Moore Trees
Arboricultural Services
ABN 90887347745

ARBORICULTURAL IMPACT ASSESSMENT REPORT

New Shellharbour Hospital - HV Route

Dunmore Road, Dunmore NSW 2529
Lot 1 DP1144885 & Lot 1 DP302910
September 2022
Final

Prepared for: Health Infrastructure
c/o Savills Australia

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VERSION CONTROL

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12th July 2022	Draft 1 issued
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1 INTRODUCTION

1.1 This report has been conducted to assess the health and condition of eighty five (85) individual and groups of trees along the proposed HV Route for the Early / Enabling works REF submission for the proposed New Shellharbour Hospital. The site is located at Dunmore Road, Dunmore 2529 NSW. This Arboricultural Report has been prepared for Savills Australia.

The purpose of this report is to collect the appropriate tree related data on the subject trees and to provide advice and recommendations to the design and possible construction alternatives in order to reduce impacts to the trees located along the study area.

The following data was collected for each tree:

1) A site plan locating all trees over three (3) metres in height, including all street trees.
2) All trees were assessed for Safe Useful Life Expectancy (SULE), health and amenity value.
3) Genus and species identification of each tree.
4) Impact of the proposed works on each tree.
5) The Tree Protection Zone (TPZ) calculated for each tree.
6) Any branch or root pruning that may be required for trees.

Also noted for the purpose of this report were:

- Health and Vigour; using foliage colour and size, extension growth, presence of deadwood, dieback and epicormic growth throughout the tree.
- Structural condition using visible evidence of bulges, cracks, leans and previous pruning.
- The suitability of the tree taking into consideration the proposed works.
- Age rating; Over-mature (>80% life expectancy), Mature (20-80% life expectancy), Young, Sapling (<20% life expectancy).

1.2 **Location:** The study area is the proposed HV Route, located along several streets and parks that lead from Dunmore Road, Dunmore 2529 NSW, known as Lot 1 DP1144885 & Lot 1 DP302910. The proposed HV Route from herein will be referred to as "the Site". The Site study area can be seen in Diagram 2.

Diagram 1: Location of subject site, Dunmore Road, Dunmore 2529 NSW (Red arrow) (whereis.com.au, 2022)

Diagram 2: Location of the study area. The blue portion of the line shows the route alternative to avoid private trees (Google earth, 2022).

2 METHODOLOGY

2.1 To record the health and condition of the trees, a Visual Tree Assessment (VTA) was undertaken on the subject trees on 27 May 2022. This method of tree evaluation is adapted from Matheny and Clark, 1994 and is recognised by The International Society of Arboriculture, Arboriculture Australia and The Institute Australian of Consulting Arborists (IACA). It is also known as a Level 2: Limited Visual Assessment Process as per the International Society of Arboriculture best management practices.

2.2 This report is only concerned with trees on the site that come under the Shellharbour Local Environmental Plan (SLEP) 2013. Council's LEP provides for certain trees or other vegetation to be prescribed in the Development Control Plan (DCP). Trees or other vegetation prescribed in the DCP require a tree management permit if it is sought to ringbark, cut down, top, lop, remove, injure or wilfully destroy them. In the DCP a tree is prescribed if it meets any one or more of the following criteria:

(a.) is 3 metres or more in height

(b.) has a trunk circumference of 30 cm or more at natural ground level

(c.) has a branch spread of three (3) metres or more

(d.) is a hollow bearing tree (has cavities in trunk or branches, which can be used by native animals for foraging, shelter, roosting and nesting).

2.3 **Height:** The heights and distances within this report have been measured with a Bosch DLE 50 laser measure.

2.4 **Tree Protection Zone (TPZ):** The 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. TPZ's have been calculated for each tree to determine construction impacts. The TPZ calculation is based on the Australian Standard *Protection of trees on development sites*, AS 4970, 2009.

2.5 **Structural Root Zone (SRZ)**: The SRZ is a specified distance measured from the trunk that is set aside for the protection of tree roots, both structural and fibrous. The woody root growth and soil cohesion in this area are necessary to hold the tree upright. The TPZ and SRZ are measured as a radial measurement from the trunk. No roots should be severed within the SRZ area. A detailed methodology on the TPZ and SRZ calculations can be found in Appendix 4.

2.6 **Safe Useful Life Expectancy (SULE)**: The subject trees were assessed for a Safe Useful Life Expectancy (SULE). The SULE rating for each tree can be seen in the Tree Assessment Schedule (Appendix 2). A detailed explanation of SULE can be found in Appendix 3.

2.7 **Plans and information provided:** For this Arboricultural Report I was supplied the following documents:

- Endeavour Energy Connection of Load Proposed Method of Supply Plans 1-4 dated 26/10/2021 File # ULL3373.
- Endeavour Energy, 86 Dunmore Road, Dunmore, New Shellharbour Hospital HV enabling works for REF 1-6, dated 09/09/2022 File # ULL3373.

2.8 **Impact Assessment:** An impact assessment was conducted on the site trees. This was conducted by assessing the site survey and plans provided by Savills Australia. The plans provided were assessed for the following:

- Reduced Level (R.L.) at base of tree.
- Incursions into the Tree Protection Zone (TPZ).
- Assessment of the likely impact of the works.

3 RELEVANT BACKGROUND INFORMATION

3.1 This Arboricultural Report concerns a proposed HV mains route associated with the proposed New Shellharbour Hospital to be located on Dunmore Road, Dunmore. The route of the HV mains is proposed to extend from Wattle Road, corner Baragoot Road and extend along Wattle Road, across sports fields, adjacent to a nearby creek, then run along Burrinjuck Avenue before exiting onto Munmorah Circuit. From there, it will extend up Lakewood Boulevard and follow Shellharbour Road (Road B65) and enter into Dunmore Road, extending down to the proposed Hospital site (Diagram 2).

3.2 Soil mapping of the Kiama area by Hazelton and Tille (1990) indicates the occurrence of the Killalea Soil Landscape Group over the site. Soils of the Killalea Group consist of broad to moderately inclined plains with scattered swamps on quarternary sediments. Soils are moderately deep, prairie soils on the drainage plains and alluvial soils on the alluvial plains. The limitations of this soil type include flood hazard, waterlogging, and permanently high water tables along with high organic matter (Hazelton and Tille 1990).

3.3 **Environmental Significance:** Although this is not a Development Application the approval/control framework regarding trees within the Shellharbour City Council have been used as a basis for this report. The SCC Development Control Plan (DCP), amended 6 July 2016, details tree management for the Shellharbour LGA. Section 20.8 (Existing trees/vegetation and development) of the DCP states;

…The arborist report must identify trees by genus and species, be clearly numbered on a survey plan, provide a health and SULE rating, provide a report on the impacts of the proposed development on the tree/s, recommend trees suitable for retention, nominate a tree protection zone plan, recommend the method of tree management, including any branch or root pruning.

These specifications in this DCP have been covered by this Arboricultural Assessment Report.

3.4 **The Site Trees:** The site was inspected on 27 May 2022. Each tree has been given a unique number for this site and can be viewed on the Tree Location Plan (Appendix 1).

3.5 Trees 1-3 are located on the western side of Dunmore Road. The species consist of Acacia maidenii and River she oak *(Casuarina cunninghamiana)* and are within the grounds of the Shellharbour Anglican College. These trees are part of the car park planting associated with the College (Plate 1). These trees are not large mature examples however the Tree Protection Zones (TPZs) will extend onto the road verge area with minimal canopy overhang. These trees are quite hardy and of an age where they will tolerate a degree of soil and root disturbance for the trenching.

Plate 1: Image showing the area of trees within the Shellharbour Anglican College on Dunmore Road. P. Vezgoff.

3.6 From Dunmore Road, leading onto the northern side of Shellharbour Road, which contains Trees 5-18, the location of the trench in this area will need to be confirmed and it shall be no closer than two (2) metres to the residential boundaries due to trees and shrubs growing within private properties (Plate 2). These trees are growing within private properties however as they have been planted on the boundaries, they will have roots that will extend into the proposed trenching area.

3.7 The species growing along this section were identified as *Acacia maidenii*, River she oak *(Casuarina cunninghamiana)*, Spotted gum *(Corymbia maculata)*, Bangalay *(Eucalyptus botryoides)*, River she oak *(Casuarina cunninghamiana)* and a single mature Port Jackson fig *(Ficus rubiginosa).*

Plate 2: Shellharbour Road vegetation, showing the residential vegetation to the left.

3.8 Trees 15-18 are located on the corner of Lakewood Boulevard and Shellharbour Road (Plate 4). These trees are all natives and appear to have been planted as a screen between the road and residential buildings located in Collins Way. These trees are a mixture of Eucalyptus specimens, Acacia and Fig trees growing on the corner. These trees are all in good in health and condition, and as individual specimens they would not be considered significant, however their value is as a group planting, providing visual amenity and screening between residential houses and the freeway. It is anticipated that the trenching in this area is possible, and should be no closer than the calculated Structural Root Zone (SRZ) distances associated with these trees.

Plate 3: Image showing Trees 6-14 growing on a raised embankment. P. Vezgoff.

Plate 4: Image showing the larger Fig trees on the corner of Shellharbour Road and Woodlands. (Google Earth).

3.9 Trees 19-41 are located on the northern side of Lakewood Boulevard, which has what would be considered an avenue planting of Broad leaved paperbark *(Melaleuca quinquenervia)*. This avenue planting is named so because all of the trees in this area have been planted at a similar time and spacing, and have now reached proportions where they all create a themed visual presence along the entire length of Lakewood Boulevard (Plate 5). There is a grass median strip running down the centre of Lakewood Boulevard that separates the two (2) directional lanes. The main issues for trenching along this section will be impacting on these numerous established plantings.

Plate 5: Image showing the Lakewood Boulevard avenue planting and grass median strip. P. Vezgoff.

3.10 Trees 42 to 48 are located on Munmorah Circuit. These trees are again all Broadleaf Paperbarks in good health and condition. These species are slightly older than the Lakewood Boulevard specimens and, as such, their root systems are creating a little more damage to the kerb, gutter and footpath sections in this area. There are extensive woody surface roots noted in this location. The kerb and gutter are generally in good condition with most of the damage occurring to the footpath and road verge areas. It is possible that the roots from these trees will be slightly asymmetrical, and with a bias towards the residential houses. The kerb and gutter, due to its depth and construction requirements

is likely to have caused the roots to grow in a direction downwards, or along the edge of the kerb and gutter area. Trees 42 to 48 would be considered to be quite visually significant.

Plate 6: Image showing Trees 42-48 along Munmorah Circuit. P. Vezgoff.

3.11 From Munmorah Circuit there are Trees 49 and 50 which are located to the northwest of a cycleway. These trees are in good health and condition. Trees 51-79 are located along Burrinjuck Avenue. These trees are a mixture of natives Spotted gum *(Corymbia maculata),* Broad leaved paperbark *(Melaleuca quinquenervia),* Hill's weeping fig *(Ficus microcarpa var. Hillii),* Cocos palm *(Syagrus romanzoffiana)* and Grey gum *(Eucalyptus punctata).* Several of these trees have been planted in clumps between the road and pedestrian footpath (Plate 9). The majority of these trees are in good health and condition, however due to a lack formative pruning they have developed quite multi stemmed canopies and some show evidence of storm damage. From here the trench would extend across some sports fields which will not have any impact on the adjacent Casuarina specimens that line the local creek (Plate 10).

Plate 7: Image showing the route exiting from Munmorah through to Burrinjuk Avenue. P. Vezgoff.

Plate 8: Image showing Burrinjuk Avenue road verge. P. Vezgoff.

Plate 9: Image showing Burrinjuk Avenue road verge tree group. P. Vezgoff.

Plate 10: Image showing dense plantings of River she oak *(Casuarina cunninghamiana)* along the water course. P. Vezgoff.

3.12 Trees 80-85 are located on the northeastern side of Wattle Road. These trees consist of Kaffir plum *(Harpephyllum caffrum)*, Woollybutt *(Eucalyptus longifolia)* and Spotted gum *(Corymbia maculata)*. It is difficult to determine if these are Council or privately owned trees due to the absence of survey detail provided. Tree 80 is clearly within private property, whereas it is possible that Trees 81-85 may be within the Council road verge. Tree 85 is a large mature Spotted gum that has a substantial wound on the main stem with evidence of a cavity and it is possible that a decay pathogen has colonised this tree as evidenced by the dieback in the upper canopy. Trenching will be difficult to undertake along this section of the route due to the large mature specimens and overlapping TPZs. It is likely under boring may have to be considered for this section of the route should this direction be selected.

Plate 11: Image showing the Trees 80-85 along Wattle Road. P. Vezgoff.

Plate 12: Image showing the Trees 84 and 85 along Wattle Road. P. Vezgoff.

3.13 Exempt trees: Shellharbour Council has an exempt tree species list. None of the trees assessed for this report are on this list.

3.14 Safe Useful Life Expectancy (SULE) is a method of evaluating individual trees. The evaluation is a subjective assessment, not an absolute judgement, because the nature of trees and opinions on trees can vary greatly. SULE assessments are made only by those who are experienced and knowledgeable in tree management. SULE is generally accepted and used world-wide as a method of evaluating trees. Each category has a number of sub-categories. These sub-categories should always be recorded to help future users of the information appreciate the reason for each allocation decision. It is normal to have instances where trees will not fit neatly into a single SULE category. SULE ratings are listed in the Tree Schedule (Appendix 2). The more significant trees are numbered as 19-50 and 80-85. Still significant, but will tolerate construction impacts, are numbered as Trees 1-18, 51-79.

3.15 Potential habitat: No trees were found to have habitat hollows.

4 IMPACTS & DISCUSSION

4.1 Root systems support trees, store energy reserves and absorb water. Tree root systems are made up of woody structural support roots that taper down to the finer feeder roots (Shigo, 2002), they are essential to the ongoing health and structural stability of a tree. Root growth is opportunistic; that is, roots proliferate in areas conducive to root growth. In fertile soils, in the absence of competition, individual roots may extend in more or less a symmetrical manner. Roots of most plants, including large trees, grow primarily in the top one (1) metre of soil (Diagram 3). For this reason, it will be important to limit root damage and severing of roots for the proposed works. It should be noted that Diagram 3 shows a tree growing in ideal ground conditions. Most of the site tree roots will be located between the gutter and residential boundary fences.

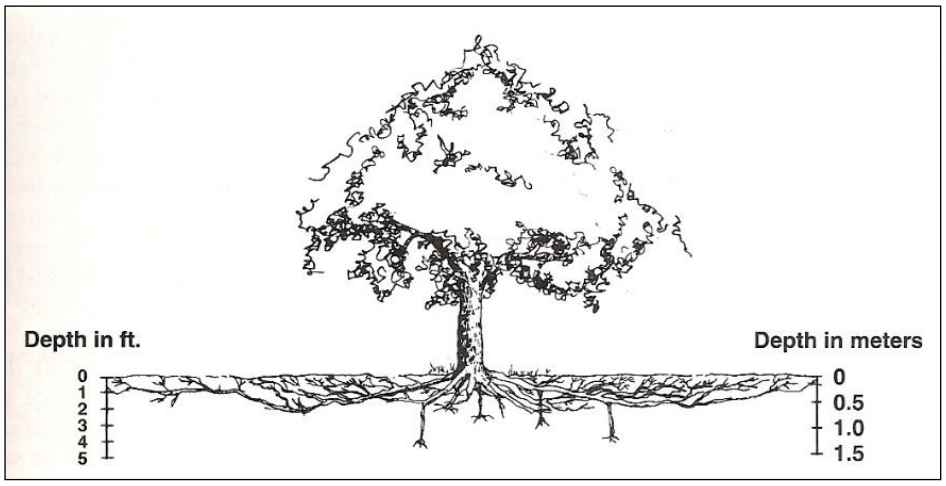

Diagram 3: In the mature tree the tap root is either lost or reduced in size. The vast majority of the root system is composed of horizontally oriented lateral roots (Harris, Clark, Matheny, 1999). It should be noted that this image is of a tree in an ideal situation not an urban environment.

4.2 Root loss (for single roots) for this project is possible however it should be limited to roots <50mm in diameter. Any roots larger than fifty (50) millimeters in diameter are becoming structural woody roots. Damaging woody roots will expose heartwood that can often lead to the establishment of decay fungi over time. Strip trenching through a TPZ will cause detrimental impacts to any tree, even destabilising them.

4.3 Options to avoid open trenching may include directional drilling or Hydrovac (Excavation through high pressure water) When undertaking hydro-vacuum excavation the water pressure shall be calibrated so as to not damage, remove bark, or sever roots over 30mm in diameter. Canopy clearance will require assessment based on the size of the truck that will be used however with most trenching being next to the road access should not be an issue. Plate A shows an example of Hydro excavation showing just how many roots are likely to be encountered on a paper bark tree.

Plate A: Example of Hydro excavation and the extent of roots that can sometimes be encountered. The yellow area is within the SRZ of this tree, the yellow is part of the TPZ. P. Vezgoff.

4.4 Horizontal boring with grundomat®: Grundomat pneumatic piercing tools have been providing accurate horizontal bores beneath roads, railways, and landscaping across around the world for nearly 45 years. Water, gas, sewer and electrical industries have used this technology in order to reduce open trenching. Minimal operating space is required (Plate B) and the horizontal boring tool serves as a complement, and in many situations an economical alternative to, larger, more expensive directional drilling equipment. Should directional drilling be used entry and exit holes for the boring machine will need to be located outside of any TPZ distance.

Plate B: Image showing the example of the Grundomat drill used for small entry hole drilling.

4.5 TPZ and SRZ incursions will need to be used to determine if a tree would remain viable or not. Based on early discussions, the greatest impacts to the study area HV route trees will be along Lakewood Boulevard and Munmorah Circuit. Potentially these two (2) streets could be heavily impacted by the proposed works and the loss of trees planted as avenue plantings is likely to raise environmental concerns locally. Burrinjuck Avenue will also potentially be impacted, however many of the trees and shrubs in this section could be replaced with compensatory planting or directional drilling utilised under some of the larger tree groups like Trees 55-60 and Tree group 74. The Trees along Wattle Road (Trees 80-85) should be possible to negotiate around with the use of hydro excavation across the TPZ areas.

4.6 Updated designs following my initial report show that the route can now be installed through the centre of Lakewood Boulevard thus negating the impacts to the street trees along this section of the study area.

4.7 The impacts to Trees 42 to 48 have also been negated along Munmorah Circuit however the route has now been moved to the other side of this street and now impacts park trees that are growing on the road verge (Plate C).

4.8 Trees 80-85 will now not be impacted as the route has been altered along Parklands Drive and into an easement between building where it enters the end of the route at the substation.

Plate C: Image showing the trees to the left of the image now impacted by the new route.

5 RECOMMENDATIONS

5.1 The site trees numbered in this report are recommended to be added to the survey to enable a more accurate assessment to be undertaken for tree impacts.

5.2 Fill can occur over a TPZ area provided it does not increase levels around the trunk of the tree or shrub. If fill increases above any basal area then the tree or shrub should be removed.

5.3 Following the site trees being added to the survey, the excavation of trenches in within TPZ and SRZ areas may be possible to undertake through open trenching. This shall be undertaken with a flat bucket excavator so as not to tear roots. A spotter shall be used, and excavations shall be undertaken in small increments so as to limit root damage. No roots greater than fifty (50) millimetres in diameter shall be severed. Should large structural woody roots be uncovered, that are greater than fifty (50) millimetres in diameter, these should be retained with infrastructure to be threaded under the roots

5.4 **The Tree Protection Zone (TPZ) and Structural Root Zone (SRZ):** The TPZ is implemented to ensure the protection of the trunk and branches of the subject tree. The TPZ is a radial measurement based on the Diameter at Breast Height (DBH) of the tree. The SRZ is also a radial measurement from the trunk used to protect and restrict damage to the roots of the tree. In a disturbed situation, such as these trees are growing in, root growth is difficult to predict and is often opportunistic.

5.5 The Tree Protection Zone (TPZ) and Structural Root Zone (SRZ) have been measured from the center of the trunk. The following activities shall be avoided within the TPZ and SRZ of the trees to be retained;

- Storage of building materials.
- Disposal of waste materials, solid or liquid.

If you have any questions in relation to this project please contact me.

Paul Vezgoff
Consulting Arborist
Dip Arb (Dist), Arb III, Hort cert, AA, ISA
16th September 2022

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Appendix 1

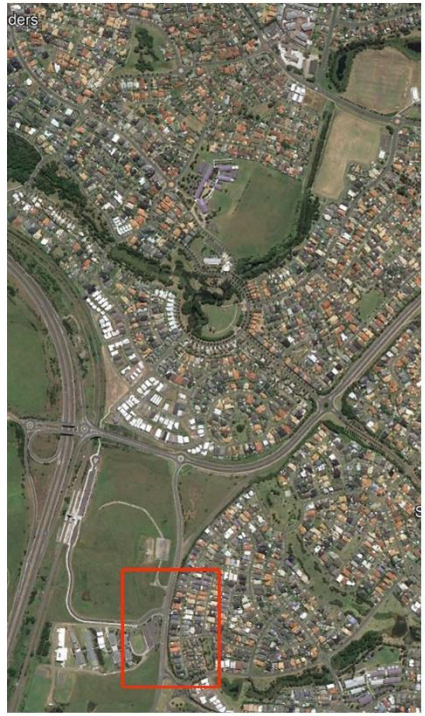
Plans 1-4

Tree Location Plans

Tree Location Plan

Moore Trees

Plan 1



Date:	11.7.2022
Drawn:	P.Vezgoff
Site Address:	Dunmore Road, Dunmore NSW 2529 Lot 1 DP1144885 & Lot 1 DP302910

Tree Location Plan

Plan 2

Moore Trees

Date:	11.7.2022
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Site Address:	Dunmore Road, Dunmore NSW 2529 Lot 1 DP1144885 & Lot 1 DP302910

Tree Location Plan

Moore Trees

Plan 3

Date:	11.7.2022
Drawn:	P.Vezgoff
Site Address:	Dunmore Road, Dunmore NSW 2529 Lot 1 DP1144885 & Lot 1 DP302910

Moore Trees

Tree Location Plan

Plan 4

Date:	11.7.2022
Drawn:	P.Vezgoff
Site Address:	Dunmore Road, Dunmore NSW 2529 Lot 1 DP1144885 & Lot 1 DP302910

Appendix 2

Tree health & condition assessment schedule

TREE HEALTH AND CONDITION ASSESSMENT SCHEDULE – New Shellharbour Hospital, HV mains Route

Tree	Species	Height (m)	Spread (m)	DBH (m)	SRZ basal	Live canopy %	SULE	Condition	Age	Comments	TPZ (m)	SRZ (m)
1	Acacia maidenii	5	4	0.2	0.3	100	2a May only live for 15-40 years	Good	Mature		2.4	1.9
2	Acacia maidenii	5	4	0.2	0.3	100	2a May only live for 15-40 years	Good	Mature		2.4	1.9
3	River she oak (Casuarina cunninghamiana)	8	4	0.26	0.36	100	1a >40 years	Good	Mature		3.1	2.1
4	Spotted gum (Corymbia maculata)	6	3	0.21	0.31	60	2c removed for more suitable planting	Poor	Mature	Storm Damage , loss of main leader	2.5	2
5	Spotted gum (Corymbia maculata)	6	3	0.21	0.31	100	2c removed for more suitable planting	Good	Mature	group of 8	2.5	2
6	Bangalay (Eucalyptus botryoides)	13	3.5	0.25	0.35	100	1a >40 years	Good	Mature		3	2.1
7	Bangalay (Eucalyptus botryoides)	13	3.5	0.25	0.35	100	1a >40 years	Good	Mature		3	2.1
8	Bangalay (Eucalyptus botryoides)	13	3.5	0.25	0.35	100	1a >40 years	Good	Mature		3	2.1
9	Bangalay (Eucalyptus botryoides)	13	3.5	0.25	0.35	100	1a >40 years	Good	Mature		3	2.1
10	Bangalay (Eucalyptus botryoides)	13	3.5	0.25	0.35	100	1a >40 years	Good	Mature		3	2.1
11	Bangalay (Eucalyptus botryoides)	13	3.5	0.25	0.35	100	1a >40 years	Good	Mature		3	2.1
12	Bangalay (Eucalyptus botryoides)	13	3.5	0.25	0.35	100	1a >40 years	Good	Mature		3	2.1
13	Bangalay (Eucalyptus botryoides)	14	4.5	0.35	0.45	100	1a >40 years	Good	Mature		4.2	2.3
14	River she oak (Casuarina cunninghamiana)	9	4	0.3	0.4	100	1a >40 years	Good	Mature		3.6	2.2
15	River she oak (Casuarina cunninghamiana)	10	5	0.3	0.4	100	1a >40 years	Good	Mature		3.6	2.2
16	River she oak (Casuarina cunninghamiana)	10	5	0.3	0.4	100	1a >40 years	Good	Mature		3.6	2.2
17	River she oak (Casuarina cunninghamiana)	10	5	0.3	0.4	100	1a >40 years	Good	Mature		3.6	2.2
18	Port jackson fig (Ficus rubiginosa)	8	6.3	0.45	0.55	100	1a >40 years	Good	Mature	Multi-Stemmed Specimen	5.4	2.5
19	Spotted gum (Corymbia maculata)	17	6	0.48	0.58	100	1a >40 years	Good	Mature		5.8	2.6
20	Spotted gum (Corymbia maculata)	12	4	0.25	0.35	100	1a >40 years	Good	Mature		3	2.1
21	Broad leaved paperbark (Melaleuca quinquenervia)	8	4	0.58	0.68	100	1a >40 years	Good	Mature		7	2.7
22	Broad leaved paperbark (Melaleuca quinquenervia)	6.5	1.5	0.2	0.3	100	1a >40 years	Good	Mature		2.4	1.9

Tree	Species	Height (m)	Spread (m)	DBH (m)	SRZ basal	Live canopy %	SULE	Condition	Age	Comments	TPZ (m)	SRZ (m)
23	Broad leaved paperbark (Melaleuca quinquenervia)	9	2.5	0.25	0.35	100	1a >40 years	Good	Mature		3	2.1
24	Broad leaved paperbark (Melaleuca quinquenervia)	9	2.5	0.25	0.35	100	1a >40 years	Good	Mature		3	2.1
25	Broad leaved paperbark (Melaleuca quinquenervia)	9	2.5	0.25	0.35	100	1a >40 years	Good	Mature		3	2.1
26	Broad leaved paperbark (Melaleuca quinquenervia)	9	2.5	0.25	0.35	100	1a >40 years	Good	Mature		3	2.1
27	Broad leaved paperbark (Melaleuca quinquenervia)	9	2.5	0.25	0.35	100	1a >40 years	Good	Mature		3	2.1
28	Broad leaved paperbark (Melaleuca quinquenervia)	9	2.5	0.25	0.35	100	1a >40 years	Good	Mature		3	2.1
29	Broad leaved paperbark (Melaleuca quinquenervia)	9	2.5	0.25	0.35	100	1a >40 years	Good	Mature		3	2.1
30	Broad leaved paperbark (Melaleuca quinquenervia)	9	2.5	0.25	0.35	100	1a >40 years	Good	Mature		3	2.1
31	Broad leaved paperbark (Melaleuca quinquenervia)	9	2.5	0.25	0.35	100	1a >40 years	Good	Mature		3	2.1
32	Broad leaved paperbark (Melaleuca quinquenervia)	11	2.5	0.3	0.4	100	1a >40 years	Good	Mature		3.6	2.2
33	Broad leaved paperbark (Melaleuca quinquenervia)	11	2.5	0.3	0.4	100	1a >40 years	Good	Mature		3.6	2.2
34	Broad leaved paperbark (Melaleuca quinquenervia)	11	2.5	0.3	0.4	100	1a >40 years	Good	Mature		3.6	2.2
35	Broad leaved paperbark (Melaleuca quinquenervia)	11	2.5	0.3	0.4	100	1a >40 years	Good	Mature		3.6	2.2
36	Broad leaved paperbark (Melaleuca quinquenervia)	11	2.5	0.3	0.4	100	1a >40 years	Good	Mature		3.6	2.2
37	Broad leaved paperbark (Melaleuca quinquenervia)	11	2.5	0.3	0.4	100	1a >40 years	Good	Mature		3.6	2.2
38	Broad leaved paperbark (Melaleuca quinquenervia)	11	2.5	0.3	0.4	100	1a >40 years	Good	Mature		3.6	2.2
39	Broad leaved paperbark (Melaleuca quinquenervia)	11	2.5	0.3	0.4	100	1a >40 years	Good	Mature		3.6	2.2
40	Broad leaved paperbark (Melaleuca quinquenervia)	11	2.5	0.3	0.4	100	1a >40 years	Good	Mature		3.6	2.2
41	Broad leaved paperbark (Melaleuca quinquenervia)	11	2.5	0.3	0.4	100	2c removed for more suitable planting	Fair	Mature	Included codom stems	3.6	2.2
42	Broad leaved paperbark (Melaleuca quinquenervia)	11	2.5	0.55	0.65	100	1a >40 years	Good	Mature		6.6	2.7

Tree	Species	Height (m)	Spread (m)	DBH (m)	SRZ basal	Live canopy %	SULE	Condition	Age	Comments	TPZ (m)	SRZ (m)
43	Broad leaved paperbark (Melaleuca quinquenervia)	11	2.5	0.55	0.65	100	1a >40 years	Good	Mature		6.6	2.7
44	Broad leaved paperbark (Melaleuca quinquenervia)	11	2.5	0.55	0.65	100	1a >40 years	Good	Mature		6.6	2.7
45	Broad leaved paperbark (Melaleuca quinquenervia)	11	2.5	0.55	0.65	100	1a >40 years	Good	Mature		6.6	2.7
46	Broad leaved paperbark (Melaleuca quinquenervia)	11	2.5	0.55	0.65	100	1a >40 years	Good	Mature		6.6	2.7
47	Broad leaved paperbark (Melaleuca quinquenervia)	11	2.5	0.55	0.65	100	1a >40 years	Good	Mature		6.6	2.7
48	Broad leaved paperbark (Melaleuca quinquenervia)	11	2.5	0.55	0.65	100	1a >40 years	Good	Mature	slight lean	6.6	2.7
49	Broad leaved paperbark (Melaleuca quinquenervia)	10	5	0.33	0.43	100	1a >40 years	Good	Mature	slight lean	4	2.2
50	Broad leaved paperbark (Melaleuca quinquenervia)	10	5	0.33	0.43	100	1a >40 years	Good	Mature	slight lean	4	2.2
51	Broad leaved paperbark (Melaleuca quinquenervia)	6	5	0.3	0.4	100	1a >40 years	Fair	Mature	Multi-Stemmed Specimen	3.6	2.2
52	Broad leaved paperbark (Melaleuca quinquenervia)	6	5	0.3	0.4	100	1a >40 years	Fair	Mature	Multi-Stemmed Specimen	3.6	2.2
53	Hill's weeping fig (Ficus microcarpa var. Hillii)	5	2.5	0.2	0.3	100	2c removed for more suitable planting	Good	Mature	Multi-Stemmed Specimen	2.4	1.9
54	Cocos palm (Syagrus romanzoffiana)	5.5	3.5	0.27	0.37	100	1a >40 years	Good	Mature		3.2	2.1
55	Grey gum (Eucalyptus punctata)	9	3.5	0.3	0.4	100	1a >40 years	Good	Mature	Multi-Stemmed Specimen	3.6	2.2
56	Grey gum (Eucalyptus punctata)	9	3.5	0.3	0.4	100	1a >40 years	Good	Mature	Multi-Stemmed Specimen	3.6	2.2
57	Grey gum (Eucalyptus punctata)	9	3.5	0.3	0.4	100	1a >40 years	Good	Mature	Multi-Stemmed Specimen	3.6	2.2
58	Grey gum (Eucalyptus punctata)	9	3.5	0.5	0.6	100	1a >40 years	Good	Mature	Multi-Stemmed Specimen	6	2.6
59	Grey gum (Eucalyptus punctata)	9	3.5	0.5	0.6	100	1a >40 years	Good	Mature	Multi-Stemmed Specimen	6	2.6
60	Grey gum (Eucalyptus punctata)	9	3.5	0.5	0.6	100	1a >40 years	Good	Mature	Multi-Stemmed Specimen	6	2.6
61	Broad leaved paperbark (Melaleuca quinquenervia)	9	4	0.19	0.29	100	1a >40 years	Good	Mature		2.3	1.9
62	Grey gum (Eucalyptus punctata)	13	6	0.32	0.42	100	2c removed for more suitable planting	Good	Mature	Multi-Stemmed Specimen, 1 stem removed	3.8	2.2
63	Grey gum (Eucalyptus punctata)	13	5.5	0.28	0.38	100	1a >40 years	Good	Mature	Multi-Stemmed Specimen	3.4	2.1
64	Grey gum (Eucalyptus punctata)	13	5.5	0.56	0.66	100	1a >40 years	Good	Mature	twin stems	6.7	2.7

Tree	Species	Height (m)	Spread (m)	DBH (m)	SRZ basal	Live canopy %	SULE	Condition	Age	Comments	TPZ (m)	SRZ (m)
65	Grey gum (Eucalyptus punctata)	13	5.5	0.28	0.38	100	1a >40 years	Good	Mature	Multi-Stemmed Specimen	3.4	2.1
66	Grey gum (Eucalyptus punctata)	13	5.5	0.56	0.66	100	1a >40 years	Good	Mature	twin stems	6.7	2.7
67	Grey gum (Eucalyptus punctata)	13	5.5	0.56	0.66	100	1a >40 years	Good	Mature	twin stems	6.7	2.7
68	Grey gum (Eucalyptus punctata)	13	5.5	0.28	0.38	100	1a >40 years	Good	Mature	twin stems	3.4	2.1
69	Bangalay (Eucalyptus botryoides)	11	4.5	0.28	0.38	100	1a >40 years	Good	Mature		3.4	2.1
70	Swamp mahogany (Eucalyptus robusta)	13	5	0.6	0.7	100	1a >40 years	Good	Mature		7.2	2.8
71	Swamp mahogany (Eucalyptus robusta)	9	3	0.25	0.35	100	1a >40 years	Good	Mature		3	2.1
72	Grey gum (Eucalyptus punctata)	12	6	0.3	0.4	100	1a >40 years	Good	Mature		3.6	2.2
73	Broad leaved paperbark (Melaleuca quinquenervia)	7	4	0.55	0.65	100	1a >40 years	Good	Mature		6.6	2.7
74	Mixed native species	13	5	0.5	0.6	100	2c removed for more suitable planting	Good	Mature	group planting	6.6	2.7
75	Broad leaved paperbark (Melaleuca quinquenervia)	6.5	3	0.3	0.4	100	1a >40 years	Good	Mature	Multi-Stemmed Specimen	3.6	2.2
76	Broad leaved paperbark (Melaleuca quinquenervia)	6.5	3	0.3	0.4	100	1a >40 years	Good	Mature	Multi-Stemmed Specimen	3.6	2.2
77	Broad leaved paperbark (Melaleuca quinquenervia)	6.5	3	0.3	0.4	100	1a >40 years	Good	Mature	Multi-Stemmed Specimen	3.6	2.2
78	Broad leaved paperbark (Melaleuca quinquenervia)	6.5	3	0.3	0.4	100	1a >40 years	Good	Mature	Multi-Stemmed Specimen	3.6	2.2
79	Broad leaved paperbark (Melaleuca quinquenervia)	6.5	3	0.3	0.4	100	1a >40 years	Good	Mature	Multi-Stemmed Specimen	3.6	2.2
80	Kaffir plum (Harpephyllum caffrum)	11	8	0.6	0.7	100	1a >40 years	Good	Mature		7.2	2.8
81	Woollybutt (Eucalyptus longifolia)	10	3	0.3	0.4	100	1a >40 years	Fair	Mature	Multi-Stemmed Specimen	3.6	2.2
82	Kaffir plum (Harpephyllum caffrum)	11	4	0.65	0.75	100	1a >40 years	Good	Mature		7.8	2.8
83	Spotted gum (Corymbia maculata)	13	5	0.8	0.9	70	2a May only live for 15-40 years	Good	Mature	pruned for powerline clearance	9.6	3.1
84	Spotted gum (Corymbia maculata)	14	7	0.48	0.58	100	1a >40 years	Good	Mature		5.8	2.6
85	Spotted gum (Corymbia maculata)	15	10	0.97	1.07	70	2a May only live for 15-40 years	Fair	Mature	cavity with fungal bracket	11.6	3.3

KEY

Tree No: Relates to the number allocated to each tree for the Tree Plan.

Height: Height of the tree to the nearest metre.

Spread: The average spread of the canopy measured from the trunk.

DBH: Diameter at breast height. An industry standard for measuring trees at 1.4 metres above ground level, this measurement is used to help calculate Tree Protection Zones.

Live Crown Ratio: Percentage of foliage cover for a particular species.

Age Class:	Young:	Recently planted tree	Semi-mature:< 20% of life expectancy
	Mature:	20-90% of life expectancy	Over-mature:>90% of life expectancy

SULE: See SULE methodology in the Appendix 3

Tree Protection Zone (TPZ): The minimum area set aside for the protection of the trees trunk, canopy and root system throughout the construction process. Breaches of the TPZ will be specified in the recommendations section of the report.

Structural Root Zone (SRZ): The SRZ is a specified distance measured from the trunk that is set aside for the protection of the trees roots both structural and fibrous.

Appendix 3

SULE categories (after Barrell, 2001)[1]

SULE Category	Description
Long	*Trees that appeared to be retainable at the time of assessment for more than 40 years with an acceptable level of risk.*
1a	Structurally sound trees located in positions that can accommodate for future growth
1b	Trees that could be made suitable for retention in the long term by remedial tree care.
1c	Trees of special significance that would warrant extraordinary efforts to secure their long term retention.
Medium	*Trees that appeared to be retainable at the time of assessment for 15-40 years with an acceptable level of risk.*
2a	Trees that may only live for 15-40 years
2b	Trees that could live for more than 40 years but may be removed for safety or nuisance reasons
2c	Trees that could live for more than 40 years but may be removed to prevent interference with more suitable individuals or to provide for new planting.
2d	Trees that could be made suitable for retention in the medium term by remedial tree care.
Short	*Trees that appeared to be retainable at the time of assessment for 5-15 years with an acceptable level of risk.*
3a	Trees that may only live for another 5-15 years
3b	Trees that could live for more than 15 years but may be removed for safety or nuisance reasons.
3c	Trees that could live for more than 15 years but may be removed to prevent interference with more suitable individuals or to provide for a new planting.
3d	Trees that require substantial remedial tree care and are only suitable for retention in the short term.
Remove	*Trees that should be removed within the next five years.*
4a	Dead, dying, suppressed or declining trees because of disease or inhospitable conditions.
4b	Dangerous trees because of instability or loss of adjacent trees
4c	Dangerous trees because of structural defects including cavities, decay, included bark, wounds or poor form.
4d	Damaged trees that are clearly not safe to retain.
4e	Trees that could live for more than 5 years but may be removed to prevent interference with more suitable individuals or to provide for a new planting.
4f	Trees that are damaging or may cause damage to existing structures within 5 years.
4g	Trees that will become dangerous after removal of other trees for the reasons given in (a) to (f).
4h	Trees in categories (a) to (g) that have a high wildlife habitat value and, with appropriate treatment, could be retained subject to regular review.
Small	*Small or young trees that can be reliably moved or replaced.*
5a	Small trees less than 5m in height.
5b	Young trees less than 15 years old but over 5m in height.
5c	Formal hedges and trees intended for regular pruning to artificially control growth.

updated 01/04/01)

1 (Barrell, J. (2001) "SULE: Its use and status into the new millennium" in *Management of mature trees*, Proceedings of the 4th NAAA Tree Management Seminar, NAAA, Sydney.

Appendix 4

TPZ and SRZ methodology

Determining the Tree Protection Zone (TPZ)

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

TPZ = DBH x 12

Where

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 no greater than 15 metres (except where crown protection is required.). Some instances may require variations to the TPZ.

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

Determining the 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 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 or Figure 1. Root investigation may provide more information on the extent of these roots.

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 0.15m will be 1.5m (see Figure 1).

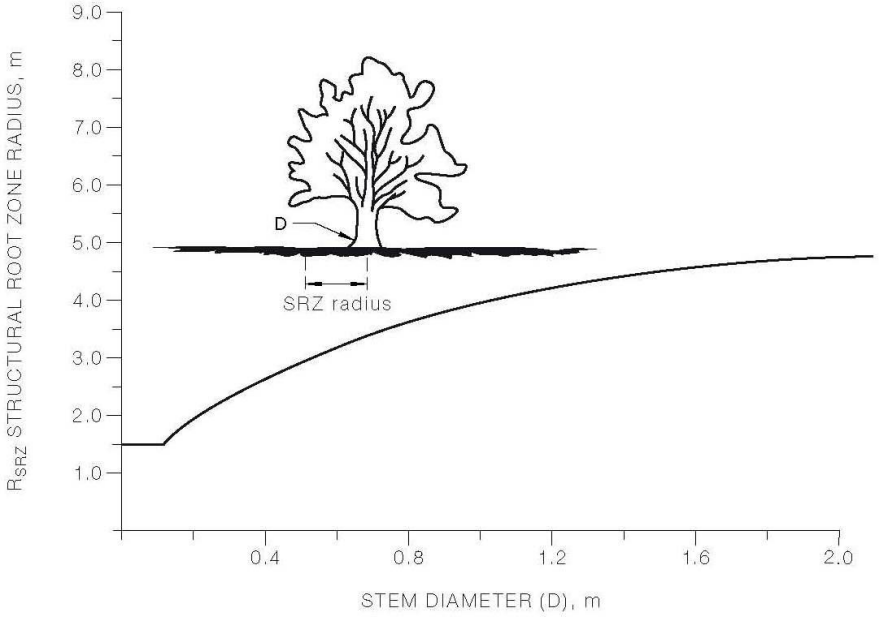

FIGURE 1 - STRUCTURAL ROOT ZONE

Notes:

1 R_{SRZ} is the structural root zone radius.
2 *D* is the stem diameter measured immediately above root buttress.
3 The SRZ for trees less than o.15 metres diameter is 1.5 metres.
4 The SRZ formula and graph do not apply to palms, other monocots, cycads and tree ferns.
5 This does not apply to trees with an asymmetrical root plate.

Appendix 5

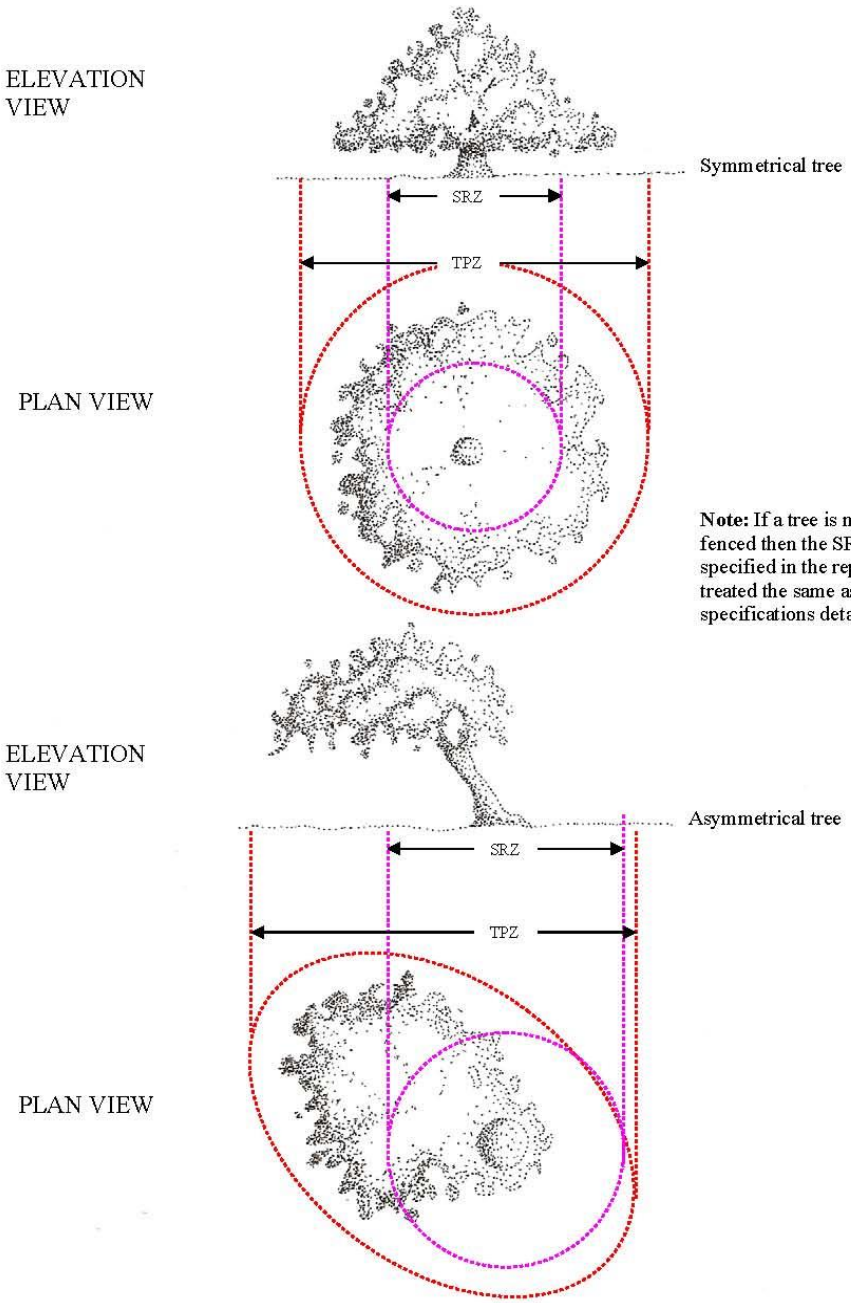

Figure 1: Indicative Tree Protection Zone (TPZ) and Root Protection Zone (SRZ)
Drawn: P. Vezgoff ©

Appendix 6

Tree structure information diagram

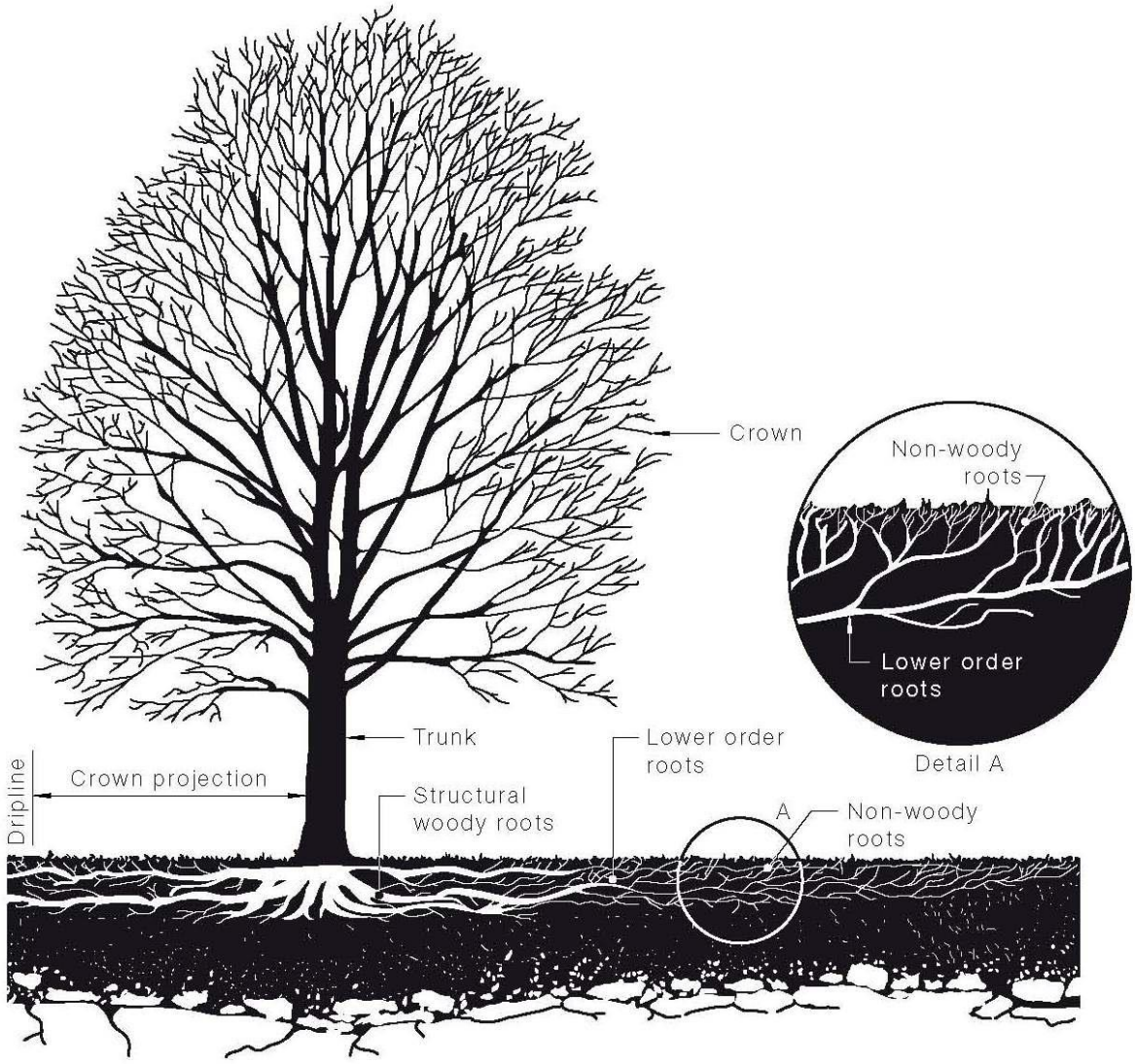

Figure 2: Structure of a tree in a normal growing environment (AS 4970, 2009.).

Appendix 7

Explanatory Notes

- **Mathematical abbreviations:** > = Greater than; < = Less than.

- **Measurements/estimates:** All dimensions are estimates unless otherwise indicated. Less reliable estimated dimensions are indicated with a '?'.

- **Species:** The species identification is based on visual observations and the common English name of what the tree appeared to be is listed first, with the botanical name after in brackets. In some instances, it may be difficult to quickly and accurately identify a particular tree without further detailed investigations. Where there is some doubt of the precise species of tree, it is indicated with a '?' after the name in order to avoid delay in the production of the report. The botanical name is followed by the abbreviation sp if only the genus is known. The species listed for groups and hedges represent the main component and there may be other minor species not listed.

- **Height:** Height is estimated to the nearest metre.

- **Spread:** The maximum crown spread is visually estimated to the nearest metre from the centre of the trunk to the tips of the live lateral branches.

- **Diameter:** These figures relate to 1.4m above ground level and are recorded in centimetres. If appropriate, diameter is measure with a diameter tape. 'M' indicates trees or shrubs with multiple stems.

- **Estimated Age:** Age is estimated from visual indicators and it should only be taken as a provisional guide. Age estimates often need to be modified based on further information such as historical records or local knowledge.

- **Distance to Structures:** This is estimated to the nearest metre and intended as an indication rather than a precise measurement.

Appendix 8

Bibliography

Draper D B & Richards P A (2009) *Dictionary for managing trees in urban environments*
CSIRO Publishing
Collingwood, Vic

Harris R.W, Clark J.R, Matheny N.P (1999). *Arboriculture.* Third edition.
Prentice Hall
New Jersey.

Matheny N.P & Clark J.R. (1994) *Evaluation of hazard trees in Urban areas*
Second edition, International Society of Arboriculture
Illinois.

Mattheck C & Breloer H (2003) *The Body Language of Trees: A handbook for failure analysis.* Research for Amenity Trees No. 4,
Seventh edition, The Stationary Office, London.

Shigo A.L. (2002) *A New Tree Biology.*
Shigo and Trees, Associates,Durham, New Hampshire.

Schwarze, F.W.M.R, Engels, J. Mattheck. C (2000) *Fungal strategies of wood decay in trees*
Springer-Verlag Berlin Heidelberg
Germany

Standards Australia, 2007, *Pruning of amenity trees* AS 4373, 2007
Standards Australia Ltd
Sydney

Standards Australia, 2009. *Protection of trees on development sites,* AS 4970, 2009
Standards Australia Ltd
Sydney

Hazelton, P.A. and Tille, P.J. 1990. *Soil Landscapes of Kiama, sheet 9028 1:100 000 Sheet and Map.*
Soil Conservation Service of NSW
Sydney

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- 1997 – Completed Certificate in Crane and Plant Electrical Safety
- 1996 – Attained Tree Surgeon Certificate (AQF Cert II) at Ryde TAFE
- 1990 – Completed two month intensive course on garden design at the Inchbald School of Design, London, United Kingdom
- 1990 – Completed patio, window box and balcony garden design course at Brighton College of Technology, United Kingdom
- 1989 – Awarded the Big Brother Movement Award for Horticulture (a grant by Lady Peggy Pagan to enable horticulture training in the United Kingdom)
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- QTRA Conference, Sydney Australia (November 2016)
- TRAQ Conference, Auckland NZ / Sydney (2013/2018)
- International Society of Arboriculture Conference (Brisbane 2008)
- Tree related hazards: recognition and assessment by Dr David Londsdale (Brisbane 2008)
- Tree risk management: requirements for a defensible system by Dr David Londsdale (Brisbane 2008)
- Tree dynamics and wind forces by Ken James (Brisbane 2008)
- Wood decay and fungal strategies by Dr F.W.M.R. Schwarze (Brisbane 2008)
- Tree Disputes in the Land & Environment Court – The Law Society (Sydney 2007)
- Barrell Tree Care Workshop- Trees on construction sites (Sydney 2005).
- Tree Logic Seminar- Urban tree risk management (Sydney 2005)
- Tree Pathology and Wood Decay Seminar presented by Dr F.W.M.R. Schwarze (Sydney 2004)
- Inaugural National Arborist Association of Australia (NAAA) tree management workshop- Assessing hazardous trees and their Safe Useful Life Expectancy (SULE) (Sydney 1997).