

# ARBORICULTURAL IMPACT ASSESSMENT AND TREE MANAGEMENT PLAN



## PROPOSED BUILDING, RENOVATIONS AND EXTENSIONS DEVELOPEMNT APPLICATION

Watchtower Bible and Tract Society Australia

Report prepared for:

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8th July 2019

## **DISCLAIMER**

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This report has been prepared in accordance with the scope of services described in agreement between Horticultural Management Services and the client.

This report relies upon data, surveys and site inspections results taken at or under the particular time and or conditions specified herein.

Any representation, statement, opinion or advice, expressed or implied in this publication is made in good faith but on the basis that Horticultural Management Services, its agents and employees are not liable (whether by reason of negligence, lack of care or otherwise) to any person for any damage or loss whatsoever which has occurred or may occur in relation to that person taking or not taking (as the case may be) action in respect of any representation, statement, or advice referred to above.

Every effort has been made in this report to include, assess and address all defects, structural weaknesses, instabilities of the subject trees. All inspections were made from ground level using only visual means and no intrusive or destructive means of inspection were used. For many structural defects, such as decay and inclusions, internal inspection is required by means of resistograph or similar. No such investigation has been made in this case. Trees are living organisms and are subject to failure through a variety of causes not able to be identified by means of this inspection and assessment.

Information contained in this report covers only the subject tree that was assessed and reflects the condition of the subject tree at the time of inspection. Any finding, conclusion or recommendations only apply to the aforementioned circumstances and no greater reliance should be assumed or drawn by the Client.

There is no warranty or guarantee, expressed or implied that problems or deficiencies regarding the subject trees or the subject site may not arise in the future.

Furthermore, this report has been prepared solely for the use by the Client. The Client acknowledges that this assessment, and any opinions, advice or recommendations expressed or given in it, are based on the information supplied by the Client and based on the data observations, measurements and analysis carried out or obtained by Horticultural Management Services and referred to in the assessment.

Horticultural Management Services accepts no responsibility for its use by other parties.

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## **1.0 INTRODUCTION AND BACKGROUND**

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This Arboricultural Assessment Report and Tree Management Plan was prepared Horticultural Management Services.

Horticultural Management Services were engaged to conduct an Arboriculture Assessment Report with particular regard to the Commonwealth Environment Protection and Biodiversity Conservation Act 1999, with reference made to the Office of Environment and Heritage (OEH) (formerly National Parks and Wildlife Services), Threatened Species Conservation Act 1995, Biosecurity Act 2015 and Liverpool City Council Tree Preservation Order (TPO).

It is understood that this report is to form part of a development application for proposed new back-lot support building and building extensions and alterations/renovations to existing residence buildings, removal of Three-(3) trees, tree retention, management and associated landscaping as per Annexure A Proposed Development Layout.

A site investigation was undertaken on Tuesday 2nd July 2019 to determine the existing trees overall health, structural integrity and identification of other physical conditions that may be present within the proposed development sites, which may be affected by the proposed development.

The purpose of this report is to identify the trees within the development sites, provide information on their individual current health and condition, determine their remaining life expectancy and significance in the landscape and assess their suitability for retention/preservation.

The potential impact of the proposed developments has also been assessed, together with recommendations for amendments to the design or construction to ensure the retention of trees considered worthy of preservation.

This assessment takes into consideration the ecological qualities of all trees and other significant vegetation on the site and its biotic, ecological, historical and visual significance.

The scope of this report includes the allocation of SULE ratings (Safe Useful Life Expectancy), identification of arboricultural and recommended work as required.

Information contained in this report covers only the subject trees that were assessed and reflects the condition of the subject trees on site at the time of inspection.

## 2.0 SITE LOCATION

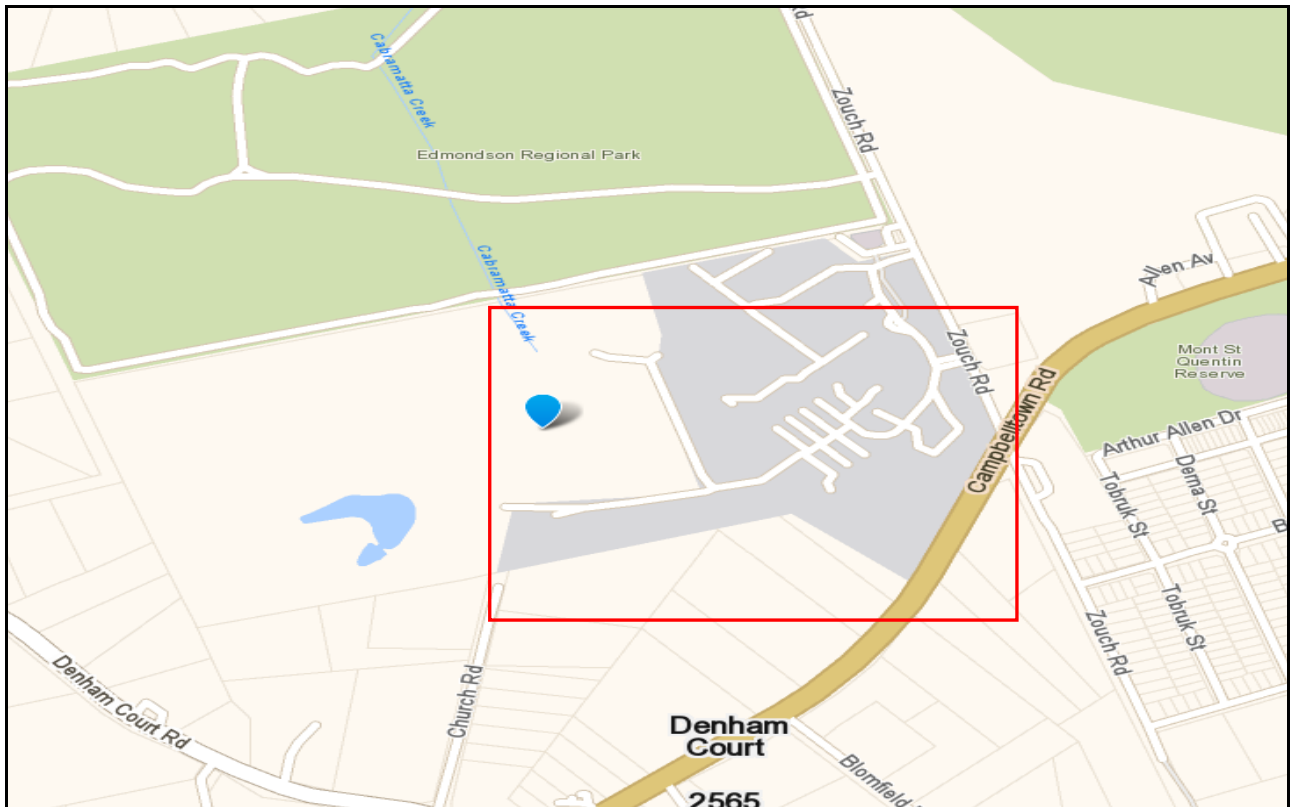


Figure 1 Shows the location of the study site. Source [whereis.com.au](http://whereis.com.au)

## 2.1 AERIAL SITE LOCATION



Figure 2 Shows an aerial location of the study site. Source [Nearmaps.com](http://Nearmaps.com)

### **3.0 AIMS**

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To detail the condition of the trees and consider the location and condition of such in relation to their surrounds.

Provide as an outcome of the assessment the following;

- Carry out an inspection of the subject trees within and adjacent to the site/s and site conditions,
- Assess the condition of the subject tree(s),
- A description of the tree's and other vegetation on the subject site,
- Observations made,
- Discussion on the tree's in their current landscape,
- Determine the subject trees' Landscape Significance including cultural, environmental and aesthetic values,
- Consider the benefits of retention or removal of the trees for the medium to long-term benefit of the tree's and on-going public safety,
- Provide recommendations for Tree Management, if or as required, within the context of a development application, and
- Prepare site specific tree protection specifications for trees recommended for retention,

### **4.0 SITE DESCRIPTION AND PROPOSED DEVELOPMENT**

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Relevant site plans and or documents were viewed prior to undertaking the Arborist Assessment.

A site plan accompanies this report and identifies all trees located on and or adjoining this proposed development, which may be impacted upon.

The site is identified as Watchtower Bible and Tract Society Australia, 12-14 Zouch Road, Denham Court NSW 2565

The sites contain a mixture of introduced/planted exotic and native vegetation observed. The herbaceous or grass vegetation consists of a mixture of introduced pastoral grasses due to the sites long term pursuits.

It is understood that this report is to form part of a development application for proposed new back-lot support building and building extensions and alterations/renovations to existing residence buildings, removal of Three-(3) trees, tree retention, management and associated landscaping as per Annexure A Proposed Development Layout.

## 5.0 METHODOLOGY

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This report was determined as a result of a comprehensive site inspection undertaken on Tuesday 2nd July 2019. The subject trees were inspected by Horticultural Management Services (HMS).

The comments and recommendations in this report are based on findings from this site inspection. Each tree has been provided with identification number for reference purposed denoted on the attached tree location plan and correlating with the Tree Assessment Schedule and as discussed within the report.

The method of assessment applied to the proposed development site is adapted from the principles developed by the Local Government Tree Resources Association (LGTRA). This recognised form of assessment considers the trees health/condition and subsequent stability, both in the long and short term at the time of the assessment and including but not limited to;

- Species identification (botanical and common),
- Height and form,
- Observations made including an evaluation of the tree's health and vigour using Crown spread and cover, 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,
- Likely future amenity based on a visual assessment,
- The trees tolerance to development impacts based on surface observations,
- Significance -specific heritage, cultural or intrinsic importance,
- Amenity value -as shade, windbreak etc or subjective, aesthetic values,
- Habitat value -both as an individual tree and as part of an ecological community,
- Observations of soil conditions and likely root spread,
- Overall condition assessment and suitability,
- Hazard/failure potential of tree to damage property or result in death,
- Safe Useful Life Expectancy (SULE) after Barrell (1995),

**Retention Value**, was based on the subject tree's Remaining Life Expectancy Range and Landscape Significance. The Retention Value was modified where necessary to take in consideration the subject tree's health, structure and site suitability.

**Landscape Significance**, was determined by assessing the combination of the cultural, environmental and aesthetic values of the subject trees. Whilst these values are subjective, a rating of high, moderate, low or insignificant has been allocated to the trees. This provides a relative value of the trees' Landscape Significance which may aid in determining their Retention Value. A more detailed explanation is outlined in Section 5.3 Landscape Significance.

**Tree height and canopy spread**, were estimated only. Diameter at Breast Height (DBH) was determined by measuring the main stem at 1.4m above ground. Photos were taken of the subject trees and subject site for the inclusion in this tabled report.

The components of **tree risk assessment** include the trees failure potential or in the case of the proposed, an environment conducive to tree failure.

## **5.1 VISUAL TREE ASSESSMENT**

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The inspection was limited to a visual examination of the subject trees from ground level.

This assessment process is used to determine the sustainability of each tree in the landscape. The assessment of each tree was made using Visual Tree Assessment (VTA).

All trees were assessed from the ground without dissection, probing or coring. No woody tissue testing was undertaken as part of this assessment.

Destructive, resistance testing or aerial inspections have not been undertaken as part of this assessment. The health of the trees was determined by assessing the following:

- a) Foliage size and colour,
- b) Pest and disease infestation noted,
- c) Extension growth,
- d) Canopy density and form,
- e) Percentage of deadwood noted/observed,
- f) Presence of epicormic growth observed,
- g) Visible evidence of structural defects or instability,
- h) Evidence of previous pruning or physical damage,
- i) Observations made including an evaluation of the tree's health and vigour using Crown spread and cover, foliage size, colour, extension growth, presence of disease or pest infestation, canopy density, presence of deadwood, dieback and epicormic growth as indicators,
- j) Condition, using visible evidence of structural defects, instability, evidence of previous pruning and physical damage as indicators,
- k) 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,

## **5.2 HERITAGE SIGNIFICANCE**

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There are no trees within the site that have been identified as Heritage Items under Liverpool City Council Planning Instrument or identified within a Significant Tree Register.

Trees proposed to be removed will be replaced in the landscape upon completion of the building scope of works.

### 5.3 LANDSCAPE SIGNIFICANCE

The sites Landscape Significance was determined by assessing the combination of the cultural, environmental and aesthetic values of the subject trees.

Whilst these values are subjective, a rating of high, moderate, low or insignificant has been allocated to the trees.

This provides a relative value of the trees' Landscape Significance which may aid in determining their overall retention value. Generally, the following criteria have been used to determine the Landscape Significance of the subject trees.

| LANDSCAPE SIGNIFICANCE | DESCRIPTION                                                                                                                                      |
|------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>HIGH</b>            | The subject tree is listed as a Heritage Item under the <i>Local Environmental Plan</i> with a local or state level of significance.             |
|                        | The subject tree forms part of the curtilage of a heritage item.                                                                                 |
|                        | The subject tree creates a 'sense of place' or is considered 'landmark' tree.                                                                    |
|                        | The subject tree is of local, cultural or historical importance or is widely known.                                                              |
|                        | The subject tree is listed on Council's Significance Tree Register.                                                                              |
|                        | The subject tree is scheduled as a Threatened Species or Threatened Plant Community under the <i>Threatened Species Conservation Act</i> (1995). |
|                        | The subject tree is a remnant tree.                                                                                                              |
|                        | The subject tree is a locally indigenous species and is representative of the original vegetation of the area.                                   |
|                        | The subject tree provides habitat to a threatened species.                                                                                       |
|                        | The subject tree is an excellent representative of the species in terms of aesthetic value.                                                      |
| <b>MODERATE</b>        | The subject tree makes a positive contribution to the visual character or amenity of the area.                                                   |
|                        | The subject tree provides a specific function such as screening or minimising the scale of a building.                                           |
|                        | The subject tree has a known habitat value.                                                                                                      |
|                        | The subject tree is a good representative of the species in terms of aesthetic value.                                                            |
| <b>LOW</b>             | The subject tree is an environmental pest species or is exempt under the provisions of the local Council's Tree Preservation Order.              |
|                        | The subject tree makes little or no contribution to the amenity of the locality.                                                                 |
|                        | The subject tree is a poor representative of the species in terms of aesthetic value.                                                            |
| <b>INSIGNIFICANT</b>   | The subject tree is declared a Noxious Weed under the Biosecurity Act (2015).                                                                    |

\*NOTE: If the tree can be categorised into more than one value, the higher value should be allocated.

## **5.4 TREES ON ADJOINING LAND**

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In accordance with Council's requirements, trees adjoining the development have been assessed as part of this report.

There are no additional trees that will be affected by this development.

## **5.5 IMPACT ASSESSMENT**

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A summary of each tree identified within the study site is outlined in section 10.0 Assessment of Existing Trees Identified on Site.

The assessment in each case has considered the following issues;

- Structural Root Zones (SRZ),
- Building works or footprint within TPZ or SRZ,
- Optimum Tree Protection Zones (TPZ) and Structural Root Zones (SRZ),
- SULE Rating for value of the tree assessed,
- Assessment of the likely impact of the proposed works,
- Recommendations for retention, management or removal,

Changing the drainage patterns around a tree by constructing a building, driveways, road and paths etc will alter the amount of water the tree receives and may cause root death or damage. Trenches dug beside or adjoining large trees for water, sewer or services may also damage the roots and will make a tree unstable.

Older trees will tolerate far less stress than younger trees as with age they become less responsive and find it very strenuous to respond to changes in their environment.

The components of tree risk assessment include the trees failure potential or in the case of land clearing/management, an environment conducive to tree failure.

Other factors are also considered related to the site, such as potential development or land use, soil condition and prevailing winds must be considered in conjunction when assessing the potential of failure for any tree.

## **6.0 PRUNING/REMOVAL STANDARDS**

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Any pruning recommended in this report is to be to the Australian Standard® AS4373 'Pruning of Amenity Trees', Amenity Tree Industry "Code of Practice 1998 and conducted in accordance with the NSW Work Cover Authority Code of Practice for Tree Work 2007.

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

Tree maintenance work is specialised and in order to be undertaken safely and to ensure the works carried out are not detrimental to the survival of the tree or surrounding vegetation, all works should be undertaken by a qualified Arborist with appropriate competencies recognised within the Australian Qualification frame work, with a minimum of 5 years of continual experience within the industry of operational amenity arboriculture, and covered by appropriate and current types of insurance to undertake such works.

Any pruning near electricity wires should be undertaken in accordance with relative Electrical Safety Rules and be performed by persons individually authorised by Energy Australia with a "Work Near Overhead Power Lines" Certificate to undertake this scope of works.

## **7.0 TREE PROTECTION ZONES AND ROOT SYSTEM**

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On average, the trees roots will extend to the outer reaches of their canopies, depending on morphology and disposition of the individual tree's roots, when known to be influenced by past or existing site conditions including but not limited to;

- The individual tree species,
- Soil type, structure and location,
- Topography and existing drainage,
- Location of either manmade hard structures of group environment
- Pruning requirements, if required,

These roots have two major functions, which are to obtain water and minerals from the soil and to give anchorage support to the tree.

This area is known as the Tree Protection Zone (TPZ), this is a designated area around tree where optimum protection and preservation efforts are implemented.

No disturbance should occur within this area. It is calculated by using a formula that considers the tolerance level of the species to disturbance, its age class, and its condition and trunk diameter.

The main area for surface feeding roots to occur is from the tree trunk to the outer canopy known as the drip zone. These fibrous roots are less likely to occur under or near other buildings, as there is little surface moisture or soil air presence for root survival. These fibrous roots are those that take up water and nutrients.

While some tree roots will deeply penetrate the soil profile, in search of available water, most will occupy the first 60-70cm of the soil, as to obtain the needed sustenance. At times, it will not be possible to retain the optimum TPZ around each tree and any activities proposed within this area must be carefully analysed to minimise any effects on its health and/or stability.

The actual spread of the root system is largely dependent on the particular species involved, and their localised environment. Any work carried out within the TPZ should be reviewed and supervised by an appropriately qualified Arborist.

Construction works proposed to be undertaken around the trees if not correctly assessed may modify the natural water table and reduce the amount of soil air and moisture present/available to the trees and their longevity may be greatly diminished.

If under the course of construction, the tree roots are damaged or adversely affected, their demise will cause drought stress; poor uptake of water and nutrients, slower dispersal of gums and resins and could, in the long term, have an effect on the movement of certain compounds which make up the structure of the tree.

## **8.0 TREE PROTECTION ZONE**

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A Tree Protection Zone (TPZ) is a radial distance measured from the centre of the trunk of the tree. The intention of the TPZ is to minimise incursions to the root system and canopy to ensure the long-term health and stability of the tree.

A commonly used delineation for the TPZ is the dripline (extent of the crown spread projected to the ground plane). However, this may not provide adequate protection for trees that have prominent leans or distorted imbalanced or narrow crowns. A more appropriate guideline is the trunk diameter.

The Tree trunk measurement is recorded and known as the Diameter at Breast Height (DBH) at 1.4 metres from ground level using a metric tape measure. The TPZ area is then calculated by  $\times 12$ , another formula is then applied for the trees Structural Root Zone (SRZ) if the development is proposed to encroach into the TPZ.

Other factors included within the TPZ are the individual tree species, soil type, location and proposed scope of works.

The above criteria also consider the following elements;

- The trunk diameter,
- The sensitivity/tolerance of the species to construction impacts,
- The level of maturity,
- The health, vigour and structural integrity of the tree,
- The trees root and crown formation,

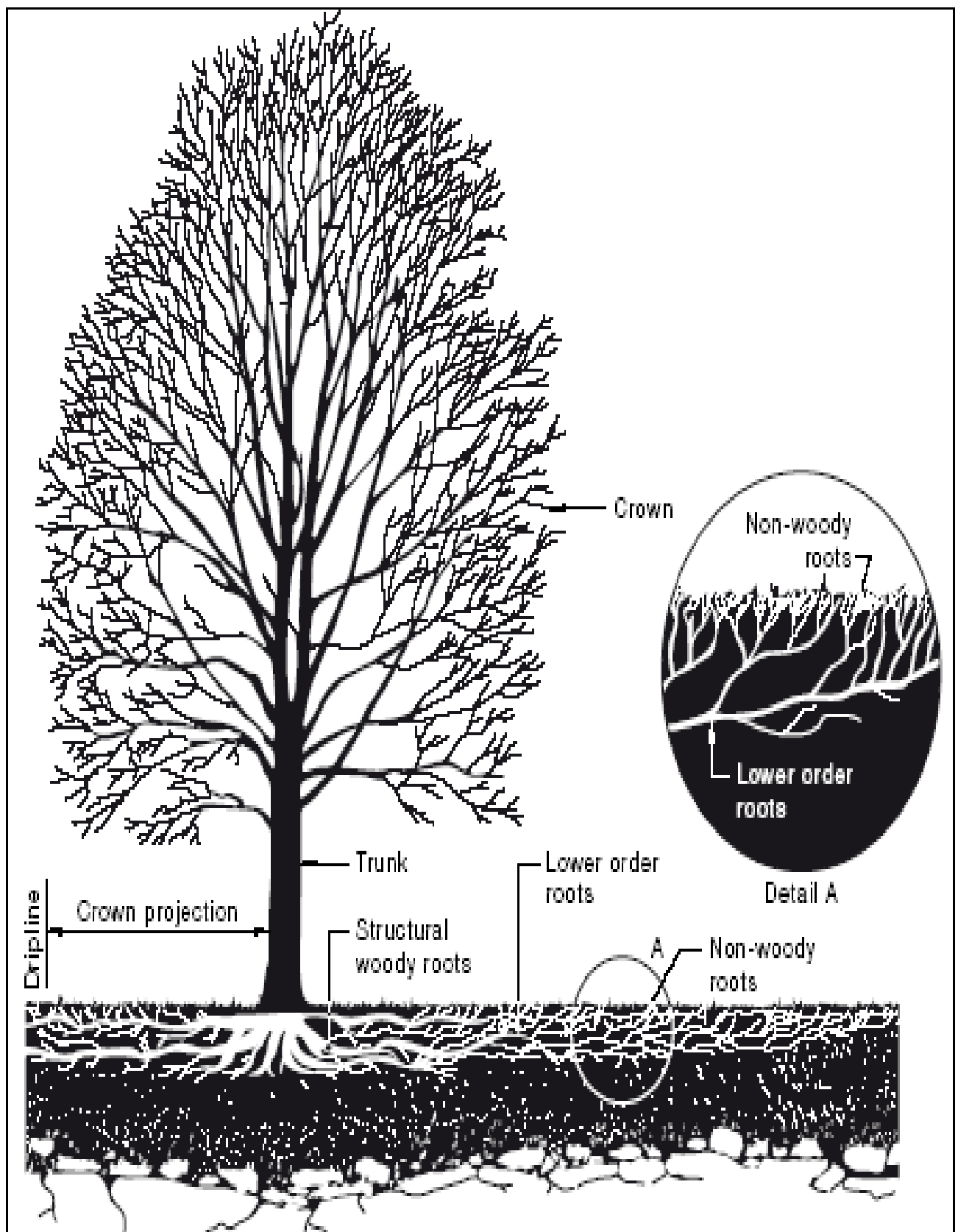
Construction Tolerance considers the following elements,

- Good – Good tolerance to construction impacts,
- Moderate – Moderate tolerance to construction impacts,
- Poor- Poor tolerance to construction impacts,

Maturity class of the tree considers the following elements,

- Over-mature – Greater than 80% of the life expectancy for the species,
- Mature – Greater than 50 – 80% of the life expectancy for the species,
- Immature – Less than 20% of the life expectancy for the species,

## 8.1 NORMAL STRUCTURAL ROOT FORM OF A TREE



**Figure 3 Shows a diagram of a typical tree root structure.**

*Source: Australian Standards - AS 4970-2009 Protection of trees on development sites.*

## **8.2 TYPES OF TREE ROOTS**

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The trees root system develops in accordance with its pre-determined, height, soil conditions (availability of water and nutrients) and location of the root systems in response to the need to support the tree.

Unless conditions are uniform around the tree, which would be highly unusual, the extent of the root-systems can be irregular and difficult to predict. As tree roots are very opportunistic, they will not generally show the symmetry seen in the aerial parts.

The majority of the root system is in the surface 600mm to 700mm, extending radially for distances which are frequently in excess of the tree height.

## **8.3 ROOT PLATE**

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This forms the main structural woody roots which provides overall anchorage for the tree. It is this central part of the root-system (large root mass with sub-soil normally attached) which may tilt over or rotates in storm events.

## **8.4 WOODY ROOTS**

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Beyond the root plate the root system rapidly subdivides into smaller diameter woody roots (hydrotropic) which conduct water and nutrients from the non-woody roots.

## **8.5 NON-WOODY ROOTS**

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Off the smaller diameter woody root system, a mass of non-woody, fine feeder roots system develops. These are the roots which are active in water and nutrient uptake, are very fine in structure, typically less than 0.5mm diameter, and include mycorrhizal associations with some soil fungi. They are short lived, growing in response to the needs of the tree, with the majority dying back each winter.

Conditions should be conducive for maintaining the growth of these non-woody roots to provide for the water and nutrient requirements of the tree.

Non-woody roots are vulnerable to damage, and once it occurs, water and nutrient uptake will be restricted until new ones are produced. Vigorous young trees will be capable of rapid regeneration, but more mature to over mature trees will respond slowly, if at all.

Any root damage and or demise may cause some drought stress; poor uptake of water and nutrients, slower dispersal of gums and resins and could, in the long term, have an effect on the movement of certain compounds which make up the structure of the tree, resulting in the slow decline to death of the trees.

## 9.0 DEFINITION OF ASSESSED HEALTH AND CONDITION OF TREE

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The condition of each tree has been related in overall terms as one of the following headings and information is presented in section 11.0 Assessment of Existing Trees Identified on Site.

**Good**, the tree is generally healthy, vigorous, and free from the presence of major disease, obvious structural weaknesses, and fungal or insect infestation and is expected to continue to live in the same condition as at the time of the inspection. Only small recommendations may be required to help continue the trees longevity.

**Fair**, the tree is generally vigorous but has some indication of decline due to the early effects of disease, fungal or insect infestation, or has been affected by physical (storm damage) or mechanical damage (Vandalism or involved in an accident by a vehicle) or is faltering due to the modification of the trees environment essential for its survival.

This tree group may recover with remedial work undertaken by a Qualified Arborist where appropriate or without intervention and may regain some vigour and stabilise over time. Medium recommendations are required to bring this tree up to a satisfactory standard.

**Poor**, the tree is exhibiting symptoms of advanced and irreversible decline due to factors such as fungal infestation, termite damage, ring barking of the trees trunk due to borer infestation, major die-back in branches and the foliage is thinning in the crown due to various effects, epicormic growth is present throughout the inner canopy while the tree is using up its stored sugar and is in a state of stress.

This tree group will decline further to death over a period of time regardless of remedial works or modifications undertaken.

**Dead**, the tree is no longer alive and is in poor structural condition, that may cause damage to people or property and removal is strongly recommended.

## 9.1 TREE AGE CLASS TERMINOLOGY

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The following maturity class have been allocated to each tree and considers the following elements,

|                     |                                                                                                                    |
|---------------------|--------------------------------------------------------------------------------------------------------------------|
| <b>Immature:</b>    | Less than 20% of the life expectancy for the species,                                                              |
| <b>Semi-mature:</b> | Middle age trees, 20% to 50% of life expectancy,                                                                   |
| <b>Mature:</b>      | Greater than 50 – 80% of the life expectancy for the species,                                                      |
| <b>Over-mature:</b> | Greater than 80% of the life expectancy for the species, senescent tree, or those declining irreversibly to death, |

## 9.2 SAFE USEFUL LIFE EXPECTANCY (SULE)

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The remaining Safe Useful Life Expectancy of a tree is an estimate of the sustainability of the tree within the site/landscape, calculated based on an estimate of the average age of the species in an urban area, compared with its estimated current age.

The estimated SULE of each tree is discussed with the following values;

- Greater than 40 years (Long),
- Between 15 and 40 years (Medium),
- Between 5 and 15 years (Short),
- Less than 5 years,
- Dead or hazardous,

### 9.3 ASSESSED STRUCTURAL CONDITION

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This refers to the tree's form and growth habit modified by its environment, the state of the trunk and main structural branches.

It includes the presence of defects as decay, weak branch junctions and other visible abnormalities. Although some trees without defects fail in major storms, the presence of any defect will increase the chances of failure.

- Good;** Trees with a single dominant trunk along which evenly spaced branches are spread. Branches have properly formed collars which provide strong attachment to the trunk and are about 25% of the trunk diameter. Minor structural defects may be present with low failure potentials.
- Average;** Trees with structural defects with low failure potential.
- Fair;** Trees with structural defects with medium failure potentials and require monitoring on an annual basis.
- Poor;** Trees with defects which have failed, or have a high risk of failing soon, and corrective action must be taken soon as possible.

### 9.4 ECOLOGICAL VALUE OF TREE

---

These categories are based upon the criteria used in the Thyer Tree Valuation Method (1996) to evaluate a tree's ecological benefit.

- |    |           |                                                                   |
|----|-----------|-------------------------------------------------------------------|
| 0. | None      | Weed species                                                      |
| 1. | Low       | Restricts desirable plants or of little benefit to fauna.         |
| 2. | Medium    | Beneficial to flora & fauna provides food source and/or shelter.  |
| 3. | High      | Remnant /indigenous species of native vegetation.                 |
| 4. | Very High | Indigenous species being an integral part of a natural ecosystem. |

### 9.5 VISUAL AMENITY PROVIDED-PROMINENCE

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Criteria for the assessment of amenity values are based upon the criteria used in the Thyer Tree Valuation Method (1996) to evaluate a tree's visibility in the local area.

The amenity value of a tree is a measure of its visibility, its overall position within the site, its contribution to the visual amenity and character of the area, its living crown size/spread, visual appearance including natural form/habit and crown density percentage.

As a general rule, a prominent (location) larger and significant subject tree, with good form, habit, density etc will achieve a higher amenity value.

- |    |           |                                                          |
|----|-----------|----------------------------------------------------------|
| 0. | None      | Seldom/rarely seen (remote location).                    |
| 1. | Low       | Seen frequently by private owners or adjacent residents. |
| 2. | Medium    | Seen by neighbourhood residents and or passers-by.       |
| 3. | High      | Known locally or seen by many passers-by.                |
| 4. | Very High | Of local historical importance or known widely.          |

## 9.6 RETENTION VALUE WITHIN THE LANDSCAPE

The Retention Values of the trees have been determined on the basis of the estimated longevity of the individual tree with consideration of its landscape significance rating. Together with recommendations contained within this report the information should be used to determine the most appropriate action for protection, retention of trees considered worthy of preservation and or removal.

| Retention Value Rating                     | Landscape/Environmental Significance |                      |                                 |                            |                    |        |        |
|--------------------------------------------|--------------------------------------|----------------------|---------------------------------|----------------------------|--------------------|--------|--------|
| Estimated Life Expectancy                  | 1- Very High                         | 2- Very High to High | 3- High to Moderate             | 4 - Moderate               | 5- Moderate to Low | 6- Low | 7- Nil |
| <b>HIGH</b> – (H)<br>Greater than 40 Years | <b>High Retention Value</b>          |                      |                                 |                            |                    |        |        |
| <b>MEDIUM</b> - (M) 15 to 40 Years         |                                      |                      | <b>Moderate Retention Value</b> |                            |                    |        |        |
| <b>LOW</b> – (L)<br>5 to 15 years          |                                      |                      |                                 | <b>Low Retention Value</b> |                    |        |        |
| <b>Less than 5 Years</b>                   |                                      |                      |                                 |                            |                    |        |        |
| <b>Dead or Hazardous</b>                   |                                      |                      |                                 |                            |                    |        |        |

**Table 2 Landscape Significance Value**

## 9.7 RISK LEVEL MATRIX- CONSEQUENCES OF EVENT OCCURRING

Occupational Health and Safety Legislation places a “Duty of Care” on individuals and companies to ensure potential hazards and risks regarding tree management are eliminated as best as possible and develop controls for long term tree management.

Whilst a trees overall health may be hard to determine to a “Lay or Common person” there are some visible signs that may flag potential safety concerns including but not limited to; Limb shedding, poor canopy and foliage colour, major deadwood or die-back of out limbs etc.

The Risk Matrix table below involves determining the potential risk verses the probable consequence of exposure to the hazard and the likelihood of the event occurring.

| RISK LEVEL MATRIX – CONSEQUENCES OF EVENT OCCURRING |                            |                           |                                 |                      |                              |
|-----------------------------------------------------|----------------------------|---------------------------|---------------------------------|----------------------|------------------------------|
| LIKELIHOOD                                          | Catastrophic<br>(Fatality) | Major<br>(Serious Injury) | Moderate<br>(Medical treatment) | Minor<br>(First Aid) | Insignificant<br>(No Injury) |
| <b>Almost Certain</b>                               | <b>E 25</b>                | <b>E 23</b>               | <b>E 20</b>                     | <b>H 16</b>          | <b>H 11</b>                  |
| <b>Likely</b>                                       | <b>E 24</b>                | <b>E 21</b>               | <b>H 17</b>                     | <b>H 12</b>          | <b>M 7</b>                   |
| <b>Possible</b>                                     | <b>E 22</b>                | <b>E 18</b>               | <b>H 13</b>                     | <b>M 8</b>           | <b>L 4</b>                   |
| <b>Unlikely</b>                                     | <b>E 19</b>                | <b>H 14</b>               | <b>M 9</b>                      | <b>L 5</b>           | <b>L 2</b>                   |
| <b>Rare</b>                                         | <b>H 15</b>                | <b>H 10</b>               | <b>M 6</b>                      | <b>L 3</b>           | <b>L 1</b>                   |

**Table 3 RISK LEVEL MATRIX**

**Risk Levels are;**    **E = Extreme** (18 to 25) – Act Now  
                               **H = High** (12 to 17) – ASAP  
                               **M = Moderate** (7 to 11) – Plan, and  
                               **L = Low Risk** (1 to 6) – Review/assess tree annually

## 9.8 ENVIRONMENTAL ZONE DEFINITIONS

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- 1. Landscaped:** Ornamental gardens including managed open lawns, tree/shrub planting.
- 2. Remnant:** Remnant vegetation significant to a local ecological community but managed with hard scaped areas i.e. paved areas, driveways,
- 3. Natural Bushland:** Natural bushland vegetation significant to local and broader ecological Vegetation communities and or identified under the Threatened Species Conservation Act 1995. Natural Bushland can then be defined further subject to ground truthing into the following sub-sections.
  - a) Good.** High-quality vegetation and habitat values,
  - b) Medium.** Good quality vegetation with some introduced weed species, and
  - c) Poor.** Low-quality remnant vegetation, high-level weed infestation (and range of weed species), erosion, limited native habitat, requires site specific Vegetation Management Plan.
- 4. Mapped Environmental Constraint Areas:**

As per Council mapping e.g. Slope constraint ( $> 18^\circ$ ), watercourse buffer, sensitive vegetation buffer, Flora/Fauna significant/buffer as identified on site.

## 10.0 TREE IDENTIFICATION ASSESSMENT SUMMARY

| <b>Risk Matrix</b> | <b>Catastrophic</b><br>Urgent- Tree requires immediate removal to due WH&S concern | <b>Major</b><br>Tree requires removal or corrective action for on-going retention/maintenance | <b>Moderate</b><br>Annual Monitoring with corrective maintenance | <b>Minor/Insignificant</b><br>Annual Monitoring or No Action | <b>Negligible/No Risk</b><br>No Action, Re-Assess in 3yrs |
|--------------------|------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|------------------------------------------------------------------|--------------------------------------------------------------|-----------------------------------------------------------|
|--------------------|------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|------------------------------------------------------------------|--------------------------------------------------------------|-----------------------------------------------------------|

| <b>Tree Number</b> | <b>Tree Species</b>                                 | <b>Height</b> | <b>Spread</b> | <b>DBH @ 1.4m</b> | <b>Canopy %</b> | <b>SRZ Required</b> | <b>TPZ Required</b> | <b>Tree Age</b><br>* Young<br>* Semi-mature<br>* Mature<br>* Over Mature | <b>Tree Health</b><br>* Good<br>* Fair<br>* Poor<br>* Dead | <b>Tree Structure</b><br>* Good<br>* Fair<br>* Poor | <b>Ecological Significance</b><br>* High<br>* Moderate<br>* Low<br>* Nil | <b>Landscape Significance</b><br>* High<br>* Moderate<br>* Low<br>* Nil | <b>Risk Matrix</b><br>* Catastrophic<br>* Major<br>* Moderate<br>* Minor | <b>Defects Observed</b><br>* Yes<br>* No | <b>Retention Value</b><br>* High<br>* Moderate<br>* Low<br>* Nil | <b>SULE Rating</b> | <b>Tree to be Retained and Arborist Comments</b><br>* Yes<br>* No                                                                                                                                                      |
|--------------------|-----------------------------------------------------|---------------|---------------|-------------------|-----------------|---------------------|---------------------|--------------------------------------------------------------------------|------------------------------------------------------------|-----------------------------------------------------|--------------------------------------------------------------------------|-------------------------------------------------------------------------|--------------------------------------------------------------------------|------------------------------------------|------------------------------------------------------------------|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>T1</b>          | Wallangarra White Gum<br><i>Eucalyptus scoparia</i> | 14m           | 8 x 8m        | 580mm             | 65%             | 2.7m                | 7m                  | Mature                                                                   | Good to Fair                                               | Good to Fair                                        | Low                                                                      | Low to Moderate                                                         | Minor – M 5                                                              | No                                       | Low to Moderate                                                  | <b>3</b>           | Yes, based on AS4970-2009 Protection of Trees on Development Sites, this tree is sufficiently distanced to be safely retained and protected. It requires minor dead wood to be removed, pruned and monitored annually. |

|           |                                           |     |          |       |     |    |      |        |      |              |                 |                 |             |     |                 |          |                                                                                                                                                                                                                                        |
|-----------|-------------------------------------------|-----|----------|-------|-----|----|------|--------|------|--------------|-----------------|-----------------|-------------|-----|-----------------|----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>T2</b> | Red Ironbark<br><i>Eucalyptus fibrosa</i> | 15m | 12 x 12m | 760mm | 70% | 3m | 9.1m | Mature | Good | Good         | Low             | Low to Moderate | Minor – M95 | Yes | Low to Moderate | <b>3</b> | Yes, based on AS4970-2009 Protection of Trees on Development Sites, this tree is sufficiently distanced to be safely retained, protected. It requires to be monitored due to Cockatoo damaged noted in an upper scaffold branch union. |
| <b>T3</b> | Red Ironbark<br><i>Eucalyptus fibrosa</i> | 15m | 9 x 69   | 710mm | 65% | 3m | 8.5m | Mature | Good | Good to Fair | Low to Moderate | Low to Moderate | Minor – M 8 | No  | Low to Moderate | <b>3</b> | Yes, based on AS4970-2009 Protection of Trees on Development Sites, this tree is sufficiently distanced to be safely retained, protected and monitored.                                                                                |

|           |                                                                    |     |          |               |     |      |      |        |      |              |                 |                 |             |    |                 |          |                                                                                                                                                                    |
|-----------|--------------------------------------------------------------------|-----|----------|---------------|-----|------|------|--------|------|--------------|-----------------|-----------------|-------------|----|-----------------|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>T4</b> | Forest Red Gum<br><i>Eucalyptus tereticornis</i>                   | 15m | 12 x 12m | 940mm         | 65% | 2.8m | 7.7m | Mature | Good | Good to Fair | Low to Moderate | Low to Moderate | Minor – M 8 | No | Low to Moderate | <b>3</b> | Yes, based on AS4970-2009 Protection of Trees on Development Sites, this tree is sufficiently distanced to be safely retained, protected and monitored.            |
| <b>T5</b> | Forest Red Gum<br><i>Eucalyptus tereticornis</i>                   | 15m | 10 x 10m | 640mm         | 60% | 3.3m | 11m  | Mature | Good | Good to Fair | Low to Moderate | Low to Moderate | Minor – M 8 | No | Low to Moderate | <b>3</b> | Yes, based on AS4970-2009 Protection of Trees on Development Sites, this tree is sufficiently distanced to be safely retained, protected and monitored.            |
| <b>T6</b> | Swamp Oak x<br><i>Casuarina glauca</i><br><br><i>Planted group</i> | 6m  | 4 x 4m   | Average 220mm | 90% | 2m   | 3.1m | Mature | Good | Good         | Nil to Low      | Low             | Minor – M 5 | No | Low to Moderate | <b>3</b> | Yes, based on AS4970-2009 Protection of Trees on Development Sites, this group planting are sufficiently distanced to be safely retained, protected and monitored. |

|    |                                                  |     |          |        |     |      |     |             |              |      |                 |                 |                     |     |                 |    |                                                                                                                                                                                                                        |
|----|--------------------------------------------------|-----|----------|--------|-----|------|-----|-------------|--------------|------|-----------------|-----------------|---------------------|-----|-----------------|----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| T7 | Forest Red Gum<br><i>Eucalyptus tereticornis</i> | 17m | 9 x 9m   | 1300mm | 30% | N/A  | N/A | Over Mature | Good to Fair | Poor | Low to Moderate | Low             | Catastrophic – E 19 | Yes | Nil to Low      | 4C | No, this tree is required to be removed due to its poor structural condition and density, that represents a WH&S concern if retained.                                                                                  |
| T8 | Forest Red Gum<br><i>Eucalyptus tereticornis</i> | 14m | 12 x 12m | 860mm  | 65% | 3.3m | 10m | Mature      | Good         | Good | Low to Moderate | Low to Moderate | Minor – M 5         | No  | Low to Moderate | 3  | Yes, based on AS4970-2009 Protection of Trees on Development Sites, this tree is sufficiently distanced to be safely retained and protected. It requires minor dead wood to be removed, pruned and monitored annually. |

|            |                                                                    |     |          |             |     |     |     |        |      |      |                 |                 |             |    |                 |          |                                                                                                                                                                                                                        |
|------------|--------------------------------------------------------------------|-----|----------|-------------|-----|-----|-----|--------|------|------|-----------------|-----------------|-------------|----|-----------------|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>T9</b>  | Grey Gum<br><i>Eucalyptus moluccana</i>                            | 14m | 10 x 12m | 850mm       | 65% | 3m  | 10m | Mature | Good | Good | Low to Moderate | Low to Moderate | Minor – M 5 | No | Low to Moderate | <b>3</b> | Yes, based on AS4970-2009 Protection of Trees on Development Sites, this tree is sufficiently distanced to be safely retained and protected. It requires minor dead wood to be removed, pruned and monitored annually. |
| <b>T10</b> | Grey Gum<br><i>Eucalyptus moluccana</i><br><br>Council street tree | 16m | 12 x 12m | 680mm       | 60% | N/A | N/A | Mature | Fair | Fair | Low             | Low to Moderate | Minor – M 5 | No | Low to Moderate | <b>4</b> | No, this street tree is required to be removed as it is located within the proposed new gate house entrance and scope of works.                                                                                        |
| <b>T11</b> | Prickly Paperbark<br><i>Melaleuca styphelioides</i>                | 4m  | 5 x 5m   | Multi trunk | 90% | N/A | N/A | Mature | Good | Good | Nil to Low      | Low             | Minor – M 5 | No | Low             | <b>3</b> | No, minor tree is required to be removed as it is located within the proposed new gate house building envelope and scope of works.                                                                                     |

**Figure 4 Shows a detailed list of trees observed and assessed in relation to this application. All species were identified, assessed and referenced against Councils Tree Preservation Guidelines by a Qualified Horticulturist and AQF Level 5 Arborist (Dip Arb).**

## 11.0 TREE LOCATION NUMBERING BASED ON THE PROPOSED BUILDING ALTERATIONS

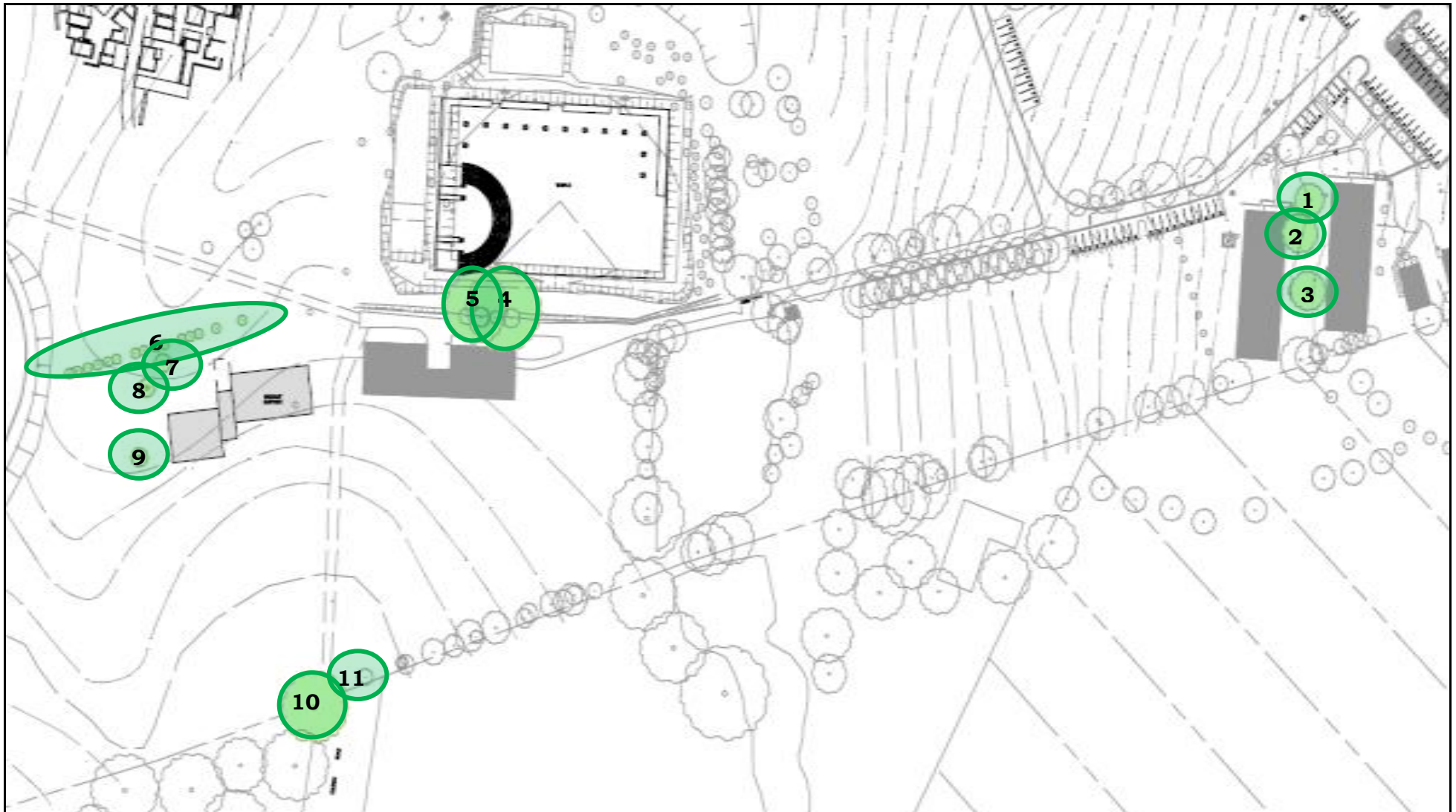


Figure 5 Shows the trees location assessed based on the plans provided.

## 12.0 TREES PROPOSED TO BE RETAINED OR REMOVED BASED ON THE PROPOSED BUILDING ALTERATIONS

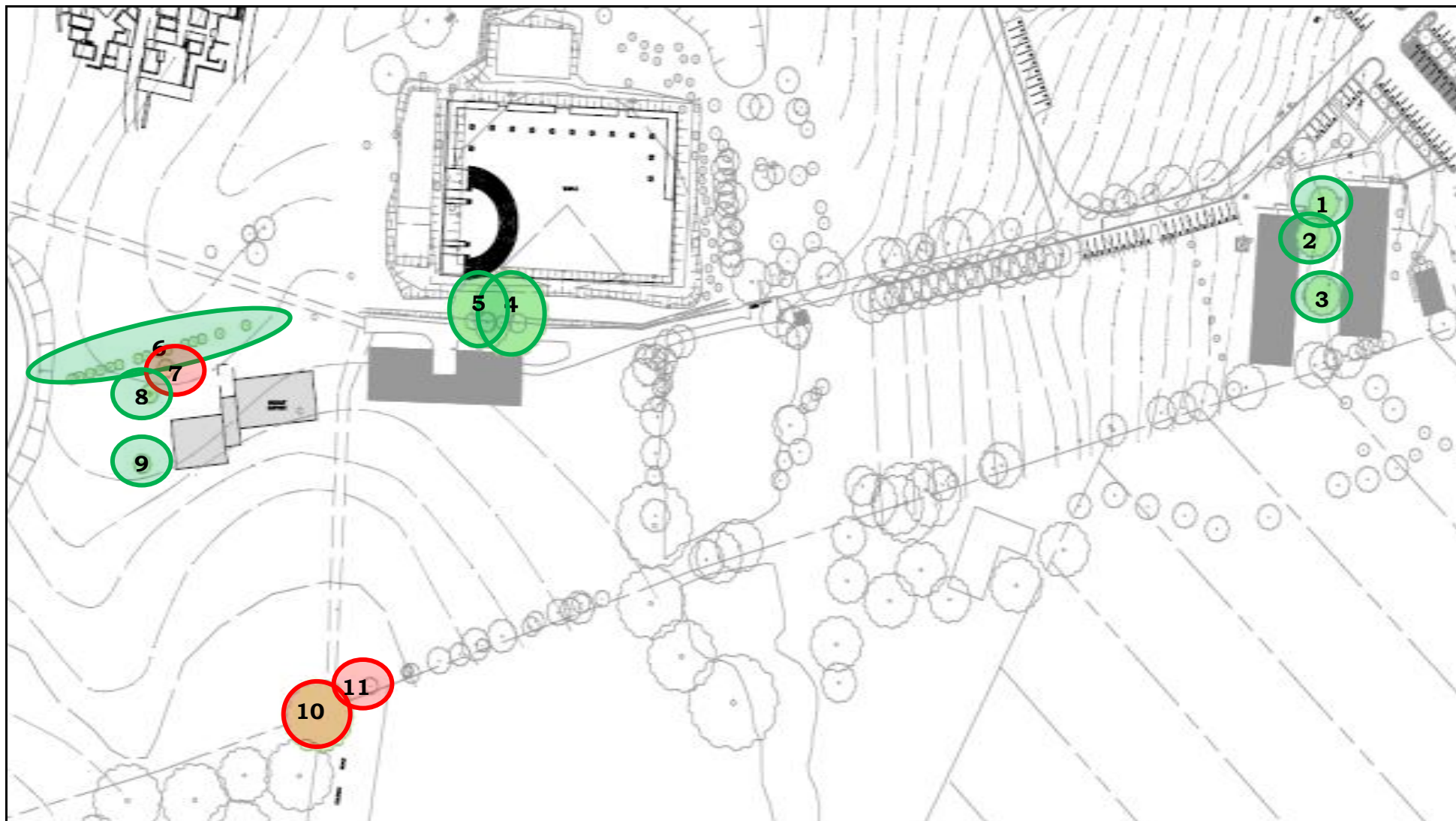


Figure 6 Shows trees proposed to be removed based on the development location and or poor health.

## 12.1 TREE MANAGEMENT PLAN FOR RETAINED TREES

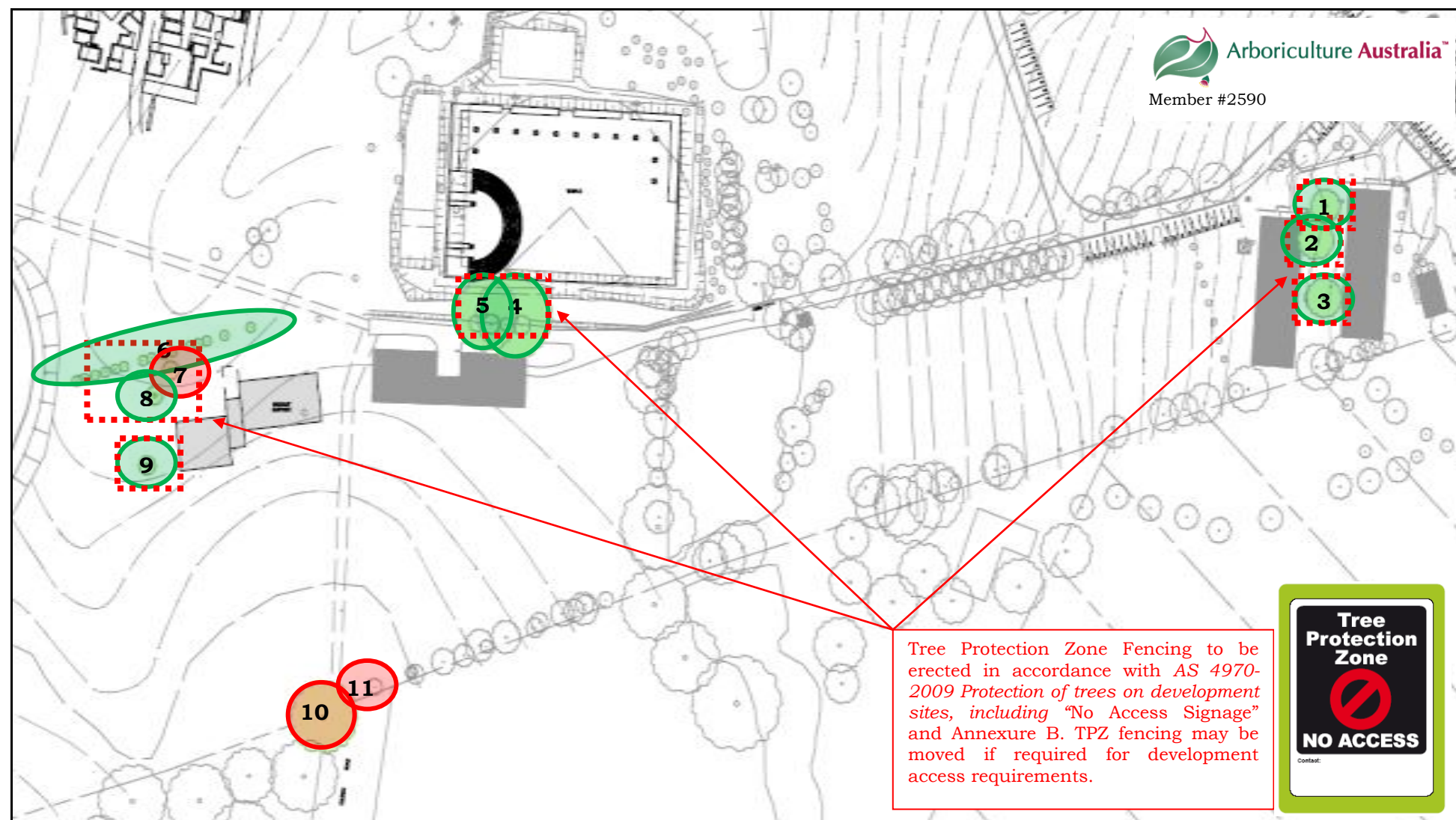


Figure 7 Shows trees to be retained and on-site tree management.

### 13.0 SITE PHOTOGRAPHS

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**Figure 8 Shows looking at Trees 1 to 3 that are proposed to be retained.**



**Figure 9 Shows Tree 2 to be retained and protected.**



**Figure 10 Shows Tree 2 Cockatoo damage to be monitored.**



**Figure 11 Shows Trees 4 and 5 sufficiently distanced to be retained.**



**Figure 12 Shows minor Swamp Oaks to be retained and protected.**



**Figure 13 Shows Trees 7, 8 and 9 from a distance.**



**Figure 14 Shows Tree 7 poor trunk and open wounds, hence full removal.**



**Figure 15 Shows separation of the lower scaffold branch from the trunk that is required to be removed due to WH&S concerns.**



**Figure 16 Shows Tree 8 from a distance to be retained.**



**Figure 17 Shows Tree 8 to be retained and protected.**



**Figure 18 Shows Tree 11 from a distance.**



**Figure 19 Shows Tree 10 from a distance.**

#### **14.0 RETENTION AND MANAGEMENT OF SITE AND ADJOINING TREES NUMBERED 1, 2, 3, 4, 5, 6, 8 AND 9 (General Overview)**

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The following points may be considered for the long-term retention of trees under this application.

- Avoid large changes to the surface structure due to modification of the tree's moisture / surface feeding roots,
- A Qualified Arborist/Horticulturalist undertakes all Arboricultural works,
- All trenching near the trees as required is to be hand dug to ensure minimal disturbance to additional surface feeding roots,
- Any tree roots discovered are cut cleanly with root pruning devices,
- Vertical deep watering points for stressed mature trees if or as required,
- Air-knife treatments, to alleviate soil compaction where trees are suffering stress, and to inspect tree root structures and growth patterns,
- Any proposed work located near the trunk or outer canopy of the trees drip line, where services are known to be in the vicinity, any excavation for services should be hand dug to ensure minimal impact to the trees surface feeding and support roots,
- Any tree roots that are exposed will be removed by approved Arboricultural techniques and have a root hormone i.e. Formula 20® or equivalent applied at the manufacture's specification,
- Any trenches undertaken near tree drip zones will be backfilled and compacted with an approved Australian Standard orchid mix 60/40 containing washed river sand and peat moss to a minimum depth of 700mm, the remaining soil profile is to be filled with an approved topsoil to meet the existing soil surface,
- No building waste is to be disposed of/or stored near the tree trunk or drip zone,
- In order to ameliorate impact of any development, advanced plants may be used in the Landscape Master Plan,
- Plantings should take into consideration the high priority of the streetscape and visual amenity,
- In order to ameliorate impact of any development, standard erosion and sediment controls are recommended,
- The trees drip line/zone is to be mulched to the Horticultural standard of 75mm,
- Regular watering is to be undertaken in hot dry periods to alleviate any short-term stress or loss of available water,
- Erection of a chain mesh safety fence be installed to ensure the protection of Trees Critical Root Zone as per Annexure B,
- A qualified Arborist should monitor these trees over a twelve (12) month period to evaluate the trees recovery and provide technical information to Council as required.

## 15.0 SENSITIVE CONSTRUCTION APPROACH FOR SITE TREES

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Where works are unavoidable within the Tree Protection Zone (TPZ) and or Structural Root Zone (SRZ) of trees to be retained, the following should be considered, but not limited to;

- Minimise the direct and indirect impacts to tree roots and soil such as root severance or damage, soil excavation, compaction and contamination,
- Allow for the free movement of water and oxygen within the soil of the TPZ,
- Allow for future rooting area adjacent to the TPZ,

Where the placement of footings within the SRZ cannot be avoided, root sensitive footing systems should be considered i.e. Terrabond®, Rocla Tri hex® paver or Eco paver® series would be sufficient to allow surface moisture and air into both trees surface feeding zone. These footings systems are minimal in their need for excavation by comparison to strip footings.

Footing systems such as pier and beam, screw pile and waffle slab have the potential to reduce the impact on trees by retaining sections of soil and roots between the piers.

To achieve the most benefit from this type of construction, the following is recommended;

- Discontinuous footings should be used within the SRZ of the subject tree. (standard footing design could be used outside this area),
- All beams should be above the natural soil grade/surface,
- The footing design should allow for the greatest achievable span between Piers (as per engineer's specifications/advice),
- Piers should not be placed within the Root Plate Radius of the subject tree,
- Foundations for the proposed piers should be initially hand dug to a depth of 500mm or to rock. If any roots are found that are greater than 40mmØ, the pier position should be relocated, subject to engineer's advice,
- The proposed excavations should not result in the severance of roots greater than 40mmØ,
- Care should be taken to avoid soil compaction between piers and any drilling machinery should remain outside the Tree Protection Zone. If access within the Tree Protection Zone by machinery cannot be avoided, appropriate compaction control methods should be used,
- Consider the type of equipment that will be used to drill holes for the piers and the clearance/tolerance requirement under the subject tree's canopy,
- These construction methods may require the implementation of post-construction maintenance such as irrigation and mulching. This would assist in minimising the potential impacts on tree health by providing favourable environment conditions for continued root growth and development.

Where achievable, pedestrian / vehicular access ways should be constructed of a semipermeable material (as listed above) and placed above grade to minimize the need for excavation. The strength of the pavement shall be selected to reduce the reliance on sub-base for strength. Where appropriate, hand excavation and root pruning should be undertaken along the length of excavations adjacent to SRZs prior to any machine construction work. Major roots (greater than 40mmØ) should not be severed or damaged. Minor roots (less than 40mmØ) to be pruned should be cleanly severed.

## **16.0 PRE-CONSTRUCTION TREE PROTECTION MEASURES**

### **16.1 APPOINTMENT OF SITE ARBORIST**

A Site Arborist shall be appointed prior the commencement of all works on- site.

The Site Arborist shall monitor the trees to be retained and supervise the tree protection measures. The Site Arborist shall have a minimum qualification equivalent (using the Australian Qualifications Framework) of NSW TAFE Certificate Level 5 or above in Arboriculture. An allowance of Five-(5) working days' notice to allow inspections to be undertaken at the following stages would be considered standard practice.

| <b>INSPECTION/HOLD POINT</b>                                                                                                                  | <b>INSPECTION PERSONNEL</b>                      |
|-----------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------|
| Identification of retained trees and installation of tree protection zone including protection fencing, silt fencing and appropriate signage. | Site Arborist to undertake with Site Supervisor. |
| Modification of the Tree Protection Zone if or as required.                                                                                   | Site Arborist to undertake with Site Supervisor. |
| Works within the Tree Protection Zone if or as required.                                                                                      | Site Arborist to undertake with Site Supervisor. |
| Completion of the construction works (Post Construction) and final inspection/sign off.                                                       | Site Arborist to undertake with Site Supervisor. |

### **16.2 EDUCATION**

The project development applicant, contractors and site workers shall receive a copy of the final/Council approved Arborist Assessment and specifications with a minimum of 3 working days prior to commencing work on-site.

Contractors and site workers undertaking works within the Tree Protection Zones shall sign the site log confirming they have read and understand these specifications, prior to undertaking works on-site.

### **16.3 SITE WORKS TREE PROTECTION ZONES**

The trees identified to be retained shall be protected prior to and during the construction process from activities that may result in an adverse effect on its health, structure or longevity.

The area within the Tree Protection Zone shall exclude the following activities, unless otherwise stated and or approved by Council/Consent Authority;

Modification of existing soil levels,  
Excavations and trenching,  
Cultivation of the soil,  
Mechanical removal of vegetation,  
Soil disturbance,  
Movement of natural rock,  
Storage of materials, plant or equipment,  
Erection of site sheds,

Affixing of signage or hoarding to the tree,  
Preparation of building materials,  
Disposal of waste materials and chemicals,  
Movement of pedestrian or vehicular traffic,  
Temporary or permanent location of services,

## 16.4 TREE PROTECTION FENCING

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Tree Protection Fencing shall be installed at the perimeter of the Tree Protection Zone as specified.

As a minimum, the Tree Protection Fence shall consist of 1.8m high temporary chain wire panels supported by steel poles/stakes. They shall be fastened together and supported to prevent sideways movement. The fence must have a lockable opening for access. The tree's woody roots shall not be damaged during the installation of the Tree Protection Fencing.

Shade cloth material shall be attached to the outer surface of the Tree Protection Fence. The shade cloth material shall be transparent to provide visibility into the Tree Protection Zone.

The Tree Protection Fence shall be erected prior to the commencement of works on-site and shall be maintained in good condition for the duration of the development period.

The Tree Protection Fence shall only be removed, altered, or relocated with the authorization from the Site Arborist in consultation with the Site Supervisor.

## 16.5 SIGNAGE

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Tree Protection Signage shall be attached to the Tree Protection Zone and displayed in a prominent position on each tree protection fencing.

The signs shall be repeated at 10m intervals or closer where the fence changes direction. The signage shall be installed prior to the commencement of works on-site and shall be maintained in good condition for the duration of the development period.

The lettering for each sign shall be a minimum 72-point font size. The signs shall be a minimum size of 600 x 500mm. The lettering on the sign should comply with AS 1319. Each sign shall advise the following details;



- This fence has been installed to prevent damage to the tree and its natural environment. **Access is restricted.**
- If access, encroachment or incursion into this Tree Protection Zone is required, prior authorisation is required by the Site Arborist.
- Name, address, and telephone number of the firm.

**Source AS 4970-2009 Protection of trees on development sites**

## 16.6 SILT FENCING, SEDIMENT CONTROL AND SOIL EROSION

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In order to protect the sites habitat from soil erosion, an approved sedimentation control fence should be erected prior to the construction process.

The purpose of the silt fencing, and sediment control is to ensure that no soil material (erosion) enters or leaves the building site into Tree Protection Zones or any nearby dams or creeks etc. Silt fence shall be installed parallel to the contours in the area immediately above the Tree Protection Zone. The silt fence shall be installed by securing geo-fabric to secure post fencing.

The post pickets shall be placed at 200mm below existing soil surface. Any sedimentation barrier used is to remain in place for a minimum of 12 weeks after practical completion and can be removed after this time provided, plant growth, health; density and condition have been noted by the Site Arborist.

A hay/straw bale shall be placed up slope from the silt fence and secured with timber stakes. The bottom of the geo-fabric shall be folded underneath the hay/straw bale.

To allow for the maintenance of both the Tree Protection Fence and the silt fence, the two- (2) fences shall be constructed separately and stand independently of each other. The silt fence shall be erected prior to the commencement of works on-site and shall be maintained in good condition for the duration of the development period.

It should be noted that the installation of silt fences as part of this Tree Protection Plan are not erosion and sediment control measures for the development.

The method and type of barrier is to be directed by Council and or as identified in EPA Guidelines, which covers the recently revised document "**Managing Urban Storm water: Soil and Construction Vol.1 (4th Edition)**" (also referred to as the "**Blue Book**"). The Blue Book covers a range of technical and management issues relating to erosion and sediment control in urban development (including standard drawings).

In addition, contractors must refrain from including but not limited to doing any of the following activities within or adjoining the tree protection zones.

- Stockpiling of soils, rubble, or other materials,
- Placement of a site office or shed,
- Mixing materials,
- Parking of construction machinery or other vehicles,
- Repairing machinery and or re-fuelling,
- Lighting of fires,

The Site should be left in a clean and tidy manner ensuring suitable mulch cover is applied within the trees drip zone prior to the sedimentation barrier removed.

## **17.0 SITE MANAGEMENT OF RETAINED TREES**

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### **17.1 MATERIALS STORAGE**

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No materials shall be stored or located within the specified Tree Protection Zone.

A silt fence shall be installed down slope of any storage points. Storage points (where applicable) shall be covered when not in use. An appropriate Environmental spill kit shall be on site at all times for any unlikely spillages.

### **17.2 WASTE STORAGE**

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Waste storage shall not be located within the specified Tree Protection Zone.

A silt fence box style collection point shall be installed down slope from any waste/rubbish collection point. All rubbish shall be stored to prevent material loss caused by wind and or water. Skip bins shall be covered when not in use.

All debris collected should be removed from the site and disposed of in an authorized waste management facility. Natural debris such as logs, and rocks may be left as wildlife habitat provided it does not present a safety hazard or become an obstruction. In such cases it should be appropriately re-arranged and or secured.

Site sheds shall not be located within the specified Tree Protection Zone for any reason.

## **18.0 TREE PROTECTION MEASURES FOR CONSTRUCTION PROCESS**

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### **18.1 SITE ACCESS**

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Pedestrian and vehicular movement shall not occur within any section of the specified Tree Protection Zone.

### **18.2 TEMPORARY SERVICES**

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Temporary services i.e. water, electricity, sewer shall not be located within any section of the Tree Protection Zone, for any purpose.

### **18.3 WORKS WITHIN THE TREE PROTECTION ZONE**

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The Tree Protection Zone may need to be modified during the construction process to allow access between the tree to be retained and the construction works.

The Tree Protection Zone shall remain intact as specified and approved by Council until these works are to project completion. If access, encroachment or incursion into the Tree Protection Zone is deemed essential, prior authorization is required by the Site Arborist.

The modification of the Tree Protection Zones may necessitate the dismantling of sections of the Tree Protection Fencing in the short term as part of the construction process. The Tree Protection Fence shall only be removed, altered, or relocated with the authorization of the Site Arborist in writing.

### **18.3.1 TREE TRUNK PROTECTION WORKS**

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Where deemed necessary by the Site Arborist, trunk protection shall be provided. Trunk protection may vary subject to the scope of works, trees age, height and environmental conditions. For semi mature to mature trees shall be installed by wrapping around two-(2) layers of carpet underlay or similar around the trunk to a minimum height of 2m or were the lower scaffold branches allow.

The trunk shall further be protected with 2m lengths of timbers (75 x 50 x 200mm) spaced at 100mm centres, secured by wire rope. The wire rope shall not be fixed to the tree in any way.

### **18.3.2 TREE BRANCH PROTECTION WORKS**

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Where deemed necessary by the Site Arborist, branch protection shall be provided. Branch protection shall be installed by wrapping around two-(2) layers of carpet underlay or similar around the branch, secured by wire rope.

The wire rope shall not be fixed to the tree in any way.

### **18.3.3 ROOT PRUNING AND EXCAVATION WORKS**

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Minor roots (less than 40mm in diameter) to be pruned shall be cleanly severed with sharp, sterilised pruning implements. Hessian material shall be placed over the face of the excavation. Exposed roots shall be kept in a moist condition during the construction phase.

The main area for surface feeding roots to occur is from the tree trunk to the outer canopy known as the drip zone. These fibrous roots are less likely to occur under or near other buildings, as there is little surface moisture or soil air presence for root survival. These fibrous roots are those that take up water and nutrients.

While some tree roots will deeply penetrate the soil profile, in search of available water, most will occupy the first 60-70cm of the soil, as to obtain the needed sustenance. At times, it will not be possible to retain the optimum TPZ around each tree and any activities proposed within this area must be carefully analysed to minimise any effects on its health and/or stability.

The actual spread of the root system is largely dependent on the particular species involved, and their localised environment. Any work carried out within the Tree Protection Zone should be reviewed and supervised by the engaged Site Arborist.

Construction works proposed to be undertaken around the trees if not correctly assessed may modify the natural water table and reduce the amount of soil air and moisture present/available to the trees and their longevity may be greatly diminished.

If under the course of construction, the tree roots are damaged or adversely affected, their demise will cause drought stress; poor uptake of water and nutrients, slower dispersal of gums and resins and could, in the long term, have an effect on the movement of certain compounds which make up the structure of the tree. Where major roots (greater than 40mmØ) are encountered during excavations, further advice from the Site Arborist shall be sought prior to any pruning. Certain instances may require hand digging to ensure the trees health and overall stability.

#### **18.3.4 TREE DAMAGE DURING WORKS**

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In the event of the tree that is to be retained becoming damaged during the development period, the Site Arborist shall be informed to inspect and provide advice on remedial action if or as required.

#### **18.3.5 COMPLETION OF WORKS WITHIN TREE PROTECTION ZONE**

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Upon completion of the works within the Tree Protection Zone, the Tree Protection Fencing shall be shall erected until site machinery, sheds, storage facilities are removed.

Where the construction of new structures does not provide sufficient area for the specified Tree Protection Zone, the Tree Protection Zone shall be modified by the Site Arborist prior to any works commencing and be documented.

#### **18.3.6 MONITORING**

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The Site Arborist shall monitor the site fortnightly throughout the development period to ensure these specifications are maintained.

A site log shall record the details of the site inspections for review by the Principal Certifying Authority prior to the release of the Compliance/Occupation Certificate.

Any changes to the proposed design or through development on site will require additional arboricultural assessment.

The applicant/contractor shall complete all works tabled in this Arborist Assessment in accordance with this program as agreed with, any variations are to be formally submitted to the Site Arborist and or Certifying Authority for approval.

The work shall be deemed 'practically complete' when all works have been completed to the satisfaction of the Contractor and Certifying Authority.

#### **18.4 SOIL PROTECTION WORKS**

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Where deemed necessary by the Site Arborist, the ground surface within the Tree Protection Zone shall be protected by laying geo-textile over the existing mulch cover.

Large diameter (up to 70mm) recycled railway ballast (basalt) shall be placed over the geo-textile material to a depth of 100mm.

The soil layers shall not be inverted during the excavation works and topsoil shall be stockpiled on site for use in the landscape works. However, it is expected that stringent controls are imposed and implemented to minimise adverse impacts on the soil. These should be site specific and are beyond the scope of this report.

#### **18.5 PEST AND DISEASE MONITORING**

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All plants should be monitored for pest and disease every two weeks as part of the programmed site inspections. Insecticide is not recommended for native plant species unless the problem becomes severe.

Most native plants will re-shoot after insect predation has passed.

## 19.0 POST CONSTRUCTION MAINTENAINCE PROCESS

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Upon the completion of construction works, a final assessment of the tree(s) shall be undertaken by the Site Arborist in consultation with the Site Supervisor. Items to be inspected and addressed shall include but not limited to;

- Tree Protection Zone measures, (*where they adequate*)
- Any damage to the tree's root system, (*if applicable*)
- Any visible damage to the tree's trunk, branches or canopy, (*if applicable*)
- Any changes in levels, soil structure, erosion, or loss of organic matter, (*if applicable*)
- Changes to wind loading in the crown through pruning requirement and effects of new structures, (*if applicable*)
- Pest and disease infestation, (*if observed*)
- Drought stress,
- Requirement for decompaction works, (*if applicable*)
- Requirement for further pruning works, (*if required*)
- Requirement for ongoing maintenance such as watering, mulching.

## 20.0 RECOMMENDATIONS

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After close visual and physical investigation of the trees condition (VTA) the results from the field investigations indicated the following;

Subject to Council process, approval is recommended for the removal of Three-(3) Trees tabled as 7, 10 and 12.

**Tree 7** Forest Red Gum, is required to be removed due to its poor declining health and structural faults consisting of large open wounds, dead apical leader, splitting of the trunk and separation of the first order scaffold limbs from the trunk. Whilst this tree is sufficiently distanced from the proposed new building, it is required to be removed due to WH&S concerns if it fails.

**Tree 10** Grey Gum, Council street tree is required to be removed for the proposed new building entrance gate house. It is in fair health and condition, however it will be removed and replaced with an appropriate species within the Watchtower grounds.

**Group 11** Prickly Paperbark, is required to be removed for the proposed new building entrance gate house. It is in fair health and condition, however it will be removed and replaced with an appropriate species within the Watchtower grounds.

Site and adjoining trees numbered 1, 2, 3, 4, 5, 6, 8 and 9 are sufficiently distanced to be retained with no adverse impacts anticipated to this tree based upon the proposed new buildings, renovations, alterations and best practice arboricultural techniques tabled. The proposed works will conform to AS4970 - 2009. No adverse impacts and or long-term effects are anticipated to these trees.

The following points may be considered for the proposed scope of works under this application;

- Avoid large changes to the surface structure due to modification of the tree's moisture / surface feeding roots,
- A Qualified Arborist/Horticulturalist undertakes all Arboricultural works,
- **ANY** trenching near the trees that is required is to be hand dug to ensure minimal disturbance to additional surface feeding roots,
- Any tree roots discovered are cut cleanly with root pruning device by a qualified horticulturist or arborist,
- Any proposed work located near the trunk or outer canopy of the trees drip line, where services are known to be in the vicinity, any excavation for services should be hand dug to ensure minimal impact to the trees surface feeding and support roots,
- No building waste is to be disposed of/or stored near the tree trunk or drip zones of any trees,
- In order to ameliorate impact of any development, standard erosion and sediment controls are recommended,
- Regular watering is to be undertaken in hot dry periods to alleviate any short-term stress or loss of available water,
- Replacement of the removed trees with similar species in 45lt is recommended within the grounds,
- A qualified Arborist should monitor these trees over a twelve (12) month period to evaluate the trees recovery and provide technical information to Council as required.

## 21.0 CONCLUSION

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The trees which are subject of this report are protected under Liverpool Council Tree Preservation Order.

Consideration of retaining mature significant vegetation to the area was paramount. After close visual and physical investigation of the various trees condition the results from field investigations are as follows;

Site and adjoining trees numbered 1, 2, 3, 4, 5, 6, 8 and 9 are sufficiently distanced to be retained with no adverse impacts anticipated to this tree based upon the proposed new buildings, renovations, alterations and best practice arboricultural techniques tabled. The proposed works will conform to AS4970 - 2009. No adverse impacts and or long-term effects are anticipated to these trees.

Underneath Trees 4 and 5 there are several self-seeded African Olive trees, that should be removed. These species are known nuisance environmental weed species and may be removed without further consent/approval.

Subject to Council process, approval is recommended for the removal of Three-(3) Trees tabled as 7, 10 and 12.

**Tree 7** Forest Red Gum, is required to be removed due to its poor declining health and structural faults consisting of large open wounds, dead apical leader, splitting of the trunk and separation of the first order scaffold limbs from the trunk. Whilst this tree is sufficiently distanced from the proposed new building, it is required to be removed due to WH&S concerns if it fails.

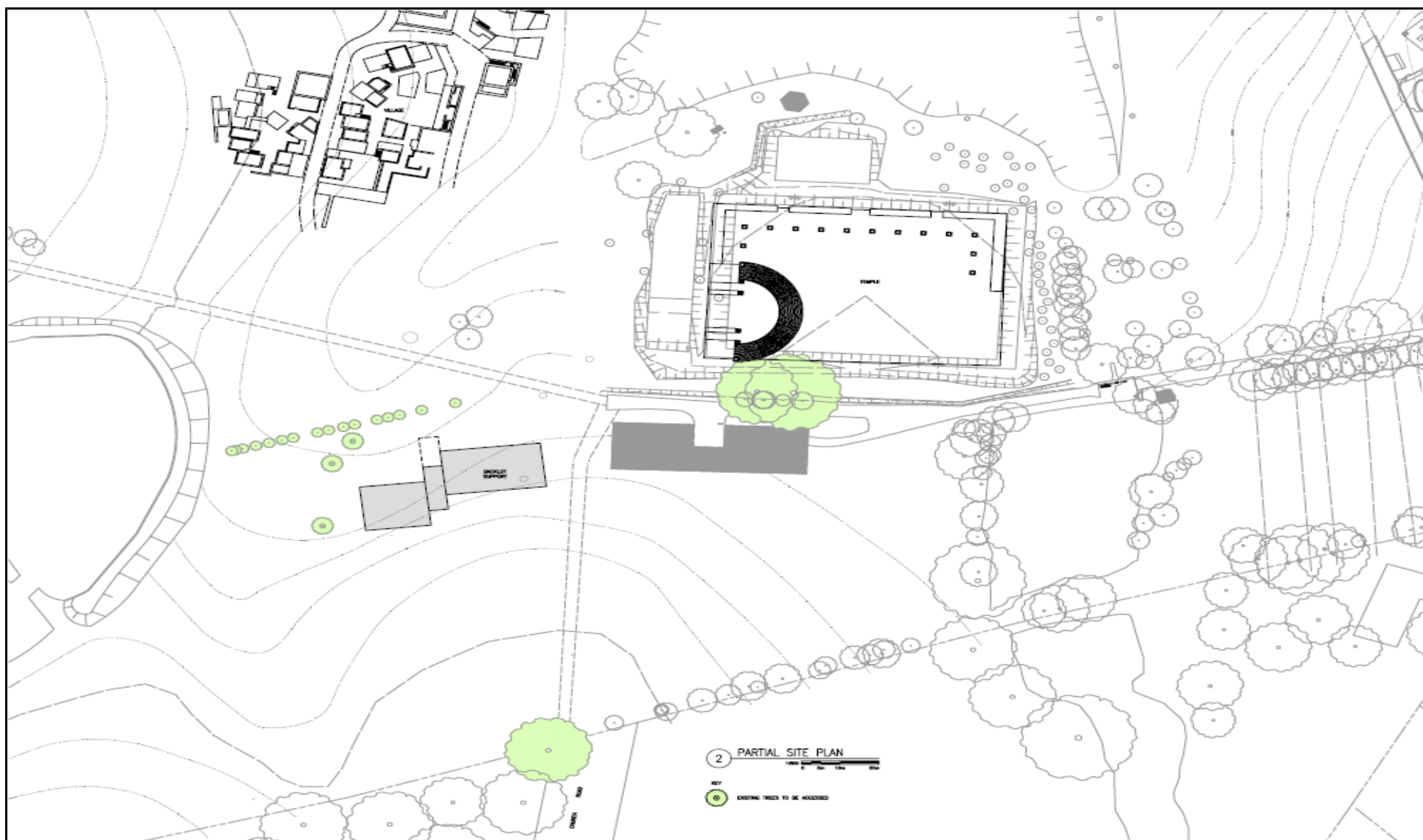
**Tree 10** Grey Gum, Council street tree is required to be removed for the proposed new building entrance gate house. It is in fair health and condition, however it will be removed and replaced with an appropriate species within the Watchtower grounds.

**Group 11** Prickly Paperbark, is required to be removed for the proposed new building entrance gate house. It is in fair health and condition, however it will be removed and replaced with an appropriate species within the Watchtower grounds.

As stated, this tabled report is a snapshot of the existing trees structural condition, health and condition at that particular point in time on site and should be used as a guide when assessing this Development Application.

In summary, there are no unforeseen tree/vegetation issues that would arise out of the proposed development that would require modification to the proposal.

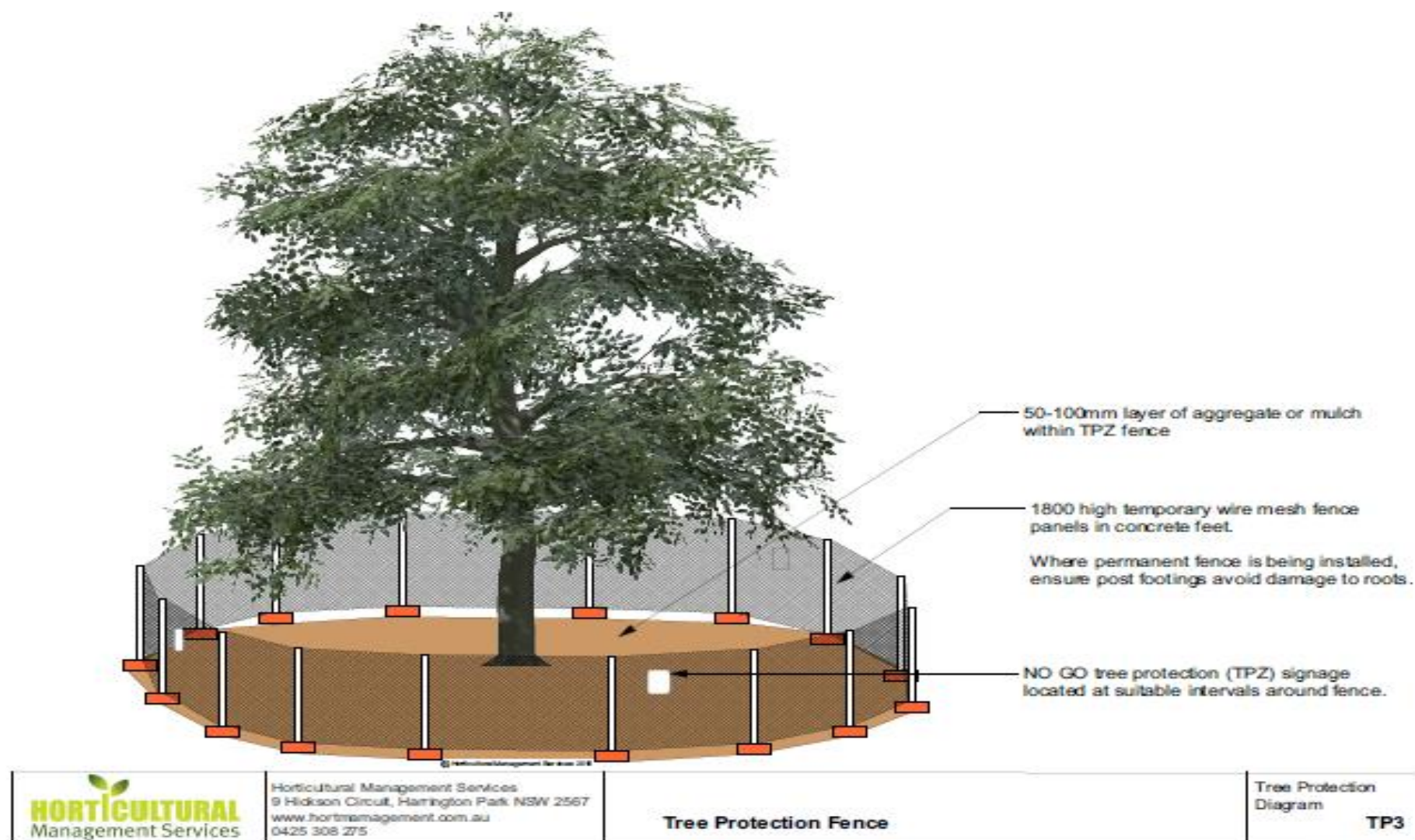
## ANNEXURE A: PROPOSED DEVELOPMENT LAYOUT







## ANNEXURE B: TREE PROTECTION DETAIL



Source AS 4970-2009 Protection of trees on development sites.

## ANNEXURE C: S.U.L.E- SAFE USEFUL LIFE EXPECTANCY (Barrell 1995)

|   | 1<br>LONG                                                                                                                                      | 2<br>MEDIUM                                                                                                                                                 | 3<br>SHORT                                                                                                                                                    | 4<br>REMOVAL                                                                                                                                                 | 5<br>MOVED OR REPLACED                                      |
|---|------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------|
|   | Likely to be useful for over 40 years with acceptable risk and assuming reasonable maintenance                                                 | Likely to be useful for 15-40 years with acceptable risk and assuming reasonable maintenance                                                                | Trees that appeared to be retainable at the time of assessment for 5 to 15 years with acceptable level of risk.                                               | Tree to be removed within the next 5 years                                                                                                                   | Tree which can be reliably moved or replaced.               |
| A | Structurally sound trees growing in positions that can accommodate future growth                                                               | Trees which may only live 15-40 years                                                                                                                       | Trees that may only live between 5 and 15 more years.                                                                                                         | Dead, dying, suppressed or declining trees through disease or inhospitable conditions.                                                                       | Small tree less than 5m in height.                          |
| B | Trees which could be made suitable for long term retention by further care                                                                     | Trees which may live for more than 40 years but which would be removed for safety or nuisance reasons                                                       | Trees which may live for more than 15 years but which would be removed for safety or nuisance reasons                                                         | Dangerous trees through instability or recent loss of adjacent trees.                                                                                        | Young trees less than 15 years old but over 5m in height.   |
| C | Trees of special significance for history, commemorative or rarity reasons that warrant extraordinary efforts to secure their long-term future | Trees that may live for more than 40 years but would be removed to prevent interference with more suitable individuals or to provide space for new planting | Trees that may live for more than 15 years but should be removed to prevent interference with more suitable individuals or to provide space for new plantings | Dangerous trees through structural defects including cavities, decay included bark, wounds or poor form.                                                     | Trees that have been pruned to artificially control growth. |
| D |                                                                                                                                                | Trees which could be made suitable for medium term retention by remedial care                                                                               | Trees which require substantial remediation tree care and are only suitable for retention in the short term.                                                  | Damaged trees that are clearly not safe to retain.                                                                                                           |                                                             |
| E |                                                                                                                                                |                                                                                                                                                             |                                                                                                                                                               | Trees that may live for more than 5 years but should be removed to prevent interference with more suitable individuals or to provide space for new plantings |                                                             |
| F |                                                                                                                                                |                                                                                                                                                             |                                                                                                                                                               | Trees damaging<br>Or which may cause damage to existing structures within the next 5 years                                                                   |                                                             |
| G |                                                                                                                                                |                                                                                                                                                             |                                                                                                                                                               | Trees that will become dangerous after removal of other trees for reasons given in A) to F)                                                                  |                                                             |

**NOTE:** No tree is “safe” i.e. entirely without hazard potential. The SULE rating given to any tree in this report assumes that reasonable maintenance will be provided by & qualified arborist using correct and acknowledged techniques. Retained trees are to have a reasonable setback and be protected from root damage. Incorrect practices can significantly accelerate tree decline and increase hazard potential.

## **ANNEXURE D: DEFINITION OF TREE TERMINOLOGY**

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This attachment is to accompany this Arborist Assessment to explain the terminology used and the rationale and assessment of factors used in the Safe Useful Life Expectancy (SULE) method of tree evaluation.

### **TERMINOLOGY USED:**

**DBH:** Acronym for trunk diameter at breast height (1.4m from ground level)

**DEADWOOD:** Many trees are noted as having various diameter deadwood over the course of their lifecycle. Deadwood is a normal function for plant growth and development. The tree's upper canopy foliage or crown condition is an important indicator of an individual tree's health. Dieback is the progressive death of branches or shoots originating from the tips. Dieback and decline are parts of a disease complex that have similar causal agents. Crown dieback is a recognizable, visible symptom of the early stages of decline and potential tree death ([www.fhm.fs.fed.us](http://www.fhm.fs.fed.us)).

The safety of the target, namely pedestrians, is considered the primary basis for deadwood removal. As deadwood has an ecological value, the removal of deadwood is usually only carried out where it is a potential hazard to site users. Deadwooding a tree does not increase its life expectancy.

**EPICORMIC GROWTH:** The production of epicormic growth from dormant buds is a response to stress. Epicormic growth may be initiated by various causes such as branch loss, excessive pruning, fire damage, drought, defoliation and/or disease.

Epicormic growth comes from dormant buds held in the cambium. Under normal growth conditions, these buds are held in a dormant state by hormones produced in the canopy. These shoots are often produced by the tree in response to injury or environmental stress. Epicormic growth has implications for tree structure as the attachment of an epicormic shoot is much weaker than that of a 'naturally' developed branch (Fakes, 2004).

**MYCORRHIZAE / RHIZOSPHERE:** Mycorrhizae are fungi that grow in symbiotic association with tree roots (especially the fine root hairs) and are attributed with increasing the uptake of nutrients, particularly phosphorus, and reducing infection from soil-borne pathogens. They greatly increase the surface area of a tree's root system. Mycorrhizae require aerobic soil conditions and are reduced in number by compaction, waterlogging and over-use of soil fertilisers. Forest litter or similar mulch provides ideal conditions for the proliferation of mycorrhizae. Rhizosphere is a term describing the peripheral area of a tree's root system where this symbiotic association most commonly occurs.

**CONDITION:** An evaluation of the structural status of the tree including defects that may affect the useful life of an otherwise healthy specimen. Such influencing factors include cavities and decay, weak unions between scaffolds (major branches) or trunks and faults of form or habit.

**TREE HAZARD POTENTIAL:** An assessment of the risks associated in retaining a tree in its existing or proposed surrounds. Factors to consider are the growth characteristics of the species, tree vitality, condition and the frequency and type of potential targets. The impact the proposed works may have on tree vitality can only be assumed.

**CO-DOMINANT STEMS:** Co-dominant stems were noted on several trees throughout the subject site. The term 'co-dominant' is used to describe two or more stems or leaders that are approximately the same diameter and emerge from the same location on the main trunk. The junction where the two stems meet is a common location of above ground tree failure (Harris, Clark & Matheny, 1999).

The relative size of the two leaders is important to the tree's structural stability. Co-dominant stems split apart more easily than branches that are small, relative to trunk size. This is because the only way trunk xylem can grow around a branch, and form a strong attachment, is for the trunk to be larger in diameter than the branch attachment. If the branch diameters are near the same size, their attachment will be weak because their xylem tissues are essentially parallel and are not able to grow around each other. Co-dominant stems typically lack this overlapping tissue present in a collar, which can lead to possible failure at the point of attachment. Additionally, the weight and leverage of the co-dominant stems will increase with age, intensifying the stress on the attachment (Harris, Clark & Matheny, 1999).

Furthermore, co-dominant stems do not have built in protection zones as with normal branches. This is because they are actually extensions of the stem. This enables pathogens and insects to spread downward and upward with little natural protection (Shigo, 1989)

**DOMINANT:** Trees with crowns above the upper layer of the canopy and generally receiving light from above and the sides.

**EDGE:** Trees located on the edge of a more dominant canopy of trees, and frequently possessing asymmetrical crowns, (heavier on the open side) and trunks that may be distorted due to competing with others for valuable nutrients i.e. soil air, water, light.

**FOREST:** Trees that have grown in a forest setting and only have about 1/3 of their canopy located on tall straight trunks.

**INCLUDED BRANCH JUNCTIONS:** Included bark was noted on trees throughout the site. Included bark often forms when two branches or trunks grow together at sharply acute angles, producing a wedge of inward-rolling bark.

Junctions with included bark form weak attachments, as there is little connective tissue between the two stems. Although all co-dominant stems should be considered comparatively weak, co-dominant stems that have bark trapped in the union are significantly weaker than those that do not have bark included (Smiley, 2003).

Tree failure can occur when the strength of wood is exceeded by a mechanical stress and/or is compromised by the presence of defects

**INTERMEDIATE:** Trees that have been overtopped, and become part of the understorey canopy

**PROJECT ARBORIST:** The person responsible for carrying out the tree assessment, report preparation, consultation with designers, specifying tree protection measures, monitoring and certification. The project arborist will be suitably experienced and competent in arboriculture, having acquired through training, qualification (minimum Australian Qualification Framework (AQF) Level 5, Diploma of Horticulture (Arboriculture)) and/or equivalent experience, the knowledge and skills enabling that person to perform the tasks required by this Standard.

**STRUCTURAL ROOT ZONE (SRZ):** The area around the base of a tree required for the tree's stability in the ground. The woody root growth and soil cohesion in this area are necessary to hold the tree upright. The SRZ is nominally circular with the trunk at its centre and is expressed by its radius in metres.

This zone considers a tree's structural stability only, not the root zone required for a tree's vigour and long-term viability, which will usually be a much larger area.

**TREE:** Long lived woody perennial plant greater than (or usually greater than) 3 m in height with one or relatively few main stems or trunks (or as defined by the determining authority).

**TREE PROTECTION ZONE (TPZ):** A specified area above and below ground and at a given distance from the trunk set aside for the protection of a tree's roots and crown to provide for the viability and stability of a tree to be retained where it is potentially subject to damage by development.

**VIGOUR:** Ability of a tree to sustain its life processes. The term 'vigour' in this document is synonymous with commonly used terms such as 'health' and 'vitality'.

**VITALITY:** Indicates the energy reserves of the tree and is determined by the observed crown colour and density, the percentage of dead / dying branches and epicormic growth. The vitality of the canopy and that of the root system is interdependent; root damage or heavy pruning draws on a tree's energy reserves. The tree's ability to initiate internal defence systems (compartmentalisation of damage) is reduced and it can also become predisposed to attack by insects and pathogens.

**WORK:** Any physical activity in relation to land that is specified by the determining authority.

**WOUNDING:** Generally, the wounds were located on the lower 2m of trees' trunk or on exposed roots. This suggests that the wounding may be a result of mechanical injury from landscape maintenance equipment. However, wounds were also noted higher up on the trunk and main branches. The likely cause of this wounding is branch failure, splitting or cracking during high wind events.

The primary effect of wounding is reduced translocation of water, minerals and sugars because of loss of bark, cambium and sapwood. Mechanical injury may also have implications for tree structure as the long-term effects of tree wounding is the potential development of decay. The long-term effects of tree wounding are the potential development of decay and loss of wood strength (Harris, Clark, Matheny, 1999).

## ANNEXURE E: REFERENCES

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1. American Society of Consulting Arborists (1995), *A Guide to Report Writing for Consulting Arborists*, International Society of Arboriculture, USA.
2. Australian Standards - AS 4970-2009 Protection of trees on development sites.
3. Barrell, J., (1993) 'Pre-planning Tree Surveys: Safe Useful Life Expectancy (SULE) is the Natural Progression' *Arboricultural Journal* Vol. 17, pp 33-46, AB Academic Publishers, Great Britain.
4. Barrell, J., (1995) 'Pre-development Tree Assessment', from *Trees & Building Sites*, Proceedings of an International Conference Held in the Interest of Developing a Scientific Basis for Managing Trees in Proximity to Buildings, The International Society of Arboriculture, Illinois, USA, pp. 132-142.
5. Barrell, J., (2001) 'Safe Useful Life Expectancy Categories updated 4/01' from *Management of Mature Trees*, proceeding of the 4th NAAA Tree Management Seminar, National Arborists Association of Australia, Sydney, Australia, Appendix 3.
6. Bradshaw, Hunt & Walmsley (1995), *Trees in the Urban Landscape*, E & FN Spon, London.
7. Fakes J (2004), *Introduction to Arboriculture*, Ryde TAFE, NSW.
8. Fakes J (2005), *Arboriculture Notes*, Ryde TAFE, NSW.
9. Gilman E (1997), *Trees for Urban and Suburban Landscapes: An Illustrated Guide to Pruning*, Delmar, USA.
10. Hadlington & Johnston (1988), *Australian Trees: Their Care & Repair*, UNSW Press, Sydney.
11. Harris R W, 1983, *Arboriculture*. Prentice- Hall Inc., Englewood Cliffs, New Jersey.
12. Harris, Clark & Matheny (1999), *Arboriculture: Integrated Management of Landscape Trees*,
13. Heatwole, H. & Lawman, M. (1986) 'Dieback. death of an Australian landscape' Reed Books Pty Ltd. Frenchs Forest, NSW
14. Matheny & Clark (1994), *A Photographic Guide to the Evaluation of Hazard Trees in Urban Areas*, International Society of Arboriculture, USA
15. Mattheck & Breloer (1994), *The Body Language of Trees: A Handbook for Failure Analysis*, The Stationary Office, London.
16. Rowell, R. J. (1980) 'Ornamental Flowering Trees of Australia' Reed Books Pty Ltd.
17. *Shrubs And Vines*, Prentice Hall, New Jersey.
18. Simon, Dormer & Hartshorne (1973), *Lowson's Botany*, Bell & Hyman, London.
19. Thyer, P. (1996) 'Thyer Tree Valuation Method'
20. [www.whereis.com.au](http://www.whereis.com.au).
21. [www.Nearmaps.com](http://www.Nearmaps.com).
22. Liverpool City Council Tree Preservation Order (TPO).

## **ANNEXURE F: CERTIFICATION**

---

I certify that the enclosed “Arboricultural Assessment and Tree Management Plan” for the proposed development for Watchtower Bible and Tract Society Australia, 12-14 Zouch Road, Denham Court NSW has been prepared by Horticultural Management Services.

To the best of my knowledge and professional integrity, it is true in all material particulars and does not, by its presentation or omission of information, materially mislead.

### **Qualifications:**

- *Diploma of Arboriculture (AQF L5)*
- *International Society of Arboriculture (ISA) Tree Risk Assessment TRAQ Certified*
- *Diploma of Horticulture*
- *Diploma of Conservation and Land Management*

*Scott Freeman*

**Scott Freeman  
Principal  
Horticultural Management Services**

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