



HUGH
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Arboricultural Impact Assessment Report

Client Name: Jack Zhang
Site Address: 12 – 14 Gladys Avenue, Frenches Forest NSW
Authors Details: Hugh Millington
Email: hugh@hughtheArborist.com.au
Phone: 0426 836 701
Date Prepared: 30th August 2022
Revision A: 15th September 2022

Table of Contents

1.	INTRODUCTION.....	3
2.	SCOPE OF THE REPORT	4
3.	LIMITATIONS	4
4.	METHODOLOGY.....	5
5.	SITE LOCATION AND BRIEF DESCRIPTION OF THE PROPOSAL	6
6.	OBSERVATIONS AND GENERAL INFORMATION IN RELATION TO PROTECTING TREES ON DEVELOPMENT SITES	8
7.	ASSESSMENT OF CONSTRUCTION IMPACTS	10
8.	CONCLUSIONS.....	18
9.	RECOMMENDATIONS.....	22
10.	ARBORICULTURAL WORK METHOD STATEMENT (AMS) AND TREE PROTECTION REQUIREMENTS	23
11.	HOLD POINTS.....	29
12.	BIBLIOGRAPHY/REFERENCES.....	31
13.	LIST OF APPENDICES.....	32

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1. INTRODUCTION

- 1.1 Hugh The Arborist Pty Ltd has been instructed by Jack Zhang to inspect trees located on and adjoining the site that may be impacted by a proposed development.
- 1.2 All tree data was collected during one site inspection on Wednesday 12th June 2019, the weather was clear with average visibility.
- 1.3 The trees and the data were reviewed for the purpose of this report on Wednesday 8th July 2020. And again in April 2022. Several of the trees have been removed from the site plans and the assessment as a result of the widespread damage from the major storm events since the initial assessment. As a result, the trees have been re numbered to assist with the identification of retentions, removals, and replacement volumes.
- 1.4 Since the re inspection and the preparation of this report, three more trees have failed. For consistency, the failed trees have retained their identification numbers but do not feature in the summary or trees retained or removed. These trees have been clearly identified in the recommendations section and the Appendices of this report.
- 1.5 This report supersedes all previous AIA reports prepared for the site.

Table 1: Documents and plans provided.

Title	Author	Date created	Plan/Doc. Ref.
Site Survey	ENG Land Services	56/12/2016 (updated August 2022)	161205D1-REV J
Proposed Site Plan	RK Designs	21/7/2022	Issue D
Stormwater Plans	JCO Consultants	5/9//2022	DA-SW 100,200,201, 300,500,501,502, 600

2. SCOPE OF THE REPORT

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

- 2.1.1 Conduct a visual assessment from ground level of trees located on and adjoining the site as identified on the plans provided. For the purpose of this report, a tree taken to have height equal to or greater than 5 metres.
- 2.1.2 Dead trees and trees less than five metres in height have not been included in the report.
- 2.1.3 Determine the trees estimated contribution years and remaining, useful life expectancy and award the trees a retention value.
- 2.1.4 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).
- 2.1.5 Provide pragmatic recommendations for the management of trees and mitigation of construction impacts on retained trees.
- 2.1.6 Specify tree protection measures for trees to be retained in accordance with AS 4970-2009.

3. LIMITATIONS

- 3.1 The findings of this report are based on the observations and site conditions at the time of inspection.
- 3.2 Where access was limited due to trespass issues, measurements have been estimated.
- 3.3 Several trees assessed have not been located on the site plans provided. Their locations have been estimated using available setbacks taken on site.
- 3.4 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.
- 3.5 The tree inspections were 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.
- 3.6 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.

- 3.7 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.
- 3.8 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 a spp.
- 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 Hugh The Arborist neither guarantees, nor is responsible for, the accuracy of information provided by others that is contained within this report.
- 3.11 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 trees at the site.
- 3.12 The ultimate safety of any tree cannot be categorically guaranteed. Even trees apparently free of defects can collapse or partially collapse in extreme weather conditions. Trees are dynamic, biological entities subject to changes in their environment, the presence of pathogens and the effects of ageing. These factors reinforce the need for regular inspections. It is generally accepted that hazards can only be identified from distinct defects or from other failure-prone characteristics of a tree or its locality.
- 3.13 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 above ground level) – millimetres.
 - 4.1.5 Estimated height – metres
 - 4.1.6 Estimated crown spread (Radius of crown) – metres
 - 4.1.7 Health
 - 4.1.8 Structural condition

- 4.1.9 Amenity value
- 4.1.10 Estimated remaining contribution years (SULE)¹
- 4.1.11 Retention value (Tree AZ)²
- 4.1.12 Notes/comments
- 4.2 An assessment of the trees condition was made using the visual tree assessment (VTA) model (Mattheck & Breloer, 1994).³
- 4.3 Tree diameter was measured using a DBH tape or in some cases estimated. All other measurements were estimations unless otherwise stated. The other tools I used during the assessment were a digital camera, Japanese made 170mm blade digging knife and a Leica DistoD410 digital laser tape.
- 4.4 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). See appendices for more information.
- 4.5 Details of how the observations in this report have been assessed are listed in the appendices.

5. SITE LOCATION AND BRIEF DESCRIPTION OF THE PROPOSAL

- 5.1 The site is located in the in the Northern Beaches Council suburb of Frenches Forest. All trees at the site are managed under the following policy and legislation.
 - 5.1.1 Warringah Local Environmental Plan (LEP) 2011
 - 5.1.2 Warringah Development Control Plan (DCP) 2011
 - 5.1.3 Northern Beaches Tree Management Controls
 - 5.1.4 State Environmental Planning Policy (Vegetation in Non-Rural Areas 2017)
- 5.2 For the purpose of this assessment 'the site' is taken to be both 12 and 14 Gladys Avenue. The site is a large battle-axe block orientated South (front) to north (rear). There are two existing dwellings located to the centre east and west of the site. The site becomes increasingly steep from approximately the middle and falls significantly with a series of near vertical natural rock outcrops toward the rear.

¹ Barrell Tree Consultancy, *SULE: Its use and status into the New Millennium*, TreeAZ/03/2001, <http://www.treeaz.com/>.

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).

- 5.3 The vegetation community on site is highly varied with a range of native and non-native tree species with a varying maturity. Most of the significant, high value trees are located on adjoining properties. There is an abundance of trees and Palms that are located within the site that feature on the Northern Beaches Council exempt tree species list.
- 5.4 The site is not located within a heritage conservation area, does not contain terrestrial biodiversity, and does not form part of a wildlife corridor.⁴
- 5.5 The development proposal consists of the subdivision of the two sites into four lots with dwellings and associated ancillary structures.

Tile 1: Site Location⁵



⁴ <https://services.northernbeaches.nsw.gov.au/icongis/index.html>

⁵ <https://www.google.com/maps/place/12+Gladys+Ave,+Frenches+Forest+NSW+2086>

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

- 6.1 **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.
- 6.2 **Site plans:** Appendix 1 contains three site plans.
- Appendix 1 shows the existing trees on the provided survey plan.
 - Appendix 1A shows the existing trees over the proposed site plan.
 - Appendix 1B shows the existing trees over the proposed stormwater plan.
- 6.3 Tree location, Trunk, Canopy spread, TPZ and SRZ information has been overlaid across all plans.
- 6.4 **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.

- 6.5 **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 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.
- 6.6 **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.
- 6.7 **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.

7. ASSESSEMENT OF CONSTRUCTION IMPACTS

7.1 **Table 2:** In the table below the impact of proposed development impact to all trees included in the report has been assessed. **See recommendations section for impact mitigation advice.**

Tree ID	Species	Retention value	TPZ radius (m)	SRZ radius (m)	TPZ encroachment	Discussion/ Conclusion	Recommendation
1	Smooth Barked Apple	A1	7.2	2.8	Major	<p>Tree located on an adjoining site. The proposed bin storage area and proposed driveway will encroach into the Tree Protection Zone and the Structural Root Zone by up to 40%. This is a major encroachment that has the potential to cause the tree to decline and potentially become unstable in the event major roots are severed.</p> <p>If the tree is to be retained in a viable condition, the bin storage area should be constructed above grade using lightweight materials such as a metal grill/grid which will only require small piers/pad footings and no roof to allow rain to filter to the roots below. See section 8.2 for further details.</p> <p>The proposed driveway alone will occupy up to 22% encroachment into the Tree Protection Zone. It will also be required to be demonstrated the driveway can be installed via tree sensitive methods and design to minimise the impact on the neighboring tree. See section 8.2.</p>	Tree Sensitive Construction
2	Red Mahogany	A1	2.0	1.7	Footprint	Tree located within the footprint of the proposed bin storage area.	Remove
3	Smooth Barked Apple	A1	4.8	2.3	None	Tree located on an adjoining site. No encroachment proposed.	Retain and protect
4	Red Mahogany	A1	4.1	2.5	Major	No structures are proposed within the TPZ area. The proposed soft landscaping can be maintained at a tolerable level of impact if it is installed in accordance with section 10.16 of this report.	Tree sensitive construction required
5	Smooth Barked Apple	AA 1	6.4	2.7	Major	The proposed driveway will encroach into the Tree Protection Zone and the Structural Root Zone of the tree by up to 33%. Severance of major roots within the SRZ may cause the tree to decline or become unstable. The impact of the proposed works is likely to cause the tree to decline in the long term.	Remove



Tree ID	Species	Retention value	TPZ radius (m)	SRZ radius (m)	TPZ encroachment	Discussion/ Conclusion	Recommendation
6	Italian Cypress	Z3	3.6	2.1	Major	The proposed driveway will encroach into the Tree Protection Zone and the Structural Root Zone of the tree by up to 43%. Severance of major roots within the SRZ may cause the tree to decline or become unstable. The impact of the proposed works is likely to cause the tree to decline.	Remove
7	Lawsons Cypress	Z3	2.2	1.7	Major	The proposed driveway will encroach into the Tree Protection Zone and the Structural Root Zone of the tree by up to 39%. Severance of major roots within the SRZ may cause the tree to decline or become unstable. The impact of the proposed works is likely to cause the tree to decline.	Remove
8	Lawsons Cypress	Z3	2.2	1.7	-	Tree failed in storm and has been removed from the assessment.	-
9	Monterey Cypress	Z3	10.8	3.3	Major	The proposed driveway will encroach into the Tree Protection Zone and the Structural Root Zone of the tree by up to 45%. Severance of major roots within the SRZ may cause the tree to decline or become unstable. The impact of the proposed works is likely to cause the tree to decline.	Remove
10	Monterey Cypress	Z3	10.8	3.3	Major	The proposed driveway will encroach into the Tree Protection Zone and the Structural Root Zone of the tree by up to 45%. Severance of major roots within the SRZ may cause the tree to decline or become unstable. The impact of the proposed works is likely to cause the tree to decline.	Remove
11	Cocos Palm	Z3	4.0	NA	Footprint	Tree located within the footprint of the proposed driveway.	Remove
12	Weeping Bottlebrush	A1	3.3	2.8	Major	The proposed driveway will encroach into the Tree Protection Zone and the Structural Root Zone of the tree by up to 35%. The proposed driveway profile shows excavations in excess of one meter which will require the severance of all tree roots which will significantly impact the health and condition of the tree.	Remove
13	Bangalow Palm	Z3	2.0	NA	Footprint	Tree located within the footprint of the proposed building.	Remove



Tree ID	Species	Retention value	TPZ radius (m)	SRZ radius (m)	TPZ encroachment	Discussion/ Conclusion	Recommendation
14	Bangalow Palm	Z3	2.0	NA	Footprint	Tree located within the footprint of the proposed building.	Remove
15	Bangalow Palm	Z3	2.0	NA	Footprint	Tree located within the footprint of the proposed building.	Remove
16	Bangalow Palm	Z3	2.0	NA	Footprint	Tree located within the footprint of the proposed building.	Remove
17	Bangalow Palm	Z3	2.0	NA	Footprint	Tree located within the footprint of the proposed building.	Remove
18	Bangalow Palm	Z3	2.0	NA	Footprint	Tree located within the footprint of the proposed building.	Remove
19	Bangalow Palm	Z3	2.0	NA	Footprint	Tree located within the footprint of the proposed building.	Remove
20	Bangalow Palm	Z3	2.0	NA	Footprint	Tree located within the footprint of the proposed building.	Remove
21	Bangalow Palm	Z3	2.0	NA	Footprint	Tree located within the footprint of the proposed building.	Remove
22	Cocos Palm	Z3	3.0	NA	Footprint	Tree located within the footprint of the proposed building.	Remove
23	Cocos Palm	Z3	3.0	NA	Footprint	Tree located within the footprint of the proposed building.	Remove
24	Broad Leaved Paperbark	Z4	6.4	3.2	Footprint	Tree located within the footprint of the proposed OSD tank.	Remove
25	Broad Leaved Paperbark	A1	9.6	3.2	Major	The proposed dwelling and associated stormwater will encroach into the Tree Protection Zone and the Structural Root Zone by at least 45%. This is a major encroachment that is likely to require the severance of major tree roots and lead to the decline and potential destabilization of the tree.	Remove
26	Illawarra Flame	Z3	3.9	2.3	Major	The proposed dwelling and associated stormwater will encroach into the Tree Protection Zone and the Structural Root Zone by at least 30%. This is a major encroachment that is likely to require the severance of major tree roots and lead to the decline and potential destabilization of the tree.	Remove
27	Bangalow Palm	Z3	3.0	NA	None	No encroachment is proposed.	Retain and protect



Tree ID	Species	Retention value	TPZ radius (m)	SRZ radius (m)	TPZ encroachment	Discussion/ Conclusion	Recommendation
28	Macadamia	A2	2.0	1.5	None	No encroachment is proposed.	Retain and protect
29	African Olive	Z3	4.2	2.3	Footprint	Tree located within the footprint of the proposed Lot 2 garage and driveway.	Remove
30	Broad Leaved Paperbark	Z10	3.1	2.3	Footprint	Tree located within the footprint of the proposed Lot 2 garage and driveway.	Remove
31	African Olive	Z3	3.1	2.3	Footprint	Species is a listed weed and is recommended for removal irrespective of the proposal.	Remove
32	Lilly Pilly	A1	7.6	2.8	Minor	The proposed stormwater will encroach into the Tree Protection Zone by less than 5% and will be of negligible impact.	Retain and protect
33	Blue Jacaranda	Z3	2.8	2.0	Minor	The proposed dwelling will encroach into the Tree Protection Zone by less than 5% and will be of negligible impact to the tree.	Retain and protect
34	Cocos Palm	Z3	4.0	NA	Footprint	Tree located within the footprint of the proposed building.	Remove
35	Cocos Palm	Z3	4.0	NA	Footprint	Tree located within the footprint of the proposed building.	Remove
36	Cocos Palm	Z3	4.0	NA	Footprint	Tree located within the footprint of the proposed building.	Remove
37	Coastal Banksia	A2	2.5	2.0	Footprint	Tree located within the footprint of the proposed building.	Remove
38	Cocos Palm	Z3	4.0	1.5	Footprint	Tree is situated low on the embankment of the existing pool paving which is proposed to be demolished. The tree is highly likely to become unstable as a result.	Remove
39	Port Jackson Fig	A2	3.4	2.1	Footprint	Tree is situated low on the embankment of the existing pool paving which is proposed to be demolished. The tree is highly likely to become unstable as a result.	Remove
40	Red Mahogany	Z4	5.1	2.5	Major	Tree 40 has been assessed as un declining health and allocated a category Z tree rating. While the tree has not been shown on the plans provided it will be	Remove



Tree ID	Species	Retention value	TPZ radius (m)	SRZ radius (m)	TPZ encroachment	Discussion/ Conclusion	Recommendation
						subject to major encroachment greater than 10% in the Tree Protection Zone and the Structural Root Zone from the proposed stormwater installation and installation of a sandstone retaining wall. The proposed works are likely to cause the tree to decline further and it is not considered retainable.	
41	Blue Jacaranda	Z3	2.3	2.3	Major	Tree will be subject to encroachment into the Tree Protection Zone and the Structural Root Zone on two sides by up to 25% which is likely to cause the tree to decline in health.	Remove
42	Coastal Banksia	A1	2.0	1.6	Major	The proposed structure will encroach into the Tree Protection Zone and the Structural Root Zone by up to 32%. This is a major encroachment that is likely to cause the tree to decline or become unstable.	Remove
43	Blue Jacaranda	Z3	2.8	2.3	None	No encroachment proposed.	Retain and protect
44	Broad Leaved Paperbark	A1	6.8	2.5	None	No encroachment proposed.	Retain and protect
45	Broad Leaved Paperbark	A1	6.8	2.5	None	No encroachment proposed.	Retain and protect
46	Broad Leaved Paperbark	A1	4.8	2.5	None	No encroachment proposed.	Retain and protect
47	Broad Leaved Paperbark	A1	4.8	2.5	None	No encroachment proposed.	Retain and protect

Tree ID	Species	Retention value	TPZ radius (m)	SRZ radius (m)	TPZ encroachment	Discussion/ Conclusion	Recommendation
48	Broad Leaved Paperbark	A1	3.4	2.0	Major	The proposed stormwater pipe will encroach into the Tree Protection Zone and the Structural Root Zone by up to 18% which is a major encroachment that has the potential to cause the tree to decline or become unstable. If the tree is to be retained in a viable condition the pipe is to be installed above ground or the pipe is to be installed via tree sensitive construction methods. See section 8.2.	Tree sensitive construction
49	Broad Leaved Paperbark	A1	4.6	2.3	Major	Tree located on a neighboring site. Up to 11% of the Tree Protection Zone may extend within the subject site. The tree is situated approximately 700 millimeters lower than the subject site and the proposed works indicating the development is unlikely to significantly impact the tree.	Retain and protect
50	Blue Jacaranda	Z3	2.0	1.7	-	Tree failed in storm and has been removed from the assessment.	-
51	Old Man Banksia	A1	2.2	2.0	-	Tree failed in storm and has been removed from the assessment.	-
52	Smooth Barked Apple	Z10	3.5	2.0	Footprint	Tree located within the footprint of the proposed stormwater pipe.	Remove
53	Smooth Barked Apple	A2	3.4	2.0	None	No encroachment proposed.	Retain and protect
54	Smooth Barked Apple	A2	4.2	2.3	Major	The proposed stormwater will encroach into the Tree Protection Zone by up to 15% with no encroachment into the Structural Root Zone. The associated impact may be reduced to retain the tree providing the excavations are carried out manually within the TPZ area and major tree roots are retained undamaged.	Tree sensitive construction required
55	Sydney Peppermint	Z10	2.0	1.5	None	No encroachment proposed.	Retain and protect



Tree ID	Species	Retention value	TPZ radius (m)	SRZ radius (m)	TPZ encroachment	Discussion/ Conclusion	Recommendation
56	Old Man Banksia	A2	4.4	2.4	None	No encroachment proposed.	Retain and protect
57	Old Man Banksia	A2	3.1	2.0	None	No encroachment proposed.	Retain and protect
58	Sweet Pittosporum	A1	3.7	2.3	None	No encroachment proposed.	Retain and protect
59	Old Man Banksia	A1	3.6	2.2	None	No encroachment proposed.	Retain and protect
60	Red Mahogany	A1	5.4	2.5	None	No encroachment proposed.	Retain and protect
61	Old Man Banksia	A2	2.4	2.1	None	No encroachment proposed.	Retain and protect
62	Swamp Oak	A1	2.2	1.7	None	No encroachment proposed.	Retain and protect
63	Camphor Laurel	Z3	3.6	2.3	None	No encroachment proposed.	Retain and protect
64	Camphor Laurel	Z3	3.6	2.3	None	No encroachment proposed.	Retain and protect
65	Sweet Pittosporum	A2	2.0	1.7	None	No encroachment proposed.	Retain and protect
66	Sweet Pittosporum	A2	2.0	1.7	None	No encroachment proposed.	Retain and protect
67	Illawarra Flame	Z3	2.5	2.0	None	No encroachment proposed.	Retain and protect

Report on trees at: 12-14 Gladys Avenue, Frenches Forest, NSW
Prepared for: Jack Zhang
Prepared by: Hugh Millington hugh@hughtheArborist.com.au
Date prepared: 30th August 2022
Revision A: 15th September 2022



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Tree ID	Species	Retention value	TPZ radius (m)	SRZ radius (m)	TPZ encroachment	Discussion/ Conclusion	Recommendation
68	Jacaranda	Z3	6.6	2.8	Major	Tree located on an adjoining site. The proposed stormwater easement will encroach into the tree Protection Zone by up to 13% with no encroachment into the Structural Root Zone. The proposed easement is up to 1 meter wide however the installation of the proposed pipe and pit are unlikely to require excavating the full width of the trench. In addition, the tree is situated on a lower RL than the subject site indicating the root system will be located deeper in the soil within the site boundaries and is less likely to be impacted by the proposed pit. The installation of the stormwater is not anticipated to significantly impact the tree.	Retain and protect

8. CONCLUSIONS

8.1 Table 3: Summary of the impact to trees during the development.

Impact	Reason	Category A	Category Z
		A	Z
Trees to be removed	Building/landscape construction, new surfacing and/or proximity, or trees in poor condition.	2,5,12,25,37,39,42 Seven Trees	6, 7, 9, 10, 11, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 26, 29, 30, 31, 34, 35, 36, 38, 40, 41, 52 Twenty Eight Trees
Retained trees subject to TPZ encroachment or no encroachment	Removal of existing surfacing/structures and/or installation of new surfacing/structures will not significantly impact the tree or located outside of the construction area	3, 28, 32, 44, 45, 46, 47, 49, 53, 56, 57, 58, 59, 60, 61, 62, 65, 66 Eighteen Trees	27,33,43,55,63,64,67,68 Eight Trees
Tree sensitive construction required	Trees subject to encroachment that will require tree sensitive construction methods to enable retention	1,4,48,54 Four Trees	None

8.2 Tree Sensitive Construction Specification: To ensure that trees identified for retention 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 completed in accordance with these specifications, the trees may not be viable for retention

8.2.1 Tree Sensitive Hard Surfacing Construction (proposed driveway and trees 1 and 4): Hard surfacing within the TPZ of the trees should be constructed in a tree sensitive method. The hard surfacing should be constructed above existing grades in the TPZ of the trees. The diagram below (Image C) 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 hard surfacing should be carried out manually to avoid impacting retained tree roots. All tree roots greater than 40mm in diameter should be retained unless the project arborist has assessed and advised that the pruning/severing of the root will not impact the condition or stability of the tree. Manual excavation may include the use of pneumatic and hydraulic tools, high-pressure air or a combination of high-pressure

water and a vacuum device. Where tree roots greater than 40mm are encountered that must be retained, the hard surfacing 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 D and E). Using pier and beam bridges as per image E is the recommended/preferred method, as it will allow for future growth of the tree roots, reducing future damage to the surfacing from the roots.

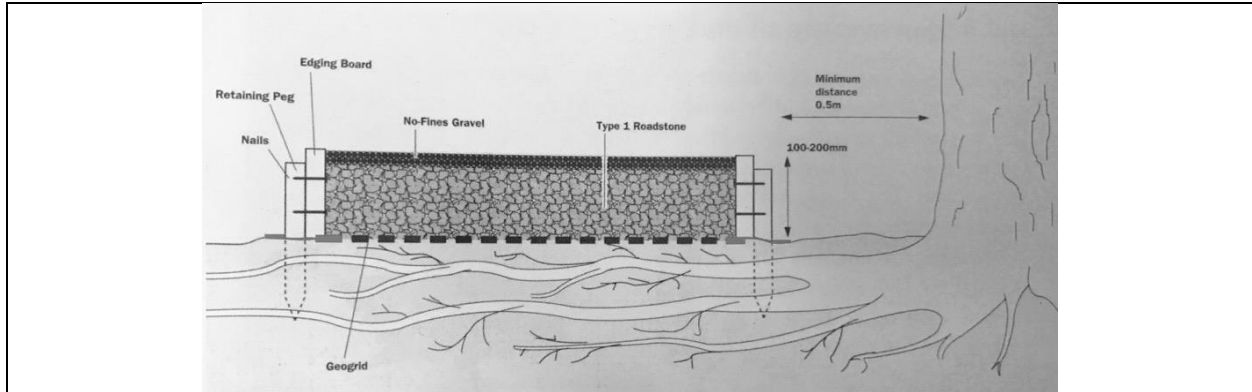


Image C: An image from 'Tree Roots in the Built Environment'⁶, showing how to construct hard surfacing above a trees root system without excavation. Type 1 Roadstones are an example of blue metal or crushed sandstone.

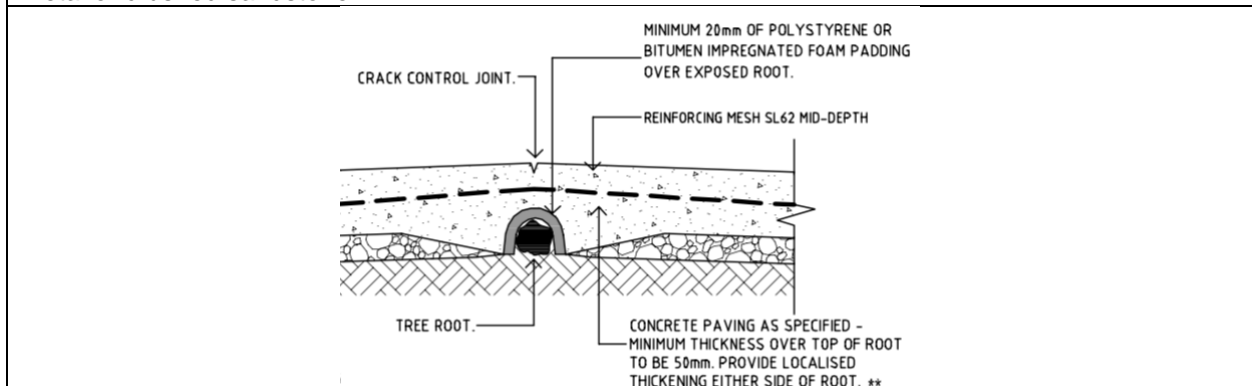
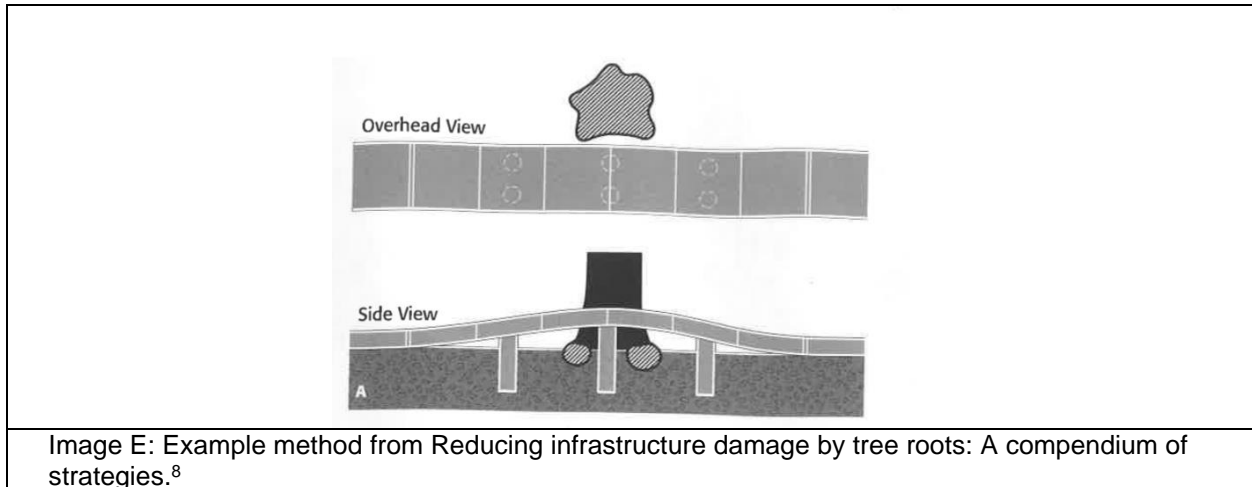


Image D: Example method for bridging concrete surfacing over tree roots provided in the Canterbury Bankstown Council standard drawings.⁷

⁶ Roberts, J., Jackson, N., & Smith, M., *Tree Roots in the Built Environment*, The Stationary Office, London, England (2006). Page 305 & 306.

⁷ Canterbury Bankstown Council standard drawing S-209 Existing street tree treatments, <https://www.cbccity.nsw.gov.au/development/planning-control-policies/council-standard-drawings>, accessed 3 October 2019.



8.2.1 **Proposed bin area and Tree 1:** To minimise the encroachment on tree 1 the structure must be installed above the natural ground level, be supported on small piers/pads and have no roof to allow rainwater to filtrate to the tree roots below. To achieve this a steel grid system or Fibre Reinforced Polymer (FRP) sheets may be suitable material choices. The natural ground level is to be retained with the exception of the proposed piers that are to be installed using the following method.

8.2.2 **Tree Sensitive Pier Construction Method:** To minimise root loss in the TPZ of the trees, all pier footings for the proposed driveway extension must be located to avoid significant roots. To ensure that significant tree roots are not impacted, it must be demonstrated by the project engineer that the following construction methods can be implemented.

- All excavations for piers must be carried out manually under the supervision of the project arborist (see section 11 for details of manual excavation and project arborist).
- The location of piers must be flexible to avoid significant roots (roots greater than 40mm in diameter). All roots greater than 40mm in diameter must be retained unless the project arborist has assessed and approved in writing that severing the root will not impact the condition or stability of the tree.
- The piers should be located a minimum of 200mm from any root to be retained that is greater than 40mm in diameter.

⁸ 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.

8.2.3 Underground services (trees 48 and 54): AS4970 Protection of trees on development sites (2009) recommends that all underground services located inside the TPZ of any tree to be retained should 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.

If directional drilling is proposed, section 4.5.5 of AS4970-2009 says that ‘The directional drilling bore should be at least 600 mm deep. The project Arborist should assess the likely impacts of boring and bore pits on retained trees’.⁹ If manual excavations are proposed, all excavations for the services should be carried out manually under the supervision of the project Arborist (minimum qualification AQF 5). 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. All roots greater than 40mm in diameter should be retained in the service trench. The service pipe should then be threaded below the retained roots where practical. Roots greater than 40mm within the alignment of the service pipe should only be severed/pruned under the approval of the project Arborist. All root pruning should be in accordance with AS4373 Pruning of amenity trees (2007). Open trenching in the SRZ of trees can be impractical without impacting significant roots, as often dense root growth is present in the SRZ. Open trenching should therefore be avoided in the SRZ. It is recommended that any section of pipe that is located in the SRZ of trees to be retained is installed via sub-surface boring/directional drilling methods only. The feasibility of sub-surface boring/directional drilling will need to be investigated by a sub-surface boring/directional drilling specialist. The project Arborist should provide advice and supervise excavations for bore pits, which must be carried out manually if located within the TPZ. The top of the pipe must be at least 600mm below the existing soil grade. The location of bore pits should be flexible in the TPZ to avoid significant roots, the project Arborist should assess and advise in writing the impact of any significant root severance to the condition of the tree.

⁹ Council Of Standards Australia, *AS 4970 Protection of trees on development sites* (2009) page 18.

9. RECOMMENDATIONS

9.1 Refer to tables 2 and 3 for individual tree identification and discussions.

9.2 Three trees have failed due to storms and have been identified in table 3 section 8. The tree identification numbers have been maintained in the report but have been excluded from the assessment totals, site plans and recommendations.

Therefore, this report assesses the impact of the proposed development on sixty five trees located on and adjoining the site.

9.3 The proposed works will require the removal of thirty five trees. Of these, seven are assessed as category A trees (one of which is a category AA T5). The remaining twenty eight trees are lower value category Z trees.

9.4 A further twenty six trees will be retained under a tolerable level of development impact consisting on eighteen category A trees and eight category Z trees.

9.5 Four trees have been assessed as requiring tree sensitive design or design to facilitate their retention. Specifications have been included in section 8.2.

9.6 Trees 1 and 4 Will require tree sensitive design for the proposed driveway and bin area. It will be required to be demonstrated the structures can be installed in accordance with section 8.2 of this report if the tree is to be retained.

9.7 Trees 48 and 54 are located to the rear of the site and will be subject to impact from the proposed stormwater pipe. If the trees are to be retained in a viable condition the pipe is to be situated on small cradles on the existing soil grade, or, the pipe is to be installed via directional drilling as specified in section 8.2.1. Tree 54 is likely to only require manual excavation and the retention of major tree roots for the pipe installation.

9.8 All landscaping is to be carried out in accordance with section 10.16 to minimise the impacts on retained trees.

9.9 The existing driveway is recommended to be retained for the duration of the development to assist with providing ground protection. When the driveway is removed (surfacing) it shall be carried out under the guidance of the Project Arborist. A small excavator using a ripper tooth can be used to loosen the surface from one end of the drive to the other remaining on the asphalt and working backwards. The material is to be removed manually where in the TPZ areas of retained trees. Track mats are to be installed once the surface has been removed within the TPZ areas of trees on the driveway.

9.10 **New boundary walls** should avoid continuous strip footings and be constructed using timber posts, lap, and cap style fencing. This is considered to be non-invasive to trees and will be suitable to install where necessary inside the structural root zones of retained trees.

- 9.11 All works within the TPZ and SRZ of retained trees are to be overseen by an AQF5 Consulting Arborist to assist with minimising development impact.

10. ARBORICULTURAL WORK METHOD STATEMENT (AMS) AND TREE PROTECTION REQUIREMENTS

- 10.1 **Use of this report:** All contractors must be made aware of the tree protection requirements prior to commencing works at the site and be provided a copy of this report.
- 10.2 **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.
- 10.3 **Tree work:** All tree work must 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).
- 10.4 **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. I recommend regular site inspections on a frequency based on the longevity of the project; this is to be agreed in the initial meeting.
- 10.5 **Site Specific Tree Protection Recommendations.**

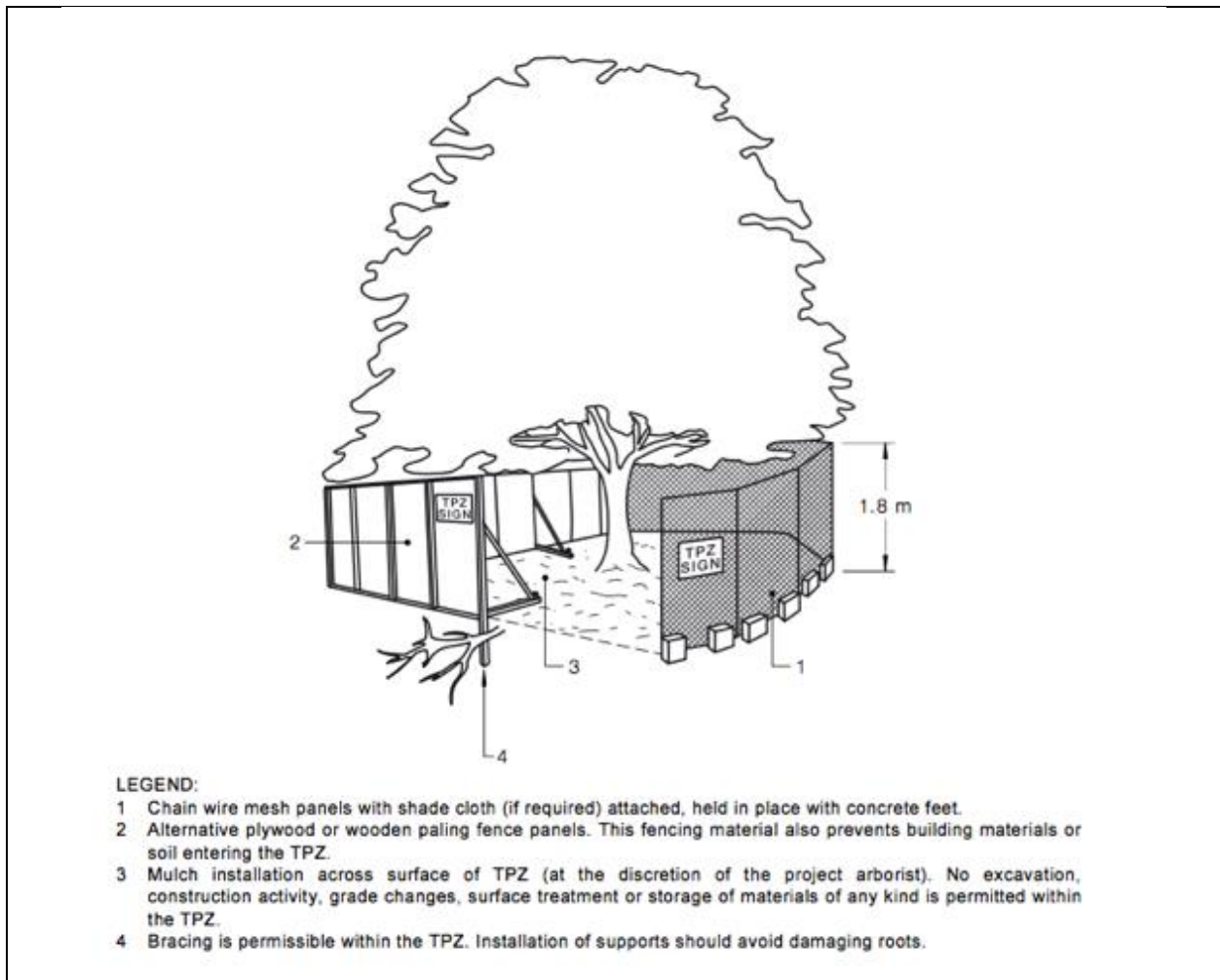
Table 4: Protection Specifications

Tree Number	Protection Specification
All retained trees	<ul style="list-style-type: none"> - Must be protected in accordance with section 10 and 11 of this report and AS4970 Protection of Trees on Development Sites (2009).
All retained trees at the rear of the site	<ul style="list-style-type: none"> - Due to the significant site constraints, it is recommended a site specific tree protection plan be developed in conjunction with the sites construction management plan prior to the commencement of works. - Coir log sediment and tree protective fencing the entire width of the site.

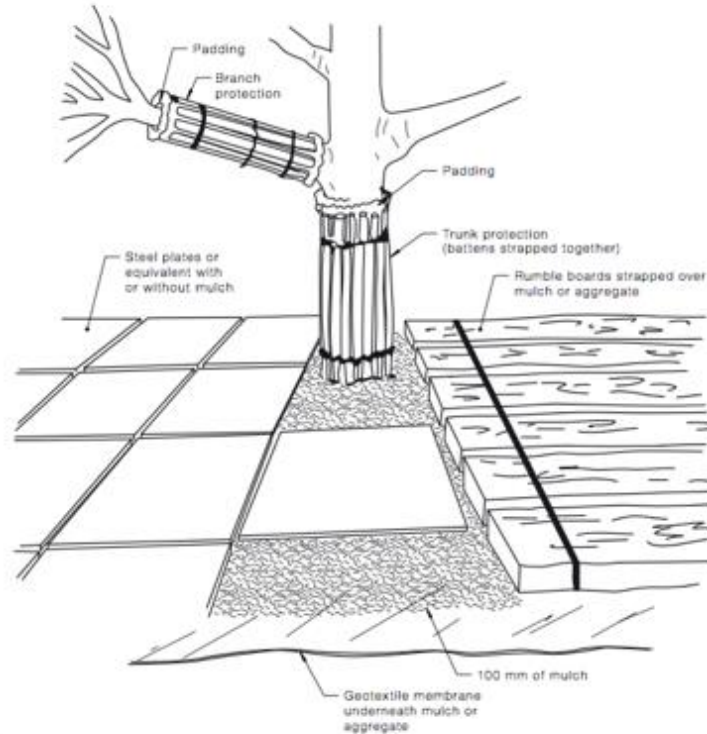
- 10.6 **Tree protection Specifications:** See sections below for site/tree specific requirements. It is the responsibility of the principle contractor to install tree protection prior to works commencing at the site (prior to demolition works) and to ensure that the tree protection remains in adequate 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.
- 10.7 **Protective fencing:** 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. Where the installation of fencing is unfeasible due to restrictions on space, trunk and branch protection will be required (see below). The protective fencing must be constructed of 1.8 metre 'cyclone chainmesh fence'. The fencing must only be removed for the landscaping phase and must be authorised by the project Arborist. Any modifications to the fencing locations must be approved by the project Arborist.
- 10.8 **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
- 10.9 **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.

10.10 **Mulch:** Any areas of the TPZ located inside the subject site (only trees to be retained directly adjacent to site works must be mulched to a depth of 75mm with good quality composted wood chip/leaf mulch.

10.11 **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, overlaid with durable timber boards/plywood. If vehicles are to be using the area, additional protection will be required such as rumble boards or track mats to spread the weight of the vehicle and avoid load points. Ground protection is to be specified by the project Arborist as required.



An image from AS4970-2009,¹⁰ with example tree protection.



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 AS4970-2009,¹¹ with example tree protection.

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

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

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

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

- 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.
- 10.13 **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.
- 10.14 **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 10mm 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).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.

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

10.15 **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.

10.16 **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.

- 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 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.
- 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.

10.17 **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.

- 10.18 **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.
- 10.19 **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.

11. HOLD POINTS

- 11.1 **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.

Hold Point	Stage	Responsibility	Certification	Complete Y/N and date
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.	Prior to work commencing.	Principle contractor	Project Arborist	
Project Arborist to assess and certify that tree protection has been installed in accordance with section 11 and AS4970-2009 prior to works commencing at site.	Prior to development work commencing.	Principle contractor	Project Arborist	
In accordance with AS4970-2009 the project arborist should carryout regular site inspections to ensure works are carried out in accordance with the recommendations.	Ongoing throughout the development	Principle contractor	Project Arborist	



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Project Arborist to oversee all manual excavations for piers and demolition inside the TPZ of any tree to be retained.	Construction	Principle contractor	Project Arborist	
Project Arborist to certify that all pruning of roots greater than 40mm in diameter has been carried out in accordance with AS4373-2007. All root pruning must be carried out by a qualified Arborist/Horticulturalist with a minimum AQF level 3.	Construction	Principle contractor	Project Arborist	
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	Principle contractor	Project Arborist	
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 minimize the impact to trees.	Landscape	Principle contractor	Project Arborist	
After all construction works are complete the project Arborist should assess that the subject trees have been retained in the same condition and vigor and authorize the removal of protective fencing. If changes to condition are identified the project Arborist should provide recommendations for remediation.	Upon completion of construction	Principle contractor	Project Arborist	
Any wounding or injury that occurs to a tree during the demolition/construction process will require the project arborist to be contacted for an assessment of	Ongoing throughout the development	Principle contractor	Project Arborist	

<p>the injury and provide mitigation/remediation advice. All remediation work is to be carried out by the project arborist, at the contractor's expense.</p>				
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12. BIBLIOGRAPHY/REFERENCES

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- *Northern Beaches Council - Removing and Pruning Trees on Private Land*, <https://www.northernbeaches.nsw.gov.au/planning-development/tree-management/private-land>

13. LIST OF APPENDICES

The following are included in the appendices:

- Appendix 1 – Existing site plan
- Appendix 1A – Proposed Site Plan
- Appendix 1B – Proposed Stormwater Plan
- Appendix 2 - Tree inspection schedule
- Appendix 3 – Health
- Appendix 4 – Amenity Value
- Appendix 5 – Age Class
- Appendix 6 – Structural Condition
- Appendix 7 – SULE Categories
- Appendix 8 – Retention Values
- Appendix 9 – Trees AZ
- Appendix 10 – TPZ Encroachment

Hugh Millington



Diploma of Arboriculture (AQF5)
NC Forestry and Arboriculture III (UK)
RFS Tech. Cert. II (UK)
QTRA Registered User
ISA Tree Risk Assessment Qualification

0426836701

hugh@hughtheArborist.com.au

Hugh The Arborist Pty Ltd

hugh@hughthearborist.com.au
www.hughthearborist.com.au

12-14 Gladys Avenue Frenchs Forest

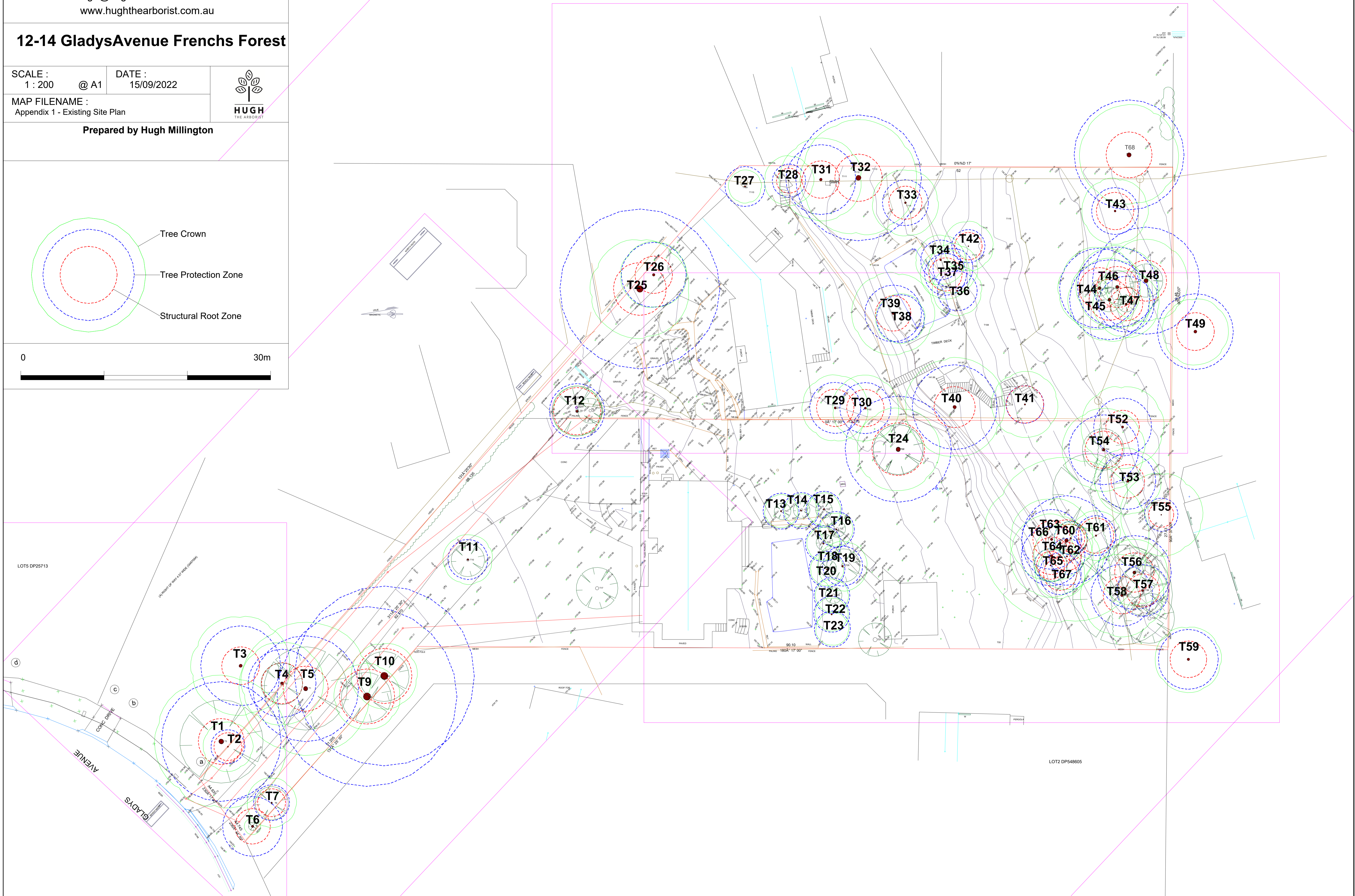
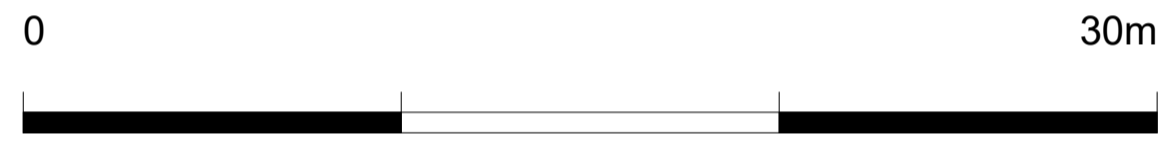
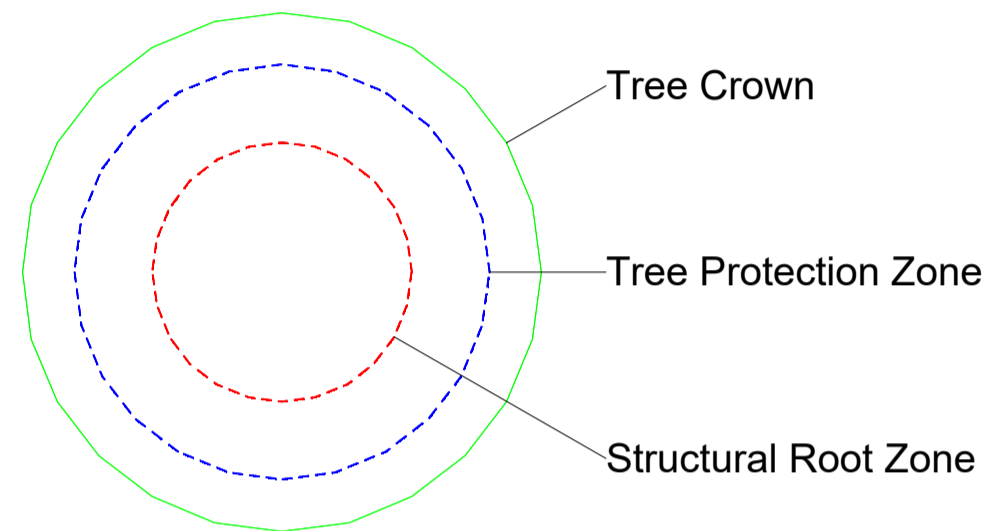
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Prepared by Hugh Millington



Hugh The Arborist Pty Ltd

hugh@hughthearborist.com.au

www.hughthearborist.com.au

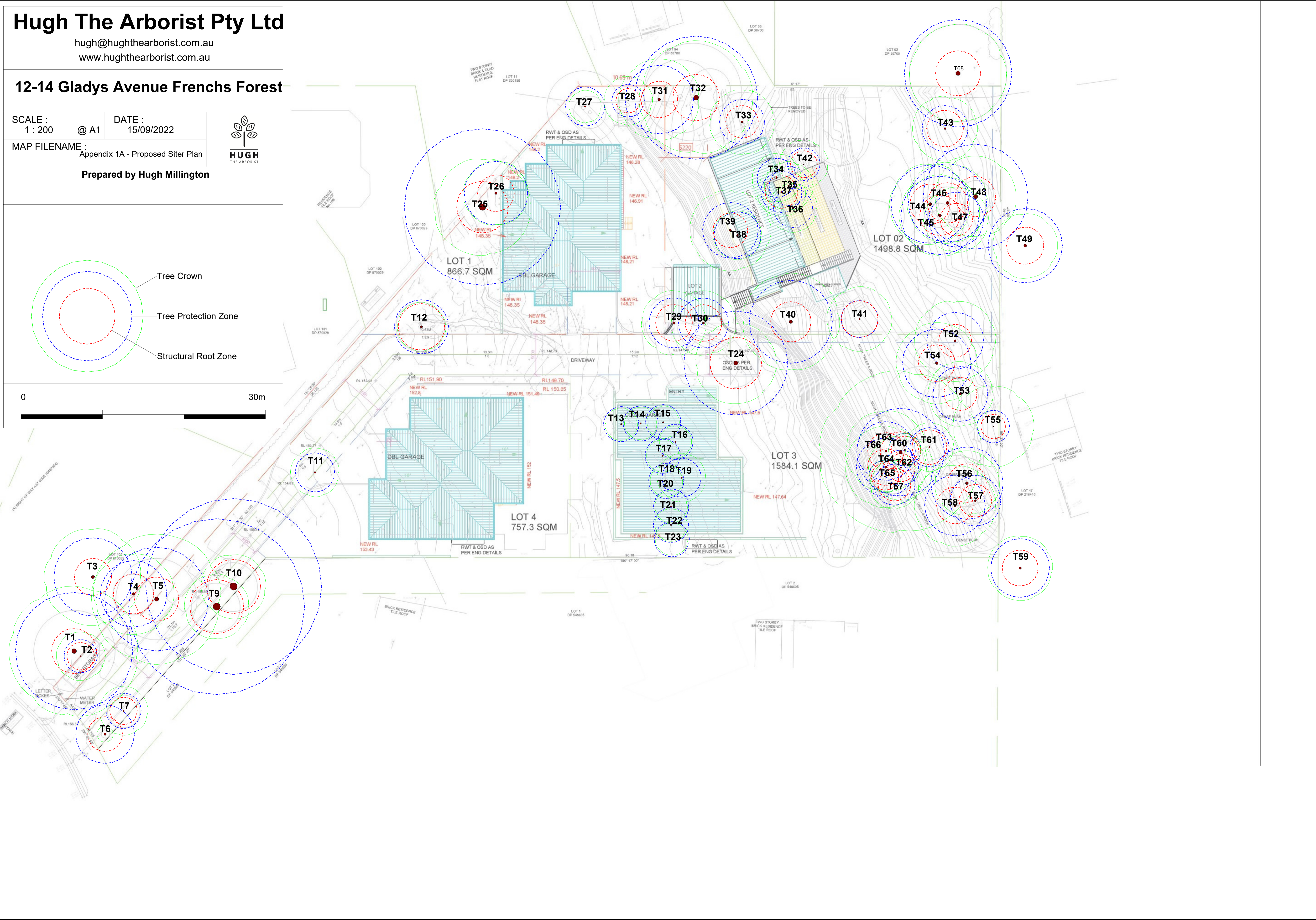
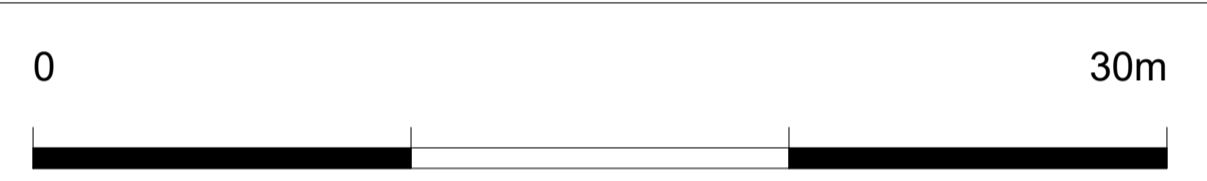
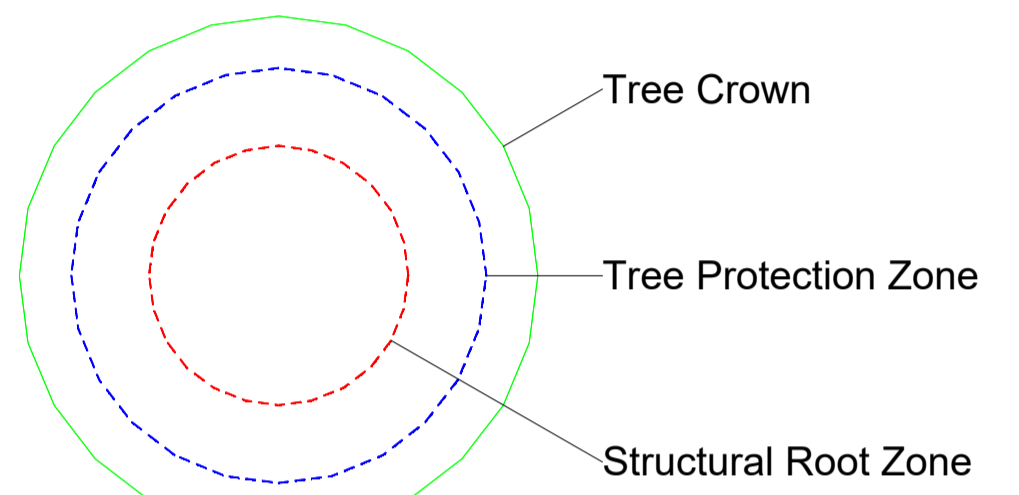
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Appendix 2 - Tree Inspection Schedule

Tree ID	Common Name	Botanical Name	Age Class	Height (m)	Canopy Spread Radius (m)	Stem 1 (mm)	Stem 2 (mm)	DBH (mm)	DAB (mm)	Health	Structure	Amenity Value	SULE	Retention Value	TPZ Radius (m)	SRZ Radius (m)	Notes
1	Smooth Barked Apple	<i>Angophora costata</i>	Mature	16	8	600		600	650	Good	Good	Very High	1. Long	A1	7.2	2.8	Neighboring tree.
2	Red Mahogany	<i>Eucalyptus resinifera</i>	Semi-mature	8	3	170		170	200	Good	Good	High	1. Long	A1	2.0	1.7	None.
3	Smooth Barked Apple	<i>Angophora costata</i>	Mature	15	6	400		400	410	Good	Good	High	1. Long	A1	4.8	2.3	Neighboring tree.
4	Red Mahogany	<i>Eucalyptus resinifera</i>	Mature	11	5	340		340	500	Good	Good	High	1. Long	A1	4.1	2.5	Neighboring tree.
5	Smooth Barked Apple	<i>Angophora costata</i>	Mature	16	8	530		530	620	Good	Good	Very High	1. Long	AA1	6.4	2.7	Slight drying of cambium in upper crown.
6	Italian Cypress	<i>Cupressus sempervirens</i>	Mature	8	1	300		300	350	Fair	Fair	Low	2. Medium	Z3	3.6	2.1	Exempt species.
7	Lawsons Cypress	<i>Chamycyparis lawsoniana</i>	Mature	7	3	180		180	200	Good	Good	Low	2. Medium	Z3	2.2	1.7	Lawson's exempt species.
8	Lawsons Cypress	<i>Chamycyparis lawsoniana</i>	Mature	7	3	180		180	200	NA	NA	NA	NA	NA	2.2	1.7	Tree failed in storm.
9	Monterey Cypress	<i>Cupressus macrocarpa</i>	Mature	14	4	900		900	1000	Fair	Fair	Low	2. Medium	Z3	10.8	3.3	Exempt species.
10	Monterey Cypress	<i>Cupressus macrocarpa</i>	Mature	14	4	900		900	1000	Fair	Fair	Low	2. Medium	Z3	10.8	3.3	Exempt species.
11	Cocos Palm	<i>Syagrus romanzoffianum</i>	Mature	9	3	200		200	0	Good	Good	Low	1. Long	Z3	4.0	NA	Exempt species.
12	Weeping Bottlebrush	<i>Callistemon viminalis</i>	Mature	7	3	210	150	277	700	Good	Good	Medium	1. Long	A1	3.3	2.8	None.
13	Bangalow Palm	<i>Archontophoenix cunninghamiana</i>	Semi-mature	6	2	180		180	0	Good	Good	Low	1. Long	Z3	2.0	NA	Exempt species.
14	Bangalow Palm	<i>Archontophoenix cunninghamiana</i>	Semi-mature	6	2	180		180	0	Good	Good	Low	1. Long	Z3	2.0	NA	Exempt species.
15	Bangalow Palm	<i>Archontophoenix cunninghamiana</i>	Semi-mature	6	2	180		180	0	Good	Good	Low	1. Long	Z3	2.0	NA	Exempt species.
16	Bangalow Palm	<i>Archontophoenix cunninghamiana</i>	Semi-mature	6	2	180		180	0	Good	Good	Low	1. Long	Z3	2.0	NA	Exempt species.
17	Bangalow Palm	<i>Archontophoenix cunninghamiana</i>	Semi-mature	6	2	180		180	0	Good	Good	Low	1. Long	Z3	2.0	NA	Exempt species.
18	Bangalow Palm	<i>Archontophoenix cunninghamiana</i>	Semi-mature	6	2	180		180	0	Good	Good	Low	1. Long	Z3	2.0	NA	Exempt species.
19	Bangalow Palm	<i>Archontophoenix cunninghamiana</i>	Semi-mature	6	2	180		180	0	Good	Good	Low	1. Long	Z3	2.0	NA	Exempt species.
20	Bangalow Palm	<i>Archontophoenix cunninghamiana</i>	Semi-mature	6	2	180		180	0	Good	Good	Low	1. Long	Z3	2.0	NA	Exempt species.
21	Bangalow Palm	<i>Archontophoenix cunninghamiana</i>	Semi-mature	6	2	180		180	0	Good	Good	Low	1. Long	Z3	2.0	NA	Exempt species.
22	Cocos Palm	<i>Syagrus romanzoffianum</i>	Mature	6	3	200		200	0	Good	Good	Low	1. Long	Z3	3.0	NA	Exempt species.
23	Cocos Palm	<i>Syagrus romanzoffianum</i>	Mature	6	3	200		200	0	Good	Good	Low	1. Long	Z3	3.0	NA	Exempt species.
24	Broad Leaved Paperbark	<i>Melaleuca quinquenervia</i>	Mature	9	5	400	350	532	900	Fair	Poor	Medium	3. Short	Z4	6.4	3.2	Internal decay at base. Canopy sparse.
25	Broad Leaved Paperbark	<i>Melaleuca quinquenervia</i>	Mature	11	6	800		800	900	Good	Good	High	1. Long	A1	9.6	3.2	None.
26	Illawarra Flame	<i>Brachychiton acerifolius</i>	Mature	10	4	230	230	325	400	Good	Poor	Medium	2. Medium	Z3	3.9	2.3	Exempt species.
27	Bangalow Palm	<i>Archontophoenix cunninghamiana</i>	Mature	10	2	200		200	0	Good	Good	Low	1. Long	Z3	3.0	NA	Exempt species.
28	Macadamia	<i>Macadamia Spp.</i>	Mature	6	3	100		100	150	Good	Good	Medium	1. Long	A2	2.0	1.5	X 3 trees.
29	African Olive	<i>Olea europaea subsp. cuspidata</i>	Mature	9	5	350		350	400	Good	Good	Low	1. Long	Z3	4.2	2.3	Exempt species.
30	Broad Leaved Paperbark	<i>Melaleuca quinquenervia</i>	Mature	6	4	160	200	256	400	Poor	Poor	Low	3. Short	Z10	3.1	2.3	Tree in severe decline.
31	African Olive	<i>Olea europaea subsp. cuspidata</i>	Mature	9	4	160	200	256	400	Poor	Poor	Low	3. Short	Z3	3.1	2.3	Tree in severe decline.
32	Lilly Pilly	<i>Acmena smithii</i>	Mature	11	7	630		630	700	Good	Good	High	1. Long	A1	7.6	2.8	Bark inclusion between stems, partially fused.
33	Blue Jacaranda	<i>Jacaranda mimosifolia</i>	Mature	6	4	230		230	300	Good	Fair	Low	1. Long	Z3	2.8	2.0	Exempt species.
34	Cocos Palm	<i>Syagrus romanzoffianum</i>	Mature	8	3	200		200	0	Good	Good	Low	1. Long	Z3	4.0	NA	Exempt species.
35	Cocos Palm	<i>Syagrus romanzoffianum</i>	Mature	8	3	200		200	0	Good	Good	Low	1. Long	Z3	4.0	NA	Exempt species.
36	Cocos Palm	<i>Syagrus romanzoffianum</i>	Mature	8	3	200		200	0	Good	Good	Low	1. Long	Z3	4.0	NA	Exempt species.
37	Coastal Banksia	<i>Banksia integrifolia</i>	Mature	10	3	210		210	300	Good	Fair	Medium	2. Medium	A2	2.5	2.0	May have been lopped in the past. Mature epicormic canopy structure.
38	Cocos Palm	<i>Syagrus romanzoffianum</i>	Mature	11	3	240		240	0	Good	Good	Low	1. Long	Z3	4.0	1.5	Exempt species.
39	Port Jackson Fig	<i>Ficus rubiginosa</i>	Mature	5	5	220	180	284	350	Good	Fair	Medium	2. Medium	A2	3.4	2.1	Beetles Growing out of rock, has been lopped in the past.
40	Red Mahogany	<i>Eucalyptus resinifera</i>	Mature	12	6	300	300	424	500	Poor	Fair	Medium	3.Short	Z4	5.1	2.5	Declining health.
41	Blue Jacaranda	<i>Jacaranda mimosifolia</i>	Mature	8	4	160	100	189	400	Good	Good	Low	1. Long	Z3	2.3	2.3	Exempt species.
42	Coastal Banksia	<i>Banksia integrifolia</i>	Mature	8	3	110		110	190	Good	Good	Medium	1. Long	A1	2.0	1.6	None.
43	Blue Jacaranda	<i>Jacaranda mimosifolia</i>	Mature	6	4	150	150	235	400	Good	Good	Low	1. Long	Z3	2.8	2.3	Exempt species.
44	Broad Leaved Paperbark	<i>Melaleuca quinquenervia</i>	Mature	13	7	400	400	566	500	Good	Good	High	1. Long	A1	6.8	2.5	Forms part of group.
45	Broad Leaved Paperbark	<i>Melaleuca quinquenervia</i>	Mature	13	7	400	400	566	500	Good	Good	High	1. Long	A1	6.8	2.5	Forms part of group.
46	Broad Leaved Paperbark	<i>Melaleuca quinquenervia</i>	Mature	13	5	400		400	500	Good	Good	High	1. Long	A1	4.8	2.5	Measurement averaged. Part of group.
47	Broad Leaved Paperbark	<i>Melaleuca quinquenervia</i>	Mature	13	5	400		400	500	Good	Good	High	1. Long	A1	4.8	2.5	Measurement averaged. Part of group.
48	Broad Leaved Paperbark	<i>Melaleuca quinquenervia</i>	Mature	10	4	280		280	300	Good	Good	High	1. Long	A1	3.4	2.0	Part of group.
49	Broad Leaved Paperbark	<i>Melaleuca quinquenervia</i>	Mature	8	4	380		380	410	Good	Good	High	1. Long	A1	4.6	2.3	Neighboring tree.
50	Blue Jacaranda	<i>Jacaranda mimosifolia</i>	Mature	5	3	150		150	200	NA	NA	NA	NA	Z3	2.0	1.7	Tree failed in storm.
51	Old Man Banksia	<i>Banksia serrata</i>	Mature	5	3	180		180	300	NA	NA	NA	NA	A1	2.2	2.0	Tree failed in storm.
52	Smooth Barked Apple	<i>Angophora costata</i>	Mature	6	5	290		290	310	Poor	Poor	Low	3. Short	Z10	3.5	2.0	Heavy lean to north. May have partially failed.
53	Smooth Barked Apple	<i>Angophora costata</i>	Mature	12	4	280		280	310	Fair	Good	High	2. Medium	A2	3.4	2.0	Large dead wood in canopy. Some drying of the cambium on main stem.
54	Smooth Barked Apple	<i>Angophora costata</i>	Mature	14	5	350		350	400	Fair	Fair	High	2. Medium	A2	4.2	2.3	Canopy sparse. Dry bark and splits on trunk, minor.
55	Sydney Peppermint	<i>Eucalyptus piperita</i>	Young	6	5	120		120	150	Poor	Poor	Low	3. Short	Z10	2.0	1.5	Heavy lean to north. No apical leader formed.

Appendix 2 - Tree Inspection Schedule

Tree ID	Common Name	Botanical Name	Age Class	Height (m)	Canopy Spread Radius (m)	Stem 1 (mm)	Stem 2 (mm)	DBH (mm)	DAB (mm)	Health	Structure	Amenity Value	SULE	Retention Value	TPZ Radius (m)	SRZ Radius (m)	Notes
56	Old Man Banksia	<i>Banksia serrata</i>	Mature	8	4	370		370	450	Good	Fair	Medium	1. Long	A2	4.4	2.4	None.
57	Old Man Banksia	<i>Banksia serrata</i>	Mature	6	0	260		260	300	Good	Fair	Medium	2. Medium	A2	3.1	2.0	Heavy Lean to north.
58	Sweet Pittosporum	<i>Pittosporum undulatum</i>	Mature	8	5	310		310	400	Good	Good	Medium	2. Medium	A1	3.7	2.3	None.
59	Old Man Banksia	<i>Banksia serrata</i>	Mature	5	4	300		300	380	Good	Good	High	1. Long	A1	3.6	2.2	Neighboring tree.
60	Red Mahogany	<i>Eucalyptus resinifera</i>	Mature	17	10	448		448	510	Good	Good	High	1. Long	A1	5.4	2.5	None.
61	Old Man Banksia	<i>Banksia serrata</i>	Mature	5	3	200		200	350	Good	Fair	High	1. Long	A2	2.4	2.1	None.
62	Swamp Oak	<i>Casuarina glauca</i>	Mature	10	4	180		180	210	Fair	Good	Low	2. Medium	A1	2.2	1.7	Suppressed.
63	Camphor Laurel	<i>Cinnamomum camphora</i>	Mature	10	5	300		300	400	Good	Good	Low	1. Long	Z3	3.6	2.3	Exempt species.
64	Camphor Laurel	<i>Cinnamomum camphora</i>	Mature	10	5	300		300	400	Good	Good	Low	1. Long	Z3	3.6	2.3	Exempt species.
65	Sweet Pittosporum	<i>Pittosporum undulatum</i>	Mature	8	2	150		150	200	Fair	Good	Medium	2. Medium	A2	2.0	1.7	None.
66	Sweet Pittosporum	<i>Pittosporum undulatum</i>	Mature	8	2	150		150	200	Fair	Good	Medium	2. Medium	A2	2.0	1.7	None.
67	Illawarra Flame	<i>Brachychiton acerifolius</i>	Mature	10	3	210		210	300	Fair	Good	Low	1. Long	Z3	2.5	2.0	None.
68	Jacaranda	<i>Jacaranda mimosifolia</i>	Mature	10	6	550		550	650	Good	Good	Low	1. Long	Z3	6.6	2.8	Neighbors tree measurements estimated.

Explanatory Notes

Tree Species - Botanical name followed by common name in brackets. 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), Dead (D).

Diameter at Breast Height (DBH) - Measured with a DBH tape or estimated at approximately 1.4m above ground level. Where DBH has been estimated it is indicated with an 'est'.

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) - $DBH \times 12$. Measured in radius from the centre of the trunk. Rounded to nearest 0.1m. For monocots, the TPZ is set at 1 metre outside the crown projection.

Structural Root Zone (SRZ) - $(DAB \times 50)^{0.42} \times 0.64$. Measured in radius from the centre of the trunk. Rounded up to nearest 0.1m.

Health - Good/Fair/Poor/Dead

Structure - Good/Fair/Poor

Safe Useful Life Expectancy (SULE) - 1. Long (40+years), 2. Medium (15 - 40 years), 3. Short (5 - 15 years), 4. Remove (under 5 years), 5. Small/young.

Amenity Value - Very High/High/Medium/Low/Very Low.

(x) Indicates the measurement taken for the diameter at tree base above the buttress roots.

(E) Indicates estimated measurements.

Appendix 3 - Health/Physiological condition

<u>Category</u>	<u>Example condition</u>	<u>Summary</u>
Good	<ul style="list-style-type: none"> • 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. 	<ul style="list-style-type: none"> • The tree is in above average health and condition and no remedial works are required.
Fair	<ul style="list-style-type: none"> • 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. 	<ul style="list-style-type: none"> • The tree is in below average health and condition and may require remedial works to improve the trees health.
Poor	<ul style="list-style-type: none"> • 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. 	<ul style="list-style-type: none"> • The tree is displaying low levels of health and removal or remedial works may be required.
Dead	<ul style="list-style-type: none"> • The tree is dead or almost dead. 	<ul style="list-style-type: none"> • The tree should generally be removed.

Appendix 4 - 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.

Appendix 5 - 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.

<u>Category</u>	<u>Description</u>
Young/Newly planted	<ul style="list-style-type: none">• Young or recently planted tree.
Semi Mature	<ul style="list-style-type: none">• Up to 20% of the usual life expectancy for the species.
Early mature/Mature	<ul style="list-style-type: none">• Between 20% - 80% of the usual life expectancy for the species.
Over mature	<ul style="list-style-type: none">• Over 80% of the usual life expectancy for the species.
Dead	<ul style="list-style-type: none">• Tree is dead or almost dead.

Appendix 6 - Structural condition

<u>Category</u>	<u>Example condition</u>	<u>Summary</u>
Good	<ul style="list-style-type: none"> • 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. 	<ul style="list-style-type: none"> • The tree is considered structurally good with well developed form.
Fair	<ul style="list-style-type: none"> • 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. 	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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. 	<ul style="list-style-type: none"> • The identified defects are likely to cause either partial or whole failure of the tree.

Appendix 7 - 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 retention in the existing situation.

Category	Description
1. Long	Useful life expectancy over 40 years
2. Medium	Useful life expectancy 15 to 40 years
3. Short	Useful life expectancy 5 to 15 years
4. Remove	Useful life expectancy under 5 years
5. Small/Young	Trees that could be transplanted or replaced with similar specimen.
6. Unstable	Tree has become hazardous or structurally unstable.

Appendix 8 - Retention value

The retention value that has been allocated to each tree in this report is not definitive and should only be used as a guideline by the client. We have assigned the retention value after assessing the combined SULE, structural condition, health, and amenity value of the tree. Any heritage listing that may apply to the tree has not been considered in this value, although if it has been identified it is included in the notes for the tree. Each tree has been assessed individually and consideration has not been given to value of the tree within a group.

<u>Category</u>	<u>Example recommendation</u>
Very high	Every effort should be made to preserve and retain trees in this category.
High	The trees in this category should be retained if it is reasonably possible.
Medium	The trees in this category should be retained if they do not constrain the development on the site.
Low	The trees in this category should not cause a constraint on the development proposals. They should be retained only if they do not or will not cause a risk to people or property.
Very low	The tree should generally be removed unless they do not or will not cause a risk to people or property.

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 <u>cannot</u> 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 <u>temporarily</u> 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.

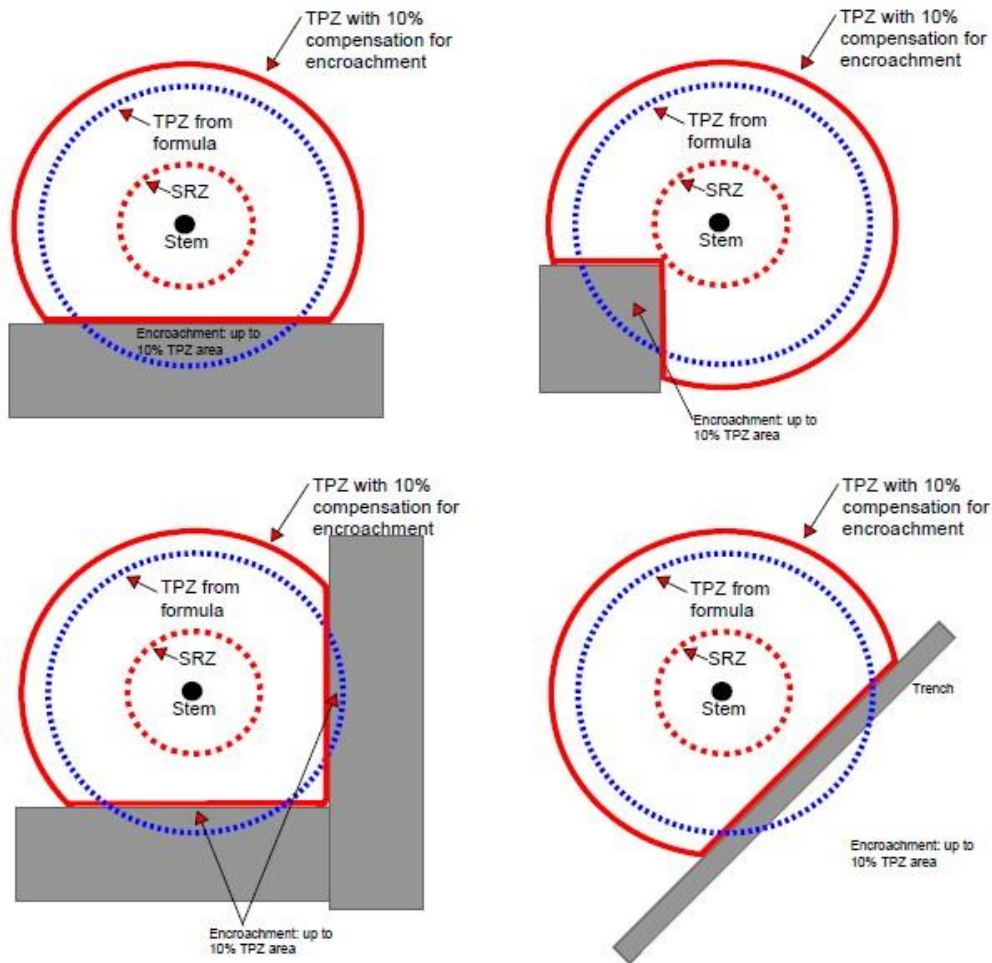
Category A: Important trees suitable for retention for more than 10 years and worthy of being a material constraint

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 10 – Examples of TPZ Encroachment

Encroachment into the Tree Protection Zone is sometimes unavoidable. The following diagram shows examples of acceptable levels of encroachment and how they may be compensated for by providing additional space contiguous to the TPZ area.



Note: Less than 10% TPZ area and outside SRZ. Any loss of TPZ compensated for elsewhere.