URBAN ARBOR
The Trusted Name in Tree Management

Arboricultural Impact Assessment Report

Site Location:

22 Melwood Avenue Forestville NSW

Prepared for: Forestville RSL Club

Prepared by: Alex Kurath
Urban Arbor Pty Ltd
Reference: 240925_Forestville RSL_AIA
Revision: A

Date Prepared: 25 September 2024

URBAN ARBOR
The Trusted Name in Tree Management

PO Box 450, Turramurra NSW 2074
Phone: (02) 8004 2802
www.urbanarbor.com.au

Executive Summary

This Arboricultural Impact Assessment for 22 Melwood Avenue Forestville, commissioned by Forestville RSL Club, evaluates the impact of the proposed development works to significant trees located within the site and adjoining sites. The project involves the demolition of the existing buildings and the construction of new club facilities and a residential unit block.

Twenty-one trees have been recommended for removal to accommodate the development works, including tree 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 21, 22, 23, 24, 25, 26, 27, 28, 30, 31 and 32. Tree 30 and 31 have been awarded a higher value A retention value and are located on council managed land. All other trees recommended to be removed have been awarded lower value category Z retention value, including tree 5, 6, 7, 8, 21, 22, 23, 24, 25, 26, 27, 28 and 32.

Three trees have been recommended to be retained that require tree sensitive design and construction methods to reduce the impact to the trees, including tree 19, 20 and 36. See section 9.2 for tree sensitive construction recommendations.

The remaining sixteen trees can be retained in a viable condition, including tree 1, 2, 13, 14, 15, 16, 17, 18, 29, 33, 34, 35, 37, 38, 39 and 40.

No services plans have been assessed in this report. Any such plans should be subject to review by the consulting arborist, in order to assess any potential impacts to the trees.

Tree protection specifications are detailed in section 11.5 of this report. A project arborist should be appointed to oversee the implementation of these protection measures and conduct regular site inspections throughout the development process to ensure compliance and mitigate potential damage to the trees.

Should you have any questions in relation to the content of this report, please contact me by email or phone on the details below.

Alex Kurath
Phone: 02 8004 2802
sales@urbanarbor.com.au
Diploma of Arboriculture (AQF5)
ISA Tree Risk Assessment Qualification (TRAQ)
Quantified Tree Risk Assessment Registered (QTRA)
Member Arboriculture Australia

Table of Contents

1. INTRODUCTION

1.1 Urban Arbor have been instructed by Forestville RSL Club to inspect all significant trees located within the site and adjoining sites and prepare an Arboricultural Impact Assessment Report in relation to a development at the site.

1.2 Below is a list of all documents and information provided to assist in preparing this report:

A. Survey, Bee & Lethbridge, Ref: 7899, 18 June 2009

B. Detail and Level Survey, LTS, Sheet 1-11, Ref: 52165 002DT, 17 July 2024

C. Landscape Master Plan, Space Landscape Design, Drawing No: L-01, Revision B, 29 August 2024.

D. Civil Services Plans, ACOR Consultants, Revision B, 20 September 2024, including the following drawings;

DRAWING INDEX		
DRAWING NUMBER	**DRAWING TITLE**	**REVISION**
C01-0001	COVER SHEET, LEGENDS AND DRAWING INDEX	B
C01-0101	NOTES SHEET	B
C03-0001	SOIL EROSION AND SEDIMENT CONTROL PLAN	B
C03-0101	SOIL EROSION AND SEDIMENT CONTROL NOTES - AND DETAILS	B
C04-0001	BULK EARTHWORKS PLAN	B
C04-0101	BULK EARTHWORKS SECTIONS - SHEET 1 - NOT IN THIS SET	#N/A
C08-0001	STORMWATER MANAGEMENT PLAN	B
C08-0301	STORMWATER DETAILS - SHEET 1	B
C08-0302	STORMWATER DETAILS - SHEET 2	B
C08-0303	STORMWATER DETAILS - SHEET 3	B
C08-0401	STORMWATER MANAGEMENT CATCHMENT PLAN	B
C09-0001	PAVEMENT PLAN	B

E. Architectural Plans, Quattro Architects, Revision D, 30 August 2024, including the following drawings;

Sheet ID	1 of 1
DA_A_000	COVER SHEET
DA_A_047	REGIONAL SITE PLAN
DA_A_048	SURVEY & SURROUNDINGS
DA_A_049	SURVEY PHOTOS
DA_A_050	SITE ANALYSIS
DA_A_051	SITE ANALYSIS
DA_A_052	SITE ANALYSIS - CAR PARKING
DA_A_053	SITE ANALYSIS - OPEN SPACE
DA_A_054	SITE ANALYSIS - AREA CALCS
DA_A_055	SITE PLAN - EXISTING
DA_A_098	SITE PLAN - BASEMENT 3/4/5
DA_A_099	SITE PLAN - BASEMENT 1/2
DA_A_100	SITE PLAN - GROUND
DA_A_101	SITE PLAN - LEVEL 1
DA_A_102	SITE PLAN - LEVEL 2
DA_A_103	SITE PLAN - ROOF
DA_A_200	ELEVATIONS
DA_A_201	3D MONTAGE
DA_A_250	SECTIONS
DA_A_300	HEIGHT ENVELOPE STUDY
DA_A_301	HEIGHT ENVELOPE STUDY 9.5m
DA_A_302	HEIGHT ENVELOPE STUDY 11.5m
DA_A_400	SHADOW DIAGRAMS

1.3 The site and tree inspections were carried out on 12 August 2024. Access was available to the subject site and adjoining public areas only. All tree data contained in this report was collected during this site inspection.

2. SCOPE OF THE REPORT

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

2.1.1 Conduct a ground level visual assessment of all significant trees located within 10 metres of development works. For the purpose of this report, a significant tree is a tree with a height equal to or greater than 5 metres.

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

2.1.3 Provide an assessment of the potential impact the proposed development is likely to cause to the condition of the subject trees in accordance with AS4970 'Protection of trees on development sites' (2009).

2.1.4 Specify tree protection measures in accordance with AS4970-2009 for any tree to be retained during the development.

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 While an assessment of the subject trees estimated useful life expectancy is included in this report, no specific tree risk assessment has been undertaken for any of the trees at the site.

3.6 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 of deficiencies relating to the subject tree, or subject site may not arise in the future.

3.7 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.*

3.8 Urban Arbor neither guarantees, nor is it responsible for, the accuracy of information provided by others that is contained within this report.

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

3.10 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):

- Tree common name.
- Tree botanical name.
- Tree age class.
- DBH (Trunk/stem diameter at breast height/1.4m) – millimetres.
- Estimated height – metres.
- Estimated crown spread (radius of crown) – metres.
- Health.
- Structural condition.
- Amenity value.
- Estimated remaining contribution years (SULE) [1].
- Retention value (Tree AZ) [2].
- 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 Trunk diameter was measured using a DBH tape or in some cases estimated. The trunk diameter of all trees in adjoining sites has been 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 tool used during the assessment was a digital camera.

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

4.5 All DBH measures, tree protection zones, and structural root zones were calculated in accordance with the methods set out in AS4970 'Protection of trees on development sites' (2009) in a Microsoft Excel spreadsheet.

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

[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.

[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)

5. SITE LOCATION AND BRIEF DESCRIPTION

5.1 The site is located in the suburb of Forestville, which is located in the Northern Beaches Local Government Area (LGA). Therefore, all trees at the site are subject to protection under the Warringah Local Environmental Plan (LEP) 2011[4] and Development Control Plan (DCP) 2011.[5] The site is not located within a heritage conservation area or forms part of a heritage item. None of the site has been identified as containing 'High Value Biodiversity' in the 'Biodiversity Values Map' on the NSW Planning Portal Spatial Viewer.[6]

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

6.1 **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 extent 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 4.

6.2 **Structural Root Zone (SRZ):** This is the area around the base of a tree required for the tree's 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: $(DAB \times 50)^{0.42} \times 0.64$. There are several factors that can vary the SRZ which include height, crown area, soil type, and soil moisture. It can also be influence 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.

6.3 **Minor Encroachment into the 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] Warringah Local Environmental Plan LEP 2011, https://legislation.nsw.gov.au/view/html/inforce/current/epi-2011-0649, accessed on 15 August 2024

[5] Warringah DCP 2011, rhttps://eservices.northernbeaches.nsw.gov.au/ePlanning/live/pages/plan/Book.aspx?exhibit=DCP&hid=192, accessed on 15 August 2024.

[6] NSW Planning Portal Spatial Viewer, https://www.planningportal.nsw.gov.au/propertyreports/135780da-ccd3-483f-98fc-12e53a8d2fe2.pdf, accessed 15 August 2024.

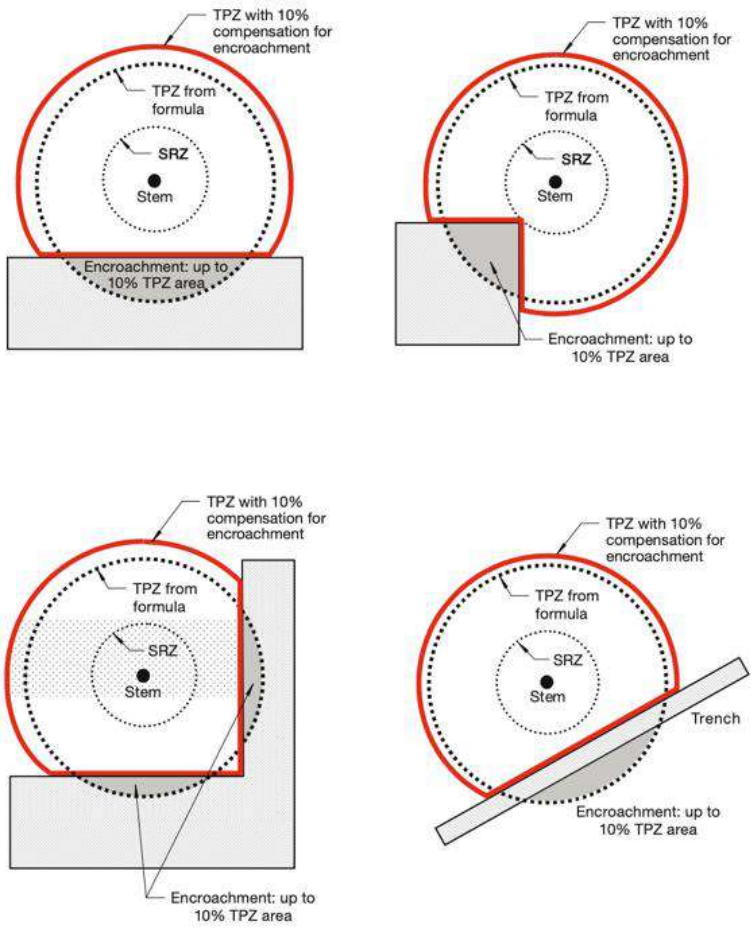


Image 1: Example of minor TPZ encroachment from AS4970-2009.

6.4 **Major Encroachment into the 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 sized 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 4 for more information in relation to root investigations).

7. 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 3, 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 AS 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 4 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.

7.2 **Site Plan:** In Appendix 1, three site plans have been prepared, where the tree information including canopy spread, TPZ, and SRZ have been overlaid onto the site plans. The following site plans are included:

- Appendix 1A: Existing Site Plan
- Appendix 1B: Proposed Basement Plan
- Appendix 1C: Proposed Master Landscape Plan

8. ASSESSMENT OF CONSTRUCTION IMPACTS

8.1 **Table 1:** In the table below, the impact of the proposed development has been assessed for all trees included in the report. The assessed TPZ encroachments include proposed structures and hard surfacing only. All soft landscaping should be completed in accordance with section 11.10.

Tree ID	Species	Retention Value	TPZ Radius (m)	TPZ Area (m^2)	SRZ Radius	TPZ Encroachment	Discussion/Conclusion	Recommendation
1	*Lophostemon confertus*	A2	5.4	91.6	2.5	None	There is no proposed TPZ encroachment.	Retain and protect
2	*Lophostemon confertus*	Z10	4.9	76.0	2.5	None	There is no proposed TPZ encroachment.	Retain and protect
3	*Banksia integrifolia*	Z10	4.1	52.3	2.2	Major	The proposed garden path will encroach into the TPZ by 43% (22.5m^2) and into the SRZ. This is considered a major TPZ encroachment and has the potential to impact the stability and/or condition of the tree.	Remove
4	*Melaleuca bracteata*	Z10	4.3	58.6	2.3	Footprint	The trunk of the tree is located in the footprint of the proposed garden path.	Remove
5	*Cupressus sempervirens Stricta*	Z3	2.0	12.6	1.7	Footprint	The trunk of the tree is located in the footprint of the proposed garden path.	Remove
6	*Cupressus sempervirens Stricta*	Z3	2.0	12.6	1.7	Footprint	The trunk of the tree is located in the footprint of the proposed garden path.	Remove
7	*Cupressus sempervirens Stricta*	Z3	2.5	19.6	1.7	Major	The proposed garden path will encroach into the TPZ by 23% (4.6m^2) and into the SRZ. This is considered a major TPZ encroachment and has the potential to impact the stability and/or condition of the tree.	Remove

Tree ID	Species	Retention Value	TPZ Radius (m)	TPZ Area (m^2)	SRZ Radius	TPZ Encroachment	Discussion/Conclusion	Recommendation
8	*Cupressus sempervirens Stricta*	Z3	2.0	12.6	1.7	Major	The proposed garden path will encroach into the TPZ by 25% (3.2m^2) and into the SRZ. This is considered a major TPZ encroachment and has the potential to impact the stability and/or condition of the tree.	Remove
9	*Banksia integrifolia*	Z10	3.6	40.7	2.2	Footprint	The trunk of the tree is located within the footprint of the proposed lawn bowling area.	Remove
10	*Banksia integrifolia*	Z10	2.6	21.9	1.9	Footprint	The trunk of the tree is located in the footprint of the proposed basement.	Remove
11	*Banksia integrifolia*	Z4	3.8	46.3	2.2	Footprint	The trunk of the tree is located in the footprint of the proposed basement.	Remove
12	*Banksia integrifolia*	Z1	3.1	30.6	2.0	Major	The proposed Pickleball Court will encroach into the TPZ by 45% (13.8m^2) and into the SRZ. This is considered a major TPZ encroachment and has the potential to impact the stability and/or condition of the tree.	Remove
13	*X Cupressocyparis leylandii*	Z3	3.8	46.3	2.1	Major	The tree is located on the adjoining site. The proposed Pickleball Court will encroach into the TPZ by 30% (13.9m^2) and into the SRZ. This is considered a major TPZ encroachment and has the potential to impact the stability and/or condition of the tree. However, there is an existing masonry boundary wall located between the trunk of the tree and the proposed area of works, which would have restricted significant root development into the area of the TPZ encroachment. Therefore, the works will not significantly impact the tree.	Retain and protect

Tree ID	Species	Retention Value	TPZ Radius (m)	TPZ Area (m^2)	SRZ Radius	TPZ Encroachment	Discussion/Conclusion	Recommendation
14	*Jacaranda mimosifolia*	Z3	4.3	58.1	2.4	Major	The tree is located on the adjoining site. The proposed Pickleball Court will encroach into the TPZ by 32% (18.7m^2) and into the SRZ. This is considered a major TPZ encroachment and has the potential to impact the stability and/or condition of the tree. However, there is an existing masonry boundary wall between the trunk of the tree and the proposed area of works, which would have restricted significant root development into the area of the TPZ encroachment. Therefore, the works will not significantly impact the tree.	Retain and protect
15	*Archontophoenix cunninghamiana*	Z3	2.5	19.6	N/A	Minor	The tree is located on the adjoining site. The proposed garden path will encroach into the TPZ by 1% (0.2m^2). This is considered a minor and acceptable TPZ encroachment and will not significantly impact the condition of the tree.	Retain and protect
16	*Archontophoenix cunninghamiana*	Z3	2.5	19.6	N/A	Minor	The tree is located on the adjoining site. The proposed garden path will encroach into the TPZ by 9% (1.8m^2). This is considered a minor and acceptable TPZ encroachment and will not significantly impact the condition of the tree.	Retain and protect
17	*Archontophoenix cunninghamiana*	Z3	2.5	19.6	N/A	Minor	The tree is located on the adjoining site. The proposed garden path will encroach into the TPZ by 9% (1.7m^2). This is considered a minor and acceptable TPZ encroachment and will not significantly impact the condition of the tree.	Retain and protect

Tree ID	Species	Retention Value	TPZ Radius (m)	TPZ Area (m^2)	SRZ Radius	TPZ Encroachment	Discussion/Conclusion	Recommendation
18	*Archontophoenix cunninghamiana*	Z3	2.5	19.6	N/A	Minor	The tree is located on the adjoining site. The proposed garden path will encroach into the TPZ by 10% (2.0m^2). This is considered a minor and acceptable TPZ encroachment and will not significantly impact the condition of the tree.	Retain and protect
19	*Melaleuca quinquenervia*	A1	7.7	185.5	2.8	Major	The proposed Vegetable Gardens will encroach into the TPZ by 10% (18.1m^2) but not into the SRZ. Additionally, the proposed garden path will encroach into the TPZ by 11% (19.8m^2) and into the SRZ. This is a combined TPZ encroachment of 20% (37.9m^2), which is considered a major TPZ encroachment and has the potential to impact the stability and/or condition of the tree. Provided the garden path is constructed on or above existing soil grade in accordance with section 9.2, the root system of the tree can be retained below the path and the tree will not be significantly impacted.	Tree sensitive design and construction
20	*Angophora costata*	A1	9.4	277.1	3.0	Major	The proposed Vegetable Gardens will encroach into the TPZ by 9% (23.6m^2) but not into the SRZ. Additionally, the proposed garden path will encroach into the TPZ by 9% (25m^2) but not into the SRZ. This is a combined TPZ encroachment of 18% (48.6m^2), which is considered a major TPZ encroachment and has the potential to impact the condition of the tree. Provided the garden path is constructed on or above existing soil grade in accordance with section 9.2, the root system of the tree can be retained below the path and the tree will not be significantly impacted.	Tree sensitive design and construction
21	*Cupressus sempervirens Stricta*	Z3	2.2	14.7	1.8	None	There is no proposed TPZ encroachment. However, the tree has been indicated for removal on the proposed landscape plans and is listed as an exempt species within the Northern Beaches DCP.	*Remove

Tree ID	Species	Retention Value	TPZ Radius (m)	TPZ Area (m^2)	SRZ Radius	TPZ Encroachment	Discussion/Conclusion	Recommendation
22	*Cupressus sempervirens Stricta*	Z3	2.2	14.7	1.8	None	There is no proposed TPZ encroachment. However, the tree has been indicated for removal on the proposed landscape plans and is listed as an exempt species within the Northern Beaches DCP.	*Remove
23	*Cupressus sempervirens Stricta*	Z3	2.2	14.7	1.8	None	There is no proposed TPZ encroachment. However, the tree has been indicated for removal on the proposed landscape plans and is listed as an exempt species within the Northern Beaches DCP.	*Remove
24	*Cupressus sempervirens Stricta*	Z3	2.2	14.7	1.8	None	There is no proposed TPZ encroachment. However, the tree has been indicated for removal on the proposed landscape plans and is listed as an exempt species within the Northern Beaches DCP.	*Remove
25	*Cupressus sempervirens Stricta*	Z3	2.2	14.7	1.8	None	There is no proposed TPZ encroachment. However, the tree has been indicated for removal on the proposed landscape plans and is listed as an exempt species within the Northern Beaches DCP.	*Remove
26	*Cupressus sempervirens Stricta*	Z3	2.2	14.7	1.8	Footprint	The trunk of the tree is located in the footprint of the proposed paved courtyard area.	Remove
27	*Cupressus sempervirens Stricta*	Z3	2.2	14.7	1.8	Footprint	The trunk of the tree is located in the footprint of the proposed driveway.	Remove
28	*Cupressus sempervirens Stricta*	Z3	2.2	14.7	1.8	Footprint	The trunk of the tree is located in the footprint of the proposed car parking area.	Remove

Tree ID	Species	Retention Value	TPZ Radius (m)	TPZ Area (m^2)	SRZ Radius	TPZ Encroachment	Discussion/Conclusion	Recommendation
29	*Lophostemon confertus*	A1	6.5	131.9	2.7	Minor	The tree is located on the nature strip. The proposed car parking will encroach into the TPZ by 4% (5.5m^2) but not into the SRZ. Additionally, the proposed entry path will encroach into the TPZ by 2% (2.8m^2) but not into the SRZ. This is a combined TPZ encroachment of 6% (8.3m^2), which is considered a minor and acceptable TPZ encroachment and will not significantly impact the condition of the tree.	Retain and protect
30	*Lophostemon confertus*	A1	5.5	95.7	2.5	Footprint	The tree is located on the nature strip. The trunk of the tree is located in the footprint of the proposed driveway.	**Remove
31	*Lophostemon confertus*	A2	4.9	76.9	2.4	Footprint	The tree is located on the nature strip. The trunk of the tree is located in the footprint of the proposed pedestrian access ramp.	**Remove
32	*Lophostemon confertus*	Z4	4.8	72.4	2.4	Major	The tree is located on the nature strip. The proposed driveway will encroach into the TPZ by 40% (28.8m^2) and into the SRZ. This is considered a major TPZ encroachment and has the potential to impact the stability and/or condition of the tree.	**Remove
33	*Syzygium australe*	Z2	3.5	38.6	2.3	Major	The proposed children's playground will encroach into the TPZ by 13% (4.9m^2) and into the SRZ. This is considered a major TPZ encroachment and has the potential to impact the stability and/or condition of the tree. However, the works are located within the footprint of the existing building, which would have restricted significant root development into the area of the TPZ encroachment. Therefore, the works will not significantly impact the tree.	Retain and protect
34	*Syzygium australe*	A1	4.2	56.7	2.5	None	There is no proposed TPZ encroachment.	Retain and protect

Tree ID	Species	Retention Value	TPZ Radius (m)	TPZ Area (m^2)	SRZ Radius	TPZ Encroachment	Discussion/Conclusion	Recommendation
35	*Syzygium australe*	Z10	2.6	20.4	1.9	None	There is no proposed TPZ encroachment.	Retain and protect
36	*Eucalyptus saligna*	A1	6.1	117.7	2.7	Major	The proposed vegetable gardens will encroach into the TPZ by 5% (5.8m^2) but not into the SRZ. Additionally, the proposed garden path will encroach into the TPZ by 13% (14.8m^2) but not into the SRZ. This is a combined TPZ encroachment of 18% (20.6m^2), which is considered a major TPZ encroachment and has the potential to impact the condition of the tree. Provided the garden path is constructed on or above existing soil grade in accordance with section 9.2, the root system of the tree can be retained below the path and the tree will not be significantly impacted.	Tree sensitive design and construction
37	*Eucalyptus saligna*	A1	3.4	35.5	2.2	None	There is no proposed TPZ encroachment.	Retain and protect
38	*Grevillea robusta*	Z3	4.7	68.8	2.4	Minor	The proposed garden path will encroach into the TPZ by 4% (2.6m^2) but not into the SRZ. This is considered a minor and acceptable TPZ encroachment and will not significantly impact the condition of the tree.	Retain and protect
39	*Melaleuca quinquenervia*	Z10	2.0	13.1	1.7	None	There is no proposed TPZ encroachment.	Retain and protect
40	*Melaleuca quinquenervia*	Z10	2.0	12.6	1.6	None	There is no proposed TPZ encroachment.	Retain and protect

Note: *Remove = The tree is not significantly impact by the proposed works, however, has been indicated for removal for relandscaping purposes.

**Remove = The tree is located on council managed land and the removal of the trees is subject to approval from Northern Beaches Council.

9. CONCLUSIONS

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

Impact	Reason	Category A	Category Z	Total
		A	Z	
Trees recommended to be removed	Building construction, new surfacing and/or proximity to structures, or trees in poor condition	**30, **31	3, 4, 5, 6, 7, 8, 9, 10, 11, 12, *21, *22, *23, *24, *25, 26, 27, 28, **32	**21 Trees**
Trees requiring tree sensitive construction/design methods	Removal of existing surfacing/structures and/or installation of new surfacing/structures may impact the viability of the trees	19, 20, 36	None	**3 Trees**
Trees recommended to be retained	Removal of existing surfacing/structures will not impact the viability of the trees	1, 29, 34, 37	2, 13, 14, 15, 16, 17, 18, 33, 35, 38, 39, 40	**16 Trees**

Note: Trees marked with * are not significantly impacted by the proposed works, however, have been indicated for removal for relandscaping purposes.
Trees marked with ** are located on council managed land and the removal of the trees is subject to approval from Northern Beaches Council.

9.2 **Construction Design/Specification Requirements for Tree 19, 20 and 36:** The proposed development works will significantly encroach into the TPZ of tree 19, 20 and 36. To ensure the trees are not adversely impacted by the construction, it must be demonstrated the following design and construction specifications can be implemented within the TPZ of the trees. If the construction cannot be implemented in accordance with these specifications, the trees may not be viable for retention.

9.2.1 **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. The diagram below (Image 2) gives an example of a no-excavation method for constructing hard surfacing close to trees. The location of retaining pegs should be flexible, avoiding damage to structural roots.

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, 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 3 and Image 4). Using pier and beam bridges as per the image below 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.

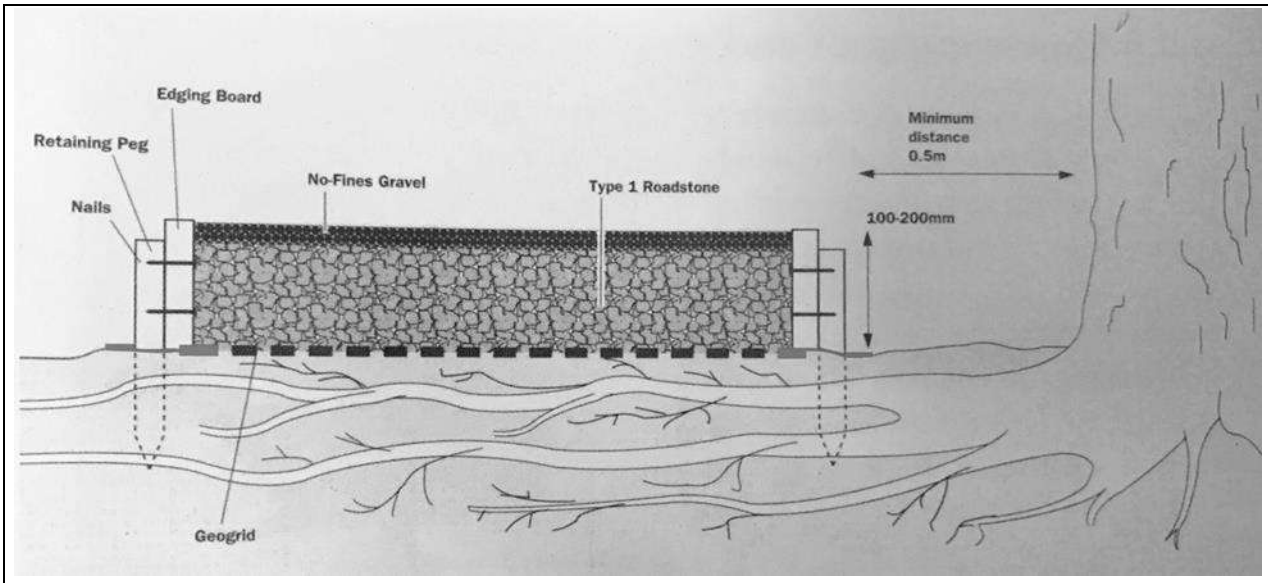


Image 2: An image from 'Tree Roots in the Built Environment'[7], showing how to construct hard surfacing above a tree's root system without excavation. Type 1 Roadstones are an example of blue metal or crushed sandstone.

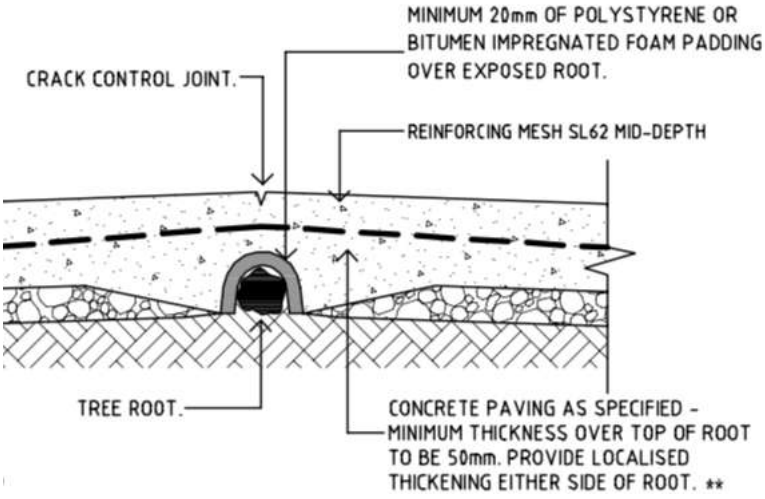


Image 3: Example method for bridging concrete footpaths over tree roots provided in the Canterbury Bankstown Council standard drawings.[8]

[7] Roberts, J., Jackson, N., & Smith, M., *Tree Roots in the Built Environment*, The Stationary Office, London, England (2006). Page 305 & 306.

[8] *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.

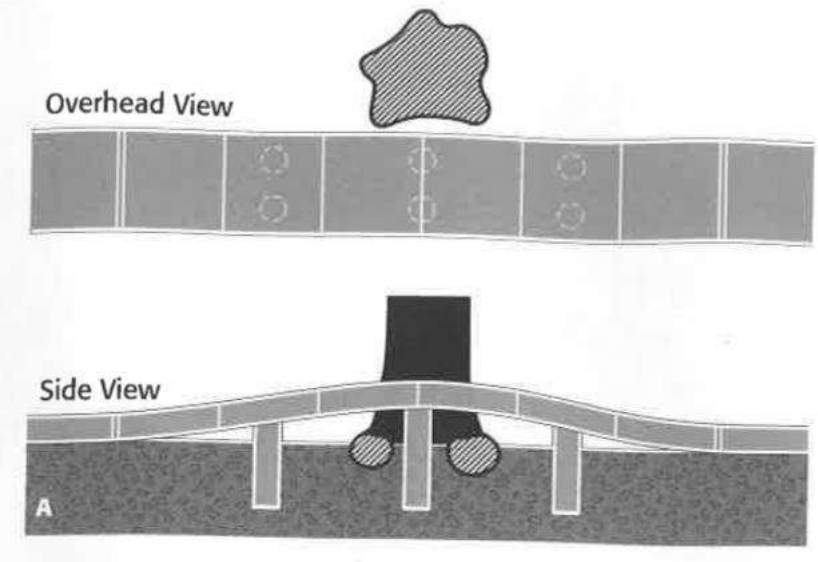


Image 4: Example method from Reducing infrastructure damage by tree roots: A compendium of strategies.[9]

[9] 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.

10. RECOMMENDATIONS

10.1 This report assesses the impact of a proposed development at the subject site to all significant trees located within 10 metres of the development works. Forty trees have been identified and assessed.

10.2 In Appendix 1, three site plans have been prepared, where the tree information including canopy spread, TPZ, and SRZ have been overlaid onto the site plans. The following site plans are included:

- Appendix 1A: Existing Site Plan
- Appendix 1B: Proposed Basement Plan
- Appendix 1C: Proposed Master Landscape Plan

10.3 Twenty-one trees have been recommended for removal to accommodate the development works, including tree 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 21, 22, 23, 24, 25, 26, 27, 28, 30, 31 and 32. Tree 30 and 31 have been awarded a higher value A retention value and are located on council managed land. All other trees recommended to be removed are lower value category Z retention value trees, including tree 5, 6, 7, 8, 21, 22, 23, 24, 25, 26, 27, 28 and 32. Trees 21, 22, 23, 24 and 25, will not be significantly impacted by the proposed works, however, the trees have been indicated for removal on the proposed plans for relandscaping purposes. Trees 30, 31 and 32 are located on council managed land and the removal of the trees is subject to approval from the Northern Beaches Council.

10.4 Three trees have been recommended to be retained that require tree sensitive design and construction methods being implemented to reduce the impact to the trees, including tree 19, 20 and 36. See section 9.2 for tree sensitive construction recommendations. If it is not feasible to carry out the work as outlined in section 9.2, the trees may not be viable for retention.

10.5 The remaining sixteen trees can be retained in a viable condition, including tree 1, 2, 13, 14, 15, 16, 17, 18, 29, 33, 34, 35, 37, 38, 39 and 40.

10.6 All trees to be retained must be protected in accordance with AS4970-2009, details of which are included in section 11.

10.7 No services plan has been assessed in this report. All services plans should be subject to review by a consulting Arborist. Where possible, underground services should be located outside the TPZ of trees to be retained. All underground services located inside the TPZ of any tree to be retained, must be installed via tree sensitive techniques with AS4970-2009, see section 11.11 for more information.

10.8 This report does not provide approval for tree removal or pruning works. All recommendations in this report are subject to approval by the relevant authorities and/or tree owners. This report should be submitted as supporting evidence with the development application.

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 in Appendix 1 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 of 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 the 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 carry out 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:** 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 an 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. See section 11.6 for requirements of tree protection. See Appendix 1 for indicative fencing location.

Tree ID	Tree Species	TPZ Radius (m)	SRZ Radius (m)	Recommendations
1	*Lophostemon confertus*	5.4	2.5	Retain and protect. Trunk protection to be installed in accordance with section 11.6.1.
2	*Lophostemon confertus*	4.9	2.5	Retain and protect. Trunk protection to be installed in accordance with section 11.6.1.
3	*Banksia integrifolia*	4.1	2.2	Remove
4	*Melaleuca bracteata*	4.3	2.3	Remove
5	*Cupressus sempervirens Stricta*	2.0	1.7	Remove
6	*Cupressus sempervirens Stricta*	2.0	1.7	Remove
7	*Cupressus sempervirens Stricta*	2.5	1.7	Remove

Tree ID	Tree Species	TPZ Radius (m)	SRZ Radius (m)	Recommendations
8	*Cupressus sempervirens Stricta*	2.0	1.7	Remove
9	*Banksia integrifolia*	3.6	2.2	Remove
10	*Banksia integrifolia*	2.6	1.9	Remove
11	*Banksia integrifolia*	3.8	2.2	Remove
12	*Banksia integrifolia*	3.1	2.0	Remove
13	*X Cupressocyparis leylandii*	3.8	2.1	Retain and protect. The boundary fence provides adequate protection. No additional protection measures will be required.
14	*Jacaranda mimosifolia*	4.3	2.4	Retain and protect. The boundary fence provides adequate protection. No additional protection measures will be required.
15	*Archontophoenix cunninghamiana*	2.5	N/A	Retain and protect. The boundary wall provides adequate protection. No additional protection measures will be required.
16	*Archontophoenix cunninghamiana*	2.5	N/A	Retain and protect. The boundary wall provides adequate protection. No additional protection measures will be required.
17	*Archontophoenix cunninghamiana*	2.5	N/A	Retain and protect. The boundary wall provides adequate protection. No additional protection measures will be required.
18	*Archontophoenix cunninghamiana*	2.5	N/A	Retain and protect. The boundary wall provides adequate protection. No additional protection measures will be required.
19	*Melaleuca quinquenervia*	7.7	2.8	Retain and protect. Tree protection fencing to be installed on the subject site to encompass the TPZ area of trees 19, 20, 34-40. TPZ signage to be installed on fencing. See Appendix 1C for fencing location. The fencing can only be moved at landscaping stage under the approval of the project arborist.
20	*Angophora costata*	9.4	3.0	Retain and protect. See protection measures for tree 19.
21	*Cupressus sempervirens Stricta*	2.2	1.8	Remove
22	*Cupressus sempervirens Stricta*	2.2	1.8	Remove
23	*Cupressus sempervirens Stricta*	2.2	1.8	Remove
24	*Cupressus sempervirens Stricta*	2.2	1.8	Remove
25	*Cupressus sempervirens Stricta*	2.2	1.8	Remove
26	*Cupressus sempervirens Stricta*	2.2	1.8	Remove

Tree ID	Tree Species	TPZ Radius (m)	SRZ Radius (m)	Recommendations
27	*Cupressus sempervirens Stricta*	2.2	1.8	Remove
28	*Cupressus sempervirens Stricta*	2.2	1.8	Remove
29	*Lophostemon confertus*	6.5	2.7	Retain and protect. Trunk protection to be installed in accordance with section 11.6.1.
30	*Lophostemon confertus*	5.5	2.5	Remove
31	*Lophostemon confertus*	4.9	2.4	Remove
32	*Lophostemon confertus*	4.8	2.4	Remove
33	*Syzygium australe*	3.5	2.3	Retain and protect. Tree protection fencing to be installed on the subject site to encompass the TPZ area. TPZ signage to be installed on fencing. See Appendix 1C for fencing location.
34	*Syzygium australe*	4.2	2.5	Retain and protect. See protection measures for tree 19.
35	*Syzygium australe*	2.6	1.9	Retain and protect. See protection measures for tree 19.
36	*Eucalyptus saligna*	6.1	2.7	Retain and protect. See protection measures for tree 19.
37	*Eucalyptus saligna*	3.4	2.2	Retain and protect. See protection measures for tree 19.
38	*Grevillea robusta*	4.7	2.4	Retain and protect. See protection measures for tree 19.
39	*Melaleuca quinquenervia*	2.0	1.7	Retain and protect. See protection measures for tree 19.
40	*Melaleuca quinquenervia*	2.0	1.6	Retain and protect. See protection measures for tree 19.

11.6 Tree Protection Specifications:

11.6.1 **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 the 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.

11.6.2 **Protective Fencing:** The protective fencing must be constructed of 1.8 metre high ‘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 as restricting access to areas of the site or for constructing new structures, an alternative location and protection specification must be agreed upon with the

Project Arborist. Any modifications to the fencing locations must be approved by the Project Arborist.

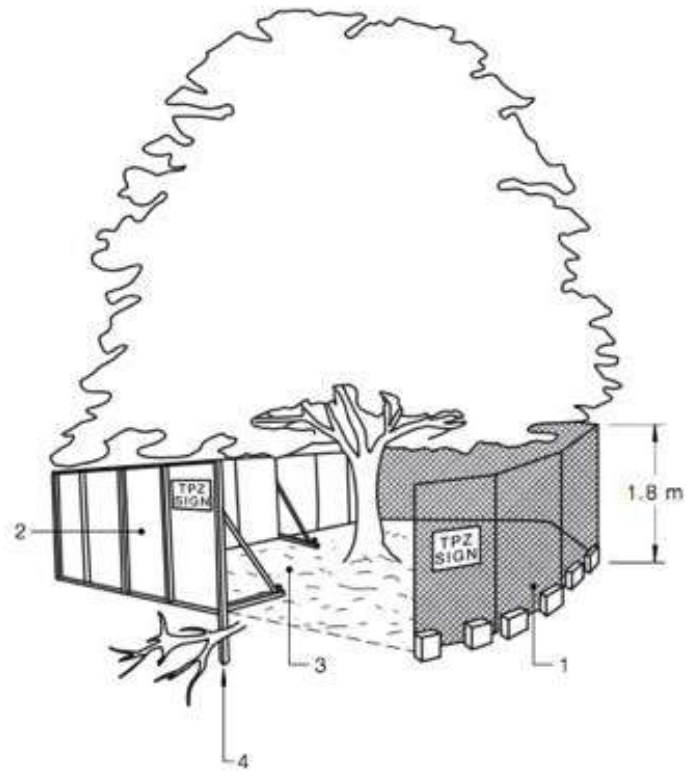
11.6.3 **TPZ Signage:** Tree protection signage is to be attached to the protective fencing, displayed in a prominent position and the sign repeated at 10 metre intervals or closer where the fence changes direction. Each sign shall contain in a clearly legible form, the following information:

- Tree protection zone/NO access.
- This fence has been installed to prevent damage to the tree/s and their growing environment above/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.

11.6.4 **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 of 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 the whole TPZ, while allowing space for construction. Ground protection must consist of good quality composted wood chip/leaf mulch to a depth of 150-300mm, laid on top of geo textile fabric, with timber/plywood boards overlaid. If vehicles are to be used in 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 and approved by the Project Arborist as required.

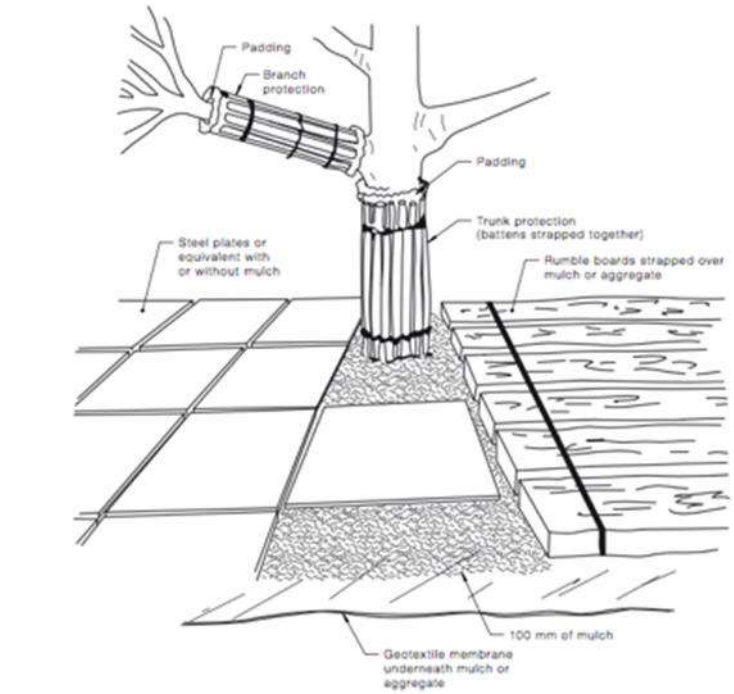
11.6.6 **Temporary Irrigation:** Temporary irrigation should distribute water evenly throughout the area of the TPZ. The irrigation should be used for two hours weekly (minimum) throughout all stages of the development, and may require a higher frequency, this should be advised by the Project Arborist.



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.

Image 5: An image from AS4970-2009,[10] with example tree protection.

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



NOTES:

1 For trunk and branch protection use boards and padding that will prevent damage to bark. Boards are to be strapped to trees, not nailed or screwed.

2 Rumble boards should be of a suitable thickness to prevent soil compaction and root damage.

Image 6: An image from AS4970-2009,[11] with example tree protection.

11.7 **Restricted Activities Inside the 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. Refuelling.
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.

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

11.7.1 **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 located machinery outside the TPZ of the trees to be retained, ground protection will be required. The demolition be undertaken inwards into the footprint of the existing structures, sometimes referred to as the 'top down, pull back' method.

11.7.2 **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 the 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 than 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 sharp tool in accordance with AS4373 Pruning of amenity trees (2007).[12] 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.

11.7.3 **Landscaping:** All landscaping works within the TPZ of trees to be retained are to be undertaken in consultation with a Consulting Arborist to minimise the impact to trees. General guidance is provided below to minimise the impact of new landscaping to trees to be retained.

- All excavations for landscaping works should be manual and in accordance with section 11.9.
- Replacement planting for all trees recommended for removal should be incorporated into the landscape plan. It is recommended that at minimum one tree for each tree proposed to be removed are planted to maintain/increase overall canopy cover at the site when mature. Any replacement tree must be selected in accordance with AS2303-2018 Tree stock for landscape use.
- The location of new plantings inside the TPZ of trees to be retained should be flexible to avoid unnecessary damage to tree roots greater than 40mm in diameter.
- Level changes should be minimised. The existing ground levels within the landscape areas should not be lowered by more than 50mm or increased by more 100mm without assessment by a Consulting Arborist.
- New retaining walls should be avoided. Where new retaining walls are proposed inside the TPZ of trees to be retained, they should be constructed from tree

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

sensitive materials, such as timber sleepers, that require minimal footings/excavations. If brick retaining walls are proposed inside the TPZ, consider pier and beam type footings to bridge significant roots that are critical to the tree's condition. Retaining walls must be located outside the SRZ and sleepers/beams located above existing soil grades.

- New footpaths and hard surfaces should be minimised, as they can limit the availability of water, nutrients, and air to the tree's root system. Where they are proposed, they should be constructed on or above existing soil grades to minimise root disturbance and consider using a permeable surface. Footpaths should be located outside the SRZ.
- Where fill/sub-base is used inside the TPZ, fill material should be a coarse granular material that does not restrict the flow of water and air to the root system below. This type of material will also reduce the impact of soil compaction during construction.
- Any new fencing in the TPZ of trees should be constructed carefully to avoid impacting significant roots. The location of fence posts should be flexible to allow for the retention of roots greater than 40mm in diameter. The base of the fence panels should be located above the existing soil grades.

11.7.4 **Underground Services:** Where possible, underground services should be located outside the TPZ of trees to be retained. All underground services located inside the TPZ of any tree to be retained must be installed via tree sensitive techniques. This should include either directional drilling methods or manual excavations to minimise the impact to the trees identified for retention. No roots greater than 30mm in diameter should be severed during the installation of service pipes unless approved in writing by the Project Arborist.

11.7.5 **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.

11.7.6 **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.

11.7.7 **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.

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 check 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 Points	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 measure and resolve any issues in relation to feasibility of tree protection requirements that may arise. Project Arborist to mark all trees approved for removal under DA consent.	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 carry out regular site inspections to ensure works are carried out in accordance with the recommendations. Site inspections are recommended on a monthly frequency.	On-going throughout 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 in diameter inside the 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/Landscaping	
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 the condition are identified, the Project Arborist should provide recommendations for remediation	Upon completion of development works.	

13. BIBLIOGRAPHY/REFERENCES

- Council Of Standards Australia, AS4970 Protection of trees on development sites (2009).
- Council Of Standards Australia, AS4373 Pruning of amenity trees (2007).
- Mattheck, C. & Breloer, H., The body language of trees - A handbook for failure analysis, The Stationary Office, London, England (1994).
- Lonsdale, D., Principles of tree hazard assessment and management, The Stationary Office, London, England (1999).
- Matheny, N. & Clark, J. R, A technical guide to preservation of trees during land development, International Society of Arboriculture, P.O Box 3029, Champaign, IL, USA (1998).
- 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
- Barrell Tree Consultancy, Tree AZ version 10.10-ANZ, http://www.treeaz.com/.
- Warringah Local Environmental Plan LEP 2011, https://legislation.nsw.gov.au/view/html/inforce/current/epi-2011-0649.
- Warringah DCP 2011, https://eservices.northernbeaches.nsw.gov.au/ePlanning/live/pages/plan/Book.aspx?exhibit=DCP&hid=192.

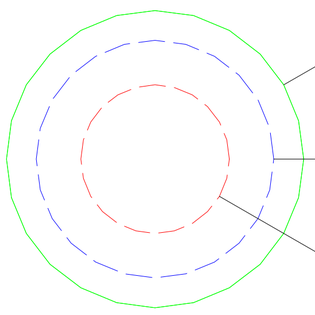
14. LIST OF APPENDICES

The following are included in the appendices:

- Appendix 1A: Existing Site Plan
- Appendix 1B: Proposed Basement Plan
- Appendix 1C: Proposed Master Landscape Plan
- Appendix 2: Tree Inspection Schedule
- Appendix 3: Further Information of Methodology
- Appendix 4: Glossary of Terms

Plan Title: Appendix 1B - Proposed Site Plan

Tree Legend



0 40m

Urban Arbor Pty Ltd

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

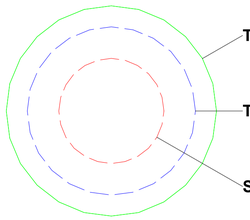
Site Location: Forestville RSL Club
22 Melwood Avenue, Forestville NSW

SCALE :	DATE :
1 : 300 @ A1	8/15/2024

Prepared By: Alex Kurath

Appendix 1A: Existing Site Plan

Tree Legend



0 30m

Urban Arbor Pty Ltd

PO Box 450, Turramurra NSW 2074
Phone: 02 8004 2802, Email: sales@urbanarbor.com.au

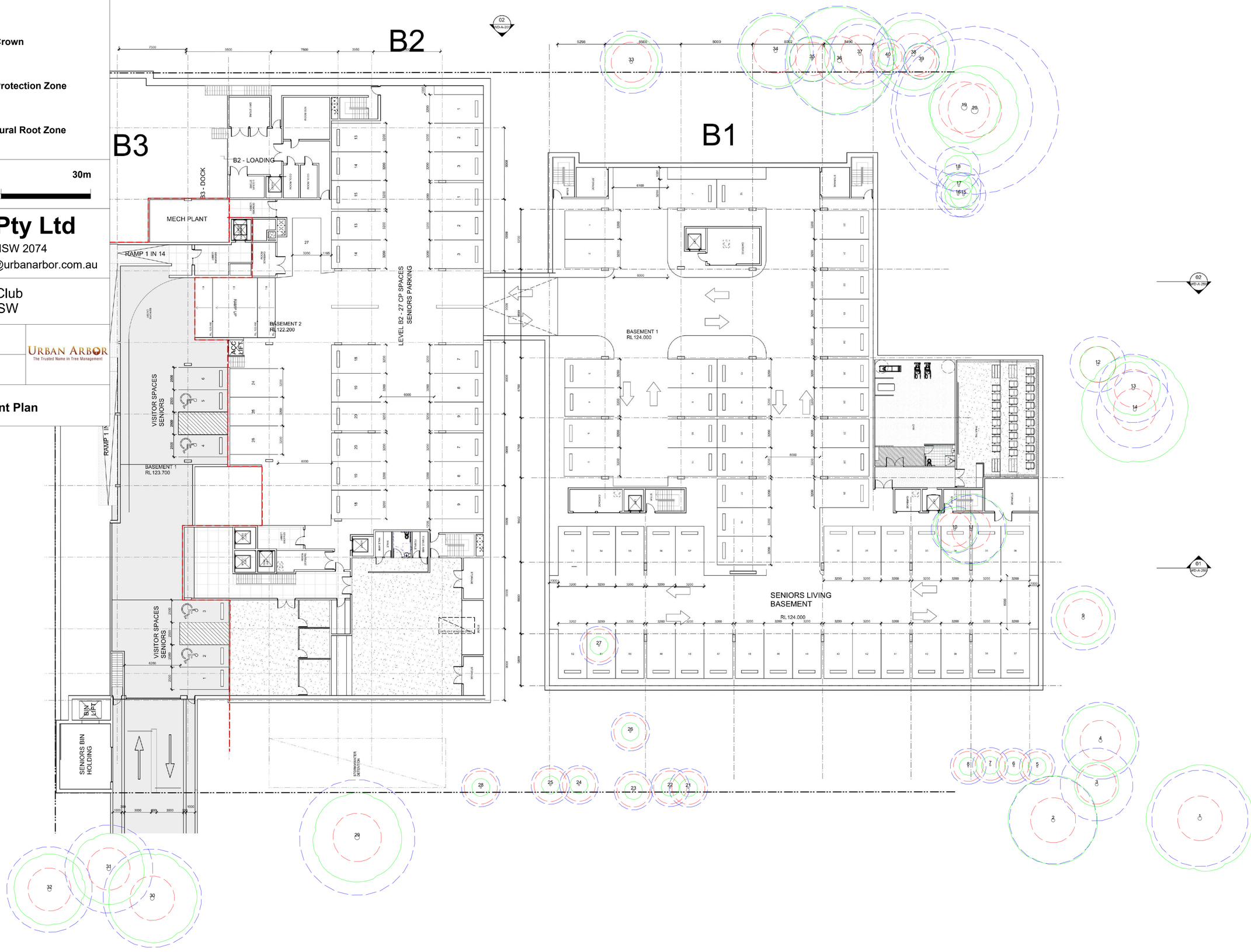
Site Location: Forestville RSL Club
22 Melwood Ave, Forestville NSW

SCALE :	DATE :
1 : 200 @ A1	25/09/2024

URBAN ARBOR
The Trusted Name in Tree Management

Prepared By: Alex Kurath

Appendix 1B: Proposed Basement Plan



Tree Legend

- TPZ Fencing
- Trunk Protection
- Tree Crown
- Tree Protection Zone
- Structural Root Zone

0 — 30m

Urban Arbor Pty Ltd

PO Box 450, Turramurra NSW 2074
Phone: 02 8004 2802, Email: sales@urbanarbor.com.au

Site Location: Forestville RSL Club
22 Melwood Avenue, Forestville NSW

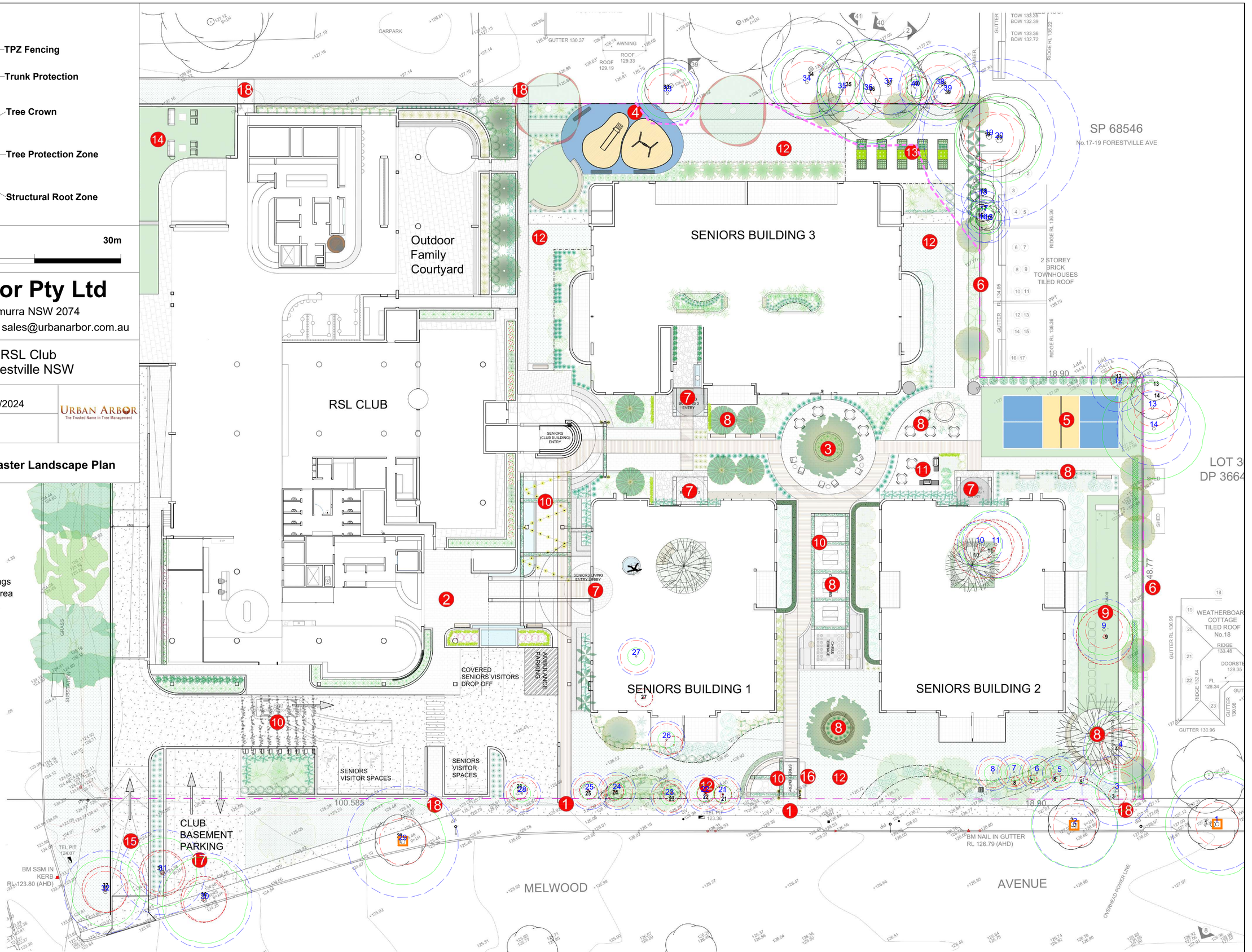
SCALE :	DATE :
1 : 200 @ A1	25/09/2024

Prepared By: Alex Kurath

URBAN ARBOR
The Trusted Name in Tree Management

Appendix 1C: Proposed Master Landscape Plan

1. Pedestrian entry to seniors buildings
2. Public cafe - takeaway / seating area
3. Central Courtyard - yarning circle, communal seating
4. Chicldrens Playground
5. Pickleball court
6. New screen planting
7. Entry to Seniors Living Lobby
8. Seniors Communal Seating Area
9. Bowling green
10. Climber over pergola
11. BBQ Common Area
12. Open Turf
13. Seniors Vegetable Gardens
14. Outdoor Cinema , seating area
15. Carpark Entry
16. Club basement parking
17. Mailboxes
18. Pedestrian paths



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	Queensland Brushbox	*Lophostemon confertus*	Mature	10	6	450	0	0	0	0	450	520	Good	Fair	High	2. Medium	A2	5.4	2.5	Located on nature strip. Central canopy remove for overhead power lines.
2	Queensland Brushbox	*Lophostemon confertus*	Mature	7	5	410	0	0	0	0	410	530	Good	Fair	Medium	2. Medium	Z10	4.9	2.5	Located on nature strip. Topped for power lines, with two taller branches on property side.
3	Coastal Banksia	*Banksia integrifolia*	Mature	7	2.5	340	0	0	0	0	340	380	Good	Fair	Low	2. Medium	Z10	4.1	2.2	Previously topped at 2m with epicormic regrowth.
4	Black Tea Tree	*Melaleuca bracteata*	Mature	6	4	360	0	0	0	0	360	410	Good	Fair	Medium	2. Medium	Z10	4.3	2.3	Previously topped at 2m and 4m with epicormic regrowth.
5	Italian Cypress	*Cupressus sempervirens Stricta*	Semi-mature	6	1	150	0	0	0	0	150	200	Good	Good	Low	5. Small/Young	Z3	2.0	1.7	Exempt from protection.
6	Italian Cypress	*Cupressus sempervirens Stricta*	Semi-mature	6	1	150	0	0	0	0	150	200	Good	Good	Low	5. Small/Young	Z3	2.0	1.7	Exempt from protection.
7	Italian Cypress	*Cupressus sempervirens Stricta*	Semi-mature	6	1	150	0	0	0	0	150	200	Good	Good	Low	5. Small/Young	Z3	2.5	1.7	Exempt from protection.
8	Italian Cypress	*Cupressus sempervirens Stricta*	Semi-mature	6	1	150	0	0	0	0	150	200	Good	Good	Low	5. Small/Young	Z3	2.0	1.7	Exempt from protection.
9	Coastal Banksia	*Banksia integrifolia*	Semi-mature	7	3	300	0	0	0	0	300	360	Good	Fair	Medium	2. Medium	Z10	3.6	2.2	Previously topped at 3m, with epicormic regrowth.
10	Coastal Banksia	*Banksia integrifolia*	Semi-mature	5	2.5	220	0	0	0	0	220	260	Good	Fair	Low	5. Small/Young	Z10	2.6	1.9	Asymmetric canopy due to adjacent tree.
11	Coastal Banksia	*Banksia integrifolia*	Semi-mature	6	4	320	0	0	0	0	320	360	Fair	Fair	Low	3. Short	Z4	3.8	2.2	Early stages of decline with dieback in canopy. Restricted root development due to kerb and guttering.
12	Coastal Banksia	*Banksia integrifolia*	Semi-mature	8	2	260	0	0	0	0	260	310	Good	Fair	Low	2. Medium	Z1	3.1	2.0	Not on survey.
13	Leyland Cypress	*X Cupressocyparis leylandii*	Mature	12	3	320	0	0	0	0	320	350	Good	Good	Medium	1. Long	Z3	3.8	2.1	Not on survey. Located on adjacent property. DBH estimated. Exempt from protection.
14	Blue Jacaranda	*Jacaranda mimosifolia*	Mature	10	6	280	0	200	100	0	358	450	Good	Fair	Medium	2. Medium	Z3	4.3	2.4	Not on survey. Located on adjacent property. DBH estimated. Exempt from protection.
15	Bangalow Palm	*Archontophoenix cunninghamiana*	Mature	7	1.5	200	0	0	0	0	200	0	Good	Good	Medium	1. Long	Z3	2.5	N/A	Located on adjacent property. DBH estimated. Exempt from protection.
16	Bangalow Palm	*Archontophoenix cunninghamiana*	Mature	7	1.5	200	0	0	0	0	200	0	Good	Good	Medium	1. Long	Z3	2.5	N/A	Located on adjacent property. DBH estimated. Exempt from protection.
17	Bangalow Palm	*Archontophoenix cunninghamiana*	Mature	7	1.5	200	0	0	0	0	200	0	Good	Good	Medium	1. Long	Z3	2.5	N/A	Located on adjacent property. DBH estimated. Exempt from protection.
18	Bangalow Palm	*Archontophoenix cunninghamiana*	Mature	7	1.5	200	0	0	0	0	200	0	Good	Good	Medium	1. Long	Z3	2.5	N/A	Located on adjacent property. DBH estimated. Exempt from protection.
19	Broad Leaved Paperbark	*Melaleuca quinquenervia*	Mature	14	4	400	500	0	0	0	640	700	Good	Good	High	1. Long	A1	7.7	2.8	Located on adjacent property. DBH estimated.
20	Smooth Barked Apple	*Angophora costata*	Mature	17	5	350	700	0	0	0	783	800	Good	Good	High	1. Long	A1	9.4	3.0	Not on survey. Located on adjacent property. DBH estimated.
21	Italian Cypress	*Cupressus sempervirens Stricta*	Semi-mature	7	1	180	0	0	0	0	180	250	Good	Good	Low	5. Small/Young	Z3	2.2	1.8	Exempt from protection. DBH estimated.
22	Italian Cypress	*Cupressus sempervirens Stricta*	Semi-mature	7	1	180	0	0	0	0	180	250	Good	Good	Low	5. Small/Young	Z3	2.2	1.8	Exempt from protection. DBH estimated.
23	Italian Cypress	*Cupressus sempervirens Stricta*	Semi-mature	7	1	180	0	0	0	0	180	250	Good	Good	Low	5. Small/Young	Z3	2.2	1.8	Exempt from protection. DBH estimated.
24	Italian Cypress	*Cupressus sempervirens Stricta*	Semi-mature	7	1	180	0	0	0	0	180	250	Good	Good	Low	5. Small/Young	Z3	2.2	1.8	Exempt from protection. DBH estimated.
25	Italian Cypress	*Cupressus sempervirens Stricta*	Semi-mature	7	1	180	0	0	0	0	180	250	Good	Good	Low	5. Small/Young	Z3	2.2	1.8	Exempt from protection. DBH estimated.
26	Italian Cypress	*Cupressus sempervirens Stricta*	Semi-mature	7	1	180	0	0	0	0	180	250	Good	Good	Low	5. Small/Young	Z3	2.2	1.8	Exempt from protection. DBH estimated.
27	Italian Cypress	*Cupressus sempervirens Stricta*	Semi-mature	7	1	180	0	0	0	0	180	250	Good	Good	Low	5. Small/Young	Z3	2.2	1.8	Exempt from protection. DBH estimated.

Appendix 2 - Tree Inspection Schedule

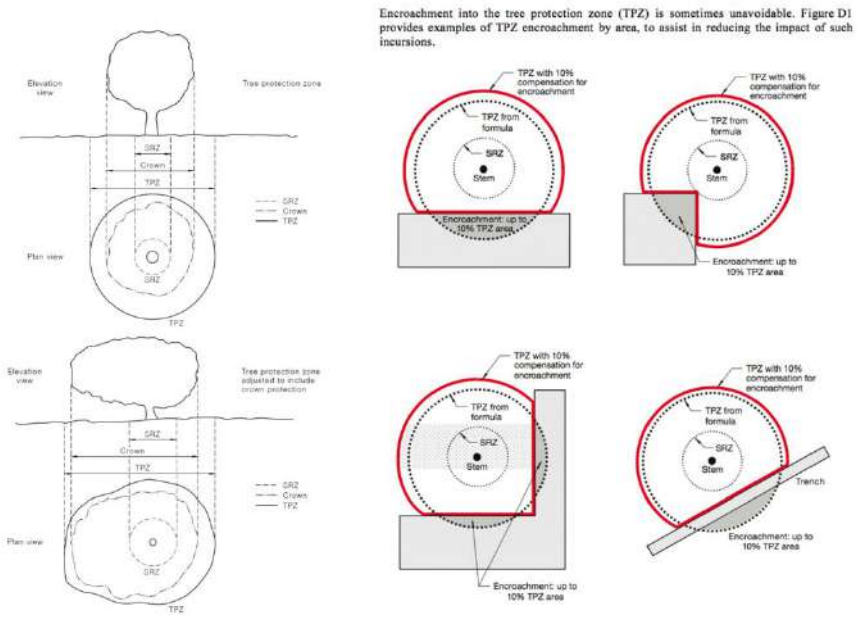
28	Italian Cypress	*Cupressus sempervirens Stricta*	Semi-mature	7	1	180	0	0	0	0	180	250	Good	Good	Low	5. Small/Young	Z3	2.2	1.8	Exempt from protection. DBH estimated.
29	Queensland Brushbox	*Lophostemon confertus*	Mature	13	5	540	0	0	0	0	540	620	Good	Fair	High	1. Long	A1	6.5	2.7	Located on nature strip. Asymmetric canopy due to power line pruning.
30	Queensland Brushbox	*Lophostemon confertus*	Mature	12	5	460	0	0	0	0	460	510	Good	Good	High	1. Long	A1	5.5	2.5	Located on nature strip.
31	Queensland Brushbox	*Lophostemon confertus*	Mature	13	4	320	260	0	0	0	412	450	Fair	Fair	High	2. Medium	A2	4.9	2.4	Located on nature strip. Reduced foliage density for the species.
32	Queensland Brushbox	*Lophostemon confertus*	Mature	10	4	400	0	0	0	0	400	470	Poor	Fair	Medium	4. Remove	Z4	4.8	2.4	Located on nature strip. Very low foliage density with approximately 20% live foliage and tip dieback.
33	Brush Cherry	*Syzygium australe*	Mature	6	3	180	130	190	0	0	292	400	Fair	Fair	Medium	2. Medium	Z2	3.5	2.3	Located on adjacent property. Minor apical dieback. Codominant stems at base. Within 2m of building.
34	Brush Cherry	*Syzygium australe*	Mature	11	4	210	130	200	120	100	354	500	Good	Fair	Medium	1. Long	A1	4.2	2.5	Located in dog park. Multi trunked at base. DAB estimated.
35	Brush Cherry	*Syzygium australe*	Mature	7	2.5	140	160	0	0	0	213	260	Good	Fair	Low	2. Medium	Z10	2.6	1.9	Located in dog park. Stem on RSL side previously topped at 3m.
36	Sydney Blue Gum	*Eucalyptus saligna*	Mature	19	6	510	0	0	0	0	510	600	Good	Good	High	1. Long	A1	6.1	2.7	Located in adjacent property.
37	Sydney Blue Gum	*Eucalyptus saligna*	Semi-mature	17	4	280	0	0	0	0	280	360	Good	Good	High	1. Long	A1	3.4	2.2	Located on adjacent property.
38	Silky Oak	*Grevillea robusta*	Mature	18	4	390	0	0	0	0	390	450	Good	Good	High	1. Long	Z3	4.7	2.4	Located on adjacent property. Exempt from protection.
39	Broad Leaved Paperbark	*Melaleuca quinquenervia*	Semi-mature	7	2	170	0	0	0	0	170	210	Good	Good	Low	5. Small/Young	Z10	2.0	1.7	Located on adjacent property. Suppressed by adjacent trees.
40	Broad Leaved Paperbark	*Melaleuca quinquenervia*	Semi-mature	6	1	140	0	0	0	0	140	170	Good	Good	Low	5. Small/Young	Z10	2.0	1.6	Located on adjacent property. Suppressed by adjacent trees

Explanatory Notes

Tree Species - 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 x 50) $^{0.42}$ x 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

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 by twelve. 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 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 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 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 of the crown projection.
2. **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.
3. **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 sized roots, or if it can be demonstrated that significant roots will not be impacted.



4. **Structural Root Zone:** This is the area around the base of a tree required for the tree's stability in the ground. An area larger than the SRZ always needs to be maintained to preserve a viable tree as it will only have a minor effect on the tree's 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 can be determined from the diameter of the trunk measured immediately above the root buttresses. Root investigations could provide more information about the extent of the SRZ. The following formula should be used to calculate the SRZ:

   SRZ Radius = $(D \times 50)^{0.42} \times 0.64$, where D = diameter above root buttress.

5. **Tree Age Class:** It can be difficult to determine the age of a tree without carrying out invasive tests that may damage the tree, so we have categorised their 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.
   - 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.

6. **Health and Physiological Condition:** Below are example 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 likely 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 reaction 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 tree's health.
Poor	• The tree 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 the species. • Pathogens or pests are having a significant detrimental effect on the tree's 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.

7. **Structural Condition:** Below are example conditions sued 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 have 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 to 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 tree failure.

8. **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 statutory conditions.
- The habitat value of the tree.
- Whether the tree is considered a noxious weed species.

The amenity value is then rated using one of the following categories:

- Very High
- High
- Moderate
- Low
- Very Low

9. Safe Useful Life Expectancy – SULE, (Barrel, 2001): A tree's 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 for retention in the existing situation.

Category	Description
1. Long – Over 40 years	a) Structurally sound trees located in positions that 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 plantings. 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 5 metres in height. b) Young trees less than 15 years old but over 5 metres in height. c) Formal hedges and trees intended for regular pruning to artificially control growth.

10. Root Investigations: The root investigations should identify roots greater than 30mm in diameter that are located along the edge of the structure's 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 be 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 with a minimum AQF Level 3. 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 the investigation, including photographs as supporting evidence in the report.

11. **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 Field Sheet (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.

APPENDIX 4: GLOSSARY OF TERMS

Abiotic[1] – 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 of 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 the natural tree shape as far as possible.

Diameter Above Buttress (DAB) – 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, this is usually caused by pathogenic micro-organisms.

Dominance – In tree, 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, this is the loss of physiological function, especially water conduction in sapwood.

Diameter at Breast Height (DBH) – Stem diameter measured at a height of 1.4 metres or the nearest measurable point. Where measurement at

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

a height of 1.4 metres is not possible, another height may be specified.

Deadwood – A branch or stem 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 bark branch 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.

Habitat – The overall growth characteristics and 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.

Heartwood/False-heartwood – The dead central wood that 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 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 synthesising 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 plan 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 occurs in response to an 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, e.g. a lack of water, inadequate nutrition, or extreme of temperature.

Structural Root Zone (SRZ) – the area around the base of the tree required for tree’s 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 the 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 a major portion 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.

Tree Protection Zone (TPZ) – 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 grown 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. -

White Rot – A range of kinds of wood decay in which lignin together with cellulose and other wood constituent 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.