



Arboricultural Assessment Former Altona Gate Primary School

Prepared for
Department of Education and Early Childhood Development

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treelogic

Tree management for the urban forest

Contents.

Client Brief 3

1. Summary 3

2. Method:..... 4

3 Observations 5

4 Permit requirement: 7

5 Design proposal:..... 7

6. Photographic examples 9

7. Conclusion and Recommendations:..... 10

References: 10

Appendix 1: Tree details: former Altona Gate Primary School. 11

Appendix 2: Tree numbers & locations: former Altona Gate Primary School..... 12

Appendix 3: Arboricultural Descriptors (August 2013)..... 13

Appendix 4: Tree protection zones 19

Title Page Images

Left: Shows Tree 79, a River Red Gum (*Eucalyptus camaldulensis*) located on south side of subject site.

Top Right: Shows trees located along the eastern boundary.

Bottom Right: Shows Trees 69, a Swamp Gum (*Casuarina glauca*) and Tree 70, a Brown Mallet (*Eucalyptus astringens*) located in the south east corner of the site.

Ref: DEECD site_former Altona Gate Primary School.

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Client Brief

Department of Education and Early Childhood Development contracted Tree Logic to undertake an assessment of trees associated with rezoning and potential development of the former Altona Gate Primary School at 430 Blackshaws Road, Altona North.

The arboricultural consultancy was required to;

- Describe assessment methods.
- Provide a detailed tree assessment including species, dimensions, condition and arboricultural rating.
- Provide guidelines for tree protection.
- Provide a plan (aerial image) that geographically locates and identifies (unique identifier - Tree No.) the assessed trees.
- Additional information included
 - Recommendations on any tree pruning works required to successfully retain suitable trees.
 - Geo-location point data for each tree point (X, Y co-ordinates).

1. Summary

- 1 Eighty one (81) trees were assessed within the tree study area.
- 2 In general the site comprised trees of below average quality primarily confined to perimeter plantings.
- 3 All trees were attributed an arboricultural rating that reflects the retention value of each tree.
 - Twenty one (21) trees were attributed an arboricultural rating of Moderate. (26 %)
 - Fifty four (54) trees were rated Low. (66 %)
 - Six (6) trees were attributed an arboricultural rating of None. (8 %)

Refer to Table 3 in Section 3 for tree numbers and tree assessment data in Appendix 1.

- 3.1 Moderate rated trees represent the best opportunity to retain established trees of fair or better quality.
- 3.2 Low rated trees had health or structural deficiencies, were small in size or were established tree weed species. Such trees are not considered worthy of being a constraint on reasonable design intent.
- 3.3 Trees rated None generally had structural defects or were hazardous and beyond practical arboricultural management.
- 4 Tree protection zones (TPZ) have been calculated for each tree in accordance with the Australian Standard for Protection of Trees on Development Sites (AS 4970-2009). The TPZ is provided in the tree assessment data in Appendix 1, as a radial measurement.
 - 4.1 The nominated TPZ may be reduced by 10% on one side if a commensurate area is allocated elsewhere and contiguous with the TPZ. Reduced TPZs have also been supplied in Appendix 1.
 - 4.2 Existing soil grades must remain unaltered within the reduced tree protection zone.
 - 4.3 Excavation or trenching for installation of footings or underground services must not occur within the reduced TPZ of any retained trees unless based on the results of a Non-destructive root investigation (NDRI) and approved by the site arborist and the relevant authority.

2. Method:

2.1 Site inspection methodology;

A site inspection was undertaken during mild conditions on Thursday, December 12, 2013.

The trees were inspected from the ground and observations were made of the growing environment and surrounding area. The trees were not climbed and no samples of the trees or site soil were taken.

Observations were made of the trees to determine age and condition, with measurements taken to establish tree height (measured with a height meter), crown width (paced) and trunk diameter (measured at 1.4m above grade unless otherwise stated). Definitions of arboricultural descriptors can be seen in Appendix 3.

The trees were plotted on orthorectified aerial imagery with GIS based software on field tablet computers with GPS and measuring tool capabilities. Geographical latitude and longitudinal reference points (X, Y coordinates) have been generated and included in the assessment data tables supplied with the report. These coordinates are accurate to within 2 to 3 metres and are considered adequate for pre-planning purposes. The location of trees nominated to be retained should be accurately located by conventional survey means prior to preparing any final designs.

The report includes assessment details in the Tree Assessment Tables in Appendix 1 and relate to the trees numbered on the site plan in Appendix 2.

Photographs of some trees and site conditions were taken for further reference and inclusion in the report.

2.2 Arboricultural assessment method;

The health and structural characteristics of each tree were assessed and each tree was attributed an 'Arboricultural Rating'. The arboricultural rating correlates the combination of tree condition factors (health, structure & form) with tree amenity value. Amenity relates to the trees biological, functional and aesthetic characteristics within a built environment. The arboricultural rating in combination with other factors can assist the project team and planners in nominating trees suitable for retention. The four arboricultural ratings used by Tree Logic include:

- **High:** Trees of high quality in good to fair condition. Retention of such trees is highly desirable.
- **Moderate:** Trees with a Moderate arboricultural rating were generally suitable for retention and design should attempt to incorporate these trees and provide adequate clearances during development stages where reasonable design intent is not unduly hampered.
- **Low:** Trees with a Low arboricultural rating generally had low retention values. They were either fair specimens of relatively small size, were environmental weed species or displayed general health or structural deficiencies. Retention of Low rated trees may be considered in some instances if not requiring a disproportionate expenditure of resources to successfully incorporate into the design or manage ongoing condition.
- **None:** Trees attributed an arboricultural rating of None have health or structural characteristics that were beyond practical arboricultural maintenance.

Full tree descriptors are attached as Appendix 3.

2.3 Establishing Tree Protection Zones (TPZ);

2.3.1 To successfully retain suitable trees within or around a development site, consideration must be given to protecting the trunk, crown and roots of each specimen. Tree protection zones (TPZ's) are used to provide adequate space for the preservation of sufficient roots to maintain tree health (particularly important for mature trees) whilst providing a buffer zone between construction activity and the tree trunk and crown.

- 2.3.2 The method for determining tree protection zones adopted in this report is the 'Australian Standard for Protection of trees on development sites' (AS4970-2009). The TPZ area is based on the trunk diameter measurement measured in metres at 1.4m and multiplied by 12 and is a guide for planning purposes. The trunk of the tree is used as the centre point for the measurement. TPZ measurements are included in the tree assessment data in Appendix 1.
- 2.3.3 Additional measurements can be calculated to determine the allowable encroachment on one side of the TPZ (Reduced TPZ) and the Structural Root Zone (SRZ) which is the absolute minimum required to maintain tree stability without consideration to ongoing health. Details of tree protection zone establishment, permissible encroachment and management guidelines are outlined in Appendix 4.

2.4 Documents reviewed include;

- Planning property reports and City of Hobsons Bay Council planning zones and overlays. The site is currently zoned Public Use Zone-Education (PUZ2).
- Clause 52.17 of the Victorian Planning Provisions of the Planning and Environment Act, 1987 (Vic) applies to the site because the allotment is greater than 4,000 m² in area.

Under clause 52.17 it is necessary to demonstrate what steps have been taken

- To avoid the removal of (Victorian) native vegetation.
- To minimise the removal of native vegetation.
- To appropriately offset the loss of native vegetation.
- Clause 52.17 applies only to vegetation native to Victoria. Vegetation planted for purposes of 'shelter belts, woodlots, street trees, gardens or the like' are exempt under 52.17-6 *unless planted with assistance from public funding*.

3 Observations

The tree study area is the former site of Altona Gate Primary School on the north side of Blackshaws Road in Altona North. It is a flat allotment of approximately 2.4 Ha with no creeks or natural drainage lines within the site. Residential housing surrounds the site to the north, east and west. All of the school buildings have been removed and only trees and some of the previous pavement sections have been retained.

- 3.1 The subject site comprises open space that was formerly playing fields and building footprints. The majority of trees are located around the perimeter of the site.
- 3.2 Herbaceous weed species and grasses occupied the areas where playing fields and buildings were located.

Tree population.

- 3.3 Eighty one (81) trees were inspected.
Refer to Appendix 2 for tree locations and numbering.
- 3.4 The origin of all trees was assessed to determine if any trees were indigenous to the local area, Victorian Native or were of botanical significance. The origin of the assessed trees is indicated in Table 1.

Table 1: Tree origin	Total	
Victorian Native	20	25 %
Australian Native	54	66 %
Exotic Conifer	2	3 %
Exotic Deciduous	5	6 %
Total	81	100%

Twenty trees of Victorian Native origin were distributed throughout the tree population. Based on the species selection, spatial arrangement and generally even age and size, it is concluded that all trees were specimens planted primarily for garden and amenity purposes and there were no naturally occurring indigenous trees.

- 3.5 Twenty nine (29) different species were observed within the tree population. The most prevalent species on site are indicated in Table 2.

Table 2. Predominant species	Number of trees
Bushy Sugar Gum (<i>Eucalyptus cladocalyx</i> 'Nana')	14
Swamp She Oak (<i>Casuarina glauca</i>)	11
Bracelet-honey Myrtle (<i>Melaleuca armillaris</i>)	10
Prickly Paper bark (<i>Melaleuca styphelioides</i>)	5
Claret Ash (<i>Fraxinus</i> 'Raywood')	3
Cootamundra Wattle (<i>Acacia balieyana</i>)	3
Late Black Wattle (<i>Acacia mearnsii</i>)	3
River Red Gum (<i>Eucalyptus camaldulensis</i>)	3
Total	52 of 81

These species represented 64 % of the total tree population. Some of these trees made a significant contribution to the site in terms of amenity and landscape values.

- 3.6 Tree health:

The health rating was assessed based on foliage colour, size and density as well as shoot initiation and elongation.

In general the trees displayed Fair health (94 %) considered to be typical for the species growing in this environment under current conditions.

- 3.7 Tree structure:

The structure of the trees was assessed for structural defects and deficiencies, likelihood of failures and presence of targets.

In general the trees displayed Fair - Poor structural condition (62 %), some of which are considered typical for the species and few structural defects that could not be amended with arboricultural maintenance.

Structural defects observed within the tree population included; limb decay, adventitious shoots developing from the tree stump and bifurcations with included bark. Structural deficiencies included; crown bias and over extended limbs and suckering growth developing from tree roots.

Several She Oak trees were sending out suckering growth from surface roots. If left unmanaged the suckers would develop into a copse or dense stand requiring future management which involves pruning the main root where the suckers are emanating from. In no instances should herbicides be applied to the suckers, as tree death will result.

- 3.8 Trees may be considered significant to the landscape because of their size, dominance within the site, presence within outlooks and general amenity in terms of shade, screen, foliage and flowers and historic, cultural or horticultural characteristics. The key requirement for successful tree retention is to identify the trees that represent the best opportunity for retention and implement tree protection and design amendments before any site works commence. The arboricultural rating in combination with other factors can assist the project team and planners in nominating trees suitable for retention.

Each of the assessed trees was attributed an 'Arboricultural Rating'. The arboricultural rating correlates the combination of tree condition factors (health, structure & form) with tree amenity value. Amenity relates to the trees biological, functional and aesthetic characteristics within an urban landscape context and its ability to continue provide these qualities into the medium to long term future.

It should be noted that the arboricultural rating is different to the conservation/ecological values placed on trees by other professions.

Table 3 indicates the arboricultural ratings attributed to the trees inspected.

Table 3: Arb. Rating	Total	Trees number
Moderate	21	1, 2, 8, 11, 13, 19, 20, 22, 30, 35, 36, 39, 43, 44, 51, 58, 59, 66, 72, 73, 79
Low	54	3, 4, 5, 6, 7, 9, 10, 12, 14, 15, 16, 17, 18, 21, 23, 24, 25, 26, 27, 28, 29, 31, 32, 33, 34, 37, 38, 40, 41, 45, 46, 47, 50, 53, 55, 56, 57, 60, 61, 62, 63, 64, 65, 67, 68, 69, 70, 71, 74, 75, 76, 78, 80, 81
None	6	42, 48, 49, 52, 54, 77
Total	81	

- 3.7.1 Moderate rated trees represent trees of fair or better condition. These trees are considered to be suitable to retain and as having the best potential to be medium to long term features of the surrounding landscape if retained.

Pruning recommendations should be undertaken to enhance the longevity and safe retention of these trees.

- 3.7.2 Low rated trees were generally either of relatively small dimensions, of unremarkable quality, had a relatively short useful life expectancy, were environmental weed species or displayed below typical health or structure.

Low rated trees are not considered to be worthy of being a constraint on reasonable design intent and development within the site. Such trees may still contribute to the landscape amenity as an established tree resource and have the potential to be safely retained if appropriate tree protection measures and arboricultural maintenance is provided as required.

- 3.7.3 Trees rated None were generally defective or hazardous that were beyond practical arboricultural management and should be removed.

(Refer to Appendix 2 for tree location and numbering and Appendix 3 for tree descriptors).

4 Permit requirement:

Based on the species selection, spatial arrangement and generally even age and size, it is concluded that all trees were specimens planted primarily for garden and amenity purposes and are exempt from consideration under Clause 52.17 of the Victorian Planning Provisions of the Planning and Environment Act, 1987 (Vic).

5 Design proposal:

- 5.1 The pre-development arboricultural inspection report provides planners and designers with information on the measures required to protect trees suitable to be retained. At the time of undertaking the tree assessment there was no requirement to undertake a concept design review.

- 5.2 In the absence of formal design plans, it is not appropriate to speculate on which trees are most appropriate for retention beyond the general guide provided by the arboricultural ratings attributed to each tree feature.
- 5.3 It is recommended that trees of Moderate arboricultural value be considered for retention and protection over trees of Low or No arboricultural value during any redevelopment of the site.
- 5.4 The Low rated trees within the site were either deficient in health or structure, considered to be environmental weed species or were of small size and are not worthy of being a constraint on reasonable design intent.
- 5.4.1 However not all Low rated trees should be dismissed altogether. Some Low rated trees can be retained as an established tree resource where they are not impacted directly by any proposed construction activity or where they perform a role such as screening neighbouring properties or the like or protect from erosion, winds, frosts or other actions.
- 5.5 Weed species should generally be removed for sound environmental reasons.
- 5.6 The tree protection zones (TPZ) have been determined for each tree based on the Australian Standard for Protection of Trees on Development Sites (AS 4970-2009). The method for calculating, applying and managing the tree protection zone is described in Appendix 4.
- 5.6.1 Where construction related activity is confined to only one side of the tree, the nominal TPZ may be reduced by 10% of the TPZ area which is equivalent to approximately 1/3 radial distance.
- 5.6.2 It is recommended that no construction be proposed beneath the canopy extents of any River Red Gums or for that matter any of the larger maturing trees including Bushy Sugar Gums and Brown Mallets due to the potential for limb failure and mature trees being more sensitive to site disturbance.
- 5.7 It is recommended that where maturing native trees occur within any proposed subdivision allotments, the allotment must be of sufficient size to permit reasonable use and development of the site in conjunction with allowing for sufficient area surrounding the tree to fully protect the nominated tree protection zone.
- 5.8 It is well understood that trees develop a relatively shallow lateral root system as opposed to a 'tap' root. Managing these surface roots must be considered with regard to any tree that is to be retained. Ensuring that existing soil levels are maintained within the nominated tree protection zone is important and any construction proposed within the TPZ of a retained tree must adopt a root sensitive design and construction method approved under consultation with the site arborist or the relevant authorities.
- 5.9 It is recommended that exclusion fencing be established around all retained trees prior to any further works occurring on site including bulk earthworks, excavation for footings or installation of underground services or any construction related activity to prevent damage to roots, buttress, trunk or limbs and to prevent soil compaction.
- 5.9.1 The area within the TPZ should be mulched to 100mm depth with matured wood chip mulch with a particle size of 25mm for 75% of the volume.
- 5.9.2 The growth of self-sown saplings or weed invasion should be controlled within the TPZ areas.

6. Photographic examples



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Photo 1: Shows Trees 6, a Swamp Mallet (*Eucalyptus spathulata*) and Tree 7, Willow-leaved Bottlebrush (*Callistemon Salignus*). The Swamp Mallet was of Low arboricultural value due to a basal wound and previous limb failure. Tree 7 was small in size.

Photo 2: Shows trees 10, 11, 12, 13 and 16 located on the western boundary. The larger Bushy Sugar Gums were suppressing the smaller Trees 10 and 12.

Photo 3: Shows Trees 19, 20 and 21, all Bushy Sugar Gums (*Eucalyptus cladocalyx* 'Nana'). Trees 19 and 20 were of Moderate arboricultural value and in a condition suitable to be retained. Tree 21 was becoming suppressed by the adjacent Bushy Sugar Gum.

Photo 4: Shows Trees 34 – 43, a mixture of Eucalyptus and She Oak species located along the eastern boundary. Some of the She Oaks were suckering at the base that would eventually form a copse or dense stand requiring management. Generally the Eucalyptus were of Low arboricultural value.

Photo 5: Shows an example of a structural defect of a bifurcated union that has developed included bark in one of the Swamp She Oaks (*Casuarina glauca*). The type of union is considered to be weak and at a higher probability of failure than a union without included bark.

Photo 6: Shows Tree 55, a Sydney Blue Gum (*Eucalyptus saligna*) in poor condition displaying crown dieback.

Photo 7: Shows an example of a limb wound as a result of a limb failure, commonly seen in mature Bushy Sugar Gums where over extended branches have developed.

7. Conclusion and Recommendations:

7.1. Eighty one (81) trees were inspected within the site of the former Altona Gate Primary School at 430 Blackshaws Road in Altona North.

7.2. All trees were attributed an arboricultural rating that reflects the retention value of each tree.

- Twenty one trees were attributed an arboricultural rating of Moderate.
- Fifty four trees were rated Low.
- Six trees were attributed an arboricultural rating of None.

Refer to Page 7, Table 3 for tree numbers, Appendix 2 for tree locations and Appendix 3 for tree descriptors.

7.3. To successfully retain the nominated suitable trees, tree protection measures must be implemented prior to any commencing any construction related activity including demolition, bulk earthworks and must be maintained for the duration of the construction process including landscaping.

7.3.1. Tree protection zones must be appropriately fenced to prevent vehicle access, excavation, trenching, contamination or raised soil levels occurring within the reduced TPZ.

7.4. Any pruning recommendations must be undertaken by a suitably qualified and experienced arborist and comply with Australian Standard AS 4373-2007 - Pruning of Amenity trees to extend the useful life expectancy of retained trees.

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.

Standards Australia (2007), Australian Standard (4373-2007) - Pruning of Amenity trees, Standards Australia, Homebush, NSW.

Appendix 1: Tree details: former Altona Gate Primary School.

Refer to following 7 pages.

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

TPZ = Tree Protection Zone (metre radius). Radius distances measured in metres from the centre of the trunk.

For tree location and numbering refer Appendix 2. See Appendix 3 for Tree descriptors.

Appendix 1: Tree Assessment detail: former Altona Gate Primary School (Tree Logic, 2014).

Tree No.	Common Name (Botanical Name)	Origin	DBH (cm)	Height (m)	Crown Width (m)	Life Stage	Health	Structure	Retention Value	Comments	TPZ (radial metres)	reduced TPZ (metres)	Recommended Work	Latitude	Longitude
1	Prickly-leaved Paperbark (Melaleuca styphelioides)	Australian Native	26 @ 1.0m	5	7	Semi-mature	Fair	Fair - Poor	Moderate		3.1	2.2		-37.8302	144.83998
2	Bushy Sugar Gum (Eucalyptus Cladocalyx 'Nana')	Australian Native	70	17	16	Mature	Fair	Fair	Moderate		8.4	5.9		-37.8301	144.84002
3	Snow in Summer (Melaleuca linariifolia)	Australian Native	12,11,15,14,14 @ 0.5m	3	4	Semi-mature	Fair	Fair - Poor	Low		3.6	2.5		-37.8301	144.83998
4	Prickly-leaved Paperbark (Melaleuca styphelioides)	Australian Native	17,15,14,13 @ 0.5m	4	5	Semi-mature	Fair	Fair	Low	Small size	3.6	2.5		-37.83	144.83998
5	Bottlebrush (Callistemon sp.)	Australian Native	16,8 @ 0.5m	3	4	Semi-mature	Fair	Fair - Poor	Low		2.1	1.5		-37.8298	144.84007
6	Swamp Mallet (Eucalyptus spathulata)	Australian Native	40	9	10	Semi-mature	Fair	Fair - Poor	Low	Basal Wound, limb failures	4.8	3.4		-37.8296	144.84009
7	Willow Bottlebrush (Callistemon salignus)	Australian Native	12,7,6,7 @ 0.5m	3	2	Semi-mature	Fair	Fair - Poor	Low		2.0	1.4		-37.8295	144.84009
8	Snow in Summer (Melaleuca linariifolia)	Australian Native	23,22,15 @ 0.5m	5	7	Semi-mature	Fair	Fair - Poor	Moderate		4.2	3.0		-37.8293	144.84012
9	Willow Bottlebrush (Callistemon salignus)	Australian Native	11,12 @ 0.5m	4	5	Semi-mature	Fair	Fair - Poor	Low		2.0	1.4		-37.8292	144.84016
10	Swamp Mallet (Eucalyptus spathulata)	Australian Native	15	9	6	Semi-mature	Fair	Fair - Poor	Low	Partly Suppressed. Crown bias to south	2.0	1.4		-37.8291	144.84016
11	Bushy Sugar Gum (Eucalyptus Cladocalyx 'Nana')	Australian Native	55	15	16	Mature	Fair	Fair - Poor	Moderate	Limb Decay. Reduce limb above decayed area	6.6	4.6	Crown reduction	-37.829	144.84016
12	Bushy Sugar Gum (Eucalyptus Cladocalyx 'Nana')	Australian Native	24,16,20	8	12	Semi-mature	Fair	Fair - Poor	Low	Partly Suppressed. Crown Bias-	4.2	2.9		-37.829	144.84016
13	Bushy Sugar Gum (Eucalyptus Cladocalyx 'Nana')	Australian Native	60	15	19	Mature	Fair	Fair	Moderate		7.2	5.0		-37.829	144.84019

Appendix 1: Tree Assessment detail: former Altona Gate Primary School (Tree Logic, 2014).

Tree No.	Common Name (Botanical Name)	Origin	DBH (cm)	Height (m)	Crown Width (m)	Life Stage	Health	Structure	Retention Value	Comments	TPZ (radial metres)	reduced TPZ (metres)	Recommended Work	Latitude	Longitude
14	Leyland Cypress (XCupressocyparis leylandii)	Exotic Conifer	11,7 @ 0.5m	4	3	Semi-mature	Fair	Fair - Poor	Low		2.0	1.4		-37.829	144.84023
15	Leyland Cypress (XCupressocyparis leylandii)	Exotic Conifer	11,9,8 @ 0.5m	4	4	Semi-mature	Fair	Fair - Poor	Low		2.0	1.4		-37.829	144.84026
16	Bushy Sugar Gum (Eucalyptus Cladocalyx 'Nana')	Australian Native	26,26,19	8	9	Semi-mature	Fair	Fair	Low	Becoming suppressed	5.0	3.5		-37.829	144.84019
17	Gum Tree (Eucalyptus sp.)	Australian Native	13,13	6	5	Semi-mature	Fair	Poor	Low	Stump Resprout.	2.2	1.5		-37.8288	144.84023
18	Bushy Sugar Gum (Eucalyptus Cladocalyx 'Nana')	Australian Native	15,9,11	5	6	Semi-mature	Fair	Fair	Low	Becoming suppressed	2.5	1.7		-37.8287	144.84023
19	Bushy Sugar Gum (Eucalyptus Cladocalyx 'Nana')	Australian Native	70	17	15	Mature	Fair	Fair	Moderate		8.4	5.9	Crown Maintenance	-37.8286	144.84026
20	River Red Gum (Eucalyptus camaldulensis)	Victorian Native	35	15	8	Semi-mature	Fair	Fair	Moderate		4.2	2.9		-37.8286	144.84026
21	Bushy Sugar Gum (Eucalyptus Cladocalyx 'Nana')	Australian Native	19,14	6	11	Semi-mature	Fair	Fair	Low	Becoming suppressed	2.8	2.0		-37.8285	144.84026
22	Bushy Sugar Gum (Eucalyptus Cladocalyx 'Nana')	Australian Native	50	15	17	Mature	Fair	Fair	Moderate		6.0	4.2	Crown Maintenance	-37.8285	144.84026
23	Bushy Sugar Gum (Eucalyptus Cladocalyx 'Nana')	Australian Native	17,17,15,14,15	7	13	Semi-mature	Fair	Poor	Low	Stump Resprout.	4.2	2.9		-37.8285	144.84026
24	Desert Ash (Fraxinus angustifolia subsp. angustifolia)	Exotic Deciduous	10 @ 0.5m	3	2	Semi-mature	Fair	Fair - Poor	Low		2.0	1.4		-37.8283	144.84029
25	Bracelet Honey-myrtle (Melaleuca armillaris)	Victorian Native	17,11,9 @ 0.5m	3	5	Semi-mature	Fair	Fair - Poor	Low		2.7	1.9		-37.828	144.84033
26	Golden Wreath Wattle (Acacia saligna)	Australian Native	17,14,10,9,10 @ 0.5m	3	7	Mature	Fair	Fair - Poor	Low		3.3	2.3		-37.828	144.84033
27	Bushy Sugar Gum (Eucalyptus Cladocalyx 'Nana')	Australian Native	15,19	6	6	Semi-mature	Fair	Poor	Low	Stump Resprout.	2.9	2.0		-37.8278	144.84044

Appendix 1: Tree Assessment detail: former Altona Gate Primary School (Tree Logic, 2014).

Tree No.	Common Name (Botanical Name)	Origin	DBH (cm)	Height (m)	Crown Width (m)	Life Stage	Health	Structure	Retention Value	Comments	TPZ (radial metres)	reduced TPZ (metres)	Recommended Work	Latitude	Longitude
28	Bushy Sugar Gum (Eucalyptus Cladocalyx 'Nana')	Australian Native	17,19,21,16 @ 1.0m	7	11	Semi-mature	Fair	Poor	Low	Stump Resprout.	4.4	3.1		-37.8278	144.84066
29	Bracelet Honey-myrtle (Melaleuca armillaris)	Victorian Native	14,23,12,12,14 @ 0.5m	5	9	Semi-mature	Fair	Fair - Poor	Low		4.2	2.9		-37.8278	144.84092
30	Victorian Blue Gum (Eucalyptus bicostata)	Victorian Native	55	14	12	Semi-mature	Fair	Fair	Moderate	Past Power line clearance.	6.6	4.6		-37.8279	144.84118
31	Bracelet Honey-myrtle (Melaleuca armillaris)	Victorian Native	19 @ 0.5m	3	3	Semi-mature	Fair	Fair - Poor	Low		2.3	1.6		-37.828	144.8413
32	Bracelet Honey-myrtle (Melaleuca armillaris)	Victorian Native	14.13,9,11,12 @ 1.0m	4	6	Semi-mature	Fair	Fair - Poor	Low		2.8	2.0		-37.828	144.8413
33	Sweet-scented Hakea (Hakea drupacea)	Australian Native	14,12,12 @ 0.5m	3	5	Semi-mature	Fair	Fair - Poor	Low		2.6	1.8		-37.8281	144.84126
34	Southern Mahogany (Eucalyptus botryoides)	Victorian Native	43	11	10	Semi-mature	Fair	Poor	Low		5.2	3.6		-37.8281	144.84126
35	Swamp She-oak (Casuarina glauca)	Australian Native	60	16	11	Semi-mature	Fair	Fair	Moderate		7.2	5.0		-37.8282	144.84126
36	River She-oak (Casuarina Cunninghamiana)	Australian Native	39	12	12	Semi-mature	Fair	Fair	Moderate		4.7	3.3		-37.8283	144.84125
37	Yate (Eucalyptus cornuta)	Australian Native	44	12	17	Semi-mature	Fair	Fair - Poor	Low		5.3	3.7		-37.8284	144.84126
38	Swamp She-oak (Casuarina glauca)	Australian Native	26	11	5	Semi-mature	Fair	Fair - Poor	Low	Suckering at base	3.1	2.2		-37.8284	144.84126
39	Gum Tree (Eucalyptus sp.)	Australian Native	21	11	11	Semi-mature	Fair	Fair	Moderate		2.5	1.8		-37.8285	144.84124
40	Swamp She-oak (Casuarina glauca)	Australian Native	15	8	5	Semi-mature	Fair	Fair - Poor	Low	Basal Wound, suckering at base	2.0	1.4		-37.8285	144.84122
41	Swamp She-oak (Casuarina glauca)	Australian Native	46	12	12	Semi-mature	Fair	Fair - Poor	Low	Acute Branch union, suckering at base	5.5	3.9		-37.8286	144.84122
42	Swamp She-oak (Casuarina glauca)	Australian Native	5,5,5,5,5	5	5	Semi-mature	Fair	Poor	None	Suckering	2.0	1.4		-37.8286	144.84123

Appendix 1: Tree Assessment detail: former Altona Gate Primary School (Tree Logic, 2014).

Tree No.	Common Name (Botanical Name)	Origin	DBH (cm)	Height (m)	Crown Width (m)	Life Stage	Health	Structure	Retention Value	Comments	TPZ (radial metres)	reduced TPZ (metres)	Recommended Work	Latitude	Longitude
43	Swamp She-oak (Casuarina glauca)	Australian Native	50 @ 1.0m	13	10	Semi-mature	Fair	Fair - Poor	Moderate	Included Bark Fork.	6.0	4.2	Reduce Lesser Co-dominant Stem	-37.8286	144.84123
44	Swamp She-oak (Casuarina glauca)	Australian Native	46	14	9	Semi-mature	Fair	Fair - Poor	Moderate	Included Bark Fork.	5.5	3.9	Reduce Lesser Co-dominant Stem	-37.8288	144.84121
45	Prickly-leaved Paperbark (Melaleuca styphelioides)	Australian Native	30,15,15 @ 0.5m	6	9	Semi-mature	Fair	Fair - Poor	Low		4.4	3.1		-37.8289	144.84117
46	Bushy Sugar Gum (Eucalyptus Cladocalyx 'Nana')	Australian Native	59	13	14	Mature	Fair	Fair - Poor	Low	Past limb failure, end weight lower north & west	7.1	5.0	Weight Reduce	-37.8289	144.84114
47	Swamp She-oak (Casuarina glauca)	Australian Native	40	12	10	Semi-mature	Fair	Fair - Poor	Low	Partly Suppressed. Crown bias to south	4.8	3.4		-37.829	144.84114
48	Bracelet Honey-myrtle (Melaleuca armillaris)	Victorian Native	23,18,18,23,18 @ 0.5m	5	9	Mature	Fair	Very Poor	None	Active Split.	5.4	3.8		-37.8291	144.84081
49	Buxton Gum (Eucalyptus crenulata)	Victorian Native	5,5,5,3 @ 1.0m	4	4	Semi-mature	Fair	Very Poor	None	Stump Resprout.	2.0	1.4		-37.8292	144.84074
50	Bottlebrush (Callistemon sp.)	Australian Native	13,10,12,9,9 @ 1.0m	4	4	Semi-mature	Fair	Fair - Poor	Low		2.9	2.0		-37.8293	144.84078
51	Prickly-leaved Paperbark (Melaleuca styphelioides)	Australian Native	16,23,14,24 @ 1.0m	8	7	Semi-mature	Fair	Fair - Poor	Moderate		4.7	3.3		-37.8293	144.84087
52	Late Black Wattle (Acacia mearnsii)	Victorian Native	44 @ 0.5m	7	9	Over Mature	Poor	Poor	None	In decline.	5.3	3.7		-37.8293	144.84091
53	Showy Honey-myrtle (Melaleuca nesophila)	Australian Native	19,25 @ 0.5m	5	7	Mature	Fair	Fair - Poor	Low	Partly Suppressed. Crown bias to west	3.8	2.6		-37.8293	144.841
54	Cootamundra Wattle (Acacia baileyana)	Australian Native	28	7	11	Over Mature	Poor	Poor	None	In decline.	3.4	2.4		-37.8293	144.84106

Appendix 1: Tree Assessment detail: former Altona Gate Primary School (Tree Logic, 2014).

Tree No.	Common Name (Botanical Name)	Origin	DBH (cm)	Height (m)	Crown Width (m)	Life Stage	Health	Structure	Retention Value	Comments	TPZ (radial metres)	reduced TPZ (metres)	Recommended Work	Latitude	Longitude
55	Sydney Blue Gum (Eucalyptus saligna)	Australian Native	57	15	12	Semi-mature	Fair	Poor	Low	Basal Wound, previous crown die back, epicormics	6.8	4.8		-37.8292	144.8411
56	Cootamundra Wattle (Acacia baileyana)	Australian Native	22 @ 1.0m	5	10	Semi-mature	Fair	Fair - Poor	Low	Partly Suppressed. Crown bias to west, short lived	2.6	1.8		-37.8292	144.84114
57	Gum Tree (Eucalyptus sp.)	Australian Native	44	10	7	Semi-mature	Poor	Poor	Low	Borer damage, half crown dead	5.3	3.7		-37.8294	144.84108
58	Prickly-leaved Paperbark (Melaleuca styphelioides)	Australian Native	35,31,24,20 @ 0.5m	8	11	Semi-mature	Fair	Fair - Poor	Moderate		7.2	5.0		-37.8295	144.84104
59	Claret Ash (Fraxinus 'Raywood')	Exotic Deciduous	33	10	12	Semi-mature	Fair	Fair - Poor	Moderate	Planted on mound, would need further soil around root system if retained.	4.0	2.8	Action - other	-37.8296	144.84093
60	Claret Ash (Fraxinus 'Raywood')	Exotic Deciduous	27	9	9	Semi-mature	Fair	Poor	Low	Root decay on windward side of tree. Planted on mound.	3.2	2.3		-37.8298	144.84091
61	Cootamundra Wattle (Acacia baileyana)	Australian Native	24 @ 1.0m	5	10	Semi-mature	Fair - Poor	Poor	Low	Exposed roots, borer damage.	2.9	2.0		-37.8297	144.84102
62	Bracelet Honey-myrtle (Melaleuca armillaris)	Victorian Native	8,8,10,7 @ 1.0m	3	4	Semi-mature	Fair	Fair - Poor	Low		2.0	1.4		-37.8298	144.841
63	Bracelet Honey-myrtle (Melaleuca armillaris)	Victorian Native	11,15,10,10,17 @ 0.5m	4	7	Semi-mature	Fair	Fair - Poor	Low		3.5	2.4		-37.8298	144.84097
64	Bracelet Honey-myrtle (Melaleuca armillaris)	Victorian Native	10,10,10,10,13 @ 0.5m	4	5	Semi-mature	Fair	Fair - Poor	Low		2.9	2.0		-37.8299	144.84097

Appendix 1: Tree Assessment detail: former Altona Gate Primary School (Tree Logic, 2014).

Tree No.	Common Name (Botanical Name)	Origin	DBH (cm)	Height (m)	Crown Width (m)	Life Stage	Health	Structure	Retention Value	Comments	TPZ (radial metres)	reduced TPZ (metres)	Recommended Work	Latitude	Longitude
65	Claret Ash (Fraxinus 'Raywood')	Exotic Deciduous	15	6	6	Semi-mature	Fair	Fair - Poor	Low	Suckering from rootstock, planted on mound exposed roots.	2.0	1.4		-37.8299	144.84093
66	Swamp She-oak (Casuarina glauca)	Australian Native	52,53	19	12	Mature	Fair	Fair - Poor	Moderate	Included Bark Fork. Reduce northern limb	8.9	6.2	Crown Reduce	-37.83	144.84097
67	Gossamer Wattle (Acacia floribunda)	Australian Native	22 @ 0.5m	5	9	Mature	Fair	Fair - Poor	Low	Partly Suppressed. Crown Bias to west	2.6	1.8		-37.83	144.84097
68	Bracelet Honey-myrtle (Melaleuca armillaris)	Victorian Native	18 @ 0.1m	3	5	Semi-mature	Fair	Fair - Poor	Low		2.2	1.5		-37.8301	144.84095
69	Swamp She-oak (Casuarina glauca)	Australian Native	48	16	11	Semi-mature	Fair	Fair - Poor	Low	Suckering at base, over extended limb north.	5.8	4.0	Crown Reduce	-37.8301	144.84095
70	Brown Mallet (Eucalyptus astringens)	Australian Native	14,55	18	15	Mature	Fair	Fair - Poor	Low	Included bark union, past limb failure	6.8	4.8		-37.8302	144.84093
71	Grey Box (Eucalyptus microcarpa)	Australian Native	29	10	10	Semi-mature	Fair	Fair - Poor	Low		3.5	2.4		-37.8303	144.84091
72	Moonah (Melaleuca lanceolata)	Australian Native	27,25,32 @ 1.0m	7	9	Mature	Fair	Fair - Poor	Moderate		5.9	4.1		-37.8303	144.84083
73	Bushy Sugar Gum (Eucalyptus Cladocalyx 'Nana')	Australian Native	52	12	18	Mature	Fair	Fair	Moderate	Over-extended Limbs.	6.2	4.4	Crown Reduce	-37.8303	144.84068
74	Drooping She-oak (Allocasuarina verticillata)	Victorian Native	12 @ 1.0m	5	5	Semi-mature	Fair	Fair - Poor	Low		2.0	1.4		-37.8302	144.84066
75	River Red Gum (Eucalyptus camaldulensis)	Victorian Native	49	12	11	Semi-mature	Fair	Fair - Poor	Low	Limb Decay.	5.9	4.1		-37.8302	144.84055
76	Late Black Wattle (Acacia mearnsii)	Victorian Native	25	10	9	Mature	Fair	Fair - Poor	Low		3.0	2.1		-37.8302	144.84049

Appendix 1: Tree Assessment detail: former Altona Gate Primary School (Tree Logic, 2014).

Tree No.	Common Name (Botanical Name)	Origin	DBH (cm)	Height (m)	Crown Width (m)	Life Stage	Health	Structure	Retention Value	Comments	TPZ (radial metres)	reduced TPZ (metres)	Recommended Work	Latitude	Longitude
77	Late Black Wattle (Acacia mearnsii)	Victorian Native	24	9	8	Mature	Poor	Poor	None		2.9	2.0		-37.8302	144.84042
78	Desert Ash (Fraxinus angustifolia subsp. angustifolia)	Exotic Deciduous	32,26 @ 0.5m	9	11	Semi-mature	Fair	Fair - Poor	Low	Weed Species.	4.9	3.5		-37.8302	144.8404
79	River Red Gum (Eucalyptus camaldulensis)	Victorian Native	54	16	12	Semi-mature	Fair	Fair	Moderate		6.5	4.5		-37.8302	144.84038
80	Bracelet Honey-myrtle (Melaleuca armillaris)	Victorian Native	25	5	6	Semi-mature	Fair	Poor	Low	Trunk lean, past limb failure	3.0	2.1		-37.8303	144.84015
81	Swamp She-oak (Casuarina glauca)	Australian Native	33,28	11	14	Semi-mature	Fair	Fair - Poor	Low		5.2	3.6		-37.8303	144.84008

Appendix 2: Tree numbers & locations: former Altona Gate Primary School.

Refer to following page.

Appendix 2: Tree location & numbers: former Altona Gate Primary School (Tree Logic, 2014).



Appendix 3: Arboricultural Descriptors (August 2013)

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.

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. 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 author.

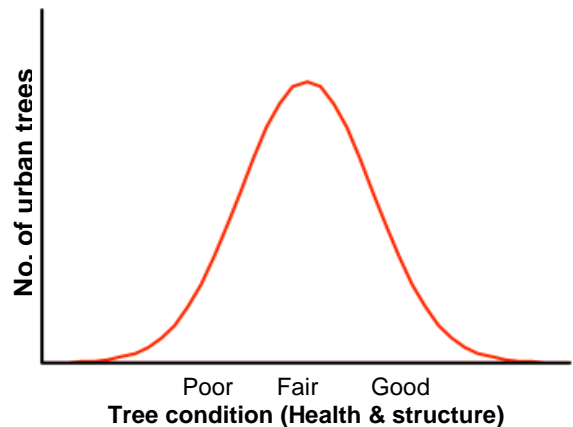


Diagram 1: Indicative normal distribution curve for tree condition

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.

Tree Name

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

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
Victorian native	Occurs naturally within some part of the State of Victoria (not exclusively) but is not indigenous
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

Category	Description
Native Palm	Occurs naturally within Australia. Woody monocotyledon
Exotic Palm	Occurs outside of Australia. Woody monocotyledon

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 author'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).

Trunk diameters

The position where trunk diameters are captured may vary dependent on the requirements of the specific assessment. 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.

Diameter at Breast Height (DBH)

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

Health

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

Category	Vigour/Extension growth	Decline symptoms/Deadwood /Dieback	Foliage density, colour, size, intactness	Pests and or disease
Good	Above typical	Negligible	Better than typical	Negligible
Fair	Typical	Minor or expected	Typical	Minor, within damage thresholds
Fair to Poor	Below typical	More than typical	Exhibiting deficiencies	Exceeds damage thresholds

Category	Vigour/Extension growth	Decline symptoms/Deadwood /Dieback	Foliage density, colour, size, intactness	Pests and or disease
Poor	Minimal	Excessive, large and/or prominent amount/size	Exhibiting severe deficiencies	Extreme and contributing to decline
Dead	N/A	N/A	N/A	N/A

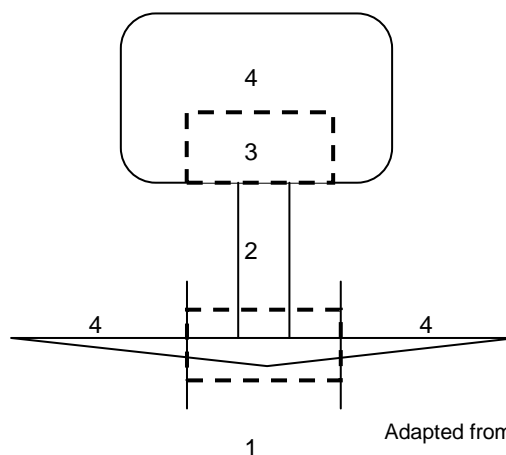
Structure

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 obvious damage, disease, decay or structural defect
Fair	Minor damage or decay. Basal flare present.	Minor damage or decay	Typically formed, attached, spaced and tapered	Minor damage, disease or decay; minor branch end-weight or over-extension
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
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 resprout	Decayed, cavities or has acute branch attachments with included bark; excessive compression flaring; failure likely	Major damage, disease or decay; fungal fruiting bodies present; major branch end-weight or over-extension
Very Poor	Excessive damage, disease or decay; unstable / loose in ground; altered exposure; failure probable	Excessive damage, disease or decay; cavities. Excessive lean. Stump resprout	Decayed, cavities or branch attachments with active split; failure imminent	Excessive damage, disease or decay; excessive branch end-weight or over-extension

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 the 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 take into account the combination of likelihood of failure and impact, including the perceived importance of the target(s).

Life Stage

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.
Maturing	Specimen approaching expected size in situation, with reduced incremental growth
Over-mature	Tree is senescent and in decline. Significant decay generally present

Arboricultural Rating

Relates to the combination of tree condition factors, including health and structure (arboricultural merit), and also conveys an amenity value. Amenity relates to the trees biological, functional and aesthetic characteristics (Hitchmough 1994) within an urban landscape context.

Category	Description
High	Tree of high quality in good to fair condition. Generally a prominent arboricultural feature. These trees have the potential to be a medium- to long-term component of the landscape if managed appropriately. Retention of these trees is highly desirable.
Moderate	Tree of moderate quality, in fair or better condition. Tree may have a condition, and or structural problem that will respond to arboricultural treatment. These trees have the potential to be a medium- to long-term component of the landscape if managed appropriately. Retention of these trees is generally desirable.

Low	<p>Tree of low quality and/or little amenity value. Tree in poor health and/or with poor structure.</p> <p>Tree is not significant because of its size and/or age. These trees are easily replaceable.</p> <p>Tree (species) is functionally inappropriate to specific location and would be expected to be problematic if retained.</p> <p>Retention of such trees may be considered if not requiring a disproportionate expenditure of resources for a tree in its condition and location.</p>
None	<p>Tree has a severe structural defect and/or health problem that cannot be sustained with practical arboricultural techniques and the loss of tree would be expected in the short term.</p> <p>Tree whose retention would not be viable after the removal of adjacent trees (includes trees that have developed in close spaced groups and would not be expected to acclimatise to severe alterations to surrounding environment – removal of adjacent shelter trees).</p> <p>Tree has a detrimental effect on the environment, for example, the tree is a woody weed with potential to spread into waterways or natural areas.</p>

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 criterion 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	<p>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.</p> <p>Tree commemorates a particular occasion, including plantings by notable people, or having associations with an important event in local history.</p>
Ecological Value	<p>Tree could have value as habitat for indigenous wildlife, including providing breeding, foraging or roosting habitat, or is a component of a wildlife reserve.</p> <p>Remnant Indigenous vegetation that contribute to biological diversity</p>

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Appendix 4: Tree protection zones. Tree logic Pty. Ltd. © 2005

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.

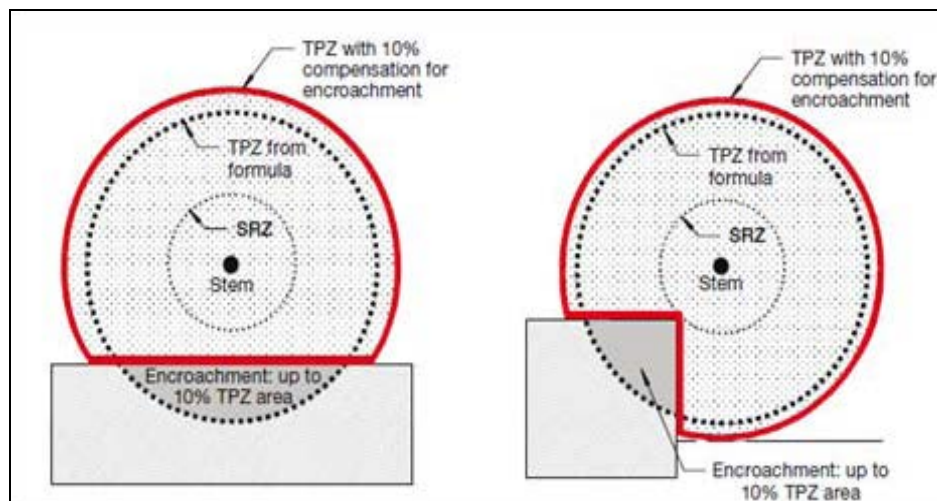


Diagram 1: Examples of minor encroachment into a TPZ. Extract from: AS4970-2009, Appendix D, p30 of 32

The 10% encroachment on one side equates to approximately $\frac{1}{3}$ radial distance. Tree root growth is opportunistic and occurs where the essentials to life (primarily air and water) are present. Heterogeneous soil conditions, existing barriers, hard surfaces and buildings may have inhibited the development of a symmetrically radiating root system.

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

The TPZ should also 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. 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.

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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