Independent Arboricultural Services

BCC DS
RECEIVED
22/10/2026
APPLICATION REF
A007138307



Vegetation Management Plan

Prepared For: Celia Roberts

166 Pacey Road
Upper Brookfield QLD 4069

29 April 2022

IAS9556

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 transplantation 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.

This report is subject to copyright laws and no part of it may be reproduced or used without the express written permission of the client or Independent Arboricultural Services, nor shall it be conveyed to the public through advertising, public relations, news, sales or other media without the written consent of the consultant and no responsibility will be accepted by Independent Arboricultural Services should such unauthorised use of this report be made. The consultant shall not be required to give testimony or to attend court by reason of this report unless subsequent contractual arrangements have been made including payment of additional fees for such services.

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.

Table of Contents

Independent Arboricultural Services - Disclaimer 1
Document Tracking & Information 3
Contact Details 4
Abbreviations 4
Map 5
Introduction 6
Executive Summary 7
Arborist Comment 8
Key Hold Points 9
Conclusion 10
Tree Management Plan 11
Tree Detail 13
Plans 19
Site Photos 22
Site Photos 23
Tree Protection Measures and Guidelines 24
Tree Management Plan (TMP) – Works Progress: Development Phase 25
Reference Page 26
Appendix 1 27
Appendix 2: Explanation of Terminology 28
Appendix 3: Normal Function of a Tree 30
Reference Page 32
Company Details 33

Document Tracking & Information

Project Name	Arboricultural Impact Assessment & Vegetation Management Plan		
Project Arborist	Steven Richards (AQF Level 5)		
Client	Celia Roberts		
Address	166 Pacey Road, Upper Brookfield QLD 4069		
IAS Reference	IAS9556		
Prepared By	Steven Richards (AQF Level 5)		
Checked By	Roger Rankine (AQF Level 8)	**Date**	8th May 2022
Revision	1		
Andrew Rankine ***Director*** Mobile: 0412 035 396	• Diploma Arb. (AQF Level 5) • Arboriculture Australia Registered Professional Arborist • QTRA (Lic. 2768)	• TRAQ (Qualified) • ISA Certified Arborist & Municipal Specialist AU-0269AM • QAA Qualified Member	
Roger Rankine ***Director*** Mobile: 0408 161 015	• Diploma Arb. (AQF Level 5) • Grad Cert Arb. (AQF Level 8) • ISA Qualified Arborist (QL-0001A) • QTRA (Lic. 4988)	• TRAQ (Qualified) • Arboriculture Australia Registered Professional Arborist • QAA Qualified Member	
Stephen Catchpoole ***Consulting Arborist*** Mobile: 0400 473 500	• Diploma Arb. (AQF Level 5) • QTRA (Qualified) • Doctor of Philosophy in Forestry (PhD)	• TRAQ (Qualified) • Bachelor of Science Forestry • Bachelor of Science (Hons Botany) • QAA Qualified Member	
Mick Maher ***Consulting Arborist*** Mobile: 0400 606 640	• Diploma Arb. (AQF Level 5) • Cert IV Project Management • Cert III Conservation and Land Management	• TRAQ (Qualified) • Cert II Horticulture (Turf Management) • QAA Qualified Member	
Garry Rangi ***Consulting Arborist*** Mobile: 0418 793 534	• Diploma Arb. (AQF Level 5) • Cert III in Civil Construction: (Plant Operations), (Pipe Laying), (Road Construction & Maintenance) • Advanced Diploma of Civil Construction • Cert III in Conservation Earthworks	• TRAQ (Qualified) • Diploma Horticulture • Diploma Project Management • Diploma Business Management • Associate Diploma (Wilderness Reserves & Wildlife) • Arboriculture Australia Registered Consulting Arborist • QAA Qualified Member	
Sam Gilbey ***Consulting Arborist*** *Mobile: 0400 229 587*	• Diploma Arb. (AQF Level 5) • QTRA / TRAQ Qualified	• Bachelor of Science in Ecology and Conservation Biology	
Kieran Pentland ***Consulting Arborist*** Mobile: 0448 827 976	• Diploma Arb. (AQF Level 5) • Grad Cert Arb. (AQF Level 8) • MSc. Arb. & Urban Forestry (AQF Level 9) • QAA Qualified Member • QTRA Qualified	• TRAQ (ISA Qualifications) • Bachelor of Arts in Leisure Management • National Cert in Tree Management • National Cert in Horticulture	

Contact Details

Phone	(07) 3399 5865
Enquiries	office@independentarb.com.au
Accounts	accounts@independentarb.com.au
Web	www.independentarb.com.au
Postal Address	PO Box 287, Morningside QLD 4170
ABN	65 062 099 495

Abbreviations

BCC	Brisbane City Council	**RPA**	Root Protection Area
DA	Development Application	**TMP**	Tree Management Plan
VPO	Vegetation Protection Order	**CMP**	Construction Management Plan
ULE	Useful Life Expectancy	**VMP**	Vegetation Management Plan
BLF	Building Location Footprint	**AS**	Australian Standard
BLE	Building Location Envelope	**AS 4373: 2007**	Pruning of amenity trees
TPZ	Tree Protection Zone	**AS 4970: 2009**	Protection of trees on development sites
SRZ	Structural Root Zone	**DBH**	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.



Steven Richards

Consulting Arborist

Map



Figure 1: Subject Site – Lot 2-166 Pacey Rd, Upper Brookfield, QLD, 4069 (Source: Metromap 2022)

Introduction

This report is based on a visual inspection carried out from the ground on 29 April 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. This Vegetation Management Plan will address section 10A of the approved development application, reference: A005322550.

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 Celia Roberts to assess potential impacts to the nominated vegetation resulting from approved subdivision at Lot 2- 166 Pacey Road, Upper Brookfield QLD 4069. Steven Richards (AQF Level 5) attended site on 29 April 2022 to undertake the assessment of the impact of the works.

The 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.

Trees within the Building Location Envelope (BLE) and incursion into the TPZ include 33 Trees, 1-19, 97-102, 109-114 and 118 and 120.

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

- 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). See tree management for proposed alignment.
- Tree protection fencing is to be fauna friendly (i.e., a minimum 200mm gap is left at the bottom of the fencing to allow fauna to pass through.
- Supervision by a Project Arborist (Min AQF Level 5) and Fauna Spotter/Catcher of the approved tree removals.
- During operational works if a fauna interaction occurs the contractor to contact an appropriately qualified fauna spotter/catcher for advice who possesses a Rehabilitation Permit/Damage Mitigation Permit issued under the Nature Conservation Act 1992.
- Any works proposed within the TPZ of retained trees requires supervision of a minimum AQF5 Project 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.

Arborist Comment

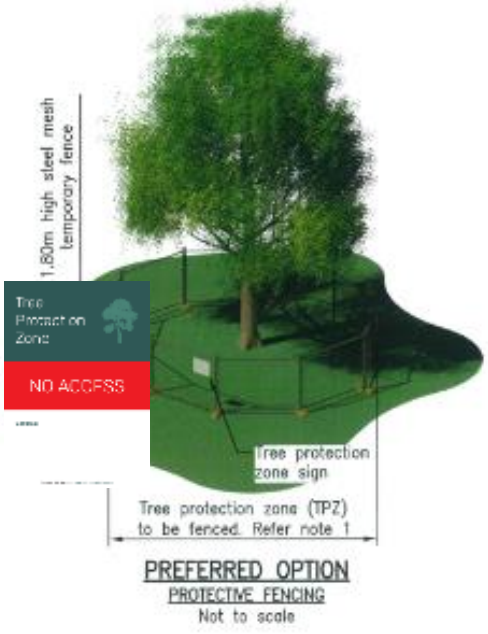
- **Protection of retained trees during construction works**
- **Impact of the proposed works on nominated trees**

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. The fencing is to be fauna friendly with a minimum 200mm gap between the ground and the base of the fencing.

Impact of The Proposed Works on Nominated Trees

Impact on retention trees should be negligible if adherence to Arboricultural methodology and AS4970 is maintained and observed. As part of the works thirty-three (33) trees have been identified for removal due to building works and / or bushfire fire management requirements.





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 (see Tree Management Plan for recommended alignment). Please note, the selected Tree Protection Fencing is to utilise a fauna friendly set up (i.e minimum 200mm gap between the ground and the start of the fencing.

Key Hold Points

Project Arborist Requirements	Fauna Requirements
Pre-Start Inspection and Audit of Tree Protection Fencing Before Works Commence	An appropriately qualified fauna spotter catcher is to be appointed to the project.
Brisbane City Council Pre-Start Meeting including the Project Arborist, Project Spotter Catcher & Civil contractor to be undertaken and NALL permissions granted before operational works occurs.	
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.	Pre-clearing inspection and report is undertaken to identify location of habitat features and trees are clearly marked with flagging tape or paint
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.	Clearing is undertaken as directed in the fauna report and the fauna spotter catcher to be present on site at all times during clearing. Clearing works is proposed to be undertaken within 1 (one) day. If any stacked trees (removed as part of the works) is left for greater than 48 hours the pile is to be reinspected.
All work is to be excluded from the Structural Root Zone (SRZ) and supervised if located within Tree Protection Zone.	If any fauna is encountered during construction works, then works must cease immediately and the contractor should contact an appropriately qualified fauna spotter/catcher for advice who possesses a Rehabilitation Permit/Damage Mitigation Permit issued under the Nature Conservation Act 1992.
The Project Arborist to be consulted if changes to plans are made that affect any retained vegetation.	Spotter catcher to provide a post clearing report & fauna friendly fencing is to be utilised for the duration of the project.
At the Completion of works, Project Arborist to undertake a site assessment and an audit report compile of any further remedial actions required.	

Conclusion

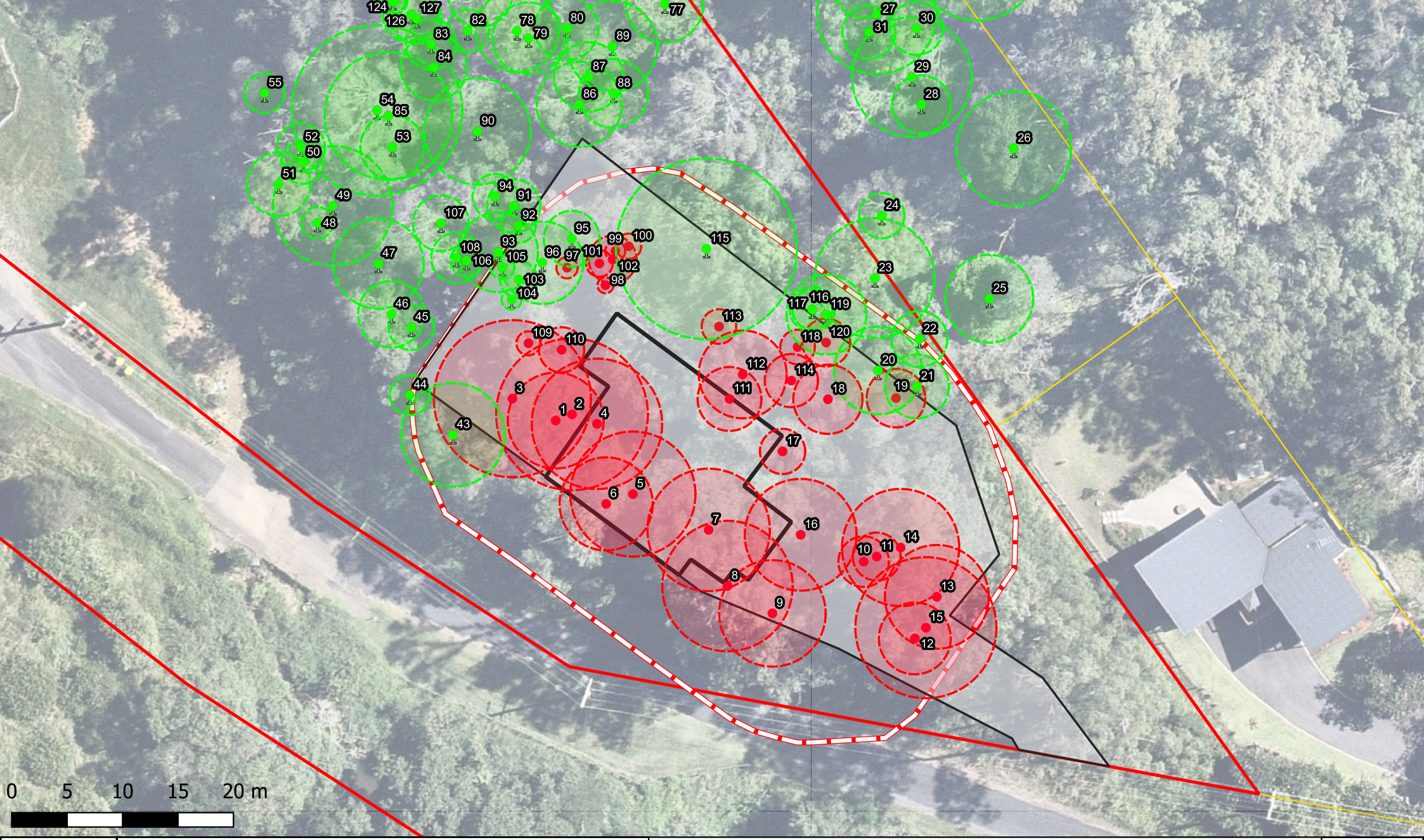
For all retained trees, with due care, implementation of appropriate work methodology as noted in this report and isolation of all TPZs of retained trees from construction works, the potential for ill-effect to retained/affected trees can be minimised in accordance with guidelines of AS4970:2009 – Protection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

The following must occur:

BCC 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 the utility alignment
- 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.**

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).



Independent Arboricultural Services

Site: 166 Pacey Road, Upper Brookfield		
Client: Celia Roberts	Page: 1 of 1	IAS Job Reference: IAS9556
Date: 22 April 2022	Map Projection: MGA Zone 56	Datum: GDA 94

Legend:

- Site Boundary
- Proposed dwelling location
- Proposed BLE (including driveway)
- Bushfire Buffer Zone
- Property Boundaries
- Tree to be retained
- TPZ - Tree to be retained
- Tree to be removed
- TPZ - Tree to be removed
- 1 Tree ID

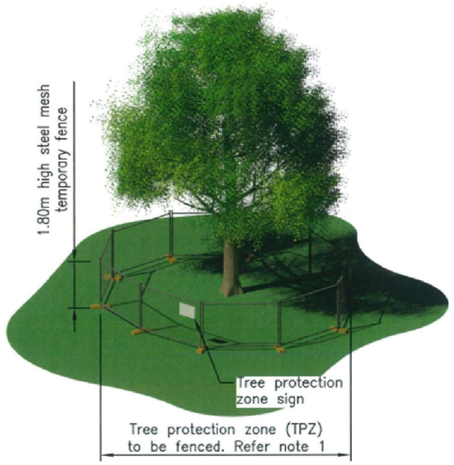
NearMap 2022

N

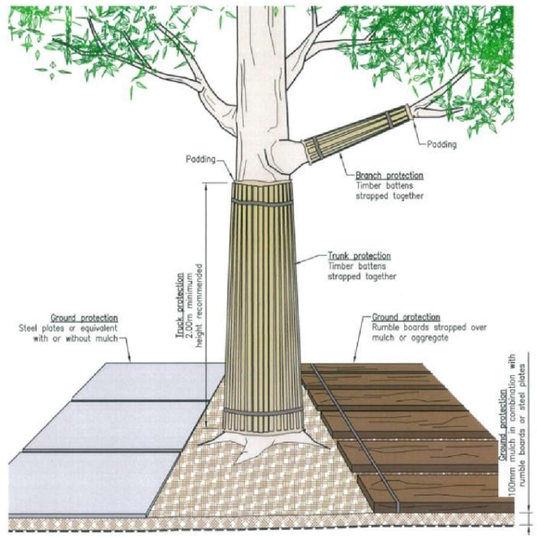
Scale: 1 : 300

XREF'S:

TREE PROTECTION MEASURES AND NOTES

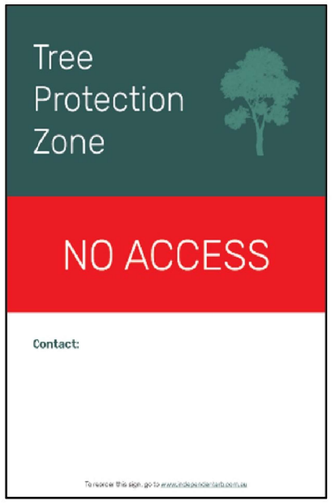


PREFERRED OPTION
PROTECTIVE FENCING
Not to scale



Tree Protection Measures are to be audited by the Project Arborist before works commence. Standard fencing is 1.8 metre mesh fencing. Further protection measures including branch and stem protection to be installed as directed by the Project Arborist. No laydown, storage of materials, chemicals or machinery within the Tree Protection Zone at any time. If access is required within the TPZ the Project Arborist to be consulted.

Trees nominated for removal are to be marked with a Pink X.



Tree Protection Signage to be attached to each panel with the key site contact details.

Signage is to be attached at a minimum every second panel and is to be audited by the Project Arborist before works comment.

PROJECT HOLD POINTS

PROJECT ARBORIST REQUIREMENTS

1.	All council / statutory body permissions to be in place before works commence.
2.	Pre-Start Inspection and Audit of Tree Protection Fencing Before Works Commence
3.	Any required tree pruning 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.
4.	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.
5.	All works to be excluded from the Structural Root Zone (SRZ) and supervised if located within Tree Protection Zone.
6.	The Project Arborist to be consulted if changes to plans are made that affect any retained vegetation.
7.	Tree Protection Fencing is not to be removed before the completion of works.
8.	At the Completion of works, Project Arborist to undertake a site assessment and an audit report compile of any further remedial actions required.

FAUNA AND MULCH REQUIREMENTS

All fauna management requirements are to be undertaken by a qualified wildlife specialist who holds a Spotter Catcher licence issued by the Queensland Department of Environment and Science (DES).

The following to be undertaken;

- Pre-clearing clearing inspection of the site to identify and mark (i.e. using flagging tape or marking paint) all potential habitat values (e.g. tree hollows, nests, fissures, dreys, arboreal termitaria, ground resources).
- A Pre-Clearing report should be prepared by the Spotter-Catcher that identifies the location of habitat features and specifies any operational requirements.
- Clearing of any vegetation is to be undertaken in accordance with the Pre-Clearing Report and subsequent Spotter-Catcher directions.
- Spotter catcher to supervise all clearing and provide a post clearing summary report.
- Fauna friendly Tree Protection and site fencing to be utilised as required and directed by either the Spotter Catcher or Project Arborist.

All staff and contractors attending site are to be made aware of the exclusion area on site and the management measures adopted to minimise impacts to both fauna and flora. All vegetation cleared on site is to be stockpiled on site and left for approximately 12 weeks to age. Aged mulch to be utilised in landscaping requirements on site. Any additional mulch requirements are to utilise aged style forest mulch aged for approximately 12 weeks and spread to a maximum depth of 75-100mm.

PRELIMINARY DRAWING
NOT TO BE USED FOR CONSTRUCTION PURPOSES

Rev	Date	Description	By	Chk
01	09.09.20	Issued for Approval	KN	RR

The concepts and information contained in this document are the copyright of INDEPENDENT ARBORICULTURAL SERVICES. Use or copying of the document in whole or in part without the written permission of INDEPENDENT ARBORICULTURAL SERVICES constitutes an infringement of copyright.
Do not scale drawings. If in doubt, ask!

Independent Arboricultural Services
A Po Box 287, Morningside QLD 4170
P 07 3399 5865
E office@independentarb.com.au

Client: Celia Roberts

Project Name:

Title: TREE PROTECTION DETAILS

Discipline: ARBORICULTURAL		Status: APPROVAL
Designed By:	Checked By: RR	Approved By: RR
Project No.: IAS#9556	Drawn By: KN	Scale: N.T.S. (at A3)
Drawing No.: VMP05		Revision: 01

FULL SIZE ON ORIGINAL 0 10 20 30 40 50mm

PLOT DATE:
FILENAME:

Tree Detail

Tree Id	Botanical Name	Common Name	DBH [mm]	TPZ [m]	Tree Height [m]	Canopy Spread [m]	Health	Form	Recommendation
1	*Acacia disparrima*	Hickory Wattle	360	4.32	16	8	Good	Typical	Remove
2	*Lophostemon confertus*	Queensland Brush Box	570	6.84	17	9	Good	Typical	Remove
3	*Lophostemon confertus*	Queensland Brush Box	590	7.08	17	6	Good	Typical	Remove
4	*Lophostemon confertus*	Queensland Brush Box	490	5.88	16	6	Good	Typical	Remove
5	*Lophostemon confertus*	Queensland Brush Box	470	5.64	16	6	Good	Typical	Remove
6	*Lophostemon confertus*	Queensland Brush Box	350	4.2	18	7	Good	Typical	Remove
7	*Lophostemon confertus*	Queensland Brush Box	460	5.52	18	8	Good	Typical	Remove
8	*Eucalyptus propinqua*	Small Fruited Grey Gum	490	5.88	19	7	Good	Typical	Remove
9	*Eucalyptus crebra*	Narrow Leaved Ironbark	400	4.8	18	7	Good	Typical	Remove
10	*Eucalyptus propinqua*	Small Fruited Grey Gum	190	2.28	14	5	Good	Typical	Remove
11	*Eucalyptus propinqua*	Small Fruited Grey Gum	180	2.16	14	6	Good	Typical	Remove
12	*Eucalyptus propinqua*	Small Fruited Grey Gum	270	3.24	17	6	Good	Typical	Remove
13	*Eucalyptus propinqua*	Small Fruited Grey Gum	390	4.68	17	6	Good	Typical	Remove
14	*Eucalyptus crebra*	Narrow Leaved Ironbark	440	5.28	19	8	Good	Typical	Remove
15	*Eucalyptus crebra*	Narrow Leaved Ironbark	530	6.36	19	9	Good	Typical	Remove
16	*Lophostemon confertus*	Queensland Brush Box	420	5.04	17	10	Good	Typical	Remove
17	*Acacia disparrima*	Hickory Wattle	170	2.04	16	5	Good	Typical	Remove
18	*Lophostemon confertus*	Queensland Brush Box	260	3.12	16	5	Good	Typical	Remove
19	*Acacia disparrima*	Hickory Wattle	220	2.64	15	3	Good	Typical	Remove
20	*Acacia disparrima*	Hickory Wattle	330	3.96	16	3	Declining	Typical	Retain
21	*Acacia disparrima*	Hickory Wattle	240	2.88	15	4	Good	Typical	Retain
22	*Commersonia bartramia*	Brown Currajong	210	2.52	6	4	Good	Typical	Retain
23	*Eucalyptus propinqua*	Small Fruited Grey Gum	450	5.4	18	8	Good	Typical	Retain
24	*Acacia disparrima*	Hickory Wattle	170	2.04	8	4	Good	Typical	Retain

Tree Id	Botanical Name	Common Name	DBH [mm]	TPZ [m]	Tree Height [m]	Canopy Spread [m]	Health	Form	Recommendation
25	*Macadamia integrifolia*	Macadamia	330	3.96	8	4	Good	Typical	Retain
26	*Araucaria sp*	Araucaria	430	5.16	15	8	Good	Typical	Retain
27	*Acacia complanata*	Long Pod Wattle	450	5.4	7	6	Good	Typical	Retain
28	*Acacia disparrima*	Hickory Wattle	220	2.64	7	5	Good	Typical	Retain
29	*Elaeocarpus sp*	Elaeocarpus	450	5.4	8	5	Good	Typical	Retain
30	*Eucalyptus acmenoides*	White Mahogony	200	2.4	9	3	Good	Typical	Retain
31	*Eucalyptus crebra*	Narrow Leaved Ironbark	200	2.4	16	3	Good	Typical	Retain
32	*Eucalyptus microcorys*	Tallow Wood	240	2.88	17	5	Good	Typical	Retain
33	*Corymbia citriodora subsp. variegata*	Northern Grey Ironbark	480	5.76	18	9	Good	Typical	Retain
34	*Eucalyptus acmenoides*	Spotted Gum	700	8.4	17	8	Good	Typical	Retain
35	*Corymbia citriodora subsp. variegata*	Lemon Scented Gum	150	1.8	14	6	Good	Typical	Retain
36	*Eucalyptus acmenoides*	White Mahogony	240	2.88	16	6	Good	Typical	Retain
37	*Corymbia citriodora subsp. variegata*	Lemon Scented Gum	440	5.28	19	8	Good	Typical	Retain
38	*Acacia disparrima*	Hickory Wattle	240	2.88	14	6	Good	Typical	Retain
39	*Corymbia citriodora subsp. variegata*	Lemon Scented Gum	360	4.32	17	6	Good	Typical	Retain
40	*Eucalyptus microcorys*	Tallow Wood	130	1.56	15	4	Good	Typical	Retain
41	*Acacia concurrens*	Black Wattle	300	3.6	9	6	Good	Typical	Retain
42	*Eucalyptus microcorys*	Tallow Wood	240	2.88	15	6	Good	Typical	Retain
43	*Acacia disparrima*	Hickory Wattle	390	4.68	12	6	Good	Typical	Retain
44	*Lophostemon confertus*	Queensland Brush Box	150	1.8	16	6	Good	Typical	Retain
45	*Alphitonia excelsa*	Queensland Brush Box	170	2.04	9	6	Good	Typical	Retain
46	*Acacia disparrima*	Hickory Wattle	250	3	10	6	Good	Typical	Retain
47	*Guoia semiglauca*	Wild Quince	340	4.08	12	6	Good	Typical	Retain

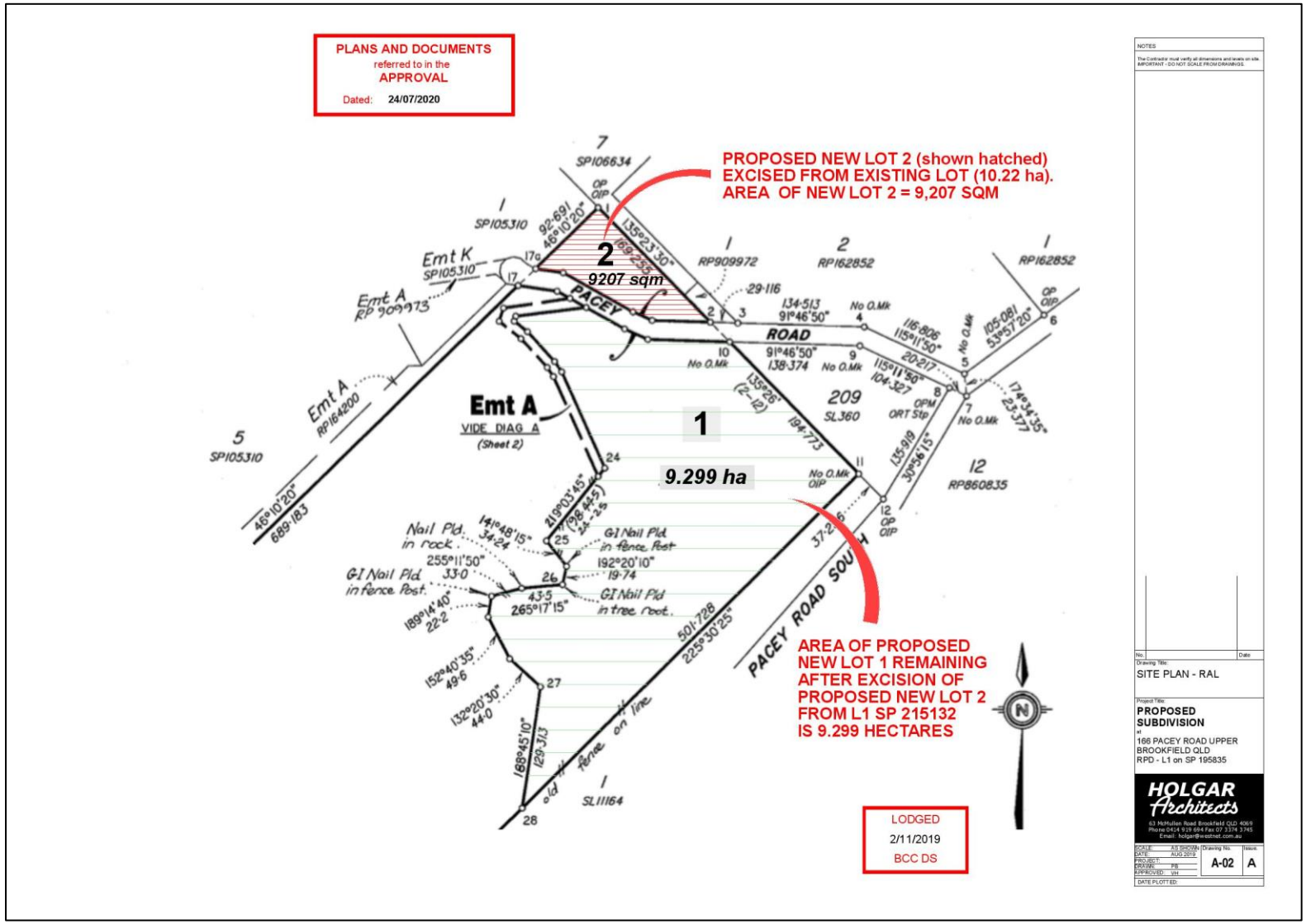
Tree Id	Botanical Name	Common Name	DBH [mm]	TPZ [m]	Tree Height [m]	Canopy Spread [m]	Health	Form	Recommendation
48	*Lophostemon confertus*	Queensland Brush Box	120	1.5	14	3	Good	Typical	Retain
49	*Eucalyptus propinqua*	Small Fruited Grey Gum	450	5.4	18	8	Good	Typical	Retain
50	*Eucalyptus propinqua*	Small Fruited Grey Gum	160	1.92	18	8	Good	Typical	Retain
51	*Melia azedarach*	White Cedar	240	2.88	12	8	Good	Typical	Retain
52	*Eucalyptus microcorys*	Tallow Wood	180	2.16	10	6	Good	Typical	Retain
53	*Acacia disparrima*	Hickory Wattle	240	2.88	14	5	Good	Typical	Retain
54	*Acacia disparrima*	Hickory Wattle	640	7.68	17	8	Good	Typical	Retain
55	*Acacia disparrima*	Hickory Wattle	150	1.8	15	4	Good	Typical	Retain
56	*Acacia disparrima*	Hickory Wattle	190	2.28	16	3	Good	Typical	Retain
57	*Acacia disparrima*	Hickory Wattle	190	2.28	16	3	Good	Typical	Retain
58	*Acacia disparrima*	Hickory Wattle	220	2.64	17	3	Good	Typical	Retain
59	*Lophostemon confertus*	Queensland Brush Box	90	1.5	6	3	Good	Typical	Retain
60	*Acacia disparrima*	Hickory Wattle	230	2.76	14	4	Good	Typical	Retain
61	*Acacia disparrima*	Hickory Wattle	270	3.24	14	4	Good	Typical	Retain
62	*Acacia disparrima*	Hickory Wattle	170	2.04	14	4	Good	Typical	Retain
63	*Acacia disparrima*	Hickory Wattle	200	2.4	14	4	Good	Typical	Retain
64	*Acacia disparrima*	Hickory Wattle	170	2.04	14	4	Good	Typical	Retain
65	*Acacia disparrima*	Hickory Wattle	190	2.28	15	4	Good	Typical	Retain
66	*Eucalyptus crebra*	Narrow Leaved Ironbark	410	4.92	19	9	Good	Typical	Retain
67	*Jagera psuedorhus*	Foam Bark	330	3.96	15	6	Good	Typical	Retain
68	*Eucalyptus crebra*	Narrow Leaved Ironbark	550	6.6	19	9	Good	Typical	Retain
69	*Acacia disparrima*	Hickory Wattle	230	2.76	16	6	Good	Typical	Retain
70	*Acacia disparrima*	Hickory Wattle	220	2.64	16	6	Good	Typical	Retain
71	*Acacia disparrima*	Hickory Wattle	150	1.8	16	6	Good	Typical	Retain
72	*Lophostemon confertus*	Queensland Brush Box	90	1.5	6	2	Good	Typical	Retain
73	*Acacia disparrima*	Hickory Wattle	170	2.04	10	3	Good	Typical	Retain

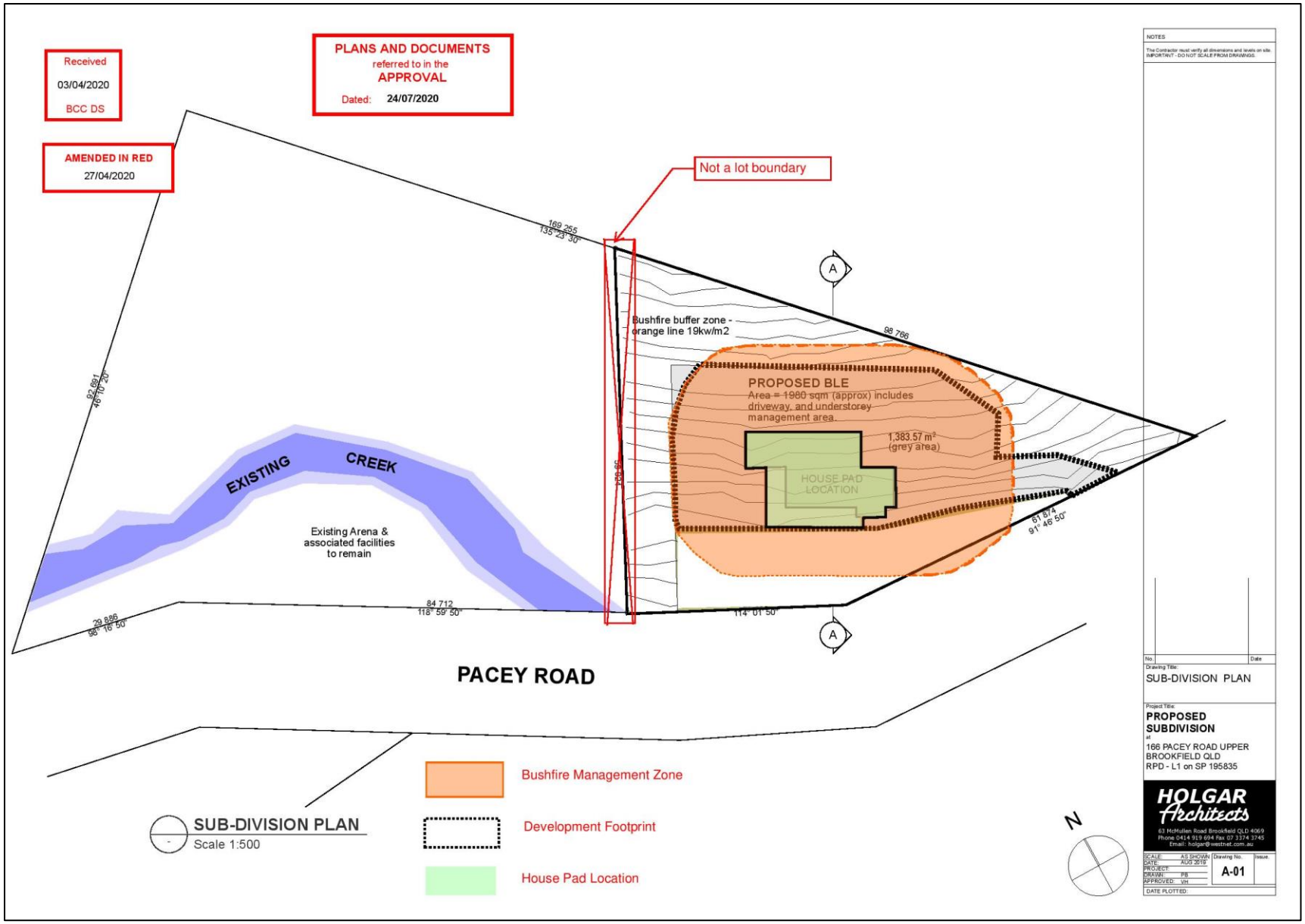
Tree Id	Botanical Name	Common Name	DBH [mm]	TPZ [m]	Tree Height [m]	Canopy Spread [m]	Health	Form	Recommendation
74	*Acacia disparrima*	Hickory Wattle	200	2.4	12	5	Good	Typical	Retain
75	*Eucalyptus microcorys*	Tallow Wood	500	6	16	6	Good	Typical	Retain
76	*Eucalyptus microcorys*	Tallow Wood	600	7.2	19	8	Good	Typical	Retain
77	*Eucalyptus microcorys*	Tallow Wood	290	3.48	17	8	Good	Typical	Retain
78	*Eucalyptus crebra*	Narrow Leaved Ironbark	310	3.72	18	8	Good	Typical	Retain
79	*Eucalyptus crebra*	Narrow Leaved Ironbark	270	3.24	17	8	Good	Typical	Retain
80	*Acacia disparrima*	Hickory Wattle	240	2.88	16	5	Good	Typical	Retain
81	*Acacia disparrima*	Hickory Wattle	240	2.88	16	5	Good	Typical	Retain
82	*Acacia disparrima*	Hickory Wattle	160	1.92	15	5	Good	Typical	Retain
83	*Acacia disparrima*	Hickory Wattle	190	2.28	15	5	Good	Typical	Retain
84	*Acacia disparrima*	Hickory Wattle	250	3	15	5	Good	Typical	Retain
85	*Acacia disparrima*	Hickory Wattle	480	5.76	15	5	Good	Typical	Retain
86	*Acacia disparrima*	Hickory Wattle	320	3.84	16	6	Good	Typical	Retain
87	*Acacia disparrima*	Hickory Wattle	260	3.12	16	6	Good	Typical	Retain
88	*Acacia disparrima*	Hickory Wattle	260	3.12	16	6	Good	Typical	Retain
89	*Acacia disparrima*	Hickory Wattle	340	4.08	16	6	Good	Typical	Retain
90	*Lophostemon confertus*	Queensland Brush Box	400	4.8	12	6	Good	Typical	Retain
91	*Lophostemon confertus*	Queensland Brush Box	200	2.4	12		Good	Typical	Retain
92	*Lophostemon confertus*	Queensland Brush Box	130	1.56	12	6	Good	Typical	Retain
93	*Lophostemon confertus*	Queensland Brush Box	300	3.6	12	6	Good	Typical	Retain
94	*Acacia disparrima*	Hickory Wattle	170	2.04	12	6	Good	Typical	Retain
95	*Eucalyptus crebra*	Narrow Leaved Ironbark	210	2.52	14	3	Good	Typical	Retain
96	*Acacia disparrima*	Hickory Wattle	310	3.72	12	6	Good	Typical	Retain
97	*Lophostemon confertus*	Queensland Brush Box	80	1.5	5	3	Good	Typical	Remove
98	*Lophostemon confertus*	Queensland Brush Box	60	1.5	5	3	Good	Typical	Remove
99	*Lophostemon confertus*	Queensland Brush Box	75	1.5	5	3	Good	Typical	Remove

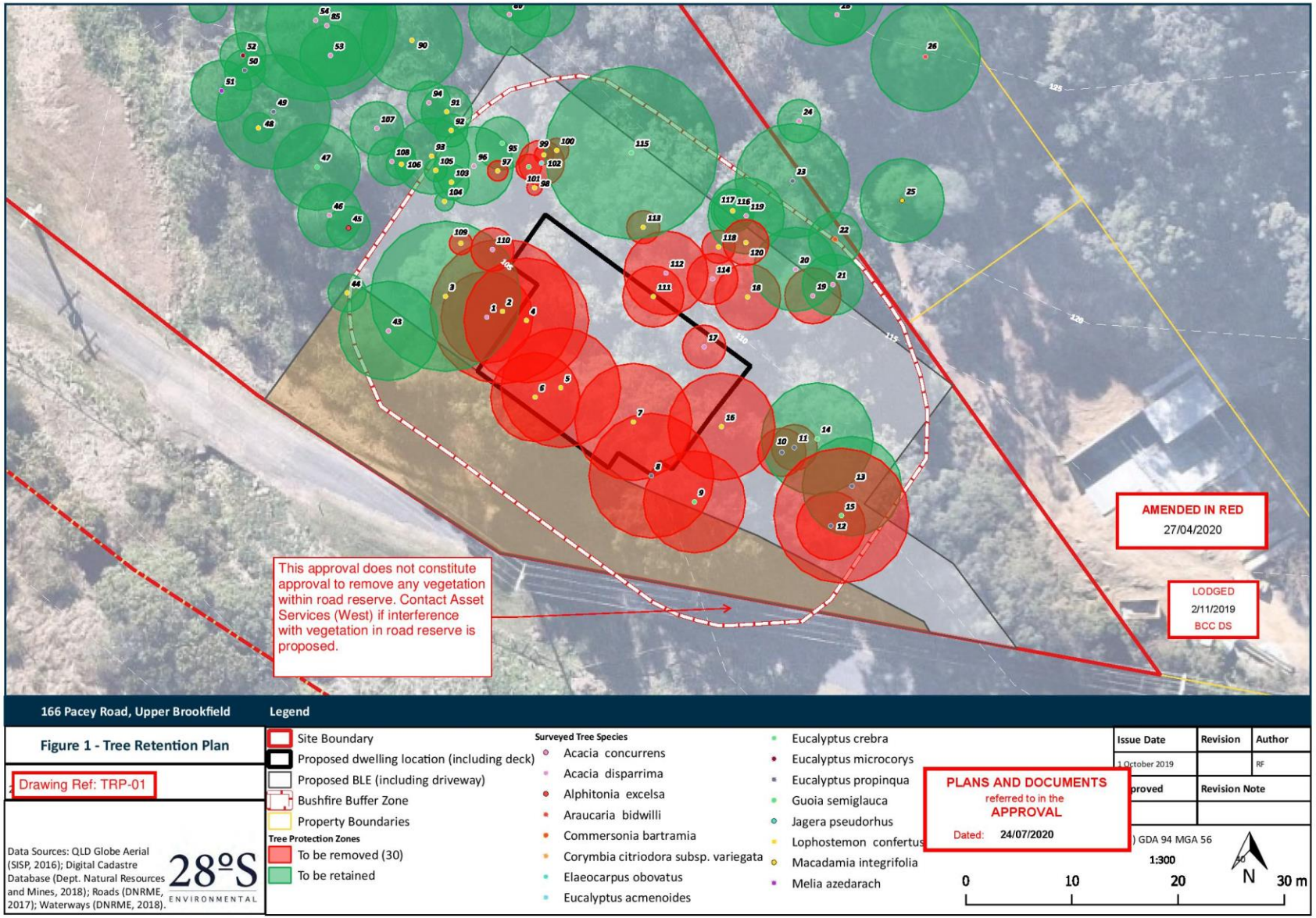
Tree Id	Botanical Name	Common Name	DBH [mm]	TPZ [m]	Tree Height [m]	Canopy Spread [m]	Health	Form	Recommendation
100	*Lophostemon confertus*	Queensland Brush Box	95	1.5	5	3	Good	Typical	Remove
101	*Eucalyptus crebra*	Narrow Leaved Ironbark	100	1.5	6	3	Good	Typical	Remove
102	*Eucalyptus acmenoides*	White Mahogony	180	2.16	12	4	Good	Typical	Remove
103	*Lophostemon confertus*	Queensland Brush Box	140	1.68	8	4	Good	Typical	Retain
104	*Lophostemon confertus*	Queensland Brush Box	75	1.5	6	4	Good	Typical	Retain
105	*Lophostemon confertus*	Queensland Brush Box	90	1.5	6	4	Good	Typical	Retain
106	*Lophostemon confertus*	Queensland Brush Box	120	1.5	7	4	Good	Typical	Retain
107	*Acacia disparrima*	Hickory Wattle	210	2.52	8	4	Good	Typical	Retain
108	*Acacia disparrima*	Hickory Wattle	190	2.28	10	5	Good	Typical	Retain
109	*Lophostemon confertus*	Queensland Brush Box	90	1.5	6	2	Good	Typical	Remove
110	*Acacia disparrima*	Hickory Wattle	170	2.04	8	4	Good	Typical	Remove
111	*Lophostemon confertus*	Queensland Brush Box	240	2.88	10	5	Good	Typical	Remove
112	*Acacia disparrima*	Hickory Wattle	330	3.96	14	6	Good	Typical	Remove
113	*Lophostemon confertus*	Queensland Brush Box	130	1.56	7	3	Good	Typical	Remove
114	*Acacia disparrima*	Hickory Wattle	200	2.4	9	3	Good	Typical	Remove
115	*Eucalyptus crebra*	Narrow Leaved Ironbark	680	8.16	18	9	Good	Typical	Retain
116	*Lophostemon confertus*	Queensland Brush Box	170	2.04	15	6	Good	Typical	Retain
117	*Lophostemon confertus*	Queensland Brush Box	150	1.8	14	6	Good	Typical	Retain
118	*Lophostemon confertus*	Queensland Brush Box	130	1.56	12	5	Good	Typical	Remove
119	*Acacia disparrima*	Hickory Wattle	300	3.6	9	5	Good	Typical	Retain
120	*Lophostemon confertus*	Queensland Brush Box	180	2.16	7	4	Good	Typical	Remove
121	*Acacia disparrima*	Hickory Wattle	260	3.12	14	4	Good	Typical	Retain
122	*Acacia disparrima*	Hickory Wattle	160	1.92	14	4	Good	Typical	Retain
123	*Lophostemon confertus*	Queensland Brush Box	95	1.5	7	2	Good	Typical	Retain
124	*Lophostemon confertus*	Queensland Brush Box	110	1.5	7	2	Good	Typical	Retain
125	*Lophostemon confertus*	Queensland Brush Box	80	1.5	7	2	Good	Typical	Retain

Tree Id	Botanical Name	Common Name	DBH [mm]	TPZ [m]	Tree Height [m]	Canopy Spread [m]	Health	Form	Recommendation
126	*Acacia disparrima*	Hickory Wattle	210	2.52	9	3	Good	Typical	Retain
127	*Acacia disparrima*	Hickory Wattle	190	2.28	14	5	Good	Typical	Retain
128	*Acacia disparrima*	Hickory Wattle	210	2.52	14	5	Good	Typical	Retain
129	*Acacia disparrima*	Hickory Wattle	170	2.04	14	5	Good	Typical	Retain
130	*Acacia disparrima*	Hickory Wattle	260	3.12	14	5	Good	Typical	Retain
131	*Eucalyptus crebra*	Narrow Leaved Ironbark	300	3.6	15	6	Good	Typical	Retain
132	*Lophostemon confertus*	Queensland Brush Box	100	1.5	8	3	Good	Typical	Retain
133	*Acacia disparrima*	Hickory Wattle	310	3.72	14	6	Good	Typical	Retain

Plans


PLANS AND DOCUMENTS
referred to in the
APPROVAL
Dated: 24/07/2020
PROPOSED NEW LOT 2 (shown hatched)
EXCISED FROM EXISTING LOT (10.22 ha).
AREA OF NEW LOT 2 = 9,207 SQM
2
9207 sqm
1
9.299 ha
Emt A
VIDE DIAG A
(Sheet 2)
Emt K
SP105310
Emt A
RP909973
Emt A
RP164200
PACEY ROAD
PACEY ROAD SOUTH
AREA OF PROPOSED
NEW LOT 1 REMAINING
AFTER EXCISION OF
PROPOSED NEW LOT 2
FROM L1 SP 215132
IS 9.299 HECTARES
LODGED
2/11/2019
BCC DS
SITE PLAN - RAL
PROPOSED
SUBDIVISION
at
166 PACEY ROAD UPPER
BROOKFIELD QLD
RPD - L1 on SP 195835
HOLGAR
Architects
A-02
A


Received
03/04/2020
BCC DS
PLANS AND DOCUMENTS
referred to in the
APPROVAL
Dated: 24/07/2020
AMENDED IN RED
27/04/2020
Not a lot boundary
169.255
135° 23' 30"
Bushfire buffer zone -
orange line 19kw/m2
98.766
92.691
46° 10' 20"
PROPOSED BLE
Area = 1980 sqm (approx) includes
driveway, and understorey
management area.
1,383.57 m²
(grey area)
HOUSE PAD
LOCATION
125.86
61.874
91° 46' 50"
EXISTING
CREEK
Existing Arena &
associated facilities
to remain
84.712
118° 59' 50"
29.886
98° 16' 50"
114° 01' 50"
A
A
PACEY ROAD
SUB-DIVISION PLAN
Scale 1:500
Bushfire Management Zone
Development Footprint
House Pad Location
N
NOTES
The Contractor must verify all dimensions and levels on site.
IMPORTANT - DO NOT SCALE FROM DRAWINGS.
No.
Date
Drawing Title:
SUB-DIVISION PLAN
Project Title:
PROPOSED
SUBDIVISION
at
166 PACEY ROAD UPPER
BROOKFIELD QLD
RPD - L1 on SP 195835
HOLGAR
Architects
63 McMullen Road Brookfield QLD 4069
Phone 0414 919 694 Fax 07 3374 3745
Email: holgar@westnet.com.au
SCALE: AS SHOWN
DATE: AUG 2019
PROJECT:
DRAWN: PB
APPROVED: VH
Drawing No.
A-01
Issue.
DATE PLOTTED:


AMENDED IN RED
27/04/2020
LODGED
2/11/2019
BCC DS
This approval does not constitute approval to remove any vegetation within road reserve. Contact Asset Services (West) if interference with vegetation in road reserve is proposed.
166 Pacey Road, Upper Brookfield
Figure 1 - Tree Retention Plan
Drawing Ref: TRP-01
Data Sources: QLD Globe Aerial (SISP, 2016); Digital Cadastre Database (Dept. Natural Resources and Mines, 2018); Roads (DNRME, 2017); Waterways (DNRME, 2018).
28ºS ENVIRONMENTAL
Legend
Site Boundary
Proposed dwelling location (including deck)
Proposed BLE (including driveway)
Bushfire Buffer Zone
Property Boundaries
Tree Protection Zones
To be removed (30)
To be retained
Surveyed Tree Species
Acacia concurrens
Acacia disparrima
Alphitonia excelsa
Araucaria bidwilli
Commersonia bartramia
Corymbia citriodora subsp. variegata
Elaeocarpus obovatus
Eucalyptus acmenoides
Eucalyptus crebra
Eucalyptus microcorys
Eucalyptus propinqua
Guoia semiglauca
Jagera pseudorhus
Lophostemon confertus
Macadamia integrifolia
Melia azedarach
PLANS AND DOCUMENTS
referred to in the
APPROVAL
Dated: 24/07/2020
Issue Date
Revision
Author
1 October 2019
RF
Revision Note
GDA 94 MGA 56
1:300
0
10
20
30 m
N

Site Photos









Site Photos









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

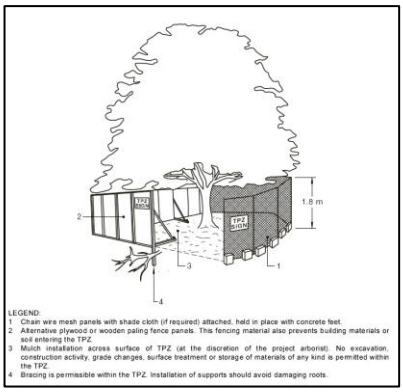


Figure 2

Examples of Trunk, Branch & Ground Protection

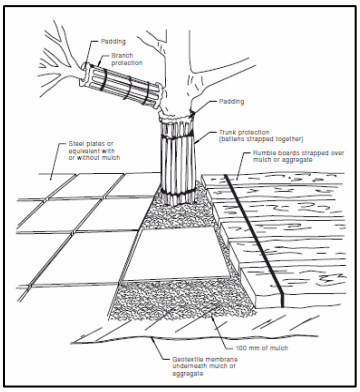


Figure 3

Tree Protection Zone Signage

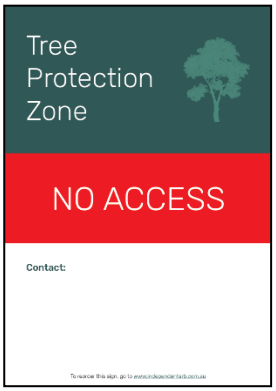


Figure 4

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

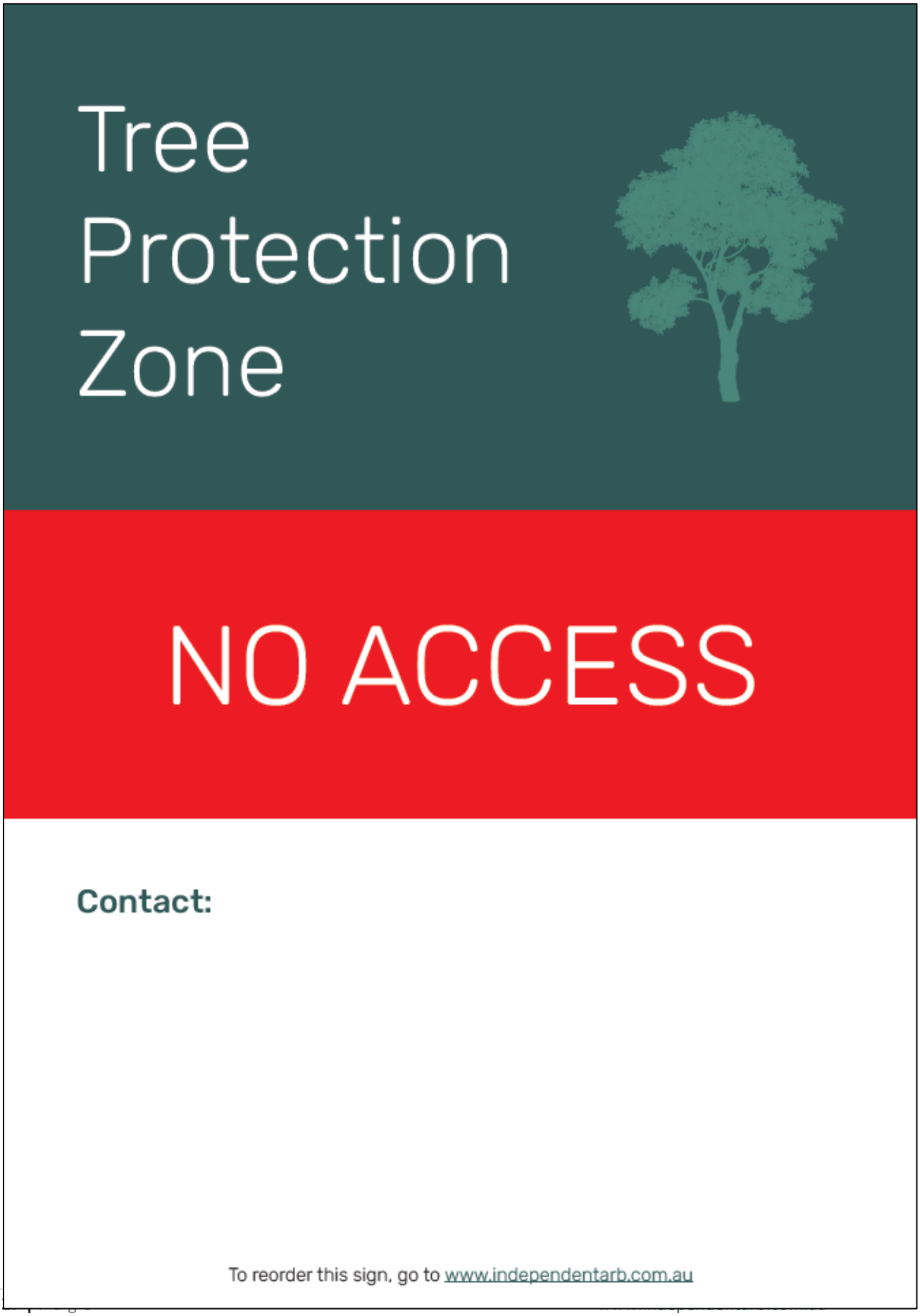
Tree Management Plan (TMP) – Works Progress: Development Phase

Stage	Tasks	Specific Outcomes
Pre-construction Phase		
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 **Arboricultural Report, TMP & Council approval copies to be included in CMP** and made available to onsite crews	Prestart Certification and approvals in place & available onsite with CMP
Commencement - Construction Phase		
Initial Site Preparation	Project Arborist to supervise all tree work. **Construction crew or others are not to remove any part of a tree.** 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 each work phase. Project Arborist must 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. Arboricultural Site Audit Statement/s will not be issued retrospectively
Construction Phase		
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. **Project Arborist to provide ongoing Site Audit Certification of all work within TPZ**	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
Post Construction Phase		
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.

Reference Page

1. Australian Standards 2009, AS 4970-2009 Protection of trees on development sites
2. Australian Standards 2007, AS 4737-2007 Pruning of Amenity Trees
3. Mattheck K, Breloer H. 1994. The body language of trees, a handbook for failure analysis, London, England
4. Shigo, A.L. 1986. A New Tree Biology. Shigo & Trees, Associates, Durham, New Hampshire
5. Shigo, A.L. 1991, Modern Arboriculture. Shigo & Trees, Associates, Durham, New Hampshire
6. Bassuk, Nina, Jason Grabosky, Peter Trowbridge, and James Urban. "Structural Soil." Urban Horticulture Institute. Cornell University, 1996. Web. 26 Apr 2010. <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

Appendix 1


Tree
Protection
Zone
NO ACCESS
Contact:
To reorder this sign, go to www.independentarb.com.au

Appendix 2: Explanation of Terminology

Definition	Process Description
Removal	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]
Remove and grind	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.
Crown Clean (Deadwood)	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.
Crown Clean (General pruning)	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.
Crown Reduction (Canopy reduction)	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.
Crown Raising (Canopy lift)	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.
Crown Restoration	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.
Hanger Limb / Unattached branch	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.
Directional Pruning	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.

Habitat Pruning	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
Deadwood	Dead branches within canopy of tree59F. 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.
Decay	The process of degradation of woody tissues by micro-organisms61F
Compaction	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 soils55F
Codominant Structure:	Stems or trunks of about the same size originating from the same position from the main stem52F. 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 union53F

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.

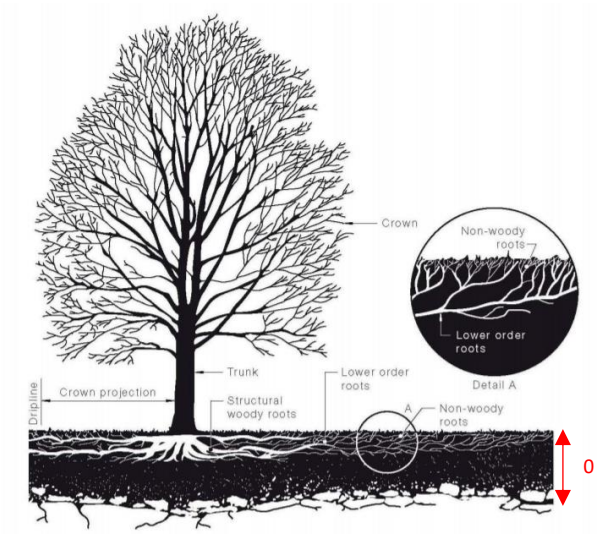


Figure 11: Structure of a tree in a normal growing environment

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).

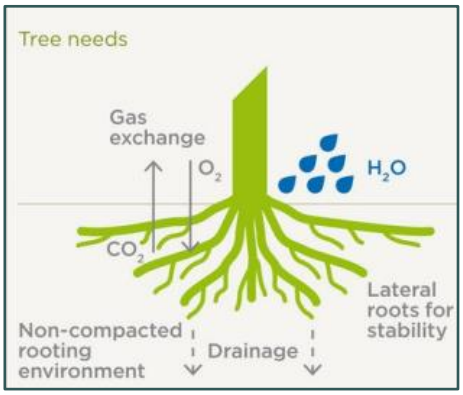


Figure 12: Gas exchange in woody tissues: the diffusion of gases into and out of a particular region (Jaluzot)

Reference Page

9. Australian Standards 2009, AS 4970-2009 Protection of trees on development sites.
10. Australian Standards 2007, AS 4737-2007 Pruning of Amenity Trees.
11. Mattheck K, Breloer H. 1994. The body language of trees, a handbook for failure analysis, London, England.
12. Shigo, A.L. 1986. A New Tree Biology. Shigo & Trees, Associates, Durham, New Hampshire.
13. Shigo, A.L. 1991, Modern Arboriculture. Shigo & Trees, Associates, Durham, New Hampshire.
14. Bassuk, Nina, Jason Grabosky, Peter Trowbridge, and James Urban. "Structural Soil." Urban Horticulture Institute. Cornell University, 1996. Web. 26 Apr 2010. <http://www.hort.cornell.edu/uhi/outreach/csc/article.html>.
15. Urban, J 2008, Up by Roots, Healthy Soils and Trees in the Built Environment, International Society of Arboriculture
16. Shigo, A.L. 1991, Modern Arboriculture. Shigo & Trees, Associates, Durham, New Hampshire.
17. Londsdale, David, Principles of Tree Hazard Assessment and Management Tree Hazard Assessment & Management TSO (The Stationery Shop, PO Box 29, Norwich, NR3 IGN)
18. Nearmap. (www.nearmap.com.au); accessed 21st March 2021.

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.

ers and coal fired power sources.