



Rev: 3rd May 2021

27th November 2020

Department of Human Services

50 Lonsdale Street,

Melbourne,

Victoria 3000



BOROONDARA
City of Harmony

Received

29/6/2021

RE: Bills Street, Hawthorn – Arboriculture Assessment

Brief

I was initially contacted by you and asked to provide a details arboriculture assessment of the trees to this property, following a previous arborist report prepared by this company, and the demolition and removal of the buildings and paving to the site. Following this initial revision of the report, I have since been engaged to assess a range of trees to council land that maybe impacted by a future stage of the proposal.

Method

The trees were inspected visually; as per Australian standard 4970 – Protection of Trees on Development Sites (AS 4970), as required to facilitate this report. Heights and canopy spreads estimated, Diameter at Breast Height (DBH) and Diameter at Buttress (DAB) measured within subject site only, unless neighbouring trees are accessible; otherwise their DBH and DAB are estimated. No root excavations were carried out and images were taken as required.

Date Visited –10th November 2020.

The Site

The site is two recently cleared areas, that formally had several smaller residence a larger multistorey housing complex, and interconnecting paths and infrastructure. The site slopes down from the north-eastern to the south-west, with a large retaining wall along the northern boundary Through the middle of the site runs Bills street with Robinson Road to the west and Auburn road to the east. Following a review of planning overlays on planning.vic.gov.au it appears there are no planning overlays affecting the removal of vegetation from the site. As the site is within Boroondara City Council the Local Law applies to vegetation on the site. Under the Local Law:

A person must not without a Permit:

- (a) remove, Prune, Damage, kill or destroy or direct, authorise, or allow to be removed, Pruned, Damaged, killed or destroyed a Significant Tree.*
- (b) carry out, or direct, authorise or allow to be carried out, any Works within the Tree Protection Zone of a Significant Tree.*
- (c) remove, Damage, kill or destroy or direct, authorise, or allow to be removed, Damaged, killed or destroyed a Canopy Tree.*
- (d) carry out, or direct, authorise or allow to be carried out any Works within the Structural Root Zone of a Canopy Tree.*



(e) remove, Damage, kill or destroy or direct, authorise, or allow to be removed, Damaged, killed or destroyed a tree required to be planted as a condition of a Permit.

"Canopy Tree" means any tree:

- (a) with a total trunk circumference of 110cm or more measured at a point 1.5 metres along the trunk's length from the closest point above ground level; or
- (b) if multi-stemmed, with a total trunk circumference of all its trunks of 110cm or more measured at a point 1.5 metres along the trunks' lengths from the closest point above ground level; or
- (c) with a trunk circumference of 150cm or more measured at ground level.

A "Significant Tree" is:

A tree listed in Council's Significant Tree Study.

As such no vegetation should be removed from the site unless approved by the relevant authority.

Overview

Trees to the site represent a range of mature to over-mature native and exotic species, with some semi-mature environmental weeds present across the site.

Several trees are of a high retention value, with Tree 20 of the highest retention value, providing significant amenity to the site, and of horticultural significance as a species uncommon in cultivation, compared to other oak species.

To the other end of the spectrum there are a range of environmental weeds and species that have self sown that are recommended for removal, with several less significant trees that should not be considered a constraint on the development process.

Across the site there are three potentially hazardous Trees, being Tree 17, 30 and 36. All three are discussed further under *Hazardous Trees* and are recommended for removal.

Works Schedule

Scope of Works

Time frame of Works

Works are to be carried out as follows:

- Immediately – Works must be carried out within the next day or week, with the area to be cordoned off, and restricted, due to the significant risk posed to the general public from the trees potential to fail, or the likelihood of spreading highly infectious pests and diseases. Examples include any works required on a tree deemed hazardous.
- 1 week – 1 month – Works must be prioritized over other projects, completing them in full as soon as possible. Where works cannot be attended to within this time frame the fall zone of the affected tree must be cordoned off and access restricted. Examples include irrigating and mitigation works around drought affected trees.
- 1 month – 6 months – Works are required and must be carried out within the maximum time frame. Examples include coppicing old growth form suitable Lignotuberous Trees.



- 6 months – 1 year – Works are not considered urgent and can be taken within a reasonable time frame. Examples include the annual mulching and irrigation of trees at risk from the extreme heat and prolonged dry periods.
- Indefinite: no action is required, and works can be taking out when and if time is available.

Cycle of works

Some works will need to be carried out at regular intervals to ensure recommended works are achieving the required outcomes. Cycles include:

- One-off works – Major works that will only need to occur once, such as the removal of a tree.
- 10-15 Years – Works such as coppicing appropriate Lignotuberous trees will only need to be carried out within this time frame.
- 5 – 10 years – Works that will have a significant impact on tree and will only need occasional revision, such as weight reduction works and canopy lifting.
- 1- 5 years – works need to be carried on a regular basis to reduce the risk of minor failures occurring such as removal of hangers and mulching around trees.
- 6month – 1 year – Regular works that need to be carried out annually at a minimum, such as reducing epicormics and suckers of mature trees.
- 0 – 6months – General maintenance works that are generally going to be required within 6months, such a irrigation of drought sensitive historic trees.

Checks and Review Points.

At the end of each stage of proposed works, all trees assessed should be inspected, by a suitably qualified arborist who is to make recommendations on any modifications to schedule of work.

Specification of Works



All tree pruning works to be conducted by a minimum Cert 3 qualified arborist, and to AS-4737, making pruning cuts at a right angle to the bark ridge line, ensuring a clear cut using sharp sterilized pruning equipment.

Tree removal works should be carried out prior to any other development works taking place on the site.




Works Required.

Following is a list of all trees assessed, the required works, time frame for implementation and re-occurrence of works.

| Tree 01 – <i>Melaleuca nesophila</i> – Showy Honey Myrtle | | | |
|---|---|--------------------|----------------|
|  | Works Required | Timeframe of Works | Cycle of Works |
| | Removal – Lacks vigor, and unlikely to recover. | 1month – 6months | One off |
| Tree 02 – <i>Platanus orientalis</i> – Cut Leaf Plane tree | | | |
|  | Works Required | Timeframe of Works | Cycle of Works |
| | N/A – Council Tree | - | - |



Tree 03 – *Platanus orientalis* – Cut Leaf Plane tree

|  | Works Required | Timeframe of Works | Cycle of Works |
|--|----------------|--------------------|----------------|
| | Canopy Lifting | 6month – 1years | One off |

Tree 04 – *Liquidambar styraciflua* – Sweet Gum

|  | Works Required | Timeframe of Works | Cycle of Works |
|---|---|--------------------|----------------|
| | Removal – Lacks vigor, and unlikely to recover. | 1month – 6months | One off |

Tree 05 – *Lophostemon confertus* - Brush Box

|  | Works Required | Timeframe of Works | Cycle of Works |
|--|--|--------------------|----------------|
| | Canopy Lifting | 6month – 1years | One off |
| | Dead wooding of minor branches from canopy | 1month – 6months | 1 – 5 years |

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Tree 05a – *Citrus limon* – Lemon tree



| Works Required | Timeframe of Works | Cycle of Works |
|---|--------------------|----------------|
| Removal – Lacks vigor, and unlikely to recover. | 1month – 6months | One off |

Tree 06 – *Waterhousia floribunda* – Weeping Lily Pily



| Works Required | Timeframe of Works | Cycle of Works |
|--------------------|--------------------|----------------|
| N/A – Council Tree | 6month – 1years | One off |

Tree 07 - 11 – *Causurina cunninghamiana* – River Sheoak




| Works Required | Timeframe of Works | Cycle of Works |
|----------------------------------|--------------------|----------------|
| To be removed for proposed works | 1 week – 1month | One off |




Tree 12 – *Lophostemon confertus* - Brush Box

|  | Works Required | Timeframe of Works | Cycle of Works |
|--|----------------------------------|--------------------|----------------|
| | To be removed for proposed works | 1 week – 1month | One off |

Tree 13 – *Lophostemon confertus* – Brush Box

|  | Works Required | Timeframe of Works | Cycle of Works |
|---|----------------------------------|--------------------|----------------|
| | To be removed for proposed works | 1 week – 1month | One off |

Tree 14 – *Lophostemon confertus* – Brush Box


|  | Works Required | Timeframe of Works | Cycle of Works |
|--|----------------------------------|--------------------|----------------|
| | To be removed for proposed works | 1 week – 1month | One off |

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Tree 14a – *Fraxinus angustifolia subsp. angustifolia* – Desert Ash

|  | Works Required | Timeframe of Works | Cycle of Works |
|--|---------------------------------|--------------------|----------------|
| | Removal – Environmental Weed | 1month – 6months | One Off |

Tree 14b – *Ligustrum lucidum*– Brush Box

|  | Works Required | Timeframe of Works | Cycle of Works |
|---|---------------------------------|--------------------|----------------|
| | Removal – Environmental Weed | 1month – 6months | One Off |

Tree 15 – *Salix humboldtiana* – Chilean Willow

|  | Works Required | Timeframe of Works | Cycle of Works |
|--|---------------------------------|--------------------|----------------|
| | Removal – Environmental Weed | 1month – 6months | One Off |

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Tree 15a – *Pittosporum tenuifolium*– Hedge Pittosporum

|  | Works Required | Timeframe of Works | Cycle of Works |
|--|--------------------|--------------------|----------------|
| | N/A – Neighbouring | - | - |

Tree 16 – *Schefflera actinophylla* – Umbrella Tree

|  | Works Required | Timeframe of Works | Cycle of Works |
|---|----------------|--------------------|----------------|
| | None Required | - | - |

Tree 16a – *Fraxinus angustifolia subsp. angustifolia* – Desert Ash

|  | Works Required | Timeframe of Works | Cycle of Works |
|--|-------------------------|--------------------|------------------|
| | Seed Removal | 1 – 6months | 6months – 1 year |
| | Works Required | Timeframe of Works | Cycle of Works |
| | Canopy Weight Reduction | 6months – 1 year | 5 -10 years |



Tree 17 – *Agonis flexuosa*– Willow Myrtle

|  | Works Required | Timeframe of Works | Cycle of Works |
|--|---------------------|--------------------|----------------|
| | Removal – Hazardous | 1 week – 1month | One Off |

Tree 17a – *Ligustrum lucidum* – Glossy Privet


|  | Works Required | Timeframe of Works | Cycle of Works |
|---|--------------------------------|--------------------|----------------|
| | None Required – Neighboring | - | - |

Tree 18 & 19 – *Eucalyptus viminalis* – Manna Gum

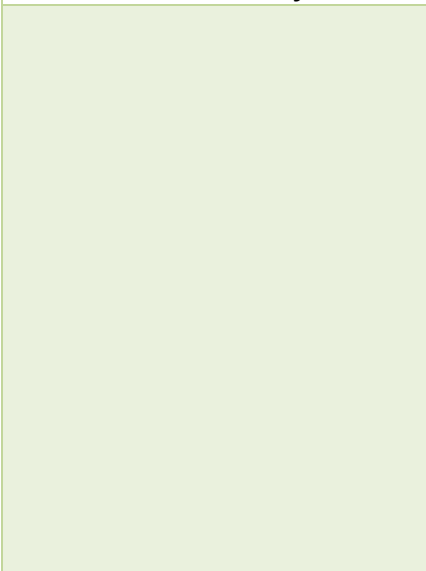
| | Works Required | Timeframe of Works | Cycle of Works |
|--|----------------|--------------------|----------------|
| | N/A – Removed | - | - |



Tree 20 – *Quercus macrocarpa* – Burr Oak

|  | Works Required | Timeframe of Works | Cycle of Works |
|--|--|--------------------|----------------|
| | Canopy Weight Reduction | 6months – 1 year | 5 -10 years |
| | Dead wooding of minor stems and branches from extent of canopy | 1month – 6months | 1 – 5 years. |

Tree 21 – *Prunus cerasifera* - Cherry Plum

|  | Works Required | Timeframe of Works | Cycle of Works |
|---|----------------|--------------------|----------------|
| | N/A – Removed | - | - |

Tree 22 – *Ligustrum lucidum* – Glossy Privet


|  | Works Required | Timeframe of Works | Cycle of Works |
|--|----------------|--------------------|----------------|
| | Removal – Weed | 1month – 6months | One Off |




Tree 22a – *Fraxinus angustifolia subsp. angustifolia* – Desert Ash

|  | Works Required | Timeframe of Works | Cycle of Works |
|--|----------------|--------------------|----------------|
| | Removal – Weed | 1month – 6months | One Off |

Tree 23 – *Cupressus sempriverens* – Pencil Pine

|  | Works Required | Timeframe of Works | Cycle of Works |
|---|---|--------------------|----------------|
| | N/A – No works required. | - | - |
| | Consider Removal, as low retention tree, not worthy of being a constraint for future development. | 6 months – 1 year | One Off |

Tree 24 – *Callistemon salignus* – Willow Bottlebrush

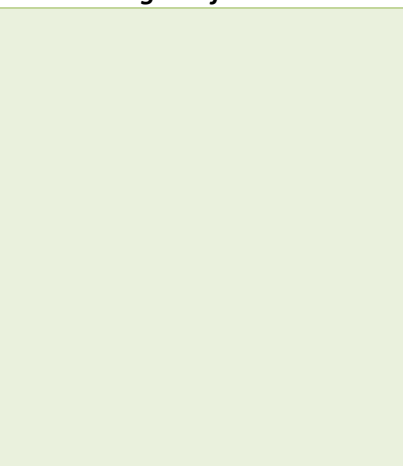
|  | Works Required | Timeframe of Works | Cycle of Works |
|--|---|--------------------|----------------|
| | N/A – No works required. | - | - |
| | Consider Removal, as low retention tree, not worthy of being a constraint for future development. | 6 months – 1 year | One Off |




Tree 25 – *Fraxinus angustifolia* subsp. *angustifolia* – Desert Ash

|  | Works Required | Timeframe of Works | Cycle of Works |
|--|-------------------|--------------------|----------------|
| | N/A – Neighboring | - | - |

Tree 26 – *Agonis flexuosa* – Willow Myrtle


|  | Works Required | Timeframe of Works | Cycle of Works |
|---|----------------|--------------------|----------------|
| | N/A – Removed | - | - |

Tree 27 – *Fraxinus excelsior* ‘Aurea’ – Golden Ash

|  | Works Required | Timeframe of Works | Cycle of Works |
|--|---|--------------------|----------------|
| | Formative Pruning to reduce over elongated branches, and Canopy Reduction works to reduce weight of canopy. | 1 – 6 months | One off |
| | Dead wooding | 1 – 6months | 1 – 5 years |




Tree 28 – *Eriobotrya japonica* – Loquat

|  | Works Required | Timeframe of Works | Cycle of Works |
|--|---|--------------------|----------------|
| | N/A – No works required. | - | - |
| | Consider Removal, as low retention tree, not worthy of being a constraint for future development. | 6 months – 1 year | One Off |

Tree 29 – *Grevillea robusta* – Silky Oak


|  | Works Required | Timeframe of Works | Cycle of Works |
|---|--------------------|--------------------|----------------|
| | N/A – Neighbouring | - | - |

Tree 30 – *Eucalyptus botryoides* – Southern Swamp Mahogany

|  | Works Required | Timeframe of Works | Cycle of Works |
|--|--|--------------------|----------------|
| | Removal – Hazardous. Refer Hazardous Tree | 1 week – 1 month | One Off |



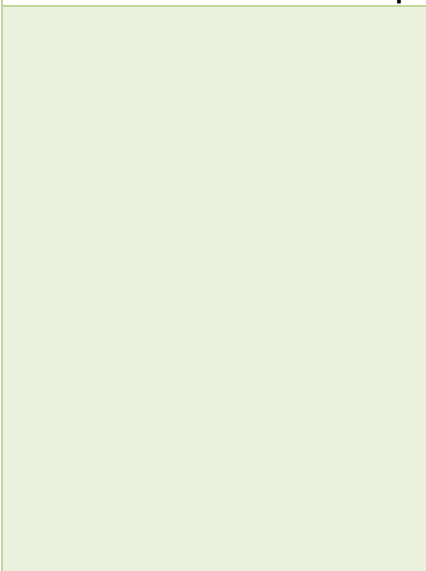
Tree 31 – *Acer campestre* – Hedge Maple

|  | Works Required | Timeframe of Works | Cycle of Works |
|--|---|--------------------|----------------|
| | Formative Pruning to reduce over elongated branches, and Canopy Reduction works to reduce weight of canopy. | 1 – 6 months | One off |
| | Dead wooding | 1 – 6months | 1 – 5 years |

Tree 32 – 34 – *Lophostemon confertus* – Brush Box

|  | Works Required | Timeframe of Works | Cycle of Works |
|---|----------------|--------------------|----------------|
| | N/A – Council | - | - |
| | | | |

Tree 35 – *Prunus armeniaca* - Apricot


|  | Works Required | Timeframe of Works | Cycle of Works |
|--|----------------|--------------------|----------------|
| | N/A – Removed | - | - |
| | | | |



Tree 36 – *Agonis flexuosa* – Willow Myrtle

|  | Works Required | Timeframe of Works | Cycle of Works |
|--|--|--------------------|----------------|
| | Removal – Hazardous. Refer Hazardous Tree | 1 week – 1 month | One Off |

Tree 37 – *Ulmus procera* – English Elm

|  | Works Required | Timeframe of Works | Cycle of Works |
|---|--------------------|--------------------|----------------|
| | N/A – Council Tree | - | - |



Hazardous Trees

The following trees are deemed hazardous and require removal. Following is a discussion on why each tree is defined as hazardous.

Tree 17



Tree 17 is a Willow Myrtle to the southern side of Bills Street to the centre of the site. It is over mature and in the early stages of senescence. It has a several over elongated branches, with epicormic branches close to the branch unions, indicated the branch is under stress and likely to fail. The main trunk seemingly developed under torsional loading and has partially split with a large open and partially decayed cavity present to its centre. This structural presentation cannot be easily remediated and poses some risk to pedestrians and vehicles along Bills Street. It is recommended for removal, in a time frame of 1 week to 1month.

Tree 30



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Tree 30 is a young Southern Swamp Mahogany to the northern boundary, growing between the existing stone retaining wall and neighbouring concrete retaining wall. As a vigorous fast-growing species capable of reaching 20 meters + in height it cannot be safely retained in its current location. Its root system is already cracking and displacing rock work around its base and is likely to fail in the near future. If this were to occur it is likely to have a significant impact on the structural integrity of the stone retaining wall. Whilst the site is currently secure it poses a low risk, however if retained and a proposal proceeds the longer it remains the greater the level of risk posed, as aside from its location it is a healthy tree, that appears likely to only fail from base, particularly during strong winds and or storms.

Tree 36



Tree 36 is a Willow Myrtle of a similar age and condition to Tree 17. It is located to the south of the site, just north of the existing carpark. Whilst its overall condition is average, the structure of its trunk and main branches is of concern. There has been previous pruning works that have left a large open pruning wound that has actively decayed. When viewing the branch it is clear that a fungal pathogen has developed, with a yellow discoloration to the wood and several woody bracts present. When tapped with a solid object the wood running down from this point has a hollow resonance and is likely part of extensive decay. The location of this decay indicates that secondary branches are likely to fail as the connective tissue holding them to the main trunk continues to decay. If this was to occur once the proposal proceeded, it poses a moderate to high level of risk. Due to the location and nature of the decay, remedial works are unlikely to significantly reduce the risks of failure with removal is recommended.

Additional Council Reserve Trees

Overview

Following our re-engagement to assess trees to adjoining council land, the trees within the area that may be impacted by the proposal can be loosely grouped into three main types. Firstly there is a range of mature native and exotic trees, that are generally in average to good condition and of a moderate to high retention value. Secondly is a range of weedy native and exotic regrowth between the Gardiners Creek Trail and Bike path, and Thirdly indigenous Blackwattles planted around the Robinsons Road Pavilion.

On the following pages is a brief summary of each tree, refer to the Tree Legend for data set of each tree.

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Tree 38 – *Eucalyptus fibrosa* – Broad Leaf Ironbark



Comment

Unusual species not often seen in cultivation in Melbourne. Has developed in a manner typical of a larger growing Eucalypt, with some dead wood and irregularity to its branch structure.

Tree 39 – *Corymbia citriodora* – Lemon Scented Gum



Comment

Widely grown large ornamental Gum Tree. Has developed typically for the species, with some minor branch tear outs, that have generally healed well.

Tree 40 – *Eucalyptus leucoxylon* – Yellow Gum



Comment

Has formed in a manner typical for the species with a broad low canopy. Has some dead wood in canopy, with some older branch failures having generally healed well.



Tree 41 – *Eucalyptus leucoxylon* – Yellow Gum



Comment

Tree 41 has matured in a particularly sound manner and is a good example of a Yellow Gum. Some minor dead wood is present, and typical of the species.

Tree 42 – *Corymbia citriodora* – Lemon Scented Gum



Comment

Showing a slightly more open canopy, with slight over extension to its branches. These are common presentations of the species and of minor concern.

Tree 43 – *Corymbia citriodora* – Lemon Scented Gum



Comment

Young specimen that has likely self-seeded from a nearby mature specimen. Maturing well with a single well-formed trunk.



Tree 44 – *Corymbia citriodora* – Lemon Scented Gum



Comment

Likely self-seeded from a nearby mature tree, it has formed a poorly structured bifurcation that as it matures poses a serious risk of failure with the Gardiners bike path within its fall zone. If this were to occur it proposes a high level of risk to pedestrian and cyclists.

Tree 45 – *Eucalyptus camaldulensis* – River Red Gum



Comment

Possibly self-seeded or planted has matured poorly with no clear trunk and a range of branches radiating from near its base.




Tree 46 – *Eucalyptus camaldulensis* – River Red Gum



Comment

Indigenous to the area and maturing well. Has potential to become a significant tree to the area over time.



| Tree 47 – <i>Schinus molle</i> – Peppercorn Tree | |
|--|---|
|  | Comment |
| | Weedy exotic specimen that has likely self-seeded. Maturing poorly with multiple branches radiating from its base. |
| Tree 45 – <i>Eucalyptus camaldulensis</i> – River Red Gum | |
|  | Comment |
| | Possibly self-seeded or planted has matured poorly with no clear trunk and a range of branches radiating from near its base. |
| Tree 48 and 49 – <i>Grevillea robusta</i> – Silky Oak | |
|  | Comment |
| | Both have likely self-seeded and for the time are maturing well with good condition. They may mature poorly over time as the species often does in Melbourne's climatic conditions. |



Tree 50 – *Corymbia citriodora* – Lemon Scented Gum



Comment

Substantial tree that makes a significant contribution to the amenity of the landscape. Its good condition indicates it is likely to continue its contribution to the surrounding landscape.

Tree 51 – *Ulmus procera* – English Elm



Comment

Generally, has a good form and vigor, however the main branch unions radiating from its short trunk are of concern. There is signs of white flux disease, and internal decay, with a major branch failure likely to occur over time.

Tree 52 – *Eucalyptus leucoxylon subsp. megalocarpa* – Large Fruited Yellow Gum



Comment

Lacks vigor and may fail shortly if its new growth fails to hold. Cause of poor vigor unclear. On occasion Eucalyptus shed their leaves and reform their canopy. This may explain its current condition.



Tree 53 – *Eucalyptus leucoxylon subsp. megalocarpa* – Large Fruited Yellow Gum



Comment

Semi-Mature tree that is maturing well and has potential to become a tree of significance.

Tree 54 – *Eucalyptus leucoxylon subsp. conata* – Melbourne Yellow Gum



Comment

Indigenous to the area, in the past a major branch has failed triggering significant decay along its trunk. It is likely to fail over time. On closer inspection the previous failure has a yellow discoloration it appears a fungal infection maybe in the decaying wood.

Tree 55 and 56 – *Eucalyptus leucoxylon subsp. megalocarpa* – Large Fruited Yellow Gum



Comment

Semi-Mature tree that is maturing well in a similar manner to Tree 53. It has potential to become a tree of significance.



Tree 57 – *Acacia mearnsii* – Blackwattle



Comment

Indigenous fast growing colonizing tree. Currently in average condition, however Blackwattle's deteriorate quickly from boring insect attack. The early signs of boring insect damage is present with sap starting to ooze from the tree.

Tree 58 – *Acacia mearnsii* – Blackwattle



Comment

Young indigenous tree, appearing to be recently planted. As noted for Tree 57 this species has a short life span and generally becomes hazardous within 30 years.

Tree 59 & 60 – *Eucalyptus leucoxylon subsp. megalocarpa* – Large Fruited Yellow Gum



Comment

Young trees that are maturing well with not notable defects that may impact them long term.



Tree 61 – *Melaleuca styphilooides* – Prickly Tea Tree



Comment

Well formed tree, that has matured typically for a specimen in Melbourne. The trunk does have some minor faults, however the branch unions appear sound.

Tree 62 – *Fraxinus excelsior* – European Ash



Comment

Broad canopied tree that has poorly structured branches, particularly to the two lowest branches that are over elongated and at risk of failure.

Tree 63 – *Eucalyptus fibrosa* – Broad Leaf Ironbark



Comment

Unusual species rarely seen in cultivation in Melbourne. Maturing poorly with poor branch structure and canopy form.



Tree 64, 65 and 66 – *Acacia mearnsii* – Blackwattle



Comment

Semi-mature to mature trees, that are maturing typically for the species. Tee 66 has a large basal wound that is poorly healed and may lead to it failing.

Tree 67 – *Eucalyptus saligna* – Sydney Blue Gum



Comment

Maturing poorly, it has an old branch wound near the main branch unions that has decayed, with dead wood down its trunk. It is heavily affected by lumps that are further reducing its vigor.

Tree 68 – *Acacia mearnsii* – Blackwattle



Comment

Young Indigenous tree to the area, forming well so far, however as noted elsewhere declines quickly often from boring insect attack.



Tree 69 – *Callistemon salignus* – Willow Bottlebrush



Comment

Small ornamental native tree. It is heavily impacted by scale, resulting in sooty mold.

Tree 70 - 73 – *Acacia mearnsii* – Blackwood



Comment

Semi-mature to young indigenous trees. Currently they are in good condition with no signs of boring insects present.

Tree 74 – *Cedrus deodara* – Himalayan Cedar



Comment

Exotic ornamental tree, that is in serious decline and may shortly fail completely. Cause of failure was not noted on site.



Tree 75 – *Cupressus torulosa* – Himalayan Cypress



Comment

Large exotic ornamental tree. It is in generally good condition, however its branch structure is showing some signs of structural weakness, in the form of reaction wood and included bark around branch unions.

Tree 76 - *Corymbia citriodora* – Lemon Scented Gum



Comment

Generally well formed native tree that is in good condition, making a significant contribution to the amenity of the area.

Tree 77 – *Eucalyptus mannifera* – Brittle Gum



Comment

Street tree, near the corner of Reserve and Robinsons Road. Has been heavily pruned to ensure clearance from the overhead powerline, adversely affecting its form and structure.



Tree 78 - *Corymbia citriodora* – Lemon Scented Gum



Comment

Young tree that appears to be recently planted. If it continues to mature well, it is likely to form a valuable tree like Tree 76.

Proposed Encroachment for a proposal.

A proposed development can encroach a maximum of 10% as per AS-4970 into the TPZ of any tree on the site and or neighbouring. Further encroachment maybe possible, with consideration given to existing structures that would prevent the development of roots in a given area.

An example of this would be Tree 29 neighbouring the site, that would not be able to develop roots into the site, given the extensive level difference and retaining wall separating it from the adjacent land.

In areas of contiguous space where further encroachment is required, a Non-Destructive Root Investigation (NDRI), maybe used to ascertain what roots are present. Assuming no root greater than 40mm diameter or mass of fibrous roots are present, then further encroachment would be feasible, assuming there is sufficient contiguous space surrounding the impacted tree to develop into the future.

If roots are present, depending on the size, depth, and location of roots a proposal may require modification to facilitate the roots present.

All services must be located clear of a TPZ, or hydro-excavated into position to avoid damage to a tree's roots. Wherever possible pits should be located clear of a TPZ, or hand excavated into position, retaining roots as noted for an NDRI.

Protection of Trees during a development.

All trees retained must be protected as per AS-4970, prior to a development proceeding. Tree Protection Fencing (TPF) is to be used as per AS-4970, and used to the extent of a trees Tree Protection Zone (TPZ), as per AS-4970, offset 2m from any proposed works.

Within the 2m offset Ground Protection Measures must be used, to ensure site access, whilst protecting any underlying roots.

TPF is to be Temporary Steel Mesh fencing panels to 2m high secured with concrete pad, or similar footings.



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Ground Protection Measures are to be hardwood timber battens secured with steel strapping or Steel Sheeting. Either is to be laid on a bed of leaf mulch to a depth of 75mm.

Refer Separate A1 Site Sketch 01 and 02. Worksheet as Follows

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| Tree Legend | | | | | | | | | | | | | | |
|-------------|---|---------------------|--------|--------|--------|-------------|--------|-----------|--------------------|--------------------|---------|-----------|---------|--------------|
| No | Botanical Name | Common Name | Origin | Height | Canopy | DBH @ 1.4 m | TPZ | Condition | SULE | Significance | Vigor | Structure | Form | Ret Value |
| 01 | Melaleuca nesophila | Showy honey myrtle | Native | 7000 | 8000 | 363 | 4356 | Average | Short (5-15 yrs) | Less Significant | Average | Poor | Average | Low |
| 02 | Platanus orientalis | Cut Leaf Plane | Exotic | 14000 | 10000 | 599 | 7188 | Good | Medium (16-39 yrs) | Highly Significant | Good | Average | Good | High |
| 03 | Platanus orientalis | Cut Leaf Plane | Exotic | 16000 | 12000 | 730 | 8760 | Good | Medium (16-39 yrs) | Highly Significant | Good | Average | Good | High |
| 04 | Liquidambar styraciflua | Sweet Gum | Exotic | 7000 | 5000 | 343.1 | 4117.2 | Poor | Removal | Less Significant | Poor | Poor | Poor | Low |
| 05 | Lophostemon confertus | Brush Box | Native | 10000 | 9000 | 455 | 5460 | Average | Medium (16-39 yrs) | Highly Significant | Good | Poor | Average | Moderate |
| 05a | Citrus limon | Lemon tree | Exotic | 4000 | 5000 | 214.8 | 2577.6 | Poor | Removal | Less Significant | Average | Poor | Poor | Low |
| 06 | Waterhousia floribunda | Weeping Lilly Pilly | Native | 8000 | 7000 | 440 | 5280 | Average | Short (5-15 yrs) | Less Significant | Average | Poor | Average | Moderate |
| 07 | Casuarina cunninghamiana | River Sheoak | Native | 13000 | 5000 | 440 | 5280 | Average | Removal | Less Significant | Average | Poor | Average | Low |
| 08 | Casuarina cunninghamiana | River Sheoak | Native | 13000 | 5000 | 370 | 4440 | Average | Removal | Less Significant | Average | Poor | Average | Low |
| 09 | Casuarina cunninghamiana | River Sheoak | Native | 14000 | 4000 | 320 | 3840 | Average | Removal | Less Significant | Average | Poor | Average | Low |
| 10 | Casuarina cunninghamiana | River Sheoak | Native | 15000 | 6000 | 350 | 4200 | Average | Removal | Less Significant | Average | Poor | Average | Low |
| 11 | Casuarina cunninghamiana | River Sheoak | Native | 8000 | 4000 | 220 | 2640 | Poor | Removal | Least Significant | Poor | Poor | Poor | Low |
| 12 | Lophostemon confertus | Brush Box | Native | 12000 | 10000 | 480 | 5760 | Poor | Removal | Less Significant | Poor | Poor | Average | Moderate |
| 13 | Lophostemon confertus | Brush Box | Native | 12000 | 8000 | 400 | 4800 | Poor | Removal | Less Significant | Poor | Poor | Poor | Low |
| 14 | Lophostemon confertus | Brush Box | Native | 14000 | 5000 | 375 | 4500 | Average | Removal | Less Significant | Average | Poor | Average | Low |
| 14a | Fraxinus angustifolia subsp. angustifolia | Desert Ash | Exotic | 4000 | 2000 | 110 | 2000 | Average | Removal | Less Significant | Average | Poor | Average | Weed |
| 14b | Ligustrum lucidum | Shiny Privet | Exotic | 4000 | 4000 | 160 | 2000 | Average | Removal | Less Significant | Average | Poor | Average | Weed |
| 15 | Salix humboldtiana | Chilean Willow | Exotic | 4000 | 1000 | 149 | 2000 | Average | Removal | Less Significant | Good | Average | Average | Low |
| 15a | Pittosporum tenuifolium | Hedge Pittosporum | Exotic | 6000 | 3000 | 120 | 2000 | Average | Short (5-15 yrs) | Less Significant | Average | Poor | Average | Neighbouring |
| 16 | Schefflera actinophylla | Umbrella Tree | Native | 5000 | 3000 | 125.3 | 2000 | Average | Medium (16-39 yrs) | Less Significant | Average | Poor | Average | Low |
| 16a | Schefflera actinophylla | Umbrella Tree | Exotic | 12000 | 16000 | 799.6 | 9595.2 | Average | Medium (16-39 yrs) | Highly Significant | Good | Poor | Average | Moderate |
| 17 | Agonis flexuosa | Willow myrtle | Native | 8000 | 8500 | 904 | 10848 | Average | Removal | Hazardous | Average | Poor | Average | Low |



| | | | | | | | | | | | | | | |
|-----|---|---------------------|--------|-------|-------|-------|--------|---------|--------------------|--------------------|---------|---------|---------|--------------|
| 17a | Ligustrum lucidum | Shiny Privet | Exotic | 5000 | 6000 | 161.2 | 2000 | Average | Short (5-15 yrs) | Less Significant | Good | Average | Average | Neighbouring |
| 18 | Eucalyptus viminalis | Manna gum | Native | 18000 | 9000 | 1100 | 13200 | Not Set | Removal | Not Set | Not Set | Not Set | Not Set | Removed |
| 19 | Eucalyptus viminalis | Manna gum | Native | 16000 | 6000 | 800 | 9600 | Not Set | Removal | Not Set | Not Set | Not Set | Not Set | Removed |
| 20 | Quercus macrocarpa | Burr Oak | Exotic | 18000 | 12000 | 760 | 9120 | Average | Long (40 + yrs) | Highly Significant | Good | Average | Average | High |
| 21 | Prunus cerasifera | Cherry Plum | Exotic | 6500 | 7000 | 189 | 2268 | Not Set | Not Set | Not Set | Not Set | Not Set | Not Set | Removed |
| 22 | Ligustrum lucidum | Glossy Privet | Exotic | 5000 | 3000 | 225.2 | 2702.4 | Poor | Removal | Least Significant | Average | Poor | Poor | Weed |
| 22a | Fraxinus angustifolia subsp. angustifolia | Desert Ash | Exotic | 6000 | 3000 | 100 | 2000 | Average | Removal | Least Significant | Average | Average | Average | Weed |
| 23 | Cupressus sempervirens | Green pencil pine | Exotic | 6000 | 1000 | 150 | 2000 | Average | Medium (16-39 yrs) | Less Significant | Average | Average | Average | Low |
| 24 | Callistemon salignus | Willow Bottle Brush | Native | 7000 | 4000 | 250 | 3000 | Average | Short (5-15 yrs) | Less Significant | Good | Poor | Average | Low |
| 25 | Fraxinus angustifolia | Desert Ash | Exotic | 4000 | 2000 | 100 | 2000 | Poor | Short (5-15 yrs) | Least Significant | Average | Poor | Poor | Neighbouring |
| 26 | Agonis flexuosa | Willow Myrtle | Native | 5000 | 7000 | 482 | 5784 | Not Set | Not Set | Not Set | Not Set | Not Set | Not Set | Removed |
| 27 | Fraxinus excelsior aurea | Golden Ash | Exotic | 7000 | 12000 | 492.4 | 5908.8 | Average | Medium (16-39 yrs) | Less Significant | Average | Poor | Average | Moderate |
| 28 | Eriobotrya japonica | Loquat tree | Exotic | 5000 | 4000 | 170 | 2040 | Average | Medium (16-39 yrs) | Less Significant | Average | Average | Average | Low |
| 29 | Grevillea robusta | Silky Oak | Native | 8000 | 7000 | 300 | 3600 | Average | Short (5-15 yrs) | Hazardous | Good | Average | Average | Low |
| 30 | Eucalyptus botryoides | Southern Mahogany | Native | 5000 | 3000 | 250 | 3000 | Average | Removal | Hazardous | Good | Average | Average | Low |
| 31 | Acer campestre | Hedge Maple | Exotic | 7000 | 8000 | 436 | 5232 | Average | Medium (16-39 yrs) | Highly Significant | Average | Poor | Average | Moderate |
| 32 | Lophostemon confertus | Brush Box | Native | 8000 | 7000 | 300 | 3600 | Average | Medium (16-39 yrs) | Highly Significant | Average | Poor | Average | High |
| 33 | Lophostemon confertus | Brush Box | Native | 12000 | 8000 | 430 | 5160 | Average | Removal | Highly Significant | Good | Poor | Average | Moderate |
| 34 | Lophostemon confertus | Brush Box | Native | 9000 | 7000 | 559 | 6708 | Average | Removal | Highly Significant | Good | Poor | Average | Moderate |
| 35 | Prunus armeniaca | Apricot | Exotic | 6000 | 5000 | 223 | 2676 | Not Set | Not Set | Not Set | Not Set | Not Set | Not Set | Removed |
| 36 | Agonis flexuosa | Willow myrtle | Native | 8000 | 10000 | 694.6 | 8335.2 | Poor | Removal | Hazardous | Average | Poor | Average | Low |
| 37 | Ulmus procera | English Elm | Exotic | 12000 | 13000 | 660 | 7920 | Average | Removal | Highly Significant | Poor | Poor | Average | Low |
| 38 | Eucalyptus fibrosa | Broad Leaf Ironbark | Native | 14000 | 10000 | 460 | 5520 | Average | Medium (16-39 yrs) | Highly Significant | Average | Average | Average | High |
| 39 | Corymbia citriodora | Lemon Scented Gum | Native | 11000 | 11000 | 490 | 5880 | Average | Medium (16-39 yrs) | Highly Significant | Average | Average | Average | High |
| 40 | Eucalyptus leucoxylon | Yellow Gum | Native | 8000 | 9000 | 490 | 5880 | Average | Medium (16-39 yrs) | Highly Significant | Good | Average | Average | High |
| 41 | Eucalyptus leucoxylon | Yellow Gum | Native | 8500 | 8000 | 520 | 6240 | Good | Long (40 + yrs) | Most Significant | Good | Average | Good | Highest |
| 42 | Corymbia citriodora | Lemon Scented Gum | Native | 16000 | 11000 | 560 | 6720 | Average | Medium (16-39 yrs) | Highly Significant | Average | Average | Average | High |



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|----|--|--------------------------|------------|-------|-------|-------|--------|---------|--------------------|--------------------|---------|---------|---------|----------|
| 43 | Corymbia citriodora | Lemon Scented Gum | Native | 6500 | 4000 | 160 | 2000 | Good | Long (40 + yrs) | Less Significant | Good | Average | Good | Low |
| 44 | Corymbia citriodora | Lemon Scented Gum | Native | 9000 | 6500 | 361 | 4332 | Average | Short (5-15 yrs) | Hazardous | Average | Poor | Average | Low |
| 45 | Eucalyptus camaldulensis | River Red Gum | Indigenous | 6000 | 4500 | 184.9 | 2218.8 | Poor | Short (5-15 yrs) | Less Significant | Average | Poor | Poor | Low |
| 46 | Eucalyptus camaldulensis | River Red Gum | Indigenous | 6000 | 4500 | 155 | 2000 | Good | Long (40 + yrs) | Less Significant | Good | Average | Good | Moderate |
| 47 | Schinus molle | Peppercorn Tree | Exotic | 4500 | 4000 | 205.4 | 2464.8 | Poor | Long (40 + yrs) | Less Significant | Average | Poor | Poor | Low |
| 48 | Grevillea robusta | Silky Oak | Native | 4000 | 2000 | 80 | 2000 | Good | Long (40 + yrs) | Less Significant | Good | Average | Good | Low |
| 49 | Grevillea robusta | Silky Oak | Native | 5000 | 3000 | 140 | 2000 | Good | Long (40 + yrs) | Less Significant | Good | Average | Good | Low |
| 50 | Corymbia citriodora | Lemon Scented Gum | Native | 14000 | 16000 | 700 | 8400 | Good | Long (40 + yrs) | Most Significant | Good | Average | Good | Highest |
| 51 | Ulmus procera | English Elm | Exotic | 10000 | 12000 | 630 | 7560 | Average | Short (5-15 yrs) | Highly Significant | Average | Poor | Average | Moderate |
| 52 | Eucalyptus leucoxylon subsp. megalocarpa | Large Fruited Yellow Gum | Native | 6000 | 3000 | 248.4 | 2980.8 | Poor | Short (5-15 yrs) | Less Significant | Poor | Poor | Average | Low |
| 53 | Eucalyptus leucoxylon subsp. megalocarpa | Large Fruited Yellow Gum | Native | 5000 | 5000 | 240 | 2880 | Average | Medium (16-39 yrs) | Less Significant | Good | Average | Average | Low |
| 54 | Eucalyptus leucoxylon subsp. conata | Melbourne Yellow Gum | Native | 9000 | 6000 | 417.7 | 5012.4 | Poor | Short (5-15 yrs) | Hazardous | Average | Poor | Poor | Low |
| 55 | Eucalyptus leucoxylon subsp. megalocarpa | Large Fruited Yellow Gum | Native | 3000 | 3000 | 177.2 | 2126.4 | Average | Medium (16-39 yrs) | Less Significant | Average | Average | Average | Low |
| 56 | Eucalyptus leucoxylon | Yellow Gum | Native | 4500 | 6000 | 210 | 2520 | Good | Long (40 + yrs) | Less Significant | Good | Good | Good | Low |
| 57 | Acacia mearnsii | Black Wattle | Indigenous | 6000 | 4000 | 180 | 2160 | Good | Short (5-15 yrs) | Less Significant | Good | Average | Good | Low |
| 58 | Acacia mearnsii | Black Wattle | Indigenous | 2000 | 1000 | 20 | 2000 | Good | Short (5-15 yrs) | Less Significant | Good | Average | Good | Low |
| 59 | Eucalyptus leucoxylon subsp. megalocarpa | Large Fruited Yellow Gum | Native | 4000 | 2000 | 110 | 2000 | Average | Long (40 + yrs) | Less Significant | Good | Average | Average | Low |
| 60 | Eucalyptus leucoxylon subsp. megalocarpa | Large Fruited Yellow Gum | Native | 4000 | 2000 | 90 | 2000 | Average | Long (40 + yrs) | Less Significant | Good | Average | Average | Low |
| 61 | Melaleuca styphiloidea | Prickly Tea Tree | Native | 9000 | 8000 | 840 | 10080 | Good | Medium (16-39 yrs) | Highly Significant | Good | Average | Good | High |
| 62 | Fraxinus excelsior | European Ash | Exotic | 10000 | 12000 | 931.5 | 11178 | Average | Short (5-15 yrs) | Less Significant | Average | Poor | Average | Moderate |
| 63 | Eucalyptus fibrosa | Broad Leaf Ironbark | Native | 9000 | 6000 | 400 | 4800 | Poor | Short (5-15 yrs) | Less Significant | Average | Poor | Poor | Low |
| 64 | Acacia mearnsii | Black Wattle | Indigenous | 6000 | 3000 | 130 | 2000 | Average | Short (5-15 yrs) | Less Significant | Average | Poor | Average | Low |
| 65 | Acacia mearnsii | Black Wattle | Indigenous | 7000 | 3000 | 160 | 2000 | Average | Short (5-15 yrs) | Less Significant | Average | Poor | Average | Low |
| 66 | Acacia mearnsii | Black Wattle | Indigenous | 10000 | 5000 | 290 | 3480 | Poor | Short (5-15 yrs) | Hazardous | Average | Poor | Poor | Low |

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|----|----------------------|--------------------|------------|-------|-------|-------|--------|---------|--------------------|--------------------|---------|---------|---------|---------|
| 67 | Eucalyptus saligna | Sydney Blue Gum | Native | 8000 | 5000 | 400 | 4800 | Average | Short (5-15 yrs) | Hazardous | Average | Poor | Average | Low |
| 68 | Acacia mearnsii | Black Wattle | Indigenous | 6000 | 3000 | 110 | 2000 | Average | Short (5-15 yrs) | Less Significant | Good | Average | Average | Low |
| 69 | Callistemon salignus | Willow Bottlebrush | Indigenous | 6000 | 5000 | 204.9 | 2458.8 | Average | Short (5-15 yrs) | Less Significant | Average | Poor | Average | Low |
| 70 | Acacia mearnsii | Black Wattle | Indigenous | 8000 | 4000 | 180 | 2160 | Average | Short (5-15 yrs) | Less Significant | Average | Average | Average | Low |
| 71 | Acacia mearnsii | Black Wattle | Indigenous | 7000 | 4000 | 250 | 3000 | Average | Short (5-15 yrs) | Less Significant | Average | Average | Average | Low |
| 72 | Acacia mearnsii | Black Wattle | Indigenous | 7000 | 3000 | 160 | 2000 | Average | Short (5-15 yrs) | Less Significant | Average | Average | Average | Low |
| 73 | Acacia mearnsii | Black Wattle | Indigenous | 7000 | 5000 | 260 | 3120 | Average | Short (5-15 yrs) | Less Significant | Average | Average | Average | Low |
| 74 | Cedrus deodara | Himalayan Cedar | Exotic | 9000 | 8000 | 483 | 5796 | Poor | Short (5-15 yrs) | Hazardous | Poor | Poor | Average | Low |
| 75 | Cupressus torulosa | Himalayan Cypress | Exotic | 12000 | 7000 | 870 | 10440 | Good | Medium (16-39 yrs) | Highly Significant | Good | Poor | Good | High |
| 76 | Corymbia citriodora | Lemon Scented Gum | Native | 12000 | 11000 | 612.9 | 7354.8 | Good | Long (40 + yrs) | Most Significant | Good | Average | Good | Highest |
| 77 | Eucalyptus mannifera | Brittle Gum | Native | 6000 | 4000 | 280 | 3360 | Poor | Short (5-15 yrs) | Less Significant | Average | Poor | Poor | Low |
| 78 | Corymbia citriodora | Lemon Scented Gum | Native | 4000 | 1500 | 60 | 2000 | Good | Long (40 + yrs) | Less Significant | Good | Good | Good | Low |



Definitions

As per Australian Standard 4970 – 2009 – Protection of Trees on Development Sites (AS 4970):

TPZ and SRZ Methodology

Determining the Tree Protection Zone (TPZ)

The radius of the TPZ is calculated for each tree by multiplying its DBH x 12. $TPZ = DBH \times 12$

Where - DBH = trunk diameter measured at 1.4 metres above ground; radius is measured from the centre of the stem at ground level.

A TPZ should not be less than 2 metres and no greater than 15 metres except where crown protection is required. Some instances may require variations to the TPZ.

The TPZ of palms, other monocots, cycads and tree ferns should not be less than 1 metre outside the crown projection. This area is an estimate of the space required to maintain the health of a tree long term. It is entirely possible to work inside this Zone providing due care is exercised according to AS 4970.

Determining the Structural Root Zone (SRZ)

The SRZ is the area required for tree stability. A larger area is required to maintain a viable tree. The SRZ only needs to be calculated when major encroachment into a TPZ is proposed.

There are many factors that affect the size of the SRZ; e.g. tree height, crown area, soil type, soil moisture etc. The SRZ may also be influenced by natural or built structures, such as rocks and footings. An indicative SRZ radius can be determined from the trunk diameter measured immediately above the root buttress using the following formula:

$$SRZ \text{ radius} = (D \times 50)^{0.42} \times 0.64$$

Where - D = trunk diameter, in m, measured above the root buttress.

The SRZ for trees with trunk diameters less than 0.15m will be 1.5m.

It needs to be emphasised that this is an indicative calculation which generalizes all the conditions influencing the estimate. SRZ is often less than the indicated calculation. An Exploratory Root Excavation (ERE) or root investigation according to AS 4970 may provide more information on the extent of these roots.

TPZ and SRZ Encroachment

Any encroachment into TPZ should be advised and supervised by a qualified Arborist

AS 4970 says:

3.3.2 Minor encroachment

If the proposed encroachment is less than 10% of the area of the TPZ and is outside the SRZ detailed root investigations should not be required. The area lost to this encroachment should be compensated for elsewhere and contiguous with the TPZ.

AS 4970 also says:

3.3.4 TPZ encroachment considerations

When determining the potential impacts of encroachment into the TPZ, the project arborist should consider the following:

(a) Location and distribution of the roots to be determined through non-destructive investigation methods (pneumatic, hydraulic, hand digging or ground penetrating radar). Photographs should be taken and a root zone map prepared.

NOTE: Regardless of the method, roots must not be cut, bruised or frayed during the process.

It is imperative that exposed roots are kept moist and the excavation back filled as soon as possible.

(b) The potential loss of root mass resulting from the encroachment: number and size of roots.



(c) *Tree species and tolerance to root disturbance.*

(d) *Age, vigour and size of the tree.*

(e) *Lean and stability of the tree.*

NOTE: Roots on the tension side are likely to be most important for supporting the tree and are likely to extend for a greater distance.

(f) *Soil characteristics and volume, topography and drainage.*

(g) *The presence of existing or past structures or obstacles affecting root growth.*

(h) *Design factors.*

Tree sensitive construction measures such as pier and beam, suspended slabs, cantilevered building sections, screw piles and contiguous piling can minimize the impact of encroachment.

When siting a structure near to a tree, the future growth of the tree, both above and below ground should be taken into account. Precautions should be taken at the planning and design stage to minimize potential conflict between trees and new structures

When the root zone is reactive clay, techniques such as localized pier and beam (bridged), screw pile footings or root and soil moisture control barriers may be appropriate to minimize effects on structures.

NOTE: Collaboration may be required between the project arborist and the geotechnical or structural engineer.

Landscapes by Design believes it is vital to ensure that construction is strong enough to withstand any encroachment by the tree as it grows. Pro-active measure like root control barriers and moisture barriers before trees grow to maximum size may be considered.

Tree Protection Fencing

Tree Protection Fencing must be erected prior to any works of any nature commencing and before any machinery or materials are brought onto the site. Once erected this protective fencing must not be removed or altered until such time as all works associated with the construction are complete, unless approved and supervised by an Arborist. Immediately following erection of the Tree Protection Fencing, the Tree Protection Zones are to be weeded and then mulched with 75 mm depth leaf mulch or similar, that has been aged for at least 12 weeks.

No trenching or excavation is to occur within this Tree Protection Zones. If underground services must be routed within the TPZ, they should be installed by directional drilling or in manually excavated trenches. The directional drilling bore should be at least 600 mm deep. The project arborist should assess the likely impacts of boring and bore pits on retained trees. An Exploratory Root Excavation (ERE) may assist in this case. See Later section.



The Tree Protection Fencing Zone should be secured to restrict access.

AS 4687 – Temporary Fencing and Hoardings specifies applicable fencing requirements. Shade cloth or similar should be attached to reduce the transport of dust, other particulate matter and liquids into the protected area.

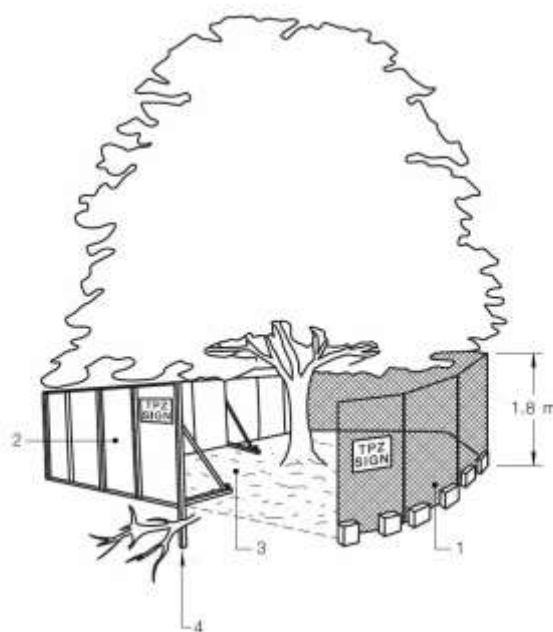
Fence posts and supports should have a diameter greater than 20 mm and be located clear of roots.

Existing perimeter fencing and other structures may be suitable as part of the protective fencing.

The image below on provides an example of suitable protective fencing:

Legend:

1. Chain wire mesh panels with shade cloth (if required) attached, held in place with concrete feet.
2. Alternative plywood or wooden paling fence panels. This fencing material also prevents building materials or soil entering the TPZ.
3. Mulch installation across surface of TPZ (at the discretion of the project arborist). No excavation, construction activity, grade changes, surface treatment or storage of materials of any kind is permitted within the TPZ. Bracing is permissible within the TPZ. Installation of supports should avoid damaging roots.



If it is necessary to remove the Tree Protection Fencing to allow works to be carried out it must be reinstated on a daily basis immediately following completion of works. If works are carried out within the Tree Protection Zones this work must be supervised by an Arborist. During required work suitable planking should be laid within the Tree Protection Zone to protect against compaction to the roots of the tree / trees from workers and others. It is recommended that machinery does not enter the Tree Protection Zone (see 4.2 from AS 4970 below: “Activities generally excluded”), however rumble boards, plates, or sheets of heavy duty materials over mulch and an impervious membrane can be used if vehicles need to move through the zone. Excavation can be carried out by machine using skilled operators briefed by and observed by an Arborist. Mini-excavators should be used and if possible the vehicle located outside the zone with its tool arms moving within the site. In the case of an Exploratory Root Excavation (ERE) being conducted the workmen and their equipment are only in the area for a short time however extreme care must be taken to protect the trunk, canopy and roots of the tree/s.

Irrigation – during warmer periods the Tree Protection Zones should be irrigated with 1 litre of clean water for every 1 cm of trunk girth measured at the soil / trunk interface on a weekly basis.

No persons, vehicles or machinery are to enter the Tree Protection Zones unless authorised to do so, preferably with permission from the Determining Authority.



No fuel, oil dumps or chemicals are allowed to be used or stored within the Tree Protection Zones; the servicing and refuelling of equipment and vehicles must be carried out away from the TPZ; no storage of material or equipment is to take place within them; nothing whatsoever, including temporary services wires, nails, screws or any other fixing device, is to be attached to any tree.

4.2 ACTIVITIES RESTRICTED WITHIN THE TPZ

Activities generally excluded from the TPZ include but are not limited to—

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

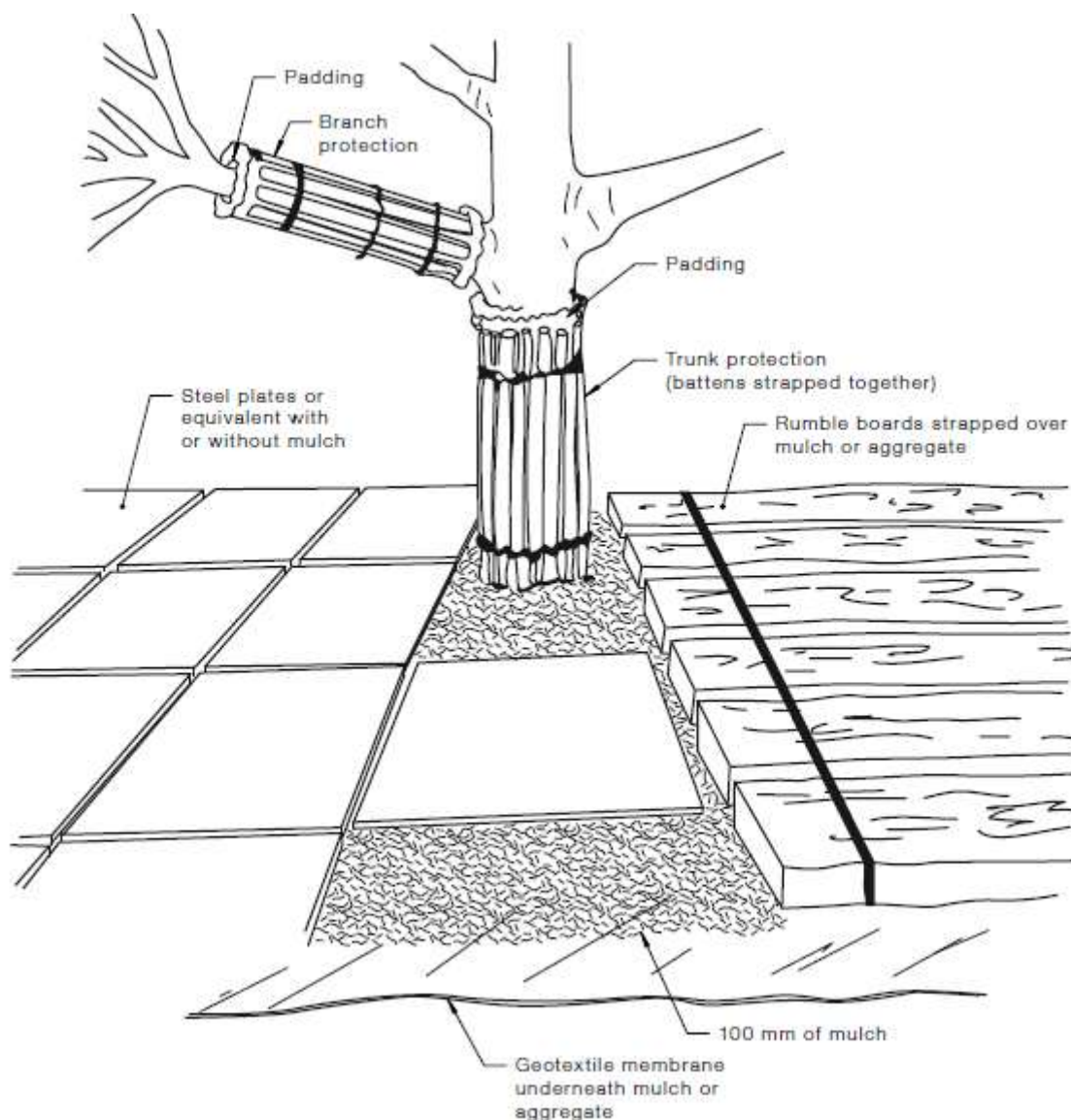
Trunk and Branch Protection

Trees impacted upon by construction works should be protected as per the Sketch 1 below. It is suggested that suitable rubberised padding material be used under 75 by 50 hardwood timber which is strapped with galvanised tin strapping approximately 30 mm wide at 900 mm spacing from bottom of trunk upwards, and nailed or screwed to the hardwood timber with 25 mm long galvanised fasteners. The rubberised padding material should be perforated to allow air to the trunk, and not soak water into itself. No nails or screws are to enter the tree trunk or branches and care must be taken to ensure that no materials bite into the tree surface and scar or damage its surface in any way.

Ground Protection

The planking to the right in the sketch following is an example of the planking that could be used. 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 should include a permeable membrane such as

Geo-textile fabric beneath a layer of mulch or crushed rock, below rumble boards as per sketch 1. Rubber matting and packing plywood may also be used. Under this planking or sheeting within the TPZ, a 75 mm layer of leaf mulch or similar, aged for at least 12 weeks and proven to contain no toxic substances must be installed. These measures may also be applied to root zones beyond the TPZ. Rumble boards should be of a suitable thickness to prevent soil compaction and root damage.



Exploratory Root Excavation

An Exploratory Root Excavation (ERE) or root investigation according to AS 4970 may be conducted to provide more information on the extent of a tree's SRZ. The SRZ is an indicative measure and the actual positions and extent of the roots can only be determined by an investigation. A trench is carefully excavated along a pre-determined line (for example, the edge of a proposed slab or decking posts) to a depth of at least 650 mm and no more than 300mm wide. If roots are located they must be carefully exposed without any damage to the root. The position and size of any roots found can be photographed, recorded and mapped. If there are too many large roots or root mats found the Arborist may decide to move the trench further out from centre of trunk. An ERE may indicate that a building can or cannot be placed in the proposed location, or that piers/stumps can be placed between roots, or that roots are not extending far enough to directly damage a building/path/pipe. The ERE map may lead to design and engineering changes to enable a building, extensions, or earthworks that encroach into the TPZ, to proceed or be moved. Where possible the trenching is done by hand but there are times when machinery or water pressure excavation can be used under the supervision of an Arborist.



Root Protection during Works within the TPZ

Some approved works within the TPZ, such as regrading, installation of piers or landscaping may have the potential to damage roots.

If the grade is to be raised the material should be coarser or more porous than the underlying material. Depth and compaction should be minimized.

Manual excavation is the preferred method and should be carried out under the supervision of an arborist to identify roots critical to tree stability and determine the actual extent of the SRZ. An ERE may be used with photographs and maps to serve as a guide for designers and workers. Relocation or redesign of construction works may be required. (See preceding section)

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

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

Other excavation works in proximity to trees, including landscape works such as paving, irrigation and planting can adversely affect root systems. The project arborist should be consulted and supervise any works.

TPZ Encroachment Over 10%

If the proposed building footprint encroaches into the TPZ more than 10%; either the building footprint will have to change to reduce the encroachment to 10% or an Exploratory Root Excavation (ERE) could be carried out by an Arborist to determine the exact location of any roots present. Prior to an ERE make certain to contact the Determining Authority to see if permission is required. If roots are discovered belonging to the tree that are under 40 mm diameter they could be cut by an arborist to allow either the entire building footprint to be accommodated, or if that is not possible, a smaller redesigned building footprint to be accommodated. If the TPZ is varied following an ERE (as per AS 4970) room must be allowed for the lost area to be compensated for elsewhere. Roots greater than 40 mm diameter and fibrous root mats or clumps greater than 50mm diameter should not be cut, but need to be worked around. A well-qualified arborist may cut a root greater than 40 mm diameter, but not greater than 50 mm diameter unless given permission to cut from the Determining Authority.

Alternatively, if an ERE shows it is impossible to vary the TPZ, alternative "tree friendly" construction methods could be employed, such as installing a building slab above grade, pier and beam methods, or building on stumps. Piers and stumps can be relocated to avoid damage to any significant roots discovered by the ERE. These alternative building methods should be specified by a suitably qualified person.

Installing Underground Services within TPZ

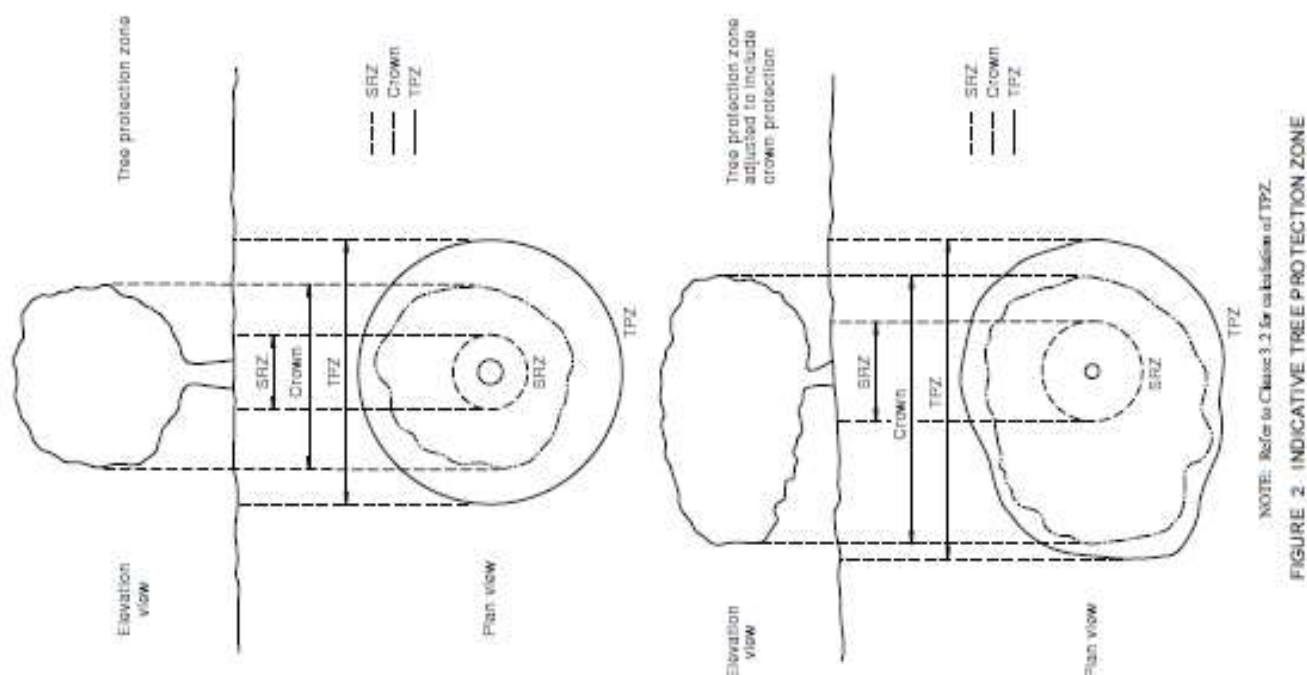
All services should be routed outside the TPZ. If underground services must be routed within the TPZ, they should be installed by directional drilling or in manually excavated trenches. The directional drilling bore should be at least 600 mm deep. The project arborist should assess the likely impacts of boring and bore pits on retained trees.

For manual excavation of trenches, the project arborist should advise on roots to be retained and should monitor the works. Manual excavation may include the use of pneumatic and hydraulic tools.



Crown protection

Tree crowns may be injured by machinery such as excavators, drilling rigs, cranes, trucks, hoarding installation and scaffolding. The TPZ may need to include additional protection of above ground parts of the tree. Where crown protection is required, it will usually be located at least one metre outside the perimeter of the crown (see Figure 2). The erection of scaffolding may require an additional setback from the edge of the crown. Crown protection may include pruning, tying-back of branches or other measures. If pruning is required, requirements are specified in AS 4373 and should be undertaken before the establishment of the TPF. NOTE: Pruning may require approval from the Determining Authority. See following section on Pruning and Removal of Trees



Pruning and Removal of Trees

If pruning is required, it should be carried out in accordance with Australian Standard 4373 - Pruning of Amenity Trees (AS4373) and any root pruning also as per AS 4973 – Specialist advice from a person with a minimum AQF Level 4 in Arboriculture should be sought before any root pruning occurs.

Prior to the pruning of or removal of any tree the Determining Authority, usually the local council must be consulted to be certain the pruning or removal is allowed by them and is lawful.

In any development seek approval for tree removal and encroachment into the TPZ of trees from the Determining Authority; before planning or building preparation and drawings are completed. This is to ensure that building or other drawings are not prepared on the basis of this report, when a relevant Determining Authority does not allow the trees nominated in our report to be removed, or their TPZ's encroached into.

Scaffolding

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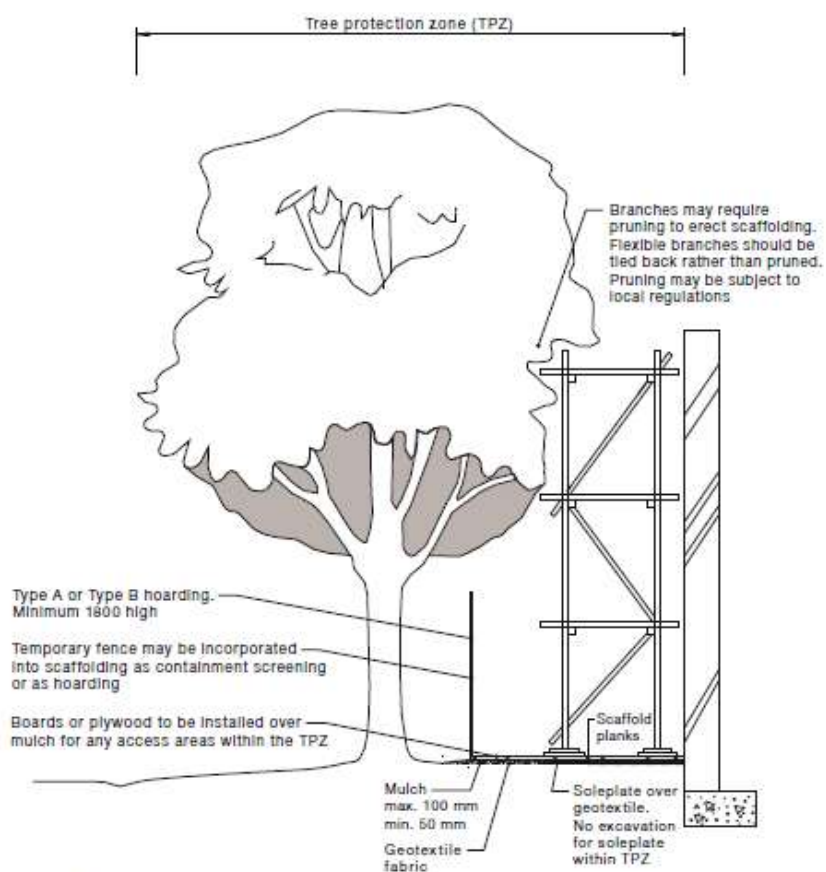
Where scaffolding is required, it should be erected outside the TPZ. Where it is essential for scaffolding to be erected within the TPZ, branch removal should be minimized. This can be achieved by designing scaffolding to avoid branches or tying back branches. Where pruning is unavoidable it must be specified by the project arborist in accordance with AS 4970 and 4373.

NOTE: Pruning works may require approval by the determining authority.

Ground below the scaffolding should be protected by boarding (e.g. scaffold board or plywood sheeting) as shown in Trunk and Branch Protection earlier. Where access is required, a board walk or other surface material should be installed to minimize soil compaction. Boarding should be placed over a layer of mulch and impervious sheeting to prevent soil contamination. The boarding should be left in place until the scaffolding is removed.

There is a risk of materials falling off the scaffold decking and into the TPZ, damaging the tree. Care must be exercised and solid walls or mesh barriers be installed on any scaffolding over the TPZ.

Impervious membrane, mulch, boards or plywood must be used under the scaffold soleplates and no excavation is to be performed for the soleplates. It may be possible to erect secondary fencing inside the general TPZ fencing to further protect the tree from damage.



NOTE: Excavation required for the insertion of support posts for tree protection fencing should not involve the severance of any roots greater than 20 mm in diameter, without the prior approval of the project arborist.

FIGURE 5 INDICATIVE SCAFFOLDING WITHIN A TPZ



Parameters – Used as required:

Condition, Vigour, Structure and Form - Each has four parameters: Excellent, Good, Average and Poor.

ULE – Useful Life Expectancy - Has four parameters – Long (40 + years), Medium (16 to 39 years), Short (5 to 15 years) and Removal

Significance - Has five parameters – Most, Highly, Less, Least and Hazardous

Age – Has four parameters:

Young – Less than one third of expected life span

Semi Mature – Into second third of expected life span

Mature – Into last third of expected life span

Over Mature – Beyond normal life span or age related state of decline

Retention Value – has six parameters High, Moderate, Low, Weed, Neighbouring, Council and Hazardous when required following other parameter. Generally Neighbouring Trees must be retained and protected unless suitable arrangements can be made for their removal with the owner, and that removal is legal. Council trees to streets or neighbouring parks are that Council's responsibility. After a tree report is submitted that includes Council trees, it is suggested that council should inspect their trees to ensure they are safe and worthy of retention.

Definitions - Terms:

Acute Branch Crotch – Angle on the inner side of the branch crotch is less than 90 degrees.

Apical Dominance - the main central stem of the plant is dominant over the other branches.

Branch Union – point where a branch originates from the trunk or another branch; may be referred to as a crotch.

Co-dominant Stems – 'Co-dominant stems are two stems or trunks of equal size that develop from 2 apical buds at the tip of the same stem. Each co-dominant stem is a direct extension of the stem below its origin. There are no branch collars or trunk collars at the base of co-dominant stems' (Dr Alex Shigo) – Similar to Bi-furcated meaning two and Tri-furcated meaning three.

Compartmentalise – (CODIT: Compartmentalization of Decay In Trees. Dr Alex Shigo) natural process of defence in trees by which they wall off decay in wood and heal wounds.

De-current – growth habit developing a more rounded form with multiple scaffold branches

Determining Authority – Usually refers to the Council responsible for the property being assessed but includes any government or semi-governmental authority that has control or liability under common law, and the role to encourage and enforce the developmental process including legislation relating to trees and plants.

Epicormic Shoots - An epicormic shoot is a shoot growing from an epicormic bud which lies underneath the bark of a trunk, stem, or branch of a plant. In older wood, epicormic shoots can result from severe defoliation or radical pruning.

Etoliation is a process in plants grown in partial or complete absence of light. It is characterized by long, weak stems; smaller, sparser leaves due to longer internodes; and a pale yellow colour (chlorosis).

Ex-current - growth habit with pyramidal crown and a central leader

Fall Zone – area under a tree or adjacent to it where if it failed it could impact upon.



Frass – Granular wood particles produced by borer insects that can be fine, medium or coarse depending on the type of insect.

Flush Cut - Pruning technique in which both branch and stem tissue are removed; generally considered poor practice. Flush cuts can allow decay to enter back into the main trunk or branch.

Gall - abnormal outgrowth of tissues and can be caused by various parasites, from fungi and bacteria, to insects and mites. Sometimes called a burl.

Hedges – Are not assessed as trees; therefore, a canopy dimension is represented in drawings not the TPZ.

Included Bark - bark that becomes embedded in a crotch between branch and trunk or Co-Dominant Stems and causes a weak structure.

Indigenous – a plant occurring naturally in the area or region of the subject site.

Obtuse Branch Crotch – where the angle on the inner side of the union is greater than 90 degrees.

Tomograph - a technique for displaying a representation of a cross section through an object using X-rays or ultrasound. In Arborescence this technique is used to establish the level of decay within a tree.

Phototropism or Phototropic Lean - is the phenomenon in which plants follow or grow towards a light source, most commonly the sun.

Reaction Wood - tree wood formed as a result of mechanical stress helping to provide strength to affected areas as in leaning trees, wind exposure, over weighting, compartmentalisation of decay etc.

Scaffold Branch – the permanent or structural branches of a tree

Senescence – the condition or process of growing old especially the condition resulting from the transitions and accumulations of the deleterious aging process.

Torsional Loading – When a tree generally by the wind has had part of its structure twisted as it grows.

?? – After a tree's name means identity of species may not be exact.

Tree – As defined by AS 4970: A long lived woody perennial plant greater than (or usually greater than) 3 m in height with one or relatively few main stems or trunks (or as defined by the determining authority). Landscapes by Design believes that the definition is too loose and too general to include all the plants that we would include in the definition of a tree, however it serves to encompass most plants that we assess. We also assess where required, neighbouring plants other than trees.

Disclaimer etc

No examination of any sort has been carried out to the root systems of these trees. Given factors like environmental, vegetative and other overlays and local or other planning controls it is difficult to accommodate or satisfy all parties when assessing trees and other vegetation. It is very difficult to establish clear outcomes and impossible to determine that a tree can be deemed safe under all circumstances. No guarantee can be given that a tree is totally safe or will remain healthy given short term adverse weather conditions or long term climatic conditions or other environmental and physical factors. No guarantees can be given for any part of a tree's current or future stability. The writer and Landscapes by Design Pty Ltd does not accept any responsibility for any tree or part of it assessed, with regard to its ongoing stability and safety, or its capacity to damage property, other assets or people. Any dead trees have not been included within this report but should be removed immediately.



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