arboricultural impact assessment report

AIA-01

Revision A, Issued for Development Application
12 July, 2018

DOCUMENT INCLUDES

- ART-T-01 Tree Protection Specifications
- ART-T-02 to ART-T-06 Tree Protection & Removal Plans

PROJECT

Westfield Warringah Mall - Stage 2

Condamine Street & Pittwater Road
Brookvale, NSW 2100

CLIENT / PRINCIPAL

Scentre Design and Construction Pty Ltd

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Sydney, NSW 2000

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i EXECUTIVE SUMMARY

Arterra Design was engaged by Scentre Design and Construction Pty Ltd (the client) in October 2016, to undertake an arboricultural assessment of the site and prepare the relevant reports and plans to help guide Stage 2 of the re-development of Westfield Warringah Mall, Brookvale.

Scentre proposes to demolish portions of the existing building and infrastructure within the Stage 2 site area, reconfigure the car parking and access ramps and rebuild the southern portion of the centre towards Pittwater Road/ Condamine Street. The works are mainly centred around refurbished and additional retail and commercial spaces towards the southern part of the existing centre. There is also improvements proposed to the vehicular access, car parking arrangements and pedestrian circulation together with a revitalised streetscape and main entry treatment along the Condamine Street / Pittwater Road frontage. A new slip lane is proposed to enter the site off Condamine Street just north of the Old Pittwater Road intersection.

On the 18th November 2016 Robert Smart carried out a detailed assessment of the trees located within and immediately adjacent to the Stage 2 project area. The information regarding the trees was further verified and updated on the 5th December 2017 due to a reconfiguration of the project scope. The trees' health and condition were assessed via a visual inspection of the trees from the ground only. A tree assessment and impact schedule was completed for all the trees. (Refer to Appendix 4.2 – Tree Impact Assessment Schedule). The trees were photographed and given a unique identification number and plotted onto a scaled survey base plan for referencing and identification throughout the report and for future discussions and co-ordination with contractors and stakeholders.

In summary, there were **91** trees assessed:-

- **30** (33%) trees are proposed to be **retained**;
- **56** (61%) trees are proposed to be **removed**;
- **5** (6%) (1 *Howea forsteriana*, 1 *Livistona australis, 1 Araucaria heterophylla, 1 Ficus rubiginosa,* 1 *Magnolia grandiflora*) are proposed to be transplanted and reused in the proposed new landscaping.
- Trees that are proposed for removal are either located within the footprint of the proposed Stage 2 construction works or are likely to suffer unacceptable impacts as a result of their proximity to the proposed works and the associated changes in levels. The trees to be retained and removed are graphically illustrated in Appendix 4.1 Tree Protection & Removal Plans.

As with all aspects in the development and construction process, the tree related constraints have to be weighed up against many other relevant development opportunities and constraints. The retention of the trees on the site must also consider economic, social, environmental, construction and practical realities. This document has been prepared by Arterra Design Pty Ltd, using the expertise of our in-house, AQF Level 5 consulting arborists, Robert Smart. He is a member of the International Society of Arboriculture and also a Registered Consulting Arborist with Arboriculture Australia.

Robert Smart AAILA , ISA, AA
Director, Registered Landscape Architect (054),
Registered Consulting Arborist (1804).

1.0 INTRODUCTION

1.1 Background

On the 28 October 2016, Arterra Design was engaged by Scentre Design and Construction Pty Ltd (Scentre) to undertake an arboricultural assessment of the site and prepare the relevant reports and plans to help guide the Westfield Warringah Mall Stage 2 re-development. This assessment was restricted to the trees within and in close proximity to the site, which are likely to be impacted by the proposed works.

Scentre proposes to demolish much of the existing building and infrastructure within the Stage 2 site area then to reconfigure and rebuild with additional retail space, improved vehicular access, pedestrian circulation and parking, together with a revitalised streetscape and entry treatments on the Condamine Street / Pittwater Road frontage.

Refer to Figure 1 below, showing the Stage 2 site extent, shaded orange. The site currently contains a variety of existing buildings, roadways, pedestrian pathways, gardens and other infrastructure. Trees are scattered throughout the site in gardens, in at-grade carparking, and a variety of other planters. The majority of the trees are located in the roadside landscape and garden beds on the perimeter of the site, bordering Pittwater Road and Condamine Street. Under the current design, a number of the trees on the periphery of the site, particularly those in the southern portion fronting Condamine Street, are likely to be impacted by the proposed extent of works. The proposed construction works will require removal of those trees within the footprint of the works together with those trees adjacent and likely to experience unacceptable construction related impacts.

This impact assessment has been prepared to clearly identify the trees to be retained and those to be removed as part of the development. It will also Scentre Group to take a proactive approach to the management of the trees to be retained and put in place appropriate measures to protect them during the construction.

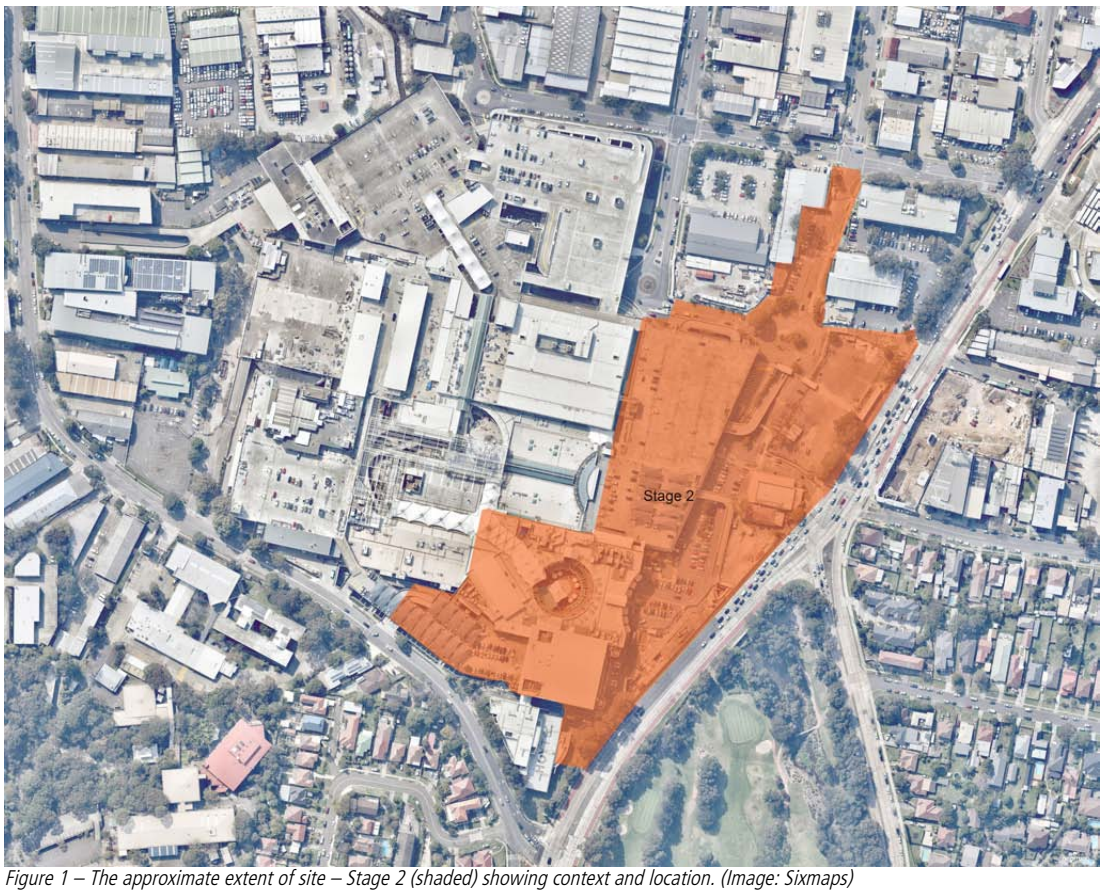


Figure 1 – The approximate extent of site – Stage 2 (shaded) showing context and location. (Image: Sixmaps)

1.2 Aims of This Report

The aim of this report is to assess the impact of the proposed development on the existing trees within, and immediately adjacent, to the Stage 2 project site. Specifically the report aims to:-

- assess the health and condition of the trees;
- accurately record information relevant to the existing trees;

- assess the significance, SULE and retention values of the existing trees;
- provide clear recommendations as to which trees should be retained and protected;
- identify the proposed Tree Protection Zones (TPZ) of the trees being retained and identify and assess the likely arboricultural impacts of the development on the trees and
- provide preliminary advice on the tree protection measures that will be required during construction to ensure the trees are successfully retained.

The following limitations apply to this reports use: -

1. Plans: All plans are based on provided information. They should only be used relating to tree issues and are not suitable for any other purpose.
2. Notification of proposed alterations to disturbance within TPZs: Arterra must be clearly notified of any proposed alterations to the plans or additional disturbance in TPZs, so that we can advise on the implications before any work is undertaken.

1.3 Conduct and Author Qualifications

Given the above stated aims of this report, as author of this report, Arterra Design confirms that Robert Smart is suitably qualified (AQF 5 Consulting Arborist) to provide comment and the required arboricultural advice pertaining to these matters.

Furthermore, Mr Smart confirms that he has read and agrees to be bound by the NSW Uniform Civil Procedure Rules 2005, Part 31 Division 2 Provisions, Schedule 7 - Expert witness code of conduct.

Arterra provides specialist consulting arborist services only and does not provide any physical tree work services such as climbing, pruning, removal, root investigations or root pruning. Our advice is based on impartial professional assessment only, as we do not derive any financial benefit from specifying pruning or other physical services. We will not specify any such activities unless we determine them to be essential to ongoing tree health or stability.

1.4 Key Definitions and Abbreviations

The following abbreviations are used throughout this report.

"TPZ" = Tree Protect Zone

This is the area as defined by AS 4970 – "Protection of Trees on Development Sites" and means the typical minimum area above and below ground at a given distance from the trunk to provide for protection of the tree. Most importantly it represents the root zone required to be kept uninjured to maintain a healthy and viable tree. Please note, that roots will usually extend well beyond this zone, so *this represents the minimum remaining root zone required*, assuming all others are lost or damaged due to construction. It is typically calculated as a circle centred on the trunk unless existing site conditions can be assessed and indicate otherwise.

"SRZ" = Structural Root Zone

This is the area as defined by AS 4970 – "Protection of Trees on Development Sites" and means the area immediately around the base of the tree at a given distance from the trunk. The woody roots and soil cohesion in this area are considered vital to the structural stability of the tree. *Damage or removal of soil and roots from this area will typically render the tree unstable and require its removal.* It is typically calculated as a circle, centred on the trunk, unless existing site conditions can be assessed and indicate otherwise.

DBH = Diameter at Breast Height

This is the diameter of the trunk measured at 1.4m above ground level

DGL = Diameter at Ground Level

This is the diameter of the trunk measured at ground level, but just above any root flare.

Inclusion or Included Bark Branch Union

Growth of bark at the interface of two or more branches on the inner side of the branch union which is unable to be lost from the tree and accumulates, or is trapped, between the acutely divergent branches. This can form a weakened branch union in some species.

1.5 Relevant Controls or Legislation

There are a number of planning instruments that apply to the site:-

Warringah (Northern Beaches) Council Documents:-

- Local Environment Plan 2011 (WLEP 2011)
- Development Control Plan 2011 (WDCP 2011)
    - WDCP Sect G4 Warringah Mall
    - WDCP Part E1- Private Property Tree Management

A tree for the purposes of this report is any palm or woody perennial plant greater than 6m in height or 7m in canopy width. Heights of palms are measured from ground level to top of the trunk.

1.6 Documents Reviewed

Plans and documents referenced and reviewed as part of this tree impact assessment were:-

Scentre Design & Construction:-

- WR2_PRO_SCH14F_01 – Proposed Ground Level
- WR2_PRO_SCH14F_03 – Proposed Level 1
- WR2_PRO_SCH14F_04 – Proposed Level 1 Mezzanine
- WR2_PRO_SCH14F_05 – Proposed Level 2
- WR2_PRO_SCH14F_07 – Proposed Level 3
- WR2_PRO_SCH14F_07 – Proposed Roof Plan

Arterra Design

- -ART-LSD-01 Overall Landscape Plan
- -ART-LSD-02 Northern Entry Landscape Plan
- -ART-LSD-03 Southern Entry Landscape Plan
- -ART-LSD-04 Typical Sections
- -ART-LSD-05 Typical Sections
- -ART-LSD-06 Planting Palette
- -ART-LSD-07 Character Imagery
- -ART-LSD-08 Perspective Imagery

We have also reviewed the proposed concept civil and drainage plans for the work by Cardno Engineers.

Although detailed proposed servicing plans for the development are still to be prepared, we understand that a development of this type will involve major services, which together with the building work and re-grading can have significant implications for tree retention. The likely impacts from the installation of such services and regrading have been taken into account in our assessment.

1.7 Site Location, History and Context

The site is located approximately 26km north from the Sydney CBD within the suburb of Brookvale, 2.6km from the coast at Manly, in the southern portion of the Brookvale light industrial and commercial area. The site is part of the landholding historically associated with Brookvale House, which was purchased in 1957 and subsequently demolished in 1960 to make way for the construction of the original Warringah Mall, which was opened, 3 April 1963. (http://dictionaryofsydney.org - Accessed 15 November 2016)

No remnant native vegetation was expected, or observed, with the site having been entirely cleared for agriculture prior to the original commercial development that occurred between 1960 and 1963.

1.8 Assessment Methodology

On the 18th November 2016, Robert Smart of Arterra carried out a detailed assessment of the trees located within and immediately adjacent to the site. This assessment was subsequently updated and re-verified on the 5th December 2017. The trees' health and condition were assessed via a visual inspection of the trees from the ground only. Requisite tree data (including DBH, DGL, height & canopy spread, condition & proximity to services) was recorded using an Apple iPad and Filemaker Pro database.

The basic health and condition criteria that were inspected for each tree can be summarised as follows: -

- Tree size, broad age-class and general balance of the tree;
- Above ground obstructions;
- Evidence of recent site disturbance;
- Canopy foliage size, colour and density;
- Dieback and epicormic growth;
- Trunk or branch wounding, branch tear outs and pruning history;
- Structural defects such as any co-dominant stems, cracks, splits, included bark, decay and
- Pests and disease evidence or occurrence.

All of the trees were photographed and given a unique identification number and plotted onto a scaled base plan for referencing and identification throughout the report and for future discussions and co-ordination. (Refer Appendix 4.1, Tree Protection and Removal Plans and Appendix 4.2 Tree Impact Assessment Schedule). The photographic record of trees and general site context was taken using the inbuilt Apple iPad camera and a Nikon Coolpix AW120 digital camera with GPS recording. Files have been resized, dated, named and filed in accordance with normal office procedures and protocols. No other image manipulation has been undertaken.

Tree trunk diameters were measured using a metric diameter tape measure. Tree heights were measured using the two point clinometer function of a Nikon Forestry Pro laser range finder. Canopy spreads were estimated by pacing out distances along the cardinal axis of the canopy and cross-referencing to survey information and recent aerial photos. Canopy position and extents were then altered on the plans to more accurately portray the canopy extent and position.

No exploratory excavations were done to determine location and or condition of roots and no detailed soil laboratory testing was undertaken. No specialised equipment or methods were employed to test for the extent of decay in any of the trees, apart from a nylon 'sounding' mallet. No plant samples were analysed or independently tested to verify or formally identify any pests or diseases.

Desktop Review and Research

Digital AutoCAD files of the proposed works were imported into Arterra's standard CAD software (ArchiCAD v21) and superimposed over the tree and site survey information. The extent of site disturbance was analysed for the proposed building works, landscaping, services and other site grading. An assessment was made of the likely extent of impacts on the TPZs, taking into account the likely construction impacts depending on the type of work being undertaken (ie: cut or fill, roadworks, suspended slabs, decks, service trenches). Various area calculations and measurements were made in the CAD software of the likely incursions into the TPZs or SRZs.

Recent aerial photography was data was obtained from the Nearmap website with aerial photos of the site dating from 18 January 2018 imported into the above software for cross checking and assessment. (http://www.nearmap.com/ accessed 7/6/2018)

Climatic data was obtained from the Bureau of Meteorology using statistics from Sydney Observatory Hill which is located approximately 11.5km south from the site. (http://www.bom.gov.au/climate/data/ accessed 15th October 2016)

1.9 Pre-Development Tree Assessment – Tree Retention Values

The information gathered in the field was tabulated and the tree retention value assessed using a combination of techniques commonly used and recognised in the arboricultural industry. The tree life expectancy was established using the Safe Useful Life Expectance (SULE) system. A brief summary of these systems is provided below.

SULE

This is a system developed by Jeremy Barrell in 1993 that determines the time a tree may be expected to be retained based on its age, health, condition, safety and location. This is then moderated by the economics of maintenance or other costs of retaining the tree. A long SULE means the tree is presently expected to live longer than 40 years with minimal intervention and cost. A short SULE indicates a tree that is not expected to live longer than 5 years or may require substantial intervention or costs to retain it.

RETENTION VALUE

The proposed retention value of the trees was determined based on a considered combination of the size, age, condition and suitability of the tree.

Each tree was then ranked according to one of 4 retention categories.

1. **"High" Retention Value** – these are trees that are typically in good or very good condition, large and visually prominent, historically or environmentally important. They may also be lesser quality trees, but part of an important grouping of trees. They should represent a serious physical constraint to the development and their removal avoided where possible and feasible.
2. **"Moderate" Retention Value** – these are trees that are in good to reasonable condition and should be retained where possible and feasible to do so. They may also be lesser trees, but part of an important grouping of trees and therefore warrant retention based on the groups value.
3. **"Low" Retention Value** – these are trees that are of poor condition or have structural defects, are particularly small or commonplace, are not historically, environmentally or socially significant and should not be considered as a constraint to the development. They could be retained only if they are not likely to be impacted by, or constrain potential desirable, development outcomes.
4. **"Should Remove" / No Retention Value** – these are trees that are in very poor health, or exhibit poor form, or have serious structural defects, are considered weeds or combination of these factors and therefore should be considered for removal regardless of any development.

Consideration has also been given to the relationship of the trees to one and other and their proximity to the proposed works. For example, trees that are part of a closely spaced group, or are likely to be significantly misshapen or unstable with the removal of surrounding trees and structures are considered with these factors in mind.

1.10 Tree Assessment – Tree Protection Zones

In order to ensure the long-term survival and growth of any trees to be retained on the development site, a suitable area is required to be protected around the tree. This area should typically be as large as possible. It should also take into consideration: -

- The size and age of the tree;
- Above and below ground properties;
- The health and condition of the tree;
- The species of tree and its tolerance to disturbance;
- Soil conditions, type, depth and site hydrology and
- Site-specific conditions and any existing obstructions to root development.

The Tree Protection Zones (TPZs) have been calculated using the formula and criteria outlined in AS 4970-2009 Protection of Trees on Development Sites. In summary the standard applies the calculation for the radius of the TPZ as 12 x (the tree trunk diameter (in metres) calculated at breast height (DBH)). DBH is taken at 1.4m above ground level.

A maximum TPZ radius will be 15m (unless crown protection is required) while the minimum TPZ radius shall be 2m.

The TPZ is typically assumed to be radial and centred on the centre of the tree's trunk unless other site factors or tree canopy size and location dictate an adjustment. Encroachments of up to 10% of the area may be accepted within the TPZ as long as it is outside of the Structural Root Zone (SRZ). This is known as a "minor encroachment". Encroachments greater than this, known as "major encroachments" will only be accepted with additional specific evidence that the tree will not be unduly impacted.

Whenever an encroachment is made into a TPZ, a suitable compensation should be made elsewhere and physically contiguous to the remaining TPZ.

The Structural Root Zone (SRZ) is the area defined as the minimum area required to retain the structural stability of the tree. The formula for calculating the SRZ is outlined in AS 4970, Section 3.3.5. No encroachment into the SRZ shall typically be allowed.

2.0 KEY FINDINGS & OBSERVATIONS

2.1 The Proposed Development

The proposed demolition and redevelopment will result in a major site disturbance. This will potentially have a significant impact on the trees within and adjacent to the site.

Specifically the proposed development will involve:-

- Major demolition works;
- Use of large scale civil and earthmoving equipment;
- Access to and from the site with large trucks and construction plant;
- Major excavations;
- Large stockpiles of excavated material and demolition waste;
- Stockpiles/ storage of building materials;
- Regrading and filling of the surface levels;
- Trenching for major services;
- Major building works involving shoring, piling, concreting, steelwork, painting and general construction;
- Use of large cranes;
- Parking for site personnel and deliveries;
- Paving and retaining walls and
- Landscaping.

Key Assumptions:-

- The provision of a slip lane off Condamine street will involve the re-grading and excavation of the verge area and potential relocation and trenching for services that may exist within the road reserve. A suitable verge and footway will have to be extended beyond the new kerb to facilitate pedestrian movement. The minimum width of such a verge would be 3.5m.
- All excavations close to retained trees are to be undertaken and retained using temporary sheet, soldier or contiguous piling techniques. Even relatively small excavations, when done near trees are to be retained using soldier piling or similar.
- Despite the above, the line of disturbance outside of the building line has been typically estimated at 3.0m from the face of the building to allow for provision of water proofing, services, construction access and scaffolding around the building during construction.
- All future services for the building will enter and exit the site in such a manner as to be clear of any retained trees' TPZs.
- All construction access and deliveries are to be made in such a manner as to avoid all TPZs. Concrete will typically be pumped from an appropriate location and will not require any trafficking through TPZs.
- Where no spot levels are indicated or shown it is assumed that the existing surface levels are retained.
- It is assumed that any new landscape grading within the TPZs will be very minimal.
- That traditional cantilevered retaining wall footings will be used (ie: footings extending to the rear of the face of the wall, and typically equalling the height of the wall).

2.2 Climate and Microclimate

Brookvale is located on the northern beaches of Sydney and therefore shares the general climate of this region with moderate temperatures, good rainfall and minimal climatic and weather extremes. It is typically described as a temperate climate with hot to warm summers and cool winters, with relatively uniform rainfalls greater than 800mm / year. There is no distinct dry season.

Brookvale is located approximately 2.6km from the ocean and the coastal beaches of Manly. It has an average annual rainfall of 1215mm, fairly evenly spread across the year but with a slightly drier period during the late winter and early spring months. The highest rainfall period is usually June with an average of 133mm and the driest month being September with an average of 68mm.

Maximum average daily temperatures range from 25.9ºC in January to 16.4ºC in July. The minimum average daily temperatures range from a high of 18.8ºC in February down to lows of 8.1ºC in July.
The primary wind direction is from the south-east to the north-east in the afternoons while it is predominantly from the west and south-west in the mornings. This is common of coastal areas dominated by "sea breeze" affects. Sea breezes are caused by unequal heating and cooling of adjacent land and sea surfaces. A sea breeze is one that blows from the sea to the land in consequence of this differential heating. With a weak general wind circulation, a sea breeze will commence over the coastline soon after the land temperature begins to exceed the

sea temperature (late morning to early afternoon). As the difference increases, so the sea breeze will become stronger and will extend farther inland. (Source: Australian Bureau of Meteorology)

The strongest winds (>40km/h) are normally experienced from the westerly directions and later in the day.

The site has a primarily easterly aspect being protected by Beacon Hill and Allambie Heights to the west as well as the building development on the western portion of the site, while it is more exposed to the weather approaching from the coast to the east and across the open space of the Warringah Golf Course to the southeast. The most prominent microclimatic influences on the site are the general protection offered by Beacon Hill and Allambie Heights to the west and the protection offered to the internal spaces of the Mall by the surrounding commercial development.

2.3 Soils and Landform

The site soils are likely to be highly disturbed, predominantly sandy, with little if any of the original soil profile remaining. The entire site area has been highly disturbed over the years, historically for farming and more recently, since the early 1960s, with the construction of the extensive commercial development known as Warringah Mall.

The high sand content results in soil with low available water holding capacity and soil that is not prone to compaction under trafficking. In general terms, the site soil should not be seen as a limiting or concerning factor in relation to tree retention or protection.

2.4 Tree Assessment - General

A total of **91** trees, being a mixture of endemic, native and exotic species, were assessed for this report. The trees proposed to be retained and protected are primarily situated around the perimeter street frontages of the site. Those trees proposed to be retained and the tree protection requirements are discussed in greater detail in Section 2.6 of the report.

Most of the trees located within the central area of the site have been recommended for removal due to the likely construction impacts. These trees are typically within the footprint of the construction or are likely to suffer unacceptable impacts as a result of the building construction, proposed changes in levels, construction of roadways or other associated infrastructure works. The trees proposed for removal and located within or adjacent to the footprint of the works have not been discussed at length in the report. Please refer to Appendix 4.1 Tree Protection & Removal Plans for graphical representation of the trees to be retained and those to be removed.

Detailed information on each tree including; species, height, trunk diameter, canopy spread, age class and condition are provided in Appendix 4.2 Tree Impact Assessment Schedule.

2.5 Tree Biology and Tree Care Basics

Trees are dynamic living organisms. Trees can be very susceptible to damage, stress and declining rapidly if overly impacted by construction. Trees take decades to grow but can be injured and killed in a very short time frame. This is particularly due to the irreparable damage to the often shallow, extensive and unseen root systems. It is rarely possible to repair a stressed or damaged tree, after the damage has occurred. Prevention of damage through proper protection is the key. Severing of roots within the Structural Root Zone (SRZ) can also lead to potentially unsafe instability of the tree as a structure.

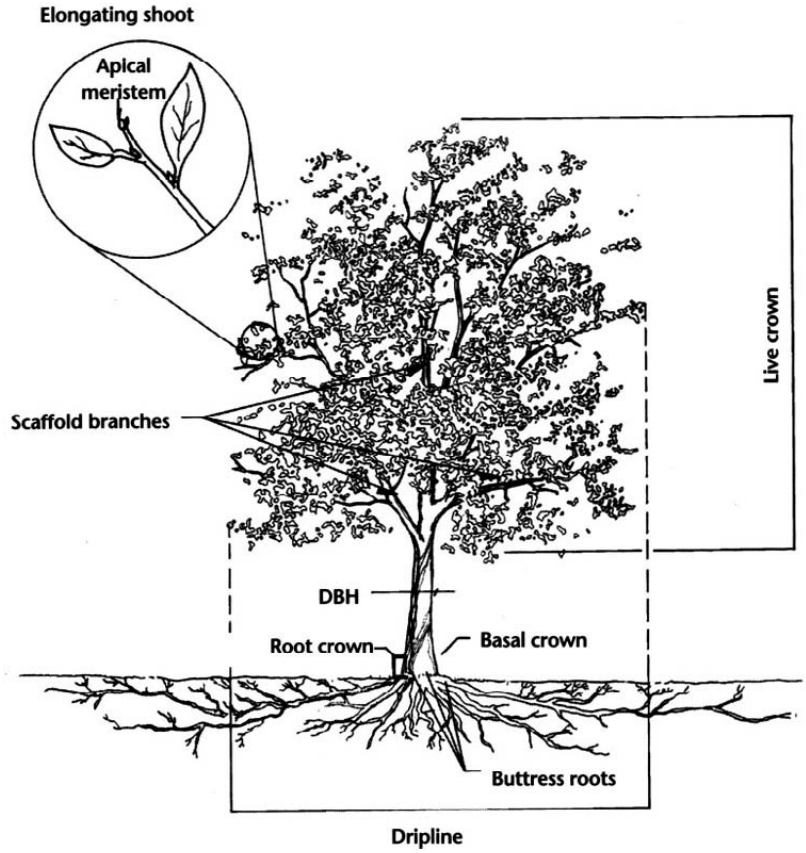


Figure 2 – Typical form and structure of a tree illustrating the typical form, location and extent of root growth (Source: Matheny and Clark, 1998)

Basic Tree Needs

As a living organism a tree remains alive by completing the following chemical reaction - Carbon Dioxide and water in combination with chlorophyll and light is converted to Glucose and Oxygen [$CO_2 + H_2O$ + light = sugar (CH_2O [Glucose]) + O_2]

The process ultimately leads to the plant cells 'respiring' and producing energy for survival, a natural requirement for all living cells. Anything that affects a plant's photosynthesis and then cellular respiration will affect the overall plant health. The limiting factors of photosynthesis and respiration will typically be the availability of oxygen, water and nutrients that make up the important chemical molecules and reactions.

Trees have five basic requirements to survive and grow:-

1. Oxygen (and particularly oxygen within the soil);
2. Water (a cellular necessity and primarily taken up by the tree roots);
3. Light & Sufficient Foliage (in order to photosynthesise and create the resources needed for cellular survival);
4. Soil (for physical anchorage and critical chemical nutrients) and
5. Physical Space (both above and below ground to grow).

Importantly, a minimum of 15% soil oxygen is required for active root growth and nutrient uptake. Less than 10% available soil oxygen starts to restrict root extension and growth and a minimum of 3% soil oxygen is required to just maintain root existence. Less than this will result in root death (Harris 1999).

One of the most insidious affects of construction on trees is often that of soil compaction or covering of root zones with impervious surfaces, as it:-

- Reduces infiltration rates of surface water;
- Reduces the availability of water to the roots as they can't naturally extract remaining moisture when soil becomes too dry;
- Reduces air to roots (roots cease to function properly and die without oxygen);
- Increased soil strength caused by compaction mean that roots need more energy to growth through it or can't even physically penetrate the soil;
- Roots are physically broken or crushed and there is increased potential for fungal and pathogen attack. (Harris 1999).

Tree Tolerance

Typically older and larger trees are less tolerant of construction impacts. Different species also have different tolerance of injury and disturbance. Importantly it needs to be stressed, that a tree does not "heal" from injury as animals do. Typically any injury made to a tree results in the tree expending considerable energy reserves to create new growth that "seals" and surrounds a wound and then attempting to compensate structurally and physically for any losses. Impacts to trees are therefore cumulative and a series of otherwise small and unrelated impacts can easily result in the death of a tree.

A tree that is already compromised or showing signs of stress is far less likely to tolerate construction impacts due to its lower levels of energy reserves and already weakened state. Therefore a tree that is only in a fair condition or poor condition is less likely to tolerate construction impacts than a young tree in good or excellent condition.

Weakened or stressed trees are also far less able to combat the myriad of normal environmental stresses and pathogens that are naturally imposed against them such as drought, decay, fungi, bacteria and insect pests.

2.6 Tree Impact Assessment

The intention of this assessment is to clearly illustrate the trees to be retained and removed as part of the development. It is also to determine any incursions into the retained trees' root zones and canopies by the proposed development and evaluate the likely impact of the proposed works on the trees.

Only the trees outside the actual footprint of the proposed works and that are likely to suffer some degree of impact have been discussed below together with the likely impacts to result from the proposed works. A graphical representation of the trees, tree protection zones and any likely incursions are shown in Appendix 4.1 Tree Protection and Removal Plans. A detailed listing of the incursions and likely impacts of the proposed development on each tree is shown in Appendix 4.2 Tree Impact Assessment Schedule.

The trees on site may be summarised as follows:

91 trees were assessed:-

- **30** (33%) trees are proposed to be retained;
- **56** (62%) trees are proposed to be removed as they are in the footprint of the proposed construction works or likely to suffer unacceptable impacts as a result of their proximity to the proposed works and associated changes in levels. They are clearly shown in Appendix 4.1 Tree Protection & Removal Plans.
- **5** (6%) trees (1 *Magnolia grandiflora*, 1 *Howea forsteriana*, 1 *Livistona australis, 1 Araucaria heterophylla, 1 Ficus rubiginosa*) are proposed to be transplanted and reused in the final landscaping.

Group (T105 – T123)

This is a group of 19 trees (**T105-T123**) situated along the south-eastern boundary of the site, from just north of the Old Pittwater Road intersection along Condamine Street to the end of the planting opposite the step in the Music Centre building. The group is comprised of a mixed planting of 9 x *Melaleuca quinquenervia* (Broad Leafed Paperbark), 3 x *Corymbia citriodora* (Lemon Scented Gum), 3 x *Eucalyptus botryoides* (Bangalay) and one each of *Callistemon salignus cv.* (Willow Bottlebrush), *Corymbia maculata* (Spotted Gum), *Eucalyptus robusta* (Swamp Mahogany), and *Cupaniopsis anacardioides* (Tuckeroo).

Most of these trees are within the grassed area and garden bed between the existing carpark and building to the west and the roadway of Condamine Street to the east.

There are major works proposed in the vicinity of the trees including reconfiguration of the carpark and widening of Condamine Street to accommodate a new slip lane for entry to the site. The widening of Condamine Street is proposed, running north from the intersection of Condamine Street and Old Pittwater Road at the southern end of the site. This will occupy much of the existing roadside verge and result in level changes. Level changes are also likely to be required to connect the slip lane with the internal access driveway. Due to this work, only three of the trees in this group can be retained. The road widening and change in level between the existing grades, the necessary construction of a retaining wall between the existing music centre carpark and the adjacent slip lane will result in major incursions to the root zones of the other trees.

The trees to be retained, trees **T106, T107** and **T111** are situated just beyond the area likely to be impacted by these road works and are proposed to be retained and protected. **T111** is likely to experience a minor encroachment within the nominal TPZ of 9.7%. The impacts are expected to be minor and unlikely to have any significant long-term effect on the condition of tree. The remaining 16 trees in this group are proposed for removal to facilitate the slip lane and provide appropriate sight lines for vehicles entering the site. Appropriate replacement tree planting is proposed to compensate for these tree removals.

Please refer to Appendix 4.1 Tree Protection and Removal Plans for a graphical representation of the nominal group TPZ and the likely minor incursion to tree **T111**.

Figure 3 – View south along Condamine Street toward Old Pittwater Road intersection. The trees at right of frame are in conflict with the proposed new slip-lane and site entry. (Image: Arterra)

Group (T1-T4)

A group of 4 x *Livistona australis* (Cabbage Palm) (T1-T4), located at the northern end of the site on the Pittwater Road frontage, will be outside the area directly impacted by the proposed works. They are mature palms in good condition, unlikely to experience any negative impacts resulting from the proposed works. They are to be retained and protected to compliment the proposed landscape scheme.

Figure 4 – Group (T1-T4) - View to west from Condamine Street toward Bunnings. (Image: Arterra)

Group (T157, T158 & T168-T173)

This group of 8 trees is situated adjacent to the northern portion of the new bus interchange on Condamine Street. Trees **T168** *Araucaria heterophylla* (Norfolk Island Pine) and **T170** *Ficus rubiginosa* (Port Jackson Fig) are both newly planted and young trees. They are located within the footprint of a proposed pedestrian pathway that will provide the main access from the bus interchange to the Centre. These two young trees are proposed to be transplanted elsewhere within the proposed finished landscape scheme. The other six trees in the group are beyond the area impacted by the proposed works and are proposed to be retained and protected throughout the course of construction.

Figure 5 – Group (T157, T158 & T168-T173) - View to west from Condamine Street toward Bunnings. (Image: Arterra)

Group (T154-T156, T159-T162 & T174-T176)

This group of 10 trees is situated adjacent to the southern portion of the new bus interchange on Condamine Street. These trees are beyond the area impacted by the proposed works and are proposed to be retained and protected throughout the course of construction.

Figure 6 –Group (T157, T158, T168-T173) - View to north west from Condamine Street near the current vehicular entry to the centre. (Image: Arterra)

Trees Proposed for Transplant

The following 5 trees are proposed to be transplanted and used within the proposed finished landscape scheme of Stage 2. Each of the species are known to be tolerant of transplanting and the individual trees are in good condition and likely to survive and thrive if prepared appropriately and then relocated and maintained with due care.

- *Livistona australis* Cabbage Palm **T124**, currently situated within a garden bed that will be in the footprint of the proposed works.
- *Magnolia grandiflora* (American Bull Bay Magnolia) **T133** currently situated within a garden bed that will be in the footprint of the proposed works.
- *Howea forsteriana* (Kentia Palm) **T139** currently situated within a garden bed that will be in the footprint of the proposed works.
- **T168** *Araucaria heterophylla* (Norfolk Island Pine) and **T170** *Ficus rubiginosa* (Port Jackson Fig) are both noted above, situated adjacent to the northern bus interchange.

Refer Appendix 4.1 Tree Protection and Removal Plans for tree protection details.
Refer to Appendix 4.2 Tree Impact Assessment Schedule for details of individual trees.

2.7 Potential Tree Related Impacts to be Managed During Construction

The main potential impacts from the proposed construction activity can be summarised as tree damage and 'reduced life expectancy' caused by:-

- Root loss and disturbance due to excavation for the building foundations, driveways, basement and other significant underground infrastructure;
- Compaction of the root zone from storage and stockpiling of materials;
- Contamination of the soil from; the preparation of chemicals, wash down/ cleaning of equipment, refuelling of vehicles and dumping of waste;
- Compaction of the root zone from haul roads, access routes and the parking of vehicles/ plant equipment;
- Root disturbance from cut and fill and soil level changes;
- Physical damage to the tree trunks and branches from passing machinery;
- Damage to the tree roots from landscaping and pedestrian pathway construction.

The following Section provides recommendations and proposed measures that aim to minimise and avoid these impacts as much as realistically possible.

3.0 TREE MANAGEMENT RECOMMENDATIONS

3.1 Key Recommendations to Reduce Tree Impacts

In order to adequately protect the trees proposed to be retained, appropriate tree protection measures will need to be implemented for the duration of all major construction work.

Please refer to Appendix 4.1 - Tree Protection and Removal Plans and Appendix 4.2 Tree Impact Assessment Schedule for tree protection details and a graphical representation of the nominal TPZs, trees removed, trees retained and trees to be transplanted.

The proposed tree protection specifications are fully outlined on Drawing ART-T-01 "Tree Protection Specifications". This drawing should be referenced via Council conditions to ensure tree protection is adequately carried out and maintained for the duration of the works.

3.2 Palms To Be Removed and Transplanted

In the course of reviewing and assessing the groups of trees discussed in Section 2.6 above, a number of trees and palms (5 in total) were identified as being very suitable for transplanting and incorporation within the proposed new landscape scheme. These trees and palms are to be carefully lifted, removed and stored on-site for re-use in the final Stage 2 landscapes. Please refer to Appendix 4.1 and Appendix 4.2 for details.

Transplanting is to be undertaken by an experienced tree transplanting company, and their transplant methodology is to be approved by the Project Consulting Arborist prior to commencement of the transplant works. Suitable containerisation, maintenance and the provision of a temporary automatic watering shall be applied while the trees and palms are stored, and awaiting final re-planting.

3.3 Proposed Tree Protection & Construction Activity Sequencing

The following sequence of activities shall be followed for this project: -

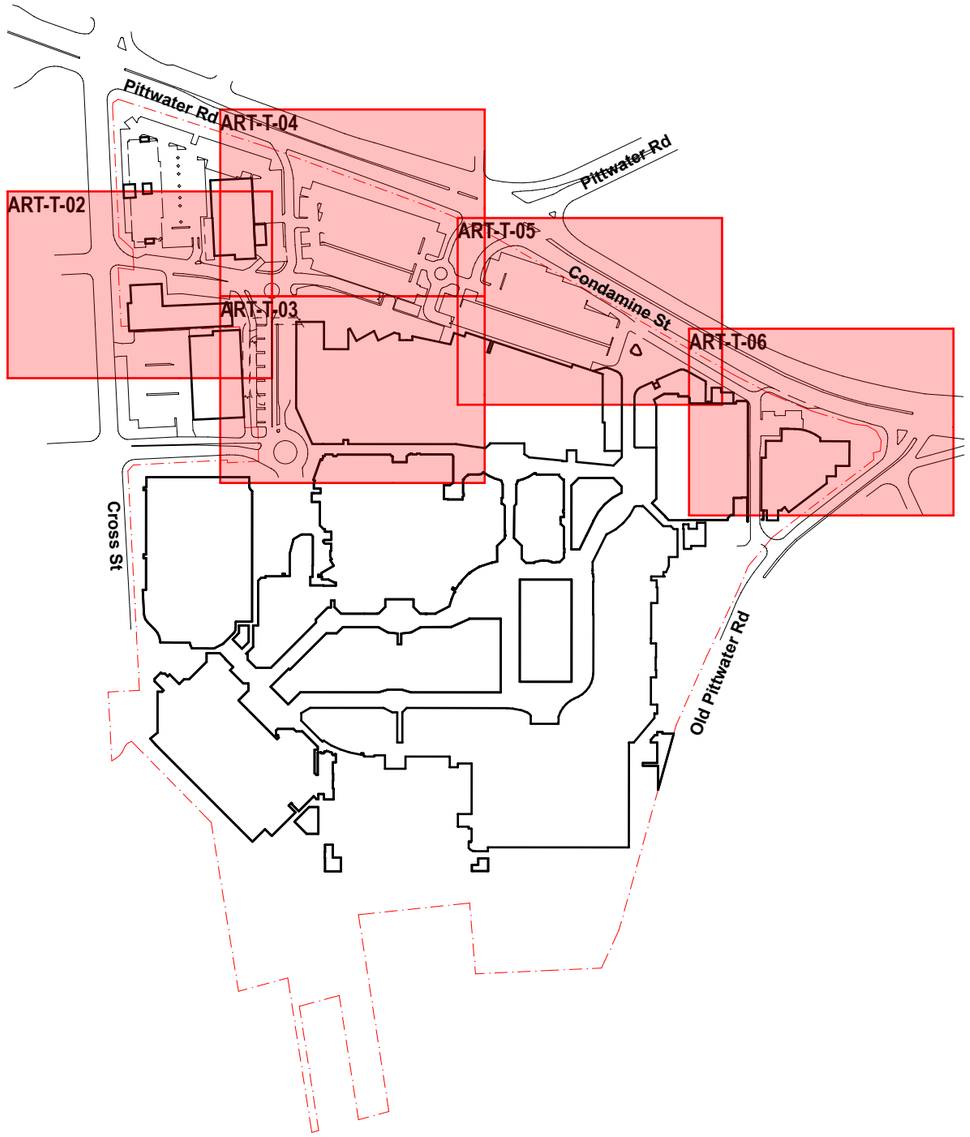
1. Tree Protection and Removal Plans are to be issued as part of the construction contract prior to any further construction work commencing.
2. Palms and other trees to be transplanted shall be excavated, lifted, containerised and moved to a suitable temporary holding area on site, awaiting final planting areas to be prepared.
3. Trees to be removed shall be cleared. When trees are removed in close proximity to retained trees, the remnant stumps shall be ground out to avoid damage to any intertwined roots of the trees retained. Excavators and the like shall not be used to grub out stumps, which may lead to damage of any intertwined and roots.
4. The Project Consulting Arborist, Landscape Architect, Civil and Structural Engineers, Client and Contractors Site Foreman are to meet prior to beginning any work on the site to discuss and review all work procedures, construction access routes, stockpiling and tree protection measures (ie: fence types and locations, access, cranage points, piling methods etc.).
5. The Construction Phase TPZs shall be defined and fenced off with a 1.8m high, metal or plywood temporary fence prior to any further work within the vicinity of the trees.
6. Designated TPZs shall be mulched with 75mm of recycled hardwood woodchip mulch to improve soil conditions around tree and remain in place until future proposed landscaping occurs (only if not already mulched).
7. Building works to be undertaken and completed (external).
8. Contractor to remove the TPZ fencing and then install final pathways and landscaping within the TPZs, but only after the primary construction of the building exterior and civil works is completed.

3.4 References

- Harris, R.W, Clark, J.R & Matheny, Nelda P, 1999*, Arboriculture: Integrated management of landscape trees, shrubs and vines*. 3rd Ed. Prentice Hall. New Jersey, US
- Matheny, Nelda P and Clark J.R, 1998, *Trees and development - a technical guide to preservation of trees during land development*, International Society of Arboriculture, Illinois, US.
- Roberts, J. Jackson, N. and Smith, M. 2006. *Tree roots in the built environment. No.8* Research for Amenity Trees, Dept. for Communities and Local Government, London.
- Standards Australia, 2007, *AS 4373-2007 Pruning of amenity trees*. Standards Australia, Sydney.
- Standards Australia, 2009, *AS 4970-2009 Protection of Trees on Development Sites*. Standards Australia, Sydney.
- Standards Australia, 2007, AS 4687-2007 *Temporary fencing and hoardings*. Standards Australia, Sydney.

4.0 APPENDICES

4.1 Tree Protection & Removal Plans



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PROJECT & CLIENT

Warringah Mall Stage 2

Stage 2
Lot 100, DP1015283, 145 Old Pitwater Rd Brookvale NSW 2100

Prepared for :
Scentre Design & Construction Pty Ltd

Arboricultural Plans

DRAWING INDEX

Drawing No:	Drawing Name	Current Rev.
ART-T-00	Cover Sheet	A
ART-T-01	Tree Protection Specifications	A
ART-T-02	Tree Protection and Removal Plan	A
ART-T-03	Tree Protection and Removal Plan	A
ART-T-04	Tree Protection and Removal Plan	A
ART-T-05	Tree Protection and Removal Plan	A
ART-T-06	Tree Protection and Removal Plan	A

DATE :
12 July 2018

ISSUE :
FOR DEVELOPMENT APPLICATION

TREE PROTECTION SPECIFICATIONS

1. Tree Protection Measures and Protocols.
All work around existing trees to be retained shall be in accordance with AS 4970-2009 Protection of trees on development sites with the clear establishment of the required Tree Protection Zones (TPZ's). If the scope of work allowed within or the extent of the Tree Protection Zones of existing trees is not clear, please refer to the Contract Manager or Project Consulting Arborist for clarification.

Before any site works commence tree protection zones and other measures must be established and conveyed to those all working on the site. The Contractor shall ensure all subcontractors are inducted prior to working on the site. All inductions shall include description and identification of the Tree Protection Zones and the restriction on work and activities with regard to trees.

Damage to roots or degradation of the soil through compaction and/or excavation within TPZ's is likely to cause serious damage to the tree. Any work operations required within TPZ's must be carried out with extreme care. All trees, palms and other shrubs within TPZ's are to be retained unless shown otherwise on the Tree Protection Plan(s). Trees marked for retention shall not be used to display signage, or as fence or cable supports for any reason. No materials stockpiling, chemicals or washout areas are permitted immediately upslope of or within the Tree Protection Zone. The washing down of wheel barrows, paint cans/ brushes, acids and the like shall not to be done near existing trees as the runoff is very harmful to tree roots.

No fuel powered pumps or generators or air compressors are to be placed within TPZ's. No fuel or chemicals shall be stored and no equipment or vehicles shall be serviced or re-fuelled within a TPZ.

2. Controlled Construction Access
Construction access points, stockpiling and storage areas shall be clearly identified on site and fenced off where appropriate. Uncontrolled access and parking of vehicles inside TPZ's shall be avoided. If access is required through a tree protection zone, the access way shall be treated with ground protection.

3. Tree Protection Fencing & Signage
The Tree Protection Plan(s) shows the extent of areas to be fenced and protected. Protection measures shall be certified as adequate by the Project Consulting Arborist. This fencing may form part of the general construction site fencing, where practical. It shall remain in place as long as possible and typically not be removed until the final landscape installation in those areas begins.

All tree protection fencing shall be 1800mm high galvanised chain wire or welded steel mesh. Fencing must be bolted together and secured with the necessary back stays and bracing.

Star pickets with bunting or danger tape shall not constitute acceptable tree protection fencing.

Suitable signage as defined by AS 4970-2009 Appendix C shall be affixed to the external side of the fencing at a spacing of not less than 1 sign per 20 lineal metres of fence.

If fence locations conflict with the proposed works, contact the Project Consulting Arborist and Contract Manager for resolution. No new services (unless under-bored) shall be located within or through the Tree Protection Zone.

4. Trunk and Lower Branch Protection
A trunk barrier is to be erected around the circumference of the tree trunk and root buttress where shown. This barrier will consist of a double layer of used carpet or carpet underfelt placed around the trunk. A layer of battens is to be placed over the underfelt. The battens are to have a maximum spacing of 50mm. The height of the battens is to be 2 metres or to the height of the first branches. Lower large branches may require the same protection if likely to be damaged by passing vehicles or equipment. Secure in place with galvanised steel bracing straps. Do not nail into or otherwise injury the trunk or bark. Battens may be made from any suitable waste timber of similar sizes and depths. All sharp or protruding edges are to be properly covered with tape or similar padding.

5. Works within the TPZ
All work within the root zone of existing trees shall be undertaken with the utmost care. If by necessity a tree requires removal of branches for building or access, pruning shall be done in strict accordance with accepted arboriculture techniques and AS 4373-2007. No rubbish, spoil or new materials shall be placed on the root zone of any existing tree or against their trunks.

6. Ground Protection
If it is proposed to create any access route, or similar, within the TPZ of a retained tree, the Contractor shall install rumble boards over the TPZ ground surface. No excavation shall be allowed. Contractor shall first place a suitable permeable geotextile to the extent required and then a 100mm thick layer of wood chip mulch or coarse no-fines gravel over the extent to be covered. Then place hardwood boards (minimum 3600 x 200 x 75mm) on their flat edge, side by side, with a 30 - 50mm gap to form a rumble strip. These boards are to be held together with three galvanised metal bracing straps nailed to each board. The two outer straps are to be approximately 200mm in from the ends of the boards. The third strap is to be along the centre line of the boards.

7. Structural Demolition Within TPZ's
Project Consulting Arborist shall be on site during all demolition work within the TPZ's to monitor and advise on tree protection. Secateurs and a handsaw shall be available to deal with and cleanly cut any exposed roots that have to be cut. Machines with a long reach may be used if they can work from outside TPZ's or from protected areas within TPZ's. They shall not encroach onto unprotected soil in TPZ's.

Debris to be removed from TPZ's must be moved across existing hard surfacing or temporary ground protection in a way that prevents compaction and disturbance of soil. Alternatively, it can be lifted out by machines provided this does not disturb TPZ's or damage the canopy. If appropriate, leave below ground structures such as footings and disused pipes in place if their removal will cause excessive root disturbance.

When pulling up existing paving the Contractor shall work backwards, lifting demolished paving back onto the existing paving. Roots may be found growing under the pavement and should not be trafficked. Roots growing into existing sub-base should be left and new surface finishes placed over the top without disturbance.

8. Excavations or Trenching within TPZ's
Excavation within TPZ's shall not be allowed using mechanical equipment such as excavators or backhoes. Excavation within TPZ's shall only be carried out carefully by hand taking care not to damage the bark and wood of any roots. Specialist tools for removing soil around roots using compressed air (air spade), or water vacuum extraction shall be an appropriate alternative to hand digging and is the preferred method.

Exposed roots to be removed shall be cut cleanly with a sharp saw or secateurs at the face of the excavation. Roots temporarily exposed must be protected by appropriate covering with damp hessian or sand. Roots greater than 50mm in diameter are to be retained and shall only be cut in exceptional circumstances and only after consultation with the Project Consulting Arborist. Roots greater than 100mm in diameter shall typically not be allowed to be cut and must be worked around.

9. Soft Landscaping Installation
Final trimming and planting shall be judiciously undertaken around trees. All soft landscaping within the tree protection zones will be installed with care to avoid root disturbance from irrigation trenching, lighting installation and the planting of larger plants. Permanent irrigation (if used) shall be installed as spray heads located outside of TPZ's and spraying inwards. All other services such as small-scale electrical services shall also be designed and installed to avoid any excavation or trenching around the trees.

No significant excavation or cultivation, especially by rotary hoes or excavators, shall occur within TPZs. Where new designs require the levels to be increased, good quality and permeable top soil shall be used. It should be firmed into place but not over compacted. All areas close to tree trunks shall be kept at the original ground level. Where turf is to be installed tree trunks shall have mulched rings applied rather than grass laid up to the trunk.

The size of the installed plants shall typically be less than 5L pots so that the maximum depth of the new root balls is less than 200mm. Any planting proposed that is larger than this shall be only installed outside of the SRZ and with care to not injure roots while digging planting holes.

10. Canopy Pruning
The Contractor shall prune branches of protected trees only as directed by the Project Consulting Arborist. Pruning is only to be undertaken by a qualified arborist (under the supervision of a person with AQF Level 4 or above). The Project Consulting Arborist is to be at present at all times during the pruning work. Work is to be in strict accordance with to AS4373 Pruning of Amenity Trees. Do not treat wounds.

11. Root Pruning
Pruning of roots of protected trees shall only be as directed the Project Consulting Arborist. The Tree Contractor shall use only a qualified arborist (AQF Level 4 or above). The Project Consulting Arborist is to be present at all times during the root pruning.

Roots are not to be cut using normal excavation machinery of any sort. This usually results in splitting and massive disturbance well past the intended line of cut. When required to cut roots, use hand methods and sharp hand tools (e.g. secateurs, hand saw) such that the remaining root systems are preserved intact and undamaged. Roots are to be cut back by hand square to the direction of the root travel (or edge of the excavation). Do not cut any tree roots exceeding 50mm diameter unless permitted. Excavations within root zones should be kept open for as short a period as possible. Any excavated face containing roots is to be temporarily supported, where necessary, to prevent soil loss from around the other retained roots.

12. Accidental Tree Damage
Should a tree be accidentally damaged, the Contractor shall immediately notify the Project Consulting Arborist. Timing can be of the essence, particularly with bark injuries, trunk damage or chemical contaminations.

If a branch has been broken, it shall be removed and the damaged end pruned to a suitable branch collar. If the branch has been torn out of the trunk, assessment shall be made and the damage cleaned up by as much as possible without further damage to the tree.

If roots are accidentally disturbed or excavated, any broken, crushed and torn sections shall be exposed and pruned leaving clean cuts to minimise risk of infection by fungal pathogens and promote good conditions for new root growth.

Example image of acceptable ground protection rumble boards

Example image of acceptable tree tree protection battens

Example image of acceptable tree protection fencing measures to be applied.
(1.8m high rigid metal fencing with appropriate lateral bracing)

Westfield Warringah Mall - Stage 2, Brookvale - Tree Impact Assessment Schedule

Tree ID	Tree Species	Common Name	Trunk Diameter Breast Height (dbh) (m)	Trunk Diameter at base (dgl) (m)	Nominal TPZ radius (m) 12xdbh (AS 4970)	Nominal SRZ radius (m) (AS 4970)	Retention Value	Recommendation
1	*Livistona australis*	**Cabbage Palm**	0.60	0.67	3.00	2.80	**Moderate**	Retain and Protect
2	*Livistona australis*	**Cabbage Palm**	0.40	0.47	3.00	2.41	**Moderate**	Retain and Protect
3	*Livistona australis*	**Cabbage Palm**	0.47	0.53	3.00	2.53	**Moderate**	Retain and Protect
4	*Livistona australis*	**Cabbage Palm**	0.40	0.48	3.00	2.43	**Moderate**	Retain and Protect
57	*Dypsis decaryi*	**Triangle Palm**	0.35	0.35	2.50	2.13	**Low**	Retain and Protect
58	*Elaeocarpus reticulatus x 5*	**Blueberry Ash**	0.18	0.23	2.16	1.79	**Low**	Remove
60	*Eucalyptus microcorys*	**Tallowood**	0.77	0.94	9.24	3.22	**High**	Remove
105	*Callistemon salignus cv.*	**Willow Bottlebrush**	0.65	0.68	7.80	2.81	**Moderate**	Remove
106	*Corymbia citriodora*	**Lemon Scented Gum**	0.44	0.56	5.28	2.59	**Moderate**	Retain and Protect
107	*Corymbia citriodora*	**Lemon Scented Gum**	0.37	0.51	4.44	2.49	**Moderate**	Retain and Protect
108	*Corymbia citriodora*	**Lemon Scented Gum**	0.33	0.44	3.96	2.34	**Moderate**	Remove
109	*Eucalyptus botryoides*	**Bangalay**	0.68	0.84	8.16	3.08	**High**	Remove
110	*Eucalyptus botryoides*	**Bangalay**	0.40	0.51	4.80	2.49	**Moderate**	Remove
111	*Eucalyptus botryoides*	**Bangalay**	0.58	0.68	6.96	2.81	**High**	Retain and Protect
112	*Melaleuca quinquenervia*	**Broad Leafed Paperbark**	0.44	0.50	5.28	2.47	**Moderate**	Remove
113	*Melaleuca quinquenervia*	**Broad Leafed Paperbark**	0.64	0.81	7.68	3.03	**Moderate**	Remove
114	*Melaleuca quinquenervia*	**Broad Leafed Paperbark**	0.40	0.54	4.80	2.55	**Moderate**	Remove
115	*Corymbia maculata*	**Spotted Gum**	0.60	0.75	7.20	2.93	**High**	Remove
116	*Eucalyptus robusta*	**Swamp Mahogany**	0.23	0.30	2.76	2.00	**High**	Remove
117	*Melaleuca quinquenervia*	**Broad Leafed Paperbark**	0.48	0.72	5.76	2.88	**Moderate**	Remove
118	*Melaleuca quinquenervia*	**Broad Leafed Paperbark**	0.60	0.70	7.20	2.85	**Moderate**	Remove
119	*Melaleuca quinquenervia*	**Broad Leafed Paperbark**	0.66	0.66	7.92	2.78	**Moderate**	Remove
120	*Melaleuca quinquenervia*	**Broad Leafed Paperbark**	0.92	0.99	11.04	3.30	**Moderate**	Remove
121	*Melaleuca quinquenervia*	**Broad Leafed Paperbark**	0.62	0.70	7.44	2.85	**Moderate**	Remove
122	*Melaleuca quinquenervia*	**Broad Leafed Paperbark**	0.52	0.72	6.24	2.88	**Moderate**	Remove
123	*Cupaniopsis anacardioides*	**Tuckeroo**	0.35	0.45	4.20	2.37	**Moderate**	Remove
124	*Livistona australis*	**Cabbage Palm**	0.33	0.51	3.96	2.49	**Moderate**	Transplant
125	*Cupaniopsis anacardioides*	**Tuckeroo**	0.22	0.27	2.64	1.91	**Low**	Remove
126	*Melaleuca quinquenervia*	**Broad Leafed Paperbark**	0.33	0.41	3.96	2.28	**Low**	Remove
127	*Melaleuca quinquenervia*	**Broad Leafed Paperbark**	0.48	0.51	5.76	2.49	**Low**	Remove
128	*Melaleuca quinquenervia*	**Broad Leafed Paperbark**	0.52	0.51	6.24	2.49	**Low**	Remove
129	*Cupaniopsis anacardioides*	**Tuckeroo**	0.20	0.22	2.40	1.75	**Low**	Remove
130	*Cupaniopsis anacardioides*	**Tuckeroo**	0.24	0.29	2.88	1.97	**Low**	Remove
131	*Cupaniopsis anacardioides*	**Tuckeroo**	0.30	0.33	3.60	2.08	**Moderate**	Remove
132	*Cupaniopsis anacardioides*	**Tuckeroo**	0.28	0.29	3.36	1.97	**Moderate**	Remove
133	*Magnolia grandiflora*	**American Bull Bay Magnolia**	0.26	0.35	3.12	2.13	**Moderate**	Transplant
134	*Acacia saligna*	**WA Golden Wattle**	0.22	0.31	2.64	2.02	**Low**	Remove
135	*Elaeocarpus reticulatus x 20*	**Blueberry Ash**	0.14	0.17	2.00	1.57	**Low**	Remove
136	*Corymbia citriodora*	**Lemon Scented Gum**	0.48	0.72	5.76	2.88	**Low**	Remove
137	*Corymbia citriodora*	**Lemon Scented Gum**	0.80	1.15	9.60	3.51	**V Low / Remove**	Remove
139	*Howea forsteriana*	**Kentia Palm**	0.19	0.26	2.28	1.88	**High**	Transplant
141	*Tristaniopsis laurina*	**Water Gum**	0.17	0.18	2.04	1.61	**Low**	Remove
144	*Eucalyptus grandis*	**Flooded Gum**	0.42	0.57	5.04	2.61	**Moderate**	Retain and Protect
145	*Eucalyptus grandis*	**Flooded Gum**	0.62	0.92	7.44	3.20	**High**	Retain and Protect
146	*Eucalyptus grandis*	**Flooded Gum**	0.41	0.47	4.92	2.41	**Moderate**	Retain and Protect
147	*Livistona australis*	**Cabbage Palm**	0.40	0.61	3.00	2.69	**High**	Retain and Protect
148	*Livistona australis*	**Cabbage Palm**	0.40	0.54	3.00	2.55	**High**	Retain and Protect
149	*Livistona australis*	**Cabbage Palm**	0.40	0.86	3.00	3.11	**High**	Retain and Protect
154	*Livistona australis*	**Cabbage Palm**	0.00	0.56	2.00	2.59	**Moderate**	Retain and Protect
155	*Livistona australis*	**Cabbage Palm**	0.00	0.39	2.00	2.23	**Moderate**	Retain and Protect
156	*Phoenix canariensis*	**Canary Island Date Palm**	0.00	0.74	2.00	2.92	**Moderate**	Retain and Protect
157	*Fraxinus pennsylvanica?*	**Red Ash**	0.24	0.36	2.88	2.15	**Low**	Retain and Protect
158	*Fraxinus pennsylvanica?*	**Red Ash**	0.22	0.29	2.64	1.97	**Low**	Retain and Protect
159	*Livistona australis*	**Cabbage Palm**	0.00	0.53	2.00	2.53	**Moderate**	Retain and Protect
160	*Livistona australis*	**Cabbage Palm**	0.00	0.34	2.00	2.10	**Moderate**	Retain and Protect
161	*Livistona australis*	**Cabbage Palm**	0.00	0.49	2.00	2.45	**Moderate**	Retain and Protect
162	*Livistona australis*	**Cabbage Palm**	0.00	0.48	2.00	16.82	**Moderate**	Retain and Protect
163	*Xylosma senticosum*	**Shiny Xylosma**	0.37	0.45	4.44	2.37	**Moderate**	Remove
167	*Michelia champaca*	**Champaca**	0.57	0.63	6.84	2.73	**Low**	Remove
168	*Araucaria heterophylla*	**Norfolk Island Pine**	0.07	0.10	2.00	1.26	**Moderate**	Transplant
169	*Ficus rubiginosa*	**Port Jackson Fig**	0.07	0.10	2.00	1.26	**Moderate**	Retain and Protect
170	*Ficus rubiginosa*	**Port Jackson Fig**	0.07	0.10	2.00	1.26	**Moderate**	Transplant
171	*Ficus rubiginosa*	**Port Jackson Fig**	0.07	0.10	2.00	1.26	**Moderate**	Retain and Protect
172	*Ficus rubiginosa*	**Port Jackson Fig**	0.10	0.12	2.00	1.36	**Moderate**	Retain and Protect
173	*Ficus rubiginosa*	**Port Jackson Fig**	0.10	0.12	2.00	1.36	**Moderate**	Retain and Protect
174	*Lophostemon confertus*	**Brush Box**	0.05	0.07	2.00	1.08	**Moderate**	Retain and Protect
175	*Araucaria heterophylla*	**Norfolk Island Pine**	0.07	0.10	2.00	1.26	**Moderate**	Retain and Protect
176	*Araucaria heterophylla*	**Norfolk Island Pine**	0.07	0.10	2.00	1.26	**Moderate**	Retain and Protect

NOTE
Refer to the accompanying Arboricultural Impact Assessment Report for full description of trees, measurements and methods used to assess the trees, and proposed tree protection measures.

REVISION	DESCRIPTION	CHKD	DATE
A	For Development Application	RWS	12/07/18

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SUITE 602 / 51 RAWSON STREET, EPPING, NSW 2121
P 02 9957 2466 **F** 02 9957 3977 **W** ARTERRA.COM.AU

PROJECT & CLIENT
Warringah Mall Stage 2
Scentre Design & Construction Pty Ltd

Project No : 16.36
Designed : RWS
Drawn : RWS/CB
Scale : N/A

DRAWING TITLE
Tree Protection Specifications

DRAWING NUMBER
ART-T-01

REVISION
A

Plotted at : 10:11 am 12/7/18

ART-T-02

CROSS STREET

DALE STREET

CROSS STREET

REFER TO ART-T-04

REFER TO ART-T-03

ART-T-03

T57

T147

T148

T149

T145

T146

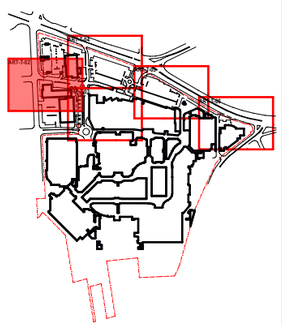
T144

T58x5

Tree Impact and Protection Plan Legend

- Existing Tree Retained — Extent of canopy as verified by site measure and aerial photos
- Existing Tree Removed (Note: no TPZ's shown for these trees)
- Existing Tree to be transplanted to new location
- Tree (yet to be installed) requiring to be removed
- T26 — Tree Identification Number
- Construction Period Tree Protection Zone - consolidated area
- Tree Protection Zone temporary fencing
- Trunk Protection Battens to be installed
- Ground Protection- Rumble Boards to be installed
- Loss of roots due to excavation or trenching
- Surface impact to be managed - minimal root loss expected
- Nominal Tree Protection Zone Radius (TPZ) (only shown where relevant)
- Nominal Structural Root Zone (SRZ) (only shown where relevant)
- Proposed Future Building
- Proposed Future Building Over
- Extent of major site disturbance/ grading
- Extent of tree assessment study area

NOTE
Refer to the accompanying Arboricultural Impact Assessment Report for full description of trees, measurements and methods used to assess the trees, and proposed tree protection measures.



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0 5 10 25m

REVISION	DESCRIPTION	CHKD	DATE
A	For Development Application	RWS	12/07/18

PROJECT & CLIENT
Warringah Mall Stage 2
Scentre Design & Construction Pty Ltd

Project No : 16.36
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Drawn : RWS/CB
Scale : 1:250@A1 , 1:500@A3

DRAWING TITLE
Tree Protection and Removal Plan

DRAWING NUMBER
ART-T-02

REVISION
A

Plotted at : 10:11 am 12/7/18

ART-T-03

REFER TO ART-T-02

TREES NEED TO BE REMOVED FOR BUILDING/GRADING AND SERVICES CONNECTION

T60

T139

T141

T135x20

T134

T133

PITTWATER ROAD

REFER TO ART-T-05

GREEN STREET

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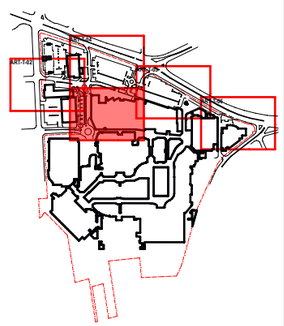

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Scentre Design & Construction Pty Ltd

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DRAWING TITLE
Tree Protection and Removal Plan

DRAWING NUMBER
ART-T-03

REVISION
A

Plotted at : 10:11 am 12/7/18

ART-T-04

ART-T-05

REFER TO ART-T-02

REFER TO ART-T-03

REFER TO ART-T-05

ART-T-03

T1 T2 T3 T4 T58x5 T136 T137 T154 T155 T156 T157 T158 T159 T160 T161 T162 T168 T169 T170 T171 T172 T173 T174 T175 T176

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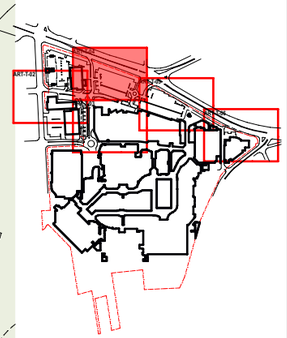

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DRAWING TITLE
Tree Protection and Removal Plan

DRAWING NUMBER
ART-T-04

REVISION
A

Plotted at : 10:12 am 12/7/18

ART-T-05

ART-T-06

REFER TO ART-T-03

REFER TO ART-T-06

T163 T167 T132 T131 T130 T129 T128 T125 T127 T126 T124

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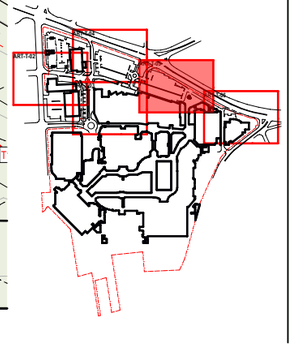

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DRAWING NUMBER
ART-T-05

REVISION
A

Plotted at : 10:12 am 12/7/18

ART-T-06

REFER TO ART-T-05

Existing pathways to be carefully removed to ensure existing levels are retained. Minimal root impact expected.

Assumed root loss due to excavation for additional vehicular slip lane. Level is approx. 300mm below existing ground levels. A low retaining wall shall be built adjacent the new footpath to retain existing ground levels around the trees.

T121 T119 T122 T116 T120 T118 T117 T123 T115 T114 T113 T112 T108 T110 T109 T111 T107 T105 T106

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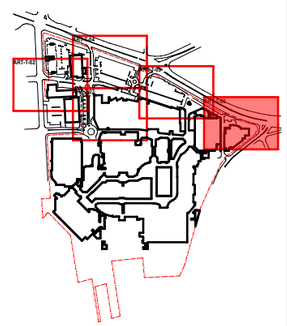

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ART-T-06

REVISION
A

Plotted at : 10:12 am 12/7/18

4.2 Tree Impact Assessment Schedule

Westfield Warringah Mall - Stage 2, Brookvale - Tree Impact Assessment Schedule

Tree ID	Tree Species	Common Name	Height (m)	Clearance to underside (m)	Spread North (m)	Spread West (m)	Spread South (m)	Spread East (m)	Trunk Diameter Breast Height (dbh) (m)	Trunk Diameter at base (dgl) (m)	Nominal TPZ radius (m) 12xdbh (AS 4970)	Nominal SRZ radius (m) (AS 4970)	Age Class	Current Vigour	Current Form	Noted Defects	SULE Rating	Retention Value	General Comments and Notes	Incursion and Impact	Recommendation
1	*Livistona australis*	**Cabbage Palm**	6.0	6.0	2.0	2.0	2.0	2.0	0.60	0.67	3.00	2.80	Mature	Good	Good		Long (>40 years)	**Moderate**	Group of 4 palms.	Outside of proposed work zone. Nil impact expected	Retain and Protect
2	*Livistona australis*	**Cabbage Palm**	4.0	4.0	2.0	2.0	2.0	2.0	0.40	0.47	3.00	2.41	Mature	Good	Good		Long (>40 years)	**Moderate**	Group of 4, smallest of the group.	Outside of proposed work zone. Nil impact expected	Retain and Protect
3	*Livistona australis*	**Cabbage Palm**	5.0	5.0	2.0	2.0	2.0	2.0	0.47	0.53	3.00	2.53	Mature	Good	Good		Long (>40 years)	**Moderate**	Group of 4	Outside of proposed work zone. Nil impact expected	Retain and Protect
4	*Livistona australis*	**Cabbage Palm**	5.0	4.5	2.0	2.0	2.0	2.0	0.40	0.48	3.00	2.43	Mature	Good	Good		Long (>40 years)	**Moderate**	Group of 4 palms.	Outside of proposed work zone. Nil impact expected	Retain and Protect
57	*Dypsis decaryi*	**Triangle Palm**	3.0	3.0	1.5	1.5	1.5	1.5	0.35	0.35	2.50	2.13	Mature	Good	Average		Medium (15-40 years)	**Low**	Good form, slight yellowing.	Outside of proposed work zone. Nil impact expected	Retain and Protect
58	*Elaeocarpus reticulatus x 5*	**Blueberry Ash**	5.5	1.5	2.0	2.0	1.0	1.0	0.18	0.23	2.16	1.79	Semi-mature	Good	Average	Asymmetric Canopy		**Low**	5 trees in a row, roots severed for path, poor pruning, height varies 5.5 - 7.5m, closely planted.	Within proposed major work zone. Can not be retained	Remove
60	*Eucalyptus microcorys*	**Tallowood**	15.7	3.0	7.0	7.0	7.0	7.0	0.77	0.94	9.24	3.22	Mature	Good	Average	Asymmetric Canopy		**High**	Little tree protection in place during previous construction works, soil build up at base, good tree, lower branches northwest side removed up to 4.5m to provide site access.	Within proposed major work zone. Can not be retained	Remove
105	*Callistemon salignus cv.*	**Willow Bottlebrush**	7.0	3.0	7.0	3.0	3.0	7.0	0.65	0.68	7.80	2.81	Mature	Fair	Average	Deadwood-Minor, Epicormic Growth, Lean-Minor, Co-dominant Stems, Inclusions, Asymmetric Canopy	Long (>40 years)	**Moderate**	Crown lifted.	Within proposed major work zone. Can not be retained	Remove
106	*Corymbia citriodora*	**Lemon Scented Gum**	18.0	8.0	3.0	4.0	6.0	1.0	0.44	0.56	5.28	2.59	Mature	Good	Average	Asymmetric Canopy	Long (>40 years)	**Moderate**	Very close to paths and car park.	Outside of proposed work zone. Nil impact expected	Retain and Protect
107	*Corymbia citriodora*	**Lemon Scented Gum**	18.0	8.0	1.0	6.0	0.0	0.5	0.37	0.51	4.44	2.49	Mature	Good	Average	Asymmetric Canopy	Long (>40 years)	**Moderate**	Very close to paths and car park.	Outside of proposed work zone. Nil impact expected	Retain and Protect
108	*Corymbia citriodora*	**Lemon Scented Gum**	16.0	8.0	5.0	1.0	1.0	5.0	0.33	0.44	3.96	2.34	Mature	Good	Average	Asymmetric Canopy	Long (>40 years)	**Moderate**	Very close to paths and car park.	Within proposed major work zone. Can not be retained	Remove
109	*Eucalyptus botryoides*	**Bangalay**	19.5	4.0	3.0	6.0	4.0	5.0	0.68	0.84	8.16	3.08	Mature	Good	Good	Deadwood-Minor	Long (>40 years)	**High**	Very close to paths and car park.	Major incursion into root zone due to grade changes. Can not realistically be retained	Remove
110	*Eucalyptus botryoides*	**Bangalay**	10.5	4.0	3.0	3.0	5.0	6.0	0.40	0.51	4.80	2.49	Mature	Good	Good	Deadwood-Minor, Asymmetric Canopy, Lean-Major	Long (>40 years)	**Moderate**	Very close to paths and car park. Lean to east. Very asymmetric canopy. Crown lifted.	Major incursion into root zone due to grade changes. Can not realistically be retained	Remove
111	*Eucalyptus botryoides*	**Bangalay**	10.5	4.0	7.0	3.0	3.0	7.0	0.58	0.68	6.96	2.81	Mature	Good	Good	Deadwood-Minor, Asymmetric Canopy, Lean-Major	Long (>40 years)	**High**	Very close to paths and car park. Lean to east. Very asymmetric canopy. Crown lifted.	Adjacent proposed works for new slip lane. Minor incursion 9.7%. Minimal impact expected if adequate protection applied and levels maintained aorund tree.	Retain and Protect
112	*Melaleuca quinquenervia*	**Broad Leafed Paperbark**	12.0	3.0	2.0	3.0	2.0	3.0	0.44	0.50	5.28	2.47	Mature	Fair	Average	Asymmetric Canopy	Long (>40 years)	**Moderate**	Very close to pathways. Closely spaced.	Major incursion into root zone due to grade changes. Can not realistically be retained	Remove
113	*Melaleuca quinquenervia*	**Broad Leafed Paperbark**	15.5	3.0	4.0	2.0	3.0	5.0	0.64	0.81	7.68	3.03	Mature	Fair	Average		Long (>40 years)	**Moderate**	Very close to pathways. Closely spaced.	Within proposed major work zone. Can not be retained	Remove
114	*Melaleuca quinquenervia*	**Broad Leafed Paperbark**	13.5	3.0	3.0	3.0	2.0	3.0	0.40	0.54	4.80	2.55	Mature	Fair	Average	Asymmetric Canopy	Long (>40 years)	**Moderate**	Very close to pathways. Closely spaced.	Within proposed major work zone. Can not be retained	Remove
115	*Corymbia maculata*	**Spotted Gum**	21.0	9.0	5.0	4.0	4.0	6.0	0.60	0.75	7.20	2.93	Mature	Fair	Good	Decay-Minor	Long (>40 years)	**High**		Within proposed major work zone. Can not be retained	Remove
116	*Eucalyptus robusta*	**Swamp Mahogany**			1.0	1.0	2.0	2.0	0.23	0.30	2.76	2.00	Semi-mature	Good	Good		Long (>40 years)	**High**		Within proposed major work zone. Can not be retained	Remove
117	*Melaleuca quinquenervia*	**Broad Leafed Paperbark**	13.5	3.0	0.5	3.0	2.5	1.5	0.48	0.72	5.76	2.88	Mature	Fair	Average	Asymmetric Canopy, Pest/Disease	Long (>40 years)	**Moderate**	Very close to road/kerb. Closely spaced grouping.	Within proposed major work zone. Can not be retained	Remove
118	*Melaleuca quinquenervia*	**Broad Leafed Paperbark**	13.5	3.0	1.5	3.0	4.0	3.0	0.60	0.70	7.20	2.85	Mature	Fair	Average	Asymmetric Canopy	Long (>40 years)	**Moderate**	Very close to road/kerb. Closely spaced grouping.	Within proposed major work zone. Can not be retained	Remove
119	*Melaleuca quinquenervia*	**Broad Leafed Paperbark**	13.5	3.0	3.0	1.0	1.5	5.0	0.66	0.66	7.92	2.78	Mature	Fair	Average	Asymmetric Canopy	Long (>40 years)	**Moderate**	Very close to road/kerb. Closely spaced grouping.	Within proposed major work zone. Can not be retained	Remove
120	*Melaleuca quinquenervia*	**Broad Leafed Paperbark**	16.0	4.0	1.5	3.0	4.0	3.0	0.92	0.99	11.04	3.30	Mature	Fair	Average	Asymmetric Canopy	Long (>40 years)	**Moderate**	Very close to road/kerb. Closely spaced grouping.	Within proposed major work zone. Can not be retained	Remove
121	*Melaleuca quinquenervia*	**Broad Leafed Paperbark**	14.0	3.0	2.0	4.0	1.0	4.0	0.62	0.70	7.44	2.85	Mature	Fair	Average		Long (>40 years)	**Moderate**	Very close to road/kerb. Closely spaced grouping.	Within proposed major work zone. Can not be retained	Remove
122	*Melaleuca quinquenervia*	**Broad Leafed Paperbark**	13.0	4.0	3.0	4.0	2.0	4.0	0.52	0.72	6.24	2.88	Mature	Fair	Average		Long (>40 years)	**Moderate**	Very close to road/kerb. Closely spaced grouping. Major pruning to north and recent excavation.	Within proposed major work zone. Can not be retained	Remove
123	*Cupaniopsis anacardioides*	**Tuckeroo**	9.0	4.0	4.0	4.0	3.0	2.0	0.35	0.45	4.20	2.37	Mature	Good	Average		Long (>40 years)	**Moderate**		Within proposed major work zone. Can not be retained	Remove
124	*Livistona australis*	**Cabbage Palm**	9.0	9.0	2.0	2.0	2.0	2.0	0.33	0.51	3.96	2.49	Mature	Good	Good		Long (>40 years)	**Moderate**		Within proposed major work zone. Can not be retained in current position. Recommend transplanting.	Transplant
125	*Cupaniopsis anacardioides*	**Tuckeroo**	6.0	3.0	3.0	3.0	3.0	3.0	0.22	0.27	2.64	1.91	Mature	Poor	Average	Inclusions, Branch Tearouts	Long (>40 years)	**Low**	In car park island.	Within proposed major work zone. Can not be retained	Remove
126	*Melaleuca quinquenervia*	**Broad Leafed Paperbark**	8.0	3.0	2.0	2.0	2.0	2.0	0.33	0.41	3.96	2.28	Mature	Fair	Average	Tip Dieback, Deadwood-Minor, Epicormic Growth	Medium (15-40 years)	**Low**	Very close to road/kerb.	Within proposed major work zone. Can not be retained	Remove
127	*Melaleuca quinquenervia*	**Broad Leafed Paperbark**	9.5	3.0	2.0	2.0	2.0	2.0	0.48	0.51	5.76	2.49	Mature	Fair	Average	Tip Dieback, Deadwood-Minor, Epicormic Growth	Medium (15-40 years)	**Low**	Very close to road/kerb.	Within proposed major work zone. Can not be retained	Remove
128	*Melaleuca quinquenervia*	**Broad Leafed Paperbark**	9.0	3.0	3.5	3.5	3.5	3.5	0.52	0.51	6.24	2.49	Mature	Fair	Average	Deadwood-Minor, Tip Dieback, Epicormic Growth	Medium (15-40 years)	**Low**	Very close to road/kerb.	Within proposed major work zone. Can not be retained	Remove
129	*Cupaniopsis anacardioides*	**Tuckeroo**	4.5	2.0	2.5	2.5	2.5	2.5	0.20	0.22	2.40	1.75	Mature	Fair	Average	Root Impacts, Branch Tearouts	Medium (15-40 years)	**Low**	In car park island.	Within proposed major work zone. Can not be retained	Remove
130	*Cupaniopsis anacardioides*	**Tuckeroo**	4.5	2.0	2.5	2.5	2.5	2.5	0.24	0.29	2.88	1.97	Mature	Fair	Average	Root Impacts, Inclusions	Medium (15-40 years)	**Low**	In car park island.	Within proposed major work zone. Can not be retained	Remove
131	*Cupaniopsis anacardioides*	**Tuckeroo**	8.5	2.5	2.5	2.5	2.5	2.5	0.30	0.33	3.60	2.08	Mature	Fair	Average	Inclusions, Root Impacts	Medium (15-40 years)	**Moderate**	In car park island.	Within proposed major work zone. Can not be retained	Remove
132	*Cupaniopsis anacardioides*	**Tuckeroo**	9.0	2.5	1.5	1.5	1.5	1.5	0.28	0.29	3.36	1.97	Mature	Fair	Average		Medium (15-40 years)	**Moderate**	In car park island.	Within proposed major work zone. Can not be retained	Remove
133	*Magnolia grandiflora*	**American Bull Bay Magnolia**	5.5	1.0	2.0	2.0	2.0	2.0	0.26	0.35	3.12	2.13	Mature	Good	Good	Co-dominant Stems	Medium (15-40 years)	**Moderate**	In car park island.	Within proposed major work zone. Can not be retained in current position. Recommend transplanting.	Transplant
134	*Acacia saligna*	**WA Golden Wattle**	6.0	2.0	2.5	2.5	2.5	2.5	0.22	0.31	2.64	2.02	Mature	Good	Good	Co-dominant Stems, Asymmetric Canopy	Medium (15-40 years)	**Low**	In car park island.	Within proposed major work zone. Can not be retained	Remove
135	*Elaeocarpus reticulatus x 20*	**Blueberry Ash**	6.0	2.0	1.5	1.5	1.5	1.5	0.14	0.17	2.00	1.57	Mature	Fair	Average	Co-dominant Stems, Asymmetric Canopy	Medium (15-40 years)	**Low**	In car park island, screening ramp. Varying conditions and forms.	Within proposed major work zone. Can not be retained	Remove
136	*Corymbia citriodora*	**Lemon Scented Gum**	16.0	6.0	8.0	8.0	8.0	8.0	0.48	0.72	5.76	2.88	Mature	Fair	Poor	Decay-Minor, Tip Dieback	Medium (15-40 years)	**Low**	Very close to paths and car park. Numerous pruning wounds. Large branches lopped.	Low quality tree.Within proposed major work zone. Removal recommended	Remove
137	*Corymbia citriodora*	**Lemon Scented Gum**	16.0	6.0	6.0	6.0	6.0	6.0	0.80	1.15	9.60	3.51	Mature	Poor	Poor	Decay-Minor, Tip Dieback, Deadwood-Major	Short (5-15 years)	**V Low / Remove**	Very close to paths and car park. Numerous pruning wounds. Large branches lopped. Extensive basal wounding.	Low quality tree.Within proposed major work zone. Removal recommended	Remove
139	*Howea forsteriana*	**Kentia Palm**	10.0	10.0	2.0	2.0	2.0	2.0	0.19	0.26	2.28	1.88	Mature	Good	Good		Long (>40 years)	**High**		Within proposed major work zone. Can not be retained. Recommend transplant.	Transplant
141	*Tristaniopsis laurina*	**Water Gum**	5.0	2.4	1.5	1.5	1.5	1.5	0.17	0.18	2.04	1.61	Semi-mature	Fair	Average		Medium (15-40 years)	**Low**	Small trees.	Within proposed major work zone. Can not be retained	Remove
144	*Eucalyptus grandis*	**Flooded Gum**	13.5	6.0	7.0	7.0	0.0	5.0	0.42	0.57	5.04	2.61	Mature	Excellent	Average	Asymmetric Canopy, Lean-Minor		**Moderate**	Leans away from group to south.	Outside of proposed work zone. Nil impact expected	Retain and Protect
145	*Eucalyptus grandis*	**Flooded Gum**	18.0	6.0	9.0	7.0	4.0	6.0	0.62	0.92	7.44	3.20	Mature	Excellent	Average	Asymmetric Canopy		**High**	Leans south away from group.	Outside of proposed work zone. Nil impact expected	Retain and Protect
146	*Eucalyptus grandis*	**Flooded Gum**	14.0	6.0	4.0	7.0	7.0	6.0	0.41	0.47	4.92	2.41	Mature	Excellent	Average	Asymmetric Canopy, Root Impacts		**Moderate**	Asymmetric canopy to north, long branch to north away.	Outside of proposed work zone. Nil impact expected	Retain and Protect
147	*Livistona australis*	**Cabbage Palm**	5.0	5.0	2.0	2.0	2.0	2.0	0.40	0.61	3.00	2.69	Mature	Good	Good		Long (>40 years)	**High**		Outside of proposed work zone. Nil impact expected	Retain and Protect
148	*Livistona australis*	**Cabbage Palm**	5.0	5.0	2.0	2.0	2.0	2.0	0.40	0.54	3.00	2.55	Mature	Good	Good		Long (>40 years)	**High**		Outside of proposed work zone. Nil impact expected	Retain and Protect
149	*Livistona australis*	**Cabbage Palm**	5.0	5.0	2.0	2.0	2.0	2.0	0.40	0.86	3.00	3.11	Mature	Good	Good		Long (>40 years)	**High**		Outside of proposed work zone. Nil impact expected	Retain and Protect
154	*Livistona australis*	**Cabbage Palm**	4.0	4.0	3.0	3.0	3.0	3.0	0.00	0.56	2.00	2.59	Mature	Good	Good		Long (>40 years)	**Moderate**	Transplanted in 2017. Mechanical damage to trunk base from construction activity	Outside of proposed work zone. Nil impact expected	Retain and Protect
155	*Livistona australis*	**Cabbage Palm**	5.5	5.5	2.5	2.5	2.5	2.5	0.00	0.39	2.00	2.23	Mature	Good	Good		Long (>40 years)	**Moderate**	Transplanted in 2017	Outside of proposed work zone. Nil impact expected	Retain and Protect
156	*Phoenix canariensis*	**Canary Island Date Palm**	3.5	3.5	3.5	3.5	3.5	3.5	0.00	0.74	2.00	2.92	Mature	Good	Good		Long (>40 years)	**Moderate**	Transplanted in 2017	Outside of proposed work zone. Nil impact expected	Retain and Protect
157	*Fraxinus pennsylvanica?*	**Red Ash**	7.0	3.0	5.5	5.5	5.5	5.5	0.24	0.36	2.88	2.15	Mature	Fair	Average		Medium (15-40 years)	**Low**	Branch damage due to previous construction activity	Outside of proposed work zone. Nil impact expected	Retain and Protect
158	*Fraxinus pennsylvanica?*	**Red Ash**	6.0	2.0	5.5	5.5	5.5	5.5	0.22	0.29	2.64	1.97	Mature	Fair	Average		Medium (15-40 years)	**Low**	Branch damage due to previous construction activity	Outside of proposed work zone. Nil impact expected	Retain and Protect
159	*Livistona australis*	**Cabbage Palm**	4.5	4.5	2.5	2.5	2.5	2.5	0.00	0.53	2.00	2.53	Mature	Good	Good		Long (>40 years)	**Moderate**	Part of Group of 4	Outside of proposed work zone. Nil impact expected	Retain and Protect
160	*Livistona australis*	**Cabbage Palm**	5.0	5.0	2.5	2.5	2.5	2.5	0.00	0.34	2.00	2.10	Mature	Good	Good		Long (>40 years)	**Moderate**	Part of Group of 4	Outside of proposed work zone. Nil impact expected	Retain and Protect
161	*Livistona australis*	**Cabbage Palm**	4.5	4.5	2.5	2.5	2.5	2.5	0.00	0.49	2.00	2.45	Mature	Good	Good		Long (>40 years)	**Moderate**	Part of Group of 4	Outside of proposed work zone. Nil impact expected	Retain and Protect
162	*Livistona australis*	**Cabbage Palm**	5.5	5.5	2.5	2.5	2.5	2.5	0.00	48.00	2.00	16.82	Mature	Good	Good		Long (>40 years)	**Moderate**	Part of Group of 4	Outside of proposed work zone. Nil impact expected	Retain and Protect
163	*Xylosma senticosum*	**Shiny Xylosma**	7.0	3.0	3.5	3.5	3.5	3.5	0.37	0.45	4.44	2.37	Mature	Good	Good		Medium (15-40 years)	**Moderate**		Within proposed major work zone. Can not be retained	Remove
167	*Michelia champaca*	**Champaca**	15.5	5.0	5.0	8.0	7.0	5.0	0.57	0.63	6.84	2.73	Mature	Good	Good		Long (>40 years)	**Low**	Previously growing against structure. Mechanical damage to trunk and some roots.	Poor quality tree, impacted by previous construction work. Within proposed major work zone. Recommend removal	Remove
168	*Araucaria heterophylla*	**Norfolk Island Pine**	2.5	0.5	1.0	1.0	1.0	1.0	0.07	0.10	2.00	1.26	Young	Fair	Average		Long (>40 years)	**Moderate**	New planting - Late 2017	Within proposed major work zone. Can not be retained in current position. Recommend transplanting.	Transplant
169	*Ficus rubiginosa*	**Port Jackson Fig**	2.0	0.5	1.0	1.0	1.0	1.0	0.07	0.10	2.00	1.26	Young	Fair	Average		Long (>40 years)	**Moderate**	New planting - Late 2017	Outside of proposed work zone. Nil impact expected	Retain and Protect
170	*Ficus rubiginosa*	**Port Jackson Fig**	2.0	0.5	1.0	1.0	1.0	1.0	0.07	0.10	2.00	1.26	Young	Fair	Average		Long (>40 years)	**Moderate**	New planting - Late 2017	Within proposed major work zone. Can not be retained in current position. Recommend transplanting.	Transplant
171	*Ficus rubiginosa*	**Port Jackson Fig**	2.0	0.5	1.0	1.0	1.0	1.0	0.07	0.10	2.00	1.26	Young	Fair	Average		Long (>40 years)	**Moderate**	New planting - Late 2017	Outside of proposed work zone. Nil impact expected	Retain and Protect
172	*Ficus rubiginosa*	**Port Jackson Fig**	2.2	0.5	1.0	1.0	1.0	1.0	0.10	0.12	2.00	1.36	Young	Fair	Average		Long (>40 years)	**Moderate**	New planting - Late 2017	Outside of proposed work zone. Nil impact expected	Retain and Protect
173	*Ficus rubiginosa*	**Port Jackson Fig**	2.0	0.5	1.0	1.0	1.0	1.0	0.10	0.12	2.00	1.36	Young	Fair	Average		Long (>40 years)	**Moderate**	New planting - Late 2017	Outside of proposed work zone. Nil impact expected	Retain and Protect
174	*Lophostemon confertus*	**Brush Box**	3.0	1.0	1.0	1.0	1.0	1.0	0.05	0.07	2.00	1.08	Young	Fair	Average		Long (>40 years)	**Moderate**	New planting - Late 2017	Outside of proposed work zone. Nil impact expected	Retain and Protect
175	*Araucaria heterophylla*	**Norfolk Island Pine**	2.0	1.0	1.0	1.0	1.0	1.0	0.07	0.10	2.00	1.26	Young	Fair	Poor	Top leader broken out	Long (>40 years)	**Moderate**	New planting - Late 2017	Outside of proposed work zone. Nil impact expected	Retain and Protect
176	*Araucaria heterophylla*	**Norfolk Island Pine**	3.5	1.0	1.0	1.0	1.0	1.0	0.07	0.10	2.00	1.26	Young	Fair	Average		Long (>40 years)	**Moderate**	New planting - Late 2017	Outside of proposed work zone. Nil impact expected	Retain and Protect