EARTHSCAPE HORTICULTURAL SERVICES
Arboricultural, Horticultural and Landscape Consultants

ABN 36 082 126 027

DEVELOPMENT IMPACT ASSESSMENT REPORT

PROPOSED MIXED-USE DEVELOPMENT

17-23 MERRIWA STREET, GORDON

November 2013

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1 INTRODUCTION

1.1.1 This report was commissioned by the Brewster Murray Pty Ltd to assess the health and condition of thirty-eight (38) trees located within or immediately adjacent 17-23 Merriwa Street, Gordon. The report has been prepared to aid in the assessment of a Development Application (DA) for the demolition of the existing commercial office building and construction of a new mixed-use development within the property.

1.1.2 The purpose of this report is to assess the potential impact of the proposed development on the subject trees, together with recommendations for amendments to the design or construction methodology where necessary to minimise any adverse impact. The report also provides recommended tree protection measures to ensure the long-term preservation of the trees to be retained where appropriate.

1.1.3 This report has been prepared in accordance with Ku-ring-gai Council's guidelines for preparation of Arborists Reports as outlined in Section 5 of Council's Development Application Guide dated October 2010 and Sections 2.3.2 -2.3.5 of the Australian Standard for *Protection of Trees on Development Sites* (AS 4970:2009).

2 THE SITE

2.1.1 The subject property is known as Lot 40 in DP 803006, being 17-23 Merriwa Street, Gordon. For the purposes of this report, the subject allotment will be referred to as "the Site". The total area of the site is 4,320 m². The site is zoned Mixed Use (B4) under the Ku-ring-gai Local Environmental Plan (Local Centres) 2012. The site contains an existing commercial office building complex with basement car parking facilities located centrally within the lot. The site exhibits a moderate south-westerly gradient, containing garden areas and a variety of mature trees around the periphery of the site. The trees include a variety of locally-indigenous, non-local native and exotic (introduced) species.

2.1.2 Soils of this area are typical of the Glenorie Soil Landscape Group (as classified in the Soil Landscapes of the Sydney 1:100,000 Sheet), consisting of "shallow to moderately deep (less than 1000mm) *Red Podzolic Soils* on crests, moderately deep (700 – 1500 mm) *Red & Brown Podzolic Soils* on upper slopes and deep (greater than 2000mm) *Yellow Podzolic Soils* on lower slopes*"*. Soil materials are derived from Wianamatta shales. The landscape of the area generally consists of undulating to rolling low hills with slopes of 5-20%.[1]

2.1.3 The original vegetation of this area consisted of tall open forest (Blue Gum High Forest) which was logged early in the nineteenth century then cleared for agricultural and later residential development.[2] Dominant locally-indigenous tree species formerly found in this area included *Eucalyptus saligna* (Sydney Blue Gum) and *Eucalyptus pilularis* (Blackbutt). Other species occurring in this association may include *Syncarpia glomulifera* (Turpentine), *Eucalyptus paniculata* (Grey Ironbark), *Angophora floribunda* (Rough Barked Apple), *Eucalyptus acmenoides* (White Mahogany), *Angophora costata* (Sydney Red Gum), *Eucalyptus resinifera* (Red Mahogany) and *Allocasuarina torulosa* (Forest Oak).

3 SUBJECT TREES

3.1.1 The subject trees were inspected by Earthscape Horticultural Services (EHS) on the 22nd October 2013. Each tree has been provided with an identification number for reference purposes denoted on the attached Tree Location Plan (**Appendix 5**), based on the survey prepared by M. U. XU & Co., Dwg. Ref No. 13207 dated 09/09/2013. The numbers used on this plan correlate with the Tree Assessment Schedule (**Appendix 3**). Tree No.s T23a, T23b, T29a, T30a, T30b & T30c were not shown on the original survey and have been plotted on the drawing in their approximate positions by taking offsets from existing features.

4 HEALTH AND CONDITION ASSESSMENT

4.1 Methodology

4.1.1 An assessment of each tree was made using the Visual Tree Assessment (VTA) procedure.[3] All of the trees were assessed in view from the ground. No aerial inspection or diagnostic testing has been undertaken as part of this assessment.

4.1.2 The following information was collected for each tree:-

- Tree Species (Botanical & Common Name);
- Approximate height;
- Canopy spread; measured using a metric tape and an average taken.
- Trunk diameter (measured at 1.4 metres from ground level);
- Live Crown Size; (measured by subtracting the total height of the tree from the lowest point of the crown and multiplying by the average crown spread to give a value in square metres).
- Health & vigour; using foliage size, colour, extension growth, presence of disease or pest infestation, canopy density, presence of deadwood, dieback and epicormic growth as indicators,
- Condition; using visible evidence of structural defects, instability, evidence of previous pruning and physical damage as indicators.
- Suitability of the tree to the site and its existing location; in consideration of damage or potential damage to services or structures, available space for future development and nuisance issues.

This information is presented in a tabulated form in **Appendix 3.**

4.2 Safe Useful Life Expectancy (SULE)

4.2.1 The remaining Safe Useful Life Expectancy[4] of the tree is an estimate of the sustainability of the tree in the landscape, calculated based on an estimate of the average age of the species in an urban area, less its estimated current age. The life expectancy of the tree has been further modified where necessary in consideration of its current health and vigour, condition and suitability to the site. The estimated SULE of each tree is shown in **Appendix 3.**

4.2.2 The following ranges have been allocated to each tree:-

- Greater than 40 years (Long)
- Between 15 and 40 years (Medium)
- Between 5 and 15 years (Short)
- Less than 5 years (Transient)
- Dead or immediately hazardous (defective or unstable)

5 LANDSCAPE SIGNIFICANCE

5.1 Methodology for Determining Landscape Significance

5.1.1 The significance of a tree in the landscape is a combination of its amenity, environmental and heritage values. Whilst these values may be fairly subjective and difficult to assess consistently, some measure is necessary to assist in determining the retention value of each tree. To ensure in a consistent approach, the assessment criterion shown in **Appendix 1** have been used in this assessment.

5.1.2 A rating has been applied to each tree to give an understanding of the relative significance of each tree in the landscape and to assist in determining priorities for retention, in accordance with the following categories:-

1. **Significant**
2. **Very High**
3. **High**
4. **Moderate**
5. **Low**
6. **Very Low**
7. **Insignificant**

5.2 Environmental Significance

5.2.1 Tree Preservation Order

A Tree Preservation Order (TPO) applies to all land within the Municipality of Ku-ring-gai, made under Clause 42 (4) of the Ku-ring-gai Planning Scheme Ordinance and adopted by Council on 12th December 2006 and gazetted 25th January 2007. The TPO generally protects all trees of a height of five (5) metres or greater or with a trunk diameter of 150mm or greater. Some exemptions apply. However all of the subject trees are protected under the provisions of Ku-ring-gai Council's Tree Preservation Order.

5.2.2 Wildlife Habitat

Angophora costata (Sydney Red Gum) [T22 & T23a], *Syncarpia glomulifera* (Turpentine) [T23 & T31] and *Eucalyptus paniculata* (Grey Ironbark) [T32] are all locally-indigenous species, representative of the original vegetation of the area and would be of benefit to native wildlife. However, none of the trees contain cavities suitable as nesting hollows for arboreal mammals or birds. T23 (a Magenta Cherry) contains a Ringtail Possum nest (Dray) at 11 metres and T24 (Turpentine) shows evidence of bark harvesting (for nesting material) by Ringtail Possums at 6 metres. There were no other visible signs of wildlife habitation.

5.2.3 Noxious Plants & Environmental Weeds

None of the trees assessed are scheduled as Noxious Weeds under the meaning of *Noxious Weeds Act* (NSW) 1993. *Cotoneaster sp*. (Cotoneaster) [T21] is considered to be an Environmental Weed Species within the Ku-ring-gai Local Government Area (LGA). Note that this tree may still be afforded some protection under Section 138 (c) of the *Roads Act* (NSW) 1993 and Section 629 of the *Local Government Act* (NSW) 1993, being located within the adjoining Road Reserve.

5.2.4 Threatened Species & Ecological Communities

Syzygium paniculatum (Magenta Cherry or Lilly Pilly) [T17, T19 & T23] is listed as a Vulnerable Species on Schedule 2 of the *Threatened Species Conservation Act* 1995 (NSW) and a Nationally Vulnerable species under the *Environmental Protection and Biodiversity Conservation Act* 1999. Whilst this species is listed as vulnerable, it is a commonly planted ornamental tree and is not endemic to this area. As such, it does not have any ecological significance in the context of this site.

The National Parks and Wildlife Service (NPWS) 1:25000 Mapping Series (Native Vegetation of the Cumberland Plain)[5] indicates that the dominant remnant native vegetation community within the area occupied by the site is Turpentine Ironbark Margin Forest (TIMF) [Map Unit 43]. TIMF is a sub-group of Sydney Turpentine Ironbark Forest (STIF). STIF is listed as an Endangered Ecological Community (EEC) under the *Threatened Species Conservation Act* 1995 (NSW) and a Critically Endangered Ecological Community under the *Environmental Protection and Biodiversity Conservation Act* 1999. *Syncarpia glomulifera* (Turpentine) [T23 & T31] and *Eucalyptus paniculata* (Grey Ironbark) [T32] are both Positive Diagnostic Species of this vegetation community.[6] *Angophora costata* (Sydney Red Gum) [T22 & T23a] is an associated canopy species. It should be noted that T22, T23 & T23a appear to have been planted within the site. T31 & T32 may be remnant of the original vegetation community.

5.2.5 Biodiversity

The site does not contain any 'Areas of Biodiversity Significance' as indicated on Council's Biodiversity Map forming part of the Ku-ring-gai Local Environmental Plan (Local Centres) 2012.

5.3 Heritage Significance

5.3.1 Heritage Items

The subject property is *not* listed as a Heritage under Schedule 7, Part 1 of the Ku-ring-gai Planning Scheme Ordinance (KPSO). There is no known or suspected heritage significance of any of the subject trees.

5.3.2 Heritage Conservation Area

The site is *not* located within a Heritage Conservation Area under the Ku-ring-gai Local Environmental Plan (Local Centres) 2012.

5.3.3 Significant Tree Register

Ku-ring-gai Council does not currently maintain a Register of Significant Trees.

5.4 Amenity Value

5.4.1 Criteria for the assessment of amenity values are incorporated into **Appendix 1**. The amenity value of a tree is a measure of its live crown size, visual appearance (form, habit, crown density), visibility and position in the landscape and contribution to the visual character of an area. Generally the larger and more prominently located the tree, and the better its form and habit, the higher its amenity value.

6 TREE RETENTION VALUES

6.1.1 The Retention Values shown in **Appendix 3** and **Appendix 5** have been determined on the basis of the estimated longevity of the trees and their landscape significance rating, in accordance with **Table One**. Together with guidelines contained in **Section 7** (Tree Protection Zones) this information should be used to determine the most appropriate position of building footprints and other infrastructure within the site, with due consideration to other site constraints, to minimise the impact on trees considered worthy of preservation.

TABLE 1 – TREE RETENTION VALUES – ASSESSMENT METHODOLOGY

	Landscape Significance Rating						
Estimated Life Expectancy	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Long - Greater than 40 Years	High Retention Value						
Medium- 15 to 40 Years			Moderate Retention Value				
Short - 5 to 15 years				Low Ret. Value			
Transient - Less than 5 Years				Very Low Retention Value			
Dead or Potentially Hazardous							

7 TREE PROTECTION ZONES

7.1.1 The Tree Protection Zone (TPZ) is a radial distance measured from the centre of the trunk of the tree as specified in **Appendix 4**. These have been calculated in accordance with AS 4970-2009 (Protection of Trees on Development Sites).[7]

7.1.2 The intention of the TPZ is to ensure protection of the root system and canopy from the potential damage from construction works and ensure the long-term health and stability of each tree to be retained. Incursions to the root zone may occur due to excavations, changes in ground levels, (either lowering or raising the grade), trenching or other forms or soil disturbance such as ripping, grading or inverting the soil profile. Such works may cause damage or loss of part of the root system, leading to an adverse impact on the tree.

7.2 Structural Root Zone (SRZ)

7.2.1 The Structural Root Zone (SRZ) provides the bulk of mechanical support and anchorage for a tree. This is also a radial distance measured from the centre of the trunk as specified in **Appendix 4**. The SRZ has been calculated in accordance with AS 4970-2009 (Protection of Trees on Development Sites).

7.2.2 Incursions within the SRZ are not recommended as they are likely to result in the severance of woody roots which may compromise the stability of the tree or lead to its decline and demise.

7.3 Acceptable Incursions to the Tree Protection Zone.

7.3.1 Where encroachment to the TPZ is unavoidable, an incursion to the TPZ of not exceeding 10% of the area of the TPZ and outside the SRZ may be acceptable. Examples of acceptable incursions are shown in **Appendix 2**. Greater incursions to the TPZ may result in an adverse impact on the tree.

7.3.2 Where incursions greater than 10% of the TPZ are unavoidable, exploratory excavation using non-destructive methods may be required to evaluate the extent of the root system affected and determine whether or not the tree can remain viable.

7.1 Acceptable Incursions to the Canopy.

7.1.1 The removal of a small portion of the crown (foliage and branches) is generally tolerable provided that the extent of pruning required is less than 10% of the total foliage volume of the tree and the removal of branches does not create large wounds or disfigure the natural form and habit of the tree. All pruning cuts must be undertaken in accordance with AS 4373:2007. This generally involves reduction of the affected branches back to the nearest branch collar at the junction with the parent branch, rather than at an intermediate point. The latter is referred to as “lopping” and is no longer an acceptable arboricultural practice. Generally speaking, the minimum pruning as required to accommodate any proposed works is desirable. Extensive pruning can result in a detrimental impact on tree health and may lead to exposure of remaining branches to wind forces that they were previously sheltered from, leading to a greater risk of branch failure.

7.1.2 Clearance to between the building line and canopy should take into account any projecting structures, such as balconies, awnings and the roofline and any requirement for temporary scaffolding to be erected during construction (typically 1-1.5 metres wide). High structures should preferably be located outside the canopy dripline (as shown indicatively on the attached plans) in order to avoid or minimise canopy pruning.

8 PROPOSED DEVELOPMENT

8.1.1 The proposed development includes the demolition of the existing commercial office building and construction of a new mixed used development within the site.

9 IMPACT ASSESSMENT

9.1.1 The intention of this assessment is to determine the incursions to the root zones and canopies created by the proposed development and evaluate the likely impact of the proposed works on the subject trees. Details shown on the following plans were used in this assessment:-

Title	Author	Dwg No.	Date
Basement Floor Plans2A, 1a & 1B	Brewster Murray	13_5472 PRE04-06	August 2013
Ground Floor Plan	Brewster Murray	13_5472 A2.05 Rev. A	22/11/2013
Level 1 – Level 6 Floor Plans	Brewster Murray	13_5472 PRE08-13	August 2013
Roof Plan	Brewster Murray	13_5472 PRE14	August 2013
Section 1 & 2	Brewster Murray	13_5472 PRE15-16	August 2013
Elevations	Brewster Murray	13_5472 PRE17-22	August 2013
Ground Floor Stormwater	J & M Group	1333 H5504 Rev B	19/11/2013

9.1.2 A summary of the impact of the proposed development on each tree within the site is shown in **Appendix 5**. The following criteria have been examined as part of this assessment:-

- Existing Relative Levels (R.L.);
- Tree Protection Zone (TPZ);
- Structural Root Zone (SRZ);
- Footprint and envelope of the proposed development and temporary structures (scaffolding, hoardings etc);
- Incursions to the TPZ & SRZ, including estimated cut & fill beyond the building footprint;
- Incursions to the tree canopy from the building envelope and temporary structures; and
- Assessment of the likely impact of the works on existing trees.

9.1.3 The proposed development will necessitate the removal of two (2) trees of low and very low retention value. These include Tree No.s T27 (Western Red Cedar) and T28 (Swamp Oak). Neither of these trees are considered significant or worthy of special measures to ensure their preservation.

9.1.4 The proposed development will also necessitate the removal of eleven (11) trees of moderate retention value. These include Tree No.s T4 (Lemon-scented Gum), T9, T10, T11 & T12 (Broad-leaved Paperbark), T13, T14 & T15 (Bangalow Palm), T23a (Sydney Red Gum) and T25 & T26 (Swamp Oak). These trees are not considered significant, but are in good health and condition and make a fair contribution to the amenity of the site and surrounding properties. In order to compensate for loss of amenity, consideration should be given to replacement planting within the site in accordance with Section 11.

9.1.5 The proposed development will also necessitate the removal of a further two (2) trees of High Retention Value. These include Tree No.s T24 (Turpentine) and T32 (Grey Ironbark), both of which are constituents of STIF, an EEC. Of these, T24 appears to have been planted and T32 may be remnant. Given the land zoning, the extent of development proposed and existing site constraints, there are no feasible alternatives that would permit the retention of these trees. In order

to compensate for loss of amenity, consideration should be given to replacement planting within the site in accordance with Section 11.

9.1.6 The removal of T21 (a Cotoneaster on the nature strip) is also recommended. This tree is considered to be an Environmental Weed Species. Replacement planting should be undertaken elsewhere on the nature strip with a more appropriate species in accordance with Council's Street Tree Master Plan.

9.1.7 A proposed pedestrian ramp is located within the TPZs of T1 & T2 (Tallowwood), T3 & T5 (Lemon-scented Gum) and T17 & T19 (Magenta Cherry). Given that the ramp will be elevated and supported by piers within the TPZ, these works should not result in any adverse impact on these trees provided that all excavations for the pier foundations are undertaken in accordance with Section 10.6. The ramp to the east of T17 is located beyond an existing retaining wall and as such will not result in any encroachment to the root zone of this tree.

9.1.8 The proposed basement is located within the TPZs of T3 & T5 (Lemon-scented Gums), T17 & T19 (Magenta Cherry), T29 (Swamp Oak), T30 (Himalayan Cedar) and T31 (Turpentine). In all cases, the proposed basement is within the footprint of the existing building. Assuming that the basement will be constructed using a soldier pier shotcrete panel method, the proposed works will not result in any actual incursion to the root zones of these trees. As such, the proposed works should not result in any adverse impact on these trees provided that the existing buildings within the TPZs are demolished in accordance with Section 10.5 and all excavations for the basement within the TPZs are undertaken in accordance with Section 10.6.

9.1.9 A proposed at grade pedestrian pathway is located within the TPZs of T16 (Melaleuca), T29 (Swamp Oak), T30 (Himalayan Cedar) and T31 (Turpentine). Excavations and compaction for the proposed pathway has the potential to result in some soil disturbance wand compaction within the TPZs of these trees and therefore could result in some adverse impact. However, provided that the pathway is installed slightly above grade in accordance with Section 12.8, the proposed pathway should not result in any adverse impact on these trees. All excavations for the pathway sub-grade within the TPZs should be undertaken in accordance with Section 10.6.

9.1.10 The proposed basement ramp from Merriwa Street is located within the TPZs of T23b (Broad-leaved Paperbark) and T23 (Magenta Cherry). In both cases, the extent of the encroachment to the TPZ exceeds acceptable limits under AS 4970:2009. It should be noted that the ramp is within an existing concrete paved area within the TPZ of T23 and will be close to existing grade within most of the TPZ of T23b. In order to minimise any adverse impact on these trees, all excavations for the basement ramp and associated kerbs and retaining walls within the TPZs of these trees should be undertaken in accordance with Section 10.6

9.1.11 Trenching for proposed stormwater pipelines are located within the TPZs of Tree No.s T17, T19 & T23 (Magenta Cherry), T30 (Himalayan Cedar and T29 (Swamp Oak). Open trenching within the TPZs of these trees has the potential to result in root damage and severance, resulting in an adverse impact on these trees. In order to minimise and adverse impact, the proposed pipelines should be offset as far from these trees as possible and all trenching within the TPZs should be carried out in accordance with Section 10.7.

9.1.12 Minor canopy pruning of Tree Nos T2, T5, & T7 may be required to clear the building envelope and temporary scaffolding. The pruning should not result in any adverse impact provided that it is undertaken in accordance with Section 12.10. In order to minimise pruning, temporary scaffolding within the TPZs of these trees should be installed in accordance with Section 10.13

9.1.13 No other trees will be adversely affected by the proposed development.

10 RECOMMENDED TREE PROTECTION MEASURES

10.1 Tree Protection Plan

10.1.1 The following Tree Protection Measures should be read in accordance with the Tree Protection Plan (**Appendix 6**). The Tree Protection Plan (TPP) indicates the position of tree protection devices and other recommended measures to ensure the protection of trees within the site to be retained as part of the proposed development.

10.2 Prohibited Activities

10.2.1 The following activities should be avoided within specified Tree Protection Zones (refer **Appendix 4 & 6** for extent of the TPZ for each tree):-

- Excavations and trenching (with exception of the approved remediation works, underground services, building foundations or pavement sub-grade);
- Soil disturbance, surface grading, compaction, tyning, ripping or cultivation of soil;
- Mechanical removal of vegetation, including extraction of tree stumps;
- Soil level changes including the placement of fill material (excluding imported validated fill for remediation works or placement of fill for approved works)
- Movement and storage of plant, equipment & vehicles (except within defined temporary haul roads, where ground protection has been installed, or within the footprint of existing floor slabs or paved areas);
- Erection of site sheds (except where approved by the site arborist);
- Affixing of signage, barricades or hoardings to trees;
- Storage of building materials, waste and waste receptacles;
- Stockpiling of spoil or fill;
- Stockpiling of bulk materials, such as soil, sand, gravel, roadbase or the like;
- Stockpiling of demolition waste;
- Disposal of waste materials and chemicals including paint, solvents, cement slurry, fuel, oil and other toxic liquids;
- Other physical damage to the trunk or root system; and
- Any other activity likely to cause damage to the tree.

10.3 Tree Protection Fencing

10.3.1 All trees within the site to be retained shall be protected prior to and during construction from all activities that may result in detrimental impact by erecting a suitable protective fence beneath the canopy to the full extent of the Tree Protection Zone, excluding the footprint of the proposed works and areas within adjoining properties, as indicated on the Tree Protection Plan. As a minimum, the fence should consist of temporary chain wire panels of 1.8 metres in height, supported by steel stakes as required and fastened together and supported to prevent sideways movement using corner braces where required. The fence shall be erected prior to the commencement of any work on-site and shall be maintained in good condition for the duration of construction. Where tree protection zones merge together a single fence encompassing the area is deemed to be adequate. Existing site boundary fences may form part of the enclosure.

10.3.2 Appropriate signage shall be installed on the fencing to prevent unauthorised movement of plant and equipment or entry to the Tree Protection Zone.

10.3.3 A 50mm layer of woodchip mulch shall be installed to the full extent of the Tree Protection Zone of all trees to be retained. Mulch shall be installed and spread by hand to avoid soil disturbance and compaction within the root zone.

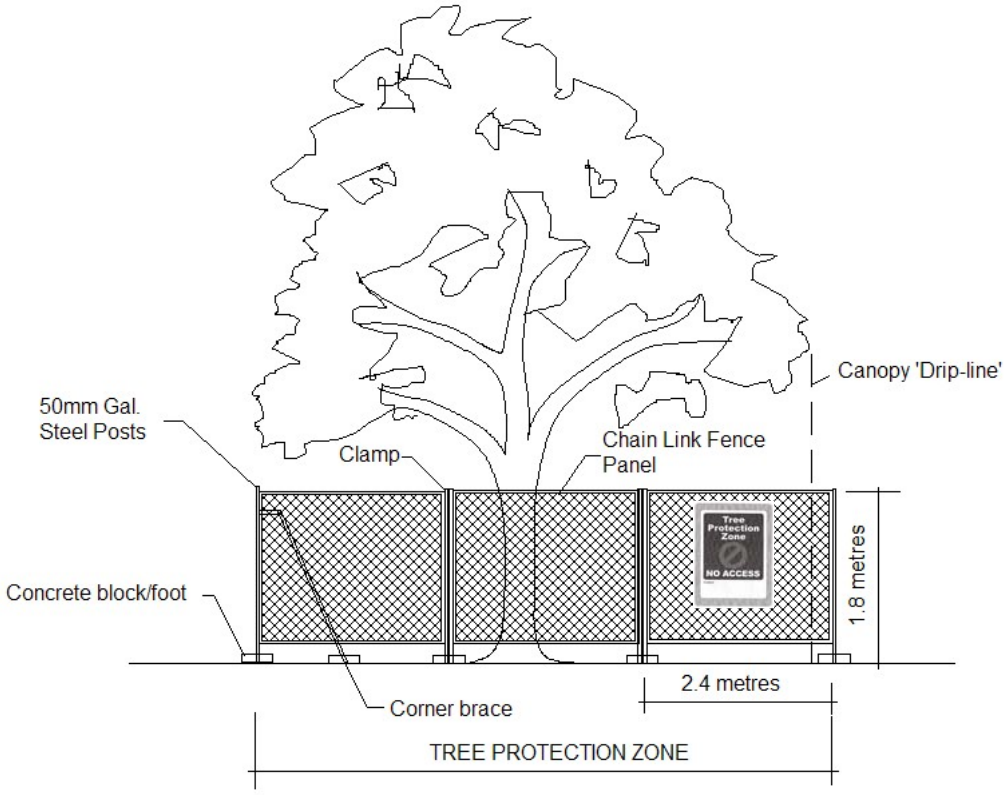


Figure 1 – Detail of Tree Protection Fence

10.4 Tree Protection Signs

10.4.1 Signs shall be installed on the Tree Protection Fence to prevent unauthorised movement of plant and equipment or entry to the Tree Protection Zone. The signs shall be securely attached to the fence using cable ties or equivalent. Signs shall be placed at minimum 10 metre intervals. The wording and layout of the sign shall comply with AS 4970-2009 as shown in **Figure 2**.

Figure 2 – Detail of Tree Protection Sign

10.5 Demolition Works within Tree Protection Zones

10.5.1 Demolition of paved areas within the Tree Protection Zones of trees to be retained shall be undertaken under the supervision of the Site Arborist. The pavement surface and sub-base within the TPZ shall be gradually removed in layers of no greater than 50mm thick using a small rubber tracked excavator or alternative approved method to avoid damage to underlying roots and minimise disturbance and compaction of the underlying soil profile. The machine shall work within the footprint of the existing paved surfaces to avoid compaction of the underlying soil. The final layer of sub-base material shall be removed using hand tools were required to avoid compaction of the underlying soil profile and damage to woody roots.

10.5.2 Following removal of the pavement surface and sub-base, clean, friable topsoil shall be used to fill in the excavated area and bring flush with surrounding levels within new landscape areas. Soil shall only be imported and spread when the underlying soil conditions are dry to avoid compaction of the soil profile. Where there is insufficient recovered site topsoil for this purpose, any imported

material shall be free of rocks, vegetation, heavy clay or other extraneous matter. Any imported soil material should be similar in texture to the existing site topsoil.

10.5.3 Demolition of existing walls, kerbs and other structures within the Tree Protection Zone of trees to be retained shall be undertaken under the supervision of the Site Arborist. The structures shall be demolished using equipment on stationed outside the TPZ where possible or within the footprint of existing hardstand areas. Care shall be taken to avoid the root systems, trunks and lower branches of trees in the vicinity of the structures during demolition works, with special attention required during demolition of the footings and other sub-surface members to avoid damage to woody roots.

10.6 Excavations within Tree Protection Zones

10.6.1 Prior to any mechanical excavations for building foundations or pavement sub-grade within the Tree Protection Zone of all trees nominated for retention, exploratory excavation using non-destructive techniques shall be taken along the perimeter of the structure or pavement within the TPZ. Non-destructive excavation techniques may include the use of hand-held implements, air pressure (using an Air-spade® device) or water pressure. The exploratory excavation shall be undertaken along the perimeter of the foundation or pavement (within the TPZ) to the depth of the foundation or to a maximum of 800mm from surface levels, to locate and expose any woody roots prior to any mechanical excavation. All care shall be undertaken to preserve woody roots intact and undamaged during exploratory excavation. Any roots encountered of less than 50mm in diameter may be cleanly severed with clean sharp pruning implements at the face of the excavation. The root zone in the vicinity of the excavation shall be kept moist following excavation for the duration of construction to minimise moisture stress on the tree.

10.6.2 Where large woody roots (greater than 50mm diameter) are encountered during exploratory excavations, further advice from a qualified arborist shall be sought prior to severance. Where necessary, (to avoid severing large woody roots) consideration should be given to the installation of an elevated structure (e.g. pier and beam footing, suspended slab or floor supported on piers, cantilevered slab, up-turned edge beam etc) in preference to structures requiring a deep edge beam or continuous perimeter strip footing. The beam section of any pier and beam footing should be placed **above** grade to avoid excavation within the SRZ. Pier footings intersecting large woody roots should be slightly offset where necessary to avoid root severance.

10.6.3 For masonry walls or fences it may be acceptable to delete continuous concrete strip footings and replace with suspended in-fill panels (eg steel or timber pickets, lattice etc) fixed to pillars. For paved areas, consideration should be given to raising the proposed pavement level and using a porous fill material in preference to excavation where large woody roots are found within the sub-base.

10.7 Underground Services

10.7.1 All proposed stormwater lines and other underground services should be located as far away as practicable, or suspended beneath the floor of the building where possible, to avoid excavation within the Tree Protection Zone of trees to be retained.

10.7.2 For underground services, where the incursion to the root zone is less than 20% of the total TPZ, mechanical excavation may be undertaken under the supervision of an arborist. A skid steer loader is unacceptable due to the potential for excessive compaction and root damage. Where large woody roots (greater than 50mm in diameter) are encountered during excavation or trenching, these shall be retained intact wherever possible (e.g. by sub-surface boring beneath roots or re-routing the service etc).

10.7.3 Excavations required for underground services within the Structural Root Zone of any tree to be retained should only be undertaken by sub-surface boring (Horizontal Directional Drilling). The

Invert Level of the pipe, plus the pipe diameter, must be lower than the estimated root zone depth as specified. This will depend on the soil conditions at the site. Where this is not practical and root pruning is the only alternative, proposed root pruning should be assessed by the arborist to determine continued health and stability of the subject tree.

10.8 Pavements

10.8.1 Pavements should be avoided within the Tree Protection Zone of trees to be retained where possible. Proposed paved areas within the Tree Protection Zone of trees to be retained should be placed above grade to minimise excavations within the root zone and avoid root severance and damage. Pavement sub-base material should be as per Section 10.9.

10.9 Fill Material

10.9.1 Placement of fill material within the Tree Protection Zone of trees to be retained should avoided wherever possible. Where placement of fill is unavoidable, the material should be a well-drained friable material, equivalent in texture to the existing site topsoil material. The fill should be free from rocks, vegetation and other extraneous material. The fill may be consolidated but should not be compacted to engineering standards. No fill material should be placed in direct contact with the trunk.

10.9.2 Where placement of fill is required for pavement sub-grade is required within TPZs of trees to be retained, a coarse, gap-graded material such as 20 – 50mm crushed basalt (Blue Metal) or equivalent shall be used to provide some aeration to the root zone. Note that Roadbase or crushed sandstone or other material containing a high percentage of fines is unacceptable for this purpose. The fill material should be consolidated with a non-vibrating roller to minimise compaction of the underlying soil. A permeable geotextile may be used beneath the sub-base to prevent migration of the stone into the sub-grade.

10.10 Canopy & Root Pruning

10.10.1 All canopy pruning work required shall be carried out in accordance with Australian Standard 4373-2007 – Pruning of Amenity Trees. Written approval from Council may be required under the Tree Preservation Order prior to undertaking this work. All pruning work shall be carried out by a qualified and experienced arborist or tree surgeon [Australian Qualification Framework Level 3] in accordance with the NSW WorkCover Code of Practice for the Amenity Tree Industry (1998). No branches of greater than 100mm in diameter should be removed or pruned without further advice from a Consulting Arborist [Australian Qualification Framework Level 5].

10.10.2 Where root pruning is required, roots shall be severed with clean, sharp pruning implements and retained in a moist condition during the construction phase using Hessian material or mulch where practical. Severed roots shall be treated with a suitable root growth hormone containing the active constituents Indol-3-yl-Butric Acid (IBA) and 1-Naphthylacetic Acid (NAA) to stimulate rapid regeneration of the root system.

10.11 Tree Damage

10.11.1 Care shall be taken when operating cranes, drilling rigs and similar equipment near trees to avoid damage to tree canopies (foliage and branches). Under no circumstances shall branches be torn-off by construction equipment. Where there is potential conflict between tree canopy and construction activities, the advice of the Site Arborist must be sought.

10.11.2 In the event of any tree becoming damaged for any reason during the construction period a consulting arborist [Australian Qualification Framework Level 5] shall be engaged to inspect and

provide advice on any remedial action to minimise any adverse impact. Such remedial action shall be implemented as soon as practicable and certified by the arborist.

10.12 Tree Removal

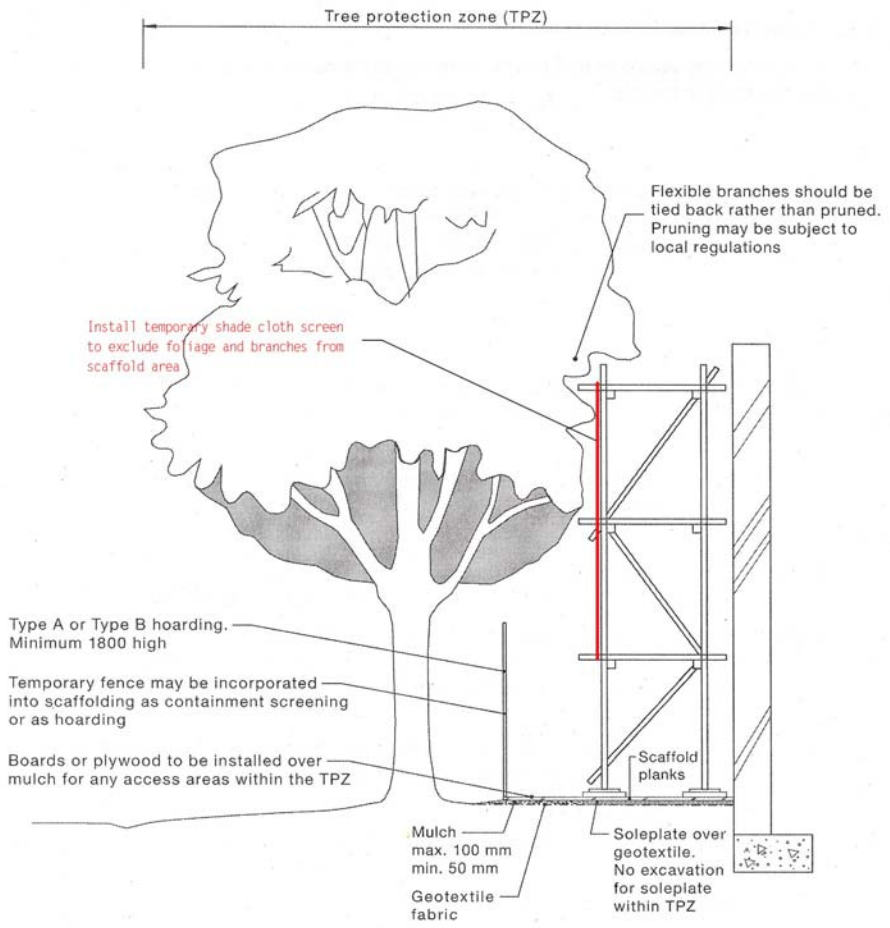
10.12.1 The approval of Ku-ring-gai Council shall be obtained prior to the removal or pruning of any tree protected under the Tree Preservation Order.

10.12.2 Tree removal work shall be carried out by an experienced tree surgeon in accordance with the NSW WorkCover Code of Practice for the Amenity Tree Industry (1998). Care shall be taken to avoid damage to other trees during the felling operation.

10.12.3 Stumps located within the TPZs of trees to be retained shall be grubbed-out where required using a mechanical stump grinder (or by hand where less than 150mm in diameter) without damage to the root system of other trees. Where trees to be removed are within the SRZ of any trees to be retained, consideration should be given to cutting the stump close to ground level and retaining the root crown intact. Stumps within the Tree Protection Zone of other trees to be retained shall **not** be pulled out using excavation equipment or similar.

10.13 Temporary Scaffolding

10.13.1 Where temporary scaffolding must be erected within the TPZ of trees to be retained (as indicated in **Appendix 6**), the scaffold shall be erected in accordance with **Figure 5**. Where foliage or branches project through the scaffold and create a safety hazard, this foliage and branches shall be temporarily excluded from the inner part of the scaffold by affixing a shade cloth screen on the outside of the scaffold **(**refer to **Figure 5)**, or alternatively temporarily tying back branches where required. The pruning or removal of branches to accommodate the scaffold should be avoided wherever possible. Suitable ground protection shall be installed beneath the scaffold as shown in **Figure 5** to prevent contamination, disturbance and compaction of the soil profile within the scaffold zone during construction.



NOTE: Excavation required for the insertion of support posts for tree protection fencing should not involve the severance of any roots greater than 20 mm in diameter, without the prior approval of the project arborist.

Figure 5 - Detail of Temporary scaffolding within a Tree Protection Zone

10.13.2 Where pruning or removal of branches to accommodate temporary scaffolding is unavoidable, all such pruning work shall be undertaken in accordance with **Section 10.8**.

11 REPLACEMENT PLANTING

11.1.1 In order to compensate for loss of amenity resulting from the removal of trees to accommodate the proposed development, a minimum of six (6) new trees capable of attaining a minimum height of thirteen (13) metres at maturity should be planted within the allotment in accordance with Council's Tree Replenishment Policy under the Ku-ring-gai Local Centres DCP. Replacement trees should preferably include some locally indigenous species. These will be most appropriate to the site conditions and be most valuable in terms of preserving the landscape character and wildlife habitat of the area.

Andrew Morton
EARTHSCAPE HORTICULTURAL SERVICES
25th November 2013

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Cunninghamia 8 (1) 2003, (Journal of Plant Ecology for Eastern Australia)
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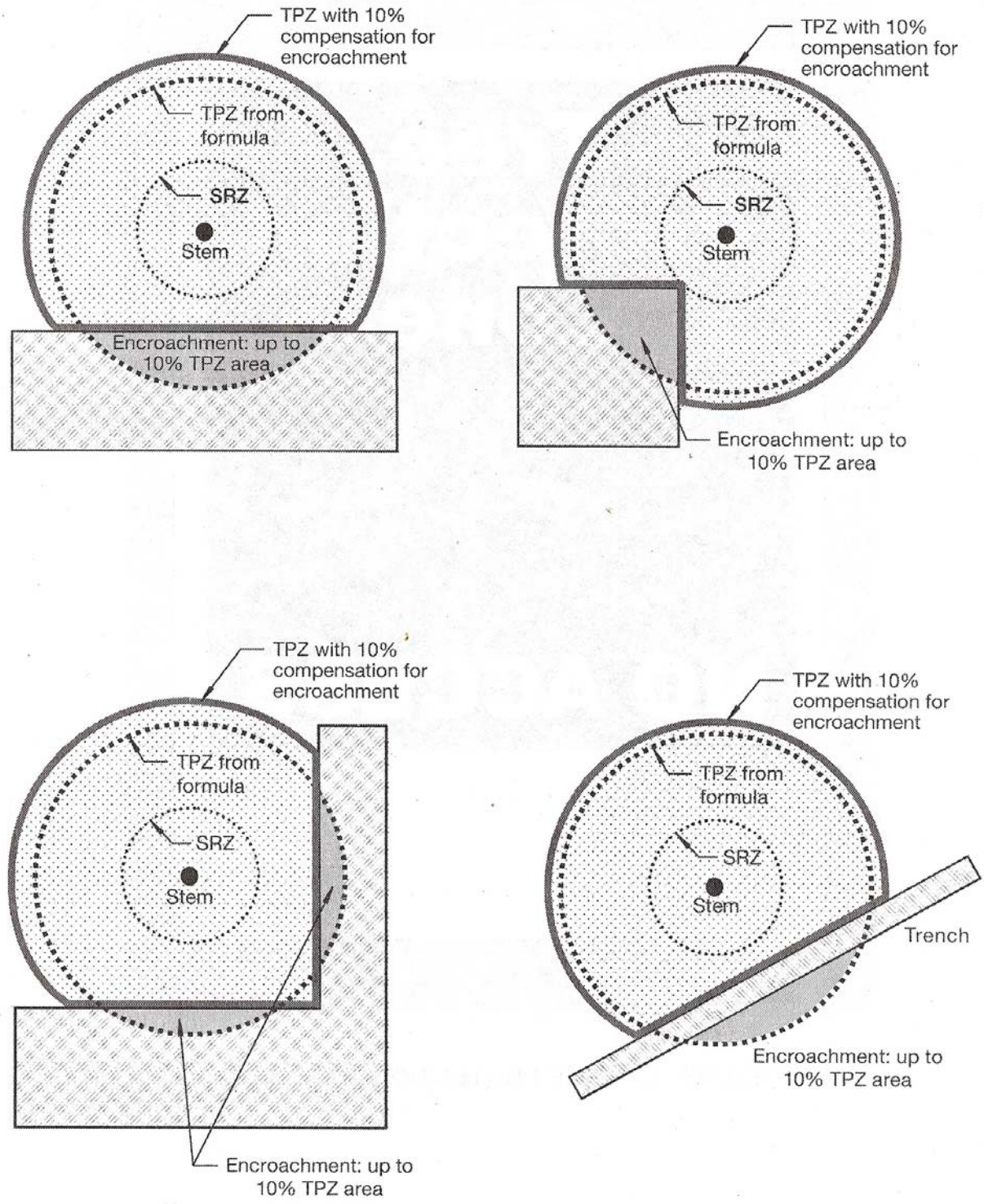
AS 4970 – 2009 – Protection of Trees on Development Sites
Standards Australia, Sydney

APPENDIX 1 - CRITERIA FOR ASSESSMENT OF LANDSCAPE SIGNIFICANCE

RATING	HERITAGE VALUE	ECOLOGICAL VALUE	AMENITY VALUE
1. SIGNIFICANT	The subject tree is listed as a Heritage Item under the Local Environment Plan (LEP) with a local, state or national level of significance or is listed on Council's Significant Tree Register	The subject tree is scheduled as a Threatened Species as defined under the Threatened Species Conservation Act 1995 (NSW) or the Environmental Protection and Biodiversity Conservation Act 1999	The subject tree has a very large live crown size exceeding 300m^2 with normal to dense foliage cover, is located in a visually prominent position in the landscape, exhibits very good form and habit typical of the species
	The subject tree forms part of the curtilage of a Heritage Item (building /structure /artefact as defined under the LEP) and has a known or documented association with that item	The tree is a locally indigenous species, representative of the original vegetation of the area and is known as an important food, shelter or nesting tree for endangered or threatened fauna species	The subject tree makes a significant contribution to the amenity and visual character of the area by creating a sense of place or creating a sense of identity
	The subject tree is a Commemorative Planting having been planted by an important historical person (s) or to commemorate an important historical event	The subject tree is a Remnant Tree, being a tree in existence prior to development of the area	The tree is visually prominent in view from surrounding areas, being a landmark or visible from a considerable distance.
2. VERY HIGH	The tree has a strong historical association with a heritage item (building/structure/artefact/garden etc) within or adjacent the property and/or exemplifies a particular era or style of landscape design associated with the original development of the site.	The tree is a locally-indigenous species, representative of the original vegetation of the area and is a dominant or associated canopy species of an Endangered Ecological Community (EEC) formerly occurring in the area occupied by the site.	The subject tree has a very large live crown size exceeding 200m^2; a crown density exceeding 70% (normal-dense), is a very good representative of the species in terms of its form and branching habit or is aesthetically distinctive and makes a positive contribution to the visual character and the amenity of the area
3. HIGH	The tree has a suspected historical association with a heritage item or landscape supported by anecdotal or visual evidence	The tree is a locally-indigenous species and representative of the original vegetation of the area and the tree is located within a defined Vegetation Link / Wildlife Corridor or has known wildlife habitat value	The subject tree has a large live crown size exceeding 100m^2; The tree is a good representative of the species in terms of its form and branching habit with minor deviations from normal (e.g. crown distortion/suppression) with a crown density of at least 70% (normal); The subject tree is visible from the street and surrounding properties and makes a positive contribution to the visual character and the amenity of the area
4. MODERATE	The tree has no known or suspected historical association, but does not detract or diminish the value of the item and is sympathetic to the original era of planting.	The subject tree is a non-local native or exotic species that is protected under the provisions of this DCP.	The subject tree has a medium live crown size exceeding 40m^2;The tree is a fair representative of the species, exhibiting moderate deviations from typical form (distortion/suppression etc) with a crown density of more than 50% (thinning to normal); and The tree is visible from surrounding properties, but is not visually prominent – view may be partially obscured by other vegetation or built forms. The tree makes a fair contribution to the visual character and amenity of the area.
5. LOW	The subject tree detracts from heritage values or diminishes the value of a heritage item	The subject tree is scheduled as exempt (not protected) under the provisions of this DCP due to its species, nuisance or position relative to buildings or other structures.	The subject tree has a small live crown size of less than 40m^2 and can be replaced within the short term (5-10 years) with new tree planting
6. VERY LOW	The subject tree is causing significant damage to a heritage item.	The subject tree is listed as an Environment Weed Species in the Leichhardt Local Government Area, being invasive, or is a known nuisance species.	The subject tree is not visible from surrounding properties (visibility obscured) and makes a negligible contribution or has a negative impact on the amenity and visual character of the area. The tree is a poor representative of the species, showing significant deviations from the typical form and branching habit with a crown density of less than 50% (sparse).
7. INSIGNIFICANT	The tree is completely dead and has no visible habitat value	The tree is a declared Noxious Weed under the Noxious Weeds Act (NSW) 1993 within the relevant Local Government Area.	The tree is completely dead and represents a potential hazard.

APPENDIX 2 – ACCEPTABLE INCURSIONS TO THE TREE PROTECTION ZONE (TPZ)



NOTE: Less than 10% TPZ area and outside SRZ. Any loss of TPZ compensated for elsewhere.

REF:- Council of Standards Australia (August 2009)
AS 4970 – 2009 – Protection of Trees on Development Sites
Standards Australia, Sydney

APPENDIX 3 - TREE HEALTH AND CONDITION ASSESSMENT SCHEDULE

Tree Identification No.	Species	Height (m)	Spread (m)	Trunk Diameter (mm)	Live Crown Size (m^2)	Maturity Class	Condition	Previous Pruning	Health		Remaining Safe Useful Life Expectancy (SULE)	Landscape Significance Rating	Retention Value	Location
									Vigour	Pest & Disease				
1	***Eucalyptus microcorys*** (Tallowwood)	12	11	376	121	SM	Appears stable with sound branching structure. Crown suppressed on the west side due to overshadowing.	No Evidence	Good	No Evidence	Medium 15-40 Years	4	**Moderate**	Adjoining property
2	***Eucalyptus microcorys*** (Tallowwood)	17	13	592	195	M	Appears stable with fair branching structure. Exhibits a moderate bark inclusion at 1.5 and 2.5 metres.	No Evidence	Good	No Evidence	Long - more than 40 years	3	**High**	On-site
3	***Corymbia citriodora*** (Lemon-scented Gum)	20	15	548	150	M	Appears stable with sound branching structure.	No Evidence	Good	No Evidence	Long - more than 40 years	3	**High**	On-site
4	***Corymbia citriodora*** (Lemon-scented Gum)	18	18	548	108	M	Appears stable with sound branching structure. Growing through cut out in concrete vehicular access ramp with limited potential for future growth.	No Evidence	Good	No Evidence	Short 5-15 Years	3	**Moderate**	On-site
5	***Corymbia citriodora*** (Lemon-scented Gum)	18	12	414	84	M	Appears stable with sound branching structure.	No Evidence	Good	No Evidence	Long - more than 40 years	3	**High**	On-site
6	***Melaleuca bracteata*** (Black Tea-tree)	8	5	140x2	30	SM	Appears stable with sound branching structure. Crown suppressed on western side due to overshadowing	No Evidence	Good	No Evidence	Medium 15-40 Years	5	**Low**	Adjoining property
7	***Corymbia maculata*** (Spotted Gum)	16	13	513	104	M	Appears stable with sound branching structure.	No Evidence	Very Good	No Evidence	Long - more than 40 years	3	**High**	Adjoining property
8	***Melaleuca quinquenervia*** (Broad-leaved Paperbark)	9	6	200x2	45	SM	Appears stable with fair branching structure. Crown suppressed on south side due to overshadowing. Moderate bark inclusion at 1.5 metres.	No Evidence	Very Good	Moderate English Ivy infestation	medium 15-40 Years	4	**Moderate**	Adjoining property
9	***Melaleuca quinquenervia*** (Broad-leaved Paperbark)	10	5	250	30	SM	Appears stable with sound branching structure.	Crown lifted to 5 metres	Good	No Evidence	Medium 15-40 Years	4	**Moderate**	On-site
10	***Melaleuca quinquenervia*** (Broad-leaved Paperbark)	11	7	300	49	SM	Appears stable with sound branching structure.	Crown lifted to 5 metres	Good	No Evidence	Medium 15-40 Years	4	**Moderate**	On-site
11	***Melaleuca quinquenervia*** (Broad-leaved Paperbark)	13	5	300	30	SM	Appears stable with sound branching structure.	Crown lifted to 5 metres	Good	No Evidence	Medium 15-40 Years	4	**Moderate**	On-site

APPENDIX 3 - TREE HEALTH AND CONDITION ASSESSMENT SCHEDULE

Tree Identification No.	Species	Height (m)	Spread (m)	Trunk Diameter (mm)	Live Crown Size (m^2)	Maturity Class	Condition	Previous Pruning	Health		Remaining Safe Useful Life Expectancy (SULE)	Landscape Significance Rating	Retention Value	Location
									Vigour	Pest & Disease				
12	***Melaleuca quinquenervia*** (Broad-leaved Paperbark)	14	8	450	80	M	Appears stable with fair branching structure. Multiple low bark inclusions at 2-3 metres.	No Evidence	Good	No Evidence	Long - more than 40 years	4	**Moderate**	On-site
13	***Archontophoenix cunninghamii*** (Bangalow Palm)	11	5	200	25	M	Appears stable with sound branching structure.	No Evidence	Very Good	No Evidence	Long - more than 40 years	4	**Moderate**	On-site
14	***Archontophoenix cunninghamii*** (Bangalow Palm)	10	4	150	16	SM	Appears stable with sound branching structure.	No Evidence	Very Good	No Evidence	Long - more than 40 years	4	**Moderate**	On-site
15	***Archontophoenix cunninghamii*** (Bangalow Palm)	8	4	120	12	SM	Appears stable with sound branching structure.	No Evidence	Very Good	No Evidence	Long - more than 40 years	5	**Moderate**	On-site
16	***Melaleuca bracteata*** (Black Tea-tree)	11	7	320	63	M	Appears stable with fair branching structure. Crown suppressed on east side due to overshadowing.	No Evidence	Fair with thinning crown	No Evidence	Short 5-15 Years	4	**Low**	Adjoining property
17	***Syzygium paniculatum*** (Magenta Cherry)	12	8	303	80	SM	Appears stable with sound branching structure.	Crown lifted to 3 metres	Good	No Evidence	medium 15-40 Years	4	**Moderate**	On-site
18	***Callistemon sp.*** (Bottlebrush)	4	4	90x3	8	SM	Appears stable with fair branching structure. Crown suppressed on the north side due to previous pruning.	Lopped at 3 metres to clear powerlines	Fair	No Evidence	Short 5-15 Years	5	**Low**	Nature strip
19	***Syzygium paniculatum*** (Magenta Cherry)	13	9	350	99	M	Appears stable with sound branching structure.	Crown lifted to 3 metres	Good	No Evidence	Long - more than 40 years	4	**Moderate**	On-site
20	***Callistemon sp.*** (Bottlebrush)	9	11	750	77	M	Appears stable with poor branching structure.	Topped and lopped to clear power lines (gully cut)	Fair with slightly thinning crown	No Evidence	Short 5-15 Years	4	**Low**	Nature strip
21	***Cotoneaster sp.*** (Cotoneaster)	4	7	180 + 130x2	21	M	Appears stable with fair branching structure. Exhibits multiple small wounds due previous pruning with decay evident in lower trunk. 30% epicormic growth.	Crown lifted to 3 metres. Lopped at 3 metres to clear powerlines	Good	No Evidence	Short 5-15 Years	6	**very low**	Nature strip
22	***Angophora costata*** (Sydney Red Gum)	8	5	140	32.5	I	Appears stable with sound branching structure.	No Evidence	Very Good	Low foliar insect infestation.	Long - more than 40 years	5	**Moderate**	On-site

APPENDIX 3 - TREE HEALTH AND CONDITION ASSESSMENT SCHEDULE

Tree Identification No.	Species	Height (m)	Spread (m)	Trunk Diameter (mm)	Live Crown Size (m^2)	Maturity Class	Condition	Previous Pruning	Health		Remaining Safe Useful Life Expectancy (SULE)	Landscape Significance Rating	Retention Value	Location
									Vigour	Pest & Disease				
23	***Syzygium paniculatum*** (Magenta Cherry)	14	11	420	137.5	M	Appears stable with sound branching structure. Exhibits a low bark inclusion at 3 metres.	Crown lifted to 3 metres	Very Good	Low foliar insect infestation.	Long - more than 40 years	3	**High**	On-site
23a	***Angophora costata*** (Sydney Red Gum)	5	2	80	8	I	Appears stable with sound branching structure.	No Evidence	Very Good	No Evidence	Long - more than 40 years	5	**Moderate**	On-site
23b	***Melaleuca quinquenervia*** (Broad-leaved Paperbark)	16	8	530	112	M	Appears stable with sound branching structure. Crown suppressed on western side due to overshadowing	No Evidence	Good	No Evidence	Long - more than 40 years	4	**Moderate**	Adjoining property
24	***Syncarpia glomulifera*** (Turpentine)	13	10	436	115	M	Appears stable with sound branching structure. Located close to existing concrete paved area.	No Evidence	Good	No Evidence	medium 15-40 Years	2	**High**	On-site
25	***Casuarina glauca*** (Swamp Oak)	18	7	490	105	M	Appears stable with fair branching structure. Twin trunked at 2 metres due suppressed leader with adaptive growth in primary limbs close to junction. Located close to existing concrete paved area. Roots visible in concrete joint lines.	Crown lifted to 3 metres	Good	No Evidence	medium 15-40 Years	4	**Moderate**	On-site
26	***Casuarina glauca*** (Swamp Oak)	16	9	471	126	M	Appears stable with sound branching structure. Located close to existing concrete paved area	Crown lifted to 3 metres	Good	No Evidence	Medium 15-40 Years	4	**Moderate**	On-site
27	***Thuja plicata*** (Western Red Cedar)	6	4	230	16	M	Appears stable with fair branching structure.	Crown lifted to 3 metres	Fair with slightly thinning crown	No Evidence	Short 5-15 Years	5	**Low**	On-site
28	***Casuarina glauca*** (Swamp Oak)	16	5.5	201	77	SM	Appears stable with sound branching structure.	No Evidence	Good	No Evidence	Long - more than 40 years	5	**Low**	On-site
29	***Casuarina glauca*** (Swamp Oak)	14	4	191	52	SM	Appears stable with fair branching structure. Exhibits a prominent lean to the SE (self-corrected). Abrupt bend in main trunk.	No Evidence	Good	No Evidence	Medium 15-40 Years	5	**Low**	On-site
29a	***Jacaranda mimosifolia*** (Jacaranda)	7	9	236	27	SM	Stability suspect with sound branching structure. Exhibits a very prominent lean to the NW. Most of the crown distributed to the NW. Exhibits a large wound from GL to 1.2 metres with decay evident.	Crown lifted to 4 metres	Good	No Evidence	Short 5-15 Years	5	**Low**	Adjoining property

APPENDIX 3 - TREE HEALTH AND CONDITION ASSESSMENT SCHEDULE

Tree Identification No.	Species	Height (m)	Spread (m)	Trunk Diameter (mm)	Live Crown Size (m^2)	Maturity Class	Condition	Previous Pruning	Health		Remaining Safe Useful Life Expectancy (SULE)	Landscape Significance Rating	Retention Value	Location
									Vigour	Pest & Disease				
30	***Cedrus deodara*** (Himalayan Cedar)	17	15	573	225	M	Appears stable with sound branching structure.	Crown lifted to 2 metres	Good	No Evidence	Long - more than 40 years	3	**High**	On-site
30a	***Callistemon viminalis*** (Weeping Bottlebrush)	6	7	300	28	M	Appears stable with fair branching structure. Crown suppressed on east side due to crowding.	Crown lifted to 2 metres	Fair	No Evidence	Short 5-15 Years	5	**Low**	On-site
30b	***Callistemon viminalis*** (Weeping Bottlebrush)	9	9	360 + 270	63	M	Appears stable with fair branching structure. Multiple moderate bark inclusions at GL to 1 metre. Lifting and displacing kerb.	Crown lifted to 2 metres	Fair	No Evidence	Short 5-15 Years	4	**Low**	On-site
30c	***Callistemon viminalis*** (Weeping Bottlebrush)	6	10	240	40	M	Appears stable with fair branching structure. Crown suppressed on west side due to crowding. Moderate wound at 2.5 metres due to branch loss.	Crown lifted to 2 metres	Fair with slightly thinning crown	No Evidence	Short 5-15 Years	5	**Low**	On-site
31	***Syncarpia glomulifera*** (Turpentine)	15	15	500x2 + 650	180	M	Appears stable with fair branching structure. 10% deadwood.	Selectively pruned on the south side to clear the building.	Fair with slightly thinning crown	Moderate termite infestation	Long - more than 40 years	2	**High**	On-site
32	***Eucalyptus paniculata*** (Grey Ironbark)	15	18	678	198	M	Appears stable with sound branching structure. 15% epicormic growth.	Selectively pruned & deadwooded	Very Good	No Evidence	Long - more than 40 years	2	**High**	On-site

APPENDIX 4 - IMPACT ASSESSMENT SCHEDULE

Tree Identification No.	Species	Construction Tolerance	Tree Protection Zone (m R)	Structural Root Zone (m R)	TPZ (m^2)	Incursions To Root Zone &/or Canopy	Likely Impact	Recommendation
1	***Eucalyptus microcorys*** (Tallowwood)	P	5.6	2.2	99.8	Proposed pedestrian ramp offset 5.1 metres west at RL 110.319 (at grade to approximately 300mm above grade). Excavations for ramp foundations within TPZ. Encroachment to TPZ = 3%	Extent of encroachment to the root zone is less than 10% of the TPZ, which is considered within acceptable limits under AS 4970:2009. No adverse impact.	Retain in accordance with recommended Tree Protection Measures (Section 10). Undertake all excavations for the ramp foundations within the TPZ in accordance with Section 10.6.
2	***Eucalyptus microcorys*** (Tallowwood)	P	7.1	2.7	158.7	Existing suspended ramp offset 0.6 metres west to be demolished within TPZ. Proposed pedestrian ramp offset 3.7 metres west at RL 110.319 (at grade to 300mm above grade). Excavations for ramp foundations within TPZ. Encroachment to TPZ = 8%	Extent of encroachment to the root zone is less than 10% of the TPZ, which is considered within acceptable limits under AS 4970:2009. No adverse impact.	Retain in accordance with recommended Tree Protection Measures (Section 10). Undertake all excavations for the ramp foundations within the TPZ in accordance with Section 10.6.
3	***Corymbia citriodora*** (Lemon-scented Gum)	P	8.2	2.6	212.0	Existing suspended ramp offset 0.3 metres west to be demolished within TPZ. Proposed pedestrian ramp offset 3.1 metres west at RL 110.319 (at grade to 300mm above grade). Excavations for ramp foundations within TPZ. Proposed basement offset 4.6 metres west at RL 102.62 (7.5 metres below grade). Encroachment to TPZ = 21% (9% suspended, basement 8%).	Extent of encroachment to the root zone exceeds acceptable limits under AS 4970:2009. However, much of the area of the encroachment consists of a suspended concrete ramp on piers. As such, actual incursion to the root zone is approximately 12%. The tree will tolerate this encroachment provided that the proposed works are carried out as recommended.	Retain in accordance with recommended Tree Protection Measures (Section 10). Undertake all excavations for the ramp foundations within the TPZ in accordance with Section 10.6.
4	***Corymbia citriodora*** (Lemon-scented Gum)	P	9.0	2.6	254.3	Within footprint of existing suspended ramp to be demolished within TPZ. Proposed pedestrian ramp offset 1.6 metres west at RL 110.319- (0.3 above grade to 0.9 above grade). Excavations for ramp foundations within SRZ. Basement offset 2.9 metres west at RL102.62 (7.5 metres below grade). Encroachment to TPZ = 20% (excluding ramp).	Extent of encroachment to the root zone exceeds acceptable limits under AS 4970:2009. Proposed works will result in an adverse impact, necessitating removal	Remove tree. Undertake replacement planting elsewhere within the site in accordance with Section 11.

APPENDIX 4 - IMPACT ASSESSMENT SCHEDULE

Tree Identification No.	Species	Construction Tolerance	Tree Protection Zone (m R)	Structural Root Zone (m R)	TPZ (m^2)	Incursions To Root Zone &/or Canopy	Likely Impact	Recommendation
5	***Corymbia citriodora*** (Lemon-scented Gum)	P	6.2	2.3	121.1	Existing suspended ramp offset 0.8 metres west to be demolished within TPZ. Proposed pedestrian ramp offset 2.1 metres west at RL 110.319- (0.3 above grade to 0.9 above grade, partly beyond existing retaining wall). Excavations for ramp foundations within TPZ. Basement offset 4.0 metres west at RL102.62 (7.5 metres below grade). Encroachment to TPZ = 12% (excluding ramp)	Extent of encroachment to the root zone exceeds acceptable limits under AS 4970:2009. However, much of the area of the encroachment consists of a suspended concrete ramp on piers. As such, actual incursion to the root zone is approximately 12%. The tree will tolerate this encroachment provided that the proposed works are carried out as recommended.	Retain in accordance with recommended Tree Protection Measures (Section 10). Undertake all excavations for the ramp foundations within the TPZ in accordance with Section 10.6.
6	***Melaleuca bracteata*** (Black Tea-tree)	M	3.2	1.7	31.2	No incursion to root zone or canopy.	No adverse impact	To be retained - no special Tree Protection Measure required.
7	***Corymbia maculata*** (Spotted Gum)	P	7.7	2.5	185.7	Proposed stairway and associated retaining wall offset 5.3 metres west at RL 105.955 to RL 104.414 (900mm above grade to 800mm below grade) - beyond existing retaining wall on boundary. Minor canopy pruning may be required to accomodate temporary scaffolding.	No adverse impact	Retain in accordance with recommended Tree Protection Measures (Section 10). Undertake demolition of existing concrete block retaining wall (where required) in accordance with Section 10.5. Erect temporary scaffolding within TPZ in accordance with Section 10.13. Undertake any required canopy pruning (to clear temporary scaffolding) in accordance with Section 10.10.
8	***Melaleuca quinquenervia*** (Broad-leaved Paperbark)	M	3.6	2.0	40.7	Proposed stairway and associated retaining wall offset 4.0 metres west at RL 105.955 to RL 104.414 (900mm above grade to 800mm below grade) - beyond existing retaining wall on boundary.	No adverse impact	Retain in accordance with recommended Tree Protection Measures (Section 10). Undertake demolition of existing concrete block retaining wall (where required) in accordance with Section 10.5.
9	***Melaleuca quinquenervia*** (Broad-leaved Paperbark)	M	3.0	1.8	28.3	Proposed stairway, path and associated retaining wall offset 1.2 metres west at RL 104.414 (800mm below grade). Excavations for wall foundations within SRZ.	Proposed works will necessitate removal.	Remove tree. Undertake replacement planting elsewhere within the site in accordance with Section 11.

APPENDIX 4 - IMPACT ASSESSMENT SCHEDULE

Tree Identification No.	Species	Construction Tolerance	Tree Protection Zone (m R)	Structural Root Zone (m R)	TPZ (m^2)	Incursions To Root Zone &/or Canopy	Likely Impact	Recommendation
10	***Melaleuca quinquenervia*** (Broad-leaved Paperbark)	M	3.6	2.0	40.7	Proposed stairway, path and associated retaining wall offset 1.1 metres west at RL 104.414 (800mm below grade). Excavations for wall foundations within SRZ.	Proposed works will necessitate removal.	Remove tree. Undertake replacement planting elsewhere within the site in accordance with Section 11.
11	***Melaleuca quinquenervia*** (Broad-leaved Paperbark)	M	3.6	2.0	40.7	Proposed stairway, path and associated retaining wall offset 1.5 metres west at RL 104.414 (800mm below grade). Excavations for wall foundations within SRZ.	Proposed works will necessitate removal.	Remove tree. Undertake replacement planting elsewhere within the site in accordance with Section 11.
12	***Melaleuca quinquenervia*** (Broad-leaved Paperbark)	M	5.4	2.4	91.6	Proposed stairway, path and associated retaining wall offset 1.3 metres west at RL 104.414 (800mm below grade). Excavations for wall foundations within SRZ.	Proposed works will necessitate removal.	Remove tree. Undertake replacement planting elsewhere within the site in accordance with Section 11.
13	***Archontophoenix cunninghamii*** (Bangalow Palm)	G	3.0	1.7	28.3	Located within footprint of proposed building & basement.	Proposed works will necessitate removal.	Remove tree. Undertake replacement planting elsewhere within the site in accordance with Section 11.
14	***Archontophoenix cunninghamii*** (Bangalow Palm)	G	2.5	1.5	19.6	Located within footprint of proposed building & basement.	Proposed works will necessitate removal.	Remove tree. Undertake replacement planting elsewhere within the site in accordance with Section 11.
15	***Archontophoenix cunninghamii*** (Bangalow Palm)	G	2.5	1.4	19.6	Located within footprint of proposed building & basement.	Proposed works will necessitate removal.	Remove tree. Undertake replacement planting elsewhere within the site in accordance with Section 11.
16	***Melaleuca bracteata*** (Black Tea-tree)	M	3.8	2.1	46.3	Proposed pedestrian ramp offset 2.4 metres west at RL 104.414 (close to existing grade). Excavations for ramp foundations within TPZ. Encroachment to TPZ = 11%	Extent of encroachment to the root zone exceeds acceptable limits under AS 4970:2009. No adverse impact provided that the proposed works are undertaken as recommended.	To be retained - no special Tree Protection Measure required.

APPENDIX 4 - IMPACT ASSESSMENT SCHEDULE

Tree Identification No.	Species	Construction Tolerance	Tree Protection Zone (m R)	Structural Root Zone (m R)	TPZ (m^2)	Incursions To Root Zone &/or Canopy	Likely Impact	Recommendation
17	***Syzygium paniculatum*** (Magenta Cherry)	M	4.5	2.0	64.7	Proposed basement offset 2.4 metres west at RL 104.414 (close to existing grade, beyond existing retaining wall). Encroachment to TPZ = 15%. Proposed pedestrian ramp offset 2.4 metres north at RL 104.414 (5-600mm above grade). Proposed basement offset 3.1 metres NW. Excavations for basement within TPZ. Encroachment = 3%. Total encroachment (excluding ramp to north = 18%). Proposed stormwater line offset 3 metres SE. Trenching within TPZ.	Extent of encroachment to the root zone exceeds acceptable limits under AS 4970:2009. However, much of the area of the encroachment consists of a suspended concrete ramp on piers or beyond existing structures. As such, actual incursion to the root zone is relatively minor. Trenching for stormwater line may result in some adverse impact.	Retain in accordance with recommended Tree Protection Measures (Section 10). Undertake all excavations for the ramp foundations within the TPZ in accordance with Section 10.6. Demolish existing concrete wall in accordance with Section 10.5.Relocate stormwater line outside TPZ if possible. Undertake all trenching for stormwater lines within TPZ in accordance with Section 10.7.
18	***Callistemon sp.*** (Bottlebrush)	M	2.7	1.6	22.9	No incursion to root zone or canopy.	No adverse impact	To be retained - no special Tree Protection Measure required.
19	***Syzygium paniculatum*** (Magenta Cherry)	M	5.3	2.1	86.7	Proposed basement offset 3.6 metres north at RL 98.50 (5.2 metres below grade). Encroachment to TPZ = 10%. Proposed pedestrian ramp offset 2.7 metres north at RL 104.414 to 103.87 (0.5-2.5 m above grade). Existing concrete ret. wall offset 2.3 metres west & building 2.7 metres north to be demolished within TPZ. Proposed stormwater line offset 4 metres south. Trenching within TPZ.	Extent of encroachment to the root zone (excluding pedestrian ramp) is 10% of the TPZ, which is considered within acceptable limits under AS4970:2009 - no adverse impact provided that the proposed works are undertaken as recommended. Trenching for stormwater line may result in some adverse impact.	Retain in accordance with recommended Tree Protection Measures (Section 10). Undertake all excavations for the ramp foundations within the TPZ in accordance with Section 10.6. Demolish existing concrete wall in accordance with Section 10.5. Undertake all trenching for stormwater lines within TPZ in accordance with Section 10.7.
20	***Callistemon sp.*** (Bottlebrush)	M	6.0	2.9	113.0	No incursion to root zone or canopy.	No adverse impact	Retain in accordance with recommended Tree Protection Measures (Section 10). Undertake all excavations for the retaining wall foundations within the TPZ in accordance with Section 10.6.
21	***Cotoneaster sp.*** (Cotoneaster)	M	3.9	1.9	47.8	No incursion to root zone or canopy.	No adverse impact	Consider removal and replacement with a more appropriate species in accordance with Council's Street Tree Master Plan.

APPENDIX 4 - IMPACT ASSESSMENT SCHEDULE

Tree Identification No.	Species	Construction Tolerance	Tree Protection Zone (m R)	Structural Root Zone (m R)	TPZ (m^2)	Incursions To Root Zone &/or Canopy	Likely Impact	Recommendation
22	***Angophora costata*** (Sydney Red Gum)	P	3.0	1.4	28.3	Proposed retaining walls offset 2.5 metres SW & 2.8 metres NE. Excavations for wall foundations within TPZ. Encroachment to TPZ = 5%. OSD tank offset 2.6 metres north. Excavations for OSD within TPZ.	Extent of encroachment to the root zone is less than 10% of the TPZ, which is considered within acceptable limits under AS 4970:2009. No adverse impact.	Retain in accordance with recommended Tree Protection Measures (Section 10). Undertake all excavations for the retaining wall foundations & OSD within the TPZ in accordance with Section 10.6.
23	***Syzygium paniculatum*** (Magenta Cherry)	M	6.3	2.3	124.9	Proposed basement ramp and associated retaining wall offset 3.7 metres NW at RL 98.50. Excavations for wall foundations within TPZ. Encroachment to TPZ = 16%. Proposed stairs & asociated retaining wall offset 4.3 metres east at RL 100.80 to 102.81 (at grade to 1.6 metres above grade, within footprint of existing concrete pavement). Excavations for wall foundations within TPZ. Encroachment to TPZ 6%. Pathway offset 3.0 metres east at RL? (close to existing grade, within footprint of existing driveway). Encroachment to TPZ = 17%. Total 33%. Proposed stormwater line offset 3 metres NE.	Extent of encroachment to the root zone exceeds acceptable limits under AS 4970:2009. Proposed works has the potential to result in some adverse impact, but all proposed works are within the footprint of existing structures and pavements. No adverse impact provided that all demolition works and all excavation works are undertaken as recommended. Trenching for stormwater line may result in some adverse impact.	Retain in accordance with recommended Tree Protection Measures (Section 10). Undertake all excavations for the retaining wall foundations within the TPZ in accordance with Section 10.6. Undertake demolition of all existing structures and pavements in accordance with Section 10.5. Relocate stormwater line outside TPZ if possible. Undertake all trenching for stormwater lines within TPZ in accordance with Section 10.7.
23a	***Angophora costata*** (Sydney Red Gum)	P	1.5	1.1	7.1	Located within footprint of proposed basement ramp.	Proposed works will necessitate removal.	Remove tree. Undertake replacement planting elsewhere within the site in accordance with Section 11.
23b	***Melaleuca quinquenervia*** (Broad-leaved Paperbark)	M	6.4	2.5	127.0	Proposed basement ramp and associated retaining wall offset 1.1 metres east at RL ? (close to grade to 0.5m below grade). Excavations for wall foundations within SRZ. Encroachment to TPZ = 39%.	Extent of encroachment to the root zone exceeds acceptable limits under AS 4970:2009. May result in some adverse impact.	Retain in accordance with recommended Tree Protection Measures (Section 10). Undertake all excavations for the basement ramp and kerbs/walls within the TPZ in accordance with Section 10.6.
24	***Syncarpia glomulifera*** (Turpentine)	M	5.2	2.3	86.1	Located within footprint of proposed basement ramp.	Proposed works will necessitate removal (high retention value)	Proposed to be removed. Undertake replacement planting elsewhere within the site in accordance with Section 11.

APPENDIX 4 - IMPACT ASSESSMENT SCHEDULE

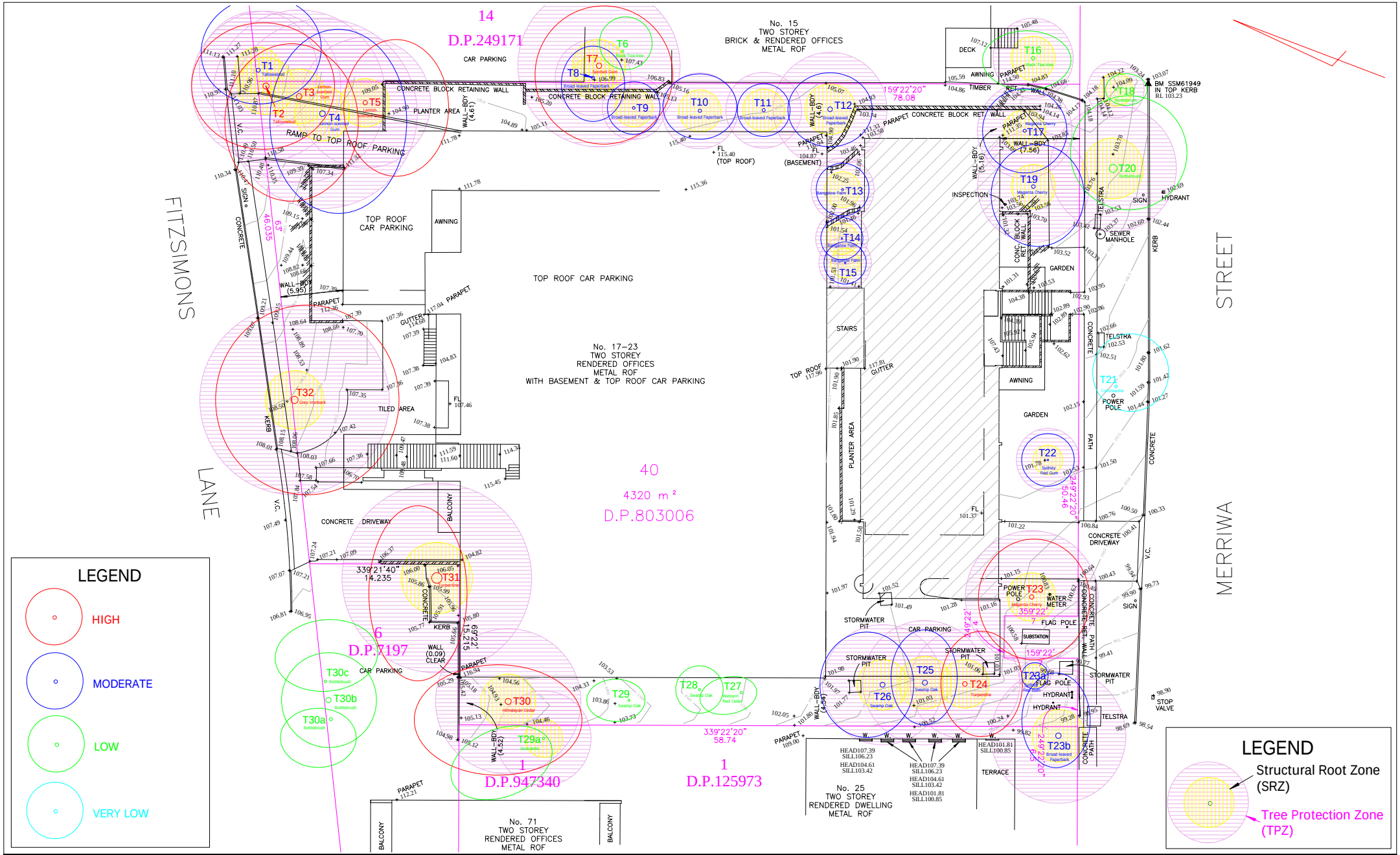
Tree Identification No.	Species	Construction Tolerance	Tree Protection Zone (m R)	Structural Root Zone (m R)	TPZ (m^2)	Incursions To Root Zone &/or Canopy	Likely Impact	Recommendation
25	***Casuarina glauca*** (Swamp Oak)	M	5.9	2.5	108.8	Proposed basement ramp and associated retaining wall offset 1.5 metres SE at RL ? (2-3 m below grade). Excavations for wall foundations within SRZ. Encroachment to TPZ = 35%.	Proposed works will necessitate removal.	Remove tree. Undertake replacement planting elsewhere within the site in accordance with Section 11.
26	***Casuarina glauca*** (Swamp Oak)	M	5.7	2.4	100.5	Proposed basement offset 0.9 metres east at RL 98.50. Excavations for basement within SRZ.	Proposed works will necessitate removal.	Remove tree. Undertake replacement planting elsewhere within the site in accordance with Section 11.
27	***Thuja plicata*** (Western Red Cedar)	M	2.8	1.8	23.9	Proposed basement offset 1.7 metres east at RL 98.50. Excavations for basement within SRZ.	Proposed works will necessitate removal.	Remove tree.
28	***Casuarina glauca*** (Swamp Oak)	M	3.0	1.7	28.4	Proposed basement offset 1.3 metres east at RL 98.50. Excavations for basement within SRZ.	Proposed works will necessitate removal.	Remove tree.
29	***Casuarina glauca*** (Swamp Oak)	M	2.9	1.7	25.8	Proposed basement offset 2.4 metres east at RL 98.50 (within footprint of existing building). Excavations for basement within TPZ. Encroachment to TPZ = 5%. Proposed pathway (at grade) offset 1.1 metres west. Excavations for pavement sub-grade within TPZ.	Extent of encroachment to the root zone from basement is less than 10% of the TPZ, which is considered within acceptable limits under AS 4970:2009. No adverse impact.	Retain in accordance with recommended Tree Protection Measures (Section 10). Undertake all excavations for the basement within the TPZ in accordance with Section 10.6.
29a	***Jacaranda mimosifolia*** (Jacaranda)	M	4.5	1.8	63.6	Proposed pathway (at grade) offset 1.3 metres east. Excavations for pavement sub-grade within TPZ.	Proposed works will not result in any adverse impact provided that the pathway is installed slightly above grade as recommended.	Retain in accordance with recommended Tree Protection Measures (Section 10). Undertake all excavations for the pavement sub-grade within the TPZ in accordance with Section 10.6.

APPENDIX 4 - IMPACT ASSESSMENT SCHEDULE

Tree Identification No.	Species	Construction Tolerance	Tree Protection Zone (m R)	Structural Root Zone (m R)	TPZ (m^2)	Incursions To Root Zone &/or Canopy	Likely Impact	Recommendation
30	***Cedrus deodara*** (Himalayan Cedar)	M	6.9	2.6	148.6	Proposed basement offset 2.7 metres south-east at RL 99.50 (5 metres below grade) - within footprint of existing building and basement. Demolition of existing building and basement within TPZ. Encroachment = 11%. Proposed pathway offset 1 metre west and 3.4 metres north at RL? (close to existing grade). Proposed stormwater line offset 6 metres south.	Extent of encroachment to the root zone from basement marginally exceeds acceptable limits under AS 4970:2009. No adverse impact provided that the pathway is installed slightly above grade as recommended.	Retain in accordance with recommended Tree Protection Measures (Section 10). Undertake all excavations for the basement within the TPZ in accordance with Section 10.6. Undertake demolition of existing building within TPZ in accordance with Section 10.5. Undertake all excavations for the pavement sub-grade within the TPZ in accordance with Section 10.6.
30a	***Callistemon viminalis*** (Weeping Bottlebrush)	M	3.6	2.0	40.7	No incursion to root zone or canopy.	No adverse impact	To be retained - no special Tree Protection Measure required.
30b	***Callistemon viminalis*** (Weeping Bottlebrush)	M	6.0	2.5	113.0	No incursion to root zone or canopy.	No adverse impact	To be retained - no special Tree Protection Measure required.
30c	***Callistemon viminalis*** (Weeping Bottlebrush)	M	3.6	1.8	40.7	No incursion to root zone or canopy.	No adverse impact	To be retained - no special Tree Protection Measure required.
31	***Syncarpia glomulifera*** (Turpentine)	M	9.0	3.4	254.3	Proposed basement offset 2.1 metres east (beyond existing retaining wall) - no incursion to root zone. Proposed basement offset 7.9 metres south (within footprint of existing building). Existing building offset 2.1 metres south and existing retaining wall offset 1.2 metres east to be demolished within TPZ. Proposed pathway (at grade) offset 1.3 metres east and 2.1 metres south. Excavations for pavement sub-grade within TPZ.	No adverse impact provided that the existing building and retaining wall are demolished as recommended and the pathway is installed slightly above grade as recommended.	Retain in accordance with recommended Tree Protection Measures (Section 10). Undertake demolition of existing building and retaining wall within the TPZ in accordance with Section 10.5. Undertake all excavations for the pavement sub-grade within the TPZ in accordance with Section 10.6.

APPENDIX 4 - IMPACT ASSESSMENT SCHEDULE

Tree Identification No.	Species	Construction Tolerance	Tree Protection Zone (m R)	Structural Root Zone (m R)	TPZ (m^2)	Incursions To Root Zone &/or Canopy	Likely Impact	Recommendation
32	***Eucalyptus paniculata*** (Grey Ironbark)	P	9.0	2.8	254.3	Proposed basement offset 2.1 metres south at RL 102.62 (5.4 metres below grade). Excavations for basement foundations within TPZ/SRZ. Encroachment to TPZ = 31%. Proposed reatining wall offset 0.9 metres south. Excavations for wall foundations within SRZ. Proposed building will necssitate significant canopy pruning.	Proposed works will necessitate removal (high retention value).	Proposed to be removed. Undertake replacement planting elsewhere within the site in accordance with Section 11.



APPENDIX 5
TREE LOCATION PLAN SHOWING
TREE RETENTION VALUES

17-23 Merriwa Street, GORDON

Earthscape Horticultural Services
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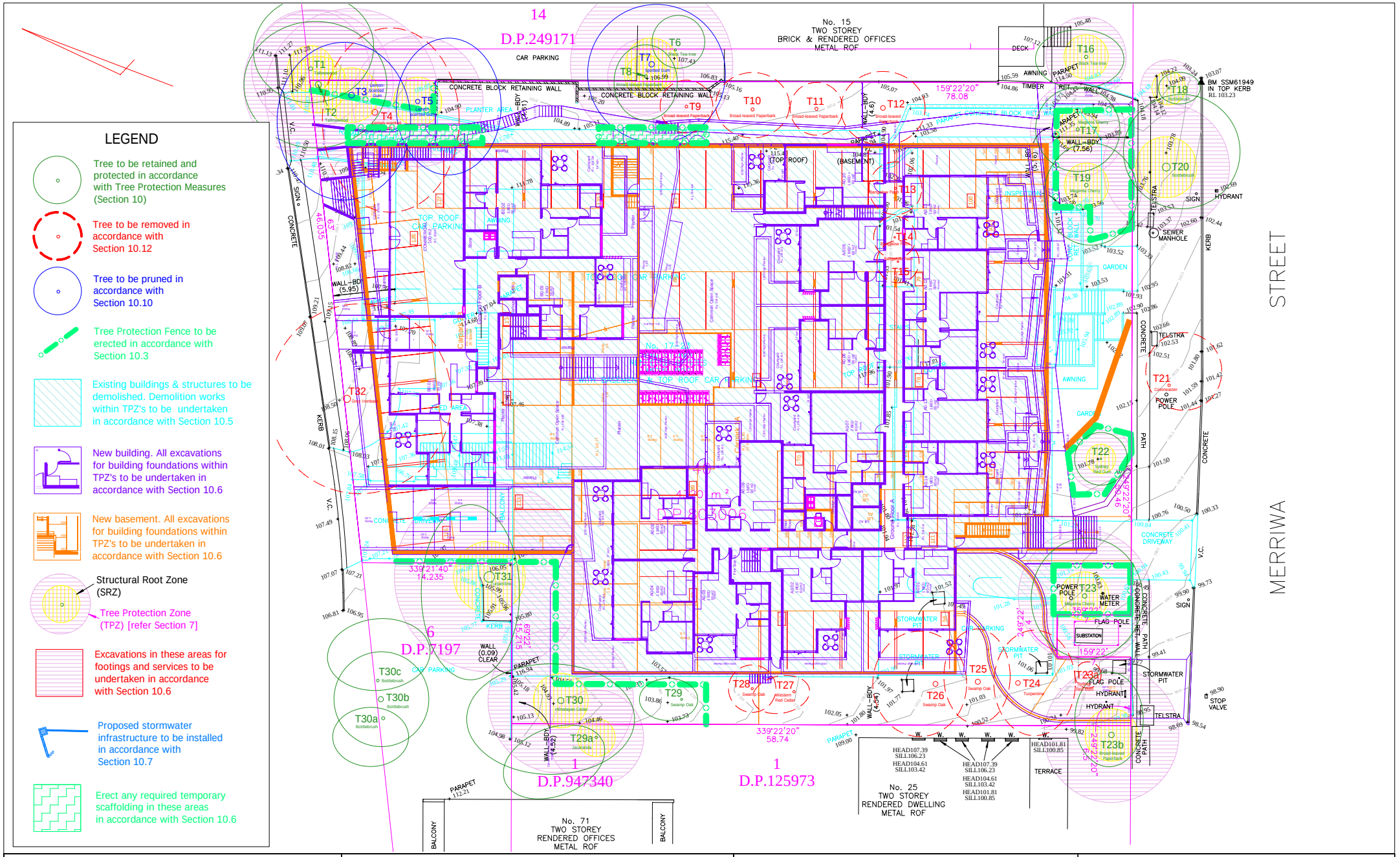
Based on the Survey Drawing
prepared by M. Y. XU & Co.
Dwg Ref No. 13207
Dated 09/09/2013

DWG No. T13-102501

DATE: 25/10/2013



APPENDIX 6
TREE PROTECTION PLAN

17-23 Merriwa Street, GORDON

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Based on the Survey Drawing
prepared by M. Y. XU & Co.
Dwg Ref No. 13207
Dated 09/09/2013

DWG No. T13-102502

DATE: 25/11/2013