



# Independent Arboricultural Services



## Arboricultural Impact Assessment Prepared For: School Infrastructure NSW

Proposed ancillary works at Narrabeen North Public School in a mapped coastal wetlands area

Narrabeen North Public School  
Narrabeen NSW 2101  
8th November 2022  
IAS8602



## Independent Arboricultural Services - Disclaimer

The material contained in this document has been prepared on an independent basis free of any bias and represents the honest opinion of the consulting arborist.

Tissue or soil samples have not been collected nor submitted for testing unless otherwise stated. Excavation is limited to minor earthworks and we submit this assessment on the basis that all data is based on visual inspection of the tree/s and its/their location, species, health and condition at the time of writing unless otherwise stated. Measurements and tree locations noted in this report are approximate and have not been determined by survey unless information and analysis has been provided by the consultant or such information is otherwise noted. Please request a more detailed arborist report if further information and analysis is required. Depending on site requirements, specific alternate specialist advice including engineering consultancy and certification maybe required in combination with this assessment. This assessment contains arborist advice and associated general information only and does not purport to provide other site-specific specialist advice such as engineering certification unless arrangement to source such advice for inclusion in this assessment has been requested and authorised.

This report containing opinions, advice and recommendations based on information and data gathered from site inspections carried out by personnel from Independent Arboricultural Services as well as information provided by the client and/or its representatives, is to be relied on by the client in that context. It is assumed that all such information provided to Independent Arboricultural Services is correct. All recommended arboricultural works detailed in this assessment including pruning of tree canopy or roots, tree removal, tree transplanted or other associated works including stump grinding or the application of any prescribed treatment shall be carried out in accordance with applicable standards including Australian Standards AS 4373-2007 Pruning of amenity trees and AS 4970-2009 Protection of trees on development sites.

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The invoice for this report will be issued to the person or entity as per the address advised at the time of confirmation of appointment. Assessment in this report is based on plans provided at the time of confirmation of engagement and report preparation. Additional time required for re-assessment of report detail due to subsequent re-issue of plans after report preparation will be subject to an additional fee which will be charged at our hourly rate. This report shall not be conveyed to any third party including regulatory authority/s until full payment of this invoice is received by Independent Arboricultural Services and a finalised report has been issued unless agreement to do so has been granted.

Factors including the absence of historical records or local knowledge, recognition of the variability of the integrity of a tree as a naturally living organism as well as the impact of conditions within its surrounds to which it maybe subject including the impacts of mechanical force and the occurrence of weather events, do not allow an arborist to guarantee the age of a tree, or the length of time a tree/s may live or such time as it /they may fail. There is no warranty or guarantee, expressed or implied that the problems or deficiencies of the plants or property in question may not arise in the future.

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<b>IAS Reference</b>	IAS8602		
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## Abbreviations

<b>NBC</b>	Northern Beaches Council	<b>RPA</b>	Root Protection Area
<b>DA</b>	Development Application	<b>TMP</b>	Tree Management Plan
<b>VPO</b>	Vegetation Protection Order	<b>CMP</b>	Construction Management Plan
<b>ULE</b>	Useful Life Expectancy	<b>VMP</b>	Vegetation Management Plan
<b>BLF</b>	Building Location Footprint	<b>AS</b>	Australian Standard
<b>BLE</b>	Building Location Envelope	<b>AS 4373: 2007</b>	Pruning of amenity trees
<b>TPZ</b>	Tree Protection Zone	<b>AS 4970: 2009</b>	Protection of trees on development sites
<b>SRZ</b>	Structural Root Zone	<b>DBH</b>	Diameter at Breast Height

All comments and recommendations in this report have been determined in accordance with Australian Standards AS 4373-2007 Pruning of amenity trees and AS 4970-2009 Protection of trees on development sites. All recommended tree work should be carried out in accordance with these standards.



**Roger Rankine**  
Consulting Arborist



Figure 1: Source - DFP

## Introduction

This report is based on a visual inspection carried out from the ground on the 24<sup>th</sup> November 2021 & 9<sup>th</sup> May 2022. No soil or tissue sampling has been conducted. Tree assessment and Qualitative Visual Tree Analysis has been carried out in accordance with TRAQ ISA guidelines. Data and information provided to the client by others has been incorporated into this report as appropriate.

All Arboricultural recommendations contained in this report have been determined in accordance with Australian Standards AS 4373-2007 Pruning of amenity trees and AS 4970-2009 Protection of trees on development sites.

For the purposes of this report reference to a Consulting or Project Arborist is held to mean an Arboricultural specialist who holds minimum Arboricultural qualifications of Dip Arb/AQF 5, appropriate professional insurances and has appropriate experience in the protection of trees on construction sites. Where tree work is specified, all recommended tree work is to be carried out in accordance with the above-mentioned standards by an appropriately trained and AQF qualified arborist practitioner/s with an up-to-date record of training and membership of a recognised Australian Arboricultural association, e.g. Qld Arboricultural Association (QAA), Arboriculture Australia (AA), or a recognised international Arboricultural association. No climbing spikes are to be used if pruning is to be carried out on live trees except in the instance of an emergency.

Qualifications of the report authors include Diploma of Arboriculture/AQF Level 5 and ISA Certified Arborist accreditation. Report authors hold current insurances and memberships including qualified memberships of Queensland Arboricultural Association (QAA), and Arboriculture Australia (AA) as well as current accreditation and membership of International Society of Arboriculture (ISA).

Independent Arboricultural Services is a qualified registrant on the QAA Register of Consulting Arborists.

## Executive Summary

Independent Arboricultural Services have been engaged by School Infrastructure NSW to assess potential impacts to the vegetation within the coastal wetlands area. The proposed works the subject of the Designated Development application comprise:

- Removal of eight (8) trees;
- New accessible pedestrian pathways;
- New substation on Namona Street frontage along with associated conduit connections;
- New fire hydrant booster and associated conduit connections; and
- New hard and soft landscaping including the planting of 12 new trees

Chantalle Hughes (AQF Level 5) attended site on 24<sup>th</sup> November 2022 & 9<sup>th</sup> May 2022 to undertake the assessment of the impact of the works. Roger Rankine (AQF Level 5) attended site on the 21<sup>st</sup> June 2022. Assessment of the impacts of proposed development on the identified trees in and around the development envelope, roads and services has been undertaken. Advice on both specific and general tree protection measures and Project Arborist Requirements have been detailed in this report. It is important as the design is refined, further reviews are undertaken by the Project Arborist and protection measures are further specified as required.

Protection measures and assessment of incursion has been based on the available information provided. Based on the current designs, eight (8) trees have major incursion and the long term health and structural viability will be affected by the works. A remaining eleven (11) trees are noted for retention subject to amended construction including the use of low pressure water excavation.

As part of the design process and operational works it is recommended that the following is undertaken,

- The Project Arborist is to be consulted during the detailed design phase to minimise impacts to retained vegetation.
- Current retention/removal recommendations are based on plans provided. Detailed assessment of final design plans and bulk earthworks are required prior to final retention/removal recommendations.
- Project Arborist (AQF Level 5) to supervise and / audit all works within the TPZ of retained trees including soft and hard landscaping.
- Ensure all approvals and permits are in place before works commence.
- Undertake a pre-start meeting with contractors before works commence.
- Tree Protection Fencing is to be erected before works commence and audited by the Project Arborist (Min AQF Level 5).
- Supervision by a Project Arborist (Min AQF Level 5) and Fauna Spotter/Catcher of the approved tree removals.
- Any works proposed within the TPZ of retained trees requires supervision of a minimum AQF5 Project Arborist.



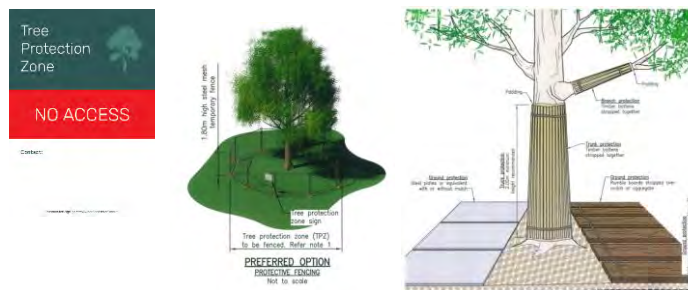
- Tree Pruning is to be undertaken by a minimum AQF Level 3 Arborist.
- Lay down areas and site shed/office locations are to be identified/finalised and excluded from the Tree Protection Zones of retained trees and minimise public impact.
- Route vehicles and equipment outside of TPZs. If access is required within TPZ, mulch to a depth of 100mm and tree padding needs to be installed with the option of track mats as determined and signed off by a minimum AQF5 Project Arborist.
- Construction materials, spoil, stockpiles, tools and equipment are not permitted within the TPZs of retained trees.

## Arborist Comment

- Protection of retained trees during construction works
- Impact of the proposed works on nominated trees

### Protection of Retained Trees During Construction Works

An exclusion zone is to be established along the perimeters of retained trees and cordoned off with a physical barrier of wire mesh fence, 1.8m in height, which is securely anchored (as noted on the Tree Protection Plan). The role of these fences is to prevent any damage to the complete tree including root system (SRZ & TPZ), stem and branch structure as well as the crown or canopy. Alternatively, and on approval of a minimum AQF5 Project Arborist, plastic mesh fencing, 1.2m in height, secured with star pickets and caps with straining wire can be utilised. All TPZ fencing will require appropriate signage to signify the relevant protection zones. This will require audit and sign off prior to operational works onsite.



Tree Protection Fencing to be utilised. Where works will be undertaken close to and within Tree Protection Zones specific tree protection measures to be utilised a directed by the project Arborist.

## Project Hold Points





Engage an AQF5 minimum Project Arborist during the project life;

- Once tree protection fencing and signage has been established and finalised. Project Arborist (minimum AQF Level 5) to audit and sign off.
- Supervision of approved tree removals in conjunction with a fauna spotter.
- Any works within the TPZ of retained trees is required.
- If tree roots are encountered over 50mm in diameter outside of TPZs of retained trees.
- Changes to the plans occur.
- On completion of the project to conduct a final audit and summary.

(Site audits/summary reports will be conducted at each hold point interval by the Project Arborist)

Project Arborist Requirements	
1.	Pre-Start Inspection and Audit of Tree Protection Fencing Before Works Commence
2.	Any required Tree Works to be undertaken by a minimum AQF Level 3 Arborist under the Supervision of the Project Arborist (Min AQF Level 5). Tree Services Company to be a member of Queensland Arboricultural Association or Arboriculture Australia.
3.	All works within the Tree Protection Zones of the retained vegetation to be supervised by the Project Arborist (Min AQF Level 5). Audit Reports to be completed and submitted by the Project Arborist. Any below ground incursion to be water excavated under low pressure, under the supervision of the Project Arborist.
4.	All works to be excluded from the Structural Root Zone (SRZ) and supervised if located within Tree Protection Zone.
5.	The Project Arborist to be consulted if changes to plans are made that affect any retained vegetation.
6.	At the Completion of works, Project Arborist to undertake a site assessment and an audit report compile of any further remedial actions required.

## Examples of Amended Protection Measures

Examples	Photos
<p>Example of the use low pressure water excavation for the installation of conduits</p>	
<p>Example of the use of black plastic to line pier holes</p>	
<p>Example of the use of black plastic to line concrete</p>	
<p>Example of the use of Structural Soil. Structural Soils – (Source: Cornell University)</p>	 <p data-bbox="1007 1989 1294 2018">Fig. 1.7 Conceptual diagram of CU-Structural Soil™ including stone-on-stone compaction and soil to interstitial spaces used as a base course for pavements.</p>

## Conclusion

For all retained trees, with due care, implementation of appropriate work methodology as noted in this report and isolation of all TPZs of retained trees from construction works, the potential for ill-effect to retained/affected trees can be minimised in accordance with guidelines of AS4970:2009 – Protection of trees on development sites.

### The following must occur:

NBC / SI NSW approvals must be in place prior to the commencement of any tree work for future construction work. Approvals are required should the Project Arborist prescribe pruning such as crown clean, canopy lift and/or directional pruning.

- Project Arborist must be appointed and engaged to guide the protection of protected trees from project commencement, i.e. during Design Planning and during the construction period until its completion.
- **All Arboricultural reports, TMPs, VMPs & approvals must be included in the CMP**
- Design Plans must be drafted to incorporate raised foundations supported by sleeved pier design or similar low impact design to bridge the roots zone of any development within TPZ's. Exploratory low pressure water excavation is to be undertaken as specified.
- Arborist briefing of all engaged persons on their commencement as well as diligent work practice must occur during all approved future construction work.
- Root disturbance must be minimised to prevent accidental injury, compression and the creation of exposure points to allow future entry of pests and pathogens.
- **All work within any TPZ must be supervised by the Project Arborist.**

All work within TPZs must be carried out with due care to avoid mechanical impact with retained tree/s during the construction phase. Where present existing strip footings or installed pier locations are to be utilised for any replacement of existing fence structures; alternatively, any removal of existing fence structures and new replacement work is to be carried out as detailed above, i.e. new fence foundations should utilise post and rail design with no concreted footing unless authorised by the Project Arborist. Sleeving should be installed to provide an impervious barrier between exposed TPZ perimeter/s and new concreted areas to prevent chemical leeching into the surrounding soil of retained trees.

Reactionary processes, such as the emergence of deadwood, dieback etc. are likely to occur as a result of disturbance and/or injury to any retained tree on a construction site. Amended design plans and construction methodology can serve to avoid or minimise the likely emergence of such issues and therefore their associated future OH&S issues to the future occupants of the new dwellings and or pedestrian or vehicular traffic within the vicinity of retained tree/s. Any required pruning is to be undertaken by a minimum AQF Level 3 Arborist under the supervision of the Project Arborist (AQF Level 5).

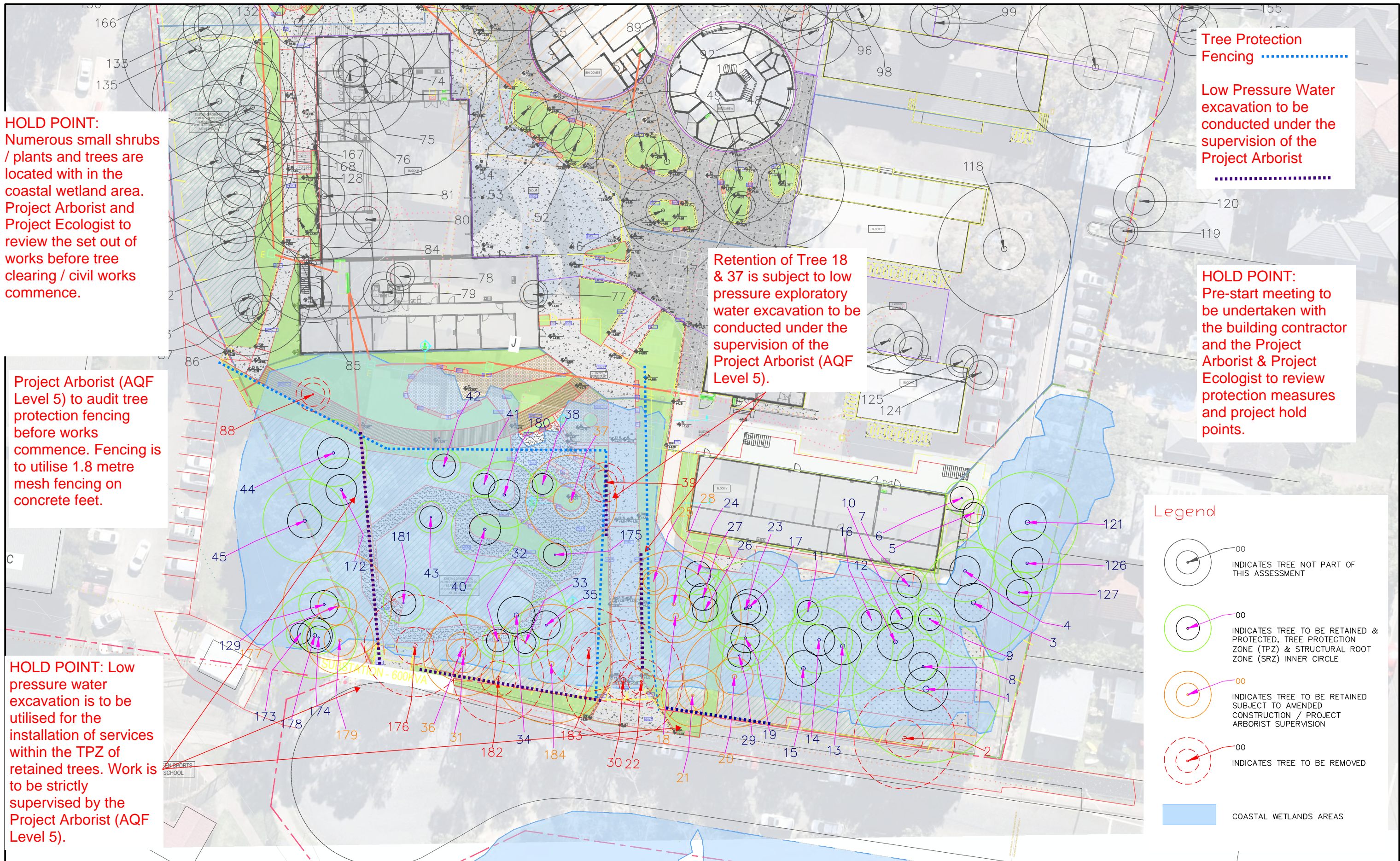
## Tree Locations W/O TPZ



Please Note: Tree Locations are approximate only. Green circles represent TPZ as defined in AS4970 -2009 Protection of trees on development sites

## Tree Locations with Tree Protection Zones





**HOLD POINT:**  
 Numerous small shrubs / plants and trees are located within the coastal wetland area. Project Arborist and Project Ecologist to review the set out of works before tree clearing / civil works commence.

Project Arborist (AQF Level 5) to audit tree protection fencing before works commence. Fencing is to utilise 1.8 metre mesh fencing on concrete feet.

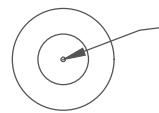
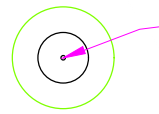
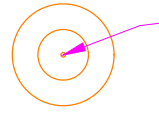
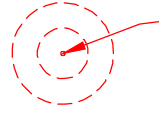
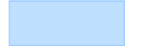
**HOLD POINT:** Low pressure water excavation is to be utilised for the installation of services within the TPZ of retained trees. Work is to be strictly supervised by the Project Arborist (AQF Level 5).

**Tree Protection Fencing** .....  
 Low Pressure Water excavation to be conducted under the supervision of the Project Arborist  
 .....

Retention of Tree 18 & 37 is subject to low pressure exploratory water excavation to be conducted under the supervision of the Project Arborist (AQF Level 5).

**HOLD POINT:**  
 Pre-start meeting to be undertaken with the building contractor and the Project Arborist & Project Ecologist to review protection measures and project hold points.

**Legend**

-  00 INDICATES TREE NOT PART OF THIS ASSESSMENT
-  00 INDICATES TREE TO BE RETAINED & PROTECTED, TREE PROTECTION ZONE (TPZ) & STRUCTURAL ROOT ZONE (SRZ) INNER CIRCLE
-  00 INDICATES TREE TO BE RETAINED SUBJECT TO AMENDED CONSTRUCTION / PROJECT ARBORIST SUPERVISION
-  00 INDICATES TREE TO BE REMOVED
-  COASTAL WETLANDS AREAS

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ISSUE	DESCRIPTION	DATE	DRAWN	AUTH	NOTES
PR7	UPDATE TREES ASSESSED SCOPE	9/9/2022	JA	RR	NARRABEEN NORTH PUBLIC SCHOOL, 6 NAMONA ST., NORTH NARRABEEN NSW 2101
PR8	UPDATE LA BASE	1/11/2022	JA	RR	--
PR9	UPDATE REMOVE/RETAIN	3/11/2022	JA	RR	--
PR10	UPDATE TREES ASSESSED SCOPE	7/11/2022	JA	RR	--

PROJECT	TITLE	DESIGN	DESIGN CHECK
NARRABEEN NORTH PUBLIC SCHOOL	TREE MANAGEMENT PLAN SHEET 1	DESIGNING	DESIGNING
		DRAWN	DRAWING CHECK
		JA	RR
		DATE	DATE
		7/11/2022	7/11/2022
		AUTHORISED FOR ISSUE	REFERENCE NO.
		RR	--
		PROJECT NUMBER / SHEET	SCALE
		0000 / TMP1	1:500
		ISSUE	ORIG. SIZE
		PR10	A3

## Tree Detail

Tree Id	Botanical Name	Common Name	DBH [cm]	TPZ [m]	SRZ (m)	Height [m]	Spread [m]	Est Height to Lowest Branch (m)	Health	Form	STARS - Tree Significance	Tree Retention Value	SULE	Observations
1	<i>Ficus macrophylla</i>	Moreton Bay Fig	88	10.56	3.28	18	20	1	Good	Typical	High Significance	High	2A-2D	Deadwood under 50mm
2	<i>Angophora costata</i>	Smooth-barked Apple Myrtle	60.61	7.27	3.01	20	20	6	Good	Poor	High Significance	High	2A-2D	Pruning for power lines, twisted upper branching.
3	<i>Banksia integrifolia</i>	Coast Banksia	66	7.92	3.06	18	10	3	Good	Typical	High Significance	High	2A-2D	
4	<i>Corymbia citriodora subsp. variegata</i>	Lemon-scented Gum	37	4.44	2.2	18	8	12	Good	Typical	Medium Significance	Medium	2A-2D	
5	<i>Corymbia citriodora subsp. variegata</i>	Lemon-scented Gum	7	2	1.26	7	3	6	Good	Typical	Medium Significance	Medium	2A-2D	
6	<i>Corymbia citriodora subsp. variegata</i>	Lemon-scented Gum	20	2.4	1.97	17	8	7	Good	Typical	Medium Significance	Medium	2A-2D	
7	<i>Acacia elata</i>	Cedar Wattle	22	2.64	2.05	17	7	12	Poor	Typical	Low Significance	Medium	3A-3D	Deadwood under 50mm
8	<i>Eucalyptus robusta</i>	Swamp Mahogany	32	3.84	2.3	17	6	10	Fair	Poor	Low Significance	Medium	3A-3D	Nesting box in tree, tied back to branch union.
9	<i>Corymbia citriodora subsp. variegata</i>	Lemon-scented Gum	19	2.28	1.97	16	5	12	Good	Typical	Medium Significance	Medium	2A-2D	
10	<i>Corymbia citriodora subsp. variegata</i>	Lemon-scented Gum	17	2.04	1.79	15	5	9	Good	Typical	Medium Significance	Medium	2A-2D	
11	<i>Corymbia citriodora subsp. variegata</i>	Lemon-scented Gum	15	2	1.68	17	5	8	Good	Typical	Medium Significance	Medium	2A-2D	
12	<i>Eucalyptus botryoides</i>	Southern Mahogany	58.82	7.06	2.92	20	12	1	Good	Typical	High Significance	High	2A-2D	
13	<i>Melaleuca quinquenervia</i>	Common Paperbark	60	7.2	2.92	21	16	1.5	Good	Typical	High Significance	High	2A-2D	
14	<i>Angophora costata</i>	Smooth-barked Apple Myrtle	40	4.8	2.25	19	14	2	Good	Typical	High Significance	High	2A-2D	Phototropic
15	<i>Eucalyptus botryoides</i>	Southern Mahogany	55	6.6	2.74	19	6	12	Good	Typical	High Significance	High	2A-2D	Heavily crown raised, nest box
16	<i>Corymbia citriodora subsp. variegata</i>	Lemon-scented Gum	13	2	1.68	8	4	7	Good	Typical	Medium Significance	Medium	2A-2D	



Tree Id	Botanical Name	Common Name	DBH [cm]	TPZ [m]	SRZ (m)	Height [m]	Spread [m]	Est Height to Lowest Branch (m)	Health	Form	STARS - Tree Significance	Tree Retention Value	SULE	Observations
17	<i>Angophora costata</i>	Smooth-barked Apple Myrtle	55	6.6	2.78	22	20	2	Good	Typical	High Significance	High	2A-2D	
18	<i>Eucalyptus botryoides</i>	Southern Mahogany	78	9.36	3.01	24	22	6	Good	Typical	High Significance	High	2A-2D	Epicormic growth
19	<i>Banksia integrifolia</i>	Coast Banksia	34	4.08	2.23	17	10	3	Good	Typical	Medium Significance	High	2A-2D	
20	<i>Banksia integrifolia</i>	Coast Banksia	61	7.32	2.98	20	11	5	Good	Typical	High Significance	High	2A-2D	Wound
21	<i>Eucalyptus botryoides</i>	Southern Mahogany	37	4.44	2.47	19	16	15	Good	Typical	High Significance	High	2A-2D	Epicormic growth
22	<i>Cinnamomum camphora</i>	Camphor Laurel	26.94	3.23	1.91	8	12	1.5	Good	Poor	Low Significance	Low	2A-2D	Epicormic growth
23	<i>Banksia serrata</i>	Saw Leaf Banksia	35	4.2	2.37	12	8	2	Good	Typical	Medium Significance	Medium	2A-2D	
24	<i>Casuarina cunninghamiana</i>	River She-oak	25	3	2.02	16	8	2	Good	Typical	Medium Significance	Medium	2A-2D	
25	<i>Banksia integrifolia</i>	Coast Banksia	14	2	1.61	5	4	2	Good	Typical	Medium Significance	Medium	2A-2D	Phototropic
26	<i>Banksia ericifolia</i>	Golden Banksia	25	3	1.85	4	6	1	Good	Poor	Medium Significance	Medium	2A-2D	Phototropic, suppressed
27	<i>Banksia integrifolia</i>	Coast Banksia	29	3.48	2.1	13	6	4	Good	Typical	Medium Significance	Medium	2A-2D	
28	<i>Eucalyptus botryoides</i>	Southern Mahogany	46	5.52	2.69	20	16	2	Good	Typical	High Significance	High	2A-2D	Epicormic growth
29	<i>Banksia integrifolia</i>	Coast Banksia	20	2.4	1.75	6	4	2	Good	Typical	Medium Significance	Medium	2A-2D	Group of coast banksia and tea tree.
30	<i>Eucalyptus botryoides</i>	Southern Mahogany	71.06	8.53	3.14	23	20	6	Good	Typical	High Significance	High	2A-2D	
31	<i>Banksia integrifolia</i>	Coast Banksia	48	5.76	2.51	17	8	5	Good	Typical	High Significance	High	2A-2D	Deadwood over 50mm
32	<i>Brachychiton acerifolius</i>	Flame Tree	18	2.16	1.68	9	6	4	Good	Typical	Medium Significance	Medium	2A-2D	
33	<i>Brachychiton acerifolius</i>	Flame Tree	16	2	1.65	9	4	2	Good	Typical	Medium Significance	Medium	2A-2D	
34	<i>Eucalyptus botryoides</i>	Southern Mahogany	60	7.2	2.67	16	8	7	Fair	Typical	Low Significance	Medium	3A-3D	

Tree Id	Botanical Name	Common Name	DBH [cm]	TPZ [m]	SRZ (m)	Height [m]	Spread [m]	Est Height to Lowest Branch (m)	Health	Form	STARS - Tree Significance	Tree Retention Value	SULE	Observations
35	<i>Banksia integrifolia</i>	Coast Banksia	32	3.84	2.15	5	1	N/A	Very Poor	Poor	Low Significance	Low	4A-4D	Head died out
36	<i>Banksia integrifolia</i>	Coast Banksia	40	4.8	2.25	20	8	7	Fair	Poor	Low Significance	Medium	3A-3D	Broken limbs, deadwood over 50mm, dieback, epicormic growth
37	<i>Angophora costata</i>	Smooth-barked Apple Myrtle	54.41	6.53	2.74	20	20	1	Good	Typical	High Significance	High	2A-2D	Low branches over demountable.
38	<i>Cinnamomum camphora</i>	Camphor Laurel	10	2	1.4	6	2	3	Good	Typical	Low Significance	Low	2A-2D	Group of self sown camphor
39	<i>Glochidion ferdinandi</i>	Cheese Tree	23.6	2.83	1.82	8	10	2	Good	Typical	Medium Significance	Medium	2A-2D	Included bark
40	<i>Livistona australis</i>	Cabbage Fan-palm	40	4.8	2.25	12	6	5	Good	Typical	High Significance	High	1A-1D	
41	<i>Acacia sp.</i>	Wattle	16	2	1.53	12	6	3	Good	Typical	Medium Significance	Medium	2A-2D	
42	<i>Elaeocarpus sp.</i>	Blue Berry Ash	20	2.4	1.68	5	4	3	Good	Typical	Medium Significance	Medium	2A-2D	
43	<i>Glochidion ferdinandi</i>	Cheese Tree	19	2.28		14	14	2	Good	Typical	Medium Significance	Medium	2A-2D	
44	<i>Eucalyptus botryoides</i>	Southern Mahogany	40	4.8	2.39	20	12	8	Good	Typical	High Significance	High	2A-2D	
45	<i>Ficus benjamina</i>	Weeping Fig	50	6	2.47	20	20	1	Good	Typical	Medium Significance	Medium	2A-2D	Just outside fence.
46	<i>Eucalyptus scoparia</i>	Wallangarra Gum	49	5.88	2.67	18	12	9	Good	Typical	Medium Significance	Medium	2A-2D	Deadwood over 50mm
47	<i>Eucalyptus resinifera</i>	Red Mahogany	12.21	2		4	6	1	Good	Poor	Low Significance	Low	2A-2D	Regrowth.
48	<i>Eucalyptus resinifera</i>	Red Mahogany	76	9.12	3.04	20	16	9	Good	Typical	High Significance	High	2A-2D	Epicormic growth
49	<i>Eucalyptus resinifera</i>	Red Mahogany	54	6.48	2.78	20	24	4	Good	Typical	High Significance	High	2A-2D	Epicormic growth
50	<i>Eucalyptus botryoides</i>	Southern Mahogany	84	10.08	3.17	18	14	7	Good	Typical	High Significance	High	2A-2D	Habitat box

Tree Id	Botanical Name	Common Name	DBH [cm]	TPZ [m]	SRZ (m)	Height [m]	Spread [m]	Est Height to Lowest Branch (m)	Health	Form	STARS - Tree Significance	Tree Retention Value	SULE	Observations
51	<i>Eucalyptus botryoides</i>	Southern Mahogany	48	5.76	2.67	17	6	6	Good	Typical	High Significance	High	2A-2D	
52	<i>Glochidion ferdinandi</i>	Cheese Tree	32	3.84	2.15	14	8	1	Good	Typical	Medium Significance	Medium	2A-2D	Included bark
53	<i>Eucalyptus botryoides</i>	Southern Mahogany	32	3.84	2.3	16	14	1.5	Fair	Poor	Medium Significance	Medium	2A-2D	Deadwood over 50mm
54	<i>Eucalyptus botryoides</i>	Southern Mahogany	58	6.96	2.74	21	14	2	Good	Typical	High Significance	High	2A-2D	
55	<i>Eucalyptus botryoides</i>	Southern Mahogany	46.1	5.53	2.57	14	18	3	Good	Typical	High Significance	High	2A-2D	
56	<i>Eucalyptus botryoides</i>	Southern Mahogany	68	8.16	2.93	24	14	8	Good	Typical	High Significance	High	2A-2D	Dead section (old branch) has cavity.
57	<i>Populus deltoides</i>	Cotton Wood	46	5.52	2.45	12	7	2	Good	Typical	High Significance	High	2A-2D	
58	<i>Eucalyptus botryoides</i>	Southern Mahogany	64	7.68	3.01	26	8	2	Good	Typical	High Significance	High	2A-2D	
59	<i>Ficus microcarpa</i>	Hills Weeping Fig	147	15	3.89	16	34	6	Good	Typical	High Significance	High	2A-2D	
60	<i>Harpephyllum caffrum</i>	Kaffir Plum	78.29	9.39	3.17	18	16	2	Good	Typical	High Significance	High	2A-2D	
61	<i>Lophostemon confertus</i>	Queensland Brush Box	80	9.6	3.12	19	16	4	Good	Typical	High Significance	High	2A-2D	Habitat box in canopy
62	<i>Eucalyptus sp.</i>	Gum	38	4.56	2.39	18	8	6	Good	Typical	High Significance	High	2A-2D	
63	<i>Eucalyptus scoparia</i>	Wallangarra Gum	52	6.24	2.71	18	8	10	Good	Typical	High Significance	High	2A-2D	Scratches up stem
64	<i>Eucalyptus robusta</i>	Swamp Mahogany	46	5.52	2.71	18	12	6	Good	Typical	High Significance	High	2A-2D	Epicormic growth
65	<i>Glochidion ferdinandi</i>	Cheese Tree	29.83	3.58	2.2	14	8	2	Fair	Typical	Medium Significance	Medium	2A-2D	Included bark
66	<i>Syagrus romanzoffiana</i>	Queen Palm	30	3.6	2	10	4	3	Fair	Poor	Low Significance	Low	4A-4D	Suppressed
67	<i>Glochidion ferdinandi</i>	Cheese Tree	51	6.12	2.67	16	12	2	Good	Typical	High Significance	High	2A-2D	

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68	<i>Eucalyptus scoparia</i>	Wallangarra Gum	57	6.84	2.73	16	7	2	Poor	Poor	Low Significance	Medium	3A-3D	Borers, deadwood, epicormic growth, kino flow, wound
69	<i>Banksia integrifolia</i>	Coast Banksia	76.58	9.19	2.97	20	20	3	Good	Typical	Medium Significance	Medium	2A-2D	Kino flow, heavily pruned. Trifurcation at ground level.
70	<i>Glochidion ferdinandi</i>	Cheese Tree	21	2.52	1.82	12	10	1	Good	Typical	Medium Significance	Medium	2A-2D	Included bark
71	<i>Acacia elata</i>	Cedar Wattle	37.74	4.53	2.3	14	10	2	Good	Typical	Low Significance	Medium	2A-2D	
72	<i>Eucalyptus saligna</i>	Sydney Blue Gum	93	11.16	3.31	12	2	6	Fair	Poor	Low Significance	Low	4A-4D	Habitat features, previously lopped (habitat pruned)
73	<i>Pinus radiata</i>	Monterey Pine	117	14.04	3.72	21	18	10	Good	Typical	High Significance	High	2A-2D	Broken limbs, deadwood over 50mm
74	<i>Pinus radiata</i>	Monterey Pine	67	8.04	3	22	16	10	Good	Typical	High Significance	High	2A-2D	
75	<i>Glochidion ferdinandi</i>	Cheese Tree	58.71	7.05	2.65	16	20	3	Good	Typical	High Significance	High	2A-2D	Sections of decay in lower stem, epicormic growth
76	<i>Elaeocarpus sp.</i>	Blue Berry Ash	20	2.4	1.68	6	4	0	Good	Typical	Medium Significance	Medium	2A-2D	
77	<i>Howea forsteriana</i>	Kentia Palm	10	2	1.26	6	5	2	Good	Typical	Medium Significance	Medium	2A-2D	
78	<i>Syzygium sp.</i>	Lilly Pilly	12.81	2	1.68	6	3	0	Fair	Typical	Medium Significance	Medium	2A-2D	
79	<i>Cupaniopsis anacardioides</i>	Tuckeroo	24	2.88	2.1	7	6	1	Good	Typical	Medium Significance	Medium	2A-2D	Nearly all canopy over classroom
80	<i>Angophora costata</i>	Smooth-barked Apple Myrtle	28	3.36	2.05	12	8	3	Good	Typical	High Significance	High	2A-2D	
81	<i>Eucalyptus punctata</i>	Grey Gum	76	9.12	3.22	24	18	7	Good	Typical	High Significance	High	2A-2D	
82	<i>Glochidion ferdinandi</i>	Cheese Tree	71	8.52	2.95	20	20	1	Good	Typical	High Significance	High	2A-2D	Tip of main leader has died back

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83	<i>Glochidion ferdinandi</i>	Cheese Tree	71.4	8.57	3.11	24	20	5	Good	Poor	Low Significance	Low	2A-2D	Co-dominant limbs, head died out
84	<i>Eucalyptus sideroxylon</i>	Red Ironbark	45	5.4	2.47	24	8	10	Good	Typical	High Significance	High	2A-2D	Deadwood under 50mm
85	<i>Cinnamomum camphora</i>	Camphor Laurel	24	2.88	2	10	7	8	Good	Typical	Low Significance	Low	2A-2D	
86	<i>Glochidion ferdinandi</i>	Cheese Tree	21	2.52	1.82	6	5	7	Good	Typical	Medium Significance	Medium	2A-2D	Phototropic, suppressed
87	<i>Glochidion ferdinandi</i>	Cheese Tree				4	1	1	Good	Typical	Medium Significance	Medium	2A-2D	
88	<i>Cupaniopsis anacardioides</i>	Tuckeroo	20.32	2.44	1.68	6	6	0	Good	Typical	Medium Significance	Medium	2A-2D	
89	<i>Eucalyptus botryoides</i>	Southern Mahogany	53	6.36	2.69	16	14	3	Good	Poor	Medium Significance	Medium	2A-2D	Co-dominant limbs, dieback, epicormic growth
90	<i>Eucalyptus botryoides</i>	Southern Mahogany	21	2.52	2	6	5	2	Good	Typical	Medium Significance	Medium	2A-2D	
91	<i>Eucalyptus botryoides</i>	Southern Mahogany	12	2	1.53	6	3	8	Good	Poor	Low Significance	Low	3A-3D	Previously removed leader
92	<i>Eucalyptus botryoides</i>	Southern Mahogany	40	4.8	2.39	10	10	7	Good	Typical	Medium Significance	Medium	2A-2D	
93	<i>Eucalyptus botryoides</i>	Southern Mahogany	50	6	2.57	14	18	6	Good	Typical	Medium Significance	Medium	2A-2D	Deadwood over 50mm, suppressed
94	<i>Eucalyptus botryoides</i>	Southern Mahogany	65	7.8	2.88	14	18	6	Good	Typical	High Significance	High	2A-2D	Deadwood over 50mm, epicormic growth
95	<i>Eucalyptus robusta</i>	Swamp Mahogany	73	8.76	3.01	20	16	2	Good	Typical	High Significance	High	2A-2D	Deadwood under 50mm
96	<i>Eucalyptus botryoides</i>	Southern Mahogany	42	5.04	2.37	18	8	12	Good	Typical	High Significance	Medium	2A-2D	
97	<i>Eucalyptus botryoides</i>	Southern Mahogany	56	6.72	2.78	18	8	17	Fair	Poor	Low Significance	High	3A-3D	
98	<i>Acacia sp.</i>	Wattle	26	3.12	2.05	12	8	1	Good	Typical	Medium Significance	Medium	2A-2D	

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99	<i>Acacia sp.</i>	Wattle	30	3.6	2	10	8	1	Good	Typical	Medium Significance	Medium	2A-2D	
100	<i>Eucalyptus botryoides</i>	Southern Mahogany	42	5.04	2.55	13	12	7	Fair	Typical	High Significance	High	2A-2D	Deadwood under 50mm, epicormic growth, suppressed
101	<i>Acacia sp.</i>	Wattle	27	3.24	2.15	10	9	4	Good	Typical	Medium Significance	Medium	2A-2D	Co-dominant limbs
102	<i>Elaeocarpus reticulatus</i>	Blueberry Ash	10	2	1.36	6	5	1	Fair	Typical	Medium Significance	Medium	2A-2D	
103	<i>Eucalyptus scoparia</i>	Wallangarra Gum	55	6.6	2.81	18	16	10	Good	Typical	High Significance	High	2A-2D	Wound
104	<i>Melaleuca bracteata</i>	Black Tea-tree	10	2	1.49	5	4	3	Good	Poor	Low Significance	Low	2A-2D	
105	<i>Eucalyptus botryoides</i>	Southern Mahogany	25	3	1.94	7	8	1	Fair	Poor	Low Significance	Medium	3A-3D	
106	<i>Eucalyptus botryoides</i>	Southern Mahogany	40	4.8	2.25	8	6	8	Poor	Poor	Low Significance	Remove	4A-4D	Head died out
107	<i>Melaleuca quinquenervia</i>	Common Paperbark	79.85	9.58	3.47	14	18	1	Good	Typical	High Significance	High	2A-2D	Low sprawling specimen. Low limbs will require removal to allow assess for demountable. On site staff made aware.
108	<i>Eucalyptus botryoides</i>	Southern Mahogany	70	8.4	3.03	17	9	2	Good	Typical	High Significance	High	2A-2D	
109	<i>Eucalyptus robusta</i>	Swamp Mahogany	52	6.24	2.69	18	18	6	Good	Typical	High Significance	High	2A-2D	Deadwood over 50mm
110	<i>Eucalyptus robusta</i>	Swamp Mahogany	64	7.68	2.95	16	16	7	Good	Typical	High Significance	High	2A-2D	Deadwood over 50mm, epicormic growth
111	<i>Casuarina glauca</i>	Grey She-oak	40	4.8	2.51	17	7	5	Good	Typical	High Significance	High	2A-2D	Co-dominant limbs
112	<i>Eucalyptus robusta</i>	Swamp Mahogany	48	5.76	2.59	17	20	3	Good	Typical	High Significance	High	2A-2D	Deadwood under 50mm , epicormic growth
113	<i>Cinnamomum camphora</i>	Camphor Laurel	144	15	3.87	22	18	4	Fair	Typical	Low Significance	Low	2A-2D	Deadwood over 50mm, epicormic growth
114	<i>Mangifera indica</i>	Mango	30	3.6	2	6	8	1	Good	Typical	Low Significance	Low	2A-2D	
115	<i>Eucalyptus robusta</i>	Swamp Mahogany	47	5.64	2.55	20	20	5	Good	Typical	High Significance	High	2A-2D	Co-dominant limbs, epicormic growth

Tree Id	Botanical Name	Common Name	DBH [cm]	TPZ [m]	SRZ (m)	Height [m]	Spread [m]	Est Height to Lowest Branch (m)	Health	Form	STARS - Tree Significance	Tree Retention Value	SULE	Observations
116	<i>Eucalyptus botryoides</i>	Southern Mahogany	40	4.8	2.47	18	14	7	Good	Typical	High Significance	High	2A-2D	Deadwood over 50mm; group of trees. Acacia sp. (one dead and requires removal)
117	<i>Corymbia citriodora subsp. variegata</i>	Lemon-scented Gum	95	11.4	3.28	21	20	4	Good	Typical	High Significance	High	1A-1D	
118	<i>Corymbia citriodora subsp. variegata</i>	Lemon-scented Gum	80	9.6	3.17	21	24	5	Good	Typical	High Significance	High	1A-1D	Deadwood under 50mm
119	<i>Persea americana</i>	Avocado	17	2.04	1.85	8	6	3	Good	Typical	Low Significance	Low	2A-2D	
120	<i>Eucalyptus sp.</i>	Gum	32	3.84	2.3	18	10	7	Good	Typical	Medium Significance	Medium	2A-2D	Neighbour's tree, minor branch overhang into site only
121	<i>Eucalyptus saligna</i>	Sydney Blue Gum	60	7.2	2.93	26	20	6	Good	Typical	High Significance	High	2A-2D	Neighbour's tree, low limb overhangs subject site driveway
122	<i>Banksia serrata</i>	Saw Leaf Banksia	40	4.8	2.49	6	6	4	Good	Typical	Medium Significance	Medium	2A-2D	
123	<i>Cupressus sempervirens 'Stricta'</i>	Pencil Pine	21	2.52	1.75	10	3	5	Good	Poor	Low Significance	Low	2A-2D	
124	<i>Syagrus romanzoffiana</i>	Queen Palm	21	2.52	2.05	7	6	7	Fair	Typical	Low Significance	Low	2A-2D	
125	<i>Plumeria alba</i>	Frangipani	19.21	2.31	1.82	6	8	1	Good	Typical	Low Significance	Low	2A-2D	
126	<i>Casuarina glauca</i>	Grey She-oak	40	4.8	2.47	20	8	15	Good	Poor	Medium Significance	Medium	2A-2D	
127	<i>Callistemon citrinus</i>	Crimson Bottle Brush	25	3	2	8	6	5	Good	Typical	Medium Significance	Medium	2A-2D	
128	<i>Glochidion ferdinandi</i>	Cheese Tree	45	5.4	2.47	6	6	5	Good	Typical	High Significance	High	2A-2D	Group of trees including self seeding.
129	<i>Banksia integrifolia</i>	Coast Banksia	30	3.6	2.25	14	4	3	Good	Typical	High Significance	High	2A-2D	
130	<i>Glochidion ferdinandi</i>	Cheese Tree	90	10.8	3.31	22	24	8	Poor	Typical	Low Significance	High	3A-3D	Co-dominant limbs, dieback, epicormic growth, head died out, included bark
131	<i>Glochidion ferdinandi</i>	Cheese Tree	53.38	6.41	2.53	18	16	8	Fair	Typical	High Significance	High	2A-2D	
132	<i>Brachychiton acerifolius</i>	Flame Tree	45	5.4	2.53	20	10	1	Good	Typical	Low Significance	Low	2A-2D	
133	<i>Cinnamomum camphora</i>	Camphor Laurel	30	3.6	2.25	17	15	5	Good	Typical	Low Significance	Low	2A-2D	Dieback, epicormic growth

Tree Id	Botanical Name	Common Name	DBH [cm]	TPZ [m]	SRZ (m)	Height [m]	Spread [m]	Est Height to Lowest Branch (m)	Health	Form	STARS - Tree Significance	Tree Retention Value	SULE	Observations
134	<i>Glochidion ferdinandi</i>	Cheese Tree	80	9.6	3.01	18	10	1.5	Good	Typical	High Significance	High	2A-2D	
135	<i>Glochidion ferdinandi</i>	Cheese Tree	90	10.8	3.44	22	24	1.5	Excellent	Typical	High Significance	High	2A-2D	
136	Group of trees	Group of trees						0.5	Good	Typical	Medium Significance	Medium	2A-2D	Group of trees
137	<i>Cinnamomum camphora</i>	Camphor Laurel	120	14.4	3.57	6	5	N/A	Dead	Dead	Low Significance	Low	2A-2D	Lopped
138	Acacia sp.	Wattle	23.32	2.8	1.88	8	7	1	Fair	Poor	Medium Significance	Medium	2A-2D	
139	<i>Eucalyptus robusta</i>	Swamp Mahogany	8	2	1.36	7	4	1	Fair	Typical	Medium Significance	Medium	2A-2D	
140	Acacia sp.	Wattle	28.98	3.48	2.18	10	12	2	Good	Typical	Medium Significance	Medium	2A-2D	
141	<i>Banksia integrifolia</i>	Coast Banksia	35.72	4.29	2.15	12	9	1	Good	Poor	Medium Significance	Medium	2A-2D	Multi from root crown.
142	<i>Casuarina glauca</i>	Grey She-oak	20	2.4	1.82	11	5	1	Good	Typical	Medium Significance	Medium	2A-2D	
143	<i>Eucalyptus robusta</i>	Swamp Mahogany	22	2.64	1.82	8	5	1	Good	Typical	Medium Significance	Medium	2A-2D	
144	<i>Eucalyptus robusta</i>	Swamp Mahogany	24	2.88	1.94	14	6	2	Good	Typical	Medium Significance	Medium	2A-2D	
145	<i>Casuarina glauca</i>	Grey She-oak	15.62	2	1.82	14	6	1	Good	Typical	Medium Significance	Medium	2A-2D	
146	<i>Casuarina glauca</i>	Grey She-oak	24	2.88	1.94	13	6	1	Good	Typical	Medium Significance	Medium	2A-2D	
147	<i>Eucalyptus robusta</i>	Swamp Mahogany	24	2.88	1.88	12	4	1	Good	Typical	Medium Significance	Medium	2A-2D	
148	<i>Casuarina glauca</i>	Grey She-oak	22	2.64	1.82	8	4	1	Good	Typical	Medium Significance	Medium	2A-2D	
149	<i>Eucalyptus robusta</i>	Swamp Mahogany	8	2	1.26	6	3	3	Good	Typical	Medium Significance	Medium	2A-2D	
150	<i>Eucalyptus saligna</i>	Sydney Blue Gum	46	5.52	2.55	16	14	2	Good	Typical	Medium Significance	Medium	3A-3D	
151	<i>Jacaranda mimosifolia</i>	Jacaranda	12.81	2	1.75	6	8	2	Fair	Typical	Low Significance	Low	2A-2D	
152	<i>Syagrus romanzoffiana</i>	Queen Palm	30	3.6	2	12	6	4	Good	Typical	Low Significance	Low	2A-2D	
153	<i>Syagrus romanzoffiana</i>	Queen Palm	30	3.6	2	12	6	4	Good	Typical	Low Significance	Low	2A-2D	



Tree Id	Botanical Name	Common Name	DBH [cm]	TPZ [m]	SRZ (m)	Height [m]	Spread [m]	Est Height to Lowest Branch (m)	Health	Form	STARS - Tree Significance	Tree Retention Value	SULE	Observations
154	<i>Syagrus romanzoffiana</i>	Queen Palm	30	3.6	2	12	6	4	Good	Typical	Low Significance	Low	2A-2D	
155	<i>Syagrus romanzoffiana</i>	Queen Palm	30	3.6	2	12	6	4	Good	Typical	Low Significance	Low	2A-2D	
156	<i>Syagrus romanzoffiana</i>	Queen Palm	30	3.6	2	12	6	4	Good	Typical	Low Significance	Low	2A-2D	
157	<i>Cupaniopsis anacardioides</i>	Tuckeroo	41.23	4.95	2.57	12	16	1	Good	Typical	High Significance	High	2A-2D	
158	<i>Acacia elata</i>	Cedar Wattle	60	7.2	2.88	17	14	3	Good	Poor	Medium Significance	High	3A-3D	
159	<i>Phoenix canariensis</i>	Canary Island Date Palm	75	9	2.93	10	8	3	Good	Typical	Medium Significance	Medium	2A-2D	
160	<i>Glochidion ferdinandi</i>	Cheese Tree	45	5.4	2.51	14	14	2	Good	Typical	High Significance	High	2A-2D	
161	<i>Glochidion ferdinandi</i>	Cheese Tree	28	3.36	2.1	15	8	3	Good	Typical	High Significance	High	2A-2D	
162	<i>Acacia elata</i>	Cedar Wattle	53	6.36	2.59	16	14	2	Good	Typical	Medium Significance	High	3A-3D	
163	<i>Glochidion ferdinandi</i>	Cheese Tree	24	2.88	1.94	12	8	1	Good	Typical	High Significance	High	2A-2D	
164	<i>Cinnamomum camphora</i>	Camphor Laurel	24	2.88	1.94	10	8	1	Good	Typical	Low Significance	Low	2A-2D	
165	<i>Glochidion ferdinandi</i>	Cheese Tree	34	4.08	2.2	16	10	1	Good	Typical	High Significance	High	2A-2D	
166	<i>Glochidion ferdinandi</i>	Cheese Tree	26	3.12	2	14	8	1	Good	Typical	High Significance	High	2A-2D	
167	<i>Glochidion ferdinandi</i>	Cheese Tree	40.31	4.84	2.13	14	10	2	Good	Typical	High Significance	High	2A-2D	
168	<i>Glochidion ferdinandi</i>	Cheese Tree	39.29	4.71	2.2	12	10	3	Good	Typical	High Significance	High	2A-2D	
169	Various spp.	Group of Trees	26	3.12	2.1	12	8	1	Good	Typical	High Significance	High	2A-2D	Group of cheese trees. Several
170	<i>Eucalyptus</i> sp.	Gum	40	4.8	2.47	16	10	8	Fair	Poor	High Significance	High	2A-2D	Fruiting bodies at base, recommend further investigation
171	<i>Eucalyptus</i> sp.	Gum	35	4.2	2.2	14	10	7	Fair	Poor	High Significance	High	2A-2D	Fruiting bodies at base, recommend further investigation
172	<i>Eucalyptus</i> sp.	Gum	38.42	4.61	2.2	14	10	7	Good	Typical	High Significance	High	2A-2D	Two trees shared root crown.
173	<i>Pittosporum undulatum</i>	Sweet Pittosporum	14	2	1.61	6	6	1	Fair	Typical	High Significance	High	2A-2D	

Tree Id	Botanical Name	Common Name	DBH [cm]	TPZ [m]	SRZ (m)	Height [m]	Spread [m]	Est Height to Lowest Branch (m)	Health	Form	STARS - Tree Significance	Tree Retention Value	SULE	Observations
174	<i>Osmanthus fragrans</i>	Fragrant Olive	20	2.4	1.68	5	2	1	Fair	Poor	Low Significance	Low	2A-2D	
175	<i>Archontophoenix cunninghamiana</i>	Bangalow Palm	20	2.4	1.68	8	4	6	Good	Typical	Medium Significance	Medium	2A-2D	
176	<i>Eucalyptus botryoides</i>	Southern Mahogany	61.03	7.32	2.69	17	14	1	Good	Typical	High Significance	High	2A-2D	
177	<i>Eucalyptus botryoides</i>	Southern Mahogany	65	7.8	2.85	16	14	1	Good	Typical	High Significance	High	2A-2D	Located outside fence.
178	<i>Eucalyptus robusta</i>	Swamp Mahogany	51.48	6.18	2.49	16	14	2	Good	Typical	High Significance	High	2A-2D	
179	<i>Banksia integrifolia</i>	Coast Banksia	40	4.8	2.25	16	16	4	Good	Typical	High Significance	High	2A-2D	
180	<i>Livistona australis</i>	Cabbage Fan-palm	40	4.8	2.25	8	4	2	Good	Typical	High Significance	High	2A-2D	
181	<i>Glochidion ferdinandi</i>	Cheese Tree	24	2.88	1.94	10	8	1	Good	Typical	High Significance	High	2A-2D	
182	<i>Eucalyptus robusta</i>	Swamp Mahogany	54	6.48	2.25	17	14	5	Good	Typical	High Significance	High	2A-2D	
183	<i>Banksia integrifolia</i>	Coast Banksia	50	6	2.47	16	10	3	Good	Typical	High Significance	High	2A-2D	
184	<i>Eucalyptus botryoides</i>	Southern Mahogany	71.06	8.53	3.12	19	16	3	Good	Typical	High Significance	High	2A-2D	

Table Legend:			
Health	Form	Aged Class	Further Detail
Good: Trees foliage is in exceptional condition and can be considered an excellent specimen of its species. No pests or diseases are present.	Good: Trees structure is exceptional and can be considered an excellent specimen of its species. No visible defects are present.	Juvenile: Tree will generally grow rapidly in this phase of its life cycle.	Diameter at Breast Height (DBH) measured at 1.4m above ground level. Diameter at Root Flare (DRF) measured at the base of the tree, at the trunk / root system transition zone. Diameter = circumference divided by $\pi$
Fair: Trees foliar condition is satisfactory but may be exhibiting some signs of stress such as tip dieback or chlorosis, pests or diseases may be present but not adversely affecting the tree.	Typical: Trees structure is normal for the species; some minor structural constraints may be present.	Mature: Tree has reached maturity and is producing flowers, fruits and seeds. Tree continues to grow.	Tree Protection Zone (TPZ) defined as metres radius. Calculated being $DBH \times 12$ (minimum 2.0m and no greater than 15m).
Poor: Foliage density is sparse or largely discoloured, tree health is at or approaching a critical value which may be irreversible, pests or diseases are highly prevalent throughout the crown.	Poor: Structure is a poor example of its species and exhibits a combination of structural issues.	Full to Late Maturity: Tree has reached the maximum height for its species, elongation has stopped but the trunk continues to thicken, overall growth rate is starting to slow, foliar density may be starting to thin.	Structural Root Zone (SRZ) displaced as metres radius. Calculation being $(DRF \times 50)^{0.42} \times 0.64$ (never less than 1.5m or greater than 15m).
Dead: Tree is in advanced decline or completely dead.	Dead: Tree is in advanced decline or completely dead.	Senescent: Tree has / is starting to retract in size through dieback and shedding of limbs. Trees in this age class may be ecologically valuable, as their structure contains habitat necessary for native fauna.	

## Tree Recommendations

Tree Id	Botanical Name	Common Name	DBH [cm]	TPZ [m]	Impact	Recommendations*
1	<i>Ficus macrophylla</i>	Moreton Bay Fig	88	10.56		Retain and protect
2	<i>Angophora costata</i>	Smooth-barked Apple Myrtle	60.61	7.27	Major – power infrastructure	Remove and replaced in accordance with landscaping plans
3	<i>Banksia integrifolia</i>	Coast Banksia	66	7.92		Retain and protect
4	<i>Corymbia citriodora subsp. variegata</i>	Lemon-scented Gum	37	4.44		Retain and protect
5	<i>Corymbia citriodora subsp. variegata</i>	Lemon-scented Gum	7	2		Retain and protect
6	<i>Corymbia citriodora subsp. variegata</i>	Lemon-scented Gum	20	2.4		Retain and protect
7	<i>Acacia elata</i>	Cedar Wattle	22	2.64		Retain and protect
8	<i>Eucalyptus robusta</i>	Swamp Mahogany	32	3.84		Retain and protect
9	<i>Corymbia citriodora subsp. variegata</i>	Lemon-scented Gum	19	2.28		Retain and protect
10	<i>Corymbia citriodora subsp. variegata</i>	Lemon-scented Gum	17	2.04		Retain and protect
11	<i>Corymbia citriodora subsp. variegata</i>	Lemon-scented Gum	15	2		Retain and protect
12	<i>Eucalyptus botryoides</i>	Southern Mahogany	58.82	7.06		Retain and protect
13	<i>Melaleuca quinquenervia</i>	Common Paperbark	60	7.2		Retain and protect
14	<i>Angophora costata</i>	Smooth-barked Apple Myrtle	40	4.8		Retain and protect
15	<i>Eucalyptus botryoides</i>	Southern Mahogany	55	6.6		Retain and protect
16	<i>Corymbia citriodora subsp. variegata</i>	Lemon-scented Gum	13	2		Retain and protect
17	<i>Angophora costata</i>	Smooth-barked Apple Myrtle	55	6.6		Retain and protect
18	<i>Eucalyptus botryoides</i>	Southern Mahogany	78	9.36	Major – pathway / haul road cut	Low pressure water excavation to be undertaken along the edge of the cut line to determine the retention of the <i>Subject Tree</i> .
19	<i>Banksia integrifolia</i>	Coast Banksia	34	4.08		Subject to alternate assessment pathway
20	<i>Banksia integrifolia</i>	Coast Banksia	61	7.32	Minor – power infrastructure	Retain and protect, low pressure water excavation to be undertaken for the installation of power infrastructure under the supervision of the Project Arborist (AQF level 5).
21	<i>Eucalyptus botryoides</i>	Southern Mahogany	37	4.44	Major – power infrastructure	Retain and protect, low pressure water excavation to be undertaken for the installation of power infrastructure under the supervision of the Project Arborist (AQF level 5).
22	<i>Cinnamomum camphora</i>	Camphor Laurel	26.94	3.23	Major – pathway	Remove and replaced in accordance with landscaping plans
23	<i>Banksia serrata</i>	Saw Leaf Banksia	35	4.2		Retain and protect
24	<i>Casuarina cunninghamiana</i>	River She-oak	25	3		Retain and protect
25	<i>Banksia integrifolia</i>	Coast Banksia	14	2	Minor – pathway / haul road	Retain and protect, low pressure water excavation to be undertaken along the edge of the cut line under the supervision of the Project Arborist.
26	<i>Banksia ericifolia</i>	Golden Banksia	25	3		Retain and protect
27	<i>Banksia integrifolia</i>	Coast Banksia	29	3.48		Retain and protect
28	<i>Eucalyptus botryoides</i>	Southern Mahogany	46	5.52	Minor – pathways	Retain and protect, low pressure water excavation to be undertaken along the edge of the cut line under the supervision of the Project Arborist.
29	<i>Banksia integrifolia</i>	Coast Banksia	20	2.4		Retain and protect
30	<i>Eucalyptus botryoides</i>	Southern Mahogany	71.06	8.53	Major – pathway	Remove and replaced in accordance with landscaping plans
31	<i>Banksia integrifolia</i>	Coast Banksia	48	5.76	Major – power infrastructure	Retain and protect, low pressure water excavation to be undertaken for the installation of power infrastructure under the supervision of the Project Arborist (AQF level 5).

Tree Id	Botanical Name	Common Name	DBH [cm]	TPZ [m]	Impact	Recommendations*
32	<i>Brachychiton acerifolius</i>	Flame Tree	18	2.16		Retain and protect
33	<i>Brachychiton acerifolius</i>	Flame Tree	16	2		Retain and protect
34	<i>Eucalyptus botryoides</i>	Southern Mahogany	60	7.2		Retain and protect
35	<i>Banksia integrifolia</i>	Coast Banksia	32	3.84		Retain and protect
36	<i>Banksia integrifolia</i>	Coast Banksia	40	4.8	Major – power infrastructure	Retain and protect, low pressure water excavation to be undertaken for the installation of power infrastructure under the supervision of the Project Arborist (AQF level 5).
37	<i>Angophora costata</i>	Smooth-barked Apple Myrtle	54.41	6.53	Major – pathways	Retain and protect, low pressure water excavation to be undertaken along the edge of the cut line under the supervision of the Project Arborist.
38	<i>Cinnamomum camphora</i>	Camphor Laurel	10	2		Retain and protect
39	<i>Glochidion ferdinandi</i>	Cheese Tree	23.6	2.83	Major – pathway	Remove and replaced in accordance with landscaping plans
40	<i>Livistona australis</i>	Cabbage Fan-palm	40	4.8		Retain and protect
41	<i>Acacia sp.</i>	Wattle	16	2		Retain and protect
42	<i>Elaeocarpus sp.</i>	Blue Berry Ash	20	2.4		Retain and protect
43	<i>Glochidion ferdinandi</i>	Cheese Tree	19	2.28		Retain and protect
44	<i>Eucalyptus botryoides</i>	Southern Mahogany	40	4.8	Minor – power infrastructure	Retain and protect, low pressure water excavation to be undertaken for the installation of power infrastructure under the supervision of the Project Arborist (AQF level 5).
88	<i>Cupaniopsis anacardioides</i>	Tuckeroo	20.32	2.44	Major – pathway	Remove and replaced in accordance with landscaping plans
121	<i>Eucalyptus saligna</i>	Sydney Blue Gum	60	7.2		Retain and protect
126	<i>Casuarina glauca</i>	Grey She-oak	40	4.8		Retain and protect
127	<i>Callistemon citrinus</i>	Crimson Bottle Brush	25	3		Retain and protect
172	<i>Eucalyptus sp.</i>	Gum	38.42	4.61	Major – power infrastructure	Retain and protect, low pressure water excavation to be undertaken for the installation of power infrastructure under the supervision of the Project Arborist (AQF level 5).
173	<i>Pittosporum undulatum</i>	Sweet Pittosporum	14	2		Retain and protect
174	<i>Osmanthus fragrans</i>	Fragrant Olive	20	2.4		Retain and protect
175	<i>Archontophoenix cunninghamiana</i>	Bangalow Palm	20	2.4		Retain and protect
176	<i>Eucalyptus botryoides</i>	Southern Mahogany	61.03	7.32	Major – power infrastructure	Remove and replaced in accordance with landscaping plans
177	<i>Eucalyptus botryoides</i>	Southern Mahogany	65	7.8	Major – power infrastructure	Retain and protect, low pressure water excavation to be undertaken for the installation of power infrastructure under the supervision of the Project Arborist (AQF level 5).
178	<i>Eucalyptus robusta</i>	Swamp Mahogany	51.48	6.18		Retain and protect
179	<i>Banksia integrifolia</i>	Coast Banksia	40	4.8	Major – power infrastructure	Retain and protect, low pressure water excavation to be undertaken for the installation of power infrastructure under the supervision of the Project Arborist (AQF level 5).
180	<i>Livistona australis</i>	Cabbage Fan-palm	40	4.8		Retain and protect
181	<i>Glochidion ferdinandi</i>	Cheese Tree	24	2.88		Retain and protect
182	<i>Eucalyptus robusta</i>	Swamp Mahogany	54	6.48	Major – power infrastructure	Remove and replaced in accordance with landscaping plans
183	<i>Banksia integrifolia</i>	Coast Banksia	50	6	Major – pathway	Remove and replaced in accordance with landscaping plans
184	<i>Eucalyptus botryoides</i>	Southern Mahogany	71.06	8.53	Major – power infrastructure	Retain and protect, low pressure water excavation to be undertaken for the installation of power infrastructure under the supervision of the Project Arborist (AQF level 5).

\*Project Arborist (AQF Level 5) to be engaged during detailed design through to construction works. Reviews the final footprint of building works including cut / fill, building and services layout.

\*\*Retention of trees is subject to a review of the finalised design, set out and pruning requirements by the Project Arborist (AQF Level 5).

# Tree Protection Measures and Guidelines

**Note 1:** TPZ perimeter fencing should be grouped where perimeters overlap and appropriate.

**Note 2:** Signage is to be installed in accordance with Australian Standard AS 4970-2009 Protection of trees on development sites as illustrated below.

**Protective Fencing**



- LEGEND:**
- Chain wire mesh panels with shade cloth (if required) attached, held in place with concrete feet.
  - Alternative plywood or wooden paneling fence panels. This fencing material also prevents building materials or soil entering the TPZ.
  - Mesh installation across surface of TPZ (at the discretion of the project arboreal). No excavation, construction activity, grass drainage, surface treatment or storage of any kind is permitted within the TPZ.
  - Bracing is permitted within the TPZ. Installation of supports should avoid damaging roots.

Figure 2

**Examples of Trunk, Branch & Ground Protection**

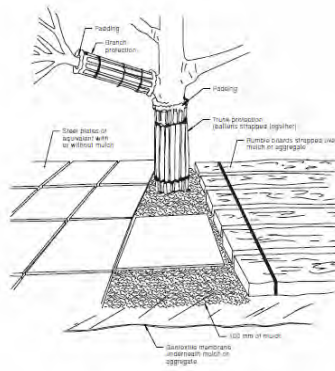


Figure 3

**Tree Protection Zone Signage**

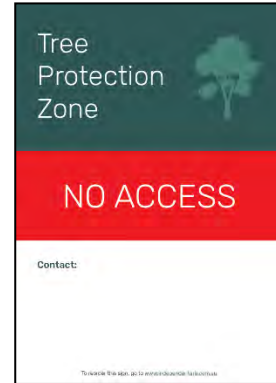


Figure 4

## Low pressure Ground Excavation & Water Cutting

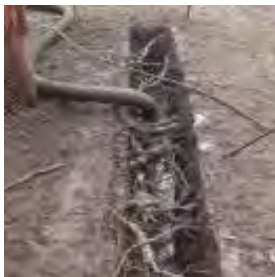


Figure 5



Figure 6



Figure 7



Figure 8

## Example of Fauna Friendly Rigid Style Temporary Fencing



Figure 9



Figure 10

Source: AS4970-2009 Protection of Trees on Development Sites

## Tree Management Plan (TMP) – Works Progress: Development Phase

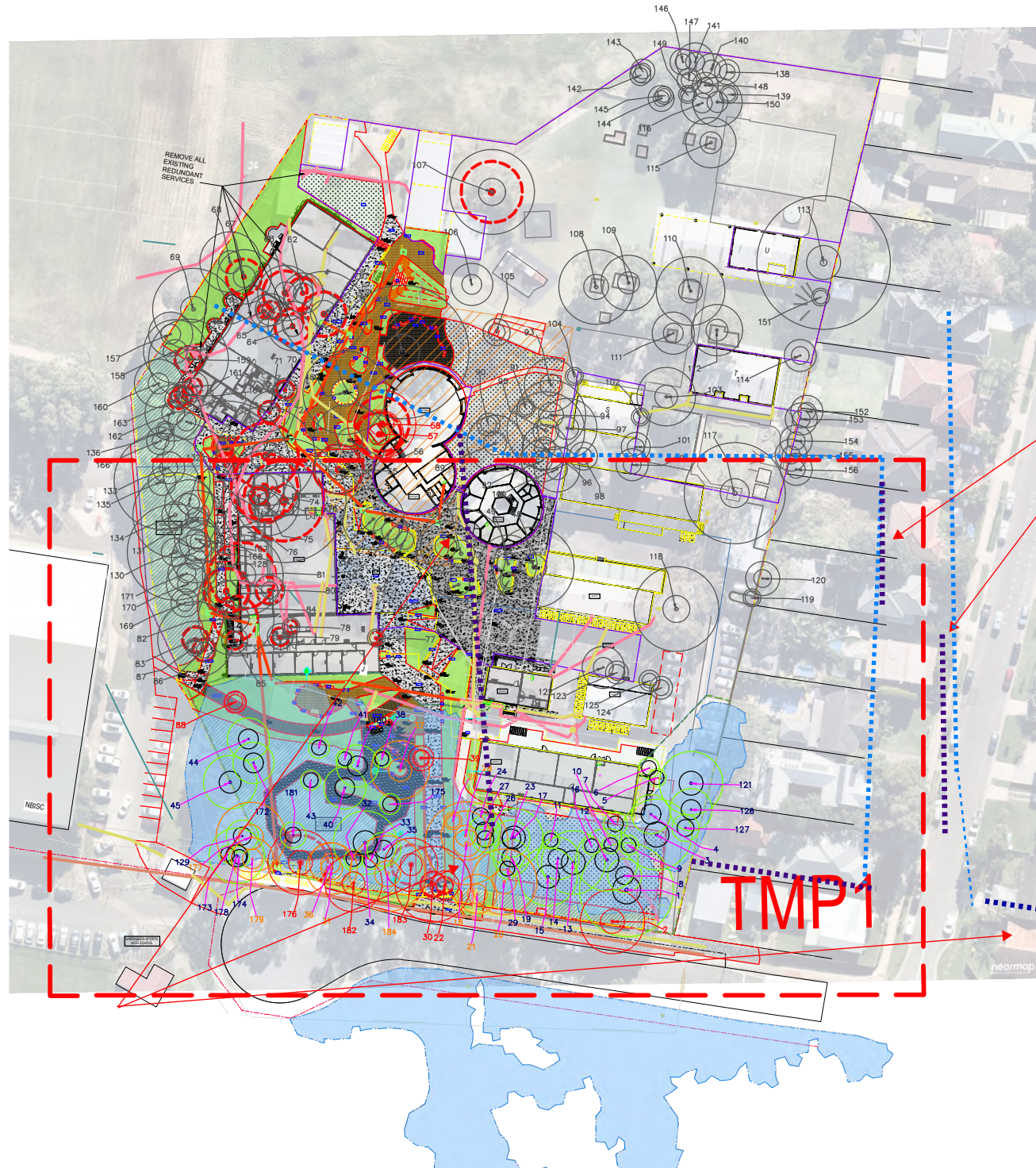
Stage	Tasks	Specific Outcomes
<b>Pre-construction Phase</b>		
Prepare and finalise Arboricultural Impact Assessments for submission to Council	Project Arborist to be appointed Review tree details in all approved Arboricultural reports following any new issue of plans	Submit Arboricultural reports including Arboricultural Impact Assessment for final Council Approval
Project Arborist to conduct Prestart Meeting with all representatives involved in construction	Prior to meeting: TPZ temporary protection/fencing installed <b>Arboricultural Report, TMP &amp; Council approval copies to be included in CMP</b> and made available to onsite crews	Prestart Certification and approvals in place & available onsite with CMP
<b>Commencement - Construction Phase</b>		
Initial Site Preparation	Project Arborist to supervise all tree work. <b>Construction crew or others are not to remove any part of a tree.</b> Arborist prestart site inspection.	Compliance Certification of Arboricultural works for lodgement to Council  Arborist certification of TPZ measures.
Prestart Toolbox Meeting	All relevant onsite crews to be briefed by Project Arborist prior to commencement of <u>each</u> work phase. Project Arborist <u>must</u> be notified and onsite at all times when construction works are within or close to TPZ. Note: Onsite attendance of Project Arborist is a condition for issue of Arboricultural Site Audit Statement/s.	Arborist Site Audit Reporting system to be in place. Copies of Arboricultural Report to be retained onsite.  <u>Arboricultural Site Audit Statement/s will not be issued retrospectively</u>
<b>Construction Phase</b>		
Site Establishment	Project Arborist to monitor tree health during establishment phase including bulk earthworks, changes in hydrology etc.	Instigate remedial tree care measures if required
Construction work	Site Manager to liaise with and ensure Project Arborist is advised in time to allow them to be present for all work carried out within TPZ area including any work likely to affect identified tree/s. Any deviation/s from approved plans to be approved by Project Arborist. <b>Project Arborist to provide ongoing Site Audit Certification of all work within TPZ</b>	Any remedial tree works to be carried out by qualified arborists under supervision of Project Arborist.  Project Arborist is responsible for issue of Arborist Site Audit Reports.
Practical Completion	Project Arborist to carryout review of tree health and vigour and advise on TPZ fencing.	On Project Arborist approval, carryout removal of remaining temporary tree protection measures
<b>Post Construction Phase</b>		
Final Arborist inspection	Carryout tree health review and provide recommendations for required tree care.	Issue of final Arborist Site Audit Compliance Statement for inclusion in final DA documentation and sealing.

Sheet List Table	
Sheet Number	Sheet Title
CO1	COVER SHEET
TMP1	TREE MANAGEMENT PLAN 1

# NARRABEEN NORTH PUBLIC SCHOOL

## 6 NAMONA STREET NORTH NARRABEEN NSW 2101

### TREE MANAGEMENT PLAN



**Independent Arboricultural Services**  
 ABN 65 062 099 495  
 PO Box 287,  
 Morningside QLD 4170  
 Phone: (07) 3399 5865  
 Email: office@independentarb.com.au

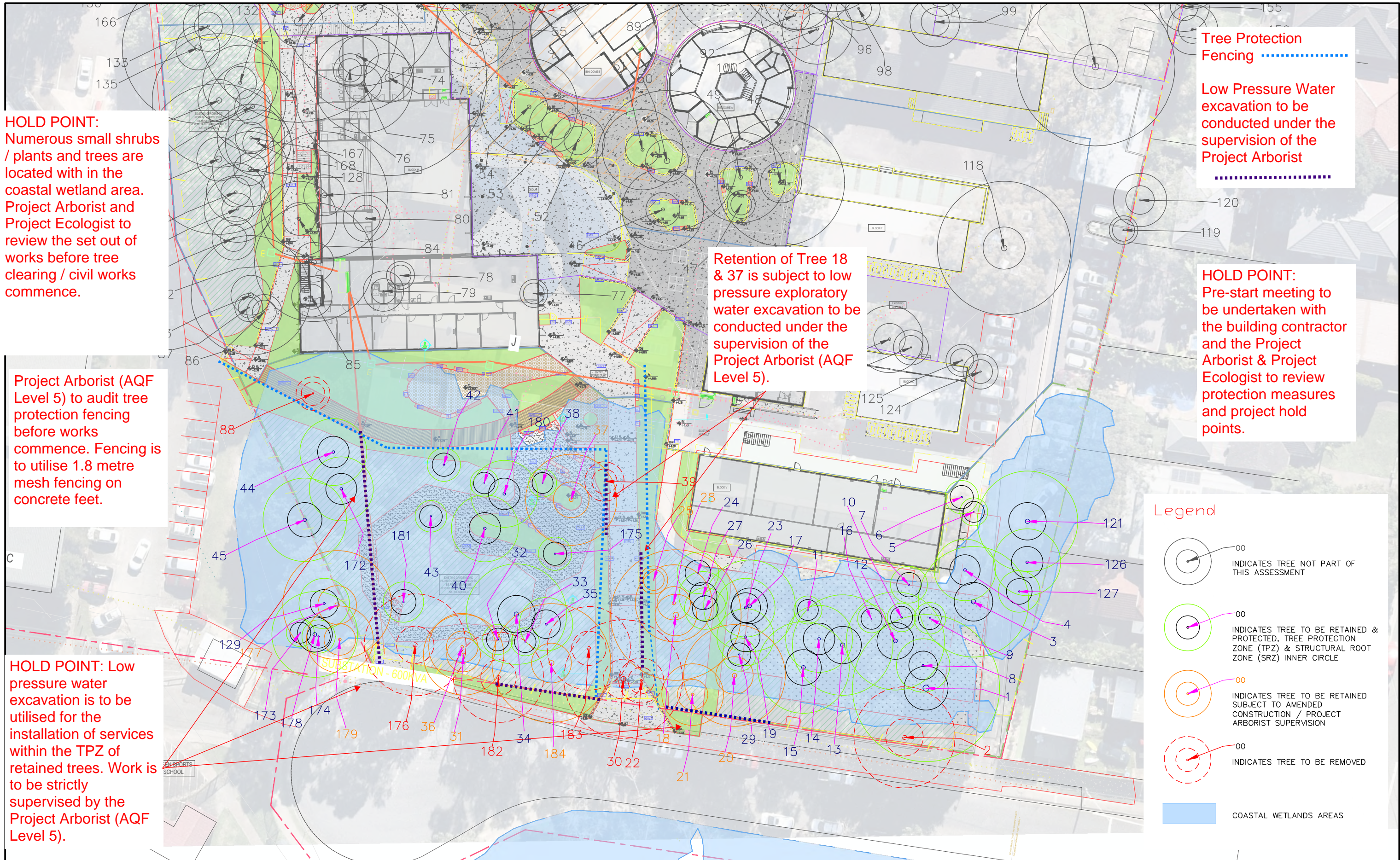
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ISSUE	DESCRIPTION	DATE	DRAWN	AUTH.	NOTES
PR7	UPDATE TREES ASSESSED SCOPE	9/9/2022	JA	RR	NARRABEEN NORTH PUBLIC SCHOOL, 6 NAMONA ST., NORTH NARRABEEN NSW 2101
PR8	UPDATE LA BASE	1/11/2022	JA	RR	--
PR9	UPDATE REMOVE/RETAIN	3/11/2022	JA	RR	--
PR10	UPDATE TREES ASSESSED SCOPE	7/11/2022	JA	RR	--

PROJECT	NARRABEEN NORTH PUBLIC SCHOOL
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TITLE	TREE MANAGEMENT PLAN COVER SHEET
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DESIGN	DESIGNING	DESIGN CHECK	DESIGNING
DRAWN	DATE	DRAWING CHECK	DATE
JA	7/11/2022	RR	7/11/2022
AUTHORISED FOR ISSUE	RR	REFERENCE NO.	--
PROJECT NUMBER / SHEET	0000 / CO1	SCALE	N/A
		ORIG. SIZE	A3
		ISSUE	PR10



**HOLD POINT:**  
 Numerous small shrubs / plants and trees are located within the coastal wetland area. Project Arborist and Project Ecologist to review the set out of works before tree clearing / civil works commence.

Project Arborist (AQF Level 5) to audit tree protection fencing before works commence. Fencing is to utilise 1.8 metre mesh fencing on concrete feet.


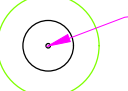
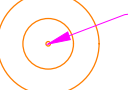

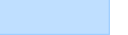
**HOLD POINT:** Low pressure water excavation is to be utilised for the installation of services within the TPZ of retained trees. Work is to be strictly supervised by the Project Arborist (AQF Level 5).

**Tree Protection Fencing** .....  
 Low Pressure Water excavation to be conducted under the supervision of the Project Arborist  
 .....

Retention of Tree 18 & 37 is subject to low pressure exploratory water excavation to be conducted under the supervision of the Project Arborist (AQF Level 5).

**HOLD POINT:**  
 Pre-start meeting to be undertaken with the building contractor and the Project Arborist & Project Ecologist to review protection measures and project hold points.

**Legend**

-  00 INDICATES TREE NOT PART OF THIS ASSESSMENT
-  00 INDICATES TREE TO BE RETAINED & PROTECTED, TREE PROTECTION ZONE (TPZ) & STRUCTURAL ROOT ZONE (SRZ) INNER CIRCLE
-  00 INDICATES TREE TO BE RETAINED SUBJECT TO AMENDED CONSTRUCTION / PROJECT ARBORIST SUPERVISION
-  00 INDICATES TREE TO BE REMOVED
-  COASTAL WETLANDS AREAS



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ISSUE	DESCRIPTION	DATE	DRAWN	AUTH	NOTES
PR7	UPDATE TREES ASSESSED SCOPE	9/9/2022	JA	RR	NARRABEEN NORTH PUBLIC SCHOOL, 6 NAMONA ST., NORTH NARRABEEN NSW 2101
PR8	UPDATE LA BASE	1/11/2022	JA	RR	--
PR9	UPDATE REMOVE/RETAIN	3/11/2022	JA	RR	--
PR10	UPDATE TREES ASSESSED SCOPE	7/11/2022	JA	RR	--

PROJECT	TITLE	DESIGN	DESIGN CHECK
NARRABEEN NORTH PUBLIC SCHOOL	TREE MANAGEMENT PLAN SHEET 1	DESIGNING	DESIGNING
		DRAWN	DRAWING CHECK
		JA	RR
		DATE	DATE
		7/11/2022	7/11/2022
		AUTHORISED FOR ISSUE	REFERENCE NO.
		RR	--
		PROJECT NUMBER / SHEET	SCALE
		0000 / TMP1	1:500
		ISSUE	ORIG. SIZE
		PR10	A3



## Photos



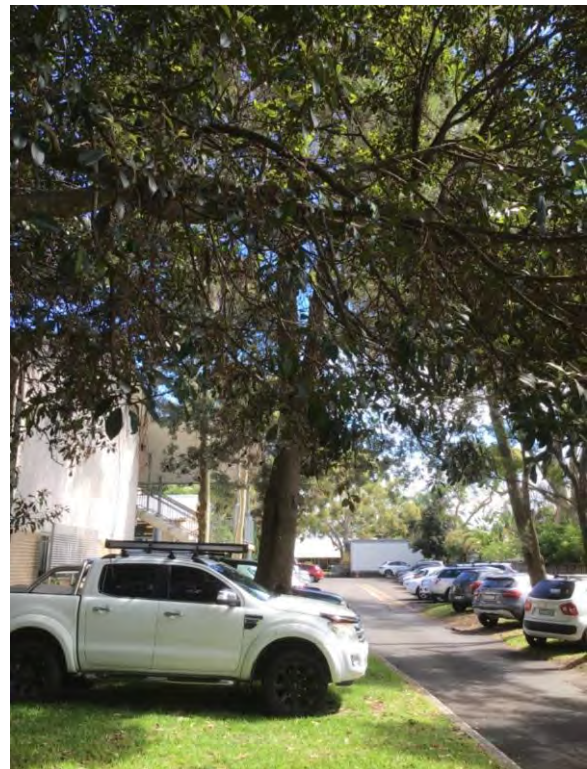
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Tree 2



Tree 3



Tree 4



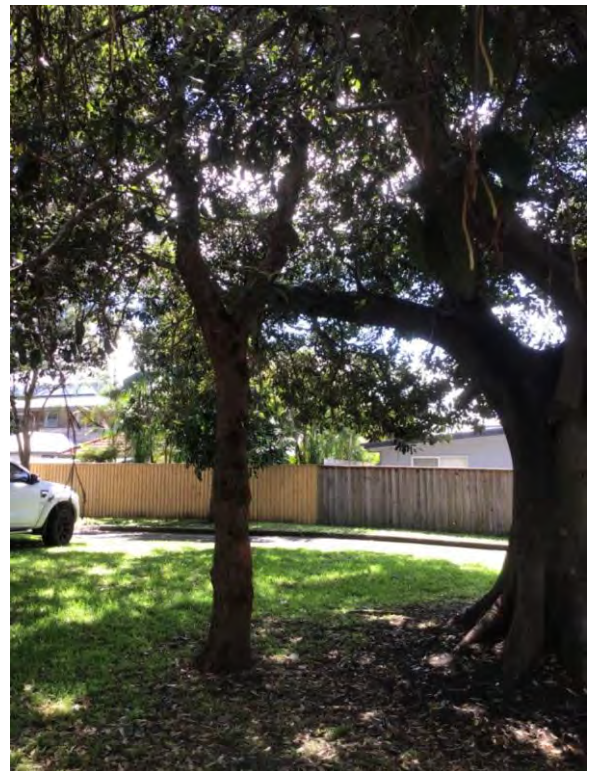
Tree 5



Tree 6



Tree 7



Tree 8



Tree 9



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Tree 11



Tree 12



Tree 13



Tree 14



Tree 15



Tree 16



Tree 17



Tree 18



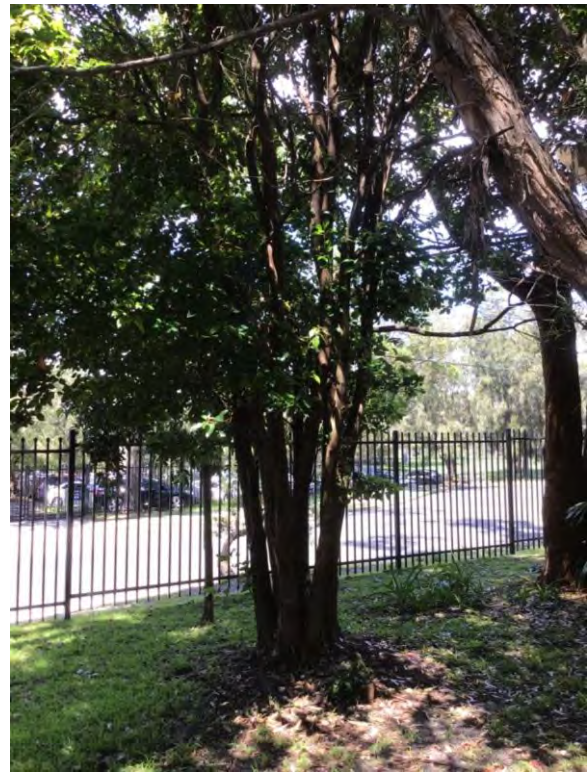
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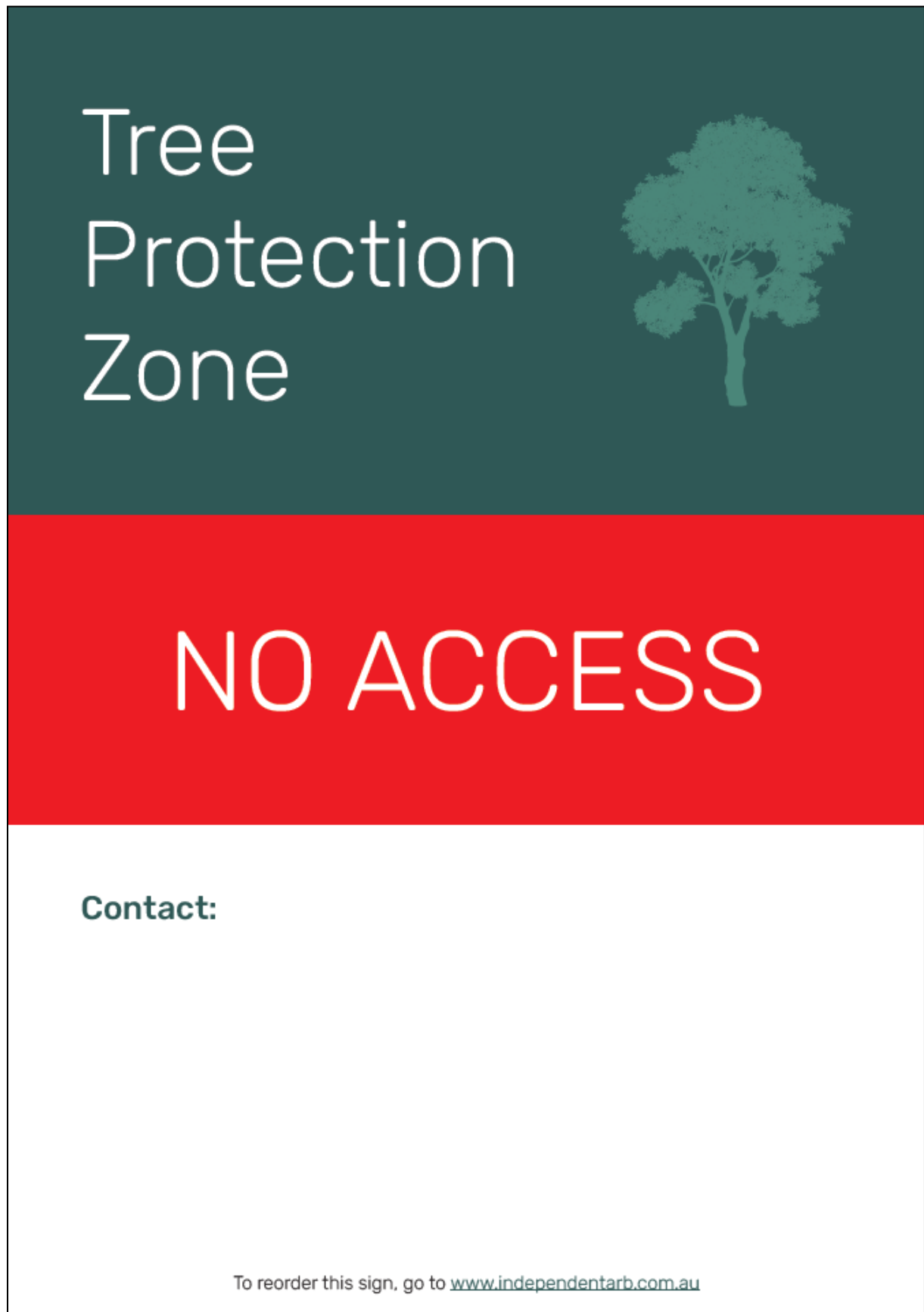


Tree 137

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<<http://www.hort.cornell.edu/uhi/outreach/csc/article.html>>
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8. Nearmap 2020, [www.nearmap.com.au](http://www.nearmap.com.au)

## Appendix 1



## Appendix 2: Explanation of Terminology

Definition	Process Description
<b>Removal</b>	Complete tree removal leaving stump as close as possible to ground level. Recommended process will include chipping of all foliage limbs and timber and reinstatement of work site. Recommendation typically based on tree being assessed as representing a health and safety concern [Dead, dying, structurally unsound, unstable, poor form]
<b>Remove and grind</b>	Complete tree removal to include grinding of stump to a depth of 75 millimetres unless otherwise specified. Recommended process will include chipping of all foliage limbs and timber and reinstatement of work site. Stump site will be cleaned of all grinding debris and sawdust and backfilled with premium topsoil free from weeds.
<b>Crown Clean (Deadwood)</b>	Removal of all major/significant deadwood and dead branches up to [and including] 30 millimetres in diameter in trees overhanging pedestrian or vehicular areas or removal of dead branches > 50mm diameter in canopy of trees located in parkland or similar area unless otherwise specified.
<b>Crown Clean (General pruning)</b>	Recommended pruning process will include removal of broken, crossing, rubbing, diseased, stressed or dying branches or limbs with poor attachment. Additional work process may include pruning to define leaders, balance the crown, reduce weight load, or clear the tree from obstructions. In summary, to rectify, as far as is possible, any structural defects and eliminate undesirable growth or deadwood.
<b>Crown Reduction (Canopy reduction)</b>	Recommended pruning process may include light and general pruning typically to encompass removal of up to 15% but no more than 20% of the leaf-bearing crown. By definition the unique shape and form of the tree will not be altered or compromised by the pruning process. Typically, the consulting arborist will nominate the reduction percentage [%] appropriate to species, condition and assessment.
<b>Crown Raising (Canopy lift)</b>	Pruning processes maybe involve the raising of the tree's lower canopy to a height specified in metres. Typically, the process is performed to provide for pedestrian and or vehicular clearance and unless otherwise specified the default parameters will be to provide 2 metres clearance from ground level or as specified by local or state government regulation. From time to time pruning requirements may be altered to accommodate various site-specific requirements as advised by the consulting arborist accordingly.
<b>Crown Restoration</b>	Pruning process will encompass crown restoration and remedial works where the tree has been previously lopped or otherwise damaged. Not feasible when tree has extensive decay and should only be considered when there is evidence of healthy re- growth. When performed correctly the process of remedial pruning will most likely take several years to complete.
<b>Hanger Limb / Unattached branch</b>	Pruning process may be restricted to the removal of any hanger/s or dangerous/dead/dying limbs and will typically involve the removal of a single limb. In some instances, removal of an individual limb may be necessary to accommodate an obstruction and the consulting arborist will advise accordingly.
<b>Directional Pruning</b>	Pruning process will be restricted to pruning canopy away from buildings/service wires/property boundary and will typically be performed to avoid future growth in these areas. Where appropriate future growth will be directed away from obstruction by selected pruning so as to encourage the development of the growth of new leaders.

<b>Habitat Pruning</b>	When pruning deadwood from trees, simple techniques and methods can be employed to achieve hazard reduction whilst leaving food and habitat for tree dwelling fauna. Long pieces of deadwood can be reduced in length to limit potential hazard but still retain food for the insects and microorganisms. Stubs that have been left by old pruning or previous branch failure can be retained, and with the use of a hole-saw or chainsaw they may also be bored out to create a nesting hollow for native birds or small mammals. Source: Mosman Council
<b>Deadwood</b>	Dead branches within canopy of tree <sup>59F</sup> . Deadwood is a naturally occurring feature of most tree species and comprises dead or decaying branches within the canopy of a tree. Deadwood may have habitat value and require removal only according to the considered risk of its location, i.e. high use pedestrian area or damage to adjacent infrastructure.
<b>Decay</b>	The process of degradation of woody tissues by micro-organisms <sup>61F</sup>
<b>Compaction</b>	Results from loads or stress forces applied to the soil as well as shear forces. Both foot traffic and vehicle traffic exert both forces on soils. Vehicle traffic may cause significant compaction at depths of 150–200 mm (the area in which most absorbing roots are located). The degree of compaction will depend on weight of vehicles, number of movements, soil moisture levels and clay content. Soil handling, stockpiling and transporting also tend to lead to the breakdown of soil structure and thus to compaction. Vibration as a result of frequent traffic or adjacent construction activities will also compact soils <sup>55F</sup>
<b>Codominant Structure:</b>	Stems or trunks of about the same size originating from the same position from the main stem <sup>52F</sup> . When the stem bark ridge turns upward the union is strong; when the ridge turns inward the union is weak, a likely point of failure in storm or windy weather conditions or where increasing weight causes undue stress on the defective union <sup>53F</sup>

Source: AS4373-2003 Pruning of Amenity Trees & AS 4970-2009 Protection of Tree on Development Sites & Habitat Creation By Kieran O'Neill, Mosman Council.

## Appendix 3: Normal Function of a Tree

**Background Note:** The following diagrams and explanatory notes are useful to illustrate the structure of a tree in a normal growing environment. This information is taken from AS4970-2009 Protection of trees on development sites which has been released subsequently to AS4373-2007 Pruning of amenity trees.

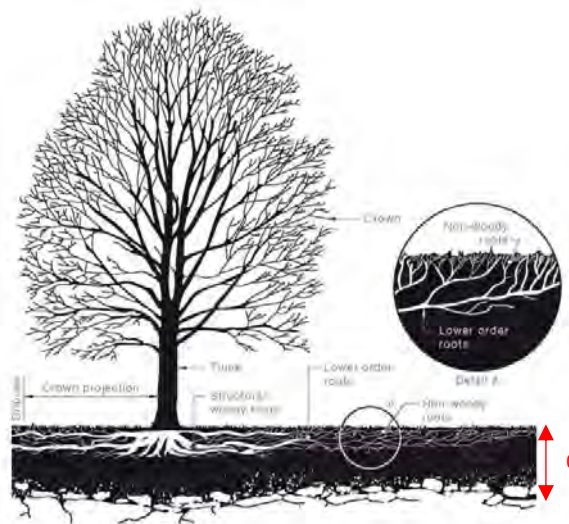


Figure 11: Structure of a tree in a normal growing environment

### Leaves

The main function of leaves is photosynthesis, that is, the production of sugars. The sugars produced by the leaves (and any other green tissue) are the source of chemical energy for all living cells in the entire plant and as such are essential for the normal functioning and survival of the tree. Anything that directly or indirectly damages the leaves will interfere with photosynthesis.

### Trunks and branches

Branches and trunks are composed of many tissues with specialized functions including the bark (protection), phloem (transport of sugars from the leaves), vascular cambium (growth of new transport tissues), sapwood (transport of water and nutrients from the roots), heartwood (strength and structural support) and rays (internal transport and storage of sugars). Damage to branches or trunks may allow infection by plant pathogens (disease causing organisms), disrupt the movement of vital materials and structurally weaken the tree.

### Roots

The main functions of roots include the uptake of water and nutrients, anchorage, storage of sugar reserves and the production of some plant hormones required by the shoots. For roots to function, they must be supplied with oxygen from the soil. The root system of trees consists of several 'types' of roots found in different parts of the soil and is generally much more extensive than commonly thought. The importance of roots is easily overlooked because they are not visible, that is 'out of sight, out of mind'. Damage to the root system is a common cause of tree decline and death and is the most common form of damage associated with development sites.

Root systems consist of three main parts:

1. The structural woody roots (anchorage, storage and transport);
2. Lower order roots (anchorage, storage and transport); and
3. Non-woody roots (absorption of water and nutrients, extension, synthesis of amino acids and growth regulators) (see Figure).



In addition to lateral root spread being underestimated, root depth in trees has also been grossly exaggerated. Deep root systems or taproots are the exception rather than the rule. Most roots of most trees are found in the very top of the soil. The vast majority of these roots are small non-woody absorbing roots which grow upward into the very surface layers of the soil and leaf litter. This delicate, non-woody system, because of its proximity to the surface, is very vulnerable to injury.”

**Explanatory Note: The importance of gas exchange in soils**

The fact that tree roots require oxygen to function is often misunderstood. Accessibility to available oxygen and water within the soil structure is dependent on the integrity of soil structure within their surrounds; when soils are compacted there is little space between soil aggregates with soil volume and total pore space, especially macropore space diminished. In turn, good soil oxygenation and gas exchange (Lonsdale) levels allow for successful function of tree roots. Oxygen levels in soils will typically decrease as soil depth increases and /or soils are heavily compacted.

Macropore is the term used to describe the relatively large space between soil particles that is usually air filled and allows for water movement and root penetration. Micropore is the term used to describe the space between soil particles that is relatively small and likely to be water filled.

Compaction results from loads or stress forces applied to the soil as well as shear forces. When soil within the root zone of a plant, including a tree, is compacted through either pedestrian or vehicular traffic, or by the heavy weight of stored materials or machinery, the ability of water and oxygen to penetrate the soil around the roots of living plants is compromised. Whilst tree roots are typically found in the top 600mm of the soil horizon, vehicle traffic, in particular may cause significant compaction at depths of 150–200 mm (the area in which most absorbing roots are located). (Refer Tree Function Note above).

The degree of soil compaction will depend on weight of vehicles, number of movements, soil moisture levels and clay content. Soil handling, stockpiling and transporting also tend to lead to the breakdown of soil structure and thus to soil compaction. Vibration, as a result of frequent traffic or adjacent construction activities, will also cause compaction of soil.

Contrary to the commonly held myth that all trees have tap roots, tree roots are typically located within the top 600mm of soil. Just as leaves perform the vital function of photosynthesis, tree roots are vital for the primary functions of anchorage, storage, absorption and conduction. Larger tree roots fulfil the main functions of anchorage, storage and conduction and smaller more fibrous tree roots, which grow primarily at the end of the main woody roots, fulfil a vital role in absorbing oxygen, essential mineral elements and moisture from the soil, often through a symbiotic relationship with soil borne fungi referred to as Mycorrhizae; the extent of root loss has the potential to jeopardise any or all of these main functions and most importantly may compromise the structural integrity of an established tree and its associated potential OH&S risk of failure occurring; any OH&S risk of potential failure in a high use area such as public roads, is noteworthy for all the wrong reasons and should be of major concern and avoided at all times. (Refer Appendix 2, Tree Function Note).

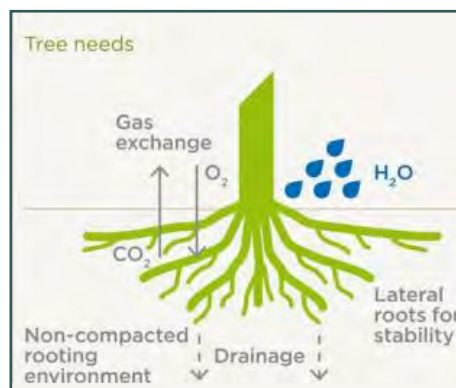


Figure 12: Gas exchange in woody tissues: the diffusion of gases into and out of a particular region (Jaluzot)

## Reference Page

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## Company Details

### Independent Arboricultural Services

Independent Arboricultural Services, incorporated in May 2007, offers a completely independent arborist consulting and reporting service. Its directors and associated consultants bring extensive arboricultural knowledge gained over many years to this company. All consulting staff hold AQF Level 5 (Diploma of Arboriculture). Specialised advice when required, such as provision of survey mapping or engineering advice and certification is sourced from reputable professional providers according to site requirements as per Australian Standard 4970-2009.

### Statement of Goal

To deliver continual improvement through the use of world's best arboricultural practices, supported by ongoing education and exposure to leading industry experts and research throughout the world.

### Mission Statement

To provide timely, relevant and actionable consulting advice and practice based on the latest available and best scientific arboricultural knowledge.

### Environmental Statement

Independent Arboricultural Services supports long term environmental sustainability sustainable sourced paper and ensuring all inks cartridges are recycled where possible.

Independent Arboricultural Services actively seeks to maintain a positive carbon footprint status and to that end is committed to protecting and preserving the environment, continuing to carry out tree planting, transplanting and replacement planting where practical, having planted in excess of 4000 trees in the first 2 years after its inception in May 2007 alone. Arboricultural recommendations involving the removal of tree/s will include replanting at a minimum ratio of 2 trees for any tree removed where possible. All arboricultural recommendations are made in accordance with world's best arboricultural practice and within the Australian Standards AS 4373-2007 Pruning of amenity trees and AS 4970-2009 – Protection of trees on development sites so as to ensure optimal outcomes for all living trees.

Independent Arboricultural Services acknowledges the benefits of healthy trees with good vigour and vitality and actively promotes better understanding in the general community of the contribution that trees make to reducing greenhouse gasses, the contribution of trees to better water retention and the prevention of soil erosion, the ability of trees to provide protection to infrastructure by diffusing strong winds in weather events and the contribution of trees to general liveability within the urban environment.

It is an acknowledged fact that air temperature beneath a tree canopy can be in excess of 5° Celsius lower than the surrounding ambient air temperature thereby reducing reliance on greenhouse gas producing air conditioners and coal fired power sources.