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Arboricultural Impact Assessment Report

Site Location:
The Crest - Stage 2 Oxford Falls NSW

Prepared for:
Gelder Architects

Prepared by: Jack Williams Urban Arbor Pty Ltd PO Box 450 Turramurra NSW 2074
Date Prepared: 31 October 2019
Our Ref: 19/10/31/100MAOF

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1. INTRODUCTION

1.1 Urban Arbor have been instructed by Gelder Architects to provide an Arboricultural Impact Assessment Report for trees located at the site and adjoining neighbouring sites in relation to a proposed development.

1.2 Below is a list of all documents and information provided for assessment in this report;

A) Plan of Details and Levels, Hill and Blume, 12 June 2018.
B) Architectural Plans, Gelder Architects, Issue D - 30 September 2019, Drawings DA00, DA01, DA02, DA03, DA04, DA05, DA06, DA07, DA08, DA09 and DA10.

1.3 The site and tree inspections were carried out on 23 October 2019. Access was available to the subject site and adjoining public areas only.

2. SCOPE OF THE REPORT

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

2.1.1 Conduct a ground level visual assessment of all significant trees located within 10 metres of stage 2 development works from ground level. For the purpose of this report, a significant tree is a tree with a height 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 stage 2 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 for trees to be retained in accordance with AS4970 Protection of trees on development sites (2009).

3. LIMITATIONS

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

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

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

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

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

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

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

3.8 Alteration of this report invalidates the entire report.

4. METHODOLOGY

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

4.1.1 Tree common name

4.1.2 Tree botanical name

4.1.3 Tree age class

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

4.1.5 Estimated height - metres

4.1.6 Estimated crown spread (diameter of crown) - metres

4.1.7 Health

4.1.8 Structural condition

4.1.1 Amenity value

4.1.2 Estimated remaining contribution years (SULE)[1]

4.1.3 Retention value (Tree AZ)[2]

4.1.4 Notes/comments

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

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

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

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

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

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

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

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

5. SITE LOCATION AND BRIEF DESCRIPTION

5.1 The site is located in the suburb of Oxford Falls, New South Wales, which is located in the Northern Beaches Council area. All trees at the site are subject to protection under the Warringah Local Environmental Plan (LEP) 2011[5] and Warringah Development Control Plan (DCP) 2011.[6] The site is not located inside a Heritage Conservation Area and does not form part of a heritage item in the LEP heritage maps.[7]

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

[5] *Warringah Local Environmental Plan 2011,* https://legislation.nsw.gov.au/#/view/EPI/2011/649, accessed 31 October 2019.

[6] *Warringah Development Control Plan 2011,* https://eservices.northernbeaches.nsw.gov.au/ePlanning/live/pages/plan/book.aspx?exhibit=DCP, accessed 31 October 2019.

[7] *Warringah LEP Heritage Mapping - Sheet Her_007,* https://legislation.nsw.gov.au/maps/25bec6cb-4aa5-44f0-9bc3-e74eb764f61e/1800_COM_HER_007_020_20161221.pdf, accessed 31 October 2019.

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

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

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

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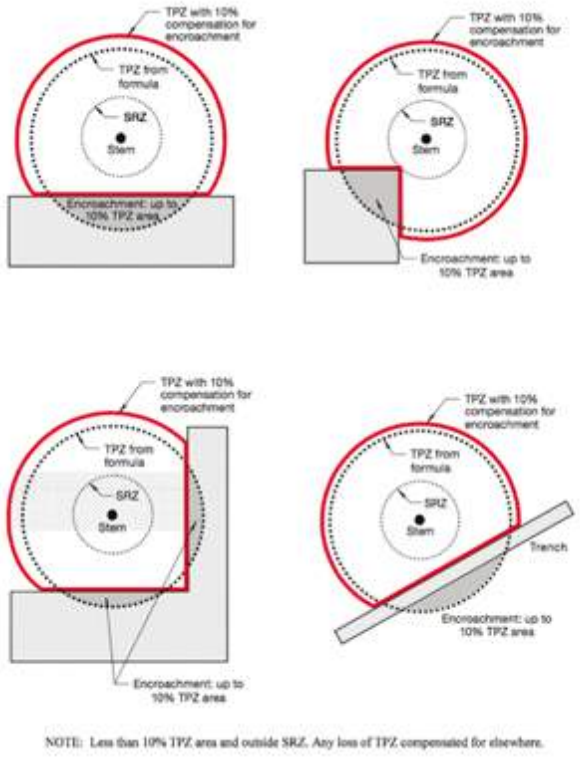

Image 1: Example minor TPZ encroachment from AS4970-2009.

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

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

7.2 **Site plan:** In appendix 1 a site plan has been prepared, where the tree information including canopy spread, TPZ and SRZ have been overlaid onto the proposed site 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, excavations and hard landscaping only. Level changes/proposed excavation is based on the excavation plan (drawing DA10)only, no bulk earthworks plan has been assessed. All soft landscaping should be completed in accordance with section 11.10.

Tree ID	Botanical Name	Retention value	TPZ radius (m)	TPZ area (m^2)	SRZ radius (m)	TPZ encroachment	Discussion/ Conclusion	Recommendation
1	*Eucalyptus haemastoma*	Z10	3.8	46.3	2.2	None	No encroachment into the TPZ.	Retain and protect
2	*Eucalyptus sieberi*	A1	3.3	33.7	2.1	None	No encroachment into the TPZ.	Retain and protect
3	*Callistemon spp*	Z1	2.3	16.3	1.8	None	No encroachment into the TPZ.	Retain and protect
4	*Pittosporum undulatum*	Z10	3.1	30.6	2.0	None	No encroachment into the TPZ.	Retain and protect
5	*Eucalyptus punctata*	A2	6.2	122.3	2.6	None	No encroachment into the TPZ.	Retain and protect
6	*Eucalyptus punctata*	A2	5.7	101.8	2.8	None	No encroachment into the TPZ.	Retain and protect
7	*X Cupressocyparis leylandii*	Z3	7.7	185.3	2.9	Minor	The proposed area of cut encroaches into the TPZ by less than 5%, which is minor TPZ encroachment and will not impact the tree.	Retain and protect
8	*Eucalyptus punctata*	A2	4.3	58.6	2.3	None	No encroachment into the TPZ.	Retain and protect
9	*Eucalyptus punctata*	A4	11.2	391.3	3.3	None	No encroachment into the TPZ.	Retain and protect
10	*Eucalyptus punctata*	ZZ 4	3.7	43.5	2.1	None	No encroachment into the TPZ. Dead tree in close proximity to development to be removed.	Remove

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Tree ID	Botanical Name	Retention value	TPZ radius (m)	TPZ area (m^2)	SRZ radius (m)	TPZ encroachment	Discussion/ Conclusion	Recommendation
11	*Eucalyptus saligna*	A2	8.9	246.6	3.2	None	No encroachment into the TPZ.	Retain and protect
12	*Eucalyptus saligna*	AA	12.7	508.3	3.5	None	No encroachment into the TPZ.	Retain and protect
13	*Eucalyptus saligna*	A2	4.3	58.6	2.3	None	No encroachment into the TPZ.	Retain and protect
14	*Eucalyptus saligna*	A1	4.3	58.6	2.2	Minor	A proposed area of cut encroaches into the TPZ by 11% (6.2m^2) but not into the SRZ, however the area of cut is within 0.5m of the SRZ, and over excavation would potentially impact the tree. The building encroaches closer to the trunk, and encroaches by a total of 18% and into the SRZ. The existing driveway is located directly adjacent to the trunk, and removal of the driveway and re landscaping of the area will potentially impact the tree. The tree is likely to be impacted by the development and is recommended to be removed.	Remove
15	*Eucalyptus haemastoma*	Z5	5.6	99.9	2.7	Major	A proposed building/area of cut encroaches into the TPZ by 21% (21.2m^2) and into the SRZ, indicating that the condition and stability of the tree will be impacted.	Remove
16	*Syagrus romanzoffiana*	Z3	2.5	19.6	N/A	Footprint	Trunk within footprint of building/area of cut.	Remove
17	*Corymbia torelliana*	ZZ 5	7.3	168.3	2.9	Footprint	Trunk within footprint of building/area of cut.	Remove
18	*Corymbia torelliana*	A1	8.3	215.4	3.0	Footprint	Trunk within footprint of building/area of cut.	Remove
19	*Syagrus romanzoffiana*	Z3	2.5	19.6	N/A	Footprint	Trunk within footprint of driveway/area of cut.	Remove
20	*Acmena smithii*	A2	5.8	105.9	2.8	Footprint	Trunk within footprint of driveway/area of cut.	Remove
21	*Cupressus torulosa*	Z3	5.4	91.6	2.4	Major	Trunk directly adjacent to the driveway/area of cut.	Remove

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Tree ID	Botanical Name	Retention value	TPZ radius (m)	TPZ area (m^2)	SRZ radius (m)	TPZ encroachment	Discussion/ Conclusion	Recommendation
22	*Eucalyptus saligna*	AA	6.2	122.3	2.7	Major	A proposed building/area of cut encroaches into the TPZ by 38% (46.7m^2) and into the SRZ, indicating that the condition and stability of the tree will be impacted.	Remove
23	*Eucalyptus punctata*	ZZ 4	3.8	46.3	2.1	Major	A proposed building/area of cut encroaches into the TPZ by 36% (16.7m^2) and into the SRZ, indicating that the condition and stability of the tree will be impacted.	Remove
24	*Eucalyptus punctata*	Z10	5.8	105.0	2.9	Footprint	Trunk within footprint of building/area of cut.	Remove
25	*Angophora floribunda*	A1	3.5	38.0	2.1	Major	A proposed building/area of cut encroaches into the TPZ by 41% (15.6m^2) and into the SRZ, indicating that the condition and stability of the tree will be impacted.	Remove
26	*Eucalyptus saligna*	A1	3.8	46.3	2.2	None	No encroachment into the TPZ.	Retain and protect
27	*Corymbia gummifera*	ZZ 4	2.9	26.1	2.0	None	No encroachment into the TPZ. Dead tree in close proximity to development to be removed.	Retain and protect
28	*Dead Tree*	ZZ 4	10.2	326.9	3.1	Major	A proposed building/area of cut encroaches into the TPZ by more than 10%. Dead tree in close proximity to development to be removed.	Remove
29	*Corymbia gummifera*	Z10	5.8	104.2	2.5	Minor	The proposed building/area of cut encroaches into the TPZ by less than 5%, which is minor TPZ encroachment and will not impact the tree.	Retain and protect
30	*Dead Tree*	ZZ 4	4.0	50.0	2.3	None	No encroachment into the TPZ. Dead tree in close proximity to development to be removed.	Retain and protect
31	*Corymbia gummifera*	A2	3.6	40.7	2.1	None	No encroachment into the TPZ.	Retain and protect
32	*Eucalyptus punctata*	A1	4.7	68.8	2.3	None	No encroachment into the TPZ.	Retain and protect
33	*Corymbia gummifera*	AA	5.6	99.9	2.6	None	No encroachment into the TPZ.	Retain and protect

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Tree ID	Botanical Name	Retention value	TPZ radius (m)	TPZ area (m^2)	SRZ radius (m)	TPZ encroachment	Discussion/ Conclusion	Recommendation
34	*Corymbia gummifera*	A1	3.2	33.0	2.0	None	No encroachment into the TPZ.	Retain and protect
35	*Corymbia gummifera*	Z10	2.4	18.1	1.8	None	No encroachment into the TPZ.	Retain and protect
36	*Corymbia gummifera*	A1	7.4	170.1	2.9	None	No encroachment into the TPZ.	Retain and protect
37	*Corymbia gummifera*	A2	4.6	65.3	2.3	None	No encroachment into the TPZ.	Retain and protect
38	*Corymbia gummifera*	Z4	2.9	26.1	1.9	None	No encroachment into the TPZ.	Retain and protect
39	*Eucalyptus punctata*	A2	3.7	43.5	2.1	None	No encroachment into the TPZ.	Retain and protect
40	*Eucalyptus haemastoma*	A1	5.3	87.6	2.5	None	No encroachment into the TPZ.	Retain and protect
41	*Corymbia gummifera*	A1	2.6	21.9	1.8	None	No encroachment into the TPZ.	Retain and protect
42	*Corymbia gummifera*	AA	4.6	65.3	2.4	None	No encroachment into the TPZ.	Retain and protect
43	*Corymbia gummifera*	Z10	3.4	35.5	2.1	None	No encroachment into the TPZ.	Retain and protect
44	*Eucalyptus saligna*	Z1	2.0	12.6	1.6	Major	A proposed building/area of cut encroaches into the TPZ by 20% (2.5m^2) and into the SRZ, indicating that the condition and stability of the tree will be impacted.	Remove
45	*Corymbia gummifera*	Z10	3.0	28.3	1.9	Major	A proposed building/area of cut encroaches into the TPZ by 17% (4.9m^2) and into the SRZ, indicating that the condition and stability of the tree will be impacted.	Remove

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Tree ID	Botanical Name	Retention value	TPZ radius (m)	TPZ area (m^2)	SRZ radius (m)	TPZ encroachment	Discussion/ Conclusion	Recommendation
46	*Eucalyptus haemastoma*	A2	7.6	182.6	3.1	Major	A proposed building/area of cut encroaches into the TPZ by 30% (55.1m^2) and into the SRZ, indicating that the condition and stability of the tree will be impacted.	Remove
47	*Eucalyptus haemastoma*	Z10	2.3	16.7	1.8	Footprint	Trunk within footprint of building/area of cut.	Remove
48	*Eucalyptus haemastoma*	A2	6.3	123.0	2.9	Footprint	Trunk within footprint of building/area of cut.	Remove
49	*Eucalyptus haemastoma*	AA	9.8	300.4	3.0	Major	A proposed building/area of cut encroaches into the TPZ by 53% (159.1m^2) and into the SRZ, indicating that the condition and stability of the tree will be impacted.	Remove
50	*Corymbia gummifera*	Z10	2.0	12.6	1.6	Major	A proposed building/area of cut encroaches into the TPZ by 23% (2.9m^2) and into the SRZ, indicating that the condition and stability of the tree will be impacted.	Remove
51	*Eucalyptus haemastoma*	A1	3.6	40.7	2.1	Footprint	Trunk within footprint of building/area of cut.	Remove
52	*Eucalyptus punctata*	A1	3.7	43.5	2.1	Footprint	Trunk within footprint of building/area of cut.	Remove
53	*Eucalyptus punctata*	Z1	2.0	12.6	1.6	Major	A proposed building/area of cut encroaches into the TPZ by 19% (2.4m^2) and into the SRZ, indicating that the condition and stability of the tree will be impacted.	Remove
54	*Eucalyptus punctata*	Z1	2.0	12.6	1.6	None	No encroachment into the TPZ.	Retain and protect
55	*Eucalyptus punctata*	Z1	2.2	14.7	1.7	None	No encroachment into the TPZ.	Retain and protect
56	*Corymbia gummifera*	A1	2.5	20.0	1.8	None	No encroachment into the TPZ.	Retain and protect
57	*Eucalyptus haemastoma*	A1	3.7	43.5	2.1	None	No encroachment into the TPZ.	Retain and protect

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Tree ID	Botanical Name	Retention value	TPZ radius (m)	TPZ area (m^2)	SRZ radius (m)	TPZ encroachment	Discussion/ Conclusion	Recommendation
58	*Corymbia gummifera*	A2	5.0	78.8	2.8	Major	A proposed building/area of cut encroaches into the TPZ by 30% (23.9m^2) and into the SRZ, indicating that the condition and stability of the tree will be impacted.	Remove
59	*Eucalyptus sieberi*	A1	4.0	49.3	2.2	None	No encroachment into the TPZ.	Retain and protect
60	*Eucalyptus punctata*	Z10	2.0	13.1	1.7	None	No encroachment into the TPZ.	Retain and protect
61	*Eucalyptus punctata*	A1	2.8	23.9	1.9	None	No encroachment into the TPZ.	Retain and protect
62	*Eucalyptus punctata*	A1	3.3	35.1	2.1	None	No encroachment into the TPZ.	Retain and protect
63	*Corymbia gummifera*	A2	4.1	52.3	2.2	None	No encroachment into the TPZ.	Retain and protect
64	*Eucalyptus punctata*	Z10	3.4	36.3	2.2	None	No encroachment into the TPZ.	Retain and protect
65	*Corymbia gummifera*	Z4	4.0	50.5	2.8	None	No encroachment into the TPZ.	Retain and protect
66	*Eucalyptus punctata*	A1	3.5	38.0	2.1	None	No encroachment into the TPZ.	Retain and protect
67	*Eucalyptus punctata*	A2	2.0	13.1	1.7	None	No encroachment into the TPZ.	Retain and protect
68	*Corymbia gummifera*	A2	4.9	76.0	2.5	None	No encroachment into the TPZ.	Retain and protect
69	*Eucalyptus haemastoma*	A1	4.3	58.6	2.3	None	No encroachment into the TPZ.	Retain and protect
70	*Corymbia gummifera*	A1	3.2	33.0	2.0	None	No encroachment into the TPZ.	Retain and protect

9. CONCLUSIONS

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

Impact	Reason	Category A		Category Z	
		AA	A	Z	ZZ
Trees recommended to be removed	Building construction, new surfacing and/or proximity, trees in poor condition or re landscaping	22, 49 (two trees)	14, 18, 20, 25, 46, 48, 51, 52, 58 (Nine trees)	15, 16, 19, 21, 24, 44, 45, 47, 50, 53 (ten trees)	10, 17, 23, 28 (four trees)
Trees recommended to be retained	Removal of existing surfacing/structures and/or installation of new surfacing/structures will not impact the trees	12, 33, 42 (three trees)	2, 5, 6, 8, 9, 11, 13, 26, 31, 32, 34, 36, 37, 39, 40, 41, 56, 57, 59, 61, 62, 63, 66, 67, 68, 69, 70 (twenty-seven trees)	1, 3, 4, 7, 29, 35, 38, 43, 54, 55, 60, 64, 65 (thirteen trees)	27, 30 (two trees)

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10. RECOMMENDATIONS

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

10.2 In appendix 1 a site plan has been prepared, where the tree information including canopy spread, TPZ and SRZ have been overlaid onto the proposed site plan.

10.3 Twenty-five trees have been recommended for removal to accommodate the development, including tree 10, 14 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 28, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53 and 58. Eleven of these trees are higher value category A retention value trees (two are AA retention value), the other fourteen trees are lower value category Z retention value trees

10.4 The other forty-five trees can be retained in a viable condition, including tree 1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 26, 27, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 54, 55, 56, 57, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69 and 70.

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

10.6 No landscape plan has been assessed in this report. See section 11.10 for general guidance in relation to minimising the impact of proposed landscaping to retained trees and replacement tree planting.

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 in accordance 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.

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11. TREE PROTECTION REQUIREMENTS

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

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

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

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

11.5 **Site Specific Tree Protection Recommendations:** It is the responsibility of the principle contractor to install tree protection prior to works commencing at the site (prior to demolition works) and to ensure that the tree protection remains in adequate condition for the duration of the development. The tree protection must not be moved without prior agreement of the project Arborist. The project Arborist must inspect that the tree protection has been installed in accordance with this document and AS4970-2009 prior to works commencing. See section 11.6 for requirements of tree protection. See appendix 1C for indicative fencing location.

- Tree 1-12: Protective fencing should be installed to create a combined TPZ exclusion zone, the fencing should be aligned at the as close to the existing/proposed structures as practical. TPZ signage on fencing.
- Tree 13: Protective fencing should be at the extent of the TPZ/ aligned at the as close to the existing structures as practical. TPZ signage on fencing.
- 26-70: The existing site topography (rock slopes) will provide some protection for the these trees. Where the rock does not restrict access to the area near the trunks of the trees, TPZ fencing should aligned at the as close to the proposed structures as practical. The location of fencing should be agreed with the project arborist prior to construction works commencing. TPZ signage on fencing.

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11.6 Tree Protection Specifications:

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

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

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

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

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

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

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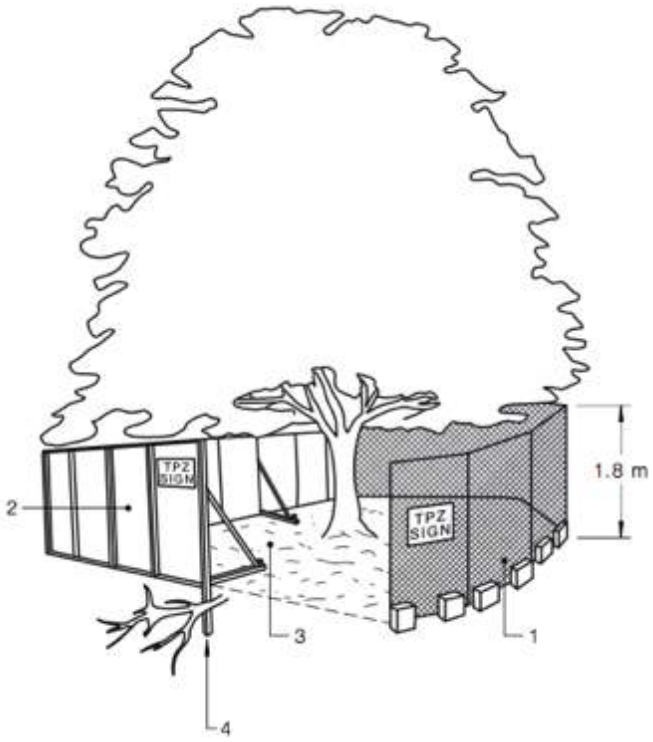

LEGEND:
1 Chain wire mesh panels with shade cloth (if required) attached, held in place with concrete feet.
2 Alternative plywood or wooden paling fence panels. This fencing material also prevents building materials or soil entering the TPZ.
3 Mulch installation across surface of TPZ (at the discretion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

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

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

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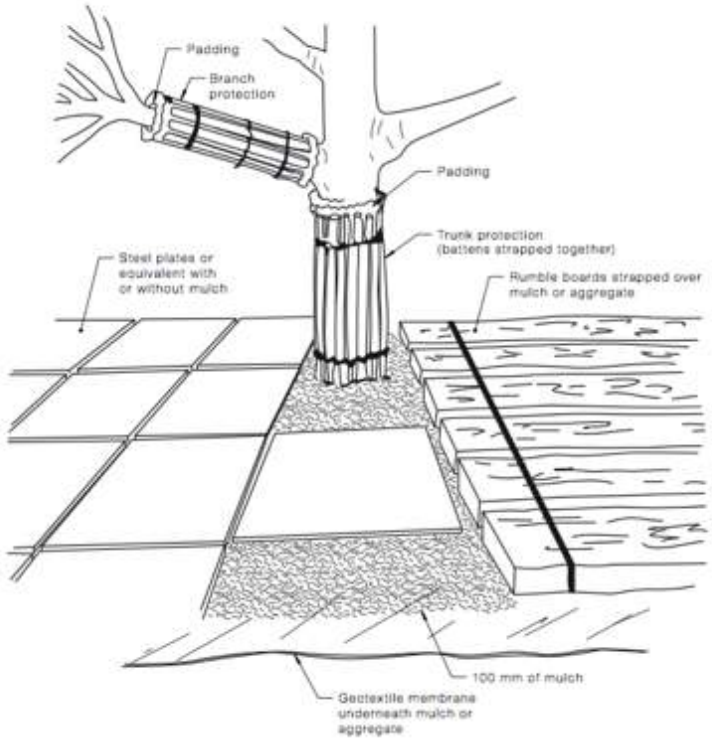

NOTES:

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.

An image from AS4970-2009,[9] with example tree protection.

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

A) Machine excavation.
B) Ripping or cultivation of soil.
C) Storage of spoil, soil or any such materials
D) Preparation of chemicals, including preparation of cement products.
E) 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.

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

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

11.9 **Excavations:** The project Arborist must supervise and certify that all excavations and root pruning are in accordance with AS4373-2007 and AS4970-2009. For continuous strip footings, first manual excavation is required along the edge of the structures closest to the subject trees. Manual excavation should be a depth of 1 metre (or to unfavourable root growth conditions such as bed rock or heavy clay, if agreed by project Arborist). Next roots must be pruned back in accordance with AS4373-2007. After all root pruning is completed, machine excavation is permitted within the footprint of the structure. For tree sensitive footings, such as pier and beam, all excavations inside the TPZ must be manual. Manual excavation may include the use of pneumatic and hydraulic tools, high-pressure air or a combination of high-pressure water and a vacuum device. No pruning of roots greater 30mm in diameter is to be carried out without approval of the project arborist. All pruning of roots greater than 30mm in diameter must be carried out by a qualified Arborist/Horticulturalist with a minimum AQF level 3. Root pruning is to be a clean cut with a sharp tool in accordance with AS4373 Pruning of amenity trees (2007).[10] The tree root is to be pruned back to a branch root if possible. Make a clean cut and leave as small a wound as possible.

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

- 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 AS2303-2015 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 30mm 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.

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

- 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 sensitive material, such as timber sleepers, that require minimal footings/excavations. If brick retaining walls are proposed inside the TPZ, considerer pier and beam type footings to bridge significant roots that are critical to the trees 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 trees 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. Footpath 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.

11.11 **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 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. Pipes should be threaded below/between retained roots within the service trenches.

11.12 **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.

11.13 **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.

11.14 **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.

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12. CONSTRUCTION HOLD POINTS FOR TREE PROTECTION

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

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

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13. BIBLIOGRAPHY/REFERENCES

- 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).
- *Warringah Local Environmental Plan 2011,* https://legislation.nsw.gov.au/#/view/EPI/2011/649.
- *Warringah Development Control Plan 2011,* https://eservices.northernbeaches.nsw.gov.au/ePlanning/live/pages/plan/book.aspx?exhibit=DCP, accessed 31 October 2019.
- 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/.

14. LIST OF APPENDICES

The following are included in the appendices:

- Appendix 1: Proposed Site Plan
- Appendix 2: Tree Inspection Schedule
- Appendix 3: Further Information of Methodology

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Site Location: The Crest - Stage 2
Oxford Falls NSW

SCALE :	DATE :
1 : 250 @ A1	10/31/2019

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Plan Title: Appendix 1 - Proposed Site Plan

Prepared by: Jack Williams, Urban Arbor Pty Ltd

Map Legend

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

0 40m

Appendix 2 - Tree Inspection Schedule

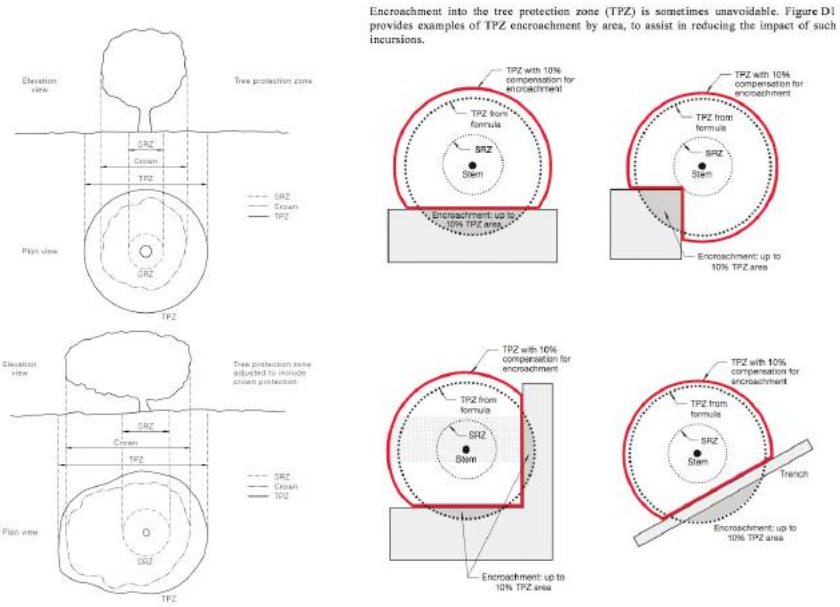
Tree ID	Common Name	Botanical Name	Age Class	Height (m)	Canopy Spread Radius (m)	Stem 1	Stem 2	Stem 3	Stem 4	Stem 5	DBH (mm)	DAB (mm)	Health	Structure	Amenity Value	SULE	Retention Value	TPZ Radius (m)	SRZ Radius (m)	Notes
1	Broad Leaved Scribbly Gum	*Eucalyptus haemastoma*	Mature	6	2	320					320	360	Fair	Poor	Medium	4. Remove	Z10	3.8	2.2	Whole crown has failed at 5m.
2	Silvertop Ash	*Eucalyptus sieberi*	Mature	10	3.5	250	110				273	340	Good	Fair	Medium	1. Long	A1	3.3	2.1	None.
3	Bottlebrush	*Callistemon spp*	Semi-mature	7	3	190					190	230	Fair	Fair	Low	3. Short	Z1	2.3	1.8	Low foliage density for species. .
4	Sweet Pittosporum	*Pittosporum undulatum*	Mature	5	2.5	260					260	290	Fair	Poor	Low	4. Remove	Z10	3.1	2.0	Poor suppressed form.
5	Grey Gum	*Eucalyptus punctata*	Mature	12	6	520					520	570	Good	Fair	High	2. Medium	A2	6.2	2.6	Trunk and crown covered by vine. Asymmetric crown shape with bias to NW.
6	Grey Gum	*Eucalyptus punctata*	Mature	12	7	390	270				474	680	Good	Fair	High	2. Medium	A2	5.7	2.8	Asymmetric crown shape with bias to NW. Significant deadwood in lower crown.
7	Leyland Cypress	*X Cupressocyparis leylandii*	Mature	11	3.5	640					640	720	Good	Good	Low	2. Medium	Z3	7.7	2.9	Exempt species.
8	Grey Gum	*Eucalyptus punctata*	Mature	10	4	360					360	400	Fair	Good	High	2. Medium	A2	4.3	2.3	Significant deadwood in crown (10-15%). Asymmetric crown shape with bias to NW.
9	Grey Gum	*Eucalyptus punctata*	Mature	20	11	930					930	1020	Fair	Fair	Very High	3. Short	A4	11.2	3.3	Wound with fungal bracket at 3m. Low foliage density and small foliage for species. Co-dominant stems at 1m with bark inclusion at union.
10	Grey Gum	*Eucalyptus punctata*	Mature	14	4	310					310	340	Poor	Poor	Low	4. Remove	ZZ4	3.7	2.1	Dead tree.
11	Sydney Blue Gum	*Eucalyptus saligna*	Mature	18	9	650	350				738	890	Fair	Fair	High	2. Medium	A2	8.9	3.2	Asymmetric crown shape with bias to N. Significant deadwood.
12	Sydney Blue Gum	*Eucalyptus saligna*	Mature	22	11	1060					1060	1120	Good	Good	Very High	1. Long	AA	12.7	3.5	Co-dominant stems at 1m.
13	Sydney Blue Gum	*Eucalyptus saligna*	Mature	14	5	360					360	400	Fair	Good	High	2. Medium	A2	4.3	2.3	Reduced foliage density for species.
14	Sydney Blue Gum	*Eucalyptus saligna*	Semi-mature	14	4	360					360	390	Good	Fair	High	1. Long	A1	4.3	2.2	Wound on trunk at 1m.
15	Broad Leaved Scribbly Gum	*Eucalyptus haemastoma*	Mature	9	4	470					470	600	Fair	Poor	High	4. Remove	Z5	5.6	2.7	Extensive decay at base of trunk. Health in decline.
16	Cocos Palm	*Syagrus romanzoffiana*	Mature	11	1.5	340					340	N/A	Good	Good	Low	2. Medium	Z3	2.5	N/A	Exempt species.
17	Cadaghi	*Corymbia torelliana*	Mature	14	7	610					610	720	Poor	Poor	Medium	4. Remove	ZZ5	7.3	2.9	Decay at base of trunk. Asymmetric crown shape with bias to the NW. 90% crown dieback.
18	Cadaghi	*Corymbia torelliana*	Mature	15	7	690					690	770	Good	Fair	High	2. Medium	A1	8.3	3.0	Asymmetric crown shape with bias to NW.
19	Cocos Palm	*Syagrus romanzoffiana*	Mature	12	1.5	390					390	N/A	Good	Good	Low	2. Medium	Z3	2.5	N/A	Exempt species.
20	Lilly Pilly	*Acmena smithii*	Mature	12	8	350	260	210			484	680	Fair	Good	High	2. Medium	A2	5.8	2.8	Reduced foliage density for species. Asymmetric crown shape with bias to NW.
21	Bhutan Cypress	*Cupressus torulosa*	Mature	14	3	450					450	470	Good	Fair	Medium	2. Medium	Z3	5.4	2.4	Co-dominant stems at 1m with bark inclusion at union. Exempt species.
22	Sydney Blue Gum	*Eucalyptus saligna*	Mature	18	8	520					520	590	Good	Good	High	1. Long	AA	6.2	2.7	None.
23	Grey Gum	*Eucalyptus punctata*	Mature	8	3	320					320	350	Poor	Fair	Medium	4. Remove	ZZ4	3.8	2.1	90% crown dieback.
24	Grey Gum	*Eucalyptus punctata*	Mature	9	8	360	320				482	720	Fair	Fair	High	3. Short	Z10	5.8	2.9	Suppressed form. Trunk diameter estimated.
25	Rough Barked Apple	*Angophora floribunda*	Mature	13	3	290					290	330	Good	Good	High	1. Long	A1	3.5	2.1	None.
26	Sydney Blue Gum	*Eucalyptus saligna*	Semi-mature	15	4	320					320	360	Good	Good	High	1. Long	A1	3.8	2.2	None.
27	Red Bloodwood	*Corymbia gummifera*	Mature	9	2	240					240	310	Poor	Poor	Low	4. Remove	ZZ4	2.9	2.0	Dead tree.
28	Dead Tree	*Dead Tree*	Dead	8	4	850					850	850	Poor	Poor	Low	4. Remove	ZZ4	10.2	3.1	Dead tree. Not marked on survey.
29	Red Bloodwood	*Corymbia gummifera*	Mature	14	8	480					480	530	Fair	Fair	High	3. Short	Z10	5.8	2.5	Fire damaged. 20% crown dieback (central stem).
30	Dead Tree	*Dead Tree*	Dead	9	3	230	240				332	400	Poor	Poor	Low	4. Remove	ZZ4	4.0	2.3	Dead tree. Not marked on survey.
31	Red Bloodwood	*Corymbia gummifera*	Mature	14	3.5	300					300	340	Good	Fair	High	2. Medium	A2	3.6	2.1	None.
32	Grey Gum	*Eucalyptus punctata*	Mature	10	5	390					390	440	Good	Good	High	1. Long	A1	4.7	2.3	None.
33	Red Bloodwood	*Corymbia gummifera*	Mature	15	6	470					470	540	Good	Good	High	1. Long	AA	5.6	2.6	None.
34	Red Bloodwood	*Corymbia gummifera*	Mature	9	3	270					270	300	Good	Fair	Medium	2. Medium	A1	3.2	2.0	Asymmetric crown shape with bias to SW.
35	Red Bloodwood	*Corymbia gummifera*	Semi-mature	8	2	200					200	220	Fair	Fair	Medium	3. Short	Z10	2.4	1.8	Co-dominant stems at 3m, both stems failed higher in crown.
36	Red Bloodwood	*Corymbia gummifera*	Mature	14	7	560	250				613	730	Fair	Good	High	2. Medium	A1	7.4	2.9	Reduced foliage density for species.
37	Red Bloodwood	*Corymbia gummifera*	Mature	14	6	380					380	430	Fair	Fair	High	3. Short	A2	4.6	2.3	Wound at base of trunk. Crown consists of 30% deadwood.
38	Red Bloodwood	*Corymbia gummifera*	Mature	10	2	240					240	270	Poor	Fair	Medium	4. Remove	Z4	2.9	1.9	80% crown dieback.

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
39	Grey Gum	*Eucalyptus punctata*	Mature	10	4	310					310	350	Fair	Fair	High	2. Medium	A2	3.7	2.1	Crown consists of 20% deadwood.
40	Broad Leaved Scribbly Gum	*Eucalyptus haemastoma*	Mature	10	5	440					440	500	Fair	Good	High	2. Medium	A1	5.3	2.5	None.
41	Red Bloodwood	*Corymbia gummifera*	Semi-mature	9	1.5	140	170				220	250	Good	Fair	Medium	1. Long	A1	2.6	1.8	Not marked on survey.
42	Red Bloodwood	*Corymbia gummifera*	Mature	17	5	380					380	450	Good	Good	High	1. Long	AA	4.6	2.4	None.
43	Red Bloodwood	*Corymbia gummifera*	Mature	13	5	280					280	320	Fair	Fair	High	3. Short	Z10	3.4	2.1	Asymmetric crown shape with bias to NW. Suppressed form.
44	Sydney Blue Gum	*Eucalyptus saligna*	Young	9	1.5	150					150	180	Good	Good	Medium	1. Long	Z1	2.0	1.6	Not marked on survey.
45	Red Bloodwood	*Corymbia gummifera*	Semi-mature	9	2	250					250	280	Fair	Fair	Medium	2. Medium	Z10	3.0	1.9	None.
46	Broad Leaved Scribbly Gum	*Eucalyptus haemastoma*	Mature	11	7	560	300				635	880	Good	Fair	High	2. Medium	A2	7.6	3.1	Asymmetric crown shape with bias to W.
47	Broad Leaved Scribbly Gum	*Eucalyptus haemastoma*	Semi-mature	9	2	170	90				192	250	Good	Fair	Medium	1. Long	Z10	2.3	1.8	Significant trunk lean to NW.
48	Broad Leaved Scribbly Gum	*Eucalyptus haemastoma*	Mature	10	5	440	280				522	750	Fair	Fair	High	2. Medium	A2	6.3	2.9	Asymmetric crown shape with bias to S.
49	Broad Leaved Scribbly Gum	*Eucalyptus haemastoma*	Mature	11	6	400	710				815	820	Good	Good	High	1. Long	AA	9.8	3.0	None.
50	Red Bloodwood	*Corymbia gummifera*	Semi-mature	8	1.5	150					150	180	Fair	Fair	Medium	3. Short	Z10	2.0	1.6	Suppressed form. Not marked on survey.
51	Broad Leaved Scribbly Gum	*Eucalyptus haemastoma*	Semi-mature	9	4	300					300	340	Good	Fair	Medium	2. Medium	A1	3.6	2.1	Trunk lean W. Wound on trunk at 1m.
52	Grey Gum	*Eucalyptus punctata*	Semi-mature	8	4	310					310	340	Good	Good	Medium	1. Long	A1	3.7	2.1	None.
53	Grey Gum	*Eucalyptus punctata*	Semi-mature	7	3	160					160	180	Good	Good	Medium	1. Long	Z1	2.0	1.6	Not marked on survey.
54	Grey Gum	*Eucalyptus punctata*	Semi-mature	7	1.5	150					150	170	Good	Good	Medium	1. Long	Z1	2.0	1.6	Not marked on survey.
55	Grey Gum	*Eucalyptus punctata*	Semi-mature	9	2.5	180					180	210	Good	Good	Medium	1. Long	Z1	2.2	1.7	Not marked on survey.
56	Red Bloodwood	*Corymbia gummifera*	Semi-mature	8	3	210					210	240	Good	Good	Medium	1. Long	A1	2.5	1.8	Trunk lean S.
57	Broad Leaved Scribbly Gum	*Eucalyptus haemastoma*	Mature	10	4	310					310	350	Good	Good	High	1. Long	A1	3.7	2.1	None.
58	Red Bloodwood	*Corymbia gummifera*	Mature	16	7	290	300				417	700	Fair	Good	High	2. Medium	A2	5.0	2.8	Reduced foliage density for species.
59	Silvertop Ash	*Eucalyptus sieberi*	Mature	12	4	330					330	370	Good	Good	High	1. Long	A1	4.0	2.2	None.
60	Grey Gum	*Eucalyptus punctata*	Semi-mature	8	2	170					170	200	Fair	Fair	Medium	2. Medium	Z10	2.0	1.7	Suppressed form. Not marked on survey.
61	Grey Gum	*Eucalyptus punctata*	Semi-mature	10	3	230					230	260	Good	Fair	Medium	1. Long	A1	2.8	1.9	Trunk lean W.
62	Grey Gum	*Eucalyptus punctata*	Semi-mature	9	4	260	100				279	350	Good	Fair	Medium	1. Long	A1	3.3	2.1	None.
63	Red Bloodwood	*Corymbia gummifera*	Mature	11	4	340					340	380	Fair	Fair	High	2. Medium	A2	4.1	2.2	None.
64	Grey Gum	*Eucalyptus punctata*	Semi-mature	8	4	190	210				283	390	Fair	Fair	Medium	3. Short	Z10	3.4	2.2	Suppressed form. Asymmetric crown shape with bias to NW.
65	Red Bloodwood	*Corymbia gummifera*	Mature	10	4	260	210				334	680	Fair	Fair	High	3. Short	Z4	4.0	2.8	Aerial termite nest. Health in decline.
66	Grey Gum	*Eucalyptus punctata*	Mature	11	4	290					290	330	Good	Fair	High	2. Medium	A1	3.5	2.1	Asymmetric crown shape with bias to W.
67	Grey Gum	*Eucalyptus punctata*	Semi-mature	10	3	170					170	200	Fair	Good	Medium	2. Medium	A2	2.0	1.7	Not marked on survey. Reduced foliage density for species.
68	Red Bloodwood	*Corymbia gummifera*	Mature	15	4	410					410	490	Fair	Fair	High	2. Medium	A2	4.9	2.5	None.
69	Broad Leaved Scribbly Gum	*Eucalyptus haemastoma*	Mature	11	5	360					360	400	Fair	Fair	High	2. Medium	A1	4.3	2.3	Asymmetric crown shape with bias to N. Reduced foliage density for species.
70	Red Bloodwood	*Corymbia gummifera*	Semi-mature	8	3	270					270	300	Good	Fair	Medium	2. Medium	A1	3.2	2.0	None.

Appendix 3 - Further Information of Methodology

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



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

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

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

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

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

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

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

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

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

Category	Description
1. Long - Over 40 years	(a) Structurally sound trees located in positions that can accommodate future growth. (b) Trees that could be made suitable for retention in the long term by remedial tree care. (c) Trees of special significance for historical, commemorative or rarity reasons that would warrant extraordinary efforts to secure their long term retention.
2. Medium - 15 to 40 years	(a) Trees that may only live between 15 and 40 more years. (b) Trees that could live for more than 40 years but may be removed for safety or nuisance reasons. (c) Trees that could live for more than 40 years but may be removed to prevent interference with more suitable individuals or to provide space for new planting. (d) Trees that could be made suitable for retention in the medium term by remedial tree care.
3. Short - 5 to 15 years	(a) Trees that may only live between 5 and 15 more years. (b) Trees that could live for more than 15 years but may be removed for safety or nuisance reasons. (c) Trees that could live for more than 15 years but may be removed to prevent interference with more suitable individuals or to provide space for new planting. (d) Trees that require substantial remedial tree care and are only suitable for retention in the short term.
4. Remove - Under 5 years	(a) Dead, dying, suppressed or declining trees because of disease or inhospitable conditions. (b) Dangerous trees because of instability or recent loss of adjacent trees. (c) Dangerous trees because of structural defects including cavities, decay, included bark, wounds or poor form. (d) Damaged trees that are clearly not safe to retain. (e) Trees that could live for more than 5 years but may be removed to prevent interference with more suitable individuals or to provide space for new planting. (f) Trees that are damaging or may cause damage to existing structures within 5 years. (g) Trees that will become dangerous after removal of other trees for the reasons given in (a) to (f). (h) Trees in categories (a) to (g) that have a high wildlife habitat value and, with appropriate treatment, could be retained subject to regular review.
5. Small/Young	(a) Small trees less than 5m in height. (b) Young trees less than 15 years old but over 5m in height. (c) Formal hedges and trees intended for regular pruning to artificially control growth.

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

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

TreeAZ Categories (Version 10.04-ANZ)

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

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

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

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

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

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

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

Glossary of Terms

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Sapwood - Living xylem tissues

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

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

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

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

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

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

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

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

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

TPZ (Tree Protection Zone) - A specified area above and below ground and at a given distance from the trunk set aside for the protection of a tree's roots and crown to provide for the viability and stability of a tree to be retained where it is potentially subject to damage by development.

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

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

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

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

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

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

Windthrow - The blowing over of a tree at its roots

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