



ADVERTISED PLAN

ARBORICULTURAL IMPACT ASSESSMENT

SITE ADDRESS:

34 George Street, Reservoir, Vic. 3073

REPORT DATE:

8 December 2023

TREETEC REFERENCE:

geor0623to_AIA

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DOCUMENT SUMMARY				
STAGE	REPORT REF	PURPOSE	VERSION	DATE
	geor0623to_PAR	Preliminary assessment	1	07/07/2023
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1 Introduction

1.1 Purpose

Treetec have been engaged to assess the tree population at, or in close proximity to, 34 George Street, Reservoir (the site).

In accordance with AS4970-2009 Protection of trees on development sites (section 2.3.5), the purpose of this report is to identify and assess development related impacts relating to assessed trees, and to provide a summary of the assessment herein.

1.2 Background

The proposed works involve a high-density housing development of the site. Works will include demolition of existing structures and vegetation removal as well as a new crossover and modification of the existing crossover.

The existing church (heritage overlay) is proposed to be retained and renovated.

1.3 Scope

- Based on the current proposal, determine which trees on or near the site (the subject trees) may be impacted by the development
- Provide details on the subject trees including their species, amenity value, condition and dimensions
- Assess the impact the proposed development is likely to have on the subject trees
- Comment on measures likely to be required to enable the protection of subject trees proposed to be retained.

1.4 Method

- Tom Oldmeadow undertook an arboricultural assessment on 04 December 23
- All observations were taken at ground level, using stage 1 of the Visual Tree Assessment (VTA) method (Mattheck and Breloer 1994)
- Data collected has been categorised in line with definitions found in Appendix 7.2- Glossary.

1.5 Limitations

- Root assessment requiring excavation was not undertaken. Therefore, root condition has not been included unless above ground signs, such as soil heaving or cracking were observed
- Aerial examination (tree climbing) was not undertaken
- Tree height and canopy width were estimated
- Only noteworthy trees that might be significantly impacted by the proposed works (regardless of property boundaries) are included in this report
- Environmental weeds, shrubs, dead trees and juvenile exotic trees of very low amenity/retention value were not assessed individually
- Diameter at Breast Height (DBH) of trees on neighbouring properties was estimated.

For the full list of assumptions and limitations for this report please refer to Appendix 7.1

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1.6 Documents viewed

Site plan. Project number- 2301. Dated- 12/2023. Prepared by- Ys Housing.

1.7 Planning scheme and applicable overlays

The site is covered by the Darebin Planning Scheme and is zoned General Residential Zone – Schedule 2 (GRZ2).

Local law

The Darebin City Council Tree Protection on Private Property Local Law No. 1 of 2019 applies to the site.

Applies to trees that have a single or combined trunk circumference greater than 100cm (1000mm) measured at 1.5m above ground level and is taller than 8m.

Relevant overlays

Heritage Overlay (HO264) applies to the site but does not include tree controls.

2 Findings

2.1 Site summary

The subject site includes both titles 34 and 34a Georges Street with a total size of ~3000sqm.

The site supports the Heritage listed (HO264 Overlay) Methodist Church building as well as multiple large newer additions at the rear.



Plate 1: Panoramic view of the front of the site.

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Plate 2: Panoramic view of the rear of the site.

2.2 Vegetation on adjoining land

Tree number	Location
Trees 1 and 2	Nature strip of George St
Tree group 7	Neighbouring property to the east



2.3 Vegetation not detailed

Some additional vegetation has been identified on the plan (plotted as 'V1 – V13'), but these have not been individually assessed as they are very low amenity value shrubs/plants (see appendix for photos). None of this vegetation meets the criteria for protection under the applicable Local Law.

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2.4 Tree data

Tree #	1	
Species	<i>Eucalyptus leucoxylon</i>	
Common name	Yellow Gum	
Type	Australian native	
DBH (cm)	44	
Height (m)	12	
Spread (m)	6	
Structure	Fair	
Health	Good	
Age	Semi-mature	
Amenity value	Medium	
ULE (yrs)	>40	
TPZ (m)	5.3	
SRZ (m)	2.5	
Notes	Nature strip/street tree. Co-dominant stems from 1m with included bark union.	
Impact assessment	Moderate. The proposed crossover will result in a 22% encroachment within the TPZ and includes works within the SRZ. Further investigation will be required determine the long-term viability of this tree.	
Recommendations	Undertake a non-destructive root investigation across the nature strip to identify any significant roots that would be impacted.	
Tree #	2	
Species	<i>Eucalyptus leucoxylon</i>	
Common name	Yellow Gum	
Type	Victorian native	
DBH (cm)	25	
Height (m)	8	
Spread (m)	5	
Structure	Good	
Health	Good	
Age	Juvenile / semi-mature	
Amenity value	Medium	
ULE (yrs)	>40	
TPZ (m)	3.0	
SRZ (m)	2.1	
Notes	Nature strip/street tree.	
Impact assessment	Low. Proposed works are outside of the TPZ; however, may be impacted by construction related activities (see discussion).	
Recommendations	Erect TPZ fencing surrounding the TPZ to protect from construction related impacts. Fencing should encompass the entire TPZ available within the bounds of the nature strip, whilst not impeding pedestrian or vehicle through traffic.	

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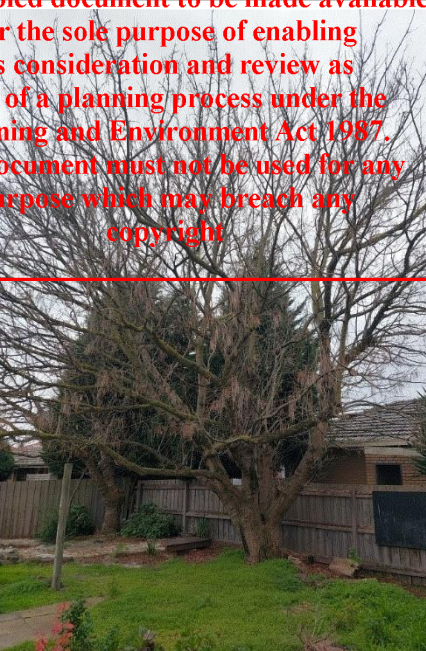
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Tree #	3 (group)	
Species	<i>Photinia serratifolia</i>	
Common name	Chinese Hawthorn	
Type	Exotic	
DBH (cm)	22	
Height (m)	5	
Spread (m)	4	
Structure	Fair / good	
Health	Good	
Age	Mature	
Amenity value	Low	
ULE (yrs)	15 > 40	
TPZ (m)	2.6 (largest)	
SRZ (m)	2.1 (largest)	
Notes	Group of two trees.	
Impact assessment	Proposed to be removed.	

Tree #	4	
Species	<i>Callistemon viminalis</i>	
Common name	Weeping Bottlebrush	
Type	Australian native	
DBH (cm)	29	
Height (m)	5	
Spread (m)	5	
Structure	Fair	
Health	Good	
Age	Mature	
Amenity value	Low	
ULE (yrs)	5 > 15	
TPZ (m)	3.5	
SRZ (m)	2.3	
Notes	Tree not shown on feature survey. Multiple stems from base. Large surface root visible.	
Impact assessment	Proposed to be removed.	



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Tree #	5	
Species	<i>Acer negundo</i>	
Common name	Box Elder	
Type	Exotic	
DBH (cm)	45	
Height (m)	9	
Spread (m)	6	
Structure	Fair	
Health	Good	
Age	Mature	
Amenity value	Medium	
ULE (yrs)	15 > 40	
TPZ (m)	5.4	
SRZ (m)	2.7	
Notes	Tree not shown on feature survey. Canopy weight bias to west due to previous fence line pruning. Low canopy extends ~8m into site. Protected under the applicable Local Law.	
Impact assessment	Proposed to be removed, subject to approval.	
Tree #	6	
Species	<i>Acer negundo</i>	
Common name	Box Elder	
Type	Exotic	
DBH (cm)	72	
Height (m)	12	
Spread (m)	14	
Structure	Fair	
Health	Good	
Age	Mature	
Amenity value	Medium	
ULE (yrs)	15 > 40	
TPZ (m)	8.6	
SRZ (m)	3.1	
Notes	Canopy bias to west due to previous fence line pruning (lopping). Included bark union at 1m. Low canopy extends ~9.5m into site. Protected under the applicable Local Law.	
Impact assessment	Proposed to be removed, subject to approval.	

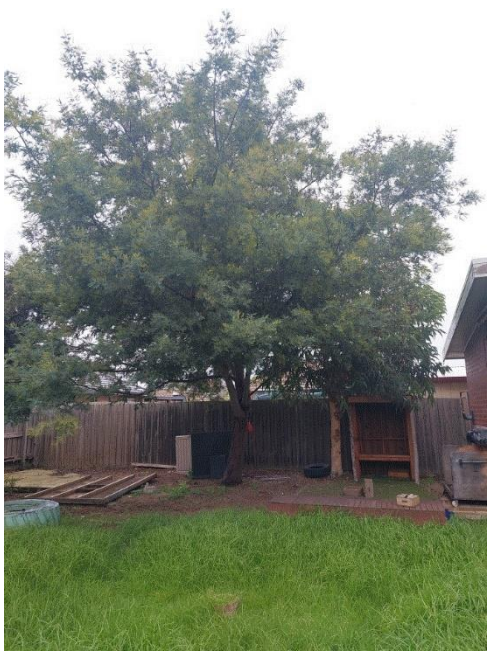
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Tree #	7 (Group)	
Species	<i>Chamaecyparis lawsoniana</i>	
Common name	Lawson's Cypress	
Type	Exotic	
DBH (cm)	20	
Height (m)	9	
Spread (m)	4	
Structure	Fair / good	
Health	Good	
Age	Semi-mature	
Amenity value	Low	
ULE (yrs)	15 > 40	
TPZ (m)	2.4	
SRZ (m)	2	
Notes	2 trees from a larger group growing within the neighbouring property to the east. Trees are ~300mm from fence. Multiple stems in one tree.	
Impact assessment	Moderate. The proposed building footprint will result in a 9% TPZ encroachment and includes works within the SRZ. There is the potential for root severance during these works.	
Recommendations	Engage a qualified arborist to supervise excavation required within the TPZ/SRZ. Any roots encountered should be managed by the arborist in accordance with Section 4.5.4 of Australian Standard AS 4970-2009 Protection of trees on development sites.	
Tree #	8 (group)	
Species	<i>Cupressus sempervirens</i>	
Common name	Italian Cypress	
Type	Exotic	
DBH (cm)	21	
Height (m)	12	
Spread (m)	1.5	
Structure	Fair / good	
Health	Good	
Age	Mature	
Amenity value	Medium	
ULE (yrs)	15 > 40	
TPZ (m)	2.5	
SRZ (m)	1.8	
Notes	Row of 3 trees. Northern tree has co-dominant stems with included bark union.	
Impact assessment	Proposed to be removed.	

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Tree #	9	
Species	<i>Acacia baileyana</i>	
Common name	Cootamundra Wattle	
Type	Victorian native	
DBH (cm)	31	
Height (m)	8.2	
Spread (m)	7	
Structure	Good	
Health	Good	
Age	Mature	
Amenity value	Low	
ULE (yrs)	5 > 15	
TPZ (m)	3.7	
SRZ (m)	2.3	
Notes	Protected under the applicable Local Law.	
Impact assessment	Proposed to be removed.	

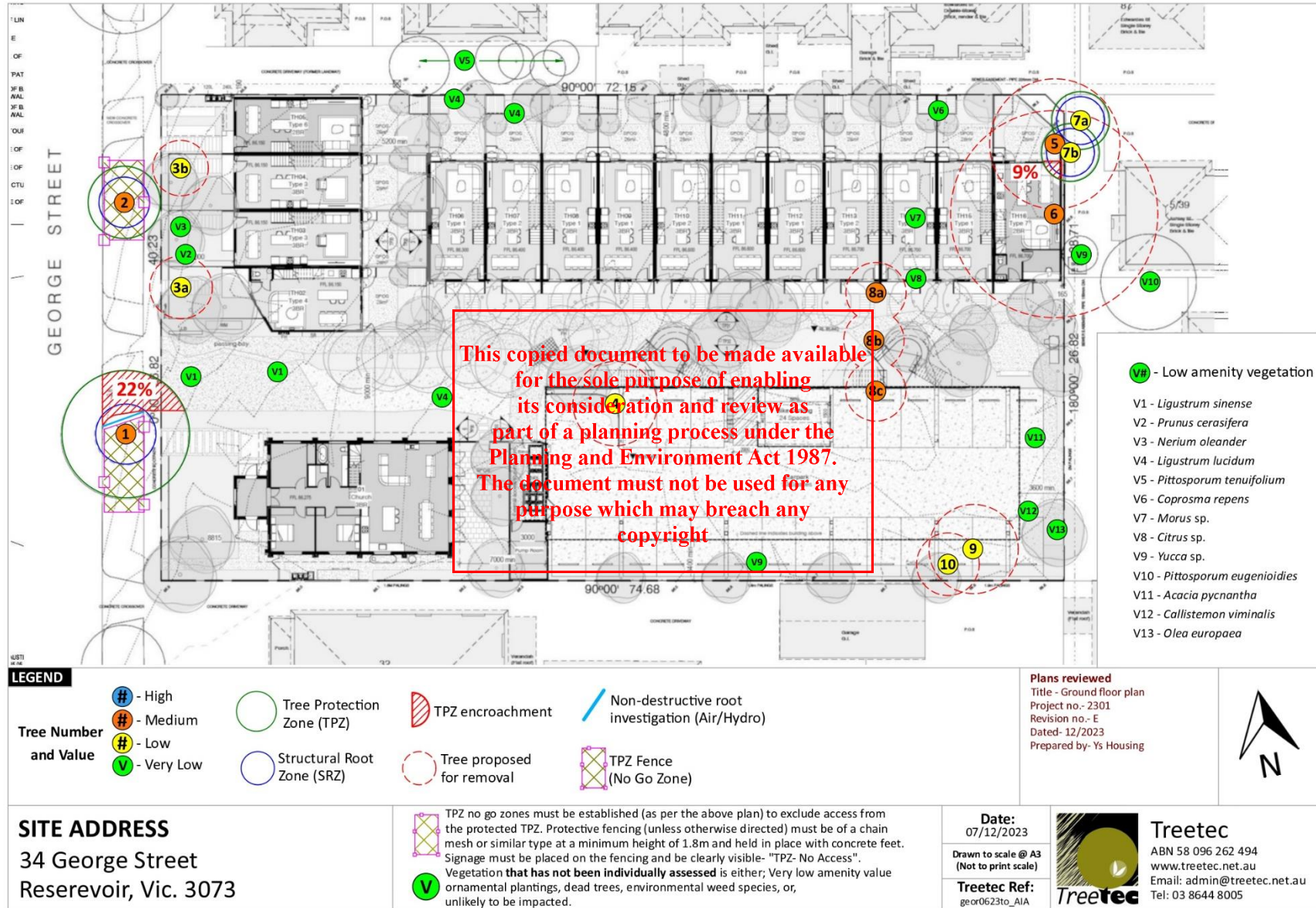
Tree #	10	
Species	<i>Corymbia eximia</i>	
Common name	Yellow Bloodwood	
Type	Australian native	
DBH (cm)	22	
Height (m)	5	
Spread (m)	3	
Structure	Fair	
Health	Fair	
Age	Semi-mature	
Amenity value	Low	
ULE (yrs)	5 > 15	
TPZ (m)	2.6	
SRZ (m)	1.9	
Notes	Canopy damage due to browsing. Included bark unions. Branch growth constricted by webbing (ringbarked).	
Impact assessment	Proposed to be removed.	



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2.5 Site plan



3 Discussion

3.1 Vegetation proposed for removal

All vegetation on site is proposed to be removed to facilitate the development.

Three subject trees; Trees 5 and 6 (*Acer negundo*) and Tree 9 (*Acacia baileyana*), all meet the requirements for protection under the applicable Local Law. Any proposal to remove these trees to accommodate the development will require a permit from the responsible authority.

Any decision to grant a permit for removal should consider that *Acer negundo* and *Acacia baileyana* are both listed as weed species within multiple Melbourne municipalities as well as within the *Advisory list of environmental weeds in Victoria* (Arthur Rylah Institute 2018).

3.2 Encroachment/ Impacts on trees

Works such as site cut and fill, re-grading, trenching, installation of underground services, building footings, landscaping, or reducing the rain catchment within Tree Protection Zones (TPZ) are considered as encroachment. These activities may damage trees; this may be via direct (physical wounding) or indirect (soil alteration) impacts. Encroachment may result in wounds, decay, increased deadwood, thinning foliage, decreased health, instability, failures and death.

Likely impacts are assessed based on the degree of encroachment, the type of proposed works, the tree, and surrounding conditions.

(see Appendix 7.3 - General comments for further detail).

3.3 Construction related activities

Trees without encroachment but in the vicinity of works may be impacted by construction related activities including, (but not limited to); compaction from vehicle parking, positioning of plant and/or foot traffic, and mechanical damage to trunk/branches from delivery/drop off of materials, etc.




Adequate tree protection measures including fencing or ground protection are important in preventing these impacts during construction.

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4 Conclusion

The arboricultural assessment undertaken at 34 George Street, Reservoir comprised ten trees, including three tree groups. Two trees are growing within the nature strip of Georges Street, one tree group is growing within the adjoining property to the east of the subject site and five trees and two groups are growing within the boundaries of the subject site.

The amenity values of the trees assessed and the likely impacts resulting from the proposed works are outlined in the following table.

Amenity Value	Impact assessment			Proposed to be removed
	Low Proposed works are outside of the TPZ, impacts are likely to be NIL. Or, impacts unlikely to be detrimental to the ULE.	Moderate Physical impacts, and/or adverse health impacts are possible, including a reduced ULE. (see further detail below).	High Physical damage, and/or indirect adverse health impacts are likely. Reduced ULE. (see further detail below).	
 - Low				Trees 4, 9 and 10 Group 3
 - Medium	*Tree 2	*Trees 1 and *7b		Trees 5 and 6 Group 8
 - High				

*Denotes trees growing within adjoining properties.

Further detail relating to specific impacts on the assessed trees is summarised below.

- The proposed crossover modification will result in a major (22%) encroachment into the TPZ of Tree 1 and includes works with the SRZ. Further investigation will be required determine the long-term viability of this tree.
- The proposed works are outside of the TPZ of Tree 2, therefore adverse impacts are unlikely, however, if it remains unprotected during construction there is potential that this street tree may be impacted by construction related activities.
- The proposed building footprint will result in a minor (9%) encroachment into the TPZ of Tree 7b and includes works within the SRZ where there is the potential for root severance to occur.
- Below ground service/utility locations are not shown or accurately detailed on site plans, therefore, assessed impacts may be greater if trenching occurs within TPZs of retained trees.

No other trees are expected to be impacted by the proposed development.

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5 Recommendations

Tree 1 - Undertake a non-destructive root investigation across the nature strip to identify any significant roots that would be impacted.

Tree 2 - Erect TPZ fencing to protect from development related impacts. The fencing should encompass the entire TPZ within the bounds of the nature strip, while not impeding pedestrian or vehicle through traffic.

Tree 7b – Engage a qualified arborist to supervise excavation required within the TPZ/SRZ.

Any roots encountered should be managed by the arborist in accordance with Section 4.5.4 of Australian Standard AS 4970-2009 *Protection of trees on development sites*.

Underground services/utilities – Ensure underground installations are routed outside of TPZs. If they must pass through a TPZ, utilise low impact methods for the installation, such as;

- horizontal boring at a depth greater than 700mm
- hydro excavation under arborist supervision, ensuring significant roots (to be determined by the arborist) are retained and protected from damage.

General - Design of any landscaping should be cognisant of root protection. Do not excavate within the nominated tree protection zones of retained trees including those trees on neighbouring properties unless permitted by the responsible authority.

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6 References

Department of Transport and Planning. VicPlan, Accessed - December 23, Available at: <https://mapshare.vic.gov.au/vicplan/>

Mattheck, C. and Breloer, H. (1994), *The Body Language of Trees: A Handbook for Failure Analysis*, London: HMSO.

Costermans, L. (1981), *Native Trees and Shrubs of South-Eastern Australia*, New Holland publishers (Australia) Pty Ltd, Sydney

ProofSafe Tree Protection Zone encroachment calculator, available online at: https://proofsafe.com.au/tpz_incursion_calculator.html

Standards Australia (2009), AS 4970-2009 *Protection of trees on development sites*

Standards Australia (2007), AS 4373-2007 *Pruning of amenity trees*

7 Appendix

7.1 Assumptions & Limitations

1. **Treetec** does not assume responsibility for legal matters, and assumes that legal descriptions, titles and ownerships are correct and good.
2. **Treetec** assumes that any property or project is not in violation of any applicable codes, ordinances, statutes or other government regulations.
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9. This report and any values expressed herein represent the opinion of **Treetec** and **Treetec's** fee is in no way contingent upon the reporting of a specified value, the occurrence of a subsequent event, nor upon any finding to be reported.
10. Site plans, diagrams, graphs and photographs in this report, being intended as visual aids, are not necessarily to scale and should not be construed as engineering or architectural reports or surveys.
11. Information in this report covers only those items that were examined in accordance with the Terms of Reference, and reflects the condition of those items that were examined at the time of the inspection.
12. Inspections are limited to visual examination of accessible components unless otherwise stated in the "Method of Inspection".
13. There is no warranty or guarantee, expressed or implied, that the problems or deficiencies of the plants or property in question may not arise in the future.
14. Due to the dynamic nature of trees and development there can be no guarantee that the Useful Life Expectancy (ULE) of the subject tree/s won't be adversely impacted.

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7.2 Glossary

AGE CATEGORY	The age of the tree is represented as Juvenile, Semi-mature, Mature or Senescent.
Juvenile:	A young tree, given normal environmental conditions for that tree it will not yet flower or fruit.
Semi-mature:	Able to reproduce but not yet nearly the size of a mature specimen in that location.
Mature:	Has reached or nearly reached full size and spread for that species in the given location.
Senescent:	Health and / or structure is being adversely impacted by the old age of the tree.
ARBORICULTURAL VALUES	Values assigned to a tree or group of trees to provide an overview of their significance with consideration to a range of factors (see below)
AMENITY VALUE	Provides a summary of the general condition and also the overall significance contributed to the landscape (Visual appeal). Factors include; physical condition (health, structure, form), age, size, and species. Trees may possess one or more of the attributes listed.
Low:	Small common species, poor health and structure, insignificant in relation to the local landscape, environmental weed.
Medium:	Moderate size, fair health and/or structure, somewhat significant in relation to the local landscape, prominent location.
High:	Large size, good health and structure, significant in relation to the local landscape, prominent location.
CANOPY SPREAD	Overall size of the canopy as looking from a plan view. Recorded at the widest point.
CO-DOMINANT STEMS	Two stems of the same or similar height originating from the same position in the tree.
COMMON NAME	A non-scientific name commonly used for that tree.
CROWN WIDTH	See 'Canopy spread'
DEAD (AS DEAD)	Cessation of all metabolic processes (or very soon to be)
DEADWOOD	Deceased above ground tree parts such as stems or branches (varying in size). <ul style="list-style-type: none"> • Minor deadwood – less than 40mm diameter • Major deadwood – greater than 40mm diameter
DEVELOPMENT	The use of land including; the subdivision of land, erection or demolition of a building or works, the carrying out of a work, road works, the installation of utilities and services, and any other act, matter or thing as defined by the relevant legislation.
DIAMETER AT BREAST HEIGHT (DBH)	The diameter of the trunk measured at or near 1.4m above ground level. Where there is more than 1 stem originating below 1.4m the measurement recorded is calculated as described in AS 4970-2009.
DIAMETER ABOVE ROOT BUTTRESS (DARB)	The diameter of the trunk measured above the root buttress. This measurement is used to calculate the structural root zone (see SRZ).
EPICORMIC GROWTH (also see coppice)	New shoots forming from dormant buds within the bark on the trunk and/or branches.
HEALTH	A trees vigour as exhibited by the crown density, leaf colour, seasonal extension growth, presence of stress indicators, ability to withstand diseases and pests, and the degree of dieback. Where a deciduous tree is inspected without foliage and health is undetermined a '?' will be noted.

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Dead:	Cessation or near cessation of all metabolic processes.
Poor:	Indicating symptoms of extreme stress such as minimal foliage, or extensively damaged leaves from pests and diseases. Death probable if condition of tree deteriorates.
Fair:	Some minor deadwood or terminal dieback indicating a stressed condition. Minor leaf damage from pests.
Good:	Usual for that species given normal environmental conditions – full canopy with only minor deadwood, normal leaf size and extension growth, minimal pest or disease damage
HEIGHT	The distance in metres from the ground to the highest point in the crown, calculated in the vertical plane. This measurement unless otherwise specified is an estimation only.
IMPACT ASSESSMENT	An assessment of adverse impact the proposed works are likely to have on a tree or tree group. May be short or long term; usually judged on the likely reduction in ULE directly attributable to the works. Impact usually relates to the level of TPZ encroachment, but also factors the type of impact. One or more factors may apply.
Low:	Proposed works are outside of the TPZ and impacts are likely to be nil. Or, minor damage may occur such as; smaller roots may be damaged or a small area of canopy pruned. Unlikely to significantly impact tree health, form, or ULE.
Moderate:	Direct (physical wounding), or indirect (environmental impacts) are possible, root damage may occur, canopy pruning likely, and an occurrence will reduce the ULE.
High:	Tree/s likely to be lost in the medium or short term, or adversely impacted so that tree health, and therefore, ULE are significantly reduced, or the tree will become unstable and/or present an unacceptable level of risk.
Proposed to be removed:	Trees that are within the footprint of works and proposed to be removed by the client, or are not viable to retain due to the factors listed in the conclusions of this report. Trees proposed for removal are not always required to be removed.
INCLUDED BARK UNION	A union within a tree that has included bark (bark pressing on bark), these unions are usually poorly attached and more likely to fail as the included bark is equivalent to a split. Often characterized by an acute angle and sometimes forming ribs or flaring immediately below the union where the tree reacts to the weakness by placing secondary growth. Though these unions are weaker than a 'good' union, the risk of failure cannot be calculated and a poor union does not automatically justify the removal of the tree.
PRUNING	Systematic removal of branches of a plant whilst giving consideration to the trees natural defence systems.
RESPONSIBLE AUTHORITY	Those bodies, such as councils, responsible for the area to which the report relates to
STRUCTURAL ROOT ZONE (SRZ)	The area around the base of a tree required for the tree's stability in the ground. The woody root growth and soil cohesion in this area are necessary to hold the tree upright. The SRZ is nominally circular with the trunk at its centre and is expressed by its radius in metres. This zone considers a tree's structural stability only, this is different from the root zone required for a tree's vigour and long-term viability, which will usually be a much larger area.

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STRUCTURE	Reference to the structural integrity of the tree with consideration of the crown, trunk and roots. Determined using the Visual Tree Assessment (VTA) method (Mattheck and Breloer 1994). The failure of small (<60mm calliper) live or dead limbs is normal and not considered here.
	Very poor: Clear indications that a significant failure is likely in the near future
	Poor: Obvious signs of structural weakness and a failure is likely, one might expect a significant failure event within the next 5 years, possibly tomorrow
	Fair: Signs of weakness present though not obviously significant, likely to become worse over time
	Good: No obvious signs of structural weakness
TREE	Long-lived, woody perennial plant with one or relatively few main, self-supporting, stems or trunks. Greater than (or usually greater than) 3m in height (or as defined by the responsible authority).
TREE NUMBER	Identifying number allocated to individual trees or groups of trees, may be used to locate trees using site plans or tags on trees.
TREE PROTECTION ZONE (TPZ)	An exclusion area radius measured from the centre of the trunk at ground level that allows for protection of canopy and roots; both the structural roots that give the tree stability and the smaller absorption roots. The radius of the TPZ is normally calculated for each tree by multiplying the DBH × 12. The minimum distance will be 2m and maximum 15 as stipulated in AS 4970-2009 – Protection of Trees on Development Sites.
TREETEC REFERENCE	Unique identifier assigned to an individual report by Treetec
TYPE	Status of the species as it relates to the location.
	Indigenous: Naturally occurring to the local area
	Victorian Native: Naturally occurring within Victoria
	Australian Native: Naturally occurring within Australia
	Exotic: Introduced species to Australia
UNION	The point where a branch or stem is attached to another branch or stem.
USEFUL LIFE EXPECTANCY (ULE)	Useful Life Expectancy is an estimation of how many years a tree can reasonably be retained in the landscape provided growing conditions do not significantly worsen and any recommended works are completed. It takes into consideration factors such as risk, species, age, health and site conditions. Usually represented as either 0, <5, 5 - 15, 15 - 40, or >40.
WORKS	Any physical activity in relation to development. See 'development'.

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7.3 General comments

Pruning standards/Lopping

An Australian Standard exists to give guidance on pruning of trees (*AS 4373 2007 - Pruning of Amenity Trees*).

It is important that all remedial works are carried out by a competent contractor in accordance with the Australian Standard.

Lopping, as defined within the standard, is detrimental to trees and often results in decay and poorly attached epicormic shoots. Natural Target Pruning methods should be used wherever possible when removing sections from trees.

7.4 Impact on trees

Physical/Mechanical damage to trees

Physical damage to tree parts, particularly the trunk, provides entry points for pests and diseases such as fungal infections. This may cause long-term decay and can lead to partial or complete tree failure and death.

Alteration of soil levels

Alteration of soil levels around trees will affect the root zone and stability of a tree as well as tree metabolism. This may result in reduced tree health, excessive deadwood, thinning foliage and poor vigour. It can take years for impacts to become evident, at which time it is usually irreversible.

Works within a TPZ

Works such as site cut and fill, re-grading, installation of underground services, building footings or landscaping have the potential to damage tree roots.

It may be possible to work within a TPZ without significantly impacting a tree, however the size and number of roots in the area, and the specifics of the tree and its resilience to impacts, would all need to be reviewed prior to commencement. Design and construction methods may need alteration to minimise adverse impacts.

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Site cut and fill has the potential to physically impact roots and thus should be located to ensure minimal disturbance within the TPZ of retained trees. If a shallow cut is proposed within a TPZ, consider increasing fill to eliminate the cut. If the grade is to be raised, the material should be coarser or more porous than the underlying material. If site cuts must occur, avoid batter cuts and instead design a vertical retaining wall to minimise disturbance.

Installation of underground services should also be routed outside TPZs; if there is no other option, they should be installed using non-destructive methods such as air or hydro excavation, or installed by boring under the TPZ at a depth of at least 700 mm (where practicable). The project arborist should assess the likely impacts of boring (including bore pit locations) on retained trees.

Driveways and pathways should not encroach into a TPZ; if encroachment is unavoidable, any hard surfaces should:

- 1) not involve any scraping or excavation – most small absorbing roots are within the upper 100mm of soil.
- 2) be constructed of a permeable material and laid on a base and sub-base specifically designed to allow the movement of water through and into the soil below.

If buildings are permitted within a TPZ, foundations should be suspended on piers leaving the ground undisturbed other than the careful placement of pier holes. The bottom of supporting

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beams should be above existing ground level or, if this is not possible, beams should run radially away from the tree trunk. There should be no excavation of any description, including piers, within a Structural Root Zone (SRZ).

All works within TPZs must be approved by the responsible authority prior to commencement.

Description of TPZ encroachment

In accordance with *Australian Standard 4970-2009 (Protection of trees on development sites)* encroachment and TPZ variations is determined as per below.

General

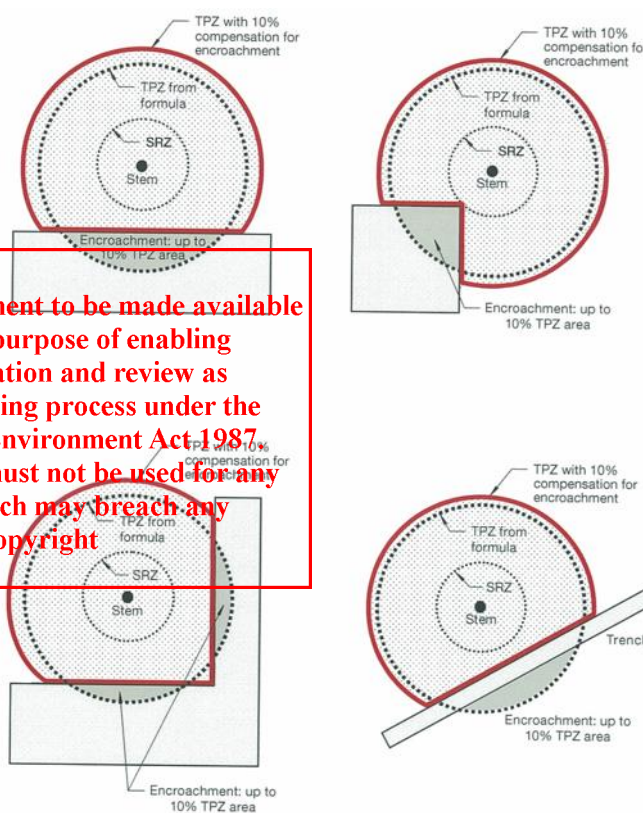
It may be possible to encroach into or make variations to the standard TPZ. Encroachment includes excavation, compacted fill and machine trenching.

Minor encroachment

If the proposed encroachment is less than 10% of the area of the TPZ and is outside the SRZ detailed root investigations should not be required. The area lost to this encroachment should be compensated for elsewhere and contiguous with the TPZ. Variations must be made by the project arborist considering relevant factors listed in (see standard)...

Major encroachment

If the proposed encroachment is greater than 10% of the TPZ or inside the SRZ, the project arborist must demonstrate that the tree(s) would remain viable. The area lost to this encroachment should be compensated for elsewhere and contiguous with the TPZ. This may require root investigation by non-destructive methods and consideration of relevant factors listed in (see standard)...



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NOTE: Less than 10% TPZ area and outside SRZ. Any loss of TPZ compensated for elsewhere.

Any additional encroachment that becomes necessary as the site works progress should be reviewed by the project arborist and be approved by the Responsible Authority before being carried out.

Where the project arborist identifies roots to be pruned within or at the outer edge of the TPZ, they should be pruned with a final cut to undamaged wood. Pruning cuts should be made with sharp tools such as secateurs, pruners, handsaws or chainsaws. Pruning wounds should not be treated with dressings or paints.

It is not acceptable for roots within the TPZ to be severed with machinery such as backhoes or excavators.

7.5 Protection of retained trees

Establishment of Tree Protection Zones

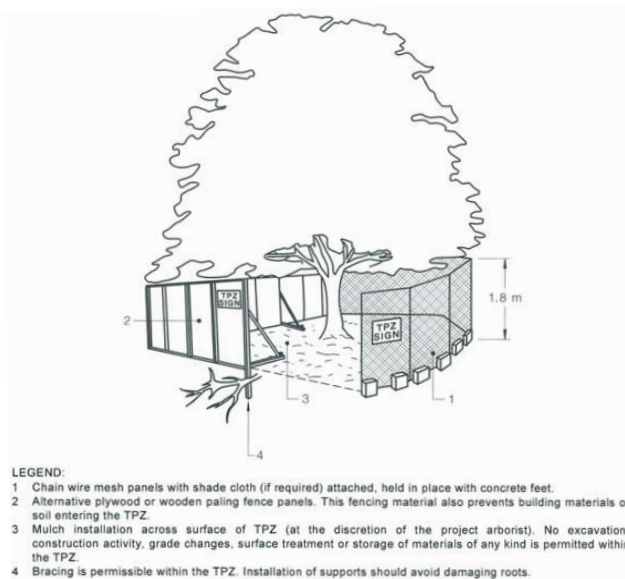
The tree protection zone (TPZ) is the principal means of protecting trees on development sites. Usually fencing will delineate the Tree Protection Zones (TPZ) as defined by *AS 4970-2009 Protection of trees on development sites*.

Fencing is installed following permitted vegetation removal and pruning, but prior to site establishment. Unless stated otherwise and approved by the responsible authority, fencing should be retained until completion of all construction related activity.

Tree protection zone fencing

The fence must provide high visibility and act as a physical barrier to construction activity. The fence should be adequately signed "Tree Protection Zone – No Access", be sturdy and prevent the entry of heavy equipment, vehicles, workers and the public.

Where feasible, tree protection fencing will consist of chain wire mesh panels held in place with concrete feet. Where chain mesh fencing is impractical to implement, alternate protection measures must be arranged.



Restricted activities within TPZ

A TPZ area may surround a single tree or group, or a patch of vegetation. Activities that must NOT be carried out within a TPZ unless permitted by the Responsible Authority include, but are not limited to, the following:

Source – *AS 4970-2009 Protection of trees on development sites*
(Tree Protection)

- (a) machine excavation including trenching;
- (b) excavation for silt fencing;
- (c) cultivation;
- (d) storage;
- (e) preparation of chemicals, including preparation of cement products;
- (f) parking of vehicles and plant;
- (g) refuelling;
- (h) dumping of waste;
- (i) wash down and cleaning of equipment;
- (j) placement of fill;
- (k) lighting of fires;
- (l) soil level changes;
- (m) vehicle movement – access ways;
- (n) changes of grade;
- (o) temporary or permanent installation of utilities and signs, and
- (p) damage to the tree.

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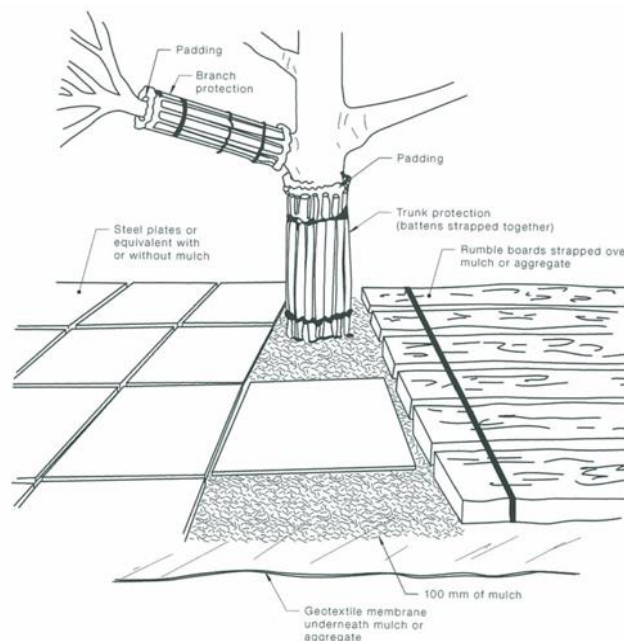
Alternative protection measures

If temporary access to the TPZ is required, protection for the trunk, branches or ground may be required. The materials and positioning of protection will be specified by the project arborist.

For temporary foot traffic through the TPZ, this may be facilitated using sheets of heavy plywood or similar material; this should not be considered a long term solution.

For machinery access within the TPZ, ground protection should be utilised to prevent root damage and soil compaction. Measures may include a permeable membrane such as geotextile fabric beneath a layer of mulch, or crushed rock below rumble boards or HPDE track mats. These measures may also be applied to root zones beyond the TPZ.

Where roots within the TPZ are exposed during approved works, temporary root protection should be installed to prevent them drying out. This may include jute mesh or hessian sheeting as multiple layers over any exposed roots and the excavated soil profile, extending to the full depth of the root zone. Root protection sheeting should be pegged in place and kept moist at all times.



NOTES:

- 1 For trunk and branch protection use boards and padding that will prevent damage to bark. Boards are to be strapped to trees, not nailed or screwed.
- 2 Rumble boards should be of a suitable thickness to prevent soil compaction and root damage.

Source – AS 4970-2009 Protection of trees on development sites
(Ground Protection)

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7.6 Alternative design options

Designing all works outside the TPZ is the preferred option to ensure trees remain viable post construction. The options below may mitigate some tree damage and facilitate works within TPZs if approved by the Responsible Authority.

Non-destructive investigation

Air or Hydro excavation can be utilised to explore the proposed encroached TPZ area. These methods use compressed air or high pressure water to dislodge soil without damaging larger roots. This option should be employed during the design stage to identify roots, and during construction to minimise impacts.



Non-destructive investigation

Pier and beam construction

Pier footings with beams above ground level, or cantilevered to support the floor of a building can be used to minimise encroachment into a TPZ and root damage. Consideration must be given to the soil type and lost catchment area beneath a raised structure. Footings should be positioned so as not to damage larger (>30mm diameter) roots.

Permeable, porous, and pervious surfaces

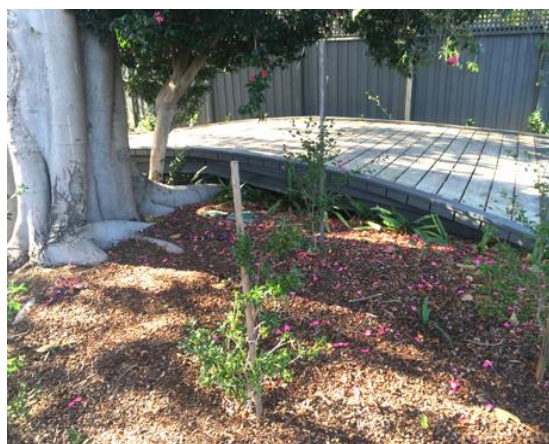
Unlike traditional concrete surfaces, these alternatives enable a hard surface to be created whilst also allowing moisture to penetrate into the soil below. There are numerous options available, however, most usually require excavation to create a stable base that will allow water to filter into the soil below. This excavation can impact roots, thus nullifying the benefit of the alternative construction method.

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If permeable paving is utilised, it is of greater benefit if no disturbance to natural grade occurs and no compacted gravel subbase is installed. Soil pH is also a consideration as leeching from the bonding material of a poured surface will increase soil pH levels and may impact tree health through nutrient deficiencies.

Bridging over the TPZ

Post/screw pile footings with cross members to support a bridge like structure raised above the TPZ can be used for driveways or pathways. Footings should be positioned so as not to damage larger (>30mm diameter) roots. Structures should be engineered to tolerate the expected loads. Consideration should be given to the location of transition between natural grade surfaces and the bridging structure, as some excavation at this location would be required. This is preferably outside of the TPZ.



Bridging over the TPZ