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13 October 2018

11 WANDEARAH AVENUE – AVALON BEACH, NSW
SWIMMING POOL DEVELOPMENT PROPOSAL
ARBORICULTURAL ASSESSMENT & IMPACT REPORT

Ref No: RTC-15018

INTRODUCTION

This report has been commissioned to assess potential impacts that may occur to significant trees in relation to a new swimming pool development proposal. The proposal requires excavation and associated infrastructure within tree protection zones of two (2) local occurring significant trees. Provided within this report are recommendations for the management of the trees based on the current site conditions, design and associated impacts by the proposal.

METHODOLOGY

In preparation for this report a site and tree inspection was undertaken by the author on Thursday 11th October 2018. Documentation reviewed and works undertaken to complete the assessment include:

- Undertaking a limited site & ground level Visual Tree Assessment adopted from components of Mattheck *& Breloer* 1994 '*The Body Language of Trees*' & the ISA TRAQ manual 2013. The inspection included assessment of the overall health and vigour of the trees, tree form, structure and structural condition as best as site conditions would allow. On completion of the VTA the retention value of the tree was summarised utilizing the Tree Assessment Checklist provided within Attachment- A.
- Measuring trunk diameter in accordance with AS4970 to determine the estimated Structural Root Zone (SRZ) *the area required for tree stability*, and Tree Protection Zone (TPZ) radius.
- According the trees with temporary tree numbers where each tree is referred to by number throughout this report.

Documents reviewed to assist in preparation of this report includes

ArcLab Pty Limited, job No. 180/18, specific to

- Part Site Plan Sheet No. 02-DA rev --, dated 10.9.2018
- Elevations Sheet No. 04-BC & Sheet 05-DA rev --, dated 10.9.2018
- Section A & B Sheet No's. 06, 07 & 09-DA rev --, dated 10.9.2018

Adam Clerke Surveying Pty Limited

- Survey Plan ref No. 5884-B dated 12.12.2017

Acknowledgement of Australian Standards 'Protection of Trees on Development Sites' AS4970 – 2009. Unless specified otherwise all development offsets provided within this report are taken from the centre of the tree.

1. SUMMARY OF ASSESSMENT

General

1.1 Both trees 1 & 2 are unlikely to be significantly affected by proposed works.

Given the existing site conditions the root system of trees 1 & 2 has likely been altered by recent works restricting or altering natural radial root distribution. No further root disturbance is recommended given the amount of root loss that has already occurred.

Appropriate tree protection and management is recommended throughout the course of works with arborist supervision and certification required during the initial pool excavation cut.

Observations & Discussions

1.2 **Tree 1**. Proposed excavation cut is located outside of the trees 5.4m Tree Protection Zone (TPZ) with minor encroachment for decking and landscape infrastructure. The extent of TPZ incursion is considered negligible with the following recommendations provided to ensure the tree remains viable:

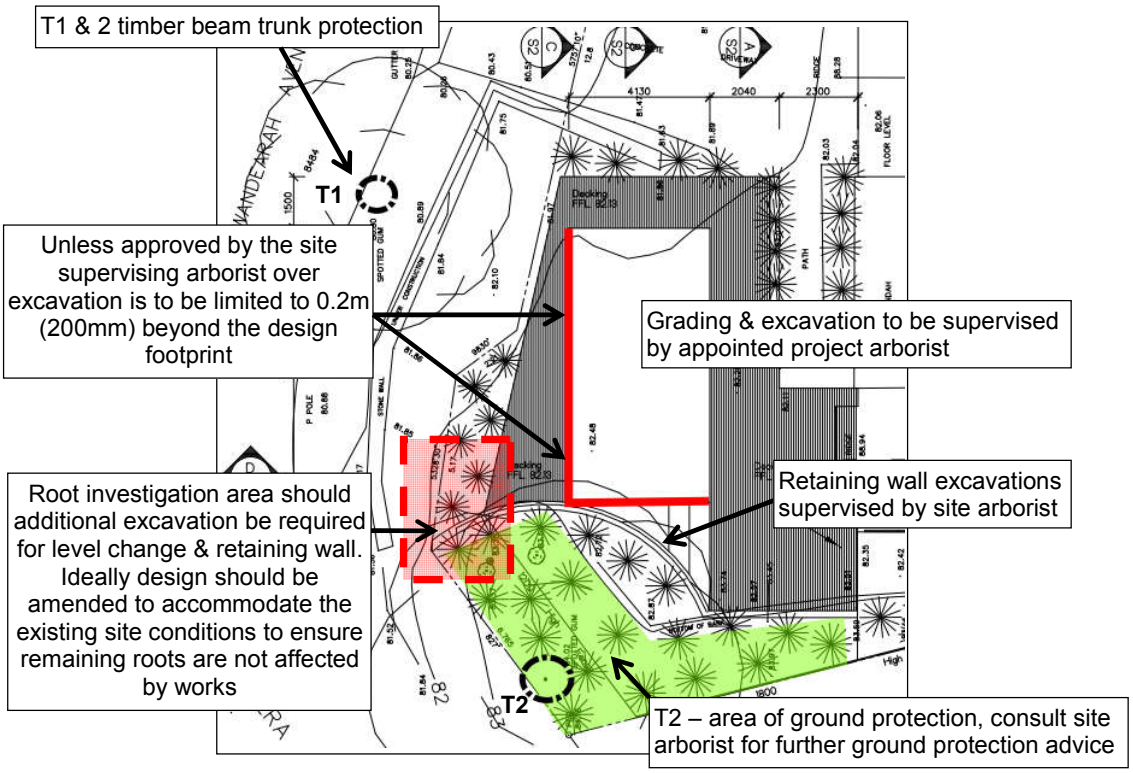
1. To ensure the trunk of the tree is not damaged by material deliveries timber beam trunk protection is recommended to be installed as indicated within Figure 2 p4. Timber beams should be no less than 2.2m in height and protect the circumference of the tree at even spacing.
2. Unless approved by the site supervising arborist over excavation to accommodate the swimming pool cut should be limited to 0.2m (200mm) beyond the footprint of the pool design.
3. For the management of the root system the initial excavation cut to a depth of 0.7m (700mm) is to be supervised by appointed project arborist to treat any encountered tree root.

1.3 **Tree 2**. Under limited observations of the existing excavation cut and site grading (leveling) it appears that works have altered any root extension within the proposed construction envelope. Excavations have highly likely removed the extending root zone where the new proposal is unlikely to additionally affect the tree. Based on a notional 11.4m TPZ, pool footprint encroachment would be considered manageable at <15% excavation impact. Due to the existing cut and under the current site conditions the tree should be managed in accordance with any other arboricultural recommendations provided to protect and manage the anchoring root zone. Based on the current works proposed the following recommendations are to be adopted for the purpose of managing the tree during development activities.

1. No additional excavation should occur beyond the existing cut face supporting the Structural Root Zone (SRZ), *the area required for tree stability*.

2. Unless approved by the site supervising arborist over excavation to accommodate the swimming pool cut should be limited to 0.2m (200mm) beyond the pool design footprint. Where site grading (lower) is proposed the arborist shall supervise the entire excavation activity within the 11.4m TPZ.
3. Excavation to accommodate retaining wall footings should be located within the existing disturbed areas only. Should additional cut be required root investigations are recommended to identify the impact on extending and likely critical roots. The treatment of encountered roots should only occur if the root removal has no effect on the tree. Should an effect on tree be identified redesign to ensure the viability of the tree is maintained is recommended.
4. Where the project arborist identifies roots that are damaged and capable of being pruned without affecting the tree the roots are to be clean cut back to undamaged wood.
5. Backfilling behind the proposed retaining wall should consist of clean free draining soils supplied in accordance with Australian Standards AS4419-2003 Soils for landscaping & garden use.
6. Prior to works timber beam trunk and ground protection is to be installed. Timber beams should be no less than 2.2m in height and protect the circumference of the tree at even spacing. During main work activities ground protection, geotextile fabric or similar is to extend along the top of the upper level soil profile protecting underlying tree roots as shown below.
7. Final certification is to be provided by the appointed project arborist certifying the construction of tree protection zones and root management during excavation activities.

Figure 1, Showing tree management area



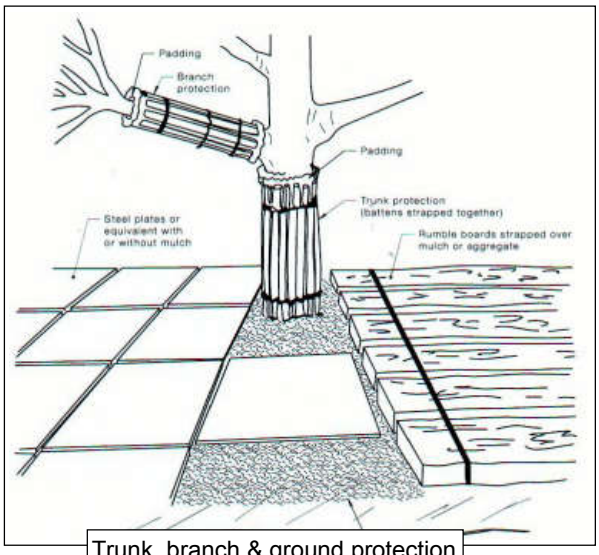
2. CONCLUSIONS & RECOMMENDATIONS

2.1 The proposed development is occurring on already altered soils where root activity has highly likely been disrupted or removed from the construction footprint. Given the altered site conditions the proposed works are not expected to additionally affect the trees. That which may affect tree 2 is additional retaining wall excavation cut towards the northwestern corner where tree root investigations are recommended to provide more advice on potential impacts. Ideally design should be amended to accommodate the existing site conditions to prevent any further root interference.

2.2 To ensure both trees remain viable and development impacts are appropriately managed the following recommendations are provided:

- The limit of over excavation to accommodate design should not exceed 200mm past the line of the proposed swimming pool footprint. Additional over excavation should only occur under the supervision of an appointed project arborist where no roots have been encountered. As the Survey RL's have changed by current grading cut (level change), should additional grading (level change) over the site be required the extent of grading cut and RL change from existing levels should be clearly marked within construction drawings for project arborist review and additional recommendations.
- Within tree protection zone setbacks all retaining wall footing excavations are to be located within the existing cut / excavated areas with excavation supervised by an appointed project arborist.
- Where additional cut is required in the northwestern corner adjacent T2 tree root investigations are recommended to identify impact on remaining tree roots. Given that root disturbances has occurred no further root interference should occur with the design amended to accommodate the existing site conditions.
- In specific there is to be no additional excavation within SRZ setbacks without prior arborist advice, and no further root loss or disturbance by the proposal.
- Prior to works the trees are to be protected with 2.2m high timber beam trunk protection with ground protection installed adjacent T2.

Figure 2, Ground and trunk protection detail



Trunk, branch & ground protection

General tree protection requirements

2.3 Where tree retention is required the trees are recommended to be protected as specified within this report with the following additional protection advice provided:

1. In accordance with AS4970 - 2009 (1.4.4) a Project Arborist is to be engaged to monitor, supervise excavation within TPZ setbacks and provide certification of protection works conducted (AS4970 S/5.5.2 *Final certification*).

   There is to be no excavation or disturbance within the Structural Root Zone (SRZ), see SRZ & TPZ distance column Attachment- B.
2. The Project Arborist is to be familiar with all protection measures as specified within AS4970 – 2009 and shall supervise and/or certify prior to works commencing the construction of Tree Protection Zones (TPZ). To allow for adequate site access alternate tree protection may be required ensuring tree protection is compliant with AS4970 Section 4.5 *Other Tree Protection Measures.*
3. Should there be any uncertainty by the development superintendent or project manager the Project Arborist is to be consulted prior to works activities commencing.
4. The designated TPZ is to be maintained as specified within AS4970 Section 4.6 *Maintaining the TPZ*, which includes no storage of builder's material, addition of leaf mulch, watering and weed removal as directed by the project arborist.
5. During approved excavation root pruning is to be conducted by the appointed arborist in accordance with AS4970 – 2009 Section 4.5.4 *Root protection during works within the TPZ*, such that tree roots are not damaged or ripped beyond the point of excavation. Exposed roots at the excavated cut face are to be protected with jute mesh, geotextile fabric or similar being secured in place to avoid drying of the root mass and soil profile.
6. There is to be no open trench excavation within designated tree protection zone setbacks without prior arborist advice, refer to the SRZ & TPZ radiuses noted within Attachment- B.
7. *Additional inground services within TPZ's* which may include sewer, stormwater, water and electrical services, final design and impact to trees shall be reviewed and endorsed by the project arborist prior to their installment..
8. The development site superintendent is responsible for ensuring that all tree protection measures are conducted accordingly and that all site contractors are aware of tree protection requirements prior to their engagement

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Should you require further liaisons in this matter please contact me direct on 0419 250 248

Yours sincerely

Mark A Kokot

AQF Level 5 consulting arborist

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Certified Arborist / Tree Surgeon (AQF3), ISA Tree Risk Assessment Qualified 6/2014
Member: Arboriculture Australia No.1292, Working With Children No: WWC0144637E

ATTACHMENT- A: Visual Tree Inspection Checklist

VTA i) Landscape Significance (LS): The significance of a tree in the landscape is a combination of its amenity, environmental and heritage values.

Values may be subjective however, offer a visual understanding of the relative importance of the tree to the environment. The Landscape Significance of a tree is described in seven categories to assist in determining the retention value of trees.

1	Significant	2	Very High	3	High	4	Moderate	5	Low	6	Very Low	7	Insignificant

ii) Visual Tree Assessment (VTA)

0	If appropriate to VTA - **exempt* trees from Local Government Authority (LGA) Tree Management or Preservation Orders (TPO)	2E	Trees location likely to be affected by infrastructure restricting root growth potential, or tree has potential to cause infrastructure damage where risk mitigation or rectification works may likely compromise tree anchorage
0A	Noxious or invasive species located within heritage conservation area		
1	Trees that are dead, significantly declining >75% volume or obviously hazardous	3	This rating incorporates trees that may require further investigation of defects such as pathogen activity, cavities or symptoms indicating internal decay of an extent that cannot be quantified under visual examination. Further inspections may be in the way of arborist climbing inspection within the canopy, root crown investigation and/or drill penetrating or Picus Sonic Tomograph ultrasound testing procedures to determine percentage of internal decay.
2	Trees that are structurally damaged. Have poor structure or weak & detrimental large stem inclusions capable or failure opposed to 2B. Tree also may be affected by extensive borer damage, fungal pathogens (wood rot) or viruses. Some symptoms may be reversible, remediated or controlled give appropriate management.		
2A	Tree damage specific to basal and/or root plate damage, very shallow soils or steep topography resulting in poor anchorage, where condition may become problematic in the future / may include trees with included bark splits to ground level	4	Trees which appear specifically environmentally stressed by drought, poor soil or site conditions. Symptoms may be reversible given appropriate management
2B	Defect specific to stem inclusions development (weak branch attachments) where the condition may not be immediately detrimental however, require annual to biannual monitoring with control to prevent stem failure by installing slings, cable or bracing. Tree may also contain multi stems or codominant twin stems	5	Trees that would benefit from crown maintenance pruning as identified within the Australian Standards AS 4373 – 2007 Pruning of Amenity Trees
		5A	Trees that require little or no maintenance at time of inspection other than close monitoring
2C	Tree may contain minor wounds, pest or minor pathogen activity, altered by minor pruning or storm damaged that is not considered immediately detrimental - may also display average form. Likely to require close annual monitoring or minor corrective pruning	6	Trees may be typical for species type, of good form and visual condition for age class May have suppressed one sided canopies or are low risk trees
2D	Trees significantly altered by recent storm or over pruning events which may reduce retention values due to average form- or tree extensively pruned for power line clearance	7	VTA restricted by canopy or plant material vine or ivy covering tree parts, or site conditions which do not allow access- fences to neighbouring sites

iii) Retention Value (RV): [1] Low risk - tree fee of visual defects & viable for retention, [2] Medium – low risk - viable for retention with minor faults which may reduce ULE, [3] Medium risk - trees which containing issues or faults that are likely to become problematic in the near future, [4] M/High risk - trees to be considered for removal due to poor condition.

1	High retention	2	Medium retention	3	Low retention	4	Consider removal

iv) U.L.E. categories Useful Life Expectancy (after *Barrell* 1996, modified by the author)

A trees U.L.E. category is the life expectancy of the tree modified first by its age, health, condition, safety and location. U.L.E. assessments are not static but may be modified as dictated by changes in trees health and environment. The five categories of U.L.E. are as follows:

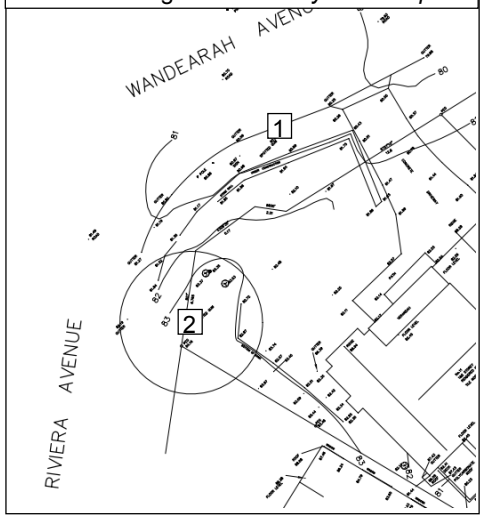
1. Long U.L.E. - Appear retainable at the time of assessment for over 40 years with an acceptable degree of risk assuming reasonable maintenance.
2. Medium U.L.E. - Appear to be retainable at the time of assessment for 15 to 40 years with an acceptable degree of risk assuming reasonable maintenance.
3. Short U.L.E. - Trees appear to be retainable at the time of assessment for 5 to15 years with an acceptable degree of risk assuming reasonable maintenance.
4. Very short - Removal- Trees which should be scheduled for removal within the very short term or as specified within this report.
5. Small, young or regularly pruned – Trees under 5m in height that can be easily moved or replaced, includes screen plantings or hedge lines.

ATTACHMENT- B: Tree Assessment Schedule & Location Plan

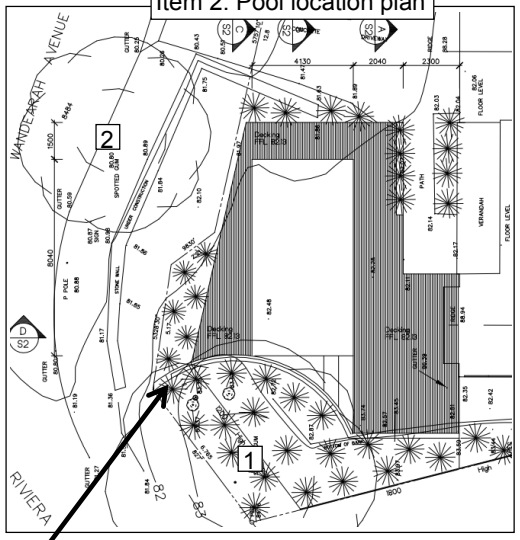
Refer VTA Checklist p6

Tree No:	Species	Height x Span	DBH mm	SRZ / TPZ	Age	Health	Condition	Signifi-cance	VTA	RV	ULE	Comments CV = Council Verge tree
1 CV	*Corymbia maculata* Spotted Gum	15 x 11	450	2.5m / 5.4	ESM	Fair / Good	Good	3	4/2E	2	2	Environmentally stressed with low foliage volume, minor kerb gutter damage evident
2	*Corymbia maculata* Spotted Gum	23 x 15	950	3.3 / 11.4	EM	Good	Fair / Good	3	2A	2	2	Located at edge of embankment, restricted radial root development WST side (descending), excavation at 3 – 3.5m EST, NTH/EST, site conditions restricting visual assessment of SRZ

Item 1. Existing – *tree Survey location plan*

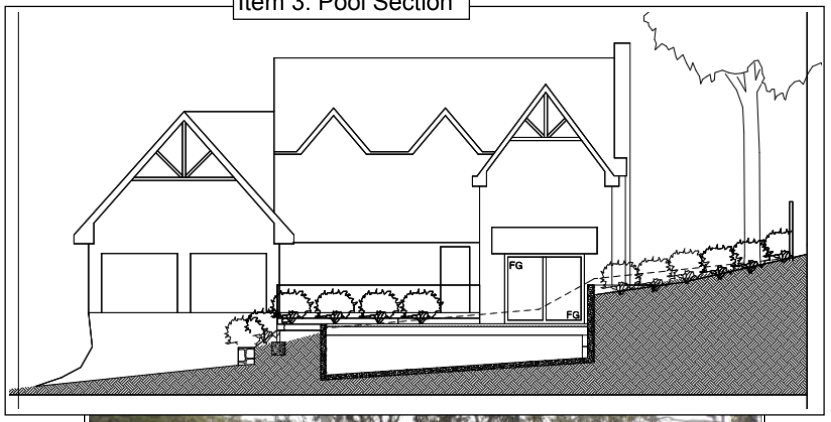


Item 2. Pool location plan



No additional excavation should occur in this area without root investigations, where design should ideally be amended to accommodate existing site conditions.

Item 3. Pool Section



Item 4. Existing site conditions & pool excavation area

ATTACHMENT- C: Terminology, notes & references

Age classes: (I) Immature refers to a well established but juvenile tree. (ESM) refers to an early semi mature tree not of juvenile appearance. (SM) Semi-mature refers to a tree at growth stages advancing into maturity and full size. (LSM) Late Semi- Mature, refers to a tree between semi-mature and close to mature. (EM) refers to a tree at the first stages of maturity. (M) Mature refers to a full size tree with some capacity for future growth. **Health:** Refers to a trees vigor exhibited by the crown density, leaf colour, presence of epicormic shoots, ability to withstand disease invasion and the degree of dieback. **Condition:** Refers to the tree's form and growth habit, as modified by its environment (aspect, suppression by other trees, soils) and the state of the scaffold (i.e. Trunk and major branches), including structural defects such as cavities, crooked trunks or week trunk / branch junctions. These are not directly connected with health and it is possible for a tree to be healthy but in poor condition. **Decay:** (*N*) – an area of wood that is undergoing decomposition. (*V*) – decomposition of an area of wood by fungi or bacteria. **Decline:** Is the response of a tree to a reduction of energy levels resulting from stress. Recovery from decline is difficult and slow; is usually irreversible. **Defect:** A identifiable fault in a tree. **Footprint:** The area occupied by site structures, including the dwelling driveways and hard surfaces. **Hazard:** When a tree failure hazard is present when a tree has potential to cause harm to people or property. (A source of potential harm). **Order of branches:** First order being those that are the first to extend from the main trunk or codominant limbs, second order branches extend from the first order and third order branches extend from the second order. **Probability:** The likelihood of some event happening. **Risk:** Is the probability of something adverse happening. **Wound:** Damage inflicted upon a tree through injury to its living cells, may continue to develop further weakening of the structure compromising structural integrity.

NOTES: 1) This report acknowledges the current Australian Standards 'Protection of Trees on Development Sites' AS 4970 – 2009 with reference to the Tree Protection Zone (TPZ): being a combination of the root and crown area requiring protection. The TPZ takes into consideration the Structural Root Zone (SRZ): The area required for tree stability. Determined by AS4970 - 2009 Figure 1, Table of determining the SRZ, section 3.3.5 of the standards. The standard states where a greater than 10% encroachment occurs the arborist is to take into consideration the schedule of determining impacts as set within AS4970 s. 3.3.4. Encroachments are referred to within this report as major or minor encroachments (AS4970 s. 3.3.2 & 3.3.3). Given the existing site conditions both the SRZ & TPZ cannot be accurately determined

2) The extent of encroachment within the TPZ radius has been categorized as follows:
No impact (0%) incursion, Low impact (<10%) of minor consequence, Medium impact (<20%) incursion where the project arborist is to demonstrate the tree/s remain viable by tree sensitive construction techniques and/or design changes, and High level impact (>20%) where design changes or further information is required to manage tree vitality.

Care has been taken to obtain information from reliable sources. All data has been verified as far as possible, however, I can neither guarantee nor be responsible for the accuracy of information provided by others.

3) Do not scale from documents provided within this report

SELECTED REFERENCES:

Barrell J. 1993, 'Preplanning Tree Surveys: Safe useful Life expectancy (SULE) is the Natural Progression", Arboricultural Journal 17: 1, February 1993, pp. 33-46.
Matheny N. & Clark J. 1998, Trees & Development *'A Technical Guide to Preservation of Trees During Land Development'* International Society of Arboriculture, Champaign USA.
Standards Australia 2009, *Australian Standards 4970 Protection of Trees on Development Sites* - Standards Australia, Sydney, Australia.
Standards Australia 2007, *Australian Standards 4373 Pruning of Amenity Trees* - Standards Australia, Sydney, Australia.