arboricultural impact assessment report

AIA-01
Revision A, Issued for Development Application
19 June, 2020

DOCUMENT INCLUDES
- T-01 Tree Protection Specification
- T-02 Tree Retention Value Plan
- T-03 Tree Protection & Removal Plan
- Tree Impact Assessment Schedule

PROJECT
Calvary Ryde – South East Carpark
642-678 Victoria Road
Ryde, NSW 2047

CLIENT / PRINCIPAL
Calvary Retirement Community Ryde Ltd
C/- Donald Cant Watts Corke
Level 1, 14 Martin Place
Sydney, NSW, 2000
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EXECUTIVE SUMMARY

On the 1 May 2020, Arterra Design was engaged by Donald Cant Watts Corke on behalf of Calvary Ryde, to undertake an arboricultural assessment of the site and prepare the relevant reports and plans to help guide the development. This assessment was restricted to the trees within or immediately adjacent to the site that were likely to be impacted by the proposed works. The other trees within the broader site and unlikely to be impacted are not specifically addressed as part of this report.

Calvary Ryde are proposing to construct new carparking south-east of O’Regan Avenue. The proposed development area currently has a variety of native and exotic tree species scattered throughout, with the majority of trees concentrated along the eastern boundary. The proposed demolition, site re-grading and construction works will have moderate impacts on the trees within the study area.

A tree assessment and impact schedule was completed for all the trees. (Refer to Appendix 4.4 – Tree Impact Assessment Schedule). The trees were photographed and given a unique identification number and plotted onto a scaled survey base plan for referencing and identification throughout the report and for future discussions and co-ordination with contractors and stakeholders.

In summary, of the trees assessed for this report:-

- 77 existing trees were identified and assessed in total.
- 18 trees are proposed for removal. These represent a variety of exotic and native trees, and are either within the footprint of the proposed works or in poor condition or are not able to be retained due to proposed surface levels changes and excavations. 11 of the trees that are to be removed were ranked as being ‘low’ or ‘very low’ retention value.
- Of the 13 of the high retention value trees, 11 are to be retained and protected. The other 2 are within or very close to the proposed works and are therefore unable to be accommodated.
- 55 trees have no or minimal foreseeable impact from construction related activity;
- 4 trees have minor encroachments as defined under AS 4970;
- There are no major encroachments as defined under AS 4970.

As with all aspects in the development and construction process, the tree related constraints have to be weighed up against many other relevant development opportunities and constraints. The retention of the trees on the site must also consider economic, social, environmental, construction and practical realities.

This document has been prepared by Arterra Design Pty Ltd, using the expertise of our in-house consulting arborist (AQF Level 5), Chloe Bristow.

Chloe Bristow
Landscape Architect / Consulting Arborist
cbristow@arterra.com.au
1.0 INTRODUCTION

1.1 Background

On the 1 May 2020, Arterra Design was engaged by Donald Cant Watts Corke on behalf of Calvary Ryde, to undertake an arboricultural assessment of the site and prepare the relevant reports and plans to help guide the development. This assessment was restricted to the trees within or immediately adjacent to the site that were likely to be impacted by the proposed works. The other trees within the broader site and unlikely to be impacted are not specifically addressed as part of this report.

Calvary Ryde are proposing to construct new carparking south-east of O'Regan Avenue. The proposed development area currently has a variety of native and exotic tree species scattered throughout, with the majority of trees concentrated along the eastern boundary. The proposed demolition, site re-grading and construction works will have moderate impacts on the trees within the study area.

![Figure 1 – Typical photo of the site and conditions. Many of the existing trees are located on the eastern boundary of the site which form a softened and buffered screen to the adjoining street and residential properties. View is to the north east from O'Regan Street. (Photo: Arterra 6/05/20)](image)

Arterra completed a “Pre-development Assessment” of the existing trees that identified the trees and ranked their relative significance, health and retention values. This work was distributed to the client and also to the design team to help guide the development proposals.

This impact assessment has been prepared to identify the trees to be retained and removed as part of the development and so that Calvary can take a proactive approach to the management of the trees to be retained and put in place appropriate measures to protect them during the construction.

1.2 Aims of This Report

The aim of this report is to assess the impact of the new development on the existing trees within the site. Specifically, the report aims to:

- Assess the health and condition of the trees;
- Accurately record information relevant to the existing trees;
- Assess the significance, Safe Useful Life Expectancy (SULE) and retention values of the existing trees;
- Provide clear recommendations as to which trees should ideally be retained and protected;
- Identify the proposed Tree Protection Zones (TPZ) of the tree being retained and identify and assess the likely arboricultural impacts of the development on the trees and
- Provide preliminary advice on the tree protection measures that will be required during construction to ensure the trees are successfully retained.

The following limitations apply to this reports use: -

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

1.3 Relevant Controls or Legislation
The City of Ryde Council DCP 2014, Section 9.5, Tree Preservation, defines a tree as follows: ‘A Tree that has a height greater than 5m or a circumference of 450mm at 1.4m above ground level’. Section 9.5.2.0 sets out certain exempt works, which may be carried out without formal approval from Council.

All other tree works require formal approval from Council, either in the form of a Tree Permit (Section 9.5.3.0) or a Development Application (Section 9.5.4.0).

City of Ryde Council LEP 2014 Protection of Trees or Vegetation, applies to trees and vegetation within the LGA. Section 5.9.3 Pruning and removal of trees states:

“A person must not ringbark, cut down, top, lop, remove, injure or wilfully destroy any tree or other vegetation to which this development control plan applies without the authority conferred by:

- Development consent, or;
- A permit granted by Council.

If the site is heritage listed, no exemptions apply and a Development Application is required to be lodged with Council to remove any tree. Even dead and noxious weed trees on heritage properties are subject to the development application process. The Calvary Ryde site is listed under the Ryde Council LEP 2014 as a heritage listed property. (Item no. 148)

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

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

1.5 Key Definitions and Abbreviations
The following abbreviations are used throughout this report.

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

"TPA" = Tree Protection Area
Although based on the nominal TPZ above, this is a consolidated and often simplified area to be applied during construction for tree protection. This area is often shaped to deal with practical construction realities whilst maintaining appropriate protection of the nominal TPZ (i.e fencing a nominal circular TPZ can be difficult and impractical. TPA areas often define a square or rectangular shape which includes the area calculated as the nominal TPZ). It often amalgamates and simplifies tree protection zones, particularly when they are overlapping and can be amended for items such as buildings, walls, pathways and existing fences. It also protects areas that are contiguous to the calculated nominal TPZ, which are to be applied when the nominal TPZ is not completely circular due to structures potentially impeding root growth, or when there is an incursion calculated within the TPZ.

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

DBH = Diameter at Breast Height
This is the diameter of the trunk measured at 1.4m above ground level.
DGL = Diameter at Ground Level
This is the diameter of the trunk measured at ground level, but just above any root flare.

Non-Destructive Digging
This is the process of safely excavating the ground surface to minimise the risk of damage to existing tree roots. This method is used to map and locate existing tree roots within the TPZ and/or SRZ and helps to guide and inform the installation and/or construction of proposed services and/or structures which are in close proximity to retained trees. This is often achieved through hand digging using a shovel, trowel and/or fork with care not to damage the bark and wood of any roots. Compressed air (air spade) or water vacuum extraction are appropriate non-destructive alternatives to hand digging, but pressures must be reduced to avoid damaging the roots protective bark covering. When this work occurs within a TPZ and/or SRZ of a tree to be retained, a consulting arborist should always be present to monitor the works.

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

Warren Smith & Partners:-
- 5468003-WS+P-CS-DD-C1.01 Cover Sheet [01]
- 5468003-WS+P-CS-DD-C1.02 Specification Notes [01]
- 5468003-WS+P-CS-DD-C1.03 Existing Survey [01]
- 5468003-WS+P-CS-DD-C2.01 Sediment & Control Plan [01]
- 5468003-WS+P-CS-DD-C2.02 Sediment & Control Details [01]
- 5468003-WS+P-CS-DD-C4.01 Siteworks Plan [01]
- 5468003-WS+P-CS-DD-C4.11 Typical Sections [01]
- 5468003-WS+P-CS-DD-C6.01 Stormwater Layout Plan [01]
- 5468003-WS+P-CS-DD-C6.02 Stormwater Catchment Plan [01]
- 5468003-WS+P-CS-DD-C6.03 Stormwater Drainage Details [01]

Summitt Geomatic:-
- 5770_DE_Partial_Lot_1012_LCM_Site_Victoria_Rd_Ryde_120320-DE_Rv8

Arterra Design Pty Ltd
- L-SD-01 Cover Page
- L-SD-02 Landscape Concept Plan
- L-SD-03 Landscape Section and Indicative Planting

At present no other proposed service, other than those detailed above, are to be installed as part of this proposed development. At present no new services are proposed to be extended into the proposed TPZs and any existing services that are no longer required will be capped off and left in situ.
1.7 Site Location and Context

The site is located at 642-678 Victoria Road Ryde and is occupied by Calvary Retirement Community Ryde as an existing aged care facility. The site is listed as an item of local heritage significance within the City of Ryde LEP 2014 (Dalton Gardens Hospital, Item 148). The site has a total area of approximately 78,000m² and the extent of the proposed development covers approximately 600m². The general area surrounding the site is a mixture of new and well established low density residential development. The site is located approximately 10.8 km west from the Sydney CBD.

Figure 2 – Site context – approximate Calvary Ryde Retirement Community boundary shown in red with the proposed site filled in red (Source: Nearmap)

Figure 3 – Site – approximate site outline shown in red (Source: Nearmap)
1.8 Site Ownership and Zoning
The site is owned and managed by Calvary Retirement Community Ryde, a not for profit, Catholic healthcare organisation. The development site is identified as part of Lot 1012 DP 836977 and is zoned R2 Low Density Residential under the City of Ryde Local Environmental Plan 2014.

The site is listed as an item of local heritage significance (Item 148 – Dalton Gardens Hospital) in the City of Ryde Local Environmental Plan 2014. (http://www.ryde.nsw.gov.au/accessed 08/05/20).

1.9 Assessment Methodology
On the 6 May 2020, Robert Smart and Chloe Bristow of Arterra completed a detailed assessment of existing trees located within the site and those immediately adjacent and likely to be impacted by the proposed development. The trees’ health and condition were assessed via a visual inspection of the trees from the ground only. Requisite tree data (including DBH, DGL, height & canopy spread, condition & proximity to services) were recorded using an Apple iPad and Filemaker Pro database.

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

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

All of the trees were photographed and given a unique identification number and plotted onto a scaled base plan for referencing and identification throughout the report and for future discussions and co-ordination. (Refer Appendix 4.2 T-02 ‘Tree Retention Value Plan’ and 4.3 T-03 ‘Tree Protection and Removal Plan’). The photographic record of trees and general site context was taken using the inbuilt Apple iPad camera and a Panasonic Lumix TZ220 digital camera with GPS recording. Files have been resized, dated, named and filed in accordance with normal office procedures and protocols. No other image manipulation has been undertaken.

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

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

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

Recent aerial photography data was obtained from the Nearmap website with aerial photos of the site dating from 22/10/19 imported into the above software for cross checking and assessment. (http://www.nearmap.com/accessed 03.06.20)

Climatic data was obtained from the Bureau of Meteorology using statistics from Observatory Hill which is located approximately 10.0km from the site. (http://www.bom.gov.au/climate/data/ accessed 03 June 2020)
1.10 Pre-Development Tree Assessment – Tree Retention Values & Risk Assessment

The information gathered in the field was tabulated and the retention value assessed using a combination of techniques commonly used and recognised in the arboricultural industry. The proposed retention value of the trees was determined based on a considered combination of the size, age, condition and suitability of the tree. Each tree was then ranked according to one of 4 retention categories.

1. **“High” Retention Value** – these are trees that are typically in good or very good condition, large and visually prominent, historically or environmentally important. They may also be lesser quality trees, but part of an important grouping of trees. They should represent a serious physical constraint to the development and their removal avoided where possible and feasible.

2. **“Moderate” Retention Value** – these are trees that are in good to reasonable condition and should be retained where possible and feasible to do so. They may also be lesser trees, but part of an important grouping of trees and therefore warrant retention based on the group’s value.

3. **“Low” Retention Value** – these are trees that are in poor condition or have structural defects, are particularly small or commonplace, are not historically, environmentally or socially significant and should not be considered as a constraint to the development. They could be retained only if they are not likely to be impacted by, or constrain potential desirable, development outcomes.

4. **“Should Remove” / No Retention Value** – these are trees that are in very poor health, exhibit poor form, or have serious structural defects, are considered weeds or combination of all these, and therefore should be considered for removal regardless of any development.

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

1.11 Tree Assessment – Tree Protection Zones

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

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

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

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

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

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

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

2.1 The Proposed Development
The works will result in a major site disturbance. This will potentially have a significant impact on the trees within and adjacent to the site. Specifically, the proposed development will involve:-

- Demolition works;
- Use of large scale civil and earthmoving equipment;
- Access to and from the site with large trucks and construction plant;
- Minor excavations;
- Small stockpiles of excavated material and demolition waste;
- Stockpiles/ storage of materials;
- Regrading and filling of the surface levels;
- Trenching for services;
- Parking for site personnel and deliveries and
- Landscaping.

**Key Assumptions:-**

- All excavations near the retained trees are to be undertaken from within the proposed construction zones and retained. Where necessary, temporary shoring is to be used to avoid significant battering.
- Despite the above, the line of disturbance outside of the carpark footprint has been typically estimated at 1.0m from the back of kerb to allow for access during construction to complete kerb formwork and installation.
- All major services for the carpark are clear of the trees shown to be retained.
- All construction access and deliveries are to be made via the existing defined internal access roads. No traffic will typically be allowed through the defined TPAs. Concrete will typically be pumped and will not require any truck movements through TPAs for delivery.
- Where no spot levels are indicated it is assumed that the existing surface levels are retained.
- It is assumed that any new landscape grading within the TPAs will be minimal.

2.2 Climate and Microclimate
Ryde is located in Sydney’s inner western suburbs, and shares the general climate of this region with moderate temperatures, good rainfall and minimal climatic and weather extremes. It is typically described as a temperate climate with hot to warm summers and cool winters, with relatively uniform rainfalls. There is no distinct dry season.

The site is located approximately 1.0km from the Parramatta River at Putney. The area has an average annual rainfall of 1214mm, fairly evenly spread across the year but with a slightly drier period during the late winter and early spring months. The highest rainfall period is usually June with an average of 133mm and the driest month being September with an average of 68mm.

Maximum average daily temperatures range from 25.9°C in January to 16.3°C in July. The minimum average daily temperatures range from a high of 18.8°C in February down to lows of 8.1°C in July.

The site has a northerly aspect, and its position is relatively exposed to the elements being located towards the ridge top and close to the Parramatta River.

The predominant wind direction is from the south/south-east to the north-east in the afternoons while it is predominantly from the west and north-west in the mornings. This is common of coastal areas dominated by “sea breeze” affects. Sea breezes are caused by unequal heating and cooling of adjacent land and sea surfaces. A sea breeze is one that blows from the sea to the land in consequence of this differential heating. With a weak general wind circulation, a sea breeze will commence over the coastline soon after the land temperature begins to exceed the sea temperature (late morning to early afternoon). As the difference increases, so the sea breeze will become stronger and will extend farther inland. (Source: Australian Bureau of Meteorology)

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

There are no prominent microclimatic influences on the site apart from the general coastal influence and the protection offered to the interior spaces of the site by the surrounding trees and buildings.
2.3 Soils and Landform

Soil landscape mapping of the area indicates the area to be part of the Glenorie Soil Landscape association, the topography is typically described as undulating rolling hills on Wianamatta Shales. Generally the soil is expected to be a red podzolic soil with low to moderate fertility, moderate acidity with good water holding capacities. (Chapman 1989).

A representative topsoil sample was taken from the eastern boundary of the study area, amongst the existing trees. The soil sample results are summarised below. The soil observed on the site was a red/brown podzolic soil, consistent with the natural soil expected on the site and outlined in the above natural soil mapping.

The topsoil which extended to 300mm depth was a light clay to clay loam texture with a pH of 6.0. It had a moderately pedal structure with coarse sub-angular blocky peds. The subsoil was a light to medium clay with a pH of 5.5 with a very pedal structure and coarse subangular blocky peds.

In other locations throughout the study area most of the soils are likely to be highly variable due to previous construction disturbances, grading and levelling and possible importation of soil and fill.

The existing soils pose little restriction to the growth of the trees or create any special requirements for tree protection. The soils are very clayey and will be subject to compaction if trafficked or traversed, particularly when wet or moist.

![Figure 4 – Typical light clay - clay loam soil profile to a depth of 80cm, with heavy clay in the lower profile. (Source: Arterra)](image)

2.4 Tree Biology and Tree Care Basics

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

As a living organism, a tree remains alive by completing the following chemical reaction:

\[ \text{Carbon Dioxide and water in combination with chlorophyll and light is converted to Glucose and Oxygen} \]

\[ [\text{CO}_2 + \text{H}_2\text{O} + \text{light} = \text{sugar} (\text{CH}_2\text{O} \text{ [Glucose]}) + \text{O}_2] \]

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

Trees therefore have five basic requirements to survive and successfully grow:

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

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

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

- Reduces infiltration rates of surface water;
- Reduces the availability of water to the roots as they can’t naturally extract remaining moisture when soil becomes too dry;
- Reduces air to roots (roots cease to function properly and die without oxygen);
- Increased soil strength caused by compaction mean that roots need more energy to growth through it or can’t even physically penetrate the soil;
- Roots are physically broken or crushed and there is increased potential for fungal and pathogen attack (Harris 1999).
Tree Tolerance
Typically older and larger trees are less tolerant of construction impacts. Different species also have different
tolerance of injury and disturbance. Importantly it needs to be stressed, that a tree does not "heal" from injury
as animals do. Typically any injury made to a tree results in the tree expending considerable energy reserves to
create new growth that "seals" and surrounds a wound and then attempting to compensate structurally and
physically for any losses. Impacts to trees are therefore cumulative and a series of otherwise small and unrelated
impacts can easily result in the death of a tree.

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

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

2.5 Tree Assessment - General
A total of 77 trees were assessed for this report and were generally determined to be in fair to good health.
Many of the trees are concentrated along the eastern boundary and are predominantly native species. Very small
trees and shrubs (<5m), dead trees or obviously known weeds have typically not been included in our
assessment.

Please refer to Appendix 4.3 T-03 – ‘Tree Protection and Removal Plan’ for a graphical representation of the
trees to be removed and those to be retained and protected. Detailed information on each tree including: heights,
trunk diameters, canopy spreads, age classes and condition are all provided in Appendix 4.4 - ‘Tree Impact
Assessment Schedule’.

<table>
<thead>
<tr>
<th>Tree Retention Value</th>
<th>No. of Trees</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>13</td>
<td>17%</td>
</tr>
<tr>
<td>Moderate</td>
<td>44</td>
<td>57%</td>
</tr>
<tr>
<td>Low</td>
<td>17</td>
<td>22%</td>
</tr>
<tr>
<td>Very Low (should remove)</td>
<td>3</td>
<td>4%</td>
</tr>
<tr>
<td><strong>Grand Total</strong></td>
<td><strong>77</strong></td>
<td><strong>100%</strong></td>
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<thead>
<tr>
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<tr>
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<td>Lemon Scented Gum</td>
<td>Corymbia citriodora</td>
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<td>Smooth-barked Apple</td>
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<td>Spotted Gum</td>
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<td><strong>Grand Total</strong></td>
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The most significant trees relating to the site are:

- **T71** - *Brachychiton acerfolius* (Illawarra Flame Tree)
- **T07 to T58** - Eastern screen planting
- **T02, T03 & T04** - *Eucalyptus microcorys* (Tallowood)

These trees are discussed in more detail below.

**T71 – *Brachychiton acerfolius* (Illawarra Flame Tree)**

This tree is believed to have been planted in 2007 as a memorial tree in remembrance of one of the members of Calvary’s Garden Club. The tree has been identified by the client as significant to Calvary and its residents.

It is situated in the centre of the proposed development site to the east of O’Regan Avenue. It is approximately 6m east of the existing road kerb. It is currently fenced and protected as part of the Icon Construction builders site sheds who are completing the large development to the east of the carpark site (approved under a separate DA). This tree has been rated with a ‘High’ retention value and has a relatively even spread canopy with good form and vigour. This tree is to be retained.

![Figure 6 – View to the east of O’Regan Avenue looking at ‘High’ retention value tree – T71 Brachychiton acerfolius (Photo: Artterra 06/05/20)](image)

**T07 to T58 – Eastern Screen Planting**

This group of 51 trees is situated along the eastern site boundary. Some of the most prominent trees in this group are:

- **T07** – *A Sydney Blue Gum* (*Eucalyptus saligna*) is the largest and most visually significant tree on the carpark site. It is situated to the north of the proposed development site and east of O’Regan Avenue. It is located adjacent to the road kerb behind an existing stormwater pit, with existing car parking to the north. It has a large and spreading canopy, that provides shade and amenity to the adjacent residents and has been given a ‘High’ retention rating. It is a prominent tree and is to be retained.
- **T18 – A Spotted Gum** (*Corymbia maculata*) is a tall and visually significant tree situated to the east of O’Regan Avenue. It is located immediately adjacent to the road kerb. It has a uniform canopy and a clearance of 7m from the underside of the canopy. This tree has been rated with a ‘Moderate’ retention rating. This tree is to be retained.

- **T30 – A Sydney Blue Gum** (*Eucalyptus saigna*) which is also a visually significant tree is located approximately 10m east of O’Regan Avenue. It has a good form and vigour. This larger canopy tree contributes greatly to the screening along the eastern boundary and provides great landscape amenity. This tree has been rated with a ‘High’ retention rating. It is a prominent tree and is to be retained.

![Figure 7](Image)

*Figure 7 – (left image) View to the east from O’Regan Avenue looking at ‘High’ retention value tree – T30 Eucalyptus saigna
(right image) View to the east from O’Regan Avenue looking at ‘Moderate’ retention value tree – T18 Corymbia maculata (Photos: Arterra 06/05/20)*

![Figure 8](Image)

*Figure 8 – View to the east from O’Regan Avenue looking at ‘High’ retention value tree – T30 Eucalyptus saigna (Photo: Arterra 06/05/20)*
As a group, trees T7 to T58 are generally very good trees and provide an appropriately scaled landscape element. They provide an extensive softened screen between the adjoining residential development and the site. The majority of the trees are in good condition and have been recommended for retention. Within this group 3 trees (T16, T36, T55) are identified with a retention rating of Very Low/Remove and are to be removed as they are either moribund or extremely poor specimens (Refer Figure 9 below).

![Figure 9 – View to the south west from Colebee Street looking at the eastern boundary planting T7 to T58, providing an extensive softened screen between the site and the adjoining existing residential housing. (Photo: Arterra 06/05/20)](image)

**T02, T03 & T04 – Eucalyptus microcorys** (Tallowood)

This is a row of three very visually and environmentally significant trees. These trees are situated to the west of the proposed development site, immediately adjacent the existing kerb of O’Regan Avenue. Two of the trees have been rated with a ‘High’ retention value, and the other a ‘Moderate’ retention value. They have relatively large spreading canopies that extend over O’Regan Avenue and provide good landscape amenity. Extreme care is to be taken at the base of these trees as they have large surface roots immediately adjacent the kerb. These trees are to be retained.

![Figure 10 – View to the south from O’Regan Street looking at ‘High’ and Moderate retention value trees - T02, T03 & T04 Eucalyptus microcorys. (Photo: Arterra 06/05/20)](image)
The Remaining Trees to the South
The remaining trees are located along the southern boundary of the site, south of an existing carpark. They vary from ‘High’ to ‘Moderate’ retention value. Trees T61, T62, and T63 are all *Corymbia citriodora* (Lemon Scented Gum) and T64, T65, T66 and T67 are all *Eucalyptus microcorys* (Tallowood). These trees offer great screening to the adjoining residential properties to the south and south west and provide great landscape amenity. It is believed that the existing carpark to the north of these trees is to be retained, allowing these trees to be retained with minimal impacts.

2.6 Assessment of Tree Impacts
The intention of this assessment is to clearly illustrate the trees to be retained and removed as part of the development. It is also to determine any incursions into the retained trees’ root zones and canopies by the proposed development and evaluate the likely impact of the proposed works on the trees. A detailed summary of the incursions and likely impacts of the proposed development on each tree is shown in Appendix 4.4 – Tree Impact Assessment Schedule.

Of the trees assessed on the site:-
- **77** existing trees were identified and assessed in total.
- **18** trees are proposed for removal. These represent a variety of exotic and native trees, and are either within the footprint of the proposed works or in poor condition or are not able to be retained due to proposed surface levels changes and excavations. **11** of the trees that are to be removed were ranked as being ‘low’ or ‘very low’ retention value.
- Of the **13** of the high retention value trees, **11** are to be retained and protected. The other 2 are within or very close to the proposed works and are therefore unable to be accommodated.
- **55** trees have no or minimal foreseeable impact from construction related activity;
- **4** trees have minor encroachments as defined under AS 4970;
- There are **no major encroachments** as defined under AS 4970.

2.7 Potential Tree Related Impacts to be Managed During Construction
The main potential impacts from the proposed construction activity can be summarised as tree damage and ‘reduced life expectancy’ caused by:-
- Root loss and disturbance due to excavation for the proposed at grade carparking;
- Compaction of the root zone from storage and stockpiling of materials;
- Contamination of the soil from; the preparation of chemicals, wash down/ cleaning of equipment, refuelling of vehicles and dumping of waste;
- Compaction of the root zone from haul roads and the parking of vehicles/ plant equipment;
- Root disturbance from cut and fill and soil level changes;
- Physical damage to the tree trunks and branches from passing machinery;
- Damage to the tree roots from landscaping and shelter construction.

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

3.1 Potential Amendments to Site Layout and Design
The landscape concept design and proposed building layout have been developed in consultation with the Client and Civil Engineers. Arterra, as both the consulting arborists and landscape architects for the project have aimed to minimise the impact on the existing site trees to be retained and the design has been modified to this effect wherever possible. The trees noted for removal, as well as those to be retained, have been given careful consideration and recommendation for removal has not been given lightly.

As the current design has been developed in consultation with the consulting arborist, appropriate changes have been implemented throughout the design development process to accommodate existing trees wherever possible. On this basis there are no recommendations to alter the design further at this time.

3.2 Key Recommendations to Reduce Tree Impacts
The following recommendations are made to potentially reduce the negative construction impacts on the trees.

- Appropriately fence all TPAs as detailed for the duration of all major site construction work. See Appendix 4.3 T-03 'Tree Protection and Removal Plan’ for location and extent.
- Carefully control and fence general access to and from the construction area so that uncontrolled movement does not occur through the nominated TPA.
- Ensure all the above and below ground services are excluded from running through any of the identified and nominated TPAs.
- Minimise the ‘landscape’ re-grading of the ground surface within the nominated TPA, where required to meet and match the proposed carpark. Where it is required, limit fill to a maximum depth of 200mm above existing ground levels and ensure it is only quality manufactured sandy organic garden soil.
- Mulching of the TPZs, for all retained trees, unless they are already mulched. This will aid tree health with moisture retention, remove competition from any grasses and improve soil conditions within the TPZs during the construction period.
- Avoid digging into any existing root zones for the installation of any proposed landscaping around the trees with installation sizes of new plants to be 2SL or less to ensure that excavations are less than 200mm in depth. Build up soil levels when planting to a maximum of 150-200mm to enable the planting to occur without disturbing tree roots.
- Do not allow storage or stockpiling of any materials or site sheds within the nominated TPZs unless it can be demonstrated that this will not impact on the tree retention and is approved in writing by the Consulting Arborist.

3.3 Proposed Tree Protection & Construction Activity Sequencing
The following sequence of activities should be followed for this project:

1. A Tree Protection Specification & Plan be prepared and issued as part of the construction contract prior to any construction work.
2. Project Consulting Arborist and Civil Engineers, Client and Contractor Site Foreman are to meet prior to beginning any work on the site to discuss and review all work procedures, construction access routes, stockpiling and tree protection measures (ie: fence types and locations, access, craneage points, piling methods etc.).
3. Contractor’s to discuss locations and type of any sediment and erosion controls (if any) and install them with minimal tree impact when within or passing through the TPA.
4. Existing bitumen carpark, pathways, fences, furniture and shrubs nominated for removal are to be carefully removed from within the TPA.
5. Existing surrounding trees nominated for removal are to be removed. Stumps are to be ground to avoid the use of excavators and the like from grubbing out stumps, which may lead to damage of any intertwined roots.
6. Trunk protection to be placed on nominated trees to be retained.
7. The Construction Phase TPA is to be defined and fenced off with a 1.8m high metal or plywood temporary fence prior to any further work within the vicinity of the trees.
8. Construction works to be completed.
9. Contractor to remove the TPA fencing and then install final pathways and landscaping within the TPA under the trees, after construction of the at grade carparking is completed.

3.4 Demolition Work Near Trees or within TPAs
Demolition of paths and other structures required within a TPA shall be done with small tracked equipment or by hand, with care to limit damage and disturbance of the root zone. All such work within TPAs shall be supervised and overseen by a qualified Project Consulting Arborist.
3.5 Tree Protection Fencing & Definition of TPAs
Establish a clearly defined tree protection zone as indicated in Appendix 4.3 - "T-03 Tree Protection and Removal Plan". Install a 1.8m high temporary fence with either plywood hoarding or temporary steel mesh or chain wire fencing with adequate lateral bracing. Fencing shall comply with the requirements of AS 4687-2007 Temporary fencing and hoardings. These areas around the trees shall be delineated as a “Tree Protection Zone” during the remaining construction process, via appropriate weatherproof signage. Access will typically be excluded from these zones and the levels will be left largely at the existing levels with the exception of the installation of the 75mm of mulch. No stockpiling, excavation, trenching, re-fuelling or material storage should be allowed in this area.

3.6 Ground Protection within TPAs
Vehicular movement and access shall typically not be required or approved through the TPA. If it is necessary and it is proposed to create any access or haul road, or similar, within the TPZ of a retained tree, the Contractor shall install rumble strips / boards over the TPZ ground surface. No excavation shall be allowed. Contractor shall first place a suitable permeable geotextile to the extent required and then a 100mm thick layer of wood chip mulch or coarse no-fines gravel over the extent to be covered with the rumble strip / boards. Then place hardwood boards (minimum 3600 x 200 x 75mm) on their flat edge, side by side, with a 30 - 50mm gap to form a rumble strip. These boards are to be held together with three galvanised metal bracing straps nailed to each board. The two outer straps are to be approximately 200mm in from the ends of the boards. The third strap is to be along the centre line of the boards.

Figure 11 – Example of acceptable Tree Protection Area ground protection

3.7 Trunk and Lower Branch Protection
A trunk barrier is to be erected around the circumference of the tree trunk and trunk flare and root buttress. This barrier will consist of a double layer of suitable ‘used’ artificial grass matting, carpet or carpet underfelt placed around the trunk. A layer of battens is to be placed over the underfelt. The battens are to have a maximum spacing of 50-100mm. The height of the battens is to be 2 metres or to the height of the first branches. Lower large branches may require the same protection if they are likely to be damaged by passing vehicles or equipment. Secure in place with galvanised steel bracing straps. Do not nail into or otherwise injure the trunk or bark. Battens may be made from any suitable waste timber of similar sizes and depths. All sharp or protruding edges are to be properly covered with tape or similar padding.
3.8 Final Landscaping within TPZs
Once final levels are set by the finished carpark surface levels. The final trimming and landscaping shall be judiciously undertaken. The final pedestrian pavements shall be installed without undue excavation or compaction to the soil and all soft landscaping within the tree protection zone will be installed with care to avoid root disturbance via irrigation trenching, lighting installation and the planting of larger plants. The installation of 100-200mm of new garden mix topsoil over the pre-existing soil will provide a suitable medium in which to plant new plants without damage to existing tree roots. Permanent irrigation (if used) shall be installed as spray heads located outside of TPZs and spraying inwards. All other services such as electrical services shall also be designed and installed to avoid any excavation or trenching around the trees.

3.9 Other Tree Protection Measures to be Implemented
The following is a summary of the main measures that will be required during construction. These should be adopted for the Construction Contract and conditioned by Council.

Controlled Construction Access & Parking
Construction access points and stockpiling and storage areas shall be clearly identified and fenced where appropriate. Uncontrolled access points and parking of vehicles outside of designated areas is to be avoided. If temporary access is required through a tree protection zone, ground protection shall be employed to limit soil compaction and root damage and disturbance.

Clearing and Removal of Trees to be Removed
Removal and clearing of existing trees should be done by qualified arboricultural staff with care not to impact or damage other surrounding trees throughout the process. Existing stumps should be grubbed out or ground in a controlled fashion to remove wood that may decay and promote unwanted pathogens.

Communication – Tool Box Meetings and Construction Inductions
All contractors and subcontractors shall be inducted prior to working on the site. All inductions shall include description and identification of the Tree Protection Zones and the restriction on work and activities with regard to trees. The site foreman shall ensure that all new staff and contractors are appropriately inducted and that brief “tool box” meetings are conducted regularly to ensure Tree Protection is maintained at the forefront of all construction workers minds.

3.10 References
- Chapman, G.A and Murphy, C.L 1989, Soil Landscapes of the Sydney 1:100 000 Sheet Report, Soil Conservation Service of NSW, Sydney, NSW.


• Rowell, R. J 1980, *Ornamental Flowering Trees in Australia*, Reed, Sydney NSW.


- End of report.
4.0 APPENDICES
4.1 T-01 Tree Protection Specification
### TREE PROTECTION SPECIFICATIONS

1. **Tree Protection Measures and Protocols.**

   - All solid surfaces around trees must be in accordance with AS 4970:2009 Protection of trees on development sites with the clear establishment of retention value (or value for trees). Trees shall be treated for all works within the Tree Protection Area (TPA). If the scope of work allowed within the extent of the Tree Protection Area is not retained, refer to the Contract Manager or Project Consulting Arborist for clarification.

2. **Defining any site works or vegetation protection areas and other measures.**

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

#### Example image of acceptable tree protection methods

**Turfing & Chopping within TPA's**

- Project Consulting Arborist shall be on site during all demolition work within the TPA's to monitor and advise on tree protection. Seclusions in a stockpile shall be covered with shade cloth and kept wet. Any works to trees in a stockpile area within TPA's shall not be commenced until all works are completed.

#### Example image of acceptable ground protection methods

- All work around existing trees to be retained shall be in accordance with AS 4970:2009 Protection of trees on development sites with the clear establishment of retention value (or value for trees).

#### Example image of unacceptable tree protection methods

- If a tree has been trimmed, it shall be removed and the damaged root crown shall be covered with shade cloth and kept wet. Any works to trees in a stockpile area within TPA's shall not be commenced until all works are completed.

#### Example image of unacceptable ground protection methods

- All work around existing trees to be retained shall be in accordance with AS 4970:2009 Protection of trees on development sites with the clear establishment of retention value (or value for trees).
4.2 T-02 Tree Retention Value Plan
TREE RETENTION VALUE NOTES

1. "High" Retention Value - these are trees that are in very poor health, or poor form, or have structural defects, or have been marked for removal.

2. "Moderate" Retention Value - these are trees that are in good to reasonable condition, with minimally adverse characteristics, and are structurally sound.

3. "Low" Retention Value - these are trees that are in poor condition or have some condition that makes them unsuitable for retention, or are generally of poor health, or are not structurally sound.

4. "V Low / W Fl " Retention Value - these are trees that are in very poor condition or have some condition that makes them unsuitable for retention, or are generally of poor health, or are not structurally sound.

5. "Plotted Retention Value" - these are trees that are to be plotted on the map and their presence in the surrounding development is to be noted.

6. "Scored" Retention Value - these are trees that have been scored for their overall condition, and are to be noted on the map.

7. "Removed" Retention Value - these are trees that have been removed from the site, and are not to be noted on the map.

8. "Revised" Retention Value - these are trees that have been revised for their overall condition, and are to be noted on the map.

9. "Proposed" Retention Value - these are trees that are to be proposed for retention, and are to be noted on the map.

10. "Existing Tree Removal" - these are trees that are to be removed from the site, and are to be noted on the map.

11. "Existing Tree Protection" - these are trees that are to be protected, and are to be noted on the map.

12. "Tree Identification Number" - these are trees that have been identified for their overall condition, and are to be noted on the map.

NOTE: Refer to the accompanying Arboricultural Impact Assessment Report for full description of trees, measurements and methods used to assess the trees, and proposed tree protection measures.
4.3 T-03 Tree Protection & Removal Plan
No expected disturbance. All trees to be
Existing road and western kerb to be
sensitively. Do not over excavate the area
Existing footpath to be retained.

Existing footpath to be retained.

Existing footpath to be retained.

No expected disturbance. All trees to be

Existing footpath to be retained.

Existing road and western kerb to be

sensitively. Do not over excavate the area

Existing footpath to be retained.

Existing footpath to be retained.

Existing footpath to be retained.

Existing footpath to be retained.

Installation of stormwater line is to be
undertaken sensitively. Temporary
shoring of trenches with timber boards to
be used ahead of battering within the tree
protection area.

Existing footpath to be retained.

Existing footpath to be retained.

Existing footpath to be retained.

Existing footpath to be retained.

Installation of new stormwater line to
existing pit is to be undertaken sensitively.
Do not over excavate the area
surrounding the existing pit.

Installation of stormwater line is to be
undertaken sensitively. Temporary
shoring of trenches with timber boards to
be used ahead of battering within the tree
protection area.

Installation of stormwater line is to be
undertaken sensitively. Temporary
shoring of trenches with timber boards to
be used ahead of battering within the tree
protection area.

Existing footpath to be retained.

Existing footpath to be retained.

Existing footpath to be retained.

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Existing footpath to be retained.

Installation of stormwater line is to be
undertaken sensitively. Temporary
shoring of trenches with timber boards to
be used ahead of battering within the tree
protection area.

Existing footpath to be retained.

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