TREE WISE MEN®
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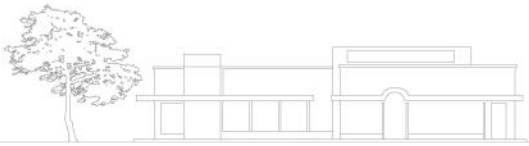
Arboricultural Impact Assessment
For
Garage and Driveway Access
At
'Kumale'
949 Barrenjoey Road
PALM BEACH

Prepared for:

Pamela Marshall
C/o Wood Marsh Pty Ltd Architecture
30 Beaconsfield Parade
PORT MELBOURNE VIC 3207

Ref: 2303AIAGarage

December 2015



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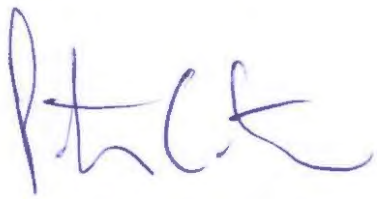

Peter Castor
Director

BSc (For.)
Member: IACA, AA, ISA, LGTRA, PIA, UDIA, MAE (UK)
21 December 2015

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1. BACKGROUND

1.1 INTRODUCTION

1.1.1 This Arboricultural Impact Assessment (AIA) was prepared at the request of Wood Marsh Pty Ltd Architecture for owner Pamela Marshall in relation to a Garage and Driveway access at 'Kumale' 949 Barrenjoey Road, Palm Beach (the subject site).

1.1.2 The purpose of this AIA is to describe and categorise the existing trees on and adjacent to the subject site and to assess the impact of the proposed Garage development on these trees.

1.1.3 This AIA will assist in the preparation of the Statement of Environmental Effects forming part of the Development Application (DA) to Pittwater Council.

1.1.4 This DA is separate from existing approved *DA No. N0050/09* dated 22 June, 2009.

1.1.5 Australian Standard *AS4970-2009 Protection of trees on development sites* has been used as a benchmark in the preparation of this report.

1.2 THE SUBJECT SITE

1.2.1 At the time of our inspection the subject site consisted of a partially renovated, multi-storey residence known as 'Kumale' located on steeply sloping ground with surrounding paths, retaining walls and garden areas. The existing features of the site are detailed on *Detail and Levels Survey, Ref 5608F, dated 20.12.13* prepared by Adam Clerke Surveyors.

1.2.2 The subject site has a south-westerly aspect characterised by a change in a grade from a high point of approximately 18.40 metres in the northeastern corner, to a low point of MHWM at the southern boundary.

1.2.3 The pre-development Soil Landscape[1] for the site is indicated as Colluvial Soil Landscape Watagan (*wn*) characterised by rugged, rolling to very steep hills on fine grained Narrabeen Group sediments. Many of the trees on the site are typical of those found naturally on this soil landscape.

[1] **Chapman, G.A. and Murphy, C.L.** (1989). *Soil Landscapes of the Sydney 1:100000 Sheet. Soil Conservation Service of NSW, Sydney.*

Locality Plan (source Google Earth, image date 1.1.2014)

1.3 THE SUBJECT TREES

1.3.1 The general findings and data collected for each of the five (5) subject trees are contained in Tree Schedule (Attachment A). The trees are numbered and located on the Tree Protection Plan (Attachment E).

1.3.2 The subject trees are planted and naturally occurring Australian natives with Tree 5 (Spotted Gum, *Corymbia maculata*) located on the adjoining property to the west being the most significant of the assessed trees given its prominence in the streetscape.

1.3.3 Trees assessed were those indicated on the supplied Detail Survey Plan. Additional unsurveyed trees protected under the Pittwater 1 DCP[2] were plotted (approximate location only) on the Tree Protection Plan.

1.3.4 Those trees within 5 metres of the proposed development that met the criteria of Pittwater Council's Tree Preservation Order are assessed of this report. Tree 5 was located on the neighbouring private property (#951 Barrenjoey Road). Trees 3 and 4 were groups of small trees located on the road reserve.

1.3.5 The native understorey and ground cover vegetation were highly disturbed or absent due to the existing development and land use. Formal plantings and terraces replaced former natural vegetation on the site.

[2] Pittwater 21 DCP, Control B4.22 Preservation of Trees and Bushland Vegetation includes any tree with a height equal to or exceeding three (3) metres in height (excluding Table 1: Exempt Species).

1.4 THE PROPOSAL

1.4.1 The proposed Garage development is as detailed in *Architectural Drawings Job No. 306 dated 10.10.15* prepared by Wood Marsh Pty Ltd Architecture.

1.4.2 The recommendations and comments in this Report assume the following:

- A high quality, shady, outdoor environment is desired.
- The amenity of the adjoining neighbours needs to be considered.
- Existing landscape character should be retained where possible through the retention of existing significant trees.

2. METHODOLOGY

2.1 DATA COLLECTION

2.1.1 In preparation of this Report a ground level, visual tree assessment (VTA)[3] was undertaken on 25 November, 2015. No aerial (climbing) inspections, woody tissue testing or tree root mapping were undertaken as part of this assessment.

2.1.2 Attachment B provides definition of terms used in this Report. Tree heights were estimated. Trunk diameter at breast height (DBH) was measured at 1.4 metres above ground level (unless otherwise stated) and rounded to the nearest 0.1 metre. Structural Root Zones (SRZ) and Tree Protection Zones (TPZ) were rounded to the nearest 0.5 metre.

2.1.3 All tree offsets mentioned in this Report are to centre of trunk unless otherwise stated.

2.2 IDENTIFICATION OF SUBJECT TREES

2.2.1 The five assessed trees are those indicated on the Tree Protection Plan (TPP) and Tree Schedule. Tree 3 and the western-most of tree group Tree 4 were not indicated on the Detail Survey and have been plotted in approximate locations on the Tree Protection Plan.

2.3 AUSTRALIAN STANDARD AS4970-2009

2.3.1 The Australian Standard *AS4970–2009 Protection of trees on development sites* has been used as a benchmark in the preparation of this report and the terminology and impact assessment methodology have been adopted from this document. This AIA complies with *2.3.5 Arboricultural Impact Assessment* of *AS4970-2009.*

2.3.2 Recommendations have been based on tree ©Retention Value, Vigour, Condition, ULE and construction offsets (refer to Attachment B). Trees with ©Retention Value "A" should be given greater priority for retention than trees with ©Retention Value "B" or "C". Trees with *Long* (40 years +) ULE should be given greater priority for retention than trees with *Short* (5-15 years) ULE (refer to Attachment B).

2.3.3 Tree Protection Zones (TPZ) and Structural Root Zones (SRZ) are as per *Section 3* of *AS4970-2009* and are defined at Attachment B of this report.

2.3.4 "Construction" for the purpose of this AIA means excavation (greater than 100mm), compacted fill or machine trenching[4]. "Excavation" includes cut batters, boxing–out for the various pavement types, trenching for utilities and footings for retaining walls.

2.3.5 Trees within proposed construction footprints are recommended for removal (**Rm**).

2.3.6 Where construction is proposed within Structural Root Zone (SRZ) offsets, those trees have been similarly recommended for removal (**Rm**). Fully elevated, pier and beam type construction or hand dug services trenches (or horizontal boring) is however possible within a SRZ.

[3] VTA – Visual Tree Assessment, undertaken by tree professionals, is a recognised (International Society of Arboriculture, Journal of Arboriculture, Vol. 22 No. 6, Nov. 1996) systematic method of identifying tree characteristics and hazard potential. VTA is also an assessment method described by Claus Mattheck in *The Body Language of Trees – A handbook for failure analysis*. The Stationery Office, London (1994)

[4] "Construction" is equivalent to "works" as defined at 1.4.9 of AS4970-2009.

2.3.7 Trees with greater than 25% of the Tree Protection Zone (TPZ) impacted by construction are recommended for removal (**Rm**). There are however different types of construction incursions proposed (e.g. fill, cut, services, pavement type, retaining walls) with varying tree impacts likely. Existing constraints to root development also vary the TPZ. Compacted fill can be equally as damaging to tree longevity: root development is restricted within heavily compacted soils.

2.3.8 Trees to be retained with construction impacting less than 25% of the TPZ area were rated as Retain Plus (**R+**). Specific construction monitoring will be required for the Retain (**R+**) trees (refer to Recommendations).

2.3.9 TPZ encroachments of >10% are defined (3.3.3 of *AS4970*) as '*major*'. This does not mean that the tree will be fatally injured, but that '*the project arborist must demonstrate that the tree(s) would remain viable'.* Refer to Section 4.2 of this Report for explanation of tree retention recommendations.

2.3.10 Where construction is proposed beyond the TPZ, those trees are rated as Retain (**R**) with no specific tree protection design or tree protection monitoring required (refer to Attachment D).

3. TREE IMPACTS

3.1 SUMMARY

3.1.1 Tree 1 Swamp Sheoak, *Casuarina glauca* is located within the Garage footprint and will need to be removed.

3.1.2 Tree 2, Eucalypt, *Eucalyptus sp.* and Tree 3, Lilly Pilly, *Syzygium sp.* (group of three trees) are located within the proposed Driveway/crossover and will need to be removed. Tree 2 at the time of the site inspection had partially uprooted (Photo A) and will need to be removed in any event.

3.1.3 The western-most of the three trees comprising Tree 4 is located within 1 metre of the proposed Driveway and will need to be removed.

3.1.4 The eastern-most two trees comprising Tree 4 can be retained along with Tree 5 located on the adjoining property.

3.1.5 Refer to Section 4 Recommendation for tree protection recommendations during construction.

3.2 LANDSCAPE PLANS

3.2.1 Landscape Plans have not been reviewed during the preparation of this report. Tree protection measures should be incorporated into the landscape design and the proposed planting schedule should reinforce the use of indigenous plants.

3.3 STORMWATER PLANS

3.3.1 Stormwater Plans have not been reviewed during the preparation of this report. Tree protection measures should be incorporated into the stormwater layout.

4. RECOMMENDATIONS FOR TREE MANAGEMENT

4.1 ARBORIST INVOLVEMENT

4.1.1 An Arborist (the Project Arborist) experienced in tree protection on construction sites should be engaged prior to the commencement of construction work on the site. The Project Arborist shall monitor and report regularly to the Principal Certifying Authority (PCA) and the Applicant on the condition and protection of the retained trees during the construction works. The Project Arborist is to monitor any excavation, machine trenching or compacted fill placed within the TPZ of all retained trees.

4.1.2 The schedule of works for the development must acknowledge the role of the Project Arborist and the need to protect the retained trees. Sufficient notice must be given to the Arborist where his/her attendance is required. Should the proposed design change from that reviewed, additional arboricultural assessment will be required.

4.1.3 The Project Arborist should certify tree protection measures at key stages of the construction. Copies of the Certification should be sent to PCA.

4.2 TREE RETENTION

4.2.1 Tree 5 and the eastern-most two trees comprising Tree 4 are to be retained.

4.3 TREE RETENTION RECOMMENDATIONS

4.3.1 Tree Protection Fencing

Tree protection fencing as indicated on the Tree Protection Plan at Attachment E (Sheet 1 of 2) and Figure 3 (Sheet 2 of 2) should be erected prior to commencement of works. The following activities are prohibited within the fenced area:

- soil excavation or fill
- storage or stockpiling of soil or building material
- parking or movement of heavy machinery
- depositing of potentially phytotoxic materials such as concrete tailings, paints etc.

4.3.2 Tree Protection Plan

The Tree Protection Plan (Attachment E) should be kept in the site office during the construction period to guide tree protection procedures. The recommendations contained in the TPP should be incorporated into the Construction Management Plan and Sediment Control Plan.

4.4 TREE REMOVAL

4.4.1 Formal approval from Pittwater Council should be obtained for the removal of Trees 2 and 3 and part Tree 4 which are located within the road reserve.

4.4.2 All tree removal works must comply with the Draft WorkCover Code of Practice for The Amenity Tree Industry 1998. The removal of Tree 1 should be undertaken by professional Arborists with minimum AQF Level 3 arboriculture qualifications.

Attachment A: Tree Schedule

AIA Tree Schedule -

Kumale (Garage) 949 Barrenjoey Road, Palm Beach

TREE No.	COMMON NAME/ GENUS SPECIES	DBH (m)	HEIGHT (m)	CANOPY RADIUS (m)	AGE CLASS	VIGOUR	CONDITION	SRZ RADIUS (m)	TPZ RADIUS (m)	ULE	©SIG RATING	©RETENTION INDEX	RECOMMENDATION	COMMENTS
1	Swamp Sheoak, *Casuarina glauca*	0.3	12	4	SM	G	G	2.1	3.6	M	3	B	Rm	*Remove.*
2	Eucalypt, *Eucalyptus* sp.	0.1	6	1	IM	G	P	1.5	2.0	S	4	D	Rm	*Verge tree. Leaning and partially uprooted. Remove.*
3	Lilly Pilly, *Syzygium* sp.	0.1 @g	4	1	IM	G	G	1.5	2.0	M	4	C	Rm	*Verge tree. Not plotted on Survey. Three trees in group. Remove.*
4	Blueberry Ash, *Elaeocarpus reticulatus*	0.1	4	1	SM	F	F	1.5	2.0	S	4	D	R+	*Verge tree. Three trees in group. Remove western-most stem only.*
5	Spotted Gum, *Corymbia maculata*	0.5	15	8	M	G	G	2.6	6.0	L	2	A	R+	*Located at #951 Barrenjoey Road. Minor TPZ encroachment.*
5														

AIA Tree Schedule -
Kumale (Garage) 949 Barrenjoey Road, Palm Beach

Summary Data

©RETENTION INDEX	NO. OF TREES
A	1
B	1
C	1
D	2
Total	5

RECOMMENDATION	NO. OF TREES
R	0
R+	2
T	0
Rm	3
Total	5

©RETENTION INDEX	RECOMMENDATION			
	R	R+	T	Rm
A	0	1	0	0
B	0	0	0	1
C	0	0	0	1
D	0	1	0	1

Attachment B: Definition of Terms

COMMON NAME/GENUS SPECIES CULTIVAR – Common names can vary with selected texts. Where species is unknown, "*sp*." indicated after genus. Where cultivar is unknown "*cv*" indicated after species.

DBH – Diameter at Breast Height. Tree trunk diameter measured at breast height (1.4 metres above ground level). Fabric diameter tape is used which assumes a circular cross section. Multiple measurements indicate multiple trunks. Where DBH measurement cannot be taken at 1.4m the height at which it has been taken is indicated.

CANOPY SPREAD RADIUS – Average canopy radius (widest + narrowest ÷ 2). Circular canopy depictions on Tree Plan/Survey are indicative only. Where canopy spread was significantly skewed, all four cardinal point measurements were recorded.

AGE CLASS – Immature (IM), Semi-mature (SM), Mature (M), Over-mature (OM). Assessment of the tree's current Age. A **Mature (M)** tree has reached a near stable size (biomass) above and below ground. Trees can have a *Mature* age class for >90% of life span. **Over-mature (OM)** trees show symptoms of irreversible decline and decreasing biomass.

VIGOUR – Good (G), Fair (F) or Poor (P). The general appearance of the canopy/foliage of the tree at the time of inspection. Vigour can vary with the season and rainfall frequency. A tree can have *Good* vigour but be hazardous due to *Poor* condition. A tree in *Good* vigour has the ability to sustain its life processes. Vigour is synonymous with health.

CONDITION – Good (G), Fair (F) or Poor (P). The general form and structure of the trunk/s and branching. Trunk lean, trunk/branch structural defects, canopy skewness or other hazard features are considered.

SRZ RADIUS – Structural Root Zone. The area around a tree required for tree stability. Earthworks should be prohibited within the SRZ. The area is calculated from the formula and graph at Figure 1 of *AS4970-2009.* The SRZ graph has been adapted from the work of Claus Mattheck (1994). DBH + 10% has been used for the calculation of SRZ. Where DBH is measured at grade or at a height other than 1.4m above grade, 10% has not been added.

TPZ RADIUS – Tree Protection Zone. Radial offset (m) of twelve times (12x) trunk DBH measured from centre of trunk (for trees less than 0.3 metre DBH minimum TPZ is 2.0 metres). To satisfactorily retain the tree, construction activity (both soil cut and fill) must be restricted within this offset. TPZ offsets are rounded to the nearest 0.1 metre. Existing constraints to root spread can vary. Generally an area equivalent to the TPZ should be available to the tree post development. Encroachment occupying up to 10% of the TPZ area is acceptable without detailed rootzone assessment. Encroachments greater than 10% require specific arboricultural assessment.

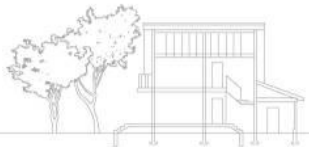
ULE – Useful Life Expectancy. The length of time from the date of inspection that the Arborist estimates the tree will live and provide a useful positive contribution to the landscape amenity of the site. ULE ratings are **Long** (retainable for 40 years or more), **Medium** (retainable for 16-39 years), **Short** (retainable for 5-15 years) and **Removal** (tree requiring immediate removal due to imminent risk or absolute unsuitability).

©SIG. RATING – ©Significance Rating Scale (see notes over)

©RETENTION INDEX (see notes over)

RECOMMENDATIONS – ***Retain (R) No TPZ encroachments***; ***Retain Plus (R+) Acceptable levels of TPZ encroachment***; ***Transplant (T)*** or ***Remove (Rm)***.

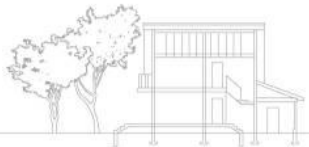
COMMENTS – Comments relating to the location, surroundings and hazard potential of the trees at the time of inspection and where applicable the reason for removal.



©SIG. RATING – ©Significance Rating Scale. A site specific qualitative evaluation of a tree relative to the existing land use developed by Tree Wise Men® Australia Pty Ltd. Takes into consideration the impact of the tree on the surrounding landscape, streetscape and bushland. Rarity, habitat value, historical/cultural value and structural form of the tree are considered in this rating system. It is possible for a tree to have a *Short* ULE and a ©Significance Rating of 1. Likewise it is possible for a tree to be given a *Long* ULE and a ©Significance Rating of 4 (e.g. weed species). The ©Significance Ratings used in this Report are as outlined in Table 1.

Table 1: ©Significance Rating Characteristics

Rating	Significance	Characteristics (some or all)
©Sig. Rating 1	**Exceptional**	▪ Major contribution to site amenity ▪ Remnant specimen ▪ Heritage Listed ▪ Listed on Significant Tree Register ▪ Threatened Species ▪ *Good* vigour and condition ▪ Cultural significance ▪ Possible habitat tree for threatened fauna ▪ Excellent, well formed specimen ▪ Rare or unusual species ▪ Large above ground biomass ▪ Unique within the site and surrounds
©Sig. Rating 2	**High**	▪ Considerable contribution to site amenity ▪ Remnant specimen ▪ *Good* vigour and condition ▪ Threatened Species ▪ Cultural significance ▪ Possible habitat tree for threatened fauna ▪ Well formed specimen ▪ Rare or unusual species ▪ Large or moderate above ground biomass ▪ Other specimens with similar characteristics within the site and surrounds
©Sig. Rating 3	**Moderate**	▪ Minor contribution to site amenity ▪ Remnant or planted ▪ *Fair* or *Poor* vigour and condition ▪ Potential for growth ▪ Well formed or asymmetrical form ▪ Other specimens with similar characteristics within the site and surrounds
©Sig. Rating 4	**Low**	▪ Small/poor specimen ▪ *Poor* vigour and condition ▪ Inappropriate for the location ▪ Minor contribution to landscape amenity ▪ Easily replaced ▪ Weed species or TPO Exempt ▪ Hazardous ▪ Previously ©Sig. Rating 5 tree



©RETENTION INDEX. A site specific assessment of an individual tree's retention value developed by Tree Wise Men® Australia Pty Ltd. Incorporating ULE and ©Significance Rating each tree is allocated a ©Retention Value of A, B, C or D. The ©Retention Index values can be described as follows:

©Retention Value A	**Should be retained**	▪ Major redesign may be required (e.g. movement of building footprint, re-alignment of roadway).
©Retention Value B	**Could be retained**	▪ Minor redesign may be required (e.g. level changes, pavement detail).
©Retention Value C	**Could be removed**	▪ Should not constrain proposed development.
©Retention Value D	**Should be removed (irrespective of development layout**.)	▪ Should not constrain proposed development. ▪ **Remove ULE** should be removed irrespective of development layout.
	Should be removed or permanently fenced off	▪ Should not constrain proposed development ▪ **Short ULE** could be retained pending landscape proposal.

©Retention Index		**©Significance Rating**			
		1	**2**	**3**	**4**
ULE Rating	**Long (40+ years)**	**A**		**B**	**C**
	Medium (15-40 years)				
	Short (5-15 years)	**B**		**C**	**D**
	Remove (< 5 years)	**D**			

Attachment C: Site Photographs

Photo A: Existing trees in the vicinity of the proposed Garage. Trees 1, 2, 3 and 4 (part only) are to be removed (looking southwest).

Photo B: Existing features in the vicinity of the proposed Garage (looking northeast).

Attachment D: Tree Protection Requirements (Generic)

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TREE PROTECTION REQUIREMENTS (GENERIC)

The following generic tree protection requirements (1-12) should be implemented to minimise the impact of the proposed development on the retained trees. These requirements shall be implemented during the construction period in the event that no site-specific requirements are detailed in this document. Tree Protection Requirements should comply with *Section 4 Tree Protection Measures* of *AS4970-2009 Protection of trees on development sites* and the Tree Protection Plan (TPP) attached to this document.

1. Arborist Involvement – An Arborist (the project Arborist) with minimum AQF Level 5 qualifications, experienced in tree protection on construction sites shall be engaged prior to the commencement of work on the site. The Arborist's tasks will be to monitor and report regularly to the PCA and the Applicant on the condition of the retained trees for the duration of works on site. The Project Arborist shall be present to certify tree protection measures and to supervise any excavation, trenching or tunnelling within the TPZ of any retained trees.

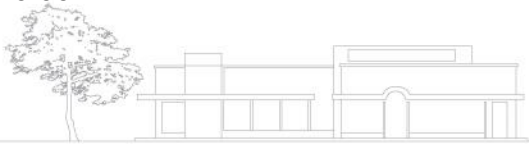
The schedule of works for the development shall acknowledge the role of the Project Arborist and the need to protect the retained trees. Sufficient notice shall be given to the Project Arborist where his/her attendance is required. Should the proposed design change from that reviewed, additional arboricultural assessment will be required.

2. Tree Pruning and Removal – All tree pruning (including root pruning) and tree removal shall be carried out by a qualified and experienced Arborist (minimum AQF Level 3 qualification) to Australian Standard *AS4373-2007 Pruning of amenity trees* and the Work Cover Code of Practice for the Amenity Tree Industry, 1998.

When tree stumps are within the TPZ of retained trees, stump grinding of rootballs shall be performed rather than complete "grubbing". This will minimise unnecessary root damage to the retained trees. Unnecessary damage often occurs to retained trees when undertaken by earthmoving machinery.

3. Mulching – If construction activity is proposed within TPZ offsets mulching is required. Mulch to a depth of 100 millimetres using partially composted green waste mulch. The mulch should be free of weed seeds and other contaminants. Should constant access be required within the trees' TPZs, outside the protective fencing, heavier mulch should be spread to a depth no greater than 100 millimetres to reduce soil compaction.

4. Temporary Irrigation – Where construction related activity or root cutting is proposed within the TPZ of retained trees, temporary irrigation or water cart access may need to be provided to the remaining unimpacted TPZ areas to maintain adequate soil moisture levels. Delivery volumes are to allow for mulch layer and recent rainfall. The Project Arborist is to monitor soil moisture levels.



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5. Tree Protection Fencing – The retained trees shall be protected by means of fencing as per Figure 3 of *AS4970-2009* or as detailed in the TPP prior to commencement of demolition or bulk earthworks.

It should be constructed from 1.8 metre high chain link wire or welded mesh suspended by galvanised steel pipe or equivalent and enclose as much of the TPZ as practicable allowing for building alignments.

The location of the fence may need to be altered from that indicated on the Tree Protection Plan at a project meeting between the Civil Contractor and the Project Arborist. The area enclosed shall be mulched (**3**) and irrigated (**4**) and kept free from all building materials, contaminants and other debris and shall not be used for storage of any building materials or parking of vehicles or plant. If scaffolding (**8**) is required within a tree protection zone, the ground is to be mulched prior to erection of scaffolding.

6. Trunk Protection – Trunk and branch protection is to comply with *Figure 4* of *AS4970-2009* or as detailed in the TPP. Lengths of timber (75mm x 50mm x 2000mm) shall be used to protect a tree's trunk if construction or traffic is proposed within its SRZ and the tree cannot be fenced. The lengths of timber should be fastened around the trunk at 200 millimetre centres with hoop iron strapping or similar.

7. Signs – Signs complying with *Figure C1* of *AS4970-2009* should be placed at regular intervals (min. 1 per 15 metres) on tree protection fencing.

8. Scaffolding – If scaffolding or hoarding is required within the TPZ, install as per *Figure 5* of *AS4970-2009* or as detailed in the TPP. Installation is to be prior to demolition or bulk earthworks.

9. Bulk Earthworks – To prevent unnecessary root damage, walk machinery within defined haul routes beyond TPZs wherever possible. The excavation shall be carried out under the supervision of the Project Arborist. All roots within TPZ of retained trees are to be hand cut prior to machine cutting. Immediately following excavation, the face of the cut within the TPZ shall be draped and maintained moist until backfilled. This should be done using a 10mm thick jute matting or equivalent, pinned at ground level and allowed to cover the full depth of the rootzone excavation.

There is to be no soil battering or unnecessary over excavation within TPZ offsets. Topsoil stripping should be prohibited within TPZ offsets unless approved by the Project Arborist.

10. Prevention of Soil Compaction – During the construction period there may be considerable traffic movement associated with general building activities. The resultant soil compaction and possible contamination of the soil can have an equally detrimental impact on the tree as the severing of roots during excavation.

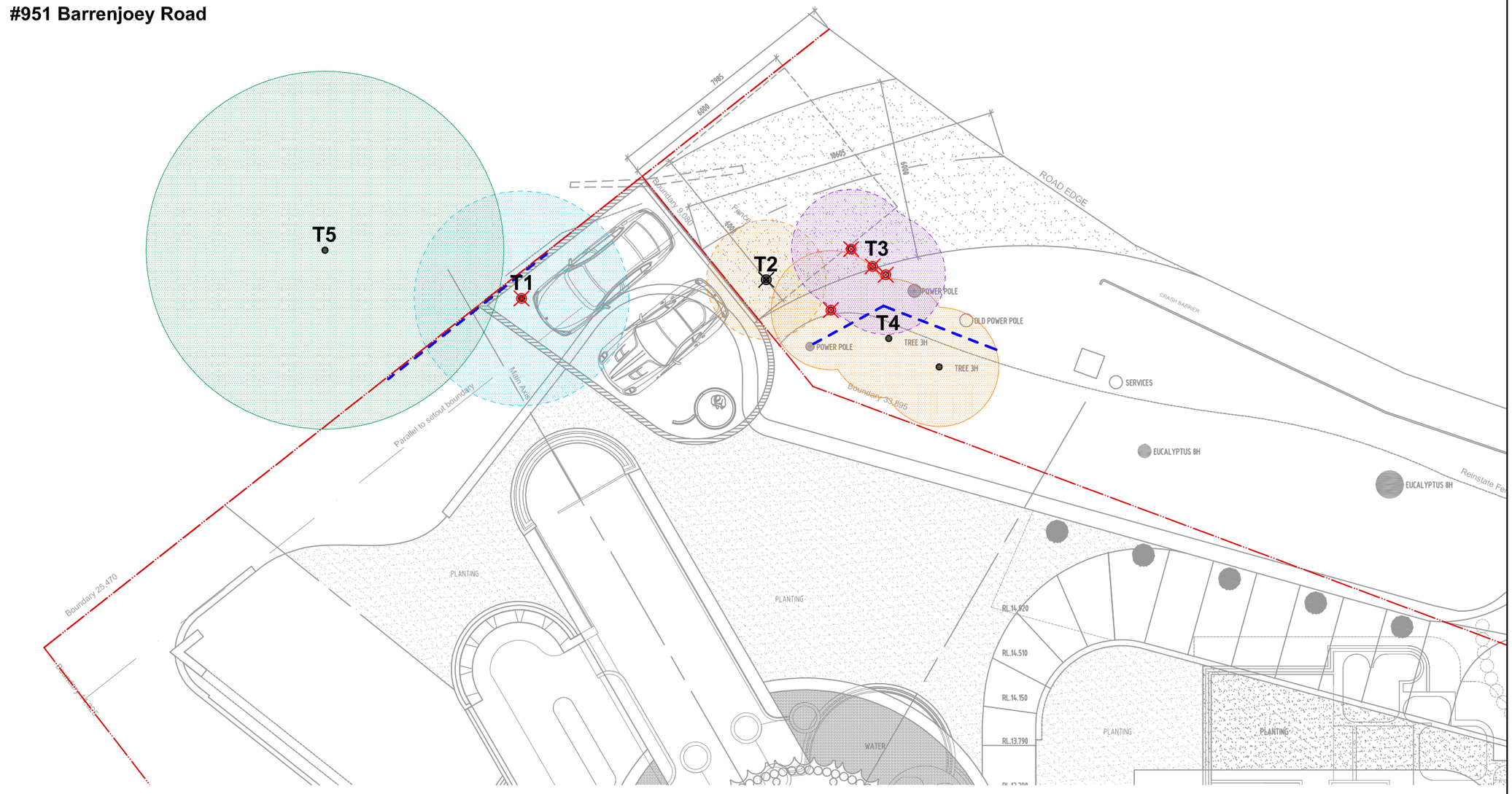
Specific machinery access tracks should be determined through consultation between the Civil Contractor and the project Arborist. Should heavy vehicle movement be required within a retained tree's TPZ, a track should be formed at grade using large diameter (up to 100mm) aggregate over geofabric or a corduroy of heavy timbers.

11. Prevention of Soil Inversion – Care shall be taken to avoid inversion of the soil layers on the site and particularly within TPZs. Clays placed over coarse textured soils reduces water infiltration, creating a perched water table, resulting in decline and/or death of underlying tree roots due to moisture stress.

12. Services – Trenching for services is to be regarded as "construction". Trenching within TPZ offsets should be avoided wherever possible to ensure <20% root loss (of TPZ) occurs on retained trees. Directional ("trenchless") boring or suspension of services should be used wherever possible. Where trenching is to occur within TPZ offsets, it is to be undertaken by hand to rock with no roots >50mm to be cut, under supervision of the Project Arborist.

Attachment E: Tree Protection Plan

#951 Barrenjoey Road



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LEGEND

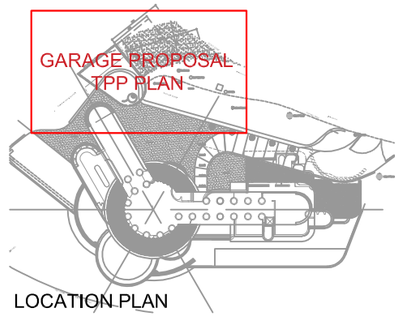
Site boundary:	
Tree number with trunk as plotted on Site Survey:	T5
Tree number with trunk not plotted on Site Survey (approximate location shown):	T3
Protective fencing:	

©Retention Index:

- ©Retention Value A TPZ:
- ©Retention Value B TPZ:
- ©Retention Value C TPZ:
- ©Retention Value D TPZ:

Dead, dying or dangerous trees or noxious weeds to be removed irrespective of proposed development:

Trees requiring removal to facilitate development:

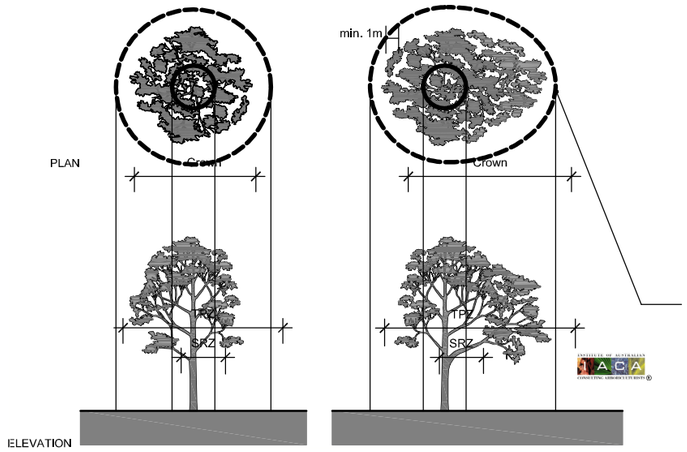


LOCATION PLAN

TITLE:	**©TREE PROTECTION PLAN**
CLIENT:	Pamela Marshall
PROJECT:	Kumale (Garage) 949 Barrenjoey Road, Palm Beach
DRAWING NO:	2303TPP SHT 1 OF 2
DRAWN BY:	MH
BASED ON:	Lvl 7 -Revised Garage Plan by Wood/Marsh Pty Ltd Architecture, DWG No A000, Job No 306, Dated 10.10.2015
DATE:	27/11/2015
REV:	REV DATE:
SCALE:	1:150@A3

0 1 2 3 4 5

N



TPZ = Tree Protection Zone
Referred to as radius in metres and calculated using the formula:

$$TPZ = 12 \times DBH^{0.42}$$

where:
DBH = Diameter at Breast Height (measured 1.4 m above ground level)

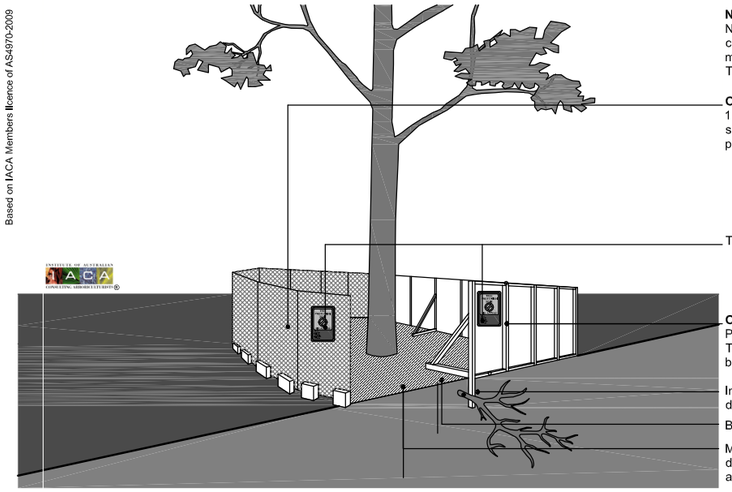
SRZ = Structural Root Zone
Referred to as radius in metres and calculated using the formula:

$$R_{SRZ} = (D \times 50) \times 0.64$$

where:
R_{SRZ} = Radius of Structural Root Zone
D = Stem Diameter (measured directly above root buttress in metres)

TPZ adjusted to include crown protection. Adjusted TPZ should be a minimum of 1m outside the perimeter of the crown.

02 Indicative Tree Protection Zone (TPZ) — Scale 1:500 @ A4



Note:
No excavation, construction activity, grade changes, surface treatment or storage of materials of any kind is permitted within the TPZ.

Option 1 - Fencing
1.8m high chain wire mesh panels with shade cloth attached (if required), held in place with concrete feet.

Tree Protection Zone (TPZ) sign

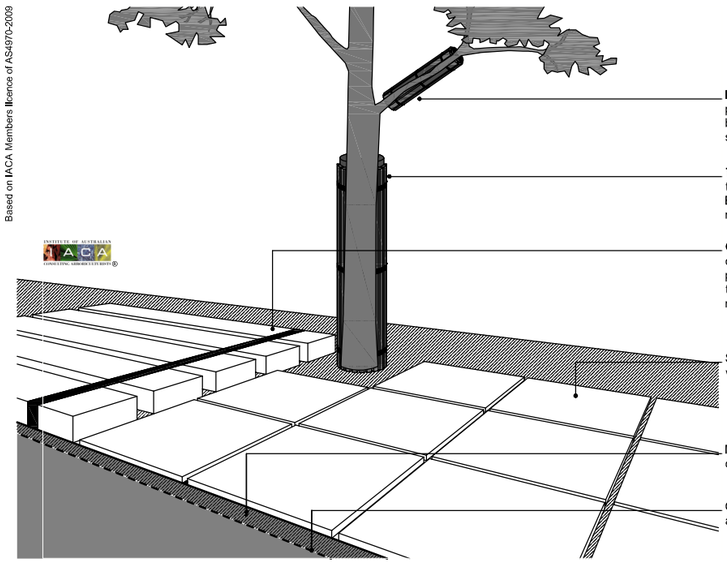
Option 2 - Fencing
Plywood or wooden panel paling fence. This type of fencing material also prevents building materials or soil entering the TPZ.

Installation of supports should avoid damaging roots.

Bracing is permissible within the TPZ.

Maximum 100mm and minimum 50mm depth mulch or aggregate layer installed across surface of TPZ.

03 Tree Protection Fencing — Not to Scale



Branch Protection - use boards and padding to prevent damage to bark on branch. Boards are to be strapped, not screwed or nailed to the branch.

Trunk Protection - use boards and padding to prevent damage to bark (minimum 2m). Boards are to be strapped, not screwed or nailed to the trunk.

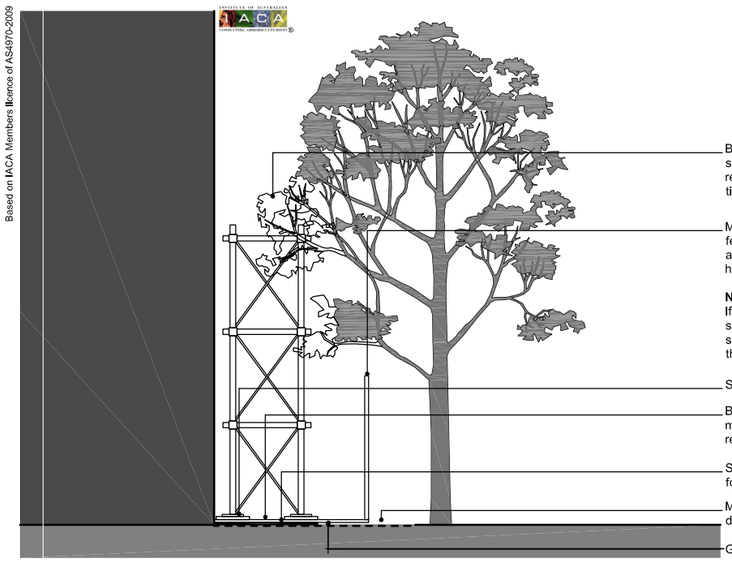
Ground Protection - use device strapped over mulch or aggregate layer. Ground protection device should be of a suitable thickness to prevent soil compaction and root damage.

Steel plates (or approved equivalent) with or without mulch or aggregate layer below.

Maximum 100mm and minimum 50mm depth mulch or aggregate layer.

Geotextile fabric underneath mulch or aggregate layer.

04 Examples of Branch, Trunk and Ground Protection — Not to Scale



Branches may require pruning to erect scaffolding. Pruning may be subject to local regulations. Flexible branches should be tied back in preference to pruning.

Minimum 1.8m high hoarding. Temporary fencing may be incorporated into scaffolding as either containment screening or as hoarding.

Note:
If excavation is required for installation of support post for fencing, the Project Arborist should assess any pruning of roots greater than 20mm diameter.

Scaffold planks

Boards or plywood to be installed over mulch or aggregate layer for any areas requiring access within the TPZ.

Soleplate over geotextile. No excavation for soleplate within TPZ.

Maximum 100mm and minimum 50mm depth mulch or aggregate layer within TPZ.

Geotextile fabric

05 Indicative Scaffolding within a Tree Protection Zone (TPZ) — Not to Scale

TREE WISE MEN®
AUSTRALIA PTY LTD

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Notes:

1. Tree Impact assessment has been considered in relation to ***AS4970-2009 Protection of trees on development sites***.

2. This ***Tree Protection Plan*** is equivalent to the Development Submission Plan identified in Table 1, ***AS4970-2009***.

3. This ***Tree Protection Plan*** should be incorporated into the site Construction Management Plan and the Sediment Control Plan.

4. Tree impact assessment includes likely impacts from development including: building platforms, driveways/ accessways, services/infrastructure installation and cut/fill batters.

5. The extent of TPZ shown on this plan does not reflect any confinement of roots by existing structures, buildings, walls, topography, etc.

6. A ***Project Arborist*** with minimum AQF Level 5 qualifications is to be engaged to supervise works within TPZ areas and monitor and report regularly on the condition of trees.

7. ***Tree Protection Fencing*** as indicated, should be installed prior to demolition of existing structures and other site preparation works. Tree Protection Fencing should comprise of chainlink wire or wire mesh panels as per Figure 03 of the TPP. If the location of the fencing needs to be altered, this shall be determined at a project meeting between the Civil Contractor and the Project Arborist. The following activities are to be prohibited within tree protection fencing: topsoil stripping, excavation, placement of soil fill, storage of any materials, placement of site sheds/offices, parking of heavy machinery, placement of machinery haul roads.

8. If ***scaffolding*** is required within TPZ, install as shown in Figure 05 of the TPP.

9. Services installation should be supervised by the ***Project Arborist***, using directional boring wherever possible or manual excavation where trenching is to occur. No roots greater than 50mm diameter are to be cut or damaged. Services should be routed beyond TPZ wherever possible.

10. ***Trunk battening*** and ***ground protection*** to be installed to trees where works are required within Tree Protection Fencing. Battening to comply with Figure 04 of the TPP.

11. All ***tree pruning*** is to comply with ***AS4373-2007, Pruning of amenity trees***. All approved tree removal is to comply with WorkCover Code of Practice for the Amenity Tree Industry. All tree pruning and removal shall be carried out by a qualified and experienced Arborist (minimum AQF Level 3 qualification).

12. ***Mulch*** is to be spread to a depth of 100mm within the TPZs if construction activity is proposed within TPZ offsets. Where TPZs are greater than 5 metres or where native seedling regeneration would be prohibited by the mulch, seek advice from the Project Arborist and Ecologist.

13. ***Over-excavation*** or battering towards trees is to be avoided unless indicated on Approved earthworks or services drawings and approved by the Project Arborist.

14. Contiguous ***strip footings*** are to be avoided wherever possible. Use discontinuous pier and beam type footings or other lightweight construction for walling and fencing within TPZs.

15. ***Temporary irrigation***, hand watering or water cart may be required to maintain adequate soil moisture levels. The Project Arborist is to monitor soil moisture levels and advise on delivery volumes and frequency.

16. Temporary ***haul roads*** may be required to be installed where heavy machinery movements are proposed within TPZs of trees to minimise compaction. Woodchip mulch should be used as a minimum. Recycled concrete or other aggregate placed over a geofabric may be required for heavy use areas.

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CLIENT:	Pamela Marshall
PROJECT:	Kumale (Garage) 949 Barrenjoey Road, Palm Beach
DRAWING NO:	2303TPP SHT 2 OF 2
DRAWN BY:	MH
BASED ON:	IACA Licence of *AS4970-2009 Protection of trees on development sites*
DATE:	27/11/2015
REV:	REV DATE: