



**SEASONED TREE
CONSULTING**

ARBORICULTURAL IMPACT ASSESSMENT REPORT

Prepared for
Mark + Kate O'Brien

Site address
**8 Tottenham Street,
North Balgowlah**

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1. INTRODUCTION

- 1.1 This report has been commissioned by the site owners Mark + Kate O'Brien to provide an Arboricultural Impact Assessment Report in relation to trees located on or close to the site that may be affected by a proposed development.

TABLE 1: DOCUMENTS PROVIDED FOR THE ASSESSMENT

Title	Author	Date	Reference on document
DA Preliminary Issue	Action Plans	13/12/2021	Rev A
Revised Driveway Plan (Proposed Ground Floor Plan)	Action Plans	4/2/2022	Rev A

- 1.2 One site inspection was carried out for the purpose of this assessment. This site inspection was undertaken as a visual tree and site assessment on 21/10/2021 undertake root exploration works for T4. The site inspection was undertaken to collect tree and site data.
- 1.3 The weather during both site inspections was sunny with good visibility.

2. SCOPE OF THE REPORT

- 2.1 **This report has been undertaken to meet the following objectives.**
- 2.2 Conduct a visual assessment from ground level of all trees located on or close to the site.
- 2.3 Determine the trees estimated contributing years, remaining useful life expectancy and award the tree a retention value.
- 2.4 Provide an assessment of the potential impact the proposed development is likely to have on the condition of the subject trees in accordance with AS4970 Protection of trees on development sites (2009).
- 2.5 Recommend methods to mitigate development impacts where appropriate.
- 2.6 Recommend pragmatic tree protection measures for any tree to be retained in accordance with AS4970 Protection of Trees on Development Sites - 2009.

3. LIMITATIONS

- 3.1 Observations and recommendations are based on the single site inspection. The findings of this report are based on the observations and site conditions at the time inspection.
- 3.2 All observations were carried out from ground level. No detailed additional testing was carried out on trees or soil on site and none of the surrounding surfaces were lifted for investigation.
- 3.3 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.
- 3.4 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.
- 3.5 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.
- 3.6 All diagrams, plans and photographs included in this report are visual aids only and are not to scale unless otherwise indicated.
- 3.7 Seasoned Tree Consulting neither guarantees, nor is responsible for, the accuracy of information provided by others that is contained within this report.
- 3.8 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.
- 3.9 Where trees are stated as retainable under the current proposal, this will only become a reality if all recommendations and specifications are followed exactly.
- 3.10 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.
- 3.11 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).
- 4.2 Tree common name
- 4.3 Tree botanical name
- 4.4 Tree age class
- 4.5 DBH (Trunk/Stem diameter at breast height/1.4m above ground level) - millimetres.
- 4.6 Estimated height - metres
- 4.7 Estimated crown spread (Radius of crown) - metres
- 4.8 Health
- 4.9 Structural condition
- 4.10 Amenity value
- 4.11 Estimated remaining contribution years (SULE)¹
- 4.12 Retention value (Tree AZ)²
- 4.13 Notes/comments
- 4.14 An assessment of the trees condition was made using the visual tree assessment (VTA) model (Mattheck & Breloer, 1994).³
- 4.15 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 and a Leica DistoD410 digital laser tape.
- 4.16 All DBH measurements, tree protection zones, and structural root zones were calculated in accordance with methods set out in AS4970 Protection of trees on development sites (2009) ⁴ and in some cases estimated. See appendices for information.
- 4.17 Details of how the observations in this report have been assessed are listed in the appendices.

5. ROOT EXPLORATION METHODOLOGY

- 5.1 Root exploration was undertaken with a shovel and trowel to carefully and sensitively excavate within certain areas close to trees.

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).

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

6. SITE LOCATION AND BRIEF DESCRIPTION OF PROPOSAL

- 6.1 The site is located in the suburb of North Balgowlah in the Northern Beaches Council LGA. This assessment has been carried out in accordance with the following documents and legislation;
- 6.1.1 Warringah Local Environmental Plan 2011
 - 6.1.2 Warringah Development Control Plan (DCP) 2011
 - 6.1.3 State Environmental Planning Policy (Vegetation in Non-Rural Areas 2017).
- 6.2 The site is a gently sloping residential block (with a slight rise from the street towards the back of the block) with an existing house, driveway and mature gardens and trees.
- 6.3 The block is zoned as R2: Low density Residential and is approx. 507sqm in size. There are no biodiversity or heritage overlays for the site⁵. Most of the trees on or close to the site are protected under the Northern Beaches Council Tree preservation order.
- 6.4 The proposal consists of extensive alterations and additions to the existing house, inclusive of new driveway and carport with construction of a pool and associated landscaping within the back yard.

Tile 1: Site location ⁶



⁵ <https://www.planningportal.nsw.gov.au/spatialviewer/#/find-a-property/address>

⁶ <https://maps.six.nsw.gov.au/>

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

- 7.1 **Tree information:** Details of each individual tree assessed, including the observations taken during the site inspection can be found in the tree inspection schedule in appendix 2, where the indicative tree protection zone (TPZ) for the subject trees has been calculated. The TPZ and SRZ should be measured in radius from the centre of the trunk. Trees have been awarded a retention value based on site observations. The system used to award the retention value is Tree AZ. Tree AZ is used to identify higher value trees worthy of being a constraint to development and lower value trees that should generally not be a constraint to the development. A field sheet of Tree AZ categories sheet (Barrell Tree Consultancy) has been included at the end of the report to assist with understanding the retention values. The retention value that has been allocated to the subject trees in this report is not definitive and should only be used as a guideline.
- 7.2 **Site plans:** Appendix 1 contains an existing site plan identifying tree locations and an overlay of the indicative TPZ and SRZ of each tree. Appendix 1A contains the proposed site plans, trees retained through the development and Appendix 1B tree protection advice.
- 7.3 **Tree protection zone (TPZ):** The TPZ is 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 AS4970-2009 to be the extent 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 tree protection also incorporates the SRZ (see below for more information about the SRZ). The TPZ of palms, other monocots, cycads and tree ferns has been calculated at one metre outside the crown projection. Appendix 4 contains additional information about the TPZ including information about calculating the TPZ and examples of TPZ encroachment.
- 7.4 **Structural Root Zone (SRZ):** This is the area around the base of a tree required for the trees stability in the ground. An area larger than the SRZ always needs to be maintained to preserve a viable tree. There are several factors that can vary the SRZ which include height, crown area, soil type and soil moisture. It can also be influenced by other factors such as natural or built structures. Generally work within the SRZ should be avoided. Soil level changes should also generally be avoided inside the SRZ of trees to be retained. Palms, other monocots, cycads and tree ferns do not have an SRZ. See appendix 5 for more information about the SRZ.

- 7.5 **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.
- 7.6 **Major encroachment into TPZ:** Where encroachment of more than 10% of the overall TPZ area is proposed an 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.

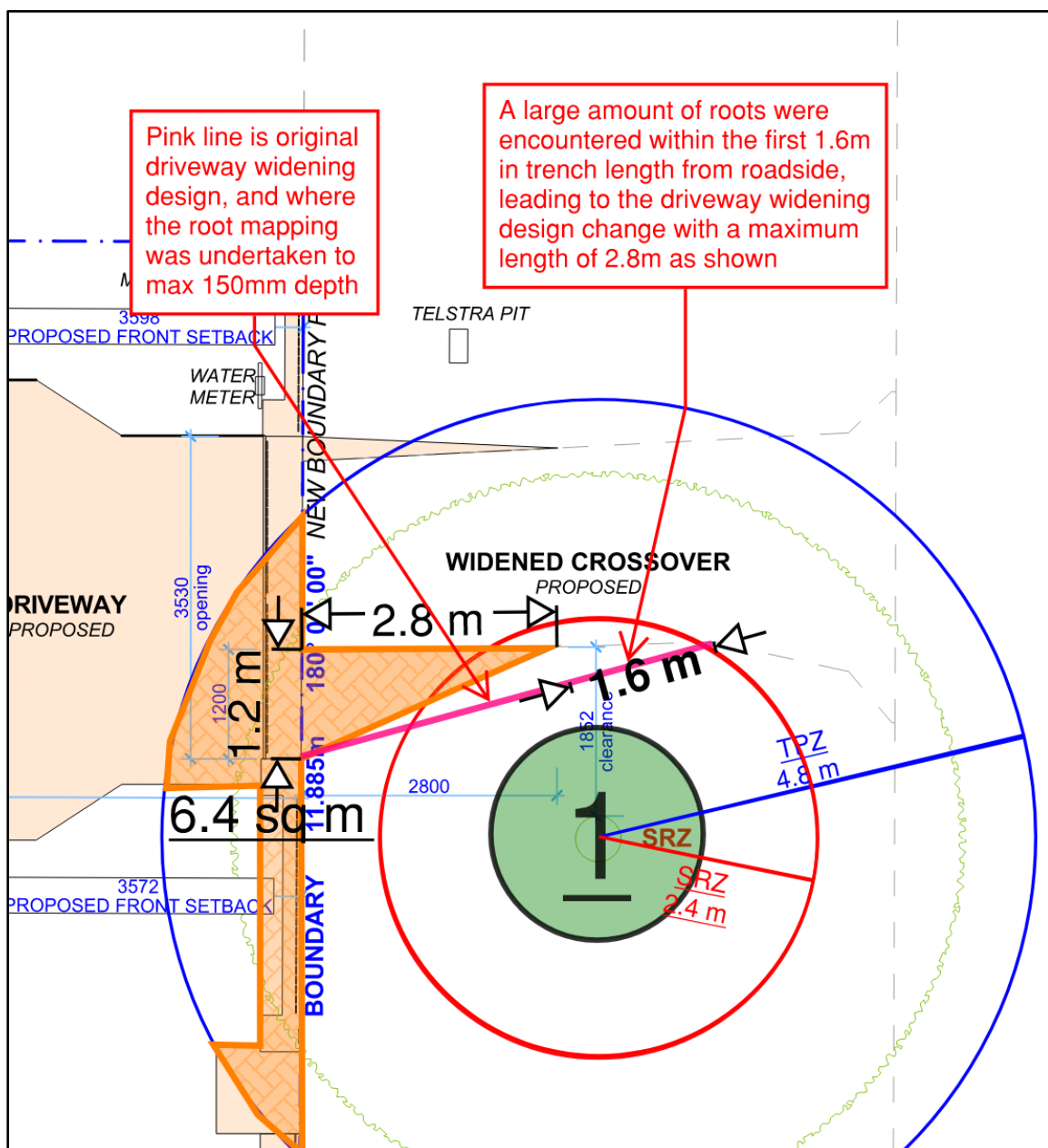
8. ASSESSEMENT OF CONSTRUCTION IMPACTS

8.1 **Table 2:** The table below contains a summary of the impact of proposed development impact to all trees included in the assessment.

Tree ID	Common name	Retention value	TPZ radius (m)	SRZ Radius (m)	TPZ Area (sq m)	TPZ Encroachment See Appendix 1A	Discussion/ Conclusion	Recommendation
1	Brushbox	A2	4.8	2.4	72.4	Major.	<p>The subject tree is located within the front nature strip area.</p> <p>There is a major encroachment from the proposed widening of the crossover (which is within the SRZ) plus construction of the front boundary masonry fence.</p> <p>The replacement crossover has been deemed a negligible encroachment as long as the replacement concrete is the same size and thickness.</p> <p>The previous driveway widening design was modified to be smaller in size due to the presence of significant roots towards the roadside.</p> <p>Due to the major encroachment, root mapping has been undertaken and is described in detail within section 9 (page 10 of this report), with photos showing the root exploration works on the following pages.</p> <p>As a result of these driveway design modifications (that have already been undertaken), this tree will be able to be retained in a viable condition from these proposed works.</p> <p>With strict arboricultural supervision throughout the demolition and construction process this tree can be retained in a viable condition.</p>	Tree to be retained and protected.
2	Jacaranda	A1	7.2	2.8	162.9	Minor	<p>The subject tree is located within the rear neighbours back yard.</p> <p>There is a minor encroachment from proposed works, this tree can be retained in a viable condition.</p>	Tree to be retained and protected.
3	Bangalow Palm	Z3				Footprint	<p>Tree is within the footprint of proposed works.</p> <p>This tree is exempt due to being a Bangalow Palm.</p>	Tree to be removed.
4	Magnolia	Z1				Footprint	<p>Tree is within the footprint of proposed works.</p> <p>This tree is exempt due to its size under 5m in height.</p>	Tree to be removed.

9. ROOT MAPPING RESULTS

- 9.1 This report describes and assesses the amount and size of the roots uncovered during a root mapping investigation exercise within the TPZ and SRZ of T1.
- 9.2 Root Mapping was undertaken by shovel and hand trowel. This work was undertaken on 15th November 2021. A single trench was dug to a maximum of 150mm in depth, in the area close to where the original driveway widening was proposed (see below).
- 9.3 Field observations were recorded on paper and are attached as a marked up diagram (below). All CAD (including all plotting/ diagrams) work was completed with Bluebeam Revue™. Photographs of tree roots and other features were taken using an iPhone 12 camera.
- 9.4 As a result of major significant roots being encountered within the initial driveway widening design, a modification was undertaken to shorten the length of the driveway widening so no roots would be damaged or pruned/ removed.



9.4.1.1 Root Mapping Photographs



Image k: Trench to 150mm in depth. Many roots encountered within first 1.6m in length of trench from road



Image l: Significant roots found within this zone

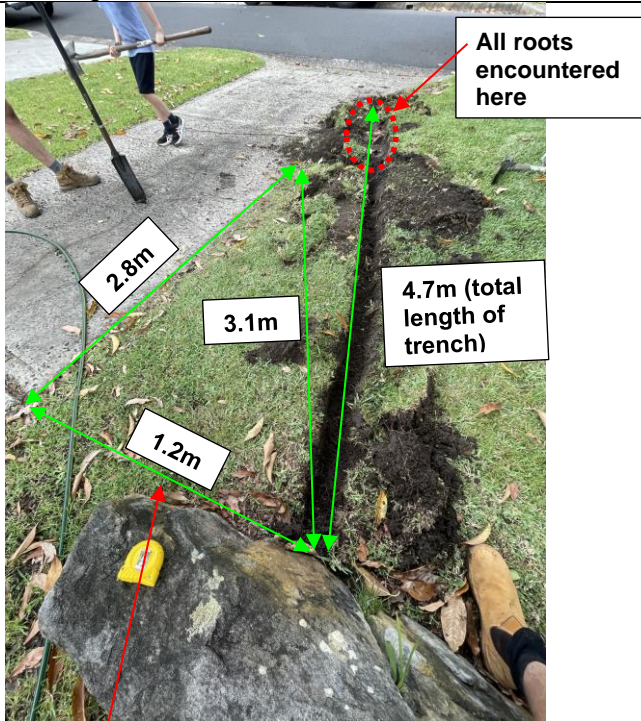


Image m: Current proposed (and recommended) re-design



Image n: Trench, looking from house towards the street

10. CONCLUSIONS

10.1 **Table 3:** Summary of the impact to trees during the development;

Impact	Reason	A	Z
Trees to be removed	Building construction, new surfacing and/or proximity, trees in poor condition	None	T3, T4 (1 tree)
Retained trees that will be subject to TPZ encroachment	Removal of existing surfacing/structures and/or installation of new surfacing/structures	T1, T2 (3 trees)	None
Trees to be retained that will not be subject to TPZ encroachment	Space for development	None	None
Trees requiring further investigation (Root Mapping)	Soil characteristics, topography and level changes within the TPZ	None	None

11. PHOTOGRAPHS



Image a: T1, Brushbox



Image b: T2, Jacaranda located neighbours rear yard

12. RECOMMENDATIONS

- 12.1 This report assesses the impact of a proposed development at the site on 4 trees located on or close to the site in accordance with AS4970 Protection of trees on development sites (2009).
- 12.2 For the construction of the development, it is recommended that T3 and T4 (total of 2 trees) are removed.
- 12.3 It is recommended that T1 and T2 (total of 2 trees) are both to be retained and protected for the life of the development.
- 12.4 Strict project arborist supervision of works within the TPZ and SRZ of T1 will be required. All works are to be carried out in consultation with the project Arborist.
- 12.5 All construction activity is to comply with Australian Standard AS4970 Protection of Trees on Development Sites (2009), sections 7, 10 and 11 of this report.
- 12.6 This report does not provide approval for tree removal or pruning works. All recommendations in this report are subject to approval by the relevant authorities and/or tree owners. This report should be submitted as supporting evidence with any tree removal/pruning or development application.
- 12.7 All works within the TPZ and SRZ of retained trees are to be overseen by an AQF5 Consulting Arborist to assist with minimising the development impact.
- 12.8 Where possible underground services should be modified to be located outside the TPZ of trees to be retained. All underground services located inside the TPZ of any tree to be retained must be installed via tree sensitive techniques. This should include either directional drilling methods or manual excavations to minimise the impact to trees identified for retention.

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

- 13.1 **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.
- 13.2 **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.
- 13.3 **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).
- 13.4 **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.

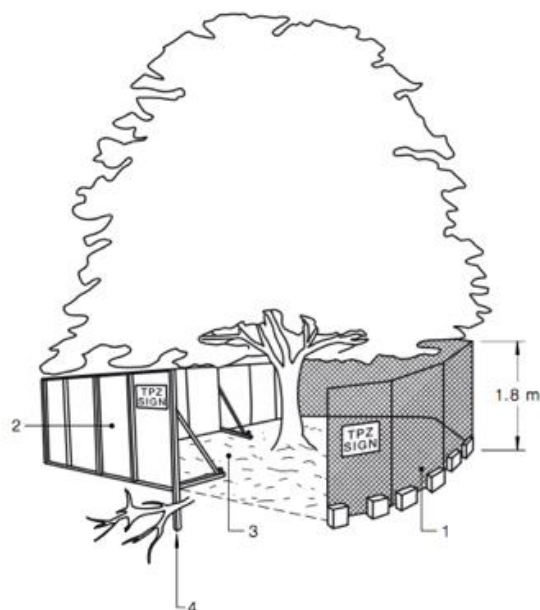
13.5 Site Specific Tree Protection Recommendations:

Table 4: Individual tree protection requirements, see Appendix 1B for locations and further guidance.

Tree Number	Protection specification
T1, T2	<ul style="list-style-type: none"> - Retain and protect. - Tree protection fencing or tree trunk protection is required as per the Tree Protection Plan. - TPZ signage is required on the fencing. - The fencing can only be moved upon the approval of the project arborist.

- 13.6 Tree protection Specifications:** 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.
- 13.7 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 in 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.
- 13.8 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
- 13.9 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.
- 13.10 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.

- 13.11 **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. 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.

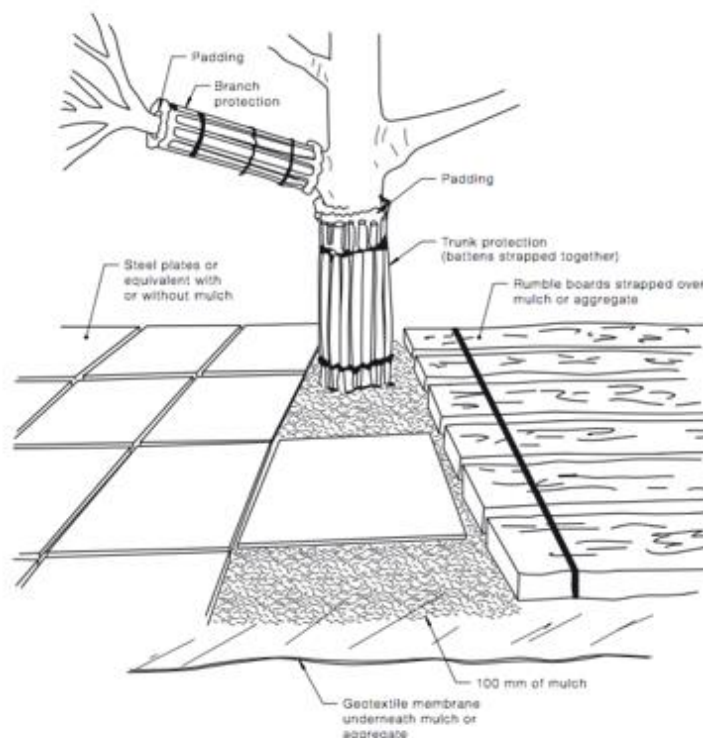


LEGEND:

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

An image from AS4970-2009,⁷ with example tree protection.

⁷ Council of Standards Australia, *AS4970 Protection of trees on development sites* (2009), page 16.



NOTES:

- 1 For trunk and branch protection use boards and padding that will prevent damage to bark. Boards are to be strapped to trees, not nailed or screwed.
- 2 Rumble boards should be of a suitable thickness to prevent soil compaction and root damage.

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

13.12 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.
- 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.

⁸ Council of Standards Australia, *AS4970 Protection of trees on development sites* (2009), page 17.

- 13.13 **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.
- 13.14 **Excavations and root pruning:** The project Arborist must supervise and certify that all excavations are in accordance with AS4373-2007 and AS4970-2009. For excavations within the TPZ, manual excavation is required along the edge of the structures closest to the subject trees. 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.
- 13.15 **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.
- 13.16 **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 than 100mm without assessment by a consulting Arborist.
- 13.17 **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.
- 13.18 **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.
- 13.19 **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.

14. HOLD POINTS

14.1 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. I recommend site inspections on a monthly frequency.	Ongoing throughout the development	Principle contractor	Project Arborist	
Project Arborist to supervise all manual excavations 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 less 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	

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 the injury and provide mitigation/remediation advice. All remediation work is to be carried out by the project arborist, at the contractor's expense.	Ongoing throughout the development	Principle contractor	Project Arborist	

15. BIBLIOGRAPHY/REFERENCES

- Barrell Tree Consultancy, *SULE: Its use and status into the New Millennium*, TreeAZ/03/2001, <http://www.treeaz.com/>.
- Barrell Tree Consultancy, *Tree AZ version 10.10-ANZ*, <http://www.treeaz.com/>. Property.
- Council of Standards Australia, *AS4970 Protection of trees on development sites* (2009).
- Council of Standards Australia, *AS4373 Pruning of amenity trees* (2007).
- *Northern Beaches Council - Removing and Pruning Trees on Private Land*, <https://www.northernbeaches.nsw.gov.au/planning-development/tree-management/private-land>
- Mattheck, C. & Breloer, H., *The body language of trees - A handbook for failure analysis*, The Stationary Office, London, England (1994).
- State Environmental Planning Policy (Vegetation in Non-Rural Areas 2017).

16. LIST OF APPENDICES

The following are included in the appendices:

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- Appendix 5 – Structural Root Zone
- Appendix 6 – Amenity Value
- Appendix 7 – Age Class
- Appendix 8 – Structural Condition
- Appendix 9 – SULE Categories
- Appendix 10 – Trees AZ

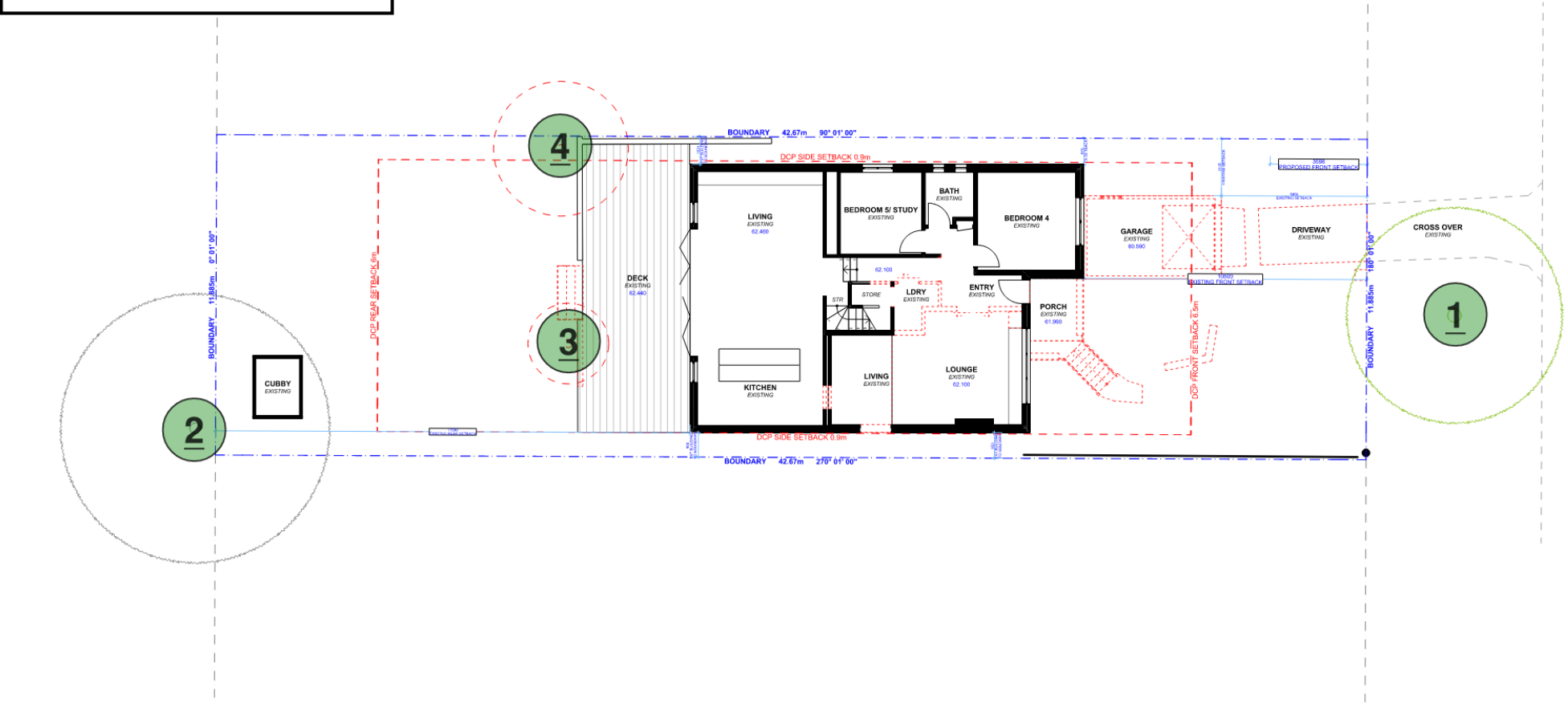
APPENDIX 1 – TREE LOCATION/ SITE PLAN

Tree Location Plan

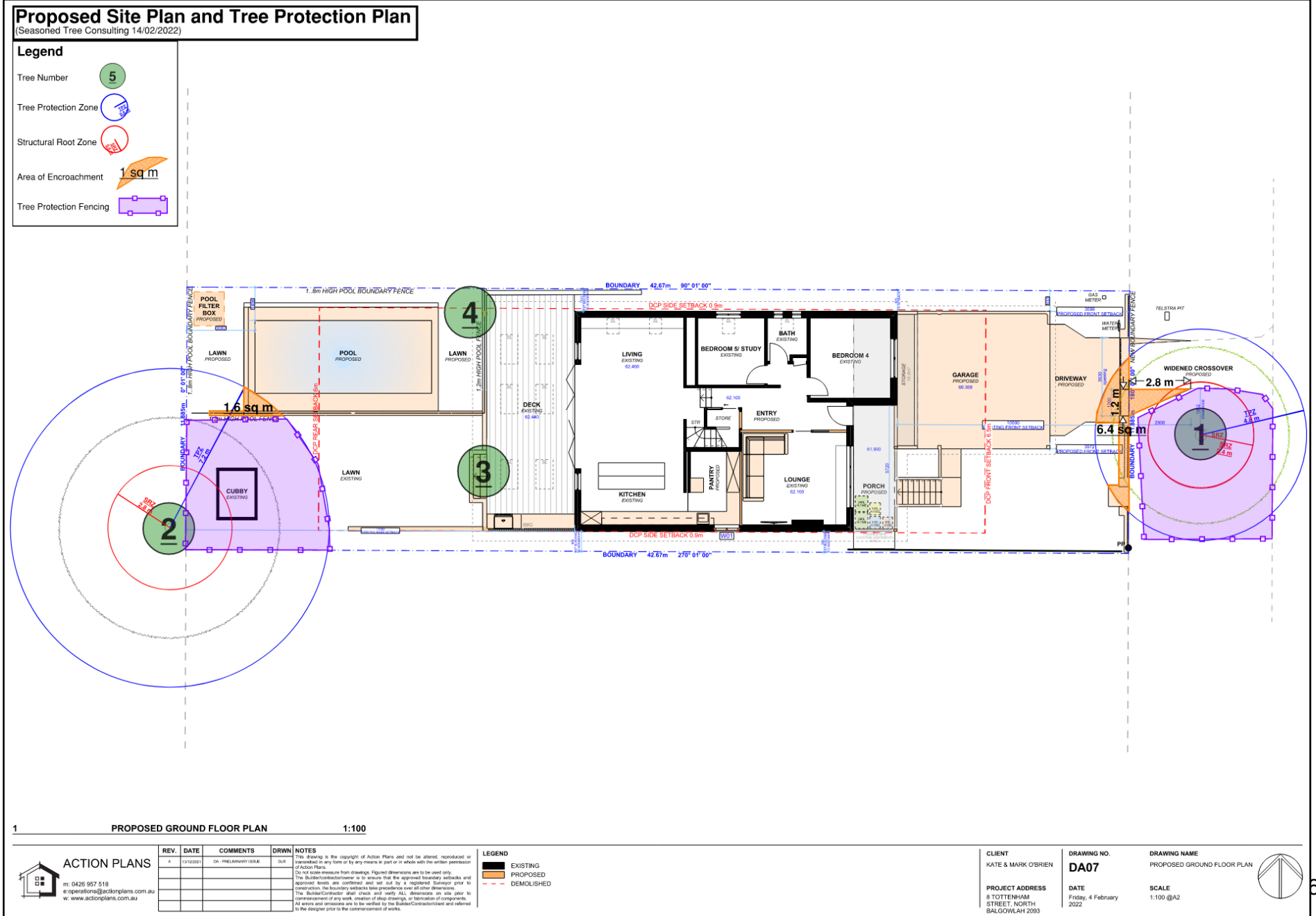
(Seasoned Tree Consulting 14/02/2022)

Legend

Tree Number 1



APPENDIX 1A – PROPOSED SITE PLAN AND TREE PROTECTION PLAN



APPENDIX 2- TREE INSPECTION SCHEDULE

Tree Inspection Site: 8 Tottenham Ave, North Balgowlah

Surveyed by: David Gowenlock

Date of Inspection: 03/02/2022

Tagged: No

Tree ID	Tree Species	DBH (CM)	TPZ radius (M)	TPZ Area (Sq.M)	DAB (CM)	SRZ radius (M)	Height (M)	Spread (M)	Age Class	Health	Structure	Amenity value	SULE (yrs.)	TreeAZ retention Value	Comments
1	<i>Lophostemon confertus</i> , Brushbox	40	4.8	72.4	45	2.4	7	10	Mature	Good	Fair	Medium	15 > 40	A2	Poor form due to powerline clearance through middle of the tree.
2	<i>Jacaranda mimosifolia</i> , Jacaranda	60	7.2	162.9	70	2.8	12	15	Mature	Good	Good	High	15 > 40	A1	Multi stem, DBH estimated as over back fence line
3	<i>Archontophoenix cunninghamiana</i> , Bangalow palm													Z3	Exempt species under Northern beaches Council Tree management policy. No data recorded as a result.
4	<i>Magnolia grandiflora</i> , Magnolia little gem						4.5	4						Z1	Exempt tree size under Northern beaches Council Tree management policy. No data recorded as a result.

Tree Species - Botanical name followed by common name in brackets. Where species is unknown it is indicated with an 'spp'.

Diameter at Breast Height (DBH) - Measured with a DBH tape or estimated at approximately 1.4m above ground level. If trees are inaccessible due to dense bush or being in private property they are generally estimated.

Tree Protection Zone (TPZ) - DBH x 12. Measured in radius from the center of the trunk. Rounded to nearest 0.1m. For monocots, the TPZ is set at 1 meter outside the crown projection.

TPZ Area (Sq.M) - The area of the TPZ calculated in square metres.

Diameter Above root Buttresses (DAB) - Measured with a DBH tape or estimated above root buttresses (DAB) for calculating the SRZ.

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

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.

Age Class - Over mature (OM), Mature (M), Early mature (EM), Semi mature (SM), Young (Y), Dead (D).

Health - Good/Fair/Poor/Dead

Structure - Good/Fair/Poor

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

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.

TreeAZ retention Value - See Appendix 10

Appendix 3 – Condition/Overall health

<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. • 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 in above average health and condition and no remedial works are required. • The tree is considered structurally good with well developed form.
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. • 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 tree is in below average health and condition and may require remedial works to improve the trees health. • 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 may be in decline, have extensive dieback or have over 30% deadwood. • The canopy may be sparse or the leaves may be unusually small for species. • Pathogens or pests are having a significant detrimental effect on the tree health. • The tree 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 tree is displaying low levels of health and removal or remedial works may be required. • The identified defects are likely to cause either partial or whole failure of the tree.
Dangerous	<ul style="list-style-type: none"> • The tree is dead or almost dead. • The tree is an imminent danger to people or property. 	<ul style="list-style-type: none"> • The tree should generally be removed.

Appendix 4 - Tree Protection Zone (TPZ)

The tree protection zone (TPZ) is the principle means of protecting trees on development sites. The TPZ is a combination of the root area and crown area requiring protection. It is an area isolated from construction disturbance, so that the tree remains viable. The TPZ incorporates the structural root zone (SRZ).

Determining the TPZ

The radius of the TPZ is calculated for each tree by multiplying its DBH \times 12.

$$\text{TPZ} = \text{DBH} \times 12$$

Where

DBH = trunk diameter measured at 1.4 m above ground

Radius is measured from the centre of the stem at ground level.

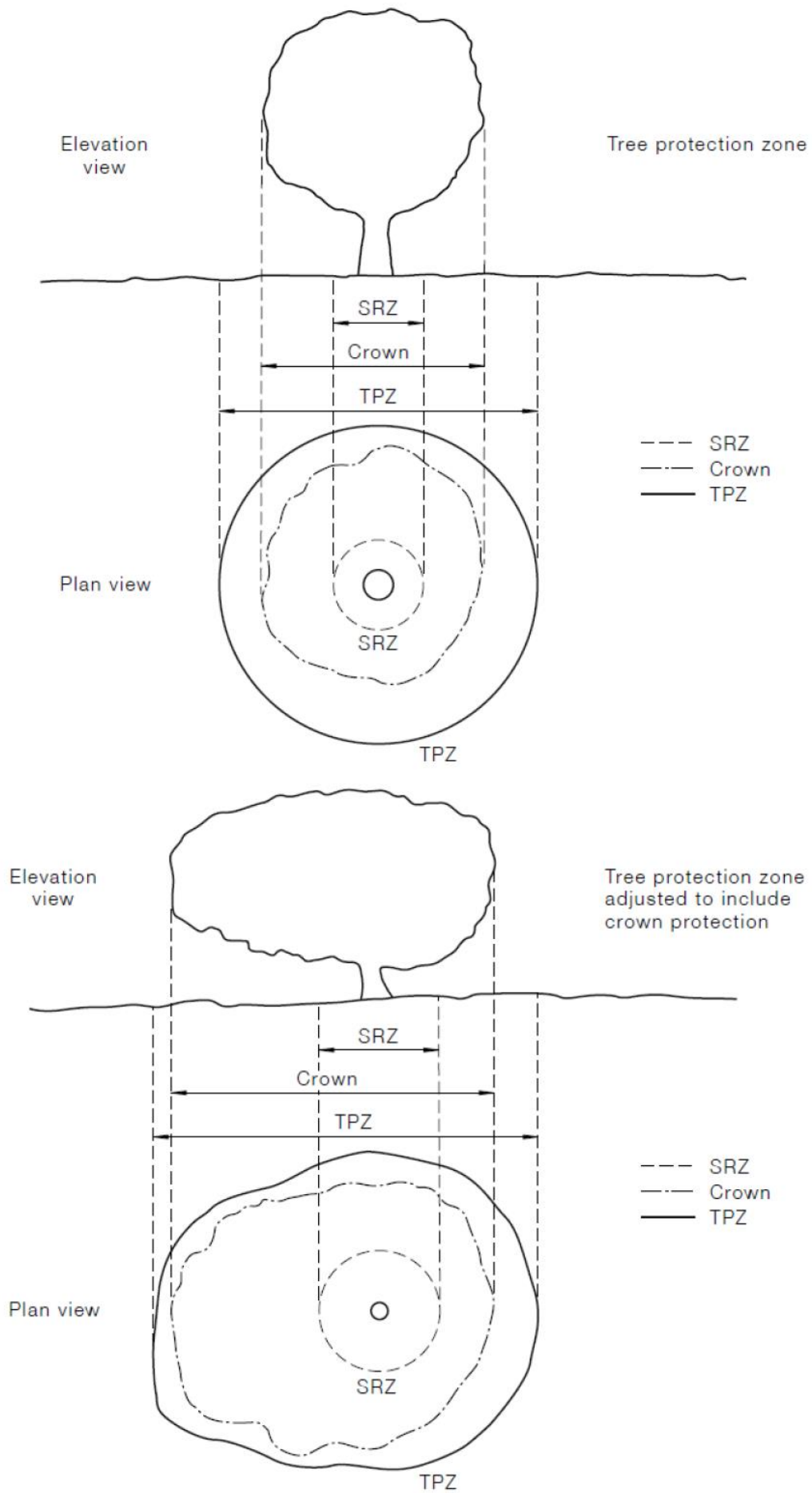
A TPZ should not be less than 2 m nor greater than 15 m (except where crown protection is required).

Minor encroachment into the TPZ

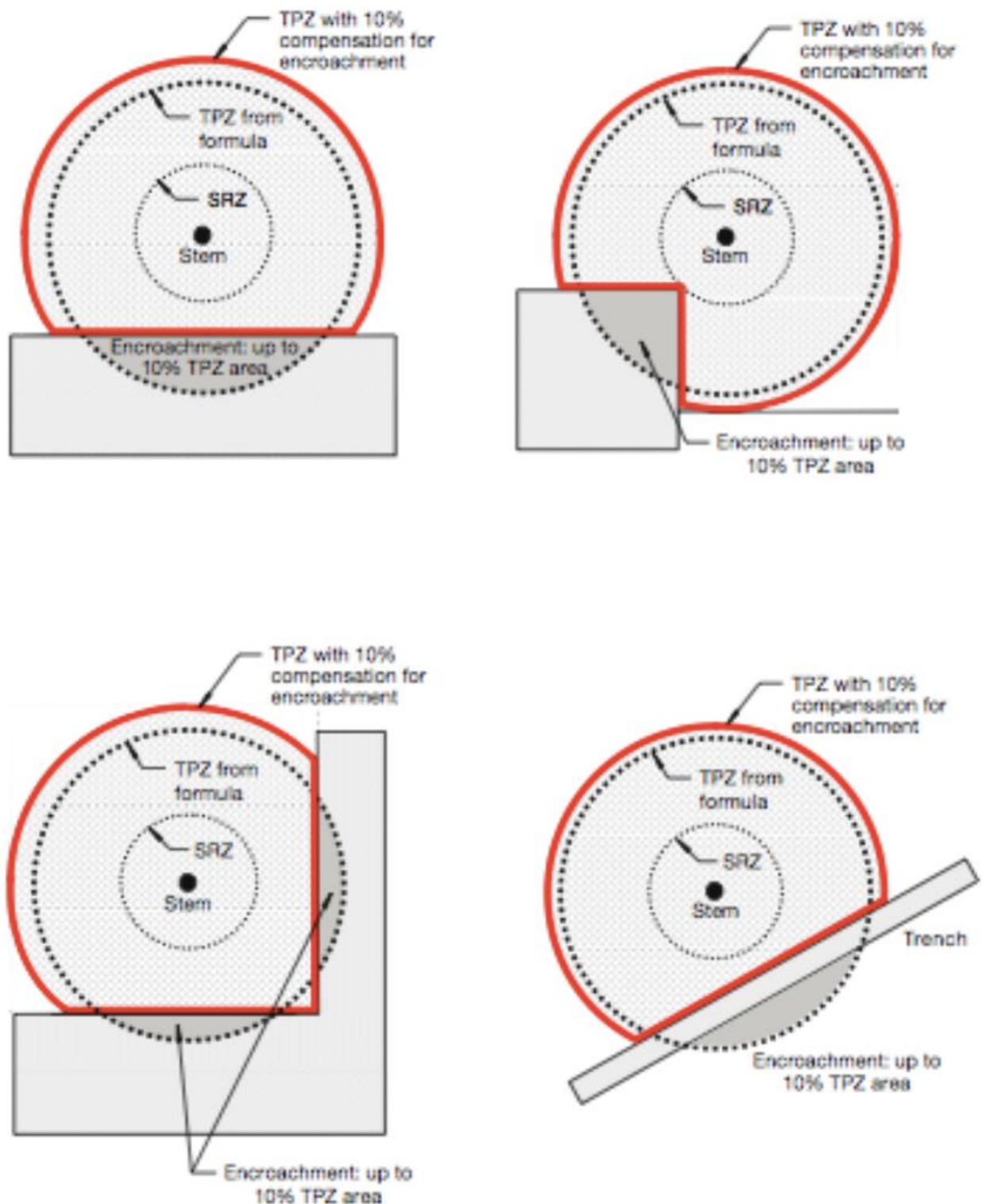
Where encroachment into the TPZ is unavoidable it is generally accepted that encroachment of under 10% of the total TPZ is possible without carrying out detailed root investigations. This minor loss of root area is normally compensated by the roots developing elsewhere.

Major encroachment into the TPZ

If an encroachment of more than 10% is proposed into the TPZ it would be necessary to demonstrate that the tree would remain viable. Non destructive root investigations may be required to determine any potential impact the encroachment may have on the tree.



Encroachment into the tree protection zone (TPZ) is sometimes unavoidable. Figure D1 provides examples of TPZ encroachment by area, to assist in reducing the impact of such incursions.



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

Appendix 5 - Structural root zone (SRZ)

This is the area around the base of a tree required for the trees stability in the ground. An area larger than the SRZ always need to be maintained to preserve a viable tree as it will only have a minor effect on the trees vigour and health. There are several factors that determine the SRZ which include height, crown area, soil type and soil moisture. It can also be influenced by other factors such as natural or built structures. Generally work within the SRZ should be avoided.

Determining the SRZ

An indicative SRZ radius can be determined from the diameter of the trunk measured immediately above the root buttresses. Root investigation could provide more information about the extent of the SRZ. The following formula should be used to calculate the SRZ.

$$\text{SRZ radius} = (D \times 50)^{0.42} \times 0.64$$

where

D = trunk diameter in m, measured above the root buttress.

Note - The SRZ for trees with trunk diameters less than 0.15 will be 1.5m.

Appendix 6 - Amenity value

To determine the amenity value of a tree we assess a number of different factors which include but are not limited to the information below.

- The visibility of the tree to adjacent sites.
- The relationship between the tree and the site.
- Whether the tree is protected by any statutory conditions.
- The habitat value of the tree.
- Whether the tree is considered a noxious weed species.

Appendix 7 - 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 8 - 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 9 - Safe Useful Life Expectancy (SULE), (Barrel, 2001)

A trees safe useful life expectancy is determined by assessing a number of different factors including the health and vitality, estimated age in relation to expected life expectancy for the species, structural defects, and remedial works that could allow retention in the existing situation.

Category	Description
1. Long - Over 40 years	<ul style="list-style-type: none"> (a) Structurally sound trees located in positions that can accommodate future growth. (b) Trees that could be made suitable for retention in the long term by remedial tree care. (c) Trees of special significance for historical, commemorative or rarity reasons that would warrant extraordinary efforts to secure their long term retention.
2. Medium - 15 to 40 years	<ul style="list-style-type: none"> (a) Trees that may only live between 15 and 40 more years. (b) Trees that could live for more than 40 years but may be removed for safety or nuisance reasons. (c) Trees that could live for more than 40 years but may be removed to prevent interference with more suitable individuals or to provide space for new planting. (d) Trees that could be made suitable for retention in the medium term by remedial tree care.
3. Short - 5 to 15 years	<ul style="list-style-type: none"> (a) Trees that may only live between 5 and 15 more years. (b) Trees that could live for more than 15 years but may be removed for safety or nuisance reasons. (c) Trees that could live for more than 15 years but may be removed to prevent interference with more suitable individuals or to provide space for new planting. (d) Trees that require substantial remedial tree care and are only suitable for retention in the short term.
4. Remove - Under 5 years	<ul style="list-style-type: none"> (a) Dead, dying, suppressed or declining trees because of disease or inhospitable conditions. (b) Dangerous trees because of instability or recent loss of adjacent trees. (c) Dangerous trees because of structural defects including cavities, decay, included bark, wounds or poor form. (d) Damaged trees that are clearly not safe to retain. (e) Trees that could live for more than 5 years but may be removed to prevent interference with more suitable individuals or to provide space for new planting. (f) Trees that are damaging or may cause damage to existing structures within 5 years. (g) Trees that will become dangerous after removal of other trees for the reasons given in (a) to (f). (h) Trees in categories (a) to (g) that have a high wildlife habitat value and, with appropriate treatment, could be retained subject to regular review.
5. Small/Young	<ul style="list-style-type: none"> (a) Small trees less than 5m in height. (b) Young trees less than 15 years old but over 5m in height. (c) Formal hedges and trees intended for regular pruning to artificially control growth.

Appendix 10- TreeAZ Categories

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.