Travers

bushfire & ecology

Tree Assessment

Residential Aged Care Facility

158 Macquarie Road,
CARDIFF

November 2016
REF: (A15069T)

Travers

bushfire & ecology

Tree Assessment

(Residential Aged Care Facility)

Lot 2 DP 788892,
158 Macquarie Road, Cardiff

November 2016

Report Authors:	Michael Sheather-Reid, Robert Sansom, Kathy Maguire
Plans prepared:	Kelly Tucker/ Trent Matheson
Checked by:	Michael Sheather-Reid
Date:	8 November 2016
File:	A15069T

Disclaimer:

This report has been prepared to provide advice to the client on matters pertaining to the particular and specific development proposal as advised by the client and / or their authorised representatives. This report can be used by the client only for its intended purpose and for that purpose only. Should any other use of the advice be made by any person including the client then this firm advises that the advice should not be relied upon. The report and its attachments should be read as a whole and no individual part of the report or its attachments should be interpreted without reference to the entire report.

The mapping is indicative of available space and location of features which may prove critical in assessing the viability of the proposed works. Mapping has been produced on a map base with an inherent level of inaccuracy, the location of all mapped features are to be confirmed by a registered surveyor.

ABN 64 083 086 677

PO Box 7138
Kariong NSW 2250

38A The Avenue
Mt Penang Parklands
Central Coast Highway
Kariong NSW 2250

t: 02 4340 5331
e: info@traversenvironmental.com.au
www.traversecology.com.au

Executive Summary

This tree assessment report has been prepared by *Travers bushfire & ecology* to assess the condition and significance of one hundred and eighty-one (181) trees located within Lot 2 DP 788892 No. 158, Macquarie Road, Cardiff, within the Lake Macquarie City Council local government area (LGA). This lot will hereafter be referred to as the 'subject site'.

A safe useful life expectancy (SULE – Barrel 1993) assessment has been undertaken on 29-30th May 2015 and this tree assessment report has been prepared in accordance with Australian Standard *AS4970 (2009) – Amendment No. 1 2010.*

The purpose of this information shall be used to document trees to be removed for development approval compliance and to identify the ecological, historical and visual significance of trees to be removed and/or retained as part of the future development of the site. Those trees to be retained within the development should also be of sufficient condition and form to minimise the risk of tree damage to property or persons.

Selected trees within the subject site will be removed for the proposed dwelling due to being directly or indirectly impacted by proposed building footprints, access or services.

Impact of the proposed development on trees

Ninety seven (97) trees within the subject site are expected to be removed for the proposed residential aged care facility due to being unsafe or being directly or indirectly impacted by proposed building footprints, roads, carparks or services.

Of the ninety seven (97) trees to be removed, eighty nine (89) will be removed to accommodate the various development footprints, or will be removed on the expectation too much of the structural root zone would be impacted. Eight (8) trees will be removed in close proximity to development footprint areas that were considered dangerous to retain.

On the provision of a raised pathway or pathway with negligible ground and root disturbance, trees in the south-eastern corner of the site may be retained.

Tree protection zones (TPZ) are to be implemented for any retained tree in accordance with Australian Standard *AS4970* (Section 4). This report defines the Structural Root Zone (SRZ), Tree Protection Zone (TPZ) and other protection measures required for trees to be retained also in accordance with Australian Standard *AS4970.*

Significant trees

The trees present are consistent with the locally occurring vegetation type containing Smooth-barked Apple, Red Bloodwood and Scribbly Gum. However, due to past management practices and current use as a golf driving range, the vegetation consists of canopy only over well maintained lawns. These trees are not commensurate with any Endangered Ecological Community (EEC) known within the region.

There are twenty-one (21) visually prominent trees within the subject site. This is generally due to their size, however, all of these trees have been given a V2 rating which means that they are marginally larger or have a better form than most of their peers. These V2 tree species are common in the locality, their removal is not likely to be significant.

The Lake Macquarie Council Tree Managment Guidelines and the related Significant Tree Register lists do not list any significant trees of conservation significance within the subject

site. Trees may however be included into a tree significance register if the specimen displays cultural, historic, scientific and/ or aesthetic value. No trees present on site are considered appropriate for nomination to this register.

Seven trees containing thirteen (13) small hollows or fissures were observed within the subject site. Three of these trees containing three (3) hollows will be retained. Hollow bearing trees identified for removal require supervision by a fauna ecologist at the time of removal to effectively recover any residing fauna, particularly threatened species, if present.

List of abbreviations

AS 4970	Protection of trees on a development site
APZ	asset protection zone
BPA	bushfire protection assessment
CRZ	critical root zone
DCP	Development Control Plan
DOE	Commonwealth Department of Environment
EEC	endangered ecological community
EPA	Environmental Protection Agency
EP&A Act	*Environmental Planning and Assessment Act*
EPBC Act	*Environment Protection and Biodiversity Conservation Act*
ESMP	ecological site management plan
FF	flora and fauna assessment
FM Act	*Fisheries Management Act*
FMP	fuel management plan
ha	hectares
HTA	habitat tree assessment
IPA	inner protection area
LEP	local environment plan
LGA	local government area
m	metres
NES	national environmental significance
NPWS	NSW National Parks and Wildlife Service
NSW DPI	NSW Department of Industry and Investment
OEH	Office of Environment and Heritage (Part of the NSW Department of Premier and Cabinet)
OPA	outer protection area
PBP	*Planning for bush fire protection 2006*
RF Act	*Rural Fires Act*
RFS	NSW Rural Fire Service
ROTAP	rare or threatened Australian plants
SEPP 44	*State Environmental Protection Policy No 44 – Koala Habitat Protection*
SRZ	structural root zone
SULE	safe useful life expectancy
TPO	tree preservation order
TPZ	tree protection zone
TRRP	tree retention and removal plan
TSC Act	*Threatened Species Conservation Act*

Table of Contents

Attachments

Background 1

This tree assessment report has been prepared by *Travers bushfire & ecology* to assess the condition and significance of one hundred and eighty-one (181) trees located within Lot 2 DP 788892 No. 158, Macquarie Road, Cardiff, within the Lake Macquarie City Council local government area (LGA). This lot will hereafter be referred to as the 'subject site'. The location and extent of the subject site is shown in Figure 1.

This assessment is based on the SULE classification (Barrell, 1993). The purpose of this information shall be used to document the health of trees within the subject site and also to identify the ecological, historical and visual significance of these trees. Those trees to be retained within the development should also be of sufficient condition and form to minimise the risk of tree damage to property or persons.

Figure 1 – Study Area (approximate)

Survey Methods 2

2.1 Tree survey and condition assessment

Tree survey and assessment of the study area was carried out on 29-30th May 2015. Tree inspections and assessment were undertaken in accordance with Australian Standard *AS4970(2009)-Amendment 1 (2010).*

The aim of this tree assessment is to assess the condition and significance of one hundred and eighty-one (181) trees within the subject site as well as determine tree locations according to building envelopes and services.

The following survey and assessments were undertaken:

- an inspection of the site and relevant trees
- aerial photographic interpretation of the study area
- a health assessment (SULE rating) of the trees
- an assessment of the significance of individual trees
- compilation of this report detailing the results of the above assessments

Trees with a height greater than 3m were assessed. The tree assessment data is provided within Schedule 1, the location and number of each tree is shown in Schedule 2 and a description of terminology used is provided as Schedule 3.

The management requirements for maintaining safe trees (pruning, thinning etc.) was also considered in determining the health rating, therefore health ratings given to trees within this report assumes that appropriate maintenance will be provided by a qualified arborist during the life of the assessed trees. Incorrect or absent tree maintenance can significantly accelerate tree decline and increase hazard potential.

An AQF 5 Arborist inspection was undertaken on 3rd November, 2016 to inspect the condition of trees which have the potential to be affected by construction works and to identify specific tree protection measures for these trees prior to and during construction together with management measures for ongoing tree protection. This report, dated 4th November 2016, is attached (Attachment 1).

2.2 Identification of tree species

The identification of tree species is undertaken using available field guides and botanical texts. For any unidentifiable species a qualified and experienced botanist is utilised to confirm the tree identification. In many cases exotic species are identified to family name only. Samples may be sent off to the Royal Botanic Gardens should a potential threatened

or rare species be present and where the identification is not clear. Further samples may be required during flowering and fruiting seasons of the tree to confirm the identification.

2.3 Structural faults and decay

Visible evidence of structural defects and evidence of decay is briefly assessed during tree inspections. Structural defects are categorised into (Matheny & Clark 1994):

- root defects – including but not limited to suspect root rot, root exposure, root pruning or restriction

- trunk defects – including but not limited to evidence of decay, structural damage, *Phytophthora* and bracket fungi, excessive lean, borer damage, hollows, cracks, deadwood and multiple attachments

- crown defects - including but not limited to poor taper, bow or sweep, forks, multiple attachments, excessive end weight, cracks, splits, hangers, girdling, wounds, decay, cavities, conks, mushroom or bracket fungi, bleeding/sap flow, hollows, deadwood, borers, termites, ants, cankers, balls, burls and previous failures

Visible evidence of structural defects or decay are noted during inspections however we advise that the individual trees require detailed assessment if they are located or are to be retained in close proximity to buildings or proposed works.

Overall tree health is an indicator of the life of the tree but structural defects or decay can cause immediate structural failure when a tree is stressed due to high winds or other activities.

Structural defects or decay are not always visible from the exterior and may only become evident after failure. In the event that internal structural faults are detected or suspected, such as caused by hollows or rot, the internal diagnostic testing of the trees structural integrity is recommended.

Internal Diagnostic Testing (IDT) can be undertaken by Resistograph® to determine the structural integrity of the tree by measuring the extent and positioning of internal decay at the defects detected.

Travers bushfire & ecology advises that an AQ5 qualified arborist is to be engaged to undertake IDT testing and oversee works within the nominated tree protection zones. An AQ 5 inspection and report was also undertaken in November 2016 to define any further protective measures for the trunk, canopy and root zone (Attachment 1).

Survey results 3

A total of one hundred and eighty-one (181) trees with a with a height greater than 3m were assessed within the subject site (see Schedule 1). Trees were numbered T001, T002, T003, etc., through to T181 and a metal tag with the number embossed upon it was placed on the trunk for re-identification during future works.

3.1 Threatened species or endangered ecological communities (EECs)

The trees present within the subject site are Smooth-barked Apple, Red Bloodwood and Scribbly Gum with occasional exotics such as Slash Pine, Camphor Laurel, Privet or cultivar Callistemon. The understorey (shrub and ground layer) vegetation has been cleared and managed as well maintained lawns throughout the subject site. The native tree species present are not commensurate with any listed Endangered Ecological Community (EEC) which is also supported by local vegetation mapping (Bell and Driscoll 2013). The vegetation within the subject site is best described as Map Unit 30e - Coastal Plains Stringybark / Apple Forest as described in Bell and Driscoll (2013).

This vegetation community is not commensurate with any Endangered Ecological Community (EEC) listed within the NSW *TSC Act* (1995) or the Commonwealth *EPBC Act* (1999).

No threatened flora or fauna species were recorded within the subject site during the SULE assessment survey or during survey undertaken by *Travers bushfire & ecology* for the preparation of the Flora and Fauna Assessment.

3.2 Council's significant tree register

The Lake Macquarie Council Tree Preservation and Native Vegetation Management Guidelines do not list any trees species of conservation significance within the subject site. Trees may however be included into a tree significance register if the specimen displays cultural, historic, scientific and/or aesthetic value.

No trees present on site are considered appropriate for nomination to Council's significant tree register.

3.3 Visually prominent trees

There are twenty one (21) visually prominent trees within the subject site. This is generally due to their size, however, all of these trees have been given a V2 rating which means that they are marginally larger or have a better form than most of their peers. These V2 tree species are common in the locality, their removal is not likely to be significant.

3.4 Hollow-bearing trees

Seven trees containing thirteen (13) small hollows or fissures were observed within the subject site. Three of these trees containing three (3) hollows will be retained to the north east of the existing electrical easment.

If any tree with a hollow is found and identified for removal, then supervision by a fauna ecologist at the time of removal is recommended to effectively recover and relocate any residing fauna, particularly threatened species, if present.

3.5 SULE rating

An assessment of the attributes and health of each tree is contained in Schedule 1. Where trees have been downgraded with respect to health, a comment as to the reasons for the downgrade is generally provided.

A summary of SULE results in provided in the following table:

Table 1 - Summary of SULE ratings

SULE rating	No. of trees assessed	Proportion of trees assessed
1a	0	0.00%
1b	0	0.00%
1c	0	0.00%
2a	43	23.76%
2b	4	2.21%
2c	11	6.08%
2d	1	0.55%
3a	11	6.08%
3b	22	12.15%
3c	46	25.41%
3d	5	2.76%
4a	21	11.60%
4b	0	0.00%
4c	16	8.84%
4d	1	0.55%
4e	0	0.00%
4f	0	0.00%
Total	181	100%

Generally, the trees on site were found to be in a moderate condition, however, quite a few located centrally in the golf range show extensive bark damage due to the impacts of golf balls. There are also a number of trees that have been impacted by suppression from other nearby trees resulting in narrowing, tilting and even dieback of canopies and foliage. Various other defects related to poor health were observed for different trees and are noted in Schedule 1. Where a tree has been given a lower SULE rating, comments are generally provided in Schedule 1 giving reasons for the lower rating.

Trees of lower health or vigour have mostly been given a SULE of 2b or 3b as they tend to have a moderate to large amount of deadwood which indicates a decline in health and potential safety concerns now or in the near future, despite the potential for them to remain alive for another five (5) years or more.

Trees of a suppressed nature with limited or minor defects are likely to be retainable. However, those that are heavily suppressed or have some defect due to over-competition have largely been rated as a 2c or 3c which indicates although, if the trees are a sufficient distance from future infrastructure, they should be retained with a further assessment carried out within two (2) years.

Tree Removal & Impacts 4

4.1 Removal of trees due to proposed development

The proposal is for Stage 1 of a development involving the construction of a number of small cottage facilities for residential aged care use. Ninety seven (97) trees within the subject site are expected to be removed for the proposed residential aged care facility due to being unsafe or being directly or indirectly impacted by proposed building footprints, roads, carparks or services. Eighty four (84) trees are to be retained. Details regarding the status of each tree are provided within the attached Schedule 1 - Tree Assessment Table. These trees require removal regardless of their SULE rating.

4.2 Removal of trees due to condition

As a general rule, trees assessed with a SULE rating of 4a – 4f are recommended for removal based on a dangerous or very poor condition. This is particularly in the case of trees in close proximity to dwellings or other site assets. All other health ratings are for trees considered suitable for retention subject to ongoing maintenance and future damage caused by storms or disease.

Of the ninety-three (93)trees to be removed, five (5) trees will be removed in close proximity to development footprint areas that were considered too dangerous to retain.

Thirty-seven (40) of the assessed trees had a SULE rating of 2b, 3b or 4a-f. One (1) of these had a SULE rating of 2b while a further thirteen (13) had a SULE rating of 3b. These 2b and 3b trees will likely cause safety or nuisance given their likely proximity to proposed development areas. Twenty-six (26) trees near the development footprint had a SULE rating of 4a – 4f which is a rating which shows significant risk to life and property due to the existing trees.

It was decided however that some of these poor SULE trees could be retained insitu given their distance to the proposed development or onground works.

4.3 Impact assessment

A flora and fauna investigation and impact assessment of the subject site has been undertaken (*Travers bushfire and ecology*, May 2016, Ref: A15069F) which concludes that the proposed future development of the subject site for residential aged care use at 158 Macquarie Road, Cardiff (Lot 2 DP 788892) is unlikely to have significant impact upon threatened species, endangered populations or endangered ecological communities.

The Lake Macquarie Council Tree Preservation and Native Vegetation Management Guidelines do not list any tree species of conservation significance within subject site. Trees may however be included into a tree significance register if the specimen displays cultural,

historic, scientific and /or aesthetic value. No trees present on site are considered appropriate for nomination to this register.

Seven trees containing thirteen (13) small hollows or fissures were observed within the subject site. Three of these trees containing three (3) hollows will be retained within the subject site. Hollow bearing trees identified for removal require supervision by a fauna ecologist at the time of removal to effectively recover any residing fauna, particularly threatened species, if present.

As recommended by *Travers bushfire & ecology*, an AQ5 qualified arborist was engaged in November 2016 to define any mitigation measures to maintain or improve their condition where the works proposed impact on more than 10% of the TPZ. These are outlined in Attachment 1.

The TPZ of retained trees will potentially be impacted by the proposed development. Calculated areas of impact of the proposed building within the nominated TPZ of retained trees is provided below.

Where the impact of the proposed development is less than 10% of the TPZ these trees have had the TPZ expanded to 1.1 times the calculated TPZ as compensation. This fulfils the requirement for the compensatory expansion of the TPZ as required in *AS4970-2009-Amendment 1-2010*.

Trtees where the TPZ is impacted by greater than TPZ have been nominated for removal.

Tree Protection Guidelines 5

The following sections provide guidance as to the expected TPZs required for trees to be retained within the development site (either in the staged or ultimate development scenario), or affected by associated works. TPZs consist of:

(a) Tree protection zone (TPZ) which aims to protect the full extent of the tree, and
(b) Structural root zone (SRZ) which aims to define the critical root zone (CRZ) for the tree without causing fatal damage to the tree.

5.1 Tree protection measures

The following is applied in accordance with Australian Standard *AS4970 – 2009 – Amendment 1-2010*.

The tree protection zone (TPZ) radius is calculated as DBH x 12. For instance, if a tree has a DBH of 50cm, the TPZ would be 6m radius and a tree of DBH 30cm would have a TPZ radius of 3.6m.

The TPZ should not be less than 2m radius or greater than 15m radius. For monocots such as Palms, Cycads and Tree Ferns, the TPZ should not be less than 1m outside of the crown projection. For trees that are impacted by the development of no more than 10% of the TPZ, the TPZ is to be compensated elsewhere for the equivalent area of loss of potential root zone e.g. a 10% increase in the TPZ radius where the tree is not impacted by the proposed development.

In some cases the above formula over protects the root zone of a tree. Where this calculation clearly results in overprotection, the TPZ is adjusted to a minimum of 1m radius beyond the current canopy spread.

The structural root zone (SRZ) radius is the area which is required to maintain a tree's stability. The SRZ is measured as:

SRZ radius = $(D \times 50)^{0.42} \times 0.64$ where D is the basal trunk diameter, in metres, measured above the root buttress. The SRZ for trees with D of less than 0.15m (15cm) will be 1.5m. As an example - if D is 50cm, then the SRZ radius would be 2.47m.

During the survey, DBH and basal trunk diameters were measured for each tree to allow for TPZ and SRZ to be calculated.

Table 2 – Estimated TPZ for trees

DBH (cm)	TPZ (m)
15	1.8 - increased to minimum 2.0
20	2.4

Table 2 – Estimated TPZ for trees

DBH (cm)	TPZ (m)
25	3
30	3.6
35	4.2
40	4.8
45	5.4
50	6
55	6.6
60	7.2
65	7.8
70	8.4
75	9
80	9.6
85	10.2
90	10.8
95	11.4
100	12
105	12.6
110	13.2
115	13.8
120	14.4
150	18 - in most cases can be reduced to 15 m or canopy spread + 1m
200	24 - as above
250	30 - as above

Table 3 – Estimated SRZ for trees

D (cm)	SRZ (m)
12	1.5
15	1.5
20	1.68
25	1.85
30	2
35	2.13
40	2.25
45	2.37
50	2.47
55	2.57
60	2.67
65	2.76
70	2.85
75	2.93
80	3.01
85	3.09
90	3.17
95	3.24
100	3.31
105	3.38
110	3.44

115	3.51
120	3.57
150	3.92
200	4.43
250	4.86
300	5.25

The SRZ and TPZ calculated for each of the trees assessed within the subject site are provided in Schedule 1.

When working in close proximity of any tree to be retained or the nominated TPZ located within or adjacent to potential development areas, the following general management principles should be adopted:

- earthworks around subject trees are to be undertaken in the presence of a qualified ecologist / arborist who may provide additional on-site advice
- machine digging within the root mass or SRZ of the subject tree (or trees) is to be minimised and, where possible, replaced by hand digging
- any exposed roots of the subject tree should be wrapped and protected during exposure and be replaced in a similar position prior to disturbance
- inspection of retained trees by a project arborist is recommended to be conducted at 3, 6, 9 and 12 months and then annually to 3 years after development completion.

Any retained tree on site will require protection both during and after development construction, applying the following tree protection guidelines:

The following protection measures are required in relation to any trees that are being retained within or adjacent to the proposed works area:

i. Installation of a TPZ will be required surrounding any retained tree. This TPZ can generally be provided by preserving an area equivalent to that shown in Schedule 1. A SRZ will apply to all retained trees in close proximity to work areas. No more than 10% of the TPZ should be impacted by earthworks with no infiltration into the SRZ. The impact of 10% or less to the TPZ is to be compensated elsewhere on the impacted tree to compensate for the loss of small areas of the TPZ. This is achieved by increasing the TPZ to an equivalent area to the area of impacted TPZ (Figure 2).

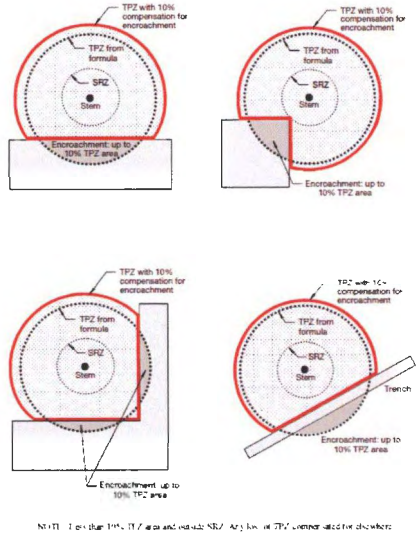


Figure 2 Minor encroachment on TPZ and 10% compensation for encroachment (Source AS 4970-2009)

ii. Trees to be retained, and in close proximity to any works, are to be protected by temporary protection fencing erected on the TPZ line. Such fencing can be constructed from temporary materials such as high visibility plastic fencing, post and wire, chain link fencing panels, or from permanent fencing such as post and wire or chain link fences. All fence posts and supports are to be located clear of the roots and have sufficient strength to support the fence without bending or collapsing. TPZs in close proximity to proposed works are to be marked and sign-posted. The protection fencing is not to be removed or altered without the approval an appointed arborist. TPZ fencing is to be inspected on a regular basis and maintained in good condition.

iii. All trees nominated for removal are to be removed prior to any construction activity or bulk earthworks. Approved tree removal operations in the vicinity of retained trees are to be undertaken in a manner that avoids canopy or root damage and/or soil compaction to any TPZ associated with any retained tree. Such works should be supervised by a qualified arborist.

iv. Stumps are to be ground not dozed or dug out unless they impact on the installation of services, roads or building works.

v. All excavation including but not limited to trenches, footings and major earth movement are to be avoided within TPZ's.

vi. All machinery and vehicles are to be excluded from TPZs during all operations.

vii. Where the proposed works are likely to cause excessive dust generation, the Tree is to be protected with shade cloth on the tree protection fence to minimise dust collection on the leaves.

viii. Prohibit the following activities including but not limited to:-

- machine excavation (including trenching)
- excavation for silt fencing
- cultivation

- Storage
- preparation of chemicals, including cement products
- parking of vehicles or plant
- refuelling
- dumping of waste
- refuelling
  wash down or cleaning of equipment
- placement of fill
- lighting of fires
- soil level changes
- temporary or permanent installation of signs
- physical damage to trees.

ix. Any works undertaken within TPZs are to be supervised and certified (photographed and documented) by a qualified arborist.

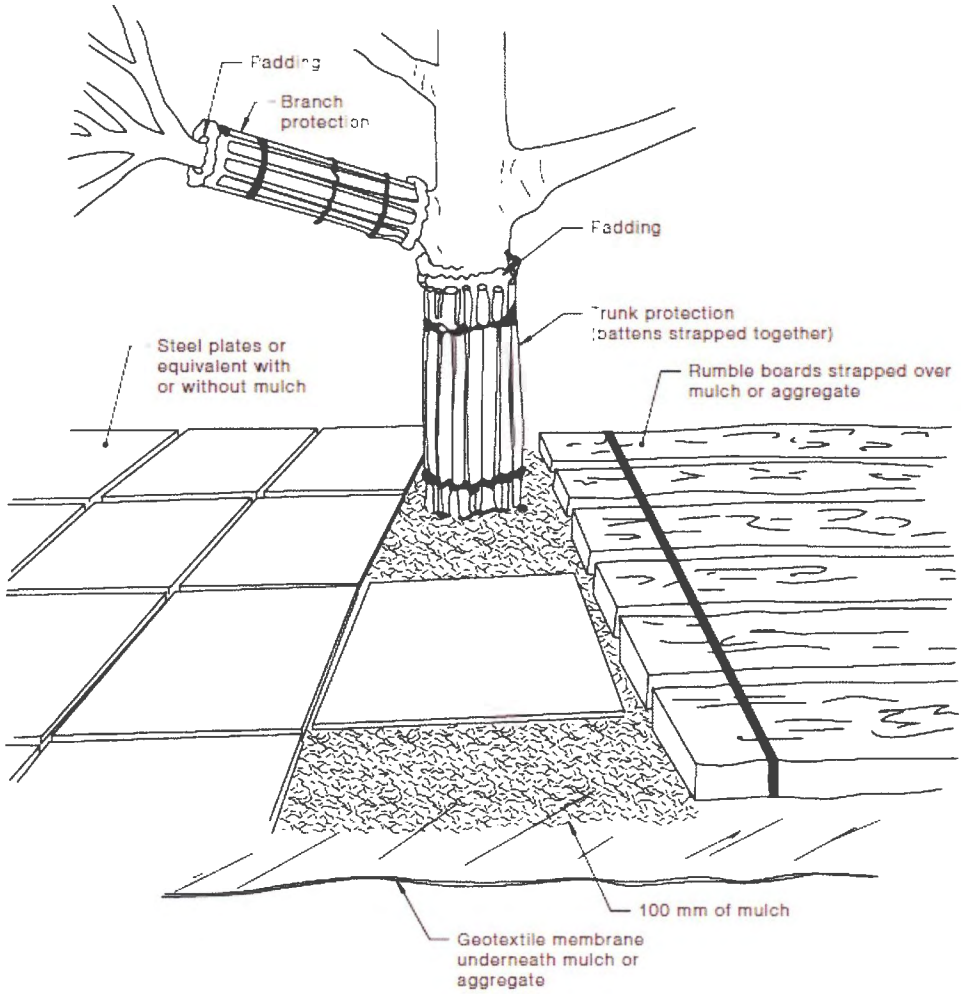
x. Where advised by the arborist, trunk and branch protection (Figure 3) is to be installed to a minimum height of 2 m using materials and positioning as advised by an appointed arborist.

xi. Where advised by the arborist, other temporary root protection measures (Figure 3) such as thick mulch (50-100mm deep) or crushed rock below rumble boards, are to be installed to prevent root damage and soil compaction within the TPZ.

xii. Scaffolding is to be erected outside of the TPZ, where unavoidable protection measures are to be specified by the appointed arborist.

xiii. All services are to be routed outside of the TPZ. Where not possible the arborist will specify directional drilling (at least 600mm deep) or manual excavation to avoid impacted on the insitu roots subject to the works and potential root damage.

xiv. Pruning if required (such as for T12 & T24) is to be undertaken by an arborist in accordance with AS4373 to prevent structural damage, disease and poor form.



NOTES:

1 For trunk and branch protection use boards and padding that will prevent damage to bark. Boards are to be strapped to trees, not nailed or screwed.

2 Rumble boards should be of a suitable thickness to prevent soil compaction and root damage.

Figure 3 Examples of trunk, branch and ground protection as per AS4970- 2009

xv. AQ 5 Arborist recommendations for protection of specific retained trees in the vicinity of construction works are outlined in Attachment 1

5.2 Tree protection fencing

Tree protection fencing should be erected before any machinery or materials are brought onto the site and before the commencement of works (including demolition). Once erected, protective fencing must not be removed or altered without approval by the project arborist. The TPZ is to be fully secured to prevent access onto the protected Structural Root Zone (SRZ).

Should the TPZ need to be moved for any reason, then the project arborist is to direct the installation of protective measures, at their discretion, within the TPZ to minimise damage to the trees.

AS 4687 specifies applicable fencing requirements. Installed construction fencing on the recommended alignment of the TPZ fencing can be installed as part of the protective fencing.

For construction crews, signage identifying the TPZ shall be placed at 10 metre intervals along the TPZ fencing. These signs will face towards the development site and shall have lettering that complies with *AS 1319*.

TPZ fencing is to be inspected on a regular basis and maintained in good condition. It is recommended that the TPZ fencing be installed as shown in Figure 4. Any works within the mapped tree protection zones is to be supervised (for excavation works) or under the direction of an AQ5 qualified arborist to limit damage to root zones and to install additional root, trunk and branch protection measures.

Conclusions & Recommendations 6

6.1 Conclusions

Ninety seven (97) trees within the subject site are expected to be removed for the proposed residential aged care facility due to being unsafe or being directly or indirectly impacted by proposed building footprints, roads, carparks or services. Eighty four (84) trees are to be retained.

Tree protection zones (TPZ) are to be implemented for any retained tree in accordance with Australian Standard *AS4970* and as required within this report (section 5.1).

6.2 Recommended tree management

To minimise impacts on local ecology and to maintain a stand of healthy trees, during tree removal operations the following recommendations apply:

- Aim to retain any hollow bearing trees of good condition throughout the landscape,
- Preferentially remove dangerous or very poor condition trees,
- Site manager is to ensure the implementation of tree protection measures as required by AS4970-2009,
- Engage an arborist to advise or undertake any tree management works, supervise excavation works within the TPZ and specify addition branch, trunk and root protection measures,
- Consider the placement of services away from root zones to minimise impacts to trees,
- Boring of services a minimum of 600mm below ground surface where they cross a mapped tree protection zone,
- Where appropriate, retain and create clumps of good quality trees for future public or private use,
- Plant and mulch the root zones of existing trees to minimise the risk of soil compaction and root damage,
- Remove suppressed or poor condition trees to reduce fuel loads or for creating discontinuous canopies in asset protection zones,
- Favour removal of trees with poor SULE ratings over healthier trees, and
- Actively replant endemic (locally occurring native) trees within the lot, street scape and any open space areas to maximise local amenity within the development.

6.3 Inspections and Certifications

A project arborist is to be appointed to provide direction & advice on the protection and ongoing management of the insitu trees (during construction), supervision of tree removal, installation of tree protection measures, to treat or manage any inadvertent damage to trees and to provide final certification of compliance.

The project arborist is to assess the condition of the trees and their growing environment, make recommendations for any necessary remedial actions.

Following the final inspection and compliance with any remediation works, the project arborist is to certify (as appropriate) that the completed works have been carried out in compliance with the approved plans and specifications for tree protection. Certification is to include a testament on the condition of retained trees, detail any deviations from the approved tree protection measures and their impacts on trees.

The project arborist is to maintain records of any site visits including photos of trees in close proximity to the proposed works to be used for certification purposes.

6.4 Tree pruning and remedial actions

Remedial actions are to be recommended by the project arborist in the event that damage is caused to trees or if site management is potentially causing a deterioration in tree health. This may include pruning of trees in accordance with AS4373 and or soil remediation.

Remedial actions may include but is not limited to:-

- Protection measures over the root zone and remediation of any contaminants in the soil within the tree protection zone.
- Mulching and planting around the base of the tree to remediate potential root compaction
- Installation of protective platform above the ground surface to allow free root expansion and to prevent soil compaction from constant passage or use of the area
- Replanting of trees within the site due to damage or actions that have caused the loss.
- Replacement of dead or dying trees of the same species and in a location that will ensure long term good health.

Bibliography

Barrell, J. (1993) *Pre-planning Tree Surveys: Safe Useful Life Expectancy (SULE) is the Natural Progression.* Arboricultural Journal Vol. 17, pp 33-46, AB Academic Publishers, Great Britain

Boland, D. J., Brooker, M. I. H., Chippendale, G. G., Hall, N., Hyland, B. P. M., Johnston, R. D., Kleinig, D. A., Turner, J. D. (1992) *Forest Trees of Australia.* CSIRO, Melbourne

British Standard BS5837 (1991) *Guide for Trees in Relation to Construction, BSi* Standards

Brooker, M. I. H. and Kleinig, D. A. (1999) *Field Guide to Eucalyptus - South-eastern Australia.* Volume 1, Second Edition, Bloomings Books

Florence, R. G. (1996) *Ecology and Silviculture of Eucalypt Forests.* CSIRO, Collingwood Victoria

Hadlington, P. W. and Johnston, J. A. (1977) *Australian Trees, a Guide to Their Care and Cure.* Printed in Hong Kong by South China Printing Company

Harden, G. (1993) *Flora of New South Wales* University NSW Press

Queensland Arboricultural Association Inc (website)
http://www.qaa.net.au/calculations.php?

Mattheck, C. and Breloer, H (1998) ' The Body Language of Trees- A Handbook for Failure Analysis.' HMSO, London.

Rinn, F 2011 'Basic Aspects of Mechanical Stability of Tree Cross-Sections', *Arborist News*, Feb 2011, pp. 52-54.

Simpfendorfer, K. J. (1992) *An Introduction to Trees for South-eastern Australia.* Inkata Press

Threatened Species Conservation Act (TSC Act) (1995) *Schedules 1, 2 and 3.* NSW Scientific Committee

Schedule 1

Tree Assessment Table

No. 158 Macquarie Road, Cardiff

Tree No.	Common Name	Scientific Name	DBH (cm)	BD (cm)	Height (m)	Spread (m)	Vigour (%)	SULE	Retain / Remove	Reason for Removal	Visual Signif	TPZ Radius (m) *Note 4	SRZ Radius (m)	Habitat Tree	Comments
T001	Broad-leaved White Mahogany	*Eucalyptus umbra*	43	45	16	7	85	2a	RETAIN			5.16	2.4		
T002	Scribbly Gum	*Eucalyptus signata*	7	8	4	3	90	2a	RETAIN			2.00	1.1		
T003	Red Bloodwood	*Corymbia gummifera*	23	25	18	7	90	2a	RETAIN			2.76	1.8		
T004	Smooth-barked Apple	*Angophora costata*	57	65	23	14	90	2a	RETAIN			6.84	2.8		
T005	Broad-leaved White Mahogany	*Eucalyptus umbra*	55	59	21	9	45	3b	RETAIN			6.60	2.7		'S' shaped base at 1m, bark damage at 1m, kino, termites in trunk
T006	Broad-leaved White Mahogany	*Eucalyptus umbra*	17	20	12	7	90	2a	RETAIN			2.04	1.7		
T007	Brown Stringybark	*Eucalyptus capitellata*	35	39	22	9	90	2a	RETAIN			4.20	2.2		slightly crowded, canopy off centre
T008	Smooth-barked Apple	*Angophora costata*	31	33	18	9	90	2a	RETAIN			3.72	2.1		
T009	Smooth-barked Apple	*Angophora costata*	45, 40, 33	94	24	12	75	2b	RETAIN			8.24	3.2		3x trunks at 0.5m
T010	Camphor Laurel	*Cinnamomum camphora*	7	12	10	4	90	2a	RETAIN			2.00	1.4		exotic spp
T011	Camphor Laurel	*Cinnamomum camphora*	6	8	8	3	90	2a	RETAIN			2.00	1.1		exotic sp
T012	Camphor Laurel	*Cinnamomum camphora*	5, 5	7	7	3	80	2c	RETAIN			2.00	1.1		multiple trunks at 0.0m
T013	Red Bloodwood	*Corymbia gummifera*	17	19	14	6	80	2c	RETAIN			2.04	1.6		crowded, canopy off centre
T014	Smooth-barked Apple	*Angophora costata*	36	39	23	9	90	2a	RETAIN			4.32	2.2		
T015	Smooth-barked Apple	*Angophora costata*	10	14	7	3	90	2a	RETAIN			2.00	1.4		
T016	Smooth-barked Apple	*Angophora costata*	7	9	6	3	90	2a	RETAIN			2.00	1.2		
T017	Brown Stringybark	*Eucalyptus capitellata*	33	35	20	9	90	2a	RETAIN			3.96	2.1		
T018	Smooth-barked Apple	*Angophora costata*	7	9	5	3	90	2a	RETAIN			2.00	1.2		
T019	Smooth-barked Apple	*Angophora costata*	14	17	12	5	75	2c	RETAIN			2.00	1.6		damage, exposed wood & borers at 2m
T020	Cheese Tree	*Glochidion ferdinandii*	13	25	4	6	30	2b	RETAIN			2.00	1.8		growin from felled horizontal trunk
T021	Smooth-barked Apple	*Angophora costata*	43, 79	90	22	18	75	3c	RETAIN		V2	10.79	3.2		twin trunks & bark damage at 1.5m,
T022	Sydney Peppermint	*Eucalyptus piperita*	24	26	15	7	70	3c	RETAIN			2.88	1.9		malformed trunk atb1.5m, med deadwood
T023	Broad-leaved White Mahogany	*Eucalyptus umbra*	6	8	4	3	80	3c	RETAIN			2.00	1.1		suppressed
T024	Red Bloodwood	*Corymbia gummifera*	6	8	6	4	90	2a	RETAIN			2.00	1.1		
T025	Scribbly Gum	*Eucalyptus signata*	29	32	10	9	45	3b	REMOVE	Development		3.48	2.1		leaning >20deg, exposed wood at base
T026	Smooth-barked Apple	*Angophora costata*	48	52	24	14	90	2a	REMOVE	Development		5.76	2.5		smll deadwood
T027	Smooth-barked Apple	*Angophora costata*	43	47	23	12	60	3b	REMOVE	Development		5.16	2.4		exposed wood & fungal attack at 2m
T028	Smooth-barked Apple	*Angophora costata*	10	14	10	5	60	3c	REMOVE	Development		2.00	1.4		crowded, suppressed
T029	Sydney Peppermint	*Eucalyptus piperita*	85	90	24	16	75	3b	REMOVE	Development	V2	10.20	3.2		malformed trunk at 1.5m. borers in trunk
T030	Red Bloodwood	*Corymbia gummifera*	10	12	6	5	90	2a	REMOVE	Development		2.00	1.4		
T031	Smooth-barked Apple	*Angophora costata*	15	19	12	7	80	2c	REMOVE	Development		2.00	1.6		crowded, suppressed
T032	Red Bloodwood	*Corymbia gummifera*	40	44	23	10	85	2a	REMOVE	Development		4.80	2.3		kino @ several places
T033	Sydney Peppermint	*Eucalyptus piperita*	64, 46	82	23	13	65	3b	REMOVE	Development	V2	9.46	3.0		2x trunks at 0.3m, both leaning 10deg
T034	Red Bloodwood	*Corymbia gummifera*	57	64	22	14	70	3c	RETAIN			6.84	2.7		suppressed, leaning 10deg, two trunks @ 4m, med deadwood
T035	Red Bloodwood	*Corymbia gummifera*	20	23	15	8	60	3c	RETAIN			2.40	1.8		suppressed, crowded, canopy off centre
T036	Red Bloodwood	*Corymbia gummifera*	15	17	8	3	25	4c	REMOVE	Development		2.00	1.6		exposed wood at 1.5m, kino, borers
T037	Scribbly Gum	*Eucalyptus signata*	17	20	10	4	50	3c	RETAIN			2.04	1.7		crowded, suppressed, footbound with

No. 158 Macquarie Road, Cardiff

Tree No.	Common Name	Scientific Name	DBH (cm)	BD (cm)	Height (m)	Spread (m)	Vigour (%)	SULE	Retain / Remove	Reason for Removal	Visual Signif	TPZ Radius (m) *Note 4	SRZ Radius (m)	Habitat Tree	Comments
															T038
T038	Red Bloodwood	*Corymbia gummifera*	37	40	20	10	70	3c	RETAIN			4.44	2.3		rootbound w T037
T039	Broad-leaved White Mahogany	*Eucalyptus umbra*	30	33	20	9	85	2a	RETAIN			3.60	2.1		crowded, leaning 5deg
T040	Scribbly Gum	*Eucalyptus signata*	34	37	16	8	35	4a	RETAIN			4.08	2.2		exposed wood at 1.5m, kino, fungal attack, med deadwood
T041	Brown Stringybark	*Eucalyptus capitellata*	33	36	18	8	80	2a	RETAIN			3.96	2.2		canopy off centre
T042	Red Bloodwood	*Corymbia gummifera*	18, 15	40	9	4	40	4a	REMOVE	Development		2.81	2.3		dying, lots med deadwood, kino, suppressed, crowded
T043	Brown Stringybark	*Eucalyptus capitellata*	47	50	20	7	50	4a	REMOVE	Development		5.64	2.5		crowded, lge deadwood, thin crown
T044	Broad-leaved White Mahogany	*Eucalyptus umbra*	57	64	23	12	55	3b	RETAIN			6.84	2.7		lge deadwood, epicormic growth, stressed
T045	Smooth-barked Apple	*Angophora costata*	65	68	23	7	15	4a	REMOVE	Development	V2	7.80	2.8	3	90% circ of bark gone, exposed wood at 0m, borers in trunk
T046	Broad-leaved White Mahogany	*Eucalyptus umbra*	40	43	20	11	75	4c	RETAIN			4.80	2.3		termites in trunk, thin crown, epicormic growth, lots smll deadwood
T047	Broad-leaved White Mahogany	*Eucalyptus umbra*	47	50	22	8	75	2c	RETAIN			5.64	2.5		canopy off centre, smll deadwood
T048	Brown Stringybark	*Eucalyptus capitellata*	31	34	16	9	65	3c	RETAIN			3.72	2.1		suppressed, canopy off centre, leaning 10deg
T049	Smooth-barked Apple	*Angophora costata*	30	34	17	5	65	3c	RETAIN			3.60	2.1		crowded, suppressed, med deadwood, canopy off centre, exposed wood & kino at 1.2m
T050	Red Bloodwood	*Corymbia gummifera*	67	73	24	14	90	2a	RETAIN		V2	8.04	2.9		
T051	Scribbly Gum	*Eucalyptus signata*	27	32	18	4	45	4a	REMOVE	Dangerous Tree		3.24	2.1		crowded, suppressed, crown off centre, bark damaged & exposed wood to 8m
T052	Scribbly Gum	*Eucalyptus signata*	36	39	18	11	35	4a	REMOVE	Dangerous Tree		4.32	2.2		damaged bark on n side, exposed wood, kino, v. thin canopy
T053	Broad-leaved White Mahogany	*Eucalyptus umbra*	27	29	18	8	65	3b	REMOVE	Dangerous Tree		3.24	2.0		borers in trunk, leaning 10deg, smll deadwood
T054	Smooth-barked Apple	*Angophora costata*	18	20	18	7	65	4a	REMOVE	Development		2.16	1.7		bark damage on nside, kino, exposed wood, bark splitting jigsaw all round
T055	Red Bloodwood	*Corymbia gummifera*	32	35	19	8	70	3c	REMOVE	Development		3.84	2.1		suppressed, canopy off centre, leaning 5deg
T056	Sydney Peppermint	*Eucalyptus piperita*	37	40	18	7	70	3c	REMOVE	Development		4.44	2.3		suppressed, epicormic growth, thin canopy, lots smll deadwood
T057	Red Bloodwood	*Corymbia gummifera*	36	40	20	10	75	3c	REMOVE	Development		4.32	2.3		suppressed, canopy off centre, bark splits, kino
T058	Smooth-barked Apple	*Angophora costata*	46	50	22	12	80	2a	REMOVE	Development		5.52	2.5		exposed wood at 6m, kino
T059	Dead Stag	Dead Stag	34	37	22	7	0	4a	REMOVE	Development		4.08	2.2		fallen, leaning on adjacent tree T056
T060	Smooth-barked Apple	*Angophora costata*	17	20	7	3	25	3c	RETAIN			2.04	1.7		major trunk faiure at 4m, termites, kino, med deadwood
T061	Red Bloodwood	*Corymbia gummifera*	32, 36	68	23	4	15	4a	REMOVE	Dangerous Tree close proximity to development		5.78	2.8		1 trunk dead, 2nd trunk 60% dead, lge deadwood, bracket fungi
T062	Sydney Peppermint	*Eucalyptus piperita*	78	80	23	7	70	3b	REMOVE	Dangerous Tree close proximity to development	V2	9.36	3.0		borers in base, 2x trunks from1.7m, suppressed
T063	Smooth-barked Apple	*Angophora costata*	57	60	23	9	60	3c	REMOVE	Development		6.84	2.7		roots & canopy intertwined w T064, med deadwood

No. 158 Macquarie Road, Cardiff

Tree No.	Common Name	Scientific Name	DBH (cm)	BD (cm)	Height (m)	Spread (m)	Vigour (%)	SULE	Retain / Remove	Reason for Removal	Visual Signif	TPZ Radius (m) *Note 4	SRZ Radius (m)	Habitat Tree	Comments
T064	Brown Stringybark	*Eucalyptus capitellata*	72	80	22	8	20	4a	REMOVE	Development		8.64	3.0		50% of base gone/exposed, termites in base, roots & canopy intertwined w T063
T065	Broad-leaved White Mahogany	*Eucalyptus umbra*	42, 26	65	23	12	80	3a	REMOVE	Development		5.93	2.8		2x trunks at 0.5m
T066	Broad-leaved White Mahogany	*Eucalyptus umbra*	37	40	18	7	60	3c	REMOVE	Development		4.44	2.3		suppressed, epicormic growth, stressed, lots smll deadwood
T067	Smooth-barked Apple	*Angophora costata*	8	9	7	3	90	2a	RETAIN			2.00	1.2		
T068	Broad-leaved White Mahogany	*Eucalyptus umbra*	49	54	22	14	70	3b	REMOVE	Development		5.88	2.6		termites in base
T069	Red Bloodwood	*Corymbia gummifera*	62	64	23	12	80	3a	REMOVE	Development	V2	7.44	2.7		exposed wood at base
T070	Smooth-barked Apple	*Angophora costata*	39	43	22	12	90	2a	REMOVE	Development		4.68	2.3		
T071	Smooth-barked Apple	*Angophora costata*	58	63	22	15	90	2a	REMOVE	Development		6.96	2.7		1x med deadwood
T072	Smooth-barked Apple	*Angophora costata*	58, 32	63	22	14	80	2c	REMOVE	Development		7.95	2.7		exposed wood at 5m, kino, 2x trunks from 0m
T073	Smooth-barked Apple	*Angophora costata*	60, 65	80	18	12	30	4a	RETAIN		V2	10.62	3.0	2	2x trunks from 0.5m, 60% of larger trunk dead, exposed wood from 0 to 8m, borers
T074	Camphor Laurel	*Cinnamomum camphora*	7, 6	9	4	5	90	3c	RETAIN			2.00	1.2		exotic sp
T075	Camphor Laurel	*Cinnamomum camphora*	22, 12, 11, 34	68	8	11	80	2c	REMOVE	Development		5.24	2.8		exotic sp
T076	Black She-oak	*Allocasuarina littoralis*	16	17	8	4	65	3c	RETAIN			2.00	1.6		major crown damage from fallen tree adjacent
T077	Scribbly Gum	*Eucalyptus signata*	19	22	16	7	65	3b	RETAIN			2.28	1.8		leaning 10deg, canopy off centre, epicormic growth
T078	Smooth-barked Apple	*Angophora costata*	52	68	23	11	90	2a	RETAIN			6.24	2.8		2x lge deadwood at 5 & 11m
T079	Camphor Laurel	*Cinnamomum camphora*	8	10	4	3.5	90	3c	RETAIN			2.00	1.3		exotic spp
T080	Scribbly Gum	*Eucalyptus signata*	11, 6	14	6	4	70	2b	RETAIN			2.00	1.4		2x trunks at 0m
T081	Smooth-barked Apple	*Angophora costata*	48	53	23	10	90	2a	RETAIN			5.76	2.5		
T082	Brown Stringybark	*Eucalyptus capitellata*	47	51	20	10	15	4a	REMOVE	Development		5.64	2.5		dying, trunk damage at 1m, fungal attack, termites
T083	Smooth-barked Apple	*Angophora costata*	18	20	19	4	60	4c	REMOVE	Development		2.16	1.7		crowded, suppressed, dmge at base, exposed wood to 2m, kino
T084	Smooth-barked Apple	*Angophora costata*	38	42	22	12	90	2a	REMOVE	Development		4.56	2.3		
T085	Broad-leaved White Mahogany	*Eucalyptus umbra*	15	18	12	4	70	2c	RETAIN			2.00	1.6		crowded, suppressed
T086	Smooth-barked Apple	*Angophora costata*	80	80	22	14	65	3b	RETAIN		V2	9.60	3.0		malformed trunk base - s shape, 2x trunks from 2m
T087	Smooth-barked Apple	*Angophora costata*	78	84	22	14	35	4c	REMOVE	Development	V2	9.36	3.1		half circumference wood exposed 0 to 8m, borers, fungal attack, lge deadwood
T088	Camphor Laurel	*Cinnamomum camphora*	24, 22, 7, 7	37	10	8	80	3c	RETAIN			4.08	2.2		exotic sp
T089	Camphor Laurel	*Cinnamomum camphora*	24, 20, 20	39	14	10	90	3c	RETAIN			4.45	2.2		exotic sp.
T090	Smooth-barked Apple	*Angophora costata*	34	38	20	12	90	2a	RETAIN			4.08	2.2		
T091	Dead Stag	Dead Stag	43	48	22	7	0	4a	RETAIN			5.16	2.4		
T092	Small-leaved Privet	*Ligustrum sinense*	8, 7, 6	15	3	6	90	3c	RETAIN			2.00	1.5		exotic sp.
T093	Sydney Peppermint	*Eucalyptus piperita*	20, 20	26	9	8	65	3b	RETAIN			3.39	1.9		lopped for powerline, exposed wood, kino,
T094	Large-leaved Privet	*Ligustrum lucidum*	14x trunks, 6 to 18	56	9	9	90	3c	RETAIN			6.00	2.6		exotic sp.

No. 158 Macquarie Road, Cardiff

Tree No.	Common Name	Scientific Name	DBH (cm)	BD (cm)	Height (m)	Spread (m)	Vigour (%)	SULE	Retain / Remove	Reason for Removal	Visual Signif	TPZ Radius (m) *Note 4	SRZ Radius (m)	Habitat Tree	Comments
T095	Slash Pine	*Pinus elliotti*	42	48	22	9	75	3c	RETAIN			5.04	2.4		leaning 5deg, canopy off centre, exotic sp.
T096	Bottlebrush	*Callistemon* sp. cultivar	10x trunks <9cm	-	3.5	3	90	3a	REMOVE	Development		4.80	2.4		
T097	Bottlebrush	*callistemon* sp. cultivar	5x <7cm	-	5	3	90	3a	REMOVE	Development		4.56	2.1		
T098	Brown Stringybark	*Eucalyptus capitellata*	41	48	18	8	0	4a	REMOVE	Development		4.92	2.4		recently fell, cut into sections
T099	Slash Pine	*Pinus elliotti*	15	17	5	3	10	4a	REMOVE	Development		2.00	1.6		recently fell
T100	Slash Pine	*Pinus elliotti*	32	36	8	6	90	2a	RETAIN			3.84	2.2		
T101	Slash Pine	*Pinus elliotti*	17	19	11	3	85	2a	RETAIN			2.04	1.6		slightly crowded
T102	Slash Pine	*Pinus elliotti*	17	19	8	4	70	2c	RETAIN			2.04	1.6		L shaped base, poor form
T103	Bottlebrush	*Callistemon* sp. cultivar	10x <5cm	-	3	2.5	90	2a	RETAIN			4.80	2.2		
T104	Brown Stringybark	*Eucalyptus capitellata*	38	42	22	7	55	4a	REMOVE	Dangerous Tree		4.56	2.3		dying, 50% canopy, lots smll deadwood
T105	Brown Stringybark	*Eucalyptus capitellata*	16	19	11	5	50	3c	RETAIN			2.00	1.6		crowded, suppressed, lge deadwood
T106	Red Bloodwood	*Corymbia gummifera*	33	37	22	10	90	2a	RETAIN			3.96	2.2		
T107	Sydney Peppermint	*Eucalyptus piperita*	34	37	20	6	55	3c	RETAIN			4.08	2.2		crowded suppressed, epicormic growth, L shaped base
T108	Brown Stringybark	*Eucalyptus capitellata*	72, 36	85	22	13	60	3b	RETAIN		V2	9.66	3.1		2x trunks at 0.5m, termite nest at 6m bark dmg at base
T109	Sydney Peppermint	*Eucalyptus piperita*	75	78	23	10	50	4c	REMOVE	Development	V2	9.00	3.0		termites to 15m, lots smll deadwood
T110	Brown Stringybark	*Eucalyptus capitellata*	64	68	22	11	75	3c	RETAIN		V2	7.68	2.8		lots smll deadwood, stressed, termite nest at 10m
T111	Red Bloodwood	*Corymbia gummifera*	33	36	20	8	70	3c	REMOVE	Development		3.96	2.2		crowded, suppressed, trunk leaning 10deg, canopy off centre
T112	Smooth-barked Apple	*Angophora costata*	31	35	22	13	85	2a	REMOVE	Development		3.72	2.1		
T113	Smooth-barked Apple	*Angophora costata*	63	68	23	12	85	2a	RETAIN		V2	7.56	2.8		
T114	Brown Stringybark	*Eucalyptus capitellata*	31	33	18	9	70	3b	REMOVE	Dangerous Tree		3.72	2.1		leaning 10deg, crowded, suppressed, smll deadwood
T115	Scribbly Gum	*Eucalyptus signata*	34	37	22	6	70	3a	RETAIN			4.08	2.2	3	soil to 1m deep placed around base
T116	Red Bloodwood	*Corymbia gummifera*	36	40	22	9	90	2a	REMOVE	Development		4.32	2.3		
T117	Scribbly Gum	*Eucalyptus signata*	38	41	22	10	70	3c	REMOVE	Development		4.56	2.3		crowded, suppressed, leaning 5deg, canopy off centre
T118	Brown Stringybark	*Eucalyptus capitellata*	34	37	22	6	65	3c	REMOVE	Development		4.08	2.2		crowded, suppressed, med deadwood
T119	Red Bloodwood	*Corymbia gummifera*	23, 31	52	22	12	80	2b	REMOVE	Development		4.63	2.5		2x trunks at 0.5m
T120	Sydney Peppermint	*Eucalyptus piperita*	58	63	18	9	55	4c	REMOVE	Development		6.96	2.7		leaning 10deg, canopy off centre, termite nest in base, lge deadwood
T121	Smooth-barked Apple	*Angophora costata*	32, 14	38	22	9	80	2a	REMOVE	Development		4.19	2.2		crowded
T122	Scribbly Gum	*Eucalyptus signata*	56	60	24	10	65	3b	REMOVE	Development		6.72	2.7		soil placed around base to 1m deep, lge deadwood
T123	Scribbly Gum	*Eucalyptus signata*	27	32	16	8	60	3c	REMOVE	Development		3.24	2.1		crowded, suppressed, med deadwood, canopy off centre
T124	Scribbly Gum	*Eucalyptus signata*	32	36	22	7	75	3a	REMOVE	Development		3.84	2.2		crowded, smll deadwood
T125	Scribbly Gum	*Eucalyptus signata*	28	32	22	6	60	3c	REMOVE	Development		3.36	2.1		crowded, suppressed, canopy off centre
T126	Scribbly Gum	*Eucalyptus signata*	28	32	20	4	60	4a	REMOVE	Development		3.36	2.1		crowded, suppressed, exposed wood at base, borers in base
T127	Scribbly Gum	*Eucalyptus signata*	28	34	5	2	20	4c	REMOVE	Development		3.36	2.1		trunk broken at 5m, epicormic growth

No. 158 Macquarie Road, Cardiff

Tree No.	Common Name	Scientific Name	DBH (cm)	BD (cm)	Height (m)	Spread (m)	Vigour (%)	SULE	Retain / Remove	Reason for Removal	Visual Signif	TPZ Radius (m) *Note 4	SRZ Radius (m)	Habitat Tree	Comments
T128	Smooth-barked Apple	*Angophora costata*	55	60	22	7	20	4c	REMOVE	Development		6.60	2.7		70% bark circumference gone 0-2m, borers in exposed wood, lge deadwood
T129	Scribbly Gum	*Eucalyptus signata*	64	70	20	12	70	3d	REMOVE	Development	V2	7.68	2.8		3x lge deadwood
T130	Smooth-barked Apple	*Angophora costata*	28	31	20	7	75	2d	REMOVE	Development		3.36	2.0		crowded, suppressed, smll deadwood
T131	Smooth-barked Apple	*Angophora costata*	34	38	22	11	80	3c	REMOVE	Development		4.08	2.2		crowded, suppressed, canopy off centre
T132	Smooth-barked Apple	*Angophora costata*	38	42	20	9	75	3b	REMOVE	Development		4.56	2.3		exposed wood 1 to 1.6m, kino, borers in trunk
T133	Brown Stringybark	*Eucalyptus capitellata*	64	67	23	13	85	3b	REMOVE	Development	V2	7.68	2.8		borers in trunk
T134	Scribbly Gum	*Eucalyptus signata*	68	70	18	9	70	3b	REMOVE	Development	V2	8.16	2.8		leaning 15deg, canopy off centre, epicormic growth, exposed wood 2-6m
T135	Smooth-barked Apple	*Angophora costata*	32	35	13	5	55	3b	REMOVE	Development		3.84	2.1		leaning 10deg, med deadwood, stressed, many bark splits
T136	Red Bloodwood	*Corymbia gummifera*	42	46	19	5	65	3c	REMOVE	Development		5.04	2.4		crowded, suppressed, lots smll deadwood, kino at base
T137	Smooth-barked Apple	*Angophora costata*	42	46	15	8	50	3c	REMOVE	Development		5.04	2.4		leaning 10deg, canopy off centre, bark dmge on N side
T138	Scribbly Gum	*Eucalyptus signata*	33	36	9	4	20	4c	REMOVE	Development		3.96	2.2	3	exposed wood 50% of circumference 0-6m, borers in trunk
T139	Scribbly Gum	*Eucalyptus signata*	46, 38	78	16	9	40	4c	REMOVE	Development		7.16	3.0		bark gone 50% circ on N side, bracket fungi at 3m, lge deadwood
T140	Scribbly Gum	*Eucalyptus signata*	54	60	20	10	65	3c	REMOVE	Development		6.48	2.7		crowded, suppressed, major limb failure at 5m, exposed wood on N side, med deadwood
T141	Smooth-barked Apple	*Angophora costata*	42	46	20	11	80	3d	REMOVE	Development		5.04	2.4		crowded, bark damaged on N side, kino
T142	Red Bloodwood	*Corymbia gummifera*	54	60	22	12	90	2a	REMOVE	Development		6.48	2.7		
T143	Scribbly Gum	*Eucalyptus signata*	50	54	20	9	65	3b	REMOVE	Development		6.00	2.6	2	lots med deadwood, exposed wood at base, kino
T144	Smooth-barked Apple	*Angophora costata*	17	21	19	8	80	2c	REMOVE	Development		2.04	1.7		crowded, suppressed, major bark splits & kino at 4m
T145	Scribbly Gum	*Eucalyptus signata*	41	45	21	8	70	3c	REMOVE	Development		4.92	2.4		crowded, suppressed, leaning 5deg, canopy off centre
T146	Red Bloodwood	*Corymbia gummifera*	38	43	23	8	90	2a	REMOVE	Development		4.56	2.3		
T147	Scribbly Gum	*Eucalyptus signata*	23	26	18	5	75	3c	REMOVE	Development		2.76	1.9		crowded, suppressed, leaning 5deg, canopy off centre
T148	Scribbly Gum	*Eucalyptus signata*	49	53	22	9	50	4c	REMOVE	Development		5.88	2.5		cavity in base, fungal attack
T149	Smooth-barked Apple	*Angophora costata*	21	24	18	8	70	2c	REMOVE	Development		2.52	1.8		crowded, suppressed, smll deadwood
T150	Scribbly Gum	*Eucalyptus signata*	18	21	3	1	25	4d	REMOVE	Development		2.16	1.7		bark missing from 50% circumference, epicormic growth, exposed wood, termites
T151	Scribbly Gum	*Eucalyptus signata*	18	23	10	3	25	4c	REMOVE	Development		2.16	1.8		cavity 0-1m, termites, epicormic growth, major failure at 4m
T152	Scribbly Gum	*Eucalyptus signata*	63	68	21	11	85	3d	REMOVE	Development	V2	7.56	2.8		lge deadwood
T153	Scribbly Gum	*Eucalyptus signata*	16	18	10	7	45	3c	REMOVE	Development		2.00	1.6		crowded, suppressed, leaning 10deg, canopy off centre

No. 158 Macquarie Road, Cardiff

Tree No.	Common Name	Scientific Name	DBH (cm)	BD (cm)	Height (m)	Spread (m)	Vigour (%)	SULE	Retain / Remove	Reason for Removal	Visual Signif	TPZ Radius (m) *Note 4	SRZ Radius (m)	Habitat Tree	Comments
T154	Scribbly Gum	*Eucalyptus signata*	31	34	20	7	55	3c	RETAIN			3.72	2.1		crowded, suppressed, damaged on N side, kino, exposed wood, canopy off centre
T155	Brown Stringybark	*Eucalyptus capitellata*	47	54	22	11	60	3d	REMOVE	Development		5.64	2.6		stressed, epicormic growth, leaning 5deg, med deadwood
T156	Scribbly Gum	*Eucalyptus signata*	52	57	22	10	80	3a	REMOVE	Firetrail		6.24	2.6		
T157	Scribbly Gum	*Eucalyptus signata*	37	42	19	9	70	3c	RETAIN			4.44	2.3	3	canopy off centre, epicormic growth, smll deadwood
T158	Scribbly Gum	*Eucalyptus signata*	34	37	9	4	20	4a	RETAIN			4.08	2.2		dying, v lge deadwood, exposed wood 0-8m, termites
T159	Smooth-barked Apple	*Angophora costata*	21	25	14	5	80	2a	REMOVE	Firetrail		2.52	1.8		smll deadwood
T160	Scribbly Gum	*Eucalyptus signata*	27	32	20	5	60	3c	RETAIN			3.24	2.1		crowded, suppressed, med deadwood
T161	Smooth-barked Apple	*Angophora costata*	28	32	18	9	85	2a	REMOVE	Firetrail		3.36	2.1		smll deadwood
T162	Red Bloodwood	*Corymbia gummifera*	56	60	22	12	90	3a	RETAIN			6.72	2.7		leaning 5deg, smll deadwood, kino at 5m
T163	Brown Stringybark	*Eucalyptus capitellata*	15	17	11	3	40	3d	RETAIN			2.00	1.6		all epicormic growth, v stressed
T164	Brown Stringybark	*Eucalyptus capitellata*	69	74	22	15	70	3b	RETAIN		V2	8.28	2.9		termites in trunk, lge deadwood, leaning 5deg
T165	Red Bloodwood	*Corymbia gummifera*	20	23	12	6	25	3c	RETAIN			2.40	1.8		crowded, suppressed, lots smll deadwood
T166	Dead Stag	Dead Stag	52	56	18	8	0	4a	RETAIN			6.24	2.6		leaning 10deg, termites in trunk
T167	Brown Stringybark	*Eucalyptus capitellata*	14	16	7	6	30	4c	RETAIN			2.00	1.5		leaning 15deg, suppressed
T168	Red Bloodwood	*Corymbia gummifera*	13	16	7	4	85	3a	REMOVE	Close proximity to firetrail		2.00	1.5		crowded
T169	Brown Stringybark	*Eucalyptus capitellata*	64	69	23	14	60	4c	RETAIN		V2	7.68	2.8		termites in trunk
T170	Red Bloodwood	*Corymbia gummifera*	45	50	22	12	30	4a	REMOVE	Dangerous tree cose proximity to firetrail		5.40	2.5		termites in trunk, 50% canopy & bark dead,
T171	Brown Stringybark	*Eucalyptus capitellata*	14	16	7	4	70	3c	RETAIN			2.00	1.5		crowded, suppressed
T172	Brown Stringybark	*Eucalyptus capitellata*	18	20	19	7	85	2a	RETAIN			2.16	1.7		crowded, smll deadwood
T173	Red Bloodwood	*Corymbia gummifera*	43	48	22	11	80	3a	REMOVE	Firetrail		5.16	2.4		smll deadwood
T174	Smooth-barked Apple	*Angophora costata*	49	53	23	14	90	2a	RETAIN			5.88	2.5		
T175	Brown Stringybark	*Eucalyptus capitellata*	20, 25	32	20	8	60	3a	REMOVE			3.84	2.1		2x trunks at 1m, leaning 10deg
T176	Scribbly Gum	*Eucalyptus signata*	65	70	23	14	70	3b	RETAIN		V2	7.80	2.8		exposed wood at 1m, termites 0-15m
T177	Red Bloodwood	*Corymbia gummifera*	53	57	23	8	70	3c	RETAIN			6.36	2.6		crowded, suppressed, canopy off centre
T178	Red Bloodwood	*Corymbia gummifera*	36, 27	65	22	12	70	3c	REMOVE	Development		5.40	2.8		2x trunks at 0m, kino at base, smll deadwood
T179	Scribbly Gum	*Eucalyptus signata*	33	36	20	7	70	4c	REMOVE	Development		3.96	2.2		exposed wood at base, leaning 10deg, epicormic growth, smll deadwood
T180	Brown Stringybark	*Eucalyptus capitellata*	57	62	22	12	30	4c	REMOVE	Development		6.84	2.7	3	leaning 15deg, exposed wood at base, lge deadwood, 2x trunks from 3m, rootmass lifting on S side
T181	Broad-leaved White Mahogany	*Eucalyptus umbra*	21	23	16	7	25	4a	REMOVE	Development		2.52	1.8		50% canopy, termites in trunk

Note 1: Visual Significance

V1 – High significance typically >25m height/ >20m spread / >600mm DBH – Large emergent tree

V2 – Moderate significance generally 15-25m height/ >10m spread>600mm DBH – Prominent tree typically with a large spread
V3 – Low significance >10m height/ >10m spread>600mm DBH –Typically a visually attractive low tree with large spread and DBH

Note 2: Habitat Trees

The habitat trees recorded within the study area fall under one of three categories:

Category 1: Significant habitat trees (high):

- Large hollow suitable for cockatoos or large forest owls >30cm and/or
- Trees containing two (2) or more good quality medium hollows 10-30cm and/or
- >8 small hollows

Category 2: Significant habitat trees (moderate)

- Trees containing one medium hollow 10-30cm and/or
- 3-8 small hollows

Category 3: Remaining hollow bearing trees generally containing small or low numbers of hollows

Note 3: SULE Rating (refer to detailed breakdown in Schedule 3)

1A to 1C	Trees that appear to be retainable at the time of assessment with more than 40 years life expectancy with acceptable risk.
2A to 2D	Trees that appear to be retainable at the time of assessment with 15-40 years life expectancy with acceptable risk.
3A to 3D	Trees that may be retainable at the time of assessment with 5-15 years life expectancy with risks assessed on a case by case basis.
4A to 4F	Trees with a high level of risk and should be removed.

Note 4: If the proposed encroachment is less than 10% of the TPZ and is outside the SRZ, detailed root investigations should not be required. The area lost to this encroachment should be compensated for elsewhere, and be contiguous with the TPZ (S3.3.2, *AS4970-2009*)

* Indicates an exotic or non-locally endemic species

Schedule 2

SULE Assessment Plan

Legend

- Study site
- Proposed SFPP (aged care dwellings)
- 'Other' development (non aged care)
- Carpark/road
- Fire trail
- Footpath
- Tree for retention
- Tree for removal
- Habitat tree
- V2 Visually significant tree

SULE Tree Assessment

- 1a >40 years life expectancy, sound tree
- 1b >40 years life expectancy, with remedial care
- 1c Tree of historical, commemorative merit or rarity
- 2a 15 - 40 years life expectancy
- 2b >40 years life expectancy, may represent future safety or nuisance problems
- 2c >40 years life expectancy, suppressing better quality trees
- 2d 15 - 40 years, with remedial care
- 3a 5 - 15 years life expectancy
- 3b >15 years life expectancy, may represent further safety or nuisance problems
- 3c >15 years life expectancy, suppressing better quality trees
- 3d 5 - 15 years life expectancy, requiring significant remedial work
- 4a Dead or dying, suppressed or declining tree (Remove)
- 4b A dangerous tree due to instability (Remove)
- 4c A dangerous tree (Remove)
- 4d A damaged tree, not safe to retain (Remove)
- 4e Tree damaging or may cause damage to existing structures (Remove)
- 4f Will become dangerous after removal of trees classed A-E (Remove)

Aerial source: Nearmap

Travers bushfire & ecology
www.traversecology.com.au

PROJECT & MXD REFERENCE	DATE & ISSUE NUMBER	COORDINATE SYSTEM
Macquarie Rd, Cardiff A15069_T003	7/11/2016 Issue 1	1:1,000 @ A3 GDA 1994 MGA Zone 56

0 20 40 m

TITLE

SULE Assessment and Tree Retention and Removal Plan (Overview)

Disclaimer: The mapping is indicative of available space and location of features which may prove critical in assessing the viability of the proposed works. Mapping has been produced on a map base with an inherent level of inaccuracy, the location of all mapped features are to be confirmed by a registered surveyor.

Document Path: N:\GIS STORAGE\TI Drive\A15069_Macquarie Rd_Cardiff\MXDs\A15069_T003.mxd

Legend

- Study site
- Proposed SFPP (aged care dwellings)
- 'Other' development (non aged care)
- Carpark/road
- Fire trail
- Footpath
- Tree for retention
- Tree for removal
- Structural Root Zone
- Habitat tree
- V2 Visually significant tree

SULE Tree Assessment

- 1a >40 years life expectancy, sound tree
- 1b >40 years life expectancy, with remedial care
- 1c Tree of historical, commemorative merit or rarity
- 2a 15 - 40 years life expectancy
- 2b >40 years life expectancy, may represent future safety or nuisance problems
- 2c >40 years life expectancy, suppressing better quality trees
- 2d 15 - 40 years, with remedial care
- 3a 5 - 15 years life expectancy
- 3b >15 years life expectancy, may represent further safety or nuisance problems
- 3c >15 years life expectancy, suppressing better quality trees
- 3d 5 - 15 years life expectancy, requiring significant remedial work
- 4a Dead or dying, suppressed or declining tree (Remove)
- 4b A dangerous tree due to instability (Remove)
- 4c A dangerous tree (Remove)
- 4d A damaged tree, not safe to retain (Remove)
- 4e Tree damaging or may cause damage to existing structures (Remove)
- 4f Will become dangerous after removal of trees classed A-E (Remove)

Aerial source: Nearmap

Travers bushfire & ecology
www.traversecology.com.au

PROJECT & MXD REFERENCE
Macquarie Rd, Cardiff
A15069_T003

DATE & ISSUE NUMBER
19/05/2016
Issue 1

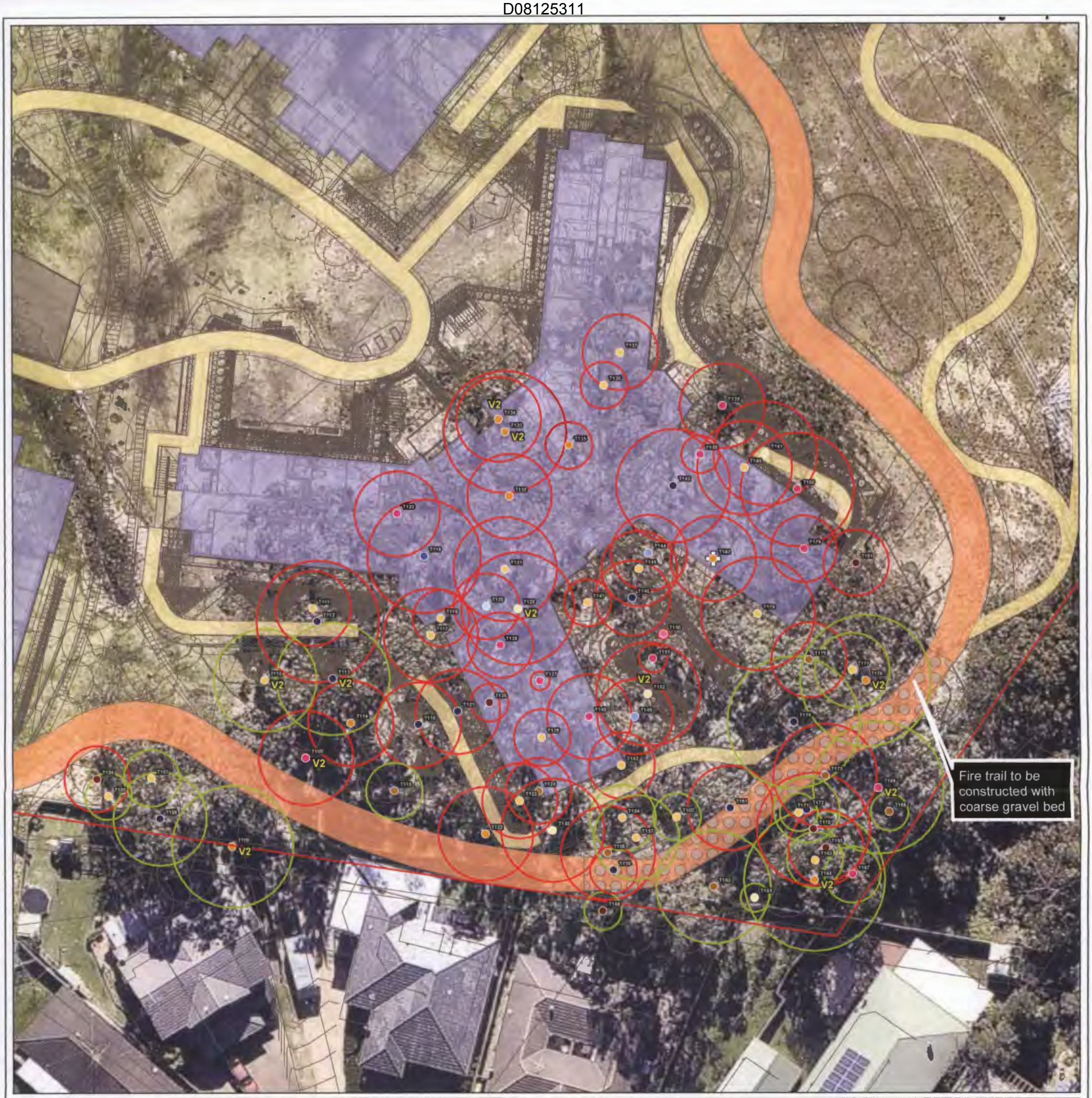
COORDINATE SYSTEM
1:500 @ A3
GDA 1994 MGA Zone 56

0 10 20m

SULE Assessment and Tree Retention and Removal Plan (North)

Document Path: N:\GIS STORAGE\N Drive\A15069_Macquarie Rd, Cardiff\MXDs\A15069_T003.mxd

Disclaimer: The mapping is indicative of available space and location of features which may prove critical in assessing the viability of the proposed works. Mapping has been produced on a map base with an inherent level of inaccuracy, the location of all mapped features are to be confirmed by a registered surveyor.



Legend

- Study site
- Proposed SFPP (aged care dwellings)
- 'Other' development (non aged care)
- Carpark/road
- Fire trail
- Footpath
- Tree for retention
- Tree for removal
- Habitat tree
- V2 Visually significant tree

SULE Tree Assessment

- 1a >40 years life expectancy, sound tree
- 1b >40 years life expectancy, with remedial care
- 1c Tree of historical, commemorative merit or rarity
- 2a 15 - 40 years life expectancy
- 2b >40 years life expectancy, may represent future safety or nuisance problems
- 2c >40 years life expectancy, suppressing better quality trees
- 2d 15 - 40 years, with remedial care
- 3a 5 - 15 years life expectancy
- 3b >15 years life expectancy, may represent further safety or nuisance problems
- 3c >15 years life expectancy, suppressing better quality trees
- 3d 5 - 15 years life expectancy, requiring significant remedial work
- 4a Dead or dying, suppressed or declining tree (Remove)
- 4b A dangerous tree due to instability (Remove)
- 4c A dangerous tree (Remove)
- 4d A damaged tree, not safe to retain (Remove)
- 4e Tree damaging or may cause damage to existing structures (Remove)
- 4f Will become dangerous after removal of trees classed A-E (Remove)

Aerial source: Nearmap

Travers bushfire & ecology
www.traversecology.com.au

PROJECT & MAP REFERENCE
Macquarie Rd, Cardiff
A15069_T003

DATE / ISSUE NUMBER
7/11/2016
Issue 1

COORDINATE SYSTEM
1:400 @ A3
GDA 1994 MGA Zone 56

0 10 20 m

TITLE
SULE Assessment and Tree Retention and Removal Plan (South)

Disclaimer: The mapping is indicative of available space and location of features which may prove critical in assessing the viability of the proposed works. Mapping has been produced on a map base with an inherent level of inaccuracy, the location of all mapped features are to be confirmed by a registered surveyor.

Document Path: R:\GIS_STORAGE\N Drive\A15069_Macquarie_Cardiff\MXD\A15069_T003.mxd

Legend

- Study site
- Proposed SFPP (aged care dwellings)
- 'Other' development (non aged care)
- Carpark/road
- Fire trail
- Footpath
- Tree for retention
- Tree for removal
- Habitat tree
- V2 Visually significant tree

SULE Tree Assessment

- 1a >40 years life expectancy, sound tree
- 1b >40 years life expectancy, with remedial care
- 1c Tree of historical, commemorative merit or rarity
- 2a 15 - 40 years life expectancy
- 2b >40 years life expectancy, may represent future safety or nuisance problems
- 2c >40 years life expectancy, suppressing better quality trees
- 2d 15 - 40 years, with remedial care
- 3a 5 - 15 years life expectancy
- 3b >15 years life expectancy, may represent further safety or nuisance problems
- 3c >15 years life expectancy, suppressing better quality trees
- 3d 5 - 15 years life expectancy, requiring significant remedial work
- 4a Dead or dying, suppressed or declining tree (Remove)
- 4b A dangerous tree due to instability (Remove)
- 4c A dangerous tree (Remove)
- 4d A damaged tree, not safe to retain (Remove)
- 4e Tree damaging or may cause damage to existing structures (Remove)
- 4f Will become dangerous after removal of trees classed A-E (Remove)

Aerial source: Nearmap

Travers bushfire & ecology
www.traversecology.com.au

PROJECT & MXD REFERENCE	DATE & ISSUE NUMBER	COORDINATE SYSTEM
Macquarie Rd, Cardiff A15069_T003	7/11/2016 Issue 1	1:500 @ A3 GDA 1994 MGA Zone 56

0 10 20m

TITLE

SULE Assessment and Tree Retention and Removal Plan (West)

Disclaimer: The mapping is indicative of available space and location of features which may prove critical in assessing the viability of the proposed works. Mapping has been produced on a map base with an inherent level of inaccuracy, the location of all mapped features are to be confirmed by a registered surveyor.

Document Path: N:\GIS STORAGE\N Drive\A15069_MaquarieRd_Cardiff\MXDs\A15069_T003.mxd

Schedule 3

SULE Ratings and Terminology

SULE Ratings and Terminology

SULE (an acronym for **safe useful life expectancy**). Particular consideration is given to the following points when making the final SULE assessment for each tree;

- obvious past influences (suppression)
- present health and condition, and future potential in current position
- estimated age at assessment in relation to the life expectancy for the species
- observed and potential structural defects which may influence potential life expectancy
- potential remedial work which may allow retention in the existing location.

An outline of the four relevant SULE categories and their subgroups used in this report is as follows:

---

1 Long **SULE** (trees that appear to be retainable at the time of assessment for more than 40 years with an acceptable level of risk)

A A structurally sound tree, located where potential future growth can be accommodated.
B A damaged or defective tree that could be made suitable in the long term (40+ years), where remedial care is given.
C A tree of particular significance (historical / commemorative merit or rarity) that warrants extensive efforts in securing long term retention.

---

2 Medium **SULE** (trees that appear to be retainable at the time of assessment, for 15 - 40 years with an acceptable level of risk)

A A tree predicted to only live between 15 and 40 years
B A tree that may live for more than 40 years, but should be removed to prevent safety or nuisance problems
C A tree that may live for more than 40 years, but should be removed to prevent competition with more suitable individuals, or to provide space for new planting
D A damaged or defective tree that could be made suitable in the medium term (15-40 years), where remedial care is given.

---

3 Short **SULE** (trees that appear to be retainable at the time of assessment for 5 - 15 years with an acceptable level of risk)

A A tree predicted to only live between 5 - 15 years
B A tree that may live for more than 15 years, but should be removed to prevent safety or nuisance problems
C A tree that may live for more than 15 years, but should be removed to prevent competition with more suitable individuals or to provide space for new planting
D A damaged or defective tree that could only be made suitable in the short term (5-15 years), and would require significant remedial work.

---

4 **Removals** (Trees with a high level of risk that should be removed within the next 5 years)

A A dead, dying, suppressed or declining tree

B A dangerous tree made so through instability or recent loss of neighbouring trees

C A dangerous tree made so through structural defects (cavities, decay, included bark, wounds or poor form)

D A damaged tree that is clearly not safe to retain

E A tree that is damaging, or may cause damage, to existing structures within 5 years

F A tree that will become dangerous after removal of neighbouring trees for the reasons given in A to E.

SULE ratings given to any tree in this report assumes that appropriate maintenance (if required) will be provided by a qualified arborist. Incorrect tree work practices can significantly accelerate tree suppression and increase hazard potential

EXPLANATION OF TERMINOLOGY USED

DBH - An acronym for bole or trunk diameter at breast height (1.4m from ground level).

Health - An indication of the vigour of a tree and is determined by the observed crown colour, density, presence of insect attack, the percentage of dead or dying branches and the amount of epicormic growth. The health of the canopy and that of the root system is interdependent and significant loss of tree vigour can result through both root and canopy (pruning, suppression) damage.

Suppressed, unhealthy trees have reduced ability to initiate internal defence systems (by the process of compartmentalisation) thus predisposing them to attack by insects and pathogenic decay organisms which increase the potential to drop dangerous branches.

Cambium - The part of the tree situated between the bark and the true wood of a tree. This area is where the tree transports water, nutrients and waste products to and from the roots and leaves. It is this area that is targeted when "ring-barking" a tree in order to disrupt the nutrient transport system of the tree and cause its death.

Condition - An evaluation of the structural integrity of a tree, including defects that may affect the useful life of an otherwise healthy individual. Such influencing factors include cavities and decay, weak unions between branches or trunks and faults of form or habit.

Fungal Attack - Many fungi have evolved to break down wood and return its nutrients to the biocycle of the environment. Fungi usually gain access to the wood through the actions of borers, or from physical damage resulting in exposed wood. Trees suffering from fungal attack may be severely weakened on a structural basis but may not show any external signs of the weakness. This can result in a catastrophic structural failure of a branch or trunk when subjected to stress such as a windy day.

Kino - A dark reddish exudate, rich in polyphenols (tannins), developed in the cambial region of eucalypts often as a result of injury; incorrectly called gum (Boland *et.al.* 1992).

Deadwood - The mature crown of a eucalypt maintains itself by the continual production of new crown units, which die in turn. Thus there will always be some dead branches in a healthy mature crown (Florence, 1996). Minor deadwood refers to dead branchlets, Major deadwood refers to main branches from the trunk.

ATTACHMENT 1

AQ 5 Arborist Report

ASSURANCE
TREES

158 Macquarie Rd, Cardiff

RECOMMENDED RETENTION SPECIFICATIONS

Aaron Bath – AQF 5, TRAQ Assessor
ASSURANCE TREES | PO BOX 852, MAITLAND, NSW, 2320

4/11/2016

Assurance Trees Pty Ltd

ABN: 87 158 399 350
ACN: 158 399 350

Assessor: Aaron Bath, *dip arb*

2 Forest Hill Drive
Oakhampton Heights
NSW 2320

Public Liability #: 463552
Professional Indemnity #: HC-ME-SPC-02-125866

Disclaimer

The contents of this report and the assessment conducted do not guarantee that trees are not a risk to people or assets. All trees present a risk and Assurance Trees Pty Ltd and any of its consultants do not take any responsibility for a tree that fails. Tree inspections are conducted at a given point in time and there is no guarantee that after the inspection the trees conditions could change. Reference should be made to the methodology used to assess trees and any limitations present being physical of monetary. Any specifications give in this report are preliminary as the project is still in planning phase and accurate onsite inspections are limited because there are no survey pegs defining exact locations of works.

Contents

1. Executive Summary

1.1. Inspection of twelve (12) trees scheduled for retention in accordance with the Tree Assessment prepared by Travers Ecology & Bushfire; ref A15069T.

1.2. There are 3 trees that have a high-risk rating, that should be removed prior to construction.

1.3. There are tree protection measures to be implemented for trees near earthworks for fire trail.

2. Introduction

2.1. The site is located at Lot 2 DP788892, Number 158 Macquarie Road, Cardiff, within the Lake Macquarie City Council LGA.

2.2. The site inspection took place on 3rd November 2016.

2.3. This report is to be read in conjunction with the Tree Assessment report prepared by Travers Bushfire & Ecology, Ref A15069T.

2.4. The purpose of this report is to further assess the suitability for retention of twelve trees that have TPZ and/or SRZ within the proposed earthworks corridors, and/or have general safety concerns.

2.5. There are three areas within the site that are to be inspected

2.5.1. **Area 1** T048 & T049 are in the north of the site near the edge of the proposed fire trail;

2.5.2. **Area 2** Specific Trees - T061 & T062 are the two trees specifically referred to by Council for determination as to whether they're safe or can be rendered safe prior to, during and post construction; and

2.5.3.**Area 3** The remainder of trees earmarked for retention are clustered near proposed fire trail works on the south-east

2.6. Proposal of fire trail construction method for use in TPZ.

2.7. General considerations for retained trees.

3. Methodology

3.1. Trees have been assessed onsite using the ISA Tree Risk Assessment Qualification, Limited Visual Assessment (level 2). (Julian Dunster, 2013) The route taken to assess the trees was a walk around of the site looking at all specified trees to identify obvious defects, hazards and suitability for retention.

3.2. A trainee arborist (AQF3) was present and assisting in measurements, inspections and data recording.

3.3. Tools used include a diameter tape, probe, camera, tablet and sounding hammer

3.4. Tree risk ratings are ranked by Low, Moderate, High or Extreme ratings.

3.5.

4. Tree Data

Below is a table for general information regarding the trees that have been inspected

Table 1 – Tree Details

Tree #	Common Name	Botanical Name	DBH (cm)	BD (cm)	Height (m)	Spread (m)	Vigour (%)	SULE	TPZ (m)	SRZ (m)	Retain/Remove
T048	Brown Stringybark	Eucalyptus capitellata	31	34	16	9	65	3c	3.72	2.1	Retain
T049	Smooth-barked Apple	Angophora costata	30	34	17	5	65	3c	3.60	2.1	Retain
T061	Red Bloodwood	Corymbia cummifera	32,36	68	23	4	15	4a	5.78	2.8	Remove
T062	Sydney Peppermint	Eucalyptus piperita	78	80	23	7	70	3b	9.36	3.0	Remove
T154	Scribbly Gum	Eucalyptus signata	31	34	20	7	55	3c	3.72	2.1	Retain
T157	Scribbly Gum	Eucalyptus signata	37	42	19	9	70	3c	4.44	2.3	Retain
T162	Red Bloodwood	Corymbia cummifera	56	60	22	12	90	3a	6.72	2.7	Retain
T170	Red Bloodwood	Corymbia cummifera	45	50	22	12	30	4a	5.40	2.5	Remove
T171	Brown Stringybark	Eucalyptus capitellata	14	16	7	4	70	3c	2.00	1.5	Retain
T172	Brown Stringybark	Eucalyptus capitellata	18	20	19	7	85	2a	2.16	1.7	Retain
T174	Smooth-barked Apple	Angophora costata	49	53	23	14	90	2a	5.88	2.5	Retain
T176	Scribbly Gum	Eucalyptus signata	65	70	23	14	70	3b	7.80	2.8	Retain

Below is a map indicating the overall locations of each tree on the site

Figure 1 – Overview of tree locations

Below is a map showing the TPZ's and SRZ of Trees T048 & T049.

Figure 2 - Map of T048 & T049 (Travers Ecology)

Below is a map showing the possible major encroachment of SRZ of T061 and T062.

Figure 3 - Map of T061 & T062 (Travers Ecology)

Below is a map showing the positions of the 8 trees inspected along the fire trail in the South-East corner.

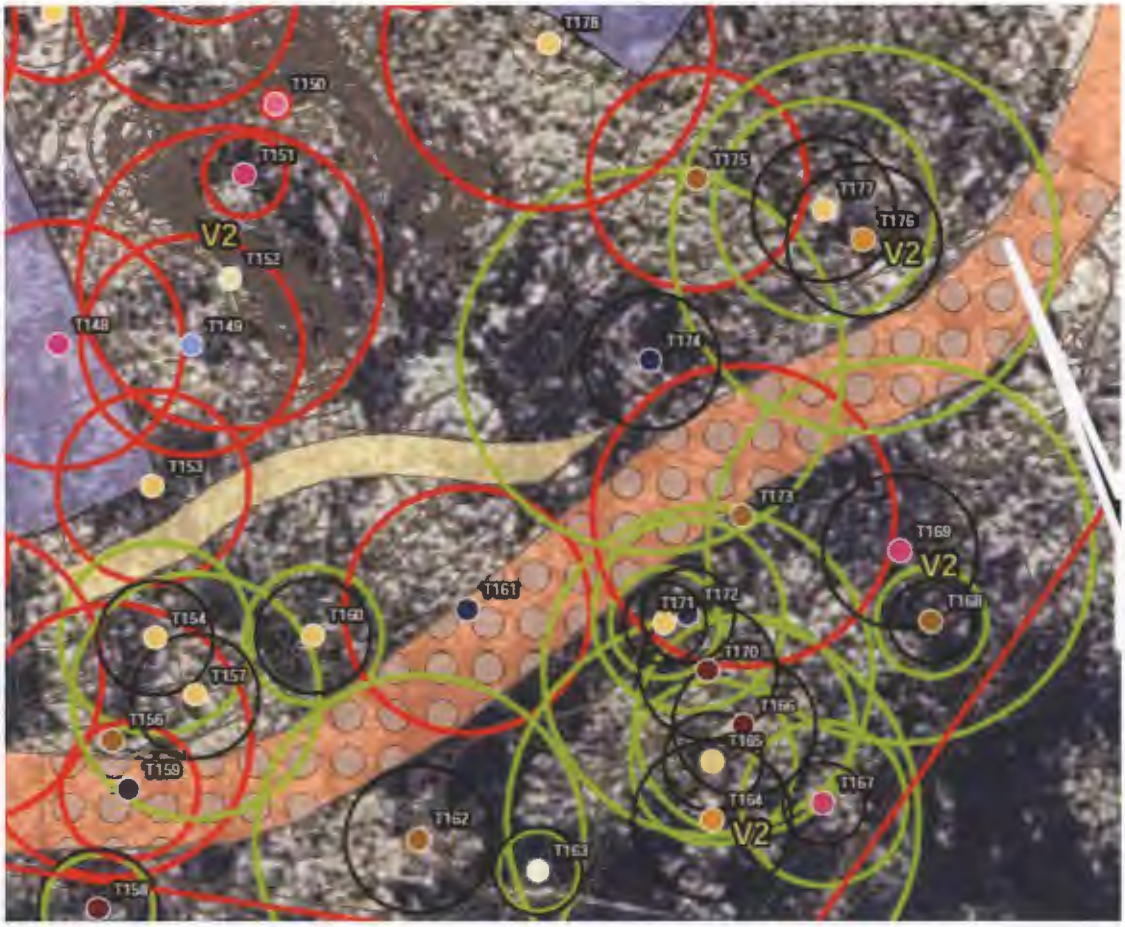


Figure 4 - Map of South East part of fire trail (Travers Ecology)

5. GEOHEX Fire Trail Construction Method

The existing fire trail winds through the trees entering over the TPZ of several trees along the corridor. If significant excavation occurs during the construction of this trail the trees will suffer from reduced feeder roots, significant ground compaction and increased chance of mechanical damage from earthmoving equipment. I have looked at the existing design and am in favour of the proposed route through the trees, however for the trees to have a good chance of long term survival I propose the following method of construction.

Excavation should be a slight grading of the existing ground level not exceeding 150mm of depth within any TPZ of trees marked for retention. Following shaping, GEOHEX erosion control system (http://www.geohex.com.au/specifications.aspx) can be installed and topped with a 10-20mm coarse aggregate or similar material that allows water inflow to form the finished surface of the trail. This method would provide the least amount of disturbance to the existing root systems of the trees during construction and provide;

- Ongoing protection against erosion;
- Future protection against ground compaction within the TPZ of retained trees;
- Allow natural water inflow into the soil within the drip zone of all trees under the trail;
- Provide a stable trail for use by heavy plant and equipment

This method of construction should be considered along tree lined sections of the fire trail.

Figure 5 - example of geohex for fire trail use (google images)

6. Tree Number T048

6.1. This tree is a Brown Stringybark (Eucalyptus capitellata) located on the north corner of the proposed fire trail (see figure 2). This tree has a significant lean toward the proposed fire trail. The tree shows poor vigour with some deadwood present. The trunk appears to have suffered some heartwood decay at approximately 2.5 metres from the ground resulting in deformed trunk development; response growth to strengthen this part of the tree appears to be well formed. Given that the development of the fire trail will be performed on the compressive side of the tree root system, it is likely that the largest structural roots will not be interfered with during the development.

6.2. Leaf mulch from clearing on site should be spread around the base of tree drip line to a thickness of 100mm to help long term viability.

6.3. Protection measures should be established with the use of temporary fence panels around the TPZ during construction. If construction of the fire trail involves breaking natural ground levels within the TPZ than an AQF5 arborist must be present during that part of construction as specified in accordance with AS4970. The arborist will determine if the tree has been destabilised during the works and decide on remedial work.

7. Tree Number T049

7.1. This tree is a Smooth-barked Apple (Angophora costata) also located on the north corner of the proposed fire trail, and bordering the proposed carpark (see figure 2). This tree is of very poor structure with multiple previous failures and a small, clustered canopy mostly comprising of regrowth (epicormic growth). This tree will never be a pleasing tree and has little retention value. Due to its large quantity of clustered epicormic growth the future branches of this tree will be prone to failure during weather events. This will be further compounded by the removal of several large surrounding trees to make way for the proposed carpark.

7.2. Leaf mulch from clearing on site should be spread around the base of tree drip line to a thickness of 100mm to help long term viability.

7.3. Protection measures should be established with the use of temporary fence panels around the TPZ during construction. If construction of the carpark involves breaking natural ground levels within the TPZ than an AQF5 arborist must be present during that part of construction as specified in accordance with AS4970. The arborist will determine if the tree has been destabilised during the works and decide on remedial work.

8. Tree Number T061

8.1. This tree is a Red Bloodwood (Corymbia cummifera) located on the west side of the driveway toward the north carpark (see figure 3). This tree is co-dominant with one side completely dead and the other side leaning toward the bush, away from the development. The driveway excavation works are likely to impact the TPZ of this tree by more than 10% and will cause further decline of the remaining canopy and overall health of the tree. If large roots are contacted during construction of the driveway than large pieces of deadwood may fall because of the vibrations. Construction is likely to cause damage to roots that are in tension and thus destabilising the tree.

8.2. This tree would be classified as high risk during the construction process. I recommend this tree for removal prior to construction.

8.3. No protection measures should be considered for this tree as carpark excavations will most likely cause this tree to be considered high risk during the construction phases and after the development is complete.

9. Tree Number T062

9.1. This tree is a Sydney Peppermint (Eucalyptus piperita) located on the west side of the driveway toward the north carpark (see figure 3). This tree is co-dominant with signs of borers throughout the tree. The tree is located on the edge of the construction for the driveway. Due to the size of this tree and the large SRZ the earthworks are most likely going to cause further decline and structural root destabilisation. There are multiple structural faults in this tree. The planned development places targets around the tree.

9.2. This tree will have a high-risk classification and should be removed prior to construction works.

9.3. This tree has a short life expectancy after construction works have been completed.

9.4. No protection measures should be considered for this tree as carpark excavations will most likely cause this tree to be considered high risk during the construction phases and after the development is complete.

10. South East Fire Trail Area

10.1. T170 should be removed as it is considered high risk during construction based on significant weakness within the trunk.

10.2. The following refers to trees numbered T154, T157, T162, T171, T172, T174 and T176.

10.2.1. All trees marked for retention in this area should be cleaned of deadwood prior to construction. All deadwood over 40mm in diameter should be removed. This should be completed by an AQF3 arborist by way of climbing or with an EWP. Pruning conducted to AS4373 standards.

10.2.2. Once deadwood cleaning has been completed these trees are considered low risk during the construction phase.

10.2.3. Construction of the fire trail within the TPZ of these trees, if possible, should not involve the digging of more than 150mm down from the natural ground level.

10.2.4. An AQF5 arborist (project arborist) must be present during construction work involving earthmoving equipment within the TPZ of these trees.

10.2.5. These trees should have trunk protection consisting of lengths of timber 70mmx45mm placed vertically to a minimum of 3 metres high from the ground at 100mm intervals around the tree trunk. Hold these in position with ratchet straps or ropes. These must stay in position if heavy equipment is being used inside the TPZ.

10.2.6. Placement of leaf mulch from tree removal works completed on the site should be spread below the entire dripline of the trees wherever possible to help with moisture retention, nutrient uptake, microorganism development, and to decrease compaction during operations.

10.2.7. Temporary fencing panels should be installed around the tree protection zones of each tree as specified in the Travers Ecology tree assessment. Where this is not possible due to the need for works on the fire trail, an AQF 5 arborist must be present during these works to ensure that the trees remain stable and viable.

10.2.8. These trees should be monitored for a period of 1 year after construction has finished, on a 3-monthly cycle.

11. General Considerations

11.1. It is very important that structural roots are not cut during excavation works. For this reason, earthworks inside SRZ of trees to be retained should be reconsidered or the trees scheduled for removal prior to commencing earthworks.

11.2. An excellent way to help protect trees viability during and after construction is to install 100mm of leaf mulch within the calculated TPZ or dripline of the tree. This significantly improves moisture in the root zone and helps offset the effects of the disturbances.

11.3. Mulch also helps reduce compaction in the soil in the event of a TPZ breach.

11.4. Temporary fencing panels should be installed where possible to prevent machinery from parking/traveling inside the TPZ's of trees.

11.5. For any breach of a TPZ by more than 10% there should be an AQF5 arborist that can assess the amount of damage done to the trees root area and provide specific advice on how to practically offset this damage.

11.6. Root deflection barrier should be considered for installation along retaining walls to prevent future root interference.

11.7. Providing trees with clean water during hot periods throughout the construction phase will benefit the long-term health of the trees.

11.8. All tree work should be conducted by an experienced arborist with a minimum AQF3 qualification. Demonstrated experience/expertise with tree retention works is advised for all works conducted on trees for retention.

References

Julian Dunster, T. S. N. M. S. L., 2013. *Tree Risk Assessment Manual.* Champaign, Illinois: International Society of Arboriculture.

AS4373 *Pruning of Amenity Trees*

AS4970 Protection of Trees on Development Sites

Travers Ecology & Bushfire, Tree Assessment REF A15069T