APPENDIX G

Flora and Fauna Assessment including Arborist Report

Abel Ecology

Flora and fauna assessment report

for

Kempsey District Hospital

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Report	Version	Prepared by	Checked by	Submission	
				Method	Date
Final report	Issue 1	Dr Danny Wotherspoon	Margot de Regt	Email	24 Jan 13
Interim report	Issue 2	Dr Danny Wotherspoon	Margot de Regt	Email	25 Feb 13
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Final report	Issue 4	Dr Danny Wotherspoon	Margot de Regt	Email	3 Apr 13
Final report	Issue 5	Dr Danny Wotherspoon	Margot de Regt	Email	26 Apr 13
Final report	Issue 6	Dr Danny Wotherspoon	Margot de Regt	Email	13 May13

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List of Abbreviations

d.b.h.	Diameter at breast height (~1.3 metres)
EEC	Endangered Ecological Community
LGA	Local Government Area
PDA	Principal Development Area
ROTAP	Rare or Threatened Australian Plant

Note regarding maps in this report

The diagrams/site maps used in this report have been supplied by and are used with the permission of Donovan Hill, Johnstaff and NSW Health.

With regard to maps provided by the Land Information Centre, Topographic maps used with the permission of © Land and Property Information, NSW.

Local Arborist for Kempsey

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Figure 1. Air photo of the site and surrounding area

Site locality

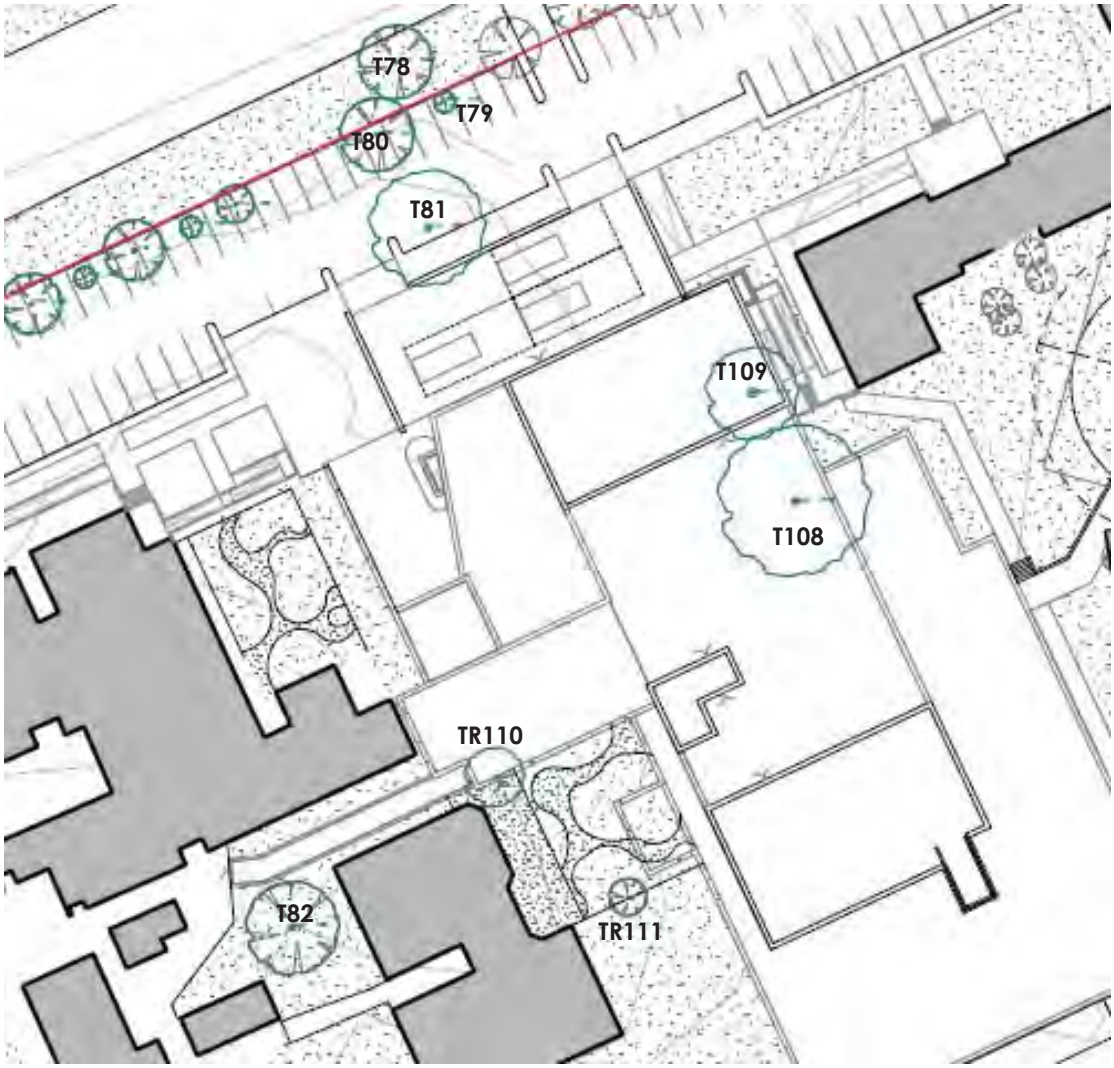


Figure 2. EXTRACT Proposal Diagram for building works showing trees

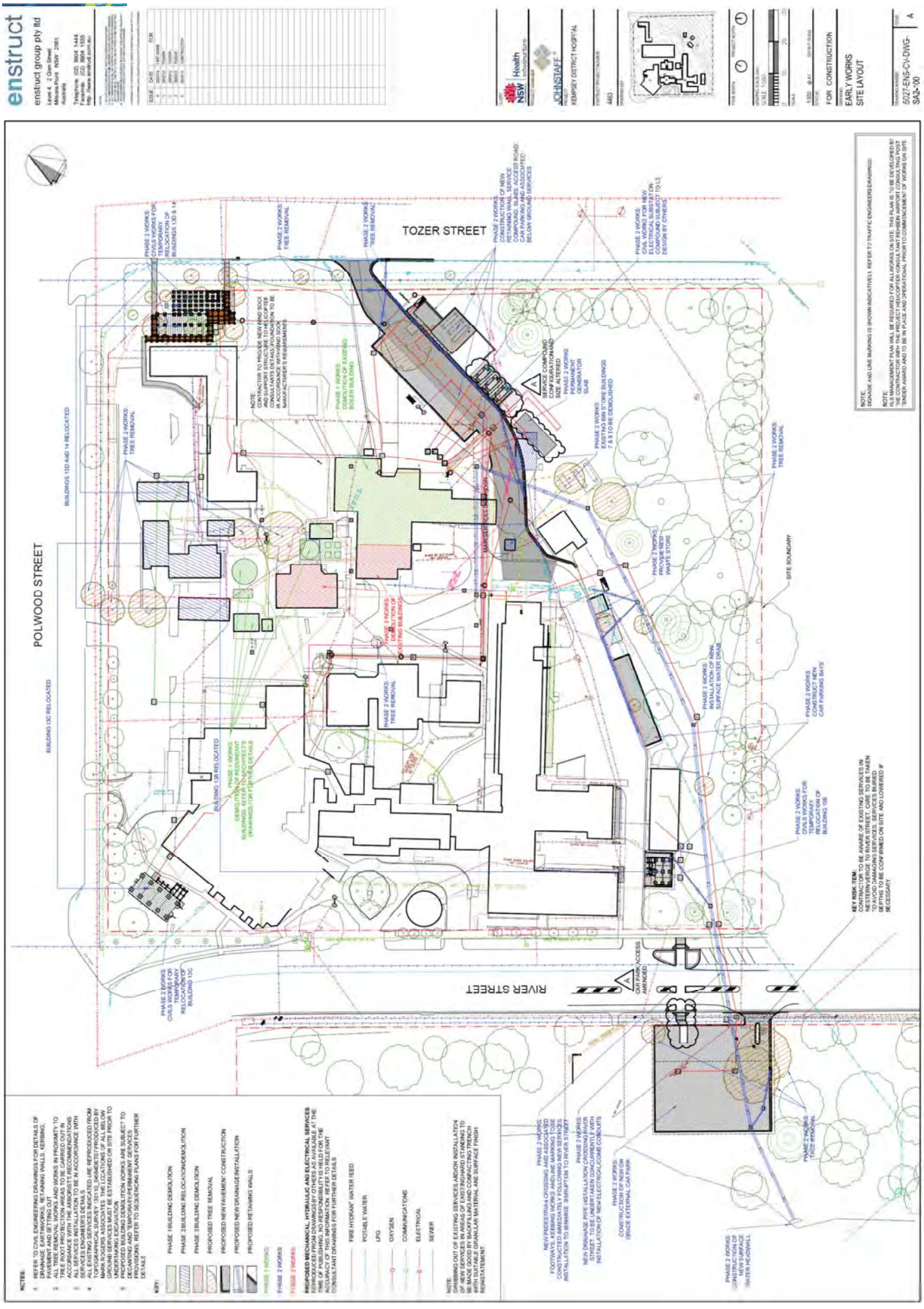


Figure 3. Proposal Diagram

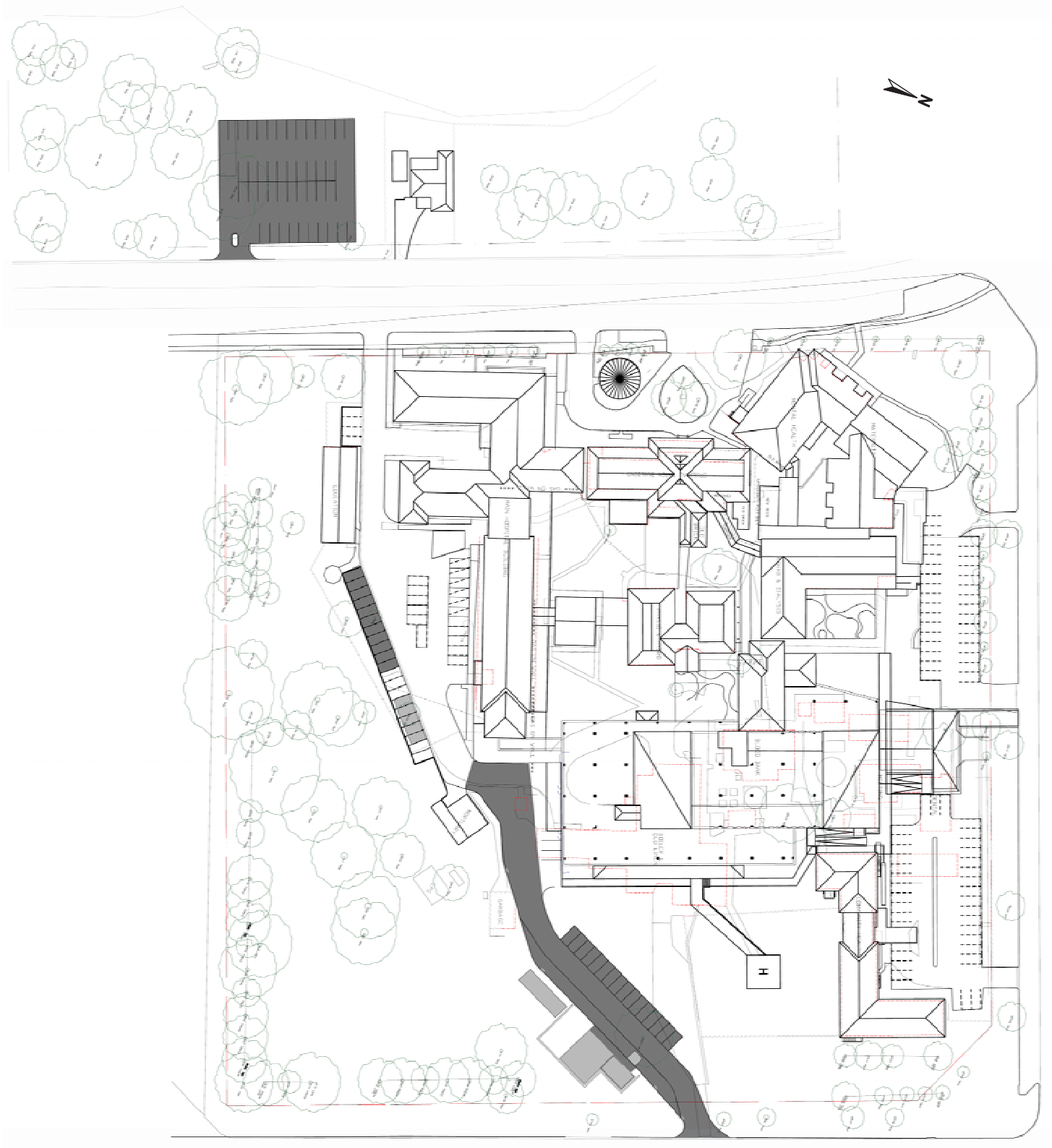
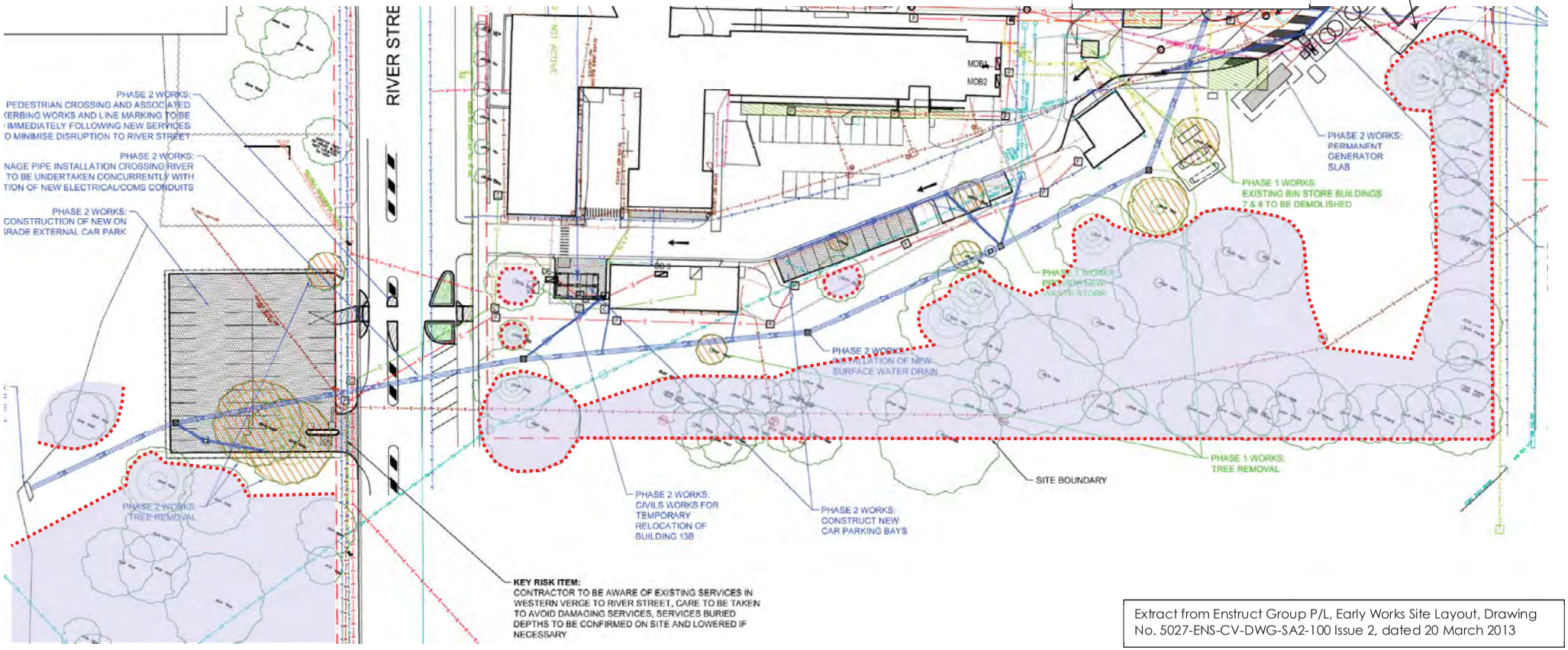


Figure 4. Tree numbering diagram



Access denied areas

Protective chain wire temporary fence

Figure 5. Tree protection works corridor diagram

Executive Summary

A fauna and flora survey of the proposed Kempsey Hospital Redevelopment at Kempsey Hospital ('the site' – Figure 1) was undertaken on the 1st January and 18th February 2013.

The relevant Director-General's requirement DGR 7 states:

> "Address impacts on flora and fauna, including threatened species, populations and endangered ecological communities and their habitats and steps taken to mitigate any identified impacts to protect the environment."

The Flora and Fauna scope of works relates to:

Enabling Works Phases 1 and 2 (subject to approval from Health infrastructure under a Review of Environmental Factors)

The majority of tree removals are associated with the Phase 1 and 2 Enabling Works for the Project, including those associated with the River St car park and building relocations to the north west and north east of the site. The car park construction is in this approval process.

Main works phase (subject to a State Significant Development Application)

Residual Jacaranda trees located to the north of the site, off Polwood St, will be removed during the Main Works Phase, along with the relocation of palms.

The following conclusions and recommendations apply:

a) There is no impediment to the proposed works in the scope of this report. There is no unacceptable or significant impact on flora and fauna, including threatened species, populations and endangered ecological communities and their habitats.

b) Tree protection and tree removal will occur before other works.

c) Protection of trees to be retained and those adjacent to the works corridor is as per AS4970 *Protection Of trees On Development Sites*.

d) A works corridor is to be defined by temporary fencing so as to exclude machinery and materials from the area of trees beyond the works corridor.

e) Certification of tree protection works by the project ecologist is required before other works commence in order to ensure protection of retained trees (REF works).

f) A landscape plan showing replacement planting for lost trees is recommended.

g) For replacement of demolished trees and for any future landscaping Abel Ecology recommends a landscape plan with the inclusion of locally indigenous species, such as, but not limited to:

   i. Trees
      Red Cedar *Toona australis*
      Teak *Flindersia australis*

Lilly Pilly *Acmena smithii, Syzygium crebrinerve*
Black Bean *Castanospermum australe*
Rusty Fig *Ficus rubiginosa*

ii. Shrubs
Blueberry Ash *Elaeocarpus reticulatus*
Lilly Pilly *Syzygium oleosum*

h) The Bangalow Palms and other Palms are recommended for transplanting on site so any possible use by native fauna is not lost.

1. Introduction

A fauna and flora survey of the proposed development site at Kempsey Hospital ('the site' – Figure 1) was undertaken on the 1st January and 18th February 2013.

The main aim of this survey was to determine whether the present proposal is likely to cause a significant effect on any endangered ecological community, endangered population, threatened species or their habitats. This assessment is based on the seven factors listed in Section 5A of the Environmental Planning and Assessment Act 1979, no. 203, (as amended).

This assessment addresses both 'endangered' and 'vulnerable', as required by the Threatened Species Conservation Act, 1995 (TSC Act 1995). Throughout this report 'threatened' refers to those species and communities listed as 'endangered' or 'vulnerable' in Schedules 1 & 2 of the TSC Act 1995. 'Protected fauna' refers to any native bird, mammal (except the dingo), reptile or amphibian in NSW.

Removal of trees is to be done under a Review of Environmental Factors.

1.1 Planning relationships

1.1.1 Legislation

i) Section 79C(1)(c) EP & A Act

j) TSC Act 1995

k) EPBC Act 1999

2. The site and proposed development

2.1 The proposal

The proposal (Figure 1) subject to approval by Health Infrastructure under a Review of Environmental Factors is to:

- Demolish some existing buildings and landscaped areas to construct a new building complex;
- Construct new car parks;
- Construct new access roads including from Tozer St;
- Install new stormwater and sewer lines;
- Install new high voltage electricity lines from Tozer St;

A number of trees are proposed to be removed for:

- the construction of buildings;
- installation of services including stormwater, sewer and electricity;

- aviation safety for the helicopter flight path.

A number of trees that are in very poor health or that are dying are also recommended for removal.

New stormwater drainage is to constructed to amplify existing drainage capacity. Stormwater is presently piped under River St and dispersed by a headwall at the top of a cliff adjacent to the Macleay River. A new pipe and headwall will replace the existing structure and disperse stormwater further back from the cliff (subject to approval by Health Infrastructure under a Review of Environmental Factors).

A new sewer line and replaced boundary trap is proposed for the Tozer St boundary and new high voltage electricity supply provided from Tozer St to a new pole mounted substation.

A new landscape plan with replacement local native trees is recommended.

2.2 Survey methodology

The site was inspected on 1st January and 18th February 2013 and trees proposed for removal or near proposed works were recorded, with any potential for fauna use assessed. Tree protection zones were calculated so that trees are to be either removed for construction or appropriate protection measures applied.

2.3 Site description

For the purposes of this report, the site is defined by property boundaries with the present study area confined to the footprint of the proposal and areas immediately adjacent.

There are no water bodies or creeks or remnant vegetation community on the site. Stormwater drainage is presently piped to the Macleay River under River Road and thence through a parkland.

The site is adjacent to a cemetery.

2.4 Vegetation and fauna habitat description

The site was cleared for construction of the hospital in 1881, with the Centenary celebrated in 1981 and a (now) heritage listed building constructed in 1913. Vegetation on site comprises planted specimen trees of mostly exotic species. Some remnant native trees occur along the western road reserve of River Road and on the bank of the Macleay River.

3. Flora and fauna results

3.1 Threatened flora and fauna

There are no threatened species, populations and communities, or their habitats, listed in the TSC Act 1995 or EPBC Act 1999 known to applicant. No part of the land has been identified as critical habitat.

Vegetation on the site comprises a planted landscape. Remnant native trees between River St and the Macleay River have had the understorey removed and the grass layer mown. Trees to be removed or requiring protection due to proximity of works are shown below (Section 5.2).

4. Methodology

Tree assessments were undertaken on 1st January 2013.

The SULE (Safe Useful Life Expectancy) method of tree evaluation was used to indicate tree suitability. Explanatory notes on SULE categories and terminology that may be used in this report are detailed in Appendix 1.

The vitality and condition of trees was visually assessed from ground level using the VTA (Visual Tree Assessment) method (Mattheck, 1999). Setback distances were determined using the plans provided. Tree heights were determined by visual estimation compared with a 5 m height pole as shown in photographs of each tree (Section 5.2).

5. Survey results

5.1 Condition and vitality of trees on site

The vitality and condition of trees is generally good. No trees of low vitality and/or poor structural integrity have a limited safe useful life.

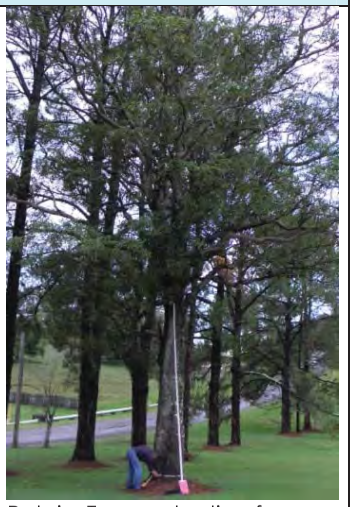
The trees on site are a planted mix of natives and exotics.

Local endemic tree species impacted or potentially affected identified within and adjacent to the site include:

Scientific name	Common name
Archontophoenix cunninghamiana	Bangalow Palm (planted)
Corymbia intermedia	Bloodwood
Eucalyptus microcorys	Tallowwood
Eucalyptus umbra	Stringybark
Ficus rubiginosa	Rusty Fig (planted)
Lophostemon confertus	Brush Box

5.2 Tree Schedule

2 The following tree schedule describes the numbered trees shown on the Tree Retention Plan.

Tree no.	Species	Age class	Height (m)	Diam. At base (cm)	d.b.h. (cm)	Radius	Vitality	Condition	TPZ Full/ reduced (m)	SRZ (m)	SULE	Comments
TR 2	Brush Box *Lophostemon confertus*	M	12	101	81	N 4 S 5 E 4 W 10	E	E	9.72/ 6.68	3.32	1A	 Retain. Tree protection fence required. No encroachment by trench for High voltage power line.

Tree no.	Species	Age class	Height (m)	Diam. At base (cm)	d.b.h. (cm)	Radius	Vitality	Condition	TPZ Full/ reduced (m)	SRZ (m)	SULE	Comments
TR 3	Brush Box *Lophostemon confertus*	M	10	107	87	N 5 S 3 E 3 W 3	E	E	10.44/ 7.17	3.4	1A	 Tree protection fence required Clearance distance variable to encroachment by excavation for sewer access chamber excavation. New sewer pipe by underboring
TR 6	Camphor Laurel *Cinnamomum camphora*											Adjacent filling for batter. Isolate by means of works corridor fencing

Tree no.	Species	Age class	Height (m)	Diam. At base (cm)	d.b.h. (cm)	Radius	Vitality	Condition	TPZ Full/ reduced (m)	SRZ (m)	SULE	Comments
TR 7	Camphor Laurel *Cinnamomum camphora*											Adjacent filling for batter. Isolate by means of works corridor fencing
TR 8	Camphor Laurel *Cinnamomum camphora*											Not affected Isolate by means of works corridor fencing
TR 10	Tallowwood *Eucalyptus microcorys*											Not affected Isolate by means of works corridor fencing
TR 11	Liquid Amber *Liquidambar* sp.	M	10	79	67	N 11 S 6 E 8 W 8	E	E	8.04/ 5.52	3.00	1A	 Tree protection fence required minimum 5.52m upslope. Prune lower limbs to allow machinery access for excavation.

Tree no.	Species	Age class	Height (m)	Diam. At base (cm)	d.b.h. (cm)	Radius	Vitality	Condition	TPZ Full/ reduced (m)	SRZ (m)	SULE	Comments
TR 12	Coral Tree *Erythrina* sp.	M	5	87	141	N 7 S 7 E 7 W 7	F	P	15.00/ 10.31	3.12	4C	 CD, TW, TC, ep, sw Recommend removal
TR 13	*Spathodea campanulata* EXOTIC ORNAMENTAL TREE FROM AFRICA	M	7	NA	NA	NA	E	E	NA	NA	1A	 Remove

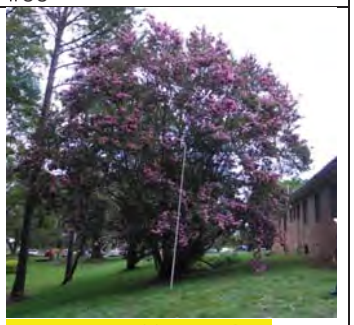
Tree no.	Species	Age class	Height (m)	Diam. At base (cm)	d.b.h. (cm)	Radius	Vitality	Condition	TPZ Full/ reduced (m)	SRZ (m)	SULE	Comments
TR 16	Tallowwood *Eucalyptus microcorys*	M	18	150	102	N 14.5 S 10 E 8 W 8	G	E	12.24/ 8.41	3.63	1A	 Tree protection fence required Isolate by means of works corridor fencing CD, DW, dw. Minimum 8.41m clearance distance upslope side

Tree no.	Species	Age class	Height (m)	Diam. At base (cm)	d.b.h. (cm)	Radius	Vitality	Condition	TPZ Full/ reduced (m)	SRZ (m)	SULE	Comments
TR 17	Ironbark *Eucalyptus* sp.	M	18	98	77	N 13 S 8 E 8 W 8	E	E	9.24/ 6.35	3.28	1A	 Tree protection fence required Minimum 6.35m clearance distance upslope side
TR 18	Gordonia axillaris. Exotic shrub related to Camellias.					N 4 S E W						 Shrub. Recommend removal

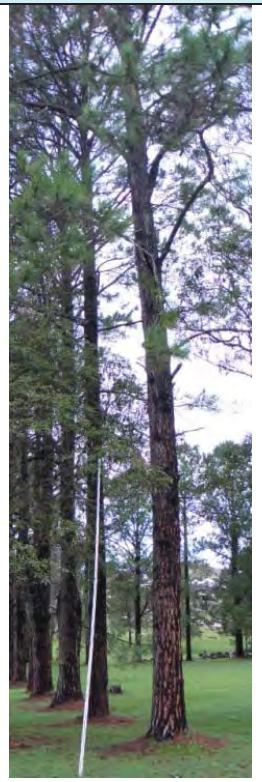
Tree no.	Species	Age class	Height (m)	Diam. At base (cm)	d.b.h. (cm)	Radius	Vitality	Condition	TPZ Full/ reduced (m)	SRZ (m)	SULE	Comments
TR 29	Tallowwood *Eucalyptus microcorys*	M	20	188	154	N 14 S 16 E 15.5 W 13.5	E	E	15.00/ 10.31	3.63	1A	 Tree protection fence required all around Minimum 10.0m clearance distance upslope side

Tree no.	Species	Age class	Height (m)	Diam. At base (cm)	d.b.h. (cm)	Radius	Vitality	Condition	TPZ Full/ reduced (m)	SRZ (m)	SULE	Comments
TR 30	Liquid Amber *Liquidambar* sp.	M	12	68	59	N 9.5 S 7.3 E 9 W 10.2	E	E	7.08/ 4.86	2.81	1A	 Tree protection fence required Minimum 4.86m clearance distance upslope side

Tree no.	Species	Age class	Height (m)	Diam. At base (cm)	d.b.h. (cm)	Radius	Vitality	Condition	TPZ Full/ reduced (m)	SRZ (m)	SULE	Comments
TR 31	*Spathodea campanulata* EXOTIC ORNAMENTAL TREE FROM AFRICA	M	9	56	42	N 4.5 S 4.5 E 6 W 7.2	F	F	5.04/ 3.46	2.59	2D	 Tree protection fence required 3.46m toward stormwater trench and 5.04m downslope. Dw, ep

Tree no.	Species	Age class	Height (m)	Diam. At base (cm)	d.b.h. (cm)	Radius	Vitality	Condition	TPZ Full/ reduced (m)	SRZ (m)	SULE	Comments
TR 32	Jacaranda *Jacaranda mimosifolia*	M	5	35	35	N 4 S 3 E 3 W 3	E	E	2.5	2	1A	 Provide tree protection fence if trenches are dug near this tree
TR 33	Crepe Myrtle shrub. Exotic ornamental shrub					N S E W						 Recommend to REMOVE

Tree no.	Species	Age class	Height (m)	Diam. At base (cm)	d.b.h. (cm)	Radius	Vitality	Condition	TPZ Full/ reduced (m)	SRZ (m)	SULE	Comments
Pine 58	Radiata Pine	M	18	73	56	N 3 S 3 E 3 W 7	G	G	6.72/ 4.62	2.9	2B	 Retain

Tree no.	Species	Age class	Height (m)	Diam. At base (cm)	d.b.h. (cm)	Radius	Vitality	Condition	TPZ Full/ reduced (m)	SRZ (m)	SULE	Comments
PINE 60	Radiata Pine	M	18	73	56	N 3 S 3 E 3 W 7	G	G	6.72/ 4.62	2.9	2B	 Tree protection fence required Clearance distance 2.9m

Tree no.	Species	Age class	Height (m)	Diam. At base (cm)	d.b.h. (cm)	Radius	Vitality	Condition	TPZ Full/ reduced (m)	SRZ (m)	SULE	Comments
TR 61	*Callistemon viminalis* Native shrub	M	4	10	NA	N S E W 2	P	P	NA	NA	4D	 Shrub. Recommend removal
T 62	Jacaranda *Jacaranda mimosifolia*	SM	4	10	NA	N S E W 2	F	F	2	2	4D	 Recommend removal for fight path and access road

Tree no.	Species	Age class	Height (m)	Diam. At base (cm)	d.b.h. (cm)	Radius	Vitality	Condition	TPZ Full/ reduced (m)	SRZ (m)	SULE	Comments
T 63	Cheese Tree *Glochidion ferdinandi* Shrub form	M	4	NA	NA	N 5 S E W	G	G	NA	NA	1B	 Recommend removal for flight path
T 64	*Callistemon viminalis*	M	5	15	NA	N 2 S E W	F	G	NA	NA	3D	 Recommend removal for flight path

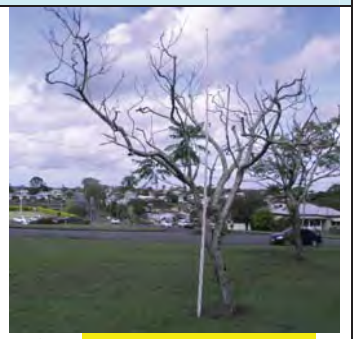
Tree no.	Species	Age class	Height (m)	Diam. At base (cm)	d.b.h. (cm)	Radius	Vitality	Condition	TPZ Full/ reduced (m)	SRZ (m)	SULE	Comments
T 65	Jacaranda *Jacaranda mimosifolia*	M	6	20	50	N S E W 5	F	F	6.00/ 4.12	NA	2D	 Recommend removal for flight path. DW, dw, CD, CB, TL, TW

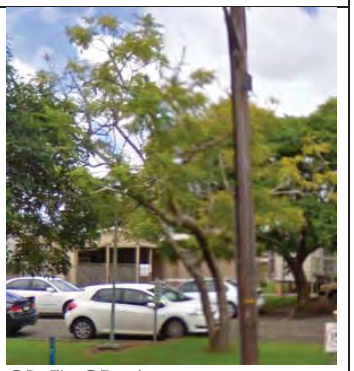
Tree no.	Species	Age class	Height (m)	Diam. At base (cm)	d.b.h. (cm)	Radius	Vitality	Condition	TPZ Full/ reduced (m)	SRZ (m)	SULE	Comments
T 66	Jacaranda *Jacaranda mimosifolia*	m	7	29	29	N S E W 4.5	F	F	3.48/ 2.39	NA	3D	 Recommend removal for flight path

Tree no.	Species	Age class	Height (m)	Diam. At base (cm)	d.b.h. (cm)	Radius	Vitality	Condition	TPZ Full/ reduced (m)	SRZ (m)	SULE	Comments
T 67	Jacaranda *Jacaranda mimosifolia*	M	8	NA	34	N S E W 5.4	G	F	4.08/ 2.8	NA	1B	 Remove for construction
T 69	Jacaranda *Jacaranda mimosifolia*	M	6	25	24	N 2 S E W	P	P	2.88/ 2.00	NA	4A	 Remove for construction. DW, DW, CB, TL,

Tree no.	Species	Age class	Height (m)	Diam. At base (cm)	d.b.h. (cm)	Radius	Vitality	Condition	TPZ Full/ reduced (m)	SRZ (m)	SULE	Comments
T 70	*Callistemon viminalis*	M	5	NA	20	N S E W	F	P	NA	NA	4C	 Recommend removal. CB, TL, dw, TW
T 71	Jacaranda *Jacaranda mimosifolia*	M	6	NA	24	N S E W 3.8	F	F	2.88/ 2.00	NA	2D	 TL, CB. Recommend removal for construction

Tree no.	Species	Age class	Height (m)	Diam. At base (cm)	d.b.h. (cm)	Radius	Vitality	Condition	TPZ Full/ reduced (m)	SRZ (m)	SULE	Comments
72	Jacaranda *Jacaranda mimosifolia*	SM	6	NA	17	N S E W 3	P	P	2.04/ 2.00	NA	4A	 Dying. Recommend removal
T 73	Jacaranda *Jacaranda mimosifolia*	SM	5	NA	26	N S E W 1.8	P	P	3.12/ 2.14	NA	4A	 Dying. Recommend removal.

Tree no.	Species	Age class	Height (m)	Diam. At base (cm)	d.b.h. (cm)	Radius	Vitality	Condition	TPZ Full/ reduced (m)	SRZ (m)	SULE	Comments
T 74	Jacaranda *Jacaranda mimosifolia*	SM	5	NA	20	N S E W 1	P	P	2.4/ 2.00	NA	4A	 Dying, Recommend removal
T 75	Jacaranda *Jacaranda mimosifolia*	M	6	35	30	N S E W 4.3	G	G	3.6/ 2.47	NA	1B	 Remove for construction

Tree no.	Species	Age class	Height (m)	Diam. At base (cm)	d.b.h. (cm)	Radius	Vitality	Condition	TPZ Full/ reduced (m)	SRZ (m)	SULE	Comments
T 78	Brush Box *Lophostemon conferta*	SM	5	30	25	N 2 S 3 E 4 W 3	G	G			1B	 CD Remove for car park, access
T 79	Jacaranda *Jacaranda mimosifolia*	SM	5	20	20	N 3 S 1 E 4 W 1	F	F			4C	CD, TL, DW Remove for car park, access
T 80	Jacaranda *Jacaranda mimosifolia*	SM	6	30	25	N 5 S 5 E 4 W 5	F	F			4C	 CB, TL, CD, dw Remove for car park, access

Tree no.	Species	Age class	Height (m)	Diam. At base (cm)	d.b.h. (cm)	Radius	Vitality	Condition	TPZ Full/ reduced (m)	SRZ (m)	SULE	Comments
T 81	Jacaranda *Jacaranda mimosifolia*	M	7	70	70	N 5 S 5 E 4 W 5	G	G	8.40/ 5.77	2.85	1A	Flush cut branch at 1.2 m. Previously lopped. TW, dw.  REMOVE for car parking and ambulance access

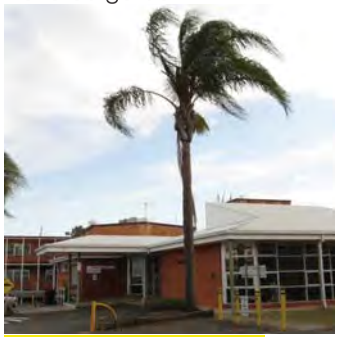
Tree no.	Species	Age class	Height (m)	Diam. At base (cm)	d.b.h. (cm)	Radius	Vitality	Condition	TPZ Full/ reduced (m)	SRZ (m)	SULE	Comments
T 82	Liquid Amber *Liquidambar* sp.	M	18	110	55	N 5 S 4 E 5 W 6	E	E	6.6/ 4.53	3.44	1A	Lower branches trimmed. Flush cut. Multiple trunks at 8 m  Proposed to retain with tree protection
F100	Fig tree *Ficus rubiginosa*	M	7	90	64	N 5 S 5 E 5 W 5	P	P	7.68/ 5.28	3.17	4A	 Declining. Remove for flight path

Tree no.	Species	Age class	Height (m)	Diam. At base (cm)	d.b.h. (cm)	Radius	Vitality	Condition	TPZ Full/ reduced (m)	SRZ (m)	SULE	Comments
TR105	Callistemon Shrub	M										 Remove for car park
T 106	Shrub	M	5	25	NA	1.5						 Remove for car park

Tree no.	Species	Age class	Height (m)	Diam. At base (cm)	d.b.h. (cm)	Radius	Vitality	Condition	TPZ Full/ reduced (m)	SRZ (m)	SULE	Comments
T 107	Illawarra Flame Tree *Brachychiton acerifolius*	SM	6	65	62	N 4 S 4 E 4 W 4	E	E	7.44/ 5.11	2.76	1A	 CD, TW. Available clearance distance 2.5m north, 5m south, inadequate for tree survival. Provide whatever protection space is available and accept a moderate risk to the tree. Branch pruning may be required.

Tree no.	Species	Age class	Height (m)	Diam. At base (cm)	d.b.h. (cm)	Radius	Vitality	Condition	TPZ Full/ reduced (m)	SRZ (m)	SULE	Comments
T 108	Jacaranda *Jacaranda mimosifolia*	M	11	70	35 40 30 (105)	N 7 S 6 E 7 W 7	G	G	12.6/ 8.66	2.85	1A	Triple trunk. CD, TL, dw.  Proposed to REMOVE for building

Tree no.	Species	Age class	Height (m)	Diam. At base (cm)	d.b.h. (cm)	Radius	Vitality	Condition	TPZ Full/ reduced (m)	SRZ (m)	SULE	Comments
T 109	Firewheel Tree *Stenocarpus sinuatus*	M	10	60	45	N 2 S 3 E 3 W 4	F	F	5.4/ 3.71	2.67	1B	Juvenile Rusty Fig *Ficus rubiginosa* on tree. DW, ep.   Proposed to REMOVE for building

Tree no.	Species	Age class	Height (m)	Diam. At base (cm)	d.b.h. (cm)	Radius	Vitality	Condition	TPZ Full/ reduced (m)	SRZ (m)	SULE	Comments
TR 110	Bangalow Palm *Archontophoenix cunninghamiana*	M	10	65	35	N 4 S 4 E 4 W 4	G	G	5/5	5	2C	Elevated garden  Proposed to REMOVE for building. Suitable to relocate.
TR 111	Bangalow Palm *Archontophoenix cunninghamiana*	M	10	60	30	N 2 S 2 E 2 W 2	G	G	3/3	3	2C	Elevated garden  Proposed to REMOVE for building. Suitable to relocate.

Tree no.	Species	Age class	Height (m)	Diam. At base (cm)	d.b.h. (cm)	Radius	Vitality	Condition	TPZ Full/ reduced (m)	SRZ (m)	SULE	Comments
TR 120	Stringybark *Eucalyptus umbra*	M	18	123	100	N 11.2 S 7.3 E 6.9 W 10	E	E	12.00/ 8.24	3.61	1A	 Tree protection fence required 8.24m clearance distance from trench. CD, DW, dw

Tree no.	Species	Age class	Height (m)	Diam. At base (cm)	d.b.h. (cm)	Radius	Vitality	Condition	TPZ Full/ reduced (m)	SRZ (m)	SULE	Comments
TR 121	Stringybark *Eucalyptus umbra*	M	15	112	104	N 13.5 S 9 E 11 W 8.3	F	G	12.48/ 8.57	3.47	2D	 Tree protection fence required 8.57m clearance distance from trench.

Tree no.	Species	Age class	Height (m)	Diam. At base (cm)	d.b.h. (cm)	Radius	Vitality	Condition	TPZ Full/ reduced (m)	SRZ (m)	SULE	Comments
TR 124	Bloodwood *Corymbia intermedia*	M`	18	109	82	N 12 S 11 E 11.5 W 2.7	G	F	9.84/ 6.76	3.43	1B	 Remove for car park CL, dw

Tree no.	Species	Age class	Height (m)	Diam. At base (cm)	d.b.h. (cm)	Radius	Vitality	Condition	TPZ Full/ reduced (m)	SRZ (m)	SULE	Comments
TR 125	Bloodwood *Corymbia intermedia*	M	20	134	113	N 15 S 13.7 E 11.5 W 9.5	E	E	13.56/9.32	3.63	1A	 Remove for car park CD, dw

Tree no.	Species	Age class	Height (m)	Diam. At base (cm)	d.b.h. (cm)	Radius	Vitality	Condition	TPZ Full/ reduced (m)	SRZ (m)	SULE	Comments
TR 126	Bunya Pine	M	12	127	110	N 6.5 S 6.5 E 6.5 W 6.5	E	F	13.2/ 9.07	3.63	4C	 CD, CB, Remove for car park

Tree no.	Species	Age class	Height (m)	Diam. At base (cm)	d.b.h. (cm)	Radius	Vitality	Condition	TPZ Full/ reduced (m)	SRZ (m)	SULE	Comments
TR 131	Stringybark *Eucalyptus umbra*	M	10	72	75	N 9 S 2 E 6 W 3	F	F	9.00/ 6.18	2.88	1A	 Tree protection fence required 6.18m clearance distance from trench. Tree on right. CB. TL.

Tree no.	Species	Age class	Height (m)	Diam. At base (cm)	d.b.h. (cm)	Radius	Vitality	Condition	TPZ Full/ reduced (m)	SRZ (m)	SULE	Comments
TR 132	Stringybark *Eucalyptus umbra*.	M	15	67	57	N 8 S 7 E 7.7 W 7	G	G	6.84/ 4.7	2.8	1A	 Tree on left. Tree protection fence required 4.7m clearance distance from trench.
None	Kentia Palm (?)	M	3	15	15		E	E			1A	 SUITABLE TO RELOCATE

Tree no.	Species	Age class	Height (m)	Diam. At base (cm)	d.b.h. (cm)	Radius	Vitality	Condition	TPZ Full/ reduced (m)	SRZ (m)	SULE	Comments
None	Kentia Palm (?)	M	3	15	15		E	E			1A	 SUITABLE TO RELOCATE

2 **KEY**

Age Class
J - juvenile
SM - semi-mature
M - mature
OM – over-mature

Vitality and condition
E - excellent
G - good
F - fair
P - poor

Comments
CD - codominant stems
CB - canopy bias
TL - trunk lean
EC - elevated crown
BI - bark inclusion
TW - trunk wound
TC - trunk cavity
ep - epicormic growth
dw - small diameter deadwood
DW - large diameter deadwood

d.b.h. - Trunk diameter at 1.4m

6. Anticipated impact of the development to trees on site

6.1 Tree retention

The proposal indicates the retention of trees within the site that are not affected by works. Trees adjacent to works are to be protected by either standard tree protection measures for single trees or fenced as a stand as per Appendix 2.

6.2 Tree removal

The proposal indicates the removal of the following trees.

TR12 Coral Tree
TR13 Spathodea
TR18 Gordonia axillaris
TR33 Crepe Myrtle
TR61 Callistemon
TR62 Jacaranda
TR63 Cheese Tree
TR64 Callistemon
TR65 Jacaranda
TR66 Jacaranda
TR67 Jacaranda
TR69 Jacaranda
TR70 Callistemon
TR71 Jacaranda
TR72 Jacaranda
TR73 Jacaranda
TR74 Jacaranda
TR75 Jacaranda
TR78 Jacaranda
TR79 Jacaranda
TR80 Jacaranda
TR81 Jacaranda
TR105 Shrub
TR106 Shrub
TR108 Jacaranda
TR109 Firewheel Tree
TR110 Bangalow Palm can be transplanted for future inclusion in landscaping.
TR111 Bangalow Palm can be transplanted for future inclusion in landscaping.
TR124 Bloodwood
TR125 Bloodwood
TR126 Bunya Pine
F100 Fig tree for flight path and road works

6.3 Works corridor fencing for retained trees

Some trees, in proximity to the proposed building and excavation works, are anticipated to sustain some root loss from the proposal. Protection measures are indicated in section 5.2 Tree Schedule. A works corridor is to be defined by temporary fencing as per Figure 5.

6.4 Services

High voltage electricity supply, sewer and stormwater services all require trenching. Clearances are shown in the table in section 5.2 Tree Schedule above. A variety of small shrubs which are not numbered appear on some plans. Those shrubs may be removed where they are affected by proposed works. Other small and unnumbered shrubs are illustrated below.

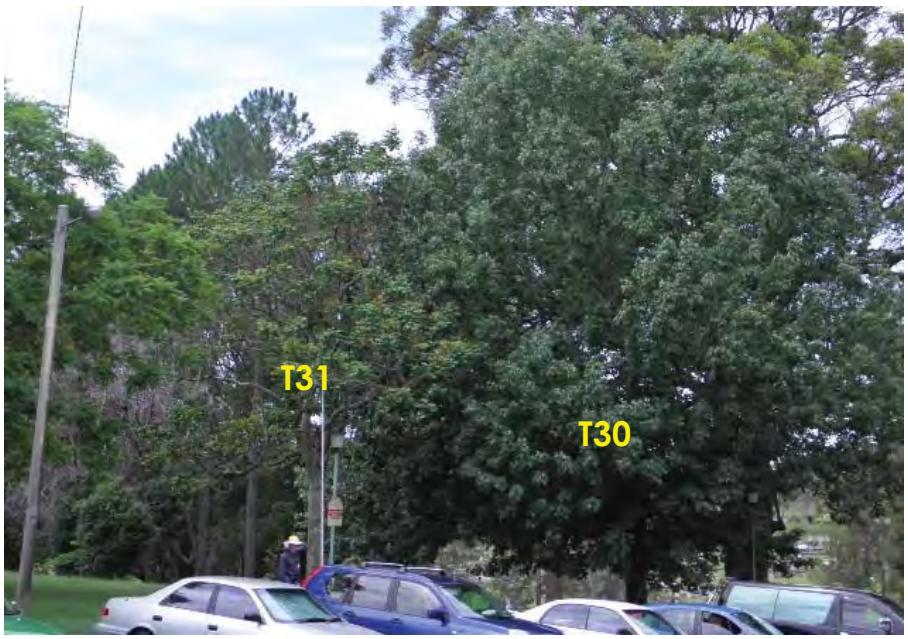


Figure 6. Stormwater trench to pass between Trees T30 and T31

Figure 7. Unnumbered shrubs in the area of Trees T106 and T107 affected by car park works

Figure 8. Unnumbered shrubs in the area of Trees T106 and T107 affected by stormwater trench works and car park

Figure 9. Fallen vegetation near Tree T33 may be cleared for the stormwater trench

Figure 10. Vegetation near Tree T33 may be cleared for stormwater trench if required

Figure 11. Approximate line of trench for High Voltage cable where T1, T2 and Pine 60 are to be protected by temporary fencing

Figure 12. Tree TR13 Spathodea to be removed

7. Macleay River riparian zone works

The Macleay River, a fourth order tidal stream, is west of the proposed western car park (early works subject to approval from HI under a REF). NSW Office of Water Guidelines require works within 40 m of a fourth order stream to be assessed under the Water Management Act (WMA) 2000. The project does not require referral to NSW Office of Water.

> A riparian corridor forms a transition zone between the land, also known as the terrestrial environment, and the river or watercourse or aquatic environment. Riparian corridors perform a range of important environmental functions such as:
>
> - providing bed and bank stability and reducing bank and channel erosion
> - protecting water quality by trapping sediment, nutrients and other contaminants
> - providing diversity of habitat for terrestrial, riparian and aquatic plants (flora) and animals (fauna)
> - providing connectivity between wildlife habitats
> - conveying flood flows and controlling the direction of flood flows
> - providing an interface or buffer between developments and waterways
> - providing passive recreational uses.
>
> The protection, restoration or rehabilitation of vegetated riparian corridors is important for maintaining or improving the shape, stability (or geomorphic form) and ecological functions of a watercourse.
>
> NSW Office of Water, July 2012 *Controlled activities on waterfront land - Guidelines for riparian corridors on waterfront land*

The top of bank for the Macleay River is adjacent to the water's edge at the east side and on the west side occurs as a flood plain. The ecological and functional eastern edge of the riparian zone is the base of a cliff that runs parallel to the river between River St and the river, as a discrete Vegetated Riparian Zone.

The elevation at the top of the cliff is 20 m and at the river bank approximately 2 m. 'Top of Bank' for the Macleay River is adjacent to the normal flow edge of the river.

The proposed work is on the top of the cliff, which as a dry forest is functionally significantly different from the ecological and hydrological riparian function of the river. There is no impact of works on the riparian zone.

The functions of the riparian zone are all met in the riparian corridor between the base of the cliff and the river, with the area between the top of cliff and River St being outside that zone.

Stormwater outlets or essential services are allowed in the Riparian Corridor. Works within the 40 m Riparian Corridor are permissible with appropriate offsetting and vegetation management.

Non riparian corridor works and activities can be authorised within the outer riparian corridor, so long as the average width of the vegetated riparian zone can be achieved over the length of the watercourse within the development site. That is, where appropriate 50 per cent of the outer vegetated riparian zone width may be used for non-riparian uses including asset protection zones, recreational areas, roads, development lots and infrastructure. However, an equivalent area connected to the riparian corridor must be offset on the site.

Figure 13. Macleay River and proposed car park area

Approximate edge of 40m riparian zone shown in blue, yellow scale bar is 10m. Approximate location of new headwall is shown by a pink star.

The existing stormwater outlet headwall is adjacent to the cliff edge with water dispersing directly over the cliff. The proposed new headwall is adjacent to the edge of the cliff (Figure 14). There are no mature trees downslope of the headwall in the likely flow path of stormwater so no impact on trees is anticipated.

Figure 14. Approximate location of proposed new stormwater outlet

Note that water flows downslope from right to left.

8. Impact assessment

The site is not natural habitat for any species of flora or fauna, having been cleared more than 100 years ago and supporting recent horticultural landscape plantings. No species of threatened native fauna are likely to use the planted trees on site. The Bangalow Palms are recommended for transplanting on site so any possible use by native fauna is not lost.

The remnant trees adjacent to the Macleay River are in a mown park-like area. In that area two Bloodwood trees are to be removed. Those trees have no hollows for fauna occupation. A planted Bunya Pine stands next to a house at the north side of the proposed car park off River St. A small planted Firewheel tree and a small planted fig tree are to be removed from the grounds of the hospital.

A flora and fauna survey was carried out on 1st January and 20th February 2013 at the construction site to assess the likely impacts of construction on species present on the site, and whether there is likely to be any significant effect on any endangered ecological community, endangered population, threatened species or their habitats, as per the listings in the Threatened Species Conservation Act 1995 (TSC Act 1995) (state legislation) and the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act 1999) (Commonwealth legislation). The survey was visual and trees found are detailed above.

Under Section 5A of the EP&A Act several factors (below) need to be considered in deciding whether there is likely to be a Significant effect on threatened species, populations or ecological communities, or their habitats. If there is likely to be a significant effect on threatened species, etc., a Species Impact Statement is recommended.

The Assessment of Significance (NSW Department of Environment and Climate Change, August 2007) states that "*Proposed measures that mitigate, improve or compensate for the action, development or activity should not be considered in determining the degree of the effect on threatened species, populations or ecological communities, unless the measure has been used successfully for that species in a similar situation.*"

8.1 Assessment of significance

a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,

No. Removal or modification of habitat will not affect survival of any species. Local populations of any threatened species are not likely to depend on any of the trees that are proposed for removal.

b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,

There is no endangered population on site.

c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:,

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

There is no endangered ecological community or critically endangered ecological community on site.

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

There is no endangered ecological community or critically endangered ecological community on site.

d) in relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

The site does not support threatened species. Habitat to be removed comprises a variety of trees, mostly exotic. The five local native trees to be removed are few in number and in the local context are an insignificant proportion of the local forest.

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

No.
The site does not support threatened species and none are likely to depend on the trees proposed for removal.

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,

Negligible.
The site does not support threatened species.

e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),

No. Critical habitat has not been declared for any species in the locality.

f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

No particular plan applies to this site or the proposal.

g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

Yes. Removal of two remnant native trees (T124, T125) is 'Clearing of Native Vegetation', a Key Threatening Process (TSC Act 1995). However the proposal is to plant a range of species to replace trees removed. The nature and extent of clearing is minor.

Conclusion

The proposed activity is unlikely to have a significant effect on any species of community. Therefore a Species Impact Statement is not recommended.

9. Conclusions and recommendations

The following conclusions and recommendations apply:

a) There is no impediment to the proposed works in the scope of this report. There is no unacceptable or significant impact on flora and fauna, including threatened species, populations and endangered ecological communities and their habitats.

b) Tree protection and tree removal will occur before other works.

c) Protection of trees to be retained and those adjacent to the works corridor is as per AS4970 *Protection Of trees On Development Sites*.

d) A works corridor is to be defined by temporary fencing so as to exclude machinery and materials from the area of trees beyond the works corridor.

e) Certification of tree protection works by the project ecologist is required before other works commence in order to ensure protection of retained trees (REF works).

f) A landscape plan showing replacement planting for lost trees is recommended.

g) For replacement of demolished trees and for any future landscaping Abel Ecology recommends a landscape plan with the inclusion of locally indigenous species, such as, but not limited to:

   i. Trees
      Red Cedar *Toona australis*
      Teak *Flindersia australis*
      Lilly Pilly *Acmena smithii, Syzygium crebrinerve*
      Black Bean *Castanospermum australe*
      Rusty Fig *Ficus rubiginosa*

   ii. Shrubs
      Blueberry Ash *Elaeocarpus reticulatus*
      Lilly Pilly *Syzygium oleosum*

h) The Bangalow Palms and other Palms are recommended for transplanting on site so any possible use by native fauna is not lost.

Appendix 1. Safe Useful Life Expectancy (SULE) terminology and rationale

Explanation of terminology

d.b.h. - Acronym for trunk diameter at breast height (1.4m from ground level)

Vitality - Indicates the energy reserves of the tree and is determined by the observed crown colour and density, the percentage of dead/dying branches and epicormic growth. The vitality of the canopy and that of the root system is interdependent; root damage or heavy pruning draws on a tree's energy reserves. The tree's ability to initiate internal defence systems (compartmentalisation of damage) is reduced and it can also become predisposed to attack by insects and pathogens.

Epicormic Growth - The production of epicormic growth from dormant buds is a response to stress. Epicormic growth may be initiated by various causes such as branch loss, excessive pruning, fire damage, drought, defoliation and/or disease.

Mycorrhizae/Rhizosphere - Mycorrhizae are fungi that grow in symbiotic association with tree roots (especially the fine root hairs) and are attributed with increasing the uptake of nutrients, particularly phosphorus, and reducing infection from soil borne pathogens. They greatly increase the surface area of a tree's root system. Mycorrhizae require aerobic soil conditions and are reduced in number by compaction, waterlogging and overuse of soil fertilisers. Forest litter or similar mulch provides ideal conditions for the proliferation of Mycorrhizae. Rhizosphere is a term describing the peripheral area of a tree's root system where this symbiotic association most commonly occurs.

Condition - An evaluation of the structural status of the tree including defects that may effect the useful life of an otherwise healthy specimen. Such influencing factors include cavities and decay, weak unions between scaffolds (major branches) or trunks and faults of form or habit.

Tree Hazard Potential - An assessment of the risks associated with retaining a tree in its existing or proposed surroundings. Factors to consider are the growth characteristics of the species, tree vitality, condition and the frequency and type of potential targets. The impact the proposed works can have on tree vitality can only be assumed.

SULE categories and subgroups

The various SULE categories indicate the safe useful life anticipated for an individual tree or for trees assessed as a group. Factors such as the location, age, condition and vitality of the tree are significant to the determination of this rating. Other influences such as the tree's effect on 'better' specimens and the economics of managing the tree successfully in its location are also relevant to SULE (Barrell 1993, 1995, 2001).

1 = Long SULE of >40 years

A Structurally sound in suitable location	B Suitable to retain with some remedial care	C Significant status - requires special care to preserve

2 = Medium SULE of 15-40 years

A Lifespan limit	B Eventual removal for safety or nuisance	C Remove for adjacent trees or replanting	D Suitable with remedial care

3 = Short SULE of 5-15 years

A Lifespan limit	B Eventual removal for safety or nuisance	C Remove for adjacent trees or replanting	D Requires extensive remedial care

4 = Remove tree within 5 years

A Dead, dying or diseased	B Unstable or exposed by new clearing	C Structurally defective	D Damaged and unsafe	E Remove for adjacent trees or replanting	F Damaging existing structures	G Clearing will affect stability	H 4A-4G SULE category with high wildlife habitat value - could retain

5 = Trees suitable to transplant

A Small trees less than 5m high	B Young trees (<15yrs) over 5m high	C Height/width contained by pruning

References

Barrell, J. (1993) 'Pre-planning Tree Surveys: Safe Useful Life Expectancy (SULE) is the natural progression' *Arboricultural Journal* Vol. 17, pp 36-46.

Barrell, J. (1995) 'Pre-development Tree Assessment' from *Trees and Building Sites, Proceedings of an International Conference held In the interest of developing a scientific basis for managing trees in proximity to buildings*, the International Society of Arboriculture, Illinois, USA, pp 132-142.

Barrel, J. (2001) 'Safe Useful Life Expectancy Categories updated 4/01' from Management of Mature Trees, proceedings of the 4th NAAA Tree Management Seminar, National Arborists Association of Australia, Sydney, Appendix 3.

Appendix 2. Tree Protection Guidelines

A Pre-construction/Demolition Phase

The following methods are to be implemented to minimise potential damage to retained trees, e.g. from soil compaction and site activity. Trees are to be protected at all stages of the development, and growing conditions are to be improved within the Tree Protection Zone (TPZ). These guidelines are consistent with AS4970-2009 *Protection of trees on development sites*.

A 1. All site workers are to be aware of relevant tree protection requirements. Nominated trees will be removed or transplanted as per the tree protection plan. An arborist is to supervise tree removal, pruning and transplanting and certify the completed works.

A 2. All trees not nominated for retention are to be removed prior to any construction activity. Approved tree pruning and removal operations near retained trees are to be carried out in a way that avoids soil compaction and damage to canopy, trunk or roots. Works are to be supervised by an arborist or the person responsible for site management.

A 3. Stumps are to be ground, not dozed or dug out, if in the vicinity of retained trees. Machinery (other than stump machines) is to be kept beyond the nominated protection zones of retained trees during all operations.

A 4. A works corridor is to be defined by paraweb temporary fencing (or similar) and be certified prior to trenching works. Tree protection fencing is to be in place before the introduction of machinery or other materials to the site and before commencement of earthworks. Fencing is to be located to the distances specified in section 5.2, page 16, be of sturdy construction and retained in-situ during works unless altered by the project arborist. All site activities are excluded from this zone. Refer to Appendix 2 for specific minimum setback distances. AS4687 specifies applicable fencing requirements.

A 5 The TPZ is to be mulched using material compatible with 'AS4454-2003 Composts, soil conditioners and mulches', e.g. decomposed leaf litter, and maintained at 50-100 mm depth. Some areas, e.g. turf, may not require mulch. Temporary irrigation may be required. Weeds are to be removed and controlled.

A 6. Pruning is to be undertaken by suitably qualified, skilled and insured people to comply with AS4373-2007, Australian Standard: Pruning of Amenity Trees. Initial pruning provides adequate clearances and general crown maintenance. Flexible branches are to be tied back, not pruned.

B **Construction Phase** (Maintain tree protection fencing)

B 1 Where access is required within a TPZ, temporary ground protection measures will be required (e.g. metal plates, rumble boards or exterior-grade ply over aggregate) capable of supporting the required load without deflection. Trunk protection may be required, e.g. battens wrapped around the trunk to a height of 2 m.

B 2 Material stockpiles or dumps, parking, excavation, site sheds, preparation of chemicals, fires, wash down areas or similar are to be located clear of TPZs. Areas designated for such requirements are not to divert drainage water into tree protection areas.

B 3 Machine trenching is to be excluded from the TPZ of retained trees. Any required root excavation inside a TPZ is to be done by hand and intact roots >40 mm in diameter are to be retained. Services are to be installed 100 mm clear of such roots. Damaged roots **must** be cut cleanly with sharp implements (backhoe blades and similar are excluded), with no root dressings or paints. Trenches are to be backfilled promptly to minimise soil desiccation. Underbore if no suitable alternative location is possible. All works within the TPZ are to be supervised by an arborist.

Appendix 3. Company Profile

Abel Ecology has been in the flora and fauna consulting business since 1991, starting in the Sydney Region, and progressively more state wide in New South Wales since 1998, and now also in Victoria. During this time extensive expertise has been gained with regard to Master Planning, Environmental Impact assessments including flora and fauna, bushfire reports, Vegetation Management Plans, Management of threatened species, Review of Environmental Factors, Species Impact Statements and as Expert Witness in the Land and Environment Court. We have done consultancy work for industrial and commercial developments, golf courses, civil engineering projects, tourist developments as well as residential and rural projects. This process has also generated many connections with relevant government departments and city councils in NSW. Our team consists of four scientists and two administrative staff, plus casual assistants as required.

Areas of expertise

Aboriginal cultural heritage
Bushfire assessment and design
Ecology
Horticulture
Landscape design

Licences

NPWS s132C Scientific licence number is SL100780 expires 30 April 2013
NPWS GIS data licence number is CON95034
DG NSW Dept of Primary Industries Animal Care and Ethics Committee Approval expires 8 December 2015
DG NSW Dept of Primary Industries Animal Research Authority expires 8 December 2013