URBAN FORESTRY AUSTRALIA

TREE MANAGEMENT CONSULTING ARBORICULTURISTS

ARBORICULTURAL IMPACT ASSESSMENT

for

Jason and Janine Crawford
C/- Turnbull Planning International
2301/4 Daydream Street
WARRIEWOOD NSW 2102

SITE ADDRESS

39 CABBAGE TREE ROAD
BAYVIEW

OCTOBER 2019

Prepared by
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1 INTRODUCTION

1.1 This Arboricultural Impact Assessment (AIA) was commissioned by Jason and Janine Crawford, owners of 39 Cabbage Tree Road, Bayview ("the site"). The site is identified as Lot 2 in D.P. 531960, and known as 39 Cabbage Tree Road, Bayview, New South Wales.

1.2 This AIA is to accompany a development application to Northern Beaches Council for a proposed gym facility at the site.

1.3 The purpose of this report is to assess the *health* and *condition* of the surveyed trees, and identify the potential impacts the proposed development may have on those trees in proximity to the works.

1.4 This report gives recommendations for tree retention or removal and provides guidelines for tree protection and maintenance.

1.5 Care has been taken to obtain all information from reliable sources. All data has been verified as far as possible; however, I can neither guarantee nor be responsible for the accuracy of information provided by others.

1.6 This AIA is not intended as an assessment of any impacts on trees by any proposed future development of the site other than this current development application.

1.7 This report is not intended to be a comprehensive tree *risk* assessment, however, the report may make recommendations, where appropriate, for further assessment, treatment or testing of trees where potential structural problems have been identified, or where below ground investigation may be required.

2 METHODOLOGY

2.1 In preparation for this report, ground level, *visual tree assessments*[1] of eighty-five (85) trees or tree groups, including several trees on the adjoining golf course property, were undertaken by Catriona Mackenzie and Mark Jamieson for Urban Forestry Australia, on 22 February and 15 March 2018, and 22 August 2019. Inspection details of these trees are provided in Appendix D—*Schedule of Assessed Trees.*

2.2 This AIA takes account of prescribed trees pursuant to Part B4.22 *Preservation of Trees and Bushland* of the Pittwater 21 Development Control Plan 2014 (PDCP), and non-prescribed (exempt) trees as specified in B4.22, Table 1 of the PDCP.

2.3 Tree heights and canopy spreads were visually estimated or measured using a Nikon ForestryPro Laser measurer. Unless otherwise noted in Appendix E, all trunk diameters were measured at approximately 1.4 metres above ground level ("the DBH"), using a Yamiyo diameter tape.

2.4 Field observations were written down, and photographs of the site and trees were taken using an iphone 6 and/or Canon EOS SLR digital camera.

2.5 No *aerial inspections*, *root mapping* or woody tissue testing were undertaken as part of this tree assessment. Information contained in this tree report covers only the trees that were examined and reflects the condition of those trees at the time of inspection.

2.6 Plans and documents referenced for the preparation of this report include:

- Details and Levels Survey, Ref. No. 4066A, Issue 1 dated 19/12/2017, by C.M.S. Surveyors Pty Limited.
- Plans, Dwg. No's. A101 - A113, dated 27/09/2019, by Blue Sky Building Designs.
- Landscape Plans, Dwg. No's 1905/1 – 5, dated 10/10/2019, by Pam Fletcher.
- Stormwater Management Concept C1.00 – C1.03, dated 09/10/19, by Waddington Consulting.
- AS4970-2009 *Protection of trees on development sites*, Standards Australia.
- Schedule 5 Environmental Heritage of the Pittwater Local Environment Plan.

2.7 The subject trees are shown on a marked-up excerpt of the survey plan. This marked-up plan is attached as Appendix E—Tree Location Plan.

[1] Visual Tree Assessment (VTA) is a procedure of defect analysis developed by Mattheck and Breloer (1994) that uses the growth response and form of trees to detect defects.

3 OBSERVATIONS AND DISCUSSION

3.1 Brief Site Details

3.1.1 The site is bounded on its south side by a creek, possibly a small tributary of Cahill Creek which runs through the Bayview Golf Club grounds, and to the north by the road reserve of Cabbage Tree Road. The site is triangular in shape and relatively level, lower than the road, with a slight fall from the north to south.

3.1.2 The site is located within a High Priority (HP) Wildlife Corridor. Existing vegetation within the site and immediate surrounds consists primarily of locally indigenous trees in the road reserve and adjoining property to the west and a planted row of native species along the site frontage facing Cabbage Tree Road. Naturally occurring and planted locally indigenous and introduced native tree species occur within the site proper. There is no understorey vegetation of note. Ground cover is almost entirely exotic turf grass and the weed *Convulvulus* on modified soils. The soil is very moist, consistent with its proximity to the creek and existing topography.

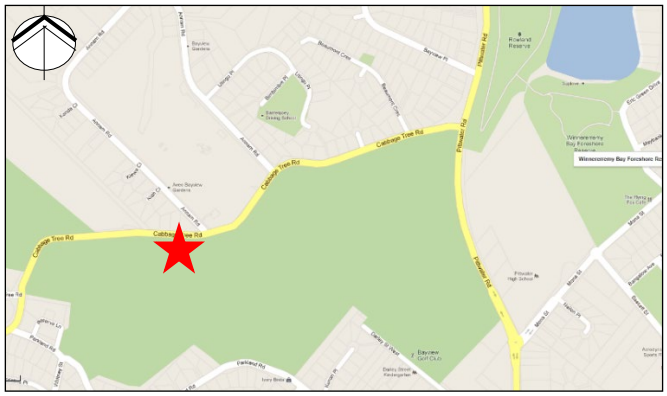
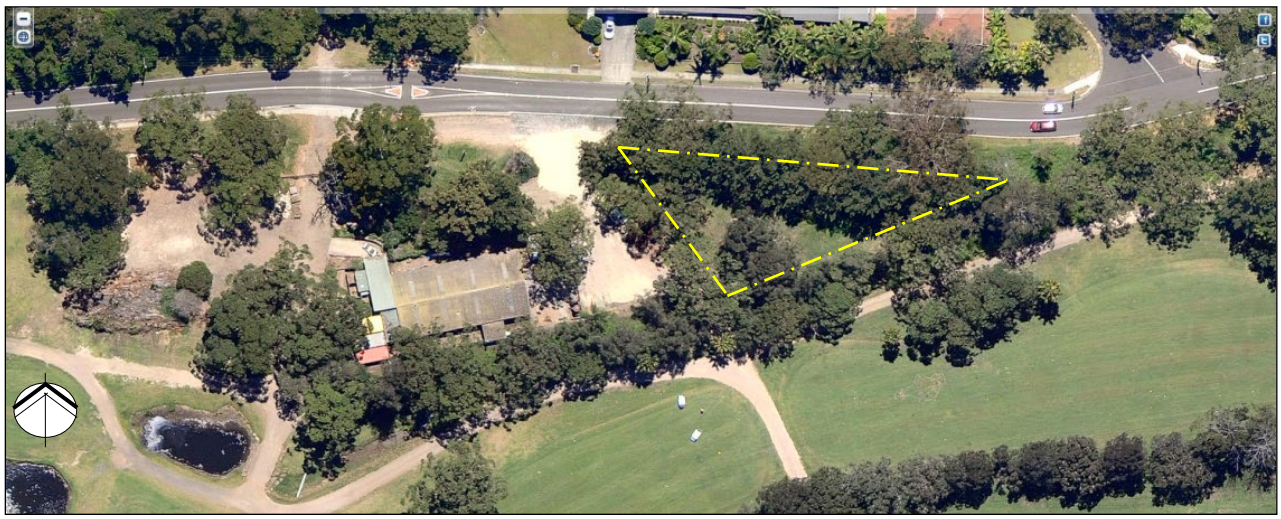


Figure 1 (left)
Location of site on map indicated by red star.
Image – Google Maps (not to scale).

Figure 2 (below)
Aerial image below shows the relationship of the site to Cabbage Tree Road, adjoining golf course and maintenance sheds. The site boundaries are outlined in yellow (approximate only-not to scale)
Image – Nearmap.com



3.2 Assessed Trees Details

3.2.1 A total of 85 trees were identified at the site visit and tree assessment. Details of the individual trees or tree groups are included in the Schedule of Assessed Trees – Appendix D.

3.2.2 Of these trees:

- Four (4) trees are dead (Tree 1 in the road reserve, and Trees 11, 13 and 29 in the site).
- Seven (7) living trees are located in the road reserve in front of the site (Trees 2–8).
- Thirty-eight (38) living trees more or less straddle the boundary of the site and road reserve (i.e. the bases of the trees are either fully or partially within the site (Group G1 – G38).
- Fourteen (14) living trees are located within the adjoining golf course (Trees 15, 16, 19–28, 30–33).
- Seven (7) living trees are located within the site (Trees 9–12, 14, 18 and 21).
- Fifteen (15) living trees in one group fall within the site (Tree 17).

3.2.3 The Retention Value (RV – detailed at Appendix B) of the 81 living, assessed trees is accorded as follows:

- Low RV—Trees 2, 10, 14, 17 (a group of 15 trees, mainly saplings, with low individual retention values), 25 and 30 (20 trees).
- Medium RV—Trees 5, 6, 8, 9, 12, 21, 22, 23, 24, 26, 27, 32, 33 and G1-G38 (51 trees).
- High RV—Trees 3, 4, 7, 15, 16, 18, 19, 28, 31 and 33 (10 trees).

3.2.4 With the exception of Tree 18, a mature *Casuarina glauca* (Swamp She-oak), all of the High Retention Value trees are *Eucayptus robusta* (Swamp Mahogany).

3.2.5 No tree species identified on the site is listed as vulnerable, endangered, or critically endangered under Schedules 1 and 2 of the Biodiversity Conservation Act 2016 or the Environment Protection and Biodiversity Conservation Act 1999.

3.3 Proposed Tree Removal

3.3.1 The 3 dead site trees (Trees 11, 13 and 29) will be removed. These trees do not appear to have any obvious habitat value, such as hollows, and removal is recommended to ensure the evacuation/emergency travel path is not unsafe due to its proximity to these dead trees.

3.3.2 Twenty-five (25) of the 81 identified living trees would be removed under the development proposal. These are discussed in more detail, below.

3.3.3 Tree 17 – *Casuarina glauca* (Swamp She-oak)

This is a group of fifteen (15) semi-mature, planted and suckering trees. The trees are closely spaced and have developed very slim, tall stems. Few, if any, of the trees would be suitable for retention as an individual specimen. As the tree group is near the centre of the site, they fall well within the proposed building footprint. The reasonable and economic development of the site requires the removal of this tree group in its entirety.

3.3.4 Tree 18—Swamp She-oak

This large tree stands within the proposed building footprint. It has a High RV as it does not have any obvious defects and has grown relatively unencumbered by nearby trees.

3.3.5 Trees G1 to G38 – *Casuarina cunninghamiana* (River She-oak)

This is a planted row of thirty-eight (38) River She-oaks along the north boundary of the site. As a row planting they have visual prominence from the street, however, individually they have Low RV's. The trees are relatively closely spaced and appear to have been topped many years ago. As a result, the branching habit is generally strongly ascending, and the stems and branches are tall and of poor taper. Several trees have notable branch inclusions, compression forks and other defects.

3.3.6 Of the above 38 River She-oaks, nine (9) would be removed to accommodate the driveway and building footprint—Trees G15 – G23. It is noted; most of them are lanky and/or suppressed, G21 is declining, G25 is heavily suppressed, and the majority of G26 grows to the east.

3.4 Potential Impacts on Trees Proposed for Retention.

3.4.1 Fifty-seven (57) assessed trees are proposed to be retained. These are:

- Trees 1 (dead), 2, 3, 4, 5, 6, 7 and 8 on the road reserve;
- Trees 15, 16, 19 – 28, 30 – 33 on the adjoining golf course land;
- Trees 9, 10, 12, 14 within the site, and
- Trees G1 – G14, G24 – G38 straddling the site and road reserve boundary.

3.4.2 Forty-one (41) trees will have nil or negligible Tree Protection Zone (TPZ) encroachments and are not expected to have any impact upon them as a result of the proposal. These trees are identified as Trees 1, 3, 4, 5, 8, 9, 10, 19 – 28, 30 – 33, G1 – G11, G30 – G38.

3.4.3 Some of the above trees may require some light pruning to clear the building line along the south/southeast section of the boundary with the golf course. No pruning is anticipated to be greater than 5-10% of overall crown density or of branches >50 – 80mm diameter and is not anticipated to be of any adverse impact on tree viability and long-term retention.

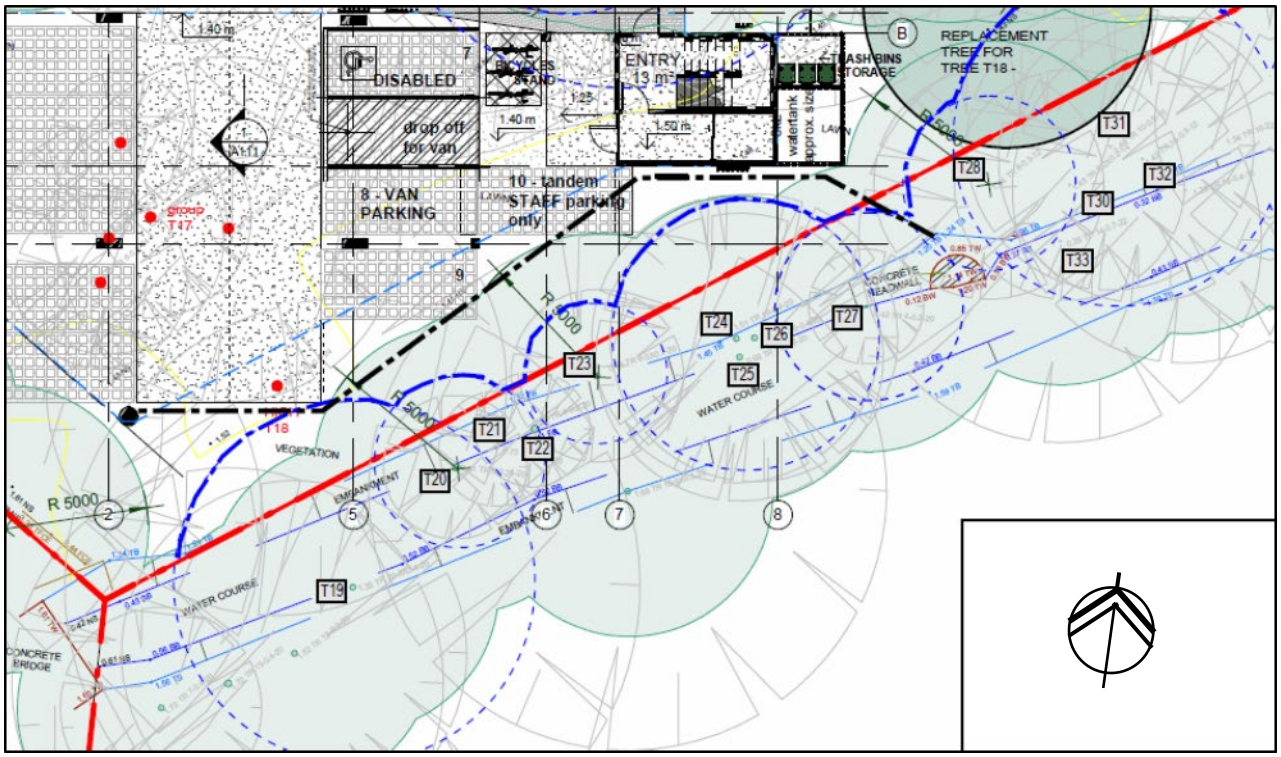


Figure 1
Illustrates the TPZ 's (dashed blue circles) of Trees 19 – 33 are outside the built footprint, with negligible encroachment into T19, T27 and T28 for stormwater pipe (black, dashed line) and will not be affected by the proposal, provided they are appropriately protected. Level 0 plan A103, dated 27/092019, marked up by C. Mackenzie.

3.4.4 Under the Australian Standard 4970-2009 *Protection of trees on development sites* (AS4970), encroachments less than 10% of the *Tree Protection Zone* (TPZ) are considered to be minor. There are no specifications provided in AS4970 for potential impacts of 10% or greater. The 10% figure is taken to be a threshold and a trigger where arboricultural investigation into TPZ encroachments beyond this figure need to be considered. However, the extent of impacts to the trees can be rated using table 1, below.

IMPACT LEVEL RATING	
0	0 – 1% of root zone impacted – ***no*** impact of significance
L	>1 to 10% of root zone impacted – ***low*** level of impact
L - M	>10 to 15% of root zone impacted – ***low to moderate*** level of impact
M	>15 to 20% of root zone impacted – ***moderate*** level of impact
M – H	>20 to 25% of root zone impacted – ***moderate to high*** level of impact
H	>25 to 35% of root zone impacted – ***high*** level of impact
S	>35% of root zone impacted – ***significant*** level of impact

Table 1: Guideline to the rating of impacts on trees to be retained.
Based on discussions with executive members of the Institute of Australian Consulting Arboriculturists.

3.4.5 Encroachments into the *Structural Root Zone* (SRZ), and extent of encroachments into the TPZ of the larger and significant trees proposed to be retained, are summarised in the table below, and discussed in more detail in the following paragraphs.

Table 2: Estimated encroachments into the SRZ and TPZ of trees proposed for retention.
***** TPZ encroachment columns - top row is the calculated encroachment for the notional TPZ, allowing for disturbance zone and permanent encroachment. Bottom row is the anticipated actual TPZ encroachment, allowing for fine, non-woody roots to generate and occupy disturbance zone post-construction.

Tree No.	Tree RV	Tree located on site?	SRZ affected?	TPZ area (m^2)	TPZ encroachment (approx. m^2)	TPZ encroachment (approx. %)*	TPZ Impact Rating
6	**M**	×	×	255.0	53.2	21	L-M
					38.45	15	
7	**H**	×	×	290.0	21.9	7.5	L
					17.	5.8	
12	**M**	✓	×	104.0	14.	13.5	L
					0.5	0.5	
14	**L**	✓	×	113	2.5	2.4	L
					<01	Neg.	
15	**H**	×	×	163.0	27.15	16.6	L
					13.9	8.5	
16	**H**	×	×	180.0	27.	15	L
					14.6	8.1	

3.4.6 **Tree 6**—Swamp Mahogany

Structural Root Zone impacts:

- The pedestrian path and possibly a very low retaining wall would be located approximately 1.5m outside the notional SRZ offset. The tree has a slight lean to the south suggesting the main anchorage is likely to be on its northern side rather than the side closer to the proposed path.
- There are at least five River She-oaks (G22 – G26) between this tree and the proposed path. The mass of She-oak roots is likely to have inhibited root growth of Tree 6 towards the site

Tree Protection Zone impacts:

- Approximately 53.2m^2 (21%) of the notional TPZ is affected on plan (including a 300mm disturbance zone around the path and low retaining wall), see Figure 2.
- Broken down, this is:
  - 38.45m^2 (15%) for ground level changes for pedestrian path and low retaining wall within notional TPZ.
  - 14.75m^2 (5.8%) disturbance zone where non-woody roots can occupy the disturbed/unbuilt upon soil area following construction.
- Given the above, the more realistic encroachment of the notional TPZ is likely to be in the vicinity of 38.45m^2, equating to around 15%, which is in the low to moderate/moderate range of impact rating.
- The preference was to move the driveway closer to Tree 6 rather than Tree 7 which has a larger TPZ offset and also has a higher RV. This proposal is the preferred option for minimising impacts on trees to be retained, as well as meeting vehicle and pedestrian access requirements.
- It is my opinion the tree will tolerate changes in the TPZ (as, in my past experience, this species has proven to be quite robust), provided it is given due consideration and supervision during driveway and retaining wall construction.

Pruning impacts:

- The lowest NE branch may require removal. Pruning is unlikely to have a long-term, detrimental impact on tree viability and retention.

3.4.7 **Tree 7**—Swamp Mahogany

Structural Root Zone impacts:

- Nil SRZ encroachment.

Tree Protection Zone impacts:

- The notional encroachment is less than 10% and this includes approximately 500 – 600mm allowance for some disturbance beyond the driveway footprint during construction. This is a negligible amount and puts the impact rating in the low (minor) range. Following driveway construction, the disturbed area will be again be available for fine, non-woody root occupation, see Figure 3.

Pruning impacts:

Pruning of the tree is not required.

3.4.8 **Tree 12**—Swamp Mahogany

Structural Root Zone impacts:

- Nil SRZ encroachment.

Tree Protection Zone impacts:

- I note the proposed vertical louvres on the west wall exterior appear to meet the ground level. Discussion with the architect reveals this feature does not require excavation of the ground and can in fact be constructed to be slightly above existing ground, and therefore not impede tree root occupation of the ground beneath it.
- About 14.0m^2 (13.5%) of the notional TPZ is affected on plan (including a 400 – 600mm disturbance zone around footprint). However, as the building is elevated on isolated columns and the external stairs are for the most part above ground, the encroachment will be much less. See Figure 4.
- Broken down, this is:
  - 0.5m^2 (0.52%) for negligible excavation for stairs posts within notional TPZ.
  - 13.5m^2 (13%) disturbance zone and fully elevated structure where non-woody roots can potentially occupy the disturbed/unbuilt upon soil area following construction.
- Given the above, the more realistic encroachment of the notional TPZ is likely to be in the vicinity of 0.5m^2 (including proposed roof drainage line) equating to less than 1%, which is in the low (minor) range of impact rating and supportable provided appropriate care is taken during construction to limit additional disturbances.

Pruning impacts:

- Pruning of live branches is unlikely. A dead limb extends to the NE and possibly would be affected by the building. The limb could be removed if required.

3.4.9 **Tree 14**—Swamp Mahogany

Structural Root Zone impacts:

- Nil SRZ encroachment.

Tree Protection Zone impacts:

- Approximately 3.1m^2 (2.7%) of the notional TPZ is affected on plan (including a 400 – 600mm disturbance zone around footprint). Essentially, one supporting column is located marginally inside the TPZ. The real encroachment is likely to be less than 0.5m, which is eminently supportable. See Figure 4.

Pruning impacts:

- Pruning is unlikely.

3.4.10 **Tree 15**—Swamp Mahogany

Structural Root Zone impacts:

- Nil SRZ encroachment.

Tree Protection Zone impacts:

- Approximately 27.15m^2 (16.6%) of the notional TPZ is affected on plan (including a disturbance zone), see Figure 5.
- Broken down, this is:
  - 13.9m^2 (8.5%) for ground level changes for car parking area and support column within notional TPZ.
  - 13.2m^2 (8.1%) disturbance zone and fully elevated structure where non-woody roots can potentially occupy the disturbed/unbuilt upon soil area following construction.
- Given the above, the more realistic encroachment of the notional TPZ is likely to be in the vicinity of 14m^2, equating to around 8.5%, which is in the low (minor) range of impact rating and supportable provided appropriate care is taken during construction to limit additional disturbances.

Pruning impacts:

- May require removal of one branch, possibly two, i.e. the lowest two on NE side, to clear proposed building. The lowest limb is almost devoid of foliage. The second is better, although neither have a high density of live foliage. Most of the tree's crown is concentrated in the upper third of the tree.
- Pruning of the two limbs over the site is unlikely to have a long-term, detrimental impact on tree viability and retention.

3.4.11 **Tree 16**—Swamp Mahogany

Structural Root Zone impacts:

- Nil SRZ encroachment.

Tree Protection Zone impacts:

- Approximately 27m^2 (15%) of the notional TPZ is affected on plan (including a 300 – 500mm disturbance zone around footprint), see Figure 5.
- Broken down, this is:
  - 14.6m^2 (8.1%) for ground level changes for car parking area and support column within notional TPZ.
  - 9.3m^2 (5.2%) disturbance zone and fully elevated structure where non-woody roots can potentially occupy the disturbed/unbuilt upon soil area following construction.
- Given the above, the more realistic encroachment of the notional TPZ is likely to be in the vicinity of 15m^2, equating to around 8.3%, which is in the low (minor) range of impact rating and supportable provided appropriate care is taken during construction to limit additional disturbances.

Pruning impacts:

- The lowest NE branch may require removal. Pruning is unlikely to have a long-term, detrimental impact on tree viability and retention.

3.4.12 **Trees G12 – G14**—River-She-oaks

Note: TPZ encroachment for the tree closest to proposed works (G14) and therefore with greatest potential for construction related impacts, is calculated below.

Structural Root Zone impacts:

- Nil SRZ encroachment, although potential disturbance zone could be at the edge of the SRZ perimeter of G13 and G14.

Tree Protection Zone impacts:

- Approximately 16.6m^2 (23%) of the notional TPZ is affected on plan (including a 300mm disturbance zone), see Figure 6.
- Broken down, this is:
  - 10.5m^2 (14.5%) for ground level changes for car parking area and driveway within notional TPZ.
  - 6.1m^2 (8.5%) disturbance zone and fully elevated structure where non-woody roots can potentially occupy the disturbed/unbuilt upon soil area following construction.
- Given the above, the more realistic encroachment of the notional TPZ is likely to be in the vicinity of 15m^2, equating to around 15-20%, which is in the moderate range of impact rating. This encroachment is supportable provided appropriate care is taken during construction to limit additional disturbances.

Pruning impacts:

- Pruning of the trees is unlikely as their stems are very tall and lanky and the foliage is concentrated in the upper third of the trees. Some deadwood and perhaps an occasional small, inferior branch may be required to be removed from the south.

3.4.13 **Trees G24 – G27**—River-She-oaks G24

Note: TPZ encroachment for the tree closest to proposed works (G24) and therefore with greatest potential for construction related impacts, is calculated below.

Structural Root Zone impacts:

- Nil SRZ encroachment.

Tree Protection Zone impacts:

- Approximately 8.7m^2 (12.1%) of the notional TPZ is affected on plan (including a 300mm disturbance zone), see Figure 7.
- Broken down, this is:
  - 5.5m^2 (7.6%) for low retaining wall and path within notional TPZ.
  - 3.3m^2 (4.5%) disturbance zone where non-woody roots can potentially occupy the disturbed/unbuilt upon soil area following construction of the retaining wall.
- Given the above, the more realistic encroachment of the notional TPZ is likely to be in the vicinity of 5.5m^2, equating to around 7.6%, which is in the low (minor) range of impact rating. This encroachment is supportable provided appropriate care is taken during construction to limit additional disturbances.

Pruning impacts:

Pruning of the trees is unlikely as their stems are very tall and lanky and the foliage is concentrated in the upper third of the trees. Some deadwood and perhaps an occasional small, inferior branch may be required to be removed from the south.

3.4.14 Potential future road reserve pedestrian and/or bike path

I note there is a potential future 3m wide pedestrian path outlined on Plan A103 which would introduce works within the SRZ of Trees 3, 4, 7 and 8. I also note at page 47 of the Pittwater Draft Bike Plan 2016 a potential future shared bike path along the south side of Cabbage Tree Road, from the roundabout at Pittwater Road, extending west would also affect the road reserve in front of the subject site. This could also be problematic with the protection and retention of these road reserve trees.

3.4.15 The possibility that a future pedestrian pathway and/or shared bike path, or perhaps road kerb and gutters constructed by others, has greater potential for TPZ encroachments and associated impacts on the road reserve trees than the current proposal within the site.

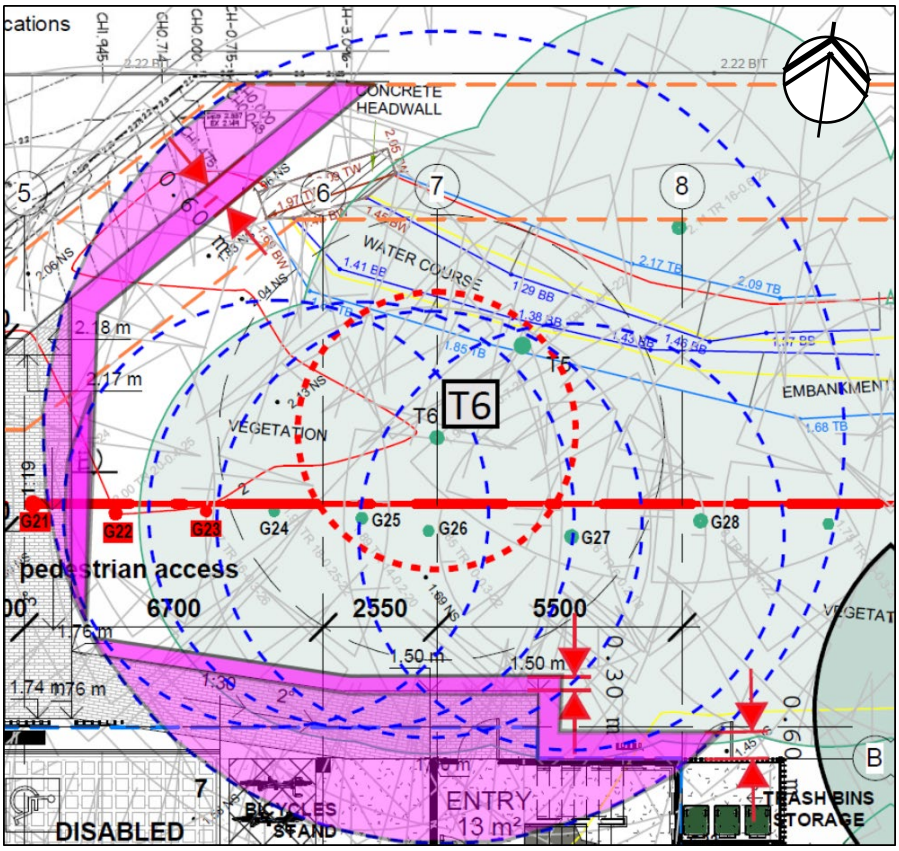


Figure 2
Illustrates the TPZ (outer, blue dashed circle) and SRZ (inner, red dashed circle) of T6 (Swamp Mahogany) The estimated encroachment into the notional TPZ is demonstrated by the pink shaded area, with an additional 300mm wide disturbance zone around the proposed path and low wall. (Numbers in red identify those River She-oaks proposed to be removed). Not to scale. Level 0 plan A103, dated 27/09/2019, marked up by C. Mackenzie.

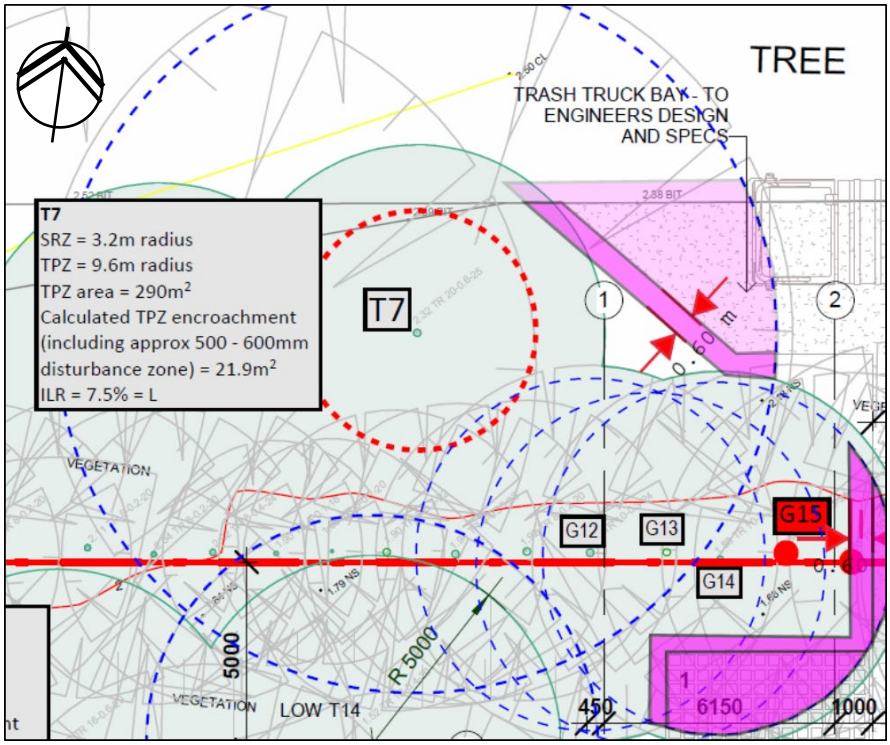


Figure 3
Illustrates the TPZ and SRZ of Tree 7 (Swamp Mahogany). The pink shaded area identifies the encroachment including up to 600mm disturbance zone for driveway works. (Numbers in red identify those River She-oaks proposed to be removed). Not to scale. Level 0 plan A103, dated 27/09/2019, marked up by C. Mackenzie.

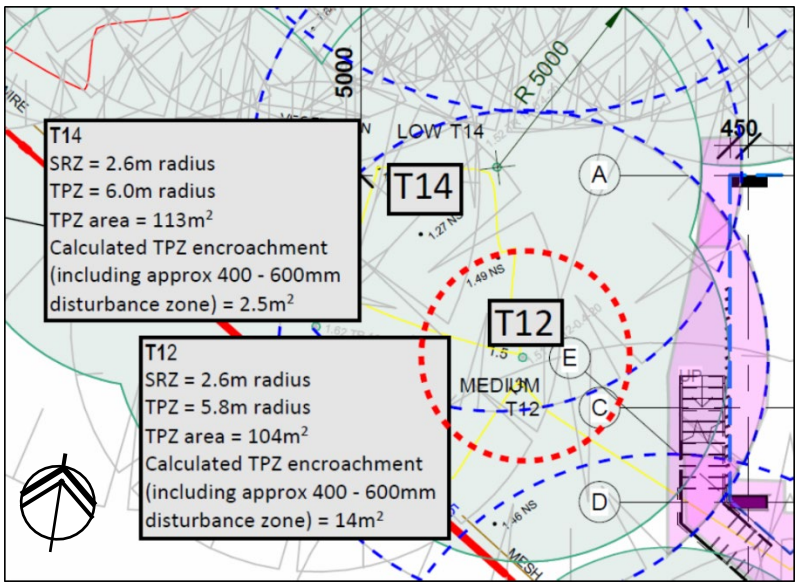


Figure 4
Illustrates the SRZ and TPZ of Tree 12 and of Tree 14 (Swamp Mahoganies)
The pink shaded areas identify the approximate location of fully elevated structures with no changes to existing levels. Two concrete columns are depicted.
Not to scale. Level 0 plan A103, dated 27/092019, marked up by C. Mackenzie.

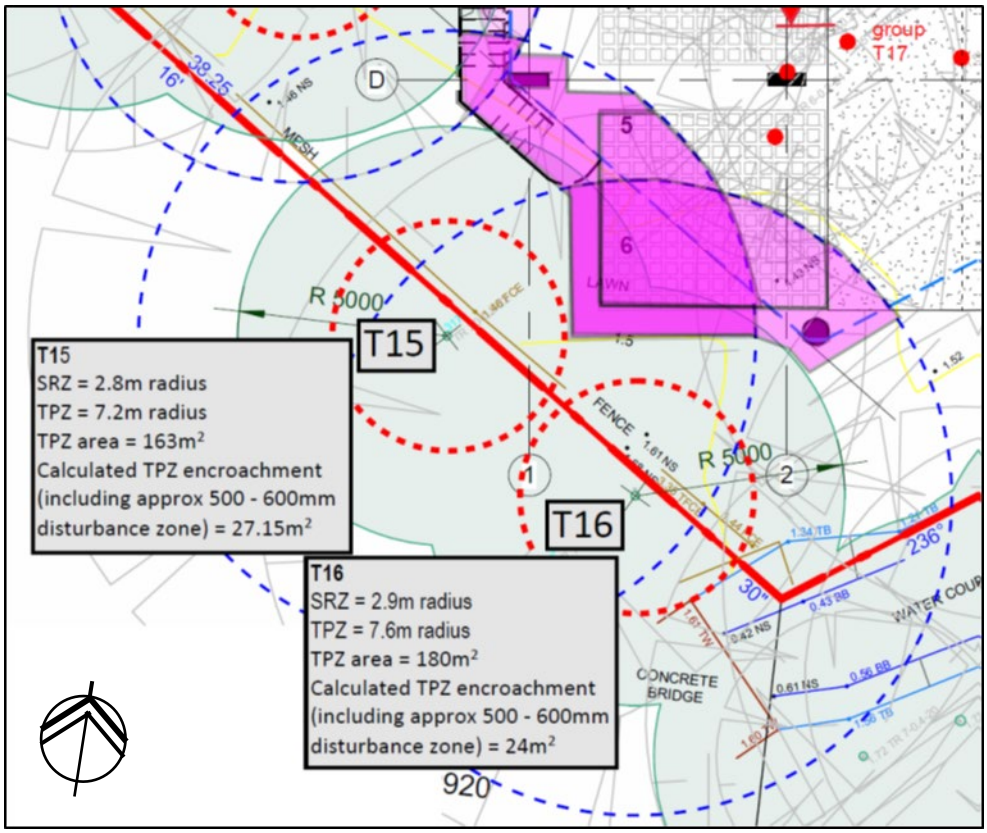


Figure 5
Illustrates the TPZ and SRZ of Trees 15 and 16 (Swamp Mahoganies)
The pink shaded areas identify the approximate location of fully elevated structures with shallow excavation at ground level to provide a level parking area, including a disturbance zone around a concrete pillar and parking area. Not to scale. Level 0 plan A103, dated 27/092019, marked up by C. Mackenzie.

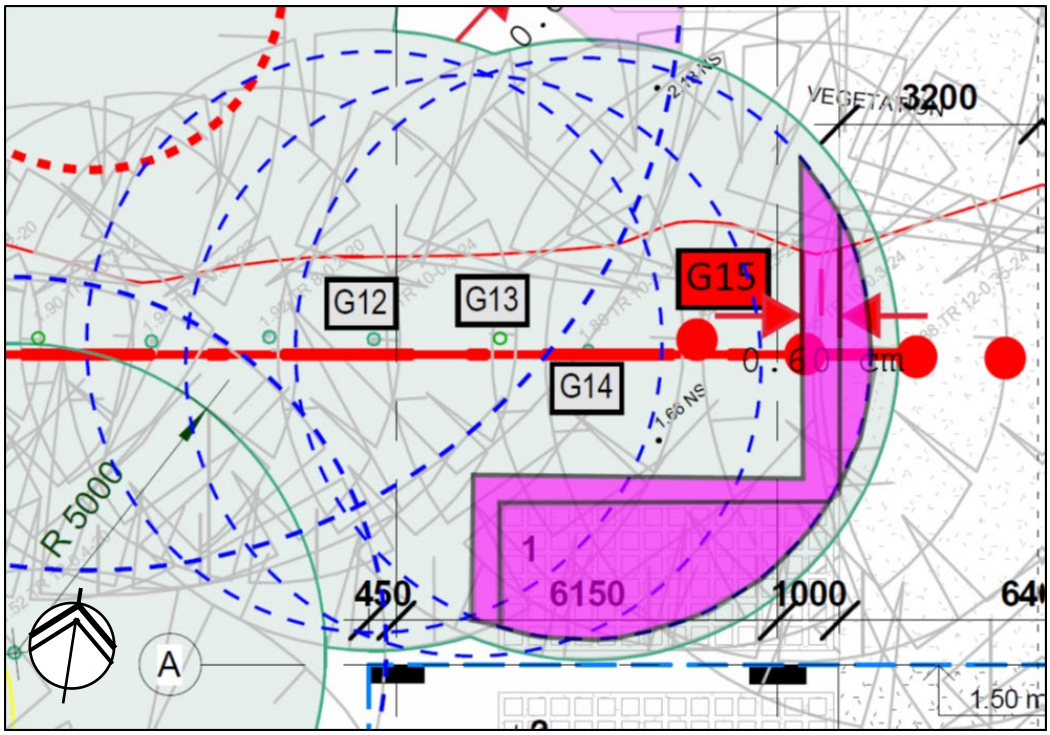


Figure 6
Illustrates the TPZ's of Trees G12 – G14 (River She-oaks to be retained. The pink shaded area identifies the encroachment including up to 600mm disturbance zone for driveway and car parking works. Note trees in red are those proposed to be removed. Not to scale. Level 0 plan A103, dated 27/09/2019, marked up by C. Mackenzie.

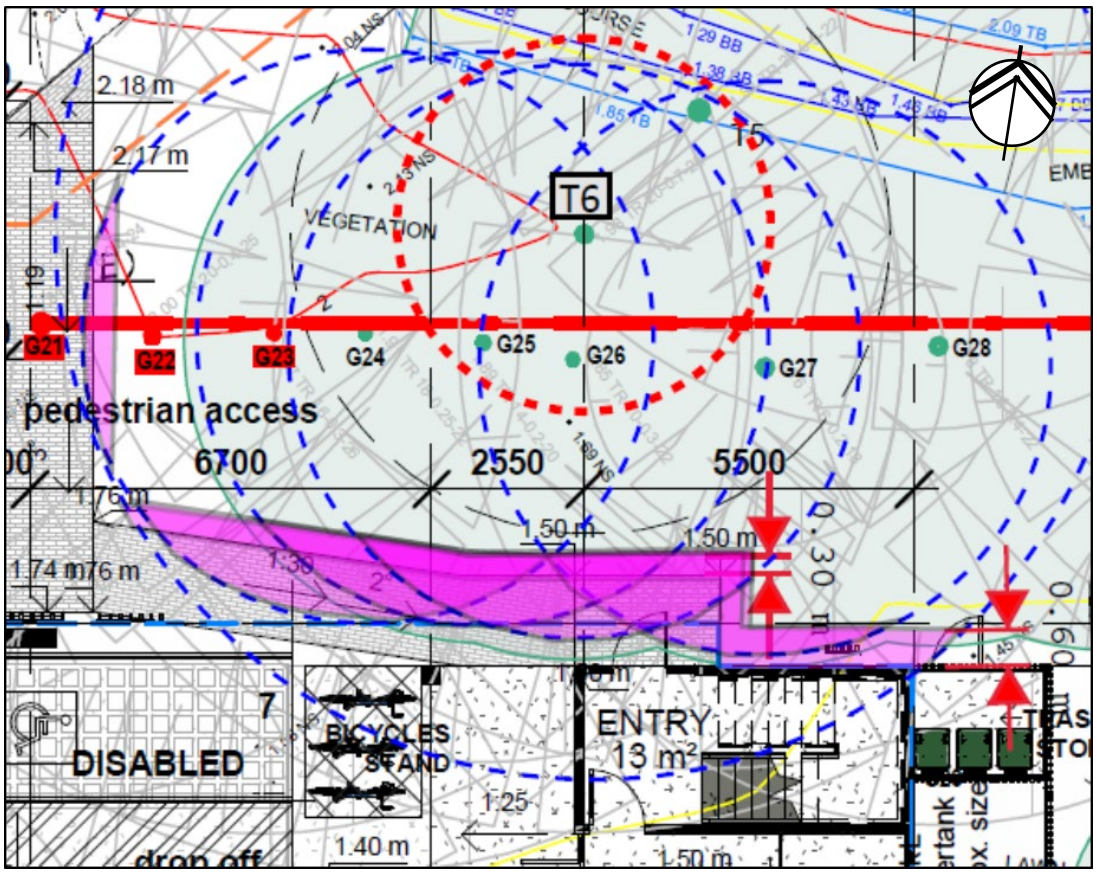


Figure 7
Illustrates the TPZ's of Trees G24 – G27 (River She-oaks). The pink shaded area identifies the encroachment including up to 300mm disturbance zone for pedestrian path works and 600mm from building alignment.
(Note trees in red are those proposed to be removed.
Not to scale. Level 0 plan A103, dated 27/09/2019, marked up by C. Mackenzie.

4 CONCLUSIONS

- Eighty-five (85) trees were assessed or included in this report for the proposed development.
  - Four (4) trees are dead (Trees 1, 11, 13 and 29).
  - Fifty-three (53) trees fall within two (2) tree groups; each of these groups is assessed as though it is a single tree due to the mutual growth, suppression and sharing of resources that limit sound structural condition. Removal of one or more individuals may affect the stability and viability of any individuals remaining (Tree 17 = 15 trees, and Group G1 – G38 = 38 trees).
  - The remaining twenty-eight (28) trees are of various states of vigour and condition ranging from very poor to good.

- Of the eighty-one (81) living, assessed trees:
  - Twenty-five (25) are proposed to be removed to facilitate the proposed development:
    - Low RV—Tree 17, which is a group of 15 trees, mainly saplings, with low individual retention values (15 trees).
    - Medium RV (some individuals, at best; many are low RV)—Trees G15 – G23 (9 trees).
    - High RV—Tree 18.
  - Fifty-six (56) living trees are proposed to be retained and protected:
    - Low Retention Value—Trees 2, 10, 14, 25 and 30 (5 trees).
    - Medium (Low individual RV) Retention Value—Trees 5, 6, 9, 12, 20, 21, 22, 23, 24, 26, 27, G1-G14 and G24 – G38 (40 trees).
    - High Retention Value—Trees 3, 4, 7, 8, 15, 16, 19, 28, 31, 32 and 33 (11 trees).

- The majority of trees will experience nil or low TPZ encroachments which will have no impact on their current vigour and condition.

- Tree 6 (Medium RV) will experience a notionally low to moderate TPZ encroachment, and these proposed works are not expected to affect its viability and long-term retention provided it is appropriately managed during the course of site works

- Potential future works on the road (e.g. Council or RMS) and potential future pedestrian and/or shared bike plan routes in the road reserve could introduce high levels of tree impacts on the existing large trees T3, T4, T7 and T8. This involves works outside the site which are not directly related to this proposal.

- Provided the recommendations of this report are adopted, and a site arboriculturist provides appropriate supervision and management of the trees during development, adverse impacts on tree vigour and structural condition of trees to be retained will be managed as practically as possible, and it is unlikely any tree decline, or additional tree removal will result.

5 RECOMMENDATIONS

5.1 Tree Removal

5.1.1 Dead trees 11, 13 and 29 should be removed to accommodate the proposal, and for safety reasons.

5.1.2 The 25 trees to be removed are identified in the Schedule of Assessed Trees—Appendix D.

5.1.3 To avoid any confusion between trees to be removed and retained, the Project Arboriculturist shall identify and clearly mark with high visibility paint or tags those trees to be removed, prior to tree removals undertaken by a minimum AQF3 tree contractors.

5.2 Minimising Impacts on Trees to be Retained.

5.2.1 PRE-COMMENCEMENT

- A minimum AQF Level 5 arboriculturist shall be engaged prior to commencement of any works and act as the primary Project Arboriculturist (PA) for the duration of works.
- Tree retention is the priority. Routine liaison between the site owner, architect and PA must be maintained during driveway construction detailing and installation to ensure appropriate construction methods are adopted to reduce the potential impacts on trees to be retained.
- All trees to be retained shall be protected according to the recommendations of this report and compliance with those recommendations provided in writing by the PA, prior to commencement of site works.
- Tree protection devices are to be placed as advised by the PA or Council's Tree Management Officer, prior to any site works commencing.
- Mulch derived from removed trees (excepting those with identified fungal disease) may be used as temporary ground protection in conjunction with other tree protection devices (e.g. fencing, timber sheeting or temporary boardwalk, etc) within the tree protection zones of trees to be retained.

5.2.2 ROAD RESERVE TREES

- Protection of the existing ground within the road reserve is crucial in preventing compaction of the soil and subsequent impacts on tree health. The road reserve trees shall be protected with exclusion fencing and other tree protection devices where deemed necessary by the PA.
- Additional recommendations are provided in section 5.3 *Tree Protection* Zones and are to be adopted in general and where applicable. Advice from the PA is to be sought where any potential/ unidentified conflicts arise with any proposed future works and tree retention.

5.2.3 ADJOINING TREES

- The TPZ of the trees on the golf course land are to be protected by temporary site fencing placed no less than 2m from the boundary.

5.2.4 ALL TREES TO BE RETAINED

Construction

- The PA must advise on all aspects of tree protection prior to and during construction.
- Concrete columns are not to be located within 1000mm of the SRZ radius of any tree to be retained.
- All works, including shallow excavation for car parking spaces, within the TPZ of Trees 6, 7, 12, 15 and 16 shall be directly supervised by the PA.
- Irrigation—The PA should determine whether irrigation should be carried out during extended periods of drought.
- Refer to sections 5.2 and 5.3 and Appendices D and E for additional recommendations that may require adoption during development.
- Pest management—Monitoring is required as trees under stress are more prone to insect attack.

Post-construction

- Mulching; removal of mulch after construction to remove any contaminants. Replacement with a good quality mulch and addition of 10% organic matter will improve beneficial soil micro-organisms, retain moisture and improve aeration and water infiltration.

5.3 Tree Protection—General Recommendations

5.3.1 The Tree Protection is to be in accordance with the following:

- Tree Protection Devices (TPD) may include mulching, tree guards and other devices other than fencing.
- The TPD must be in place prior to any site works commencing, including clearing, demolition or grading.
- The most appropriate fencing for tree protection is 1.8m chainlink with 50mm metal pole supports. During installation, care must be taken to avoid damage to significant roots. The practicality of providing this fencing on this site must be addressed by the arboriculturist.
- Locate large primary roots by careful removal of soil within the fencing area. ***Do not drive any posts or pickets into tree roots.*** Replace soil back over tree roots.
- It is recommended that the arboriculturist provide written certification that the TPD is/are installed and will satisfy tree protection requirements.
- Nothing should occur inside the tree protection fenced areas, so therefore all access to personnel and machinery, storage of fuel, chemicals, cement or site sheds is prohibited.
- Signage should explain exclusion from the area defined by TPD and carry a contact name for access or advice (see Appendix C – Tree Protection Devices).
- The TPD cannot be removed, altered, or relocated without the project arborists' prior assessment and approval.

5.4 Arboricultural advice

5.4.1 Tree and Root Pruning

- Any pruning required is to be assessed and approved by the project arboriculturist, prior to undertaking any of this type of work
- Pruning shall not be undertaken by unqualified site personnel at any time.
- Pruning of branches must be undertaken by a minimum AQF Level 3 arborist in accordance with the Australian Standard AS4373-2007 *Pruning of amenity trees*,
- Unless otherwise approved by the Conditions of Development Consent, or by separate application and approval by the consent authority, pruning is to be limited to cutting of limbs less than 80mm diameters, and no more than 10% total live material removed.

5.4.2 Stockpiling and location of site sheds

- The project arboriculturist must be consulted prior to placing any items within a tree's TPZ.
- Where stockpiling must be located within the TPZ offset of trees to be retained, the existing/undisturbed natural ground must be covered with thick, coarse mulch to a minimum 75-100mm thickness.
- Large, or bulky materials (non-contaminating) can be stacked on wooden pallets or boards placed over the mulch.
- Tarpaulins (or similar) placed on boards or pallets on top of mulch shall be used to prevent loose or potentially contaminating materials from moving into the soil profile within the TPZ of trees or within 10m upslope of trees.
- Where site sheds must be located within the TPZ offset of a tree/s, the shed must be fully elevated on all sides with a minimum 300m between existing ground and the

floor/floor bearers. Isolated pad footings must be carefully dug by hand and not damage or sever any roots greater than 20mm diameters.

- Any conflict between footing locations and larger roots (i.e. 20mm Ø plus) must be brought to the attention of the project arboriculturist who is to provide practical alternatives that do not include unnecessary tree root removal.

5.4.3 Fill Material

- Placement of fill material within the TPZ of trees to be retained should be avoided where possible. Where placement of fill cannot be avoided, the material should be a coarse, gap graded material such as 20 — 50mm crushed basalt or equivalent to provide some aeration to the root zone. Note that roadbase or crushed sandstone or other material containing a high percentage of fines is unacceptable for this purpose.
- The fill material should be consolidated with a non-vibrating roller to minimise compaction of the underlying soil.
- Permeable geotextile may be used beneath the sub-base to prevent migration of the stone into the sub-grade. No fill material shall be placed in direct contact with the trunk.

5.4.4 Pavements

- Pavements should be avoided within the TPZ of trees to be retained where possible.
- Proposed paved areas within the TPZ of trees to be retained is to be placed above grade to minimise excavations within the root zone, avoiding root severance and damage.

5.4.5 Fencing and walls within the SRZ and TPZ of retained trees.

- Where fencing and/or masonry walls are to be constructed along site boundaries, they must provide for the presence of any living woody tree roots greater than 50mm diameter.
- Hand digging must occur within the SRZ of trees to be retained.
- For masonry walls/fences it may be acceptable to delete continuous concrete strip footings and replace with suspended in-fill panels (e.g. steel or timber pickets, lattice etc) fixed to pillars.

5.4.6 Landscaping within tree root zones.

- The level of introduced planting media into any proposed landscaped areas within the TPZ is not to be greater than 75mm depth, and be of a coarse, sandy material to avoid development of soil layers that may impede water infiltration.
- Appropriate container size of proposed plants within the SRZ of trees should be determined prior to purchase of plants. Otherwise, any proposed landscaping within the SRZ must consist of tubestock only. This is required to ensure that damage to tree roots is avoided.
- Mattocks and similar digging instruments must not be used within the TPZ of the trees. Planting holes should be dug carefully by hand with a garden trowel, or similar small tool.
- Where possible, do not plant canopy trees beneath, or within 6 - 8m of overhead lines.

5.4.7 Other

- No washing or rinsing of tools or other equipment, preparation of any mortars, cement mixing, or brick cutting is to occur within 8m upslope of any palms or trees to be retained.
- Regular monitoring of the trees during development works for unforeseen changes or decline will help maintain the trees in a healthy state.

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October, 2019

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APPENDIX A

TERMS AND DEFINITIONS

TERMS AND DEFINITIONS

The following relates to terms or abbreviations that may have been used in this report and provides the reader with a detailed explanation of those terms.

Aerial inspection Where the subject tree is climbed by a professional tree worker or arborist specifically to inspect and assess the upper stem and crown of the tree for signs or symptoms of defects, disease, etc.

Age classes

- **Y** *Young* refers to a well-established but juvenile tree
- **SM** *Semi-mature* refers to a tree at growth stages between immaturity and full size
- **EM** *Early-mature* refers to a tree that is more or less full sized and vigourously growing.
- **M** *Mature* refers to a full sized tree with some capacity for further growth
- **LM** *Late Mature* refers to a full sized tree with little capacity for growth, not yet about to enter decline
- **OM** *Over-mature* refers to a tree about to enter decline or already declining.

Buttress A flange of adaptive wood occurring at a junction of a trunk and root or trunk and branch in response to loading.

Condition refers to the tree's form and growth habit, as modified by its environment (aspect, suppression by other trees, soils) and the state of the scaffold (i.e. trunk and major branches), including structural defects such as cavities, crooked trunks or weak trunk/branch junctions. These are not directly connected with health and it is possible for a tree to be healthy but in poor condition.

Crown All the parts of a tree arising above the trunk where it terminates by its division forming branches, e.g. the branches, leaves, flowers and fruit: or the total amount of foliage supported by branches.

Crown raise pruning Pruning technique where lower limbs are removed, thereby lifting the overall crown above the ground.

Deadwood refers to any whole limb that no longer contains living tissues (e.g. live leaves and/or bark). Some dead wood is common in a number of tree species.

Diameter at Breast Height (DBH) refers to the tree trunk diameter at breast height, i.e. measured at 1.4 m above ground level.

Dieback Death of growth tips/shoots and partial limbs, generally from tip to base. Dieback is often an indicator of stress and tree health.

Form refers to the crown shape of the tree as influenced by the availability or restriction of space and light, or other contributing factors within its environment. Crown form may be determined by tree shape, species and habit and described as Dominant, Codominant, Intermediate, Emergent, Forest and Suppressed, as well as Forest Form or Open Grown. May also be described qualitatively as Good Form or Poor Form.

Growth crack / split Longitudinal crack/split that may develop as a rupture in the bark from normal growth. Longitudinal crack/split that may develop in the trunk of some fast growing palms.

Habit The shape of a tree when its growth is unencumbered by constraints for space and light, e.g. idealized by an isolated field grown specimen with consideration of the species and the type of environment in which it evolved e.g. rainforest, open forest, etc.

Habitat A habitat is an ecological or environmental area that is inhabited by a particular species of animal, plant or other type of organism. It is the natural environment in which an organism lives, or the physical environment that

surrounds (influences and is utilised by) a species population. In restoration ecology of native plant communities or habitats, some invasive species create monotypic stands that replace and/or prevent other species, especially indigenous ones, from growing there.

Health (syn. vigour) refers to the tree's vigour as exhibited by the crown density, leaf colour, presence of epicormic shoots, ability to withstand disease invasion, and the degree of dieback.

Inclusion - the pattern of development at branch or stem junctions where bark is turned inward rather than pushed out. This fault is located at the point where the stems/branches meet. This is normally a genetic fault and potentially a weak point of attachment as the bark obstructs healthy tissue from joining together to strengthen the joint.

Indigenous Native to an area, and not introduced.

Impact Level Rating (ILR) refers to the estimated percentage of the Tree Protection Zone (TPZ) affected by development impacts. These figures may vary due to the specific conditions and constraints on a particular site, tree species tolerance to impacts, age, vigour, condition of the tree, etc.

IMPACT LEVEL RATING	
0	0 – 0.9% of root zone impacted – **no** impact of significance
L	1 to 10% of root zone impacted – **low** (minor) level of impact
L - M	>10 to 15% of root zone impacted – **low** (minor) **to moderate** level of impact
M	>15 to 20% of root zone impacted – **moderate** level of impact
M – H	>20 to 25% of root zone impacted – **moderate to high** level of impact
H	>25 to 35% of root zone impacted – **high** level of impact
S	>35% of root zone impacted – **significant** level of impact

Note: This is a general guide only. These figures may vary due to the specific conditions and constraints on a particular site, tree species tolerance to impacts, age, vigour, condition of the tree, etc.

Lopping Cutting between branch unions (not to branch collars), or at internodes on a tree, with the final cut leaving a stub. Lopping may result in dieback of the stub and can create infection courts for disease or pest attack.

Root Mapping The exploratory process of recording the location of roots usually in reference to a datum point where depth, root diameter, root orientation and distance from trunk to existing or proposed structures are measured. It may be slightly invasive (disturbs or displaces soil to locate but not damage roots, e.g. hand excavation, or use of air or water knife), or non-invasive (does not disturb soil, e.g. ground penetrating radar).

Scaffold branch/root A primary structural branch of the crown or primary structural root of the tree.

Structural Root Zone (SRZ) Refers to the radial distance in metres, measured from the centre of the tree stem, which defines the critical area required to maintain stability of the tree. Only thorough investigation into the location of structural roots within this area can identify whether any minor incursions into this protection zone are feasible. Note: The SRZ is calculated on the diameter measured immediately above the root/stem buttress (DAB). Where this measurement is not taken in the field, it is calculated by adding 12.5% to the stem diameter at breast height (DBH). Note: The SRZ may not be symmetrical in shape/area where there is existing obstruction or confinement to lateral root growth, e.g. structures such as walls, rocky outcrops, etc).

Snub-nosed rib Adaptive wood formed over a crack, included bark or enclosed bark and may be a round edged (snub-nosed) rib where a broad convex swelling is formed over the crack by the addition of new growth increments, and the cracking is slowed or prevented from developing further (Or, may be a sharp-edged rib as an elongated protuberance where a crack continues to develop).

Suppressed In crown class, trees which have been overtopped, whose crown development is restricted from above.

Sweep A curve in the trunk, generally near the ground. This usually occurs when a tree is partially wind thrown when young, but then stabilises itself and straightens due to reaction wood. Stem sweep can also be a naturally developed feature of some tree species. e.g. *Araucaria columnaris* (Cook Pine), that has no relationship to a defect or partial windthrow.

Tree Protection Zone (TPZ). Refers to the radial distance in metres, measured from the centre of the tree stem which defines the *tree protection zone* for a tree to be retained. This is generally the minimum distance from the center of the tree trunk where protective fencing or barriers are to be installed to create an exclusion zone. The **TPZ** surrounding a tree aids the tree's ability to cope with disturbances associated with construction works. Tree protection involves minimising root damage that is caused by activities such as construction. Tree protection also reduces the chance of a tree's decline in health or death and the possibly damage to structural stability of the tree from root damage.
To limit damage to the tree, protection within a specified distance of the tree's trunk must be maintained throughout the proposed development works. No excavation, stockpiling of building materials or the use of machinery is permitted within the TPZ. Note: In many circumstances the tree root zone does not occupy a symmetrically radial area from the trunk, but may be an irregular area due to the presence of obstructions to root spread or inhospitable growing conditions.

Tree Risk Assessment is the systematic process to identify, analyze, and evaluate tree risk. A tree risk rating of Low, Moderate, High or Extreme is derived by categorising or quantifying both the *likelihood* (probability) of tree or tree part(s) failure and impact on a target(s) and the severity of consequences of the impact on the target(s).

USEFUL LIFE EXPECTANCY (ULE) In a planning context, the time a tree can expect to be usefully retained is the most important long-term consideration. ULE i.e. a system designed to classify trees into a number of categories so that information regarding tree retention can be concisely communicated in a non-technical manner. ULE categories are easily verifiable by experienced personnel without great disparity. A tree's ULE category is the life expectancy of the tree modified first by its age, health, condition, safety and location (to give the life expectancy); then by economics (i.e. cost of maintenance - retaining trees at an excessive management cost is not normally acceptable); and finally, effects on better trees, and sustained amenity (i.e. establishing a range of age classes in a local population). ULE assessments are not static but may be modified as dictated by changes in tree health and environment. Trees with a short ULE may at present be making a contribution to the landscape, but their value to the local amenity will decrease rapidly towards the end of this period, prior to them being removed for safety or aesthetic reasons. For details of ULE categories see Appendix B, modified from Barrell 2001.

Vigour (syn. health) refers to the tree's health as exhibited by the crown density, leaf colour, presence of epicormic shoots, ability to withstand disease invasion, and the degree of dieback.

Woody roots usually used in reference to the first order roots i.e. structural (anchor) roots and woody lateral roots within the Structural Root Zone. Damage, disturbance to, or severing of these roots can compromise the stability of the tree.

APPENDIX B

TREE RETENTION VALUE ASSESSMENT

APPENDIX B—TREE RETENTION VALUE ASSESSMENT

Part 1 of 3—Useful Life Expectancy (ULE)

In a planning context, the time a tree can expect to be usefully retained is the most important long-term consideration. ULE i.e. a system designed to classify trees into a number of categories so that information regarding tree retention can be concisely communicated in a non-technical manner. ULE categories are easily verifiable by experienced personnel without great disparity.
A tree's ULE category is the life expectancy of the tree modified first by its age, health, condition, safety and location (to give the life expectancy); then by economics (i.e. cost of maintenance - retaining trees at an excessive management cost is not normally acceptable); and finally, effects on better trees, and sustained amenity (i.e. establishing a range of age classes in a local population). ULE assessments are not static but may be modified as dictated by changes in tree health and environment. Trees with a short ULE may at present be making a contribution to the landscape, but their value to the local amenity will decrease rapidly towards the end of this period, prior to them being removed for safety or aesthetic reasons.

ULE categories (modified from Barrell 2001) The five categories and their sub-groups are as follows:

1. Long ULE - tree appeared retainable at the time of assessment for over 40 years with an acceptable degree of risk, assuming reasonable maintenance:

A. structurally sound trees located in positions that can accommodate future growth
B. trees which could be made suitable for long term retention by remedial care
C. trees of special significance which would warrant extraordinary efforts to secure their long term retention

2. Medium ULE - tree appeared to be retainable at the time of assessment for 15 to 40 years with an acceptable degree of risk, assuming reasonable maintenance:

A. trees which may only live from 15 to 40 years
B. trees which may live for more than 40 years but would be removed for safety or nuisance reasons
C. trees which may live for more than 15 years but would be removed to prevent interference with more suitable individuals or to provide space for new planting
D. trees which could be made suitable for retention in the medium term by remedial care

3. Short ULE - tree appeared to be retainable at the time of assessment for 5 to 15 years with an acceptable degree of risk, assuming reasonable maintenance:

A. trees which may only live from 5 to 15 years
B. trees which may live for more than 15 years but would be removed for safety or nuisance reasons
C. trees which may live for more than 15 years but would be removed to prevent interference with more suitable individuals or to provide space for new planting
D. trees which require substantial remediation and are only suitable for retention in the short term

4. Removal - trees which should be removed within the next 5 years.

A. dead, dying, suppressed or declining trees because of disease or inhospitable conditions.
B. dangerous trees through instability or recent loss of adjacent trees
C. dangerous trees because of structural defects including cavities, decay, included bark, wounds or poor form.
D. damaged trees that are clearly not safe to retain.
E. trees which may live for more than 5 years but would be removed to prevent interference with more suitable individuals or to provide space for new planting.
F. trees which are damaging or may cause damage to existing structures within the next 5 years.
G. trees that will become dangerous after removal of other trees for the reasons given in (a) to (f).
H. trees in categories (a) to (g) that have a high wildlife habitat value and, with appropriate treatment, could be retained subject to regular review.

5. Small, young or regularly pruned - Trees that can be reliably moved or replaced.

A. small trees less than 5m in height.
B. young trees less than 15 years old but over 5m in height.
C. formal hedges and trees intended for regular pruning to artificially control growth

Part 2 of 3—IACA Significance of a Tree, Assessment Rating System (STARS)©

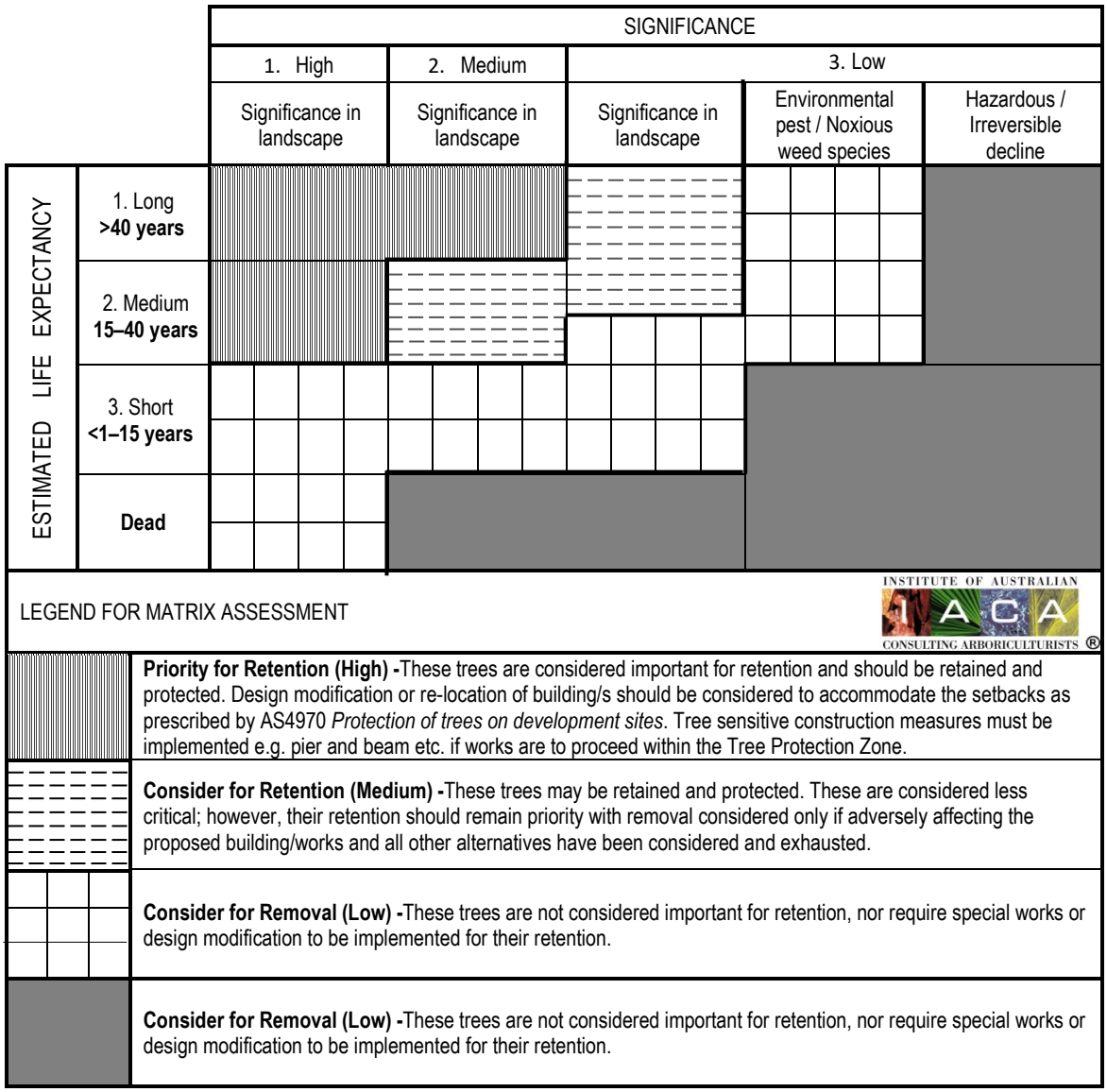
The landscape significance of a tree is an essential criterion to establish the importance that a particular tree may have on a site. However, rating the significance of a tree becomes subjective and difficult to ascertain in a consistent and repetitive fashion due to assessor bias. It is therefore necessary to have a rating system utilising structured qualitative criteria to assist in determining the retention value for a tree. To assist this process all definitions for terms used in the *Tree Significance - Assessment Criteria* and *Tree Retention Value - Priority Matrix*, are taken from the IACA Dictionary for Managing Trees in Urban Environments 2009.
The system uses a scale of *High*, *Medium* and *Low* significance in the landscape. Once the landscape significance of an individual tree has been defined, the retention value can be determined.

Tree Significance - Assessment Criteria

1. HIGH SIGNIFICANCE IN LANDSCAPE
The tree is in good condition and good vigour
The tree has a form typical for the species
The tree is a remnant or is a planted locally indigenous specimen and/or is rare or uncommon in the local area or of botanical interest or of substantial age
The tree is listed as a Heritage Item, Threatened Species or part of an Endangered Ecological Community, or listed on Councils Significant Tree Register
The tree is visually prominent and visible from a considerable distance when viewed from most directions within the landscape due to its size and scale and makes a positive contribution to the local amenity
The tree supports social and cultural sentiments or spiritual associations, reflected by the broader population or community group or has commemorative values
The tree's growth is unrestricted by above and below ground influences, supporting its ability to reach dimensions typical for the taxa *in situ* - tree is appropriate to the site conditions
2. MEDIUM SIGNIFICANCE IN LANDSCAPE
The tree is in fair-good condition and good or low vigour
The tree has a form typical or atypical for the species
The tree is a planted locally indigenous or a common species with its taxa commonly planted in the area
The tree is visible from surrounding properties, although not visually prominent as partially obstructed by other vegetation or buildings when viewed from the street.
The tree provides a fair contribution to the visual character and amenity of the local area.
The tree's growth is moderately restricted by above and/or below ground influences, reducing its ability to reach dimensions typical for the taxa *in situ*.
3. LOW SIGNIFICANCE IN LANDSCAPE
The tree is in fair-poor condition and good or low vigour
The tree has a form atypical for the species
The tree is not visible or is partly visible from surrounding properties as obstructed by other vegetation or buildings
The tree provides a minor contribution or has a negative impact on the visual character and amenity of the local area.
The tree is a young specimen which may or may not have reached dimension to be protected by local Tree Preservation orders or similar protection mechanisms and can easily be replaced with a suitable specimen
The tree's growth is severely restricted by above or below ground influences, unlikely to reach dimensions typical for the taxa *in situ* - tree is inappropriate to the site conditions
The tree is listed as exempt under the provisions of the local Council Tree Preservation Order or similar protection mechanisms
The tree has a wound or defect that has potential to become structurally unsound.
Environmental Pest / Noxious Weed Species
–The tree is an Environmental Pest Species due to its invasiveness or poisonous/ allergenic properties
–The tree is a declared noxious weed by legislation
Hazardous/Irreversible Decline
–The tree is structurally unsound and/or unstable and is considered potentially dangerous
–The tree is dead, or is in irreversible decline, or has the potential to fail or collapse in full or part in the immediate to short term

The tree is to have a minimum of three (3) criteria in a category to be classified in that group.
The assessment criteria are for individual trees only, however, can be applied to a monocultural stand in its entirety e.g. hedge.
In the development of this document IACA acknowledges the contribution and original concept of the Tree Significance & Retention Value Matrix, developed by Footprint Green Pty Ltd and Andrew Morton in June 2001.

Part 3 of 3—Tree Retention Value Priority Matrix



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APPENDIX C

TREE PROTECTION DEVICES

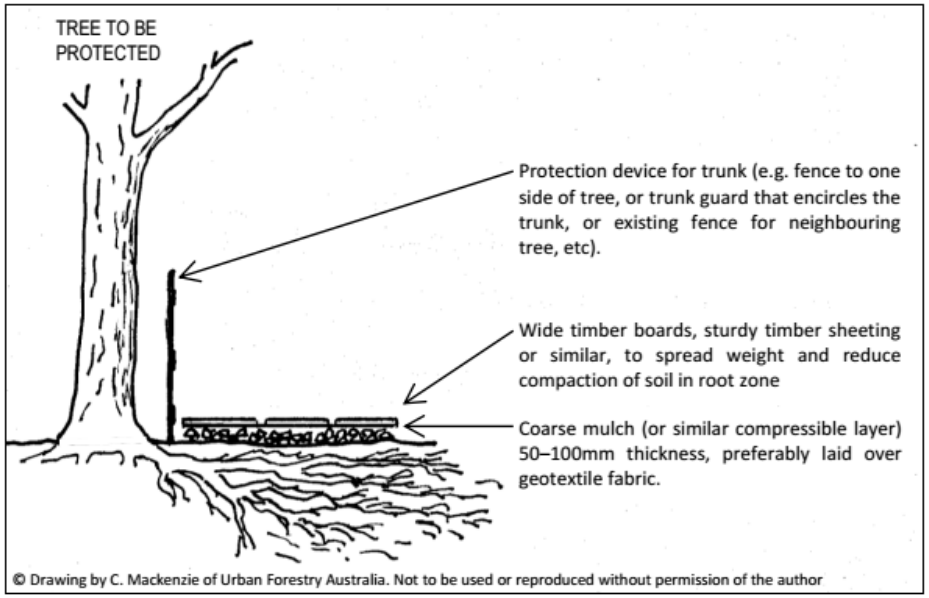


Figure 1
A method of reducing risk of root damage and soil compaction within the tree's Structural Root Zone.

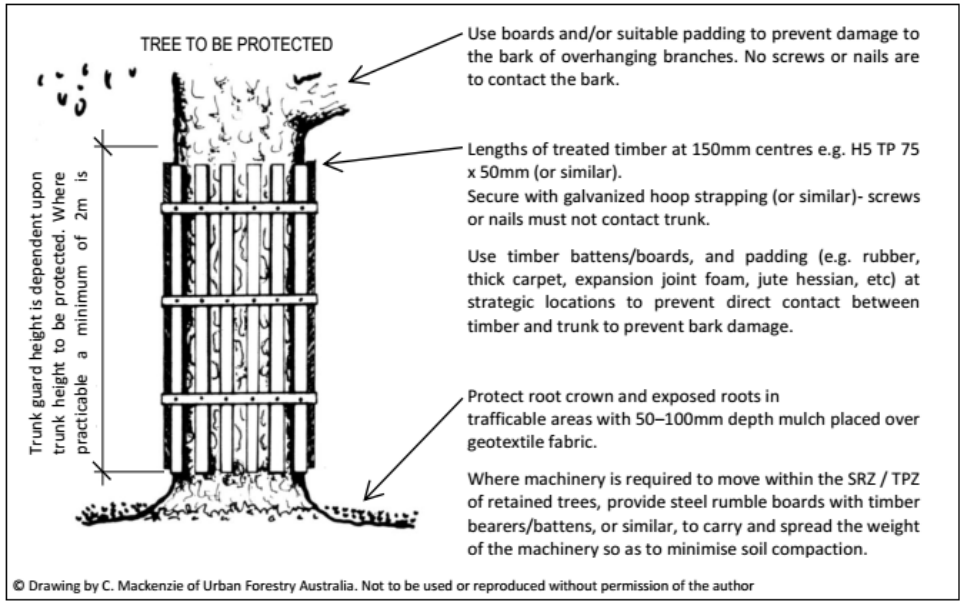


Figure 2
Example of tree trunk and tree branch protection.

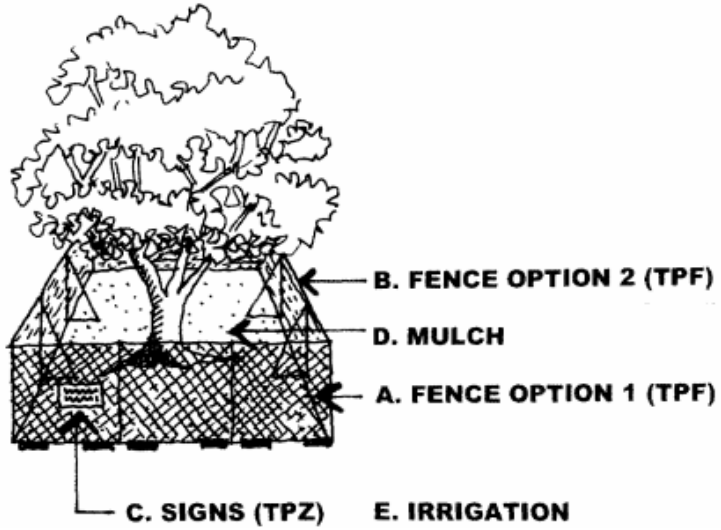
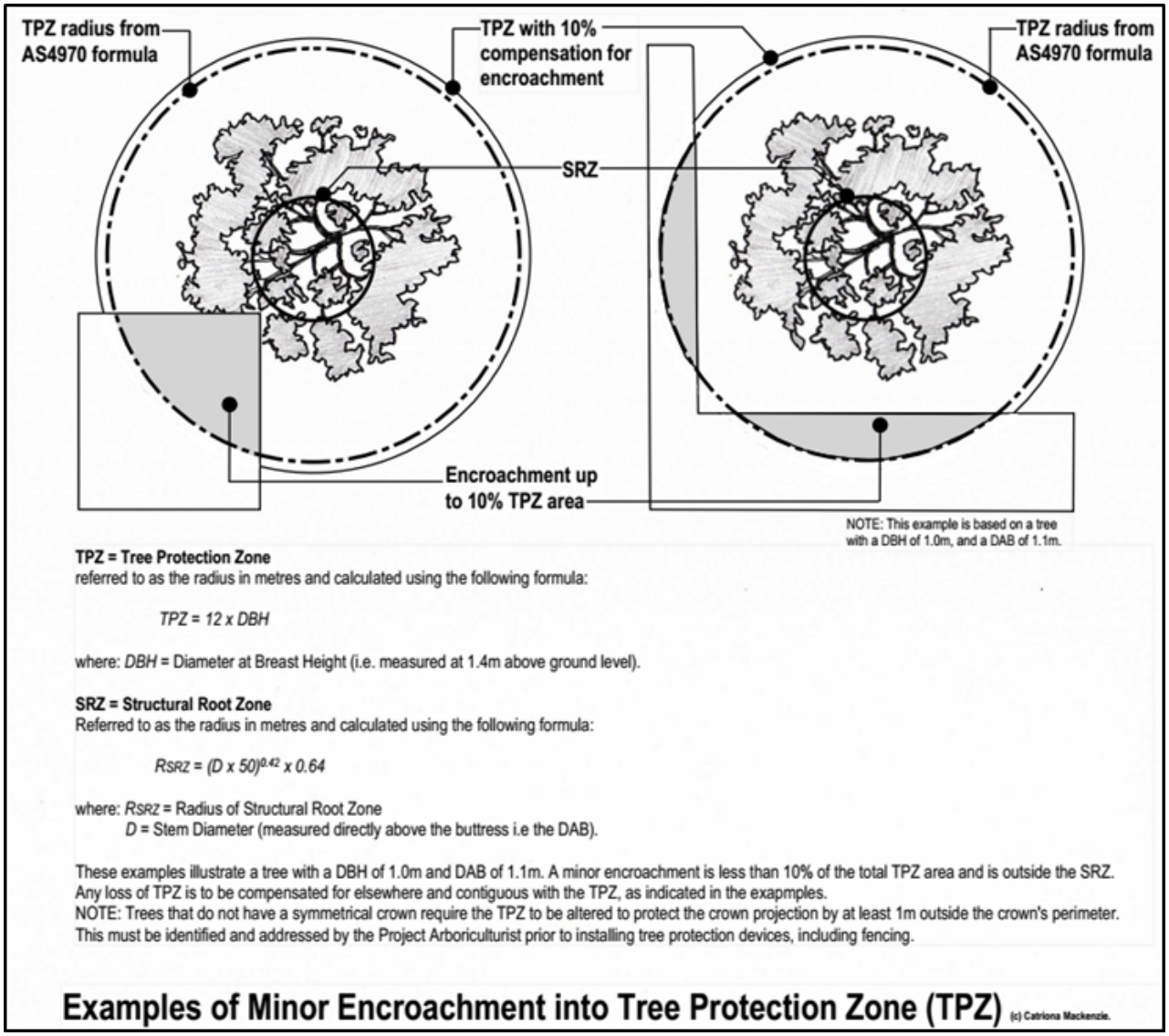


Figure 3
TREE PROTECTIVE FENCING (TPF)
A. Fence Option 1 (TPF)
1.8 metre high chain wire mesh panels with shade cloth attached if required, to be held in place with concrete blocks.
B. Fence Option 2 (TPF)
1.8 metre high plywood or wooden panel/paling fence (prevents soil or building contaminants from coming under fence when panels are laid flush to ground).
C. Signs (TPZ)
Tree Protection Zone Signs
D. Mulch
50mm to 100mm thick layer of organic mulch, or aggregate, installed across surface area of TPZ.
E. Irrigation
Irrigation to arborist's advice.
© Drawing by Selena Hannan. Used with permission.

TREE PROTECTION ZONE SIGNAGE

Size: Approximate dimensions 225 x 300mm.
Material: Polypropylene or colourbond steel.



Include the Project Arboriculturist's details in the 'Contact' panel.

APPENDIX D

SCHEDULE OF ASSESSED TREES

Schedule of Assessed Trees—39 Cabbage Tree Road, Bayview. February 2018 and August 2019

Tree No.	*Genus & species* Common Name	Ht (m)	Sp (m)	DBH (mm)	Age	V	C	Comments	ULE	TSR	RV	SRZ (m)	TPZ (m)	TPZ (m^2)
1	*Eucalyptus robusta* **Swamp Mahogany**	-	-	-	-	-	-	Tree is dead. No observable hollows.	-	-	-	-	-	-
2	*Eucalyptus robusta* **Swamp Mahogany**	9 – 10	9	450	M	Fair	Poor	Locally indigenous species. Street tree. Suppressed and overtopped by other Swamp Mahoganies. Dieback of smaller, interior branches. Dieback to S with epicormic shoots to scaffolds. Minor abrasion injury to branches from nearby River She-oak.	3D	M	L	2.5	5.4	92.0
3	*Eucalyptus robusta* **Swamp Mahogany**	26	18	1135	OM	Fair	Fair	Locally indigenous species. Street tree. Thinning crown. Several old branch tears/failures. Large hanger in crown over road. Scattered dieback of tips and smaller branches throughout crown. No major deadwood noted. Possible termites. Needs aerial inspection by Council.	2D	H	H	3.8	13.6	581.0
4	*Eucalyptus robusta* **Swamp Mahogany**	20	13	700	LM	Fair to Good	Fair	Locally indigenous species. Street tree. Crown bias to N, over road. Moderate amount of scattered deadwood up to 180mmØ. Some dieback to tips and smaller branches in mid-crown area.	2D	H	H	2.9	8.4	222.0
5	*Eucalyptus robusta* **Swamp Mahogany**	16 – 17	12	525	M	Good	Fair	Locally indigenous species. Street tree. On edge of bank of open drain. Slight stem lean and crown bias to NNW. Some suppression, with deadwood up to 110mmØ to lower interior of crown.	2D	M	M	2.7	6.3	124.0
6	*Eucalyptus robusta* **Swamp Mahogany**	23	14	750	LM	Good	Fair	Locally indigenous species. Street tree. Stem to S with some bulging @ 2 & 6m. Co-dominant scaffolds @ 9m, with obvious compression fork. Moderate amount of deadwood to 80mmØ.	2D	H	M	3.1	9.0	255.0
7	*Eucalyptus robusta* **Swamp Mahogany**	22 – 24	18	800	LM	Good	Fair	Locally indigenous species. Street tree. Dead and broken low scaffold to SSE. Suppressed to S. Crown bias to N, over road. Moderate amount of deadwood up to 100mmØ.	2D	H	H	3.2	9.6	290.0

Tree No.	*Genus & species* Common Name	Ht (m)	Sp (m)	DBH (mm)	Age	V	C	Comments	ULE	TS R	RV	SRZ (m)	TPZ (m)	TPZ (m^2)
8	*Eucalyptus robusta* **Swamp Mahogany**	23	15	700	M	Good	Fair?	Locally indigenous species. Street tree. Stem and crown bias to N. Moderate amount of deadwood throughout crown – up to 200mmØ. Some tip and small branch dieback to lower-mid scaffolds, with many epicormic shoots. Cavity approximately 13m AGL. Tree should be subject to aerial inspection.	2D?	H	H?	2.9	8.4	222.0
9	*Eucalyptus robusta* **Swamp Mahogany**	13	10	575	M	Fair	Fair	Locally indigenous species. Canopy bias to W. Large branch tear-out at 2.5m, probable old termite damage. Large diameter deadwood throughout. Many large Ø epicormic branches.	2D	M	M	2.8	7.0	152.0
10	*Eucalyptus robusta* **Swamp Mahogany**	16	9	400	M	Fair	Fair to Poor	Locally indigenous species. Two stems from ground level. Smaller stem bent at 90º at 3m, with large tear-out at 2m. Larger stem with large Ø surface root -damage on W (cut or torn close to base). Some large Ø deadwood, large Ø epicormics. Many small epicormics.	3A	M	L	2.5	4.8	72.0
11	*Eucalyptus robusta* **Swamp Mahogany**	-	-	-	-	-	-	Dead. No observable hollows.	-	-	-	-	-	-
12	*Eucalyptus robusta* **Swamp Mahogany**	18	8	475	M	Fair to Good	Fair	Locally indigenous species. Large Ø deadwood. Some large Ø branch failures/tear-outs in upper canopy. Minor dieback, large Ø epicormics-fairly typical condition of tree of this age. High crown. May require removal of one branch heading towards SE for clearance of proposed building.	2D	M	M	2.6	5.8	104.0
13	*Eucalyptus robusta* **Swamp Mahogany**	-	-	-	-	-	-	Dead. No observable hollows.	-	-	-	-	-	-
14	*Eucalyptus robusta* **Swamp Mahogany**	16	9	500	M	Very poor	Very poor	Locally indigenous species. Smaller, secondary stem dead. Live stem with crown bias to E. Termite damage evident. Lean at base towards S, has self-corrected, but has old large wound with decay on N side at ground level. Large Ø deadwood, very sparse foliage, mostly epicormic.	4A	M	L	2.6	6.0	113.0

Tree No.	*Genus & species* Common Name	Ht (m)	Sp (m)	DBH (mm)	Age	V	C	Comments	ULE	TSR	RV	SRZ (m)	TPZ (m)	TPZ (m^2)
15	*Eucalyptus robusta* **Swamp Mahogany**	22	16	*600	M	Fair	Good?	Locally indigenous species. Inspection limited –within neighbouring property. Near fence of golf course storage yard, with unsealed road immediately adjacent to tree-roots probably compromised/compacted by vehicles. Minor epicormics, minor dieback. Possible stem wound at ground level on S.	2D?	H	H?	2.8	7.2	163.0
16	*Eucalyptus robusta* **Swamp Mahogany**	20	13	*625	M	Fair	Fair?	Locally indigenous species. Inspection limited as tree located within adjacent property - as above. Large swelling on S side at 1m. Extensive epicormics, moderate amount of medium Ø deadwood. Large branch failure/tear-out with bark cracking in central stem.	2D?	H	H?	2.9	7.6	180.0
17	*Casuarina glauca* **Swamp She-Oak** (Group of 15 trees)	22	4	100 – 200	SM	Good	Fair	Locally indigenous species. Grove of 15 stems/trees – some may be **suckers** of previously removed trees; some are secondary stems of same trees, closely spaced. Narrow, suppressed form, some dieback on lower branches. Poor stem **taper**. Too closely grouped to consider retention of individuals in any case.	3D	H	L	1.8	2.4	18.0
18	*Casuarina glauca* **Swamp She-Oak**	20	12	600	LM	Good	Fair to Good	Locally indigenous species. Extensive lower canopy dieback due to low light levels. Appears structurally sound, no obvious previous failures. Significant tree.	2A	H	H	2.8	7.2	163.0
19	*Eucalyptus robusta* **Swamp Mahogany**	17	11	*325 + 400 (525)	LM	Good	Good	Locally indigenous species. Limited inspection – outside site boundary. Stem level with base of bank and intermittently submerged. *Convulvulus* vine climbing up stem. Lower/mid-crown epicormics. Some deadwood to 100mm Ø, not excessive volume.	2A?	H	H?	2.6	6.3	124.0
20	*Casuarina glauca* **Swamp She-oak**	21	4	*250	EM	Good	Fair	Locally indigenous species. Outside site boundary-limited inspection. Forest form. Co-dominant stems @ 3m with compression fork.	2D?	M	M?	2.0	3.0	28.0
21	*Casuarina glauca* **Swamp She-Oak**	18	3	*150	EM	Good	Fair	Locally indigenous species. Outside site boundary-limited inspection. Forest form. Stem kink 3m, bias to N.	2D?	M	M?	1.6	2.0	10.0
22	*Casuarina glauca* **Swamp She-Oak**	17	3	200	EM	Good	Fair	Locally indigenous species. Outside site boundary-limited inspection. Forest form.	2D?	M	M?	1.8	2.4	18.0

Tree No.	*Genus & species* Common Name	Ht (m)	Sp (m)	DBH (mm)	Age	V	C	Comments	ULE	TSR	RV	SRZ (m)	TPZ (m)	TPZ (m^2)
23	*Casuarina glauca* **Swamp She-Oak**	18	4	100, 175, 175	EM	Good	Fair	Locally indigenous species. Outside site boundary-limited inspection. Forest form. 3 trees in small grouping. Forest form.	2D?	M	M?	1.7	2.2	15.0
24	*Casuarina glauca* **Swamp She-Oak**	21	6	350	M	Good	Fair	Locally indigenous species. Outside site boundary-limited inspection. Forest form.	2D?	M	M?	2.3	4.2	55.0
25	*Eucalyptus robusta* **Swamp Mahogany**	14	8	*400	SM	Fair	?	Locally indigenous species. Outside site boundary. Suppressed with crown bias to E. Growing adjacent to Tree 19, on side of bank of canal. Difficult to assess due to dense canopy of adjacent trees and palms. Appears to have three stems arising at 5m with bracket fungus near union. Inspection recommended. Canopy sparse, some dieback.	3D?	M	L?	2.4	4.8	72.0
26	*Ceratopetalum apetalum* **Coachwood**	11	8	*150 + 200 (250)	EM	Good	Good	Locally indigenous species. Outside site boundary. Growing on top of bank of canal. Canopy dense to ground level, extends approximately 4m to NW. May require some light pruning to clear proposed building.	2A?	L	M?	2.0	3.0	28.0
27	*Casuarina glauca* **Swamp She-Oak**	21	3	275	EM	Good	Good	Locally indigenous species. Outside site boundary-limited inspection. Growing on top of bank. Appears stable.	2A?	M	M?	2.1	3.3	35.0
28	*Livistona australis* **Cabbage-tree Palm**	9	4	*300	EM	Good	Good	Locally indigenous species. Outside site boundary-limited inspection. Typical form and habit. *Convulvulus* vine up stem.	1A	M	H	NA	3.0	28.0
29	*Eucalyptus robusta* **Swamp Mahogany**	-	-	-	-	-	-	Dead. No observable hollows.	-	-	-	-	-	-
30	*Cinnamomum camphora* **Camphor Laurel**	-	-	-	-	-	-	Introduced exotic weed species. Outside site boundary.	-	-	L	-	-	-
31	*Eucalyptus robusta* **Swamp Mahogany**	15	13	*475	EM	Good	Good?	Locally indigenous species. Outside site boundary-limited inspection. Minor tip dieback. Moderate volume of medium Ø deadwood and branch failures.	2D?	H	H?	2.6	5.8	104.0

Tree No.	*Genus & species* Common Name	Ht (m)	Sp (m)	DBH (mm)	Age	V	C	Comments	ULE	TSR	RV	SRZ (m)	TPZ (m)	TPZ (m^2)
32	*Livistona australis* **Cabbage-tree Palm**	9	4	*300	EM	Good	Good	Locally indigenous species. Outside site boundary-limited inspection. Typical form and habit. No special problems observable at time of inspection.	1A	M	H	NA	3.0	28.0
33	*Eucalyptus robusta* **Swamp Mahogany**	15	7	*350	EM	Good	Fair to Good	Locally indigenous species. Outside site boundary-limited inspection. Suppressed crown to E. No major dieback or deadwood noted.	2A?	M	H?	2.3	4.2	55.0
G1 - G38	*Casuarina cunninghamiana* **River She-oak** **NOTE: TREES G15 – G23 TO BE REMOVED FOR DRIVEWAY.**	16 – 24	8 – 14	Av. 400 (200 – 600)	EM	Good	Fair	Introduced native species. Planted row of 38 trees, generally at boundary of street frontage. Trees numbered C1 – C38 from W to E. Most appear to have been topped at some point. Closely spaced-between 1.5 – 2.5m centres, resulting in strongly ascending branch habit – many with very poor taper. Some trees with inclusions/ notable compression forks. C-26 carries entire stem and crown S into site. Branches extend up to 6-7m into site, at approximately 4m AGL. High landscape significance as a group. Individuals not significant.	2D	H	M	2.4	4.8	72.0

KEY

Prescribed trees to be retained

Prescribed trees proposed to be removed.

Non-prescribed trees exempt from preservation controls under PDCP

L — LOW Retention Value-These trees are not considered important for retention.

M — MEDIUM Retention Value-These trees may be retained and protected.

H — HIGH Retention Value -These trees are considered important for retention and should be retained and protected.

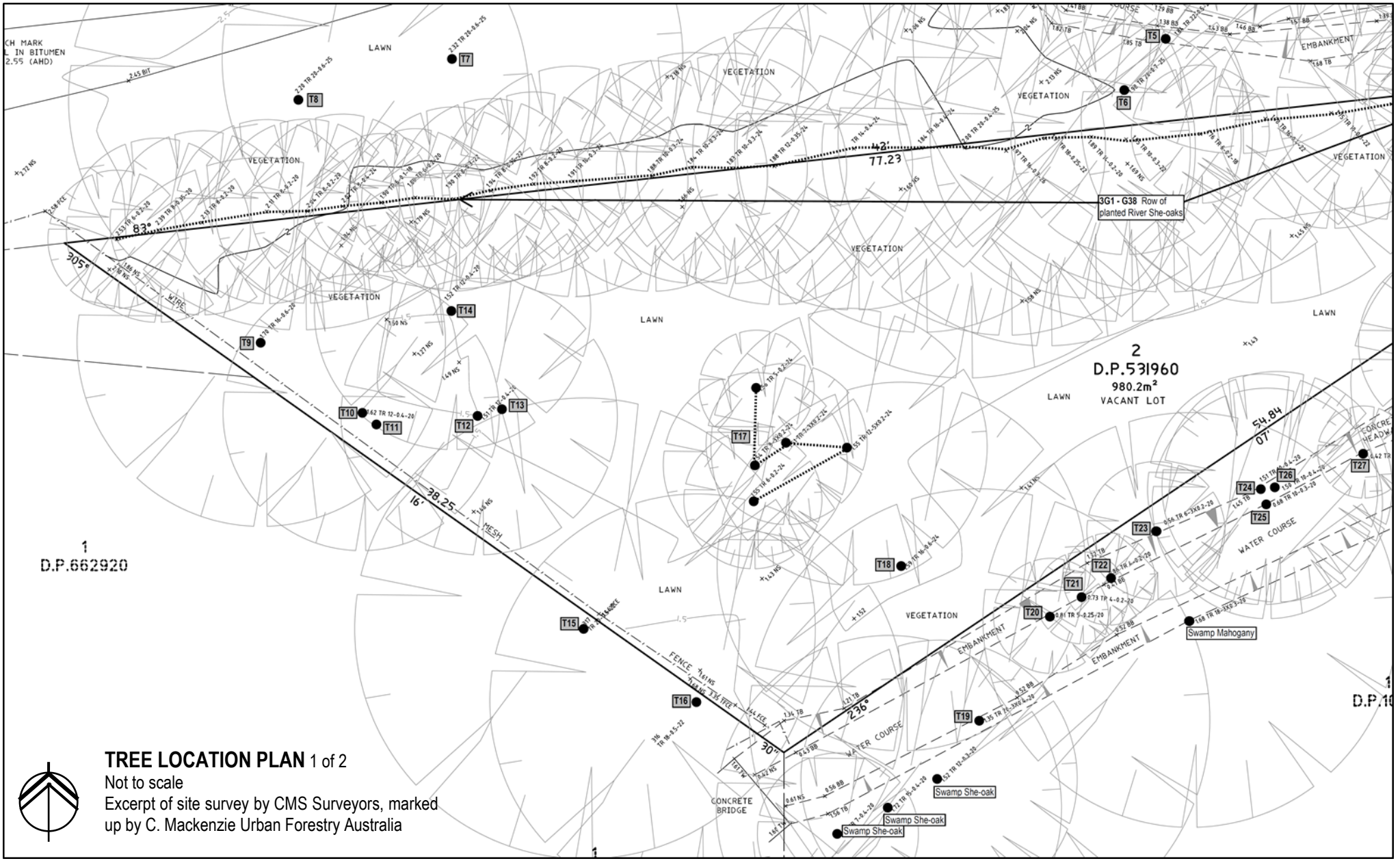
DETAILS FOR HEADINGS AND SYMBOLS USED IN TREE SCHEDULE

***** Denotes those situations where the tree's Diameter at Breast Height (DBH) has been visually estimated (usually adjoining trees or those that are hard to access and/or physically measure).
† The numerical figure in parentheses is the calculated DBH for a multiple stemmed tree, using the AS4970 formula, *or,* is the calculated DBH where the measurement cannot be made at the standard 1.4m above ground level, e.g. where the diameter of the stem is measured at ground level (DGL) or above the buttress (DAB). All calculated figures are rounded up to the nearest 225mm to determine the TPZ offsets.
DAB—The trunk/stem diameter measured *above the buttress*/root and trunk confluence, using a diameter tape
DGL—The trunk/stem diameter measured *at ground level*, using a diameter tape.
AGL—*above ground level*.
? —a tentative result due to inspection limitations, e.g. limited visual access to an adjoining tree, very dense vegetation obscuring tree parts or preventing visual access, a tree that requires more detailed assessment, such as an aerial inspection, decay diagnostic tests, pathology tests, etc.

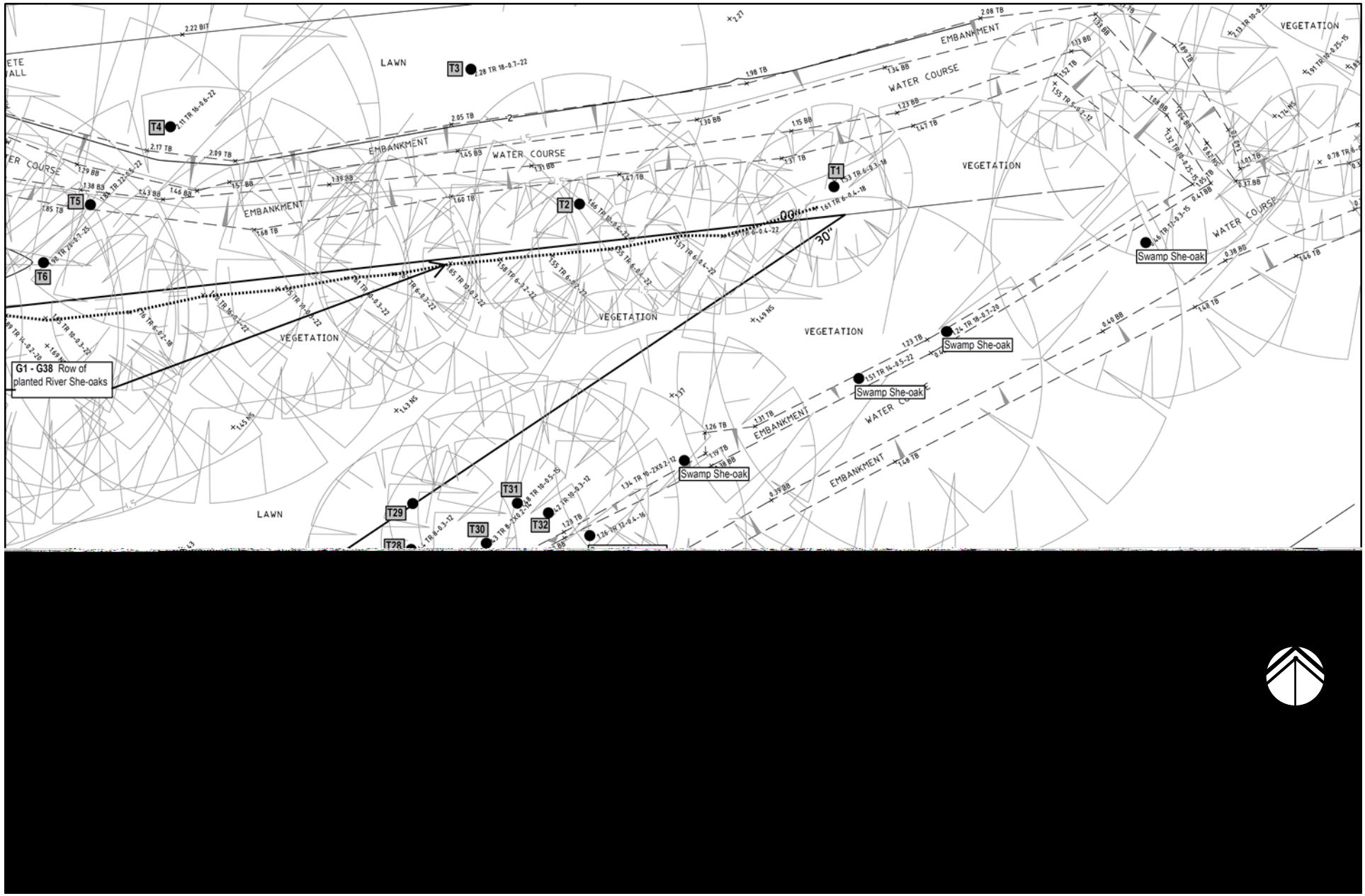
H refers to the approximate height of a tree in metres, from base of stem to top of tree crown.
Sp refers to the approximate and average spread in metres of branches/canopy (the 'crown') of a tree.
DBH refers to the approximate diameter of tree stem at breast height i.e. 1.4 metres above ground (unless otherwise noted) and expressed in millimetres.
Age refer to Appendix A -Terms and Definitions for more detail.
V refers to the tree's vigour (health) Refer to Appendix A -Terms and Definitions for more detail.
C refers to the tree's structural condition. Refer to Appendix A -Terms and Definitions for more detail.
ULE refers to the estimated *Useful Life Expectancy* of a tree. Refer to Appendices A and B for details.
TSR The *Tree Significance Rating* considers the importance of the tree as a result of its prominence in the landscape and its amenity value, from the point of public benefit. Refer to Appendix B – Significance of a Tree Assessment Rating for more detail.
RV Refers to the retention value of a tree, based on the tree's ULE *and* Tree Significance. Refer to Appendix B – Significance of a Tree Assessment Rating for more detail.
SRZ Structural Root Zone (SRZ) refers to the critical area required to maintain stability of the tree. Refer to Appendix A -Terms and Definitions for more detail.
TPZ Tree Protection Zone (TPZ) refers to the *tree protection zones* for trees to be retained. Refer to Appendix A -Terms and Definitions for more detail.
ILR Impact Level rating. Refer to Appendix A -Terms and Definitions for more detail.

APPENDIX E

TREE LOCATION PLANS



TREE LOCATION PLAN 1 of 2
Not to scale
Excerpt of site survey by CMS Surveyors, marked up by C. Mackenzie Urban Forestry Australia


LAWN
EMBANKMENT
WATER COURSE
VEGETATION
T1
T2
T3
T4
T5
T6
T28
T29
T30
T31
T32
Swamp She-oak
G1 - G38 Row of planted River She-oaks