

Consulting & Project Arborists

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Arboricultural Impact Assessment

16 Cabarita Road Avalon 2017 NSW

Prepared 13 April 2020 Revised 7 July 2020 Our Ref: 2006

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1.0 Background:

- 1.1 Mr Cameron Gillespie of Railius Au Pty Ltd commissioned this arboricultural impact assessment following a preliminary site and tree assessment conducted in January 2020. The report consists of a survey of the existing trees within 5m of proposed 2 new Railius Railgliders, and includes species identification, dimensions, health and structural condition, and significance and retention ratings.
- 1.2 Craig Martin carried out a survey of the site's trees on the 3rd April 2020.
- 1.3 The results of this assessment using VTA methodology after (Mattheck & Breloer, 1994) are tabulated below with the trees (1 6 inclusive) location shown on site plan by peter downes designs, Ref 200301, dated 19 March 2020.
- 1.4 Recommendations are made regarding the retention, removal, transplanting or remediation of site trees. The assessment and tree protection recommendations follow the requirements as set out in AS 4970 (2009) Protection of trees on development sites.
- 1.5 The assessment referenced the following plans prepared by peter downes designs dated 19 March 2020:
 - Cover Sheet Ref: A2 2003 00
 - Site Plan Ref: A2 2003 01
 - Sections Ref: A2 2003 02
 - Notes/ESCP Ref: A2 2003 03

2.0 The Site:

The site is rectangular in shape with the longest axis running northeast to southwest, with a frontage to Cabarita Road to the south. The site slopes down garage on front boundary to level courtyard at top level of existing dwelling and again down steeply to approved boatshed under construction with flat area at shore end of jetty. The majority of the existing vegetation contains mature Lelyland Cypress hedging and one *Melaleuca quinquenervia* on site and on adjacent sites mature locally indigenous trees and shrubs with an understory of exotic turf or ornamental groundcovers. The trees on site are likely planted specimens, whilst the large canopy trees on adjacent sites likely remnant or remnant progeny. This report is concerned with proposed works to construct two new Railius Rail gliders to provide pedestrian/goods access from jetty to upper levels of site.

3.0 Tree Assessment

Tree 1: *Plumeria rubra* var. *acutifolia* - Frangipani located adjacent site mature specimen with fair vigour, fair condition, medium life expectancy, dominant crown form, 5m estimated height, crown spread 4m. 60% crown cover with 70% crown density, diameter at 1.4m of 280mm, crown overhanging site by 50% with roots truncated back into slope of #14, medium significance scale and medium retention value.

Tree 2: *Corymbia maculata* – Spotted Gum, located adjacent site mature specimen with fair vigour, fair condition, medium life expectancy, co-dominant pruned to stub at 8m, 23m estimated height, crown spread 16m. 70% crown cover with 70% crown density, diameter at 1.4m of 600mm, acaulescent trunk, no roots evident, no pest/disease, branch inclusion, poor form, high significance scale and high retention value.

Tree 3: *Eucalyptus paniculata* – located adjacent site Grey Ironbark semi-mature specimen with good vigour, fair condition, medium life expectancy, intermediate crown form, 6m estimated height, crown spread 1m to N, 4m to S, 2m to E, 1m to W. 80% crown cover with 80% crown density, diameter at 1.4m of 600mm, localised borer lower to mid stem, good form, medium significance scale and medium retention value.

Tree 4: *Melaleuca quinquenervia* – Broad leaved paperbark, located site, mature specimen with good vigour, fair condition, medium life expectancy, dominant crown form, 12m estimated height, crown spread 8m. 60% crown cover with 70% crown density, diameter at 1.4m of 1100mm, strong trunk lean, basal root flare evident, asymmetrical crown to N, fair form, medium significance scale and high retention value.

Tree 5: *Syzygium australe* – Scrub Cherry, hedge of five (5) semi-mature specimens, located adjacent site, good vigour, fair condition, medium life expectancy, co-dominant crown form planted as privacy hedge, 6m estimated height, crown spread 3m, 50% crown cover with 80% crown density, diameter at 1.4m of 150mm, medium significance scale and medium retention value.

Tree 6: Corymbia maculata – Spotted Gum, located adjacent site with good vigour, good condition, medium life expectancy, co-dominant crown form, 20m estimated height, crown spread 12. 60% crown cover with 70% crown density, diameter at 1.4m of 675mm, acaulescent, high significance scale and high retention value.

Tree 7 (hedge) Cupressocyparis x leylandii (Leyland Cypress) located around perimeter of mid-slope courtyard, 4-5m in height and 1200mm in width regularly pruned to shape.

Tree	Genus species	Diameter at breast height	Structural Root Zone (SRZ)	Tree Protection Zone (TPZ)
#		(DBH) mm	m	
1	Plumeria rubra var. acutifolia	280	1.9	3.4
2	Corymbia maculata	600	2.7	7.2
3	Eucalyptus paniculata	600	2.7	7.2
4	Melaleuca quinquenervia	1100	3.4	13.2
5	Syzygium australe	150	1.5	2.0
6	Corymbia maculata	675	2.8	8.0
7	Cupressocyparis x leylandii	100	1.5	2.0

4.0 Structural Root Zone & Tree Protection Zone Calculations (AS4970)

5.0 Summary Tree Retention Values

Tree No.	Retention Value	Exempt to DCP due to <5m height or exempt species
1	Medium	Yes to be retained neighbouring site
2	High	No to be retained neighbouring site
3	High	No to be retained neighbouring site
4	Medium	No to be retained on site
5	Medium	No to be retained neighbouring site
6	High	No to be retained neighbouring site
7	Low	Yes to be retained on site

6.0 Discussion Tree Impacts by Proposed Works

6.1 Tree 1 *Plumeria rubra* var. *acutifolia* is proposed for retention and is setback >12m from proposed works and has a TPZ of 3.4m and is therefore not affected by the proposal.

6.2 Tree 2 *Corymbia maculata* is proposed for retention and is setback >12m from proposed works and has a TPZ of 7.2m and is therefore not affected by the proposal.

6.3 Tree 3 Eucalyptus paniculata is proposed for retention and is setback >12m from proposed works and has a TPZ of 7.2m and is therefore not affected by the proposal.

6.4 Tree 4 *Melaleuca quinquenervia* is proposed for retention and has a calculated TPZ of 13.2m. Approved works have been carried out recently (retaining wall as part of approved boatshed DA) on the lower compression side of tree's stem. The excavation for retaining wall was carried out by hand by builder under instruction from project arborist. No woody roots were encountered during works. A further retaining wall consisting of sandstone blocks was constructed mid-slope above the tree in order to stabilize a steep eroding slope with failing amateur built garden wall. Again the construction was carried out with hand digging only and no roots > 25mm were severed in process. Following this construction, very high rainfall was encountered on site and the tree showed no sign of movement downslope. A sole concrete pier was installed as part of retaining wall process, again with no root disturbance and this serves as a pier to cantilever the proposed rail 8m across the majority of the TPZ and all the SRZ of tree. Minor landscape treatment is the only proposed final treatment for the upslope portion of the TPZ, and accordingly in the author's opinion the installation rail fully suspended across the tree's tensile root system would not adversely impact the tree's stability or long term health.

6.5 Tree 5 *Syzygium australe* is proposed for retention and has calculated TPZ of 2.0m. The first two specimens in this hedge will require some minor pruning to accommodate the railius platform, howver root disturbance will be minimal due to pier and rail construction.

6.6 Tree 6 *Corymbia maculata* is proposed for retention and is setback 7m from proposed works and has a TPZ of 8.0m and therefore is a minor encroachment from one pier.

6.7 Tree 7 *Cupressocyparis* x *leylandii* is an exempt species in the Northern beaches Council LGA. Notwithstanding this, the proposed upper lift will require limited incursion into the hedge to faciliatate access.

7.0 Recommendations

Specific:

- 1. Trees 1, 2, 3, 4, 5, 6 and 7 to be retained TPZ fencing and mulch to be installed prior to commencement of any building works as close to calculated TPZ as practicable on site as determined by project arborist.
- Excavation of proposed pier adjacent tree 5 to be supervised by project arborist. Where
 roots > 25mm in diameter are encountered, footing design to bridge roots so that they are
 not severed.
- 3. If pruning for clearance from approved works is required for tree 5 it is to be carried out under supervision of project arborist. Contractor to be insured and AQF Level 3 Arborist and works to be carried out according to AS4373 Pruning amenity trees.

General:

Tree Protection Zone Methodology

Tree preservation cannot wait until construction.

The fencing of tree preservation area should be done before any work is carried out, including clearing and grading. No stockpiling should take place around the root zone of any tree intended for retention.

The inclusion of a mulch layer of composted leaf and woodchip to a depth of 75mm will help retain soil moisture and protect soil from contaminants.

Nothing should occur in the TPZ, so therefore all access to personnel and machinery, and storage of fuel, chemicals, cement or site sheds are prohibited.

Tree health is dependent on root health and the majority of non-woody absorption roots are in the top 300mm of soil. Compaction and contamination of this area is a common cause of tree decline and death on development sites.

The most appropriate fencing for TPZ is 1.8m chainlink with 50mm metal pole supports. Given the small scale of this development bunting attached to star pickets to delineate TPZ is considered adequate. Signage should explain exclusion from TPZ and carry contact for access or advice.

Service trenches should not pass through a fenced area, although if this cannot be avoided, a qualified arborist should be present to supervise excavation, cut torn roots cleanly or redesign around roots.

Regular monitoring of protected trees during development works for unforeseen changes or decline, will help maintain healthy trees.

Post Construction Tree Care Recommendations

Tree preservation requires a long-term commitment to monitoring and rectifying problems associated with trees.

Some recommendations for care of trees after construction are:

Mulching – removal of mulch after construction to remove any contaminants. Replacement with a good quality mulch and addition of 10% organic matter will improve beneficial soil micro-organisms, retain moisture and improve aeration and water infiltration.

Pruning – removal of deadwood from trees to be retained is recommended for hazard abatement when the TPZ fencing is removed at the end of the project. A minimum amount of live material should be removed from trees so they have maximum photosynthetic ability to develop new roots to adapt to new conditions. All pruning work should be carried out by qualified arborist and be to Australian Standard for Pruning Amenity Trees-AS4373 1996

Irrigation – an arborist should determine whether irrigation should be carried out during extended periods of drought.

Pest management - monitoring as trees under stress are more open to insect attack

Hazard management – monitoring of the trees and re-assessment is required for adequate longterm safety of the residents. These trees are not part of a natural system and will require observation and treatment if they are to remain an asset to the development and the community

8.0 Conclusions:

Seven (7) trees (including hedge groups) are potentially affected by the proposed works. Trees 1, 2, 3, and 6 are considered setback at distance where no impact will occur.

Trees 4 and 5 are subject to a minor encroachment from the proposed works mitigated by existing site conditions and tree sensitive design.

Citat.

Craig Martin Diploma of Horticulture (Arboriculture) Graduate Certificate Wildlife Management (Habitat) Certificate of Horticulture (Distinction)

This assessment was carried out from the ground, and covers what was reasonably able to be assessed, and available to this assessor at the time of inspection. No aerial inspections were carried out.

LIMITATIONS ON THE USE OF THIS REPORT

This report is to be utilised in its entirety only. Any written or verbal submission, report or presentation that includes statements taken from the findings, discussions, conclusions or recommendations made in this report, may only be used where the whole of the original report (or a copy) is referenced in, and directly attached to that submission, report or presentation.

ASSUMPTIONS

Care has been taken to obtain information from reliable resources. All data has been verified insofar as possible; however, Tree Consult can neither guarantee nor be responsible for the accuracy of information provided by others.

Unless stated otherwise:

- Information contained in this report covers only the tree that was examined and reflects the condition of the tree at the time of inspection: and
- The inspection was limited to visual examination of the subject tree without dissection, excavation, probing or coring. There is no warranty or guarantee, expressed or implied, that problems or deficiencies of the subject tree may not arise in the future.

9.0 REFERENCES

- 1. Draper BD and Richards PA 2009, *Dictionary for Managing Trees in Urban Environments*, Institute of Australian Consulting Arboriculturists (IACA), CSIRO Publishing, Collingwood, Victoria, Australia.
- 2. Standards Australia 2007, Australian Standard 4373 Pruning of amenity trees, Standards Australia, Sydney, Australia.
- 3. Standards Australia 2009, Australian Standard 4970 Protection of trees on development sites, Standards Australia, Sydney, Australia.
- 4. Fairley, A., Moore, P., 2000, Native Plants of the Sydney District- An Identification Guide, Kangaroo Press, Sydney.
- 5. Mattheck, C., & Breloer, H., 1994, *The Body Language of Trees, A handbook for failure analysis,* Department of the Environment, Transport and the Regions, London
- 6. Robinson, L., 1994 Field Guide to the Native Plants of Sydney (3rd edition), Simon & Schuster, Sydney

Appendix A – Tree Location Plan



Appendix B: Glossary of Terms

Source: Dictionary for Managing Trees in Urban Environments by Draper BD and Richards PA 2009, Institute of Australian Consulting Arboriculturists (IACA), CSIRO Publishing, Collingwood, Victoria, Australia.

Age of Trees

Age Most trees have a stable biomass for the major proportion of their life. The estimation of the age of a tree is based on the knowledge of the expected lifespan of the taxa in situ divided into three distinct stages of measurable biomass, when the exact age of the tree from its date of cultivation or planting is unknown and can be categorized as *Young*, *Mature* and *Over-mature* (British Standards 1991, p. 13, Harris *et al*, 2004, p. 262).

Young Tree aged less than <20% of life expectancy, in situ.

Mature Tree aged 20-80% of life expectancy, in situ.

Over-mature Tree aged greater than >80% of life expectancy, in situ, or senescent with or without reduced vigour, and declining gradually or rapidly but irreversibly to death.

Condition of Trees

Condition A tree's *crown form* and growth habit, as modified by its *environment* (aspect, suppression by other trees, soils), the *stability* and *viability* of the *root plate*, trunk and structural branches (first (1st) and possibly second (2nd) order branches), including structural defects such as wounds, cavities or hollows, *crooked* trunk or weak trunk/branch junctions and the effects of predation by pests and diseases. These may not be directly connected with *vigour* and it is possible for a tree to be of *normal vigour* but in *poor condition*. Condition can be categorized as *Good Condition, Fair Condition, Poor Condition* and *Dead*.

Good Condition Tree is of good habit, with *crown form* not severely restricted for space and light, physically free from the adverse effects of *predation* by pests and diseases, obvious instability or structural weaknesses, fungal, bacterial or insect infestation and is expected to continue to live in much the same condition as at the time of inspection provided conditions around it for its basic survival do not alter greatly. This may be independent from; or contributed to by vigour.

Fair Condition Tree is of good habit or *misshapen*, a form not severely restricted for space and light, has some physical indication of *decline* due to the early effects of *predation* by pests and diseases, fungal, bacterial, or insect infestation, or has suffered physical injury to itself that may be contributing to instability or structural weaknesses, or is faltering due to the modification of the *environment* essential for its basic survival. Such a tree may recover with remedial works where appropriate, or without intervention may stabilise or improve over time, or in response to the implementation of beneficial changes to its local environment. This may be independent from; or contributed to by vigour.

Poor Condition Tree is of good habit or *misshapen*, a form that may be severely restricted for space and light, exhibits symptoms of advanced and *irreversible decline* such as fungal, or bacterial infestation, major die-back in the branch and *foliage crown, structural deterioration* from insect damage e.g. termite infestation, or storm damage or lightning strike, ring barking from borer activity in the trunk, root damage or instability of the tree, or damage from physical wounding impacts or abrasion, or from altered local environmental conditions and has been unable to adapt to such changes and may decline further to death regardless of remedial works or other modifications to the local *environment* that would normally be sufficient to provide for its basic survival if in *good* to *fair* condition. Deterioration physically, often characterised by a gradual and continuous reduction in vigour but may be independent of a change in vigour, but characterised by a proportionate increase in susceptibility to, and *predation* by pests and diseases against which the tree cannot be sustained. Such conditions may also be evident in trees of advanced senescence due to normal phenological processes, without modifications to the growing environment or physical damage having been inflicted upon the tree. This may be independent from; or contributed to by vigour.

Senescent / Moribund Advanced state of decline, dying or nearly dead.

Dead Tree is no longer capable of performing any of the following processes or is exhibiting any of the following symptoms;

Processes

Photosynthesis via its foliage crown (as indicated by the presence of moist, green or other coloured leaves); Osmosis (the ability of the root system to take up water); Turgidity (the ability of the plant to sustain moisture pressure in its cells);

Epicormic shoots or *epicormic strands* in Eucalypts (the production of new shoots as a response to stress, generated from latent or adventitious buds or from a *lignotuber*); Symptoms

Permanent leaf loss;

Permanent wilting (the loss of turgidity which is marked by desiccation of stems leaves and roots);

Abscission of the *epidermis* (bark desiccates and peels off to the beginning of the sapwood).

Removed No longer present, or tree not able to be located or having been cut down and retained on a site, or having been taken away from a site prior to site inspection.

Branch

Branch An elongated woody structure arising the development of other branches. A branch successive orders of branches with the length the crown. These may develop initially as a division as in a young tree or a tree of terminates at or some distance from the root the foliage crown. In an acaulescent tree, may arise from a sprout mass from damaged

Orders of branches The marked divisions 168) commencing at the initial division where branches on an *excurrent* tree. Successive in branch diameters at each division, and numerically, e.g. first order, second order,



initially from the trunk to support leaves, flowers, fruit and may itself fork and continue to divide many times as and taper decreasing incrementally to the *outer extremity* of gradually tapering continuation of the *trunk* with minimal *excurrent habit*, or in a *sapling*, or may arise where the trunk *crown*, dividing into *first order branches* to form and support branches arise at or near the *root crown*. Similarly, branches *roots, branches* or *trunk*.

between successively smaller branches (James 2003, p. the trunk terminates on a *deliquescent* tree or from *lateral* branching is generally characterised by a gradual reduction each gradation from the trunk can be categorised third order etc. (See Figure 21.)

<u>Crown</u>

Canopy 1. Of multiple trees, the convergence, or merging in full or part, of the crowns of two or more trees due to their proximity, or where competition for light and space available in a forest environment is limited as each tree develops forming a continuous layer of foliage. 2. Used as a plural for crown. 3. Sometimes synonymously used for crown (USA).

Crown Of an individual tree all the parts arising above branches, e.g. the branches, leaves, flowers and fruit; or crown of any tree can be divided vertically into three and *upper crown* (Figure 8). For a *leaning* tree these can *base* to *apex*. The volume of a crown can be categorised *crown*.

Lower crown *proximal* or lowest section of a crown also *Crown*, *Mid crown* and *Upper crown*.

Mid crown middle section of a crown when divided *Lower crown* and *Upper crown*.

Upper crown *distal* or highest section of a crown when *Crown, Mid crown* and *Lower crown.*

Crown Projection (CP) Area within the *dripline* or beneath the and *Dripline*.



the trunk where it terminates by its division forming the total amount of foliage supported by the branches. The sections and can be categorised as *lower crown*, *mid crown* be divided evenly into crown sections of one-third from the as the *inner crown*, *outer crown* and *outer extremity of*

when divided vertically into one-third (1/3) increments. See

vertically into one-third (1/3) increments. See also Crown,

divided vertically into one-third (1/3) increments. See also

lateral extent of the crown (Geiger 2004, p. 2). See also Crown spread

Dripline A line formed around the edge of a tree by the lateral extent of the *crown*. Such a line may be evident on the ground with some trees when exposed soil is displaced by rain shed from the crown. See also *Crown Projection*.

Crown Form of Trees

Crown Form The shape of the crown of a tree as influenced by the availability or restriction of space and light, or other contributing factors within its growing environment. Crown Form may be determined for tree shape and habit generally as *Dominant*, *Codominant*, *Intermediate*, *Emergent*, *Forest* and *Suppressed*. The habit and shape of a *crown* may also be considered qualitatively and can be categorized as *Good Form* or *Poor Form*.

Good Form Tree of *typical* crown shape and habit with proportions representative of the taxa considering constraints such as origin e.g. indigenous or exotic; but does not appear to have been adversely influenced in its development by environmental factors in situ such as *soil water* availability, prevailing wind, or cultural practices such as lopping and competition for space and light.

Poor Form Tree of *atypical* crown shape and habit with proportions not representative of the species considering constraints and appears to have been adversely influenced in its development by environmental factors in situ such as *soil water* availability, prevailing wind, cultural practices such as lopping and competition for space and light; causing it to be *misshapen* or disfigured by disease or vandalism.

Crown Form Codominant Crowns of trees restricted for space and light on one or more sides and receiving light primarily from above e.g. constrained by another tree/s or a building.

Crown Form Dominant Crowns of trees generally not restricted for space and light receiving light from above and all sides.

Crown Form Emergent Crowns of trees restricted for space on most sides receiving most light from above until the *upper crown* grows to protrude above the canopy in a stand or forest environment. Such trees may be *crown form dominant* or transitional from *crown form intermediate* to *crown form forest* asserting both *apical dominance* and *axillary dominance* once free of constraints for space and light.

Crown Form Forest Crowns of trees restricted for space and light except from above forming tall trees with narrow spreading crowns with foliage restricted generally to the top of the tree. The trunk is usually erect, straight and continuous, tapering gradually, crown often excurrent, with first order branches becoming structural, supporting the live crown concentrated towards the top of the tree, and below this point other first order branches arising radially with each *inferior* and usually temporary, divergent and ranging from horizontal to ascending, often with internodes exaggerated due to competition for space and light in the *lower crown*.

Crown Form Intermediate Crowns of trees restricted for space on most sides with light primarily from above and on some sides only.

Crown Form Suppressed Crowns of trees generally not restricted for space but restricted for light by being *overtopped* by other trees and occupying an understorey position in the canopy and growing slowly.



Deadwood

Deadwood Dead branches within a tree's crown and considered quantitatively as separate to *crown cover* and can be categorised as *Small Deadwood* and *Large Deadwood* according to diameter, length and subsequent *risk* potential. The amount of dead branches on a tree can be categorized as *Low Volume Deadwood*, *Medium Volume Deadwood* and *High Volume Deadwood*. See also *Dieback*.

Deadwooding Removing of dead branches by pruning. Such pruning may assist in the prevention of the spread of decay from dieback or for reasons of safety near an identifiable target.

Small Deadwood A dead branch up to 10mm diameter and usually <2 metres long, generally considered of low *risk* potential.
Large Deadwood A dead branch >10mm diameter and usually >2 metres long, generally considered to be of high risk potential.
High Volume Deadwood High Volume Deadwood Where >10 dead branches occur that may require *removal*.
Medium Volume Deadwood Where 5-10 dead branches occur that may require *removal*.
Low Volume Deadwood Where <5 dead branches occur that may require *removal*.

Dieback The death of some areas of the *crown*. Symptoms are leaf drop, bare twigs, dead branches and tree death, respectively. This can be caused by root damage, root disease, bacterial or fungal canker, severe bark damage, intensive grazing by insects, *abrupt changes* in growth conditions, drought, water-logging or over-maturity. Dieback often implies reduced *resistance, stress* or *decline* which may be temporary. Dieback can be categorized as *Low Volume Dieback, Medium Volume Dieback* and *High Volume Dieback*.

High Volume Dieback Where >50% of the *crown cover* has died.

Medium Volume Dieback Where 10-50% of the *crown cover* has died.

Low Volume Dieback Where <10% of the crown cover has died. See also Dieback, High Volume Dieback and Medium Volume Dieback.

Epicormic shoots

Epicormic Shoots Juvenile shoots produced at branches or trunk from *epicormic strands* in some Eucalypts (Burrows 2002, pp. 111-131) or sprouts produced from dormant or latent buds concealed beneath the bark in some trees. Production can be triggered by fire, pruning, wounding, or root damage but may also be as a result of *stress* or *decline*. Epicormic shoots can be categorized as *Low Volume Epicormic Shoots*, *Medium Volume Epicormic Shoots* and *High Volume Epicormic Shoots*.

High Volume Epicormic Shoots Where >50% of the *crown cover* is comprised of live *epicormic shoots*. **Medium Volume Epicormic Shoots** Where 10-50% of the *crown cover* is comprised of live *epicormic shoots*. **Low Volume Epicormic Shoots** Where <10% of the *crown cover* is comprised of live *epicormic shoots*.

General Terms

Cavity A usually shallow void often localized initiated by a *wound* and subsequent *decay* within the trunk, branches or roots, or beneath bark, and may be enclosed or have one or more opening.

Decay Process of degradation of wood by microorganisms (Australian Standard 2007, p. 6) and fungus.

Hazard The threat of danger to people or property from a tree or tree part resulting from changes in the physical condition, growing environment, or existing physical attributes of the tree, e.g. included bark, soil erosion, or thorns or poisonous parts, respectively.

Included bark 1. The bark on the inner side of the *branch union*; or is within a concave *crotch* that is unable to be lost from the tree and accumulates or is trapped by *acutely divergent* branches forming a *compression fork*. 2. Growth of bark at the interface of two or more branches on the inner side of a branch union or in the crotch where each branch forms a branch collar and the collars roll past one another without forming a graft where no one collar is able to subsume the other. Risk of failure is worsened in some taxa where branching is *acutely divergent* or *acutely convergent* and ascending or erect.

Hollow A large void initiated by a *wound* forming a *cavity* in the trunk, branches or roots and usually increased over time by *decay* or other contributing factors, e.g. fire, or fauna such as birds or insects e.g. ants or termites. A hollow can be categorized as an *Ascending Hollow* or a *Descending Hollow*.

Risk The random or potentially foreseeable possibility of an episode causing harm or damage.

Significant Important, weighty or more than ordinary.

Significant Tree A tree considered important, weighty or more than ordinary. Example: due to prominence of location, or *in situ*, or contribution as a component of the overall landscape for *amenity* or aesthetic qualities, or *curtilage* to structures, or importance due to uniqueness of taxa for species, subspecies, variety, *crown form*, or as an historical or cultural planting, or for age, or substantial dimensions, or habit, or as *remnant vegetation*, or habitat potential, or a rare or threatened species, or uncommon in cultivation, or of aboriginal cultural importance, or is a commemorative planting.

Substantial A tree with large dimensions or proportions in relation to its place in the landscape.

Visual Tree Assessment (VTA) A visual inspection of a tree from the ground based on the principle that, when a tree exhibits apparently superfluous material in its shape, this represents repair structures to rectify *defects* or to reinforce weak areas in accordance with the *Axiom of Uniform Stress* (Mattheck & Breloer 1994, pp. 12-13, 145). Such assessments should only be undertaken by suitably competent practitioners.

Leaning Trees

Leaning A tree where the *trunk* grows or moves away from upright. A lean may occur anywhere along the *trunk* influenced by a number of contributing factors e.g. genetically predetermined characteristics, competition for space or light, prevailing winds, aspect, slope, or other factors. A *leaning* tree may maintain a *static lean* or display an increasingly *progressive lean* over time and may be hazardous and prone to *failure* and *collapse*. The degrees of leaning can be categorized as *Slightly Leaning*, *Moderately Leaning*, *Severely Leaning* and *Critically Leaning*.

Slightly Leaning A leaning tree where the trunk is growing at an angle within 0°-15° from upright. **Moderately Leaning** A leaning tree where the trunk is growing at an angle within 15°-30° from upright. **Severely Leaning** A leaning tree where the trunk is growing at an angle within 30°-45° from upright. **Critically Leaning** A leaning tree where the trunk is growing at an angle greater than >45° from upright. **Progressively Leaning** A tree where the degree of *leaning* appears to be increasing over time. **Static Leaning** A leaning tree whose lean appears to have stabilized over time.

Periods of Time

Periods of Time The life span of a tree in the urban environment may often be reduced by the influences of encroachment and the dynamics of the environment and can be categorized as *Immediate, Short Term, Medium Term* and *Long Term*.

Immediate An *episode* or occurrence, likely to happen within a twenty-four (24) hour period, e.g. tree failure or collapse in full or part posing an imminent danger. **Short Term** A period of time less than <1 - 15 years. **Medium Term** A period of time 15 - 40 years. **Long Term** A period of time greater than >40 years

Roots

First Order Roots (FOR) Initial woody roots arising from the *root crown* structural support and *stability*. Woody roots may be buttressed and continuous or tapering rapidly at a short distance from the root crown. and not be evident at the root crown; or become buried by changes in 221), or more first order roots which may radiate from the trunk with a aspect, dependent upon physical characteristics e.g. leaning trunk, *environment* from topography e.g. slope, soil depth, rocky outcrops, *water table* etc.

Orders of Roots The marked divisions between woody roots, trunk, at the *root crown* where successive branching is generally each gradation from the trunk and can be categorized numerically, e.g. Roots may not always be evident at the *root crown* and this may be environment. Palms at maturity may form an adventitious root mass.

Root Plate The entire root system of a tree generally occupying the top may extend laterally for distances exceeding twice the height of the tree dependent on water availability, soil type, *soil depth* and the physical

Root Crown Roots arising at the base of a trunk.

Zone of Rapid Taper The area in the *root plate* where the diameter of from the *trunk*. Considered to be the minimum radial distance to provide *Structural Root Zone (SRZ)*.

Structural Roots Roots supporting the infrastructure of the *root plate* may taper rapidly at short distances from the *root crown* or become dicotyledonous angiosperms and are usually 1st and 2nd order roots; or angiosperms (palms). Such roots may be crossed and grafted and are extend just beyond the *dripline*.



at the base of the *trunk*, or as an *adventitious root mass* for divided as a marked gradation, gradually tapering and Depending on soil type these roots may descend initially soil levels. Trees may develop 4-11 (Perry 1982, pp. 197relatively even distribution, or be prominent on a particular *asymmetrical* crown; and constraints within the growing exposure to predominant wind, soil moisture, depth of

commencing at the initial division from the base of the characterised by a gradual reduction in root diameters and *first order roots*, second order roots, third order roots etc. dependent on species, age class and the growing

300-600mm of soil including roots at or above ground and (Perry 1982, pp. 197-221). Development and extent are characteristics of the surrounding landscape.

structural roots reduces substantially over a short distance structural support and root plate stability. See also

providing strength and *stability* to the tree. Such roots large and woody as with gymnosperms and form an *adventitious root mass* in monocotyledonous usually contained within the area of *crown projection* or

Symmetry

Symmetry Balance within a *crown,* or *root plate,* above or below the *axis* of the trunk of branch and foliage, and root distribution respectively and can be categorized as *Asymmetrical* and *Symmetrical*.

Asymmetrical Imbalance within a crown, where there is an uneven distribution of branches and the foliage crown or root plate around the vertical axis of the trunk. This may be due to

Crown Form Codominant or *Crown Form Suppressed* from competition for space and light with other trees, for clearance of roads, buildings or power lines. An asymmetrical, bias to west.

Symmetrical Balance within a crown, where there is around the vertical *axis* of the trunk. This usually *Forest*. An example of an expression of this may be



as a result of natural restrictions e.g. from buildings, or or from exposure to wind, or artificially caused by pruning example of an expression of this may be, crown

an even distribution of branches and the *foliage crown* applies to trees of *Crown Form Dominant* or *Crown Form* crown symmetrical.

<u>Trunk</u>

Trunk A single stem extending from the root crown to support or elevate the crown, terminating where it divides into separate stems forming first order branches. A trunk may be evident at or near ground or be absent in acaulescent trees of deliquescent habit; or may be continuous in trees of excurrent habit. The trunk of any caulescent tree can be divided vertically into

three (3) sections and can be categorized as *Lower Trunk*, be divided evenly into sections of one third along the trunk.

Acaulescent A *trunkless* tree or tree growth forming a very

Caulescent Tree grows to form a trunk. See also

Lower trunk Lowest, or *proximal* section of a trunk when *Trunk*, *Mid trunk* and *Upper trunk*.

Mid trunk A middle section of a trunk when divided into onetrunk and Upper trunk.

Upper trunk Highest, or *distal* section of a trunk when divided *Lower trunk* and *Mid trunk*.



Mid Trunk and Upper Trunk. For a leaning tree these may

short trunk. See also Caulescent. (See Fig. 21)

Acaulescent. (See Fig. 21)

divided into one-third (1/3) increments along its axis. See also

third (1/3) increments along its axis. See also Trunk, Lower

into one-third (1/3) increments along its axis. See also Trunk,

Diameter at Breast Height (DBH) Measurement of trunk width calculated at a given distance above ground from the base of the tree often measured at 1.4 m. The trunk of a tree is usually not a circle when viewed in cross section, due to the presence of *reaction wood* or *adaptive wood*, therefore an average diameter is determined with a *diameter tape* or by recording the trunk along its narrowest and widest axes, adding the two dimensions together and dividing them by 2 to record an average and allowing the orientation of the longest axis of the trunk to also be recorded. Where a tree is growing on a lean the distance along the top of the trunk is measured to 1.4m and the diameter then recorded from that point perpendicular to the edge of the trunk. Where a *leaning* trunk is *crooked* a vertical distance of 1.4m is measured from the ground. Where a tree branches from a trunk that is less than 1.4m above ground, the trunk diameter is recorded perpendicular to the length of the *trunk* from the point immediately below the base of the flange of the *branch collar* extending the furthest down the trunk, and the distance of this point above ground recorded as *trunk* length. Where a tree is located on sloping ground the DBH should be measured at half way along the side of the trunk at or near ground and noting where the measurement was recorded e.g. at ground.

<u>Vigour</u>

Vigour Ability of a tree to sustain its life processes. This is independent of the *condition* of a tree but may impact upon it. Vigour can appear to alter rapidly with change of seasons (seasonality) e.g. *dormant*, deciduous or semi-deciduous trees. Vigour can be categorized as *Normal Vigour*, *High Vigour*, *Low Vigour* and *Dormant Tree Vigour*.

Normal Vigour Ability of a tree to maintain and sustain its life processes. This may be evident by the *typical* growth of leaves, *crown cover* and *crown density*, branches, roots and trunk and *resistance* to *predation*. This is independent of the *condition* of a tree but may impact upon it, and especially the ability of a tree to sustain itself against predation.

High Vigour Accelerated growth of a tree due to incidental or deliberate artificial changes to its growing *environment* that are seemingly beneficial, but may result in *premature aging* or failure if the favourable conditions cease, or promote *prolonged senescence* if the favourable conditions remain, e.g. water from a leaking pipe; water and nutrients from a leaking or disrupted sewer pipe; nutrients from animal waste, a tree growing next to a chicken coop, or a stock feed lot, or a regularly used stockyard; a tree subject to a stringent watering and fertilising program; or some trees may achieve an extended lifespan from continuous *pollarding* practices over the life of the tree.

Low Vigour Reduced ability of a tree to sustain its life processes. This may be evident by the *atypical* growth of leaves, reduced *crown cover* and reduced *crown density*, branches, roots and trunk, and a deterioration of their functions with reduced *resistance* to *predation*. This is independent of the *condition* of a tree but may impact upon it, and especially the ability of a tree to sustain itself against predation