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Arboricultural Impact Assessment Report

Client Name: E & B Hanson C/- Your Beautiful Home
Site Address: 13 Kalianna Crescent Beacon Hill NSW
Authors Details: Hugh Millington
Email: hugh@hughtheArborist.com.au
Phone: 0426 836 701

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1. INTRODUCTION

1.1 Hugh The Arborist Pty Ltd has been instructed by Your Beautiful Home on behalf of the clients Elizabeth and Ben Hanson to assess trees located on the site that may be impacted by a proposed development.

1.2 All tree data was collected during a site inspection on Wednesday 4th June 2020, the weather was clear with average visibility.

Table 1: documents provided for the assessment.

Title	Author	Date created	Plan/Doc. Ref.
Survey Plan	Waterview Surveying	6/12/2019	1049 Rev B
Architectural Plan set	YBH	18/5/2020	Site Plan, Floor Plans and Sections

2. SCOPE OF THE REPORT

2.1 **This report has been undertaken to meet the following objectives;**

2.1.1 Conduct a visual assessment from ground level of four trees located on the site as identified on the survey plan provided. For the purpose of this report, a tree is taken to have height equal to or greater than 5 metres.

2.1.2 Dead trees and trees less than five metres in height have not been assessed.

2.1.3 Determine the trees estimated contribution years and remaining, useful life expectancy and award the trees a retention value.

2.1.4 Provide an assessment of the potential impact the proposed development is likely to cause to the condition of the subject trees in accordance with AS4970 Protection of trees on development sites (2009).

2.1.5 Provide pragmatic recommendations for the management of trees and mitigation of construction impacts on retained trees.

2.1.6 Specify tree protection measures for trees to be retained in accordance with AS 4970-2009.

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3. LIMITATIONS

3.1 The findings of this report are based on the observations and site conditions at the time of inspection.

3.2 Where access was limited due to trespass issues, measurements have been estimated.

3.3 Several trees assessed have not been located on the site plans provided. Their locations have been estimated using available setbacks taken on site.

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

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

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

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

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

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

3.10 Hugh The Arborist neither guarantees, nor is responsible for, the accuracy of information provided by others that is contained within this report.

3.11 While an assessment of the subject trees estimated useful life expectancy is included in this report, no specific tree risk assessment has been undertaken for any of trees at the site.

3.12 The ultimate safety of any tree cannot be categorically guaranteed. Even trees apparently free of defects can collapse or partially collapse in extreme weather conditions. Trees are dynamic, biological entities subject to changes in their environment, the presence of pathogens and the effects of ageing. These factors reinforce the need for regular inspections. It is generally accepted that hazards can only be identified from distinct defects or from other failure-prone characteristics of a tree or its locality.

3.13 Alteration of this report invalidates the entire report.

4. METHODOLOGY

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

- 4.1.1 Tree common name
- 4.1.2 Tree botanical name
- 4.1.3 Tree age class
- 4.1.4 DBH (Trunk/Stem diameter at breast height/1.4m above ground level) - millimetres.
- 4.1.5 Estimated height - metres
- 4.1.6 Estimated crown spread (Radius of crown) - metres
- 4.1.7 Health
- 4.1.8 Structural condition
- 4.1.9 Amenity value
- 4.1.10 Estimated remaining contribution years (SULE)[1]
- 4.1.11 Retention value (Tree AZ)[2]
- 4.1.12 Notes/comments

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

4.3 Tree diameter was measured using a DBH tape or in some cases estimated. All other measurements were estimations unless otherwise stated. The other tools I used during the assessment were a digital camera, Japanese made 170mm blade digging knife and a Leica DistoD410 digital laser tape.

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[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).

4.4 All DBH measurements, tree protection zones, and structural root zones were calculated in accordance with methods set out in AS4970 Protection of trees on development sites (2009). See appendices for more information.

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

5. SITE LOCATION AND BRIEF DESCRIPTION OF THE PROPOSAL

5.1 The site is located in the in the Northern Beaches Council suburb of Beacon Hill. All trees at the site are managed under the following policy and legislation;

5.1.1 Warringah Local Environmental Plan (LEP) 2011[4]

5.1.2 Warringah Development Control Plan (DCP) 2011

5.1.3 Northern Beaches Tree Management Controls

5.1.4 State Environmental Planning Policy (Vegetation in Non-Rural Areas 2017)

5.2 The site is divided south (front) to north (rear) by the existing residential dwelling. The site itself is largely flat with the exception of a large rock shelf to the rear of the site.

5.3 The site is not located within a heritage conservation area, does not contain terrestrial biodiversity and does not form part of a wildlife corridor.[5]

5.4 The development consists of alterations and additions to the existing residence to include a new driveway, second storey additions and a swimming pool.

[4] https://eservices.northernbeaches.nsw.gov.au/ePlanning/live/Public/XC.Track/SearchProperty.aspx?id=128235

[5] https://services.northernbeaches.nsw.gov.au/icongis/index.html

Tile 1: Site Location and approximate boundary[6]

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

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

6 https://www.google.com.au/maps/place/33A+Central+Rd,+Avalon+Beach+NSW+2107

6.2 **Site plans:** Appendix 1 shows the existing site plan, Appendix 1a shows the proposed site plan with tree protection advice overlaid.

6.3 TPZ, SRZ and canopy spread have been have been overlaid across all plans.

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

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

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

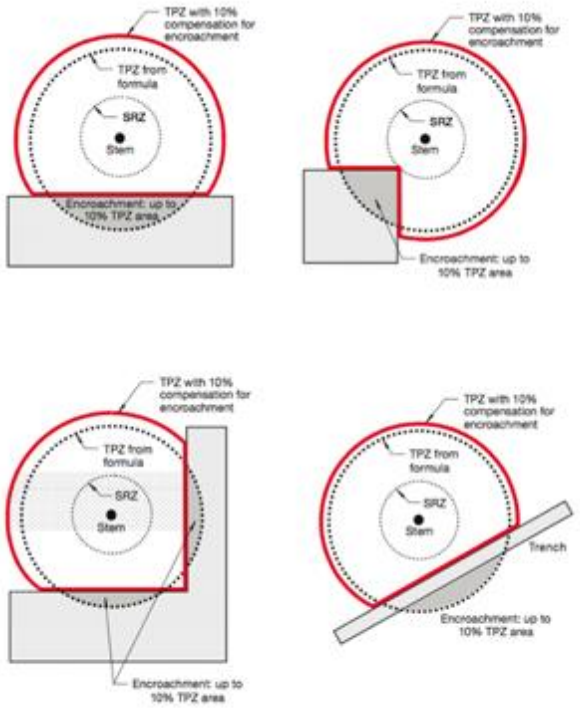

Image 1: Example minor TPZ encroachment from AS4970-2009.

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

7. ASSESSEMENT OF CONSTRUCTION IMPACTS

7.1 **Table 2:** In the table below the impact of proposed development impact to all trees included in the report has been assessed.

Tree ID	Species	Retention value	TPZ radius (m)	SRZ radius (m)	TPZ encroachment	Discussion/ Conclusion	Recommendation
1	Leyland Cypress *(Cupressus Leylandii)*	Z3	3.7	2.1	Minor	The proposed decking will encroach into the TPZ area and the notional SRZ area by less than 10%. While AS4970 Protection of Trees on Development Sites (2009) stated that any incursion into the SRZ area is considered to be 'major', the same standard makes an allowance for the alteration of the distribution of roots as a result of existing structures. The proposed decking is located above the existing brick stairs and concrete section within the TPZ area. The impact to the tree is assessed as negligible under the current proposal. As the tree will not be impacted by the development, it will be marked for retention in this assessment. However, the species is listed as exempt from protection in NBLGA and may be removed without Council permit prior to the approval of the development application.	Retain and protect
2	Spotted Gum *(Corymbia macculata)*	A2	9.9	3.1	Minor	As discussed with tree1, AS4970-2009 allows for consideration to be made for the presence of existing structures affecting the spread and distribution of tree roots. Tree 2 is situated atop of a large rock shelf approximately one meter higher than the rest of the site. There is clearly defined bare rock between the tree and the area proposed for the construction of the swimming pool therefore it is assumed there are minimal tree roots located within the proposed swimming pool location.	Retain and protect

Tree ID	Species	Retention value	TPZ radius (m)	SRZ radius (m)	TPZ encroachment	Discussion/ Conclusion	Recommendation
						The plans provided show there to be approximately 800mm of rock to be excavated for the north eastern corner of the pool, this is unlikely to have any effect on the subject tree. Tree 2 is clearly growing within a shallow soil profile assessed by the exposed rock and the fused buttress roots at the base. Through routine visual assessment (VTA) the tree has not been affected by the storm events in February 2020 and is likely to be anchored into the rock fissures and the neighboring site. Recommendations will be made later in this report in the event the owners of the tree would like to monitor the trees movement in the future. The tree will be subject to low to negligible levels of impact and is recommended for retention and protection.	
3	Grey Gum *(Eucalyptus punctata)*	Z10	3.5	2.4	None	Tree 3 will not be impacted by the development however it is recommended for removal based on its condition and lack of potential. The tree is assumed to be self-seeded on the steepest part of the rock section to the north east of the site. Limited growing conditions have created conflict between the trunk and the rocks. The tree has extensive cambial decline at the base and is considered to be in poor condition.	Remove and replace
4	Atlas Cedar *(Cedrus atlantica)*	A1	4.3	2.2	Minor	The proposed driveway is situated 3 meters away from tree 4. This contributes a TPZ encroachment of 9.5% with no disturbance to the structural root zone. The subject tree was assessed as having good health and vitality at the time of the inspection. The impact is considered to be low and acceptable.	Retain and protect

8. CONCLUSIONS

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

Impact	Reason	Category A	Category Z
		A	Z
Trees to be removed	Building/landscape construction, new surfacing and/or proximity, or trees in poor condition.	None	3 (One Tree)
Retained trees subject to TPZ encroachment	Removal of existing surfacing/structures and/or installation of new surfacing/structures will not significantly impact the tree	2,4 (Two Tree)	1 (One Tree)
Retained trees subject to no TPZ encroachment	Located outside of the construction area	None	None

9. PHOTOGRPAPHS

Photo A: Tree 2 and extent of tree protective fencing required.

Photo B: Tree 2, 3 and the existing rock shelf.

Photo C: Tree 3 poor basal condition.

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10. RECOMMENDATIONS

10.1 This report assesses the impact of a proposed development at the site to four trees located on the site.

10.2 One tree has been recommended for removal based on its condition and lack of potential to become a viable tree in the long term. Tree number 3 is recommended for removal.

10.3 The remaining three trees (T1, T2 and T4) will be subject to acceptable levels of impact from the proposed development in its current form.

10.4 Tree number 1 has been recommended for retention as it will be subject to low impact, however this species is listed as exempt from protection in the municipality and may be removed prior to the approval of the development without Council permit.

10.5 Tree number 2 will be subject to low or negligible levels of impact as a result of the rock shelf between the tree and the proposed swimming pool.

10.6 It is noted that tree number 2 is situated atop of a rock shelf and is assumed to have a shallow soil profile. The tree will be anchored into the rock fissures and was not assessed as unstable at the time of the inspection. It is possible, if the owners of the tree wish to pursue further information, to install tree motion sensors. Further information can be found at http://www.treesensor.com/About.aspx.

10.7 The monitoring of the tree for movement is not recommended as part of the development or assessed development impact, it is a suggestion in the event further information is requested by the client.

10.8 Replacement planting for trees removed through the development process is recommended to be implemented at a ratio of 1:1. The usage of the site is likely to benefit from deciduous species of tree providing colour in autumn and a variation in the landscape features at the front if the site.

10.9 The eastern edge of the proposed driveway shall be manually excavated to a depth of 200 millimetres to prune all tree roots clear of the area.

10.10 **One month prior to the commencement to works**, all trees are to be provided with soil conditioner (Seasol or GoGo) and a balanced NPK fertiliser suitable for native species (Nitrosol). This is to be carried out by the project Arborist and repeated midway through the development phase. Additional remedial measures are to be implemented by the project Arborist during the development depending on site and climatic conditions.

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

10.12 All revised plans should be subject to review by a consulting Arborist prior to construction. Where possible underground services should be located outside the TPZ of trees to be retained. All underground services located inside the TPZ of any tree to be retained must be installed via tree sensitive techniques. This should include either directional drilling methods or manual excavations to minimise the impact to trees identified for retention.

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

11.1 **Use of this report:** All contractors must be made aware of the tree protection requirements prior to commencing works at the site and be provided a copy of this report.

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

11.3 **Tree work:** All tree work 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).

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

11.5 **Site Specific Tree Protection Recommendations:**

Table 4: Protection Requirements: See appendix 1a for indicative protection location.

Tree Number	Protection Specification Ref Appendix 1a Site Plan and Tree Management Plan
1	- Tree protective fencing.
2	- Tree protective fencing around the surface roots and soil area. The exposed rock is not required to be isolated.
4	- Trunk Protection and ground protection for site access.

11.6 **Tree protection Specifications:** See sections below for site/tree specific requirements. It is the responsibility of the principle contractor to install tree protection prior to works commencing at the site (prior to demolition works) and to ensure that the tree protection remains in adequate condition for the duration of the development. The tree protection must not be moved without prior agreement of the project Arborist. The project Arborist must inspect that the tree protection has been installed in accordance with this document and AS4970-2009 prior to works commencing.

11.7 **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.

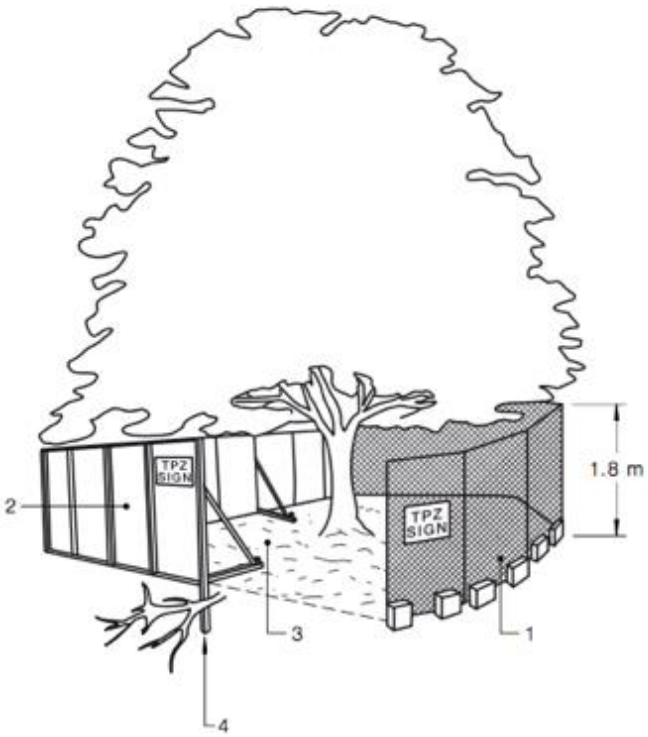
11.8 **TPZ signage:** Tree protection signage is to be attached to the protective fencing, displayed in a prominent position and the sign repeated at 10 metres intervals or closer where the fence changes direction. Each sign shall contain in a clearly legible form, the following information:

- 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

11.9 **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.

11.10 **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.

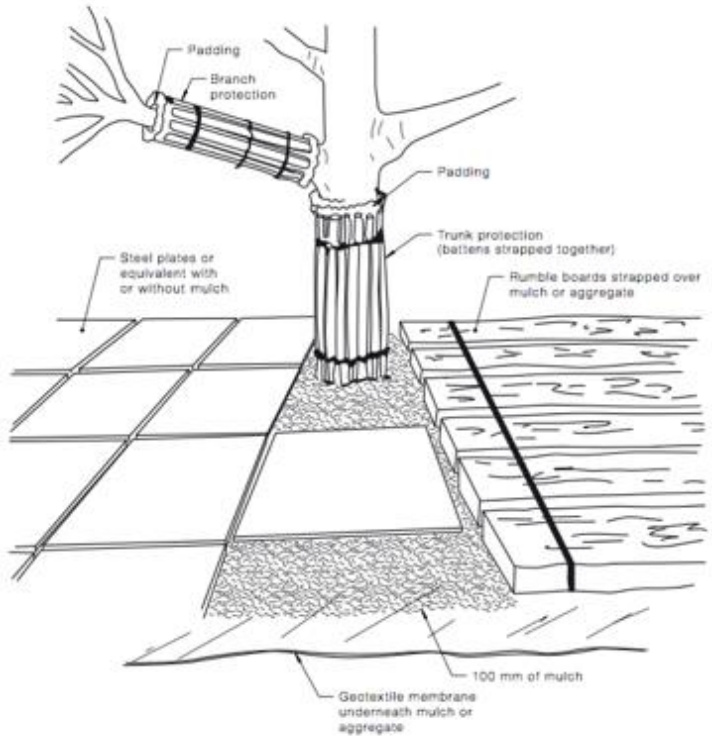
11.11 **Ground Protection:** Ground protection is required to protect the underlying soil structure and root system in areas where it is not practical to restrict access to whole TPZ, while allowing space for construction. Ground protection must consist of good quality composted wood chip/leaf mulch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



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.

11.12 **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.

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

G) Wash down and cleaning of equipment.
H) Placement of fill.
I) Lighting of fires.
J) Soil level changes.
K) Any physical damage to the crown, trunk, or root system.
L) Parking of vehicles.

11.13 **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.

11.14 **Excavations:** The project Arborist must supervise and certify that all excavations and root pruning are in accordance with AS4373-2007 and AS4970-2009. For continuous strip footings, first manual excavation is required along the edge of the structures closest to the subject trees. Manual excavation should be a depth of 1 metre (or to unfavourable root growth conditions such as bed rock or heavy clay, if agreed by project Arborist). Next roots must be pruned back in accordance with AS4373-2007. After all root pruning is completed, machine excavation is permitted within the footprint of the structure. For tree sensitive footings, such as pier and beam, all excavations inside the TPZ must be manual. Manual excavation may include the use of pneumatic and hydraulic tools, high-pressure air or a combination of high-pressure water and a vacuum device. No pruning of roots greater 30mm in diameter is to be carried out without approval of the project arborist. All pruning of roots greater than 10mm in diameter must be carried out by a qualified Arborist/Horticulturalist with a minimum AQF level 3. Root pruning is to be a clean cut with a sharp tool in accordance with AS4373 Pruning of amenity trees (2007).[9] The tree root is to be pruned back to a branch root if possible. Make a clean cut and leave as small a wound as possible.

11.15 **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.

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

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

- Level changes should be minimised. The existing ground levels within the landscape areas should not be lowered by more than 50mm or increased by more 100mm without assessment by a consulting Arborist.
- New retaining walls should be avoided. Where new retaining walls are proposed inside the TPZ of trees to be retained, they should be constructed from tree sensitive material, such as timber sleepers, that require minimal footings/excavations. If brick retaining walls are proposed inside the TPZ, considerer pier and beam type footings to bridge significant roots that are critical to the trees condition. Retaining walls must be located outside the SRZ and sleepers/beams located above existing soil grades.
- New footpaths and hard surfaces should be minimised, as they can limit the availability of water, nutrients and air to the trees root system. Where they are proposed, they should be constructed on or above existing soil grades to minimise root disturbance and consider using a permeable surface. Footpath should be located outside the SRZ.
- Where fill/sub base is used inside the TPZ, fill material should be a coarse granular material that does not restrict the flow of water and air to the root system below. This type of material will also reduce the impact of soil compaction during construction.
- The location of new plantings inside the TPZ of trees to be retained should be flexible to avoid unnecessary damage to tree roots greater than 30mm in diameter.

11.17 **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.

11.18 **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.

11.19 **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.

12. HOLD POINTS

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

12.2 **Hold points applicable to the development have been shaded in grey.**

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 12 and AS4970-2009 prior to works commencing at site.	Prior to development work commencing.	Principle contractor	Project Arborist	
In accordance with AS4970-2009 the project arborist should carryout regular site inspections to ensure works are carried out in accordance with the recommendations.	Ongoing throughout the development	Principle contractor	Project Arborist	
Project Arborist to oversee all manual excavations for piers and demolition inside the TPZ of any tree to be retained.	Construction	Principle contractor	Project Arborist	

Project Arborist to certify that all pruning of roots greater than 40mm in diameter has been carried out in accordance with AS4373-2007. All root pruning must be carried out by a qualified Arborist/Horticulturalist with a minimum AQF level 3.	Construction	Principle contractor	Project Arborist	
Project Arborist to certify that all underground services including storm water inside TPZ of any tree to be retained have been installed in accordance with AS4970-2009.	Construction	Principle contractor	Project Arborist	
Project arborist to approve relocation of tree protection for landscaping. All landscaping works within the TPZ of trees to be retained are to be undertaken in consultation with the project Arborist to minimize the impact to trees.	Landscape	Principle contractor	Project Arborist	
After all construction works are complete the project Arborist should assess that the subject trees have been retained in the same condition and vigor and authorize the removal of protective fencing. If changes to condition are identified the project Arborist should provide recommendations for remediation.	Upon completion of construction	Principle contractor	Project Arborist	
Any wounding or injury that occurs to a tree during the demolition/construction process will require the project arborist to be contacted for an assessment of 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	

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14. LIST OF APPENDICES

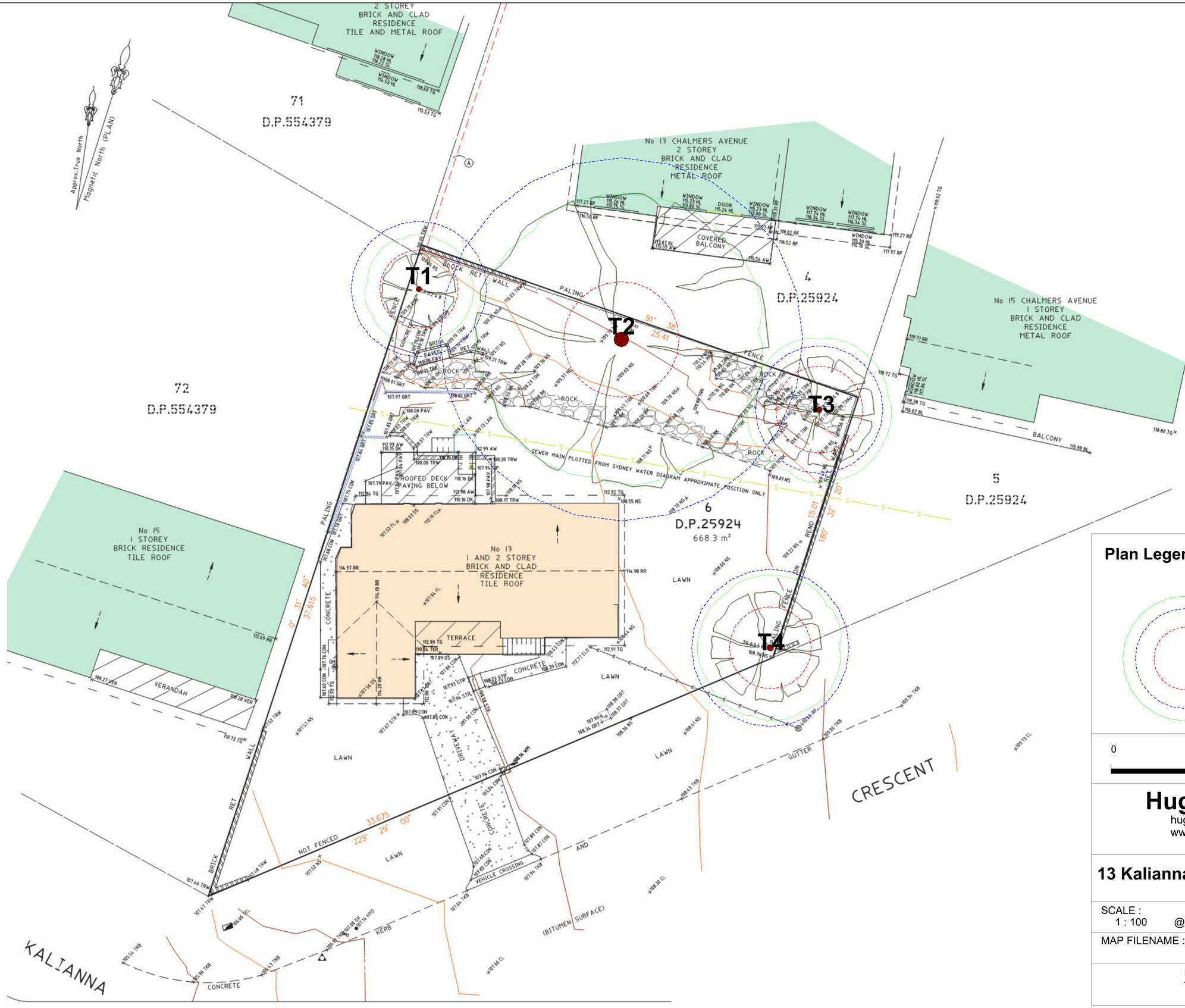
The following are included in the appendices:

Appendix 1 – Existing Site Plan
Appendix 1a – Proposed Site Plan and Tree Protection Plan
Appendix 2 - Tree inspection schedule
Appendix 3 - Health
Appendix 4 – Tree Protection Zone
Appendix 5 – Structural Root Zone
Appendix 6 – Amenity Value
Appendix 7 – Age Class
Appendix 8 – Structural Condition
Appendix 9 – SULE Categories
Appendix 10 – Retention Values
Appendix 11 – Trees AZ

Hugh Millington

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

0426836701
hugh@hughtheArborist.com.au



Plan Legend

Tree Crown

Tree Protection Zone

Structural Root Zone

0 — 15m

Hugh The Arborist

hugh@hughthearborist.com.au
www.hughthearborist.com.au
0426836701

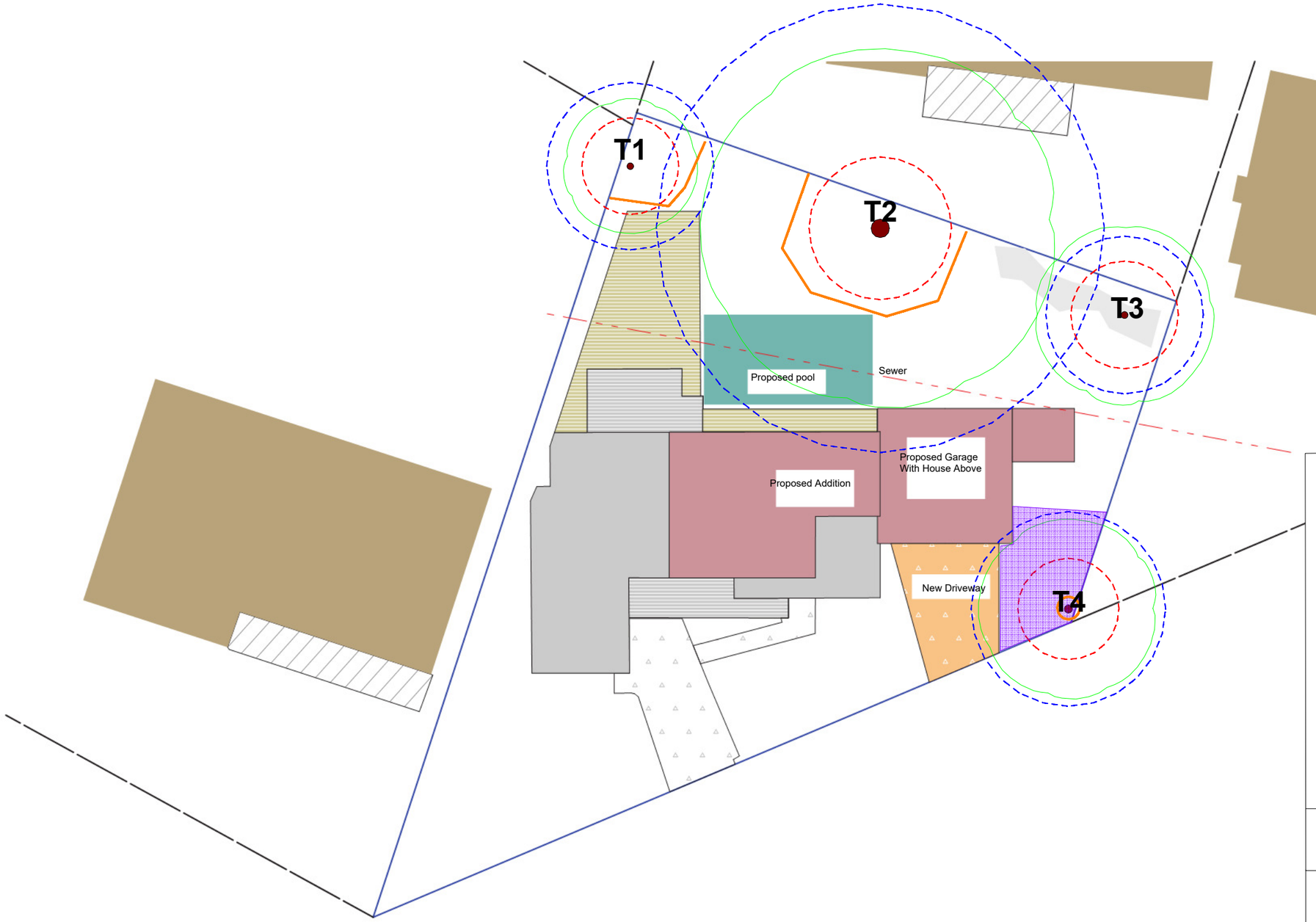
13 Kalianna Crescent Beacon Hill NSW

SCALE :	DATE :
1 : 100 @ A1	26/06/2020

MAP FILENAME : Appendix 1 - Existing Site Plan

HUGH THE ARBORIST

Prepared by Hugh Millington
for E&B Hanson andd YBH



Plan Legend

- Trunk Protection
- Tree Protective Fencing
- Ground Protection
- Tree Crown
- Tree Protection Zone
- Structural Root Zone

0 — 15m

Hugh The Arborist

hugh@hughthearborist.com.au
www.hughthearborist.com.au
0426836701

13 Kalianna Crescent Beacon Hill NSW

SCALE :	DATE :
1 : 200 @ A3	26/06/2020

MAP FILENAME :
Appendix 1A - Proposed Site Plan

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Prepared by Hugh Millington
for E&B Hanson and YBH

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THE ARBORIST

Appendix 2 - Tree Inspection Schedule

Tree ID	Tree Species	Age Class	DBH (MM)	DAB (MM)	Height (M)	Spread (M)	TPZ radius (M)	SRZ radius (M)	Health	Structure	Amenity Value	SULE	Retention Value	Notes/comments
1	Leyland Cypress *(Cupressus Leylandii)*	S M	310	360	9	3	3.7	2.1	Good	Good	Low	1.Long	Z3	Species is exempt from protection in NBLGA.
2	Spotted Gum *(Corymbia macculata)*	M	830	900	18	8	9.9	3.1	Fair	Good	High	2.Medium	A2	Canopy density reduced by approximately 20% at the time of inspection. Shallow soil volume.
3	Grey Gum *(Eucalyptus punctata)*	S M	230/180	460	9	4	3.5	2.4	Fair	Poor	Medium	4.Remove	Z10	Self-seeded growing out of rock shelf. Extensive cambium decay around base. Lower branches declining.
4	Atlas Cedar *(Cedrus atlantica)*	S M	360	400	9	4	4.3	2.2	Good	Good	High	1.Long	A1	None.

Explanatory Notes

Tree Species - Botanical name followed by common name in brackets. Where species is unknown it is indicated with an '*spp'.*
Age Class - Over mature (OM), Mature (M), Early mature (EM), Semi mature (SM), Young (Y), Dead (D).
Diameter at Breast Height (DBH) - Measured with a DBH tape or estimated at approximately 1.4m above ground level. Where DBH has been estimated it is indicated with an 'Est'. The (1) indicates the stem number and the (t) indicates the total DBH when calculated in accordance with AS4970-2009 definition.
Diameter Above root Buttresses (DAB): Measured with a DBH tape or estimated above root buttresses (DAB) for calculating the SRZ.
Height - Height from ground level to top of crown. All heights are estimated unless otherwise indicated.
Spread - Radius of crown at widest section. All tree spreads are estimated unless otherwise indicated.
Tree Protection Zone (TPZ) - DBH 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.
Structural Root Zone (SRZ) - (DAB x 50) $^{0.42}$ x 0.64. Measured in radius from the center of the trunk. Rounded up to nearest 0.1m.
Health - Good/Fair/Poor/Dead
Structure - Good/Fair/Poor
Safe Useful Life Expectancy (SULE) - 1. Long (40+years), 2. Medium (15 - 40 years), 3. Short (5 - 15 years), 4. Remove (under 5 years), 5. Small/young.
Amenity Value - Very High/High/Medium/Low/Very Low.

Appendix 3 – Condition/Overall health

Category	Example condition	Summary
Good	• Crown has good foliage density for species. • Tree shows no or minimal signs of pathogens that are unlikely to have an effect on the health of the tree. • Tree is displaying good vigour and reactive growth development. • Branch unions appear to be strong with no sign of defects. • There are no significant cavities. • The tree is unlikely to fail in usual conditions. • The tree has a balanced crown shape and form.	• The tree is in above average health and condition and no remedial works are required. • The tree is considered structurally good with well developed form.
Fair	• The tree may be starting to dieback or have over 25% deadwood. • Tree may have slightly reduced crown density or thinning. • There may be some discolouration of foliage. • Average reactive growth development. • There may be early signs of pathogens which may further deteriorate the health of the tree. • There may be epicormic growth indicating increased levels of stress within the tree. • The tree may have minor structural defects within the structure of the crown that could potentially develop into more significant defects. • The tree may a cavity that is currently unlikely to fail but may deteriorate in the future. • The tree is an unbalanced shape or leans significantly. • The tree may have minor damage to its roots. • The root plate may have moved in the past but the tree has now compensated for this. • Branches may be rubbing or crossing.	• The 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	• The may be in decline, have extensive dieback or have over 30% deadwood. • The canopy may be sparse or the leaves may be unusually small for species. • Pathogens or pests are having a significant detrimental effect on the tree health. • The tree 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 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.

	• The tree crown may have poor weight distribution which could cause failure.	
Dangerous	• The tree is dead or almost dead. • The tree is an imminent danger to people or property.	• 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 × 12.

TPZ = DBH × 12

Where

DBH = trunk diameter measured at 1.4 m above ground

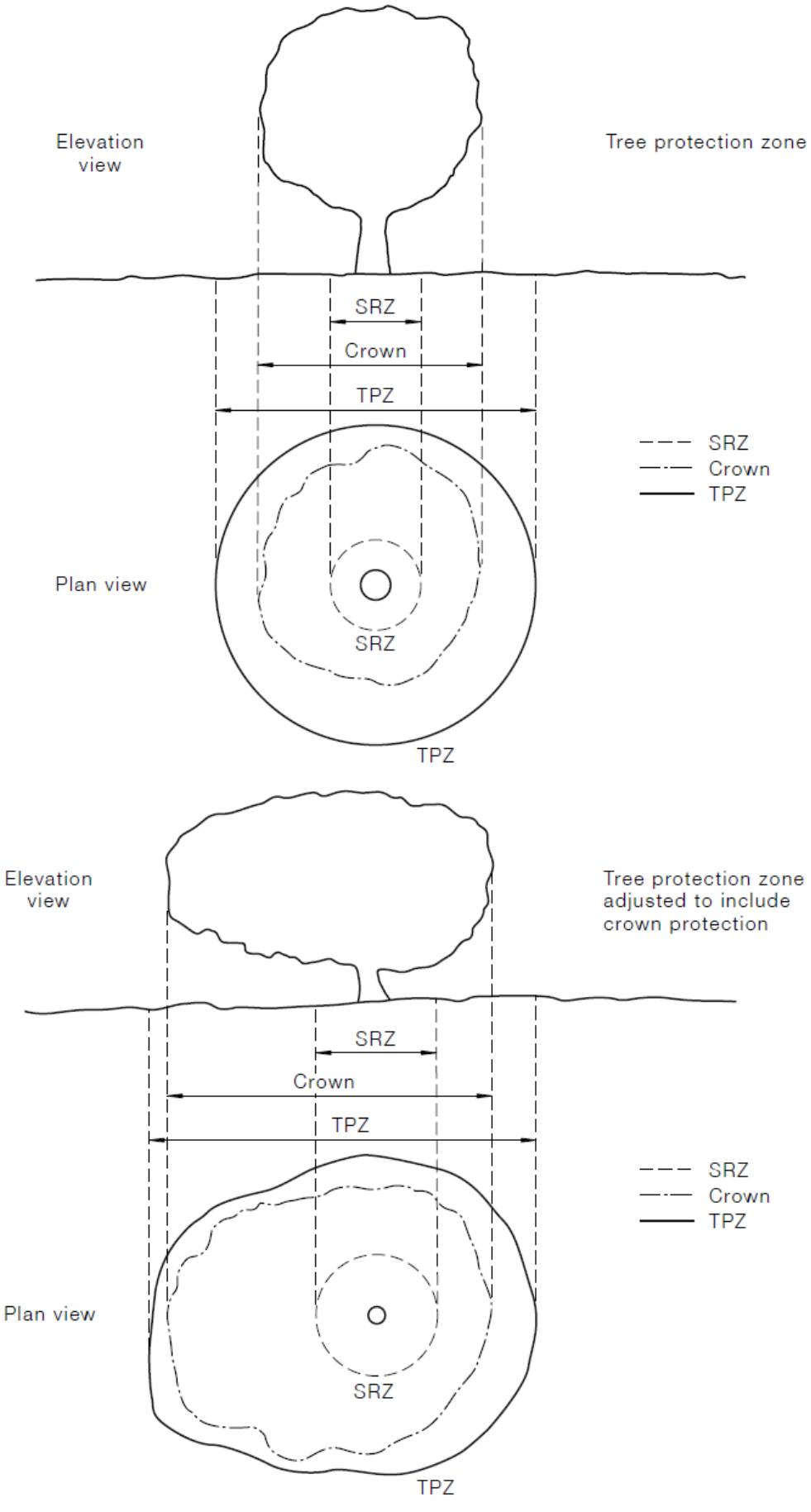
Radius is measured from the centre of the stem at ground level.
A TPZ should not be less than 2 m nor greater than 15 m (except where crown protection is required).

Minor encroachment into the TPZ

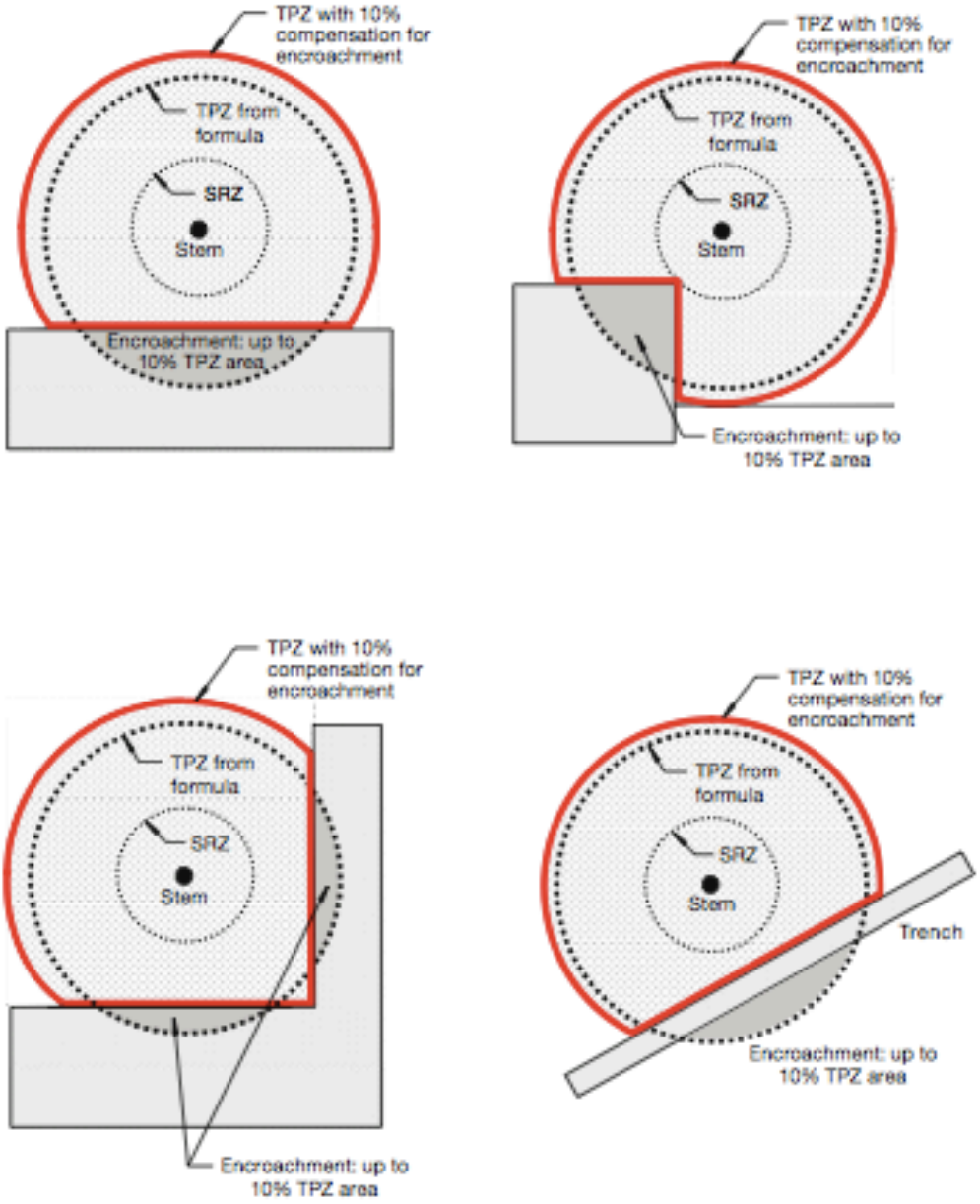
Where encroachment into the TPZ is unavoidable it is generally accepted that encroachment of under 10% of the total TPZ is possible without carrying out detailed root investigations. This minor loss of root area is normally compensated by the roots developing elsewhere.

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. None destructive root investigations may be required to determine any potential impact the encroachment may have on the tree.


Elevation view
Tree protection zone
SRZ
Crown
TPZ
SRZ
Crown
TPZ
Plan view
SRZ
TPZ
Elevation view
Tree protection zone adjusted to include crown protection
SRZ
Crown
TPZ
SRZ
Crown
TPZ
Plan view
SRZ
TPZ

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.

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 statuary 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.

Category	Description
Young/Newly planted	• Young or recently planted tree.
Semi Mature	• Up to 20% of the usual life expectancy for the species.
Early mature/Mature	• Between 20% - 80% of the usual life expectancy for the species.
Over mature	• Over 80% of the usual life expectancy for the species.
Dead	• Tree is dead or almost dead.

Appendix 8 - Structural condition

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

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

5. Small/Young	(a) Small trees less than 5m in height. (b) Young trees less than 15 years old but over 5m in height. (c) Formal hedges and trees intended for regular pruning to artificially control growth.

TreeAZ Categories (Version 10.04-ANZ)

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

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

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

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

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

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

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