City of Newcastle

Newcastle Art Gallery
Conductor Clearance Assessment Report

23rd September 2021

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Document Control

Version	Date	Author	Reviewer	Revision Details
A	23/09/2021	Steve Goman	Brendon Burns	Initial Issue

1. BACKGROUND / SCOPE OF WORKS

As part of the proposed Newcastle Art Gallery Expansion, City Of Newcastle (CoN) requested clearance calculations be performed on the existing overhead conductors along the Queen Street and Darby Street frontages to the proposed development once the building has been completed. These calculations are required to ensure there is adequate clearance from the existing overhead conductors to the proposed development under all weather conditions.

Using the software package PLS-CADD, it was determined that the final arrangement of the proposed development does have adequate clearance from the existing overhead mains in all weather conditions and no changes to the structure or Ausgrid assets are required.

Due to the proximity of the conductors, consultation with Ausgrid will be required to install scaffolding to work on the building extents. Scaffolding will need to be outside of the clearance zones (under all weather conditions) which are outlined in Section 4 of this report.

2. EXISTING INFRASTRUCTURE

The overhead powerlines in the area are part of the Ausgrid Electricity Network and consists of a set of four bare Low Voltage (LV) conductors on Queen Street, and a single street light (SL) copper conductor on Darby Street.

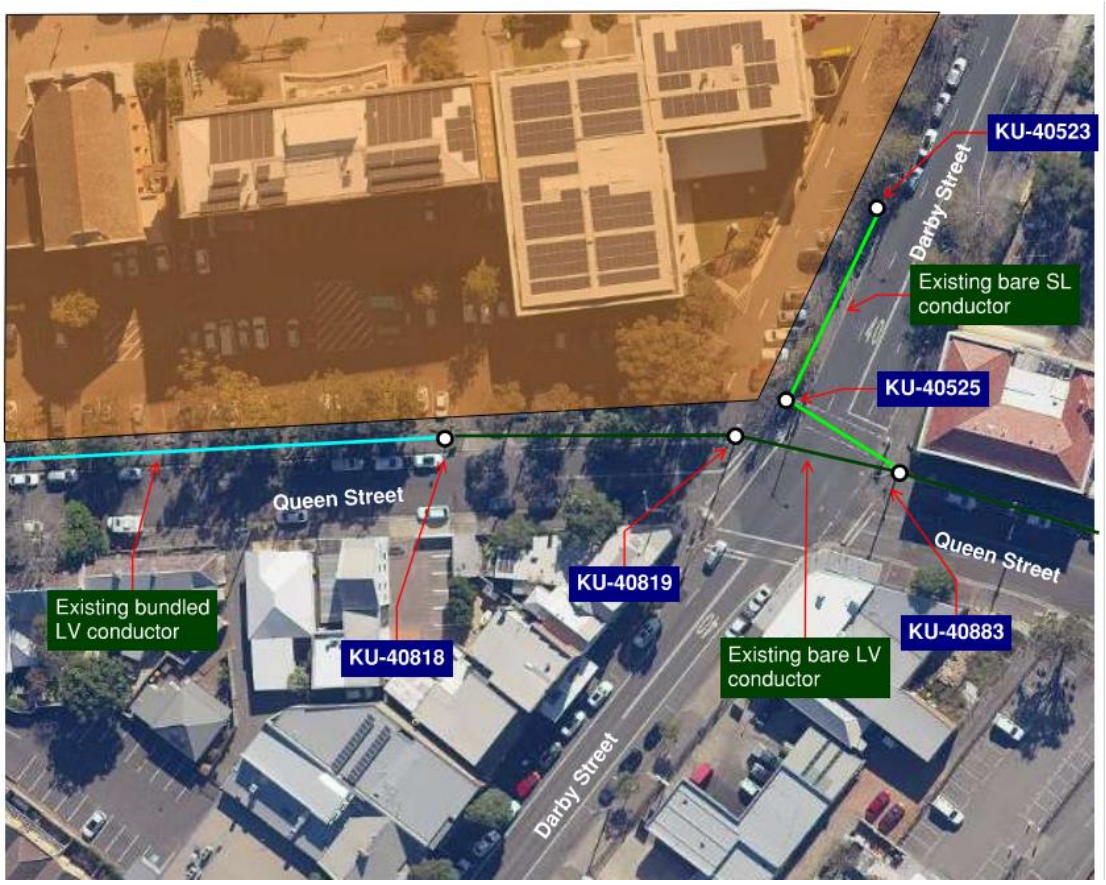


Figure 1 – Satellite view of existing electrical infrastructure

For the development to be compliant with Australian Standard AS7000: Overhead line design and Ausgrid Network Standard NS220, the LV and SL conductors must maintain adequate clearances from the edge of the development under all weather conditions (ambient temperature, maximum operating temperature and maximum wind).

This design report details the methodology for the clearance calculations.

3. CALCULATION METHODOLOGY – CLEARANCE TO BUILDING

Ausgrid Network Standard NS220

The Ausgrid Network Standard NS220, (Figure 3 below), stipulates the minimum clearance from structures to overhead conductors. The edge of the roof of the development will be the closest points to the overhead conductors.

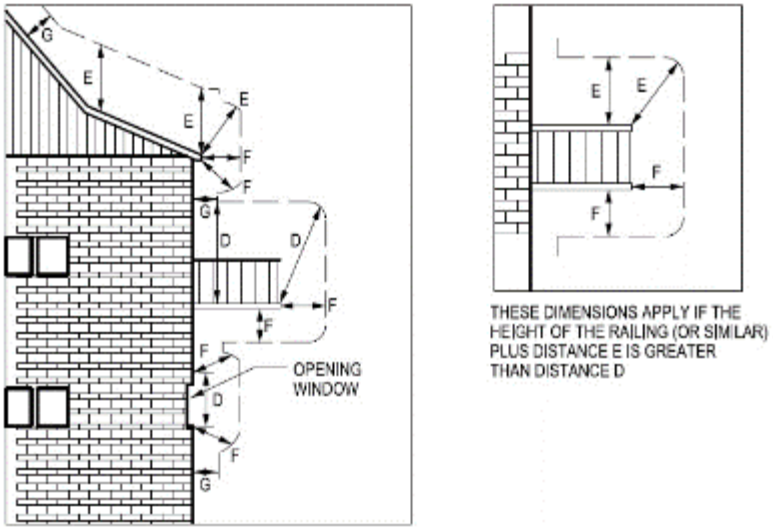


Figure 2 – Ground and structure clearances for overhead conductors (Extract from NS220)

Using Table 3.7 from NS220 in Figure 4 below, the required clearances from the development are:

E: Vertically above those parts of any structure not normally accessible to persons but on which a person can stand.

F: In any direction (other than vertically above) from those parts of any structure normally accessible to persons, or from any part not normally accessible to persons but on which a person can stand.

G: In any direction from those parts of any structure not normally accessible to persons.

Table 29 - Minimum clearance from structures, buildings and easement boundaries

DIMENSION	LOCATION	LV			11kV to 33kV			66kV to 132kV
		Insulated (LV ABC)	Bare or covered neutral	Bare or covered active	Insulated with earthed screen	Insulated without earthed screen	Bare or covered	Bare
		m	m	m	m	m	m	m
D	Vertically above those parts of any structure normally accessible to persons	2.7	2.7	3.7	2.7	3.7	4.5	5.0
E	Vertically above those parts of any structure not normally accessible to persons but on which a person can stand	2.0	2.7	2.7	2.7	2.7	3.7	4.5
F	In any direction (other than vertically above) from those parts of any structure normally accessible to persons, or from any part not normally accessible to persons but on which a person can stand	1.0	0.9	1.5	1.5	1.5	2.1	3.0
G	In any direction from those parts of any structure not normally accessible to persons	0.1	0.3	0.6	0.1	0.6	1.5	2.5

Figure 3 – Table 29 reproduced from NS220

From Table 29 (above) the minimum allowable horizontal/radial distances from the development to the conductors are:

- **2.7m** (vertical) and **0.9m** (horizontal) for the LV neutral conductor
- **2.7m** (vertical) and **1.5m** (horizontal) for the LV active conductor

Note that as per the table above, the SL conductor on Darby Street is classified as a bare active LV cable.

Methodology Discussion – Edge of development

From NS220 Figure 29, the clearance from the edge of the development is made up of a vertical and horizontal component (distances ‘E’ and ‘F’ and ‘G’) as per the diagram below. The conductor location was calculated under all weather conditions to determine if they are compliant with the Australian Standards.

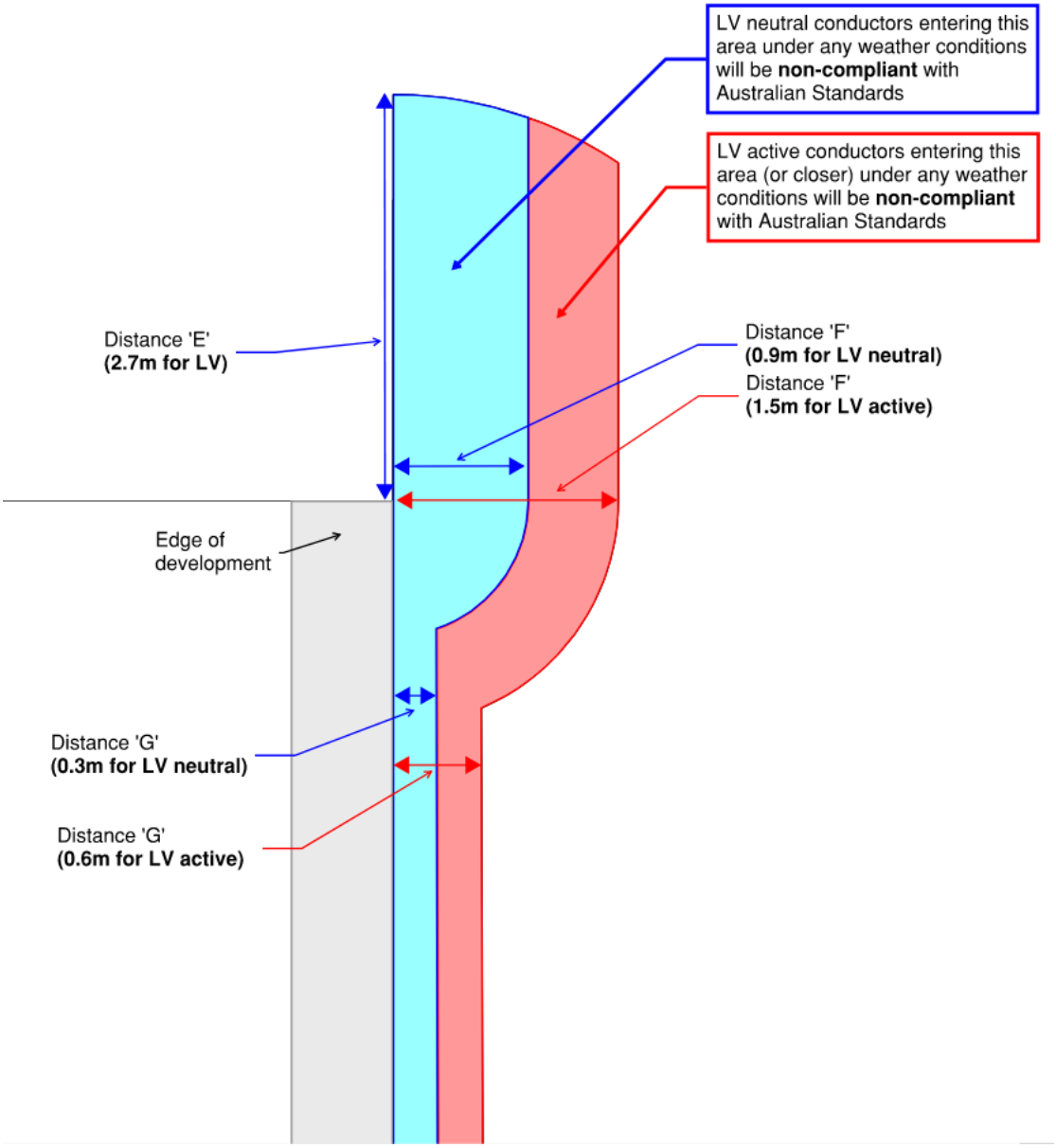


Figure 5 – Clearance methodology from edge of development

4. CONSTRUCTION CLEARANCE REQUIREMENTS

SafeWork NSW's Code of Practice (2006)

The scaffolding design for erecting and dismantling scaffolding must ensure that a person, tools or equipment must not come within 4m of the conductor as per Figure 6 below.

If a person, tools or equipment encroaches this distance during the erection and dismantling of scaffolding, an outage should be considered and discussed with the Network Operator.

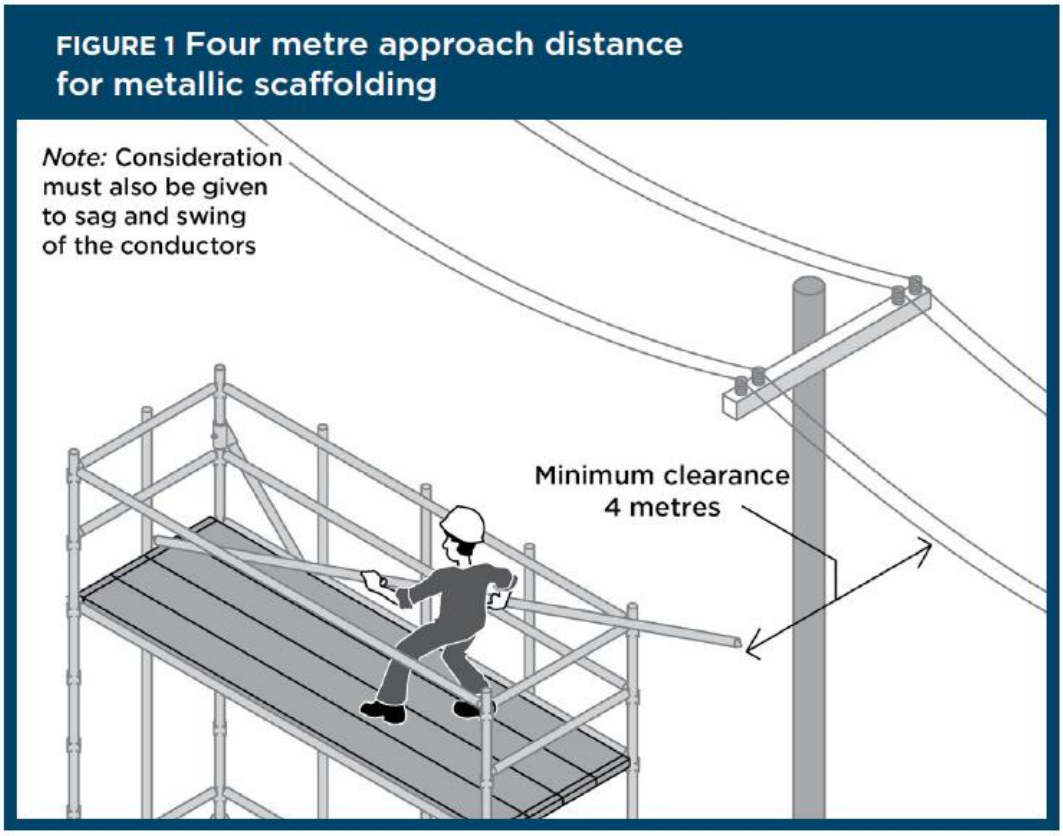


Figure 6 – Edge of Development – Clearance of metallic scaffolding to conductors

SafeWork NSW classifies persons as either Ordinary or Accredited. Each clasification has different approach distances as visualised in Figure 7.

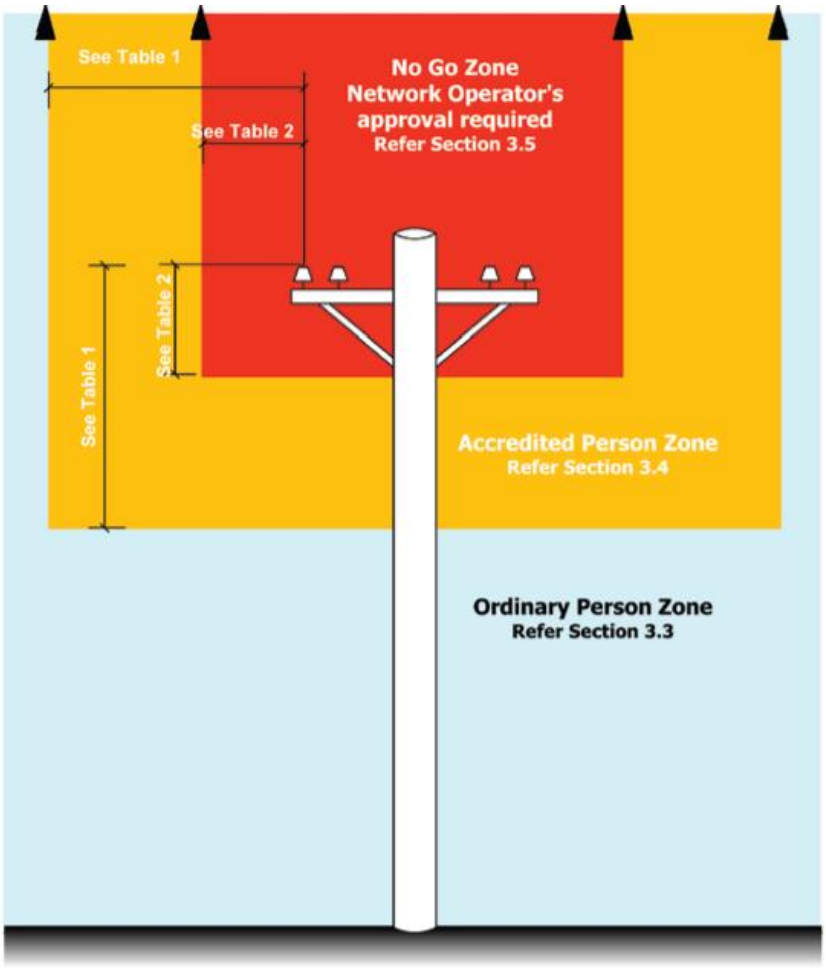


Figure 7 – No Go Zone

Ordinary Person

An Ordinary person has an approach distance of 3.0m as outlined in Figure 8 below. An Ordinary person using plant, hand tools, equipment and any other material held by a person must not encroach this distance.

TABLE 1

Approach distances for work performed by Ordinary Persons

Nominal phase to phase a.c. voltage (volts)	Approach distance (m)
Up to and including 132,000	3.0
Above 132,000 up to and including 330,000	6.0
Above 330,000	8.0
Nominal pole to earth d.c. voltage (volts)	**Approach distance (m)**
Up to and including +/- 1500 Volts	3.0

Figure 8 – Ordinary persons approach distances

Accredited Person with Observer

An Accredited person with an Accredited safety observer, have a reduced approach distance compared to an Ordinary person. An Accredited person has an approach distance of, in the case of your development, 1.0m to bare LV conductors as outlined in Figure 9 below.

A person is considered Accredited if they meet the requirements of Appendix 4 in SafeWork NSW's Code of Practice for Work Near Overhead Power Lines (CoP).

Therefore, persons working on the development, and who want to be Accredited, can complete the training for Working safely near overhead power lines for a nonelectrical worker (UETTDREL14) which is delivered through a registered training organisation.

TABLE 2

Approach Distances for work performed by Accredited Persons, with a Safety Observer

Nominal phase to phase a.c. voltage (volts)	**Approach distance (m)**
Insulated low voltage cables up to 1000, including LV ABC	0.5
Un-insulated low voltage conductors up to 1000	1.0
Above 1000 up to and including 33,000	1.2
Above 33,000 up to and including 66,000	1.4
Above 66,000 up to and including 132,000	1.8
Above 132,000 up to and including 220,000	2.4
330,000	3.7
500,000	4.6
Nominal pole to earth d.c. voltage (volts)	**Approach distance (m)**
Up to +/- 1,500	1.0

Figure 9 – Accredited persons approach distances

Scaffold with hoarding

Scaffolding must be installed clear of the existing conductors under all weather conditions as per the diagram below.

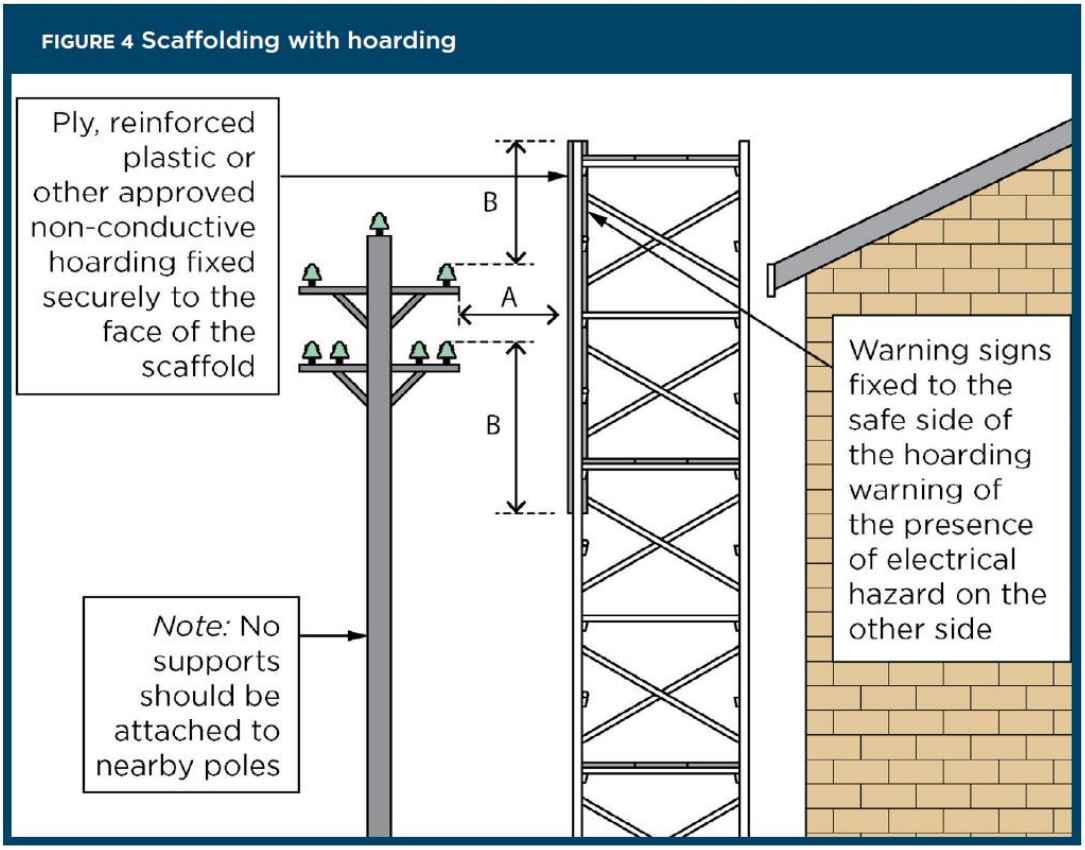


Figure 10 – Scaffolding clearances with hoarding

The Code Of Practices' requirement for the 'A' and 'B' measurements are:

- **A** = **0.6m** for LV and **1.5m** for HV; and
- **B** = **2.0m** for LV and **2.0m** for HV.

The Network Operator may also request that any physical barriers erected must ensure a person is prohibited from coming within 4m of overhead conductors. During the scaffolding design a theoretical 'string line' (to maintain safe distances) from persons working aloft on the scaffolding to the overhead conductors with the hoarding erected.

5. MODEL INPUTS

As the development is still in construction, the proposed development has been modelled from the site inspection and construction drawings (see below).

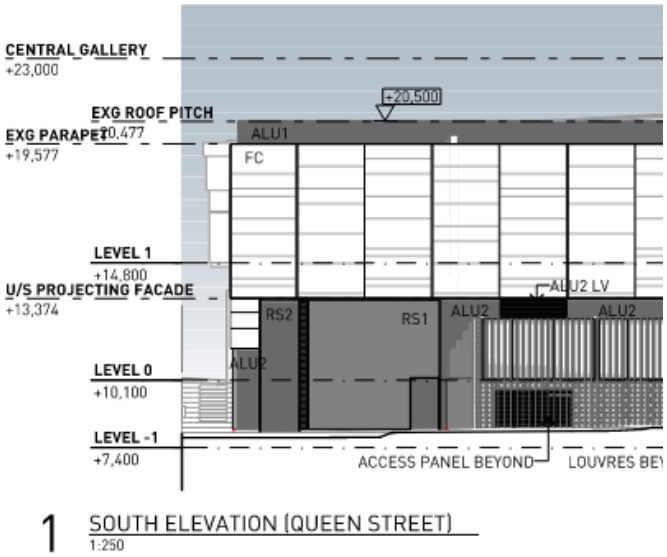


Figure 11 – Drawings showing RLs of development

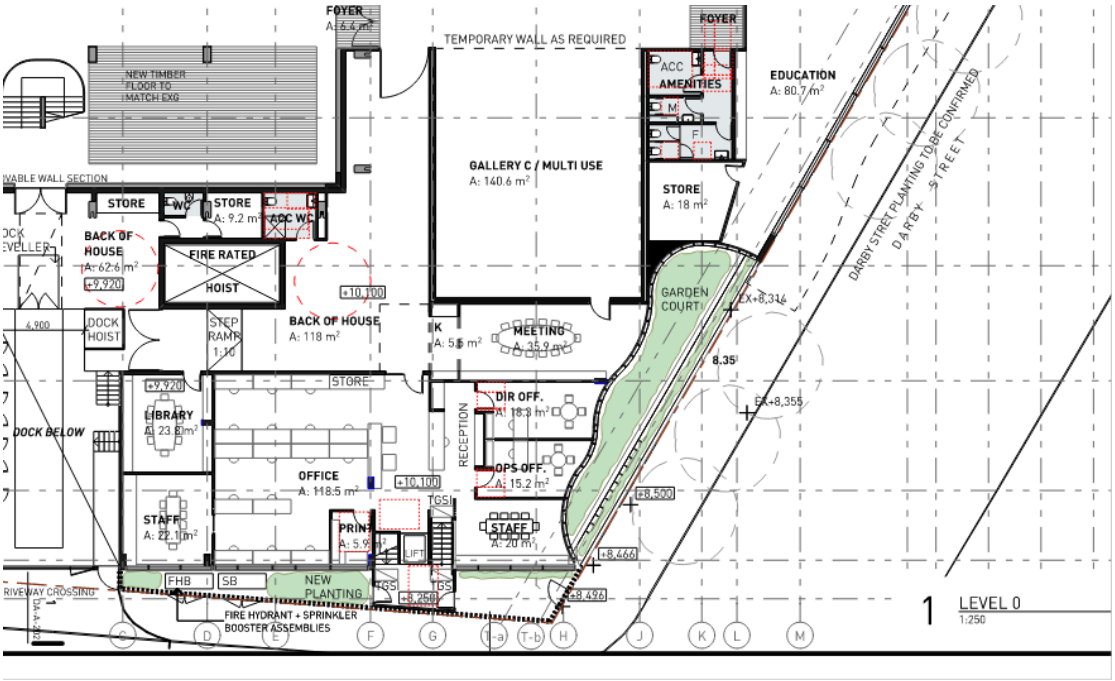


Figure 12 – Drawings of development (plan view)

6. CALCULATION RESULTS

PLS-CADD was the overhead line design program used to model the existing overhead conductors and perform the clearance calculations to the proposed development under all weather conditions. The model was built in PLS-CADD using the construction drawings provided along with site inspection of the existing poles and overhead conductors.

The clearance from the conductors to the development was calculated for ambient temperature, maximum wind and maximum temperature conditions as per NS220. The minimum calculated distances from the conductors to the proposed development are as follows.

Figure 13 – Points on development considered

Fence 1

The LV Neutral conductor was found to be outside the clearance zone by **1.42m** under worst-case conditions and is therefore **compliant** with the required Australian Standards.

The LV Active conductor was found to be outside the clearance zone by **1.54m** under worst-case conditions and is therefore **compliant** with the required Australian Standards.

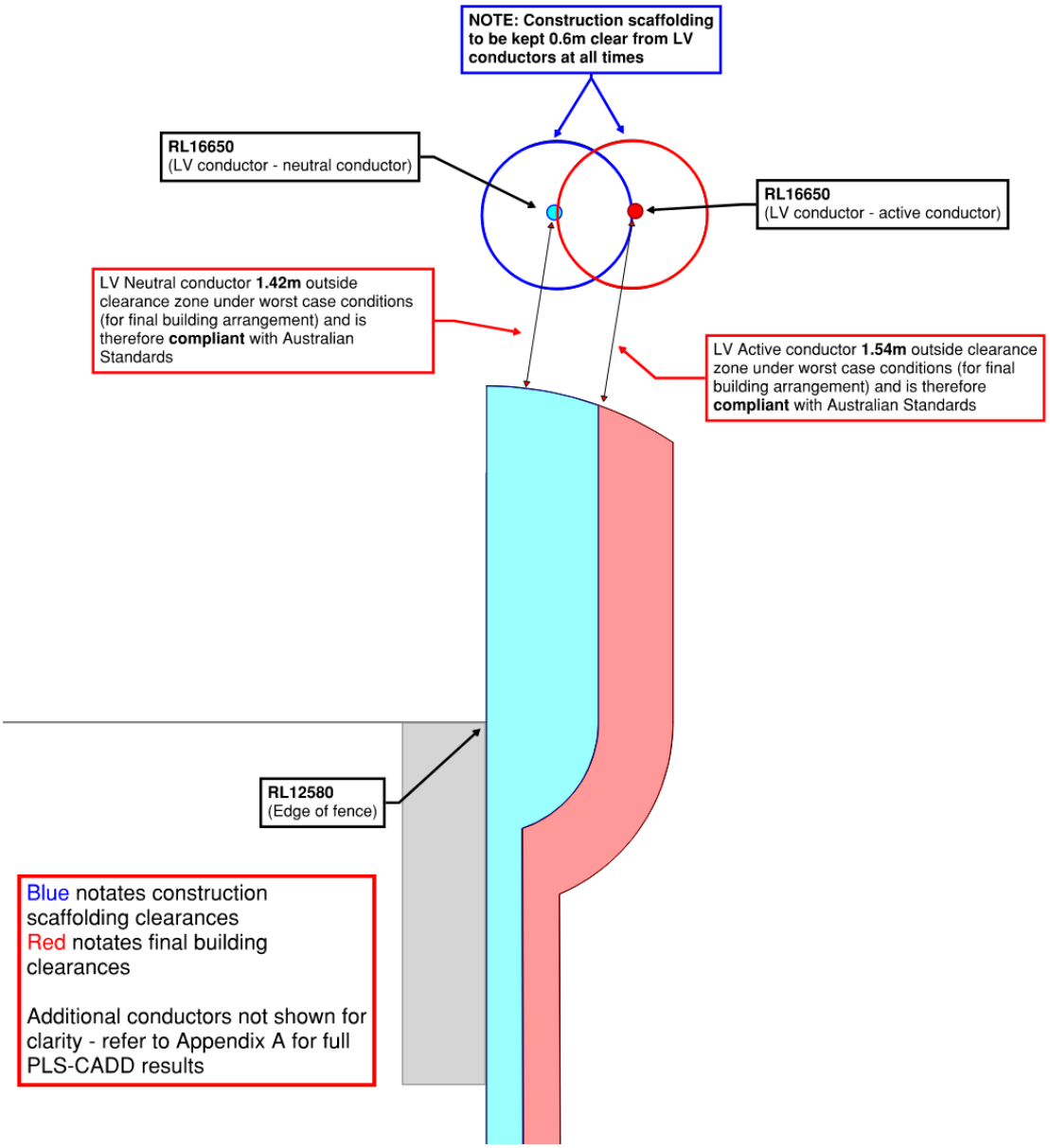


Figure 14 – Fence 1 – Clearance to conductors

Fence 2

The LV Neutral conductor was found to be outside the clearance zone by **3.26m** under worst-case conditions and is therefore **compliant** with the required Australian Standards.

The LV Active conductor was found to be outside the clearance zone by **3.43m** under worst-case conditions and is therefore **compliant** with the required Australian Standards.

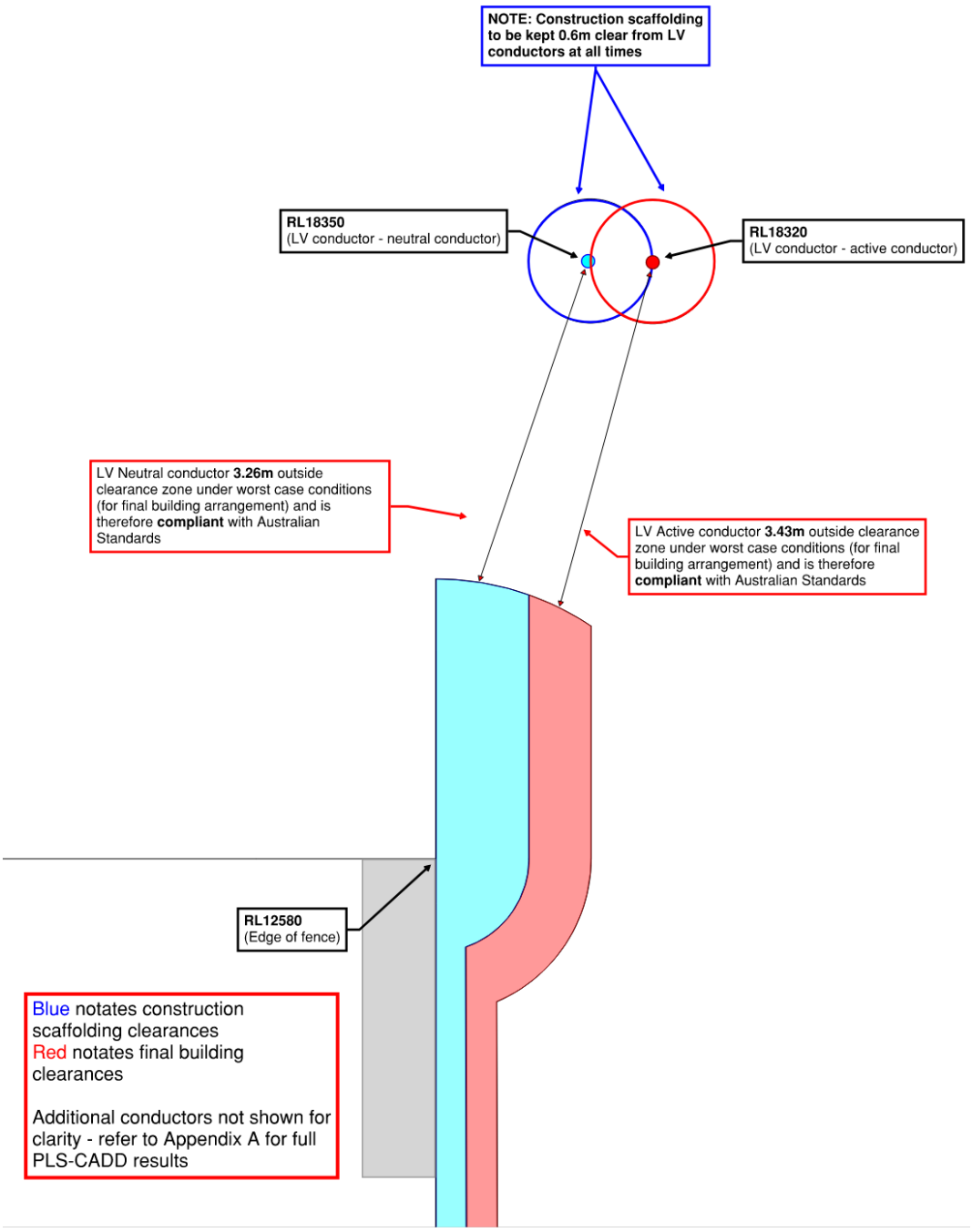


Figure 15 – Fence 2 – Clearance to conductors

Fence 3

The LV Active conductor was found to be outside the clearance zone by **2.83m** under worst-case conditions and is therefore **compliant** with the required Australian Standards.

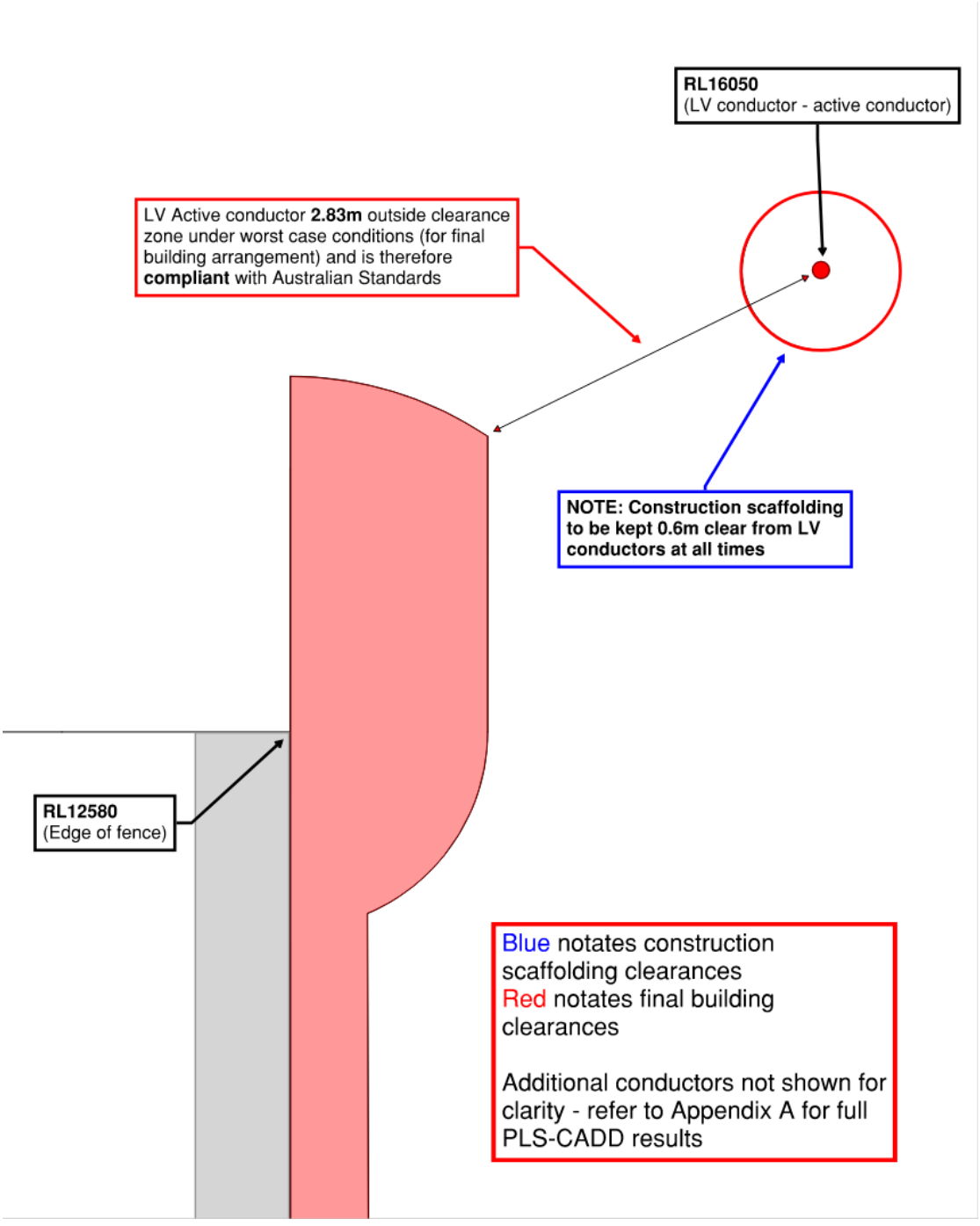


Figure 16 – Fence 3 – Clearance to conductors

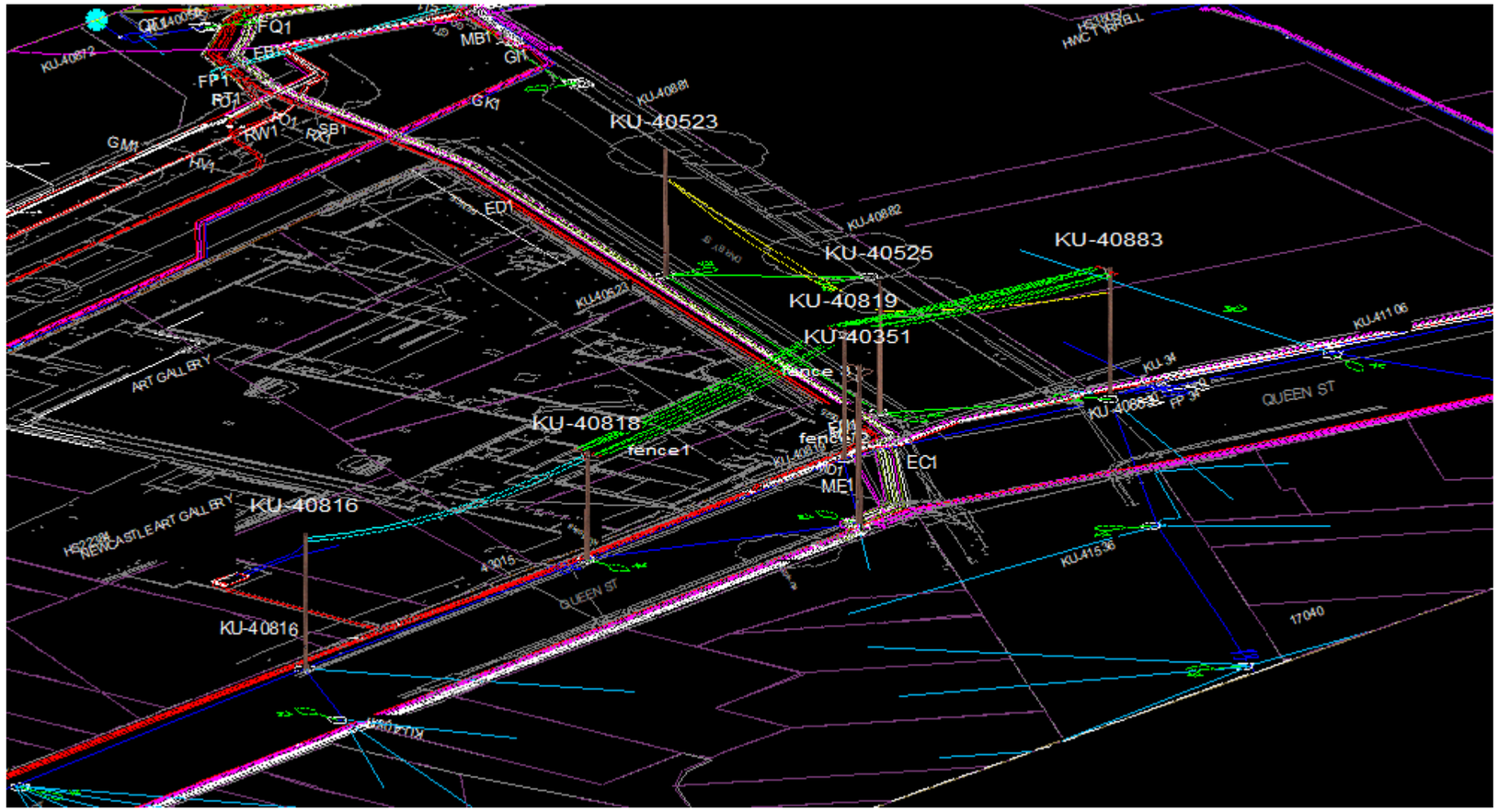
7. CONCLUSIONS

Based on the results above, the distance from the proposed development to the overhead conductors are **greater** than the minimum distance set out in the Ausgrid Network Standard NS220.

As such, the proposed development is compliant with the relevant Australian Standards under all weather conditions and no change to the building design or Ausgrid conductors are required.

Due to the proximity of the conductors, consultation with Ausgrid will be required to install scaffolding to work on the building extents. Scaffolding will need to be outside of the clearance zones (under all weather conditions) which is outlined in Section 4 of this report.

Model Screenshot



Fence 1

PLS-CADD Version 16.81x64 3:26:32 PM Thursday, 23 September 2021
Power Solutions - Australia
Project Name: 'C:\Users\Steve\Desktop\4141\4141.don'

Clearance to Survey Point Report (Radial)

Explanation of Comments printed in this report
Ground clear controls: Constrained by required clearance to ground rather than required clearances for point Feature Code.
Line below point controls: Radial clearance from wire to line extending downward from point is less than clearance to point.
Point above wires: Aerial obstacle that is above wires for specified criteria.
Closer inspection may be required to ensure wires remain below obstacle at colder temperatures.
Point between wires: Aerial obstacle that is above some wires and below other wires for specified criteria.
Closer inspection may be required to ensure there are no violations when transitioning from cold to hot temperatures.
Nonprojectable: Point can't be projected onto span. Constrained by clearance to end of span.

Point ID		**'TINPTXY'**
Prof Comment		**''**
Plan Comment		**'fence1'**
Feature code		**200 '?UNKNOWN FEATURE CODE?'**
Station		**Can't compute station without at least 2 PI points to define alignment**
Offset		**Can't compute offset without at least 2 PI points to define alignment**
X	**(m)**	**385271.88**
Y	**(m)**	**6355826.59**
Z	**(m)**	**4.50**
Height	**(m)**	**0.00**
Line angle	**(deg)**	**0**

Sec.	**Back Structure #**	**Back Set #**	**Back Phase #**	**Ahead Structure #**	**Ahead Set #**	**Ahead Phase #**	**Controlling Weather Case**	**Wind From**	**Cat. Const. (m)**	**Radial Clearance Margin (m)**	**Radial Clearance Calc. (m)**	**Radial Clearance Req. (m)**	**OK**	**Comment**
3	KU-40818	3	0	KU-40819	3	0	Everyday 15	Right	297	5.1	5.1	0.0	OK	
3		2			2		Everyday 15	Right	297	4.6	4.6	0.0	OK	
3		1			1		Everyday 15	Right	297	4.4	4.4	0.0	OK	
3		3			3		Hot 75	Right	161	4.8	4.8	0.0	OK	
3		2			2		Hot 75	Right	161	4.2	4.2	0.0	OK	
3		1			1		Hot 75	Right	161	4.1	4.1	0.0	OK	
3		3			3		Blowout 500(adj 28.9m/s)	Right	209	4.8	4.8	0.0	OK	
3		2			2		Blowout 500(adj 20.4m/s)	Right	210	4.4	4.4	0.0	OK	
3		1			1		Blowout 500(adj 14.4m/s)	Right	212	4.3	4.3	0.0	OK	
4							Blowout 500(adj 28.9m/s)	Right	209	5.1	5.1	0.0	OK	

Controlling case: Hot 75, radial clearance margin 4.1 (m)

Fence 2

PLS-CADD Version 16.81x64 3:27:49 PM Thursday, 23 September 2021
Power Solutions - Australia
Project Name: 'C:\Users\Steve\Desktop\4141\4141.don'

Clearance to Survey Point Report (Radial)

Explanation of Comments printed in this report
Ground clear controls: Constrained by required clearance to ground rather than required clearances for point Feature Code.
Line below point controls: Radial clearance from wire to line extending downward from point is less than clearance to point.
Point above wires: Aerial obstacle that is above wires for specified criteria.
Closer inspection may be required to ensure wires remain below obstacle at colder temperatures.
Point between wires: Aerial obstacle that is above some wires and below other wires for specified criteria.
Closer inspection may be required to ensure there are no violations when transitioning from cold to hot temperatures.
Nonprojectable: Point can't be projected onto span. Constrained by clearance to end of span.

Point ID		**'TINPTXY'**
Prof Comment		**''**
Plan Comment		**''**
Feature code		**200 '?UNKNOWN FEATURE CODE?'**
Station		**Can't compute station without at least 2 PI points to define alignment**
Offset		**Can't compute offset without at least 2 PI points to define alignment**
X	**(m)**	**385293.11**
Y	**(m)**	**6355827.70**
Z	**(m)**	**4.50**
Height	**(m)**	**0.00**
Line angle	**(deg)**	**0**

Sec.	**Back Structure #**	**Back Set #**	**Back Phase #**	**Ahead Structure #**	**Ahead Set #**	**Ahead Phase #**	**Controlling Weather Case**	**Wind From**	**Cat. Const. (m)**	**Radial Clearance Margin (m)**	**Radial Clearance Calc. (m)**	**Radial Clearance Req. (m)**	**OK**	**Comment**
3	KU-40819	2	0	KU-40883	2	0	Everyday 15	Right	297	6.1	6.1	0.0	OK	
3		1			1		Everyday 15	Right	297	5.9	5.9	0.0	OK	
3		2			2		Hot 75	Right	161	6.0	6.0	0.0	OK	
3		1			1		Hot 75	Right	161	5.7	5.7	0.0	OK	
3	KU-40818	3		KU-40819	3		Blowout 500(adj 0.0m/s)	Right	213	8.2	8.2	0.0	OK	
3		2			2		Blowout 500(adj 0.0m/s)	Right	213	7.9	7.9	0.0	OK	
3		1			1		Blowout 500(adj 0.0m/s)	Right	213	7.8	7.8	0.0	OK	
3	KU-40819	2		KU-40883	2		Blowout 500(adj 25.0m/s)	Right	210	6.0	6.0	0.0	OK	
3		1			1		Blowout 500(adj 20.4m/s)	Right	212	5.8	5.8	0.0	OK	
4	KU-40818			KU-40819			Blowout 500(adj 0.0m/s)	Right	212	8.4	8.4	0.0	OK	

Controlling case: Hot 75, radial clearance margin 5.7 (m)

Fence 3

PLS-CADD Version 16.81x64 3:29:51 PM Thursday, 23 September 2021
Power Solutions - Australia
Project Name: 'C:\Users\Steve\Desktop\4141\4141.don'

Clearance to Survey Point Report (Radial)

Explanation of Comments printed in this report
Ground clear controls: Constrained by required clearance to ground rather than required clearances for point Feature Code.
Line below point controls: Radial clearance from wire to line extending downward from point is less than clearance to point.
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Closer inspection may be required to ensure there are no violations when transitioning from cold to hot temperatures.
Nonprojectable: Point can't be projected onto span. Constrained by clearance to end of span.

Point ID		**'TINPTXY'**
Prof Comment		**''**
Plan Comment		**'fence 3'**
Feature code		**200 '?UNKNOWN FEATURE CODE?'**
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Offset		**Can't compute offset without at least 2 PI points to define alignment**
X	**(m)**	**385294.27**
Y	**(m)**	**6355830.38**
Z	**(m)**	**4.50**
Height	**(m)**	**0.00**
Line angle	**(deg)**	**0**

Sec.	**Back Structure #**	**Back Set #**	**Back Phase #**	**Ahead Structure #**	**Ahead Set #**	**Ahead Phase #**	**Controlling Weather Case**	**Wind From**	**Cat. Const. (m)**	**Radial Clearance Margin (m)**	**Radial Clearance Calc. (m)**	**Radial Clearance Req. (m)**	**OK**	**Comment**
3	KU-40818	3	0	KU-40819	3	0	Everyday 15	Right	297	10.1	10.1	0.0	OK	
3		2			2		Everyday 15	Right	297	9.5	9.5	0.0	OK	
3		1			1		Everyday 15	Right	297	9.3	9.3	0.0	OK	
3	KU-40819	3		KU-40883	3		Everyday 15	Right	297	8.6	8.6	0.0	OK	
3		2			2		Everyday 15	Right	297	7.7	7.7	0.0	OK	
3		1			1		Everyday 15	Right	297	7.3	7.3	0.0	OK	
4	KU-40818			KU-40819			Everyday 15	Right	296	10.5	10.5	0.0	OK	
5	KU-40883			KU-40525			Everyday 15	Right	206	5.4	5.4	0.0	OK	
6	KU-40525			KU-40523			Everyday 15	Right	249	5.4	5.4	0.0	OK	
3	KU-40818	3		KU-40819	3		Hot 75	Right	161	10.1	10.1	0.0	OK	
3		2			2		Hot 75	Right	161	9.5	9.5	0.0	OK	
3		1			1		Hot 75	Right	161	9.3	9.3	0.0	OK	
3	KU-40819	3		KU-40883	3		Hot 75	Right	161	8.5	8.5	0.0	OK	
3		2			2		Hot 75	Right	161	7.6	7.6	0.0	OK	
3		1			1		Hot 75	Right	161	7.2	7.2	0.0	OK	
4	KU-40818			KU-40819			Hot 75	Right	161	10.5	10.5	0.0	OK	
5	KU-40883			KU-40525			Hot 75	Right	100	5.4	5.4	0.0	OK	
6	KU-40525			KU-40523			Hot 75	Right	174	5.4	5.4	0.0	OK	
3	KU-40818	3		KU-40819	3		Blowout 500(adj 0.0m/s)	Right	213	10.1	10.1	0.0	OK	
3		2			2		Blowout 500(adj 0.0m/s)	Right	213	9.5	9.5	0.0	OK	
3		1			1		Blowout 500(adj 0.0m/s)	Right	213	9.3	9.3	0.0	OK	
3	KU-40819	3		KU-40883	3		Blowout 500(adj 28.9m/s)	Right	209	8.5	8.5	0.0	OK	
3		2			2		Blowout 500(adj 28.9m/s)	Right	209	7.6	7.6	0.0	OK	
3		1			1		Blowout 500(adj 28.9m/s)	Right	209	7.2	7.2	0.0	OK	

4	KU-40818	KU-40819	Blowout 500(adj 0.0m/s)	Right	212	10.5	10.5	0.0	OK
4	KU-40819	KU-40883	Blowout 500(adj 28.9m/s)	Right	209	9.1	9.1	0.0	OK
5	KU-40883	KU-40525	Blowout 500(adj 25.0m/s)	Left	136	5.4	5.4	0.0	OK
6	KU-40525	KU-40523	Blowout 500(adj 25.0m/s)	Left	207	5.4	5.4	0.0	OK

Controlling case: Everyday 15, radial clearance margin 5.4 (m)