



13 April 2023

**File Ref:** S521151\_RFI\_Response

**Contact:** Rob Siddle

Planning Services South  
Development Services  
Brisbane City Council  
Brisbane Square, 266 George Street,  
Brisbane Qld 4000

**Attention:** Joel Wake, Senior Urban Planner

**26 CLOVERDALE ROAD, DOOLANDELLA (A006067610) – RESPONSE TO INFORMATION REQUEST**

I refer to the above Brisbane City Council (BCC) issued Information Request letter regarding the proposed Development Application for Reconfiguring a Lot at 26 Cloverdale Road, Doolandella (herein referred to as the 'subject site'), dated 6<sup>th</sup> September 2022.

To date, S5 Environmental have provided the following documentation:

- Detailed Ecological Assessment (S521210DEA001v1.0); and
- Vegetation Retention Plan (S521210\_VRP\_001-003(A)).

S5 Environmental's response on behalf of the proponent are as follows:

***Item 3. Biodiversity areas and waterway corridor***

***The drainage corridor proposed running from the north of the site, down the western boundary and out towards the proposed bio-basin to the east will encroach significantly into a mapped local waterway corridor. Additionally, it has been noted that a portion of this corridor has been located within the rear of some of the proposed lots. The proposal is required to demonstrate that the corridor is located completely outside of the rear of private lots and that the extent of earthworks (i.e. cut required to establish the drainage corridor/bio-basin) has been minimised as much as possible without compromising its stormwater conveyance/stormwater quality function.***

***Note: The location of the stormwater corridor is to not intrude any further into mapped HES and HESS areas.***

***Further to this, Council requires an easement within Lot 41 to allow for stormwater infrastructure and access to the creek at the rear of the site. This must be clearly indicated on the proposed plans and the tree retention plan is required to be updated to include any trees with a DBH of 100mm or greater within and out to 6m from the proposed easement. The location of the easement must be sited in a practical location from an engineering perspective whilst also minimising impacts to native vegetation. The proposal also needs to demonstrate that the degree of native vegetation clearing as a whole on the site will not exceed that which is considered exempt under Schedule 24, Section 3 of the Planning Regulation (2017). The following amendments are required:***

***a. A Development Footprint Plan (DFP) for the 'environmental house location' on Lot 41;***

**Response:** A DFP has been provided for the 'Environmental house location'. The lot number has been updated from Lot 41 to Lot 100. Refer to updated layout, shown in Vegetation Retention Plan (refer to Appendix A).

***b. Remove elements of the drainage corridor from private lots. The stormwater corridor is not to extend any further south;***

**Response:** The western boundary lots have been redesigned to no longer include the drainage corridor, with the corridor not extending any further south. Refer to updated layout, shown in Vegetation Retention Plan (refer to Appendix A).

***c. Demonstration that the extent of earthworks associated with the stormwater corridor and bio-basin have been minimised;***

**Response:** Upon discussion with the assessment officer at BCC, S5 Environmental understand that Council are generally supportive of the proposed encroachment into HES and HESS to the south, though will not be supportive of encroachment any further south. S5 Environmental understand that no additional tree surveying is required unless plans significantly change. S5 Environmental Ecologists have worked closely with project engineers to reduce impact to ecological features while maintaining necessary drainage functionality.

***d. Location and extent of any stormwater drainage easements required through Lot 41 down to the creek at the rear. The proposed tree retention plan must be updated to include all vegetation with a diameter of 100mm or greater within the impact area and out to 6m. This easement must be sited and designed to minimise the amount of native vegetation being impacted;***

**Response:** All necessary trees are tagged in this area as currently shown. Refer to Appendix A.

- e. **An arborist report prepared by a minimum AQF Level 5 qualified arborist that assesses any impacts within the tree protection zones of trees proposed for retention including within the drainage easement;**

**Response:** An Arborist Assessment has been provided. Refer to **Appendix B**.

- f. **An impact area assessment in relation to the loss of native vegetation from mapped state core koala habitat areas including within the drainage easement that is required through Lot 41. Provide confirmation of any exemptions that the development may achieve under Schedule 24, Section 3 of the Planning Regulation (2017); and**

**Response:** Refer to **Figure 1** for removal of native vegetation within mapped KHA. The Arborist has recommended removing trees 103 and 104 (both located within KHA), as impacts to the trees are expected to be major. Loss of trees will be mitigated through onsite rehabilitation (refer below). The encroachment into State mapped KHA has been calculated to be approx. 145.2 m<sup>2</sup> and hence is considered exempt development under Schedule 24 of the Planning Regulation 2017.



**Figure 1. Removal of Native Vegetation within KHA**

- g. **A revised conceptual rehabilitation area for areas south of the area already subject to rehabilitation under Council enforcement notice with the exception of the drainage corridor that is to be rehabilitated following natural channel design principals.**



**Response:** A Concept Rehabilitation Plan has been provided. Refer to **Appendix C**.

In summary, S5 Environmental have provided the above response to Item 3 and have updated the Vegetation Retention Plan (refer to **Appendix A**), provided an Arborist Assessment (refer to **Appendix B**), and prepared a Concept Rehabilitation Plan (refer to **Appendix C**). We trust this adequately address the additional information required by Council.

Should you wish to discuss the above, please do not hesitate to contact the undersigned on the number or email address below.

Yours sincerely,

A handwritten signature in blue ink, appearing to read 'Rob Siddle'.

---

**Rob Siddle**

**Director**

**T:** 07 3505 3053

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Enc:   **Appendix A**   Vegetation Retention Plan (S521210\_VRP\_001-003(C))  
      **Appendix B**   Arboricultural Impact Assessment - S5 Environmental - IAS11176 - 18 November 2022  
      **Appendix C**   Concept Rehabilitation Plan (S521210\_CRP\_v1.0)

# APPENDIX A

## Vegetation Retention Plan

BCC DS  
Plans/Documents  
RECEIVED  
08/06/2023  
APPLICATION REF  
A006067610.

BCC DS  
 Plans/Documents  
 RECEIVED  
 08/06/2023  
 APPLICATION REF  
 A006067610.



**LEGEND / NOTES**

- 20 Tree Numbering
- Tree Protection Zone Retained Tree
- Tree To Be Removed
- Tree To Be Retained (Subject To Arborist Inspection)
- Surveyed Trees - Exotic Species
- Proposed 20m Easement
- Proposed Drainage Channel Extent
- Q50 Overland Flow Flood Extent
- Earthworks - Fill
- Earthworks - Cut
- Existing Waterway
- Proposed Retaining Walls
- Proposed Building Envelope

NOTE:  
 - SURVEY PLAN



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ISSUE	DESCRIPTION	DATE
A	FOR ISSUE	20/04/2022
B	LAYOUT AMENDED	29/03/2023
C	CIVIL LAYOUT AMENDED	06/04/2023

PROJECT NO.  
 S521210

CLIENT  
 QLD INTERNATIONAL INVESTMENT PTY LTD

PROJECT NAME  
 PROPOSED RESIDENTIAL DEVELOPMENT

SITE  
 12, 18 & 26 CLOVERDALE ROAD DOOLANDELLA

DRAWING NAME  
 VEGETATION RETENTION PLAN

DRAWING NO.  
 S521210\_VRP\_001

SCALE	SHEET SIZE	DRAWN	APPROVED
1:1250	A3	SAJ	RS

2/265 Sandgate Road  
 Albion Qld 4010  
 ph 3505 3053  
 www.s5consulting.com.au  
 ABN 82 440 704 793

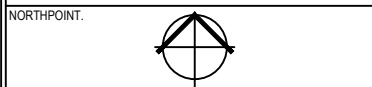


**ENVIRONMENTAL**

VEGETATION MANAGEMENT SCHEDULE																
Site Address: 12, 18 and 26 Cloverdale Road, Doolandella																
Codes: FS = Fauna Scratches; SH = Small Hollow; MH = Medium Hollow; LH = Large Hollow; T = Termitaria; BN = Bird Nest; DL = Double leader; TL = Triple Leader; ML = Multi-leader; NB = Nest Box; SF = Evidence of Sap Feeding																
No.	STATUS	SCIENTIFIC NAME	COMMON NAME	DBH 1 [mm]	DBH 2 [mm]	DBH 3 [mm]	DBH 4 [mm]	DBH 5 [mm]	DBH 6 [mm]	Total DBH [mm]	SPREAD [m]	HEIGHT [m]	HEALTH	HABITAT	NOTES	TPZ [mm]
1	Retain	<i>Corymbia torelliana</i>	Cadaghi	200						200	5	12	Good		4 m off western fence, Monkey rope	2400
2	Retain	<i>Corymbia torelliana</i>	Cadaghi	260						260	7	16	Good		1 m off western fence, monkey rope	3120
3	Remove	<i>Phoenix canariensis</i>	Date Palm	400						400	4	6	Good			4800
4	Retain	<i>Corymbia torelliana</i>	Cadaghi	250						250	7	15	Good		1m off western fence	3000
5	Remove	<i>Archontophoenix alexandrae</i>	Alexandra Palm	260						260	3	8	Good			3120
6	Remove	<i>Tipuana tipu</i>	Tipuana	300						300	12	17	Good		On boundary	3600
7	Retain	<i>Melaleuca quinquenervia</i>	Broad-leaved Paperbark	300						300	14	6	Good	N	4m off western boundary	3600
8	Remove	<i>Tipuana tipu</i>	Tipuana	520	500	580	350			990	20	16	Good		Asparagus fern	11880
9	Remove	<i>Livistonia sp.</i>	Fan Palm	300						300	2	4	Good			3600
10	Remove	<i>Tipuana tipu</i>	Tipuana	200	170					263	8	6	Good			3156
11	Retain	<i>Eucalyptus tereticornis</i>	Forest Red Gum	500						500	10	19	Good		6m off western	6000
12	Remove	<i>Acacia leiocalyx</i>	Early Black Wattle	250						250	6	8	Good			3000
13	Retain	<i>Eucalyptus tereticornis</i>	Forest Red Gum	350						350	7	16	Good		4m off western boundary	4200
14	Retain	<i>Melaleuca quinquenervia</i>	Broad-leaved Paperbark	180	170					248	6	14	Good		4m off western boundary	2976
15	Retain	<i>Corymbia torelliana</i>	Cadaghi	350						350	6	14	Good		4m off western boundary	4200
16	Retain	<i>Lophostemon suaveolens</i>	Swamp Box	200						200	4	10	Good		3m off western boundary	2400
17	Retain	<i>Alphitonia excelsa</i>	Red Ash	280						280	8	10	Poor		3m off western boundary	3360
18	Retain		Stag	150						150	1	4	Dead	T,H		0
19	Retain	<i>Eucalyptus seeana</i>	Narrow-leaved Red Gum	340						340	5	18	Good		FS	4080
20	Retain	<i>Glochidion ferdinandi</i>	Cheese Tree	250						250	5	8	Good			3000
21	Retain	<i>Eucalyptus tereticornis</i>	Forest Red Gum	620						620	21	12	Good		FS	7440
22	Retain	<i>Eucalyptus seeana</i>	Narrow-leaved Red Gum	360						360	20	8	Good		FS	4320
23	Retain	<i>Eucalyptus crebra</i>	Narrow-leaved Ironbark	280						280	20	4	Good	T	1m off western fence	3360
24	Retain	<i>Eucalyptus tereticornis</i>	Forest Red Gum	260						260	6	16	Good		FS	3120
25	Retain	<i>Jacaranda mimosifolia</i>	Jacaranda	240	100	150				301	5	8	Good			3612
26	Retain	<i>Acacia leiocalyx</i>	Early Black Wattle	230						230	7	6	Good			2760
27	Retain	<i>Lophostemon suaveolens</i>	Swamp Box	250						250	5	12	Good	T		3000
28	Retain	<i>Eucalyptus seeana</i>	Narrow-leaved Red Gum	420						420	5	17	Good		FS	5040
29	Retain	<i>Lophostemon suaveolens</i>	Swamp Box	290						290	3	14	Good	T		3480
30	Remove	<i>Livistonia sp.</i>	Fan Palm	320						320	3	4	Good			3840
31	Remove	<i>Schinus terebinthifolia</i>	Broadleaf Pepper Tree	280						280	12	4	Good			3360
32	Remove	<i>Syagrus romanzoffiana</i>	Cocos palm	220						220	3	8	Good			2640
33	Remove	<i>Schefflera actinophylla</i>	Umbrella Tree	430						430	5	7	Good			5160
34	Remove	<i>Syagrus romanzoffiana</i>	Cocos palm	230						230	4	10	Good			2760
35	Remove	<i>Syagrus romanzoffiana</i>	Cocos palm	370						370	4	15	Good			4440
36	Remove	<i>Syagrus romanzoffiana</i>	Cocos palm	220						220	4	10	Good			2640
37	Remove	<i>Syagrus romanzoffiana</i>	Cocos palm	300						300	4	12	Good			3600
38	Remove	<i>Syagrus romanzoffiana</i>	Cocos palm	320						320	4	11	Good			3840
39	Remove	<i>Syagrus romanzoffiana</i>	Cocos palm	300						300	4	12	Good			3600
40	Remove	<i>Dyopsis decaryi</i>	Triangle Palm	360						360	4	7	Good			4320
41	Remove	<i>Archontophoenix alexandrae</i>	Alexandra Palm	160						160	3	7	Good			1920
42	Remove	<i>Cupressus lusitanica</i>	Arizona Smooth Bark Cypress	330						330	1	5	Good			3960
43	Remove	<i>Plumeria rubra</i>	Frangipani	190	180					262	4	4	Good			3144
44	Remove	<i>Castanospermum Australe</i>	Black Bean	340	190	320				505	6	10	Good			6060
45	Remove	<i>Dyopsis decaryi</i>	Triangle Palm	350						350	4	7	Good			4200
46	Remove	<i>Syagrus romanzoffiana</i>	Cocos palm	270						270	3	10	Good		Group of Syagrus romanzoffiana inaccessible	3240
47	Remove	<i>Syagrus romanzoffiana</i>	Cocos palm	280						280	3	8	Good			3360
48	Remove	<i>Corymbia torelliana</i>	Cadaghi	800						750	16	16	Good			9000
49	Remove	<i>Spathodea campanulata</i>	African Tulip Tree	310	150	150	280			469	6	12	Good		FS	5628
50	Remove	<i>Spathodea campanulata</i>	African Tulip Tree	170						170	4	7	Good			2040
51	Remove	<i>Celtis sinensis</i>	Chinese Celtis	180	140					229	6	10	Good			2748
52	Remove	<i>Cinnamomum camphora</i>	Camphor Laurel	170	500					529	10	13	Good	T		6348
53	Remove	<i>Melaleuca quinquenervia</i>	Broad-leaved Paperbark	160						160	3	7	Good			1920
54	Remove	<i>Melaleuca quinquenervia</i>	Broad-leaved Paperbark	270						270	3	8	Good			3240
55	Remove	<i>Celtis sinensis</i>	Chinese Celtis	190	100					215	6	7	Good			2580
56	Remove	<i>Libidibia ferrea</i>	Leopard Tree	190	200	220	200			406	8	13	Good		FS	4872
57	Remove	<i>Schefflera actinophylla</i>	Umbrella Tree	170	200					263	6	10	Good			3156
58	Remove	<i>Cupressus lusitanica</i>	Arizona Smooth Bark Cypress	190	200	240	150			396	5	4	Good			4752
59	Remove	<i>Syzygium sp</i>	Syzygium	720						720	6	18	Fair			8640
60	Remove	<i>Melaleuca bracteata</i>	Black Tea Tree	240	230					333	8	16	Good			3996

LEGEND / NOTES

NOTE:  
- SURVEY PLAN



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A	FOR ISSUE	20/04/2022
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PROJECT NO.  
S521210

CLIENT  
QLD INTERNATIONAL INVESTMENT PTY LTD

PROJECT NAME  
PROPOSED RESIDENTIAL DEVELOPMENT

SITE  
12, 18 & 26 CLOVERDALE ROAD DOOLANDELLA

DRAWING NAME  
VEGETATION RETENTION PLAN SCHEDULE SHEET 1 OF 2

DRAWING NO.  
S521210\_VRP\_002

SCALE	SHEET SIZE	DRAWN	APPROVED
N.T.S.	A3	SAJ	RS

2/265 Sandgate Road  
Albion Qld 4010  
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No.	STATUS	SCIENTIFIC NAME	COMMON NAME	DBH 1 [mm]	DBH 2 [mm]	DBH 3 [mm]	DBH 4 [mm]	DBH 5 [mm]	DBH 6 [mm]	Total DBH [mm]	SPREAD [m]	HEIGHT [m]	HEALTH	HABITAT	NOTES	TPZ [mm]
61	Remove	<i>Schotia brachypetala</i>	Drunken Parrot	340	230	290				503	10	5	Good			6036
62	Remove	<i>Melaleuca viminalis</i>	Weeping Bottlebrush	350						350	6	8	Good			4200
63	Remove	<i>Ficus sp.</i>	Unknown	200	200					283	8	5	Poor			3396
64	Remove	<i>Notelea sp.</i>	Unknown	140	100	100	120	160		283	6	6	Good			3396
65	Remove	<i>Jacaranda mimosifolia</i>	Jacaranda	230	200					305	6	8	Good			3660
66	Remove	<i>Melaleuca bracteata</i>	Black Tea Tree	330	230					403	6	12	Good			4836
67	Remove	<i>Jacaranda mimosifolia</i>	Jacaranda	150	190	140	140	230		389	7	10	Good			4668
68	Remove	<i>Melaleuca viminalis</i>	Weeping Bottlebrush	250	250	170				393	9	6	Good			4716
69	Remove	<i>Lophostemon suaveolens</i>	Swamp Box	270						270	5	8	Good			3240
70	Remove	<i>Eucalyptus tereticornis</i>	Forest Red Gum	230	190					299	4	7	Good			3588
71	Remove	<i>Eucalyptus siderophloia</i>	Grey Ironbark	270						270	5	16	Good			3240
72	Remove	<i>Eucalyptus tereticornis</i>	Forest Red Gum	180						180	5	15	Good			2160
73	Remove	<i>Melaleuca nodosa</i>	Prickly Leaf Paperbark	130	190					231	4	5	Poor			2772
74	Remove	<i>Eucalyptus tereticornis</i>	Forest Red Gum	320						320	6	17	Good			3840
75	Remove	<i>Eucalyptus tereticornis</i>	Forest Red Gum	400						400	7	17	Good			4800
76	Remove	<i>Eucalyptus tereticornis</i>	Forest Red Gum	220						220	5	15	Good			2640
77	Remove	<i>Melaleuca nodosa</i>	Prickly Leaf Paperbark	290	100	140	240	150		441	4	4	Good			5292
78	Remove	<i>Eucalyptus tereticornis</i>	Forest Red Gum	350						350	6	16	Good			4200
79	Remove	<i>Eucalyptus tereticornis</i>	Forest Red Gum	180	180					255	4	9	Good			3060
80	Remove	<i>Acacia leiocalyx</i>	Early Black Wattle	170						170	3	4	Poor			2040
81	Retain	<i>Eucalyptus siderophloia</i>	Grey Ironbark	590						590	8	23	Good			7080
82	Remove	<i>Melaleuca quinquenervia</i>	Broad-leaved Paperbark	190	150	240	310			461	6	12	Good			5532
83	Remove	<i>Celtis sinensis</i>	Chinese Celtis	330						330	10	8	Good			3960
84	Retain	<i>Eucalyptus tereticornis</i>	Forest Red Gum	1000						1000	16	25	Good			12000
85	Retain	<i>Eucalyptus tereticornis</i>	Forest Red Gum	350						350	8	20	Good			4200
86	Retain	<i>Eucalyptus tereticornis</i>	Forest Red Gum	400						400	8	19	Good			4800
87	Remove	<i>Eucalyptus crebra</i>	Narrow-leaved Ironbark	180						180	5	17	Good			2160
88	Remove	<i>Eucalyptus siderophloia</i>	Grey Ironbark	180						180	5	17	Good			2160
89	Remove	<i>Eucalyptus siderophloia</i>	Grey Ironbark	290						290	7	18	Good			3480
90	Remove	<i>Eucalyptus siderophloia</i>	Grey Ironbark	390	110					406	6	21	Good			4872
91	Remove	<i>Acacia leiocalyx</i>	Early Black Wattle	190						190	6	8	Good			2280
92	Remove	<i>Melaleuca quinquenervia</i>	Broad-leaved Paperbark	320						320	2	18	Poor			3840
93	Remove	<i>Melaleuca quinquenervia</i>	Broad-leaved Paperbark	140	180	130				263	3	7	Poor		Smothered by Monkey rope	3156
94	Remove	<i>Melaleuca quinquenervia</i>	Broad-leaved Paperbark	200	230					305	4	10	Poor		Smothered by Monkey rope	3660
95	Remove	<i>Melaleuca quinquenervia</i>	Broad-leaved Paperbark	190	210					284	2	12	Dead		Smothered by Monkey rope	0
96	Remove	<i>Melaleuca quinquenervia</i>	Broad-leaved Paperbark	230	140					270	4	10	Poor		Smothered by Monkey rope	3240
97	Remove	<i>Acacia leiocalyx</i>	Early Black Wattle	160						160	5	7	Fair			1920
98	Remove	<i>Allocasuarina littoralis</i>	Black She-oak	190						190	4	14	Good			2280
99	Retain	<i>Acacia leiocalyx</i>	Early Black Wattle	220						220	5	7	Fair			2640
100	Retain	<i>Melaleuca quinquenervia</i>	Broad-leaved Paperbark	220	190	210				359	5	13	Good			4308
101	Retain	<i>Eucalyptus racemosa</i>	Scribbly Gum	150	240					284	6	16	Good			3408
102	Retain	<i>Eucalyptus seeana</i>	Narrow-leaved Red Gum	440	400					595	12	18	Good			7140
103	Remove	<i>Allocasuarina littoralis</i>	Black She-oak	200						200	6	14	Good			2400
104	Remove	<i>Eucalyptus seeana</i>	Narrow-leaved Red Gum	660						660	15	18	Poor		Reshooting poisoned	7920
105	Remove	<i>Corymbia torelliana</i>	Cadaghi	420						420	15	10	Poor		Reshooting poisoned	5040
106	Retain	<i>Allocasuarina littoralis</i>	Black She-oak	230						230	4	10	Fair	T	Smothered by asparagus fern	2760
107	Retain	<i>Melaleuca quinquenervia</i>	Broad-leaved Paperbark	310						310	5	13	Good			3720
108	Retain	<i>Allocasuarina littoralis</i>	Black She-oak	270						270	4	11	Fair		Dead leader	3240

LEGEND / NOTES

NOTE:  
- SURVEY PLAN



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PROJECT NAME  
PROPOSED RESIDENTIAL  
DEVELOPMENT

SITE  
12, 18 & 26 CLOVERDALE ROAD  
DOOLANDELLA

DRAWING NAME  
VEGETATION RETENTION PLAN  
SCHEDULE SHEET 2 OF 2

DRAWING NO.  
S521210\_VRP\_003

SCALE	SHEET SIZE	DRAWN	APPROVED
N.T.S.	A3	SAJ	RS

2/265 Sandgate Road  
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ph 3505 3053  
www.s5consulting.com.au  
ABN 82 440 704 793



**ENVIRONMENTAL**

# APPENDIX B

## Arboricultural Impact Assessment

BCC DS  
Plans/Documents  
RECEIVED  
08/06/2023  
APPLICATION REF  
A006067610.

BCC DS

Plans/Documents  
RECEIVED

08/06/2023

APPLICATION REF

A006067610.



# Independent Arboricultural Services



## Arboricultural Impact Assessment

Prepared For: S5 Environmental

26 Cloverdale Road  
Doolandella QLD 4077

18 November 2022

IAS11176



## 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.

## Executive Summary

In order to fulfill conditions provided by Brisbane City Council pertaining to 26 Cloverdale Road Doolandella QLD 4077 (the subject site) in an initial assessment letter dated the 6<sup>th</sup> of September 2022 (Application Reference: A006067610), Independent Arboricultural Services (IAS) have been engaged by S5 Environmental (the client) to address condition 3(e) of the above-mentioned communication.

### Condition 3(e):

**An arborist report prepared by a minimum AQF Level 5 qualified arborist that assesses any impacts within the tree protection zones proposed for retention including within the drainage easement.**

Kieran Pentland (AQF Level 9) attended the subject site on 18 November 2022 to undertake an assessment of the impact of the proposed works on trees identified as “to be retained subject to an arborist inspection” on the periphery of the site as per S5 Environmental Vegetation Retention Plan (Drawing #: S521210\_VRP\_001).

Trees assessed as per the above mentioned VRP: 2, 21, 25, 84, 86, 87, 102, 103, and 104.

Further detailed designed will be assessed as available during the project. Protection measures and assessment of incursion has been based on the available information provided.

Specific Tree Protection Measures include;

- 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.
- Laydown 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.

# Table of Contents

Independent Arboricultural Services - Disclaimer .....	1
Executive Summary .....	2
Document Tracking & Information .....	4
Contact Details .....	5
Abbreviations .....	5
Map .....	6
Introduction.....	7
Arborist Comment.....	8
Project Hold Points.....	9
Tree Protection Plan.....	10
Tree Detail* .....	11
Tree Retention Recommendations .....	13
Tree Removal Recommendations .....	14
Tree Protection Measures and Guidelines.....	15
Tree Management Plan (TMP) – Works Progress: Development Phase .....	16
Plans .....	17
Photos.....	18
Reference Page.....	19
Appendix 1.....	20
Appendix 2: Explanation of Terminology .....	21
Appendix 3: Normal Function of a Tree .....	23
Company Details.....	25

## Document Tracking & Information

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<b>Client</b>	S5 Environmental		
<b>Address</b>	26 Cloverdale Road Doolandella QLD 4077.		
<b>IAS Reference</b>	IAS11176		
<b>Prepared By</b>	Kieran Pentland (AQF Level 9)		
<b>Checked By</b>	Roger Rankine (AQF Level 8)	<b>Date</b>	11 <sup>th</sup> December 2022
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## Abbreviations

<b>BCC</b>	Brisbane City 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.



**Kieran Pentland**  
Consulting Arborist

## Map

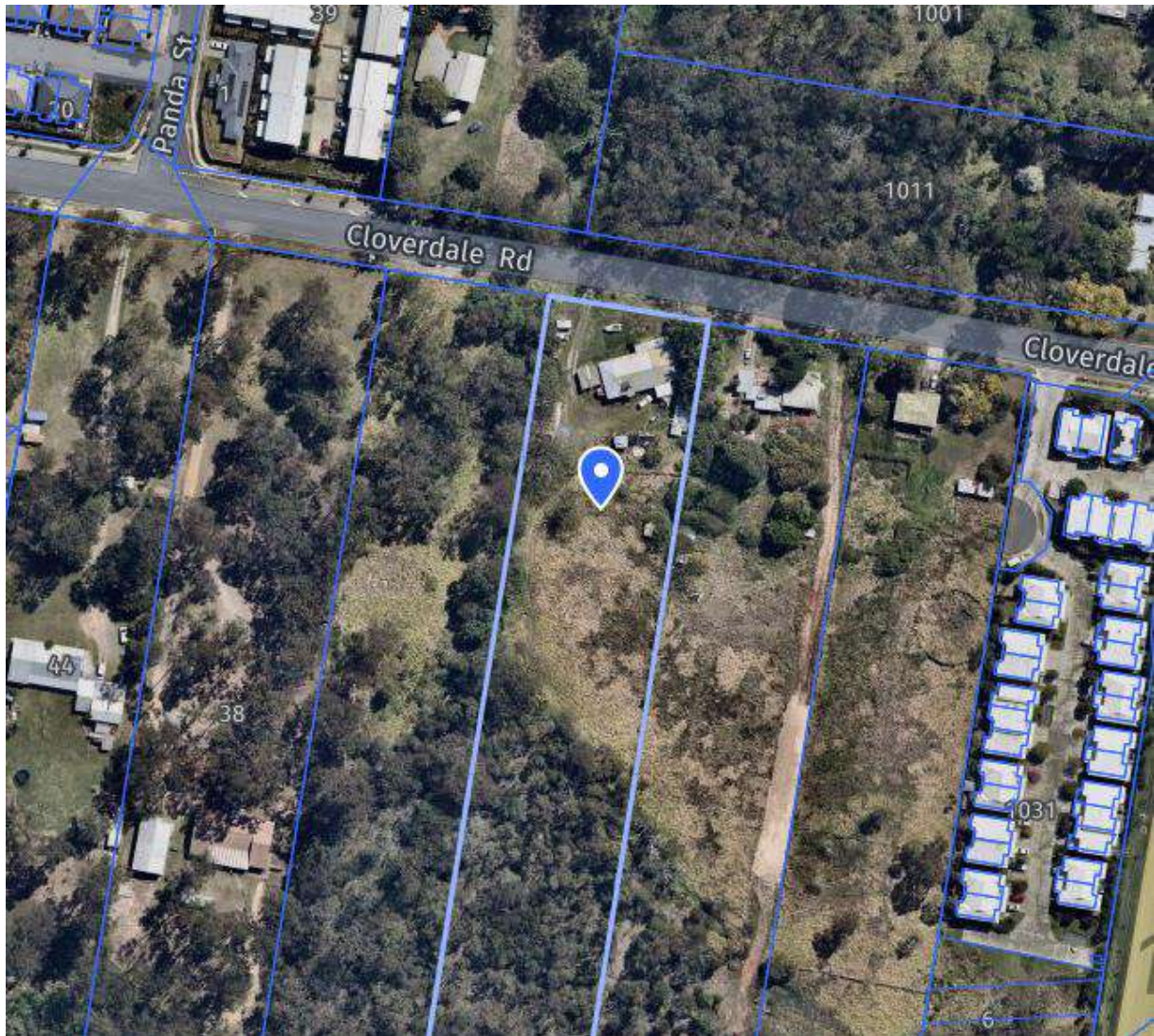


Figure 1: Subject Site - 26 Cloverdale Road Doolandella QLD 4077 (Source: Nearmap 2022)

## Introduction

This report is based on a visual inspection carried out from the ground on 18 November 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.

## Arborist Comment

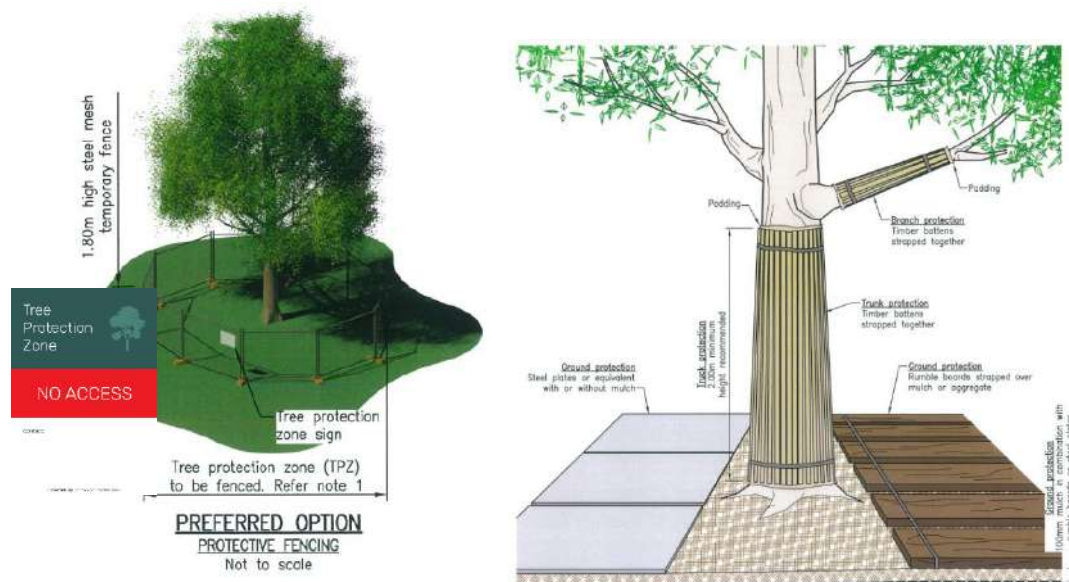
- Protection of retained trees during construction works
- Impact of the proposed works on nominated trees

### 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. 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.

### Impact of The Proposed Works on Nominated Trees

On review of the current plans, it is determined there is capacity to retain six (6) of the nine (9) trees assessed of the periphery of the subject site. The volume of cut within the TPZ of Tree 87, 103, and 104 has rendered them unsuitable for retention. The remaining trees can be retained in the event that excavation within their TPZ is controlled and supervised by the sites Project Arborist. It is recommended that the volume of cut within the TPZ of Tree 102 will be reduced to less than 10%, it appears that the cut reduction can be accommodated within the current plans, with no design changes required.



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 as 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)

<b>Project Arborist Requirements</b>
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.

## Tree Protection Plan



Vacuum excavate edge of cut within the TPZ of retained trees. Exposed roots to be pruned and treated with a horticultural fungicide prior to the commencement of all other earth works. Vacuum excavation supervision and root pruning to be performed by an AQF Level 5 Project Arborist.

Tree removals to be performed under the supervision of a minimum AQF Level 5 Project Arborist and a licensed Fauna Spotted Catcher.

Erect TPZ fencing to delineate TPZ of retained trees and construction site. TPZ fencing alignment to be audited by a minimum AQF Level 5 Project Arborist prior to the commencement of any tree removals or earthworks.

Reduce the volume of cut within the TPZ of Tree 102

Source: S5 Environmental Tree Retention Plan

## Tree Detail\*

Tree No.	Botanical Name	Common Name	DBH (cm)	TPZ (m)	Height (m)	Spread (m)	Health	Form	Comment
2	<i>Corymbia torelliana</i>	Cadagi	26	3.1	16	7	Fair	Typical	Cut proposed within TPZ of tree.
21	<i>Eucalyptus tereticornis</i>	Forest Red Gum	62	7.4	21	12	Fair	Typical	Cut proposed within TPZ of tree.
25	<i>Jacaranda mimosifolia</i>	Jacaranda	30	3.6	8	5	Fair	Typical	Cut proposed within TPZ of tree.
84	<i>Eucalyptus tereticornis</i>	Forest Red Gum	100	12	25	16	Fair	Typical	Fill proposed within TPZ of tree.
86	<i>Eucalyptus tereticornis</i>	Forest Red Gum	40	4.8	19	8	Fair	Typical	Cut proposed within TPZ of tree.
87	<i>Eucalyptus crebra</i>	Narrow-leaved Ironbark	18	2.2	17	5	Fair	Typical	Cut proposed within TPZ of tree.
102	<i>Eucalyptus seeana</i>	Narrow-leaved Red Gum	44	5.3	18	12	Fair	Typical	Cut proposed within TPZ of tree.
103	<i>Allocasuarina littoralis</i>	Black She-Oak	20	2.4	14	6	Fair	Typical	Cut proposed within TPZ of tree.
104	<i>Eucalyptus seeana</i>	Narrow-leaved Red Gum	66	7.9	18	15	Poor	Typical	Cut proposed within TPZ of tree.
									*As per S5 Environmental VRP S521210

<b>Table Legend:</b>			
<b>Health</b>	<b>Form</b>	<b>Aged Class</b>	<b>Further Detail</b>
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 Retention Recommendations

Tree No.	Botanical Name	Common Name	DBH (cm)	TPZ (m)	Impact	Recommendation
2	<i>Corymbia torelliana</i>	Cadagi	26	3.1	Minor	Retain and protect tree. Project Arborist to supervise excavation within TPZ.
21	<i>Eucalyptus tereticornis</i>	Forest Red Gum	62	7.4	Minor	Retain and protect tree. Project Arborist to supervise excavation within TPZ.
25	<i>Jacaranda mimosifolia</i>	Jacaranda	30	3.6	Minor	Retain and protect tree. Project Arborist to supervise placement of fill within TPZ of fill within TPZ of tree. Fill to be no greater than 10cm in depth.
84	<i>Eucalyptus tereticornis</i>	Forest Red Gum	100	12	Minor	Retain and protect tree. Project Arborist to supervise excavation within TPZ.
86	<i>Eucalyptus tereticornis</i>	Forest Red Gum	40	4.8	Minor	Retain and protect tree. Project Arborist to supervise placement of fill within TPZ of fill within TPZ of tree. Fill to be no greater than 10cm in depth.
102	<i>Eucalyptus seeana</i>	Narrow-leaved Red Gum	44	5.3	Major	Retain and protect tree. Project Arborist to supervise excavation within TPZ. It is recommended to locally adjust earthworks to reduce the level of cut within the TPZ of under 10%.

## Tree Removal Recommendations

Tree No.	Botanical Name	Common Name	DBH (cm)	TPZ (m)	Impact	Recommendation
87	<i>Eucalyptus crebra</i>	Narrow-leaved Ironbark	18	2.2	Major	Remove and replace tree.
103	<i>Allocasuarina littoralis</i>	Black She-Oak	20	2.4	Major	Remove and replace tree.
104	<i>Eucalyptus seeana</i>	Narrow-leaved Red Gum	66	7.9	Major	Remove and replace tree.

# 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

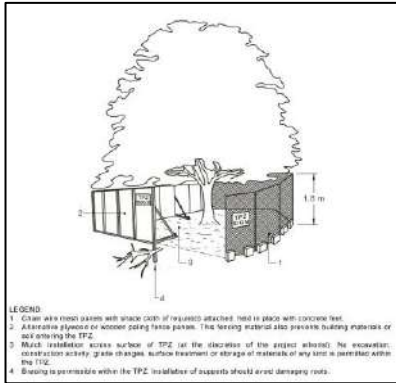


Figure 2

## Examples of Trunk, Branch & Ground Protection

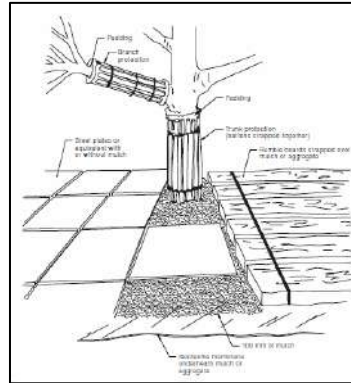


Figure 3

## Tree Protection Zone Signage

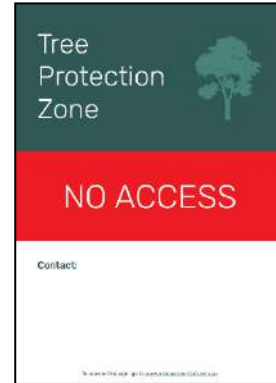


Figure 4

## 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.

# Plans



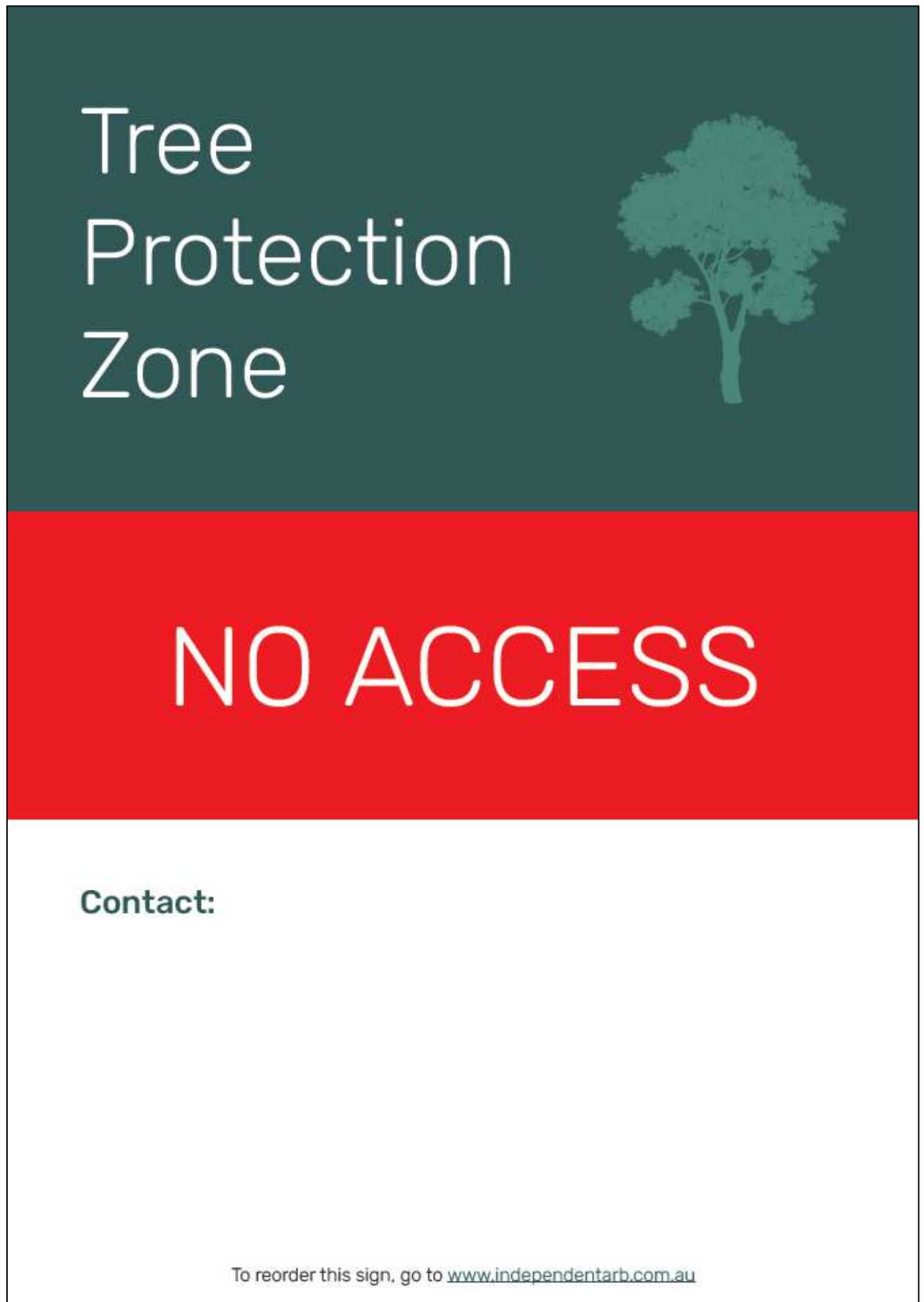
## Photos



## Reference Page

1. Australian Standards 2009, AS 4970-2009 Protection of trees on development sites
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<<http://www.hort.cornell.edu/uhi/outreach/csc/article.html>>
7. Urban, J 2008, Up By Roots, Healthy Soils and Trees in the Built Environment, International Society of Arboriculture
8. Nearmap 2022, [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.

<p><b>Habitat Pruning</b></p>	<p>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</p>
<p><b>Deadwood</b></p>	<p>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.</p>
<p><b>Decay</b></p>	<p>The process of degradation of woody tissues by micro-organisms<sup>61F</sup></p>
<p><b>Compaction</b></p>	<p>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></p>
<p><b>Codominant Structure:</b></p>	<p>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></p>

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.

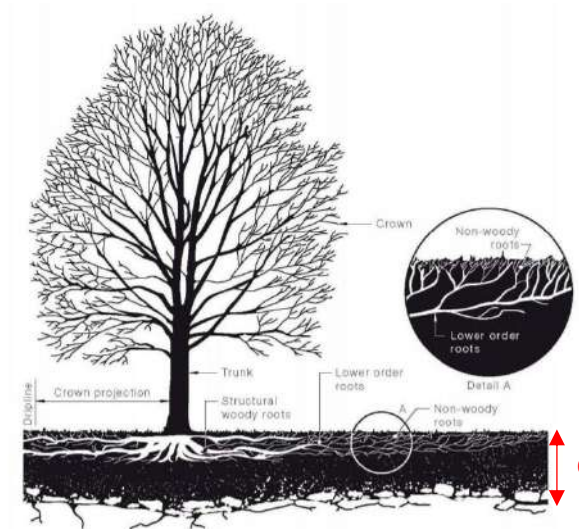


Figure 11: Structure of a tree in a normal growing environment

### 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).

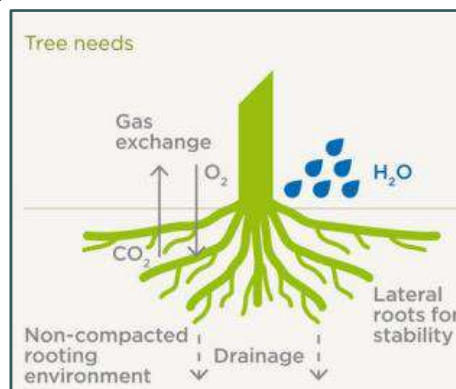


Figure 12: Gas exchange in woody tissues: the diffusion of gases into and out of a particular region (Jaluzot)

# 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.