS-1B1S-YPROT	RELAY TRIPPING SUPPLY FAIL ALSTOM MVAX12	ARIVA	MVAX12	No	13.88	5.44														
					H005-SSS-1B1S-XPROT	RELAY CB FAIL BUS TRIP RACE	RMS	CB FAIL TRIP RACK	No	13.88	5.44														
					H005-SSS-1B1S-XPROT	RELAY CB FAIL BUS TRIP RACE	RMS	CB FAIL TRIP RACK	No	13.88	5.44														
					H005-SSS-1B1S-YPROT	RELAY TRIPPING LOW BURDEN ALSTOM MVAX13	ARIVA	MVAX13	No			10.88	5.44												
					H005-SSS-1B1S-YPROT	RELAY TRIPPING LOW BURDEN ALSTOM MVAX13	ARIVA	MVAX13	No			10.88	5.44												
					H005-SSS-1B1S-YPROT	RELAY TRIPPING SUPPLY FAIL ALSTOM MVAX12	ARIVA	MVAX12	No			10.88	5.44												
					H005-SSS-1B1S-YPROT	RELAY DIFF ALSTOM MIACH4 RANGE 25-325VAC	ALSTOM	MIACH4	No			10.88	5.44												
					H005-SSS-1B1S-YPROT	RELAY CB FAIL BUS TRIP RACE	RMS	CB FAIL TRIP RACK	No			10.88	5.44												
2 BUS ZONE (275kV +BC2)	275kV 2 BUS - BUS ZONE, CB FAIL BUS TRIP X AND Y PROTECTION CUBICLE	+BA2	2009	3.14	H005-SSS-2B1S-BAPCONT	REMOTE TERMINAL UNIT FOXBORO C50	FOXBORO	C50	Yes					10.63	5.31					3.14	3.14	>2044	2035/30 (L)	>2044	>2044
					H005-SSS-2B1S-XPROT	RELAY TRIPPING SUPPLY FAIL ALSTOM MVAX12	ARIVA	MVAX12	No	13.62	5.31														
					H005-SSS-2B1S-XPROT	RELAY CB FAIL BUS TRIP RACE	RMS	CB FAIL TRIP RACK	No	13.62	5.31														
					H005-SSS-2B1S-XPROT	RELAY CB FAIL BUS TRIP RACE	RMS	CB FAIL TRIP RACK	No	13.62	5.31														
					H005-SSS-2B1S-XPROT	RELAY DIFF ALSTOM MIACH4 RANGE 25-325VAC	ALSTOM	MIACH4	No	13.62	5.31														
					H005-SSS-2B1S-YPROT	RELAY CB FAIL BUS TRIP RACE RMS 3A11183	RMS	CB FAIL TRIP RACK	No			17.26	8.63												
					H005-SSS-2B1S-YPROT	RELAY TRIPPING SUPPLY FAIL ALSTOM MVAX12	ARIVA	MVAX12	No			10.62	5.31												
					H005-SSS-2B1S-YPROT	RELAY DIFF ALSTOM MIACH4 RANGE 25-325VAC	ALSTOM	MIACH4	No			10.62	5.31												
					H005-SSS-2B1S-YPROT	RELAY CB FAIL BUS TRIP RACE	RMS	CB FAIL TRIP RACK	No			10.62	5.31												
1-1 BUS COUPLER (132kV	132kV BAY D08 BUS COUPLER X AND Y PROTECTION CUBICLE	+BA7	2009	3.14	H005-SSS-4B1-BAPCONT	REMOTE TERMINAL UNIT FOXBORO C50	FOXBORO	C50	Yes					10.19	5.10					3.14	3.14	>2044	2035/30 (L)	>2044	>2044
					H005-SSS-4B1-XPROT	RELAY CB MGMT GE C60 (VER 2.93 FIRMWARE)	GE	C60 (VER 2.93)	No	13.40	6.70														
					H005-SSS-4B1-YPROT	RELAY CBMAN SEL-351-1 (1A)	SCHWEITZER	SEL-351-1 (1A)	Yes			10.28	5.10												
T3 TRAN (132kV +D17)	132kV BAY +D17-C10 3 TRANSFORMER LV CUBICLE	+BB3	2009	3.14	H005-SSS-4A5-BAPCONT	REMOTE TERMINAL UNIT FOXBORO C50	FOXBORO	C50	Yes					10.53	5.27					3.14	3.14	>2044	2035/30 (L)	>2044	>2044
					H005-SSS-4A5-XPROT	RELAY CB MGMT GE C60 (VER 2.93 FIRMWARE)	GE	C60 (VER 2.93)	Yes	13.98	5.38														
					H005-SSS-4A5-YPROT	RELAY CBMAN SEL-351-1 (1A)	SCHWEITZER	SEL-351-1 (1A)	Yes			10.63	6.27												
T5 TRAN (132kV +D08)	132kV BAY +D08-C10 5 TRANSFORMER LV CUBICLE	+BA8	2009	3.14	H005-SSS-4A6-BAPCONT	REMOTE TERMINAL UNIT FOXBORO C50	FOXBORO	C50	Yes					10.24	5.12					3.14	3.14	>2044	2035/30 (L)	>2044	>2044
					H005-SSS-4A6-XPROT	RELAY CB MGMT GE C60 (VER 2.93 FIRMWARE)	GE	C60 (VER 2.93)	Yes	13.80	5.26														
					H005-SSS-4A6-YPROT	RELAY CBMAN SEL-351-1 (1A)	SCHWEITZER	SEL-351-1 (1A)	Yes			10.24	5.12												
1 CAP (330kV +D12)	132kV BAY +D12-D16 CAPACITOR BANK MOC X AND Y PROTECTION CUBICLE	+SA12	2009	3.14	H005-SSS-4B1-BAPCONT	REMOTE TERMINAL UNIT FOXBORO C50	FOXBORO	C50	Yes					10.48	5.24					3.14	3.14	>2044	2035/30 (L)	>2044	>2044
					H005-SSS-4B1-POWR1E	RELAY POW 10 CONTROLLER MITSUBISHI 3TDB	MITSUBISHI	10 CONTROLLER	No					11.63	5.81										
					H005-SSS-4B1-XPROT	RELAY OC & EF ABB SPAJ140C	ABB	SPAJ140C	No	13.48	6.24														
					H005-SSS-4B1-XPROT	RELAY CAP PROTN ABB SPAJ140C	ABB	SPAJ140C	No	13.48	6.24														
					H005-SSS-4B1-XPROT	RELAY CB MGMT GE C60 (VER 2.93 FIRMWARE)	GE	C60 (VER 2.93)	No	13.80	5.26														
					H005-SSS-4B1-YPROT	RELAY TRIP MONITORING RMS 3A20620	RMS	3A11609	Yes			15.95	8.00												
					H005-SSS-4B1-YPROT	RELAY CBMAN SEL-351-1 (1A)	SCHWEITZER	SEL-351-1 (1A)	Yes			10.68	5.34												
2 CAP (330kV +D11)	132kV BAY +D11-D16 CAPACITOR BANK MOC X AND Y PROTECTION CUBICLE	+SA11	2009	3.14	H005-SSS-4B2-BAPCONT	REMOTE TERMINAL UNIT FOXBORO C50	FOXBORO	C50	Yes					10.48	5.24					3.14	3.14	>2044	2035/30 (L)	>2044	>2044
					H005-SSS-4B2-POWR1E	RELAY POW 10 CONTROLLER MITSUBISHI 3TDB	MITSUBISHI	10 CONTROLLER	No					11.63	5.81										
					H005-SSS-4B2-XPROT	RELAY OC & EF ABB SPAJ140C	ABB	SPAJ140C	No	13.48	6.24														
					H005-SSS-4B2-XPROT	RELAY CAP PROTN ABB SPAJ140C	ABB	SPAJ140C	No	13.48	6.24														
					H005-SSS-4B2-XPROT	RELAY CB MGMT GE C60 (VER 2.93 FIRMWARE)	GE	C60 (VER 2.93)	No	13.80	5.26														
					H005-SSS-4B2-YPROT	RELAY CBMAN SEL-351-1 (1A)	SCHWEITZER	SEL-351-1 (1A)	Yes			10.68	5.34												
SVC HMI	SVC HMI PANEL	HMI	2013	3.00	H005-SSS-41VC-XOUTPUT	RELAY BASED OFF ABB RPTA/3	ABB	RET 621	Yes					11.18	5.59					3.00	3.00	>2044	2033/18 (L)	>2044	>2044
					H005-SSS-41VC-EVT	ELECTRONIC VOLTAGE TRANSDUCER RECEIVER	RTD	3GSM 311 GE	No					11.18	5.59										
					H005-SSS-41VC-HMI	LOCAL CONTROL FACILITY PC & TERMINAL	WYSE	29867	No					4.34	2.81										
					H005-SSS-41VC-CHKPTWB	CHECK POINT 12 WB IPS RUGGED APPLIANCE	CHECKPOINT		No									2.36	1.96						
SVC PROTECTION (+RA.1)	SVC +RA.1 PROTECTION PANEL	+RA.1	2009	3.43	H005-SSS-41VC-TRFRPROT	RELAY BASED OFF ABB RPTA/3	ABB	RET 621	Yes	11.18	5.59									3.43	3.43	>2043	2033/29 (L)	>2043	>2043
					H005-SSS-41VC-TRFRPROT	TRANSFORMER GUARD UNIT	ABB	RX 8R0101-AA	?	11.18	5.59														
					H005-SSS-41VC-TRFRPROT	SVC TRIP UNIT	ABB	SPER 1C1	No	11.18	5.59														
					H005-SSS-41VC-TRFRPROT	TEST SWITCH MODULE 1	ABB	RTXP24	No	11.18	5.59														
					H005-SSS-41VC-TRFRPROT	TEST SWITCH MODULE 2	ABB	RTXP24	No	11.18	5.59														
					H005-SSS-41VC-TRFRPROT	LOCKOUT UNIT	ABB	L/O UNIT	?	11.18	5.59														
SVC PROTECTION (+RB.1)	SVC +RB.1 PROTECTION PANEL	+RB.1	2009	3.43	H005-SSS-41VC-TRFRPROT	RELAY BASED OFF ABB RPTA/3	ABB	RET 621	Yes			11.18	5.59							3.43	3.43	>2043	2033/29 (L)	>2043	>2043
					H005-SSS-41VC-TRFRPROT	TRANSFORMER GUARD UNIT	ABB	RX 8R0101-AA	?			11.18	5.59												
					H005-SSS-41VC-TRFRPROT	SVC TRIP UNIT	ABB	RXMH 2	No			11.18	5.59												
					H005-SSS-41VC-TRFRPROT	TEST SWITCH MODULE	ABB	L-ORDER 305163	?			11.18	5.59												
275kV COUPLER 1	275kV BAY C01-C10 BUS COUPLER X AND Y PROTECTION CUBICLE	+BB5	2009	3.14	H005-SSS-5B1-BAPCONT	REMOTE TERMINAL UNIT FOXBORO C50	FOXBORO	C50	Yes					10.68	5.44					3.14	3.14	>2044	2035/30 (L)	>2044	>2044
					H005-SSS-5B1-XPROT	RELAY CB MGMT GE C60 (VER 2.93 FIRMWARE)	GE	C60 (VER 2.93)	Yes	13.88	5.44														
					H005-SSS-5B1-YPROT	RELAY CB MGMT SEL 351 1A, 125Vdc, 4U	SCHWEITZER	SEL-351 (1A) (4U)	No			10.88	5.44												
275kV COUPLER 2	275kV BAY C02-C10 BUS COUPLER X AND Y PROTECTION CUBICLE	+BB6	2009	3.14	H005-SSS-5B2-BAPCONT	REMOTE TERMINAL UNIT FOXBORO C50	FOXBORO	C50	Yes					10.77	5.38					3.14	3.14	>2044	2035/30 (L)	>2044	>2044
					H005-SSS-5B2-XPROT	RELAY CB MGMT GE C60 (VER 2.93 FIRMWARE)	GE	C60 (VER 2.93)	Yes	13.77	5.38														
					H005-SSS-5B2-YPROT	RELAY CB MGMT SEL 351 1A, 125Vdc, 4U	SCHWEITZER	SEL-351 (1A) (4U)	No			10.77	5.38												
275kV COUPLER 3	275kV BAY C03-C10 BUS COUPLER X AND Y PROTECTION CUBICLE	+BB11	2009	3.14	H005-SSS-5A3-BAPCONT	REMOTE TERMINAL UNIT FOXBORO C50	FOXBORO	C50	Yes					10.73	5.36					3.14	3.14	>2044	2035/30 (L)	>2044	>2044
					H005-SSS-5A3-XPROT	RELAY CB MGMT GE C60 (VER 2.93 FIRMWARE)	GE	C60 (VER 2.93)	Yes	13.73	5.36														
					H005-SSS-5A3-YPROT	RELAY CB MGMT SEL 351 1A, 125Vdc, 4U	SCHWEITZER	SEL-351 (1A) (4U)	No			10.73	5.36												
275kV COUPLER 4	275kV BAY C04-C10 BUS COUPLER X AND Y PROTECTION CUBICLE	+BA11	2009	3.14	H005-SSS-5A4-BAPCONT	REMOTE TERMINAL UNIT FOXBORO C50	FOXBORO	C50	Yes					10.97	5.49					3.14	3.14	>2044	2035/30 (L)	>2044	>2044
					H005-SSS-5A4-XPROT	RELAY CB MGMT GE C60 (VER 2.93 FIRMWARE)	GE	C60 (VER 2.93)	Yes	13.97	5.49														
					H005-SSS-5A4-YPROT	RELAY CB MGMT SEL 351 1A, 125Vdc, 4U	SCHWEITZER	SEL-351 (1A) (4U)	No			10.97	5.49												
275kV COUPLER 5	275kV BAY C05-C10 BUS COUPLER X AND Y PROTECTION CUBICLE	+BA9	2009	3.14	H005-SSS-5A5-BAPCONT	REMOTE TERMINAL UNIT FOXBORO C50	FOXBORO	C50	Yes					10.88	5.44					3.14	3.14	>2044	2035/30 (L)	>2044	>2044
					H005-SSS-5A5-XPROT	RELAY CB MGMT GE C60 (VER 2.93 FIRMWARE)	GE	C60 (VER 2.93)	Yes	13.88	5.44														
					H005-SSS-5A5-YPROT	RELAY CB MGMT SEL 351 1A, 125Vdc, 4U	SCHWEITZER	SEL-351 (1A) (4U)	No			10.88	5.44												
275kV COUPLER 7	275kV BAY C07-C10 BUS COUPLER X AND Y PROTECTION CUBICLE	+BA6	2008	3.43	H005-SSS-5A7-BAPCONT	REMOTE TERMINAL UNIT FOXBORO C50	FOXBORO	C50	Yes					11.18	5.59					3.43	3.43	>2043	2033/29 (L)	>2043	>2043
					H005-SSS-5A7-XPROT	RELAY CB MGMT GE C60 (VER 2.93 FIRMWARE)	GE	C60 (VER 2.93)	Yes	11.38	5.59														
					H005-SSS-5A7-YPROT	RELAY CB MGMT SEL 351 1A, 125Vdc, 4U	SCHWEITZER	SEL-351 (1A) (4U)	No			11.18	5.59												

APPENDIX A - H005 WOOLOOGA 132/275KV SUBSTATION AND SVC SECONDARY SYSTEMS - EQUIPMENT HEALTH INDICES AND RECOMMENDED REPLACEMENT TIMEFRAME

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

RECOMMENDED REPLACEMENT TIMING (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 Description	Panel No.	Year	HI	Functional Loc.	Description	Manufacturer	Model number	Obsolescence (Yes / No)	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)
T3 TFMR (275kV +C07)	275/132/19.1kV 3 TRANSFORMER 275kV BAY +C07-Q20 CUBICLE	+2A1	2009	3.14	H005-S15-543-BAYCONT	REMOTE TERMINAL UNIT FOXBORO C50	FOXBORO	C50	Yes					10.70	5.20					3.14	3.14	> 2044	2029/30 (b)	> 2044	> 2044
					H005-S15-543-XPROT	RELAY TRANSF O/LOAD GE F35 (2.90)	GE	F35 (2.90)	Yes	10.82	5.41														
					H005-S15-543-XPROT	RELAY DIFF 25-125V 1POLE AREVA MFAC14	AREVA	MFAC14	No	10.70	5.35														
					H005-S15-543-XPROT	RELAY TRANSF DIFF GE T60 (3.40)	GE	T60 (3.40)	Yes	10.70	3.35														
					H005-S15-543-YPROT	RELAY BIASED DIFF SEL-387-5 (1A) (DU)	SCHWEITZER	SEL-387-5 (1A) (D,U)	Yes			10.70	5.20												
T5 TFMR (275kV +C04)	275/132/19.1kV 5 TRANSFORMER 275kV BAY +C04-Q20 CUBICLE	+2A12	2009	3.14	H005-S15-545-BAYCONT	REMOTE TERMINAL UNIT FOXBORO C50	FOXBORO	C50	Yes					10.97	5.49					3.14	3.14	> 2044	2029/30 (b)	> 2044	> 2044
					H005-S15-545-XPROT	RELAY TRANSF O/LOAD GE F35 (2.90)	GE	F35 (2.90)	Yes	10.97	5.49														
					H005-S15-545-XPROT	RELAY TRANSF DIFF GE T60 (3.40)	GE	T60 (3.40)	Yes	10.57	5.49														
					H005-S15-545-XPROT	RELAY DIFF 25-125V 1POLE AREVA MFAC14	AREVA	MFAC14	No	7.14	3.67														
					H005-S15-545-YPROT	RELAY BIASED DIFF SEL-387-5 (1A) (D,U)	SCHWEITZER	SEL-387-5 (1A) (D,U)	Yes			10.97	5.49												
3 CAP (275kV +C08)	275kV BAY +C08-Q10 CAPACITOR BANK NO3 X AND Y PROTECTION CUBICLE	+2A8	2009	3.14	H005-S15-583-BAYCONT	REMOTE TERMINAL UNIT FOXBORO C50	FOXBORO	C50	Yes					10.56	5.28					3.14	3.14	> 2044	2029/30 (b)	> 2044	> 2044
					H005-S15-583-POWAVE	CB S832 POINT ON WAVE RELAY	ABB	SWITCHSYNC 2/3	Yes					20.00	10.00										
					H005-S15-583-XPROT	RELAY CAP PROTN ABB SPAJ160C	ABB	SPAJ160C	No	10.56	5.28														
					H005-S15-583-XPROT	RELAY DIFF ALSTOM MFAC34 RANGE 25-325VAC	ALSTOM	MFAC34	No	10.56	5.28														
					H005-S15-583-XPROT	RELAY CB MGMT GE C60 (VER 1.50 FIRMWARE)	GE	C60 (VER 1.50)	Yes	10.60	5.30														
					H005-S15-583-YPROT	RELAY CAP PROTN ABB SPAJ160C	ABB	SPAJ160C	No			10.56	5.28												
					H005-S15-583-YPROT	RELAY CAP PROTN ABB SPAJ160C	ABB	SPAJ160C	No			10.46	4.18												
					H005-S15-583-YPROT	RELAY CBMAN SEL-351-1 (1A)	SCHWEITZER	SEL-351-1 (1A)	Yes			10.58	5.28												
4 SVC (275kV +C07)	275kV BAY C07-Q10 SVC FEEDER X AND Y PROTECTION CUBICLE	+2A3	2008	3.42	H005-S15-584-BAYCONT	REMOTE TERMINAL UNIT FOXBORO C50	FOXBORO	C50	Yes					11.18	5.59					3.42	3.42	> 2040	2026/28 (b)	> 2043	> 2043
					H005-S15-584-XPROT	RELAY CB MGMT GE C60 (VER 1.50 FIRMWARE)	GE	C60 (VER 1.50)	Yes	11.18	5.59														
					H005-S15-584-YPROT	RELAY CB MGMT SEL 352 1A, 125Vdc, 4U	SCHWEITZER	SEL-352 (1A) (4U)	No			11.18	4.99												
132kV FEEDER 7190 (+D14)	132kV FEEDER 7190 (D14-Q10 - MUNGAR) CUBICLE X & Y PROTECTION CUBICLE	+0B11	2009	3.14	H005-S15-7190-BAYCONT	REMOTE TERMINAL UNIT FOXBORO C50	FOXBORO	C50	Yes					10.49	5.25					3.14	3.14	> 2044	2029/30 (b)	> 2044	> 2044
					H005-S15-7190-XPROT	RELAY DISTANCE MICOM P442 (WITH R/PORT)	AREVA	P442 (WITH R/PORT)	Yes	10.50	5.25														
					H005-S15-7190-YPROT	RELAY DISTANCE SEL-311C (1A)	SCHWEITZER	SEL-311C (1A)	Yes			10.49	5.25												
132kV FEEDER 747 (+D19)	132kV FEEDER 747 (D19-Q10 - TRAVESTON TEE GYMPIE) CUBICLE X & Y PROTECTION CUBICLE	+6B7	2009	3.14	H005-S15-747-BAYCONT	REMOTE TERMINAL UNIT FOXBORO C50	FOXBORO	C50	Yes					10.46	5.23					3.14	3.14	> 2044	2029/30 (b)	> 2044	> 2044
					H005-S15-747-PSDIT	DEWAR DM1200 PROT SIG VF 90-320V SUPPLY	DEWAR	DM1200 VF	Yes					11.41	5.71										
					H005-S15-747-PSRIT	DEWAR DM1200 PROT SIG VF 90-320V SUPPLY	DEWAR	DM1200 VF	Yes					11.41	5.71										
					H005-S15-747-XPROT	RELAY DISTANCE MICOM P442 (WITH R/PORT)	AREVA	P442 (WITH R/PORT)	Yes	11.01	5.66														
					H005-S15-747-YPROT	RELAY DISTANCE SEL-311C (1A)	SCHWEITZER	SEL-311C (1A)	Yes			10.46	5.23												
132kV FEEDER 748 (+D18)	132kV FEEDER 748 (D18-Q10 - COOROY TEE GYMPIE) CUBICLE X & Y PROTECTION CUBICLE	+3B8	2009	3.14	H005-S15-748-BAYCONT	REMOTE TERMINAL UNIT FOXBORO C50	FOXBORO	C50	Yes					10.52	5.27					3.14	3.14	> 2044	2029/30 (b)	> 2044	> 2044
					H005-S15-748-PSDIT	DEWAR DM1200 PROT SIG VF 90-320V SUPPLY	DEWAR	DM1200 VF	Yes					11.41	5.71										
					H005-S15-748-PSRIT	DEWAR DM1200 PROT SIG VF 90-320V SUPPLY	DEWAR	DM1200 VF	Yes					11.41	5.71										
					H005-S15-748-XPROT	RELAY DISTANCE MICOM P442 (WITH R/PORT)	AREVA	P442 (WITH R/PORT)	Yes	10.53	5.27														
					H005-S15-748-YPROT	RELAY DISTANCE SEL-311C (1A)	SCHWEITZER	SEL-311C (1A)	Yes			12.69	6.34												
132kV FEEDER 764 (+D02)	132kV FEEDER 764 (D02-Q10 - KILKIVAN) CUBICLE X & Y PROTECTION CUBICLE	+4A4	2009	3.14	H005-S15-764-BAYCONT	REMOTE TERMINAL UNIT FOXBORO C50	FOXBORO	C50	Yes					10.26	5.13					3.14	3.14	> 2044	2029/30 (b)	> 2044	> 2044
					H005-S15-764-PSDITB	DEWAR DM1200 PROT SIG VF 90-320V SUPPLY	DEWAR	DM1200 VF	Yes					11.41	5.71										
					H005-S15-764-PSRITB	RFL 9745 PROT SIG VF 2 TONE I/O 48-125v	RFL ELECTRONICS	9745 VF	Yes					10.25	5.13										
					H005-S15-764-XPROT	CURR DIFF RELAY MICOM P542 + 2ND PORT	MICOM	P542 (+ 2nd Port)	Yes	13.50	6.75														
					H005-S15-764-YPROT	RELAY DISTANCE SEL-311C 1A	SCHWEITZER	SEL-311C (1A)	Yes			16.51	8.26												
132kV FEEDER 765 (+D03)	132kV FEEDER 765 (D03-Q10 - KILKIVAN) CUBICLE X & Y PROTECTION CUBICLE	+3A5	2009	3.14	H005-S15-765-BAYCONT	REMOTE TERMINAL UNIT FOXBORO C50	FOXBORO	C50	Yes					10.37	5.19					3.14	3.14	> 2044	2029/30 (b)	> 2044	> 2044
					H005-S15-765-PSDITB	DEWAR DM1200 PROT SIG VF 90-320V SUPPLY	DEWAR	DM1200 VF	Yes					11.41	5.71										
					H005-S15-765-PSRITB	RFL 9745 PROT SIG VF 2 TONE I/O 48-125v	RFL ELECTRONICS	9745 VF	Yes					10.37	5.19										
					H005-S15-765-XPROT	COMMS INTERFACE UNIT ALSTOM P591	ALSTOM	P591 (NWDC)	Yes	13.50	6.75														
					H005-S15-765-XPROT	CURR DIFF RELAY MICOM P543 + 2ND PORT	MICOM	P543 (+ 2nd Port)	Yes	10.56	5.28														
					H005-S15-765-YPROT	RELAY DISTANCE SEL-311C (1A)	SCHWEITZER	SEL-311C (1A)	Yes			10.37	5.19												
275kV FEEDER 807 (+C02)	275kV FEEDER 807 (C02-Q10 - SOUTHPINE) CUBICLE X & Y PROTECTION CUBICLE	+2B9	2009	3.14	H005-S15-807-BAYCONT	REMOTE TERMINAL UNIT FOXBORO C50	FOXBORO	C50	Yes					10.88	5.44					3.14	3.14	> 2044	2029/30 (b)	> 2044	> 2044
					H005-S15-807-PSRITY	RFL 9745 PROT SIG DIG I/O 48-125V	RFL ELECTRONICS	9745 DIGITAL	Yes					12.14	6.07										
					H005-S15-807-PSDITA	DEWAR DM1200 PROT SIG DIG 90-320V SUPPLY	DEWAR	DM1200 DIGITAL	Yes					8.83	4.41										
					H005-S15-807-PSRITB	RFL 9745 PROT SIG DIG I/O 48-125V	RFL ELECTRONICS	9745 DIGITAL	Yes					12.14	6.07										
					H005-S15-807-XPROT	CURR DIFF RELAY MICOM P544 + 2ND PORT	MICOM	P544 (+ 2nd Port)	Yes	10.88	5.44														
					H005-S15-807-YPROT	RELAY DISTANCE SEL-421 (1A) (5U)	SCHWEITZER	SEL-421 (1A) (5U)	Yes			10.88	5.44												
275kV FEEDER 810 (+C03)	275kV FEEDER 810 (C03-Q10 - PALMWOODS) CUBICLE X & Y PROTECTION CUBICLE	+2B12	2009	3.14	H005-S15-810-BAYCONT	REMOTE TERMINAL UNIT FOXBORO C50	FOXBORO	C50	Yes					10.78	5.39					3.14	3.14	> 2044	2029/30 (b)	> 2044	> 2044
					H005-S15-810-PSDIT	DEWAR DM1200 PROT SIG DIG 90-320V SUPPLY	DEWAR	DM1200 DIGITAL	Yes					10.78	5.39										
					H005-S15-810-PSDITA	DEWAR DM1200 PROT SIG DIG 90-320V SUPPLY	DEWAR	DM1200 DIGITAL	Yes					12.12	6.06										
					H005-S15-810-PSRITB	RFL 9745 PROT SIG DIG I/O 48-125V	RFL ELECTRONICS	9745 DIGITAL	Yes					12.14	6.07										
					H005-S15-810-XPROT	RELAY CURR DIFF DISTANCE MICOM P546	AREVA	P546	Yes	10.78	5.39														
					H005-S15-810-YPROT	RELAY DISTANCE SCHW'ZER 421-5 1A 24 (8D)	SCHWEITZER	SEL-421-5 (1A) (5U)	Yes			9.00	4.50												
275kV FEEDER 814 (+C02)	275kV FEEDER 814/2 (C02-Q20 - CALLIOPE RIVER TEE GIN GIN) CUBICLE X & Y PROTECTION CUBICLE	+2B7	2009	3.14	H005-S15-814-BAYCONT	REMOTE TERMINAL UNIT FOXBORO C50	FOXBORO	C50	Yes					10.68	5.34					3.14	3.14	> 2044	2029/30 (b)	> 2044	> 2044
					H005-S15-814-XPROT	RELAY CURR DIFF DISTANCE MICOM P546	AREVA	P546	Yes	10.68	5.34														
					H005-S15-814-YPROT	RELAY CURR/DIFF ABB RED670 DNP3	ABB	RED670 V1.2	No			4.55	2.28												
275kV FEEDER 815/809 (+C01)	275kV FEEDER 815/809 (C01-Q20 - CALLIOPE RIVER TEE GIN GIN) CUBICLE X & Y PROTECTION CUBICLE	+1B4	2011	2.97	H005-S15-815-BAYCONT	REMOTE TERMINAL UNIT FOXBORO C50	FOXBORO	C50	Yes					10.86	5.43					3.14	2.97	> 2046	2031/32 (b)	> 2046	> 2046
					H005-S15-815-XPROT	RELAY CURR DIFF DISTANCE MICOM P546	AREVA	P546	Yes	10.23	5.11														
					H005-S15-815-YPROT	RELAY CURR/DIFF ABB RED670 DNP3	ABB	RED670 V1.2	No			0.44	0.22												
275kV FEEDER 8850 (+C09)	275kV FEEDER 8850 (C09-Q10 - TEEBAR CREEK) CUBICLE X & Y PROTECTION CUBICLE	+2B10	2009	3.14	H005-S15-8850-BAYCONT	REMOTE TERMINAL UNIT FOXBORO C50	FOXBORO	C50	Yes					10.72	5.36					3.14	3.14	> 2044	2029/30 (b)	> 2044	> 2044
					H005-S15-8850-PSPITY	DEWAR DM1200 PROT SIG DIG 90-320V SUPPLY	DEWAR	DM1200 DIGITAL	Yes					12.12	6.06										
					H005-S15-8850-PSDITA	DEWAR DM1200 PROT SIG DIG 90-320V SUPPLY	DEWAR	DM1200 DIGITAL	Yes					10.78	5.39										
					H005-S15-8850-PSRITB	RFL 9745 PROT SIG VF 2 TONE I/O 48-125v	RFL ELECTRONICS	9745 VF	Yes					10.78	5.39										
					H005-S15-8850-XPROT	CURR DIFF RELAY MICOM P544 + 2ND PORT	MICOM	P544 (+ 2nd Port)	Yes	10.72	5.36														
					H005-S15-8850-YPROT	RELAY DISTANCE SCHW'ZER 421-5 1A 24 (8D)	SCHWEITZER	SEL-421-5 (1A) (5U)	Yes			9.00	4.50												
132kV BUS ZONE (KD1 / KD2)	132kV 1 AND 2 - BUS ZONE, CB FAIL BUS TRIP Y PROTECTION CUBICLE	+3A2	2009	3.14	H005-S15-824-BAYCONT	REMOTE TERMINAL UNIT FOXBORO C50	FOXBORO	C50	Yes					10.53	5.27					3.14	3.14	> 2044	2029/30 (b)	> 2044	> 2044
					H005-S15-824-YPROT	RELAY BUS ZONE 1A 125V SEL-487B (R124)	SCHWEITZER	SEL-487B (R116)	Yes			10.53	5.27												
					H005-S15-824-YPROT	RELAY BUS ZONE 1A 125V SEL-487B (R124)	SCHWEITZER	SEL-487B (R116)	Yes			10.53	5.27												
					H005-S15-824-YPROT	RELAY BUS ZONE 1A 125V SEL-487B (R124)	SCHWEITZER	SEL-487B (R116)	Yes			10.53	5.27												
132kV BUS ZONE (KD1 / KD2)	132kV 1 AND 2 - BUS ZONE, CB FAIL BUS TRIP Y PROTECTION CUBICLE	+3A1	2009	3.14	H005-S15-824-XPROT	RELAY BUS ZONE 1A 125V SEL-487B (R124)	SCHWEITZER	SEL-487B (R116)	Yes	10.53	5.27									3.14	3.14	> 2044	2029/30 (b)	> 2044	> 2044
					H005-S15-824-XPROT	RELAY BUS ZONE 1A 125V SEL-487B (R124)	SCHWEITZER	SEL-487B (R116)	Yes	10.53	5.27														
					H005-S15-824-XPROT	RELAY BUS ZONE 1A 125V SEL-487B (R124)	SCHWEITZER	SEL-487B (R116)	Yes	10.53	5.27														

APPENDIX A - H005 WOOLOOGA 132/275KV 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 secondary systems equipment
(b) Recommended Timeframe is based on majority of Equipment Health Indices
(c) Based on Visual inspection and Subject to the decision of the Control Building and Secondary Systems Panels. A number of New Cables may be required if location of control building or secondary systems panels is changed.
(d) As a minimum requirement, Rubber Seals, Air filter and Terminals and Links are required to be replaced by the recommended timeframe. New Marshalling Kiosks should be considered if Existing Cables are to be replaced.

RECOMMENDED REPLACEMENT TIMING (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 Description	Panel No.	Year	HI	Functional Loc.	Description	Manufacturer	Model number	Obsolescence (Yes / No)	HT Age	HI	HT Age	HI	HT Age	HI	HT Age	HI	HT 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)
OPSWAN CAMERA	OPSWAN OUTDOOR CAMERA	OUTDOOR	2020	0.00	H005-SSS-IONS-HARDWARE	AXIS ETHERNET CAMERA ASSEMBLY H005WCDA	Take a Look	P5635-E	No									2.86	2.06	N/A	N/A	N/A	N/A	N/A	N/A
					H005-SSS-IONS-HARDWARE	AXIS ETHERNET CAMERA ASSEMBLY H005WCDB	Take a Look	P5642-E	No									4.64	4.61						
					H005-SSS-IONS-HARDWARE	AXIS ETHERNET CAMERA ASSEMBLY H005WCDC	Take a Look	P5532-E	No									4.55	3.51						
REVENUE METERING	132kV REVENUE METERING CUBICLE	+2A3	2008	3.14	H005-SSS-METR-REVMET1	WH/VARH METER (CHECK)	EDMI	RS232 & DEMAND MEM.	Yes							4.37	2.18			3.14	3.14	> 2044	2029/30 (b)	> 2044	> 2044
					H005-SSS-METR-REVMET2	KWH/KVARH EDMI 2000-0400 CL 0.5 REVENUE	EDMI	2000-0400 1A Cl 0.5	Yes							10.64	5.27								
					H005-SSS-METR-REVMET3	METER KWH/KVARH 1A 110V/PH CL.2/ 50LREV)	EDMI	2000-0400 1A Cl 0.5	Yes							8.46	4.23								
					H005-SSS-METR-REVMET4	KWH/KVARH EDMI 2000-0400 CL 0.5 (CHECK)	EDMI	2000-0400 1A Cl 0.5	Yes							10.53	5.27								
					H005-SSS-METR-REVMET5	KWH/KVARH EDMI 2000-0400 CL 0.5 REVENUE	EDMI	2000-0400 1A Cl 0.5	Yes							10.26	5.13								
					H005-SSS-METR-REVMET5	KWH/KVARH EDMI 2000-0400 CL 0.5 CHECK	EDMI	2000-0400 1A Cl 0.5	Yes							10.25	5.13								
					H005-SSS-METR-REVMET5	KWH/KVARH EDMI 2000-0400 CL 0.5 CHECK	EDMI	2000-0400 1A Cl 0.5	Yes							8.46	4.23								
					H005-SSS-METR-REVMET6	KWH/KVARH EDMI 2000-0400 CL 0.5 REVENUE	EDMI	2000-0400 1A Cl 0.5	Yes							10.37	5.18								
BLDG +2 COMMON OPSWAN NSC/LCF	275kV CONTROL BUILDING +2 NSC/LCF/COMMON RTU AND OPSWAN CUBICLE	+2B2	2009	3.18	H005-SSS-RSAY-LCF2	LOCAL CONTROL FACILITY SUN ULTRA 25	SUN	SUN ULTRA 25	Yes					7.73	6.44					3.18	3.18	> 2044	2029/30 (b)	> 2044	> 2044
					H005-SSS-RSAY-LCF2INT	REMOTE TERMINAL UNIT FOXBORO C50	FOXBORO	C50	Yes					10.97	5.49										
					H005-SSS-RSAY-NSCLNK12	REMOTE TERMINAL UNIT FOXBORO C50	FOXBORO	C50	Yes					10.97	5.49										
					H005-SSS-RSAY-NSCLNK22	REMOTE TERMINAL UNIT FOXBORO C50	FOXBORO	C50	Yes					10.97	5.49										
					H005-SSS-RSAY-OWINVRT2	INVERTER 125VDC/240VAC 1800W	LATRONICS	[illegible]	No									10.97	5.49						
					H005-SSS-RSAY-OWNTWK2	LOCAL CONTROL FACILITY PC X TERMINAL	WYSE	V90LEW	Yes									5.73	4.78						
					H005-SSS-RSAY-OWNTWK2	LOCAL CONTROL FACILITY PC X TERMINAL	WYSE	V90LEW	Yes									5.73	4.78						
					H005-SSS-RSAY-OWNTWK2	SWITCH 8PORT	RUGGEDCOM	RS8000A-HI-MM-MS	No									4.19	3.66						
					H005-SSS-RSAY-OWNTWK2	SWITCH E/NET 32PRT RUGGED RSG2300 OPSWAN	RUGGEDCOM	RSG2300 (32PT) 48VDC	No									4.32	3.60						
					H005-SSS-RSAY-OWNTWK2	SWITCH E/NET 32PRT RUGGED RSG2300 OPSWAN	RUGGEDCOM	RSG2300 (32PT) 48VDC	No									4.32	3.60						
					H005-SSS-RSAY-OWNTWK	SERVER PORT 48VDC PERLE 04030453 -OPSWAN	PERLE	IOLAN STS16DC	No									12.00	10.00						
					H005-SSS-RSAY-OWNTWK	SERVER PORT 48VDC PERLE 04030453 -OPSWAN	PERLE	IOLAN STS16DC	No									12.00	10.00						
					H005-SSS-RSAY-TIMING2	GPS CLOCK TEKRON TCG01 D:1	TEKRON	TCG01	Yes					10.73	5.36										
BLDG +3 COMMON OPSWAN NSC/LCF	132kV CONTROL BUILDING +3 NSC/LCF/COMMON RTU AND OPSWAN CUBICLE	+3B1	2009	3.18	H005-SSS-RSAY-LCF3INT	REMOTE TERMINAL UNIT FOXBORO C50	FOXBORO	C50	Yes					10.53	5.27					3.18	3.18	> 2044	2029/30 (b)	> 2044	> 2044
					H005-SSS-RSAY-NSCLNK13	REMOTE TERMINAL UNIT FOXBORO C50	FOXBORO	C50	Yes					10.53	5.27										
					H005-SSS-RSAY-NSCLNK23	REMOTE TERMINAL UNIT FOXBORO C50	FOXBORO	C50	Yes					10.53	5.27										
					H005-SSS-RSAY-OWINVRT3	INVERTER 125VDC/240VAC 1600W	LATRONICS	415-992-C8	No									10.64	5.27						
					H005-SSS-RSAY-OWNTWK3	SWITCH ETHERNET 3 x 8 PORT	ALLOY	MS888G2	Yes									10.53	8.78						
					H005-SSS-RSAY-OWNTWK2	SWITCH ETHERNET 3 x 8 PORT	ALLOY	MS888G2	Yes									10.53	8.78						
					H005-SSS-RSAY-OWNTWK2	LOCAL CONTROL FACILITY PC X TERMINAL	WYSE	V90LEW	Yes									5.73	4.78						
					H005-SSS-RSAY-OWNTWK3	SWITCH 8PORT	RUGGEDCOM	RS8000A-HI-MM-MS	No									4.19	3.66						
					H005-SSS-RSAY-TIMING3	GPS CLOCK TEKRON TCG01 D:1	TEKRON	TCG01	Yes					10.73	5.36										
275kV POWER MONITORING	POWER MONITORING PANEL	+2E2	2014	1.71	H005-SSS-RSAY-PWRQUAL1	PQ ANALYSER UNIPOWER UP-2210 VT & RET IN	UNIPOWER	UP-2210	Yes					5.08	2.54					1.71	1.71	> 2049	2034/35 (b)	> 2049	> 2049
SVC OPSWAN	SVC BUILDING +4 OPSWAN CUBICLE	+4OPSWAN	2009	3.14	H005-SSS-RSAY-OWINVRT4	INVERTER 125VDC/240VAC 1000W	LATRONICS	415-992-C9125	No									10.72	5.36	3.14	3.14	> 2044	2029/30 (b)	> 2044	> 2044
					H005-SSS-RSAY-OWNTWK4	LOCAL CONTROL FACILITY PC X TERMINAL	WYSE	V90LEW	Yes									5.73	4.78						
					H005-SSS-RSAY-OWNTWK4	SWITCH ETHERNET 3 x 8 PORT	ALLOY	MS888G2	Yes									5.75	4.79						
					H005-SSS-RSAY-OWNTWK4	SERVER PORT 48VDC PERLE 04030453 -OPSWAN	PERLE	IOLAN STS16DC	No									4.67	3.89						
					H005-SSS-RSAY-OWNTWK4	GEN 4 SERVER OPSWAN	IBM	E813050	No									2.85	2.12						
					H005-SSS-RSAY-OWNTWK4	GEN 4 SERVER OPSWAN	HSL	H813002	No									2.85	2.12						
					H005-SSS-RSAY-OWNTWK4	SWITCH E/NET RUGGED RS8000H 125V OPSWAN	RUGGEDCOM	RS8000H	No									5.87	4.73						
					H005-SSS-RSAY-OWNTWK4	SWITCH E/NET RUGGED RS8000H 125V OPSWAN	RUGGEDCOM	RS8000H	No									5.67	4.73						
					H005-SSS-RSAY-OWNTWK4	SWITCH E/NET RUGGED RS8000H 125V OPSWAN	RUGGEDCOM	RS8000H	No									5.67	4.73						
					H005-SSS-RSAY-TIMING4	TIMING SYSTEM MEINBERG GPS170	MEINBERG	GPS170	Yes					3.05	1.52										
MASTER OPSWAN	MASTER OPSWAN CUBICLE	SW6	2007	2.71	H005-SSS-RSAY-INTSWIT	SUB INTERROGATION SWITCH - H005	COMMUNITRON	DATAGATE	Yes					20.00	10.00					2.71	2.71	> 2042	2027/28 (b)	> 2042	> 2042
					H005-SSS-RSAY-INVERT	INVERTER BAY 1 RACK 2	LATRONICS	LTRO 100	No					17.00	8.51										
					H005-SSS-RSAY-OWNTWK	SWITCH ETHERNET 3 x 8 PORT	ALLOY	MS888G2	Yes									12.00	10.00						
					H005-SSS-RSAY-OWNTWK	SWITCH ETHERNET 3 x 8 PORT	ALLOY	MS888G2	Yes									12.00	10.00						
					H005-SSS-RSAY-OWNTWK	SERVER PORT 48VDC PERLE 04030453 -OPSWAN	PERLE	IOLAN STS16DC	No									12.00	10.00						
					H005-SSS-RSAY-OWNTWK	ROUTER CISCO 2811 48VDC - OPSWAN	CISCO	2811-DC	Yes									12.00	10.00						
					H005-SSS-RSAY-OWNTWK	SWITCH E/NET 32PRT RUGGED RSG2300 OPSWAN	RUGGEDCOM	RSG2300 (32PT) 48VDC	No									5.89	2.57						
					H005-SSS-RSAY-OWNTWK	LOCAL CONTROL FACILITY PC X TERMINAL	WYSE	V90LEW	Yes									5.73	4.78						
					H005-SSS-RSAY-OWPRINT	PRINTER	HEWLETT PACKARD	HP5200TN	Yes									12.00	10.00						
					H005-SSS-RSAY-OWSKBV	MONITOR/KEYBOARD	ICP GLOBAL	C-24178	Yes									12.00	10.00						
					H005-SSS-RSAY-OWSERV	SERVER WITH RAID 2405 CARD - OPSWAN	ICP ELECTRONICS	IMB-Q354-R10	Yes									10.43	8.68						
					H005-SSS-RSAY-RTU2	REMOTE TERMINAL UNIT - ICFRTU	FOXBORO	C50	Yes					20.00	10.00										
					H005-SSS-RSAY-RTU3	REMOTE TERMINAL UNIT - ACCRTU	FOXBORO	C50	Yes					20.00	10.00										
					H005-SSS-RSAY-RTU4	REMOTE TERMINAL UNIT - TRANRTU	FOXBORO	C50	Yes					20.00	10.00										
					H005-SSS-RSAY-RTUCOMM3	REMOTE TERMINAL UNIT FOXBORO C50	FOXBORO	C50	Yes					10.53	5.27										
					H005-SSS-RSAY-VHMI	HMI ZENON ## SERVER 4500 TAGS FOR UTR	ZENON	ZKIT-XD	No					1.91	1.59										
					H005-SSS-RSAY-VHMI	HMI ZENON WEBSERVER PRO - 5 CLIENTS	ZENON	ZKIT-ED	No					1.91	1.59										
BLDG +2 DC AUXILIARY SUPPLY	BUILDING +2 125V DC X BATTERY		2010	8.33		BUILDING +2 125V DC X BATTERY	EXIDE	VRLA (MODEL 90A09)															2022		
	BUILDING +2 125V DC X BATTERY MONITOR AND CHARGER		2010	4.00		BUILDING +2 125V DC X BATTERY MONITOR AND CHARGER	RECTIFIER TECHNOLOGIES	RT4B-130V/12A & MRMC50-2 125V															2030		
	BUILDING +2 125V DC Y BATTERY		2010	8.33		BUILDING +2 125V DC Y BATTERY	EXIDE	VRLA (MODEL 90A09)															2022		
	BUILDING +2 125V DC Y BATTERY MONITOR AND CHARGER		2010	4.00		BUILDING +2 125V DC Y BATTERY MONITOR AND CHARGER	RECTIFIER TECHNOLOGIES	RT4B-130V/12A & MRMC50-2 125V															2030		
	BUILDING +2 125V DC DISTRIBUTION BOARD		2010	4.00		BUILDING +2 125V DC DISTRIBUTION BOARD																	2030		
BLDG +3 DC AUXILIARY SUPPLY	BUILDING +3 125V DC X BATTERY		2009	9.17		BUILDING +3 125V DC X BATTERY	EXIDE	VRLA (MODEL 90A09)															2021		
	BUILDING +3 125V DC X BATTERY MONITOR AND CHARGER		2009	5.50		BUILDING +3 125V DC X BATTERY MONITOR AND CHARGER	RECTIFIER TECHNOLOGIES	RT4B-130V/12A & MRMC50-2 125V															2029		
	BUILDING +3 125V DC Y BATTERY		2009	9.17		BUILDING +3 125V DC Y BATTERY	EXIDE	VRLA (MODEL 90A09)															2021		
	BUILDING +3 125V DC Y BATTERY MONITOR AND CHARGER		2009	5.50		BUILDING +3 125V DC Y BATTERY MONITOR AND CHARGER	RECTIFIER TECHNOLOGIES	RT4B-130V/12A & MRMC50-2 125V															2029		
	BUILDING +3 125V DC DISTRIBUTION BOARD		2009	5.50		BUILDING +3 125V DC DISTRIBUTION BOARD																	2029		

APPENDIX A - H005 WOOLOOGA 132/275KV SUBSTATION AND SVC SECONDARY SYSTEMS - EQUIPMENT HEALTH INDICES AND RECOMMENDED REPLACEMENT TIMEFRAME

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

RECOMMENDED REPLACEMENT TIMING (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		OPTAWAN		CABLES (m)	YARD MARSHALLING BOXES (no)	C&P PANELS (Chassis)	Sec Sys Equipment	CABLES	YARD MARSHALLING BOXES
Function	Panel Description	Panel No.	Year	HI	Functional Loc.	Description	Manufacturer	Model number	Obsolescence (Yes / no)	Eff. Age	HI	Eff. Age	HI	Eff. Age	HI	Eff. Age	HI	Eff. Age	HI	C&P Panels to HV Yard Marshalling Blocks (CB, MR, CT, VT, AC, DC, COOLING)	Yard Marshalling Blocks (CB, MR, CT, VT, AC, DC, COOLING)	C&P Panels	Sec Sys Equipment & Ancillary Components	C&P Panels to HV Yard Marshalling Blocks (CB, MR, CT, VT, AC, DC, COOLING)	Yard Marshalling Blocks (CB, MR, CT, VT, AC, DC, COOLING)
SVC BLDG +4 DC AUXILIARY SUPPLY	SVC BUILDING +4 125V DC X BATTERY		2008	10.00		SVC BUILDING +4 125V DC X BATTERY	EXIDE	VRLA (MODEL 90409)															2028		
	SVC BUILDING +4 125V DC X BATTERY MONITOR AND CHARGER		2008	6.00		SVC BUILDING +4 125V DC X BATTERY MONITOR AND CHARGER	RECTIFIER TECHNOLOGIES	RT48-110W/12A 0. MHVKSU-2 125V															2028		
	SVC BUILDING +4 125V DC Y BATTERY		2008	10.00		SVC BUILDING +4 125V DC Y BATTERY	EXIDE	VRLA (MODEL 90409)															2028		
	SVC BUILDING +4 125V DC Y BATTERY MONITOR AND CHARGER		2008	6.00		SVC BUILDING +4 125V DC Y BATTERY MONITOR AND CHARGER	RECTIFIER TECHNOLOGIES	RT48-110W/12A 0. MHVKSU-2 125V															2028		
	SVC BUILDING +4 125V DC DISTRIBUTION BOARD		2008	6.00		SVC BUILDING +4 125V DC DISTRIBUTION BOARD																	2028		

Planning Report	9/04/2020
Title	CP.02392 – H005 Woolooga Secondary Systems Replacement [1]
Zone	Wide Bay
Need Driver	Emerging compliance risks arising from condition and obsolescence of Woolooga's ageing secondary systems.
Network Limitation	Woolooga substation is needed to meet Powerlink Queensland's N-1-50MW/600MWh reliability obligations and maintain Central to Southern Queensland power transfer capability.
Pre-requisites	None

Executive Summary

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

Energy Queensland forecasts confirm there is an enduring need to maintain electricity supply into the Wide Bay area. The removal or reconfiguration of the Woolooga 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 Central and South Queensland.

The preferred network solution for Powerlink to continue to meet its statutory obligations is the replacement of the at-risk secondary systems by December 2029.

[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)).

Table of Contents

1. Introduction

The Woolooga Substation was established in 1973 to supply the Ergon and Energex loads in the Wide Bay zone, and to support Central to South Queensland power transfers. Woolooga Substation also includes an SVC, (located adjacent to the substation and commissioned in 2008). The SVC provides reactive power support for high Central to South Queensland power transfers.

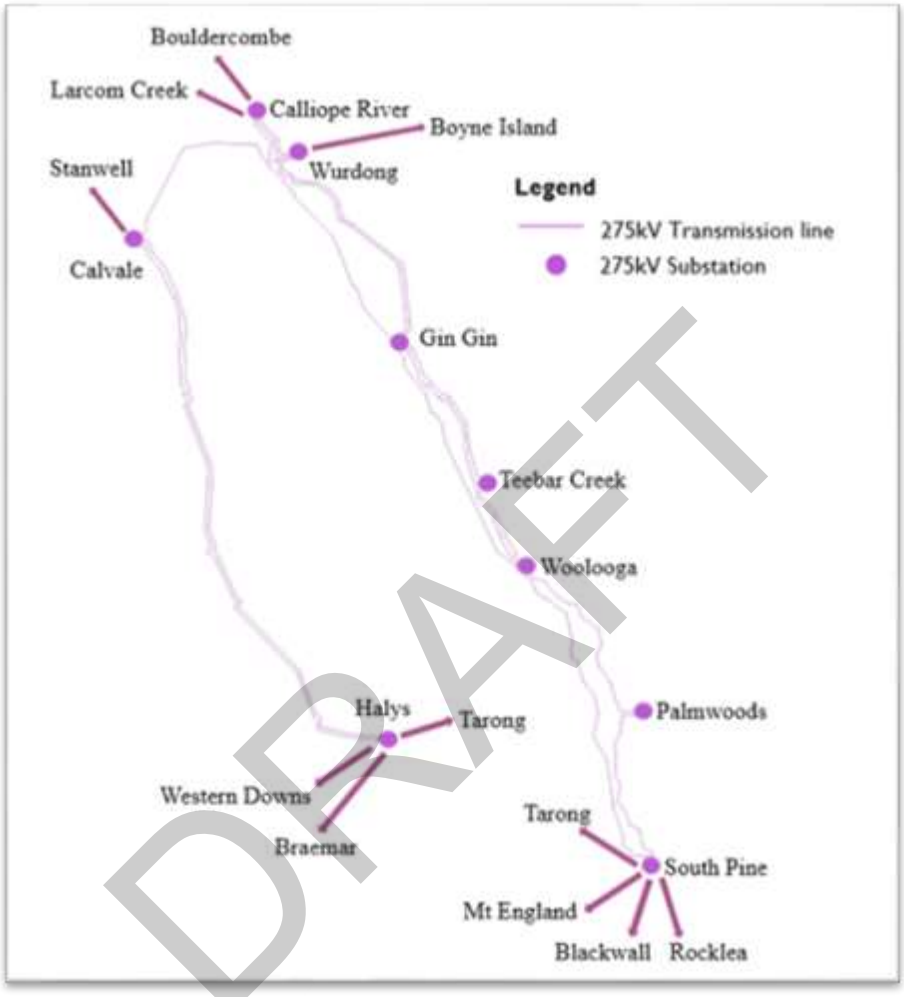


Figure 1: Woolooga locates on the CQSQ transmission corridor

A condition assessment of the 275 and 132kV secondary systems has determined they are approaching the end of their technical life and recommends that they be replaced by the end of 2029.

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

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 Woolooga Substation.

2. Woolooga Demand Forecast

The substation is comprised of two switchyards;

1. The 275kV switchyard, which has feeders connecting to Gin Gin, South Pine, Palmwoods and Teebar Creek, and

2. The 132kV switchyard, which provides 3 X 132 kV connections to Ergon and 2 X 132 kV connections to Energex for supply to Wide Bay, Gympie and North Coast Regions.

Figure 2 shows connection of Woolooga Substation to the South Pine, Palmwoods, Teebar Creek, Gin Gin and Calliope River substations, by 275kV transmission circuits, as well as its connection to the Ergon and Energex networks in the Wide Bay area via two 275/132kV 250MVA transformers.

Figure 2 – 275/132kV Woolooga Substation and SVC Electrical Single Line Diagram

Figure 3 shows that the Woolooga Substation supplies the loads at Kilkivan, Mungar, Gympie, Cooran, Noosaville, Sunrise Hill and QR Traveston.

Figure 3 - Woolooga supply area

Figure 4 shows historical load duration curves for Woolooga Substation.

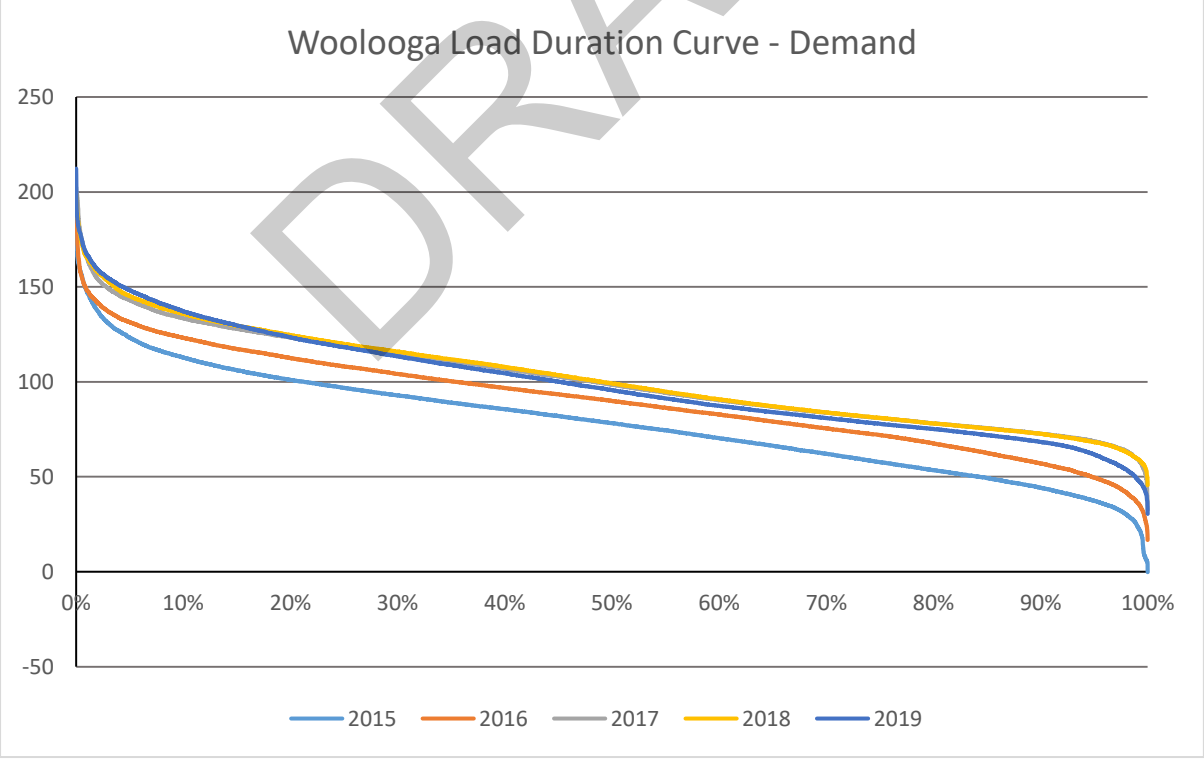


Figure 4 - Load Curve for Woolooga 132kV

Figure 5 shows the historical and forecast of peak load at Woolooga in the next 10 years.

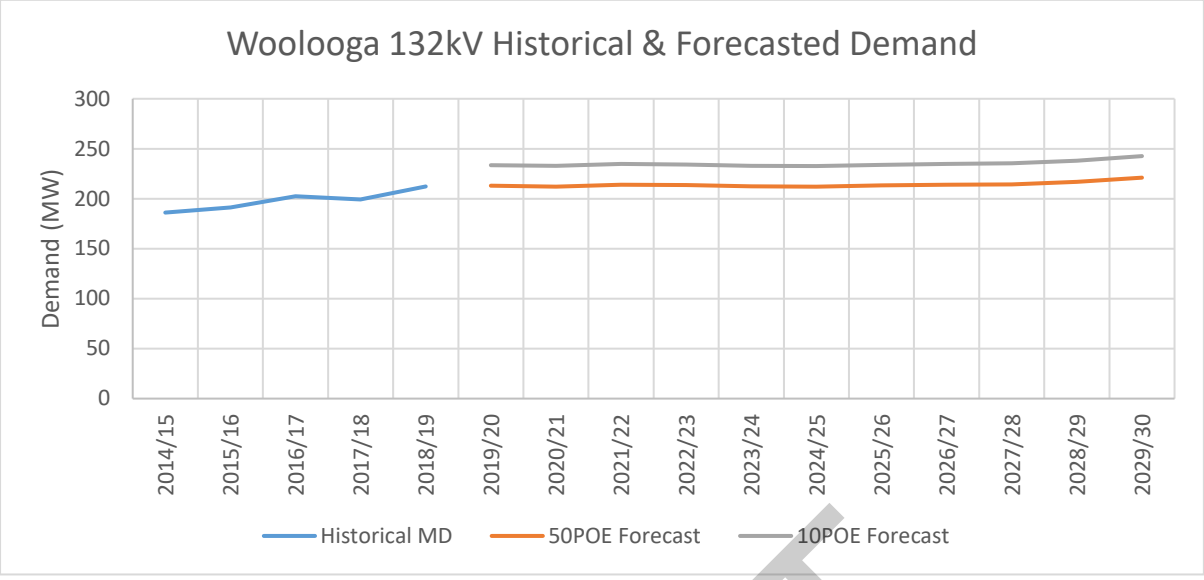


Figure 5 - Woolooga 132kV Maximum Demand

Figure 5 shows the forecast summer maximum demand is not expected to change materially in coming years. The summer 10% PoE maximum demand is forecast to increase from 233.6MW in 2019/20 to 242.6MW in 2029/30. There are no major additional loads proposed or committed in the Woolooga area.

There is also significant interest from proponents wanting to connect inverter-based generators in the area surrounding the Woolooga Substation.

3. Statement of Investment Need

As outlined in Section 2, the Woolooga Substation is a major transmission node between Central and South Queensland, as well as an essential bulk supply substation to supply Ergon and Energex loads in the Wide Bay zone.

Removing the functionality of this substation would have a major impact on the performance of the CQ-SQ grid section as well as impacting the reliability of supply to the loads in the Wide Bay area (including loads at Kilkivan, Mungar, Gympie, Cooran, Noosaville, Sunrise Hill and QR Traveston).

The secondary systems are required to operate Woolooga Substation. Therefore, the secondary systems at Woolooga 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 CQ-SQ grid section.

4. Network Risk

The table below presents the load at risk, as well as the energy at risk, at Woolooga 132kV.

Table 1 Load at Risk

Load At Risk	Contingency Event	Quantity	2020	2030
Woolooga TCP Load	Woolooga Total Secondary Systems Outage	Max (MW)	240	250
		Average (MW)	116	117
		24h Energy Unserved Max (MWh)	3750	3804
		24h Energy Unserved Average (MWh)	2789	2819
Kilkivan Load	Feeders 764 and 765	Max (MW)	20	21
		Average (MW)	9	9
		24h Energy Unserved Max (MWh)	332	339
		24h Energy Unserved Average (MWh)	207	208
Mungar Load	Feeder 7190	Max (MW)	9	9
		Average (MW)	3	3
		24h Energy Unserved Max (MWh)	115	120
		24h Energy Unserved Average (MWh)	64	67
Gympie, Traveston, Cooran, Noosaville and Sunrise Hill Load	Feeders 747 and 748	Max (MW)	214	224
		Average (MW)	105	106
		24h Energy Unserved Max (MWh)	3378	3402
		24h Energy Unserved Average (MWh)	2518	2544

5. Non Network Options

The Woolooga 275/132kV Substation facilitates 275kV flow between Central and Southern Queensland. The substation hosts two 275/132kV transformers to facilitate supply to Ergon loads between Woolooga and Teebar Creek and Energex loads located between Woolooga and Palmwoods.

To meet the Woolooga demand, the non-network solution must be capable to delivering up to 250MW of power and 3800MWh of energy each day. The non-network solution would be required to be capable of operating during a contingency or outage on a continuous basis until normal supply is restored.

Potential non-network solutions may provide supply to individual 132kV Woolooga loads (per the load at risk table) to reduce the scope of this project.

Powerlink is not aware of any Demand Side Solutions (DSM) in the area supplied by Woolooga 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.

6. Network Options

6.1 Proposed Option to address the identified need

Planning recommends the replacement of all 275 and 132kV secondary systems at H005 Woolooga Substation by end of 2029. This option ensures that all reliability of supply and asset condition criteria is met as well as maintaining the power transfer capability between Central and South Queensland.

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

6.2 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.

1.1.1 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.

7. Recommendations

Powerlink has reviewed the condition of the secondary systems at Woolooga Substation and anticipates they will reach end of technical service life by 2029. It is therefore recommended that the systems be replaced by December 2029.

Retaining Woolooga Substation will allow Powerlink to continue to meet its required reliability obligations (N-1-50MW/600MWh) and maintain power transfer capability between central and South Queensland.

Powerlink is currently unaware of any feasible alternative options to minimise or eliminate the load at risk at Woolooga 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.

8. References

1. H005 Woolooga Secondary Systems Condition Assessment Report 20 March 2020
2. Transmission Annual Planning Report 2019
3. Asset Planning Criteria Framework

Base Case Risk and Maintenance Costs Summary Report for Reset

CP.02392 Woolooga Secondary Systems Replacement

Version Number	Objective ID	Date	Description
1.0	A3395056	09/07/2020	Original document.

1 Purpose

The purpose of this model is to quantify the base case risk cost profiles for the secondary systems at Woolooga substation which is proposed for reinvestment under CP.02392.

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 Woolooga 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 service 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 south west Queensland area;
- Woolooga substation supplies a mixture of residential, commercial and agricultural loads. Historical load data and estimates have been used to analyse the proportion of these load types; and
- VCRs for residential, agricultural and commercial load types 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. A weighted average VCR of $30,583/MWh has been used when evaluating network risk cost, derived from the proportions identified from historical data.

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 Woolooga, 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 Woolooga 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.

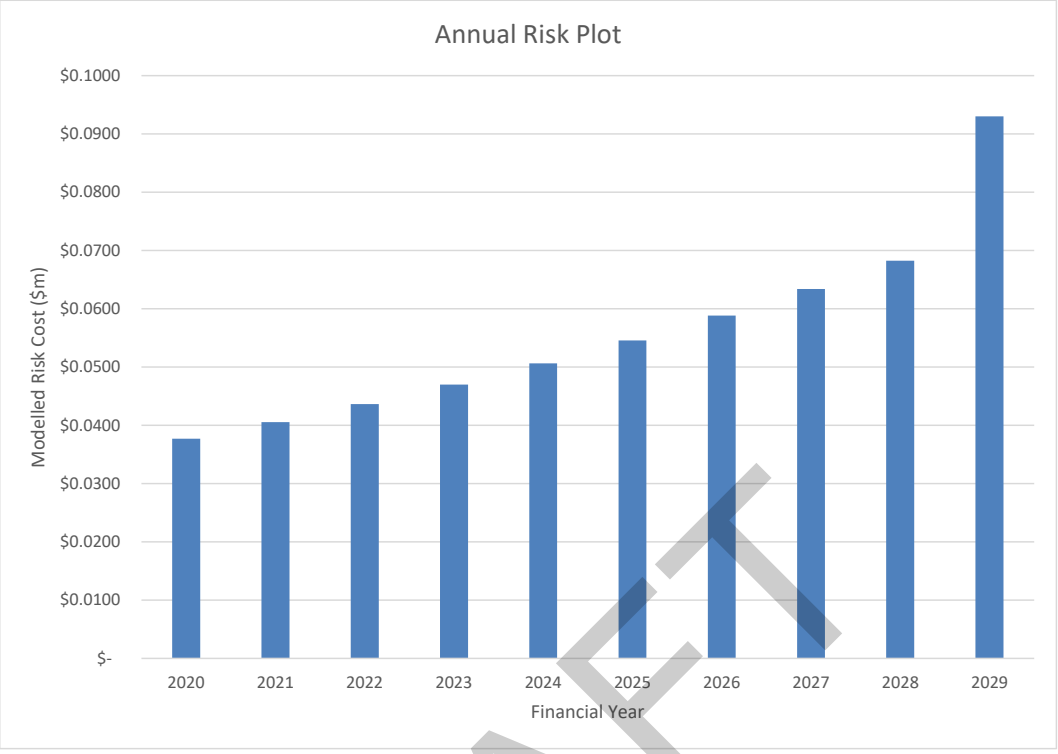


Figure 1 – Woolooga secondary systems total risk cost

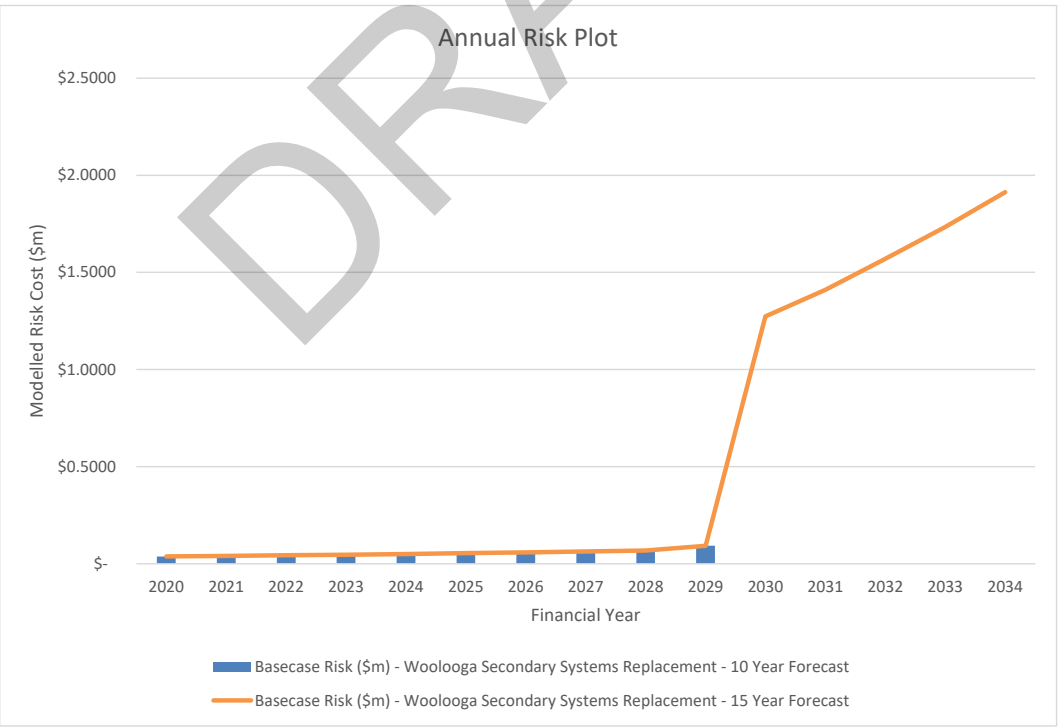


Figure 2 – Woolooga secondary systems risk cost (10 and 15 years)[2]

[2] The significant increase in modified risk cost in 2030 coincides with the depletion of available spares (refer Section 4).

Figure 3 – Woolooga secondary systems risk cost by category

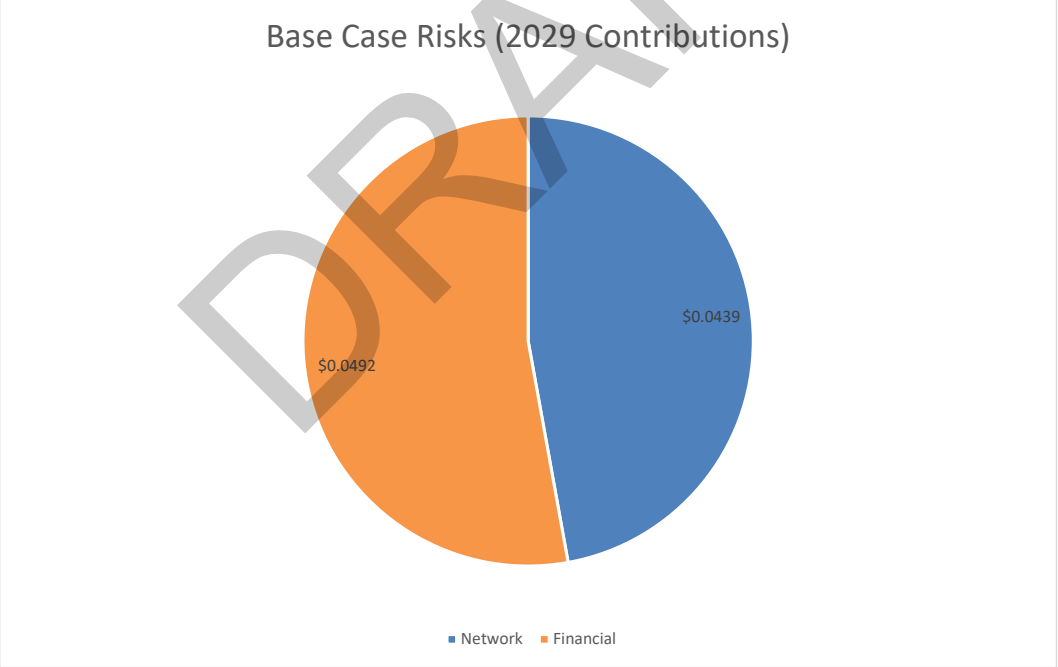


Figure 4 – Woolooga 2029 risk cost by category

3.4 Base case risk statement

The main base case risks for the secondary systems at Woolooga 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 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 77.5%. Hence, an increase in VCR of 100% would increase the overall risk cost by around 77.5%.

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 following observations can be made:

- Pre-secondary systems obsolescence: the model is most sensitive to VCR followed by emergency replacement cost.
- Post-secondary systems obsolescence: the model is most sensitive to plant restoration time followed by VCR.

Table 1: Input values, secondary systems model

	Item	Value	Unit
Network	VCR	30,583	$/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

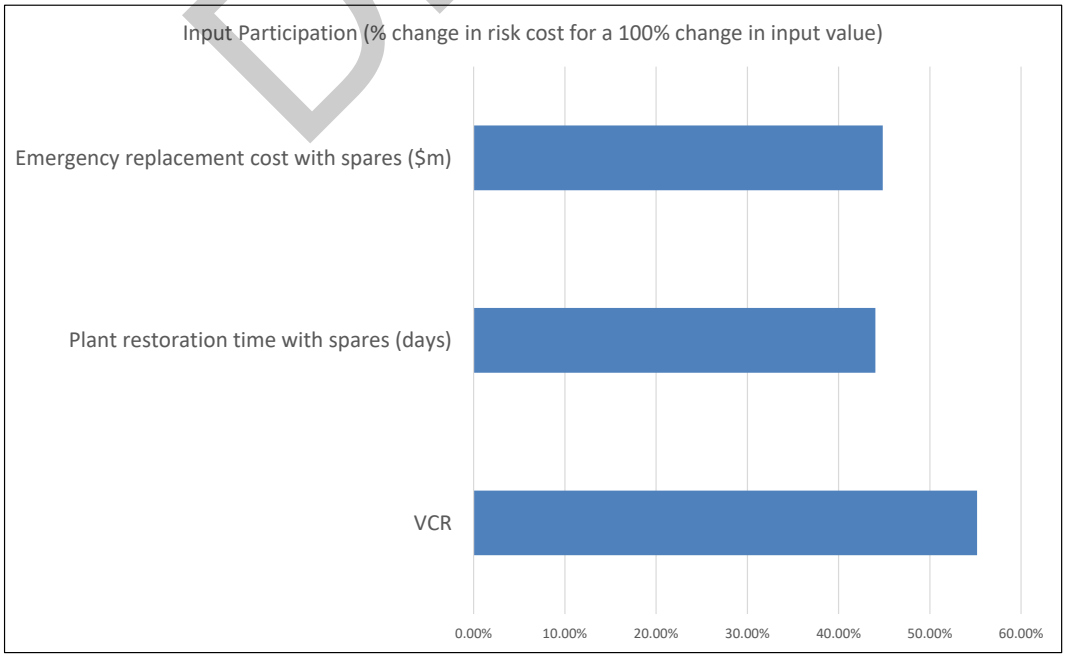


Figure 5 - Participation factors, secondary systems model – pre secondary systems obsolescence

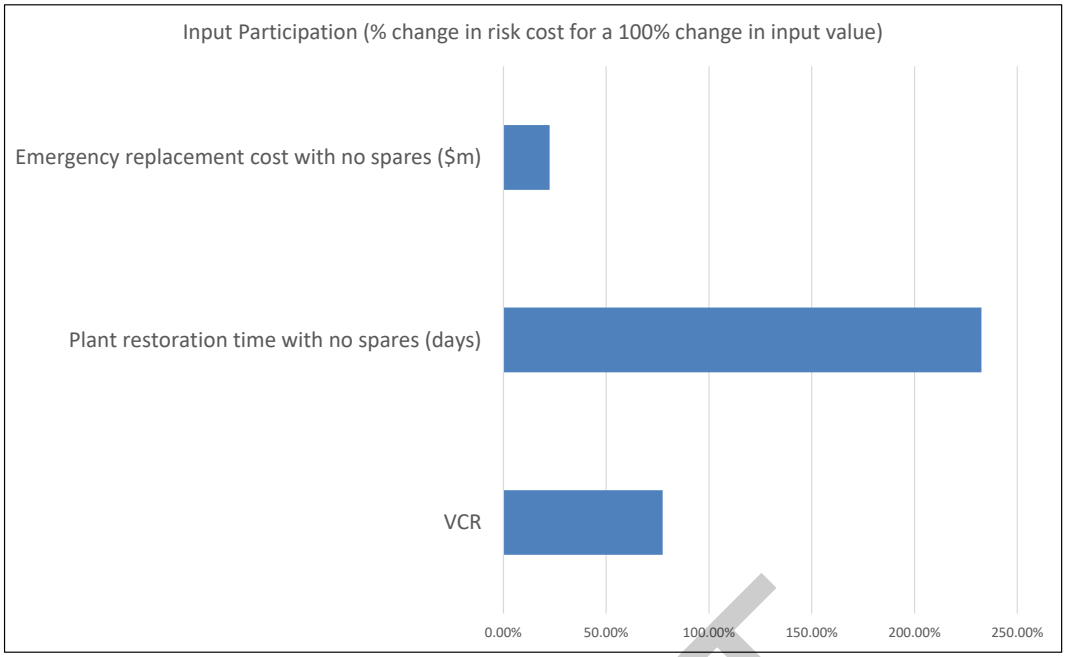


Figure 6 - Participation factors, secondary systems model – post secondary systems obsolescence

Project Scope Report

CP.02392

Woolooga 275/132kV Secondary System Replacement

Concept – Version 1

Document Control

Change Record

Issue Date	Responsible Person	Objective Document Name	Background
20/04/20	[redacted]	Project Scope Report CP.02392 Woolooga 275/132kV Secondary System Replacement	Preliminary scope

Related Documents

Issue Date	Responsible Person	Objective Document Name
20/03/2020	[redacted]	H005 Woolooga Secondary Systems Condition Assessment Report – 20 March 2020 (Obj ID: A3338686)

Project Contacts

Project Sponsor	[redacted]	Ext. [redacted]
Connection & Development Manager	<name>	Ext.
Strategist – HV/Digital Asset Strategies	<name>	Ext.
Planner – Main/Regional Grid	<name>	Ext.
Manager Projects	<name>	Ext.
Project Manager	<name>	Ext.
Design Coordinator	<name>	Ext.
<delete or insert more if needed>		

Project Details

1. Project Need & Objective

H005 Woolooga is a 275/132kV substation located approximately 165km north-west of Brisbane and was established in 1973 to assist with the CQSQ transfer. An SVC connected to the 275kV was established a separate switchyard in 2008.

The main substation is comprised of two (2) switchyards, as follows:

- a 275kV switchyard which has feeders connecting to Calliope River/Gin Gin, South Pine, Palmwoods and Teebar Creek; and,
- a 132kV switchyard which has 3x132kV feeders connecting to Ergon and 2x132kV feeders connecting to Energex for supply to Wide Bay, Gympie and North Coast Regions.

The objective of this project is to replace the 275/132kV secondary systems at H005 Woolooga by 31st October 2029.

2. Project Drawings

Figure 1 – 132kV/275kV Woolooga Substation and SVC Aerial View

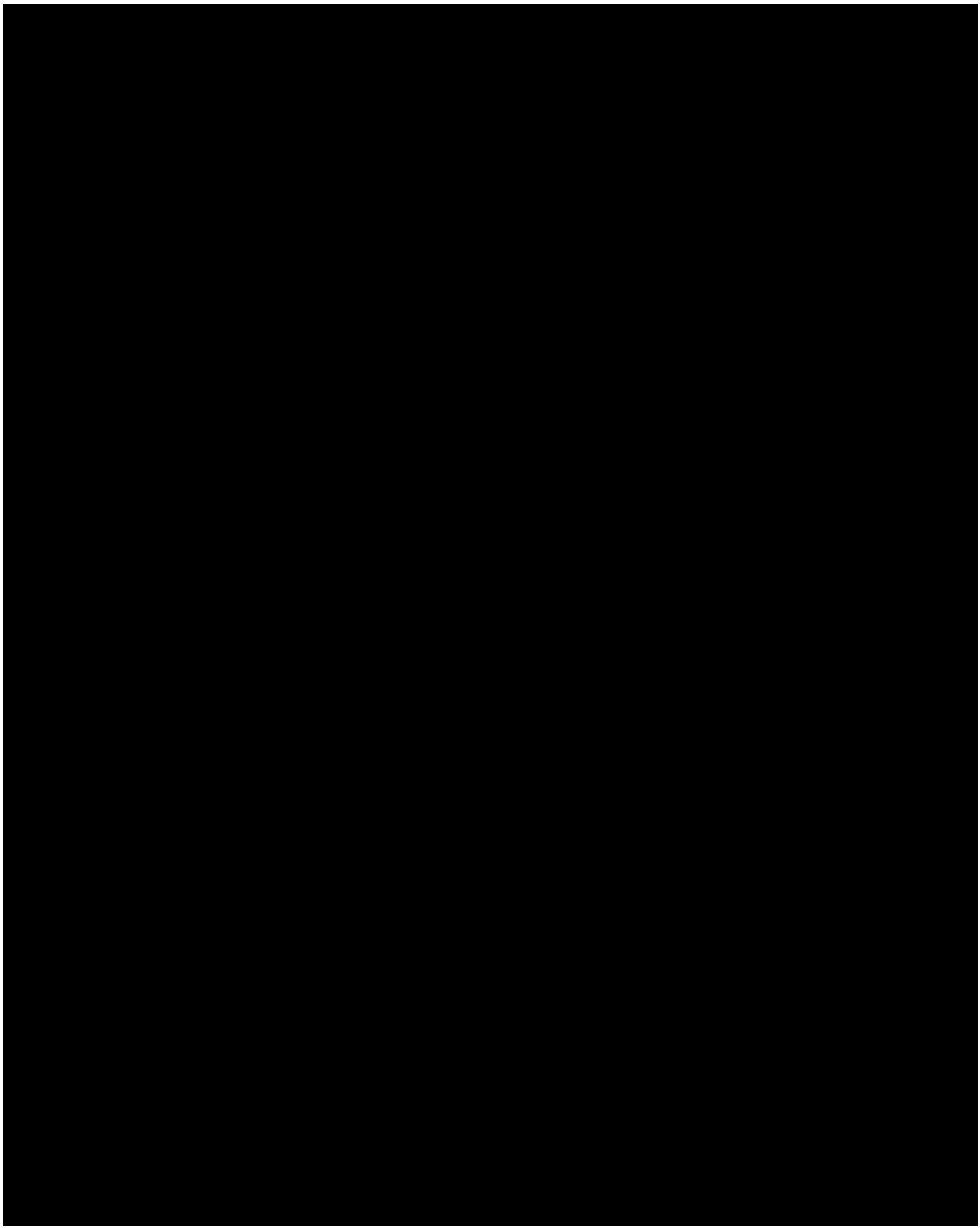


Figure 2 – 132kV/275kV Woolooga Substation and SVC Electrical Single Line Diagram

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, the project consists of replacing the 275kV and 132kV secondary systems equipment at H005 Woolooga substation utilising the spare space in the old brick control building. It should be noted that the replacement of the SVC secondary systems is to be carried out under a separate project CP.02810 'Woolooga SVC Secondary System Replacement'.

3.1.1. Transmission Line Works

Not Applicable

3.1.2. H005 Woolooga Substation Works

Design, procure, construct and commission the following items:

Refurbishment of the old brick control building +4 to meet current Powerlink standards including, but not limited to:

- Upgrade of air conditioning, if required;
- Upgrade of AC supplies, if required; and
- Upgrade of cable entries, if required.

From Building +2:

- Replacement of all 275kV secondary systems in the following panels utilising the spare space within the old brick control building +4 (currently empty):
  - 275kV Bus Zone 1;
  - 275kV Bus Zone 2;
  - C01 - 275kV Bus Coupler 1;
  - C01 - 275kV Feeder 813/815 Calliope River Tee Gin Gin;
  - C02 - 275kV Bus Coupler 2;
  - C02 - 275kV Feeder 807 South Pine;
  - C02 - 275kV Feeder 814 Calliope River Tee Gin Gin;
  - C03 - 275kV Bus Coupler 3;
  - C03 - 275kV Feeder 810 Palmwoods;
  - C03 - 275kV Feeder 8850 Teebar Creek;
  - C04 - 275kV Bus Coupler 4;
  - C04 - Transformer T5 (275kV);
  - C05 - 275kV Bus Coupler 5;
  - C06 - 275kV Capacitor Bank 3;
  - C07 - 275kV Bus Coupler 7;
  - C07 - Transformer T3 (275kV);
  - C07 - 275kV Static Var Compensator 4;
- Replacement of 125V DC X & Y DB, Batteries, Battery Charger and Cubicle; and
- Replacement of NSC/LCF, Common RTU, OPSWAN and associated panel;

- Replacement of GPS Clock.

From Building +3: -

- Replacement of all 132kV secondary systems in the following panels utilising the spare space within the old brick control building +4 (currently empty):
  - 132kV Bus Zone 1;
  - 132kV Bus Zone 2;
  - D02 - 132kV Feeder 764 Kilkivan
  - D03 - 132kV Feeder 765 Kilkivan;
  - D04 - Transformer T5 (132kV);
  - D05 - 132kV Bus Coupler;
  - D11 - 132kV Capacitor Bank 2;
  - D12 - 132kV Capacitor Bank 1;
  - D14 - 132kV Feeder 7190 Mungar;
  - D17 - Transformer T3 (132kV);
  - D18 - 132kV Feeder 748 Cooroy Tee Gympie;
  - D19 - 132kV Feeder 747 Traveston Tee Gympie;
- Replacement of 125V DC X & Y DB, Batteries, Battery Charger & Cubicle;
- Replace all Revenue Metering equipment and panel based on current standard;
- Replacement of NSC/LCF, Common RTU, OPSWAN and associated panel;
- Replacement of Power Quality Monitoring panel;
- Replacement of GPS clock.

Associated switchyard civil works including new cable termination racks across trenches, cable trenches and cable termination kiosks as appropriate.

Installation of new cables from the cable termination racks to the newly installed panels in the old brick control building +4.

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

3.1.3. Substation Works – Remote Ends

Minimal works are planned for the remote ends. The scope is limited to minor works including adjustment to CT ratios and protection settings consequential to the replacement of secondary systems in the selected bays at Woolooga.

3.1.4. Telecoms Works

Not applicable

3.1.5. Easement/Land Acquisition & Permits Works

Not applicable

4. Project Timing

4.1. Project Approval Date

The anticipated date by which the project will be approved is 31 October 2026.

4.2. Site Access Date

H005 Woolooga is an existing Powerlink operational substation and access to the site is immediately available.

4.3. Commissioning Date

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

5. Special Considerations

Not applicable

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 Investment & Planning.

[redacted] will provide the primary customer interface with Energy Queensland. 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.

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. Options

Not applicable

10. Division of Responsibilities

A division of responsibilities document will be required to cover the changes to the interface boundaries with Energy Queensland. The Project Manager will be required to draft the document and consult with the Project Sponsor who will arrange sign-off between Powerlink and the relevant customer.

11. Related Projects

Project No.	Project Description	Planned Comm Date	Comment
Pre-requisite Projects			
Co-requisite Projects			
Other Related Projects			
CP.02810	Woolooga SVC Secondary System Replacement	31 Oct 2029	

Concept Estimate for CP.02392 - Woolooga 275/132kV Secondary Systems Replacement

Record ID	A3372053	
Policy stream	Asset Management	
Authored by	Project Manager	[redacted]
Reviewed by	Project Manager	[redacted]
Reviewed by	Team Leader	[redacted]
Approved by	Manager Projects	[redacted]

Table of Contents

1. Executive Summary

This concept estimate has been developed on the basis of the CP.02392 – Woolooga 275/132kV Secondary Systems Project Scope Report (PSR) – Version 1, (Objective ID: A3345045).

The H005 Woolooga Secondary Systems Condition Assessment Report – 20 March 2020 (Obj ID: A3338686, dated 20 March 2020) has been referenced for the development of this concept estimate.

H005 Woolooga is a 275/132kV Substation located approximately 165km north-west of Brisbane and was established to assist with the electricity transfer between the central and southern regions. The main substation is comprised of a 275kV switchyard and 132kV bays sharing a common perimeter fence.

There are 10 supplies to remote ends that will require integration with the new secondary system at H005 Woolooga under this project. The 275kV feeders connect to the Powerlink substations and the Woolooga Static Var Compensator (SVC) and the 132kV feeders connect to Energy Queensland substation. For the purpose of this estimate, all works at the H005 SVC site is included as a remote end.

A recent secondary systems condition assessment report indicates that the secondary systems is reaching the end of its technical asset life and requires replacement.

As indicated in the Project Scope Report, the target commissioning date is October 2029. To achieve the scope of works with minimal network and load at risk issues, the project design will need to commence in 2025 to achieve the required network outages, that will be completed during the 2027 to 2029 winter and shoulder months. A revised project approval date of June 2025 and a project commissioning date of December 2029, are proposed.

The objective of this project is to replace and relocate the 275/132kV secondary systems into the existing brick control room at H005 Woolooga by the target commissioning date of December 2029.

1.1 Project Estimate

Estimate Components - Reset 2023-27 Project		Base $	Escalated $
Estimate Class	3		
Estimate Accuracy	+ 30% / - 20%		
Base Estimate		**26,799,956**	**37,516,088**
Mitigated Risk	[redacted]	[redacted]	[redacted]
Contingency Allowance	[redacted]	[redacted]	[redacted]
TOTAL		[redacted]	[redacted]

1.2 Project Financial Year Cash Flows

Cash Flow Table	June 2020 Base Date	Completion
To June 2025	[redacted]	[redacted]
To June 2026	[redacted]	[redacted]
To June 2027	[redacted]	[redacted]
To June 2028	[redacted]	[redacted]
To June 2029	[redacted]	[redacted]
To June 2030	[redacted]	[redacted]
TOTAL	**26,799,956**	**37,516,088**

2. Project and Site Specific Information

H005 Woolooga is a 275/132kV Substation located approximately 165km north-west of Brisbane and was established in 1973 to assist with the electricity transfer between the Central/Southern Regions.

An SVC connected to the H005 Woolooga 275kV Substation was established in a separate switchyard in 2008

2.1 Project Dependencies & Interactions

The project dependency and interactions will be confirmed during the definition and concept stages.

2.2 Site Specific Issues

H005 Woolooga is a 275/132kV Substation located approximately 165km north-west of Brisbane on the Wide Bay Highway and 25km from Gympie CBD.

An SVC connected to the 275kV was established a separate switchyard in 2008.

Minor Secondary systems works only is expected to integrate the remote end substations with the new H005 secondary systems.

3. 132/275kV Secondary Systems Replacement

3.1 Definition

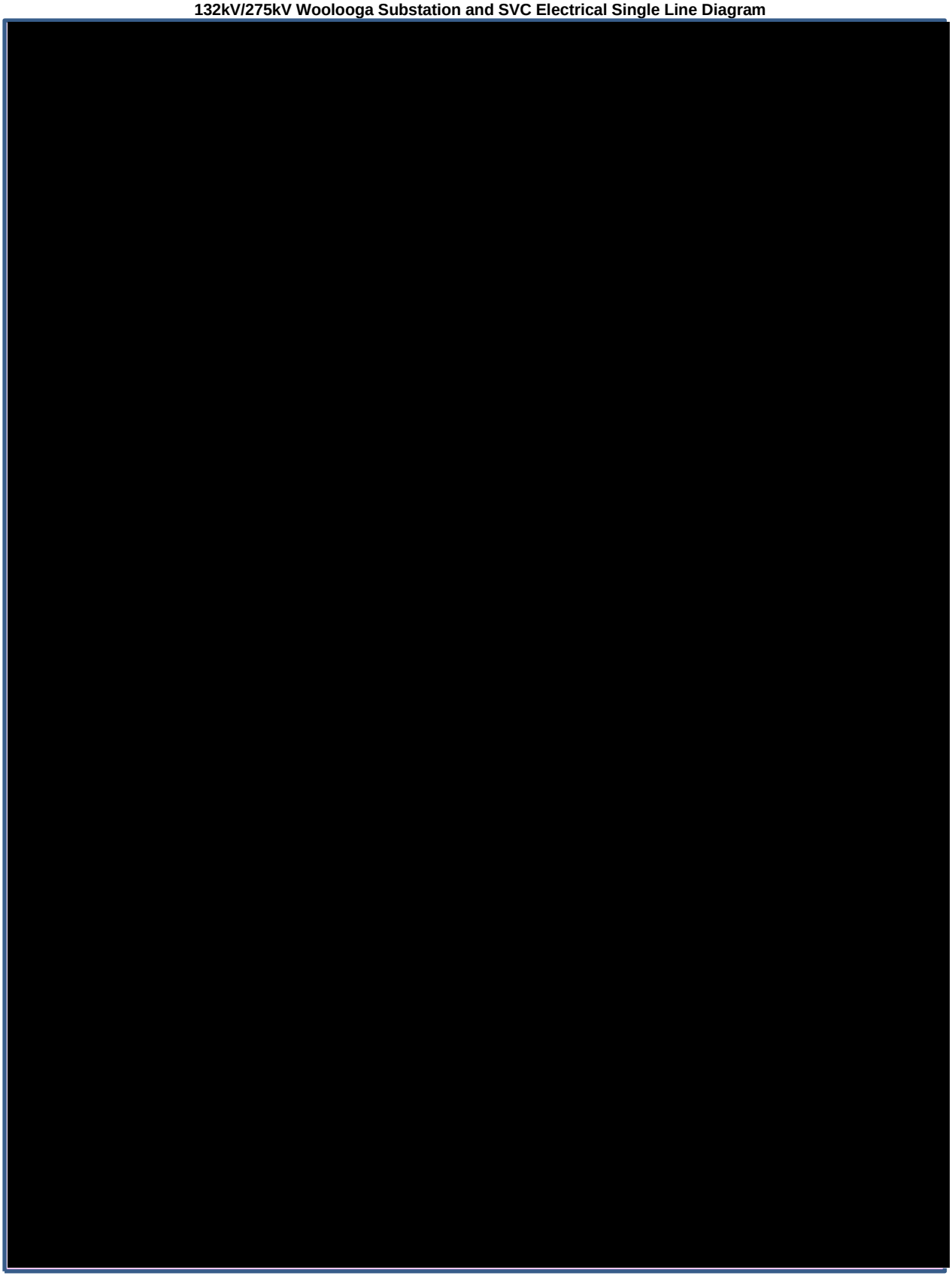
3.1.1 Scope

The option proposed in this estimate is for the replacement and relocation of the 275kV and 132kV secondary systems equipment at H005 Woolooga Substation into the existing original brick control building +4.

The estimate includes the refurbishment of the existing brick control building +4 to meet current Australian / Powerlink standards including air conditioning, fire detection systems, security system and WHS facilities and requirements.

The decommissioning, removal and disposal of the redundant secondary systems control cabling, control panels and control buildings +2 and +3 including support structures to foundation level are included.

132kV/275kV Woolooga Substation and SVC Electrical Single Line Diagram



3.1.1.1 H005 Woolooga Substations Works

The scope of works at H005 Woolooga are:

Civil works including minor cable trenches and new external cable termination rack enclosures and cable pits.

Refurbishment of the old brick control building +4 to meet current Powerlink standards including upgrade / replacement / integration of:

- Air conditioning
- AC supplies
- Secondary systems control cable entries to wall entry
- Floor mounted cable tray arrangement
- The fire detection systems
- The security system
- WHS requirements

Design, procure, construct and commission the following items:

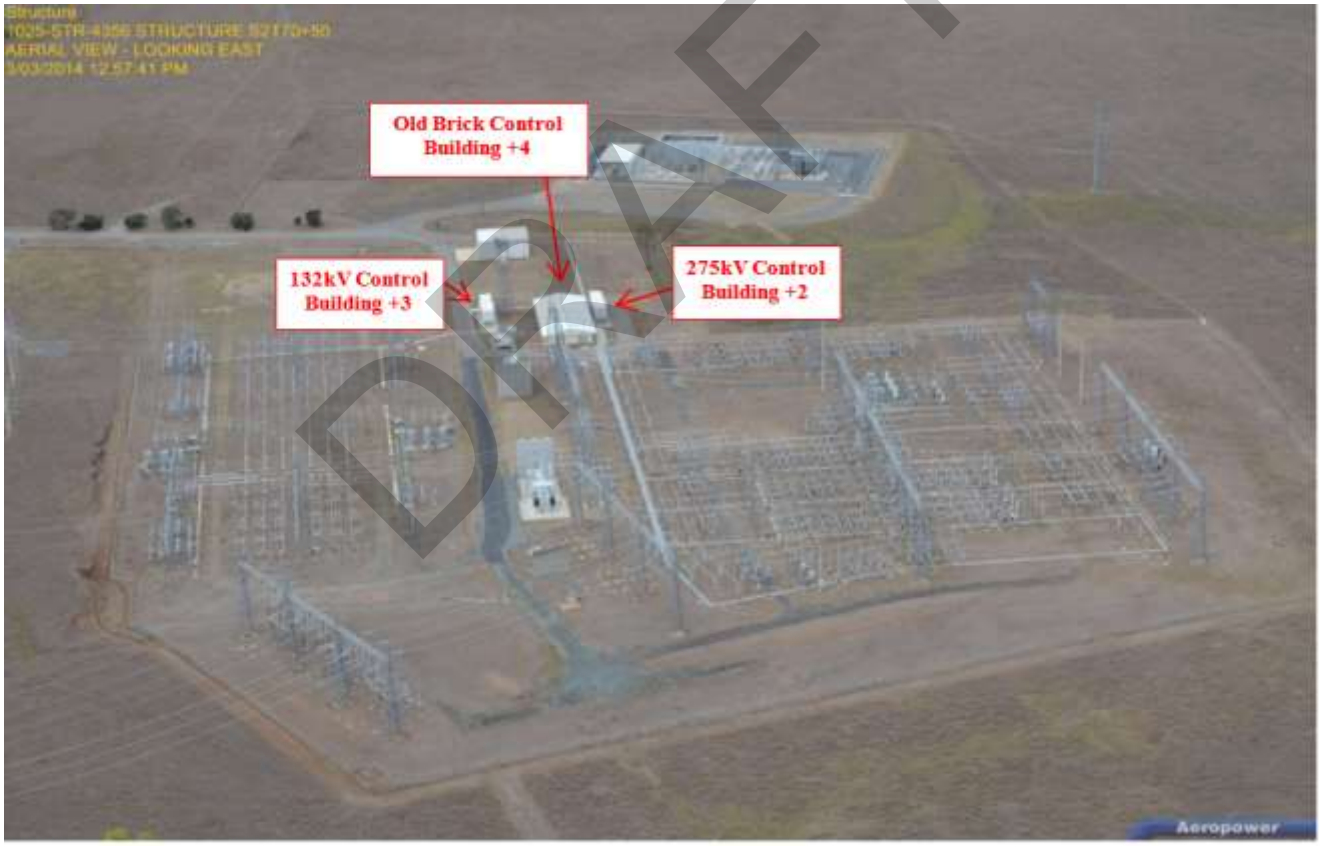
From Building +2:

- Replacement of all 275kV secondary systems in the following panels:
    - Bus Zone 1 & 2;
    - Bus Couplers
    - Feeder 813/815 Calliope River Tee Gin Gin;
    - Feeder 807 South Pine;
    - Feeder 814 Calliope River Tee Gin Gin;
    - Feeder 810 Palmwoods;
    - Feeder 8850 Teebar Creek;
    - Transformer T5 (275kV);
    - Capacitor Bank 3;
    - Transformer T3 (275kV);
    - Static Var Compensator 4;

From Building +3:

- replacement of all 132kV secondary systems in the following panels:
    - Bus Zone 1 & 2;
    - Feeder 764 Kilkivan
    - Feeder 765 Kilkivan;
    - Transformer T5 (132kV);
    - Bus Coupler;
    - Capacitor Bank 1 & 2;
    - Feeder 7190 Mungar;

  - Transformer T3 (132kV);
  - Feeder 748 Cooroy Tee Gympie;
  - Feeder 747 Traveston Tee Gympie;
- replacement of 125V DC X & Y DB, Batteries, Battery Charger & Cubicles;
- replace all Revenue Metering equipment and panel based on current standard;
- replacement of NSC/LCF, Common RTU, OPSWAN and associated panel;
- replacement of Power Quality Monitoring panel;
- replacement of GPS clock.
- installation of new 275/132kV control panels into control building +4;
- installation and termination of new control cables from the panels in control building +4 to the external cable termination rack enclosures;
- cutover bays to new control system;
  - all existing panels located within buildings +2 and +3 shall be decommissioned, redundant secondary systems cabling and control buildings +2 and +3 to be removed from site.



132kV/275kV Woolooga Substation control room arrangement

132kV/275kV Woolooga Substation proposed termination rack locations

3.1.1.2 Transmission Line Works

Not applicable.

3.1.1.3 Telecommunication Works

Minor telecommunication works is expected for the cutover works.

3.1.1.4 Easement/Land Acquisition & Permit Works

Not applicable.

3.1.2 Major Scope Assumptions

It is assumed that;

- For the purpose of this estimate, the secondary systems asset boundary between the H005 substation and SVC yard will be at the 275kV terminal rack.
- The existing Control building +4 is structurally and mechanically deemed ‘fit for purpose’ and cost effective to upgrade up to Australian and Powerlink Standards
- The existing brick building work includes replacement of the air conditioning to meet the cooling requirements of the new control equipment.
- The proposed side entry of the control cable through the walls / window of the +4 buildings is approved.
- The control panels will be built and point to point (P2P) tested at the vendors premises before sent to site for contractor to integrate and wire to new termination racks.
- Existing field cable are fit for purpose and can be re-used and re-terminated into the new cable termination rack enclosures panel.
- All new foundations will be a high level design.
- Minor Asbestos works is required and an allowance is included in the estimate.

- An outage on QR Feeder 7190 will be difficult and early negotiation with network operations will be required.
- It is assumed that Energy Queensland resources will be available when required to complete works at the remote ends.
- There are no Energy Queensland projects that may impact on the Powerlink schedule of works.
- Estimate is based on Powerlink architectures, standards and equipment in place and available at the time of development.
- An approved safe work method has been approved for works in confined spaces for the removal of any redundant new secondary systems cabling.

3.1.3 Scope Exclusions

- All Internal segregations / walls in control building +4.
- All works to secure closure of the cable basement at the completion of the project.
- Rock is excluded from the base estimate (an item is included in the risk).
- The addition of more renewable generation in the region is likely to create less favourable outage requirements. These have not been considered or any allowance included.
- This estimate does not include any costs for repairing or modification to primary plant.
- The estimate excludes upgrades for the following: earth grid, internal roads, lights, fences and gates.
- No modification on the existing transmission lines are considered in this estimate.
- No time allowance is included in the project schedule for any Energy Queensland projects that may impact Powerlink schedule of works.
- The Project Scope Report does not indicate the replacement of the 50VDC battery system. The cost for the battery system is included as project risk.
- Any works for the Replacement of the SVC secondary systems. It will be completed under a separate project CP.02810 ‘Woolooga SVC Secondary System Replacement’.

3.2 Project Execution

3.2.1 Project Schedule

A High Level Project Schedule should be developed and should address the following project stages:

Task	Target Completion
Project Approval, PAN Issued	June 2025
Contract Award	October 2025
Design Commencement	October 2025
Procurement Orders	November 2025
Site Access Date	February 2026
Control Building (+4) Upgrades	February 2026
Civil works and Cable termination rack works	February 2026
Staged 275kV Bay Commissioning	March 2027
Staged 132kV Bay Commissioning	June 2028
Staged Bus Commissioning	October 2029
Final Commission Notice	October 2029
Final Decommissioning	December 2029
Project Practical Completion	December 2029

3.2.2 Network Impacts

- Outages to be scheduled in shoulder and winter periods - Late April/ May to October
- Outage on QR Feeder 7190, will be difficult and early negotiation with network operations will be required.
- Detailed Restoration plans for every outage

3.2.3 Project Staging

The proposed staging for the CP.02392 project works is to be completed in multiple individual stages.

Secondary System Replacement Construction/Commissioning Stages
Contractor to complete +4 control building upgrades
Contractor to complete civil works and installation of outdoor cable terminal rack enclosures and install new secondary systems cables
MSP to witness point to point testing of the new control panels with vendor
Contractor to install new control panels and battery into control building +4
Contractor handover to MSP
MSP - 275KV cutover to new control panels in control building +4
MSP -132kV cutover to new control panels in control building +4
MSP - 275kV bus cutover
MSP - 132kV bus cutover
MSP - Final commissioning of new 275/132kV secondary systems
Contractor to decommissioning and removal of all redundant cables, panels and control buildings +2 and +3
Project Post Commissioning and Drawing Management

3.2.4 Resourcing

Resources for the project will be a combination of the design works and will be completed by external design partners with reviews conducted by internal Powerlink design staff. The construction works will be completed by a combination of the Maintenance Service providers and Substation Panel contractors.

3.3 Project Estimate

Estimate Components - Reset 2023-27 Project		Base $	Escalated $
Estimate Class	3		
Estimate Accuracy	+ 30% / - 20%		
Base Estimate		**26,799,956**	**37,516,088**
Mitigated Risk	[redacted]	[redacted]	[redacted]
Contingency Allowance	[redacted]	[redacted]	[redacted]
TOTAL		[redacted]	[redacted]

3.4 Project Financial Year Cash Flows

Cash Flow Table	June 2020 Base Date	Completion
To June 2025	[redacted]	[redacted]
To June 2026	[redacted]	[redacted]
To June 2027	[redacted]	[redacted]
To June 2028	[redacted]	[redacted]
To June 2029	[redacted]	[redacted]
To June 2030	[redacted]	[redacted]
TOTAL	**26,799,956**	**37,516,088**

3.5 Project Asset Classification

Asset Class	Asset Life	Base $	Percentage
Secondary systems	15 years	22,573,489	84%
Communications	15 years	910,168	3%
Primary plant	40 years	3,316,298	12%
Transmission lines	50 years		
TOTAL		**26,799,956**	

4. References

Document name	Version	Date
Project Scope Report	1.0	20/04/2020