Temporal
TREE MANAGEMENT

Arboricultural Impact Assessment

20 Woodward Street, Cromer
DA2021/1328
27/09/2021

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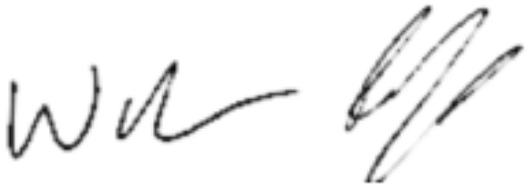
DISCLAIMER

The provision of this report is for the property owners (Kerrie and Alan Leo) for the DA submission for a proposed development at 20 Woodward Street, Cromer. The purpose of this report is to assess the impact on eleven trees adjacent to the property boundaries associated with the proposed development. The author of this report is *Temporal Tree Management Pty Ltd.* This report is not designed for any other purpose. The author accepts no responsibility for the use of this report for purposes other than as an Arboricultural Impact Assessment or if used by any other person / party.

All observations, recommendations and advice expressed within this report are based on *the Australian Standard for the Protection of Trees on Development Sites (AS 4970 2009),* the professional experience of the author, information gathered during the site assessments and information provided by the client(s). Trees are dynamically growing organisms that change over time. No guarantee is implied with respect to future tree condition or safety beyond the advice and recommendations within the report.



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27 September 2021

1. Summary

The purpose of this report is to provide an Arboricultural Impact Assessment (AIA) for the trees located inside and within five metres of the property boundaries at 20 Woodward Street, Cromer. Eleven trees are included in this assessment.

An assessment of the trees within and adjacent to the subject site was undertaken by William Dunlop of *Temporal Tree Management Pty Ltd* on 21/09/2021. The trees were located, identified and their retention value assessed using the TreeAZ model (10.10 NZ) (Barrell Tree Consultancy 2012). Tree protection measures are drawn from and relating to the *Australian Standard for the Protection of Trees on Development Sites* (AS 4970 2009).

Six specimens included in this assessment (Trees 1-3, 5, 7 and 9) were determined to be of High retention value. This reflects their native species significance, larger size and / or external ownership. Five specimens (Trees 4, 6, 8, 9 and 10) were determined to be of Low retention value. This primarily reflects the low species significance, smaller size and / or poor position of these trees.

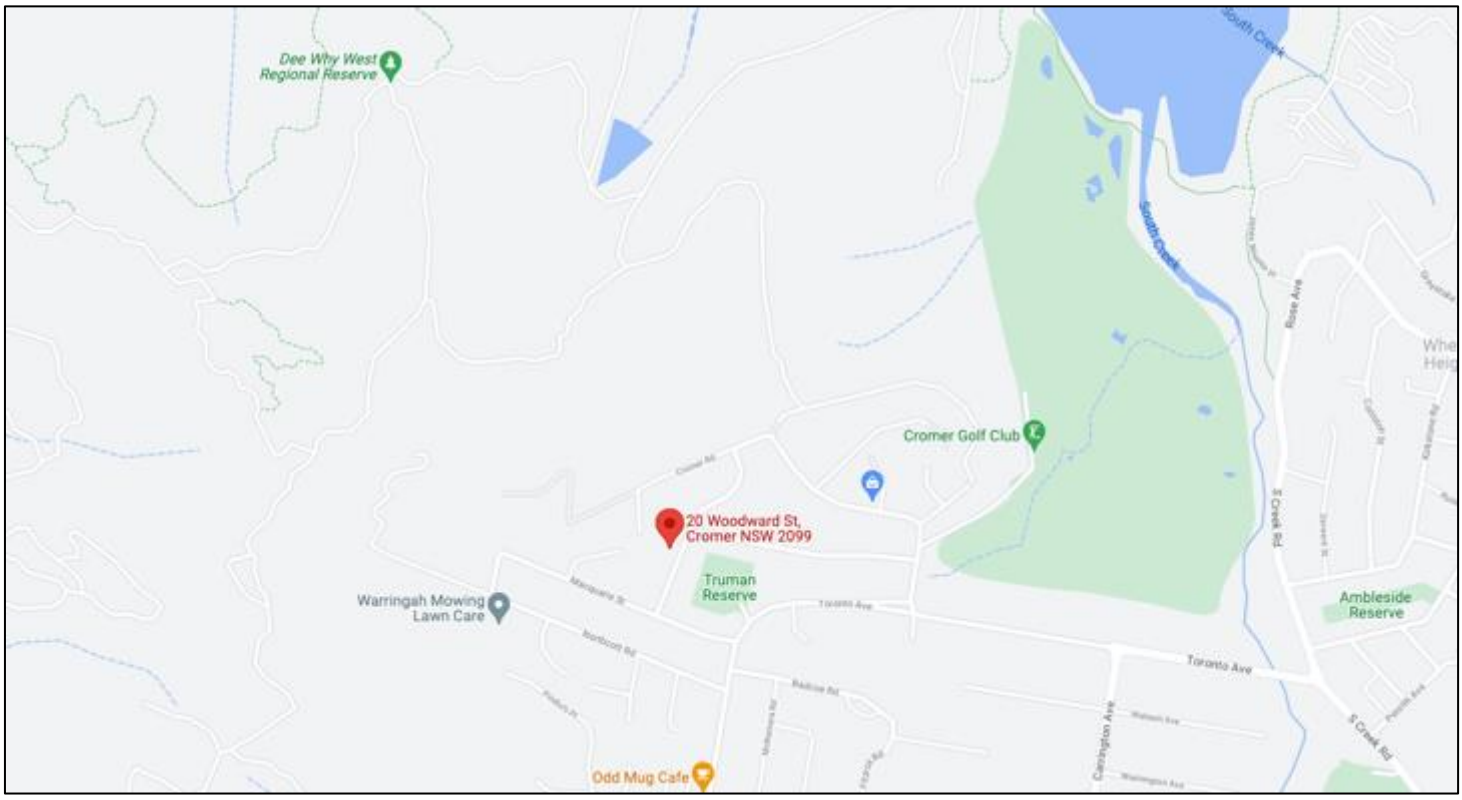
Tree 9 will require pruning to facilitate the proposed development. Specified lateral and descending second and third-order branches within the tree's lower south-eastern canopy will require reduction to allow for the construction of the second storey. A total live canopy reduction of 10-15% and maximum pruning cut diameter of 180mm is estimated for these pruning works. This tree's reasonably high vitality suggests it will respond suitably to the recommended pruning.

Trees 4, 5 and 11 can be suitably retained without the installation of protection measures. Customised tree protection measures are specified for Trees 1-3, 4-6 and 9 due to their position outside or adjacent to the property boundaries of the subject site. Combined TPZs are recommended for Trees 1-3 and 4-6. Exclusion fencing must be installed around the grassed verge in front of Trees 1-3. Exclusion fencing must also be installed along the edge of the raised garden bed containing Trees 6-8. Stem protection measures must be installed on the exposed portion of the stem of Tree 8 above the existing deck. The major TPZ encroachments sustained by Tree 9 is acceptable due to restricted root growth conditions associated with the bedrock and shallow grassed area to be absorbed by the proposed development. The extension on the north-western side of the dwelling must be built on a pier and beam foundation. All pier holes must be excavated using hand tools only. There must be no major root (diameter of 40mm or greater) cutting during the excavation required for the pier holes.

2. Location

2.1. Site Location

The subject site for this Arboricultural Impact Assessment is 20 Woodward Street, Cromer. The land use surrounding this subject site is primarily residential. The subject site is also closely positioned to a number of public green spaces, including Truman Reserve, Dee Why West Regional Reserve and Cromer Golf Club (Map 1). The role played by the mature trees within the subject site in maintaining local amenity and ecological connectivity between these green spaces will be an important consideration of this report.



Map 1. Site location is 20 Woodward Street, Cromer. Image sourced from Google (2021).

2.2. Relevant Policy Context

This property is located within the Northern Beaches local government area. The property is part of an R2 Low-Density Residential zone (Planning NSW 2016). The environmental policy regulations relevant to the trees (woody vegetation taller than 5 metres) within the subject site are drawn from Part 3 of the NSW State Environmental Planning Policy (SEPP) (Vegetation in Non-rural Areas). The policy controls governing the management of the trees are outlined in Part E1 'Preservation of Trees or Bushland Vegetation' of the former Warringah Development Control Plan (2011), which the Northern Beaches Council has adopted for this area (Northern Beaches Council 2021). These policy controls draw from *the Australian Standard for the Protection of Trees on Development Sites* (AS4970 2009) and *the Australian Standard for Pruning Amenity Trees* (AS4373 2007).

2.3. Tree Locations

An assessment of the trees within and adjacent to the subject site was undertaken on 21/09/2021. All trees inside and within five metres of the property boundaries of the subject site were included in this Arboricultural Impact Assessment (Map 2). As stipulated in Part E1 of the Warringah Development Control Plan (2011), woody vegetation was classed as a 'tree' if it was 5 metres or taller in height (Northern Beaches Council 2021). Small trees and shrubs within and adjacent to the western boundary were not included in this assessment as their height did not exceed this threshold requirement (Figure 1).

Eleven trees were included in this assessment (Map 2). The ownership of the trees included in this assessment varied. Trees 1 and 2 are public trees positioned outside the eastern boundary within the Woodward Street grassed verge. Tree 5 is positioned 3.1. metres outside the south-eastern boundary of the subject site within the property of 18 Woodward Street. Trees 8 and 9 are positioned outside the northern boundary within the property of 22 Woodward Street. The stem of Tree 8 is positioned 0.5 metres outside the subject site while the stem of Tree 9 is 4.8 metres outside the northern boundary. The remaining trees are positioned within the property boundaries of the subject site. Trees 3 and 4 are positioned on a steep embankment within the eastern boundary. Trees 6-8 are positioned adjacent to and within the existing balcony on the eastern side of the dwelling. Tree 11 is in an elevated position on an exposed slab of bedrock within the south-western boundary corner (Map 2).

Map 2. Location of eleven trees positioned inside and within five metres of the property boundaries of 20 Woodward Street, Cromer (property boundaries defined in red). Image sourced from SixMaps 2021.

Figure 1. Small trees and shrubs within the northern portion of site were not included in this assessment as their heights did not exceed the threshold requirement.

3. Site Development Plans

Development plans for this property are at the final stage of preparation prior to resubmission. An initial submission response letter from the Northern Beaches Council (15/09/2021) identified the requirement for an Arboricultural Impact Assessment to evaluate the impact of proposed works on the trees within and adjacent to the subject site. The findings of this Preliminary Assessment will determine the retention value of the assessed trees and contribute to the planning and any required redesign for the proposed development. The findings of the Tree Protection Plan will ensure that high retention trees identified in the Preliminary Assessment are suitably protected during the development process.

The planned development works for the subject site involve the addition of a second level to the northern portion of the existing dwelling and an adjoining extension of the dwelling on the north-western side (Figure 3). The adjoining extension will require an expansion of the existing building footprint into the shallow grassed area on the north-western side of the dwelling (Figure 4). This extended building footprint will maintain a 1.07 metre setback from the northern boundary. The existing driveway, deck and dwelling will be retained as part of this development.

There may be an impact on the trees within and adjacent to the subject site associated with the proposed development. Trees 8 and 9 be directly impacted by the planned development due to the position of their stems and structural canopies close to the proposed construction areas within the subject site (Figure 4). Trees 6, 7, 10 and 11 may also be impacted due to their reasonably close proximity to the proposed works areas. Despite their suitable distance from the construction areas, Trees 1-5 may be indirectly impacted through compaction or contamination associated with site access and / or material storage.

It is therefore important that there be an accurate evaluation of the trees' retention value, and for an effective tree protection plan be implemented.

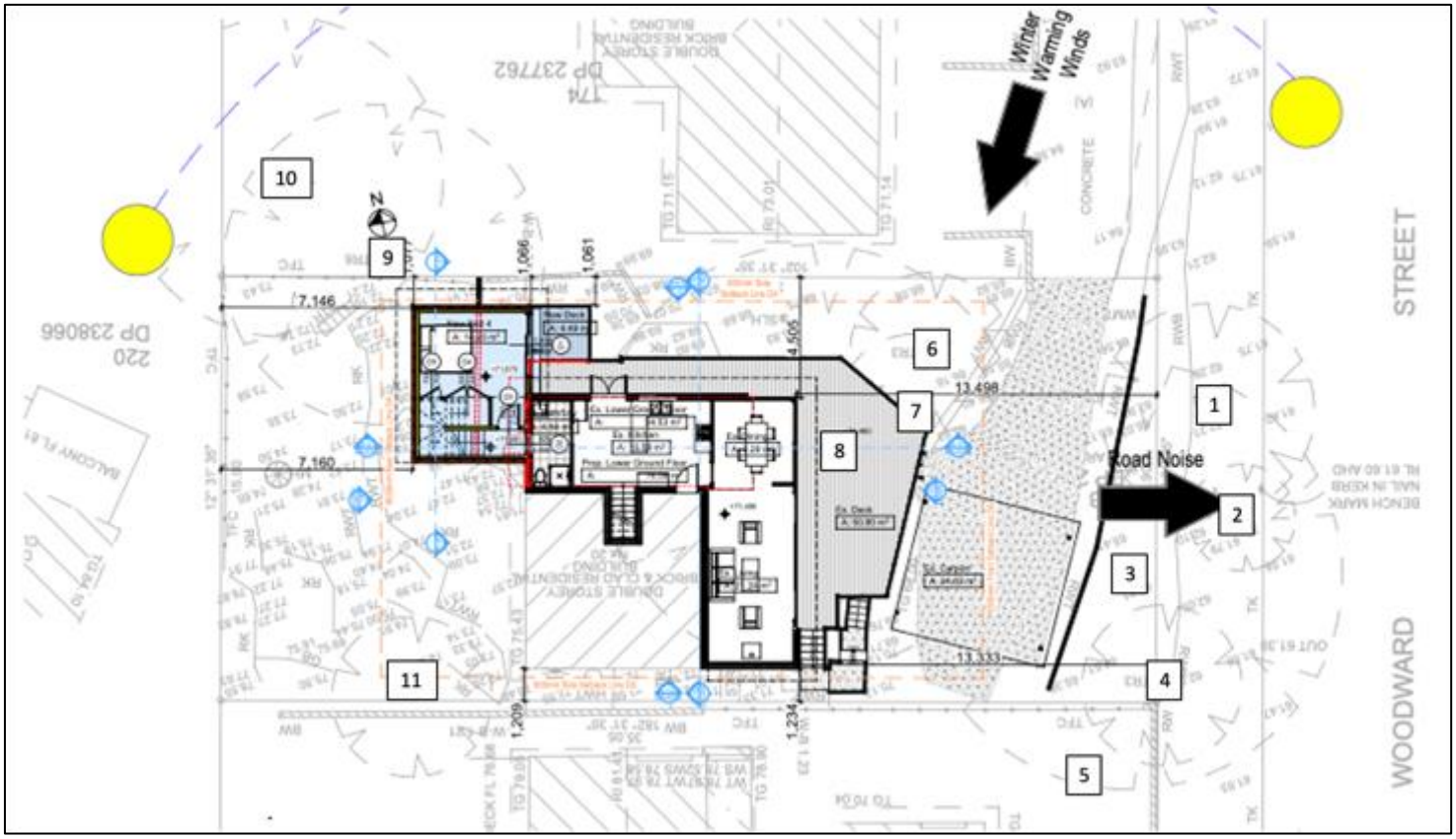


Figure 3. Position of the proposed development works at 20 Wooward Street in relation to Trees 1-11. Site Plan (DA1004) drawn by *Rapid Plans* (10/06/2021) annotated by William Dunlop of *Temporal Tree Management Pty Ltd* (27/09/2021).

Figure 4. Shallow grassed area on north-western side of dwelling to be absorbed by proposed extension in relation to Trees 9 and 10.

4. Preliminary Assessment

4.1 Assessment Methodology

An assessment of the trees within and adjacent to the subject site was undertaken by William Dunlop of *Temporal Tree Management Pty Ltd.* on 21/09/2021. After being located and numbered a visual assessment was carried out for each tree. Visual assessments of trees' health and structure were underpinned by the Visual Tree Assessment method established by Mattheck and Breloar (1994) and the Visual Vitality Index method established by Johnston et al. (2012). The data collected for each individual was used in simple characterisation models for age, origin, health, structure, life expectancy and retention value. Simple characterisations were used to ensure outcomes remained clear and consistent. The format for data collection included:

Ø Tree Number: Determined in Map 2.

Ø Botanical Name: Vegetation was identified and described using botanical names to avoid confusion associated with common name descriptions.

Ø Common Name: Only one common name was used.

Ø Age: Juvenile, Semi – mature, Mature or Over Mature. Judgement on these four categories was determined by professional knowledge and research on the species present.

Ø Origin: Exotic, Native or Indigenous.

Ø Diameter at Breast Height (DBH): An important tree measurement used in arboriculture. DBH was described in mm and used to determine the Tree Protection Zone for each tree.

Ø Diameter at Root Flare (DRF): An important tree measurement used in arboriculture. DRF was described in mm and used to determine the Structural Root Zone for each tree.

Ø Height: Measured in metres using a *Nikon Forestry Pro* laser height meter.

Ø Canopy Width: Estimated in metres from north– south x east – west. This information is included in Appendix A.

Ø Health: Dead, Poor, Fair, Good or Excellent. Professional experience along with the visual vitality index established by Johnston et al. (2012) was used to underpin these categories (Appendix B).

Ø Structure: Failed, Very Poor, Poor, Fair, Good or Excellent. Professional experience along with VTA method established by Mattheck and Breloar (1994) was used to underpin these categories.

Ø Useful Life Expectancy (ULE): Long (greater than 30 years), Medium (30 years – 7 years), Short (7 – 1 years) or Remove (less than 1 year). These categories were established by Barrell Tree Consultancy (2010) and provide an important estimate of a tree's remaining safe life span based on species knowledge and an individual's structure and health.

Ø Retention Value: Retention value was split into two categories as defined by the TreeAZ method; A or Z (Barrell Tree Consultancy 2012). Category A stipulates that a tree should be retained, and efforts made in the design planning and construction to ensure its survival. Category Z determines that a tree's retention is not a priority and it should not constrain design, planning or construction. Categories were determined using the tree assessment data and TreeAZ model criteria (Figure 5) (Barrell Tree Consultancy 2012).

Ø Tree Protection Zone (TPZ): This measure provides the principle means of protecting trees on construction sites. A TPZ radius (R_{TPZ}) may be calculated using the equation from the Australian Standard for the Protection of Trees on Development Sites (AS 4970 2009):

$$\mathbf{R_{(TPZ)} = DBH \times 12.}$$

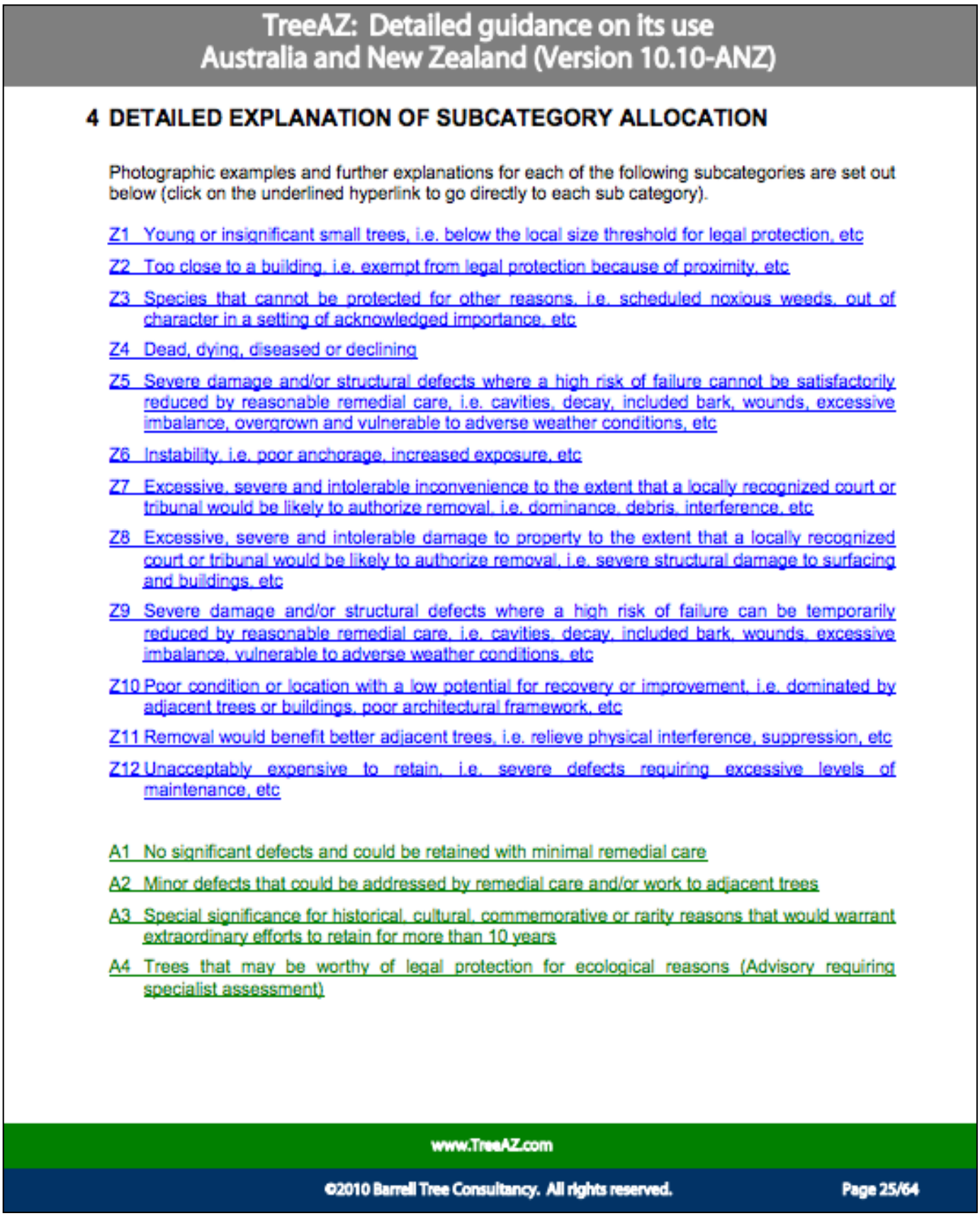
Once a TPZ is established, all construction activity should be excluded from within its borders. Encroachments may occur under further arboricultural assessment, advice and supervision.

Ø Structural Root Zone (SRZ): This measure provides an indication of the portion of a tree's root plate that is considered fundamentally important for the maintenance of structural integrity. An SRZ radius (R_{SRZ}) may be calculated using the equation from the *Australian Standard for the Protection of Trees on Development Sites* (AS 4970 2009):

$$\mathbf{R_{(SRZ)} = (DRF \times 50)^{0.42 \times} 0.64}$$

Ø Encroachment (%): Proportional encroachment area of the building envelope of the proposed development within an individual tree's TPZ. Calculated using the Treetec TPZ Encroachment Calculator (2021). This category is included in Table 1.

Ø Comments: Any additional information explaining an individual's health, structure, ULE or retention value categorization. This information is included in Appendix A.



TreeAZ: Detailed guidance on its use
Australia and New Zealand (Version 10.10-ANZ)

4 DETAILED EXPLANATION OF SUBCATEGORY ALLOCATION

Photographic examples and further explanations for each of the following subcategories are set out below (click on the underlined hyperlink to go directly to each sub category).

Z1 Young or insignificant small trees, i.e. below the local size threshold for legal protection, etc

Z2 Too close to a building, i.e. exempt from legal protection because of proximity, etc

Z3 Species that cannot be protected for other reasons, i.e. scheduled noxious weeds, out of character in a setting of acknowledged importance, etc

Z4 Dead, dying, diseased or declining

Z5 Severe damage and/or structural defects where a high risk of failure cannot be satisfactorily reduced by reasonable remedial care, i.e. cavities, decay, included bark, wounds, excessive imbalance, overgrown and vulnerable to adverse weather conditions, etc

Z6 Instability, i.e. poor anchorage, increased exposure, etc

Z7 Excessive, severe and intolerable inconvenience to the extent that a locally recognized court or tribunal would be likely to authorize removal, i.e. dominance, debris, interference, etc

Z8 Excessive, severe and intolerable damage to property to the extent that a locally recognized court or tribunal would be likely to authorize removal, i.e. severe structural damage to surfacing and buildings, etc

Z9 Severe damage and/or structural defects where a high risk of failure can be temporarily reduced by reasonable remedial care, i.e. cavities, decay, included bark, wounds, excessive imbalance, vulnerable to adverse weather conditions, etc

Z10 Poor condition or location with a low potential for recovery or improvement, i.e. dominated by adjacent trees or buildings, poor architectural framework, etc

Z11 Removal would benefit better adjacent trees, i.e. relieve physical interference, suppression, etc

Z12 Unacceptably expensive to retain, i.e. severe defects requiring excessive levels of maintenance, etc

A1 No significant defects and could be retained with minimal remedial care

A2 Minor defects that could be addressed by remedial care and/or work to adjacent trees

A3 Special significance for historical, cultural, commemorative or rarity reasons that would warrant extraordinary efforts to retain for more than 10 years

A4 Trees that may be worthy of legal protection for ecological reasons (Advisory requiring specialist assessment)

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Figure 5. TreeAZ model 10.10.NZ criteria as used by Barrell Tree Consultancy (2012). (Access via http:/www.treeaz.com/downloads/Document-06-311210.pdf 2017).

4.2. Tree Data

Table 1. Summarised tree data for eleven trees assessed at 20 Woodward Street, Cromer. Trees determined to be of High retention value (A1-4) are annotated in Blue, trees of Low retention value are annotated in Red (Z1-12).

Tree	Botanical Name	Health	Structure	ULE	Retention	DBH (m)	DRF (m)	Height (m)	$R_{(TPZ)}$ (m)	$R_{(SRZ)}$ (m)	Encroachment (%)
1	*Araucaria columnaris*	Good	Good	Long	A4	0.39	0.43	9	4.68	2.32	0
2	*Liquidambar styraciflua*	Fair	Poor	Medium	A4	0.2	0.23	5	2.4	1.79	0
3	*Eucalyptus botryoides*	Good	Fair	Medium	A1	0.53	0.69	19	6.36	2.83	0
4	*Angophora costata* subsp. *costata*	Poor	Poor	Short	Z10	0.29	0.42	6	3.48	2.30	0
5	*Angophora costata* subsp. *costata*	Poor	Fair	Medium	A1	0.35	0.42	8	4.2	2.30	0
6	*Syagrus romanzoffiana*	Good	Good	Short	Z3	0.23	0.4	10	2.5	N/A	0
7	*Livestona austrlis*	Good	Good	Medium	A1	0.29	0.41	9	2.5	N/A	0
8	*Angophora costata* subsp. *costata*	Very Poor	Poor	Short	Z2	0.63	0.78	3	7.56	2.98	0
9	*Angophora costata* subsp. *costata*	Fair	Poor	Medium	A1	0.42	0.48	12	5.04	2.43	30.1
10	Dead Tree	Dead	Poor	Remove	Z4	0.44	0.5	11	5.28	2.47	0
11	*Callistemon viminalis*	Fair	Poor	Medium	Z10	0.25	0.28	5	3	1.94	0

5. Summary and Recommendations

The eleven trees included in this assessment were observed to be of variable size, condition and ownership. The retention values observed for these specimens were also variable.

Six trees were determined to be of High retention value within the surrounding landscape. Trees 1 and 2 are street trees positioned outside the eastern boundary of the subject site within the Woodward Street grassed verge. These two trees were determined to be of A4 High retention value due to their public ownership. Trees 3 and 7 are specimens positioned inside the subject site that were observed to be in good condition and are of indigenous species value. They were therefore determined to be of A1 High retention value within the surrounding landscape. Trees 5 and 9 are positioned outside the property boundaries of the subject site. These trees were both observed to have reduced health or structural condition, which underpinned their shortened ULE estimates. Despite this, their indigenous species value and external ownership renders them of A1 High retention value within the surrounding landscape.

The retention of these six trees is therefore a priority within this landscape. If retained, protection measures compliant with *the Australian Standard for the Protection of Trees on Development Sites (AS4970 2009)* must be established for these trees prior to the commencement of any demolition or construction activity as part of the proposed development.

Five specimens were determined to be Low retention value in this assessment. Tree 4 was observed to be a small tree in poor condition and with a short ULE estimate. This tree was therefore determined to be of Z10 low retention value despite its indigenous species value. Trees 6, 8 and 10 were observed to be very closely positioned to the existing dwelling, low species significance and or dead/dying condition. These three specimens were therefore determined to be of Z3 Low retention value due to their exemption from the protection controls outlined in Part E1 of the Warringah DCP (2011). Tree 11, which is a Bottlebrush specimen positioned within the south-western boundary of the subject site, was determined to be of Z10 low retention status due to its small size and poor structural condition.

The retention of these fi trees should therefore not obstruct or alter the proposed development plans. If retained, these trees must also be adequately protected in compliance with the *AS4970 (2009)* for the duration of the works.

6. Tree Protection Plan

The relevant tree protection measures outlined in *AS4970 (2009)* have been included for the purpose of providing an effective Tree Protection Plan for the proposed development.

6.1. Tree Protection Measures

All tree protection measures have been established in accordance with the *AS4970 (2009)*. Tree protection zones (TPZs) and structural root zones (SRZs) have been calculated for all trees in Section 4.2 of this report. These zones are aimed at preventing soil compaction, contamination and physical damage to trees above and below ground (Matheny and Clark 1994). As such, all construction activity is excluded from designated TPZ areas. The TPZ and SRZ measurements are provided as a radial measurement that determines the circular areas of above and below ground exclusion (Figure 6).

The calculation of the radial measurement for the TPZ areas of palm specimens differs due to differences in their root plate morphology. The radial measurement for palm specimens was calculated by adding 1 metre to an individual's canopy width as specified in AS4970 (2009).

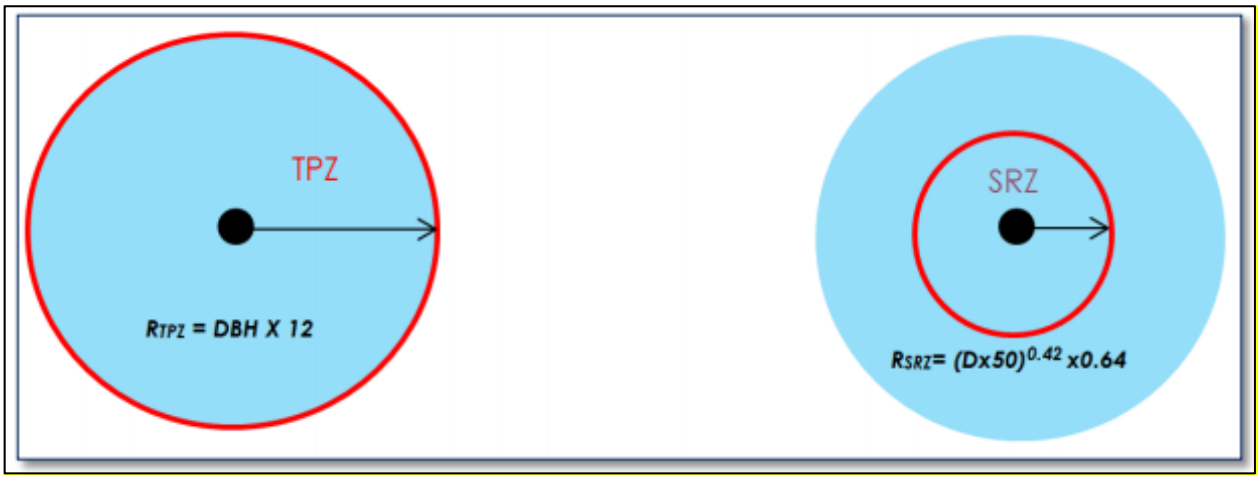

Figure 6. TPZ and SRZ radial measurement equations.

6.2. Tree Protection Zones

The Tree Protection Zone (TPZ) is an above and below – ground area that excludes any construction activity and is the principal means of protecting trees on construction sites (Matheny and Clark 1994). The area contained within the TPZ is fundamentally important in trees' long-term survival (Matheny and Clark 19994).

The area established by the radial measurement should be enclosed by 1.8 metre steel fencing that is securely fixed to the ground as stated in Section 4.3 of AS4970 (2009) (Figure 7). Signage stating the purpose of these exclusion zones should be fixed to the fencing so that it is visible from all points within the site.

The structural root zone is the predicted area in which roots that ensure a trees' stability are located (Day et al. 2009). The SRZ for a tree is located within its TPZ. Under no circumstances should construction activity occur within the SRZ without the presence and consultation of the project arborist.

Encroachments of construction activity may only occur with the consultation and permission of the project arborist. As defined in Section 5 of the AS4970 (2009), encroachments of less than 10% of the total TPZ area may occur without the site presence of the project arborist providing there is an equal compensation of area elsewhere within the TPZ. Major encroachments of more the 20% require added consultation from the project arborist. Suitability for major encroachments is site specific and depend on the vitality of the tree and extent of the encroachment. A root mapping report may be required to determine if the tree will be able to sustain the level of encroachment. The presence of the project arborist during all such construction activity is required. An equal amount of compensated area should also be added to the TPZ elsewhere.

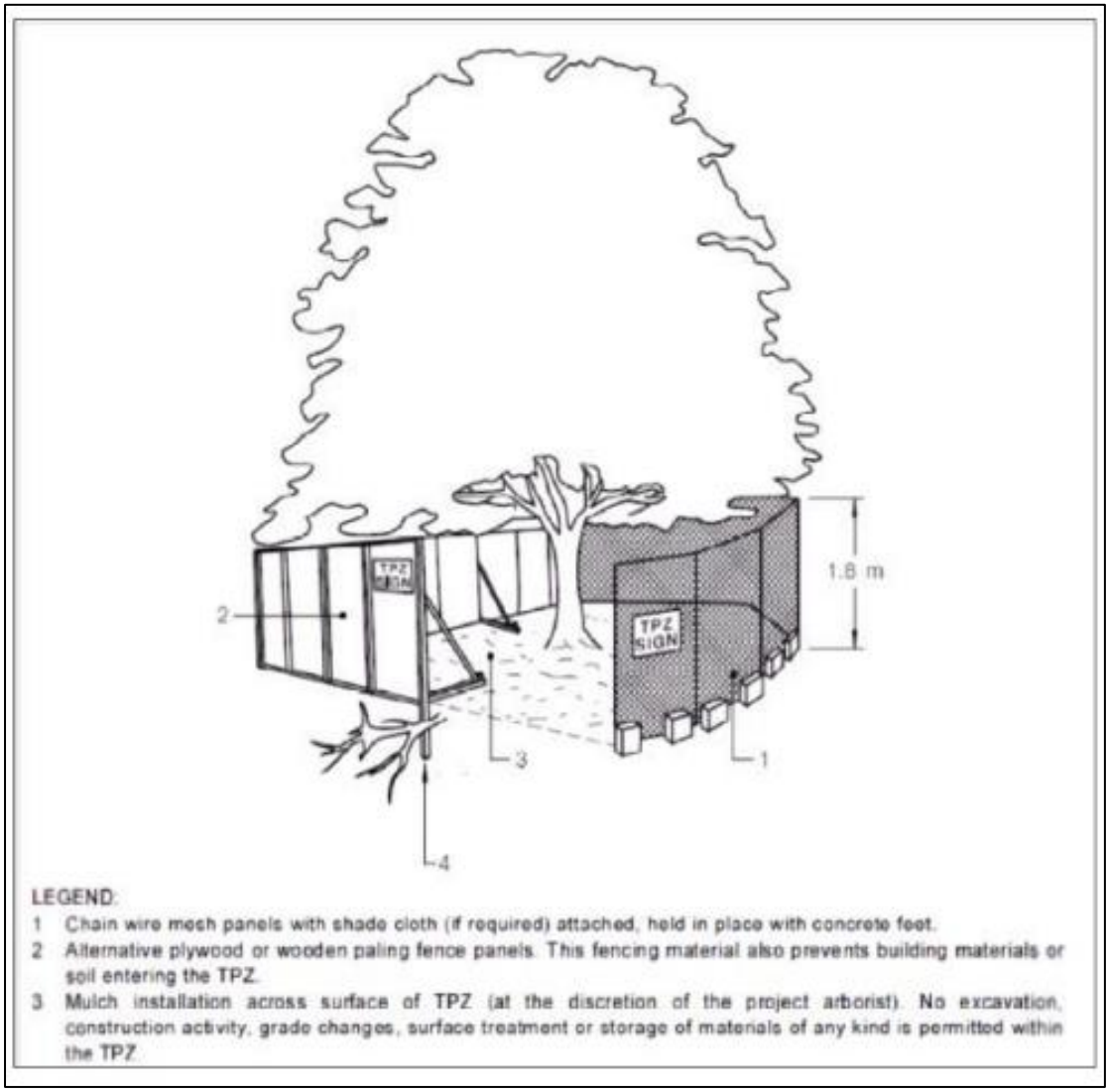

Figure 7. Steel fencing should be erected around the perimeter of TPZs in accordance with AS4970.

6.3. Pre – Construction Vegetation Management

Tree 9 will require pruning over the north-western portion of the dwelling to facilitate the proposed first storey addition. Three large lateral branches were observed to be extended over and descending towards this portion of the dwelling (Figure 8). These lateral and descending branches will conflict with the construction of the proposed addition.

It is recommended that the three large lateral limbs that extend over the north-western portion of the dwelling be reduced to provide 1 metre clearance from the proposed addition. The largest second-order limb, which does not contain any branch unions suitable for reduction, must be removed entirely (Figure 9 and Figure 10). The final pruning cut diameter for this large limb's removal was estimated to be 180 mm. The lateral and descending third order branches extending from the two other lateral limbs must be reduced back to suitable branch unions to provide the required clearance (Figure 9 and Figure 10). A maximum final pruning cut diameter for the reduction of these two limbs was estimated to be 100mm mm. A total live canopy reduction of 10-15% was estimated for this tree as a result of the recommended pruning.

Tree 9 was determined to be in fair health in Section 4.2 of this report (Table 1). Its reasonably high vitality suggests it will respond suitably to the recommended pruning (Johnstone et al. 2012). Approval from Northern Beaches Council Tree Management Officer must be obtained as part of the DA Notice of Assessment approval for this project prior to the pruning of Tree 9.

All recommended tree pruning works must be undertaken by a suitably qualified arborist (minimum AQF Level 3) and in compliance with *the Australian Standard for Pruning Amenity Trees (AS4373 2007)* and the *WorkSafe Guide to Managing Risks of Tree Trimming and Removal Work (2016)*.

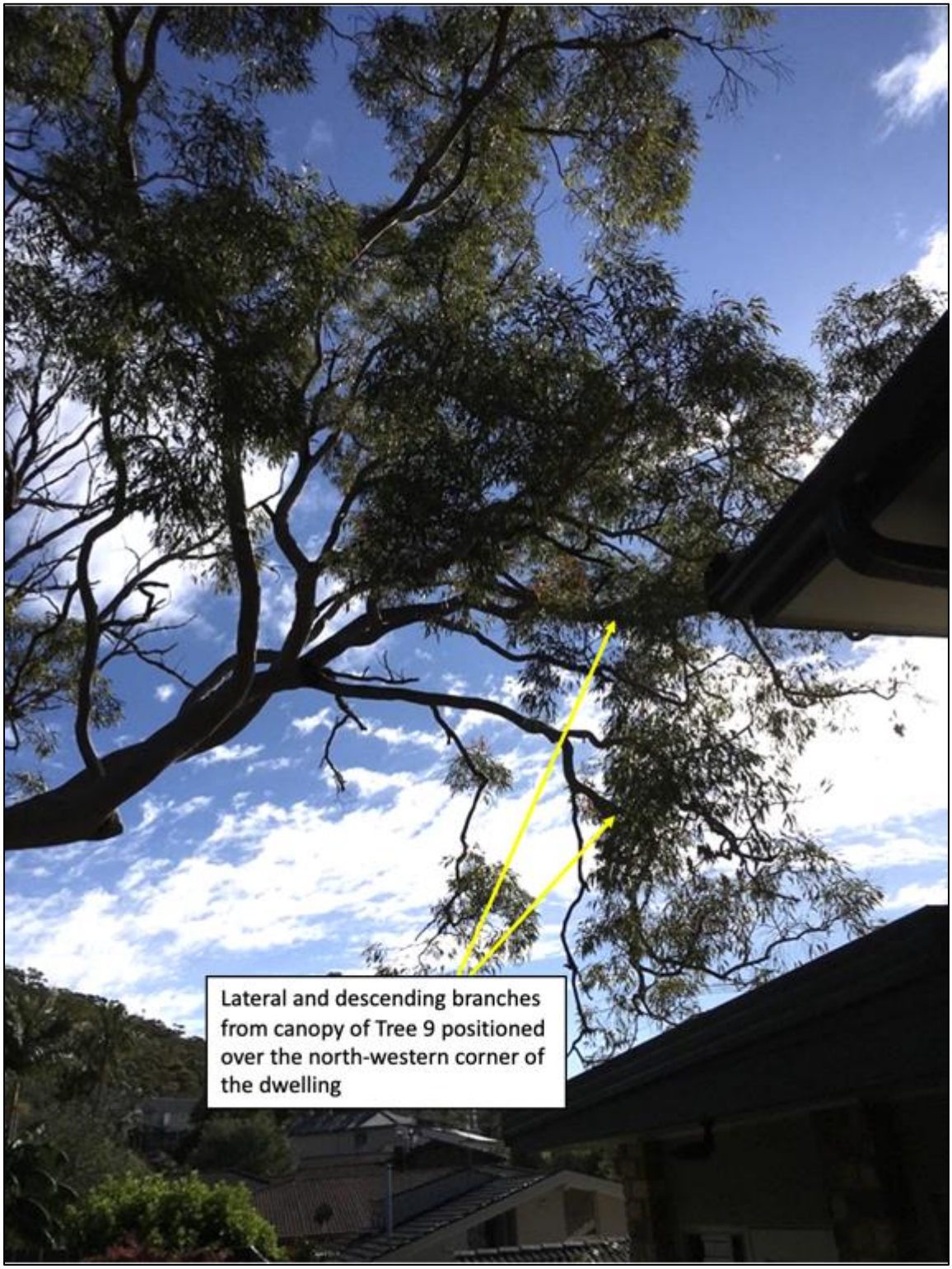

Figure 8. Lateral and descending branches over north-western corner of dwelling will require reduction to facilitate the proposed development.

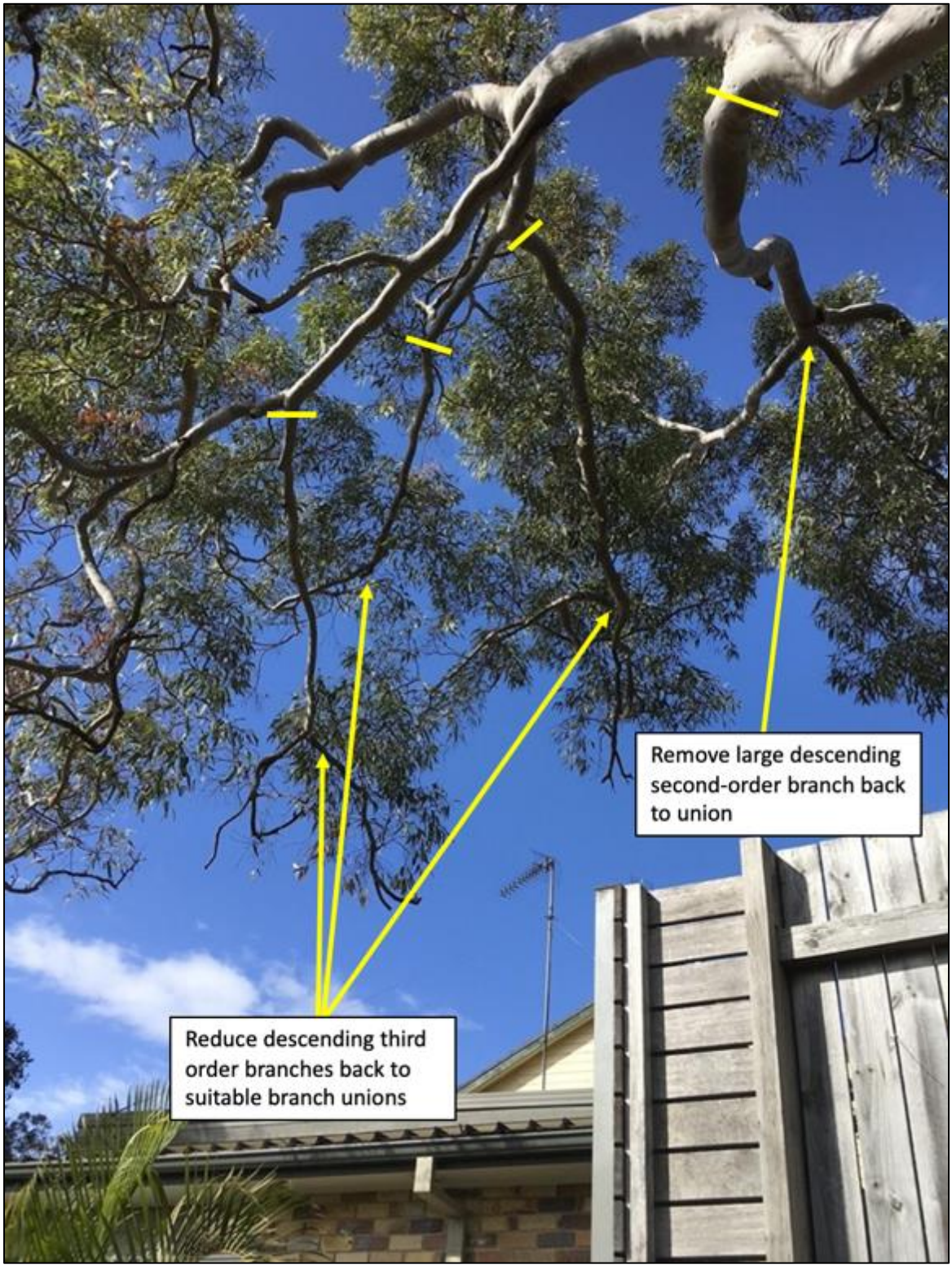

Figure 9. The south-eastern canopy of Tree 9 will require reduction pruning to facilitate the construction of the new level on the existing dwelling.

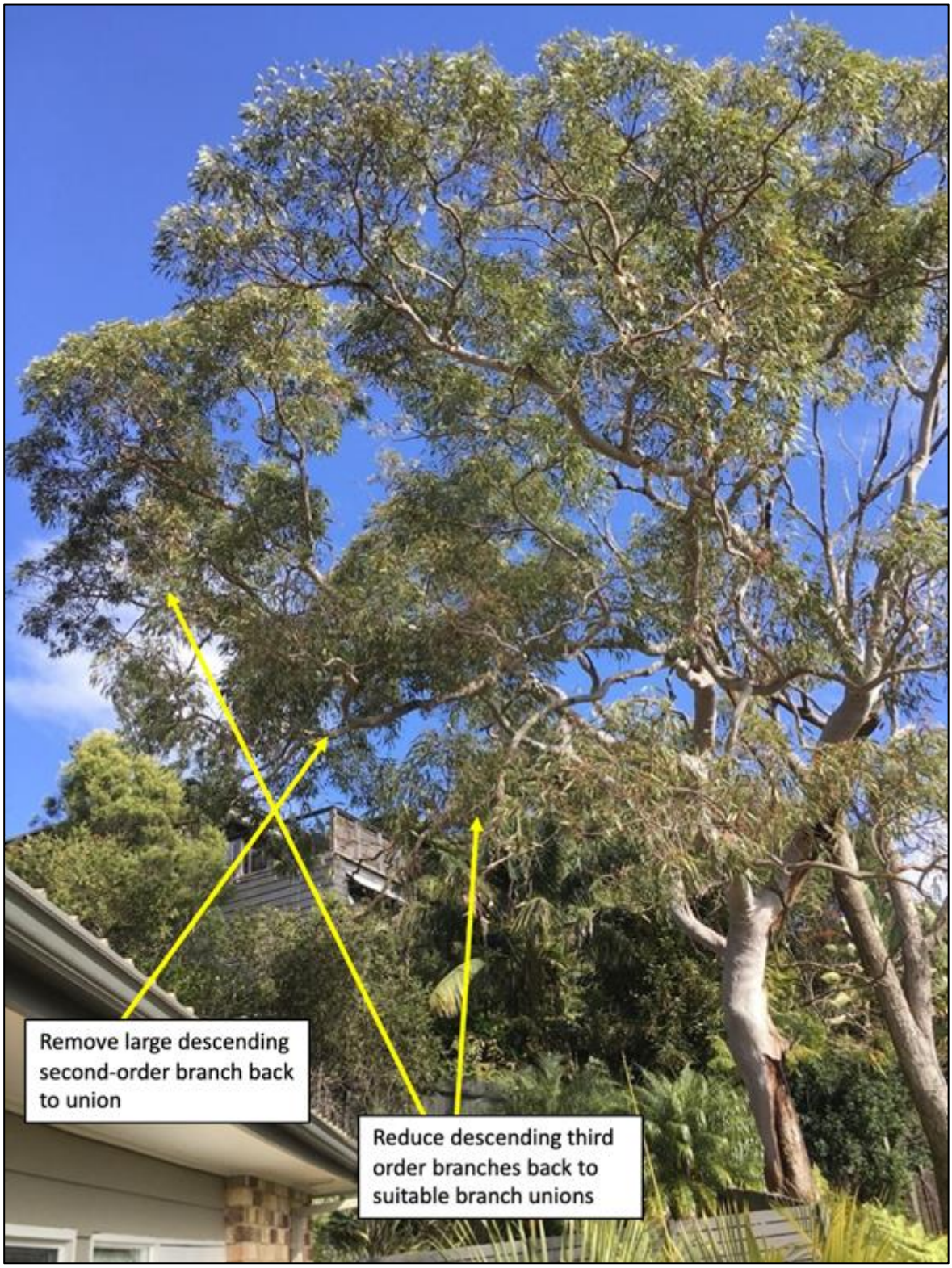

Figure 10. The south-eastern canopy of Tree 9 will require reduction pruning to facilitate the construction of the new level on the existing dwelling.

6.4 Site Specific Tree Protection Measures

The stems of Trees 1-11 are not within the building envelope of the proposed development and must be retained as part of the project. Conventional TPZs will not be feasible due to their position adjacent to or outside the property boundaries of the subject site and close proximity the construction areas. As such, customised protection measures are recommended for the eleven retained trees (Figure 11, Appendix C).

Trees 1-3 are positioned within or adjacent to the eastern boundary of the subject site. The steep, rocky embankment and the dense shrubs adjacent to the driveway will ensure these trees are suitably protected from any indirect impact from within the subject site. A fenced exclusion zone should be established in front of the rocky embankment to ensure these three trees are suitably protected from potential indirect impacts associated with site access and material storage from outside the property. The R_{TPZ} for Tree 3 (6.36 metres measured from the centre of the stem of Tree 3) must be used to establish the southern edge of this exclusion zone. The R_{TPZ} for Tree 1 (4.68 metres measured from the centre of the stem of Tree 1) must be used to establish the northern edge. This fenced exclusion zone must not encroach beyond the Woodward Street kerb (Figure 12). All fencing and signage requirements outlined in Section 6.2 of this report must be complied with in the construction of this combined tree protection zone.

Due to their smaller size and suitable distance from the proposed works areas, Trees 4, 5 and 11 can be effectively retained for the duration of the proposed development without the installation of protection measures (Figure 11).

A combined tree protection zone must also be established for Trees 6-8 to ensure they are not negatively impacted during site access for the duration of the proposed development. Exclusion fencing must be established along the eastern edge of the raised garden bed that contains Trees 6-8 (Figure 13). All fencing and signage requirements outlined in Section 6.2 of this report must be complied with in the construction of this combined tree protection zone.

Stem protection measures compliant with Section 4.5.2 of *AS 4970 (2009)* must also be installed on the exposed portion of the stem of Tree 8 that emerges from the existing deck (Figure 14). Hessian or carpet underlay padding must first be wrapped around the tree's stem and fixed in place using duct tape. Timber batons must then be spaced no more than 200mm around the stem and fixed to one

another using steel strapping. Timber batons must not be fixed directly to the tree's stem (Figure 15). Stem protection measures may be installed using the aforementioned specifications by the project builder. Stem protection measures must remain in place for the duration of the development and until the final arboricultural certification is given at the stage of practical completion.

The stems of Trees 9 and 10 will be suitably protected without the installation of protection measures due to their position outside the northern boundary fence. Tree 9 will sustain a major encroachment (30.1%) within the southern portion of its TPZ as a result of the proposed development. The true impact of this major encroachment is mitigated considerably by the nature of the grassed area being absorbed by the proposed addition. Exposed bedrock was observed on the southern side of the grassed area, which suggests the soil depth is shallow in this area (Figure 16). A depth spike was used to determine the soil depth at various points in this grassed area. At no point was the soil depth measured to be greater than 100mm. It is considered unlikely that extensive major roots (diameter of 40mm or greater) will be encountered on the southern side of Tree 9 (Day et al. 2010).

Sensitive construction methods should be used to further mitigate any potential impact associated with these encroachments. Due to its position within the SRZ of Tree 9 it is recommended that the extension on the north-western side of the dwelling be built on a pier and beam foundation. All pier hole excavation within permeable ground (not into bedrock) must be carried using hand tools only.

There must be no cutting of major tree roots (diameter of 40mm or greater) during this excavation. The excavated pier holes and any additional excavation required in the southern portion of the property must be inspected and certified by the Project Arborist prior to the installation of the pool pavilion ensure no root damage or disturbance has occurred. Any major tree roots encountered must be retained and, if required, severed only by the Project Arborist in compliance with *AS4970 (2009).*

It is a key recommendation of this report that, prior to the piers being built for the extension, all fully excavated pier holes be inspected by the Project Arborist and certification provided that no major tree roots have been cut.

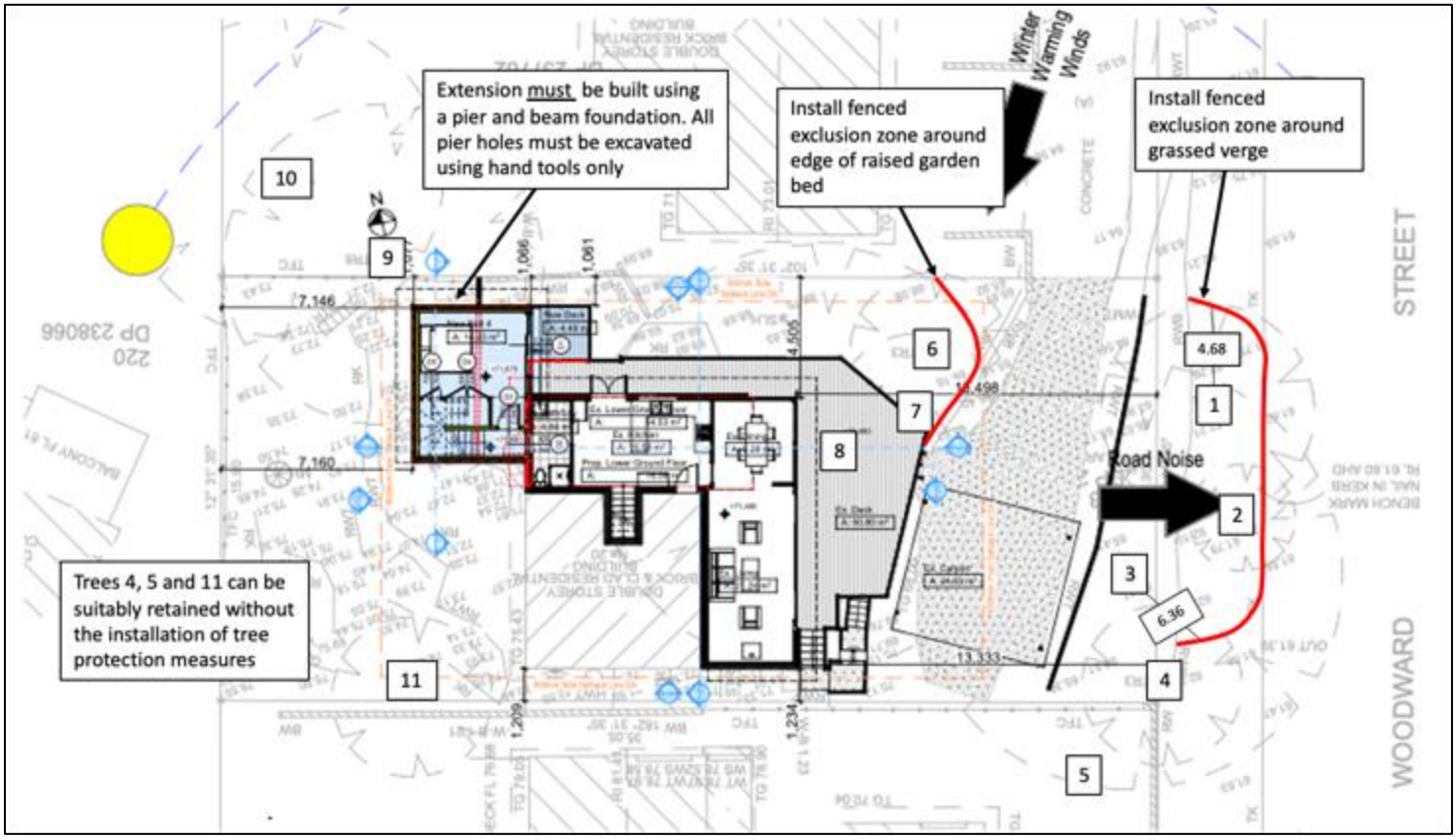

Figure 11. Required tree protection plan for the proposed development at 20 Woodward Street, Cromer. Site Plan (DA1004) drawn by *Rapid Plans* (10/06/2021) annotated by William Dunlop of *Temporal Tree Management Pty Ltd* (27/09/2021).

Figure 12. Fenced (yellow) exclusion zone within grassed verge to protect Trees 1-3.

Figure 13. Exclusion fencing (yellow) must be installed along the edge of the raised garden to protect Trees 6-8.

Figure 14. Install protection measures on the exposed portion of the stem of Tree 8.

Figure 14. Tree Protection Zone to be established for Tree 1 with fencing (yellow) installed along the edge of the existing retaining wall.

Figure 15. Impact of major encroachment within TPZ and SRZ of Tree 9 diminished by exposed bedrock and shallow potential root growth area.

6.5. Certifications

To ensure that the protection of the eleven retained trees is carried out to meet the objectives of the Tree Protection Plan and the planning permit, a Project Arborist must be appointed (minimum AQF Level 5) to provide monitoring and certification at the following hold points in line with *AS4970 (2009).*

- Site establishment – Successful installation of exclusion zones for Trees 1-3 and 4-6 and stem protection measures for Tree 6 as specified in Section 6.4 prior to the commencement of any demolition or construction works. The pruning of only Tree 9 must also be certified by the Project Arborist at this time.

- Required excavation certification – Hand excavation of pier holes as specified in Section 6.4 must be inspected and certified by the Project Arborist prior to the construction of piers to ensure that no major tree roots have been damaged / disturbed.

- Major root cutting – Inspection, compliant cutting and certification by the Project Arborist for any major tree roots that must be severed to facilitate the aforementioned structures. Certification provided by the Project Arborist must also be provided for any major roots that are pruned in compliance with *AS4970 (2009).*

- Practical completion – Successful implementation of the Tree Protection Plan for the duration of the development. Tree protection measures must be left installed after practical completion and inspected by the Project Arborist prior as part of this final assessment.

The Project Arborist must be notified should any alteration to the Tree Protection Plan be required during the proposed development. The Project Arborist must provide an onsite assessment and certification of any required changes prior to them being undertaken.

References:

Australian Standard AS 4970 (2009) Protection of trees on development sites. Standards Australia.

Australian Standard AS 4373 (2007) Pruning of amenity trees. Standards Australia.

Australian Standard AS 2303 (2015) Tree stock for landscape use. Standards Australia.

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Shigo, A. L. (1991) Modern arboriculture: A systems approach to the care of trees and their associates. Shigo and Trees Associates, New Hampshire (pp 114, 122, 151, 175).

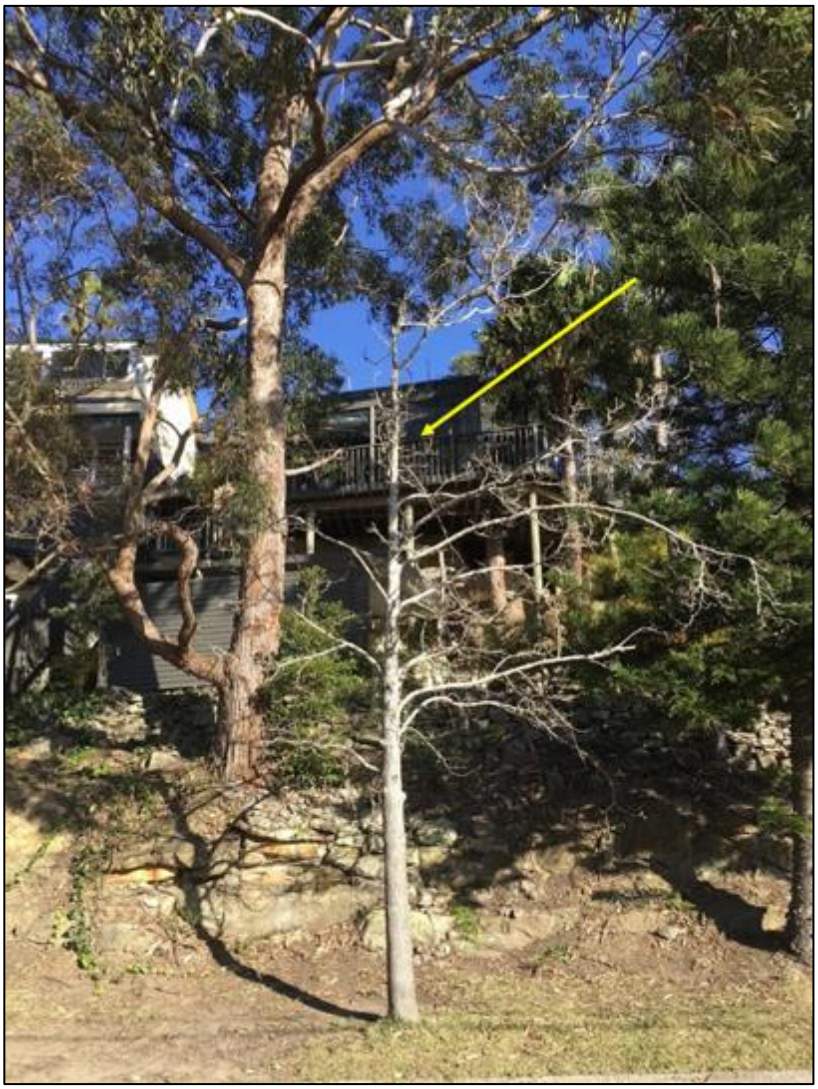
Treetec (2019) TPZ Encroachment Calculator. Accessed via: https://www.treetec.net.au/tpz_srz_dbh_calculator/ (17/08/2021)/

WorkSafe Australia (2016) Guide to Managing Risks of Tree Trimming and Removal Works. Accessed via: https://www.safeworkaustralia.gov.au/system/files/documents/1702/guide-to-managing-risks-tree-trimming-removal-01082016.pdf (14/09/2020).

Appendix A: Tree Data

Tree Nº: 1.
Botanical Name: *Araucaria columnaris*
Common Name: Cook Island Pine
Age: Mature
Origin: Exotic
DBH: 0.39 metres
DGL: 0.43 metres
Height: 9 metres
Width: 3 metres x 3 metres
Health: Good
Structure: Good
ULE: Long
Retention Value: A4
TPZ: 4.68 metres
SRZ: 2.32 metres
Comments: This Cook Island Pine is positioned outside the eastern boundary of the subject site within the Woodward Street grassed verge. Due to its good condition and public ownership this tree is of High retention value within this landscape.

Tree Nº: 2.
Botanical Name: *Liquidambar styraciflua*
Common Name: Liquidambar
Age: Semi-mature
Origin: Exotic
DBH: 0.2 metres
DGL: 0.23 metres
Height: 5 metres
Width: 2 metres x 3 metres
Health: Fair
Structure: Poor
ULE: Medium
Retention Value: A4
TPZ: 2.4 metres
SRZ: 1.79 metres
Comments: This Liquidambar is positioned outside the eastern boundary of the subject site within the Woodward Street grassed verge. Its canopy growth has been suppressed by its larger neighbour. Despite its poor structural condition and low species significance, its public ownership renders this tree is of High retention value within this landscape.



Tree Nº: 3.
Botanical Name: *Eucalyptus botryoides*
Common Name: Southern Mahogany
Age: Mature
Origin: Indigenous
DBH: 0.53 metres
DGL: 0.69 metres
Height: 19 metres
Width: 16 metres x 15 metres
Health: Good
Structure: Fair
ULE: Medium
Retention Value: A1
TPZ: 6.36 metres
SRZ: 2.83 metres
Comments: This Southern Mahogany specimen is positioned within the eastern boundary of the subject site on a steep embankment. Its somewhat poor position underpinned its reduced ULE estimate. Despite this, its large size, good condition and indigenous species significance render this tree of High retention value within this landscape.

Tree Nº: 4.
Botanical Name: *Angophora costata* subsp. *costata*
Common Name: Smooth-barked Apple
Age: Semi-mature
Origin: Indigenous
DBH: 0.29 metres
DGL: 0.42 metres
Height: 6 metres
Width: 4 metres x 5 metres
Health: Poor
Structure: Poor
ULE: Short
Retention Value: Z10
TPZ: 3.48 metres
SRZ: 2.3 metres
Comments: This Smooth-barked Apple specimen is positioned inside the south-eastern corner of the subject site on the steep embankment. Deadwood and significant dieback were observed within its southern canopy. Its stem becomes codominant at ground level. Its poor condition and poor positioned underpinned this tree's reduced ULE estimate and Low retention status within this landscape.

Tree Nº: 5.
Botanical Name: *Angophora costata* subsp. *costata*
Common Name: Smooth-barked Apple
Age: Semi-mature
Origin: Indigenous
DBH: 0.35 metres
DGL: 0.42 metres
Height: 8 metres
Width: 6 metres x 5 metres
Health: Fair
Structure: Fair
ULE: Medium
Retention Value: A1
TPZ: 4.2 metres
SRZ: 2.3 metres
Comments: This Smooth-barked Apple specimen is positioned 3.1 metres outside the south-eastern boundary of the subject site and is within the property of 18 Woodward Street. Its canopy was observed to be thin and has been somewhat suppressed by the larger neighbouring tree. Despite this, its indigenous species significance and external ownership underpinned this tree's High retention status within this landscape.

Tree Nº: 6.
Botanical Name: *Syagrus romanzoffiana*
Common Name: Cocos Palm
Age: Mature
Origin: Exotic
DBH: 0.23 metres
DGL: 0.4 metres
Height: 10 metres
Width: 3 metres x 3 metres
Health: Good
Structure: Good
ULE: Short
Retention Value: Z3
TPZ: 2.5 metres
SRZ: N/A
Comments: This Cocos Palm is positioned 2.3 metres from the existing balcony. This species is exempt from the protection controls outlined in Part E1 of the Warringah DCP (2011). This palm is therefore of Low retention value within this landscape.

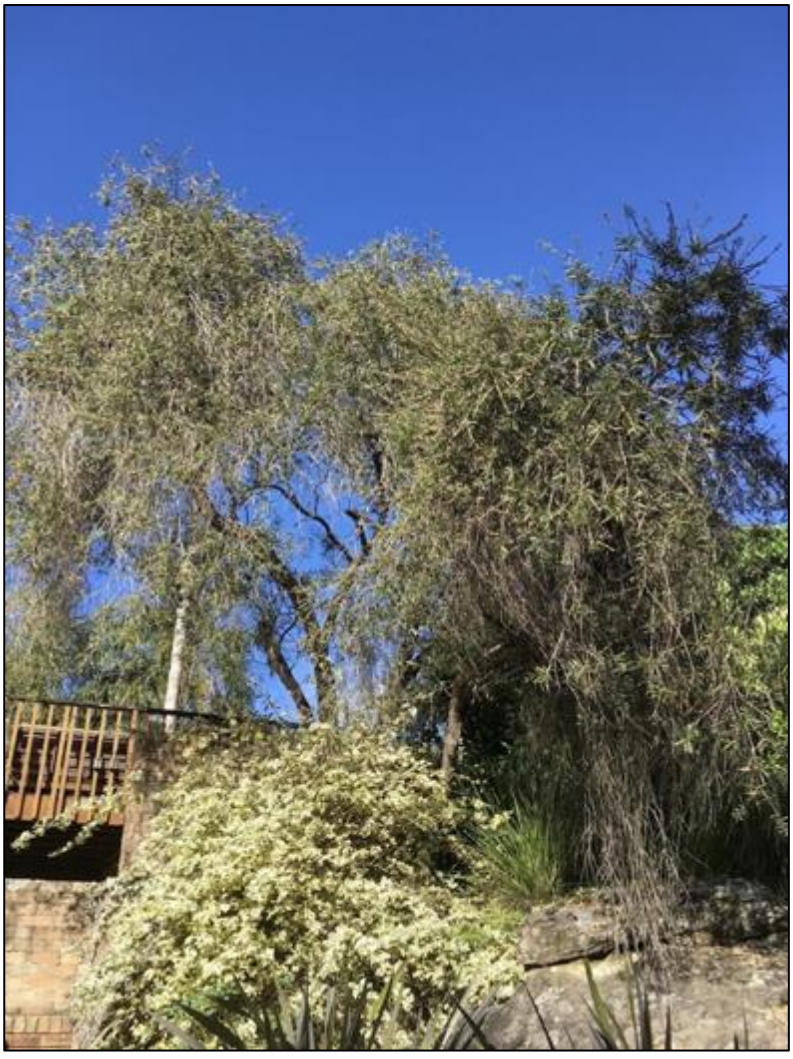
Tree Nº: 7.
Botanical Name: *Livestona australis*
Common Name: Cabbage Palm
Age: Mature
Origin: Indigenous
DBH: 0.29 metres
DGL: 0.41 metres
Height: 9 metres
Width: 3 metres x 3 metres
Health: Good
Structure: Good
ULE: Medium
Retention Value: A1
TPZ: 2.5 metres
SRZ: N/A
Comments: This Cabbage Palm specimen is positioned 200mm from the existing balcony. Its stem was measured to be more than 2 metres from the existing walls / foundations of the dwelling. Its indigenous species significance and good condition render this palm of High retention status within this landscape.

Tree Nº: 8.
Botanical Name: *Angophora costata* subsp. *costata*
Common Name: Smooth-barked Apple
Age: Mature
Origin: Indigenous
DBH: 0.63 metres
DGL: 0.78 metres
Height: 14 metres
Width: 8 metres x 7 metres
Health: Very Poor
Structure: Poor
ULE: Short
Retention Value: Z2
TPZ: 2.88 metres
SRZ: 1.88 metres
Comments: This Smooth-barked Apple specimen is positioned within the existing deck and is 1.3 metres from the eastern wall of the existing dwelling. This tree is exempt from the protection controls outlined in Part E1 of the Warringah DCP (2011) due to its very close proximity to the eastern wall of the dwelling. Therefore, despite its high species significance, its poor condition and poor positioned underpinned this tree's reduced ULE estimate and Low retention status within this landscape.

Tree No: 9.
Botanical Name: *Angophora costata* subsp. *costata*
Common Name: Smooth-barked Apple
Age: Mature
Origin: Indigenous
DBH: 0.42 metres
DGL: 0.48 metres
Height: 12 metres
Width: 9 metres x 7 metres
Health: Fair
Structure: Poor
ULE: Medium
Retention Value: A1
TPZ: 5.04 metres
SRZ: 2.43 metres
Comments: This Smooth-barked Apple specimen is positioned 0.5 metres outside the north-western boundary within the property of 22 Woodward Street. A large column of necrotic tissue with signs of advanced decay was observed on the northern side of this tree's stem extending from ground level to 4 metres height. Tissue necrosis and signs of decay were also observed within this tree's lower structural canopy. Its canopy growth has been suppressed and is now with asymmetric form with laterally extended limbs within its southern and eastern canopy. These features underpinned the poor structural rating and shortened ULE estimate for this tree. Despite this, its indigenous species significance and external ownership render it of High retention value within this landscape.

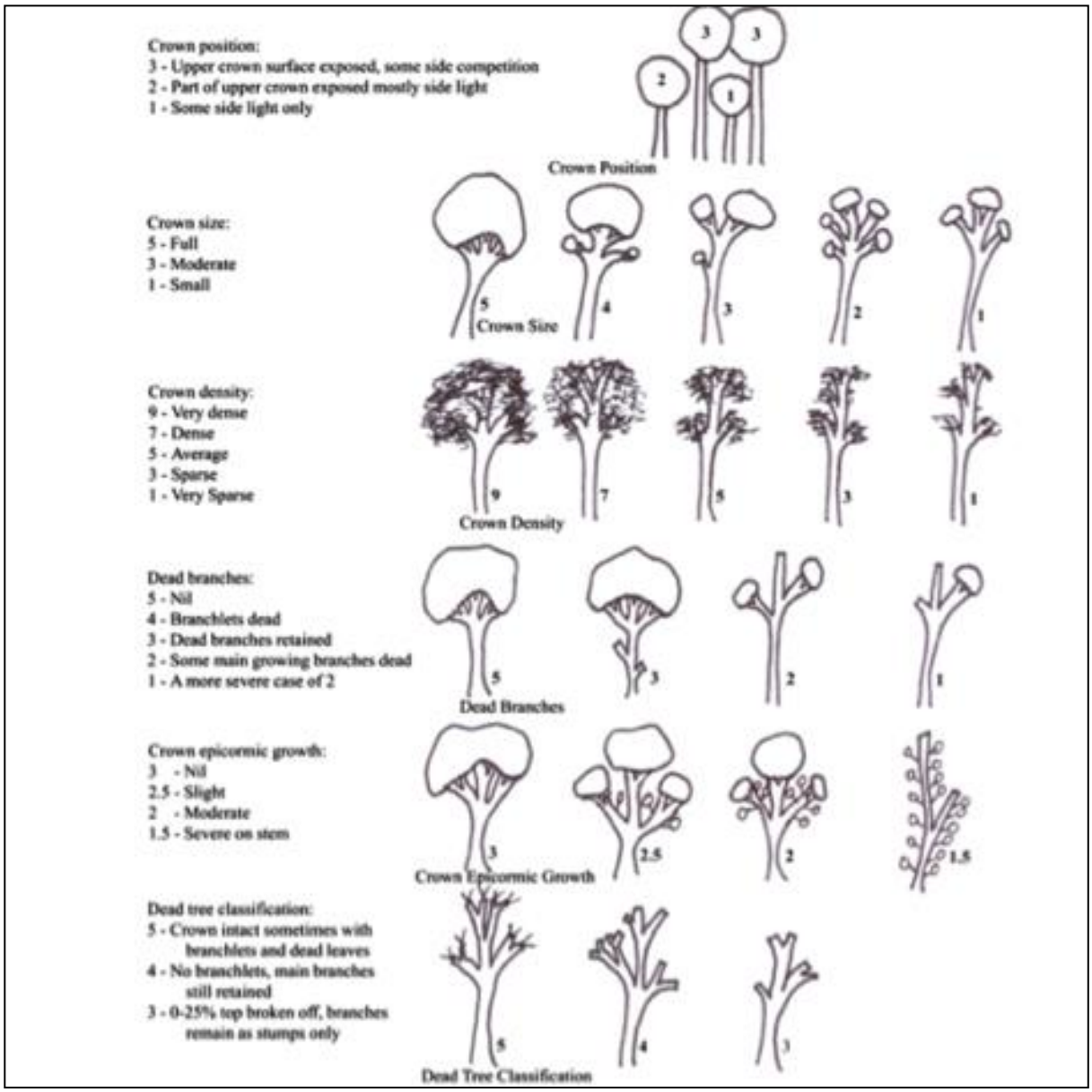
Tree Nº: 10.
Botanical Name: *N/A*
Common Name: Dead Tree
Age: Dead
Origin: Native
DBH: 0.44 metres
DGL: 0.5 metres
Height: 11 metres
Width: 6 metres x 6 metres
Health: Dead
Structure: Poor
ULE: Remove
Retention Value: Z4
TPZ: 5.28 metres
SRZ: 2.47 metres
Comments: This dead tree is positioned within the existing deck and is 4.8 metres outside the north-western boundary within the property of 22 Woodward Street. This tree has died and is exempt from the protection controls outlined in Part E1 of the Warringah DCP (2011) This tree was therefore determined to be of Low retention status within this landscape.

Tree Nº: 11.
Botanical Name: *Callistemon viminalis*
Common Name: Bottlebrush
Age: Mature
Origin: Native
DBH: 0.25 metres
DGL: 0.28 metres
Height: 5 metres
Width: 4 metres x 4 metres
Health: Fair
Structure: Poor
ULE: Medium
Retention Value: Z10
TPZ: 3 metres
SRZ: 1.94 metres
Comments: This Bottlebrush specimen is positioned inside the south-western boundary in an elevated position on exposed bedrock. Its stem becomes codominant from basal unions that showed signs of bark inclusion. This feature underpinned the poor structural rating and reduced ULE for this tree. Due to its small size and reduced ULE estimate this tree was determined to be of Low retention value within this landscape.



Appendix B: Vitality using Visual Vitality Index (Johnstone et al. 2012).

VVI = 3/3 (Upper crown exposed) + 5/5 (Good crown size) + 8/9 (Good crown density) + 4/5 (Very little deadwood) + 2/3 (Moderate epicormic growth) + 5/5 (Crown in tact).
=26/30.



Appendix C: Tree Protection Plan.

Site Plan (DA1004) drawn by *Rapid Plans* (10/06/2021) annotated by William Dunlop of *Temporal Tree Management Pty Ltd* (27/09/2021).