

Arboricultural Impact Assessment

Proposed New Residence at

40 Pine Street, Manly

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2 Introduction

2.1 Background

This Arboricultural Impact Assessment (AIA) was prepared for James Bell in relation to the existing trees and proposed new residence at 40 Pine Street, Manly.

The purpose of this AIA is to assess the likely impacts of the proposed works on the existing site trees and to make recommendations regarding construction methods and tree protection measures to limit adverse impacts on trees recommended for retention.

This AIA has been guided by the principles set out in the Australian Standard 4970-2009, *Protection of trees on development sites.*

2.2 Subject Site/Proposed Works

The subject site is a small residential lot that is currently fee of built structures. The proposed works include construction of new single storey residential dwelling.

2.3 Subject Trees

Seven (7) trees have been assessed due to their proximity to the proposed works. Refer to Figure A (following page) for tree locations. These are made up of the following species:

- Cheese Tree, Glochidion ferdinandi (Trees 1 and 2)
- Red Cedar, Toona ciliata (Tree 3)
- Coast Banksia, Banksia integrifolia (Tree 3a)
- Sydney Blue Gum, Eucalyptus saligna (Tree 4)
- Canary Island Date Palm, Phoenix canariensis (Tree 5)
- Cocos Palm, Syagrus romanzoffianum (Tree 6)

Trees 1, 2, 3, 3a and 4 are protected under Part 3 of SEPP (Vegetation in Non-Rural Areas) 2017.

Trees 5 and 6 are likely to have self-sown as environmental weeds and are exempt from protection within the Northern Beaches LGA.

A detailed description of the subject trees is included in the Tree Assessment Table (Section 4 – page 6).



Figure A: Excerpt from the Survey Plan showing tree locations and numbering.

3 Methodology

3.1 Site Inspection/Tree Assessment

Site inspection and tree assessment was undertaken by Alexis Anderson on the 27th of October, 2021. The trees were assessed from ground level using a Tree Assessment Table, as outlined in Section 4. The definitions and explanations of terms used are outlined in the Tree Table Definitions page which is included at Attachment A.

3.2 Trunk Decay and Tree Risk Assessment (Tree 4)

The dimensions of the trunk decay spread were determined by undertaking trunk drilling at 2.5m height along the W, N and S axis'. A 280mm x 6mm auger bit was used to determine the average thickness of remaining sound wood surrounding the column of internal decay. The purpose of this was to allow an assessment of trunk strength loss associated with the hollow and decay. The assessment was undertaken using the t/R formula outlined in Mattheck, Claus, and Helge Breloer. 1994. *The Body Language of Trees. A Handbook for Failure Analysis*. HMSO, London, UK.

The risk assessment was undertaken using the TRAQ method as outlined in the ISA Tree Risk Assessment manual (second edition). Alexis Anderson is an ISA qualified user of this method. Refer to Attachment B for a summary of this method.

3.3 Plan Review

This report is based upon a review of the set of plans provided by Carlisle Architects (Revision A dated 19/10/2021).

No Landscape Plan, Hydraulics Plans or Engineering Detail was available for review at the time of assessment.

3.4 **Tree Protection Zones**

Tree assessments in accordance with the Australian Standard 4970-2009, *Protection of trees on development sites*, require calculation of a Tree Protection Zone (TPZ) and Structural Root Zone (SRZ). The following is a brief explanation of these terms:

Tree Protection Zone -TPZ: This is the area that should be isolated from construction disturbance so that the tree remains viable. Some disturbance within the TPZ may be possible following arboricultural assessment.

<u>Structural Root Zone -SRZ</u>: This is the area of undisturbed soil and roots required to maintain tree stability. Excavation within the SRZ can lead to whole tree failure.

3.5 Retention Values

Retention values are derived from a combination of Estimated Life Expectancy rating and Landscape and Environmental Significance ratings.

- **HIGH Retention Value**: These trees are worthy of retention and design consideration should be made where possible to allow their retention. Removal of these trees will have an impact on the landscape amenity or local environment.
- **MEDIUM Retention Value**: These trees are worthy of retention and minor design consideration should be made to retain these trees wherever possible (e.g. placement of ancillary structures, garden retaining walls, driveway levels). Removal of these trees will not have a significant impact on the landscape amenity or local environment.
- **LOW Retention Value**: These trees should not be considered to be a constraint to design layout. Some of these trees should be removed irrespective of any proposed development.

The method of determining and defining retention values used in this report has been derived from the ©Retention Index developed by Tree Wise Men[®] Australia Pty Ltd.

3.6 **Consideration for Tree Retention and Removal**

Tree removal recommendations have been based on tree Retention Values and construction offsets. Trees may generally be recommended for removal in the following circumstances:

- Trees located within construction footprints.
- Trees with construction proposed within the SRZ where root loss cannot be avoided through sensitive design.
- Trees with a TPZ loss of more than 25%, may be recommended for removal providing tree sensitive design cannot be implemented to avoid significant root and canopy loss.
- Trees with low Retention Values may be recommended for removal irrespective of proposed development.

4 Tree Assessment Details

4.1 **Tree Assessment Table**

	Species	Trunk Diameter @ 1.4m	Height	Canopy Spread Radius	Age Class	Health/ Vitality	Structural Condition	Estimated Life Expectancy	Landscape and Environmental Significance	Retention Value
1	Cheese Tree, Glochidion	38cm, 28cm	7m	7m	Mature	Good	Good	Long (30+ yrs)	2	High
	jerainanai	Comments: Lo	ocally native	species. Li	kely to have s	elf-sown.				
2	Cheese Tree, Glochidion ferdinandi	10cm	3m	2m	Early- mature	Good	Good	Long (30+ yrs)	3	Medium
		Comments: L	ocally nativ	e species. L	ikely to have s	self-sown.				
3	Red Cedar, Toona Ciliata	35cm (approx)	8m	6m	Mature	Good	Good	Long (30+ yrs)	2	High
		Comments: L	ocated on t	he neighbou	uring property	. The trunk	diameter was	s estimated. Pla	anted Australian nat	ive.
3 a	Coast Banksia, Banksia	8cm	3m	1m	Immature	Good	Good	Long (30+ yrs)	3	Medium
	integrifolia	Comments: Planted locally native species. Located on the Council verge. Not plotted on the survey.								
4	Sydney Blue Gum, Eucalyptus saligna	58cm	16m	8m	Mature	Good	Fair	Long (30+ yrs)	2	High
		Comments: P There is a surf There is a fung internal trunk and likely effe	lanted (pos ace structur gal fruiting t decay. Fur ct on trunk	sible self-so ral root visik body located ther testing stability. Re	wn) Australian ble on the nor d on the weste was recomm efer to Sectior	n native. Th thern side u ern side of t ended and s n 4.2 for find	is species is n ip to 2.0m from he trunk at 2.1 subsequently lings.	ot found natura m the trunk. 5m height. This undertaken to o	Illy in this locality. indicates that there determine the exter	e is some at of decay
5	Canary Island Date Palm, Phoenix	80cm	6m	2m	Early- Mature	Good	Good	Long (30+ yrs)	4	Low
	canariensis	Comments: W property.	leed species	s. Exempt fr	om protectior	n within the	Northern Bea	ches LGA. Loca	ited on the neighbo	uring
6	Cocos Palm, Syagrus	25cm	5m	2m	Early- Mature	Good	Good	Long (30+ yrs)	4	Low
	romanzoffiamum	Comments: W	leed species	s. Exempt fr	om protectior	n within the	Northern Bea	ches LGA.	1	1



Tree 4

Photo A: Trees 1,2 and 4 viewed facing north-west.



Photo B: Trees 3-6 viewed facing north.



Photo C: Trunk of Tree 4 with the fungal fruiting body visible on the western side.

4.2 Trunk Decay Investigation and Tree Risk Assessment (Tree 4)

The visible spread of trunk wounding associated with the decay extends from the base to 3.0m height. Trunk drilling was undertaken at a height of 2.5m height to correspond with the location of the fungal fruiting body.

Drilling Height	2.5m	Drill 3
Trunk Diamater @ drill height	55cm	
Average trunk radius (minus bark)	27cm	
Drill 1 (from west)	Decay - 0-16cm	Aprovimate area
	Sound wood -16-28cm	of decay
Drill 2 (from south)	Sound wood - 0-28cm	
Drill 3 (from north)	Sound wood -0-28cm	2800
Average thickness of sound wood	23cm	16cm 10-200
(undecayed) surrounding the		Drill 1 0-10-
decay pocket		0-28
t/R ratio (average % of trunk	23/27= 85%	ŝ .
radius remaining as sound wood)		
		Drill 2
Discussion	This finding suggests that	at trunk failure is improbable within the next 5 years.
	Given the good health a	nd vitality of the tree it is likely that the spread of decay
	will be successfully inhib	pited by the tree's natural strategies of decay
	compartmentalisation.	

Tree Risk Assessment (refer to Attachment B for methodology)					
Potential Targets	Proposed new house (constant occupancy). The house is likely to be strong enough to				
	protect its residents from branch failure.				
Likelihood of Failure	Failure of the trunk resulting from the decay between between 0-3m height -Improbable				
(within the next 5 years)	Live branch failure (Storm damage or summer branch drop)-Possible.				
Likelihood of Impact	Low (Whole tree falling on new house). The trunk has a lean away from the house.				
	Medium (Branch falling on new house). Approx. 30% of canopy will overhang the house.				
Likelihood of Failure +	Unlikely (Whole tree impacting house following trunk failure)				
Impact	Unlikely (Live branch failure impacting house)				
Consequences of Failure +	Severe (house damage from trunk failure)				
Impact	Significant (house damage from live branch failure).				
Risk Rating	Low -Live branch failure impacting the house				
	Low - Whole tree impacting house following trunk failure				
Recommended Action	Remove the dead branch on the southern side of the canopy.				
	Engage an AQF Level 5 Arborist to re-assess the tree in 5 years.				

Tree Protection Offsets based on								
AS49	AS4970-2009-Protection of Trees on Development Sites							
Tree Number Tree Protection Zone radius Structural Root Zone radi								
	5 7	2.4						
1	5.7m	2.4m						
2	2.4m	1.5m						
3	4.2m	2.1m						
За	2.0m	1.5m						
4	7.0m	2.7m						
5 3.0m		1.0m						
6	3.0m	1.0m						

4.3 **Tree Protection Zones**



Figure B: Excerpt from the Floor Plan showing the TPZ's (green circles) of the retained trees.

5 Potential Impacts of Proposed Works

5.1 **Trees Proposed for Removal**

Tree Number/Species	Retention Value	Works Proposed Within the Tree Protection Zone (TPZ)
6 Cocos Palm	Low	Undesirable species. Remove to create space for planting of more appropriate species. This species is exempt from protection within the Northern Beaches LGA and approval would not be needed to remove this tree outside of a DA context.

5.2 **Potential Impacts of Proposed Works on Retained Trees**

Tree Number/Species	Retention Value	Works Proposed Within the Tree Protection Zone (TPZ)
1 Cheese Tree	High	The proposed new building is to be fully elevated above existing
2	Medium	ground levels on steel post footings. The post footings will be
Cheese Tree		founded on the sandstone rock. The roots of these trees are mostly
3	High	tree reets will be able to continue to exist beneath the new building
Red Cedar		tree roots will be able to continue to exist beneath the new building.
4	_	Although there will be a reduction in the area of open ground exposed
Sydney Blue Gum	High	to direct rainfall, the trees will be able to continue to benefit from ground-water moving down the steep slope from above.
5 Canary Island Date Palm	Low	The building shall sit beneath the canopy spread of Tree 4. No canopy pruning will be required to accommodate the roof -line.

Incidental Impacts: Trees are commonly impacted on construction sites in the following ways. These impacts can be easily avoided through awareness and basic tree protection measures.

- Stripping of existing ground cover, topsoil and removal of organic material from the soil surface.
- Compaction of the topsoil and damage to surface roots through use of heavy machinery and frequent foot traffic.
- Soil contamination through washing out barrows and disposal or spillage of chemical materials.
- Root loss due to unforeseen excavation for plumbing upgrades and landscape construction.
- Bark/trunk and branch injuries from accidental contact with machinery.

6 Recommendations

6.1 Site Establishment – Prior to Construction

Appointment of a Project Arborist: An Arborist with an AQF Level 5 qualification should be engaged prior to the commencement of work on the site. The Project Arborist may be required for the following:

- Provide root mapping to enable adjustment of pier locations to avoid roots greater that 50mm in diameter
- At the project start-up to discuss tree protection requirements with the site foreman.
- Following installation of tree protection fencing, trunk battening and ground protection around Tree 4.
- During excavation for the steel post footings.
- At project completion to verify tree protection and retention.

Tree Protection Fencing: Tree Protection Fencing should be installed prior to any machinery or materials being bought on site and remain in position throughout the entire project. Tree Protection Fencing should be erected in the position outlined in Figure E (following page). Tree Protection Fencing should consist standard temporary steel mesh fencing was not recommended for this site.



Figure C: Example of adequate tree protection fencing.

Trunk Protection (Tree 4): Trunk Protection is recommended for Tree 4 to prevent accidental injury to the bark and cambium during the construction process. Trunk protection should be installed to the roof height of the proposed building. Refer to Figure D for detail of adequate trunk protection.

Root Protection (Tree 4): Root protection is recommended for the large surface structural root on the northern side of Tree 4 in the area outlined in Figure E. The purpose of this is to protect the root from accidental injury during construction. The type of root protection shall be determined by the Project Arborist in consultation with the Site Foreman. Root protection may be removed when building framing is complete.



Figure D: Example of adequate trunk protection for Tree 4.



Figure E: Areas where tree protection fencing and root protection is recommended.

<u>Tree Protection Zones</u>: The following should be prohibited within Tree Protection Zones of the assessed trees:

- Removal or stripping of topsoil / organic surface material.
- Landscape works involving retaining walls or ground levelling.
- Disposal of solid, liquid or chemical waste.
- Any excavation, fill or other construction activity other than that discussed in this report.

Steel Post Footing Set-Out: The majority of the posts shall be founded into exposed sandstone rock. The final positions of any footings that are within soil covered areas must be determined following test digging. Footings must be re-located as necessary to avoid contact with tree roots greater than 50mm diameter. Footings must also be clear of the large visible surface root on the northern side of Tree 4.

Landscaping Works: The existing ground levels must be maintained within the TPZ of Tree 4. There must be no ground levelling or soil stripping. Mulched garden beds are preferable to lawn or pavement.

6.3 Post Construction Tree Care

At the completion of the project, all retained trees should be inspected by the Project Arborist. Depending on the health and vitality of retained trees, the Project Arborist may prescribe some remedial tree care. This may include installation of temporary or permanent irrigation, application of soil conditioners, compost application, fertiliser application and installation of mulch.

7 Statement of Impartiality

- This report prepared by Bluegum Tree Care & Consultancy (BTCC) reflects the impartial and expert opinion of Alexis Anderson.
- BTCC is acting independently of and not as the advocate for the owners of the subject trees.
- BTCC does not undertake tree pruning and removal works and will not have any involvement with pruning or removing trees which are the subject of this report.

8 Limitations

- The tree assessment was undertaken for the purpose of pre-development planning. Detailed tree risk assessment was not requested or included in the scope of works.
- The findings of this report are based upon and limited to visual examination of trees from ground level without any climbing, internal testing or exploratory excavation.
- This report reflects the health and structure of trees at the time of inspection. Bluegum cannot guarantee that a tree will be healthy and safe under all circumstances or for a specified period of time. There is no guarantee that problems or defects with assessed trees, will not arise in the future. Liability will not be accepted for damage to person or property as a result of failure of assessed trees.
- This report must be read in its entirety. No part of this report may be referred to, verbally or in writing, unless taken in full context of the whole report.

Attachment A: TREE ASSESSMENT DEFINITIONS

<u>**Height**</u>. Tree height is estimated from ground level. This assessment is made independently of data plotted on survey plan. These measurements have not been confirmed with clinometer or other surveying instrument.

Trunk Diameter. Trunk diameter is measured at 1.4 metres above ground level. A diameter tape is used which calculates the diameter from a measurement of the circumfrence. DBH is primarily used for the calculation of the TPZ and SRZ.

If a tree has more than 4 trunks, the diameter of the four largest trunks is recorded. For irregular trunk formations the DBH is calculated as outlined in Appendix A of AS4970-2009 -*Protection of Trees on Development Sites*.

Canopy Spread Radius. Average canopy spread radius is estimated from the centre of trunk to the outer edge of canopy. Refer to Comments column for detail of heavily skewed canopy spread.

<u>Age Class</u> - This is an estimation of the tree's current age class based on size, growth habit, local environmental conditions and comparison with surrounding trees.

- Immature (IM): This is a juvenile specimen that is likely to have germinated within the previous 5 years.
- Early Mature (EM): This is a tree that is established within its growing environment, though has not reached an age of reproductive maturity or the natural growth habit of a mature individual.
- Mature (M): This is a tree has reached both reproductive maturity and a physical form and shape typical for the species. Trees can have a Mature Age Class for the majority of their life span.
- Late-Mature (LM): There trees show early signs of senescence with symptoms such as reduced canopy density and an accumulation of dead branches.
- **Over-mature (OM)**: These trees show symptoms of irreversible decline such as canopy dieback with dead branches concentrated in the upper canopy.

<u>Health/Vitality</u> - Good (G), Fair (F) or Poor (P). This is primarily based on the extent of vigorous new foliage growth at branch tips and the colour, size and density of foliage generally. The percentage of live branches to dead branches is considered. The location of any dead branches is also considered. The presence of any pest or disease is considered as part of this assessment. Health can vary with climatic conditions.

<u>Structural Condition</u> - Good (G), Fair (F) or Poor (P). This is an assessment of tree structure and stability. Root anchorage, trunk lean, structural defects, canopy skew and any hazardous features are considered. Dead branches can be considered as part of Structural Condition if they are of a size and location that could cause injury or property damage.

Tree Protection Zone (TPZ). This is a radial distance of (12X) the DBH measured from centre of trunk. TPZ is rounded to the nearest 0.1 metre. A TPZ should not be less than 2m or greater than 15m. The TPZ for palms and other monocots should not be less than 1m outside of the crown projection. Existing constraints to root spread can vary the TPZ. For a tree to remain viable, construction activity should be excluded or undertaken with care within the TPZ. Disturbance within up to 10% of the TPZ area is considered to be a minor encroachment. Disturbance to more than 10% of the TPZ area is considered a major encroachment. Major encroachment into the TPZ is possible depending on the type of disturbance, and species tolerance to disturbance. Exploratory excavation may be required to quantify the presence of roots at the alignment of proposed ground disturbance.

This is based upon the Australian Standard AS 4970, 2009, Protection of trees on development sites and the Matheney & Clarke "Guidelines for adequate tree preservation zones for healthy, structurally stable trees".

<u>Structural Root Zone (SRZ).</u> This is a radial distance based on the following formula- SRZ =(D x 50) $^{0.42}$ x 0.64 (for trees less than 150mm Diameter, a minimum SRZ of 1.5 metres). SRZ measurements are rounded to the nearest 0.1m.

The Structural Root Zone is the area of soil and roots required to maintain tree stability. Excavation within the SRZ can result in whole tree failure. Fully elevated construction is possible within SRZ with specific rootzone assessment. Existing constraints to root spread can vary the SRZ. This method of determining SRZ is outlined at Section **3.3.5** of Australian Standard AS 4970, 2009, *Protection of trees on development sites.*

Estimated Remaining Life Expectancy: This gives a length of time that the Arborist believes a particular tree can be retained from the time of assessment with an acceptable level of risk based on the information available at the time of the inspection. This system of rating does not take into consideration the likely impacts of any proposed development. Ratings are **Long** (retainable for 30 years or more with an acceptable level of risk), **Medium** (retainable for 10-30 years), **Short** (retainable for 0-10 years) and **Removal** (tree requiring removal due to risk/hazard or absolute unsuitability).

Landscape & Environmental Significance^{*}. This is an assessment of the impact of the tree on the surrounding landscape amenity and natural environment. Rarity, habitat value, physical prominence, historical and cultural significance of the tree are considered in this rating system. The Landscape & Environmental Value ratings used in this report are:

1. Very High Value: This is an outstanding specimen that holds irreplaceable environmental, landscape or cultural value.

2. High Value: An excellent specimen that holds environmental, landscape or cultural value that is present in other site trees or that could be replaced.

3. Moderate Value: Can be a good to fair specimen with environmental, landscape or cultural value that is common within other trees in the locality.

4. Low Value: Removal would not result in any loss of site amenity or environmental value. Can include undesirable or weed species or trees growing in unsuitable locations.

5. Very Low Value : Dead or hazardous with no other environmental or cultural value. Could also include weed species. These trees should be removed or pruned in a way to make safe irrespective of any development.

*Note: The concept of using a five (5) point scale to assess tree significance was derived from the Tree Wise Men® Australia Pty Ltd ©Significance Rating Scale.

<u>Retention Value</u>*. Retention values are derived from a combination of Estimated Life Expectancy rating and Landscape and Environmental Significance ratings.

					y		
				Long	Medium	Short	Removal
<u>s</u>	En	La	Very High (1)				
gnifi	vironment	ndso	High (2)	HIGH		MEDIUM	
cance		cape 8	Medium (3)	MED	NUM		1
	<u>a</u>	Xo	Low (4)			LOW	
			Very Low (5)				

HIGH Retention Value: These trees are worthy of retention and major design consideration should be made where feasible to allow this.

MEDIUM Retention Value: These trees are worthy of retention and minor design consideration should be made to retain these trees wherever possible (e.g. placement of ancillary structures, garden retaining walls, driveway levels).

LOW Retention Value: These trees should not be considered to be a constraint to design layout. Some of these trees should be removed irrespective of any proposed development.

*Note: The method of determining and defining retention values used in this report has been derived from the ©Retention Index developed by Tree Wise Men® Australia Pty Ltd.

Attachment B - Tree Risk Assessment Methodology

The tree risk rating has been determined using the method outlined in the ISA Tree Risk Assessment manual. Alexis Anderson is a trained and qualified user of this method. A summary of this method is detailed below.

Part A- Likelihood of Failure and Impact

Likelihood of branch/tree failure within the inspection period (24 months)

This part of the assessment is related to the part of the tree most likely to fail. The part of the tree most likely to fail is allocated one of the following categories; *Imminent, Probable, Possible, Improbable*.

Likelihood of a tree failure impacting a target

This is an assessment of the likelihood of a falling part of tree connecting with a person or property. The occupancy rate of the area within the potential fall-zone is considered here as well as factors that may protect a target such as a shelter. The likelihood of a tree failure impacting a target is categorized as; *Very Low, Low, Medium, High.*

Likelihood of	Likelihood of Impact				
Failure	Very Low	Low	Medium	High	
Imminent	Unlikely	Somewhat likely	Likely	Very Likely	
Probable	Unlikely	Unlikely	Somewhat likely	Likely	
Possible	Unlikely	Unlikely	Unlikely	Somewhat likely	
Improbable	Unlikely	Unlikely	Unlikely	Unlikely	

Part B- Rating the Risk

Consequence of Tree Failure and Impact

This part of the assessment categorises the likely extent of injury or property damage once impact has occurred. This takes into consideration the size and height of the defective tree part. The consequence of tree failure and impact is categorised as *Negligible, Minor, Significant* and *Severe*.

Using the Risk Rating Matrix to categorise the risk

Part A and the Consequence of Tree Failure and Impact are combined in the following matrix to give a risk rating.

Likelihood of	Consequences of Failure				
Failure & Impact	Negligible	Minor	Significant	Severe	
Very Likely	Low	Moderate	High	Extreme	
Likely	Low	Moderate	High	High	
Somewhat Likely	Low	Low	Moderate	Moderate	
Unlikely	Low	Low	Low	Low	