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NEW PRIMARY SCHOOL AT GREGORY HILLS

GREGORY HILLS, NSW

DEVELOPMENT PROPOSAL ARBORICULTURAL IMPACT ASSESSMENT REPORT

Ref No- 9622

Prepared for
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SSDA Preamble – New Primary School at Gregory Hills

1.1 Introduction

This Arboricultural Impact Assessment Report accompanies an Environmental Impact Statement (EIS) pursuant to Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act), in support of a State Significant Development Application (SSDA) for the construction and operation of a new primary school at Gregory Hills (SSD-41306367).

This report addresses the Secretary's Environmental Assessment Requirements (SEARs) issued for the project, notably:

SEARs Requirement	Response
Section 7. Trees and Landscaping	Assess the number, location, condition and significance of trees to be removed and retained and note any existing canopy coverage to be retained on-site. The proposal identifies the retention of twelve (12) mature trees forming existing canopy cover that requires no reduction pruning to accommodate the proposal.

1.2 Proposal

The proposal is for a new primary school at Gregory Hills that generally comprises the following:

- 44 General Learning Spaces.
- 4 Support Learning Spaces.
- Administration, staff hub, amenity and building service areas.
- Library, communal hall and canteen.
- Outside School Hours Care (OSHC) services.
- Sport courts, outdoor play space, a Covered Outdoor Learning Area (COLA) and site landscaping.
- Dedicated bicycle and scooter parking.
- Three (3) kiss and drop spaces for Supported Learning Students (SLS) located on Wallarah Circuit.
- On-site car parking.
- Signage.
- Footpath widening on Wallarah Crescent.



Figure 1 – Site Plan (source Bennett & Trimble)

1.3 Site Description and Location

The site is located in Dharawal Country at 28 Wallarah Circuit, Gregory Hills NSW 2557, and is legally described as Lot 3257 DP1243285.

The site is located within the Camden Local Government Area and is within the Turner Road Precinct of the South-West Growth Centre.

The site has an area of approximately 2.926ha (by Deposited Plan). This will be reduced to 2.907ha under approved DA2022/742/1 once Long Reef Circuit has been widened.

Topography is minimal with a fall from the south-east corner (RL116.5) to the north- west corner (RL113).

The site has three (3) street frontages:

- Wallarah Circuit (southern boundary)
- Gregory Hills Drive (northern boundary)
- Long Reef Circuit (eastern Boundary)

The site is primarily vacant land, with the exception of an existing group of trees that have been retained in the southwest corner of the site that pre-date the subdivision and development of the precinct. There is also an existing electrical substation located on the south-eastern boundary.

There are easements of varying widths located to the northern boundary identified for drainage.

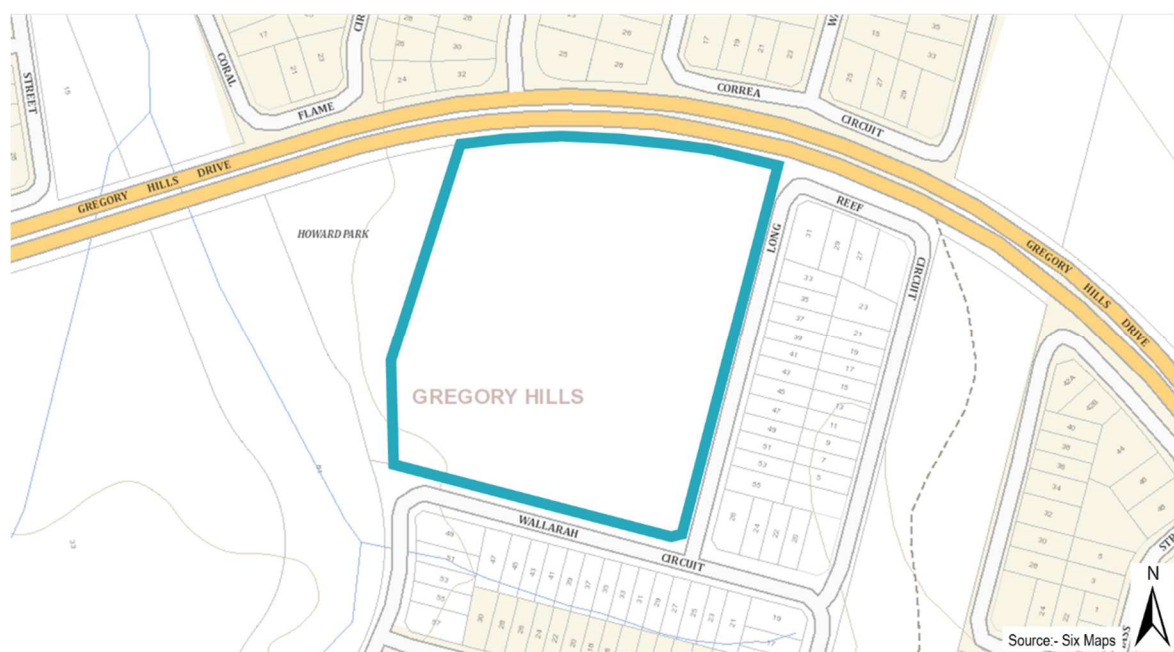


Figure 2 – Locality Map (Six Maps)



Figure 3 – Site Aerial Map, (Source Bennet and Trimble)

1.4 Surrounding Development

To the north, east and south of the site is emerging and recently completed residential development.

To the east of the residential area fronting Long Reef Circuit are high voltage power lines within an easement which include pedestrian paths and cycleways.

To the west of the site, beyond Sykes Creek and Howard Park, is the Gregory Hills town centre. A pedestrian bridge links Wallarah Circuit with the town centre across Sykes Creek.



Figure 4 – Surrounding

SCOPE OF WORKS - INTRODUCTION

This arboricultural report has been commissioned by Kleinfelder Australia Pty Limited (Kleinfelder). The purpose of the report is to provide an arboricultural assessment of trees affected by the Gregory Hills Primary School development proposal located within Lot 3257 of DP 1243285, Gregory Hills NSW 2557.

The project is of a State Significant Development (SSD) identified as SSSD-41306367 in support of a new school known as The New Primary School at Gregory Hills, NSW.

Within this report the remaining Useful Life Expectancy (ULE) and potential impacts that may occur to significant trees have been provided based on a concept design of indicative building and infrastructure footprints.

Recommendations for retention or removal of trees is based on the tree's structural condition, accorded ULE category and potential impacts based on the concept design proposal.

Development incursions within notional tree protection zones (TPZ) and impacts to trees have been outlined within Note 2 of Appendix- B where incursions are described as Minor (<10%) & Major (>10%) TPZ occupancy having low, moderate to high level impacts within the TPZ. Where site restrictions within notional root zone radiuses exist development impacts or encroachment disturbances are based on author's experience, observations of site conditions, tree location to infrastructure, soil type and topography.

Each tree assessed has been provided a temporary identification number and is referred to by number throughout this report. The trees, their location and general assessment have been referenced within the Tree Assessment Schedule and Tree Location Plan of Appendices F & G.

General tree risk assessment has also been provided within Appendix- D and is based on low consequence of tree or tree part failure due to rare person usage and target occupancy under the current site conditions.

The viability of this report, accuracy of tree and risk inspections is based on a two (2) year period where additional inspections are recommended when person occupancy increases and development commences within the site.

Care has been taken to obtain information from reliable sources. All data has been verified as far as possible, however, I can neither guarantee nor be responsible for the accuracy of information provided by others.

DISCLAIMER & LIMITATION ON THE USE OF THIS REPORT: This report is to be utilized in its entirety only. Any written or verbal submission, report or presentation that includes statements taken from the findings, discussions, conclusions or recommendations made in this report, may only be used where the whole of the original report (or copy) is referenced in, and directly to that submission, report or presentation. Unless stated otherwise: Information contained in this report covers only the tree/s that were examined and reflects the condition of the trees at the time of inspection: and the inspection was limited to visual examination of the subject tree without dissection, excavation, probing or coring. There is no warranty or guarantee, expressed or implied, that problems or deficiencies of the subject tree/s may not arise in the future. Arborist cannot guarantee that a tree will be healthy or safe under all circumstances, or for a specific period of time. Trees are a living entity and change continuously, they can be managed but not controlled and to be associated near one involves some degree of risk.

METHODOLOGY

1. In preparation for this report a site consultation and ground level visual tree inspection was conducted on Friday 8th July 2022 by the author of this report. The principles of tree inspection were primarily adopted from components of Mattheck & Breloer 1994 '*The Body Language of Trees*' with basic Level 1 & 2 risk assessment conducted utilising criteria noted within the ISA Tree Risk Assessment Qualification (TRAQ) manual 2017. The inspection included observing the overall health and vigour of trees, tree form, structure and structural condition commencing from the lower trunk to the upper first and second order branch division as best as site conditions would allow. On completion of the inspection the retention value of the tree was summarised utilizing the tree inspection Checklist provided within Appendix- E. Each tree, health and condition including retention value may be referenced within the Tree Assessment Schedule of Appendix- F.

Unless specified otherwise risk assessments exclude the risk of deadwood fall as the time frame for determining deadwood fall cannot be predicted with discussions of deadwood management provided within this report.

2. The inspection of trees within the site was limited to a visual inspection only without invasive investigations. Tree height and canopy spread was estimated and expressed in metres with trunk diameters measured at approximately 1.4 metres above ground level, rounded off to the nearest 50mm and expressed as DBH (Diameter at Breast Height). Within this report general discussions of riparian zone trees located SW of the site and street tree planting within Wallarah Circuit have been included.
3. This report acknowledges and utilizes the current Australian Standards 'Protection of Trees on Development Sites' AS 4970 – 2009 as explained within Notes of Appendix- B. To ensure tree impacts are minimized ideally development should not encroach within >10% of tree protection zones.
4. Unless specified otherwise all distances and development offsets within this report are taken from the centre of the tree based on tree survey plotted documentation.
5. Plans and/or documentation received to assist in preparation of this report include:
 - Kleinfelder
 - GHPS SSDA_10.0_Ecological Assessment Report No:20230077 dated 09 September 2022
 - Taylor Brammer Landscape Architects
 - GHPS SSDA_7.11_Landscape Plans Report, Section 4.0 Design revision 01, dated October 2022
 - Rygate Surveyors, job No. 5600-22
 - Survey Plan, ref No: 79882 dated 16.3.2022

1. DISCUSSION OF OBSERVATIONS

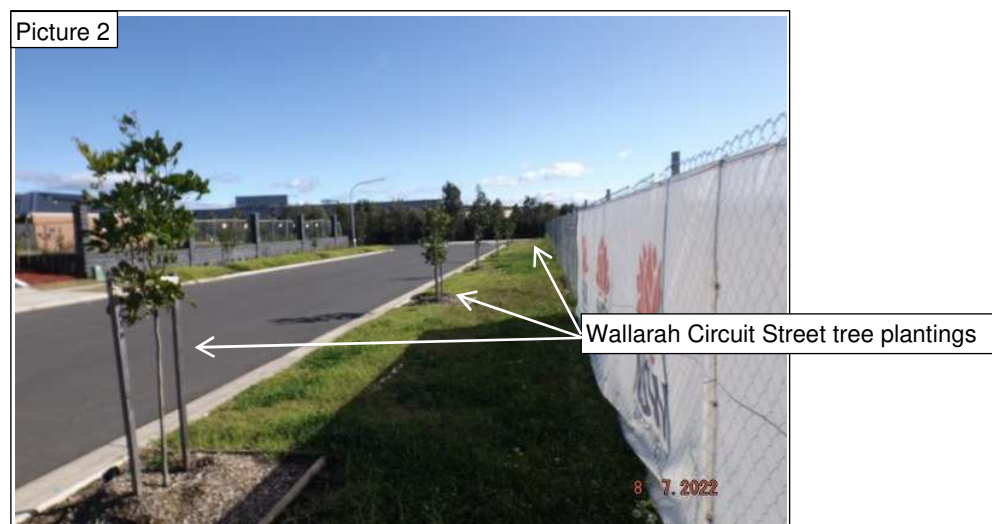
1.1 Riparian zone southwest(SW) of 'the site'

- 1.1.1 The riparian zone contains recently planted young native specimen trees. All trees are closely grouped, are at or less than 6m in height containing basal stem diameters between 100 & 150mm(Ø). The Structural Root Zone (SRZ) radius being a development activity exclusion zone is calculated at 1.5m, with the radial Tree Protection Zone (TPZ) 2m from the centre of individual trees. The trees are viable trees and capable of further. Based on site observations the existing footpath provides a suitable ground protection barrier. Should development occur adjacent these trees further arborist advice and tree protection fencing is recommended to be installed under the guidance and certification of appointed project arborist.



1.2 Wallarah Circuit Street tree plantings

- 1.2.1 The Street tree plantings consist of Tuckeroo trees (*Cupaniopsis anacardioides*). They not established trees being very young plantings having basal diameters <50mm(Ø). The trees are likely to grow to provide the desired canopy cover for street tree plantings with risk of slip hazards on public pathways or hard surfaces during seed fall.



1.3 Trees within the site

- 1.3.1 Twenty (20) trees have been assessed within the site and consist of established Forest Red Gum trees (*Eucalyptus tereticornis*). Given the site is a disturbed site fruit samples were not able to be collected where the trees closely resemble Cabbage Gums (*Eucalyptus amplifolia*). Both species form part of the plant community of the Cumberland Plain Woodlands categorized as a Critically Endangered Ecological Community (CEEC) protected under the Threatened Species Conservation Act 1995.
- 1.3.2 Observations note that the trees form a group planting, are not individual trees and have developed to form a combined canopy wind protection factor. Each tree therefore somewhat relies on an adjacent tree to reduce or manage wind loading pressures where should an adjacent tree be removed an increase in branch bending stress, large tree part or whole tree failure may occur. *Harris, Clark & Matheny* state the possible consequences of exposing previously protected trees must be carefully considered.

1.4 Discussion of tree retention values

- 1.4.1 Of the twenty (20) trees inspected three (3) trees are dead or near dead trees, one (1) tree is considered a high-risk tree and four (4) trees have been assessed as containing short retention values. All trees are proposed for removal, display symptoms of environmental stress, some in higher degree of decline with all trees containing a degree of dieback.
- 1.4.2 Dead trees: Dead or near dead trees are identified as trees:
- T8, 10 & 19.
- The trees are likely to stand dead within the assessment period where during this time large limb drop can be expected. Whole tree collapse is also likely at some stage as the anchoring root zone degrades in its support function. The trees are therefore considered at risk of failure trees where person(s) or structures should be limited or prevented within a tree or tree part fall range.
- 1.4.3 High risk of failure tree(s): One (1) tree T13 has been assessed as a structurally defective tree and highly likely to fail. The tree contains a deep open cavity and unsound surrounding wood on three (3) sides of the lower trunk. The tree is weight loaded to the west(W) by mass canopy weight and branch extension where should the tree fail contact within the adjacent neighbouring playground is highly likely. Given estimated tree height of 22m the target area is determined at 24.2m where the target zone of at or near 7m within the adjoining property will be affected by tree fall in the westerly direction.
- The tree will likely be affected by sudden exposure and loss of canopy wind protection factors where sudden exposure may increase the risk of limb snap by wind loading pressures further increasing the failure potential of adjacent dead or defective trees.
- The tree has been identified for removal to eliminate associated risks and consequence of injury or damages in the event of failure.

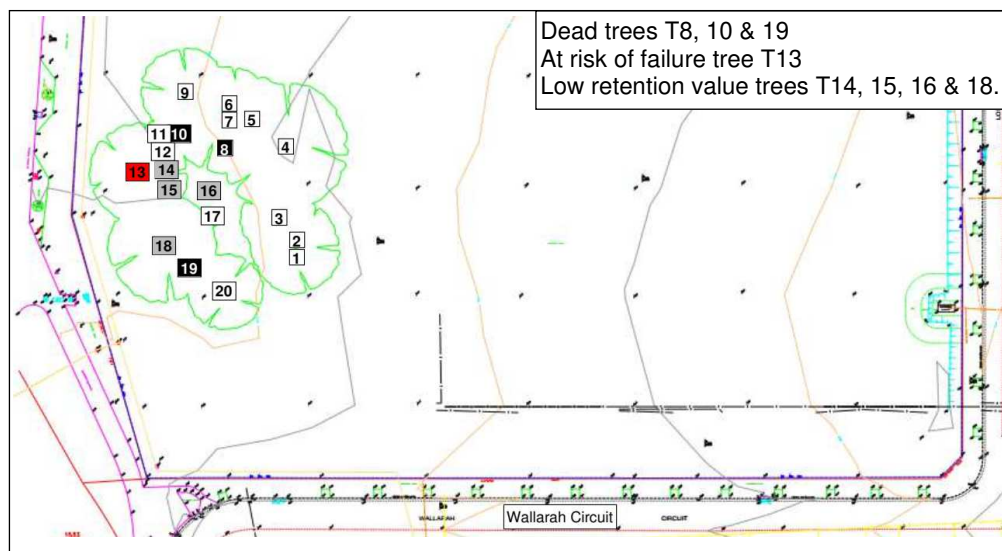
1.4.4 Low retention value trees: Those trees identified as containing structural faults, are significantly environmentally stressed and in decline having low retention values are identified as trees:

- T14, 15, 16 & 18.

The trees may also display recent mechanical wounding where the effects of mechanical impact or site disturbances within tree protection zones are unknown. The inner circle trees may also become effected by the removal of significant canopy protection factor from tree T13 as shown within Picture 3 below.

1.4.5 Remaining trees 1, 2, 3, 4, 5, 6, 7, 9, 11, 12, 17 & 20 are considered somewhat viable trees without change in existing site conditions or modification within their Tree Protection Zone (TPZ) radiuses as indicated within the SRZ & TPZ distance column of Appendix- F.

Figure 1, tree retention value site plan



1.5 Addressing tree risk

- 1.5.1 As detailed within Appendix- D, with exception of defective tree 13, based on the existing site conditions without person occupancy within a tree or tree part fall range the consequences of tree or tree part failure is considered low.

In the event of T13 failure in the westerly direction the potential for person injury is considered somewhat possible, where consequences of damage or injury could range from minor to severe depending on the size of part to fail and area contacted.

Where design places structures or increases the person occupancy within a tree or tree part fall range (target area) the consequences of tree or tree part failure within the site are likely to increase due to average tree condition and extent of branch dieback that increases the risk of deadwood fall.

As risk of deadwood fall is always possible and excluded from risk assessment as timing of deadwood fall cannot be predicted, placing person or structures within the target area of deadwood fall is not recommended. Generally, within a school site or active person area there should be no deadwood within a tree that could cause injury to person unless the principal undertakes acceptable risk of the issue.

If all deadwood is removed trees would be of very poor form having little remaining branch structure and poor canopy extension, if any.

- 1.5.2 Given that trees 8, 10 & 19 are dead trees that will likely fail at some stage the consequence of failure is likely to be low or negligible as no person or structures are within the site. Design should therefore be mindful of placing person or structures at risk within a dead tree fall range or target area being tree height + 10%. The trees have been recommended for removal to accommodate the development proposal.



1.6 Addressing risk of limb snap

- 1.6.1 Some tree species, particularly *Eucalypt*, *Corymbia* & *Angophora* are typically known for Sudden Branch Failure (SBF) or Summer Branch Drop (SBD). Without specific visual faults arborists cannot predict the timing of such events or if a tree can be considered safe for any specific period as trees are living entities that change continuously. Trees may also be compromised by ongoing storm events where part or whole tree failure is possible after initial site inspection periods.
- 1.6.2 As the trees are eucalypt species, are semi mature to mature trees it is likely that Summer Branch Drop (SBD) or Sudden Branch Failure (SBF) can be expected during the progressing life cycle of the trees. As branch failure is a phenomenon of the eucalypt tree and is the natural ecology of the eucalypt species (*Florence* 1996), ongoing limb snap can be expected.
- 1.6.3 Given that the trees are prone to sudden branch failure the trees pose a risk to person or property should design place person or property within a tree part fall range. Site observations noted that select trees contain evidence of past limb snap indicating ongoing limb failures are highly likely for as long as the trees exist. It may also be possible that mechanical damage by site machinery impact could be a contributor factor to areas of identified limb snap. This is evident on lower and upper trunks including outer branch scaffolds of the following trees:
- T1, 2, 4, 5, 7 & 9.

1.7 Determining cause of tree decline

- 1.7.1 The actual cause of tree decline is somewhat unknown with site observations noting the following possible causes:
- The trees may have been subject to past prolonged drought periods resulting in environmental stress and dieback.
 - Leaf pest or psyllid infestation may be a contributing factor with psyllid and scale insect noted on lower foliage parts of select trees. The pest activity may be a secondary reaction to environmental stress caused by past drought conditions and tree stress.
 - Soil compaction and fill are common causes of such tree decline where visual inspection noted pooling of water that may be held by clay subsoils used as fill within tree protection zones. Areas of disturbed soils and potential fill were noted close to the base of select trees with slight raised site level adjacent the boundary to the playground area that indicates potential fill. Geotechnical advice and further soil probing inspections including review of past survey plans may provide more advice in the matter of fill within the site.
 - Soil compaction by machinery use within the TPZ may also be a contributing factor. Based on tree wounds located on trees 7, 9, 14, 16, 17, 19 & 20, it is likely the use of machinery occurred within both the structural and tree protection zone areas. Given that it is possible that such works within the SRZ occurred the impact on critical anchoring roots is unclear.

- 1.7.2 Should fill be identified within tree protection zones the consequences of fill could make remediation of tree vitality difficult. Fill may also impede good growth potential of new plantings in landscape design where new planting may fail or poorly perform. Prior to ongoing works soil profile and pH testing is recommended to aid with ongoing tree remediation advice and new landscape planting advice.

2. DEVELOPMENT IMPACTS & TREE PROTECTION ZONES

2.1 Trees specified for retention

- 2.1.1 Trees to be retained ideally should receive Minor (at or <10%) design encroachment within tree protection zone radiuses as identified within Appendix- F the SRZ & TPZ distance column. For trees to be retained these radiuses are recommended to be shown within design and construction drawings.
- 2.1.2 Trees that receive Major (>10%) encroachments require specialist arborist advice in maintaining trees on development sites. Tree sensitive design is recommended to be adopted within tree protection zones with specific protection requiring final arboricultural planning advice. Report requirements and ongoing arborist activities as identified within Australian Standard AS4970 '*Protection of Trees on Development Sites*' 2009 are specific to:
- AS4970 section 2.3.4: *Development design and review*, the ongoing review of architectural, engineering (e.g. bulk earthworks and construction drawings) services and landscape drawings. The purpose of this is to determine the potential impacts on trees proposed for retention.
 - AS4970 section 2.3.5: *Arboricultural impact Assessment or statement*, to be prepared once the final development layout is complete. This report identifies trees to be removed, retained or transplanted. The report explains tree protection methodology required to minimise development impacts where development encroachment is within the TPZ. The location of tree protection methods should also be shown on other documents such as demolition, bulk earth works, construction and landscape plans.
- 2.1.3 Based on Picture 6 design diagram of proposed site layout, the following discussion relating to tree management within tree protection zones are provided.
- Car Parking Bay & drop off zone*
- Tree 20: Ideally the carpark footprint should be located outside of the 6m TPZ.
 - Trees 1 & 2: Ideally the carpark footprint and hard surfaces should be located outside of the TPZ being 8.4m from T1 & 6m from T2.

Hard surfaces & pathways

- Given the condition of trees public access hard surfaces & pathways are not recommended within tree protection zones of any tree proposed for retention. Where located within tree target areas specific risk mitigation works require to be carried out that reduces the risk of deadwood fall or branch contact that may occur from whole tree or sudden limb failure.
- The exclusion area includes ensuring the sports ground & access area(s) are located outside of tree protection zones or canopy driplines being specific to 12.6m of T4, 5.4m from T5, 8.4m from T6 and 10.2m from T9.
- Where development within tree protection zones is required further arborist advice is recommended.

2.1.4 At no stage should works, including excavation, trenching or landscaping be located with Structural Root Zones (SRZ) being *the area required for tree stability*.

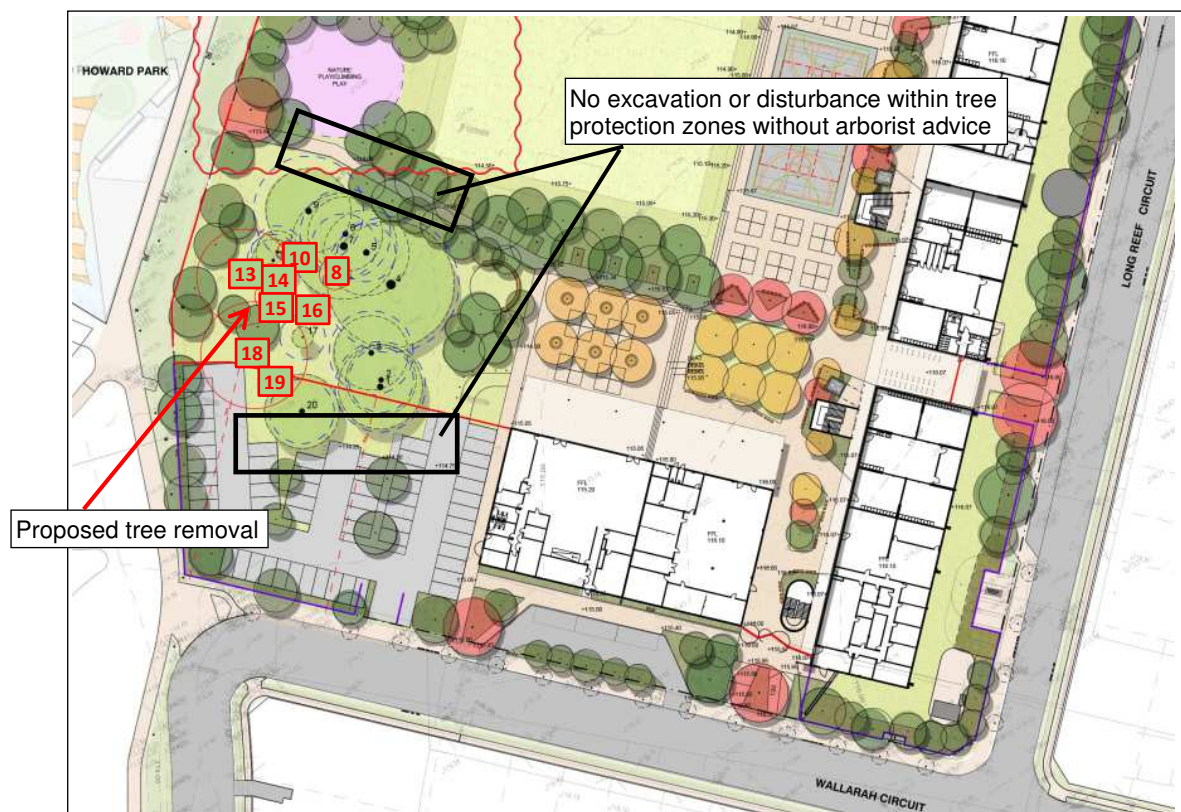
2.2 Proposed tree removal

2.2.1 Based on the design proposal the following eight (8) trees are proposed for removal.

- T8, 10, 13, 14, 15, 16, 18 & 19.

The identified development impacts and/or design requirements have been detailed within Appendix- F.

Figure 2, showing proposed development footprint & tree removal plan



2.3 Protection of trees on development sites

- 2.3.1 A specific Arboricultural Impact Assessment (AIA) report, Tree Protection Plan (TPP) and management advice should be provided when all construction drawing & civil plans have been finalized.

The management of trees should be specifically conducted in accordance with Australian Standard AS4970 Protection of Trees on Development Sites – 2009 with reference to Section 2.3.5: Arboricultural impact Assessment or statement that is to be prepared once the final development layout is complete.

The final AIA report should address AS4970 Section 4: *Tree Protection Measures* and Section 5: *Monitoring & Certification* when works are proposed within the Tree Protection Zone (TPZ).

2.4 General tree protection requirements

- 2.4.1 The following general recommendations are provided as a guide to managing trees on development sites.

- a) Prior to demolition works Tree Protection Fencing (TPF) and/or zones as identified within Appendix- A are recommended to be located under the guidance of an appointed site arborist. Unless specified otherwise the location of tree protection fencing is to be positioned to allow for adequate work access and/or be located at the extremity of the TPZ radius, see SRZ & TPZ distance column Appendix- F. Where design & construction access may be restrictive timber beam trunk protection is recommended to be installed, with ground protection mats provided to protect underlying tree roots within tree protection zones or designated protection areas.
- b) Unless approved otherwise activities prevented within the TPZ include: machine excavation, including trenching, storage & work preparation, wash down areas, soil level change, utility services and physical damage to trees.
- c) In accordance with AS4970 - 2009 (1.4.4) a Project or Site Arborist is to be engaged to monitor, supervise excavation within TPZ setbacks, advise and provide certification of protection works conducted. The project arborist is recommended to hold a minimum Australian Qualification Framework (AQF) Level 5 certification and be competent in methodology of protecting trees on development sites.
- d) The project arborist is to provide final certification outlining tree protection measures with photographic evidence of ongoing works retained for certification purposes (AS4970 S/5.5.2 *Final certification*).
- e) The project arborist is to be familiar with protection measures specific to Australian Standard AS4970 'Protection of Trees on Development Sites' – 2009 requirements with any modification in Tree Protection Fencing (TPF) or Zones (Z) to be compliant with AS4970 Section 4.5 *Other Tree Protection Measures*.

- f) Unless specified otherwise during approved excavation within TPZ setbacks excavation is to be conducted manually (by hand) under the supervision of an appointed project arborist.

Where approved by the arborist the pruning of roots at or <30mm(Ø) is to be conducted in accordance with AS4970 – 2009 Section 4.5.4

Root protection during works within the TPZ, such that tree roots are not damaged or ripped beyond the point of excavation by site machinery.

Where larger roots have been encountered, they are to be referred to an independent Level 5 arborist for further advice.

For deep excavations exposed roots at the excavated cut face are to be protected with jute mesh, geotextile fabric or similar being secured in place to avoid drying of roots and the exposed soil profile.

- g) During approved excavation within TPZ setbacks there shall be no over excavation beyond the line of cut as shown within construction drawings. Should over excavation be required the extent of excavation should be detailed within approved drawings or a construction management plan for arborist review and certification.
- h) *Additional inground services* which may include landscape works, fencing, sewer, stormwater, water and electrical services, final design and impact to trees shall be reviewed and endorsed by the project arborist prior to their installment. Where landscaping (excavation) is required within the SRZ further advice from an appointed project arborist is recommended.
- i) *Tree sensitive construction measures* such as pier and beam bridging over critical roots, suspended slabs, cantilevered building sections, screw piles and contiguous piling can minimise the impact of encroachment (AS4970). Where Bushfire BAL construction conflicts exist with tree management the appointed project arborist shall be consulted to advise on an appropriate design outcome.
- j) *Canopy pruning / tree removal*: where required tree removal and canopy reductions are to be approved by the Local Government Authority. Works are to be conducted by a suitably qualified AQF Level 3 certified arborist in accordance with AS4373 Pruning Standards, and specifically be conducted in accordance with Safe Work Australia – Guide to managing risks of tree trimming and removal works 2016 (www.swa.gov.au).
- k) To ensure tree(s) are appropriately protected the development site superintendent is recommended to be familiar with all tree protection and ongoing certification requirements.

The superintendent is responsible for informing all subcontractors of the responsibilities and requirements of tree protection prior to their engagement.

- l) *Hold points*: specific to no works are to commence without arborist advice, inspections & certifications:
 - 1) Prior to construction arboricultural certification is required ensuring that all trees have been adequately protected in accordance with arboricultural recommendations, or as specified within the Australian Standard AS4970 Protection of Trees on Development Sites - 2009.
 - 2) No works (including landscaping) shall occur within the SRZ of any tree without prior arborist advice and certification. Where excavation may be required prior exploratory tree root investigation are to identify the location, distribution and impact to underlying tree roots.
 - 3) No excavation shall occur within the TPZ without prior project arborist notification and/or site supervision.
 - 4) No access or work activity is permitted within fenced or designated tree protection zones or areas (TPA's) without arborist advice.
 - m) Should there be any uncertainty with tree protection requirements the development site superintendent shall contact the appointed project arborist for advice prior to works occurring within tree protection zones (TPZ) or specified tree protection areas (TPA).
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Should you require further liaisons in this matter please contact me direct on 0419 250 248

Yours sincerely



Mark A Kokot

AQF Level 5 consulting arborist

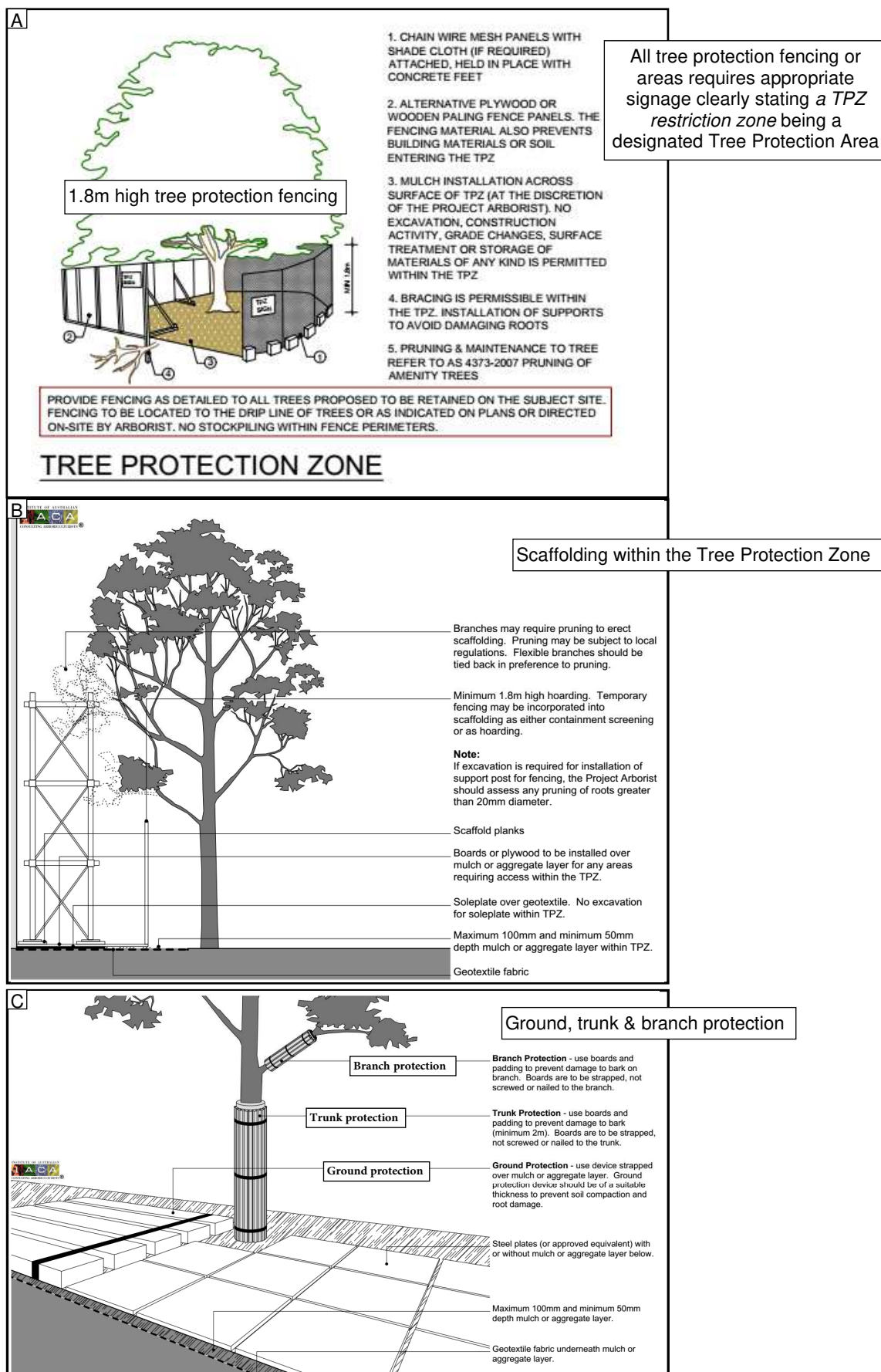
Diploma of Hort/Arboriculture (AQF5), Associate Diploma Parks Management (AQF4)
Certified Arborist / Tree Surgeon (AQF3), ISA Tree Risk Assessment Qualified 2024
Member: ISA, Arboriculture Australia & IACA, Working With Children No: WWC0144637E



APPENDICES

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APPENDIX- A: Tree protection fencing, ground and trunk protection detail



APPENDIX- B: Terminology, notes & references

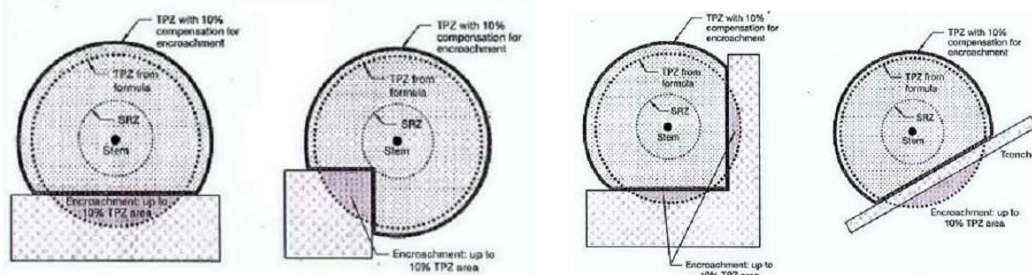
Acceptable Risk: Exposure to or reject risk of varying degrees. The acceptable risk is defined as 'The person who accepts some degree of risk in return for a benefit being exposed to some risk of varying degree. **Age classes:** (I) Immature refers to a well established but juvenile tree. (ESM) refers to an early semi mature tree not of juvenile appearance. (SM) Semi-mature refers to a tree at growth stages advancing into maturity and full size. (LSM) Late Semi- Mature, refers to a tree between semi-mature and close to mature. (EM) refers to a tree at the first stages of maturity. (M) Mature refers to a full size tree with some capacity for future growth. **Health:** Refers to a trees vigor exhibited by the crown density, leaf colour, presence of epicormic shoots, ability to withstand disease invasion and the degree of dieback. **Condition:** Refers to the tree's form and growth habit, as modified by its environment (aspect, suppression by other trees, soils) and the state of the scaffold (i.e. Trunk and major branches), including structural defects such as cavities, crooked trunks or weak trunk / branch junctions. These are not directly connected with health and it is possible for a tree to be healthy but in poor condition. **Decay:** (N) – an area of wood that is undergoing decomposition. (V) – decomposition of an area of wood by fungi or bacteria. **Decline:** Is the response of a tree to a reduction of energy levels resulting from stress. Recovery from decline is difficult and slow; is usually irreversible. **Defect:** A identifiable fault in a tree. **Deadwood:** Small = 5-50mmØ, Medium = >50 to 100mmØ, Large = >100mmØ. **Epicormic Shoots:** Shoots that arise from latent or adventitious buds that occur on stems and branches and on suckers produced from the base of the tree. A symptom / result of stress related factors. **Footprint:** The area occupied by site structures, including the dwelling driveways and hard surfaces. **Included Bark:** (Inclusion) a genetic weak fault, pattern of development at branch junctions where the bark is turned inwards rather than pushed out, can pose a potential hazard. **Order of branches:** First order being those that are the first to extend from the main trunk or codominant limbs, second order branches extend from the first order and third order branches extend from the second order. **Probability:** The likelihood of some event happening. **Risk:** Is the probability of something adverse happening. **Suppression:** Restrained growth pattern from competition of other trees or structures. **Wound:** Damage inflicted upon a tree through injury to its living cells, may continue to develop further weakening of the structure compromising structural integrity. **Target area / fall zone:** = anything in range of tree height + 10% ie. 20m + 2m (10%) = 22m target area

NOTE 1: This report acknowledges the current **Australian Standards 'Protection of Trees on Development Sites'** AS 4970 – 2009 with reference to the Tree Protection Zone (TPZ): being a combination of the root and crown area requiring protection. The TPZ takes into consideration the Structural Root Zone (SRZ): The area required for tree stability. Determined by AS4970 - 2009 Figure 1, Table of determining the SRZ, section 3.3.5 of the standards. The standard states where a greater than 10% encroachment occurs the arborist is to take into consideration the schedule of determining impacts as set within AS4970 s. 3.3.4. Encroachments are referred to within this report as major or minor encroachments (AS4970 s. 3.3.2 & 3.3.3). Below is the terminology used for estimated percentage of development incursion used within this report. To retain specific trees and ensure their viability development must take into consideration protection of the TPZ radius.

NOTE 2: The extent of inclusion within the TPZ radius has been categorised as follows:

No impact (0%) incursion, Low to negligible impact (<10%) of minor consequence, 10 - <15% incursion of moderate to low impact, 15 - <20% Medium to moderate level of impact and incursion where the project arborist is to demonstrate the tree/s remain viable by tree sensitive construction techniques, 20 - <25% incursion of Medium to high level of impact, 25 - <35% of High level impact to significant >35% incursion where moderate to high level impacts may require design changes or further information to manage tree vitality. **WBF** = located within the building footprint where design necessitates tree removal.

Showing acceptable incursion within the TPZ (AS4970)



SELECTED REFERENCES:

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- Harris R. Clark R. & Matheny N. 2004 *Arboriculture Integrated Management of Landscape trees, shrubs and Vines*. Fourth edition. Prentice Hall, New Jersey
- Matheny N. & Clark J. 1998, *Trees & Development 'A Technical Guide to Preservation of Trees During Land Development'* International Society of Arboriculture, Champaign USA.
- ProSafe: TPZ encroachment calculator https://proofsafe.com.au/tpz_incursion_calculator.html
- Standards Australia 2009, *Australian Standards 4970 Protection of Trees on Development Sites* - Standards Australia, Sydney, Australia.
- Standards Australia 2007, *Australian Standards 4373 Pruning of Amenity Trees* - Standards Australia, Sydney, Australia.

APPENDIX- C: ISA terminology & Risk Matrix System

Terminology

Likelihood of failure

Improbable. The tree or branch is not likely to fail during normal weather conditions and may not fail in many severe weather conditions within the specified time frame.

Probable. Failure may be expected under normal weather conditions within the specified time frame.

Possible. Failure may be expected in extreme weather conditions within a specified time frame.

Imminent. Failure has stated or is most likely to occur in the near future, even if there is no significant wind or increased load.

Likelihood of impacting target

High. The failed tree or branch will most likely impact the target. This is the case when a fixed target is fully exposed to the assessed tree or near a high-use road or walkway with an adjacent street frontage.

Medium. The failed tree or branch may or may not impact the target, with nearly equal likelihood.

Low. It is not likely the tree or branch will impact the target.

Very Low. The chance of the failed tree or branch impacting the specified target is remote. This is the case in a rarely used site fully exposed to the assessed tree or an occasional use site that is partially protected by trees and structures.

Consequence of failure

Negligible. Low-value property damage or disruption that can be replaced or repaired and does not involve personal injury.

Minor. Low to moderate property damage, small disruption to traffic, infrastructure, services, or very minor injury.

Significant. Property damage of a moderate to high value, resulting in considerable disruption or person injury.

Severe. Serious person injury or death, damage to high value property & utility services, or disruption to important activities.

Risk rating

Low. Defined by its placement within the risk matrix (below), where consequences are negligible and likelihood is unlikely, or consequences are minor and likelihood is somewhat likely.

Moderate. Defined by its placement within the risk matrix (below), where consequences are minor and likelihood is very likely or likely, or likelihood is somewhat likely and consequences are significant or severe.

High. Defined by its placement within the risk matrix (below), where consequences are significant and likelihood is very likely or likely, or consequences are severe and likelihood is likely.

Extreme: Where failure is immanent with a high likelihood of impacting the target with severe consequences of damages.

ISA Risk Matrix: Based on tree failure within a given target range, rate of occupancy within the target range within a given time frame and consequence of damage in the event of failure

Matrix 1 – Likelihood matrix

Likelihood of failure	Likelihood of Impacting Target			
	Very low	Low	Medium	High
Imminent	Unlikely	Somewhat likely	Likely	Very likely
Probable	Unlikely	Unlikely	Somewhat likely	Likely
Possible	Unlikely	Unlikely	Unlikely	Somewhat likely
Improbable	Unlikely	Unlikely	Unlikely	Unlikely

Matrix 2 – Risk rating matrix

Likelihood of failure & Impact	Consequence of Failure			
	Negligible	Minor	Significant	Severe
Very Likely	Low	Moderate	High	Extreme
Likely	Low	Moderate	High	High
Somewhat likely	Low	Low	Moderate	Moderate
Unlikely	Low	Low	Low	Low

APPENDIX- D: General risk assessment schedule

Refer ISA terminology Appendix- C

Tree No.	Botanical Name COMMON NAME	Height x Span (m)	DBH (mm)	Age	Vitality (health)	Condition (structure)	Failure potential part Risk rating	Estimated target area & occupancy Targets – landscape & potential person. Occupancy – no current active usage in area, with rare maintenance contractor activity.				
1	<i>Eucalyptus tereticornis</i> Forest Red Gum	22 x 7	700	M	Fair / Good	Fair	Low, likely to increase with target occupancy					
Failure part size [P]mm		Likelihood of failure		Likelihood of target impact		Consequence of failure		Risk	Low	Medium	High	Extreme
P1- 700mm(Ø), base		Improbable		-		-			P1			
General observations: No defined at-risk part of failure evident. Base Part P1-700(Ø) failure potential unlikely due to no significant visual fault, tree with no past lower branch scaffolds limb snap evident. Risk of deadwood fall very likely in exposed grassed area, refer to notes of risk assessment criteria.												
Tree No.	Botanical Name COMMON NAME	Height x Span (m)	DBH (mm)	Age	Vitality (health)	Condition (structure)	Risk rating	Estimated target area & occupancy Targets – landscape & potential person. Occupancy – no current active usage in area, with rare maintenance contractor activity.				
2	<i>Eucalyptus tereticornis</i> Forest Red Gum	23 x 11	500	SM	Fair / Poor	Fair	Low, likely to increase with target occupancy					
Failure part size [P]mm		Likelihood of failure		Likelihood of target impact		Consequence of failure		Risk	Low	Medium	High	Extreme
P1- 500mm(Ø), base		Improbable		-		-			P1			
P2- 250mm(Ø), stem		Possible		Unlikely – person contact		Low			P2			
General observations: Base Part P1-500(Ø) failure potential unlikely due to no significant visual fault. Has past limb snap indicating limb failure potential with torsion twisted stem 250mm(Ø) at 11m E = Part P2-250(Ø) Sudden Branch Failure (SBF) failure potential possible. Risk of deadwood fall very likely in exposed grassed area.												
Tree No.	Botanical Name COMMON NAME	Height x Span (m)	DBH (mm)	Age	Vitality (health)	Condition (structure)	Failure potential part Risk rating	Estimated target area & occupancy Targets – landscape & potential person. Occupancy – no current active usage in area, with rare maintenance contractor activity.				
3	<i>Eucalyptus tereticornis</i> Forest Red Gum	22 x 11	650	SM	Poor	Fair / Poor	Low, likely to increase with target occupancy					
Failure part size [P]mm		Likelihood of failure		Likelihood of target impact		Consequence of failure		Risk	Low	Medium	High	Extreme
P1- 650mm(Ø), base		Improbable		-		-			P1			
General observations: No defined at-risk part of failure evident. Base Part P1-650(Ø) failure potential unlikely due to no significant visual fault, tree with no past lower branch scaffold limb snap evident. Risk of deadwood fall very likely in exposed grassed area.												
Tree No.	Botanical Name COMMON NAME	Height x Span (m)	DBH (mm)	Age	Vitality (health)	Condition (structure)	Risk rating	Estimated target area & occupancy Targets – landscape & potential person. Occupancy – no current active usage in area, with rare maintenance contractor activity.				
4	<i>Eucalyptus tereticornis</i> Forest Red Gum	26 x 20	1050	M	Fair / Good	Fair	Moderate to Low, higher with greater occupancy					
Failure part size [P]mm		Likelihood of failure		Likelihood of target impact		Consequence of failure		Risk	Low	Medium	High	Extreme
P1- 1050mm(Ø), base		Improbable		-		-			P1			
P2- 200mm(Ø), stems		Possible		Unlikely – person contact		Low			P2			
General observations: Base Part P1-1050(Ø) failure potential unlikely due to no significant visual fault. Has past limb snap indicating limb failure potential of <200mm(Ø) stems NNE side = Part P2-200(Ø) SBF failure potential of upper branch scaffolds NNE side possible. Risk of deadwood fall very likely in exposed grassed area.												

Tree No.	Botanical Name COMMON NAME	Height x Span (m)	DBH (mm)	Age	Vitality (health)	Condition (structure)	Risk rating	Estimated target area & occupancy Targets – landscape & potential person. Occupancy – no current active usage in area, with rare maintenance contractor activity.				
5	<i>Eucalyptus tereticornis</i> Forest Red Gum	18 x 11	450	SM	Fair / Good	Fair / Good	Moderate to Low, higher with greater occupancy					
Failure part size [P]mm		Likelihood of failure		Likelihood of target impact		Consequence of failure		Risk	Low	Medium	High	Extreme
P1- 450mm(Ø), base		Improbable		-		-			P1			
P2- 200mm(Ø), stem		Possible		Unlikely – person contact		Low			P2			
General observations: Base Part P1-450(Ø) failure potential unlikely due to no significant visual fault. Has past limb snap <200mm(Ø) SE side indicating potential for additional limb failure potential of stems <200mm(Ø)= Part P2-200(Ø) Sudden Branch Failure (SBF) failure potential possible. Risk of deadwood fall very likely in exposed grassed area.												
Tree No.	Botanical Name COMMON NAME	Height x Span (m)	DBH (mm)	Age	Vitality (health)	Condition (structure)	Risk rating	Estimated target area & occupancy Targets – landscape & potential person. Occupancy – no current active usage in area, with rare maintenance contractor activity.				
6	<i>Eucalyptus tereticornis</i> Forest Red Gum	25 x 15	700	M	Fair / Good	Fair / Good	Moderate to Low, higher with greater occupancy					
Failure part size [P]mm		Likelihood of failure		Likelihood of target impact		Consequence of failure		Risk	Low	Medium	High	Extreme
P1- 700mm(Ø), base		Improbable		-		-			P1			
P2- 200mm(Ø), stem		Possible		Unlikely – person contact		Low			P2			
General observations: Base Part P1-700(Ø) failure potential unlikely due to no significant visual fault. Contains twin stems at 5m, junction no significant visual faults with twin stem failure = Part P2-<300(Ø) SBF failure potential unlikely due to adjacent tree protection factors and no significant visual faults. Risk of deadwood fall very likely in exposed grassed area.												
Tree No.	Botanical Name COMMON NAME	Height x Span (m)	DBH (mm)	Age	Vitality (health)	Condition (structure)	Risk rating	Estimated target area & occupancy Targets – landscape & potential person. Occupancy – no current active usage in area, with rare maintenance contractor activity.				
7	<i>Eucalyptus tereticornis</i> Forest Red Gum	24 x 12	500	SM	Fair	Fair / Good	Low, likely to increase with target occupancy					
Failure part size [P]mm		Likelihood of failure		Likelihood of target impact		Consequence of failure		Risk	Low	Medium	High	Extreme
P1- 500mm(Ø), base		Improbable		-		-			P1			
P2- 200mm(Ø), stem		Possible		Unlikely – person contact		Low			P2			
General observations: Base Part P1-500(Ø) failure potential unlikely due to no significant visual fault. Has past limb snap NE & E side <200mm(Ø) indicating limb failure potential, of Part P2-200(Ø) Sudden Branch Failure (SBF) failure potential possible. Risk of deadwood fall very likely in exposed grassed area.												
Tree No.	Botanical Name COMMON NAME	Height x Span (m)	DBH (mm)	Age	Vitality (health)	Condition (structure)	Failure potential part Risk rating	Estimated target area & occupancy Targets – landscape & potential person. Occupancy – no current active usage in area, with rare maintenance contractor activity.				
8	<i>Dead eucalypt tree</i>	17 x 6	350	-	-	-	Moderate to Low, higher with greater occupancy					
Failure part size [P]mm		Likelihood of failure		Likelihood of target impact		Consequence of failure		Risk	Low	Medium	High	Extreme
P1- 350mm(Ø), base		Possible		Unlikely – person contact		Low			P1			
General observations: Dead standing tree, failure expected as anchoring root system degrades = Base Part P1-350(Ø) failure potential possible due to dead tree. Risk of deadwood fall very likely in exposed grassed area.												

Tree No.	Botanical Name COMMON NAME	Height x Span (m)	DBH (mm)	Age	Vitality (health)	Condition (structure)	Risk rating	Estimated target area & occupancy Targets – landscape & potential person. Occupancy – no current active usage in area, with rare maintenance contractor activity.				
9	<i>Eucalyptus tereticornis</i> Forest Red Gum	22 x 15	850	M	Good	Fair / Good	Low, likely to increase with target occupancy					
Failure part size [P]mm		Likelihood of failure		Likelihood of target impact		Consequence of failure		Risk	Low	Medium	High	Extreme
P1- 855mm(Ø), base		Improbable		-		-			P1			
P2- <250mm(Ø), stems		Possible		Unlikely		Low			P2			
General observations: Base Part P1-500(Ø) failure potential unlikely due to no significant visual fault. Has past limb snap N & E sides <250mm(Ø) with parrot damaged branch collars at 7 & 8m NE indicating potential for limb failure potential = Part P2-<250(Ø) Sudden Branch Failure (SBF) failure potential possible. Risk of deadwood fall very likely in exposed grassed area.												
Tree No.	Botanical Name COMMON NAME	Height x Span (m)	DBH (mm)	Age	Vitality (health)	Condition (structure)	Failure potential part Risk rating	Estimated target area & occupancy Targets – landscape & potential person. Occupancy – no current active usage in area, with rare maintenance contractor activity.				
10	<i>Dead eucalypt tree</i>	14 x 3	250	-	-	-	Moderate to Low, higher with greater occupancy					
Failure part size [P]mm		Likelihood of failure		Likelihood of target impact		Consequence of failure		Risk	Low	Medium	High	Extreme
P1- 350mm(Ø), base		Possible		Unlikely – person contact		Low			P1			
General observations: Dead standing tree, failure expected as anchoring root system degrades = Base Part P1-250(Ø) failure potential possible due to dead tree. Risk of deadwood fall very likely in exposed grassed area.												
Tree No.	Botanical Name COMMON NAME	Height x Span (m)	DBH (mm)	Age	Vitality (health)	Condition (structure)	Failure potential part Risk rating	Estimated target area & occupancy Targets – landscape & potential person. Occupancy – no current active usage in area, with rare maintenance contractor activity.				
11	<i>Eucalyptus tereticornis</i> Forest Red Gum	17 x 6	400	SM	Fair	Fair / Good	Low, likely to increase with target occupancy					
Failure part size [P]mm		Likelihood of failure		Likelihood of target impact		Consequence of failure		Risk	Low	Medium	High	Extreme
P1- 400mm(Ø), base		Improbable		-		-			P1			
General observations: No defined at-risk part of failure evident. Base Part P1-400(Ø) failure potential unlikely due to no significant visual fault. Risk of deadwood fall very likely in exposed grassed area.												
Tree No.	Botanical Name COMMON NAME	Height x Span (m)	DBH (mm)	Age	Vitality (health)	Condition (structure)	Failure potential part Risk rating	Estimated target area & occupancy Targets – landscape & potential person. Occupancy – no current active usage in area, with rare maintenance contractor activity.				
12	<i>Eucalyptus tereticornis</i> Forest Red Gum	20 x 6	400	SM	Fair / Good	Fair / Good	Low, likely to increase with target occupancy					
Failure part size [P]mm		Likelihood of failure		Likelihood of target impact		Consequence of failure		Risk	Low	Medium	High	Extreme
P1- 400mm(Ø), base		Improbable		-		-			P1			
General observations: No defined at-risk part of failure evident. Base Part P1-400(Ø) failure potential unlikely due to no significant visual fault. Risk of deadwood fall very likely in exposed grassed area.												

Tree No.	Botanical Name COMMON NAME	Height x Span (m)	DBH (mm)	Age	Vitality (health)	Condition (structure)	Failure potential part Risk rating	Estimated target area & occupancy Targets – landscape, persons in playground. Occupancy – no current active usage in area, with rare maintenance contractor activity.				
13	<i>Eucalyptus tereticornis</i> Forest Red Gum	22 x 16	800	M	Fair / Good	Poor	High, due to structurally defective part					
Failure part size [P]mm		Likelihood of failure		Likelihood of target impact		Consequence of failure		Risk	Low	Medium	High	Extreme
P1- 700mm(Ø), trunk / base		Improbable		Somewhat possible playground contact		Moderate					P1	
General observations: Lower trunk unsound on three sides at 1.5+m, open cavity hollow and degraded, tree extensively one sided and weight loaded above wound indicating trunk Part P1-800(Ø) failure potential probable, with target area of part adjacent children's playground. Tree considered an at-risk tree of failure. Tree has broad canopy form offering wind protection factors to internal trees where loss of trees canopy wind protection factors would likely compromise the retention value of surrounding trees due to sudden exposure.												
Tree No.	Botanical Name COMMON NAME	Height x Span (m)	DBH (mm)	Age	Vitality (health)	Condition (structure)	Failure potential part Risk rating	Estimated target area & occupancy Targets – landscape & potential person. Occupancy – no current active usage in area, with rare maintenance contractor activity.				
14	<i>Eucalyptus tereticornis</i> Forest Red Gum	23 x 10	400	SM	Good	Fair / Good	Low, likely to increase with target occupancy					
Failure part size [P]mm		Likelihood of failure		Likelihood of target impact		Consequence of failure		Risk	Low	Medium	High	Extreme
P1- 400mm(Ø), base		Improbable		-		-			P1			
General observations: Lower trunk wounds sound = Base Part P1-400(Ø) failure potential unlikely as wounds likely a result of recent mechanical impact. Tree with no lean or lower branch scaffold significant visual faults or limb snap evident. Risk of deadwood fall very likely in exposed grassed area.												
Tree No.	Botanical Name COMMON NAME	Height x Span (m)	DBH (mm)	Age	Vitality (health)	Condition (structure)	Risk rating	Estimated target area & occupancy Targets – landscape & potential person. Occupancy – no current active usage in area, with rare maintenance contractor activity.				
15	<i>Eucalyptus tereticornis</i> Forest Red Gum	18 x 7	450	SM	Fair / Poor	Poor	Low, likely to increase with target occupancy					
Failure part size [P]mm		Likelihood of failure		Likelihood of target impact		Consequence of failure		Risk	Low	Medium	High	Extreme
P1- 500mm(Ø), base		Improbable		-		-			P1			
P2- 300mm(Ø), stem		Possible		Unlikely – person contact		Low			P2			
General observations: Base Part P1-500(Ø) failure potential unlikely due to no significant visual fault. Upper trunk 300mm(Ø) with cavity at 5m W side = Part P2-300(Ø) failure potential possible, however unlikely in assessment period. Risk of deadwood fall very likely in exposed grassed area.												
Tree No.	Botanical Name COMMON NAME	Height x Span (m)	DBH (mm)	Age	Vitality (health)	Condition (structure)	Failure potential part Risk rating	Estimated target area & occupancy Targets – landscape & potential person. Occupancy – no current active usage in area, with rare maintenance contractor activity.				
16	<i>Eucalyptus tereticornis</i> Forest Red Gum	15 x 2	250	ESM	Poor	Fair / Poor	Low, likely to increase with target occupancy					
Failure part size [P]mm		Likelihood of failure		Likelihood of target impact		Consequence of failure		Risk	Low	Medium	High	Extreme
P1- 250mm(Ø), base		Possible		Unlikely – person contact		Low			P1			
General observations: No defined at-risk part of failure in upper branch scaffolds evident. Base Part P1-250(Ø) failure potential possible, however unlikely in assessment period due to mechanical wounds on lower trunk NE & S sides. Tree more likely to stand dead in short term due to condition with risk of deadwood fall very likely within grassed area.												

Tree No.	Botanical Name COMMON NAME	Height x Span (m)	DBH (mm)	Age	Vitality (health)	Condition (structure)	Failure potential part Risk rating	Estimated target area & occupancy Targets – landscape & potential person. Occupancy – no current active usage in area, with rare maintenance contractor activity.			
17	<i>Eucalyptus tereticornis</i> Forest Red Gum	20 x 7	350	SM	Fair	Fair	Low, likely to increase with target occupancy				
Failure part size [P]mm		Likelihood of failure	Likelihood of target impact		Consequence of failure		Risk	Low	Medium	High	Extreme
P1- 350mm(Ø), base		Possible	Unlikely – person contact		Low			P1			
General observations: No defined upper branch scaffolds at-risk part of failure evident. Base & trunk Part P1-350(Ø) wound at 1m S side failure potential possible however, unlikely in assessment period due to likely recent mechanical impact. Risk of deadwood fall very likely in exposed grassed area.											
Tree No.	Botanical Name COMMON NAME	Height x Span (m)	DBH (mm)	Age	Vitality (health)	Condition (structure)	Risk rating	Estimated target area & occupancy Targets – landscape & potential person. Occupancy – no current active usage in area.			
18	<i>Eucalyptus tereticornis</i> Forest Red Gum	22 x 18	700	M	Poor	Fair / Poor	Low, likely to increase with target occupancy				
Failure part size [P]mm		Likelihood of failure	Likelihood of target impact		Consequence of failure		Risk	Low	Medium	High	Extreme
P1- 700mm(Ø), base		Possible	Unlikely – person contact		Low			P1			
P2- 250mm(Ø), stem		Possible	Unlikely		Low			P2			
General observations: Base Part P1-700(Ø) failure potential possible however, unlikely in assessment period with small wound at base slightly unsound, surrounding wound site sound. May benefit from further investigations to determine extent of cavity decay. Upper branch scaffolds of stems <250mm(Ø) contain parrot damage at branch collars = Part P2-<250(Ø) failure potential possible but unlikely in assessment period. Risk of deadwood fall very likely in exposed grassed area as is future Sudden Branch Failure (SBF) from parrot damage sections											
Tree No.	Botanical Name COMMON NAME	Height x Span (m)	DBH (mm)	Age	Vitality (health)	Condition (structure)	Failure potential part Risk rating	Estimated target area & occupancy Targets – landscape & potential person. Occupancy – no current active usage in area, with rare maintenance contractor activity.			
19	<i>Eucalyptus tereticornis</i> Forest Red Gum	15 x 6	400	SM	Poor	Poor	Low, likely to increase with target occupancy				
Failure part size [P]mm		Likelihood of failure	Likelihood of target impact		Consequence of failure		Risk	Low	Medium	High	Extreme
P1- 400mm(Ø), base		Possible	Unlikely – person contact		Low			P1			
General observations: Tree likely to stand dead with basal wound from likely mechanical damage SSW sides = Base Part P1-400(Ø) failure potential possible however, unlikely in assessment period. Risk of deadwood fall very likely in exposed grassed area.											
Tree No.	Botanical Name COMMON NAME	Height x Span (m)	DBH (mm)	Age	Vitality (health)	Condition (structure)	Failure potential part Risk rating	Estimated target area & occupancy Targets – landscape & potential person. Occupancy – no current active usage in area, with rare maintenance contractor activity.			
20	<i>Eucalyptus tereticornis</i> Forest Red Gum	18 x 12	500	SM	Fair / Poor	Fair	Low, likely to increase with target occupancy				
Failure part size [P]mm		Likelihood of failure	Likelihood of target impact		Consequence of failure		Risk	Low	Medium	High	Extreme
P1- 500mm(Ø), base		Possible	Unlikely – person contact		Low			P1			
General observations: Mechanical damage Wd E side = Base Part P1-500(Ø) failure potential unlikely in assessment period. Tree exposed to bending stress with no UIBS faults other than exposure due to decline indicating risk of Sudden Branch Failure (SBF) possible during storm events with deadwood fall very likely in exposed grassed area.											

APPENDIX- E: Tree Retention Value Checklist @rainTree consulting

VTA i) Landscape Significance (LS): The significance of a tree in the landscape is a combination of its amenity, environmental and heritage values. Values may be subjective however, are based after IACA Sustainable Retention Index Value (SRVI) which offer a visual understanding of the relative importance of the tree within the environment. The Landscape Significance for this assessment is described in seven categories to assist in determining the retention value of trees.

1	Significant	2	Very High	3	High	4	Moderate	5	Low	6	Very Low	7	Insignificant
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ii) Visual Tree Assessment (VTA)

0	If appropriate to VTA - *exempt trees from Local Government Authority (LGA) Tree Management or Preservation Orders (TPO)	2E	Trees location likely to be affected by infrastructure restricting root growth potential, or tree has potential to cause infrastructure damage where risk mitigation or rectification works may compromise tree anchorage. Tree(s) may be contained by sloid structures with restricted anchoring root potential
0A	Noxious or invasive species located within heritage or biodiversity conservation areas		
1	Trees that are dead, significantly declining >75% volume or obviously hazardous	3	This rating incorporates trees that require further investigation of faults & defects such as pathogen ID, cavities or symptoms indicating internal damage or decay that cannot be assessed by visual examination. Further inspections may include Plant Disease Diagnostic Unit (PDDU) pathogen testing, arborist climbing inspection within the canopy, root crown investigation, drill penetrating and/or Pcus Sonic Tomograph ultrasound testing procedures to determine extent of internal damage or decay.
2	Trees that are structurally damaged. Have poor structure or weak & detrimental large branch bark stem inclusions capable of sudden failure opposed to 2B. Tree may also be affected by extensive borer damage, fungal pathogens (wood rot) or viruses. Some symptoms may be reversible, remediated or controlled give appropriate management		
2A	Tree damage specific to basal and/or root plate damage, very shallow soils or steep topography resulting in poor anchorage where condition may become problematic in the near future, may include trees with included branch bark splits to ground level	4	Trees which appear specifically environmentally stressed by drought, poor soil or site conditions. Symptoms may be reversible given appropriate management
2B	Defect specific to stem inclusions development (weak branch attachments) where the condition may not be immediately detrimental however, require annual to biannual monitoring with control to prevent stem failure by installing slings, cable or bracing. Tree may also contain multi stems or codominant twin stems	5	Trees that have become exposed, are subject to wind loading pressure, or have tall forest form where exposure may result in windthrow or limb snap
		5A	Screen trees or shrubs that are routinely hedged or pruned for height control
2C	Tree may contain minor wounds, pest or minor pathogen activity, altered from storm damaged to an extent that is not considered immediately detrimental, may also display average form. Likely to require close annual monitoring or minor corrective pruning	6	Trees may be typical for species type, of good form and visual condition for age class. May have suppressed one sided canopies or are visually low risk trees noted under a limited inspection only
2D	Trees significantly altered by recent storm or over pruning events which may reduce retention values due to average form- or tree extensively pruned for power line clearance	7	VTA restricted by canopy or plant material, vine or ivy covering tree parts or site conditions which do not allow access i.e. fences to neighbouring sites

iii) Retention Value (RV): Determined by [1] High - tree free of visual defects and viable for retention, [2] Medium – Consider retention with minor visual faults which may reduce ULE, [3] Low - trees which contain faults that are likely to become problematic in the near future, [4] Removal - trees to be considered for removal due to poor condition.

1	High retention	2	Medium retention	3	Low retention	4	Consider removal
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iv) U.L.E. categories Useful Life Expectancy (after Barrell 1996, modified by the author)

A trees U.L.E. category is the life expectancy of the tree modified first by its age, health, condition, safety and location. U.L.E. assessments are not static but may be modified as dictated by changes in trees health and environment. The five categories of U.L.E. are as follows:

1. Long U.L.E. - Appear retainable at the time of assessment for over 40 years with an acceptable degree of risk assuming reasonable maintenance.
2. Medium U.L.E. - Appear to be retainable at the time of assessment for 15 to 40 years with an acceptable degree of risk assuming reasonable maintenance.
3. Short U.L.E. - Trees appear to be retainable at the time of assessment for 5 to 15 years with an acceptable degree of risk assuming reasonable maintenance.
4. Very short - Removal- Trees which should be scheduled for removal within the very short term or as specified within this report.
5. Small, young or regularly pruned – Trees under 5m in height that can be easily moved or replaced, includes screen plantings or hedge lines.

APPENDIX- F: Tree Assessment Schedule

Refer Appendix- E Tree retention value check list

Trees recommended for removal due to hazardous or dead condition (subject to ecologist advice for habitat values)							Trees with low retention values: senescence, developing defects or being *non-prescribed exempt trees or known invasive *environmental weed species					
Tree No	Botanical Name COMMON NAME	Height x spread (m)	DBH (mm)	SRZ TPZ (m)	Age	Vigour (health)	Condition (structure)	LS	VTA	RV	ULE	Comments
1	<i>Eucalyptus tereticornis</i> Forest Red Gum	22 x 7	700	2.8 8.4	M	Fair / Good	Fair	3	4	2	2	Appears somewhat viable for retention without change in site conditions
Pre DA notes: Environmentally stressed with fine tip dieback throughout potential causes soil change & psyllid activity, stress related epicormic shoots make up near 80% foliage volume, has one sided canopy biomass SSE with medium diameter deadwood throughout canopy, has past limb snap sections evident, no significant visual structural defects noted. Proposed car parking bays are located outside of the SRZ and occupy the TPZ with likely Major (>10%) TPZ encroachment												
2	<i>Eucalyptus tereticornis</i> Forest Red Gum	23 x 11	500	2.6 6	SM	Fair / Poor	Fair	3	4	2	2	Appears somewhat viable for retention without change in site conditions
Pre DA notes: Environmentally stressed with significant decline in central canopy, stress related epicormic shoots make up near 80% foliage volume, has one sided canopy biomass - SE with medium diameter deadwood throughout canopy, has past limb snap & torsion twist limb damage at 11m E, with high percent of large diameter deadwood throughout, no significant visual structural defects noted. Proposed car parking bays are located outside of the SRZ & TPZ of negligible TPZ encroachment.												
3	<i>Eucalyptus tereticornis</i> Forest Red Gum	22 x 11	650	2.8 7.8	SM	Poor	Fair / Poor	3	1/4	3	3	State of stress and decline indicates likely low retention value
Pre DA notes: Significant decline in canopy, environmental stress resulting in near dead tree, emerging stress related epicormic shoots make up near 90% foliage volume with very low normal terminal foliage growth. Canopy contains large diameter deadwood, no significant visual structural defects noted. Proposed car parking bays are located outside of the SRZ & TPZ of negligible TPZ encroachment.												
4	<i>Eucalyptus tereticornis</i> Forest Red Gum	26 x 20	1050	3.5 12.6	M	Fair / Good	Fair	3	4/2	2	<2	Appears somewhat viable for retention without change in site conditions. Requires ecologist advice on habitat values
Pre DA notes: Environmentally stressed with low natural outer foliage volume, emerging stress related epicormic shoots on lower branch scaffolds make up near 15% foliage volume, tree likely past lightning struck with W side dead, having large limb dead section 350mm+(Ø)with potential cavities for habitat and large diameter deadwood throughout canopy. Large dead section W side extends from 2.2m to 17m above ground level. Remaining active canopy extension E, SE & NE of broad form with lower limb snap evident. Proposed pathways are located outside of the SRZ & TPZ of negligible TPZ encroachment.												
5	<i>Eucalyptus tereticornis</i> Forest Red Gum	18 x 11	450	2.5 5.4	SM	Fair / Good	Fair / Good	3	4/2C	2	<2	Appears somewhat viable for retention without change in site conditions
Pre DA notes: Environmentally stressed with decline in canopy, emerging stress related epicormic shoots make up near 60% foliage volume with very average normal terminal foliage growth. Canopy with large diameter deadwood throughout, contains past limb snap at 4m SE with canopy suppressed in growth development by T4 & 6 location. Proposed pathways are located outside of the SRZ & TPZ of negligible TPZ encroachment.												

Refer Appendix- E Tree retention value check list

Trees recommended for removal due to hazardous or dead condition (subject to ecologist advice for habitat values)							Trees with low retention values: senescence, developing defects or being *non-prescribed exempt trees or known invasive *environmental weed species					
Tree No	Botanical Name COMMON NAME	Height x spread (m)	DBH (mm)	SRZ TPZ (m)	Age	Vigour (health)	Condition (structure)	LS	VTA	RV	ULE	Comments
6	<i>Eucalyptus tereticornis</i> Forest Red Gum	25 x 15	700	2.8 8.4	M	Fair / Good	Fair / Good	3	4/2B	2	2	Appears somewhat viable for retention without change in site conditions
<i>Pre DA notes: Environmentally stressed with decline in canopy, emerging stress related epicormic shoots make up near 40% foliage volume with central apical stems in decline. Tree codominant / twin stems at 5m 250 & 300mm(Ø) with medium diameter deadwood throughout canopy and no significant visual faults. Proposed pathways are located outside of the SRZ & TPZ of negligible TPZ encroachment.</i>												
7	<i>Eucalyptus tereticornis</i> Forest Red Gum	24 x 12	500	2.6 6	SM	Fair	Fair / Good	3	4	2	2	Appears somewhat viable for retention without change in site conditions
<i>Pre DA notes: Environmentally stressed with minor decline in canopy, canopy suppressed with biomass E with emerging stress related epicormic shoots making up near 50% foliage volume, medium to large diameter deadwood throughout canopy evident. Has lower branch scaffolds limb snap at 3m NE & 5m E being visual indicators of sudden branch failure or mechanical impact damage. Proposed pathways are located outside of the SRZ & TPZ of negligible TPZ encroachment.</i>												
8	<i>Eucalyptus tereticornis</i> Forest Red Gum	17 x 6	350	2.3 -	-	-	-	5	1	4	4	Dead tree not viable to place targets in tree fall zone, refer to ecologist for further advice
<i>Pre DA notes: Dead tree with potential habitat or environmental benefits, refer to ecologist for advice. Likely to stand dead pending on extent of past impacts & activities within Structural Root Zone (SRZ), with dead limb snap or whole tree collapse likely. Proposed hazardous tree removal to accommodate design.</i>												
9	<i>Eucalyptus tereticornis</i> Forest Red Gum	22 x 15	850	3.1 10.2	M	Good	Fair / Good	3	2C	2	2	Appears somewhat viable for retention without change in site conditions
<i>Pre DA notes: Tree of good vigour, slightly environmentally stressed with high foliage volume / canopy cover, emerging stress related epicormic shoots making up near 40% foliage volume. Lower branch scaffolds long, bowing to NNE with potential for Sudden Branch Failure (SBF), large limb snap evident at 2.2m N and 4.5m E being visual indicators of sudden branch failure or mechanical impact damage. Canopy has medium to large diameter deadwood throughout, contains parrot damage at branch collars at 7 & 8m NE side on long bowing stems capable of Sudden Branch Failure (SBF). Proposed pathway is located outside of the SRZ with likely Minor (<10%) TPZ encroachment</i>												
10	<i>Eucalyptus tereticornis</i> Forest Red Gum	14 x 3	250	2 -	-	-	-	5	1	4	4	Dead tree not viable to place targets in tree fall zone, refer to ecologist for further advice
<i>Pre DA notes: Dead tree with potential habitat or environmental benefits, refer to ecologist for advice. Likely to stand dead pending on extent of past impacts & activities within Structural Root Zone (SRZ), with dead limb snap or whole tree collapse likely. Proposed hazardous tree removal to accommodate design.</i>												
11	<i>Eucalyptus tereticornis</i> Forest Red Gum	17 x 6	400	2.4 4.8	SM	Fair	Fair / Good	3	4/5	2	2	Appears somewhat viable for retention without change in site conditions
<i>Pre DA notes: Environmentally stressed with decline in canopy and fine tip dieback, emerging stress related epicormic shoots making up near 15% foliage volume. Tree of tall forest form with suppressed canopy form biomass N, with medium diameter deadwood evident. Proposed works are located outside of the SRZ & TPZ of negligible TPZ encroachment.</i>												

Refer Appendix- E Tree retention value check list

Trees recommended for removal due to hazardous or dead condition (subject to ecologist advice for habitat values)							Trees with low retention values: senescence, developing defects or being *non-prescribed exempt trees or known invasive *environmental weed species					
Tree No	Botanical Name COMMON NAME	Height x spread (m)	DBH (mm)	SRZ TPZ (m)	Age	Vigour (health)	Condition (structure)	LS	VTA	RV	ULE	Comments
12	<i>Eucalyptus tereticornis</i> Forest Red Gum	20 x 6	400	2.4 4.8	SM	Fair / Good	Fair / Good	3	4/5	2	2	Appears somewhat viable for retention without change in site conditions
Pre DA notes: Canopy slightly environmentally stressed, displays good vigour where emerging stress related epicormic shoots making up near 30% foliage volume, central canopy decline and deadwood throughout evident. Proposed works are located outside of the SRZ & TPZ of negligible TPZ encroachment.												
13	<i>Eucalyptus tereticornis</i> Forest Red Gum	22 x 16	800	3 9.6	M	Fair / Good	Poor	3	3/4/2	4	4	Structurally defective tree not viable to retain, benefit from further investigations by structural testing to confirm failure potential
Pre DA notes: Structurally defective tree with hollow lower trunk, unsound on 3x sides adjacent cavity at 2m S side, above hollow trunk spiral wound to 7m = likely high-risk tree of large part failure, canopy with small to medium diameter deadwood throughout, refer to ecologist for further advice, has parrot damaged branch collar at 11m E side at main stem junction. Proposed hazardous tree removal to accommodate design.												
14	<i>Eucalyptus tereticornis</i> Forest Red Gum	23 x 10	400	2.4 4.8	SM	Good	Fair / Good	3	4/2C/5	3	3	Appears of average retention value where lower trunk wounds may become problematic in the future
Pre DA notes: Tree of tall forest form, canopy slightly environmentally stressed with slight decline, lower trunk wound N & S sides may become problematic in the future, open wounds with sound wound wood faces, tree likely to become problematic if exposed by loss of adjacent tree wind protection factors, canopy with medium diameter deadwood throughout. Proposed hazardous tree removal to accommodate design.												
15	<i>Eucalyptus tereticornis</i> Forest Red Gum	18 x 7	450	2.5 5.4	SM	Fair / Poor	Poor	3	2	4	3	Appears of low retention value being a structurally defective tree
Pre DA notes: Structurally defective tree, potentially past lightning struck with spiral wound from 2.3m to 18m above ground level, upper branch scaffolds dead, with lower trunk stress related epicormic shoots only, no terminal foliage development. Wound at 5m W side indicates potential failure location of upper 13m section, can be remediated / pruned back, generally tree in poor structural condition. Tree likely to stand dead with dead limb fall having large diameter deadwood throughout. Proposed hazardous tree removal to accommodate design.												
16	<i>Eucalyptus tereticornis</i> Forest Red Gum	15 x 2	250	2 3	ESM	Poor	Fair / Poor	3	4/2A	3	<3	Appears of low retention value being a structurally defective tree
Pre DA notes: Structurally defective tree, environmentally stressed with significant decline in canopy with all foliage consisting of stress related epicormic shoots with medium diameter deadwood throughout. Contains mechanical impact damage at base NE & S sides where extent and location of wounding is likely to become problematic in the future indicating a likely developing high risk tree. Proposed hazardous tree removal to accommodate design.												
17	<i>Eucalyptus tereticornis</i> Forest Red Gum	20 x 7	350	2.3 4.2	SM	Fair	Fair	3	4/2	3	<2	Appears of average retention value where lower trunk wounds may become problematic in the future
Pre DA notes: Environmentally stressed with decline in canopy throughout having emerging stress related epicormic shoots making up near 90% foliage volume with medium diameter deadwood throughout. Tree of tall forest form with poor branch architecture, lower trunk wound at 1m S side extending to ground level likely to become problematic in the future. Proposed works are located outside of the SRZ & TPZ of negligible TPZ encroachment.												

Refer Appendix- E Tree retention value check list

Trees recommended for removal due to hazardous or dead condition (subject to ecologist advice for habitat values)							Trees with low retention values: senescence, developing defects or being *non-prescribed exempt trees or known invasive *environmental weed species					
Tree No	Botanical Name COMMON NAME	Height x spread (m)	DBH (mm)	SRZ TPZ (m)	Age	Vigour (health)	Condition (structure)	LS	VTA	RV	ULE	Comments
18	<i>Eucalyptus tereticornis</i> Forest Red Gum	22 x 18	700	2.8 8.4	M	Poor	Fair / Poor	3	1/4	4	<3	Near dead tree, appears of low retention value due to structural condition
Pre DA notes: Environmentally stressed >70% in decline SSE & W sides, foliage mostly stress related epicormic shoots having low foliage volume & medium diameter deadwood, unable to prune to make safe, cavity at base S side slightly unsound indicating wound may become problematic in the future, has parrot damaged branch collars at 6 & 6.5m W. Proposed hazardous tree removal to accommodate design.												
19	<i>Eucalyptus tereticornis</i> Forest Red Gum	15 x 6	400	2.4 4.8	SM	Poor	Poor	4	1	4	4	Near dead tree, of low retention value where decline appears irreversible
Pre DA notes: Near dead tree, <5% live foliage volume, all epicormic shoots with evidence of epicormic shoot decline, trunk debarking N side from ground level to upper branch scaffolds 12m+ above ground level indicating decline irreversible, contains mechanical impact damage at base SSW sides. Proposed hazardous tree removal to accommodate design.												
20	<i>Eucalyptus tereticornis</i> Forest Red Gum	18 x 12	500	2.6 6	SM	Fair / Poor	Fair	3	4/2A	3	<2	Appears of average retention value where declining tree condition may become problematic in the future
Pre DA notes: Environmentally stressed with significant decline in canopy, limited internal canopy foliage growth, select areas of natural terminal canopy foliage volume with large diameter deadwood. Base with open wound E side indicator or potential past mechanical damage. Proposed parking bay is located outside of the SRZ with likely very Minor (<10%) TPZ encroachment												

APPENDIX- G: Tree Location Plan

