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ARBORICULTURAL IMPACT ASSESSMENT
TREE PROTECTION SPECIFICATION

45-47 Tennyson Avenue
105 Eastern Road
Turramurra

Prepared for: WINSTON LANGLEY

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Revision C

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1.0 INTRODUCTION

1.1 Background

1.1.1 This Arboricultural Impact Assessment Report and Tree Protection Specification was prepared for Winston Langley in relation to the proposed development at 45-47 Tennyson Road and 105 Eastern Avenue, Turramurra. The purpose of this Report is to undertake a Visual Tree Assessment[1] (VTA), determine the impact of the proposed works on the trees, and where appropriate, recommend the use of tree sensitive construction methods and tree protection measures to minimise adverse impacts. This Report also includes the results of internal diagnostic testing (Resistograph®) which was undertaken for Trees 19 and 20 as recommended in the treeiQ Revision A Report (TENN/EAST/AIA/A, dated 05.07.2018).

1.1.2 This Revision C Report was prepared in relation to the revised Architectural Concept Plans (dated 18.04.19). These plans have amended the proposed building footprint to reduce impacts on the remnant Blue Gum High Forest as requested in the Local Planning Officers Report (dated 18th March 2019) and later resolved by Council on 26th March 2019.

1.1.3 The authors of this Report have read the *NSW Land and Environment Court Practice Note (2007),* Division 2, Part 31 of the *Uniform Civil Procedure Rules (2005)* and the *Expert Witness Code of Conduct* in Schedule 7 to the *Uniform Civil Procedural Rules (2005)*. This Report has been prepared in accordance with the requirements of the Practice Note and Code of Conduct.

1.1.4 In preparing this Report, the author is aware of and has considered the objectives of the *State Environmental Planning Policy-Vegetation in Non-Rural Areas (2017)*, *Ku-ring-gai Development Control Plan Part 13 Tree & Vegetation Preservation*, *Australian Standard 4970 Protection of Trees on Development Sites (2009)*, *Australian Standard 4373 Pruning of Amenity Trees (2007), Australian Standard 2303 Tree Stock for Landscape Use (2015)* and *Safe Work Australia Guide for Managing Risks of Tree Trimming and Removal Work (2016).*

Refer to Methodology **(Appendix 1)**

1.1.5 This impact assessment is based on an assessment of the following supplied documentation/plans only:

- Contour & Detail Survey (1996, dated 26.06.2018) prepared by SurDevel
- Basement Level Plan (A101/04, dated 18.04.2019) prepared by Tandum
- Ground Level Plan (A200/4, dated 18.04.2019) prepared by Tandum
- Roof Plan (A201/04, dated 18.04.2019) prepared by Tandum
- Tree Protection Plans (dated 17.04.2019) prepared by Oculus

Refer to Plans **(Appendix 2)**

1.2 The Proposal

1.2.1 The proposal seeks to amend the *Ku-ring-gai Local Environmental Plan (KLEP) 2015* by way of a zoning change to facilitate the renewal of the existing and longstanding commercial use of the land with alternative commercial use.

[1] Mattheck & Breloer (2003)

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1.2.2 The proposal generates the following outcomes:

- Remediation of any contaminated land associated with the existing service station and existing garden centre on the site
- Retention of twenty-six (26) existing trees
- Creation of a publicly accessible orchard
- Removal of existing vehicular access to and from the site from Tennyson Avenue
- Provision of vehicular access into and egress from the site via Eastern Road to both on-grade and basement car parking facilities
- Placement of all loading, service and waste areas underground
- Provision of landscaped setbacks

2.0 RESULTS

2.1 The Site

2.1.1 The land is comprised of the following:

- 45-47 Tennyson Avenue – an existing garden centre with associated car parking and structures
- 105 Eastern Road – an existing service station and associated vehicle mechanical workshop

2.1.2 The legal description is Lot 1 DP 4323, Lot 2 DP 515147, and Lot 1 DP 515147, and the site has an area of approximately 5,129m2. The site has frontages to Tennyson Avenue to the south, Eastern Road to the west, and Alice Street to the north.

2.2 The Trees

2.2.1 Thirty-one (31) trees were assessed using the Visual Tree Assessment[2] (VTA) criteria and notes. The trees comprise of a mix of locally indigenous, Australian native and exotic species such as *Syncarpia glomulifera* (Turpentine), *Eucalyptus pilularis* (Blackbutt), *Eucalyptus saligna* (Sydney Blue Gum), *Melaleuca quinquenervia* (Broad Leaf Paperbark), *Agonis flexuosa* (Willow Myrtle), *Liquidambar styraciflua* (Liquidambar) and *Prunus serrulata* cvs (Flowering Cherry).

2.2.2 Trees 3-10 and 31 are located on the Alice Street and Eastern Road road reserves and are managed by Ku-ring-gai Council. Tree 22 is located within the adjoining property to the east (1 Alice Street) and Tree 23 is located on the boundary of 43 and 45-47 Tennyson Avenue. The remaining trees are located within the site boundaries.

2.2.3 Tree 2 *Acer negundo* (Box Elder) is listed as an Exempt Tree Species within Part 13 of the *Ku-ring-gai Development Control Plan.*[3]

2.2.4 The species *Syncarpia glomulifera* Turpentine (Trees 17, 18, 24, 25, 26, 28 & 29), *Eucalyptus pilularis* Blackbutt (Trees 19 & 27) and *Eucalyptus saligna* Sydney Blue Gum (Trees 20 & 30) are represented in the Blue Gum High Forest ecological community.[4] Blue Gum High Forest is listed as a *Critically Endangered Ecological Community* under the NSW *Biodiversity Conservation Act (2016)* and *Environment Protection and Biodiversity Conservation Act 1999.*[5]

[2] Mattheck & Breloer (2003)
[3] Ku-ring-gai Council (2015)
[4] Ku-ring-gai Council (2015)
[5] NSW Environment & Heritage (2016)

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2.2.5 A search of the BioNet Atlas of NSW Wildlife Database was undertaken in June 2018. No individual threatened tree species listed within this database for the area were identified during the current field investigations of the site.[6] The ecological significance and habitat value of the trees has not been assessed and is beyond the scope of this report.

2.2.6 As required by Clause 2.3.2 of *Australian Standard 4970 Protection of Trees on Development Sites (2009),* each tree assessed has been allocated a Retention Value. The Retention Value is based on the tree's Useful Life Expectancy and Landscape Significance with consideration to its health, structural condition and site suitability. The Retention Values do not consider any proposed development works and are not a schedule for tree retention or removal. The trees have been allocated one of the following Retention Values:

- Priority for Retention
- Consider for Retention
- Consider for Removal
- Priority for Removal

Refer to Tree Assessment Schedule **(Appendix 3)**

3.0 ARBORICULTURAL IMPACT ASSESSMENT

3.1 Tree Removal

3.1.1 Tree 1

Tree 1 was identified as *Melaleuca quinquenervia* (Broad Leaf Paperbark) and is located adjacent to the Eastern Road frontage. The tree has an estimated Useful Life Expectancy (ULE) of 15-40 years, is of moderate Landscape Significance and has been allocated a Retention Value of *Consider for Retention.*

3.1.2 The supplied plans show that Tree 1 will need to be removed to accommodate the proposed vehicular access. Replacement planting using healthy, advanced-size specimens could replace the loss of amenity from tree removal within a medium timeframe.

3.1.3 Tree 2

Tree 2 was identified as *Acer negundo* (Box Elder) and is located adjacent to the Eastern Road frontage. The tree has an estimated ULE of 5-15 years, is of low Landscape Significance and has been allocated a Retention Value of *Consider for Removal.*

3.1.4 The supplied plans show that Tree 2 will need to be removed to accommodate the proposed vehicular access. Replacement planting using healthy, advanced-size specimens could replace the loss of amenity from tree removal within a short timeframe.

3.1.5 Trees 11 & 12

Trees 11 and 12 were identified as *Agonis flexuosa* (Willow Myrtle) and are located adjacent to the eastern site boundary. The trees are in poor health and fair structural condition as evidenced by a reduction in the density of their crowns and the presence of high volumes of deadwood, bark inclusions and decay. The trees have a ULE of less than 5 years, are of moderate Landscape Significance and have been allocated a Retention Value of *Priority for Removal.*

[6] NSW Office of Environment and Heritage (2011)

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3.1.6 The supplied plans show that Trees 11 and 12 are to be removed as part of the proposed landscape treatment. These trees are recommended for removal due to their poor overall condition, irrespective of future development. Replacement planting using healthy, advanced-size specimens could replace the loss of amenity from tree removal within a short to medium timeframe.

3.1.7 Tree 30

Tree 30 was identified as *Eucalyptus saligna* (Sydney Blue Gum) and is located between the existing buildings in the centre of the site. The tree has an estimated ULE of 5-15 years, is of high Landscape Significance and has been allocated a Retention Value of *Priority for Retention.* Whilst Tree 30 meets the criteria to be allocated a Retention Value of *Priority for Retention* (as a species of Blue Gum High Forest, refer Appendix 1: Methodology), it is a relatively small, semi-mature specimen with low amenity value. The tree appears to be self-sown and has developed an etiolated form due to shading from the adjacent buildings to the east and west, and has been extensively crown lifted to provide building clearance. The tree's ULE is reduced by the proximity of the adjacent buildings which provide insufficient space to accommodate the width of the trunk in maturity.

3.1.8 The supplied plans show that Tree 30 will need to be removed to accommodate the proposed building footprint. Replacement planting using healthy, advanced-size specimens could replace the loss of amenity from tree removal within a short timeframe.

3.2 Tree Retention

3.2.1 The supplied plans show that twenty-six (26) trees are to be retained as part of the proposed development. This includes four (4) trees with a Retention Value of *Priority for Retention,* fourteen (14) trees with a Retention Value of *Consider for Retention* and eight (8) trees with a Retention Value of *Consider for Removal.*

3.2.2 Table 1: Trees to be retained

Priority for Retention	Consider for Retention	Consider for Removal	Priority for Removal
17, 19, 20 & 27	4, 13, 14, 15, 18, 21, 22, 23, 24, 25, 26, 28, 29 & 31	3, 5, 6, 7, 8, 9, 10 & 16	

3.2.3 The supplied plans show that the proposed building and basement is located within the Tree Protection Zone (TPZ) areas of Trees 13, 14, 16, 17, 18, 19, 20, 27 and 31. As the encroachments into the individual TPZ is less than 10% and outside of the Structural Root Zone (SRZ), the extent of work represents *Minor Encroachments* as defined by *Australian Standard 4970-2009 Protection of Trees on Development Sites* (AS-4970). A *Minor Encroachment* is considered acceptable by AS-4970 when it is compensated for elsewhere and contiguous within the TPZ. The encroachments into TPZ areas should be compensated for by extending the TPZ in areas not subject to encroachment.

3.3 Other Works within TPZ Areas

3.3.1 Demolition Works

Demolition works within TPZ areas should be supervised by the Project Arborist and utilise tree sensitive methods. Structures should be demolished in small sections ensuring demolition machinery/equipment does not contact with any part of the tree. Structures within an SRZ can contribute to tree stability by providing ballast to the rootplate or acting as a stop to the overturning of the rootplate. If possible, existing underground structures and sub-base materials should be left in situ and reused.

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3.3.2 Basement Installation

Preliminary excavation and root pruning should be undertaken by the along the basement line within and adjacent to TPZ areas prior to the commencement of the bulk excavation works. No over-excavation, battering or benching should be undertaken beyond the basement footprint.

3.3.3 Underground Services

Underground services should be located outside of the TPZ areas. Where this is not possible, services should be installed using tree sensitive excavation (hand/hydrovac etc) methods with the services located around/below roots (>25mmø) as deemed necessary by the Project Arborist. Excavation using compact machinery fitted with a flat bladed bucket is permissible where approved by the Project Arborist. Excavation using compact machinery should be undertaken in small increments, guided by a spotter who is to look for and prevent damage to roots (>25mmø).

3.3.4 Alternatively, boring methods may be used for underground service installation where the obvert level (highest interior level of pipe) is greater than 1000mm below existing grade. Excavations for starting and receiving pits for boring equipment should be located outside of the TPZ areas or located to avoid roots (>25mmø) as deemed necessary by the Project Arborist. OSD tanks (where required) should be located outside of the TPZ areas.

3.3.5 Landscape Levels

Existing levels should be maintained wherever possible. Where minor regrading is required, these works should be undertaken using tree sensitive methods (hand/hydrovac/airspade etc) to enable the retention of roots (>25mmø) as deemed necessary by the Project Arborist. The placement of fill should be limited to depths no greater than 150mm and should utilise materials with a high level of porosity. Fill must not be placed around the base of the trunk/root collar of a tree.

Pavements (including sub-base materials) within TPZ areas should be installed above existing grade and utilise existing sub-base layers where possible. Pavement sub-base layers should either be thinned, or finished pavement levels and kerbs modified as required to enable the retention of roots (>25mmø) as deemed necessary by the Project Arborist.

3.3.6 Landscape Structures

Landscape structures (such as light poles, fences etc) should be supported on isolated piered footings (with all other parts of the structures positioned above existing ground levels). Excavation for the pier holes should be undertaken using tree sensitive methods (hand/hydrovac/airspade etc). Pier hole locations should be flexible to enable the retention of roots (>25mmø) as deemed necessary by the Project Arborist. Structures should be located a minimum of 500mm from a tree's trunk to allow for future growth.

3.3.7 Landscape Planting

The installation of plants should be undertaken using hand tools and roots (>25mmø) should be protected. No mechanical cultivation/ripping of soils should be undertaken. Other than the installation of soil conditioners to a maximum depth of 50mm above the existing soil profile, the installation of imported soil mixes should be excluded from the TPZ.

3.4 Pruning

3.4.1 The supplied plans show that Trees 9, 14, 17, 19, 20, 22, 24, 27 and 31 will need to be pruned for building and construction clearance.

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3.4.2 Table 2: Tree 9

Branch Orientation	Order of Branch	Branch Diameter	Height Above Grade	Comments	Figure (Appendix 5)
S	Higher order branches only	<50mm	2-3m	Reduction Prune for proposed canopy clearance	1

3.4.3 Table 3: Tree 14

Branch Orientation	Order of Branch	Branch Diameter	Height Above Grade	Comments	Figure (Appendix 5)
W	3rd	150mm	5m	Prune for piling rig clearance	2
W	2nd	200mm	5.5m	Reduction Prune to 3rd order lateral for piling rig clearance	2
W	3rd	150mm	4.5m	Prune for piling rig clearance	2

3.4.4 Table 4: Tree 17

Branch Orientation	Order of Branch	Branch Diameter	Height Above Grade	Comments	Figure (Appendix 5)
NW	2nd	200mm	3m	Prune to remove branch stub	3

3.4.5 Table 5: Tree 19

Branch Orientation	Order of Branch	Branch Diameter	Height Above Grade	Comments	Figure (Appendix 5)
N	2nd	300mm	3.5m	Prune for piling rig clearance	4

3.4.6 Table 6: Tree 20

Branch Orientation	Order of Branch	Branch Diameter	Height Above Grade	Comments	Figure (Appendix 5)
N	3rd order and above	<150mm	4-12m	Prune for piling rig clearance	5
The extent of pruning will have a minor impact on the visual symmetry of the crown. However, the extent of pruning works should not impact the tree's ULE.					

3.4.7 Table 7: Tree 22

Branch Orientation	Order of Branch	Branch Diameter	Height Above Grade	Comments	Figure (Appendix 5)
W	Higher order branches only	<100mm	4-7m	Reduction Prune for piling rig clearance	6

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3.4.8 Table 8: Tree 24

Branch Orientation	Order of Branch	Branch Diameter	Height Above Grade	Comments	Figure (Appendix 5)
W	Higher order branches only	<100mm	6-9m	Reduction Prune for piling rig clearance	7

3.4.9 Table 9: Tree 27

Branch Orientation	Order of Branch	Branch Diameter	Height Above Grade	Comments	Figure (Appendix 5)
W	3rd	250mm	14m	Prune for piling rig clearance	8

3.4.10 Table 10: Tree 31

Branch Orientation	Order of Branch	Branch Diameter	Height Above Grade	Comments	Figure (Appendix 5)
E	Higher order branches only	<100mm	2-5m	Crown Lift for carpark clearance	9

3.4.11 **The assessment of the pruning requirements detailed in this Report was estimated from ground level only.** A Surveyor should be engaged prior to the completion of the final design to mark out critical sections of the building footprint to allow a comprehensive assessment of tree pruning requirements for building and construction clearance. During the construction phase of a project some additional minor pruning works may be required to provide building and construction clearances. A two-stage approach is recommended to reduce the potential for unnecessary over pruning in the early stages of a project. Stage one pruning addresses the main branches where conflict will occur followed by a second, minor prune around the time of erection of scaffolding to address any (generally smaller) conflicting branches which could not be accurately identified during the initial ground level assessment.

3.4.12 Deadwood greater 25mmø should be removed from those trees which are situated in close proximity to 'high target' areas (i.e. areas of frequent use/vulnerable structures).

3.4.13 Pruning works should be carried out by a Practising Arborist. The Practising Arborist should hold a minimum qualification equivalent (using the Australian Qualifications Framework) of Level 3 or above, in Arboriculture or its recognised equivalent. The Practising Arborist should have a minimum of 3 years' experience in practical Arboriculture. Pruning work should be undertaken in accordance with *Australian Standard 4373: Pruning of Amenity Trees (2007), Safe Work Australia Guide for Managing Risks of Tree Trimming and Removal Work (2016)* and other applicable legislation and codes.

3.5 Replacement Planting

3.5.1 The proposed development includes the provision of new tree planting across the site. Replacement planting should be supplied in accordance with *Australian Standard 2303 (2015) Tree Stock for Landscape Use.*

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3.6 Ongoing Tree Management

3.6.1 A number of the trees to be retained are large specimens which were identified as having structural defects. Refer to Tree Assessment Schedule **(Appendix 3).** Ongoing monitoring and maintenance (including deadwood removal) should be undertaken for trees which are situated in close proximity to 'high target' areas (i.e. areas of frequent use/vulnerable structures).

3.6.2 Internal diagnostic testing (Resistograph®) was undertaken for Trees 19 and 20 on the 5th October 2018 as recommended in the treeiQ Revision A Report (TENN/EAST/AIA/A, dated 05.07.2018).

3.6.3 Tree 19

Three (3) resistance drilling tests were undertaken in the lower trunk of Tree 19 at a height of 1100mm above grade. Due to the highly asymmetric shape of the trunk in the cross-sectional plane tested and the presence of the existing building which limits access to the northern side of the trunk, the precautionary t/R methodology could not be applied. Refer to Appendix 1 **(Methodology)**. However, based on the average trunk diameter of 1200mm in the north/south orientation, a minimum drilling depth of 200mm was used. The test results are summarised below:

- Test Site 1 – South-east at a height of 1100mm above grade adjacent to the large rib of adaptive growth. Results indicate healthy tissue to a minimum depth of 200mm.
- Test Site 2 – South at a height of 1100mm above grade. Results indicate healthy tissue to a depth of 150mm with potential incipient decay of tissue at depth >150mm.
- Test Site 3 – West at a height of 1100mm above grade. Results indicate healthy tissue to a depth of 140mm with potential incipient decay of tissue at depth >140mm.

3.6.4 In summary, the results indicate that wood decay is likely present within the trunk of Tree 19 which may reduce its ULE. However, incipient (i.e. early stage) decay is generally not associated with a significant loss in tissue strength and the risk of a failure of the lower trunk over the short to medium term is low. Further internal diagnostic testing in the northern side of the trunk should be undertaken (when the existing building to the north of the tree is removed) to determine if more advanced decay is present.

3.6.5 Tree 20

Six (6) resistance drilling tests were undertaken in the lower trunk of Tree 20 to determine the extent of potential decay between the co-dominant stems. Two (2) cross sectional planes were tested; 400mm above grade and 1200mm above grade. Due to the asymmetric shape of the trunk in the cross-sectional planes tested, the precautionary t/R methodology could not be applied. However, based on the average trunk diameter at the test sites a minimum drilling depth of 200mm was used. The test results are summarised below:

- Test Site 1 – North at a height of 400mm above grade. Results indicate healthy tissue to a depth of 200mm with the potential incipient decay of tissue at depth >200mm.
- Test Site 2 – East at a height of 400mm above grade. Results indicate healthy tissue to a minimum depth of 200mm with the potential incipient decay of tissue at depth >200mm.
- Test Site 3 – South at a height of 400mm above grade. Results indicate healthy tissue to a minimum depth of 150mm with potential incipient decay of tissue at depth >150mm.

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- Test Site 4 – North at a height of 1200mm above grade. Results indicate healthy tissue to a depth of 230mm.
- Test Site 5 – East at a height of 1200mm above grade. Results indicate healthy tissue to a depth of 170mm with potential incipient decay of tissue at depth >170mm.
- Test Site 6 – South at a height of 1200mm above grade. Results indicate healthy tissue to a depth of 120mm with a potential pocket of advanced decay between 120mm and 180mm. Beyond 180mm, depth the tissue density increases, indicating the decay may be at least partially compartmentailised.

3.6.6 In summary, the results indicate that a column of wood decay is likely present within the trunk of Tree 20 between a height of 400-1200mm above grade (and potentially beyond) which may reduce its ULE. However, the decay appears to be asymmetrically located within the upper section of the trunk and potentially contained by the tree's internal walls of compartmentailsation. Furthermore, the potential incipient (i.e. early stage) decay identified in the lower trunk is generally not associated with a significant loss in tissue strength and the failure of the lower trunk over the short to medium term is low. Repeat internal diagnostic testing should be undertaken in 24 months to monitor the rate of spread of the decay.

Refer to Plates 10 and 11 **(Appendix 4)**

4.0 CONCLUSIONS

4.1 Thirty-one (31) trees were assessed within this Report and comprise of a mix of locally indigenous, Australian native and exotic species.

4.2 The proposal seeks to amend the KLEP 2015 by way of a zoning change.

4.3 The supplied plans show that five (5) trees are proposed for removal as part of the development works. These are Trees 1, 2, 11, 12 and 30.

4.4 The supplied plans show that twenty-six (26) trees are to be retained as part of the proposed development. These are 3-10, 13-29 and 31. Works are proposed within the TPZ areas of Trees 13, 14, 16-20, 27 and 31 however the encroachment is limited to *Minor Encroachments* as defined by AS-4970. *Minor Encroachments* are considered acceptable by AS-4970 when compensated for elsewhere and contiguous within the TPZ. The encroachments into TPZ areas should be compensated for by extending the TPZ in areas not subject to encroachment. The trees to be retained should be protected in accordance with the Tree Protection Specification **(Appendix 6)**.

4.5 The supplied plans show that Trees 9, 14, 17, 19, 20, 22, 24, 27 and 31 will need to be pruned for building and construction clearance. The assessment of the pruning requirements detailed in this Report was estimated from ground level only. A Surveyor should be engaged prior to the completion of the final design to mark out critical sections of the building footprint to allow a comprehensive assessment of tree pruning requirements for building and construction clearance. Pruning work should be undertaken in accordance with *Australian Standard 4373: Pruning of Amenity Trees (2007), Safe Work Australia Guide for Managing Risks of Tree Trimming and Removal Work (2016)* and other applicable legislation and codes.

4.6 The proposed development includes the provision of new tree planting across the site. Replacement planting should be supplied in accordance with *Australian Standard 2303 (2015) Tree Stock for Landscape Use.*

4.7 Further internal diagnostic testing in the northern side of the trunk of Tree 19 should be undertaken (when the existing building to the north of the tree is removed) to determine if more advanced decay is present. Repeat internal diagnostic testing should be undertaken on Tree 20 in 24 months to monitor the rate of spread of the decay.

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5.0 LIMITATIONS & DISCLAIMER

TreeiQ takes care to obtain information from reliable sources. However, TreeiQ can neither guarantee nor be responsible for the accuracy of information provided by others. Plans, diagrams, graphs and photographs in this Arboricultural Report are visual aids only and are not necessarily to scale. This Report provides recommendations relating to tree management only. Advice should be sought from appropriately qualified consultants regarding design/construction/ecological/heritage etc issues.

This Report has been prepared for exclusive use by the client. This Report shall not be viewed by others or for any other reason outside its intended target or without the prior written consent of TreeiQ. Unauthorised alteration or separate use of any section of the Report invalidates the Report.

Many factors may contribute to tree failure and cannot always be predicted. TreeiQ takes care to accurately assess tree health and structural condition. However, a tree's internal structural condition may not always correlate to visible external indicators. There is no warranty or guarantee, expressed or implied that problems or deficiencies regarding the trees or site may not arise in the future. Information contained in this report covers only the trees assessed and reflects the condition of the trees at the time of inspection. Additional information regarding the methodology used in the preparation of this Report is attached as Appendix 1. A comprehensive tree risk assessment and management plan for the trees is beyond the scope of this Report.

Reference should be made to any relevant legislation including Tree Management Controls. All recommendations contained within this Report are subject to approval from the relevant Consent Authority.

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7.0 APPENDICES

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Appendix 1: Methodology

1.1 **Site Inspection**: This report was determined as a result of a comprehensive site inspection during July 2018. The comments and recommendations in this report are based on findings from this site inspection.

1.2 **Visual Tree Assessment (VTA)**: The subject tree(s) was assessed using the Visual Tree Assessment criteria and notes as described in *The Body Language of Trees – A Handbook for Failure Analysis.*[7] The inspection was limited to a visual examination of the subject tree(s) from ground level only. No internal diagnostic or tissue testing was undertaken as part of this assessment. Trees outside the subject site were reviewed from the property boundaries only.

1.3 **Internal Diagnostic Testing**: Internal diagnostic testing was undertaken on the 05.10.2019 using an IML Resistograph F400-S™. In general, testing and interpretation of the test results references the t/R ratio which is the ratio of the sound wood shell thickness (t), without the bark, to the radius of the cross section (R).[8] This method proposes a .0.3 to 0.35 t/R ratio threshold and notes that failures begin to significantly increase as the ratio begins to fall under 0.25. The model also indicates that a cavity/defect representing more than 120 degrees of the cross-sectional area further contributes to the increased risk of structural failure. It should be noted that the t/R ratio is based on field studies of centrally located decay within vertical and cylindrical trunks only and there are a number of limitations of this model.[9] Nonetheless, the t/R ratio provides a starting point from which quantifiable and comparative results can be produced. As part of the tree and risk assessment processes, additional factors such as tree form/mechanical loading, defect location and size, tree health and vigour, pathogen virulence, typical species tissue density and growth response, tree location and significance, occupancy rates and consequences of failures are considered when making tree management recommendations.

Where possible, Resistograph testing was undertaken using a precautionary methodology where the minimum residual wall thickness (i.e. the amount of remaining sound wood required to support the tree) plus a 10% approx. safety margin is calculated and drill testing is limited to this depth. The purpose of this testing method is to minimise the potential for breaching internal walls of compartmentalisation where the residual wall thickness (structurally sound tissue) falls within acceptable limits.[10]

1.4 **Tree Dimensions**: The dimensions of the subject tree(s) are approximate only.

1.5 **Tree Locations:** The location of the subject tree(s) was determined from the supplied plans. Trees not shown on the plans were plotted in their approximate location only.

1.6 **Trees & Development**: Tree Protection Zones, Tree Protection Measures and Sensitive Construction Methods for the subject tree were based on methods outlined in *Australian Standard 4970-2009 Protection of Trees on Development Sites*.

The *Tree Protection Zone* (TPZ) is described in AS-4970 as a combination of the root area and crown area requiring protection. It is an area isolated from construction disturbance, so that the tree remains viable.

The *Structural Root Zone* (SRZ) is described in AS-4970 as the area around the base of a tree required for the tree's stability in the ground. Severance of structural roots within the SRZ is not recommended as it may lead to the destabilisation and/or demise of the tree.

In some cases it may be possible to encroach into or make variations to the theoretical TPZ. A *Minor Encroachment* is less than 10% of the area of the TPZ and is outside the SRZ. The area lost to this encroachment should be compensated for elsewhere and contiguous with the TPZ. A *Major Encroachment* is greater than 10% of the TPZ or inside the SRZ. In this situation the Project Arborist must demonstrate that the tree would remain viable. This may require root investigation by non-destructive methods or the use of sensitive construction methods.

1.7 **Tree Health**: The health of the subject tree(s) was determined by assessing:

I. Foliage size and colour
II. Pest and disease infestation
III. Extension growth
IV. Crown density
V. Deadwood size and volume
VI. Presence of epicormic growth

1.8 **Tree Structural Condition**: The structural condition of the subject tree(s) was assessed by:

I. Assessment of branching structure
(i.e co-dominant/bark inclusions, crossing branches, branch taper, terminal loading, previous branch failures)
II. Visible evidence of structural defects or instability
(i.e root plate movement, wounds, decay, cavities, fungal brackets, adaptive growth)
III. Evidence of previous pruning or physical damage
(root severance/damage, lopping, flush-cutting, lions tailing, mechanical damage)

[7] Mattheck & Breloer (2003)
[8] International Society of Arboriculture (2016)
[9] Mattheck & Breloer (2003); Bond (2006); Kane & Ryan (2003)
[10] International Society of Arboriculture (2016)

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1.9 **Useful Life Expectancy (ULE)**: The ULE is an estimate of the longevity of the subject tree(s) in its growing environment. The ULE is modified where necessary to take in consideration tree(s) health, structural condition and site suitability. The tree(s) has been allocated one of the following ULE categories (Modified from Barrell, 2001):

I. 40 years +
II. 15-40 years
III. 5-15 years
IV. Less than 5 years

1.10 **Landscape Significance**: Landscape Significance was determined by assessing the combination of the cultural, environmental and aesthetic values of the subject tree(s). Whilst these values are subjective, a rating of high, moderate, low or insignificant has been allocated to the tree(s). This provides a relative value of the tree's Landscape Significance which may aid in determining its Retention Value. If the tree(s) can be categorized into more than one value, the higher value has been allocated.

Landscape Significance	Description
Very High	The subject tree is listed as a Heritage Item under the *Local Environmental Plan* with a local or state level of significance.
	The subject tree is listed on Council's Significant Tree Register or is considered to meet the criteria for significance assessment of trees and/or landscapes by a suitably qualified professional. The criteria are based on general principles outlines in the Burra Charter and on criteria from the Register of the National Estate.
High	The subject tree creates a 'sense of place' or is considered 'landmark' tree.
	The subject tree is of local, cultural or historical importance or is widely known.
	The subject tree has been identified by a suitably qualified professional as a species scheduled as a Threatened or Vulnerable Species or forms part of an Endangered Ecological Community associated with the site, as defined under the provisions of the NSW *Biodiversity Conservation Act (2016)* or the Commonwealth *Environmental Protection and Biodiversity Conservation Act* (1999).
	The subject tree is known to provide habitat to a threatened species.
	The subject tree is an excellent representative of the species in terms of aesthetic value.
	The subject tree is of significant size, scale or makes a significant contribution to the canopy cover of the locality.
	The subject tree forms part of the curtilage of a heritage item with a known or documented association with that item.
Moderate	The subject tree makes a positive contribution to the visual character or amenity of the area.
	The subject tree provides a specific function such as screening or minimising the scale of a building.
	The subject tree has a known habitat value.
	The subject tree is a good representative of the species in terms of aesthetic value.
Low	The subject tree is an environmental pest species or is exempt under the provisions of the local Council's Tree Management Controls
	The subject tree makes little or no contribution to the amenity of the locality.
	The subject tree is a poor representative of the species in terms of aesthetic value.
	The subject tree is a recognised environmental weed species for the area.

1.11 **Retention Value**: Retention Value was based on the subject tree's Useful Life Expectancy and Landscape Significance. The Retention Value was modified where necessary to take in consideration the subject tree's health, structural condition and site suitability. The subject tree(s) has been allocated one of the following Retention Values:

I. Priority for Retention
II. Consider for Retention
III. Consider for Removal
IV. Priority for Removal

<table>
<tr><th>ULE</th><th colspan="4">Landscape Significance</th></tr>
<tr><td></td><td>Very High</td><td colspan="2">High</td><td>Moderate</td><td>Low</td></tr>
<tr><td>40 years +</td><td rowspan="3">Priority for Retention</td><td colspan="3">Priority for Retention</td><td rowspan="3">Consider for Removal</td></tr>
<tr><td>15-40 years</td><td>Priority for Retention</td><td>Consider for Retention</td></tr>
<tr><td>5-15 years</td><td colspan="3">Consider for Retention</td></tr>
<tr><td>Less than 5 years</td><td>Consider for Removal</td><td colspan="4">Priority for Removal</td></tr>
</table>

The above table has been modified from the Footprint Green Tree Significance and Retention Value Matrix.

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Appendix 2: Plans

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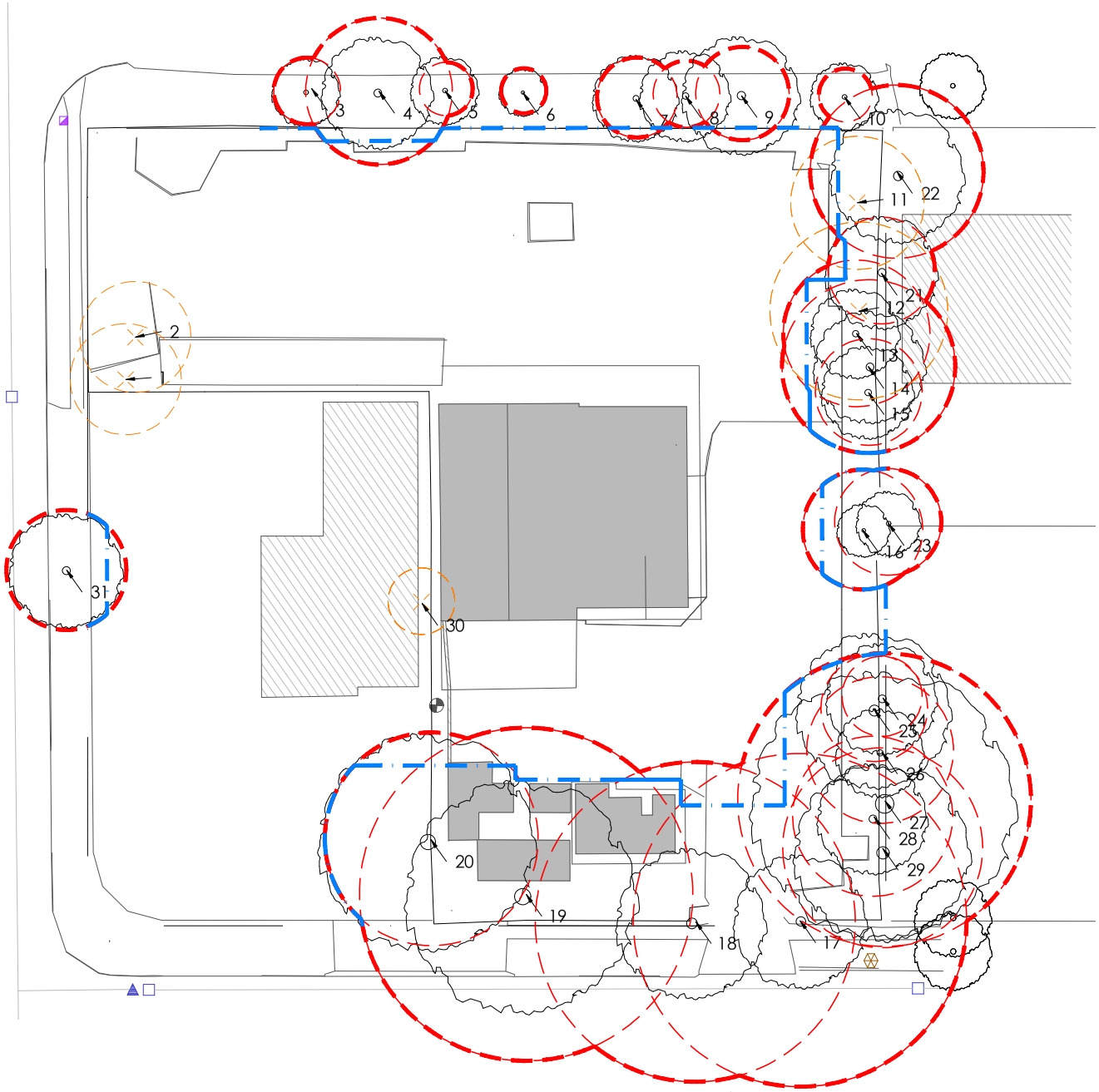
17.04.2019



LEGEND

- COMBINED TREE PROTECTION ZONE AS PER TreeIQ REPORT
- TREE TO BE RETAINED AND PROTECTED
- TREE TO BE REMOVED
- TPZ WITH 10% MINOR ENCROACHMENT AS PERMITTED UNDER AS-4970

'THE FARM' TURRAMURRA: TREE PROTECTION PLAN

1:200

2 0M 2 4 10M

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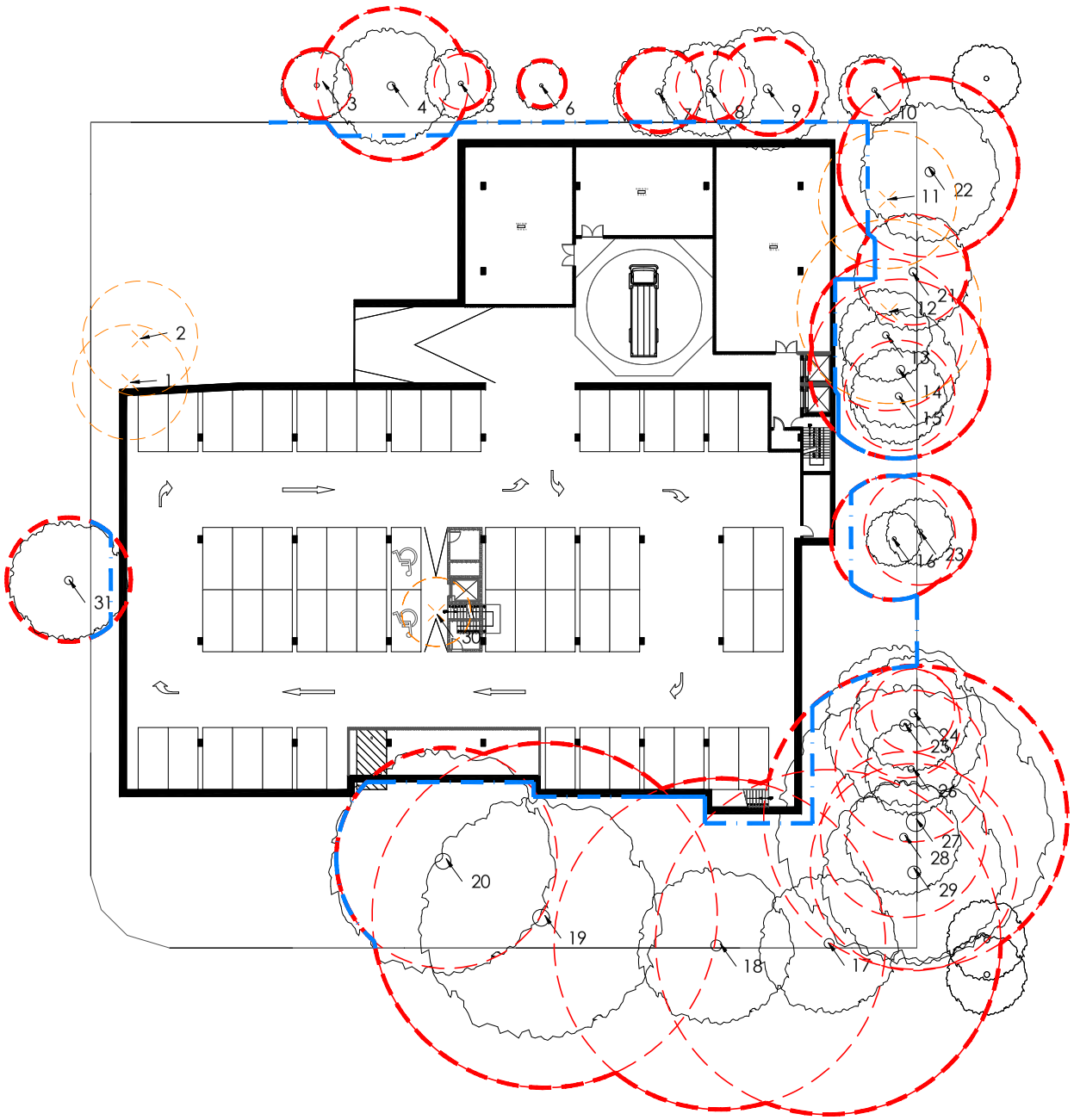

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'THE FARM' TURRAMURRA: TREE PROTECTION PLAN

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