

Arboricultural Impact Assessment

An assessment addressing the potential viability of trees in relation to the proposed development.

Prepared for
Capital Insight Pty Limited
No. 77 Berry Street
North Sydney NSW 2060

For the proposed development located at
Sutherland Hospital
Corner of Kingsway & Kareena Road
CARINGBAH, NSW
Within the D.P. 432285, 119519

Prepared by
Warwick Varley
Consulting Arborist

Prepared: 3rd April, 2015
Reference No: D2503

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1.0 Introduction

- 1.1 The following Arborist report is an amended version that has been requested by Kevin MacLennan, care of BVN and capital Insight P/L, based on an updated design. The initial arborist report (referenced D2445, dated 1st December 2014) had been requested by Emma Jowsey (Project Manager) care of TSA Management Pty Limited, for the trees located within and adjacent to the areas proposed for the development of the western portion (fronting Kareena Road) of the Sutherland Hospital, Caringbah.
- 1.2 This report will address for these trees, the:
- species' identification, location, dimensions and condition;
 - SULE and SRIV rating;
 - impact of the proposed works on the trees;
 - recommendations for the removal, retention and/or pruning;
 - tree protection zones and protection specifications for trees recommended for retention.

2.0 Standards

- 2.1 Allied Tree Consultancy provides an ethical and unbiased approach to all assignments, possessing no association with private utility arboriculture or organisations which may reflect a conflict of interest.
- 2.2 This report must be made available to all contractors during the tendering process so that any cost associated with the required works for the protection of trees can be accommodated.
- 2.3 **It is the responsibility of the project manager to provide the requirements outlined within this report relative to the Protection Zones, Measures (section 7.0) and Specifications (section 8.0) to all contractors associated with the project before the initiation of work.**
- 2.4 All tree related work outlined in this report is to be conducted in accordance with the:
- Australian Standard – AS4373; “Pruning of Amenity Trees”.
 - NSW Work cover Authority Code of Practice for the Amenity Tree Industry, August 1998; Catalogue No. 034.
 - All tree works must be carried out by a tertiary level (minimum Certificate-level 3) qualified and experienced (minimum five years) arboriculturist.
 - For any works within the vicinity of electrical lines, the arboriculturist must possess the ISSC26 endorsement (Interim guild for operating cranes and plant in proximity to overhead powerlines).
- 2.6 As a minimum requirement, all trees recommended for retention within this report must have removed all dead, diseased, and crossing limbs and branch stubs to be pruned to the branch collar. This work can be conducted by any person so long as they comply with section 2.2 and 2.5.

3.0 Disclosure Statement

Trees are living organisms and therefore possess natural variability. This cannot be controlled, however risks associated with trees can be managed. An arborist cannot guarantee that a tree will be safe under all circumstances, nor predict the time when a tree will fail. To live or work near a tree involves some degree of risk and this evaluation does not preclude all the possibilities of failure.

4.0 Methodology

4.1 The following tree assessment was undertaken using criteria based upon the guidelines laid down by the International Society of Arboriculture.

4.2 The format of the report is composed of:

4.2.1 Plan 1; Tree Location Relative to Site: This is an unscaled plan reproduced from the Site Plan as referenced in Section 4.3.

4.2.2 Table 1; This table compiles the species, dimensions, condition and brief assessment (history, structure, pest, disease or any other variables subject to the tree) of the tree as referenced within Plan 1. All measurements are in meters.

4.2.3 Tree Protection; This offers an outline of the proposal with regards to the existing trees and the specific requirements for their retention. This will include the allocation of a Tree Protection Zone (TPZ), Protection Measures and any changes or additions required as part of the proposed works.

4.2.4 Protection Specification; This section details the requirements of the TPZ for trees recommended for retention.

4.3 The process involved in compiling the information for this assessment involves:

1. Site assessment on the 26th November 2014 using the method of the Visual Tree Assessment¹. The assessment was conducted by Matthew Reed² (Consulting arborist), care of Allied Tree Consultancy.
2. Raw data from the preliminary assessment including the specimen's dimensions was compiled by the use of a diameter tape, height clinometer, angle finder, compass, steel probes, Teflon hammer, binoculars and recording instruments.

1. Mattheck, C. Breloer, H.
The Body Language of Trees – A handbook for failure analysis
The Stationary Office, London, 1994

2 Consulting Arborist, AQF Level 5 (Arboriculture, member of Arboriculture Australia.

4.4 Documentation provided

All dimensions and grades referenced in this report are interpreted from the following plan, including the establishment of the trees location in relation to the proposed works.

Surveyor

Drawn by: *LTS Lockley Surveys*

Ph. 1300 587 000

Title: Plan of detail and levels.....

Date: 4th April 2014

Project No.: 35394

Drawing: Sheet 3 of 6

Design

Drawn by: *BVN*

Title: Proposed site plan

Date: not dated

Project No.: BVN00001

Drawing: A-SHP-DA-A03

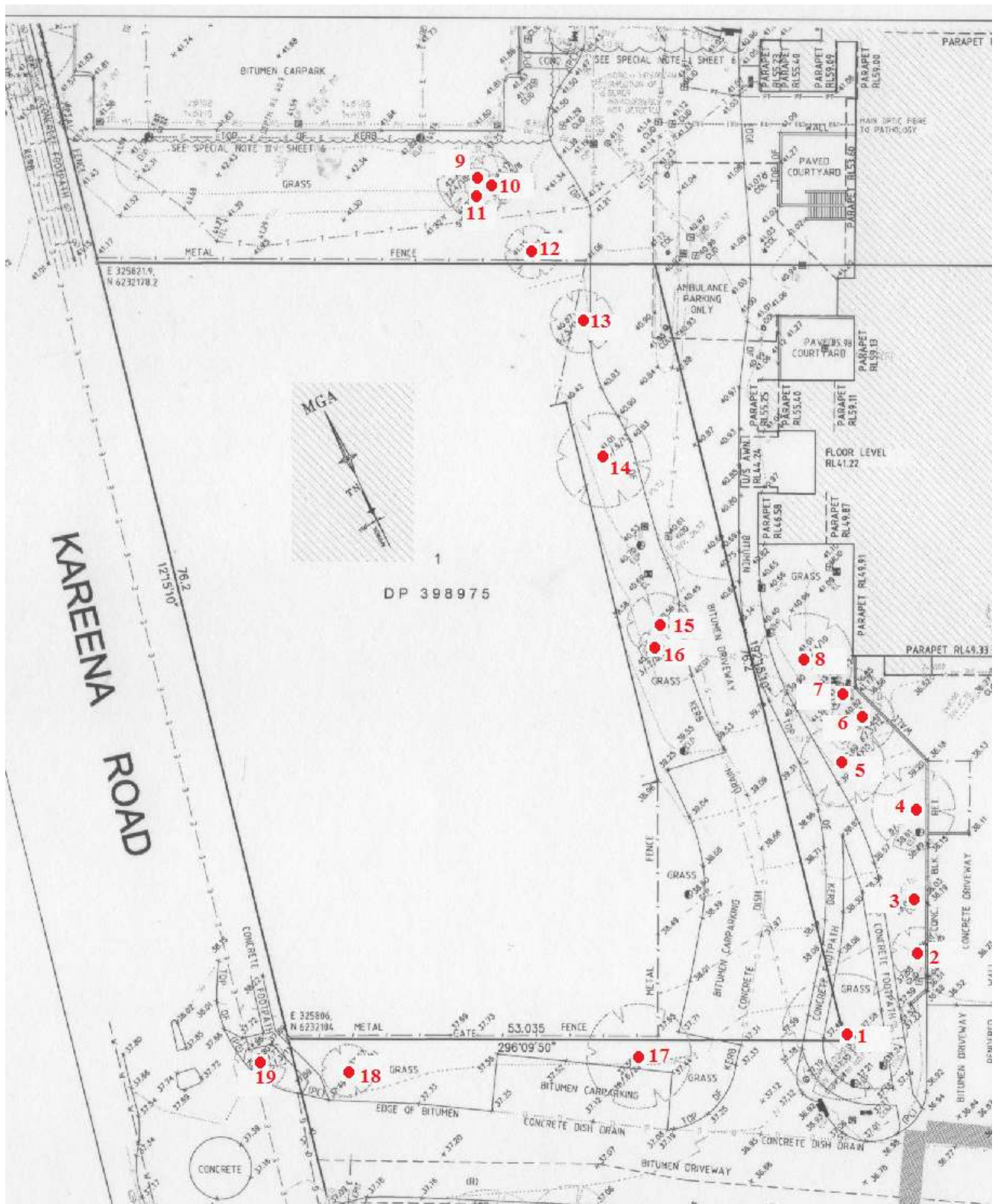
Arborist Report

Author: Allied Tree Consultancy

Reference: D2445

Dated: 1st December 2014

5.0 Plan 1; Numbered location of trees



Not to scale

Source: Adapted from *LTS Lockley Surveys*, dated 4th March 2014, Survey Data; Sheet 3 of 6

6.0 Table 1 – Tree Species Data, Terminology/references provided within Appendix A.

Tree No.	Botanical Name	Common Name	Height (m)	DBH (m)	Crown Spread (m)	Age	Crown Class	Crown Aspect	Crown Ratio	SRIV Rating	SULE Rating
1	<i>Eucalyptus paniculata</i>	Grey Ironbark	20	0.88	14 x 19	M	D	Sym.	F	NVG 10	A1 ¹
Assessment		This tree is composed of two leaders that initiate from a 3m high stem. Some prior pruning has occurred and the wounds are occluding, some evidence of termite activity exists within one of these wounds. The crown structure is typical, and the vigour is normal. An assessment including internal investigation of the trees structure within the vicinity of the root crown and lower stem is recommended to determine the structural integrity and any related risk.									
Remnant											
2	<i>Brachychiton acerifolius</i>	Illawarra Flame Tree	3	0.1	2 x 2	Y	I	Sym.	F	NVF 9	A2
Assessment		This tree provides the habit typical for the species and normal vigour.									
Native											
3	<i>Jacaranda mimosifolia</i>	Jacaranda	5	0.15 0.18	5 x 5	M	C	Sym.	F	NVF 8	A2
Assessment		This tree provides the habit typical for the species and normal vigour.									
Exotic											
4	<i>Eucalyptus sideroxylon</i>	Mugga Ironbark	12	0.45	6 x 6	M	C	Sym.	F	NVF 9	A2
Assessment		This tree provides the habit typical for the species and normal vigour.									
Native											

Tree No.	Botanical Name	Common Name	Height (m)	DBH (m)	Crown Spread (m)	Age	Crown Class	Crown Aspect	Crown Ratio	SRIV Rating	SULE Rating
5	<i>Eucalyptus paniculata</i>	Grey Ironbark	12	0.45	6 x 7	M	C	Sym.	F	NVF 9	A2
Assessment		This tree provides the habit typical for the species and normal vigour.									
Native ²											
6	<i>Melaleuca quinquenervia</i>	Broad Leaf Paperbark	10	0.34	3 x 4	M	C	Sym.	F	NVF 9	A2
Assessment		This tree provides the habit typical for the species and normal vigour.									
Native											
7	<i>Casuarina glauca</i>	Swamp She Oak	11	0.23	4 x 4	M	C	Sym.	F	NVF 9	A2
Assessment		This tree provides the habit typical for the species and normal vigour.									
Native											
8	<i>Eucalyptus. cladocalyx</i>	Sugar Gum	12	0.34 0.27	16 x 12	M	D	Sym.	F	NVF 9	D2 ¹
Assessment		This tree divides into two leaders from ground level, some basal wounds and exposed roots display repeated mechanical wounding. A prior leader failure at 2m from the northern side of the crown, appears to be the result of a pathogenic decay fungi. Kino bleed is also evident in the vicinity and the western leader indicating possible pathogen induced injuries. A follow up assessment to assess the condition of support wood in the stem and crotches is recommended, due to the existing pathogen attack.									
Native											
9	<i>E. botryoides x saligna</i>	Wollongong Woollybutt	16	0.26 0.32	5 x 6	M	D	Sym.	F	NVF 9	A2
Assessment		This tree provides the habit typical for the species and normal vigour.									

Tree No.	Botanical Name	Common Name	Height (m)	DBH (m)	Crown Spread (m)	Age	Crown Class	Crown Aspect	Crown Ratio	SRIV Rating	SULE Rating
Native											
10	<i>Corymbia citriodora</i>	Lemon Scented gum	11	0.18	3 x 5	Y	S	E	F	NVF 8	A2
Assessment		This tree provides the habit typical for the species and normal vigour.									
Native											
11	<i>Corymbia citriodora</i>	Lemon scented-Gum	12	0.23	5 x 3	Y	S	S	F	NVF 8	A2
Assessment		This tree bows strongly over towards the north due to the co-dominant class. The crown extends over the footpath.									
Native											
12	<i>Lagerstroemia petersonii</i>	Lemon Scented Tea Tree	8	0.2 0.25 0.29	7 x 6	O	D	Sym.	S	LVF 2	A4
Assessment		This tree was composed of several leaders (typical for the species) and some leaders have been removed close to ground level, another is dead, and of the few remaining, one has a bracket fungus, indicating active decay exists within the tree. This tree is beyond remedial work and is nominated for removal based upon poor form.									
Native											
13	<i>Lagerstroemia petersonii</i>	Lemon Scented Tea Tree	8	0.67	5 x 5	M	D	Sym.	F	NVF 9	A2
Assessment		This tree provides the habit typical for the species and normal vigour.									
Native											
14	<i>Casuarina glauca</i>	Swamp She Oak	12	0.33 0.48	8 x 6	M	D	Sym.	F	NVF 9	A2
Assessment		This tree divides into two leaders at ground level, the eastern leader and primary limbs have been lopped on the western (road) side.									
Native											

Tree No.	Botanical Name	Common Name	Height (m)	DBH (m)	Crown Spread (m)	Age	Crown Class	Crown Aspect	Crown Ratio	SRIV Rating	SULE Rating
15	<i>Pinus radiata</i>	Radiata Pine	15	0.39	5 x 5	M	D	Sym.	F	NVF 9	A2
Assessment		This tree provides the habit typical for the species and normal vigour.									
Exotic											
16	<i>Banksia integrifolia</i>	Coastal Banksia	8	0.15	3 x 3	Y	S	Sym.	F	NVF 8	A2
Assessment		This tree provides the habit typical for the species and normal vigour.									
Native											
17	<i>Eucalyptus eugenioides</i>	Thin-leaved Stringybark	10	0.45	6 x 6	M	D	Sym.	F	NVF 9	A2
Assessment		This tree provides the habit typical for the species and normal vigour.									
Native ²											
18	<i>Eucalyptus scoparia</i>	Wallangarra White Gum	6	0.26	2 x 2	Y	C	Sym.	F	NVP 6	A4
Assessment		This tree divides into two leaders at 1.5m, the northern leader has been almost ringbarked by borers. This tree poses a limited life expectancy, and is nominated for removal.									
Native											
19	<i>Eucalyptus paniculata</i>	Grey Ironbark	8	0.27	4 x 4	Y	C	Sym.	F	NVF 8	B3
Assessment		This street tree is a scant specimen, predominately due to the co-dominant class. The stem and crown bow to the west and partially over the road, and extensive wounding has occurred to the western side of the stem and wound wood development has initiated. This wounding has occurred from vehicles colliding with the tree. The mature growth of this tree may obstruct traffic and be prone to continuing damage.									
Native											

1. Further investigation required to determine a confident assessment
2. This species is indigenous to the area, and this tree may be remnant planting.

7.0 Tree Protection

7.0.1 The size of the Tree Protection Zone (TPZ) has been calculated from the *Australian Standard, 4970; 2009 – Protection of Trees on Development Sites*

7.0.2 The TPZ does not provide the limit of root extension, however offers an area of the root zone that requires predominate protection from development works. The allocated TPZ can be modified within some circumstances; however will require compensation equivalent to the area loss, elsewhere and adjacent to the TPZ. The requirements of the TPZ are detailed within the Protection Specification, Section 8.0.

7.1 Table 2 – Protection Measures and Zones

Tree No.	Nomination	Tree Protection Zone (m)	Structural Root Zone (m)	Protection Measure
1	Retain	10.5	3.3	Type 1
2	Retain	2.0	1.5	Type 1
3	Retain	2.8	1.9	Type 1
4	Retain	5.4	2.5	Type 1
5	Retain	5.4	2.5	Type 1
6	Retain	4.1	2.2	Type 1
7	Retain	2.8	1.9	Type 1
8	Retain	5.2	2.4	Type 1
9	Remove: Conflicting location	-	-	-
10	Remove: Conflicting location	-	-	-
11	Remove: Conflicting location	-	-	-
12	Remove: Poor form	-	-	-
13	Retain	6.0	2.5	Type 1
14	Retain	7.0	2.7	Type 1
15	Retain	4.7	2.3	Type 1
16	Retain	2.0	1.5	Type 1
17	Retain	5.4	2.5	-
18	Remove: Poor form	-	-	-
19	Retain	3.2	2.0	-

Legend

○ Nomination

- **Retain:** trees to be retained and protected during site works.
- **Remove:** trees that require removal for one or more of the following reasons;
 - Over planted:** Trees mature size is too large for the existing area
 - Conflicting location:** Trees location exists within or too close to an existing structure or the proposed development.
 - Weed species:** Tree species deemed undesirable
 - Poor form:** the habit, vigour and/or ailing structural integrity reduces the safe, useful life expectancy. Generally those trees listed with a SULE rating of 3 or 4.

- **Tree Protection Zone (TPZ)** is an area of protection required for maintaining the trees vigour and long term viability. Measured in meters as a radius from the trees centre. The requirements of this zone are outlined within the Protection Specification, Section 8.0, and are to be adhered to, unless otherwise stated.
- **Structural Root Zone (SRZ)** is the area around the tree containing the woody roots necessary for stability. Measured in meters as a radius from the trees centre. The requirements of this zone are outlined within the Protection Specification, Section 8.0, and are to be adhered to, unless otherwise stated.
- **Protection Measure** Protective barriers are required to be installed before the initiation of demolition and/or construction, and are to be maintained up to the time of landscaping. Samples of the recommended protection measures are illustrated within Appendix B.

7.2 Site assessment

The grounds of the hospital are composed of maintained lawns and tree plantings. These trees have been predominately planted (except tree no. 1, and possibly trees no. 5 and 17), and based upon the tree age and size conform to two periods where plantings have occurred. The larger trees have been estimated to be approximately 40 years old, and the younger trees are estimated to be 20 years old. They are all native species (except for trees no. 3 and 15).

7.3 Tree species significance

All but three trees on site are common urban plantings and have been introduced to the site. These trees are predominately all good condition. A tree management policy exists within Caringbah with Sutherland Shire Council. Therefore, all trees within this assessment would, usually, require an application and permit for work/removal. Only one of the trees included within this report are protected by state/federal legislation, and another two may be pending confirmation of remnant status.

One tree, being no. tree no. 1 is considered to be remnant planting, based upon the species, age, and habit. Another two trees, being trees no. 5 and 17, may also be remnant plantings, however the estimated age, places these two trees as also potentially planted. Confirmation may be established based upon cores being extracted from each tree for the purpose of dating the age, or whether past landscape plans are available. Tree no. 1 and 5 are *Eucalyptus paniculata* (Grey Iron bark) and tree no. 17 is *Eucalyptus eugenioides* (Thin-leaved Stringybark).

Tree no. 1 is a significant and iconic planting within the local vicinity due to the size and age. This species is generally slow growing and allowing for the dimensions, this tree is estimated to be in approximately 60-80 years of age. This tree is a remnant planting, and based upon the species and geographical location, is considered to be part of either the *Sydney Turpentine Ironbark Forest* and/or the *Shale/sandstone transitional forest*. Both forest communities were typical for this area. Both these ecological communities and the vegetation (trees) that form part of them, including this tree are listed as endangered within the Threatened Species Conservation Act (1995) and the Environment Protection and Biodiversity Act (1999). This tree poses high significance and is protected by state legislation. Based upon the protected status, this tree will require retention and protected based upon the allocated Tree Protection Zone and Structural Root Zone (see Table 2, section 7.1).

7.4 Proposed works relative to the site trees

Based upon the drawing supplied³, the proposed design of the site consists of the construction of car parking bays and service road. No practical opportunity exists for the retention of trees that fall within the area of the car park footprint without modification of the design. This has been reflected by the nomination for the removal of trees that fall within this area (see table 2, section 7.1). All trees other than tree no. 1 that fall within the footprint have been nominated for removal.

Trees no. 1; *Eucalyptus paniculata* (Grey Iron bark)

This tree is a significant planting and would warrant retention. Based on the proposed design (section 4.4; Design) no works appear to occur within the area of the TPZ. Tree no. 1 does provide some symptoms that suggest the structural integrity could be compromised and may pose a risk. A specialised assessment⁴ of this tree and specifically addressing any loss of support wood within the stem and root crown by termite activity/decay is recommended. If such an increased risk is associated with the tree where removal is recommended then modification of the car park design for the purpose of accommodating this tree will not be required.

Trees no. 2, 3, 4, 5, 6, 7 and 8

These trees do not conflict with any proposed site works and can be retained. Based on the proposed design (section 4.4; Design) no works appear to occur within the area of the TPZ's. Allowing for the age and condition, these trees are considered viable for retention.

Trees no. 9, 10 and 11

These trees have been nominated for removal due to the conflicting location with the proposed 'electrical kiosk'. The footings for this structure have been proposed to be installed within the initial stage of works, therefore these trees will require removal for this process to proceed.

Trees no. 12 and 18

These trees have been nominated for removal due to the poor form and related risk for failure.

Trees no. 13, 14, 15, 16, 17, and 19

These trees reside close to the service road, however the existing service road falls within the same footprint, therefore so long as this section of road is not proposed to be replaced, these trees will not be impacted upon. If this section of road is proposed to be replaced, then the opportunity for retention will depend upon any modification to the changes to the grades supporting a new road. That is; any impact to the root system that resides beneath the roadway by the engineering design/site works could adversely impact upon these trees.

7.5 Protection measures

The following protection measure is required to be implemented for the tree nominated for retention and is installed before initiation of site works (including demolition/excavation) and retained until the landscaping works are required.

³ See section 4.4; Designer

⁴ Decay detection equipment; eg. *Resistograph*™, *Sonicgraph*, etc.

Type 1: Protective fence

A Type 1 protection measure (protective fence) is required to be installed to protect the TPZ's from all site related work and are recommended to be located in accordance with the requirements of the AS 4970, listed within appendix B. The fence is required to be secured to the ground with pegs to avoid movement during construction. This must be installed prior to the commencement of any demolition, excavation or construction works and shall be maintained throughout the entire construction phase of the development.

8.0 Protection Specification

Limitations of work permitted within the area of the Tree Protection Zone (TPZ).

1. Foundation/footing types should not be strip type, but utilise footing types that are sympathetic towards retaining the root system. That is screw, pier, etc. Slab on the ground can be accommodated in some circumstances and will be nominated by the project arborist. The extent of encroachment will be dependent upon the tree species, soil type (texture and profile) and gradients.
2. Sub-surface utilities can extend through the TPZ and Structural Root Zone (SRZ), however are limited to the method of installation. That is under boring is permitted, however exit and entry points must be outside the TPZ. Trenching is limited and depends on the proposed route within the TPZ. No trenching is permitted within the area of the TPZ unless stipulated by the project arborist.
3. Crown pruning can be accommodated, however must conform to the AS 4373; *Pruning of amenity trees*, and not misshape the crown nor remove in excess of 10-15% of the existing crown, pending on the species, and vigour. The opportunity for, type and proportion of pruning will be required to be nominated by the project arborist.
4. Soil levels within the TPZ must remain the same. Any excavation within the TPZ must have been previously specified and allowed for by the project arborist:
 - a) So it does to not alter the drainage to the tree.
 - b) Under specified circumstances,:
 - Added fill soil does not exceed 100mm in depth over the natural grade. Construction methodologies exist that can allow grade increases in excess of 100mm, via the use of an impervious cover, an approved permeable material or permanent aeration system or other approved methods.
 - Excavation cannot exceed a depth of more than 50mm within the area of the TPZ, not including the SRZ. The grade within the SRZ cannot be reduced without the consent from a project arborist.

5. No form of material or structure, solid or liquid, is to be stored or disposed of within the TPZ.
6. No lighting of fires is permitted within the TPZ.
7. All drainage runoff, sediment, concrete, mortar slurry, paints, washings, toilet effluent, petroleum products, and any other toxic wastes must be prevented from entering the TPZ.
8. No activity that will cause excessive soil compaction is permitted within the TPZ. That is, wheel barrows, machinery, excavators, etc. must refrain from entering the area of the TPZ unless measures have been taken, and with consultation with the project arborist to protect the root zone.
9. No site sheds, amenities, or similar site structures are permitted to be located or extend into the area of the TPZ unless prior consent is provided by the project arborist.
10. No form of construction work or related activity such as the mixing of concrete, cutting, grinding, generator storage, or cleaning of tools is permitted within the TPZ.
11. No part of any tree may be used as an anchorage point, nor should any noticeboard, telephone cable, rope, guy, framework, etc. be attached to any part of a tree.
12. Unless conditioned or recommended by the project arborist, tree(s) will not be fertilised during the excavation/construction process.
13.
 - (a) All excavation work within the TPZ will utilise methods to preserve root systems intact and undamaged. Examples of methods permitted are by hand tools, hydraulic, or pneumatic air excavation technology.
 - (b) Any root unearthed which is less than 50mm in diameter must be cleanly cut and dusted with a fungicide, and not allowed to dry out, with minimum exposure to the air as possible.
 - (c) Any root unearthed which is greater than 50mm in diameter must be located in regard to their directional spread and potential impact. A project arborist will be required to assess the situation and determine future action in regard to retaining the tree in a healthy state.
14. Any excavation, that has been conditioned to occur within the area of the TPZ, should be avoided during hot, dry weather, that is temperatures in excess of 30°C.

Project arborist: person nominated as responsible for the provision of the tree assessment, arborist report, consultation with stakeholders, and certification for the development project. This person will be

adequately experienced and qualified with a minimum of a level 5 (AQF); Diploma in Horticulture (Arboriculture)⁵.

9.0 Recommendations

9.1 Trees no. 9, 10, 11, 12 and 18 (5 trees in total)

These trees are nominated for removal based upon the conflicting location with the proposed design and poor form.

9.2 Trees no. 2-8, 13-17 and 19 (14 trees in total)

These trees do not conflict with the proposed works and have been nominated for retention.

9.2.1 Trees no. 13, 14, 15, 16, 17, and 19

These trees reside close to the service road, however the existing service road falls within the same footprint, therefore so long as this section of road is not proposed to be replaced, these trees will not be impacted upon. If this section of road is proposed to be replaced, then the opportunity for retention will depend upon any modification to the changes to the grades supporting a new road. That is; any impact to the root system that resides beneath the roadway by the engineering design/site works could adversely impact upon these trees.

9.3 Tree no. 1; This tree poses high significance and is protected by state legislation. Based upon the protected status, this tree will require retention and protected based upon the allocated Tree Protection Zone: 10.5m radius.

This tree provides symptoms that suggest the structural integrity could be compromised and may pose a risk for failure. A specialised assessment⁶ of this tree and specifically addressing any loss of support wood within the lower stem and root crown by termite activity/decay is recommended. If such an increased risk is associated with the tree where removal is recommended then modification of the car park, design for the purpose of accommodating this tree will not be required.

9.4 Protection measures

The following protection measure is required to be implemented for the tree nominated for retention and is installed before initiation of site works (including demolition/excavation) and retained until the landscaping works are required.

Type 1: Protective fence

A Type 1 protection measure (protective fence) is required to be installed to protect the TPZ's from all site related work and are recommended to be located in accordance with the requirements of the AS 4970, listed within appendix B. The fence is required to be secured to the ground with pegs to avoid movement during construction. This must be installed prior to the

⁵ Based upon the definition of a 'consulting arborist' from the AS 4970; Protection of trees on development sites; 2009, section 1.4.4, p 6.

⁶ Decay detection equipment; eg. *Resistograph*™, Sonicgraph, etc.

commencement of any demolition, excavation or construction works and shall be maintained throughout the entire construction phase of the development.

The opinions expressed in this report by the author have been provided within the capacity of a Consulting Arborist. Any further explanation or details can be provided by contacting the author.

DATED: 4th April 2015



Warwick Varley
Consulting Arborist
MIACA; Reg. #18
MISA
MIAH; Reg. # 32



10.0 Appendix A- Terminology Defined

DBH

Diameter at Breast Height – being the stem diameter in meters, measured at 1.4m from ground level, including the thickness of the bark.

Crown Spread

A two dimension linear measurement (in metres) of the crown plan. The first figure being the north-south span, the second being the east-west measurement.

Age

Is the estimate of the specimen's age based upon the expected life span of the species. This is divided into three stages.

Young (Y)	Trees less than 20% of life expectancy.
Mature (M)	Trees aged between 20% to 80% life expectancy.
Over-mature (O)	Trees aged over 80% of life expectancy with probably symptoms of senescence.

Crown Aspect

In relation to the root crown, this refers to the aspect the majority of the crown resides in. This will be either termed Symmetrical (SYM) where the centre of the crown resides over the root crown, or the cardinal direction the centre of the crown resides in, being either North (N), South (S), East (E) or West (W).

Crown Ratio; Live Crown Ratio

This is a ratio specific to conifers (and few genus of Angiosperms), and offers the proportion of existing crown relative to the overall height. This figure acts as an indicator for stability, vigour and the potential for retention. Trees with a Live Crown Ratio less than 30% typically are “weak, lack vigour and have low diameter growth”⁷

Height

Is a measure of the vertical distance from the average ground level around the root crown to the top surface of the crown, and on palms - to the apical growth point.

Origin

Refers to the natural occurrence of the tree species as referenced in Forest Trees of Australia⁸

This may be summarised by one of the three terms:

<u>Remnant</u> :	natural occurrence within area, and part of the natural planting
<u>Endemic</u> :	natural occurrence to the area the species is located (and possibly other areas).
<u>Native</u> :	does not naturally occur within the area the species is located but is found elsewhere in Australia.
<u>Exotic</u> :	naturally occurs in another country but not in Australia.

Limb Diameter

Is measured adjacent to the branch collar, which is the cross-section offering the largest diameter of the limb.

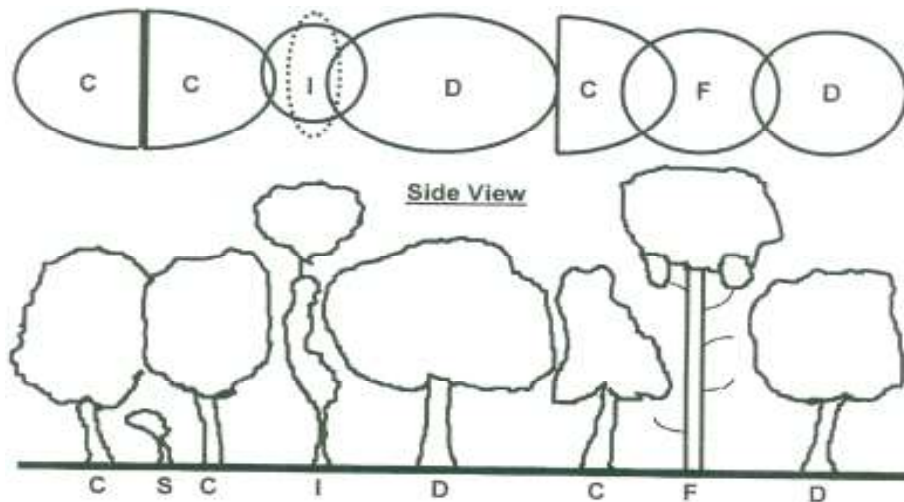
⁷ Dunster J. and Dunster K.
Dictionary of Natural Resource Management
UBC Press, University of British Columbia. Vancouver, B.C, Canada, 1996

⁸ Boland D. J. Brooker M. I. H. Chippendale G. M. Hall N. Hyland B. P. M. Johnson R. D. Kleinig D. A. Turner J. D.
Forest Trees of Australia
CSIRO Pub. Victoria 2002

Crown Class

Is the differing crown habits as influenced by the external variables within the surrounding environment? They are:

- D** – *Dominant* Crown is receiving uninterrupted light from above and sides, also known as emergent.
- C** – *Codominant* Crown is receiving light from above and one side of the crown.
- I** – *Intermediate* Crown is receiving light from above but not the sides of the crown.
- S** – *Suppressed* Crown has been shadowed by the surrounding elements and receives no light from above or sides.
- F** – *Forest* Characterised by an erect, straight stem (usually excurrent) with little stem taper and virtually no branching over the majority of the stem except for the top of the tree which has a small concentrated branch structure making up the crown.

Top View

D, C, I & S and side view, after (Matheny, N. & Clark, J. R. 1998, Trees Development, Published by International Society of Arboriculture, P.O. Box 3129, Champaign IL 61826-3129 USA, p.20, adapted from the Hazard Tree Assessment Program, Recreation and Park Department, City of San Francisco, California).

Safe Useful Life Expectancy – S.U.L.E (Barell 1995)

	1. Long	2. Medium	3. Short	4. Removal	5. Moved or Replaced
	Trees that appeared to be retainable at the time of assessment for more than 40 years with an acceptable level of risk.	Trees that appeared to be retainable at the time of assessment for 15 – 40 years with an acceptable level of risk.	Trees that appeared to be retainable at the time of assessment for 5 – 15 years with an acceptable level of risk.	Trees that should be removed within the next 5 years.	Trees which can be reliably moved or replaced.
A	Structurally sound trees located in positions that can accommodate future growth.	Trees that may only live between 15 and 40 years.	Trees that may only live between 5 and 15 more years.	Dead, dying, suppressed or declining trees through disease or inhospitable conditions.	Small trees less than 5m in height.
B	Trees that could be made suitable for retention in the long term by remedial tree care.	Trees that may live for more than 40 years but would be removed for safety or nuisance reasons.	Trees that may live for more than 15 years but would be removed for safety or nuisance reasons.	Dangerous trees through instability on recent loss of adjacent trees.	Young trees less than 15 years old but over 5m in heights
C	Trees of special significance for historical, commemorative or rarity reasons that would warrant extraordinary efforts to secure their long term retention.	Trees that may live for more than 40 years but would be removed to prevent interference with more suitable individuals or to provide space for new planting.	Trees that may live for more than 15 years but should be removed to prevent interference with more suitable individuals or to provide space for new planting.	Damaged trees through structural defects including cavities, decay, included bark, wounds or poor form.	Trees that have been pruned to artificially control growth.
D		Trees that could be made suitable for retention in the medium term by remedial tree care.	Trees that require substantial remedial tree care and are only suitable for retention in the short term.	Damaged trees that are clearly not safe to retain.	
E				Trees that may live for more than 5 years but should be removed to prevent interference with more suitable individuals or to provide space for new plantings.	
F				Trees that are damaging or may cause damage to existing structures within 5 years.	
G				Trees that will become dangerous after removal of other trees for reasons given in (A) to (F).	

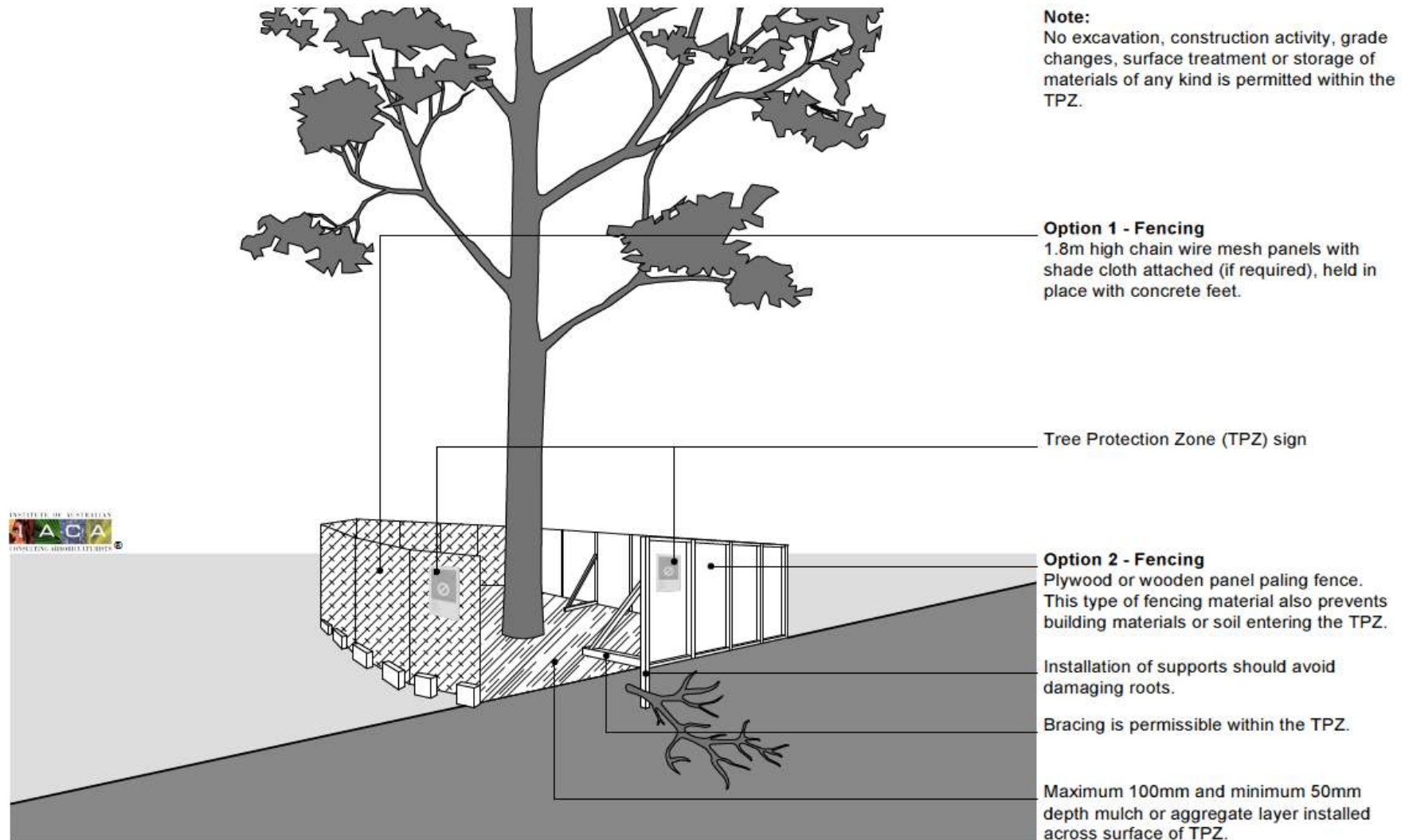
Matrix – Sustainable Retention Index Value (S.R.I.V.) ©
Developed by IACA – Institute of Australian Consulting Arboriculturists

Index values as indicated where (10) ten is the highest value.

Age Class	Vigour Class and Condition Class					
	Normal Vigour & Good Condition (NVG)	Normal Vigour & Fair Condition (NVF)	Normal Vigour & Poor Condition (LVP)	Low Vigour & Good Condition (LVG)	Low Vigour & Fair Condition (LVF)	Low Vigour & Poor Condition (LVP)
	Able to be retained if sufficient space available above and below ground for future growth. No remedial work or improvement to growing environment required. May be subject to abnormal vigour. Retention potential – Medium–Long Term	Able to be retained if sufficient space available above and below ground for future growth. Potential work may be required or improvement to growing environment may assist. Retention potential – Medium Term. Potential for longer with remediation or favourable environmental conditions.	Able to be retained if sufficient space available above and below ground for future growth. Potential work unlikely to assist condition, improvement to growing environment may assist. Retention potential – Short Term. Potential for longer with remediation or favourable environmental conditions.	May be able to be retained if sufficient space available above and below ground for future growth. No remedial work required but improvement to growing environment may assist vigour. Retention potential – Short Term. Potential for longer with remediation or favourable environmental conditions.	May be able to be retained if sufficient space available above and below ground for future growth. Remedial work or improvement to growing environment may assist condition and vigour. Retention potential – Short Term. Potential for longer with remediation or favourable environmental conditions.	Unlikely to be able to be retained if sufficient space suitable above and below ground for future growth. Remedial work or improvement to growing environment unlikely to assist condition of vigour. Remediation potential – Likely to be removed or retained for immediate – Short Term. Potential for longer with remediation or favourable environmental conditions.
Young (Y)	Index Value 9 Retention potential – Long Term. Likely to provide minimal contribution to local amenity if height <6m. High potential for future growth and adaptability. Retain, move or replace.	Index Value 8 Retention potential – Short-Medium Term. Potential for longer with improved growing conditions. Likely to provide minimal contributions in local amenity if height <5m. High-moderate potential for future growth and adaptability. Retain, move or replace.	Index Value 5 Retention potential – Short Term. Potential for longer with improved growing conditions. Likely to provide minim contribution to local amenity if height <5m. Moderate-low potential for future growth and adaptability. Retain, move or replace.	Index Value 4 Retention potential – Short Term. Potential for longer with improved growing conditions. Likely to provide minimal contribution to local amenity if height <5m. Moderate potential for future growth and adaptability. Retain, move or replace.	Index Value 3 Retention potential – Short Term. Potential for longer with improved growing conditions. Likely to provide minimal contribution to local amenity if height <5m. Moderate-low potential for future growth and adaptability. Retain, move or replace.	Index Value 1 Retention potential – Likely to be removed or retained for immediate – Short Term. Likely to provide minimal contribution to local amenity if height <5m. Low potential for future growth and adaptability.
Mature (M)	Index Value 10 Retention potential – Medium-Long Term.	Index Value 9 Retention potential – Medium Term. Potential for longer with improved growing conditions.	Index Value 6 Retention potential – Short Term. Potential for longer with improved growing conditions.	Index Value 5 Retention potential – Short Term. Potential for longer with improved growing conditions.	Index Value 4 Retention potential – Short Term. Potential for longer with improved growing conditions.	Index Value 2 Retention potential – Likely to be removed or retained for immediate – Short Term.
Over-mature (O)	Index Value 8 Retention potential – Medium-Long Term.	Index Value 5 Retention potential – Medium Term.	Index Value 4 Retention potential – Short Term.	Index Value 3 Retention potential – Short Term. Potential for longer with improved growing conditions.	Index Value 2 Retention potential – Short Term.	Index Value 0 Retention potential – Likely to be removed or retained for immediate – Short Term.

Appendix B- Protection measures

Type 1; Protective fence



Tree protection zone sign; requirements

