



93-107 Cecil Ave & 9-10 Roger Ave
CASTLE HILL NSW 2154

Arboriculture Impact Assessment (AIA)

Client: Alton Property Group

Submission Date: 04/03/26

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1 Quality Information

Document: 93-107 Cecil Ave & 9-10 Roger Ave CASTLE HILL NSW 2154 AIA

Date: 04/03/26

Prepared by: Nick Nelson

Table 1, Revision History

Revision	Revision Date	Details	Authorised	
			Name/Position	Signature
1	6/11/24	First Draft	Nick Nelson, Consultant Arborist	
2	08/11/24	Revisions/Clarifications	Nick Nelson, Consultant Arborist	
3	11/11/24	Revisions/Clarifications	Nick Nelson, Consultant Arborist	
4	04/03/26	Updated design impacts to additional trees	Nick Nelson, Consultant Arborist	

2 Disclaimer

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- Xylem TreeCare’s instructions as to the Purpose of the Report.
- Xylem TreeCare’s instructions as to the identity of the Client.
- The use by the Client of the Report.
- Reliance on the Report by the Client.

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- The Report does not or may not purport to be the sole basis for any decision-making process embarked upon by the Client who should, wherever necessary, seek independent professional advice on legal, financial, or other relevant matters not within the Expertise.
- Xylem TreeCare has not independently reviewed, verified or audited any of the material in the instructions provided by the Client to Xylem TreeCare, and the Client acknowledges that insofar as the findings of the Report are reliant on instructions provided by the Client to Xylem TreeCare, no representation nor warranty, express or implied, as to the accuracy, reasonableness or completeness of the Report is made by Xylem TreeCare, which expressly disclaims any and all liability for or based upon or relating to any use of the instructions provided by the Client to Xylem TreeCare.
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3 Executive Summary

The *93–107 Cecil Ave & 9–10 Roger Ave Arboricultural Impact Assessment* (Report) relates to a total of one hundred and twenty-nine (129) trees located within the grounds of the existing private residences and business premises at 93–107 Cecil Ave & 9–10 Roger Ave CASTLE HILL NSW 2154. Alton Property Group (referred to as the Client) has identified the subject site as having trees that could potentially be affected by the proposed demolition of the existing dwellings and construction of the new mixed-use residential development. The client is applying to the NSW State Government under a State Significant Development Application (SSDA) to undertake the planned development. None of the subject trees were found to be covered under existing heritage orders or had any specific ecological status.

As part of the project scope, Xylem TreeCare were engaged to determine which trees would be negatively impacted by the proposed works to the extent that removal would be required to facilitate construction. One hundred and thirteen (113) of the trees inspected will require removal due to either being within the footprint of the works or due to an unacceptable level of encroachment associated with the proposed development. Sixteen (16) trees can be retained as either not affected by the works or as a result of an acceptable level of encroachment subject to the implementation of appropriate tree protection measures.

Only trees of 6 m in height or greater have been included in this report as trees less than 6 m in height are not protected under The Hills Local Environment Plan, Clause 5.9. Tree species that were found to be exempt from the requirement for permission from The Hills Shire Council were not included in the survey except where they were found to provide amenity to the existing treescape.

4 Purpose

The purpose of this report is to undertake a review of the existing trees within the subject area to identify those trees which will need to be removed to undertake the required construction and provide recommendations for minimising the impact of the proposed development on the existing tree population that is to be retained.

The report has been requested by the client in order to support and address the requirements of the State Significant Development Application for the 93-107 Cecil Ave & 9-10 Roger Ave CASTLE HILL NSW 2154 site.

The report findings and recommendations are based on the information and guidance contained within Australian Standard AS 4970-2009: *Protection of Trees on Development Sites*.

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4.1 Project Requirements

Undertake an audit of all trees within the subject area.

- Provide information on the current condition of each tree.
- Provide general information i.e. Botanical name and dimensions i.e. height, canopy spread and DBH.
- Calculate the Tree Protection Zones (TPZ) and Structural Root Zones (SRZ) of individual trees.

Review the proposed plans and where possible make recommendations for adjusting the works based on the proximity to individual trees within the subject area.

- Create an Arboricultural Impact Assessment Report outlining the following items:
 - Provide the current tree condition within the subject area in relation to the proposed development.
 - Utilise existing maps and plans provided outlining the planned works in relation to the existing tree population.

5 Method

This assessment was undertaken on site on the 15th of October 2024 using a ground-based visual assessment by Nick Nelson, followed by undertaking an in-office desktop review of the proposed plans. A further update was undertaken between the 27th of February and the 4th of March 2026 to assess the impacts of a proposed drainage easement and public domain works on Cecil Ave.

The EOS Arrow 100 GNSS was used to collect tree location data to sub-meter level utilising the Esri Fieldmaps application with the Ipad Pro 13 Inch M4. The Nikon Forestry Pro laser rangefinder was used to capture tree heights, span was estimated, and a standard forestry diameter tape measure was used to capture diameter at breast height and diameter above buttress dimensions.

The trees have been assessed for Arboricultural value using tree attributes and overall condition to assist in determining the retention value and significance.

The retention value ascribed to each tree in this report is not definitive and should be used as a guide only. Many factors influence the comparative value of a tree, and a number of these factors are outside the scope of arboriculture assessment.

The assessment report provides information about the species, size, and condition of the trees, as well as any potential risks or hazards they may pose.

Site Plans, Aerial views and site photographs utilised in this report have been captured on site, downloaded from open source GIS maps and as provided by the client.

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5.1 Limitations of Assignment

- Information obtained from publicly available databases has been used in the preparation of this report. The accuracy of information obtained from such sources cannot be guaranteed and has not been verified.
- The hybridization of flora species can cause an intermediate or incomplete form of morphological features and thereby affect the accuracy of field identification.
- Seasonal variations influence the presence of flowering and fruiting in flora species and thereby can affect the accuracy of field identification. Seasonal variation was not captured during the field assessment due to the short duration of the assessment.
- Xylem TreeCare has not undertaken any of the following items which may impact tree health:
 - Soil analysis
 - Below ground root analysis
 - Aerial tree inspections

5.2 Consulting Arborist

Table 2: Outlines the qualifications, experience and involvement of staff that have assisted in the development of this report.

Table 2, Staff Qualifications

Staff Member	Qualifications	Experience	Project Involvement
Nick Nelson Consulting Arborist	Certificate V in Arboriculture, QQTRA, Cert II ESI	Nick has 26 years' experience within the arboriculture industry; 17 years as a Consulting Arborist	Completion of review and update of AIA

5.3 Site Information

Xylem TreeCare Pty Ltd has been commissioned to provide an AIA on one hundred and twenty nine (129) trees located within the grounds and on the council owned nature strips outside the existing residential and commercial properties at the following locations:

Table 3, Lot/DP Numbers & Property Addresses subject sites.

Lot/DP	Property Address	Lot/DP	Property Address
Lot 27 DP 15399	93 Cecil Avenue, Castle Hill	Lot 2 DP 581293	101 Cecil Avenue, Castle Hill
Lot 22 DP 77859	95 Cecil Avenue, Castle Hill	Lot 4 DP 581293	101A Cecil Avenue, Castle Hill
Lot 1 DP 531559	95A Cecil Avenue, Castle Hill	Lot 1 DP 547897	103 Cecil Avenue, Castle Hill
Lot 21 DP 778595	95B Cecil Avenue, Castle Hill	Lot 2 DP 547897	103A Cecil Avenue, Castle Hill
Lot 6 DP 705913	97 Cecil Avenue, Castle Hill	Lot 1 DP 591676	105 Cecil Avenue, Castle Hill
Lot 4 DP 531559	97A Cecil Avenue, Castle Hill	Lot 2 DP 591676	105A Cecil Avenue, Castle Hill
Lot 5 DP 705913	97B Cecil Avenue, Castle Hill	Lot 20 DP 15399	107 Cecil Avenue, Castle Hill
Lot 1 DP 581293	99 Cecil Avenue, Castle Hill	Lot 6 DP 29141	9 Roger Avenue, Castle Hill
Lot 3 DP 581293	99A Cecil Avenue, Castle Hill	Lot 5 DP 29141	10 Roger Avenue, Castle Hill

The sites as listed in Table 3 are located in the suburb of Castle Hill in the Hills Shire Council LGA in an area that is dominated by single dwelling house blocks, with several green spaces nearby. Castle Hill is a prominent suburb in Sydney, Australia, located in the Hills District, about 30 km northwest of the Sydney Central Business District (CBD). The Proposed Site occupies the entirety of the properties listed in Table 3 and currently contains existing structures, areas of hardstand, and planted urban native and exotic landscaped gardens, with planted tree species present that are typical of an urban environment.

5.3.1 Topography

Castle Hill is characterized by its gently undulating hills, which is typical of the broader Hills District. The suburb has a varied landscape that includes low-lying areas as well as elevated ridges, with altitudes ranging roughly between 60 to 180 meters above sea level.

The topography of Castle Hill is generally sloping, with gradual gradients and natural water drainage patterns leading into creeks and tributaries. The area is part of the upper catchment for the Parramatta River, with several smaller creeks such as Cattai Creek flowing through parts of the suburb. This natural drainage system is complemented by a mix of urban development and preserved bushland.

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5.3.2 Soil Types

The soils in Castle Hill primarily belong to the Hawkesbury and Wianamatta soil groups, which are common in the Sydney Basin:

1. **Hawkesbury Sandstone-derived Soils:** These soils are typically found on the elevated areas and ridges. They are light, sandy, and well-draining but often low in fertility due to their coarse texture and low organic matter content. The shallow, stony nature of these soils can sometimes present challenges for gardening without amendments.
2. **Wianamatta Shale-derived Soils:** In the lower, flatter areas, especially toward the south and west, the soil composition shifts to clay-rich profiles derived from Wianamatta shale. These soils are heavier, more fertile, and retain moisture better than the sandstone-derived soils. However, they can become compacted and waterlogged, particularly in low-lying areas during wet periods.
3. **Alluvial Soils:** Found along creek lines and drainage areas, these soils are richer and more fertile due to sediment deposits from flowing water. These soils support a greater diversity of vegetation and are suitable for gardens and landscaping.



Figure 1 – 93-107 Cecil Ave & 9-10 Roger Ave CASTLE HILL NSW 2154 - Image extracted from SIXMAPS 2024

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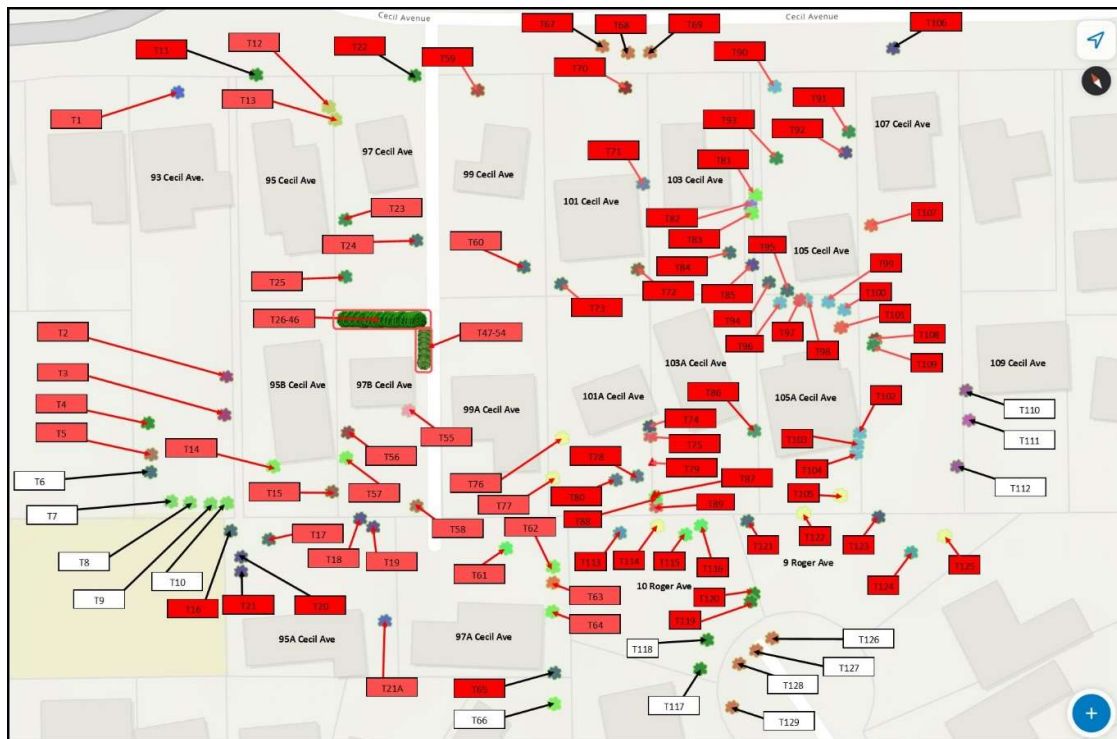


Figure 2 – Site Map Showing Tree Locations, retentions in white and removals in red.

5.4 Planning and Considerations

Trees 1-129 were found to be with a few exceptions (exempt trees found to offer a high level of amenity were included in the report) protected under the provisions of the State Environmental Planning Policy (Biodiversity and Conservation) 2021 Chapter 2 Vegetation in non-rural areas and the Hills Local Environment Plan 2019. The trees that are the focus of the Arboricultural Impact Assessment Report (as shown in Figure 2) were identified through discussions with the client. Additionally, the identification process involved walking the site, reviewing the plans provided and a review of the requirements of the Hills Shire Council and NSW State Government planning provisions.

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6 Observations

The following observations were identified during the field and desktop assessments.

6.1 Tree Condition

One hundred and twenty-nine (129) trees were surveyed on site. The trees were found to be a mixture of indigenous and exotic species ranging from semi-mature to mature age classes. The trees were found to be representatives of thirty-four (34) genera of Tree species including the following genera:

Table 4, List of tree genera surveyed on site.

Tree genera surveyed on site:			
<u>Acacia</u>	<u>Citharexylum</u>	<u>Grevillea</u>	<u>Lophostemon</u>
<u>Acer</u>	<u>Corymbia</u>	<u>Harpephyllum</u>	<u>Melaleuca</u>
<u>Alnus</u>	<u>Cupressocyparis</u>	<u>Jacaranda</u>	<u>Melia</u>
<u>Brachychiton</u>	<u>Cupressus</u>	<u>Juniperus</u>	<u>Pinus</u>
<u>Callistemon</u>	<u>Eucalyptus</u>	<u>Lagerstroemia</u>	<u>Pyrus</u>
<u>Cedrus</u>	<u>Ficus</u>	<u>Launaria</u>	<u>Viburnum</u>
<u>Ceratopetalum</u>	<u>Fraxinus</u>	<u>Leptospermum</u>	<u>Waterhousea</u>
<u>Chamaecyparis</u>	<u>Gleditsia</u>	<u>Liquidambar</u>	
<u>Cinnamomum</u>	<u>Gordonia</u>	<u>Liriodendron</u>	

Trees surveyed on site range in current health and condition from dead trees with poor structure through to healthy and structurally sound significant tree specimens.

Three (3) trees were found to have a high retention value, three (3) trees were found to have a low retention value, and one hundred and twenty-three (123) trees were found to have a moderate retention value.

Trees subject of this report have not been tagged on site with their unique tree number.

Complete data for each tree can be found in 10.2 Attachment 10.2 – Tree Data Detail.

6.2 Tree Retention Values

The retention value ascribed to each tree in this report is not definitive and should be used as a guide only. Many factors influence the comparative value of a tree, and a number of these factors are outside the scope of arboriculture assessment. These factors cannot therefore be addressed in a single rating system.

The retention value is comprised of two parts. These are the Amenity Value of the tree rated as Very Low to Very High and the Useful Life Expectancy (ULE) of the tree.

The Amenity Value of the tree relates to the contribution of the tree to the aesthetic amenity of the area. The primary determinants of amenity value are tree health, size and form.

The Amenity Value is then modified by the ULE of the tree with short ULE values reducing the RV of the tree and long ULE values increasing the RV of the tree.

Table 5, Tree retention categories

Category	Example	Amenity Value Value (AVV)
Very High	Generally, a very large tree that exhibits excellent health and/or for or a tree that is listed on a heritage or significance register	10
High	Generally, a large tree that exhibits good health and/or form	8
Medium	Generally, a medium tree that exhibits good health and/or form. May be a large tree that exhibits fair health and/or form.	6
Low	Generally, a small tree that exhibits good health and/or form. May be a large or medium tree that exhibits fair or poor health and/or form	4
Very Low	Generally, a small tree that exhibits poor health and/or form. May be a large or medium tree that exhibits poor, or worse, health and/or form	2

Table 6, Tree Retention Values Project specific

Category	Tree Numbers
Very high	Nil
High	65, 77, 122
Medium	1–64, 66-75, 78-113, 115-121, 122-124, 126-129
Low	76, 114, 125
Very Low	Nil

6.3 Trees of Significance

6.3.1 Heritage Status

None of the one hundred and twenty-nine (129) trees were found to be covered under existing heritage orders.

6.3.2 Ecological Status

As per the Narla Environmental BDAR Waiver (31/10/24) prepared for the SSDA, the tree species within the landscape of the Subject Site does not conform to any locally occurring Plant Community Type (PCT) and has therefore been classified as Landscaped Exotic and Native Vegetation.

6.4 Proposed Construction

6.4.1 Proposed Development

The state significant development application proposal for the site (SSDA) seeks consent for:

- Site preparation, demolition, and bulk excavation for basement parking.
- Residential accommodation (apartment buildings and mixed-use buildings).
- Publicly accessible recreation area and through site links.
- Associated landscaping and public domain works.
- Augmentation of, and connection to, existing utilities as required.

6.5 Design Review

The design has been reviewed in the context of tree retention and removal across the site utilising guidance provided within Australian Standard AS 4970-2009 *Protection of Trees on Development Sites*.

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6.5.1 Significant root damage due to major TPZ encroachment:

Where major Tree Protection Zone (TPZ) encroachment occurs levelling, filling and cutting of soil grades will result in the same types of damage that are associated with excavating, trenching and soil compaction. Ninety percent of the fine roots that absorb water and minerals are in the upper 150-300mm of soil. This area is the most conducive to root growth as it usually has available space, oxygen, nutrients, and water. Altering the soil level during trenching may either strip away the fine absorbing roots from the soil surface or remove the nutrient-rich topsoil that supplies the basic elements trees require for growth.

Raising or filling grades around trees reduces oxygen diffusion, and exchange, in the rhizosphere. As little as 100mm of soil placed over the established root systems of some species is enough to cause their death. Grade changes to the soil outside the rhizosphere of the tree may also affect water drainage, causing root dieback due to changes in soil moisture content in the situation where roots have been identified and require extraction, it is important that this be undertaken under the direct supervision of a qualified Arborist. The use of earth moving equipment has the potential to cause significant damage not only to the exposed root needing removal but also to major anchorage roots within the Structural Root Zone (SRZ); this is due to the roots being removed, split and compresses vascular tissue away from the target site. Where possible roots should be removed radially from the root zone rather than directly across the root system, this will reduce secondary damage to structural roots.

6.5.2 Allowable Encroachment

The assumption of allowable encroachment and minimal long-term health or structural impacts to the subject trees assessed as capable of being retained on this site requires the adaptation of the following impact limiting measures

- The adoption of root sensitive construction methods within the TPZ, minimal excavation within the TPZ to limit root severance as agreed and supervised by the project arborist (i.e. construction placed outside the TPZ where possible).
- Utilisation of fill rather than excavation to affect level changes where possible (i.e. to minimise root severance and allow the tree’s root system time to adjust).
- No construction occurring within the SRZ, compensatory area being available around the un-impacted aspects of the trees and the enhancement of the existing TPZ area (where allowable encroachment has occurred and the results of non-destructive digging (NDD) reveal root damage, mulching, soil conditioning and or irrigation may be required).

6.5.3 Trees affected by encroachment

The development will affect one hundred and thirteen (113) site trees through encroachment via excavation and/or due to being within the footprint of the proposed development. Trees 6–10, 66, 69, 110–112, 117–118 and 126–129 are capable of being retained with either generic or specific tree protection measures.

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6.5 TPZ Encroachment

6.5.1 Major encroachment

As per the Australian Standard AS 4970–2009: *Protection of Trees on Development Sites*, a major encroachment into the TPZ of any tree is considered to occur when it is beyond a theoretical 10% of the total TPZ area. Trees with major encroachment may require removal or, in certain instances, be retained with specific protection requirements throughout the construction stage.

6.5.2 Minor encroachment

Under AS 4970-2009, a minor encroachment is determined as less than a theoretical 10% of the total TPZ area. Trees with minor encroachment may be retained with specific, generic or no protection requirements throughout the construction stage.

6.5.3 No encroachment

Trees with no encroachment may be retained with generic or no protection requirements throughout the construction stage.

6.5.4 Identification of trees to be retained and or removed

Trees in the AIA for this project have been categorised as follows:

- Trees to be retained and protected through the development process.
- Trees that could be retained but could be removed to make way for more suitable replacement plantings.
- Trees to be removed due to an unacceptable level of impact from the planned construction or from being within the footprint of the planned works.

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7 Recommendations

7.1 Tree Removal

Following the review of the proposed designs provided, one hundred and thirteen (113) trees that were identified as being potentially affected by the works will need to be removed to allow for the planned development to be undertaken.

Table 7, Tree Removals

Recommendations	High retention value		Medium retention value		Low retention value		Very Low	
	QTY	Tree Numbers	QTY	Tree Numbers	QTY	Tree Numbers	QTY	Tree Numbers
Remove for Development TPZ impact greater than 10% or located within the footprint of works	3	65, 77, 122	107	1-5, 11-64, 67-68, 70-75, 78-109, 113, 115-116, 119-121, 123-124	3	76, 114, 125	0	Nil

7.2 Tree Retention & Pruning

Trees 6-10, 66, 69, 110-112, 117-118 and 126-129 are capable of being retained with either generic or specific tree protection measures.

Trees 6-10, 66, 69, 110-112 and 117-118 can be retained with generic tree protection measures as per Attachment 10.5.

Trees 126-129 can be retained with specific tree protection measures consisting of trunk protection and ground protection as per Attachment 10.5.

Trees 117-118 can be retained with generic protection measures but could be removed to allow for their replacement with more suitable endemic tree species.

Should pruning of retained trees be required during the construction process the project arborist must be contacted for direction and any pruning must be carried out by a suitably experienced minimum Australian Qualification Framework Level III Arborist as per the requirements of the AS4373-2007 *Pruning of amenity trees* standard.

7.3 Protective Fencing, Trunk and Ground Protection Specification

AS4970-2009 *Protection of Trees on Development Sites* states that Protective fencing (as per Attachment 10.5) is to be installed as far as practicable from the trunk of any retained trees. Fencing should be erected as per the image and specifications in Attachment 10.5 before any machinery or materials are brought to site and before commencement of construction and or any demolition.

Once erected, protective fencing must not be removed or altered without approval from the project arborist. The TPZ fencing should be secured to restrict access.

TPZ fencing is to be constructed as per Attachment 10.5.

Tree protection fencing must remain intact throughout all proposed construction works and must only be dismantled after their conclusion. The temporary dismantling of tree protection fencing must only be done with the authorisation of the project arborist and/or the responsible authority.

7.4 Tree Protection Signs

Signs identifying the TPZ (As per image in Attachment 10.5) should be placed at 10m intervals around the edge of the TPZ and should be visible from within the development site.

7.5 Project Arborist

The AS4970-2009 Protection of trees on development standard requires the appointment of a Project Arborist.

The project arborist must have a minimum five (5) years industry experience in the field of arboriculture with relevant demonstrated experience in tree management on construction sites, and Diploma level qualifications in arboriculture.

Inspections are to be conducted by the project arborist at several key points during the construction to ensure that protection measures are being adhered to during construction stages and any potential decline in tree health or additional remediation measures can be identified.

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7.6 Project Milestones

The following visits and milestones are recommended as to when on-site tree inspection by the project arborist is required:

Table 8, Project Milestones

Item	Purpose of Visit	Timing of Visit(s)	Prerequisites
1	Certification of Tree Protection Measures	Prior to the commencement of works on site	Tree protection installed as per the requirements of the AS4970-2009 <i>Protection of Trees on Development sites</i> standard.
2	Regular site inspections	Minimum frequency quarterly for the duration of the project where works are affecting trees to be retained	The checklist must be completed by the Project Arborist at each site inspection and signed by both parties.
3	Supervision of excavation within TPZ	Whenever works are to take place that could impact the TPZ of retained trees.	5 working days' notice.
2	Final certification of retained trees	At the end of the construction process.	Clear access to all retained trees.

7.7 Compliance Reporting

Following the completion of the development process, the project arborist shall prepare a report detailing the completion of the works. This report will certify whether the works have been completed in compliance with any approved conditions of consent relating to required tree protection.

The report will contain photographic evidence where required to demonstrate that the work has been carried out as specified.

Matters to be monitored and included in the report will include the condition of retained trees, tree protection measures and impact of site works which may arise from changes to the approved plans.

The completed tree register, report and compliance statement shall be submitted to the client following the completion of the development process.

8 Offset Tree Planting

Offset planting should reflect the number of trees removed and the initial loss of amenity and biomass. New trees should be of long-term potential and sourced from a reputable supplier.

Replacement tree species must suit their location on the site in terms of their potential physical size and their tolerance(s) to the surrounding environmental conditions. To avoid unethical or unprofessional tree selection and/or their placement within the landscape, replacement tree species must be selected in consultation with a consulting arborist, who can also assist in implementing successful tree establishment techniques.

Replacement tree species must have the genetic potential to reach a mature size potential of those trees removed to facilitate the development. As a guide, potential height will be a minimum of 10m (or more) and produce a spreading canopy so as they may provide amenity value to the property and contribute to the tree canopy of the surrounding area in the future.

9 Documents Reviewed

The following documents were reviewed in preparation of this report.

Table 9, Cited Project Documents

Date	Title	Revision Number	Attachment
2024/12/04	SSDA	A	NA
22/02/17	Detail and level survey	C	NA
19/12/25	Amended DA Plans A44023	NA	NA

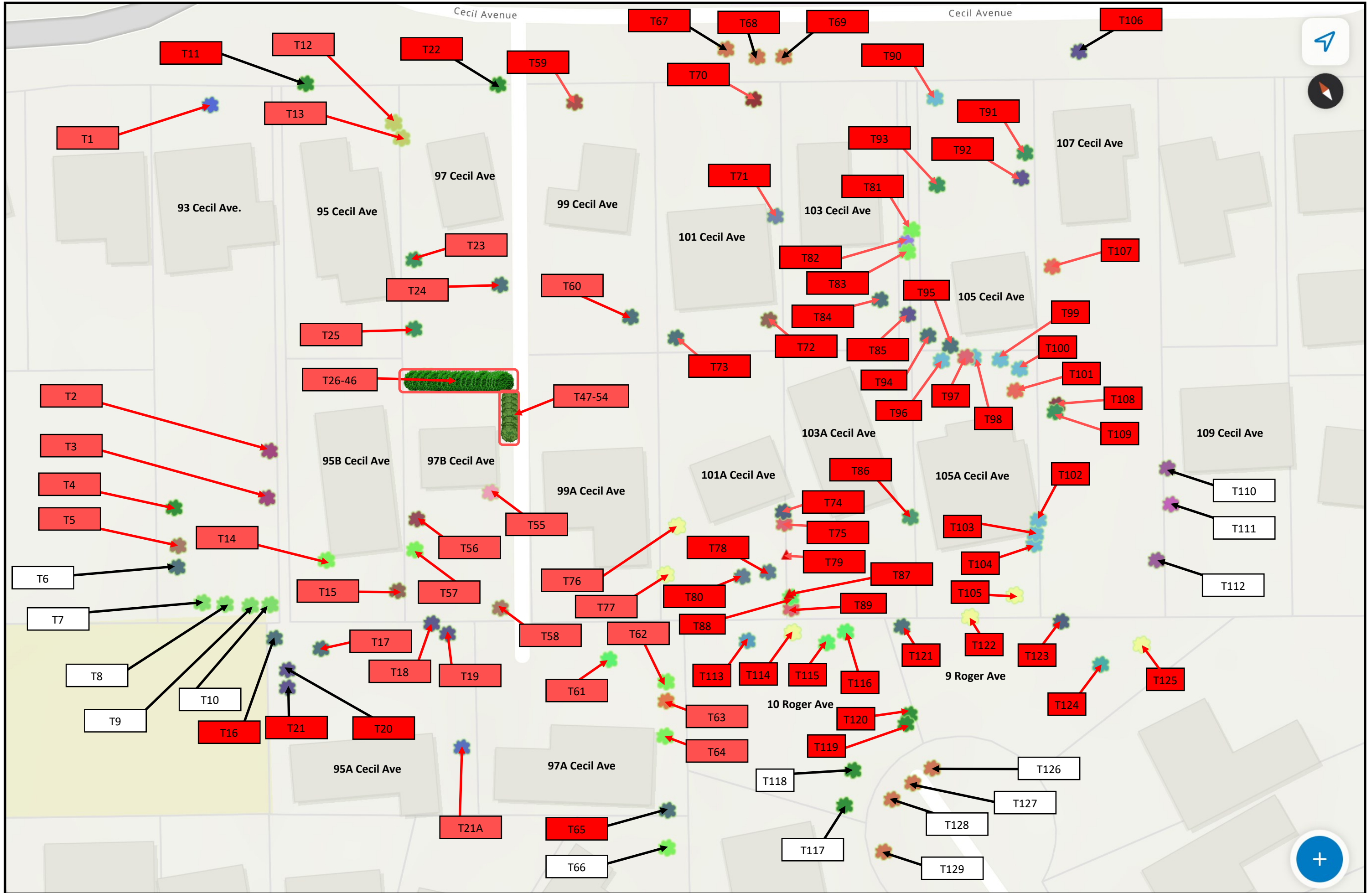
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- Narla Environmental BDAR Waiver 93-107 Cecil Ave & 9-10 Roger Ave CASTLE HILL NSW 2154 31/10/24.

10 Attachments

- 10.1 Attachment 1 – Site Map Showing Tree Locations**
- 10.2 Attachment 2 – Tree Data Detailed**
- 10.3 Attachment 3 – Construction Drawings**
- 10.4 Attachment 4 – Descriptions**
- 10.5 Attachment 5 – TPZ Management**

Xylem TreeCare Pty Ltd	93-107 Cecil Ave & 9-10 Roger Ave CASTLE HILL NSW 2154 <i>Arboriculture Impact Assessment</i>	Prepared By: Nick Nelson
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10.2 Attachment 2 Tree Data Detail - A+ Design Group 93-107 Cecil Ave 9-10 Roger Ave CASTLE HILL NSW 2154 Rev 4

Tree No.	Genus	Species	Common Name	Tree Significance	Height (m)	Spread (m)	Diameter Breast Height (cm)	Diameter Above Buttress (cm)	TPZ	SRZ	TPZ m2	% Encroachment	Health	Structure	Amenity Value	ULE	Retention Value	Origin	Maturity	Defects	Retention Comments
1	<i>Cedrus</i>	<i>deodara</i>	Himalayan Cedar	Desirable	8.60	10	97	100	11.60	3.30	426	28.60%	Fair	Fair	Moderate	15-25	Moderate	Exotic	Mature	Nil	Remove within footprint of works
2	<i>Alnus</i>	<i>gorulensis</i>	Mexican Alder	Undesirable	8.00	6	30	34	3.60	2.10	41	Within footprint of works	Fair	Fair	Moderate	15-25	Moderate	Exotic	Mature	Nil	Remove within footprint of works
3	<i>Alnus</i>	<i>gorulensis</i>	Mexican Alder	Undesirable	8.00	6	50	52	6.00	2.50	113	Within footprint of works	Fair	Fair	Moderate	15-25	Moderate	Exotic	Mature	Nil	Remove within footprint of works
4	<i>Cupressus</i>	<i>sp.</i>	Cypress Pine	Desirable	9.40	4	40	42	4.80	2.30	72	Within footprint of works	Fair	Fair	Moderate	15-25	Moderate	Exotic	Mature	Bark inclusions as for the habit of this species	Remove within footprint of works
5	<i>Fraxinus</i>	<i>angustifolia</i>	Narrow Leaved Ash	Desirable	9.00	3	20	22	2.40	1.80	18	Within footprint of works	Fair	Fair	Moderate	15-25	Moderate	Exotic	Mature	Nil tree was coming back into leaf at time of inspection	Remove within footprint of works
6	<i>Jacaranda</i>	<i>mimosifolia</i>	Jacaranda	Desirable	11.00	8	30	32	3.60	2.10	41	Works outside of TPZ	Fair	Fair	Moderate	15-25	Moderate	Exotic	Mature	Nil	Retain and protect
7	<i>Cupressocyparis</i>	<i>leylandii</i>	Leightons Green Cypress	Desirable	13.00	4	50	55	6.00	2.60	113	5.00%	Fair	Fair	Moderate	15-25	Moderate	Exotic	Mature	Bark inclusions as for the habit of this species	Retain and protect
8	<i>Cupressocyparis</i>	<i>leylandii</i>	Leightons Green Cypress	Desirable	15.00	19	50	55	6.00	2.60	113	Works outside of TPZ	Fair	Fair	Moderate	15-25	Moderate	Exotic	Mature	Bark inclusions as for the habit of this species	Retain and protect
9	<i>Cupressocyparis</i>	<i>leylandii</i>	Leightons Green Cypress	Desirable	13.00	4	50	55	6.00	2.60	113	Works outside of TPZ	Fair	Fair	Moderate	15-25	Moderate	Exotic	Mature	Bark inclusions as for the habit of this species	Retain and protect
10	<i>Cupressocyparis</i>	<i>leylandii</i>	Leightons Green Cypress	Desirable	11.00	4	50	55	6.00	2.60	113	Works outside of TPZ	Fair	Fair	Moderate	15-25	Moderate	Exotic	Mature	Bark inclusions as for the habit of this species	Retain and protect
11	<i>Cupressus</i>	<i>sp.</i>	Cypress Pine	Desirable	7.80	3	32	30	3.80	2.00	13	Affected by public Domain Works	Fair	Fair	Moderate	15-25	Moderate	Exotic	Mature	Bark inclusions as for the habit of this species	Remove due to major encroachment
12	<i>Brachychiton</i>	<i>acerifolius</i>	Kurrajong	Desirable	9.00	3	50	48	6.00	2.40	113	19.60%	Good	Good	Moderate	15-25	Moderate	NSW	Mature	Nil	Remove due to major encroachment
13	<i>Brachychiton</i>	<i>acerifolius</i>	Kurrajong	Desirable	9.00	3	50	48	6.00	2.40	113	Within footprint of works	Good	Good	Moderate	15-25	Moderate	NSW	Mature	Nil	Remove within footprint of works
14	<i>Melaleuca</i>	<i>bracteata</i> "Revolution Gold"	Honey Myrtle	Desirable	8.40	3	40	45	4.80	2.40	72	Within footprint of works	Fair	Fair	Moderate	15-25	Moderate	NSW	Mature	Nil	Remove within footprint of works
15	<i>Melia</i>	<i>azedarach</i>	White Cedar	Desirable	7.00	6	51	55	6.00	2.60	113	Within footprint of works	Fair	Fair	Moderate	15-25	Moderate	Australian	Mature	Minor deadwood	Remove within footprint of works
16	<i>Jacaranda</i>	<i>mimosifolia</i>	Jacaranda	Desirable	11.00	4	25	27	3.00	1.90	28	Drainage easement	Fair	Fair	Moderate	15-25	Moderate	Exotic	Mature	Minor deadwood	Remove within footprint of drainage easement works
17	<i>Jacaranda</i>	<i>mimosifolia</i>	Jacaranda	Desirable	11.00	4	40	44	4.00	2.30	72	Within footprint of works	Fair	Fair	Moderate	15-25	Moderate	Exotic	Mature	Minor deadwood	Remove within footprint of works
18	<i>Gleditsia</i>	<i>triacanthos</i> "Lime Gold"	Honey Locust	Desirable	7.00	5	30	34	3.60	2.10	41	Within footprint of works	Fair	Fair	Moderate	15-25	Moderate	Exotic	Mature	Nil	Remove within footprint of works
19	<i>Gleditsia</i>	<i>triacanthos</i> "Lime Gold"	Honey Locust	Desirable	6.00	3	30	34	3.60	2.10	41	Within footprint of works	Fair	Fair	Moderate	15-25	Moderate	Exotic	Mature	Nil	Remove within footprint of works
20	<i>Callistemon</i>	<i>viminialis</i>	Weeping Bottlebrush	Desirable	8.00	3	30	35	3.60	2.10	41	Drainage easement	Fair	Fair	Moderate	15-25	Moderate	NSW	Mature	Nil	Remove within footprint of drainage easement works
21	<i>Callistemon</i>	<i>salianus</i>	White Bottlebrush	Desirable	9.00	4	40	44	4.00	2.40	72	Drainage easement	Fair	Fair	Moderate	15-25	Moderate	NSW	Mature	Nil	Remove within footprint of drainage easement works
22	<i>Cupressus</i>	<i>sp.</i>	Cypress Pine	Desirable	9.20	4	40	44	4.00	2.40	72	Affected by public Domain Works	Fair	Fair	Moderate	15-25	Moderate	Exotic	Mature	Bark inclusions as for the habit of this species	Remove due to major encroachment
23	<i>Grevillea</i>	<i>robusta</i>	Silky Oak	Desirable	15.00	10	50	55	6.00	2.60	113	Within footprint of works	Fair	Fair	Moderate	15-25	Moderate	NSW	Mature	Nil	Remove within footprint of works
24	<i>Jacaranda</i>	<i>mimosifolia</i>	Jacaranda	Desirable	8.00	5	35	37	4.20	2.20	55	Within footprint of works	Fair	Fair	Moderate	15-25	Moderate	Exotic	Mature	Nil	Remove within footprint of works
25	<i>Grevillea</i>	<i>robusta</i>	Silky Oak	Desirable	16.00	10	50	55	6.00	2.60	113	Within footprint of works	Fair	Fair	Moderate	15-25	Moderate	NSW	Mature	Minor deadwood	Remove within footprint of works
26 to 46	<i>Cupressocyparis</i>	<i>leylandii</i>	Leightons Green Cypress	Desirable	Avg 10	Avg 2.5	Avg 15	Avg 15	Avg 2	Avg 1.5	252	Within footprint of works	Average	Average	Moderate	5-15	Moderate	Exotic	Mature	Suppressed	Remove within footprint of works
47 to 54	<i>Cupressus</i>	<i>macrocarpa</i>	Cypress Pine	Desirable	Avg 12	Avg 8	Avg 40	Avg 42	Avg 4.8	Avg 2.3	507	Within footprint of works	Average	Average	Moderate	5-15	Moderate	Exotic	Mature	Bark inclusions as for the habit of this species	Remove within footprint of works

10.2 Attachment 2 Tree Data Detail - A+ Design Group 93-107 Cecil Ave 9-10 Roger Ave CASTLE HILL NSW 2154 Rev 4

55	<i>Chamaecyparis</i>	<i>pisifera</i>	Sawara Cypress	Desirable	7.20	2	20	22	2.40	1.80	18	Within footprint of works	Fair	Fair	Moderate	15-25	Moderate	Exotic	Mature	Nil	Remove within footprint of works
56	<i>Ceratopetalum</i>	<i>gummiferum</i>	NSW Christmas Bush	Desirable	8.00	3	25	27	3.00	1.90	28	Within footprint of works	Fair	Fair	Moderate	15-25	Moderate	Sydney	Mature	Nil	Remove within footprint of works
57	<i>Melaleuca</i>	<i>bracteata "Revolution Gold"</i>	Honey Myrtle	Desirable	7.00	4	30	32	3.60	2.10	41	Within footprint of works	Fair	Fair	Moderate	15-25	Moderate	NSW	Mature	Nil	Remove within footprint of works
58	<i>Fraxinus</i>	<i>angustifolia</i>	Narrow Leaved Ash	Desirable	11.40	10	40	42	4.80	2.30	72	Within footprint of works	Fair	Fair	Moderate	15-25	Moderate	NSW	Mature	Nil	Remove within footprint of works
59	<i>Juniperus</i>	<i>sp.</i>	Juniper	Desirable	7.00	10	56	58	6.70	2.60	142	22.60%	Fair	Fair	Moderate	15-25	Moderate	Exotic	Mature	Nil	Remove due to major encroachment
60	<i>Jacaranda</i>	<i>mimosifolia</i>	Jacaranda	Desirable	11.00	12	50	55	6.00	2.60	113	Within footprint of works	Fair	Fair	Moderate	15-25	Moderate	Exotic	Mature	Nil	Remove within footprint of works
61	<i>Acer</i>	<i>sp.</i>	Maple	Desirable	10.00	12	45	47	5.40	2.40	92	Within footprint of works	Fair	Fair	Moderate	15-25	Moderate	Exotic	Mature	Nil	Remove within footprint of works
62	<i>Melaleuca</i>	<i>quinquenervia</i>	Broad Leaved Paperbark	Desirable	10.00	5	50	55	6.00	2.60	113	Within footprint of works	Fair	Fair	Moderate	15-25	Moderate	Exotic	Mature	Nil	Remove within footprint of works
63	<i>Viburnum</i>	<i>odoratissimum</i>	Sweet Viburnum	Desirable	6.00	8	20	22	2.40	1.80	18	Within footprint of works	Fair	Fair	Moderate	15-25	Moderate	Exotic	Mature	Nil	Remove within footprint of works
64	<i>Melaleuca</i>	<i>armillaris</i>	Honey Bracelet Myrtle	Desirable	9.00	6	40	42	4.80	2.30	72	Within footprint of works	Fair	Fair	Moderate	15-25	Moderate	Sydney	Mature	Bark inclusions as for the habit of this species	Remove within footprint of works
65	<i>Jacaranda</i>	<i>mimosifolia</i>	Jacaranda	Desirable	10.00	6	30	32	3.60	2.10	41	Within footprint of works	Fair	Fair	Moderate	15-25	High	Exotic	Mature	Minor deadwood	Remove within footprint of works
66	<i>Melaleuca</i>	<i>quinquenervia</i>	Broad Leaved Paperbark	Desirable	11.00	6	45	47	5.40	2.40	92	Located on adjacent property works outside of TPZ	Fair	Fair	Moderate	15-25	Moderate	NSW	Mature	Bark inclusions as for the habit of this species	Retain and protect
67	<i>Liquidambar</i>	<i>styraciflua</i>	Liquidambar	Desirable	6.60	5	35	40	4.20	2.30	55	Affected by public Domain Works	Average	Average	Moderate	15-25	Moderate	Exotic	Mature	Pruned for powerline clearance	Remove due to major encroachment
68	<i>Liquidambar</i>	<i>styraciflua</i>	Liquidambar	Desirable	6.00	3	30	35	3.60	2.10	41	Affected by public Domain Works	Average	Average	Moderate	15-25	Moderate	Exotic	Mature	Pruned for powerline clearance	Remove due to major encroachment
69	<i>Liquidambar</i>	<i>styraciflua</i>	Liquidambar	Desirable	6.00	4	40	45	4.80	2.40	72	Located on Council managed nature strip works outside of TPZ	Average	Average	Moderate	15-25	Moderate	Exotic	Mature	Pruned for powerline clearance	Retain and protect
70	<i>Acacia</i>	<i>melanoxydon</i>	Blackwood	Desirable	6.40	3	20	22	2.40	1.80	18	Within footprint of works	Fair	Fair	Moderate	5-15	Moderate	NSW	Mature	Minor deadwood	Remove within footprint of works
71	<i>Leptospermum</i>	<i>peteronii</i>	Lemon Scented Tea Tree	Desirable	6.60	3	20	22	2.40	1.80	18	Within footprint of works	Fair	Fair	Moderate	15-25	Moderate	NSW	Mature	NIL	Remove within footprint of works
72	<i>Melia</i>	<i>azedarach</i>	White Cedar	Desirable	10.00	10	51	55	6.10	2.60	118	Within footprint of works	Fair	Fair	Moderate	15-25	Moderate	Australian	Mature	Minor deadwood	Remove within footprint of works
73	<i>Jacaranda</i>	<i>mimosifolia</i>	Jacaranda	Desirable	11.00	12	50	55	6.00	2.60	113	Within footprint of works	Fair	Fair	Moderate	15-25	Moderate	Exotic	Mature	Minor deadwood	Remove within footprint of works
74	<i>Citharexylum</i>	<i>spinosum</i>	Fiddlewood	Desirable	10.00	8	40	44	4.80	2.30	72	Within footprint of works	Fair	Fair	Moderate	15-25	Moderate	Exotic	Mature	Bark inclusions as for the habit of this species	Remove within footprint of works
75	<i>Ficus</i>	<i>microcarpa var hillii</i>	Hills Weeping Fig	Desirable	16.00	14	90	85	10.80	3.10	366	Within footprint of works	Fair	Fair	Moderate	15-25	Moderate	Exotic	Mature	Bark inclusions as for the habit of this species	Remove within footprint of works
76	<i>Eucalyptus</i>	<i>sp.</i>	Gum Tree	Undesirable	11.00	8	50	55	NA	NA	NA	Within footprint of works	Dead	Poor	Low	0-5	Low	Australian	Mature	Dead tree	Remove within footprint of works
77	<i>Eucalyptus</i>	<i>microcorys</i>	Tallowwood	Desirable	22.00	20	80	85	9.60	3.10	290	Within footprint of works	Good	Good	High	15-25	High	NSW	Mature	Minor deadwood	Remove within footprint of works
78	<i>Pyrus</i>	<i>calleryana</i>	Callery Pear	Desirable	10.00	5	42	45	5.00	2.40	80	Within footprint of works	Fair	Fair	Moderate	15-25	Moderate	Exotic	Mature	Minor deadwood	Remove within footprint of works
79	<i>Harpephyllum</i>	<i>caffrum</i>	Wild Plum	Desirable	12.00	3	30	28	3.60	1.90	41	Within footprint of works	Fair	Fair	Moderate	15-25	Moderate	Exotic	Mature	Included bark unions	Remove within footprint of works
80	<i>Pyrus</i>	<i>calleryana</i>	Callery Pear	Desirable	10.00	5	42	45	5.00	2.40	80	Within footprint of works	Fair	Fair	Moderate	15-25	Moderate	Exotic	Mature	Minor deadwood	Remove within footprint of works
81	<i>Melaleuca</i>	<i>stypelioides</i>	Prickly Paperbark	Desirable	12.80	9	97	99	11.60	3.30	426	Within footprint of works	Fair	Fair	Moderate	15-25	Moderate	Sydney	Mature	Minor Deadwood	Remove within footprint of works
82	<i>Lophostemon</i>	<i>confertus</i>	Brushbox	Desirable	11.40	7	35	37	4.20	2.20	55	Within footprint of works	Fair	Fair	Moderate	15-25	Moderate	NSW	Mature	Minor deadwood suppressed crown	Remove within footprint of works
83	<i>Melaleuca</i>	<i>stypelioides</i>	Prickly Paperbark	Desirable	10.00	7	54	55	6.50	2.60	132	Within footprint of works	Fair	Fair	Moderate	15-25	Moderate	Sydney	Mature	Minor Deadwood	Remove within footprint of works

84	<u>Jacaranda</u>	<u>mimosifolia</u>	Jacaranda	Desirable	7.40	3	15	16	2.00	1.50	13	Within footprint of works	Fair	Fair	Moderate	15-25	Moderate	Exotic	Semi-mature	Nil	Remove within footprint of works
85	<u>Callistemon</u>	<u>viminalis</u>	Weeping Bottlebrush	Desirable	9.00	14	68	70	8.20	2.80	209	Within footprint of works	Fair	Fair	Moderate	15-25	Moderate	NSW	Mature	Minor deadwood	Remove within footprint of works
86	<u>Corymbia</u>	<u>eximia</u>	Yellow Bloodwood	Desirable	6.60	4	32	33	3.00	2.10	46	Within footprint of works	Fair	Fair	Moderate	15-25	Moderate	Sydney	Early-mature	Minor deadwood, minor dieback	Remove within footprint of works
87	<u>Harpephyllum</u>	<u>caffrum</u>	Wild Plum	Desirable	10.00	3	25	27	3.00	1.90	28	Within footprint of works	Fair	Fair	Moderate	15-25	Moderate	Exotic	Mature	Included bark unions	Remove within footprint of works
88	<u>Acer</u>	<u>buergerianum</u>	Trident Maple	Desirable	8.00	3	17	20	2.00	1.70	13	Within footprint of works	Fair	Fair	Moderate	15-25	Moderate	Exotic	Mature	Minor deadwood	Remove within footprint of works

1 Descriptors

1.1.1 Origin

Category	Description
Indigenous	Native to the greater Sydney metropolitan area
NSW	Native to NSW but not the greater Sydney Metropolitan area
Australian	Native to Australia but not NSW
Exotic	Not native to Australia

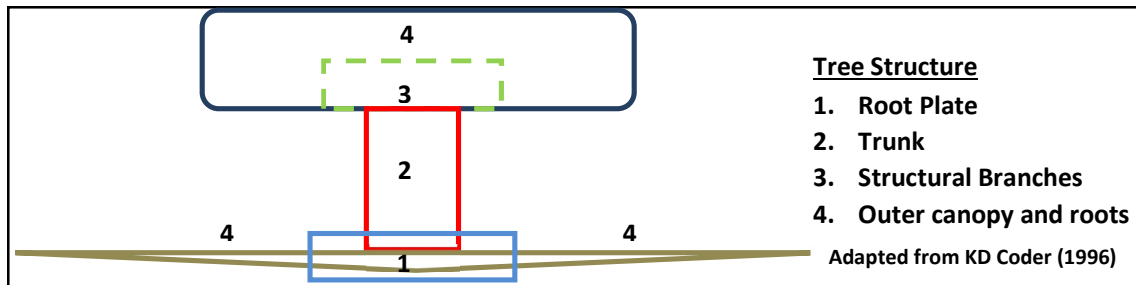
1.1.2 Maturity

Category	Description
Young	Sapling tree and/or recently planted. Approximately five or less years in location
Semi mature	Tree increasing in size and yet to achieve expected size in situation. Primary developmental stage
Early mature	Tree established, generally growing vigorously. > 50% of attainable age/size
Mature	Specimen approaching expected size in situation, with reduced incremental growth
Over-mature	Mature full-size with a retrenching crown. Tree is senescent and in decline. Significant decay present

1.1.3 Health

Category	Description
Good	Full crown, with good foliage density. Foliage is entire with average colour, minimal or no pathogen damage. Above average growth indicators such as extension growth, leaf size and canopy density. Little or no canopy die-back. Generally, no deadwood on the perimeter of the canopy. Good wound wood development. Tree exhibits above average health, and no works are required.
Fair	Tree may have more than 30% deadwood or may have minor canopy dieback. Foliage density may be slightly below average for the species. Foliage colour may be slightly lower than average, and some discolouration may be present. Typical growth indicators, e.g., extension growth, leaf size, canopy density for species and location. Average wound wood development The tree exhibits below average health, and remedial works may be employed to improve health
Poor	Tree may have more than 30% deadwood and canopy dieback may be present. Leaves may be discoloured and/or distorted, often small, and excessive epicormic growth may be present. Pathogens and/or stress agents may be present that could lead, or are leading to, the decline of the tree. Poor wound wood development. The tree exhibits low health and remedial works, or removal may be required
Very Poor	The tree has more than 30% dead wood. Extensive canopy die back is present. Canopy is very sparse. Pathogens and/or stress agents are present that are leading to the decline of the tree. Very poor wound wood development. The tree exhibits very low health and remedial works, or removal are required.
Dead	Tree is dead and generally should be removed.

1.1.4 Structure



Descriptor	Zone 1	Zone 2	Zone 3	Zone 4
	Root Plate	Trunk	Structural Branches	Outer crown and roots
Good	No damage, disease, or decay, obvious basal flare / stable in ground	No damage, disease or decay, good taper	Well formed, attached, spaced and tapered	No damage, disease or decay or structural defects
Average	Minor damage or decay	Minor damage or decay	Typically formed, attached, and tapered	Minor damage, disease or decay, minor branch end weight or over-extension
Fair	Moderate damage or decay, minimal basal flare	Moderate damage or decay; approaching recognised thresholds	Weak, decayed or with acute branch attachments, previous branch failure evident	Moderate damage, disease, or decay; moderate branch end weight or over extension
Poor	Major Damage, disease, or decay; conks present	Major damage disease or decay; exceeds recognised thresholds, conks present	Decayed, cavities or has acute branch attachments with included bark; excessive compression flaring, failure likely	Major damage, disease, or decay; conks present; major branch end weight or over extension
Very Poor	Excessive damage, disease, or decay; unstable / loose in ground; failure probable	Excessive damage, disease, or decay; cavities	Decayed, cavities or branch attachments with active splits, failure imminent	Excessive damage, disease, or decay; excessive branch end weight or over extension

1.2 Retention Value (RV)

The retention value ascribed to each tree in this report is not definitive and should be used as a guide only. Many factors influence the comparative value of a tree and a number of these factors are outside the scope of arboriculture assessment. These factors cannot therefore be addressed in a single rating system.

Retention value is comprised of two parts. These are the Amenity Value of the tree rated as Very Low to Very High and the Useful Life Expectancy (ULE) of the tree.

The Amenity Value of the tree relates to the contribution of the tree to the aesthetic amenity of the area. The primary determinants of amenity value are tree health, size, and form.

The Amenity Value is then modified by the ULE of the tree with short ULE values reducing the RV of the tree and long ULE values increasing the RV of the tree.

Trees that are listed on a register of heritage or significant trees are not accommodated within the rating system as these values are often independent from the Arboricultural attributes of the tree. Heritage and significant trees may be ascribed a very low retention value despite their listing on any register. Where known, any heritage or significant register listing will be noted within the report.

RV is assessed on each tree as a single entity. The value of a group of trees is not considered in this context and each tree within the group will be assessed as an individual.

1.2.1 Amenity Value

Category	Example	Amenity Value Value (AVV)
Very High	Generally, a very large tree that exhibits excellent health and/or for or a tree that is listed on a heritage or significance register	10
High	A large tree that exhibits good health and/or form	8
Medium	A medium tree that exhibits good health and/or form. May be a large tree that exhibits fair health and/or form.	6
Low	A small tree that exhibits good health and/or form. May be a large or medium tree that exhibits fair or poor health and/or form	4
Very Low	A small tree that exhibits poor health and/or form. May be a large or medium tree that exhibits poor, or worse, health and/or form	2

1.2.2 Useful Life Expectancy

Category	Description	ULE Modifier (ULEM)
0 year	The tree is dead or mostly dead or constitutes an immediate and unacceptable hazard	0
0-5 years	The tree is unlikely to provide useful amenity for longer than 5 years. The tree is in advanced decline, poses an unacceptable hazard and/or requires a level of maintenance disproportionate with its' value.	4
5-15 years	The tree is unlikely to provide useful amenity for longer than 15years. The tree may be in serious decline, be a very short-lived species, present a moderately elevated hazard and/or require high levels of maintenance.	7
15-25 years	The tree is unlikely to provide useful amenity for longer than 25 years. The tree may be in moderate decline, a short-lived species, present a slightly elevated hazard and/or requires a moderate level of maintenance.	10
25-50 years	The tree is unlikely to provide useful amenity for longer than 50 years. The tree may be in a fair to good condition, have a moderate lifespan, present a low to moderate level of hazard and/or require moderate levels of maintenance.	11
>50 years	The tree is unlikely to provide useful amenity for greater than 50 years. The tree may be in good to excellent condition, a long-lived species, presents a low level of hazard and/or require a low level of maintenance.	12

*RV is derived from the multiplication of AVV by ULEM and the resulting score is categorised as Very high to Very Low

1.2.3 Retention Value Score

Category	Example	RV Value
Very High	Every effort should be made to preserve trees in this category	96-120
High	These trees should be retained is at all possible	72-95
Moderate	These trees should be retained if they do not overly constrain the development on the site	48-71
Low	These trees should create a material constraint on the development of the site. These trees should be removed where they conflict with the development of the site	24-47
Very Low	A small tree the exhibits poor health and/or form. May be a large or medium tree that exhibits poor, or worse, health and/or form. This tree should generally be removed	1-23
Remove	These trees are not suitable for retention within the site and are recommended for removal	0

1.3 Definitions

1.3.1 Diameter at Breast Height (DBH)

The Diameter at Breast Height (DBH) is the diameter of a tree trunk/s measured at 1.4m from ground level as described within AS4970 – Protection of trees on development sites.

1.3.2 Tree Protection Zone (TPZ)

A specified area above and below ground and at a given distance from the trunk set aside for the protection of a tree’s roots and crown to provide for the viability and stability of a tree to be retained where it is potentially subject to damage by development (AS4970-2009, 2009). The TPZ is calculated by:

$$\text{TPZ radius} = 12 \times \text{DBH, minimum of 2.0m and maximum of 15m}$$

The TPZ is nominally circular with the trunk at its centre and is expressed by its radius in metres.

1.3.3 Structural Root Zone (SRZ)

The area around the base of a tree required for the tree’s stability in the ground. The woody root growth and soil cohesion in this area is necessary to hold the tree upright. The SRZ is nominally circular with the trunk at its centre and is expressed by its radius in metres.

This zone considers a tree’s structural stability only, not the root zone required for a tree’s vigour and long-term viability, which will usually be a much larger area (AS4970-2009, 2009).

The SRZ is calculated using the following mathematical equation.

$$\text{SRZ radius} = (D \times 50)^{0.43} \times 0.64, \text{ minimum of 1.5m}$$

Diameter (D) = trunk diameter, in meters, measured above the root buttress.

1.3.4 Tree Root System

The root system is the below ground component of a tree, Harris. P, 2004 describes the primary roles of a root system is to provide the tree.

- Anchorage
- Absorption of water and mineral nutrients
- Storage of food reserves
- Synthesis of certain organic materials, including those that may regulate activities in the top of the plant/tree.

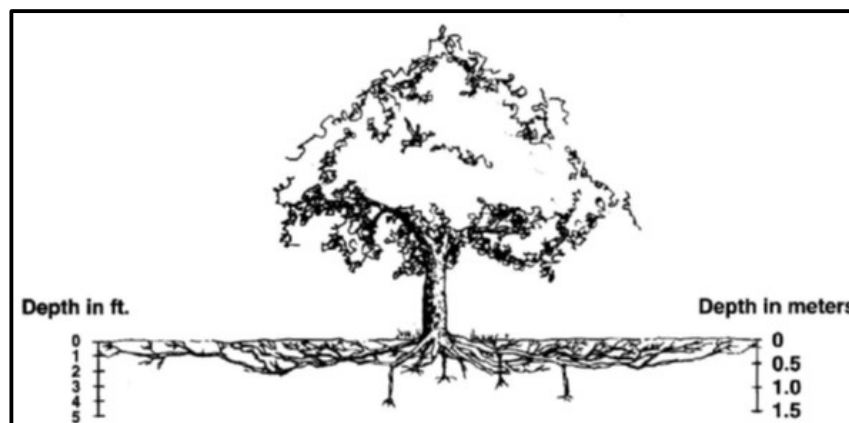
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1.4 Tree Protection Zone Management

1.4.1 Tree Root Systems

It is important to understand the extent of root development of an average tree growing in optimum growing conditions, to be able to establish the requirements of the individual tree during the construction activity. As with all things growing in nature there are exceptions to the rule however as a generalisation most of the growth is contained within the top 600mm of soil with most of their absorbing roots being in the upper 150mm of soil (Harris 2004).

A common misconception is that root systems only grow to the extent of the trees dripline; Zimmermann and Brown, 1971; Perry, 1982 state; roots of trees in the open often extend two to three times the radius of the crown, therefore consideration for the extent of a root system and the potential impact caused by excavation be given well outside the trees dripline.



Theoretical model of a typical root system (Harris, Clark and Matheny, 2004)

Although the above diagram depicts a root system as being symmetrically dispersed from the trunk, this is not always the case. Tree root direction and symmetry is determined by the growing environment that they find themselves in. Roots will grow towards optimum growing conditions, where there is adequate water, nutrient, and oxygen levels. Therefore, root systems will grow to an obstruction e.g. wall, then change directions to find better growing conditions. This may inadvertently cause the root system of a tree to be confined to one side of the tree; this is more evident within an urban environment where more underground obstacles are present. When assessing trees suitability for retention, consideration is required for the presence of underground obstacles and the available growing space of a tree's root system.

1.4.2 Tree Protection Zones

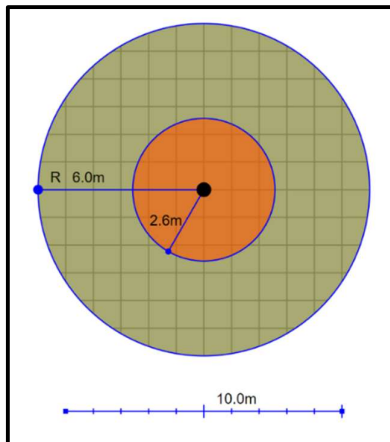
Prior to commencing any work on site, it important to protect the existing trees from mechanical damage, soil compaction and the introduction of contaminates to the site, this can be achieved by setting up a Tree Protection Zone (TPZ) parameter around the trees.

The Tree Protection Zone (TPZ) has been developed as an industry standard used to determine an area around a tree which is to be protected to ensure the ongoing health of the tree. Trees have a varying ability to tolerate soil and root disturbance; in general, a younger actively growing tree will be better able to withstand some damage to root zones than a slower growing older tree or one that is already under some stress (Trowbridge J. and Bassuk N, 2004). The Australian Standard (AS4970-2009 - Protection of trees on development sites) has developed a methodology for calculating the TPZ which has an allowance for most trees in most environments.

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1.4.3 Tree Protection Zone (TPZ)

A specified area above and below ground and at a given distance from the trunk set aside for the protection of a tree's roots and crown to provide for the viability and stability of a tree to be retained where it is potentially subject to damage by development (AS4970-2009, 2009). The TPZ is calculated at $12 \times \text{DBH}$, where DBH is trunk diameter measured at 1.4m above the ground. The TPZ is the radius measured from the centre of the tree. For example:



TPZ - is the radius measured from the centre of the tree.

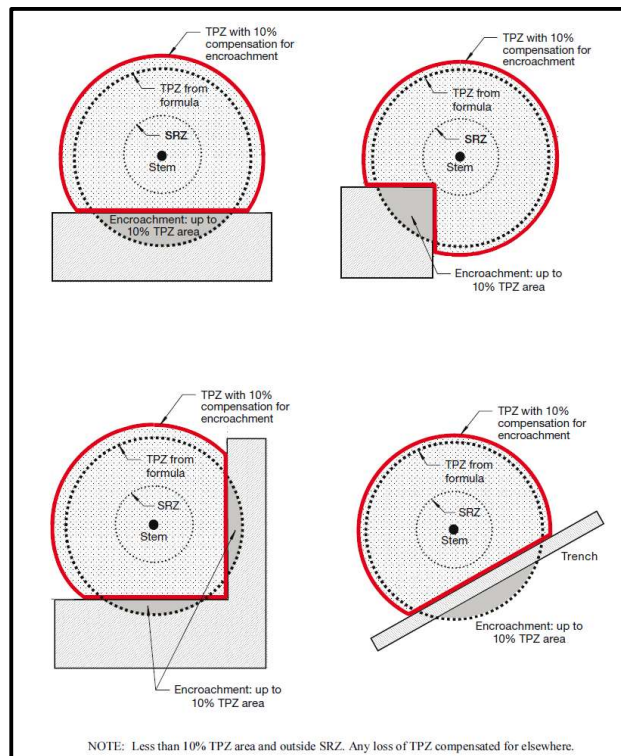
Developing a TPZ will require the installation of a physical barrier around the subject tree(s); this can be achieved by the installation of a temporary fence located at the parameter of the calculated TPZ. The installation of TPZ fencing is to prevent potential mechanical damage to the upper canopy, trunk region or root system of the tree; the TPZ is also an area which is designated to prevent certain activities from being undertaken (Refer to Activities restricted within the TPZ).

In some circumstances the installation of temporary fencing may not be appropriate due to either the physical area available e.g. narrow nature-strips or the works to be undertaken are within the designated TPZ. In these circumstances it is important to ensure this work is monitored to ensure the impact to the tree is minimised. All monitoring is to be undertaken by a qualified Arborist, the primary role of the Arborist is to monitor the construction, troubleshoot onsite problems relating to tree health and ensure activities restricted within the TPZ are avoided.

1.4.4 Allowable Encroachment into the TPZ

Although not ideal some tolerable encroachment has been allowed for within the TPZ, this is calculated at 10% of the TPZ, however the total amount lost in area needs to be compensated by increasing the remaining TPZ by the total amount lost by the encroachment. The following diagram extracted from AS4970 Protection of trees on development sites further explains the allowable encroachment within the TPZ.

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Allowable encroachments within the TPZ

1.4.5 Ground Protection

Consideration should be given to tree sensitive measures such as ground protection in areas close to or encroaching into the TPZ. Additional tree protection measures when considering encroachment of TPZ is the installation of permanent tree guards to reduce physical damage to the tree structure. Elevating the tree canopy may also be necessary when considering encroachment of the TPZ.

Due to the limited space, available on this site and trees to be retained, encroachment into the TPZ will be required and must be carefully planned and supervised. There should be minimal or no disturbance to existing soil grade under the tree canopy.

The proposed vehicle access should be limited to travel in and out, no parking of vehicles on this site. For all vehicle access **only traverse on defined surface that consists of Geo-textile fabric and large rock or rumble boards**. This is necessary to limit ground compaction. **The remaining are within the TPZ must be mulched.**

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1.4.6 Activities Restricted Within the TPZ

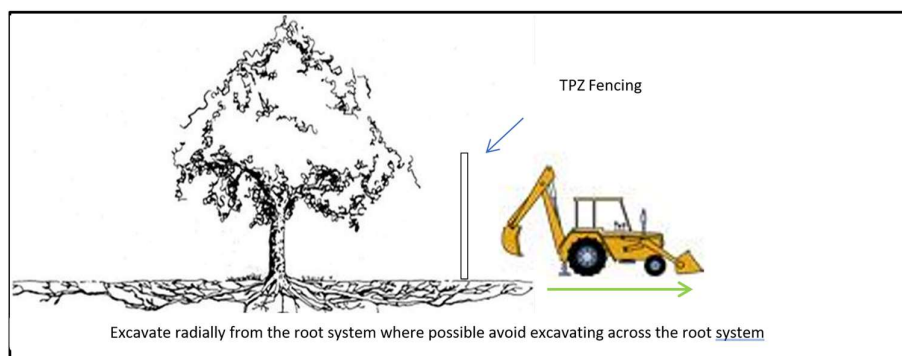
AS4970-2009 Protection of Trees on Development Sites, Section 4 Tree Protection Measures outlines that the following activities are to be avoided within the TPZ:

- Machine excavation including trenching.
- Excavation for silt fencing
- Cultivation
- Storage
- Preparation of chemicals, including preparation of cement products
- Parking or movement of vehicles and plant
- Refuelling
- Dumping of waste
- Wash down and clearing of equipment.
- Placement of fill
- Lighting of fires
- Soil level changes
- Temporary or permanent installation of utilities and signs
- Physical damage to the tree

1.4.7 Tree Root Management

Levelling, filling, and cutting of soil grades will result in the same types of damage associated with excavating, trenching and soil compaction. Ninety percent of the fine roots that absorb water and minerals are in the upper 150-300mm of soil. This area is the most conducive to root growth as it usually has available space, oxygen, nutrients, and water. Altering the soil level during trenching may either strip away the fine absorbing roots from the soil surface or remove the nutrient-rich topsoil that supplies the basic elements trees require for growth.

Raising or filling grades around trees reduces oxygen diffusion, and exchange, in the rhizosphere. As little as 100mm of soil placed over the established root systems of some species is enough to cause their death. Grade changes to the soil outside of the tree may also affect water drainage, causing root dieback due to changes in soil moisture content in the situation where roots have been identified and require extraction, it is important that this be undertaken under the direct supervision of a qualified Arborist. The use of earth moving equipment has the potential to cause significant damage not only to the exposed root needing removal but also to major anchorage roots within the SRZ; this is due to the roots being removed, split, and compresses vascular tissue away from the target site. Where roots should be removed radially from the root zone rather than directly across the root system, this will reduce secondary damage to structural roots - refer to figure below.



Preferred excavation method

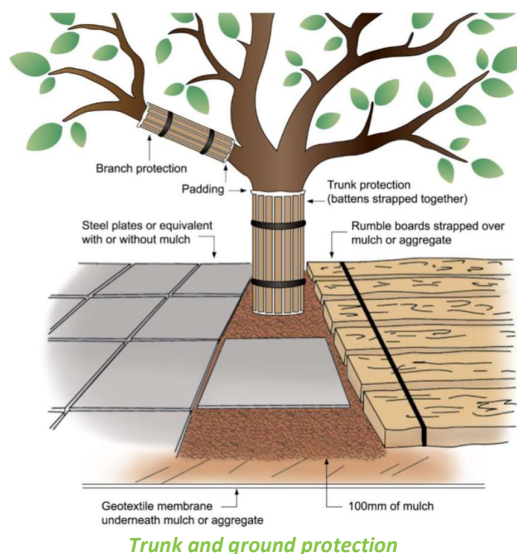
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1.4.8 Trunk and Ground Protection

Given that proposed works are often within the TPZs of retained trees, standard protective fencing may not always be a viable method of protection. In these areas trunk protection and ground protection should be installed prior to the commencement of works and remain in place after construction works have completed.

Where construction access into the TPZ of retained trees cannot be avoided, the root zone of each tree must be protected using either teel plates or rumble boards strapped over mulch/aggregate until such a time as permanent above ground surfacing (cellular confinement system or similar) is installed as shown in Figure 15.

Trunk and ground protection should be undertaken in accordance with the Australian Standard AS 4790-2009: Protection of Trees on Development Sites as per the image below.

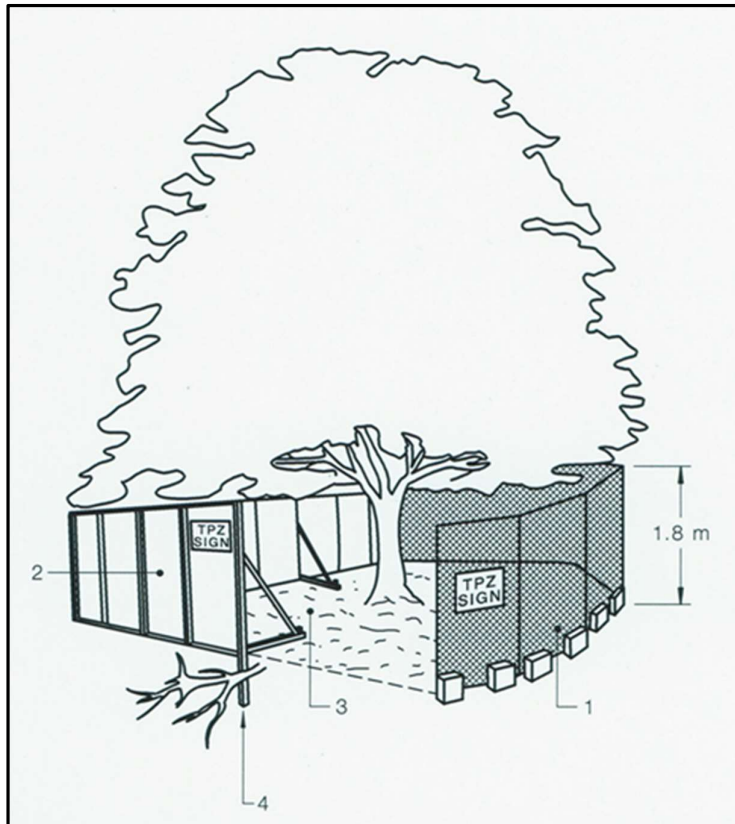


1.4.9 Tree Protection Fencing

The type of fencing employed to isolate the TPZ is less important than the desired outcome from the fencing. The indicator for successful tree protection fencing will be its ability to deter the entry of heavy equipment and vehicles, and the entry of workers and/or the public into the TPZ.

Where minimum requirements for the fencing are desirable, it should be a minimum of 1.2 - 1.5 metres in height, of chain mesh or like fence with 1.8 metre posts (e.g. treated pine) or like support every 3-4 metres and a top line of high visibility plastic hazard tape. The posts should be strong enough to sustain knocks from on-site excavation equipment. On large projects, with large numbers of trees, para-webbing may be used. However, the maintenance of this type of fencing must be enforced regularly. Para-webbing could also be used to isolate groups of trees at the fringe of the work zone to indicate that access is not permitted.

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Tree Protection Zone Fencing

Direct extract from AS4970-2009

Legend

1. Chain wire mesh panels with shade cloth (if required) properly secured to the ground.
2. Alternative plywood or wooden paling fence panels.
3. Mulch installation across surface of TPZ, no excavation, construction activity, grade change, or storage of materials of any kind are permitted within the TPZ
4. Bracing is permissible within the TPZ. Installation of supports should avoid damaging significant roots.

The tree protection fences should only be removed or shifted by the consent of the site manager in conjunction with the site arborist. In situations where the recommended TPZ encroaches on to a road, path, private property or building, the fencing should extend the maximum distance that is reasonable and practical.

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An additional recommendation would be to attach signs to the fencing indicating their purpose and the restrictions applying to the TPZ. Contact details could also be attached to assist persons/contractors seeking information on the TPZ - refer to figure 6.

Example of sign:



Tree Protection signage

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