arboricultural impact assessment & moreton bay fig management plan

AIA-01

Revision A, Issued for Development Application
15 August, 2019

DOCUMENT INCLUDES

- T-01 Tree Retention Plan
- T-02 Tree Protection & Removal Plan
- T-03 *Ficus macrophylla* – Existing Conditions
- T-04 *Ficus macrophylla* – Canopy Impact Plan
- T-05 *Ficus macrophylla* – Root Impact Plan
- T-06 *Ficus macrophylla* – Tree Protection Plan
- T-07 *Ficus macrophylla* – Section East – West
- T-08 *Ficus macrophylla* – Section North – South

PROJECT

Site 2A and 2B, Sydney Olympic Park
Australia Avenue,
Sydney Olympic Park, NSW 2127

CLIENT / PRINCIPAL

Ecove Group
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Sydney, NSW 2000

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i EXECUTIVE SUMMARY

On the 27 May 2019, Arterra Design was engaged by Ecove Group to undertake an arboricultural assessment of the site at Australia Avenue, Sydney Olympic Park and prepare the relevant reports and plans to help guide the re-development. A tree assessment and impact assessment was completed for all the trees. (Refer to Appendix 5.2 – Tree Impact Assessment Schedule).

The very large and prominent Moreton Bay Fig tree (*Ficus macrophylla*) situated on the corner of Australia Avenue and Murray Rose Avenue (within the site) is proposed to be retained and the development strategically designed to integrate it with the building and landscape to provide a positive and cohesive contribution to the overall urban design. Given the size of the tree and the relationship to the street and the proposed building, this is a complex operation and one that will require careful design, construction control and implementation to achieve a successful outcome for both the project and the tree.

Large trees such as this can be easily damaged by poor design or careless construction activities and once damaged, cannot be easily rectified. Adequate soil volumes, sufficient drainage, irrigation and soil aeration are all critical aspects to consider and factor into the design. Although this tree is large and fully mature, it is also important to remember that trees must, and will, keep growing, so some space for future growth above and below ground must be considered. This document outlines the key tree management procedures and protocols that are to be followed during the detailed design and construction period of the project. It is the authors opinion that the current design allows the successful retention of the Morton Bay Fig tree, with the main impacts being judicious and strategic pruning of the lower and outer canopy to facilitate the development.

There are also a range of other trees within and surrounding the site, including street trees along Australia Avenue and Parkview Avenue. Of the **46** trees assessed:-

- **17** (37%) have no or minimal foreseeable impact from construction related activity;
- **6** (13%) have minor encroachments as defined under AS 4970;
- **11** (24%) have major encroachments as defined under AS 4970.

There is an alternating avenue of *Acmena smithii* (Lilly Pilly) & *Eucalyptus microcorys* (Tallowood) totalling 11 trees, that vary from poor to average form and poor to good vigour. These trees, however, occur on the neighbouring property. The trees are planted extremely close to the site boundary and are only semi-mature and relatively small. These trees will be significantly impacted by excavation for the proposed building basement. The impacts are far from ideal from an arboricultural perspective. SOPA have a masterplan for the precinct, which includes the construction of new laneways and roads which have been incorporated into this proposed development and include a laneway running north to south along the eastern boundary line. Given these circumstances, these trees will ultimately need to be removed. Given this situation, their long-term health and viability is taken as a secondary consideration and they are therefore proposed to be retained for the short term. Should the trees display any resulting instability following the basement construction works they may need to be removed or otherwise temporarily guyed.

Similarly, there is another *Ficus macrophylla* (Moreton Bay Fig) (T34) that is situated on the neighbouring property. It is a relatively small, but historically significant tree, that most likely relates to the original plantings of the paddocks surrounding the abattoirs, before the site became Sydney Olympic Park. An incursion is required into the root zone of this tree due to the basement construction. As part of SOPA's future masterplan, the new laneway and central street will also impact on the future retention of this tree in its current location. This tree will most likely be prepared for transplanting and may have roots pruned in the future well beyond the line that is currently proposed. We also note that Figs are very tolerant of root disturbance and have the potential to regenerate roots quite easily, given proper after care. It is the authors opinion that the incursion is considered tolerable given the above circumstances, the health of the tree and the species tolerance to root pruning.

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), Robert Smart. Robert is a member of the International Society of Arboriculture - Australian Chapter and is also a Registered Consulting Arborist with Arboriculture Australia.

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

1.0 INTRODUCTION

1.1 Background

On the 27 May 2019, Arterra Design was engaged by Ecove Group to undertake an arboricultural assessment of the site at Australia Avenue, Sydney Olympic Park and prepare the relevant reports and plans to help guide the re-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. The very large and prominent Moreton Bay Fig tree (*Ficus macrophylla)* situated on the corner of Australia Avenue and Murray Rose Avenue (within the site) is proposed to be retained and development strategically designed to integrate it within the designed building and landscape to provide a positive and cohesive contribution to the urban design. Given the size of the tree and the relationship to the street and the proposed building, this is a complex operation and one that will require careful design, construction control and implementation to achieve a successful outcome for the project and the tree.

The site is currently used as an at-grade carpark for the Sydney Olympic Park precinct and has scattered trees, and other minor service infrastructure throughout. The site at Australia Avenue, Sydney Olympic Park is ear-marked for redevelopment as a mixed-use development including a hotel and commercial building, with civic landscape spaces fronting the surrounding streets. The proposed development introduces a centralised road running west to east, dividing the proposed buildings, and a laneway along the eastern boundary. It is likely that the construction work on the site will have impacts on the numerous surrounding mature trees.

The retention of the Moreton Bay Fig tree (*Ficus macrophylla*) in good and healthy condition is a key component to the design of the new development. A transplantation feasibility assessment was undertaken to consider and investigate whether this tree could be raised. Given the following reasons, the risks and costs associated with potentially moving or lifting the tree were considered far too high:

- The sheer size of the tree.
- Relatively unique and extensive root buttressing.
- The historic significance of the tree and the more appropriate heritage outcome of leaving it in its original location. SOPA and the Office of Heritage may have significant issues with the proposed relocation/raising of the tree.
- The extreme difficulty in gaining appropriate and workable access to all sides of the tree and the likely engineering difficulties with undermining the retaining structures to the north and west. This would require a very massive engineering feat. It would likely involve thrust boring for a length of some 17-20m, installation of massive steel girders, extensive and complex hydraulic jacking systems and then working out a way to successful and safely 'under fill' the tree.
- The substantial costs associated with the engineering of the support systems required and the jacking of the extensive weights.
- The costs associated with the ongoing maintenance of the tree, once it is compromised by the move.
- The likelihood of substantially altering the natural hydrology under, and around, the tree leading to its potential decline.
- The very real likelihood, even if successfully raised, of the tree declining in overall health and condition and then shedding limbs, having a sparse canopy and ending up a saftey 'risk' and an eye-sore at the front door of an otherwise prestigious and prominent development.

It was considered a far better outcome to work with the tree in its current level and form and ensure the tree is maintained in a healthy state. With this in mind, and given the trees size and location, it will be essential to properly design the surrounding environment with best practice tree management at the forefront. Large trees such as this can be easily damaged by poor design or careless construction activities and once damaged cannot be easily rectified. Adequate soil volumes, sufficient drainage, irrigation and soil aeration are all critical aspects to consider and factor into the design. It is also important to remember that trees must, and will, keep growing, so some space for future growth above and below ground must be considered.

As both landscape architects and AQF level 5 arborists, Arterra are uniquely positioned and have an in-depth understanding of the design development process. This assists with the integration of the tree and its needs within what is being proposed as part of the landscape and the built form. Arterra also have experience in the management of *Ficus sp.* on development sites having successfully advised regarding tree retention and the management of Fig trees on the following projects:

- Westfield Miranda – 1 x Mature *Ficus hillii* impact assessment and management (2011-2015) for Westfield
- Bradfield Plaza South – 2 x Mature *Ficus hillii* transplanting (2005-2008) for North Sydney Council
- Barangaroo Stage 1 (Hickson Road) – 72 x *Ficus hillii* impact assessment and management (2011-2012) for Barangaroo Delivery Authority

- Trinity Grammar Junior School Development, Seaview Street, Summer Hill (2010-2011) Mature 10 x *Ficus hilli* tree management plan.
- Greenoaks Luxury Apartments (Bishops Court), Double Bay NSW 1998-2007 – 3 x mature *Ficus macrophylla* tree management during construction.
- Sydney International Athletic and Aquatic Centre, Sydney Olympic Park (Olympic 2000) – 5 x Mature *Ficus macrophylla and F. rubiginousa* transplanting (1990-1992) (R. Smart while with Belt Collins & Assoc.)

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 Ecove Group 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 and immediately surrounding 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 trees being retained and identify and assess the likely arboricultural impacts of the development on the trees and
- Provide 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 Sydney Olympic Park Authority (SOPA) are the landowners of this site, however, the development review and assessment process ultimately lie with the NSW Department of Planning, Industry and Environment who are the consent authority. We have considered the 'Guidelines for the Protection of Trees on Construction Sites' provided by SOPA, however, this guideline does not define a tree within the Sydney Olympic Park precinct. The other authority considered is Parramatta City Council and the Auburn DCP 2010, Tree Preservation which applies to trees and vegetation within the LGA.

A tree for the purposes of the DCP is defined as a perennial plant with at least one self-supporting stem, which has:

- a height of, or greater than, three and a half (3.5) metres;
- an outside circumference of 400mm or greater
- a cycad or mangrove, irrespective of its dimensions

Certain exemptions apply to species listed in Section 2 Table 1 of the DCP.

1.4 Conduct and Author Qualifications

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

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.

"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.

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

1.6 Documents Reviewed

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

Sydney Olympic Park Authority (SOPA):

- Guidelines for the Protection of Trees on Construction Sites – October 2004

Parramatta City Council DCP:

- Auburn DCP 2010 – Tree Preservation

Architects - Fitzpatrick + Partners:

- Site Master Plan – Project No.21810, Drawing No. DA-001 to DA-045, Rev A, Issued for DA, Received 15/08/19

Landscape Architects – Arcadia

- Draft Landscape Concept Plans, Revision A, Received 15/08/19

LTS Lockley Surveyors:

- Survey – Reference No. 50357 003DT, Rev B, Received 05/06/19
- LIDAR Scan/Point Cloud - 50357-004_TREE_OPTIMISED.e57, Received 01/08/19

At present we have not reviewed any of the proposed servicing plans for the development but advise that 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, History and Context

The site is located approximately 15km west of the Sydney CBD. Positioned on the corner of Australia Avenue and Murray Rose Avenue, this site is currently used as an at grade carpark for the Sydney Olympic Park Precinct. The largest and most prominent tree on site is a *Ficus macrophylla*, which is positioned in the north-western corner of the site.

The surrounding area, known as Sydney Olympic Park, is a large sports and entertainment complex in the west of Sydney. Many of the facilities used throughout the precinct are for sporting, musical and cultural events, which sit closely alongside commercial development and extensive parklands. The site is positioned north-east of Sydney Olympic Park train station, north of Bicentennial Park and south of Brickpit Park.

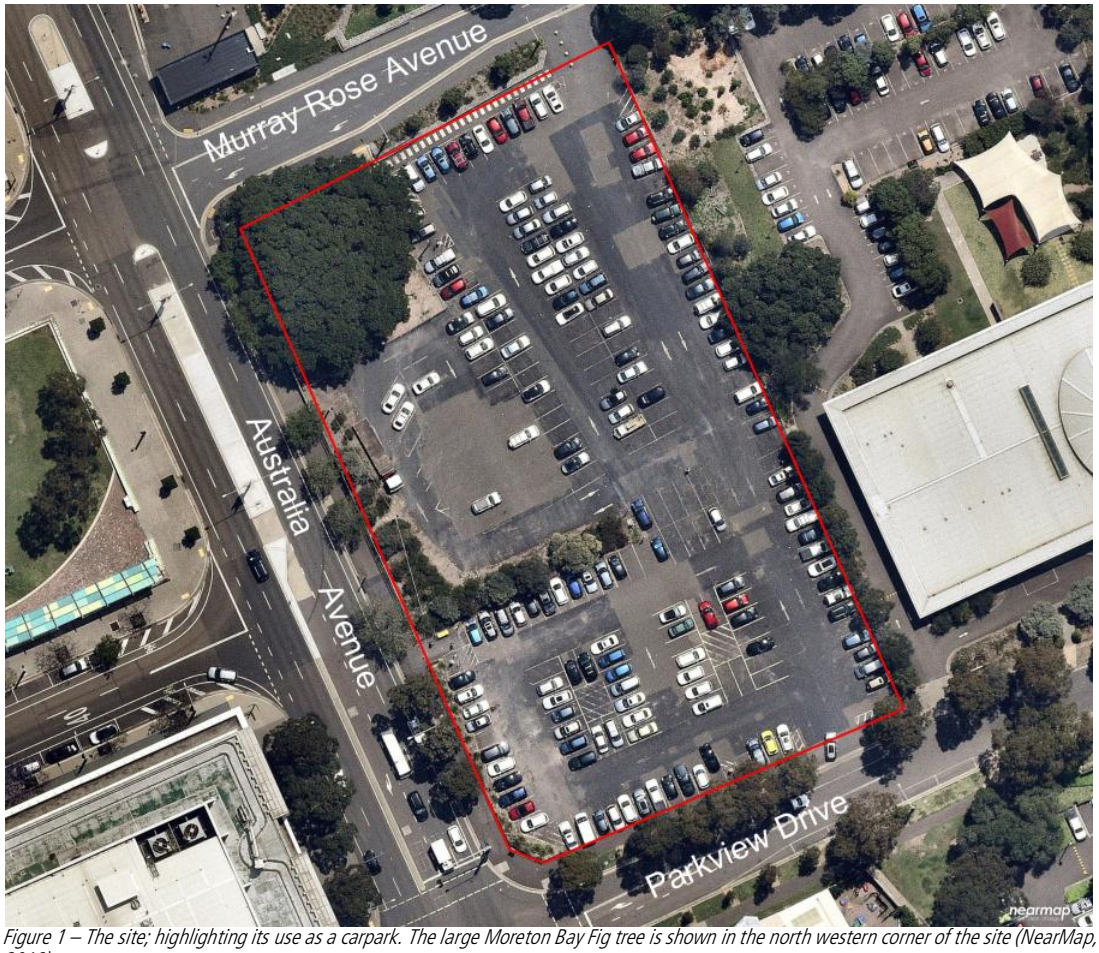

Figure 1 – The site; highlighting its use as a carpark. The large Moreton Bay Fig tree is shown in the north western corner of the site (NearMap, 2019).

Historically, prior to the Sydney Olympic Park development, the site (formerly known as Homebush) was an abattoir surrounded by holding paddocks. The Government authorised the construction of this new State Abattoir at Homebush in 1906. The choice of Sydney Olympic Park for the abattoir's site was logical, as there were established sale yards at Homebush from 1882, and the area was serviced by an efficient goods rail line.

The abattoir complex opened in April 1915. Despite later decentralisation, the facilities were upgraded in 1965 to handle meat export demands. In 1979, the facilities were again assessed, and found to be at the end of their economic life. The economic viability of the abattoir continued to decline until its closure in 1988. Sydney's bid for the 2000 games began in 1991. The abattoir site, wholly owned by the NSW Government, was earmarked as the site for the Sydney Olympic park. When the Games were awarded to Sydney in 1993, full-scale redevelopment of the Homebush Bay area began, including efforts to rehabilitate and rejuvenate land affected by years of industrial use.

As part of the abattoirs, the holding paddocks surrounding the facility were planted with a regular grid of Figs to provide shade and shelter for the animals. Based on the size of the trees within 1943 aerials of the area, it is likely the trees were planted soon after the establishment of the abattoirs in the late 1910s or early 1920s. Most of these have long since perished as a result of the Olympic development, age or neglect. The fig on the subject site is one of the last remaining figs still in its original location. Probably only two other figs remain in their original location, one of which is on the neighbouring property. Approximately 12 other such Figs were transplanted (10 Morton Bay and 2 Port Jackson Figs) as part of the Olympic work around the stadiums in the early to mid 1990s.

Figure 2 – Aerial view in 1943 of the extensive abattoir development at Sydney Olympic Park (formerly Homebush) where the regular pattern of Figs, that were installed in the holding paddocks around the facility, can be seen. All but 2 or 3 of these figs have since been moved or destroyed with the redevelopment of the site over the last 3 decades. (Source : Lands Dept-SixViewer)

Figure 3 – Aerial view circa 1940 of the extensive abattoir development at Sydney Olympic Park (formerly Homebush) where the regular pattern of Figs that were installed in the holding paddocks around the facility can be observed. (Source : NLA - NLS_nla.obj-142184384-1)

Figure 4 – Aerial view in 1943 of the Fig (arrowed) which was even at this time one of the larger and healthier figs. It is one of only a select few that remain in their pre-existing locations. (Source : Lands Dept-SixViewer)

The street trees assessed along Australia Avenue and Parkview Drive are believed to have been planted as part of the Sydney Olympic Park development. They are established as part of avenue plantings which extend beyond the extents of the site. The street trees along Murray Rose Drive were planted as part of a street upgrade some time between October 2011 and July 2012.

1.8 Assessment Methodology

On the 30th May and 5th June 2019, Robert Smart of Arterra completed a detailed assessment of the existing *Ficus macrophylla* tree on the corner of Australia Avenue and Murray Rose Avenue. The remaining trees were assessed on the 30th July. Trees assessed include ones which are 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 5.4 'T-01 Tree Retention Value Plan' and 5.5 'T-02 Tree Protection & 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. 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.

A LIDAR (Light Detection and Ranging) scan of the site was undertaken by the client. This is an optical remote sensing technology that can measure the distance to, or other properties of a target by illuminating the target with light, often using pulses from a laser. This has enabled a relatively accurate digital rendition of T01 (*Ficus macrophylla)* main structure and shape to be created and imported into 3D CAD software. Arterra has imported this information and used it to generate elevations and sections that accurately depict the location of the trees' primary branches in relation to the existing and proposed levels.

Figure 5 – LIDAR information of T-01 Ficus macrophylla imported into 3D ArchiCAD software, along with the proposed 3D building model to assist with analysis of tree impacts. Piling of the proposed basement can be seen in the foreground of the image (Photo Arterra 12/08/19)

A representative soil sample was taken in the immediate vicinity of T01 and tested for pH, structure, colour and soil texture class to get a basic understanding of likely soil conditions and topsoil depths surrounding the trees. The testing was done using a Dormer 50mmØ hand soil auger.

Tests for pH were done using a Manutec field pH test kit. Soil structure was assessed by observation of soil pedality and soil texture assessment was done using procedures outlined for the field-testing of a moist bolus by McDonald et al, 1998 and Roberts, et al, 2006.

No exploratory excavations were done to determine further 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 October 2018 imported into the above software for cross checking and assessment. (http://www.nearmap.com/ accessed 07/06/2019)

Climatic data was obtained from the Bureau of Meteorology using statistics from Sydney Olympic Park weather station. (http://www.bom.gov.au/climate/averages/tables/cw_066195.shtml accessed 12/08/2019)

1.9 Pre-Development Tree Assessment – Tree Retention Values

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.

1.10 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 proposed building and development will result in a major site disturbance. This will potentially have a significant impact on the trees within and adjacent to the site.

Specifically, the proposed development will involve:-

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

Key Assumptions:-

- All excavations are to be undertaken and retained using sheet, soldier or contiguous piling techniques. Even relatively small excavations, when done near trees are to be retained using soldier piling or similar.
- Despite the above, where needed and warranted, the line of disturbance outside of the building line has been typically estimated at 1.5m from the face of the building to allow for provision of water proofing, services, access and scaffolding around the building during construction.
- All services for the building will enter and exit from Australia Avenue and will be clear of any retained trees TPZs
- All construction access and deliveries are to be made from Australia Avenue or Murray Rose Avenue. Concrete will typically be pumped and will not require any truck movements through TPZs to deliver concrete.
- Where no spot levels are indicated it is assumed that the existing surface levels are retained.
- Pavements and decks will be suspended via suitable piling when created within or around T01.

2.2 Climate and Microclimate

Sydney Olympic Park is located in Sydney's western suburbs, and therefore would share the general climate of this region with moderate temperatures, good rainfall and minimal climatic and weather extremes. It is typically described as a temperate climate with hot to warm summers and cool winters, with relatively uniform rainfalls greater than 800mm / year. There is no distinct dry season.

It has an average annual rainfall of 880mm, 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 February with an average of 109mm and the driest month being September with an average of 52mm.

Maximum average daily temperatures range from 28.4ºC in January and to 17.6ºC in July. The minimum average daily temperatures range from a high of 19.4ºC in February down to lows of 7.8ºC in July.

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

The strongest winds (>40km/h) are normally experienced from the south or westerly directions and later in the day. There are no prominent microclimatic influences visible on the site.

2.3 Soils and Landform – Particularly Around T01 (*Ficus macrophylla*)

The soils are extremely reflective of what the expected naturally occurring soil profiles would be. From soil landscape mapping, the area is underlain by what is referred to as the Blacktown Soil Landscape Group. These are clay soils, derived from the underlying Wianamatta Shales. They are shallow red to brown Podzolic Soils. The topsoil is dark brown clay loam with a moderately pedal medium sub-angular blocky structure. Below this is usually strongly pedal, light to heavy clays.

Representative soil samples were taken at two locations around the root plate of the *Ficus*. One to the northern side and one to the southern side of the tree. The sample to the lower lying northern side was hampered by the profile being saturated. Free water was evident less than 300mm below the surface. Given the lower lying position, impeded drainage due to the adjoining retaining walls and the heavy clay soils, this soil is likely to be saturated or very moist for very long periods. This may account for the trees excellent condition as soil moisture is plentiful. The sample to the south was noticeably drier and very representative of the naturally expected soil describe above. The sample was taken down to 1300mm depth.

The topsoil was 300-400mm in depth and a very friable clay loam with a slightly acid pH of 6.0. Below this, from 400-1000mm was a heavy reddy-brown clay with an acidic pH of 5.5. Below 1000mm the soil profile was representative of a very weathered shale material and was a very heavy and plastic reddy-grey clay with a very acidic pH of 5.0-5.5.

Figure 6 – View of the natural red-brown podzolic soil profile to the south side of the tree. A similar profile was found on the north side of the tree, although below 300mm depth, the soil was saturated with free water. (Photo Arterra 5/6/19)

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.

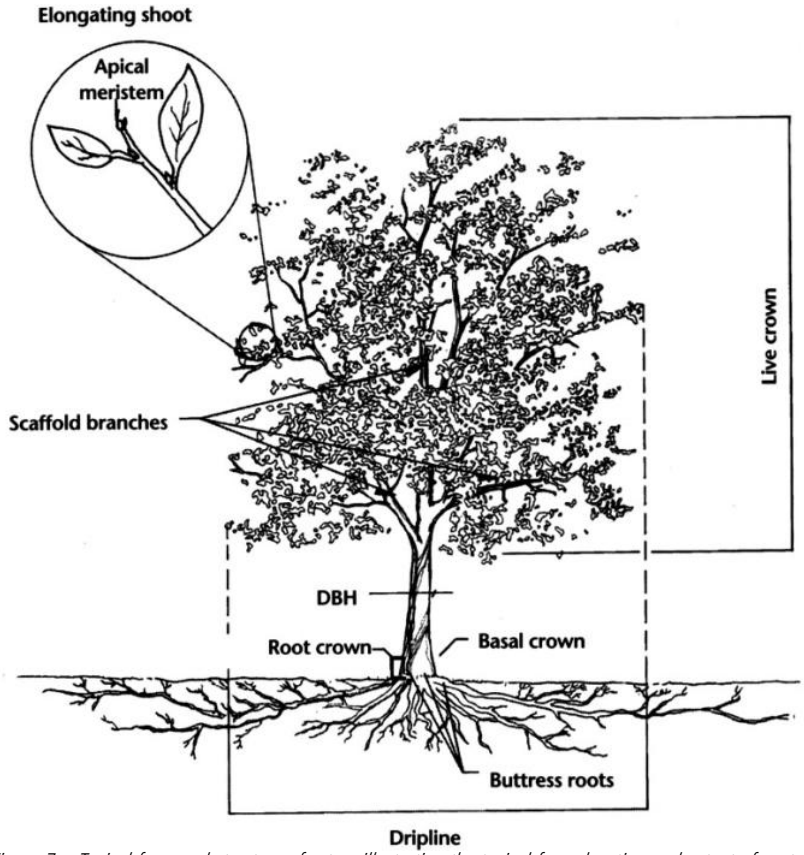

Figure 7 – Typical form and structure of a tree illustrating the typical form, location and extent of root growth (Source: Matheny and Clark, 1998)

Basic Tree Needs

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

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

Trees 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 Impact Assessment - General

A total of **46** trees were observed and assessed for this report and were generally determined to be in fair to good health. They are mostly located around the perimeter of the site, with the most prominent tree being the *Ficus macrophylla* (T01) located on the corner of Australia Avenue and Murray Rose Avenue (within the site). This tree is explained further in Section 2.6 of this report. The majority of the assessed trees (21) are street trees, which contribute to wider avenue plantings within the Sydney Olympic Park Precinct. Many of the other assessed trees (15) are neighbouring trees, which are situated close to the eastern boundary.

In summary, of the **46** trees assessed on the site:

- **9** (20%) are *Acacia binervia* (Coast Myall)
- **8** (17%) are *Eucalyptus microcorys* (Tallowood)
- **8** (17%) are *Corymbia maculata* (Spotted Gum)
- **6** (13%) are *Pyrus ussuriensis* (Manchurian Pear)
- **6** (13%) are *Acmena smithii* (Lilly Pilly)
- **4** (9%) are *Lophostemon confertus* (Brush Box)
- **2** (4%) are *Eucalyptus paniculata?* (Grey Ironbark)
- **2** (4%) are *Ficus macrophylla* (Moreton Bay Fig)
- **1** (2%) is an *Acacia parramattensis* (Parramatta Wattle)

Detailed information on each tree including; heights, trunk diameters, canopy spreads, age classes and condition are all provided in Appendix 5.2 - 'Tree Impact Assessment Schedule'.

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 5.2 – Tree Impact Assessment Schedule.

Of the **46** trees assessed:-

- **17** (37%) have no or minimal foreseeable impact from construction related activity;
- **6** (13%) have minor encroachments as defined under AS 4970;
- **11** (24%) have major encroachments as defined under AS 4970.

The major encroachments are discussed further below and also outlined graphically in Appendix 5.5 T-02 Tree Protection and Removal Plan and listed in Appendix 5.2 Tree Impact Assessment Schedule

Trees T22 to T32 - Alternating Avenue of *Acmena smithii* (Lilly Pilly) & *Eucalyptus microcorys* (Tallowood)
This avenue of trees are situated along the south eastern boundary line on the neighbouring property. The trees are an alternating avenue of *Acmena smithii* (Lilly Pilly) and *Eucalyptus microcorys* (Tallowood) and vary from poor to average form and poor to good vigour.

Figure 8 – The trees located on the neighbouring property and their proximity to the boundary and driveway (Image by Arterra 30/07/19).

The cause of the likely incursion from the proposed development will be from the excavation for the proposed building basement. The basement will be constructed using piling techniques which will help to assist with limiting the amount of excavation required to construct the basement levels of the proposed building. The trees are planted extremely close to the site boundary and, given their projected mature size, are inappropriately positioned in a small garden bed adjacent a driveway. They are still semi-mature and relatively small.

All but one of the noted trees will have major incursions into their TPZs. Many of these trees also have incursions into their structural root zones, resulting in significant impacts. These significant impacts are far from ideal and, from an arboricultural perspective, are an undesirable outcome. This significant impact will most likely adversely affect the health and vitality of the trees and their structural stability may potentially be compromised from the resulting incursions.

It is important to note that SOPA have a masterplan for the precinct, which include the construction of new laneways and roads. These masterplan objectives have been incorporated into this proposed development and include a laneway running north to south along the eastern boundary line. As part of this development Ecove Group are proposing to build the western portion of this laneway only, with the other half to be built as part of future development on the neighbouring property. Given these circumstances, these trees ultimately need to be removed. Given this situation, their long-term health and viability may not be a key consideration. Should the trees display any resulting instability following the basement construction works they may need to be removed or temporarily guyed.

Tree T34 *Ficus macrophylla* (Moreton Bay Fig)

This tree is situated on the neighbouring property, and is a relatively small, historically significant tree, most likely related to the original plantings of the paddocks surrounding the abattoirs, before the site became Sydney Olympic Park.

The percentage of incursion into the nominal TPZ is 13.7%.

This incursion, as discussed above, is due to the excavation required to build the piled basement wall of the proposed building. Roots have been observed travelling out from the neighbouring property into the carpark area of the site. As part of SOPA's future masterplan, the new laneway will also impact on the future retention of this tree in its current location. As part of future development and the new lane way proposed by SOPA, it is most likely that this tree will be prepared for transplant and may have roots severed and cut in the foreseeable future beyond the proposed level of impact incurred by this current development.

It is important to note that Figs are often very tolerant of root disturbance and have the potential to regenerate roots quite easily, given proper after care. The roots will be adequately exposed and cleanly cut at the boundary. This is expected to have minimal impact to the tree as it is occurring approximately 7m from the trunk of the tree. It is in the authors opinion that the incursion is considered tolerable given the above circumstances and the species tolerance to root pruning.

Figure 9 – T34 Ficus macrophylla located on the neighbouring property highlighting its close proximity to the boundary (Image by Arterra 30/07/19).

2.6 Tree Impact Assessment – T01 *Ficus macrophylla* (Moreton Bay Fig)

Key Observations & Findings

This tree is located prominently on the corner of Australia Avenue and Murray Rose Avenue. This large, visually significant tree was planted as part of the paddocks surrounding the original abattoirs before the site become Sydney Olympic Park. It is likely the tree was planted soon after the establishment of the abattoirs in the late 1910s or early 1920s. The development of Sydney Olympic Park saw the build of Australia Avenue and Murray Rose Avenue to the north and west of the tree. These two roads are at a higher level above the tree, giving the impression that the tree is sunken into the ground from the road.

It is a Moreton Bay Fig (*Ficus macrophylla*). These are large evergreen trees native to the rainforest of coastal Queensland. Rowell (1980) and Wringley and Fagg (1996) describe the species as typically 15-20m tall with short main trunks branching low into several large branches carrying a thick handsome crown of dark green leaves on slightly pendulous branchlets. The spread is defined as typically 12-15m, but often much larger when in good conditions.

The tree displays the characteristics of this description and may be classed as an above average tree in its habit, form, structure and health. At 14-16m high and a 34-38m spread it is at the upper limit of its naturally expected size. Relatively few specimens have been observed by the author at a larger size. Trees must grow to survive, however, and some consideration for moderate expansion in the trees height and spread should be factored into the design.

Figure 10 – T01 Ficus macrophylla located in the north-western corner of the site (Image by Arterra 30/07/19).

Wrigley and Fagg (1996) add that the species will accept hard pruning and is often shaped or hedged but is best used as a shade tree in parks. It is a species commonly planted throughout Sydney in parks and as a street tree, particularly in older suburbs, such as Roseberry, Glebe, Moore Park, Darlinghurst and Summer Hill.

It is a very common misconception that tree roots extend down deep into the soil. A tree root system is typically very extensive and horizontally oriented. The horizontal extent of tree roots usually extends well beyond the perimeter of 'dripline' of the crown. This is typically even more pronounced with Figs. Tree roots are likely to extend well past the canopy or drip-line of the tree. Personal observations of the author verify that other similar sized specimens of *Ficus macrophylla* have roots extending well in excess of 30-45m from the centre of tree in the absence of any barriers.

Figure 11 – T01 Ficus macrophylla and its extensive buttressing root system and low branching habit (Image by Arterra 05/06/19).

It is also a species that has very commonly been successfully transplanted at mature sizes. It appears to be very tolerant of root disturbance and pruning.

Several factors working in favour for the viability of the Fig Tree and for its ability to tolerate the impacts imposed by the proposed development:-

- The tree appears to be in very good health with strong vigour.
- There are no noticeable diseases, pest or major structural problems with the tree

- The species is tolerant of root disturbance and construction activity. It is a very commonly transplanted species that demonstrates quick regeneration of roots to replace roots that have been lost or damaged, even in harsh urban conditions.
- The tree is tolerant of pruning activity with good branch architecture which facilitates easy reduction and clearance pruning. It is important to note that this tree was pruned in the 1990s on the north and west side to develop and build Australia Avenue and Murray Rose Avenue.
- Existing surrounding microclimate and soils have been ideal for the long-term vitality and good health of the tree, with a decent depth of rich clay soils. The tree located at a low point in the car parking area results in the tree receiving plenty of water, with the existing clay soil providing optimal water holding capacity.

The main factor working against the Fig Tree and for its ability to be integrated into the development is to tolerate the impacts imposed by the proposed development. The tree is large with a low and wide spreading canopy, leading to difficult access under the tree for construction and potential conflict with pedestrians and building clearances. Some minor pruning to reduce the canopy and raise the canopy will be required.

Key Tree statistics and measurements:-

1. DBH at 1.0m above ground level = **2.91m**
2. Tree Canopy Spread = **34m** East-West and **35.5m** North-South, with the canopy development being slightly asymmetric to the east.
3. Tree height = **14-16m** (to top of foliage)
4. SRZ radius = **5.18m**
5. TPZ radius = **15.0m** (as per AS 4970) but canopy is marginally past this measurement. (This equates to a nominal area of 706m2 (15mx15mx3.14))
6. Existing roots will have extended well past the drip line of the tree, particularly to the east and south. To facilitate the development as planned it will be necessary to accept cutting of roots at approximately 12-15m from the centre of the tree. It will be extremely valuable to provide protection of existing soil around the tree.
7. Soil tests indicate topsoil depth is **in excess of 1m.** Most root development is expected to be within this layer.
8. The existing soil is a very friable clay loam with a slightly acid pH of 6.0 (and appears to be reflective of what the expected naturally occurring soil profile would be)
9. Ultimate mature tree diameter is not expected to exceed **40m**
10. Given that irrigation will be available, it is our opinion that the soil volumes stated above are realistic to sustain the tree and its ongoing requirements in perpetuity.
11. Minimal **clearance is available under canopy** of tree, particularly to the east and south. This is an issue for final levels as well as doing any work or piling during construction.

Applying the Lindsey and Bassuk calculations, to sustain the tree in the longer term a notional soil volume of about 700-750m3 would be required around the tree to meet its mid-summer water demands. An automated and targeted irrigation system can help to slightly reduce this demand (Lindsey and Bassuk 1991).

It is our opinion that the majority of the tree roots will be in the area within the naturally mulched bed at the base of the tree, with potential for these roots to have extended under the asphalt carpark to the east and south of the tree. This tree has an extensively large buttressing base which has developed well in the deep naturally structured podzolic soils. This can be seen with the many large visible surface roots present in the area. It is very unlikely that many roots still exist under the north and western road walls.

Bulk Excavation for Basement and Root Cutting

In order to achieve the basement car parking and the development proposed, it will be necessary to sever the trees roots at a given distance from the tree. The loss of these roots will reduce the trees ability to uptake water and nutrients until they are adequately replaced. It will also likely cause some setback to the tree and typically result in a temporary loss of some of the foliage as the tree compensates for root loss.

This has been evident in transplant operations of the same species of similar size where roots have been severed at a much closer radius of approx 3-5m from the centre of the tree trunk. Experience has shown however, that with appropriate after care and maintenance and the provision of suitable rooting volumes and soil for roots to regenerate into, the tree can recover and continue to flourish. This type of extreme root cutting is of course only necessary for transplanting.

Figure 12 – Example of a Ficus tree and its extensive root system, highlighting their ability to fuse, which may potentially contribute to the trees tolerance of root pruning (Image by Arterra 05/06/19).

It is not proposed to sever the roots to the extent that would be required for transplanting. The tree impact plan illustrates where the proposed bulk excavation is required and where the existing roots will be cut. The basement layout has been positioned to minimise the root loss to what, in our opinion and experience, is an acceptable distance.

Once the basement is constructed, the soil will be topped up and mulch reapplied to ensure moisture retention and microbial activity. Irrigation (both temporary and permanent will be provided to facilitate root survival and growth throughout the existing and new root zone.)

Figure 13 – Example of an automatic and battery operated irrigation spray system during construction (Image by Arterra 19/06/19).

The root cutting will be a critical part of the initial development and construction. This shall be carefully monitored and overseen by the Project Consulting Arborist. It is proposed that the cutting line will be carefully set out and the existing roots exposed via non-destructive means such as air or water jetting. This will then allow the roots to be properly cut by hand using sharp implements. Temporary boards will then be placed on the outer edge of the trench and initial excavations and then backfilled with appropriate horticultural soil and kept moist to facilitate root regeneration.

Figure 14 – Example of roots being non-destructively exposed using water jetting (Image by Arterra 06/06/13).

Bulk excavation, shoring and piling can then take place outside of this line without fear of any further root damage or disturbance and roots won't be left exposed for extended periods. Cutting of roots with other methods or the use of excavators, trench diggers and the like will result in excessive damage and splitting of roots well past the line intended for cutting, and will not be permitted.

Figure 15 – Example of cleanly cutting exposed roots (Image by Arterra 06/06/13).

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 excavations;
- 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 pedestrian pathway construction.

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

3.0 GENERAL SITE & SURROUNDING TREE MANAGEMENT

3.1 Key Recommendations to Reduce Tree Impacts

The following recommendations are made to potentially reduce the negative construction impacts on the trees. Refer to section 4.0 of this report for specific construction management recommendations for T01 *Ficus macrophylla* (Moreton Bay Fig).

- Undertake exploratory non-destructive root mapping investigations (ie: using air spades or hand excavation) on the western side of **T34** to verify location of major roots to guide piling locations for the basement wall along the eastern boundary.
- Strategically position piles, as directed on site by the project arborist, to avoid impacts within the structural root zones of trees **T22, T23, T24, T25, T26, T27, T28, T29, T30, T31 & T32**.
- Ensure that an appropriately qualified Arborist is on site and supervises all demolition work within the identified TPZ areas.
- Install trunk protection battens. See Appendix 5.5 T-02 Tree Protection and Removal Plan for locations.
- Appropriately fence all TPZs outside of the incursion for the duration of all major site construction work. See Appendix 5.5 T-02 Tree Protection and Removal Plan for locations.
- Carefully control and fence access to and from the construction area so that movement does not occur through any TPZ other than the building incursion.
- Ensure all the above and below ground services are excluded from running through any TPZs beyond the noted incursion.
- Minimise the re-grading of the ground surface within the TPZ, beyond the noted building incursion, to meet and match proposed pathways and building levels. Where it is required, limit it to a maximum depth of 300mm above existing ground levels and ensure it is only quality sandy manufactured organic garden mix.
- Mulching of the entire TPZ, beyond the noted building incursion, for all retained trees, not just the smaller areas identified on the landscaping plans. This will aid tree health with moisture retention, remove competition from grasses, and improve soil condition within the TPZs.
- Avoid digging into existing root zones for the installation of the proposed landscaping around the trees and installation sizes of new plants to be 5L or less to ensure that excavations are less than 200mm in depth. Build up soil levels when planting to a maximum of 200mm to enable the planting to occur without disturbing roots.
- Do not allow storage or stockpiling of any materials or site sheds within established TPZs unless that it can be demonstrated that this will not impact on the tree retention and is approved in writing by the Consulting Arborist.

3.2 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, Landscape Architect, Civil and Structural 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, cranage 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 TPZ.
4. Existing pathways, fences, driveways, furniture and shrubs are to be carefully removed from within the TPZ.
5. Existing surrounding trees 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. Designated TPZs are to be mulched with 75mm of recycled hardwood woodchip mulch to improve soil conditions around tree and remain in place until future landscaping.
7. Trunk protection to be placed on all trees to be retained.
8. The Construction Phase TPZ 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. Any required rumble boards installed to protect TPZ areas where access is required.
9. Install temporary irrigation system to TPZs.
10. A utility Arborist is to undertake selective pruning of canopy or branches to facilitate construction of the building and the use of any large-scale piling equipment without accidental damage to the tree canopy. Pruning to be done in accordance with AS4373 - Pruning of Amenity Trees and performed by staff with minimum AQF 3 qualification.
11. Plywood is to be placed under any scaffolds or works paths when running through TPZs
12. Building works to be completed (external).
13. Contractor to remove the TPZ fencing and then install final pathways and landscaping within the TPZ under the trees, after construction of the building exterior is completed.

3.3 Demolition Work Near Trees or within TPZs

Demolition of paths and other structures required within a TPZ 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 TPZs shall be supervised and overseen by a qualified Project Consulting Arborist.

3.4 Tree Protection Fencing & Definition of TPZs

Establish a clearly defined tree protection zone as indicated in Appendix 5.5 - "T-02 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.

3.5 Ground Protection within TPZs

Vehicular movement and access shall typically not be required or approved through the TPZ areas. 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 16 – Example of acceptable Tree Protection Area ground protection

3.6 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 injury the trunk or bark. Battens may be made from any suitable waste timber of similar sizes and depths. All sharp or protruding edges are to be properly covered with tape or similar padding.

Figure 17 – Example of acceptable Trunk Protection batten installation

3.7 Provision of Temporary Irrigation

A temporary and automated (battery powered timer is sufficient) watering system to be placed within the TPZs to maintain adequate water to the retained trees and help maintain their healthy condition. This can be a surface mounted 'residential-style' soaker hose and/or surface sprinkler systems. It is to be surface visible and spray delivered so that is operation can be easily visible and verified. It should be on a designated supply line, separate from other construction related water supplies to minimise its likelihood of being disconnected.

Typically, during spring and summer months it should be set to run for a minimum of 30 minutes every day, in the early morning. During, autumn and winter months it should be set to run for 1 hour once every week. The operation can be suspended temporarily in periods of extensive and prolonged rain.

The system is to remain in place for the duration of construction, or until the project consulting arborist approves it's removal. It may be removed to allow final landscape treatments to proceed. If accidentally disturbed or damaged by construction activities, it is to be reinstated as soon as practicable.

3.8 Final Landscaping within TPZs

Once final levels are set by the finished structural elements. 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 Final Building and Pedestrian Clearance Pruning

Once the final levels and finishes are in place the Project Consulting Arborist shall supervise the selective pruning of any lower peripheral branches to retained trees to achieve any clearances for final pedestrian access. This shall be minimised as much as possible. It is anticipated that the final pruning of any of the retained trees will be less than 5% of the existing canopy and will not have any serious impact to the trees health or habit.

The branches of the tree shall only be pruned as specifically needed and directed by the Project Consulting Arborist. Work is to be in strictly accordance with to AS4373 - Pruning of Amenity Trees. Do not treat wounds. Only clean, sharp pruning implements shall be used for all pruning work, ensuring that cuts are made without damage, tearing or bruising of the vascular tissue.

3.10 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.

4.0 *FICUS MACROPHYLLA* (MORTON BAY FIG) TREE MANAGEMENT

4.1 Key Amendments to Site Layout and Design

The landscape concept design and proposed building layout have been developed in consultation with the Client and Architects to cater for the needs of T01 *Ficus macrophylla* (Moreton Bay Fig). Arterra have aimed to minimise the impact on the existing tree and the design has been modified to this effect wherever possible.

The development essentially surrounds the tree on the eastern and southern sides. The existing roadways to the north and west are to be retained. The tree will most likely continue to receive good sunlight as the building is largely to the south-east of the tree. To ensure that the tree is retained in good health and vigour, it is important to minimise impacts for the foreseeable future. The tree is a valued and worthwhile addition to the development.

The aim is to maintain the trees overall form and habit, whilst promoting views into the canopy and celebrating this large majestic tree. It is seen as desirable and achievable to judiciously open up views into and around the base of the tree from a designated and urban design perspective. Views from the interior of the proposed building looking back to the canopy of the Fig have been considered and could be quite special and dramatic.

Figure 18 – Suspended concrete terraced stairs have been considered within the design to provide special views and access to the large Fig tree that can be viewed and accessed from the entry of the proposed building on the north-eastern corner. The image above shows a similar design and is a recent example at Westfield Miranda. (Photo Arterra – Westfield Miranda)

Figure 19 – It is important to consider the potential for quite special views into the canopy of a very healthy tree from the interior of the hotel lobby and other facilities. The image above is a recent example of a similar concept at Westfield Miranda (Photo Arterra – Westfield Miranda)

The proposed building extents and basement are set well back from the tree and outside the nominal 15m radius from the centre of the tree. The basement is 14.5m from the trunk to the east and 11.5m from the trunk to the south. The overall remaining soil area around the tree is 26m x 27m (702m2).

Apart for the pruning of the asymmetric canopy component to the east, the basement can most likely be constructed without excessive damage to the tree or canopy. Subsurface drainage will be accommodated as part of the basement wall construction and will therefore ensure the tree does not become overly waterlogged, which is most likely better than what is currently provided. Surface drainage will be continued in the lower north-east corner of the site to deal with surface water and to prevent the water from excessively ponding around the tree.

Space has been provided around the tree to limit impacts to the large buttress roots and lower branches but still facilitates and shows off the sculptural qualities of the trees structure. Pavements between the basement line and the tree will be suspended using a combination of suspended concrete slabs and light weight decking. Large sections will be suspended via appropriately spaced and positioned piers. Light weight decking will be installed using screw piles or similar. The location of the OSD tank is to the east of the tree and its size and configuration has been shaped to attempt to avoid encroachment into the TPZ. The structure will be suspended over the existing levels using appropriately spaced and positioned piers. Any piling or screw piles required under the canopy of the tree shall be installed using appropriately sized, low height piling equipment only.

Figure 20 – Example of low height piling equipment being used under a Fig tree at Westfield Miranda (Image By Arterra 09/10/13)

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 tree T01 *Ficus macrophylla* situated on the north western corner of the site. On this basis there are no recommendations to alter the design further at this time.

4.2 Key Protection Measures & Considerations

Absolutely no construction work, other than landscaping, shall be undertaken within a 5.2m radius of the tree to prevent damage to any structural root system. Some judicious piling/ piers under the tree canopy, as mentioned above, are acceptable, outside of the SRZ, as long as major roots are not damaged and clearance under the canopy can be achieved. This should be minimised as much as physically possible. Piling diameters should also be minimised to ensure appropriate tree and root protection.

A tree protection area is to be clearly defined through the installation of a 1.8m high temporary fence with either plywood hoarding or temporary steel mesh fencing. This area around the tree shall be delineated as a tree protection zone during the construction process and shall aim to be free from disturbance or compaction. Access will typically be excluded from this zone and the levels will be left largely at the existing levels with the exception of the installation of 100-200mm depth of imported organic garden soil and 75-100mm of mulch. This is to ensure that there are adequate soil volumes for the long-term health and survival of the tree. Refer to Section 2.3 for information on the existing soil profile. A temporary and automated irrigation system shall be installed across the entire TPZ to provide water to the tree. This shall be monitored and maintained throughout the building construction period.

Figure 21 – Example of 100-200mm of new top soil spread under a Fig tree at Westfield Miranda (Image by Arterra 09/10/13)

The proposed development must protect and minimise damage to existing roots, particularly the above ground and larger buttress roots. This is to ensure that the tree is not opened up to sites of future decay or pathogen, particularly close to the trunk or base.

Canopy pruning is to be undertaken under strict supervision from an AQF Level 5 arborist with a view to restricting pruning to branches less than 250mm diameter and a focus on branches that are around the lower perimeter of the tree. Judicious pruning shall be done selectively and incrementally to ensure that the maximum amount of canopy volume can be retained. Pruning shall aim to maintain the overall aesthetic qualities and general broad domed habit of the tree. The largest pruning is restricted to the eastern side of the tree, that is somewhat asymmetrical in nature, to facilitate the construction of the building and basement and provide access at a critical part of the site. The following images reflect the current expected proposed pruning which may need to be undertaken for construction access.

Figure 22 – Proposed canopy pruning for construction access on the north western side of the tree for the proposed 'viewing platform'. All pruning is to be undertaken on lower branches, less than 250mm only. All pruning is to be undertaken with strict supervision from an AQF Level 5 arborist (Image by Arterra 30/07/19)

Figure 23 – Proposed canopy pruning for construction access on the south western side of the tree for pedestrian access into the site and to accommodate suspended concrete steps. All pruning is to be undertaken with strict supervision from an AQF Level 5 arborist (Image by Arterra 30/07/19)

Figure 24 – Proposed canopy pruning for construction access on the south eastern side of the tree for pedestrian access into the site and to accommodate suspended concrete steps. All pruning is to be undertaken with strict supervision from an AQF Level 5 arborist (Image by Arterra 30/07/19)

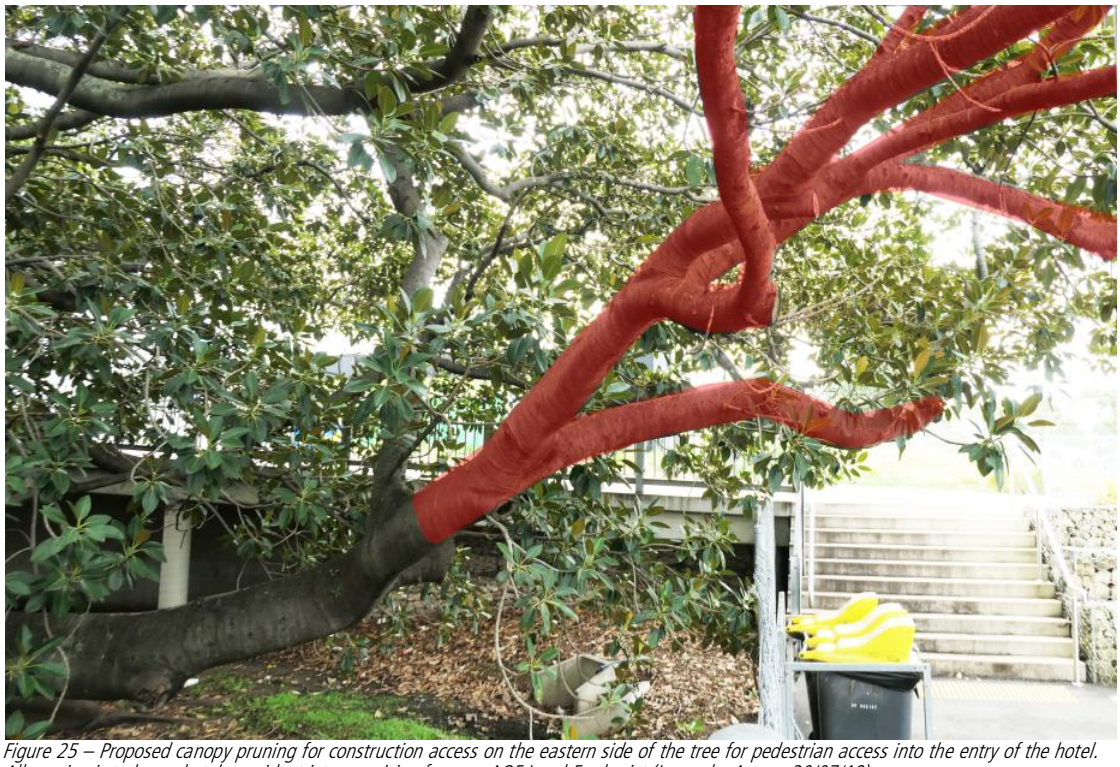

Figure 25 – Proposed canopy pruning for construction access on the eastern side of the tree for pedestrian access into the entry of the hotel. All pruning is to be undertaken with strict supervision from an AQF Level 5 arborist (Image by Arterra 30/07/19)

It is important to ensure that all branches removed consider the impacts on the upper canopy of the tree. Branches that may open up the canopy 'roof' and expose the lower branches and trunk to sunscald are not to be removed. This is also in line with the philosophy of maintaining the overall habit and form of the tree.

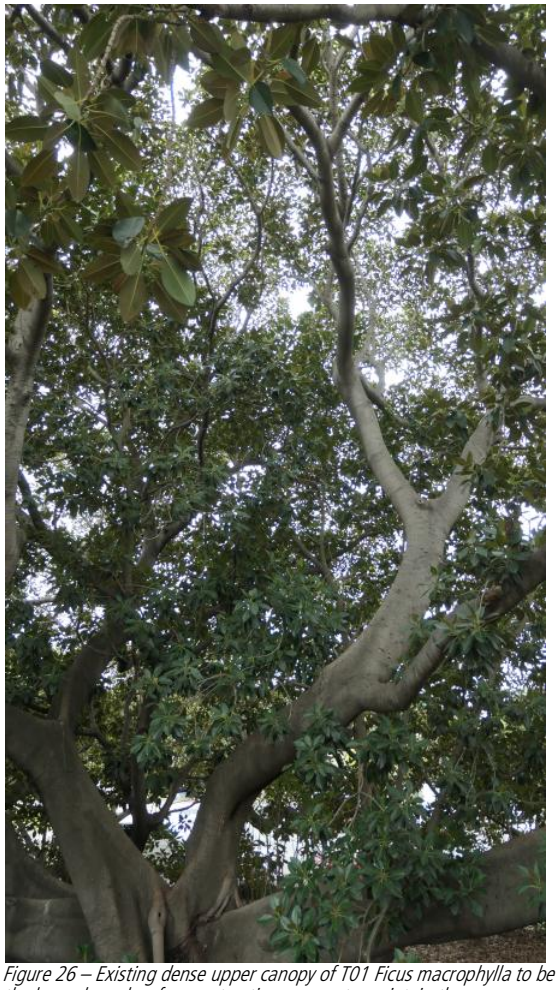

Figure 26 – Existing dense upper canopy of T01 Ficus macrophylla to be retained. Pruning shall be selectively and incrementally undertaken on the lower branches for construction access, to maintain the upper canopy (Image by Arterra 30/07/19)

Root pruning is to be undertaken under strict supervision from an AQF Level 5 arborist. Roots at the periphery of the tree are to be appropriately exposed via either hand excavation and/or air or water spade and then cleanly cut at the direction of the project arborist. Final excavation can then proceed past this point with no further damage or impact to retained roots. The extent of the roots present and severed at this point are to be assessed and recorded. This work should not be undertaken during the heat of summer. If possible, the root pruning shall take place between April and October.

A shallow addition of organic, sandy soil media and mulch is to be placed around the base of the tree to protect the finer fibrous roots during construction and provide additional soil volume and media into which to plant final ground cover landscaping. This addition of soil may also promote the development of additional new finer fibrous roots to help and assist the tree in maintaining good health and vigour. The ground surface within the tree protection zone shall be protected from disturbance or compaction.

Services, such as drainage, water and electrical shall be affixed to the underside of the slabs and decking, where possible, to avoid any excavation or trenching around the tree during construction and in the future. Trenching for all services are to be excluded from the tree protection area, unless approved and supervised by an AQF5 arborist and undertaken in a non-destructive fashion.

The final concrete steps and light weight decking shall be suspended over the existing and new perimeter soil areas. The tree protection fencing will need to be removed or relocated closer to the tree to facilitate this. Decking and concrete structures shall be suspended on piers and screw piles. Care shall be taken to avoid contamination of the soil with wash down, etc. Once the final levels are set by the finished structural elements, the final trimming and landscaping shall be judiciously undertaken to avoid undue compaction to the soil and to avoid root disturbance via irrigation trenching, lighting and planting of larger plants. Permanent spray irrigation will be installed under the mulch layer and suspended under the adjoining decks and suspended slabs.

During the construction of infrastructure within the tree protection area and in close proximity to the tree, such as the OSD tank and the tiered landscape stairs, low height and lightweight equipment must be used. If likely to be damaged by passing vehicles or equipment, the trunk and lower, larger branches are to have a protection barrier installed to ensure the tree is protected from damage.

Tree protection measures and sequencing is to be thoroughly documented and included in any construction contract. The Project arborist shall inspect and report on the tree and the works on the tree to the client and PCA/ SOPA at least monthly.

The Project arborist is to oversee and monitor all work within the Tree Protection Area such as:

- Installation of initial tree protection measures
- Any demolition within the tree protection area
- Defining the extent of basement lines on site and the exposure and cutting of roots and installation of temporary shoring and tree protection fencing
- Branch and canopy pruning to facilitate construction and access
- Installation of temporary irrigation system
- Drilling and installation of piles or piers
- Construction of footings and suspended slabs and decking
- Installation of any services or lighting
- Final landscaping
- Final canopy shaping and pruning

4.3 Arboricultural Expertise

A suitably qualified Project Consulting Arborist shall be engaged for the duration of the construction period to monitor works and assess the condition of the tree and shall be appointed and contracted to the client, not the contractor. They shall be a professional member of the Arboriculture Australia or the Institute of Australian Consulting Arboriculturalists with a minimum AQF level 5 qualification in arboriculture. Where possible, and reasonable, the same arborist shall be used for all ongoing tree assessments on the site.

For any physical tree work, such as pruning, a suitably qualified Tree Contractor/Arborist shall be engaged. They are to be supervised by an Arborist with a minimum AQF level 3 qualification in arboriculture.

The Tree Contractor, all their employees and any subcontractors are to abide by all appropriate safety standards and undergo an applicable site induction procedure. Specifically, all Tree Work shall be done in strict accordance with the Safe Work Australia Guide to Managing Risks of Tree Trimming and Removal Work (July 2016) and the AS 4373-2007 Pruning of amenity trees.

4.4 Proposed Tree Protection & Construction Activity Sequencing

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

1. Clearly define and mark extent of basement and non-destructively expose roots to a depth of around 600-700mm along this line and then record and cleanly cut roots 300-500mm back from the proposed pilling alignment. This is to prevent damage to roots from piling and excavation equipment and to cleanly cut roots that may extend past the tree protection area.
2. Install temporary shoring and backfill after the above process. This will most likely prevent fretting away of soil as excavations and piling is undertaken and allow backfilling and protection around exposed roots.
3. Undertake incremental and judicious pruning of lower and peripheral branches and foliage that have been identified for removal as conflicting with proposed construction and access requirements. (typically all less than 250mm diameter and in accordance with AS4373-2007). This is to facilitate construction access, piling rig access and views under the tree to the proposed building and plaza, while maintaining overall form and habit of the tree.
4. Carefully install 100-200mm of relatively sandy organic soil mix and then 75-100mm of coarse organic mulch around base of tree to protect the ground surface and underlying fibrous and woody roots from damage by pedestrian and small machinery access later in the construction process, increase soil volumes available to the tree and promote new and additional fibrous root development.
5. Install surface mounted temporary, but battery automated, spray irrigation system around tree base. This is to provide water to the tree during the construction period, particularly for when hot and dry conditions are experienced and to maintain existing tree health.
6. Install 1.8m high chain wire semi-permanent fencing and gates around the tree at the line of the basement to limit access around the tree. This is to prevent accidental damage to tree roots and branches, to prevent storage of materials and equipment under and around the tree and to protect the temporary irrigation system from damage or tampering. Gates are to be secured and locked with key access available to only select personnel, client and consulting arborist.
7. Undertake basement excavations and general building construction
8. Monitor tree health and for pest and diseases and ensure soil moisture levels are being maintained. Provide periodic fertilisation surrounding the tree and report monthly to the client/ contract manager. This is to monitor and maintain the health and vigour of the tree and to promote additional and replacement roots. Ensure compliance with the relevant tree protection measures.

9. Only after the bulk of building work is completed, remove outer protection fencing and install temporary fencing closer to tree to facilitate construction of landscape works and structures within closer proximity to the tree. Provide temporary ground and branch protection as needed or directed by the project arborist. This shall protect the tree while allowing construction of works closer to the tree.
10. Mark and identify piling locations within the tree protection area. Undertake exploratory digging at identified locations to ensure major roots are not encountered. If major roots are encountered piling positions are to be reviewed and potentially relocated. This is to ensure piling support locations within the tree protection area are appropriately sited and avoid damage to major roots or branches.
11. Drill for subsurface piles and install reinforcing and concrete. Install capping beams, slab formwork and other structures, at or generally above ground level to minimise damage to roots or branches. Remove spoil and overburden from the tree area progressively. This will allow for the construction of supports but avoid contamination of surrounding soils with material excavated from much lower depths.
12. Install final irrigation and lighting services under and around decks. Maintain them within more recently placed surface layers of soil. This is to ensure installation of final services without damage to underlying roots.
13. Install final landscaping and remove all tree protection measures and fencing
14. Undertake final review of tree and undertake final 'clean' up pruning and clearance pruning from building and to facilitate clearances for pedestrians.

- End of report.

5.0 APPENDICES

5.1 References

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5.2 Tree Impact Assessment Schedule

Site 2A and 2B - Australia Avenue, Homebush - Tree Impact Assessment Schedule

Tree ID	No. Trees in Group	Tree Species	Common Name	Height (m)	Spread North (m)	Spread West (m)	Spread South (m)	Spread East (m)	Trunk Diameter Breast Height (dbh) (m)	Trunk Diameter at base (dgl) (m)	Nominal TPZ radius (m) 12xdbh (AS 4970)	Nominal SRZ radius (m) (AS 4970)	Age Class	Current Vigour	Current Form	Noted Defects	SULE Rating	Retention Value	General Comments and Notes	Incursion and Impact	Recommendation
1	1	*Ficus macrophylla*	**Moreton Bay Fig**	16.5	18.0	13.0	17.5	21.0	2.91	2.91	15.00	5.18	Mature	Excellent	Good	Root Impacts, Epicormic Growth, Decay-Minor, Branch Tearouts, Deadwood-Minor	Long (>40 years)	**High**	Massive buttressing roots in all directions. Large concrete retaining wall and road to north and western sides. Minor decay at old pruning wounds. Biggest issue with potentially transplanting is access and size of buttressing. Wiring for car park floodlighting going through canopy to south. Some deadwood and previous branch failures noted.	Primary focus of project has been around retaining and protecting tree while intergrating it within the urban form . Minor incursion of 2% to nominal TPZ due to basement construction. Pruning of canopy to eastern side to facilitate building. Minor lower canopy pruning to facilitate views, access and construction. Structures within Tree protection area to be suspended above roots and soil level. Isolated piling to be undertaken around base of tree using low height equipment.	Retain
2	1	*Lophostemon confertus*	**Brush Box**	7.5	2.0	2.0	2.0	2.0	0.17	0.22	2.04	1.75	Semi-mature	Good	Average	Lean-Minor	Long (>40 years)	**Moderate**		Within development footprint of facility for driveway and construction access.	Remove
3	1	*Lophostemon confertus*	**Brush Box**	7.5	2.0	2.0	2.0	2.0	0.17	0.23	2.04	1.79	Semi-mature	Good	Average		Long (>40 years)	**Moderate**		Within development footprint of facility for driveway and construction access.	Remove
4	1	*Lophostemon confertus*	**Brush Box**	5.0	1.5	1.5	1.5	1.5	0.11	0.16	2.00	1.53	Semi-mature	Fair	Average		Long (>40 years)	**Low**		Within development footprint of facility for driveway and construction access.	Remove
5	1	*Pyrus ussuriensis*	**Manchurian Pear**	6.0	4.0	2.5	3.0	2.0	0.23	0.26	2.76	1.88	Mature	Good	Good		Long (>40 years)	**Moderate**	Street tree.	Nil impact expected	Retain
6	1	*Pyrus ussuriensis*	**Manchurian Pear**	6.0	4.0	3.0	4.0	2.0	0.26	0.30	3.12	2.00	Mature	Good	Good	Asymmetric Canopy, Branch Tearouts	Long (>40 years)	**Moderate**	Street tree. A little overshadowed by Fig canopy to east. Branch tear out on street side at 2.4m	Nil impact expected	Retain
7	1	*Pyrus ussuriensis*	**Manchurian Pear**	7.0	2.5	3.0	3.0	4.5	0.28	0.33	3.36	2.08	Mature	Good	Good	Branch Tearouts, Epicormic Growth	Long (>40 years)	**Moderate**	Street tree. Branch tear out on street side at 3.0m. May need pruning at boundary for piling clearance.	5.6% incursion into nominal TPZ for piling. Minor canopy pruning to east for piling rig access.	Retain
8	1	*Pyrus ussuriensis*	**Manchurian Pear**	6.5	3.5	3.0	4.0	2.0	0.25	0.28	3.00	1.94	Mature	Good	Good	Branch Tearouts, Co-dominant Stems	Long (>40 years)	**Moderate**	Street tree. Partial inclusion at primary junction.	4.6% incursion into nominal TPZ for piling. Minor canopy pruning to east for piling rig access.	Retain
9	1	*Pyrus ussuriensis*	**Manchurian Pear**	6.5	4.0	2.5	2.0	4.0	0.27	0.30	3.24	2.00	Mature	Good	Good	Co-dominant Stems, Inclusions	Long (>40 years)	**Moderate**	Street tree. Slight overhang of boundary.	Within development footprint of new road.	Remove
10	1	*Pyrus ussuriensis*	**Manchurian Pear**	6.5	5.0	5.0	5.0	5.0	0.34	0.36	4.08	2.15	Mature	Good	Good	Branch Tearouts, Epicormic Growth, Inclusions	Long (>40 years)	**Moderate**	Street tree. Slight overhang of boundary. Minor inclusions in upper canopy.	Within development footprint of new road.	Remove
11	1	*Eucalyptus microcorys*	**Tallowood**	12.5	4.5	5.0	3.0	5.0	0.53	0.66	6.36	2.78	Mature	Good	Good	Epicormic Growth	Long (>40 years)	**Moderate**	Street tree. Slight overhang of boundary.	Minor surface impact to north-east for plaza pavement construction. Minimal root loss expected	Retain
12	1	*Eucalyptus microcorys*	**Tallowood**	11.5	3.5	3.5	3.5	3.5	0.36	0.45	4.32	2.37	Mature	Good	Good	Epicormic Growth	Long (>40 years)	**Moderate**	Street tree. Slight overhang of boundary. Conflict with street lighting.	Minor surface impact to north-east for plaza pavement construction. Minimal root loss expected	Retain
13	1	*Eucalyptus microcorys*	**Tallowood**	9.5	4.0	4.0	3.0	3.5	0.27	0.35	3.24	2.13	Mature	Good	Good	Deadwood-Minor	Long (>40 years)	**Moderate**	Street tree. Slight overhang of boundary.	Minor surface impact to north-east for plaza pavement construction. Minimal root loss expected	Retain
14	1	*Corymbia maculata*	**Spotted Gum**	13.0	4.0	3.0	3.0	4.0	0.35	0.44	4.20	2.34	Mature	Good	Good		Long (>40 years)	**Moderate**	Street tree.	1.3% incursion into nominal TPZ for building footings. Minor canopy pruning to northern side for scaffold and awning construction.	Retain
15	1	*Corymbia maculata*	**Spotted Gum**	3.0	0.5	0.5	0.5	0.5	0.05	0.05	2.00	0.94	Young	Good	Average		Replaceable (Small/Young)	**Low**	Street tree. Recently planted.	Nil impact expected	Retain
16	1	*Corymbia maculata*	**Spotted Gum**	15.5	4.0	4.0	4.0	3.5	0.33	0.43	3.96	2.32	Mature	Good	Good		Long (>40 years)	**Moderate**	Street tree.	Minor canopy pruning to northern side for scaffold and awning construction.	Retain
17	1	*Corymbia maculata*	**Spotted Gum**	13.0	4.0	2.5	4.0	3.5	0.30	0.38	3.60	2.20	Mature	Good	Good		Long (>40 years)	**Moderate**	Street tree.	Minor canopy pruning to northern side for scaffold and awning construction.	Retain
18	1	*Corymbia maculata*	**Spotted Gum**	13.5	4.5	3.5	4.5	3.0	0.35	0.44	4.20	2.34	Mature	Good	Good		Long (>40 years)	**Moderate**	Street tree. Near light pole.	1.5% incursion into nominal TPZ for building footings. Minor canopy pruning to northern side for scaffold and awning construction.	Retain
19	1	*Corymbia maculata*	**Spotted Gum**	14.0	5.0	3.0	5.0	3.5	0.40	0.52	4.80	2.51	Mature	Good	Good		Long (>40 years)	**Moderate**	Street tree. Near light pole.	6.1% incursion into nominal TPZ for building footings. Minor canopy pruning to northern side for scaffold and awning construction.	Retain
20	1	*Corymbia maculata*	**Spotted Gum**	14.0	3.0	2.5	3.5	4.0	0.30	0.37	3.60	2.18	Mature	Good	Good	Deadwood-Minor	Long (>40 years)	**Moderate**	Street tree.	4.6% incursion into nominal TPZ for building footings. Minor canopy pruning to northern side for scaffold and awning construction.	Retain
21	1	*Corymbia maculata*	**Spotted Gum**	16.0	4.5	4.0	4.0	5.0	0.40	0.45	4.80	2.37	Mature	Good	Good		Long (>40 years)	**Moderate**	Street tree. Witches broom to east at 4.5m which should be pruned off.	Within development footprint of new road.	Remove

Tree ID	No. Trees in Group	Tree Species	Common Name	Height (m)	Spread North (m)	Spread West (m)	Spread South (m)	Spread East (m)	Trunk Diameter Breast Height (dbh) (m)	Trunk Diameter at base (dgl) (m)	Nominal TPZ radius (m) 12xdbh (AS 4970)	Nominal SRZ radius (m) (AS 4970)	Age Class	Current Vigour	Current Form	Noted Defects	SULE Rating	Retention Value	General Comments and Notes	Incursion and Impact	Recommendation
22	1	*Acmena smithii*	**Lilly Pilly**	7.0	2.0	2.0	2.0	2.0	0.23	0.22	2.76	1.75	Semi-mature	Fair	Average	Congested Branches	Medium (15-40 years)	**Moderate**	Adjoining screen planting along boundary. Planted in 2.0m wide garden area.	Relatively small semi-mature tree very close to boundary in neighbouring site. Located within footprint of future proposed laneway. Tree is proposed to be retained in the short term despite significant impacts. 18.9% incusrion into nom. TPZ and some disturbance to western side of SRZ due to basement excavation.	Retain [short term]
23	1	*Eucalyptus microcorys*	**Tallowood**	8.5	3.0	3.0	3.0	3.0	0.23	0.26	2.76	1.88	Semi-mature	Good	Average		Medium (15-40 years)	**Moderate**	Adjoining screen planting along boundary. Planted in 2.0m wide garden area.	Relatively small semi-mature tree very close to boundary in neighbouring site. Located within footprint of future proposed laneway. Tree is proposed to be retained in the short term despite significant impacts. 19.2% incusrion into nom. TPZ and some disturbance to western side of SRZ due to basement excavation.	Retain [short term]
24	1	*Acmena smithii*	**Lilly Pilly**	7.0	2.0	2.0	2.0	2.0	0.16	0.17	2.00	1.57	Semi-mature	Poor	Poor	Epicormic Growth, Congested Branches	Medium (15-40 years)	**Low**	Adjoining screen planting along boundary. Planted in 2.0m wide garden area.	6.2% incusrion into nom. TPZ and some disturbance to western side of canopy due to basement excavation.	Retain [short term]
25	1	*Eucalyptus microcorys*	**Tallowood**	8.5	3.0	3.0	3.0	3.0	0.20	0.23	2.40	1.79	Semi-mature	Good	Average		Medium (15-40 years)	**Moderate**	Adjoining screen planting along boundary. Planted in 2.0m wide garden area.	Relatively small semi-mature tree very close to boundary in neighbouring site. Located within footprint of future proposed laneway. Tree is proposed to be retained in the short term despite significant impacts. 13.8% incursion into nom. TPZ and some disturbance to western side of SRZ due to basement excavation.	Retain [short term]
26	1	*Acmena smithii*	**Lilly Pilly**	7.0	2.0	2.0	2.0	2.0	0.14	0.18	2.00	1.61	Semi-mature	Fair	Average	Epicormic Growth, Branch Tearouts, Congested Branches	Medium (15-40 years)	**Low**	Adjoining screen planting along boundary. Planted in 2.0m wide garden area.	Relatively small semi-mature tree very close to boundary in neighbouring site. Located within footprint of future proposed laneway. Tree is proposed to be retained in the short term despite significant impacts. 10.3% incursion into nom. TPZ and some disturbance to western side of SRZ due to basement excavation.	Retain [short term]
27	1	*Eucalyptus microcorys*	**Tallowood**	7.0	3.0	3.0	3.0	3.0	0.22	0.25	2.64	1.85	Semi-mature	Fair	Average		Medium (15-40 years)	**Moderate**	Adjoining screen planting along boundary. Planted in 2.0m wide garden area.	Relatively small semi-mature tree very close to boundary in neighbouring site. Located within footprint of future proposed laneway. Tree is proposed to be retained in the short term despite significant impacts. 20.2% incursion into nom. TPZ and some disturbance to western side of SRZ due to basement excavation.	Retain [short term]
28	1	*Acmena smithii*	**Lilly Pilly**	7.5	2.0	2.0	2.0	2.0	0.29	0.30	3.48	2.00	Semi-mature	Fair	Average	Inclusions, Epicormic Growth, Congested Branches	Medium (15-40 years)	**Moderate**	Adjoining screen planting along boundary. Planted in 2.0m wide garden area.	Relatively small semi-mature tree very close to boundary in neighbouring site. Located within footprint of future proposed laneway. Tree is proposed to be retained in the short term despite significant impacts. 27.0% incursion into nom. TPZ and some disturbance to western side of SRZ due to basement excavation.	Retain [short term]
29	1	*Eucalyptus microcorys*	**Tallowood**	7.5	3.0	3.0	3.0	3.0	0.17	0.19	2.04	1.65	Semi-mature	Fair	Average		Medium (15-40 years)	**Moderate**	Adjoining screen planting along boundary. Planted in 2.0m wide garden area.	Relatively small semi-mature tree very close to boundary in neighbouring site. Located within footprint of future proposed laneway. Tree is proposed to be retained in the short term despite significant impacts. 10.9% incursion into nom. TPZ and some disturbance to western side of SRZ due to basement excavation.	Retain [short term]
30	1	*Acmena smithii*	**Lilly Pilly**	7.5	2.0	2.0	2.0	2.0	0.25	0.29	3.00	1.97	Semi-mature	Fair	Average		Medium (15-40 years)	**Moderate**	Adjoining screen planting along boundary. Planted in 2.0m wide garden area.	Relatively small semi-mature tree very close to boundary in neighbouring site. Located within footprint of future proposed laneway. Tree is proposed to be retained in the short term despite significant impacts. 17.3% incursion into nom. TPZ and some disturbance to western side of SRZ due to basement excavation.	Retain [short term]
31	1	*Eucalyptus microcorys*	**Tallowood**	8.0	3.0	3.0	3.0	3.0	0.25	0.31	3.00	2.02	Semi-mature	Fair	Average		Medium (15-40 years)	**Moderate**	Adjoining screen planting along boundary. Planted in 2.0m wide garden area.	Relatively small semi-mature tree very close to boundary in neighbouring site. Located within footprint of future proposed laneway. Tree is proposed to be retained in the short term despite significant impacts. 24.7% incursion into nom. TPZ and some disturbance to western side of SRZ due to basement excavation.	Retain [short term]
32	1	*Acmena smithii*	**Lilly Pilly**	7.0	2.0	2.0	2.0	2.0	0.20	0.23	2.40	1.79	Semi-mature	Fair	Poor	Inclusions	Medium (15-40 years)	**Moderate**	Adjoining screen planting along boundary. Planted in 2.0m wide garden area.	Relatively small semi-mature tree very close to boundary in neighbouring site. Located within footprint of future proposed laneway. Tree is proposed to be retained in the short term despite significant impacts. 19.3% incursion into nom. TPZ and some disturbance to western side of SRZ due to basement excavation.	Retain [short term]
33	1	*Acacia parramattensis*	**Parramatta Wattle**	12.0	3.0	3.0	3.0	6.0	0.34	0.44	4.08	2.34	Dead	Dead	Poor	Lean-Minor	Remove (<5 years)	**V Low / Remove**	Adjoining site. Lean away to the east. Tree dead.	Tree is currently dead and on neighbouring property - assumed to be removed by neighbour. Nom impact from development.	Remove
34	1	*Ficus macrophylla*	**Moreton Bay Fig**	9.0	8.0	9.0	7.5	11.0	1.09	1.09	13.08	3.43	Mature	Good	Good	Decay-Minor, Epicormic Growth, Inclusions	Long (>40 years)	**High**	Adjoining site. Roots and canopy extend into site. DBH taken at 800mm due to trunk and branching structure.	13.7% incursion into nominal TPZ for building footings, basement excavation. Given this tree is destined to be transplanted in the future and is a healthy Fig, this level of incursion is consdiered acceptable and will likely have minimal impact to tree. Very minor canopy pruning to western side for piling rig access with less than 1.5m length of outlying small branchlets.	Retain
35	1	*Eucalyptus paniculata?*	**Grey Ironbark**	7.0	2.0	2.0	2.0	2.0	0.13	0.18	2.00	1.61	Semi-mature	Fair	Good	Pest/Disease	Long (>40 years)	**Moderate**	Adjoining site. Recently planted. No fruit for positive ID.	Nil impact expected	Retain
36	1	*Eucalyptus paniculata?*	**Grey Ironbark**	7.5	2.0	2.0	2.0	2.0	0.19	0.20	2.28	1.68	Semi-mature	Fair	Poor	Pest/Disease, Inclusions	Long (>40 years)	**Moderate**	Adjoining site. Recently planted. No fruit for positive ID.	2.5% incursion into nominal TPZ for building footings. Minor canopy pruning to northern side for piling rig access.	Retain
37	1	*Lophostemon confertus*	**Brush Box**	14.0	6.0	4.5	3.5	5.0	0.52	0.62	6.24	2.71	Mature	Good	Average	Lean-Minor	Long (>40 years)	**High**	Street tree.	Minor surface impact to north-west for laneway pavement construction. Minimal root loss expected	Retain
38	9	*Acacia binervia x 9*	**Coast Myall**	5.5	3.0	3.0	3.0	3.0	0.16	0.18	2.00	1.61	Mature	Good	Average		Long (>40 years)	**Low**	Largest specimen recorded for typical dimensions. Other specimens are smaller than this. Planted together with Callistemons as screen planting within carpark.	Within building footprint.	Remove

5.3 Tree Summary Sheets

ID # **001**
Species: Ficus macrophylla
Common: Moreton Bay Fig

Tree Height: 16.50
DBH: 2.91 DGL: 2.91
TPZ: 15.00 SRZ: 5.18

Current Form: Good
Current Vigour: Excellent
Age Class: Mature
SULE: Long (>40 years)

Retention Value: **High**

ID # **002**
Species: Lophostemon confertus
Common: Brush Box

Tree Height: 7.5
DBH: 0.17 DGL: 0.22
TPZ: 2.04 SRZ: 1.75

Current Form: Average
Current Vigour: Good
Age Class: Semi-mature
SULE: Long (>40 years)

Retention Value: **Moderate**

ID # **003**
Species: Lophostemon confertus
Common: Brush Box

Tree Height: 7.5
DBH: 0.17 DGL: 0.23
TPZ: 2.04 SRZ: 1.79

Current Form: Average
Current Vigour: Good
Age Class: Semi-mature
SULE: Long (>40 years)

Retention Value: **Moderate**

ID # **004**
Species: Lophostemon confertus
Common: Brush Box

Tree Height: 5.0
DBH: 0.11 DGL: 0.16
TPZ: 2.00 SRZ: 1.53

Current Form: Average
Current Vigour: Fair
Age Class: Semi-mature
SULE: Long (>40 years)

Retention Value: **Low**

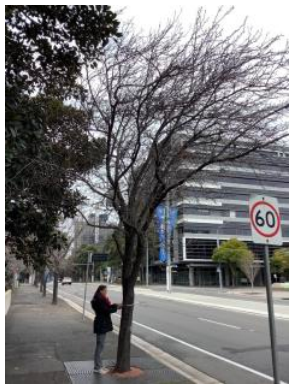
ID # **005**
Species: Pyrus ussuriensis
Common: Manchurian Pear

Tree Height: 6.0
DBH: 0.23 DGL: 0.26
TPZ: 2.76 SRZ: 1.88

Current Form: Good
Current Vigour: Good
Age Class: Mature
SULE: Long (>40 years)

Retention Value: **Moderate**

ID # **006**
Species: Pyrus ussuriensis
Common: Manchurian Pear

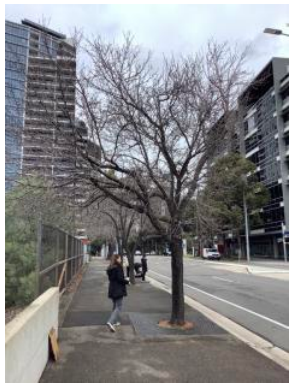


Tree Height: 6.0
DBH: 0.26 DGL: 0.30
TPZ: 3.12 SRZ: 2.00

Current Form: Good
Current Vigour: Good
Age Class: Mature
SULE: Long (>40 years)

Retention Value: **Moderate**

ID # **007**
Species: Pyrus ussuriensis
Common: Manchurian Pear



Tree Height: 7.0
DBH: 0.28 DGL: 0.33
TPZ: 3.36 SRZ: 2.08

Current Form: Good
Current Vigour: Good
Age Class: Mature
SULE: Long (>40 years)

Retention Value: **Moderate**

ID # **008**
Species: Pyrus ussuriensis
Common: Manchurian Pear

Tree Height: 6.5
DBH: 0.25 DGL: 0.28
TPZ: 3.00 SRZ: 1.94

Current Form: Good
Current Vigour: Good
Age Class: Mature
SULE: Long (>40 years)

Retention Value: **Moderate**

ID # **009**
Species: Pyrus ussuriensis
Common: Manchurian Pear

Tree Height: 6.5
DBH: 0.27 DGL: 0.30
TPZ: 3.24 SRZ: 2.00

Current Form: Good
Current Vigour: Good
Age Class: Mature
SULE: Long (>40 years)

Retention Value: **Moderate**

ID # **010**
Species: Pyrus ussuriensis
Common: Manchurian Pear

Tree Height: 6.5
DBH: 0.34 DGL: 0.36
TPZ: 4.08 SRZ: 2.15

Current Form: Good
Current Vigour: Good
Age Class: Mature
SULE: Long (>40 years)

Retention Value: **Moderate**

ID # **011**
Species: Eucalyptus microcorys
Common: Tallowood

Tree Height: 12.5
DBH: 0.53 DGL: 0.66
TPZ: 6.36 SRZ: 2.78

Current Form: Good
Current Vigour: Good
Age Class: Mature
SULE: Long (>40 years)

Retention Value: **Moderate**

ID # **012**
Species: Eucalyptus microcorys
Common: Tallowood

Tree Height: 11.5
DBH: 0.36 DGL: 0.45
TPZ: 4.32 SRZ: 2.37

Current Form: Good
Current Vigour: Good
Age Class: Mature
SULE: Long (>40 years)

Retention Value: **Moderate**

ID # **013**
Species: Eucalyptus microcorys
Common: Tallowood

Tree Height: 9.5
DBH: 0.27 DGL: 0.35
TPZ: 3.24 SRZ: 2.13

Current Form: Good
Current Vigour: Good
Age Class: Mature
SULE: Long (>40 years)

Retention Value: **Moderate**

ID # **014**
Species: Corymbia maculata
Common: Spotted Gum

Tree Height: 13.0
DBH: 0.35 DGL: 0.44
TPZ: 4.20 SRZ: 2.34

Current Form: Good
Current Vigour: Good
Age Class: Mature
SULE: Long (>40 years)

Retention Value: **Moderate**

ID # **015**
Species: Corymbia maculata
Common: Spotted Gum

Tree Height: 3.0
DBH: 0.05 DGL: 0.05
TPZ: 2.00 SRZ: 1.50

Current Form: Average
Current Vigour: Good
Age Class: Young
SULE: Replaceable

Retention Value: **Low**

ID # **016**
Species: Corymbia maculata
Common: Spotted Gum

Tree Height: 15.5
DBH: 0.33 DGL: 0.43
TPZ: 3.96 SRZ: 2.32

Current Form: Good
Current Vigour: Good
Age Class: Mature
SULE: Long (>40 years)

Retention Value: **Moderate**

ID # **017**
Species: Corymbia maculata
Common: Spotted Gum

Tree Height: 13.0
DBH: 0.30 DGL: 0.38
TPZ: 3.60 SRZ: 2.20

Current Form: Good
Current Vigour: Good
Age Class: Mature
SULE: Long (>40 years)

Retention Value: **Moderate**

ID # **018**
Species: Corymbia maculata
Common: Spotted Gum

Tree Height: 13.5
DBH: 0.35 DGL: 0.44
TPZ: 4.20 SRZ: 2.34

Current Form: Good
Current Vigour: Good
Age Class: Mature
SULE: Long (>40 years)

Retention Value: **Moderate**

ID # **019**
Species: Corymbia maculata
Common: Spotted Gum

Tree Height: 14.0
DBH: 0.40 DGL: 0.52
TPZ: 4.80 SRZ: 2.51

Current Form: Good
Current Vigour: Good
Age Class: Mature
SULE: Long (>40 years)

Retention Value: **Moderate**

ID # **020**
Species: Corymbia maculata
Common: Spotted Gum

Tree Height: 14.0
DBH: **0.30** DGL: **0.37**
TPZ: 3.60 SRZ: 2.18

Current Form: Good
Current Vigour: Good
Age Class: Mature
SULE: Long (>40 years)

Retention Value: **Moderate**

ID # **021**
Species: Corymbia maculata
Common: Spotted Gum

Tree Height: 16.0
DBH: 0.40 DGL: 0.45
TPZ: 4.80 SRZ: 2.37

Current Form: Good
Current Vigour: Good
Age Class: Mature
SULE: Long (>40 years)

Retention Value: **Moderate**

ID # **022**
Species: Acmena smithii
Common: Lilly Pilly

Tree Height: 7.0
DBH: 0.23 DGL: 0.22
TPZ: 2.76 SRZ: 1.75

Current Form: Average
Current Vigour: Fair
Age Class: Semi-mature
SULE: Medium (15-40 years)

Retention Value: **Moderate**

ID # **023**
Species: Eucalyptus microcorys
Common: Tallowood

Tree Height: 8.5
DBH: 0.23 DGL: 0.26
TPZ: 2.76 SRZ: 1.88

Current Form: Average
Current Vigour: Good
Age Class: Semi-mature
SULE: Medium (15-40 years)

Retention Value: **Moderate**

ID # **024**
Species: Acmena smithii
Common: Lilly Pilly

Tree Height: 7.0
DBH: 0.16 DGL: 0.17
TPZ: 2.00 SRZ: 1.57

Current Form: Poor
Current Vigour: Poor
Age Class: Semi-mature
SULE: Medium (15-40 years)

Retention Value: **Low**

ID # **025**
Species: Eucalyptus microcorys
Common: Tallowood

Tree Height: 8.5
DBH: 0.20 DGL: 0.23
TPZ: 2.40 SRZ: 1.79

Current Form: Average
Current Vigour: Good
Age Class: Semi-mature
SULE: Medium (15-40 years)

Retention Value: **Moderate**

ID # **026**
Species: Acmena smithii
Common: Lilly Pilly

Tree Height: 7.0
DBH: 0.14 DGL: 0.18
TPZ: 2.00 SRZ: 1.61

Current Form: Average
Current Vigour: Fair
Age Class: Semi-mature
SULE: Medium (15-40 years)

Retention Value: **Low**

ID # **027**
Species: Eucalyptus microcorys
Common: Tallowood

Tree Height: 7.0
DBH: 0.22 DGL: 0.25
TPZ: 2.64 SRZ: 1.85

Current Form: Average
Current Vigour: Fair
Age Class: Semi-mature
SULE: Medium (15-40 years)

Retention Value: **Moderate**

ID # **028**
Species: Acmena smithii
Common: Lilly Pilly

Tree Height: 7.5
DBH: 0.29 DGL: 0.30
TPZ: 3.48 SRZ: 2.00

Current Form: Average
Current Vigour: Fair
Age Class: Semi-mature
SULE: Medium (15-40 years)

Retention Value: **Moderate**

ID # **029**
Species: Eucalyptus microcorys
Common: Tallowood

Tree Height: 7.5
DBH: 0.17 DGL: 0.19
TPZ: 2.04 SRZ: 1.65

Current Form: Average
Current Vigour: Fair
Age Class: Semi-mature
SULE: Medium (15-40 years)

Retention Value: **Moderate**

ID # **030**
Species: Acmena smithii
Common: Lilly Pilly

Tree Height: 7.5
DBH: 0.25 DGL: 0.29
TPZ: 3.00 SRZ: 1.97

Current Form: Average
Current Vigour: Fair
Age Class: Semi-mature
SULE: Medium (15-40 years)

Retention Value: **Moderate**

ID # **031**
Species: Eucalyptus microcorys
Common: Tallowood

Tree Height: 8.0
DBH: 0.25 DGL: 0.31
TPZ: 3.00 SRZ: 2.02

Current Form: Average
Current Vigour: Fair
Age Class: Semi-mature
SULE: Medium (15-40 years)

Retention Value: **Moderate**

ID # **032**
Species: Acmena smithii
Common: Lilly Pilly

Tree Height: 7.0
DBH: 0.20 DGL: 0.23
TPZ: 2.40 SRZ: 1.79

Current Form: Poor
Current Vigour: Fair
Age Class: Semi-mature
SULE: Medium (15-40 years)

Retention Value: **Moderate**

ID # **033**
Species: Acacia parramattensis
Common: Parramatta Wattle

Tree Height: 12.0
DBH: 0.34 DGL: 0.44
TPZ: 4.08 SRZ: 2.34

Current Form: Poor
Current Vigour: Dead
Age Class: Dead
SULE: Remove (<5 years)

Retention Value: V Low / Remove

ID # **034**
Species: Ficus macrophylla
Common: Moreton Bay Fig

Tree Height: 9.0
DBH: 1.09 DGL: 1.09
TPZ: 13.08 SRZ: 3.43

Current Form: Good
Current Vigour: Good
Age Class: Mature
SULE: Long (>40 years)

Retention Value: High

ID # **035**
Species: Eucalyptus paniculata?
Common: Grey Ironbark

Tree Height: 7.0
DBH: 0.13 DGL: 0.18
TPZ: 2.00 SRZ: 1.61

Current Form: Good
Current Vigour: Fair
Age Class: Semi-mature
SULE: Long (>40 years)

Retention Value: Moderate

ID # **036**
Species: Eucalyptus paniculata?
Common: Grey Ironbark

Tree Height: 7.5
DBH: 0.19 DGL: 0.20
TPZ: 2.28 SRZ: 1.68

Current Form: Poor
Current Vigour: Fair
Age Class: Semi-mature
SULE: Long (>40 years)

Retention Value: Moderate

ID # **037**
Species: Lophostemon confertus
Common: Brush Box

Tree Height: 14.0
DBH: 0.52 DGL: 0.62
TPZ: 6.24 SRZ: 2.71

Current Form: Average
Current Vigour: Good
Age Class: Mature
SULE: Long (>40 years)

Retention Value: High

ID # **038**
Species: Acacia binervia x 9
Common: Coast Myall

Tree Height: 5.5
DBH: 0.16 DGL: 0.18
TPZ: 2.00 SRZ: 1.61

Current Form: Average
Current Vigour: Good
Age Class: Mature
SULE: Long (>40 years)

Retention Value: Low

5.4 Tree Retention Value Plan – Whole of Site

TREE RETENTION VALUE NOTES

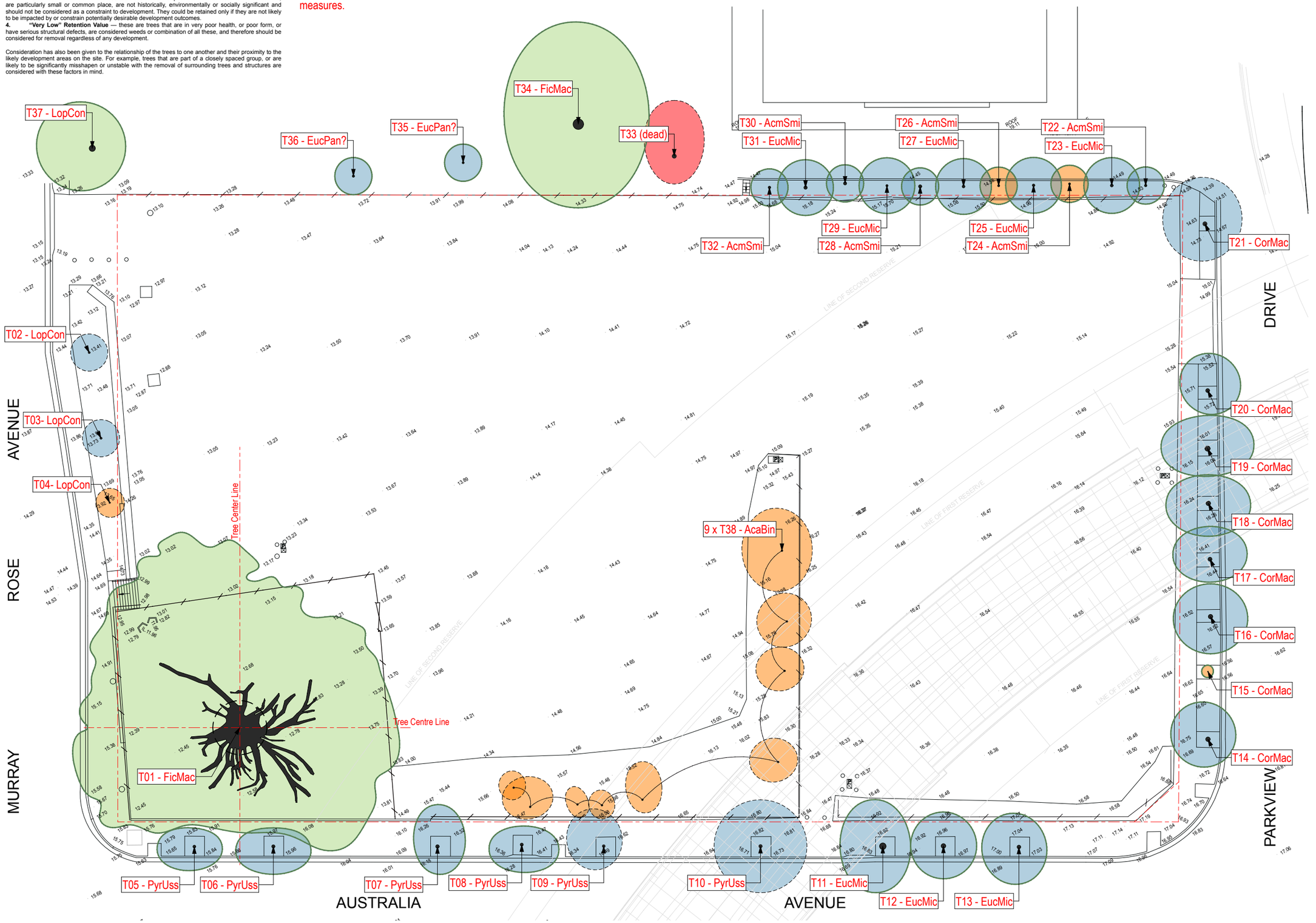
The proposed retention value of the trees was determined based on a considered combination of the size, age, condition and suitability of the tree. Each tree was then ranked according to one of 4 retention categories;

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 should represent a serious physical constraint to development and their removal avoided where possible and feasible.
2. **"Moderate" Retention Value** — these are trees that are in good to reasonable condition, with no major structural defects and could be retained where possible and feasible to do so.
3. **"Low" Retention Value** — these are trees that are of poor condition or have structural defects, are particularly small or common place, are not historically, environmentally or socially significant and should not be considered as a constraint to development. They could be retained only if they are not likely to be impacted by or constrain potentially desirable development outcomes.
4. **"Very Low" Retention Value** — these are trees that are in very poor health, or 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 another 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.

NOTE

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



0 4 10 20m

ARTERRA DESIGN PTY LTD ABN 40 069 552 610
SUITE 602 / 51 RAWSON STREET, EPPING, NSW 2121
P 02 9957 2466 **F** 02 9957 3977 **W** ARTERRA.COM.AU

Tree Retention Value Legend

- High Retention value
- Moderate Retention value
- Low Retention value (Note: no TPZ's shown for these trees)
- Very Low Retention value (should remove) (Note : no TPZ's shown for these trees)
- Extent of canopy as verified by site measure and aerial photos
- T26 — Tree Identification Number

REVISION	DESCRIPTION	CHKD	DATE
A	For Development Application	RWS	15/08/19

PROJECT & CLIENT

Australia Avenue, Sydney Olympic Park - Site 2A & 2B

Ecove / Foresight Management

DRAWING TITLE

Tree Retention Value

Project No	:	18.00
Designed	:	RWS
Drawn	:	CLB
Scale	:	1:200@A1; 1:400@A3

DRAWING NUMBER T-01 REVISION A

Plotted at : 3:58 pm 15/8/19

5.5 Tree Protection & Removal Plan – Whole of Site

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

Surface impacts to be managed. Construction of driveway is assumed to be close to the existing levels with minimal cut expected (nom. 150mm). No root loss expected.

T37 - LopCon
T36 - EucPan?
T35 - EucPan?
T34 - FicMac
T33 (dead)
T30 - AcmSmi
T31 - EucMic
T26 - AcmSmi
T27 - EucMic
T22 - AcmSmi
T23 - EucMic
T29 - EucMic
T28 - AcmSmi
T25 - EucMic
T24 - AcmSmi
T32 - AcmSmi
T21 - CorMac
T20 - CorMac
T19 - CorMac
T18 - CorMac
T17 - CorMac
T16 - CorMac
T15 - CorMac
T14 - CorMac
T02 - LopCon
T03- LopCon
T04- LopCon
T01 - FicMac
T05 - PyrUss
T06 - PyrUss
T07 - PyrUss
T08 - PyrUss
T09 - PyrUss
T10 - PyrUss
T11 - EucMic
T12 - EucMic
T13 - EucMic
9 x T38 - AcaBin

AVENUE
ROSE
MURRAY
AUSTRALIA
AVENUE
DRIVE
PARKVIEW

Refer to Architectural documentation for proposed building.

Refer to Architectural documentation for proposed building.

TREES SHOWN TO BE REMOVED ARE REQUIRED TO BE REMOVED FOR BUILDING/GRADING AND SERVICES CONNECTION

Refer to drawings T-03 to T-07 for further details

Tree Centre Line

Tree Centre Line

Minor selective canopy pruning to be undertaken for trees along Park View Drive for building and awning clearance.

Selective canopy pruning to the east of T07 to allow for piling rig access and clearances.

Minor filling of ground surface to the east of trees T11, T12 and T13. No root loss expected and minor surface impacts to be managed.

0 4 10 20m

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

Tree Impact and Protection Plan Legend

- Existing Tree Retained — Extent of canopy as verified by site measure and aerial photos
- Existing Tree Removed (Note: no TPZ's shown for these trees)
- T26 — Tree Identification Number
- Construction Period Tree Protection Zone - consolidated area
- Tree Protection Zone temporary fencing
- Trunk Protection Battens to be installed
- Expected loss of roots due to excavation or trenching
- Surface impact to be managed - minimal root loss expected
- Nominal Tree Protection Zone Radius (TPZ)
- Nominal Structural Root Zone (SRZ) shown where relevant

REVISION	DESCRIPTION	CHKD	DATE
A	For Development Application	RWS	15/08/19

PROJECT & CLIENT
Australia Avenue, Sydney Olympic Park - Site 2A & 2B

Ecove / Foresight Management

DRAWING TITLE
Tree Protection & Removal Plan

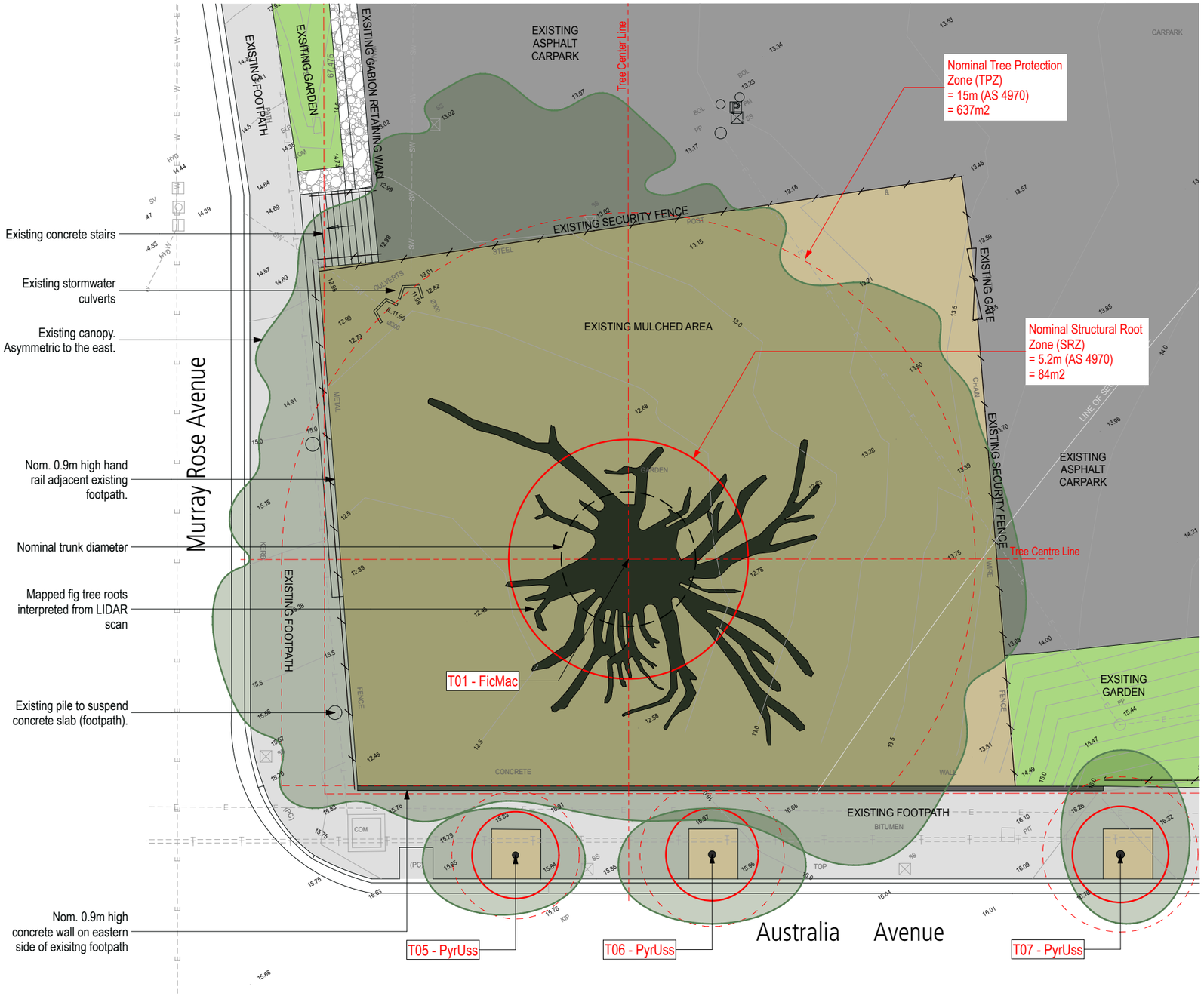
Project No : 18.00
Designed : RWS
Drawn : CLB
Scale : 1:200@A1; 1:400@A3

DRAWING NUMBER T-02
REVISION A

Plotted at : 3:58 pm 15/8/19

5.6 *Ficus macrophylla* –Existing Conditions Plan

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



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Tree Existing - Legend

- Existing Moreton Bay Fig Tree (Extent of canopy as verified by site measure, aerial photos & LIDAR)
- T26 — Tree Identification Number
- Nominal Tree Protection Zone Radius (TPZ)
- Nominal Structural Root Zone (SRZ)
- Existing Asphalt Carpark
- Existing Garden Bed
- Existing Mulch Area
- Existing Footpath
- Existing Gabion Retaining Wall

0 2 4 10m

REVISION	DESCRIPTION	CHKD	DATE
A	For Development Application	RWS	15/08/19

PROJECT & CLIENT
Australia Avenue, Sydney Olympic Park - Site 2A & 2B
Ecove / Foresight Management

DRAWING TITLE
Ficus macrophylla - Existing Conditions

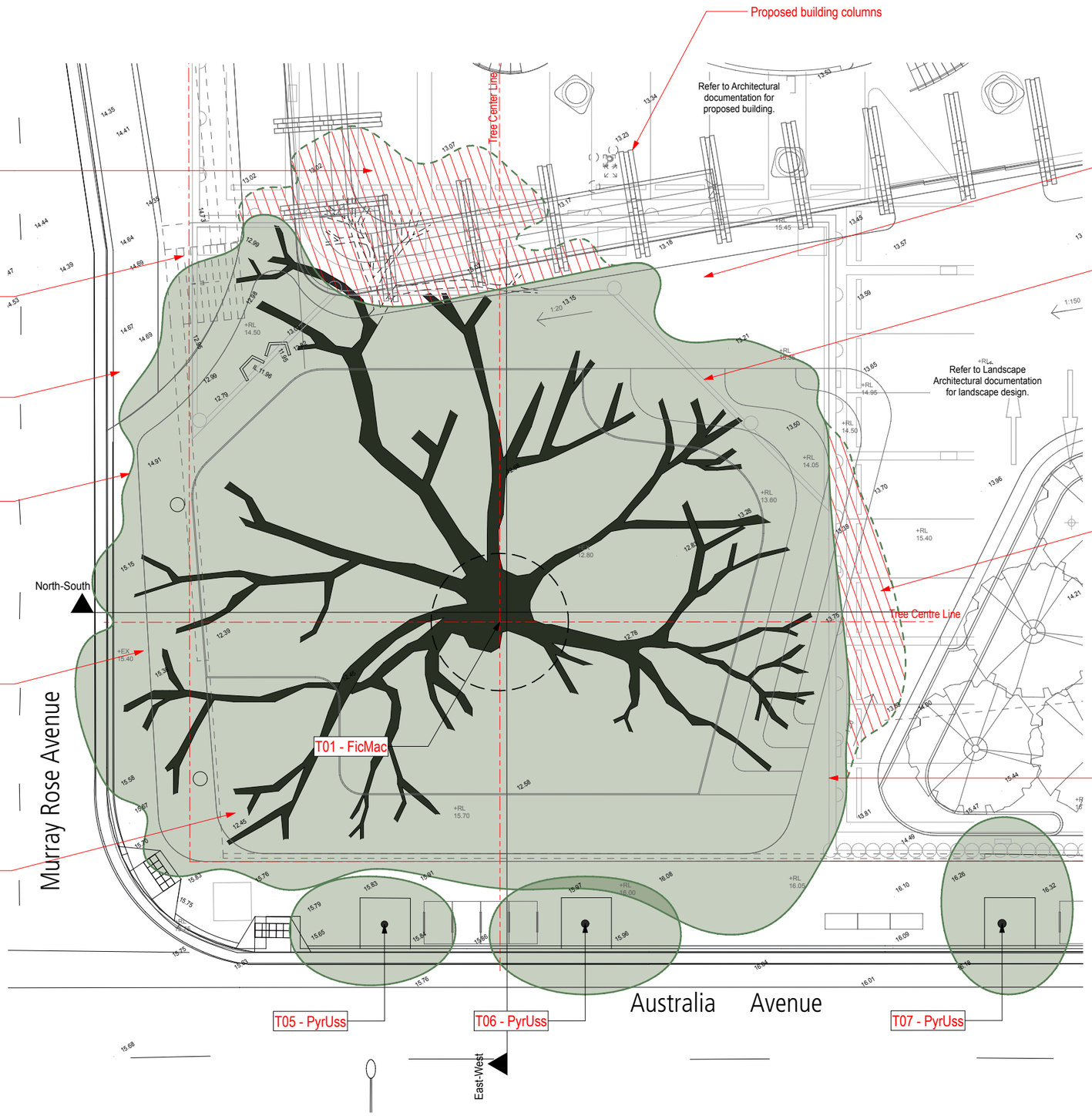
Project No	:	18.00
Designed	:	RWS
Drawn	:	CLB
Scale	:	1:100@A1/1:200@A3

DRAWING NUMBER T-03
REVISION A

Plotted at : 3:58 pm 15/8/19

5.7 *Ficus macrophylla* – Canopy Impact Plan

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



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Tree Canopy Impact - Legend

- Existing Moreton Bay Fig Tree — Extent of canopy and branches as verified by site measure, aerial photos & LIDAR
- T26 — Tree Identification Number
- Extent of canopy proposed to be pruned for building and access clearances
- Nominal trunk

REVISION	DESCRIPTION	CHKD	DATE
A	For Development Application	RWS	15/08/19

PROJECT & CLIENT
Australia Avenue, Sydney Olympic Park - Site 2A & 2B
Ecove / Foresight Management

DRAWING TITLE
Ficus macrophylla - Canopy Impact Plan

Project No	:	18.00
Designed	:	RWS
Drawn	:	CLB
Scale	:	1:100@A1/1:200@A3

0 2 4 10m

DRAWING NUMBER T-04
REVISION A

Plotted at : 3:59 pm 15/8/19

5.8 *Ficus macrophylla* – Root Impact Plan

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

Assumed that building columns will be piled, connected by a capping beam above the existing ground surface. No root loss expected.

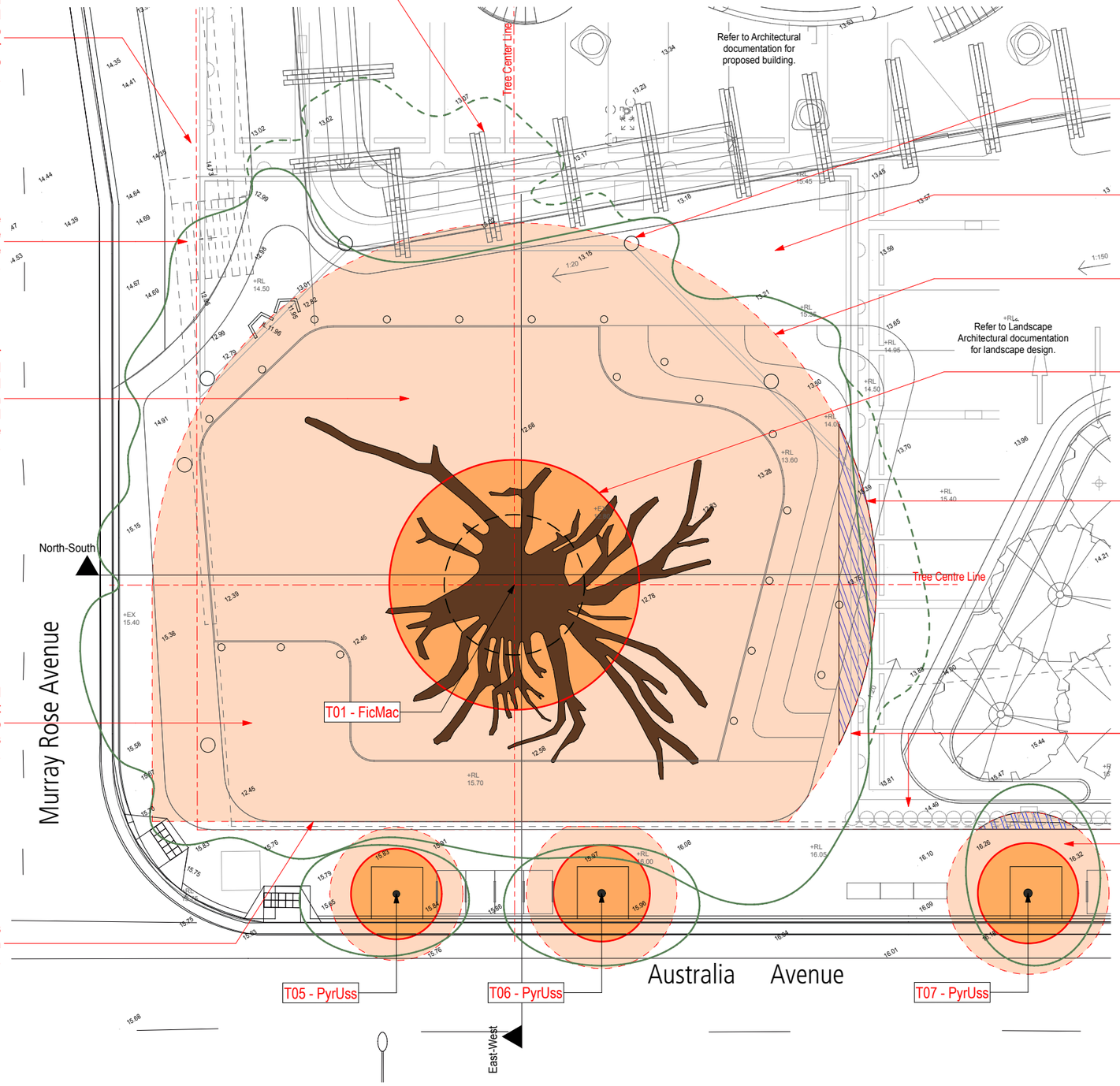
Entry pathway and driveway to proposed building, assumed to be suspended over existing levels. No root loss expected.

Stairs to be demolished. Surface impacts to be managed.

Indicative location of piles for suspended OSD tank and suspended concrete slabs and light weight decks. Final location of piles are to be determined during detailed design and on site (guided by the Project Arborist).

Viewing platform to be suspended over tree protection zone. No root loss expected. Recommended to be cantilevered to avoid impacts to roots below.

Assumed no roots beyond retaining wall on western side of tree.



Extent of OSD tank. Tank is to be suspended above the existing groundline using piles. Refer to Civil Engineers documentation.

Proposed concrete stairs to be suspended using piling construction techniques. Location of piles are indicatively shown. Final location of piles will be determined on site after exploratory root investigation is undertaken.

Nominal Tree Protection Zone (TPZ)
= 15m (AS 4970)
= 637m2

Nominal Structural Root Zone (SRZ)
= 5.2m (AS 4970)
= 84m2

Nominal incursion into TPZ for basement piling. Approx. 2% of total TPZ area.

Proposed extent of piled wall for basement carpark.

For street trees, refer to T-02 Tree Protection and Removal Plan

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Tree Root Impact - Legend

- Existing Moreton Bay Fig Tree — Extent of canopy and roots as verified by site measure, aerial photos & LIDAR
- Extent of canopy proposed to be pruned for building and access clearances
- T26 — Tree Identification Number
- Expected loss of roots due to excavation or trenching
- Nominal Tree Protection Zone Radius (TPZ)
- Nominal Structural Root Zone (SRZ) shown where relevant
- Nominal trunk

REVISION	DESCRIPTION	CHKD	DATE
A	For Development Application	RWS	15/08/19

PROJECT & CLIENT
Australia Avenue, Sydney Olympic Park - Site 2A & 2B

Ecove / Foresight Management

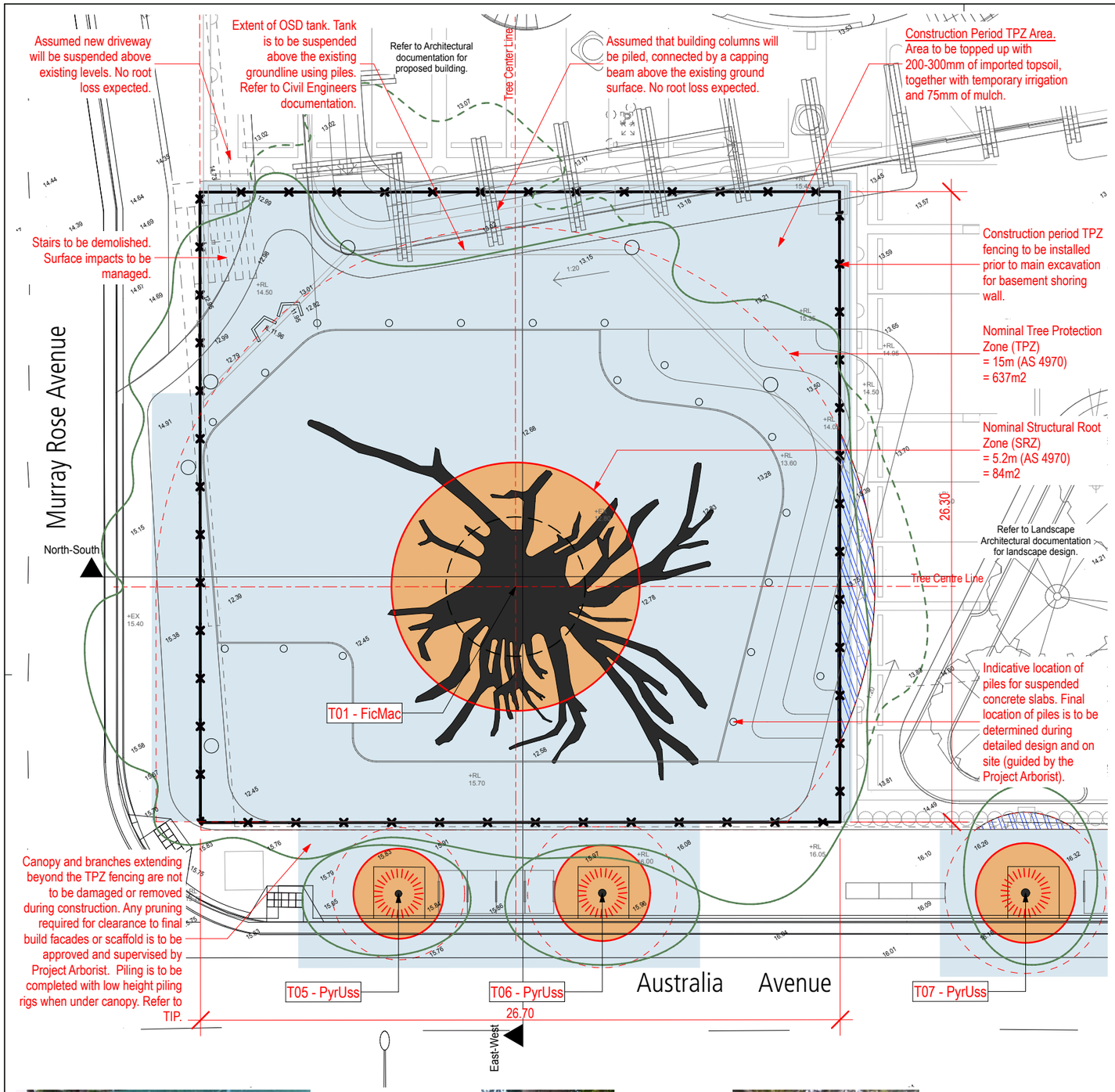
DRAWING TITLE
Ficus macrophylla - Root Impact Plan

Project No	:	18.00
Designed	:	RWS
Drawn	:	CLB
Scale	:	1:100@A1/1:200@A3

DRAWING NUMBER: T-05
REVISION: A

Plotted at : 3:59 pm 15/8/19

5.9 *Ficus macrophylla* – Tree Protection Plan



Example image of acceptable ground protection rumble boards

Example image of acceptable tree tree protection battens

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

TREE PROTECTION SPECIFICATIONS

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

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

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

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

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

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

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

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

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

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

4. Trunk and Lower Branch Protection
A trunk barrier is to be erected around the circumference of the tree trunk and root buttress where shown. This barrier will consist of a double layer of used carpet or carpet underfelt placed around the trunk. A layer of battens is to be placed over the underfelt. The battens are to have a maximum spacing of 50mm. The height of the battens is to be 2 metres or to the height of the first branches. Lower large branches may require the same protection if likely to be damaged by passing vehicles or equipment. Secure in place with galvanised steel bracing straps. Do not nail into or otherwise injury the trunk or bark. Battens may be made from any suitable waste timber of similar sizes and depths. All sharp or protruding edges are to be properly covered with tape or similar padding. At the discretion of the Project Arborist, the lower branches of T01 (*Ficus macrophylla)* may need to have branch projection applied to them before works are undertaken.

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

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

7. Provision of Temporary Irrigation
A temporary and automated (battery powered timer is sufficient) watering system to be placed within the TPZs of all trees to maintain adequate water to the retained trees and help maintain their healthy condition. This shall be a surface mounted 'residential-style' soaker hose and/or similar surface sprinkler systems. It is to be surface visible and spray delivered so that is operation can be easily visible and verified. It should be on a designated supply line, separate from other construction related water supplies to minimise its likelihood of being disconnected.

Typically, during spring and summer months it should be set to run for a minimum of 30 minutes every day, in the early morning. During, autumn and winter months it should be set to run for 1 hour once every week. The operation can be suspended temporarily in periods of extensive and prolonged rain.

The system is to remain in place for the duration of construction, or until the project consulting arborist approves it's removal. It may be removed to allow final landscape treatments to proceed. If accidentally disturbed or damaged by construction activities, it is to be reinstated as soon as practicable.

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

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

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

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

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

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

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

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

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

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

Roots are not to be cut using normal excavation machinery of any sort. This usually results in splitting and massive disturbance well past the intended line of cut. When required to cut roots, use hand methods and sharp hand tools (e.g. secateurs, hand saw) such that the remaining root systems are preserved intact and undamaged. Roots are to be cut back by hand square to the direction of the root travel (or edge of the excavation). Do not cut any tree roots exceeding 40mm diameter unless permitted. Excavations within root zones should be kept open for as short a period as possible. Any excavated face containing roots is to be temporarily supported, where necessary, to prevent soil loss from around the other retained roots.

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

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

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

0 2 4 10m

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Tree Impact and Plan Legend

- Existing Tree Retained — Extent of canopy as verified by site measure and aerial photos
- Existing Tree Removed (Note: no TPZ's shown for these trees)
- T26 — Tree Identification Number
- Construction Period Tree Protection Zone - consolidated area
- Tree Protection Zone temporary fencing
- Trunk Protection Battens to be installed
- Expected loss of roots due to excavation or trenching
- Surface impact to be managed - minimal root loss expected
- Nominal Tree Protection Zone Radius (TPZ)
- Nominal Structural Root Zone (SRZ) shown where relevant

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

REVISION	DESCRIPTION	CHKD	DATE
A	For Development Application	RWS	15/08/19

PROJECT & CLIENT
Australia Avenue, Sydney Olympic Park - Site 2A & 2B

Ecove / Foresight Management

DRAWING TITLE
Ficus macrophylla - Tree Protection Plan

Project No	:	18.00
Designed	:	RWS
Drawn	:	CLB
Scale	:	1:100@A1/1:200@A3

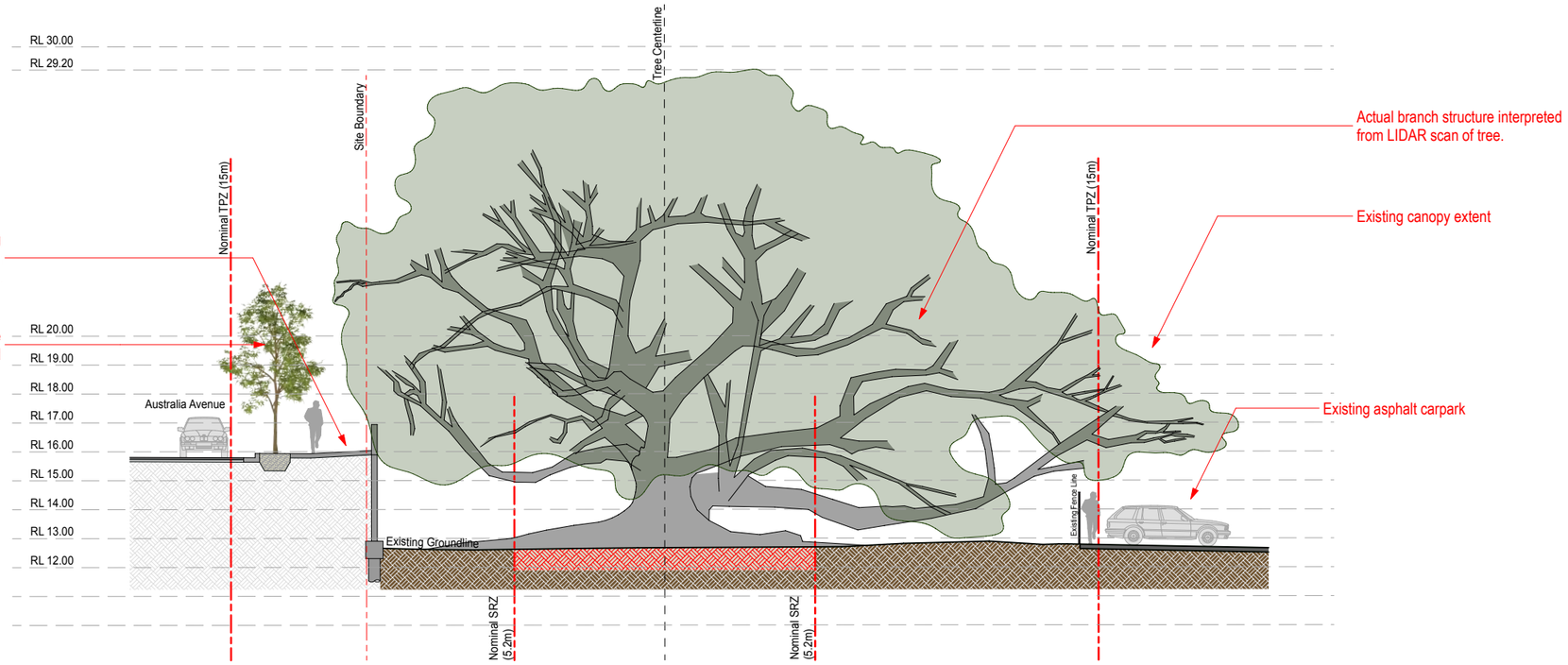
DRAWING NUMBER T-06 REVISION A

Plotted at : 3:59 pm 15/8/19

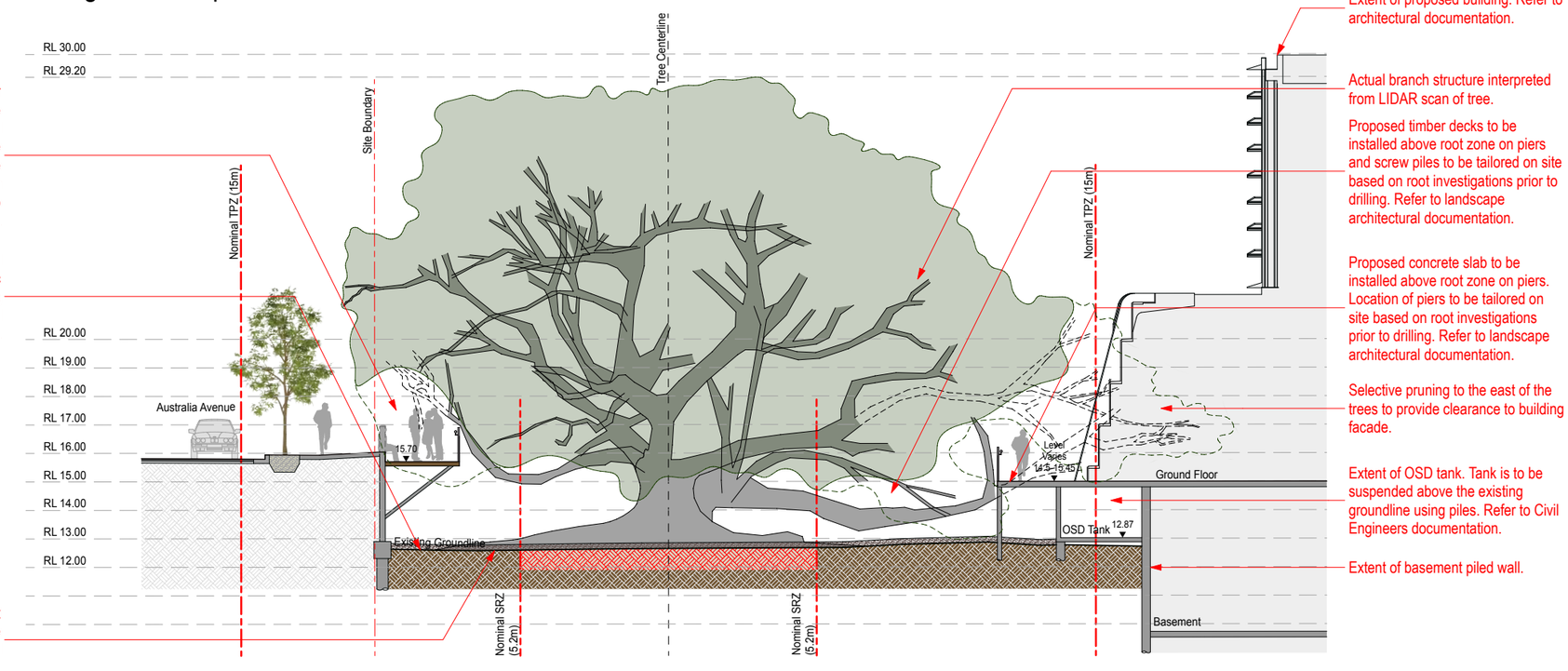
5.10 *Ficus macrophylla* – Section East-West

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

SECTION A - East - West
Through Tree Existing Condition



SECTION A - East - West
Through Tree Proposed



0 2 4 10m

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REVISION	DESCRIPTION	CHKD	DATE
A	For Development Application	RWS	15/08/19

PROJECT & CLIENT
Australia Avenue, Sydney Olympic Park - Site 2A & 2B

Ecove / Foresight Management

DRAWING TITLE
Ficus macrophylla - Section- East-West

Project No : 18.00
Designed : RWS
Drawn : CLB
Scale : 1:100@A1/1:200@A3

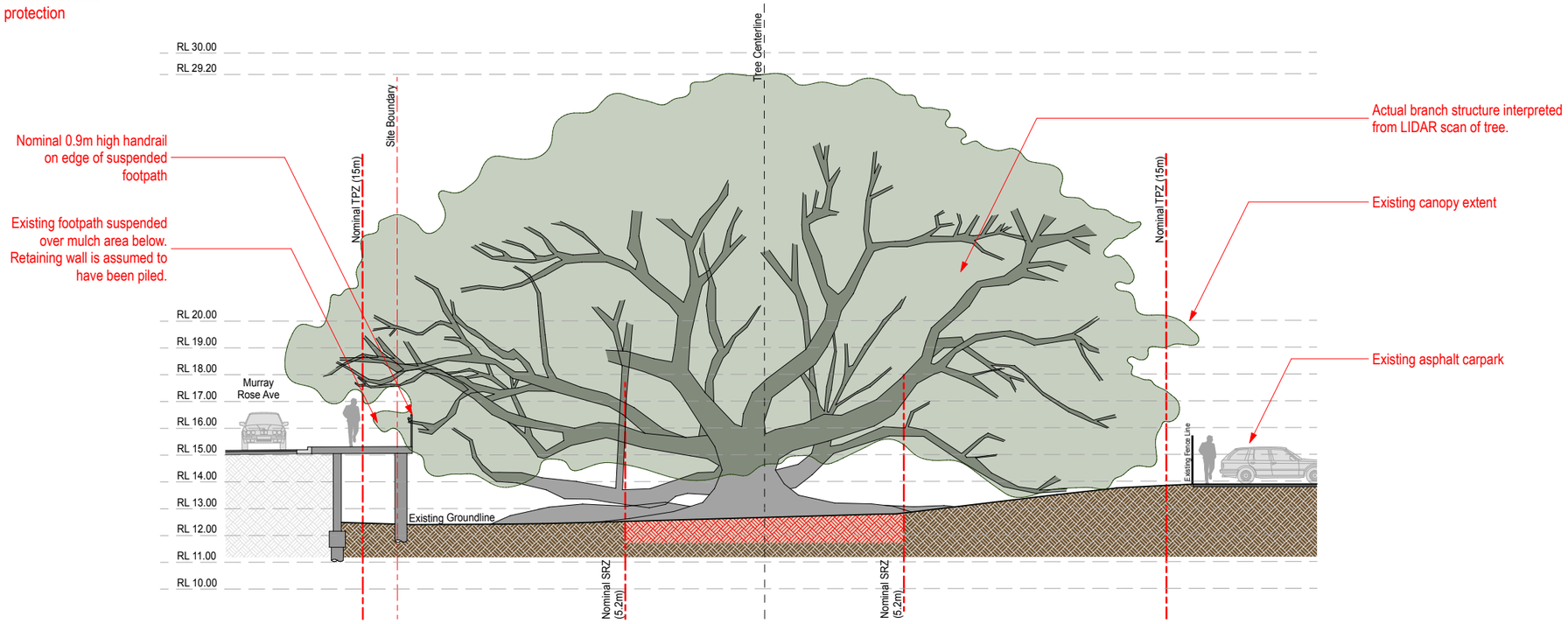
DRAWING NUMBER T-07
REVISION A

Plotted at : 3:59 pm 15/8/19

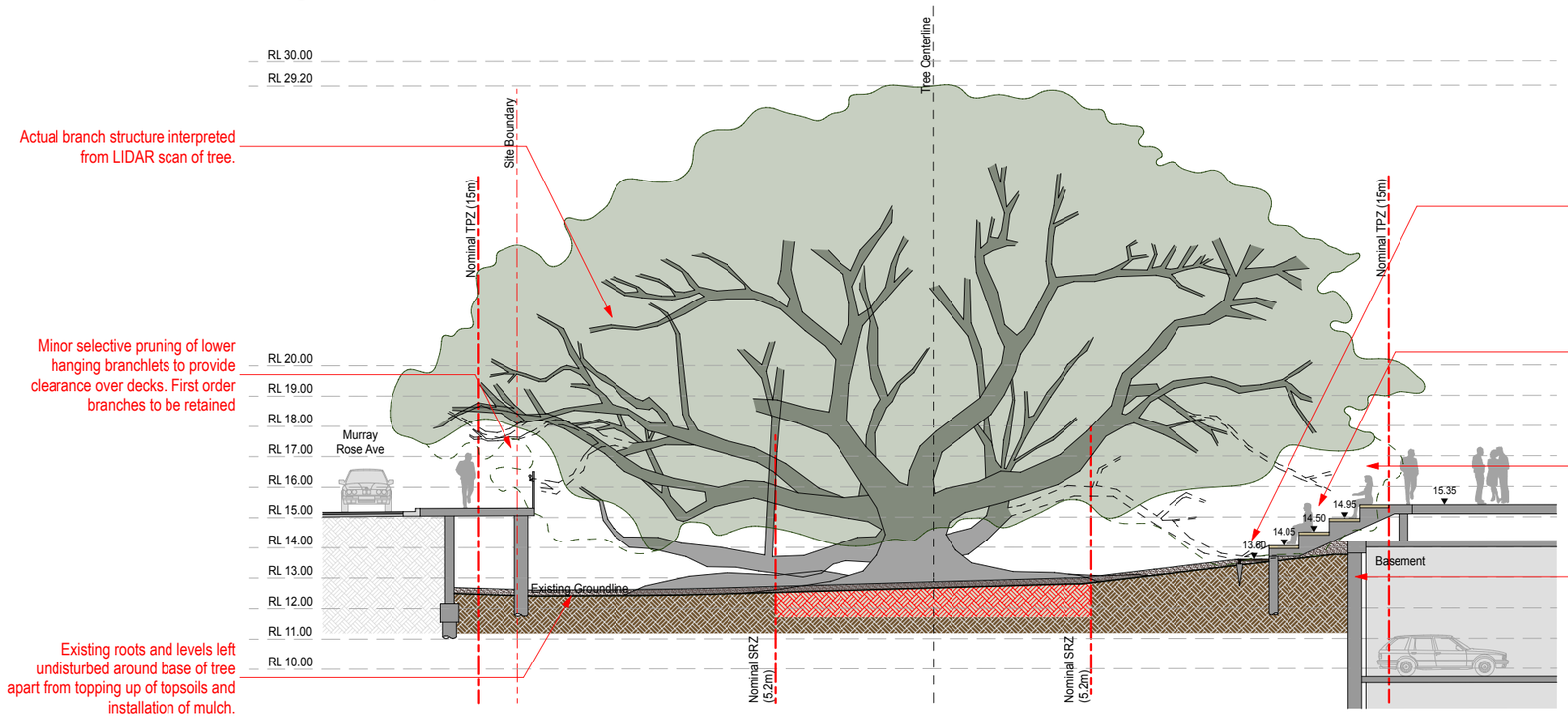
5.11 *Ficus macrophylla* – Section North-South

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

SECTION B - North - South
Through Tree Existing Condition



SECTION B - North - South
Through Tree Proposed



0 2 4 10m

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REVISION	DESCRIPTION	CHKD	DATE
A	For Development Application	RWS	15/08/19

PROJECT & CLIENT
Australia Avenue, Sydney Olympic Park - Site 2A & 2B

Ecove / Foresight Management

DRAWING TITLE
Ficus macrophylla - Section-North-South

Project No : 18.00
Designed : RWS
Drawn : CLB
Scale : 1:100@A1/1:200@A3

DRAWING NUMBER T-08
REVISION A

Plotted at : 4:00 pm 15/8/19