Moore Trees
Arboricultural Services

ABN 90887347745

Arboricultural Development Assessment Report

Fairways North
Bingara Gorge
BG-ST-01
October 2018
FINAL

Member 2018

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VERSION CONTROL

Date of Issue	Details
25 October 2018	Draft 1 issued
25 October 2018	Final version issued

1 INTRODUCTION

1.1 This report has been prepared for Lendlease. The report is an arboricultural assessment report in relation to a tree which, I have been informed, may contain signs of scarring from pre-European times. The scope of the report will cover the age, health and likely origin of the scar and assess whether the tree is 200 years old or greater.

Also included in this report are tree protection distances that have been calculated, should the tree be retained, so as to minimise any potential impacts regarding fire trail construction or changes in levels.

The following data was collected for the subject tree:

1) The tree was assessed for Safe Useful Life Expectancy (SULE), health and amenity value.
2) Genus and species identification of the tree.
3) Estimated age of the tree.
4) The Tree Protection Zone (TPZ) calculated for the tree.
5) Aerial photography from 1956.

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.
- Age rating; Over-mature (>80% life expectancy), Mature (20-80% life expectancy), Young, Sapling (<20% life expectancy).

1.3 Location: The site and subject tree are located at Bingara Gorge, known as Lot 31 in Plan Number 270536. Parcel number 25089.

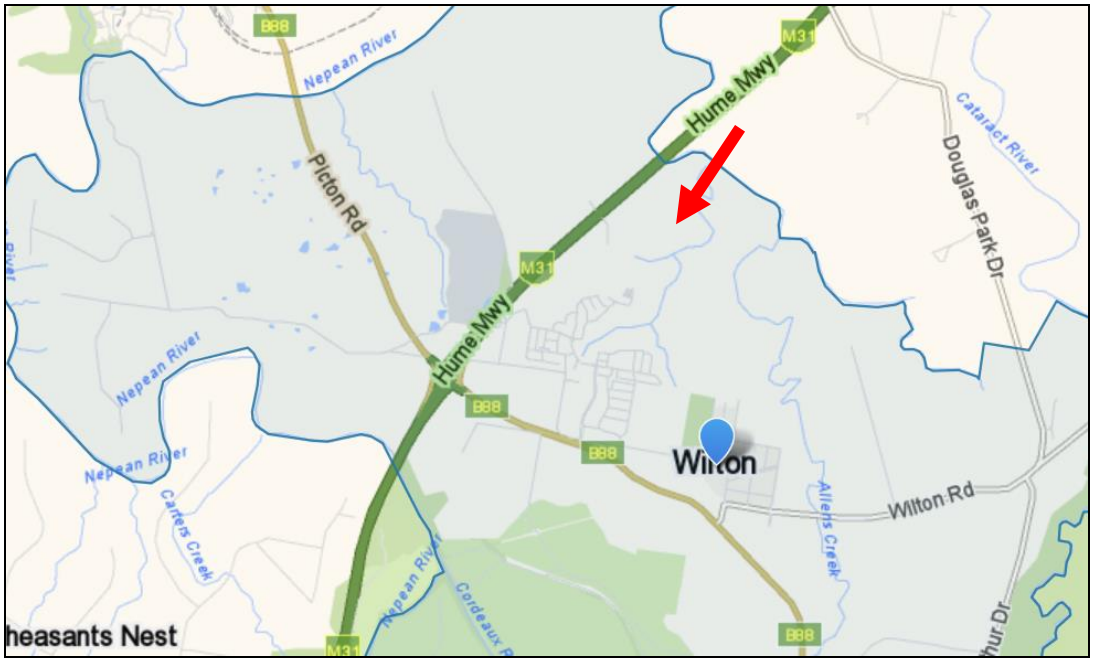

Diagram 1: Location of subject tree, (Red arrow) (whereis.com.au, 2018)

2 METHODOLOGY

2.1 To record the health and condition of the tree, a Visual Tree Assessment (VTA) was undertaken on the tree on 12th October 2018. This method of tree evaluation is adapted from Matheny and Clark, 1994 and is recognised by The International Society of Arboriculture. All inspections were undertaken from the ground. No diagnostic devices were used on this tree.

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

2.3 **Tree Protection Zones (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. A TPZ has been calculated for this tree. The TPZ calculation is based on the Australian Standard *Protection of trees on development sites,* AS 4970, 2009.

2.4 **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 this area. A detailed methodology on the TPZ and SRZ calculations can be found in Appendix 3.

2.5 **Safe Useful Life Expectancy (SULE)**: The subject tree was assessed for a SULE. A detailed explanation of SULE can be found in Appendix 2.

3 RELEVANT BACKGROUND INFORMATION

3.1 This Report concerns a Grey Gum *(Eucalyptus punctata),* growing on the edge of a sandstone gorge south east of the Hume Highway. The subject tree is nineteen (19) metres in height with a diameter at breast height (DBH) of eight hundred and sixty (860) millimetres. It has a basal measurement of one thousand and fifty (1050) millimetres. This equates to a TPZ of ten (10) metres and SRZ of 3.2 metres. The canopy measures nine (9) metres north, seven (7) metres south, six (6) metres east and nine (9) metres to the west.

Plate 1: The subject tree. Red marker is 2 metres in length. P. Vezgoff

3.2 The main trunk bifurcates at approximately 2.8 metres from ground level into a multibranched, generally symmetrical, tree. There is scattered deadwood throughout the canopy of one hundred (100) millimetres in diameter. There are no large habitat hollows noted. There is a large wound located on the southern side of the trunk on the clear paddock side of a stand of trees that follows the gorge line of Stringybark Creek.

3.3 The wound is approximately 1.4 metres in height and varies between one hundred and fifty (150) and two hundred (200) millimetres wide from ground level and tapering off towards the top of the wound. The internal area of the wound shows no signs of decay, pest or other diseases however the exposed sapwood does show signs of fire damage as evidenced by the charcoal. It was also noted that the surrounding trees in the area also show signs of fire damage that would have occurred at some stage within the last fifty (50) years (See cover page image).

Plate 2: Image showing the scar. Red and white tape is 2 metres in length. P. Vezgoff

3.4 Based on the images shown in Plate 7, the open field area to the south of the tree has been previously cleared for pastoral purposes since European settlement of the area, it is possible that this wound has been caused through mechanical damage during the clearing process.

3.5 Although scar trees are a specialist subject and my experience in this area is limited, I would add the following in terms of the way wood reacts to wounding. Other scar trees that I have been able to investigate in the past, show that more often a traditional scar tree will often have rounded ends where a section of wood has been delaminated from the tree to produce what is known as items of Aboriginal heritage/significance/lifestyle uses. A tree would need to be large enough in the first place to be utilised for this purpose.


Plates 3 & 4: Images showing two registered scar trees near Narellan. Note the height of the scar from ground level and the rounded tops and bottoms of each scar. P. Vezgoff

3.6 When sections of wood are removed from a tree, "wound wood" develops around this wound over many years, producing a rolled effect around the wound which leads to quite an oval appearance of the wound. The wound can stay like this for many decades. Plates 5 and 6 shows a canoe scar tree over an 80 year period where the wound has remarkably stayed quite static. It is clear that the subject tree of this report is possibly no more than 100 years old (See Section 3.8) so the wound would be expected to be more oval like as seen in Plate 3 and 4. When mechanical damage occurs to trees, such as contact from machinery or other equipment, more often than not the wound is more lineal/tangential, due to the growth patterns of wood grain.

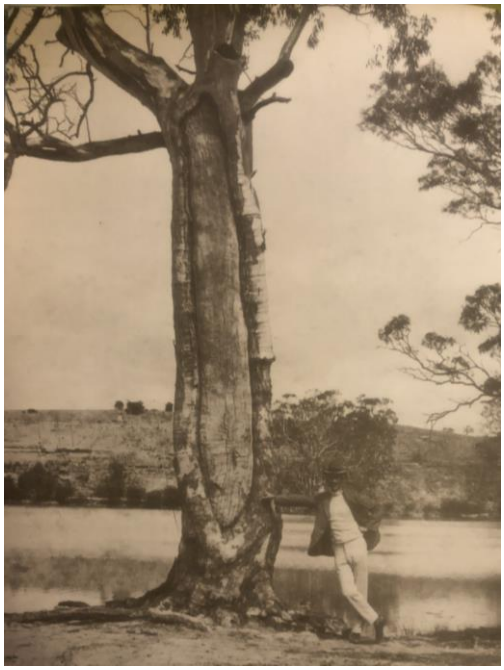

Plate 5 and 6: Image showing a canoe scar tree near Blanche Town, South Australia. There is 80 years difference between these two images, so they provide a good indication of how slow the occlusion process can be with little deformation of the original shape.

3.7 Age estimate: Dating a tree is often difficult due to a variety of reasons. Often the best way is through a photographic record, however this is not always possible. Plate 7 does show the extent of clearing that has occurred and clearly the subject tree is located on the edge of this clearing area.

Several studies have been undertaken on the growth rates of *Eucalyptus* species. One of the more recent scientific papers (Ngugi et. al., 2015) published in the *Journal of Forestry Research* drew on an impressive historical dataset to develop growth models that can be used to calculate the age of some trees (although mainly commercial timber species).

The data included DBH (diameter at breast height) measurements collected for 75 years (1936-2011) on over 86,000 trees (155 species) in more than 640 permanent forest plots in South East Queensland. This allowed the authors to study trends in incremental growth rates in tree species across sites that receive similar annual rainfall. The findings

of this study are considered consistent with other studies using tree core samples and carbon dating.

Plate 7: Image the extent of clearing that has occurred since 1956. (NSW Spatial services). The red dot is the approximate location of the tree.

The study did state;

As a tree gets older its growth rate slows and the author warns that age estimates for large trees (>80 cm DBH) should be used cautiously because they had a limited representation in the dataset.

The subject tree measured eighty six (86) centimetres at DBH. The studies have shown that a *Eucalyptus* can grow anywhere from one (1) centimetre, in diameter per year, to five (5) centimetres. Based on these figures, the tree is certainly older than seventeen (17) years (86 divided by 5) but is more likely closer to eighty six (86) years based, on one (1) centimetres of growth per year. Even adding on a 15% allowance, this would make the tree no older than one hundred (100) years' old.

Just as a person's skin condition will often be an indicator of their age, so too are certain characteristic of a tree. As seen in Plate 1, showing the extent of the tree's form, there are no large diameter limb failures, no hollows and only small diameter dead wood. When we compare this with the still living Narrellan scar tree (Plate 8) that has many old failures, large diameter deadwood and many hollows that take many decades to form.

Plate 8: Image showing one of the scar trees near Narellan. This is clearly an old tree as evidenced by the many fractured limbs that has failed over the years and the hollows that has developed within these fractures. Height is not always an indicator of age. P. Vezgoff

3.8 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. The subject tree has a SULE rating of 1a *life expectancy of greater than forty (40) years*

3.9 **OEH Native vegetation Mapping:** The online Native Vegetation Regulatory (NVR) Map was prepared by OEH under Part 5A of the amended *Local Land Services Act 2013* (LLS Act) and supporting regulation.

The Native Vegetation Regulatory Map is a tool to give landholders certainty when planning future management of their land. The Map is a regulatory requirement. Part 5A of the Local Land Services Act 2013 (LLS Act), requires the Chief Executive of the Office of Environment and Heritage (OEH) to prepare and maintain a Native Vegetation Regulatory (NVR) Map.

The NVR Map generally covers rural land in NSW. It categorises land where management of native vegetation can occur without approval or where management of native vegetation may be carried out in accordance with Part 5A of the LLS Act. A summary of categories used in the NVR Map is shown below (Table 1). The site and location of the tree is mapped as *Excluded land.* It should be noted that other Government regulations and policies may apply to this tree and surrounding vegetation and are outside the scope of this report.

Colour	Category	Definition
Blue	**Category 1** Unregulated Land	Rural lands where clearing is not regulated by the Part 5A of the LLS Act. Other legislation may apply.
Yellow	**Category 2** Regulated Land	Rural lands where clearing is regulated and can be carried out in accordance with the Part 5A of the LLS Act or other legislation. This includes complying with the Codes and Allowable activities.
Orange	**Category 2** Vulnerable Regulated Land	Rural land where clearing of native vegetation is more restricted than on other Category 2 land. This includes steep and highly erodible lands and riparian land and special category land (as declared).
Pink	**Category 2** Sensitive Regulated Land	Rural lands where clearing of native vegetation is more restricted than other Category 2 land. This includes lands that are Sensitive Lands due to factors such as the presence of coastal wetlands, littoral rainforests, rainforest, or land that is subject to protection covenants such as conservation or incentive property vegetation plans.
Grey	Excluded Land	Land not regulated by the Part 5A of the LLS Act. This land includes urban zones, environmental conservation zones and R5 large lot residential as gazetted under a Local Environment Plan (LEP). It also includes public conservation lands such as National Parks and State Forests.

Table 1: Categories used in the NVR Map (OEH 2018)

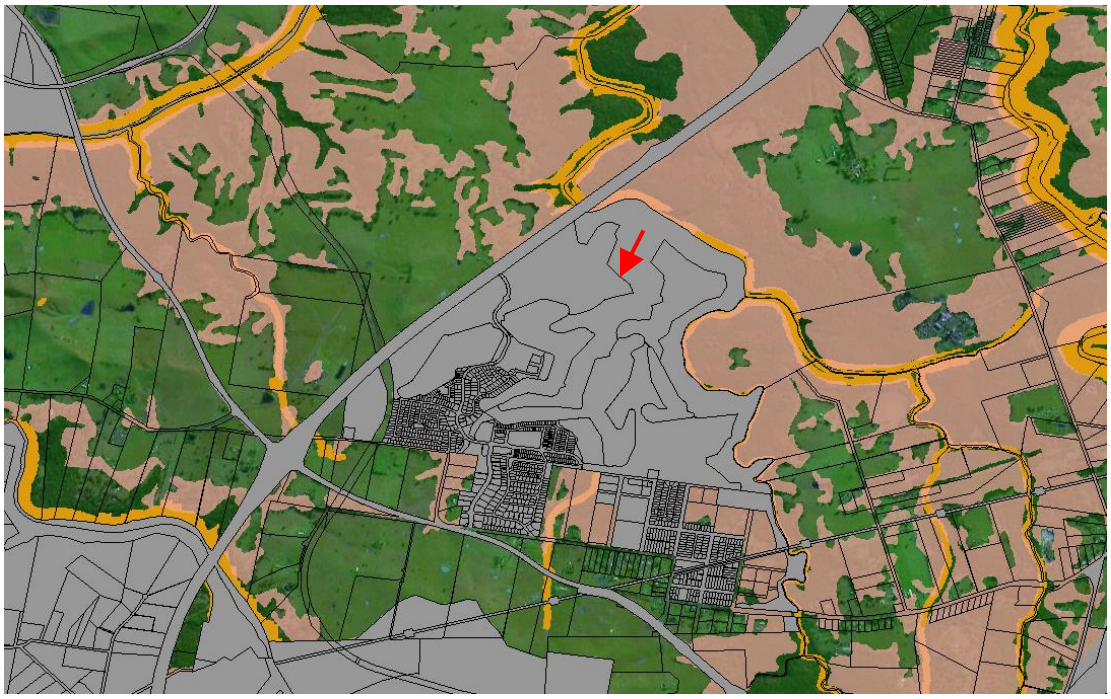

Diagram 2: Native Vegetation Regulatory Map (OEH 2018). Red arrow is the location of the tree.

3.10 The Grey Gum (*E. punctata*) is associated with *Shale Sandstone Transition Forest* that can be found in the surrounding areas. This forest class is listed as a Critically Endangered Ecological Community. Although this report does not constitute an Ecological Assessment based on the tree species present, the site is closer to *Shale Sandstone Transition Forest* than *Cumberland Plain Woodland*.

3.11 *Shale Sandstone Transition Forest* occurs at the edges of the Cumberland Plain, where clay soils from the shale rock intergrade with earthy and sandy soils from sandstone, or where shale caps overlay sandstone. The boundaries are indistinct, and the species composition varies depending on the soil influences. The main tree species include Forest Red Gum (*Eucalyptus tereticornis*), Grey Gum (*E. punctata*), Stringybarks (*E. globoidea, E. eugenioides*) and Ironbark (*E. fibrosa* and *E. crebra*). Areas of low sandstone influence (more clay-loam soil texture) have an understorey that is closer to Cumberland Plain Woodland. Shale Sandstone Transition Forest in the Sydney Basin Bioregion contains many more species than described for the canopy (above) and other references should be consulted to identify these.

4 RECOMMENDATIONS

4.1 Based on aerial photographs and the history of the post-European settlement of the site, i.e. clearing of the site, I feel that this wound has potentially been caused by mechanical means, possibly associated with the clearing, and less likely to be an Aboriginal scar tree. However, I do need to clarify that Aboriginal Heritage is not my specialty and that this report is based more on the reaction of wood and how it reacts when damaged.

4.2 I am confident that this tree is no older than 100 years old and at the most 130 years old.

4.3 Should this tree be retained a site specific tree protection specification will be required for this tree to ensure it is protected prior to and during the construction process of fire trails, roads nearby.

4.4 The tree has a TPZ calculated at ten (10) metres radius. In general, a 10% encroachment of a TPZ is possible. Further incursions into the TPZ for each tree will require further assessment once the plans have progressed.

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

Paul Vezgoff
Consulting Arborist
Dip Arb (Dist), Arb III, Hort cert, AA, ISA

18th October 2018

Appendix 1

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 2

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).

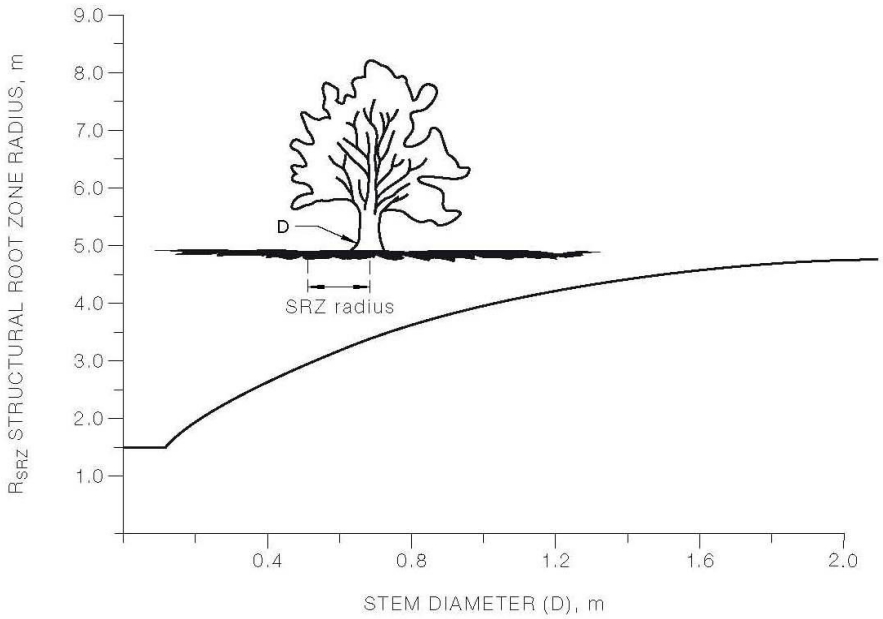

FIGURE 1 - STRUCTURAL ROOT ZONE

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 3

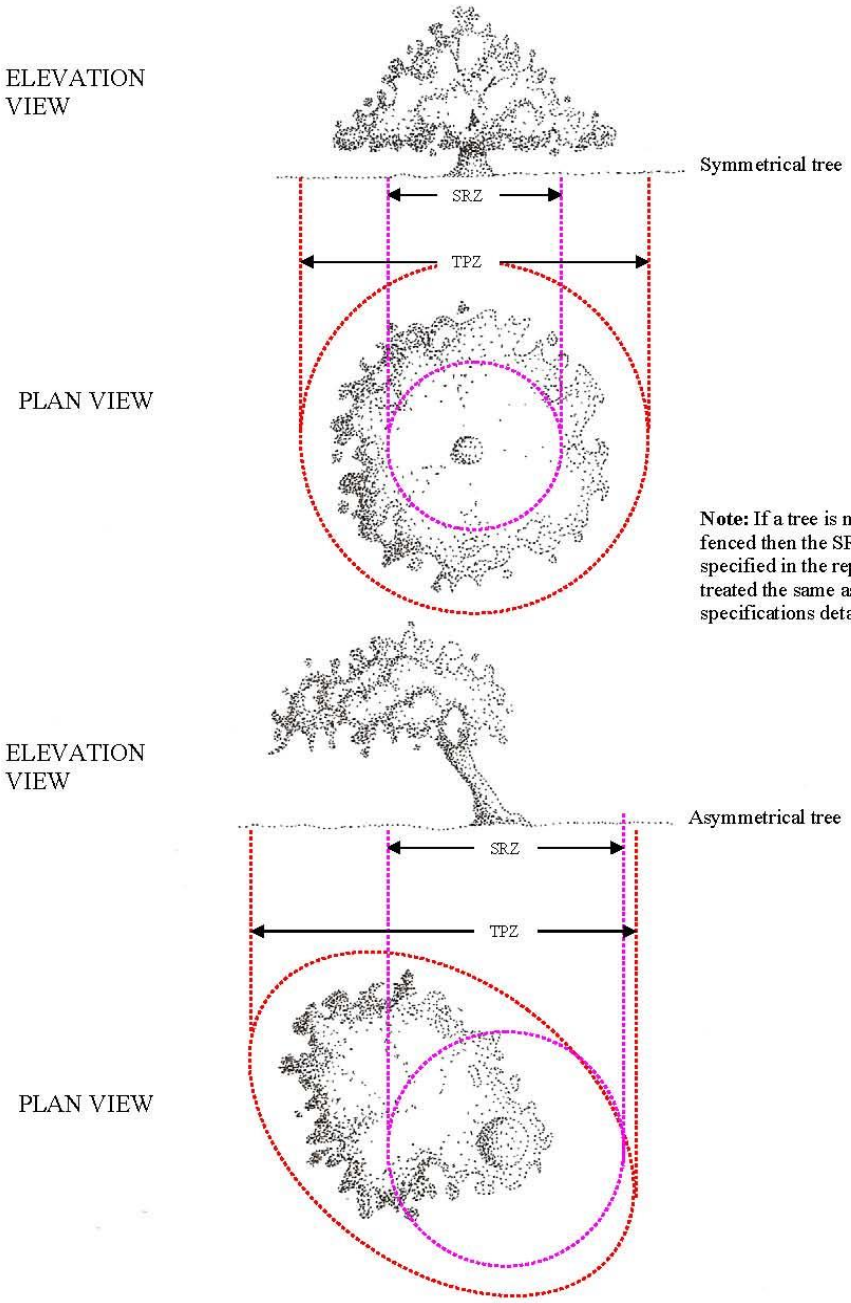

Figure 1: Indicative Tree Protection Zone (TPZ) and Root Protection Zone (SRZ)
Drawn: P. Vezgoff ©

Appendix 4

Tree structure information diagram

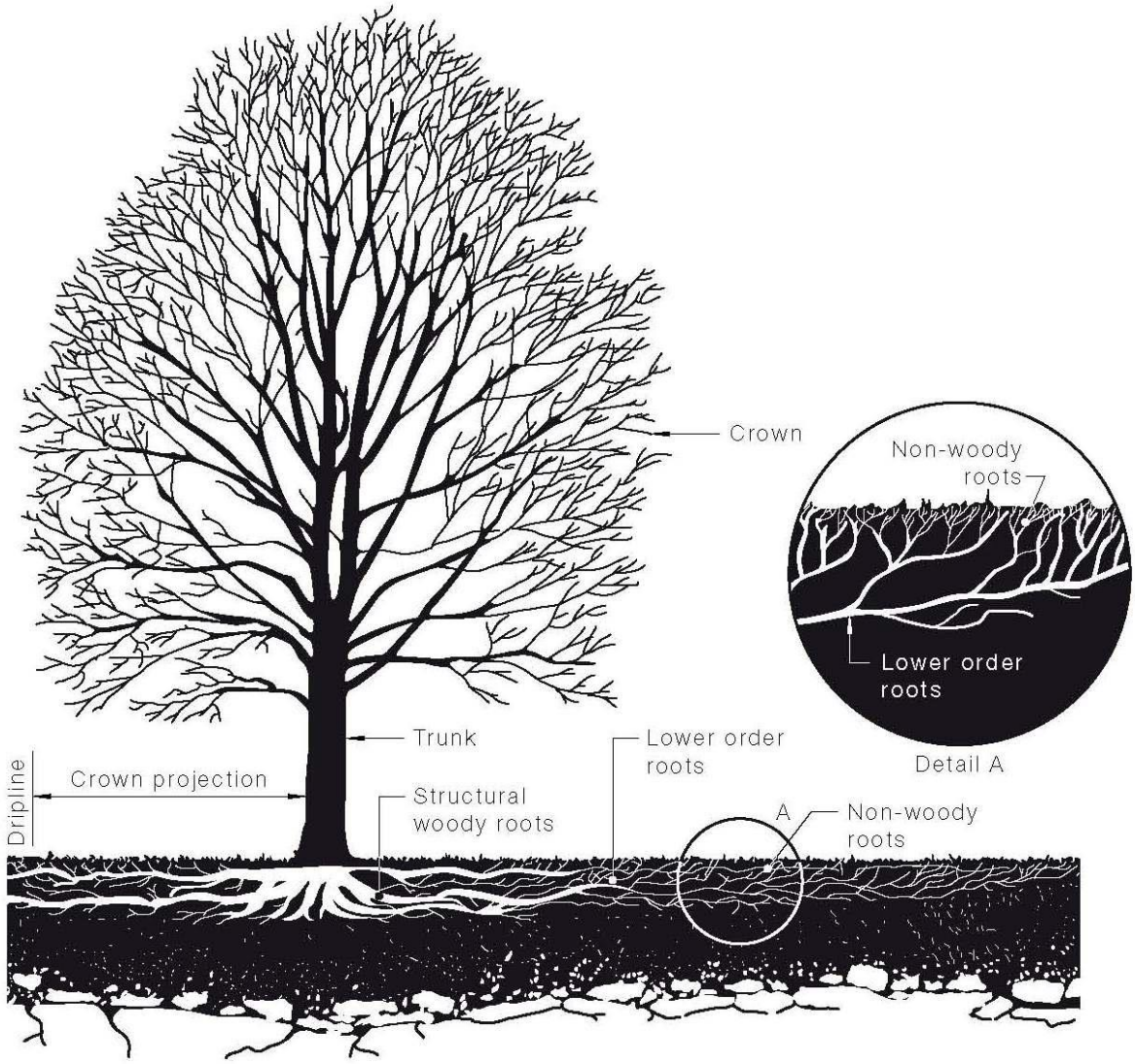

Figure 2: Structure of a tree in a normal growing environment (AS 4970, 2009.).

Appendix 5

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 indicate it 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 6

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Sydney

Curriculum Vitae

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EDUCATION and QUALIFICATIONS

- 2013 – ISA TRAQ qualification
- 2007 – Diploma of Arboriculture (AQF Cert V) Ryde TAFE. (Distinction)
- 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)
- 1989 – Attained Certificate of Horticulture (AQF Cert IV) at Wollongong TAFE

INDUSTRY EXPERIENCE

Moore Trees Arboricultural Services **January 2006 to date**
Tree Consultancy and tree ultrasound. Tree hazard and risk assessment, Arborist development application reports
Tree management plans.

Woollahra Municipal Council **Oct 1995 to February 2008**
ARBORICULTURE TECHNICAL OFFICER
August 2005 – February 2008
ACTING COORDINATOR OF TREES MAINTENANCE
June – July 2005, 2006
TEAM LEADER
January 2003 – June 2005
September 2000 – January 2003
HORTICULTURALIST
October 1995 – September 2000

Northern Landscape Services **July to Oct 1995**
Tradesman for Landscape Construction business

Paul Vezgoff Garden Maintenance (London, UK) **Sept 1991 to April 1995**

CONFERENCES AND WORKSHOPS ATTENDED

- International Society of Arboriculture Conference (Canberra May 2017)
- QTRA Conference, Sydney Australia (November 2016)
- TRAQ Conference, Auckland NZ (October 2013)
- 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).