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Arboricultural Impact Assessment

Barings Bankstown
83-99 North Terrace,
Bankstown,
NSW 2200

Prepared for:

Altis Bulky Rental Pty Ltd

Prepared by:

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1 EXECUTIVE SUMMARY

Truth About Trees Pty. Ltd. have been engaged by Altis Bulky Rental Pty Ltd, to prepare an Arboricultural Impact Assessment (AIA) report in accordance with the requirements of AS4970-2009: The Protection of Trees on Development Sites (Standards Australia, 2009) and all relevant planning guidelines and legislation.

The purpose of this assessment is to provide an AIA report in relation to a proposed development at 83-99 North Terrace Bankstown located within the Canterbury-Bankstown City Council (CBCC) catchment area.

The proposal seeks to develop the existing structures and surfaces and construct a multi-storey commercial and residential tower development inclusive of underground parking.

The scope of the report was to inspect and assess all trees within the property boundary and all trees within the neighbouring properties where directly adjacent to the proposed development.

Assessment of the trees was undertaken on 26th February 2024 by Tom Hare using the framework of the *Visual Tree Assessment procedure* (VTA) as prescribed by Mattheck & Breloer (Claus Mattheck, 1994).

Trees within the survey area were geo-located and data collected using a TRIMBLE TDC600 data collector, with an external DA2 aerial capable of 30cm accuracy when used in optimal conditions.

Details provided for the trees are as follows:

a) Correct botanical identification and common name
b) Health assessment & rating
c) Basic structural assessment & rating
d) Dimensions: height, crown spread, DBH & DAB
e) TPZ & SRZ calculations
f) Age class
g) Landscape significance assessment & rating
h) Estimated life expectancy
i) Retention value in accordance with the STARS system

Tree Protection Zones (TPZ) and Structural Root Zones (SRZ) were calculated in accordance with Australian Standard *AS4970-2009: Protection of Trees on Development Sites* (AS4970).

Tree Retention Values were determined using the Institute of Australian Consulting Arborists (IACA) *'Significance of a Tree, Assessment Rating System'* (STARS) (IACA©, 2010).

A detailed Arboricultural assessment methodology can be found in Appendix 1 of this report.

The site subject to assessment for the purposes of this report is made up of multiple lots as shown in figure 2, and is located at 83-99 North Terrace Bankstown NSW 2200, and will be further referenced as 'the site'.

The site is zoned as B4- Mixed Use and currently contains commercial properties and residential dwellings.

- Twenty-two (22) trees within the subject site will require removal to enable the development to proceed in its current form- 7,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39.
- Four (4) council trees will require removal to enable the development to proceed in its current form- 1,8,17,18.
- Thirteen (13) trees can be retained under the current design- 2,3,4,5,6,9,10,11,12,13,14,15,16.

2 CONTENTS

3 INTRODUCTION & AIM

Truth About Trees Pty. Ltd. have been engaged by Altis Bulky Rental Pty Ltd, to prepare an Arboricultural Impact Assessment (AIA) report in accordance with the requirements of AS4970-2009: The Protection of Trees on Development Sites (Standards Australia, 2009) and all relevant planning guidelines and legislation.

The purpose of this assessment is to provide an AIA report in relation to a proposed development at 83-99 North Terrace Bankstown located within the Canterbury-Bankstown City Council (CBCC) catchment area.

The proposal seeks to develop the existing structures and surfaces and construct a multi-storey commercial and residential tower development inclusive of underground parking.

The scope of the report was to inspect and assess all trees within the property boundary and all trees within the neighbouring properties where directly adjacent to the proposed development.

Only trees that had the potential to be impacted upon by the proposed development were captured, provided they satisfied the definition criteria of a 'tree' in accordance with Councils Development Control Plan (DCP).

Figure 1 - Showing the approximate site boundary overlay on aerial imagery - Image MetroMap 2024.

At the request of the client, this report was produced to provide an AIA assessment of the trees related to the development only, this report does not satisfy the requirements of a detailed Arboricultural risk assessment.

4 METHODOLOGY

Assessment of the trees was undertaken on 26th February 2024 by Tom Hare using the framework of the *Visual Tree Assessment procedure* (VTA) as prescribed by Mattheck & Breloer (Claus Mattheck, 1994).

Trees within the survey area were geo-located and data collected using a TRIMBLE TDC600 data collector, with an external DA2 aerial capable of 30cm accuracy when used in optimal conditions.

Details provided for the trees are as follows:

j) Correct botanical identification and common name
k) Health assessment & rating
l) Basic structural assessment & rating
m) Dimensions: height, crown spread, DBH & DAB
n) TPZ & SRZ calculations
o) Age class
p) Landscape significance assessment & rating
q) Estimated life expectancy
r) Retention value in accordance with the STARS system

Tree Protection Zones (TPZ) and Structural Root Zones (SRZ) were calculated in accordance with Australian Standard *AS4970-2009: Protection of Trees on Development Sites* (AS4970).

Tree Retention Values were determined using the Institute of Australian Consulting Arborists (IACA) *'Significance of a Tree, Assessment Rating System'* (STARS) (IACA©, 2010).

A detailed Arboricultural assessment methodology can be found in Appendix 1 of this report.

4.1 LIMITATIONS OF THE REPORT:

- No internal diagnostic testing has been completed.
- No sub surface root testing or soil analysis has been completed.
- All observations were made from ground-level only and where access was reasonably available.
- Tree height, canopy spreads and trunk diameters have been estimated.
- This report has been compiled based only on the information provided by the client as detailed in Table 1 below, and from observations made at the time of the site inspection(s) only.
- Only trees located within or directly adjacent to the subject site(s) boundaries that had the potential to be impacted were captured, provided they satisfied the definition criteria of a 'tree' in accordance with Councils Development Control Plan (DCP).
- Assessment of tree health and condition has been included to guide assessment of tree retention aspects only and is based on a basic visual assessment using elements of the VTA method. Tree structure and defects may be discussed briefly within this report; however, this report is not designed to be, nor does it satisfy the requirements of a detailed Arboricultural Risk Assessment report.
- This report does not in any part count as consent for the development, tree pruning, or tree removal works. Any information, conclusions or recommendations within this report must only be acted upon following approval from the consent authority.

4.2 DOCUMENT SCHEDULE

The documents listed below have been provided to Truth About Trees by the client and have been relied upon to complete the assessment.

Document	Prepared by	Date
240130_Barings_Arch Plans (B03-Roof + Sections_ Bound Set	PTW Architects	30/01/24
136-23G T01(5)- Detail & Level Survey	Craig & Rhodes	22/06/23

Table 1 – Document Register

5 Site Details

The site subject to assessment for the purposes of this report is made up of multiple lots as shown in figure 2 below, and is located at 83-99 North Terrace Bankstown NSW 2200, and will be further referenced as 'the site'.

The site is zoned as B4- Mixed Use and currently contains commercial properties and residential dwellings.

The site is not mapped on the NSW Department of Planning & Environment Biodiversity Values Map, as an area of Biodiversity value.

The site is not located within Bushfire Prone Lands and the site is not subject to a bushfire hazard assessment or controls.

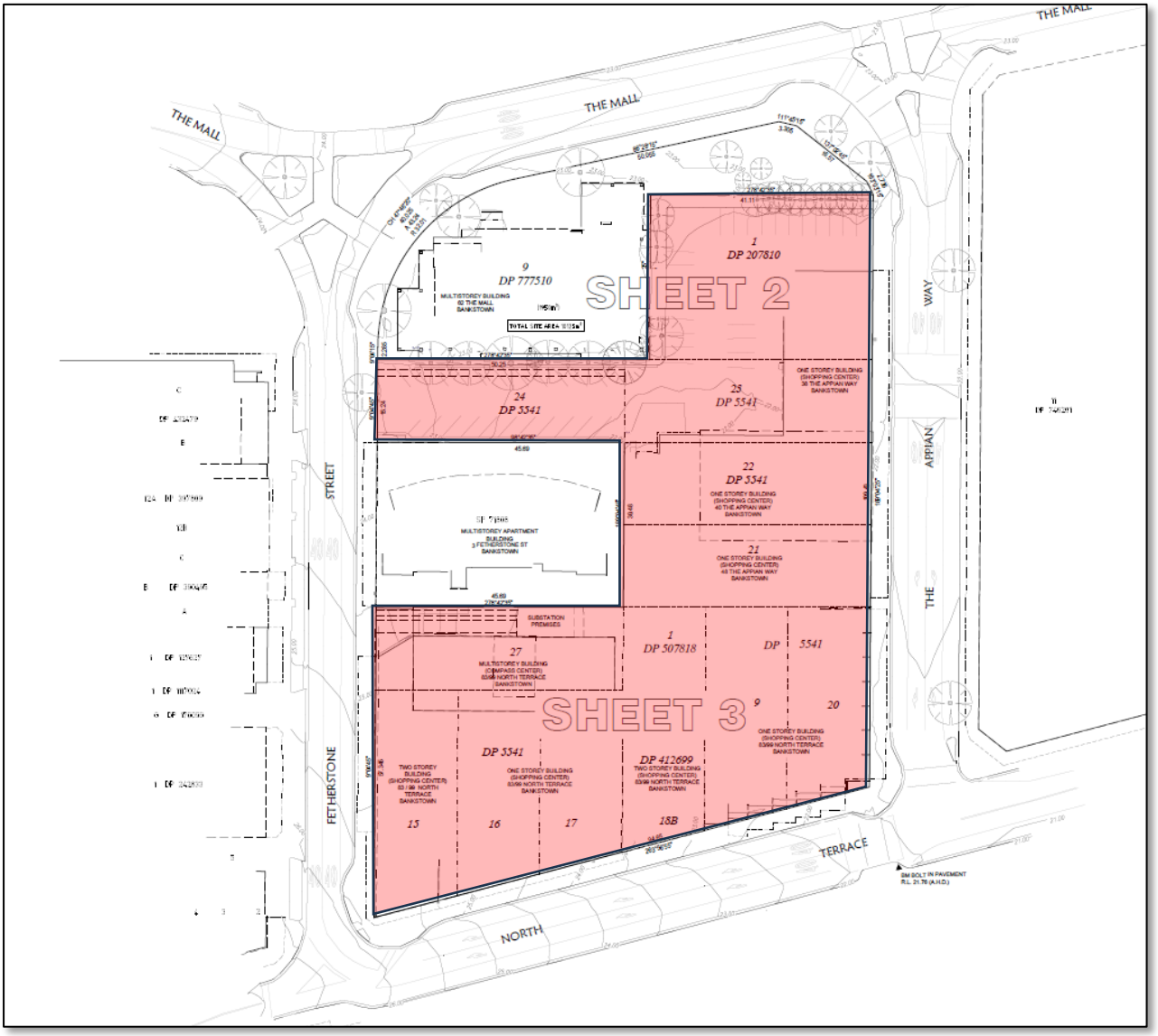

Figure 2 – Showing the subject site proposed for development highlighted in red.

6 THE PROPOSAL

Figure 3 - Showing the Basement 02 Plan -Please refer to Architectural Plans for greater clarity.

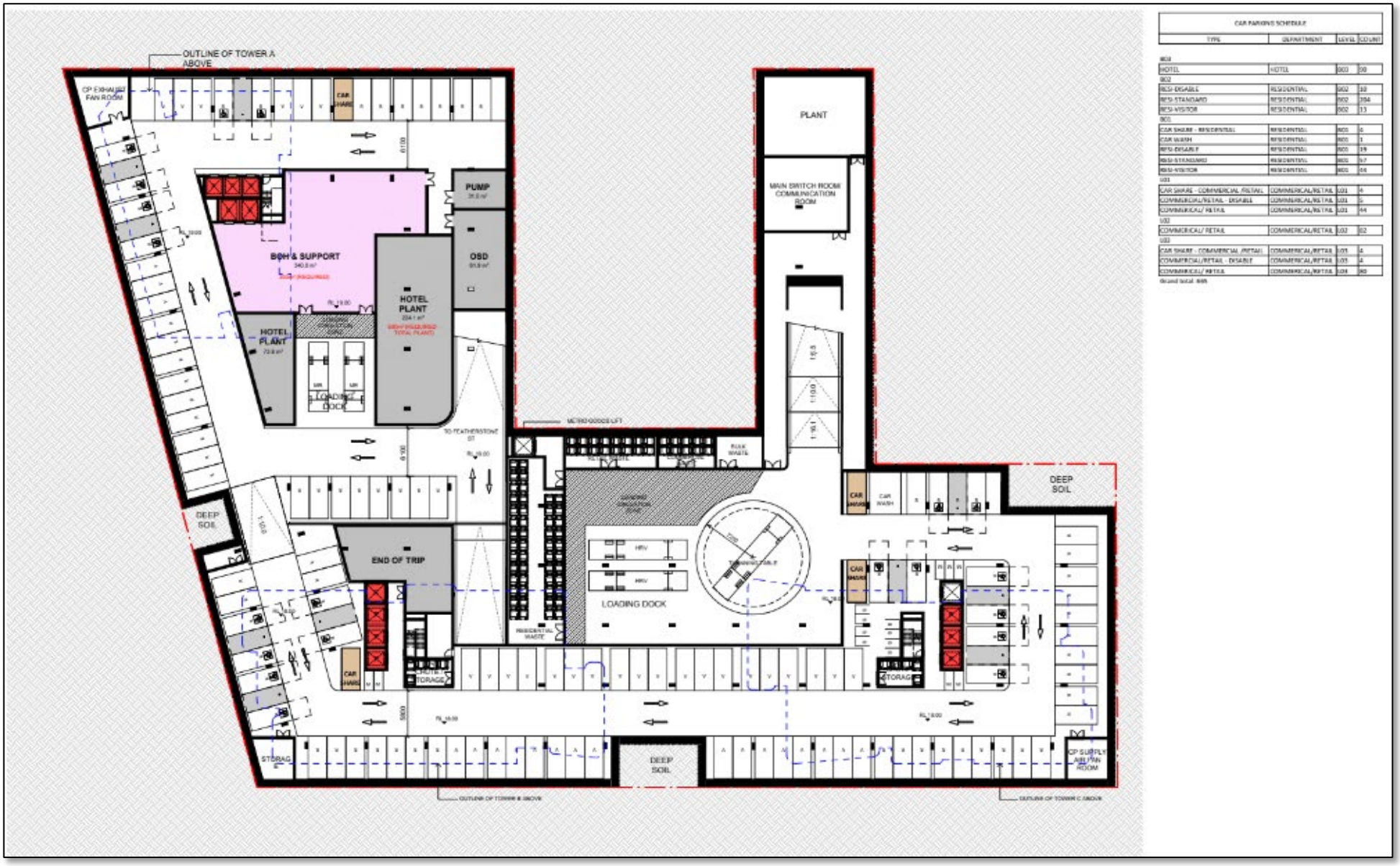

Figure 4-Proposed Basement 01 Plan- Please refer to Architectural Plans for greater clarity.

Figure 5-Proposed ground floor plan- Please refer to Architectural Plans for greater clarity.

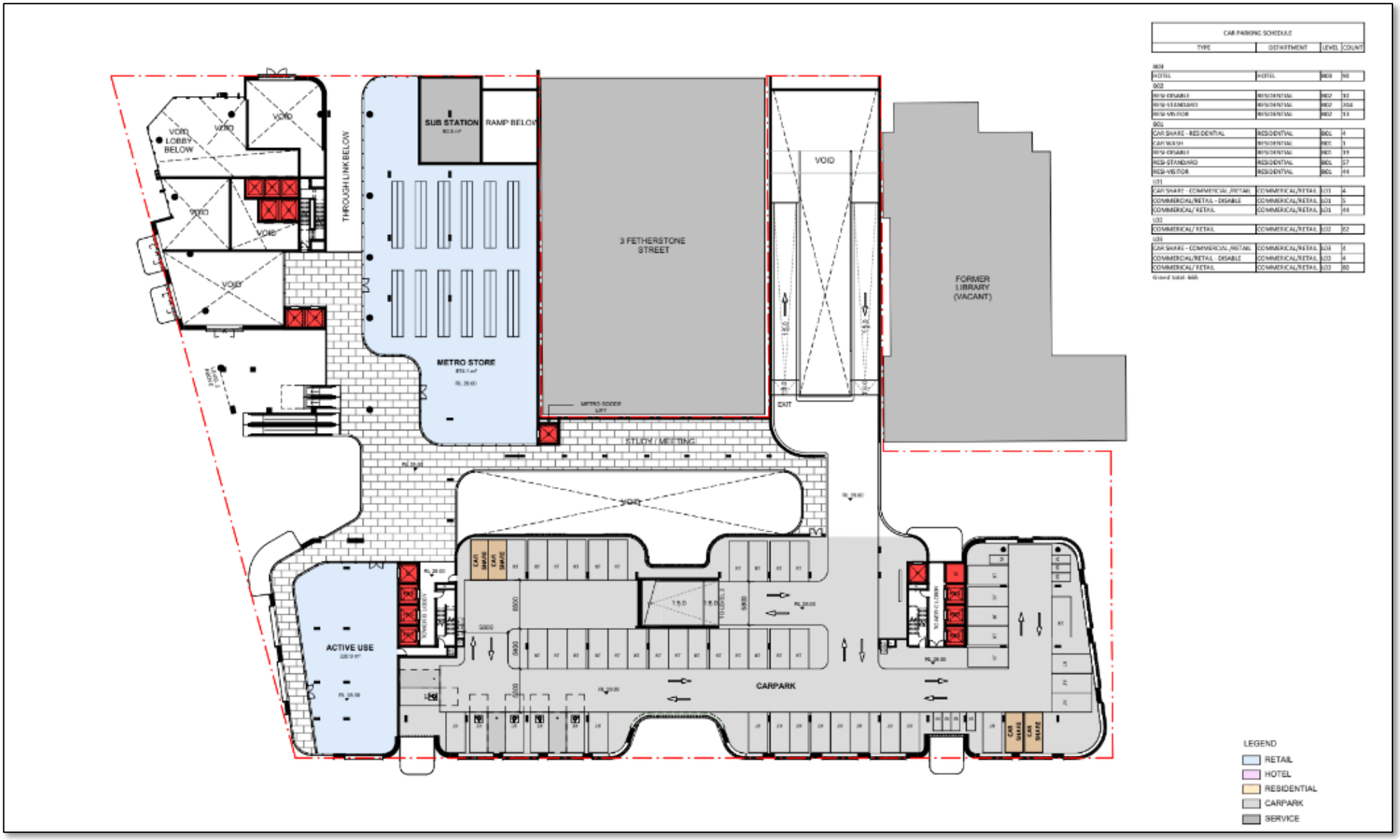

Figure 6-Proposed Level 01 Plan- Please refer to Architectural Plans for greater clarity.

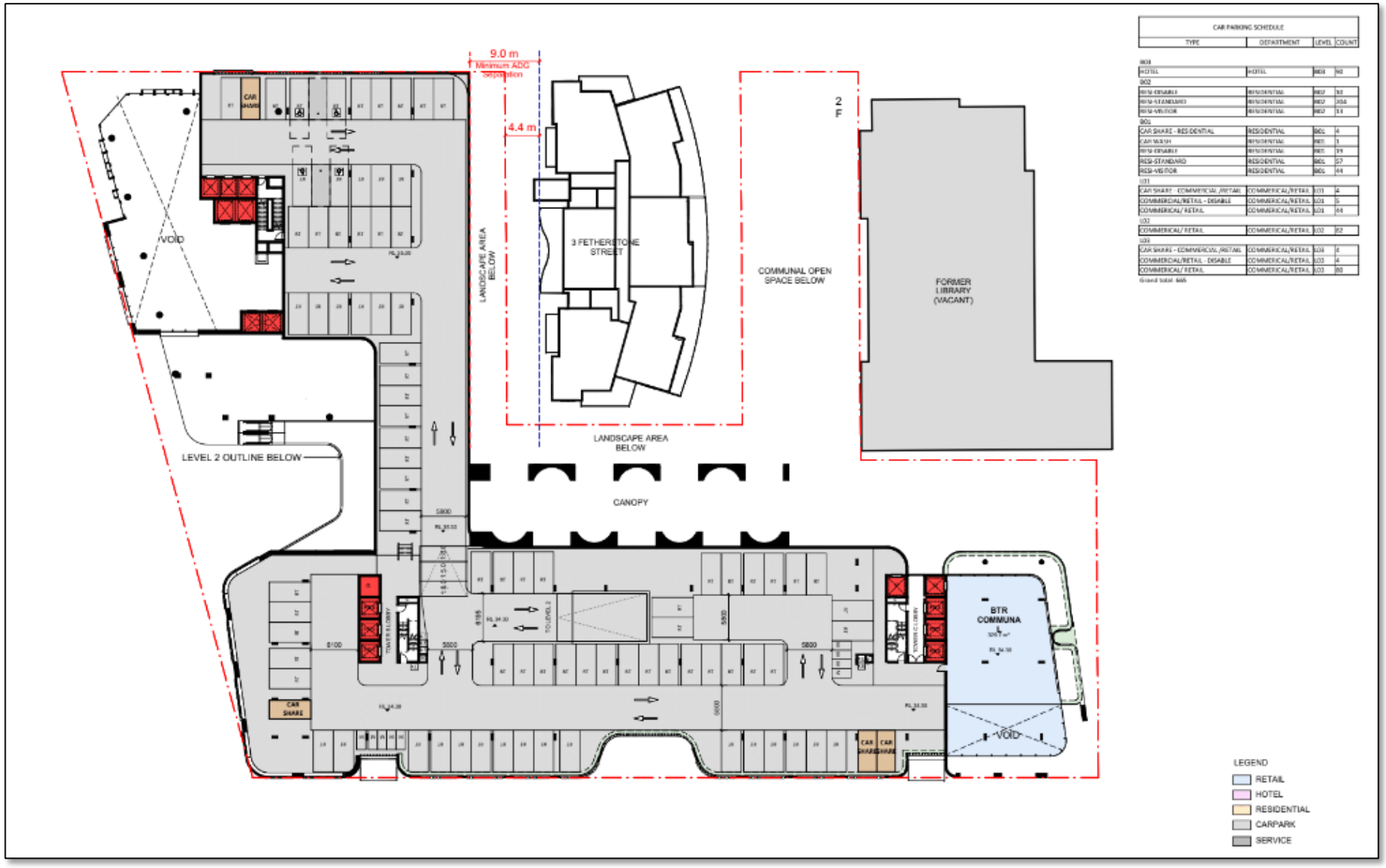

Figure 7- Proposed Level 03 Plan- Please refer to Architectural Plans for greater clarity.

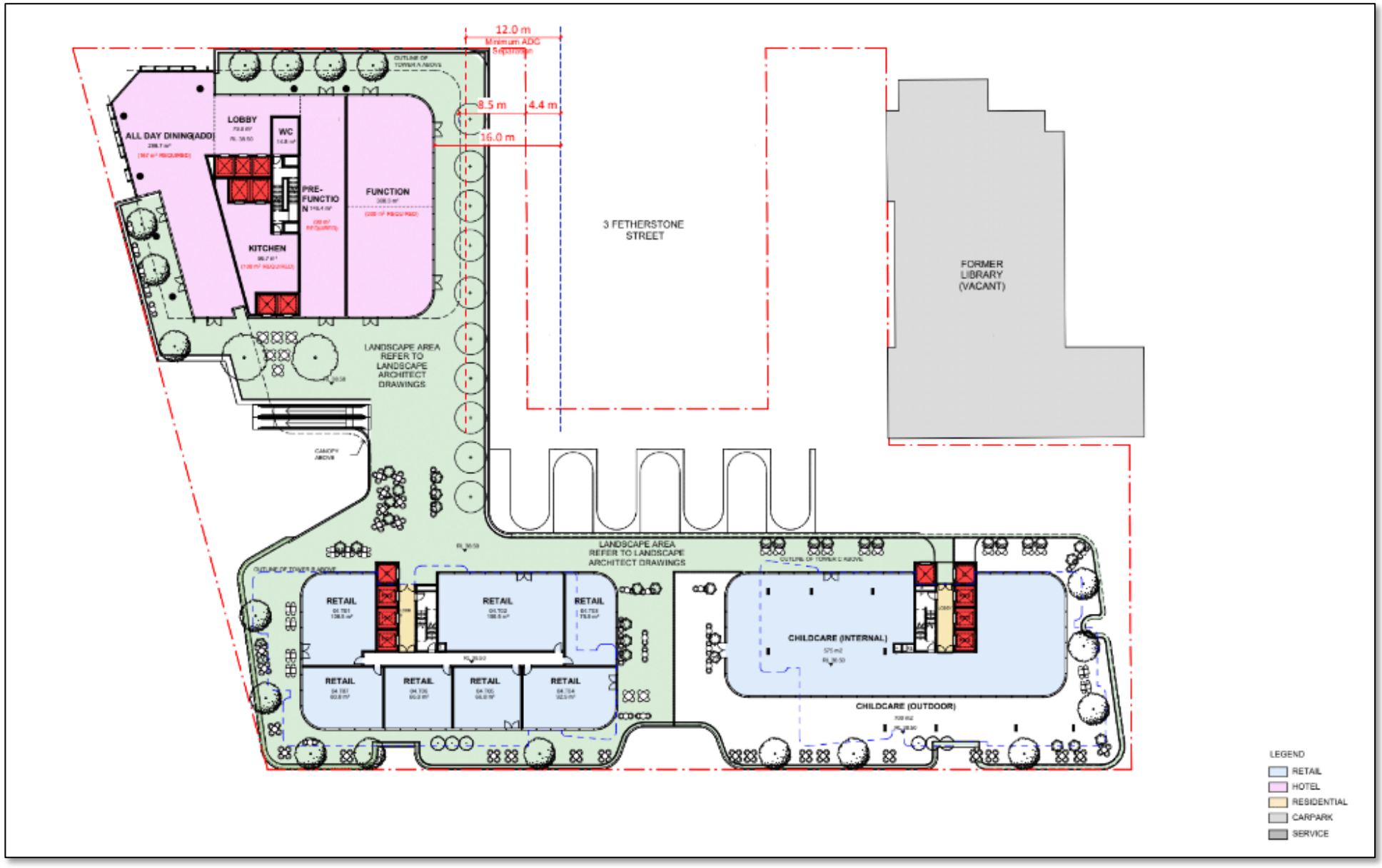

Figure 8- Proposed Level 04 Plan- Please refer to Architectural Plans for greater clarity.

7 TREE SCHEDULE

Tree No	Species	Height	Spread	DBH mm	DAB mm	TPZ (mm)	SRZ (mm)	Health	Structure	Tree Defects	Landscape Significance	ELE	Retention Value
1	Lophostemon confertus | Queensland Box	8	10	380	640	4560	2744	Fair	Fair		Medium	Medium	Medium
2	Angophora costata | Smooth-barked Apple Myrtle	20	15	445	630	5340	2726	Fair	Fair		Medium	Medium	Medium
3	Angophora costata | Smooth-barked Apple Myrtle	17	11	460	540	5520	2555	Fair	Fair		Medium	Medium	Medium
4	Lophostemon confertus | Queensland Box	16	9	355	435	4260	2333	Good	Fair		Medium	Medium	Medium
5	Angophora costata | Smooth-barked Apple Myrtle	14	10	360	425	4320	2310	Good	Fair		Medium	Medium	Medium
6	Platanus X acerifolia | London Plane	13	18	470	565	5640	2604	Good	Good		Medium	Medium	Medium
7	Callistemon citrinus | Crimson Bottlebrush	4	6	240	300	2880	1996	Poor	Poor		Low	Short	Low
8	Callistemon citrinus | Crimson Bottlebrush	5	5	125	265	2000	1895	Good	Poor		Low	Short	Low
9	Callistemon citrinus | Crimson Bottlebrush	5	5	155	285	2000	1953	Fair	Poor		Low	Short	Low
10	Callistemon citrinus | Crimson Bottlebrush	4	3	65	85	2000	1500	Poor	Poor		Low	Short	Low
11	Callistemon citrinus | Crimson Bottlebrush	4	3	70	85	2000	1500	Poor	Poor		Low	Short	Low
12	Callistemon citrinus | Crimson Bottlebrush	4	3	65	100	2000	1500	Poor	Poor		Low	Short	Low
13	Callistemon citrinus | Crimson Bottlebrush	5	4	100	180	2000	1611	Poor	Poor		Low	Short	Low
14	Callistemon citrinus | Crimson Bottlebrush	6	5	200	270	2400	1910	Good	Fair		Low	Short	Low
15	Lophostemon confertus | Queensland Box	14	10	430	485	5160	2442	Good	Fair		Medium	Medium	Medium
16	Lophostemon confertus | Queensland Box	12	12	440	555	5280	2584	Fair	Fair		Medium	Medium	Medium
17	Melaleuca bracteata | Black Tea Tree	7	8	240	265	2880	1895	Good	Fair		Low	Medium	Low
18	Melaleuca bracteata | Black Tea Tree	8	8	265	335	3180	2091	Good	Fair		Low	Medium	Low
19	Cupressus torulosa | Bhutan Cypress	15	7	460	555	5520	2584	Good	Fair		Medium	Medium	Medium
20	Cupressus torulosa | Bhutan Cypress	15	7	460	555	5520	2584	Good	Fair		Medium	Medium	Medium
21	Cupressus torulosa | Bhutan Cypress	15	7	460	555	5520	2584	Good	Fair		Medium	Medium	Medium
22	Cupressus torulosa | Bhutan Cypress	15	7	460	555	5520	2584	Good	Fair		Medium	Medium	Medium
23	Cupressus torulosa | Bhutan Cypress	15	7	460	555	5520	2584	Good	Fair		Medium	Medium	Medium
24	Cupressus torulosa | Bhutan Cypress	13	6	385	435	4620	2333	Good	Fair		Medium	Medium	Medium
25	Cupressus torulosa | Bhutan Cypress	15	6	385	435	4620	2333	Good	Fair		Medium	Medium	Medium

Tree No	Species	Height	Spread	DBH mm	DAB mm	TPZ (mm)	SRZ (mm)	Health	Structure	Tree Defects	Landscape Significance	ELE	Retention Value
26	Cupressus torulosa | Bhutan Cypress	14	6	365	400	4380	2252	Good	Fair		Medium	Medium	Medium
27	Cupressus torulosa | Bhutan Cypress	17	7	465	535	5580	2545	Good	Fair		Medium	Medium	Medium
28	Cupressus torulosa | Bhutan Cypress	17	7	445	465	5340	2399	Good	Fair		Medium	Medium	Medium
29	Callistemon viminalis | Weeping Bottlebrush	9	9	310	355	3720	2142	Good	Fair		Low	Medium	Low
30	Callistemon viminalis | Weeping Bottlebrush	9	9	355	400	4260	2252	Good	Fair		Low	Medium	Low
31	Angophora costata | Smooth-barked Apple Myrtle	10	5	185	245	2220	1833	Good	Poor	Decay| Poor tree form| Mechanical damage| Previous failures	Low	Short	Low
32	Angophora costata | Smooth-barked Apple Myrtle	11	14	425	580	5100	2633	Fair	Poor	Cavity(s)|Decay| Poor tree form| Wound(s)|Mechanical damage	Medium	Short	Low
33	Melaleuca quinquenervia | Broad-leaved Paperbark	17	11	585	685	7020	2823	Fair	Fair	Dieback-general| Included bark| Poor tree form| Damaging infrastructure	Medium	Short	Low
34	Melaleuca quinquenervia | Broad-leaved Paperbark	16	11	565	625	6780	2717	Fair	Fair		Medium	Medium	Medium
35	Melaleuca quinquenervia | Broad-leaved Paperbark	15	7	405	490	4860	2453	Fair	Fair		Medium	Medium	Medium
36	Hymenosporum flavum | Native Frangipani	18	6	260	295	3120	1982	Good	Good		Medium	Medium	Medium
37	Melaleuca quinquenervia | Broad-leaved Paperbark	16	14	600	655	7200	2771	Fair	Poor	Included bark| Poor tree form| Damaging infrastructure	Medium	Short	Low
38	Melaleuca quinquenervia | Broad-leaved Paperbark	15	8	365	515	4380	2504	Fair	Fair	Wound(s)|Mechanical damage	Medium	Medium	Medium
39	Melaleuca quinquenervia | Broad-leaved Paperbark	18	18	780	1050	9360	3378	Good	Fair	Included bark| Damaging infrastructure	Medium	Medium	Medium

Table 2-Tree Schedule

7.1 TREE RETENTION VALUES

Retention Value	Tree number(s)	Total
High	N/A	**0**
Medium	1,2,3,4,5,6,15,16,19,20,21,22,23,24,25,26,27,28,34,35,36,38,39.	**23**
Low	7,8,9,10,11,12,13,14,17,18,29,30,31,32,33,37.	**16**
Very low	N/A	**0**

Table 3 - Showing tree retention values in accordance with the STARS system of assessment.

8 Tree Location & Encroachment Mapping

Figure 9-Tree locations and TPZ/SRZ plan- Please refer to High-resolution PDF Plans for greater clarity.

8.1 PROPOSED DESIGN AND ENCROACHMENTS

Figure 10- Tree locations in relation to the Basement 02 parking level.

Figure 11- Encroachments from existing design.

8.2 IMPACT SCHEDULE

Tree #	Potentially Impacted by	TPZ Encroachment %	Potential Mitigation	Practical to retain
2,3,4,5,6,9, 11,12,13,14 15,16	• No obvious impacts noted.	0%	• Tree protection fencing and signage.	YES
1	• Driveway entrance into basement and associated earthworks and retaining walls.	100%	• Tree #1 is in the centre of the proposed driveway entrance and would require removal.	NO
10	• Minor encroachment from the basement footprint	0.4%	• Tree protection fencing and signage.	YES
8,17,18	• Major encroachment from the basement construction.	30.2%,23.5% & 35.4% respectively	• No suitable mitigation measures possible under current design. Trees will require removal.	NO
7,19-39	• Trees are within the footprint of the basement excavation.	100%	• No suitable mitigation measures possible under current design. Trees will require removal.	NO

Table 4- Tree impact schedule

9 DISCUSSION

Trees 2,3,4,5,6,9,11,12,13,14,15 & 16 appear to be unaffected by the proposed design with tree two (2) being located on the Western side of the old Library building and the remaining trees being located to the North of the proposed development area within and around Phil Engish Reserve, however, there may be some public domain works to tie the new development into the existing streetscape. This detail has not been provided thus far so it is assumed that these trees can be successfully retained.

Tree ten (10) suffers only minor encroachment from the development of 0.4%, however, the tree has poor health and poor structure, so may be considered for removal and replacement as part of the project.

Trees 8,17 & 18 suffer major encroachment from the Northern portion of the basement which is to be excavated to a depth of fifteen (15) metres. These trees are all relatively poor specimens, and the construction impacts are considered to be unsustainable, so the trees will require removal.

Trees 1,7,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39 are within the construction footprint of the basement and driveway entrance and the impacts upon the trees are unsustainable, so the trees will require removal under the current design.

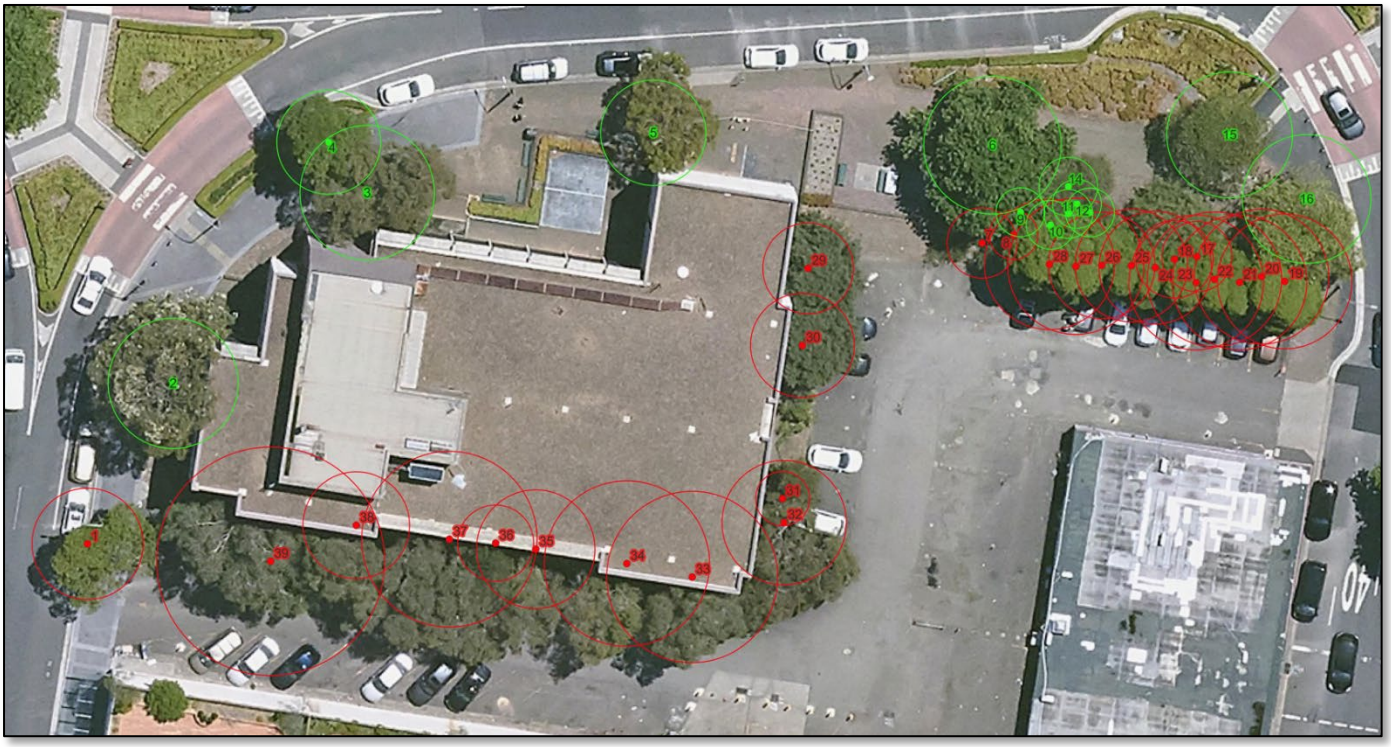

Figure 12- Tree removal and retention plan showing trees which require removal in red and trees which can be retained in green.

10 CONCLUSION

- A total of thirty-nine (39) trees were surveyed as part of this assessment.
- Twenty-three (23) trees were allocated a medium retention value in accordance with the STARS system of assessment- 1,2,3,4,5,6,15,16,19,20,21,22,23,24,25,26,27,28,34,35,36,38,39.
- Sixteen (16) trees were allocated a low retention value in accordance with the STARS system of assessment- 7,8,9,10,11,12,13,14,17,18,29,30,31,32,33,37.
- Trees with a low retention value are generally not considered to be worthy of a material constraint upon design or development, however, may be retained if there is no impact to the trees from the proposed development.
- Twenty-two (22) trees within the subject site will require removal to enable the development to proceed in its current form- 7,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39.
- Four (4) council trees will require removal to enable the development to proceed in its current form- 1,8,17,18.
- Thirteen (13) trees can be retained under the current design- 2,3,4,5,6,9,10,11,12,13,14,15,16.

Proposed for:	Tree Number(s):	Total
Trees proposed for removal to enable development in its current form	1,7,8,17,18,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34, 35,36,37,38,39.	26
Trees to be retained	2,3,4,5,6,9,10,11,12,13,14,15,16.	13
Trees to be removed on neighbouring properties will require consent from the land/tree manager/owner regardless of health, structure, or species.		

Table 5 - Tree retention & removal requirements

11 RECOMMENDATIONS

- Removal of twenty-six (26) trees in accordance with Table 5 to facilitate the development in its current form.
- Any tree removals located outside of the subject site will require the approval from both the consent authority and the tree owner/manager.
- Tree pruning and removal works are to be undertaken by a suitably qualified, experienced and insured Arboricultural contractor with a minimum AQF level 3 qualification in Arboriculture.

  Tree removal works should be undertaken in accordance with the following:

  - *(AS4373 – 2007) Pruning of Amenity Trees*
  - *NSW Code of Practice for the Amenity Tree Industry 1998*
  - *NSW Code of Practice for Work Near Overhead Power Lines 2006*
  - *NSW Work Health & Safety Act & Regulations 2011*
  - *Safe Work Guide to managing Risks of Tree Trimming and Removal Work 2016*
- Retain thirteen (13) trees in accordance with Table 5. Trees proposed for retention and are to be protected in accordance with Australian Standard AS4970-2009: *Protection of trees on development sites*. Detail for the required retention and protection measures for each tree can be found in the Impact Schedule and the Tree Protection Specification contained within this report.
- A detailed Tree Protection Assessment & Specification has been undertaken and included within Section 16 of this report. This specification provides detailed guidance as to the proper management and protection of trees proposed for retention on site.
- Section (16.1) of the specification, highlights the key tree protection items to be considered as part of this development project. These items should be reviewed carefully as they will form an integral part of the successful tree retention and management for the project.
- Any trees and tree numbers not specifically listed, recorded and discussed within this report are to be retained in accordance with AS4970-2009.

This report does not in any part count as consent for the development, tree pruning, or tree removal works. Any information, conclusions or recommendations within this report must only be acted upon following approval from the consent authority.

12 REFERENCES

Australia, M. M. (2024). *Aerial Imagery*. Retrieved February 29, 2024, from MetroMaps: https://web.metromap.com.au/map#

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IACA©. (2010). *Significance of a Tree, Assessment Rating System (STARS)©*. Institute of Australian Consulting Arboriculturists IACA©.

Lonsdale, D. (1999). *Principles of Tree Hazard Assessment and Management* (2007 5th ed.). Norwich: The Stationary Office.

Nelda P Matheny, J. R. (2009). *A Photographic guide to the Evaluation of Hazard Trees in Urban Areas*. Champaign: International Society of Arboriculture.

Standards Australia. (2007). *Australian Standard AS4373-2007 Pruning of amenity trees*. Sydney: SAI Global.

Standards Australia. (2009). *AS4970-2009 - Protection of trees on development sites*. Sydney: SAI Global.

13 GLOSSARY OF TERMS & ABBREVIATIONS

Age class – Described as Juvenile, Semi-Mature, Mature, Over-Mature. These definitions are variable subject to species and growing environment.

- **Juvenile** - Trees that are generally a sapling, or a new planting, usually within the first two (2) years of their life.
- **Semi-mature** - Tree aged less than <20% of life expectancy, *in situ*
- **Mature** - Tree aged 20-80% of life expectancy, *in situ*.
- **Senescent/ Over Mature** - Tree aged greater than >80% of life expectancy, *in situ,* or *senescent* with or without reduced *vigour*, and declining gradually or rapidly but irreversibly to death

Arboriculture - The science and culture of the growth, planning, management, care and maintenance of trees primarily for amenity and utility purposes.

Arborist - An individual with competence to cultivate, care and maintain trees for *amenity* or utility purposes.

Australian Standard AS4970-2009 (AS4970) – Australian Standard AS4970-2009: 'Protection of trees on development sites' is the underpinning standard to which development-based Arboricultural works and guidance are based upon within Australia.

Australian Standard AS4373-2007 (AS4373) – Australian Standard AS4373-2007: 'Pruning of amenity trees' is the underpinning standard to which practical Arboricultural works are based upon within Australia.

Batter – The process of grading the land in a slope formation away from an excavation or built structure.

Benching - Relatively level strips of earth or rock in a broad step-like formation breaking the continuity of a slope usually for reasons of safety. Depending on soil and rock type a commonly used ratio for vertical to horizontal cutting is 2:1.

Building envelope - Total surface area of ground that is or will be covered by a building.

Building footprint - *See Building envelope*.

Deep soil - Soil to a depth of 1000 mm or more (Craul 1992, p. 32).

Defect - Any feature of a tree that is likely to make it less safe (in the case of a structural defect) or otherwise to reduce its health, longevity, landscape prominence or conservation value for any other reason.

Diameter at Base (DAB) - The diameter of the tree taken at ground level above the root buttress flare

Diameter at Breast Height (DBH) - Measurement of trunk width calculated at a given distance above ground from the base of the tree often measured at 1.4m.

Easement - Areas of land above or below ground, subject to statutory constraints being either public or private provided for access or the location of utilities.

Estimated Life Expectancy (ELE) - Assessed on trees of particular species in the urban environment, including health and structural conditions which may exist.

Footing - Of a building, the lowest part of a structural wall or *pier* (in any form), that rests upon or into the earth. See also *Foundation*.

Foundation - The point at the earth surface upon which a building *footing* rests. See also *Footing*.

Height over Diameter (H/D) - The height of the tree divided by the Diameter at Base (DAB) used to determine structural integrity of trees in relation to windthrow when trees have developed slender form due to competition.

Significance of a Tree Assessment Rating System (STARS) – A methodology produced by the Institute of Australian Consulting Arborists (IACA) for the use in determining tree retention value(s). (IACA©, 2010)

Structural Root Zone (SRZ) -

Tree Protection Zone (TPZ)

Vigour - Physical strength and health. A tree with good vigour has the ability to sustain life processes and is synonymous with good health.

Visual Tree Inspection (VTA) - Is a detailed visual inspection of a tree and surrounding site (Claus Mattheck, 1994)

14 DISCLAIMER

The information contained within this report is to be used solely for the purposes that were specified at the time of engagement.

All attempts have been made to ensure the legitimacy of any information which has been gathered in the process of compiling this report, however Truth About Trees Pty Ltd cannot be held liable for inaccurate or misguiding information which has been provided by others.

Any tree inspections or assessments which have been carried out for the purposes of this report are valid only at the time of inspection and are based on what could reasonably be seen or diagnosed from a visual inspection carried out from ground level.

All inspections, unless otherwise stated, are based upon Visual Tree Assessment (VTA) techniques, industry best practice and applied knowledge.

No internal diagnostic testing or below ground investigation has been carried out unless otherwise stated.

Trees are a dynamic living organism and as such they have a finite lifespan the end of which cannot always be predicted or understood, even apparently healthy trees can die suddenly or fall without warning. As such there is no warranty or guarantee provided, or implied, regarding the future risks associated with any tree.

Unless specifically stated within the scope and methodology sections of this report, this report does not constitute a detailed Arboricultural Risk Assessment if relating to construction and development related report types.

Assessment of tree health and condition has been included to guide assessment of tree retention aspects only and is based on a basic visual assessment using elements of the VTA method. Tree defects may be discussed briefly within this report; however, this report does not satisfy the requirements of a detailed Arboricultural Risk Assessment report.

It is noted that upon acceptance and completion of any development, that there may be trees that impose a risk of impacting a target that was not previously present prior to the development.

It is up to the client and the tree owner/manager to determine the risk threshold that they are willing to accept and undertake a suitably detailed Arboricultural risk assessment that identifies potential tree risk(s) and provides tree management recommendations in line with this threshold.

Please feel free to contact me either via telephone or email if you have any questions regarding this report.

15 APPENDIX 1: TREE ASSESSMENT METHODOLOGY

15.1 VISUAL TREE ASSESSMENT (VTA)

The VTA system is based on the theory of tree biology and physiology, as well as tree architecture and structure. This method is used by arborists to identify visible signs on trees that indicate good health, or potential problems. Symptoms of decay, growth patterns and defects are identified and assessed as to their potential to cause whole-tree, part-tree and/or branch failure. This system (represented by the image below) is based around methods discussed in `*The Body Language of Trees*'. (Claus Mattheck, 1994)

For the purpose of this report, elements of the VTA system will be used, along with industry standard literature, and other relevant studies that provide an insight into potential hazards in trees. This assessment is a snapshot of what could be reasonably seen or determined from a basic visual inspection. The VTA system is generally used as a means to identify hazardous trees; however, it is important to realize that for a tree to be hazardous there must be a target; a hazard poses no risk if there is no exposure to the hazard.

15.2 HEALTH & VIGOUR ASSESSMENT

The health and vigour of a tree are assessed by looking at the tree canopy and how it is performing. Certain indicators provide information on which to base the assessment. Abnormally small leaves, chlorosis (yellowing), sparse crown, wilting, and die-back can be signs of ill-health or decline but may also be related to a temporary imbalance due to drought or pest infestations. Epicormic growth can be a sign of stress and low energy reserves but can also be related to increased light levels through the removal or pruning of adjacent trees. Extension growth can be a good indicator of vigour, but this can vary greatly between species and under differing climatic conditions. For these reasons, each individual symptom or observation needs to be assessed with objectivity and consideration of all available information.

15.3 STRUCTURAL ASSESSMENT

The structural assessment of trees is carried out using the basic framework of Visual Tree Assessment. Signs and symptoms of defects are assessed to gauge the likelihood of failure, because not every defect constitutes a hazard e.g., *"…co-dominant stems are a structural defect. The severity of the defect is increased by included bark, large crowns and strong wind."* (Nelda P Matheny, 2009)

If trees were removed purely on the basis that there were defects present without assessing the likelihood of failure or whether practical mitigation measures are available, the urban forest would cease to exist. A basic visual tree assessment is undertaken from ground level, if defects are suspected further investigation may be required and recommended.

"*[When using] the Visual Tree Assessment (VTA) procedure for assessing trees, as the suspicion increases that defects are present, the examination becomes more thorough and searching."* (Claus Mattheck, 1994)

"Some defects, especially some forms of decay, do not give rise to external signs and therefore tend to escape detection in a purely visual survey. If there is no reason for suspecting a hidden defect to occur within a particular part of the tree, there is no reasonable basis for carrying out a detailed internal assessment. Although in theory an unsuspected defect might be detectable by the use of specialized diagnostic devices, this would be impracticable in the absence of some external sign to indicate the place which should be probed. Also, internal examination without good reason is undesirable, as it usually causes injury to the tree and is unreasonably time consuming and costly." (Lonsdale, 1999)

15.4 TREE PROTECTION ZONE (TPZ) & STRUCTURAL ROOT (SRZ) ZONE CALCULATIONS

In accordance with Australian Standard *AS4970-2009 Protection of trees on development sites* (Standards Australia, 2009), Tree Protection Zone (TPZ) radius is calculated using the following procedure. Diameter of the trunk is measured at approximately 1.4m above ground level; this measurement is referred to as DBH (Diameter at Breast Height). R_{TPZ} = ***DBH X 12***. For multi-stemmed trees the formula used is $R_{TPZ} = \sqrt{[(DBH1)^2 + (DBH2)^2 + (DBH3)^2]}$. The TPZ is measured radially from the centre of the stem and must be protected on all sides.

The Structural Root Zone (SRZ) radius is calculated by measuring the diameter of the stem close to ground level, just above the basal flare. This measurement is taken as ***D*** and then used in the following formula: $R_{SRZ} = (Dx50)^{0.42} \times 0.64$ and becomes the Structural Root Zone, measured radially from the centre of the stem.

It is important to realize that these calculations provide a notional figure only and tree dynamics, form and site conditions will greatly affect these zones, and it is the job of the arborist to interpret the information correctly.

For palms, cycads, tree ferns, and similar monocots, the TPZ is positioned at least 1m outside the crown projection. SRZs are not applicable to these plant types.

AS4970-2009 states "*a TPZ should not be less than 2m nor greater than 15m (except where crown protection is required*" and the minimum radius for an SRZ is 1.5m.

15.5 Reference Diagrams

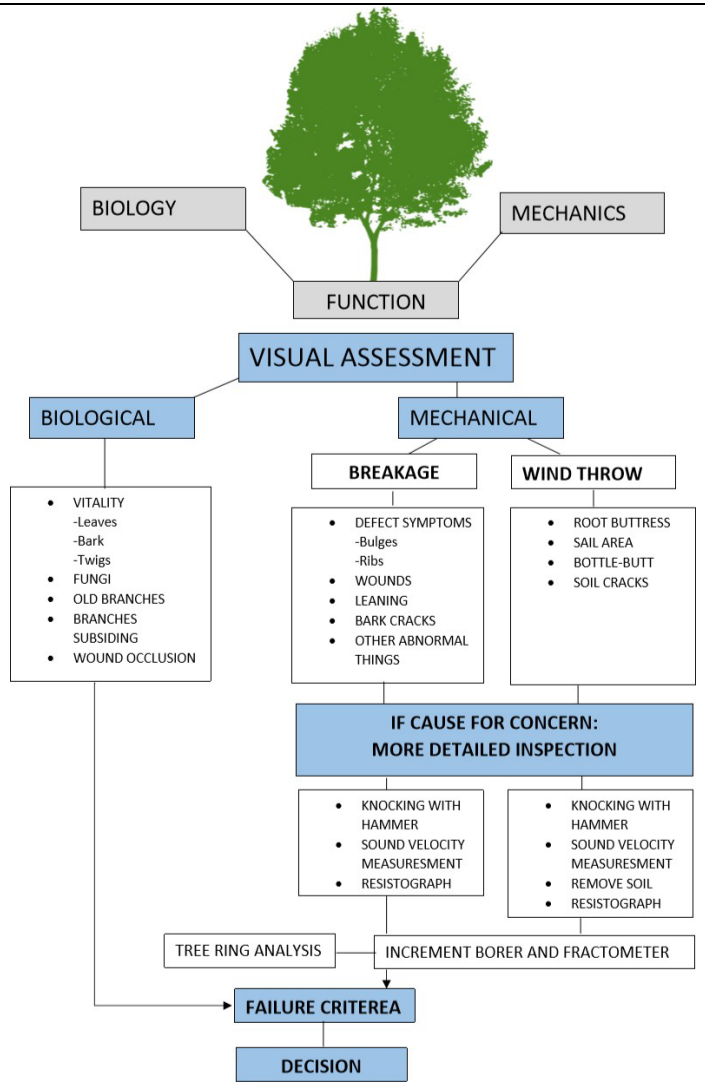


Figure 13 - VTA Procedure flowchart

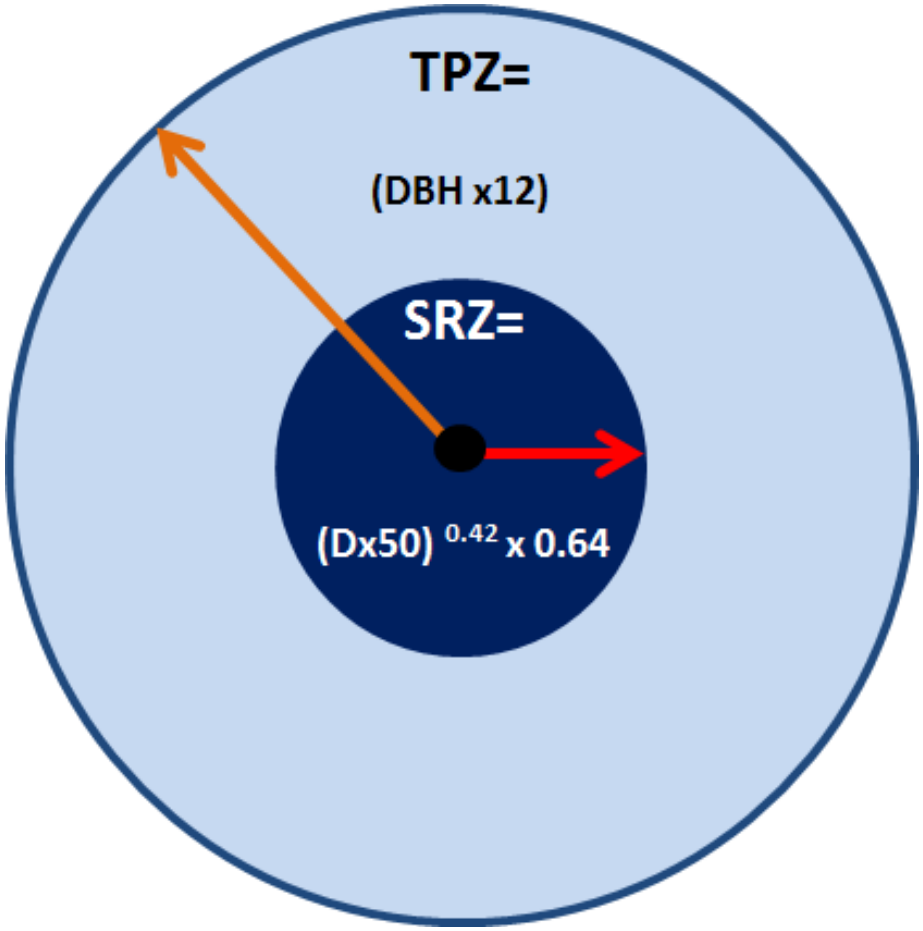


Figure 14 - A representation of TPZ & SRZ calculations

15.5.1 SIGNIFICANCE OF A TREE, ASSESSMENT RATING SYSTEM (STARS)

IACA Significance of a Tree, Assessment Rating System (STARS)© (IACA 2010)©

In the development of this document IACA acknowledges the contribution and original concept of the Footprint Green Tree Significance & Retention Value Matrix, developed by Footprint Green Pty Ltd in June 2001.

The landscape significance of a tree is an essential criterion to establish the importance that a particular tree may have on a site. However, rating the significance of a tree becomes subjective and difficult to ascertain in a consistent and repetitive fashion due to assessor bias. It is therefore necessary to have a rating system utilising structured qualitative criteria to assist in determining the retention value for a tree. To assist this process all definitions for terms used in the *Tree Significance - Assessment Criteria* and *Tree Retention Value - Priority Matrix*, are taken from the IACA Dictionary for Managing Trees in Urban Environments 2009.

This rating system will assist in the planning processes for proposed works, above and below ground where trees are to be retained on or adjacent a development site. The system uses a scale of *High*, *Medium* and *Low* significance in the landscape. Once the landscape significance of an individual tree has been defined, the retention value can be determined. An example of its use in an Arboricultural report is shown as Appendix A.

Tree Significance - Assessment Criteria

1. High Significance in landscape

- The tree is in good condition and good vigour;
- The tree has a form typical for the species;
- The tree is a remnant or is a planted locally indigenous specimen and/or is rare or uncommon in the local area or of botanical interest or of substantial age;
- The tree is listed as a Heritage Item, Threatened Species or part of an Endangered ecological community or listed on Councils significant Tree Register;
- The tree is visually prominent and visible from a considerable distance when viewed from most directions within the landscape due to its size and scale and makes a positive contribution to the local amenity;
- The tree supports social and cultural sentiments or spiritual associations, reflected by the broader population or community group or has commemorative values;
- The tree's growth is unrestricted by above and below ground influences, supporting its ability to reach dimensions typical for the taxa *in situ* - tree is appropriate to the site conditions.

2. Medium Significance in landscape

- The tree is in fair-good condition and good or low vigour;
- The tree has form typical or atypical of the species;
- The tree is a planted locally indigenous or a common species with its taxa commonly planted in the local area
- The tree is visible from surrounding properties, although not visually prominent as partially obstructed by other vegetation or buildings when viewed from the street,
- The tree provides a fair contribution to the visual character and amenity of the local area,
- The tree's growth is moderately restricted by above or below ground influences, reducing its ability to reach dimensions typical for the taxa *in situ*.

3. Low Significance in landscape

- The tree is in fair-poor condition and good or low vigour;
- The tree has form atypical of the species;
- The tree is not visible or is partly visible from surrounding properties as obstructed by other vegetation or buildings,
- The tree provides a minor contribution or has a negative impact on the visual character and amenity of the local area,
- The tree is a young specimen which may or may not have reached dimension to be protected by local Tree Preservation orders or similar protection mechanisms and can easily be replaced with a suitable specimen,
- The tree's growth is severely restricted by above or below ground influences, unlikely to reach dimensions typical for the taxa *in situ* - tree is inappropriate to the site conditions,
- The tree is listed as exempt under the provisions of the local Council Tree Preservation Order or similar protection mechanisms,
- The tree has a wound or defect that has potential to become structurally unsound.

Environmental Pest / Noxious Weed Species

- The tree is an Environmental Pest Species due to its invasiveness or poisonous/ allergenic properties,
- The tree is a declared noxious weed by legislation.

Hazardous/Irreversible Decline

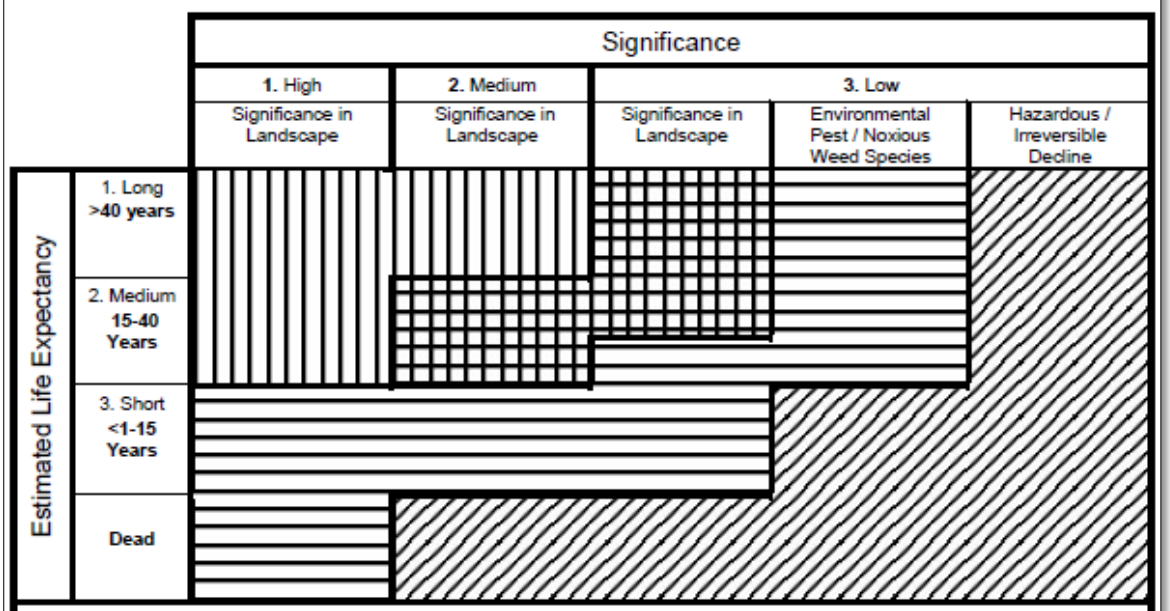
- The tree is structurally unsound and/or unstable and is considered potentially dangerous,
- The tree is dead, or is in irreversible decline, or has the potential to fail or collapse in full or part in the immediate to short term.

The tree is to have a minimum of three (3) criteria in a category to be classified in that group.

Note: The assessment criteria are for individual trees only, however, can be applied to a monocultural stand in its entirety e.g. hedge.

IACA 2010, *IACA Significance of a Tree, Assessment Rating System (STARS)*, Institute of Australian Consulting Arboriculturists, www.iaca.org.au

Table 1.0 Tree Retention Value - Priority Matrix.



Legend for Matrix Assessment

INSTITUTE OF AUSTRALIAN CONSULTING ARBORICULTURISTS

Priority for Retention (High) - These trees are considered important for retention and should be retained and protected. Design modification or re-location of building/s should be considered to accommodate the setbacks as prescribed by the Australian Standard AS4970 *Protection of trees on development sites*. Tree sensitive construction measures must be implemented e.g. pier and beam etc if works are to proceed within the Tree Protection Zone.

Consider for Retention (Medium) - These trees may be retained and protected. These are considered less critical; however their retention should remain priority with removal considered only if adversely affecting the proposed building/works and all other alternatives have been considered and exhausted.

Consider for Removal (Low) - These trees are not considered important for retention, nor require special works or design modification to be implemented for their retention.

Priority for Removal - These trees are considered hazardous, or in irreversible decline, or weeds and should be removed irrespective of development.

USE OF THIS DOCUMENT AND REFERENCING

The IACA Significance of a Tree, Assessment Rating System (STARS) is free to use, but only in its entirety and must be cited as follows:

IACA, 2010, *IACA Significance of a Tree, Assessment Rating System (STARS)*, Institute of Australian Consulting Arboriculturists, Australia, www.iaca.org.au

REFERENCES

Australia ICOMOS Inc. 1999, *The Burra Charter – The Australian ICOMOS Charter for Places of Cultural Significance*, International Council of Monuments and Sites, www.icomos.org/australia

Draper BD and Richards PA 2009, *Dictionary for Managing Trees in Urban Environments*, Institute of Australian Consulting Arboriculturists (IACA), CSIRO Publishing, Collingwood, Victoria, Australia.

Footprint Green Pty Ltd 2001, *Footprint Green Tree Significance & Retention Value Matrix*, Avalon, NSW Australia, www.footprintgreen.com.au

IACA 2010, *IACA Significance of a Tree, Assessment Rating System (STARS)*, Institute of Australian Consulting Arboriculturists, www.iaca.org.au

Figure 15- Significance of a Tree Assessment Rating System (STARS) – IACA

16 Appendix 2: Tree Protection Specification

16.1 Introduction

- Early identification & protection of important trees on development sites is essential from the outset & will minimise problems associated with retaining inappropriate trees, & in turn focus time, resources & budget on the retention & protection of the most valuable trees on site (Standards Australia, 2009).
- Tree protection will form an essential part of the success of the development & should be prioritised at the earliest stage of the project. Where trees are proposed for retention on site, proper tree protection & management procedures will be crucial in ensuring that the trees remain valuable assets over the long-term.
- The following specification has been developed to provide detailed guidance for tree protection measures & processes associated with the development project.

16.2 Tree Protection Assessment Schedule

Table 6 below has been provided to identify the key tree protection measures that are applicable to the individual trees, or groups of trees proposed for retention on site.

The heading number* provided in column three (3) of Table 6 below, correlates to the applicable section within the following specification.

It is important to note that the below table identifies the key tree protection measures for the individual tree(s) only, and not all that apply. Therefore, it is important that the specification is read in its entirety, and works are guided by the Project Arborist to ensure that all trees are protected in accordance with AS4970.

Tree #	Tree Protection Measure (TPM) Recommendations	Specification Heading Reference
2,3,4,5,6,9,10,11, 12,13,14,15,16.	• General physical TPM's i.e., fencing & signage apply, in accordance with AS4970-2009 & Appendix 2 • Restricted activities within the TPZ • Supervision of any & all works within TPZ by Project Arborist • Certification required in accordance with specified hold points & TPM	• 16.2.1 & 16.8 • 16.6.3 • 16.11.1 • 16.11 & 16.11.2
**Note - Select (Control + left-click-mouse-button) each heading number in column 3 to be taken to the applicable section of the specification*		

Table 6 - Tree Protection Assessment Schedule

16.2.1 Applicable Standards

16.2.1.1 Australian Standard AS4970-2009: Protection of trees on development sites (Standards Australia, 2009)

16.2.1.2 Australian Standard AS4373-2007: Pruning of amenity trees (Standards Australia, 2007)

- Australian Standards AS4373-2007 & AS4970-2009 are the underpinning documents that Arboricultural practice within Australia is based upon.
- The preparation of this specification has been prepared in accordance with & has been closely aligned with the foundations & principles of these standards.
- As such, this specification & any associated report(s) should be read in conjunction with AS4970 & AS4373.

16.2.2 Approval from consent authority

- It is important to note that this specification & any associated report(s), do not count as approval for the recommendations contained within. It is vital that approval is obtained from the consent authority prior to following any recommendations provided by Truth About Trees as part of this specification or report.
- Upon approval from the consent authority, it is important that any variation between this specification & the Conditions of Consent (CoC) are identified, discussed & addressed with the Project Arborist, Project Manager & the consent authority to resolve any discrepancies.
- Unless otherwise advised by the consent authority, the CoC shall prevail.

16.3 PLANNING & DESIGN

- In addition to the commonly identified physical tree protection measures, tree protection is most effective when addressed through early-stage planning & design. Ideally this would mitigate the need to encroach on the tree(s) TPZ entirely resulting in only basic physical tree protection measures being required.
- The undertaking of a Preliminary Tree Assessment report is a key step in the process of tree protection. As through consultation between planners, the design team, project managers, the principal contractor & the project arborist; redesign, planning & detailed site management can achieve an outcome that both mitigates impacts to significant trees on site, & maintains the desired outcomes of the development.
- However, this may not always be feasible or have been considered early on in the development. Therefore, tree protection measures become paramount for the development to proceed successfully. At this point, the use of tree sensitive construction methods, combined with physical tree protection measures should be utilised for any part of the development that encroaches the TPZ of a tree proposed for retention.

16.3.1 TREE SENSITIVE CONSTRUCTION METHODS

- Tree sensitive construction methods are methods of construction that minimise the impact(s) to the tree(s) on site. Typically, in the form of minimising impacts associated with the below ground parts of the tree(s) root system.
- Examples of tree sensitive construction methods include, but are not limited to:
  - Pier & Beam style footings
  - Cantilevered Building Sections
  - Contiguous Piling
  - Suspended Slabs
  - Screw Piles
  - Directional under-boring

16.3.2 CONSTRUCTION MANAGEMENT PLAN

- A Construction Management Plan (CMP) should be compiled by the principal contractor in consultation with the Project Arborist in order to address any issues related to aspects such as the access & egress of vehicles and machinery & the storage of site materials.

16.3.3 ORDER OF WORKS

- It is important that works are undertaken with a methodical approach to mitigate conflict during the different stages of construction. When works are undertaken out of sequence, it can result in additional impacts to the tree(s) proposed for retention. ***(See Section 16.12)***
- One of the most effective ways to ensure that tree protection measures remain successful, is by ensuring compliance with AS4970 and this specification. ***(See Sections 16.4 & 16.5)***

16.4 COMPLIANCE

- Compliance with this specification is best managed through the appointment of a Project Arborist to ensure that works are undertaken in accordance with the recommendations & hold-points detailed within this specification. ***(See Section 16.12)***
- This specification should be clearly communicated with the Principal Contractor & Project Manager to ensure that all works are undertaken in accordance with this specification.
- Tree protection measures should form part of the site-specific induction process to ensure that all workers on site are familiar with the requirements set out within the specification.
- The Project Arborist & Project Manager are to be responsible for the monitoring & enforcement of all tree protection measures on site.

16.5 THE PROJECT ARBORIST

16.5.1 PROJECT ARBORIST APPOINTMENT & QUALIFICATIONS

- A Project Arborist (PA) with a minimum Australian Qualification Framework (AQF) Level-5 qualification in arboriculture should be appointed as the Consulting Arborist for the project.
- The PA is to have sufficient experience in managing trees on development sites & must be familiar with the required legislation & standards, & up to date on industry best practice methodologies.
- The PA is to be appointed prior to the start of any works on site, inclusive of tree pruning & removal works & prior to site establishment & occupation.

16.5.2 Responsibilities of the Project Arborist & Record Keeping

- The PA is to be consulted at the design stage to ensure that impacts to valuable trees on site is either mitigated, or effectively managed throughout the project.
- The PA is to attend an on-site meeting with the Project Manager & Principal Contractor to discuss the requirements for tree protection measures for the project. This is to be conducted prior to any works on site & prior to site establishment & occupation.
- The PA is to be responsible for the compliance with the specification, AS4970 & any CoC placed upon the development by the consent authority.
- The PA is to guide all tree pruning & removal works in accordance with AS4970 & AS4373.
- Certification of the installation of tree protection measures and any additional relevant hold-points as detailed within ***Sections 16.11 & 16.12*** of this specification is to be undertaken by the PA in accordance with the relevant industry standards and reporting requirements.
- The PA is responsible for supervision of any & all works within the TPZ of any tree proposed for retention.
- Record keeping of all supervision works by the PA is to be completed via a statement of attendance, detailing what works were undertaken and certifying that they were undertaken in accordance with the relevant standards e.g., AS4970 & AS4373. ***(See Sections 16.11 & 16.12)***
- Whilst the above noted responsibilities are primarily that of the PA, it is the responsibility of the project manager/site manager to contact the PA prior to any works that require Arborist involvement and to assist with direct enforcement of all tree protection measures with all contractors.

16.6 Tree Protection Zone (TPZ)

16.6.1 Tree Protection Zone: Definition & Purpose

- The Tree Protection Zone (TPZ) is defined within AS4970 as:

  ''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.'' (Standards Australia, 2009)
- The TPZ is calculated in accordance with AS4970 by taking the Diameter at Breast Height (DBH) of the subject tree and multiplying it by twelve (12).
- It is important to note that this calculation provides a notional TPZ only, which is indicative of a generalised area that a tree may require to maintain tree health & structure. There are many aspects that contribute to the TPZ, and it is up to the PA to ensure that all aspects have been considered when determining the TPZ as this may differ from the notional TPZ calculation. ***(See section 16.7)***

16.6.2 Structural Root Zone: Definition & Purpose

- The Structural Root Zone (SRZ) is defined within AS4970 as:

  'The area around the base of a tree required for the tree's stability in the ground. The woody root growth and soil cohesion in this area are necessary to hold the tree upright. The SRZ is nominally circular with the trunk at its centre and is expressed by its radius in metres. This zone considers a tree's structural stability only, not the root zone required for a tree's vigour and long-term viability, which will usually be a much larger area.'' (Standards Australia, 2009)

16.6.3 Restricted activities

- It is important to restrict certain activities within the TPZ in order to mitigate any detrimental impacts to the tree(s) health and condition. Some activities may not appear to be of concern, however even indirect impacts can have a long-term and lasting effect on tree health and condition.

  Examples of restricted activities as detailed within AS4970 are listed below:

- machine excavation including trenching
- excavation for silt fencing
- cultivation
- storage
- preparation of any chemicals, including cement
- parking of vehicles and plant
- refuelling
- dumping of waste
- wash down and cleaning of equipment
- placement of fill
- lighting of fires
- soil level changes
- temporary or permanent installation of utilities
- physical damage to the tree

16.7 VARIATIONS TO THE TPZ

16.7.1 TPZ ENCROACHMENTS

- Encroachment to the TPZ may at times be a necessity due to site limitations and constraints & are generally decided upon during the planning & Development Application stages. It is imperative that any encroachment to the TPZ is only undertaken with prior approval from the Consent Authority & under the guidance of the PA.
- TPZ encroachments are considered to be items that have a longer-term effect on the TPZ e.g., excavation, trenching, building footings, installation of services etc.
- There are typically two (2) categories of TPZ encroachment which each have their own specific assessment & management processes as detailed below.

16.7.1.1 Minor TPZ Encroachments:

- Where an encroachment is <10% of the trees total TPZ area & provided it is outside of the SRZ, then it is considered to be a minor encroachment.
- A minor encroachment would not generally warrant further, or detailed root investigation.
- Where an encroachment occurs, the TPZ must be adapted to compensate for the loss of area due to the encroachment, the compensated area must be contiguous to the existing TPZ.

16.7.1.2 Major TPZ Encroachments:

- Where an encroachment is >10% of the trees total TPZ area, or if it encroaches the SRZ, then it is considered to be a major encroachment.
- A major encroachment will require assessment by the PA and may require exploratory root investigation works to demonstrate the viability of the tree over the long-term. ***(See Sections 16.9.1 & 16.9.2)***
- As with a minor encroachment, where an encroachment occurs, the TPZ must be adapted to compensate for the loss of area due to the encroachment, the compensated area must be contiguous to the existing TPZ.

16.7.2 CANOPY PROTECTION

- As well as the below-ground parts, the above-ground parts of the tree also require protection throughout development.
- On occasion, the notional TPZ calculation may be located within the tree canopy, therefore, the TPZ will require adjustment to 1m outside of the dripline to ensure that the tree canopy is properly protected.
- This will generally require the TPZ and associated fencing to be extended to a distance of 1m outside the perimeter of the tree canopy dripline as a minimum. ***(See section 16.8.1)***
- In some cases, site space & constraints may result in the requirement for tree branches to be pruned. In this instance, a pruning specification may be required & must be undertaken in accordance with the relevant standards & under the guidance of the PA. ***(See sections 16.2.1.2 & 16.10.1)***

16.7.3 ADDITIONAL CONSIDERATIONS

- Variations to the TPZ may also be required where the PA has demonstrated that one of the following (or other) aspects are impacting the likely TPZ requirement for the subject tree:
    - Existing or historical structures that are likely to have impacted the location of tree roots
    - The future growth requirements of the tree, including both above & below ground parts
    - Tree health
    - Tree structure
    - The characteristics of the individual tree species & its ability to tolerate development impacts
    - Site topography & soil type

16.8 PHYSICAL TREE PROTECTION MEASURES

16.8.1 TPZ FENCING & SIGNAGE

- TPZ fencing will be required for all trees proposed for retention, unless there is an existing structure that acts as physical barrier to access of the tree.
- Fencing must be erected in accordance with AS4970 & AS4687 & should be positioned to the perimeter of the TPZ.
- Where the notional TPZ is located within or below the tree canopy, the fencing should be extended to a minimum of 1m outside of the dripline.
- Access to, or relocation of the TPZ fencing must only be acted upon following guidance from the PA.
- Signage must be attached to the TPZ fencing in a position that is clearly visible from within the site.
- Signage must be a minimum of A4 paper size & must be weather-proofed (laminated) & securely attached to the fencing in a way that ensures it remains in place throughout the development.

  (See section 16.13)

16.8.2 TRUNK & BRANCH PROTECTION

- Trunk & branch protection may be required where there is likely to be an impact to the tree from the access & egress of vehicles & machinery on site & will be advised by the PA.
- Where trunk & branch protection is required, it should comply with AS4970 & consist of:
  - Wrapping a fabric layer (hessian/geotextile) around the tree trunk/branches,
  - Placing timber battens (90mm x 45mm) spaced at 150mm & to a height of 2m above-grade around the tree.
  - Timbers are not to be attached directly to the tree. ***(See section 16.13)***

16.8.3 GROUND PROTECTION

- Ground protection is to be utilised where temporary access & egress of vehicles & machinery is required into any part of the TPZ to prevent soil compaction & root damage.

  Unless otherwise specified, ground protection should consist of a layer of geotextile fabric, well composted native woodchip mulch to a depth of 75mm-100mm & timber rumble boards placed on top. ***(See section 16.13)***

16.9 CONSTRUCTION PROCESSES & TREE SENSITIVE METHODOLOGIES

16.9.1 ROOT INVESTIGATIONS

- Where a major encroachment occurs root investigation may be required in order to ensure that any impacts to significant roots are mitigated, and tree health & structure remains viable.
- This should be completed and documented prior to the start of any works on site.
- Root investigation can be conducted using a number of methods, each with their own benefits & constraints. Whilst all methods should be non-destructive, some methods are considered to be less invasive than others such as Ground Penetrating Radar (GPR).
- The investigation should be focused along the proposed line of construction.
- However, accuracy of the results can vary depending on characteristics of the individual site. As such, the PA will need to advise as to the most appropriate & effective method of investigation. Site constraints may impact upon the feasibility of a particular method & therefore site-specific recommendations will be required.
- Regardless of the method utilised, the following aspects should be assessed & documented as part of the investigation:
  - Method used
  - Date, time & location of works.
  - Individual tree identifying reference
  - Location, size, depth & direction of travel of all roots observed.
  - Summary of the estimated significance of the observed roots
  - Recommendations for construction processes to mitigate significant impacts to the roots (generally to be included as part of AIA reporting)

16.9.2 Exploratory Excavation

- Exploratory excavation is a method that can be utilised as part of a root investigation to guide design & construction. However, due to its invasive nature it is imperative that it is conducted in a way that minimises impacts to the tree.
- Exploratory excavation must be undertaken in accordance with the aspects detailed above in; ***section 16.9.1***.
- Exploratory excavation must be undertaken as detailed below in; ***section 16.9.3***.

16.9.3 Excavation Within the TPZ

- Any excavation within the TPZ must only be undertaken following approval from the consent authority & under the supervision & guidance of the PA.
- Works must be undertaken using non-destructive measures such as hand digging, AirSpade or a Dry Vac*

  *Note that a Dry Vac differs from a regular Hydro Vac. The Dry Vac uses air pressure to break up the soil profile, rather than a water jet, reducing the likelihood of tree roots being damaged by the high-pressure water jet.
- Works must be documented & certified by the PA ***(See section 16.11)***

16.9.3.1 Root Protection

- Where roots are likely to be exposed for an extended period of time, it is important that they are adequately protected to prevent them from drying out.
- This can be achieved by wrapping the roots in hessian & ensuring that they remain moist throughout the works.
- The hessian wrap must be removed & the area back-filled with a suitable material as soon as practicable upon completion of the works.

16.9.4 Root Pruning

- Root Pruning must only be undertaken under the guidance & supervision of the PA.
- Pruning cuts should be made using a fit-for-purpose & sharp tool to ensure that cuts are made cleanly and back to a suitable point in accordance with AS4373. ***(See Section 16.2.1.2)***
- No roots greater than 25mm in diameter are to be pruned unless demonstrated viable by the PA.

16.9.5 Grade Changes Within the TPZ

- Grade changes within the TPZ will require prior approval by the consent authority & the PA. They will generally consist of a raise in soil level only & not a reduction in grade.
- Where grade changes are permitted, they will generally be restricted to a maximum fill of 200mm above existing grade.
- The fill material must be a non-compacted material that is coarser than the existing soil & must be inspected & approved by the PA.

16.9.6 Underground Services

- Where feasible, all underground services should be located outside of the TPZ.
- In situations where site limitations dictate the location of service within the TPZ, then they would ideally be installed using directional under-boring to minimise disturbance to the TPZ. ***(See Section 16.9.7)***
- Should under-boring not be feasible, then the services must be installed in accordance with ***sections 16.9.1, 16.9.2 & 16.9.3*** of this specification.

16.9.7 Directional Under-boring

- Directional under-boring is undertaken using specialist equipment that can bore below ground to avoid conflict with trees, structures & infrastructure. Whilst it is a highly beneficial method for minimising impacts with trees, there are certain aspects that must still be considered to successfully mitigate any significant impact with tree root systems.
- Entry/exit pits – The directional drilling equipment requires an entry & exit pit in order to start the drilling process, the size may vary depending on the make/model of equipment, but 2m² should be considered as a minimum requirement. It is important to ensure that the entry/exit pit is located outside of the TPZ where possible. Where the entry or exit pit must be within the TPZ of a tree, the PA is to assess the viability of the proposal and the entry/exit pit is to be excavated using non-destructive means.
- Drilling depth – different machines are capable of drilling to different depths, and different soil types or bedrock may guide the desired depth of the bore, but generally speaking most machines are capable of drilling to a depth that avoids conflict with the tree's root system. The PA is to provide guidance on the minimum depth required based on soil type, tree species and site conditions.

16.9.8 Above-ground Services & Structures

16.9.8.1 Scaffolding

- Should scaffolding be required within the TPZ, it should be designed to mitigate impacts with the tree canopy.
- Where there is no alternative but to place scaffolding within the TPZ, it should be constructed in a way that mitigates the requirement for tree pruning where feasible.
- Should pruning be required, it should be guided by the PA in accordance with AS4373 & the relevant DCP. Note that a pruning Specification may also be required. ***(See section 16.10.2)***
- Scaffolding within the TPZ will also require adequate ground protection to minimise soil compaction & damage to the tree roots. This can be achieved by utilising the methods detailed in ***section 16.8.3.***
- A layer of impervious black plastic or similar must be utilised instead of geotextile to assist in preventing chemical spills from entering the soil.
- Additionally, scaffold boards or similar can be utilised on top of the mulch.

16.9.8.2 Building Alignment

- Where feasible, building alignments should be positioned outside of the TPZ & must consider the future growth of the trees above & below ground parts. This should be considered at the design stage to avoid encroachment into the TPZ. ***(See Section 16.3)***
- Where the building alignment is to be positioned within the trees TPZ, it must be done so only after consultation & assessment with the PA and following approval from the consent authority. ***(See Sections 16.4 & 16.5)***
- Tree sensitive design & construction methods will need to be utilised to minimise impacts and the PA is to supervise all works within the TPZ. ***(See sections 16.3.1 & 16.5)***

16.9.8.3 Above-ground services – pruning spec

- Consideration needs to be given at the design stage to the location of above-ground services to minimise conflict with the trees canopy. ***(See Section 16.3)***
- Where services are to pass near to, or within the tree canopy, consultation with the PA will be required.
- A pruning specification may be required to guide the installation of the service(s) and the tree(s). ***(See Section 16.10.2)***

16.10 Tree Removal & Pruning Works

16.10.1 General

- No tree pruning or removal works should be undertaken without prior approval from the consent authority and without consultation with the PA.
- Tree pruning and removal works are to be undertaken by a suitably qualified, experienced and insured Arboricultural contractor with a minimum AQF level 3 qualification in Arboriculture.
  Works should be undertaken in accordance with the following:
  - (AS4373 – 2007) Pruning of Amenity Trees ***(See Section 16.2.1.2)***
  - NSW Code of Practice for the Amenity Tree Industry 1998
  - NSW Code of Practice for Work Near Overhead Power Lines 2006
  - NSW Work Health & Safety Act & Regulations 2011
  - Safe Work Guide to managing Risks of Tree Trimming and Removal Work 2016

16.10.2 Pruning Specification

- A pruning specification may be required where the proposed works exceed the allowances within the applicable DCP exemptions.
- The PA will advise when this is required, & the pruning specification must be compiled in accordance with AS4373 & AS4970. ***(See Section 16.2.1)***
- The pruning specification should clearly identify which branches require pruning & the suitable reduction point(s) that they should be pruned back to in order to ensure that tree health, form & condition are maintained.
- The pruning specification should be provided to the consent authority for approval as required & the document available on site during the pruning works.
- The PA should be advised by the Project Manager when pruning is to be undertaken, & consultation between the PA & the Arboricultural contractor that is undertaking the works, should occur prior to the works commencing.

16.11 MONITORING & CERTIFICATION

16.11.1 SUPERVISION

- This refers to the supervision of any works within the TPZ of a tree proposed for retention.
- Supervision should be undertaken by the PA or a suitably qualified & experienced AQF Lvl-5 Arborist.
- The primary purpose of supervision is to ensure that the PA is on site during works within the vicinity of the TPZ(s), to ensure that damage to the subject tree(s) is avoided by ensuring that works in these areas are undertaken in accordance with AS4970 & industry best practice.
- A secondary purpose of supervision is to ensure that the PA is present during works to provide guidance & advice should tree roots be encountered, or otherwise unforeseen tree related matters arise during the works.
- All supervision works should be documented & certified as detailed below.

16.11.2 HOLD POINTS & MONITORING

- Monitoring of the project is essential in order to ensure that tree protection measures remain in place & all tree protection & tree sensitive construction methods are undertaken in accordance with the specification & CoC.
- This can be achieved by ensuring compliance with the hold points detailed below in ***Section 16.12.***
- All hold points will require certification by the PA.
- Certification is generally provided in a memo style certification letter, that will clearly identify & document the following items as a minimum:
    - Date, time & location of assessment/works & details of the person(s) and company(s) involved,
    - Detailed description of the works/assessment & detail of the involvement of the PA,
    - Description & location of trees subject to assessment,
    - Description of subject trees health & condition,
    - Photographic evidence that clearly shows examples of the works processes,
    - Items of non-compliance are clearly identified, documented & remediation recommendations provided.
    - Confirmation that any areas of non-compliance requiring remediation have been rectified (as required).
    - Signed acknowledgement of complying works and standards to which they have been assessed by.
- Certification will be provided to the client & will be the responsibility of the client to ensure that the certification is provided to the relevant consent authority & certifier as required.

16.12 HOLD-POINT INSPECTION SCHEDULE

Hold-Point	Description	Applicable Stage of Development	Required Actions
1	**Installation of tree protection measures**	Prior to site establishment & occupation & prior to any work activities commencing on site.	• Confirm that tree protection measures have been installed in accordance with the: ◦ Conditions of Consent ◦ Tree Protection Specification & Tree Protection Plan/Drawing ◦ AS4970-2009 • Ideally installed prior to tree pruning/removal to ensure TPZ's are not unnecessarily encroached by tree contractor vehicles & equipment
2	**Tree Protection Certification**	Following tree pruning & removal works & prior to site work activities commencing.	• Inspect and assess the installation of all tree protection measures • Confirm that have been installed in accordance with: ◦ Conditions of Consent ◦ Tree Protection Specification & Tree Protection Plan/Drawing ◦ AS4970-2009 • Provide letter of certification in accordance with *section 16.11* of this specification
3	**Tree Pruning & Removal**	Following the installation of all tree protection measures & prior to site establishment & occupation	• Confirm that tree pruning & removal works are undertaken in accordance with the: ◦ Conditions of Consent ◦ Tree Protection Specification & Tree Protection Plan/Drawing ◦ Pruning Specification (where applicable) ◦ AS4373-2007
4	**Construction & Landscaping Within the TPZ** Supervision of all access, demolition, construction & landscaping works within the TPZ Periodic site inspections to provide ongoing monitoring of the subject trees and compliance with tree protection measures	Following tree protection certification Periodically throughout demolition & construction. At any time that access or works are required within the TPZ, temporary or otherwise.	• Assess tree health & condition • Ensure that tree protection measures remain in situ • Ensure that all works are complying with: ◦ Conditions of Consent ◦ Tree Protection Specification & Tree Protection Plan/Drawing ◦ AS4970-2009 • Provide letter of certification in accordance with *section 16.11* of this specification
5	**Post Works Certification** Final inspection of the site & trees	Following project completion to assess tree health & condition post-development	• Confirm that all tree protection measures have been removed • Undertake an assessment of the health & condition of all trees and recommend remedial works if required • Provide letter of certification in accordance with *section 16.11* of this specification

Table 7 - Hold-point Inspection Schedule

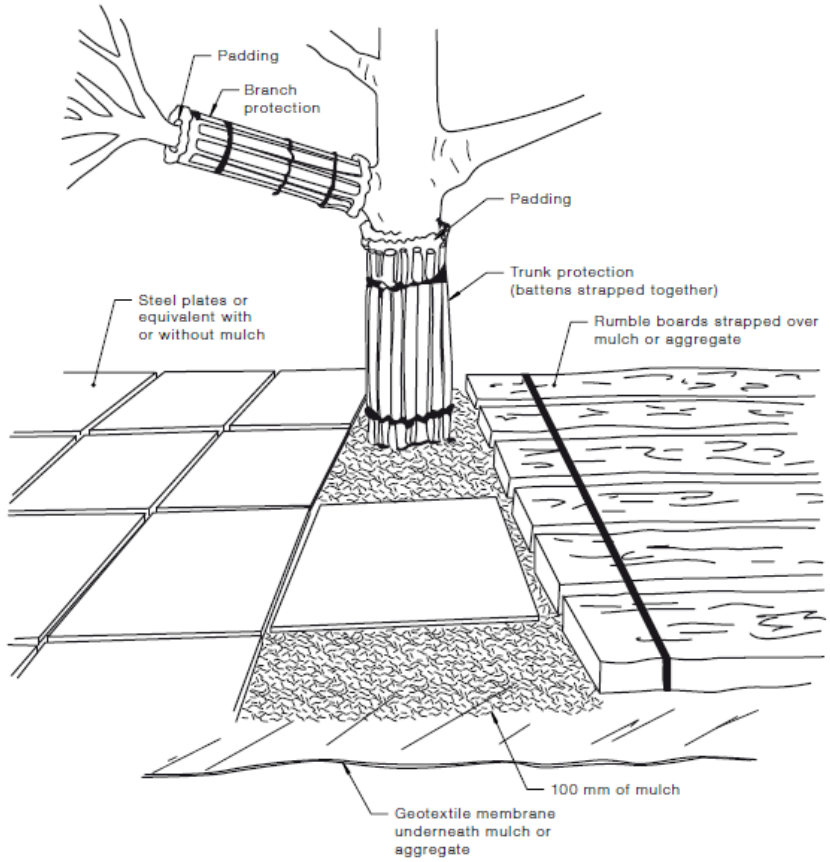
16.13 REFERENCE DIAGRAMS

Figure 16-TPZ Sign Example

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.

Figure 17 - Tree protection fencing example - Image: (Standards Australia, 2009)



NOTES:

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

Figure 18 - Trunk, branch & ground protection example - Image: (Standards Australia, 2009)

17 Tree Protection Drawing

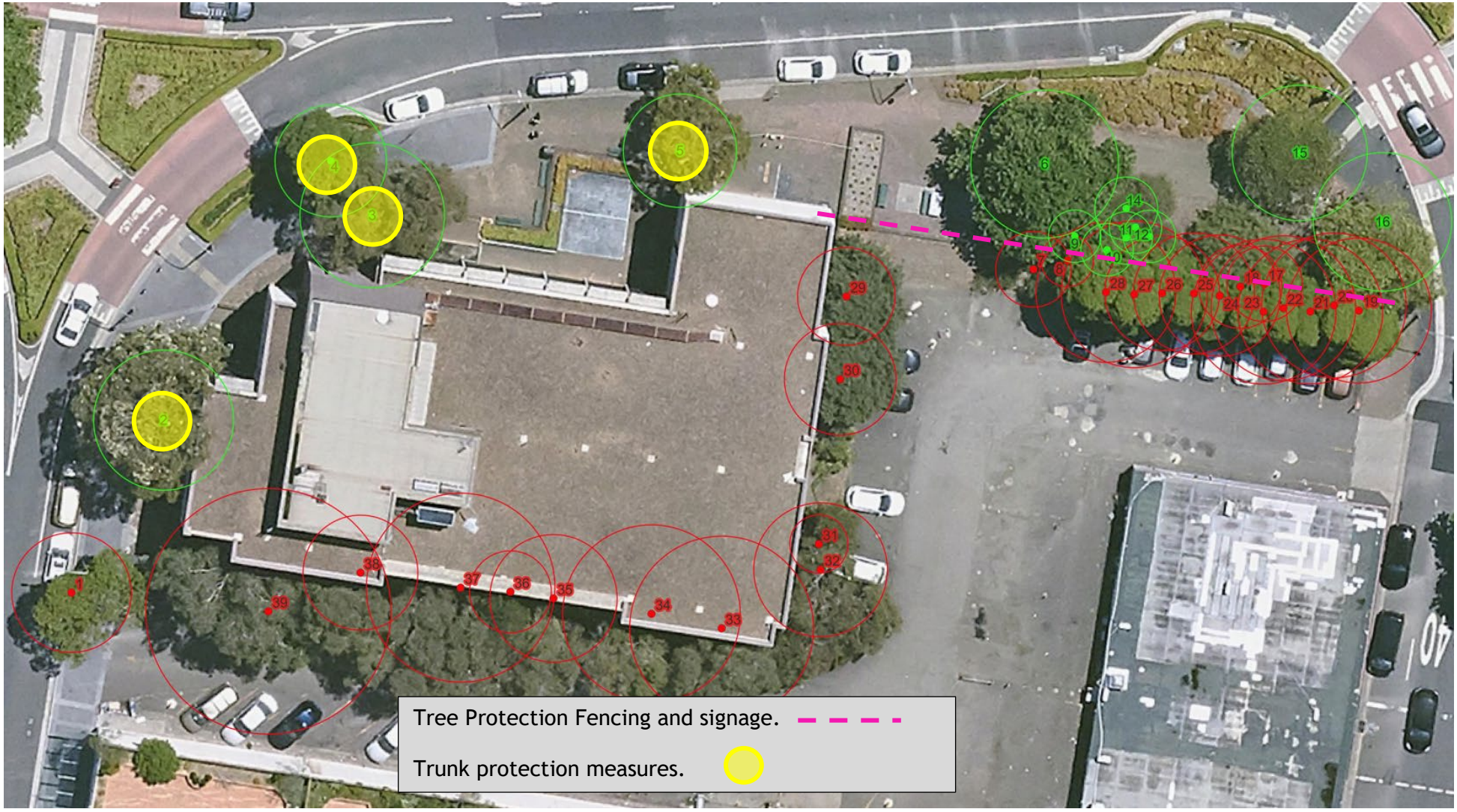


Figure 19-Tree protection drawing.