**ADVANCED TREESCAPE CONSULTING**
**AQF5 ARBORICULTURIST & HORTICULTURIST**
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# ARBORICULTURAL IMPACT ASSESSMENT

## Lot 3, DP242332 "Parkview Estate"
## Tallwoods, Blackhead Road
## HALLIDAYS POINT NSW 2430

**- updated 16/07/2020 -**

**requested by**

**Wales & Associates Pty Ltd**

prepared by

Russell Kingdom
Qualified AQF5 Arboriculturist

16/07/2020

Principal: Russell Kingdom
Fully Insured: Public Liability $20M, Professional Indemnity $5M & Personal Accident.
**Advanced Treescape Consulting is committed to providing a safe working environment for its employees in accordance with The Occupational Health & Safety Act NSW 2000.**

INSTITUTE OF AUSTRALIAN CONSULTING ARBORICULTURISTS
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# 1.0 Proposal

Wales & Associates Pty Ltd has commissioned Advanced Treescape Consulting to prepare an Arboricultural Impact Assessment at 'Parkview Estate' Tallwoods, Blackhead Road, Hallidays Point. This site is in the MidCoast Council Local Government Area where there is a Tree Preservation Order in force.

It is proposed to build a housing estate development.

The subject site was inspected on 25/09/2019. The plans supplied are from Lidbury, Summers & Whiteman (Surveyors, Planners & Engineers), Drawing No. 6397MHE, Issue E, dated 15/07/2020. The site plan in Appendix 1 illustrates the location of all surveyed trees.

This assessment has been carried out by Russell Kingdom: Diploma in Arboriculture (AQF5), Graduate Diploma of Horticulture (AQF8) - Australian Qualification Framework (AQF) (Department of Education and Training, Australian Government) (see Appendix 11).

# 2.0 Scope of Report

- Assess the trees on site identified by council to be retained in Pre-DA meeting. All trees on the site are not assessed in this report.
- Assess the impact of the proposed development on the trees.
- Identify trees to be retained and those that require removal to facilitate the proposed development plans.
- Make recommendations to ensure the impact on the retained trees is acceptable and complies with AS 4970-2009 Protection of trees on development sites (Australian Standard®, 2009).

# 3.0 Site Inspection

The property faces south and is a large parcel of undeveloped land with a single cottage located in the south-western corner. The land gently slopes from north to south.

This site has clearly been used for grazing and there are some remnant trees and regrowth trees located mainly towards the edge of the site and there is a row of trees through the centre of site.

The soil texture was observed to be clay based Failford Road[1] soil. *Failford Road soil qualities and limitations are* localised foundation hazard, localised recharge zone, localised discharge zone, localised gully erosion hazard, localised sheet erosion hazard, localised high run-on, localised poor drainage, localised seasonal waterlogging, localised flood hazard.

Drainage characteristics are considered to be good.

[1] https://www.environment.nsw.gov.au/Salis5app/resources/spade/reports/fru.pdf

## 3.1 Site Assessment

- The microclimate is considered good as all trees appear to have reached their genetic potential.
- There are no re-reflected heat load issues.
- There are no sunlight level issues.
- There is no irrigation visible on the site.
- The site is exposed to all winds.

# 4.0 Method of Assessment

**An objective visual inspection** was made from the ground of the health and condition of the trees based on the Levels of Visual Assessment method (Appendix 4a) – 'Level 2: Basic Assessment Process' (Dunster, et al., 2013) as well as the *Visual Tree Assessment* (VTA) technique described by Mattheck and Breloer (Mattheck, et al., 1994) (Appendix 4b). The Tree Schedule (provided in '5.0 Assessment of VTA, Recommendations of Impact & Tree Protection Measures required by Proposed Plans') was based upon:

- Estimation of tree heights by Silva Clino Master/Heightmeter™ plus visual estimates of canopy spreads.
- Distances of trees, etc. are measured using a Leica Disto™ D2 Laser Distance Meter.
- All photographs that appear in this report are unaltered originals which were taken during site inspection (see Appendix 2).
- Hazard ratings for all trees (see Tree Schedule in clause 5.0 'Assessment of VTA, Impact & Tree Protection Measures') refer to Failure Potential, Size of Defective Part & Target Rating = Hazard Rating is out of 12.
- Significance Rating.
- Calculation of Tree Protection Zones (TPZ) and Structural Root Zones (SRZ) using AS 4970-2009 Protection of trees on development sites (Australian Standard®, 2009) (see Appendix 5 and 6).
- Any additions, mark-ups and/or calculations to plans included in this report have been made using Bluebeam® Revu®[2].
- The application of TPZs and SRZs using AS 4970-2009 Protection of trees on development sites (Australian Standard®, 2009) (see Appendix 7 and 8).
- Glossary (see Appendix 10).
- Trees were numbered with aluminium tags for easy identification.

It should be noted that this objective assessment and related VTA assessments are based upon health and condition that were observed at the time of inspection.

The recommendations of this report regarding retention, works or removal are based upon Safe & Useful Life Expectancy (SULE – see Appendix 9) and hazard ratings being applied.

This information has guided the conclusions in this report.

[2] http://www.bluebeam.com

# 5.0 Assessment of VTA, Impact & Tree Protection Measures required by Proposed Plans

Accepted tree management practices recommend removal of trees where SULE ratings are 3 (or listed as dead), and/or where hazard ratings are high [where ratings adapted from Matheny and Clark range from low=3 to dangerous=12] (Matheny, et al., 1994). A detailed explanation of SULE ratings is provided in Appendix 9. Height/Diameter Ratio should not exceed 1:30 (Mattheck, et al., 1994).

The trees contained within the Tree Schedule (see below) range from having short to long SULEs. These trees also have a broad range of hazard ratings which limits the retention of such trees within development sites.

Appendix 3 provides explanations of abbreviations and assessment criteria.

**Tree Protection Zones for each of the trees that are assessed to be retained and protected are highlighted in yellow in the Tree Schedule below. It should be noted that distance stated is a radius, not a diameter. AS 4970-2009 Protection of trees on development sites (Australian Standard®, 2009) states that an intrusion of the TPZ of less than 10% is considered minor. No above-ground intrusion into the TPZ is to exceed 20% of total TPZ area (e.g. cantilevered building, balcony etc.).**

## *Tree Schedule*

**ABBREVIATIONS: m**-metres, **mm**-millimetres, **DBH**-trunk diameter @ 1.4m, **DGL**-trunk diameter at ground level, **VP**-very poor, **P**-poor, **F**-fair, **G**-good, **VG**-very good, **CD**-co-dominant trunk, **TD**-tri-dominant trunk, **QD**-quad-dominant trunk, **Multi**-5+ trunks/leaders, **J**-juvenile, **YM**-young mature, **SM**-semi mature, **M**-mature, **OM**-over mature, **REC**-recommendation, **S**-save, **R**-remove, **T**-transplant, **C**-council determination, **W**-work needed to be carried out, **mon**-monitor, **VTA**-visual tree assessment, **Hazard Rating**-**3**=low hazard ~ **12**=dangerous, **N/A**-not applicable, **SULE**-safe & useful life expectancy, **STARS**-Significance of a Tree, Assessment Rating System, **BT**-(refer to ecologist report).

| TREE NO. | SPECIES | HEIGHT (m) | DBH (mm) | DGL (mm) | RADIUS OF FULL TPZ (m) | RADIUS OF FULL SRZ (m) | HEALTH/VIGOUR | STRUCTURAL CONDITION | CANOPY SPREAD (m) N S E W | AGE CLASS | VTA | HAZARD RATING (3 - 12) | SIGNIFICANCE RATING | SULE | STARS | (1) COMMENT ON TREE ASSESSMENT (2) ASSESSMENT OF IMPACT (3) TREE PROTECTION MEASURES | REC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 42 | *Eucalyptus pilularis* (Blackbutt) | 10 | 80 | 140 | 2.0 | 1.5 | G | G | 2 radial | J | Pass | 4 | Medium | 2B | Medium | 1. This tree is located outside the 10m set-back from the boundary<br>2. This tree is located within the proposed roadway. Removal is required to facilitate the proposed development plans.<br>3. N/A. | R |
| 43 | *E. pilularis* (Blackbutt) | 30 | 840 | 1010 | 10.1 | 3.3 | G | F | 4 4 4 - | M | Pass | 6 | Medium | 2B | Medium | 1. This tree is located outside the 10m set-back from the boundary<br>2. This tree is located within the proposed roadway. Removal is required to facilitate the proposed development plans.<br>3. N/A. | R |

**ABBREVIATIONS: m**-metres, **mm**-millimetres, **DBH**-trunk diameter @ 1.4m, **DGL**-trunk diameter at ground level, **VP**-very poor, **P**-poor, **F**-fair, **G**-good, **VG**-very good, **CD**-co-dominant trunk, **TD**-tri-dominant trunk, **QD**-quad-dominant trunk, **Multi**-5+ trunks/leaders, **J**-juvenile, **YM**-young mature, **SM**-semi mature, **M**-mature, **OM**-over mature, **REC**-recommendation, **S**-save, **R**-remove, **T**-transplant, **C**-council determination, **W**-work needed to be carried out, **mon**-monitor, **VTA**-visual tree assessment, **Hazard Rating**-**3**=low hazard ~ **12**=dangerous, **N/A**-not applicable, **SULE**-safe & useful life expectancy, **STARS**-Significance of a Tree, Assessment Rating System, **BT**-(refer to ecologist report).

| TREE NO. | SPECIES | HEIGHT (m) | DBH (mm) | DGL (mm) | RADIUS OF FULL TPZ (m) | RADIUS OF FULL SRZ (m) | HEALTH/VIGOUR | STRUCTURAL CONDITION | CANOPY SPREAD (m) N S E W | AGE CLASS | VTA | HAZARD RATING (3 - 12) | SIGNIFICANCE RATING | SULE | STARS | (1) COMMENT ON TREE ASSESSMENT (2) ASSESSMENT OF IMPACT (3) TREE PROTECTION MEASURES | REC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 44 | *Eucalyptus resinifera* (Red Mahogany) | 12 | 480 | 550 | 5.8 | 2.6 | G | G | 8 radial | M | Pass | 4 | Medium | 2B | Low | 1. This tree is located outside the 10m set-back from the boundary<br>2. This tree is located within the proposed roadway. Removal is required to facilitate the proposed development plans.<br>3. N/A. | R |
| 45<br>46<br>47<br>48<br>49 | *Group of 5 x E. pilularis* (Blackbutt) | 12 | 180 | 220 | 2.2 | 1.8 | G | G | 2 radial | J | Pass | 4 | Medium | 2B | Medium | 1. These trees are all saplings along the fence. These trees pass the VTA and are suitable to be considered for retention.<br>2. These trees are located in a proposed park. Retain and protect.<br>3. TPZ fencing is required as per Appendix 8. The size of the TPZ is shown in this table (radius of full TPZ) and highlighted in yellow. | S |
| 79 | *E. microcorys* (Tallow-wood) | 26 | 900 | 1150 | 10.8 | 3.5 | F | G | 8 radial | VM | Pass | 6 | High | 2B | High | 1. This tree has some small deadwood and epicormic shoots.<br>2. This tree is located centrally within Lot 89 of the proposed development. Removal is required to facilitate the proposed development plans.<br>3. N/A | R |
| 80 | *E. microcorys* (Tallow-wood) | 25 | 820 | 1000 | 9.8 | 3.3 | F | G | 8 radial | VM | Pass | 6 | High | 2B | High | 1. This tree has some small deadwood and epicormic shoots.<br>2. This tree is located centrally within Lot 50 of the proposed development. Removal is required to facilitate the proposed development plans.<br>3. N/A | R |
| 92<br>93<br>94 | *Group of 3 x E. pilularis* (Blackbutt) | 12 | 150 | 180 | 2.0 | 1.6 | G | G | 2 radial | J | Pass | 4 | Medium | 2B | Medium | 1. These trees are all saplings along the fence. These trees pass the VTA and are suitable to be considered for retention.<br>2. These trees are located in a proposed park. Retain and protect.<br>3. TPZ fencing is required as per Appendix 8. The size of the TPZ is shown in this table (radius of full TPZ) and highlighted in yellow. | S |

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| TREE NO. | SPECIES | HEIGHT (m) | DBH (mm) | DGL (mm) | RADIUS OF FULL TPZ (m) | RADIUS OF FULL SRZ (m) | HEALTH/VIGOUR | STRUCTURAL CONDITION | CANOPY SPREAD (m) N S E W | AGE CLASS | VTA | HAZARD RATING (3 - 12) | SIGNIFICANCE RATING | SULE | STARS | (1) COMMENT ON TREE ASSESSMENT (2) ASSESSMENT OF IMPACT (3) TREE PROTECTION MEASURES | REC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 95 | *E. pilularis* (Blackbutt) | 28 | 1090 | 1100 | 13.1 | 3.4 | F | G | 10 4 4 10 | VM | Pass | 6 | Medium | 2B | Medium | 1. BT 19. This tree has epicormic shoots, small deadwood and tropism to the north west. This tree passes the VTA and is suitable to be considered for retention.<br>2. This tree is located in a proposed park. Retain and protect.<br>3. TPZ fencing is required as per Appendix 8. The size of the TPZ is shown in this table (radius of full TPZ) and highlighted in yellow. | S |
| 96 | *E. pilularis* (Blackbutt) | 26 | 1200 | 1500 | 14.4 | 3.9 | G | P | 6 6 15 - | VM | Fail | 10 | Low | 3B | **Priority for Removal** | 1. BT 18. This tree has a 30° trunk lean to the east-north-east with heaving soil. There is basal decay present and this tree is dangerous.<br>2. Removal is required to facilitate proposed plans.<br>3. N/A. | R |
| 102 | *Eucalyptus resinifera* (Red Mahogany) | 10 | 200 | 280 | 2.4 | 1.9 | P | G | 3 1 1 1 | YM | Pass | 5 | Low | 2B | Low | 1. BT 20. This tree has a suppressed crown. This tree passes the VTA and is suitable to be considered for retention.<br>2. This tree is located in a proposed park. Retain and protect.<br>3. TPZ fencing is required as per Appendix 8. The size of the TPZ is shown in this table (radius of full TPZ) and highlighted in yellow. | S |
| 103 | *E. resinifera* (Red Mahogany) | 18 | 240 | 300 | 2.9 | 2.0 | G | G | 4 2 2 3 | YM | Pass | 4 | Medium | 2B | Medium | 1. BT 21. This tree has small deadwood and epicormic shoots. This tree passes the VTA and is suitable to be considered for retention.<br>2. This tree is located in a proposed park. Retain and protect.<br>3. TPZ fencing is required as per Appendix 8. The size of the TPZ is shown in this table (radius of full TPZ) and highlighted in yellow. | S |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 104 | *E. microcorys* (Tallow-wood) | 26 | 870 | 990 | 10.4 | 3.3 | F | G | 10 radial | M | Pass | 6 | Medium | 2B | Medium | 1. BT 22. This tree has small deadwood and tip dieback. This tree passes the VTA and is suitable to be considered for retention.<br>2. This tree is located in a proposed park. Retain and protect.<br>3. TPZ fencing is required as per Appendix 8. The size of the TPZ is shown in this table (radius of full TPZ) and highlighted in yellow. | S |
| 105 | *E. pilularis* (Blackbutt) | 16 | 540 | 660 | 6.5 | 2.8 | G | G | 4 radial | YM | Pass | 4 | Medium | 2B | Medium | 1. This tree is good. This tree passes the VTA and is suitable to be considered for retention.<br>2. This tree is located in a proposed park. Retain and protect.<br>3. TPZ fencing is required as per Appendix 8. The size of the TPZ is shown in this table (radius of full TPZ) and highlighted in yellow. | S |
| 106 | *E. microcorys* (Tallow-wood) | 9 | 260 | 320 | 3.1 | 2.1 | G | G | - 2 2 2 | J | Pass | 4 | Medium | 2B | Medium | 1. This tree is good. This tree passes the VTA and is suitable to be considered for retention.<br>2. This tree is located in a proposed park. Retain and protect.<br>3. TPZ fencing is required as per Appendix 8. The size of the TPZ is shown in this table (radius of full TPZ) and highlighted in yellow1 | S |
| 107 | *Allocasuarina littoralis* (Black She-Oak) | 10 | 380 | 400 | 4.6 | 2.3 | G | G | 1 3 3 3 | YM | Pass | 4 | Medium | 2B | Medium | 1. This tree is grouped with T108 & T109 and is on the edge of the dam.<br>2. The full TPZ of these trees will be impacted by the proposed development. The removal of the dam will have a serious impact on this tree. Removal will be required to facilitate the proposed plans.<br>3. N/A | R |
| 108 | *Corymbia intermedia* (Pink Bloodwood) | 14 | 540 | 660 | 6.5 | 2.8 | G | G | 4 radial | M | Pass | 4 | Medium | 2B | Medium | 1. This tree is grouped with T107 & T109 and is on the edge of the dam.<br>2. The full TPZ of these trees will be impacted by the proposed development. The removal of the dam will have a serious impact on this tree. Removal will be required to facilitate the proposed plans.<br>3. N/A | R |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 109 | *A. littoralis* (Black She-Oak) | 10 | 490 | 560 | 5.9 | 2.6 | G | G | 3 1 3 3 | YM | Pass | 4 | Medium | 2B | Medium | 1. This tree is grouped with Tree 107 & 108 and is on the edge of the dam.<br>2. The full TPZ of these trees will be impacted by the proposed development. The removal of the dam will have a serious impact on this tree. Removal will be required to facilitate the proposed plans.<br>3. N/A | R |
| 110 | *E. microcorys* (Tallow-wood) | 14 | 440 | 570 | 5.3 | 2.6 | F | G | 1 3 3 3 | YM | Pass | 4 | Medium | 2B | Medium | 1. This tree is on the dam wall. It has small deadwood and epicormic shoots.<br>2. The full TPZ of this tree will be impacted by the proposed development. The removal of the dam will have a serious impact on this tree. Removal will be required to facilitate the proposed plans.<br>3. N/A | R |
| 111 | *E. microcorys* (Tallow-wood) | 13 | 370 | 465 | 4.4 | 2.4 | F | G | 3 1 3 3 | YM | Pass | 4 | Medium | 2B | Medium | 1. This tree is on the dam wall. It has small deadwood and epicormic shoots.<br>2. The full TPZ of this tree will be impacted by the proposed development. The removal of the dam will have a serious impact on this tree. Removal will be required to facilitate the proposed plans.<br>3. N/A | R |
| 112 | *E. microcorys* (Tallow-wood) | 12 | 300 | 400 | 3.6 | 2.3 | P | F | 3 1 3 3 | YM | Fail | 6 | Low | 3B | Low | 1. This tree has some large deadwood, epicormic shoots and a sparse canopy. This tree fails the VTA and is not suitable to be considered for retention.<br>2. Removal is recommended.<br>3. N/A. | R |
| 113 115 116 119 120 121 123 124 | *Group of 8 x A. littoralis* (Black She-Oak) | up to 8m | 50 to 150 | 100 to 200 | up to 2.0 | up to 1.7 | All F | All F | 1 – 2 radial | J | Pass | 4 | Low to Medium | 2B | Low to Medium | 1. These trees are all saplings.<br>2. The trees within this group that lie within the roadway will need to be removed. Trees that lie within 2m from the edge of the road can be retained.<br>3. N/A or TPZ fencing is required as per Appendix 8. The size of the TPZ is shown in this table (radius of full TPZ) and highlighted in yellow. | R/S |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 114 | *C. intermedia* (Pink Bloodwood) | 12 | 100 | 160 | 2.0 | 1.5 | F | P | 1 radial | J | Pass | 6 | Medium | 2B | Medium | 1. This tree has forest architecture and a small crown.<br>2. The trees within this group that lie within the roadway will need to be removed. Trees that lie within 2m from the edge of the road can be retained.<br>3. N/A or TPZ fencing is required as per Appendix 8. The size of the TPZ is shown in this table (radius of full TPZ) and highlighted in yellow. | R/S |
| 122 | *Eucalyptus propinqua* (Small-fruited Grey Gum) | 3 | 60 | 80 | 2.0 | 1.5 | F | F | 1 radial | J | Pass | 4 | Low | 2B | Low | 1. This tree is at the edge of group at the dam.<br>2. The trees within this group that lie within the roadway will need to be removed. Trees that lie within 2m from the edge of the road can be retained.<br>3. N/A or TPZ fencing is required as per Appendix 8. The size of the TPZ is shown in this table (radius of full TPZ) and highlighted in yellow. | R/S |
| 117<br>118<br>125<br>126 | *Group of 4 x E. microcorys* (Tallow-wood) | up to 10m | 100 to 300 | 140 to 350 | up to 3.6 | up to 2.1 | All F | All F | 1 – 3 radial | J | Pass | 4 | Low to Medium | 2B | Low to Medium | 1. These trees are all saplings.<br>2. The trees within this group that lie within the roadway will need to be removed. Trees that lie within 2m from the edge of the road can be retained.<br>3. N/A or TPZ fencing is required as per Appendix 8. The size of the TPZ is shown in this table (radius of full TPZ) and highlighted in yellow. | R/S |
| 129 | *E. microcorys* (Tallow-wood) | 26 | 840 | 1030 | 10.1 | 3.4 | F | F | 12 radial | VM | Fail | 6 | Medium | 3B | Low | 1. This tree has *Nasutitermes walkeri* (Arboreal Nests – Termites) tracks and was recently poisoned. It has a trunk lean of 3° to the north and the residence is in the target zone. It has some large deadwood, previous failure sites and tip dieback. This tree fails the VTA and is not suitable to be considered for retention.<br>2. Removal is recommended.<br>3. N/A. | R |

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| TREE NO. | SPECIES | HEIGHT (m) | DBH (mm) | DGL (mm) | RADIUS OF FULL TPZ (m) | RADIUS OF FULL SRZ (m) | HEALTH/VIGOUR | STRUCTURAL CONDITION | CANOPY SPREAD (m) N S E W | AGE CLASS | VTA | HAZARD RATING (3 - 12) | SIGNIFICANCE RATING | SULE | STARS | (1) COMMENT ON TREE ASSESSMENT (2) ASSESSMENT OF IMPACT (3) TREE PROTECTION MEASURES | REC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 130 | *E. microcorys* (Tallow-wood) | 14 | 300 | 420 | 3.6 | 2.3 | F | F | 3 radial | YM | Pass | 4 | Medium | 2B | Medium | 1. Habitat Tree #25. This is a habitat tree with small deadwood.<br>2. The full TPZ of this tree will not be impacted by the proposed development. Retain and protect.<br>3. TPZ fencing is required as per Appendix 8. The size of the TPZ is shown in this table (radius of full TPZ) and highlighted in yellow. | S |
| 133 | *E. microcorys* (Tallow-wood) | 16 | 450 | 620 | 5.4 | 2.7 | F | G | 4 1 3 3 | YM | Pass | 4 | Medium | 2B | Medium | 1. Habitat Tree #21. This is a habitat tree with small deadwood and epicormic shoots.<br>2. The full TPZ of this tree will not be impacted by the proposed development. Retain and protect.<br>3. TPZ fencing is required as per Appendix 8. The size of the TPZ is shown in this table (radius of full TPZ) and highlighted in yellow. | S |
| 134 | *E. microcorys* (Tallow-wood) | 15 | CD 320 400 (510) | 550 | 6.1 | 2.6 | G | F | 1 3 3 3 | YM | Pass | 4 | Medium | 2B | Medium | 1. Habitat Tree #22. This is a habitat tree with an inclusive main fork union and tip dieback.<br>2. The full TPZ of this tree will not be impacted by the proposed development. Retain and protect.<br>3. TPZ fencing is required as per Appendix 8. The size of the TPZ is shown in this table (radius of full TPZ) and highlighted in yellow. | R |
| 135 | *E. microcorys* (Tallow-wood) | 14 | 380 | 450 | 4.6 | 2.4 | G | F | 3 radial | YM | Pass | 4 | Medium | 2B | Medium | 1. Habitat Tree #20. This is a habitat tree with small deadwood. This tree passes the VTA and is suitable to be considered for retention.<br>2. This tree is located within a proposed park. Retain and protect.<br>3. TPZ fencing is required as per Appendix 8. The size of the TPZ is shown in this table (radius of full TPZ) and highlighted in yellow. | S |

**ABBREVIATIONS: m**-metres, **mm**-millimetres, **DBH**-trunk diameter @ 1.4m, **DGL**-trunk diameter at ground level, **VP**-very poor, **P**-poor, **F**-fair, **G**-good, **VG**-very good, **CD**-co-dominant trunk, **TD**-tri-dominant trunk, **QD**-quad-dominant trunk, **Multi**-5+ trunks/leaders, **J**-juvenile, **YM**-young mature, **SM**-semi mature, **M**-mature, **OM**-over mature, **REC**-recommendation, **S**-save, **R**-remove, **T**-transplant, **C**-council determination, **W**-work needed to be carried out, **mon**-monitor, **VTA**-visual tree assessment, **Hazard Rating**-**3**=low hazard ~ **12**=dangerous, **N/A**-not applicable, **SULE**-safe & useful life expectancy, **STARS**-Significance of a Tree, Assessment Rating System, **BT**-(refer to ecologist report).

| TREE NO. | SPECIES | HEIGHT (m) | DBH (mm) | DGL (mm) | RADIUS OF FULL TPZ (m) | RADIUS OF FULL SRZ (m) | HEALTH/VIGOUR | STRUCTURAL CONDITION | CANOPY SPREAD (m) N S E W | AGE CLASS | VTA | HAZARD RATING (3 - 12) | SIGNIFICANCE RATING | SULE | STARS | (1) COMMENT ON TREE ASSESSMENT (2) ASSESSMENT OF IMPACT (3) TREE PROTECTION MEASURES | REC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 136 | *C. intermedia* (Pink Bloodwood) | 22 | 420 | 610 | 5.0 | 2.7 | G | G | 6 radial | M | Pass | 5 | Medium | 2B | Medium | 1. Habitat Tree #19. This is a habitat tree and is co-dominant at 1.8m. It has an inclusive main fork union and small deadwood. This tree passes the VTA and is suitable to be considered for retention.<br>2. This tree is located within a proposed park. The full TPZ of this tree will not be impacted. Retain and protect.<br>3. TPZ fencing is required as per Appendix 8. The size of the TPZ is shown in this table (radius of full TPZ) and highlighted in yellow. | S |
| 137 | *E. microcorys* (Tallow-wood) | 20 | 450 | 620 | 5.4 | 2.7 | F | F | 4 4 6 4 | M | Pass | 5 | Medium | 2B | Medium | 1. Habitat Tree #18. This is a habitat tree with small deadwood and tip dieback. This tree passes the VTA and is suitable to be considered for retention.<br>2. This tree is located within a proposed park. The full TPZ of this tree will not be impacted. Retain and protect.<br>3. TPZ fencing is required as per Appendix 8. The size of the TPZ is shown in this table (radius of full TPZ) and highlighted in yellow. | S |
| 138 | *E. microcorys* (Tallow-wood) | 24 | 450 | 600 | 5.4 | 2.7 | F | F | 5 radial | M | Pass | 5 | Medium | 2B | Medium | 1. Habitat Tree #17. This is a habitat tree with small deadwood and tip dieback. This tree passes the VTA and is suitable to be considered for retention.<br>2. This tree is located within a proposed park. The full TPZ of this tree will not be impacted. Retain and protect.<br>3. TPZ fencing is required as per Appendix 8. The size of the TPZ is shown in this table (radius of full TPZ) and highlighted in yellow. | S |
| 139 | *C. intermedia* (Pink Bloodwood) | 17 | 420 | 560 | 5.0 | 2.6 | P | P | 4 radial | YM | Pass | 8 | Low | 3B | Low | 1. Habitat Tree #16. This is a habitat tree with small deadwood, tip dieback and a suppressed canopy.<br>2. This tree is located within a proposed park. The full TPZ of this tree will not be impacted. Retain and protect.<br>3. TPZ fencing is required as per Appendix 8. The size of the TPZ is shown in this table (radius of full TPZ) and highlighted in yellow. | S |

**ABBREVIATIONS: m**-metres, **mm**-millimetres, **DBH**-trunk diameter @ 1.4m, **DGL**-trunk diameter at ground level, **VP**-very poor, **P**-poor, **F**-fair, **G**-good, **VG**-very good, **CD**-co-dominant trunk, **TD**-tri-dominant trunk, **QD**-quad-dominant trunk, **Multi**-5+ trunks/leaders, **J**-juvenile, **YM**-young mature, **SM**-semi mature, **M**-mature, **OM**-over mature, **REC**-recommendation, **S**-save, **R**-remove, **T**-transplant, **C**-council determination, **W**-work needed to be carried out, **mon**-monitor, **VTA**-visual tree assessment, **Hazard Rating**-**3**=low hazard ~ **12**=dangerous, **N/A**-not applicable, **SULE**-safe & useful life expectancy, **STARS**-Significance of a Tree, Assessment Rating System, **BT**-(refer to ecologist report).

| TREE NO. | SPECIES | HEIGHT (m) | DBH (mm) | DGL (mm) | RADIUS OF FULL TPZ (m) | RADIUS OF FULL SRZ (m) | HEALTH/VIGOUR | STRUCTURAL CONDITION | CANOPY SPREAD (m) N S E W | AGE CLASS | VTA | HAZARD RATING (3 - 12) | SIGNIFICANCE RATING | SULE | STARS | (1) COMMENT ON TREE ASSESSMENT (2) ASSESSMENT OF IMPACT (3) TREE PROTECTION MEASURES | REC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 140 | *Eucalyptus siderophloia* (Northern Grey Ironbark) | 26 | 560 | 720 | 6.7 | 2.9 | G | G | 6 4 6 6 | M | Pass | 5 | High | 2B | High | 1. This tree has small and large deadwood. This tree passes the VTA and is suitable to be considered for retention.<br>2. This tree is located within a proposed park. The full TPZ of this tree will not be impacted. Retain and protect.<br>3. TPZ fencing is required as per Appendix 8. The size of the TPZ is shown in this table (radius of full TPZ) and highlighted in yellow. | S |
| 141 | *E. siderophloia* (Northern Grey Ironbark) | 26 | 480 | 700 | 5.8 | 2.9 | G | G | 10 4 6 6 | M | Pass | 5 | High | 2B | High | 1. This tree has small deadwood, epicormic shoots and mistletoe. This tree passes the VTA and is suitable to be considered for retention.<br>2. This tree is located within a proposed park. The full TPZ of this tree will not be impacted. Retain and protect.<br>3. TPZ fencing is required as per Appendix 8. The size of the TPZ is shown in this table (radius of full TPZ) and highlighted in yellow. | S |
| 142 | *E. siderophloia* (Northern Grey Ironbark) | 25 | 470 | 840 | 5.6 | 3.1 | G | G | 4 8 6 6 | M | Pass | 5 | High | 2B | High | 1. This tree has epicormic shoots, small deadwood and tip dieback. This tree passes the VTA and is suitable to be considered for retention.<br>2. This tree is located within a proposed park. The full TPZ of this tree will not be impacted. Retain and protect.<br>3. TPZ fencing is required as per Appendix 8. The size of the TPZ is shown in this table (radius of full TPZ) and highlighted in yellow. | S |
| 143 | *E. microcorys* (Tallow-wood) | 10 | 400 | 450 | 4.8 | 2.4 | G | G | 3 radial | YM | Pass | 4 | Medium | 2B | Medium | 1. This tree is in the fence with wire around the trunk. This tree passes the VTA and is suitable to be considered for retention.<br>2. This tree is located close to the boundary in a proposed park. The full TPZ of this tree will not be impacted by the proposed development. Retain and protect.<br>3. TPZ fencing is required as per Appendix 8. The size of the TPZ is shown in this table (radius of full TPZ) and highlighted in yellow. | S |

**ABBREVIATIONS: m**-metres, **mm**-millimetres, **DBH**-trunk diameter @ 1.4m, **DGL**-trunk diameter at ground level, **VP**-very poor, **P**-poor, **F**-fair, **G**-good, **VG**-very good, **CD**-co-dominant trunk, **TD**-tri-dominant trunk, **QD**-quad-dominant trunk, **Multi**-5+ trunks/leaders, **J**-juvenile, **YM**-young mature, **SM**-semi mature, **M**-mature, **OM**-over mature, **REC**-recommendation, **S**-save, **R**-remove, **T**-transplant, **C**-council determination, **W**-work needed to be carried out, **mon**-monitor, **VTA**-visual tree assessment, **Hazard Rating**-**3**=low hazard ~ **12**=dangerous, **N/A**-not applicable, **SULE**-safe & useful life expectancy, **STARS**-Significance of a Tree, Assessment Rating System, **BT**-(refer to ecologist report).

| TREE NO. | SPECIES | HEIGHT (m) | DBH (mm) | DGL (mm) | RADIUS OF FULL TPZ (m) | RADIUS OF FULL SRZ (m) | HEALTH/VIGOUR | STRUCTURAL CONDITION | CANOPY SPREAD (m) N S E W | AGE CLASS | VTA | HAZARD RATING (3 - 12) | SIGNIFICANCE RATING | SULE | STARS | (1) COMMENT ON TREE ASSESSMENT (2) ASSESSMENT OF IMPACT (3) TREE PROTECTION MEASURES | REC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 144 | *E. propinqua* (Small-fruited Grey Gum) | 26 | 450 | 500 | 5.4 | 2.5 | G | F | 6 radial | M | Pass | 5 | Medium | 2B | Medium | 1. This tree has forest architecture and small deadwood. This tree passes the VTA and is suitable to be considered for retention.<br>2. This tree is located within a proposed park. The full TPZ of this tree will not be impacted. Retain and protect.<br>3. TPZ fencing is required as per Appendix 8. The size of the TPZ is shown in this table (radius of full TPZ) and highlighted in yellow. | S |
| 145 | *E. siderophloia* (Northern Grey Ironbark) | 26 | 456 | 630 | 5.5 | 2.7 | G | G | 6 radial | M | Pass | 5 | Medium | 2B | Medium | 1. Habitat Tree #9. This is a habitat tree. This tree passes the VTA and is suitable to be considered for retention.<br>2. This tree is located within a proposed park. The full TPZ of this tree will not be impacted. Retain and protect.<br>3. TPZ fencing is required as per Appendix 8. The size of the TPZ is shown in this table (radius of full TPZ) and highlighted in yellow. | S |
| 146 | *E. siderophloia* (Northern Grey Ironbark) | 26 | 440 | 590 | 5.3 | 2.7 | G | G | 6 6 4 4 | M | Pass | 5 | Medium | 2B | Medium | 1. Habitat Tree #8. This is a habitat tree.<br>2. The full TPZ of this tree will be impacted by the proposed development. This tree is located within the proposed roadway. Removal is required to facilitate the proposed roadway.<br>3. N/A. | R |
| 147 | *E. microcorys* (Tallow-wood) | 14 | 360 | 480 | 4.3 | 2.4 | G | G | 4 radial | M | Pass | 4 | Medium | 2B | Medium | 1. Habitat Tree #1. This is a habitat tree.<br>2. The full TPZ of this tree will be impacted by the proposed development. This tree is located within the proposed roadway. Removal is required to facilitate the proposed roadway.<br>3. N/A. | R |
| 148 | *E. propinqua* (Small-fruited Grey Gum) | 24 | 520 | 710 | 6.2 | 2.9 | G | G | 8 4 6 6 | M | Pass | 5 | Medium | 2B | Medium | 1. Habitat Tree #2. This is a habitat tree.<br>2. The full TPZ of this tree will be impacted by the proposed development. This tree is located within the proposed roadway. Removal is required to facilitate the proposed roadway.<br>3. N/A. | R |

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| TREE NO. | SPECIES | HEIGHT (m) | DBH (mm) | DGL (mm) | RADIUS OF FULL TPZ (m) | RADIUS OF FULL SRZ (m) | HEALTH/VIGOUR | STRUCTURAL CONDITION | CANOPY SPREAD (m) N S E W | AGE CLASS | VTA | HAZARD RATING (3 - 12) | SIGNIFICANCE RATING | SULE | STARS | (1) COMMENT ON TREE ASSESSMENT (2) ASSESSMENT OF IMPACT (3) TREE PROTECTION MEASURES | REC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 149 | *E. microcorys* (Tallow-wood) | 22 | 460 | 520 | 5.5 | 2.5 | G | G | 4 radial | M | Pass | 5 | Medium | 2B | Medium | 1. Habitat Tree #3. This is a habitat tree. This tree passes the VTA and is suitable to be considered for retention.<br>2. This tree is located within a proposed park. The full TPZ of this tree will not be impacted by the proposed development. Retain and protect.<br>3. TPZ fencing is required as per Appendix 8. The size of the TPZ is shown in this table (radius of full TPZ) and highlighted in yellow. | S |
| 150 | *Eucalyptus carnea* (Thick-leaved Mahogany) | 16 | 410 | 500 | 4.9 | 2.5 | G | G | 4 radial | M | Pass | 4 | Medium | 2B | Medium | 1. Habitat Tree #7. This is a habitat tree. This tree passes the VTA and is suitable to be considered for retention.<br>2. This tree is located within a proposed park. The full TPZ of this tree will not be impacted by the proposed development. Retain and protect.<br>3. TPZ fencing is required as per Appendix 8. The size of the TPZ is shown in this table (radius of full TPZ) and highlighted in yellow. | S |
| 151 | *E. siderophloia* (Northern Grey Ironbark) | 22 | 450 | 650 | 5.4 | 2.8 | F | G | 6 radial | M | Pass | 5 | Medium | 2B | Medium | 1. Habitat Tree #4. This is a habitat tree with a basal trunk wound, epicormic shoots, small deadwood and tip dieback. This tree passes the VTA and is suitable to be considered for retention.<br>2. This tree is located within a proposed park. The full TPZ of this tree will not be impacted by the proposed development. Retain and protect.<br>3. TPZ fencing is required as per Appendix 8. The size of the TPZ is shown in this table (radius of full TPZ) and highlighted in yellow. | S |
| 152 | *E. carnea* (Thick-leaved Mahogany) | 18 | 320 | 420 | 3.8 | 2.3 | G | G | 4 radial | M | Pass | 4 | Medium | 2B | Medium | 1. Habitat Tree #5. This is a habitat tree. This tree passes the VTA and is suitable to be considered for retention.<br>2. This tree is located within a proposed park. The full TPZ of this tree will not be impacted by the proposed development. Retain and protect.<br>3. TPZ fencing is required as per Appendix 8. The size of the TPZ is shown in this table (radius of full TPZ) and highlighted in yellow. | S |

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| TREE NO. | SPECIES | HEIGHT (m) | DBH (mm) | DGL (mm) | RADIUS OF FULL TPZ (m) | RADIUS OF FULL SRZ (m) | HEALTH/VIGOUR | STRUCTURAL CONDITION | CANOPY SPREAD (m) N S E W | AGE CLASS | VTA | HAZARD RATING (3 - 12) | SIGNIFICANCE RATING | SULE | STARS | (1) COMMENT ON TREE ASSESSMENT (2) ASSESSMENT OF IMPACT (3) TREE PROTECTION MEASURES | REC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 153 | *E. carnea* (Thick-leaved Mahogany) | 20 | 450 | 560 | 5.4 | 2.6 | F | G | 4 6 4 6 | M | Pass | 5 | Medium | 2B | Medium | 1. Habitat Tree #6. This is a habitat tree. This tree passes the VTA and is suitable to be considered for retention.<br>2. This tree is located within a proposed park. The full TPZ of this tree will not be impacted by the proposed development. Retain and protect.<br>3. TPZ fencing is required as per Appendix 8. The size of the TPZ is shown in this table (radius of full TPZ) and highlighted in yellow. | S |
| 163 | *E. pilularis* (Blackbutt) | 34 | 1970 | 3400 | 15.0 | 5.5 | F | VP | 20 10 20 20 | OM | Fail | 12 | Low | 4D | **Priority for Removal** | 1. This is a habitat tree. It has a 15° trunk lean to the north, heaving soil, and a basal trunk wound. The trunk hollow 1.6m – north/south and 1.4m east/west (t/R 76.14% - 23.86%) This tree is hollow to the crown. This tree is Dangerous.<br>2. Removal is recommended.<br>3. N/A | R |
| 182 | *Eucalyptus microcorys x pilularis* (Tallow-wood x Blackbutt) | 24 | 750 | 920 | 9.0 | 3.2 | G | F | 8 2 4 4 | VM | Pass | 8 | Medium | 2D | Medium | 1. Habitat Tree #28. This is a habitat tree with some small deadwood, epicormic shoots and tip dieback. The crown has failed and there is a *Nasutitermes walkeri* (Arboreal Nests – Termites) nest.<br>2. The full TPZ of this tree will be impacted by the proposed development. This tree is located in the proposed roadway. Removal is required to facilitate the proposed roadway.<br>3. N/A. | R |
| 183 | *E. microcorys* (Tallow-wood) | 16 | 400 | 510 | 4.8 | 2.5 | F | F | 6 - 2 2 | M | Fail | 8 | Low | 3B | Low | 1. Habitat Tree #29. This is a habitat tree with a failed crown, basal trunk wound, some small deadwood, epicormic shoots and is unbalanced. This tree fails the VTA and is not suitable to be considered for retention.<br>2. Removal is recommended.<br>3. N/A. | R |

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| TREE NO. | SPECIES | HEIGHT (m) | DBH (mm) | DGL (mm) | RADIUS OF FULL TPZ (m) | RADIUS OF FULL SRZ (m) | HEALTH/VIGOUR | STRUCTURAL CONDITION | CANOPY SPREAD (m) N S E W | AGE CLASS | VTA | HAZARD RATING (3 - 12) | SIGNIFICANCE RATING | SULE | STARS | (1) COMMENT ON TREE ASSESSMENT (2) ASSESSMENT OF IMPACT (3) TREE PROTECTION MEASURES | REC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 184 | *C. intermedia* (Pink Bloodwood) | 20 | 440 | 610 | 5.3 | 2.7 | G | G | 6 2 3 3 | M | Pass | 5 | Medium | 2B | Medium | 1. Habitat Tree #30. This is a habitat tree with some small deadwood and epicormic shoots. This tree passes the VTA and is suitable to be considered for retention.<br>2. The full TPZ of this tree will not be impacted by the proposed development. This tree is located in a proposed park. Works within the TPZ must be supervised by the project arborist (AQF5). Retain and protect.<br>3. TPZ fencing is required as per Appendix 8. The size of the TPZ is shown in this table (radius of full TPZ) and highlighted in yellow. | S |
| 185 | *E. microcorys* (Tallow-wood) | 25 | 450 | 600 | 5.4 | 2.7 | F | F | 6 radial | M | Pass | 6 | Medium | 2B | Medium | 1. Habitat Tree #27. This is a habitat tree with some small deadwood, forest architecture, epicormic shoots and a sparse canopy. This tree passes the VTA and is suitable to be considered for retention.<br>2. The full TPZ of this tree will not be impacted by the proposed development. This tree is located in a proposed park. Works within the TPZ must be supervised by the project arborist (AQF5). Retain and protect.<br>3. TPZ fencing is required as per Appendix 8. The size of the TPZ is shown in this table (radius of full TPZ) and highlighted in yellow. | S |
| 186 | *E. microcorys* (Tallow-wood) | 25 | 480 | 630 | 5.8 | 2.7 | G | G | 6 1 6 6 | M | Pass | 6 | Medium | 2B | Medium | 1. Habitat Tree #25. This is a habitat tree with some small deadwood. This tree passes the VTA and is suitable to be considered for retention.<br>2. The full TPZ of this tree will not be impacted by the proposed development. This tree is located in a proposed park. Works within the TPZ must be supervised by the project arborist (AQF5). Retain and protect.<br>3. TPZ fencing is required as per Appendix 8. The size of the TPZ is shown in this table (radius of full TPZ) and highlighted in yellow. | S |

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| TREE NO. | SPECIES | HEIGHT (m) | DBH (mm) | DGL (mm) | RADIUS OF FULL TPZ (m) | RADIUS OF FULL SRZ (m) | HEALTH/VIGOUR | STRUCTURAL CONDITION | CANOPY SPREAD (m) N S E W | AGE CLASS | VTA | HAZARD RATING (3 - 12) | SIGNIFICANCE RATING | SULE | STARS | (1) COMMENT ON TREE ASSESSMENT (2) ASSESSMENT OF IMPACT (3) TREE PROTECTION MEASURES | REC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 187 | *E. microcorys* (Tallow-wood) | 24 | 460 | 620 | 5.5 | 2.7 | G | G | 6 2 2 6 | M | Pass | 4 | Medium | 2B | Medium | 1. Habitat Tree #26. This is a habitat tree with some small deadwood and epicormic shoots. This tree passes the VTA and is suitable to be considered for retention.<br>2. The full TPZ of this tree will not be impacted by the proposed development. This tree is located in a proposed park. Works within the TPZ must be supervised by the project arborist (AQF5). Retain and protect.<br>3. TPZ fencing is required as per Appendix 8. The size of the TPZ is shown in this table (radius of full TPZ) and highlighted in yellow. | S |
| 188 | *E. microcorys* (Tallow-wood) | 18 | 450 | 670 | 5.4 | 2.8 | G | G | 5 4 2 6 | M | Pass | 4 | Medium | 2B | Medium | 1. Habitat Tree #23. This is a habitat tree with some small deadwood and tropism to the west. This tree passes the VTA and is suitable to be considered for retention.<br>2. The full TPZ of this tree will not be impacted by the proposed development. This tree is located in a proposed park. Works within the TPZ must be supervised by the project arborist (AQF5). Retain and protect.<br>3. TPZ fencing is required as per Appendix 8. The size of the TPZ is shown in this table (radius of full TPZ) and highlighted in yellow. | S |
| 189 | *E. microcorys* (Tallow-wood) | 24 | 480 | 650 | 5.8 | 2.8 | G | G | 6 radial | M | Pass | 4 | Medium | 2B | Medium | 1. Habitat Tree #24. This is a habitat tree with some small deadwood and epicormic shoots. This tree passes the VTA and is suitable to be considered for retention.<br>2. The full TPZ of this tree will not be impacted by the proposed development. This tree is located in a proposed park. Works within the TPZ must be supervised by the project arborist (AQF5). Retain and protect.<br>3. TPZ fencing is required as per Appendix 8. The size of the TPZ is shown in this table (radius of full TPZ) and highlighted in yellow. | S |

**ABBREVIATIONS: m**-metres, **mm**-millimetres, **DBH**-trunk diameter @ 1.4m, **DGL**-trunk diameter at ground level, **VP**-very poor, **P**-poor, **F**-fair, **G**-good, **VG**-very good, **CD**-co-dominant trunk, **TD**-tri-dominant trunk, **QD**-quad-dominant trunk, **Multi**-5+ trunks/leaders, **J**-juvenile, **YM**-young mature, **SM**-semi mature, **M**-mature, **OM**-over mature, **REC**-recommendation, **S**-save, **R**-remove, **T**-transplant, **C**-council determination, **W**-work needed to be carried out, **mon**-monitor, **VTA**-visual tree assessment, **Hazard Rating**-**3**=low hazard ~ **12**=dangerous, **N/A**-not applicable, **SULE**-safe & useful life expectancy, **STARS**-Significance of a Tree, Assessment Rating System, **BT**-(refer to ecologist report).

| TREE NO. | SPECIES | HEIGHT (m) | DBH (mm) | DGL (mm) | RADIUS OF FULL TPZ (m) | RADIUS OF FULL SRZ (m) | HEALTH/VIGOUR | STRUCTURAL CONDITION | CANOPY SPREAD (m) N S E W | AGE CLASS | VTA | HAZARD RATING (3 - 12) | SIGNIFICANCE RATING | SULE | STARS | (1) COMMENT ON TREE ASSESSMENT (2) ASSESSMENT OF IMPACT (3) TREE PROTECTION MEASURES | REC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 190 | *C. intermedia* (Pink Bloodwood) | 14 | 200 | 280 | 2.4 | 1.9 | F | G | 3 radial | YM | Pass | 4 | Low | 2B | Low | 1. Habitat Tree #22. This is a habitat tree with some small deadwood, previous failure sites and the crown is suppressed by Tree 191. This tree passes the VTA and is suitable to be considered for retention.<br>2. The full TPZ of this tree will not be impacted by the proposed development. This tree is located in a proposed park. Works within the TPZ must be supervised by the project arborist (AQF5). Retain and protect.<br>3. TPZ fencing is required as per Appendix 8. The size of the TPZ is shown in this table (radius of full TPZ) and highlighted in yellow. | S |
| 191 | *E. pilularis* (Blackbutt) | 26 | 980 | 1300 | 11.8 | 15.0 | G | G | 10 radial | M | Pass | 6 | Medium | 2B | Medium | 1. Habitat Tree #21. This is a habitat tree with some small deadwood, previous failure sites and some epicormic shoots. This tree passes the VTA and is suitable to be considered for retention.<br>2. The full TPZ of this tree will not be impacted by the proposed development. This tree is located in a proposed park. Works within the TPZ must be supervised by the project arborist (AQF5). Retain and protect.<br>3. TPZ fencing is required as per Appendix 8. The size of the TPZ is shown in this table (radius of full TPZ) and highlighted in yellow. | S |
| 193 | *E. pilularis* (Blackbutt) | 26 | CD 480 180 (680) | 1200 | 8.2 | 3.6 | G | G | 10 4 8 8 | M | Pass | 6 | Medium | 2B | Medium | 1. Habitat Tree #18. This is a habitat tree with some small deadwood and previous failure sites. This tree passes the VTA and is suitable to be considered for retention.<br>2. The full TPZ of this tree will not be impacted by the proposed development. This tree is located in a proposed park. Works within the TPZ must be supervised by the project arborist (AQF5). Retain and protect.<br>3. TPZ fencing is required as per Appendix 8. The size of the TPZ is shown in this table (radius of full TPZ) and highlighted in yellow. | S |

**ABBREVIATIONS: m**-metres, **mm**-millimetres, **DBH**-trunk diameter @ 1.4m, **DGL**-trunk diameter at ground level, **VP**-very poor, **P**-poor, **F**-fair, **G**-good, **VG**-very good, **CD**-co-dominant trunk, **TD**-tri-dominant trunk, **QD**-quad-dominant trunk, **Multi**-5+ trunks/leaders, **J**-juvenile, **YM**-young mature, **SM**-semi mature, **M**-mature, **OM**-over mature, **REC**-recommendation, **S**-save, **R**-remove, **T**-transplant, **C**-council determination, **W**-work needed to be carried out, **mon**-monitor, **VTA**-visual tree assessment, **Hazard Rating**-**3**=low hazard ~ **12**=dangerous, **N/A**-not applicable, **SULE**-safe & useful life expectancy, **STARS**-Significance of a Tree, Assessment Rating System, **BT**-(refer to ecologist report).

| TREE NO. | SPECIES | HEIGHT (m) | DBH (mm) | DGL (mm) | RADIUS OF FULL TPZ (m) | RADIUS OF FULL SRZ (m) | HEALTH/VIGOUR | STRUCTURAL CONDITION | CANOPY SPREAD (m) N S E W | AGE CLASS | VTA | HAZARD RATING (3 - 12) | SIGNIFICANCE RATING | SULE | STARS | (1) COMMENT ON TREE ASSESSMENT (2) ASSESSMENT OF IMPACT (3) TREE PROTECTION MEASURES | REC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 194 | *E. pilularis* (Blackbutt) | 26 | 950 | 1100 | 11.4 | 3.4 | G | G | 8 10 6 6 | M | Pass | 6 | Medium | 2B | Medium | 1. Habitat Tree #20. This is a habitat tree with some small deadwood. This tree passes the VTA and is suitable to be considered for retention.<br>2. The full TPZ of this tree will not be impacted by the proposed development. This tree is located in a proposed park. Works within the TPZ must be supervised by the project arborist (AQF5). Retain and protect.<br>3. TPZ fencing is required as per Appendix 8. The size of the TPZ is shown in this table (radius of full TPZ) and highlighted in yellow. | S |
| 195 | *E. pilularis* (Blackbutt) | 26 | 940 | 950 | 11.3 | 3.2 | G | G | 2 10 10 10 | M | Pass | 6 | Medium | 2B | Medium | 1. Habitat Tree #19. This is a habitat tree with some small deadwood and epicormic shoots. This tree passes the VTA and is suitable to be considered for retention.<br>2. The full TPZ of this tree will not be impacted by the proposed development. This tree is located in a proposed park. Works within the TPZ must be supervised by the project arborist (AQF5). Retain and protect.<br>3. TPZ fencing is required as per Appendix 8. The size of the TPZ is shown in this table (radius of full TPZ) and highlighted in yellow. | S |
| 197 | *E. pilularis* (Blackbutt) | 18 | 680 | 810 | 8.2 | 3.0 | G | F | 8 4 8 10 | M | Pass | 6 | Medium | 2D | Medium | 1. Habitat Tree #17. This is a habitat tree. This tree is stag headed, has some large deadwood, a basal trunk wound and epicormic shoots.<br>2. The full TPZ of this tree will be impacted by the proposed development. This tree is located in the proposed building lot. Removal is required to facilitate the proposed development plans.<br>3. N/A. | R |

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| TREE NO. | SPECIES | HEIGHT (m) | DBH (mm) | DGL (mm) | RADIUS OF FULL TPZ (m) | RADIUS OF FULL SRZ (m) | HEALTH/VIGOUR | STRUCTURAL CONDITION | CANOPY SPREAD (m) N S E W | AGE CLASS | VTA | HAZARD RATING (3 - 12) | SIGNIFICANCE RATING | SULE | STARS | (1) COMMENT ON TREE ASSESSMENT (2) ASSESSMENT OF IMPACT (3) TREE PROTECTION MEASURES | REC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 198 | *E. pilularis* (Blackbutt) | 24 | 1210 | 1400 | 14.5 | 3.8 | G | G | 12 radial | M | Pass | 6 | Medium | 2B | Medium | 1. Habitat Tree #16. This is a habitat tree.<br>2. The full TPZ of this tree will be impacted by the proposed development. This tree is located in the proposed building lot. The sewer runs under this tree. Removal is required to facilitate the proposed development plans.<br>3. N/A. | R |
| A | *E. siderophloia* (Northern Grey Ironbark) | 26 | 550 | 800 | 6.6 | 3.0 | G | G | 8 8 2 8 | M | Pass | 5 | Medium | 2B | Medium | 1. Habitat Tree #10 (no tag). This tree has small deadwood This tree passes the VTA and is suitable to be considered for retention.<br>2. This tree is located within a proposed park. The full TPZ of this tree will not be impacted by the proposed development. Retain and protect.<br>3. TPZ fencing is required as per Appendix 8. The size of the TPZ is shown in this table (radius of full TPZ) and highlighted in yellow. | S |
| B | *E. siderophloia* (Northern Grey Ironbark) | 22 | 460 | 640 | 5.5 | 2.7 | G | G | 4 radial | M | Pass | 4 | Medium | 2B | Medium | 1. Habitat Tree #11 (no tag). This tree has small deadwood. This tree passes the VTA and is suitable to be considered for retention.<br>2. This tree is located within a proposed park. The full TPZ of this tree will not be impacted by the proposed development. Retain and protect.<br>3. TPZ fencing is required as per Appendix 8. The size of the TPZ is shown in this table (radius of full TPZ) and highlighted in yellow. | S |
| 308 | *E. microcorys* (Tallow-wood) | 24 | 720 | 1130 | 8.6 | 2.5 | G | G | 8 radial | M | Pass | 6 | Medium | 2B | Medium | 1. Habitat Tree #2. This is a habitat tree with some small deadwood, tip dieback and previous failure sites.<br>2. The full TPZ of this tree will be impacted by the proposed development. This tree is located in a proposed building lot. Removal is required to facilitate the proposed development plans.<br>3. N/A. | R |

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| TREE NO. | SPECIES | HEIGHT (m) | DBH (mm) | DGL (mm) | RADIUS OF FULL TPZ (m) | RADIUS OF FULL SRZ (m) | HEALTH/VIGOUR | STRUCTURAL CONDITION | CANOPY SPREAD (m) N S E W | AGE CLASS | VTA | HAZARD RATING (3 - 12) | SIGNIFICANCE RATING | SULE | STARS | (1) COMMENT ON TREE ASSESSMENT (2) ASSESSMENT OF IMPACT (3) TREE PROTECTION MEASURES | REC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 309 | *E. resinifera* (Red Mahogany) | 24 | CD 460 450 (640) | 820 | 7.7 | 3.0 | G | F | 6 6 6 2 | M | Pass | 6 | Medium | 2B | Medium | 1. Habitat Tree #1. This is a habitat tree with some small deadwood, horizontal branches, tip dieback and previous failure sites.<br>2. The full TPZ of this tree will be impacted by the proposed development. This tree is located in a proposed roadway, footpath and Lot 158. Removal is required to facilitate the proposed roadway.<br>3. N/A. | R |
| 310 | *C. intermedia* (Pink Bloodwood) | 24 | 430 | 550 | 5.2 | 2.6 | G | G | 6 radial | M | Pass | 5 | Medium | 2B | Medium | 1. Habitat Tree #3. This is a habitat tree with some small deadwood.<br>2. The full TPZ of this tree will be impacted by the proposed development. This tree is located in a proposed roadway, footpath and Lot 177. Removal is required to facilitate the proposed roadway.<br>3. N/A. | R |
| 311 | *C. intermedia* (Pink Bloodwood) | 18 | 340 | 450 | 4.1 | 2.4 | F | G | 6 6 6 4 | M | Pass | 6 | Medium | 2B | Medium | 1. Habitat Tree #4. This is a habitat tree with new epicormic shoots and some small deadwood.<br>2. The full TPZ of this tree will be impacted by the proposed development. This tree is located in a proposed roadway. Removal is required to facilitate the proposed roadway.<br>3. N/A. | R |
| 312 | *C. intermedia* (Pink Bloodwood) | 24 | 310 | 450 | 3.7 | 2.4 | G | F | 4 4 8 - | M | Pass | 6 | Medium | 2B | Medium | 1. Habitat Tree #6. This is a habitat tree with forest architecture, epicormic shoots and is unbalanced.<br>2. The full TPZ of this tree will be impacted by the proposed development. This tree is located in a proposed footpath and Lot 175/176. Removal is required to facilitate the proposed development plans.<br>3. N/A. | R |

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| TREE NO. | SPECIES | HEIGHT (m) | DBH (mm) | DGL (mm) | RADIUS OF FULL TPZ (m) | RADIUS OF FULL SRZ (m) | HEALTH/VIGOUR | STRUCTURAL CONDITION | CANOPY SPREAD (m) N S E W | AGE CLASS | VTA | HAZARD RATING (3 - 12) | SIGNIFICANCE RATING | SULE | STARS | (1) COMMENT ON TREE ASSESSMENT (2) ASSESSMENT OF IMPACT (3) TREE PROTECTION MEASURES | REC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 313 | *E. resinifera* (Red Mahogany) | 26 | 1210 | 1410 | 13.4 | 3.8 | F | P | 8 8 6 4 | OM | Fail | 10 | Low | 3B | Low | 1. Habitat Tree #7 This tree is stag headed, has a 5° trunk lean to the south, some large deadwood and is declining. There is a *Nasutitermes walkeri* (Arboreal Nests – Termites) nest. This tree fails the VTA and is not suitable to be considered for retention.<br>2. Removal is recommended.<br>3. N/A. | R |
| 314 | *C. intermedia* (Pink Bloodwood) | 24 | CD 280 340 (440) | 710 | 5.3 | 2.9 | G | G | 4 6 6 2 | M | Pass | 6 | Medium | 2B | Medium | 1. Habitat Tree #5. This is a habitat tree with some small deadwood.<br>2. The full TPZ of this tree will be impacted by the proposed development. This tree is located in a proposed roadway. Removal is required to facilitate the proposed roadway.<br>3. N/A. | R |
| 315 | *E. microcorys* (Tallow-wood) | 22 | 510 | 720 | 6.1 | 2.9 | G | F | 6 - 6 2 | M | Pass | 6 | Medium | 2B | Medium | 1. Habitat Tree #8. This is a habitat tree with some small deadwood, a 3° trunk lean to the north east and is unbalanced.<br>2. The full TPZ of this tree will be impacted by the proposed development. This tree is located within the building lot. This tree would be isolated & would not remain viable. Removal is required to facilitate the proposed plans.<br>3. N/A. | R |
| 316 | *E. microcorys* (Tallow-wood) | 22 | 890 | 1100 | 10.7 | 3.4 | F | VP | 8 6 6 10 | OM | Fail | 10 | Low | 3B | Low | 1. Habitat Tree #3 (no tag) This tree is stag headed, has horizontal branches and some large deadwood. There is a *Nasutitermes walkeri* (Arboreal Nests – Termites) nest, a basal trunk wound and a 3° trunk lean. This tree fails the VTA and is not suitable to be considered for retention.<br>2. Removal is recommended.<br>3. N/A. | R |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 317 | *E. resinifera* (Red Mahogany) | 18 | 960 | 1210 | 11.5 | 3.6 | P | VP | 4 4 4 6 | OM | Fail | 8 | Low | 3B | Low | 1. Habitat Tree #2. This is a habitat tree which is stag headed and a 3° trunk lean to the south. It has some large deadwood, epicormic shoots, tip dieback and is declining. This tree fails the VTA and is not suitable to be considered for retention.<br>2. Removal is recommended.<br>3. N/A. | R |
| 318 | *E. microcorys* (Tallow-wood) | 16 | 560 | 230 | 6.7 | 2.9 | G | G | 6 radial | M | Pass | 5 | Medium | 2B | Medium | 1. This tree has some small deadwood.<br>2. The full TPZ of this tree will be impacted by the proposed development. This tree is located in a proposed roadway. Removal is required to facilitate the proposed roadway.<br>3. N/A. | R |
| 319 | *E. resinifera* (Red Mahogany) | 12 | 190 | 250 | 2.3 | 1.9 | G | G | 4 2 2 4 | YM | Pass | 4 | Medium | 2B | Medium | 1. This tree has a suppressed crown.<br>2. The full TPZ of this tree will be impacted by the proposed development. This tree is located in a proposed roadway, footpath and Lot 105. Removal is required to facilitate the proposed roadway.<br>3. N/A. | R |
| 320 | *C. intermedia* (Pink Bloodwood) | 22 | 460 | 640 | 5.5 | 2.8 | G | G | 6 radial | M | Pass | 6 | Medium | 2B | Medium | 1. This tree has some small deadwood.<br>2. The full TPZ of this tree will be impacted by the proposed development. This tree is located in a proposed building Lot 105. Removal is required to facilitate the proposed roadway.<br>3. N/A. | R |
| 322 | *E. resinifera* (Red Mahogany) | 15 | CD 280 280 (400) | 600 | 4.8 | 2.7 | G | G | 6 2 2 6 | M | Pass | 6 | Medium | 2B | Medium | 1. This tree is unbalanced and has tropism to the north west.<br>2. The full TPZ of this tree will be impacted by the proposed development. This tree is located within a proposed building Lot 105. This tree would be isolated & would not remain viable. Removal is required to facilitate the proposed plans.<br>3. N/A. | R |

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| TREE NO. | SPECIES | HEIGHT (m) | DBH (mm) | DGL (mm) | RADIUS OF FULL TPZ (m) | RADIUS OF FULL SRZ (m) | HEALTH/VIGOUR | STRUCTURAL CONDITION | CANOPY SPREAD (m) N S E W | AGE CLASS | VTA | HAZARD RATING (3 - 12) | SIGNIFICANCE RATING | SULE | STARS | (1) COMMENT ON TREE ASSESSMENT (2) ASSESSMENT OF IMPACT (3) TREE PROTECTION MEASURES | REC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 323 | *E. pilularis* (Blackbutt) | 26 | 760 | 1000 | 9.1 | 3.3 | G | F | 10 radial | M | Pass | 6 | Medium | 2B | Medium | 1. This tree is codominant at 1.6m and has an inclusive main fork union.<br>2. The full TPZ of this tree will be impacted by the proposed development. This tree is located within a proposed building Lot 94. This tree would be isolated & would not remain viable. Removal is required to facilitate the proposed plans.<br>3. N/A. | R |
| 324 | *E. resinifera* (Red Mahogany) | 16 | 390 | 460 | 4.7 | 2.4 | G | G | 6 radial | M | Pass | 5 | Medium | 2B | Medium | 1. This tree has some small deadwood.<br>2. The full TPZ of this tree will be impacted by the proposed development. This tree is located within a proposed building Lot 94. This tree would be isolated & would not remain viable. Removal is required to facilitate the proposed plans.<br>3. N/A. | R |
| 325 | *E. pilularis* (Blackbutt) | 15 | 530 | 680 | 6.4 | 2.7 | F | VP | 10 radial | OM | Fail | 12 | Low | 3B | **Priority for Removal** | 1. This tree has basal decay, a wound 6m to 10m, scaffold branches failing and hanging. It has some large deadwood and tip dieback. This tree is Dangerous. This tree fails the VTA and is not suitable to be considered for retention.<br>2. Removal is recommended.<br>3. N/A. | R |
| 326 | *E. propinqua* (Small-fruited Grey Gum) | 24 | 510 | 680 | 6.1 | 2.8 | P | P | 6 8 6 6 | OM | Fail | 10 | Low | 3B | Low | 1. This tree is stag headed. It has some small deadwood, tip dieback and is declining. This tree fails the VTA and is not suitable to be considered for retention.<br>2. Removal is recommended.<br>3. N/A. | R |
| 327 | *E. propinqua* (Small-fruited Grey Gum) | 26 | 580 | 730 | 7.0 | 2.9 | P | P | 6 radial | OM | Fail | 10 | Low | 3B | Low | 1. Habitat Tree #8. This is a habitat tree which is stag headed and is declining. It has some small deadwood, tip dieback and has a *Nasutitermes walkeri* (Arboreal Nests – Termites) nest. This tree fails the VTA and is not suitable to be considered for retention.<br>2. Removal is recommended.<br>3. N/A. | R |

**ABBREVIATIONS: m**-metres, **mm**-millimetres, **DBH**-trunk diameter @ 1.4m, **DGL**-trunk diameter at ground level, **VP**-very poor, **P**-poor, **F**-fair, **G**-good, **VG**-very good, **CD**-co-dominant trunk, **TD**-tri-dominant trunk, **QD**-quad-dominant trunk, **Multi**-5+ trunks/leaders, **J**-juvenile, **YM**-young mature, **SM**-semi mature, **M**-mature, **OM**-over mature, **REC**-recommendation, **S**-save, **R**-remove, **T**-transplant, **C**-council determination, **W**-work needed to be carried out, **mon**-monitor, **VTA**-visual tree assessment, **Hazard Rating**-**3**=low hazard ~ **12**=dangerous, **N/A**-not applicable, **SULE**-safe & useful life expectancy, **STARS**-Significance of a Tree, Assessment Rating System, **BT**-(refer to ecologist report).

| TREE NO. | SPECIES | HEIGHT (m) | DBH (mm) | DGL (mm) | RADIUS OF FULL TPZ (m) | RADIUS OF FULL SRZ (m) | HEALTH/VIGOUR | STRUCTURAL CONDITION | CANOPY SPREAD (m) N S E W | AGE CLASS | VTA | HAZARD RATING (3 - 12) | SIGNIFICANCE RATING | SULE | STARS | (1) COMMENT ON TREE ASSESSMENT (2) ASSESSMENT OF IMPACT (3) TREE PROTECTION MEASURES | REC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 328 | *E. propinqua* (Small-fruited Grey Gum) | 22 | 630 | 820 | 7.6 | 3.0 | F | F | 4 radial | VM | Pass | 6 | Medium | 2B | Medium | 1. This tree has small deadwood, epicormic shoot and is stressed. It passes the VTA and is suitable to be considered for retention.<br>2. The full TPZ of this tree will not be impacted by the proposed development. This tree is located within a proposed park. Retain and protect.<br>3. TPZ fencing is required as per Appendix 8. The size of the TPZ is shown in this table (radius of full TPZ) and highlighted in yellow. | S |
| 329 | *E. microcorys* (Tallow-wood) | 8 | TD 100 180 240 (320) | 600 | 3.8 | 2.7 | G | VP | 2 radial | J | Fail | 5 | Low | 3B | Low | 1. This tree has coppiced growth and is a poor specimen. This tree fails the VTA and is not suitable to be considered for retention.<br>2. Removal is recommended.<br>3. N/A. | R |
| 330 | *E. microcorys* (Tallow-wood) | 16 | 530 | 680 | 6.4 | 2.7 | F | VP | 4 6 6 6 | M | Fail | 8 | Low | 3B | Low | 1. This tree has reaction wood in the trunk, is stag headed, has tip dieback and some large deadwood. This tree fails the VTA and is not suitable to be considered for retention.<br>2. Removal is recommended.<br>3. N/A. | R |

# 5.1 Discussion

**TREES THAT PASS THE VTA (ONSITE) & ARE TO BE RETAINED:** 45, 46, 47, 48, 49, 92, 93, 94, 95, 102, 103, 104, 105, 106, 130, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 149, 150, 151, 152, 153, 184, 185, 186, 187, 188, 189, 190, 191, 193, 194, 195, A, B & 328.

**TREES THAT FAIL THE VTA & ARE RECOMMENDED TO BE REMOVED:** 96, 112, 129, 163, 183, 313, 316, 317, 325, 326, 327, 329 & 330.

**TREES THAT REQUIRE REMOVAL TO FACILITATE THE PROPOSED DEVELOPMENT PLANS:** 42, 43, 44, 79, 80, 107, 108, 109, 110, 111, 134, 146, 147, 148, 182, 197, 198, 308, 309, 310, 311, 312, 314, 315, 318, 319, 320, 322, 323 & 324.

**TREES LOCATED WITHIN 2M OF THE EDGE OF THE ROAD IN THIS GROUP WILL NEED TO BE REMOVED (ALL OTHER TREES IN THIS GROUP OT BE RETAINED):**.....
.....113, 114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125 & 126.

The subject site has previously had trees identified by MidCoast Council as priorities for retention. Each of these trees has been individually assessed and the proposed plans have also been considered as to the impact on these trees. Many of the trees identified by Council for retention are in a stressed condition and are not suitable for retention. With extensive changes to the soil conditions and site usage, many of the trees would not remain viable in the future. This is typical of residentially zoned land which is subject to redevelopment.

Trees located along the rear boundary of the site are numbered 45 to 49, 92 to 95 and 102 to 106 are all suitably located with a proposed communal recreation area and will provide substantial amenity to the site. Also, along the rear boundary Tree A & B, Tree 135 to 145 and Tree 149 to 153, 106 and 129 through to 153 are all suitably located with a proposed communal recreation area and will provide substantial amenity to the site.

Trees 113 to 126 are all located around an existing dam. Due to the density of the trees in this group they are unable to be individually located on plans. When the dam is filled and levelled, this will change the soil conditions. This work will impact some of these trees. The trees within this group that are located within the roadway and within 2m from the edge of the road and will need to be removed. All other trees in this group will be able to be retained as the roadworks will not impact their SRZs. Retained trees will require TPZ fencing as per Appendix 8.

In relation to the trees located in the centre of the site which are numbered 308 through to 328, many of these trees are not suitable to be considered for retention as they are in a highly stressed condition and poor health.

Trees 184 to 195 are all located with proposed communal recreation areas. These trees are to be retained and will provide important amenity to the site.

Tree 163 is an extremely old tree that is completely piped. In the past, this tree has been of a significant nature, but it is now completely hollow within the barrel. It has a significant lean of 15° and a height of 34m with heaving soil in the tension side of the root plate. This specimen is considered dangerous as the decay and burnt out section of the trunk exceeds the t/R ratio of 70/30 (t/R 76.14% - 23.86%). Detailed measurements were required for the t/R assessment which clearly showed this to be the case. These measurements were obtained using a trunk diameter tape by entering a hollow of this large tree at the base and measuring the DBH internally by affixing the diameter tape using small, unobtrusive tacks in order to obtain an accurate measurement. The actual viable timber in the trunk of this tree will

be less than this measurement as there was a large amount of burnt charcoal on this inside of the trunk. because of the above issues this tree has been assessed[3].

In the event of a failure the target zone of this tree will be within an area identified for future residences, roadways and footpaths that are to be built. The removal of this tree should be regarded as a priority. If left within the development, it could pose a serious public risk factor that would be unacceptable within a residential environment.

Matheny and Clark state that forest formed trees are not suitable to be retained on residential development sites because the trees roots extend up to 2 times the height of the tree. The hydrology of the site during and after development will change greatly which will impact the trees in the long term (Matheny, et al., 1994).

It is always proven to be a more sustainable long-term outcome to replant suitable species on a disturbed site as these trees will grow into good quality trees with a long useful life expectancy having adapted to the new landform and site hydrology.

**WASTEWATER PLANS**
The wastewater plans show the location of all sewer pipes. These plans have been assessed and the impact of works included in this report.

## 5.2 Tree Significance (Appendix 4)

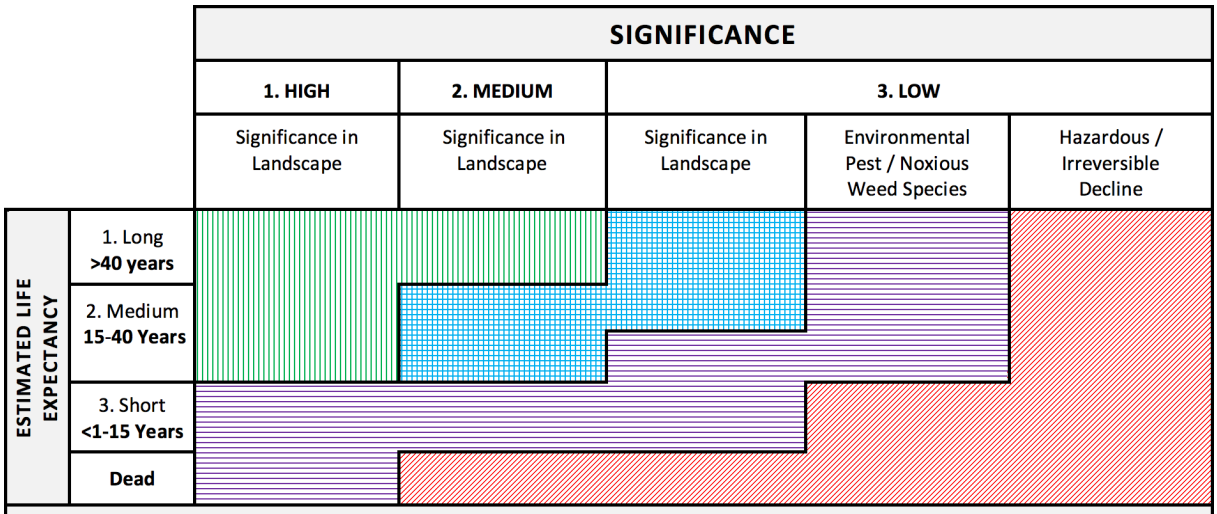
- Tree 79, 80, 140, 141 & 142 listed in this report are of **high** significance.
- Tree 42, 43, 44, 45, 46, 47, 48, 49, 92, 93, 94, 95, 103, 104, 105, 106, 107, 108, 109, 110, 111, 114, 129, 130, 133, 134, 135, 136, 137, 138, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152, 153, 182, 184, 185, 186, 187, 188, 189, 191, 193, 194, 195, 197, 198, A, B, 308, 309, 310, 311, 312, 314, 315, 318, 319, 320, 322, 323, 324 & 328 listed in this report are of **medium** significance.
- Tree 96, 102, 112, 122, 139, 163, 183, 190, 313, 316, 317, 325, 326, 327, 329 & 330 listed in this report are of **low** significance.
- Tree groups 113, 115, 116, 117, 118, 119, 120, 123, 124, 125 & 126 are listed as being **low to medium** significance.

[3] Some specialists suggest that any lean greater than 15°, particularly if it is in the direction of the target, is probably cause for removal. (Worrall) - see Appendix 10: Glossary, pg. 77/78 for more information.

https://forestpathology.org/hazard-trees/hazard-tree-defects

# 5.3 Significance of a Tree, Assessment Rating System (STARS)

## TABLE 1.0 TREE RETENTION VALUE - PRIORITY MATRIX.




**Legend for Matrix Assessment**

| | |
|---|---|
| | **Priority for Retention (High) -** These trees are considered important for retention and should be retained and protected. Design modification or relocation of building/s should be considered to accommodate the setbacks as detailed in Table 2. Special construction works 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 a 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. |

## SUMMARY OF TREES & STARS RECOMMENDATIONS

- Tree 79, 80, 140, 141 & 142 listed in this report have a **High** STARS rating (Priority for Retention).
- Tree 42, 43, 45, 46, 47, 48, 49, 92, 93, 94, 95, 103, 104, 105, 106, 107, 108, 109, 110, 111, 114, 130, 133, 134, 135, 136, 137, 138, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152, 153, 182, 184, 185, 186, 187, 188, 189, 191, 193, 194, 195, 197, 198, A, B, 308, 309, 310, 311, 312, 314, 315, 318, 319, 320, 322, 323, 324 & 328 listed in this report have a **Medium** STARS rating (Consider for Retention).
- Tree 44, 102, 112, 122, 129, 139, 183, 190, 313, 316, 317, 326, 327, 329 & 330 listed in this report have a **Low** STARS rating (Consider for Removal).
- Tree 96, 163 & 325 listed in this report have a **Priority for Removal**.
- Tree groups 113, 115, 116, 117, 118, 119, 120, 123, 124, 125 & 126 are listed as **Low to Medium** STARS.

# 6.0 Tree Protection Plan

## for Lot 3, "Parkview Estate", Tallwoods; Blackhead Road HALLIDAYS POINT NSW 2430

### *a) Project Arborist (AQF5)*

A project arborist (AQF5) is to be engaged to supervise implementation of works for the duration of construction.

### *b) Induction for Tree Protection*

All workers entering the site involved in construction must be advised of the tree protection measures and specifications outlined within this report during the site induction. This is to be verbally acknowledged and signed off before the commencement of works.

### *c) Identify Further Potential Impacts on Trees by Proposed Plans*

- No fill soils be used in any TPZ unless approved by MidCoast Council.
- Soil cuts are not permitted in any TPZ unless approved by MidCoast Council.
- Services should not be in or run through any TPZ unless approved by MidCoast Council.
- Site Office/Toilet, etc., are not to be located within any TPZ unless approved by MidCoast Council.
- All materials must not be stored in any TPZ unless approved by MidCoast Council.
- Aeration of the soil is managed by the TPZ fencing. Refer to AS 4970-2009 Protection of trees on development sites (Australian Standard®, 2009).
- An area is to be set aside for tradespeople to wash down equipment away from any TPZ. The location of the wash down point should be approved by the project arborist unless approved by MidCoast Council.

### *d) Tree Protection Zones using AS 4970-2009 Protection of trees on development sites (Australian Standard®, 2009)*

DBH – Diameter at Breast Height (1.4 metres)
DGL – Diameter at Ground Level
TPZ = DBH (stem) x 12 (radius)
SRZ radius = $(D \times 50)^{0.42} \times 0.64$

See Appendix 5 and Appendix 6
**Refer to the Tree Schedule in clause 5.0 'Assessment of VTA, Impact & Tree Protection Measures' required by Proposed Plans' for TPZ and SRZ details**

* Minimum TPZ is 2 metres – Maximum TPZ is 15 metres | # Minimum SRZ is 1.5 metres

## *e) Tree Protection Works*

- TPZ fences are to be erected around the retained trees (Tree 45, 46, 47, 48, 49, 92, 93, 94, 95, 102, 103, 104, 105, 106, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 149, 150, 151, 152, 153, 184, 185, 186, 187, 188, 189, 190, 191, 193, 194, 195, A, B & 328) before construction commences (see Appendix 8).
- The distance from the tree trunk to the TPZ fence is specified in Tree Schedule in clause 5.0 'Assessment of VTA, Impact & Tree Protection Measures' and highlighted. N.B: This is a radius, not diameter.
- The TPZ fence is to be constructed of two (2) metres high temporary chain wire fencing. This is preferable to star pickets as it would require them to be hammered into the ground which could damage roots. This action will greatly reduce the stress on the trees. The TPZ fence should be left in place until the landscaping phase of construction begins.
- TPZ signage as per Appendix 7 to be attached to TPZ fencing.

## *f) Tree Works*

- All tree work is to be carried out by a suitably qualified and insured Arborist (AQF3).
- Any crown reduction/management works required must comply with AS 4373-2007 Pruning of amenity trees (Australian Standard®, 2007).

## *g) Tree Protection Schedule*

1. Mark all trees on site for removal or retention - certification letter required.
2. Inspect site after tree removal and certify trees identified for retention are still there - certification letter required.
3. Inspect tree protection fencing. Ensure that all requirements of approved development application (DA) have been complied with - certification letter required.
4. After the initial certification inspection and arboriculturist appointment letter, the site will be regularly inspected at monthly intervals unless otherwise specified in approved DA.
5. Supervision of in-ground works as specified in the DA e.g. root cutting trenching, pipe installation etc. - certification letter required.
6. At the completion of works all tree protection measures are to be inspected and when appropriate, authorised to be removed - certification letter required.
7. Supervision of landscaping in-ground works within the TPZs of retained trees - certification of correct planting and landscaping procedures required.
8. Certification of correct planting methods for replacement trees as specified in an approved landscape plan - certification for planting of replacement trees required.

# 7.0 Tree Protection Stages

## *a) Works Prior to Demolition of Residence.*

- All trees within the site are to be marked for Removal or Protection (retention).
- TPZ fencing to be erected around retained trees as per Appendix 8 prior to any works commencing.
- TPZ fencing is to be inspected by the Project Arborist (AQF5) and a letter certifying compliance is to be sent to the Principal Certifying Authority.

## *b) Works During Demolition*

- Tree removal works can be carried out during demolition by a suitably qualified and insured Arborist (AQF3).
- All TPZ fencing is to be retained during works.

## *c) Excavation/Earthworks*

There will be earthworks to level the site. Any tree roots encountered within the works area need to be correctly terminated by the Project Arborist (AQF5), which is cut by a hand saw and not smashed off with an excavator bucket. Correctly terminating a root will ensure that the tree roots do not suffer from decay.

## *d) Construction Works*

TPZ fencing to remain in place during construction and regularly inspected by the project arborist.

## *e) Landscaping Phase*

- The TPZ fencing may be removed during the Landscaping Phase.
- All trees removed should, where practicable, be replaced at the landscaping phase as part of the proposed Development Application (DA).
- At the landscaping phase, the retained trees must only have tube stock plants planted with the structural root zone (SRZ). No additional (fill) soil is to be added within the TPZ of any retained tree.
- The Project Arborist (AQF5) should supervise planting with TPZ areas of retained trees.

# 8.0 Conclusions

The proposed development would require the removal of a large number of proposed residential sites to accommodate the retention of trees identified by the council. Some of the trees are suitably located to be retained and could easily be accommodated, but the retention of all the trees identified by council is not realistic as many of these trees are stressed and unsuitable to be considered for retention.

As previously stated Matheny and Clark (Matheny, et al., 1994) indicated the retention of trees on construction sites is not recommended and it has been well documented and proven that removal of trees on a site like this, with suitable replacement plantings will provide the best long-term amenity for the site and surrounding area.

# 9.0 Recommendations

Implement all recommendations contained in Clauses 5.0, 5.1, 6.0 & 7.0.

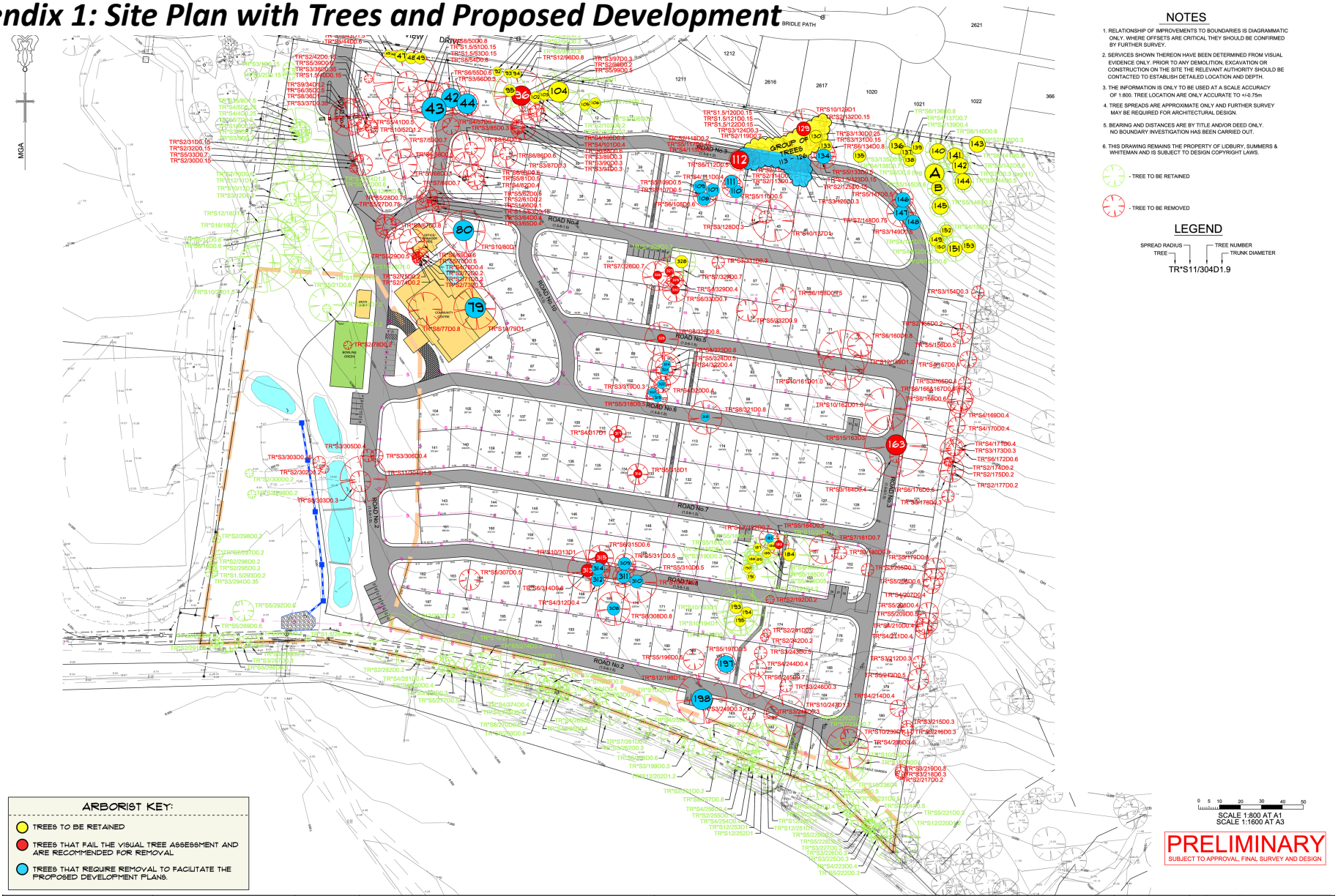
**Reason:** These recommendations have been developed in accordance with AS 4970-2009 (Australian Standard®, 2009) to reduce the impact of the proposed development on the retained trees.

The trees to be removed have been assessed as being unsuitable to be considered for retention or they have an unacceptable impact from the proposed development.

Russell Kingdom
Arboriculturist & Horticulturist

MIACA MAIH MAA
Diploma of Arboriculture (AQF5) | Graduate Diploma of Horticulture (AQF8)

# *Appendix 1: Site Plan with Trees and Proposed Development*




NOTE: The contractor shall check and verify all works on site (including works by others) before commencing any works. All discrepancies are to be reported to the Project Manager or Lidbury, Summers & Whiteman prior to commencing work. Do not scale dimensions from the plan. All dimensions to be confirmed by dimensions from the plan. All dimensions to be confirmed by Lidbury, Summers & Whiteman.



HORIZONTAL
CO-ORDINATE SYSTEM: MGA LOCAL
MARKS ADOPTED: SSM
EAST: NORTH:

PLOT FILE/DWG No.: F:\D6397\6397MHE\6397MHE PRELIM R&D new layout.dwg

VERTICAL
DATUM: AHD
BENCHMARK: SSM
R.L.:

DRAWN/CHECKED: SH

PROJECT

# CONCEPT PLAN FOR DEVELOPMENT OF LOT 3 DP 242332 COASTAL VIEW DRIVE - TALLWOODS TREE RETENTION / REMOVAL PLAN

LS&W LIDBURY, SUMMERS & WHITEMAN
CONSULTING SURVEYORS, PLANNERS & ENGINEERS
INCORPORATING DEGOTARDI, SMITH & PARTNERS (FORSTER)
1st FLOOR, 3 WHARF ST. FORSTER 2428 (02) 65547988 FAX (02) 65549378
PO BOX 510 FORSTER NSW 2428 EMAIL consult@lswsurveyors.com.au WEBSITE www.lswsurveyors.com.au

SCALES
HORIZONTAL: 1:800
VERTICAL: N/A
SHEET SIZE: A1

FIELD SHEETS
Date of survey:

COUNCIL: MID-COAST

DATE: 14/06/18

SHEET 1 OF 1

FILE No.: 6397MHE

| ISSUE | DATE | COMMENTS |
|---|---|---|
| A | 21/01/20 | FIRST ISSUE |
| B | 15/06/20 | SECOND ISSUE |
| C | 30/06/20 | THIRD ISSUE |
| D | 08/07/20 | FOURTH ISSUE |
| E | 15/07/20 | FIFTH ISSUE |

# *Appendix 2: Photographs of Trees on the Site*

Figure 1

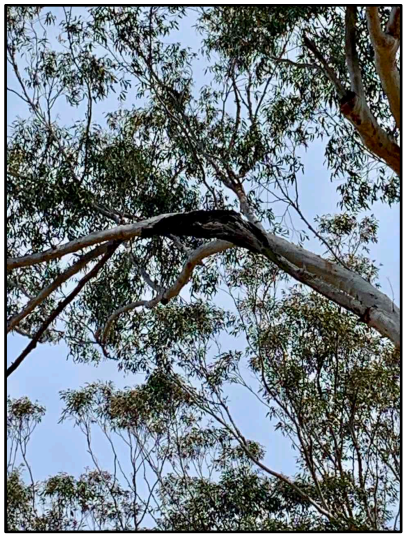


Figure 2

Figure 3

Figure 4

Figure 5

Figure 6

Figure 7

Figure 8

Figure 9

Figure 10

Figure 11

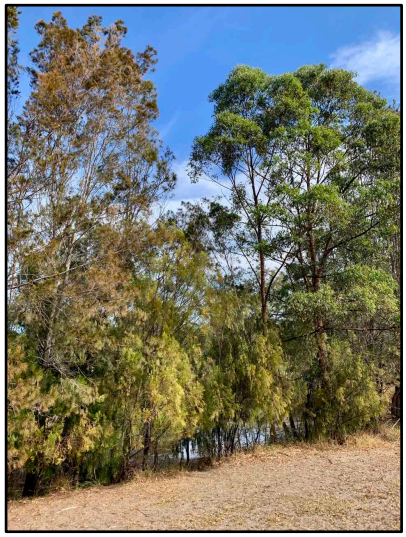


Figure 12

Figure 13

Figure 14

Figure 15

Figure 16

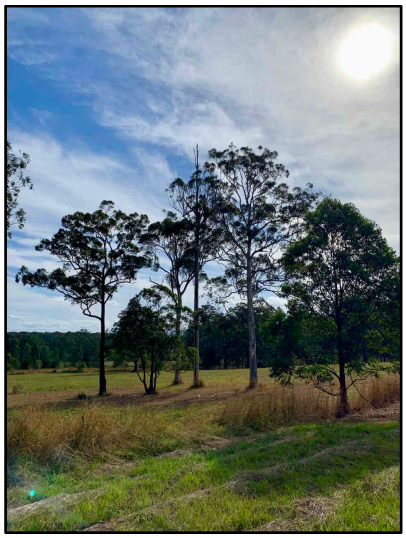


Figure 17

Figure 18

Figure 19

Figure 20

Figure 21

Figure 22

Figure 23

Figure 24

Figure 25

Figure 26

Figure 27

Figure 28

Figure 29

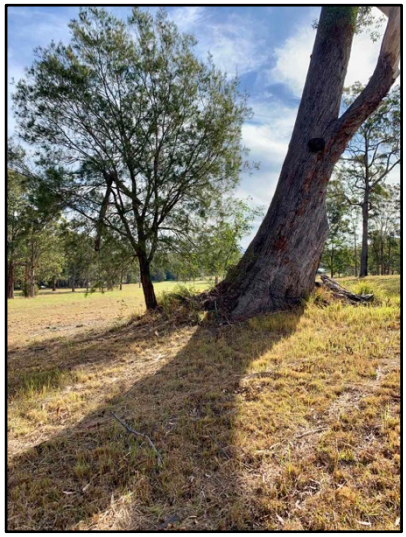


Figure 30

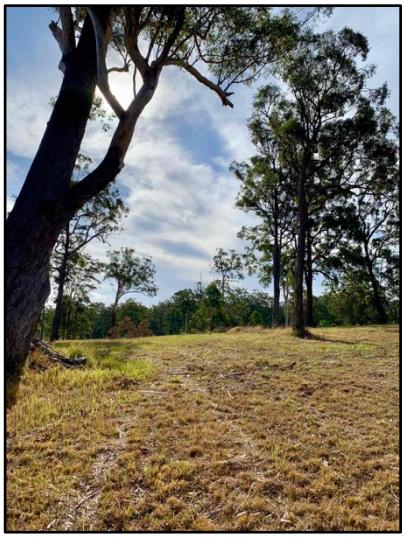


Figure 31: Showing target zone of Tree 163.

Figure 32: Tree 163.

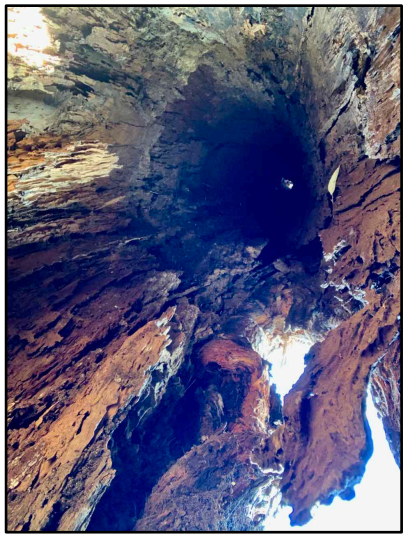


Figure 33: Tree 163. Looking up inside of the trunk. Daylight is visible.

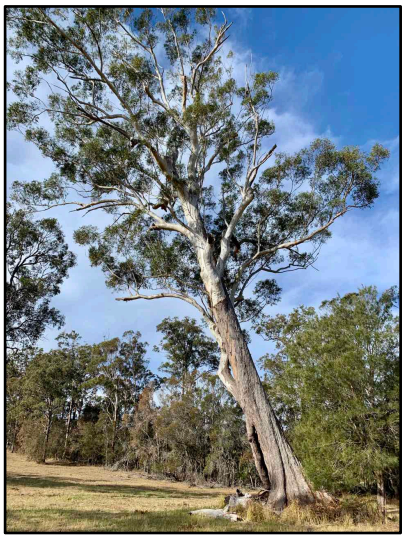


Figure 34: Tree 163.

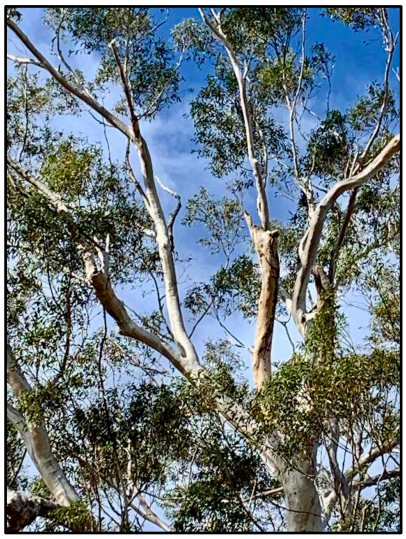


Figure 35

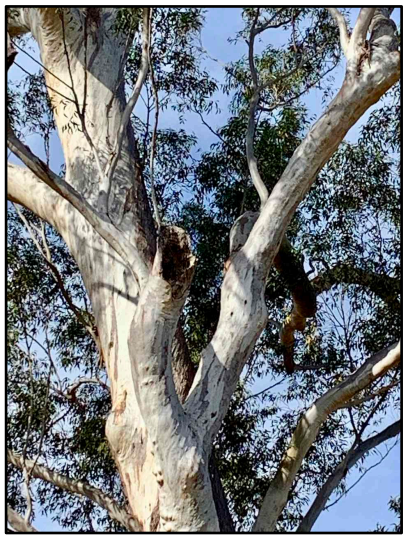


Figure 36

# *Appendix 3: Notes on Tree Assessment*

| Key | Criteria | Comments |
|---|---|---|
| **Tree No** | Must relate to the number on your site diagram | |
| **Species** | Botanical name and common name of Tree | |
| **Diameter of trunk** | DBH Diameter at Breast Height (1.4 metres)<br>DGL Diameter at Ground Level | |
| **Height** | In metres | |
| **Spread** | Average diameter of canopy in metres | |
| **Crown Condition** | Overall vigour and vitality<br>0 Dead<br>1 Severe decline (<20% canopy; major dead wood)<br>2 Declining (20-60% canopy density; twig and branch dieback)<br>3 Average/low vigour (60-90% canopy density; twig dieback)<br>4 Good (90-100% crown cover; little or no dieback or other problems)<br>5 Excellent (100% crown cover, no deadwood or other problems) | This requires knowledge of species. |
| **Age class** | Y Young = recently planted<br>SM Semi-mature (< 20% of life expectancy)<br>M Mature (20-80% of life expectancy)<br>OM Over-mature (> 80% of life expectancy) | |
| **Special Significance** | A Aboriginal<br>C Commemorative<br>Ha Habitat<br>Hi Historic<br>M Memorial<br>R Rare<br>U Unique form<br>O Other | This may require specialist knowledge. |
| **Services/adjacent structures** | Bs Bus stop<br>Bu Building within 3m<br>HVo High voltage open-wire construction<br>HVb High Voltage bundled (ABC)<br>LVo Low Voltage open-wire construction<br>LVb Low Voltage bundled (ABC)<br>Na No services above<br>Nb No services below ground<br>Si Signage<br>Sl Street light<br>T Transmission lines (>33KV)<br>U Underground services<br>O Other | More than one of these may apply. |
| **Defects** | B Borers<br>C Cavity<br>D Decay<br>dw Deadwood<br>E Epicormics<br>FA Forest Architecture<br>H/D Height/Diameter ratio<br>I Inclusions<br>L Lopped<br>LDCMP Leaf damage by chewing mouthpiece insects<br>M Mistletoe/Parasites<br>MBA Multiple Branch Attachments<br>PD Parrot Damage<br>PFS Previous Failure Sites<br>S Splits/cracks<br>T Termites<br>TL Trunk Lean<br>TW Trunk Wound<br>O Other | More than one of these may apply.<br><br>H/D if ratio is higher than 50:1 then tree is defective (Mattheck, et al., 1994). |

| Key | Criteria | Comments |
|---|---|---|
| **Root zone** | C Compaction<br>D Damaged/wounded roots (e.g. by mowers)<br>E Exposed roots<br>Ga Tree in garden bed<br>Gi Girdled roots<br>Gr Grass<br>Kb Kerb close to tree<br>L+ Raised soil level<br>L- Lowered soil level<br>M Mulched<br>Pa Paving/concrete/bitumen<br>Pr Roots pruned<br>O Other | More than one of these may apply. |
| **Failure Potential** | Identifies the most likely failure and rates the likelihood that the structural defect(s) will result in failure within the inspection period.<br>1. Low – defects are minor (e.g. dieback of twigs, small wounds with good wound wood development)<br>2. Medium – defects are present and obvious (e.g. cavity encompassing 10-25% of the circumference of the trunk)<br>3. High – numerous and or significant defects present (e.g. cavity encompassing 30-50% of the circumference of the trunk, major bark inclusions)<br>4. Severe – defects are very severe (e.g. heart rot fruiting bodies, cavity encompassing more than 50% of the trunk) | This requires specialist knowledge. |
| **Size of defective part** | Rates the size of the part most likely to fail. The larger the part that fails, the greater the potential for damage.<br>1. Most likely failure less than 150mm in diameter<br>2. Most likely failure 150-450mm in diameter<br>3. Most likely failure 450-750mm in diameter<br>4. Most likely failure more than 750mm in diameter | |
| **Target Rating*** | Rates the use and occupancy of the area that would be struck by the defective part.<br>1. Occasional use (e.g. jogging/cycle track)<br>2. Intermittent use (e.g. picnic area, day use parking)<br>3. Frequent use, secondary structure (e.g. seasonal camping area, storage facilities)<br>4. Constant use, structures (e.g. year-round use for a number of hours each day, residences) | |
| **Hazard rating*** | Failure potential + size of part + target rating<br>Add each of the above sections for a number out of 12 | The final number identifies the degree of risk. The next step is to determine a management strategy. A rating in this column does not condemn a tree but may indicate the need for more investigation and a risk management strategy. |

# *Appendix 4: Significance of a Tree, Assessment Rating System (STARS) (IACA)*

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' (Draper, et al., 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.

**TREE SIGNIFICANCE - ASSESSMENT CRITERIA**

1. **High Significance in landscape**
   - The tree is in good condition, or normal vigour and form typical of 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 grand age.
   - The tree is listed as a Heritage Item, Threatened Species or part of a Threatened Community or listed on council's significant tree register.
   - The tree is visually prominent and visible from a considerable distance when viewed from most directions within the landscape by bulk and scale and makes a positive contribution to the local amenity.
   - The tree has been influenced by historic figures, events or part of the heritage development of the place.
   - The tree supports social and cultural sentiments or spiritual associations, reflected by the broader population or community group or has commemorative values. (ICOMOS)
   - The growing environment supports the tree to its full dimensions above and below ground without conflict or constraint.

2. **Medium Significance in landscape**
   - The tree is in fair-good condition, or normal or low vigour and form typical or atypical of the species.
   - The tree is a planted locally indigenous or a common species with its taxa readily 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 area.
   - The tree is moderately constrained by above or below ground influences of the built environment to reach full dimensions.

3. **Low Significance in landscape**
   - The tree is in fair-poor condition, or normal or low vigour and form typical or atypical of the species,
   - The tree is not visible or is partly 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 area.
   - The tree is severely constrained by above or below ground by influences of the built environment and therefore will not reach full dimensions; the tree is inappropriate to the site conditions.
   - The tree is listed as exempt under the provisions of the local Council Tree Preservation Order.
   - The tree has a wound or defect that has the potential to become structurally unsound.

**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.

# TABLE 1.0 TREE RETENTION VALUE - PRIORITY MATRIX.

| | | SIGNIFICANCE | | | | |
|---|---|---|---|---|---|---|
| | | 1. HIGH | 2. MEDIUM | 3. LOW | | |
| | | Significance in Landscape | Significance in Landscape | Significance in Landscape | Environmental Pest / Noxious Weed Species | Hazardous / Irreversible Decline |
| ESTIMATED LIFE EXPECTANCY | 1. Long **>40 years** | | | | | |
| | 2. Medium **15-40 Years** | | | | | |
| | 3. Short **<1-15 Years** | | | | | |
| | **Dead** | | | | | |

**Legend for Matrix Assessment**

| | |
|---|---|
| | **Priority for Retention (High) -** These trees are considered important for retention and should be retained and protected. Design modification or relocation of building/s should be considered to accommodate the setbacks as detailed in Table 2. Special construction works 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 a 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. |

# *Appendix 4a: Levels of Visual Assessment*

The following Visual Assessment information is from 'Tree Risk Assessment Manual', published by International Society of Arboriculture (Dunster, et al., 2013).

The level of assessment used in this report is specified in '4.0 Method of Assessment' (Page 4).

**LEVEL I: LIMITED VISUAL ASSESSMENT PROCESS**

- Identify the location and/or selection criteria of trees to be assessed.
- Determine the most efficient route for assessing large populations of trees and documenting the route taken.
- Assess the tree(s) of concern from the defined perspective (for example, walk-by, drive-by).
- Record information about the tree as specified in the scope of work (for example, significant defects or other conditions of concern), and identify locations of trees that need a higher level of assessment and/or prompt action.
- Evaluate the risk of trees that meet the selection criteria (a risk rating is optional).
- Submit a report indicating risk level and mitigation options and/or recommendations.

**LEVEL 2: BASIC ASSESSMENT PROCESS**

- Locate and identify the tree or trees to be assessed.
- Determine the targets and target zone for the tree or branches of concern.
- Review site history, conditions, and species failure profile.
- Assess potential loads on the tree and its parts.
- Assess general tree health.
- Inspect the tree visually—using binoculars, mallet, probes, or shovels, as desired by the arborist or as specified in the scope of work.
- Record observations of site conditions, defects, and outward signs of possible internal defects and response growth.
- If necessary, recommend an advanced assessment.
- Analyse data to determine the likelihood and consequences of failure in order to evaluate the degree of risk.
- Develop mitigation options and estimate residual risk for each option.
- Develop and submit the report/documentation, including, when appropriate, advice on reinspection intervals.

**LEVEL 3: ADVANCED TECHNIQUES**

There are many techniques that can be considered for advanced risk assessment. *Some situations may be assessed with several techniques. Advanced assessment techniques include the following:

- Aerial inspection and evaluation of structural defects in branches
  - Visual inspection; Decay testing; Load testing.
- Detailed target analysis
- Detailed site evaluation
- Decay testing
  - Increment boring; Drilling with small-diameter bit; Resistance-recording drilling; Single-path sonic (stress) wave; Sonic tomography; Electrical impedance tomography; Radiation (radar, X-ray, and gamma ray)
- Health evaluation
  - Tree ring analysis (in temperate trees); Shoot length measurement; Detailed health/vigour analysis; Starch assessment
- Storm/wind load analysis
  - Detailed assessment of tree exposure and protection; Computer-based estimations according to engineering standards; Wind reaction monitoring over a defined interval
- Measuring and assessing the change in trunk lean
- Load testing
  - Hand pull; Measured static pull

*Inclusion of specific techniques in this list should not be considered an endorsement of the use of that technique.

# *Appendix 4b: Visual Tree Assessment*

The Visual Tree Assessment (VTA) methods as described in 'The Body Language of Trees. A Handbook for Failure Analysis. Research for Amenity Trees' by Mattheck and Breloer (Mattheck, et al., 1994) is used in association with the International Society of Arboriculture's guidelines in this report.

196 THE BODY LANGUAGE OF TREES

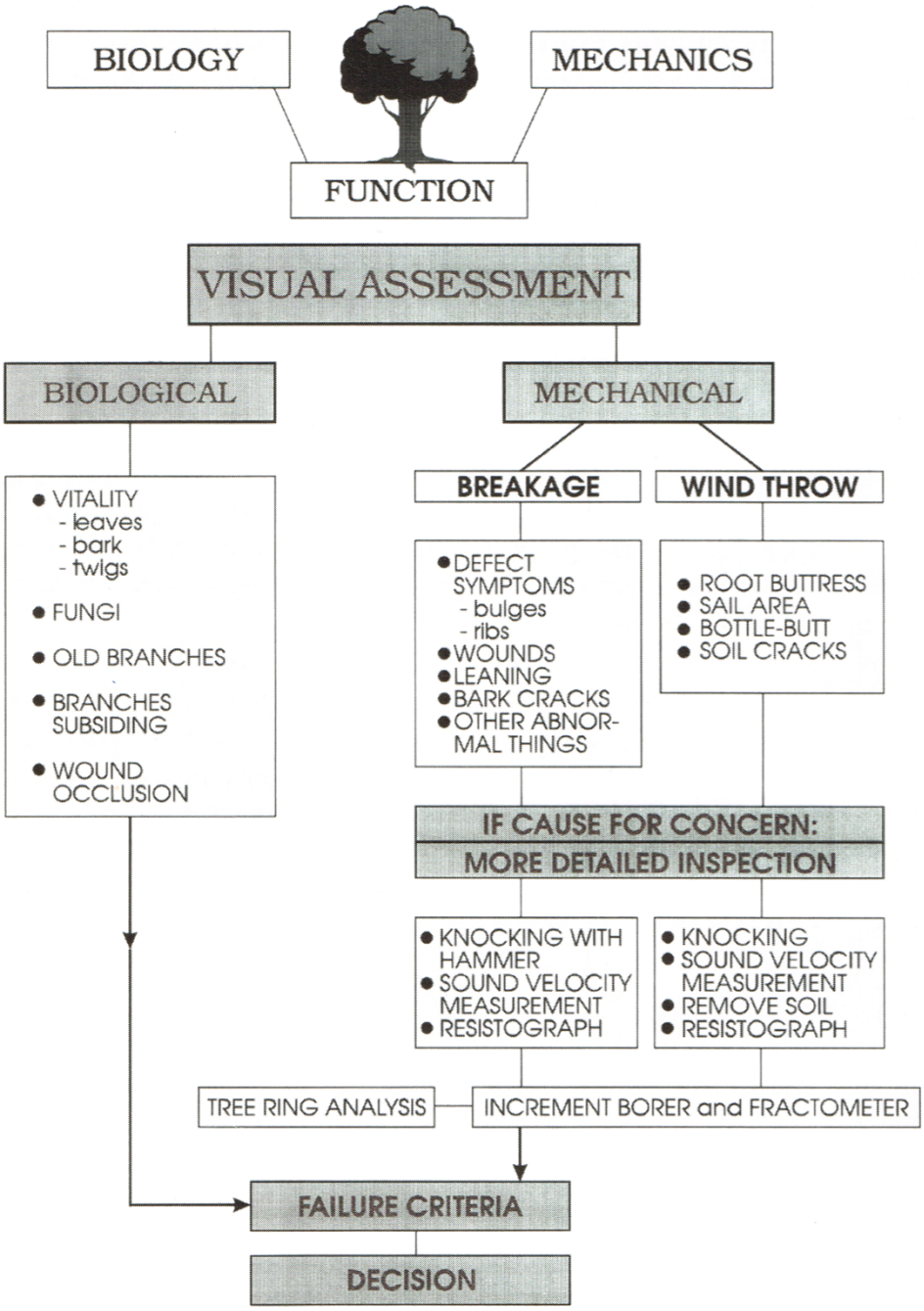



*Fig 120. The Visual Tree Assessment (VTA) procedure for assessing trees. As the suspicion increases that defects are present, the examination becomes more thorough and searching.*

# *Appendix 5: Extract from AS 4970-2009 Protection of trees on development sites (Australian Standard®, 2009), Section 3: Determining the Tree Protection Zones of the Selected Trees, 3.1 Tree Protection Zone (TPZ)*

### 3.1 TREE PROTECTION ZONE (TPZ)

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

*The TPZ incorporates the structural root zone (SRZ) (refer to Clause 3.3.5)."*

### 3.2 DETERMINING THE TPZ

TPZ for Single Trunked Trees

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

**TPZ = DBH x 12**

TPZ for Multiple Trunked Trees

The radius of the TPZ for multiple-trunked trees is calculated using the following formula:

**----------**

**$\sqrt{(DBH_1)^2+(DBH_2)^2+(DBH_3)^2}$ = total DBH x 12**

DBH = trunk diameter measured at 1.4 metres above ground.

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

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

The TPZ of palms, other monocots, cycads and tree ferns should not be less than 1 metre outside the crown projection.

**AS 4970-2009**
**Refer to page 14 "FIGURE 2 INDICATIVE TREE PROTECTION ZONE" & page 24 "Appendix A – DIAMETER AT BREAST HEIGHT (DBH) (Informative)" in AS 4970-2009 Protection of trees on development sites** (Australian Standard®, 2009) **for more information.**

# *Appendix 6: Extract from AS 4970-2009 Protection of trees on development sites (Australian Standard®, 2009), Section 3: Determining the Protection Zones of the Selected Trees, 3.3.5 Structural Root Zone (SRZ)*

**3.3.5 Structural root zone (SRZ)**

"The SRZ is the area required for tree stability. A larger area is required to maintain a viable tree.

The SRZ only needs to be calculated when a major encroachment into a TPZ is proposed.

There are many factors that affect the size of the SRZ (e.g. tree height, crown area, soil type, soil moisture). The SRZ may also be influenced by natural or built structures, such as rocks and footings. An indicative SRZ radius can be determined from the trunk diameter measured immediately above the root buttress using the following formula. Root investigation may provide more information on the extent of these roots.

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

where

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

NOTE: The SRZ for trees with trunk diameters less than 0.15 m will be 1.5 m."

**AS 4970-2009**

**Refer to page 13 "FIGURE 1 STRUCTURAL ROOT ZONE CALCULATION" in AS 4970-2009 Protection of trees on development sites** (Australian Standard®, 2009) **for more information.**

## TABLE 2.0 TPZ AND SRZ TABLE

| DBH for TPZ (mm) | DGL for SRZ (mm) | TPZ (m) | SRZ (m) | DBH for TPZ (mm) | DGL for SRZ (mm) | TPZ (m) | SRZ (m) | DBH for TPZ (mm) | DGL for SRZ (mm) | TPZ (m) | SRZ (m) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 100 | 100 | 2.0 | 1.5 | 500 | 500 | 6.0 | 2.5 | 900 | 900 | 10.8 | 3.2 |
| 110 | 110 | 2.0 | 1.5 | 510 | 510 | 6.1 | 2.5 | 910 | 910 | 10.9 | 3.2 |
| 120 | 120 | 2.0 | 1.5 | 520 | 520 | 6.2 | 2.5 | 920 | 920 | 11.0 | 3.2 |
| 130 | 130 | 2.0 | 1.5 | 530 | 530 | 6.4 | 2.5 | 930 | 930 | 11.2 | 3.2 |
| 140 | 140 | 2.0 | 1.5 | 540 | 540 | 6.5 | 2.6 | 940 | 940 | 11.3 | 3.2 |
| 150 | 150 | 2.0 | 1.5 | 550 | 550 | 6.6 | 2.6 | 950 | 950 | 11.4 | 3.2 |
| 160 | 160 | 2.0 | 1.5 | 560 | 560 | 6.7 | 2.6 | 960 | 960 | 11.5 | 3.3 |
| 170 | 170 | 2.0 | 1.6 | 570 | 570 | 6.8 | 2.6 | 970 | 970 | 11.6 | 3.3 |
| 180 | 180 | 2.2 | 1.6 | 580 | 580 | 7.0 | 2.6 | 980 | 980 | 11.8 | 3.3 |
| 190 | 190 | 2.3 | 1.7 | 590 | 590 | 7.1 | 2.7 | 990 | 990 | 11.9 | 3.3 |
| 200 | 200 | 2.4 | 1.7 | 600 | 600 | 7.2 | 2.7 | 1000 | 1000 | 12.0 | 3.3 |
| 210 | 210 | 2.5 | 1.7 | 610 | 610 | 7.3 | 2.7 | 1010 | 1010 | 12.1 | 3.3 |
| 220 | 220 | 2.6 | 1.8 | 620 | 620 | 7.4 | 2.7 | 1020 | 1020 | 12.2 | 3.3 |
| 230 | 230 | 2.8 | 1.8 | 630 | 630 | 7.6 | 2.7 | 1030 | 1030 | 12.4 | 3.4 |
| 240 | 240 | 2.9 | 1.8 | 640 | 640 | 7.7 | 2.7 | 1040 | 1040 | 12.5 | 3.4 |
| 250 | 250 | 3.0 | 1.9 | 650 | 650 | 7.8 | 2.8 | 1050 | 1050 | 12.6 | 3.4 |
| 260 | 260 | 3.1 | 1.9 | 660 | 660 | 7.9 | 2.8 | 1060 | 1060 | 12.7 | 3.4 |
| 270 | 270 | 3.2 | 1.9 | 670 | 670 | 8.0 | 2.8 | 1070 | 1070 | 12.8 | 3.4 |
| 280 | 280 | 3.4 | 1.9 | 680 | 680 | 8.2 | 2.8 | 1080 | 1080 | 13.0 | 3.4 |
| 290 | 290 | 3.5 | 2.0 | 690 | 690 | 8.3 | 2.8 | 1090 | 1090 | 13.1 | 3.4 |
| 300 | 300 | 3.6 | 2.0 | 700 | 700 | 8.4 | 2.9 | 1100 | 1100 | 13.2 | 3.4 |
| 310 | 310 | 3.7 | 2.0 | 710 | 710 | 8.5 | 2.9 | 1110 | 1110 | 13.3 | 3.5 |
| 320 | 320 | 3.8 | 2.1 | 720 | 720 | 8.6 | 2.9 | 1120 | 1120 | 13.4 | 3.5 |
| 330 | 330 | 4.0 | 2.1 | 730 | 730 | 8.8 | 2.9 | 1130 | 1130 | 13.6 | 3.5 |
| 340 | 340 | 4.1 | 2.1 | 740 | 740 | 8.9 | 2.9 | 1140 | 1140 | 13.7 | 3.5 |
| 350 | 350 | 4.2 | 2.1 | 750 | 750 | 9.0 | 2.9 | 1150 | 1150 | 13.8 | 3.5 |
| 360 | 360 | 4.3 | 2.1 | 760 | 760 | 9.1 | 3.0 | 1160 | 1160 | 13.9 | 3.5 |
| 370 | 370 | 4.4 | 2.2 | 770 | 770 | 9.2 | 3.0 | 1170 | 1170 | 14.0 | 3.5 |
| 380 | 380 | 4.6 | 2.2 | 780 | 780 | 9.4 | 3.0 | 1180 | 1180 | 14.2 | 3.6 |
| 390 | 390 | 4.7 | 2.2 | 790 | 790 | 9.5 | 3.0 | 1190 | 1190 | 14.3 | 3.6 |
| 400 | 400 | 4.8 | 2.3 | 800 | 800 | 9.6 | 3.0 | 1200 | 1200 | 14.4 | 3.6 |
| 410 | 410 | 4.9 | 2.3 | 810 | 810 | 9.7 | 3.0 | 1210 | 1210 | 14.5 | 3.6 |
| 420 | 420 | 5.0 | 2.3 | 820 | 820 | 9.8 | 3.0 | 1220 | 1220 | 14.6 | 3.6 |
| 430 | 430 | 5.2 | 2.3 | 830 | 830 | 10.0 | 3.1 | 1230 | 1230 | 14.8 | 3.6 |
| 440 | 440 | 5.3 | 2.3 | 840 | 840 | 10.1 | 3.1 | 1240 | 1240 | 14.9 | 3.6 |
| 450 | 450 | 5.4 | 2.4 | 850 | 850 | 10.2 | 3.1 | 1250 | 1250 | 15.0 | 3.6 |
| 460 | 460 | 5.5 | 2.4 | 860 | 860 | 10.3 | 3.1 | | | | |
| 470 | 470 | 5.6 | 2.4 | 870 | 870 | 10.4 | 3.1 | | | | |
| 480 | 480 | 5.8 | 2.4 | 880 | 880 | 10.6 | 3.1 | | | | |
| 490 | 490 | 5.9 | 2.5 | 890 | 890 | 10.7 | 3.2 | | | | |

# *Appendix 7: Tree Protection Zones – Standard Procedure*

## 1.0 TREE PROTECTION ZONES - STANDARD PROCEDURE

1.1 The Protective fencing where required may delineate the ***TPZ*** and should be located as determined by the project Arborist either in accordance with the specific Council's guidelines or if no guidelines are given by the Council then using AS 4970-2009 Protection of trees on development sites (Australian Standard®, 2009), Section 4, 4.3. *"Fencing should be erected before any machinery or materials are brought onto the site and before the commencement of works including demolition. Once erected, protective fencing must not be removed or altered without approval by the project arborist. The TPZ must be secured to restrict access. AS 4687 Temporary fencing and hoardings specifies applicable fencing requirements. Shade cloth or similar should be attached to reduce the transport of dust, other particulate matter and liquids into the protected area. Fence posts and supports should have a diameter greater than 20mm and be located clear of roots. Existing perimeter fencing and other structures may be suitable as part of the protective fencing."*

Figure 03 Protective fencing shows examples of such fencing.

1.2 AS 4970-2009 Protection of trees on development sites Section 4, Tree protection measures, 4.2 Activities restricted within the TPZ

*"Activities generally excluded from the TPZ included but are not limited to-*

*(a) Machine excavation including trenching;*
*(b) Excavation for silt fencing*
*(c) Cultivation;*
*(d) Storage;*
*(e) Preparation of chemicals, including preparation of cement products;*
*(f) Parking of vehicles and plant;*
*(g) Refuelling;*
*(h) Dumping of waste;*
*(i) Wash down and cleaning of equipment;*
*(j) Placement of fill;*
*(k) Lighting of fires;*
*(l) Soil level changes;*
*(m) Temporary or permanent installation of utilities and signs, and*
*(n) Physical damage to the tree."*

**AS 4970-2009**

**Refer to page 15 "4.3 PROTECTIVE FENCING" & page 16 "FIGURE 3 PROTECTIVE FENCING" in AS 4970-2009 Protection of trees on development sites** (Australian Standard®, 2009) **for more information.**

1.3 Tree Protection signage is to be attached to each ***Tree Protection Zone*** and displayed from within the development site in accordance with AS 4970-2009 Protection of trees on development sites (Australian Standard®, 2009), Section 4.4 – see example below.


**Example of Tree Protection Zone signage**

1.4 Where a tree is to be retained and a ***Tree Protection Zone*** cannot be adequately established due to restricted access e.g. tree located alongside an access way, the trunk and branches in the lower crown will be protected by wrapping 2 layers of hessian or carpet underfelt around the trunk and branches for a minimum of 2 m or as lower branches permit, then wire or rope secures 90x50x2000mm hardwood battens together around the trunk (do not nail or screw to the trunk or branches). The number of battens to be used is as required to encircle the trunk and the planks are to extend to the base of the tree [AS 4970-2009 Protection of trees on development sites (Australian Standard®, 2009)]– see example below.


**Example of Trunk Armour**

1.5 If a tree is growing downslope from an excavation, a silt fence located along the contours of the site in the area immediately above the ***Tree Protection Zone*** fencing may need to be installed and regularly maintained to prevent burial and asphyxiation of the roots of the tree. To allow for the maintenance of both fences, the silt fence must be constructed separately to the tree protection fence and the 2 fences must be constructed independently of each other and standalone. To reduce competition with the tree the area within the ***Tree Protection Zone*** is to be kept free of weeds. These are best removed by the application of foliar herbicide with Glyphosate as the active constituent. This is the preferred method rather than removal by the cultivation of the soil within the dripline, to minimise root disturbance to the tree. The removal of woody weeds such as Privet should use the cut and paint method of herbicide application. Weeds are to be controlled within the ***Tree Protection Zone***, for the duration of the project.

1.6 The area of the Tree Protection Zone to be mulched to a depth of 50mm with the organic material being 75% leaf litter and 25% wood, and this being composted material. The depth of mulch and type as indicated, to be maintained for the duration of the project. Where deep excavation will expose the soil profile to drying out the root plate is to be protected by pegging jute matting across the ground surface 2 m back from the edge of the profile and 2 m down the face of the profile and is to be in one continuous sheet or layers up to 5mm thick and overlapped 300mm and pegged. Pegs are to be a minimum length of 200mm and spaced at 500mm increments in a grid pattern. Once installed mulch is to be placed on top of the jute matting previously described.

1.7 No services either temporary or permanent are to be located within the ***Tree Protection Zone***. If services are to be located within the ***Tree Protection Zone***, special details will need to be provided by a qualified Consulting Arboriculturist for the protection of the tree regarding the location of the service/s. Works within the TPZ should be hand dug or tunnelled.

1.8 A tree will not be fertilised during its protection within the ***Tree Protection Zone***, as this may hasten its decline if it were to decline. If a tree is to be fertilised this should be in consultation with a qualified Consulting Arboriculturist.

1.9 In the event of prolonged dry periods, or where a tree has been transplanted, or where excavation nearby, especially up slope, leads to drying out of a soil profile, or modification to ground water flow, or flows across an existing ground surface to the tree and its growing environment; deep root watering thoroughly at least twice a week is to be undertaken to irrigate the tree. The need for such watering is determined readily by observing the dryness of the soil surface within the dripline of the tree by scraping back some mulch. Mulch is to be reinstated afterwards. In the event of disrupted ground or surface water flows to the tree due to excavation, filling or construction, a reticulated irrigation system may be required to be installed within the ***Tree Protection Zone***. If an irrigation system is to be installed, consideration must be given to volume, frequency, and drainage of water delivered, and this should be in consultation with a qualified Consulting Arboriculturist.

**AS 4970-2009**

**Refer to page 17 "4.5.2 Trunk and branch protection", "4.5.3 Ground protection" & "FIGURE 4 EXAMPLES OF TRUNK, BRANCH AND GROUND PROTECTION" in AS 4970-2009 Protection of trees on development sites** (Australian Standard®, 2009) **for more information.**

# *Appendix 8: Tree Protection on Construction Sites*

## 1.0 TREE PROTECTION ON CONSTRUCTION SITES

Note: Individual protection measures to be applied where stated as applicable.

1.1.0 General notes
1.2.0 Cautionary notes for the protection of retained trees
1.3.0 Demolition of built structures - precautions to protect trees
1.4.0 Excavation and construction close to Tree Protection Zones

### 1.1.0 General notes

1.1.1 The application of any measures for the Protection of trees on development sites is determined by the species characteristics of the subject tree, and the existing physical constraints of the growing environment on site both above and below ground.

1.1.2 This report considers where applicable, AS 4970-2009 Protection of trees on development sites (Australian Standard®, 2009).

1.1.3 This report applies the ***Tree Protection Zone - Standard Procedure*** However, this does not restrict the author from applying additional or alternative conditions where it is deemed appropriate by the author for the Protection of trees on development sites. Such additional or alternative conditions may be founded upon professional judgement based on:

- the experience of the Consulting Arboriculturist
- scientific research
- new technology
- industry best practice
- consideration of the individual tree species and its relative tolerance to development impacts
- the individual or cumulative factors present or proposed to impact upon the growing environment essential for the trees' survival.

1.1.4 Where this report makes reference to the retention of subject trees it is for their incorporation into the landscaping works for the site, and they are to be documented on a Landscape Plan for the site.

### 1.2.0 Cautionary notes for the protection of retained trees

#### 1.2.1 Installing underground services within TPZ

If an underground utility service is to be located within the area of the TPZ, AS 4970-2009 Protection of trees on development sites (Australian Standard®, 2009), Section 4, 4.5.5 Installing underground services within TPZ provides the following:

*"All services should be routed outside the TPZ. If underground services must be routed within the TPZ, they should be installed by directional drilling or in manually excavated trenches.*

*The directional drilling bore should be at least 600mm deep. The project Arborist should assess the likely impacts of boring and bore pits on retained trees.*

*For manual excavation trenches, the project Arborist should advise on roots to be retained and should monitor the works. Manual excavation may include the use of pneumatic and hydraulic tools. Refer Clause 4.5.3."*

1.2.1.1 **Location of services Option B** (Driveway Construction)

If a service is to be located within the area of the dripline of a protected tree or within the Tree Protection Zone, and site conditions such as shallow bedrock or if mass rooting has occurred from multiple trees growing in close proximity to each other, the service trench is to be elevated and positioned above natural ground level within the new driveway structure. The existing driveway surface is to be scabbled and a reinforced concrete topping is to be provided with downturned thickened edges constructed under the kerb edging to prevent lateral movement. A suitable subgrade material to manufacturers' recommendations is to be utilised if and where appropriate. Construction is to occur in a manner so as not to cause damage to the subject trees root system. All works to be in accordance with engineers' details.

1.2.2 **Precautions in Respect of Temporary Work**

For Precautions in respect of temporary work, AS 4970-2009 Protection of trees on development sites (Australian Standard®, 2009), Section 4, Tree protection measures, 4.5 Other tree protection measures, provides the following:

***"4.5.3 Ground protection***

*If temporary access for machinery is required within the TPZ ground protection measures will be required. The purpose of ground protection is to prevent root damage and soil compaction within the TPZ. Measures may include a permeable membrane such as geotextile fabric beneath a layer of mulch or crushed rock below rumble boards as per Figure 4. These measures may be applied to root zones beyond the TPZ."*

***4.5.6 Scaffolding***

*Where scaffolding is required it should be erected outside the TPZ. Where it is essential for scaffolding to be erected within the TPZ, branch removal should be minimised. This can be achieved by designing scaffolding to avoid branches or tying back branches. The ground below the scaffolding should be protected by boarding (e.g. scaffolding board or plywood sheeting) as shown in Figure 5. Where access is required, a boardwalk or other surface material should be installed to minimise soil compaction. Boarding should be placed over a layer of mulch and impervious sheeting to prevent soil contamination. The boarding should be left in place until the scaffolding is removed."*

*"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 a suitable thickness to prevent soil compaction and root damage."*

**AS 4970-2009**

**Refer to page 19 "FIGURE 5 INDICATIVE SCAFFOLDING WITHIN A TPZ" in AS 4970-2009 Protection of trees on development sites** (Australian Standard®, 2009) **for more information.**

1.3.0 **Demolition of Built Structures - Precautions to Protect Trees**

1.3.1 **Demolition of Existing Buildings**

The demolition of the buildings should be undertaken with access restricted to the driveway and the building platform for each of the existing buildings, or to areas of the land where no trees are growing within 6m of any tree to be retained. Where access or space for a safe working environment is restricted, or where the area of the 6m setback must be compromised, a 100mm layer of Eucalyptus wood mulch must be laid over the area of encroachment. Where vehicular access is required across the mulch layer further root protection should be provided by laying a temporary pathway over the mulch. The temporary pathway should be constructed of a grated steel material capable of supporting the vehicles used during demolition e.g. similar to ramps used to load vehicles onto the backs of trucks. Trunks of trees are to be protected from vehicular damage as per section 1.2.2 above.

1.3.2 **Demolition of Landscape Structures**

The demolition of walls, driveways retaining walls, paths and pools etc. within 6 m of a tree to be retained should be undertaken manually using hand tools. Where a driveway is to be demolished being of concrete strip or slab type construction, it should be undertaken by working from the end of the driveway closest to the building back towards the street by utilising the driveway as a stable platform to prevent soil compaction. Where a concrete slab driveway passes less than 1 m from the base of a tree and the area beneath the driveway is to be undisturbed and incorporated into the landscape works for the site, the volume of space previously occupied by the driveway must be replaced with local top soil from the site or otherwise a loamy sand, to replace the mass of the concrete on the root plate which may be critical to the ballast and centre of mass for the stability of the tree. If the tree becomes unstable immediately contact the Consultant Arboriculturist.

1.3.3 **Removal of Existing Trees near Trees to be Retained**

Removal of a tree within 6 m of a tree to be retained should be undertaken only by cutting down such a tree without damaging the trees to be retained, and by grinding out its stump. Where possible the structural roots of 20mm diameter or greater of the tree to be cut down should not be removed, minimise soil disturbance and reduce the impact on the roots of any tree to be retained nearby. Where structural roots are to be removed this should be undertaken manually by the use of non-motorized hand tools after the stump has been ground out when such roots are often easier to locate from the site of the stump from which they have been severed.

1.4.0 **Excavation and Construction close to Tree Protection Zones**

1.4.0.1 Where structural woody roots with a diameter of 20mm or greater are to be pruned outside the area of the Tree Protection Zone, they are to be excavated manually first by using hand tools to determine their location. A Water knife or Airknife can be used as a mechanised alternative to locate such structural woody roots. Once located those roots to be severed are to be cut cleanly with a final cut to undamaged woody tissue and this will prevent tearing damage to the roots from excavation equipment which can extend beyond the point of excavation back towards the tree.

1.4.0.2 Where a large vigorous tree is to be retained near to a built structure, and dependent upon its taxa, age class and propensity for its roots system to regenerate, it may be prudent to install a root barrier immediately adjacent to the footing of the new building, or to deepen and strengthen the footings themselves to act as a root barrier, but for such structural advice an appropriately qualified chartered structural engineer should be consulted.

1.4.1 **Root Location and Protection where Structures are to be Positioned near a Retained Tree**

1.4.1.1 If walls or a driveway or other structures are to be constructed near a protected tree, careful excavation is to be undertaken manually by using non-motorized hand tools to determine the location of first order and lower order structural roots with a diameter of 20mm (*structural woody roots*) or greater, without damaging them. Boundary walls or fences should use columns or posts within fill panels, or a wall to be constructed with suspended sections 100mm clear above or beside any structural woody root or further as required, or any new wall to be built only to the depth of that existing. Structural woody roots to be further protected by utilising the construction techniques of pier or bridge footings, or screw piles between or over them with a minimum clearance above or beside of 100mm, or further as required to allow for future and on-going growth.

1.4.1.2 Where a driveway or footpath is to pass by the tree a suspended slab is to be constructed or approved similar, to protect the roots that may be encountered at, near, or above ground, and may be constructed on gap graded fill. Where such a driveway or footpath is to be constructed the edge of the structure closest to the tree is to terminate no closer than 0.5 m from the closest edge of trunk, or further depending on the species and its likely further growth to allow for future development and expansion of the trunk, buttresses, and first order and lower order roots as may be advised by a Consultant Arboriculturist. The side of the driveway closest to a tree is to be edged with a concrete kerb of minimum dimensions of 150 x 150mm, to prevent vehicular collision with the trunk. Here a *Water knife* or an *Airknife* can be used as a mechanised alternative to locate first order and lower order structural woody roots.

1.4.1.3 Alternatively a footpath or driveway may be constructed at ground level without any excavation, removing turf by raking, having sprayed with herbicide first if time permits. Here the path or driveway section is to extend for a distance past the tree equivalent to the lateral spread of the crown of that tree alongside the footpath, or driveway.

1.4.1.4 Watering / Gaseous exchange vents are to be installed in the area of the driveway that passes within the dripline of the tree or the prescribed ***Tree Protection Zone*** area and the number and location are to be determined by a Consultant Arboriculturist and the driveway design approved by a Certified Engineer. Exposed edges of the path are to be concealed with the finished level beside the path equivalent to the top of the path by minimal filling with a sandy soil and turf, or mulch, or a garden bed with minimal cultivation, or other landscape treatments as appropriate. (see image below)

1.4.2 **Root Protection where a Driveway close to a Tree is to be Demolished and a New Driveway Constructed in a Similar Location to a Previous Driveway.**

After demolition of an existing driveway as per 1.3.2, the level of the base for the new driveway should be located at the same existing level as that of the base of the previous driveway and should extend for a distance past the tree equivalent to the lateral spread of the crown of that tree alongside the driveway. To prevent excavation from damaging the existing roots which may be located at, near or above the surface of the soil beneath the base of the previous driveway, the new driveway may need to be raised by constructing it on pier or bridge footings between or over them (see 1.4.2 for minimum clearances), or based on a gap graded fill and the driveway constructed with any exposed edges concealed to the top of the driveway by minimal filling with a sandy soil and turf, or mulch, or a garden bed with

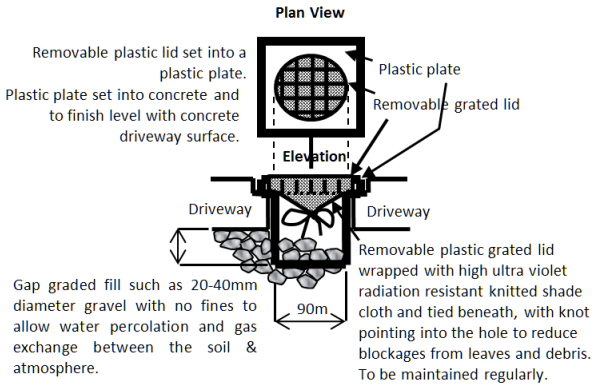
minimal cultivation, or other landscape treatments as appropriate. Where roots have grown to occupy the soil between the concrete strips of a concrete, stone or brick strip driveway, they and the soil may be excavated to the level of the base of the concrete strips, but where such roots have a diameter of 20mm or greater, a Consulting Arboriculturist should be contacted prior to such works being undertaken. Where roots are to be severed, they are to be cut cleanly with a final cut to undamaged woody tissue.

1.4.3 **Root Protection where a Footpath is to be Constructed close to a Tree.**

1.4.3.1 A footpath may be constructed at ground level without any excavation, by first killing with herbicide the plants to be removed from the pathway area, and then removing that plant material by cutting the trunks of woody shrubs to ground level and by raking all other plant material to expose the topsoil surface without organic matter. This will remove the need for physically disturbing the soil and the roots of the tree. The path section is to extend for a distance past each tree equivalent to the lateral spread of the crown of that tree where it extends alongside the footpath.

1.4.3.2 To prevent excavation from damaging the existing roots which may be located at, near, or above the surface of the soil, a gap graded fill as a fill material of a media as appropriate, to a depth of 100mm above the soil surface, or above the top of the root of any tree to be retained, or above the soil surface may be utilised as a base treatment to construct the footpath. Any exposed edges to be concealed to the top of the edges of the footpath and tapering back to the base of the trunk of each tree by minimal filling at each trunk of no greater than 100mm with a sandy soil and turf, or mulch, or a garden bed with minimal cultivation with ground covers, or other landscape treatments as appropriate. A Consultant Arboriculturist should be contacted prior to such works being undertaken or if any structural roots are considered appropriate to be severed being those roots of 20mm diameter or greater.

**Irrigation / Gaseous Exchange Vent**




NOTE: Such vents can be installed in a grid pattern at 1 per 1 $m^2$ and their planning and construction utilised in consultation with an appropriate structural or civil engineer.

1.4.4 **Structural Soil to Accommodate Load Bearing Conditions**

A structural soil should only be considered as a new media into which the trees could be planted if the planting was into a new area where the area surrounding was to be load bearing such as a footpath, driveway or road.

1.4.5 **Gap Graded Fill to Accommodate Compacted Sub Grade and Root Growth**

To further protect woody roots with a diameter of 20mm or greater, a gap graded fill with no fines such as gravel 40mm diameter should only be considered as a fill media above existing grade when soil levels are to be increased near existing trees and the roots can utilise the new media to develop on-going and future root growth and provide for gaseous exchange between the soil and the atmosphere.

# *Appendix 9: SULE (Safe & Useful Life Expectancy)*

There are a number of SULE categories that indicate the safe useful life anticipated for each tree. Factors such as the location, age, condition and health of the tree are significant to determining this rating. Other influences such as the tree's effect on better specimens and the economics of managing the tree successfully in its location are also relevant to SULE (Barrell, 1993 - 2009).

## SULE Categories and Subgroups

**1 = Long SULE OF > 40 years**

| **A** | **B** | **C** |
|---|---|---|
| Structurally sound trees located in positions that can accommodate future growth. | Storm damaged or defective trees that could be made suitable for retention in the long term by remedial tree surgery. | Trees of special significance for historical, commemorative or rarity reasons that would warrant extraordinary efforts to secure their long-term retention. |

**2 = Medium SULE of 15-40 years**

| **A** | **B** | **C** | **D** |
|---|---|---|---|
| Trees that may only live between 15 and 40 more years. | Trees that may live for more than 40 years but would be removed to allow the safe development of more suitable individuals. | Trees that may live for more than 40 years but would be removed during the course of normal management for safety or nuisance reasons. | Storm damaged or defective trees that can be made suitable for retention in the medium term by remedial work. |

**3 = Short SULE of 1-15 years**

| **A** | **B** | **C** | **D** |
|---|---|---|---|
| Trees that may only live between 1 and 15 more years. | Trees that may live for more than 15 years but would be removed to allow the safe development of more suitable individuals. | Trees that may live for more than 15 years but would be removed during the course of normal management for safety or nuisance reasons. | Storm damaged or defective trees that require substantial remedial work to make safe, and are only suitable for retention in the short term. |

**(4) Dead (and Dying)**

| **A** | **B** | **C** | **D** | **E** | **F** |
|---|---|---|---|---|---|
| Dead trees. | Dying or suppressed and declining trees through disease or inhospitable conditions. | Dangerous trees through instability or recent loss of adjacent trees. | Dangerous trees through structural defects including cavities, decay, included bark, wounds or poor form. | Damaged trees that are considered unsafe to retain. | Trees that will become dangerous after removal of other trees for the reasons given in (a) to (e). |

The SULE rating given to any tree in this report assumes that reasonable maintenance will be provided by a qualified Arboriculturist (AQF3) using the correct and acknowledged techniques. Retained trees are to be protected from root damage. Incorrect tree work practices can significantly accelerate tree decline and increase hazard potential.

# *Appendix 10: Glossary*

All Glossary items adapted from Dictionary for Managing Trees in Urban Environments, Institute of Australian Consulting Arboriculturists (IACA) 2009. (Draper, et al., 2009), unless otherwise cited.

## AGE OF TREES

Most trees have a stable biomass for the major proportion of their life. The estimation of the age of a tree is based on the knowledge of the expected lifespan of the taxa in situ divided into three distinct stages of measurable biomass, when the exact age of the tree from its date of cultivation or planting is unknown and can be categorized as Young, Mature and Over-mature (British Standard®, 1991) p.13 & (Harris, et al. 2004) p.262.

**Young** Tree aged less than <20% of life expectancy, in situ.

**Mature** Tree aged 20-80% of life expectancy, in situ.

**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.

## CONDITION OF TREES

A tree's *crown form* and growth habit, as modified by its *environment* (aspect, suppression by other trees, soils), the *stability* and *viability* of the *root plate*, trunk and structural branches (first [1st] and possibly second [2nd] order branches), including structural defects such as wounds, cavities or hollows, *crooked* trunk or weak trunk/branch junctions and the effects of predation by pests and diseases. These may not be directly connected with *vigour* and it is possible for a tree to be of *normal vigour* but in *poor condition*. The condition can be categorised as *Good Condition*, *Fair Condition*, *Poor Condition* and *Dead*.

**Good Condition** Tree is of good habit, with crown form not severely restricted for space and light, physically free from the adverse effects of predation by pests and diseases, obvious instability or structural weaknesses, fungal, bacterial or insect infestation and is expected to continue to live in much the same condition as at the time of inspection provided conditions around it for its basic survival do not alter greatly. This may be independent of or contributed to by vigour.

**Fair Condition** Tree is of good habit or misshapen, a form not severely restricted for space and light, has some physical indication of decline due to the early effects of predation by pests and diseases, fungal, bacterial, or insect infestation, or has suffered physical injury to itself that may be contributing to instability or structural weaknesses, or is faltering due to the modification of the environment essential for its basic survival. Such a tree may recover with remedial works where appropriate, or without intervention may stabilise or improve over time, or in response to the implementation of beneficial changes to its local environment. This may be independent of or contributed to by vigour.

**Poor Condition** Tree is of good habit or misshapen, a form that may be severely restricted for space and light, exhibits symptoms of advanced and irreversible decline such as fungal, or bacterial infestation, major die-back in the branch and foliage crown, structural deterioration from insect damage e.g. termite infestation, or storm damage or lightning strike, ring barking from borer activity in the trunk, root damage or instability of the tree, or damage from physical wounding impacts or abrasion, or from altered local environmental conditions and has been unable to adapt to such changes and may decline further to death regardless of remedial works or other modifications to the local environment that would normally be sufficient to provide for its basic survival if in good to fair condition. Deterioration physically, often characterised by a gradual and continuous reduction in vigour but may be independent of a change in vigour, but characterised by a proportionate increase in susceptibility to, and predation by pests and diseases against which the tree cannot be sustained. Such conditions may also be evident in trees of advanced senescence due to normal phenological processes, without modifications to the growing environment or physical damage having been inflicted upon the tree. This may be independent of or contributed to by vigour.

**Senescent / Moribund** The advanced state of decline, dying or nearly dead.

**Dead** Tree is no longer capable of performing any of the following processes or is exhibiting any of the following symptoms;

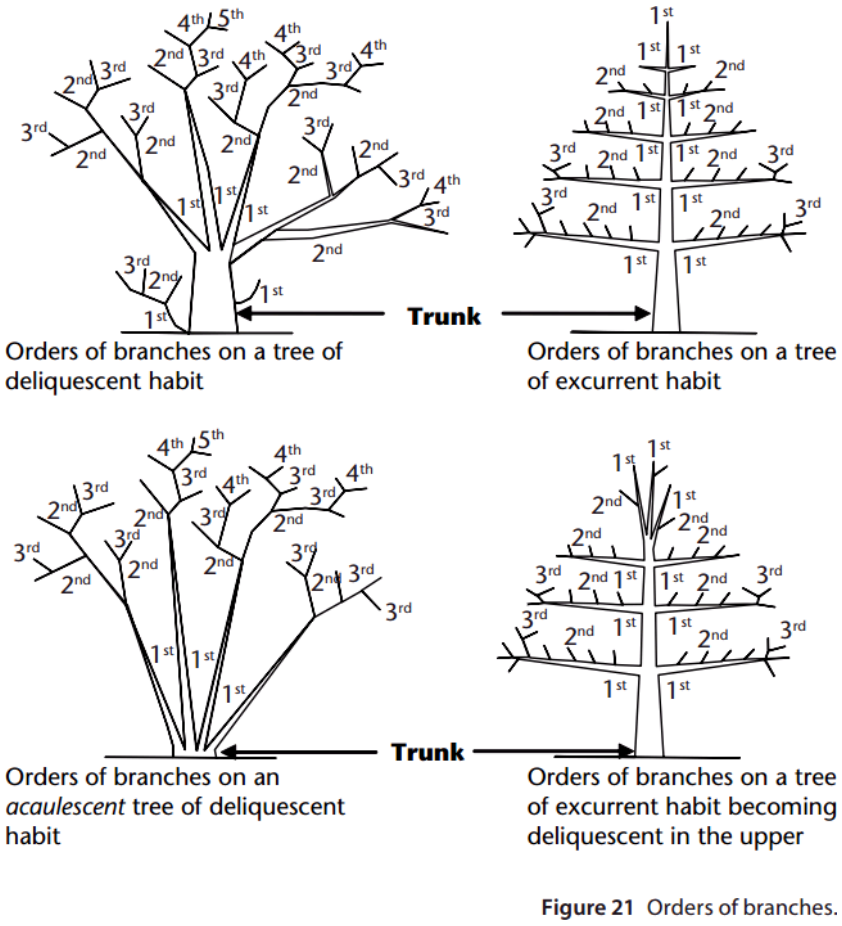
**Processes** Photosynthesis via its foliage crown (as indicated by the presence of moist, green or other coloured leaves); Osmosis (the ability of the root system to take up water); Turgidity (the ability of the plant to sustain moisture pressure in its cells); Epicormic shoots or epicormic strands in Eucalypts (the production of new shoots as a response to stress, generated from latent or adventitious buds or from a lignotuber);

**Symptoms** Permanent leaf loss; Permanent wilting (the loss of turgidity which is marked by desiccation of stems leaves and roots); Abscission of the epidermis (bark desiccates and peels off to the beginning of the sapwood).

**Removed** No longer present, or tree not able to be located or having been cut down and retained on a site or having been taken away from a site prior to site inspection.

## BRANCH

An elongated woody structure arising initially from the trunk to support leaves, flowers, fruit and the development of other branches. A branch may itself fork and continue to divide many times as successive orders of branches with the length and taper decreasing incrementally to the outer extremity of the crown. These may develop initially as a gradually tapering continuation of the trunk with minimal division as in a young tree or a tree of excurrent habit, or in a sapling, or may arise where the trunk terminates at or some distance from the root crown, dividing into first order branches to form and support the foliage crown. In an acaulescent tree, branches arise at or near the root crown. Similarly, branches may arise from a sprout mass from damaged roots, branches or trunk.




Orders of branches on a tree of deliquescent habit

Orders of branches on a tree of excurrent habit

Orders of branches on an *acaulescent* tree of deliquescent habit

Orders of branches on a tree of excurrent habit becoming deliquescent in the upper

**Figure 21** Orders of branches.

**Orders of Branches** The marked divisions between successively smaller branches (James, 2003) p. 168, commencing at the initial division where the trunk terminates on a deliquescent tree or from lateral branches on an excurrent tree. Successive branching is generally characterised by a gradual reduction in branch diameters at each division, and each gradation from the trunk can be categorised numerically, e.g. first order, second order, third order etc. (See Figure 21.)

**Branch tear out** Dislodging of a branch from its point of attachment where it is torn away from the branch collar snapping the branch tail causing a laceration, usually to the underside of the branch union of the branch or trunk to which it was attached forming a tear out wound.

**Sudden branch drop** The failure and collapse of live, usually horizontal branches, seemingly without any noticeable cause in calm hot, dry weather conditions generally after rain. Theorised to be caused by altered moisture content in the branch disturbing the longitudinal pre-stressing of the wood that normally helps support the load as formed by reaction wood in branches tending to horizontal (Lonsdale, 1999) p. 30, or incipient failure from the lengthening of existing internal cracks as the wood cools (Shigo, 1986) p. 248, or influenced by branch creep under its own weight and by wind (Mattheck, et al., 1994) p. 126, or fractures to vascular rays if pulled at right angles to their longitudinal orientation forming from subsidence cracks (Mattheck, et al., 1994) p. 169, or a combination of these factors. Such branch breakages usually occur at some distance from the branch collar leaving a stub. See also *Branch tear out*.

**Canopy**

1. Of multiple trees, the convergence, or merging in full or part, of the crowns of two or more trees due to their proximity, or where competition for light and space available in a forest environment is limited as each tree develops forming a continuous layer of foliage.
2. Used as a plural for the crown.
3. Sometimes synonymously used for the crown (USA).

Crown Of an individual tree all the parts arising above the trunk where it terminates by its division forming branches, e.g. the branches, leaves, flowers and fruit; or the total amount of foliage supported by the branches. The crown of any tree can be divided vertically into three sections and can be categorised as lower crown, mid crown and upper crown (Figure 8). For a leaning tree these can be divided evenly into crown sections of one-third from the base to apex. The volume of a crown can be categorised as the inner crown, outer crown and outer extremity of the crown.

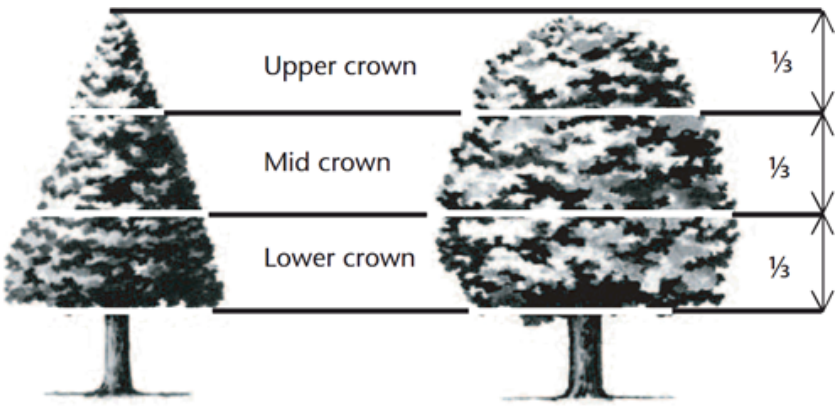



**Figure 8** Crown sections.

**Lower Crown** The proximal or lowest section of a crown when divided vertically into one-third (⅓) increments.

**Mid Crown** The middle section of a crown when divided vertically into one-third (⅓) increments.

**Upper Crown** The distal or highest section of a crown when divided vertically into one-third (½) increments.

**Crown Projection (CP)** Area within the dripline or beneath the lateral extent of the crown (Geiger, 2004) p.2.

**Dripline** A line formed around the edge of a tree by the lateral extent of the crown. Such a line may be evident on the ground with some trees when exposed soil is displaced by rain shed from the crown.

# CROWN FORM OF TREES

The shape of the crown of a tree as influenced by the availability or restriction of space and light, or other contributing factors within its growing environment. Crown Form may be determined for tree shape and habit generally as Dominant, Codominant, Intermediate, Emergent, Forest and Suppressed. The habit and shape of a crown may also be considered qualitatively and can be categorised as Good Form or Poor Form.

**Good Form** Tree of typical crown shape and habit with proportions representative of the taxa considering constraints such as origin e.g. indigenous or exotic but does not appear to have been adversely influenced in its development by environmental factors in situ such as soil water availability, prevailing wind, or cultural practices such as lopping and competition for space and light.

**Poor Form** Tree of atypical crown shape and habit with proportions not representative of the species considering constraints and appears to have been adversely influenced in its development by environmental factors in situ such as soil water availability, prevailing wind, cultural practices such as lopping and competition for space and light; causing it to be misshapen or disfigured by disease or vandalism.

**Crown Form Codominant** Crowns of trees restricted for space and light on one or more sides and receiving light primarily from above e.g. constrained by another tree/s or a building.

**Crown Form Dominant** Crowns of trees generally not restricted for space and light receiving light from above and all sides.

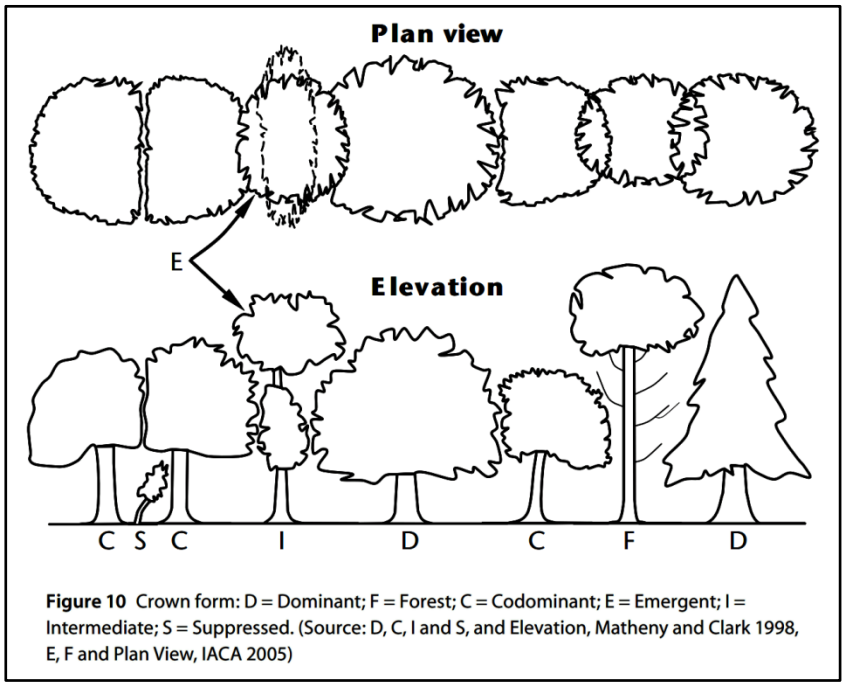



**Figure 10** Crown form: D = Dominant; F = Forest; C = Codominant; E = Emergent; I = Intermediate; S = Suppressed. (Source: D, C, I and S, and Elevation, Matheny and Clark 1998, E, F and Plan View, IACA 2005)

**Crown Form Emergent** Crowns of trees restricted for space on most sides receiving most light from above until the upper crown grows to protrude above the canopy in a stand or forest environment. Such trees may be crown form dominant or transitional from crown form intermediate to crown form forest asserting both apical dominance and axillary dominance once free of constraints for space and light.

**Crown Form Forest** Crowns of trees restricted for space and light except from above forming tall trees with narrow spreading crowns with foliage restricted generally to the top of the tree. The trunk is usually erect, straight and continuous, tapering gradually, crown often excurrent, with first order branches becoming structural, supporting the live crown concentrated towards the top of the tree, and below this point other first order branches arising radially with each inferior and usually temporary, divergent and ranging from horizontal to ascending, often with internodes exaggerated due to competition for space and light in the lower crown.

**Crown Form Intermediate** Crowns of trees restricted for space on most sides with light primarily from above and on some sides only.

**Crown Form Suppressed** Crowns of trees generally not restricted for space but restricted for light by being overtopped by other trees and occupying an understorey position in the canopy and growing slowly.

## DEADWOOD

Dead branches within a tree's crown and considered quantitatively as separate to crown cover and can be categorised as Small Deadwood and Large Deadwood according to diameter, length and subsequent risk potential. The amount of dead branches on a tree can be categorised as Low Volume Deadwood, Medium Volume Deadwood and High Volume Deadwood. See also Dieback.

**Deadwooding** Removing of dead branches by pruning. Such pruning may assist in the prevention of the spread of decay from dieback or for reasons of safety near an identifiable target.

**Small Deadwood - dw** A dead branch up to 10mm diameter and usually <2 metres long, generally considered of low-risk potential.

**Large Deadwood - DW** A dead branch >10mm diameter and usually >2 metres long, generally considered of high-risk potential.

## DIEBACK

The death of some areas of the crown. Symptoms are leaf drop, bare twigs, dead branches and tree death, respectively. This can be caused by root damage, root disease, bacterial or fungal canker, severe bark damage, intensive grazing by insects, abrupt changes in growth conditions, drought, water-logging or over-maturity. Dieback often implies reduced resistance, stress or decline which may be temporary. Dieback can be categorised as Low Volume Dieback, Medium Volume Dieback and
High Volume Dieback.

**High Volume Dieback** Where >50% of the crown cover has died.

**Medium Volume Dieback** Where 10-50% of the crown cover has died.

**Low Volume Dieback** Where <10% of the crown cover has died. See also Dieback, High Volume Dieback and Medium Volume Dieback.

## EPICORMIC SHOOTS

Juvenile shoots produced at branches or trunk from epicormic strands in some Eucalypts (Burrows, 2002) pp. 111-131, or sprouts produced from dormant or latent buds concealed beneath the bark in some trees. Production can be triggered by fire, pruning, wounding, or root damage but may also be as a result of stress or decline. Epicormic shoots can be categorised as Low Volume Epicormic Shoots, Medium Volume Epicormic Shoots and High Volume Epicormic Shoots.

**High Volume Epicormic Shoots** Where >50% of the crown cover is comprised of live epicormic shoots.

**Medium Volume Epicormic Shoots** Where 10-50% of the crown cover is comprised of live epicormic shoots.

**Low Volume Epicormic Shoots** Where <10% of the crown cover is comprised of live epicormic shoots.

# GENERAL TERMS

**Cavity** A usually shallow void often localised initiated by a wound and subsequent decay within the trunk, branches or roots, or beneath bark, and may be enclosed or have one or more opening.

**Decay** The process of degradation of wood by microorganisms (Australian Standard®, 2007) p. 6, and fungus.

**Hazard** The threat of danger to people or property from a tree or tree part resulting from changes in the physical condition, growing environment, or existing physical attributes of the tree, e.g. included bark, soil erosion, or thorns or poisonous parts, respectively.

**Included Bark** The bark on the inner side of the branch union or is within a concave crotch that is unable to be lost from the tree and accumulates or is trapped by acutely divergent branches forming a compression fork. The growth of bark at the interface of two or more branches on the inner side of a branch union or in the crotch where each branch forms a branch collar and the collars roll past one another without forming a graft where no one collar is able to subsume the other. The risk of failure is worsened in some taxa where branching is acutely divergent or acutely convergent and ascending or erect.

**Hollow** A large void initiated by a wound forming a cavity in the trunk, branches or roots and usually increased over time by decay or other contributing factors, e.g. fire, or fauna such as birds or insects e.g. ants or termites. A hollow can be categorised as an Ascending Hollow or a Descending Hollow.

**Kino** The extractive polyphenols (tannins) formed in veins in the cambial zone as a defence in response to wounding in eucalypts. Often visible as an exudate when the kino veins rupture or are injured (Boland, et al., 2006) p. 691.

**Occupancy Rating** The frequency of use of a likely target and possibility that people will be present when tree failure or collapse occurs.

**Risk** The random or potentially foreseeable possibility of an episode causing harm or damage.

**Significant** Important, weighty or more than ordinary.

**Significant** Tree A tree considered important, weighty or more than ordinary. Example: due to prominence of location, or in situ, or contribution as a component of the overall landscape for amenity or aesthetic qualities, or curtilage to structures, or importance due to uniqueness of taxa for species, subspecies, variety, crown form, or as an historical or cultural planting, or for age, or substantial dimensions, or habit, or as remnant vegetation, or habitat potential, or a rare or threatened species, or uncommon in cultivation, or of aboriginal cultural importance, or is a commemorative planting.

**Structural Root Zone (SRZ)** The minimum radial distance around the base of a tree and its root plate required for its stability in the ground against windthrow and applied only to trees with a circular root plate (Mattheck, et al., 1994) pp. 77-87.

**Stag-headed** Protruding dead branches above the live foliage of the crown as a result of dieback.

**Substantial** A tree with large dimensions or proportions in relation to its place in the landscape.

**Sustainable Retention Index Value (SRIV)** A visual tree assessment method to determine a qualitative and numerical rating for the viability of urban trees for development sites and management purposes, based on general tree and landscape assessment criteria using classes of age, condition and vigour. SRIV is for the professional manager of urban trees to consider the tree in situ with an assumed knowledge of the taxon and its growing environment. It is based on the physical attributes of the tree

and its response to its environment considering its position in a matrix for age class, vigour class, condition class and its sustainable retention with regard to the safety of people or damage to property. This also factors the ability to retain the tree with remedial work or beneficial modifications to its growing environment or removal and replacement. SRIV is supplementary to the decision made by a tree management professional as to whether a tree is retained or removed (IACA) .

**Target** People or property likely to be harmed or damaged, respectively, by being struck by a failed or collapsed tree in full or part.

**Tree Protection Zone (TPZ)** A combination of the root protection zone (RPZ) and crown protection zone (CPZ) as an area around a tree set aside for the protection of a tree and a sufficient proportion of its growing environment above and below ground established prior to demolition or construction and maintained until the completion of works to allow for its viable retention including stability.

**Visual Tree Assessment (VTA)** A visual inspection of a tree from the ground based on the principle that, when a tree exhibits apparently superfluous material in its shape, this represents repair structures to rectify defects or to reinforce weak areas in accordance with the Axiom of Uniform Stress (Mattheck, et al., 1994) pp. 12-13, 145). Such assessments should only be undertaken by suitably competent practitioners.

## LEANING TREES

A tree where the trunk grows or moves away from upright. A lean may occur anywhere along the trunk influenced by a number of contributing factors e.g. genetically predetermined characteristics, competition for space or light, prevailing winds, aspect, slope, or other factors. A leaning tree may maintain a static lean or display an increasingly progressive lean over time and may be hazardous and prone to failure and collapse. The degrees of leaning can be categorised as Slightly Leaning, Moderately Leaning, Severely Leaning and Critically Leaning.

**Slightly Leaning** A leaning tree where the trunk is growing at an angle within 0°-15° from upright. - Low Risk.

**Moderately Leaning** A leaning tree where the trunk is growing at an angle within 15°-30° from upright. - Medium Risk.

**Severely Leaning** A leaning tree where the trunk is growing at an angle within 30°-45° from upright. - High Risk.

**Critically Leaning** A leaning tree where the trunk is growing at an angle greater than >45° from upright. - Very High Risk.

**Progressively Leaning** A tree where the degree of leaning appears to be increasing over time. - Lodging.

**Static Leaning** A leaning tree whose lean appears to have stabilised over time.

## SYMMETRY

Balance within a crown, or root plate, above or below the axis of the trunk of branch and foliage, and root distribution respectively and can be categorised as Asymmetrical and Symmetrical.

**Asymmetrical** Imbalance within a crown, where there is an uneven distribution of branches and the foliage crown or root plate around the vertical axis of the trunk. This may be due to Crown Form Codominant or Crown Form Suppressed as a result of natural restrictions e.g. from buildings, or from competition for space and light with other trees, or from exposure to the wind, or artificially caused by pruning for clearance of roads, buildings or power lines. An example of an expression of this may be, crown asymmetrical, bias to the west.

**Symmetrical** Balance within a crown, where there is an even distribution of branches and the foliage crown around the vertical axis of the trunk. This usually applies to trees of Crown Form Dominant or Crown Form Forest. An example of an expression of this may be crown symmetrical.

## ROOTS

**First Order Roots (FOR)** Initial woody roots arising from the root crown at the base of the trunk, or as an adventitious root mass for structural support and stability. Woody roots may be buttressed and divided as a marked gradation, gradually tapering and continuous or tapering rapidly at a short distance from the root crown. Depending on soil type these roots may descend initially and not be evident at the root crown or become buried by changes in soil levels. Trees may develop 4-11 (Perry, 1982) pp. 197- 221, or more first order roots which may radiate from the trunk with a relatively even distribution, or be prominent on a particular aspect, dependent upon physical characteristics e.g. leaning trunk, asymmetrical crown; and constraints within the growing environment from topography e.g. slope, soil depth, rocky outcrops, exposure to predominant wind, soil moisture, depth of water table etc.

**Orders of Roots** The marked divisions between woody roots, commencing at the initial division from the base of the trunk, at the root crown where successive branching is generally characterised by a gradual reduction in root diameters and each gradation from the trunk and can be categorized numerically, e.g. first order roots, second order roots, third order roots etc. Roots may not always be evident at the root crown and this may be dependent on species, age class and the growing environment. Palms at maturity may form an adventitious root mass.

**Root Plate** The entire root system of a tree generally occupying the top 300-600mm of soil including roots at or above ground and may extend laterally for distances exceeding twice the height of the tree (Perry, 1982) pp. 197-221. Development and extent is dependent on water availability, soil type, soil depth and the physical characteristics of the surrounding landscape.

**Root Crown** Roots arising at the base of a trunk.

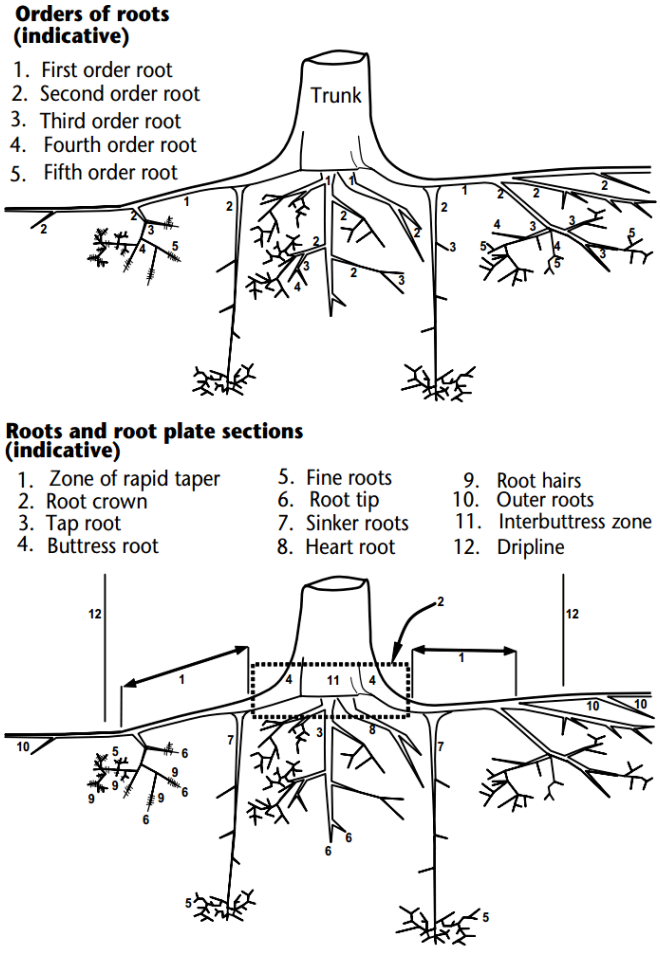



**Figure 22** Orders of roots.

**Zone of Rapid Taper** The area in the root plate where the diameter of structural roots reduces substantially over a short distance from the trunk. Considered to be the minimum radial distance to provide structural support and root plate stability. See also Structural Root Zone (SRZ).

**Structural Roots** Roots supporting the infrastructure of the root plate providing strength and stability to the tree. Such roots may taper rapidly at short distances from the root crown or become large and woody as with gymnosperms and dicotyledonous angiosperms and are usually 1st and 2nd order roots form an adventitious root mass in monocotyledonous angiosperms (palms). Such roots may be crossed and grafted and are usually contained within the area of crown projection or extend just beyond the dripline.

## TRUNK

A single stem extending from the root crown to support or elevate the crown, terminating where it divides into separate stems forming first order branches. A trunk may be evident at or near the ground or be absent in acaulescent trees of deliquescent habit or may be continuous in trees of excurrent habit. The trunk of any caulescent tree can be divided vertically into three (3) sections and can be categorised as Lower Trunk, Mid Trunk and Upper Trunk. For a leaning tree, these may be divided evenly into sections of one-third along the trunk (Figure 28).

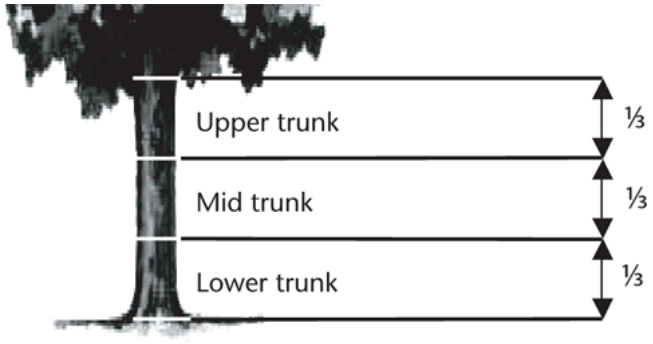



**Figure 28** Trunk sections.

**Co-Dominant** Equal in size and relative importance, usually associated with either trunk/stems or scaffold limbs/branches in the crown; in the context of crown class, trees whose crowns form the bulk of the upper layer of the canopy but which are crowded by adjacent trees (Matheny, et al., 1994).

**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 1.4 m. The trunk of a tree is usually not a circle when viewed in cross section, due to the presence of reaction wood or adaptive wood, therefore an average diameter is determined with a diameter tape or by recording the trunk along its narrowest and widest axis, adding the two dimensions together and dividing them by 2 to record an average and allowing the orientation of the longest axis of the trunk to also be recorded. Where a tree is growing on a lean the distance along the top of the trunk is measured to 1.4m and the diameter then recorded from that point perpendicular to the edge of the trunk. Where a leaning trunk is crooked a vertical distance of 1.4m is measured from the ground. Where a tree branches from a trunk that is less than 1.4m above ground, the trunk diameter is recorded perpendicular to the length of the trunk from the point immediately below the base of the flange of the branch collar extending the furthest down the trunk, and the distance of this point above ground recorded as trunk length. Where a tree is located on sloping ground the DBH should be measured at half way along the side of the tree to average out the angle of slope. Where a tree is acaulescent or trunkless branching at or near ground an average diameter is determined by recording the radial extent of the trunk at or near the ground and noting where the measurement was recorded e.g. at ground.

**Dominant** One of four types of crown class; tree whose crown extends above the height of nearby trees in the stand, receiving light from above and he side

**Leader** The topmost portion of the tree trunk (stem) that is able to grow more than the laterals below. (Harris, et al. 2004).

**Lean** A leaning tree may or may not be a substantial hazard. It is necessary to distinguish between two types:

1. Corrected or “natural” lean
   Not the greatest term, but here we mean trees that have been leaning for much of their life. You can see sweep (curvature) of the stem, or maybe even a crook, where the tree corrected the lean. The upper stem is vertical, not leaning. There is no evidence of recent change, such as soil/root plate movement, cracking or stress bending of the stem. Sometimes natural leans can increase slowly over time as the weight of the stem increases.

2. Uncorrected or “unnatural” lean
   Here we mean a lean that is due to a relatively recent change in the orientation of the stem. You

may see evidence of soil/root disturbance indicating that the root system has shifted in the soil. You may see cracking in the stem as it gives way. There may even be bending of the lower stem going on, usually associated with decay. The upper stem in an unnatural lean is mostly not vertical but leaning. Trees with such a lean have already begun to fail and are extremely hazardous. I would suggest closing or vacating sites immediately until the tree can be removed.

Some specialists suggest that any lean greater than 15°, particularly if it is in the direction of the target, is probably cause for removal. Do not put too much emphasis on direction of lean. If you have experience felling trees, you know how much a little wind and holding wood can influence the direction of fall. It would not be at all surprising to have a tree go down at right angles to the direction of lean. Under a good wind, it could even fall in the opposite direction. (Worrall)

https://forestpathology.org/hazard-trees/hazard-tree-defects

## VIGOUR

The ability of a tree to sustain its life processes. This is independent of the condition of a tree but may impact upon it. Vigour can appear to alter rapidly with change of seasons (seasonality) e.g. dormant, deciduous or semi-deciduous trees. Vigour can be categorised as Normal Vigour, High Vigour, Low Vigour and Dormant Tree Vigour.

**Normal Vigour** The ability of a tree to maintain and sustain its life processes. This may be evident by the typical growth of leaves, crown cover and crown density, branches, roots and trunk and resistance to predation. This is independent of the condition of a tree but may impact upon it, and especially the ability of a tree to sustain itself against predation.

**High Vigour** Accelerated growth of a tree due to incidental or deliberate artificial changes to its growing environment that are seemingly beneficial, but may result in premature aging or failure if the favourable conditions cease, or promote prolonged senescence if the favourable conditions remain, eg water from a leaking pipe; water and nutrients from a leaking or disrupted sewer pipe; nutrients from animal waste, a tree growing next to a chicken coop, or a stock feedlot, or a regularly used stockyard; a tree subject to a stringent watering and fertilising program; or some trees may achieve an extended lifespan from continuous pollarding practices over the life of the tree.

**Low Vigour** Reduced ability of a tree to sustain its life processes. This may be evident by the atypical growth of leaves, reduced crown cover and reduced crown density, branches, roots and trunk, and a deterioration of their functions with reduced resistance to predation. This is independent of the condition of a tree but may impact upon it, and especially the ability of a tree to sustain itself against predation.

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# *Appendix 11: Curriculum Vitae*

| | |
|---|---|
| **U W S (Hawkesbury)** | Graduate Diploma in Horticulture (AQF8)<br>Diploma in Horticulture (AQF5) |
| **Hortus Australia** | Diploma of Arboriculture (AQF5) (RTF50203-6522-6/12/2005) |
| **Ryde School of Horticulture** | Tree Surgery<br>Arboriculture Techniques |
| **Central Coast Community College** | Excel Module 1 and 2<br>Excel – Advanced |
| **Workcover** | OHS General Induction for Construction Work in NSW (CGI00871464SEQ1)<br>St Johns Ambulance First Aid Certificate |

## CONFERENCE ATTENDANCE & TRAINING

| | |
|---|---|
| **2016** | IACA Root Mapping Seminar - Ryde TAFE<br>IACA Report Writing Seminar - Ryde TAFE<br>IML Resistograph® Users Course - Belmont TAFE |
| **2015** | Quantified Tree Risk Assessment System - Estimating Probability of Failure<br>Aboriginal Scar Trees: Significance Conservation and Management of Veteran Eucalypts in the Landscape - Griffith University |
| **2012** | Australian Institute of Horticulture Inc. - 'Don Burke Field Day' Professional Development Workshop |
| **2011** | Institute of Australian Consulting Arboriculturists (IACA) AS 4970 Forum<br>Ecological Consultants Association of NSW - Impacts of Invasive Species |
| **2010** | Root Barrier Field Day |
| **2009** | Matheny & Clark: Arboriculture |
| **2008** | Quantified Tree Risk Assessment System - Principals and Application |
| **2007** | Quantified Tree Risk Assessment System - Principals and Application<br>Quantified Tree Risk Assessment System - A Practitioners Guide to Visual Tree Assessment |
| **2006** | Barrell Tree A-Z 2 Day Workshop<br>IML Resistograph® F500S Training Course |
| **2005** | Urban Tree Forum – Sydney City Council<br>Urban Tree Risk Management – Treelogic<br>DA Workshop Preparing Development Applications for Local Council –AIH<br>Urban Forest – The New Imperative – Parks and Leisure Australia |
| **2004** | Visual Tree Assessment Workshop – Professor Doctor Claus Mattheck |
| **2003** | Urban Trees - Our Urban Urgency – Parks and Leisure Australia |
| **1999** | Tree Hazard Assessment – Parramatta Park – NAAA |
| **1990** | Aero Advanced Climbers Seminar NSW |

## INDUSTRY BACKGROUND

| | |
|---|---|
| *20th June 2001 to present* | *Proprietor*<br>**Advanced Treescape Consulting**<br>(formerly known as RJK Consulting) |
| *2002 - 2005* | *Part Time Horticulturist*<br>**Acorn/Bushlands Nursery/Aquarium Centre, Erina Heights** |
| *1997 to present* | *Consultant*<br>**Horticulturist** |
| *1997 to present* | *Public Speaker*<br>**Horticulturist/Arboriculturist Topics** |
| *1997 - 2001* | *Part Time Horticulturist*<br>**Flower Power, Glenhaven** |
| *1991 - 1995* | *Proprietor*<br>**KAC Peninsula Firewood**<br>Assembled team to clear backlog of firewood |
| *1990 - 1996* | *Proprietor/Climber*<br>**Kingdom's Arbor Care** (until its sale) |
| *1986 - 1990* | *Tree Worker*<br>**Arbor 2000 Pro-Climb, Sydney** |
| *1972 to present* | *Bonsai enthusiast* |

## BUSINESS ACHIEVEMENT

Finalist in Central Coast Advocate Community Business Awards 2005 for Specialised Business category.

## MEMBERSHIPS

- Institute of Australian Consulting Arboriculturists
- Australian Institute of Horticulture
- Arboriculture Australia

Gosford City Council Tree Protection Committee - Committee Member - August 1998 to June 2004.

# Disclaimer

The author and Advanced Treescape Consulting take no responsibility for actions taken and their consequence if contrary to those expert and professional instructions are given as recommendations pertaining to safety. The conclusions and recommendations contained in this report refer to the tree(s) condition on the inspection day. All care has been taken using the most up-to-date Arboricultural information in the preparation of this report. The report is based on a visual inspection only. Tree health and environmental conditions can change irreversibly at any time due to unforeseen circumstances or events. Due to *Myrtaceae* family hybridisation, some tree species are difficult to accurately identify. Unless trees are in full flower identification is only probable.

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