



Arboricultural Impact Assessment & Tree Management Report

421 Upper Heidelberg Road, Ivanhoe

Prepared for Development Victoria

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Arb Report 012133 - 421 Upper Heidelberg Road, Ivanhoe v4.

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The site at 421 Upper Heidelberg Road, Ivanhoe

5/9/2023 | v5 updated 20 September 2023 | Tree Logic Ref. 012133

Prepared for Development Victoria

Prepared by Bruce Callander – Senior Consultant Arborist, Tree Logic Pty. Ltd.

Summary

Reason for Assessment

Tree Logic was engaged to undertake a visual assessment of trees located within and immediately adjacent to the property at The site at 421 Upper Heidelberg Road, Ivanhoe. The report provides information relating to the trees' condition and recommended tree protection zones and a high-level impact assessment of a proposed development at the site. The report is an update of a previous Tree Logic report dated 2 February 2017 (TL ref 007912).

Overview

Tree Logic arborists assessed a total of 86 trees and 3 tree groups associated with the subject site including 59 trees and 2 tree groups within the previous tank site, 9 street trees, 11 trees and 1 tree group in the northern road reserve and 7 trees within a current park.

Two (2) trees from the 2017 report (Trees 62 and 71) have been removed since that assessment.

Tree protection zones (TPZ) were assigned according to the Australian Standard® AS4970-2009 (Protection of Trees on Development Sites).

Of the 59 trees in the previous tank site, one (1) tree was rated Moderate A and nine (9) trees were rated Moderate B being early-mature to maturing specimens in fair to good condition, established in the landscape and suited to the context. These comprise larger Brush Box and River Red Gums. Most other trees were generally of lower arboricultural value being either smaller screening trees (e.g. Prickly-leaved Paperbark along north boundary), recognised weed species, or in declining condition (particularly the Bracelet Honey-myrtles along Forster Street and Silky Oaks across the site).

Tree 61 is a prominent River Red Gum street tree in Forster Street. It is in relatively good condition. Its arboricultural value and useful life expectancy are somewhat reduced due to extensive damage to surrounding hard surfaces. Long-term retention will require some modification to the surrounding paved areas and a bespoke design solution. Further discussion is included in this report. The other street trees were generally unremarkable.

Proposed designs were reviewed in June 2023 following a re-distribution of property boundaries that indicates an area designated for multi-storey residential development and a new park location. (Refer to Figure 1 overpage).

Forty (40) of 43 trees in the new development parcel are not compatible with retention under the proposed preliminary building footprint which is subject to further construction detail changes.

Refer to Appendix 1 for tree assessment data and Appendix 2A for tree location plans. Refer to Appendix 3 for descriptions of arboricultural rating and other descriptors used in this assessment and Appendix 4 for details on applying and managing the TPZ.



Background

Site description

The site at 421 Upper Heidelberg Road, Ivanhoe is the location of a decommissioned Yarra Valley Water tank and associated infrastructure. The tank is surrounded by hard surfaces and a high bluestone retaining wall around the periphery. Most vegetation on site is situated behind this retaining wall several metres above the base of the tank, including a cluster of trees towards the Forster Street entrance around a pump structure.

The property was bordered by a park to the south-east (previously 419 Upper Heidelberg Road) which is separated from the main tank by the bluestone retaining walls. The property is bordered by road reserves including Forster Street to the south, Bell-Banksia Link slip road to the north and Upper Heidelberg Road to the east.

The property boundaries were re-aligned as of June 2023 and are shown below in Figure 1.

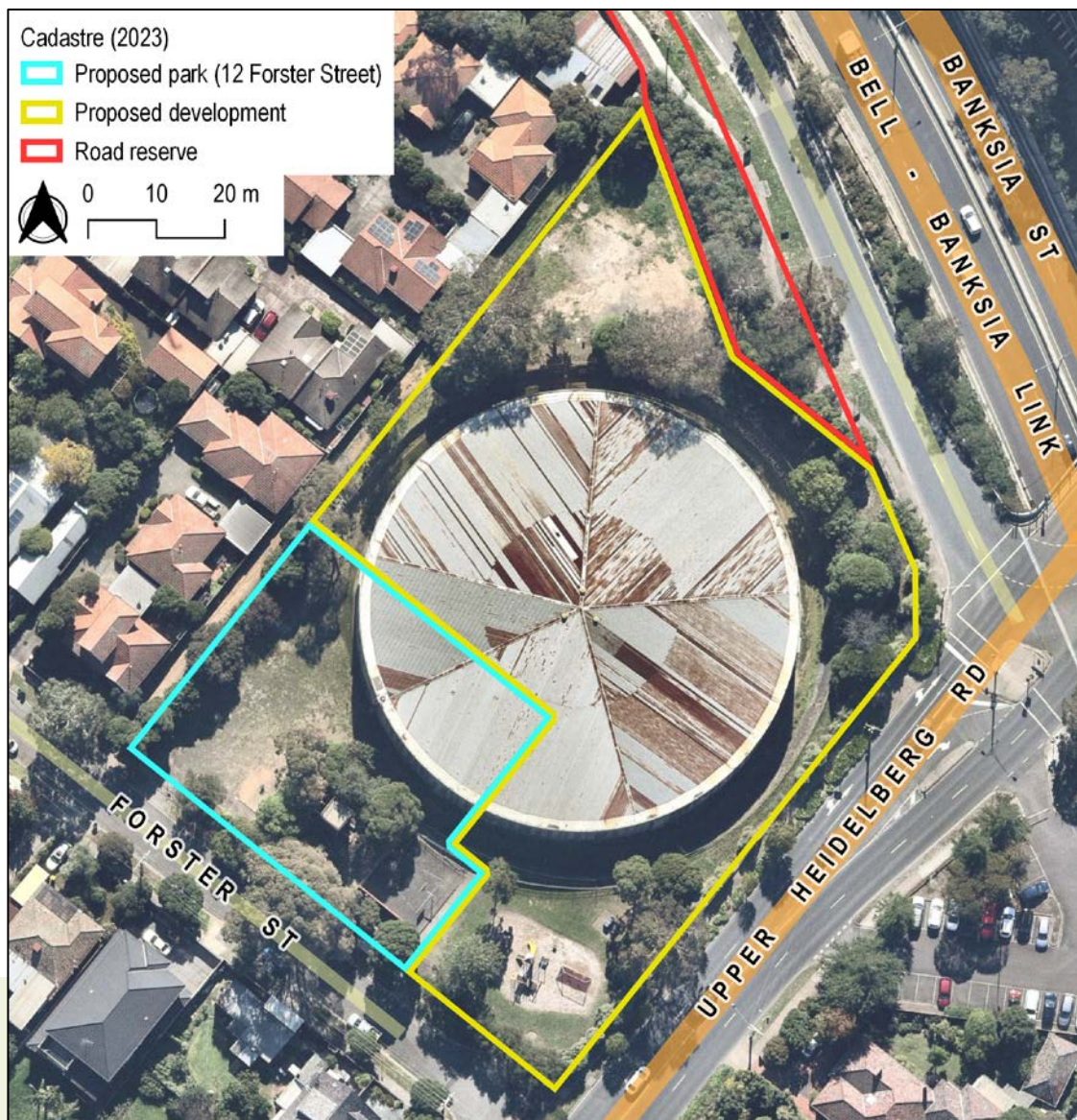


Figure 1: Overview of study area and cadastral from VicMap (2023). Aerial image: Nearmap 2023-04-24

Permit requirements

It is understood that no tree controls apply to the trees on site under any environmental overlays applicable from the local planning scheme.

Under Schedule 7 to Clause 43.04 Development Plan Overlay there is a requirement to provide a provisional *tree management plan report which identifies:*

- The existing trees to be retained, informed by the arboricultural assessment report.
- The methodology for protecting the identified trees.

The tree management plan will be subject to revision as the detailed design is finalised.

It is assumed that any Victorian native vegetation within the site will be exempt from permit and offset requirements under Native Vegetation - Clause 52.17-7 given its history of management as a water asset site and that all vegetation of Victorian native origin is assumed to be planted for amenity or ornamental purposes or as a result of direct seeding.

Method

The site was inspected on 11 March 2022 and all 73 trees from the 2017 report were checked and noted on the plan in Appendix 2, with tree numbers used from the 2017 report. Additional trees were noted and given new numbers (Trees 74 to 86). Tree locations within the tank and park sites utilised surveyed tree locations used in the 2017 Tree Logic report, based off a feature survey from 2006 by Digital Land Surveys (*ref 206055*).

The trees were assessed from the ground with observations made of their growing environment. The trees were not climbed and no inspection of below-ground or internal tree parts was undertaken.

Each of the assessed trees was attributed an 'Arboricultural Rating'. The arboricultural rating correlates the combination of tree condition factors (health and structure) with tree amenity value. Definitions of arboricultural ratings can be seen in Appendix 3.

Tree Protection Zones were calculated and mapped according to the method outlined in Australian Standard® AS4970-2009 (Protection of Trees on Development Sites). They are calculated using the formula provided in AS4970 where the Radial TPZ = Trunk diameter (DBH) measured in metres at 1.4m above grade and multiplied by 12.

TPZ distances are measured as a radius from the centre of the trunk at (or near) ground level.

The TPZ forms an area around a tree or group of trees that addresses both the stability and growing requirements of a tree. Any construction and worksite activities within the TPZ of a retained tree will need to be reviewed to assess potential impacts in order to avoid or minimise changes to tree condition of those trees.

Minor encroachment, up to 10% of the TPZ area, is generally permissible provided encroachment is compensated for by recruitment of an equal area contiguous with the TPZ. Encroachment greater than 10% is considered major encroachment under AS4970 and is only permissible if it can be demonstrated that after such encroachment the tree would remain viable. Refer to Figure 2A and 2B.

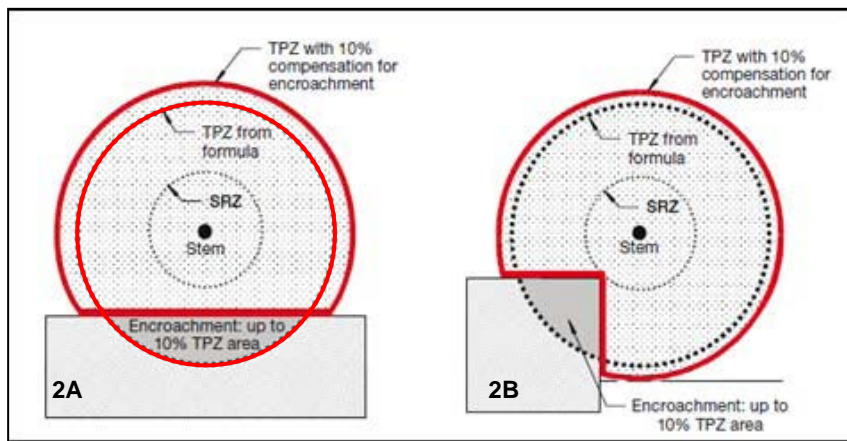


Figure 2: 2A & 2B - Examples of minor encroachment into a TPZ.

Extract from: AS4970-2009, Appendix D, pg. 30 of 32

The Structural Root Zone (SRZ) provided for each tree has been calculated using the method provided in AS4970. The SRZ is the area in which the larger woody roots required for tree stability are found close to the trunk and which then generally taper rapidly. This is the minimum area recommended to maintain tree stability but does not reflect the area required to sustain tree health. No works should occur within the SRZ radius as tree stability could be compromised. See Appendix 4 for TPZ establishment and types of encroachment.

Trees that are under third party ownership must be afforded due consideration and minimum tree protection requirements during any construction works to ensure they are successfully sustained. All TPZ measurements are provided in the tree assessment data in Appendix 1

Tree Observations

General observations

Table 1 shows the tree numbers sorted by location, species and origin within the site.

Table 1: Tree species and origin sorted by location post 2023 re-alignment

Location	Species	Common Name	Origin/Type	Count	Tree numbers
Proposed development site	<i>Acacia implexa</i>	Lightwood	Victorian native	1	9
	<i>Angophora costata</i>	Smooth-barked Apple	Australian native	2	57, 58
	<i>Calodendrum capense</i>	Cape Chestnut	Exotic evergreen	2	32, 33
	<i>Eucalyptus camaldulensis</i>	River Red Gum	Victorian native	4	8, 15, 21, 59
	<i>Grevillea robusta</i>	Silky Oak	Australian native	10	10, 11, 13, 16, 18, 20, 34, 36, 38, 56
	<i>Lophostemon confertus</i>	Brush Box	Australian native	7	12, 14, 17, 19, 35, 37, 39
	<i>Melaleuca styphelioides</i>	Prickly-leaved Paperbark	Australian native	17	7, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 40, 75, 76, 77, 78, 79
<i>Proposed development site Total</i>				43	7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 56, 57, 58, 59, 75, 76, 77, 78, 79
Proposed park	<i>Acacia melanoxylon</i>	Blackwood	Victorian native	1	74
	<i>Cinnamomum camphora</i>	Camphor Laurel	Exotic evergreen	1	80
	<i>Eriobotrya japonica</i>	Loquat	Exotic evergreen	1	3
	<i>Eucalyptus camaldulensis</i>	River Red Gum	Victorian native	1	45
	<i>Euonymus europaeus</i>	Common Spindle Tree	Exotic deciduous	1	5
	<i>Grevillea robusta</i>	Silky Oak	Australian native	3	42, 43, 46
	<i>Lophostemon confertus</i>	Brush Box	Australian native	3	41, 44, 47
	<i>Melaleuca armillaris</i>	Bracelet Honey-myrtle	Victorian native	2	50, 51
	<i>Melaleuca lanceolata</i>	Moonah	Australian native	2	4, 54
	<i>Melaleuca styphelioides</i>	Prickly-leaved Paperbark	Australian native	8	1, 2, 6, 48, 49, 52, 53, 55
<i>Proposed park Total</i>				23	1, 2, 3, 4, 5, 6, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 74, 80
Road reserve (Bell St)	<i>Allocasuarina littoralis</i>	Black She-oak	Victorian native	1	68
	<i>Casuarina glauca</i>	Swamp She-oak	Australian native	4	69, 70, 73, 81
	<i>Eucalyptus camaldulensis</i>	River Red Gum	Victorian native	2	82, 83
	<i>Eucalyptus leucoxylon</i>	Yellow Gum	Victorian native	3	84, 85, 86
	<i>Eucalyptus melliodora</i>	Yellow Box	Victorian native	1	72
<i>Road reserve (Bell St) Total</i>				11	68, 69, 70, 72, 73, 81, 82, 83, 84, 85, 86
Street (Bell St)	<i>Eucalyptus leucoxylon</i>	Yellow Gum	Victorian native	1	87
	<i>Eucalyptus melliodora</i>	Yellow Box	Victorian native	1	88
<i>Street (Bell St) Total</i>				2	87, 88
Street (Forster St)	<i>Eucalyptus camaldulensis</i>	River Red Gum	Victorian native	1	61
	<i>Photinia serratifolia</i>	Chinese Hawthorn	Exotic evergreen	1	60
<i>Street (Forster St) Total</i>				2	60, 61
Street (Upp H'berg Rd)	<i>Tilia cordata</i>	Small-leaved Linden	Exotic deciduous	5	63, 64, 65, 66, 67
<i>Street (Upp H'berg Rd) Total</i>				5	63, 64, 65, 66, 67

Table 2 shows arboricultural ratings sorted by location based on re-alignment of the boundaries in 2023.

Table 1: Arboricultural rating of trees categorised by location post 2023 re-alignment

Location / Arb. Rating	Trees	% Category	IDs
Proposed devt site	43	50.0%	
Mod.A	1	2.3%	15
Mod.B	8	18.6%	8, 17, 21, 37, 39, 40, 56, 59
Mod.C	6	14.0%	13, 14, 19, 32, 35, 58
Low	23	53.5%	7, 10, 11, 12, 16, 20, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 33, 57, 75, 76, 77, 78, 79
Very Low	5	11.6%	9, 18, 34, 36, 38
Proposed park	23	26.7%	
Mod.B	4	17.4%	1, 41, 45, 55
Mod.C	5	21.7%	2, 4, 43, 44, 47
Low	14	60.9%	3, 5, 6, 42, 46, 48, 49, 50, 51, 52, 53, 54, 74, 80
Road reserve (Bell St)	11	12.8%	
Mod.C	5	45.5%	69, 70, 72, 73, 81
Low	3	27.3%	68, 83, 86
Very Low	3	27.3%	82, 84, 85
Street	9	10.5%	
Mod.C	1	11.1%	67
Low	8	88.9%	60, 61*, 63, 64, 65, 66, 87, 88
Grand Total	86	100.0%	
* Refer to report for further details regarding Tree 61			

Tree rated Moderate A are generally a large and prominent, maturing tree that displays better than typical condition and contributes to the landscape and has a medium to long useful life expectancy.

Trees rated Moderate B are typical examples of the species growing in this setting under prevailing conditions.

Trees attributed a rating of Moderate C are either small trees in Fair condition or maturing trees with health or structural deficiencies and that are trending towards becoming of Low arboricultural value.

- Trees rated Moderate A represent the best opportunity to retain good quality trees that enhance the natural environment and amenity of the site.

Trees of Low arboricultural value that are otherwise in reasonable condition (Fair-poor or better Health and /or Structure) represent an established tree resource, even if only as an interim measure. Trees attributed an arboricultural rating of Low are generally not considered worthy of being a constraint on reasonable design intent or excessive expenditure of resources to retain and manage the trees due to either health and / or structural deficiencies.

Trees attributed an arboricultural rating of Very Low are generally unsuitable to retain and should be removed for either safety and/or environmental reasons.

Refer to Appendix 1 for individual tree data, Appendix 2 for Tree location plan and Appendix 3 for definitions of arboricultural ratings.

Proposed development site trees

The trees assessed generally followed a native theme consistent with plantings from the 1970s. Trees within the site were dominated by (a) Prickly-leaved Paperbark (*Melaleuca styphelioides*), including a more recent planting of 15 trees to the north, (b) Silky Oak (*Grevillea robusta*), (c) Brush Box (*Lophostemon confertus*) and (d) four large River Red Gums (*Eucalyptus camaldulensis*).

The landscape contains several higher-rated trees (Moderate B or higher), mainly early-mature specimens of Brush Box and all the River Red Gums, and Tree 15 in particular rated Moderate A. These trees are generally established specimens in fair or good condition, suited to the site with a potential for moderate to long useful life expectancy.

However, the condition of the remainder of the trees was mostly unremarkable due to the prevalence of many smaller trees planted predominantly for screening (including the row of 15 Paperbarks), and the poor health of many of the Silky Oaks (a common observation of the species in Melbourne). Additionally, tree condition was generally poor to unremarkable along the southern boundary with a mixture of Prickly-leaved Paperbark and declining Moonah (*Melaleuca lanceolata*).

Several Moderate C trees were also semi-mature trees with further potential to become higher rated trees, mainly smaller Brush Box and the unusual planting of Cape Chestnut (*Calodendrum capense*).

Proposed Park trees

The trees within the proposed park boundaries are currently considered to be excluded from any impacts pending landscape designs for a new park.

Road reserve trees

Trees within the road reserve north of the site facing the Bell Street on-ramp were dominated by a suckering thicket of Swamp She-oak (*Casuarina glauca*) and there were no trees of particularly great arboricultural significance, most plantings being semi-mature. Several health issues were observed with the Yellow Gum (*Eucalyptus leucoxylon*) in the area.

Street trees

The street trees in this assessment were mostly unremarkable, including two trees along the Bell Street on-ramp (Yellow Gum and Yellow Box *Eucalyptus melliodora*) with reduced foliage density and five small Small-leaved Linden (*Tilia cordata*) along Upper Heidelberg Road.

Two street trees are along Forster Street, a small Chinese Hawthorn (*Photinia serratifolia*) and Tree 61, a large, prominent River Red Gum discussed further in the following section.

Given street trees are external to site it is concluded all street trees are required to be retained.

Street tree 61 – River Red Gum

Tree 61 is the largest and most prominent of the trees assessed in this report, being a tree over 20 metres tall with an approximately 20-metre-wide canopy and a trunk diameter of 97 centimetres. The tree has no observable structural defects with good branch attachment, spacing and taper, a generally symmetrical canopy and no visible symptoms of extensive decay or damage. Tree 61 is of an exceptional size and vigour given the typically harsh growing conditions of a street tree including extensive soil compaction and hard, impermeable surfaces.

However, the remarkable condition of the tree despite apparent site constraints is due, in part, to the tree's demonstrated disruption of these constraints, evident by vigorous root growth underneath adjacent road, pavement and kerb surfaces, causing considerable damage. There is pronounced cracking and heaving of the pavement to the north of the tree, major disruption of the kerb to the south of the tree and evidence of a large surface root growing underneath the road surface causing longitudinal protrusion and cracking that has necessitated repeated repair of the road surface.

While the tree's anatomical and physiological qualities, as well as landscape dominance and overall tree size would warrant a Moderate arboricultural rating category, this must be balanced against the amenity values of tree and its suitability to the present landscape. The tree provides considerable amenity in terms of shade and biophilic qualities (including habitat potential which is beyond the scope of this report), but in considering tree retention it is also important to acknowledge the disamenity of significant infrastructure damage to an extent that cannot be easily rectified or tolerated and is likely to be ongoing. It is clear that the tree is outsized for its current growing conditions and not a suitable selection for the location.

Per the descriptors used by Treelogic (refer to Appendix 3) this places the tree in a category of short useful life-expectancy (*"Infrastructure conflicts with heightened risk potential. Tree has outgrown site constraints."*) and a Low arboricultural rating (*"Tree (species) is functionally inappropriate to the specific location. Is causing excessive damage/nuisance to adjacent infrastructure or would be expected to be problematic if retained"*).

However, the tree has additional Horticultural and Environmental values beyond the strictly arboricultural rating applied. A Low arboricultural rating and short useful life-expectancy does not preclude the tree from being retained, nor does it constitute a recommendation for removal.

An alternative road layout design or other bespoke interventions and repairs to accommodate root growth while maintaining required access around the tree could change the perception of the tree from unsuitable to a highly valued and more functional element in the landscape with an accordingly higher rating.

Any such amendments to the existing site conditions would need to be planned with arboricultural input and implemented with great care under arborist supervision to ensure the tree is not damaged in the process.



Impact assessment – development site

Based on the supplied plan as shown in Appendix 2C (A.DA0100 (*Development Plan Concept Plan*), *Ivanhoe Tank Site, Architectus Melbourne dated 25 July 2023*), 40 of 43 trees within the current development parcel are not compatible with retention under the proposed design due to being directly within or extremely close to the building footprint (inclusive of structures without basement excavation).

This includes Tree 15, a Moderate A rated River Red Gum, which cannot be retained under the proposed design due to a TPZ encroachment of approximately 32% (irrespective of location of retaining walls) and no contiguous root space for the tree to recover from such significant root loss. Additionally, retention of such a large tree of this species in such close proximity to a new development is not recommended due to ongoing maintenance issues as well as the high risk potential from large tree part failure onto building structures, due to tree decline exacerbated by construction impacts.

Tree 7 (Low-rated Prickly-leaved Paperbark), Tree 8 (Moderate B River Red Gum) and Tree 17 (Mod. B Brush Box) could potentially be retained subject to further landscaping and architectural details, including site access and construction method.

Refer to Table 4 for tree numbers sorted by potential development impacts (Could Retain / Remove)

Location	Impact	Result	Count	Tree Nos
Proposed devt site	None	Could be Retained	3	7, 10, 16
	TPZ	Could be Retained	3	8, 9, 11
	TPZ_major	Arborist supervision requ'd	1	17
	SRZ	At risk of decline & failure (Considered Lost)	4	12, 13, 15, 57
	Within	Unsustainable - Lost	32	14, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 56, 58, 59, 75, 76, 77, 78, 79
Proposed devt site Total			43	
Proposed park	None	Retain with exclusion fence	23	1, 2, 3, 4, 5, 6, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 74, 80
Road reserve (Bell St)	None	Could be Retained	8	68, 72, 81, 82, 83, 84, 85, 86
	TPZ	Could be Retained	1	73
	SRZ	At risk Arborist supervision requ'd	2	69, 70
Road reserve (Bell St) Total			11	
Street (Bell St)	None	Could be Retained	2	87, 88
Street (Forster St)	None	Could be Retained	2	60, 61
Street (Upp H'berg Rd)	None	Could be Retained	5	63, 64, 65, 66, 67

Impact assessment – park trees

Retention of trees within the new park parcel will be subject to further landscaping details, including site access and construction method for the main development, particularly in relation to demolition of existing tank maintenance structures.

Impact assessment – external trees

Retention of trees within the adjacent road reserves are subject to further landscaping details, including site access and construction method for the main development.

Selected Images



Image 1: Trees along the western boundary, facing northwest within proposed new Park.

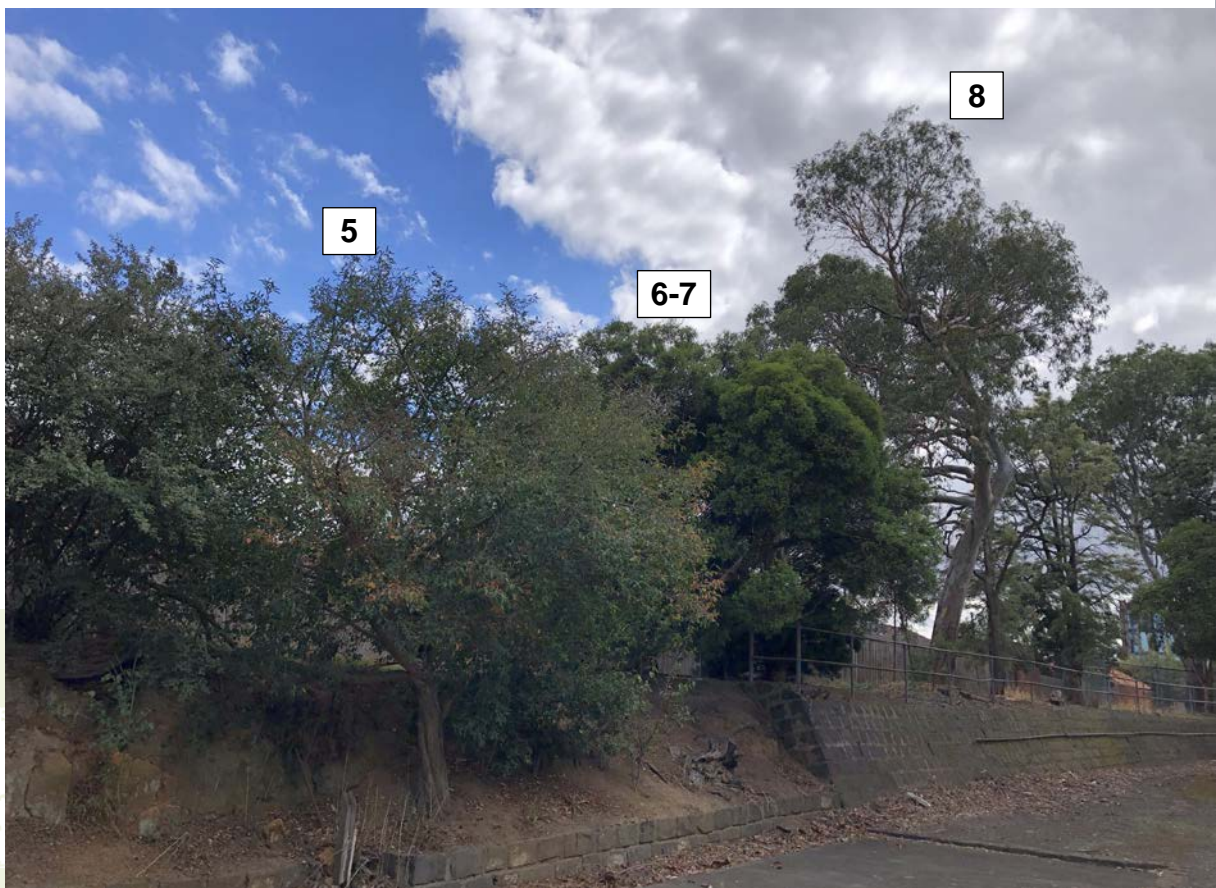


Image 2: Trees along the western boundary, facing north within proposed new Park.

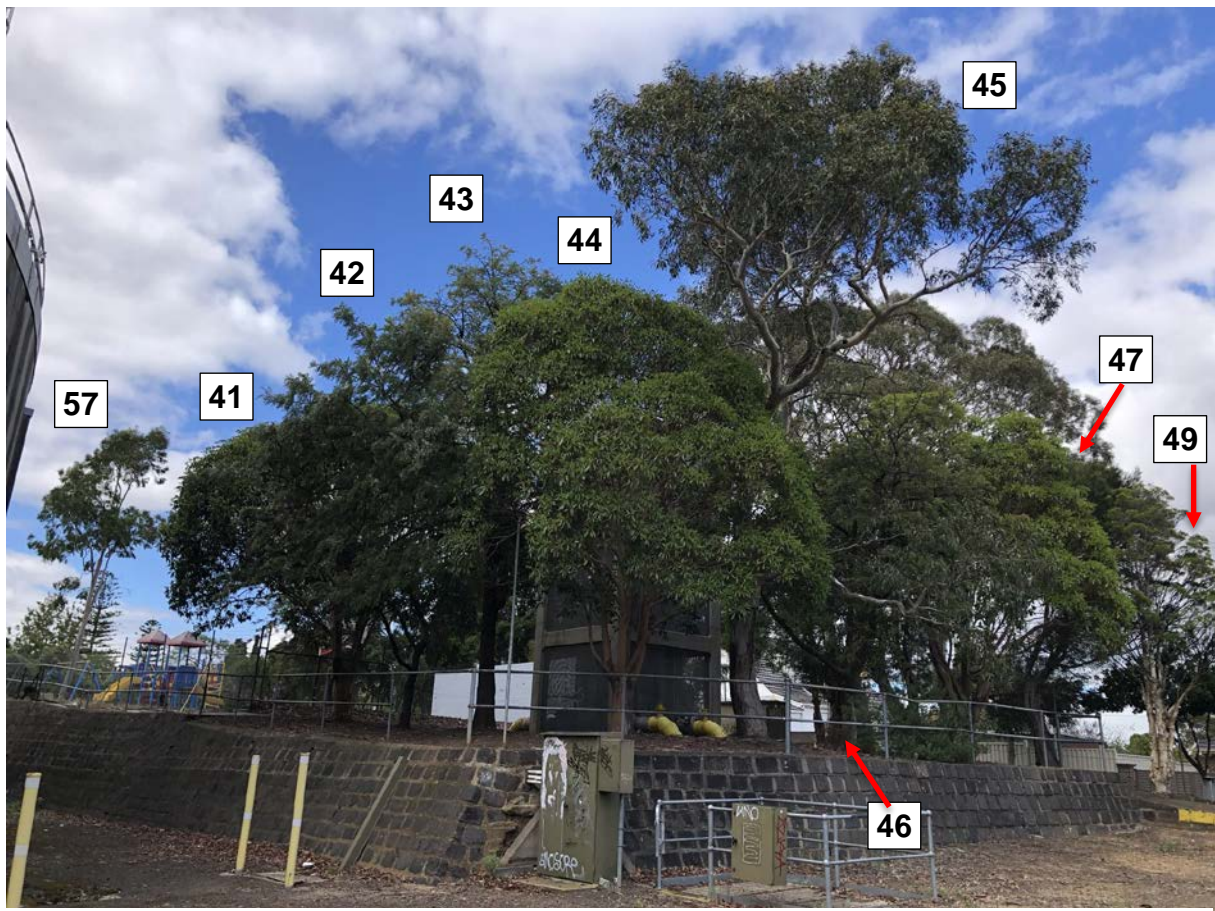


Image 3: Trees around pump infrastructure south-west of tank, facing south will be mostly within the new Park. Tree 57 will need to be removed.



Image 4: Trees along western boundary, facing northeast. These trees will be impacted by proposed development.



Image 5: Closeup of Tree 15, Mod. A-rated River Red Gum in northwest corner of site, facing west. The tree will be unsustainable with proposed development.



Image 6: Tree 17 and surrounds will be impacted by 13% TPZ incursion. It could be retained with arborist supervision during initial site works and will require TPZ fencing at edge of works for the duration of construction works.



Image 7: Trees along northern portion of retaining wall, facing southeast are within the design footprint and cannot be retained.



Image 8: Trees along northern boundary of tank site, facing east. All are within the design footprint and cannot be retained.



Image 9: Trees 32-33, Cape Chesnut (*Calodendrum capense*) in north east corner of tank site are within the design footprint and cannot be retained. (Facing southwest)



Image 10: Tree 21, Mod.B River Red Gum is unsustainable within the construction footprint. (facing west)



Image 11: Trees in north-east corner of tank site are unsustainable within the construction footprint. (facing northwest)

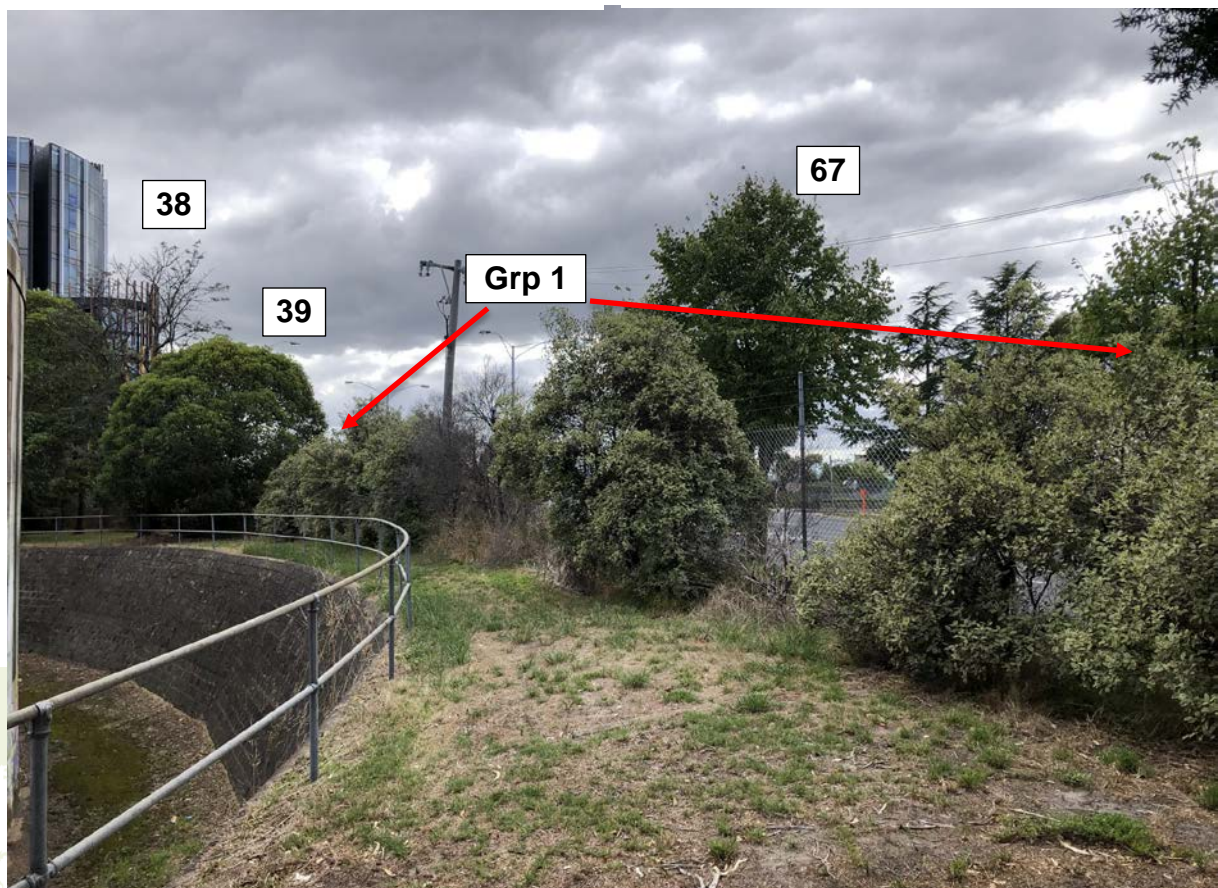


Image 12: Portion of Group 1 along Upper Heidelberg Road frontage. These trees are unsustainable within the construction footprint. (facing northeast). Tree 63 to 67 are street trees external to the site and should be retained & appropriately protected for the duration of the development process.



Image 13: Tree 40, facing southwest. This tree is unsustainable within the construction footprint.



Image 14: Moderate B Park trees, facing southwest. Tree 55 could be retained with appropriate TPZ fencing. Tree 56 is unsustainable within the construction footprint.



Image 15: Trees in northeast corner of park, facing northeast. These trees are unsustainable within the construction footprint.



Image 16: Vegetation in road reserve along Bell St slip road, facing west. The trees are external to site and can be retained. Trees 69 and 70 will require arborist supervision when preparing the initial site cut.



Image 17: Tree 61, River Red Gum street tree along Forster Street, facing east. Tree can be retained without impact.



Image 18: Tree 61, facing northwest. Appropriate TPZ fencing must be established and maintained for the duration of site works.



Image 19: Base of Tree 61 facing east, showing longitudinal damage to road surface and repairs. Appropriate TPZ fencing must be established and maintained for the duration of site works. Any alteration to the existing site conditions must be based on arboricultural advice and subject to arborist supervision to ensure no damage occurs to roots, buttress, trunk and limbs.

Tree 61

Tree 61, a maturing River Red Gum, was noted in this report as being an outstanding tree but with considerable disruption to surrounding surfaces and a resulting arboricultural rating of Low. However, the tree has additional Horticultural and Environmental values beyond the strictly arboricultural rating applied.

In the first instance, as a street tree, retention of Tree 61 is subject to Council's discretion. Additionally, the Low rating implies that "retention of such trees may be considered if not requiring a disproportionate expenditure of resources for a tree in its condition and location" (refer App 3).

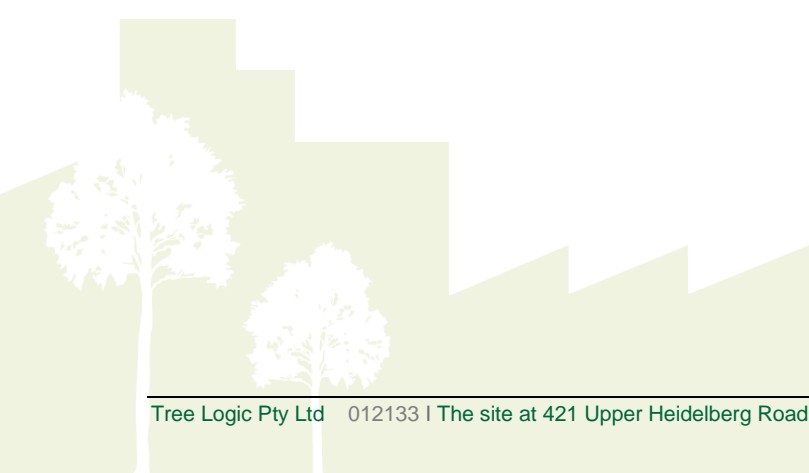
An alternative road layout design or other interventions and repairs to accommodate root growth while maintaining required access around the tree could change the perception of the tree from being unsuitable to becoming a highly valued and more functional element in the landscape with an accordingly higher rating. Any such amendments to the existing site conditions would need to be planned with arboricultural input and implemented with great care under arborist supervision to ensure the tree is not damaged in the process.

The repairs required around the tree may be costly or require an unconventional approach, but whether these costs are disproportionate to the condition of the tree in its location (noting relatively low usage in a residential cul-de-sac) is subject to the perceived values of the tree owner / manager being Banyule City Council and the surrounding community.

General retention recommendations

It should be noted that any consideration of development footprint and tree impacts must account for the retaining walls around the tank and pump and that the AS 4970-2007 protection zones in this report do not necessarily reflect the actual extent of root growth for these trees; correspondingly, tree root growth may be more significant outside these protection zones in the direction away from the retaining walls.

All external/neighbouring trees, as well as their surrounding areas, should be protected in accordance with the tree protection zones outlined in this report, unless removal or impacts have been authorised by the relevant stakeholders.



Tree management recommendations

1. Under the current design;
 - Thirty two (32) trees exist within the design footprint and will need to be removed.
 - Six (6) trees have works encroaching the Structural Root Zone (SRZ) and are at risk of decline and instability.
 - Trees 12, 13, 15, 57 within the site are deemed unsustainable and will be removed.
 - Trees 69 and 70 are external to the site. Arborist supervision will be required when the initial site excavation works occur to determine whether the trees can be sustained or not.
 - Tree 17 will have TPZ encroachment of 13%. Arborist supervision will be required when the initial site excavation works occur to determine the quantity and condition of any roots exposed during the initial excavation and to appropriately prune them if necessary.
 - Trees 8, 9, 11 and 73 will have minor TPZ encroachment (<10%). Appropriate TPZ fencing must be established to edge of works.
 - All other trees can be retained without impact providing appropriate TPZ exclusion fencing is established and maintained for the duration of all works on site.
2. The extent of the TPZ of any tree external to the site that might extend into the subject site must be protected from potential soil compaction with temporary fencing panels and appropriate ground buffering materials to prevent any soil disturbance, dumping of spoil, stock piling materials or vehicles or plant and equipment parking or operating in the TPZ.
3. All trees that are to be retained in the vicinity of any proposed works will require Tree Protection Zones to be established prior to commencing any works onsite including demolition, bulk earthworks, trenching, construction, landscaping activity, delivery and storage of materials or placement of site sheds.
4. The tree protection zones for all trees to be retained within the site must be clearly shown on all design drawings and plans with appropriate notations so that all staff and contractors are aware of the responsibility to protect trees throughout the design, development and delivery of the project.
5. The TPZ fencing must be in the form of either temporary fencing panels with concrete block feet and locked together, water filled barriers with locking pins installed or 2 metre tall star pickets at 2 metre spacing with top wire supporting fluoro para-webbing.

Whichever TPZ fencing is used, it must be sufficiently robust to withstand knocks and bumps from plant and machinery, delivery vehicles and effectively exclude or prevent any storage of materials dumping of spoil or waste products being disposed of in the Tree Protection Zone.
6. Appropriate signage stating 'Tree Protection Zone- No access' is to be fixed to the fencing to alert people as to importance of the tree protection zone. Refer to Figure 1 for fencing example.



Figure 1. Above left - Example of TPZ fencing above right -Example of TPZ signage.

7. The following activities must be excluded from or controlled within the Tree Protection Zones (TPZ) unless otherwise approved by the relevant authority or the Project Arborist.
 - Machine excavation (including trenching) for continuous strip footings or installation of underground services or road base.
 - Alteration of soil levels including placement of fill unless specified by design & project arborist.
 - Storage of wastes or materials (including fuels, oils or chemicals)
 - Preparation of or cleaning of any cement products
 - Storage and or parking of vehicles or any plant/machinery within TPZ
 - Washing down of equipment
 - Installation of utilities
 - Physical damage of any kind to the tree (including direct attachment of anything into the tree)
 - Soil cultivation unless specified by design & project arborist.
8. No form of excavation for trenching for installation of underground services is permitted within the nominated TPZ areas for any retained trees without prior consultation with the council and / or site arborist, to avoid severing roots that could be vital to the stability and continued sustainability of the retained trees.
 - Trenching for the installation of any and all underground services must be designed to avoid encroaching the TPZ of any retained trees.
 - If it is unavoidable that an underground service must pass through a defined TPZ, the service must be installed via directional boring at a minimum depth of 750mm to the top of the bore head.
All entry and exit points for the boring must be located beyond the TPZ radius.

- Lubricants or waste-water from the boring process must not be permitted to enter or contaminate the soil within the TPZ.
9. Design should ensure appropriate growing space is allocated for all trees that are to be retained. Damage to paving from root activity is most likely to occur within 2 m of the trunk base of a tree where the large woody structural root zone may contribute to upheaval. It is recommended that a minimum 2 metre clearance is provided from any tree to any hard paved surface.
 10. Temporary facilities and site sheds may be established on existing hard stand if already present within a TPZ providing there is no physical impacts to the trees and no requirement to penetrate the surface within the TPZ for installation of footings or underground services.
Access / egress to these facilities must not encroach or compact the native soil within the TPZ.
 11. Refer to Appendix 1 for all tree data, Appendix 2 for Tree Location and TPZ maps and Appendix 3 for Tree Descriptors

Tree removal.

Under the current design, only the following trees should be permitted to be removed due to unavoidable construction impacts or poor and irreversible deteriorating condition. Trees for retention or removal within the road reserve and the future public park will need to be assessed once a park design and detailed street scape design is issued as part of a planning application. That being noted, the trees on Upper Heidelberg Road (UHR) will be impacted by the vehicle access locations (crossovers) and street scape interface and it is likely these trees will need to be removed.

The Landscape plan indicates new plantings to this location.

Action	Count	Tree Nos
Trees in development to be removed + UHR	40	9, 10, 11, 12, 13, 14, 15, 16, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 56, 57, 58, 59, 75, 76, 77, 78, 79
Could be Retained	26	1, 2, 3, 4, 5, 6, 7, 8, 17, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 74, 80
External trees	15	60, 61, 63, 68, 69, 70, 72, 73, 81, 82, 83, 84, 85, 86, 87, 88
External trees likely to be removed (UHR)	5	63, 64, 65, 66, 67

The project arborist must be contacted if there is any confusion or doubt about which trees are to be removed or retained before proceeding with tree demolition works.

No other trees are permitted to be removed without prior consent from the project arborist and the responsible authority.

All trees must be removed by suitably trained and experienced arborists in a controlled manner to ensure no damage occurs to any trees that are required to be retained and protected.

Design Changes

Any changes to the proposed development, landscape or civil design which has the potential to alter existing surface or above or below ground site conditions within a TPZ that was not previously approved by the responsible authority must be subject to the approval of the Project Arborist and the Responsible Authority if they believe the works will be detrimental to the retention of the tree.

If the Project Arborist deems that the design changes pose an unacceptable risk to a tree, then appropriate design modifications or alternative construction methods must be negotiated to reduce this risk, subject to approval from the Responsible Authority. In some cases, proposed changes may not be able to proceed.

All design changes within TPZs are to be recorded for inclusion in certification reporting by the Project Arborist in accordance with the endorsed plans.

Arborist supervision schedule:

The project arborist must attend site at time of site occupation to;

- i. Be inducted to site as project arborist and meet with site managers and supervisors to convey the importance of tree preservation to all relevant parties involved with the site works.
- ii. Site managers must then ensure all contractors and site workers receive written and verbal instruction about the importance of tree protection and preservation within the site.

The project arborist must;

- iii. Attend site once the TPZ fencing and ground buffering is established to inspect and sign-off on the compliance of the tree protection as specified.
- iv. Attend periodically to inspect TPZ fencing and buffering are being maintained as required.
- v. Be present when excavation occurs within the TPZs of any retained tree to record the presence, density, size and condition of any roots exposed during the excavation and to ensure any exposed roots that can be retained are protected and left covered or any damaged roots or roots to be pruned are cut cleanly behind the face of the site cut.
- vi. Be contacted if any incident happens that may have impacted tree condition.
- vii. Complete a final inspection at completion of works and removal of TPZ fencing to assess whether trees have been successfully retained, that they remain viable and to evaluate trees for any ongoing monitoring purposes.

Project Arborist Inspection Schedule

Project Arborist Inspection Schedule		
Task	Timing	Liaison
Site induction meeting to discuss TMP & implementation.	At site occupation	Site Manager / Project Arborist
Inspect installation of TPZ fencing & ground buffering.	Pre-Demolition	Site Manager / Project Arborist /
If in doubt about which trees are to be removed before proceeding with tree demolition works	At time of demolition	Site Manager / Project Arborist / Contractor

Project Arborist Inspection Schedule		
Task	Timing	Liaison
During any excavation within more than 10% of the TPZ of any retained trees to supervise and record the presence, density, size and condition of any roots exposed. Ensure any exposed roots that can be retained are protected & left covered and that any roots that must be pruned are cut cleanly below the face of the site cut.	Identified for trees 8, 17, 69 and 70.	Site Manager / Project Arborist / Contractor
Periodic inspections at ~6 week intervals to evaluate TPZ compliance, maintenance and tree condition	During Construction	Site Manager / Project arborist
Final sign off	Post construction	Site Manager / Project arborist

The Project Arborist must maintain written and photographic records of site inspections based on the Supervision Timetable and any variations or non-compliances that could detrimentally impact on the healthy retention of protected trees. An example of a Project Arborist Certification Checklist is provided below.

PROJECT ARBORIST - CERTIFICATION CHECKLIST		
Project Permit No. & Address:		
Commencement Date:		
Project Arborist / Company Name / Qualification:		
Certification Item	Date / Signed	Comments
Initial Site meeting to discuss TMP.		
Installation of TPZ fencing / ground protection & mulching.		
Ensure correct identification of trees for demolition without damage to trees to be retained.		
Monitoring construction activities within TPZs for any retained trees as may be listed in Project arborist schedule, i.e. Excavation within the TPZs of Trees 8, 17, 69 and 70.		
~ 6 week interval site inspection to monitor tree health & effectiveness of tree protection zone fencing.		
Final inspection at completion of landscaping works		
Completion Date		

The tree management will be subject to further review and amendment on the basis that the detailed design including civil works, underground services, construction management plan and traffic management plans are yet to be finalised.

The project arborist must attend site at completion of works and removal of TPZ fencing to inspect and sign off that the retained trees have not been impacted during the construction process and remain viable.

Any damage to any tree that is required to be retained must be reported immediately to the project arborist and the relevant authority for assessment and appropriate actions.

Supplementary irrigation must be applied during the hotter and drier Summer and Autumn months as per guidelines provided in Appendix 4.

Tree condition can change quickly in response to environmental conditions or altered landscape conditions. Retained trees should be re-inspected on a 3-5 year basis or following any locally damaging weather events and appropriate remedial works undertaken as required.

I am available to answer any questions arising from this report.

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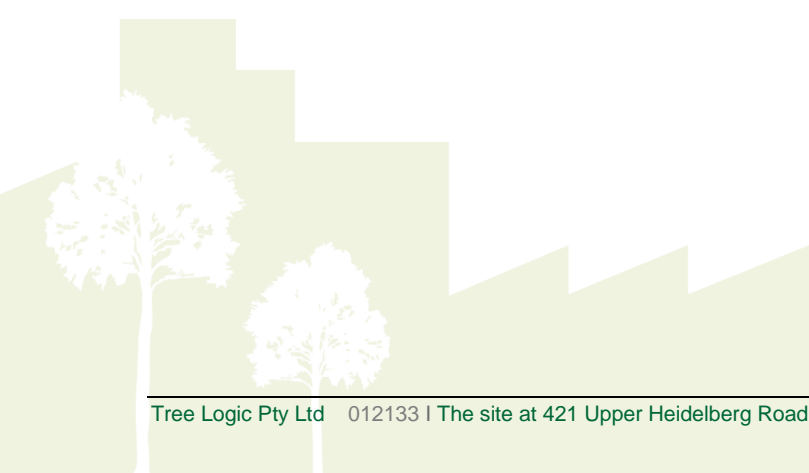
Bruce Callander



Senior Consultant Arborist
(Dip. Hort. Cert 5 Arb.)

Manori Senanayake

Consultant Arborist
GDip. (Urb. Hort.)



Appendix 1: Tree Observations Table

DBH = Diameter at Breast Height (measured 1.4m above ground unless otherwise stated).

ULE = Useful Life Expectancy.

Arb. rating = arboricultural rating.

TPZ = Tree Protection Zone.

SRZ = Structural Root Zone.

TPZ & SRZ measurements are radius in metres from the centre of the trunk per AS 4970-2009. Definitions of the descriptor categories used in the assessment can be seen in Appendix 3.

Refer to the following **4** pages.

treedid	species	comm_name	age_class	origin_typ	dbh_cm	height_m	width_m	health	structure	arb_ratn_g	ule_yrs	comments	tpz_rad_m	srz_rad_m	Location	TPZ impacts	% TPZ impacted	Action
1	<i>Melaleuca styphelioides</i>	Prickly-leaved Paperbark	Early-mature	Australian native	52 @1	6	5	Good	Fair	Mod.B	>40		6.2	2.5	Proposed park	None	NA	Retain. Fence TPZ
2	<i>Melaleuca styphelioides</i>	Prickly-leaved Paperbark	Early-mature	Australian native	41	7	6	Fair	Fair	Mod.C	>40		4.9	2.3	Proposed park	None	NA	Retain. Fence TPZ
3	<i>Eriobotrya japonica</i>	Loquat	Early-mature	Exotic evergreen	2,12,12,10	4	6	Good	Fair to Poor	Low	6-10	Woody weed sp	2.9	1.9	Proposed park	None	NA	Retain. Fence TPZ
4	<i>Melaleuca lanceolata</i>	Moonah	Maturing	Australian native	33,27,19,16	7	8	Fair	Fair to Poor	Mod.C	21-40	Cotoneaster resprout near base.	5.9	2.7	Proposed park	None	NA	Retain. Fence TPZ
5	<i>Euonymus europaeus</i>	Common Spindle Tree	Early-mature	Exotic deciduous	26	4	4	Fair	Fair to Poor	Low	11-20		3.1	2	Proposed park	None	NA	Retain. Fence TPZ
6	<i>Melaleuca styphelioides</i>	Prickly-leaved Paperbark	Early-mature	Australian native	22,17,15,15	5	5	Fair	Fair to Poor	Low	21-40	Suppressed.	4.2	2.1	Proposed park	None	NA	Retain. Fence TPZ
7	<i>Melaleuca styphelioides</i>	Prickly-leaved Paperbark	Early-mature	Australian native	29,28 @0.8	6	5	Fair	Fair	Low	21-40	Dieback to northeast due to suppression, otherwise good vitality.	4.8	2.4	Proposed devt site	None	NA	Retain. Fence TPZ
8	<i>Eucalyptus camaldulensis</i>	River Red Gum	Early-mature	Victorian native	67	14	11	Fair	Fair	Mod.B	21-40	Crown swoops significantly to west, pruned back from tank. 1x ~70mm branch dieback to south.	8	3	Proposed devt site	TPZ	7.33	Retain. Fence TPZ to edge of works
9	<i>Acacia implexa</i>	Lightwood	Over-mature	Victorian native	27	14	6	Poor	Poor	Very Low	<1	Mostly dead; trunk decay.	3.2	2.1	Proposed devt site	TPZ	0.62	Remove
10	<i>Grevillea robusta</i>	Silky Oak	Semi-mature	Australian native	15	5	3	Poor	Fair to Poor	Low	1-5	Suppressed. Major dieback.	2	1.7	Proposed devt site	None	NA	Remove
11	<i>Grevillea robusta</i>	Silky Oak	Semi-mature	Australian native	32,24	12	7	Fair to Poor	Fair to Poor	Low	6-10	Multiple leaders, one dead, peripheral & apical dieback.	4.8	2.3	Proposed devt site	TPZ	4.9	Remove
12	<i>Lophostemon confertus</i>	Brush Box	Semi-mature	Australian native	30 @1.2	9	6	Fair	Fair to Poor	Low	21-40	Suppressed.	3.6	2.1	Proposed devt site	SRZ	24.62	Remove
13	<i>Grevillea robusta</i>	Silky Oak	Early-mature	Australian native	42	16	9	Fair	Fair to Poor	Mod.C	21-40	Main leader kinked, partial suppression. Large surface roots south & east.	5	2.5	Proposed devt site	SRZ	47.77	Remove
14	<i>Lophostemon confertus</i>	Brush Box	Semi-mature	Australian native	32,18 @1.2	10	7	Fair	Fair	Mod.C	21-40	Suppressed form under adjacent canopy.	4.4	2.2	Proposed devt site	Within	100.01	Remove
15	<i>Eucalyptus camaldulensis</i>	River Red Gum	Maturing	Victorian native	111	21	15	Fair	Good	Mod.A	>40	Very slight thinning out of peripheral foliage, possums? Next to fence & low retaining wall.	13.3	3.7	Proposed devt site	SRZ	33.17	Remove
16	<i>Grevillea robusta</i>	Silky Oak	Semi-mature	Australian native	29	10	5	Fair to Poor	Poor	Low	11-20	Acute forks, co-dominant stems, lost main leader, reduced foliage density.	3.5	2.2	Proposed devt site	None	NA	Remove
17	<i>Lophostemon confertus</i>	Brush Box	Early-mature	Australian native	5,33,17 @1	8	9	Fair	Fair	Mod.B	>40		7	2.6	Proposed devt site	TPZ_major	13.24	Fence TPZ to edge of works. Arborist supervision req'd
18	<i>Grevillea robusta</i>	Silky Oak	Semi-mature	Australian native	32	9	5	Poor	Fair	Very Low	1-5	Major apical dieback.	3.8	2.4	Proposed devt site	Within	100.01	Remove
19	<i>Lophostemon confertus</i>	Brush Box	Semi-mature	Australian native	20,19,15,15	10	8	Fair	Fair	Mod.C	11-20		4.2	2.1	Proposed devt site	Within	100	Remove
20	<i>Grevillea robusta</i>	Silky Oak	Semi-mature	Australian native	32,13	12	8	Fair to Poor	Fair	Low	6-10	Reduced foliage density, suppressed.	4.1	2.4	Proposed devt site	Within	99.99	Remove
21	<i>Eucalyptus camaldulensis</i>	River Red Gum	Early-mature	Victorian native	81	17	15	Fair	Fair	Mod.B	>40	Past branch tearout to west however good response growth. Minor possum damage.	9.7	3.3	Proposed devt site	Within	100	Remove
22	<i>Melaleuca styphelioides</i>	Prickly-leaved Paperbark	Semi-mature	Australian native	17,13	7	4	Fair	Fair to Poor	Low	21-40		2.6	1.8	Proposed devt site	Within	86.08	Remove

treeid	species	comm_name	age_class	origin_typ	dbh_cm	height_m	width_m	health	structure	arb_ratin g	ule_yrs	comments	tpz_rad_ m	srz_rad_ m	Location	TPZ impacts	% TPZ impacted	Action
23	<i>Melaleuca styphelioides</i>	Prickly-leaved Paperbark	Semi-mature	Australian native	13	6	2	Fair	Fair	Low	11-20		2	1.7	Proposed devt site	Within	93.6	Remove
24	<i>Melaleuca styphelioides</i>	Prickly-leaved Paperbark	Semi-mature	Australian native	13	6	2	Fair	Fair	Low	11-20		2	1.7	Proposed devt site	Within	97.19	Remove
25	<i>Melaleuca styphelioides</i>	Prickly-leaved Paperbark	Semi-mature	Australian native	16	6	3	Fair	Fair	Low	11-20		2	1.6	Proposed devt site	Within	96.95	Remove
26	<i>Melaleuca styphelioides</i>	Prickly-leaved Paperbark	Semi-mature	Australian native	19,14	7	4	Fair	Fair	Low	21-40		2.8	1.8	Proposed devt site	Within	79.13	Remove
27	<i>Melaleuca styphelioides</i>	Prickly-leaved Paperbark	Semi-mature	Australian native	15	7	3	Fair	Fair	Low	11-20		2	1.6	Proposed devt site	Within	94.42	Remove
28	<i>Melaleuca styphelioides</i>	Prickly-leaved Paperbark	Semi-mature	Australian native	25,16	7	6	Fair	Fair	Low	21-40		3.6	2.1	Proposed devt site	Within	72.57	Remove
29	<i>Melaleuca styphelioides</i>	Prickly-leaved Paperbark	Semi-mature	Australian native	17	7	4	Fair to Poor	Fair	Low	11-20		2	1.8	Proposed devt site	Within	86.37	Remove
30	<i>Melaleuca styphelioides</i>	Prickly-leaved Paperbark	Semi-mature	Australian native	13,12,11	7	4	Fair	Fair	Low	21-40		2.5	1.8	Proposed devt site	Within	83.93	Remove
31	<i>Melaleuca styphelioides</i>	Prickly-leaved Paperbark	Semi-mature	Australian native	12,12	6	2	Fair	Fair to Poor	Low	11-20		2	1.8	Proposed devt site	Within	95.55	Remove
32	<i>Calodendrum capense</i>	Cape Chestnut	Semi-mature	Exotic evergreen	5,15,15,13,	7	10	Fair	Fair	Mod.C	21-40		3.8	2.1	Proposed devt site	Within	100.01	Remove
33	<i>Calodendrum capense</i>	Cape Chestnut	Semi-mature	Exotic evergreen	11,8,8,7,5	4	6	Fair to Poor	Fair	Low	21-40	Reduced vigour.	2.2	1.5	Proposed devt site	Within	99.99	Remove
34	<i>Grevillea robusta</i>	Silky Oak	Semi-mature	Australian native	29	7	7	Poor	Fair to Poor	Very Low	1-5	Major dieback.	3.5	2.2	Proposed devt site	Within	99.99	Remove
35	<i>Lophostemon confertus</i>	Brush Box	Semi-mature	Australian native	33 @1.3	10	7	Fair	Fair	Mod.C	>40		4	2.3	Proposed devt site	Within	100.01	Remove
36	<i>Grevillea robusta</i>	Silky Oak	Semi-mature	Australian native	28	11	7	Poor	Fair	Very Low	<1	Nearly dead.	3.4	2.2	Proposed devt site	Within	100	Remove
37	<i>Lophostemon confertus</i>	Brush Box	Early-mature	Australian native	35,35,12	12	10	Fair	Fair	Mod.B	>40		6.1	2.6	Proposed devt site	Within	100	Remove
38	<i>Grevillea robusta</i>	Silky Oak	Early-mature	Australian native	32,26,20	14	7	Poor	Fair	Very Low	<1	Almost dead.	5.5	2.6	Proposed devt site	Within	87.72	Remove
39	<i>Lophostemon confertus</i>	Brush Box	Early-mature	Australian native	40 @1.1	8	10	Fair	Fair	Mod.B	>40		4.8	2.4	Proposed devt site	Within	74.18	Remove
40	<i>Melaleuca styphelioides</i>	Prickly-leaved Paperbark	Maturing	Australian native	69	12	9	Good	Fair	Mod.B	21-40	Acute union at ~2m typical of species.	8.3	2.9	Proposed devt site	Within	79.55	Remove
41	<i>Lophostemon confertus</i>	Brush Box	Semi-mature	Australian native	39 @1	11	10	Fair	Fair	Mod.B	>40		4.7	2.3	Proposed park	None	NA	Retain. Fence TPZ
42	<i>Grevillea robusta</i>	Silky Oak	Semi-mature	Australian native	18	6	6	Fair to Poor	Poor	Low	6-10	Suppressed. Past large pruning wound.	2.2	2	Proposed park	None	NA	Retain. Fence TPZ
43	<i>Grevillea robusta</i>	Silky Oak	Semi-mature	Australian native	37 @1.2	13	8	Fair to Poor	Fair	Mod.C	11-20	Reduced foliage density. Tending towards Low.	4.4	2.5	Proposed park	None	NA	Retain. Fence TPZ
44	<i>Lophostemon confertus</i>	Brush Box	Semi-mature	Australian native	35 @0.8	7	9	Fair	Fair	Mod.C	>40		4.2	2.3	Proposed park	None	NA	Retain. Fence TPZ
45	<i>Eucalyptus camaldulensis</i>	River Red Gum	Semi-mature	Victorian native	52	15	12	Fair	Fair	Mod.B	>40	Crown bias northwest, slight reduction in foliage density - possums? No lower canopy except to southwest.	6.2	2.7	Proposed park	None	NA	Retain. Fence TPZ
46	<i>Grevillea robusta</i>	Silky Oak	Semi-mature	Australian native	29	10	8	Poor	Fair to Poor	Low	6-10	Suppressed. Apical dieback.	3.5	2.2	Proposed park	None	NA	Retain. Fence TPZ
47	<i>Lophostemon confertus</i>	Brush Box	Semi-mature	Australian native	36 @0.8	10	8	Fair	Fair	Mod.C	21-40	Slightly reduced foliage density.	4.3	2.2	Proposed park	None	NA	Retain. Fence TPZ
48	<i>Melaleuca styphelioides</i>	Prickly-leaved Paperbark	Semi-mature	Australian native	31,27,18	6	6	Fair to Poor	Fair	Low	6-10	Reduced foliage density.	5.4	2.7	Proposed park	None	NA	Retain. Fence TPZ

treedid	species	comm_name	age_class	origin_typ	dbh_cm	height_m	width_m	health	structure	arb_ratn_g	ule_yrs	comments	tpz_rad_m	srz_rad_m	Location	TPZ impacts	% TPZ impacted	Action
49	<i>Melaleuca styphelioides</i>	Prickly-leaved Paperbark	Semi-mature	Australian native	17,16,16	5	5	Fair to Poor	Fair to Poor	Low	6-10	Chlorotic foliage, reduced foliage density.	3.4	2.1	Proposed park	None	NA	Retain. Fence TPZ
50	<i>Melaleuca armillaris</i>	Bracelet Honey-myrtle	Over-mature	Victorian native	39	6	5	Fair to Poor	Fair to Poor	Low	6-10	Past limb failure, trunk decay, partly suppressed - crown bias south.	4.7	2.7	Proposed park	None	NA	Retain. Fence TPZ
51	<i>Melaleuca armillaris</i>	Bracelet Honey-myrtle	Over-mature	Victorian native	38,32,30	9	9	Fair to Poor	Poor	Low	6-10	Past limb failure, subsiding limbs, trunk decay.	7	3.1	Proposed park	None	NA	Retain. Fence TPZ
52	<i>Melaleuca styphelioides</i>	Prickly-leaved Paperbark	Semi-mature	Australian native	24,15,15	6	8	Fair	Fair to Poor	Low	11-20	Suppressed.	3.8	2.4	Proposed park	None	NA	Retain. Fence TPZ
53	<i>Melaleuca styphelioides</i>	Prickly-leaved Paperbark	Semi-mature	Australian native	45	7	7	Fair	Fair to Poor	Low	11-20	Ivy on trunk, partly suppressed - crown bias southeast.	5.4	2.5	Proposed park	None	NA	Retain. Fence TPZ
54	<i>Melaleuca lanceolata</i>	Moonah	Semi-mature	Australian native	26	4	5	Good	Fair to Poor	Low	11-20	Suppressed.	3.1	2.1	Proposed park	None	NA	Retain. Fence TPZ
55	<i>Melaleuca styphelioides</i>	Prickly-leaved Paperbark	Early-mature	Australian native	21,19,19,19	10	8	Fair	Fair	Mod.B	11-20		5.7	2.9	Proposed park	None	NA	Retain. Fence TPZ
56	<i>Grevillea robusta</i>	Silky Oak	Early-mature	Australian native	38	13	9	Fair to Poor	Fair	Mod.B	11-20	Some tip dieback upper canopy, monitor condition.	4.6	2.5	Proposed devt site	Within	42.4	Remove
57	<i>Angophora costata</i>	Smooth-barked Apple	Semi-mature	Australian native	21	12	5	Fair	Poor	Low	11-20	Past stem removal, included bark forks remain in canopy.	2.5	2.1	Proposed devt site	SRZ	9.96	Remove
58	<i>Angophora costata</i>	Smooth-barked Apple	Semi-mature	Australian native	30	15	7	Fair	Fair to Poor	Mod.C	11-20	Surface damage to large tensional root to east, 2x acute forks but relatively compact & upright canopy, crown bias north.	3.6	2.2	Proposed devt site	Within	99.99	Remove
59	<i>Eucalyptus camaldulensis</i>	River Red Gum	Early-mature	Victorian native	55 (est.)	13	14	Fair	Fair	Mod.B	>40	Base & trunk obscured by shrubs.	6.6	2.8	Proposed devt site	Within	59.37	Remove
60	<i>Photinia serratifolia</i>	Chinese Hawthorn	Semi-mature	Exotic evergreen	15,13,10 @	3	6	Fair to Poor	Fair to Poor	Low	6-10	Street tree, suppressed.	3.2	2.1	Street (Forster St)	None	NA	External
61	<i>Eucalyptus camaldulensis</i>	River Red Gum	Maturing	Victorian native	97	23	20	Fair	Fair	Low	1-5	Street tree. Healthy large tree with no major structural defects, good tree specimen but inappropriate location at present - significant infrastructure damage. Potential to be higher rated with site modification. Refer to report for further discussion.	11.6	3.5	Street (Forster St)	None	NA	External
63	<i>Tilia cordata</i>	Small-leaved Linden	Semi-mature	Exotic deciduous	11,10,9,8	3	2	Fair	Fair to Poor	Low	11-20	Street tree, trunk wounds.	2.3	1.6	Street (Upp H'berg Rd)	None	NA	External
64	<i>Tilia cordata</i>	Small-leaved Linden	Semi-mature	Exotic deciduous	10	3	2	Fair	Fair	Low	21-40	Street tree.	2	1.5	Street (Upp H'berg Rd)	None	NA	External
65	<i>Tilia cordata</i>	Small-leaved Linden	Semi-mature	Exotic deciduous	8,4,2	2	2	Fair to Poor	Fair	Low	11-20	Street tree. Low vigour - suppressed?.	2	1.5	Street (Upp H'berg Rd)	None	NA	External
66	<i>Tilia cordata</i>	Small-leaved Linden	Semi-mature	Exotic deciduous	11,9	3	3	Fair	Fair to Poor	Low	21-40	Street tree.	2	1.5	Street (Upp H'berg Rd)	None	NA	External
67	<i>Tilia cordata</i>	Small-leaved Linden	Semi-mature	Exotic deciduous	17,13	6	5	Good	Fair	Mod.C	21-40	Street tree.	2.6	1.7	Street (Upp H'berg Rd)	None	NA	External
68	<i>Allocasuarina littoralis</i>	Black She-oak	Semi-mature	Victorian native	15	7	4	Fair to Poor	Fair	Low	11-20	Apical dieback.	2	1.6	Road reserve (Bell St)	None	NA	External
69	<i>Casuarina glauca</i>	Swamp She-oak	Semi-mature	Australian native	25	12	8	Fair	Fair	Mod.C	21-40	Suckering.	3	2	Road reserve (Bell St)	SRZ	12.51	External. Arborist supervision req'd

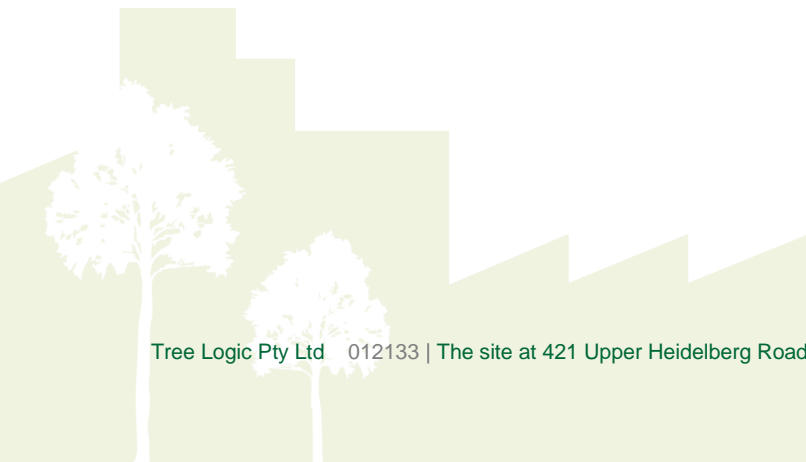
treedid	species	comm_name	age_class	origin_typ	dbh_cm	height_m	width_m	health	structure	arb_ratn_g	ule_yrs	comments	tpz_rad_m	srz_rad_m	Location	TPZ impacts	% TPZ impacted	Action
70	<i>Casuarina glauca</i>	Swamp She-oak	Semi-mature	Australian native	16	11	4	Fair	Fair	Mod.C	21-40	Suckering.	2	1.7	Road reserve (Bell St)	SRZ	9.86	External. Arborist supervision req'd
72	<i>Eucalyptus melliodora</i>	Yellow Box	Semi-mature	Victorian native	33	14	7	Fair	Fair	Mod.C	>40		4	2.3	Road reserve (Bell St)	None	NA	External
73	<i>Casuarina glauca</i>	Swamp She-oak	Semi-mature	Australian native	35	14	7	Fair to Poor	Fair	Mod.C	21-40		4.2	2.4	Road reserve (Bell St)	TPZ	5.98	External. Fence TPZ to edge of works
74	<i>Acacia melanoxylon</i>	Blackwood	Early-mature	Victorian native	12	3	4	Fair	Fair to Poor	Low	6-10	Crown bias 45 degrees south.	2	1.5	Proposed park	None	NA	Retain. Fence TPZ
75	<i>Melaleuca styphelioides</i>	Prickly-leaved Paperbark	Semi-mature	Australian native	12	7	2	Fair	Fair to Poor	Low	6-10	Suppressed.	2	1.5	Proposed devt site	Within	92.04	Remove
76	<i>Melaleuca styphelioides</i>	Prickly-leaved Paperbark	Semi-mature	Australian native	10	3	2	Fair to Poor	Fair	Low	6-10	Suppressed.	2	1.5	Proposed devt site	Within	86.97	Remove
77	<i>Melaleuca styphelioides</i>	Prickly-leaved Paperbark	Semi-mature	Australian native	10	5	2	Fair	Fair to Poor	Low	6-10	Partly suppressed - crown bias west.	2	1.5	Proposed devt site	Within	85.96	Remove
78	<i>Melaleuca styphelioides</i>	Prickly-leaved Paperbark	Semi-mature	Australian native	10,3	3	2	Fair to Poor	Fair to Poor	Low	6-10	Suppressed.	2	1.5	Proposed devt site	Within	89.16	Remove
79	<i>Melaleuca styphelioides</i>	Prickly-leaved Paperbark	Semi-mature	Australian native	13,12,10	6	4	Fair to Poor	Fair to Poor	Low	6-10	Reduced foliage density.	2.4	1.6	Proposed devt site	Within	85.49	Remove
80	<i>Cinnamomum camphora</i>	Camphor Laurel	Semi-mature	Exotic evergreen	12,12,10	4	2	Fair to Poor	Fair to Poor	Low	6-10		2.4	1.8	Proposed park	None	NA	Retain. Fence TPZ
81	<i>Casuarina glauca</i>	Swamp She-oak	Semi-mature	Australian native	20	14	5	Fair	Fair	Mod.C	21-40	Suckering.	2.4	1.8	Road reserve (Bell St)	None	NA	External
82	<i>Eucalyptus camaldulensis</i>	River Red Gum	Semi-mature	Victorian native	13	4	2	Poor	Fair to Poor	Very Low	1-5	Apical dieback, bark delamination; west of footpath.	2	1.5	Road reserve (Bell St)	None	NA	External
83	<i>Eucalyptus camaldulensis</i>	River Red Gum	Semi-mature	Victorian native	20	11	6	Fair	Fair	Low	21-40	Partly suppressed - crown bias east, juvenile foliage.	2.4	1.9	Road reserve (Bell St)	None	NA	External
84	<i>Eucalyptus leucoxylon</i>	Yellow Gum	Semi-mature	Victorian native	15	4	4	Poor	Fair to Poor	Very Low	1-5	Major dieback.	2	1.6	Road reserve (Bell St)	None	NA	External
85	<i>Eucalyptus leucoxylon</i>	Yellow Gum	Semi-mature	Victorian native	11 (est.)	4	1	Poor	Fair to Poor	Very Low	1-5	Major dieback.	2	1.5	Road reserve (Bell St)	None	NA	External
86	<i>Eucalyptus leucoxylon</i>	Yellow Gum	Semi-mature	Victorian native	10	4	2	Fair to Poor	Fair	Low	11-20	Reduced foliage density.	2	1.5	Road reserve (Bell St)	None	NA	External
87	<i>Eucalyptus leucoxylon</i>	Yellow Gum	Semi-mature	Victorian native	22,15	4	6	Fair to Poor	Fair	Low	11-20	Reduced foliage density, partly suppressed - crown bias east. Prominent surface roots to north and east, some wounding to latter. East of footpath along Bell St slip road.	3.2	2	Street (Bell St)	None	NA	External
88	<i>Eucalyptus melliodora</i>	Yellow Box	Semi-mature	Victorian native	14,8,8	3	3	Fair to Poor	Fair to Poor	Low	6-10	Partly suppressed - crown bias north, minor damage to surface roots north & east. East of footpath along Bell St slip road.	2.2	1.8	Street (Bell St)	None	NA	External

Appendix 2A: Tree Location and Protection Zone Plan (Aerial)

Appendix 2B: Tree Location and Protection Zone Plan (2006 Survey)

Appendix 2C: Tree Location and Protection Zone Plan (Design)

Refer to the following **3** pages.





APPENDIX 2A — TREE LOCATIONS AND PROTECTION ZONES (Aerial)

PROJECT
421 Upper Heidelberg Road, Ivanhoe

TL REF.
012133

MAP NO.
1 / 1

DATE
2022-03-16

CLIENT
Development Victoria

LEGEND			
Arb. Rating	Protection Zone	Tree groups	
◆ Mod-A	TPZ	Small trees	■
● Mod-B	SRZ	Removed	⊗
◆ Mod-C		Cadastre (VicMap)	—
■ Low			
▼ Very Low			

label	species
CC	Cinnamomum camphorum
CS	Cotoneaster sp.
LP	Lagunaria patersonia
PU	Pittosporum undulatum

TREE LOCATION DISCLAIMER
Tree locations within main site and park based on 2006 survey, others approximate

DATA SOURCES
Aerial image : Nearmap 2021-12-24

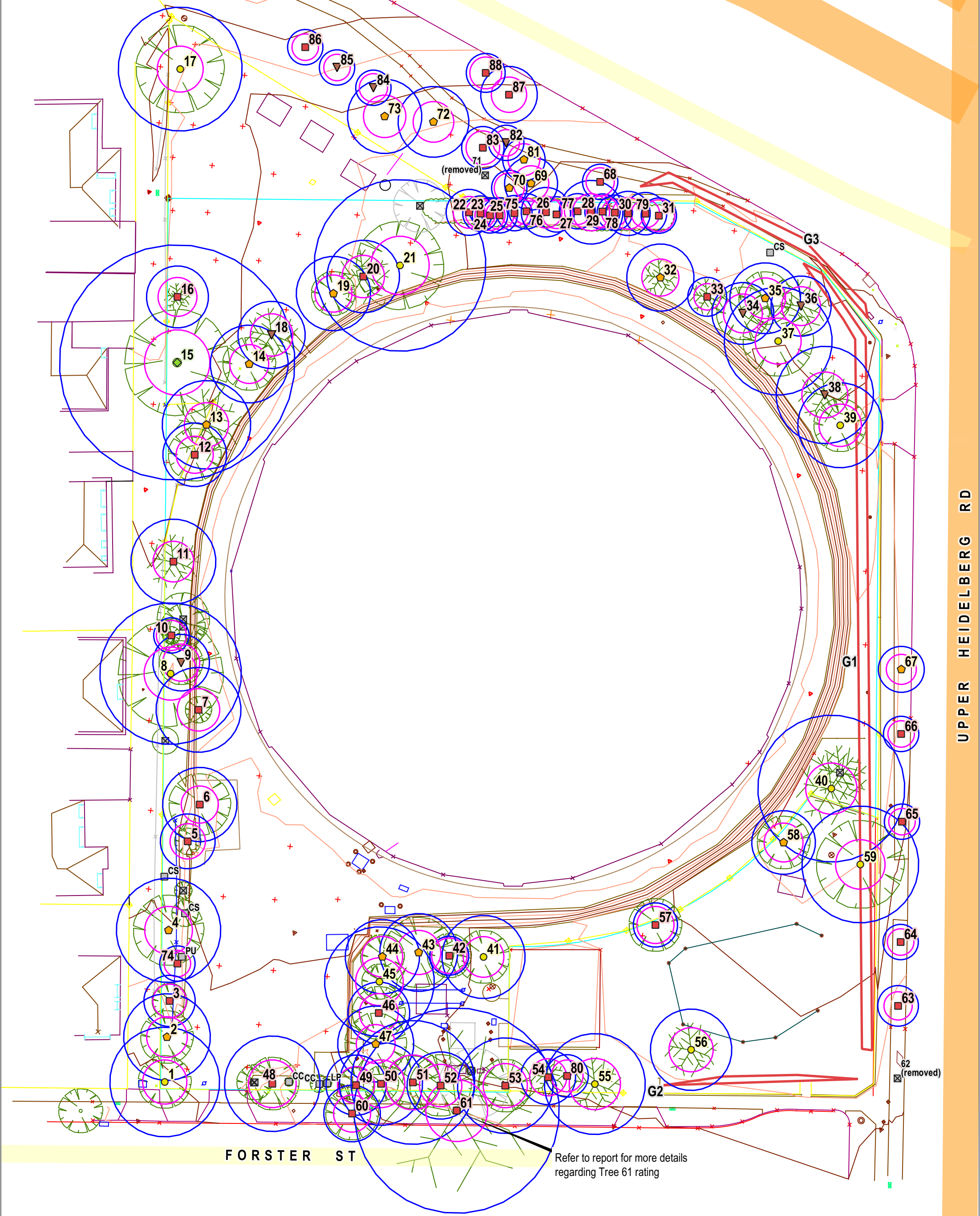
COORDINATE REFERENCE SYSTEM
EPSG:28355 | GDA 94 MGA Zone 55

0 5 10m

ABN: 95 080 021 610
TEL: 1300 656 926

TREELOGIC PTY LTD
4 / 21 Eugene Tce
Ringwood, VIC
Australia 3134

Tree logic
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APPENDIX 2B — TREE LOCATIONS AND PROTECTION ZONES (2006 Survey)

PROJECT
421 Upper Heidelberg Road, Ivanhoe

TL REF.
012133

MAP NO.
1 / 1

DATE
2022-03-16

CLIENT
Development Victoria

LEGEND

Arb. Rating

- Mod-A
- Mod-B
- Mod-C
- Low
- Very Low

Protection Zone

- TPZ
- SRZ

Tree groups

- Small trees
- Removed

label	species
CC	Cinnamomum camphorum
CS	Cotoneaster sp.
LP	Lagunaria patersonia
PU	Pittosporum undulatum

TREE LOCATION DISCLAIMER
Tree locations within main site and park based on 2006 survey, others approximate

DATA SOURCES
Feature survey : Digital Land Surveys, Ref 206055, dated 2006-04-26 (Used in previous TreeLogic report ref 007912)

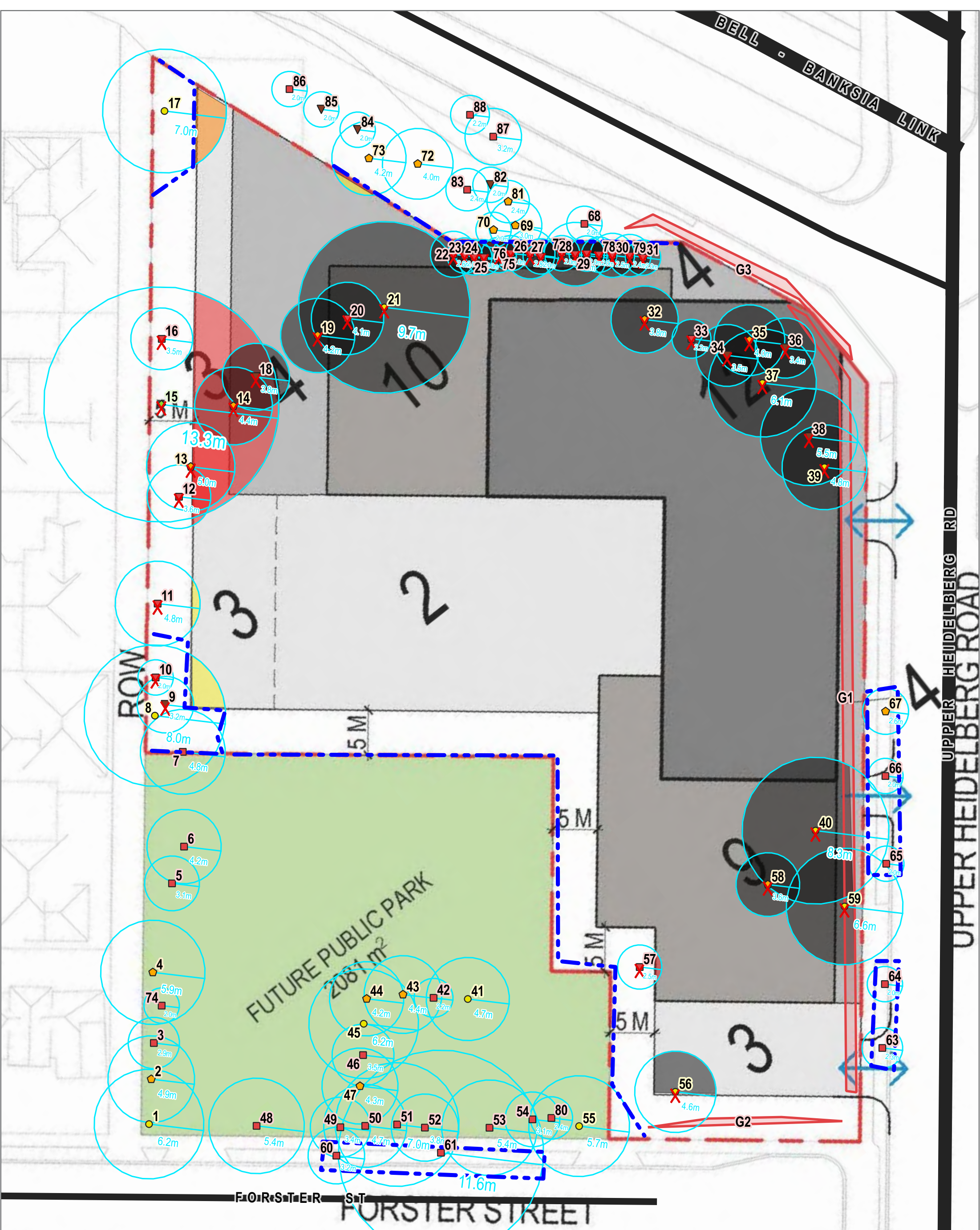
COORDINATE REFERENCE SYSTEM
EPSG:28355 | GDA 94 MGA Zone 55

0 5 10m

ABN: 95 080 021 610
TEL: 1300 656 926

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APPENDIX 2 — TREE IMPACTS & PROTECTION ZONE FENCES

PROJECT
421 Upper Heidelberg Road, Ivanhoe

TL REF.
12133

DATE
2023-09-18

MAP NO.
1 / 1

CLIENT
Development Victoria

LEGEND

Trees by Arb rating

- Mod-A
- Mod-B
- Mod-C
- Low

Groups by Arb rating

- Very Low
- Low

TPZ impacts

- TPZ (<10%)

TPZ_fence

- TPZ_major (>10%)
- SRZ (At risk)
- Within (Lost)

Tree Protection Zone Structural Root Zone

TREE LOCATION DISCLAIMER
Tree locations within main site and park based on 2006 survey, others approximate. Trees assessed 2022-03-11.

DATA SOURCES
Concept Plan: A.DA0100 (Development Plan Concept Plan), Ivanhoe Tank Site, Architectus Melbourne dated 25 July 2023

COORDINATE REFERENCE SYSTEM
EPSG:28355 | GDA 94 MGA Zone 55

0 5 10m

ABN: 95 080 021 610
TEL: 1300 656 926

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Australia 3134

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Appendix 3: Arboricultural Descriptors (February 2019)

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Note that not all of the described tree descriptors may be used in a tree assessment and report. The assessment is undertaken with regard to contemporary arboricultural practices and consists of a visual inspection of external and above-ground tree parts.

1. Tree Condition

The assessment of tree condition evaluates factors of health and structure. The descriptors of health and structure attributed to a tree evaluate the individual specimen to what could be considered typical for that species growing in its location under current climatic conditions. For example, some species can display inherently poor branching architecture, such as multiple acute branch attachments with included bark. Whilst these structural defects may technically be considered arboriculturally poor, they are typical for the species and may not constitute an increased risk of failure. These trees may be assigned a structural rating of fair-poor (rather than poor) at the discretion of the assessor.

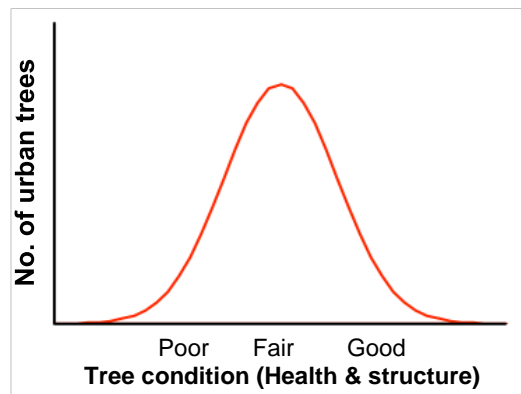


Diagram 1: Indicative normal distribution curve for tree condition

Diagram 1 provides an indicative distribution curve for tree condition to illustrate that within a normal tree population the majority of specimens are centrally located within the condition range (normal distribution curve). Furthermore, that those individual trees with an assessed condition approaching the outer ends of the spectrum occur less often.

2. Tree Name

Provides botanical name, (genus, species, variety and cultivar) according to accepted international code of taxonomic classification, and common name.

3. Tree Type

Describes the general geographic origin of the species and its type e.g. deciduous or evergreen.

Category	Description
Indigenous	Occurs naturally in the area or region of the subject site. Remnant.
Victorian native	Occurs naturally within some part of the State of Victoria (not exclusively) but is not indigenous (component of EVC benchmark). Could be planted indigenous trees.
Australian native	Occurs naturally within Australia but is not a Victorian native or indigenous
Exotic deciduous	Occurs outside of Australia and typically sheds its leaves during winter
Exotic evergreen	Occurs outside of Australia and typically holds its leaves all year round
Exotic conifer	Occurs outside of Australia and is classified as a gymnosperm
Native conifer	Occurs naturally within Australia and is classified as a gymnosperm
Native Palm	Occurs naturally within Australia. Woody monocotyledon
Exotic Palm	Occurs outside of Australia. Woody monocotyledon

4. Height and Width

Indicates height and width of the individual tree; dimensions are expressed in metres. Crown heights are measured with a height meter where possible. Due to the topography of some sites and/or the density of vegetation it may not be possible to do this for every tree. Tree heights may be estimated in line with previous height meter readings in conjunction with assessor's experience. Crown widths are generally paced (estimated) at the widest axis or can be measured on two axes and averaged. In some instances the crown width can be measured on the four cardinal direction points (North, South, East and West).

Crown height, crown spread are generally recorded to the nearest half metre (crown spread would be rounded up) for dimensions up to 10 m and the nearest whole metre for dimensions over 10 m. Estimated dimensions (e.g. for off-site or otherwise inaccessible trees where accurate data cannot be recovered) shall be clearly identified in the assessment

data.

5. Trunk diameters

The position where trunk diameters are captured may vary dependent on the requirements of the specific assessment and an individual trees specific characteristics. DBH is the typical trunk diameter captured as it relates to the allocation of tree protection distances. The basal trunk diameter assists in the allocation of a structural root zone. Some municipalities require trunk diameters be captured at different heights, with 1.0 m above grade being a common requirement. The specific planning schemes will be checked to ascertain requirements.

Stem diameters shall be recorded in centimetres, rounded to the nearest 1 cm (0.01 m).

Diameter at Breast Height (DBH)

Indicates the trunk diameter (expressed in centimetres) of an individual tree measured at 1.4m above the existing ground level or where otherwise indicated, multiple leaders are measured individually. Plants with multiple leader habit may be measured at the base. The range of methods to suit particular trunk shapes, configurations and site conditions can be seen in Appendix A of Australian Standard *AS 4970-2009 Protection of trees on development sites*. Measurements undertaken using foresters tape or builders tape.

Basal trunk diameter

The basal dimension is the trunk diameter measured at the base of the trunk or main stem(s) immediately above the root buttress. Used to ascertain the Structural Root Zone (SRZ) as outlined in AS4970.

6. Health

Assesses various attributes to describe the overall health and vitality of the tree.

Category	Vitality, Extension growth	Decline symptoms, Deadwood, Dieback	Foliage density, colour, size, intactness	Pests and or disease
Good	Above typical. Excellent. Full canopy density	Negligible	Better than typical	Negligible
Fair	Typical vitality. >80% canopy density	Minor or expected. Little or no dead wood	Typical. Minor deficiencies or defects could be present.	Minor, within damage thresholds
Fair to Poor	Below typical - low vitality	More than typical. Small sub-branch dieback	Exhibiting deficiencies. Could be thinning, or smaller	Exceeds damage thresholds
Poor	Minimal - declining	Excessive, large and/or prominent amount & size of dead wood. Significant dieback	Exhibiting severe deficiencies. Thinning foliage, generally smaller or deformed	Extreme and contributing to decline
Dead	N/A	N/A	N/A	N/A

7. Structure

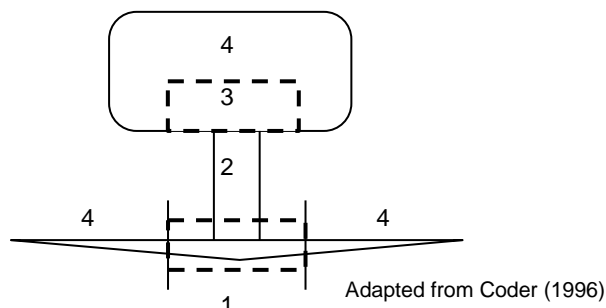
Assesses principal components of tree structure (Diagram 2).

Descriptor	Zone 1 - Root plate & lower stem	Zone 2 - Trunk	Zone 3 - Primary branch support	Zone 4 - Outer crown and roots
Good	No obvious damage, disease or decay; obvious basal flare / stable in ground	No obvious damage, disease or decay; well tapered	Well formed, attached, spaced and tapered. No history of failure.	No obvious damage, disease, decay or structural defect. No history of failure.
Fair	Minor damage or decay. Basal flare present.	Minor damage or decay	Generally, well attached, spaced and tapered branches. Minor structural deficiencies may be present or developing. No history of branch failure.	Minor damage, disease or decay; minor branch end-weight or over-extension. No history of branch failure.
Fair to Poor	Moderate damage or decay; minimal basal flare.	Moderate damage or decay; approaching recognised thresholds	Weak, decayed or with acute branch attachments; previous branch failure evidence.	Moderate damage, disease or decay; moderate branch end-weight or over-extension. Minor branch failure evident.

Poor	Major damage, disease or decay; fungal fruiting bodies present. Excessive lean placing pressure on root plate	Major damage, disease or decay; exceeds recognised thresholds; fungal fruiting bodies present. Acute lean. Stump re-sprout	Decayed, cavities or has acute branch attachments with included bark; excessive compression flaring; failure likely. Evidence of major branch failure.	Major damage, disease or decay; fungal fruiting bodies present; major branch end-weight or over-extension. Branch failure evident.
Very Poor	Excessive damage, disease or decay; unstable / loose in ground; altered exposure; failure probable	Excessive damage, disease or decay; cavities. Excessive lean. Stump re-sprout	Decayed, cavities or branch attachments with active split; failure imminent. History of major branch failure.	Excessive damage, disease or decay; excessive branch end-weight or over-extension. History of branch failure.

Diagram 2: Tree structure zones

1. Root plate & lower stem
2. Trunk
3. Primary branch support
4. Outer crown & roots



Structure ratings will also take into account general branching architecture, stem taper, live crown ratio, crown symmetry (bias or lean) and crown position such as tree being suppressed amongst more dominant trees.

The lowest or worst descriptor assigned to the tree in any column could generally be the overall rating assigned to the tree. The assessment for structure is limited to observations of external and above ground tree parts. It does not include any exploratory assessment of underground or internal tree parts unless this is requested as part of the investigation. Trees are assessed and then given a rating for a point in time. Generally, trees with a poor or very poor structure are beyond the benefit of practical arboricultural treatments.

The management of trees in the urban environment requires appropriate arboricultural input and consideration of risk. Risk potential will consider the combination of likelihood of failure and impact, including the perceived importance of the target(s).

8. Age class

Relates to the physiological stage of the tree's life cycle.

Category	Description
Young	Sapling tree and/or recently planted. Approximately 5 or less years in location.
Semi-mature	Tree increasing in size and yet to achieve expected size in situation. Primary developmental stage.
Early-mature	Tree established, generally growing vigorously. > 50% of attainable age/size.
Mature	Specimen approaching expected size in situation, with reduced incremental growth.
Over-mature	Mature full-size with a retrenching crown. Tree is senescent and in decline. Significant decay generally present.

9. Useful life expectancy

Assessment of useful life expectancy provides an indication of health and tree appropriateness and involves an estimate of how long a tree is likely to remain in the landscape based on species, stage of life (cycle), health, amenity, environmental services contribution, conflicts with adjacent infrastructure and risk to the community. It would enable tree managers to develop long-term plans for the eventual removal and replacement of existing trees in the public realm. It is not a measure of the biological life of the tree within the natural range of the species. It is more a measure of the health status and the trees positive contribution to the urban landscape.

Within an urban landscape context, particularly in relation to street trees, it could be considered a point where the costs to maintain the asset (tree) outweigh the benefits the tree is returning.

The assessment is based on the site conditions not being significantly altered and that any prescribed maintenance works are carried out (site conditions are presumed to remain relatively constant and the tree would be maintained under scheduled maintenance programs).

Useful Life Expectancy	Typical characteristics
<1 year (No remaining ULE)	Tree may be dead or mostly dead. Tree may exhibit major structural faults. Tree may be an imminent failure hazard. Excessive infrastructure damage with high risk potential that cannot be remedied.
1-5 years (Transitory, Brief)	Tree is exhibiting severe chronic decline. Crown is likely to be less than 50% typical density. Crown may be mostly epicormic growth. Dieback of large limbs is common (large deadwood may have been pruned out). Major structural defects that cannot be remedied. Tree may be over-mature and senescing. Infrastructure conflicts with heightened risk potential. Tree has outgrown site constraints.
6-10 years (Short)	Tree is exhibiting chronic decline. Crown density will be less than typical and epicormic growth is likely to present. The crown may still be mostly entire, but some dieback is likely to be evident. Dieback may include large limbs. Structural defects present that influence the tree's risk rating, amenity or vitality. Over-mature and senescing or early decline symptoms in short-lived species. Early infrastructure conflicts with potential to increase regardless of management inputs.
11-20 years (Moderate)	Tree not showing symptoms of chronic decline, but growth characteristics are likely to be reduced (bud development, extension growth etc.). Developing structural defects that reduce viability with limited scope for management. Tree may be over-mature and beginning to senesce. Potential for infrastructure conflicts regardless of management inputs.
21-40 years (Moderately long)	Trees displaying normal growth characteristics, but vitality is likely to be reduced (bud development, extension growth etc.). Structural issues relatively minor and manageable with arboricultural input. Tree may be growing in restricted environment (e.g. streetscapes) or may be in late maturity. Semi-mature and mature trees exhibiting normal growth characteristics. Juvenile trees in streetscapes.
>40 years (Long)	Generally juvenile and semi-mature trees exhibiting normal growth characteristics within adequate spaces to sustain growth, such as in parks or open space. Could also pertain to maturing, long-lived trees. No observable major structural defects. Tree well suited to the site with negligible potential for infrastructure conflicts.

Note that ULE may change for a tree dependent on the prevailing climatic conditions, sudden changes to a tree's growing environment creating an acute stress or impact by pathogens.

The ULE may not be applicable for trees that are manipulated, such as topiary, or grown for specific horticultural purposes, such as fruit trees.

There may be instances where remedial tree maintenance could extend a tree's ULE.

10. Arboricultural Rating

Relates to the combination of assigned tree condition factors, including health and structure (arboricultural merit) and ULE, and conveys an amenity value (An amenity tree can occupy a site that complements its surroundings in a useful manner which culminates in the aid, protection, comfort and emotional response of humans. Adapted from Coder, 2004). Amenity relates to the trees biological, functional and aesthetic characteristics (Hitchmough, 1994) within an urban landscape context. The presence of any serious disease or tree-related hazards that would impact risk potential are considered.

The arboricultural rating can be used by applying only the main category high, moderate, low or very low without using the sub categories. The sub-categories can assist in differentiating a trees value and/or characteristic in more detail within the specific tree assessment context, such as a development site.

Arboricultural rating	
Category	Description
High	Exemplary specimen due to multiple factors which could include; good condition and vitality, large size/canopy and prominence in the landscape. Likely to be a very long-term component in the landscape with a long ULE. Other factors that could contribute to a high rating: <ul style="list-style-type: none"> Particularly good example of the species; rare or uncommon.

	<ul style="list-style-type: none"> Tree has visual importance as a landscape feature; provides substantial contribution to landscape character. Tree may have significant ecological or conservation value. *Tree has historical, commemorative or other distinct social/cultural significance. <p>Trees in this category must be considered for retention and/or incorporated within design proposals.</p>		
Category	Description	Sub category	Description
Moderate	<p>Tree of moderate quality, in fair or typical condition. Tree may have a condition, and or structural problem that will respond to arboricultural treatment.</p> <p>These trees have the potential to be moderate- to long-term components of the landscape (moderate to long ULE) if managed appropriately.</p> <p>The sub-categories relate predominately to age, size and amenity.</p> <p>Trees in this category should be considered for retention and/or incorporated within design proposals.</p>	A	Moderate to large, maturing tree. Suited to the site & contributes to the landscape character. Tree may have conservation or other cultural/social value.
		B	Moderate sized, established tree, > 50% of attainable age/size. Suited to the site & contributes to the landscape character (other attributes covered under 'Moderate' description)
		C	<ul style="list-style-type: none"> Young to semi-mature, generally a smaller tree, established, >15 cm DBH, >5 years in the location. Not a dominant canopy. No significant qualities currently but has the potential to become a higher value tree & long-term component of the landscape. Replacement of tree is likely to take up to 6 - 10 years to attain similar attributes. Semi- to mature tree with accumulating deficiencies and reducing ULE, trending towards Low arboricultural value.
Category	Description		
Low	<p>Unremarkable tree of low quality or little amenity value. Tree in either poor health and/or with poor structure. Short to transitory useful life expectancy (<10 years).</p> <ul style="list-style-type: none"> Tree is not prominent in the landscape due to its size or age, such as young trees with a stem diameter below 15 cm. Tree < 5 years in location. These trees are easily replaceable or capable of being transplanted. Tree (species) is functionally inappropriate to the specific location. Is causing excessive damage/nuisance to adjacent infrastructure or would be expected to be problematic if retained (i.e. palm tree under power lines). Unremarkable tree of no material landscape, conservation or other cultural value. Not visible from surrounding landscapes. Tree infected with pathogens that could lead to its decline. Tree has potential to be an environmental woody weed (may be dependent on location of tree in an urban landscape). Tree impacting or suppressing trees of better quality. <p>Retention of such trees may be considered if not requiring a disproportionate expenditure of resources for a tree in its condition and location.</p>		
Category	Description		
Very low	<p>Trees of low quality with a brief to no remaining ULE (<5 years).</p> <ul style="list-style-type: none"> Tree has either a severe structural defect or health problem or combination that cannot be sustained with practical arboricultural techniques and the loss of the tree or tree part would be expected in the short term. Tree whose retention would not be viable after the removal of adjacent trees, such as trees that have developed in close spaced groups and would not be expected to adapt to severe and sudden alterations to environmental & site conditions, e.g. removal of adjacent shelter trees. Small or young tree, <5m in height, <10cm DBH. Easily replaced in short-term or capable of being transplanted. Acknowledged environmental woody weed species. Tree has a detrimental effect on the environment, for example, the tree has weed potential and is likely to spread into waterways or natural areas if nearby. Tree infected with pathogens that will lead to decline and has potential to spread to adjacent trees. Tree is dead (dead tree may offer habitat values) or is showing signs of significant, immediate, and irreversible overall decline. <p>Tree cannot realistically be retained and should be considered for removal.</p>		

Other considerations - Even though a tree may be declining or dead, a tree could be retained for other purposes such as habitat or soil stabilisation. These trees would still need to be managed appropriately to reduce risk.

*A tree may have (attract) a high value by the community for historical, commemorative or other distinct social/cultural significance factors, albeit the tree may not be in good condition. In the context of an assessment, for multiple reasons,

but more so for development, if it is a noted 'significant' tree it should receive higher consideration during the planning process.

Trees have many values, not all of which are considered when an arboricultural assessment is undertaken. However, individual trees or tree group features may be considered important community resources because of unique or noteworthy characteristics or values other than their age, dimensions, health or structural condition. Recognition of one or more of the following criteria is designed to highlight other considerations that may influence the future management of such trees.

Significance	Description
Horticultural Value/ Rarity	Outstanding horticultural or genetic value; could be an important source of propagating stock, including specimens that are particularly resistant to disease or exposure. Any tree of a species or variety that is rare.
Historic, Aboriginal Cultural or Heritage Value	Tree could have value as a remnant of a particular important historical period or a remnant of a site or activity no longer in action. Tree has a recognised association with historic aboriginal activities, including scar trees. Tree commemorates a particular occasion, including plantings by notable people, or having associations with an important event in local history.
Ecological Value	Tree could have value as habitat for indigenous wildlife, including providing breeding, foraging or roosting habitat, or is a component of a wildlife reserve. Remnant Indigenous vegetation that contribute to biological diversity

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Appendix 4: Tree Protection Zones

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1. Introduction

To sustain trees on a development site, consideration must be given to the establishment of tree protection zones.

The physical dimensions of tree protection zones can sometimes be difficult to define. The projection of a tree's crown can provide a guide but is by no means the definitive measure. The unpredictable nature of roots and their growth, differences between species and their tolerances, and observable and hidden changes to the trees growing environment, because of development, are variables that must be considered.

Most vigorous, broad canopied trees survive well if the area within the drip-line of the canopy is protected. Fine root density is usually greater beneath the canopy than beyond (Gilman, 1997). If few to no roots over 3cm in diameter are encountered and severed during excavation the tree will probably tolerate the impact and root loss. A healthy tree can sustain a loss of between 30% and 50% of absorbing roots (Harris, Clark, Matheny, 1999), however encroachment into the structural root system of a tree may be problematic.

The structural root system of a tree is responsible for ensuring the stability of the entire tree structure in the ground. A tree could not sustain loss of structural root system and be expected to survive let alone stand up to average annual wind loads upon the crown.

2. Allocation of tree protection zone (TPZ)

The most important consideration for the successful retention of trees is to allow appropriate above and below ground space for the trees to continue to grow. This requires the allocation of tree protection zones for retained trees.

The method of allocating a TPZ to a tree will be influenced by site factors, the tree species, its age, and developed form.

Once it has been established, through an arboricultural assessment, which trees and tree groups are to be retained, the next step will require careful management through the development process to minimise any impacts on the designated trees. The successful retention of trees on any particular site will require the commitment and understanding of all parties involved in the development process.

The most important activity, after determining the trees that will be retained, is the implementation of a TPZ.

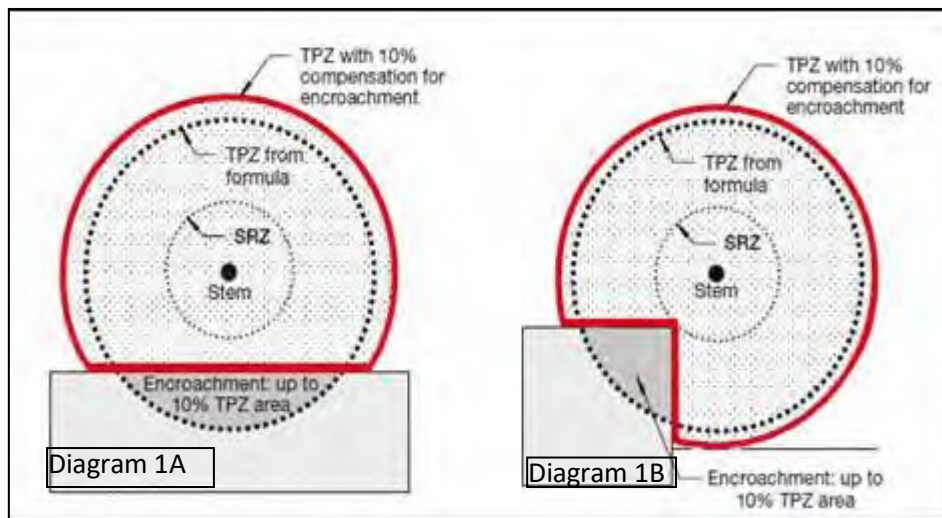
The intention of tree protection zones is to:

- mitigate tree hazards;
- provide adequate root space to sustain the health and aesthetics of the tree into the future;
- minimise changes to the trees growing environment, which is particularly important for mature specimens;
- minimise physical damage to the root system, canopy and trunk; and
- define the physical alignment of the tree protection fencing

The Australian Standard AS 4970-2009 Protection of trees on development sites has been used as a guide in the allocation of TPZs for the assessed trees. The TPZ for individual trees is calculated based on trunk (stem) diameter (DBH), measured at 1.4 metres up from ground level. The radius of the TPZ is calculated by multiplying the trees DBH by 12. The method provides a TPZ that addresses both the stability and growing requirements of a tree. TPZ distances are measured as a radius from the centre of the trunk at (or near) ground level. The minimum TPZ should be no less than 2m and the maximum no more than 15m radius. The TPZ of palms should be not less than 1.0m outside the crown projection.

Encroachment into the TPZ is permissible under certain circumstances though is dependent on both site

conditions and tree characteristics. Minor encroachment, up to 10% of the TPZ, is generally permissible provided encroachment is compensated for by recruitment of an equal area contiguous with the TPZ. Examples are provided in Diagram 1. Encroachment greater than 10% is considered major encroachment under AS4970-2009 and is only permissible if it can be demonstrated that after such encroachment the tree would remain viable.



○ Diagram 1: Examples of minor encroachment into a TPZ. (Extract from: AS4970-2009, Appendix D, p30 of 32)

The 10% encroachment on one side equates to approximately $\frac{1}{3}$ radial distance. Tree root growth is opportunistic and occurs where the essentials to life (primarily air and water) are present.

Heterogeneous soil conditions, existing barriers, hard surfaces and buildings may have inhibited the development of a symmetrically radiating root system.

Existing infrastructure around some trees may be within the TPZ or root plate radius. The roots of some trees may have grown in response to the site conditions and therefore if existing hard surfaces and building alignments are utilised in new designs the impacts on the trees should be minimal. The most reliable way to estimate root disturbance is to find out where the roots are in relation to the demolition, excavation or construction works that will take place (Matheny & Clark, 1998). Exploratory excavation prior to commencement of construction can help establish the extent of the root system and where it may be appropriate to excavate or build.

The TPZ should also consider the canopy and overall form of the tree. If the canopy requires severe pruning to accommodate a building or other works and in the process the form of the tree is diminished it may be worthwhile considering altering the design or removing the tree.

3. General tree protection guidelines

The most important factors are:

- Prior to construction works the trees nominated for tree works should be pruned to remove larger dead wood. Pruning works may also identify other tree hazards that require remedial works.
- Installation of tree protection fencing. Once the tree protection zones have been determined the next step is to mulch the zone with woodchip and erect tree protection fencing. This must be completed prior to any materials being brought on-site, erection of temporary site facilities or demolition/earth works. The protection fencing must be sturdy and withstand winds and construction impacts. The protection fence should only be moved with approval of the site supervisor. Other root zone protection methods can be incorporated if the TPZ area needs to be traversed.
- Appropriate signage is to be fixed to the fencing to alert people as to importance of the tree protection zone.
- The importance of tree preservation must be communicated to all relevant parties involved with the site.
- Inspection of trees during excavation works.

4. Exploratory excavation

The most reliable way to estimate root disturbance is to find out where the roots are in relation to the demolition, excavation or construction works that will take place (Matheny & Clark, 1998).

Exploratory excavation prior to commencement of construction can help establish the extent of the root system and where it may be appropriate to excavate or build. This also allows management decisions to be made and allows time for redesign works if required.

Any exploratory excavation within the allocated TPZ is to be undertaken with due care of the roots. Minor exploration is possible with hand tools. More extensive exploration may require the use of high pressure water or air excavation techniques. Either hydraulic or pneumatic excavation techniques will safely expose tree roots; both have specific benefits dependent on the situation and soil type. An arborist is to be consulted on which system is best suited for the site conditions.

Substantial roots are to be exposed and left intact.

Once roots are exposed decisions can be made regarding the management of the tree. Decisions will be dependent on the tree species, its condition, its age, its relative tolerance to root loss, and the amount of root system exposed and requiring pruning.

Other alternative measures to encroaching the TPZ may include boring or tunnelling.

5. How to determine the diameter of a substantial root

The size of a substantial root will vary according to the distance of the exposed root to the trunk of the tree. The further away from the trunk of a tree that a root is, the less significant the root is likely to be to the tree's health and stability.

The determination of what is a substantial root is often difficult because the form, depth and spread of roots will vary between species and sites. However, because smaller roots are connected to larger roots in a framework, there can be no doubt that if larger roots are severed, the smaller roots attached to them will die. Therefore, the larger the root, the more significant it may be.

Gilman (1997) suggests that trees may contain 4-11 major lateral roots and that the five largest lateral roots account (act as a conduit) for 75% of the total root system. These large lateral roots quickly taper within a distance to the tree, this distance is identified as the Structural Root Zone (SRZ). Within the SRZ distance, all roots and the soil surrounding the roots are deemed significant.

6. No root or soil disturbance is permitted within the SRZ

In the area outside the SRZ the tree may tolerate the loss of one or a number of roots. The table below indicates the size of tree roots, outside the SRZ that would be deemed substantial for various tree heights. The assessment of combined root loss within the TPZ would need to be undertaken by an arborist on an individual basis because the location of the tree, its condition and environment would need to be assessed

- Table 1: Estimated significant root sizes outside SRZ

Height of tree	Diameter of root	Height of tree	Diameter of root
Less than 5m	≥ 30mm	Less than 5m	≥ 30mm
Between 5m - 15m	≥ 50mm	Between 5m - 15m	≥ 50mm
More than 15m	≥ 70mm	More than 15m	≥ 70mm

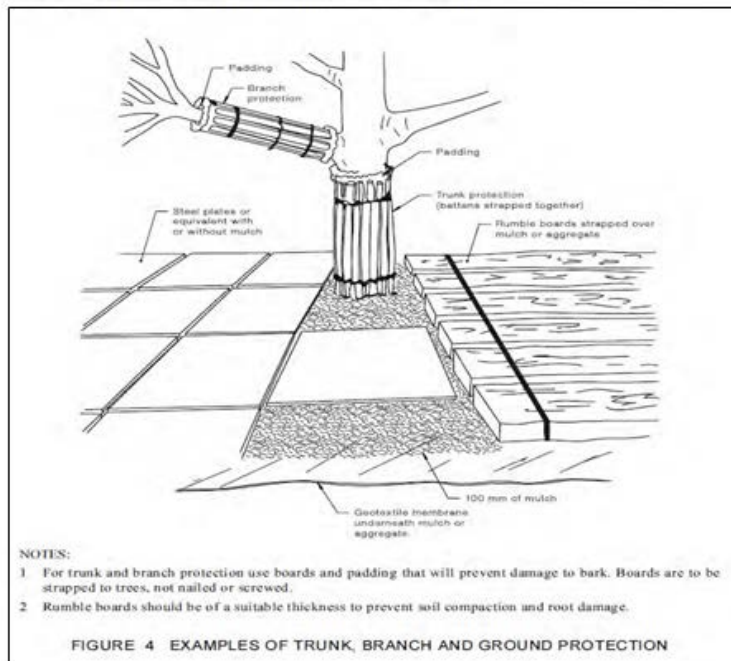
7. Ground buffering

Where works are required to be undertaken within the tree root zone, surface, ground buffering and trunk and limb protection must be provided to minimise the potential for soil to become compacted and avoid potential for impact wounds to occur to surface roots, trunk or limbs. Refer below.

4.5.3 Ground protection

If temporary access for machinery is required within the TPZ ground protection measures will be required. The purpose of ground protection is to prevent root damage and soil compaction within the TPZ. Measures may include a permeable membrane such as geotextile fabric beneath a layer of mulch or crushed rock below rumble boards as per Figure 4.

These measures may be applied to root zones beyond the TPZ.



- Diagram 2: Examples of ground buffering and trunk and limb protection

(Extract from: AS4970-2009, Appendix D, pg17)

Construction Guidelines

The following are guidelines that must be implemented to minimise the impact of the proposed construction works on the retained trees.

- The Tree Protection Zone (TPZ) is fenced and clearly marked at all times. The actual fence specifications should be a minimum of 1.2 - 1.5 metres of chain mesh or like fence with 1.8 meter posts (e.g. treated pine or star pickets) or like support every 3-4 metres and a top line of high visibility plastic hazard tape. The posts should be strong enough to sustain knocks from on site excavation equipment. This fence will deter the placement of building materials, entry of heavy equipment and vehicles and also the entry of workers and/or the public into the TPZ. Note: There are many different variations on the construction type and material used for TPZ fences, suffice to say that the fence should satisfy the responsible authority.
- Contractors and site workers should receive written and verbal instruction as to the importance of tree protection and preservation within the site. Successful tree preservation occurs when there is a commitment from all relevant parties involved in designing, constructing and managing a development project. Members of the project team need to interact with each other to minimise the impacts to the trees, either through design decisions or construction practices. The importance of tree preservation must be communicated to all relevant parties involved with the site.
- The consultant arborist is on-site to supervise excavation works around the existing trees where the TPZ will be encroached.
- A layer of organic mulch (woodchips) to a depth of no more than 100mm should be placed over the root systems within the TPZ of trees, which are to be retained so as to assist with moisture retention and to reduce the impact of compaction.
- No persons, vehicles or machinery to enter the TPZ without the consent of the consulting arborist or site manager.
- Where machinery is required to operate inside the TPZ it must be a small skid drive machine (i.e. Dingo or similar) operating only forwards and backwards in a radial direction facing the tree trunk and not altering direction whilst inside the TPZ to avoid damaging, compacting or scuffing the roots.
- Any underground service installations within the allocated TPZ should be bored and utility authorities should common trench where possible.
- No fuel, oil dumps or chemicals shall be allowed in or stored on the TPZ and the servicing and re-fuelling of equipment and vehicles should be carried out away from the root zones.
- No storage of material, equipment or temporary building should take place over the root zone of any tree.
- Nothing whatsoever should be attached to any tree including temporary services wires, nails, screws or any other fixing device.
- Supplementary watering should be provided to all trees through any dry periods during and after the construction process. Proper watering is the most important maintenance task in terms of successfully retaining the designated trees. The areas under the canopy drip lines should be mulched with woodchip to a depth of no more than 100mm. The mulch will help maintain soil moisture levels. Testing with a soil probe in a number of locations around the tree will help ascertain soil moisture levels and requirements to irrigate. Water needs to be applied slowly to avoid runoff. A daily watering with 5 litres of water for every 30 mm of trunk calliper may provide the most even soil moisture level for roots (Watson & Himelick, 1997), however light frequent irrigations should be avoided. Irrigation should wet the entire root zone and be allowed to dry out prior to another application. Watering should continue from October until April.

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There can be no guarantees provided for on-going tree safety. It should be noted that not all of the potential structural concerns associated with trees can be eliminated and that there will always be a residual risk following any mitigation works. Also, not all tree defects are observable and extreme weather events are unpredictable. Since trees are complex, living organisms, it is difficult to quantify and precisely measure all variables when inspecting a standing tree for hazard.

Trees should be reassessed on a regular basis; the scheduled period of reassessment will be dependent on the characteristics of the tree, the landscape context and perceived targets, and resources available to maintain them.