NEED/OPPORTUNITY STATEMENT (NOS)

Line 88 330kV Transmission Line Renewal

NOS- 000000001317 revision 2.0

Ellipse project description: P0007699
TRIM file: [TRIM No]

Project reason: Reliability - To meet overall network reliability requirements
Project category: Prescribed - Replacement

Approvals

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Approved	Lance Wee	Manager/Asset Strategy
Date submitted for approval	30 November 2016	

Change history

Revision	Date	Amendment
0	11 April 2016	Initial issue
1	27 July 2016	Update to 2016/17 dollars
2	30 November 2016	Revised to contain tower strength commentary and update to format

1. Background

Line 88 is a steel tower 330kV transmission line between Muswellbrook and Tamworth 330kV substations, with a route length of 127 km. The transmission line forms a key link between Queensland, Northern NSW and the Hunter region generators. This transmission line was constructed in 1969 and consists of 276 structures.

Condition assessment NACA-1317[1] performed in November 2015 has identified a number of issues with transmission Line 88 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.

2. Need/opportunity

Condition assessment NACA-1268 has identified issues which require rectification, these are summarised in Table 1.

Table 1 – Transmission Line 88 Condition Issues

Issue	Extent (% line)	Cause	Impact
Ground line corrosion of steel at footing	4%	Buried steelwork at footing	Steel corrosion of critical member, can lead to structural failure of tower
Buried concrete foundations	25%	Erosion of soil building up around footings	Accelerated corrosion of critical member
Corroded fasteners	5%	Zinc galvanising end-of-life	Structural failure
Insulator pin corrosion	3%	Pollution build up and deterioration of galvanising	Conductor drop
Corroded earth wire attachment fittings	2%	Zinc galvanising end-of-life	Conductor drop
Conductor dampers	2%	Damaged	Accelerated fatigue of conductor due to vibration

The risk cost associated with the issues identified in Table 1 is $1.08m per annum (refer Attachment 1). One of the most significant element of concern is ground line corrosion of steel transmission tower legs at the footings. These are the critical load bearing members of the tower and cannot be easily remediated if the condition passes a stage where rectification work is not possible.

The single circuit transmission line structures used on Line 88 were designed to the standards at that time but were found to be a lower set of design criteria compared with newer structures. Following a number of structure failures in extreme wind events, investigations found that these single circuit suspension towers had design deficiencies in the governing load combinations when compared to more recent design philosophies and standards. Strengthening of structures with utilisation over 85% at road crossings and public areas has occurred. As not all structures have been strengthened, it is essential that condition issues on these towers be addressed so that they do not reduce the capacity of the towers and further reduce the security of supply.

[1] NACA-1317 on PDGS Need Site

Corrosion of fasteners and fittings is as expected given the age of the asset. These items are original and the sacrificial zinc galvanising layer has reached end-of-life. These items generally had a significantly thinner layer of galvanising at the time of manufacturing compared with the steel tower members due to fabrication processes. Fasteners also have no galvanising on the nut thread which explains their poor condition relative to the main tower steelwork.

Corrosion of steel pins on ceramic insulators is also a significant issue. The pins on the underside of suspension insulator discs build up pollution and are not adequately washed by rain which leads to an increased rate of corrosion. A number of insulator failures leading to conductor drop have occurred on TransGrid's network due to the pin corrosion. Insulators of the 1965-1974 vintage make up 3% of Line 88 which require replacement to reduce the risk of conductor drop.

Damaged conductor dampers require replacement to ensure the long term health of the conductors isn't impacted by vibration.

The benefit of addressing the condition issues on Transmission Line 88 is to continue providing the service at a lower risk of failure.

3. Related needs/opportunities

No related needs/opportunities have been identified.

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 88

Option Name: 1317 - Base Case

Option Assessment Name: 1317 - 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	924	Fittings	Conductor Drop (Conductor)	$4.67	Fitting Failure	$4,314.43	0.00%	$0.03			$0.00	$0.00	$0.03	$0.00
Conductor	924	Fittings	Unplanned Outage - HV (Conductor)	$0.96	Structural Failure	$888.77	0.00%	$0.01	$0.01		$0.00			$0.00
Conductor 2	924	Insulators	Conductor Drop (Conductor 2)	$4.67	Insulator Failure	$4,314.43	0.00%	$0.07			$0.00	$0.00	$0.07	$0.00
Conductor 2	924	Insulators	Unplanned Outage - HV (Conductor 2)	$4.81	Structural Failure	$4,443.85	0.00%	$0.07	$0.07		$0.00			$0.00
Earth Wire	616	Fittings (inc Attachment)	Earth Wire Drop (Earth Wire)	$0.11	Fitting Failure	$65.17	0.00%	$0.00	$0.00		$0.00	$0.00	$0.00	$0.00
Earth Wire	616	Fittings (inc Attachment)	Unplanned Outage - HV (Earth Wire)	$0.96	Structural Failure	$592.51	0.00%	$0.00	$0.00		$0.00			$0.00
Earth Wire 2	0	Earth Wire (inc Joints)	Earth Wire Drop (Earth Wire 2)	$0.11	Break	$0.00	0.00%	$0.00	$0.00		$0.00	$0.00	$0.00	$0.00
Earth Wire 2	0	Earth Wire (inc Joints)	Unplanned Outage - HV (Earth Wire 2)	$0.96	Break	$0.00	0.00%	$0.00	$0.00		$0.00			$0.00
Structure	235	Steel Structure	Unplanned Outage - HV (Structure)	$6.73	Structural Failure	$1,582.20	0.03%	$0.52	$0.52		$0.00			$0.00
Structure	235	Steel Structure (inc Footings)	Conductor / Earth Wire / OPGW Drop (Structure)	$4.93	Structural Failure	$1,157.93	0.03%	$0.38			$0.02	$0.01	$0.35	$0.00
Structure 2	0	Earthing	Uncontrolled Electrical Contact / Discharge (Structure 2)	$0.00	Earthing Failure	$0.00	9.79%	$0.00	$0.00		$0.00	$0.00		$0.00
				$28.91		$17,359.31		$1.08	$0.60		$0.02	$0.01	$0.45	$0.00

Total VCR Risk: $0.60

Total ENS Risk: $0.00

Number of Components

The number of components used in the Risk costs summary model has been derived as follows:

- Steel Structures: The extent of the steel structures on the transmission line with advanced corrosion condition issues identified in Table 1 (25%) multiplied by the total number of original structures (235).
- Insulators: The extent of insulators on the transmission line with corrosion condition issues identified in Table 1 (3%) multiplied by the total number of suspension insulators on the line (3 per suspension structure).
- Conductor Fittings: The extent of the conductor fittings on the transmission line with advanced corrosion condition issues identified in Table 1 (2%) multiplied by the total number of fittings (3 per suspension structure and 6 per tension structure).
- Earth Wire Fittings: The extent of the earth wire fittings on the transmission line with advanced corrosion condition issues identified in Table 1 (2%) multiplied by the total number of fittings (2 per suspension structure and 4 per tension structure).

Probability of Failure

As per the Risk costs summary model.

Consequence of Failure

As per the Risk costs summary model.