Tree Impact Assessment Report – External to Rail Corridor

SMCSWSSJ-JHL-WSS-EM-REP-000003

Document and Revision History

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Revisions

Revision	Date	Description	Prepared by	Reviewed by
0	30 August 2018	Issued for Review	DK	CN
1	13 September 2019	Updated for ER comments	DK	NI
2	17 October 2018	Updated for ER comments	DK	NI
3	4 June 2020	Updated for Arborist Reports	RD	DK
4	4 June 2020	Updated for Arborist Report	RD	DK
5	17 February 2021	Updated for Arborist Report	RD	DK

Management reviews

Review date	Details	Reviewed by

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1. Introduction

1.1 Background

This report has been produced to detail the species and number of trees external to the rail corridor that will be removed as part of the Sydenham Station and Junction (SSJ) works. A separate report has been prepared and endorsed by the Environmental Representative that details trees to be removed as part of the works that are located inside the rail corridor (refer *SMCSWSSJ-JHL-WSS-EM-REP-000003 Tree Impact Assessment Report – Rail Corridor* (JHLOR, 2018). It is noted that for the purpose of this report the rail corridor includes all land owned by RailCorp where trains operate.

The ecological potential of the project site has been assessed under the Sydney Metro City & Southwest Chatswood to Sydenham Environmental Impact Statement and the subsequent Sydenham Station and Sydney Metro Trains Facility South Modification Report. The assessment found "*All vegetation identified within the study area is mapped as Urban – Exotic / Native in Native Vegetation of the Sydney Metropolitan Catchment Management Authority Area (Department of Environment, Climate Change and Water, 2009a) and field assessment has confirmed that most vegetation is planted or exotic regrowth... No native vegetation communities were observed during site inspections, and none of the vegetation in the study area meets the criteria for any threatened ecological community listed under the EPBC Act or the TSC Act... No threatened flora species were recorded*." (Page 804 C2S – EIS). Also, "*The existing biodiversity environment in the vicinity of Sydenham was described as part of the assessment of the approved project*." (Page 243 C2S EIS Modification report).

In accordance with the Sydney Metro City & Southwest Chatswood to Sydenham Conditions of Approval a tree is defined as "*Long lived woody perennial plant greater than (or usually greater than) 3 m in height with one or relatively few main stems or trunks*". Condition of Approval E6 requires a Tree Report to be prepared prior to the removal of any trees from the project area. A copy of the tree report is to be submitted to the Secretary before the removal, damage and/or pruning of any trees.

In accordance with the Sydney Metro City & Southwest Chatswood to Sydenham Conditions of Approval E6 this report is a standalone Tree Report for the area associated with the SSJ works that is external to the rail corridor.

1.2 Project Overview and Location

Sydney Metro City & Southwest is a new 30km metro line extending metro rail from the end of Sydney Metro Northwest at Chatswood under Sydney Harbour, through new CBD stations and southwest to Bankstown. It is due to open in 2024 with the capacity to run a metro train every two minutes each way through the centre of Sydney. The SSJ project forms part of the Sydney Metro City & Southwest project and includes upgrades to Sydenham Station, the surrounding network and other ancillary infrastructure to accommodate Sydney Metro trains.

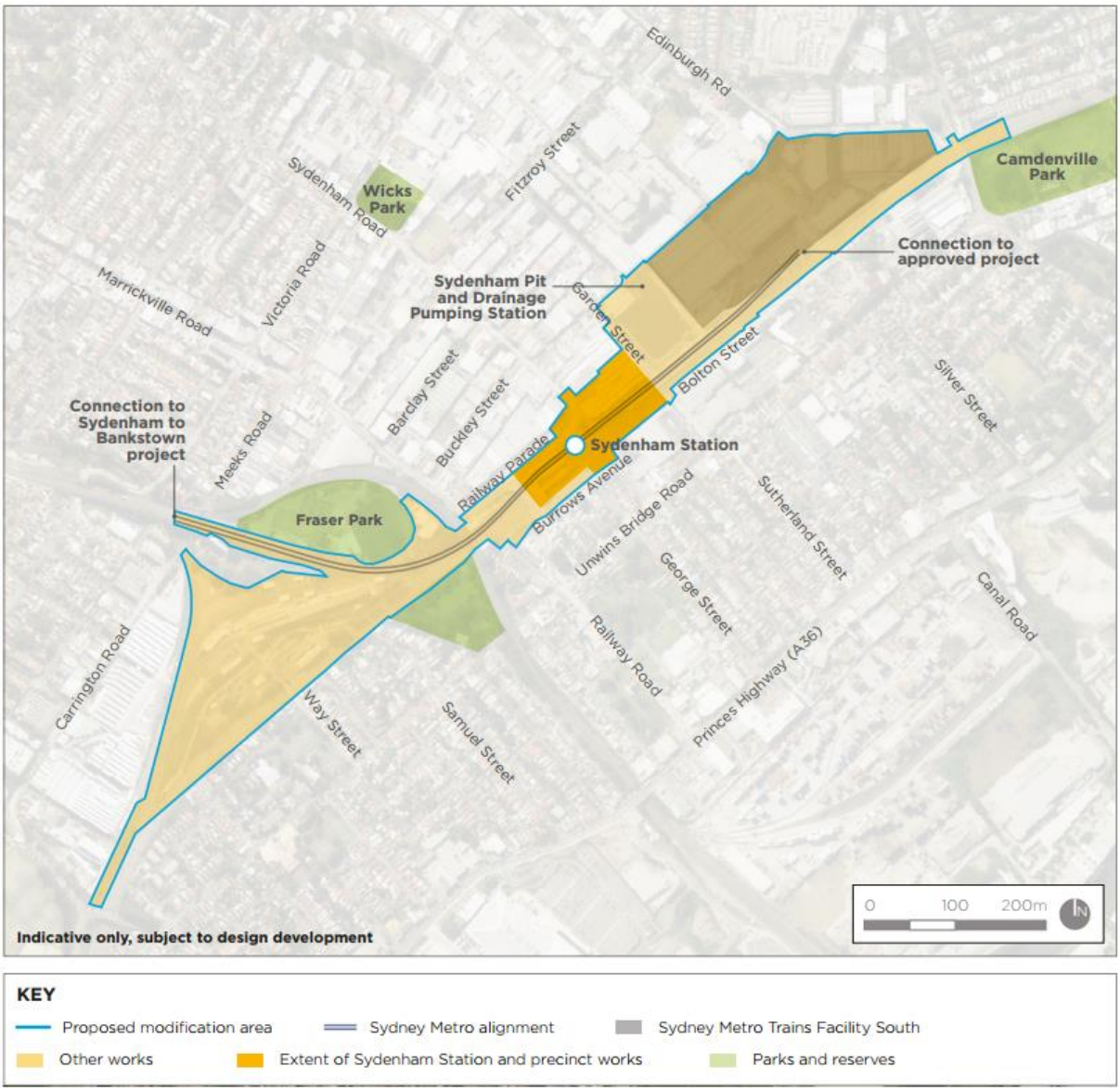
The SSJ works were not assessed under the planning approval for the Sydney City Metro Chatswood to Sydenham that was approved by the Minister on 9 January 2017 under Part 5.1 of the Environmental Assessment & Planning Act 1979. The Sydenham to Bankstown State Significant Infrastructure Application Report identified an opportunity to accelerate the phased opening of the Chatswood to Sydenham Metro Service, through to Sydenham Station if Sydenham Station and Junction works commence earlier under a separate planning approval. As such, the works have been assessed as a modification to the Sydney City Metro Chatswood to Sydenham Environmental Impact Statement to allow the phased opening of the Metro services from Chatswood to Sydenham Station.

The works include all permanent new infrastructure and modifications to existing infrastructure, which must be constructed to enable the construction of SSJ. The permanent new infrastructure and modifications to existing infrastructure to be constructed includes;

- Sydenham Station and precinct works – demolition and reconstruction of platforms 1 and 2 for metro rail operations and a new aerial concourse connecting to new station entries at Railway Parade and Burrows Avenue. Upgrades to transport interchange facilities and provision for active transport would be delivered as part of the station works
- Track and rail system facilities – reconfiguration of existing track and rail systems to segregate the T3 Bankstown Line and the Goods Line, installation of metro tracks and rail systems including crossover and turnback facilities
- Adjustments to the Sydenham Pit and Drainage Pumping Station – including a new aqueduct over the pit, new pumping station and new maintenance access ramp
- Ancillary infrastructure and works – including fencing, maintenance access, utilities works, drainage, noise barriers, road and transport network works, bridge works, and temporary facilities to support construction.

The SSJ work location and site layout is highlighted in Figure 1.

Figure 1 Site Layout



2. Site Inspections

Bryce Claassens and Jack Williams, Consulting Arborists of Urban Arbor, attended the project site to undertake a tree inspection and assessment on the 7th of March 2018 and 13th July 2018. Additional inspections were conducted on 4th November 2019 to confirm administrative correction, 5th and 27th of May 2020 to incorporate trees in the area of utility and pedestrian/plaza works, and on 2nd and 11th February 2021 to incorporate trees in the area of track construction and CSR/retaining wall construction.

Trees have been assessed for visual amenity in regards to;

- The health of the tree
- Screening provided by the tree
- Whether the tree has any cultural or heritage significance
- Whether the tree forms part of a habitat linkage

Urban Arbor have subsequently produced a Tree Report to satisfy the Planning Approval conditions related to tree removal. A copy of the Report is included in Appendix A.

Curriculum vitae for both Bryce and Jack are attached in Appendix B.

3. Inspection Results

The results of the tree inspections can be found in Section 7 and Section 8 of the Urban Arbor Tree Report in Appendix A of this Report.

A total of 27 trees external to the rail corridor will be removed as part of the works. In addition, 1 tree will be trimmed.

4. Alternatives to Design

Section 8 and Section 9 of the Urban Arbor Tree Report in Appendix A identifies why these trees must be removed. Removal of the trees predominately relates to construction of the Northern Plaza, Southern Plaza, new Metro track and track slab, and Eastern Channel Culvert (11 Sydenham Road). These design components are integral to the functionality of the new station concourse and drainage. Due to limited space within the project boundary, it is not feasible or reasonable to move these design components to accommodate the existing trees

One tree at the Portuguese Club is to receive minor trimming to allow construction vehicle access along the Bankstown Line. Due to limited space within the rail corridor, construction vehicles must access the Bankstown Line via the access track where branches from the Portuguese Club tree overhang the rail corridor fence.

The arborist has assessed that due to the impacts of the retaining wall and CSR temporary works on Railway Parade, 7 existing street trees are to be removed, numbered 33 to 41 – noting that 34 and 37 do not meet the definition of a tree.

JHLOR believes that the temporary design for the retaining wall excavation can be refined to reduce impacts further. As such the following trees and vegetation are excluded from removal under this report;

- 33
- 34

Where further design development indicates that these trees must be removed, this report will be updated. The trees are within the Project Boundary. Inner West Council will be notified of the tree removal as per Section 5.

5. Mitigation Measures

JHLOR will implement a number of measures to ensure the correct trees are removed and to mitigate the risk of damage to trees that will remain. These mitigation measures include;

- An ecologist would be present during the removal of any hollow bearing trees in accordance with REMM B1
- The project will be designed to minimise impacts to trees where possible. This will include a review of design impacts and construction impacts on trees
- Relevant Councils and the DPE will be consulted in regards to replacement tree planting locations. Relevant Councils will be consulted in regards to appropriate sizes for replacement trees.
- A Vegetation Trimming and Removal Procedure will be implemented
- All existing trees to be retained within the site area must be protected in accordance with Australian Standard AS 4970 ‘Tree protection in development sites’ to avoid and minimise impacts
- All trees to be removed or trimmed will be appropriately demarcated
- Qualified and experienced tree loppers will be engaged to removed and trim trees

- Where works will occur in the vicinity of trees that are to remain intact, demarcation or barriers will be put in place around the tree at the extent of the structural root zone
- Access tracks will be clearly delineated and defined within the Environmental Control Maps
- Staff and workers to be educated on vegetation trimming and removal requirements
- A copy of the Tree Report must be submitted to the Secretary before the removal, damage and/or pruning of any trees, including those affected by the site establishment works.
- All recommendations of the Tree Report must be implemented by the Proponent, unless otherwise agreed by the Secretary.
- JHLOR will consult with Inner West Council in regards to the timing of removal of trees on Railway Parade and Burrows Avenue.
- JHLOR will consult with the Portuguese Club in regards to the timing of trimming of branches that overhand into the rail corridor.
- Undertake all Protection Measures as identified within Appendix A of this Report

It is also noted that the Critical State Significant Infrastructure (CSSI) must be designed to retain as many trees as possible and provide replacement trees such that there a net increase in the number of trees. In the event that tree removal cannot be avoided, then replacement trees are to be planted within, or in close proximity to the CSSI or other location in consultation with the Relevant Councils and agreed by the Secretary. The size of the replacement trees will be determined in consultation with the relevant Council.

This report will be submitted to the Secretary prior to the removal, damage and/or pruning of any trees.

Appendix A – Urban Arbor Tree Report

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Arboricultural Report

Site Location: Sydenham Station and Junction Project (SSJ)

Prepared for: John Holland Laing O'Rourke

Prepared by: Jack Williams & Bryce Claassens
Urban Arbor Pty Ltd
Date prepared: 17 February 2021
Reference: 210217-SSJ-AIA
Revision: F

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1. INTRODUCTION

1.1 Urban Arbor have been instructed by John Holland Laing O'Rourke to provide an Arboricultural Report for trees located at the site and adjoining neighbouring sites in relation to the Sydenham Station and Junction Project (SSJ). The location of all areas that have been assessed in this report were identified during site meetings on 13 July 2018, 4 November 2019, 5 May 2020, 27 May 2020, 2 February 2021 and 11 February 2021.

1.2 The site and tree inspections were carried out on 13 July 2018, 4 November 2019, 5 May 2020, 27 May 2020, 2 February 2021 and 11 February 2021. Access was available to the subject site and adjoining public areas only.

2. SCOPE OF THE REPORT

2.1 This report has been undertaken to meet the following objectives.

2.1.1 Conduct a visual assessment of all significant trees located within the area identified for assessment by John Holland Laing O'Rourke. For the purpose of this report, a significant tree is a 'Long lived woody perennial plant greater than (or usually greater than) 3 m in height with one or relatively few main stems or trunks'.

2.1.2 Determine the trees estimated contribution years and remaining, useful life expectancy and award the trees a retention value.

2.1.3 Determine trees that are to be removed or retained within each area.

2.1.4 Specify tree protection measures for trees to be retained in accordance with AS4970-2009.

3. LIMITATIONS

3.1 The observations and recommendations are based on the site inspections identified in section 1 only. The findings of this report are based on the observations and site conditions at the time of inspection.

3.2 All of the observations were carried out from ground level. The accuracy of the assessment of the subject trees structural condition and health is limited to the visibility of the tree at the time of inspection.

3.3 The tree inspection was visual from ground level only. No soil or tissue testing was carried out as part of the tree inspection. None of the surrounding surfaces adjacent to trees were lifted or removed during the tree inspections.

3.4 Root decay can sometimes be present with no visual indication above ground. It is also impossible to know the extent of any root damage caused by mechanical damage such as underground root cutting during the installation of services without undertaking detailed root investigation. Any form of tree failure due to these activities is beyond the scope of this assessment.

3.5 The report reflects the subject tree(s) as found on the day of inspection. Any changes to the growing environment of the subject tree, or tree management works beyond those recommended in this report may alter the findings of the report. There is no warranty, expressed or implied, that problems or deficiencies relating to the subject tree, or subject site may not arise in the future.

3.6 Tree identification is based on accessible visual characteristics at the time of inspection. As key identifying features are not always available the accuracy of identification is not guaranteed. Where tree species is unknown, it is indicated with an *spp*.

3.7 All diagrams, plans and photographs included in this report are visual aids only, and are not to scale unless otherwise indicated.

3.8 Alteration of this report invalidates the entire report.

4. METHODOLOGY

4.1 The following information was collected during the assessment of the subject tree(s).

4.1.1 Tree common name

4.1.2 Tree botanical name

4.1.3 Tree age class

4.1.4 DBH (Trunk/Stem diameter at breast height/1.4m) - millimetres.

4.1.5 DAB (Trunk diameter directly above the root buttress) – millimetres.

4.1.6 Estimated height - metres

4.1.7 Estimated crown spread (diameter of crown) - metres

4.1.8 Health

4.1.9 Structural condition

4.1.1 Amenity value

4.1.2 Estimated remaining contribution years (SULE)[1]

4.1.3 Retention value (Tree AZ)[2]

4.1.4 Notes/comments

4.2 An assessment of the trees condition was made using the visual tree assessment (VTA) model (Mattheck & Breloer, 1994).[3]

4.3 Tree diameter was measured using a DBH tape or in some cases estimated. Tree height and tree canopy spread was measured with a clinometer or in some cases estimated. All other measurements were estimations unless otherwise stated. The other tools used during the assessment were a nylon mallet, compass, camera and a steel probe.

[1] Barrell, J. (2001), *'SULE: Its use and status in the new millennium' in Management of Mature Trees proceedings of the 4th NAAA Workshop*, Sydney, 2001. Barrell.

[2] Barrell Tree Consultancy, *Tree AZ version 10.10-ANZ*, http://www.treeaz.com/.

[3] Mattheck, C. & Breloer, H., *The body language of trees - A handbook for failure analysis*, The Stationary Office, London, England (1994).

4.4 All information was imported into our computerised geographical information system (GIS) PT-mapper pro. This software was used to measure/calculate all encroachment estimates included in this report.

4.5 All DBH measurements, tree protection zones, and structural root zones were calculated in accordance with methods set out in AS4970 Protection of trees on development sites (2009).[4]

4.6 Details of how the observations in this report have been assessed are listed in the appendices.

5. GENERAL INFORMATION IN RELATION TO PROTECTING TREES ON DEVELOPMENT SITES

5.1 **Tree protection zone (TPZ):** The TPZ is the principle means of protecting trees on development sites and is an area required to maintain the viability of trees during development. It is commonly observed that tree roots will extend significantly further than the indicative TPZ, however the TPZ is an area identified in AS4970-2009 to be the area where root loss or disturbance will generally impact the viability of the tree. The TPZ is identified as a restricted area to prevent damage to trees either above or below ground during a development. Where trees are intended to be retained proposed developments must provide an adequate TPZ around trees. The TPZ is set aside for the tree's root zone, trunk and crown and it is essential for the stability and longevity of the tree. The TPZ also incorporates the SRZ (see below for more information about the SRZ). The TPZ is calculated by multiplying the DBH by twelve, with the exception of palms, other monocots, cycads and tree ferns, the TPZ of which have been calculated at one metre outside the crown projection. Additional information about the TPZ is included in appendix 3.

5.2 **Structural Root Zone (SRZ):** This is the area around the base of a tree required for the trees stability in the ground. An area larger than the SRZ always needs to be maintained to preserve a viable tree. The SRZ is calculated using the following formula; (DAB x 50) $^{0.42}$ x 0.64. There are several factors that can vary the SRZ which include height, crown area, soil type and soil moisture. It can also be influenced by other factors such as natural or built structures. Generally, work within the SRZ should be avoided. Soil level changes should also generally be avoided inside the SRZ of trees to be retained. Palms, other monocots, cycads and tree ferns do not have an SRZ. See the appendices for more information about the SRZ.

5.3 **Minor encroachment into TPZ:** Sometimes encroachment into the TPZ is unavoidable. Encroachment includes but is not limited to activities such as excavation, compacted fill and machine trenching. Minor encroachment of up to 10% of the overall TPZ area is normally considered acceptable, providing there is space adjacent to the TPZ for the tree to compensate and the tree is displaying adequate vigour/health to tolerate changes to its growing environment.

[4] Council Of Standards Australia, *AS4970 Protection of trees on development sites* (2009).

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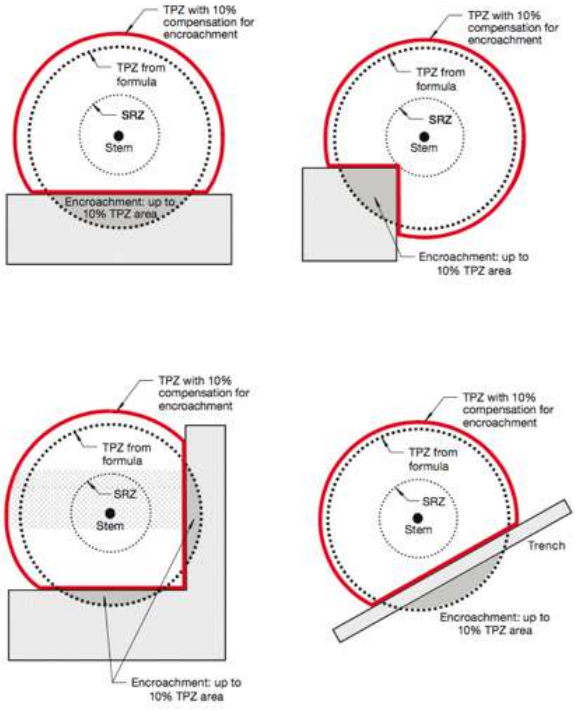

Image 1: Example minor TPZ encroachment from AS4970-2009.

5.4 **Major encroachment into TPZ:** Where encroachment of more than 10% of the overall TPZ area is proposed the project Arborist must investigate and demonstrate that the tree will remain in a viable condition. In some cases, tree sensitive construction methods such as pier and beam footings, suspended slabs, or cantilevered sections, can be utilised to allow additional encroachment into the TPZ by bridging over roots and minimising root disturbance. Major encroachment is only possible if it can be undertaken without severing significant size roots, or if it can be demonstrated that significant roots will not be impacted. Root investigations may be required to identify roots that will be impacted during major TPZ encroachment (see appendix 3 for more information in relation to root investigations).

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6. SITE LOCATION

6.1 The areas assessed in this report have been identified by John Holland Laing O'Rourke and have been listed below. Urban Arbor carried out a site inspection to identify significant trees within each area. In appendix 1 several site plans have been included that identify the location of each area that was assessed, and the location of the significant trees that were identified in each area. The tree information including canopy spread, TPZ and SRZ have been overlaid onto the site plans in appendix 1. The following areas were assessed for significant trees;

- Northern Plaza (Railway Parade)
- Aqueduct
- Area to South of 11 Sydenham Road
- Sydney Portugal Community Club
- Tillman Park
- Junction of Burrows Avenue/Gleeson Avenue
- Southern Plaza (Junction of Burrows Avenue/Hogan Avenue)
- North of Bolton Street (TSE Project Site)
- Edgeware Road
- Railway Parade (Street trees)

7. TREE OBSERVATIONS

7.1 **Tree information:** Details of each individual tree assessed, including the observations taken during the site inspection, can be found in the tree inspection schedule in appendix 2, where the indicative tree protection zone (TPZ) and Structural Root Zone (SRZ) has been calculated for each of the subject trees. The TPZ and SRZ should be measured in radius from the centre of the trunk. Each of the subject trees have been awarded a retention value based on the observations using the Tree AZ method. Tree AZ is used to identify higher value trees worthy of being a constraint to development and lower value trees that should generally not be a constraint to the development. The Tree AZ categories sheet (Barrell Tree Consultancy) has been included in appendix 3 to assist with understanding the retention values. The retention value that has been allocated to the subject trees in this report is not definitive and should only be used as a guideline.

8. ASSESSEMENT OF TREE IMPACTS BY AREA

8.1 **Northern Plaza (Railway Parade):** The trees located within this area are located within the footprint of a crane lifting pad and are to be removed to accommodate the development. The following trees have been identified in this area;

Tree ID	Species	Height (M)	Spread (M)	TPZ Radius (M)	SRZ Radius (m)	Landscape Value	SULE	Retention Value
1	*Corymbia maculata*	5	1	2.0	1.5	Low	5. Small/ Young	Z1
2	*Casuarina cunninghamiana*	9	5	7.2	2.9	High	1. Long	A1
3	*Casuarina cunninghamiana*	7	4	9.0	3.1	Medium	3. Short	Z10
4	*Corymbia maculata*	7	2	2.5	1.8	Medium	1. Long	A1
5	*Melaleuca bracteata*	6	3	7.2	2.5	Medium	1. Long	A1

8.2 **Aqueduct:** The whole of the aqueduct area was assessed. No significant trees were identified within this area.

8.3 **Area to South of 11 Sydenham Road:** The trees located within this area are located within the footprint of an underground culvert and are to be removed to accommodate the development. The following trees have been identified in this area;

Tree ID	Species	Height (M)	Spread (M)	TPZ Radius (M)	SRZ Radius (m)	Landscape Value	SULE	Retention Value
6	*Acmena smithii var. Minor*	6	2	3.7	2.0	Medium	2. Medium	A1
7	*Acmena smithii var. Minor*	6	2	3.1	1.9	Medium	2. Medium	A1
8	*Acmena smithii var. Minor*	5	1.5	3.0	1.9	Medium	2. Medium	A1
9	*Acmena smithii var. Minor*	5	1.5	3.0	1.8	Medium	2. Medium	A1
10	*Acmena smithii var. Minor*	6	1.5	2.7	1.6	Medium	2. Medium	A1
11	*Acmena smithii var. Minor*	5	1.5	3.5	1.8	Medium	2. Medium	A1
12	*Acmena smithii var. Minor*	4	1.5	4.1	1.8	Medium	2. Medium	A1

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8.4 **Sydney Portugal Community Club:** Trees in this area require crown pruning to allow vehicle access to the development. The pruning is to include providing 5 metre height access below the canopy of the trees within the rail corridor. The following trees have been identified in this area;

Tree ID	Species	Height (M)	Spread (M)	TPZ Radius (M)	SRZ Radius (m)	Landscape Value	SULE	Retention Value
13	*Quercus suber*	9	7	9.6	3.1	High	1. Long	A1
Pruning Specifications:	The South West of the canopy of tree 13 is to be crown lifted to 5 metres above ground level within the rail corridor only. The canopy extends into the rail corridor by approximately 3m. The pruning will result in removing less than 15% of the overall live canopy, which will not significantly impact the trees condition. The pruning can be carried out in accordance with AS4373-2007, pruning class C. All final pruning cuts should be to the nearest branch collar.							

8.5 **Tillman Park:** No development works are proposed in this area. The trees are to be retained and protected. The following trees have been identified in this area;

Tree ID	Species	Height (M)	Spread (M)	TPZ Radius (M)	SRZ Radius (m)	Landscape Value	SULE	Retention Value
14	*Ficus macrophylla*	7	2	3.2	2.1	Medium	1. Long	A1
15	*Acmena smithii var. Minor*	6	1.5	4.6	2.1	Medium	2. Medium	A1
16	*Syncarpia glomulifera*	8	2.5	4.7	2.3	Medium	2. Medium	A1

8.6 **Junction of Burrows Avenue/Gleeson Avenue:** No development works are proposed in this area. The trees are to be retained and protected. The following trees have been identified in this area;

Tree ID	Species	Height (M)	Spread (M)	TPZ Radius (M)	SRZ Radius (m)	Landscape Value	SULE	Retention Value
17	*Schefflera actinophylla*	5	2	5.4	2.5	Low	2. Medium	Z3

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8.7 **Southern Plaza (Junction of Burrows Avenue/Hogan Avenue):** The trees located within this area are located within the footprint of a crane lifting pad and are to be removed to accommodate the development. The following trees have been identified in this area;

Tree ID	Species	Height (M)	Spread (M)	TPZ Radius (M)	SRZ Radius (m)	Landscape Value	SULE	Retention Value
18	*Brachychiton acerifolius*	3	1	2.0	1.6	Low	5. Small/Young	Z1

8.8 **Southern Plaza (Junction of Burrows Avenue/Hogan Avenue/Bolton Street):** The tree located within this area is located within the footprint of a proposed kerb/gutter and the tree is to be removed to accommodate the development. The following trees have been identified in this area;

Tree ID	Species	Height (M)	Spread (M)	TPZ Radius (M)	SRZ Radius (m)	Landscape Value	SULE	Retention Value
18a	*Pyrus calleryana*	5	3	2.9	1.9	Low	2. Medium	A1

8.9 **Edgeware Road:** The trees located within this area are located within the footprint of shunt track construction and are to be removed to accommodate the development. The following trees have been identified in this area;

Tree ID	Species	Height (M)	Spread (M)	TPZ Radius (M)	SRZ Radius (m)	Landscape Value	SULE	Retention Value
19	*Acacia longifolia*	7	3	5.7	2.5	Low	2. Medium	A1
20	*Acacia longifolia*	7	3	4.1	2.2	Low	2. Medium	A1
21	*Celtis australis*	5	1.5	2.0	1.6	Low	5. Small/Young	Z3
22	*Acacia longifolia*	5	2	3.6	2.3	Low	2. Medium	A1
23	*Acacia longifolia*	6	2	4.7	2.4	Low	2. Medium	A1

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8.10 **Southern Plaza (Hogan Avenue):** The tree within this area is to be removed due to recent construction works completed within the TPZ and SRZ. The stability of the tree has potentially been compromised. The following tree has been identified in this area;

Tree ID	Species	Height (M)	Spread (M)	TPZ Radius (M)	SRZ Radius (m)	Landscape Value	SULE	Retention Value
24	*Acmena smithii var. minor*	5	1	2.0	1.8	Low	3. Short	Z6

8.11 **North of Bolton Street (TSE Project Site):** The tree within this area is located within the footprint of the metro track construction and is to be removed to accommodate the development. Smaller vegetation (which does not meet the definition of a tree as defined in section 2.1.1) that are located adjacent to this tree are also to be removed to accommodate the development. The following tree has been identified in this area;

Tree ID	Species	Height (M)	Spread (M)	TPZ Radius (M)	SRZ Radius (m)	Landscape Value	SULE	Retention Value
32	*Celtis sinensis*	4	1.5	2.0	1.5	Very Low	5. Small/Young	Z3

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8.12 **Southern Plaza (Hogan Avenue and Bolton Street):** The trees within this area are to be retained and protected during the proposed public footpath and turfing works. The proposed works must be completed in accordance with section 8.13 and 8.14 of this report to ensure the trees are not significantly impacted by the works. The following trees have been identified in this area;

Tree ID	Species	Height (M)	Spread (M)	TPZ Radius (M)	SRZ Radius (m)	Landscape Value	SULE	Retention Value
25	*Corymbia maculata*	15	2	3.2	2.1	Medium	1. Long	A1
26	*Pyrus calleryana*	5	2	2.0	1.8	Low	5. Small/Young	Z1
27	*Pyrus calleryana*	5	2	3.1	2.0	Medium	2. Medium	A1
28	*Pyrus calleryana*	5	2	2.5	1.8	Medium	2. Medium	A1
29	*Eucalyptus nicholii*	9	5	6.6	2.7	Medium	2. Medium	A1
30	*Cupaniopsis anacardioides*	7	3	3.6	2.1	Medium	2. Medium	A1
31	*Pyrus calleryana*	4	1	2.0	1.6	Low	5. Small/Young	Z1

8.13 **Tree Sensitive Footpath Construction :** To retain the trees in a viable condition, the footpath must be constructed in a tree sensitive method. The footpath should be constructed above existing grades in the TPZ of the trees. If excavations are essential, they must not exceed 100mm below the existing grades. The excavations should be supervised by a project Arborist with a minimum AQF level 5 qualification. All excavations for the footpath should be carried out manually to avoid impacting retained tree roots. All tree roots greater than 40mm in diameter should be retained, unless the project arborist has assessed and advised that the pruning/severing of the root will not impact the condition or stability of the tree. Manual excavation may include the use of pneumatic and hydraulic tools, high-pressure air or a combination of high-pressure water and a vacuum device.

Where tree roots greater than 40mm are encountered that must be retained, the footpath should be elevated over the individual tree root to allow for its retention. Examples of methods that can be used to bridge individual tree roots have been included below (Image A and B). Using pier and beam bridges as per image C is the recommended/preferred method, as it will allow for future growth of the tree roots, reducing future damage to the pavement from the roots.

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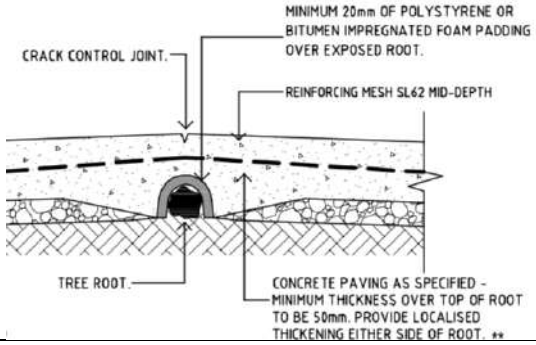

Image A: Example method for bridging concrete footpaths over tree roots provided in the Canterbury Bankstown Council standard drawings.[5]

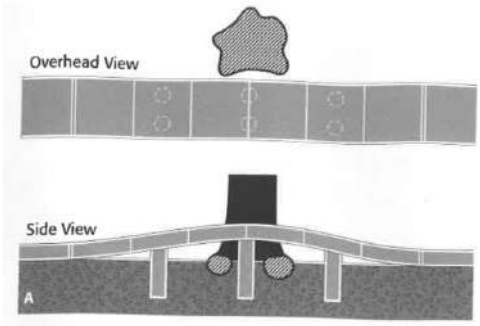

Image B: Example method from Reducing infrastructure damage by tree roots: A compendium of strategies.[6]

8.14 **Re-turfing within the TPZ:** To retain the trees in a viable condition, the turfing must be completed in a tree sensitive method. Excavations for the turf underlay must not exceed 100mm below the existing grades. The excavations should be supervised by a project Arborist with a minimum AQF level 5 qualification. All excavations for the underlay should be carried out manually to avoid impacting retained tree roots. All tree roots greater than 40mm in diameter should be retained, unless the project arborist has assessed and advised that the pruning/severing of the root will not impact the condition or stability of the tree. Manual excavation may include the use of pneumatic and hydraulic tools, high-pressure air or a combination of high-pressure water and a vacuum device.

[5] *Canterbury Bankstown Council standard drawing S-209 Existing street tree treatments*, https://www.cbcity.nsw.gov.au/development/planning-control-policies/council-standard-drawings, accessed 3 October 2019.

[6] Costello, L. R., & Jones, K. S, *Reducing infrastructure damage by tree roots: A compendium of strategies*, Western Chapter of the International Society of Arboriculture, 31883 Success Valley Drive, Porterville, CA (2003), page 27.

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8.15 **Railway Parade (street trees):** The trees within this area are located within the footprint of the proposed CSR and retaining wall construction. The trees are to be removed to accommodate the development. ID number 34 and 37 within the table below are smaller vegetation which do not meet the definition of a tree as defined in section 2.1.1, the smaller vegetation will also be required for removal to accommodate the development. The following trees and vegetation have been identified in this area;

Tree ID	Species	Height (M)	Spread (M)	TPZ Radius (M)	SRZ Radius (m)	Landscape Value	SULE	Retention Value
33	*Lophostemon confertus*	5	2	3.2	2.0	Medium	1. Long	A1
34	*Acmena smithii var. minor*	2	1	2.0	1.5	Low	5. Small/Young	Z1
35	*Acmena smithii var. minor*	3	1	2.0	1.6	Low	5. Small/Young	Z1
36	*Lophostemon confertus*	7	3	3.8	2.2	Medium	1. Long	A1
37	*Acmena smithii var. minor*	2	1	2.0	1.5	Very Low	5. Small/Young	Z1
38	*Lophostemon confertus*	7	3	4.2	2.3	Medium	1. Long	A1
39	*Lophostemon confertus*	7	2	3.5	2.1	Medium	1. Long	A1
40	*Lophostemon confertus*	6	2	2.9	2.1	Medium	1. Long	A1
41	*Lophostemon confertus*	6	2	2.5	1.9	Medium	1. Long	A1

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9. CONCLUSIONS

9.1 **Table 2:** Summary of the impact to trees by the development;

Impact	Reason	Category A	Category Z
		A	Z
Trees recommended to be removed	Building construction, new surfacing and/or proximity, trees in poor condition or low value trees to be removed and replaced	2, 4, 5, 6, 7, 8, 9, 10, 11, 12, 18a, 19, 20, 21, 22, 23, 33, 36, 38, 39, 40, 41 (Twenty-two trees)	1, 3, 18, 24, 32, 35 (Six trees)
Vegetation recommended to be removed	Building construction, new surfacing and/or proximity, trees in poor condition or low value trees to be removed and replaced	None	34, 37 (Two veg)
Trees recommended to be retained requiring canopy pruning	Building construction, new surfacing and/or proximity, trees in poor condition	13 (One tree)	None
Trees recommended to be retained requiring tree sensitive construction	Removal of existing surfacing/structures and/or installation of new surfacing/structures has potential to impact tree condition	25, 27, 28, 29, 30 (Five trees)	26, 31 (Two trees)
Trees recommended to be retained	Removal of existing surfacing/structures and/or installation of new surfacing/structures will not impact the trees viability	14, 15, 16 (Three trees)	17 (One tree)

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10. RECOMMENDATIONS

10.1 This report assesses the impact of a proposed development to forty trees and two smaller vegetation that are located at selected areas around the development site.

10.2 Twenty-eight trees have been recommended for removal, including tree 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 18, 18a, 19, 20, 21, 22, 23, 24, 32, 33, 35, 36, 38, 39, 40 and 41.

10.3 Two items of smaller vegetation, which do not meet the definition of a tree as defined in section 2.1.1, have been recommended for removal, including 34 and 37.

10.4 Seven trees could potentially be impacted by the proposed re-construction of the public footpath and turfing works, including tree 25, 26, 27, 28, 29, 30 and 31. These trees are to be retained and protected. To ensure the trees can be retained in a viable condition, the proposed works must be completed in accordance with section 8.13 and 8.14 of this report.

10.5 All other significant trees identified are to be retained and protected, including tree 13, 14, 15, 16 and 17. Each of these trees should be protected in accordance with AS4970-2009, details of which are included in section 11.

10.6 Tree 13 will require canopy pruning to allow access to the development site. The pruning should be in accordance with the following specifications;

- The South West of the canopy of tree 13 is to be crown lifted to 5 metres above ground level within the rail corridor only. The pruning should be carried out in accordance with AS4373-2007, pruning class C. All final pruning cuts should be to the nearest branch collar.

10.7 Site plans have included in appendix 1 to identify tree locations. The following site plans are included in appendix 1;

- Appendix 1A: Overall Site Plan (Aerial Image)
- Appendix 1B: Overall Site Plan
- Appendix 1C: North and South Plaza
- Appendix 1D: Area South of 11 Sydenham Road
- Appendix 1E: Sydney Portugal Community Club
- Appendix 1F: Tillman Park and Gleeson Ave
- Appendix 1G: Edgeware Road
- Appendix 1H: North of Bolton Street (TSE Project Site)
- Appendix 1I: Railway Parade (Street trees)

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11. TREE PROTECTION REQUIREMENTS

11.1 **Use of this report:** All contractors must be made aware of the tree protection requirements prior to commencing works at the site. This report and a copy of the site plans (Appendix 1) drawing must also be made available to any contractor prior to works commencing and during any on site operations.

11.2 **Project Arborist:** Prior to any works commencing at the site a project Arborist should be appointed. The project Arborist should be qualified to a minimum AQF level 5 and/or equivalent qualifications and experience, and should assist with any development issues relating to trees that may arise. If at any time it is not feasible to carryout works in accordance with this, an alternative must be agreed in writing with the project Arborist.

11.3 **Tree work:** All tree work should be carried out by a qualified and experienced Arborist with a minimum of AQF level 3 in arboriculture, in accordance with NSW Work Cover Code of Practice for the Amenity Tree Industry (1998) and AS4373 Pruning of amenity trees (2007).

11.4 **Initial site meeting/on-going regular inspections:** The project Arborist is to hold a pre-construction site meeting with principal contractor to discuss methods and importance of tree protection measures and resolve any issues in relation to tree protection that may arise. In accordance with AS4970-2009, the project Arborist should carryout regular site inspections to ensure works are carried out in accordance with this document throughout the development process. Site inspections are recommended on a monthly frequency throughout the development.

11.5 **Site Specific Tree Protection Recommendations:** Site specific tree protection measures should be specified by the project Arborist during the initial site meeting. All development works that are within the TPZ of the trees to be retained should be discussed during this meeting and required tree protection measures agreed in writing.

11.6 **Tree Protection Specifications:** It is the responsibility of the principal contractor to install tree protection prior to works commencing at the site (prior to demolition works) and to ensure that the tree protection remains in adequate condition for the duration of the development. The tree protection must not be moved without prior agreement of the project Arborist. The project Arborist must inspect that the tree protection has been installed in accordance with this document and AS4970-2009 prior to works commencing.

11.6.1 Protective fencing: The protective fencing must be constructed of 1.8 metre ‘cyclone chainmesh fence’. The fencing should only be removed for the landscaping phase and this should be approved by the project Arborist. Where it is not feasible to install fencing at the specified location due to factors such restricting access to areas of the site or for constructing new structures, an alternative location and protection specification must be agreed with the project Arborist. Any modifications to the fencing locations must be approved by the project Arborist.

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11.6.2 TPZ signage: Tree protection signage is to be attached to the protective fencing, displayed in a prominent position and the sign repeated at 10 metres intervals or closer where the fence changes direction. Each sign shall contain in a clearly legible form, the following information:

- Tree protection zone/No access.
- This fence has been installed to prevent damage to the tree/s and their growing environment both above and below ground. Do not move fencing or enter TPZ without the agreement of the project Arborist.
- The name, address, and telephone number of the developer/builder and project Arborist

11.6.3 Trunk and Branch Protection: The trunk must be protected by wrapped hessian or similar material to limit damage. Timber planks (50mm x 100mm or similar) should then be placed around tree trunk. The timber planks should be spaced at 100mm intervals, and must be fixed against the trunk with tie wire, or strapping and connections finished or covered to protect pedestrians from injury. The hessian and timber planks must not be fixed to the tree in any instance. The trunk and branch protection shall be installed prior to any work commencing on site and shall be maintained in good condition for the entire development period.

11.6.4 Mulch: Any areas of the TPZ located inside the subject site must be mulched to a depth of 75mm with good quality mulch. Mulch must not be built-up around the trunk the trees as it can cause collar rot.

11.6.5 Ground Protection: Ground protection is required to protect the underlying soil structure and root system in areas where it is not practical to restrict access to whole TPZ, while allowing space for construction. Ground protection must consist of good quality composted wood chip/leaf mulch to a depth of between 150-300mm, laid on top of geo textile fabric. If vehicles are to be using the area, additional protection will be required such as rumble boards or track mats to spread the weight of the vehicle and avoid load points. Ground protection is to be specified by the project Arborist as required.

11.6.6 Temporary irrigation: Temporary irrigation should distribute water evenly throughout the area of the TPZ. The irrigation should be used for at minimum one hour daily throughout all stages of the development.

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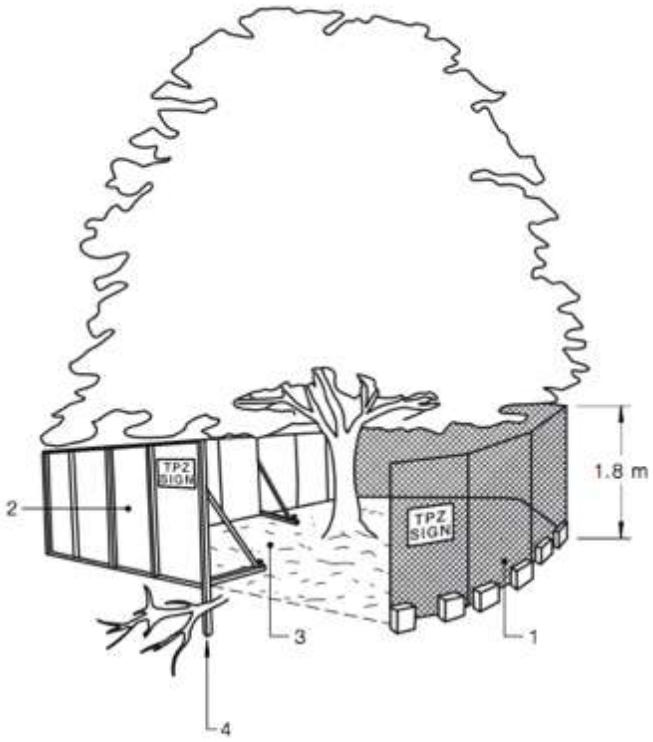

LEGEND:
1 Chain wire mesh panels with shade cloth (if required) attached, held in place with concrete feet.
2 Alternative plywood or wooden paling fence panels. This fencing material also prevents building materials or soil entering the TPZ.
3 Mulch installation across surface of TPZ (at the discretion of the project arborist). No excavation, construction activity, grade changes, surface treatment or storage of materials of any kind is permitted within the TPZ.
4 Bracing is permissible within the TPZ. Installation of supports should avoid damaging roots.

An image from AS4970-2009,[7] with example tree protection.

[7] Council Of Standards Australia, *AS4970 Protection of trees on development sites* (2009), page 16.

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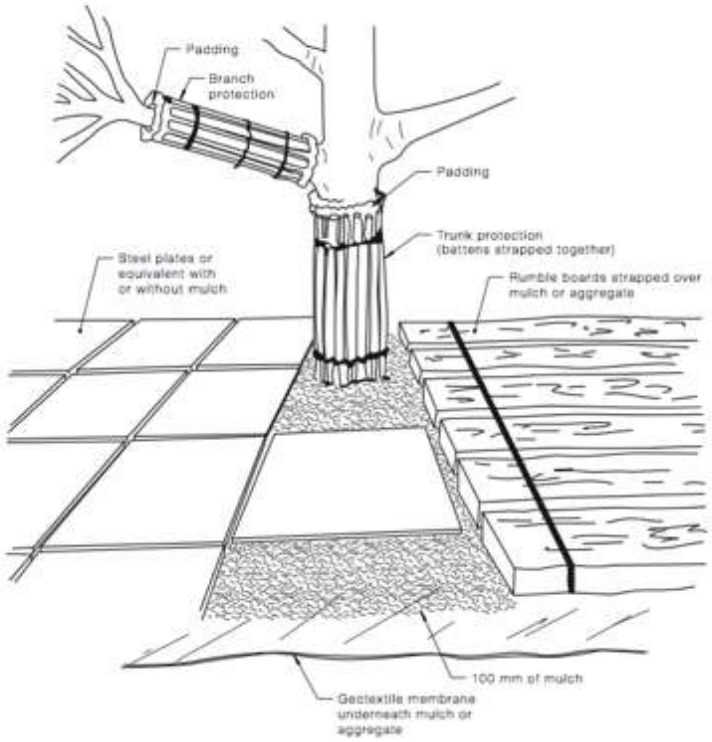

An image from AS4970-2009,[8] with example tree protection.

11.7 **Restricted activities inside TPZ:** The following activities must be avoided inside the TPZ of all trees to be retained unless approved by the project Arborist. If at any time these activities cannot be avoided an alternative must be agreed in writing with the project Arborist to minimise the impact to the tree.

A) Machine excavation.
B) Ripping or cultivation of soil.
C) Storage of spoil, soil or any such materials
D) Preparation of chemicals, including preparation of cement products.
E) Refueling.
F) Dumping of waste.
G) Wash down and cleaning of equipment.
H) Placement of fill.
I) Lighting of fires.
J) Soil level changes.
K) Any physical damage to the crown, trunk, or root system.
L) Parking of vehicles.

[8] Council Of Standards Australia, *AS4970 Protection of trees on development sites* (2009), page 17.

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11.8 **Demolition:** The demolition of all existing structures inside or directly adjacent to the TPZ of trees to be retained must be undertaken in consultation with the project Arborist. Any machinery is to work from inside the footprint of the existing structures or outside the TPZ, reaching in to minimise soil disturbance and compaction. If it is not feasible to locate demolition machinery outside the TPZ of trees to be retained, ground protection will be required. The demolition should be undertaken inwards into the footprint of the existing structures, sometimes referred to as the 'top down, pull back' method.

11.9 **Excavations:** The project Arborist must supervise and certify that all excavations and root pruning are in accordance with AS4373-2007 and AS4970-2009. For continuous strip footings, first manual excavation is required along the edge of the structures closest to the subject trees. Manual excavation should be a depth of 1 metre (or to unfavourable root growth conditions such as bed rock or heavy clay, if agreed by project Arborist). Next roots must be pruned back in accordance with AS4373-2007. After all root pruning is completed, machine excavation is permitted within the footprint of the structure. For tree sensitive footings, such as pier and beam, all excavations inside the TPZ must be manual. Manual excavation may include the use of pneumatic and hydraulic tools, high-pressure air or a combination of high-pressure water and a vacuum device. No pruning of roots greater 30mm in diameter is to be carried out without approval of the project arborist. All pruning of roots greater than 30mm in diameter must be carried out by a qualified Arborist/Horticulturalist with a minimum AQF level 3. Root pruning is to be a clean cut with a sharp tool in accordance with AS4373 Pruning of amenity trees (2007).[9] The tree root is to be pruned back to a branch root if possible. Make a clean cut and leave as small a wound as possible.

11.10 **Sediment and Contamination:** All contamination run off from the development such as but not limited to concrete, sediment and toxic wastes must be prevented from entering the TPZ at all times.

11.11 **Tree Wounding/Injury:** Any wounding or injury that occurs to a tree during the construction process will require the project Arborist to be contacted for an assessment of the injury and provide mitigation/remediation advice. It is generally accepted that trees may take many years to decline and eventually die from root damage. All repair work is to be carried out by the project Arborist, at the contractor's expense.

11.12 **Completion of Development Works:** After all construction works are complete the project Arborist should assess that the subject trees have been retained in the same condition and vigour. If changes to condition are identified the project Arborist should provide recommendations for remediation.

[9] Council Of Standards Australia, *AS 4373 Pruning of amenity trees* (2007) page 18

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12. CONSTRUCTION HOLD POINTS FOR TREE PROTECTION

12.1 **Hold Points:** Below is a sequence of hold points requiring project Arborist certification throughout the development process**.** It provides a list of hold points that must be checked and certified. All certification must be provided in written format upon completion of the development. The final certification must include details of any instructions for remediation undertaken during the development. The principal contractor should be responsible for implementing all tree protection requirements.

Hold Point	Stage	Date Completed and Signature of Project Arborist Responsible
Project Arborist to hold pre construction site meeting with principal contractor to discuss methods and importance of tree protection measures and resolve any issues in relation to feasibility of tree protection requirements that may arise. Project Arborist to mark all trees approved for removal.	Prior to development work commencing	
Project Arborist to assess and certify that tree protection has been installed in accordance with AS4970-2009 prior to works commencing at site.	Prior to development work commencing.	
In accordance with AS4970-2009 the project arborist should carryout regular site inspections to ensure works are carried out in accordance with the recommendations. Site inspection are recommended on a monthly frequency.	On-going throughout the development	
The removal of existing structures inside the TPZ of any tree to be retained, such as the existing buildings and hard surfaces must be supervised by the project Arborist.	Demolition	
Project Arborist to supervise all manual excavations and root pruning inside the TPZ of any tree to be retained. Project Arborist to approve all pruning of roots greater than 30mm inside TPZ. All root pruning of roots greater than 30mm in diameter must be carried out by a qualified Arborist/Horticulturalist with a minimum AQF level 3.	Construction	
Project Arborist to certify that all underground services including storm water inside TPZ of any tree to be retained have been installed in accordance with AS4970-2009.	Construction	
Project Arborist to approve relocation of tree protection for landscaping. All landscaping works within the TPZ of trees to be retained are to be undertaken in consultation with the project Arborist to minimise the impact to trees.	Construction/ Landscape	
After all demolition, construction and landscaping works are complete the project Arborist should assess that the subject trees have been retained in the same condition and vigour. If changes to condition are identified the project Arborist should provide recommendations for remediation.	Upon completion of development	

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13. BIBLIOGRAPHY/REFERENCES

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14. LIST OF APPENDICES

The following are included in the appendices:

- Appendix 1A: Overall Site Plan (Aerial Image)
- Appendix 1B: Overall Site Plan
- Appendix 1C: North and South Plaza
- Appendix 1D: Area South of 11 Sydenham Road
- Appendix 1E: Sydney Portugal Community Club
- Appendix 1F: Tillman Park and Gleeson Ave
- Appendix 1G: Edgeware Road
- Appendix 1H: North of Bolton Street (TSE Project Site)
- Appendix 1I: Railway Parade (Street Trees)
- Appendix 2: Tree Inspection Schedule
- Appendix 3: Further Information of Methodology

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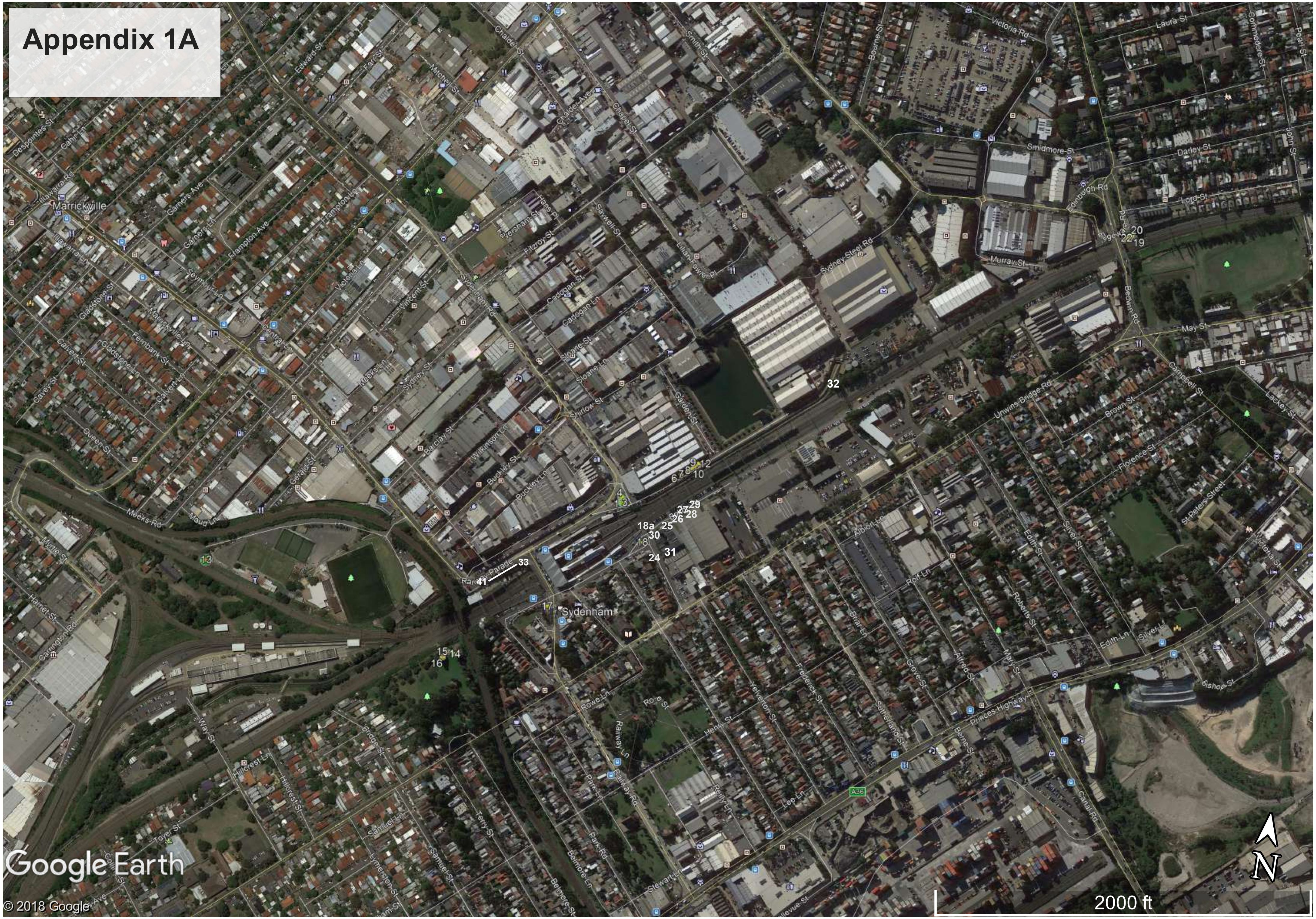
Appendix 1A



Marrickville
Sydenham
Sydney Steel Rd
Princes Highway
Railway Parade
Meeks Rd
May St
Murray St
Unwins Bridge Rd
Sydenham Rd
32
6 7 8 9 12
10
13
27 29
26 28
18a 25
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Google Earth
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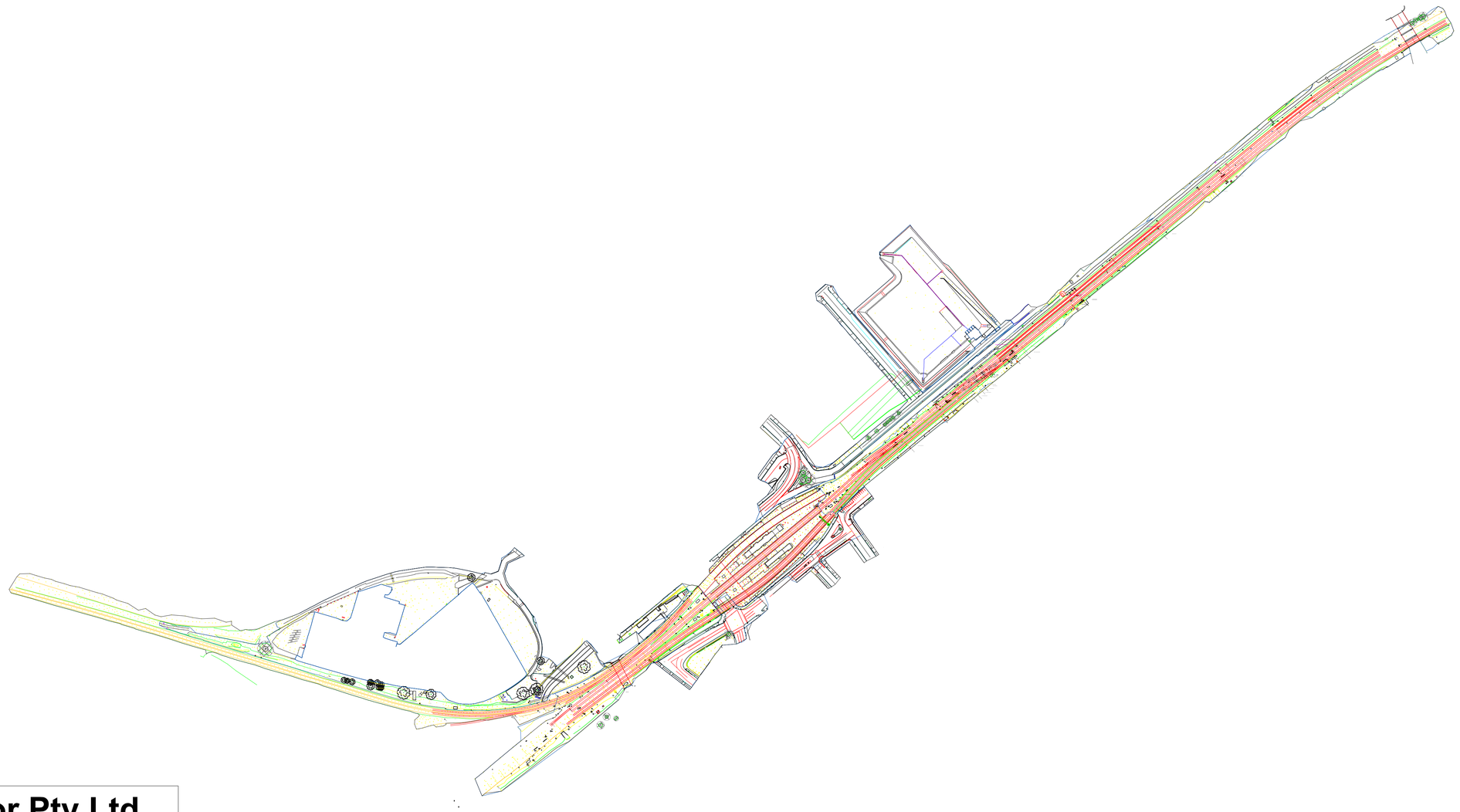


Urban Arbor Pty Ltd

PO Box 450 Turramurra NSW 2074
sales@urbanarbor.com.au

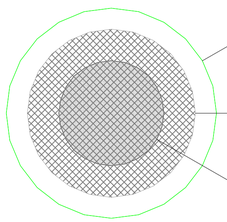
Site Location: Sydenham Station and Junction Project (SSJ)

SCALE :	DATE :	
1 : 2850 @ A1	8/7/2018	URBAN ARBOR The Trusted Name in Tree Management

Plan Title: Appendix 1B

Prepared by: Jack Williams, Urban Arbor Pty Ltd

Map Legend



Tree Crown

Tree Protection Zone

Structural Root Zone

0 — 30m

Urban Arbor Pty Ltd

PO Box 450, Turramurra, NSW, 2074
sales@urbanarbor.com.au, (02) 8004 2802

Site Location: Sydenham Station and Junction Project (SSJ) - North and South Plaza

SCALE : 1 : 200 @ A1

DATE : 27/05/2020

URBAN ARBOR
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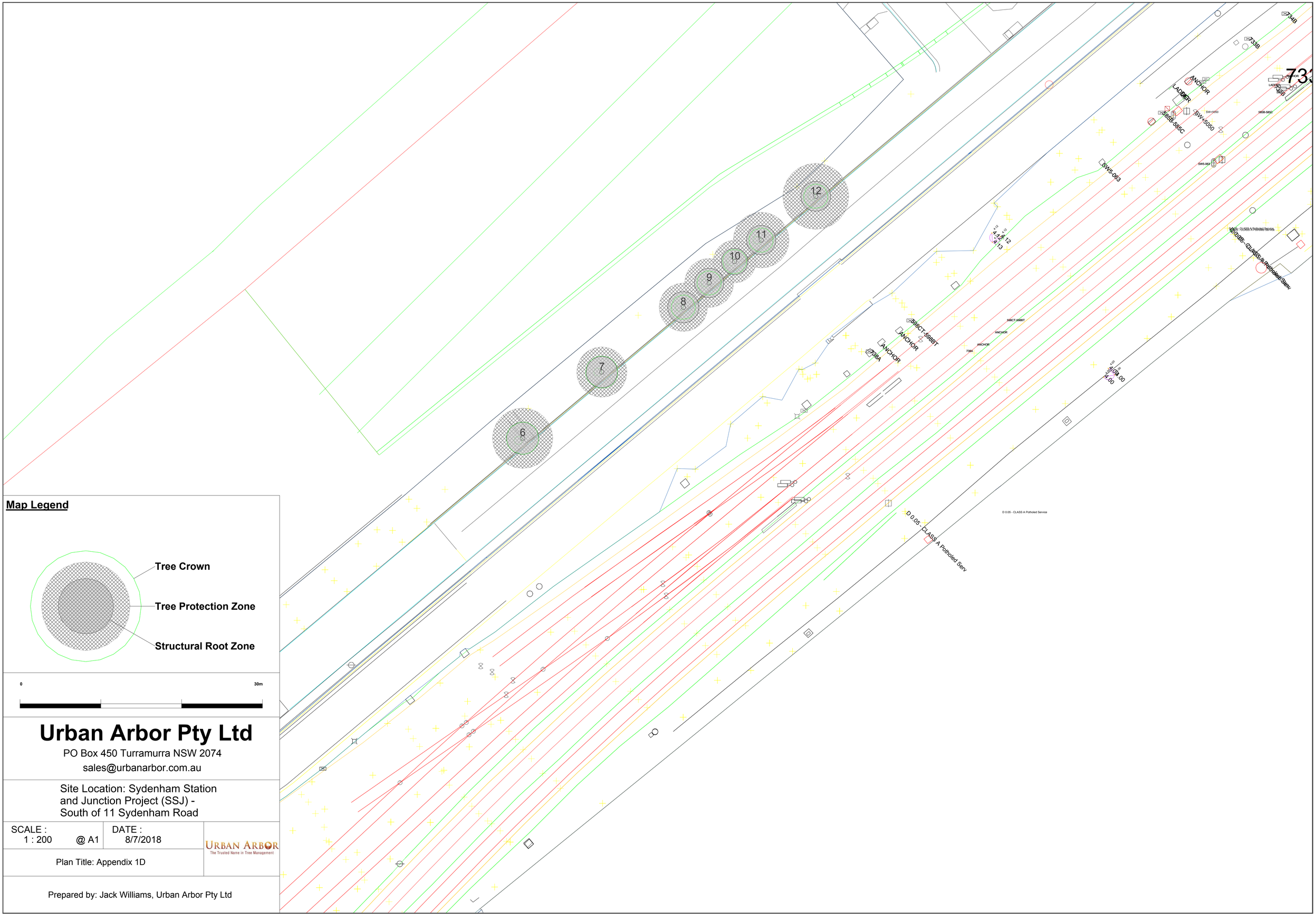
Plant Title: Appendix 1C

Prepared by: Jack Williams, Urban Arbor Pty Ltd



Map Legend

Tree Crown

Tree Protection Zone

Structural Root Zone

0 30m

Urban Arbor Pty Ltd

PO Box 450 Turramurra NSW 2074
sales@urbanarbor.com.au

Site Location: Sydenham Station and Junction Project (SSJ) - South of 11 Sydenham Road

SCALE :	DATE :
1 : 200 @ A1	8/7/2018

URBAN ARBOR
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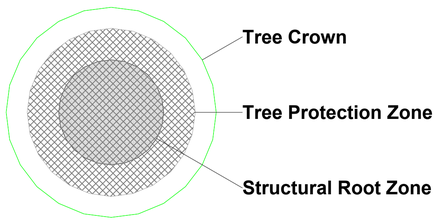
Plan Title: Appendix 1D

Prepared by: Jack Williams, Urban Arbor Pty Ltd

13

Map Legend



0 30m

Urban Arbor Pty Ltd

PO Box 450 Turramurra NSW 2074
sales@urbanarbor.com.au

Site Location: Sydenham Station and Junction Project (SSJ) - Sydney Portugal Community Club

SCALE :	DATE :
1 : 200 @ A1	8/7/2018

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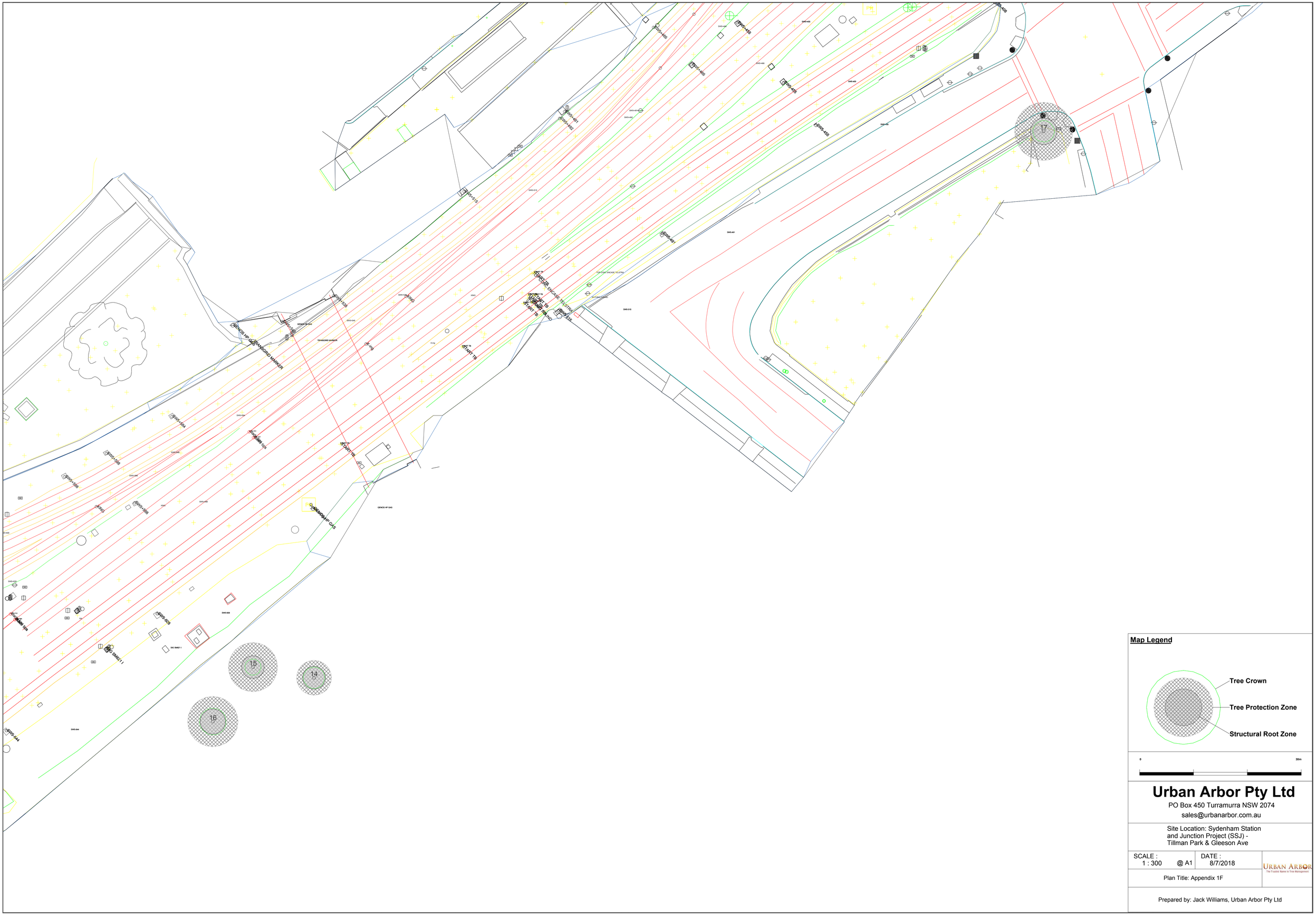
Plan Title: Appendix 1E

Prepared by: Jack Williams, Urban Arbor Pty Ltd



Map Legend

Urban Arbor Pty Ltd

PO Box 450 Turramurra NSW 2074
sales@urbanarbor.com.au

Site Location: Sydenham Station
and Junction Project (SSJ) -
Tillman Park & Gleeson Ave

SCALE :
1 : 300 @ A1

DATE :
8/7/2018

URBAN ARBOR
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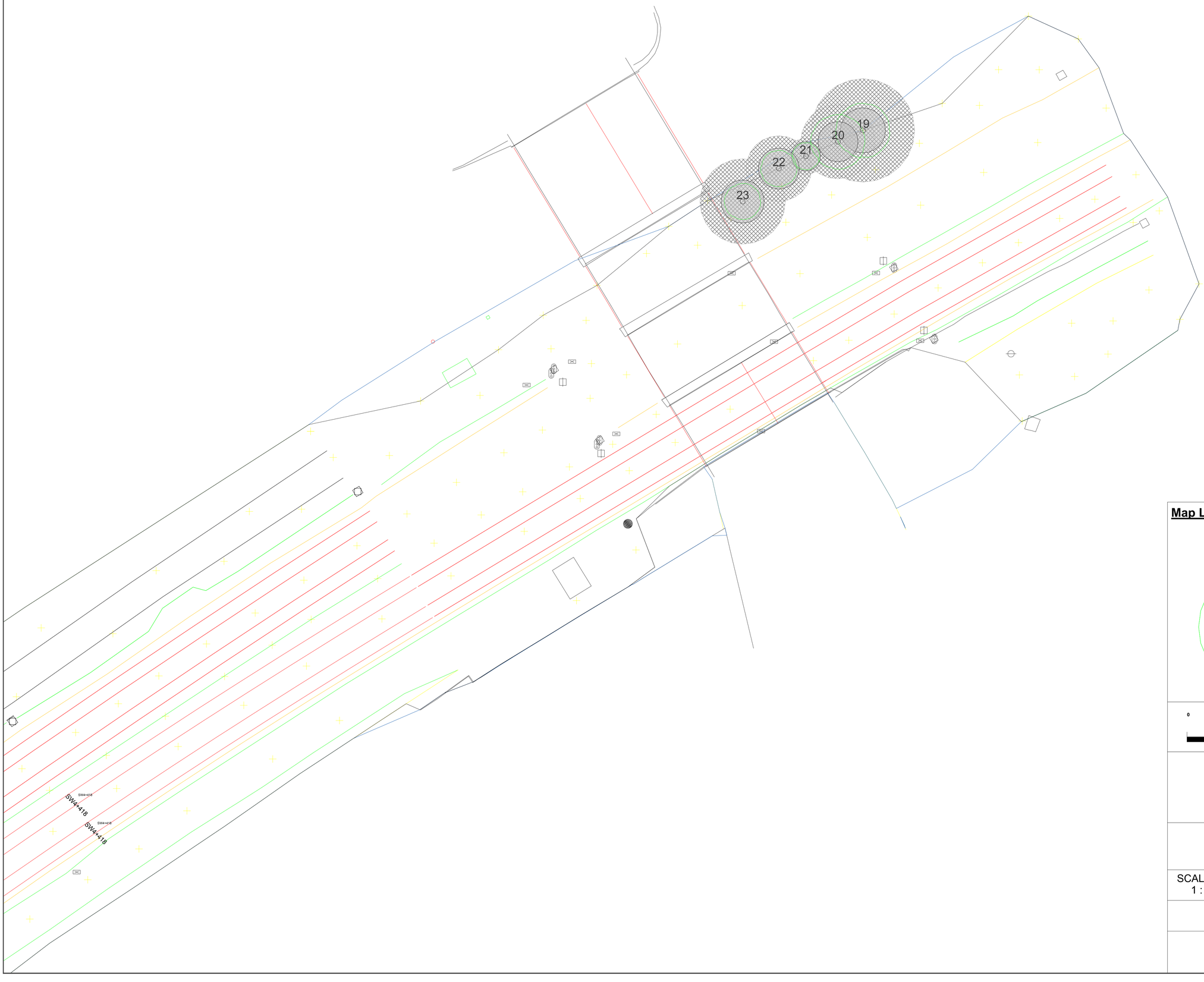
Plan Title: Appendix 1F

Prepared by: Jack Williams, Urban Arbor Pty Ltd



Map Legend

Tree Crown

Tree Protection Zone

Structural Root Zone

0 30m

Urban Arbor Pty Ltd

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Site Location: Sydenham Station and Junction Project (SSJ) - Edgeware Road

SCALE :	DATE :
1 : 200 @ A1	8/7/2018

URBAN ARBOR
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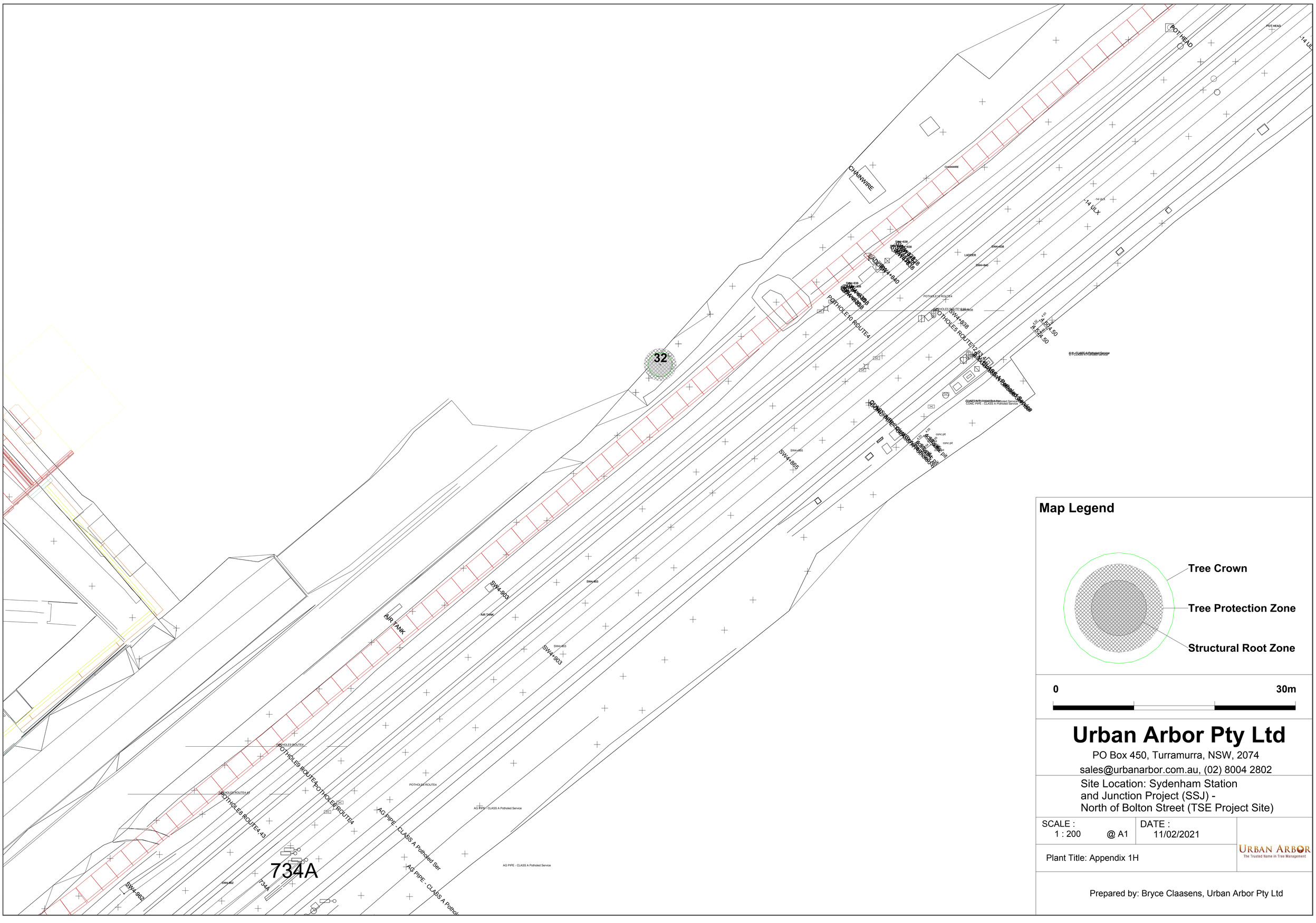
Plan Title: Appendix 1G

Prepared by: Jack Williams, Urban Arbor Pty Ltd



Map Legend

- Tree Crown
- Tree Protection Zone
- Structural Root Zone

0 — 30m

Urban Arbor Pty Ltd

PO Box 450, Turramurra, NSW, 2074
sales@urbanarbor.com.au, (02) 8004 2802

Site Location: Sydenham Station and Junction Project (SSJ) - North of Bolton Street (TSE Project Site)

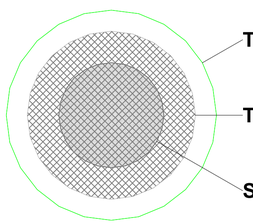
SCALE :	DATE :
1 : 200 @ A1	11/02/2021

Plant Title: Appendix 1H

URBAN ARBOR
The Trusted Name in Tree Management

Prepared by: Bryce Claasens, Urban Arbor Pty Ltd

Map Legend



0 — 30m

Urban Arbor Pty Ltd

PO Box 450, Turramurra, NSW, 2074
sales@urbanarbor.com.au, (02) 8004 2802

Site Location: Sydenham Station and Junction Project (SSJ) - Railway Parade (Street trees)

SCALE :	DATE :
1 : 200 @ A1	11/02/2021

Plant Title: Appendix 1I

URBAN ARBOR
The Trusted Name in Tree Management

Prepared by: Bryce Claasens, Urban Arbor Pty Ltd

Appendix 2 - Tree Inspection Schedule

Tree ID	Common Name	Botanical Name	Age Class	Height (m)	Canopy Spread Radius (m)	Stem 1	Stem 2	Stem 3	Stem 4	Stem 5	DBH (mm)	DAB (mm)	Health	Structure	Amenity Value	SULE	Retention Value	TPZ Radius (m)	SRZ Radius (m)	Notes
1	Spotted Gum	*Corymbia maculata*	Semi-mature	5	1	110					110	130	Good	Good	Low	5. Small/Young	Z1	2.0	1.5	None.
2	River She Oak	*Casuarina cunninghamiana*	Mature	9	5	600					600	720	Good	Good	High	1. Long	A1	7.2	2.9	None.
3	River She Oak	*Casuarina cunninghamiana*	Mature	7	4	750					750	850	Good	Poor	Medium	3. Short	Z10	9.0	3.1	Topped for power line clearance.
4	Spotted Gum	*Corymbia maculata*	Semi-mature	7	2	210					210	250	Good	Good	Medium	1. Long	A1	2.5	1.8	None.
5	Black Tea Tree	*Melaleuca bracteata*	Mature	6	3	457	250	290			596	500	Good	Good	Medium	1. Long	A1	7.2	2.5	Multi stem tree.
6	Dwarf Lilly Pilly	*Acmena smithii var. Minor*	Mature	6	2	255	180				312	300	Good	Fair	Medium	2. Medium	A1	3.7	2.0	Co-dominant stems with minor bark inclusion.
7	Dwarf Lilly Pilly	*Acmena smithii var. Minor*	Mature	6	2	212	150				260	280	Good	Fair	Medium	2. Medium	A1	3.1	1.9	Co-dominant stems with minor bark inclusion.
8	Dwarf Lilly Pilly	*Acmena smithii var. Minor*	Semi-mature	5	1.5	250					250	280	Good	Fair	Medium	2. Medium	A1	3.0	1.9	Multi stem tree.
9	Dwarf Lilly Pilly	*Acmena smithii var. Minor*	Semi-mature	5	1.5	188	120	120			253	240	Good	Fair	Medium	2. Medium	A1	3.0	1.8	Multi stem tree.
10	Dwarf Lilly Pilly	*Acmena smithii var. Minor*	Semi-mature	6	1.5	197	100				221	190	Good	Fair	Medium	2. Medium	A1	2.7	1.6	Multi stem tree.
11	Dwarf Lilly Pilly	*Acmena smithii var. Minor*	Semi-mature	5	1.5	216	130	140			288	240	Good	Fair	Medium	2. Medium	A1	3.5	1.8	Multi stem tree.
12	Dwarf Lilly Pilly	*Acmena smithii var. Minor*	Semi-mature	4	1.5	266	160	140			341	250	Good	Fair	Medium	2. Medium	A1	4.1	1.8	Multi stem tree.
13	Cork Oak	*Quercus suber*	Mature	9	7	800					800	880	Good	Good	High	1. Long	A1	9.6	3.1	Canopy extends 3m beyond fence.
14	Moreton Bay Fig	*Ficus macrophylla*	Semi-mature	7	2	270					270	350	Good	Good	Medium	1. Long	A1	3.2	2.1	None.
15	Dwarf Lilly Pilly	*Acmena smithii var. Minor*	Semi-mature	6	1.5	298	220	90			381	340	Good	Fair	Medium	2. Medium	A1	4.6	2.1	Multi stem tree. Cambium damage to trunk.
16	Turpentine	*Syncarpia glomulifera*	Mature	8	2.5	390					390	440	Good	Fair	Medium	2. Medium	A1	4.7	2.3	Co-dominant stems at 2.4m with tight union.
17	Umbrella	*Schefflera actinophylla*	Mature	5	2	450					450	500	Good	Fair	Low	2. Medium	Z3	5.4	2.5	Exempt species. Located in adjoining property. Multi stem tree.
18	Illawara Flame	*Brachychiton acerifolius*	Young	3	1	140					140	180	Good	Good	Low	5. Small/Young	Z1	2.0	1.6	None.
18a	Callery Pear	*Pyrus calleryana*	Mature	5	3	240					240	280	Good	Good	Low	2. Medium	A1	2.9	1.9	Minor bark inclusion at 2.0m.
19	Sydney Golden Wattle	*Acacia longifolia*	Mature	7	3	366	300				473	500	Good	Fair	Low	2. Medium	A1	5.7	2.5	Multi stem tree.
20	Sydney Golden Wattle	*Acacia longifolia*	Mature	7	3	340					340	380	Good	Fair	Low	2. Medium	A1	4.1	2.2	Co-dominant stems with minor bark inclusion.
21	Nettle Tree - Southern	*Celtis australis*	Semi-mature	5	1.5	160					160	180	Fair	Fair	Low	5. Small/Young	Z3	2.0	1.6	Exempt species. Not in leaf at time of inspection.
22	Sydney Golden Wattle	*Acacia longifolia*	Mature	5	2	300					300	400	Good	Fair	Low	2. Medium	A1	3.6	2.3	Multi stem tree growing through fence.
23	Sydney Golden Wattle	*Acacia longifolia*	Mature	6	2	296	150	150	100	100	391	450	Good	Fair	Low	2. Medium	A1	4.7	2.4	Multi stem tree.
24	Dwarf Lilly Pilly	*Acmena smithii var. minor*	Young	5	1	170					170	220	Good	Fair	Low	3. Short	Z6	2.0	1.8	Majority of roots on SW side of tree severed for services.
25	Spotted Gum	*Corymbia maculata*	Early-mature	15	2	270					270	330	Good	Good	Medium	1. Long	A1	3.2	2.1	Located within 8 Bolton Street.
26	Callery Pear	*Pyrus calleryana*	Semi-mature	5	2	160					160	250	Good	Fair	Low	5. Small/Young	Z1	2.0	1.8	Located within nature strip. Suckers at base of tree.
27	Callery Pear	*Pyrus calleryana*	Early-mature	5	2	260					260	300	Good	Good	Medium	2. Medium	A1	3.1	2.0	Located within nature strip.
28	Callery Pear	*Pyrus calleryana*	Early-mature	5	2	210					210	220	Good	Good	Medium	2. Medium	A1	2.5	1.8	Located within nature strip.
29	Black Peppermint	*Eucalyptus nicholii*	Mature	9	5	550					550	600	Good	Good	Medium	2. Medium	A1	6.6	2.7	Located within nature strip. Asymmetric crown shape.
30	Tuckeroo	*Cupaniopsis anacardioides*	Semi-mature	7	3	300					300	350	Good	Fair	Medium	2. Medium	A1	3.6	2.1	Located within 1 Bolton Street. Co-dominant stems with bark inclusions.
31	Callery Pear	*Pyrus calleryana*	Young	4	1	80	80	50			124	180	Good	Fair	Low	5. Small/Young	Z1	2.0	1.6	Located within nature strip.
32	Chinese Hackberry	*Celtis sinensis*	Semi-mature	4	1.5	150					150	150	Good	Fair	Very Low	5. Small/Young	Z3	2.0	1.5	Exempt species. Growing through fence.
33	Queensland Brushbox	*Lophostemon confertus*	Semi-mature	5	2	270					270	290	Good	Good	Medium	1. Long	A1	3.2	2.0	Located within nature strip.

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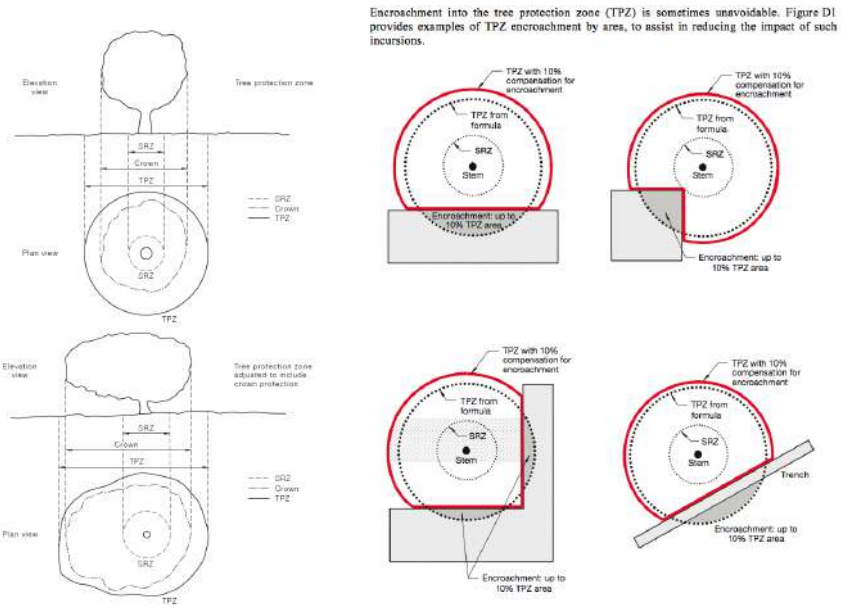
Tree ID	Common Name	Botanical Name	Age Class	Height (m)	Canopy Spread Radius (m)	Stem 1	Stem 2	Stem 3	Stem 4	Stem 5	DBH (mm)	DAB (mm)	Health	Structure	Amenity Value	SULE	Retention Value	TPZ Radius (m)	SRZ Radius (m)	Notes
34	Dwarf Lilly Pilly	*Acmena smithii var. minor*	Young	2	1	60	60	60	40		111	150	Good	Fair	Low	5. Small/Young	Z1	2.0	1.5	Located within nature strip. Not a tree as defined in scope.
35	Dwarf Lilly Pilly	*Acmena smithii var. minor*	Young	3	1	70	70	100			141	180	Good	Fair	Low	5. Small/Young	Z1	2.0	1.6	Located within nature strip. Asymmetric crown shape.
36	Queensland Brushbox	*Lophostemon confertus*	Semi-mature	7	3	320					320	390	Good	Good	Medium	1. Long	A1	3.8	2.2	Located within nature strip.
37	Dwarf Lilly Pilly	*Acmena smithii var. minor*	Young	2	1	40	40	40			69	120	Good	Fair	Very Low	5. Small/Young	Z1	2.0	1.5	Located within nature strip. Not a tree as defined in scope.
38	Queensland Brushbox	*Lophostemon confertus*	Semi-mature	7	3	350					350	410	Good	Good	Medium	1. Long	A1	4.2	2.3	Located within nature strip. Lifting concrete pavement.
39	Queensland Brushbox	*Lophostemon confertus*	Semi-mature	7	2	290					290	340	Good	Good	Medium	1. Long	A1	3.5	2.1	Located within nature strip.
40	Queensland Brushbox	*Lophostemon confertus*	Semi-mature	6	2	240					240	340	Good	Good	Medium	1. Long	A1	2.9	2.1	Located within nature strip. Stem pruned at 1m above ground.
41	Queensland Brushbox	*Lophostemon confertus*	Semi-mature	6	2	210					210	260	Good	Good	Medium	1. Long	A1	2.5	1.9	Located within nature strip.

Explanatory Notes

Tree Species - Common name followed by botanical name. Where species is unknown it is indicated with an *'spp'*.
Age Class - Over mature (OM), Mature (M), Early mature (EM), Semi mature (SM), Young (Y).
Diameter at Breast Height (DBH) - Measured with a DBH tape or estimated at approximately 1.4m above ground level.
Diameter Above root Buttresses (DAB): Measured with a DBH tape or estimated above root buttresses (DAB) for calculating the SRZ.
Height - Height from ground level to top of crown. All heights are estimated unless otherwise indicated.
Spread - Radius of crown at widest section. All tree spreads are estimated unless otherwise indicated.
Tree Protection Zone (TPZ) - DBH x 12. Measured in radius from the centre of the trunk. Rounded to nearest 0.1m. For monocots, the TPZ is set at 1 metre outside the crown projection.
Structural Root Zone (SRZ) - $(DAB \times 50)^{0.42} \times 0.64$. Measured in radius from the centre of the trunk. Rounded up to nearest 0.1m.
Health - Good/Fair/Poor/Dead
Structure - Good/Fair/Poor
Safe Useful Life Expectancy (SULE) - 1. Long (40+years), 2. Medium (15 - 40 years), 3. Short (5 - 15 years), 4. Remove (under 5 years), 5. Small/young.
Amenity Value - Very High/High/Medium/Low/Very Low.
Retention Value: Tree AZ, see appendix 3 for categories.

Appendix 3 - Further Information of Methodology

1. **Tree Protection Zone:** The tree protection zone (TPZ) is the principle means of protecting trees on development sites. The TPZ is a combination of the root area and crown area requiring protection. It is an area isolated from construction disturbance, so that the tree remains viable. The radius of the TPZ is calculated for each tree by multiplying its DBH x 12. The derived value is measured in radius from the centre of the stem/trunk at ground level. A TPZ should not be less than 2.0 metres nor greater than 15 metres (except where crown protection is required).
   It is commonly observed that tree roots will extend significant further than the indicative TPZ, however the TPZ is an area identified AS4970-2009 to be extent where root loss or disturbance will generally not impact the viability of the tree. The TPZ is identified as a restricted area to prevent damage to trees either above or below ground during a development. Where trees are intended to be retained proposed developments must provide an adequate TPZ around trees. The TPZ is set aside for the tree's root zone, trunk and crown and it is essential for the stability and longevity of the tree. The tree protection also incorporates the SRZ (see below for more information about the SRZ). I have calculated the TPZ of palms, other monocots, cycads and tree ferns at one metre outside the crown projection. See appendices for additional information about the TPZ including information about calculating the TPZ and examples of TPZ encroachment.
   Minor encroachment into TPZ: Sometimes encroachment into the TPZ is unavoidable. Encroachment includes but is not limited to activities such as excavation, compacted fill and machine trenching. Minor encroachment of up to 10% of the overall TPZ area is normally considered acceptable, providing there is space adjacent to the TPZ for the tree to compensate and the tree is displaying adequate vigour/health to tolerate changes to its growing environment.
   Major encroachment into TPZ: Where encroachment of more than 10% of the overall TPZ area is proposed the project Arborist must investigate and demonstrate that the tree will remain in a viable condition. In some cases, tree sensitive construction methods such as pier and beam footings, suspended slabs, or cantilevered sections, can be utilised to allow additional encroachment into the TPZ by bridging over roots and minimising root disturbance. Major encroachment is only possible if it can be undertaken without severing significant size roots, or if it can be demonstrated that significant roots will not be impacted.



2. **Structural Root Zone:** This is the area around the base of a tree required for the trees stability in the ground. An area larger than the SRZ always need to be maintained to preserve a viable tree as it will only have a minor effect on the trees vigour and health. There are several factors that determine the SRZ which include height, crown area, soil type and soil moisture. It can also be influenced by other factors such as natural or built structures. Generally work within the SRZ should be avoided.
   An indicative SRZ radius can be determined from the diameter of the trunk measured immediately above the root buttresses. Root investigation could provide more information about the extent of the SRZ. The following formula should be used to calculate the SRZ.
   SRZ radius = $(D \times 50)^{0.42} \times 0.64$ (D = Diameter above root buttress).

3. **Tree Age Class:** If can be difficult to determine the age of a tree without carrying out invasive tests that may damage the tree, so we have categorised there likely age class which is defined below;
   - Young/Newly planted: Young or recently planted tree.
   - Semi Mature: Up to 20% of the usual life expectancy for the species.
   - Early mature/Mature: Between 20%-80% of the usual life expectancy for the species.
   - Over mature: Over 80% of the usual life expectancy for the species.
   - Dead: Tree is dead or almost dead.

4. **Health/Physiological Condition:** Below are examples conditions used when assigning a category for tree health.

Category	Example condition	Summary
Good	• Crown has good foliage density for species. • Tree shows no or minimal signs of pathogens that are unlikely to have an effect on the health of the tree. • Tree is displaying good vigour and reactive growth development.	• The tree is in above average health and condition and no remedial works are required.
Fair	• The tree may be starting to dieback or have over 25% deadwood. • Tree may have slightly reduced crown density or thinning. • There may be some discolouration of foliage. • Average reactive growth development. • There may be early signs of pathogens which may further deteriorate the health of the tree. • There may be epicormic growth indicating increased levels of stress within the tree.	• The tree is in below average health and condition and may require remedial works to improve the trees health.
Poor	• The may be in decline, have extensive dieback or have over 30% deadwood. • The canopy may be sparse or the leaves may be unusually small for species. • Pathogens or pests are having a significant detrimental effect on the tree health.	• The tree is displaying low levels of health and removal or remedial works may be required.
Dead	• The tree is dead or almost dead.	• The tree should generally be removed.

5. **Structural Condition:** Below are examples conditions used when assigning a category for structural condition.

Category	Example condition	Summary
Good	• Branch unions appear to be strong with no sign of defects. • There are no significant cavities. • The tree is unlikely to fail in usual conditions. • The tree has a balanced crown shape and form.	• The tree is considered structurally good with well developed form.
Fair	• The tree may have minor structural defects within the structure of the crown that could potentially develop into more significant defects. • The tree may a cavity that is currently unlikely to fail but may deteriorate in the future. • The tree is an unbalanced shape or leans significantly. • The tree may have minor damage to its roots. • The root plate may have moved in the past but the tree has now compensated for this. • Branches may be rubbing or crossing.	• The identified defects are unlikely cause major failure. • Some branch failure may occur in usual conditions. • Remedial works can be undertaken to alleviate potential defects.
Poor	• The tree has significant structural defects. • Branch unions may be poor or weak. • The tree may have a cavity or cavities with excessive levels of decay that could cause catastrophic failure. • The tree may have root damage or is displaying signs of recent movement. • The tree crown may have poor weight distribution which could cause failure.	• The identified defects are likely to cause either partial or whole failure of the tree.

6. **Amenity Value:** To determine the amenity value of a tree we assess a number of different factors, which include but are not limited to the information below.
   - The visibility of the tree to adjacent sites.
   - The relationship between the tree and the site.
   - Whether the tree is protected by any statuary conditions.
   - The habitat value of the tree.
   - Whether the tree is considered a noxious weed species.

   The amenity value is rated using one of the following values.
   - Very High
   - High
   - Moderate
   - Low
   - Very Low

7. **Safe Useful Life Expectancy (SULE), (Barrel, 2001):** A trees safe useful life expectancy is determined by assessing a number of different factors including the health and vitality, estimated age in relation to expected life expectancy for the species, structural defects, and remedial works that could allow retention in the existing situation.

Category	Description
1. Long - Over 40 years	(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 - 15 to 40 years	(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 - 5 to 15 years	(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 - Under 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	(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.

8. **Root investigations:** The root investigations should identify roots greater than 30mm in diameter that are located along the edge of the structures footprint or in the location of footings. Root investigations must be carried out using non-invasive methods (manual excavations). Any excavations for the root investigations must carried out manually to avoid damaging the roots during excavations. Manual excavation may include the use of a high-pressure air/air knife, or a combination of high-pressure water and a vacuum device. When hand excavating carefully work around roots retaining as many as possible. Take care to not fray, wound, or cause damage to any roots during excavations as this may cause decay or infection from pathogens. It is essential that exposed roots are kept moist and the excavation back filled as soon as possible. The root investigations should be carried out by a qualified Arborist minimum AQF3. Once roots are exposed, a visual assessment can be carried out by a consulting Arborist to evaluate the potential impact of the proposed root loss on the health and stability of the tree. A root map/report should be prepared identifying the findings of investigations, including photographs as supporting evidence in the report.

9. **Retention Value:** The system I have used to award the retention value is Tree AZ. Tree AZ is used to identify higher value trees worthy of being a constraint to development and lower value trees that should generally not be a constraint to the development. The table below provides a brief description of each category.

TreeAZ Categories (Version 10.04-ANZ)

CAUTION: TreeAZ assessments must be carried out by a competent person qualified and experienced in arboriculture. The following category descriptions are designed to be a brief field reference and are not intended to be self-explanatory. They must be read in conjunction with the most current explanations published at www.TreeAZ.com.

Category Z: Unimportant trees not worthy of being a material constraint

Local policy exemptions: Trees that are unsuitable for legal protection for local policy reasons including size, proximity and species	
Z1	Young or insignificant small trees, i.e. below the local size threshold for legal protection, etc
Z2	Too close to a building, i.e. exempt from legal protection because of proximity, etc
Z3	Species that cannot be protected for other reasons, i.e. scheduled noxious weeds, out of character in a setting of acknowledged importance, etc
High risk of death or failure: Trees that are likely to be removed within 10 years because of acute health issues or severe structural failure	
Z4	Dead, dying, diseased or declining
Z5	Severe damage and/or structural defects where a high risk of failure cannot be satisfactorily reduced by reasonable remedial care, i.e. cavities, decay, included bark, wounds, excessive imbalance, overgrown and vulnerable to adverse weather conditions, etc
Z6	Instability, i.e. poor anchorage, increased exposure, etc
Excessive nuisance: Trees that are likely to be removed within 10 years because of unacceptable impact on people	
Z7	Excessive, severe and intolerable inconvenience to the extent that a locally recognized court or tribunal would be likely to authorize removal, i.e. dominance, debris, interference, etc
Z8	Excessive, severe and intolerable damage to property to the extent that a locally recognized court or tribunal would be likely to authorize removal, i.e. severe structural damage to surfacing and buildings, etc
Good management: Trees that are likely to be removed within 10 years through responsible management of the tree population	
Z9	Severe damage and/or structural defects where a high risk of failure can be temporarily reduced by reasonable remedial care, i.e. cavities, decay, included bark, wounds, excessive imbalance, vulnerable to adverse weather conditions, etc
Z10	Poor condition or location with a low potential for recovery or improvement, i.e. dominated by adjacent trees or buildings, poor architectural framework, etc
Z11	Removal would benefit better adjacent trees, i.e. relieve physical interference, suppression, etc
Z12	Unacceptably expensive to retain, i.e. severe defects requiring excessive levels of maintenance, etc

NOTE: Z trees with a high risk of death/failure (Z4, Z5 & Z6) or causing severe inconvenience (Z7 & Z8) at the time of assessment and need an urgent risk assessment can be designated as ZZ. ZZ trees are likely to be unsuitable for retention and at the bottom of the categorization hierarchy. In contrast, although Z trees are not worthy of influencing new designs, urgent removal is not essential and they could be retained in the short term, if appropriate.

Category A: Important trees suitable for retention for more than 10 years and worthy of being a material constraint

A1	No significant defects and could be retained with minimal remedial care
A2	Minor defects that could be addressed by remedial care and/or work to adjacent trees
A3	Special significance for historical, cultural, commemorative or rarity reasons that would warrant extraordinary efforts to retain for more than 10 years
A4	Trees that may be worthy of legal protection for ecological reasons (Advisory requiring specialist assessment)

NOTE: Category A1 trees that are already large and exceptional, or have the potential to become so with minimal maintenance, can be designated as AA at the discretion of the assessor. Although all A and AA trees are sufficiently important to be material constraints, AA trees are at the top of the categorization hierarchy and should be given the most weight in any selection process.

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Glossary of Terms

Abiotic - Pertaining to non-living agents; e.g. environmental factors

Adventitious shoots - Shoots that develop other than from apical, axillary or dormant buds; see also 'epicormic'

Anchorage - The system whereby a tree is fixed within the soil, involving cohesion between roots and soil and the development of a branched system of roots which withstands wind and gravitational forces transmitted from the aerial parts of the tree

Bark - A term usually applied to all the tissues of a woody plant lying outside the vascular cambium, thus including the phloem, cortex and periderm; occasionally applied only to the periderm or the phellem

Branch:
• **Primary**. A first order branch arising from a stem
• **Lateral**. A second order branch, subordinate to a primary branch or stem and bearing sub-lateral branches
• **Sub-lateral**. A third order branch, subordinate to a lateral or primary branch, or stem and usually bearing only twigs

Branch collar - A visible swelling formed at the base of a branch whose diameter growth has been disproportionately slow compared to that of the parent stem; a term sometimes applied also to the pattern of growth of the cells of the parent stem around the branch base

Brown-rot - A type of wood decay in which cellulose is degraded, while lignin is only modified

Buckling - An irreversible deformation of a structure subjected to a bending load

Buttress zone - The region at the base of a tree where the major lateral roots join the stem, with buttress-like formations on the upper side of the junctions

Cambium - Layer of dividing cells producing xylem (woody) tissue internally and phloem (bark) tissue externally

Canker - A persistent lesion formed by the death of bark and cambium due to colonisation by fungi or bacteria

Compartmentalisation - The confinement of disease, decay or other dysfunction within an anatomically discrete region of plant tissue, due to passive and/or active defences operating at the boundaries of the affected region

Compressive loading - Mechanical loading which exerts a positive pressure; the opposite to tensile loading

Condition - An indication of the physiological condition of the tree. Where the term 'condition' is used in a report, it should not be taken as an indication of the stability of the tree

Crown/Canopy - The main foliage bearing section of the tree

Crown lifting - The removal of limbs and small branches to a specified height above ground level

Crown thinning - The removal of a proportion of secondary branch growth throughout the crown to produce an even density of foliage around a well-balanced branch structure

Crown reduction/shaping - A specified reduction in crown size whilst preserving, as far as possible, the natural tree shape

DAB (Diameter Above Buttress) - Trunk diameter measured above the root buttress

Defect - In relation to tree hazards, any feature of a tree which detracts from the uniform distribution of mechanical stress, or which makes the tree mechanically unsuited to its environment

Dieback - The death of parts of a woody plant, starting at shoot-tips or root-tips

Disease - A malfunction in or destruction of tissues within a living organism, usually excluding mechanical damage; in trees, usually caused by pathogenic micro-organisms

Dominance - In trees, the tendency for a leading shoot to grow faster or more vigorously than the lateral shoots; also the tendency of a tree to maintain a taller crown than its neighbours

Dormant bud - An axial bud which does not develop into a shoot until after the formation of two or more annual wood increments; many such buds persist through the life of a tree and develop only if stimulated to do so

Dysfunction - In woody tissues, the loss of physiological function, especially water conduction, in sapwood

DBH (Diameter at Breast Height) - Stem diameter measured at a height of 1.4 metres or the nearest measurable point. Where measurement at a height of 1.4 metres is not possible, another height may be specified

Deadwood - Branch or stem wood bearing no live tissues. Retention of deadwood provides valuable habitat for a wide range of species and seldom represents a threat to the health of the tree. Removal of deadwood can result in the ingress of decay to otherwise sound tissues and climbing operations to access deadwood can cause significant damage to a tree. Removal of deadwood is generally recommended only where it represents an unacceptable level of hazard

Epicormic shoot - A shoot having developed from a dormant or adventitious bud and not having developed from a first year shoot

Flush-cut - A pruning cut which removes part of the branch bark ridge and or branch-collar

Girdling root - A root which circles and constricts the stem or roots possibly causing death of phloem and/or cambial tissue

Habit - The overall growth characteristics, shape of the tree and branch structure

Hazard beam - An upwardly curved part of a tree in which strong internal stresses may occur without being reduced by adaptive growth; prone to longitudinal splitting

Incorporating extracts from Lonsdale, D. 1999. Principles of Tree Hazard Assessment. Her Majesty's Stationary Office, London

Heartwood/false-heartwood - The dead central wood that has become dysfunctional as part of the aging processes and being distinct from the sapwood

Heave - A term mainly applicable to a shrinkable clay soil which expands due to re-wetting after the felling of a tree which was previously extracting moisture from the deeper layers; also the lifting of pavements and other structures by root diameter expansion; also the lifting of one side of a wind-rocked root-plate

Included bark (ingrown bark) - Bark of adjacent parts of a tree (usually forks, acutely joined branches or basal flutes) which is in face-to-face contact

Lever arm - A mechanical term denoting the length of the lever represented by a structure that is free to move at one end, such as a tree or an individual branch

Lignin - The hard, cement-like constituent of wood cells; deposition of lignin within the matrix of cellulose microfibrils in the cell wall is termed Lignification

Lions tailing - A term applied to a branch of a tree that has few if any side-branches except at its end, and is thus liable to snap due to end- loading

Loading - A mechanical term describing the force acting on a structure from a particular source; e.g. the weight of the structure itself or wind pressure

Mycelium - The body of a fungus, consisting of branched filaments (hyphae)

Occlusion - The process whereby a wound is progressively closed by the formation of new wood and bark around it

Pathogen - A micro-organism which causes disease in another organism

Photosynthesis - The process whereby plants use light energy to split hydrogen from water molecules, and combine it with carbon dioxide to form the molecular building blocks for synthesizing carbohydrates and other biochemical products

Probability - A statistical measure of the likelihood that a particular event might occur

Pruning - The removal or cutting back of twigs or branches, sometimes applied to twigs or small branches only, but often used to describe most activities involving the cutting of trees or shrubs

Radial - In the plane or direction of the radius of a circular object such as a tree stem

Reactive Growth/Reaction Wood - Production of woody tissue in response to altered mechanical loading; often in response to internal defect or decay and associated strength loss (cf. adaptive growth)

Ring-barking - The removal of a ring of bark and phloem around the circumference of a stem or branch, normally resulting in an inability to transport photosynthetic assimilates below the area of damage. Almost inevitably results in the eventual death of the affected stem or branch above the damage

Root-collar - The transitional area between the stem/s and roots

Sapwood - Living xylem tissues

Soft-rot - A kind of wood decay in which a fungus degrades cellulose within the cell walls, without any general degradation of the wall as a whole

Stem/s - Principle above-ground structural component(s) of a tree that supports its branches

Stress - In plant physiology, a condition under which one or more physiological functions are not operating within their optimum range, for example due to lack of water, inadequate nutrition or extremes of temperature

SRZ (Structural Root Zone) - The area around the base of the tree required for the trees stability in the ground

Subsidence - In relation to soil or structures resting in or on soil, a sinking due to shrinkage when certain types of clay soil dry out, sometimes due to extraction of moisture by tree roots

Taper - In stems and branches, the degree of change in girth along a given length

Targets - In tree risk assessment (with slight misuse of normal meaning) persons or property or other things of value which might be harmed by mechanical failure of the tree or by objects falling from it

Topping - In arboriculture, the removal of the crown of a tree, or of a major proportion of it

Transpiration - The evaporation of moisture from the surface of a plant, especially via the stomata of leaves; it exerts a suction which draws water up from the roots and through the intervening xylem cells

TPZ (Tree Protection Zone) - A specified area above and below ground and 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

Understory - This layer consists of younger individuals of the dominant trees, together with smaller trees and shrubs which are adapted to grow under lower light conditions

Veteran tree - Tree that, by recognised criteria, shows features of biological, cultural or aesthetic value that are characteristic of, but not exclusive to, individuals surviving beyond the typical age range for the species concerned. These characteristics might typically include a large girth, signs of crown retrenchment and hollowing of the stem

Vigour - The expression of carbohydrate expenditure to growth (in trees)

White-rot - A range of kinds of wood decay in which lignin, usually together with cellulose and other wood constituents, is degraded

Wind exposure - The degree to which a tree or other object is exposed to wind, both in terms of duration and velocity

Wind pressure - The force exerted by a wind on a particular object

Windthrow - The blowing over of a tree at its roots

Incorporating extracts from Lonsdale, D. 1999. Principles of Tree Hazard Assessment. Her Majesty's Stationary Office, London

Appendix B – Urban Arbor Curriculum Vitae

Curriculum Vitae - Bryce Claassens - Consulting Arborist
Urban Arbor Pty Ltd

Address: Urban Arbor Pty Ltd, Unit 12/36 Leighton Place, Hornsby, NSW
Contact: 0450 554 715, 02 8004 2802, bryce@urbanarbor.com.au

Arboricultural and Horticultural Qualifications

- Diploma of Arboriculture (AQF5)
- Cert III Horticulture - Landscape (AQF3)
- Registered Quantified Tree Risk Assessment assessor (QTRA)

Professional Memberships

- General Membership of Arboriculture Australia (AA)

Experience

Bryce brings ten (10) years of experience in Arboriculture and Horticulture. His career has varied experience in both landscape construction/horticulture and arboricultural consulting.

Bryce is a Consulting Arborist for Urban Arbor Pty Ltd. Urban Arbor is a consultancy company that specifically deals with tree management with no practical tree work being offered. Bryce has managed sites and provided expert reports on various projects, from single trees through to large sites with over 600 trees.
Bryce has experience delivering arboricultural management and recommendations throughout the Sydney region.

Bryce's current role includes the following;
- Report writing including preliminary reports, development impact assessments, risk assessment and tree protection during development.
- Developing and implementing tree management programs
- Risk assessments using the QTRA method
- Project Arborist work
- Diagnostic procedures for determination of various tree related issues
- Consultancy work both verbal and written format

Arboricultural and Horticultural Employment History

- 2017 to Present: Consulting Arborist at Urban Arbor Pty Ltd, Sydney, NSW
- 2015 to 2017: Landscape Construction Tradesman/Stonemason at Collaroy Stoneworks, Sydney, NSW
- 2008 to 2015: Landscape Construction Apprentice-Tradesman at All Landscape Services, Sydney, NSW

Recent Project Works Undertaken

Preparing Arboricultural Impact Assessment reports for large projects, such as the new private hospital in Terrey Hills and various public schools for the Department of Education and Training school beautification project, including providing significant tree sensitive solutions of developments within public schools across Sydney.

Project Arborist on large developments including Royal Far West in Manly and Macquarie University. Bryce has worked as a project Arborist for many first tier construction companies, such as Richard Crookes, Liang O'Rourke, PDS Group and FDC Construction.

Delivering Arboricultural Impact Assessments and Project Arborist works for private developers within Councils including Ku Ring Gai Council, Hornsby Council, The Hills Shire, Holroyd Council, Inner West Council, Manly Council, Warringah Council, Pittwater Council, North Sydney Council, Mosman Council, Hunters Hill Council, Lane Cove Council, Parramatta Council, Ryde Council, Blacktown Council, Woollahra Council, Waverley Council, Sutherland Council, and Hawkesbury Council.

Curriculum Vitae - Jack Williams - Senior Consulting Arborist - Urban Arbor Pty Ltd

Address: Urban Arbor Pty Ltd, Unit 12/36 Leighton Place, Hornsby, NSW
Contact: 0417 233 474, 02 8004 2802, jack@urbanarbor.com.au

Arboricultural and Horticultural Qualifications

- Diploma of Arboriculture (AQF5)
- Foundation Degree in Arboriculture (UK Level 5)
- National Diploma in Horticulture and Arboriculture (UK Level 3)
- First Diploma in Horticulture (UK Level 2)
- Registered Quantified Tree Risk Assessment assessor (QTRA)
- ISA Tree Risk Assessment Qualification (TRAQ)

Professional Memberships

- General Membership of Arboriculture Australia (AA)
- AA Registered Consulting Arborist No. 2556
- International Society of Arboriculture (ISA) Member No. 228863

Experience

Jack brings seventeen (17) years of experience in Arboriculture and Horticulture. His career has varied experience in both local government and the private sector. The last twelve (12) years has been specifically working in arboricultural consultancy roles, including as a Consulting Arborist, Arboricultural Surveyor and Council Officer.

Jack currently holds the role of Senior Consulting Arborist for Urban Arbor Pty Ltd. Urban Arbor is a consultancy company that specifically deals with tree management with no practical tree work being offered. Jack is the senior technical expert within the company and is also the mentor to other Consulting Arborists within the company. Jack delivers guest lecturers to Ryde and Hunter TAFE NSW students of the Diploma of Arboriculture (AQF level 5). Jack has managed sites and provided expert report on various projects, from single trees through to whole estates with over 40,000 trees.
Jack has experience delivering arboricultural management in Sydney, Melbourne and the UK.

Jack's current role includes the following;
- Report writing including development impact assessments, risk assessment, tree protection during development.
- Developing and implementing tree management programs
- Risk assessments using either QTRA or TRAQ methods
- Project Arborist work
- Developing the Computerised Tree Management systems
- Diagnostic procedures for determination of various tree related issues
- Consultancy work both verbal and written format
- Mentoring junior staff and educating senior staff in all the latest findings within the arboricultural industry

Arboricultural and Horticultural Employment History

- 2014 to Present: Senior Consulting Arborist at Urban Arbor Pty Ltd, Sydney, NSW
- 2013 to 2014: Consulting Arborist at Priority Tree Services, Sydney, NSW
- 2012: Consulting Arborist/Estimator at Aardvark Professional Tree Services, Melbourne, Victoria
- 2008 to 2011: Arboricultural Surveyor at Gallions Housing Association, London, U.K
- 2006 to 2007: Assistant Landscape Officer at Three Rivers District Council, Hertfordshire, U.K
- 2002 to 2005: Groundsman and Trainee Climber at A.T.M Tree Surgeons, Bedfordshire, U.K
- 2001 to 2002: Gardener and Landscaper at F.T. Landscapes, Hertfordshire, U.K

Recent Project Works Undertaken

Preparing Arboricultural Impact Assessment reports for large projects, such as the re development of Cherrybrook Shopping Village and various public schools for the Department of Education and Training school beautification project, including providing significant tree sensitive solutions of developments within public schools across Sydney.

Project Arborist on large developments including Barangaroo, Coles Kellyville, Royal Far West in Manly and Macquarie University. Jack has worked as a project Arborist for many first tier construction companies, such as Lend Lease, Mainbrace, Mirvac, Liang O'Rourke and Brookfield Multiplex.

Developing and Implementing a tree inventory and GIS database for Gallions Housing Association for over 40,000 trees.

Undertaking risk assessment and preparing reports for various sites including multiple public and private schools, the Sydney Museum, Sydney Adventist Hospital.

Delivering Arboricultural Impact Assessments and Project Arborist works for private developers within Councils including Ku Ring Gai Council, Hornsby Council, The Hills Shire, Holroyd Council, Inner West Council, Bankstown Council, Canterbury Council, Manly Council, Warringah Council, Pittwater Council, North Sydney Council, Mosman Council, Hunters Hill Council, Lane Cove Council, Parramatta Council, Ryde Council, Blacktown Council, The City of Sydney, Randwick Council, Woollahra Council, Waverley Council, Sutherland Council, Wollondilly Council, Blue Mountains Council, Wingecarribee Council and Hawksbury Council

Appendix C – Compliance Matrix

Table 1 lists the Section of this report that demonstrate compliance with CoA – E6.

Details	Compliance
The CSSI must be designed to retain as many trees as possible and provide replacement trees such that there a net increase in the number of trees	Section 5 of this report and Section 8 of Appendix A. Design components including the road ways, plazas and culvert have been designed to minimise the removal of trees where possible.
The Proponent must commission an independent, experienced and suitably qualified arborist to prepare a comprehensive Tree Report before removing any trees as detailed in the EIS, as amended by the documents listed in A1.	Section 2, Appendix A and Appendix B. Bryce Claassens and Jack Williams, consulting arborists from Urban Arbor were engaged to assess trees external to the rail corridor.
The Tree Report must include:	
(a) a description of the conditions of the tree(s) and its amenity and visual value;	Section 8 of Appendix A
(b) consideration of all options to avoid tree removal, including relocation of services, redesign or relocation of ancillary components (such as substations, fencing etc.) and reduction of standard offsets to underground services; and	Section 8 of Appendix A
(c) measures to avoid tree removal, minimise damage to, and ensure the health and stability of those trees to be retained and protected. This includes details of any proposed canopy or root pruning, root protection zone, excavation, site controls on waste disposal, vehicular access, materials storage and protection of public utilities.	Section 5 of this Report
In the event that tree removal cannot be avoided, then replacement trees are to be planted within, or in close proximity to the CSSI or other location in consultation with the Relevant Councils and agreed by the Secretary. The size of the replacement trees will be determined in consultation with the relevant Council.	Section 5 of this Report. 14 trees to be removed from outside the rail corridor will be replaced. Relevant Councils and the DPE will be consulted in regards to replacement tree planting locations. Relevant Councils will be consulted in regards to appropriate sizes for replacement trees.
A copy of the Tree Report must be submitted to the Secretary before the removal, damage and/or pruning of any trees, including those affected by the site establishment works.	Section 5. This report will be submitted to the Secretary prior to the removal, damage and/or pruning of any trees
All recommendations of the Tree Report must be implemented by the Proponent, unless otherwise agreed by the Secretary.	All recommendations will be implemented in accordance with Section 5 of this Report.
The Tree Report may be prepared for the entire CSSI or separate reports may be prepared for individual areas where tree removal and/or pruning is proposed	Section 1.This report is for trees external to the rail corridor only. A separate report has been prepared for trees outside of the rail corridor. Refer to *SMCSWSSJ-JHL-WSS-EM-REP-000003 Tree Impact Assessment Report – Rail Corridor (JHLOR, 2018)*