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Arboricultural Assessment

Richmond Property, Bulban Road, West Werribee

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1 Background & Summary

1.1 Tree Logic was engaged by Delfin Lend Lease to undertake an arboricultural assessment of trees within and surrounding Richmond Property, Bulban Road West Werribee. The intent of the assessment was to provide information on the arboricultural merit of the tree population to inform future planning and design processes within the area.

1.2 Thirty trees, all maturing River Red Gum (Eucalyptus camaldulensis) were assessed. No trees were of significant arboricultural merit. Ten trees attracted Moderate arboricultural ratings despite some level of structural defect within each tree. Remaining trees had more severe structural defects and attracted Low or No arboricultural rating. Retention of any assessed trees within a site redevelopment will need to will need to apply risk management principles to determine appropriate siting in the landscape.

2 Key Objectives

2.1 To undertake an assessment of thirty nominated trees within the Richmond Property, Bulban Road West Werribee.

2.2 Provide details of the tree population within the subject site, including location, context, species, type, age, condition, dimensions, and arboricultural value.

2.3 Advise on trees to be considered for retention. Advise on tree protection zones/measures where applicable.

3 Method

3.1 Field Survey

3.1.1 A site and tree inspection was conducted on Monday January 18th 2009. The tree assessment consisted of a visual inspection, which was undertaken with regard to modern arboricultural principles and practices. The assessment did not involve a detailed examination of below ground or internal tree parts. The assessment was undertaken from the ground to determine health, structure, form and age class with measurements taken to establish trunk and crown dimensions. No site soil samples were taken; foliage samples were collected to assist in specimen identification.

3.1.2 Tree identification numbering was provided by Delfin Lend Lease, which have been referred to in this report. Tree numbers appearing in column 1 of the Tree Assessment Table in Appendix 1 correspond with the tree numbers layer provided in Figures 2-4, Section 4 of this report.

3.1.3 Data on the assessed trees was recorded digitally using a hand held PDA and converted to an Excel® spreadsheet for post-collection processing.

3.2 Arboricultural Rating Rationale

3.2.1 An arboricultural rating has been allocated to individual trees or tree groups that represents a summary of the interpretation of a combination of objective assessment criterion. This rating also conveys an amenity value relating to biological, functional and aesthetic characteristics within the built environment. Whether the trees are retained or not is often not solely dependent on arboricultural considerations, therefore this is a guide to assist in

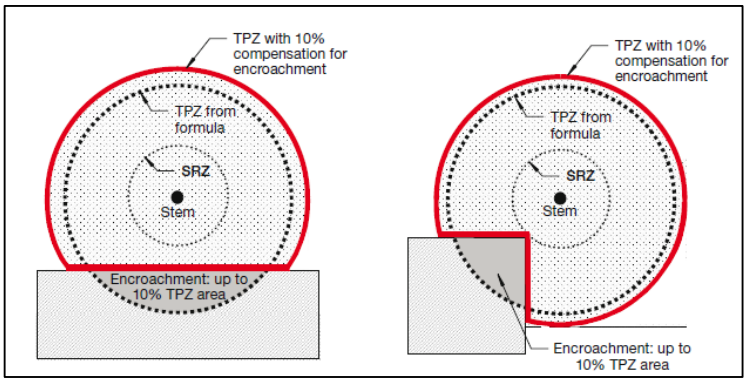
decisions relating to tree management.

3.1 Tree Protection Zones (TPZ)

3.1.1 The Tree protection zones (TPZ's) provided for each tree in the Tree Assessment Table in Appendix 1 are calculated using the formula provided in the Australian Standard *AS4970-2009. Protection of Trees on Development Sites* (Radial TPZ = Trunk diameter measured at 1.4m above grade (DBH) x 12). The TPZ forms an area around a tree or group of trees inside which construction and worksite activity may need to be controlled to preserve tree condition.

3.1.2 Encroachment into 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 below. 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.

Diagram1: Examples of minor encroachment into a TPZ



Extract from: *AS4970-2009, Appendix D, p30 of 32*

3.1.3 Further to the establishment of TPZs, tree protection success will depend on ensuring minimum disturbance within tree protection areas for the duration of the development process. Section 4 of AS4970-2009: Tree Protection Measures, included as Appendix 3 to this report provides detail on the contemporary tree protection activities and structures.

3.3 Documents Reviewed

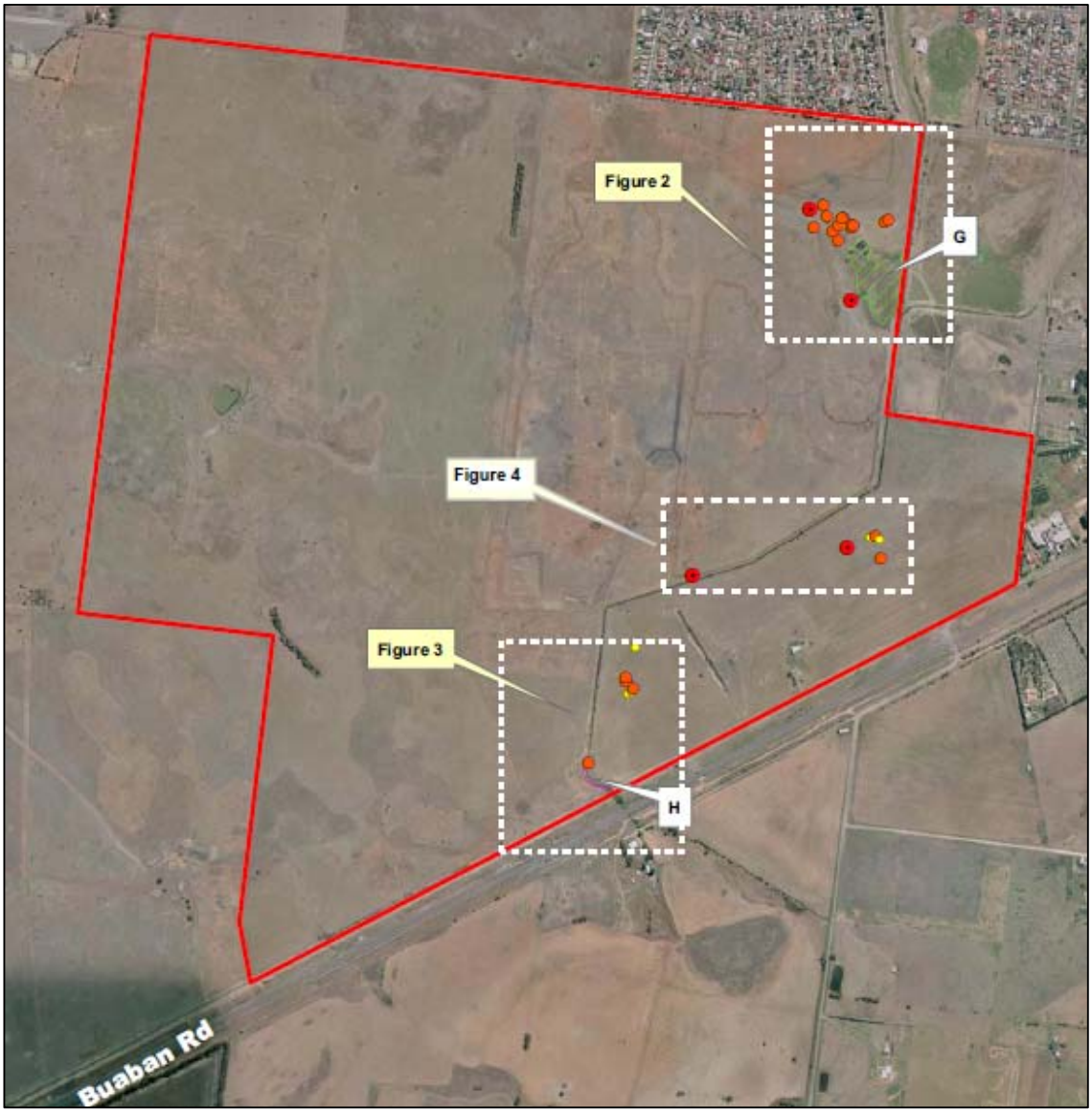
3.3.1 I have viewed and reviewed the following documents:

- Plan of Study Area and Native Vegetation Overview, Richmond Property West Werribee, Compiled by Brett Lane & Associates, project No. 9159, Dated 05.10.2009. refer to Figures 2, 3, & 4 overleaf for tree identification
- Department of Planning and Community Development (2009) Planning Property Reports, Bulban Road Werriibee, [accessed from] http://services.land.vic.gov.au, [access date] 19/01/2010.
- Department of Planning and Community Development (2009) Wyndham City Council Planning Schemes on line, [accessed from] http:// www.dse.vic.gov.au [access date] 19/01/2010.

4 Tree Identification Plan

4.1 The study area shown in Figure 1 below was characterised by open grassed fields largely devoid of trees. Assessed trees were located to the east of the study area. All assessed specimens were examples of maturing, remnant indigenous Red Gum (*Eucalyptus camaldulensis*). The trees occurred predominantly in clusters around low lying areas that appeared to be ephemeral watercourses.

Diagram 1: Study Area & Tree Identification – Richmond Property, Bulban Road West Werribee.



Adapted from: Plan of Study Area and Native Vegetation Overview, Richmond Property West Werribee, Compiled by Brett Lane & Associates, project No. 9159, Dated 05.10.2009. refer to Figures 2, 3, & 4 overleaf for tree identification.

Figure 2

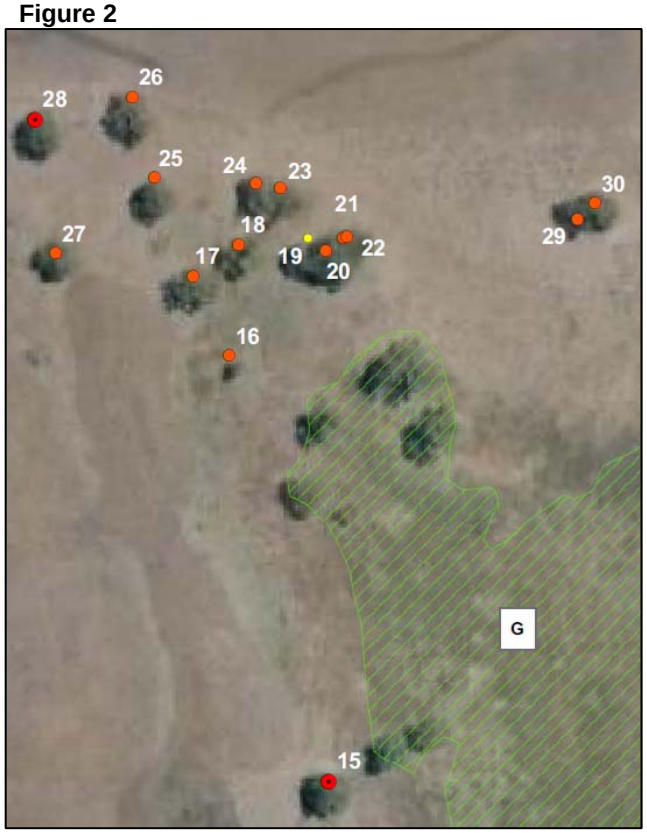
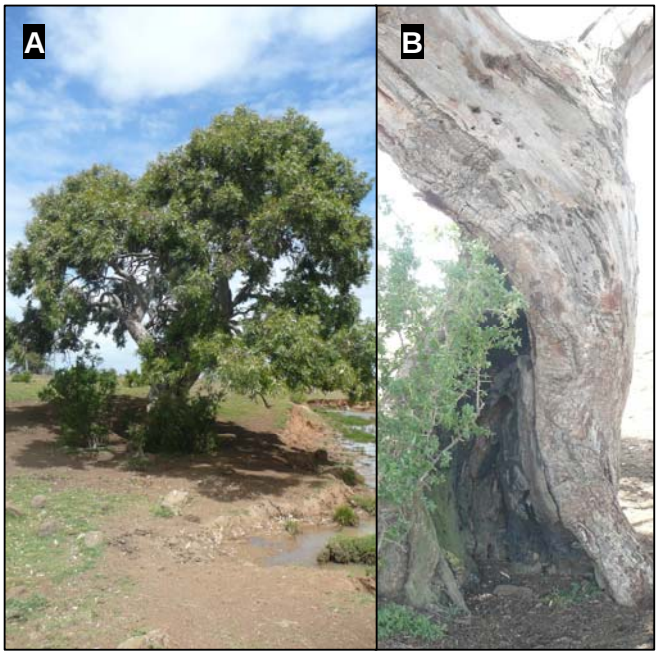


Figure 3

Figure 4

5 Photographic Catalogue



A. View South of Tree 1; a maturing specimen in good health as indicated by the full canopy of normal shaped sized and coloured foliage.

B. View east of the trunk of Tree 1, illustrating the significant structural defect – extensive cavity extending the length of the trunk, the result of past fire damage. Structural defects were common on all trees, a result of age, species type and historical environmental conditions.

C. Example of extreme structure defect of maturing Tree 16, a stump with new epicormic limbs developing. Such limbs are prone to failure.

D. Atypical example of an unhealthy River Red Gum on site. Tree 8 (left of frame) displays canopy dieback and stunted foliage, while tree 7 (right of frame) displays a healthy canopy.

E. Trees 16 to 28 occurred in a cluster, and in combination provided a strong landscape presence

6 Statutory Controls

6.1 No planning overlays that trigger a permit for tree removal affect the site.

6.2 Under the City of Wyndham Planning Scheme, the site is affected by Clause 52.17 Native Vegetation. Under this clause a permit is required to remove, destroy or lop native vegetation, including dead native vegetation.

7 Vegetation Overview

7.1 There were no trees of particular arboricultural significance in terms of age, size, and botanical rarity. Arboriculturally the trees were typical maturing specimens that had developed structural defects as a result of species type, site climatic condition and tree age.

7.2 Section 52.17 of the local Planning Scheme recognises the ecological value indigenous vegetation, and it is on these grounds that trees are likely to have the greatest value.

7.3 Generally small in stature, the absence of surrounding trees in general from the landscape gave prominence, the visual impact of the trees occurring in groups overall had greater value than the landscape merit of trees when considered individually.

7.4 Assessed trees have been given an arboricultural rating to provide information and assist in decisions relating to the trees. Ten trees attracted Moderate arboricultural ratings, nineteen trees attracted Low arboricultural ratings, while a single specimen, Tree 16 attracted No arboricultural rating. The assessment detail captured for individual trees is provided in Appendix 1. The tree numbers correspond to numbers appearing on plans provided in Section 4.

Table 1: Assessed Tree Arboricultural Rating Summar**y**

Arboricultural Rating	Tree ID Numbers	Count
Moderate	2, 3, 7, 9, 10, 11, 13, 15, 18, 27	10
Low	1, 4, 5, 6, 8, 12, 14, 17, 19, 20, 21, 22, 23, 24, 25, 26, 28, 29, 30	19
None	16	1
	Grand Total	

7.5 Trees attracting a Moderate Arboricultural rating included specimens of a generally unremarkable nature, though in this instance displaying minor health and/or structural defects. Trees attracting Low arboricultural ratings included specimens with more advanced health and/ or structural defects.

7.6 Trees attracting No arboricultural ratings included Tree 16, a specimen that had previously experienced failure of the trunk; the remaining tree was a stump with epicormic limbs developing (Plate C, Section 5).

8 Tree Management Considerations

8.1 The subject trees were all maturing River Red Gum. Each tree displayed some level of structural defect. Most defects were associated cavities and wood decay, or inferior limb attachment. An unidentified canker causing disease was affecting trees in the north-east corner of the property. Cankerous growths were noted in several trees. Limb dieback and failure were associated with the cankerous growth.

8.2 River Red Gum is a long lived species that when grown in open spaced conditions typically develop broad spreading canopies supported on massive limbs. The life cycle of River Red Gum repeated limb failure and canopy redevelopment and cavity formation, a process which can repeatedly occur over hundreds of years in response to fluctuation of climatic conditions and environmental pressures such as fire. It is common therefore for older maturing River Red Gums to have compromised structural integrity, most commonly in the form of cavities, over extended and heavy end weighted limbs, and poorly attached regrowth limbs.

8.3 The assessment of tree structure was limited to visual inspections of each tree. All trees on site displayed some level of structural defect associated most commonly with limb failure, or wood decay. Given the compromised structural condition of the subject trees overall (including seemingly less severe defects observed in Moderate Rated specimens) and propensity for further structural decline of individuals, the viability of the trees as long term assets in any future land use will need to consider appropriate siting of these trees based on risk management principles. Specifically, development designs should not place persons or property beneath the canopy of any of the trees, while persons and property should also be discouraged from using the area beneath the trees.

8.4 Furthermore, the trees should be retained in groups where possible to reduce changes in environmental conditions such as exposure to altered wind loading. Altered wind loading can increase limb failure potential.

8.5 Potential scope for the preservation of canopy trees therefore is realistically limited to areas of open space, sufficient for tree preservation requirements and the application of adequate risk management principles.

8.6 Under section 52.17 of the Wyndham Planning Scheme, permit requirements for tree removal will apply to all assessed specimens.

9 Conclusion and Recommendations

9.1 This report was commissioned to assess the arboricultural merit of trees in the subject area, provide an overview of the subject trees with respect to their condition, structure, safety and suitability for preservation, and provide recommendations regarding future tree management.

9.2 Thirty trees were assessed, of which ten attracted Moderate arboricultural ratings despite the presence of some structural defects. Nineteen trees with more advanced and severe structural defects and /or health deficiencies attracted Low arboricultural ratings, while Tree 16 a stump, attracted No arboricultural rating.

9.3 Preservation in any future development of the site of maturing River Red Gum trees that are prone to limb shed, as demonstrated in the assessed stock, requires the application of

adequate risk management principles as well as accommodating the physiological needs of the trees. Specifically, the trees are best suited to preservation in areas of open space where exposure of persons and property to the trees can be minimised through design and adequate space for the preservation of roots and canopy can be readily achieved.

9.4 Protection zones (TPZ's) for individual trees have been provided in the Tree Assessment Table contained in Appendix 1 and should be used for any retained trees.

9.5 Appendix 3 provides an extract from AS4970-2009 Protection of Trees on Development Sites: Section 4, Tree Protection Measures that should be adopted as required for retained trees.

Appendix 1: Tree Assessment Details

DBH measurement suffixed by @... indicates a stem diameter measured at a point other than 1.4m above ground level. Diameter measurements prefixed by ~.....indicates the diameter was estimated or measured using a linear tape measure. **N/A** = Attribute not applicable or not assessed.
Radial tree protection zone are capped at 2m minimum and 15m maximum. Palm TPZ's extend 1m beyond the canopy. Refer to Appendix 2 for explanation of descriptors

Tree No	Species	Common Name	Type	Age Class	DBH (cm)	H (m)	W (m)	Health	Structure	Form	Comment	TPZ (m)	Arboricultural Rating
1	*Eucalyptus camaldulensis*	River Red Gum	Indigenous	Maturing	~140	14	8N 8S 9W 9E	Fair	Fair to Poor	Asymmetric	Large primary limb failure on south side of trunk. Trunk diameter estimated.	15.0	Low
2	*Eucalyptus camaldulensis*	River Red Gum	Indigenous	Maturing	67	9	4N 7S 4W 6E	Fair	Fair	Asymmetric		8.0	Moderate
3	*Eucalyptus camaldulensis*	River Red Gum	Indigenous	Maturing	85	11	6N 7S 5W 9E	Fair	Fair to Poor	Asymmetric	Overextended lower primary limb	10.2	Moderate
4	*Eucalyptus camaldulensis*	River Red Gum	Indigenous	Maturing	72	10	5N 5S 6W 5E	Fair	Poor	Asymmetric	Previous failure of primary limbs, redeveloped limbs - crowding of unions; Necrosis of trunk	8.6	Low
5	*Eucalyptus camaldulensis*	River Red Gum	Indigenous	Maturing	96	14	7N 8S 6W 8E	Fair.~.	Fair to Poor	Asymmetric	Multiple recent limb failure throughout canopy	11.5	Low
6	*Eucalyptus camaldulensis*	River Red Gum	Indigenous	Maturing	108	9	5N 8S 6W 8E	Good	Poor	Asymmetric	Fire damage and trunk decay	13.0	Low
7	*Eucalyptus camaldulensis*	River Red Gum	Indigenous	Maturing	76	10	6N 7S 7W 5E	Fair	Fair to Poor	Asymmetric	mid-trunk cavity with active bee hive	9.1	Moderate
8	*Eucalyptus camaldulensis*	River Red Gum	Indigenous	Maturing	81	8	3N 7S 6W 6E	Fair to Poor	Poor	Asymmetric	Dieback, previous limb failure	9.7	Low
9	*Eucalyptus camaldulensis*	River Red Gum	Indigenous	Maturing	62	7	0N 5S 4W 6E	Good	Fair to Poor	Asymmetric	Strong south east canopy bias	7.4	Moderate
10	*Eucalyptus camaldulensis*	River Red Gum	Indigenous	Maturing	78	8	5N 7S 6W 6E	Good	Fair to Poor	Asymmetric	Basal cavity with active bee hive	9.4	Moderate
11	*Eucalyptus camaldulensis*	River Red Gum	Indigenous	Maturing	93	9	7N 8S 5W 6E	Good	Fair to Poor	Asymmetric	Cavity in base of primary limb with active bee hive	11.2	Moderate
12	*Eucalyptus camaldulensis*	River Red Gum	Indigenous	Maturing	84	8	5N 5S 5W 5E	Fair	Poor	Asymmetric	Extensive trunk wood dieback	10.1	Low
13	*Eucalyptus camaldulensis*	River Red Gum	Indigenous	Maturing	73	9	5N 6S 8W 5E	Fair	Fair to Poor	Asymmetric		8.8	Moderate

Tree No	Species	Common Name	Type	Age Class	DBH (cm)	H (m)	W (m)	Health	Structure	Form	Comment	TPZ (m)	Arboricultural Rating
14	*Eucalyptus camaldulensis*	River Red Gum	Indigenous	Maturing	86	8	7N 9S 4W 7E	Fair	Poor	Asymmetric	Trunk cavity; Dieback	10.3	Low
15	*Eucalyptus camaldulensis*	River Red Gum	Indigenous	Maturing	128	16	8N 9S 9W 9E	Fair	Fair	Asymmetric	Primary limb failure	15.0	Moderate
16	*Eucalyptus camaldulensis*	River Red Gum	Indigenous	Maturing	97	7	5N 2S 3W 3E	Fair	Poor	Asymmetric	Stump	11.6	None
17	*Eucalyptus camaldulensis*	River Red Gum	Indigenous	Maturing	100	14	8N 7S 7W 8E	Fair to Poor	Poor	Asymmetric	Dieback, deadwood throughout; Canker infection throughout, limb failure	12.0	Low
18	*Eucalyptus camaldulensis*	River Red Gum	Indigenous	Maturing	83	15	8N 4S 2W 8E	Good	Poor	Asymmetric	Decay and cavity of upper trunk and primary limb union; overextended primary limb north-east	10.0	Moderate
19	*Eucalyptus camaldulensis*	River Red Gum	Indigenous	Maturing	79	11	5N 7S 6W 3E	Fair	Poor	Asymmetric	Cankers and associated limb dieback / failure,	9.5	Low
20	*Eucalyptus camaldulensis*	River Red Gum	Indigenous	Maturing	87	11	7N 6S 6W 5E	Fair	Poor	Asymmetric	Cankers and associated limb dieback / failure, Basal trunk cavity (previous fire damage)	10.4	Low
21	*Eucalyptus camaldulensis*	River Red Gum	Indigenous	Maturing	108	18	10N 7S 12W 7E	Fair to Poor	Poor	Asymmetric	Dieback; overextension of primary limb west; canker throughout canopy	13.0	Low
22	*Eucalyptus camaldulensis*	River Red Gum	Indigenous	Maturing	87	8	4N 8S 3W S E	Good	Poor	Suppressed	Strong southern trunk lean, cavity mid trunk on upper plane of lean	10.4	Low
23	*Eucalyptus camaldulensis*	River Red Gum	Indigenous	Maturing	83	12	8N 8S 6W 8E	Fair	Poor	Asymmetric	Cankers and associated limb dieback / failure,	10.0	Low
24	*Eucalyptus camaldulensis*	River Red Gum	Indigenous	Maturing	68@140	11	8N 5S 6W 7E	Fair	Fair to Poor	Asymmetric	Limb failure, limb overextension	15.0	Low

Tree No	Species	Common Name	Type	Age Class	DBH (cm)	H (m)	W (m)	Health	Structure	Form	Comment	TPZ (m)	Arboricultural Rating
25	*Eucalyptus camaldulensis*	River Red Gum	Indigenous	Maturing	102	14	9N 7S 7W 8E	Fair	Poor	Asymmetric	Previous dieback of canopy and trunk. New tree developed around dead trunk	12.2	Low
26	*Eucalyptus camaldulensis*	River Red Gum	Indigenous	Maturing	99	12	9N 12S 9W 8E	Fair	Fair to Poor	Asymmetric	Foliage thinning, cavity on primary limbs, crowding of limb attachment points, limb overextension	11.9	Low
27	*Eucalyptus camaldulensis*	River Red Gum	Indigenous	Maturing	93	10	8N 8S 7W 7E	Fair	Fair to Poor	Asymmetric	Cavity in base of removed primary limb stub	11.2	Moderate
28	*Eucalyptus camaldulensis*	River Red Gum	Indigenous	Maturing	132	14	10N 10S 5W 8E	Good	Poor	Asymmetric	Basal trunk swelling (cavity). Crowding of limb attachment points at previous failed limb stubs	15.8	Low
29	*Eucalyptus camaldulensis*	River Red Gum	Indigenous	Maturing	99	9	9N 4S 8W 5E	Fair	Poor	Asymmetric	Extensive dieback and decay of trunk; Overextended primary limb	11.9	Low
30	*Eucalyptus camaldulensis*	River Red Gum	Indigenous	Maturing	85	11	7N 8S 5W 8E	Fair	Poor	Asymmetric	Canker and trunk necrosis; Limb failure	10.2	Low

Appendix 2: Tree Descriptors

Tree Logic Pty. Ltd. Tree Descriptors, Version 4 (August 2006)
Tree Condition: The assessment of tree condition evaluates factors of health, structure and form. 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.

The normal distribution curve is a statistical model which shows that for a large number of observations of a particular population, the frequency of the observations creates a bell-shaped curve. This pattern is commonly found in the natural and behavioural sciences. Diagram 4, 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. 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.

DBH: Indicates the trunk diameter (expressed in centimetres) of an individual tree measured at 1.3m above the existing ground level (Diagram 1) or where otherwise indicated (Diagram 2), multiple leaders are measured individually (Diagram 3). Plants with multiple leader habit, e.g. Cotoneaster sp., may be measured at the base. Measurements undertaken with diameter∅ tape or builders tape.

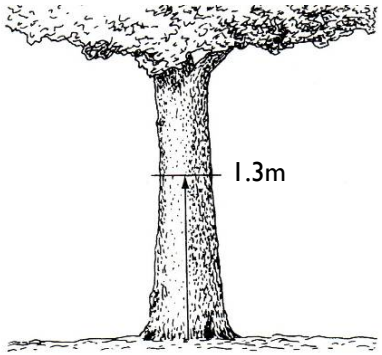


Diagram 1: Measurement of DBH on tree with single trunk

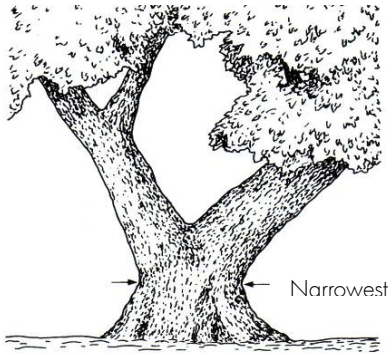


Diagram 2: Measurement of basal diameter at narrowest point above the basal flare

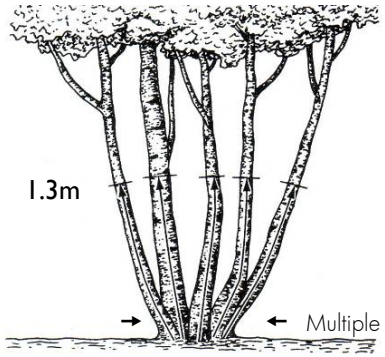


Diagram 3: Measurement of DBH on tree with multiple trunks, measured individually or at the base

Diagrams 1-3 adapted from Gooding *et al.* (2000)

H x W: Indicates height and width of the individual tree; dimensions are expressed in metres. Crown heights are measured with a heightmeter 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 heightmeter 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.

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
Palm	Woody monocotyledon
Other	Other descriptions as indicated

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

Category	Description
Young	Sapling tree and/or recently planted
Semi-mature	Tree rapidly increasing in size and yet to achieve expected size in situation
Maturing	Specimen approaching expected size in situation, with reduced incremental growth
Over-mature	Tree is senescent and in decline

Form: Describes the general shape of the tree.

Category	Description
Symmetric	Generally evenly balanced and full crown
Asymmetric	Crown generally biased in one direction; can be minor or major
Stump re-sprout	Adventitious shoots originating from stump or trunk (after severe dieback or lopping)
Suppressed	Tree form inhibited
Manipulated	Hedge, pollard, topiary, windrow; managed for specific landscape use or aesthetic

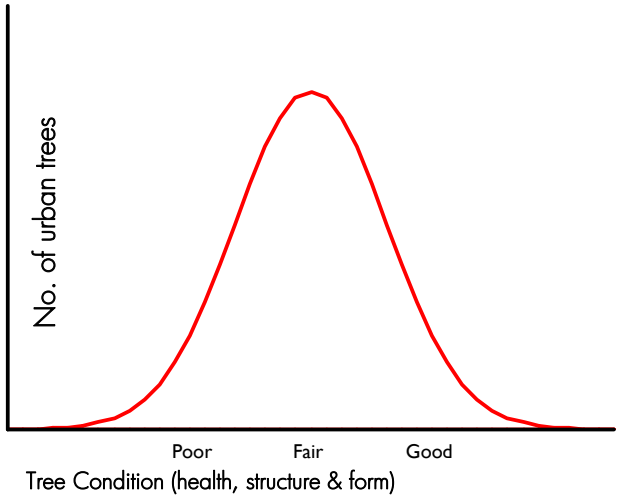


Diagram 4: Indicative normal distribution curve for tree condition

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

Category	Vigour/Extension growth	Decline symptoms/Deadwood	Foliage density, colour, size, intactness	Pests and or disease
Good	Above typical	None or minimal	Better than typical	None or minimal
Fair	Typical	Typical or expected	Typical	Typical, within damage thresholds
Fair to Poor	Below typical	More than typical	Exhibiting deficiencies	Exceeds damage thresholds
Poor	Minimal	Excessive and large 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 5).

	Zone 1	Zone 2	Zone 3	Zone 4		
Descriptor	**Root plate & lower stem**	**Trunk**	**Primary branch support**	**Outer crown and roots**	**Lean from vertical**	**Risk potential if targets present**
Good	No damage, disease or decay; obvious basal flare / stable in ground	No damage, disease or decay; well tapered	Well formed, attached, spaced and tapered	No damage, disease, decay or structural defect	Low or none	Low or none
Fair	Minor damage or decay	Minor damage or decay	Typically formed, attached, spaced and tapered	Minor damage, disease or decay; minor branch end-weight or over-extension	Minor / natural	Minor
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	Moderate	Moderate
Poor	Major damage, disease or decay; fungal fruiting bodies present	Major damage, disease or decay; exceeds recognised thresholds; fungal fruiting bodies present	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	Acute	High
Very Poor	Excessive damage, disease or decay; unstable / loose in ground; failure probable	Excessive damage, disease or decay; cavities	Decayed, cavities or branch attachments with active split; failure imminent	Excessive damage, disease or decay; excessive branch end-weight or over-extension	Excessive – root plate failure or stem failure probable	Severe/imminent

The lowest or worst descriptor assigned to the tree in any column could generally be the overall rating assigned to the tree.

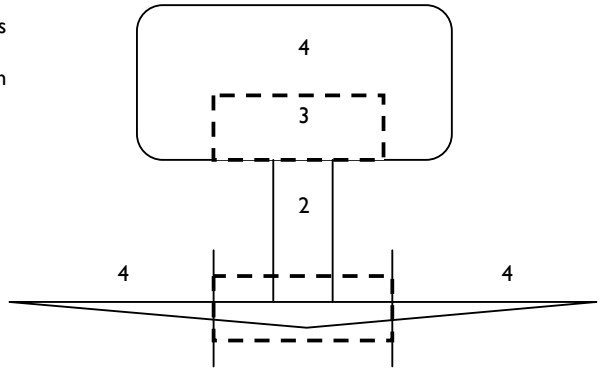
The assessment for structure is limited to observations of external and above ground tree parts. It does not include any exploratory assessment of underground or internal tree parts unless this is requested as part of the investigation.

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.

Diagram 5: Tree structure zones

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



Adapted from Coder (1996)

Arboricultural Rating: Relates to the combination of previous tree condition factors, including health, structure and form (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. Tree is capable of tolerating changes in its environment. 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. Tree is capable of tolerating changes in its environment. 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	Tree of low quality and/or little amenity value. Tree in poor health and/or with poor structure. Tree unlikely to respond positively to changes in its environment and does not warrant design modification to preserve it. Tree is not significant for its size and/or young. These trees are easily replaceable. Tree (species) is functionally inappropriate to specific location and would be expected to be problematic if retained. Retention of such trees may be considered if not requiring a disproportionate expenditure of resources for a tree in its condition and location.
None	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. Tree whose retention would be unviable 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) Tree has a detrimental effect on the environment, for example, the tree is a woody weed. These trees should be removed on the basis of sound arboricultural management.

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Appendix 3: Tree Protection Measures

Extract from AS4970-2009 Protection of Trees on Development Sites. © Standards Australia www.standards.org.au

SECTION 4 TRE PROTECTION MEASURES

4.1 GENERAL

Tree protection measures include a range of activities and structures. Structures are used to identify and isolate the TPZ (refer to Section 3). These measures are identified in the arboricultural impact assessment and tree protection plan.

The TPZ is a restricted area usually delineated by protective fencing (or use of an existing structure such as an existing fence or wall). It is installed prior to site establishment and retained intact until completion of the works.

Some works and activities within the TPZ may be authorized by the determining authority. These must be supervised by the project arborist. Any additional encroachment that becomes necessary as the site works progress must be reviewed by the project arborist and be acceptable to the determining authority before being carried out.

Approved tree removal and pruning should be carried out before the installation of tree protection measures.

4.2 ACTIVITIES RESTRICTED WITHIN THE TPZ

Activities generally excluded from the TPZ include but are not limited to—
(a) machine excavation including trenching;
(b) excavation for silt fencing;
(c) cultivation;
(d) storage;
(e) preparation of chemicals, including preparation of cement products;
(f) parking of vehicles and plant;
(g) refuelling;
(h) dumping of waste;
(i) wash down and cleaning of equipment;
(j) placement of fill;
(k) lighting of fires;
(l) soil level changes;
(m) temporary or permanent installation of utilities and signs, and
(n) physical damage to the tree.

4.3 PROTECTIVE FENCING

Fencing should be erected before any machinery or materials are brought onto the site and before the commencement of works including demolition. Once erected, protective fencing must not be removed or altered without approval by the project arborist. The TPZ should be secured to restrict access.

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

Fence posts and supports should have a diameter greater than 20 mm and be located clear of roots. Existing perimeter fencing and other structures may be suitable as part of the protective fencing.

4.4 SIGNS

Signs identifying the TPZ should be placed around the edge of the TPZ and be visible from within the development site (refer Figure 3). The lettering on the sign should comply with AS 1319.

4.5 OTHER TREE PROTECTION MEASURES

4.5.1 General
When tree protection fencing cannot be installed or requires temporary removal, other tree protection measures should be used, including those set out below.

4.5.2 Trunk and branch protection
Where necessary, install protection to the trunk and branches of trees. The materials and positioning of protection are to be specified by the project arborist. A minimum height of 2 m is recommended.

Do not attach temporary powerlines, stays, guys and the like to the tree. Do not drive nails into the trunks or branches.

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

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

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

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

Manual excavation should be carried out under the supervision of the project arborist to identify roots critical to tree stability. Relocation or redesign of works may be required.

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

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

Other excavation works in proximity to trees, including landscape works such as paving, irrigation and planting can adversely affect root systems. Seek advice from the project arborist.

4.5.5 Installing underground services within TPZ
All services should be routed outside the TPZ. If underground services must be routed within the TPZ, they should be installed by directional drilling or in manually excavated trenches.

The directional drilling bore should be at least 600 mm deep. The project arborist should assess the likely impacts of boring and bore pits on retained trees.

For manual excavation of trenches the project arborist should advise on roots to be retained and should monitor the works. Manual excavation may include the use of pneumatic and hydraulic tools. Refer Clause 4.5.3.

4.5.6 Scaffolding
Where scaffolding is required it should be erected outside the TPZ. Where it is essential for scaffolding to be erected within the TPZ, branch removal should be minimized. This can be achieved by designing scaffolding to avoid branches or tying back branches. Where pruning is unavoidable it must be specified by the project arborist in accordance with AS 4373.
NOTE: Pruning works may require approval by determining authority.

Ground below the scaffolding should be protected by boarding (e.g. scaffold board or plywood sheeting) as shown in Figure 5. Where access is required, a board walk or other surface material should be installed to minimize soil compaction. Boarding should be placed over a layer of mulch and impervious sheeting to prevent soil contamination. The boarding should be left in place until the scaffolding is removed.

4.6 MAINTAINING THE TPZ

4.6.1 Mulching

The area within the TPZ should be mulched. The mulch must be maintained to a depth of 50–100 mm using material that complies with AS 4454. Where the existing landscape within the TPZ is to remain unaltered (e.g. garden beds or turf) mulch may not be required.

4.6.2 Watering

Soil moisture levels should be regularly monitored by the project arborist. Temporary irrigation or watering may be required within the TPZ. An above-ground irrigation system should be installed and maintained by a competent individual.

4.6.3 Weed removal

All weeds should be removed by hand without soil disturbance or should be controlled with appropriate use of herbicide.

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Arboricultural Consultancy:

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