

Arboricultural Impact Assessment

Prepared for Charter Hall
Site Address: 520 Gardeners Road Alexandria
22nd December 2021

Date	Revision	Stage
15/3/2022	B	DA

Member of Arboriculture Australia, Registered Consulting Arborist No. 1286

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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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1 Introduction

This report has been prepared by Tristan Bradshaw of Bradshaw Consulting Arborists for Charter Hall at the property 520 Gardeners Road Alexandria. The report request was to inspect Twenty six trees throughout the property and surrounding properties.

The trees' characteristics have been listed in Table 1 page 6. The aim is to determine the health and condition of the trees and the impact of the proposed development. The inspection of the site was undertaken on 6th December 2021.

The report was completed on 22nd December 2021.

See appendix B Section 8 for tree locations and tree protection plan.

The site's trees are managed under Sydney City Council's Urban Tree Management Policy.

The property is not bushfire prone and not within the RFS 10/50 vegetation entitlement clearing area.

No trees are listed on council's significant tree register.

The property is not mapped as having Terrestrial Biodiversity.

1.1 Plans used in this assessment

Consultant	Company	Date	Revision
Survey	LTS	2/8/2021	
Architectural	Nettletontribe	7/12/2021	Sketch

Stormwater and Landscape are yet to be assessed.

1.2 The Site

The site is composed of a dwelling and surrounding garden.

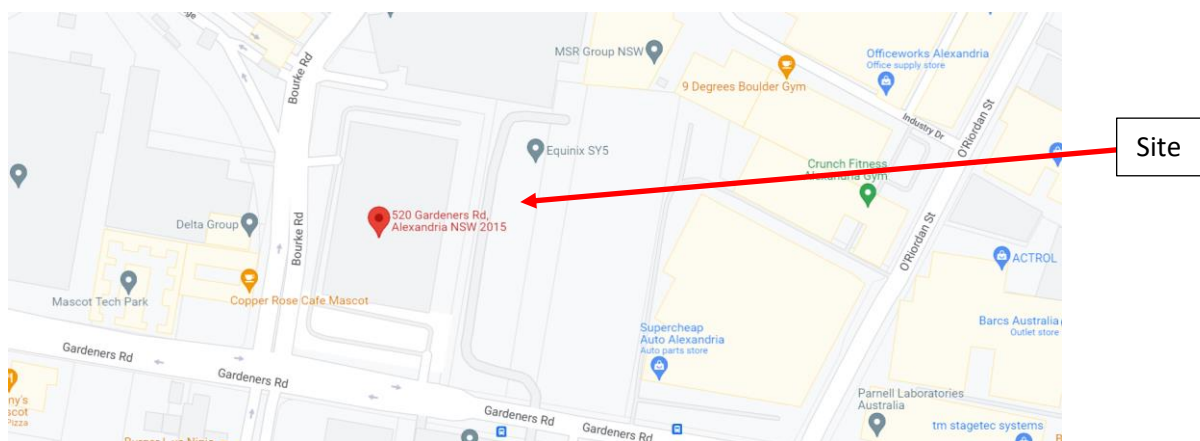


Figure 1 Site location (Google Maps 2021)

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1.3 Method

The inspection of the site was undertaken on 6th December 2021.

The inspection method used was the Visual Tree Assessment (VTA) method (Mattheck & Breloer 2010). This method involves inspecting the trees from ground level, using binoculars to aid in identification of any external's 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.

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: Based 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

(D) Dead

Landscape Significance and Retention Value see sections 6.2 and 6.3.

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Safe Useful Life Expectancy (SULE)

In a planning context, the time a tree can expect to be usefully retained is the most important long-term consideration. SULE is a system designed to classify trees into a number of defined categories so that information regarding tree retention can be concisely communicated in a non-technical manner. SULE categories are easily verifiable by experienced personnel without great disparity.

A tree's SULE category is the life expectancy of the tree modified by its age, health, condition, safety and location (to give safe life expectancy), then by economics (i.e. cost of maintenance; retaining trees at an excessive management cost is not normally acceptable), effects on better trees, and sustained amenity (i.e. establishing range of age classes in a local population).

SULE assessments are not static but may be modified as dictated by changes in tree health and environment. Trees with short SULE may at present be making a contribution to the landscape but their value to the local community will decrease rapidly towards the end of this period, prior to their being removed for safety or aesthetic reasons. For details of SULE categories see Appendix A, adapted from Barrell (1993 and 1996).

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).

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

Structural Root Zone (SRZ) - The area around the base of a tree required for the tree's stability in the ground. The woody root growth and soil cohesion in this area are necessary to hold the tree upright. The SRZ is nominally circular with the trunk at its centre and is expressed by its radius in metres. This zone considers a tree's structural stability only, not the root zone required for a tree's vigour and long-term viability, which will usually be a much larger area.

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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/ Structure	SULE	Visual Habitat	Landscape significance	Retention Value	Structural Root Zone (SRZ)	Tree Protection Zone (TPZ)	Retain or Remove notes
1	<i>Jacaranda mimosifolia</i> (Jacaranda)	150	150	2	2	2	2	4	G	S M	G	>40	No	Moderate	Moderate	1.5	2	Remove
2	<i>Eucalyptus microcorys</i> (Tallowwood)	310	350	3	3	3	3	7	G	S M	G	>40	No	Moderate	Moderate	2.1	3.7	Remove
3	<i>Eucalyptus microcorys</i> (Tallowwood)	380	410	4	3	3	3	8	E	M	G	15-40	No	Moderate	Moderate	2.3	4.6	Remove
4	<i>Ulmus parvifolia</i> (Chinese Elm)	310	310	3	3	3	3	6	F	S M	G	5-15	No	Moderate	Low	2.0	3.7	Remove
5	<i>Ulmus parvifolia</i> (Chinese Elm)	340	340	3	3	3	3	6	F	S M	G	5-15	No	Moderate	Low	2.1	4.1	Remove
6	<i>Melaleuca quinquenervia</i> (Broad leafed Paperbark)	692	850	4	4	4	4	11	F- G	M	G	15-40	No	Very High	High	3.1	8.3	Remove
7	<i>Melaleuca quinquenervia</i> (Broad leafed Paperbark)	580	500	4	4	4	4	11	F- G	M	G	15-40	No	Very High	High	2.5	7.0	Retain

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Tree Number	Botanical Name	DBH (mm)	DAB (mm)	Canopy N	Canopy S	Canopy E	Canopy W	Height	Health	Age	Condition/ Structure	SULE	Visual Habitat	Landscape significance	Retention Value	Structural Root Zone (SRZ)	Tree Protection Zone (TPZ)	Retain or Remove notes
8	<i>Melaleuca quinquenervia</i> (Broad leaved Paperbark)	430	500	4	4	4	4	11	F-G	M	G	15-40	No	Very High	High	2.5	5.2	Retain
9	<i>Melaleuca quinquenervia</i> (Broad leaved Paperbark)	536	630	4	4	4	4	12	F-G	M	G	15-40	No	Very High	High	2.7	6.4	Retain
10	<i>Melaleuca quinquenervia</i> (Broad leaved Paperbark)	618	820	4	4	4	4	12	F-G	M	G	15-40	No	Very High	High	3.0	7.4	Retain
11	<i>Melaleuca quinquenervia</i> (Broad leaved Paperbark)	537	1000	4	4	4	4	12	F-G	M	G	15-40	No	Very High	High	3.3	6.4	Retain
12	<i>Melaleuca quinquenervia</i> (Broad leaved Paperbark)	330	350	4	4	4	4	10	F-G	M	G	15-40	No	Very High	High	2.1	4.0	Retain
13	<i>Melaleuca quinquenervia</i> (Broad leaved Paperbark)	530	670	4	4	4	4	11	F-G	M	G	15-40	No	Very High	High	2.8	6.4	Retain
14	<i>Melaleuca quinquenervia</i> (Broad leaved Paperbark)	693	650	4	4	4	4	11	F-G	M	G	15-40	No	Very High	High	2.8	8.3	Remove
15	<i>Melaleuca quinquenervia</i> (Broad leaved Paperbark)	200	200	1	1	1	1	4	G	S M	G	>40	No	Very High	High	1.7	2.4	Remove

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Tree Number	Botanical Name	DBH (mm)	DAB (mm)	Canopy N	Canopy S	Canopy E	Canopy W	Height	Health	Age	Condition/ Structure	SULE	Visual Habitat	Landscape significance	Retention Value	Structural Root Zone (SRZ)	Tree Protection Zone (TPZ)	Retain or Remove notes
16	<i>Tristaniopsis laurina</i> (Water Gum)	140	140	1	1	1	1	4	P	S M	P	<5	No	Low	Very Low	1.5	2	Remove
17	<i>Melaleuca quinquenervia</i> (Broad leafed Paperbark)	330	330	2	2	2	2	5	G	S M	G	>40	No	Very High	High	2.1	4.0	Remove
18	<i>Melaleuca quinquenervia</i> (Broad leafed Paperbark)	310	350	0	2	1	1	6	G	S M	G	>40	No	Very High	High	2.1	3.7	Remove
19	<i>Ulmus parvifolia</i> (Chinese Elm)	310	340	4	4	4	4	7	F	M	G	5-15	No	Moderate	Low	2.1	3.7	Remove
20	<i>Syzygium Luehmannii</i> (Riberry)	353	380	3	3	3	3	8	F	M	G	5-15	No	Moderate	Low	2.2	4.2	Remove
21	<i>Syzygium Luehmannii</i> (Riberry)	200	200	1	1	1	1	4	P	S M	G	<5	No	Moderate	Very Low	1.7	2.4	Remove
22	<i>Syzygium Luehmannii</i> (Riberry)	150	150	1	1	1	1	8	F	S M	G	5-15	No	Moderate	Low	1.5	2	Retain
23	<i>Syzygium Luehmannii</i> (Riberry)	350	370	3	3	3	3	8	F	M	G	5-15	No	Moderate	Low	2.2	4.2	Retain

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Tree Number	Botanical Name	DBH (mm)	DAB (mm)	Canopy N	Canopy S	Canopy E	Canopy W	Height	Health	Age	Condition/ Structure	SULE	Visual Habitat	Landscape significance	Retention Value	Structural Root Zone (SRZ)	Tree Protection Zone (TPZ)	Retain or Remove notes
24	<i>Syzygium Luehmannii</i> (Riberry)	150	150	1	1	1	1	8	F	S M	G	5-15	No	Moderate	Low	1.5	2	Retain
25	<i>Syzygium Luehmannii</i> (Riberry)	270	270	3	3	3	3	8	F	M	G	5-15	No	Moderate	Low	1.9	3.2	Remove
26	<i>Syzygium Luehmannii</i> (Riberry)	230	230	2	2	2	2	8	F	M	G	5-15	No	Moderate	Low	1.8	2.8	Remove

3 Discussion

Twenty six trees have been included in this assessment.

It is proposed trees 1, 2, 3, 4 and 5 are removed. These trees are impacted by the proposed driveway. Trees 4 and 5 are suppressed, presumably from a reduced soil volume within a tree planting pit. Trees 1, 2 and 3 are young trees planted in the last 10 years, visually these trees are hidden behind trees 6-13 and do not play a significant role in softening the built form. It is proposed these trees are removed.

Tree 6 requires removal for the construction of a pathway.

Trees 7-14

These trees were planted approximately in 1980 and while endemic to the area, are not remnant. See figures 2 and 3 below.



Figure 3 1943 image of the site, no trees



Figure 2 Aerial image 1982, young tree planting

They are potentially impacted by the extension of the proposed driveway, altering the position of the entry and the inclusion of a pedestrian pathway.

Proposed levels of the driveway will be raised above relief levels yet remain at grade near the entry.

Levels at the driveway entry will remain the same as existing, this will involve excavation of approximately 300mm for the installation of the concrete driveway. It will remove a large portion of the root system of tree 14, See table 1 below. Some of the root system will be retained yet this will likely lead to a decline in tree health. It is recommended this tree is removed.

Table 1 below shows the incursion of the proposed driveway for trees 6-13. It also indicates the reduced incursion when 2 metres of permeable pavement is used for the driveway instead of concrete. The last column indicates the use of an additional 2 metres of a concrete surface, however the sub-base will consist of a compacted structural soil over, geogrid matting, geotextile fabric and the use of agricultural drainage pipes for aeration to allow excess water to drain. Grates should be

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installed in the concrete to allow water to percolate into the soil surface. It is assumed the permeable pavement access pathway will have no impact to the adjacent trees.

Table 1 TPZ incursion for trees 6-14

Tree Number	TPZ	Driveway encroachment	Incursion excluding permeable paving 2m section	Incursion excluding permeable paving and 2 metres of driveway.
6	8.3	0%	0%	0%
7	7	0%	0%	0%
8	5.2	4.5%	0%	0%
9	6.4	9.6%	0%	0%
10	7.4	18.6	8.5%	0%
11	6.4	30.8	15.5%	4%
12	4	33.5%	6.6%	0%
13	6.4	39.6%	20.8	5.5%
14	8.3	60%	51%	41.3%

Proposed Driveway

In order to retain the existing tree root system of trees 7-13, it has been proposed that the driveway levels are raised. This retains the root structure of the trees.

Complications of raising the soil level around trees includes possible lack of gaseous exchange of both oxygen infiltrating the root system and the escaping carbon dioxide produced by the root system. The soil profile also has an intricate ecosystem that requires oxygen. Filling over a tree root structure can reduce the amount of water the soil profile receives. This often-compacted layer reduces infiltration and increases runoff.

There have been many peer reviewed journal articles on the effects of fill over tree root systems. Trees young and old have survived after fill has been placed over the root systems. Day et al. (2001) found that after 200mm of compacted fill was placed over *Liquidambar styraciflua* and *Quercus alba* there was no effect to the growth of the trees after a 3-year period.

The depletion of oxygen under the fill due to poor infiltration rates was considered the major cause of trees that have died after soil levels have been raised, yet studies by MacDonald et al. (2004) and Day et al. (1995) of the effects of compacted fill and aeration systems have shown that there was not a significant reduction in the oxygen concentration below the fill layer and that aeration systems did not alter the oxygen levels either. Townsend et al. (1997) did find that oxygen levels were lower and carbon dioxide levels were higher but not to an extent that it would affect foliage growth. All authors indicated that soil oxygen levels were not the key cause to tree decline from fill, they proposed that soil water reduction, existing soil compaction during installation of fill or tree root damage are possibly more significant.

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Further studies by Day et al. (2001) and MacDonald et al. (2004) both noted that the soil below the fill layer was dryer, presumably due to poor infiltration of water caused by the fill. The lack of water reaching the tree roots was seen as more critical than aeration.

Tree species tolerance to any form of stress is also critical when assessing the likelihood of survival after fill is placed over the root zone. *Melaleuca quinquenervia* has a high tolerance to tree root damage, soil compaction, drought and soil saturation.

What can be concluded from this information is that while oxygen can be a factor, it is not major. Water infiltration is a key factor in affecting the health of trees with fill over them. More importantly it is likely tree root loss and compaction effects of the existing subbase has the greatest effects on the long-term health of the tree. Mullaney et al. (2015) found that the use of a base layer under permeable paving, increased trunk diameter growth of 55% compared to trees growing beneath a bitumen soil profile. A base layer has therefore been proposed.

The soil profile proposed to cover the root zone of trees 6, 8-13 addresses these key factors and omits the negative impacts that can occur. The process and materials used in this exercise have been addressed below.

1. The removal of the top 20-30mm of soil/grass/mulch is to occur, this is to remove the organic layer fraction of the soil. Hand excavation is recommended so as not to compact soil or glaze the soil surface. The A1 horizon will be retained containing the majority of the micro and macro nutrients. A small percentage of feeder tree roots will be removed during this process, but this will not stress the tree as there is a continual natural cycle where feeder tree roots die and are reproduced during favourable conditions.
2. The existing soil profile naturally drains to the west. This will prevent pooling of water and will not create a saturated soil profile and therefore anaerobic soil conditions.
3. Slotted agricultural drainage pipes will be laid over the existing soil surface under the fill layer. These will have two roles, one to supply oxygen and remove carbon dioxide from the natural soil profile and to provide drainage of excess water during extended periods of rainfall. They are to extend out into the surrounding garden.
4. Concrete edging to contain the raised soil profile is to be hand excavated, any tree roots greater than 20mm are to be retained and incorporated into the concrete edging. Tree roots are to be wrapped in a compressible styrofoam or similar to allow for future growth.
5. The use of plastic geogrid matting over the existing soil surface will prevent the compaction of the subbase layer after the application of the structural soil.
6. The use of the structural soil will provide the compaction requirement for the driveway and compensate for the minor amount of soil/grass/mulch removed from the soil surface prior to installing the fill layer. The structural soil will include fractions of fertiliser combined with biochar. Feeder tree roots will grow into this structural soil and overall, the soil volume available to the tree will be increased.
7. This is followed by geosynthetic, and a sharp gap graded sand or 5mm rock fraction followed by permeable paving. The geosynthetic prevents the slow mixing of the upper sand layer with the structural soil. The pavers and the engineered profile allow the free movement of water into the soil profile.

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It is proposed trees 6, 8-13 are retained and protected. The installation of the pavements must be closely supervised by the project arborist. All trees must be fully fenced with protective fencing until permeable pavement and concrete is installed.

Trees 15, 16 and 17

It is proposed these trees are removed. Tree 16 is in poor health and trees 15 and 17 are young trees planted within the last 10 years. These trees are negatively affected by the proposal.

Trees 18-26

Recent driveway widening works have occurred beside these trees and this has removed a portion of the trees' root system. This will likely affect the long-term health of these trees.

The proposed works will further reduce the planting bed and will involve the removal of trees 18, 19, 20, 21, 25 and 26. It is proposed trees 22, 23 and 24 are retained, these are small trees that are more tolerant of root disturbance. These trees will be retained and protected.

4 Recommendations

1. Removal of trees 1, 2, 3, 4, 5, 6, 14, 15, 16, 17, 18, 19, 20, 21, 25 and 26.
2. Retain trees 7, 8, 9, 10, 11, 12, 13, 22, 23 and 24
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. All trees must be retained and protected in accordance with Australian Standard 4970-2009. A tree protection plan has been provided as a guide in section 8. Tree protection fencing and trunk protection is required. See Section 10 Appendix G for generic specifications for these tree protection measures.
8. Services such as electrical/stormwater/sewer/telecommunications have not been assessed at this stage. All services should be routed outside of the TPZ as indicated in Table 1, if this is unavoidable, we must be notified to re-assess this proposed development.

5 Project Arborist Monitoring Stages

The list of monitoring stages are imperative to the long term health of those trees to be retained. The principal contractor (Site Builder) should be informed of these requirements as they often form the basis of the conditions of consent for the project. The stages set out below are a minimum requirement to aid in ensuring the long-term health of any tree recommended for retention on the site.

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Stage	Type of Monitoring	What is required
1	Ensure tree protection has been installed as per tree protection plan section 8	Tree Protection Certification
2	Any works within the TPZ of retained trees	Letter of attendance and any likely affects to trees
3	Installation of pavement surfaces within TPZ of trees 7-13	Letter identifying supervision including photographs of works during each stage
4	Final certification summarises the attendance to the site and reason for attendance. Comment on the likely long-term health of the retained trees. Provide any ongoing recommendations.	Final certificate supplied for occupation certificate

6 References

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Biology

Mechanics

7 Appendix A

A Visual Tree Assessment Procedure ⁽²⁾

Function

Visual Assessment

Biology

Mechanical

Breakage

Windthrow

- Vitality
 - o leaves
 - o twigs
- bark
- Fungi
- Old branches
- Branches subsiding

- Defect symptoms
 - o bulges
 - o ribs
- Wounds
- Leaning
- Bark cracks
- Other abnormalities

- Root Buttress
- Sail area
- Bottle butt
- Soil cracks

If cause for concern - more detailed inspection required

- Sounding with mallet
- Sound velocity measurement
- Resistograph
- Sonic Tomograph

- Root Buttress
- Sail area
- Bottle butt
- Soil cracks

Increment Borer and Fractometer

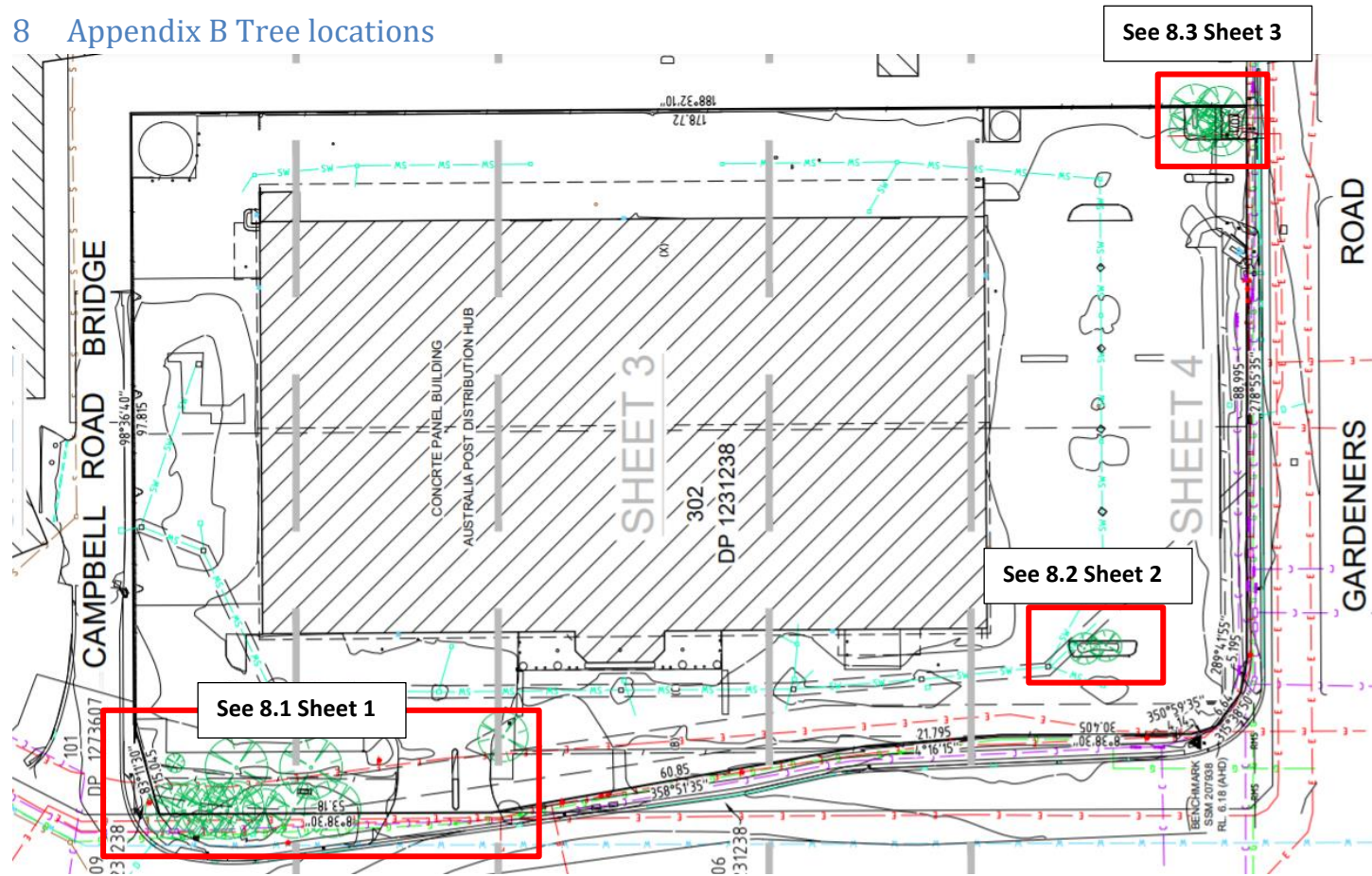
Tree Ring Analysis


Failure Critical

Decision

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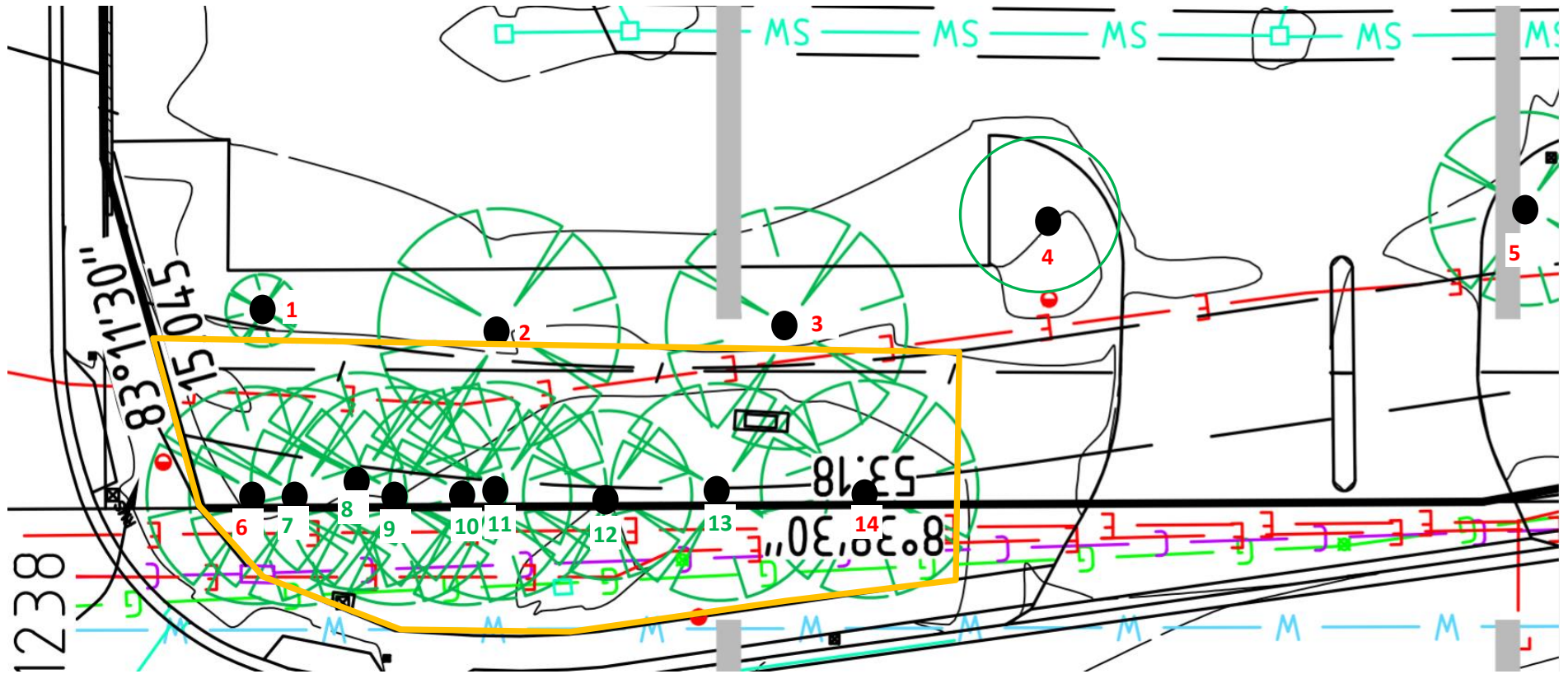
8 Appendix B Tree locations



Requirement	Total	Tree Number	Legend
Trees Removed	16	1-6, 14-21, 25, 26	Red
Trees Retained	10	7, 8, 9, 10, 11, 12, 13, 22, 23 and 24	Green
Trunk Protection	11	7-13, 22-24	
Tree protection fencing	11	7-13, 22-24	

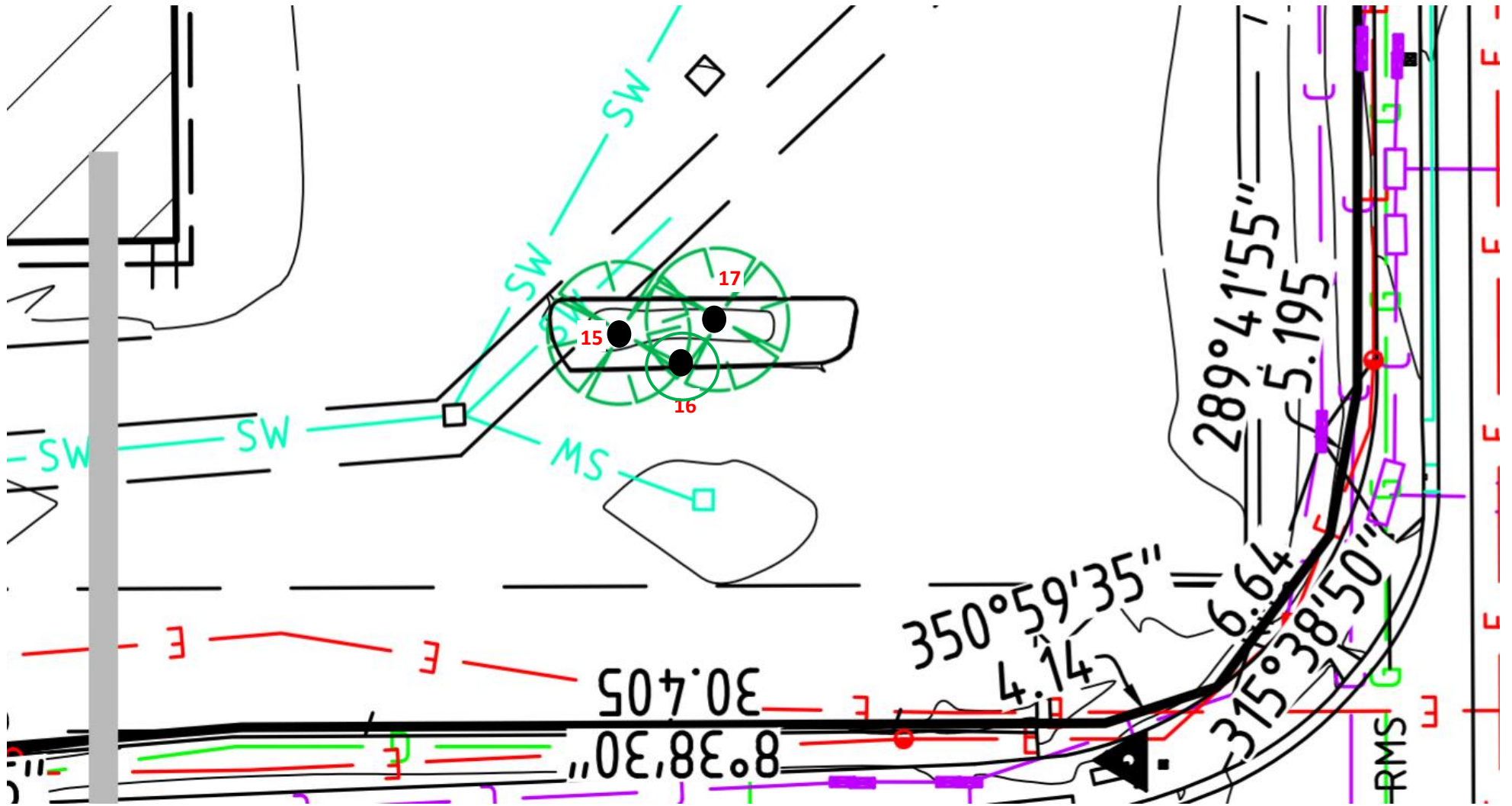
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8.1 Sheet 1

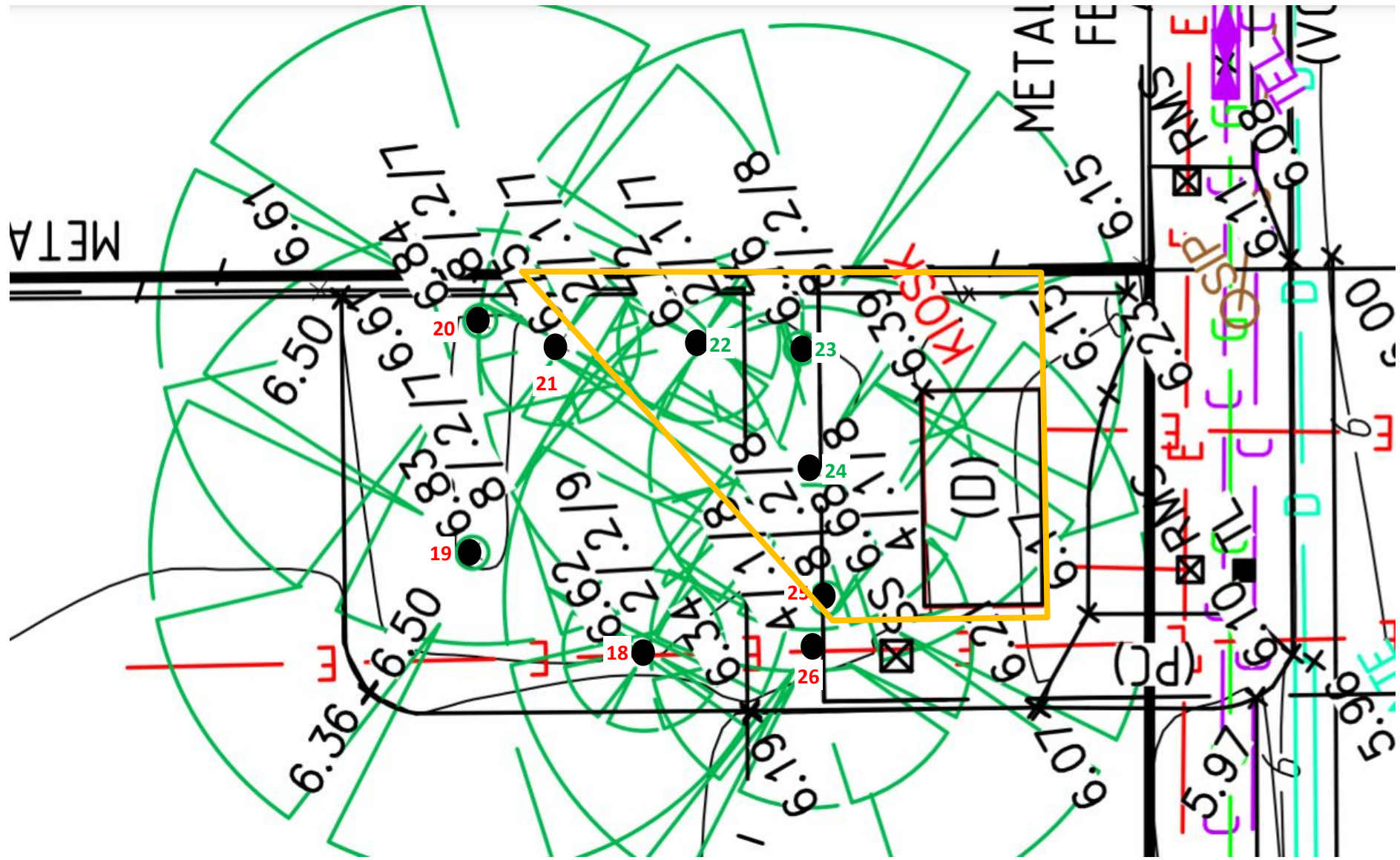


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8.2 Sheet 2



8.3 Sheet 3



9 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.

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9.1 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 100m ² 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 60m ² , 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 from 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%.

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9.2 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			
	<table border="1" style="margin: auto; border-collapse: collapse;"> <tr> <td style="padding: 5px;">Life Expectancy</td> <td style="padding: 5px;">=</td> <td style="padding: 5px;">average modified life span of species - age of tree</td> </tr> </table>	Life Expectancy	=	average modified life span of species - age of tree
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			
	<table border="1" style="margin: auto; border-collapse: collapse;"> <tr> <td style="padding: 5px;">Safe Life Expectancy</td> <td style="padding: 5px;">=</td> <td style="padding: 5px;">life expectancy modified by health, structure and location</td> </tr> </table>	Safe Life Expectancy	=	life expectancy modified by health, structure and location
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			
	<table border="1" style="margin: auto; border-collapse: collapse;"> <tr> <td style="padding: 5px;">Safe Useful Life Expectancy</td> <td style="padding: 5px;">=</td> <td style="padding: 5px;">safe life expectancy modified by economics, effects on better trees and sustaining amenity</td> </tr> </table>	Safe Useful Life Expectancy	=	safe life expectancy modified by economics, effects on better trees and sustaining amenity
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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

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9.3 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							

10 Appendix G Tree Protection specifications

Tree Protection Fencing (See Figure 4 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 4 Drawing taken from AS 4970-2009 below.

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.

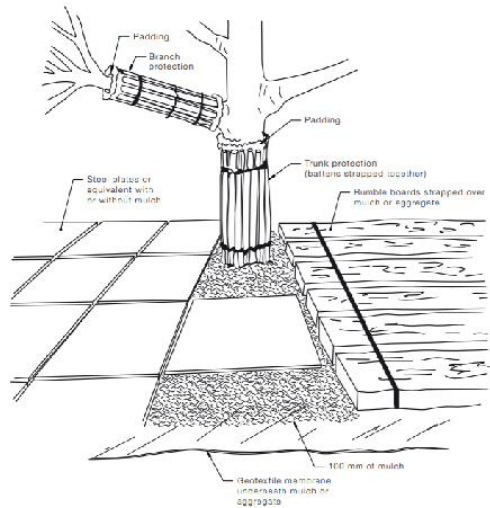
No work is to be undertaken within this Tree Protection Zone; this includes:

- 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 4 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 6 Trunk and branch Protection (AS 4970-2009)



Figure 5 Trunk Protection

Trunk/Branch Protection

Hessian or similar material is used as a wrap around the trunk/branch 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 5 and 6 above.

Ground protection

This is used to protect the Tree Protection Zone (TPZ) from soil compaction. Soil compaction reduces the available pore spaces within the soil, this reduces water holding capacity, oxygen and carbon dioxide diffusion. It can cause water to runoff the soil surface reducing infiltration. Over time the root system in a soil that is compacted (High Bulk Density) reduces in size. As the root system of a tree declines so does its canopy. When soil compaction is severe the entire tree can die.

Where scaffolding, foot traffic or wheelbarrow access is required. The soil surface should be covered by Geotextile fabric followed by plywood sheets 1.2 x 2.4 metres x 18mm thick and then covered by 100mm of mulch to provide a trafficable surface. Driveways or areas that will have heavy vehicles over the soil surface should have geotextile fabric, 100mm of mulch or gravel followed by sleepers 100x 200 x 3000mm. The sleepers are spaced 150mm apart and the gaps filled with gravel or mulch. The sleepers are then strapped together with hoop pine to prevent movement.

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10.1 Installation of underground services

All underground services must be routed outside the TPZ of any protected tree. The project arborist must be consulted (or council if required in DA conditions) if works pass through the TPZ of any tree. Methods such as thrust boring/directional drilling or hand excavation, during supervision by the project arborist are methods that reduce impact to surrounding trees. These are acceptable methods under AS 4970-2009.

11 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.

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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