

# Arboricultural Impact Assessment Report

**AIA-01**

Revision C  
5 March, 2025



PROJECT

## **BaptistCare Macquarie Park - Concept Master Plan State Significant Development Application (SSDA)**

157 Balaclava Road, Macquarie Park, NSW, 2113

CLIENT / PRINCIPAL

**BaptistCare**



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### Acknowledgements & Qualifications

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

Robert Smart is a member of the International Society of Arboriculture (ISA), an accredited member of the Institute of Australian Consulting Arboriculturists (IACA), a Registered Consulting Arborist with Arboriculture Australia (AA) and a licenced Quantified Tree Risk Assessment (QTRA) practitioner. Robert Smart has over 25 years experience in assessing and managing trees in complex development sites. Robert is also a Registered Landscape Architect with over 30 years experience.



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## i EXECUTIVE SUMMARY

Arterra was engaged by BaptistCare (the client) to undertake an arboricultural assessment of the BaptistCare campus at 157 Balaclava Road, Macquarie Park (the site) and prepare the relevant tree reports and plans to help guide the site-wide Master Planning process. This assessment included the trees within, and immediately adjacent to the site, that were likely to be impacted by the proposed works. Other trees well beyond the extent of the proposed works, and unlikely to be impacted, are not addressed as part of this report.

This report is an amendment to the State Significant Development Application (**SSD-46561712**) that was submitted to the Department of Planning, Housing and Infrastructure (consent authority) for the **Conceptual Master Plan** that will guide the redevelopment of the site over many years. This application does not seek consent for physical works on site. Future works including tree removal, remediation, demolition or construction of public domain, infrastructure and buildings will be sought under future development applications (notwithstanding the identification of trees and existing structures to be removed in the Concept plans)

The development encompasses the demolition of all the existing buildings. Extensive redevelopment will occur to create a mixed use precinct comprising six development lots with a mixture of landuses. For a detailed project description refer to the Amendment Report prepared by Ethos Urban.

The tree related impacts have been assessed based on the concept Master Plan layouts, the architectural and landscape reference schemes and a reasonable estimate of potential future proposed works which will typically include demolition of existing structures, widespread re-grading, excavations for basement car parks, installation of new major service infrastructure and the re-surfacing of a natural creek line and the ultimate construction of the proposed buildings.

The proposed Master Plan will have impacts on the existing trees that are scattered throughout the central and eastern portions of the site. It is impractical to retain many of the trees within the central portions of the site due to this level of disturbance and the need for numerous other urban design outcomes such as building separations, workable road layouts and extensive site re-grading. Arterra has worked closely with the development team to try and ensure as many trees are retained as possible and focussed particularly on those trees that will make a very positive contribution to the Master Plan outcomes, the native species and particularly those visible from the wider public domain. Importantly, many of the trees proposed for removal are low or very low retention value trees.

This impact assessment has been prepared to identify the trees to be retained and removed, an enable a proactive approach to managing the trees to be retained. Appropriate tree protection measures to manage and protect trees during construction are outlined. A total of **582** trees were assessed for this report. This includes trees within the site as well as some trees immediately adjacent to the site that could potentially be impacted and needed to be considered.

The trees assessed are those that would be considered 'trees' under Section 9.5 of the City of Ryde DCP 2014, being a tree having:

- a height of 5m or
- a stem circumference of 450mm at a height of 1.4m above the ground.

Very small trees, shrubs and dead trees have typically not been included in the assessment. We note the assessed tree quantities have been increased from 491 within the previously submitted scheme to 582 in the amended SSDA. This is due to increased numbers of trees that have been assessed within adjoining sites due to the proposed creek connection works and updated and improved survey information that has been obtained for the Macquarie University and eastern adjoining boundaries. (Total numbers of trees include 428 within the site and a further 154 immediately adjacent, but outside of the site.)

The following table summarise the trees on, or near the site, and other relevant statistics regarding the development. Refer to specifically to Section 2.6 for greater clarity of the quantities of trees within or outside the site.

**Table i – Trees Retained & Removed – Summary of Existing Trees Assessed Within the Site**

Tree Retention Values	Total Number of Existing Trees	Total Number Removed	Total Number Retained
High	28	17 (61%)	11 (39%)
Moderate	183	89 (49%)	94 (51%)
Low	201	136 (68%)	65 (32%)
Nil/Should Remove	16	16 (100%)	0 (0%)
<b>TOTAL</b>	<b>428</b>	<b>258 (60%)</b>	<b>170 (40%)</b>

**Table ii – Trees Retained & Removed – Summary of Existing Trees Assessed Immediately Adjacent but Outside the Site**

Tree Retention Values	Total Number of Existing Trees	Total Number Removed	Total Number Retained
High	30	4 (13%)	26 (87%)
Moderate	72	5 (7%)	67 (93%)
Low	49	27 (55%)	22 (45%)
Nil/Should Remove	3	3 (100%)	0 (0%)
<b>TOTAL</b>	<b>154</b>	<b>39 (25%)</b>	<b>115 (75%)</b>

**Table iii – Trees Retained & Removed – Summary of All Existing Trees Assessed (both within the site and immediately adjoining the site)**

Tree Retention Values	Total Number of Existing Trees	Total Number Removed	Total Number Retained
High	58	21 (46%)	37 (64%)
Moderate	255	94 (37%)	161 (63%)
Low	250	163 (65%)	87 (35%)
Nil/Should Remove	19	19 (100%)	0 (0%)
<b>TOTAL</b>	<b>582</b>	<b>297 (51%)</b>	<b>285 (49%)</b>

The implementation of the Master Plan will see the proposed tree removals offset by the planting of many new trees in the new proposed landscape scheme. The following points summarise the tree impact assessment. A total of **285** trees (49%) are proposed to be retained. Of those trees:

- **37** (64%) are **High** value trees.
- **161** (63%) are **Moderate** value trees.
- **87** (35%) are **Low** value trees.

There are **297** trees (51%) that are suggested for removal. With regard to these trees:

- **19** are rated with **Nil** Retention Value and should be removed regardless of any proposed works.
- **278** are within the footprint of the proposed buildings, grading and road works and are therefore unable to be retained. To be removed:
  - **21** are **High** value trees.
  - **94** are **Moderate** value trees.
  - **163** are **Low** value trees.

Of the **285** trees that are to be retained and protected:-

- Most trees (264) trees have no or minimal foreseeable impact from construction related activity.
- Only **17** trees have a 'minor incursion' (up to 10%) into their nominal TPZs, as defined by AS4970-2009 - Protection of Trees on Development Sites. These incursions are shown shaded on the Tree Retention and Removal Plan (T-02) and noted in the schedule. These minor incursions are all considered acceptable and unlikely to adversely impact the long term condition of the trees.
- Some trees will require **minor surface impacts** to be managed during demolition and construction. These minor surface impacts are shown shaded on the Tree Retention and Removal Plan (T-02) and noted in the schedule. Given the surface oriented nature of the disturbance, minimal root loss is expected and therefore considered acceptable, if adequately managed.
- **4** trees (T05, T25, T76, and T376) have a major encroachment' (>10%) into their 'nominal' TPZs, as defined by AS4970-2009 - Protection of Trees on Development Sites. This encroachment is shown shaded on the Tree Retention and Removal Plan (T-02) and noted in the schedules. These incursions are discussed in more detail within the body of the report and are supported for a variety of reasons and following exploratory root investigations carried out on some of them.

The trees proposed to be retained and protected are predominantly those on the prominent and visible periphery of the site and those on nearby neighbouring properties. By retaining and protecting many of these trees within larger and consolidated Tree Protection Areas, the proposed development will continue to maintain the important established screening from the adjacent Epping Road and Balaclava Road.

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, a Registered Consulting Arborist with Arboriculture Australia and an accredited member of the Institute of Australian Consulting Arboriculturists.



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Director, Registered Landscape Architect (054), Registered Consulting Arborist (1804).

# 1.0 INTRODUCTION

## 1.1 Overview of Amended State Significant Development Application

This tree impact report is prepared on behalf of BaptistCare and submitted to the Department of Planning, Housing and Infrastructure (DPHI) in support of an amendment to the State Significant Development Application (SSDA) (SSD-46561712) for a Concept Master Plan for the site principally located at 157 Balaclava Road, Macquarie Park. (Lot 60 in DP1107965 and part of Lot 2000 in DP1305792).

Since original lodgement, the Master Plan has been revised to address DPHI preliminary assessment, agency advice and submissions, including that made by City of Ryde Council (CoRC). Key amendments to the scheme include:

- Relocation of land uses, including removal of the proposed school, to respond to environmental concerns
- Reconfiguration of the scheme to be centred around open space and informed by Connection to Country, including resurfacing the creek and creating a new circa 1 hectare park.
- Redistribution of GFA to achieve additional open space and improved ground plane connectivity and amenity. The proposed massing has been refined with podium and tower form and increased variation in height.
- Clarifying the publicly accessible land through provision of passive recreation areas, pocket parks and a central plaza for utilisation by residents, visitors and workers.
- Realignment of the internal road network, including a new connection to Herring Road and deletion of the left-out movement onto Epping Road, to improve vehicular connections and to establish an appropriate road hierarchy that prioritises pedestrian and cyclist movement.
- Incorporation of Connecting with Country design principles and establishing a precinct scale landscape and urban design response to acknowledge ecology and the deep Indigenous history of the area.

Specifically, consent is sought under section 4.22 "Concept Development Applications" of the Environmental Planning and Assessment Act 1979 (EP&A Act) for the following:

- A mixed use precinct comprising six development lots (refer Figure 1.1), each with a maximum GFA and contributing to a maximum site-wide GFA, with the following land uses:
  - Seniors housing;
  - Co-living housing;
  - Residential accommodation;
  - Commercial premises;
  - Centre-based child care facility;
  - Health services facility;
  - Roads; and
  - Recreation area.
- A minimum GFA for each non-residential use, co-living housing, seniors housing and affordable housing.
- Planning envelope for each lot, including a maximum height and basement extent in plan (not depth).
- Public domain concept arrangement, including parks, roads and pedestrian connections.
- Identification of trees to be retained and removed.
- Identification of existing structures to be demolished
- A two-stage occupation of lots (prior to and following establishing the New Road 3 connection).

This application does not seek consent for physical works on site. Future works including tree removal, remediation, demolition or construction of public domain, infrastructure and buildings will be sought under future development applications (notwithstanding identification of trees and existing structures to be removed in the Concept plans). For a detailed project description refer to the Amendment Report prepared by Ethos Urban. This report is to be read in conjunction with the Concept Master Plan SSDA documentation prepared by BVN and Arterra.

The Concept Master Plan is supported by a Reference Scheme prepared by BVN which indicatively illustrates a possible arrangement of future detailed development within each lot. All parts of the reference scheme, including location of uses, apartment blocking, basement design, loading dock arrangement and detailed GFA breakdown of uses are subject to future detailed development applications.

The Concept Master Plan is supported by a Development Design Guidelines prepared by the project team that provides additional parameters and design-based objectives to guide future development. The Guidelines ensure

that future detailed development applications achieve the intended outcomes and urban design, sustainability and technical commitments set by the project.

The analysis conducted in this Arboricultural Impact Assessment Report is based on the Reference Scheme produced by BVN. The Reference Scheme provides one possible arrangement of future detailed development that accords with the Concept SSDA. While the Concept SSDA seeks consent for minimum gross floor areas (GFAs) for non-residential uses, co-living and seniors housing, the Reference Scheme provides an indicative GFA that exceeds the minimum and thus represents a likely development outcome. The outcomes of analysis of the Reference Scheme are therefore consistent, or no greater, than the outcomes of a scheme that is designed to the minimum Concept SSDA GFA figures. This Arboricultural Impact Assessment Report therefore finds that the Concept SSDA is supportable from an arboricultural perspective. Where required the Concept SSDA Scheme produced by BVN has also been considered.



Figure 1.1 - Concept Master Plan (Source : BVN)



Figure 1.2 – Location Plan

## 1.2 Relevant SEAR to this Report

This Arboricultural Impact Assessment Report addresses the following Secretary’s Environmental Assessment Requirements (SEARs) set out in the Table 1 below.

TABLE 1 - SEARs requirements		
Item	Description of Requirement	Section Reference (this report)
4. Tree Removal and Landscaping	Provide landscape plans and public domain plans demonstrating that the proposal has considered Part 4.5 of the Ryde DCP 2014 with respect to its public domain interface.	Refer: Section 2.5, 2.6 and 2.7 Appendices 4.0 – Tree Plans
	Provide a concept site-wide landscape plan that details indicative site planting and; provides evidence that opportunities to retain significant trees have been explored.	Refer: Section 2.5, 2.6 and 2.7 Appendices 4.0 – Tree Plans
	Demonstrates how the proposed development would: <ul style="list-style-type: none"> <li>• contribute to long term landscape setting in respect of the site and the streetscape.</li> <li>• mitigate the urban heat island effect and ensure appropriate comfort levels on-site.</li> <li>• contribute to objectives to increase urban tree canopy cover</li> <li>• maximise opportunities for green infrastructure, consistent with Greener Places.</li> </ul>	Refer: Section 2.5, 2.6 and 2.7 Appendices 4.0 – Tree Plans

## 1.3 Summary of Relevant Matters Raised

This report has been revised in response to the DPHI preliminary assessment, agency advice and submissions received following original exhibition of SSD-46561712. For a combined response to all comments received refer to the Amendment Report prepared by Ethos Urban. Table 2 on the following pages provides responses to previous arboricultural related comments.

Source	Item No.	Item Description	Response and Report Section
DPHI	8c	Assess and consider solar access, deep soil and tree retention to each open space individually.	Refer to Appendix 4.1 Tree Plans of this report for tree retention and removal.
DPHI	17d	Clearly outline which trees are to be removed and those trees impacted by construction activities and where possible, retain existing trees located within the central portion of the site to provide a continuous buffer along the Epping Road frontage.	<p>This report and its plans and schedules outlines the likely potential impacts to existing trees. It includes analysis of trees within the site as well as those immediately adjacent to the site that could foreseeably be impacted by proposed development. We note assessed tree quantities have been increased from 491 to 582 due to increased numbers of trees that have been assessed within adjoining sites due to the proposed creek connection works and updated and improved survey information obtained for the University and eastern adjoining boundaries. (Total trees include 428 within the site and a further 154 immediately adjacent but outside the site.)</p> <p>Refer to Section 2.5 and 2.6 of this report for a summary of the existing trees and general tree related impacts. Refer to Appendix 4.1 for plans illustrating trees retained and removed. Also refer to Appendix 4.3 and 4.4 for detailed tree root investigation reports prepared where relevant.</p>
DPHI	17e	Further consideration and design work is to be undertaken, to retain more trees across the entire site. Focus should also be placed on protecting and retaining existing trees identified moderate and high tree retention value.	Refer to above comments. It is noted that such developments involve large scale site disturbances for buildings, basements, services and the re-surfacing of the creek. It is our assessment that the tree loss and retention is a balanced and realistic outcome. Focus has been placed on high and moderate value trees where possible.
City of Ryde Council	3b. (01)	The scale of tree removal set to occur as a result of the overall Master Plan is not supported. With the exception of concentrated areas of trees within the neighbouring allotments and within the north-western and south-western corners of the subject site, there has been minimal attempt to maintain existing trees throughout the proposed scheme.	<p>The scale of development and requirement to achieve a cohesive and workable urban design has necessitate the removal of a large number of trees. The focus has been on retaining a high proportion of perimeter trees that are particularly relevant to the wider public domain outcomes and was considered the most successful, long term and realistic approach to good tree retention outcomes. The amended Master Plan has allowed the retention of some higher value trees in the centre of the site within Kikkiya Park and along the Boulevard.</p> <p>It is noted that the trees proposed to be removed will occur in a staged manner and the proposed Master Plan will offset the removal of trees through additional planting. Refer to Section 2.5 and 2.6 of this report for a summary of existing trees and general tree impacts. Also refer to Appendix 4.1 for tree retention and removal plan.</p>

TABLE 2 – Response to Submissions			
Source	Item No.	Item Description	Response and Report Section
City of Ryde Council	3b. (03)	Of particular note, multiple trees of 'Medium' to 'High' retention value located within the central portion of the site as well as a large number of trees, which form a continuous buffer along the Epping Road frontage, are proposed to be removed.	The scale of development and requirement to achieve a cohesive and workable urban design has necessitate the removal of a large number of trees in the central portion of the site. The current focus on retaining a high proportion of perimeter trees that are particularly relevant to the wider public domain outcomes was considered the most successful, long term and realistic approach to good tree retention outcomes. The amended Master Plan has allowed the retention of some higher value trees in the centre of the site within Kikkiya Park and along the Boulevarde. It is noted that the trees proposed to be removed will occur in a staged manner and the proposed Master Plan will offset the removal of trees through additional planting. Refer to Section 2.5 and 2.6 of this report for a summary of existing trees and general tree impacts. Also refer to Appendix 4.1 for tree retention and removal plan.
City of Ryde Council	3b. (04)	The overall level of impact to be sustained by existing trees and the actual extent of tree removal is considered to be inaccurate. The Tree Location Plans held at Appendix 4.1 of the report do not reflect incursions to Tree Protection Zones (TPZs) and Structural Root Zones (SRZs) as a result of proposed external hard paving areas, stormwater infrastructure or site grading works.	A detailed and realistic assessment of the tree related impacts has been considered and is thoroughly presented in this reports' schedules and plans and is informed by the Reference Scheme which outlines potential paving areas, stormwater and site grading. All trees were assessed and accurately measured in accordance with AS4970 and the TPZ and SRZ of each tree numerically calculated and graphically depicted and used to assess the level of potential impact. Refer to Section 2.5 and 2.6 of this report for a summary of existing trees and general tree impacts considered. Also refer to Appendix 4.1 for tree retention and removal plan, 4.2 for detailed tree impact assessment schedule, 4.3 and 4.4 for detailed tree root investigation reports.
City of Ryde Council	3b. (05)	Given these works are extensive and likely to result in extensive impacts to existing trees, detailed re-assessment of all tree impacts is required to ensure a true representation of tree removal required to facilitate construction.	As part of the redesign of the Master Plan that has occurred over the last 12 months, a thorough review of the impact to existing trees has been undertaken and is reflected in this updated AIA issued to support the Amendment application.
City of Ryde Council	3b. (07)	The level of tree removal required to facilitate has been understated and is inaccurate and requires re-assessment to ensure a true representation of tree removal required to facilitate construction.	As part of the redesign of the Master Plan that has occurred over the last 12 months, a thorough review of the impact to existing trees has been undertaken and is reflected in this updated AIA issued to support the Amendment application. It is considered an accurate representation of required tree removal.
City of Ryde Council	3b. (06)	The extent of impact from the proposed bulk earthworks on trees to be retained has not been fully considered. Several trees have been nominated for retention despite falling within the footprint of	As part of the redesign of the Master Plan that has occurred over the last 12 months, a thorough review of the impact to existing trees has been undertaken and is reflected in this updated AIA issued to support the Amendment application. It is noted that the assessment of impact to trees has

TABLE 2 – Response to Submissions			
Source	Item No.	Item Description	Response and Report Section
		proposed bulk earthworks as detailed within the Civil Engineering Plans prepared by JN Engineering, Revision 3 dated 28 October 2022	been revised following amendments to the basement plans and extent of bulk excavation proposed as part of the Reference Scheme.
City of Ryde Council	3b. (08)	“The root mapping investigations for T05 held within Section 2.6 of the report does not meet the minimum content requirements for such investigations as outlined within the City of Ryde Tree Management Technical Manual. In this regard, the following issues have been identified: * The as-excavated trench has not been completed along the alignment of the proposed works, failing to provide a reliable assessment of the likely impact to T05. * References to existing services having effectively acted as a contiguous root barrier cannot be verified due to the misalignment of the trench, insufficient photographic evidence, and the lack of a plan or section showing the as-excavated trench.”	The amended Arboricultural Impact Assessment report has been updated to provide the required detail and evidence from the root investigations/mapping. Refer specifically Appendices 4.3 and 4.4
Env & Heritage Group		According to the EIS a total of 491 trees currently exist within the site and along the perimeter boundary (page 75). The EIS indicates 217 trees / existing vegetation are to be retained where possible and 274 trees are to be removed (page 101). This means 55% of the existing trees on the site are to be removed and of these 16 trees are endemic. As 249 of the existing trees on the site have high-moderate retention value. EHG recommends a greater emphasis is placed on the retention of existing trees on the site, particularly local native trees.	<p>The summary outlined by EHG is correct for the previously submitted scheme. As part of the redesign of the Master Plan that has occurred over the last 12 months, a thorough review of the impact to existing trees has been undertaken and is reflected in this updated AIA issued to support the Amendment application. Attempts have been made to retain as many high and moderate value trees as possible. Assessed tree quantities have been increased from 491 to 582 due to increased numbers of trees that have been assessed within adjoining sites due to the proposed creek connection works and updated and improved survey information obtained for the University and eastern adjoining boundaries. Previously, as noted, 55% of assessed trees were proposed to be removed.</p> <p>In the amended scheme 51% of assessed trees are proposed to be removed. This represents a net increase, proportionally, in trees retained. Specifically, two important endemic trees in the centre of the site have been retained and 3 additional moderate value trees along the central boulevard. However, these have been offset by some additional tree removals that have been required to achieve the updated, and arguably</p>

Source	Item No.	Item Description	Response and Report Section
			<p>improved, urban design and road layouts elsewhere.</p> <p>Importantly when comparing the previous with the amended scheme and considering 'high' and 'moderate' value trees alone, the previous scheme retained 55%. The amended scheme now retains 65%. This is a proportional increase in high and moderate value trees retained.</p> <p>With regard to endemic species and also considering 'high' and 'moderate' value endemic trees alone, the previous scheme removed 7 out of 14 trees (50%). The amended scheme removes 7 out of 27 trees (26%). This is a proportional increase in high and moderate value endemic trees retained.</p> <p>Refer to Section 2.5 and 2.6 of this report for a summary of existing trees and general tree impacts. Also refer to Appendix 4.1 for tree retention and removal plan, 4.2 for tree impact assessment schedule.</p>
Env & Heritage Group		The removal of existing trees and the benefits that they provide, will take decades for a juvenile or semi-mature trees to grow and replace and may also remove the potential supply of future hollows that would be expected to form in time.	Agreed. This is why there is a staged removal and replacement strategy. Also this is why such effort has been applied to retaining larger and higher value trees and particularly the native trees that may later develop hollows. Refer to Appendix 4.1 for tree retention and removal plan.

## 1.4 Background

Arterra was engaged by BaptistCare (the client) to undertake arboricultural assessments of the BaptistCare campus at 157 Balaclava Road, Macquarie Park (the site) and prepare the relevant tree reports and plans to help guide the site-wide master planning process. This assessment included the trees within, or immediately adjacent to the site that were likely to be impacted by the proposed works. Other trees well beyond the extent of the proposed works and unlikely to be impacted, are not addressed as part of this report.

This report is an amendment report for the Concept Master Plan that will guide the redevelopment of the site over the next several years. This application does not seek consent for physical works on site. Future works including tree removal, remediation, demolition or construction of public domain, infrastructure and buildings will be sought under future development applications (the purpose of identifying trees and structures to be removed in the concept plans is to establish which is to be adhered to in the following detailed Development Applications). Extensive redevelopment will occur to create a series of mixed-use buildings that promotes 'ageing in place' within a future 'multi-generational' and diverse precinct. Earthworks and disturbance will occur across the site to facilitate the installation of:

- major new trunk services (including power, communications, water, sewer, drainage/stormwater);
- a resurfaced naturalistic creek line running through a consolidated open space area that is also re-graded and shaped to safely convey occasional flood waters;
- a new network of access roads;
- pedestrian circulation pathways; and
- associated landscaping.

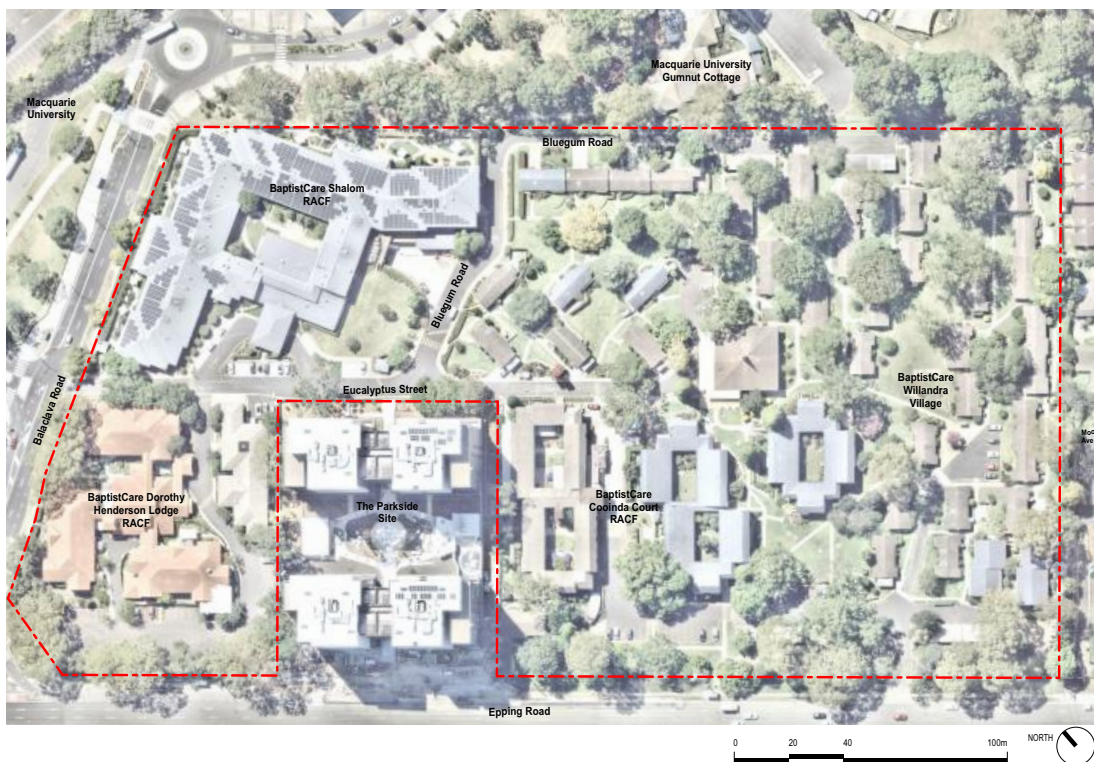


Figure 1.3 – Site context. (Source: Nearnap/ Arterra 2023)

The proposed Concept Master Plan will have impacts on the existing trees particularly those in the central and eastern portions of the site. Practical and desirable urban design outcomes and issues such as minimum building separations, road access and major site re-grading minimises the flexibility in tree retention and will result in extensive site disturbance. Arterra has worked closely with the development team to ensure as many trees are retained as possible and have focussed particularly on those trees that make a positive contribution to the Master Plan outcomes, are native species, and are particularly visible from the surroundings and wider public domain. The Master Plan has been amended to retain trees by:

- Providing 10m setback to Epping and Balaclava Road and improved building setbacks from Macquarie University.
- Tailoring the Kikkiya Creek grading to keep important native and endemic trees

- Positioning proposed roads and designing the building and road levels to retain important trees on adjoining sites.



Figure 1.4 – Photo shows typical site conditions to the eastern portions of the site. There are typically smaller ornamental trees and shrubs surrounding the buildings while the larger, more prominent trees are typically located in the central open spaces and there are large neighbouring trees in the University grounds, on periphery of the site, as can be seen in the background of this photo. (Photo: Arterra 27/11/23)



Figure 1.5 – Typical photo of the existing Kikkiya Creek on the adjoining Macquarie University site to the north. There are many exotic, non-endemic species and smaller trees within the creek corridor that are proposed to be removed to facilitate the appropriate connection of the re-surfaced creek into the existing creek channel on the University site and removal of the existing drainage headwall. (Photo: Arterra 27/11/23)

## 1.5 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 adjacent 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, Useful Life Expectancy (ULE) and retention values of the existing trees;
- Provide clear recommendations as to which trees should ideally be retained and protected;
- Identify the proposed Tree Protection Zones (TPZ) of the tree being retained and identify and assess the likely arboricultural impacts of the development on the trees; and
- Provide preliminary advice on the tree protection measures that will be required during construction to ensure the trees are successfully retained.

The following limitations apply to this report's 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.



Figure 1.6 – View south-east from the site, illustrating the large neighbouring trees (*Eucalyptus grandis*) on the adjoining University site. (T01-T03). Although these are not 'endemic' native trees they are large and prominent trees that will require protection from any development impacts due to being on the neighbouring property. (Photo: Arterra 21/12/21)



Figure 1.7 – Typical photo of the adjoining University site and conditions. There are large neighbouring trees in the University grounds on periphery of the site. These are typically well setback from the site and can, and will be, retained and protected. (Photo: Arterra 18/10/23)



Figure 1.8 – T37(L) and T38(R) are the two Camphor Laurels that remain in the centre of the site and likely date from the early 1940s, being the last remaining remnants of a previous and more extensive driveway row planting. These trees are large, and relatively historic, but are now in only fair condition and have been extensively canopy lifted and pruned and have very sparse canopies for the species. Camphor Laurels are now also a relatively undesirable species, as they are frequently invasive within gardens and surrounding bushland. Given this, their declining conditions and their sizes, these trees have not been a focus for retention. (Photo: Arterra 22/12/21).



Figure 1.9 – Prominent groupings of relatively tall and healthy Lemon-scented gums (*Corymbia citriodora*) around the south-west perimeter of the site, fronting Balaclava Rd. Although individually these may not be ‘high’ retention value trees, as a group their significance is higher and great emphasis has been placed on maintaining an extensive proportion of these trees. (Photo: Arterra 15/8/23).



Figure 1.10 – Prominent individual Spotted Gums such as **T87 (in centre and arrowed)** are located around the site. This specimen is considered one of the best trees on the site and has been a major focus for retention and protection within the Kikkiya Park creek precinct. It provides very useful softening of adjacent future towers. Site planning and grading has very seriously considered the location of this tree and maintained it within a designed and centralised park system. (Photo: Arterra 15/8/23).

## 1.6 Relevant Controls or Legislation

Provisions of the State Environmental Planning Policy (Biodiversity and Conservation) 2021, City of Ryde Development Control Plan 2021 (DCP 2014) and City of Ryde Urban Forest Technical Manual apply to the management and maintenance of existing trees and vegetation in the City of Ryde. Together these documents require that a development consent or a permit is obtained from Council before removing or altering any tree or Prescribed Vegetation. The DCP Dictionary (Part 10) defines a tree as:

- a single or multi-trunked wood perennial plant, which develops many branches, usually at a distance of not less than 1 metre above the ground. It does not include any plant, which is a noxious plant, in its location, as defined by Weed Wise NSW.

For the purposes of Section 9.5 of the DCP a tree is described as having:

- a height of 5m or
- a stem circumference of 450mm at a height of 1.4m above the ground

Section 9.5, Part 2.0 (Exempt Works) provides exemptions for certain tree works. These exemptions don't apply to listed significant trees, heritage items or items within heritage conservation areas as defined in the DCP. The site does not contain any listed 'significant trees' nor is the site identified as a heritage site. Trees in the following table are exempt from protection under the DCP

**Table 3 – Exempt Species**

Common Name	Botanical Name
Golden Wreath Wattle	<i>Acacia saligna</i>
Box Elder	<i>Acer negundo</i>
Tree of Heaven	<i>Ailanthus altissima</i>
Evergreen Alder	<i>Alnus jorulensis</i>
Cocos Palm	<i>Syagrus romanzoffianum</i>
Rhizomatous Bamboo	<i>Bambusa spp.</i>
Hackberry	<i>Celtis sinensis</i>
Camphor Laurel	<i>Cinnamomum camphora</i>
Cotoneaster	<i>Cotoneaster sp.</i>
Cockscomb Coral Tree	<i>Erythrina crista-galli</i>
Indian Coral Tree	<i>Erythrina x sykesii</i>
Weeping Fig	<i>Ficus benjamina</i>
Rubber tree	<i>Ficus elastica</i>
Norfolk Island Hibiscus	<i>Lagunaria patersonii</i>
Broad leaf Privet	<i>Ligustrum lucidum</i>
Narrow leaf Privet	<i>Ligustrum sinense</i>
Oleander	<i>Nerium oleander</i>
African Olive	<i>Olea europaea africana</i>
Poplars	<i>Populus spp.</i>
Golden Robinia or Golden Locust	<i>Robinia pseudoacacia</i>
Willows	<i>Salix spp.</i>
Umbrella tree	<i>Schefflera actinophylla</i>
Athel tree	<i>Tamarix aphylla</i>
Rhus tree	<i>Toxicodendron spp.</i>

All edible fruit and nut trees except for *Acmena spp.* (Lilly Pilly), *Syzygium spp.* (Lilly Pilly), *Elaeocarpus spp.* (Blueberry Ash) or *Macadamia spp.* (Macadamia Tree) are also exempt species.

## 1.7 Conduct and Author Qualifications

Given the above stated aims of this report, as author of this report, Arterra confirms that Robert Smart is a suitably qualified (AQF Level 5) Consulting Arborist, to provide comment and the required arboricultural advice pertaining to these matters. Robert Smart is a member of the International Society of Arboriculture, a Registered Consulting Arborist with Arboriculture Australia, an accredited member of Institute of Australian Consulting Arboriculturists and a licenced Quantified Tree Risk Assessment practitioner. Robert Smart has more than 25 years' experience in managing trees in complex development sites.

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

Arterra provides specialist consulting arborist services only and does not provide any physical tree 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.

## 1.8 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 – 2009 “Protection of Trees on Development Sites” and means the typical minimum area above and below ground at a given distance from the trunk to provide for protection of the tree. Most importantly it represents the root zone required to be left undisturbed to maintain a healthy and viable tree. Please note, that roots will usually extend well beyond this zone, so this represents the minimum remaining root zone required, assuming all others are lost or damaged due to construction. It is typically calculated as a circle centred on the trunk unless existing site conditions can be assessed and indicate otherwise.

### “TPA” = Tree Protection Area

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

### “SRZ” = Structural Root Zone

This is the area as defined by AS 4970 – 2009 “Protection of Trees on Development Sites” and means the area immediately around the base of the tree at a given distance from the trunk within which the woody roots and soil cohesion are considered vital to the structural stability of the tree. Disturbance, damage or removal of soil and roots within this area will typically render the tree unstable and require its removal. It is typically calculated as a circle, centred on the trunk, unless existing site conditions can be assessed and indicate otherwise.

### DBH = Diameter at Breast Height

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

### DGL = Diameter at Ground Level

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

### Non-Destructive Digging

This is the process of safely excavating the ground surface to minimise the risk of damage to existing tree roots. This method is used to map and locate existing tree roots within the TPZ and/or SRZ and helps to guide and inform the installation and/or construction of proposed services and/or structures close to retained trees. This is often achieved through hand digging using a shovel, trowel and/or fork with care not to damage the bark and wood of any roots. Compressed air (air spade) or dry vacuum extraction are appropriate non-destructive alternatives to hand digging. Much reduced pressures may be required to avoid stripping root bark and other live tissue. When this work occurs within a TPZ and/or SRZ of a tree to be retained, a qualified consulting arborist should always be present to monitor the works.

### 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.

### Epicormic Growth

Juvenile shoots produced along branches or trunks from dormant or latent buds concealed beneath bark. Production can be stimulated by fire, pruning, wounding or root damage and when excessively produced may also be an indicator of tree stress or decline.

## 1.9 Documents Reviewed

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

General and Wider Government Policies

The main bodies of work specifically driving the key objectives for the BaptistCare Macquarie Park Precinct are the:

- NSW Government Architects Office –(Draft) Greener Places (June 2020)
- NSW Government Architects Office - Biodiversity in Place 2024
- Clean Air and Urban Landscapes Hub - Cities for People and Nature (2020)
- Low Carbon Living CRC – Guide to Urban Cooling Strategies (July 2017)
- National Green Infrastructure Network-Urban Ecology : Theory Policy and Practice in NSW (May 2017)
- City of Melbourne/Victorian Dept. Environment, Land, Water and Planning – How to grow an urban forest
- The Nature Conservancy Washington – Outside our Doors (2016)
- The Nature Conservancy Washington – Planting Healthy Air (2016)
- Trees and Design Action Group – No trees, no future : trees in the urban realm (Nov 2008)

City of Ryde Council:-

- City of Ryde -Urban Forest Strategy 2013
- DCP 2014 (2021 update)
- City of Ryde Urban Forest Technical Manual

LTS Surveyors:-

- Detail and Levels Survey of Lot 60, DP1107965

BVN:-

- Draft Urban Design and Master Plan Design Report Rev D dated 31/12/2024

JN Engineers:-

- Civil Design Report [Draft] only [final documents unavailable prior to finalising this report]
- Services Concept Design Report [Draft] only [final documents unavailable prior to finalising this report]

Arterra Design:

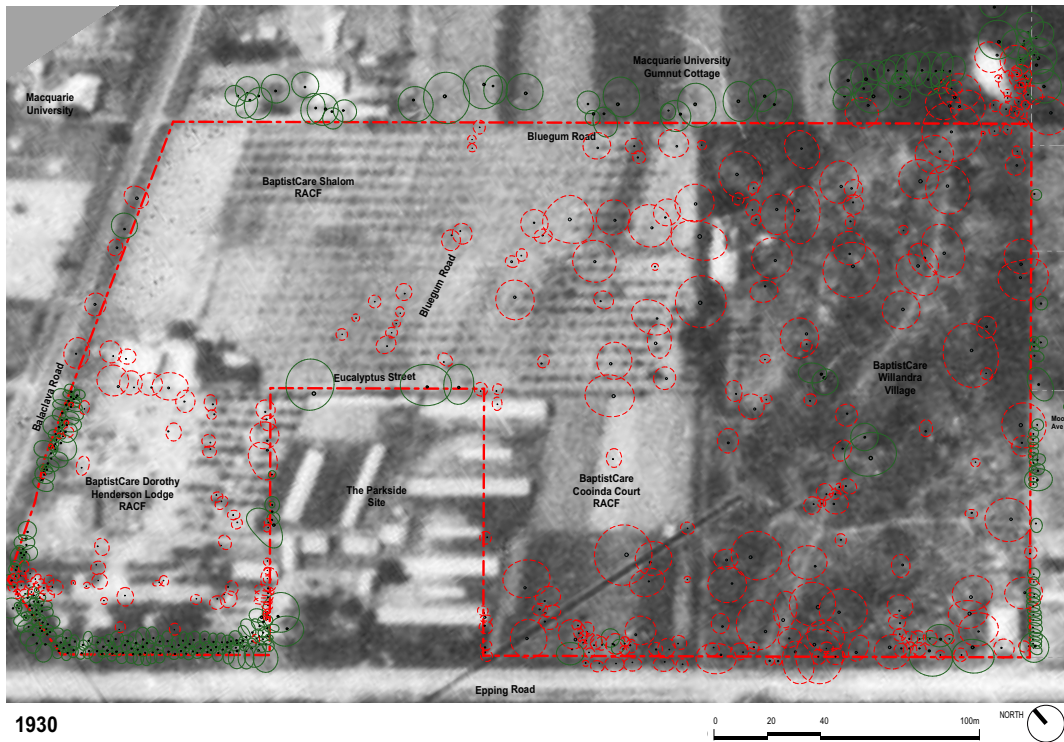
- Landscape Master Plan Report Rev C dated 5 March 2025

Based on the proposed draft servicing and infrastructure assessments and the above architectural and engineering plans we are satisfied that the proposed servicing for the development can be designed and implemented to avoid major trenching or disturbance to the existing trees that are proposed to be retained. We understand that no new services are proposed to be extended into or through the currently proposed TPAs and any existing services that are no longer required in these zones will be capped off and left in situ if located under any trees to be retained.

## 1.10 Site Location, History and Context

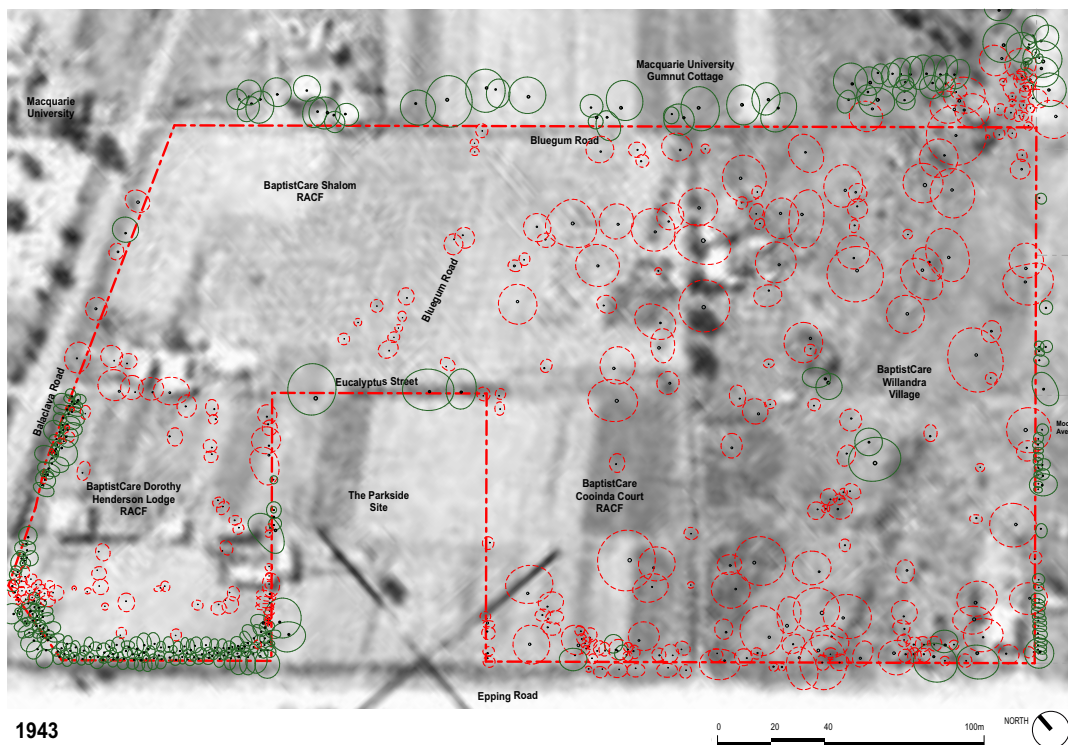
The site is located near the corner of Balaclava Road and Epping Road within the City of Ryde Local Government Area (LGA). It is directly south of Macquarie University and in close proximity to Macquarie Shopping Centre. The surrounding area is characterised by a mix of commercial and education uses, as well as student accommodation and residential dwellings. The site is in the Macquarie Park corridor as defined in the in the City of Ryde LGA DCP 2014 (2021), approximately 14km northwest of the Sydney CBD and 16.5km from the coast at Manly.

At the time of the arrival of Europeans at Sydney Cove in January 1788, the Wallumedegal or Wallumatagal were the traditional custodians of the area, which they called Wallumetta. From February 1792, small land grants were made to ex-convicts in the area called the Eastern Farms – being farming land east of Parramatta. By 1798, Eastern Farms had become important for supplying fruit, vegetables and poultry to the growing colony of Sydney. This land use was much expanded and continued throughout most of the 1800s and even into the early 1900s, until suburban housing started to dominate. Review of the earliest available aerial imagery from 1930, shows the site largely cleared of endemic vegetation and being utilised for orchards and agricultural pursuits. Development for seniors living commenced in the early 1960s, with most of the development, reflective of the current facilities, completed in the 1970s. The Shalom RACF was completed post 2002.



1930

Figure 1.11 – 1930 – Site is largely cleared of all endemic vegetation and is being used for orchards and agricultural pursuits. Almost none of the current, existing trees are believed to be present on the site at this time. (Photo: NSW Spatial Services)



1943

Figure 1.12 – 1943 – Site is largely cleared of all endemic vegetation and is being used for orchards and agricultural pursuits. (Photo: NSW Spatial Services)

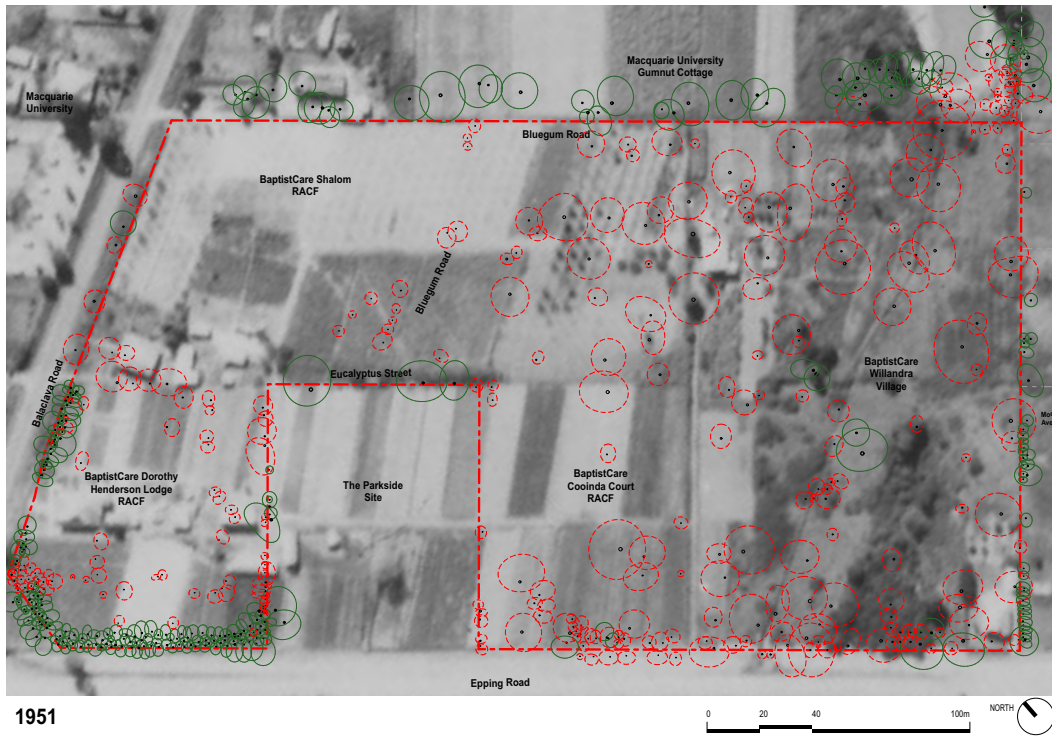


Figure 1.13 – 1951 – Site is largely cleared of all endemic vegetation and is being used for orchards and agricultural pursuits. (Photo: NSW Spatial Services)

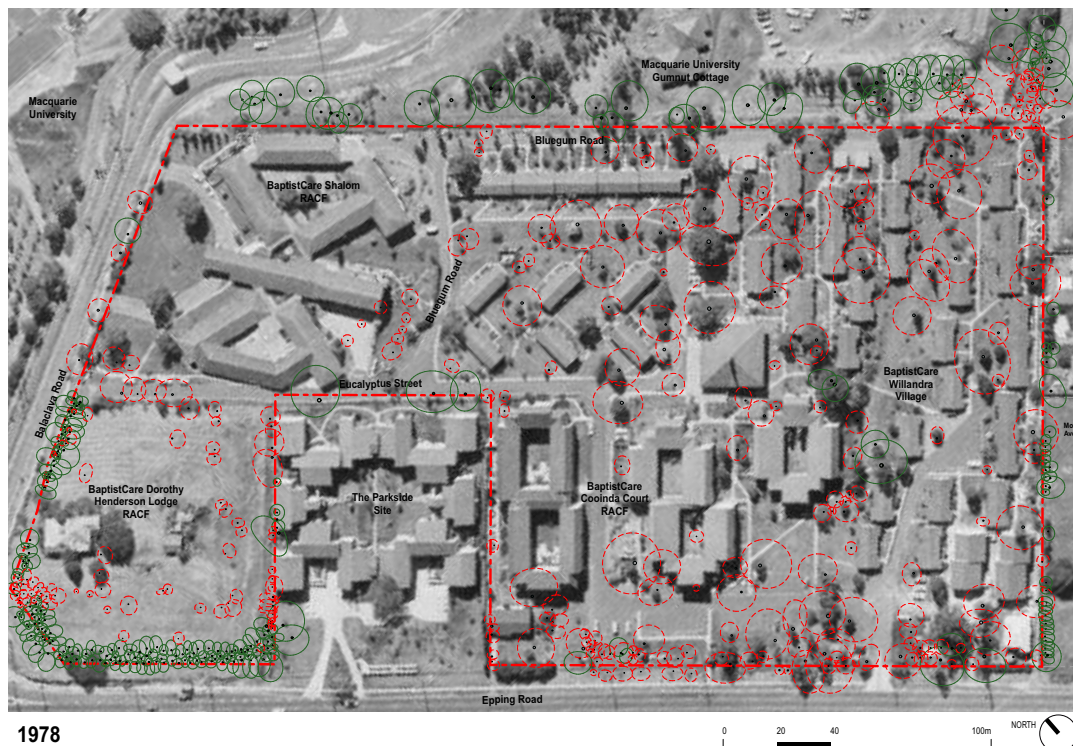


Figure 1.14 – 1961 – Site is largely cleared of all trees apart from Camphor Laurels (T38 and T39). Evidence of development beginning for aged care facilities in the northern corner fronting Balaclava Road. (Photo: NSW Spatial Services)



1965

Figure 1.15 – 1965 – Site is largely cleared of all trees apart from Camphor Laurels (T38 and T39). Evidence of development beginning for aged care facilities in the northern corner fronting Balaclava Road. (Photo: NSW Spatial Services)



1978

Figure 1.16 – 1978 – Completion of aged care facilities and existing seniors living units throughout remainder of the site. Image indicates numerous young trees were planted around the new development through the late 1960s and early 1970s, most of which remain today. Trees reflective of the positions of T04 - T10 are now visible in the university grounds and would be consistent with the size and age of these trees. (Photo: NSW Spatial Services)



Figure 1.17 – 1986 –No significant change from previous photos. (Photo: NSW Spatial Services)



Figure 1.18 – 1994 –No significant change from previous photos except for the incorporation and development of Dorothy Henderson Lodge in the south -west and Gumnut Cottage in Macquarie University. (Photo: NSW Spatial Services)



2009

Figure 1.19 – 2009 – No significant change from previous photos except for the redevelopment of Shalom Centre in the north-west. (Photo: NearMap)



2023

Figure 1.20 – 2023 (March) – The site broadly as it appears today. Notably work has finished on the adjoining Parkside site. (Photo: NearMap)

## 1.11 Site Ownership and Zoning

The site is owned by BaptistCare. It is identified as Lot 60 in DP 1107965 with an approximate land area of 6.38ha. The site is zoned MU1 Mixed Use, under City of Ryde Council LEP 2014 Land Zoning Map.

## 1.12 Assessment Methodology

On the 22 December 2021, 16 February 2022, and 11 & 12 March 2022 Robert Smart and Chloe Bristow of Arterra attended the site to undertake a detailed assessment of the trees within and immediately adjacent to the site and likely to be impacted by the proposed development. Additional trees in the University were surveyed and assessed on 27/11/23. The trees' health and condition were assessed via a visual inspection undertaken 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 is 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 trees were photographed, 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. 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.

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.

Subsurface Tree Root Investigations were carried out using non-destructive excavation along the site boundary adjacent to the neighbouring property tree T05. This was to ascertain the presence or otherwise, of significant roots growing into the site. Ground penetrating radar investigations were undertaken adjoining tree T76 to identify the likelihood of tree roots being present and their potential depth and then allow assessment of impacts and to guide future design outcomes.

The findings of the subsurface investigations are discussed further in Section 2.3 and Appendix 4.3 Sub-Surface Tree Root Investigation Report of Neighbouring Tree T05 (*Corymbia maculata*) and Appendix 4.4 Tree Root Investigation (Ground Penetrating Radar) Report of Neighbouring Tree T76 (*Eucalyptus saligna*).

### Desktop Review and Research

Digital AutoCAD files of the proposed works were imported into Arterra's standard CAD software (ArchiCAD v24) 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 nominal 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 2023 imported into the above software for cross checking and assessment. (<http://www.nearmap.com/> accessed 15/12/2021). Various historic aerial photography was also reviewed on the NSW Spatial Services website.

Climatic data was obtained from the Bureau of Meteorology using statistics from the Masons Drive weather station in North Parramatta which is approximately 10km west of the site.

(<http://www.bom.gov.au/climate/data/> accessed 03/03/2022)

### 1.13 Pre-Development Tree Assessment – Tree Retention Values

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

#### ULE

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

#### 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 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.

### 1.14 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  $12 \times$  (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 ultimate redevelopment of the site, in summary involves the following:

- Demolition of the existing buildings and surrounding infrastructure
- Earthworks and re-grading of the site and excavations for multiple basement car parks, new main services infrastructure and the re-surfaced naturalistic creek line.
- Construction of the built forms. This includes 12 multistorey buildings, some of which are associated with combined podium levels and basement footprints.
- Construction of a new access road network, adjoining pedestrian circulation and shared pathways together with extensive hard and soft landscape works adjoining the streets and amongst the building fabric.
- Extension and augmentation of existing services and other essential services infrastructure.

The proposed works will result in site disturbances which have direct impacts on the existing trees within, and directly adjacent to, the site. The proposed ultimate development (subject to future detailed SSDA applications) will involve:-

- Building demolition machinery and works;
- Use of large scale civil and earthmoving equipment;
- Access to and from the site with large trucks and construction plant;
- Major and deep excavations;
- Large stockpiles of excavated material and demolition waste;
- Extensive stockpiles and temporary storage of building materials;
- Re-grading (both cutting and filling) of the existing surface levels;
- Major trenching for new services, particularly drainage and electrical;
- Major building works and general construction;
- Use of large tower cranes and piling rigs;
- Extensive temporary parking for site personnel and deliveries;
- Paving, decks, pedestrian bridges, rockwork and retaining walls and
- Final landscaping and planting.

#### Key Assumptions:-

- All demolition, excavations and installation of services work that need to occur within any of the defined TPAs shall be done using hand tools and or other non-destructive methods only and only under the direct oversight of an appropriately qualified consulting arborist. Roots of 50mm diameter or greater are not to be damaged unless specifically approved by the supervising consulting arborist.
- Pedestrian paths that occur, or are proposed, within the TPAs shall be constructed at or above the existing surface levels to minimised surface root impacts.
- Temporary construction battering, stockpiling or grading is not to be applied into the designated TPAs.
- Despite the above, the line of disturbance outside of most building lines has been typically estimated at a minimum of 1.5-2.0m from the face of the building to allow for provision of water proofing, services, access and scaffolding around the building during construction.
- All services connections proposed for the site have also been notionally coordinated to occur clear of the proposed retained trees.
- All construction access and deliveries are to be made via existing site access from the surrounding streets and the existing or proposed internal access roads. Concrete will typically be pumped and will not require truck movements through any designated TPAs.
- Where no spot levels or proposed contours are indicated it is assumed that the existing surface levels are retained.
- It is assumed that any new landscape grading and trimming within the nominated tree protection areas will be reasonably minimal and installed using high quality, imported manufactured topsoil. No cultivation of the existing soils shall be undertaken within the defined TPA.
- That future retaining wall footings, when occurring near trees to be retained, will be oriented away from the trees (ie: footings extending to the front of the face of the wall).
- Demolition and/or any future and unavoidable excavations within a defined TPA will be under the supervision and direction of a suitably qualified Project Consulting Arborist.



Figure 2.1 –Overview render of the proposed Master Plan development when viewed from the northern side. Regrading is required to resurface the creek line within the proposed open space and excavation is required to accommodate the proposed buildings and basement levels (Source: Arterra - BVN)

## 2.2 Climate and Microclimate

Macquarie Park is in Sydney's north-western suburbs and shares the general climate of this region with moderate temperatures, good rainfall and minimal climatic and weather extremes. It is typically described as a temperate climate with hot to warm summers and cool winters, with relatively uniform rainfalls greater than 900mm / year. There is no distinct dry season.

The site is approximately 10.0km west of the Bureau of Meteorology automated weather station at North Parramatta. It has an average annual rainfall of 968mm, 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 128mm and the driest month being July with an average of 46mm.

Maximum average daily temperatures range from 28.6°C in January to 17.5°C in July. The minimum average daily temperatures range from a high of 17.7°C in January down to lows of 6.3°C in July.

The primary wind direction is from the south-east or east in the afternoons while it is predominantly from the north-west and west in the mornings (Source: Australian Bureau of Meteorology). The strongest winds (>40km/h) are normally experienced from the west later in the day. There are no significant microclimatic influences over the site at present, however, it is expected that the tower development will result in some increases in downdrafts and wind tunnelling in some areas of the site and overshadowing in portions of the site.

## 2.3 Soils and Vegetation

Soil mapping indicates the site to be within the Glenorie Soil Landscape Association which occurs extensively around the adjacent plateaus and ridge tops of Macquarie Park. These soils are often related to the remnants of highly weathered shales of the Wianamatta Group and typically characterised by undulating low and rolling hills located on the underlying Ashfield and Bringelly Shale geological formations which are interbedded shales with occasional sandstones. Typically, these areas would be shallow to moderately deep Red Podzolic soils, where the boundary between the topsoil and subsoil is relatively clear. These shale-based soils are generally of moderate fertility and because of the higher clay contents they can have reasonable nutrient and water holding capacity. Of key concern is that the subsoils can become hard setting and subject to compaction, particularly if trafficked when

moist. They are also subject to waterlogging and often are very acidic which can lead to aluminium toxicity issues for plant growth.



Figure 2.5 – Soil sample with clay loam soil to 400mm then very heavy clay below this. (Photo: Arterra 22/12/21)

A representative soil sample was taken in the northern gardens adjacent Bluegum Road, near the boundary with the Macquarie University (Gumnut Cottage). The sample results were reflective of the naturally occurring soils and indicated a red podzolic soil. From the topsoil sample taken at a depth of 250mm, the soil structure was moderately pedal with medium to fine and sub angular blocky peds. The soil texture was a clay loam with the colour being dark brown. The soil pH was neutral with a pH reading of 6.5. There was distinct change from A to B horizons at around 600mm depth. The subsoil from a depth of 800mm was also sampled. The subsoil structure was very strongly pedal with coarse sub angular blocky peds. The soil texture was a heavy clay. Its colour was orange-brown. The soil pH was slightly acidic at pH5.5—6.0. We noted several areas in the site where surface rock was observed, indicating the depths of the topsoils may also be quite variable around the site. Visible surface-oriented tree root development also supports this observation.

The natural vegetation that once characterised the Glenorie Soil Landscape Association has now been extensively cleared in the local area. It would have been tall open forest (wet sclerophyll forest) dominated by the following representative species.

- *Eucalyptus saligna* (Sydney Blue Gum)
- *Eucalyptus pilularis* (Blackbutt)
- *Eucalyptus paniculata* (Grey Ironbark)
- *Syncarpia glomulifera* (Turpentine)
- *Angophora floribunda* (Rough-barked Apple)
- *Eucalyptus globoidea* (White Stringybark)

## 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.

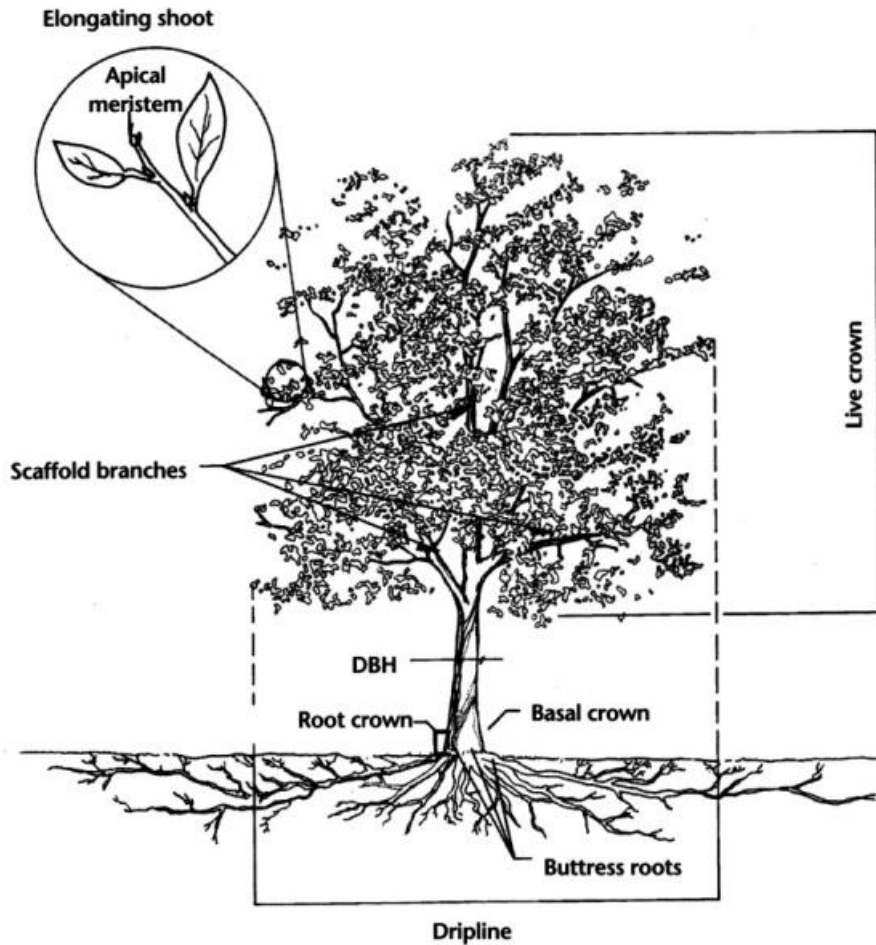


Figure 2.6 – Typical form and structure of a tree illustrating the typical form, location and extent of root growth (Source: Matheny and Clark, 1998)

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

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

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

1. Oxygen (and particularly oxygen within the soil);
2. Water (a cellular necessity and primarily taken up by the tree roots);
3. Light & Sufficient Foliage (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 effects of construction on trees is often that of soil compaction or covering of root zones with impervious surfaces, as it:-

- Reduces infiltration rates of surface water;
- Reduces the availability of water to the roots as they can't naturally extract remaining moisture when soil becomes too dry;

- Reduces air to roots (roots cease to function properly and die without oxygen);
- Increased soil strength caused by compaction mean that roots need more energy to growth through it or can't even physically penetrate the soil;
- Roots are physically broken or crushed and there is increased potential for fungal and pathogen attack. (Harris 1999).

#### Tree Tolerance

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

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

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

## 2.5 Tree Assessment - General

A total of **582** trees have been assessed for this report with most in fair to good health. (There are **428** trees within the site boundary and **154** that have been assessed and included that are along the boundaries and streets immediately adjoining the site). Within the site, the majority of trees are located on the outer periphery of the site, particularly being the massed tree planting in the south-west corner of the site on the corner of Balaclava and Epping Roads and along the frontage of Epping Road. There are also relatively numerous and large native trees adjacent to the northern site boundary, but these are within the neighbouring Macquarie University site. These are typically large and significant trees, and although native, most are not endemic to the Sydney area. (Refer specifically to tables 6,7 and 8 which itemises tree information based on their retention values and also their positions within or outside the site).

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

The following is a summary of the trees found on, or immediately adjacent, the site and some relevant factors regarding the tree population. Refer to specifically to Section 2.6 for greater clarity of the quantities of trees within or outside the site.

**Table 4 –Existing Assessed Tree Population and Retention Value (all trees regardless of location)**

Tree Retention Value	Total Number of Trees	% of Total Trees
High	58	10%
Moderate	255	44%
Low	250	43%
Nil/Should Remove	19	3%
<b>TOTAL</b>	<b>582</b>	<b>100%</b>

**Table 5 – Top Eight Species by Prevalence**

Species	Common Name	Qty	%
<i>Corymbia citriodora</i>	<b>Lemon Scented Gum</b>	118	20%
<i>Casuarina cunninghamiana</i>	<b>River She-Oak</b>	76	13%
<i>Eucalyptus grandis</i>	<b>Flooded Gum</b>	24	4%
<i>Jacaranda mimosifolia</i>	<b>Jacaranda</b>	24	4%
<i>Lophostemon confertus</i>	<b>Brush Box</b>	22	4%
<i>Liquidambar styraciflua</i>	<b>Liquidambar</b>	18	3%
<i>Corymbia maculata</i>	<b>Spotted Gum</b>	16	3%
<i>Eucalyptus saligna</i>	<b>Sydney Blue Gum</b>	14	2%

## 2.6 General Tree Impact Assessment

The intention of this assessment is to clearly illustrate the trees proposed to be retained and removed as part of the future implementation of the site wide Concept Master Plan. 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 listing of the incursions and likely impacts of the proposed development on each tree is shown in Appendix 4.2 – 'Tree Impact Assessment Schedule' and Appendix 4.1 – 'Tree Plans'.

The expected tree retention and removal is based on the Concept Master plan building envelopes, and where required the indicative information displayed in the accompanying reference scheme. It is important to note that this development is a large-scale development that requires earthworks to construct building basements, new major services, new tower buildings and a new road network. Additionally, the eastern portion of the site will require re-grading to re-surface the drainage line and to manage anticipated flood waters.

The following tables are a summary of the trees to be retained and protected. We note that some trees are located outside of the site and some are within the site boundary. To allow for appropriate assessment and appraisal we provide separate breakdowns for the trees that occur within the site, versus those outside, and then a total.

**Table 6 – Trees Retained & Removed – Summary of Existing Trees Within the Site**

Tree Retention Values	Total Number of Existing Trees	Total Number Removed	Total Number Retained
<b>High</b>	28	17 (61%)	11 (39%)
<b>Moderate</b>	183	89 (49%)	94 (51%)
<b>Low</b>	201	136 (68%)	65 (32%)
<b>Nil/Should Remove</b>	16	16 (100%)	0 (0%)
<b>TOTAL</b>	<b>428</b>	<b>258 (60%)</b>	<b>170 (40%)</b>

**Table 7 – Trees Retained & Removed – Summary of Existing Trees Adjacent but Outside the Site**

Tree Retention Values	Total Number of Existing Trees	Total Number Removed	Total Number Retained
<b>High</b>	30	4 (13%)	26 (87%)
<b>Moderate</b>	72	5 (7%)	67 (93%)
<b>Low</b>	49	27 (55%)	22 (45%)
<b>Nil/Should Remove</b>	3	3 (100%)	0 (0%)
<b>TOTAL</b>	<b>154</b>	<b>39 (25%)</b>	<b>115 (75%)</b>

**Table 8 – Trees Retained & Removed – Summary of All Existing Trees Assessed**

Tree Retention Values	Total Number of Existing Trees	Total Number Removed	Total Number Retained
High	58	21 (46%)	37 (64%)
Moderate	255	94 (37%)	161 (63%)
Low	250	163 (65%)	87 (35%)
Nil/Should Remove	19	19 (100%)	0 (0%)
<b>TOTAL</b>	<b>582</b>	<b>297 (51%)</b>	<b>285 (49%)</b>

The following points summarise the tree impact assessment. It considers all the trees both within and immediately adjacent to the site. A total of **285** trees are proposed to be retained. Of those trees:

- **37** (64%) are **High** value trees.
- **161** (63%) are **Moderate** value trees.
- **87** (35%) are **Low** value trees.

There are **297** trees that are suggested for removal. With regard to those trees:

- **19** are rated with **Nil** Retention Value and should be removed regardless of any proposed works.
- **278** are within the footprint of the proposed building and road works and are therefore unable to be retained. Their retention values are broken down as follows:
  - **21** (46%) of the **High** value trees are removed.
  - **94** (37%) of the **Moderate** value trees are removed.
  - **163** (65%) of the **Low** value trees are removed.

The implementation of the Master Plan will see the proposed tree removals offset by the planting of many new tree and predominantly endemic trees in the new proposed landscape schemes.

Of the **285** trees that are to be retained and protected:-

- **264** trees will have minimal foreseeable impact from construction related activity. These trees are not discussed further.
- **17** trees have a 'minor incursion' (up to 10%) into their nominal TPZs, as defined by AS4970-2009 - Protection of Trees on Development Sites. These incursions are shown shaded on the Tree Retention and Removal Plan (T-02) and noted in the schedule. These minor incursions are all considered acceptable and unlikely to adversely impact the long term condition of the trees.
- Some trees will require some **minor surface impacts** to be managed during demolition and construction. These minor surface impacts are shown shaded on the Tree Retention and Removal Plan (T-02) and noted in the schedule. Given the surface-oriented nature of the disturbance, minimal root loss is expected and they are therefore considered acceptable if adequately managed.
- **4** trees (T05, T25, T76, T376, T384, and T421) have a major encroachment' (>10%) into their nominal TPZs, as defined by AS4970-2009 - Protection of Trees on Development Sites. This encroachment is shown shaded on the Tree Retention and Removal Plan (T-02) and noted in the schedules. These incursions are discussed in more detail within the following section and are supported for a variety of reasons and following exploratory root investigations carried out on some of them.

### 2.6.1 Focus of Master Plan Tree Retention

The most important trees to be retained and protected are predominantly those on the highly visible periphery of the site and the nearby neighbouring property trees. Impacts to neighbouring trees have been minimised and most nearby trees are adequately maintained outside of direct impacts from the foreseeable and proposed works. By retaining and protecting many of the site trees within consolidated Tree Protection Areas, the proposed development will continue to maintain important mature trees and screening from Epping Road and Balaclava Road.

Regarding the periphery trees fronting Epping Road, trees T358 & T363, to the far east of the site have expected minor incursions for the excavation required to construct the building basement. The reference scheme basements have been modified and setback to accommodate the nominal TPZ, and the upper levels of the proposed building will need to be setback from the maximum concept envelopes to accommodate the TPZ and canopy of these trees. This final design (and the expected minor incursions into the TPZ and canopy) will be assessed and detailed as part of future detailed SSDAs.

Additionally, two existing endemic trees (T71 *Eucalyptus resinifera* & T70 *Syncarpia glomulifera*) and tree T87 (*Corymbia maculata*), a prominent tall and native tree in the central eastern portion of the site, have been a focus of retention. Great emphasis and focus have been placed on maintaining these trees, and an adjoining but smaller exotic tree. These trees have been used as a focal element in the central primary open space area along the re-established watercourse. It is expected that there will be some minor incursions as a result of the construction and the nearby excavations required to grade and install the drainage channel and expansive new open spaces. The surrounding levels around these trees, however, have been carefully considered and are expected to be maintained at or just above the existing ground levels, thereby allowing the protection and retention of these trees.

With regard to future building, it is expected that each building will have a 1.5m wide designated 'articulation zone' to accommodate wind screens/blades &/or building articulations to mitigate wind impacts across the site. At a master planning stage, it is reasonable to assume that any wind mitigation measures will not cause any impact within the root zone of any existing tree. The final positioning and installation of the wind screens/blades within the articulation zone will be designed and installed to avoid conflicts with any trees to be retained and to minimise canopy pruning. Any incursions and impacts will be considered and detailed as part of future detailed SSDAs.



Figure 2.7 – Prominent groupings of relatively tall and prominent Lemon-scented Gums around the south-west perimeter of the site, fronting Epping Rd. Although individually these are not high retention value trees, as a group their significance is greater and emphasis and focus has been placed on maintaining a good proportion of these trees as part of the ultimate Master Plan. (Photo: Arterra 11/3/22).



*Figure 2.8 – Two existing endemic trees within the site that have been a focus of retention. Great care has been taken to retain and protect these trees. T71 Eucalyptus resinifera shown above. (Photo: Arterra 11/3/22).*



*Figure 2.9 – Two existing endemic trees within the site that have been a focus of retention. Great care has been taken to retain and protect these trees. T70 Syncarpia glomulifera shown above. (Photo: Arterra 11/3/22).*



*Figure 2.10 – Tree T87 is a very prominent tall and native Corymbia maculata (Spotted Gum) in the central - eastern portion of the site and visible from Epping Rd. Great emphasis and focus have been placed on maintaining this tree, and the adjoining but much smaller exotic tree. This tree has been used as a focal element in the centre primary open space area along the re-established watercourse and gives the future landscape an immediate focal point, maturity, shade and canopy cover.(Photo: Arterra 11/3/22).*

The more major incursions into the 'nominal' TPZ expected as part of the re-development are outlined in the table below and are discussed further in the following sections. Most are only just above the accepted incursion of 10% and therefore considered acceptable.

**Table 9 – Major TPZ Incursions (>10%) (AS4970-2009)**

Tree ID	Species	Common Name	TPZ % Incursion (AS4970)
T05	<i>Corymbia maculata</i>	Spotted Gum	20% (Major Incursion)
T25	<i>Liquidambar styraciflua</i>	Liquidambar	11% (Major Incursion)
T76	<i>Eucalyptus saligna</i>	Sydney Blue Gum	12% (Major Incursion)
T376	<i>Cupressus macrocarpa cv.</i>	Monterey Cypress	14% (Major Incursion)

## 2.6.2 Comment on Major Incursions to be Managed During Demolition and Construction

### T05 *Corymbia maculata* (Spotted Gum) – Major Incursion of 20% - Sub-surface Tree Root Investigations Undertaken

This tree is a 'Moderate' retention value tree situated to the north of the site within the neighbouring Macquarie University. It has a notional 'major incursion' of 20% into the nominal TPZ, as defined by AS4970-2009 Protection of Trees on Development Sites, resulting from the proposed construction impacts, and likely excavation, required to install the new internal cycleway and road adjacent the northern boundary. Due to this theoretical incursion, additional subsurface root investigations were undertaken to determine the more realistic likely impacts within the TPZ from the proposed works. The following is a summary of the observations and findings obtained after undertaking the sub-surface tree root investigations of T05 (*Corymbia maculata*). For further detailed information and a report regarding the exploratory works undertaken, refer to Appendix 4.3 'Sub-Surface Tree Root Investigation Report of Neighbouring Tree T05 (*Corymbia maculata*)'.

On the 16 February 2022 exploratory excavations were carried out by Arterra to ascertain the presence, or otherwise, of any significant tree roots emanating from the neighbouring tree (T05 *Corymbia maculata* (Spotted Gum)) that may have been projecting into the site in an area proposed to be excavated for the new internal cycleway and road. The proposed excavations for the carriageway result in a theoretical incursion into the nominal Tree Protection Zone of this tree that is greater than commonly accepted thresholds.

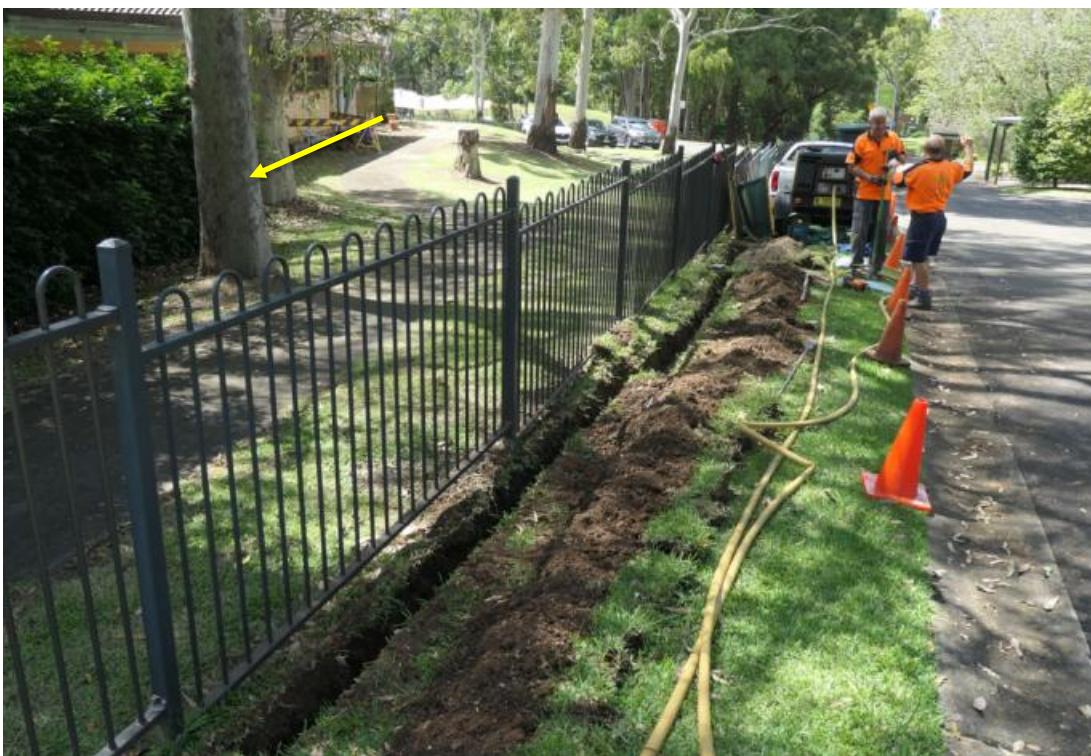


Figure 2.11 – Photo of subsurface root investigations, with trench completed. T05 arrowed at left. (Photo: Arterra 16/2/22)

The non-destructive, sub-surface investigations were completed using an air-spade to excavate a trench and expose any significant roots that may have been projecting into the site. The following observations were made:

- The trench was excavated approximately 200mm wide and for 11m in length, which was the full extent of the nominal TPZ of **T05**, where it crosses the boundary.
- The trench was carefully excavated using an air-spade and hand tools to minimise the likelihood of damaging any tree roots or services that may have been exposed.
- A relatively shallow sewer line and stormwater line were exposed during the trenching. The top of the stormwater pipe was only 200mm below the grounds surface level.
- The stormwater pipe centreline was located 1.6m from the back of the existing kerb and appears to be parallel to the roadway.
- The stormwater line was identified as a 400mm diameter concrete pipe, with a smaller PVC sewer pipe, directly adjacent to it, being a 150mm diameter PVC pipe. This was located immediately to the north of stormwater (and nearer the tree) but at the same invert level. They were likely laid within the same trench at the time of their installation. It is assumed these pipes date to the early period of the site's development, pre -1980s. The trees planted around Gumnut Cottage were probably planted after this date. Therefore, it is assumed the stormwater pipes pre-date the existence of tree **T05**.
- The larger concrete pipe was exposed at 200mm below the surface. The pipe diameter means that the pipe extends a further 400mm deeper. The tree-side of the pipe was exposed to 600mm depth and no significant roots were found. Most tree roots are usually found within the top 700mm of soil, particularly in clay-based soils. Root growing under this pipe are less likely and even if present are likely to be few in number.

No significant tree roots of any size or kind were encountered within the exploratory trench, either going over or along the northern side of the pipe to lower levels. Tree roots can not be ruled out being located deeper and going under the pipework, but in Arterra's experience, and our specialist trenching contractor's experience, this is far less likely to occur below 700mm depth. It would not normally be expected to do an exploratory root trench much deeper than 600mm, when undertaking such exploratory root investigations, particularly if other roots are not being observed or encountered. It is the author's opinion that the incursion is acceptable and unlikely to result in any material, negative impacts to the condition of the tree based on the following:

- No significant roots were exposed in the exploratory trenching.
- Significant roots are unlikely to be present below the pipe (at a greater than 600mm depth), and if they are present, are likely to be few in number.

Based on the above evidence, Arterra are satisfied that the proposed disturbance to construct a new cycleway and road can occur near the boundary and are unlikely to have any significant impacts on the health or stability of this adjoining tree.

#### **T76 *Eucalyptus saligna* (Sydney Blue Gum) – Major Incursion of 12% - Tree Root Investigations Undertaken via Ground Penetrating Radar**

This tree is a 'Moderate' retention value tree located within the adjacent Parkside site on the north-western Parkside boundary. It is currently in relatively good condition, but with a very significant borer blaze to 60% of its trunk circumference from ground level to 3m high on the southern side (Parkside tower development side). Its trunk base is level with adjoining existing roadway and now sits within a recently created garden bed.

It is to be noted that the tree was likely impacted by the earlier construction of the Parkside tower as its canopy was once much more sparse (during initial assessments undertaken by Arterra in December 2021) and the observed TPZ extent and fencing during construction works were potentially inadequate on the southern side. However, the health and vigour of the tree appears to have improved following the completion of the Parkside construction, with the canopy appearing fuller and with notable additional growth. It is the authors opinion that the additional topsoil and potential additional watering within the TPZ, through the establishment of the new Parkside gardens, has likely aided the improvement in the trees overall health and condition.



Figure 2.12 – Photo of adjoining Parkside site tree T76 *Eucalyptus saligna*. Left image captured on the 27/07/22 and right image captured on the 01/03/24. The health and vigour of the tree appears to have improved following the completion of the Parkside construction, with the tree canopy appearing fuller. It is the authors opinion that the additional topsoil and potential additional watering within the TPZ has likely aided the improvement in the trees overall health and condition (Photo: Arterra 27/07/22 and 01/03/24)

This tree has a notional ‘major incursion’ of 12% into the nominal TPZ, as defined by AS4970-2009 Protection of Trees on Development Sites, resulting from the proposed construction impacts, and likely excavation, required to construct the new internal road. Though the proposed roadway is located further north (away from the tree) compared to the existing road location, there is still a theoretical impact, as the nominal TPZ extends well into the BaptistCare site. Due to this theoretical incursion, additional root investigations, using a ground penetrating radar, were undertaken to determine the more realistic likely impacts within the TPZ from the proposed road construction works. The following is a summary of the observations and findings obtained after undertaking the tree root investigations of T76 (*Eucalyptus saligna*). For further detailed information and a report regarding the exploratory works undertaken, refer to Appendix 4.4 ‘Tree Root Investigation (Ground Penetrating Radar) Report of Neighbouring Tree T76 (*Eucalyptus saligna*)’.

On the 1 March 2024 root investigation, using a ground penetrating radar (GPR), was carried out by Arterra to ascertain the presence, or otherwise, of any significant tree roots emanating from a neighbouring tree (**T76** *Eucalyptus saligna* (Sydney Blue Gum)) that may have been projecting into the site in an area proposed to be excavated for a new internal roadway. The proposed excavations for the carriageway result in a theoretical incursion into the nominal Tree Protection Zone of this tree that is greater than commonly accepted thresholds.

After careful consideration of site conditions and alternative forms of investigation it was determined that GPR would be the most appropriate method to locate and map significant tree roots (greater than 50mm in diameter) and any underground services in the defined study area. Other forms of non-destructive investigations were considered but ultimately discounted due to the fully paved nature of the study area and the likely presence of other below ground services. We believe this still provided an adequate indication of the root development in the vicinity of the proposed works.

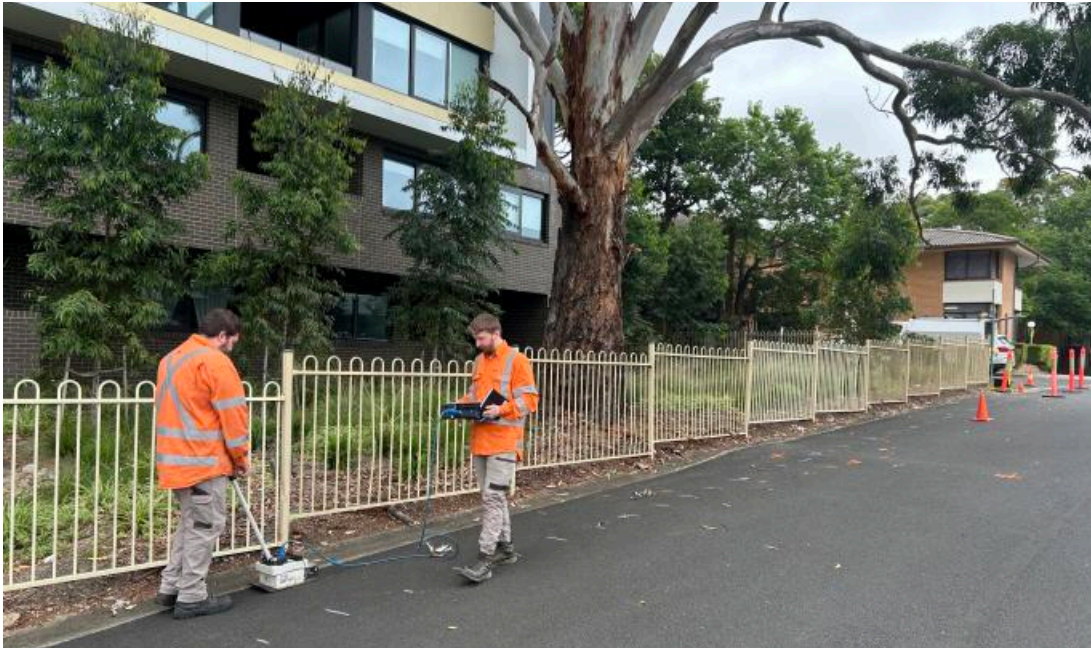


Figure 2.13 – Photo of subsurface root investigations being undertaken using ground penetrating radar north of T76 over the existing internal roadway. (Photo: Arterra 01/3/24)

The results from the GPR indicated that the tree roots found under the existing road were mostly shallow and spreading radially from the centre of the tree. An interpretation of the GPR imagery suggest that there may have been an historic trench excavated for services (likely Telstra) beneath the road to the north of the tree, with the roots typically stopping at the line of the disturbance to this trench. No significant tree roots of any size or kind were recorded to the north of this historical disturbance. Therefore, it is the author's opinion, that the notional incursion to construct the proposed road carriageway is acceptable and unlikely to result in any material, negative impacts to the condition of the tree. The existing bitumen driveway must be carefully demolished to the north of this tree, with care to minimise or root damage or disturbance near the tree.

To further protect this tree, there has been specific modifications made to the master plan reference scheme design to ensure that the proposed 'verge' close to the tree is sensitively implemented and graded to minimise disturbance. The verge footpath has been designed as a series of 1:14 ramps to ensure that the footpath level is maintained at or above the existing levels when passing through the TPZ. A low impact and low height retaining wall has been utilised, to the north of the tree adjacent to the proposed road kerb, to retain the existing levels around the tree and prevent unnecessary incursion. Additionally, with the alignment of the proposed internal road further north than the existing road alignment, this also allows for the installation of new topsoil within the TPZ which would likely help to improve the health of the tree rather than impact it.

Based on the above evidence, Arterra are satisfied that the proposed disturbance to construct a new road and verge can occur and are unlikely to have any significant impact on the health or stability of the adjoining tree. Refer to Appendix 4.5 'Tree Root Investigation (Ground Penetrating Radar) Report of Neighbouring Tree T76 (*Eucalyptus saligna*)' for the detailed root investigation report.

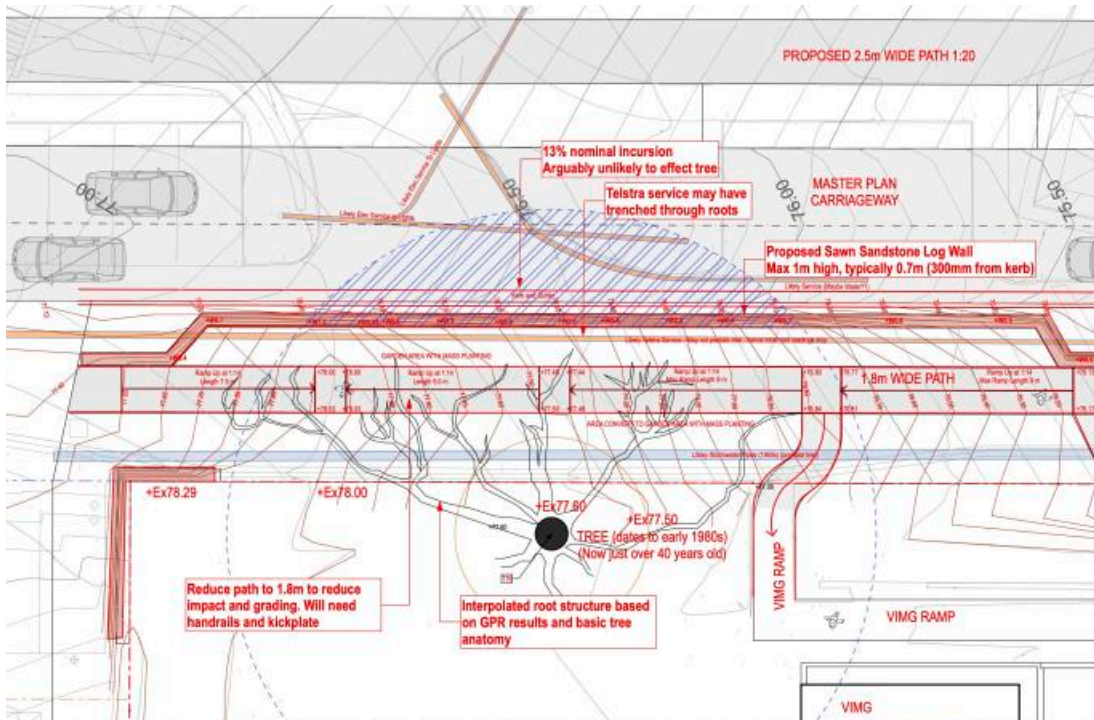


Figure 2.14 –Proposed design adjoining the Parkside site tree T76 *Eucalyptus saligna*. All efforts are being made and implemented to retain this tree. A series of 1:14 ramps are proposed to maintain the existing levels immediately north of the tree with the utilisation of a sandstone log retaining wall adjacent the proposed carriageway. The proposed roadway, though at a lower level, is not expected to adversely impact the health of the tree as no roots were found during the ground penetrating radar works in this location (Plan: Arterra 18/03/24)



Figure 2.15 –Illustrative render of proposed design highlighting the implementation of a retaining wall to maintain the existing levels to the north of the tree (Illustrative Render: Arterra)

**T25 *Liquidambar styraciflua* (Liquidambar) – Major Incursion of 11%**

This tree is a 'Moderate' retention value tree located to the north of the Parkside site on the north-eastern Parkside boundary. This tree is one part of a pair of *Liquidambar styraciflua* (Liquidambar) plantings growing in a relatively constrained environment, just south of the existing internal driveway. These trees provide significant established canopy and screening between the BaptistCare and Parkside sites. The pavement to the north of this tree is proposed to be sensitively removed with an additional garden bed installed with new soil, likely improving the ground conditions surrounding this tree. All proposed new pathways have been sensitively designed to be installed above existing levels with minimal surface impacts expected.

As part of the proposed works, a new internal road is proposed to the north of the tree. This road is proposed to be located a further 5.5m to the north from the pre-existing road alignment and its designed levels near to the existing levels. Though some root loss may be expected with the construction of this road, the impacts are considered tolerable and root investigations indicate that few roots, if any, exist in this location.

**T376 *Cupressus macrocarpa cv.* (Monterey Cypress) – Major Incursion of 14%**

This tree is a 'Moderate' retention value tree located outside of the site on the southeastern boundary. This tree is a relatively mature tree that provides established canopy and screening between the BaptistCare and adjoining Mooltan Avenue sites. The tree is currently growing adjacent an existing retaining wall on the adjoining property. The existing buildings and landscape structures to the west of this tree are proposed to be sensitively removed. The proposed new road and all proposed new pathways have been sensitively designed to be installed at or above existing levels. Though some root loss may be expected with the construction of this road, the impacts are considered tolerable.

## 2.7 Discussion on Height Compliant Scheme Tree Impacts

As part of the submission a height compliant scheme was developed to help justify the proposed design. We make the following comments regarding the arboricultural impacts of that scheme for reference and comparison.

Arterra have reviewed and assessed the height compliance scheme produced by BVN in relation to tree retention and removal. As a result of the additional proposed concept envelopes and likely landscape and stormwater regrading works, the height compliant scheme would be expected to impact upon the following trees and would require their removal:

- T70 (*Syncarpia glomulifera*)
- T71 (*Eucalyptus resinifera*), and
- T87 (*Corymbia maculata*)

No additional trees are likely to require removal across the site or its immediate surrounds beyond those already noted for the submitted scheme.

Trees T70 and T71 are large, endemic trees that have been identified as being part of an Endangered Ecological Community (EEC). They are environmentally significant and offer habitat value within the site. Tree T70 is a 'high' retention value tree and tree T71 is a 'moderate' retention value tree. These trees sit wholly within the proposed concept envelopes of the height compliant scheme and these trees would therefore require removal.

Tree T87 is a 'high' retention value tree that is large and visually prominent within the site. It has excellent form, good vigour and offers significant aesthetic and environmental value. This tree, though located outside the footprint of the proposed concept envelopes of the height compliant scheme, is likely to incur significant cumulative impacts to all sides of the tree from the proposed construction and excavation works. The building construction works to the west of the tree and the extensive regrading for new landscaping and stormwater infrastructure (there is no proposed creek in the compliant scheme, it will likely be a fully engineered underground solution) to the north, east and south of the tree are expected to result in a greater than 20% incursion within the nominal Tree Protection Zone (TPZ). Additionally, much of the canopy on the western side of the tree would require significant pruning given the offsets required for scaffolding and general building construction. The significant cumulative impacts make this tree unviable to be retained and we would recommend it be removed in such a height compliant scheme.

Compared to the proposed Master Plan the height compliant scheme results in the loss of three additional trees, all of which are significant, large and prominent specimens. Two of these are classified as part of an Endangered Ecological Community. This scheme is less desirable from an arboricultural perspective and tree retention.

## 2.8 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 inappropriate excavation for the building and services;
- Compaction of the root zone from storage or 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 zones from haul roads and the parking or use of vehicles/ plant equipment;
- Root disturbances from unauthorised 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;
- Physical damage from conflicts with piling rigs.

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

## 3.0 EXISTING TREE MANAGEMENT RECOMMENDATIONS

### 3.1 Key Recommendations to Reduce Tree Impacts

The following high-level recommendations are made to potentially reduce the negative construction impacts on the existing trees that have been identified to be retained. We note that this is a concept master plan SSDA submission and that it is expected that more detailed and updated tree impact assessments will be prepared and submitted as part of future detailed development applications for each sub-stage. The main recommendations that should be implemented at this conceptual stage are:

- Suitably **tag and/or distinctly mark** all existing trees to be retained, prior to any demolition work.
- Undertake all **initial demolition** work in a carefully controlled way and provide temporary barriers as required to protect existing trees to be retained while demolition is undertaken in other areas. Any demolition of existing residential buildings within 8m radius of a tree to be retained is to be monitored by a suitably qualified Project Consulting Arborist while this work is being undertaken. Temporary barricades and trunk protection may be required and shall be determined and directed by the Consulting Arborist in order to protect the tree adequately during demolition works. Refer to Section 3.3 for more detail regarding demolition work near trees. Site access and vehicle movement to be carefully defined to minimise ground disturbance and truck movements.
- Existing surrounding trees that are to be removed is to be done by qualified arboricultural staff only with care not to impact or damage other surrounding trees throughout the process. Existing stumps should be 'ground' out in a controlled fashion when within 8m radius of a tree to be retained. Stumps are to be ground when near the remaining trees to avoid the use of excavators and the like from grubbing out stumps, which may lead to damage of any intertwined roots.
- Appropriately fence all TPAs outside of the already noted incursions for the duration of all major site construction work. See Appendix 4.1 'Tree Plans' for the currently expected locations and extent.
- Carefully control and fence all access to and from various construction areas so that movement does not occur through any TPAs other than for the already identified building incursions.
- Ensure that any other work within the identified TPAs is carried out with appropriate skill and care to limit surface impacts. If roots greater than 50mm Ø are encountered, works shall immediately cease and direction sought from the project arborist before proceeding further.
- Ensure all the new above and below ground services are excluded from running through any TPAs beyond any already noted incursions.
- Minimise the re-grading of the ground surface within the identified TPAs, beyond the noted building incursions, in order to meet and match proposed pathways and other 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 or other suitable site topsoils. No excavation below existing levels shall typically be allowed.
- Mulching of specific TPAs as specified in Tree Plans. This will aid tree health with moisture retention, limit possible compaction from pedestrian traffic, and improve soil conditions within the TPAs.
- Avoid digging into existing root zones for the installation of any proposed landscaping around the trees and the installation sizes of new plants to be 5L or less to ensure that excavations are less than 200mm in depth. It is recommended to build up soil levels for any new planting areas, as above, to enable the new planting to occur without disturbing existing tree roots.
- Do not allow storage or stockpiling of any materials or site sheds within established TPAs unless it can be demonstrated that this will not impact on tree retention and it is specifically approved in writing by the Project Consulting Arborist.

### 3.2 Proposed Tree Protection & Construction Activity Sequencing

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

1. A detailed Tree Protection Specification & Tree Management Plan is to be prepared and issued as part of all subsequent Development Applications and construction contracts prior to any construction work.
2. The 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, craneage points, piling methods etc.).

3. Contractors are to discuss locations and type of any sediment and erosion controls (if any) and install them with minimal tree impact when within or passing through the TPA.
4. Existing pathways, fences, driveways, furniture and shrubs are to be carefully removed from within the TPA.
5. Existing surrounding trees are to be removed. Stumps are to be ground when near remaining trees to avoid the use of excavators and the like from grubbing out stumps, which may lead to damage of any intertwined roots.
6. Designated TPAs are to be mulched with 75mm of recycled hardwood woodchip mulch to improve soil conditions around tree and remain in place until future final landscaping.
7. Trunk protection to be placed on trees to be retained, where shown on the Tree Plans.
8. A utility Arborist is to undertake selective pruning of lower canopy or branches to facilitate construction of the buildings and provide pedestrian access clearances without accidental damage to the tree canopy. Pruning to be done in strict accordance with AS4373 - Pruning of Amenity Trees and performed by staff with appropriate qualifications and equipment.
9. The Construction Phase TPA is to be clearly 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 as shown on the Tree Plans. Any required rumble boards shall be installed to protect TPA areas where access is required.
10. Plywood (or similar) is to be placed under any scaffolds or pedestrian works paths when they are running through any identified TPAs.
11. Building works are to be completed (external).
12. Contractor to remove the TPA fencing and only then install final pathways and landscaping within the TPAs under the trees, but only after construction of the building exterior and all civil works are completed.

### 3.3 Demolition Work Near Trees or within TPAs

A Project Consulting Arborist shall be on site during all demolition work within the TPAs 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 TPAs or from protected areas within TPAs. They shall not encroach onto unprotected soil in TPAs.

Debris to be removed from TPA'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 TPA'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.

Excavation within TPA's shall typically not be allowed using mechanical equipment such as excavators or backhoes. Excavation within TPA'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 dry vacuum extraction shall be an appropriate alternative to hand digging and is the preferred method.

Any 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 preserved and worked around.

### 3.4 Tree Protection Fencing & Definition of TPAs

Establish a clearly defined tree protection zone as indicated in Appendix 4.1 'Tree Plans'. 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 at not more than 30m spacing. 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 TPAs

Great care will be need on this site when working around trees due to the pre-existing soil conditions. The soils that are conducive to tree root development are sometimes very shallow, noting the occasional outcropping of rock noted in portions of the site, and therefore root development may be extremely surface oriented and wide spreading, well past the trees canopy extents. The site is also underlain by heavy clays that will also be subject to serious compaction and waterlogging, if trafficked by vehicles and equipment without protection applied.

Vehicular movement and access shall typically not be required or approved through the TPAs. If it is absolutely necessary and it is proposed to create any access or haul road, or similar, within the TPA of a retained tree, the Contractor shall install rumble strips / boards over the designated TPA 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 3.1 – Example of acceptable Tree Protection Area ground protection (Photo: Arterra)

### 3.6 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 two to three 'rings' of 50mm diameter socked ag-line wrapped around tree trunk or branch and the ends cable tied to secure in place. A layer of battens is to be placed over and tight to the ag-lines. The battens are to have a maximum spacing of 50mm. The height of the battens is to be at least 2.4 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 battens in place with galvanised steel bracing straps. Do not nail or screw into or otherwise injure the trunk or bark. Battens may be made from any suitable waste timber of similar sizes and depths. All sharp or protruding edges are to be properly covered with tape or similar padding.



Figure 3.2 – Example of acceptable Trunk Protection batten installation. (Photo: Arterra)

### 3.7 Provision of Temporary Irrigation

At the sole discretion of the Project Consulting Arborist, a temporary and automated (battery powered timer is sufficient) watering system may need to be placed within some TPAs 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 its 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/or prolonged rain.

If required, the system is to remain in place for the duration of construction, or until the Project Consulting Arborist approves its removal. It may be removed to allow the 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 TPAs 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 direct and supervise any remaining selective pruning of any lower peripheral branches to the retained trees to achieve any clearances for final pedestrian or building 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 tree's 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 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 only with care not to impact or damage other surrounding trees throughout the process. Existing stumps should be grubbed out or ground in a controlled fashion to remove wood that may decay and promote unwanted pathogens.

#### Communication - Tool Box Meetings and Construction Inductions

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

### 3.11 References

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

- End of report.

## 4.0 APPENDICES

### 4.1 Tree Plans

**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. **"Nil" 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.

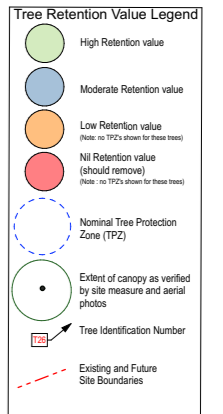
Consideration has also been given to the relationship of the trees to one another and their proximity to the likely development areas on the site. For example, trees that are part of a closely spaced group, or are likely to be significantly misshapen or unstable with the removal of surrounding trees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

**NOTE**

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



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B	For SSDA Submission	RWS	05/03/25
A	For SSDA Submission	RWS	26/10/22
REVISION	DESCRIPTION	CRWD	DATE

PROJECT & CLIENT  
**BaptistCare, Macquarie Park - Master Plan**

BaptistCare NSW & ACT  
 DRAWING TITLE  
**Tree Retention Value Plan**

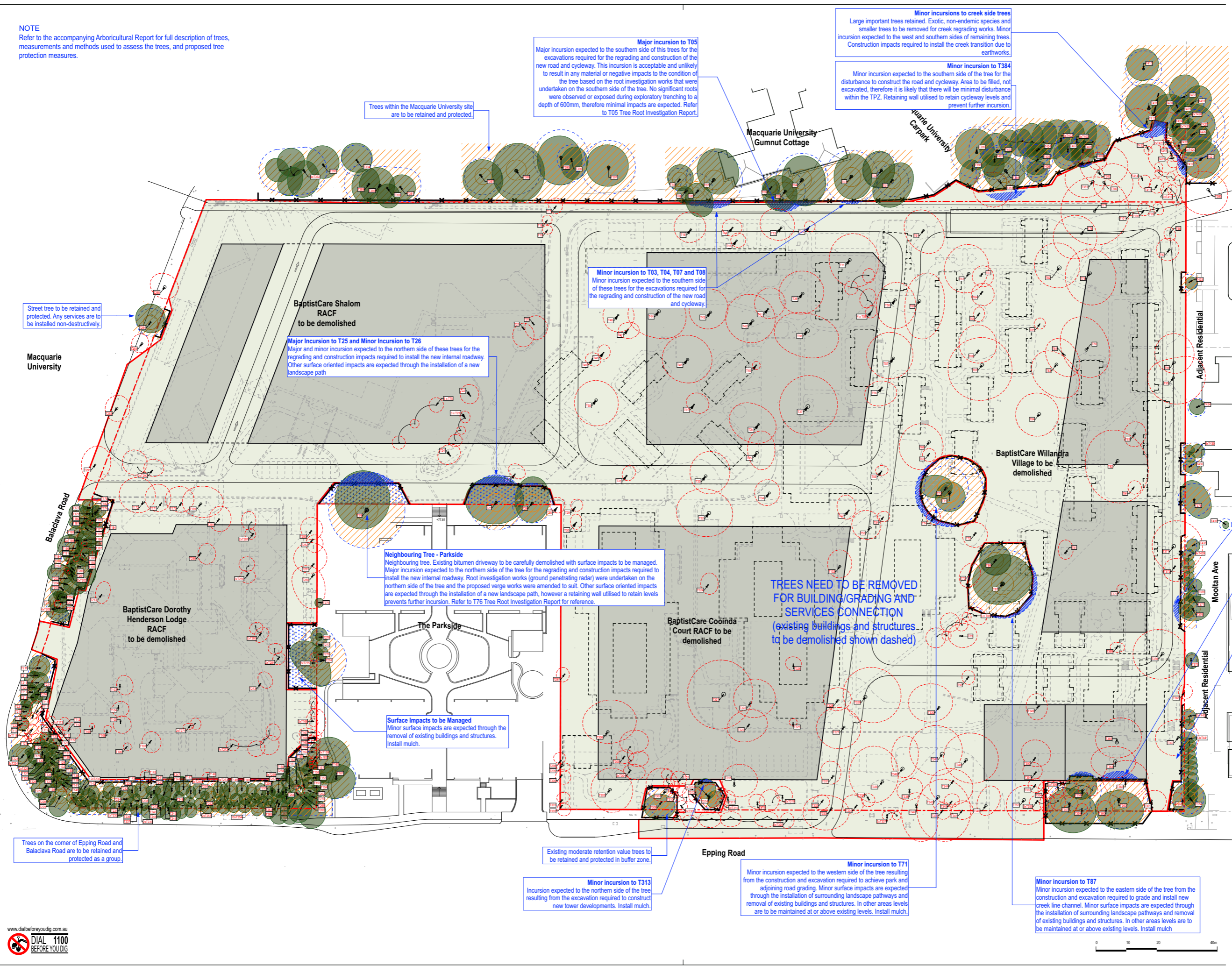
Project No : 21.39  
 Designed : CLB/RWS  
 Drawn : CLB/RWS  
 Scale : 1:400@A0 / NTS@A3

DRAWING NUMBER	REVISION
T-01	B

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

**Tree Impact and Protection Plan Legend**

- Boundary
- Existing Tree Retained (Extent of canopy as verified by site measure and aerial photos)
- Existing Tree Removed (Refer to TPO sheet for these trees)
- Tree Identification Number
- Construction Period Tree Protection Area - consolidated area
- Tree Protection Area Temporary Fencing
- 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
- Proposed Buildings
- Existing building to be demolished
- Extent of ground modification and disturbance



**Major incursion to T376**  
Major incursion noted to the western side of the tree for the disturbance to construct the new road. However, area is expected to be filled, not excavated and is considered acceptable.

**Minor incursion to T363 & T358**  
Minor incursions expected to the northern side of these trees resulting from the excavation required to construct the basement of the new building. Upper building levels are subject to detailed design and are to be offset from these trees to ensure they are appropriately retained and protected. Install mulch.

**Eastern Boundary**  
All proposed works (including vehicle access ramp) are to be set back from the eastern boundary a minimum of 1m to allow for the protection of the neighbouring trees.

B	For SSDA Submission	RWS	05/03/25
A	For SSDA Submission	RWS	26/10/22
REVISION	DESCRIPTION	CRW	DATE

**PROJECT & CLIENT**  
BaptistCare, Macquarie Park - Master Plan

**DRAWING TITLE**  
Master Plan-Tree Protection and Removal Plan

**PROJECT NO** : 21.39  
**DESIGNED** : CLB/RWS  
**DRAWN** : CLB/RWS  
**SCALE** : 1:400@A0 / NTS@A3

**DRAWING NUMBER**  
T-03



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## 4.2 Tree Impact Assessment Schedule

**BaptistCare, Macquarie Park - Tree Assessment Schedule**

Tree ID	Trees in Group	Tree Species	Common Name	Height (m)	Spread Average (m)	Trunk Diameter Breast Height (dbh) (m)	Trunk Diameter at base (dgl) (m)	Nominal TPZ radius (m) 12dbh (AS 4970)	Nominal SRZ radius (m) (AS 4970)	Age Class	Current Vigour	Current Form	Tree Origin	Noted Defects	SULE Rating	Retention Value	General Comments and Notes	Incursion and Impact	Recommendation
1	1	<i>Eucalyptus grandis</i>	Flooded Gum	22.0	11.0	0.44	0.63	5.28	2.73	Mature	Good	Average	Native	Deadwood-Minor	Long (>40 years)	High	Neighbouring property tree.	Nil impacts expected.	Retain
2	1	<i>Eucalyptus grandis</i>	Flooded Gum	25.0	9.0	0.49	0.79	5.88	3.00	Mature	Good	Average	Native	Deadwood-Minor	Long (>40 years)	High	Neighbouring property tree.	Nil impacts expected.	Retain
3	1	<i>Eucalyptus grandis</i>	Flooded Gum	24.0	11.0	0.74	0.93	8.88	3.21	Mature	Excellent	Excellent	Native	Deadwood-Minor	Long (>40 years)	High	Neighbouring property tree.	Minor incursion of 2% expected to the southern side of the tree for the regrading and construction impacts required to install the new internal cycleway.	Retain
4	1	<i>Corymbia maculata</i>	Spotted Gum	19.5	12.0	0.72	0.94	8.64	3.22	Mature	Good	Average	Native	Deadwood-Minor	Long (>40 years)	Moderate	Neighbouring property tree.	Minor incursion of 4% expected to the southern side of the tree for the regrading and construction impacts required to install the new internal cycleway and roadway. It is, however, the author's opinion that this incursion is acceptable and unlikely to result in any material or negative impacts to the condition of the tree based on the root investigation works that were undertaken on the southern side of the tree. No significant roots were observed or exposed during the exploratory trenching, therefore minimal impacts are expected.	Retain
5	1	<i>Corymbia maculata</i>	Spotted Gum	17.0	9.0	0.57	0.73	6.84	2.90	Mature	Fair	Average	Native	Very Asymmetric Form, Deadwood-Minor	Long (>40 years)	Moderate	Neighbouring property tree. Asymmetric canopy to east.	Major incursion of 20% expected to the southern side of the tree for the regrading and construction impacts required to install the new internal cycleway and roadway. It is, however, the author's opinion that this incursion is acceptable and unlikely to result in any material or negative impacts to the condition of the tree based on the root investigation works that were undertaken on the southern side of the tree. No significant roots were observed or exposed during the exploratory trenching, therefore minimal impacts are expected.	Retain
6	1	<i>Syzygium paniculatum</i>	Magenta Cherry	6.0	6.0	0.22	0.30	2.64	2.00	Mature	Good	Average	Native		Long (>40 years)	High	Neighbouring property tree.	Nil impacts expected.	Retain
7	1	<i>Corymbia maculata</i>	Spotted Gum	23.0	12.0	0.78	0.96	9.36	3.25	Mature	Good	Average	Native	Deadwood-Minor	Long (>40 years)	High	Neighbouring property tree. Growing adjacent to significant level change to east.	Minor incursion of 7% expected to the southern side of the tree for the regrading and construction impacts required to install the new internal cycleway.	Retain
8	1	<i>Corymbia maculata</i>	Spotted Gum	17.5	9.0	0.45	0.60	5.40	2.67	Mature	Fair	Average	Native	Very Asymmetric Form, Deadwood-Minor	Long (>40 years)	Moderate	Neighbouring property tree.	Minor incursion of 9% expected to the southern side of the tree for the regrading and construction impacts required to install the new internal cycleway.	Retain
9	1	<i>Corymbia maculata</i>	Spotted Gum	3.0	3.0	0.61	0.79	7.32	3.00	Mature	Poor	Poor	Native	Epicormic Growth, Decay-Minor, Tip Dieback, Major Wounding	Short (5-15 years)	Low	Neighbouring property tree. Previous mature tree completely lopped at 2.0m above ground. Poor quality epicormic regrowth evident only. Impacts to tree now largely irrelevant.	Nil impacts expected.	Retain
10	1	<i>Corymbia maculata</i>	Spotted Gum	8.0	6.0	0.31	0.45	3.72	2.37	Semi-mature	Fair	Average	Native	Co-dominant Stems, Deadwood-Minor	Long (>40 years)	Moderate	Neighbouring property tree. Tri-dominant stems from base.	Nil impacts expected.	Retain
11	1	<i>Liquidambar styraciflua</i>	Liquidambar	17.0	15.0	0.83	0.93	9.96	3.21	Mature	Excellent	Average	Exotic		Long (>40 years)	Moderate		Within footprint of works.	Remove
12	1	<i>Prunus carasifera 'Nigra'</i>	Purple-leaved Cherry-plum	6.0	4.0	0.13	0.16	2.00	1.53	Mature	Poor	Average	Exotic		Short (5-15 years)	Low	Very sparse canopy.	Within footprint of works.	Remove
13	1	<i>Jacaranda mimosifolia</i>	Jacaranda	12.0	9.0	0.54	0.62	6.48	2.71	Mature	Fair	Average	Exotic	Epicormic Growth	Medium (15-40 years)	Moderate		Within footprint of works.	Remove
14	1	<i>Callistemon viminalis cv.</i>	Weeping Bottlebrush	6.0	5.0	0.31	0.42	3.72	2.30	Mature	Good	Average	Native	Co-dominant Stems	Medium (15-40 years)	Low		Within footprint of works.	Remove
15	1	<i>Tibouchina lepidota</i>	Lasiandra	6.0	6.0	0.35	0.50	4.20	2.47	Mature	Fair	Average	Exotic	Epicormic Growth, Deadwood-Major	Medium (15-40 years)	Low		Within footprint of works.	Remove
16	1	<i>Lophostemon confertus</i>	Brush Box	12.0	9.0	0.55	0.58	6.60	2.63	Mature	Good	Average	Native	Epicormic Growth	Long (>40 years)	Moderate	Tree appears to have been historically topped at 3m.	Within footprint of works.	Remove
17	1	<i>Magnolia grandiflora</i>	American Bull Bay Magnolia	5.0	3.0	0.15	0.23	2.00	1.79	Mature	Good	Excellent	Exotic		Long (>40 years)	Moderate	Small tree.	Within footprint of works.	Remove
18	1	<i>Elaeocarpus reticulatus</i>	Blueberry Ash	7.5	2.0	0.12	0.14	2.00	1.45	Mature	Fair	Average	Endemic		Medium (15-40 years)	Low		Within footprint of works.	Remove
19	1	<i>Elaeocarpus reticulatus</i>	Blueberry Ash	7.5	2.0	0.11	0.13	2.00	1.40	Mature	Fair	Average	Endemic		Medium (15-40 years)	Low		Within footprint of works.	Remove
20	1	<i>Jacaranda mimosifolia</i>	Jacaranda	8.0	7.0	0.27	0.34	3.24	2.10	Mature	Fair	Poor	Exotic	Very Asymmetric Form, Root Impacts, Lean-Major	Medium (15-40 years)	Low	Leaning and significant surface roots visible, particularly on tension side.	Within footprint of works.	Remove
21	1	<i>Jacaranda mimosifolia</i>	Jacaranda	9.5	8.0	0.30	0.34	3.60	2.10	Mature	Fair	Average	Exotic	Root Impacts	Medium (15-40 years)	Moderate	Significant root flare and visible roots around base. Very close to adjoining pits.	Within footprint of works.	Remove
22	1	<i>Jacaranda mimosifolia</i>	Jacaranda	8.0	7.0	0.23	0.29	2.76	1.97	Mature	Good	Average	Exotic	Co-dominant Stems, Inclusions	Long (>40 years)	Moderate		Within footprint of works.	Remove
23	3	<i>Jacaranda mimosifolia</i>	Jacaranda	4.5	3.0	0.13	0.15	2.00	1.49	Semi-mature	Fair	Average	Exotic		Medium (15-40 years)	Low	Still relatively small trees.	Within footprint of works.	Remove
24	1	<i>Jacaranda mimosifolia</i>	Jacaranda	7.5	7.0	0.25	0.31	3.00	2.02	Mature	Good	Average	Exotic		Long (>40 years)	Moderate	Growing in constrained environment between base of retaining wall, path and pump room.	Within footprint of works.	Remove
25	1	<i>Liquidambar styraciflua</i>	Liquidambar	12.5	16.0	0.76	0.76	9.12	2.95	Mature	Good	Average	Exotic	Co-dominant Stems, Inclusions, Root Impacts	Long (>40 years)	Moderate	Growing in very constrained location and directly adjacent and impacting roadway.	Major incursion of 11% expected to the northern side of the tree for the regrading and construction impacts required to install the new internal roadway. It is, however, the author's opinion that this incursion is acceptable and unlikely to result in any material or negative impacts to the condition of the tree based on the levels of the proposed road being the same as the existing internal driveway. The alignment of the proposed internal road is further north than the existing road alignment, allow for the installation of new topsoil within the TPZ which would likely help to improve the health of the tree.	Retain
26	1	<i>Liquidambar styraciflua</i>	Liquidambar	13.5	10.0	0.55	0.75	6.60	2.93	Mature	Good	Average	Exotic		Long (>40 years)	Moderate	Growing in very constrained location and directly adjacent and impacting roadway.	Minor incursion of 3% expected to the northern side of the tree for the regrading and construction impacts required to install the new internal roadway. It is, however, the author's opinion that this incursion is acceptable and unlikely to result in any material or negative impacts to the condition of the tree based on the levels of the proposed road being the same as the existing internal driveway. The alignment of the proposed internal road is further north than the existing road alignment, allow for the installation of new topsoil within the TPZ which would likely help to improve the health of the tree.	Retain
27	1	<i>Acer negundo</i>	Box Elder	6.0	5.0	0.21	0.26	2.52	1.88	Mature	Fair	Poor	Exotic	Co-dominant Stems, Decay-Major, Deadwood-Major	Remove (<5 years)	Nil / Remove	Extensive decay and dysfunction at primary junction.	Within footprint of works. Poor quality tree.	Remove
28	1	<i>Callistemon viminalis cv.</i>	Weeping Bottlebrush	6.5	4.0	0.14	0.20	2.00	1.68	Mature	Fair	Average	Native		Medium (15-40 years)	Low		Within footprint of works.	Remove
29	1	<i>Thuja orientalis cv.</i>	Chinese Arborvitae	6.0	3.0	0.28	0.30	3.36	2.00	Mature	Good	Excellent	Exotic		Long (>40 years)	Moderate		Within footprint of works.	Remove
30	1	<i>Plumeria rubra</i>	Frangipani	6.0	4.0	0.21	0.28	2.52	1.94	Mature	Fair	Poor	Exotic	Root Impacts, Decay-Minor, Tip Dieback	Medium (15-40 years)	Low	Prominent butt sweep and growing out over adjoining revetment wall.	Within footprint of works.	Remove
31	1	<i>Cryptomeria japonica cv.</i>	Japanese Cedar	9.0	7.0	0.37	0.45	4.44	2.37	Mature	Good	Average	Exotic		Medium (15-40 years)	Moderate	Two low lying branches to the east, now forming almost separate tree form.	Within footprint of works.	Remove
32	1	<i>Eucalyptus microcorys</i>	Tallowood	18.0	15.0	1.07	1.16	12.84	3.52	Mature	Fair	Average	Native	Co-dominant Stems, Congested Branches	Long (>40 years)	Moderate	Highly fluted trunk with very congested branching structure at 2.5 forming multiple trunks. Growing in constrained environment between driveways.	Within footprint of works.	Remove
33	1	<i>Lophostemon confertus</i>	Brush Box	14.0	10.0	0.67	0.89	8.04	3.15	Mature	Fair	Average	Native	Deadwood-Minor	Long (>40 years)	Moderate		Within footprint of works.	Remove
34	1	<i>Cupressus torulosa</i>	Bhutan Cypress	16.0	5.0	0.68	0.73	8.16	2.90	Mature	Excellent	Excellent	Exotic		Long (>40 years)	Moderate		Within footprint of works.	Remove
35	1	<i>Ulmus glabra 'Lutescens'</i>	Golden Elm	10.0	10.0	0.75	0.96	9.00	3.25	Mature	Fair	Average	Exotic	Tip Dieback, Decay-Major, Cavity, Inclusions, Epicormic Growth	Short (5-15 years)	Low	Soundings and visible cavities indicate decay within lower trunk. Extensive canopy dieback to northern side.	Within footprint of works.	Remove
36	1	<i>Jacaranda mimosifolia</i>	Jacaranda	9.5	11.0	0.50	0.60	6.00	2.67	Mature	Fair	Average	Exotic	Co-dominant Stems	Medium (15-40 years)	Moderate		Within footprint of works.	Remove
37	1	<i>Cinnamomum camphora</i>	Camphor Laurel	16.0	16.0	1.27	1.27	15.00	3.66	Mature	Fair	Average	Invasive	Co-dominant Stems	Medium (15-40 years)	Moderate	Sparse canopy and extensively pruned in lower canopy. One of the older trees on the site.	Within footprint of works.	Remove

Tree ID	Trees in Group	Tree Species	Common Name	Height (m)	Spread Average (m)	Trunk Diameter Breast Height (dbh) (m)	Trunk Diameter at base (dg) (m)	Nominal TPZ radius (m) 12xdbh (AS 4970)	Nominal SRZ radius (m) (AS 4970)	Age Class	Current Vigour	Current Form	Tree Origin	Noted Defects	SULE Rating	Retention Value	General Comments and Notes	Incursion and Impact	Recommendation
38	1	<i>Cinnamomum camphora</i>	Camphor Laurel	15.5	14.0	1.25	1.40	15.00	3.81	Mature	Fair	Average	Invasive	Tip Dieback	Medium (15-40 years)	Moderate	Sparse canopy and extensively pruned in lower canopy. Wire embedment to northern trunk. One of the older trees on the site.	Within footprint of works.	Remove
39	1	<i>Ulmus minor 'Variegata'</i>	Smooth-leaved Elm	19.0	13.0	0.89	0.93	10.68	3.21	Mature	Good	Excellent	Exotic	Epicormic Growth	Medium (15-40 years)	High	Very good and prominent tree. Prominent surface roots visible. Cooler climate tree, relatively uncommon in Sydney in such good condition.	Within footprint of works.	Remove
40	1	<i>Cupressus sempervirens 'Swanes Golden'</i>	Swanes Golden Pencil Pine	8.0	1.0	0.24	0.34	2.88	2.10	Mature	Fair	Average	Exotic		Medium (15-40 years)	Low		Within footprint of works.	Remove
41	1	<i>Angophora costata</i>	Smooth-barked Apple	15.0	8.0	0.43	0.56	5.16	2.59	Mature	Poor	Average	Endemic	Tip Dieback, Deadwood-Minor	Short (5-15 years)	Low	Generally poor condition. Extensive trunk wounding at 4.0m to east.	Within footprint of works.	Remove
42	1	<i>Lophostemon confertus</i>	Brush Box	14.5	11.0	0.75	0.80	9.00	3.01	Mature	Fair	Average	Native		Long (>40 years)	Moderate	Relatively sparse canopy.	Within footprint of works.	Remove
43	1	<i>Syzygium paniculatum</i>	Magenta Cherry	14.5	10.0	0.73	0.80	8.76	3.01	Mature	Good	Excellent	Native		Long (>40 years)	High	Very good tree in good condition.	Within footprint of works.	Remove
44	1	<i>Ulmus glabra 'Lutescens'</i>	Golden Elm	11.0	12.0	0.83	1.07	9.96	3.40	Mature	Good	Poor	Exotic	Co-dominant Stems, Inclusions, Deadwood-Minor, Decay-Minor, Cavity, Root Impacts	Medium (15-40 years)	Moderate	Potentially infected with slime flux bacteria due to small area of exudate at included branch union in lower trunk, otherwise prominent and wide spreading shade tree.	Within footprint of works.	Remove
45	1	<i>Cedrus deodara</i>	Himalayan Cedar	14.5	11.0	0.68	0.82	8.16	3.04	Mature	Good	Excellent	Exotic		Long (>40 years)	High	Prominent root visible at surface surrounding tree.	Within footprint of works.	Remove
46	1	<i>Jacaranda mimosifolia</i>	Jacaranda	8.5	8.0	0.35	0.52	4.20	2.51	Mature	Fair	Average	Exotic	Root Impacts, Co-dominant Stems	Medium (15-40 years)	Moderate	Tridominant trunks from base. Major root visible near surface to south of tree.	Within footprint of works.	Remove
47	1	<i>Michelia figo</i>	Port-Wine Magnolia	4.5	5.0	0.25	0.42	3.00	2.30	Mature	Fair	Average	Exotic	Co-dominant Stems	Medium (15-40 years)	Low	Multi-trunked from base.	Within footprint of works.	Remove
48	1	<i>Magnolia grandiflora</i>	American Bull Bay Magnolia	6.0	4.0	0.23	0.29	2.76	1.97	Over-mature	Poor	Average	Exotic	Tip Dieback, Root Impacts, Decay-Minor	Short (5-15 years)	Low	Sparse canopy and die back noted. Minor decay at site of old pruning wounds.	Within footprint of works.	Remove
49	1	<i>Viburnum tinus</i>	Laurustinus	5.0	4.0	0.40	0.70	4.80	2.85	Mature	Good	Average	Exotic	Co-dominant Stems	Medium (15-40 years)	Low	Multitrunked from base.	Within footprint of works.	Remove
50	1	<i>Afrocarpus falcatus</i>	Outeniqua Yellow-wood	10.5	11.0	0.81	0.90	9.72	3.17	Mature	Fair	Excellent	Exotic	Root Impacts	Medium (15-40 years)	Moderate	Extensive surface roots noted. Relatively sparse canopy for species.	Within footprint of works.	Remove
51	1	<i>Jacaranda mimosifolia</i>	Jacaranda	8.0	6.0	0.26	0.37	3.12	2.18	Mature	Fair	Average	Exotic		Medium (15-40 years)	Low		Within footprint of works.	Remove
52	1	<i>Sapium sebiferum</i>	Chinese Tallow Tree	8.5	7.0	0.33	0.41	3.96	2.28	Mature	Fair	Average	Exotic	Deadwood-Minor, Root Impacts	Medium (15-40 years)	Moderate	Large surface roots visible. Growing in close proximity to retaining wall to north.	Within footprint of works.	Remove
53	1	<i>Cupressus torulosa</i>	Bhutan Cypress	14.5	6.0	0.75	0.80	9.00	3.01	Mature	Good	Average	Exotic	Very Asymmetric Form	Long (>40 years)	Moderate	Asymmetric canopy to west.	Within footprint of works.	Remove
54	1	<i>Syzygium luehmanni</i>	Small Leaf Lilly Pilly	7.5	4.0	0.18	0.22	2.16	1.75	Mature	Poor	Average	Native	Co-dominant Stems	Short (5-15 years)	Low	Very sparse canopy.	Within footprint of works.	Remove
55	1	<i>Prunus sp.</i>	Plum	6.0	3.0	0.17	0.20	2.04	1.68	Mature	Fair	Average	Exotic	Decay-Minor	Short (5-15 years)	Low	Standardise form. Fungal fruiting bodies and minor decay at primary branch junctions.	Within footprint of works.	Remove
56	1	<i>Jacaranda mimosifolia</i>	Jacaranda	10.5	10.0	0.49	0.52	5.88	2.51	Mature	Fair	Average	Exotic	Epicormic Growth, Decay-Minor, Co-dominant Stems	Medium (15-40 years)	Moderate	Minor decay at old pruning sites.	Within footprint of works.	Remove
57	1	<i>Liquidambar styraciflua</i>	Liquidambar	17.0	14.0	0.64	0.80	7.68	3.01	Mature	Good	Average	Exotic		Long (>40 years)	Moderate	Extensive basal root flare, shallow root system surrounding tree.	Within footprint of works.	Remove
58	1	<i>Liquidambar styraciflua</i>	Liquidambar	18.0	13.0	0.68	0.83	8.16	3.06	Mature	Good	Average	Exotic		Long (>40 years)	Moderate		Within footprint of works.	Remove
59	4	<i>Callistemon citrinus cv.</i>	Crimson Bottlebrush	8.0	5.0	0.20	0.24	2.40	1.82	Over-mature	Fair	Average	Native	Co-dominant Stems, Inclusions, Tip Dieback	Short (5-15 years)	Low	Group of 4 specimens. Generally sparse canopies.	Within footprint of works.	Remove
60	1	<i>Liquidambar styraciflua</i>	Liquidambar	17.0	13.0	0.66	0.92	7.92	3.20	Mature	Good	Average	Exotic		Long (>40 years)	Moderate	Clearance pruning and thinning undertaken.	Within footprint of works.	Remove
61	1	<i>Ulmus procera</i>	English Elm	9.5	10.0	0.50	0.61	6.00	2.69	Mature	Fair	Average	Exotic	Co-dominant Stems	Medium (15-40 years)	Moderate		Within footprint of works.	Remove
62	1	<i>Corymbia citriodora</i>	Lemon Scented Gum	18.5	12.0	0.68	0.88	8.16	3.14	Mature	Good	Average	Native		Long (>40 years)	High	Fungal fruiting body at base, otherwise good and prominent tree.	Within footprint of works.	Remove
63	1	<i>Araucaria heterophylla</i>	Norfolk Island Pine	17.0	10.0	0.48	0.61	5.76	2.69	Mature	Good	Average	Exotic		Long (>40 years)	Moderate	Growing under and into the canopy of adjoining Lemon-scented Gum.	Within footprint of works.	Remove
64	1	<i>Jacaranda mimosifolia</i>	Jacaranda	9.5	10.0	0.31	0.44	3.72	2.34	Mature	Good	Average	Exotic		Long (>40 years)	Moderate		Within footprint of works.	Remove
65	1	<i>Malus sp. Hybrid cv.</i>	Crabapple	5.0	6.0	0.25	0.40	3.00	2.25	Mature	Good	Average	Exotic	Co-dominant Stems	Medium (15-40 years)	Low	Heavily pruned.	Within footprint of works.	Remove
66	1	<i>Jacaranda mimosifolia</i>	Jacaranda	12.5	12.0	0.40	0.53	4.80	2.53	Mature	Good	Average	Exotic	Co-dominant Stems	Long (>40 years)	Moderate		Within footprint of works.	Remove
67	1	<i>Liquidambar styraciflua</i>	Liquidambar	17.0	15.0	0.83	1.03	9.96	3.35	Mature	Good	Average	Exotic		Long (>40 years)	Moderate	Nest box within tree.	Within footprint of works.	Remove
68	1	<i>Acacia melanoxylon</i>	Blackwood	12.0	12.0	0.74	0.85	8.88	3.09	Mature	Good	Average	Native		Medium (15-40 years)	Moderate		Within footprint of works.	Remove
69	1	<i>Stenocarpus sinuatus</i>	Queensland Firewheel Tree	6.0	4.0	0.19	0.27	2.28	1.91	Mature	Good	Average	Native	Co-dominant Stems	Medium (15-40 years)	Moderate		Within footprint of works.	Remove
70	1	<i>Syncarpia glomulifera</i>	Turpentine	10.0	9.0	0.61	0.76	7.32	2.95	Mature	Good	Average	Endemic	Very Asymmetric Form	Long (>40 years)	High	Asymmetric to north.	NI impacts expected. Only some minor filling and topping up of top soil expected within the TPZ.	Retain
71	1	<i>Eucalyptus resinifera</i>	Red Mahogany	9.5	10.0	0.94	1.02	11.28	3.34	Mature	Fair	Average	Endemic	Tip Dieback, Epicormic Growth	Medium (15-40 years)	Moderate	Extensive tip dieback and epicormic growth.	Minor incursion of 9% expected to the western side of the tree resulting from the construction and excavation required to install new feature retaining wall. Minor surface impacts are expected through the installation of surrounding landscape pathways and removal of existing buildings and structures. In other areas levels are to be maintained at or above existing levels.	Retain
72	1	<i>Tibouchina lepidota</i>	Lasiandra	9.5	10.0	0.40	0.52	4.80	2.51	Mature	Good	Average	Exotic		Medium (15-40 years)	Moderate		Within footprint of works.	Remove
73	1	<i>Magnolia x soulangeana</i>	Magnolia	9.5	10.0	0.30	0.43	3.60	2.32	Mature	Good	Excellent	Exotic		Medium (15-40 years)	Moderate		Within footprint of works.	Remove
74	1	<i>Stenocarpus sinuatus</i>	Queensland Firewheel Tree	8.5	5.0	0.24	0.31	2.88	2.02	Mature	Good	Average	Native		Medium (15-40 years)	Moderate		Within footprint of works.	Remove
75	3	<i>Angophora costata</i>	Smooth-barked Apple	7.5	4.0	0.18	0.22	2.16	1.75	Semi-mature	Fair	Average	Endemic		Long (>40 years)	Low	Group of three. Largest one measured and in better condition than other two.	Within footprint of works.	Remove
76	1	<i>Eucalyptus saligna</i>	Sydney Blue Gum	9.5	10.0	1.05	1.35	12.60	3.75	Mature	Good	Average	Endemic		Long (>40 years)	Moderate	Tree on neighbouring property. Significant borer blaze to 60% of trunk circumference from ground level to 3m high on southern (tower development side). Notably thinning canopy. Trunk base level with adjoining roadway, if not slightly higher. Tree likely to have been impacted by current tower construction. Tree protection zone and fencing appears to have been potentially inadequate on southern side.	Neighbouring tree. Existing bitumen driveway to be carefully demolished with surface impacts to be managed. Major incursion of 12% expected to the northern side of the tree for the regrading and construction impacts required to install the new internal roadway. It is, however, the author's opinion that this incursion is acceptable and unlikely to result in any material or negative impacts to the condition of the tree based on the root investigation works (ground penetrating radar) that were undertaken on the northern side of the tree. Proposed verge works have been amended to suit and therefore minimal impacts are expected.	Retain
77	1	<i>Corymbia citriodora</i>	Lemon Scented Gum	18.0	10.0	0.57	0.76	6.84	2.95	Mature	Good	Average	Native		Long (>40 years)	Moderate		Within footprint of works.	Remove
78	1	<i>Corymbia citriodora</i>	Lemon Scented Gum	17.0	10.0	0.48	0.60	5.76	2.67	Mature	Good	Average	Native	Major Wounding	Long (>40 years)	Moderate	Wound to trunk at 1m above ground to west. Slightly sparse canopy.	Within footprint of works.	Remove
79	1	<i>Liquidambar styraciflua</i>	Liquidambar	18.5	12.0	0.78	0.91	9.36	3.18	Mature	Good	Average	Exotic		Long (>40 years)	Moderate		Within footprint of works.	Remove
80	1	<i>Liquidambar styraciflua</i>	Liquidambar	18.5	12.0	0.71	0.91	8.52	3.18	Mature	Good	Average	Exotic		Long (>40 years)	Moderate		Within footprint of works.	Remove
81	1	<i>Liquidambar styraciflua</i>	Liquidambar	18.5	12.0	0.52	0.65	6.24	2.76	Mature	Good	Average	Exotic	Epicormic Growth, Very Asymmetric Form	Long (>40 years)	Moderate		Within footprint of works.	Remove
82	1	<i>Populus deltoides</i>	American Cottonwood	23.5	12.0	1.08	1.26	12.96	3.65	Mature	Good	Average	Exotic	Co-dominant Stems, Epicormic Growth, Tip Dieback	Medium (15-40 years)	Moderate	Significantly crown raised.	Within footprint of works.	Remove
83	1	<i>Populus deltoides</i>	American Cottonwood	22.0	12.0	0.84	0.95	10.08	3.24	Mature	Good	Average	Exotic	Tip Dieback, Decay-Minor, Epicormic Growth	Medium (15-40 years)	Moderate		Within footprint of works.	Remove

Tree ID	Trees in Group	Tree Species	Common Name	Height (m)	Spread Average (m)	Trunk Diameter Breast Height (dbh) (m)	Trunk Diameter at base (dg) (m)	Nominal TPZ radius (m) 12xdbh (AS 4970)	Nominal SRZ radius (m) (AS 4970)	Age Class	Current Vigour	Current Form	Tree Origin	Noted Defects	SULE Rating	Retention Value	General Comments and Notes	Incursion and Impact	Recommendation
84	1	<i>Populus deltoides</i>	American Cottonwood	22.0	12.0	0.92	0.98	11.04	3.28	Mature	Good	Average	Exotic	Co-dominant Stems, Epicormic Growth, Tip Dieback, Root Impacts	Medium (15-40 years)	Moderate	Extensive root system visible with mower scalping.	Within footprint of works.	Remove
85	1	<i>Malus sp. Hybrid cv.</i>	Crabapple	6.0	6.0	0.15	0.19	2.00	1.65	Mature	Fair	Average	Exotic		Medium (15-40 years)	Low		Within footprint of works.	Remove
86	1	<i>Sapium sebiferum</i>	Chinese Tallow Tree	10.5	9.0	0.41	0.56	4.92	2.59	Mature	Good	Excellent	Exotic		Long (>40 years)	Moderate		Nil impacts expected. Only some minor filling and topping up of top soil expected within the TPZ.	Retain
87	1	<i>Corymbia maculata</i>	Spotted Gum	18.5	12.0	0.95	1.25	11.40	3.63	Mature	Good	Excellent	Native		Long (>40 years)	High	Large and visually prominent tree, worthy of extensive attempts to retain and protect.	Minor incursion of 7% expected to the eastern side of the tree. The eastern side impacts result from the construction and excavation required to grade and install new creek line channel. Minor surface impacts are expected through the installation of surrounding landscape pathways and removal of existing buildings and structures. In other areas levels are to be maintained at or above existing levels.	Retain
88	6	<i>Acmena smithii</i>	Lilly Pilly	18.5	12.0	0.33	0.33	3.96	2.08	Mature	Fair	Average	Native	Co-dominant Stems	Long (>40 years)	Moderate	Group of six trees closely planted. Moderate rating as a group, individually low. Smaller specimens somewhat suppressed.	Within footprint of works.	Remove
89	1	<i>Pittosporum undulatum</i>	Sweet Pittosporum	12.0	10.0	0.44	0.54	5.28	2.55	Mature	Fair	Average	Endemic	Co-dominant Stems	Medium (15-40 years)	Low		Within footprint of works.	Remove
90	1	<i>Ceratopetalum gummiferum</i>	New South Wales Christmas Bush	9.5	3.0	0.28	0.39	3.36	2.23	Mature	Good	Average	Endemic	Co-dominant Stems	Medium (15-40 years)	Moderate		Within footprint of works.	Remove
91	1	<i>Tibouchina lepidota</i>	Lasiandra	6.5	6.0	0.44	0.55	5.28	2.57	Over-mature	Poor	Average	Exotic	Co-dominant Stems, Deadwood-Major, Tip Dieback, Epicormic Growth	Medium (15-40 years)	Low	Extensive deadwood and dieback in parts of canopy.	Within footprint of works.	Remove
92	1	<i>Liquidambar styraciflua</i>	Liquidambar	15.5	16.0	0.86	0.96	10.32	3.25	Mature	Good	Average	Exotic	Branch Tearouts	Long (>40 years)	Moderate	Very large and spreading tree producing excellent canopy cover and shade.	Within footprint of works.	Remove
93	1	<i>Tibouchina lepidota</i>	Lasiandra	5.0	12.0	0.40	0.65	4.80	2.76	Mature	Good	Poor	Exotic	Co-dominant Stems, Epicormic Growth	Medium (15-40 years)	Low	Tree historically topped at 4m. Extensive epicormic growth.	Within footprint of works.	Remove
94	1	<i>Robinia pseudoacacia 'Frisia'</i>	Golden Robinia	5.0	4.0	0.19	0.19	2.28	1.65	Mature	Fair	Poor	Exotic	Decay-Minor, Major Wounding, Epicormic Growth	Short (5-15 years)	Nil / Remove	Tree historically topped at 2.5m	Within footprint of works. Poor quality tree. Recommend removal.	Remove
95	1	<i>Jacaranda mimosifolia</i>	Jacaranda	16.5	12.0	0.88	0.80	10.56	3.01	Mature	Good	Average	Exotic	Co-dominant Stems, Branch Tearouts, Decay-Minor	Long (>40 years)	Low	Dysfunction and wire embedment observed at primary function. Hollow soundings in main trunks.	Within footprint of works.	Remove
96	1	<i>Lophostemon confertus</i>	Brush Box	17.5	10.0	0.81	0.92	9.72	3.20	Mature	Good	Average	Native	Co-dominant Stems	Long (>40 years)	High		Within footprint of works.	Remove
97	1	<i>Chamaecyparis obtusa cv.</i>	Hinoki Cypress Cultivar	13.0	6.0	0.61	0.61	7.32	2.69	Mature	Good	Average	Exotic	Co-dominant Stems	Medium (15-40 years)	Low		Within footprint of works.	Remove
98	1	<i>Lophostemon confertus</i>	Brush Box	9.5	4.0	0.12	0.17	2.00	1.57	Semi-mature	Good	Average	Native		Long (>40 years)	Moderate		Within footprint of works.	Remove
99	1	<i>Lophostemon confertus</i>	Brush Box	10.0	4.0	0.13	0.20	2.00	1.68	Semi-mature	Good	Average	Native		Long (>40 years)	Moderate		Within footprint of works.	Remove
100	1	<i>Eucalyptus punctata</i>	Grey Gum	10.0	4.0	0.14	0.19	2.00	1.65	Semi-mature	Good	Average	Endemic		Long (>40 years)	Moderate		Within footprint of works.	Remove
101	1	<i>Euc. sp.</i>	Gum	5.0	2.5	0.05	0.07	2.00	1.08	Semi-mature	Poor	Poor	Native	Tip Dieback	Replaceable (Small/Young)	Low	Not enough identification material to make positive identification. Peppermint smell to leaves.	Within footprint of works.	Remove
102	1	<i>Cupressus torulosa</i>	Bhutan Cypress	14.5	6.0	0.65	0.70	7.80	2.85	Mature	Good	Excellent	Exotic	Co-dominant Stems, Inclusions	Long (>40 years)	Moderate		Within footprint of works.	Remove
103	1	<i>Gleditsia triacanthos 'Shademaster'</i>	Green Honey Locust	6.5	7.0	0.15	0.30	2.00	2.00	Mature	Fair	Average	Exotic	Tip Dieback, Epicormic Growth	Medium (15-40 years)	Low		Within footprint of works.	Remove
104	1	<i>Gleditsia triacanthos 'Shademaster'</i>	Green Honey Locust	7.0	6.0	0.15	0.22	2.00	1.75	Mature	Fair	Average	Exotic	Tip Dieback, Epicormic Growth	Medium (15-40 years)	Low		Within footprint of works.	Remove
105	1	<i>Gleditsia triacanthos 'Shademaster'</i>	Green Honey Locust	7.0	6.0	0.14	0.22	2.00	1.75	Mature	Fair	Average	Exotic	Tip Dieback, Epicormic Growth	Medium (15-40 years)	Low		Within footprint of works.	Remove
106	1	<i>Gleditsia triacanthos 'Shademaster'</i>	Green Honey Locust	6.0	4.0	0.13	0.17	2.00	1.57	Mature	Fair	Average	Exotic	Tip Dieback, Epicormic Growth, Branch Tearouts	Medium (15-40 years)	Low		Within footprint of works.	Remove
107	1	<i>Gleditsia triacanthos 'Shademaster'</i>	Green Honey Locust	8.0	8.0	0.22	0.30	2.64	2.00	Mature	Fair	Average	Exotic		Medium (15-40 years)	Moderate		Within footprint of works.	Remove
108	1	<i>Liquidambar styraciflua</i>	Liquidambar	5.5	3.0	0.14	0.20	2.00	1.68	Semi-mature	Poor	Average	Exotic	Tip Dieback, Epicormic Growth, Deadwood-Minor, Pest/Disease	Short (5-15 years)	Low		Within footprint of works.	Remove
109	1	<i>Euc. sp.</i>	Gum	5.0	2.0	0.05	0.10	2.00	1.26	Semi-mature	Good	Average	Native		Replaceable (Small/Young)	Low	Insufficient identification material for positive identification.	Within footprint of works.	Remove
110	1	<i>Casuarina cunninghamiana</i>	River She-Oak	9.5	6.0	0.20	0.28	2.40	1.94	Mature	Good	Average	Native		Medium (15-40 years)	Moderate		Within footprint of works.	Remove
111	1	<i>Casuarina cunninghamiana</i>	River She-Oak	9.5	6.0	0.20	0.30	2.40	2.00	Mature	Fair	Average	Native	Deadwood-Minor, Very Asymmetric Form	Medium (15-40 years)	Low		Within footprint of works.	Remove
112	1	<i>Casuarina cunninghamiana</i>	River She-Oak	9.5	6.0	0.13	0.19	2.00	1.65	Mature	Fair	Average	Native	Very Asymmetric Form, Lean-Minor	Medium (15-40 years)	Low		Within footprint of works.	Remove
113	4	<i>Casuarina cunninghamiana</i>	River She-Oak	8.5	3.0	0.12	0.20	2.00	1.68	Mature	Poor	Poor	Native	Tip Dieback, Epicormic Growth, Deadwood-Minor	Medium (15-40 years)	Low		Within footprint of works.	Remove
114	1	<i>Casuarina cunninghamiana</i>	River She-Oak	9.5	4.0	0.15	0.25	2.00	1.85	Mature	Fair	Average	Native	Deadwood-Minor, Very Asymmetric Form	Medium (15-40 years)	Moderate		Within footprint of works.	Remove
115	1	<i>Casuarina cunninghamiana</i>	River She-Oak	11.5	6.0	0.22	0.35	2.64	2.13	Mature	Fair	Average	Native		Medium (15-40 years)	Moderate		Within footprint of works.	Remove
116	1	<i>Casuarina cunninghamiana</i>	River She-Oak	8.0	3.0	0.11	0.17	2.00	1.57	Mature	Poor	Average	Native	Tip Dieback, Epicormic Growth, Deadwood-Minor	Medium (15-40 years)	Low		Within footprint of works.	Remove
117	1	<i>Casuarina cunninghamiana</i>	River She-Oak	10.5	5.0	0.25	0.40	3.00	2.25	Mature	Fair	Average	Native	Deadwood-Minor	Medium (15-40 years)	Moderate		Within footprint of works.	Remove
118	5	<i>Casuarina cunninghamiana</i>	River She-Oak	8.5	4.0	0.11	0.16	2.00	1.53	Mature	Poor	Suppressed	Native	Tip Dieback, Deadwood-Minor	Medium (15-40 years)	Low		Within footprint of works.	Remove
119	1	<i>Corymbia citriodora</i>	Lemon Scented Gum	8.5	3.0	0.07	0.10	2.00	1.26	Mature	Fair	Suppressed	Native		Replaceable (Small/Young)	Low		Nil impacts expected.	Retain
120	1	<i>Corymbia citriodora</i>	Lemon Scented Gum	11.0	5.0	0.26	0.35	3.12	2.13	Mature	Fair	Average	Native		Long (>40 years)	Moderate	Part of very closely spaced copse.	Nil impacts expected.	Retain
121	1	<i>Corymbia citriodora</i>	Lemon Scented Gum	9.0	5.0	0.24	0.30	2.88	2.00	Mature	Fair	Average	Native		Long (>40 years)	Moderate	Part of very closely spaced copse.	Nil impacts expected.	Retain
122	1	<i>Corymbia citriodora</i>	Lemon Scented Gum	12.5	7.0	0.30	0.39	3.60	2.23	Mature	Good	Average	Native		Long (>40 years)	Moderate	Part of very closely spaced copse.	Within footprint of works.	Remove
123	1	<i>Corymbia citriodora</i>	Lemon Scented Gum	11.0	5.0	0.22	0.30	2.64	2.00	Mature	Fair	Average	Native	Very Asymmetric Form	Long (>40 years)	Moderate	Part of very closely spaced copse.	Nil impacts expected.	Retain
124	1	<i>Corymbia citriodora</i>	Lemon Scented Gum	13.0	5.0	0.19	0.26	2.28	1.88	Mature	Fair	Average	Native		Long (>40 years)	Moderate	Part of very closely spaced copse.	Nil impacts expected.	Retain
125	1	<i>Corymbia citriodora</i>	Lemon Scented Gum	9.5	5.0	0.15	0.20	2.00	1.68	Mature	Fair	Average	Native		Long (>40 years)	Low	Part of very closely spaced copse.	Nil impacts expected.	Retain
126	1	<i>Corymbia citriodora</i>	Lemon Scented Gum	15.0	10.0	0.42	0.52	5.04	2.51	Mature	Good	Average	Native		Long (>40 years)	Moderate	Part of very closely spaced copse. One of the better trees in group.	Nil impacts expected.	Retain
127	1	<i>Corymbia citriodora</i>	Lemon Scented Gum	15.0	6.0	0.24	0.30	2.88	2.00	Mature	Fair	Average	Native	Very Asymmetric Form	Long (>40 years)	Moderate	Part of very closely spaced copse.	Nil impacts expected.	Retain
128	1	<i>Corymbia citriodora</i>	Lemon Scented Gum	15.0	7.0	0.23	0.31	2.76	2.02	Mature	Fair	Average	Native		Long (>40 years)	Moderate	Part of very closely spaced copse.	Nil impacts expected.	Retain
129	1	<i>Corymbia citriodora</i>	Lemon Scented Gum	10.0	5.0	0.16	0.22	2.00	1.75	Mature	Fair	Suppressed	Native		Long (>40 years)	Low	Part of very closely spaced copse.	Nil impacts expected.	Retain
130	1	<i>Corymbia citriodora</i>	Lemon Scented Gum	9.0	3.0	0.10	0.15	2.00	1.49	Mature	Poor	Suppressed	Native		Long (>40 years)	Low	Part of very closely spaced copse.	Nil impacts expected.	Retain
131	1	<i>Corymbia citriodora</i>	Lemon Scented Gum	15.0	5.0	0.25	0.32	3.00	2.05	Mature	Fair	Average	Native		Long (>40 years)	Moderate	Part of very closely spaced copse.	Nil impacts expected.	Retain
132	1	<i>Corymbia citriodora</i>	Lemon Scented Gum	10.0	3.0	0.15	0.20	2.00	1.68	Mature	Fair	Suppressed	Native	Very Asymmetric Form	Long (>40 years)	Low	Part of very closely spaced copse.	Nil impacts expected.	Retain
133	1	<i>Corymbia citriodora</i>	Lemon Scented Gum	15.0	5.0	0.23	0.30	2.76	2.00	Mature	Fair	Average	Native	Very Asymmetric Form	Long (>40 years)	Moderate	Part of very closely spaced copse.	Nil impacts expected.	Retain
134	1	<i>Corymbia citriodora</i>	Lemon Scented Gum	15.0	7.0	0.25	0.32	3.00	2.05	Mature	Fair	Average	Native		Long (>40 years)	Moderate	Part of very closely spaced copse.	Nil impacts expected.	Retain
135	1	<i>Corymbia citriodora</i>	Lemon Scented Gum	14.0	6.0	0.23	0.29	2.76	1.97	Mature	Good	Average	Native	Lean-Minor, Very Asymmetric Form	Long (>40 years)	Moderate	Part of very closely spaced copse. Asymmetric to east.	Nil impacts expected.	Retain
136	1	<i>Corymbia citriodora</i>	Lemon Scented Gum	13.0	7.0	0.23	0.30	2.76	2.00	Mature	Good	Average	Native	Lean-Minor, Very Asymmetric Form	Long (>40 years)	Moderate	Part of very closely spaced copse. Very asymmetric to east.	Nil impacts expected.	Retain

Tree ID	Trees in Group	Tree Species	Common Name	Height (m)	Spread Average (m)	Trunk Diameter Breast Height (dbh) (m)	Trunk Diameter at base (dg) (m)	Nominal TPZ radius (m) 12xdbh (AS 4970)	Nominal SRZ radius (m) (AS 4970)	Age Class	Current Vigour	Current Form	Tree Origin	Noted Defects	SULE Rating	Retention Value	General Comments and Notes	Incursion and Impact	Recommendation
137	1	<i>Corymbia citriodora</i>	Lemon Scented Gum	9.0	6.0	0.18	0.22	2.16	1.75	Mature	Fair	Suppressed	Native	Deadwood-Minor	Long (>40 years)	Low	Part of very closely spaced copse.	Nil impacts expected.	Retain
138	1	<i>Corymbia citriodora</i>	Lemon Scented Gum	14.0	6.0	0.21	0.25	2.52	1.85	Mature	Fair	Average	Native	Very Asymmetric Form	Long (>40 years)	Moderate	Part of very closely spaced copse.	Nil impacts expected.	Retain
139	1	<i>Corymbia citriodora</i>	Lemon Scented Gum	11.0	7.0	0.18	0.23	2.16	1.79	Mature	Fair	Average	Native		Long (>40 years)	Moderate	Part of very closely spaced copse.	Nil impacts expected.	Retain
140	1	<i>Corymbia citriodora</i>	Lemon Scented Gum	15.5	8.0	0.32	0.39	3.84	2.23	Mature	Fair	Average	Native		Long (>40 years)	Moderate	Part of very closely spaced copse. One of the better trees of the group.	Nil impacts expected.	Retain
141	1	<i>Casuarina cunninghamiana</i>	River She-Oak	8.5	3.0	0.17	0.24	2.04	1.82	Mature	Fair	Average	Native		Medium (15-40 years)	Low		Nil impacts expected.	Retain
142	1	<i>Casuarina cunninghamiana</i>	River She-Oak	8.5	3.0	0.15	0.24	2.00	1.82	Mature	Fair	Average	Native		Medium (15-40 years)	Low	Excessive clearance pruning.	Nil impacts expected.	Retain
143	1	<i>Corymbia citriodora</i>	Lemon Scented Gum	13.0	7.0	0.26	0.33	3.12	2.08	Mature	Good	Average	Native	Very Asymmetric Form	Long (>40 years)	Moderate	Part of very closely spaced copse. Asymmetric to north.	Nil impacts expected.	Retain
144	1	<i>Corymbia citriodora</i>	Lemon Scented Gum	14.5	7.0	0.33	0.40	3.96	2.25	Mature	Fair	Average	Native	Very Asymmetric Form, Lean-Minor	Long (>40 years)	Low	Part of very closely spaced copse. Very asymmetric to north.	Nil impacts expected.	Retain
145	1	<i>Gleditsia triacanthos</i> 'Shademaster'	Green Honey Locust	5.5	4.0	0.15	0.15	2.00	1.49	Mature	Fair	Poor	Exotic	Tip Dieback, Epicomic Growth, Co-dominant Stems, Inclusions, Very Asymmetric Form	Medium (15-40 years)	Low		Within footprint of works.	Remove
146	1	<i>Gleditsia triacanthos</i> 'Shademaster'	Green Honey Locust	6.0	5.0	0.12	0.19	2.00	1.65	Mature	Fair	Average	Exotic	Epicomic Growth	Medium (15-40 years)	Low		Within footprint of works.	Remove
147	1	<i>Casuarina cunninghamiana</i>	River She-Oak	8.5	4.0	0.21	0.29	2.52	1.97	Mature	Good	Average	Native	Lean-Minor, Very Asymmetric Form	Medium (15-40 years)	Moderate		Nil impacts expected.	Retain
148	1	<i>Casuarina cunninghamiana</i>	River She-Oak	11.0	4.0	0.21	0.27	2.52	1.91	Mature	Good	Average	Native		Medium (15-40 years)	Moderate		Nil impacts expected.	Retain
149	1	<i>Casuarina cunninghamiana</i>	River She-Oak	9.5	4.0	0.18	0.25	2.16	1.85	Mature	Good	Average	Native	Very Asymmetric Form, Lean-Minor	Medium (15-40 years)	Moderate		Nil impacts expected.	Retain
150	1	<i>Corymbia citriodora</i>	Lemon Scented Gum	13.5	7.0	0.29	0.38	3.48	2.20	Mature	Fair	Average	Native	Very Asymmetric Form, Lean-Minor	Long (>40 years)	Moderate	Part of very closely spaced copse.	Nil impacts expected.	Retain
151	1	<i>Corymbia citriodora</i>	Lemon Scented Gum	13.0	7.0	0.31	0.39	3.72	2.23	Mature	Fair	Average	Native	Very Asymmetric Form, Lean-Minor	Long (>40 years)	Moderate	Part of very closely spaced copse.	Nil impacts expected.	Retain
152	1	<i>Corymbia citriodora</i>	Lemon Scented Gum	11.5	5.0	0.17	0.23	2.04	1.79	Mature	Fair	Suppressed	Native		Long (>40 years)	Low	Part of very closely spaced copse.	Nil impacts expected.	Retain
153	1	<i>Corymbia citriodora</i>	Lemon Scented Gum	10.0	8.0	0.23	0.32	2.76	2.05	Mature	Fair	Average	Native		Long (>40 years)	Moderate	Part of very closely spaced copse.	Nil impacts expected.	Retain
154	1	<i>Corymbia citriodora</i>	Lemon Scented Gum	8.0	4.0	0.14	0.20	2.00	1.68	Mature	Fair	Suppressed	Native	Very Asymmetric Form	Long (>40 years)	Low	Part of very closely spaced copse.	Nil impacts expected.	Retain
155	1	<i>Corymbia citriodora</i>	Lemon Scented Gum	13.0	7.0	0.24	0.31	2.88	2.02	Mature	Fair	Average	Native		Long (>40 years)	Moderate	Part of very closely spaced copse.	Nil impacts expected.	Retain
156	1	<i>Corymbia citriodora</i>	Lemon Scented Gum	15.5	7.0	0.27	0.34	3.24	2.10	Mature	Fair	Average	Native		Long (>40 years)	Moderate	Part of very closely spaced copse.	Nil impacts expected.	Retain
157	1	<i>Corymbia citriodora</i>	Lemon Scented Gum	16.0	7.0	0.34	0.52	4.08	2.51	Mature	Fair	Average	Native		Long (>40 years)	Moderate	Part of very closely spaced copse. Growth split in bark to west of trunk.	Nil impacts expected.	Retain
158	1	<i>Eucalyptus saligna</i>	Sydney Blue Gum	16.5	9.0	0.45	0.82	5.40	3.04	Mature	Fair	Average	Endemic	Co-dominant Stems	Long (>40 years)	Moderate	Part of very closely spaced copse. Tridominant trunks from base.	Nil impacts expected.	Retain
159	3	<i>Eucalyptus saligna</i>	Sydney Blue Gum	12.5	5.0	0.18	0.21	2.16	1.72	Mature	Fair	Average	Endemic	Very Asymmetric Form	Long (>40 years)	Low	Part of very closely spaced copse.	Within footprint of works.	Remove
160	1	<i>Eucalyptus saligna</i>	Sydney Blue Gum	18.0	10.0	0.58	0.65	6.96	2.76	Mature	Fair	Average	Endemic		Long (>40 years)	High	Part of very closely spaced copse. In neighbouring property.	Nil impacts expected.	Retain
161	1	<i>Eucalyptus saligna</i>	Sydney Blue Gum	22.0	10.0	0.55	0.65	6.60	2.76	Mature	Fair	Average	Endemic		Long (>40 years)	High	In neighbouring property.	Nil impacts expected.	Retain
162	3	<i>Casuarina cunninghamiana</i>	River She-Oak	6.5	3.0	0.13	0.17	2.00	1.57	Mature	Poor	Poor	Native		Medium (15-40 years)	Low	Part of very closely spaced copse.	Within footprint of works.	Remove
163	1	<i>Casuarina cunninghamiana</i>	River She-Oak	6.5	3.0	0.09	0.14	2.00	1.45	Mature	Fair	Average	Native		Medium (15-40 years)	Low	Part of very closely spaced copse.	Within footprint of works.	Remove
164	1	<i>Casuarina cunninghamiana</i>	River She-Oak	9.5	3.0	0.23	0.31	2.76	2.02	Mature	Fair	Average	Native	Very Asymmetric Form	Medium (15-40 years)	Low	Part of very closely spaced copse.	Within footprint of works.	Remove
165	1	<i>Casuarina cunninghamiana</i>	River She-Oak	11.0	5.0	0.25	0.33	3.00	2.08	Mature	Fair	Average	Native	Lean-Minor, Very Asymmetric Form	Medium (15-40 years)	Low	Part of very closely spaced copse.	Within footprint of works.	Remove
166	1	<i>Casuarina cunninghamiana</i>	River She-Oak	11.0	5.0	0.33	0.45	3.96	2.37	Mature	Fair	Average	Native	Very Asymmetric Form, Co-dominant Stems	Medium (15-40 years)	Low	Part of very closely spaced copse.	Within footprint of works.	Remove
167	1	<i>Casuarina cunninghamiana</i>	River She-Oak	11.0	5.0	0.34	0.45	4.08	2.37	Mature	Fair	Average	Native	Very Asymmetric Form, Lean-Minor	Medium (15-40 years)	Low	Part of very closely spaced copse.	Within footprint of works.	Remove
168	3	<i>Callistemon viminalis</i> cv.	Weeping Bottlebrush	6.0	4.0	0.10	0.15	2.00	1.49	Mature	Poor	Average	Native	Co-dominant Stems	Short (5-15 years)	Low		Within footprint of works.	Remove
169	1	<i>Liquidambar styraciflua</i>	Liquidambar	11.5	10.0	0.60	0.65	7.20	2.76	Mature	Good	Average	Exotic	Co-dominant Stems	Long (>40 years)	Moderate	Part of very closely spaced row along road.	Within footprint of works.	Remove
170	1	<i>Liquidambar styraciflua</i>	Liquidambar	10.5	10.0	0.39	0.50	4.68	2.47	Mature	Fair	Average	Exotic	Decay-Minor, Co-dominant Stems	Long (>40 years)	Low	Part of very closely spaced row along road.	Within footprint of works.	Remove
171	1	<i>Liquidambar styraciflua</i>	Liquidambar	9.0	10.0	0.26	0.30	3.12	2.00	Mature	Poor	Average	Exotic	Co-dominant Stems	Short (5-15 years)	Low	Part of very closely spaced row along road.	Within footprint of works.	Remove
172	1	<i>Liquidambar styraciflua</i>	Liquidambar	11.5	10.0	0.61	0.78	7.32	2.98	Mature	Good	Average	Exotic	Co-dominant Stems	Long (>40 years)	Moderate	Part of very closely spaced row along road.	Within footprint of works.	Remove
173	1	<i>Corymbia citriodora</i>	Lemon Scented Gum	19.5	9.0	0.31	0.43	3.72	2.32	Mature	Fair	Average	Native		Long (>40 years)	Moderate	Part of very closely spaced group along road. Moderate individually, but high as a group. Prominent in streetscape.	Nil impacts expected.	Retain
174	1	<i>Corymbia citriodora</i>	Lemon Scented Gum	19.5	9.0	0.38	0.50	4.56	2.47	Mature	Fair	Average	Native		Long (>40 years)	Moderate	Part of very closely spaced group along road. Moderate individually, but high as a group. Prominent in streetscape.	Nil impacts expected.	Retain
175	1	<i>Corymbia citriodora</i>	Lemon Scented Gum	18.0	9.0	0.24	0.34	2.88	2.10	Mature	Fair	Average	Native		Long (>40 years)	Moderate	Part of very closely spaced group along road. Moderate individually, but high as a group. Prominent in streetscape.	Nil impacts expected.	Retain
176	1	<i>Corymbia citriodora</i>	Lemon Scented Gum	12.0	6.0	0.22	0.28	2.64	1.94	Mature	Fair	Average	Native	Very Asymmetric Form	Long (>40 years)	Moderate	Part of very closely spaced group along road. Moderate individually, but high as a group. Prominent in streetscape.	Nil impacts expected.	Retain
177	1	<i>Corymbia citriodora</i>	Lemon Scented Gum	19.5	9.0	0.29	0.39	3.48	2.23	Mature	Fair	Average	Native	Very Asymmetric Form	Long (>40 years)	Moderate	Part of very closely spaced group along road. Moderate individually, but high as a group. Prominent in streetscape.	Nil impacts expected.	Retain
178	1	<i>Corymbia citriodora</i>	Lemon Scented Gum	18.5	8.0	0.26	0.33	3.12	2.08	Mature	Fair	Average	Native		Long (>40 years)	Moderate	Part of very closely spaced group along road. Moderate individually, but high as a group. Prominent in streetscape.	Nil impacts expected.	Retain
179	1	<i>Corymbia citriodora</i>	Lemon Scented Gum	19.5	9.0	0.26	0.35	3.12	2.13	Mature	Fair	Average	Native		Long (>40 years)	Moderate	Part of very closely spaced group along road. Moderate individually, but high as a group. Prominent in streetscape.	Nil impacts expected.	Retain
180	1	<i>Corymbia citriodora</i>	Lemon Scented Gum	20.5	10.0	0.36	0.43	4.32	2.32	Mature	Fair	Average	Native		Long (>40 years)	High	Part of very closely spaced group along road. One of the better trees in the group. Prominent in streetscape.	Nil impacts expected.	Retain
181	1	<i>Corymbia citriodora</i>	Lemon Scented Gum	18.5	8.0	0.31	0.40	3.72	2.25	Mature	Fair	Average	Native	Very Asymmetric Form	Long (>40 years)	Moderate	Part of very closely spaced group along road. Moderate individually, but high as a group. Prominent in streetscape.	Nil impacts expected.	Retain
182	1	<i>Acacia floribunda</i>	Gossamer Wattle	6.5	6.0	0.11	0.14	2.00	1.45	Mature	Fair	Average	Native	Very Asymmetric Form	Short (5-15 years)	Low		Nil impacts expected.	Retain
183	1	<i>Melaleuca bracteata</i>	Black Tea-Tree	7.5	2.0	0.09	0.11	2.00	1.31	Mature	Poor	Suppressed	Native		Short (5-15 years)	Nil / Remove		Within footprint of works.	Remove
184	1	<i>Gleditsia triacanthos</i> 'Shademaster'	Green Honey Locust	8.5	5.0	0.17	0.22	2.04	1.75	Mature	Fair	Poor	Exotic	Very Asymmetric Form	Short (5-15 years)	Low		Within footprint of works.	Remove
185	1	<i>Grevillea robusta</i>	Silky Oak	13.0	5.0	0.33	0.41	3.96	2.28	Mature	Poor	Suppressed	Invasive	Deadwood-Minor, Tip Dieback	Short (5-15 years)	Low		Nil impacts expected.	Retain
186	1	<i>Corymbia citriodora</i>	Lemon Scented Gum	19.0	8.0	0.34	0.45	4.08	2.37	Mature	Good	Average	Native	Very Asymmetric Form	Long (>40 years)	High	Part of very closely spaced group along road. High individual, and as a group. Prominent in streetscape. Very large surface roots running to north-east.	Nil impacts expected.	Retain
187	1	<i>Corymbia citriodora</i>	Lemon Scented Gum	17.0	7.0	0.32	0.40	3.84	2.25	Mature	Fair	Average	Native	Very Asymmetric Form	Long (>40 years)	Moderate	Part of very closely spaced group along road. Moderate individually, but high as a group. Prominent in streetscape.	Nil impacts expected.	Retain
188	1	<i>Corymbia citriodora</i>	Lemon Scented Gum	18.5	9.0	0.35	0.45	4.20	2.37	Mature	Fair	Average	Native	Very Asymmetric Form	Long (>40 years)	Moderate	Part of very closely spaced group along road. Moderate individually, but high as a group. Prominent in streetscape.	Nil impacts expected.	Retain
189	2	<i>Corymbia citriodora</i>	Lemon Scented Gum	14.0	3.0	0.14	0.19	2.00	1.65	Mature	Poor	Suppressed	Native	Very Asymmetric Form	Long (>40 years)	Low	Part of very closely spaced group along road. Low individual, but high as a group. Prominent in streetscape.	Nil impacts expected.	Retain

Tree ID	Trees in Group	Tree Species	Common Name	Height (m)	Spread Average (m)	Trunk Diameter Breast Height (dbh) (m)	Trunk Diameter at base (dg) (m)	Nominal TPZ radius (m) 12xdbh (AS 4970)	Nominal SRZ radius (m) (AS 4970)	Age Class	Current Vigour	Current Form	Tree Origin	Noted Defects	SULE Rating	Retention Value	General Comments and Notes	Incursion and Impact	Recommendation
190	1	<i>Corymbia citriodora</i>	Lemon Scented Gum	18.5	8.0	0.26	0.33	3.12	2.08	Mature	Fair	Average	Native	Very Asymmetric Form	Long (>40 years)	Moderate	Part of very closely spaced group along road. Moderate individually, but high as a group. Prominent in streetscape.	Nil impacts expected.	Retain
191	1	<i>Corymbia citriodora</i>	Lemon Scented Gum	18.5	8.0	0.14	0.20	2.00	1.68	Mature	Poor	Suppressed	Native		Long (>40 years)	Low	Part of very closely spaced group along road. Low individually, but high as a group. Prominent in streetscape.	Nil impacts expected.	Retain
192	1	<i>Corymbia citriodora</i>	Lemon Scented Gum	17.0	4.0	0.15	0.21	2.00	1.72	Mature	Fair	Average	Native		Long (>40 years)	Moderate	Part of very closely spaced group along road. Moderate individually, but high as a group. Prominent in streetscape.	Nil impacts expected.	Retain
193	1	<i>Corymbia citriodora</i>	Lemon Scented Gum	10.0	4.0	0.14	0.21	2.00	1.72	Mature	Fair	Suppressed	Native	Very Asymmetric Form	Long (>40 years)	Low	Part of very closely spaced group along road. Low individually, but high as a group. Prominent in streetscape.	Nil impacts expected.	Retain
194	1	<i>Corymbia citriodora</i>	Lemon Scented Gum	16.0	8.0	0.23	0.30	2.76	2.00	Mature	Fair	Average	Native	Very Asymmetric Form	Long (>40 years)	Moderate	Part of very closely spaced group along road. Moderate individually, but high as a group. Prominent in streetscape.	Nil impacts expected.	Retain
195	1	<i>Corymbia citriodora</i>	Lemon Scented Gum	19.5	8.0	0.43	0.53	5.16	2.53	Mature	Good	Average	Native	Very Asymmetric Form	Long (>40 years)	High	Part of very closely spaced group along road. Prominent in streetscape. One of the better trees of the group.	Nil impacts expected.	Retain
196	1	<i>Acacia parramattensis</i>	Parramatta Wattle	7.5	3.0	0.06	0.10	2.00	1.26	Over-mature	Poor	Poor	Endemic	Very Asymmetric Form	Remove (<5 years)	Nil / Remove		Poor quality tree. Recommend removal	Remove
197	1	<i>Olea europaea subsp. africana</i>	African Olive	5.0	4.0	0.17	0.24	2.04	1.82	Mature	Fair	Poor	Invasive	Very Asymmetric Form	Remove (<5 years)	Nil / Remove		Poor quality tree. Recommend removal	Remove
198	1	<i>Grevillea robusta</i>	Silky Oak	8.0	4.0	0.10	0.13	2.00	1.40	Semi-mature	Poor	Poor	Invasive	Very Asymmetric Form	Remove (<5 years)	Nil / Remove		Poor quality tree. Recommend removal	Remove
199	2	<i>Grevillea robusta</i>	Silky Oak	8.0	4.0	0.13	0.16	2.00	1.53	Semi-mature	Poor	Poor	Invasive	Very Asymmetric Form	Remove (<5 years)	Nil / Remove		Poor quality tree. Recommend removal	Remove
200	1	<i>Corymbia citriodora</i>	Lemon Scented Gum	17.0	9.0	0.25	0.31	3.00	2.02	Mature	Fair	Average	Native	Very Asymmetric Form	Long (>40 years)	Moderate	Part of very closely spaced group along road. Moderate individually, but high as a group. Prominent in streetscape.	Nil impacts expected.	Retain
201	1	<i>Corymbia citriodora</i>	Lemon Scented Gum	17.0	9.0	0.25	0.32	3.00	2.05	Mature	Good	Average	Native	Very Asymmetric Form, Major Wounding	Long (>40 years)	Moderate	Part of very closely spaced group along road. Moderate individually, but high as a group. Prominent in streetscape. One of the better trees of the group.	Nil impacts expected.	Retain
202	2	<i>Corymbia citriodora</i>	Lemon Scented Gum	17.0	9.0	0.10	0.13	2.00	1.40	Mature	Poor	Suppressed	Native		Long (>40 years)	Low	Part of very closely spaced group along road. Low individually, but high as a group. Prominent in streetscape.	Nil impacts expected.	Retain
203	1	<i>Corymbia citriodora</i>	Lemon Scented Gum	17.0	9.0	0.29	0.37	3.48	2.18	Mature	Good	Average	Native		Long (>40 years)	High	Part of very closely spaced group along road. Prominent in streetscape. One of the better trees of the group.	Nil impacts expected.	Retain
204	1	<i>Corymbia citriodora</i>	Lemon Scented Gum	14.0	9.0	0.27	0.32	3.24	2.05	Mature	Fair	Average	Native	Very Asymmetric Form	Long (>40 years)	Moderate	Part of very closely spaced group along road. Moderate individually, but high as a group. Prominent in streetscape.	Nil impacts expected.	Retain
205	1	<i>Corymbia citriodora</i>	Lemon Scented Gum	18.5	9.0	0.35	0.48	4.20	2.43	Mature	Good	Average	Native	Very Asymmetric Form	Long (>40 years)	Moderate	Part of very closely spaced group along road. Moderate individually, but high as a group. Prominent in streetscape. One of the better trees of the group.	Nil impacts expected.	Retain
206	1	<i>Corymbia citriodora</i>	Lemon Scented Gum	13.0	7.0	0.24	0.31	2.88	2.02	Mature	Good	Average	Native		Long (>40 years)	Moderate	Part of very closely spaced group along road. Moderate individually, but high as a group. Prominent in streetscape.	Nil impacts expected.	Retain
207	1	<i>Corymbia citriodora</i>	Lemon Scented Gum	17.0	8.0	0.30	0.37	3.60	2.18	Mature	Good	Average	Native		Long (>40 years)	High	Part of very closely spaced group along road. Prominent in streetscape. One of the better trees of the group.	Nil impacts expected.	Retain
208	1	<i>Corymbia citriodora</i>	Lemon Scented Gum	17.0	9.0	0.29	0.37	3.48	2.18	Mature	Fair	Average	Native	Very Asymmetric Form	Long (>40 years)	Moderate	Part of very closely spaced group along road. Moderate individually, but high as a group. Prominent in streetscape.	Nil impacts expected.	Retain
209	4	<i>Acacia parramattensis</i>	Parramatta Wattle	5.0	9.0	0.07	0.10	2.00	1.26	Semi-mature	Good	Average	Endemic		Replaceable (Small/Young)	Low		Nil impacts expected.	Retain
210	1	<i>Olea europaea subsp. africana</i>	African Olive	7.0	5.0	0.20	0.25	2.40	1.85	Mature	Poor	Poor	Invasive	Very Asymmetric Form	Remove (<5 years)	Nil / Remove		Poor quality tree. Recommend removal	Remove
211	1	<i>Casuarina cunninghamiana</i>	River She-Oak	12.0	9.0	0.35	0.42	4.20	2.30	Mature	Good	Average	Native		Medium (15-40 years)	Moderate		Nil impacts expected.	Retain
212	1	<i>Angophora costata</i>	Smooth-barked Apple	10.5	7.0	0.23	0.26	2.76	1.88	Mature	Fair	Poor	Endemic	Very Asymmetric Form	Long (>40 years)	Low		Nil impacts expected.	Retain
213	1	<i>Gleditsia triacanthos 'Shademaster'</i>	Green Honey Locust	9.0	7.0	0.24	0.30	2.88	2.00	Mature	Fair	Average	Exotic		Short (5-15 years)	Low		Within footprint of works.	Remove
214	1	<i>Pittosporum undulatum</i>	Sweet Pittosporum	9.0	7.0	0.26	0.30	3.12	2.00	Mature	Fair	Average	Endemic		Medium (15-40 years)	Low		Nil impacts expected.	Retain
215	1	<i>Casuarina cunninghamiana</i>	River She-Oak	11.0	7.0	0.19	0.29	2.28	1.97	Mature	Fair	Average	Native		Medium (15-40 years)	Moderate		Nil impacts expected.	Retain
216	1	<i>Casuarina cunninghamiana</i>	River She-Oak	11.0	7.0	0.22	0.28	2.64	1.94	Mature	Fair	Average	Native		Medium (15-40 years)	Moderate		Nil impacts expected.	Retain
217	1	<i>Casuarina cunninghamiana</i>	River She-Oak	12.0	9.0	0.26	0.35	3.12	2.13	Mature	Fair	Average	Native		Medium (15-40 years)	Moderate		Nil impacts expected.	Retain
218	1	<i>Casuarina cunninghamiana</i>	River She-Oak	8.0	5.0	0.11	0.14	2.00	1.45	Mature	Poor	Poor	Native	Very Asymmetric Form	Medium (15-40 years)	Low		Nil impacts expected.	Retain
219	1	<i>Casuarina cunninghamiana</i>	River She-Oak	12.0	6.0	0.20	0.24	2.40	1.82	Mature	Fair	Average	Native		Medium (15-40 years)	Moderate		Nil impacts expected.	Retain
220	1	<i>Angophora costata</i>	Smooth-barked Apple	7.5	5.0	0.11	0.14	2.00	1.45	Mature	Poor	Poor	Endemic	Very Asymmetric Form	Medium (15-40 years)	Low		Nil impacts expected.	Retain
221	1	<i>Angophora costata</i>	Smooth-barked Apple	9.0	4.0	0.15	0.22	2.00	1.75	Mature	Fair	Poor	Endemic	Very Asymmetric Form	Long (>40 years)	Low		Nil impacts expected.	Retain
222	1	<i>Casuarina cunninghamiana</i>	River She-Oak	12.0	6.0	0.26	0.39	3.12	2.23	Mature	Fair	Average	Native		Medium (15-40 years)	Moderate		Nil impacts expected.	Retain
223	1	<i>Corymbia citriodora</i>	Lemon Scented Gum	15.0	9.0	0.32	0.41	3.84	2.28	Mature	Fair	Average	Native	Very Asymmetric Form	Long (>40 years)	Moderate	Part of closely spaced copse. Prominent in streetscape.	Nil impacts expected.	Retain
224	2	<i>Angophora costata</i>	Smooth-barked Apple	6.0	2.0	0.08	0.10	2.00	1.26	Semi-mature	Poor	Suppressed	Endemic	Very Asymmetric Form	Medium (15-40 years)	Low		Nil impacts expected.	Retain
225	2	<i>Corymbia citriodora</i>	Lemon Scented Gum	7.0	2.0	0.08	0.10	2.00	1.26	Semi-mature	Poor	Suppressed	Native	Very Asymmetric Form	Medium (15-40 years)	Low	Part of closely spaced copse.	Nil impacts expected.	Retain
226	1	<i>Corymbia citriodora</i>	Lemon Scented Gum	8.5	4.0	0.12	0.20	2.00	1.68	Mature	Fair	Average	Native	Very Asymmetric Form	Long (>40 years)	Low	Part of closely spaced copse.	Nil impacts expected.	Retain
227	1	<i>Corymbia citriodora</i>	Lemon Scented Gum	15.0	9.0	0.35	0.46	4.20	2.39	Mature	Good	Average	Native		Long (>40 years)	High	Part of closely spaced copse. Prominent in streetscape.	Nil impacts expected.	Retain
228	1	<i>Corymbia citriodora</i>	Lemon Scented Gum	14.0	7.0	0.30	0.36	3.60	2.15	Mature	Good	Average	Native	Very Asymmetric Form	Long (>40 years)	Moderate	Part of closely spaced copse. Prominent in streetscape.	Nil impacts expected.	Retain
229	1	<i>Corymbia citriodora</i>	Lemon Scented Gum	15.0	9.0	0.35	0.43	4.20	2.32	Mature	Good	Average	Native	Very Asymmetric Form, Lean-Minor	Long (>40 years)	Moderate	Part of closely spaced copse. Prominent in streetscape.	Nil impacts expected.	Retain
230	12	<i>Casuarina cunninghamiana</i>	River She-Oak	9.5	5.0	0.26	0.33	3.12	2.08	Mature	Fair	Average	Native		Medium (15-40 years)	Moderate	Part of closely spaced copse of very similar trees.	Nil impacts expected.	Retain
231	1	<i>Corymbia citriodora</i>	Lemon Scented Gum	16.5	8.0	0.32	0.39	3.84	2.23	Mature	Fair	Average	Native	Very Asymmetric Form	Long (>40 years)	Low	Part of closely spaced copse. Reasonably prominent in streetscape. Generally low as individuals but moderate as a group.	Nil impacts expected.	Retain
232	1	<i>Corymbia citriodora</i>	Lemon Scented Gum	14.0	8.0	0.24	0.31	2.88	2.02	Mature	Fair	Average	Native	Very Asymmetric Form	Long (>40 years)	Low	Part of closely spaced copse. Reasonably prominent in streetscape. Generally low as individuals but moderate as a group.	Nil impacts expected.	Retain
233	2	<i>Corymbia citriodora</i>	Lemon Scented Gum	6.5	2.0	0.16	0.19	2.00	1.65	Mature	Fair	Average	Native		Replaceable (Small/Young)	Low	Part of closely spaced copse. Reasonably prominent in streetscape. Generally low as individuals but moderate as a group.	Nil impacts expected.	Retain
234	1	<i>Corymbia citriodora</i>	Lemon Scented Gum	16.5	8.0	0.34	0.42	4.08	2.30	Mature	Good	Average	Native		Long (>40 years)	High	Part of closely spaced copse. Reasonably prominent in streetscape. One of the better trees. Slightly asymmetric to north-west.	Nil impacts expected.	Retain
235	1	<i>Corymbia citriodora</i>	Lemon Scented Gum	15.0	6.0	0.24	0.32	2.88	2.05	Mature	Fair	Average	Native		Long (>40 years)	Low	Part of closely spaced copse. Reasonably prominent in streetscape. Generally low as individuals but moderate as a group.	Nil impacts expected.	Retain
236	1	<i>Corymbia citriodora</i>	Lemon Scented Gum	17.0	8.0	0.33	0.47	3.96	2.41	Mature	Good	Average	Native		Long (>40 years)	Moderate	Part of closely spaced copse. Reasonably prominent in streetscape. One of the better trees.	Nil impacts expected.	Retain

Tree ID	Trees in Group	Tree Species	Common Name	Height (m)	Spread Average (m)	Trunk Diameter Breast Height (dbh) (m)	Trunk Diameter at base (dg) (m)	Nominal TPZ radius (m) 12xdbh (AS 4970)	Nominal SRZ radius (m) (AS 4970)	Age Class	Current Vigour	Current Form	Tree Origin	Noted Defects	SULE Rating	Retention Value	General Comments and Notes	Incursion and Impact	Recommendation
237	1	<i>Corymbia citriodora</i>	Lemon Scented Gum	15.0	6.0	0.29	0.36	3.48	2.15	Mature	Fair	Average	Native		Long (>40 years)	Low	Part of closely spaced copse. Reasonably prominent in streetscape. Generally low as individuals but moderate as a group.	Nil impacts expected.	Retain
238	1	<i>Corymbia citriodora</i>	Lemon Scented Gum	14.0	6.0	0.18	0.23	2.16	1.79	Mature	Fair	Average	Native	Very Asymmetric Form	Long (>40 years)	Low	Part of closely spaced copse. Reasonably prominent in streetscape. Generally low as individuals but moderate as a group.	Nil impacts expected.	Retain
239	2	<i>Corymbia citriodora</i>	Lemon Scented Gum	15.0	5.0	0.21	0.30	2.52	2.00	Mature	Fair	Average	Native		Long (>40 years)	Low	Part of closely spaced copse. Reasonably prominent in streetscape. Generally low as individuals but moderate as a group.	Nil impacts expected.	Retain
240	1	<i>Corymbia citriodora</i>	Lemon Scented Gum	15.0	8.0	0.31	0.38	3.72	2.20	Mature	Fair	Average	Native		Long (>40 years)	Low	Part of closely spaced copse. Reasonably prominent in streetscape. Generally low as individuals but moderate as a group.	Nil impacts expected.	Retain
241	1	<i>Corymbia citriodora</i>	Lemon Scented Gum	16.5	7.0	0.25	0.32	3.00	2.05	Mature	Fair	Average	Native		Long (>40 years)	Low	Part of closely spaced copse. Reasonably prominent in streetscape. Generally low as individuals but moderate as a group.	Nil impacts expected.	Retain
242	1	<i>Corymbia citriodora</i>	Lemon Scented Gum	16.5	8.0	0.28	0.36	3.36	2.15	Mature	Fair	Average	Native	Very Asymmetric Form	Long (>40 years)	Low	Part of closely spaced copse. Reasonably prominent in streetscape. Generally low as individuals but moderate as a group.	Nil impacts expected.	Retain
243	1	<i>Corymbia citriodora</i>	Lemon Scented Gum	16.5	8.0	0.29	0.37	3.48	2.18	Mature	Fair	Suppressed	Native		Long (>40 years)	Low	Part of closely spaced copse. Reasonably prominent in streetscape. Generally low as individuals but moderate as a group.	Nil impacts expected.	Retain
244	1	<i>Corymbia citriodora</i>	Lemon Scented Gum	17.0	5.0	0.29	0.37	3.48	2.18	Mature	Fair	Average	Native		Long (>40 years)	Low	Part of closely spaced copse. Reasonably prominent in streetscape. Generally low as individuals but moderate as a group.	Nil impacts expected.	Retain
245	1	<i>Corymbia citriodora</i>	Lemon Scented Gum	17.5	9.0	0.35	0.49	4.20	2.45	Mature	Fair	Average	Native	Very Asymmetric Form	Long (>40 years)	Low	Part of closely spaced copse. Reasonably prominent in streetscape. Generally low as individuals but moderate as a group.	Nil impacts expected.	Retain
246	1	<i>Corymbia citriodora</i>	Lemon Scented Gum	13.0	4.0	0.20	0.26	2.40	1.88	Mature	Fair	Suppressed	Native		Long (>40 years)	Low	Part of closely spaced copse. Reasonably prominent in streetscape. Generally low as individuals but moderate as a group.	Nil impacts expected.	Retain
247	1	<i>Corymbia citriodora</i>	Lemon Scented Gum	18.5	9.0	0.39	0.48	4.68	2.43	Mature	Good	Average	Native		Long (>40 years)	Moderate	Part of closely spaced copse. Reasonably prominent in streetscape. One of the better specimens of group.	Nil impacts expected.	Retain
248	1	<i>Corymbia citriodora</i>	Lemon Scented Gum	17.5	8.0	0.38	0.45	4.56	2.37	Mature	Fair	Average	Native	Very Asymmetric Form	Long (>40 years)	Low	Part of closely spaced copse. Reasonably prominent in streetscape. Generally low as individuals but moderate as a group.	Nil impacts expected.	Retain
249	6	<i>Casuarina cunninghamiana</i>	River She-Oak	9.5	5.0	0.22	0.30	2.64	2.00	Mature	Fair	Average	Native		Medium (15-40 years)	Low		Nil impacts expected.	Retain
250	1	<i>Casuarina cunninghamiana</i>	River She-Oak	10.0	5.0	0.23	0.34	2.76	2.10	Mature	Fair	Average	Native		Medium (15-40 years)	Low		Nil impacts expected.	Retain
251	2	<i>Casuarina cunninghamiana</i>	River She-Oak	10.5	5.0	0.28	0.40	3.36	2.25	Mature	Fair	Average	Native		Medium (15-40 years)	Moderate		Nil impacts expected.	Retain
252	1	<i>Corymbia citriodora</i>	Lemon Scented Gum	9.0	5.0	0.15	0.20	2.00	1.68	Mature	Good	Average	Native	Very Asymmetric Form	Long (>40 years)	Moderate		Nil impacts expected.	Retain
253	9	<i>Casuarina cunninghamiana</i>	River She-Oak	10.0	4.0	0.23	0.29	2.76	1.97	Mature	Good	Average	Native		Medium (15-40 years)	Moderate	Part of closely spaced copse. Reasonably prominent in streetscape. Generally moderate as individuals and definitely moderate as a group.	Nil impacts expected.	Retain
254	10	<i>Casuarina cunninghamiana</i>	River She-Oak	10.0	4.0	0.23	0.30	2.76	2.00	Mature	Good	Average	Native		Medium (15-40 years)	Moderate	Closely spaced group of trees on mound along Epping Rd frontage. Reasonably prominent in streetscape. Generally moderate as individuals and definitely moderate as a group.	Nil impacts expected.	Retain
255	1	<i>Corymbia citriodora</i>	Lemon Scented Gum	16.0	9.0	0.35	0.43	4.20	2.32	Mature	Fair	Average	Native	Very Asymmetric Form	Long (>40 years)	Low	Part of closely spaced copse. Reasonably prominent in streetscape. Generally low as individuals but moderate as a group.	Nil impacts expected.	Retain
256	1	<i>Corymbia citriodora</i>	Lemon Scented Gum	9.0	4.0	0.12	0.16	2.00	1.53	Mature	Fair	Average	Native	Very Asymmetric Form	Long (>40 years)	Low	Part of closely spaced copse. Reasonably prominent in streetscape. Generally low as individuals but moderate as a group.	Nil impacts expected.	Retain
257	1	<i>Corymbia citriodora</i>	Lemon Scented Gum	19.0	8.0	0.35	0.48	4.20	2.43	Mature	Fair	Average	Native		Long (>40 years)	Moderate	Part of closely spaced copse. Reasonably prominent in streetscape. Generally low as individuals but moderate as a group.	Nil impacts expected.	Retain
258	1	<i>Corymbia citriodora</i>	Lemon Scented Gum	18.0	8.0	0.34	0.44	4.08	2.34	Mature	Fair	Average	Native		Long (>40 years)	Low	Part of closely spaced copse. Reasonably prominent in streetscape. Generally low as individuals but moderate as a group.	Nil impacts expected.	Retain
259	2	<i>Corymbia citriodora</i>	Lemon Scented Gum	9.0	3.0	0.10	0.15	2.00	1.49	Mature	Fair	Suppressed	Native		Long (>40 years)	Low	Part of closely spaced copse. Reasonably prominent in streetscape. Generally low as individuals but moderate as a group.	Nil impacts expected.	Retain
260	1	<i>Corymbia citriodora</i>	Lemon Scented Gum	16.5	6.0	0.20	0.27	2.40	1.91	Mature	Fair	Suppressed	Native	Very Asymmetric Form	Long (>40 years)	Low	Part of closely spaced copse. Reasonably prominent in streetscape. Generally low as individuals but moderate as a group.	Nil impacts expected.	Retain
261	1	<i>Corymbia citriodora</i>	Lemon Scented Gum	11.0	6.0	0.14	0.18	2.00	1.61	Mature	Poor	Poor	Native	Very Asymmetric Form, Pest/Disease	Medium (15-40 years)	Nil / Remove	Part of closely spaced copse. Very suppressed specimen.	Poor quality tree. Recommend removal	Remove
262	1	<i>Corymbia citriodora</i>	Lemon Scented Gum	15.0	6.0	0.22	0.29	2.64	1.97	Mature	Fair	Average	Native	Very Asymmetric Form	Long (>40 years)	Low	Part of closely spaced copse. Reasonably prominent in streetscape. Generally low as individuals but moderate as a group.	Nil impacts expected.	Retain
263	1	<i>Corymbia citriodora</i>	Lemon Scented Gum	9.0	6.0	0.20	0.26	2.40	1.88	Mature	Fair	Average	Native	Very Asymmetric Form	Long (>40 years)	Low	Part of closely spaced copse. Reasonably prominent in streetscape. Generally low as individuals but moderate as a group.	Nil impacts expected.	Retain
264	1	<i>Corymbia citriodora</i>	Lemon Scented Gum	13.0	6.0	0.23	0.27	2.76	1.91	Mature	Fair	Average	Native	Very Asymmetric Form	Long (>40 years)	Low	Part of closely spaced copse. Reasonably prominent in streetscape. Generally low as individuals but moderate as a group.	Nil impacts expected.	Retain
265	1	<i>Corymbia citriodora</i>	Lemon Scented Gum	20.0	9.0	0.46	0.59	5.52	2.65	Mature	Fair	Average	Native		Long (>40 years)	Moderate	Part of closely spaced copse. Reasonably prominent in streetscape. One of the better specimens of the group. Large specimen. Partial incursion due to excavation.	Nil impacts expected.	Retain
266	1	<i>Corymbia citriodora</i>	Lemon Scented Gum	16.0	6.0	0.27	0.34	3.24	2.10	Mature	Fair	Average	Native	Very Asymmetric Form	Medium (15-40 years)	Low	Part of closely spaced copse. Reasonably prominent in streetscape. Generally low as individuals but moderate as a group. Root area excavated for services during VIMG construction in early 2022, hence Low Retention Value.	Part of closely spaced copse. Reasonably prominent in streetscape. Generally low as individuals but moderate as a group. Root area excavated for services during VIMG construction in early 2022, hence Low Retention Value.	Retain

Tree ID	Trees in Group	Tree Species	Common Name	Height (m)	Spread Average (m)	Trunk Diameter Breast Height (dbh) (m)	Trunk Diameter at base (dg) (m)	Nominal TPZ radius (m) 12xdbh (AS 4970)	Nominal SRZ radius (m) (AS 4970)	Age Class	Current Vigour	Current Form	Tree Origin	Noted Defects	SULE Rating	Retention Value	General Comments and Notes	Incursion and Impact	Recommendation
267	1	<i>Corymbia citriodora</i>	Lemon Scented Gum	20.5	7.0	0.40	0.49	4.80	2.45	Mature	Fair	Average	Native	Very Asymmetric Form, Root Impacts	Medium (15-40 years)	Low	Part of closely spaced copse. Reasonably prominent in streetscape. Generally low as individuals but moderate as a group. Root area excavated for services during VIMG construction in early 2022, hence Low Retention Value.	Part of closely spaced copse. Reasonably prominent in streetscape. Generally low as individuals but moderate as a group. Root area excavated for services during VIMG construction in early 2022, hence Low Retention Value.	Retain
268	1	<i>Corymbia citriodora</i>	Lemon Scented Gum	20.0	8.0	0.42	0.55	5.04	2.57	Mature	Fair	Average	Native	Very Asymmetric Form	Medium (15-40 years)	Low	Part of closely spaced copse. Reasonably prominent in streetscape. One of the better specimens of the group. Badly excavated for services within SRZ. Damaged roots evident. High risk of failure. Recommend removal.	Part of closely spaced copse. Reasonably prominent in streetscape. Generally low as individuals but moderate as a group. Root area excavated for services during VIMG construction in early 2022, hence Low Retention Value.	Retain
269	1	<i>Corymbia citriodora</i>	Lemon Scented Gum	14.0	6.0	0.19	0.25	2.28	1.85	Mature	Fair	Average	Native	Very Asymmetric Form	Long (>40 years)	Low	Part of closely spaced copse. Reasonably prominent in streetscape. Generally low as individuals but moderate as a group.	Nil impacts expected.	Retain
270	1	<i>Corymbia citriodora</i>	Lemon Scented Gum	11.0	7.0	0.24	0.30	2.88	2.00	Mature	Fair	Average	Native	Very Asymmetric Form, Lean-Major	Long (>40 years)	Low	Part of closely spaced copse. Reasonably prominent in streetscape. Generally low as individuals but moderate as a group.	Nil impacts expected.	Retain
271	2	<i>Gordonia axillaris</i>	Fried Egg Tree	5.5	3.0	0.14	0.25	2.00	1.85	Mature	Fair	Average	Exotic	Very Asymmetric Form	Medium (15-40 years)	Low	Closely spaced group of 2.	Within footprint of works.	Remove
272	4	<i>Pistacia chinensis</i>	Chinese Pistachio	7.0	3.0	0.19	0.24	2.28	1.82	Mature	Fair	Average	Exotic	Very Asymmetric Form	Medium (15-40 years)	Low	Group adjacent driveway, path and building. Inappropriately positioned.	Within footprint of works.	Remove
273	1	<i>Pistacia chinensis</i>	Chinese Pistachio	8.0	4.0	0.16	0.22	2.00	1.75	Mature	Fair	Average	Exotic	Very Asymmetric Form	Medium (15-40 years)	Low		Within footprint of works.	Remove
274	1	<i>Eucalyptus saligna</i>	Sydney Blue Gum	19.5	11.0	0.70	0.85	8.40	3.09	Mature	Fair	Average	Endemic	Very Asymmetric Form	Long (>40 years)	High	Neighbouring tree. Likely to be impacted by relatively poor protection during construction.	Minor surface impacts are expected through the installation of surrounding landscape pathways and removal of existing buildings and structures.	Retain
275	2	<i>Corymbia citriodora</i>	Lemon Scented Gum	8.5	3.0	0.15	0.20	2.00	1.68	Semi-mature	Fair	Average	Native	Very Asymmetric Form	Long (>40 years)	Low	Semi-mature group of two, growing under large tree. Assumed self sown. Somewhat suppressed.	Not compatible to be retained with the demolition of adjoining existing driveway and proposed landscape works. Suggested removal to the betterment of the larger, more significant trees to be retained.	Remove
276	1	<i>Cupressus torulosa</i>	Bhutan Cypress	8.5	3.0	0.21	0.27	2.52	1.91	Mature	Fair	Average	Exotic	Very Asymmetric Form	Medium (15-40 years)	Low	Neighbouring tree.	Nil impacts expected.	Retain
277	1	<i>Cupressus macrocarpa cv.</i>	Monterey Cypress	9.5	4.0	0.46	0.46	5.52	2.39	Mature	Poor	Poor	Exotic	Very Asymmetric Form	Short (5-15 years)	Low	Neighbouring tree. Very poor condition.	Minor surface impacts are expected through the installation of surrounding landscape pathways and removal of existing buildings and structures.	Retain
278	1	<i>Liquidambar styraciflua</i>	Liquidambar	5.0	4.0	0.17	0.22	2.04	1.75	Mature	Poor	Poor	Exotic	Very Asymmetric Form, Deadwood-Major	Short (5-15 years)	Low	Neighbouring tree. Very poor condition.	Nil impacts expected.	Retain
279	1	<i>Elaeocarpus reticulatus</i>	Blueberry Ash	5.0	4.0	0.12	0.16	2.00	1.53	Mature	Fair	Average	Endemic		Medium (15-40 years)	Low	Neighbouring property tree.	Nil impacts expected.	Retain
280	1	<i>Corymbia citriodora</i>	Lemon Scented Gum	17.0	10.0	0.56	0.71	6.72	2.87	Mature	Fair	Average	Native		Long (>40 years)	High	Important tree in the context of neighbouring development. High value as a group of two.	Minor surface impacts are expected through the installation of surrounding landscape pathways and removal of existing buildings and structures.	Remove
281	1	<i>Corymbia citriodora</i>	Lemon Scented Gum	11.0	7.0	0.37	0.49	4.44	2.45	Mature	Fair	Average	Native	Very Asymmetric Form	Long (>40 years)	High	Important tree in the context of neighbouring development. High as a group of two.	Minor surface impacts are expected through the installation of surrounding landscape pathways and removal of existing buildings and structures.	Remove
282	1	<i>Sapium sebiferum</i>	Chinese Tallow Tree	9.5	7.0	0.31	0.41	3.72	2.28	Mature	Fair	Average	Exotic	Very Asymmetric Form	Medium (15-40 years)	Low		Within footprint of works.	Remove
283	1	<i>Sapium sebiferum</i>	Chinese Tallow Tree	8.0	7.0	0.30	0.42	3.60	2.30	Mature	Good	Average	Exotic	Very Asymmetric Form	Long (>40 years)	Low		Within footprint of works.	Remove
284	2	<i>Sapium sebiferum</i>	Chinese Tallow Tree	9.0	3.0	0.23	0.31	2.76	2.02	Mature	Good	Average	Exotic		Long (>40 years)	Low	Closely spaced group of 2.	Within footprint of works.	Remove
285	2	<i>Sapium sebiferum</i>	Chinese Tallow Tree	9.0	3.0	0.25	0.30	3.00	2.00	Mature	Good	Average	Exotic		Long (>40 years)	Low	Closely spaced group of 2.	Within footprint of works.	Remove
286	2	<i>Sapium sebiferum</i>	Chinese Tallow Tree	9.0	3.0	0.22	0.29	2.64	1.97	Mature	Good	Average	Exotic	Lean-Minor, Very Asymmetric Form	Long (>40 years)	Low	Closely spaced group of 2.	Within footprint of works.	Remove
287	2	<i>Sapium sebiferum</i>	Chinese Tallow Tree	9.0	4.0	0.32	0.40	3.84	2.25	Mature	Good	Average	Exotic		Long (>40 years)	Low	Closely spaced group of 2. Northern specimen in better condition and size.	Within footprint of works.	Remove
288	1	<i>Sapium sebiferum</i>	Chinese Tallow Tree	9.0	6.0	0.38	0.48	4.56	2.43	Mature	Good	Average	Exotic	Co-dominant Stems	Long (>40 years)	Low		Within footprint of works.	Remove
289	1	<i>Sapium sebiferum</i>	Chinese Tallow Tree	9.0	6.0	0.32	0.43	3.84	2.32	Mature	Good	Average	Exotic		Long (>40 years)	Low		Within footprint of works.	Remove
290	2	<i>Jacaranda mimosifolia</i>	Jacaranda	10.0	9.0	0.28	0.31	3.36	2.02	Mature	Good	Average	Exotic		Long (>40 years)	Moderate		Within footprint of works.	Remove
291	1	<i>Platanus x acerifolia</i>	London Plane	9.5	10.0	0.35	0.44	4.20	2.34	Mature	Good	Average	Exotic		Long (>40 years)	Moderate	Street tree.	Within footprint of works.	Remove
292	1	<i>Cupressus macrocarpa cv.</i>	Monterey Cypress	8.0	8.0	0.65	0.77	7.80	2.97	Mature	Poor	Poor	Exotic		Short (5-15 years)	Low	Street tree.	Within footprint of works.	Remove
293	1	<i>Cupressus macrocarpa cv.</i>	Monterey Cypress	7.0	8.0	0.54	0.63	6.48	2.73	Mature	Fair	Poor	Exotic	Lean-Major, Decay-Major	Medium (15-40 years)	Nil / Remove	Street tree. Poor form and decay.	Poor quality tree. Recommend removal	Remove
294	1	<i>Platanus x acerifolia</i>	London Plane	10.5	8.0	0.38	0.45	4.56	2.37	Mature	Good	Average	Exotic	Co-dominant Stems	Long (>40 years)	High	Street tree.	Nil impacts expected.	Retain
295	1	<i>Cupressus macrocarpa cv.</i>	Monterey Cypress	9.5	8.0	0.80	0.96	9.60	3.25	Mature	Poor	Average	Exotic	Co-dominant Stems, Tip Dieback, Deadwood-Major, Decay-Major	Short (5-15 years)	Nil / Remove	Street tree. Very poor condition.	Poor quality tree. Recommend removal	Remove
297	1	<i>Syagrus romanzoffiana</i>	Queen Palm	8.0	4.0	0.24	0.30	3.00	1.15	Mature	Fair	Average	Exotic		Long (>40 years)	Low		Within footprint of works.	Remove
298	1	<i>Cupressus torulosa</i>	Bhutan Cypress	14.0	4.0	0.39	0.45	4.68	2.37	Mature	Poor	Average	Exotic	Co-dominant Stems, Tip Dieback	Medium (15-40 years)	Nil / Remove	Major dieback in canopy.	Within footprint of works. Poor quality tree. Recommend removal	Remove
299	1	<i>Cupressus torulosa</i>	Bhutan Cypress	14.0	4.0	0.69	0.82	8.28	3.04	Mature	Poor	Average	Exotic	Co-dominant Stems, Tip Dieback	Medium (15-40 years)	Low		Within footprint of works.	Remove
300	1	<i>Cupressus torulosa</i>	Bhutan Cypress	14.0	4.0	0.44	0.48	5.28	2.43	Mature	Fair	Average	Exotic	Co-dominant Stems, Tip Dieback	Medium (15-40 years)	Low		Within footprint of works.	Remove
301	1	<i>Cupressus torulosa</i>	Bhutan Cypress	14.0	4.0	0.45	0.52	5.40	2.51	Mature	Fair	Average	Exotic	Co-dominant Stems, Tip Dieback	Medium (15-40 years)	Low		Within footprint of works.	Remove
302	1	<i>Cupressus torulosa</i>	Bhutan Cypress	9.0	4.0	0.38	0.40	4.56	2.25	Mature	Fair	Average	Exotic	Co-dominant Stems, Tip Dieback	Medium (15-40 years)	Nil / Remove	Very poor condition.	Within footprint of works. Poor quality tree. Recommend removal	Remove
303	1	<i>Liquidambar styraciflua</i>	Liquidambar	15.5	9.0	0.68	0.89	8.16	3.15	Mature	Good	Average	Exotic		Long (>40 years)	Moderate	Prominent tree.	Within footprint of works.	Remove
304	3	<i>Jacaranda mimosifolia</i>	Jacaranda	11.5	9.0	0.38	0.42	4.56	2.30	Mature	Fair	Average	Exotic		Medium (15-40 years)	Moderate	Closely spaced row of 3. Northern most specimen the best of row.	Within footprint of works.	Remove
305	1	<i>Brachychiton acerifolius</i>	Illawarra Flame Tree	12.0	7.0	0.36	0.40	4.32	2.25	Mature	Fair	Average	Native		Long (>40 years)	Moderate		Within footprint of works.	Remove
306	1	<i>Corymbia citriodora</i>	Lemon Scented Gum	20.5	12.0	0.72	0.86	8.64	3.11	Mature	Good	Average	Native		Long (>40 years)	Moderate		Within footprint of works.	Remove
307	1	<i>Corymbia maculata</i>	Spotted Gum	23.0	10.0	0.88	1.02	10.56	3.34	Mature	Good	Average	Native	Major Wounding, Decay-Minor, Cavity	Long (>40 years)	Moderate	Wounding to base.	Within footprint of works.	Remove
308	1	<i>Koelreuteria bipinnata</i>	Chinese Rain Tree	6.5	7.0	0.38	0.38	4.56	2.20	Mature	Excellent	Average	Exotic	Very Asymmetric Form	Long (>40 years)	Moderate		Nil impacts expected.	Retain
309	6	<i>Koelreuteria bipinnata</i>	Chinese Rain Tree	6.5	16.0	0.24	0.27	2.88	1.91	Mature	Good	Average	Exotic	Very Asymmetric Form	Long (>40 years)	Low	Random group of 6 specimens, assumed self sown.	Within footprint of works.	Retain
310	1	<i>Grevillea robusta</i>	Silky Oak	12.0	3.0	0.25	0.33	3.00	2.08	Mature	Fair	Poor	Invasive	Poor Taper	Long (>40 years)	Low		Within footprint of works.	Remove
311	1	<i>Cupressus semperivirens 'Stricta'</i>	Pencil Pine	9.0	2.0	0.28	0.30	3.36	2.00	Mature	Poor	Poor	Exotic		Remove (<5 years)	Nil / Remove	Very poor condition.	Within footprint of works. Poor quality tree. Recommend removal	Remove
312	1	<i>Fraxinus ornus</i>	Mana Ash	8.0	6.0	0.30	0.33	3.60	2.08	Mature	Fair	Suppressed	Exotic	Very Asymmetric Form	Medium (15-40 years)	Low	Would likely be misshapen if other trees removed.	Within footprint of works.	Remove
313	2	<i>Koelreuteria bipinnata</i>	Chinese Rain Tree	6.5	6.0	0.26	0.28	3.12	1.94	Mature	Good	Average	Exotic	Very Asymmetric Form, Lean-Minor	Long (>40 years)	Moderate	Growing around larger Robinia. Assumed self sown.	Minor incursion of 6% expected to the northern side of the tree resulting from the excavation required to construct one of the new tower developments.	Retain
314	1	<i>Robinia pseudoacacia 'Frisia'</i>	Golden Robinia	11.5	6.0	0.32	0.38	3.84	2.20	Mature	Fair	Average	Exotic	Co-dominant Stems, Inclusions	Long (>40 years)	Low		Within footprint of works.	Remove
315	1	<i>Eucalyptus botryoides</i>	Bangalay	13.5	10.0	0.62	0.68	7.44	2.81	Mature	Good	Average	Native	Major Wounding, Decay-Minor	Long (>40 years)	Moderate	Major wound to lower trunk on east side, but otherwise good tree.	Within footprint of works.	Remove
316	2	<i>Arbutus unedo</i>	Strawberry Tree	6.0	4.0	0.20	0.30	2.40	2.00	Mature	Good	Average	Exotic	Co-dominant Stems	Long (>40 years)	Low		Within footprint of works.	Remove
317	1	<i>Schefflera arborescens</i>	Dwarf Umbrella Tree	5.5	6.0	0.30	0.45	3.60	2.37	Mature	Good	Average	Exotic	Major Wounding, Decay-Minor	Long (>40 years)	Low		Within footprint of works.	Remove
318	1	<i>Fraxinus ornus</i>	Mana Ash	7.5	6.0	0.32	0.45	3.84	2.37	Mature	Poor	Average	Exotic	Tip Dieback	Remove (<5 years)	Nil / Remove	Major dieback.	Within footprint of works. Poor quality tree. Recommend removal	Remove
319	2	<i>Koelreuteria bipinnata</i>	Chinese Rain Tree	6.5	7.0	0.18	0.25	2.16	1.85	Mature	Good	Average	Exotic	Lean-Minor	Long (>40 years)	Moderate	Assumed self sown.	Within footprint of works.	Remove

Tree ID	Trees in Group	Tree Species	Common Name	Height (m)	Spread Average (m)	Trunk Diameter Breast Height (dbh) (m)	Trunk Diameter at base (dg) (m)	Nominal TPZ radius (m) 12xdbh (AS 4970)	Nominal SRZ radius (m) (AS 4970)	Age Class	Current Vigour	Current Form	Tree Origin	Noted Defects	SULE Rating	Retention Value	General Comments and Notes	Incursion and Impact	Recommendation	
320	6	<i>Prunus cerasifera 'Nigra'</i>	Purple-leaved Cherry-plum	6.0	7.0	0.22	0.25	2.64	1.85	Over-mature	Fair	Average	Exotic	Co-dominant Stems, Deadwood-Minor, Decay-Minor	Long (>40 years)	Low	Row planting along Epping road frontage under powerlines. Appear to be over-mature and subject to early leaf fall.	Within footprint of works.	Remove	
321	1	<i>Eucalyptus microcorys</i>	Tallowood	15.5	12.0	1.20	1.29	14.40	3.68	Mature	Good	Average	Native	Co-dominant Stems, Inclusions	Long (>40 years)	Moderate	Fused branches, codominant and included main stem. Prominent tree.	Within footprint of works.	Remove	
322	1	<i>Jacaranda mimosifolia</i>	Jacaranda	13.0	10.0	0.50	0.68	6.00	2.81	Mature	Good	Excellent	Exotic		Long (>40 years)	High	Could well suit retention in ultimate development.	Within footprint of works.	Remove	
323	1	<i>Jacaranda mimosifolia</i>	Jacaranda	10.5	10.0	0.39	0.42	4.68	2.30	Mature	Good	Average	Exotic	Co-dominant Stems, Very Asymmetric Form, Deadwood-Minor	Long (>40 years)	Moderate		Within footprint of works.	Remove	
324	1	<i>Magnolia x soulangiana</i>	Magnolia	5.5	6.0	0.25	0.35	3.00	2.13	Mature	Fair	Average	Exotic		Medium (15-40 years)	Low		Within footprint of works.	Remove	
325	1	<i>Magnolia grandiflora</i>	American Bull Bay Magnolia	5.0	2.0	0.13	0.16	2.00	1.53	Mature	Good	Average	Exotic		Medium (15-40 years)	Low	Replaceable (Small/Young)	Very small tree.	Within footprint of works.	Remove
326	1	<i>Elaeocarpus reticulatus</i>	Blueberry Ash	8.0	4.0	0.20	0.24	2.40	1.82	Mature	Good	Excellent	Endemic		Medium (15-40 years)	Moderate		Within footprint of works.	Remove	
327	1	<i>Jacaranda mimosifolia</i>	Jacaranda	15.0	12.0	0.59	0.59	7.08	2.65	Mature	Good	Excellent	Exotic	Co-dominant Stems	Long (>40 years)	High	Prominent and well formed tree.	Within footprint of works.	Remove	
328	1	<i>Cupressus torulosa</i>	Bhutan Cypress	16.0	7.0	0.65	0.70	7.80	2.85	Mature	Good	Excellent	Native	Co-dominant Stems, Inclusions	Medium (15-40 years)	Moderate		Within footprint of works.	Remove	
329	1	<i>Eucalyptus microcorys</i>	Tallowood	15.5	12.0	0.86	1.08	10.32	3.42	Mature	Good	Excellent	Native		Long (>40 years)	High		Within footprint of works.	Remove	
330	1	<i>Eucalyptus punctata</i>	Grey Gum	12.0	9.0	0.54	0.65	6.48	2.76	Mature	Fair	Average	Endemic		Medium (15-40 years)	Moderate	Sparse foliage, otherwise OK. Species endemic to area.	Within footprint of works.	Remove	
331	1	<i>Brachycton discolor</i>	Queensland Lacebark	8.0	6.0	0.46	0.61	5.52	2.69	Mature	Fair	Average	Native	Pest/Disease	Long (>40 years)	Moderate	Pest and disease affected, otherwise OK.	Within footprint of works.	Remove	
332	1	<i>Hymenosporum flavum</i>	Native Frangipani	12.0	3.0	0.19	0.25	2.28	1.85	Mature	Fair	Average	Native	Lean-Minor, Very Asymmetric Form	Long (>40 years)	Moderate		Within footprint of works.	Remove	
333	1	<i>Koelreuteria bipinnata</i>	Chinese Rain Tree	10.5	11.0	0.55	0.59	6.60	2.65	Mature	Good	Average	Exotic	Very Asymmetric Form	Long (>40 years)	Moderate		Within footprint of works.	Remove	
334	1	<i>Acmena smithii?</i>	Lilly Pilly	12.0	3.0	0.30	0.35	3.60	2.13	Mature	Fair	Average	Native		Long (>40 years)	Moderate		Within footprint of works.	Remove	
335	1	<i>Agonis flexuosa</i>	Willow Myrtle	8.5	4.0	0.28	0.42	3.36	2.30	Mature	Fair	Poor	Native		Short (5-15 years)	Nil / Remove	Extensively pruned. Poor form for species.	Within footprint of works. Poor quality tree. Recommend removal	Remove	
336	1	<i>Corymbia citriodora</i>	Lemon Scented Gum	23.5	12.0	0.77	0.87	9.24	3.12	Mature	Good	Average	Native		Long (>40 years)	High	Prominent and large tree.	Within footprint of works.	Remove	
337	2	<i>Melaleuca bracteata</i>	Black Tea-Tree	8.0	4.0	0.26	0.50	3.12	2.47	Mature	Good	Average	Native		Medium (15-40 years)	Low		Within footprint of works.	Remove	
338	1	<i>Melaleuca bracteata</i>	Black Tea-Tree	11.0	5.0	0.32	0.45	3.84	2.37	Mature	Good	Average	Native	Co-dominant Stems	Medium (15-40 years)	Low		Within footprint of works.	Remove	
339	1	<i>Melaleuca bracteata</i>	Black Tea-Tree	7.0	6.0	0.33	0.37	3.96	2.18	Mature	Good	Average	Native	Co-dominant Stems	Medium (15-40 years)	Low		Within footprint of works.	Remove	
340	1	<i>Melaleuca bracteata</i>	Black Tea-Tree	7.0	6.0	0.66	0.80	7.92	3.01	Mature	Good	Poor	Native	Co-dominant Stems, Inclusions, Decay-Minor, Root Impacts, Very Asymmetric Form	Medium (15-40 years)	Low	Excessively close to adjoining structure.	Within footprint of works.	Remove	
341	1	<i>Agonis flexuosa</i>	Willow Myrtle	7.5	7.0	0.24	0.33	2.88	2.08	Mature	Good	Average	Native		Short (5-15 years)	Low		Within footprint of works.	Remove	
342	1	<i>Corymbia citriodora</i>	Lemon Scented Gum	17.5	10.0	0.60	0.76	7.20	2.95	Mature	Fair	Poor	Native	Lean-Minor, Very Asymmetric Form	Long (>40 years)	Low	Very end-weighted form over power lines. Would recommend removal as part of any master planning to the betterment of adjoining trees and risk of failures over power lines.	Within footprint of works.	Remove	
343	1	<i>Corymbia citriodora</i>	Lemon Scented Gum	23.0	14.0	0.78	1.02	9.36	3.34	Mature	Good	Average	Native		Long (>40 years)	High	Prominent and large tree.	Within footprint of works.	Remove	
344	1	<i>Koelreuteria bipinnata</i>	Chinese Rain Tree	11.0	12.0	0.42	0.48	5.04	2.43	Mature	Good	Average	Exotic	Very Asymmetric Form	Long (>40 years)	Moderate		Within footprint of works.	Remove	
345	1	<i>Koelreuteria bipinnata</i>	Chinese Rain Tree	7.0	7.0	0.17	0.17	2.04	1.57	Mature	Good	Average	Exotic	Very Asymmetric Form	Long (>40 years)	Low		Within footprint of works.	Remove	
346	1	<i>Eucalyptus robusta</i>	Swamp Mahogany	23.0	10.0	0.70	1.07	8.40	3.40	Mature	Fair	Average	Native	Very Asymmetric Form	Long (>40 years)	Moderate		Within footprint of works.	Remove	
347	1	<i>Eucalyptus microcorys</i>	Tallowood	23.0	12.0	1.00	1.31	12.00	3.71	Mature	Good	Excellent	Native	Co-dominant Stems	Long (>40 years)	High	Prominent and large tree.	Within footprint of works.	Remove	
348	1	<i>Eucalyptus robusta</i>	Swamp Mahogany	19.5	10.0	0.88	0.88	10.56	3.14	Mature	Fair	Average	Native	Co-dominant Stems	Long (>40 years)	Moderate	Prominent and large tree.	Within footprint of works.	Remove	
349	1	<i>Callistemon viminalis cv.</i>	Weeping Bottlebrush	9.0	7.0	0.38	0.65	4.56	2.76	Mature	Good	Average	Native	Co-dominant Stems, Inclusions	Medium (15-40 years)	Low		Within footprint of works.	Remove	
350	1	<i>Waterhousea floribunda</i>	Weeping Lilly Pilly	11.5	9.0	0.41	0.44	4.92	2.34	Mature	Good	Average	Native	Co-dominant Stems	Long (>40 years)	High	Good early mature tree.	Within footprint of works.	Remove	
351	1	<i>Pinus halepensis</i>	Aleppo Pine	12.0	9.0	0.28	0.41	3.36	2.28	Senescent	Poor	Average	Exotic	Tip Dieback, Deadwood-Major	Short (5-15 years)	Low	Memorial tree planted in February 2001 (In celebration of Bess and Phil Haywood's Diamond Anniversary (60th))	Within footprint of works.	Remove	
352	1	<i>Acmena smithii var. minor</i>	Small Leaf Lilly Pilly	6.5	5.0	0.21	0.24	2.52	1.82	Mature	Fair	Average	Native	Co-dominant Stems, Inclusions	Medium (15-40 years)	Low		Within footprint of works.	Remove	
353	1	<i>Eucalyptus camaldulensis?</i>	River Red Gum	18.0	9.0	0.75	0.98	9.00	3.28	Mature	Poor	Average	Native	Deadwood-Minor, Cavity, Epicormic Growth	Medium (15-40 years)	Low	Minor hollows and spouts. Previous large branches pruned. Relatively sparse foliage.	Within footprint of works.	Remove	
354	1	<i>Grevillea robusta</i>	Silky Oak	18.0	7.0	0.37	0.45	4.44	2.37	Mature	Fair	Poor	Invasive	Deadwood-Minor, Co-dominant Stems	Long (>40 years)	Low		Within footprint of works.	Remove	
355	3	<i>Arbutus unedo</i>	Strawberry Tree	6.5	6.0	0.35	0.48	4.20	2.43	Mature	Good	Average	Exotic		Long (>40 years)	Low	Row of 3 along Epping Road frontage. Western most specimen largest and most dominant.	Within footprint of works.	Remove	
356	3	<i>Acmena smithii var. minor</i>	Small Leaf Lilly Pilly	7.5	5.0	0.27	0.30	3.24	2.00	Mature	Fair	Poor	Native	Deadwood-Minor, Tip Dieback, Co-dominant Stems, Inclusions	Medium (15-40 years)	Low		Within footprint of works.	Remove	
357	1	<i>Corymbia maculata</i>	Spotted Gum	19.5	10.0	0.57	0.70	6.84	2.85	Mature	Good	Excellent	Native		Long (>40 years)	High	Prominent and large tree.	Nil impacts expected.	Retain	
358	1	<i>Corymbia maculata</i>	Spotted Gum	19.5	10.0	0.52	0.65	6.24	2.76	Mature	Good	Excellent	Native		Long (>40 years)	High	Prominent and large tree.	Minor incursion of 6% expected to the northern side of the tree resulting from the excavation required to construct the basement of one of the new tower developments. Upper building levels are subject to detailed design and must be offset from the tree to ensure appropriate retention and protection.	Retain	
359	1	<i>Eucalyptus tessellaris</i>	Morton Bay Ash	7.0	4.0	0.20	0.25	2.40	1.85	Semi-mature	Good	Average	Native		Long (>40 years)	Low	Species from northern tablelands and Qld.	Suggest removal to the betterment of the larger, more significant trees to be retained.	Remove	
360	1	<i>Fraxinus ornus</i>	Mana Ash	5.0	5.0	0.23	0.27	2.76	1.91	Mature	Good	Average	Exotic		Short (5-15 years)	Low		Suggest removal to the betterment of the larger, more significant trees to be retained.	Remove	
361	1	<i>Chamaecyparis obtusa cv.</i>	Hinoki Cypress Cultivar	8.5	7.0	0.45	0.48	5.40	2.43	Mature	Good	Average	Exotic	Congested Branches, Co-dominant Stems	Medium (15-40 years)	Low		Within footprint of works.	Remove	
362	1	<i>Callistemon viminalis cv.</i>	Weeping Bottlebrush	6.5	5.0	0.20	0.25	2.40	1.85	Mature	Fair	Poor	Native	Co-dominant Stems, Inclusions, Very Asymmetric Form	Medium (15-40 years)	Nil / Remove	Very suppressed by adjoining trees.	Poor quality tree. Recommend removal	Remove	
363	1	<i>Corymbia maculata</i>	Spotted Gum	21.5	10.0	0.79	0.98	9.48	3.28	Mature	Good	Excellent	Native		Long (>40 years)	High	Prominent and large tree.	Minor incursion of 8% expected to the northern side of the tree resulting from the excavation required to construct basement of one of the new tower developments. Upper building levels are subject to detailed design and must be offset from the tree to ensure appropriate retention and protection.	Retain	
364	1	<i>Corymbia maculata</i>	Spotted Gum	21.5	10.0	0.89	1.16	10.68	3.52	Mature	Good	Excellent	Native		Long (>40 years)	High	Prominent and large tree.	Within footprint of works.	Remove	
365	1	<i>Corymbia maculata</i>	Spotted Gum	19.5	9.0	0.74	1.05	8.88	3.38	Mature	Fair	Average	Native	Deadwood-Minor, Pest/Disease	Long (>40 years)	Moderate	Some wounding and bark dysfunction on northern side of trunk from ground to 3.0m. Suspected borer. Prominent and large tree.	Within footprint of works.	Remove	
366	1	<i>Jacaranda mimosifolia</i>	Jacaranda	18.0	9.0	0.50	0.52	6.00	2.51	Mature	Good	Average	Exotic	Co-dominant Stems	Long (>40 years)	Moderate		Within footprint of works.	Remove	
367	1	<i>Eucalyptus camaldulensis?</i>	River Red Gum	18.0	9.0	0.59	0.71	7.08	2.87	Mature	Poor	Average	Native	Deadwood-Minor, Branch Tearouts, Cavity	Medium (15-40 years)	Low	Minor hollows and spouts.	Within footprint of works.	Remove	
368	1	<i>Pittosporum tenuifolium</i>	Variiegated Pittosporum	7.0	3.0	0.20	0.23	2.40	1.79	Mature	Good	Average	Exotic	Co-dominant Stems	Medium (15-40 years)	Low		Within footprint of works.	Remove	
369	1	<i>Magnolia x soulangiana</i>	Magnolia	7.0	8.0	0.31	0.45	3.72	2.37	Mature	Fair	Average	Exotic	Co-dominant Stems	Medium (15-40 years)	Low		Within footprint of works.	Remove	
370	1	<i>Corymbia maculata</i>	Spotted Gum	23.5	11.0	0.78	0.94	9.36	3.22	Mature	Good	Average	Native		Long (>40 years)	High	Prominent and large tree.	Within footprint of works.	Remove	
371	1	<i>Corymbia maculata</i>	Spotted Gum	25.0	10.0	0.97	1.22	11.64	3.60	Mature	Good	Average	Native		Long (>40 years)	High	Prominent and large tree.	Within footprint of works.	Remove	

Tree ID	Trees in Group	Tree Species	Common Name	Height (m)	Spread Average (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	Tree Origin	Noted Defects	SULE Rating	Retention Value	General Comments and Notes	Incursion and Impact	Recommendation
372	1	<i>Callistemon viminalis</i> cv.	Weeping Bottlebrush	7.0	7.0	0.41	0.45	4.92	2.37	Mature	Good	Average	Native	Co-dominant Stems, Inclusions	Medium (15-40 years)	Low		Within footprint of works.	Remove
373	1	<i>Ceratopetalum gummiferum</i>	New South Wales Christmas Bush	5.5	3.0	0.22	0.22	2.64	1.75	Mature	Good	Average	Endemic	Co-dominant Stems	Medium (15-40 years)	Low		Within footprint of works.	Remove
374	1	<i>Lophostemon confertus</i>	Brush Box	12.0	7.0	0.45	0.53	5.40	2.53	Mature	Good	Average	Native	Co-dominant Stems	Long (>40 years)	High	Neighbouring property tree.	Nil impacts expected.	Retain
375	1	<i>Eucalyptus punctata</i>	Grey Gum	13.5	4.0	0.15	0.26	2.00	1.88	Semi-mature	Good	Average	Endemic	Co-dominant Stems	Long (>40 years)	Moderate		Nil impacts expected.	Retain
376	1	<i>Cupressus macrocarpa</i> cv.	Monterey Cypress	12.0	8.0	0.48	0.48	5.76	2.43	Mature	Good	Average	Exotic		Medium (15-40 years)	Moderate		Major incursion of 14% noted to the western side of the tree for the regrading and construction impacts required to install the new internal roadway. It is, however, the author's opinion that this incursion is acceptable and unlikely to result in any material or negative impacts to the condition of the tree based on the levels of the proposed road being at the same or above the existing levels.	Retain
377	1	<i>Brachychiton acerifolius</i>	Illawarra Flame Tree	12.0	8.0	0.32	0.35	3.84	2.13	Mature	Poor	Average	Native	Very Asymmetric Form, Tip Dieback	Medium (15-40 years)	Low	Significant dieback.	Nil impacts expected.	Retain
378	1	<i>Eucalyptus punctata</i>	Grey Gum	11.0	3.0	0.13	0.20	2.00	1.68	Semi-mature	Good	Average	Endemic	Co-dominant Stems	Long (>40 years)	Moderate		Nil impacts expected.	Retain
379	1	<i>Ulmus procera</i>	English Elm	11.0	8.0	0.45	0.60	5.40	2.67	Over-mature	Poor	Average	Exotic	Co-dominant Stems, Very Asymmetric Form, Tip Dieback	Short (5-15 years)	Low		Minor surface impacts are expected through the installation of surrounding landscape pathways.	Retain
380	1	<i>Eucalyptus microcorys</i>	Tallowood	19.5	10.0	0.60	0.77	7.20	2.97	Mature	Good	Excellent	Native	Co-dominant Stems, Inclusions	Long (>40 years)	High	On university site. 4.6m from boundary. Part of a closely spaced group of 3. 3.7m to east of 381.	Within footprint of works.	Remove
381	1	<i>Eucalyptus microcorys</i>	Tallowood	19.5	10.0	0.69	0.94	8.28	3.22	Mature	Good	Excellent	Native		Long (>40 years)	High	On university site. 4.6m from boundary. Part of a closely spaced group of 3.	Within footprint of works.	Remove
382	1	<i>Eucalyptus microcorys</i>	Tallowood	19.5	10.0	0.67	0.95	8.04	3.24	Mature	Good	Excellent	Native	Deadwood-Major	Long (>40 years)	High	On university site. 7.9m from boundary. Part of a closely spaced group of 3. In centre of triangle of trees 3.7m to north of others.	Within footprint of works.	Remove
383	1	<i>Eucalyptus microcorys</i>	Tallowood	12.0	10.0	0.62	0.74	7.44	2.92	Mature	Fair	Average	Native	Co-dominant Stems, Very Asymmetric Form	Long (>40 years)	Moderate	On university site. 4.6m from boundary fence. Part of a closely spaced group of 2. Canopy overhangs boundary fence by 4m.	Within footprint of works.	Remove
384	1	<i>Eucalyptus microcorys</i>	Tallowood	20.0	10.0	0.77	1.02	9.24	3.34	Mature	Good	Excellent	Native		Long (>40 years)	High	On university site. 7.6m from boundary fence.	Minor incursion of 9% expected to the southern side of the tree for the regrading and construction impacts required to install the new internal roadway, bridge and new creek line. This incursion results from the minor filling required to regrade the area and, in the author's opinion, is unlikely to result in any major material or negative impacts to the condition of the tree.	Retain
385	1	<i>Eucalyptus tereticornis</i>	Forest Red Gum	18.0	10.0	0.51	0.62	6.12	2.71	Mature	Good	Average	Endemic	Co-dominant Stems	Long (>40 years)	High	On adjoining site. Approximately 6.0m from boundary.	Within footprint of works.	Remove
386	1	<i>Eucalyptus grandis</i>	Flooded Gum	21.0	12.0	0.67	1.03	8.04	3.35	Mature	Fair	Average	Native	Co-dominant Stems, Tip Dieback, Deadwood-Minor	Long (>40 years)	High	On university site. Approximately 9.0m from boundary.	Nil impacts expected.	Retain
387	1	<i>Eucalyptus grandis</i>	Flooded Gum	24.0	12.0	0.51	0.63	6.12	2.73	Mature	Fair	Average	Native	Tip Dieback, Deadwood-Minor	Long (>40 years)	High	On university site. Approximately 7.8m from boundary. Major roots observed towards site.	Nil impacts expected.	Retain
388	1	<i>Eucalyptus grandis</i>	Flooded Gum	22.0	9.0	0.48	0.56	5.76	2.59	Mature	Fair	Average	Native		Long (>40 years)	High	On university site. 5.9m from boundary. Retaining wall on boundary, root unlikely to be past wall.	Nil impacts expected.	Retain
389	1	<i>Eucalyptus grandis</i>	Flooded Gum	23.0	12.0	0.64	0.78	7.68	2.98	Mature	Fair	Average	Native		Long (>40 years)	High	On university site. 5.6m from boundary. Retaining wall on boundary, root unlikely to be past wall.	Nil impacts expected.	Retain
390	1	<i>Eucalyptus grandis</i>	Flooded Gum	17.0	8.0	0.41	0.55	4.92	2.57	Mature	Fair	Average	Native	Very Asymmetric Form	Long (>40 years)	High	On university site. 4.6m from boundary. Retaining wall on boundary, root unlikely to be past wall.	Nil impacts expected.	Retain
391	1	<i>Lophostemon confertus</i>	Brush Box	13.0	9.0	0.47	0.54	5.64	2.55	Mature	Fair	Average	Native		Long (>40 years)	High	On university site. 5.1m from boundary. Retaining wall on boundary, root unlikely to be past wall.	Nil impacts expected.	Retain
392	4	<i>Eucalyptus punctata</i>	Grey Gum	13.0	9.0	0.64	0.64	7.68	2.74	Mature	Fair	Average	Endemic	Deadwood-Minor, Epicormic Growth	Long (>40 years)	Moderate	On university site. Largest specimen measured.	Nil impacts expected.	Retain
393	1	<i>Eucalyptus punctata</i>	Grey Gum	13.0	9.0	0.50	0.56	6.00	2.59	Mature	Poor	Average	Endemic	Decay-Minor, Major Wounding, Tip Dieback, Deadwood-Major	Medium (15-40 years)	Low	On university site.	Nil impacts expected.	Retain
394	1	<i>Eucalyptus tereticornis?</i>	Forest Red Gum	9.5	6.0	0.42	0.49	5.04	2.45	Mature	Fair	Average	Endemic		Long (>40 years)	Moderate	On university site.	Nil impacts expected.	Retain
395	1	<i>Eucalyptus saligna</i>	Sydney Blue Gum	23.0	9.0	0.76	0.85	9.12	3.09	Mature	Fair	Average	Endemic		Long (>40 years)	High	On university site.	Nil impacts expected.	Retain
396	1	<i>Euc. sp.</i>	Gum	23.0	9.0	0.39	0.52	4.68	2.51	Mature	Fair	Average	Native		Long (>40 years)	Moderate	On university site.	Nil impacts expected.	Retain
397	1	<i>Eucalyptus saligna</i>	Sydney Blue Gum	25.0	9.0	0.74	0.93	8.88	3.21	Mature	Good	Average	Endemic		Long (>40 years)	High	On university site.	Nil impacts expected.	Retain
398	1	<i>Eucalyptus elata</i>	River Peppermint	12.0	9.0	0.36	0.49	4.32	2.45	Mature	Fair	Average	Native	Deadwood-Minor, Very Asymmetric Form	Long (>40 years)	Low	On university site. Asymmetric to west.	Nil impacts expected.	Retain
399	1	<i>Eucalyptus saligna</i>	Sydney Blue Gum	28.0	12.0	0.71	0.80	8.52	3.01	Mature	Good	Average	Endemic		Long (>40 years)	High	On university site.	Nil impacts expected.	Retain
400	1	<i>Eucalyptus saligna</i>	Sydney Blue Gum	28.0	12.0	0.78	0.93	9.36	3.21	Mature	Good	Average	Endemic	Deadwood-Minor, Cavity	Long (>40 years)	High	On university site.	Nil impacts expected.	Retain
401	1	<i>Corymbia maculata</i>	Spotted Gum	19.5	9.0	0.40	0.48	4.80	2.43	Mature	Fair	Average	Native		Long (>40 years)	Moderate	On university site.	Nil impacts expected.	Retain
402	5	<i>Lophostemon confertus</i>	Brush Box	18.0	9.0	0.42	0.52	5.04	2.51	Mature	Fair	Average	Native		Long (>40 years)	Moderate	On university site. Row planting.	Nil impacts expected.	Retain
403	3	<i>Lophostemon confertus</i>	Brush Box	18.0	9.0	0.58	0.73	6.96	2.90	Mature	Fair	Average	Native		Long (>40 years)	Moderate	On university site. Row planting.	Nil impacts expected.	Retain
404	1	<i>Lophostemon confertus</i>	Brush Box	17.0	7.0	0.38	0.47	4.56	2.41	Mature	Fair	Average	Native		Long (>40 years)	Moderate	On university site.	Nil impacts expected.	Retain
405	1	<i>Lophostemon confertus</i>	Brush Box	19.0	10.0	0.45	0.60	5.40	2.67	Mature	Fair	Average	Native		Long (>40 years)	Moderate	On university site.	Nil impacts expected.	Retain
406	1	<i>Lophostemon confertus</i>	Brush Box	9.5	6.0	0.28	0.40	3.36	2.25	Mature	Fair	Poor	Native	Co-dominant Stems, Very Asymmetric Form	Long (>40 years)	Low	On university site. Asymmetric to south.	Nil impacts expected.	Retain
407	1	<i>Lophostemon confertus</i>	Brush Box	16.0	9.0	0.38	0.45	4.56	2.37	Mature	Fair	Average	Native		Long (>40 years)	Moderate	On university site.	Nil impacts expected.	Retain
408	1	<i>Lophostemon confertus</i>	Brush Box	17.0	9.0	0.40	0.50	4.80	2.47	Mature	Fair	Average	Native		Long (>40 years)	Moderate	On university site.	Minor incursion of 4% expected to the southern side of the tree for the regrading and construction impacts required for the new creek line. This incursion results from the minor filling required to regrade the area and, in the author's opinion, it is unlikely to result in any major material or negative impacts to the condition of the tree.	Retain
409	1	<i>Lophostemon confertus</i>	Brush Box	14.0	5.0	0.24	0.32	2.88	2.05	Mature	Fair	Suppressed	Native	Lean-Minor	Medium (15-40 years)	Low	On university site.	Within footprint of works.	Remove
410	1	<i>Eucalyptus grandis</i>	Flooded Gum	22.0	10.0	0.50	0.67	6.00	2.80	Mature	Good	Average	Native	Deadwood-Minor	Long (>40 years)	High	On university site. On steep embankment. Non-endemic species.	Nil impacts expected.	Retain
411	1	<i>Eucalyptus grandis</i>	Flooded Gum	24.0	12.0	0.80	0.96	9.60	3.25	Mature	Fair	Average	Native		Long (>40 years)	High	On university site. Non-endemic species.	Minor incursion of 9% expected to the southern side of the tree for the regrading and construction impacts required for the new creek line. This incursion results from the minor filling required to regrade the area and, in the author's opinion, it is unlikely to result in any major material or negative impacts to the condition of the tree.	Retain
412	1	<i>Pinus elliotii</i>	Slash Pine	18.0	9.0	0.62	0.77	7.44	2.97	Mature	Fair	Average	Exotic	Very Asymmetric Form, Deadwood-Major	Medium (15-40 years)	Low	On university site. Asymmetric to south-west.	Within footprint of works.	Remove
413	1	<i>Eucalyptus grandis</i>	Flooded Gum	9.0	3.0	0.11	0.13	2.00	1.40	Young	Fair	Average	Native		Replaceable (Small/Young)	Low	On university site. Non-endemic species.	Within footprint of works.	Remove
414	1	<i>Melaleuca linariifolia</i>	Flax Leaved Paperbark	15.5	3.0	0.10	0.15	2.00	1.49	Semi-mature	Fair	Average	Endemic		Replaceable (Small/Young)	Low	On university site. Butt sweep then corrected.	Within footprint of works.	Remove
415	1	<i>Eucalyptus grandis</i>	Flooded Gum	14.0	5.0	0.22	0.28	2.64	1.94	Semi-mature	Fair	Average	Native		Long (>40 years)	Moderate	On university site. Non-endemic species.	Within footprint of works.	Remove

Tree ID	Trees in Group	Tree Species	Common Name	Height (m)	Spread Average (m)	Trunk Diameter Breast Height (dbh) (m)	Trunk Diameter at base (dg) (m)	Nominal TPZ radius (m) 12xdbh (AS 4970)	Nominal SRZ radius (m) (AS 4970)	Age Class	Current Vigour	Current Form	Tree Origin	Noted Defects	SULE Rating	Retention Value	General Comments and Notes	Incursion and Impact	Recommendation
416	7	<i>Eucalyptus grandis</i>	Flooded Gum	7.0	2.0	0.14	0.19	2.00	1.65	Young	Fair	Average	Native		Replaceable (Small/Young)	Low	On university site. Numerous self sown saplings. Non-endemic species	Within footprint of works.	Remove
417	1	<i>Pinus elliotii</i>	Slash Pine	11.0	9.0	0.26	0.36	3.12	2.15	Over-mature	Poor	Poor	Exotic	Very Asymmetric Form, Deadwood-Major, Tip Dieback	Remove (<5 years)	Nil / Remove	On university site.	Within footprint of works.	Remove
418	1	<i>Pinus elliotii</i>	Slash Pine	22.0	9.0	0.57	0.68	6.84	2.81	Mature	Fair	Average	Exotic		Long (>40 years)	Low	On university site. Sparse canopy.	Within footprint of works.	Remove
419	1	<i>Pittosporum undulatum</i>	Sweet Pittosporum	7.0	6.0	0.17	0.33	2.04	2.08	Mature	Fair	Average	Endemic		Medium (15-40 years)	Low	On university site.	Within footprint of works.	Remove
420	2	<i>Eucalyptus saligna</i>	Sydney Blue Gum	13.0	9.0	0.18	0.22	2.16	1.75	Semi-mature	Fair	Average	Endemic		Long (>40 years)	Moderate	On university site.	Within footprint of works.	Remove
421	1	<i>Eucalyptus microcorys</i>	Tallowood	24.0	14.0	0.63	0.82	7.56	3.04	Mature	Good	Average	Native		Long (>40 years)	High	On Morling College site.	Minor incursion of 6% expected to the western side of the tree for the regrading and construction impacts required for the new creek line. This incursion results from the minor filling required to regrade the area and, in the author's opinion, it is unlikely to result in any major material or negative impacts to the condition of the tree.	Retain
422	1	<i>Pinus elliotii</i>	Slash Pine	21.0	10.0	0.65	0.65	7.80	2.76	Mature	Fair	Average	Exotic	Co-dominant Stems, Deadwood-Major	Medium (15-40 years)	Low	On university site. Tridominant stems. Sparse canopy.	Within footprint of works.	Remove
423	2	<i>Pittosporum undulatum</i>	Sweet Pittosporum	8.5	5.0	0.20	0.24	2.40	1.82	Mature	Fair	Average	Endemic		Medium (15-40 years)	Low	On university site.	Within footprint of works.	Remove
424	1	<i>Pinus elliotii</i>	Slash Pine	20.0	9.0	0.79	0.79	9.48	3.00	Mature	Fair	Average	Exotic	Tip Dieback, Very Asymmetric Form, Deadwood-Minor	Medium (15-40 years)	Low	On university site. Asymmetric to west. Sparse canopy	Within footprint of works.	Remove
425	2	<i>Pittosporum undulatum</i>	Sweet Pittosporum	7.0	6.0	0.13	0.15	2.00	1.49	Mature	Fair	Average	Endemic		Medium (15-40 years)	Low	On university site.	Nil impacts expected.	Retain
426	1	<i>Eucalyptus grandis</i>	Flooded Gum	21.0	9.0	0.71	0.79	8.52	3.00	Mature	Good	Average	Native		Long (>40 years)	Moderate	On Morling College site.	Minor incursion of 2% expected to the southwestern side of the tree for the regrading and construction impacts required for the new creek line. This incursion results from the minor filling required to regrade the area and, in the author's opinion, it is unlikely to result in any major material or negative impacts to the condition of the tree.	Retain
427	1	<i>Eucalyptus grandis</i>	Flooded Gum	24.0	14.0	0.86	1.05	10.32	3.38	Mature	Good	Average	Native		Long (>40 years)	High	On university site.	Minor incursion of 2% expected to the southwestern side of the tree for the regrading and construction impacts required for the new creek line. This incursion results from the minor filling required to regrade the area and, in the author's opinion, it is unlikely to result in any major material or negative impacts to the condition of the tree.	Retain
428	2	<i>Eucalyptus grandis</i>	Flooded Gum	12.0	4.0	0.12	0.17	2.00	1.57	Semi-mature	Fair	Average	Native		Long (>40 years)	Moderate	On university site.	Nil impacts expected.	Retain
429	1	<i>Pinus elliotii</i>	Slash Pine	13.0	9.0	0.70	0.83	8.40	3.06	Mature	Fair	Average	Exotic	Co-dominant Stems	Long (>40 years)	Low	On university site. Sparse canopy.	Nil impacts expected.	Retain
430	1	<i>Pittosporum undulatum</i>	Sweet Pittosporum	9.5	6.0	0.14	0.18	2.00	1.61	Mature	Fair	Average	Endemic		Medium (15-40 years)	Low	On university site.	Nil impacts expected.	Retain
431	1	<i>Eucalyptus grandis</i>	Flooded Gum	17.0	9.0	0.35	0.47	4.20	2.41	Mature	Fair	Average	Native	Lean-Minor, Very Asymmetric Form	Long (>40 years)	Moderate	On university site. Asymmetric to north-east.	Nil impacts expected.	Retain
432	1	<i>Pinus elliotii</i>	Slash Pine	20.0	9.0	0.42	0.48	5.04	2.43	Mature	Fair	Average	Exotic	Deadwood-Major, Tip Dieback	Medium (15-40 years)	Low	On university site.	Nil impacts expected.	Retain
433	1	<i>Tibouchina lepidota</i>	Lasiandra	9.0	5.0	0.22	0.30	2.64	2.00	Mature	Good	Average	Exotic	Epicormic Growth	Medium (15-40 years)	Low	On neighbouring site.	Nil impacts expected.	Retain
434	1	<i>Archontophoenix alexandrae</i>	Alexandra Palm	10.0	4.0	0.25	0.40	3.00	1.20	Mature	Fair	Average	Exotic		Long (>40 years)	Moderate	On neighbouring site.	Nil impacts expected.	Retain
435	3	<i>Camellia japonica</i>	Japanese Camellia	7.0	5.0	0.24	0.30	2.88	2.00	Mature	Good	Average	Exotic	Co-dominant Stems	Long (>40 years)	Moderate	On neighbouring site.	Minor surface impacts are expected through the installation of surrounding landscape pathways.	Retain
436	1	<i>Lagerstroemia indica</i>	Crepe Myrtle	6.5	6.0	0.24	0.30	2.88	2.00	Mature	Fair	Average	Exotic	Co-dominant Stems	Long (>40 years)	Moderate	On university site.	Minor surface impacts are expected through the installation of surrounding landscape pathways.	Retain
437	1	<i>Eucalyptus punctata</i>	Grey Gum	8.5	2.5	0.09	0.14	2.00	1.45	Semi-mature	Fair	Average	Endemic		Long (>40 years)	Moderate	On university site.	Nil impacts expected.	Retain
438	1	<i>Eucalyptus punctata</i>	Grey Gum	11.0	4.0	0.15	0.21	2.00	1.72	Mature	Fair	Average	Endemic		Long (>40 years)	Moderate	On neighbouring site.	Nil impacts expected.	Retain
439	9	<i>Backhousia citriodora</i>	Lemon Scented Myrtle	7.0	2.5	0.14	0.18	2.00	1.61	Mature	Fair	Average	Native		Long (>40 years)	Moderate	Row planting along fence on neighbouring site.	Nil impacts expected.	Retain
440	2	<i>Backhousia citriodora</i>	Lemon Scented Myrtle	8.0	5.0	0.10	0.11	2.00	1.31	Mature	Good	Average	Native		Long (>40 years)	Moderate	Row planting along fence on neighbouring site.	Nil impacts expected.	Retain
441	13	<i>Waterhousea floribunda</i>	Weeping Lilly Pilly	9.0	5.0	0.21	0.25	2.52	1.85	Semi-mature	Good	Average	Native		Long (>40 years)	Moderate	Row planting along fence on neighbouring site.	Nil impacts expected.	Retain

### 4.3 Sub-Surface Tree Root Investigation Report of Neighbouring Tree T05 (*Corymbia maculata*)

16 October 2024



## **BAPTISTCARE**

c/o Luis Santeliz – Project Manager

## **TSA RILEY**

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## **RESULTS OF NON-DESTRUCTIVE EXPLORATORY TRENCHING – T05 TREE ROOT INVESTIGATIONS BAPTISTCARE MASTER PLAN, MACQUARIE PARK**

### **1. Background**

Further to our original tree assessments completed in December 2021, Arterra attended the site again on the 16 February 2022 to undertake exploratory trenching and attempt to ascertain the presence, or otherwise, of significant tree roots emanating from a neighbouring tree (T05) that may or may not be projecting into the BaptistCare development site. This is in an area that is proposed to be excavated for the projects new cycleway and road which would result in a theoretical incursion into the Tree Protection Zone of this tree that is in excess of commonly accepted thresholds.

We note that the BaptistCare site boundary is not precisely defined by the existing fence line in this location. The site surveys show the boundary to be slightly further north, on the Gumnut Cottage side of the fence closer to the tree by approx. 500mm. We undertook all exploratory excavations as close as possible to the fence, but on the BaptistCare side. We believe this has still given an more than adequate indication of the root development in the vicinity of the boundary. It is also noted that the proposed new cycleway edge is 1.1m south of the boundary, so the trench adequately represents where earthworks is likely to occur.

### **2. Site Observations**

Tree T05 is a *Corymbia maculata* (Spotted Gum) and is noted as a 'Moderate' retention value tree, but located within the adjacent Macquarie University site just north of the northern BaptistCare boundary. It is currently in relatively good condition, growing within a small open grassed area, with its trunk base relatively level or slightly higher than the existing BaptistCare internal roadway. The existing building to the north of this tree (Gumnut Cottage Daycare Centre) is situated immediately north of this tree and within its TPZ.



Figure 1 – Photo of the base of Tree T05 *Corymbia maculata* with existing concrete footpath shown close to the base of the tree. (Photo: Arterra 11/12/21)



*Figure 2 – Photo of Tree T05 *Corymbia maculata* shown within the Macquarie University site just north of the BaptistCare boundary, with the existing childcare building (Gumnut Cottage) shown in the background. The canopy of the tree is somewhat asymmetrical with much of its canopy is to the south of the tree. (Photo: Arterra 11/12/21)*

### 3. Tree and Assessment Area Details

- Tree T05 is a large, mature *Corymbia maculata* (Spotted Gum) located around 3.5m north of the site boundary, within the Macquarie University. It has a diameter at breast height (DBH) of 0.57m and a calculated nominal TPZ radius of 6.84m per AS4970 – Protection of Trees on Development Sites.
- The nominal TPZ therefore extends approximately 3.5m into the BaptistCare site along the northern boundary. Some of this TPZ is covered by an existing asphalt driveway that runs approximately east-west adjacent to the northern boundary.
- Given the existing services, other nearby trees, the relatively close proximity of proposed road and cycleway works to the tree and the theoretical incursion into the Tree Protection Zone it was determined that non-destructive excavation of an exploratory trench using an airspade would be the most appropriate method to potentially identify and locate any significant tree roots.

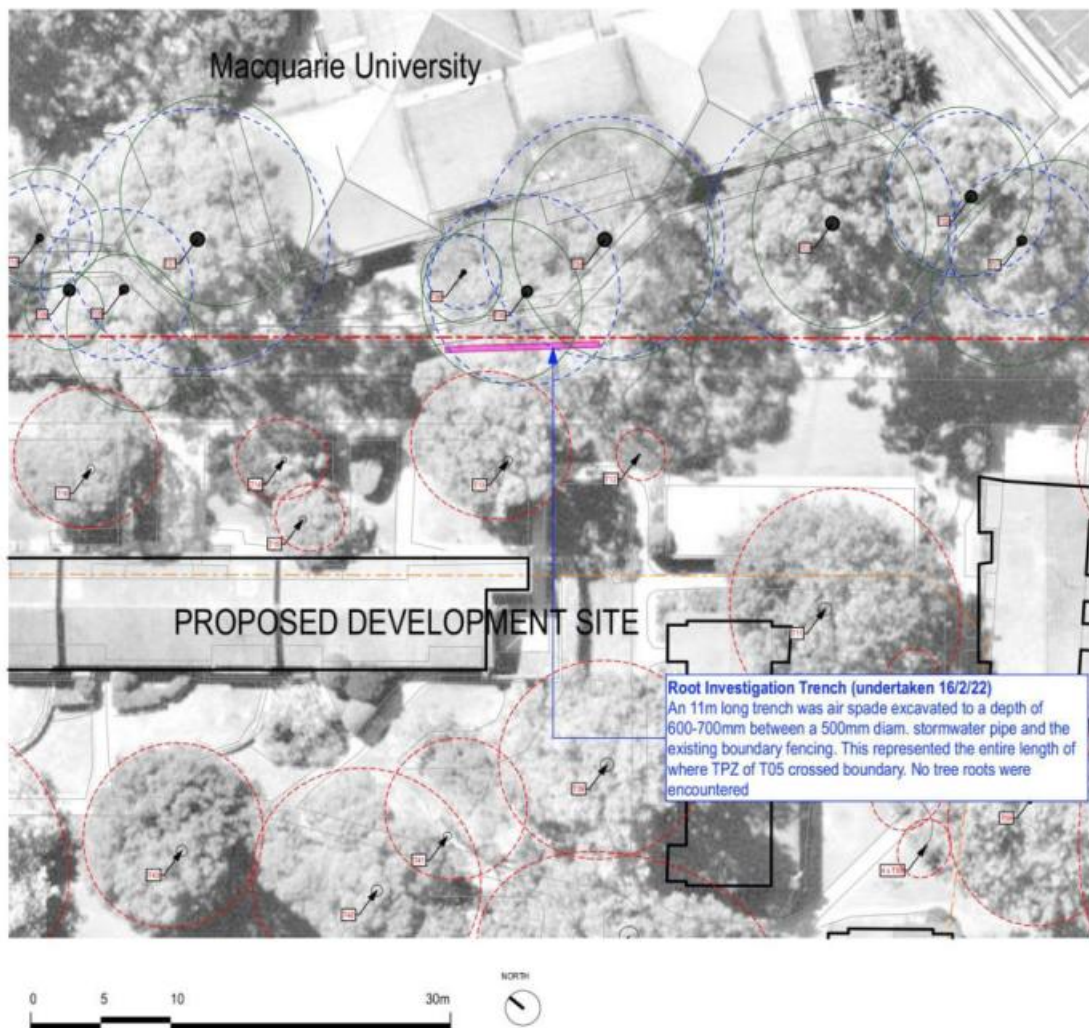


Figure 3 – Plan of the trenching location and extent and relationship to boundary and tree. (Source: Arterra)



Figure 4 – Photo of the area where root investigations were carried out. Line of trench marked in yellow. (Photo: Arterra 16/2/22)



Figure 4 – Photo of the area where root investigations were carried out, with trenching completed. (Photo: Arterra 16/2/22)

#### 4. Non-Destructive Excavation Using Airspade - Root Investigation Observations and Interpretation

- The trench was carefully excavated using an airspade and hand tools to minimise the likelihood of damaging any tree roots or services that may have been exposed.
- The trench was excavated approximately 200mm wide and for 11m in length, which was the full extent of the nominal TPZ of T05, where it crosses the boundary.
- The trench was excavated as close as possible to the fence on the BaptistCare side, adjacent to T05.
- A relatively shallow sewer line and stormwater line were exposed by the trenching. The top of the stormwater pipe was only 200mm below the grounds surface level.
- The stormwater pipe centreline was located 1.6m from the back of kerb and appears to be parallel to the roadway.

- The stormwater line was identified as a 400mm Ø concrete pipe, with a sewer pipe, adjacent to it, being a 150mm Ø PVC pipe. This was located immediately to the north of stormwater (and nearer the tree) but at the same invert (bottom) level. They were likely laid within the same trench at the time of their installation. It is assumed these pipes date to the early period of the sites development and pre 1980s. The trees planted around Gumnut Cottage were probably planted after this date. Therefore, it is assumed the stormwater pipes pre-date the existence of tree T05. Roots could have grown up to the pipes, but anything shallower than 600mm would have been blocked by the pipe and would have travelled along the pipe edge or over it.
- The larger concrete pipe was exposed at a depth of 200mm below the surface. The pipe diameter means that the pipe extends a further 400mm deeper. This, in effect, means the pipe is acting as a relatively contiguous root barrier to a depth of at least 600mm. Most tree roots are usually found within the top 700mm of soil. The northern edges of the pipe were exposed via the air spade and no roots were observed apart from one small root crossing the top of the pipe.
- Only one (1) very small root (approx. 20mm Ø) was encountered within the entire length of the exploratory trench, which was 3m west of the eastern benchmark (the start of the trench). (Refer images below).
- No significant tree roots of any size or kind were encountered within the exploratory trench, either going over or along the northern side of the pipe. We can not rule out tree roots being located deeper and going under the pipework, but in Arterra's experience, and our specialist trenching contractors experience, this is far less likely to occur when below a 700mm depth. It would not normally be expected to do an exploratory root trench in these type of clay soils deeper than 600mm, when undertaking exploratory root investigations, particularly if other roots are generally not being observed or encountered.



*Figure 5 – Photo of the area where root investigations were carried out. Line of trench and depth in some areas of the investigation were dictated by the presence of a large concrete stormwater pipe. The northern side of pipe was exposed where possible to check for any roots tracking along pipe run. Only one very small root was observed in any of the trenching. Note the riser cap from the lower sewer line which was running alongside and lower than the stormwater line. The small root, stormwater pipe and sewer shown arrowed. (Photo: Arterra 16/2/22)*



*Figure 6 – Photo of the area where root investigations were carried out. Trench depth and depth of investigation was dictated by presence of large concrete stormwater pipe. The northern side of pipe was exposed and investigated where possible to check for any roots tracking along the pipe run. None were observed. (Photo: Arterra 16/2/22)*



Figure 7 – Only one very small root (20mm  $\phi$ ) was discovered along the entire length of the trench. The root was spray painted orange for visibility and shown arrowed. (Photo: Arterra 16/2/22)

## 5. Conclusions

The excavations for the new internal cycleway and road would result in an incursion of greater than 10% (defined as a Major Incursion as per AS4970-2009) within the 'nominal' TPZ of T05. It is, the author's opinion that this incursion is considered acceptable and the construction of the proposed road and cycleway is unlikely to result in any material, or negative impacts to the condition of the tree based on the observations from the exploratory trenching and the following:

- No significant roots were exposed or observed in the exploratory trenching to a depth of 600mm below ground surface
- The large concrete pipework would have acted as a natural root barrier to around 600mm depth, that would have prevented extensive or larger root development within the area proposed for the new internal cycleway and road.
- Significant roots are far less likely to be present below the pipe, and if they are they present, are likely to be limited in number.
- 

– end of report –

#### 4.4 Tree Root Investigation (Ground Penetrating Radar) Report of Neighbouring Tree T76 (*Eucalyptus saligna*)

5 March 2025



## **BAPTISTCARE**

c/o Luis Santeliz – Project Manager

## **TSA RILEY**

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## **RESULTS OF GROUND PENETRATING RADAR – T76 TREE ROOT INVESTIGATIONS BAPTISTCARE MASTER PLAN, MACQUARIE PARK**

### **1. Background**

Further to our original tree assessments completed in December 2021, 16 February 2022, and 11 & 12 March 2022, Arterra attended the site again on the 1 March 2024 to undertake exploratory non-destructive, subsurface investigations employing Ground Penetrating Radar (GPR) to attempt to ascertain the presence, or otherwise, of any significant tree roots emanating from a neighbouring property tree (T76) that may be projecting into the BaptistCare site. This work was overseen and directed by Robert Smart (Arterra's in-house consulting arborist (AQF Level 5), member of the International Society of Arboriculture - Australian Chapter and a Registered Consulting Arborist with Arboriculture Australia and an accredited member of Institute of Consulting Arboriculturists). The ground penetrating radar was operated by a specialist in the field being GBG Group Geophysical Consultants. A full copy of their methodology, equipment and findings is included as an appendix to this report.

As part of the Concept Master Plan and Urban Design layout, it is proposed and required that a new internal roadway be installed to the north of tree T76. Its installation would likely require excavations below existing levels which would result in a theoretical incursion into the Tree Protection Zone of this tree that is in excess of commonly accepted thresholds. Arterra therefore recommended that root investigation be accrued out.

### **2. Site Observations**

Tree (T76) is a *Eucalyptus saligna* (Sydney Blue Gum) and is noted as a 'Moderate' retention value tree located within the adjacent Parkside site on the northern Parkside boundary. It is currently in relatively good condition, but with a very significant basal borer blaze to 60% of its trunk circumference from the ground level and up to 3m high on the southern side of the tree (the Parkside tower development side). This seems to have existed for numerous years and pre-dates the Parkside development. Its trunk base is adjoining an existing roadway within BaptistCare, and slightly higher. Some bulging of the road surface is evident indicating roots travelling beneath the surface. Following the completion of the Parkside development the tree now sits within a recently created garden bed. Numerous younger Eucalypts of the same species now surround this tree and are growing vigorously.

The adjacent Parkside building was built between 2021-2023 with some ground disturbance to the east of the tree through the installation of a pedestrian ramp, however, the building and basements appear to have been well set back to limit construction impacts to the tree. It is to be noted, however, that the tree was likely impacted by the construction of the Parkside tower as its canopy was previously more sparse (during initial assessment undertaken by Arterra in December 2021) and the observed TPZ extent and fencing during construction works being potentially inadequate on the southern side. However, the health and vigour of the tree appears to have radically improved following the completion of the Parkside construction. The canopy and foliage appearing to recover with notable additional and new growth evident in 2024. It is the authors opinion that the additional topsoil and potential additional watering within the TPZ, and the establishment of the new Parkside gardens has likely aided the improvement in this trees overall health and condition.



*Figure 1 – Image of Tree T76 Eucalyptus saligna (Sydney Blue Gum) on the northern boundary of the adjoining Parkside site showing the existing asphalt driveway within the BaptistCare site to the north of the tree and the recently constructed Parkside building to the south of the tree. The area defined by witch's hats outlines where the proposed master plan road edge is located approximately 9m from the base of the tree. (shown with line). (Photo: Arterra 1 March 2024)*

### 3. Tree and Assessment Area Details

- Tree T76 is a large, mature *Eucalyptus saligna* (Sydney Blue Gum) with a diameter at breast height (DBH) of 1.05m and a calculated nominal TPZ radius of 12.60m as per AS4970 – Protection of Trees on Development Sites.
- This nominal TPZ extends approximately 10.0m into the BaptistCare site along the northern boundary of the adjoining Parkside.
- Much of the TPZ, within the BaptistCare site, is largely covered by an existing asphalt roadway that runs approximately east-west and directly adjacent to the northern boundary of the adjoining Parkside site.
- The area that was investigated, is north of the tree, and measures approximately 25m in an east-west direction and 7.5m in a north-south direction, thereby encapsulating the majority of the TPZ within the BaptistCare site.
- After careful consideration of the site conditions and alternative forms of investigation it was determined that the use of Ground Penetrating Radar (GPR) would be the most appropriate method to non-destructively locate and map likely significant tree roots (typically greater than 50mm in diameter) and any underground services in the defined study area. Other forms of non-destructive investigations were considered but ultimately ruled-out due to the fully paved nature of the study area and the likely presence of other below ground services and ability to potentially locate roots over a wider area. We believe this technique provides an adequate indication of the potential and likely root development in the vicinity of the proposed BaptistCare works.
- From review of historic aerial imagery and other visual clues and the age of the infrastructure, the existing asphalt road and the underground services such as stormwater were installed before the tree was planted. The majority of services were likely built in the early 1960s, with the tree planting and growth dating to the early 1980s. The tree is approximately 40 years old.

### 4. Ground Penetrating Radar (GPR) Root Investigation Observations and Interpretation

Ground penetrating radar (GPR) is a non-destructive and non-invasive geophysical technique for rapidly imaging the shallow portions of subsurface features and producing high-resolution colour sections in real time. The raw data that was produced, following the site works, was extrapolated and interpreted by GBG and then Arterra. The following are the summary of observations and results of the GPR:

- GPR penetration was typically provided to a depth of between 1.0m and 1.5m below the existing ground surface.
- The results from the GPR indicate that the tree roots are present under the existing road and were mostly quite shallow and spreading radially from the centre of the tree.
- An interpretation of the GPR imagery suggest that there may have been an historic trench excavated for a later service (likely Telstra) beneath the centre of the road to the north of the tree, with the evidence of roots typically stopping at this line of disturbance associated with this trench.
- There has likely been some further significant ground disturbance on the northern side of the existing road during the construction and installation of services for the Shalom building which occurred in 2005 and when the tree was mature. Very few definitive root readings were found in the GPR or likely to be present beyond the area of disturbance caused by the above later trench and the electrical services and driveway construction for Shalom.
- Conditions have been and are still currently far more favourable for tree root development in the areas to the south and to the east and west of the tree. Although historically, it is noted that there were also buildings close to the southern side of the tree within the Parkside site, which were demolished to facilitate the new Parkside tower development.



Figure 2 – Image of the area where GPR root investigations were carried out. The SRZ of the tree was clearly defined with the witches hats and spray paint. Note the recently completed gardens and new *Euc. saligna* planting. (Photo: Arterra 1 March 2024)

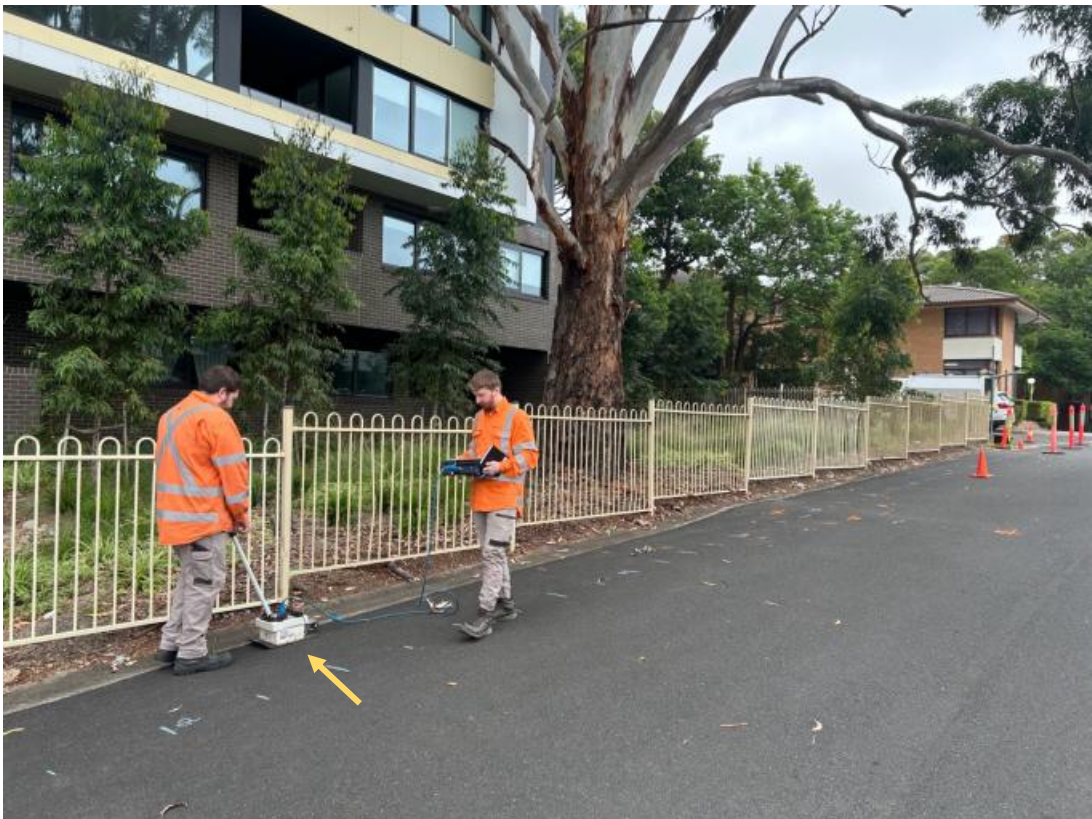


Figure 3 – Image of the area where GPR root investigations were carried out looking west. The ground penetrating radar equipment is visible (arrowed) and being used to map existing potential subsurface tree roots and services. (Photo: Arterra 1 March 2024)

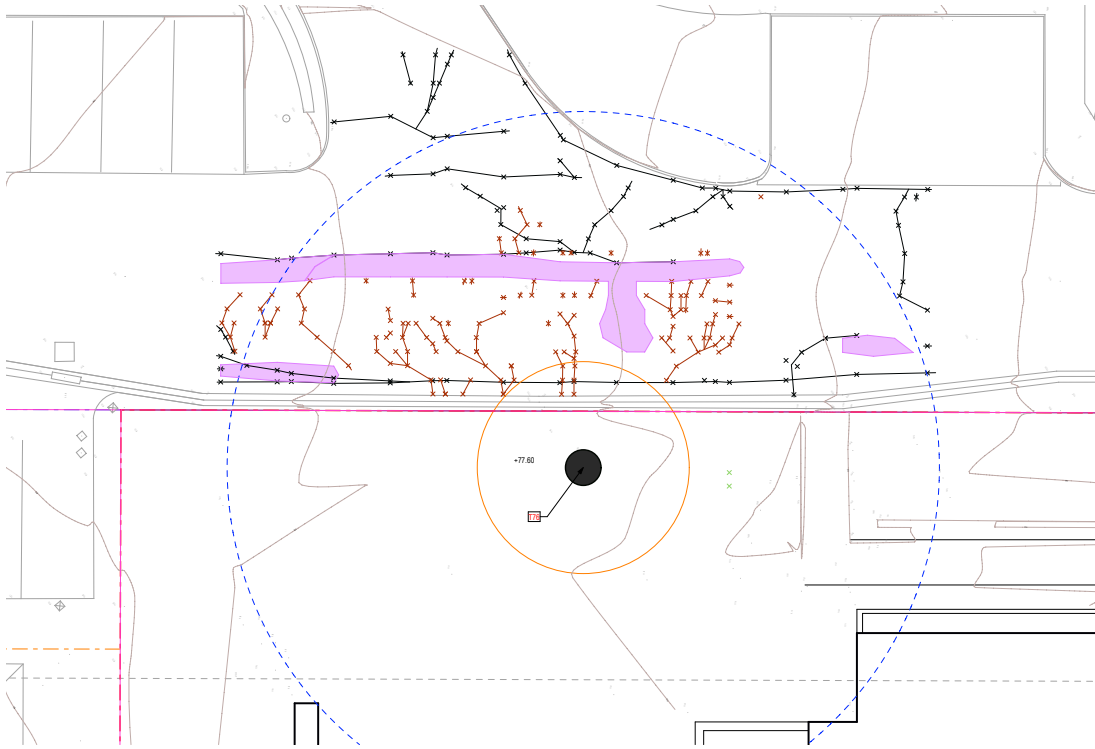


Figure 4 – Plan drawing of the root investigation area, with the RAW data results received from the GPR shown within the TPZ of T76 (TPZ shown as a blue dashed line and the SRZ shown as a solid orange line). The boundary to Parkside is shown as a red dashed line with the BaptistCare site to the north of this line. The pink fill highlights an area that was likely trenched and backfilled and/or disturbed, the red-brown line work indicates the likely location of existing tree roots, and the black line work are unknown items which are likely to be existing services. (Drawing: By Arterra - utilising GBG Group supplied CAD Data 17/05/24)

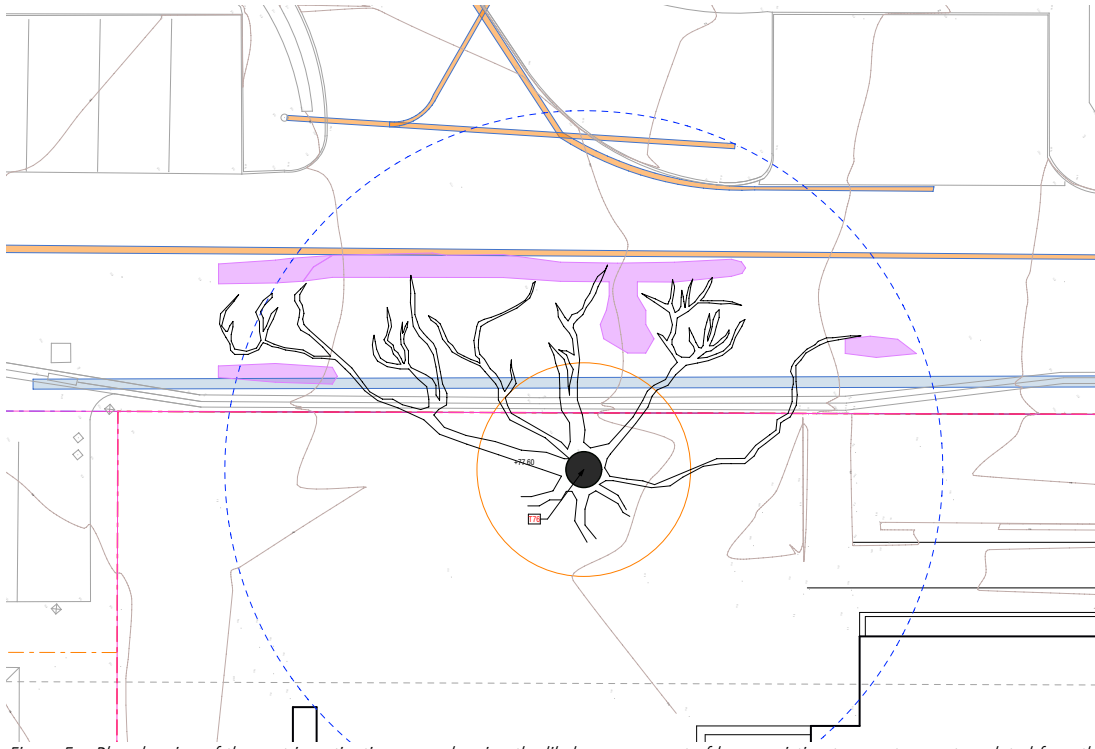


Figure 5 – Plan drawing of the root investigation area, showing the likely arrangement of larger existing tree roots as extrapolated from the RAW data results received from the GPR shown within the TPZ of T76. It is clear that the existing tree roots are probably radially emanating from the centre of the tree. The boundary to Parkside is shown as a red dashed line with the BaptistCare site to the north of this line. The pink fill highlights an area that was likely trenched and backfilled and/or disturbed with material clearly different to other subgrade treatments, likely resulting in disturbance to any existing root growth. The blue fill running east to west is the likely existing stormwater service and the orange fills are other services under the road (likely electrical and/or water) (Drawing: By Arterra - utilising GBG Group supplied Data 17/05/24)

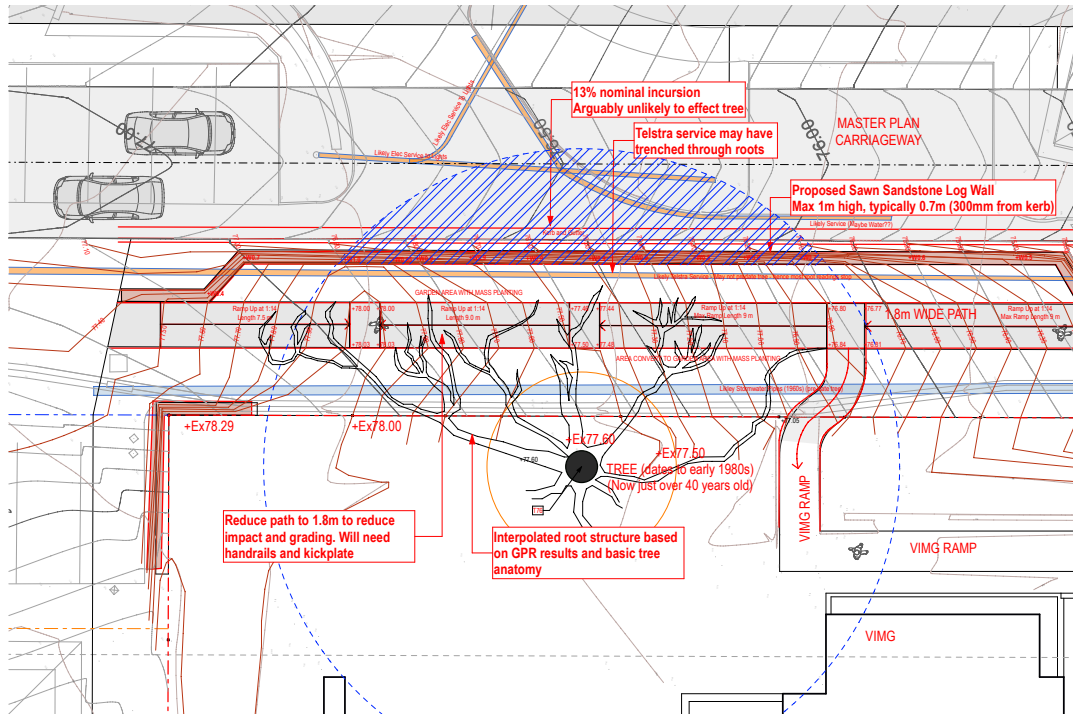


Figure 6 – The existing tree root arrangement (as extrapolated from the GPR results) were overlaid on the proposed road. The verge design has now been amended to cater for the protection of the existing tree roots close to the tree. To limit significant incursion into the TPZ, there has been significant modifications made to the masterplan designs to ensure that the proposed ‘verge’ is sensitively implemented and graded to minimise disturbance. The verge footpath has been designed with a series of 1:14 ramps to ensure that the footpath is maintained at or above the existing levels when passing through the TPZ of T76. A low impact sandstone log retaining wall (ie. no footings) has been utilised, to the north of the tree adjacent to the proposed road kerb. This is to retain the existing levels around the tree and prevent unnecessary incursions. Additionally, with the alignment of the proposed new internal road is much further north than the existing road alignment. This also allows for the removal of the existing asphalt that is close to the tree and the installation of new topsoil and better horticultural conditions within the TPZ which would likely help to further improve the health of the tree rather than impacting it. (Drawing: By Arterra - utilising G&B Group supplied Data 17/05/24)



Figure 7 – Illustrative render of the proposed Concept Master Plan highlighting the design modifications to ensure that the existing levels are retained around T76 to protect tree roots. The proposed footpath is a series of 1:14 ramps and a new low impact retaining wall has been utilised along the proposed new road edge to retain the existing levels close to the tree. (Illustrative Render: Arterra 10 October 2024)

## 5.0 Root Investigation Conclusions

The raw results and report from the GPR investigation are attached and included as an appendix to this root investigation report. The proposed road works are situated much further north of the tree than the current existing road. The new road grading will result in an incursion into 'the nominal TPZ' of approximately 13%. With this being greater than 10%, it is technically considered a Major Incursion as per AS4970-2009 within the nominal TPZ of T76. For this reason and given the history of the tree, the size and its species it was considered prudent to undertake non-destructive root investigations to guide the design.

These were undertaken and analysed by both GBG Group and Arterra. Based on these investigation it was determined that roots were present within the BaptsitCare site and that modifications to the verge grading and road details were recommended and have been subsequently adopted as part of the BaptistCare Master planning designs to be submitted for approval under the SSDA.

It is the author's opinion that the currently proposed incursion is acceptable and unlikely to result in any material, or significantly negative impacts to the condition of the tree based on the following:-

- No significant roots were identified beyond what appears to be some historic subsurface trenching beneath the existing driveway, and therefore it is expected that minimal root disturbance is likely as a result of the construction of the proposed new road vehicle carriageway.
- There is an existing Telstra underground service to the north of the tree, the installation of which, is likely to have severed any significant or fibrous roots in this area and acted as a potential preferred location for any new root growth rather than within the compacted road surfaces further north.
- The nominal 13% incursion is located in the area to the north of the historic trenching and underground Telstra services, meaning the likelihood of any significant roots within the area of incursion is very minimal.
- The alignment of the proposed internal road is further north than the existing road alignment, which also allows for the installation of new topsoil within the TPZ which would likely help to improve the overall health of the tree rather than impact upon it.
- Where roots were found within the GPR investigation, there has been significant additional modifications made to the masterplan and verge landscape design to ensure that the proposed new 'road verge' is sensitively implemented and graded to minimise subsurface disturbance. The verge footpath has been designed as a series of 1:14 ramps to ensure that the footpath level is maintained at or above the existing levels when passing through the TPZ. The footpath has been reduced in width and moved as far from the tree as reasonable and outside of the SRZ. A low impact sandstone log retaining wall has been utilised, to the north of the tree and directly adjacent to the proposed new road kerb, to enable to existing levels around the tree to be retained and thereby prevent further incursion in areas where roots were found and are most likely.
- The removal of the existing bitumen road surface and replacement with soft landscaping and new topsoil should improve horticultural growing conditions and improve tree health rather than impact it.
- On a precautionary note, even if the tree does ultimately decline, (which in the author's opinion is unlikely) there are now numerous new young replacement trees of the same species planted around the base of this tree and will very adequately cater for this tree should it ultimately require removal or pruning.

– end of report –

**Supplementary Appendix – GBG GROUP – BaptistCare,  
Macquarie Park Tree Root Mapping Report (dated 8<sup>th</sup> March  
2024 – Job No. GBGA2707)**

**Supplementary Appendix – GBG GROUP – BaptistCare,  
Macquarie Park Tree Root Mapping Report (dated 8<sup>th</sup> March  
2024 – Job No. GBGA2707)**



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REPORT

# BaptistCare, Macquarie Park Tree Root Mapping

Date: 8<sup>th</sup> March 2024

Job Number: GBGA2707



*Photo Credit: Oscar Leon Estacio*

## DETAILS

<b>Project Number:</b>	GBGA2707
<b>Document Title:</b>	BaptistCare, Macquarie Park Tree Root Mapping
<b>Site Address:</b>	Eucalyptus Street, Macquarie Park NSW 2113
<b>Client Details:</b>	Robert Smart Director / Registered Landscape Architect / Registered Consulting Arborist ARTERRA
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## 1 INTRODUCTION

At the request of Arterra, GBG Australia Pty Ltd (part of GBG Group) carried out a Non-Destructive Test (NDT) using Ground Penetrating Radar (GPR) at the BaptistCare facility on Eucalyptus Street, Macquarie Park. We are pleased to present the findings of the investigation in the following report.

The objective of the investigation was to locate and map roots across a non-public road. The tree roots are emanating from a mature tree designated as T76 on the Client's drawings. It was also requested that any potential services within the same area be plotted.

It is our understanding that the area is to be redeveloped into 'vertical villages' consisting of high-rise apartment blocks and that the road will be shifted as a result, with the current position repurposed as a grass verge. The road is therefore to be excavated and the intention is to retain the tree.

## 2 INVESTIGATION SITE

The area of interest is shown in Figure 1 as encountered on the day of the survey.



**Figure 1. Site Image looking south-east along the road towards tree T76**

The investigation was undertaken over the area specified by the Client in the scoping email and images. The site was clear, unobstructed, and generally well suited to GPR as most of the survey area was comprised of the homogenous asphalt road.

Data was collected as an orthogonal grid along series linear profile lines referenced to the established zero datum and the road layout. The zero datum was marked on site with spray paint by Robert Smart of Arterra at the start of the survey and was positioned 12.5 m along the fence line to the north-west of the tree. The survey area requested was 25 m x 7 m in total, equating to the full width of the road and 12.5 m either side of the tree.

### 3 GROUND PENETRATING RADAR (GPR) DATA ACQUISITION

Data collection involved moving the GPR system slowly and steadily along a series of parallel and perpendicular survey lines set at 0.5 to 1m intervals within the surveyable area.

The GPR was collected mostly with an antenna of 600 MHz centre frequency at 100 scans per metre along the profile lines with 512 samples collected for each scan at 16-bit amplitude resolution. The GPR system was set to record a two-way travel time of 30 ns. Chainages along the profiles were logged by using a calibrated optical encoder connected to a survey wheel, which was rechecked on site prior to data collection. The GPR data for this investigation was acquired using a GSSI SIR3000 GPR acquisition system.

Some limited 900 MHz antenna data was also collected to provide more detailed information on the road layering and build-up, as per an onsite request by the Client. This was set to a two-way travel time of 18 ns and utilised an optical distance encoder.

Antennas of high frequency provide high-resolution data but only penetrate to shallow depths, whilst low-frequency antennas provide deeper penetration with decreased resolution. The depth of penetration achievable with an antenna of a particular frequency is also dependent on the local subsurface conditions. The 600 MHz antenna was found to provide the best combination of depth of penetration and resolution with a total theoretical scan depth of 1.5 m.

On site quality control of the data was achieved in real-time by viewing profiles during acquisition. The profiles were recorded digitally for processing, analysis, and interpretation at our Sydney office. Data processing included:

- Static Correction, to correct the start-pulse signal to the surface.
- Background Removal 2D filtering, to remove noise bands and enhance the reflected signal.

### 4 RESULTS AND INTERPRETATION

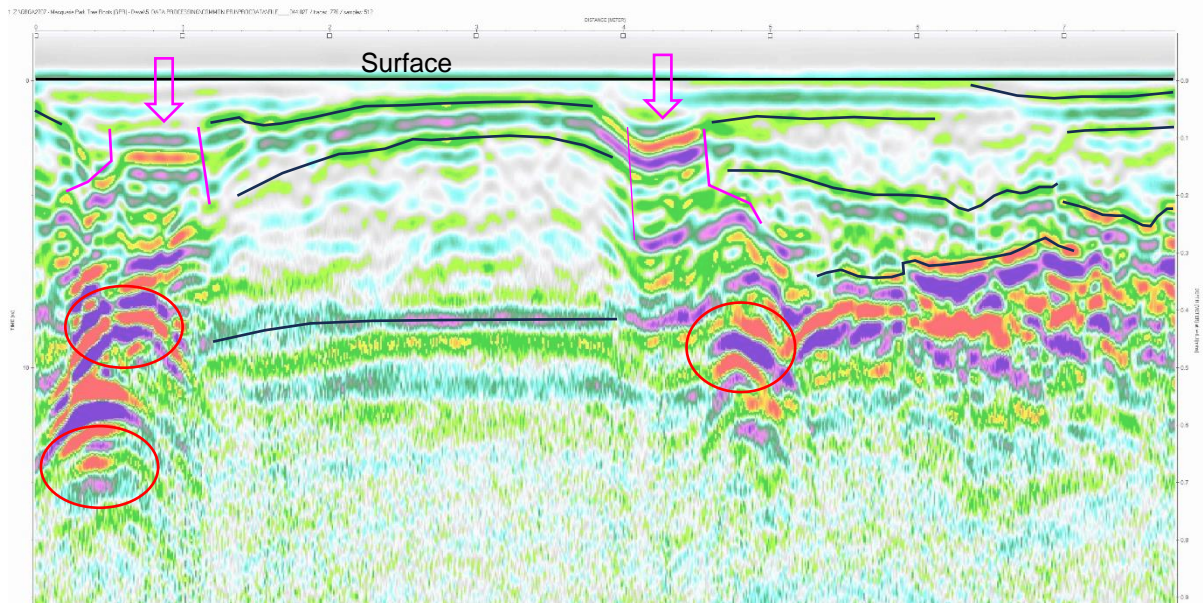
The results of the geophysical investigation for BaptistCare, Eucalyptus Street have been provided on the drawing attached at Appendix A of this report, reference DWG GBGA2707 at 1:100 scale.

The overall quality of the GPR data was satisfactory, and the effective depth of penetration post-processing was approximately 600 mm from the road surface. This was much less than what was anticipated and was primarily a result of signal attenuation through the base of the road. This can occur in instances where the road base / subbase has been chemically stabilised or has high clay content. Additives such as quicklime or hydrated lime, cement or fly ash/coal ash are often used as a binder to strengthen road base / subbase materials, and these can result in a layer of conductive material that adversely affects radar-wave transmission. Mechanical stabilisation on the other hand, generally utilises water-permeable synthetic geotextiles / geonets to physically restrain materials so are less likely to be

a factor for signal attenuation. Elevated moisture and poor compaction can also influence radar-wave propagation.

#### 4.1 Road Construction

The composition of the road structure was not consistent, there was a distinct change across the width of the road that resulted in multiple anomalous reflectors in the data at the road base further reducing signal penetration and data resolution. The point of change is at 4-5 m on the GBG survey grid (or 5.4 m from the fence line) and appears coincident with a service and an area of near-surface disturbed ground / a possible service trench at depths ranging from 100-150 mm below the surface; this is highlighted on the Appendix A drawing as a magenta hatched area. Figure 2 shows a sample radargram (File 44) taken across the width of the road using the 900 MHz antenna at 2.5 m from the zero datum. It clearly demonstrates the variation in construction.



**Figure 2:** File 44 – 900 MHz radargram highlighting the variation in road construction. The black lines denote the different layer interfaces, the magenta arrows and lines are disturbed ground / possible service trenches, and the red circles are services.

Using the higher resolution 900 MHz antenna, the GPR data indicates shallow layering from the surface to a varying depth of 100-125 mm between the chainages of 1.2-4 m, which likely represents the asphalt surface course and an underlying binder course. The material beneath this is homogenous down to a depth of 420 mm and is probably the base material.

From 4.5 m chainage onwards, the road layering is inconsistent. The asphalt topping becomes thinner and the signal becomes convoluted with the start pulse at the surface. The underside of the assumed binder course is however consistent, ranging between 60-80 mm below the surface. After this, an intermediate layer is identified at a depth of 170-200 mm followed by a deeper boundary, with a much higher amplitude response at depths ranging between 235-330 mm from the surface. It is at this boundary that the signal is greatly attenuated.

## 4.2 Tree Roots

The GPR investigation has mapped an extensive tree root system belonging to the target tree. The roots have been identified at depths ranging between 65-285 mm from the surface but were typically at 100-120 mm and are therefore within the road layers, directly beneath the assumed binder course. It is possible, and deemed very likely that additional, deeper roots are present, however these cannot be identified due to signal attenuation at the base of the road structure (approximately 0.6 m from the surface).

At the surface, there are visible indications that the tree roots are growing through the near-surface road layers. Immediately adjacent the tree is an area of deformation and cracking to the asphalt road and concrete kerb which would appear consistent with localised uplift caused by mature tree roots. This is shown on the image in Figure 3. The GPR data confirmed the presence of two individual tree roots at this location.

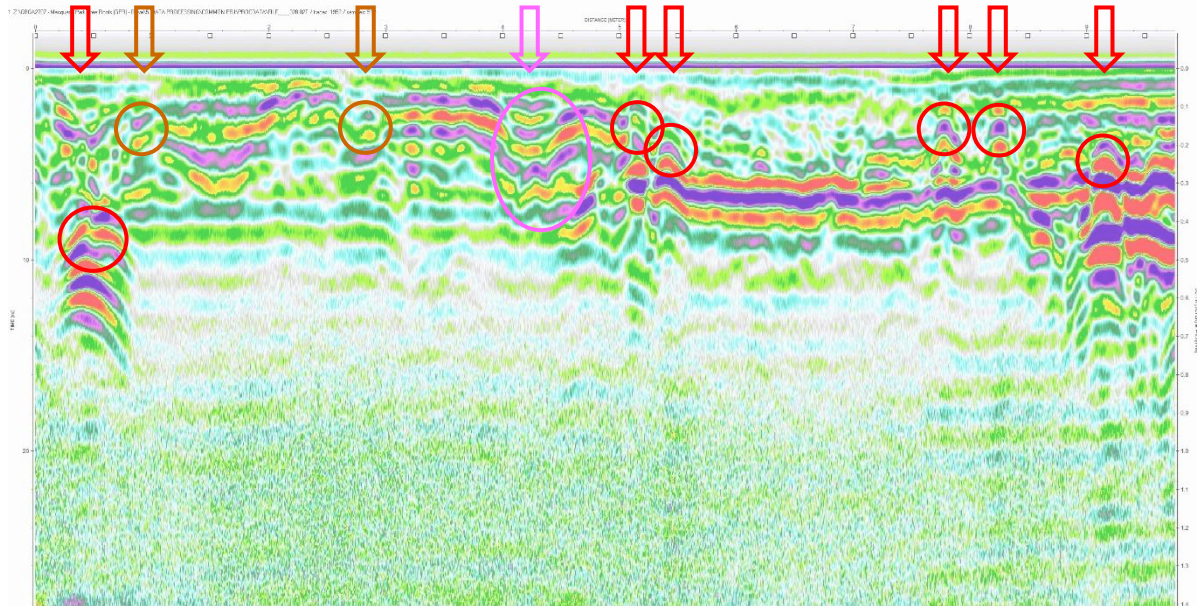


**Figure 3. Site image looking towards tree T76 and the area of ground deformation. The dashed orange lines outline the extent of the deformation.**

The roots have generally been tracking northwards from the start of the survey grid at the concrete kerb, until the construction change in the road at circa 4-5 m away. There are indications that a few roots extend beyond this point, however it has not been possible to fully trace these due to multiple reflectors in the data associated with the disturbed ground / possible service trench and individual services. As shown on the drawing, the roots and services at this location are of a similar depth profile, thus further complicating the data analysis.

Identification of roots versus services has been based on signal amplitude of the individual targets, the shape and form of the reflected signals, and how successive targets align. This is demonstrated in Figure 4, which shows the File 28 radargram with interpreted annotations. Generally, services elicit a

stronger amplitude response and a larger hyperbole in the data, consistent with larger diameter, metallic materials/features.



**Figure 4.** File 28 600 MHz radargram highlighting identification of tree roots in brown (x2), services in red (x6) and an area of disturbed ground / a possible service trench in magenta (x1).

Despite the analysts' best efforts in determining root directions/pathways, it must be noted that due to the nature of tree roots, it is not always possible to do so accurately. Individual root targets (spot locations) have been plotted onto the drawing as identified on the GPR survey lines (in green) and the most likely path between these targets has been interpreted. In some instances, a gap or break in the roots is observed and this occurs when targets do not align and/or the routes are not clear.

Roots which are smaller than 50 mm in diameter are usually too small to be observed in the GPR data and hence only larger roots have been plotted. The diameter of the roots cannot be determined from the GPR data.

Average depths to the identified tree roots and services are in millimetres rounded to the nearest 10 mm and are shown alongside the plotted feature in the same colour. The depths quoted in this investigation have been calculated using an assumed radar-wave velocity in the absence of any calibrated data. The typical radar wave speed through the subsurface can vary considerably depending on the soil type, moisture content, and various surface materials. As such, without physical calibration, quoted depths are expected to be accurate to  $\pm 25\%$ .

### 4.3 Services

Various services have been identified in addition to the tree roots and these are presented on the drawing in red.

Towards the south-west of the survey area, running parallel to the surface gully and fence line is a suspected drainage channel located at a typical depth of 400mm; this service is also highlighted on the figure 4 radargram at 0.4m chainage (i.e. the leftmost service). Based on the plotted route, it

appears likely that this connects to two manhole covers visible at the surface. No attempts were made to open these on site to verify this though.

Although the top of the service has been re-located at a depth of 400mm, additional reflectors of various amplitudes indicative of disturbed ground were observed within the radar data in the ground overlying this. As a result, it cannot be ruled out that roots or other services may be present at these shallower depths and simply obscured within the data. This is particularly the case at the western extent of the survey area where the identified service branches off into several directions, two of which appear at much shallower depths.

The nature / purpose of the other services has not been identified.

#### 4.4 Reinforced Concrete Areas

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The parking spaces to the north-east and north-west of the survey area are comprised of reinforced concrete. The joint and transition from the asphalt road to the concrete is readily visible at the surface.

As these areas were not included within the requested survey area, GPR data is limited and due to the orientation of the profile lines collected it has only been possible to provide information on the reinforcement bars spanning across the width of the parking bays. This information is provided on the drawing and details bar depth of covers (D.O.C.) and centre spacings (ccs). Both concrete slabs were identified as approximately 200 mm thick.

In addition, to the parking spaces, the concrete kerb running along the southern fence line is also reinforced. Again, limited data was collected but the bar details have been provided on the drawing and the concrete was identified as approximately 175 mm thick.

It should be noted that bar diameters cannot be determined by GPR techniques and would require a covermeter device. This was not included for within the survey scope, however.

## 5 CONCLUSION

GBG was commissioned to complete a tree root survey at BaptistCare, Eucalyptus Street, Macquarie Park to provide information prior to redevelopment works. The results are presented in plan view on that attached drawing in Appendix A and a description of the survey's main findings are included within sections 4 of this report.

We hope this report satisfies the requirements of this investigation. Should you have any questions, please do not hesitate to contact me.

For and on behalf of

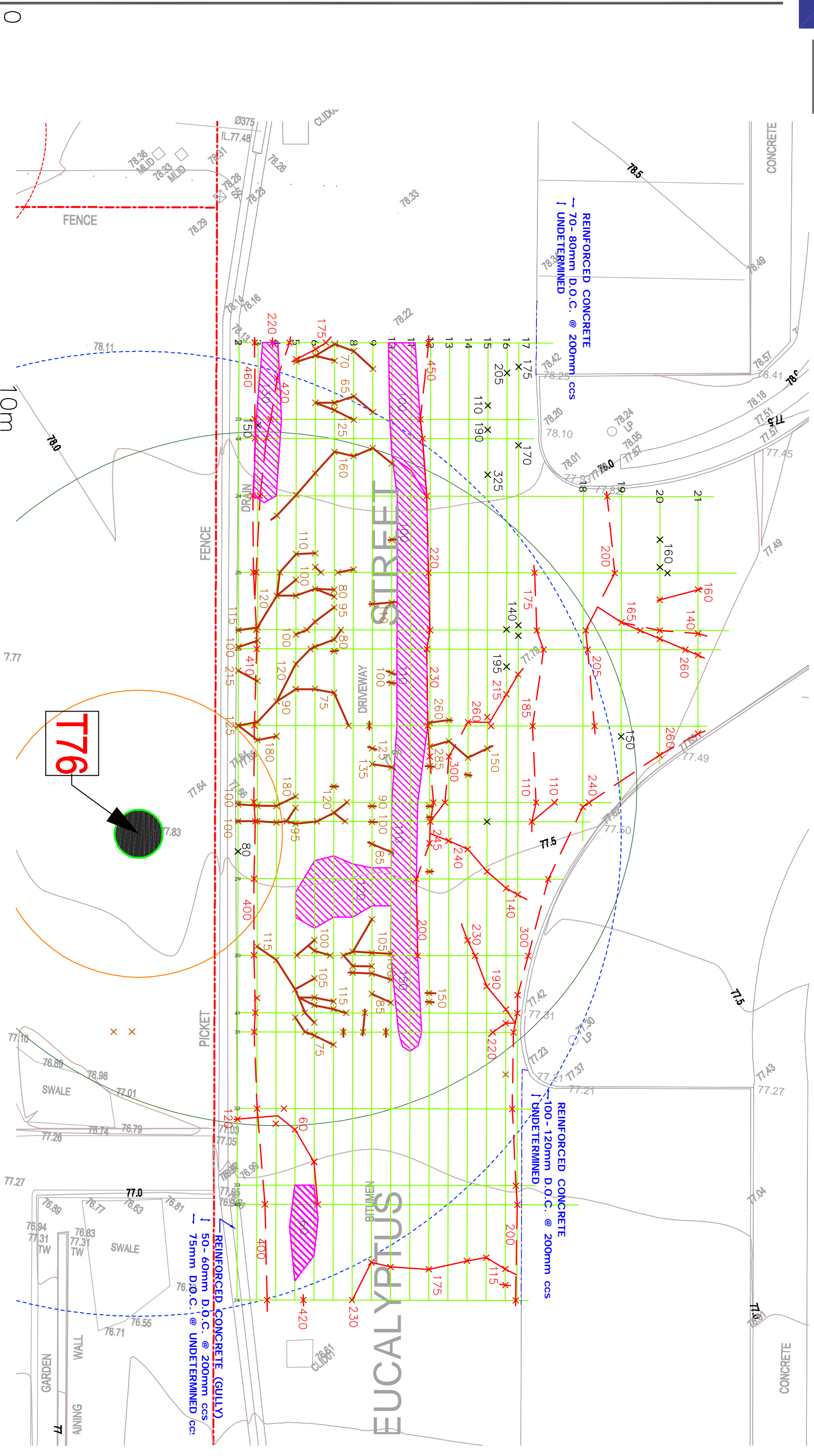
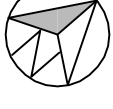
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## **APPENDIX A. GBGA2707-01 Drawing – Tree Root Mapping Results**

# GROUND PENETRATING RADAR SURVEY



**Legend**

- GPR PROFILE
- X TARGET IDENTIFIED (>50mm)
- X INTERPRETED PATHWAY (TREE ROOT)
- X INTERPRETED PATHWAY (SERVICE)
- X DISTURBED GROUND/POSSIBLE TRENCH
- DEPTH TO TARGET (mm)

**Disclaimer:**  
ALL DIMENSIONS IN mm UNLESS OTHERWISE STATED.  
THIS DRAWING HAS BEEN PREPARED USING EXISTING DRAWINGS OR PRINTS AS SUPPLIED BY THE CLIENT AND SUPPLEMENTED BY MEASUREMENTS TAKEN ON SITE. PRIOR TO COMMENCING ANY WORK, MEASUREMENTS MUST BE CHECKED.

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CLIENT: ARTERRA on behalf of BaptistCare	
TITLE: TREE ROOT MAPPING AT EUCALYPTUS STREET MACQUARIE PARK, NSW 2113	
DRAWN: DF	PROJECT MANAGER: DF
SCALE: 1:100	DATE: 07 MARCH 2024
GBG AUSTRALIA PTY LTD	
DATUM:	DRG No: GBGA2707-01
REV: 0	REV: 0
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## APPENDIX B. Ground Penetrating Radar (GPR) Theory

### APPLICATIONS

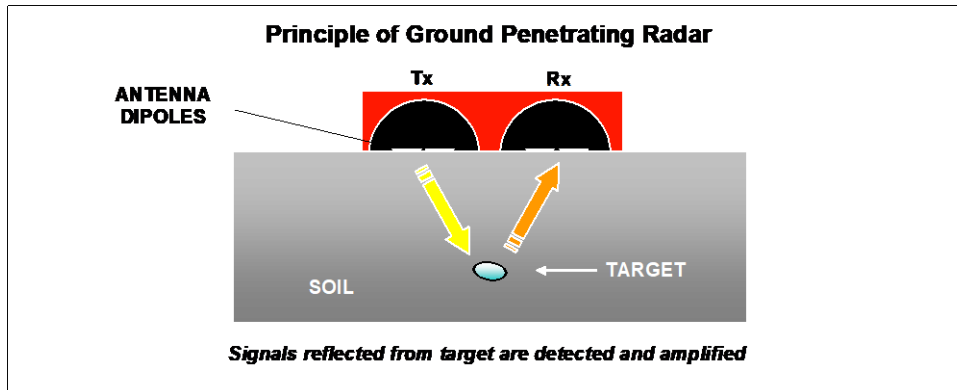
- ✓ Stratigraphic mapping including depth to bedrock
- ✓ Locating karst features, sinkholes, voids or cave systems
- ✓ Depth to water table
- ✓ Archaeology (location of graves and artifacts)
- ✓ Location of underground infrastructure, including UST's and utilities
- ✓ Tree roots assessment
- ✓ Assessment of internal condition and defects of engineered structures
- ✓ Assessment of road and rail infrastructure, including asphalt and ballast condition
- ✓ Slab thickness, reinforcement placement and void detection

### METHOD

Ground Penetrating Radar (GPR) is a non-destructive and non-invasive geophysical technique for rapidly imaging the shallow subsurface and producing high-resolution colour sections in real time. The method works by transmitting electromagnetic energy into the material being tested (most usually the ground). Typically, 100000 impulses per second are transmitted which are of very short duration and contain a wide spectrum of frequencies.

The transmitted electromagnetic energy propagates through the subsurface as a function of the subsurface material's electrical properties, which are in turn dependent on its physical and chemical properties. Reflection of radar energy occurs at boundaries between differing stratigraphic layers or inclusions which have contrasting electrical properties. Conversely, no reflections occur from a homogenous material where there are no internal reflectors. The reflections are detected by the receiving antenna placed adjacent to the transmitter. The depth to the target is proportional to the time (in nanoseconds) taken for the signal to travel from the transmitting antenna at the surface to the target and back to the receiver.





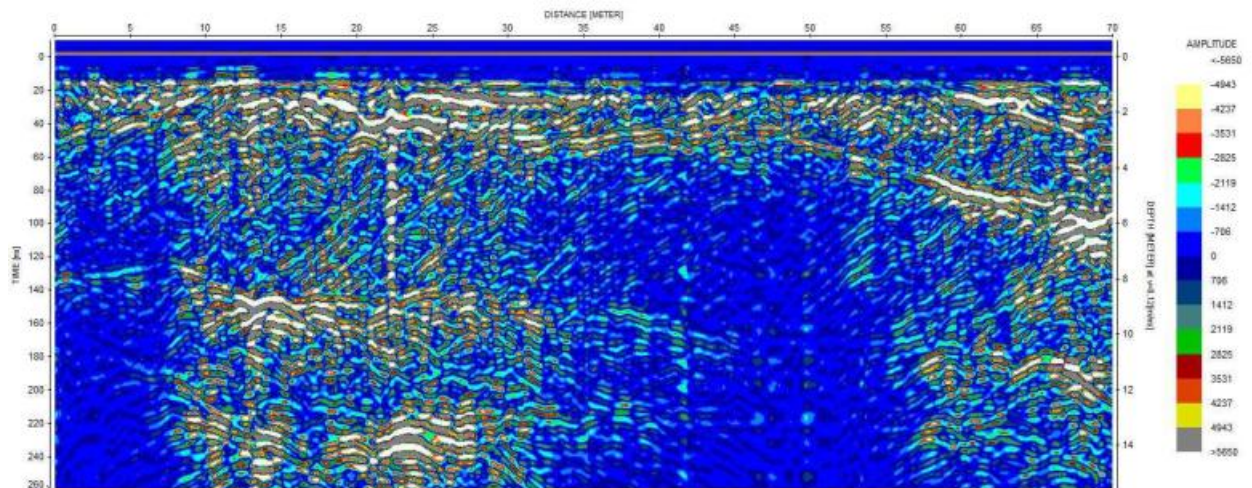
Schematic illustration of the principle behind ground penetrating radar

**DATA ANALYSIS & PRESENTATION**

A radar-gram profile is built up of continuous scans along a selected line path, see below. These are 2D cross-sections of the subsurface showing variations in reflection amplitude as a colour scale. The recorded reflections can be analysed in terms of shape, phase, travel time and signal amplitude to provide information about a target’s size, depth and orientation in relation to the material around it.

The depth of investigation achievable with the GPR method is largely a function of the antenna frequency used. Lower frequencies in the order of 100 MHz are typically used for geological mapping to a maximum depth of approximately 20 m, whilst high frequencies in the order of 1 GHz are used for high resolution investigations of structures including buildings, bridges and tunnels.

Tree roots mapping generally using a 900 and 400MHz.



Processed GPR cross-section imaging a karst formation illustrated by the variations in the radar-wave reflection amplitudes. This enables the detailed analysis of voids or caves within limestone bedrock.



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