ALLIED TREE
CONSULTANCY
Level 5 and 8 Arboriculturist

Arboricultural Impact Assessment Report

For the site address
No. 10-14 Munmurra Road and
No. 5 Bernadotte Street,
RIVERWOOD, NSW

Prepared for
NSW Land and Housing Corporation
Department of Planning and Environment

AUTHOR
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1.0 Introduction

1.1 *Allied Tree Consultancy* (ATC) has been commissioned by *NSW Land and Housing Corporation* to prepare an Arboricultural Impact Assessment for the development proposal at No. 10-14 Munmurra Road, and No. 5 Bernadotte Street, Riverwood. This proposal includes the construction of a residential dwelling development. This report includes fifteen trees located on, and adjacent to the lot, and discusses the viability of these trees based on the proposed works.

1.2 This report will address for these trees, the:

- species' identification, location, dimensions, and condition;
- SULE (Safe Useful Life Expectancy) and STARS (Significance of a Tree Assessment Rating System) rating;
- discussion and impact of the proposed works on each tree;
- tree protection zones and protection specifications for trees recommended for retention.

1.3 The subject site resides within Riverwood; for this reason, Georges River Council is the consenting authority for any tree works recommended in this report.

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 that 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 in 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.
- Guide to Managing Risks of Tree Trimming and Removal Work[1].

[1] Safe Work Australia; July 2016; Guide to Managing Risks of Tree Trimming and Removal Work, Australia

- All tree works must be carried out at a tertiary level (minimum Certificate-level 3) qualified and experienced (minimum five years) arboriculturist.
- For any works in the vicinity of electrical lines, the arboriculturist must possess the ISSC26 endorsement (Interim guide for operating cranes and plant in proximity to overhead powerlines).

2.5 As a minimum requirement, all trees recommended for retention in this report must have removed all deadwood, hangers and branch stubs to be pruned to the branch collar. This work must comply with the local government tree policy (Georges River Council) and Section 2.4.

2.6 Any tree stock subject to conditions for works carried out in this report must be supplied by a registered Nursery that adheres to the AS 2303; 2015[2].

- All tree stock must be of at least 'Advanced' size (minimum 75lt) unless otherwise requested.
- All tree stock requested must be planted with adequate protection. This may include tree guards (protect stem and crown) and if planted in a lawn area, a suitable barrier (planter ring) of an area, at least, $1m^2$ to prevent grass from growing within the area adjacent to the stem.

3.0 Disclosure Statement

Trees are living organisms and, for this reason, 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 on the guidelines issued by the International Society of Arboriculture.

4.2 The format of the report is summarised below;

4.2.1 **Plan 1;** Tree Location Relative to Site: This is an unscaled plan reproduced from the Survey Plan as referenced in Section 4.4.1, depicting the area of assessment.

4.2.2 **Table 1;** This table compiles the tree species, dimensions**,** brief assessment (history, structure, pest, disease or any other variables

[2] Australian Standard; 2015, AS2303, Tree stock for landscape use, Australia

subject to the tree), significance, allocation of the zones of protection (i.e., Tree Protection Zone[3] ;TPZ and Structural Root Zone; SRZ) for each tree illustrated in Plan 1, Section 5.0. All measurements are in metres.

4.2.3 Discussion relating to the site assessment and proposed works regarding the trees.

4.2.4 Protection Specification; Section 8.0 details the requirements for that area designated as the Tree Protection Zone (TPZ), for those trees recommended for retention.

4.3 The opinions expressed in this report, and the material, upon which they are based, were obtained from the following process and data supplied:

4.3.1 Site assessment on the 8th September 2022 using the method of the Visual Tree Assessment[4]. This has included a Level 2 risk assessment, being a *Basic Assessment*[5]. The assessment has been conducted by Warwick Varley[6] on behalf of *Allied Tree Consultancy*.

4.3.2 Trees included in this report are those that conform to the description of a prescribed tree by the local government policy.

4.3.3 All measurements, unless specified otherwise are taken from the tree centre.

4.3.4 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.

4.4 Documentation provided

The following documentation has been provided to Allied Tree Consultancy and utilised within the report.

4.4.1 Surveyor

Drawn by *Norton Survey Partners*
Date: undated
Reference: 55023
Drawing No: Sheet 1-10

[3] Australian Standard, 4970; 2009 – Protection of Trees on Development Sites, Australia
[4] Mattheck, C. Breloer, H.,1994, The Body Language of Trees – A handbook for failure analysis The Stationary Office, London
[5] Dunster J.A., 2013, Tree Risk Assessment Manual, International Society of Arboriculture, 2013, USA
[6] Consulting Arborist, Graduate Certificate and Diploma of Arboriculture (level 8 and 5)

Note 1: See Section 4.5.1

4.4.2 Design

Drawn by *Custance P/L*
Date: 17 May 2024
Reference: 3418
Drawing No: DA-000 - DA-005 Rev. 6, DA-006 Rev. 8, DA-006.A Rev. 4.

4.4.3 Engineering (Stormwater)

Drawn by *JN Engineering P/L*
Date: 13 June 2024
Reference: N0221293
Drawing No: CSK01-CSK04, Rev. G

4.5 Limitations of the assessment/discussion process

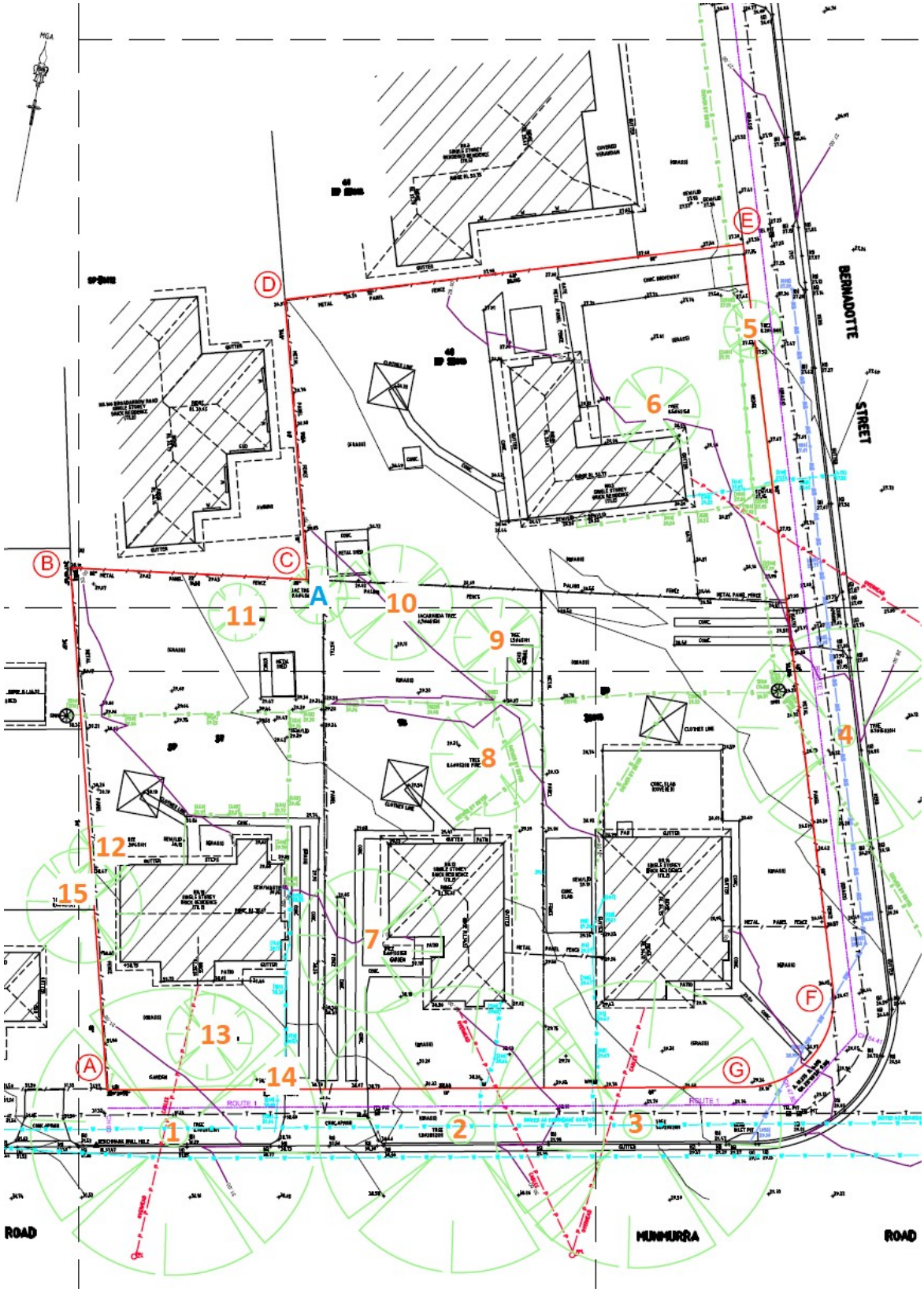
4.5.1 Tree No. 14 has been omitted from the plans provided, however, is required for inclusion because it conforms to the definition of a prescribed tree within the local government tree policy. The tree location has been plotted onto the Plan 1 by *Allied Tree Consultancy*. The tree location was established by measuring from known points and scaling onto the drawing. *Allied Tree Consultancy* is not a registered surveyor and, however, the accuracy of the survey is attempted; the true position of this tree may marginally deviate. Any such deviation provides the potential for changing the actual impact (encroachment) provided to a tree.

4.5.2 The assessment has considered only those target zones that are apparent to the author and the visually apparent tree conditions, during the time of assessment.

4.5.3 Any tree regardless of apparent defects would fail if the forces applied to exceed the strength of the tree or its parts, for example, extreme storm conditions.

4.5.4 The assessment has been limited to that part of the tree which is visible, existing from the ground level to the crown. Root decay can exist and in some circumstances provide no symptoms of the presence. This assessment responds to all the symptoms provided by a tree, however, cannot provide a conclusive recommendation regarding any tree that may have extensive root decay that leads to windthrow without the appropriate symptoms.

5.0 Plan 1; Area of assessment illustrating tree location



Not to scale
Trees labelled A are exempt species, see Section 7.0.
Source: Adapted from *Norton Survey Partners P/L,* see Section 4.4.1

6.0 Table 1 – Tree Species Data

Terminology/references provided in Appendix A.

Tree No.	Botanical Name Common Name	Height (m)	DBH (m)	Crown Spread (m)	Age	Crown Class	Crown Aspect	Vitality Rating	SULE Rating	STARS Rating	TPZ	SRZ
1	*Eucalyptus microcorys* Tallowwood	16	0.70[B]	14 x 14	M	D	Sym	A	**2D**	**High**	**8.40**	**2.85**
Assessment This street tree planting forms part of an avenue planting. The tree provides the habit typical for the urban grown species, although substantial deadwood exists. The habit is composed of five leaders that initiate from a 3m high stem.											**Development Impact** See Section 7.1.1	
2	*Eucalyptus microcorys* Tallowwood	15	0.91	18 x 16	M	D	Sym	A	**1A**	**High**	**10.92**	**3.18**
Assessment This street tree planting forms part of an avenue planting. The tree provides the habit typical for the urban grown species.											**Development Impact** See Section 7.1.4	
3	*Eucalyptus microcorys* Tallowwood	17	0.80	17 x 12	M	C	E	A	**1A**	**High**	**9.60**	**3.01**
Assessment This street tree planting forms part of an avenue planting. The tree provides the habit typical for the urban grown species.											**Development Impact** See Section 7.1.4	
4	*Eucalyptus sideroxylon* Mugga Ironbark	16	0.63	16 x 16	M	D	Sym	-	**4A**	**Low**	**7.56**	**2.73**
Assessment This street tree planting had provided the habit typical for the urban grown species. A follow-up assessment on the 25th February 2023, disclosed this tree has been recently poisoned and is now dead. The tree would typically be referred for removal based on risk. However, commentary from Kieran O'Neill (Georges River Council) has referred for this tree to be retained as a habitat asset[7].											**Development Impact** See Section 7.1.2 7.1.4	

[7] Based on Email correspondence, received 18th June 2024.

Tree No.	Botanical Name Common Name	Height (m)	DBH (m)	Crown Spread (m)	Age	Crown Class	Crown Aspect	Vitality Rating	SULE Rating	STARS Rating	TPZ	SRZ
5	*Archontophoenix cunninghamiana* Bangalow Palm	3/4	0.15 0.12	3 x 3	M	D	Sym	A	**1A**	**Medium**	**2.31**	**1.66**
Assessment This is composed of two trees growing flush with one another. Each provides typical form.											**Development Impact** See Section 7.1.5	
6	*Stenocarpus sinuatus* Firewheel Tree	9	0.60[C]	6 x 6	M	D	Sym.	-	**4A**	**Low**	**7.20**	**2.67**
Assessment This tree provides the habit typical for the species. Composed of three leaders that share an included bark crotch, with a low propensity for failure. Some climbers have obscured the assessment. Although native, this tree is not indigenous to the area. The habit, based on the species provides an exceptional specimen. A follow-up assessment on the 25th February 2023, disclosed this tree has been recently poisoned and is now dead.											**Development Impact** See Section 7.1.2	
7	*Jacaranda mimosifolia* Jacaranda	9	0.42	11 x 7	M	D	Sym.	A	**1A**	**High**	**5.04**	**2.30**
Assessment This tree provides the habit typical for the species, although the portion of the dripline that extends west into No. 10 has been pruned.											**Development Impact** See Section 7.1.3	
8	*Araucaria heterophylla* Norfolk Island Pine	8	0.50	11 x 11	M	D	Sym.	A	**2A**	**Medium**	**6.00**	**2.47**
Assessment This tree has been lopped at four meters and formed three new leaders. Remedial pruning can sustain a long useful life expectancy.											**Development Impact** See Section 7.1.3	
9	*Eriobotrya japonica* Loquat	5	0.21	6 x 5	M	D	Sym.	A	**2A**	**Medium**	**2.52**	**1.72**
Assessment This tree provides the habit typical for the species.											**Development Impact** See Section 7.1.3	

Tree No.	Botanical Name Common Name	Height (m)	DBH (m)	Crown Spread (m)	Age	Crown Class	Crown Aspect	Vitality Rating	SULE Rating	STARS Rating	TPZ	SRZ
10	*Jacaranda mimosifolia* Jacaranda	7	0.49 0.40	14 x 11	M	D	Sym.	A[D]	**2A**	**Medium**	**7.59**	**2.73**
Assessment This tree provides the habit typical for the species. Composed of two leaders that share a common root crown, the supporting crotch is included however offers a low risk for failure. The southern leader has been lopped.											**Development Impact** See Section 7.1.3	
11	*Eriobotrya japonica* Loquat	4	0.10 0.10	3 x 3	M	D	Sym.	A	**2A**	**Low**	**1.70**	**1.46**
Assessment This tree provides the habit typical for the species.											**Development Impact** See Section 7.1.3	
12	*Lagerstroemia indica* Crape Myrtle	4	0.20[B]	3 x 3	M	D	Sym.	-[D]	**2A**	**Low**	**2.40**	**1.68**
Assessment This tree provides the habit typical for the species, although the habit has formed multiple leaders.											**Development Impact** See Section 7.1.1	
13	*Podocarpus elatus* Plum Pine	12	0.52	6 x 6	M	D	Sym.	A	**1A**	**High**	**6.24**	**2.51**
Assessment This tree provides the habit typical for the species. This tree is native/indigenous to the area. The habit, based on the species provides an exceptional specimen.											**Development Impact** See Section 7.1.4	
14	*Thuja plicata* Western Red Cedar	4	0.06 0.06	2 x 2	Y	S	Sym.	A	**3A**	**Low**	**1.02**	**1.17**
Assessment Located on the end of an informal screen planting flush with the front boundary, this tree provides the habit typical for the species.											**Development Impact** See Section 7.1.2	

Tree No.	Botanical Name Common Name	Height (m)	DBH (m)	Crown Spread (m)	Age	Crown Class	Crown Aspect	Vitality Rating	SULE Rating	STARS Rating	TPZ	SRZ
15	*Ligustrum lucidum* Broad-leaf Privet	7	0.35[C]	5 x 5	M	D	Sym.	A	**2B**	**Low**	**4.20**	**2.13**
Assessment Located in the adjacent lot, this weed species provides the habit typical for the species. This tree has only been included based on the ownership.											**Development Impact** See Section 7.1.1	

A. Incomplete identification of species due to insufficiently available plant material
B. Diameter taken below 1.4m due to low stem bifurcation
C. Estimate due to the overgrown area and/or limited access
D. Deciduous species, void of foliage at the time of assessment
E. Level 3 assessment required to determine the accurate rating

7.0 Site Assessment

The area of assessment comprises four adjacent rectangular-shaped lots located on the corner of Munmurra Road and Bernadotte Street, Riverwood. These lots are bounded by private residential dwellings to the north and west.

All lots contain single-story brick dwellings located centrally on the rectangular lots, which contain a minor gradient with a northern aspect. The crossovers are concrete, however, driveways are concrete strips, typical of the design era.

The northern side of Munmurra Road provides a consistent avenue planting of Tallowwoods. These provide high amenity value. Bernadotte Street contains minimal street tree planting. Neither roadway contains any footpaths on the verge, although it contains a kerb and gutter.

Neighbouring trees, have been included based on either crown or root ingress into the lots of assessment. Other neighbouring trees exist however do not provide any such ingress. Tree No. 15 is a weed species and pending approval from the tree owner, can be removed without council consent.

The trees labeled as A that have been included in the survey drawing (Plan 1) are exempt species.
Tree A: trees located on the survey that are exempt species, being less than 3m high.

7.1 Proposed development

The proposed development consists of the demolition of existing site structures and construction of a residential unit development and basement parking, drive access, and drainage infrastructure.

This application has been subject to a Preliminary Arboricultural Assessment Report for the purpose of identifying trees that are considered as significant for the intent of retaining and designing around.

Neighbours trees: Trees No. 1, 2, 3, 4 and 15 are located in the adjacent lot, therefore constitute ownership by a second party. Any proposed works within the zones of protection for these trees must not adversely impact these zones, and the trees shall be retained and protected from any site works unless permission for removal is granted by the tree owner and Georges River Council.

The calculations included in the following discussion has not considered;

- subsurface utilities that have not been included in the design,

- Work methods related to subsurface utilities, for example concrete encasing or replacement of existing lines
- or work methods related to construction (stockpiling, site sheds, scaffolding) unless otherwise specified.
- Public infrastructure including new kerb/guttering, subsurface utilities on Munmurra and Bernadotte Street.

These may also increase the encroachment and tree impact and therefore the opportunity for tree retention.

This report discusses the impact of the proposed design on the trees. Fifteen (15) trees have been listed within this report based upon the vicinity of the proposed works. This has included any tree where any part of the zones of protection; Tree Protection Zone (TPZ) and Structural Root Zone (SRZ), encroach into the area proposed for work. Recommendations based on the tree significance and condition, together with the impact on these trees regarding the proposed development (based on the documents contained in Section 4.4) and mitigation where available follow.

7.1.1 Trees and zones of protection (TPZ/SRZ) outside of the proposed design

Trees No. 1, 12 and 15

None of the proposed works conflict with the location of these trees or respective zones of protection. These trees can be retained without impact by the proposed design.

7.1.2 Trees providing a limited useful life expectancy

Trees No. 4, 6 and 14

These trees provide low significance based on the species, habit and rating and could be removed due to the low amenity value and limited useful life expectancy, and irrespective of the proposed works.

Tree No. 4: This tree is dead (changed condition since the initial assessment), and has been referred for retention by Georges River Council, see Table 1, Section 5.0.

7.1.3 Trees directly conflicting with the design

Trees No. 7, 8, 9, 10 and 11

These trees are located in the footprint of the proposed design and would require removal based on this premise alone. The conflict is summarised as follows;

Tree No. 7; within the footprint of Unit 7

Tree No. 8; within the footprint of Unit 8

Tree No. 9, 10, 11; within the footprint of the common drive/car park

7.1.4 Trees subject to a minor encroachment

Trees No. 2, 3, 4 and 13

These trees are not directly located in the footprint of the proposed design, however, are subject to a *minor encroachment*. That is, the proportion (<10%) of encroachment provided by design will not adversely impact on the tree. These trees could be retained relative to the design.

Trees No. 2, 3 and 4: A public footpath has been introduced into the design as a mandatory requirement. Based on the limitations associated with the design of this structure, the footpath has been pushed against the boundary line with the lots proposed for development to limit the impact on these trees. Although within the SRZ's for trees 2 and 3, the inherent oblique root system[8] of this species limits the impact on the trees. However, surface roots are inevitable and can offer conflict with the footpath via root uplift and respective trip hazards. For this reason, the following conditions are recommended.

1. The grade of the footpath should be elevated as much as allowable to reduce any disturbance/conflict with roots. Excavation shall be limited to no deeper than 100mm of the existing grade, unless evidence via root mapping can support a deeper foundation.
2. Any root greater than 50mm in diameter should be retained. If potential root severance is required, the project arborist must be contacted to assess the root first to determine its viability.
3. Any excavation work required within the SRZ must be conducted with hand tools, not machines.
4. The surface of the footpath that extends along the length of Munmurra Road must utilise a flexible/porous type surface, for example *FiltaPave*[9]. The surface proposed to be used must be acceptable to the project arborist.

7.1.5 Trees subject to a major encroachment

Tree No. 5

This tree is not directly located in the footprint of the proposed design, however, located close and adjacent to the design footprint and subject to a *major encroachment*, that is, in excess of 10% of the TPZ. The extent and type of encroachment for each tree are discussed and the relative implications.

Encroachment: 30%; based on drawing DA-003, the encroachment consists of the drive/crossover servicing Unit 8. Although the encroachment appears excessive, this consists of up to 200mm depth for the drive. This

[8] Jacobs. M. R., 1955, Growth Habits of the Eucalypts, Forestry and Timber Bureau, Australia
[9] www.filtapave.com.au

species is referenced to cater to a deep root system[10], and the monocot-type root architecture will allow for a significant proportion of root system to be sustained and limit the tree impact. This tree can be retained.

7.2 Compensatory Planting

Compensatory planting is recommended to be included within the landscape plan. At least five (5) trees including one street tree are recommended to be included within the landscape plan for this lot. The tree species chosen must produce a mature height of at least 10m. The stock must be of at least 'Advanced' size (minimum 150 lt) and supplied by a registered Nursery that adheres to the Australian Standard 2303[11]. Trees must be planted with adequate protection. This may include tree guards (protect stem and crown) and if planted in a lawn area, a suitable barrier (planter ring) of an area at least $1m^2$ to prevent grass from growing within the area adjacent to the stem.

7.3 Sub-surface utilities

No drawings have been provided for the proposed route of sub-surface utilities, other than stormwater. Any trenching, other than what has been allowed for should be avoided within the area of the TPZ's for any tree nominated for retention. Any proposed route shall be re-routed outside of the TPZ. Under boring may be required if a limitation for the route of a service is restricted to an area that falls within the TPZ from any tree. Any excavation in the area of a TPZ must be authorised and conditioned by the project arborist.

7.4 Protection measures

The following protection measures are required to be implemented for the following trees before initiation of site works (including demolition/excavation) and retained until the landscaping works are required unless otherwise specified. The location of the protection measures are illustrated in Plan 2, Appendix B, and examples of the protection measures are contained in Appendix C.

7.4.1 Protective fence: Trees No. 1, 2, 3, 5, 12, 13 and 15

A protective fence is required to be installed to protect the TPZ from all site-related work and are recommended to be located in accordance with the requirements of the AS 4970, listed in Appendix C. 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, and until landscaping works and installation of the drive/cross-overs is required.

[10] Jones D., Palms in Australia, 2nd Edit., Reed Pub., Australia
[11] Standards Australia, AS 2303: 2018, Tree stock for landscape use, Australia

7.4.2 Conditions for compliance

The following conditions are required before any works proceed on site.

Site induction; All workers related to the construction process and before entering the site must be briefed about the requirements/conditions outlined in this report relative to the zone of protection, measures, and specifications before the initiation of work. This is required as part of the site induction process.

Project Arborist; A project arborist who conforms to the requirements of the AS 4970 is required to be nominated immediately after a *Notice of Determination* is issued, and they are to be provided with all related site documents.

7.5 Compliance Documentation

The following stages will require assessment and documentation (report, letter, certification) by the project arborist or person responsible for the specific work type, and the related documentation is to be issued to the principal certifying agent.

7.5.1 Table 2; Assessment/Certification stages

Hold Points	Work type	Document required
Pre- Construction	Installation of the protection measures, Section 7.3	Certificate[1]
During construction	Pruning, Project arborist required on-site before pruning proceeds.	Certificate[2]
Post Construction	Final assessment, trees have been retained in the same condition as pre-construction.	Certificate[2]
During construction	Any further works required within the area of the TPZ, or decline related to the trees that have not been covered by this report.	Report Brief
During construction	Any crown modification including pruning or root disturbance.	Report Brief

1. Requirement for the issue of Construction Certificate

2. Requirement for the issue of Occupation Certificate

Construction refers to the time between the initiation of demolition and until an occupation certificate is issued.

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)[12].

8.0 Protection Specification

The retention and protection of these trees requires the remaining Tree Protection Zone (TPZ) not subject to encroachment to conform to the conditions outlined below. These conditions provide the limitations of work permitted within the area of the Tree Protection Zone (TPZ) and must be adhered to unless otherwise stated.

Any engineering drawings issued as part of the construction certificate must conform with these requirements.

1. Subsurface 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 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.

2. 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 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.

3. No form of material or structure, solid or liquid, is to be stored or disposed of within the TPZ.

4. No lighting of fires is permitted within the TPZ.

[12] 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.

5. 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.

6. No activity that will cause excessive soil compaction is permitted within the TPZ. That is, machinery, excavators, etc. must refrain from entering the area of the TPZ unless measures have been taken, in consultation with the project arborist.

7. No site sheds, amenities or similar site structures are permitted to be located or extend into the area of the TPZ unless the project arborist provides prior consent.

8. 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.

9. 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.

10. (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 regarding their directional spread and potential impact. A project arborist will be required to assess the situation and determine future action regarding retaining the tree in a healthy state.

9.0 Summary of tree impact by design

Based on the design supplied, the following summary provides the impacts imposed on the trees included in this report.

9.1 Trees No. 1-3, 5, 12, 13 and 15

These trees are not adversely impacted by the design, that is, they conform to an acceptable encroachment based on the nominated zones of protection (TPZ, SRZ) and the requirements of the Protection Specification, Section 8.0. The proposed design does not adversely affect these trees. These trees can be retained.

Trees No. 1 and 2: The construction of the public footpath requires the following conditions.

1. The grade of the footpath should be elevated as much as possible to reduce any disturbance/conflict with roots. Excavation shall be limited to no deeper than 100mm of the existing grade, unless evidence via root mapping can support a deeper foundation.
2. Any root greater than 50mm in diameter should be retained. If potential root severance is required, the project arborist must be contacted to assess the root first to determine its viability.
3. Any excavation work required within the SRZ must be conducted with hand tools, not machines.
4. The surface of the footpath that extends along the length of Munmurra Road must utilise a flexible/porous type surface, for example *FiltaPave*[13]. The surface proposed to be used must be acceptable to the project arborist.

9.2 Trees No. 4, 6-11 and 14

The proposed design will conflict with the location of these trees and they are unable to be retained based on the design. These trees will require removal.

9.3 Sub-surface utilities

No drawings have been provided for the proposed route of sub-surface utilities, other than stormwater. Any trenching, other than what has been allowed for should be avoided within the area of the TPZ's for any tree nominated for retention. Any proposed route shall be re-routed outside of the TPZ. Under boring may be required if a limitation for the route of a service is restricted to an area that falls within the TPZ from any tree. Any excavation in the area of a TPZ must be authorised and conditioned by the project arborist.

[13] www.filtapave.com.au

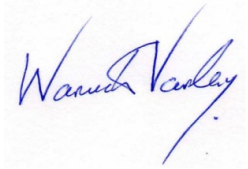
9.4 Protection measures

Protection measures (outlined in Section 7.3 and 7.4) are required to be implemented for the trees nominated for retention (referenced in Section 9.1) and installed before initiation of site works (including demolition/excavation) and retained until the landscaping works are required unless otherwise specified.

All workers related to the construction process and before entering the site must be briefed about the requirements/conditions outlined in this report relative to the zone of protection, measures, and specifications before the initiation of work.

A project arborist is required to be nominated, and the stages and related certification or similar documentation is to be issued to the principal certifying agent.

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.



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10.0 Appendix A- Terminology Defined

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.

DBH
Diameter at Breast Height – being the stem diameter in meters, measured at 1.4m from ground level, including the thickness of the bark.; Mult. refers to multiple stems, that is in excess of 4 stems.

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

Age
Is the estimate of the specimen's age based upon the expected lifespan 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 probable symptoms of senescence.

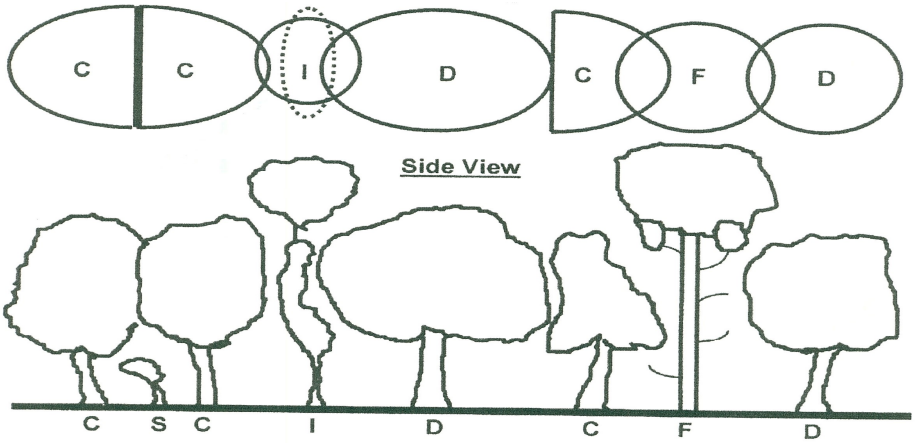
Crown Aspect
In relation to the root crown, this refers to the aspect the majority of the crown resides in. This will be either termed Symmetrical (Sym.) where the centre of the crown resides over the root crown or the cardinal direction the centre of the crown is biased towards, being either North (N),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

Vitality Rating
Is a rating of the health of the tree, irrespective and independent of the structural integrity, and defined by the 'ability for a tree to sustain its life processes' ((Draper, Richards, 2009). This is divided between three variables, and based on the assessment of symptoms including, but not limited to; leaf size, colour, crown density, woundwood development, adaptive growth formation, and epicormic growth.
A: Normal vitality, typical for the species
B: Below average vitality, possibly temporary loss of health, partial symptoms.
C: Poor vitality; obvious decline, potentially irreversible

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).

Levels of assessment

Level 1: Limited visual: a visual tree assessment to manage large populations of trees within a limited period and in order to identify obvious faults which would be considered imminent.

Level 2: Basic assessment: a standard performed assessment providing for a detailed visual assessment including all parts of the tree and surrounding environment and via the use of simple tools.

Level 3: Advanced assessment: specific type assessments conducted by either arborist who specialise with specific areas of assessment or via the use of specialised equipment. For example, aerial assessment by use of an EWP or rope/harness, or decay detection equipment.

TPZ; Tree Protection Zone

Is an area of protection required for maintaining the trees vitality 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.

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

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 by some circumstances; however will require compensation equivalent to the area loss, elsewhere and adjacent to the TPZ.

SRZ; Structural Root Zone

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 Measures

These are required for the protection of trees during demolition/construction activities.
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 in Appendix C.

All other definitions are referenced from;

Draper D.B., Richards P.A., 2009, Dictionary for Managing Trees in Urban Environments
CSIRO Pub., Australia

Significance Rating, Significance of a Tree Assessment Rating System (S.T.A.R.S), IACA, 2010[14]

Tree Significance – Assessment Criteria

1. High Significance in landscape

- The tree is in good condition and good vitality;
- The tree has a form typical for the species;
- The tree is a remnant or is a planted locally indigenous specimen and/or is rare or uncommon in the local area or of botanical interest or of substantial age;
- The tree is listed as a Heritage Item, Threatened Species or part of an Endangered ecological community or listed on Councils significant Tree Register;
- The tree is visually prominent and visible from a considerable distance when viewed from most directions within the landscape due to its size and scale and makes a positive contribution to the local amenity;
- The tree supports social and cultural sentiments or spiritual associations, reflected by the broader population or community group or has commemorative values;
- The tree's growth is unrestricted by above and below ground influences, supporting its ability to reach dimensions typical for the taxa in situ – tree is appropriate to the site conditions.

2. Medium Significance in landscape

- The tree is in fair-good condition and good or low vitality;
- The tree has form typical or atypical of the species;
- The tree is a planted locally indigenous or a common species with its taxa commonly planted in the local area
- The tree is visible from surrounding properties, although not visually prominent as partially obstructed by other vegetation or buildings when viewed from the street,
- The tree provides a fair contribution to the visual character and amenity of the local area,
- The tree's growth is moderately restricted by above or below ground influences, reducing its ability to reach dimensions typical for the taxa in situ.

3. Low Significance in landscape

- The tree is in fair-poor condition and good or low vitality;
- The tree has form atypical of the species;
- The tree is not visible or is partly visible from surrounding properties as obstructed by other vegetation or buildings,
- The tree provides a minor contribution or has a negative impact on the visual character and amenity of the local area,
- The tree is a young specimen which may or may not have reached dimension to be protected by local Tree Preservation orders or similar protection mechanisms and can easily be replaced with a suitable specimen,
- The tree's growth is severely restricted by above or below ground influences,

[14] IACA, 2010, IACA Significance of a Tree, Assessment Rating System (STARS), Institute of Australian Consulting Arboriculturists, Australia, www.iaca.org.au

unlikely to reach dimensions typical for the taxa in situ – tree is inappropriate to the site conditions,
- The tree is listed as exempt under the provisions of the local Council Tree Preservation Order or similar protection mechanisms,
- The tree has a wound or defect that has potential to become structurally unsound.
Environmental Pest / Noxious Weed Species
- The tree is an Environmental Pest Species due to its invasiveness or poisonous/ allergenic properties,
- The tree is a declared noxious weed by legislation.
Hazardous/Irreversible Decline
- The tree is structurally unsound and/or unstable and is considered potentially dangerous, - The tree is dead, or is in irreversible decline, or has the potential to fail or collapse in full or part in the immediate to short-term.

The tree is to have a minimum of three (3) criteria in a category to be classified in that group.

Note: The assessment criteria are for individual trees only, however, can be applied to a monocultural stand in its entirety e.g.

Table 3; Tree Retention Value – Priority Matrix.

		Significance				
		1. High	**2.** Medium	**3.** Low		
		Significance in Landscape	Significance in Landscape	Significance in Landscape	Environmental Pest / Noxious Weed Species	Hazardous / Irreversible Decline
Estimated Life Expectancy	1. Long **>40 years**					
	2. Medium **15-40 Years**					
	3. Short **<1-15 Years**					
	Dead					

Legend for Matrix Assessment

	Priority for Retention (High) - These trees are considered important for retention and should be retained and protected. Design modification or re-location of building/s should be considered to accommodate the setbacks as prescribed by the Australian Standard AS4970 *Protection of trees on development sites*. Tree sensitive construction measures must be implemented e.g. pier and beam etc if works are to proceed within the Tree Protection Zone.
	Consider for Retention (Medium) - These trees may be retained and protected. These are considered less critical; however their retention should remain priority with removal considered only if adversely affecting the proposed building/works and all other alternatives have been considered and exhausted.
	Consider for Removal (Low) - These trees are not considered important for retention, nor require special works or design modification to be implemented for their retention.
	Priority for Removal - These trees are considered hazardous, or in irreversible decline, or weeds and should be removed irrespective of development.

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

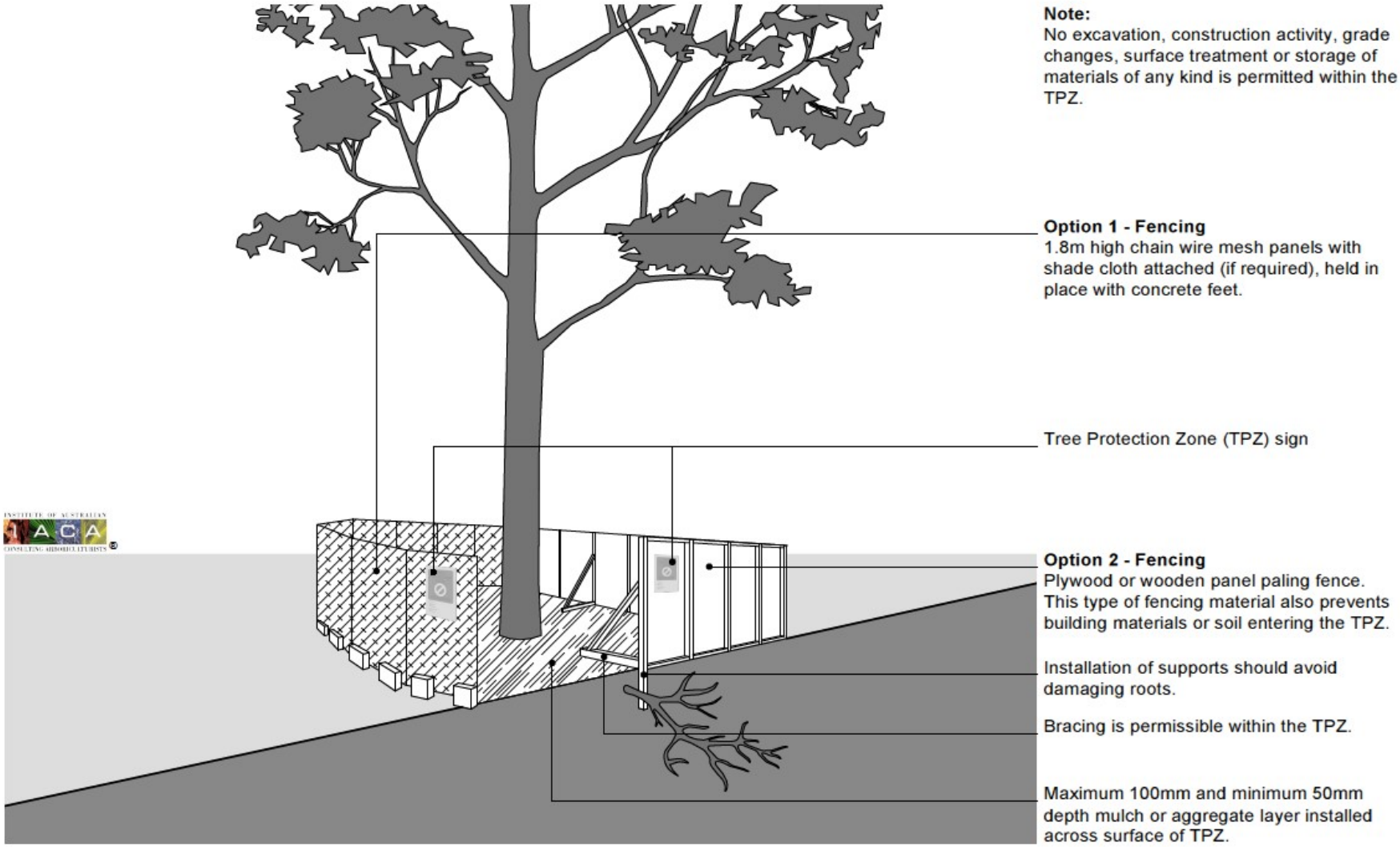
	1. Long	2. Medium	3. Short	4. Removal	5. Moved or Replaced
	Trees that appeared to be retainable at the time of assessment for more than 40 years with an acceptable level of risk.	Trees that appeared to be retainable at the time of assessment for 15 – 40 years with an acceptable level of risk.	Trees 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).	

Appendix B- Plan 2; Zones and measures of protection

Not to scale

Source: Adapted from *JN Engineering*, See Section 4.4.2

Appendix C- Protection measures;
Protective fence



Stem and Ground protection