# Arboricultural Assessment and Report

# NCCEC Point Nepean Research & Education Field Station Development.

9 December 2024
Tree Logic Ref. 011175

| | |
|---|---|
| Prepared for | Rachel Gatewood / Project Manager / Monash University. |
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## Introduction.

1.1 Treelogic Pty. Ltd. was engaged by Monash University to provide comments regarding the heritage impact from the removal of trees as part of the proposed development at the Point Nepean Research and Field Station on Jacksons Road in Portsea. The site forms part of the Point Nepean Defence and Quarantine Precinct.

1.2 The requirements of the report include:

- To provide comments on the impact to the site's heritage value from the removal of trees as part of the proposed development.
- Review the current design drawings and discuss any impacts to trees proposed for retention.
- Where appropriate, provide design and/or construction recommendations to minimise the impacts to retained trees.

## 2 Background.

2.1 Treelogic Pty. Ltd. undertook an assessment of trees on site in 2021 as part of preparing a preliminary arboricultural report for the site. The report included the assessment of twenty-three (23) trees in total.

2.2 An addendum to the preliminary report was prepared by Treelogic Pty. Ltd. that discusses the impacts from the design proposal to Tree 3. The addendum supports the design proposal as the perceived impact is expected to be tolerated by the tree.

# 3 Heritage Comments.

### Documents viewed.

- Request for Further Information, issued by Heritage Victoria, Permit App No. P35431 for Point Nepean Defence and Quarantine Precinct, dated 12/11/2024.
- Planning and property report for 3880 Point Nepean Road, Portsea 3944 (www.planning.vic.gov.au, cited 07/12/2024).
- Schedule 165 to Clause 43.01 Heritage Overlay (HO165).
- Victorian Heritage Database Report, H2030, Point Nepean Defence and Quarantine Precinct, cited 05/12/2024.
- Arboricultural Assessment Report, prepared by Treelogic Pty. Ltd., dated 29/03/2021.
- Arboricultural addendum, prepared by Treelogic Pty. Ltd., dated 19/04/2024.

### Design Plans pertinent to the Report.

- Precinct Plan, prepared by Hassell, Dwg No. A_0101, Rev 2, dated 04/10/2024.
- Site set-out & Grid Plan, prepared by Hassell, Dwg No. A_0102, Rev 2, dated 04/10/2024.
- L00 Key Plan, prepared by Hassell, Dwg No. A_0103, Rev 2, dated 04/10/2024.
- L01 Key Plan, prepared by Hassell, Dwg No. A_0104, Rev 2, dated 04/10/2024.
- Site Plan, prepared by Hassell, Dwg No. A_0301, Rev 2, dated 04/10/2024.
- Demolition Plan – Site, prepared by Hassell, Dwg No. A_0302, Rev 2, dated 04/10/2024.
- External Elevations Badcoe Hall, prepared by Hassell, Dwg No. A_2001, Rev 2, dated 04/10/2024.
- Sections Sheet 3 – Accommodation, prepared by Hassell, Dwg No. A_3003, Rev 2, dated 04/10/2024.

3.1 The RFI issued by Heritage Victoria requires '*an arborist's report, assessing the impact of the tree removal proposed*'.

3.2 The current design plans detail the refurbishment of Badcoe Hall and the construction of a two-storey accommodation building to the south. Plan A_0302 shows the extent of demolition including the demolition of Badcoe Hall's roof, doors and other selected elements. The building's structure will be retained, and its footprint is not expected to change, except for the addition of a plant room. Construction of the new accommodation will require the removal of trees during the demolition phase. These include Trees 2 and 4 – 14 and several undersized shrubs that were not formally assessed.

3.3 Trees 2 and 4 – 14 are Drooping She-oaks (*Allocasuarina verticillata*) of varying size and condition. The Treelogic report (2021) provides comment on these trees stating that '*the row of Drooping She-oaks south of Badcoe Hall varying in their condition with numerous trees exhibiting structural defects and/or crown dieback. Only three individual trees (Tree 6, 9 and 11) were rated Moderate B and expected to potentially have a longer life expectancy owing to their health and structural condition*.

*However, as part of a massed planting the arboricultural rating of these trees tends towards a lower rating and are not a significant element of the landscape, replacement of these trees in a similar condition could be accomplished in a 10-year period'*.

3.4 The arboricultural report has classified Trees 2 and 4 – 14 to be planted indigenous (natïve) trees owing to their linear planting pattern and relative even-size. According to the Victorian Heritage Database Report, She-oaks and Banksia formed part of the natural vegetation where large quantities were cut to supply lime kilns resulting in these species to become scarce in Portsea. The construction of new buildings in 1963 – 1965 saw the army carry out extensive landscape plantings of exotic and native species including She-oaks in 1965 - 1966. Based on historical images, the trees proposed for removal do not form part of these plantings.


***Figure 1:*** *Exert from the Treelogic arboricultural report showing the relative size, condition and location of Trees 4 – 14 located south of Badcoe Hall*.

3.5 The Victorian Heritage Database Report notes that the general landscape elements of the site that contribute to its heritage value is notably the Cypress and Norfolk Island Pines, and general road layout, and above and below-ground archaeological remnants. Interestingly, Schedule 165 to Clause 43.01 Heritage Overlay (HO165) does not include tree controls which shows the lack of contribution the She-oaks have on the site's heritage value.

3.6 A review of historic aerial images spanning the period 1939 – 2012 was undertaken to establish the approximate age of the Drooping She-oaks (https://imagery.aerialphotography.fsdf.org.au/, downloaded 12/07/2023). The aerial images show that Badcoe Hall is visible in the 1975 image which was constructed between 1963 – 1965 as the Assembly Hall and later renamed Badcoe Hall. In 1975, several trees appear to the south of Badcoe Hall that are associated with the army's plantings in 1965 – 1966. The location of these trees do not correspond with the trees that are proposed for removal. This earlier planting was likely removed as part of the driveway construction in 2012. Trees 4 – 14 appear in the aerial images in 2005, but not in 1992. Tree 2 is of similar age and dimensions as Trees 4 – 14 therefore it is likely that they were all planted at the same time. The trees

proposed for removal were planted between 1992 and 2005 making them approximately 20 – 30 years of age. This suggested age is generally consistent with their size in relation to the species expected growth rate and development.

***Figure 2 (above left):*** *Shows the site conditions surrounding Badcoe Hall in 1992.*
***Figure 3 (above right):*** *Shows the site conditions surrounding Badcoe Hall in 2005*.

3.7 The age of the Drooping She-oaks shows they did not form part of the landscape plantings at the time Badcoe Hall was constructed in 1963 – 1965. While today the trees contribute somewhat to the landscape character there is no direct association between the establishment of the trees and Badcoe Hall, or any other buildings from an earlier time that give the site its heritage value.

3.8 With regards to landscape views that can be important from a heritage perspective. The contribution of the She-oaks to important views is limited due to their size, location and the presence of surrounding landscape and built elements. The She-oaks are planted on the southern side of Badcoe Hall. The trees vary in height between 3 – 8 m with Badcoe Hall being approximately 11 m tall. Two Norfolk Island Pines (*Araucaria heterophylla*) stand on the northern side of Badcoe Hall that are 22 m and 19 m tall. A row of Monterey Cypresses (*Hesperocyparis macrocarpa*), being 16 – 17 m tall occupy the area to the north-west (Trees 19 – 23). The location of the conifers to the north and north-west in conjunction with Badcoe Hall screen the smaller She-oaks from views of the bay. The extensive tract of native vegetation to the south and existing buildings to the east and west also minimise their view from these directions.

# 4 Design Review

4.1 A review of the town planning drawing set was undertaken to determine whether retained trees would be impacted by the development.

4.2 Apart from Trees 2, 4 – 14, all other trees including Trees 1, 3, 15 – 23 and Tree groups 1 and 2 are nominated for retention as part of the proposed development. The proposed development includes the construction of a multi-storey building to the south of Badcoe Hall, as well as the refurbishment of Badcoe Hall. The existing driveway will be re-aligned adjacent to Tree 3 and car parking is to be established at the rear of the accommodation building.

4.3 The arboricultural addendum issued by Treelogic supports the design in relation to the impacts to Tree 3 of which it is expected to tolerate.

4.4 All other trees including Trees 1, 15 – 23 and Tree groups 1 and 2 are not expected to be impacted by the proposed development.

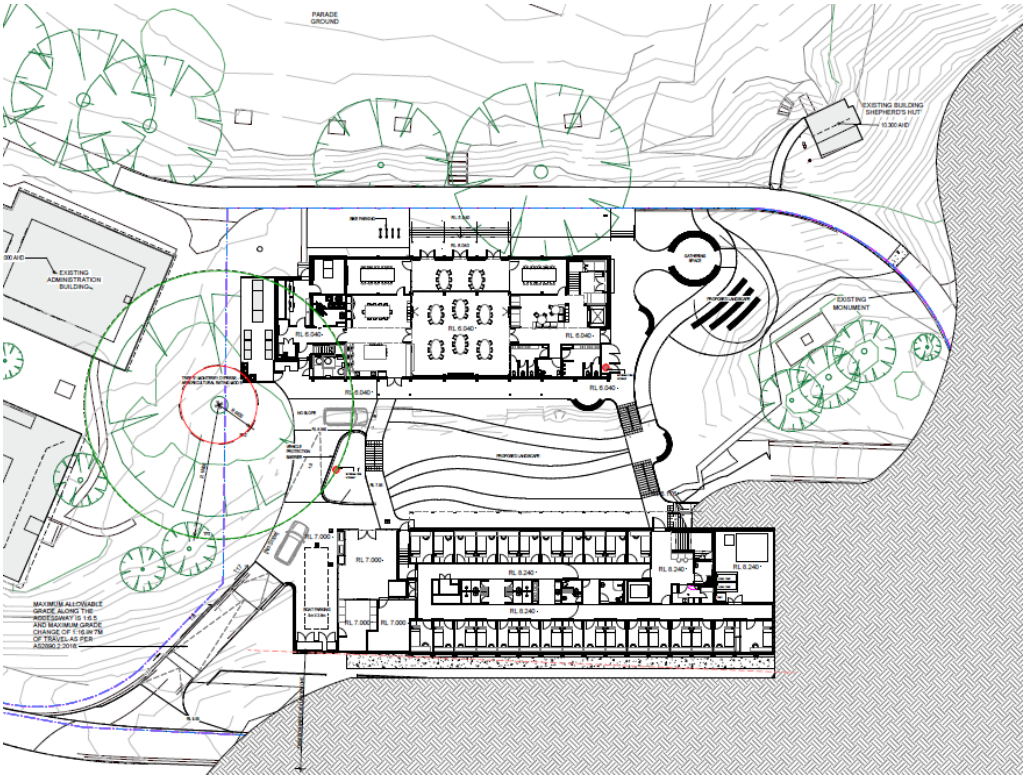


***Figure 4:*** *Exert from L00 Key Plan, Dwg No, A_0103.*

# 5 Conclusion.

5.1 The removal of Trees 2 and 4 – 14 as part of the proposed development is not expected to have a significant impact upon the heritage value of the Point Nepean Defence and Quarantine Precinct in which the subject site is located.

5.2 The heritage significance of the trees is diminished due to their age, size, location and minor contribution to the landscape character. The subject trees have no association with the built form that gives the site much of its heritage value as they were established within the landscape at a far later date. They also have no distinctive size within the landscape and are screened from views that may also form part of the site's heritage value.

5.3 There are no tree controls under Schedule 165 to Clause 43.01 Heritage Overlay that applies to the subject site.

5.4 The viability of Trees 1, 3, 15 – 23 and Tree groups 1 and 2 is expected to be maintained under the design proposal. All retained trees must be appropriately protected for the duration of the site development.

5.5 Appendix 4 provides tree protection measures that are to be adopted and implemented during all phases of the site development.

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

No part of this report is to be reproduced unless in full.

Signed

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References

Australian Standard (4970-2009) Protection of Trees on development sites. Standards Australia, Sydney NSW Australia.

Clark, J.R. & Matheny, N.P (1998), Trees and Development: A technical guide to preservation of trees during land development. ISA, Champaign, Illinois.

# Appendix 1: Tree Assessment Table: NCCEC Point Nepean Research & Education Field Station Development (Treelogic, 2021).

Key: **DBH** = Diameter at breast height, 1.4m up trunk, unless otherwise indicated. Basal dimensions is trunk diameter at base immediately above root buttress. **ARB rating** = arboricultural rating. **TPZ** = Tree protection zone in radial metres. **SRZ** = Structural root zone in radial metres. **ULE** = Useful Life Expectancy measured in years. Definition of the descriptor categories used in the assessment can be seen Appendix 3.

| No | Species | Common Name | Age Class | Origin/Type | DBH (cm) | Basal Ø (cm) | Height (m) | Width (m) | Health | Structure | Arb. Rating | ULE (yrs) | Comments | TPZ radius (m) | SRZ radius (m) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | *Allocasuarina verticillata* | Drooping She-oak | Early-mature | Indigenous (planted) | 26,24 @1.2 | 41 | 7 | 6 | Poor | Fair to Poor | Low | 1-5 | Declining, sparse canopy. Included bark union at base. | 4.2 | 2.3 |
| 2 | *Allocasuarina verticillata* | Drooping She-oak | Maturing | Indigenous (planted) | 36,33 | 48 | 12 | 7 | Fair | Fair to Poor | Mod.B | 11-20 | Past branch failure to west. | 5.9 | 2.4 |
| 3 | *Cupressus macrocarpa* | Monterey Cypress | Maturing | Exotic conifer | 190 @0.2 | 199 | 20 | 22 | Fair | Fair to Poor | Mod.B | 11-20 | Past and ongoing failures typical of species. Overextended limbs particularly to southeast at increased risk of failure. | 15.0 | 4.4 |
| 4 | *Allocasuarina verticillata* | Drooping She-oak | Early-mature | Indigenous (planted) | 55 @1.0 | 56 | 7 | 7 | Fair | Fair to Poor | Mod.C | 11-20 | Acute forks, congested primary union. | 6.6 | 2.6 |
| 5 | *Allocasuarina verticillata* | Drooping She-oak | Early-mature | Indigenous (planted) | 46 @1.2 | 47 | 7 | 7 | Fair to Poor | Poor | Low | 1-5 | Past stem failure to north, reduced foliage density. | 5.5 | 2.4 |
| 6 | *Allocasuarina verticillata* | Drooping She-oak | Early-mature | Indigenous (planted) | 34 | 42 | 7 | 7 | Fair | Fair | Mod.B | 21-40 | | 4.1 | 2.3 |
| 7 | *Allocasuarina verticillata* | Drooping She-oak | Early-mature | Indigenous (planted) | 29,17,16 | 39 | 7 | 6 | Fair to Poor | Fair | Mod.C | 11-20 | Reduced foliage density. Some dieback. | 4.5 | 2.2 |
| 8 | *Allocasuarina verticillata* | Drooping She-oak | Early-mature | Indigenous (planted) | 27,14 @1.1 | 32 | 7 | 6 | Poor | Fair | Low | 6-10 | Reduced foliage density. | 3.6 | 2.1 |
| 9 | *Allocasuarina verticillata* | Drooping She-oak | Early-mature | Indigenous (planted) | 39,21 | 49 | 7 | 8 | Fair | Fair | Mod.B | 11-20 | Overextended limb to south. | 5.3 | 2.5 |
| 10 | *Allocasuarina verticillata* | Drooping She-oak | Early-mature | Indigenous (planted) | 54 | 60 | 7 | 6 | Fair | Fair to Poor | Mod.C | 11-20 | Congested primary union, partly suppressed - crown bias west. | 6.5 | 2.7 |
| 11 | *Allocasuarina verticillata* | Drooping She-oak | Early-mature | Indigenous (planted) | 45 | 48 | 8 | 8 | Fair | Fair | Mod.B | 11-20 | | 5.4 | 2.4 |
| 12 | *Allocasuarina verticillata* | Drooping She-oak | Early-mature | Indigenous (planted) | 12,10 | 25 | 3 | 7 | Fair to Poor | Fair to Poor | Low | 6-10 | Suppressed. | 2.0 | 1.8 |
| 13 | *Allocasuarina verticillata* | Drooping She-oak | Early-mature | Indigenous (planted) | 57 @0.7 | 57 | 8 | 7 | Fair | Fair to Poor | Mod.C | 6-10 | Congested primary union. | 6.8 | 2.6 |
| 14 | *Allocasuarina verticillata* | Drooping She-oak | Semi-mature | Indigenous (planted) | 9 | 12 | 4 | 3 | Fair | Fair to Poor | Low | 6-10 | Suppressed. | 2.0 | 1.5 |
| 15 | *Allocasuarina verticillata* | Drooping She-oak | Maturing | Indigenous (planted) | 30 | 35 | 12 | 6 | Poor | Fair | Low | 1-5 | Canopy 90% dead | 3.6 | 2.1 |
| 16 | *Leptospermum laevigatum* | Coast Tea-tree | Maturing | Indigenous (planted) | 31 | 85 | 6 | 11 | Fair to Poor | Poor | Low | 1-5 | Numerous stems removed from base, past failures on remaining stem to southwest, foliage dying back. | 3.7 | 3.1 |
| 17 | *Araucaria heterophylla* | Norfolk Island Pine | Maturing | Australian conifer | 89 | 97 | 22 | 18 | Fair | Fair | Mod.A | 21-40 | On top of slope. Barcode P013074. | 10.7 | 3.3 |
| 18 | *Araucaria heterophylla* | Norfolk Island Pine | Maturing | Australian conifer | 69 | 72 | 19 | 15 | Fair | Fair | Mod.A | 21-40 | Barcode P013075. | 8.3 | 2.9 |
| 19 | *Cupressus macrocarpa* | Monterey Cypress | Maturing | Exotic conifer | 151 @1.1 | 156 | 16 | 18 | Fair | Fair | Mod.B | 11-20 | Steel cable north and south limbs. Barcode P013014. | 15.0 | 4.0 |
| 20 | *Cupressus macrocarpa* | Monterey Cypress | Maturing | Exotic conifer | 148 @0.9 | 151 | 16 | 18 | Fair | Fair to Poor | Mod.C | 6-10 | Past major failures, canopy gap to southeast. Steel cable east west limbs. Barcode P013013. | 15.0 | 3.9 |
| 21 | *Cupressus macrocarpa* | Monterey Cypress | Maturing | Exotic conifer | 183 @0.9 | 183 | 17 | 18 | Fair | Fair to Poor | Mod.C | 6-10 | Past failures esp to north. Lower canopy gap to north and west. 4x steel cables in canopy. Barcode P013012. | 15.0 | 4.3 |
| 22 | *Cupressus macrocarpa* | Monterey Cypress | Maturing | Exotic conifer | 130 @1.0 | 130 | 17 | 13 | Fair | Fair to Poor | Mod.C | 6-10 | Steel cable between two remaining stems. Canopy gaps to north and south. Recent limb failure to north. Barcode P013011. | 15.0 | 3.7 |
| 23 | *Cupressus macrocarpa* | Monterey Cypress | Maturing | Exotic conifer | 203 @0.5 | 203 | 17 | 18 | Fair | Fair to Poor | Mod.C | 6-10 | 2 stems from base, steel cable north-south and yale cable east-west, recent failures to north. Barcode P013010. | 15.0 | 4.5 |
| G1 | *Acacia longifolia var. sophorae; Leptospermum laevigatum; Lycium ferocissimum; Coprosma repens* | Coast Wattle; Coast Tea-tree; African Boxthorn; Mirror Bush | Mixed | Mixed | 18-21 | 20-23 | 9 | 3 | Fair | Fair to Poor | Low | 6-10 | Mixture of indigenous shrubs and weeds - large Mirror Bush behind shed | | |
| G2 | *Melaleuca lanceolata* | Moonah | Maturing | Indigenous | 80 @base | 80 | 6 | 5 | Fair | Fair | Mod.C | 11-20 | Row of 3x closely spaced shrubs, likely planted. Surrounded by African Boxthorn at base | | |


**LEGEND**

Arboricultural Rating
- Mod-A
- Mod-B
- Mod-C
- Low

Protection Zones
- TPZ
- SRZ
- Small trees (<5m height)

Small tree groups
- Mod-C
- Low

Study area

**NOTES**
ME = *Metrosideros excelsa* (Pohutukawa)
NO = *Nerium oleander* (Oleander)

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

**PROJECT**
Point Nepean - NCCEC

**TL REF.**
011175

**MAP NO.**
1 / 1

**CLIENT**
Monash University

**DATE**
2021-03-29

**DATA SOURCES**
Aerial imagery — Nearmap 2019-10-13

**TREE LOCATION DISCLAIMER**
Tree locations are approximate

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

0 10 20m

TREELOGIC PTY LTD
ABN: 95 080 021 610
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4 / 21 Eugene Tce
Ringwood, VIC
Australia 3134

Treelogic
Plan, manage, protect

# Appendix 3: Arboricultural Descriptors (February 2019).

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.

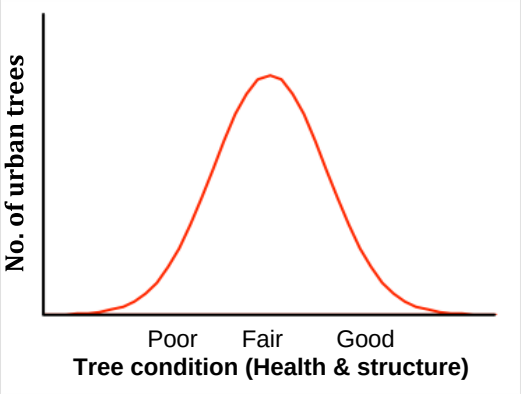



**Diagram 1:** Indicative normal distribution curve for tree condition

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 site*s. 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 |

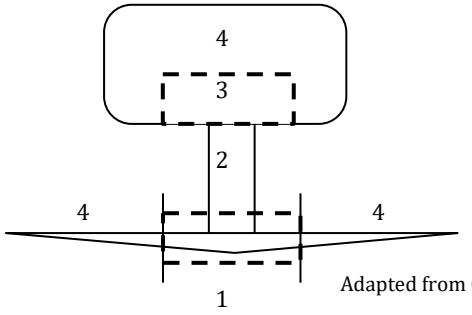
## 7. Structure

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




Adapted from Coder (1996)

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<br>(No remaining ULE) | Tree may be dead or mostly dead. Tree may exhibit major structural faults. Tree may be an imminent failure hazard.<br>Excessive infrastructure damage with high risk potential that cannot be remedied. |
| 1-5 years<br>(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.<br>Infrastructure conflicts with heightened risk potential. Tree has outgrown site constraints. |
| 6-10 years<br>(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.<br>Over-mature and senescing or early decline symptoms in short-lived species.<br>Early infrastructure conflicts with potential to increase regardless of management inputs. |
| 11-20 years<br>(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.<br>Tree may be over-mature and beginning to senesce.<br>Potential for infrastructure conflicts regardless of management inputs. |
| 21-40 years<br>(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<br>(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.<br>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.

<table>
<tr><td colspan="4">Arboricultural rating</td></tr>
<tr><td>Category</td><td colspan="3">Description</td></tr>
<tr><td>High</td><td colspan="3">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.<br>Other factors that could contribute to a high rating:<ul><li>Particularly good example of the species; rare or uncommon.</li><li>Tree has visual importance as a landscape feature; provides substantial contribution to landscape character.</li><li>Tree may have significant ecological or conservation value.</li><li>*Tree has historical, commemorative or other distinct social/cultural significance.</li></ul>Trees in this category must be considered for retention and/or incorporated within design proposals.</td></tr>
<tr><td>Category</td><td>Description</td><td>Sub category</td><td>Description</td></tr>
<tr><td rowspan="3">Moderate</td><td rowspan="3">Tree of moderate quality, in fair or typical condition. Tree may have a condition, and or structural problem that will respond to arboricultural treatment. These trees have the potential to be moderate- to long-term components of the landscape (moderate to long ULE) if managed appropriately.<br>The sub-categories relate predominately to age, size and amenity.<br>Trees in this category should be considered for retention and/or incorporated within design proposals.</td><td>A</td><td>Moderate to large, maturing tree. Suited to the site & contributes to the landscape character.<br>Tree may have conservation or other cultural/social value.</td></tr>
<tr><td>B</td><td>Moderate sized, established tree, > 50% of attainable age/size. Suited to the site & contributes to the landscape character (other attributes covered under 'Moderate' description)</td></tr>
<tr><td>C</td><td><ul><li>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.</li><li>Semi- to mature tree with accumulating deficiencies and reducing ULE, trending towards Low arboricultural value.</li></ul></td></tr>
<tr><td>Category</td><td colspan="3">Description</td></tr>
</table>

| | |
|---|---|
| Low | 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).<br>• 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.<br>• 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).<br>• Unremarkable tree of no material landscape, conservation or other cultural value. Not visible from surrounding landscapes.<br>• Tree infected with pathogens that could lead to its decline.<br>• Tree has potential to be an environmental woody weed (may be dependent on location of tree in an urban landscape).<br>• Tree impacting or suppressing trees of better quality.<br>Retention of such trees may be considered if not requiring a disproportionate expenditure of resources for a tree in its condition and location. |
| *Category* | *Description* |
| Very low | Trees of low quality with a brief to no remaining ULE (<5 years).<br>• 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.<br>• 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.<br>• Small or young tree, <5m in height, <10cm DBH. Easily replaced in short-term or capable of being transplanted.<br>• 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.<br>• Tree infected with pathogens that will lead to decline and has potential to spread to adjacent trees.<br>• Tree is dead (dead tree may offer habitat values) or is showing signs of significant, immediate, and irreversible overall decline.<br>Tree cannot realistically be retained and should be considered for removal. |

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.<br>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.<br>Remnant Indigenous vegetation that contribute to biological diversity |

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# Appendix 4: Tree protection zones & Tree Protection.



### 1.0 Introduction

In order 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, as a result 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.

### 2.0 Allocation of tree protection zone (TPZ)

The method of allocating a TPZ to a particular 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

**Tree protection**

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 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.

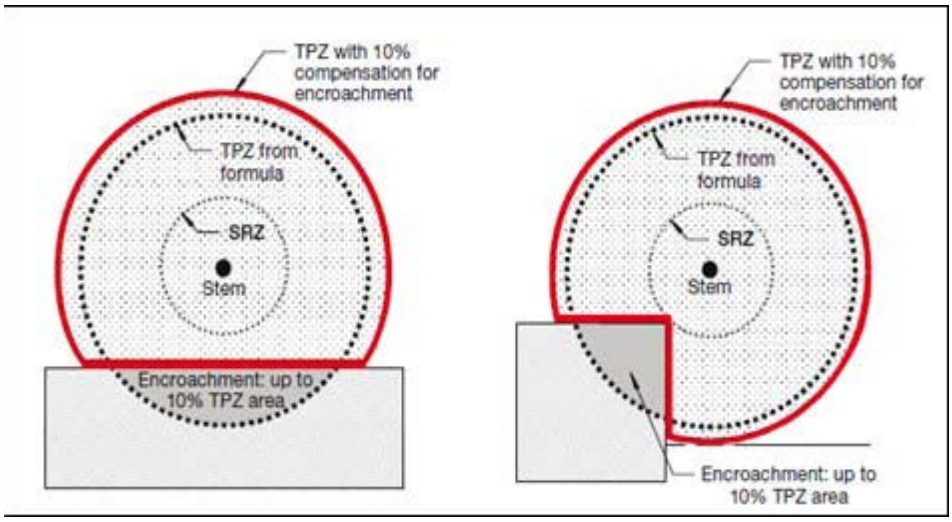


*Diagram 1: Examples of minor encroachment into a TPZ. Extract from: AS4970-2009, Appendix D, p30 of 32*

The 10% encroachment on one side equates to approximately ⅓ 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 give consideration to the canopy and overall form of the tree. If the canopy requires severe pruning in order to accommodate a building and in the process the form of the tree is diminished it may be worthwhile considering altering the design or removing the tree.

**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/arborist. 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.

**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.

**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 could be referred to as the Root Plate Radius (Mattheck & Breloer, 1994). Within the Root Plate Radius (RPR) distance, all roots and the soil surrounding the roots are deemed significant.
- No root or soil disturbance is permitted within the RPR. In the area outside the RPR, the tree may tolerate the loss of one or a number of roots. The table below indicates the size of tree roots, outside the RPR 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 RPR

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

**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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**Ground protection system (GPS).**

Where the TPZ area is to be temporarily or permanently encroached during construction activity, the area is to be protected. The aim of the GPS is to prevent root damage, soil compaction and disturbance within the TPZ. Typical measures include a permeable membrane, such as a geotextile, to cover the TPZ area beneath a 100 mm layer of crushed rock or mulch below rumble boards, steel plating or tree protection matting, such as Economat™ (See Diagram 1). This is a typical example of a GPS and a customized system may be required for large machinery or where the TPZ is to be encroached for extended periods.

Process for installation and removal of ground protection system (GPS).

- No need to remove organic matter layer. Close mow of all grass within area. If excavation is required to attain levels, no more than 100 mm in depth is to be removed.
- The entire area is to be covered with a geotextile fabric that will extend beyond the area by a distance to account for any crimping when a surface material is laid on top. Geotextile is to be firmly anchored into the soil. The geo-fabric shall comprise Bidim U34 filter fabric or equivalent. Installed by hand.
- When installing the GPS, work from the existing hard surfaces towards the extremities, using a mini track excavator to transport the rock material. Excavator is to always work on installed GPS.

- When dismantling, work from the extremities back towards the existing hard surfaces. Using a mini tracked excavator. Excavator to always work on remaining GPS.
- Geotextile comes up last (by hand).
- Reinstate grass.

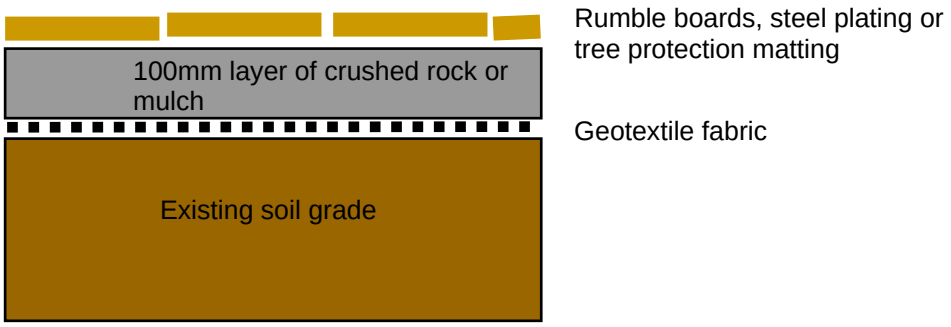


*Diagram 1: Indicative ground protection system - adapted from AS4970 Clause 4.5.3 Ground protection.*

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