URBAN TREE MANAGEMENT

**CONSULTING ARBORICULTURISTS & HORTICULTURISTS**

**Urban Tree Management Australia Pty Ltd**
ACN 098 599 805
ABN 56 098 599 805

**65 Excelsior Street**
**Merrylands NSW 2160**

**Phone 02 9760 1389**

**admin@utma.com.au**
**www.utma.com.au**

*Accredited member of*
INSTITUTE OF AUSTRALIAN CONSULTING ARBORICULTURISTS ®

# REPORT:

# ARBORICULTURAL IMPACT ASSESSMENT

## 7 & 9 Castlereagh Street
## &
## 8 - 12 Copeland Street
## Liverpool NSW

Prepared 10 February 2015
Reference 17094

# Contents

**Page**

**Summary** **3**

**1.0 Introduction** **6**

**2.0 Methodology** **7**

**3.0 Pruning Standards** **8**

**4.0 Tree Assessments** **9**
- **Assessment of tree/s or stand/s of trees**
- **Observations**
- **Discussion**

**5.0 Recommendations** **15**

**References** **16**

**Disclaimer** **16**

## Tables

**1.0 General description of trees and schedule of works** 3
**2.0 Significance Scale** 13
**3.0 Retention Value** 13
**4.0 Tree Protection Zone setbacks** 14

## Appendices

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

**Appendix B Extract from Australian Standard AS4970 2009 *Protection of trees on development sites*, Section 3, Determining the tree protection zones of the selected trees, 3.1 Tree protection zone (TPZ)**

**Appendix C Extract from Australian Standard AS4970 2009 *Protection of trees on development sites*, Section 3, Determining the protection zones of the selected trees, 3.3.5 Structural root zone (SRZ)**

**Appendix D Matrix - Sustainable Retention Index Value (SRIV), Version 4, (IACA, 2010) ©**

**Appendix E Glossary of terminology**

**Appendix F Survey of Subject Tree/s**

**Appendix G Tree Protection Plan**

# SUMMARY

This report considers 36 trees consisting of 35 trees located within the site and 1 exempt tree located on the boundary with a neighbouring property. Of the 36 trees 8 were exempt species and 1 tree was dead reducing the trees discussed to 27 trees and of these 3 trees are to be retained 25 trees removed. Trees 3, 5, 14, 30, 31, 32, 33 and 34 are exempt species and Tree 8 was dead and was not a habitat tree. Under the Liverpool Tree Management Policy adopted 27 June 2011, Trees 3, 14, 30 were exempt as "*domestic fruit trees grown specifically for their edible fruit*", and Trees 5 and 31-34 exempt species under Schedule 6 Exempt Trees LLEP 2008 (Liverpool Local Environmental Plan 2008 (LLEP 2008) and Liverpool Development Control Plan 2008 (LDCP 2008)). Exempt trees will not be discussed further by this report.

The recommendations made in this report are subject to approval by the consent authority.

No trees to be retained will be subject to a major encroachment as per AS4970 (2009) Section 3, 3.3.3 *Major Encroachment* from development works within >10% of the radial area of the Tree Protection Zone.

Trees 1, 2, 4, 6-13, 15-26, 35 and 36 are to be removed as they are located within or too close to the proposed building envelope to remain stable and viable.

Trees 27, 28 and 29 will be subject to a minor encroachment as per AS 4970 (2009) Section 3, 3.3.2 *Minor Encroachment* from development works within <10% of the radial area of the Tree Protection Zone (TPZ). These trees are located between the 2 residential towers and their basement care parks and will require a minor encroachment for excavation and construction of building footings and foundations respectively where contiguous piling including any over excavation will be located outside of the one collective Tree Protection Zone for these trees. These trees are expected to remain viable (TPZ) and stable (SRZ) with contiguous soil volumes in other directions as per AS 4970 (2009) Section 3, 3.3.2 *Minor Encroachment.* These trees may require minor selective pruning for clearance and safe working access from the proposed dwellings. The open space areas within the TPZ of these trees will need to be suspended on hand excavated piers to ensure the growing environments are not damaged by excavation and soil compaction as would occur with pavement located at ground.

The proposed works will not encroach into the Structural Root Zone (SRZ) of these trees.

The general condition of tree/s and Schedule of works is listed below in Table 1.0.

**Table 1.0** General condition of tree/s and Schedule of works. Tree described in greater detail in section 4.0.

| UTM<br>Tree No. / Stand No. | *Genus and species*<br>Common name | Condition<br>G = Good<br>F = Fair<br>P = Poor<br>M = Moribund<br>D = Dead | Description of work to be done |
|---|---|---|---|
| 1 | *Photinia glabra*<br>Photinia | G | Remove as located within or too close to the proposed building envelope to remain stable and viable. To be replaced with new trees as per the Landscape Plan. |
| 2 | *Callistemon viminalis*<br>Weeping Bottlebrush | G | Remove as located within or too close to the proposed building envelope to remain stable and viable. To be replaced with new trees as per the Landscape Plan. |
| 3 | *Macadamia integrifolia* (exempt)<br>Queensland Nut | F | Exempt, "*domestic fruit trees grown specifically for their edible fruit.*" |
| 4 | *Lagerstroemia indica*<br>Crepe Myrtle | G | Remove as located within or too close to the proposed building envelope to remain stable and viable. To be replaced with new trees as per the Landscape Plan. |
| 5 | *Lagunaria patersonii* (exempt)<br>Norfolk Island Hibiscus | G | Exempt species under Schedule 6 Exempt Trees LLEP 2008 |
| 6 | *Callistemon viminalis*<br>Weeping Bottlebrush | G | Remove as located within or too close to the proposed building envelope to remain stable and viable. To be replaced with new trees as per the Landscape Plan. |
| 7 | *Stenocarpus sinuatus*<br>Fire-wheel Tree | F | Remove as located within or too close to the proposed building envelope to remain stable and viable. To be replaced with new trees as per the Landscape Plan. |
| 8 | Dead | | Exempt tree and not a habitat tree. To be removed. |
| 9 | *Acmena smithii*<br>Lilly Pilly | F | Remove as located within or too close to the proposed building envelope to remain stable and viable. To be replaced with new trees as per the Landscape Plan. |
| 10 | *Acmena smithii*<br>Lilly Pilly | F | Remove as located within or too close to the proposed building envelope to remain stable and viable. To be replaced with new trees as per the Landscape Plan. |

**Table 1.0** General condition of tree/s and Schedule of works continued.

| UTM<br>Tree No. / Stand No. | *Genus and species*<br>Common name | Condition<br>G = Good<br>F = Fair<br>P = Poor<br>M = Moribund<br>D = Dead | Description of work to be done |
|---|---|---|---|
| 11 | *Lagerstroemia indica*<br>Crepe Myrtle | G | Remove as located within or too close to the proposed building envelope to remain stable and viable. To be replaced with new trees as per the Landscape Plan. |
| 12 | *Corymbia citriodora*<br>Lemon-scented Gum | P | Remove as located within or too close to the proposed building envelope to remain stable and viable. To be replaced with new trees as per the Landscape Plan. |
| 13 | *Harpephyllum caffrum*<br>Wild Plum | F | Remove as located within or too close to the proposed building envelope to remain stable and viable. To be replaced with new trees as per the Landscape Plan. |
| 14 | *Morus nigra* (exempt)<br>Black Mulberry | P | Exempt, "*domestic fruit trees grown specifically for their edible fruit.*" |
| 15 | *Ulmus parvifolia*<br>Chinese Weeping Elm | F | Remove as located within or too close to the proposed building envelope to remain stable and viable. To be replaced with new trees as per the Landscape Plan. |
| 16 | *Liquidambar styraciflua*<br>Liquidambar | F | Remove as located within or too close to the proposed building envelope to remain stable and viable. To be replaced with new trees as per the Landscape Plan. |
| 17 | *Ficus microcarpa*<br>Weeping Fig | F | Remove as located within or too close to the proposed building envelope to remain stable and viable. To be replaced with new trees as per the Landscape Plan. |
| 18 | *Castanospermum australe*<br>Black-bean | F | Remove as located within or too close to the proposed building envelope to remain stable and viable. To be replaced with new trees as per the Landscape Plan. |
| 19 | *Ulmus procera*<br>English Elm | F | Remove as located within or too close to the proposed building envelope to remain stable and viable. To be replaced with new trees as per the Landscape Plan. |
| 20 | *Stenocarpus sinuatus*<br>Fire-wheel Tree | F | Remove as located within or too close to the proposed building envelope to remain stable and viable. To be replaced with new trees as per the Landscape Plan. |
| 21 | *Stenocarpus sinuatus*<br>Fire-wheel Tree | G | Remove as located within or too close to the proposed building envelope to remain stable and viable. To be replaced with new trees as per the Landscape Plan. |
| 22 | *Lagerstroemia indica*<br>Crepe Myrtle | G | Remove as located within or too close to the proposed building envelope to remain stable and viable. To be replaced with new trees as per the Landscape Plan. |
| 23 | *Lagerstroemia indica*<br>Crepe Myrtle | G | Remove as located within or too close to the proposed building envelope to remain stable and viable. To be replaced with new trees as per the Landscape Plan. |
| 24 | 2 x *Archontophoenix cunninghamiana*<br>Bangalow Palm | G | Remove as located within or too close to the proposed building envelope to remain stable and viable. To be replaced with new trees as per the Landscape Plan. |
| 25 | *Callistemon viminalis*<br>Weeping Bottlebrush | F | Remove as located within or too close to the proposed building envelope to remain stable and viable. To be replaced with new trees as per the Landscape Plan. |
| 26 | *Corymbia citriodora*<br>Lemon-scented Gum | G | Remove as located within or too close to the proposed building envelope to remain stable and viable. To be replaced with new trees as per the Landscape Plan. |
| 27 | *Callistemon salignus*<br>Willow Bottlebrush | F | Retain and protect within Tree Protection Zone, selective pruning in lower crown may be required for access within area of crown projection. Will require tree sensitive construction with contiguous piling and over-excavation outside of TPO and access within the area of crown projection with elevated platforms instead of pavement at ground level to protect roots from excavation and soil compaction (see Appendix G - Tree Protection Plan). |
| 28 | *Corymbia citriodora*<br>Lemon-scented Gum | G | Retain and protect within Tree Protection Zone, selective pruning in lower crown may be required for access within area of crown projection. Will require tree sensitive construction with contiguous piling and over-excavation outside of TPO and access within the area of crown projection with elevated platforms instead of pavement at ground level to protect roots from excavation and soil compaction (see Appendix G - Tree Protection Plan). |
| 29 | *Corymbia citriodora*<br>Lemon-scented Gum | G | Retain and protect within Tree Protection Zone, selective pruning in lower crown may be required for access within area of crown projection. Will require tree sensitive construction with contiguous piling and over-excavation outside of TPO and access within the area of crown projection with elevated platforms instead of pavement at ground level to protect roots from excavation and soil compaction (see Appendix G - Tree Protection Plan). |
| 30 | *Morus nigra* (exempt)<br>Black mulberry | | Exempt, "*domestic fruit trees grown specifically for their edible fruit.*" |

**Table 1.0** General condition of tree/s and Schedule of works continued.

| UTM Tree No. / Stand No. | *Genus and species* Common name | Condition G = Good F = Fair P = Poor M = Moribund D = Dead | Description of work to be done |
|---|---|---|---|
| 31 | *Syagrus romanzoffiana* (exempt) Cocos Palm | | Exempt species under Schedule 6 Exempt Trees LLEP 2008 |
| 32 | *Syagrus romanzoffiana* (exempt) Cocos Palm | | Exempt species under Schedule 6 Exempt Trees LLEP 2008 |
| 33 | *Syagrus romanzoffiana* (exempt) Cocos Palm | | Exempt species under Schedule 6 Exempt Trees LLEP 2008 |
| 34 | *Syagrus romanzoffiana* (exempt) Cocos Palm | | Exempt species under Schedule 6 Exempt Trees LLEP 2008 |
| 35 | *Liquidambar formosana* Chinese Sweet Gum | G | Remove as located within or too close to the proposed building envelope to remain stable and viable. To be replaced with new trees as per the Landscape Plan. |
| 36 | *Corymbia citriodora* Lemon-scented Gum | G | Remove as located within or too close to the proposed building envelope to remain stable and viable. To be replaced with new trees as per the Landscape Plan. |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

# 1.0 INTRODUCTION

Urban Tree Management © has prepared this report for Mosca Pserras Australia (*the architects*), Suite 501, 7 Secant Street, Liverpool NSW 2170 on behalf of the applicant. The land is located in the Liverpool City Council (*the Council*) Local Government Area (*LGA*) and the trees require consideration subject to the Liverpool Tree Management Policy adopted 27 June 2011 under provisions of the Liverpool Local Environmental Plan 2008 (LLEP 2008) and Liverpool Development Control Plan 2008 (LDCP 2008).

It is proposed to demolish the existing dwellings across the site and construct 2 residential tower blocks and connected basement car parking. The proposed works will encroach towards 3 trees which are sufficiently set back to protect the trees as per AS4970. The trees may require minor pruning for clearance for safe working access but the works required are not expected to adversely impact the trees.

Danny Draper (*the author*) attended 7 & 9 Castlereagh Street and 8-12 Copeland Street, Liverpool NSW (*the site*) on Thursday 7 April 2016 and *the trees* and their growing environments were examined by a Visual Tree Assessment (VTA) (Mattheck & Breloer, 1994) conducted from the ground.

The site is subject to a Development Application and this report and any works recommended herein, that require approval from the consenting authority are provided to form part of that development application and its consent conditions. The Survey of subject Tree/s (Appendix F) and Tree Protection Plan (Appendix G) are to be included into and used in conjunction with the set of plans for the site.

The aims and objectives of this report are to detail and comply with the tree protection requirements specified in AS4970 (2009) *Protection of trees on development sites*, after the undertaking of the Preliminary Tree Assessment AS4970 sec. 2.3.2, and Preliminary Arboricultural Report AS4970 sec. 2.3.3 (which may be combined); Development Design and Review Report AS4970 sec. 2.3.4, prior to the undertaking of an Arboricultural Impact Assessment (AIA) Report AS4970 sec. 2.3.5. Where the other reports have not been undertaken the AIA Report will broadly endeavour to identify and assesses the condition of the subject tree/s; determine the impact of development on the subject tree/s; provide recommendations for retention or removal of the subject tree/s; provide specifications for protection of tree/s to be retained, and provide recommendations for replacement tree/s where appropriate. The information in this extensive report is intended to provided tree management and protection through all stages of development.

The tree/s are indicated in Appendix G – Survey of Subject Tree/s. This report has relied upon the following plan/s and documents:

Landscape Plan Ground Level, 7 & 9 Castlereagh Street and 8, 10 and 12 Copeland Street, Liverpool, scale 1:200 @ A1 and 1:400 @ A3, Drawing reference 14585 LDA01-B by NBRS+Partners, Level 3, 4 Glen Street, Milsons Point NSW 2061, tel. 9922 2344 and Mosca Pserras Australia, Suite 501, 7 Secant Street, Liverpool NSW 2170, t. 9601 3244.

# 2.0 METHODOLOGY

**Note: Individual methodologies applied as applicable.**

2.1 The method of assessment of tree/s applied is adapted from the principles of Visual Tree Assessment (VTA) (Mattheck & Breloer, 1994), undertaken from the ground, which considers and includes:

1. Tree health and subsequent stability, both long and short term
2. Sustainable Retention Index Value (SRIV) Version 4 (IACA, 2010) ©
3. Hazard potential to people and property
4. Amenity values
5. Habitat values
6. Significance – Significance of a Tree, Assessment Rating System (STARS) (IACA, 2010) ©

2.2 This assessment is undertaken using standard tree assessment criteria for each tree based on the values above and is implemented as a result of at least one comprehensive and detailed site inspection to undertake a visual tree assessment of each individual tree, or stand of trees, or a representative population sample.

2.3 Any dimensions recorded as averages, or by approximation are noted accordingly.

2.4 This report adopts Australian Standard AS4970 (2009) *Protection of trees on development sites* as a point of reference and guide for the recommended minimum setbacks (Appendix B) from the center of a tree's trunk to development works and the distances may be increased or decreased by the author in accordance with AS4970 as a result of other factors providing mitigating circumstances or constraints as indicated by but not restricted to the following:

1. Condition of individual trees,
2. Tolerance of individual species to disturbance,
3. Geology e.g. physical barriers in soil, rock floaters, bedrock to surface
4. Topography e.g. slope, drainage,
5. Soil e.g. depth, drainage, fertility, structure,
6. Microclimate e.g. due to landform, exposure to dominant wind,
7. Engineering e.g. techniques to ameliorate impact on trees such as structural soil, gap graded fill, lateral boring,
8. Construction e.g. techniques to ameliorate impact on trees such as pier and beam, bridge footings, suspended slabs,
9. Root mapping,
10. Physical limitations - existing modifications to the environment and any impact to tree/s by development e.g. property boundaries, built structures, houses, swimming pools, road reserves, utility services easements, previous impact by excavation, or construction in other directions, soil level changes by cutting or filling, existing landscaping works within close proximity, modified drainage patterns,
11. Extraneous factors e.g. potential future impacts from development on adjoining land when the tree is located on or near to a property boundary.

2.5 Trees in groups may be referred to as stands and a stand may exclusively contain specimens to be either retained or removed or a combination of both. A stand may be used to discuss all the trees on a given site to expedite their assessment, or refer to trees growing proximate to one another or within a defined space. Stands may be comprised by mass boundary or screen plantings, to form a group of the same or a mixture of taxa. Each stand is considered as a single unit with each component tree assessed and expressed in tabular form, or indicated by a given percentage as a population sample of each stand. Where it is appropriate for a stand of trees to be retained in full or part, the location and setback of Tree Protection Zone fences or works, are prescribed to provide for the preservation of the stand or selected component trees, in a condition not less than that at the time of initial inspection for its incorporation into the landscape works for the site, or in a reduced but sustainable condition due to the impact of the development but ameliorated through tree protection measures.

2.6 The trees/s have been allocated a significance rating as determined by using the Tree Significance - Assessment Criteria of the IACA Significance of a Tree, Assessment Rating System (STARS)© (IACA, 2010), Appendix A.

2.7 The meanings for terminology used herein are taken from the IACA Dictionary for Managing Trees in Urban Environments 2009. An extract from the IACA Dictionary forms a glossary of terms included as Appendix E.

## 3.0 PRUNING STANDARDS

3.1 Any pruning recommended in this report is to be to the Australian Standard® AS4373 *Pruning of amenity trees*, and conducted in accordance with the NSW Work Cover Authority Code of Practice, Tree Work, 1998.

3.2 All pruning or removal works are to be in accordance with the appropriate Tree Management Policy where applicable, or Tree Management Order (TMO), or Tree Preservation Order (TPO).

3.3 Tree maintenance work is specialised and in order to be undertaken safely to ensure the works carried out are not detrimental to the survival of a tree being retained, and to assist in the safe removal of any tree, should be undertaken by a qualified arboriculturist with appropriate competencies recognised within the Australian Qualification Framework, with a minimum of 5 years of continual experience within the industry of operational amenity arboriculture, and covered by appropriate and current types of insurance to undertake such works.

# 4.0 TREE ASSESSMENT

## 4.1 Assessment of tree/s or stand/s of trees.

| UTM Tree No. / Stand No. | Genus & species / Common Name | Condition G = Good F = Fair P = Poor M = Moribund D = Dead | Age Y = Young M = Mature O = Overmature | Crown Form D = Dominant C = Co-dominant I = Intermediate S = Suppressed F = Forest E = Emergent | Ht. Approx. metres | Crown spread approx. metres / Orientation R = Radial, or other | Crown Symmetry 1 = symmetrical 2 = asymmetrical / Orientation | Crown cover / Crown density % / D = dormant | DBH in mm @ 1.4m, or other, as indicated and trunk orientation other than R = radial, e.g. N/S / DARB Diameter above root buttress | Trunk Lean 1 = Upright-Slight 2 = Moderate 3 = Severe 4 = Critical 5 = Acaulescent / Orientation / ST = Static P = Progressive Sc = Self-correcting | Roots evident @ root crown 1. = None 2. = Adventitious 3. = Basal Flare 4. = Buttresses 5. = First Order Roots (FOR), No. & distribution e.g. R = radial, or one each to N, S, E, NE and W | Pests & diseases 1 = No or 2 = Yes (If 2. see comments) | Branch Bark included 1 = No or 2 = Yes or 3 = N/A | Vigour 1 = Good Vigour 2 = Low Vigour | Form 1 = Good form 2 = Poor form | SRIV Age, Vigour, Condition / Index Rating www.iaca.org.au / ESTIMATED LIFE EXPECTANCY 1. Long 2. Medium 3. Short | Significance scale STARS www.iaca.org.au 1=High 2=Medium 3=Low / Retention Value 1=High 2=Medium 3=Low 4=Remove |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | *Photinia glabra*<br>Photinia | G | M | C | 4 | 5<br>R | 2<br>W | 90<br>90 | 600 Av.<br>600 | 5 | 1 | 1 | 2 | 1 | 1 | MGVG – 10<br>1 | 2<br>3 |
| 2 | *Acmena smithii*<br>Lilly Pilly | G | Y | D | 7 | 6<br>R | 1 | 90<br>90 | 220x260, 240 Av.<br>260 | 1 | 5. x 6 R | 1 | 1 | 1 | 1 | YGVG – 9<br>1 | 1<br>2 |
| 3 | *Macadamia integrifolia* (exempt)<br>Queensland Nut | F | M | C – I | 5 | 4<br>R | 1 | 90<br>90 | 250 @ 100<br>250 | 1 | 1 | 1 | 1 | 1 | 1 | MGVF – 9<br>1 | 2<br>3 |
| 4 | *Lagerstroemia indica*<br>Crepe Myrtle | G | M | C – I | 4 | 5<br>R | 1 | 90<br>90 | 300 Av.<br>300 | 5 | 1 | 1 | 1 | 1 | 1 | MGVF – 10<br>1 | 2<br>3 |
| 5 | *Lagunaria patersonii* (exempt)<br>Norfolk Island Hibiscus | G | M | D | 5.5 | 6<br>R | 1 | 90<br>90 | 200<br>250 | 1 | 1 | 1 | 1 | 1 | 1 | MGVG – 10<br>2 | 2<br>2 |
| 6 | *Callistemon viminalis*<br>Weeping Bottlebrush | G | Y | D | 4 | 4<br>R | 2<br>W | 90<br>90 | 250 @ 200<br>250 | 1 | 1 | 1 | 1 | 1 | 1 | MGVG - 10<br>1 | 2<br>3 |
| 7 | *Stenocarpus sinuatus*<br>Fire-wheel Tree | F | M | C | 10 | 4<br>R | 2<br>W | 85<br>90 | 500 @ 200<br>500 | 5 | 5. x 6 R | 1 | 2 | 1 | 2 | MGVF – 9<br>2 | 2<br>3 |
| 8 | Dead | | | | | | | | | | | | | | | | |
| 9 | *Acmena smithii*<br>Lilly Pilly | F | M | D | 16 | S<br>R | 1 | 90<br>90 | 550 R @ 500<br>600 | 1 | 5. x 6 R | 1 | 2 | 1 | 1 | MGVF – 9<br>3 | 2<br>2 |
| 10 | *Acmena smithii*<br>Lilly Pilly | F | Y | C – S | 14 | 8<br>R | 2<br>NE | 90<br>90 | 300x260, 280 Av. N/S<br>300 | 1 | 5. x 3<br>NE, S, NW | 1 | 2 | 1 | 1 | MGVF – 9<br>1 | 2<br>2 |

| No. | Comments |
|---|---|
| 1 | Shrub. |
| 6 | Bifurcated @ 200. |
| 7 | Acaulescent, deliquescent, crown comprised of 3 first order structural branches @ 200mm, branch bark extruded with splits and collapse of first order structural branch to east. |
| 9 | Bifurcated @ 500mm, round-edge ribs below crotch on south side only. |
| 10 | Bifurcated @ 5m. |

## 4.1 Assessment of tree/s or stand/s of trees.

| UTM Tree No. / Stand No. | Genus & species / Common Name | Condition G = Good F = Fair P = Poor M = Moribund D = Dead | Age Y = Young M = Mature O = Overmature | Crown Form D = Dominant C = Co-dominant I = Intermediate S = Suppressed F = Forest E = Emergent | Ht. Approx. metres | Crown spread approx. metres / Orientation R = Radial, or other | Crown Symmetry 1 = symmetrical 2 = asymmetrical / Orientation | Crown cover / Crown density % / D = dormant | DBH in mm @ 1.4m, or other, as indicated and trunk orientation other than R = radial, e.g. N/S / DARB Diameter above root buttress | Trunk Lean 1 = Upright-Slight 2 = Moderate 3 = Severe 4 = Critical 5 = Acaulescent / Orientation / ST = Static P = Progressive Sc = Self-correcting | Roots evident @ root crown 1. = None 2. = Adventitious 3. = Basal Flare 4. = Buttresses 5. = First Order Roots (FOR), No. & distribution e.g. R = radial, or one each to N, S, E, NE and W | Pests & diseases 1 = No or 2 = Yes (If 2. see comments) | Branch Bark included 1 = No or 2 = Yes or 3 = N/A | Vigour 1 = Good Vigour 2 = Low Vigour | Form 1 = Good form 2 = Poor form | SRIV Age, Vigour, Condition / Index Rating www.iaca.org.au / ESTIMATED LIFE EXPECTANCY 1. Long 2. Medium 3. Short | Significance scale STARS www.iaca.org.au 1=High 2=Medium 3=Low / Retention Value 1=High 2=Medium 3=Low 4=Remove |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 11 | *Lagerstroemia indica*<br>Crepe Myrtle | G | M | D | 4 | 5<br>R | 1 | 90<br>90 | 300 R @ ground /<br>300 | 5 | 1. | 1 | 1 | 1 | 1 | YGVG – 9<br>1 | 2<br>2 |
| 12 | *Corymbia citriodora*<br>Lemon-scented Gum | P | Y | F – I | 12 | 2<br>R | 1 | 85<br>90 | 150 R /<br>200 | 1 | 1 | 1 | 1 | 1 | 2 | YLVP - 1<br>3 | 2<br>3 |
| 13 | *Harpephyllum caffrum*<br>Wild Plum | F | M | D | 12 | 14<br>R | 1 | 90<br>90 | 1000 @ ground /<br>1000 | 5 | 1 | 1 | 2 | 1 | 1 | MGVF - 8<br>1 | 2<br>3 |
| 14 | *Morus nigra* (exempt)<br>Black Mulberry | P | M | D | 8 | 12<br>R | 1 | 75<br>75 | 350 R /<br>390 | 1 | 1 | 1 | 1 | 1 | 2 | MLVP - 2<br>3 | 2<br>3 |
| 15 | *Ulmus parvifolia*<br>Chinese Elm | F | O | C | 5 | 3<br>R | 1 | 75<br>75 | 200 R /<br>250 | 1 | 1 | 2 | 2 | 2 | 2 | OLVF - 2<br>3 | 2<br>3 |
| 16 | *Liquidambar styraciflua*<br>Liquidambar | F | Y | I | 14 | 2<br>R | 1 | 90<br>90 | 200 R /<br>250 | 1 | 1 | 1 | 1 | 1 | 1 | YGVF – 8<br>1 | 2<br>3 |
| 17 | *Ficus microcarpa*<br>Weeping Fig | F | Y | C | 13 | 12<br>R | 2<br>S | 90<br>90 | 350 R /<br>400 | 1 | 1 | | 2 | 1 | 1 | YGVF - 8<br>1 | 2<br>2 |
| 18 | *Castanospermum australe*<br>Black-bean | F | Y | C – I | 12 | 6<br>R | 1 | 90<br>90 | 160x120, 165 Av. N/S /<br>120 | 1 | 1 | 1 | 1 | 1 | 1 | YGVG – 9<br>1 | 2<br>2 |
| 19 | *Ulmus procera*<br>English Elm | F | M | C | 14 | 9<br>R | 2<br>S | 90<br>90 | 380 R /<br>350 | 1 | 1 | 1 | 1 | 1 | 1 | MGVF – 9<br>1 | 2<br>2 |
| 20 | *Stenocarpus sinuatus*<br>Fire-wheel Tree | F | M | C – I | 14 | 6<br>R | 1 | 90<br>90 | 450 R /<br>450 | 5 | 3 R | 1 | 2 | 1 | 1 | MGVF – 9<br>1 | 2<br>2 |

| No. | Comments |
|---|---|
| 12 | Vines to upper crown. |
| 13 | Regrowth from old stump by mature epicormic shoots grown at ground level. |
| 14 | Has shed apical meristem and has die-back in upper crown. |
| 17 | Bifurcated @ 200. |
| 20 | Crown acaulescent, deliquescent, bifurcated at ground, branch bark extruded. |

## 4.1 Assessment of tree/s or stand/s of trees.

| UTM Tree No. / Stand No. | Genus & species / Common Name | Condition G = Good F = Fair P = Poor M = Moribund D = Dead | Age Y = Young M = Mature O = Overmature | Crown Form D = Dominant C = Co-dominant I = Intermediate S = Suppressed F = Forest E = Emergent | Ht. Approx. metres | Crown spread approx. metres / Orientation R = Radial, or other | Crown Symmetry 1 = symmetrical 2 = asymmetrical / Orientation | Crown cover / Crown density % / D = dormant | DBH in mm @ 1.4m, or other, as indicated and trunk orientation other than R = radial, e.g. N/S / DARB Diameter above root buttress | Trunk Lean 1 = Upright-Slight 2 = Moderate 3 = Severe 4 = Critical 5 = Acaulescent / Orientation / ST = Static P = Progressive Sc = Self-correcting | Roots evident @ root crown 1. = None 2. = Adventitious 3. = Basal Flare 4. = Buttresses 5. = First Order Roots (FOR), No. & distribution e.g. R = radial, or one each to N, S, E, NE and W | Pests & diseases 1 = No or 2 = Yes (If 2. see comments) | Branch Bark included 1 = No or 2 = Yes or 3 = N/A | Vigour 1 = Good Vigour 2 = Low Vigour | Form 1 = Good form 2 = Poor form | SRIV Age, Vigour, Condition / Index Rating www.iaca.org.au / ESTIMATED LIFE EXPECTANCY 1. Long 2. Medium 3. Short | Significance scale STARS www.iaca.org.au 1=High 2=Medium 3=Low / Retention Value 1=High 2=Medium 3=Low 4=Remove |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 21 | *Stenocarpus sinuatus*<br>Fire-wheel Tree | G | Y | C | 10 | 3<br>R | 2<br>W | 90<br>90 | 200 R /<br>250 | 1 | 1 | 1 | 2 | 1 | 1 | YCVG – 9<br>1 | 2<br>2 |
| 22 | *Lagerstroemia indica*<br>Crepe Myrtle | G | M | C | 5 | 5<br>R | 1 | 90<br>90 | 350 R /<br>350 | 5 | 1 | 1 | 2 | 1 | 1 | MGVG – 10<br>1 | 1<br>2 |
| 23 | *Lagerstroemia indica*<br>Crepe Myrtle | G | M | D | 6 | 6<br>R | 1 | 90<br>90 | 400 R /<br>400 | 5 | 1 | 1 | 2 | 1 | 1 | MGVG – 10<br>1 | 1<br>2 |
| 24 | 2 x *Archontophoenix cunninghamiana*<br>Bangalow Palm | G | M | D | 5 | 3<br>R | 1 | 90<br>90 | Crown spread @ 3m | 1 | 1 | 1 | 3 | 1 | 1 | MGVG – 10<br>1 | 2<br>2 |
| 25 | *Callistemon viminalis*<br>Weeping Bottlebrush | F | M | C | 6 | 3.5<br>R | 2<br>N | 90<br>90 | 200 R /<br>220 | 2 | 1 | 1 | 1 | 1 | 1 | MGVF – 9<br>2 | 2<br>2 |
| 26 | *Corymbia citriodora*<br>Lemon-scented Gum | G | M | F – D | 17 | 10<br>R | 1 | 90<br>90 | 500x550, 525 Av. N/S /<br>550 | 1 | 1 | 1 | 1 | 1 | 1 | MGVG<br>1 | 1<br>1 |
| 27 | *Callistemon salignus*<br>Willow Bottlebrush | F | G | D | 7 | 7<br>R | 1 | 90<br>90 | 400x300, 350 Av. @ 500 E/W /<br>400 | 1 | 1 | 1 | 2 | 1 | 1 | MGVF – 9<br>1 | 1<br>1 |
| 28 | *Corymbia citriodora*<br>Lemon-scented Gum | G | M | C – F | 20 | 22<br>R | 2<br>N | 90<br>90 | 550 R /<br>600 | 1 | 1 | 1 | 1 | 1 | 1 | MGVG – 10<br>1 | 1<br>1 |
| 29 | *Corymbia citriodora*<br>Lemon-scented Gum | G | M | C – F | 20 | 20<br>R | 2<br>S | 90<br>90 | 200x600, 650 Av. N/S /<br>750 | 1 | 1 | 1 | 1 | 1 | 1 | MGVG – 10<br>1 | 1<br>1 |
| 30 | *Morus nigra* (exempt)<br>Black Mulberry | | | | | | | | | | | | | | | | |

| No. | Comments |
|---|---|
| 21 | Branch bark extruded, round-edge ribs below both sides of crotch, crown acaulescent, bifurcated @ 500, appears stable. |
| 23 | Has *dendrophthoe vitelina* mistletoe in lower crown to west. |
| 25 | Basal epicormic, previously pruned in lower-mid crown. |
| 29 | Trunk straight to 2m, slight lean to north, bifurcated, orientation N/S; 2 x First Order Structural Branches (FOSB), 1 superior to south, erect, 1 inferior to north, acutely divergent and ascending, supporting approximately 70% and 30% of the live crown. |

## 4.1 Assessment of tree/s or stand/s of trees.

| UTM Tree No. / Stand No. | Genus & species / Common Name | Condition G = Good F = Fair P = Poor M = Moribund D = Dead | Age Y = Young M = Mature O = Overmature | Crown Form D = Dominant C = Co-dominant I = Intermediate S = Suppressed F = Forest E = Emergent | Ht. Approx. metres | Crown spread approx. metres / Orientation R = Radial, or other | Crown Symmetry 1 = symmetrical 2 = asymmetrical / Orientation | Crown cover / Crown density % / D = dormant | DBH in mm @ 1.4m, or other, as indicated and trunk orientation other than R = radial, e.g. N/S / DARB Diameter above root buttress | Trunk Lean 1 = Upright-Slight 2 = Moderate 3 = Severe 4 = Critical 5 = Acaulescent / Orientation / ST = Static P = Progressive Sc = Self-correcting | Roots evident @ root crown 1. = None 2. = Adventitious 3. = Basal Flare 4. = Buttresses 5. = First Order Roots (FOR), No. & distribution e.g. R = radial, or one each to N, S, E, NE and W | Pests & diseases 1 = No or 2 = Yes (If 2. see comments) | Branch Bark included 1 = No or 2 = Yes or 3 = N/A | Vigour 1 = Good Vigour 2 = Low Vigour | Form 1 = Good form 2 = Poor form | SRIV Age, Vigour, Condition / Index Rating www.iaca.org.au / ESTIMATED LIFE EXPECTANCY 1. Long 2. Medium 3. Short | Significance scale STARS www.iaca.org.au 1=High 2=Medium 3=Low / Retention Value 1=High 2=Medium 3=Low 4=Remove |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 31 | *Syagrus romanzoffiana* (exempt)<br>Cocos Palm | | | | | | | | | | | | | | | |
| 32 | *Syagrus romanzoffiana* (exempt)<br>Cocos Palm | | | | | | | | | | | | | | | |
| 33 | *Syagrus romanzoffiana* (exempt)<br>Cocos Palm | | | | | | | | | | | | | | | |
| 34 | *Syagrus romanzoffiana* (exempt)<br>Cocos Palm | | | | | | | | | | | | | | | |
| 35 | *Liquidambar formosana*<br>Chinese Sweet Gum | G | M | D | 8 | 9<br>R | 1 | 90<br>90 | 320<br>350 | 1 | 1 | 1 | 1 | 1 | 1 | MGVG – 10<br>1 | 1<br>2 |
| 36 | *Corymbia citriodora*<br>Lemon-scented Gum | G | Y | D | 8 | 2.5 | 1 | 90<br>90 | 100<br>110 | 1 | 1 | 1 | 1 | 1 | 1 | YGVG – 9<br>1 | 2<br>2 |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |

| No. | Comments |
|---|---|
| | |

## Observations

*Tree Significance*

4.2 Determined by using the Tree Significance - Assessment Criteria of the *IACA Significance of a Tree, Assessment Rating System* (STARS)© (IACA, 2010), Appendix A. Trees 2, 22, 23, 26, 27, 28, 29, 35 are of *high* significance due to their substantial dimensions and prominence *in situ*.

**Table 2.0 Significance Scale**

**1** – **High**
**2** – **Medium**
**3** – **Low**

| Significance Scale | 1 | 2 | 3 |
|---|---|---|---|
| UTM Tree No. / Stand No. | 2, 22, 23, 26, 27, 28, 29, 35 | 1, 3, 4, 5, 6, 7, 9, 10, 2, 12 , 13, 14, 15, 16, 17, 18, 19, 20, 21, 24, 25, 36 | |

*Tree Retention Value*

4.3 Determined by using the Retention Value - Priority Matrix of the *IACA Significance of a Tree, Assessment Rating System* (STARS) © (IACA, 2010), Appendix A.

**Table 3.0 Retention Value**

**High** – Priority for Retention
**Medium** – Consider for Retention
**Low** – Consider for Removal
**Remove** - Priority for Removal

| Retention Value | High – Priority for Retention | Medium – Consider for Retention | Low – Consider for Removal | Remove – Priority for Removal |
|---|---|---|---|---|
| UTM Tree No. / Stand No. | 26, 27, 28, 29 | 2, 5, 9, 10, 11, 17, 18, 19, 20, 21, 22, 23, 24, 25, 35, 36 | 1, 3, 4, 6, 7, 12, 13, 14, 15, 16 | |

## Discussion

4.4 AS4970 (2009) section 3 requires a radial Tree Protection Zone (TPZ) setback of 12 x DBH from center of trunk (COT) but allows for a 10% reduction of area equal to a reduction of 30% of radius on one side only as per AS4970 (2009) section 3, 3.3.3 which requires the Project Arborist to demonstrate that where a retained tree is subject to a major encroachment (>10% of area of TPZ) it can be protected to remain viable.

4.5 Trees 1, 2, 4, 6-13, 15-26, 35 and 36 are to be removed as they are located within or too close to the proposed building envelope to remain stable and viable.

4.6 Trees 27, 28 and 29 will be subject to a minor encroachment as per AS 4970 (2009) Section 3, 3.3.2 Minor Encroachment from development works within <10% of the radial area of the Tree Protection Zone (TPZ). These trees are located between the 2 residential towers and their basement care parks and will require a minor encroachment for excavation and construction of building footings and foundations respectively where contiguous piling including any over excavation will be located outside of the one collective Tree Protection Zone for these trees. These trees are expected to remain viable (TPZ) and stable (SRZ) with contiguous soil volumes in other directions as per AS 4970 (2009) Section 3, 3.3.2 Minor Encroachment. These trees may require minor selective pruning for clearance and safe working access from the proposed dwellings. The open space areas within the TPZ of these trees will need to be suspended on hand excavated piers to ensure the growing environments are not damaged by excavation and soil compaction as would occur with pavement located at ground.

Trees 28 and 29 will require Crown Modification as Crown Lifting or Reduction Pruning (AS4973 2007, pp. 13 and 16) to remove branches up to 3 m above new path and shortening of descending outer branches in the lower crown back to laterals of ½ the diameter from extending over the area of excavation and contiguous piling and is to be supervised, monitored and certified by the Project Arborist.

4.7 The proposed works will not encroach into the Structural Root Zone (SRZ) of these trees.

Table 4.0 Notes

This table only applies to trees being retained. Tree Protection Zone fencing locations as measured from the centre of each tree and the recommended distances for the side closest to the building construction works e.g. excavation (see explanatory notes below). Tree Protection Zone fences and setbacks where applicable are indicated in Appendix G.

**Explanatory notes for Table 4.0.**

This table is based upon Australian Standard AS4970 2009 *Protection of trees on development sites*, Section 3 Determining the protection zone of the selected trees (see Appendix B), where the approved building works should be no closer, including excavation, than the dimensions stated above.

***"3.3 Variations to the TPZ***

***3.3.2 Minor Encroachment***

*If the proposed encroachment is less than 10% of the area of the TPZ and is outside the SRZ, detailed root investigations should not be required. The area lost to this encroachment should be compensated for elsewhere and contiguous with the TPZ.*

***3.3.3 Major Encroachment***

*If the proposed encroachment is greater than 10% of the area of the TPZ or inside the SRZ the project arborist must demonstrate that the tree(s) would remain viable. The area lost to this encroachment should be compensated for elsewhere and contiguous with the TPZ."*

Refer also to Appendix G for further explanation of modifications to these setbacks.

**Table 4.0 Tree Protection Zone setbacks**

| 1. UTM Tree No. / Stand No. | 2. **T**runk **D**iameter at **B**reast **H**eight **DBH** 1.4 m above ground, AS4970 (2009), or mm or m above ground where indicated. # = average. (mm) | 3. **S**tructural **R**oot **Z**one **SRZ** From center of trunk (COT), trunk diameter above root buttress (DARB) AS4970 (2009) Section 3, 3.3.5 (see Appendix C) where applicable (m) | 4. **T**ree **P**rotection **Z**one (TPZ) = **12 x DBH** From center of trunk (COT) in metres AS4970 (2009) Section 3 (see Appendix B) (m) | 5. Distance of fence with TPZ setback **reduced by 10%** of area on one side of tree only, in metres equating to approx. 0.3 radius as per AS4970 (2009) Section 3, 3.3 (m) | 6. Proposed distance of works on the side closest to building construction in metres **From center of trunk (COT)**, (m) R = root plate C = crown |
|---|---|---|---|---|---|
| 27 | 350 | 2.3 | 4.2 | 2.9 | 2.9 |
| 28 | 550 | 2.7 | 6.6 | 4.6 | 4.6 |
| 29 | 650 | 3.0 | 7.8 | 5.5 | 5.5 |

**Descriptors for modified setbacks in columns above.**

1 Special conditions apply to protect the roots of trees generally, see Appendix G.
2 Additional protective fencing information is detailed in Appendices G.
3 Acceptable due to the good relative tolerance of the species to development impacts.
4 Range of setbacks for the trees at each end of a linear stand, see Appendix G.
5 Acceptable as fence located at a substantial distance beyond dripline, or may also include the location of a smaller tree in proximity to a larger tree to be retained and the smaller tree being protected well within the protective fencing for that larger tree.
6 Acceptable due to additional special protection works, see Appendix G for this tree.
7 Acceptable as pre-existing site conditions were conducive to having restricted the development of root growth in this direction.
8 Street tree with protective fencing of minimal width to allow for pedestrian access along road reserve.
9 Acceptable as tree transplanted reducing the area of the root zone.
10 Acceptable as not effected by development works.
11 Young tree not expected to have established a substantially expansive root system and able to re-establish or modify growth to be sustainable due to age and good vigour.
12 Set back prescribed by the consent authority.
13 Acceptable as tree growing on a lean and encroachment on compression wood side where root growth is of reduced structural importance.
14 Acceptable as root mapping has indicated extent of structural woody roots with a diameter of 20 mm or more.
15 Acceptable as a specimen of palm taxa tolerant of encroachment.
16 Acceptable as excavation on down slope or across slope side of tree.
17 Acceptable as encroachment into growing area below ground minor, with one corner of building or excavation works extending to within the radius of the dripline.
18 Acceptable as encroachment by pier, including screw piles, with minimal disturbance.
19 Acceptable as encroachment above grade without excavation or sub-base compaction.
20 Acceptable as located within 0.5 m from edge of dripline.
21 Acceptable as encroachment with gap graded fill that can accommodate gaseous exchange between roots/soil and the atmosphere and ongoing root growth.
22 Minimum TPZ setback 2 m, AS4970 (2009) section 3, 3.2.
23 Maximum TPZ setback 15 m, AS4970 (2009) section 3, 3.2.
24 Tree is a palm, other monocot, cycad or tree fern TPZ is to be 1 m outside crown projection AS4970 (2009) section 3, 3.2.
25 Minimum Structural Root Zone (SRZ) for trees less than 0.15 m diameter is 1.5 m, AS4970 (2009) section 3, 3.5.
26 Acceptable due to compensation of TPZ encroachment with contiguous soil volume in other directions AS4970 (2009) section 3, 3.3.3.
27 Acceptable as encroachment for bulk earthworks by shoring with piles reducing over excavation e.g. benching or batters.

# 5.0 RECOMMENDATIONS

5.1 Trees and 27, 28 and 29 are to be retained and protected within Tree Protection Zone/s. These are to be maintained and special protection works undertaken as detailed in as detailed Appendix G – Tree Protection Plan.

5.2 Where Tree Protection Zone works are to be modified or relocated this must be undertaken in consultation with the Project Arborist to ensure that tree protection is maintained.

5.3 Trees 27 and 29 are to be pruned as detailed 4.6 and Appendix G – Tree Protection Plan and undertaken in accordance with 3.0 Pruning Standards.

5.4 Trees 1, 2, 4, 6-13, 15-26, 35 and 36 are to be removed as detailed in Appendix G – Tree Protection Plan and undertaken in accordance with 3.0 Pruning Standards.

Danny Draper
Principal Consultant
**IACA ACM0012003**
Urban Tree Management Australia P/L
Dip. Hort. (Arboriculture)(AQF 5),
Assoc. Dip. Hort. (Pk. Mgmt.),
Hort. Cert.

# REFERENCES

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

2. IACA, 2010, *Sustainable Retention Index Value (SRIV)*, Version 4, A visual method of objectively rating the viability of urban trees for development sites and management, based on general tree and landscape assessment criteria, Institute of Australian Consulting Arboriculturists, Australia, www.iaca.org.au .

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

4. Liverpool City Council, Tree Management Policy viewed 12 April 2016, Liverpool.nsw.gov.au

5. Mattheck K & Breloer H 1994, *The body language of trees.* A handbook for failure analysis, Published by TSO London, UK.

6. Shigo AL 1989, *A New Tree Biology* (2nd edn.), Shigo and Tree Associates. Durham, New Hampshire USA, pp. 45, 199.

7. Standards Australia 2007, *Australian Standard 4373 Pruning of amenity trees*, Standards Australia, Sydney, Australia.

8. Standards Australia 2009, *Australian Standard 4970 Protection of trees on development sites*, Standards Australia, Sydney, Australia.

9. Work Cover NSW 1998, *Code of Practice Tree Work*, New South Wales Government, Australia.

# DISCLAIMER

The author and Urban Tree Management take no responsibility for actions taken and their consequences, contrary to those expert and professional instructions given as recommendations pertaining to safety by way of exercising our responsibility to our client and the public as our duty of care commitment, to mitigate or prevent hazards from arising or risks from being eliminated or mitigated or managed to reduce harm or damage, from a failure moment in full or part, from a structurally deficient or unsound tree or a tree likely to be rendered thus by its retention and subsequent deterioration from modification/s to its growing environment either existing or proposed, either above or below ground, contrary to our advice.

# Appendix A

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

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

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

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

## Tree Significance - Assessment Criteria

### 1. High Significance in landscape

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

### 2. Medium Significance in landscape

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

### 3. Low Significance in landscape

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

**Environmental Pest / Noxious Weed Species**

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

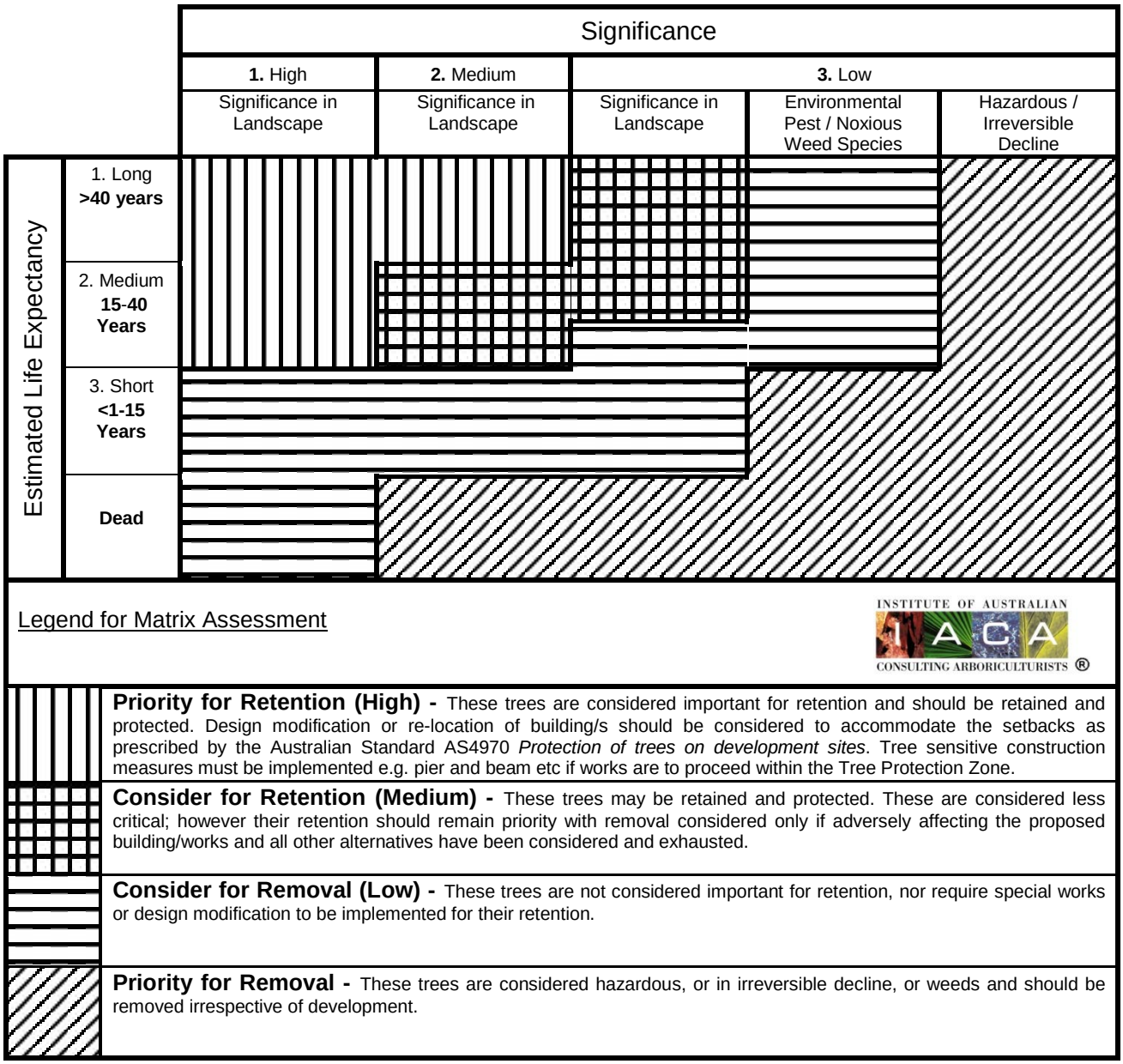
**Hazardous/Irreversible Decline**

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

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

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

## Table 1.0 Tree Retention Value - Priority Matrix.




Legend for Matrix Assessment

INSTITUTE OF AUSTRALIAN CONSULTING ARBORICULTURISTS ®

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

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

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

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

### REFERENCES

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

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

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

# Appendix B

## Extract from Australian Standard AS4970 2009 Protection of trees on development sites

### Section 3, Determining the tree protection zones of the selected trees

#### 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

The radius 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 m above ground

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

# Appendix C

## Extract from Australian Standard AS4970 2009 Protection of trees on development sites

### Section 3, Determining the protection zones of the selected trees

#### 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. Root investigation may provide more information on the extent of these roots."*

**Determining the SRZ**

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

**SRZ radius** expressed by the curve is calculated by the following formula,

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

where

*D* = trunk diameter, in metres measured immediately above the root buttress.

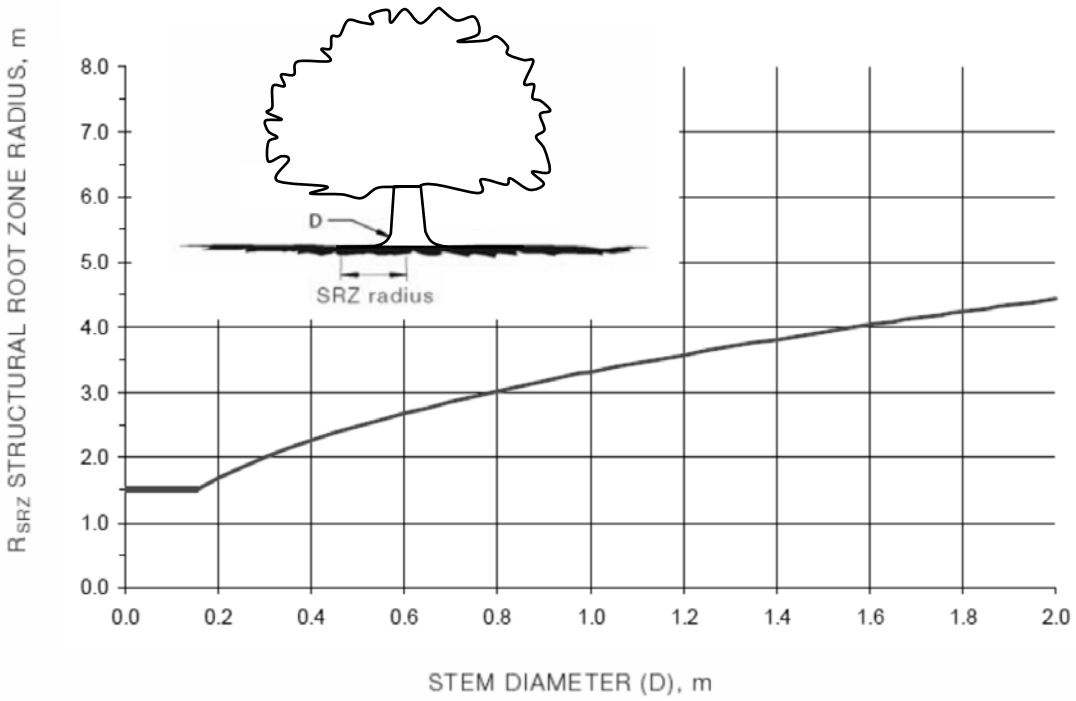



FIGURE 1 STRUCTURAL ROOT ZONE CALCULATION

(AS 4970 – 2009, Amendment No. 1 March 2010)

NOTES:

1 $R_{SRZ}$ is the calculated structural root zone radius (SRZ radius).

2 D is the stem diameter measured immediately above root buttress.

3 The $R_{SRZ}$ for trees less than 0.15 m diameter is 1.5 m.

4 The $R_{SRZ}$ 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 D

## Matrix - Sustainable Retention Index Value (SRIV) ©

Version 4, 2010
Developed by IACA – Institute of Australian Consulting Arboriculturists www.iaca.org.au

The matrix is to be used with the value classes defined in the Glossary for Age / Vigour / Condition.
An index value is given to each category where ten (10) is the highest value.

| Age Class | Vigour Class and Condition Class | | | | | |
|---|---|---|---|---|---|---|
| | Good Vigour & Good Condition (GVG) | Good Vigour & Fair Condition (GVF) | Good Vigour & Poor Condition (GVP) | Low Vigour & Good Condition (LVG) | Low Vigour & Fair Condition (LVF) | Low Vigour & Poor Condition (LVP) |
| | Able to be retained if sufficient space available above and below ground for future growth. No remedial work or improvement to growing environment required. May be subject to high vigour. Retention potential - Medium – Long Term. | Able to be retained if sufficient space available above and below ground for future growth. Remedial work may be required or improvement to growing environment may assist. Retention potential - Medium Term. Potential for longer with remediation or favourable environmental conditions. | Able to be retained if sufficient space available above and below ground for future growth. Remedial work unlikely to assist condition, improvement to growing environment may assist. Retention potential - Short Term. Potential for longer with remediation or favourable environmental conditions. | May be able to be retained if sufficient space available above and below ground for future growth. No remedial work required, but improvement to growing environment may assist vigour. Retention potential - Short Term. Potential for longer with remediation or favourable environmental conditions. | May be able to be retained if sufficient space available above and below ground for future growth. Remedial work or improvement to growing environment may assist condition and vigour. Retention potential - Short Term. Potential for longer with remediation or favourable environmental conditions. | Unlikely to be able to be retained if sufficient space available above and below ground for future growth. Remedial work or improvement to growing environment unlikely to assist condition or vigour. Retention potential - Likely to be removed immediately or retained for Short Term. Potential for longer with remediation or favourable environmental conditions. |
| (Y) Young | **YGVG - 9** Index Value 9 Retention potential - Long Term. Likely to provide minimal contribution to local amenity if height <5 m. High potential for future growth and adaptability. Retain, move or replace. | **YGVF - 8** Index Value 8 Retention potential - Short – Medium Term. Potential for longer with improved growing conditions. Likely to provide minimal contribution to local amenity if height <5 m. Medium-high potential for future growth and adaptability. Retain, move or replace. | **YGVP - 5** Index Value 5 Retention potential - Short Term. Potential for longer with improved growing conditions. Likely to provide minimal contribution to local amenity if height <5 m. Low-medium potential for future growth and adaptability. Retain, move or replace. | **YLVG - 4** Index Value 4 Retention potential - Short Term. Potential for longer with improved growing conditions. Likely to provide minimal contribution to local amenity if height <5 m. Medium potential for future growth and adaptability. Retain, move or replace. | **YLVF - 3** Index Value 3 Retention potential - Short Term. Potential for longer with improved growing conditions. Likely to provide minimal contribution to local amenity if height <5m. Low-medium potential for future growth and adaptability. Retain, move or replace. | **YLVP - 1** Index Value 1 Retention potential - Likely to be removed immediately or retained for Short Term. Likely to provide minimal contribution to local amenity if height <5 m. Low potential for future growth and adaptability. |
| (M) Mature | **MGVG - 10** Index Value 10 Retention potential - Medium - Long Term. | **MGVF - 9** Index Value 9 Retention potential - Medium Term. Potential for longer with improved growing conditions. | **MGVP - 6** Index Value 6 Retention potential - Short Term. Potential for longer with improved growing conditions. | **MLVG - 5** Index Value 5 Retention potential - Short Term. Potential for longer with improved growing conditions. | **MLVF - 4** Index Value 4 Retention potential - Short Term. Potential for longer with improved growing conditions. | **MLVP - 2** Index Value 2 Retention potential - Likely to be removed immediately or retained for Short Term. |
| (O) Over-mature | **OGVG - 6** Index Value 6 Retention potential - Medium - Long Term. | **OGVF - 5** Index Value 5 Retention potential - Medium Term. | **OGVP - 4** Index Value 4 Retention potential - Short Term. | **OLVG - 3** Index Value 3 Retention potential - Short Term. Potential for longer with improved growing conditions. | **OLVF - 2** Index Value 2 Retention potential - Short Term. | **OLVP - 0** Index Value 0 Retention potential - Likely to be removed immediately or retained for Short Term. |

# Appendix E

## Glossary

From
*Dictionary for Managing Trees in Urban Environments*
Institute of Australian Consulting Arboriculturists (IACA) 2009.

### Vigour

**Vigour** 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 categorized as *Normal Vigour, High Vigour*, *Low Vigour* and *Dormant Tree Vigour*.

**Normal Vigour** 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, e.g. 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 feed lot, 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.

**Dormant Tree Vigour** Determined by existing turgidity in lowest order branches in the outer extremity of the crown, with good bud set and formation, and where the last *extension growth* is distinct from those most recently preceding it, evident by bud scale scars. Normal vigour during dormancy is achieved when such growth is evident on a majority of branches throughout the crown.

### Age of Trees

**Age** 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 Standards 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.

### Periods of Time

**Periods of Time** The life span of a tree in the urban environment may often be reduced by the influences of encroachment and the dynamics of the environment and can be categorized as *Immediate*, *Short Term*, *Medium Term* and *Long Term*.

**Immediate** An *episode* or occurrence, likely to happen within a twenty-four (24) hour period, e.g. tree failure or collapse in full or part posing an imminent danger.

**Short Term** A period of time less than <1 – 15 years.

**Medium Term** A period of time 15 – 40 years.

**Long Term** A period of time greater than >40 years.

### Trunk

**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 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 categorized 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.

**Acaulescent** A *trunkless* tree or tree growth forming a very short *trunk*. See also *Caulescent.*

**Caulescent** Tree grows to form a *trunk*. See also *Acaulescent*.

## Condition of Trees

**Condition** 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 ($1^{st}$) and possibly second ($2^{nd}$) 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*. Condition can be categorized 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 from, 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 from, 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 from, or contributed to by vigour..

**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.

## Leaning Trees

**Leaning** 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 categorized as *Slightly Leaning*, *Moderately Leaning*, *Severely Leaning* and *Critically Leaning*.

**Slightly Leaning** A leaning tree where the trunk is growing at an angle within $0^{O}$-$15^{O}$ from upright.

**Moderately Leaning** A leaning tree where the trunk is growing at an angle within $15^{O}$-$30^{O}$ from upright.

**Severely Leaning** A leaning tree where the trunk is growing at an angle within $30^{O}$-$45^{O}$ from upright.

**Critically Leaning** A leaning tree where the trunk is growing at an angle greater than $>45^{O}$ from upright.

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

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

## Form of Trees

**Crown Form** 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 categorized 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.

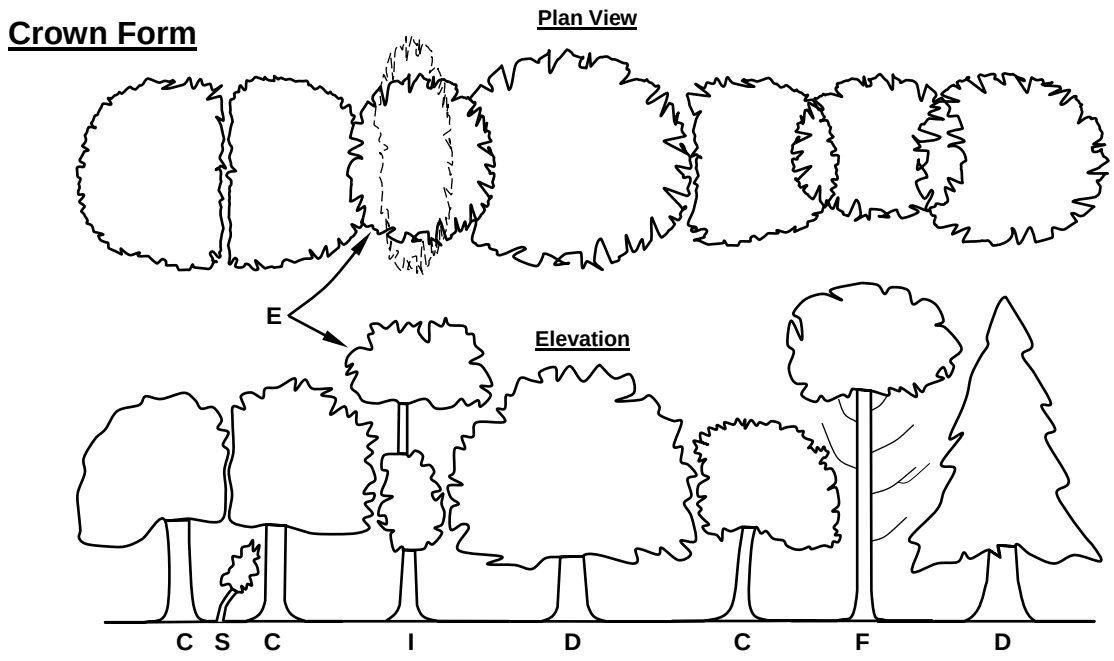
**Crown Form Dominant** Crowns of trees generally not restricted for space and light receiving light from above and all sides.

**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.




(Source: **D**, **C**, **I** and **S**, and Elevation, Matheny and Clark 1998, **E**, **F** and Plan View, IACA 2005)

**D.** Dominant, **F.** Forest, **C.** Codominant, **E.** Emergent, **I.** Intermediate, **S.** Suppressed

## Symmetry

**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 categorized 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 From 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 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 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.

**Crown Spread Orientation** Direction of the *axis* of *crown spread* which can be categorized as *Orientation Radial* and *Orientation Non-radial*.

**Crown Spread Orientation Non-radial** Where the crown extent is longer than it is wide, e.g. east/west or E/W. Further examples, north/south or N/S, and may be *Crown Form Codominant*, e.g. **A** or **B**, *Crown Form Intermediate* e.g. **A**, or *Crown Form Suppressed* e.g. **B***, and* crown symmetry is *symmetrical* e.g. **A**, or *asymmetrical* e.g. **B**.

**Crown Spread Orientation Radial** Where the *crown spread* is generally an even distance in all directions from the trunk and often where a tree has *Crown Form Dominant* and is *symmetrical.*

**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.

**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 - Institute of Australian Consulting Arboriculturists 2005).

**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 axes, 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 ground and noting where the measurement was recorded e.g. at ground.

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

**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. See also *Crown Projection*.

**Tree Protection Zone (TPZ)** Area around a tree set aside to protect the trunk, roots and crown during development works. This is to protect the tree physically and a sufficient proportion of its growing environment above and below ground to assist *stability* and prolong viability. The TPZ is often delineated by an enclosed fence and established prior to demolition or construction and maintained until the completion of works. The fenced-off area around the tree is usually located at a specific distance from the trunk determined as multiples of the trunk diameter, usually *Diameter at breast height* (DBH). Special protection or construction works may provide a TPZ without a fence having been erected, e.g. a barrier formed by site sheds located on piers. Such a protection area may form an exclusion zone for all works including the temporary or permanent location of utility services. Note: Any *encroachment* into the area would require additional tree protection specifications or works in consultation with the *Project arborist*.

**Encroachment** 1. The growth of branches, trunk or roots onto another property. 2. Any work within a *Tree Protection Zone* other than for the maintenance of the Tree Protection Zone.

## Deadwood

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

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

**Low Volume Deadwood** Where <5 dead branches occur that may require *removal*.

**Medium Volume Deadwood** Where 5-10 dead branches occur that may require *removal*.

**High Volume Deadwood High Volume Deadwood** Where >10 dead branches occur that may require *removal*.

## Dieback

**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 categorized as *Low Volume Dieback*, *Medium Volume Dieback* and *High Volume Dieback*.

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

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

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

## Epicormic shoots

**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 categorized as *Low Volume Epicormic Shoots*, *Medium Volume Epicormic Shoots* and *High Volume Epicormic Shoots*.

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

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

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

## 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, s*oil depth* and the physical characteristics of the surrounding landscape.

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

**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 1$^{st}$ and 2$^{nd}$ order roots, or 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*.

# Appendices F and G

## Appendix F – Survey of Subject Tree/s
## Appendix G – Tree Protection Plan including Tree Protection Plan

Trees the subject of this report are marked on the following plan/s and are numbered as listed below.

| UTM<br>Tree No. / Stand No. | *Genus and species*<br>Common name |
|---|---|
| 1 | *Photinia glabra*<br>Photinia |
| 2 | *Acmena smithii*<br>Lilly Pilly |
| 3 | *Macadamia integrifolia* (exempt)<br>Queensland Nut |
| 4 | *Lagerstroemia indica*<br>Crepe Myrtle |
| 5 | *Lagunaria patersonii* (exempt)<br>Norfolk Island Hibiscus |
| 6 | *Callistemon viminalis*<br>Weeping Bottlebrush |
| 7 | *Stenocarpus sinuatus*<br>Fire-wheel Tree |
| 8 | Dead |
| 9 | *Acmena smithii*<br>Lilly Pilly |
| 10 | *Acmena smithii*<br>Lilly Pilly |
| 11 | *Lagerstroemia indica*<br>Crepe Myrtle |
| 12 | *Corymbia citriodora*<br>Lemon-scented Gum |
| 13 | *Harpephyllum caffrum*<br>Wild Plum |
| 14 | *Morus nigra* (exempt)<br>Black mulberry |
| 15 | *Ulmus parvifolia*<br>Chinese Elm |
| 16 | *Liquidambar styraciflua*<br>Liquidambar |
| 17 | *Ficus microcarpa*<br>Weeping Fig |
| 18 | *Castanospermum australe*<br>Black-bean |
| 19 | *Ulmus procera*<br>English Elm |
| 20 | *Stenocarpus sinuatus*<br>Fire-wheel Tree |

Trees the subject of this report are marked on the following plan/s and are numbered as listed below.

| UTM<br>Tree No. / Stand No. | *Genus and species*<br>Common name |
|---|---|
| 21 | *Stenocarpus sinuatus*<br>Fire-wheel Tree |
| 22 | *Lagerstroemia indica*<br>Crepe Myrtle |
| 23 | *Lagerstroemia indica*<br>Crepe Myrtle |
| 24 | 2 x *Archeontophoenix cunninghamiana*<br>Bangalow Palm |
| 25 | *Callistemon viminalis*<br>Weeping Bottlebrush |
| 26 | *Corymbia citriodora*<br>Lemon-scented Gum |
| 27 | *Callistemon salignus*<br>Willow Bottlebrush |
| 28 | *Corymbia citriodora*<br>Lemon-scented Gum |
| 29 | *Corymbia citriodora*<br>Lemon-scented Gum |
| 30 | *Morus nigra* (exempt)<br>Black mulberry |
| 31 | *Syagrus romanzoffiana* (exempt)<br>Cocos Palm |
| 32 | *Syagrus romanzoffiana* (exempt)<br>Cocos Palm |
| 33 | *Syagrus romanzoffiana* (exempt)<br>Cocos Palm |
| 34 | *Syagrus romanzoffiana* (exempt)<br>Cocos Palm |
| 35 | *Liquidambar formosana*<br>Chinese Sweet Gum |
| 36 | *Corymbia citriodora*<br>Lemon-scented Gum |
| | |
| | |
| | |
| | |

# **APPENDIX F** – Survey of Subject Tree/s

**7 & 9 Castlereagh Street and 8-12 Copeland Street, Liverpool NSW, Ref: 18096**

Prepared by Urban Tree Management Australia P/L, 65 Excelsior Street, Merrylands NSW 2160, tel. 02 9760 1389.

From Landscape Plan Ground Level, 7 & 9 Castlereagh Street and 8, 10 and 12 Copeland Street, Liverpool, scale 1:200 @ A1 and 1:400 @ A3, Drawing reference 14585 LDA01-B by NBRS+Partners, Level 3, 4 Glen Street, Milsons Point NSW 2061, tel. 9922 2344 and Mosca Pserras Australia, Suite 501, 7 Secant Street, Liverpool NSW 2170, t. 9601 3244.

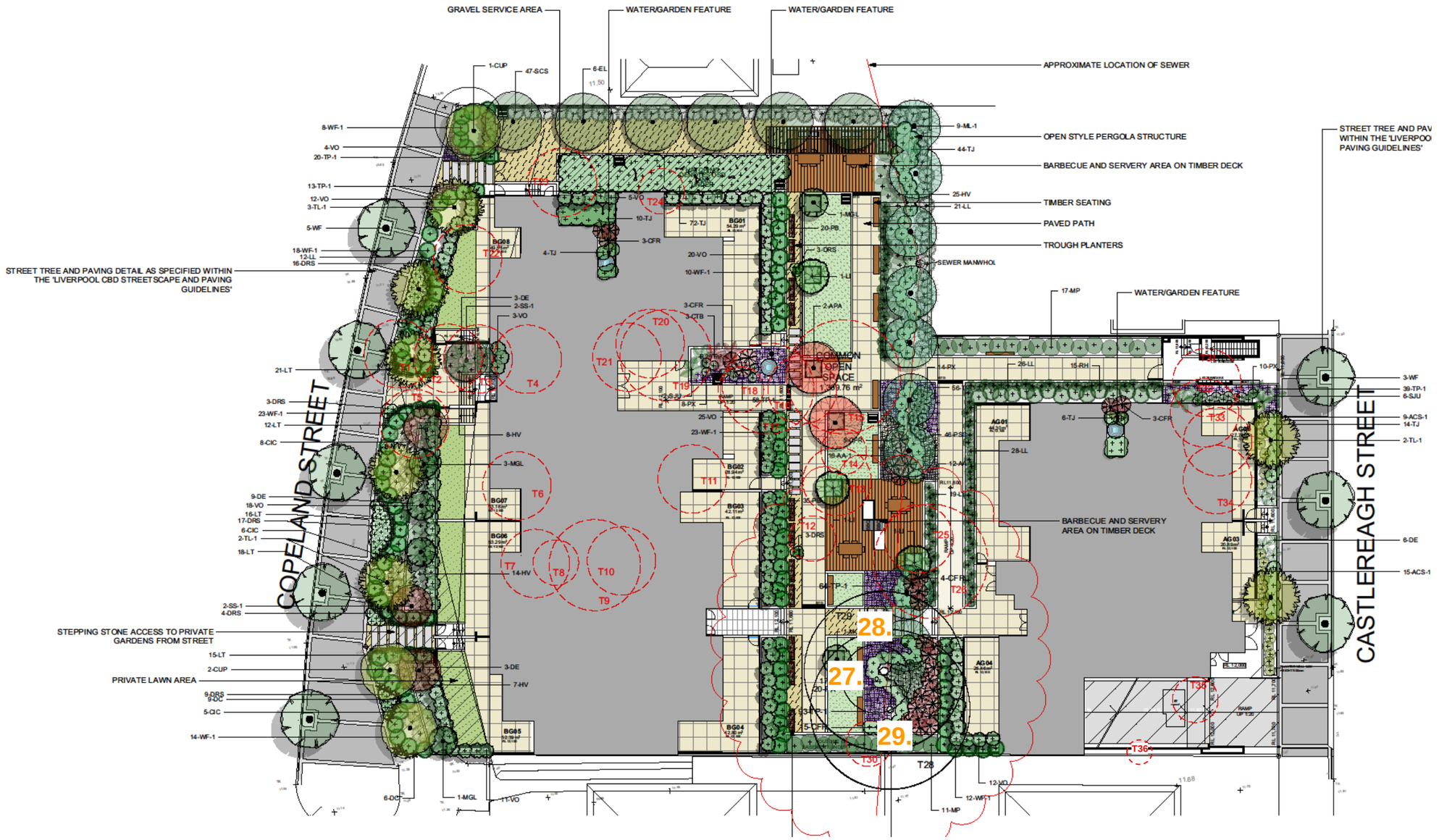
URBAN TREE MANAGEMENT

Legend

**10.** Tree/s or stands of trees numbered in orange and bold or surrounded by an unbroken line are recommended for retention.

T11. Tree/s or stands of trees numbered in red and not bold or surrounded by a broken line are recommended for removal.

Note: trees indicated, unnumbered are either shrubs, or trees of species, or dimensions, or condition class not protected by the Tree Preservation Order or trees not affected by the proposed works or were already removed.



# **APPENDIX G** – TREE PROTECTION PLAN 1 of 4 - Tree Protection Zones - Standard Procedure

The Protective fencing where required may delineate the ***TPZ*** and should be located as determined by the project arborist in accordance with AS4970 *Protection of trees on development sites*, 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. AS4687 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 20 mm and be located clear of roots. Existing perimeter fencing and other structures may be suitable as part of the protective fencing."*

AS4970 Section 4, Tree protection measures, Figure 3 Protective fencing shows examples of such fencing.

*"Legend:*
*1 Chain wire mesh panels with shade cloth (if required) attached, held in place with concrete feet.*
*2 Alternative plywood or wooden paling fence panels. The fencing material also prevents building materials or soil entering the TPZ.*
*3 Mulch installation across surface of TPZ (at the discretion of the project arborist). No excavation, construction activity, grade changes, surface treatment or storage of materials of any kind is permitted within the TPZ.*
*4 Bracing is permissible within the TPZ. Installation of supports should avoid damaging roots. "*

AS4970 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."*

**Tree Protection signage** is to be attached to each *Tree Protection Zone* and displayed from within the development site in accordance with AS4970 2009 *Protection of trees on development sites*, Section 4.4 and example Figure C1 (as shown) and lettering to comply with AS1319.

Where a tree is to be retained and a *Tree Protection Zone* cannot be adequately established due to restricted access e.g. tree located along side 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 75x50x2000 mm 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 battens are to extend to the base of the tree (AS4970 2009 *Protection of trees on development sites*, Figure 4 Examples of Trunk, Branch and ground protection).

**Trunk/Branch and root protection** If a tree is growing down slope 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 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 to be controlled within the *Tree Protection Zone*, for the duration of the project.

The area of the Tree Protection Zone to be mulched to a depth of 100 mm with organic material being 75% leaf litter and 25% wood, and this being composted material preferably from the same genus and species of tree as that to where the mulch is to be applied, i.e. species specific mulch. 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 5 mm thick and overlapped 300 mm and pegged. Pegs are to be a minimum length of 200 mm and spaced at 500 mm increments in a grid pattern. Once installed mulch is to be placed on top of the jute matting previously described.

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 the Project Arborist for the protection of the tree regarding the location of the service/s.

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 the Project Arborist as per AS4970 (2009).

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 the Project Arborist as per AS4970 (2009).

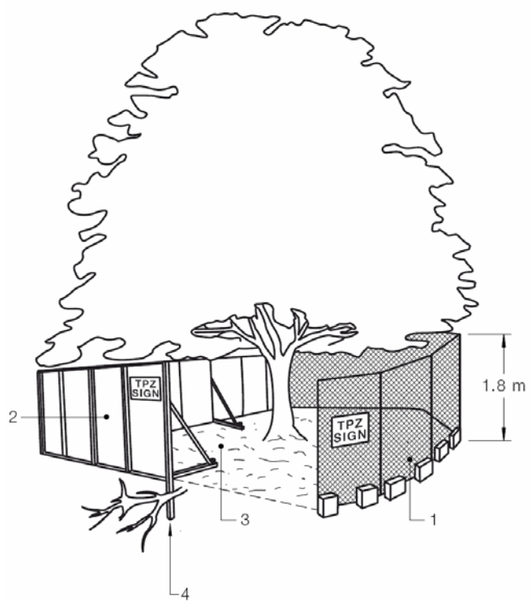



FIGURE 3 PROTECTIVE FENCING


FIGURE C1 TREE PROTECTION ZONE SIGN

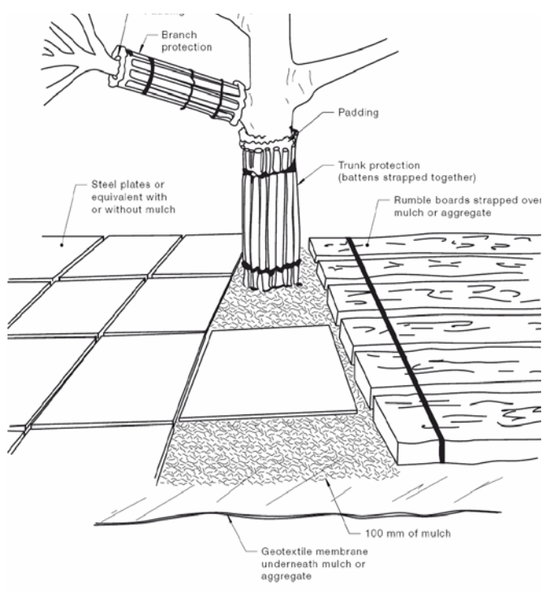



FIGURE 4 EXAMPLES OF TRUNK, BRANCH AND GROUND PROTECTION

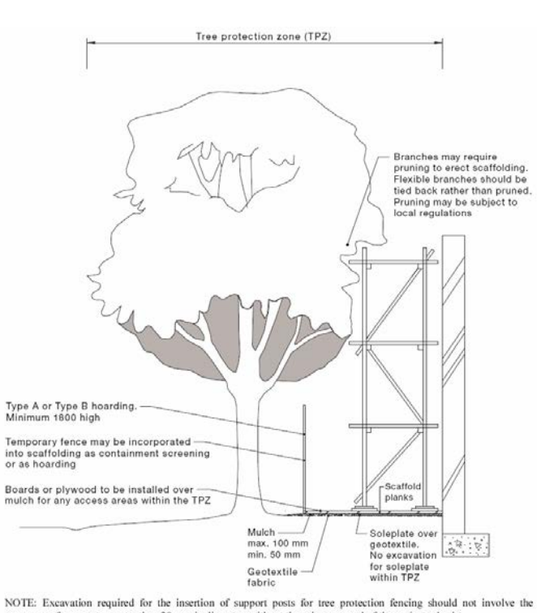



FIGURE 5 INDICATIVE SCAFFOLDING WITHIN A TPZ

**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 minimized. This can be achieved by designing scaffolding to avoid branches or tying back branches. Where pruning is unavoidable it must be specified by the project arborist in accordance with AS4373. 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 board walk 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."* (Standards Australia 2009, p. 18).

# APPENDIX G
TREE PROTECTION PLAN 2 of 4

**7 & 9 Castlereagh Street and 8-12 Copeland Street, Liverpool NSW, Ref: 18096**

Prepared by Urban Tree Management Australia P/L, 65 Excelsior Street, Merrylands NSW 2160, tel. 02 9760 1389.

URBAN TREE MANAGEMENT

## *Tree Protection Works - General*

*All retained tree/s* Existing levels are to be preserved and no excavation except by hand to protect structural roots is to be undertaken within the Tree Protection Zones. No cutting or filling is to be undertaken within any TPZ unless specified by the Project Arborist.

*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 commencement of work.

## *Tree Protection Works - Specific*

### Prior to Demolition

*TPZ Fencing or works Trees 27, 28 and 29* Prior to demolition works, these trees are to be enclosed within a Tree Protection Zone with protective fencing and maintained and retained until the completion of all building works. This is to include utilizing the existing side boundary fence. Protective fencing or alternative works is to be installed as shown in Appendix G – Tree Protection Plan - Tree Protection Zone - Standard Procedure, Plan 1 of 3.

*Trunk and branch protection – Trees 28 and 29* As per AS4970 (2009) *Protection of trees on development sites*, Section 4 Tree protection measures, 4.5.2 Trunk and branch protection, the trunk and branches to 4 m are to be protected from possible damage from collision with trucks or plant equipment and are to be wrapped with 4 layers of hessian or a single layer of carpet underfelt around the subject stems for a minimum of 4 m and extending to first order branches, then wire or rope is to be used to secure 75x50x2000 mm hardwood battens to the trunk (do not nail or screw to the trunk). The number of battens to be used is as required to encircle the trunk and the battens are to extend to the base of the tree as per AS4970 (2009) Figure 4, (see Appendix G, Plan 1 of 3).

*Pruning – Trees 28 and 29* Crown Modification as Crown Lifting or Reduction Pruning (AS4973 2007, pp. 13 and 16) to remove branches up to 3 m above new path and shortening of descending outer branches in the lower crown back to laterals of ½ the diameter from extending over the area of excavation and contiguous piling and is to be supervised, monitored and certified by the Project Arborist.

Any plant equipment is to work from outside of the TPZ reaching into the TPZ to minimise damage to overhanging branches and to protect roots.

*Root Protection – Trees 2, 3, 4, 5 and 6* No work is to be undertaken within the TPZ. Where access is required within the TPZ, roots are to be protected from soil compaction by the application of ground protection as per AS4970 (2009) section 4, 4.5.3 Ground Protection, where a permeable membrane such as geotextile fabric is to be located at existing ground level beneath a layer of mulch or crushed rock with no fines 100 mm deep and covered with rumble boards or steel plates as per AS4970 (2009) Figure 4, (see Appendix G, Plan 1 of 3). Plant equipment is to work from outside of the TPZ reaching into the TPZ to minimise soil disturbance and compaction, this to include pavement.

Maintain Tree Protection Zones and their works during this period.

*Protective Fencing* See Appendix G – Tree Protection Plan - Tree Protection Zone - Standard Procedure, Plan 1 of 3.

### During Demolition

*Exempt trees able to be removed - Trees 3, 5, 14, 30, 31, 32, 33 and 34* These trees are exempt species and Tree 8 is a dead tree with no habitat value and are exempt from protection under the Liverpool City Council Tree Management Policy under the Liverpool local Environmental Plan (LLEP 2008).

*Tree Removal – Trees 1, 2, 4, 6-13, 15-26, 35 and 36* Works to be undertaken during demolition and their stumps removed or ground to 500 mm below grade. Trees to be removed from within the Tree Protection Zone of retained trees are to have their stumps ground and not removed by excavation plant equipment, to protect the roots of the trees retained. Crowns of trees to be retained are to be protected. Any plant equipment is to work from outside of the TPZ reaching into the TPZ to minimise damage to overhanging branches and to protect roots.

*Root Protection – Trees 27, 28 and 29* No work is to be undertaken within the TPZ. Where access is required within the TPZ, roots are to be protected from soil compaction by the application of ground protection as per AS4970 (2009) section 4, 4.5.3 Ground Protection, where a permeable membrane such as geotextile fabric is to be located at existing ground level beneath a layer of mulch or crushed rock with no fines 100 mm deep and covered with rumble boards or steel plates as per AS4970 (2009) Figure 4, (see Appendix G, Plan 1 of 3).

Any plant equipment is to work from outside of the TPZ reaching into the TPZ to minimise damage to overhanging branches and to protect roots to minimising soil disturbance and compaction, this to include using existing driveways, garage floors, slabs and pavement.

Maintain Tree Protection Zones and their works during this period.

### Post Demolition and Prior to Construction

*Mulching – All retained trees or Trees 27, 28 and 29* Mulch is required within the within the TPZ of these trees to a minimum depth of 50-100 mm and is to be maintained and kept weed free for the duration of works on the site. The mulch is to be contained at by the use of CoirLogTM installed around the inside edge of the TPZ.

Maintain Tree Protection Zones and their works during this period.

*Root Protection From Soil Profile Desiccation – Trees 27, 28 and 29* As the basement excavation around these trees is undertaken the roots are to be protected from exposed soil profiles drying out. Immediately after excavation of each section exposing the soil profile adjacent the TPZ, remedial works as double layers of hessian fabric are to be installed to cover the exposed soil profiles within each Tree Protection Zone and be fixed into place by metal pegs at the bottom, and the fabric is to overlap the ground at surface by 300 mm and be pegged into place. The soil profile protection is to remain in place until contiguous piling and shot-creting or approved similar is installed and the soil profile closed over. .

### During Excavation and Construction

*Root Protection for Tree/s retained* No work is to be undertaken within the TPZ. Where access is required within the TPZ, roots are to be protected from soil compaction by the application of ground protection as per AS4970 (2009) Figure 4, (see Appendix G, Plan 1 of 3), where a permeable membrane such as geotextile fabric is to be located above the 20-30 mm diameter river pebble mulch to 100 mm deep and covered with rumble boards or steel plates as per AS4970 (2009) Figure 4, (see Appendix G, Plan 1 of 3). Where excavation is required for foundations, fence posts, bollards, piers or pits, it should be undertaken with screw piles or piers or be undertaken by hand excavation respectively, and conducted to manually to 600 mm deep to protect any structural roots (greater than >20 mm diameter). Where excavation deeper than 600 mm is required and hand excavation to 600 mm has encountered no structural roots, excavation can be undertaken mechanically while maintaining the width of the initial manual excavation. Where structural roots are encountered the design will require sufficient flexibility to relocate the pier 100 mm clear of the root for its protection or pipes are to be carefully located beneath such roots. Hand excavation is to be monitored and certified by the Project Arborist.

After completion of hand excavation or non-mechanical works within the TPZ, mechanical excavation to a greater depth may be undertaken with portable motorized tools or with plant equipment where no structural roots were located. Plant equipment is to work from outside of the TPZ reaching into the TPZ to minimise soil disturbance and compaction. The ground protection works are to remain in place until building works are completed.

*Root Pruning – Trees 27, 28 and 29* Where a situation occurs that a structural root (root greater than >20 mm diameter) requires pruning or removal, the root is to be severed with a final cut to undamaged tissue to remove injured and crushed tissues allowing the tree to develop strong internal boundaries and generate new roots (Shigo 1989, p. 199) and protect their growing environment below ground. This will prevent tearing damage to the roots from excavation equipment which can extend beyond the point of excavation back towards the tree. If such works are to be undertaken within the Tree Protection Zone they are to be monitored and certified by the Project Arborist.

*Scaffolding within the Tree Protection Zone* This is to be of minimum width to protect the roots from soil compaction and is to be installed as per AS9470 (2009) as indicated in Appendix G – Tree Protection Plan - Tree Protection Zone - Standard Procedure, Plan 1 of 5. The scaffold should be approved by an engineer.

*Excavation and construction of paths within the TPZ of Trees 27, 28 and 29* Pavements and hard landscaped elements within the TPZ are to be constructed on hand excavated piers and all paths and pavement areas elevated 200 mm above extant grade to minimize soil disturbance from excavation and soil compaction. This will protect and promote root growth, percolation of rainwater and gaseous exchange between roots/soil and atmosphere and the future root growth will not conflict with the build structures. The edge of the elevated paths are is to finish 500 mm clear of the trunk of each tree to allow for future growth. Hand excavation is to be monitored and certified by the Project Arborist as per AS4970 (2009).

*Location of underground utilities within a Tree Protection Zone – all retained trees* Utility services should not be located within the Tree Protection Zone. Any utility services to be located underground within the TPZ are to be undertaken utilising excavation techniques that prevent or minimise damage to structural roots (roots greater than >20 mm diameter). Such works should be conducted with non-motorised hand tools of with an air knife or water knife and vacuum truck or with directional drilling with minimum depth to top of bore of 600 mm, to prevent soil compaction and root damage and works are to be monitored and certified by the Project Arborist.

*Installation of boundary fences and external services near Tree 28* Boundary fences within the Tree Protection Zone of these trees are to be installed using hand excavated holes to a minimum depth of 600 mm for posts or piers where pier and beam construction is to be used. This is to minimise any impact on structural roots and any infill masonry sections are to be located on steel lintels suspended a minimum of 100 mm above ground to protect the roots within the TPZ. A fence must have the flexibility of design to move a post or pier to be 100 mm clear of any structural root (a root greater than >20 mm diameter) to protect such roots and provide sufficient space for future growth without conflict between the 2 structures. Any piers to be relocated must be approved and certified by a structural engineer or architect.

*Precautions in respect to temporary work – All retained trees* If pedestrian or vehicular access is required within a Tree Protection Zone the roots of these trees are to be protected from soil compaction by the application of ground protection as per AS4970 (2009) Figure 4, (see Appendix G, Plan 1 of 3), where a permeable membrane such as geotextile fabric is to be located at existing ground level beneath a layer of mulch or crushed rock with no fines 100 mm deep and covered with rumble boards or steel plates. Such works are to be monitored and certified by the Project Arborist. Any plant equipment is to work from outside of the TPZ reaching into the TPZ to minimise soil disturbance and compaction. The ground protection works are to remain in place until building works are completed. Maintain tree protection, and waste material is to be kept clear of the trunk and branches.

## Post Construction – Landscaping

*New paths within the areas of the Tree Protection Zones* See *Excavation and construction of path*

*Excavation for landscape plantings within the tree protection zones* This should be undertaken manually, to prevent damage to structural roots. Existing soil grades should be maintained with plant container size restricted to a maximum size of 5 litres. No more than 2 plants per square metre for 5 litre and 5 plants per square metre for 150 mm pot size.

*Mulching – All retained trees or Trees 27, 28 and 29* Mulch is to be retained and incorporated into the landscaping works below the elevated pedestrian paths and contained at by the use of CoirLogTM installed around the inside edge of the TPZ and then garden area.

Maintain Tree Protection Zones and their works during this period.

Maintain crown protection, and waste material is to be kept clear of the trunk and branches.

# **APPENDIX G** – TREE PROTECTION PLAN 4 of 4

**7 & 9 Castlereagh Street and 8-12 Copeland Street, Liverpool NSW, Ref: 18096**

Prepared by Urban Tree Management Australia P/L, 65 Excelsior Street, Merrylands NSW 2160, tel. 02 9760 1389.

From Landscape Plan Ground Level, 7 & 9 Castlereagh Street and 8, 10 and 12 Copeland Street, Liverpool, scale 1:200 @ A1 and 1:400 @ A3, Drawing reference 14585 LDA01-B by NBRS+Partners, Level 3, 4 Glen Street, Milsons Point NSW 2061, tel. 9922 2344 and Mosca Pserras Australia, Suite 501, 7 Secant Street, Liverpool NSW 2170, t. 9601 3244.

**Legend**

**10.** Trees numbered in **orange and bold** are recommended for **retention**.

T11. Trees numbered in red and not bold are recommended for removal.

***Tree Protection Zone (TPZ),*** as fencing with setbacks as indicated, or other protection measures or works as indicated.

***Tree Protection Zone***, within the site, area of special protection measures or works outside of or instead of a fenced area.

**TPZ**

**TPZ area reduced by 10%**

**Structural root Zone (SRZ)**

**Tree Protection Zone setbacks**
extract from Table 4.0 and Appendix B.

| 1. UTM Tree No. / UTM Stand No. | 2. Structural Root Zone **SRZ** From center of trunk (COT), trunk diameter above root buttress (DARB) AS4970 (2009) Section 3, 3.3.5 (see Appendix C) where applicable (m) | 3. **T**ree **P**rotection **Z**one (TPZ) = **12 x DBH** (m) From center of trunk (COT) in metres AS4970 (2009) Section 3 (see Appendix B) | 4. Distance of fence with TPZ setback **reduced by 10%** of area on one side of tree only, in metres equating to approx. 0.3 radius as per AS4970 (2009) Section 3, 3.3 (mm) | 5. Proposed distance of works on the side closest to building construction in metres From center of trunk (COT), (m) |
|---|---|---|---|---|
| **27** | 2.3 | 4.2 | 2.9 | 2.9 |
| **28** | 2.7 | 6.6 | 4.6 | 4.6 |
| **29** | 3.0 | 7.8 | 5.5 | 5.5 |

URBAN TREE MANAGEMENT