Arboricultural Impact Assessment

Prepared for Construct by Design
Site Address: 27 Bellevue Avenue Avalon

3rd September 2020, 25th February 2021 Revision C

Member of Arboriculture Australia No. 1286

Member of International Society of Arboriculture No. 157768

Bachelor of Horticultural Science, University Sydney.

AQF Level 2, 3 & 5 Diploma in Arboriculture

Graduate Certificate AQF Level 8 University Melbourne

Tree Risk Assessment Qualification (TRAQ)

Statement

Bradshaw Consulting Arborists is a company that exclusively provides tree consultancy within the tree industry. There is no conflict of interest concerning the recommendations outlined in this report.

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Contents

1 Introduction

This report has been prepared by Tristan Bradshaw for Construct by Design at the property of 27 Bellevue Avenue Avalon. The report request was to inspect 43 trees at the back of the property and any on surrounding properties. The trees' characteristics have been listed in Table 5 page 7. The aim is to determine the health and condition of the trees and their retention values to aid in determining a suitable house design. The inspection of the site was undertaken on the 12th February 2019 and again on the 4th September 2019. A tree root survey was undertaken on the 15th December 2020. See plan of dig locations after section 6.1.

A predevelopment application report was completed on 15th February 2019 and an Arboricultural Impact Statement completed on the 6th September 2019. This final Arboricultural Impact statement was completed on 3rd September 2020 and revision C completed on the 25th February 2021.

Survey plan supplied by Bee & Lethbridge dated 11/1/2019 and Architectural plans by Shed Architects received 19/2/2021 have been used in this assessment. See appendix B.

Tree numbers have been assigned to each tree on the survey plan. The trees have also been numbered onsite using metal tags.

The property is not within the RFS 10/50 vegetation clearing code.

The property is within the Northern Beaches council area and any tree taller than 5 metres is covered by their tree protection policy. The site's development is managed by Pittwater Local Environment Plan.

There is no heritage listing for this site. The site is not within a heritage conservation area.

The site is not within a 10/50 vegetation entitlement clearing area.

1.1 The Site

The site is composed of a house with trees surrounding it.

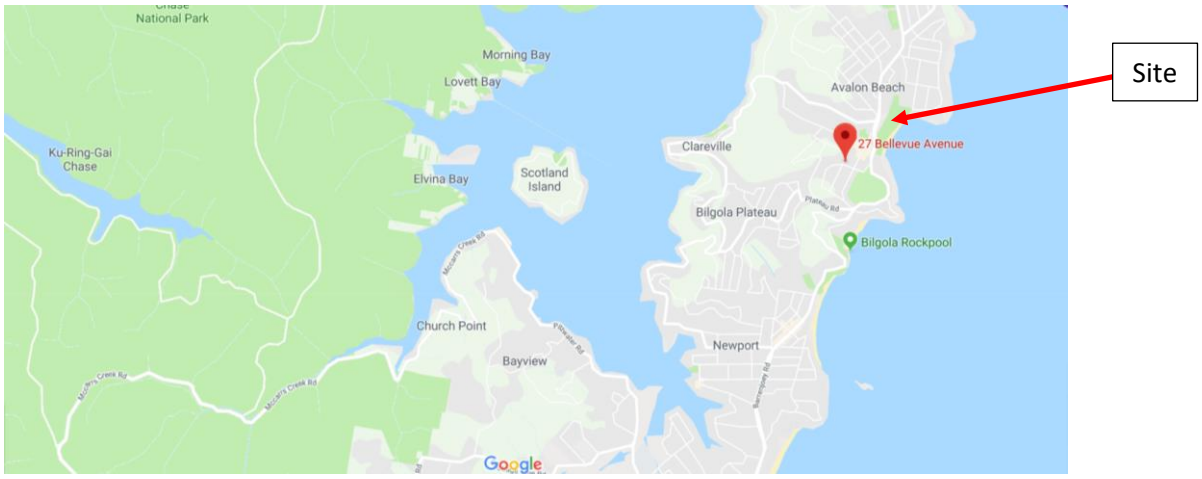

Figure 1 Site Location [3]

1.2 Method

The inspection of the site was undertaken on the 12th February 2019 and 4th September 2019 and again on 12 December 2020.

The inspection method used was the Visual Tree Assessment (VTA) method (Mattheck & Breloer 2010. [1]). This method involves inspecting the trees from ground level, using binoculars to aid in identification of any external signs of decay, physical damage, growth related structural defects and the site conditions where the tree is growing. This method will ascertain whether there is need for a more detailed inspection of any part of the tree. No aerial or subterranean inspections were carried out. See appendix A for the complete flow chart.

The Diameter at Breast Height (DBH) was estimated. The height of the measurement was at 140 cm above the ground.

The height of the tree was estimated.

The canopy spread of the tree was estimated.

A tree root survey was conducted using hand tools and a small 1 tonne excavator. All works supervised by AQF level 8 arborist.

Health: Based on vigour, callus development, % of deadwood, dieback, fruiting levels, internode lengths

(E) Excellent

(G) Good

(F) Fair

(P) Poor

(D) Dead

Age Class: (Y) Young=Recently Planted

(S) Semi mature <20% of life expectancy

(M) Mature 20-80% of life expectancy

(O) Over Mature >80% of life expectancy

Condition: Base on the structural integrity of the tree, cavities, fungal decay, branch failure, branch taper, sap or kino exudate, fruiting bodies, root condition.

(E) Excellent

(G) Good

(F) Fair

(P) Poor

Visual Habitat

This assessment is based on a visual observation of the tree, included in the VTA method.

Habitat trees are trees that provide microhabitats, these can include hollows, deeply fissured bark, cracks, epiphytes or forms of decay (Bütler, R., Lachat, T., Larrieu, L., & Paillet, Y., 2013).

2 Body Observations Results

Table 1 Individual tree characteristics

Tree Number	Botanical Name	DBH(mm)	DAB(mm)	Canopy N	Canopy S	Canopy E	Canopy W	Height	Health	Age	Condition	SULE	Landscape significance	Retention Value	Habitat	Structural Root Zone (SRZ)	Tree Protection Zone (TPZ)	Percentage encroachment	Notes
1	*Angophora costata* (Sydney Red Gum)	260	280	2	5	0	4	14	E	M	E	>40	V High	High	No	1.9	3.1	3.3%	
2	*Eucalyptus resinifera* (Red Mahogany)	500	600	8	7	6	6	15	G	M	F	15-40	High	High	No	2.7	6.0	0%	
3	E. Sp.	250	300	2	2	2	2	8	DEAD	NA	P	0	V Low	V Low	No	2.0	3.0	0%	DEAD
4	*Angophora costata* (Sydney Red Gum)	320	320	4	0	3	2	10	G	M	G	15-40	V High	High	No	2.1	3.8	0%	
5	*Angophora costata* (Sydney Red Gum)	320	340	3	5	4	3	9	G	M	G	15-40	V High	High	No	2.1	3.8	0%	
6	*Eucalyptus robusta* (Swamp Mahogany)	400	400	7	6	6	5	13	F	M	G	15-40	V High	High	No	2.3	4.8	0%	Epicormics and dieback

Tree Number	Botanical Name	DBH(mm)	DAB(mm)	Canopy N	Canopy S	Canopy E	Canopy W	Height	Health	Age	Condition	SULE	Landscape significance	Retention Value	Habitat	Structural Root Zone (SRZ)	Tree Protection Zone (TPZ)	Percentage encroachment	Notes
7	*Corymbia gummifera* (Red Bloodwood)	290	290	4	4	4	4	13	P	OM	P	<5	High	Low	No	2.0	3.5	0%	80% of the upper canopy dead.
8	*Cinnamomum camphora* (Camphor Laurel)	250	270	3	3	3	3	8	P	SM	P	5-15	Low	V Low	No	1.9	3.0	0%	Weed species
9	*Eucalyptus botryioides* (Southern Mahogany)	270	270	2	0	1	1	4	F	M	P	5-15	High	Mod	No	1.9	3.2	3%	Significantly unbalanced
10	*Eucalyptus globioidea* (Stringy Bark)	300	310	5	2	2	4	11	F	OM	F	5-15	High	Mod	No	2.0	3.6	0%	Dying
11	*Eucalyptus globioidea* (Stringy Bark)	220	220	3	0	0	3	10	P	M	F	5-15	High	Mod	No	1.8	2.6	0%	Dying
12	*Phoenix canariensis* (Canary Island Date Palm)	550	600	4	4	4	4	8	G	M	G	>40	Low	Mod	No	2.7	4	2.3%	
13	*Eucalyptus globioidea* (Stringy Bark)	260	270	4	2	5	2	9	P	M	F	<5	High	Low	No	1.9	3.1	0%	DEAD

Tree Number	Botanical Name	DBH(mm)	DAB(mm)	Canopy N	Canopy S	Canopy E	Canopy W	Height	Health	Age	Condition	SULE	Landscape significance	Retention Value	Habitat	Structural Root Zone (SRZ)	Tree Protection Zone (TPZ)	Percentage encroachment	Notes
14	*Callistemon viminallis* (Bottle Brush)	200	210	1	1	1	1	7	G	SM	G	15-40	Mod	Mod	No	1.7	2.4	0%	
15	*Phoenix canariensis* (Canary Island Date Palm)	500	500	3	3	3	3	3	G	M	G	>40	Low	Mod	No	2.5	4.0	0%	
16	*Angophora costata* (Sydney Red Gum)	950	890	7	4	6	6	14	F	M	P	<5	V High	Low	No	3.2	11.4	37%	Cavity, canopy dieback
17	*Syagrus romanzoffiana* (Cocos Palm)	270	270	3	3	3	3	7	E	M	G	15-40	Low	Low	No	1.9	4	100%	
18	*Livingstonia australis* (Cabbage Tree Palm)	290	300	3	3	3	3	10	E	M	G	>40	V High	High	No	2.0	4	100%	Within 2 metres of existing house.
19	*Washingtonia filifera* (Cotton Palm)	310	330	2	2	2	2	5	G	M	G	>40	Mod	Mod	No	2.1	3	100%	
20	*Syagrus romanzoffiana* (Cocos Palm)	260	280	3	3	3	3	9	E	M	E	>40	Low	Low	No	1.9	4	100%	

Tree Number	Botanical Name	DBH(mm)	DAB(mm)	Canopy N	Canopy S	Canopy E	Canopy W	Height	Health	Age	Condition	SULE	Landscape significance	Retention Value	Habitat	Structural Root Zone (SRZ)	Tree Protection Zone (TPZ)	Percentage encroachment	Notes
21	*Angophora costata* (Sydney Red Gum)	510	560	6	6	6	6	14	E	M	G	>40	V High	High	No	2.6	6.1	<10%	Tree root survey conducted
22	*Angophora costata* (Sydney Red Gum)	580	580	9	0	5	5	14	E	M	P	Haz	V High	Very Low	No	2.6	7.0	20%	Bracket fungus, dieback. Risk of failure.
23	*Angophora costata* (Sydney Red Gum)	400	420	7	5	6	5	14	G	M	G	>40	V High	High	No	2.3	4.8	6%	
24	*Angophora costata* (Sydney Red Gum)	500	520	5	5	5	5	14	G	M	G	>40	V High	High	No	2.5	6.0	2%	
25	*Glochidion ferdinandi* (Cheese Tree)	300	300	6	0	4	4	9	F	M	F	5-15	V High	Mod	No	2.0	3.6	0%	
26	*Angophora costata* (Sydney Red Gum)	800	890	5	8	8	8	14	F	M	G	>40	V High	High	No	3.2	9.6	0%	Tree root survey conducted
27	*Eucalyptus globioidea* (Stringy Bark)	220	230	2	3	0	3	8	F	SM	G	15-40	V High	High	No	1.8	2.6	0%	
28	*Angophora costata* (Sydney Red Gum)	200	240	3	2	0	3	7	F	SM	F	15-40	V High	High	No	1.8	2.4	0%	

Tree Number	Botanical Name	DBH(mm)	DAB(mm)	Canopy N	Canopy S	Canopy E	Canopy W	Height	Health	Age	Condition	SULE	Landscape significance	Retention Value	Habitat	Structural Root Zone (SRZ)	Tree Protection Zone (TPZ)	Percentage encroachment	Notes
29	*Angophora costata* (Sydney Red Gum)	400	420	5	7	5	5	13	G	M	G	>40	V High	High	No	2.3	4.8	7%	Tree root survey conducted
30	*Corymbia gummifera* (Red Bloodwood)	400	410	3	6	4	4	12	F	OM	F	15-40	V High	High	No	2.3	4.8	12%	Tree root survey conducted
31	*Angophora costata* (Sydney Red Gum)	360	390	6	4	5	5	13	F	M	P	<5	V High	Low	No	2.2	4.3	100%	Decaying root system. Whole tree failure
32	*Angophora costata* (Sydney Red Gum)	260	270	4	3	3	3	10	P	OM	P	<5	V High	Low	No	1.9	3.1	20%	Significant dieback
33	*Angophora costata* (Sydney Red Gum)	380	400	4	4	5	5	12	F	M	P	5-15	V High	Mod	No	2.3	4.6	2%	
34	*Corymbia gummifera* (Red Bloodwood)	390	430	4	4	4	4	12	G	M	G	15-40	V High	High	No	2.3	4.7	100%	
35	*Eucalyptus globioidea* (Stringy Bark)	260	270	5	0	3	3	12	F	M	F	5-15	High	Mod	No	1.9	3.1	100%	
36	*Eucalyptus globioidea* (Stringy Bark)	220	230	1	1	1	1	10	P	SM	P	<5	High	Low	No	1.8	2.6	100%	

Tree Number	Botanical Name	DBH(mm)	DAB(mm)	Canopy N	Canopy S	Canopy E	Canopy W	Height	Health	Age	Condition	SULE	Landscape significance	Retention Value	Habitat	Structural Root Zone (SRZ)	Tree Protection Zone (TPZ)	Percentage encroachment	Notes
37	*Lophostemon confertus* (Brush Box)	700	740	6	6	6	6	15	E	M	E	>40	High	High	No	2.9	8.4	<10%	Tree root survey conducted
38	*Syzygium smithii* (Common Lilly Pilly)	320	360	4	4	4	4	10	P	OM	P	<5	High	Low	No	2.2	3.8	100%	Dying
39	*Glochidion ferdinandi* (Cheese Tree)	310	400	7	0	5	5	11	F	M	F	5-15	V High	Mod	No	2.3	3.7	9.9%	Tree root survey conducted
40	*Largerstroemia indica* (Crepe Myrtle)	210	210	3	3	3	3	7	F	M	G	15-40	Mod	Mod	No	1.7	2.5	100%	
41	*Jacaranda mimosifolia* (Jacaranda)	250	270	3	3	3	3	9	G	M	G	15-40	Mod	Mod	No	1.9	3.0	25%	
42	*Corymbia maculata* (Spotted Gum)	250	270	2	3	0	3	9	G	M	P	15-40	V High	High	No	1.9	3.0	0%	
43	*Corymbia maculata* (Spotted Gum)	350	400	5	5	5	5	14	G	M	G	>40	V High	High	No	2.3	4.2	0%	

3 Discussion

Of the 43 trees assessed a large number of trees are located on council property and neighbours' properties. A preliminary development arborist report was submitted to ensure a large number of trees of high retention were retained and protected. Retention value is a better indication of the retainability of trees as it considers the health, ecological, amenity and landscape significance. All factors must be considered when assessing trees for development. This includes surrounding trees in neighbours' properties and council owned trees.

Trees around the periphery of the block have been retained to maintain a treed landscape, maintaining privacy and inclusion of the building into the surrounding landscape.

Of the 43 trees assessed, trees 17, 18, 19, 20, 40 and 41 are either exempt tree species or within 2 metres of the existing house. Council approval is not required to remove these trees. Trees 17, 20, 40 and 41 are exempt tree species and are irrelevant to this proposal as they can be removed at any time.

It is proposed that trees (Palms) 18 and 19 are transplanted and retained on the property. Tree 18 is of high retention and should be retained in the landscape. Palm trees can transplant with high a success rate.

Of the remaining 37 trees, trees 37, 42 and 43 are in the neighbouring property of 29 Bellevue Avenue Avalon. There is no impact projected for trees 42 and 43. The encroachment as calculated from AS 4970-2007 to tree 37 is 18%. To provide an indication of the potential tree roots severed for this development a trench 700mm deep was excavated beside tree 37. Three tree roots 40mm, 90mm and 110mm were located. See section 6.2 for a plan of excavation. Because of the size of these tree roots the impact if these were to be removed is closer to 10% compared to the calculated 18% incursion. The hardy nature of this tree species is well known and was shown to be one of the top performing trees planted in Hong Kong during forest rehabilitation programs (Corlett, 1999). Proposed works within the TPZ of tree 37 comply with AS 4970-2009. See figures 2 and 3 below.

Figure 3 Trench looking west 2 tree roots

Figure 2 40mm tree root located within trench

Of the remaining 34 trees, trees 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 21, 24, 27, 28 and 29 are located on council property. It is proposed that all these trees are retained and protected. Projected impact to the TPZ has been included in table 5 page 7. No incursion is greater than 10%. This is in accordance with AS 4970-2009. Existing levels in the proposed garden areas will remain at natural ground level with a proposed raised boardwalk weaving between the trees. The RL measurement given is for the boardwalk and not finished ground levels.

The impacts to tree 21 include curb and gutter, new driveway and driveway turning area.

The proposed new curb and gutter beside this tree is located within the existing roadway and will be raised higher than the natural ground level. Hand excavation must occur if a concrete gutter is proposed. Any tree roots to be retained can be wrapped in Styrofoam with low compression, this will protect the tree roots while still allow for future growth. Permeable pavers rather than concrete will allow water infiltration and gas exchange with the root system of the tree. These materials have been shown to be useful especially when constructed over a sandy soil subbase. (Watson etal. 1994)

The proposed new driveway/crossover is at a similar level to the existing driveway and hence will have a minimal impact. The proposed driveway on the property to the north of the tree occupies approximately 10% of the TPZ. A tree root survey was conducted to determine the impact of the proposed driveway as it curved around the TPZ. One tree root 110mm root was identified. See figure 4 below. To install the driveway in this location it would involve severing this tree root. The projected impact to the TPZ is less than 10%.

Figure 4 Tree roots 110 & 120mm found 4 metres from tree 21

Of the remaining 14 trees, trees 16, 22, 31, 32, 36 and 38 are of low retention value and it is recommended they are removed. Tree 38 was incorrectly identified as *Syzygium paniculatum* in the initial Arboricultural assessment. The tree has since been identified as *Syzygium smithii*.

Tree 16 is experiencing dieback; the tree has a significantly large hollow trunk with decay. The significant swelling of the trunk often indicates extensive internal decay. See figure 5 below.

Figure 5 Tree 16 hollow and decay

Tree 22 has a large bracket fungus in one of the trunks of the tree, swelling is evident. Pruning would reduce the risk; however, the resulting tree would be severely unbalanced and would be prone to limb drop due to its weakened structure shown in figure 8. This tree should be removed irrespective of the proposed development. The tree may be of very high landscape use, however this irrelevant as the tree is of very low retention value due to this risk. The SULE rating for the tree was revised during the second assessment from <5 years to a hazard rating with no ULE (Useful Life Expectancy) remaining. See figures 6, 7 and 8 below.

Figure 7Tree 22 Bracket fungus (*Phellinus* sp.)

Figure 6 Significant dieback on tree 22

Figure 8 Weakened branch structure, rubbing branches.

An existing masonry wall is located on the boundary beside trees 27, 28 and 29. A tree root survey was conducted to determine extent of root growth, particularly from tree 29. The trench was excavated beyond the wall to the west. No tree roots of significance were located. The masonry wall is acting as a tree root barrier and preventing tree roots from trees 27, 28 and 29 entering the property of 27 Bellevue Pde Avalon. Any proposed works inside of the existing masonry wall will not affect trees 27, 28 and 29. See figures 9, 10 and 11 below.

Figure 9 Masonry wall beside tree 29

Figure 10 Masonry wall behind trees 27, 28 and 29

Figure 11 Trench beside tree 29

Tree 31 appears to be in fair health; however, the exposed root system looks to have been severed many years prior for the existing lower driveway entry. The structural root system is decaying, and the tree is prone to whole tree failure. Sydney Red Gums that fail in strong winds often have decay of anchor roots. This tree is structurally unsound and should be removed. Moore (2014) identified that a decaying lateral root system was present in most trees assessed subject to windthrow. See figures 12 and 13 below.

Figure 13 Decaying tree roots within the SRZ

Figure 12 Decaying tree roots from tree 31

Tree 32 is in poor health; the tree is dying. This tree is likely to die within the next 5 years. Removal is recommended. See figure 14 below.

Figure 14 Tree 32, almost dead and not worthy of retention

Trees 36 and 38 are in poor health. There is extensive deadwood and epicormic growth from these trees. They are stressed and declining. Removal is recommended.

Of the remaining 8 trees. Tree 25 is proposed to be retained; the proposed raised walkway can be designed to provide clearance for this tree. The piered walkway can be constructed so as not to affect the long-term health of this tree.

Tree 23 has less than 10% encroachment into the TPZ and should be retained. Proposed garden levels will remain at natural ground levels. These have not been proposed to be altered, the RL measurements given are of the raised boardwalk not the finished ground level.

Trees 26 and 33 have a calculated 13% incursion to the TPZ this is marginally more than the acceptable 10% as per AS 4970-2009. A tree root survey was conducted to determine the size and number of tree roots that may be potentially severed for this proposed construction. The depth of the trench was 700mm, at this depth the B horizon was a heavily compacted sand.

No tree roots greater than 10mm were found in the trench beside tree 26. The proposed excavation required for the basement and concrete slab construction for the first floor (eastern building) will not impact this tree. The proposed suspended slab of the first floor to reduce the impact to tree 26 is not required as there are no tree roots of significance in this area. The proposed suspended concrete slab for the western building must be retained. See figures 15, 16 and 17 below.

Figure 16 Trench beside tree 26 looking west

Figure 15 Trench beside tree 26 looking east

Figure 17 Face of trench beside tree 26, no roots encountered.

A root survey was also conducted beside tree 33 to identify what tree roots may be severed. A trench was hand excavated 700mm deep to heavily compacted sand, 3 metres from the northern boundary and 2.7 metres from the eastern boundary. The trench was 3 metres long. The location of this trench allows for over excavation to construct the basement. See section 6.2.

One tree root 20mm was located, no other significant tree roots were encountered. See figure 11

Figure 18 Trench beside tree 33

Figure 20 Northern section, 20mm tree root located.

Figure 19 Middle section

Figure 21 Southern section

The projected TPZ impact to tree 30 is 12%, this marginally above the recommendation in AS4970-2009. The projected works are at the periphery of the TPZ, any severed tree roots will be small due to multiple division and will proliferate with new roots quickly. Soil levels around the tree have been proposed to be retained. The proposed curb and gutter is to be constructed within the existing road, it is anticipated that there are few tree roots in this compacted substrate. The project arborist should however monitor these works. This tree is to be retained and protected.

It is proposed tree 39 is retained. The proposed OSD tank occupies 9.9% of the TPZ, it encroaches into the SRZ marginally. Part of the upper building covers the TPZ, this must be a pier and beam construction that will avoid any significant tree roots and preferably bridge the SRZ. A tree root survey was conducted to identify any major tree roots (See figure 5 for the location). No tree roots greater than 30mm were located from the tree 39 during the excavation. The solid brick base for a shed beside this tree has likely prevented any large tree roots from passing under it. The actual impact to the TPZ for this tree is less than the 9.9% calculated from AS4970-2009.

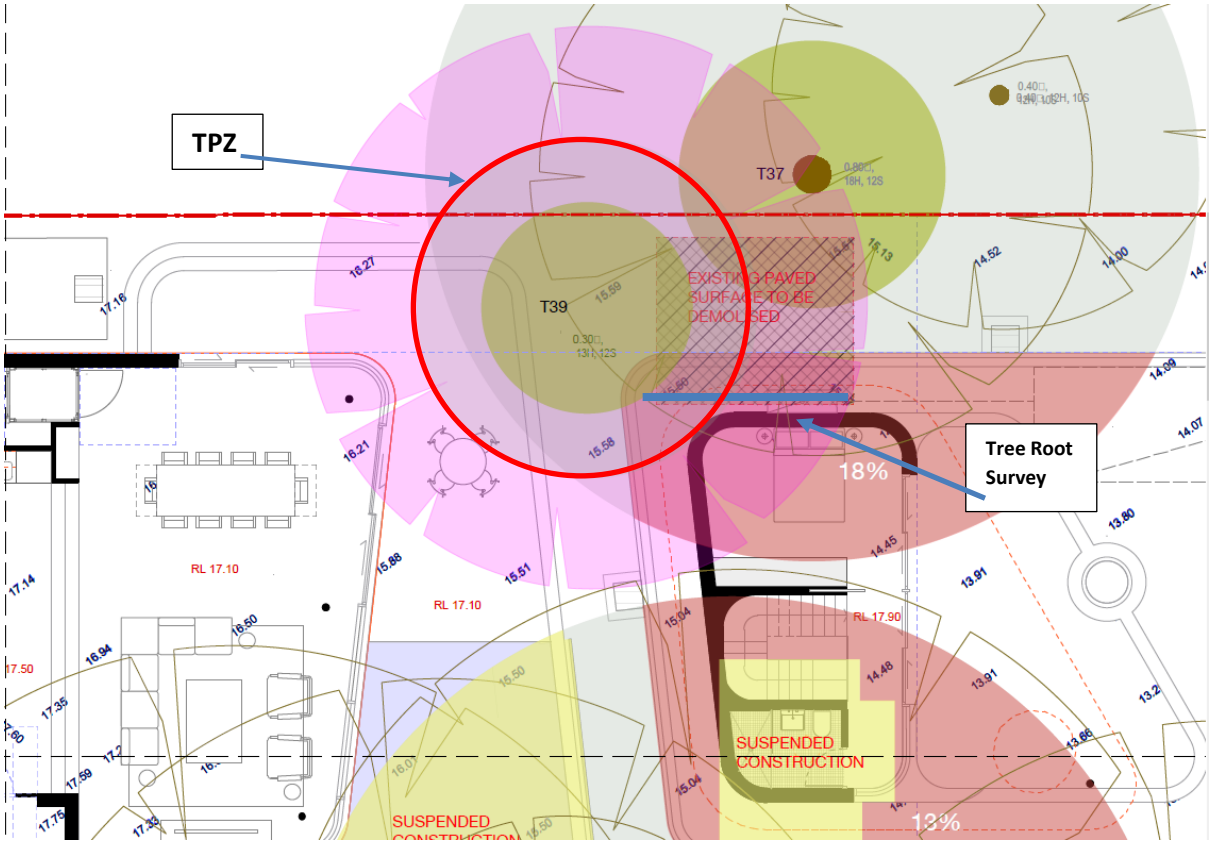

Figure 22 Position and impact to tree 39

Trees 34 and 35 are impacted negatively by this proposal and should be removed.

4 Recommendations

1. Removal of trees 16, 17, 20, 22, 31, 32, 34, 35, 36, 38, 40 and 41.
2. Retain and protect trees 1-15, 18, 19, 21, 23, 24, 25, 26, 27, 28, 29, 30, 33, 37, 39, 42 and 43.
3. Tree removal should be conducted by an Arborist with a minimum (Australian Qualification Framework) AQF level 3.
4. Work must be undertaken as per the Code of Practice Amenity Tree Industry 1998.
5. The tree removal process and staff should be skilled and undertake the removal of the tree as per the minimum industry standards.
6. Appoint project arborist. Minimum AQF Level 5 with 5 years' experience.
7. Retain and protect trees as per tree protection plan section 6.3. This is a combination of physical fencing, trunk protection and ground protection. See Section 7 Appendix G for specifications. All TPZ must have 100mm of organic mulch over the soil surface.
8. Irrigation is recommended for all trees retained if works are undertaken during summer. Scheduling of irrigation times to be coordinated by the project arborist. See section 8 regarding irrigation installation specifications.
9. Areas denoted as suspended slabs must have ground protection installed prior to any works conducted at the site. This can be left in situ if unable to be removed after construction.

10. Project arborist must supervise works within the TPZ of retained trees. This includes but not limited to excavation stage and piering works for basement concrete slabs, removal of existing driveway beside tree 21 and 29. Removal of the paving and retaining walls within TPZ of tree 37. Excavation to install curb and gutter. Piering for raise walkway within the TPZ. All excavation within TPZ should be by hand to a depth of 700mm, beyond this hydraulic equipment can be used. No heavy equipment is to enter TPZ.
11. Tree protection zones that have been fenced: if access is required to undertake construction ground protection and trunk protection must be installed for the duration of works. This must be approved by the project arborist.
12. The project arborist must inspect the site once every 2 months and provide a letter of recommendations and/or photographic evidence that tree protection has not been compromised.

5 References

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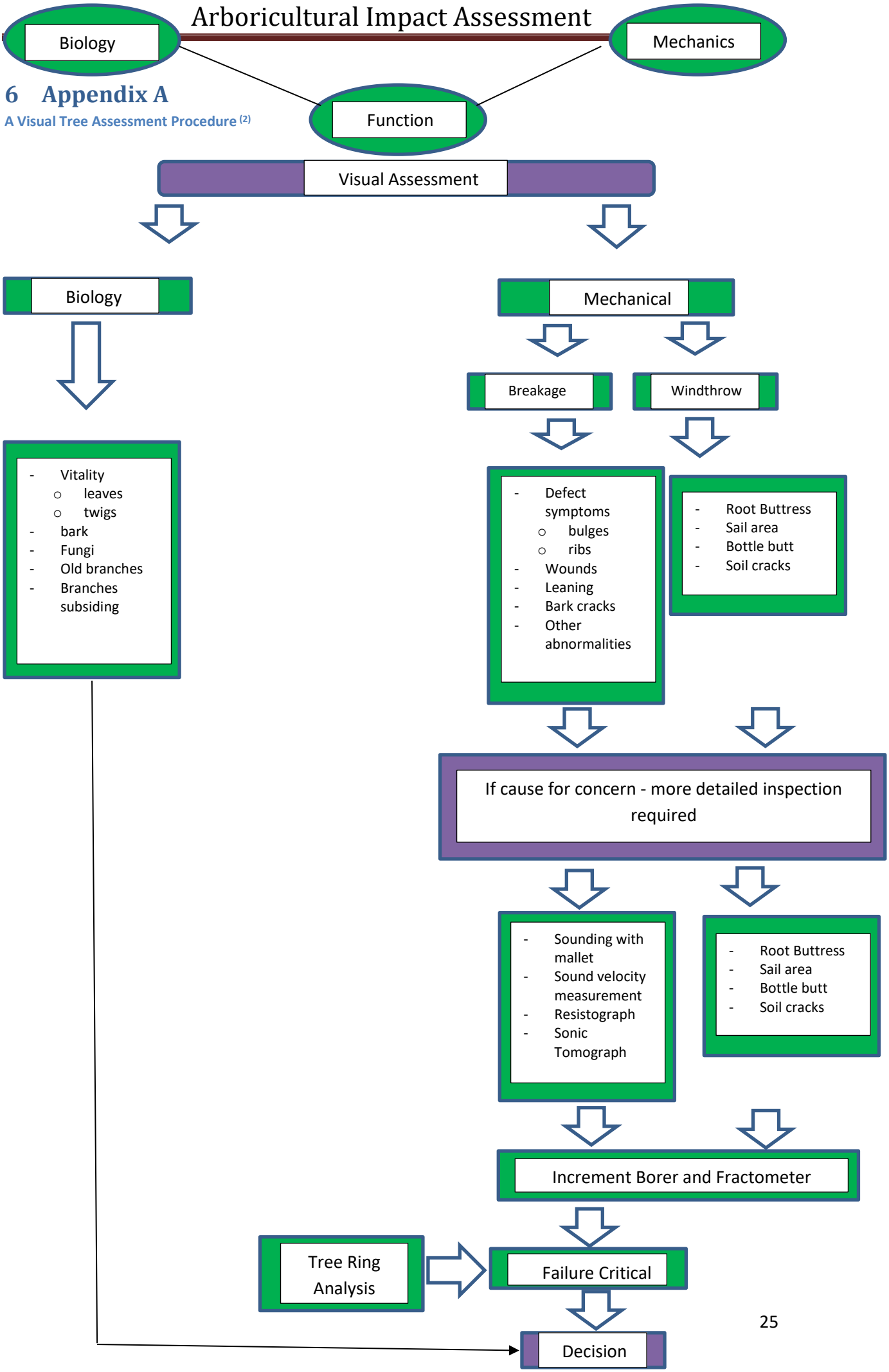
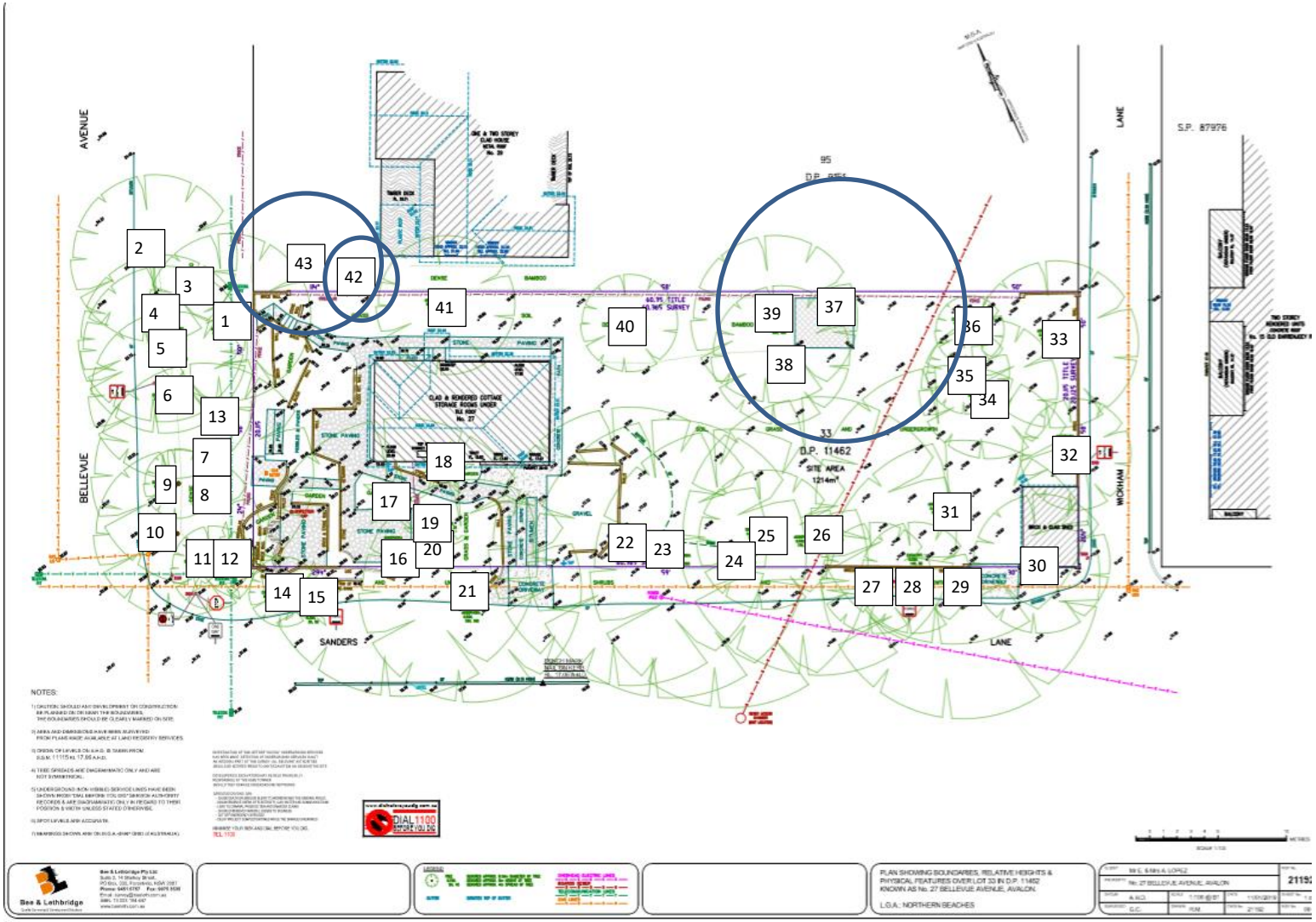
6 Appendix A

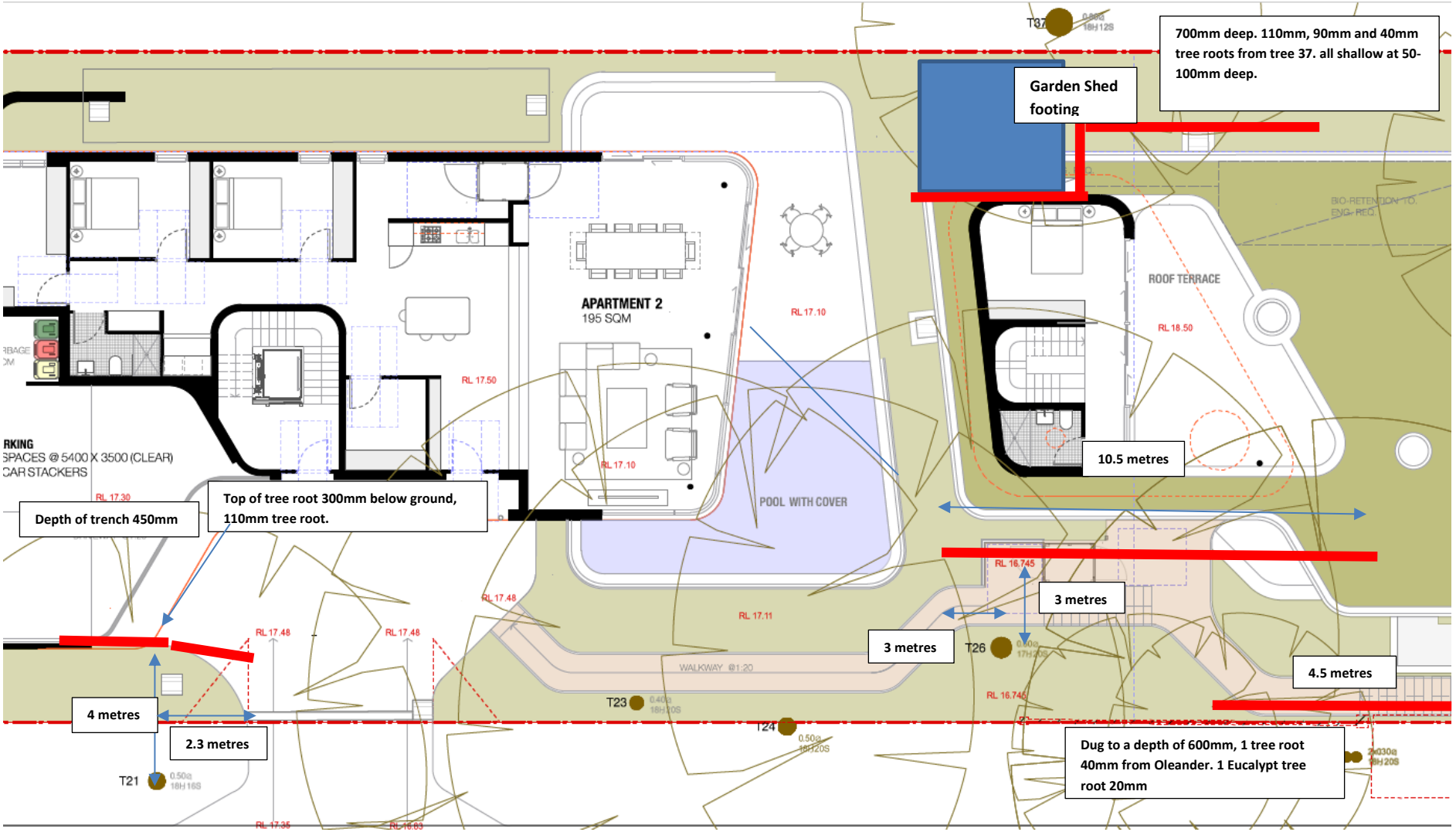
A Visual Tree Assessment Procedure [2]

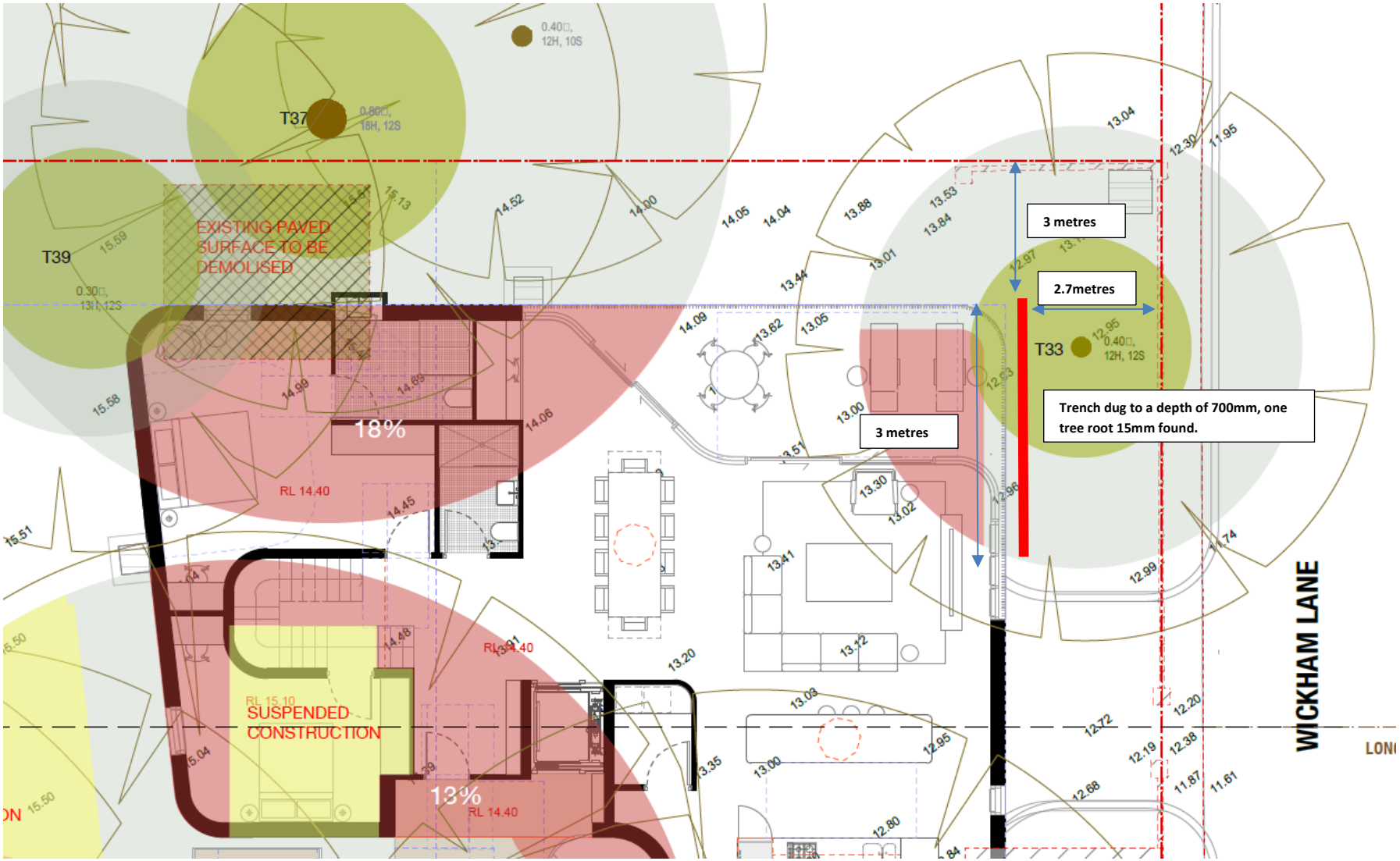


6.1 Appendix B Tree locations

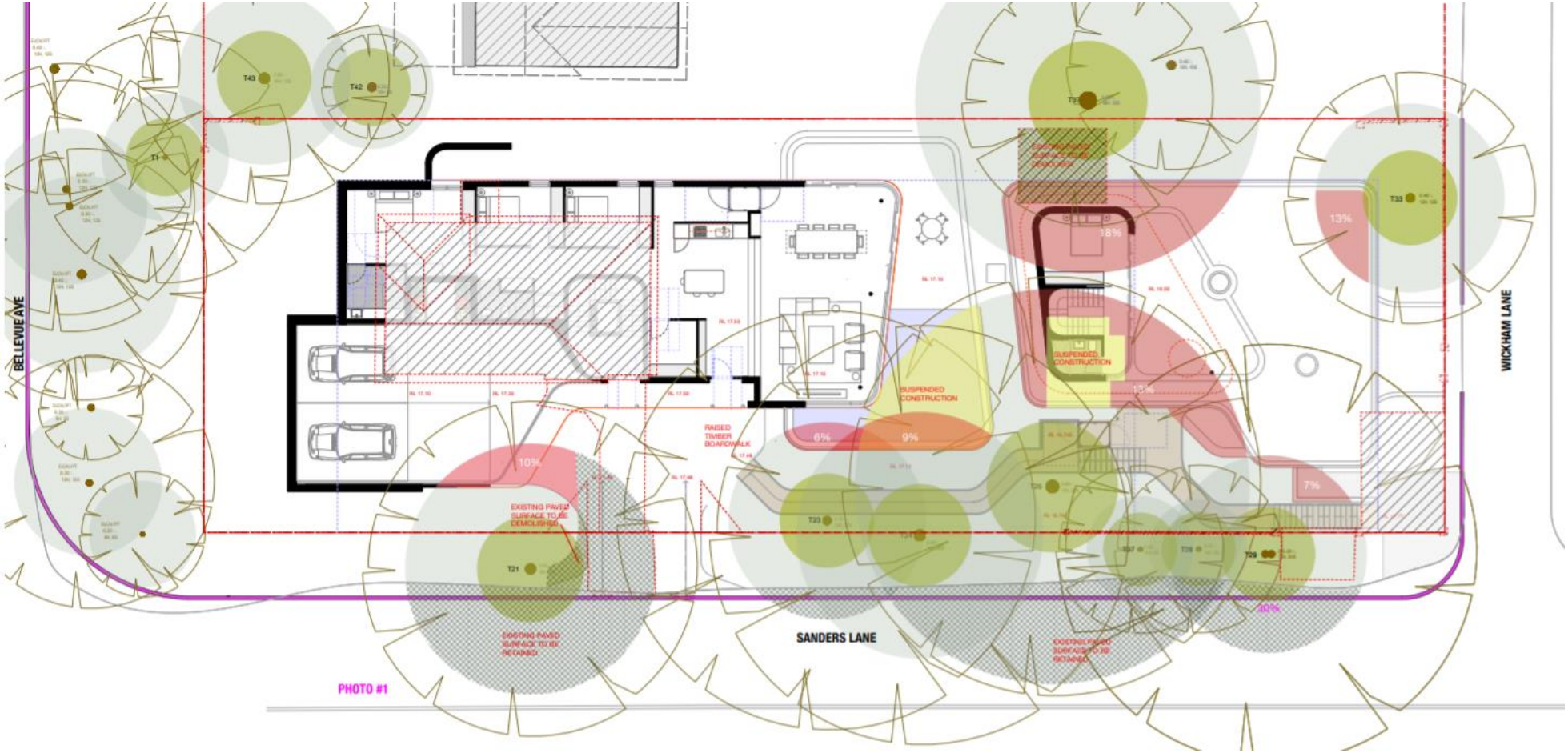


Tree Root Survey

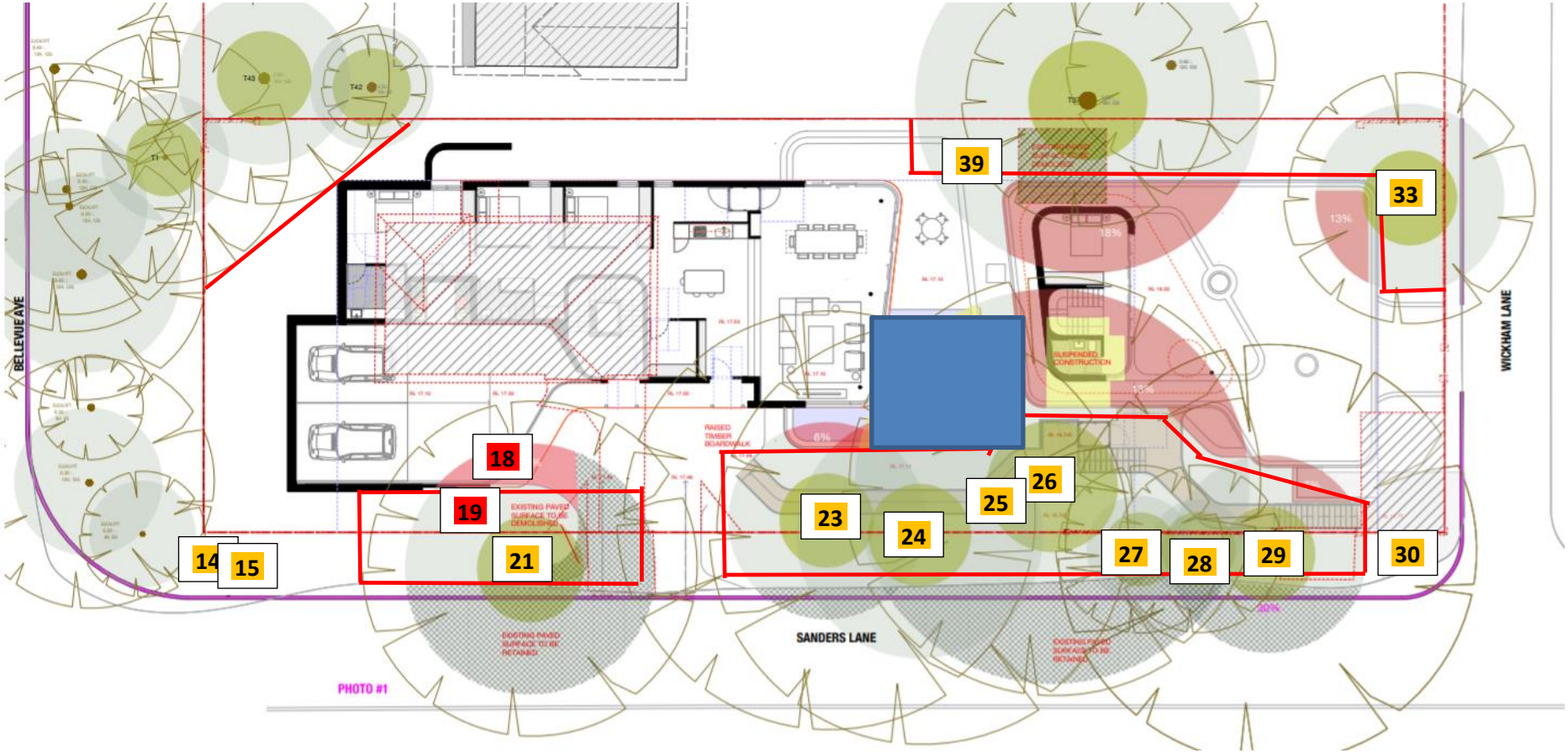



T37
T39
T33
EXISTING PAVED SURFACE TO BE DEMOLISED
18%
13%
RL 14.40
RL 15.10
SUSPENDED CONSTRUCTION
3 metres
2.7metres
3 metres
Trench dug to a depth of 700mm, one tree root 15mm found.
WICKHAM LANE

6.2 TPZ incursion of retained trees as calculated from AS 4970-2009. Tree root survey has altered these figures.



6.3 Tree Protection Plan



6.4 Appendix C Methodology for Determining Tree Retention Value

The aim of this process is to determine the relative value of each tree for retention (i.e. its Retention Value) in the context of development. This methodology assists in the decision-making process by using a systematic approach. The key objective of process is to ensure the retention of good quality trees that make a positive contribution to these values and ensure that adequate space is provided for their long term preservation. The Retention Value of a tree is a balance between its sustainability in the setting in which it is located (the 'landscape') and its significance within that setting (landscape significance).

Step 1: Determining the Landscape Significance Rating

The 'landscape significance' of a tree is a measure of its contribution to amenity, heritage, and ecological values. While these values are fairly subjective and difficult to assess consistently, some measure is necessary to assist in determining the Retention Value of each tree. To ensure in a consistent approach, the assessment criterion shown in Table 2 should be used. A Tree may be considered 'significant' for one or more reasons. A tree may meet one or more of the criteria in any value category (heritage, ecology or amenity) shown in Table 2 to achieve the specified rating. For example, a tree may be considered 'significant' and given a rating of 1, even if it is only significant based on the amenity criteria.

Based in the criterion in this table, each tree should be assigned a landscape significance rating as follows:

1. Significant
2. Very High
3. High
4. Moderate
5. Low
6. Very Low
7. Insignificant

Step 2: Determining Safe Useful Life Expectancy (SULE)

The sustainability of a tree in the landscape is a measure of its remaining lifespan in consideration of its current health, condition and suitability to the locality and site conditions. The assessment of the remaining lifespan of a tree is a fairly objective assessment when carried out by a qualified Consulting Arborist. Once a visual assessment of each tree is completed (using the Visual Tree Assessment criteria), the arborist can make an informed judgement about the quality and remaining lifespan of each tree. The Safe Useful Life Expectancy (SULE) methodology (refer to Table 3) can be used to categorise trees as follows:

- Long (Greater than 40 years)
- Medium (Between 15 and 40 years)
- Short (Between 5 and 15 years)
- Transient (less than 5 years)
- **Dead or Hazardous (no remaining SULE)**

The SULE of a tree is calculated based on an estimate of the average lifespan of the species in an urban area, less its estimated current age and then further modified where necessary in consideration of its current health, condition (structural integrity) and suitability to the site.

6.5 Appendix D Table 2 Step 1 Landscape Significance Rating

RATINGS	HERITAGE VALUE	ECOLOGICAL VALUE	AMENITY VALUE
1. SIGNIFICANT	The subject tree is listed as a Heritage item under the Local Environment Plan (LEP) with a local, state, or national level of significance or is listed on Council's Significant Tree Register.	The subject tree is scheduled as a Threatened Species as defined under the Threatened Species Conversation Act 1995 (NSW) or the Environmental Protection and Biodiversity Conservation Act 1999.	The subject tree has a very large live crown size exceeding 100m2 with normal to dense foliage cover, is located in a visually prominent position in the landscape, exhibits very good form and habit typical of the species.
	The subject tree forms part of the curtilage of a Heritage Item (building/structure/artefact as defined under the LEP) and has a known or documented association with that item.	The tree is a locally indigenous species, representative of the original vegetation of the area and is known as an important food, shelter or nesting tree for endangered or threatened fauna species.	The Subject tree makes a significant contribution to the amenity and visual character of the area by creating a sense of place or creating a sense of identity.
	The subject tree is a Commemorative Planting having been planted by an important historical person (s) or to commemorate an important historical event.	The subject tree is a Remnant Tree, being a tree in existence prior to development of the area.	The tree is visually prominent in view form surrounding areas, being a landmark or visible from a considerable distance.
2. VERY HIGH	The tree has a strong historical association with a heritage item (building/structure/artefact/garden etc) within or adjacent the property and/or exemplifies a particular era or style of landscape design associated with the original development of the site.	The tree is a locally indigenous species representative of the original vegetation of the area and is a dominant or associated canopy species of an Endangered Ecological Community (EEC) formerly occurring in the area occupied by the site.	The subject tree has a very large live crown size exceeding 60m2, a crown density exceeding 70% (normal-dense), is a very good representative of the species in terms of its form and branching habit or is aesthetically distinctive and makes a positive contribution to the visual character and the amenity of the area.
3. HIGH	The tree has a suspected historical association with a heritage item or landscape supported by anecdotal or visual evidence.	The tree is a locally indigenous and representative of the original vegetation of the area and the tree is located within a defined vegetation link/wildlife corridor or has known wildlife habitat value.	The tree is a good representative of the species in terms of its form and branching habit with minor deviations from normal (e.g. crown distortion/suppression) with a crown density of at least 70% (normal); The subject tree is visible form the street and/or surrounding properties and makes a positive contribution to the visual character and the amenity of the area.
4. MODERATE	The tree has no known or suspected historical association but does not detract or diminish the value the value of the item and is sympathetic to the original era of planting.	The subject tree is a non-local native or exotic species that is protected under the provisions of the DCP.	The subject tree has a medium live crown size exceeding 25m^2; The tree is a fair representative of the species, exhibiting moderate deviations from typical form (distortion/suppression etc) with a crown density of more than 50% (thinning to normal).
			The tree is visible from surrounding properties but is not visually prominent- view may be partially obscured by other vegetation or built forms. The tree makes a fair contribution to the visual character and amenity of the area.
5. LOW	The subject tree detracts from heritage values and diminishes the value of the heritage item.	The subject tree is scheduled as exempt (not protected) under the provisions of this DCP due to its species, nuisance or position relative to buildings or other structures.	The subject tree has a small live crown of less than 25m^2 and can be replaced within the short term (5-10 years) with new tree planting.
6. VERY LOW	The subject tree is causing significant damage to a heritage item.	The subject tree is listed as an Environment Weed Species in the Local Government Area, being invasive, or is a nuisance species.	The subject tree is not visible from surrounding properties (visibility obscured) and makes a negligible contribution or has a negative impact on the amenity and visual character of the area. The tree is a poor representative of the species, showing significant deviations from the typical form and branching habit with a crown density of less than 50%.

6.6 Appendix E Table 3 Estimating Safe Useful Life Expectancy (SULE) Step 2

1	Estimate the age of the tree
2	Establish the average life span of the species
3	Determine whether the average life span needs to be modified due to local environmental situation
4	Estimate remaining life expectancy

Life Expectancy	=	average modified life span of species - age of tree

5	Consider how health may affect safety (& longevity)
6	Consider how tree structure may affect safety
7	Consider how location will affect safety
8	Determine safe life expectancy

Safe Life Expectancy	=	life expectancy modified by health, structure and location

9	Consider economics of management (cost vs benefit of retention)
10	Consider adverse impacts on better trees
11	Consider sustaining amenity - making space for new trees
12	Determine SULE

Safe Useful Life Expectancy	=	safe life expectancy modified by economics, effects on better trees and sustaining amenity

Ref: Barrell, Jeremy (1996)
Pre-development Tree Assessment
Proceedings of the International Conference on Trees and Building Sites (Chicago)
International Society of arboriculture, Illinois, USA

6.7 Appendix F Table 4 Determining Tree Retention Values

The Retention Value of a tree is increased or diminished based on its sustainability in the landscape, which is expressed as its SULE. A tree that has a high Landscape Significance Rating, but low remaining SULE, has a diminished value for retention and therefore has an appropriate Retention Value assigned. Conversely a tree with a low Landscape Significance Rating even with a long remaining SULE, is also considered of low Retention Value. This logic is reflected in the matrix shown in Table 1.

Once the landscape Significance Rating and SULE category have been determined, the following matrix can be used to determine a relative value (or priority) for retention:

TABLE 1 – DETERMINING TREE RETENTION VALUES

	Landscape Significance Rating						
SULE	1	2	3	4	5	6	7
Long - greater than 40 years	High Retention Value						
Medium - 15 to 40 years			Moderate Retention Value				
Short - 5 to 15 years				Low Retention Value			
Transient - less than 5 years				Very Low Retention Value			
Dead or Hazardous							

7 Appendix G Tree Protection specifications

Tree Protection Fencing (See Figure 23 **below)**

Tree protection is to be carried out on all trees to be retained on site.

All fencing should be at the perimeter of the Tree Protection Zone (TPZ).

The TPZ must be enclosed with a fully supporting chainmesh protective fencing. The fencing shall be secure and fastened to prevent movement. The fencing shall have a lockable opening for access. Roots greater than 30mm diameter are not to be damaged/severed during the construction of the fence. See Figure 23 Drawing taken from AS 4970-2009below.

The enclosed area must be free of weeds and grass, the application of a 75mm layer of leaf mulch to the tree protection zone (TPZ) must be maintained for the duration of works.

Two signs on either side of the fencing are to be erected showing the name and contact details of the site Arborist and the words NO ENTRY clearly written.

No work is to be undertaken within this Tree Protection Zone; this includes:

-No removal or pruning of trees

-No construction, stockpiling or storage of chemicals, soil, and cement. Or the movement of machinery, parking and personnel is to occur within the TPZ.

-No refuelling, dumping of waste, placement of fill or Soil level changes.

-No lighting of fires or physical damage to protected trees.

-No temporary or permanent installation of utilities or signs.

-No service trenches should pass through the TPZ, unless approved and supervised by the project arborist.

Example of tree protection fencing

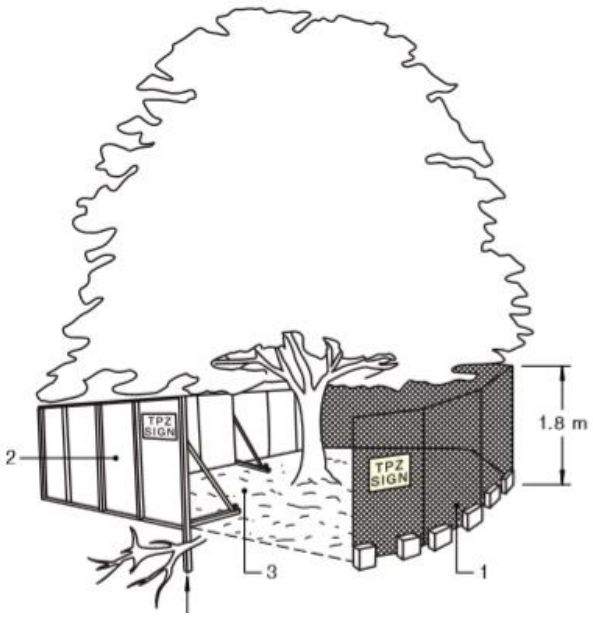
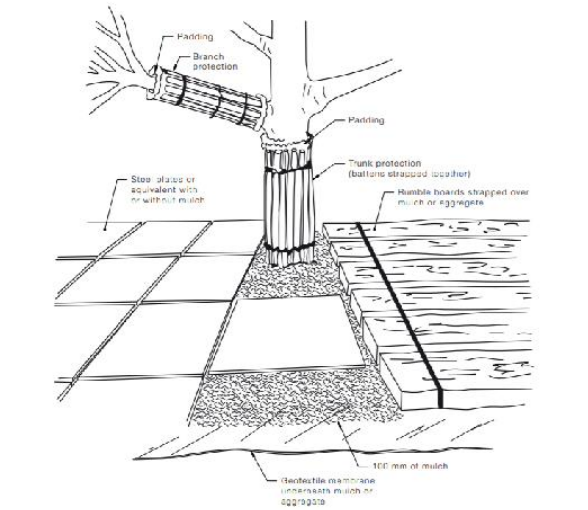


Figure 23 Drawing taken from AS 4970-2009



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.

Figure 25 Trunk and branch Protection (AS 4970-2009)

Figure 24 Trunk Protection

Trunk Protection

Hessian or similar material is used as a wrap around the trunk to a height of 2.6 metres from the base of the tree. Covering the hessian are timbers 100x50x2500mm These are to be spaced around the trunk with gaps of approximately 100mm. The timbers are to be secured with metal strapping. These materials are not to be directly fastened to the tree. See Figure 24 and Figure 25 above.

8 Installation of Drip line irrigation

Subsurface irrigation systems shall comprise of Netafim (or equivalent) pressure compensating inline dripper pipe with anti-siphon ability and copper oxide impregnated diaphragm. The subsurface lines are to be installed at a maximum of 300mm spacing's and at a rate nominated to provide the required precipitation rate to the planted garden beds whilst not exceeding the manufacturer's maximum length of drip line and to maintain an application uniformity of 90% and/or maximum frictional pressure loss representing the difference between the operating pressure and minimum operating pressure of the emitters as recommended by the manufacturers.

Drip irrigation shall be installed on the soil surface or below mulch if this has been specified. The subsurface laterals are to be pegged with steel pegs 300mm in length at a maximum of 2m centres along each drip line run. All solenoid valves providing irrigation water to areas of drip irrigation shall be fitted with a valve sized plastic bodied filter unit incorporating a disc filtration element equivalent to 120-mesh filtration. The system shall incorporate a line sized nylon ball valve located prior to the inlet of the filter and installed below ground level within a plastic valve enclosure. The filter enclosure to be sized so that filter may be easily maintained (JUMBO Valve box).

Where drip tubing is to be installed under mulch or buried directly in the soil, the contractor shall include a PVC or PE pipe to form a manifold for all of the drip tubes for both ends of the tubing, as follows:

- A water supply manifold connected to the drip irrigation filter and solenoid valve assembly.
- A water collection (drain) manifold connected to the downstream ends of all drip poly tubing runs.
- All ends of the water supply manifold shall be fitted with manually operated flushing valves.
- At least one end of the collection manifold shall be fitted with a manually operated flushing valve.
- At least one end of the collection manifold shall be fitted with an automatic drain valve.
- Air release valve shall be fitted at the highest point in the water supply manifold.
- Generally, all drain valves shall be installed at the lowest point of a drain manifold.
- Vacuum & drain valves may be interchanged, to suit the relative ground levels at the installation, the intention being that upon closure of the solenoid valve, air is allowed to enter the tubing at the high point and water is allowed to drain from the low point. All vacuum breaker valves, flushing and drain valves shall be housed within a 1910 valve box.

A manual timer or computerised timer with watering times scheduled by the project arborist should be used. See figure below.

Figure 26 Drip irrigation spacing

9 Qualifications and Experience

TRISTAN BRADSHAW

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Industry Licence AL1286-1

Professional Memberships

Member of the International Society of Arboriculture. No: 157768

Member of Arboriculture Australia No. 1286

Qualifications

2016-2018 Graduate Certificate in Arboriculture AQF8 at Melbourne University.

2015 Tree Risk Assessment Qualification (TRAQ)

2013-2014 Diploma of Arboriculture AQF5 at Ryde TAFE. Distinction

2012 Certificate III in Arboriculture at Ryde TAFE

2011 Certificate IV in Occupational Health and Safety

2010 Aboriginal Sites Awareness Course by Aboriginal Heritage Office

1996-1999 Bachelor of Horticultural Science at University of Sydney. Honours+

Tristan Bradshaw has been involved in the Horticultural and Arboricultural Industry since 1995. The business Bradshaw Horticultural Services was formed and incorporated Horticultural consulting work and landscaping. In 2000 Tristan undertook the Level 2 Arboriculture course at Ryde TAFE. The business progressively specialised in consulting, tree removal, pruning and stump grinding works. Extensive hands on knowledge was developed during the climbing of trees undertaking pruning or removal and during storm events understanding the tolerances of trees.

In 2009 the new business name Bradshaw Tree Services was registered to reflect works only being undertaken in the tree industry. The business operated throughout Sydney employing up to 25 people. Tristan Bradshaw's main role was as a consultant advising clients and writing reports. In 2019 Bradshaw Tree Services ceased operations and Tristan Bradshaw began Bradshaw Consulting Arborists exclusively undertaking tree consultancy.

Tristan Bradshaw with continued education has attained a Level 8 qualification, attends the annual Arboriculture conferences taking part in the seminars to broaden his knowledge.

This assessment was carried out from the ground and covers what was reasonably able to be assessed and available to this assessor at the time of inspection. No subterranean inspections were carried out. The preservation methods recommended where applicable are not a guarantee of the tree survival but are designed to reduce impacts and give the trees the best possible chance of adapting to new surroundings.

Limitations on the use of this report:

This report is to be utilised in its entirety only. Any written or verbal submission, report or presentation that includes statements taken from the findings, discussions, conclusions or recommendations made in this report, may only be used where the whole or the original report is referenced in, and directly attached to that submission, report or presentation.

Assumptions:

Care has been taken to obtain information from reliable resources. All data has been verified insofar as possible: however, Bradshaw Consulting Arborists can neither guarantee nor be responsible for the accuracy of information provided by others.

Unless stated otherwise:

-Information contained in this report covers only the tree/s that was/were examined and reflects the condition of the tree at the time of the assessment: and
-The inspection was limited to visual examination of the subject tree without dissection, excavation, probing or coring. There is no warranty or guarantee, expressed or implied, that problems or deficiencies of the subject tree may not arise in the future.
-The assessment does not identify hazards and associated risk; this report is not a risk assessment.

Yours sincerely,

Tristan Bradshaw (BHort Sci (USYD), Dip Arb AQF 5 (TAFE), Grad Cert AQF 8 (UMELB), TRAQ