Draft Arboricultural Impact Assessment

Figure 1 Tree 6 *Corymbia gummifera*

Site Address: Proposed Route Willoughby to Mosman132kV Feeders 9H4 and 9H6

Client: Ausgrid

Date: August 2018

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1.0 Summary

Accurate Tree Assessment has been commissioned by Ausgrid (the client) to identify areas of encroachment into the Tree Protection Zone of trees located along the proposed route of the Willoughby to Mosman132kV Feeders 9H4 and 9H6 Project. One hundred and seventeen (117) trees have been identified as being subject to potential TPZ/SRZ encroachment from the proposed works.

Conclusions

Smaller trees are unlikely to be affected by the proposed works due to their setback from the trench or being located in the proposed under-bored sections.

Larger trees will be exposed to major encroachment of the respective Tree Protection Zones (TPZ) caused by excavation of the electrical services trench. The implementation of specific protection measures detailed in section 8.0 and 8.1 of this report will therefore be required to ensure the viability of trees, and gain compliance with the provisions of AS4970-2009, "*Protection of Trees on Development Sites".*

Recommendations

That prior to the commencement of any works:

- Tree Protection Zones (TPZ) and Structural Root Zones (SRZ) of retained trees are clearly plotted on all plans and marked on-site,

- The trunks of retained trees are to be protected by the erection of protective barriers at the SRZ perimeter to create an individual exclusion zone for the duration of works in the vicinity.

That all roots are to be retained within the SRZ of the subject trees.

That where there is no other option, and subject to inspection by an arborist, roots greater than 40 millimetres diameter may be severed between the SRZ and the TPZ where they conflict directly with the conduits using clean sharp hand-tools to minimise tearing.

That if required minor pruning is carried out in accordance with the Workcover Draft Code of Practice for Tree Works and Australian Standard AS4373-2007, "Pruning of Amenity Trees", and the Workcover Code of Practice for the Amenity Tree Industry, 1998.

2.0 Disclaimer

This report is to be read and considered in its entirety. The subject trees were inspected from the ground using Visual Tree Assessment methodology, no aerial investigations; underground or internal investigations were undertaken. It is the responsibility of the client to implement all recommendations contained in this report.

The assessment is made having regard for the prevailing site conditions; and does not account for the effects that extreme weather events may have on trees.

Information contained in this report reflects the condition of the trees at the time of the inspection. As trees are living organisms their condition will change over time, there is no guarantee that problems or deficiencies of the subject trees may not arise in the future. It must be accepted that living in close proximity to trees involves some level of risk.

No investigation into the presence on the site of threatened or endangered species of shrubs, groundcovers, grasses, herbs or orchids has been undertaken.

This report is for the use of the client and their contractors to assist in determining the tree protection measures to be undertaken in conjunction with the proposed development. Distribution to other parties is not permitted except with the express permission of the author, Ian Hills. No responsibility is taken by the author for unauthorised use of the information contained in this report.

3.0 Brief

Accurate Tree Assessment has been commissioned by Ausgrid (the client) to identify areas of encroachment into the Tree Protection Zone of trees located along the proposed route of the Willoughby to Mosman132kV Feeders 9H4 and 9H6 Project. One hundred and seventeen (117) trees have been identified as being subject to potential TPZ/SRZ encroachment from the proposed works.

In accordance with the client's specification this report will:

- Identify trees that may be affected by the proposed development
- Provide recommendations for the protection of retained trees based upon the level of encroachment that is expected in accordance with the provisions of AS4970-2009, 'Protection of Trees on Development Sites'

4.0 Method

A site inspection was carried out on 7 August 2018.

Calculation of tree protection zones was carried out in accordance with the Australian Standard AS4970-2009, "Protection of Trees on Development Sites", based on the trunk diameter (DBH) measured using a standard arboricultural diameter tape.

Trees subject to assessment have been marked with red marking paint and each allocated a number that will be used as reference throughout this report. Tree numbering has been marked on the aerial photomap provided.

4.1. Documents

Aerial photomaps of the proposed route and specification for the excavation (Appendix 10.2) have been provided by Matthew Gencur of Ausgrid and have been used as reference throughout the report.

5.0 Tree Assessment

No.	Common Name	Species	DBH (M)	TPZ (M)	SRZ (M)	HEIGHT (M)	SPREAD (M)	SULE	TPZ over road	Comment
1	Cheese Tree	*Glochidion ferdinandii*	.15,.1	2.16	1.85	4	3	2a	1.6	
2	Box Elder	*Acer negundo*	0.34	4.08	2.25	8	5	2a	3.4	pruned asymmetry
3	Claret Ash	*Fraxinus raywoodi*	.5 x2	8.52	3.01	9	9	2a	7.7	
4	Chinese Elm	*Ulmus parvifolia*	0.35	4.2	2.47	9	9	2a	3.5	
5	Cheese Tree	*Glochidion ferdinandii*	.15, .075	2.04	1.68	4	3	5a	1.5	
6	Spotted Gum	*Corymbia gummifera*	.65x2	11.04	3.57	18	15	2a	6.0	
7	Spotted Gum	*Corymbia maculata*	0.8	9.6	3.31	20	15	1a	8.2	
8	Spotted Gum	*Corymbia maculata*	0.67	8.04	3.17	17	10	1a	6.6	
9	Spotted Gum	*Corymbia maculata*	0.9	10.8	3.57	20	12	1	9.4	
10	Spotted Gum	*Corymbia maculata*	0.75	9	3.31	22	14	1	7.5	
11	Olive, Bottlebrush, Privet	*Olea, callistemon, ligustrum*	.2ea	2.4 ea	2.0 ea	5	15	3a	2.3	joint bay, group of 10
12	River Oak	*Casuarina cunninghamiana*	.46, .2	6.0	2.80	16	8	2a	3.8	
13	Tallowwood	*Eucalyptus microcorys*	0.47	5.64	2.67	14	7	2a	2.9	
14	Grey Gum	*Eucalyptus punctata*	0.55	6.6	2.85	14	6	2a	5.6	
15	Box Elder	*Acer negundo*	.1x4	2.4	2.00	4	4	5a	0	Growing in roundabout
16	London Plane Tree	*Platanus X acerifolious*	0.4	4.8	2.47	10	7	2a.	3.9	
17	London Plane Tree	*Platanus X acerifolious*	. 42	5.04	2.47	11	7	2a	4.3	
18	London Plane Tree	*Platanus X acerifolious*	0.45	5.4	2.57	10	6	2a	4.5	
19	London Plane Tree	*Platanus X acerifolious*	0	5.4	2.57	10	8	2a	4.7	
20	London Plane Tree	*Platanus X acerifolious*	0.45	5.4	2.57	10	6	2a	4.7	
21	London Plane Tree	*Platanus X acerifolious*	0.4	4.8	2.47	8	6	2a	4.1	
22	London Plane Tree	*Platanus X acerifolious*	0.35	4.2	2.37	8	6	2a	3.5	
23	Red Bottlebrush	*Callistemon citrinus*	0.55	6.6	2.76	8	5	2a	2.8	
24	Mugga Iron-bark	*Eucalyptus sideroxylon*	0.5	6	2.67	12	8	2a	5.3	
25	Red Bottlebrush	*Callistemon citrinus*	0.62	7.44	2.85	7	8	2a	6.8	
26	Jacaranda	*Jacaranda mimosifolia*	.3 x 3	6.24	2.67	6	6	2a	5.5	

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No.	Common Name	Species	DBH (M)	TPZ (M)	SRZ (M)	HEIGHT (M)	SPREAD (M)	SULE	TPZ over road	Comment
27	London Plane Tree	*Platanus X acerifolious*	0.72	8.64	3.09	14	12	2a	7.8	
28	London Plane Tree	*Platanus X acerifolious*	0.48	5.76	2.63	14	8	2a	5.1	
29	Brush Box	*Lophostemon confertus*	0.52	6.24	2.76	9	8	2A	5.7	
30	Brush Box	*Lophostemon confertus*	0.62	7.44	2.85	10	10	2a	6.8	
31	Brush Box	*Lophostemon confertus*	0.5	6	2.67	10	8	2a	5.3	
32	Brush Box	*Lophostemon confertus*	.45,.55	8.52	3.17	10	10	2a	7.6	
33	Brush Box	*Lophostemon confertus*	0.55	6.6	2.85	10	10	2a	6.3	
34	Brush Box	*Lophostemon confertus*	0.6	7.2	3.01	10	10	2a	6.6	
35	Brush Box	*Lophostemon confertus*	0.65	7.8	3.09	9	10	2a	7.0	
36	Brush Box	*Lophostemon confertus*	.6, .5	9.36	3.24	9	11	2a	8.8	
37	Wangaratta White Gum	*Eucalyptus scoparia*	0.55	6.6	2.76	12	9	3a	5.7	
38	Broad-leaved Paperbark	*Melaleuca quinquenervia*	0.7	8.4	3.17	8	8	2a	7.8	
39	Broad-leaved Paperbark	*Melaleuca quinquenervia*	1	12	3.44	7	5	3b	11.2	
40	Broad-leaved Paperbark	*Melaleuca quinquenervia*	1.1	13.2	3.44	12	14	1c	12.4	
41	Broad-leaved Paperbark	*Melaleuca quinquenervia*	0.62	7.44	3.01	10	8	2a	6.7	
42	Broad-leaved Paperbark	*Melaleuca quinquenervia*	1.07	12.84	3.57	12	9	2a	12.3	
43	Broad-leaved Paperbark	*Melaleuca quinquenervia*	0.9	10.8	1.31	10	9	3a	10.4	Heavily pruned
44	Broad-leaved Paperbark	*Melaleuca quinquenervia*	1.1	13.2	3.44	10	10	2a	12.7	
45	Tallowwood	*Eucalyptus microcorys*	0.6	7.2	2.93	10	12	2a	6.5	
46	Broad-leaved Paperbark	*Melaleuca quinquenervia*	0.86	10.32	3.01	10	6	2a	9.7	
47	Broad-leaved Paperbark	*Melaleuca quinquenervia*	0.93	11.16	3.31	9	7	2a	10.5	
48	Sydney Blue-gum	*Eucalyptus saligna*	up to .4	up to 4.8	2.47 ea	12	12	2a	0	group of 5, underbore, growing in road reserve
49	Wangaratta White Gum	*Eucalyptus scoparia*	0.5	6	2.67	14	6	2a	0	underbore
50	Brush Box	*Lophostemon confertus*	.4x2	6.84	2.67	8	8	2a	0	underbore
51	Smooth-barked Applegum	*Angophora costata*	0.3	3.6	2.25	8	7	2a	0	underbore
52	Sydney Blue-gum	*Eucalyptus saligna*	0.48	5.76	2.67	10	8	2a	4.5	
53	Tallowwood	*Eucalyptus microcorys*	0.64	7.68	2.93	15	9	2a	7.4	

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No.	Common Name	Species	DBH (M)	TPZ (M)	SRZ (M)	HEIGHT (M)	SPREAD (M)	SULE	TPZ over road	Comment
54	Weeping Bottlebrush	*Callistemon viminalis*	0.2	2.4	1.85	4	3	5a	2.3	
55	Brush Box	*Lophostemon confertus*	0.86	10.32	3.31	15	10	2a	6.9	
58	Coral Tree	*Erythrina x sykesii*	1.04	12.48	3.57	10	12	3a	7.0	
57	Mexican Pine	*Pinus patula*	0.55	6.6	2.85	9	9	3a	1.8	Excessive lean angle
56	Mexican Pine	*Pinus patula*	0.48	5.76	2.67	10	6	2a	2.5	
59	Weeping Bottlebrush	*Callistemon viminalis*	.3, .2x2	4.92	2.47	7	7	2a	4.2	
60	Weeping Bottlebrush	*Callistemon viminalis*	.3x2	5.04	2.67	7	5	2a	4.1	
61	Willow Bottlebrush	*Callistemon salignus*	.35, .3	5.52	2.47	6	5	2a	5.0	
62	Weeping Bottlebrush	*Callistemon viminalis*	.3, .2x2 .15	5.28	2.47	5	4	2a	4.6	
63	Weeping Bottlebrush	*Callistemon viminalis*	.25x2	4.2	2.25	5	4	5a	3.5	
64	Weeping Bottlebrush	*Callistemon viminalis*	.3 x 2	5.04	0.55	5	5	2a	4.4	
65	Weeping Bottlebrush	*Callistemon viminalis*	.35, .25	5.16	2.47	6	5	2a	4.3	
66	Weeping Bottlebrush	*Callistemon viminalis*	.25x2	4.2	2.25	6	4	2a	3.4	
67	Southern Blue-gum	*Euclyptus bicostata*	0.76	9.12	3.24	14	10	2a	4.5	
68	Weeping Bottlebrush	*Callistemon viminalis*	.25x2	4.2	2.37	6	5	2a	3.6	
69	Weeping Bottlebrush	*Callistemon viminalis*	.3, .15x3	4.8	2.47	5	5	2a	4.0	
70	Weeping Bottlebrush	*Callistemon viminalis*	0.6	7.2	2.85	5	3	2a	6.4	
71	Weeping Bottlebrush	*Callistemon viminalis*	0.3	3.6	2.25	6	4	2a	2.9	damaged by pruning
72	Lemon-scented Gum	*Corymbia citriodora*	0.7	8.4	3.17	20	12	1a	2.1	private tree
73	Weeping Bottlebrush	*Callistemon viminalis*	0.6	7.2	3.01	4	5	3d	6.5	
74	Weeping Bottlebrush	*Callistemon viminalis*	.3x2	5.04	2.25	4	4	3b	4.2	damaged by pruning
75	Weeping Bottlebrush	*Callistemon viminalis*	0.6	7.2	3.01	4	5	3a	6.6	Asymmetry from pruning
76	Weeping Bottlebrush	*Callistemon viminalis*	.4, .3x2	6.96	2.93	5	4	2a	6.3	

No.	Common Name	Species	DBH (M)	TPZ (M)	SRZ (M)	HEIGHT (M)	SPREAD (M)	SULE	TPZ over road	Comment
77	Illawarra Flame Tree	*Brachychiton populneus*	0.35	4.2	2.37	4	3	2a	3.4	
78	Brush Box	*Lophostemon confertus*	0.85	10.2	3.31	10	10	1a	9.8	
79	Hill's Fig	*Ficus microcarpa var Hillii*	1.3	15.6	3.69	16	16	1a	10.0	private tree
80	Brush Box	*Lophostemon confertus*	0.75	9	3.17	16	16	3a	8.6	damaged, dieback
81	Jacaranda	*Jacaranda mimosifolia*	.4x2	6.84	2.85	10	12	2a	6.0	
82	Jacaranda	*Jacaranda mimosifolia*	0.44	5.28	2.57	8	10	2a	4.2	
83	Weeping Bottlebrush	*Callistemon viminalis*	0.7	8.4	3.01	8	10	2a.	7.6	
84	Lilly Pilly	*Acmena smithii*	0.4	4.8	2.47	9	5	2a	3.9	
85	Broad-leaved Paperbark	*Melaleuca quinquenervia*	0.7	8.4	3.01	14	8	2a	8.1	
86	Broad-leaved Paperbark	*Melaleuca quinquenervia*	1.1	13.2	3.69	14	9	2	12.5	
87	Broad-leaved Paperbark	*Melaleuca quinquenervia*	0.8	9.6	3.31	14	8	2a	9.0	
88	Yellow Bloodwood	*Corymbia eximea*	0.6	7.2	2.93	16	16	1c	6.5	
89	Brush Box	*Lophostemon confertus*	0.54	6.48	2.76	8	8	2a	0	in reserve
90	Flax-leaved Paperbark	*Melaleuca linarifolia*	0.9	10.8	3.31	5	7	2a	10.4	damaged by pruning
91	Camphor Laurel	*Cinnamomum camphora*	1.3	15.6	3.69	12	15	2a	12.0	private tree
92	Brush Box	*Lophostemon confertus*	0.54	6.48	2.76	6	6	2a	5.8	
93	Brush Box	*Lophostemon confertus*	0.6	7.2	2.85	6	7	2a	6.5	
94	Brush Box	*Lophostemon confertus*	1.06	12.72	1.36	9	12	1a	12.2	
95	Brush Box	*Lophostemon confertus*	0.6	7.2	2.93	9	9	2a	6.9	
96	Brush Box	*Lophostemon confertus*	0.55	6.6	2.67	9	9	2a	6.3	damaged by pruning
97	Brush Box	*Lophostemon confertus*	0.5	6	2.85	6	7	3a	5.8	damaged by pruning
98	Brush Box	*Lophostemon confertus*	0.5	6	3.09	9	4	3a	5.8	damaged by pruning
99	Brush Box	*Lophostemon confertus*	0.92	0.9	3.44	10	10	2a	0.9	damaged by pruning
100	Brush Box	*Lophostemon confertus*	0.65	7.8	2.93	7	5	2a	7.5	
101	Brush Box	*Lophostemon confertus*	0.85	10.2	3.24	8	8	2a	9.8	
102	Wangaratta White Gum	*Eucalyptus scoparia*	.45, 1.0	13.2	3.69	18	9	2a	12.7	
103	Brush Box	*Lophostemon confertus*	0.8	9.6	3.24	10	8	2a	9.2	

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No.	Common Name	Species	DBH (M)	TPZ (M)	SRZ (M)	HEIGHT (M)	SPREAD (M)	SULE	TPZ over road	Comment
104	Box Elder	*Acer negundo*	0.55	6.6	2.76	10	12	2a	3.1	
105	Broad-leaved Paperbark	*Melaleuca quinquenervia*	1	12	3.44	12	9	2a	11.1	
106	Brush Box	*Lophostemon confertus*	0.87	10.44	3.27	12	10	2a	9.9	
107	Brush Box	*Lophostemon confertus*	0.95	11.4	3.38	11	9	2a	10.9	
108	Brush Box	*Lophostemon confertus*	1.05	12.6	3.57	14	12	2a	12.1	
109	Water Gum	*Tristaniopsis laurina*	0.72	8.64	3.04	7	9	2a	8.0	
110	Brush Box	*Lophostemon confertus*	1.3	15.6	3.92	15	12	2a	15.0	
111	Brush Box	*Lophostemon confertus*	1.1	13.2	3.69	15	15	2a	12.7	
112	Brush Box	*Lophostemon confertus*	1.15	13.8	3.63	15	15	2a	13.2	
113	Brush Box	*Lophostemon confertus*	0.9	10.8	3.31	12	12	2a	10.4	
114	Brush Box	*Lophostemon confertus*	0.7	8.4	3.01	7	8	2a	8.0	
115	Brush Box	*Lophostemon confertus*	0.77	9.24	3.12	12	10	2a	8.7	
116	Tallowwood	*Eucalyptus microcorys*	0.9	10.8	3.31	18	15	1a	6.4	private tree
117	Swamp Oak	*Casuarina glauca*	.4 ea	4.8 ea	2.47 ea	18	10	2a	0.1	group of 3 trees

DBH= Trunk diameter at 1.4 metres

TPZ = Tree Protection Zone (calculated in accordance with AS4970)

SRZ = Structural Root Zone (calculated in accordance with AS4970)

SULE = Safe Useful Life Expectancy (Barrel, J -1993-95) see appendix 10.1

6.0 Development impact

All parts of a tree may be damaged by construction activities, and the effects of damage are often cumulative meaning that seemingly minor damage to the tree can have adverse effects that may not become apparent until well after the project has been completed.

Crown damage often occurs when machinery comes in contact with branches of the tree resulting in a loss of foliage. As the foliage is where the tree produces the sugars required for healthy growth it therefore stands to reason that any loss of foliage will affect the trees ability to function normally.

In addition when branches are torn or improperly pruned the trees ability to recover is affected and pathogens that cause wood decay or disease have an increased opportunity to penetrate the trees natural defenses.

Trunk damage is usually caused by mechanical impact, and again wounding predisposes the tree to infection by pathogens.

Root damage is the most common cause of damage to trees on development sites, and often has the most serious effects as it commonly goes un-noticed for some time. Damage can be caused by mechanical factors such as tearing during excavation, as well as factors such as chemical contamination, changes in hydrology and altering gaseous exchange rates by filling, and compaction during movement of equipment.

Australian Standard 4970, *Protection of Trees on Development Sites* was adopted in 2009 in an effort to provide Arborists and the construction industry with a guide to assist in the preservation of retained trees on all types of development sites.

To assist professionals working to protect trees the Standard proposes the following:

> "Tree Protection Zone - A specified area above and below ground level at a given distance from the trunk set aside for the protection of a tree's roots and crown to provide for the viability and stability of a tree to be retained where it is potentially subject to damage by development.
>
> *Structural Root Zone – The area around the base of a tree required for the tree's stability in the ground. The woody root growth and soil cohesion in this area are necessary to hold the tree upright. The SRZ is nominally circular with the trunk at its centre and is expressed by its radius in metres.*
>
> *This zone considers a tree's structural stability only, not the root zone required for a tree's vigour and long-term viability, which will usually be much larger."* (Ref. AS4970-2009)

Minor encroachment of the TPZ is sometimes unavoidable and at levels less than 10% of the total TPZ area can be tolerated if there is scope to increase the area of the TPZ contiguously about the unaffected perimeter. Where encroachment exceeds 10% further investigation will be required to determine the measures required to offset the incursion. Encroachment of the SRZ is not recommended as tree health and condition will almost certainly be adversely affected.

7.0 Discussion

Most trees on the route appear in generally good health and vigour with some deadwood and wounding noted, many of the trees exhibit asymmetrical form due to suppression by the larger trees and pruning for service line clearance. None of the trees were noted to contain hollows suitable for habitation by arboreal fauna.

The movement of machinery is to be excluded from the TPZ of retained trees by temporary fencing; with under-boring techniques used to install services through the TPZ where necessary. Locations for the storage of spoil and materials are to be detailed in the CEMP provided by Ausgrid's contractor

and marked on all plans staff and restricted to areas that are already disturbed or away from trees, and must not encroach the TPZ area of the subject trees (setbacks are to be marked on-site by an arborist).

Where excavation for the trench will cause an encroachment into the Tree Protection Zone (TPZ) of a retained tree exceeding 10% of the total TPZ area it is considered to be a major encroachment under the provisions of the Australian Standard AS4970-2009, Protection of Trees on Development Sites; and triggers the requirement for the implementation of measures to ensure that the tree will not be adversely affected by the works.

Where excavation is proposed within the TPZ of the subject trees it is to be carried out under close supervision; where roots are encountered that conflict with the location of conduits a consulting arborist is to assess the roots, making recommendations for their ongoing management. Wherever possible roots greater than 40 millimetres diameter are to be retained and protected, this may include excavating by hand around roots and passing the conduits beneath them. Wrapping roots in geo-textile fabric; utilising sandy material around retained roots when backfilling is recommended to protect retained roots from sharp edged filling materials.

Where no other option is available some roots greater than 40 millimetres diameter that conflict with the position of the electrical conduits may be severed within an established TPZ under advice from the consulting arborist using clean sharp hand-tools to minimise tearing, and therefore reducing the risk of incursion by harmful pathogens.

Prior to the commencement and for the duration of the works, the trunks of the subject trees are to be protected from unintended impacts by the erection of temporary fencing at the perimeter of the respective TPZ's or along the edge of the work area (whichever provides a greater set-back) to create an exclusion zone around each of the retained trees. Where space does not permit or where a TPZ fence needs to be temporarily moved for access, the trunks and/or branches of the retained tree will be protected by armouring as detailed in Section 4 of AS4970 (Appendix 12.4)

Several over-hanging branches are noted along the route which may be impacted by over-height machinery, branch and bark tearing is to be avoided. Where necessary branches are to be pruned by a suitably qualified contracting arborist in accordance with the Australian Standard AS4373-2007, "*Pruning of Amenity Trees*", and the Workcover Code of Practice for the Amenity Tree Industry, 1998.

8.1 Tree Protection

The following general measures are to be adopted as applicable to the site:

Site establishment

- significant trees are marked on plans
- staff are to be made aware of tree protection measures during induction to the site

During construction

- no storage of equipment or materials is permitted within the TPZ, no cement wasting or other pollutants must be allowed to enter the TPZ
- a temporary barrier is to be installed at the SRZ perimeter for the duration of works in the vicinity of individual trees to prevent mechanical damage to the trunk/branches
- excavation is to carried out by hand within 200 millimetres of roots greater than 40 mm diameter
- if required minor pruning of branches can be undertaken to avoid mechanical impacts that are likely to result in branch or bark tearing
- no roots are to be severed within an established SRZ.
- where roots greater than 40mm diameter are to be severed between the SRZ and TPZ an arborist is to be on-site to supervise the works

Post construction

- protective fencing is to be removed from site
- general maintenance pruning can be undertaken (in accordance with AS4373-2007) to remove deadwood or other defective branches up to 10% of the total canopy area of retained trees if required

8.0 Conclusions

Smaller trees are unlikely to be affected by the proposed works due to their setback from the trench or being located in the proposed under-bored sections.

Larger trees will be exposed to major encroachment of the respective Tree Protection Zones (TPZ) caused by excavation of the electrical services trench. The implementation of specific protection measures detailed in section 8.0 and 8.1 of this report will therefore be required to ensure the viability of trees, and gain compliance with the provisions of AS4970-2009, "*Protection of Trees on Development Sites".*

9.0 Recommendations

That prior to the commencement of any works:

- Tree Protection Zones (TPZ) and Structural Root Zones (SRZ) of retained trees are clearly plotted on all plans and marked on-site,

- The trunks of retained trees are to be protected by the erection of protective barriers at the SRZ perimeter to create an individual exclusion zone for the duration of works in the vicinity.

That all roots are to be retained within the SRZ of the subject trees.

That where there is no other option, and subject to inspection by an arborist, roots greater than 40 millimetres diameter may be severed between the SRZ and the TPZ where they conflict directly with the conduits using clean sharp hand-tools to minimise tearing.

That if required minor pruning is carried out in accordance with the Workcover Draft Code of Practice for Tree Works and Australian Standard AS4373-2007, "Pruning of Amenity Trees", and the Workcover Code of Practice for the Amenity Tree Industry, 1998.

Ian Hills - Principal Arborist
Accurate Tree Assessment

QTRA
Registered User

10.0 Appendices

10.1. Safe Useful Life Expectancy Categories

1: Long SULE: Trees that appeared to be retainable at the time of assessment for more than 40 years with an acceptable level of risk.
(a) Structurally sound trees located in positions that can accommodate future growth.
(b) Trees that could be made suitable for retention in the long term by remedial tree care.
(c) Trees of special significance for historical, commemorative or rarity reasons that would warrant extraordinary efforts to secure their long term retention.

2: Medium SULE: Trees that appeared to be retainable at the time of assessment for 15–40 years with an acceptable level of risk.
(a) Trees that may only live between 15 and 40 more years.
(b) Trees that could live for more than 40 years but may be removed for safety or nuisance reasons.
(c) Trees that could live for more than 40 years but may be removed to prevent interference with more suitable individuals or to provide space for new planting.
(d) Trees that could be made suitable for retention in the medium term by remedial tree care.

3: Short SULE: Trees that appeared to be retainable at the time of assessment for 5–15 years with an acceptable level of risk.
(a) Trees that may only live between 5 and 15 more years.
(b) Trees that could live for more than 15 years but may be removed for safety or nuisance reasons.
(c) Trees that could live for more than 15 years but may be removed to prevent interference with more suitable individuals or to provide space for new planting.
(d) Trees that require substantial remedial tree care and are only suitable for retention in the short term.

4: Remove: Trees that should be removed within the next 5 years.
(a) Dead, dying, suppressed or declining trees because of disease or inhospitable conditions.
(b) Dangerous trees because of instability or recent loss of adjacent trees.
(c) Dangerous trees because of structural defects including cavities, decay, included bark, wounds or poor form.
(d) Damaged trees that are clearly not safe to retain.
(e) Trees that could live for more than 5 years but may be removed to prevent interference with more suitable individuals or to provide space for new planting.
(f) Trees that are damaging or may cause damage to existing structures within 5 years.
(g) Trees that will become dangerous after removal of other trees for the reasons given in (a)to(f)
(h) Trees in categories (a) to (g) that have a high wildlife habitat value and, with appropriate treatment, could be retained subject to regular review.

5: Small, young or regularly pruned: Trees that can be reliably moved or replaced.
(a) Small trees less than 5m in height.
(b) Young trees less than 15 years old but over 5m in height.
(c) Formal hedges and trees intended for regular pruning to artificially control growth.

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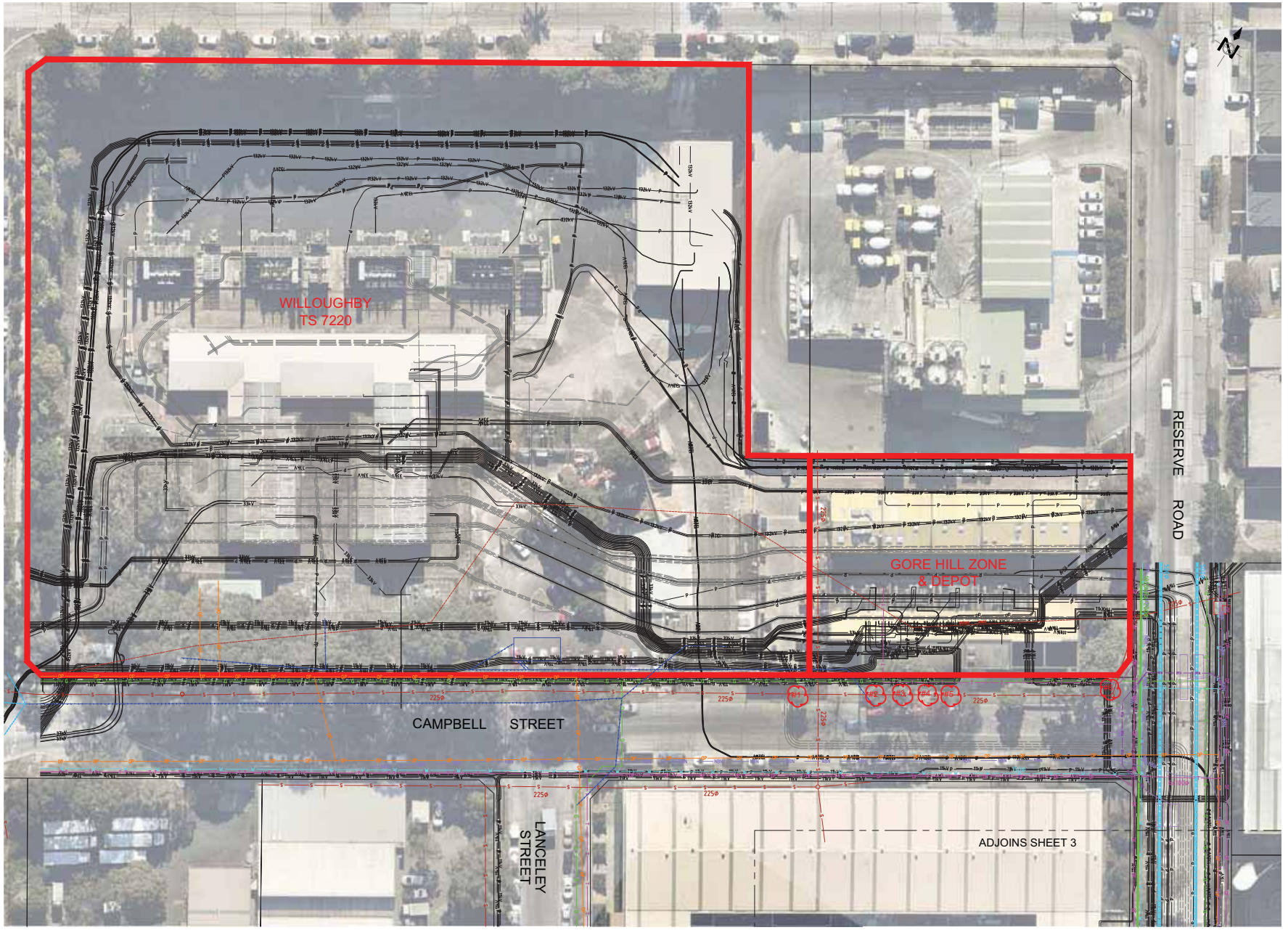

NOTES

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(BB) EASEEMNT FOR UNDERGROUND CABLES 8.535 WIDE (Z963850 – DP644263)

(CC) RIGHT OF WAY & EASEMENT FOR ELECTRICITY PURPOSES (R6441166), EASEMENT FOR ELECTRICITY PURPOSES (R58172) EASEMENT FOR PIPELINE (3114844)

(DD) EASEMENT FOR ELECTRICITY PURPOSES (S349301) EASEMENT TO USE PIPES FOR GAS (S842371 & 3114843),

(FF) EASEMENT FOR ELECTRICITY TRANSMISSION LINE 14.02 WIDE (339506), EASEMENT FOR PIPELINE 14.02 WIDE (3114844, G337203 & DP114124)

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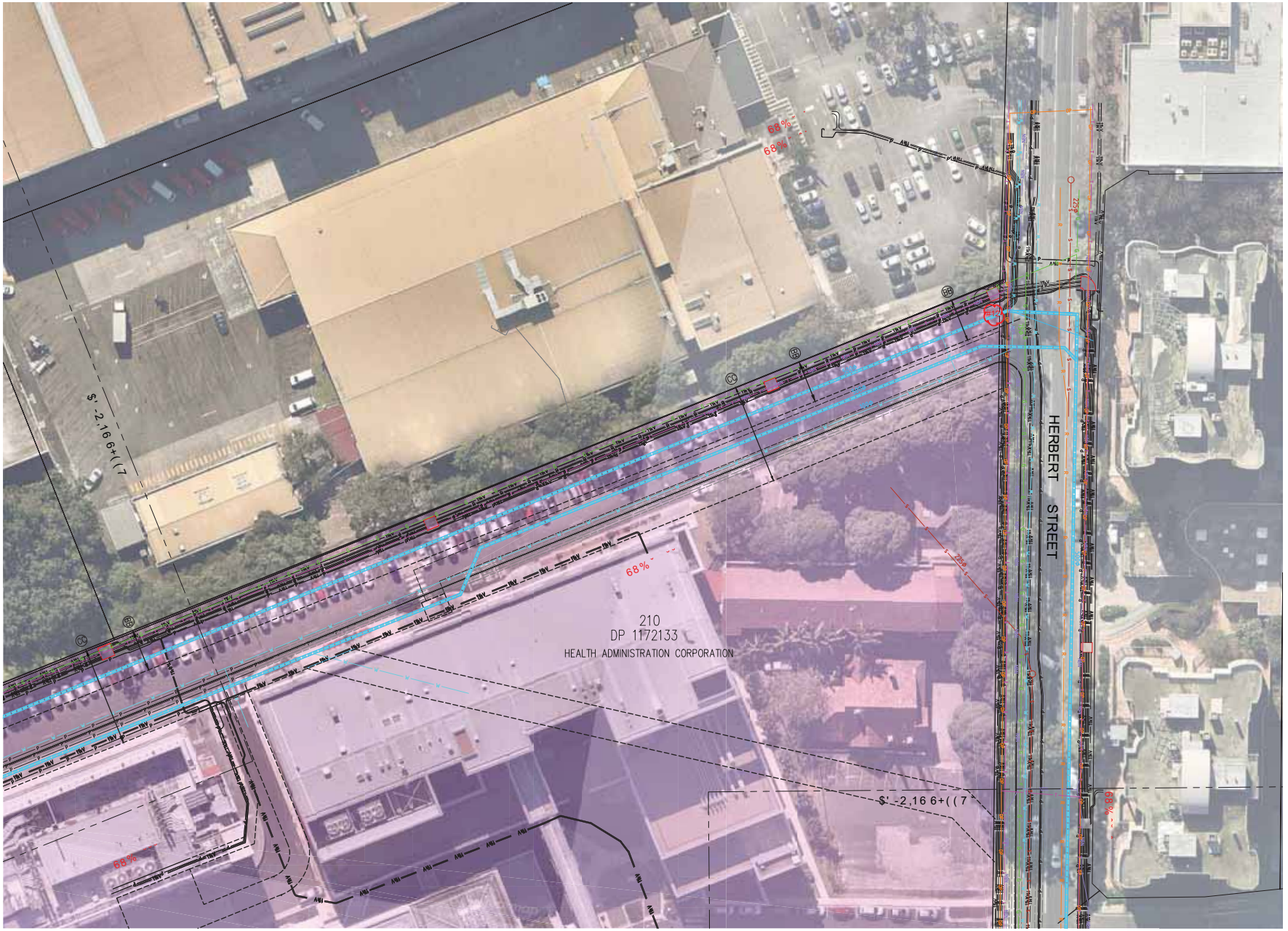

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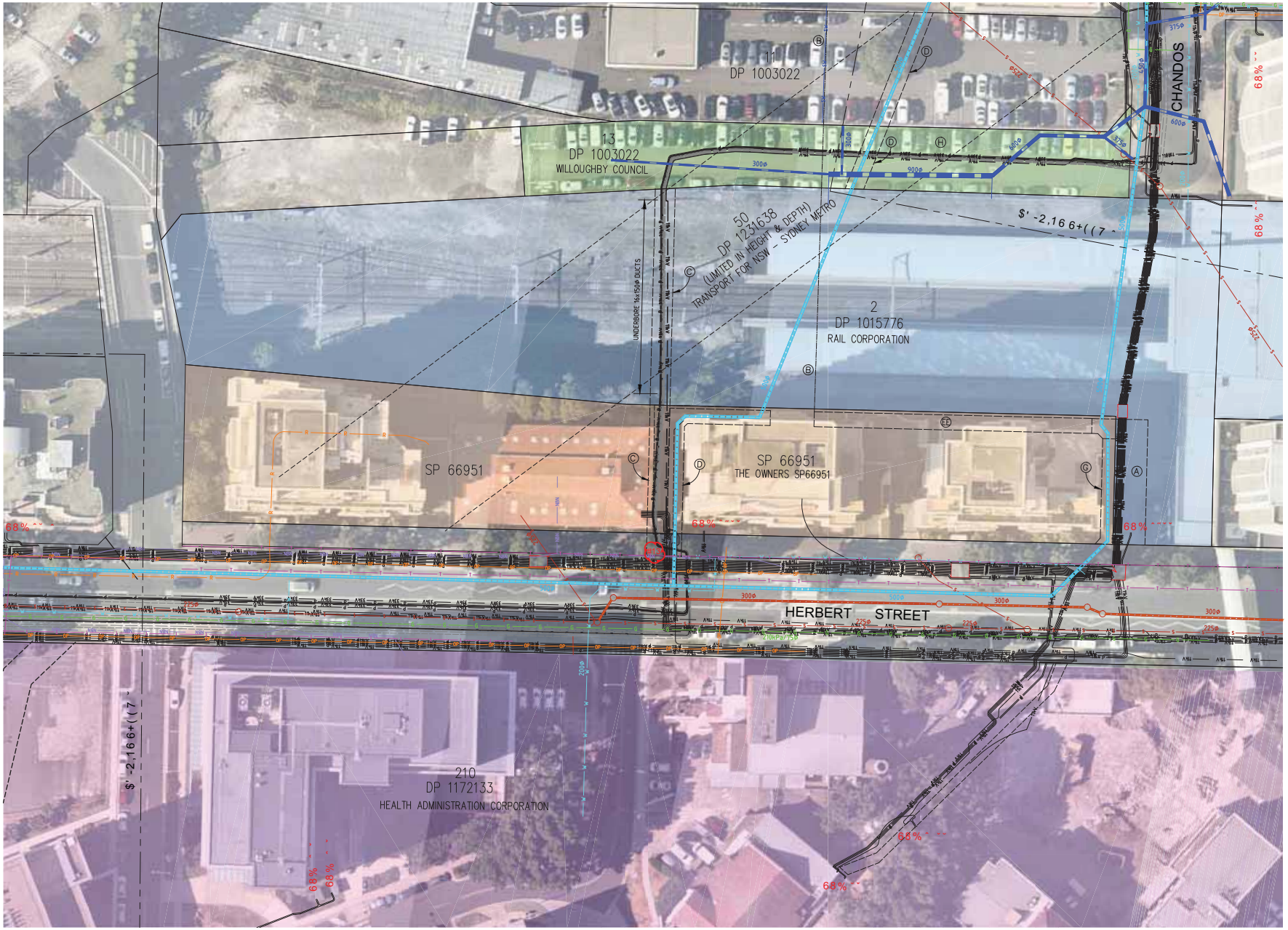

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Ⓐ EASEMENT TO DRAIN WATER 6 WIDE (DP1003022)

Ⓑ EASEMENT TO DRAIN WATER OVER EXISTING DRAINAGE STRUCTURE (DP1003022)

Ⓒ EASEMENT FOR ELECTRICITY PURPOSES 4 WIDE (DP1003022)

Ⓓ EASEMENT FOR WATER SUPPLY WORKS 3 WIDE & VAR WIDTH (DP1029926)

Ⓖ EASEMENT FOR WATER SUPPLY WORKS 3 WIDE & VAR WIDTH (DP1029926)

Ⓗ EASEMENT FOR SERVICES (DP1003022)

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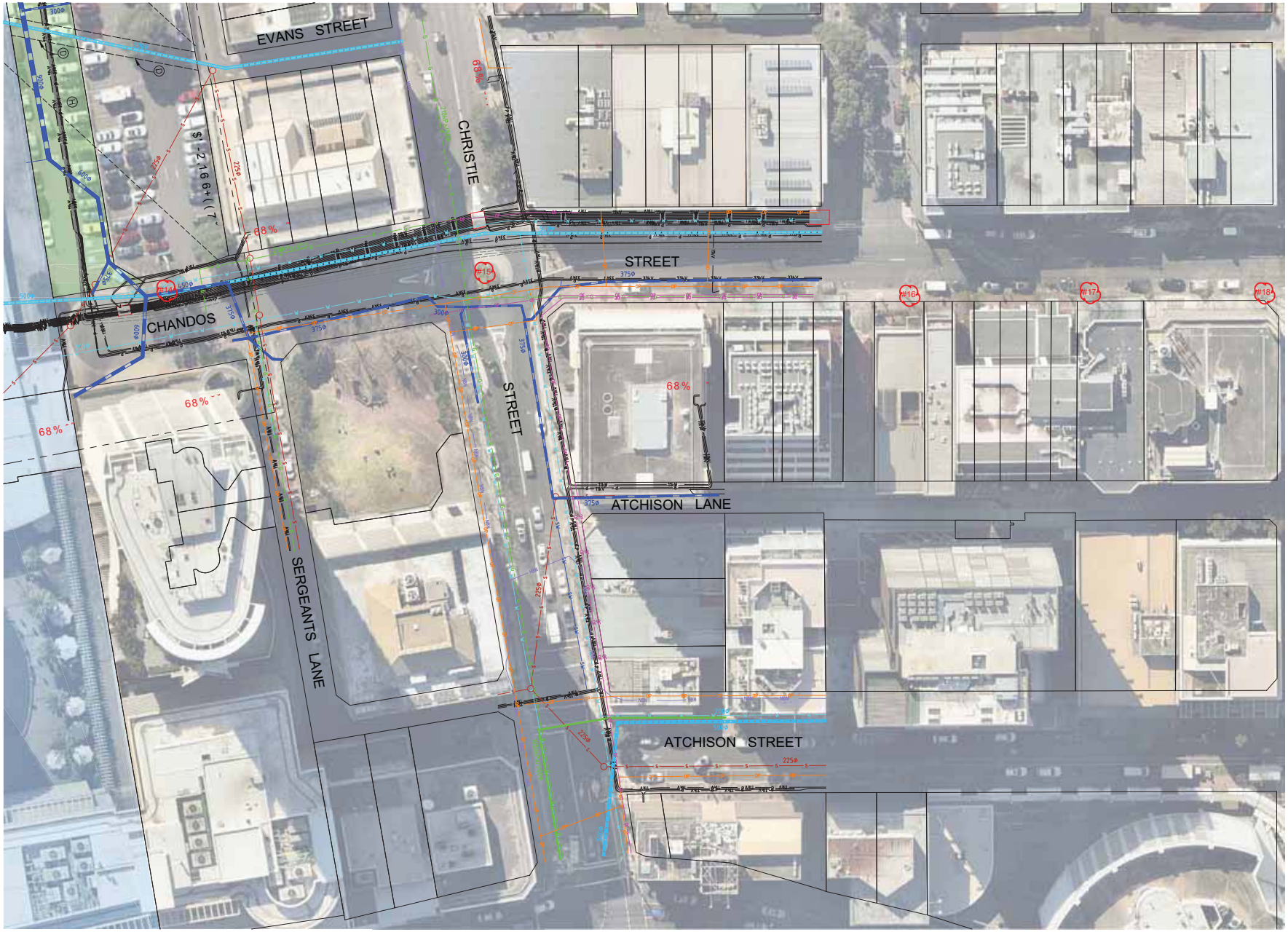

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- NBN — NBN — DENOTES NBN CO OPTIC FIBRE CABLE

8 4 0 8 16 24 32 40
SCALE IN METRES ON ORIGINAL DRAWING AT REDUCTION RATIO 1:400

CAD DRAWING
AMENDMENTS

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SCALE	1:400
DRAWN	V WADY
CHECKED	V WADY
APPROVED	M RIDDELL
DATE	8-NOV-2017
TRIM FILE	-
SURVEY JOB NUMBER	170405
PROJTRAK NUMBER	SJ-00255

LOCALITY: ST LEONARDS LGA: WILLOUGHBY

PLAN SHOWING EXISTING UTILITY SEARCH FOR REPLACEMENT OF 132kV FEDERS 9Y7 & 9Y9, WILLOUGHBY TO MOSMAN.

SIZE	DRAWING No	SHEET	AMD
A1	S 23246	2 OF 7	0

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NOTES

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THE LOCATION OF SERVICES IS APPROXIMATE ONLY.

NORTH

LINETYPE LEGEND

- 11kV 11kV — DENOTES 11kV UNDERGROUND CABLE
- 33kV 33kV — DENOTES 33kV UNDERGROUND CABLE
- 132kV 132kV — DENOTES 132kV UNDERGROUND CABLE
- G G — DENOTES MINOR GAS MAIN
- DENOTES MAJOR GAS MAIN
- S S S — DENOTES MINOR SEWER PIPE
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LOCALITY: CROWS NEST LGA: WILLOUGHBY

PLAN SHOWING EXISTING UTILITY SEARCH FOR REPLACEMENT OF 132kV FEDERS 9Y7 & 9Y9, WILLOUGHBY TO MOSMAN.

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LOCALITY: CROWS NEST LGA: WILLOUGHBY

PLAN SHOWING
(,67,1* 87,/,7< 6($5&+) 2 5
REPLACEMENT OF 132kV FEDERS 9Y7 & 9Y9,
WILLOUGHBY TO MOSMAN.

SIZE	DRAWING No	SHEET	AMD
A1	S 23246	4 OF 7	0

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LOCALITY: CROWS NEST LGA: WILLOUGHBY

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(,67,1* 87,/ ,7< 6($5&+) 2 5
REPLACEMENT OF 132kV FEDERS 9Y7 & 9Y9,
WILLOUGHBY TO MOSMAN.

SIZE	DRAWING No	SHEET	AMD
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SCALE IN METRES ON ORIGINAL DRAWING AT REDUCTION RATIO 1:400

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LOCALITY: CROWS NEST LGA: WILLOUGHBY

PLAN SHOWING
(,67,1* 87,/ ,7< 6($5&+) 2 5
REPLACEMENT OF 132kV FEDERS 9Y7 & 9Y9,
WILLOUGHBY TO MOSMAN.

SIZE	DRAWING No	SHEET	AMD
A1	S 23246	6 OF 7	0

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LOCALITY: CROWS NEST LGA: WILLOUGHBY

PLAN SHOWING
(,67,1* 87,/ ,7< 6($5&+) 2 5
REPLACEMENT OF 132kV FEDERS 9Y7 & 9Y9,
WILLOUGHBY TO MOSMAN.

SIZE	DRAWING No	SHEET	AMD
A1	S 23246	7 OF 7	0

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SCALE IN METRES ON ORIGINAL DRAWING AT REDUCTION RATIO 1:400

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DATE	17-NOV-2017
TRIM FILE	-
SURVEY JOB NUMBER	170407
PROJTRAK NUMBER	SJ-00255

LOCALITY: CAMMERAY LGA: NORTH SYDNEY

PLAN SHOWING
(,67,1* 87,/ ,7< 6($5&+) 2 5
REPLACEMENT OF 132kV FEDERS 9Y7 & 9Y9,
WILLOUGHBY TO MOSMAN.

SIZE	DRAWING No	SHEET	AMD
A1	S 23248	2 OF 16	0

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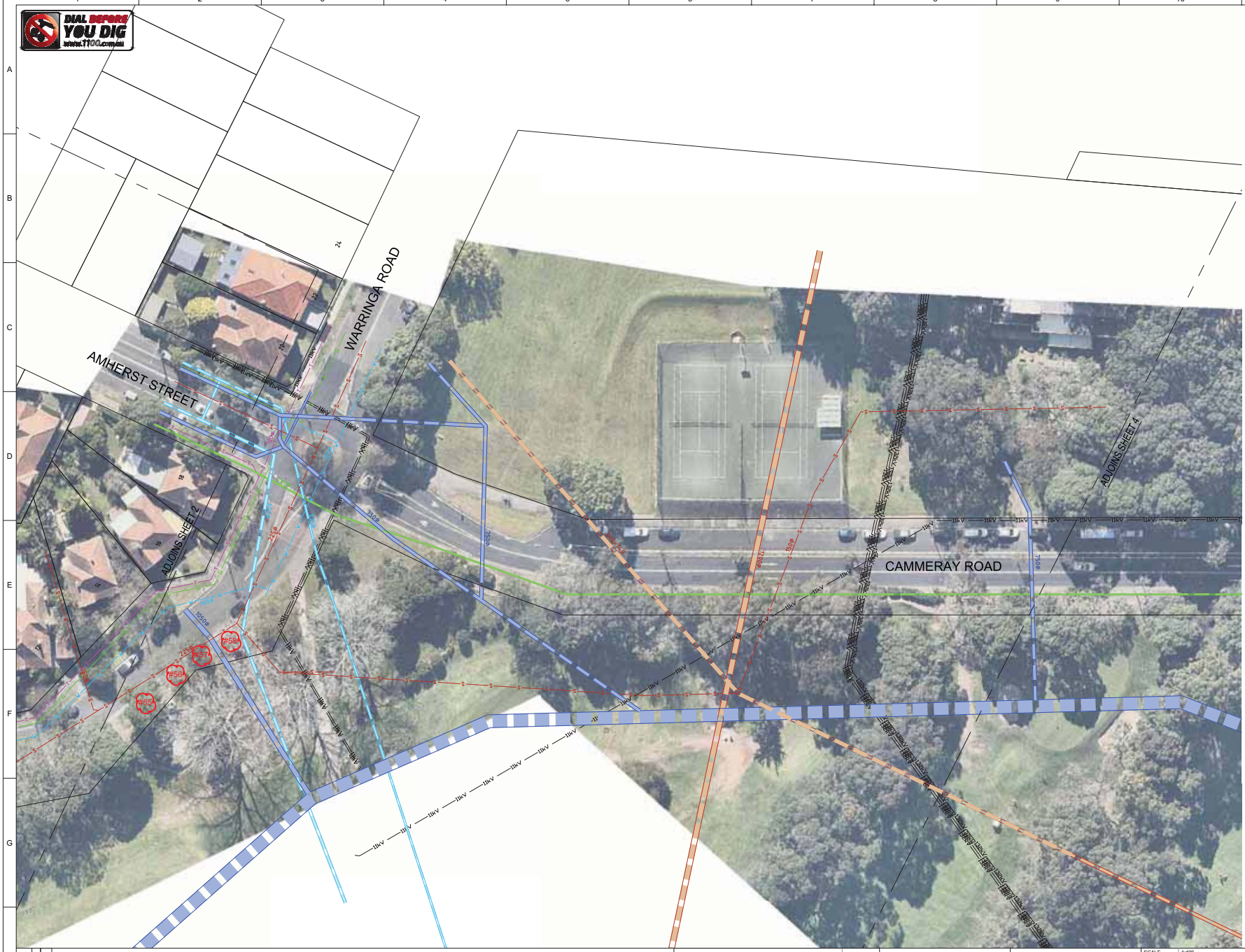

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PLAN SHOWING
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REPLACEMENT OF 132kV FEDERS 9Y7 & 9Y9,
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SIZE	DRAWING No	SHEET	AMD
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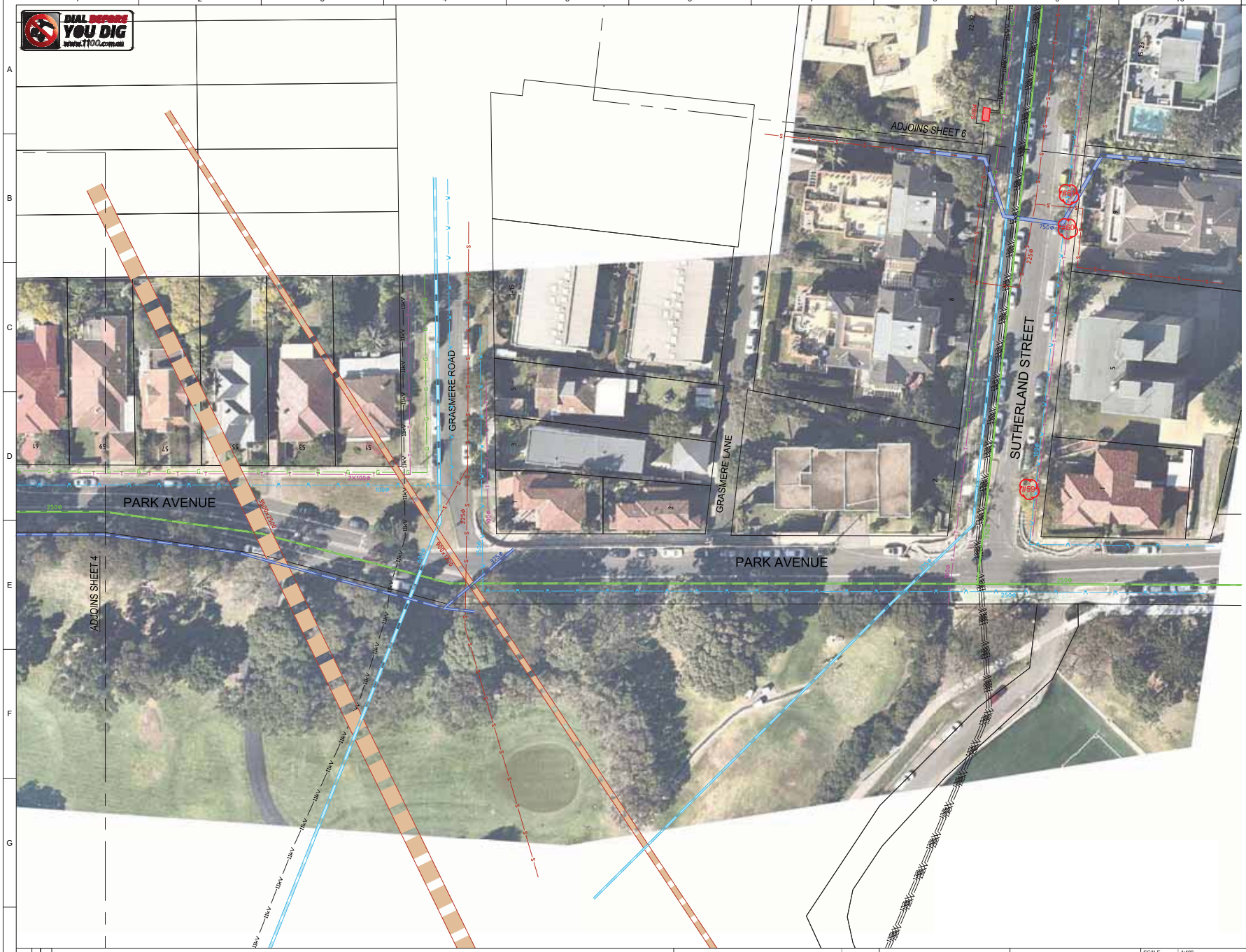

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E. survey@ausgrid.com.au
T. 02 9272 3747

SCALE	1:400
DRAWN	V WADY
CHECKED	V WADY
APPROVED	M RIDDELL
DATE	17-NOV-2017
TRIM FILE	-
SURVEY JOB NUMBER	170407
PROJTRAK NUMBER	SJ-00255

LOCALITY: CREMORNE LGA: NORTH SYDNEY

PLAN SHOWING
(,67,1* 87,/ ,7< 6($5&+) 2 5
REPLACEMENT OF 132kV FEDERS 9Y7 & 9Y9,
WILLOUGHBY TO MOSMAN.

SIZE	DRAWING No	SHEET	AMD
A1	S 23248	8 OF 16	0

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NOTES

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THE LOCATION OF SERVICES IS APPROXIMATE ONLY.

LINETYPE LEGEND

- 11kV 11kV — DENOTES 11kV UNDERGROUND CABLE
- 132kV 132kV — DENOTES 132kV UNDERGROUND CABLE
- G G — DENOTES MINOR GAS MAIN
- DENOTES MAJOR GAS MAIN
- S S S — DENOTES MINOR SEWER PIPE
- DENOTES MAJOR SEWER PIPE
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- DENOTES STORMWATER PIPE
- T T T — DENOTES TELSTRA LOCAL CABLE
- OF OF — DENOTES OPTUS OPTIC FIBRE CABLE
- NBN NBN — DENOTES NBN CO OPTIC FIBRE CABLE

8 4 0 8 16 24 32 40
SCALE IN METRES ON ORIGINAL DRAWING AT REDUCTION RATIO 1:400

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AMENDMENTS

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SURVEY JOB NUMBER	170407
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LOCALITY: CREMORNE LGA: NORTH SYDNEY

PLAN SHOWING
(,67,1* 87,/ ,7< 6($5&+)25
REPLACEMENT OF 132kV FEDERS 9Y7 & 9Y9,
WILLOUGHBY TO MOSMAN.

SIZE	DRAWING No	SHEET	AMD
A1	S 23248	9 OF 16	0

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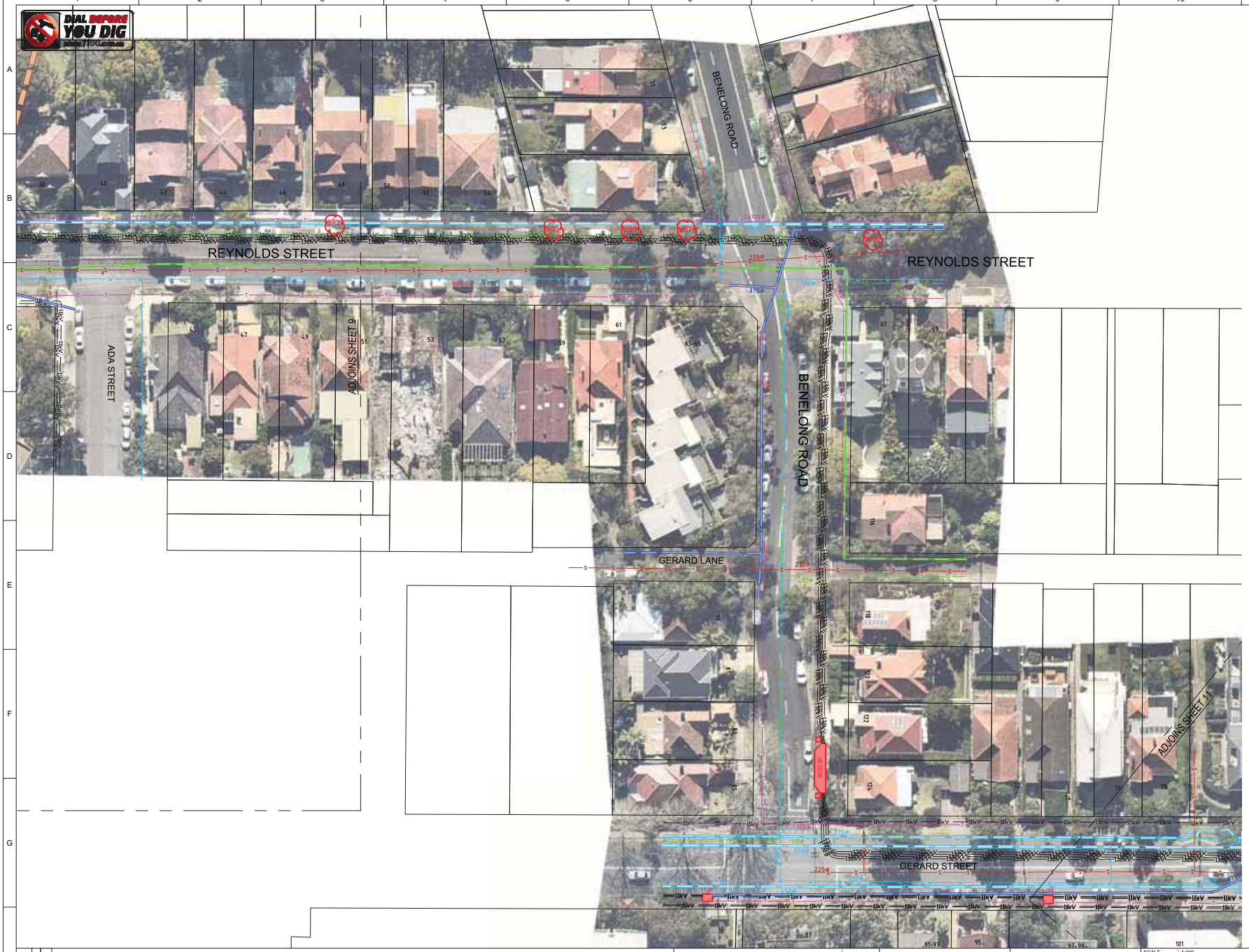

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SCALE	1:400
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CHECKED	V WADY
APPROVED	M RIDDELL
DATE	17-NOV-2017
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SURVEY JOB NUMBER	170407
PROJTRAK NUMBER	SJ-00255

LOCALITY: CREMORNE LGA: NORTH SYDNEY

PLAN SHOWING
(,67,1* 87,/ ,7< 6($5&+)25
REPLACEMENT OF 132kV FEDERS 9Y7 & 9Y9,
WILLOUGHBY TO MOSMAN.

SIZE	DRAWING No	SHEET	AMD
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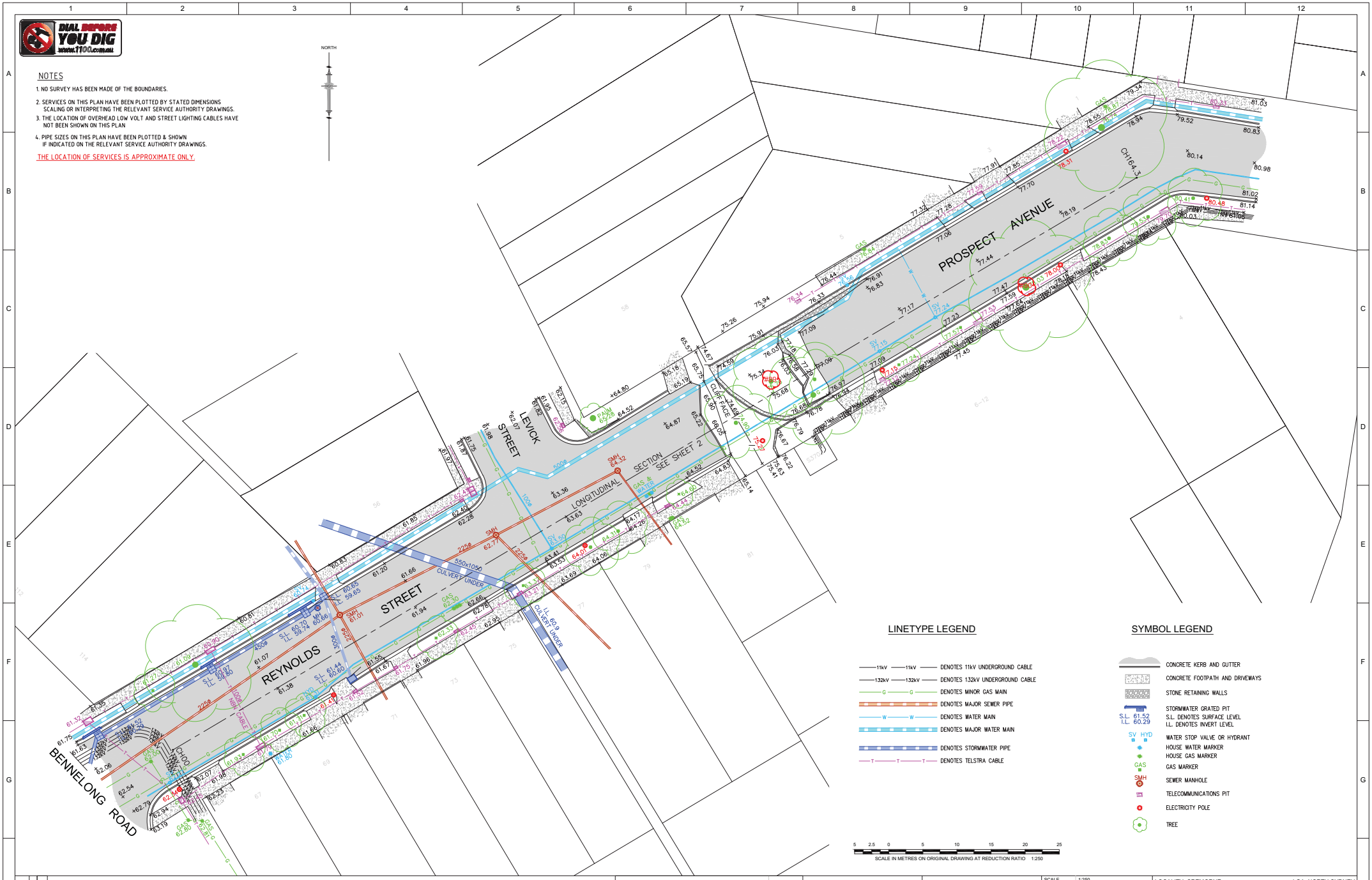

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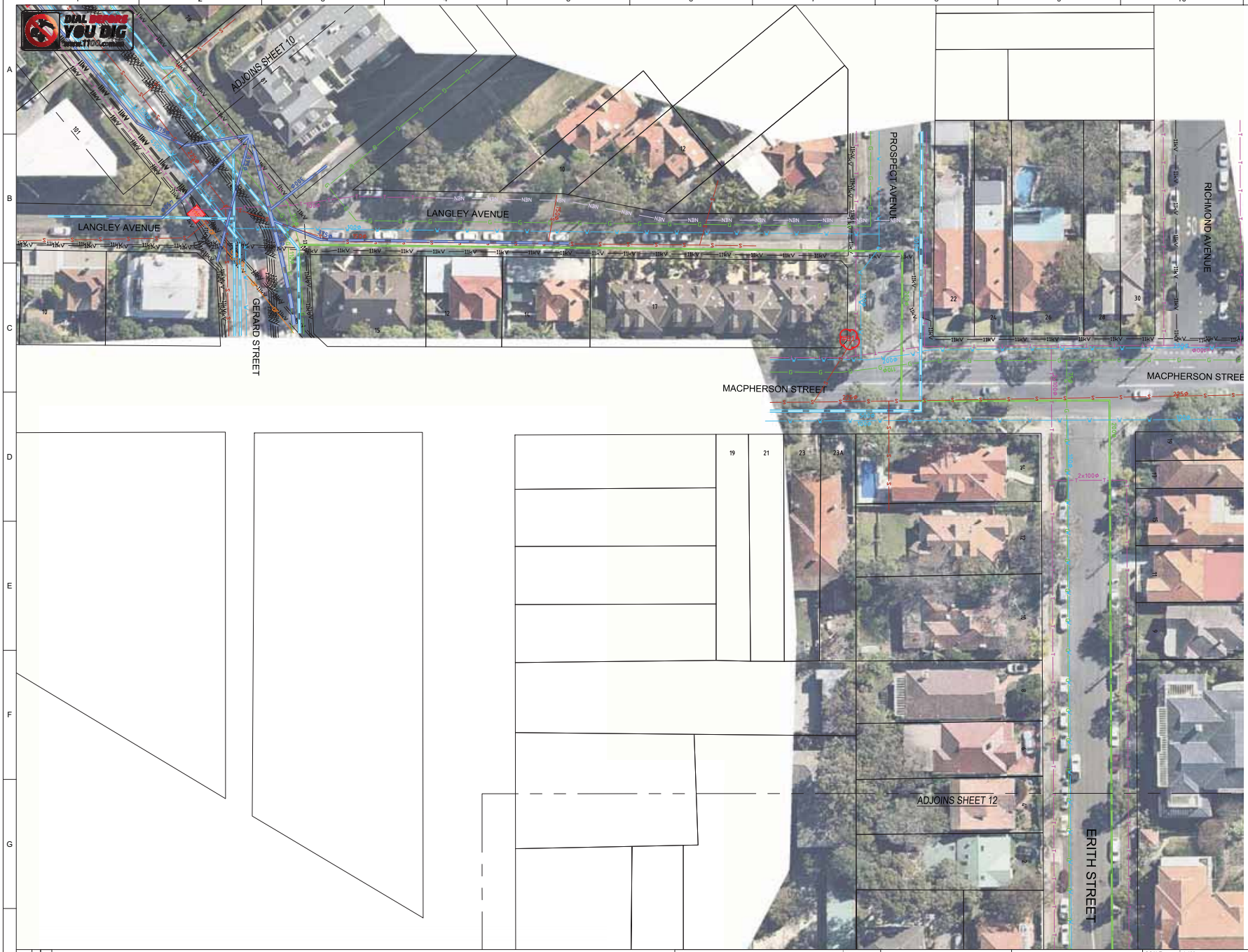
SCALE	1:250
DRAWN	V WADY
CHECKED	C MORGAN
APPROVED	M RIDDELL
DATE	24-APRIL-2018
TRIM FILE	-
SURVEY JOB NUMBER	180146
PROJTRAK NUMBER	SJ-00254

LOCALITY: CREMORNE LGA: NORTH SYDNEY

PLAN SHOWING
DETAIL SURVEY FOR
PROPOSED UNDERBORE ALONG
REYNOLDS STREET AND PROSPECT AVENUE,
CREMORNE.

SIZE	DRAWING No	SHEET	AMD
A1	S 23450	1 OF 2	0



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NORTH

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- DENOTES STORMWATER PIPE
- T T T — DENOTES TELSTRA LOCAL CABLE
- OP OP — DENOTES OPTUS OPTIC FIBRE CABLE
- NBN NBN — DENOTES NBN CO OPTIC FIBRE CABLE

8 4 0 8 16 24 32 40
SCALE IN METRES ON ORIGINAL DRAWING AT REDUCTION RATIO 1:400

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DATE	17-NOV-2017
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SURVEY JOB NUMBER	170407
PROJTRAK NUMBER	SJ-00255

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PLAN SHOWING
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REPLACEMENT OF 132kV FEDERS 9Y7 & 9Y9,
WILLOUGHBY TO MOSMAN.

SIZE	DRAWING No	SHEET	AMD
A1	S 23248	11 OF 16	0

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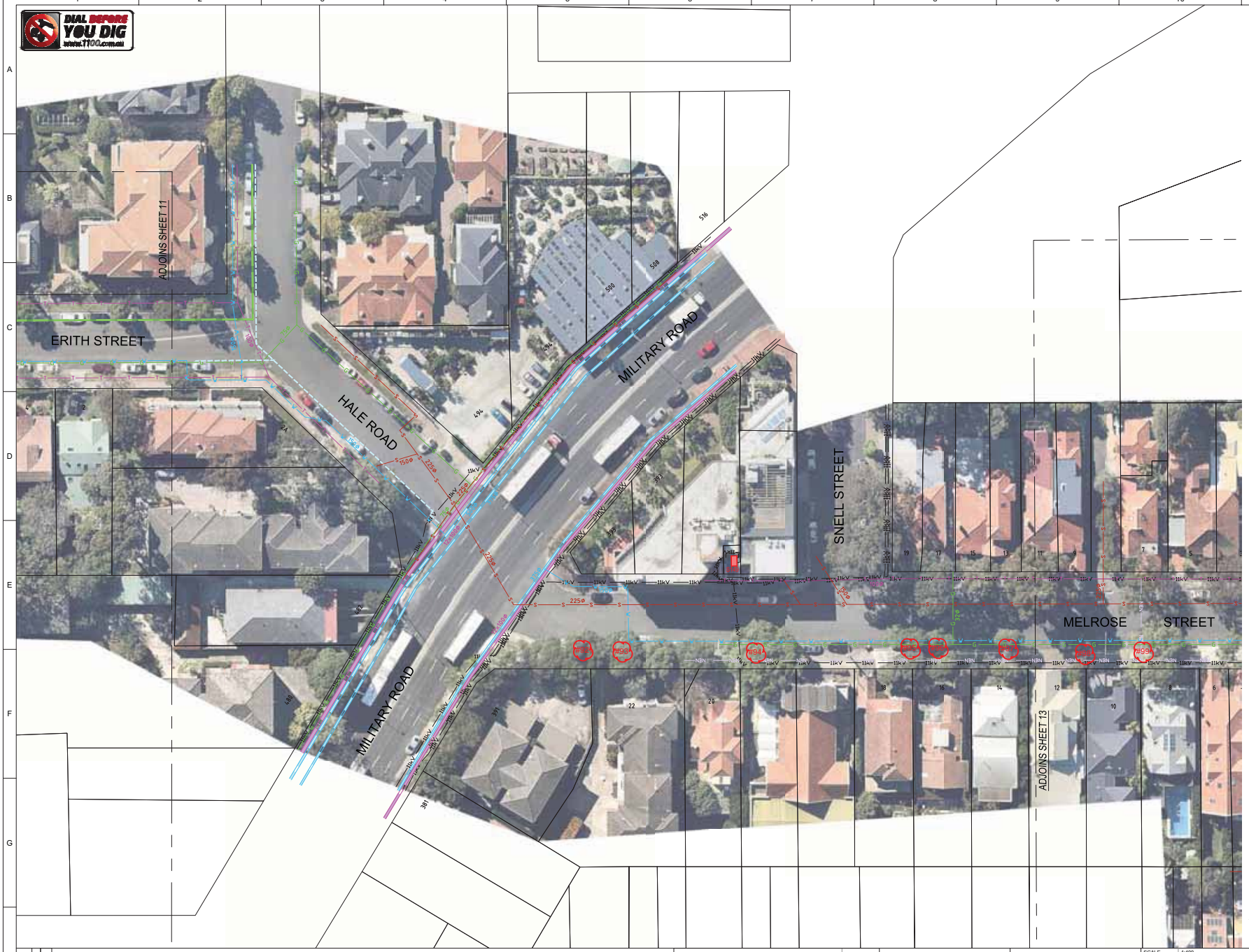

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SCALE IN METRES ON ORIGINAL DRAWING AT REDUCTION RATIO 1:400

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APPROVED	M RIDDELL
DATE	17-NOV-2017
TRIM FILE	-
SURVEY JOB NUMBER	170407
PROJTRAK NUMBER	SJ-00255

LOCALITY: MOSMAN LGA: NORTH SYDNEY

PLAN SHOWING
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REPLACEMENT OF 132kV FEDERS 9Y7 & 9Y9,
WILLOUGHBY TO MOSMAN.

SIZE	DRAWING No	SHEET	AMD
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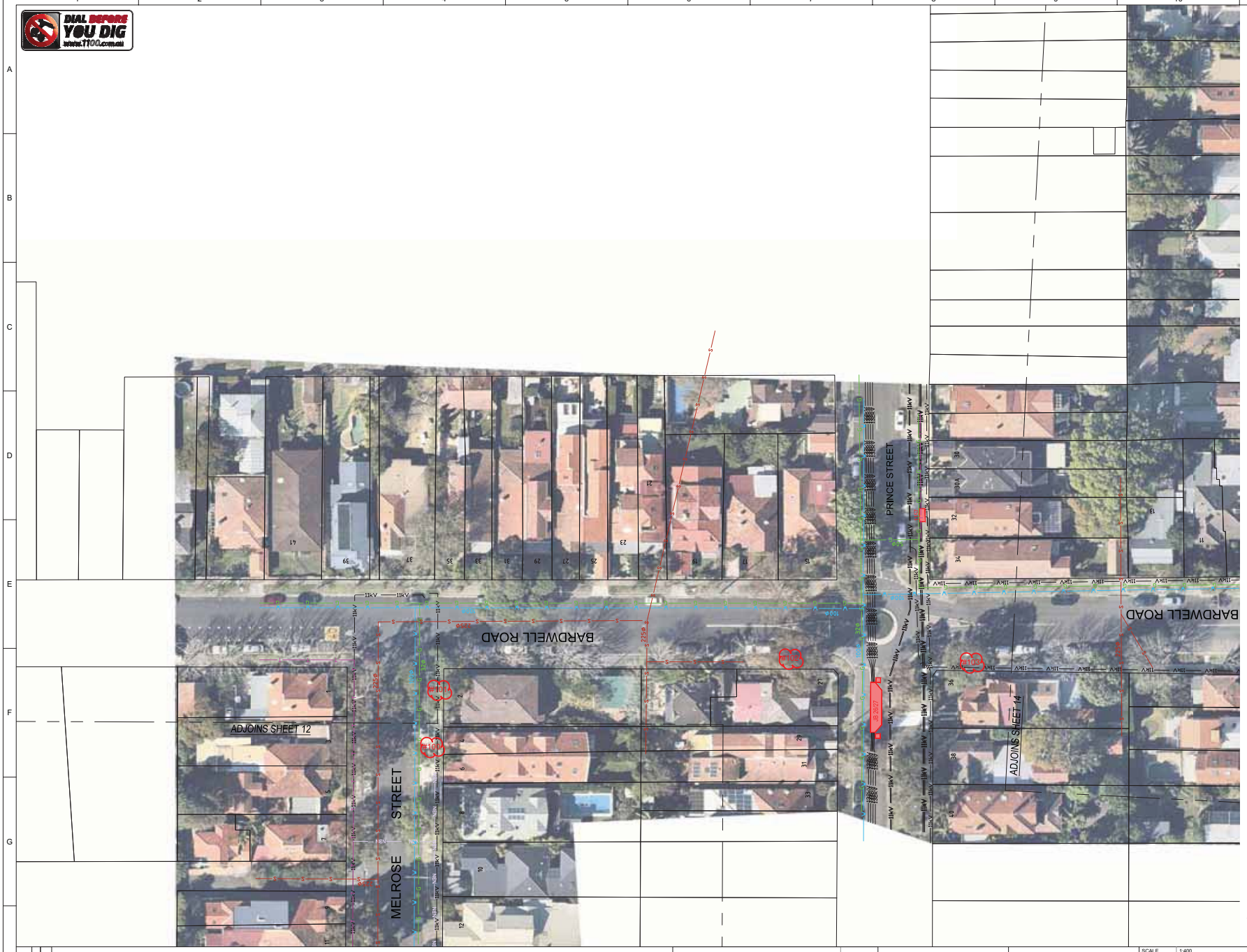

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SCALE IN METRES ON ORIGINAL DRAWING AT REDUCTION RATIO 1:400

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SCALE	1:400
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DATE	17-NOV-2017
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SURVEY JOB NUMBER	170407
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REPLACEMENT OF 132kV FEDERS 9Y7 & 9Y9,
WILLOUGHBY TO MOSMAN.

SIZE	DRAWING No	SHEET	AMD
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PLAN SHOWING
(,67,1* 87,/ ,7< 6($5&+)25
REPLACEMENT OF 132kV FEDERS 9Y7 & 9Y9,
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SIZE	DRAWING No	SHEET	AMD
A1	S 23248	14 OF 16	0

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APPROVED	M RIDDELL
DATE	17-NOV-2017
TRIM FILE	-
SURVEY JOB NUMBER	170407
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LOCALITY: MOSMAN LGA: NORTH SYDNEY

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WILLOUGHBY TO MOSMAN.

SIZE	DRAWING No	SHEET	AMD
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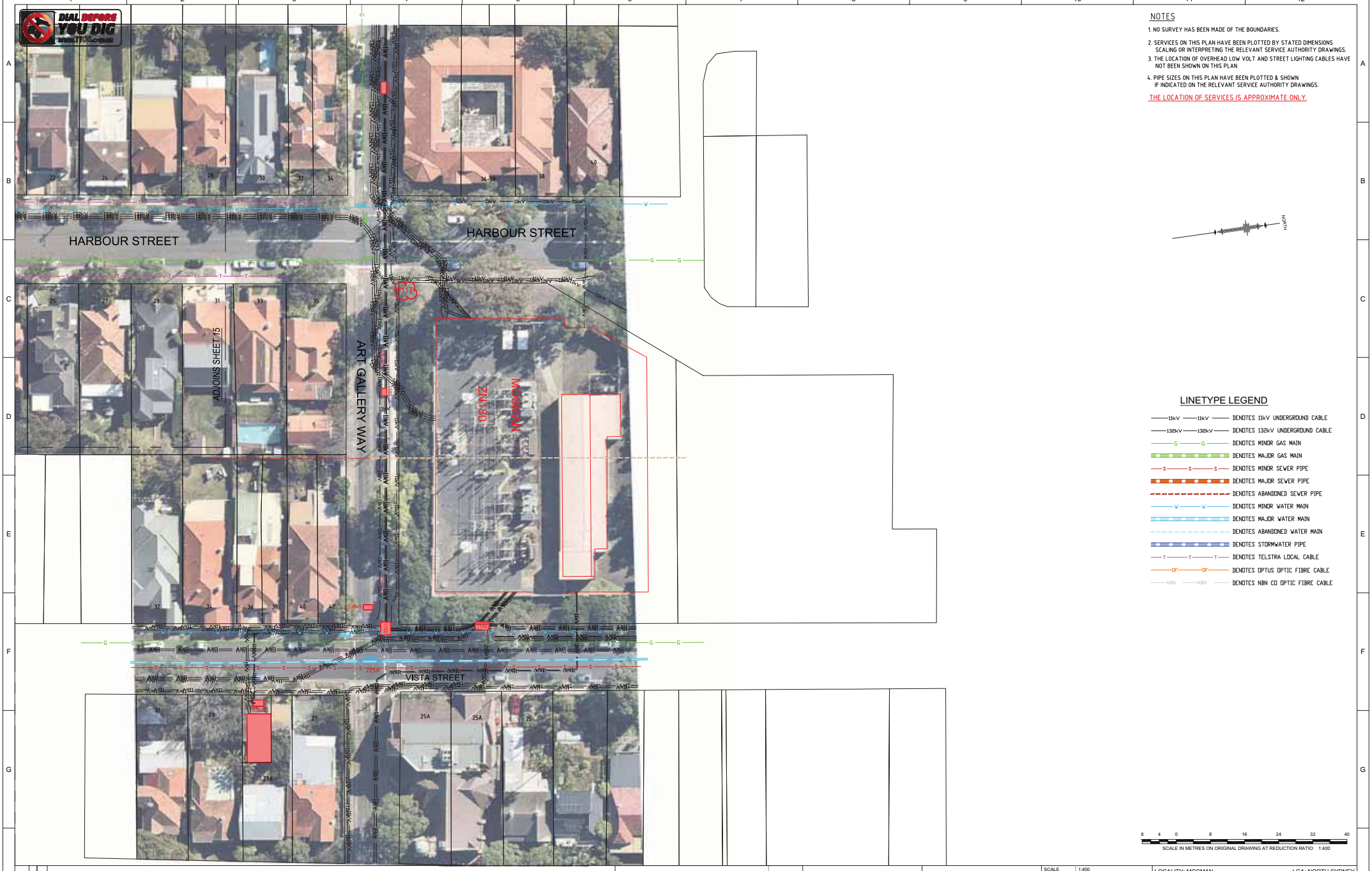

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REPLACEMENT OF 132kV FEDERS 9Y7 & 9Y9,
WILLOUGHBY TO MOSMAN.

SIZE	DRAWING No	SHEET	AMD
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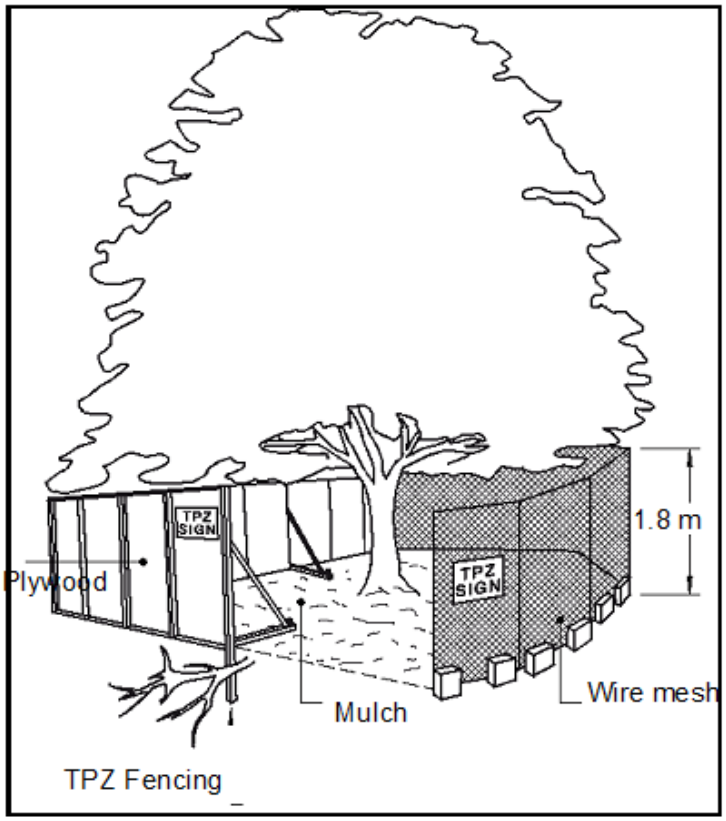
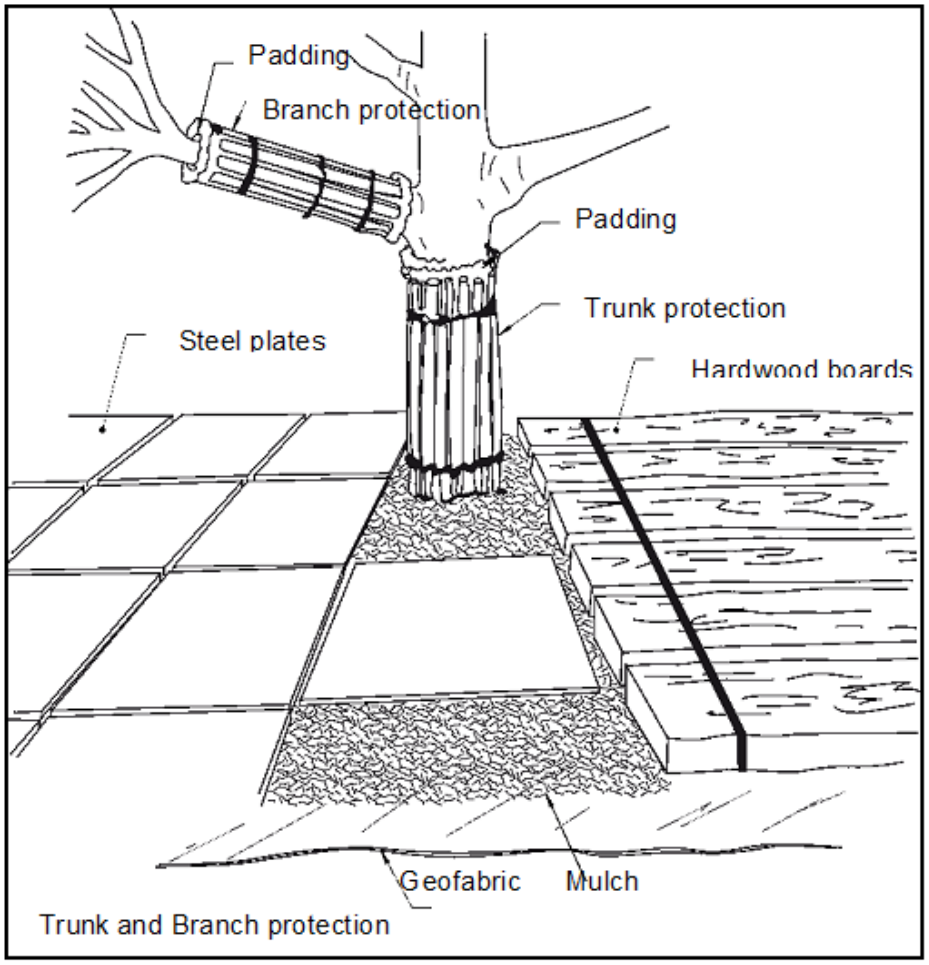
10.3 Tree, Trunk and Branch Protection Methods (Source AS4970-2009)





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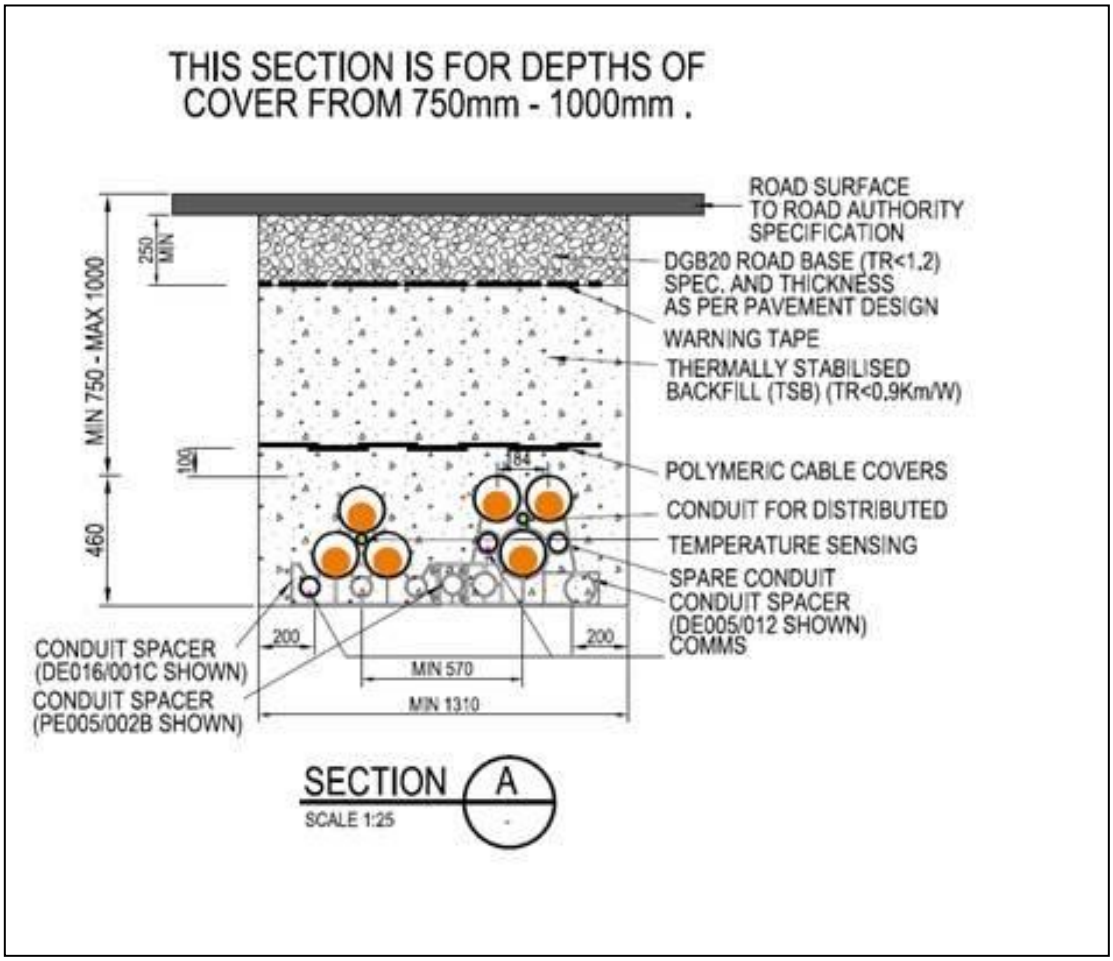
10.4 Trench Detail



10.5 References

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10.6 Qualifications – Ian Hills

Associate Diploma Horticulture	Ryde TAFE 1984
AQF3 Horticulture (Arboriculture)	Ourimbah TAFE 1998
AQF5 Diploma Horticulture (Arboriculture)	Kurri Kurri TAFE 2009 (Dux) Cert No. 5934155
QTRA Registered User 2083	December 2013
QTRA Registered Advanced User 4469	March 2018