

NEED/OPPORTUNITY STATEMENT (NOS)



Line 12 330kV Transmission Line Renewal

NOS- 000000001271 revision 2.0

Ellipse project description: P0005447

TRIM file: [TRIM No]

Project reason: Capability - Asset Replacement for end of life condition

Project category: Prescribed - Replacement

Approvals

Author	Edward Luk	Transmission Lines and Cables Analyst
Endorsed	Steve Stavropoulos	Transmission Lines and Cables Asset Manager
	Mark Jones	Secondary Systems and Communications Asset Manager
Approved	Lance Wee	Manager/Asset Strategy
Date submitted for approval	28 November 2016	

Change history

Revision	Date	Amendment
0	11 April 2016	Initial issue
1	27 July 2016	Update to 2016/17 dollars
2	28 November 2016	Update to format

1. Background

Line 12 is a steel tower 330kV transmission line between Liverpool and Sydney South 330kV substations, with a route length of 17.5 km. The transmission line links generation to the Sydney metro area. This single circuit section of this line was constructed in 1965 and consists of 23 structures, a route length of 7.4km. The line passes through urban areas of Sydney.

Condition assessment NACA-1271¹ performed in January 2016 has identified a number of issues with transmission line 12 which require rectification in the short – medium term to ensure that the asset remains operational in the long term. Corrosion of steel is the main contributing factor leading to a decline in the health of the asset.

This transmission line falls within a zone of low² steel corrosion, however is on the border of the medium² corrosion zone.

2. Need/opportunity

Condition assessment NACA-1271 has identified issues which require rectification, these are summarised in Table 1.

Table 1 – Transmission Line 12 Condition Issues

Issue	Extent (% line)	Cause	Impact
Conductor dampers	10%	Damaged	Accelerated fatigue of conductor due to vibration
Corrosion of earth wire	50%	Zinc galvanising end of life	Conductor drop

The risk cost associated with the issues identified in Table 1 is \$0.03m per annum (refer Attachment 1). The most significant element of concern is conductor drop as a result of earth wire failure.

Corrosion of the earth wire is as expected given the age and location of the asset. This item is original and the sacrificial zinc galvanising layer has reached end of life. This item generally had a significantly thinner layer of galvanising at the time of manufacturing compared with the steel tower members due to fabrication processes.

Damaged conductor dampers require replacement to ensure the long term health of the conductors is not impacted by vibration.

The corrosion issues associated with the earth wire is consistent with other transmission lines of the same vintage in the region. The benefit of addressing the condition issues on transmission line 12 is to continue providing the service at a lower risk of failure.

Given the significant proportion of earthwire identified with corrosion related issues, replacement of an earthwire with OPGW will improve the communications system by bringing fibre to Liverpool, allowing for duplicated paths between Liverpool and Sydney South (one microwave and one fibre). The benefits of this opportunity come as a result of reduced OPEX through maintenance and licensing saving, with an expected quantified benefit of

¹ [NACA-1271](#) on PDGS Need Site

² Steel corrosion rate as defined in AS 4312 – *Atmospheric corrosivity zones in Australia*

\$0.0115m per annum. It is noted that organisational benefits such as efficiency savings have not been taken into account.

3. Related needs/opportunities

Need 1094 – Line 12 Earthing and Clearance (RMS): There may be an opportunity to deliver all or part of the work more efficiently if the work under both needs is combined.

4. Recommendation

It is recommended that options be considered to address the identified need/opportunity by 2023.

Attachment 1 - Risk costs summary

Summary of results is attached below. Refer to supporting document in PDGS for full risk assessment.

Current Option Assessment - Risk Summary



Project Name: Line 12

Option Name: 1271 - Base Case

Option Assessment Name: 1271 - Base Case - Assessment 1

Rev Reset Period: Next (2018-23)

Major Component	No.	Minor Component	Sel. Hazardous Event	LoC x CoF (\$M)	Failure Mechanism	NoxLoC xCoF (\$M)	PoF (Yr 1)	Total Risk (\$M)	Risk (\$M) (Rel)	Risk (\$M) (Op)	Risk (\$M) (Fin)	Risk (\$M) (Peo)	Risk (\$M) (Env)	Risk (\$M) (Rep)
Conductor	117	Fittings	Conductor Drop (Conductor)	\$4.71	Fitting Failure	\$550.68	0.00%	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Conductor	117	Fittings	Unplanned Outage - HV (Conductor)	\$0.48	Structural Failure	\$56.00	0.00%	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Conductor	117	Insulators	Conductor Drop (Conductor)	\$4.71	Insulator Failure	\$550.68	0.00%	\$0.01	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Conductor	117	Insulators	Unplanned Outage - HV (Conductor)	\$0.48	Structural Failure	\$56.00	0.00%	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Earth Wire	4	Earth Wire (inc Joints)	Earth Wire Drop (Earth Wire)	\$0.64	Break	\$2.55	0.06%	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Earth Wire	4	Earth Wire (inc Joints)	Unplanned Outage - HV (Earth Wire)	\$0.48	Break	\$1.91	0.06%	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Earth Wire 2	78	Fittings (inc Attachment)	Earth Wire Drop (Earth Wire 2)	\$1.16	Fitting Failure	\$90.18	0.00%	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Earth Wire 2	78	Fittings (inc Attachment)	Unplanned Outage - HV (Earth Wire 2)	\$0.48	Structural Failure	\$37.34	0.00%	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Structure	6	Earthing	Uncontrolled Electrical Contact / Discharge (Structure)	\$0.16	Earthing Failure	\$0.98	0.57%	\$0.01	\$0.00	\$0.00	\$0.00	\$0.01	\$0.00	\$0.00
Structure 2	23	Steel Structure	Unplanned Outage - HV (Structure 2)	\$3.35	Structural Failure	\$77.06	0.01%	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Structure 2	23	Steel Structure (inc Footings)	Conductor / Earth Wire / OF/GW Drop (Structure 2)	\$4.98	Structural Failure	\$114.46	0.01%	\$0.01	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
						\$21.61		\$0.03	\$0.01	\$0.00	\$0.00	\$0.01	\$0.01	\$0.00
Total VCR Risk:								\$0.01	Total ENS Risk:		\$0.00			

Number of Components

The number of components used in the risk model has been derived as follows:

- > Steel Structure Earthing: The number of steel structures on the line in areas readily accessible by members of the general public (6).
- > Earth Wire: Length of earth wire on the transmission line multiplied portion with advanced corrosion condition issues identified in Table 1 (50%).

Probability of Failure

As per the Risk costs summary.

Consequence of Failure

As per the Risk costs summary.